Attachment
3

Pajaro River Watershed IRWM Implementation Proposal
Work Plan

Introduction

From its inception, the Pajaro River Watershed IRWM planning effort and associated stakeholders have focused on developing multi-beneficial management strategies to address the many needs and water resources interests in the basin. Ultimately, the effort led to the creation of the Pajaro River Watershed IRWM Plan. Borne out of the planning process was the Pajaro River Watershed IRWM project review process that prioritizes projects based on their ability to deliver multiple benefits, across a broad region, and through inter-agency cooperation. All four of the projects included in this proposal and listed below deliver broad benefits through inter-agency cooperation. Additionally, the work plan for grant administration has been included to address all tasks necessary for grant contracting, administration and reporting.

1. Hollister Urban Area Water Project
2. Critical Water Supply System Improvements for Pajaro (DAC)
3. Increased Recycled Water Storage Project
4. Pajaro Agricultural Water Quality and Aquifer Enhancement Project

Through the current IRWM Plan Update process, the region developed updated goals and objectives and updated the project scoring and prioritization process to address new IRWM standards and guidelines (Exhibit 1.2). The updated goals, objectives, and prioritization process were all approved by the Pajaro River Watershed IRWM Stakeholder Steering Committee and other stakeholders. Consistent with the procedures in the adopted IRWM Plan, the Regional Water Management Group (RWMG) initiated a call for projects in October 2012 (Exhibit 1.3). The new projects were scored utilizing the updated prioritization process (Exhibit 1.4).

The Hollister Urban Area (HUA) Water Project and the Increased Recycled Water Storage Project were both ranked as high priority projects for the region (Exhibit 1.5). The Pajaro Agricultural Water Quality and Aquifer Enhancement Project is an integration of two high priority projects originally submitted independently, the Integrated Aquifer Enhancement Program for the Pajaro Valley and the Regional Mobile Lab.

As stated in the 2012 Guidelines, projects that directly address a critical water quality or water supply issue in a Disadvantaged Community (DAC) are not required to be included in an adopted IRWM Plan. This is to encourage assistance to DACs. The Pajaro River Watershed RWMG has been actively providing assistance to the DAC Pajaro Sunny Mesa Community Services District.

The assistance includes the evaluation of water supply and quality needs and the development of the critical water supply project included in this proposal, the Critical Water Supply System Improvements for Pajaro. The project is consistent with the Pajaro River Watershed IRWM updated goals, objectives and priorities. Documentation of the presence and needs of the DAC are included in Attachment 10.

Project	Project Abstract	Project Design Status	Implementing Agency
Hollister Urban Area Water Project	The project involves the construction of an expansion to the Lessalt Water Treatment Plant (WTP), new transmission pipeline from the Lessalt WTP to Ridgemark, and a new West Hills WTP and its associated raw and treated water pipelines and raw water pump station. The project is designed to: • Improve effluent water quality to meet existing Waste Discharge Requirements (WDRs); • Provide a high quality potable water supply to meet current and projected demands; and • Improve water quality to allow for the beneficial use of recycled water.	• Lessalt WTP 95% design complete • Pipeline 95% design complete • West Hills preliminary design complete	San Benito County Water District
Critical Water Supply System Improvements for Pajaro (DAC)	The project involves the construction of a new 600,000 gallon water storage tank. The project is designed to: • Meet CDPH, CWD, and CFC requirements for a public water supply system; • Improve public health and safety; • Improve water supply reliability • Enhance water system resilience and provide more robust infrastructure.	• Preliminary design complete	Pajaro Sunny Mesa Community Services District (DAC)
Increased Recycled Water Storage Project	The project involves the construction of two 1 million gallon recycled water storage tanks. The project is designed to: • Increase recycled water deliveries by 750 AFY; and • Reduce groundwater pumping from the overdrafted basin by an equivalent 750 AFY.	• Preliminary design complete	Pajaro Valley Water Management Agency
Pajaro Agricultural Water Quality and Aquifer Enhancement Project	The project involves: • Community Water Dialogue support to lead grower-based programs for improved water management • Implement managed aquifer recharge • Cost-share and performance-based incentives for water quality and supply • Provide a Regional Mobile Lab to provide technical and outreach services to promote improved irrigation efficiency	• Recharge zones mapped (preliminary design for aquifer recharge)	Resource Conservation District of Santa Cruz County

Goals and Objectives of the Proposal

In the IRWM planning process, development of objectives is a key step, as objectives provide a basis for decision making, guide work efforts, and can be used to evaluate project benefits. The May 2007 Pajaro River Watershed IRWMP established four key regional goals, in order of priority:

1. Water Supply
2. Water Quality
3. Flood Management
4. Environmental Protection and Enhancement

After considering the revised IRWM guidelines and the current regional conditions, the RWMG, in coordination with stakeholders, chose to maintain the four goals with minor text changes and proposing no changes to the priority order of the goals. The final four goals are listed below.

1. **Water Supply Goal** - Protect and improve regional water supply reliability, protect groundwater resources from overdraft, reduce dependence on imported water, and protect watershed communities from drought while considering climate change impacts on water supply resources and demands.
2. **Water Quality Goal:** Protect and improve water quality for beneficial uses consistent with regional community interests and the RWQCB basin plan objectives through planning and implementation in cooperation with local and state agencies and regional stakeholders.
3. **Flood Management Goal:** Ensure flood management strategies are developed and implemented through a collaborative and watershed-wide approach and are designed to maximize opportunities for comprehensive management of water resources.
4. **Environmental Protection and Enhancement Goal:** Preserve the environmental wealth and well-being of the Pajaro River watershed by identifying opportunities to restore and enhance natural resources of streams, watersheds, wetlands, and the Monterey Bay when developing and implementing water management strategies.

Water supply and water quality management continues to be a statewide priority as emphasized in the IRWM planning guidelines and continue to be the highest priorities for the Pajaro River Watershed IRWM region, especially given the reduced water deliveries from the CVP, more stringent water quality regulations, and the associated threat to the local economy from both. This Pajaro River Watershed IRWM Implementation Proposal focuses on addressing the water supply and water quality goals and objectives as described below.

The water supply and water quality goals contained key measureable and prioritized objectives that established the intent of the Pajaro River Watershed IRWM Plan. These objectives were based on the significant water related needs and conflicts in the region. The RWMG reviewed the 2007 Objectives and updated them to ensure consistency with:

- Basin Plan Objectives
- 20x2020 Water Efficiency Goals
- Requirements of CWC §10540(c)

- Changes in the region's conditions and needs

Although the Basin Plan Objectives were considered during the 2007 IRWM planning process, the objectives were revisited to consider the updated Basin Plan. Additionally, the State has since established the goal to reduce water use by 20% per capita by the year 2020. The 2007 IRWM conservation objective called for a 10% reduction of total water use by 2020. Additional aspects of SBx7-7, such as improving agricultural water use efficiency, were considered in the revised objectives. The revised objectives also considered the requirements of CWC §10540(c).

After considering the revised IRWM planning guidelines and the current regional conditions, the RWMG revised and reprioritized the objectives as listed below.

> **Water Supply Goal** - Protect and improve regional water supply reliability, protect groundwater resources from overdraft, reduce dependence on imported water, and protect watershed communities from drought while considering climate change impacts on water supply resources and demands.
>
> **Water Supply Objectives:**
> 1. Meet 100% of M&I and agriculture demands (both current and future conditions) in wet to dry years including the first year of a drought.
> 2. Meet 85% M&I and 75% agriculture demands (both current and future conditions) in second and subsequent years of a drought.
> 3. Identify and address water supply needs of disadvantaged communities in the Pajaro River Watershed.
> 4. Implement water conservation programs to reduce M&I and agricultural water uses consistent with SBx7-7 and CVPIA.
> 5. Maximize the use of recycled water during the irrigation season and expand other uses of recycled water.
> 6. Optimize the use of groundwater and aquifer storage.
> 7. Maximize conjunctive use opportunities including interagency conjunctive use.
> 8. Optimize and sustain the use of existing import surface water entitlements from the San Felipe Unit.
> 9. Maximize the beneficial use of existing local water supplies while protecting existing surface water rights.

The two highest priority water supply objectives did not change. The RWMG believes the IRWM water supply focus should be on developing a water supply program that meets 100% of the demands in most years and 75% to 85% of the demands in drought years. These two objectives were followed by the DAC water supply objective, which continues to be an unmet need for the City of Watsonville and, more significantly, the Town of Pajaro. This funding proposal serves to directly address that objective and need.

The remaining objectives were prioritized based on the regional priority for reducing demands first (conservation), followed by recycling as much as possible, and then optimizing the use of other water supplies.

Water Quality Goal: Protect and improve water quality for beneficial uses consistent with regional community interests and the RWQCB basin plan objectives through planning and implementation in cooperation with local and state agencies and regional stakeholders.

Water Quality Objectives:

1. Meet or exceed all applicable groundwater, surface water, wastewater, and recycled water quality regulatory standards.
2. Identify and address the drinking water quality of disadvantaged communities in the Pajaro River Watershed.
3. Protect groundwater resources from contamination including salts and nutrients.
4. Address impacts from surface water runoff through implementation of Best Management Practices or other surface water management strategies.
5. Meet or exceed delivered water quality targets established by recycled water users.

The highest priority water quality objective did not change. The RWMG believes the IRWM water quality focus should be meeting and, when possible, exceeding the applicable water quality regulations. Following that, the DAC water quality objective continues to be a high priority for the region especially given the serious water quality issues and health threats in the Town of Pajaro. This funding proposal serves to directly address that objective and need. The third priority was protecting the groundwater resources which serve as the primary water supply for the region.

Each of the projects included in this proposal are designed to address the highest priority water supply and water quality goals and objectives and, together as a proposal, deliver a high degree of benefit towards meeting the regional goals and objectives.

Project 1 Hollister Urban Area Water Project

The overall purpose of the HUA Water Project is to:

- Provide a reliable and sustainable water supply to meet the current and future demands of the HUA.
- Improve the quality of municipal drinking water, industrial supply, and recycled water for urban and agricultural irrigation users.
- Achieve the goals of the City of Hollister (COH) Long-Term Wastewater Management Plan and the Sunnyslope County Water District (SSCWD) Long-Term Wastewater Management Plan.

The Pajaro River Watershed IRWM water supply and water quality objectives addressed by the HUA Water Project are listed in the table below.

Objective	HUA Water Project
WS1. Meet 100% of M&I and agriculture demands (both current and future conditions) in wet to dry years including the first year of a drought.	✔
WS2. Meet 85% M&I and 75% agriculture demands (both current and future conditions) in second and subsequent years of a drought.	✔
WS3. Identify and address water supply needs of disadvantaged communities in the Pajaro River Watershed.	
WS4. Implement water conservation programs to reduce M&I and agricultural water use~~s~~ consistent with SBx7-7 and CVPIA.	✔
WS5. Maximize the use of recycled water during the irrigation season and expand other uses of recycled water.	✔
WS6. Optimize the use of groundwater and aquifer storage.	✔
WS7. Maximize conjunctive use opportunities including interagency conjunctive use.	✔
WS8. Optimize and sustain the use of existing import surface water entitlements from the San Felipe Unit.	✔
WS9. Maximize the beneficial use of existing local water supplies while protecting existing surface water rights.	✔
WQ1. Meet or exceed all applicable groundwater, surface water, wastewater, and recycled water quality regulatory standards.	✔
WQ2. Identify and address the drinking water quality of disadvantaged communities in the Pajaro River Watershed.	
WQ3. Protect groundwater resources from contamination including salts and nutrients.	✔
WQ4. Address impacts from surface water runoff through implementation of Best Management Practices or other surface water management strategies.	
WQ5. Meet or exceed delivered water quality targets established by recycled water users.	✔

Project 2 Critical Water Supply System Improvements for Pajaro

The overall purpose of the Critical Water Supply System Improvements for Pajaro is to provide the Disadvantaged Community (DAC) of Pajaro the potable water storage necessary to:

- Meet the California Department of Public Health and fire code requirements for a public water supply system;
- Improve public health and safety;
- Improve water supply reliability;
- Enhance water system resilience; and
- Provide more robust infrastructure.

The Pajaro River Watershed IRWM water supply and water quality objectives addressed by the Pajaro Project are listed in the table below.

Objective	Pajaro System Improvements
WS1. Meet 100% of M&I and agriculture demands (both current and future conditions) in wet to dry years including the first year of a drought.	✔
WS2. Meet 85% M&I and 75% agriculture demands (both current and future conditions) in second and subsequent years of a drought.	✔
WS3. Identify and address water supply needs of disadvantaged communities in the Pajaro River Watershed.	✔
WS4. Implement water conservation programs to reduce M&I and agricultural water use~~s~~ consistent with SBx7-7 and CVPIA.	
WS5. Maximize the use of recycled water during the irrigation season and expand other uses of recycled water.	
WS6. Optimize the use of groundwater and aquifer storage.	
WS7. Maximize conjunctive use opportunities including interagency conjunctive use.	
WS8. Optimize and sustain the use of existing import surface water entitlements from the San Felipe Unit.	
WS9. Maximize the beneficial use of existing local water supplies while protecting existing surface water rights.	
WQ1. Meet or exceed all applicable groundwater, surface water, wastewater, and recycled water quality regulatory standards.	✔
WQ2. Identify and address the drinking water quality of disadvantaged communities in the Pajaro River Watershed.	✔
WQ3. Protect groundwater resources from contamination including salts and nutrients.	
WQ4. Address impacts from surface water runoff through implementation of Best Management Practices or other surface water management strategies.	
WQ5. Meet or exceed delivered water quality targets established by recycled water users.	

Project 3 Increased Recycled Water Storage Project

The overall purpose of the Increased Recycled Water Storage Project is to maximize the production of recycled water from the Recycled Water Facility by providing nighttime storage of recycled water when the demand for delivered water is low, and then delivering when the demand increases during the day. The project will:

- Increase recycled water deliveries by 750 AFY; and
- Reduce groundwater pumping from the overdrafted basin by an equivalent 750 AFY.

The Pajaro River Watershed IRWM water supply and water quality objectives addressed by the Increased Recycled Water Storage Project are listed in the table below.

Objective	Recycled Storage Project
WS1. Meet 100% of M&I and agriculture demands (both current and future conditions) in wet to dry years including the first year of a drought.	✔
WS2. Meet 85% M&I and 75% agriculture demands (both current and future conditions) in second and subsequent years of a drought.	✔
WS3. Identify and address water supply needs of disadvantaged communities in the Pajaro River Watershed.	
WS4. Implement water conservation programs to reduce M&I and agricultural water use~~s~~ consistent with SBx7-7 and CVPIA.	
WS5. Maximize the use of recycled water during the irrigation season and expand other uses of recycled water.	✔
WS6. Optimize the use of groundwater and aquifer storage.	✔
WS7. Maximize conjunctive use opportunities including interagency conjunctive use.	✔
WS8. Optimize and sustain the use of existing import surface water entitlements from the San Felipe Unit.	
WS9. Maximize the beneficial use of existing local water supplies while protecting existing surface water rights.	
WQ1. Meet or exceed all applicable groundwater, surface water, wastewater, and recycled water quality regulatory standards.	✔
WQ2. Identify and address the drinking water quality of disadvantaged communities in the Pajaro River Watershed.	
WQ3. Protect groundwater resources from contamination including salts and nutrients.	✔
WQ4. Address impacts from surface water runoff through implementation of Best Management Practices or other surface water management strategies.	
WQ5. Meet or exceed delivered water quality targets established by recycled water users.	✔

Project 4 Pajaro Agricultural Water Quality and Aquifer Enhancement Project

The overall purpose of the Pajaro Agricultural Water Quality and Aquifer Enhancement Project is to:

- Capture storm water and return excess surface flows to the aquifer;
- Convene stakeholders to implement community-based water supply projects; and
- Implement incentive-based programs for demand management.

The Pajaro River Watershed IRWM water supply and water quality objectives addressed by the Pajaro Agricultural Water Quality and Aquifer Enhancement Project are listed in the table below.

Objective	Agricultural Water Project
WS1. Meet 100% of M&I and agriculture demands (both current and future conditions) in wet to dry years including the first year of a drought.	✔
WS2. Meet 85% M&I and 75% agriculture demands (both current and future conditions) in second and subsequent years of a drought.	✔
WS3. Identify and address water supply needs of disadvantaged communities in the Pajaro River Watershed.	
WS4. Implement water conservation programs to reduce M&I and agricultural water use~~s~~ consistent with SBx7-7 and CVPIA.	✔
WS5. Maximize the use of recycled water during the irrigation season and expand other uses of recycled water.	
WS6. Optimize the use of groundwater and aquifer storage.	✔
WS7. Maximize conjunctive use opportunities including interagency conjunctive use.	
WS8. Optimize and sustain the use of existing import surface water entitlements from the San Felipe Unit.	
WS9. Maximize the beneficial use of existing local water supplies while protecting existing surface water rights.	✔
WQ1. Meet or exceed all applicable groundwater, surface water, wastewater, and recycled water quality regulatory standards.	✔
WQ2. Identify and address the drinking water quality of disadvantaged communities in the Pajaro River Watershed.	
WQ3. Protect groundwater resources from contamination including salts and nutrients.	✔
WQ4. Address impacts from surface water runoff through implementation of Best Management Practices or other surface water management strategies.	✔
WQ5. Meet or exceed delivered water quality targets established by recycled water users.	

As noted in the summary table below, the Pajaro River Watershed IRWM Implementation Proposal meets every water supply and water quality objective of the Pajaro River Watershed IRWM Plan.

Overview of Proposal Goals and Objectives

Objective	HUA Water Project	Pajaro System Improvements	Recycled Storage Project	Agricultural Water Project
WS1. Meet 100% of M&I and agriculture demands (both current and future conditions) in wet to dry years including the first year of a drought.	✔	✔	✔	✔
WS2. Meet 85% M&I and 75% agriculture demands (both current and future conditions) in second and subsequent years of a drought.	✔	✔	✔	✔
WS3. Identify and address water supply needs of disadvantaged communities in the Pajaro River Watershed.		✔		
WS4. Implement water conservation programs to reduce M&I and agricultural water use~~s~~ consistent with SBx7-7 and CVPIA.	✔			✔
WS5. Maximize the use of recycled water during the irrigation season and expand other uses of recycled water.	✔		✔	
WS6. Optimize the use of groundwater and aquifer storage.	✔		✔	✔
WS7. Maximize conjunctive use opportunities including interagency conjunctive use.	✔		✔	
WS8. Optimize and sustain the use of existing import surface water entitlements from the San Felipe Unit.	✔			
WS9. Maximize the beneficial use of existing local water supplies while protecting existing surface water rights.	✔			✔
WQ1. Meet or exceed all applicable groundwater, surface water, wastewater, and recycled water quality regulatory standards.	✔	✔	✔	✔
WQ2. Identify and address the drinking water quality of disadvantaged communities in the Pajaro River Watershed.		✔		
WQ3. Protect groundwater resources from contamination including salts and nutrients.	✔		✔	✔
WQ4. Address impacts from surface water runoff through implementation of Best Management Practices or other surface water management strategies.				✔
WQ5. Meet or exceed delivered water quality targets established by recycled water users.	✔		✔	

Synergies and Linkages Between Projects

From its inception, the Pajaro River Watershed IRWM planning effort and associated stakeholders have focused on developing multi-beneficial management strategies to address the many needs and water resources interests in the basin. Ultimately, the effort led to the creation of the Pajaro River Watershed IRWM Plan. Borne out of the planning process was the Pajaro River Watershed IRWM project review process that prioritizes projects based on their ability to deliver multiple benefits, across a broad region, and through inter-agency cooperation. All four of the projects included in this proposal deliver broad benefits through inter-agency cooperation. Additionally, the four projects included in the Pajaro River Watershed IRWM Implementation Proposal are linked through both geographic area and benefit area and result in synergies and added value from the proposal.

As shown in Figure 3.1, three projects are located in the lower watershed and one project is located in the upper watershed. In terms of added value through geographic area, the Increased Recycled Water Storage Project and the Pajaro Agricultural Water Quality and Aquifer Enhancement Project both help address the agricultural water supply needs and protect and preserve the Pajaro Valley groundwater basin.

The Pajaro Valley (Figure 3.2), adjacent to Monterey Bay, is one of the most productive agricultural regions in the United States; however it has aquifers suffering from long-term groundwater overdraft and seawater intrusion. Seawater intrusion is contaminating Pajaro Valley's primary source of water and threatening its $800 million agricultural economy. Elevated chloride concentrations in groundwater caused by seawater intrusion were first documented in the Valley in *Bulletin 5,* a 1953 report published by the State Water Resources Board. Long-term overdraft conditions have caused groundwater levels to fall below sea level in places throughout the Valley all year long (Figure 3.3). The combination of long-term overdraft and continued groundwater extractions has caused seawater to migrate up to three miles inland (Figure 3.4), contaminating numerous extraction wells within the groundwater basin and threatening the productivity of prime agricultural land.

The combined effects of groundwater overdraft and seawater intrusion led first to the formation of the PVWMA, and later to the development of a 2002 Basin Management Plan (BMP) with solutions to alleviating the problems of the Valley. Two of the most cost effective solutions included conservation and water recycling. Based on that plan, PVWMA constructed and began operating the Watsonville Area Water Recycling Plant. Conservation program were also implemented, however, due to legal restrictions on PVWMA revenues, a comprehensive conservation program could not be implemented.

In 2010, PVWMA initiated an update to the BMP to identify new projects or project enhancements needed to fully bring the basin into balance. The Draft 2012 BMP (Exhibit 7.16) identified a suite projects needed to balance the basin and stop seawater intrusion. The recommendation included a comprehensive conservation program and enhancements to the recycled water treatment facility as immediate term projects. This proposal includes PVWMA's implementation of the recommended recycled water enhancements and the Resource Conservation District's (RCD) implementation of a portion of the conservation program. These two projects are working together to meet the needs as identified in the BMP.

The aquifer enhancement component of the project also contributes the PVWMA BMP implementation. The project, together with the PVWMA recycled water storage project, helps reduce basin overdraft and stop seawater.

Even though the HUA Water Project is located in the upper watershed, there are some future Pajaro Valley water supply opportunities that are created through the implementation of the project. The HUA Water Project will construct the facilities necessary to better utilize the SBCWD CVP allocations, thus preserving groundwater supplies for dry years and possibly transfers to neighboring districts like PVWMA. This concept has been included in the Pajaro River Watershed IRWM Plan and will remain under consideration as supplies are developed for the region, creating better opportunities for transfers.

The Critical Water Supply System Improvements for Pajaro may not result in added water supply value to other regions, but it does address one of the highest priority water supply and water quality objectives for the entire region, meeting critical water supply and water quality needs of a DAC (Figure 3.5).

Figure 3.1. Location of Proposed Projects, Regional Boundaries and Groundwater Basins

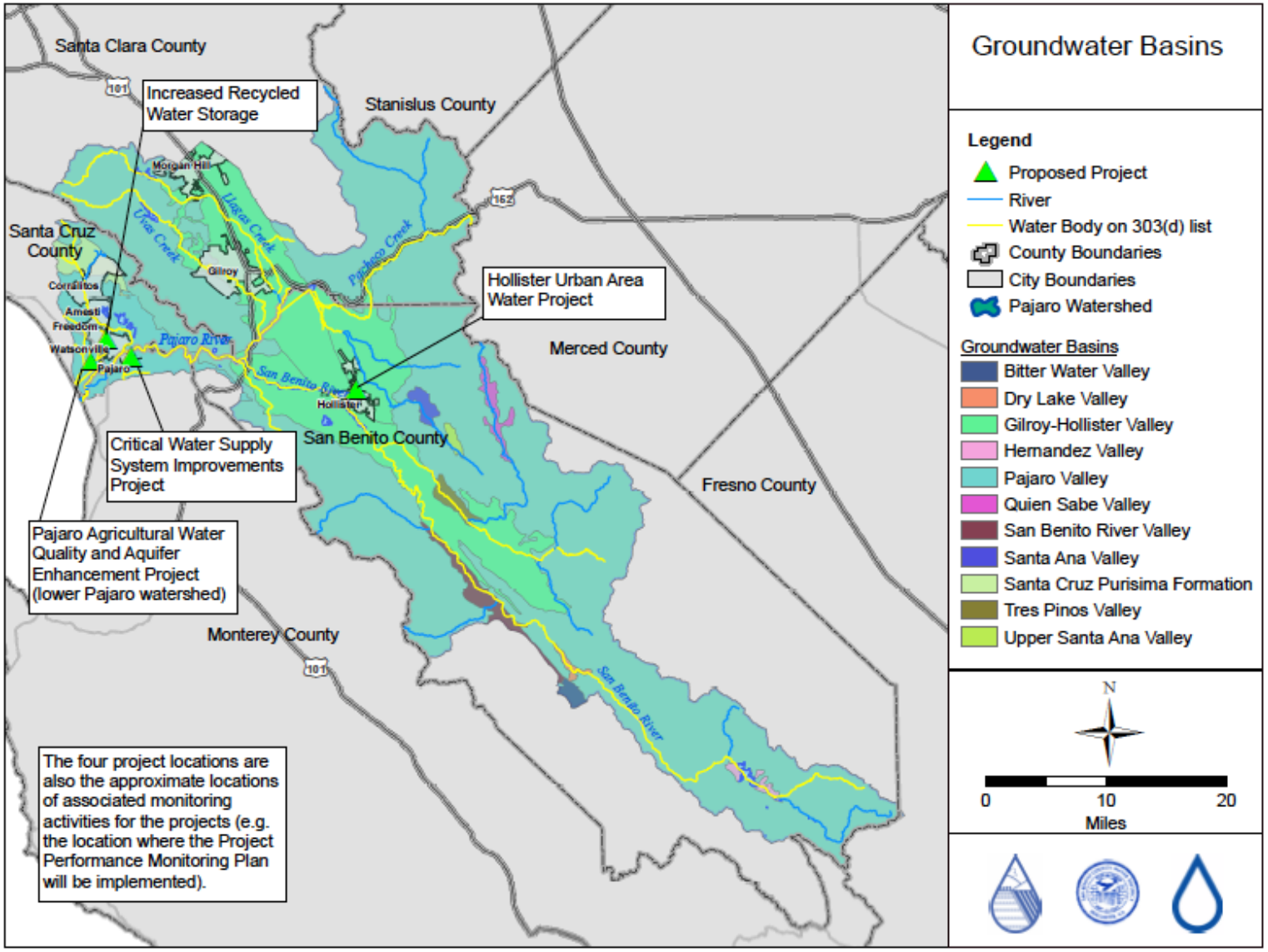


Figure 3.2 Location of the Pajaro Valley

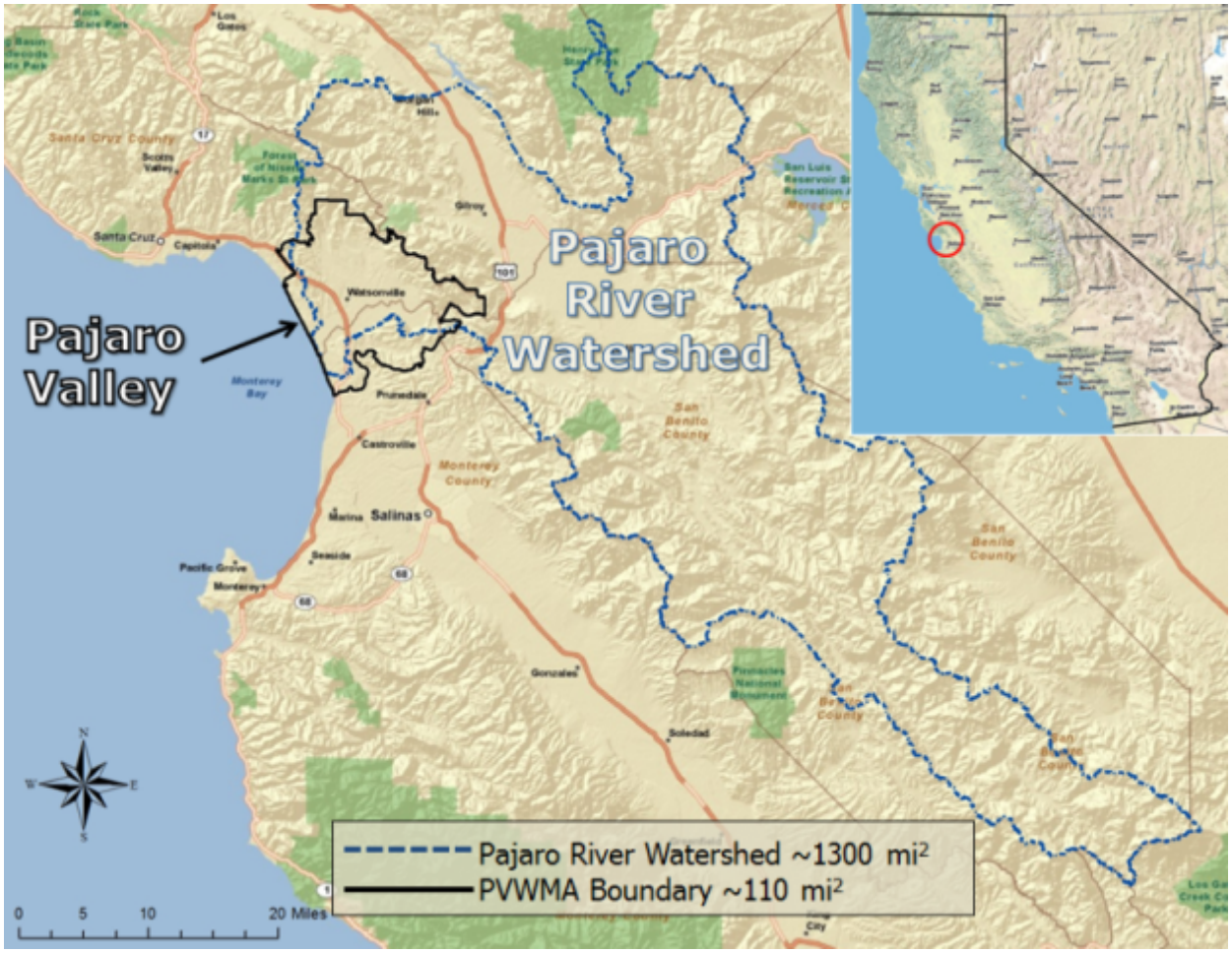


Figure 3.3 Groundwater Surface Elevation Map, Fall 2011

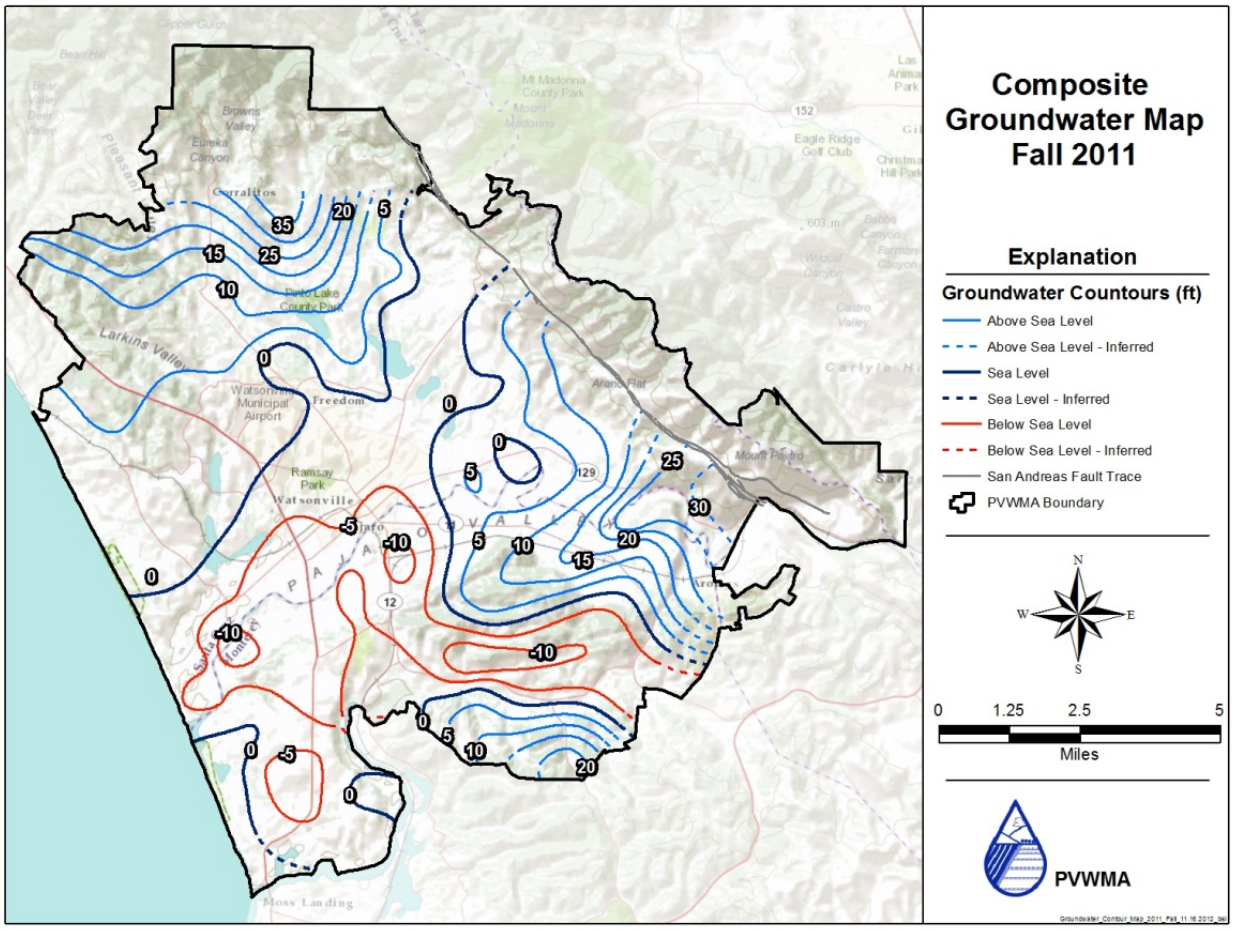


Figure 3.4 Seawater Intrusion & Delivered Water Zone Map

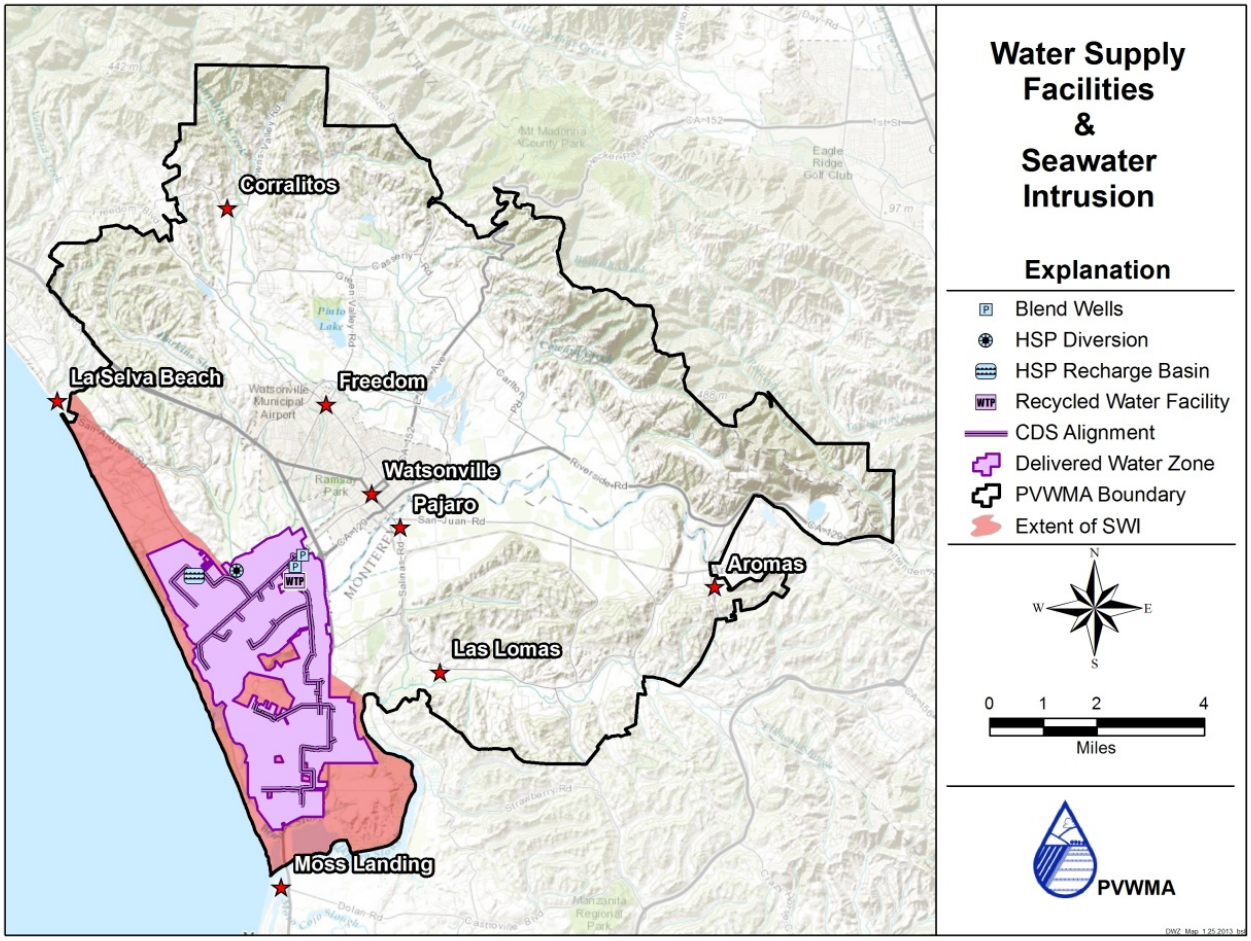
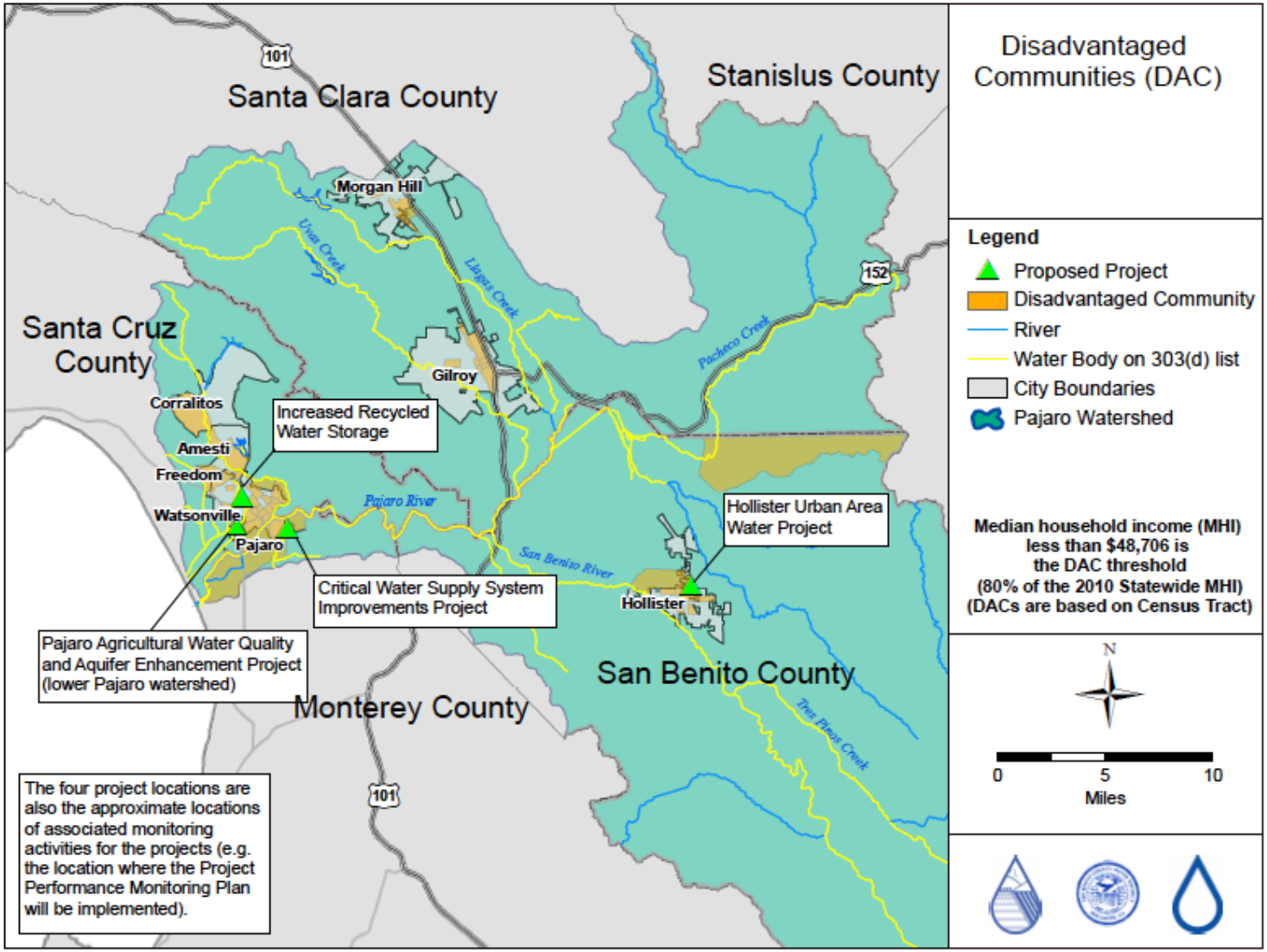


Figure 3.5 Disadvantaged Communities Boundaries Map



Project Introduction

As outlined in the PSP, the remainder of the Introduction section is dedicated to project specific information. The outline for the information is as follows:

- Project 1 HUA Water Project
  - Project Summary and Map
  - Completed Work
  - Existing Data and Studies
  - Project Timing and Phasing
- Critical Water Supply System Improvements for Pajaro
  - Project Summary and Map
  - Completed Work
  - Existing Data and Studies
  - Project Timing and Phasing
- Increased Recycled Water Storage Project
  - Project Summary and Map
  - Completed Work
  - Existing Data and Studies
  - Project Timing and Phasing
- Pajaro Agricultural Water Quality and Aquifer Enhancement Project
  - Project Summary and Map
  - Completed Work
  - Existing Data and Studies
  - Project Timing and Phasing

The summary of completed work (through October 2013) will follow the same task numbering as the proposed work section, to help provide consistency and facilitate review. The following task numbering will be followed for each project:

Task 1. Administration
Task 2. Labor Compliance Program
Task 3. Reporting
Task 4. Project Performance Monitoring Plan
Task 5. Land Purchase / Easements
Task 6. Assessment and Evaluation
Task 7. Final Design
Task 8. Environmental Documentation
Task 9. Permitting
Task 10. Construction / Implementation Contracting
Task 11. Construction / Implementation
Task 12. Environmental Compliance / Mitigation / Enhancement
Task 13. Construction Administration

Project 1 Hollister Urban Area

The overall purpose of the HUA Water Project is to:

- Provide a reliable and sustainable water supply to meet the current and future demands of the HUA.
- Improve the quality of municipal drinking water, industrial supply, and recycled water for urban and agricultural irrigation users.
- Achieve the goals of the City of Hollister (COH) Long-Term Wastewater Management Plan and the Sunnyslope County Water District (SSCWD) Long-Term Wastewater Management Plan.

The HUA Water Project required the following project elements to achieve the purpose:

- Upgrade of the Lessalt WTP,
- New transmission pipeline from the Lessalt WTP to Ridgemark / High Pressure Zone, and
- New West Hills WTP and its associated raw and treated water pipelines and raw water pump station.

These facilities are illustrated in Figure 3.6.

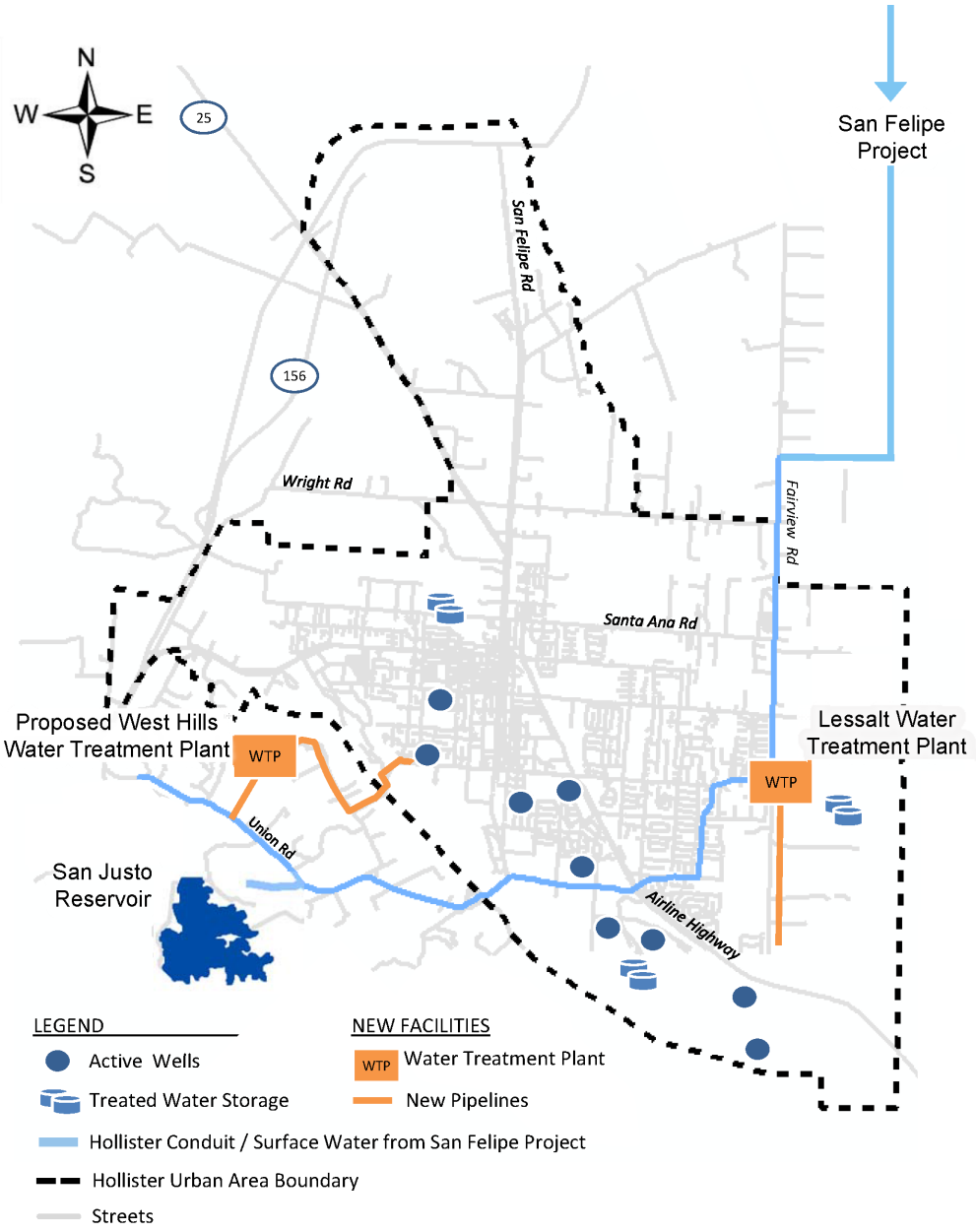
Completed Work

The HUA Water Project is being implemented by the San Benito County Water District (SBCWD), San Benito County (SBC), City of Hollister (City) and Sunnyslope County Water District (SSCWD). The roles and responsibilities for design, construction and operation have been established by numerous agreements. Since the original Memorandum of Understanding (MOU) between the City, SBCWD and SBC was signed in 2004 (Exhibit 7.3), and subsequently amended to include SSCWD in 2008 (Exhibit 7.4), a substantial effort has been undertaken. The Hollister Urban Area Water and Wastewater Master Plan was completed in 2008 (Exhibit 7.1), which included analyses on water supply reliability and demineralization. The Master Plan was followed by the Coordinated Water Supply and Treatment Agreement in early 2010 (Exhibit 7.7). These two studies laid the foundation for the currently proposed Hollister Urban Area Water Project.

As described below, work (through October 2013) on the HUA Water Project has been completed under the following tasks:

Task 5. Land Purchase / Easements
Task 6. Assessment and Evaluation
Task 7. Final Design
Task 8. Environmental Documentation
Task 9. Permitting
Task 10. Construction / Implementation Contracting
Task 11. Construction / Implementation

Figure 3.6 HUA Project Facilities



Task 5. Land Purchase / Easements

The Lessalt WTP is an existing facility and the proposed upgrade will remain within the existing parcel owned by the Hollister Water Treatment Agency (a joint powers authority between the City of Hollister and Sunnyslope County Water District); thus, no additional land acquisition or easements are needed. The alignment for the pipeline to Ridgemark is within the existing public right of way for Fairview Road, so no additional land acquisition is required. An encroachment permit will be required from San Benito County.

The West Hills WTP will be constructed on parcels jointly owned by the City of Hollister and Sunnyslope CWD. In addition, the raw and treated water pipelines alignments are within existing easements and public rights of way.

Deliverables:

Description	Schedule
County Encroachment Permit, Pipeline to Ridgemark	July 2013

Task 6. Assessment and Evaluation

An evaluation of water supply project alternatives was performed as part of the Master Plan in 2008 and was updated in the Coordinated Plan in 2010. Since then, predesign reports have been prepared for both the Lessalt WTP Upgrade and West Hills WTP project components. These reports included technical analyses as well as a siting study for the West Hills WTP. In addition, the Draft System Operations Technical Memorandum was prepared to document the assumptions for the future operation of water supply, treatment, and distribution systems. In addition, an analysis of water quality is currently underway to confirm the treatment process needs for the West Hills WTP.

Deliverables:

Description	Schedule
Lessalt WTP Upgrade Predesign Report (Exhibit 7.9)	June 2012
West Hills WTP Predesign Report (Exhibit 7.10)	December 2011
Draft System Operations Technical Memorandum (Exhibit 7.6)	December 2012

Task 7. Final Design

SSCWD retained a professional engineer (Kennedy/Jenks Consultants) to prepare and complete final design packages for the pipeline to Ridgemark and the Lessalt WTP Upgrade, respectively. These designs will be complete and ready to bid prior to award of the grant. 100% and 95% design drawings and specifications are included as Exhibits 3.1 and 3.2 for the pipeline and Lessalt WTP, respectively.

The SBCWD retained a professional engineer (HDR Engineering, Inc.), on behalf of the members of the MOU, to prepare and complete the final design package for the West Hills WTP. The design is expected to begin in Spring of 2013. The preliminary design is complete and included as Exhibit 7.10.

Deliverables:

Description	Schedule
Pipeline to Ridgemark, Final Design Plans, Specifications and Estimate (Exhibit 3.1)	March 2013
Lessalt WTP Upgrade, Final Design Plans, Specifications and Estimate (Note: 95% included as Exhibit 3.2)	April 2013
West Hills WTP, 50% Final Design Plans, Specifications and Estimate	September 2013

Task 8. Environmental Documentation
The HUA Water and Wastewater Master Plan Coordinated Water Supply and Treatment Plan was environmentally documented in a Programmatic Environmental Impact Report in 2011 (Exhibit 7.8).

The SSCWD filed a Notice of Exemption for the Pipeline to Ridgemark in 2010. In addition, the Sunnyslope CWD is in the process of preparing an Environmental Checklist and a Categorical Exemption for the Lessalt WTP Upgrade, which will be completed prior to the award of the grant.

An Environmental Impact Report is being prepared for the West Hills WTP. The Notice of Preparation was issued in July 2012. The Draft EIR is scheduled to be released in July 2013. In addition to the environmental documentation requirements under CEQA, the West Hills WTP also requires a NEPA document due to the raw water connection to a facility owned by the USBR. SBCWD has retained a consultant to assist the USBR in incorporating the analysis from the EIR into the Environmental Assessment (EA) The Draft EA is scheduled to be released for public review in September, 2013.

Deliverables:

Description	Schedule
2011 Programmatic EIR	2011
2010 Notice of Exemption, Pipeline to Ridgemark	March 2010
2013 Environmental Checklist, Lessalt WTP Upgrade	April 2013
West Hills WTP Notice of Preparation	2012
Draft West Hills WTP EIR	July 2013
West Hills WTP Draft EA	September 2013

Task 9. Permitting
The permits required for the Lessalt WTP Upgrade include the California Department of Public Health (CDPH) Water Supply Amendment Permit and a County Encroachment Permit for the Pipeline to the Ridgemark / High Pressure Zone. The applications for these permits have been or will be submitted prior to the award of the grant.

Deliverables:

Description	Schedule
Water Supply Amendment Permit – Lessalt WTP	December 2013
County Encroach Permit – Pipeline to Ridgemark / High Zone	December 2012

Task 10. Construction / Implementation Contracting
Construction of the Lessalt WTP Upgrade and Pipeline to the Ridgemark / High Pressure Zone is expected to begin in October 2013. The bid and award period is scheduled for April through July of 2013. A construction contractor and construction manager will be selected prior to the award of the grant. Note, construction of the West Hills WTP is not

scheduled to begin until 2014; if awarded, grant funds will be allocated to the West Hills WTP construction.

Deliverables:

Description	Schedule
Executed Construction Contract, Lessalt WTP and Pipeline to Ridgemark/High Pressure Zone	September 2013
Executed Construction Management Contract, Lessalt WTP and Pipeline to Ridgemark/High Pressure Zone	September 2013

Task 11. Construction / Implementation

As noted above, construction of the Lessalt WTP Upgrade and Pipeline to the Ridgemark/High Pressure Zone is expected to start in October 2013. Thus, it is expected that some limited mobilization may occur prior to the grant award date in October 2013. The applicant understands that construction work conducted prior to the grant award date is not eligible for reimbursement.

Existing Data and Studies

Since the original MOU between the City of Hollister (City), San Benito County Water District (San Benito CWD) and San Benito County was signed in 2004 (Exhibit 7.3), and subsequently amended to include Sunnyslope CWD in 2008 (Exhibit 7.4), a substantial effort has been undertaken. The Hollister Urban Area Water and Wastewater Master Plan was completed in 2008 (Exhibit 7.1), which included analyses on water supply reliability and demineralization. The Master Plan was followed by the Coordinated Water Supply and Treatment Agreement in early 2010 (Exhibit 7.7). These two studies laid the foundation for the currently proposed Hollister Urban Area Water Project. In early 2011, all four members of the MOU adopted the Hollister Urban Area Water and Wastewater Treatment Plan and Coordinated Water Supply and Treatment Plan Programmatic Environmental Impact Report (Exhibit 7.8), which provides programmatic CEQA coverage for the components of the HUA Water Project, as well as other projects not included in the HUA Water Project.

Project Timing and Phasing

The HUA Water Project has three major components, the upgrade of the Lessalt WTP upgrade, construction of a new pipeline from Lessalt WTP to Ridgemark, and construction of the West Hills WTP and associated appurtenances. The Lessalt WTP upgrade and pipeline to Ridgemark will be advertised for construction bids together as one single project and will proceed to construction award, construction and project completion together as a single project. The West Hills WTP component is a separate project that will be advertised for construction bids approximately 6 months later. Although the West Hills WTP will be constructed under a separate contract, it is integral to the overall achievement of the HUA Water Project goals and objectives.

Project 2 Critical Water Supply System Improvements for Pajaro

Pajaro Sunny Mesa Community Services District (PSMCSD) currently serves a total of 453 connections in the Disadvantaged Community (DAC) of Pajaro (Figure 3.7). The Pajaro system consists of a single 1,500 gallon per minute (gpm) well, one above-ground 600,000 gallon welded steel storage tank, and a booster pump system utilizing hydropneumatic tanks. This design severely limits the operational flexibility of the system. If the existing tank is taken out of service for repairs or in case of an emergency, there is no back-up storage for the system. Also, the existing tank is over 30 years old and in need of maintenance, as noted in the tank inspection report dated February 2, 2013 (Exhibit 7.12). The inspection recommendation called for blasting and recoating the tank. In order to make these repairs, the existing storage tank would need to be out of service for 6-12 weeks, which is currently untenable because this is the only tank serving the community (*Pajaro Sunny Mesa CSD – Proposition 84 Preliminary Engineering Report,* February 20, 2013) (Exhibit 7.13). The Critical Water Supply System Improvements for Pajaro involves the construction of a new 600,000 gallon tank, followed later by rehabilitation and repair of the existing tank when additional funding is secured. The new tank would be constructed in the undeveloped area adjacent to the site of the existing water storage tank. The new tank can be constructed without taking the existing tank and system off-line during construction and the community of Pajaro would have an uninterrupted supply. The project facility is illustrated in Figure 3.8.

Completed Work

As described below, work (through October 2013) on the Critical Water Supply System Improvements has been completed under the following tasks:

Task 5. Land Purchase / Easements
Task 6. Assessment and Evaluation

Task 5. Land Purchase / Easements

The PSMCSD currently owns several adjoin parcels of land on Railroad Avenue, near the intersection of Railroad Avenue and Allison Road Near Pajaro. The PSMCSD has acquired additional land to the west of the site of their existing facilities. This land is undeveloped and will be used for a new water storage tank. See Figure 3.9 for the location of the existing tank in relation to the proposed site of the new tank.

Task 6. Assessment and Evaluation

A preliminary engineering report was prepared by Kennedy Jenks Consultants in February 2013 (Exhibit 7.13). The report considers alternatives, develops the recommended alternative (this project), and presents a preliminary cost estimate

Deliverables:

Description	Schedule
PSMCSD Preliminary Engineering Report (Exhibit 7.13)	February 2013

Existing Data and Studies

The CDPH conducted a Water System Inspection of the system in 2010 (Exhibit 7.14). The CDPH recommendation resulting from that inspection was:

> *It is recommended by the Department that water district should develp a Capital Improvements Plan/Equipment Replacement Plan. The Pajaro Community Service District should develop a budget that includes reserves for emergencies (e.g., emergency reserve funds for unplanned equipment repair or replacement), and reserves for Capital Improvement Projects.*

PSMCSD commissioned a tank inspection in early 2013. As seen in one photo below, the exterior and interior is corroding with as much as 33% corrosion on the hatch and vent. The inspection report (Exhibit 7.12) recommendation called for blasting and recoating the tank.

Access Hatch Condition

Coating Condition: Poor
Corrosion Present: Y ☒ N ☐
Seams/Welds Condition: Good
Oxidation Present? Y ☒ N ☐
De-lamination Present? Y ☒ N ☐
Hatch Size: 2 foot square
Hatch Locked? Y ☒ N ☐
Hinge Condition: Good
Gasket Present? Y ☐ N ☒
Intact? Y ☐ N ☐ N/A ☒
Insects, Dirt Or Debris Present Under Hatch? Y ☐ N ☒

Summary: The hatch was found locked with no gasket present and in poor condition with biological growth, de-alloying, heavy oxidation, de-lamination and 33% surface corrosion noted. Recommend a gasket.

Project Timing and Phasing

The new tank is a stand alone project is does not require any future work to deliver the claimed benefits.

Figure 3.7 Pajaro Service Area and Disadvantaged Community Block Group Boundaries

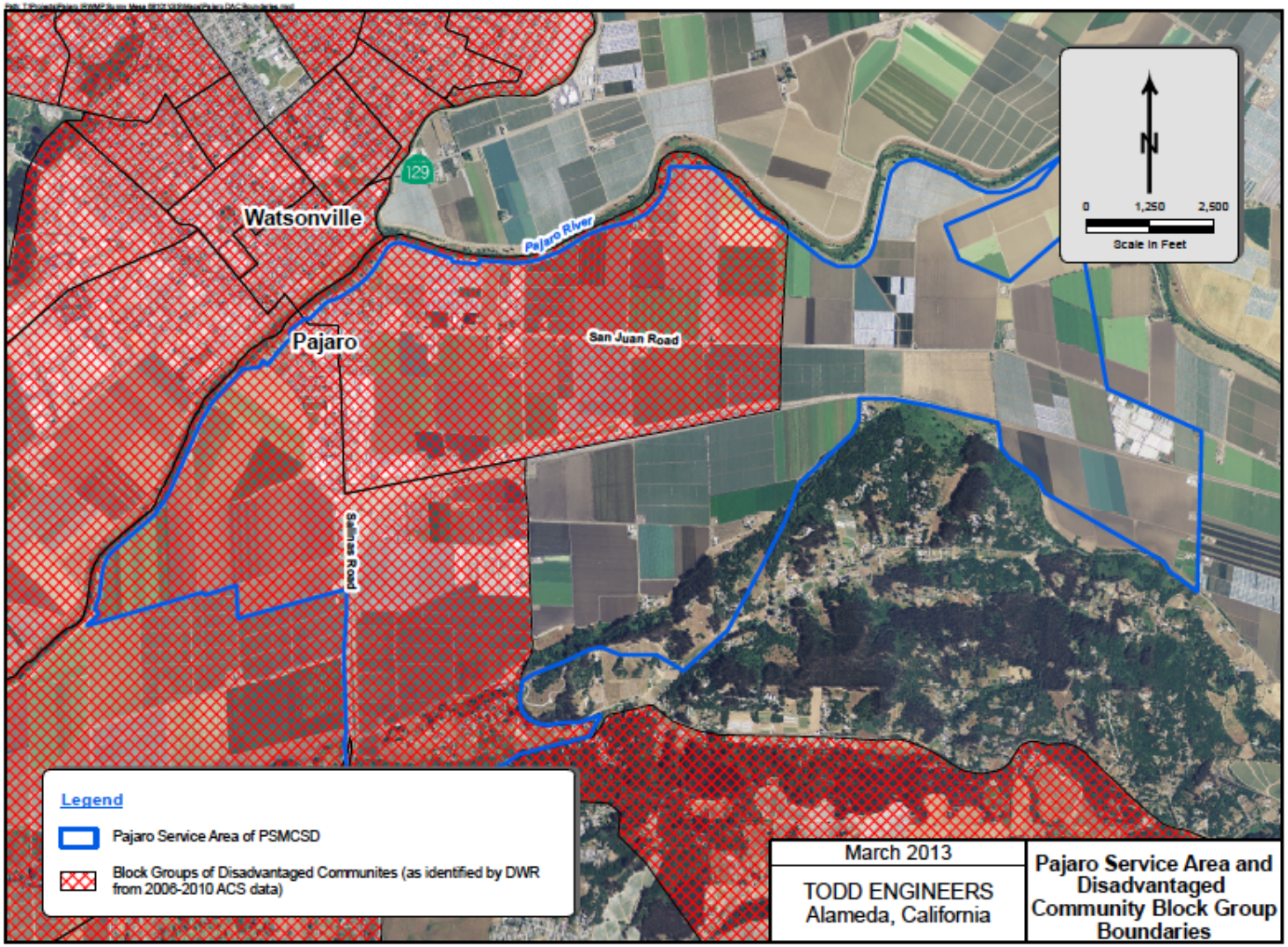
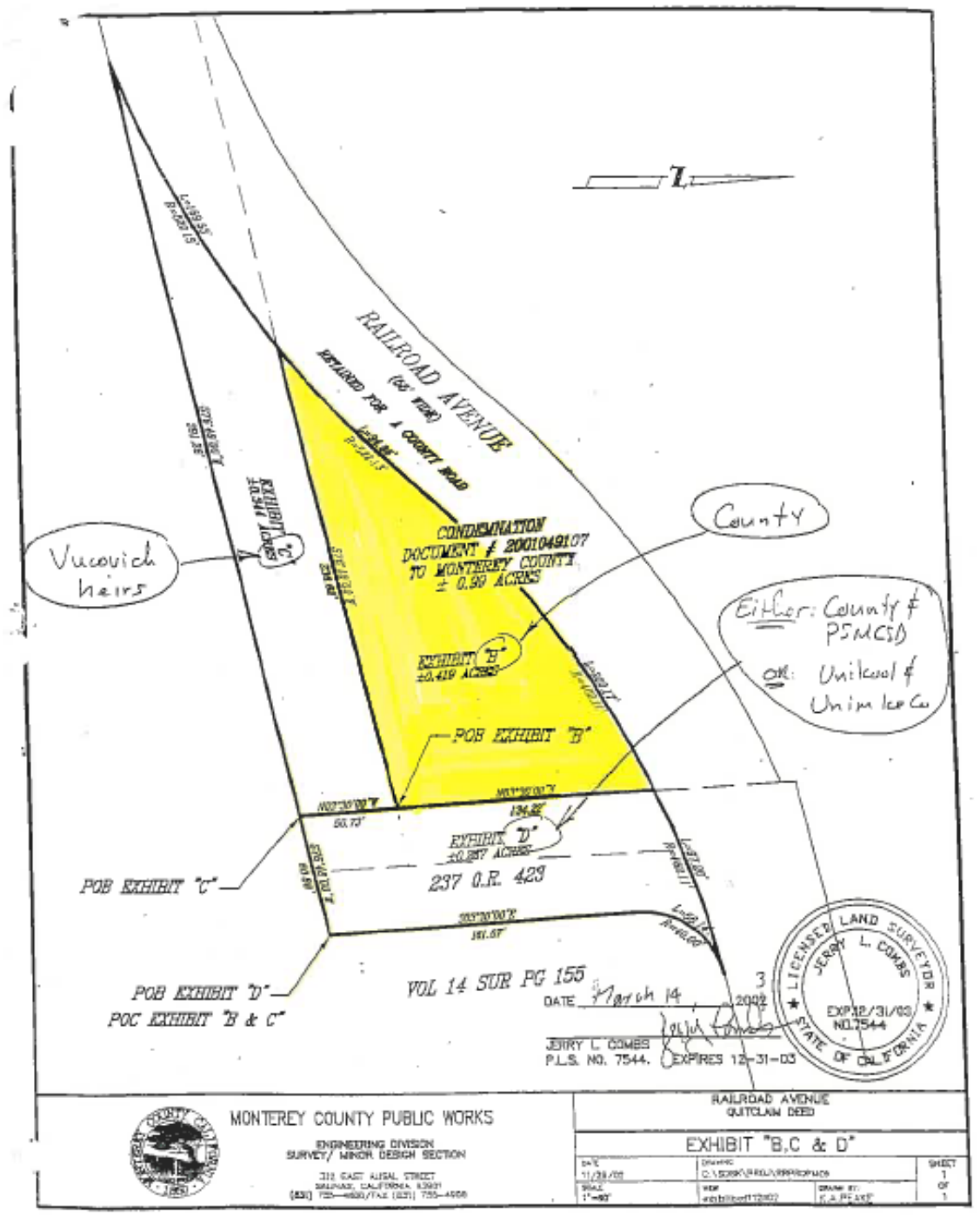


Figure 3.8 Existing and Proposed Tank Site

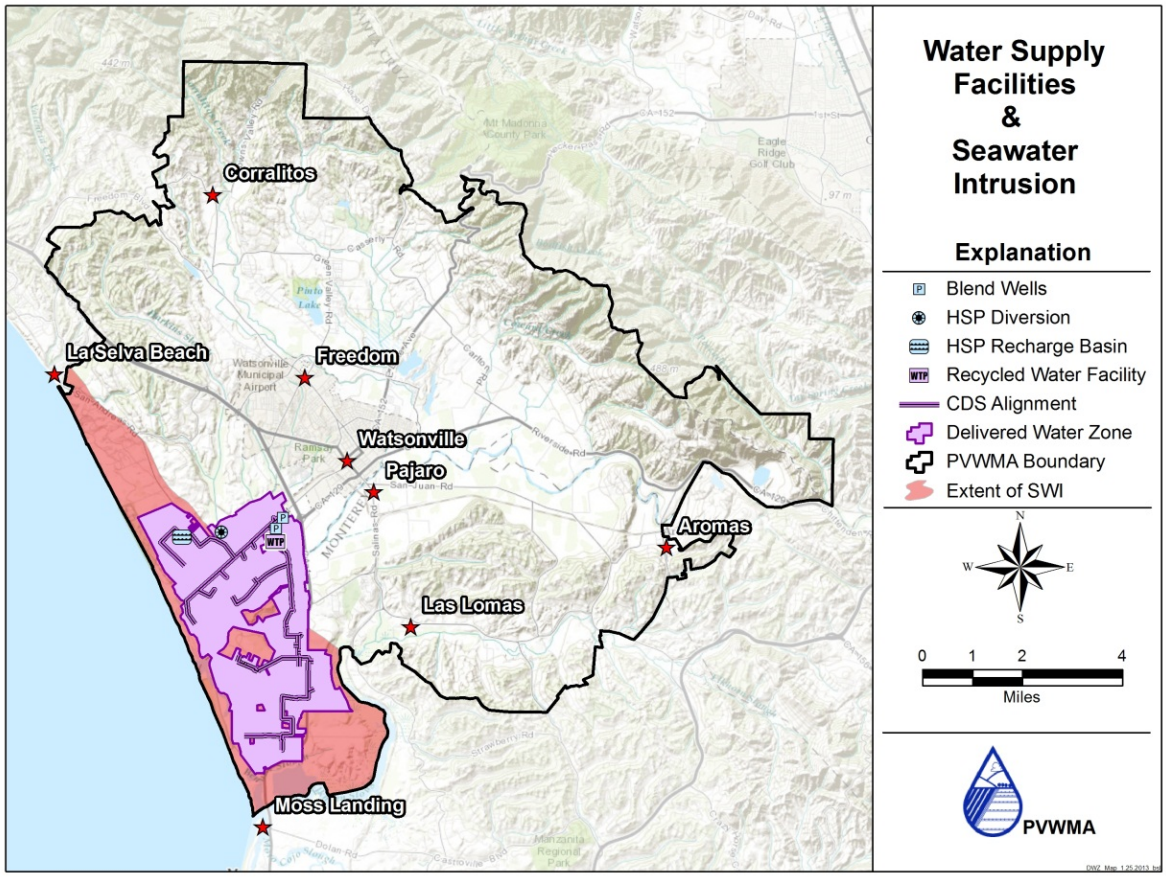
Figure 3.9 Parcel Map



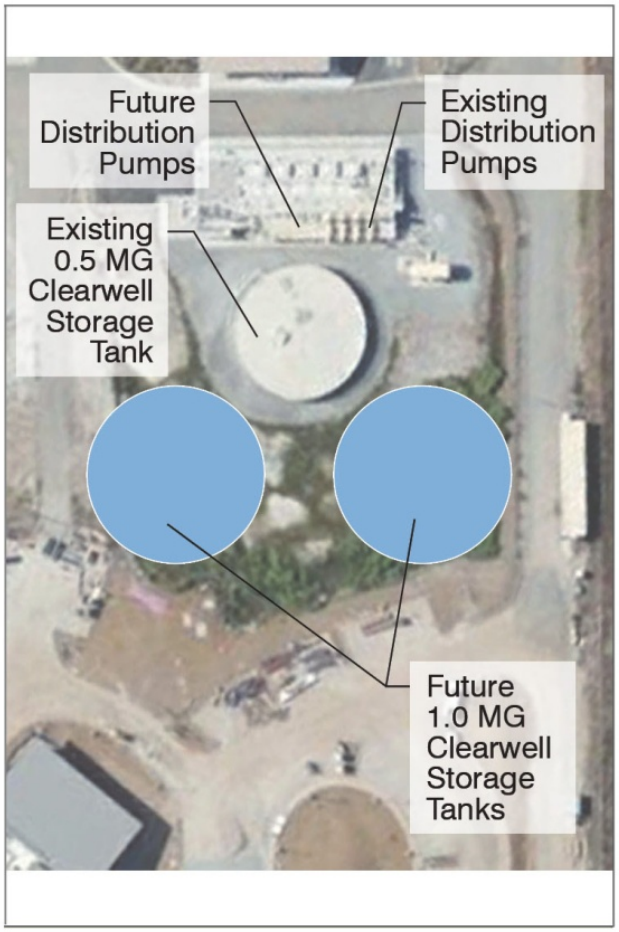
Project 3 Increased Recycled Water Storage Project

Seawater intrusion is contaminating Pajaro Valley's primary source of water and threatening its $800 million agricultural economy. Elevated chloride concentrations in groundwater caused by seawater intrusion were first documented in the Valley in *Bulletin 5,* a 1953 report published by the State Water Resources Board. Long-term overdraft conditions have caused groundwater levels to fall below sea level in places throughout the Valley all year long. The combination of long-term overdraft and continued groundwater extractions has caused seawater to migrate up to three miles inland (Figure 3.10), contaminating numerous extraction wells within the groundwater basin and threatening the productivity of prime agricultural land.

Figure 3.10 Seawater Intrusion & Delivered Water Zone Map



The objective of the Increased Recycled Water Storage Project is to construct two 1 (one) million gallon storage tanks for recycled water with a goal of enabling increased recycled water use by local agriculture. The purpose of this project is to increase recycled water deliveries by approximately 750 AFY by providing nighttime storage to allow for increased recycled water use during the daytime when irrigation demands are greatest.



Completed Work

As described below, work (through October 2013) on the Critical Water Supply System Improvements has been completed under the following tasks:

Task 5. Land Purchase / Easements
Task 6. Assessment and Evaluation
Task 7. Final Design
Task 8. Environmental Documentation
Task 9. Permitting

Task 5. Land Purchase / Easements
Additional land purchase and easements will not be required for the project as it will be located adjacent to an existing storage tank at the recycled water facility.

Task 6. Assessment and Evaluation
Additional storage at the Water Recycling Facility was one of over forty potential projects proposed by stakeholders in the Pajaro Valley and vetted through a PVWMA Board appointed committee (2012 Draft Basin Management Plan Update, Exhibit 7.16). As part of this process a general project description and an engineers cost estimate were developed as well as identification of any implantation issues.

A Draft Preliminary Geotechnical Study (Exhibit 3.3) has been completed and will be finalized prior to notice of grant award. The purpose of the geotechnical field survey was to obtain information on existing surface conditions and performance of surrounding structures in order to evaluate the geotechnical, geologic hazard and seismology aspects of the project. The conclusions indicate that the project is feasible from a geotechnical and engineering geologic standpoint, provided that the conclusions and recommendations presented in this report are incorporated into the project design and specifications.

Deliverables:

Description	Schedule
2012 Draft BMP Update (Exhibit 7.16)	January 2013
Geotechnical Evaluation	April 2013

Task 7. Final Design
Predesign of the project has begun and a preliminary design memorandum has been prepared (Exhibit 7.17). The preliminary project drawing is shown in Figure 3.11. The curves and pump sheets for the pumps are completed (Exhibit 3.4). The project will be in the initial stages of design by October 2013.

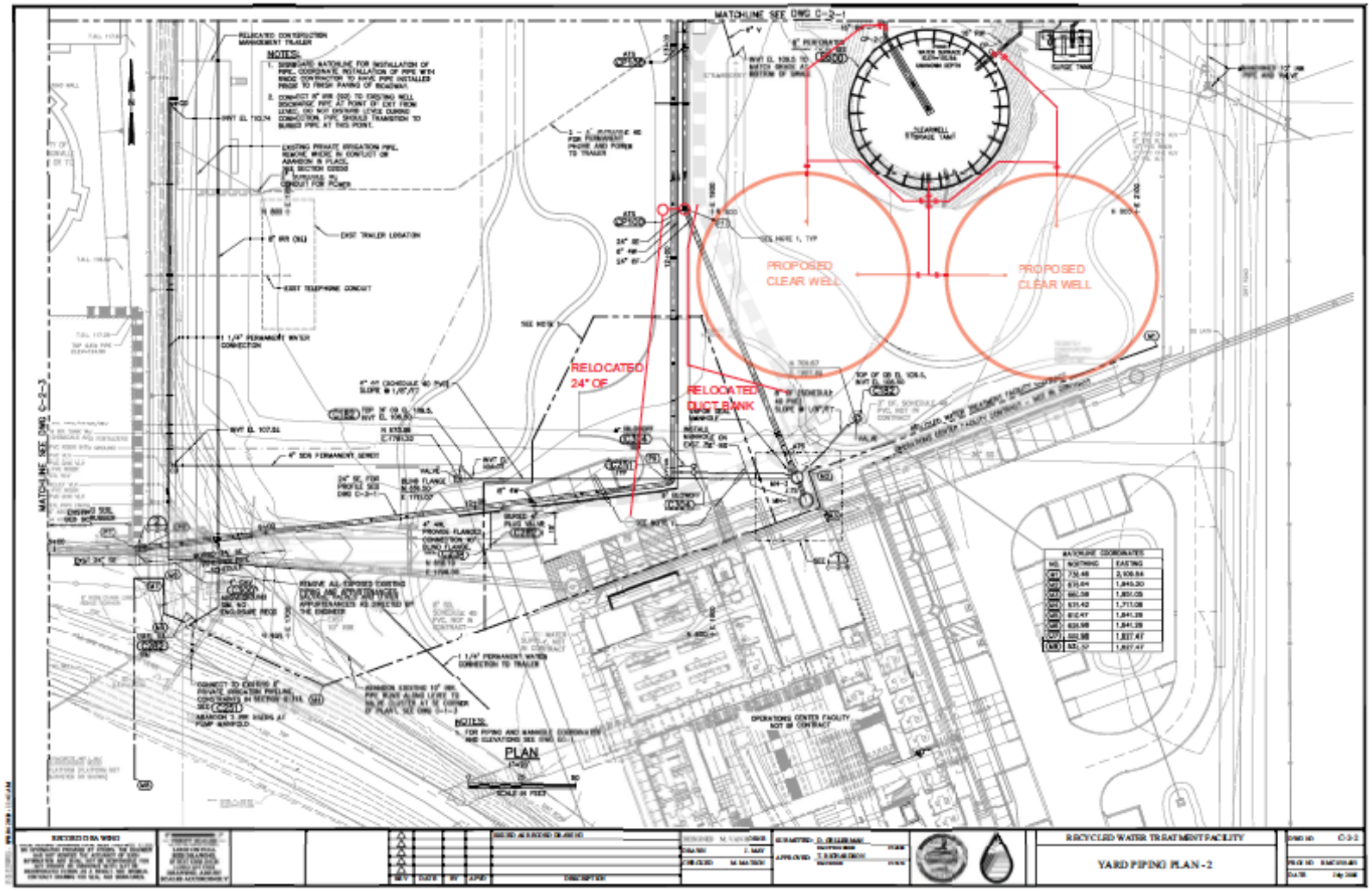
Deliverables:

Description	Schedule
Preliminary Design Memorandum (Exhibit 7.17)	February 2013
Curves and Pump Sheets (Exhibit 3.4)	March 2013

Task 8. Environmental Documentation
The storage tanks were documented in the 2002 BMP Environmental Impact Report (Exhibit 3.4). No additional environmental documentation is required.

Task 9. Permitting
All construction will occur within the existing treatment facility fenceline and will not require any new permits.

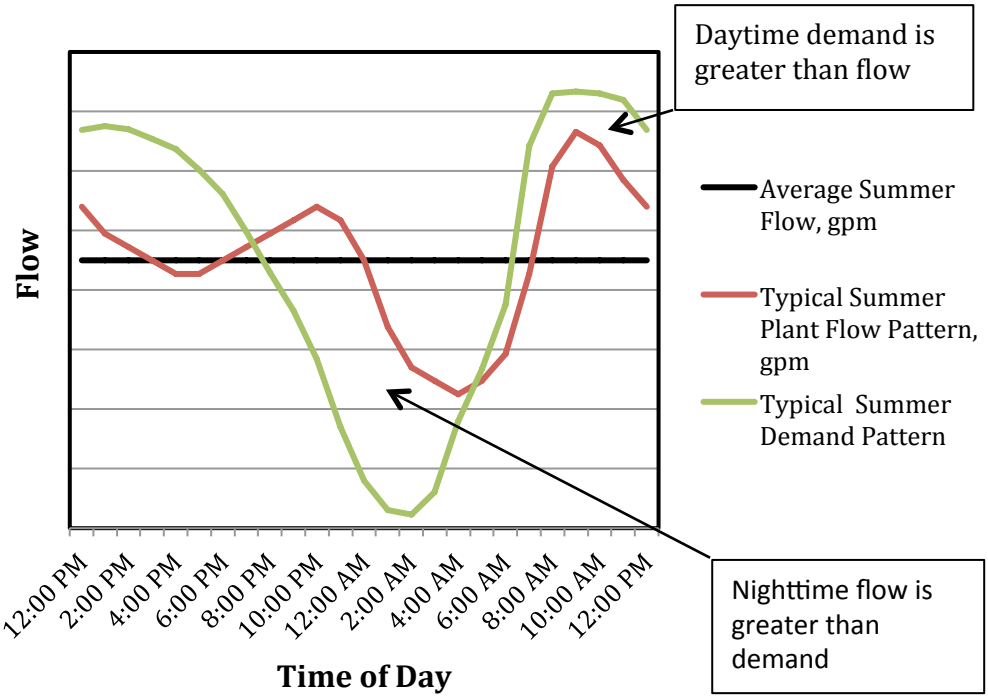
Figure 3.11 Preliminary Project Drawing



Existing Data and Studies

Significant work has been completed to assess the existing treatment plant operations and opportunities for improving those operations. Approximately 2,000 AFY of recycled water supplies are not being used due in part to insufficient nighttime and shoulder period demand. Figure 3.12 shows a typical peak irrigation system recycled water demand and supply pattern. As the figure indicates, during the daytime the irrigation demand is greater than the supply. At night, the pattern is reversed, with the flow to the wastewater treatment plant typically well in excess of the irrigation demand. The purpose of this project is to provide nighttime storage of recycled water for daytime delivery to irrigation users. The increased storage project is estimated to deliver approximately 750 AFY.

Figure 3.12 Typical Summer Demand and Supply Pattern



Project Timing and Phasing

The new tanks are a stand alone project and do not require any future work to deliver the claimed benefits.

Project 4 Pajaro Agricultural Water Quality and Aquifer Enhancement Project

Water is being withdrawn from the Pajaro Valley groundwater aquifer faster than it can be replenished resulting in depressed groundwater levels and coastal seawater intrusion according to the PVWMA Basin Management Plan (Exhibit 1.10). Further, nineteen waterbodies in the Pajaro River Watershed have been 303(d) listed by the USEPA for nitrate and sediment impairments for which agriculture has been listed as a source. To mitigate aquifer overdraft and water quality impairments in the region, there is a need to work with the agricultural community to implement management measures and build capacity to increase groundwater recharge and irrigation and nutrient efficiency.

To meet this need the Resource Conservation District of Santa Cruz County (RCDSCC) proposes the "Pajaro Agricultural Water Quality and Aquifer Enhancement Project" which includes the following components:

- Support the Community Water Dialogue to lead grower-based programs for improved water management
- Implement managed aquifer recharge (Lower Pajaro)
- Develop and implement cost-share and performance-based incentives for water quality and water supply
- Provide a Regional Mobile Lab to provide technical and outreach services to promote improved irrigation efficiency

The programs will be implemented throughout the watershed as depicted in Figure 3.12.

Completed Work

A description of work that has been completed or is expected to be completed by October 2013 is described below for each of the proposed project components.

Community Water Dialogue

The Pajaro Valley Community Water Dialogue began in 2010 as an innovative and positive approach to solving water supply issues in the Pajaro Valley, through shared sacrifice and individual and collaborative actions by diverse stakeholders and community members.

To-date, Community Water Dialogue has partnered with Driscoll's Strawberry Associates and Reiter Affiliated Companies, along with the Resource Conservation District of Santa Cruz County (RCDSCC), USDA - NRCS, the University of California at Santa Cruz, California State University Monterey Bay, the Pajaro Valley Water Management Agency (PVWMA), the City of Watsonville, and landowners, to work collaboratively to develop a series of "managed aquifer recharge" (MAR) projects that will help to improve water supply. The first pilot project was completed in 2011 to recharge excess (rainy season) surface flows into available aquifers. Location-specific strategies were tested for routing runoff, minimizing siltation, cycling nutrients, and achieving other water quality benefits as excess surface water is percolated into

underlying aquifers. Monitoring and quantification of improvements (amount of water put into aquifers, benefits to water quality) are conducted as essential components of these projects.

In addition, the partners in the Community Water Dialogue developed the idea to create a wireless irrigation network (entitled Project WIN) in the Pajaro Valley to help growers improve irrigation efficiency. This project involves installation of soil tension probes and a network of communication towers to transfer data in real time to growers. 15-30% water savings is common amongst growers using this system, with no yield loss or adverse crop effects. There are currently 5 towers and 2 repeaters in the Valley that form the core of this network, with 15 additional repeaters to be installed in the coming months. Creating this central network will drastically reduce the investment required for widespread adoption of this technology to the growers and the RCDSCC acts as the central administrator of the network.

Major tasks, associated with the Community Water Dialogue component that have been completed or are partially completed include:

- **Task 6:** Assessment and Evaluation (Managed Aquifer Recharge)
    - *Outreach to the agricultural community to identify potential managed aquifer recharge sites*

The "**Pajaro Agricultural Water Quality and Aquifer Enhancement Project**" will utilize this forum as a representative group of Pajaro Valley stakeholders to:

- Support and expand efforts of the community water dialog to inform and lead grower-based efforts for irrigation/nutrient management and recharge initiatives
- Hold quarterly forums with growers and property owners to discuss overdraft solutions
- Convene working group meetings to guide implementation of strategies
- Communicate to stakeholders through website, email, etc.

Managed Aquifer Recharge (MAR)

The Pajaro Valley Water Management Agency (PVWMA) and the U.S. Geological Survey completed a regional surface water – groundwater model to assess resource management options for bringing the groundwater basin into hydrologic balance. This complex MODFLOW-based model includes the most detailed and accurate assessment to date of regional aquifer geometries and the nature of land use, confining layers, aquifer properties, and surface water – groundwater interactions.

In 2011, the RCDSCC, in partnership with the University of California, Santa Cruz and the Natural Resource Conservation Service (NRCS) installed a basin to increase recharge from stormwater runoff in the Lower Pajaro Region. This successful pilot project (referred to as basin #1 hereafter) has allowed testing of preliminary modeling to assess managed aquifer recharge benefits and their ongoing potential impact. Results have

shown that different hydrologic scenarios result in different amounts of infiltration and runoff, some of which can be captured and routed into the subsurface to assess the impact of both pilot implementation and development of a basin-wide distributed stormwater capture and managed aquifer recharge approach.

Design, construction, maintenance and monitoring associated with basin #1 has informed a systematic process of intentionally capturing and storing water in aquifers for later reuse and for the benefit of the environment. In addition, research conducted by the Recharge Initiative (UCSC) identified areas within the Pajaro Watershed that may be suitable for managed aquifer recharge and informed the development of a 5 year managed aquifer recharge implementation plan.

Major tasks, associated with the Managed Aquifer Recharge component that have been completed or are partially completed include:

- **Task 11:** Construction
    - *Potential aquifer recharge site map developed by Tess A. Russo (Department of Earth and Planetary Sciences, UCSC)*
    - *Mobile Percolation Testing Lab developed to conduct 10 day tests to quantify percolation rates at potential recharge sites (UCSC)*
    - *Stormwater Capture, Treatment, and Recharge 5 Year Plan for the Pajaro Valley developed by Andrew T. Fisher (UCSC) and Marc Los Huertos (CSUMB)*
    - *RCDSCC and UCSC (Recharge Initiative) have monitored recharge basin #1 since 2011 to inform future methodology*
- **Task 9.** Permitting (Managed Aquifer Recharge)
    - *Partners in Restoration (PIR) Permit Coordination Program developed for Santa Cruz County and the Upper Pajaro Watershed to assist landowners interested in implementing voluntary conservation practices on their lands*
- **Task 12.** Environmental Compliance/Enhancement/Monitoring
    - *Aquifer recharge monitoring framework developed by the Recharge Initiative (UCSC)*
    - *RCDSCC and the UCSC Recharge initiative ran Mobile Percolation Tests at a potential managed aquifer recharge site to determine if it was a good site for implementation*
- **Task 13.** Construction Administration
    - *RCDSCC and the NRCS oversaw successful construction of recharge basin #1 in 2011*

The "**Pajaro Water Quality and Aquifer Enhancement Project**" will build off of this work to:

- Conduct percolation testing at potential recharge sites
- Provide outreach to landowners
- Design , permit, and implement 2 recharge basins in the Lower Pajaro Valley
- Monitor projects and quantify total increase in recharge

Cost-share and Performance Based Incentives
In 2011, the RCDSCC, Sustainable Conservation (SusCon) and Driscoll's implemented a pilot project which developed an innovative model of public and private incentives that motivate growers to improve environmental performance. Working with industry partners and growers, the project has successfully developed a robust framework to: 1) Identify conservation goals related to water quality and water supply in the Pajaro Valley 2) develop a logic framework to be implemented with participating growers that will measure progress to achieving conservation goals and 3) engage growers to implement technical assistance and performance measures.

The RCDSCC is in the process of moving this project into an implementation stage. In 2013, the RCDSCC will start to work with 15+ berry growers to implement Best Management Practices (BMPs), perform cost benefit calculations for BMPs to meet conservation targets and report savings from reduced irrigation and fertilizer inputs.

Major tasks, associated with the above project component that have been completed or are partially completed include:

- **Task 12.** Environmental Compliance Enhancement and Monitoring
  - *Performance Monitoring Framework developed through pilot project*
- **Task 11.** Construction
  - *Technical assistance and performance measures developed in partnership with Driscoll's growers and Technical Advisory Committee members*

The "**Pajaro Water Quality and Aquifer Enhancement Project**" will build off of this work to:

- Identify successful strategies for performance based incentives that are relevant to the Managed Aquifer Recharge and Regional Mobile Lab Programs
- Create public incentive structure with agencies for each program
- Integrate performance based incentive structure into program operations

Mobile Irrigation Lab (MIL)
The RCDSCC started the Irrigation and Nutrient Management (INM) Project in the Pajaro Watershed and Santa Cruz County in 2011. In partnership with the NRCS and the State Water Resources Control Board (SWRCB), the project has since worked with regional agronomists and technical experts to provide 15+ growers with technical

assistance to improve impacts to water quality and supply in the region through improved irrigation and nutrient management.

Since 1999 the Central Coast Agricultural Water Quality Coalition has represented farmers and ranchers in the development and implementation of voluntary, cost-effective, producer-directed programs to protect water quality on the Central Coast. Coalition personnel have been successfully engaging in outreach with agricultural producers throughout the Central Coast region to connect them with irrigation efficiency evaluation services for five years, including leading mobile irrigation lab programs that leveraged partnerships with the University of California, NRCS, private contractors, and Farm Bureaus, Water Districts and RCDs throughout the region. Collectively, these programs have provided irrigation evaluations services to over 100 producers. The RCDSCC will collaborate with the Central Coast Agricultural Coalition to outreach to growers and coordinate with MIL technical advisors.

Major tasks, associated with the above project component that have been completed or are partially completed include:

- **Task 11.** Construction
    - *RCDSCC Pajaro Watershed Agricultural Irrigation and Nutrient Management (INM) Project started in 2011*
    - *The Central Coast Agricultural Coalition, in conjunction with partners, has provided irrigation evaluation services to over 100 growers in the region*

The "**Pajaro Water Quality and Aquifer Enhancement Project**" will build off of this work to:

- Provide outreach to growers
- Conduct Distribution Uniformity, pump efficiency tests, nutrient monitoring and management evaluations, and data analysis, and assist with adaptive management of farming operations
- Provide education and training for irrigators and ranch managers

Existing Data and Studies:

The following assessments/watershed plans document a need for the Pajaro Agricultural Water Quality and Aquifer Enhancement Project:

- PVWMA Basin Management Plan Draft (2012)
    - Describes extent of aquifer overdraft, saltwater intrusion in coastal wells, and impact of overdraft on sustainable water supply for the city of Watsonville, and $800 million dollar agricultural industry that is dependent of the aquifer. The plan determined that there is a need to reduce groundwater pumping by 12,000 AFY and that 5,000 AFY could be accomplished through agricultural water conservation. Conservation

savings are more cost-effective than development of supplemental supplies, with a comparative annual cost of $200/acre foot for conservation as compared to $1,000-3,500/acre foot for supplemental supply projects.

- Pajaro River Watershed Integrated Regional Water Management Plan (2007)
  - Describes an analysis performed showing that recharge efforts are the most cost effective option for meeting future water supply shortages in the region when compared with recycled water and surface water treatment.
- Monterey Bay National Marine Sanctuary Final Management Plan (2008)
  - Describes the need for support for the development and implementation of economically feasible management improvements, and the development of incentives to support implementation of agricultural practices that improve water quality in the region and promote adoption of nonpoint source management practices.
- Central Coast Integrated Water Management Plan (2009)
  - Describes the impact of farming practices on the level of nutrient and toxicity water quality problems in the region and the need to implement irrigation and nutrient practices to reduce nonpoint source pollution into the surface waters.
- Lower Pajaro River Enhancement Plan (2002)
  - Describes the need for continued support and implementation of Mobile Irrigation Labs within the region to reduce the amount of fertilizer and water used to improve water quality and water supply.
- Map of High and Low Priority Recharge Locations in the Pajaro Watershed (2011)
  - This map was developed by Tess A. Russo (Department of Earth and Planetary Sciences, UCSC) to assess placement of managed aquifer recharge sites throughout the coastal area of the Pajaro Watershed.
- Hydrologic System Response to Environmental Change: Three Case Studies in California (2012)
  - Written by Tess A. Russo (Department of Earth and Planetary Sciences, UCSC), describes results from a study that indicate areas within the Pajaro Watershed that may be suitable for managed aquifer recharge (MAR).
- Stormwater Capture, Treatment, and Recharge 5 Year Plan (2012)
  - Written by Andrew T. Fisher (UCSC) and Marc Los Huertos (CSUMB), this document describes proposed work in the Pajaro Valley to mitigate the long-term imbalance between water supply and demand in the region. The document highlights results of preliminary data analysis, established partnerships and potential project areas for managed aquifer recharge initiatives.

Project Timing and Phasing:

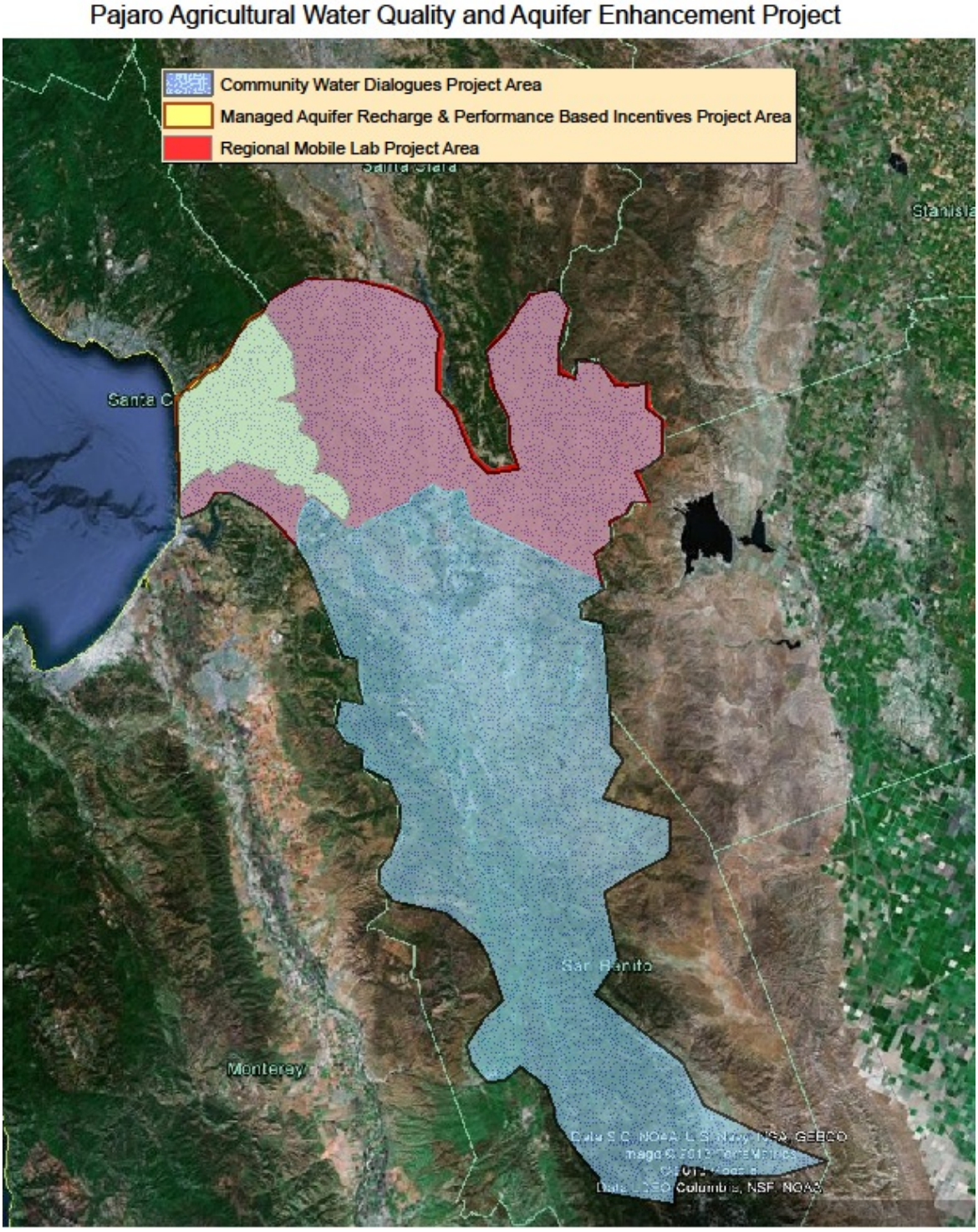
The Pajaro Agricultural Water Quality and Aquifer Enhancement Project is a holistic approach aimed at restoring water quality and water supply in the Pajaro Watershed. The project integrates the support of pre-existing partnerships and programs (Community Water Dialogue, Managed Aquifer Recharge, Performance-based Incentives and the

Mobile Irrigation Lab) while simultaneously expanding on each initiative to increase realized conservation benefits. While the Project builds off of previous smaller projects, grant funded activities are designed to operate on a standalone basis**.**

Grant money awarded would be used to implement and expand upon 2 of the 4 program components, Managed Aquifer Recharge (MAR) and the Mobile Irrigation Lab (MIL). The other two components, Community Water Dialogue and Performance-based Incentives, will provide supporting roles to MAR and MIL by providing a forum for grower outreach and a framework for engaging growers in performance-based incentive structure.

Award of this grant would 1) expand the number of programs/services that growers in the Community Water Dialogue forum have access to 2) advance the integration of performance-based incentives structure into a wider range of irrigation and nutrient management programs within the Pajaro Valley 3) advance the Aquifer Recharge Initiative 5 year plan by implementing and monitoring 2 recharge basins in the Lower Pajaro and 4) increase the number of growers that have access to MIL technical assistance.

Figure 3.12 Pajaro Agricultural Water Quality and Aquifer Project Areas



Proposed Work

The proposed work section will follow the same task order for each of the projects, to help provide consistency and facilitate review. For those tasks that are irrelevant to the project, it will be noted as such in the work plan. The following task numbering will be followed for each project:

Task 1. Administration
Task 2. Labor Compliance Program
Task 3. Reporting
Task 4. Project Performance Monitoring Plan
Task 5. Land Purchase / Easements
Task 6. Assessment and Evaluation
Task 7. Final Design
Task 8. Environmental Documentation
Task 9. Permitting
Task 10. Construction / Implementation Contracting
Task 11. Construction / Implementation
Task 12. Environmental Compliance / Mitigation / Enhancement
Task 13. Construction Administration

Project 1 Hollister Urban Area Water Project

San Benito County Water District (SBCWD) in partnership with the City of Hollister (City) and Sunnyslope County Water District (SSCWD) are proposing to construct an upgrade of the existing Lessalt Water Treatment Plant (WTP), a new pipeline from the Lessalt WTP to the Ridgemark/High Pressure Zone, and the new West Hills WTP. These projects will provide high quality, potable water to the retail customers in the City and SSCWD service areas. These projects will make use of up to 7,280 acre-feet of imported CVP water each year under the SBCWD's existing contract with the USBR.

Task 1. Project Administration

The purpose of this task is to keep the project scope, budget and schedule on track, and to communicate project progress with sponsoring agencies, stakeholders, and the City, Sunnyslope CWD, and other organizations involved with project delivery. This task includes execution and management of all consultant and construction contracts, including the following contracts already in place:

- Lessalt WTP Design and Engineering Services During Construction (ESDCs), Kennedy/Jenks
- Pipeline to Ridgemark/High Pressure Zone Design and ESDCs, Kennedy/Jenks
- WHWTP Design, ESDCs, and Construction Management, HDR Engineering
- CEQA Compliance for Lessalt WTP Upgrade, ESA
- CEQA and NEPA Compliance, and Environmental Permitting for West Hills WTP, ESA

SBCWD, and its designated Program Manager, has and will continue to be responsible for the daily management of the project under this task. Work under this task includes preparation of grant invoices and project agreements associated with project implementation.

The Project Administration task is an on-going task. Project status updates are prepared on a monthly basis in response to the various stakeholders and their meeting schedules. As milestones are met, the project manager documents and notifies sponsoring agencies and stakeholders.

Grant funding is not being requested for this work.

Deliverables:

Description	Schedule
Executed Construction Contract, West Hills WTP	July 2014
Project Baseline Schedule and Updates	November 2013
Monthly Project Budget and Schedule Updates	Monthly
Grant Invoices	Quarterly

Task 2. Labor Compliance Program

The SBCWD has an existing Labor Compliance Program consistent with subdivision (b) of Labor Code Section 1771.5. This task involves the work needed to demonstrate compliance with state labor laws. SBCWD will ensure compliance with state labor codes in three ways:

- SBCWD will submit to the State a letter with associated exhibits documenting compliance with relevant Labor Code requirements.
- The construction contract special provisions will state that adherence to Caltrans State Standard Specifications is required. Section 7 of the State Standard Specifications addresses the requirements of the State labor code for Public Works projects.
- The Construction Manager reviews the contractor's payroll submittals for labor compliance as required in the State Standard Specifications.

Grant funding is not being requested for this work. No work on this task will occur until award of grant funding for the project.

Deliverable:

Description	Schedule
Labor Compliance Documentation	November 2013

Task 3. Reporting

SBCWD is the project sponsor and will be the grant administrator, if awarded. The general grant administration activities are described as the final task in the work plan. This task addresses only the grant reporting activities required for the project. In support of the IRWM Implementation Grant administration, quarterly project reports will be prepared that describes the progress and accomplishments for the quarter and is in accordance with the Project Performance Monitoring Plan as described in Task 4. An assessment of the project schedule and budget, and updated schedules and budgets, if appropriate, will also be included. Following project close-out, SBCWD will prepare a Final Project Completion Report summarizing the project implementation, demonstrating completion of all task items, and documenting the project costs and grant distributions. The Final Report will be submitted within 90 days of project completion (including environmental mitigation and compliance work). The quarterly reports and final reports shall be prepared consistent with State grant guidelines.

A Post Completion Report will be prepared and submitted within ninety (90) calendar days after the first operational year of the project. The report will describe the project performance and performance monitoring results in accordance with the Project Performance Monitoring Plan. In subsequent years, the Post Completion Report will be prepared and submitted no later than March 15 of each year. The reporting will occur annually for a total of 10 years after the completed project begins operation.

As required for Proposition 84 funded projects, PSMCSD will provide tribal notification consistent with PRC Section 75102.

Grant funding is not being requested for this task.

Deliverables:

Description	Schedule
Tribal Notification Letter	November 2013
Quarterly Reports	Quarterly
Final Project Completion Report	November 2016
Post Completion Report	November 2017

Task 4. Project Performance Monitoring Plan

The Project Performance and Monitoring Plan (PPMP) will be prepared at the initiation of project implementation to outline how the project performance will be assessed and evaluated, consistent with Attachment 6. The PPMP will lay out an evaluation and assessment process based on the Pajaro River Watershed Integrated Proposal goals and outcomes and the specific objectives of the HUA Water Project.

There are three project goals that the completed project will be evaluated against to determine the projects performance.

> Goal #1 – Improve the quality of municipal water, industrial supply, and recycled water for urban and agricultural users.
>
> Goal #2 – Improve the reliability of the existing imported CVP water supply.
>
> Goal #3 - Achieve the respective salinity Waste Discharge Requirements of the Hollister Water Reclamation Facility (WRF) and Sunnyslope Ridgemark Wastewater Treatment Plant (WWTP).

Performance will be measured through comparison of pre-project baseline potable water quality, historical M&I use under the existing USBR CVP contract, and wastewater effluent quality. This data collection is part of existing data collection and data management programs, satisfying CDPH, RWQCB and USBR data collection and reporting programs. More details of the proposed measurement tools and methods can be found in Attachment 6.

Grant funding is not being requested for this task.

Deliverable:

Description	Schedule
Project Performance Monitoring Plan	December 2013

Task 5. Land Purchase / Easement
All improvements made and facilities constructed for the HUA Water Project will be constructed on property owned by SBCWD, the City, or SSCWD and within existing easements, County right-of-way and USBR right-of-way. Thus, the project will not require purchase of land or easements.

Task 6. Assessment and Evaluation
All planning and study work under this task has been completed or will be completed prior to the final award of the grant. Please see the Completed Work section for details and deliverables. There is no further work proposed for this task.

Task 7. Final Design
The respective design packages and estimates for the Lessalt WTP Upgrade and Pipeline to Ridgemark / High Pressure Zone have been or will be completed prior to the final award of the grant. The 100% design drawings for the Pipeline to Ridgemark / High Pressure Zone have been included. The 95% design drawings for the Lessalt WTP Upgrade have been included. Although the design of the West Hills WTP has not yet begun, the 50% Design Submittal will also be completed prior to the award of the grant. Please refer to the Completed Work section for details and deliverables.

The remaining design tasks activities are required to take the West Hills WTP to final design. The engineer will prepare and submit the 90% design drawings, specifications, and engineer's estimate of probable cost. 181 drawings are anticipated. The final bid set will include final drawings (181 drawings are anticipated) and specifications ready for advertising for bids in accordance with final review comments. Drawings will be prepared in AutoCAD. Design plans will be developed utilizing industry standard scales, in English (not metric) engineering units. Specifications will be prepared in Construction Specifications Institute (CSI) format.

Grant funding is not being requested for this task.

Deliverables:

Description	Schedule
West Hills WTP, 90% Design Plans, Specifications and Estimate	December 2013
West Hills WTP, Final Design Plans, Specifications and Estimate	February 2014

Task 8. Environmental Documentation
The environmental documentation for the Lessalt WTP Upgrade and Pipeline to Ridgemark / High Pressure Zone have been or will be completed prior to the final award of the grant. In addition, environmental documentation for West Hills has been initiated, but is not yet complete. Please refer to the Completed Work section for details and deliverables.

The remaining environmental documentation tasks yet to be completed include the Final Environmental Impact Report (CEQA) and Environmental Assessment (NEPA) for the West Hills WTP.

As describe in the Completed Work section, the SBCWD has retained a consultant to prepare an EIR for the West Hills WTP. The consultant will prepare the Final EIR with the following topical sections: Land Use and Agriculture; Geology, Soils, and Seismicity; Water Resources; Biological Resources; Cultural and Paleontological Resources; Air Quality and Greenhouse Gas Emissions; Noise and Vibration; Traffic; Visual Resources; Energy and Utilities; Hazards and Hazardous Materials; Alternatives Analysis; Cumulative Impacts; and Growth Inducement and Secondary Impacts of Growth. The consultant will also prepare a mitigation monitoring and reporting program and certification materials.

As describe in the Completed Work section, the SBCWD has retained a consultant to assist the USBR in incorporating the analysis from the EIR into the Environmental Assessment. This task includes supporting the USBR to update and finalize the Draft EA following the public comment period. The USBR will prepare the Finding of No Significant Impact.

Grant funding is not being requested for this task.

Deliverables:

Description	Schedule
West Hills WTP Final EIR	December 2013
West Hills WTP Final EA and FONSI	February 2014

Task 9. Permitting

Permits for the Lessalt WTP Upgrade and Pipeline to the Ridgemark / High Pressure have been or will be completed prior to the final award of the grant. Please refer to the Completed Work section for details and deliverables.

The remaining permitting tasks yet to be completed include permitting for the West Hills WTP only. Local, state, and federal permits will be required for design, construction, and operation of the West Hills WTP project. This task assumes that the federal, state, and local permits listed below will be required for design, construction, and operation of the facility.

- National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction Activity.
- USBR MP620
- Building Permit.
- County Grading Permit
- Encroachment Permit.
- Domestic Water Supply Permit.

- Authority to Operate Permit.

This task includes the preparation of the necessary permit applications and coordination with the respective permitting agencies.

Grant funding is not being requested for this task.
Deliverables:

Description	Schedule
USBR MP 620 Permit	February 2014
Building Permit	February 2014
Construction Stormwater Permit (NPDES)	March 2014
Grading Permit (County)	March 2014
Encroachment Permit (County)	March 2014
Water Supply Permit (Cal. Dept. of Public Health)	April 2015
Operations Plan (Cal. Dept. of Public Health)	April 2015

Task 10. Construction Contracting
Construction Contracting for the Lessalt WTP Upgrade and Pipeline to the Ridgemark / High Pressure will be completed prior to the final award of the grant. Please refer to the Completed Work section for details and deliverables.

This task includes the construction contracting activities required for the West Hills WTP component of the HUA Water Project. Activities will include preparing and advertising bid documents; preparation for and facilitation of a pre-bid contractors meeting; evaluation of bids; and contract award at a SBCWD Board Meeting.

Grant funding is not being requested for this task. No work has or will be started on the West Hills WTP until grant funding award.

Deliverables:

Description	Schedule
West Hills WTP Advertisement	March 2014
Pre-Bid Meeting Summary	April 2014
Bid Summary	June 2014

Task 11. Construction: As previously described, the Lessalt WTP Upgrade and Pipeline to the Ridgemark / High Pressure are planned to be awarded as one combined project. However, the construction tasks for each are described separately in Subtasks 11.1 and 11.2 below. The construction tasks for the West Hills WTP are described in Subtask 11.3.

Subtask 11.1 Lessalt WTP Upgrade
Construction of the project will begin after the contractor has been chosen, the contract awarded and compliance with any necessary pre-construction permit conditions (e.g. construction easements, worker training).

Construction of the project will proceed in the following manner:

Subtask 11.1.1 Mobilization, Establishing Laydown Areas, Establishing Storm Water BMPs

Subtask 11.1.2 Clearing, Grubbing, Fencing, Grading and Site Preparation

Subtask 11.1.3 Treatment Plant Construction. Disturbances related to construction for the improvements to the existing Lessalt WTP will be less than 1 acre, and will be confined to the existing site property. Construction of the improvements at the existing Lessalt WTP would include the following stages/operations:

The Contractor will construct, disinfect and test the new Treated Water Tank, high zone pumps, middle zone pumps and washwater supply pump systems. Construction of the Treated Water Tank and pump stations will require installation of a concrete equipment pad and tank foundation to support the equipment. This equipment includes a welded steel tank, piping, flow control valves, isolation valves, flow meters, air release valves, pumping equipment, plus associated electrical facilities. Electrical power will be provided to the tank and pump station equipment. The tank and pump stations will be connected to the Lessalt WTP Supervisory Control and Data Acquisition (SCADA) system.

The Contractor will next construct, disinfect and test the new source water (SW) piping and chemical feed systems, the Greensand Roughing Filters, the GAC Filters, the Spent Washwater (SWW) Tank and SWW pump systems using the source water from the suction side of Pump Station 9L. The filter systems and tank will require installation of a concrete equipment pad and tank foundation to support the equipment. This equipment includes five horizontal pressure vessels, a welded steel tank, piping, flow control valves, isolation valves, flow meters, air release valves, pumping equipment, plus associated electrical facilities. Electrical power will be provided to the filters, tank and pump station equipment. The filters, tank and pump stations will be connected to the Lessalt WTP Supervisory Control and Data Acquisition (SCADA) system.

Site improvements at the Lessalt WTP will include new fencing, new gravel ground cover, and re-paving of the existing access roads.

Subtask 11.1.4 Potable Distribution Connection. The Contractor will connect the high zone pump station to the new high zone potable distribution pipeline (See Subtask 11.2). This equipment includes piping, an isolation valve, and air release valves.

Subtask 11.1.5 Lessalt WTP Improvements & Pipeline Performance Testing
After completion, new improvements to the Lessalt WTP will be started up and tested for required performance per construction contract and manufacturer

recommendations. Temporary piping, pumps, electrical & other equipment may be installed as part of this testing and start up. Testing and start up may be phased and in portions for each subtask, or together.

After all systems and facilities have been tested as appropriate, potable water can be sent to the City and SSCWD distribution systems. Final Plant Acceptance testing shall begin, per construction contract, California Department of Public Health, SSCWD, and City requirements.

Subtask 11.1.6 Post-construction Site Restoration and Demobilization.

Subtask 11.2 Pipeline to Ridgemark / High Pressure Zone

Construction of the project will begin after the contractor has been chosen, the contract awarded & compliance with any necessary pre-construction permit conditions (e.g. construction easements, worker training). This subtask will be bid together with the Lessalt WTP Upgrade (Subtask 11.1).

Construction of the project will proceed in the following manner:

Subtask 11.2.1 Mobilization and Site Preparation. This task consists of bringing all the pipe, water valves, water appurtenances, backfill, equipment, construction trailer office, and personnel to begin the construction of the transmission pipeline from Lessalt to the Ridgemark / High Pressure Zone. There is no grading needed for the construction of the pipeline. The entire pipeline is located in the existing public right of way for Fairview Road. It is anticipated that the contractor will locate a construction trailer at the Lessalt Treatment Plant in order to supervise the construction of the pipeline in Fairview Road.

Subtask 11.2.2 Pipeline Installation. The pipeline installation will consist of building a 16-inch diameter pipeline in the Fairview Road public right of way under an encroachment permit issued by San Benito County. Construction of the pipeline will be done in accordance with the specification of the SSCWD, while all traffic control and road section replacement will be done in accordance with San Benito County policies and procedures.

Subtask 11.2.3 Performance Testing and Demobilization. The pipeline installation shall be disinfected and pressure tested in accordance with AWWA standards. Upon completion of the project, all materials not used by the project shall be removed, and the construction office trailer shall be removed by the contractor.

Subtask 11.3 West Hills WTP

Construction of the project will begin after the contractor has been chosen, the contract awarded & compliance with any necessary pre-construction permit conditions (e.g. biotic surveys, establishing biotic exclusionary structures, worker training)

Construction of the project will proceed in the following manner:

Subtask 11.3.1 Mobilization, Establishing Laydown Areas, Establishing Storm Water BMPs

Subtask 11.3.2 Clearing, Grubbing, Fencing, Grading and Site Preparation

Subtask 11.3.3 Supply Connection to USBR Hollister Conduit. Construction of the Supply Connection to USBR Hollister Conduit will require installation of a concrete vault to house the turnout equipment. This equipment includes piping, an actuated flow control valve, isolation valves, flow meter, air release valves, pumping equipment, plus associated electrical facilities. To incorporate the turnout into the Hollister Conduit system, a Supervisory Control and Data Acquisition (SCADA) system will be connected to an existing power source and backup power supply will be installed.

Subtask 11.3.4 Raw Water Pipeline Installation. Supply Pipeline Installation will include installation of a 20 inch raw water pipeline from the new supply connection, at the Hollister Conduit, to the new treatment plant site within the existing Richardson Road right-of-way and pipeline easement. This will include trench excavation, pipeline installation, and trench fill with appropriate compaction.

Subtask 11.3.5 Treatment Plant Construction. Disturbances related to construction for the new treatment plant will be approximately 7 acres. The treatment plant plus appurtenant facilities will have a footprint within those 7 acres.

Treatment at the proposed plant would include the following stages/operations: pretreatment, filtration, filtration backwash, chemical dosing (for pre-oxidation, pH control, disinfection, and treatment process optimization), solids handling, and treated water storage. Equipment and facilities will include tanks, pipes, valves, chemical storage areas, chemical feed systems (including associated tanks, piping, pumps, mixing equipment plus appurtenances), media filters (including washwater facilities, piping, and pumps), filter washwater basins, drying beds, plus a pre-stressed concrete 0.55 MG finished water storage tank.

Appurtenant to these treatment facilities will be an Administration & Operations Building which will be constructed to house a control room with SCADA system, water quality laboratory, maintenance workshop, plus electrical supply equipment & facilities for the plant.

Additionally, Richardson Road would be improved, from Union Road to the treatment plant, within the Richardson Road right of way. Currently Richardson Road is a 12-foot wide unpaved driveway used to access homes south of the treatment. Richardson Road will be improved to a 20-foot wide paved road to provide adequate access to the treatment plant site.

Subtask 11.3.6 Potable Pipeline Installation. Potable Water Pipeline Installation will include installation of a 20 inch potable gravity pipeline from the 0.55MG potable water storage tank, to the City of Hollister potable distribution pipeline within the existing Richardson Road and Nash Road right-of-ways. This will include trench excavation, pipeline installation, trench fill with appropriate compaction, and road repaving as appropriate.

Subtask 11.3.7 Potable Distribution Turnout & Connection. Construction of the Potable Distribution Turnout and Connection will require installation of a concrete vault to house the turnout equipment. This equipment includes piping, an actuated flow control valve, isolation valves, and air release valves. To incorporate the turnout into the new treatment plant & existing potable distribution system, a SCADA system will be connected to an existing power source and backup power supply will be installed

Subtask 11.3.8 Performance Testing. After completion, new Potable Plant and Pipeline facilities will be started up and tested for required performance per construction contract and manufacturer recommendations. Temporary piping, pumps, electrical & other equipment may be installed as part of this testing and start up. Testing and start up may be phased and in portions for each subtask, or together.

After all systems and facilities have been tested as appropriate, potable water can be sent to the City of Hollister distribution system. Final Plant Acceptance testing shall begin, per construction contract, California Department of Public Health, and City requirements.

Subtask 11.3.9 Post-construction Site Restoration and Demobilization

Grant funding is being requested for this task. No work has been or will be started until grant funding award.

Deliverables:

Work and deliverables associated with construction reporting and documentation are included in Task 13 Construction Administration.

Task 12. Environmental Compliance / Mitigation / Enhancement

Subtask 12.1 Lessalt WTP and Pipeline to Ridgemark / High Zone

The Lessalt site is already developed and does not support wildlife habitat. Mitigation requirements are associated with ensuring any wildlife present in adjacent dryland agricultural lands are not directly or indirectly impacted by project construction. Pre-construction surveys are required for burrowing owl, San Joaquin kit fox, horned lark, loggerhead shrike, and badgers. Contract specifications include implementation of an erosion control plan and requirements to minimize noise and dust exposure. Cultural

resources monitoring will be conducted during site grading/excavation activities. Lighting would also be designed to minimize excessive light or glare effects onto adjacent properties

Subtask 12.2 West Hills WTP
Development of the site will require compensation of habitat that would be lost on-site. Species of concern include California tiger Salamander, San Joaquin kit fox, and burrowing owl. Because only a portion of the site would be developed, habitat compensation may be accomplished on-site. If accomplished on-site, a conservation easement would be established on the remaining undeveloped portion of the site. Specific improvements will be identified in a conservation easement management plan, but are expected to include fencing and invasive plant control. Habitat monitoring and maintenance conducted on an annual basis would include maintaining fencing, grazing and vegetation. The conservation easement would include an existing seasonal wetland located adjacent to the proposed facilities. If compensatory mitigation is provided off-site, mitigation would be provided through the development of a conservation easement (and associated habitat improvements) at an appropriate site, or mitigation credits purchased from an available mitigation bank. Under this option, the on-site seasonal wetland would be preserved and protected.

Other mitigation requirements include: pre-construction surveys for wildlife; pre-construction surveys for cultural and paleontological resources; integration of site drainage best management practices (e.g. vegetated swales); implementation of a traffic control plan; construction of noise barriers at exposed fans and pumps; implementation of noise controls during construction; slope stability evaluation; utility identification and protection measures; site maintenance; and landscaping with native shrubs and grasses.

Grant funding is not being requested for this task. No work has or will be started until grant funding award.

Deliverables:

Description	Schedule
Documentation of Mitigation Activities	Ongoing during construction

Task 13. Construction Administration
Construction Management will occur for the duration of the construction period. The SBCWD will be responsible for development, negotiation and securing all contracts, including construction contractors, construction managers, and environmental monitoring consultants. There are two main components of this task, including:

- **Construction Management** – The construction manager(s) will be responsible for:
    - Providing assistance during the bid period;
    - Provide on-site representation for the San Benito CWD;

  - Perform quality assurance and control practices on the work performed; and
  - Analyze and provide recommendations on contractor claims.
  - Maintain construction contract budget, approve contractor pay requests, construction documentation.
  - Oversees environmental mitigation implementation.

- **Engineering Services During Construction (ESDC)** – Engineering services will be contracted with the design engineering firm. The engineer will be responsible for:
  - Performing submittal review;
  - Responding to contractor requests for information;
  - Issuing clarifications;
  - Recommending change orders to the owner; and
  - Creating as-built records for the project based on construction documentation.

The Construction Manager will also be responsible for reviewing the contractor's payroll submittals for labor compliance as required in the State Standard Specifications and Labor Compliance Program.

No work has or will be started for the West Hills WTP until grant funding award. Some limited construction management for the Lessalt WTP Upgrade and Pipeline to the Rigemark / High Pressure Zone will be provide prior to grant award. It is understood that construction management services prior to grant aware are not eligible for reimbursement.

Grant funding is not being requested for this task.

Deliverables:

Description	Schedule
Monthly Construction Progress Reports	Ongoing during Construction
ESDC Documentation	Ongoing during Construction
Notice of Completion – Lessalt WTP and Pipeline	July 2014
As Built Drawings – Lessalt WTP and Pipeline	July 2014
Notice of Completion – West Hills WTP	August 2016
As Built Drawings – West Hills WTP	August 2016

Project 2 Critical Water Supply System Improvements for Pajaro

Pajaro Sunny Mesa Community Services District (PSMCSD) currently serves a total of 453 connections in the Pajaro community. The Pajaro system consists of a single 1,500 gallon per minute (gpm) well, one above-ground 600,000 gallon welded steel storage tank, and a booster pump system utilizing hydropneumatic tanks. This design severely limits the operational flexibility of the system. If the existing tank is taken out of service for repairs or in case of an emergency, there is no back-up storage for the system. Also, the existing tank is over 30 years old and in need of maintenance.

The new facilities for the project will be limited to a new 600,000 gallon welded steel water storage tank and the piping associated with integrating this new tank into the existing water supply system infrastructure.

Task 1. Project Administration
The purpose of this task is to keep the project scope, budget and schedule on track. This task includes execution and management of all design consultant and construction contracts.

PSMCSD will continue to be responsible for the daily management of the project under this task. Work under this task includes preparation of grant invoices and project agreements associated with project implementation. The Project Administration task is an on-going task.

Deliverables:

Description	Schedule
Design Contract	November 2013
Construction Contract	June 2014
Monthly Project Budget and Schedule Updates	Monthly
Grant Invoices	Quarterly

Task 2. Labor Compliance Program
The PSMCSD will develop a Labor Compliance Program consistent with subdivision (b) of Labor Code Section 1771.5. This task involves the work needed to demonstrate compliance with state labor laws including the construction contract special provisions stating that adherence to Caltrans State Standard Specifications is required. Section 7 of the State Standard Specifications addresses the requirements of the State labor code for Public Works projects.

No work on this task will occur until award of grant funding for the project.

Deliverable:

Description	Schedule
Labor Compliance Plan	December 2013

Task 3. Reporting

This task includes the grant reporting activities required for the project per the DWR Grant Agreement requirements. In support of the IRWM Implementation Grant administration, quarterly project reports will be prepared that describes the progress and accomplishments for the quarter and is in accordance with the Project Performance Monitoring Plan as described in Task 4. An assessment of the project schedule and budget, and updated schedules and budgets, if appropriate, will also be included. Following project close-out, PSMCSD will prepare a Final Project Completion Report summarizing the project implementation, demonstrating completion of all task items, and documenting the project costs and grant distributions. The Final Report will be submitted within 90 days of project completion (including environmental mitigation and compliance work). The quarterly reports and final reports shall be prepared consistent with State grant guidelines.

A Post Completion Report will be prepared and submitted within ninety (90) calendar days after the first operational year of the project. The report will describe the project performance and performance monitoring results in accordance with the Project Performance Monitoring Plan. In subsequent years, the Post Completion Report will be prepared and submitted no later than March 15 of each year. The reporting will occur annually for a total of 10 years after the completed project begins operation.

As required for Proposition 84 funded projects, PSMCSD will provide tribal notification consistent with PRC Section 75102.

Deliverables:

Description	Schedule
Tribal Notification Letter	November 2013
Quarterly Reports	Quarterly during Implementation
Final Project Completion Report	September 2015
Post Completion Report	September 2016

Task 4. Project Performance Monitoring Plan

The Project Performance and Monitoring Plan (PPMP) will be prepared at the initiation of project implementation to outline how the project performance will be assessed and evaluated, consistent with Attachment 6. The PPMP will lay out an evaluation and assessment process based on the Pajaro River Watershed Integrated Proposal goals and outcomes and the specific objectives of the Critical Water Supply System Improvements for Pajaro.

There are three project goals that the completed project will be evaluated against to determine the projects performance.

Goal #1 – Provide 600,000 gallons of critical water supply storage.

Goal #2 – Improve public health and safety.

Goal #3 – Improve water supply reliability, enhanced water system resilience and more robust infrastructure.

Data collection for this task is part of the existing data collection, management and reporting program already implemented to satisfying CDPH requirements. More details of the proposed measurement tools and methods can be found in Attachment 6.

Deliverable:

Description	Schedule
Project Performance Monitoring Plan	December 2013

Task 5. Land Purchase / Easement
The parcel where the new tank will be constructed is on land acquired by Monterey County as part of the relocation project for Railroad Avenue. The County subsequently gave this parcel to the PSMCSD for use as a water tank site. The parcel map is Figure 3.9 in the completed work section. No additional land is required. PSMCSD owns all the property necessary for construction.

Task 6. Assessment and Evaluation
The preliminary engineering report has been completed for this project (Exhibit 7.13). Additionally, a tank inspection survey was completed in February 2013 (Exhibit 7.14). The DVD and report from this survey was evaluated and used to assess the condition of the existing tank. Preliminary engineering work that must still be performed includes:

- A detailed site topographic survey
- A site specific geotechnical evaluation

Deliverables:

Description	Schedule
Site Topographic Survey	December 2013
Geotechnical Evaluation	December 2013

Task 7. Final Design
At this time only the preliminary engineering report is completed.

The design consultant, Kennedy/Jenks Consultants, will develop the plans at the 60% and 100%.

The 60% plans will include plan, profile and section sheets that show the overall tank design and yard piping from the new tank to the old tank and to the pump station. Detailed sheet will not be prepared at this time and only a list of specifications will be developed. The 60% design will be reviewed by PSMCSD and incorporated into the 100% plans. The 100% plans will be complete plans and specifications that can be used for bidding purposes.

Kennedy/Jenks Consultants has designed numerous steel water storage tanks throughout California. AWWA standards D100 and D102 relative to the design, erection, and coating steel tanks will be used during the design process as well as past experience from other projects.

Specifications will be developed based on the 2008 Vega Water System Project developed by Kennedy/Jenks. This representative $2,500,000 project consisted of over 10,000 feet of 10-inch water line; fire hydrants and replacement of over 100 household services. This project also included two pump stations and 3 bolted steel water tanks.

Deliverables:

Description	Schedule
60% Design	March 2014
Final Plans and Specifications	June 2014

Task 8. Environmental Documentation

It is anticipated that a mitigated negative declaration based on an Initial Study will be sufficient. As shown on Figure 3.8, the site is a small site bordered by the PSMCSD existing tank site, railroad tracks and a County Road (Railroad Avenue). In addition, excavated soil from another project was stockpile by Monterey Count on this site in anticipation of this tank project.

Deliverables:

Description	Schedule
Mitigated Negative Declaration	March 2014

Task 9. Permitting

The only permit required for this project would be an encroachment/driveway permit from Monterey County. The PSMCSD is exempt from Monterey County planning and building permits.

Plans will be submitted to the CDPH, but no formal permit is required.

Deliverables:

Description	Schedule
Encroachment Permit	April 2014

Task 10. Construction Contracting
Construction contracting will follow the same procedures used in the bidding of the recently completed PSMCSD Vega Mutual Water Project and that are common to public works projects in California. These steps include:

- Placing of legal notices of a public works project and allowing a 30-45 day bid period
- Holding a pre-bid meeting of interested bidders
- Issuance of addenda
- Public opening of the bids
- Bid evaluation and recommendation of the lowest responsible bidder
- PSMCSD Board of Directors accepting recommendation and formally awarding contract
- Signing of the contract after insurance and bonding requirements have been met by the contractor.

Deliverables:

Description	Schedule
Advertisement, Pre-Bid Meeting Summary, Bid Summary	July 2014
Notice to Proceed	July 2014

Task 11. Construction: The required construction activities are as follows:
- Subtask 11.1 Mobilization and Excavation
- Subtask 11.2 Install Wick Drains
- Subtask 11.3 Erect and Paint Tank
- Subtask 11.4 Yard Piping and Site Improvements
- Subtask 11.5 Close out and Demobilization

Mobilization and Excavation includes the contractor's preliminary activities including but not limited to equipment submittals and moving equipment on to the site. In addition, in Subtask 11.1 site excavation would be conducted to accommodate the new tank.

In Subtask 11.2, wick drains, as explained in the preliminary engineering report would be installed in order to stabilize the tank when it is erected and filled. The actual construction of the tank foundation, erection of the tank, coating the tank and disinfection and testing of the tank occurs in Subtask 11.3

Yard piping and site improvements is included in Subtask 11.4. This subtask includes:
- Piping from the existing well and tank to the new tank
- Piping from the new tank to the existing booster pumps
- Controls to interlock the new tank into the existing control system
- A new access road with drainage improvements providing access to both tanks
- Fencing and other security improvements
- Disinfection and testing of installed equipment

Subtask 11.5 includes the contractor addressing all construction punchlist items and submitting all final paper work including record drawings.

Deliverables:

Work and deliverables associated with construction reporting and documentation are included in Task 13 Construction Administration.

Task 12. Environmental Compliance / Mitigation / Enhancement
The project is already developed and does not support any habitat or environmental conditions likely to require environmental compliance, mitigation or enhancement.

Task 13. Construction Administration
The construction administration will be handled jointly by the PSMCSD and the design engineer similar to how these activities were handled for the Vega Mutual Water Project. The primary responsibilities and overall construction management was the responsibility of the design engineer and the PSMCSD supported the design engineer in monitoring the contractor's daily activities. The design engineer held bi-weekly construction meetings that all parties attend and construction review was scheduled accordingly. Specialty inspection of compaction and concrete placement will be performed by others, as needed. In addition, all coatings will be inspected during and after their application by a coatings specialist.

There are two main components of this task:

- **Construction Management** – The PSMCSD will provide construction management and will be responsible for:

    - Providing assistance during the bid period;
    - Provide on-site representation for the PSMCSD;
    - Analyze and provide recommendations to the Board on contractor claims.
    - Maintain construction contract budget, approve contractor pay requests, construction documentation.

- **Engineering Services During Construction (ESDC)** – Engineering services will be contracted with the design engineering firm. The engineer will be responsible for:

    - Performing submittal review;
    - Perform quality assurance and control practices on the work performed
    - Responding to contractor requests for information;
    - Issuing clarifications;
    - Recommending change orders to the owner
    - Review contractor pay request and make recommendation to owner.

- Creating as-built records for the project based on construction documentation.

The Engineer will also be responsible for reviewing the contractor's payroll submittals for labor compliance as required in the State Standard Specifications and Labor Compliance Program.

Deliverables:

Description	Schedule
Monthly Construction Progress Reports	Ongoing during Construction
ESDC Documentation	Ongoing during Construction
Notice of Completion	June 2015
As Built Drawings	June 2015

Project 3 Increased Recycled Water Storage Project

The capacity of the operating Watsonville Water Recycling Treatment Facility is limited due to several factors including:

1. A lack of storage on the distribution system,
2. Insufficient nighttime demand to utilize the nighttime supplies, and
3. Insufficient demand in the "shoulder" periods before and after the peak irrigation season, particularly March to mid-April and October to mid-November.

Currently, recycled water is not produced at night unless there is sufficient demand (water order) by a grower or group of growers. Water that has received secondary treatment is sent through the City of Watsonville's ocean outfall when there is no demand for delivered water at night. The Increased Recycled Water Storage includes the construction of two 1 (one) million gallon tanks to provide nighttime storage of recycled water so that it can be delivered for irrigation during the day when there is demand. The project will increase the deliveries from the Recycled Water Treatment Facility by 750 AFY.

Task 1. Administration

The purpose of this task is to keep the project scope, budget and schedule on track, and to communicate project progress. This task includes execution and management of the design consultant and construction contract. Work under this task includes preparation of grant invoices and project agreements associated with project implementation.

The Project Administration task is an on-going task. Project status updates are prepared on a monthly basis.

Grant funding is not being requested for this work.

Deliverables:

Description	Schedule
Design Contract	November 2013
Construction Contract	July 2015
Monthly Project Budget and Schedule Updates	Monthly during Implementation
Grant Invoices	Quarterly during Implementation

Task 2. Labor Compliance Program

PVWMA has an existing Labor Compliance Program consistent with subdivision (b) of Labor Code Section 1771.5. This task involves the work needed to demonstrate compliance with state labor laws. The Pajaro Valley Water Management Agency will ensure compliance with state labor codes in three ways:

- PVWMA will submit to the State a letter with associated exhibits documenting compliance with relevant Labor Code requirements.

- The construction contract special provisions will state that adherence to Caltrans State Standard Specifications is required. Section 7 of the State Standard Specifications addresses the requirements of the State labor code for Public Works projects.
- The Construction Manager reviews the contractor's payroll submittals for labor compliance as required in the State Standard Specifications.

Grant funding is not being requested for this work. No work on this task will occur until award of grant funding for the project.

Deliverable:

Description	Schedule
Labor Compliance Documentation	November 2013

Task 3. Reporting

In support of the IRWM Implementation Grant administration, quarterly project reports will be provided to the grant administrator, SBCWD, that describes the progress and accomplishments for the quarter and is in accordance with the Project Performance Monitoring Plan as described in Task 4. An assessment of the project schedule and budget, and updated schedules and budgets, if appropriate, will also be included. Following project close-out, PVWMA will prepare a Final Project Completion Report summarizing the project implementation, demonstrating completion of all task items, and documenting the project costs and grant distributions. The Final Report will be submitted within 90 days of project completion (including environmental mitigation and compliance work). The quarterly reports and final reports shall be prepared consistent with State grant guidelines.

A Post Completion Report will be prepared and submitted within ninety (90) calendar days after the first operational year of the project. The report will describe the project performance and performance monitoring results in accordance with the Project Performance Monitoring Plan. In subsequent years, the Post Completion Report will be prepared and submitted no later than March 15 of each year. The reporting will occur annually for a total of 10 years after the completed project begins operation.

As required for Proposition 84 funded projects, PSMCSD will provide tribal notification consistent with PRC Section 75102.

Grant funding is not being requested for this task.

Deliverables:

Description	Schedule
Tribal Notification Letter	November 2013
Quarterly Reports	Quarterly during Implementation
Final Project Completion Report	November 2016
Post Completion Report	November 2017

Task 4: Project Performance Monitoring Plan (PPMP)
The Project Performance and Monitoring Plan (PPMP) will be prepared at the initiation of project implementation to outline how the project performance will be assessed and evaluated. The PPMP will lay out an evaluation and assessment process based on the Pajaro River Watershed Integrated Proposal goals and outcomes.

There are three project goals that the completed project will be evaluated against to determine the projects performance.

Goal #1 - Increase existing recycled water storage.

Goal #2 - Increased recycled water demand and deliveries during the irrigation season.

Goal #3 - Reduce groundwater pumping by an equivalent 750 AFY from the overdrafted Pajaro Groundwater Basin.

Performance will be measured through the current monitoring program implemented by the Agency which monitors delivered recycled water quantity and quality of the coastal distribution system. Additionally, the groundwater monitoring currently in place will continue to provide groundwater surface elevation data to monitor the effects of the increased of recycled water use. This data collection is part of existing data collection and data management programs, satisfying RWQCB and DWR data collection and reporting programs. More details of the proposed measurement tools and methods can be found in Attachment 6.

Grant funding is not being requested for this task.

Deliverable:

Description	Schedule
Project Performance Monitoring Plan	December 2013

Task 5. Land Purchase / Easement
The new storage tank will be constructed at the existing Recycled Water Treatment Facility. No additional land acquisition or easements are required.

Task 6. Assessment and Evaluation
As described in the completed work section, the geotechnical evaluation is complete and the pump curves have been completed. A land survey will need to be completed before commencement of final design activities. The survey report will provide the basis for pre-design and final design processes.

Grant funding is not being requested for this task.

Deliverable:

Description	Schedule
Land Survey	December 2013

Task 7. Final Design

The following design tasks will be completed as part of preparing the final design package:

1. *Prepare preliminary design*

   Recommendations for the two tanks and additional pumps at the existing pump station that will form the basis of design and requirements of the project. The reservoir preliminary design recommendations shall, at a minimum, address the following items:

   a. Size and dimensions of the reservoirs.
   b. Structural design criteria for the reservoir.
   c. Reservoir piping sizing and arrangement
   d. Inlet/outlet control valving approach.
   e. Valve vault layout.
   f. Reservoir materials, coatings and cathodic protection
   g. Reservoir accessories (ladders, access, instrumentation)
   h. Reservoir water quality sampling.
   i. Preliminary piping and instrumentation diagram.
   j. Number and type of pumps.
   k. Pump station pressure and flow control (including instrumentation and alarms).
   l. Surge protection.
   m. Pipe and valve sizing, materials, cathodic protection, and coating.
   n. Prepare a 10 percent design construction cost estimate.

2. *Prepare 30 percent design submittal package.*

   The 30 percent drawings will include sufficient dimensions and description of the selected components to illustrate how the concepts developed predesign will be implemented. The level of detail shall include such items as facility siting, facility dimensions, equipment locations and relative size, piping and other appurtenance locations, and proposed process and system control diagrams.

   Specifications will not be developed at this stage of design. Draft control descriptions of the new equipment will be prepared for review.

   The 30 percent submittal package will also include the following:

   a. Site plans
   b. Piping and instrumentation diagrams.
   c. Piping layout drawings.

d. Building floor plan.
e. Equipment locations for all major equipment.
f. Control descriptions.
g. Equipment data sheets for all major equipment.
h. Instrument lists.
i. Drawing list.
j. List of specific items requiring CITY decision.
k. Updated project cost estimate and project schedule.

The purpose of these documents is to provide sufficient information for Agency staff to assess and identify potential impacts of the improvements on the project goals, operational constraints, and maintenance issues including equipment experiences or preferences.

3. *Prepare 60 percent design submittal package.*
The 60 percent drawings will include additional dimensions and description of the selected components to illustrate how the concepts developed will be implemented. The level of detail shall include such items as facility siting, facility dimensions, equipment locations and relative size, piping and other appurtenance locations, and proposed process and system control diagrams. The 60 percent submittal will account for the comments received from the Agency on the 30 percent submittal.

Specifications will include an outline of proposed construction sequencing and constraints; general criteria, installation requirements and testing procedures for major equipment; and listing of proposed bid item breakdown.

The 60 percent submittal package will also include the following:

a. Typical details.
b. Site plans
c. Piping and instrumentation diagrams.
d. Piping layout drawings.
e. Building elevations and floor plan (if applicable).
f. Equipment layouts for all major equipment.
g. Electrical single line drawings.
h. Control descriptions.
i. Control system architecture block diagrams (SCADA).
j. Equipment data sheets for all major equipment.
k. Instrument lists.
l. Drawing list.
m. Specification table of contents.
n. Specification sections for major equipment.
o. Draft standard and special provisions.
p. List of specific items requiring agency decision.
q. Updated project cost estimate

3. *Prepare 90 percent design submittal package*
The 90 percent submittal package will address all the Agency's comments on the 60 percent submittal package as well as the comments resulting from the consultant's internal QA/QC program. This submittal will represent a near-biddable set of construction documents. The purpose of this submittal is to allow the Agency a final opportunity for comments.

4. *Prepare a 100 percent design submittal package*
The 100 percent submittal package will address the final comments made by the agency's review team as well as the consultant's review team. The purpose of this submittal package is to present to the Agency how the final comments were addressed and to obtain buy-in prior to preparing the bid package.

Grant funding is not being requested for this task.

Deliverables:

Description	Schedule
Predesign Package	March 2014
30% Design Submittal	June 2014
60% Design Submittal	September 2014
90% Design Submittal	December 2014
Final Design	February 2015
Bid Package	February 2015

Task 8. Environmental Documentation
As described in the completed work section, the 2002 BMP EIR included an evaluation of the proposed tanks. No additional environmental documentation is required.

Task 9. Permitting
The tanks are being constructed within the Recycled Water Treatment Facility fenceline. No new permits are required.

Task 10. Construction Contracting
This task includes the construction contracting activities required for the tank construction. Activities will include preparing and advertising bid documents; preparation for and facilitation of a pre-bid contractors meeting; evaluation of bids; and contract award.

Deliverables:

Description	Schedule
Advertisement	February 2015
Pre-bid Meeting Summary	February 2015
Bid Addenda	May 2015
Bid Summary / Award Contract	May 2015

Task 11. Construction:
Construction activities will include the following substasks:

Subtask 11.1 Mobilization
Subtask 11.2 Grading and Site Preparation
Subtask 11.3 Pipeline Installation
Subtask 11.4 Tank and Appurtenances Installation
Subtask 11.5 Pump Installation
Subtask 11.6 Performance Testing and Training
Subtask 11.7 Demobilization

Grant funding is being requested for this task.

Work and deliverables associated with construction reporting and documentation are included in Task 13 Construction Administration.

Task 12. Environmental Compliance / Mitigation / Enhancement
The tanks are being constructed within the Recycled Water Treatment Facility fenceline. No environmental compliance, mitigation or enhancement requirements are anticipated.

Task 13. Construction Administration
Construction Management will occur for the duration of the construction period. The consulting engineer will be responsible for development, negotiation and securing all contracts, including construction contractors, construction managers, and environmental monitoring consultants. There are two main components of this task, including:

- **Construction Management** – The consulting engineer will provide construction manager(s) and will be responsible for:
    - Providing assistance during the bid period;
    - Provide on-site representation for the Agency;
    - Perform quality assurance and control practices on the work performed; and
    - Analyze and provide recommendations on contractor claims.
    - Maintain construction contract budget, approve contractor pay requests, construction documentation.
    - Oversees environmental mitigation implementation.

- **Engineering Services During Construction (ESDC)** – Engineering services will be contracted with the design engineering firm. The engineer will be responsible for:
    - Prepare Conformed Plans and Specs
    - Pre-Construction Conference
    - Engineer Site Visits and Progress Meetings
    - Response to RFIs

- Shop Drawings Review
- Review and Preparation of Change Orders
- Prepare "Punch List"

The Construction Manager will also be responsible for reviewing the contractor's payroll submittals for labor compliance as required in the State Standard Specifications and Labor Compliance Program.

Deliverables:

Description	Schedule
Monthly Construction Progress Reports	Ongoing during Construction
ESDC Documentation	Ongoing during Construction
Notice of Completion	August 2016
As Built Drawings	August 2016

Project 4 Pajaro Agricultural Water Quality and Aquifer Enhancement Project

The Pajaro Agricultural Water Quality and Aquifer Enhancement Project includes four program goals:

- Support and expand efforts of the community water dialog to inform and lead grower-based efforts for irrigation and nutrient management;
- Implement two (2) managed aquifer recharge projects in the Lower Pajaro;
- Develop and implement cost-share and performance-based incentives for water quality and water supply; and
- Provide a Regional Mobile Lab to provide technical and outreach services to promote improved irrigation efficiency.

The following work plan describes the tasks necessary for the Resource Conservation District of Santa Cruz County (RCDSCC) to accomplish all four goals.

Task 1. Administration

The purpose of this task is to keep the project scope, budget and schedule on track, and to communicate project progress with sponsoring agencies, stakeholders, and the various organizations involved with project delivery. The RCDSCC has and will continue to be responsible for the daily management of the project under this task. Work under this task includes preparation of grant invoices and project agreements associated with project implementation.

The Project Administration task is an on-going task. Project status updates are prepared on a monthly basis in response to the various stakeholders and their meeting schedules. As milestones are met, the project manager documents and notifies sponsoring agencies and stakeholders.

Deliverables:

Deliverable	Submittal Date
Project baseline schedule	11/1/13
Grant invoices	Quarterly during Implementation

Task 2. Labor Compliance Program

The RCDSCC has an existing Labor Compliance Program consistent with subdivision (b) of Labor Code Section 1771.5. This task involves the work needed to demonstrate compliance with state labor laws. The RCDSCC will ensure compliance with state labor codes in three ways:

- The RCDSCC will submit to the State a letter with associated exhibits documenting compliance with relevant Labor Code requirements
- The construction contract special provisions will state that adherence to Caltrans State Standard Specifications is required. Section 7 of the State Standard

Specifications addresses the requirements of the State labor code for Public Works projects

- The Construction Manager reviews the contractor's payroll submittals for labor compliance as required in the State Standard Specifications

Deliverables:

Deliverable	Submittal Date
Labor compliance documentation	12/31/13

Task 3. Reporting

In support of the IRWM Implementation Grant administration, quarterly project reports will be provided to SBCWD, grant administrator, that describes the progress and accomplishments for the quarter and is in accordance with the Project Performance Monitoring Plan as described in Task 4. An assessment of the project schedule and budget, and updated schedules and budgets, if appropriate, will also be included. Following project close-out, RCDSCC will prepare a Final Project Completion Report summarizing the project implementation, demonstrating completion of all task items, and documenting the project costs and grant distributions. The Final Report will be submitted within 90 days of project completion (including environmental mitigation and compliance work). The quarterly reports and final reports shall be prepared consistent with State grant guidelines.

As required for Proposition 84 funded projects, PSMCSD will provide tribal notification consistent with PRC Section 75102.

Deliverables:

Deliverable	Submittal Date
Tribal Notification	12/31/13
Quarterly reports	Quarterly during Implementation
Final Report	1/1/17

Task 4: Project Performance Monitoring Plan (PPMP)

The Project Performance and Monitoring Plan (PPMP) will be prepared at the initiation of project implementation to outline how the project performance will be assessed and evaluated. The PPMP will lay out an evaluation and assessment process based on the Santa Cruz County Integrated Proposal goals and outcomes.

There are 2 measurable project goals that the completed project will be evaluated against to determine the project's performance.

Goal #1 – Conserve an estimated 400 AFY of water.
Goal #2 – Reduce participating growers' contribution to nitrogen load in stormwater by 10%.

More specifically, the project's goals are:

- The Community Water Dialogue will increase supply and reduce water demand as result of increased implementation of managed recharge projects and irrigation efficiency projects (water supply). Estimated Water Conservation Savings: AFY.
- Managed aquifer recharge will increase water supply. Estimated Water Conservation Savings: 200 AFY after 2015.
- Cost-share and performance-based incentives will reduce water demand and improve water quality. Estimated Water Conservation Savings: 50 AFY. Estimated Load Reduction Calculation and Reference: 10 % reduction in concentration of nitrate.
- Regional Mobile Lab services will reduce water demand and improve water quality. Estimated Water Conservation Savings: 90 AFY.

The following monitoring protocols will be used to verify project performance with respect to project benefits claimed:

- Community Water Dialog
    - Survey of community members to gage level of participation in Dialog and other project components and degree of management measure implementation
- Managed aquifer recharge (Lower Pajaro)
    - Number of projects implemented and amount of estimated annual recharge per project
    - Method to verify project performance: UCSC Aquifer Recharge Initiative monitoring program
- Cost-share and performance-based incentives for water quality and water supply
    - Number and type of projects implemented and projected results
    - Method to verify project performance: Performance based incentives monitoring framework (Exhibit 7.18)
- Regional Mobile Lab
    - Number of growers and acres served
    - Method to verify project performance (depending on practice implemented): EPA Region 5 Model, Nitrogen Index Model, DeNitrification-DeComposition (DNDC) Model, UCCE Crop Manage Tool, Agricultural Research Service (ARS) Model and the Water Quality Index (WQI) Model

Monitoring results will be reported in the quarterly progress reports described in Task 3.

Deliverables:

Deliverable	Submittal Date
Project Performance Monitoring Plan	12/31/13

Task 6. Assessment and Evaluation (Managed Aquifer Recharge Basins)

Prior to implementing managed aquifer recharge basins, the RCDSCC will collect and synthesize relevant hydrological data from potential field sites to evaluate sites for

managed aquifer recharge basin implementation. This task will include the following subtasks:

Subtask 6.1 Develop project financing
Subtask 6.2 Conduct percolation testing in potential recharge zones that have been mapped under prior efforts
Subtask 6.3 Provide outreach to landowners and secure landowner agreements

Deliverables:

Deliverable	Submittal Date
Landowner Agreements	Site 1 – 11/1/13 Site 2 – 11/1/14
Percolation Test Results	Site 1 - 4/1/14 Site 2 – 4/1/15

Task 7. Final Design (Managed Aquifer Recharge Basins)
The RCDSCC will coordinate with a design firm and/or Natural Resource Conservation District (NRCS) engineers to complete project designs. The designs will define basin size, construction requirements, and project costs.

Deliverables:

Deliverable	Submittal Date
60% Designs	Site 1 – 5/1/14 Site 2 – 5/1/15
Final Designs	Site 1 – 7/31/14 Site 2 – 7/31/15

Task 8. Environmental Documentation (Managed Aquifer Recharge)
Given the size and nature of the projects, it is anticipated that the projects will be exempt from CEQA and NEPA. However, if required, the RCDSCC will utilize the Partners in Restoration (PIR) Permit Coordination Program to document compliance. No additional documentation required.

Task 9. Permitting (Managed Aquifer Recharge)
The RCDSCC will utilize the Partners in Restoration (PIR) Permit Coordination Program to permit the design and construction of two managed aquifer recharge basins. Permitting will include the submittal PIR documentation which includes compliance with the following permits associated with this project: Master Permit for Santa Cruz County, 401 Certification from RWQCB, Regional General Permit from Army Corps of Engineers, Biological Opinion from US Fish and Wildlife Service and Permit Coordination Program.

Deliverables (if required):

Deliverable	Submittal Date
Master Permit for Santa Cruz County	Site 1 – 6/1/14 Site 2 – 6/1/15
401 Certification from RWQCB	Site 1 – 6/1/14 Site 2 – 6/1/15
Regional General Permit Army Corps of Engineers	Site 1 – 6/1/14 Site 2 – 6/1/15
Biological Opinion US fish and Wildlife Service	Site 1 – 6/1/14 Site 2 – 6/1/15
Permit Coordination Program	Site 1 – 6/1/14 Site 2 – 6/1/15

Task 10. Construction Contracting (Managed Aquifer Recharge)
The RCDSCC will be responsible for development, negotiation and securing all contracts, including construction contractors, construction managers, and environmental monitoring for construction of the two Managed Aquifer Recharge sites).

Deliverables:

Deliverable	Submittal Date
Bid advertisement & award	Site 1 – 9/1/14 Site 2 – 9/1/15

Task 11. Construction / Implementation
The RCDSCC will oversee all implementation activities associated with construction of the aquifer recharge basins including: construction oversight, documentation and overseeing permit compliance. The RCDSCC will also facilitate integration of Community Water Dialogue and Performance-based Incentives structure into other project components. The RCDSCC will coordinate with the Central Coast Agricultural Water Quality Coalition and regional MIL technical experts to provide technical assistance to growers in the Lower Pajaro. This task will include the following subtasks:

Subtask 11.1 Community Water Dialogue

Subtask 11.1.1 Support and expand efforts of the community water dialogue to inform and lead grower-based efforts for irrigation and nutrient management
Subtask 11.1.2 Hold quarterly forums and property owners to discuss overdraft solutions
Subtask 11.1.3 Convene working group meetings to guide implementation of strategies
Subtask 11.1.4 Communicate to stakeholders through website, email etc.
Subtask 11.1.5 Conduct survey's to gage the extent to which Community Water Dialogue Programs have led to water conservation benefits

Subtask 11.2 Managed Aquifer Recharge: Implementation (two aquifer recharge ponds)

Subtask 11.2 .1 Construction (Managed Aquifer Recharge)
Subtask 11.2 .2 Complete photo monitoring of projects

Subtask 11.3 Cost-share and performance-based incentives for water quality and water supply

Subtask 11.3 .1 Identify successful strategies for performance based incentives that are relevant to the Managed Aquifer Recharge and Regional Mobile Lab Programs
Subtask 11.3 .2 Create public incentives structure for agencies with each program
Subtask 11.3.3 Integrate performance based incentive structure into program operations

Subtask 11.4 Regional Mobile Lab

Subtask 11.4.1 Provide outreach to growers
Subtask 11.4.2 Conduct Distribution Uniformity, pump efficiency tests, nutrient monitoring and management evaluations, and data analysis, and assist with adaptive management of farming operations
Subtask 11.4.3 Provide education and training for irrigators and ranch managers

Deliverables:

Deliverable	Submittal Date
Quarterly Forums meeting agenda and other materials	Quarterly during Implementation
Managed Aquifer Construction Reports	See Task 13
Performance Based Incentives Memorandum	10/1/15
Regional Mobile Lab – Grower assessment reports and recommendations	Ongoing during Implementation

Task 12. Environmental Compliance/Enhancement/Monitoring
The RCDSCC will implement site appropriate methods of erosion control and revegetation at the Managed Aquifer Recharge sites after construction and will monitor the success of the revegetation.

Deliverables:

Deliverable	Submittal Date
Documentation and monitoring of revegetation	Site 1 - 10/1/14 – 4/1/15 Site 2 – 10/1/15 – 4/1/16

Task 13. Construction Administration

The RCDSCC will oversee all construction contracting and all associated project administration including: preparing and advertising bid documents, pre-bid contractors meeting, bid walk, evaluation of bids, awarding contracts and photo documentation of project construction. This task will include the following subtasks:

Subtask 13.1 Construction Management (Managed Aquifer Recharge)

Subtask 13.1.1 Provide assistance during the bid period
Subtask 13.1.2 Provide on-site representation for RCDSCC (bid walk)
Subtask 13.1.3 Perform quality assurance and control practices on the work performed
Subtask 13.1.4 Maintain construction contract budget, approve contractor pay requests and construction documentation
Subtask 13.1.5 Oversee permit compliance

Subtask 13.2 Engineer services during construction (Managed Aquifer Recharge)

Subtask 13.2.1 Perform submittal review
Subtask 13.2.2 Respond to contractor requests for information
Subtask 13.2.3 Recommend change orders to the RCDSCC
Subtask 13.2.4 Create as-built records for the project based on construction documentation

Deliverables:

Deliverable	Submittal Date
Photo Documentation	Site 1 – 12/31/14 Site 2 – 12/31/15
Construction logs	Monthly during construction
As built record drawings	Site 1 – 12/1/14 Site 2 – 12/1/15
Notice of completion	Site 1 - 12/1/14 Site 2 – 12/1/15

IRWM Implementation Grant Administration

San Benito County Water District (SBCWD) will be the grant administrator and fiscal agent for the Proposition 84 IRWM Implementation Grant, if awarded. The tasks associated with this grant administration project are:

- Develop, negotiate, and secure all grant agreements necessary for grant award and implementation, including grant agreements with the Department of Water Resources (DWR) and the project sponsors, Pajaro Sunny Mesa Community Services District (PSMCSD), Pajaro Valley Water Management Agency (PVWMA), and the Resource Conservation District of Santa Cruz County (RCD).
- Monitor and communicate project and grant progress with DWR and compile quarterly grant reports from project sponsors that describe the progress and accomplishments for the quarter, including an assessment of project schedule and budget, and updated schedules and budgets, if appropriate. The quarterly reports shall be prepared consistent with State grant guidelines and in accordance with Project Performance Monitoring Plans. Project proponents will be providing this information to the SBCWD per Task 3 for each project.
- Prepare grant reimbursement requests for each project, including completing the DWR invoices and compiling appropriate expenditure documentation per the DWR grant reimbursement requirements.
- Following project close-out for each of the four projects, prepare and submit to DWR a Final Report summarizing the project implementation, demonstrating completion of all task items, and documenting the project costs and grant distributions. The final reports shall be prepared consistent with State grant guidelines.
- Upon completion of all projects in the grant, submit to DWR a Grant Completion Report. The Grant Completion Report will be submitted within ninety (90) calendar days of submitting the Project Completion Report for the final project to be completed under the Grant Agreement. The Grant Completion Report shall include a brief description of each project completed and how they will further the goals of the Pajaro River Watershed IRWM Plan.
- Submit a Post Performance Report for each of the three projects. Post Performance Reports shall be submitted to DWR within ninety (90) calendar days after the first operational year of a project has elapsed. In subsequent operational years, all Post Performance Reports for projects completed under this grant shall be submitted concurrently, and by the date specified in the grant agreement. This record keeping and reporting process shall be repeated, for each project, annually as specified in the grant agreement. The County has assumed Post Performance Reports are required for a total of 10 years after the completed project begins operation.
- Ensure that all groundwater projects and projects that include groundwater monitoring requirements are consistent with the Groundwater Quality Monitoring Act of 2001 (Part 2.76 (commencing with Section 10780) of Division 6 of the

Water Code) and that projects that affect water quality shall include a monitoring component that allows the integration of data into statewide monitoring efforts, including but not limited to, the surface water ambient monitoring program carried out by the State Water Resources Control Board.

- Integrate data collected from the four projects for transmittance to State data programs such as the Water Data Library, Surface Water Ambient Monitoring Program, Groundwater Ambient Monitoring and Assessment program, California Environmental Information Catalog, Integrated Water Resources Information System, California Environmental Resources Evaluation System and California Statewide Groundwater Elevation Monitoring program.
- For each project, SBCWD will promptly notify DWR, in writing, of the following items:

  a) Events or proposed changes that could affect the scope, budget, or work performed under the grant agreement. The County agrees that no substantial change in the scope of a project will be undertaken until written notice of the proposed change has been provided to State and State has given written approval for such change.

  b) Any public or media event publicizing the accomplishments and/or results of the grant agreement and provide the opportunity for attendance and participation by DWR's representatives.

  c) Completion of work on a project.

  d) Final inspection of a project by a Registered Civil Engineer, in accordance with Standard Condition D-14, and provide DWR the opportunity to participate in the inspection.

Deliverables:

Deliverable	Submittal Date
DWR Grant Agreement	December 2013
Project Sponsor Subagreements	January 2014
Quarterly Reports	Quarterly throughout grant term
Grant Invoices	Quarterly throughout grant term
Final Project Reports	As noted in each project work plan
Grant Completion Report	April 2017
Post Performance Report	As noted in each project work plan
Data Integration into State Programs	Annually

Exhibit 3.1
EXHIBIT 3.1 RIDGEMARK TRANSMISSION PIPELINE 100% DESIGN DRAWINGS AND SPECIFICATIONS, 2012

Sunnyslope County Water District

Fairview Pipeline Technical Water Specifications

2012

Published: May 15, 2012

Standard Water Specifications and Details

I. Material Specifications

A. Pipe
B. Fittings
C. Fire Hydrants
D. Valves
E. Blow-Off Assembly
F. Water Main Taps
G. Sleeves & Clamps
H. ¾" & 1" Water Services
I. 1 ½" & 2" Water Services
J. 3" & 4" Water Services
K. Fire Service Meters
L. Irrigation Meters
M. Miscellaneous Steel
N. Concrete
O. Stone & Brick
P. Traffic Control Devices
Q. Erosion Control

II. Construction Specifications

A. Handling & Storage
B. Connection to Existing Mains
C. Existing Utilities
D. Water & Sewer Clearance
E. Excavation
F. Pipe-Laying
G. Installation & Assembly
H. Installing Valves, Hydrants, and Fittings
I. Water Main Taps
J. Backfill
K. Compaction
L. Removal and Restoration of Pavement
M. Concrete
N. Bores
O. Guaranteed Casings
P. Tunnels
Q. Blasting
R. Testing and Inspection
S. Repairs
T. Restoration
U. Encroachment Permit

STANDARD WATER SPECIFICATIONS AND DETAILS

DESCRIPTION: All materials, equipment, and labor for water main construction shall be furnished in accordance with these specifications and in accordance with the Plans. All water mains shall be installed in accordance with AWWA standards.

I. MATERIAL SPECIFICATIONS

Unless superseded or modified in the Detailed Specifications, all materials, apparatus, supplies, methods of manufacture, or construction shall conform to the specifications contained in this Section and Section C of the AWWA Standards. All materials/products that contact potable water must be third party certified as meeting the specifications of ANSI/NSF Standard 61. The certifying party shall be accredited by the ANSI. National material standards (ASTM, ANSI, AWWA, etc.) referred to herein shall be considered to be the latest revisions only.

A. PIPE

1. Ductile Iron Pipe: Ductile iron pipe shall conform to the requirements of AWWA Standard C150/A21.50 & C151/A21.51 and shall have a cement-mortar lining of standard thickness in accordance with AWWA C104. Unless otherwise shown on the construction plans, all ductile iron pipe shall be furnished with push on joints in accordance with AWWA C111. All ductile iron pipes shall be encased in a minimum of 8 millimeters of polyethylene encasement in conformance with AWWA C105.

   Sixteen (16) inch and larger diameter pipe shall be minimum Pressure Class 250. Also, the pipe class selection for 16-inch and larger pipe shall be based on the installation conditions. This pipe class shall be as shown on the plans and/or elsewhere in these specifications.

   Twelve-inch (12") and smaller diameter pipe shall be Pressure Class 350.

   a. Mechanical Joint Accessories: Bolts and gaskets for mechanical joint pipe and fittings shall be furnished by the pipe/fitting manufacturer and shall conform to ANSI Specifications A21.11 (AWWA C111).

   b. Push-On Joint Material: Gaskets for push-on pipe shall be furnished by the pipe manufacturer. Gaskets and gasket lubricant shall meet the requirements of ANSI Specification A21.11 (AWWA C111).

   c. Flange Joints and Accessories: Flange joints shall be in accordance with ANSI A21.10 of either Class 125 or Class 250, as required. Flanges, flange bolts and nuts, and gaskets shall conform to the dimensional requirements of ANSI B16.1 for Class 125 or ANSI B16.2 for Class 250. Bolts shall have standard Hexagonal heads and shall be provided with standard hexagonal cold pressed nuts unless otherwise specified. Bolts

and nuts shall be made of the best quality refined iron or mill steel and shall have sound, well fitting threads.

d. Restrained Joint Pipe: Flexible restrained joints shall be supplied by the pipe manufacturer. Gaskets with vulcanized internal stainless steel locking segments may be used for 6-inch through 12-inch Ductile Iron. The following manufacturers are approved, U.S. Pipe and Field Lok Gasket. Only designs using a welded retainer ring on the spigot will be allowed for 16-inch and larger diameter pipe. Push-on or mechanical joint designs may be used for the pipe and associated fittings. The following manufacturer's products are approved, American Lok Ring, American Lok Fast, Griffin Snap Lok, Griffin Bolt Lok, and U.S. Pipe TR Flex.

2. Polyvinyl Chloride (PVC) Pipe: Unless amended on the Construction Drawings or elsewhere in these specifications the following shall apply:

a. 1 ½" and 2" : Must be PVC 1120 in accordance with ASTM D-2241: PC315 with a SDR of 13.5 or less for C-900.

b. 4" through 12": Must be PVC 1120 in accordance with ASTM D-1785 or ASTM D-2241, AWWA C900, SDR-18.

c. 14" through 48": Must be in accordance with AWWA C905, SDR 18
.

d. PVC Pressure Pipe shall be made from white or blue-pigmented virgin materials and shall be furnished in lengths of 20 feet. Lesser lengths will be accepted to allow the proper placement of fittings, valves, etc.

e. All PVC Water Pipe will be shipped, stored, and strung at the project in such manner as to be protected from total accumulated exposure to sunlight and possible ultraviolet radiation of no more than four (4) weeks.

f. Push on Joint: Point jointing will be by elastomeric joints only. Joints shall conform to ASTM D3139 for two inch pipe and to AWWA C900 & C111 for six, eight and twelve inch pipe.

g. Pipe bells, with gasket seats, shall be formed as the pipe is extruded. Sleeve couplings are not permitted except as specified in the DS Section for connections to existing mains or as necessary for repairs during pressure/leakage tests.

h. Restrained Joint Pipe: Flexible restrained joints shall be supplied by the pipe manufacturer. The following manufacturers are approved:CetainTeed C905/RJ or approved equal.

3. Reinforce Concrete Cylinder Pipe: All reinforced concrete water pipe furnished shall be either prestressed concrete cylinder type with rubber and steel joint, or

prestressed concrete embedded cylinder type with rubber and steel joints all in compliance with AWWA C301. The pipe shall be designed and furnished to fit the profile and head conditions shown on the Plans and hydrostatic tests herein specified, plus the standard allowance for water hammer. All connections for main line valves will be mechanical joint unless otherwise shown on the construction plans. Connections for side outlets will be flanged or mechanical joint as indicated on the Construction Plans.

4. Galvanized Steel Pipe: All steel pipe specified shall conform to the requirements of ASTM A120. The pipe and fittings shall be Schedule 80 (extra strong) galvanized steel, with wall thickness as specified for each size in Table III of ASTM A120, shall be furnished butt welded, and shall be of the standard length for such materials but not specifically of an exact length. Both ends of the pipe shall be furnished threaded with a coupling on one end. The pipe shall be marked as specified in ASTM A120. The pipe, couplings, and fittings shall be manufactured in the United States.

5. Polyethylene Tubing: Polyethylene water service tubing shall be manufactured in accordance with ASTM D2737, using PE 3408 resin (ASTM D1248, Type IIII, Class 5, Grade P34). Polyethylene water service tubing from mains to meter boxes shall be constructed using Endopure ASTMD 2239 SDR7 PC200 pipe and shall comply with AWWA C901 and NSF 14.

6. Existing Water Main Piping: Water mains which have been previously used for conveying potable water may be reused provided they meet applicable criteria from AWWA Section C, ANSI/NSF 61, and ASTM D1785 or D2241. The mains must be thoroughly cleaned and restored practically to their original condition. (R.61-58.4.D.(2))

7. Pipe Jointing: Natural rubber or other material which will support microbiological growth may not be used for any gaskets, O-rings, and other products used for jointing pipes, setting meters or valves, or other appurtenances which will expose the material to the water. Lubricants which will support microbiological growth shall not be used for slip-on joints. Vegetable shortening shall not be used to lubricate joints (R.61-58.4.D.(3)).

8. All pipe material, solder and flux shall be lead free (less than 0.2% lead in solder and flux and less than 8.0% lead in pipes and fittings) (R.61-58.4.F.(1)-(5))

9. Solvent-weld PVC pipe and fittings shall not be used in water mains four (4) inches and larger (R.61-58.4.D(3))

10. Asbestos cement pipe shall not be used in potable water systems except in the repair of existing asbestos cement lines. (R.61-58.4.D(1))

11. Thermoplastic pipe shall not be used above grade. (R.61-58.4.D(1)).

B. FITTINGS

1. Ductile Iron Fittings: Ductile Iron fittings furnished for ductile iron or PVC pipe will be pressure Class 250, or better, ductile iron, in accordance with AWWA C110 or pressure Class 350 compact fittings, cast from ductile iron, in accordance with AWWA C153. All ductile iron pipe fittings shall be encased in a minimum of 8 millimeters of polyethylene encasement in conformance with AWWA C105. Fittings shall be furnished with mechanical or flanged joints as indicated on the construction plans. All mechanical joint fittings will be Bell and Bell unless otherwise indicated on the plans. All fittings shall have a cement mortar lining of standard thickness in accordance with AWWA C104. All fittings, including glands and bolts, shall be certified by Underwriter Laboratories.

2. Restrained Mechanical Joint Fittings:

   Mechanical joint restraints may be through the use of a follower gland with restraining device that imparts a wedging action against the pipe. The restraining device shall have twist off nuts to ensure proper contact with the pipe. Glands and restraining devices shall be manufactured of Ductile Iron. The restraining devices shall be heat treated to a hardness of 370BHN. Gland dimensions shall be compatible with the MJ fittings hereinbefore specified. The restrained joint shall be rated for a minimum 250 PSI working pressure with a 2:1 safety factor. Mechanical joint restraints may be through the use of a specially machined ductile iron ring and follower gland that is used with standard mechanical joint gaskets and T-bolts.

   Restrained mechanical joints shall be Megalug as manufactured by Ebaa Iron, Inc. or approved equal. Restrained joints may be used where shown on the plan, standard details or as approved by the Engineer.

3. PVC Fittings: All fittings for four, six, eight, ten, and twelve inch PVC pipe shall be ductile iron as specified. All Tees shall be ductile iron. Fittings for two inch PVC pipe shall be push on joint PVC or threaded malleable iron. Malleable iron fittings shall be furnished with threaded PVC adapters to connect the fittings to the push on joint pipe. Elastomeric joints for PVC adapters and PVC fittings with push on joints shall conform to ASTM D3139. PVC adapters and fittings shall have a minimum pressure of 200 PSI and shall, except for threaded area on adapters, have a SDR of 13.5.

C. FIRE HYDRANTS

1. Fire hydrants shall conform to AWWA C502, and shall be constructed for 3'-0" minimum depth of trench. All fire hydrants shall be equipped with two 2 ½ inch hose nozzles with National Standard Threads, and one 4 1/2" (minimum opening) pumper.

2. All hydrants shall open by turning to the left or counterclockwise, shall have a

minimum valve opening size of 4 ½" and shall be furnished with a 6" mechanical joint inlet. The operating nut shall be 1 1/4" and pentagon. Any extensions required shall be as recommended and supplied by the hydrant manufacturer.

3. All fire hydrants and any portions of the hydrant assembly exposed to view (above adjacent ground elevation) shall be painted with two (2) or more evenly applied coats of yellow hydrant enamel paint. Hydrants will be retouched/repaired as necessary after installation and prior to acceptance.

4. All fire hydrants shall be one of the following models or approved equal:

Manufacturer	**Model**
Long Beach Iron Works	#430
Clow	Md #860

D. VALVES

1. Gate Valves: All valves 2" through, and including 16" in diameter shall be direct bury epoxy coated, resilient wedge, gate valves and shall be furnished with Standard Valve boxes set in concrete pads as specified. Gate valves shall be furnished with non-rising stems only, and stem seals shall be of the "O" ring type only. Valves four (4") inches and larger shall be furnished with two inch square operating nuts and shall open by turning to the left or counterclockwise. Gate valves three (3") inches and smaller shall be furnished with T-Head operating nuts. Valve ends shall normally be mechanical joint with necessary glands, gaskets and bolts furnished with the valve. Flange ends shall be furnished for special installations as shown on the construction plans. Flange by mechanical joint ends shall be furnished for tapping sleeve & valve installations.

   Gate valves shall be the resilient seat type in accordance with AWWA C509 with a working pressure of 200 PSI. Resilient seated gate valves must be furnished with durable opaque end shields to prevent ultra violet damage to the rubber discs.

   Gate Valves smaller than three inches may also be of all bronze construction with iron pipe thread, screw ends, wedge gates and non-rising stems, shall open by turning to the right or clockwise, shall be furnished with a T-Head unless a hand wheel is specified and shall have a working pressure of 200 PSI. Materials for such gate valves shall be in accordance with the most recent edition of AWWA C500 and such ASTM designations as apply with reference to chemical requirements as set forth in Table 1 of ASTM B-62.

2. Butterfly Valves: All valves on water mains 18 inches in diameter and larger, except tapping valves, shall be direct bury butterfly valves with mechanical joint ends conforming to all requirements of AWWA C504. Unless otherwise shown on the construction plans, all butterfly valves shall be Class 150B.

Each butterfly valve shall be furnished with a manual operator equipped with a two-inch square-operating nut. The operator shall open the valve when the operating nut is turned to the left or counter-clockwise. The valve and operator shall be assembled for installation in a horizontal line with the main valve shaft horizontal and the operator shaft and operating nut aligned vertically to accept a valve key operated from the surface.

Butterfly valves shall be shop painted for buried service in accordance with AWWA C504.

Prior to shopping butterfly valves, the manufacturer shall submit shop drawings showing the principal dimensions, general construction, and materials used for all parts of the valves and operators. The manufacturer shall include in the submittal the dates the valves are to be tested. The testing shall be scheduled to allow a representative of the Engineer to be present at the direction of the Engineer. The valves shall be furnished in accordance with these drawings after the Engineer has approved them. The manufacturer must submit written certification that the valves furnished comply with all applicable provisions of AWWA C504. Each valve must be identifiable through a separate serial number attached to the valve. Butterfly valves shall be manufactured by American Darling, Clow, Kennedy, Muller, Pratt, or approved equal.

3. Detector Check Valve: Four-inch through ten-inch detector check valves shall be approved by the State of California, rated for 175 PSI working pressure with flanged ends per ANSI B16.1, Class 125. The valve body may be steel, cast iron, or ductile iron. Steel body valves shall be hot dip zinc galvanized or fusion bonded epoxy coated. Cast/ductile iron body valves shall be fusion-bonded epoxy coated. Operating mechanism shall be by internal weight or linkage and spring and shall be all bronze or stainless steel. Valve shall have rubber faced clapper and bronze seat. Valves shall have two tapped bosses on each side to permit installation of a metered bypass. Valve shall be UL listed/FM approved.

4. Air-Relief Valves: Air relief valves shall be provided in accordance with sound engineering practice at high points in water mains as required. Automatic air relief valves shall be used in situations where flooding of the manhole or chamber may occur.(R.61-58.4.D.(10)(a))

   The open end of an air relief pipe from automatic valves or from a manually operated valve shall be extended to the top of the pit and provided with a screened downward facing elbow.

E. BLOW-OFF ASSEMBLY

1. Blow-offs should be located in a box or other approved structure to facilitate proper use. The orifice should be provided on the fixed piping, in the valve box.

2. Blow-offs should not be directed towards roads or so that the water will flow into creeks, ect. At stream crossings direct away from streams over ground.

3. Orifices should be sized as follows:

Pipe Diameter	Minimum Flow Required	Orifice Size
2 inch	25 gpm	0.75 inch
2.5 inch	40 gpm	1 inch
3 inch	60 gpm	1.25 inch
4 inch	100 gpm	1.5 inch
6 inch	220 gpm	2 inch
8 inch	400 gpm	2 inch
10 inch	612 gpm	2 inch
12 inch	882 gpm	2 inch
14 inch	1200 gpm	2 inch
16 inch	1570 gpm	2 inch

F. WATER MAIN TAPS

1. Tapping Sleeves

Tapping sleeves to be stainless steel or epoxy coated steel full gasket with wedge gasket around tap opening. Twelve-inch (12") and smaller sleeves shall be rated for 200 PSI working pressure. Sixteen-inch (16") and larger sleeves shall be rated for 150 PSI working pressure.

Stainless steel tapping sleeves shall be manufactured from 18-8, type 304 stainless steel. The outlet flange may be ductile iron or stainless steel. The gasket shall be a grid pattern design and shall provide full circumferential sealing around the pipe to be tapped. The sleeve shall include a test plug for pressure testing the installed sleeve prior to making the tap. All welds shall be passivated. The outlet flange shall be class D per AWWA C207 ANSI 150 lb. drilling compatible with approved tapping valves.

2. Service Saddles: All corporation stops for services or air releases on PVC pipe as well as 1-inch and larger corporations installed on DIP shall be installed with service saddles having threads to accept standard AWWA Corporation valve inlet thread. Service saddles for 2-inch PVC shall be brass. Service saddles for 6, 8, & 12-inch PVC or 6-inch and larger DIP may be brass, ductile iron or stainless steel. Steel straps must be preformed at the factory to the specified outside diameters of PVC pipe.

The following manufacturers and models are approved:

BRASS SERVICE SADDLES

Manufacturer	2" PVC	6" PVC	8" PVC	12" PVC
Ford	S-70	101B	101B	101B
McDonald	3801	3805	3805	3805
Mueller	13420	16084	16088	16093
Rockwell	_____	321	321	321
Romac	_____	101B	101B	101B
Power Seal	3401	3401	3401	3401

DUCTILE IRON SERVICE SADDLES

Manufacturer	**Single Strap**	**Double Strap**	**Stainless Steel Strap**
Ford	F101	F202	FS101
Rockwell	311	313	315
Smith/Blair	311	313	315
JCM Industries	401	402	403
Romac	101	202	101S
PowerSeal	3416	3418	3415

STAINLESS STEEL SERVICE SADDLES

Manufacturer	**Saddle No.**
Ford	F304
Romac	304
Rockwell	371-372

3. Corporation Stops: Corporation stops shall comply with AWWA C-800 and shall be high pressure rated at 200 PSI in accordance with Section 3.3 of the standard. Inlet threads shall be standard AWWA Corporation valve inlet thread. Outlet threads shall be according to the indicated connection. All corporation installed on C-900 PVC pipe as well as 1-inch and larger corporations installed on DIP shall require a tapping saddle/service clamp as hereinafter specified.

   The following manufactures and models are currently approved:

	3/4" and 1"	1 ½" and 2" Services

Manufacturer	Services				
		Ball Type		Plug Type	
	Compress	FIP	Increasing IP	FIP	Increasing IP
Ford	F1100	FB1600	FB800	---	F800

Manufacturer	1" Air Release	2" Air Release			
		Ball Type		Plug Type	
		FIP	Increasing IP	FIP	Increasing IP
Ford	F200	FB1600	FB800	---	F800
McDonald	3120	3148B	---	---	3121
Mueller	H9971	---	---	H10045	H10003

G. REPAIR/TIE-IN SLEEVES/CLAMPS

1. Sleeves: Solid cast iron mechanical joint sleeves (long pattern) shall be used where indicated for tie-ins between new mains and existing mains and when replacing defective sections of pipe with new pipe.

2. Repair clamps or split sleeves will not be allowed on new constructions. These may be used to repair existing mains if specifically directed by the Engineer.

H. ¾ & 1-INCH WATER SERVICES

1. Meters to be supplied by the Sunnyslope County Water District Water & Sewer Department after all applicable tap fees and final inspections have been paid and completed. Meters shall be installed in accordance with the plans.

I. 1-1/2 & 2 INCH WATER SERVICES

1. Meters to be supplied by the Sunnyslope County Water District Water & Sewer Department after all applicable tap fees and final inspections have been paid and completed. Meters shall be installed in accordance with the plans.

.

J. 3 & 4 INCH WATER SERVICES

1. Meters to be supplied by others and must meet Sunnyslope County Water District specifications.

K. Fire Service Meters - Sizes 6", 8", 10", and 12":

1. Meters shall be supplied by others and must meet Sunnyslope County Water District specifications.

2. The following shall apply:

   a. Meters shall comply with AWWA C-703.

   b. Meters must be approved for use for fire line service by Underwriters Laboratories or National Fire Protection Association.

   c. Companion flanges , gaskets, bolts and nuts shall not be provided.

3. Backflow Protection devices shall be in accordance with to meet Sunnyslope County Water District specifications..

L. IRRIGATION METERS

1. Not applicable.

M. MISCELLANEOUS STEEL

1. Steel Encasement Pipe: Steel pipe shall be welded or seamless, consisting of Grade “B” steel as specified in ASTM A-139.

   Minimum yield strength shall be 35,000 PSI; and pipe thickness shall be as specified for each individual job.

   All pipe shall be furnished with beveled ends prepared for field welding of circumferential joints. All burrs at pipe ends shall ve removed.

   Encasement pipe must be approved by the appropriate controlling agency (D.O.T., R. R., etc.) and the Engineer prior to ordering.

2. Structural Steel Tunnel Liner Plates: The tunnel liner plates shall be either the four (4) flange type (as approved for use within D.O.T. right-of-way) or the lap seam type (as approved for use within railroad right-of-way) fabricated to permit assembly of a continuous support system as the tunnel is excavated. Tunnel liner plates shall be fabricated from hot rolled, carbon steel sheets or plates conforming to the specifications of ASTM A-569.

   The tunnel liner shall be designed in accordance with the requirements of Section 16-Division I and constructed to conform to Section 25-Division II or the current or interim AASHTO Standard Specifications For Highway Bridges.

   Liner plates shall be galvanized in accordance with AASHTO M167 and fully bituminously coated in accordance with AASHTO M190. All hardware necessary to the tunneling operation shall be hot-dip galvanized in accordance with ASTM A-153, Grade A.

   The minimum mechanical properties of the flat steel plate before cold forming used for the design of the tunnel liner shall be:

   a. Minimum Tensile Strength of Liner Plates: 42,000 P.S.I.

   b. Minimum Yield Strength of Liner Plates: 28,000 P.S.I.

   c. Steel Liner Plates must be approved by the appropriate controlling agency (D.O.T., Railroad, etc.) And the Engineer prior to ordering. Gauge of thickness of liner plates will be as noted on the plans or elsewhere in these specifications.

   d. Elongation in 2-inches: 30 percent.

   e. The moment of inertia shall be .042 inches to the 4th power per inch of width for four flange 12 gage liner plate.

3. Steel Reinforcing for Concrete:

   a. **Bars**: All reinforcement bars shall conform to the Standard Specifications for BILLET-STEEL BARS FOR CONCRETE, REINFORCEMENT, ASTM A-615. All bars shall be deformed and of structural Grade 60.

   b. Wire: All reinforcement wire fabric shall conform to the Standard Specifications for WELDED STEEL WIRE FABRIC FOR CONCRETE REINFORCEMENT, ASTM A-185.

N. CONCRETE

1. Portland Cement: All concrete shall conform to the Standard Specifications for

READY MIXED CONCRETE, ASTM C-94. An air-entraining admixture, conforming to ASTM C-260, shall be added to either Type I, Type II or Type III Portland Cement.

Fly Ash conforming to ASTM C-618 for Class C Fly Ash may be added to the Concrete mix but shall not be considered as replacement for more than 10% of the cement therein (strengths shall not be less than hereinafter required).

Types I, IA, III and IIIA Portland Cement shall only be used for manhole inverts, concrete encasement, concrete blocking, and/or as directed by the Engineer, and shall conform to ASTM C-150.

Types II and IIA Portland Cement shall be used in precast manholes, reinforced concrete pipe, reinforced concrete piers and concrete or reinforced concrete riprap as directed by the Engineer and shall conform to ASTM C-150 except that Tricalcuim Aluminate (3Ca0A1203) content shall not exceed 8%.

2. Aggregates: All aggregates used for concreting shall conform to ASTM-33 and shall be checked daily for any variances in moisture current. Said variances shall be corrected and/or taken into consideration for each batch.

   a. Coarse Aggregates: Shall be uniformly and evenly graded for each application in accordance A.C.I. Standard 318. Unless otherwise approved, aggregate shall be sound, crushed, angular grantic stone. Smooth or rounded stone (river rock) shall not be acceptable.

   b. Fine Aggregates: Shall consist of natural sand, manufactured sand or a combination thereof. Fine aggregates shall conform to the sieve analysis as specified in paragraph 4.1 of the standard except that the percent passing a No. 50 sieve shall not exceed 5% and the percent passing a No. 100 sieve shall be 0% as provided for in paragraph 4.2 of the standard.

3. Mix Design: Concrete shall be watertight, resistant to freeze-thaw cycles and moderate sulfate attack, abrasion resistant, workable, and/or finishable. These quality may be met through the use of admixtures (if and only if approved in the mix design as hereinafter specified) conforming to the appropriate ASTM with the exception of the use of calcium chloride, which shall be limited to no more than 1% by cement weight - thoroughly mixed to insure uniform distribution within the mix. If the concrete is used with reinforcing steel, no calcium chloride will be allowed.

   The Contractor shall assume responsibility for concrete mixture. The concrete shall be proportioned to meet the following requirements: (Note: This does not apply “in total” to precast manhole or reinforced concrete pipe).

   a. Compressive Strength — Minimum 3600 PSI
   b. Water-Cement Ratio

	By Weight	Maximum -0.50
c.	Slump	Minimum 3" Maximum 5"
d.	Air Content (Entrained & Entrapped)	Minimum 4% Maximum 6%
e.	Coarse Aggregate	3/4"- ½ (as required by the application)

When required by the Engineer, and prior to beginning construction, the Contractor, at his expense, shall obtain from an approved commercial testing laboratory a design for a suitable concrete mix and submit same with his list of materials and materials suppliers for approval.

4. Curing Compound: All concrete curing compounds shall conform to the standard specifications for LIQUID MEMBRANE - FORMING COMPOUNDS FOR CURING CONCRETE, ASTM C-309, Type 2.

   Curing compounds shall be applied as forms as stripped.

5. Grouts: All grouts shall be of a non-shrink nature (as may be achieved through additives or proportioning) and depending upon application range from plastic to flowable cement water paste. Testing as specified above for concrete may be required for acceptance of grouts to include frequent checks for consistency by a time-of-flow measurement.

   Expansion grouts shall be either Gilco pre-mixed or Supreme non-metallic grout as manufactured by Gifford-Hill and Company, Incorporated, or Embeco 636 grout as manufactured by Master Builders or equal.

   Acceptable range of testing requirements:

   Compressive Strength .....10,500 to 12,500 PSI Bond Strength.....1,350 to 1,700 PSI
   % Expansion.....+.025% to +0.75%

   Expansion grouts shall be used only as directed by the Engineer
   Grouts shall be mixed (if applicable) and placed in accordance with the manufacturer's current recommendations, for each specific application.

6. Mortar: Mortar used in sanitary sewer manholes shall be hydraulic cement mortar in accordance with ASTM C-398. Mortar used in water meter vaults and water valve vaults shall be Type M mortar in accordance with ASTM C-270.

O. STONE AND BRICK

1. Granular Bedding Material: All bedding material shall be angular, clean washed crushed stone graded in accordance with Size #67 in ASTM D-448 for "Standard Sizes of Coarse Aggregate " (SCDOT Standard Size #67).

Bedding material will be used only as instructed in the Specifications and/or as specifically directed by the Engineer.

2. Stone Stabilization Material: All stone stabilization material shall be angular, clean washed crushed stone graded in accordance with standard sizes #467 in ASTM D-448 (SC DOT Standard Size #467M).

   Stabilization material will be used only as instructed in the specifications and/or as specifically directed by the Engineer.

3. Silt Check Dam Material: Shall be coarse angular, clean washed crushed stone, gravel, or rock, well graded, and ranging in sized from 2-inch through 6-inch, (SCDOT stone for erosion control Class A).

4. Rip Rap: All rip rap shall consist of clean field stone or rough unhewn quarry stone, resistant to the action of air and water, varying in weight from 25 to 250 pounds with 60% weighing a minimum of 100 pounds each and no more than 5% weighing less than 50 pounds each, (SCDOT Class 2 Rip Rap). Rip Rap will be placed from a minimum of 4.0 feet below the toe of the bank to top of the bank in areas determined by field conditions. Rip rap thickness shall be 1 ½ times the diameter of the largest stones used, or 2.0 feet, whichever is greater.

5. Brick: Brick shall be clay or shale brick meeting the requirements of ASTM C-62 for Grade SW, except as otherwise provided below.

   Brick shall be of uniform standard commercial size, with straight and parallel edges and square corners. They shall be burned hard and entirely true, free from injurious cracks and flaws, tough, strong, and shall have a clear ring when struck together. The sides, ends and faces of all brick shall be plane surfaces at right angles and parallel one to the other.

   Concrete brick may be used in lieu of clay of shale brick for adjustment of water meter vaults and/or water valve vaults. Concrete brick shall meet the requirements of ASTM C-55 for Grade S-II except that the absorption of brick used in minor drainage structures shall not exceed 10 lbs./ft.

P. TRAFFIC CONTROL DEVICES

All traffic control signs, barrels, barricades, pavement markings, etc., shall conform to the “Manual on Uniform Traffic Control Devices” (MUTCD) published by the U.S.D.O.T. and any supplements to the MUTCD. All traffic control devices shall conform to the specifications of the controlling agency (ie City of Hollister, San Benito County, or CALTRANS).

Q. EROSION CONTROL

1. Seed: All seed shall be labeled to show that it meets the current requirements. Seed shall have been tested within the six (6) months immediately preceding its use.

   Further specifications for each seed item are given below:

   a. Kentucky Fescue #31: Minimum 98% pure live seed; maximum 1% weed seed; minimum 90% germination.

   b. Sericea Lespedeza (Scarified and Unscarified): Minimum 98% pure live seed; maximum .50% weed seed; minimum 85% germination. Scarified may include 20% hard seed.

   c. Rye Grass (Annual): Minimum 98% pure live seed; maximum .10% weed seed; minimum 85% germination.

   d. Sundangrass: Minimum 98% pure live seed; maximum .25% weed seed; minimum 85% germination.

   e. Seed containing prohibited noxious weed seed shall not be accepted. Seed shall conform to the state law restrictions for restricted noxious weeds.

2. Fertilizer: All fertilizer for undeveloped areas shall have minimum 5-10-10 analysis or a comparable 1-2-2 ratio. All fertilizer for established lawn areas shall have a minimum 10-10-10 analysis or a comparable 1-1-1 ratio.

   All fertilizer shall be uniform in composition, dry and free flowing and shall be delivered to the job site in the original unopened containers, each bearing the manufacturer's guaranteed analysis.

   Any fertilizer which becomes caked or otherwise damaged will not be accepted. The quality of all fertilizer and all operations in connection with furnishing same, shall comply with the current requirements.

3. Lime: All lime shall be finely ground limestone (Dolomite) containing not less than 85% total carbonates.

4. Superphosphate: All superphosphates shall be composed of finely ground phosphate rock, as commonly used agricultural purposes, containing not less than 20% available phosphoric acid.

5. Mulch: All mulch shall be small grain or tame hay. Small grain or tame hay shall be furnished undamaged, air dried, threshed and free of undesirable weed seed.

6. Erosion Control Fabric: Material shall be as specified in the Environmental Protection Section of these specifications per Erosion Control Standard Detail 16.62.

7. Jute Netting or Thatching: All jute shall be of a uniform open plain weave of single jute yarn, 18-inches in width (+1"). The yarn shall be of loosely twisted construction and shall not vary in thickness by more than one-half (½) its normal diameter. There shall be 78 warp ends (+2), per width of netting; 41 weft ends (+1), per linear yard; and the weight shall average 1.22 pounds (+5%) per linear yard of netting. Jute shall be anchored into place in accordance with the manufacturer's requirements. Installation shall only be at the direction of the Engineer.

8. Erosion Control Blanket: Erosion control blankets shall be manufactured from wood fiber, straw, coconut fiber or other degradable material woven into a mat and secured with photo degradable plastic mesh or biodegradable thread.

   Blankets shall be installed according to manufacturers recommendations where directed by the Engineer. The following manufacturers are approved, AMXCO-Curlex Blanket, North American Green-SC150, HV Excelsior or approved equal.

9. Gabions: Gabions shall be manufactured from zinc coated steel wire mesh (minimum gauge) to form rectangular units. The front, base, back and lid shall be woven into a single unit and the ends and diaphragms shall be factory connected to the base. The individual units shall be installed per the manufacturers instructions and filled with hard durable, clean stone from 4-8 inches inside, or as approved by the Engineer.

II. DETAILED SPECIFICATIONS FOR WATER MAIN CONSTRUCTION

Unless superseded or modified in the Detailed Specifications, all materials, apparatus, supplies, methods of manufacture, or construction shall conform to the specifications contained in this Section and Section C of the AWWA Standards (R.61-58.4.D.{11}{a}) and/or manufacturer's recommended installation procedures. National material standards (ASTM, ANSI, AWWA, etc.) referred to herein shall be considered to be the latest revisions only.

All excavation, trenching, and restoration of the right of way shall be done in accordance with the encroachment permit or standards of the agency which controls the public rights of way. If there is no controlling agency, all excavation and trenching shall be done in conformance with the plans. All pipelines shall be constructed to build a complete functioning system including thrust blocks. All pipelines shall be flushed, disinfected, and pressure tested in conformance with the specifications.

A. HANDLING AND STORAGE OF MATERIALS

The Contractor shall be responsible for the safe storage of materials furnished by or to him, and accepted by him and intended for the work, until they have been incorporated in the completed project. The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign materials at all times. Valves and hydrants shall be drained stored in a manner that will protect them from damage by freezing.

1. Transportation of Materials and Equipment: The Contractor and his Suppliers are directed to contact the California Department of Transportation to verify axle load limits on State maintained roads (and bridges) which are to be used for hauling equipment and materials for this project. The Contractor and his suppliers shall do all that is necessary to satisfy the Department of Transportation requirements and will be responsible for any damage to roads which may be attributed to this project.

   All materials required to construct this project shall be furnished by the contractor and shall be delivered an distributed at the site by the Contractor or his material supplier.

2. Loading/Unloading Materials: All pipe, fittings, valves, hydrants and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

3. Responsibility for Materials on Site: In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. Pedestrian or vehicular traffic shall not be unduly inconvenienced by material placed along the street right-of-way.

   The Contractor will string in advance no more than the amount of pipe and material that can be installed within two (2) weeks unless approved by the Engineer. Other material may be placed in storage yards as specified below. All materials shall be placed in such a manner as not to impede any traffic. Materials strung through residential areas (or any area with maintained lawns) shall be placed in such a manner that normal lawn maintenance is not restricted and must either be installed within two (2) weeks or removed to an approved storage yard, as required by the Engineer.

4. Material and Equipment Storage: The Contractor will be responsible for locating and providing any required offsite storage areas for construction materials and equipment. Unless prior written consent from the owner of the proposed storage area is received by this Department, the Contractor will be required to store all equipment and materials within the project site or the limits of the right-of-way provided. The materials and equipment storage shall comply with all state and local ordinances throughout the construction period. Material and equipment may only be stored within road right-of-way if approved by the controlling agency.

   The Contractor shall be responsible for safeguarding materials and equipment against fire, theft, and vandalism and shall not hold the County responsible in any way for the occurrence of the same.

5. Care of Coatings and Linings: Pipe and fittings, including hydrants, shall be so

handled that the coating and lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a manner satisfactory to the Engineer.

B. CONNECTION TO EXISTING MAINS

Connections to the existing system shall be made in the presence of Sunnyslope County Water District Water & Sewer Inspection personnel. Valves, hydrants, blow offs, etc. will be operated by Sunnyslope County Water District Water & Sewer personnel and/or the Contractor if specifically directed by Sunnyslope County Water District Water & Sewer to do so. The Contractor shall provide all labor, materials, and equipment required for connection to the existing system. Only one (1) connection between the existing system and the new extension will be allowed until testing, chlorination, and successful sampling of the new extension is complete.

If connection to existing mains will necessitate an interruption of service, the Contractor will schedule the connection for a time that is most convenient to the affected customers as determined by the Engineer. Adequate notice will be provided to those customers who will be put out of service by the connection. When such interruption of service is approved, the Contractor will have all required labor, material and equipment at the site before beginning any work and the service interruption will be kept to an absolute minimum.

The Contractor shall verify blocking at existing valves prior to making connections and will be required to block, rod, or restrain existing and new pipe, fittings and valves as necessary.

Chambers, pits or manholes containing valves, blow-offs, meters, air-relief valves, or other such appurtenances to a distribution system shall not be directly connected to any storm drain or sanitary sewer (R61-58.4.D.(10)(c)).

C. EXISTING UTILITIES

The Contractor will be required to excavate to determine the precise location of utilities, or other underground obstructions, which are shown on the Construction Plans. Such location and excavation shall be at least 500 feet ahead of construction or as noted in the Special Provision Section of this document.

All utility owners will be notified prior to excavation as required by the California Underground Service Alert (USA). Owners who are members of USA may be notified in accordance with current USA procedures. The Sunnyslope County Water District Water & Sewer Department is not a USA member. The Contractor will be fully responsible for damage to any utilities if the owners have not been properly notified as required by the Underground Service Alert.

Utility owners may, at their option, have representatives present to supervise excavation in the vicinity of their utilities. The cost of such supervision, if any, shall be borne by the

Contractor.

Conflicts with underground utilities may necessitate changes in alignment and/or grade of this construction. All such changes will be approved by the Engineer before construction proceeds.

When underground obstructions not shown on the Construction Plans are encountered, the Contractor shall promptly report the conflict to the Engineer and shall not proceed with construction until the conflict is resolved by the Engineer.

When a PVC water main crosses other buried pipeline utilities (storm drain, gas, encased or capped telephone conduit, etc.) 12-inches clearance must be maintained between the water line and utility and the water main shall receive Type III stone bedding. If this clearance requires the water main to be deeper than 5 feet, the Contractor may install a DIP (galvanized steel pipe for 2-inch mains) water main over the utility with less than 12-inches clearance provided there is 3 feet cover over the water main.

D. WATER LINE/SEWER LINE CLEARANCE

When a water main crosses or is parallel to an existing sewer main, the Contractor shall install the water main and sewer main as described below.

1. Vertical Separation of Water Lines & Sewer Lines & Storm Drains: Whenever it is necessary for a water main to cross over a sewer main or storm drain, the water main shall have 12" of vertical separation with the water main being located above the sewer line.

2. Horizontal Separation of Water Lines and Sewer Lines: Water mains shall be laid at least 10 feet horizontally, measured from edge of pipe to edge of pipe, from existing or proposed sewer mains unless local conditions or barriers prevent a 10-foot horizontal separation. Water mains shall be laid at least 4 feet horizontally, from existing storm drains

3. Special Conditions: When it is impossible to obtain the distances specified in R.61-58.4 (D)(12)(a) and (b) the Department may allow an alternative design. Any alternative design shall:

    a. maximize the distances between the water main and sewer line and the joints of each;

    b. use materials which meet the requirements R.61-58.4(D)(1) for the sewer line; and,

    c. allow enough distance to make repairs to one of the lines without damaging the other.

4. Force Mains: There shall be at least a 10 foot horizontal separation between

water mains and sanitary sewer force mains. There shall be an 12" vertical separation at crossing.

5. Sewer Manholes: No water pipe shall pass through or come in contact with any part of a sewer manhole. Water lines may come in contact with storm sewers or catch basins if there is no other practical alternative, provided that ductile iron is used, no joints of the water line are within the storm sewer or catch basin and the joints are located as far as possible from the storm sewer or catch basin.

6. Drain-Fields and Spray-Fields: Potable water lines shall not be laid less than 25 feet horizontally from any portion of a waste-water tile-field or spray-field, or shall be otherwise protected by an acceptable method approved by the Department.

7. Contaminated Areas: Water mains shall be located out of contaminated areas, unless using pipe materials that will protect (i.e., DIP with chemical resistant gaskets.) Re-route line if possible. (R.61-58.4.D.(11)(h))

E. EXCAVATION

All excavations shall be as specified below. Excavation within street rights-of-way shall be backfilled when left unattended for more than 1 hour unless otherwise approved by the controlling agency. All excavation shall be done in conformance with the specifications of the controlling jurisdictions encroachment permit. If there is no encroachment permit, all excavation shall be in conformance with the plans.

1. Trench Excavation: No more than 500 LF of trench shall be opened in advance of the pipe laying unless prior approval is given by the Engineer. Ground conditions and/or location will be considered by the Engineer in making this determination.

   a. Trench Width: Minimum trench width for pipe shall be equal to the outside diameter (as measured at the pipe barrel) of the pipe plus sixteen (16) inches.

      Trench width shall be measured between faces of cut at the top of the pipe. If the Contractor varies from this requirement without approval of the Inspector, shall at his own expense install Type II of Type III bedding defined in this specification.

2. Excavation For Structures: The excavation shall be made to the lines, grades and elevations shown on the Plans and the Standard Details. The area excavated shall be limited to no more than is necessary to allow the proper installation of the structure as determined by the Engineer. The excavation shall remain open no longer than is necessary to allow the proper and complete installation of the structure.

   a. Structure Pit Bottom Conformation: The pip bottom shall be true and

even, and capable of supporting the structure as determined by the Engineer. If the pip bottom is inadvertently cut below grade, the Contractor shall fill it to the proper elevation with approved material capable of continually maintaining adequate supportive strength.

3. Excavation for Bore Pits: The excavation shall be controlled by the limits of the existing rights-of-way and shall not exceed these without prior written approval of the current property owner. The excavation shall be made to the proper elevation, line and grade to install the casing pipe as shown on the construction plans.

   The pit bottom shall be true and even with adequate stabilization to maintain proper elevation and grade on the boring rig for the duration of the bore. The walls of the pit shall be shored or sloped to comply with OSHA requirements.

   The bore pit shall not be left open overnight on SCDOT maintained roadways without specific approval from the SCDOT. If approval is obtained, concrete median barriers are required to be placed around the bore pit within the road right-of-way.

4. Rock Excavation: Rock excavation shall be defined as solid ledge rock that requires drilling and blasting, sledging, or barring for its removal. Soft, disintegrated rock that can be removed with a pick shall not be classified as solid rock. Boulders greater than one cubic yard in volume will also be considered rock excavation. Smaller boulders and soft rock which in the opinion of the Engineer can be excavated by the use of power shovel, without undue delay, shall not be classified as rock.

   Rock shall be removed to the following limits as measured between vertical planes - twelve-inches (12") outside the pipe bell- parallel to the water line and for a depth of six (6) inches below the pipe bell. Rock around structures shall be removed to the same 12-inch limit as measured between vertical planes around the structure to a depth necessary to allow proper installation of the structure. Over excavation of rock due to removal methods, or for safety considerations, shall be the Contractors responsibility.

   When rock removal is necessary for pipeline installation, either Type II or Type III bedding shall be installed as specified and directed by the Engineer.

   All blasting shall be conducted in the manner as described elsewhere in these Specifications.

5. Piling Excavated Material: All excavated material shall be piled in a manner that will not endanger the work. Excavated material will be piled a safe distance away from the edge of the excavation allowing room for an adequate angle of repose and if shoring, sheeting, and bracing is used to protect the excavation, no material will be piled within three (3) feet of the nearest edge.

Sidewalks, driveways, hydrants, valve pit covers, valve boxes, curb stop boxes, existing manholes, fire and police call boxes, or other utility controls shall be unobstructed and accessible until the work is completed. Gutters, catch basins, and natural watercourses shall be obstructed or sited.

6. Dewatering: The Contractor shall at all times provide and maintain ample means and equipment with which to remove and properly dispose of water entering the excavation or other parts of the work and shall keep all excavations dry until such time as pipe laying and grading is completed.

   Water shall not be allowed to rise around the pipe in un-backfilled trenches nor shall it be allowed to rise over masonry until the concrete or mortar has set (minimum 24 hours). All water pumped or drained from the work shall be disposed of in such a manner as to minimize siltation and erosion on adjacent property or other construction.

7. Shoring And Shielding: The Contractor shall comply with OSHA trenching and excavation regulations as revised in Subpart P of Part 1926 in the Federal Register. Shoring and/or shielding systems shall be used as specified in Subpart P to prevent caving of trench banks and to provide a safe excavation.

   The Contractor will be responsible for excavation safety and shall designate his "competent person" (as defined in Subpart P) for the determination of proper shielding/shoring systems.

   If, in the opinion of the Engineer, the trench/excavation is not in compliance with OSHA regulations, the Contractor may be directed to stop work. Continued unsafe conditions will be reported to the appropriate regulatory agency. The Contractor will be responsible for paying all fines resulting from safety violations.

F. PIPE LAYING

In all instances, pipe shall be installed in a workmanlike manner and true to line and grade. Pipe shall be installed in conformance with the plans and the specifications of the encroachment permit specifications of the controlling agency (ie City of Hollister, County of San Benito, CALTRANS). The resulting pipeline shall be installed to furnish a complete and functioning system. All pipes shall be disinfected and tested in conformance with these specifications before acceptance. The various pipes specified shall be handled and installed in accordance with the manufacturer's recommendations and good engineering practices. The following requirements and/or standards of the Sunnyslope County Water District Water & Sewer Department shall govern this construction.

1. Pipe Bedding: Pipe bedding shall be done in accordance with the plans and in conformance with the encroachment permit.

2. Depth of Pipe Installation: Unless otherwise indicated on Plans, or required by

existing utility location, or the encroachment permit, all pipe will be installed with the top of the pipe at least 3.0' below the edge of adjacent roadway pavement or 3.0' below the ground at the pipe, whichever is greatest. The Contractor is instructed to check the construction plans and blow-up views for additional requirements.

The Contractor may be required to vary the depth of pipe to achieve minimum clearance from existing utilities while maintaining the minimum cover specified whether or not the existing pipelines, conduits, cables, mains, etc. are shown on the Plans.

3. Alignment and Grade:

a. New Subdivision Streets: The water main shall be laid and maintained to the required lines and grades with fittings, valves and hydrants at the required locations; spigots centered in bells; and all valves and hydrant stems plum. The curb must be in place and backfilled, and the area between the curb and the street right-of-way line graded smooth and to finished grade before water mains are installed. The water main shall be installed behind the curb as shown on approved plans or directed by the Engineer.
In special circumstances, the Engineer may approve installation of water mains before the curb is installed. In such cases, the street must be graded according to approved grading plans for the entire width of the street right-of-way, the water main staked five feet behind the proposed curb line with 90° offset stakes every 50 feet, and “cut sheets” provided showing the vertical distance between each offset stake and the trench bottom at that point. Such staking will be done only by a surveyor registered in the State of California.

After the curb and gutter has been installed, the location and depth of the main, valves, fire hydrants, etc., will be checked for conformance with Sunnyslope County Water District Water & Sewer Department standards. Any deficiencies will be corrected to the satisfaction of the Engineer prior to testing, disinfection and activation of the mains.

b. Existing Streets: The water mains shall be installed as shown on the plans unless an obstruction prevents such alignment or grade. The Contractor will be required to adjust the location of the water main where possible to avoid such conflicts as specified and as directed by the Engineer

All construction layout and surveying which may be required for construction shall be provided by the Contractor and any costs associated shall be included in the various pay items of the proposal. The Contractor is responsible for determining the amount of construction layout and surveying that may be required to complete construction.

4. Crossing:

a. Above-water crossings: The pipe shall be adequately supported and anchored, protected from damage and freezing, accessible for repair or replacement and approved by the Department. (R.61-58.4.D.(13)(a))

b. Underwater crossings: A minimum of 2 feet of cover shall be provided over the pipe. When crossing water courses that are greater than 15 feet in width, the following shall be provided: (R.61-58.4.D.(13)(b)(i)-(iii))

i) The pipe material and joints shall be designed appropriately.
ii) Valves shall be located so the section can be isolated for testing or repair; the valves(on both sides of crossing) shall be easily accessible and not subject to flooding.
iii) A blow-off shall be provided on the side opposite the supply service side in accordance with Section R.61-58.4.D.(7). Direct away from streams, over ground.
iv) Use DIP with mechanical joints for any lines being installed in rock.

G. INSTALLATION AND ASSEMBLY

Installation of water mains and appurtenances shall be conducted in accordance with Section C of AWWA Standards and/or manufacturer's recommended installation procedures. (R61-58.4.D.(11)(a))

Proper implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient protection of the work. All pipe, fittings, valves and hydrants shall be carefully lowered into the trench piece by piece by means of a backhoe or other suitable means, in such a manner as to prevent damage to protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench.

1. Inspection of Material: The pipe and fitting shall be inspected for defects.

2. Cleaning Pipe and Fittings: All lumps, blisters and excess coatings shall be removed from the bell and spigot ends of each pipe, and the outside of the spigot and the inside of the bell shall be wire-brushed and wiped clean and dry and free from oil and grease before the pipe is laid.

3. Laying Pipe:

a. Pipe shall be laid with bell ends facing in the direction of laying, unless otherwise approved by the Engineer. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being place. If the pipe laying crew cannot put the pipe into the trench and in place without getting earth into it, the Engineer may require that before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size

shall be placed over each end and left there until the connection is to be made to the adjacent pipe. During laying operation, no debris, tools, clothing or other materials shall be placed in the pipe.

b. After placing a length of pipe in the trench, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the bells. Precautions shall be taken to prevent dirt from entering the joint space.

c. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the Engineer. This provision shall apply during the noon hours as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.

d. All pipes must have a minimum cover of 36 inches..

e. All mains shall be detectable within three (3) feet with electronic locating equipment. Nonmetallic pipes shall be installed with copper wire or other approved means of detection. See Section G, Item 9 for PVC pipe detection specification(R.61-58.4.D.(11)(g)).

4. Permissible Deflection of Joints: Where ever it is necessary to deflect pressure pipe from a straight line, either in the vertical or horizontal plane, to avoid obstruction or plumb valve stems, or where long radius curves are permitted, the amount of deflection allowed shall not exceed that required for satisfactory sealing of the joint as recommended by the manufacturer, and shall be approved by the Engineer.

5. Installation of Push-On Joint Pipe: The gasket groove and bell socket shall be cleaned and lubricated, and the gasket inserted as specified by the pipe manufacturer. Sterile lubricant, as furnished or specified by the manufacturer shall be applied to the gasket and beveled spigot end of the pipe. The beveled spigot end of pipe shall be pushed straight into bell using either a bar, jack, lever puller, or backhoe. A timber header will be placed between the jack or backhoe bucket and the pipe to prevent damage to the pipe. At no time will the joint be made by swinging the pipe. The pipe will be deflected, if required, after the joint is made.

6. Installing Mechanical Joint Pipe and Fittings: All spigots shall be centrally located in the bell and adequate anchorage shall be provided where abrupt change in direction and dead ends occur. All pipe surfaces with which the rubber gasket seals come into contact will be brushed with a wire brush just prior to assembly in order to remove all loose rust or foreign material and to provide a clean surface for the installation of the gasket. The pipe surface with which the gasket comes into contact the gasket will be brushed with soapy water just prior to the

installation of the gasket and the making up of the joint. Torque loads shall be applied to the standard cast iron bolts used in making the joint as follows:

BOLT SIZE, INCHES	RANGE OF TORQUE, FT. POUNDS
5/8	40-60
3/4	60-90
1	70-100
1-1/4	90-120

The above torque loads may be applied with torque measuring or indicating wrenches. Torque wrenches may be used to check the application of approximate torque loads applied by men trained to give an average pull on a definite length of regular socket wrench. The following length of wrenches should satisfactorily produce the above ranges of torques when used by the average man:

BOLT SIZE, INCHES	LENGTH OF WRENCH, INCHES
5/8	8
3/4	10
1	12
1-1/4	14

When tightening bolts, the gland will be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket.

7. Bend and Fitting Location: The Contractor is advised that the bends and fittings indicated on the plans are for a guide only. The Contractor will be require to furnish additional bends and fittings as needed to complete all installations.

8. Cutting Pipe: The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or cement lining and so as to leave a smooth end at right angles to the axis of the pipe. Cut ends of a pipe shall be beveled before installation in a push-on joint bell.

   When making connections to existing mains which require water mains to be removed from service, automatic traveling pipe cutting machines will be required on 16-inch and larger. At other times, hand-held pipe saws may be used provided the pipe is marked, prior to cutting, such as to provide a cut at right angles to the axis of the pipe. Handheld pipe saws may be used in all applications for cutting pipe small than 16-inch.

   Flame cutting of pipe with an acetylene torch will not be allowed.

9. PVC Pipe Installation: PVC water main shall be installed in accordance with the Recommended Practice for the Installation of PVC Pressure Pipe UNI-B-3 and AWWA C-900. Backfill shall be as specified elsewhere in these specifications.

Tracer wire shall be installed as follows:

Tracer Wire: A 10-guage solid copper wire shall be laid on top of the PVC pipe to aid in locating the pipe for maintenance purposes. This wire shall be secured to the pipe with duct tape near every bell and at the center of each pipe joint. The wire shall be fastened securely to a cast iron fitting at each main line valve and fire hydrant and to service lines as directed by the SCDHEC (R.61-58.4.D. (11)(g)) and Sunnyslope County Water District specifications.

Unless otherwise indicated on the Plans, or required by existing utility locations, all PVC water pipe will be installed with a minimum cover of 3.0 feet. The maximum cover shall be as previously specified. Ductile Iron Pipe shall be installed when the minimum cover is less than 3.0 feet and in all crossings of other pipelines (storm drainage, gas, etc.) when the vertical distance between the water main and the other pipeline is less than 12-inches.

H. INSTALLING VALVES, HYDRANTS, AND FITTINGS

Valves, hydrants and fittings shall be installed in the manner specified for installation and assembly of pipe. Valves and hydrants shall be installed at locations shown on the plans and/or as directed by the Engineer.

1. Valve Boxes: A valve box conforming to the Standard Details shall be installed for every gate valve. The valve box shall not transmit shock or stress to the valve and shall be centered plumb over the operating nut, with the box cover flush with the surface of the pavement or other existing surface.

2. Valve Blocking: All valves shall be secured with thrust blocks as shown in the standard plans. All end of line valves 12-inch and smaller installed on PVC or DIP water mains and all 12-inch valves installed along PVC water mains shall be securely wedge blocked with concrete bearing against, and cut into the excavated sides of the trench. Care shall be taken in forming and pouring the “wedge” blocking so the fitting joints will be accessible for repair and/or valve extraction.

3. Fire Hydrants: Hydrants shall be set with no less than three (3) foot bury on water mains 12” smaller and with four (4) foot or more for water mains 16” or larger. Because of varying topography, extensions, and/or hydrants with greater bury may be required. Extensions will be made by the hydrant manufacturer.

   All hydrants and hydrant guard valves will be installed plumb and in accordance with the Standard Details. The appropriate plan view will be noted on the Plans or in the Special Provisions. Each hydrant installation will include a drainage bed of clean washed stone approximately 1 cubic foot in size at the “weep hole.” Piping from the main to the hydrant shall be 6-inch DIP.

4. Blocking/Restraint Fittings:

a. Thrust blocking or mechanical restraints must be installed for all plugs, caps, tees, and bends deflecting 11-1/4 degree or greater on lines 2 ½ inches in diameter and larger, for all post hydrants on lines 3 inches in diameter and larger, and for all hydrants on lines 6 inches in diameter and larger (R.61-58.4.D.(11)(d)). . Blocking must be placed as shown on the Plans and/or as directed by the Engineer, and consisting of ready mix concrete having a compressive strength of not less than 3,000 lbs per square inch at 28 days. Restrained joints may be substituted for blocking for 11 degree and 22 degree elbows when a full length of pipe is attached to each end of the elbow. Restrained joints may be used for 45 degree elbows, 90 degree elbows, or ends of pipe, in lieu of blocking, upon the approval of the Engineer.

b. Bagged mix concrete may be used for blocking, anchorage, concrete valve pads, etc. on water mains and valves 12-inch and smaller, when less than ½ yard is required.

c. Blocking shall be placed between solid ground and the fittings to be anchored. The area of bearing on the pipe and on the ground in each instance shall be that shown or directed by the Engineer. The blocking shall be placed that the pipe and fittings will be accessible for repair.

5. Restrained joints shall be installed where shown on the plans, standard details or when approved by the Engineer, and may be installed in lieu of blocking when approved by the Engineer. Installation shall be per manufacturer's Recommendations, as shown on the plans, special provisions, and/or as directed by the Engineer.

6. Air relief valves shall be provided in accordance with sound engineering practice at high points in water mains as required. Automatic air relief valves shall be used in situations where flooding of the manhole or chamber may occur.(R.61-58.4.D.(10)(a))

7. Chambers, pits, or manholes containing valves, blow-offs, meters, air-relief valves, or other such appurtenances to a distribution system, shall not be connected directly to any storm drain or sanitary sewer. (R. 61-58.4.D.(10)(c))

I. WATER MAIN TAPS

1. Installation Of Tapping Sleeves and Valves: Tapping sleeves and valves will be installed under inspection by the Sunnyslope County Water District Water/Sewer inspection personnel and as recommended by the Manufacturer. No work will be done (including excavation of the existing main) except when Sunnyslope County Water District Water/Sewer Inspection personnel are present.

Tapping valves shall be supported at all times to prevent the tapping sleeve from

slipping on the main. Tapping sleeves and valves will be field pressure tested after installation on the pipe but before the tap is made.

First, the tapping valve will be opened and the sleeve and valve filled with water and placed under the rated pressure of the sleeve (200 PSI for 12-inch and smaller, 150 PSI for 16-inch and larger). The pressure gauge shall be observed for five minutes with no loss of pressure. Then the pressure shall be released, the valve closed and procedure repeated with test pressure against the outside of the valve gate or wedge.

When tapping sleeves are furnished with test plugs, the test may be made in a singe step with the valve closed and pressure applied through the test plug.

2. ¾" thru 2" Water Service Connections: Applications shall be made to the Customer Service Section of the Sunnyslope County Water District Water & Sewer Department and
will pay current fees for ¾-inch and 2-inch meters prior to construction and installation of water service connections. Only those connections, which have been applied for and approved, will be made.

Service lines will be made perpendicular to the water main unless otherwise approved. All taps will be made substantially as shown on the Standard Details. Services lines will be installed with a minimum depth of cover of 20-inches and a maximum depth of cover of 30-inches. Service connections must be installed prior to pressure testing and sterilization. Allowance for the joints in service connections will be included when computing the allowable leakage. The Contractor shall flush each connection after testing and sterilization is complete.

Meter box locations shall be as shown on the standard details. Meter boxes shall be Ford Boxes or equal as previously specified. In areas with sidewalks or proposed sidewalks, the meter boxes are to be set totally out of the sidewalk. Meter boxes will not be set in driveway locations.

Meters will be installed by the Utility Department personnel after the lines are approved by the Engineer, subject to receipt of turn-on order. The location of services will be identified by the letter "W" imprinted into the curb adjacent to the service. Where a service is moved or removed, the "W" will be removed from the curb or grouted over.

On projects without curb, the Contractor will paint a "W" on the edge of pavement adjacent to the service. Markings will be made with blue paint conforming to the uniform color code established by the Utility Location And Coordination Council of the American Public Works Association.

Service connections to PVC and DIP pipe shall be made by using tapping saddles threaded to accept corporation stops.

In new streets, piping beneath pavement on “long side” taps will be installed prior to paving. Backfill shall be compacted as specified with extreme care taken to prevent damage to the piping. Piping beneath paved areas will be one continuous piece.

3. 3 Inch and Larger Services: Water meters 3-inch and larger and fire lines with detector checks shall be installed by the Contractor. Such installation shall conform to the Standard Details, as applicable for the meter installations and to the applicable MS and DS sections for service line piping. All portions of the installation, including property line valves, shall be contained within the street right-of-way. Where this is not feasible because of vault size or limited right-ofway width, the required additional right-of-way shall be transferred to the County in accordance with the General Conditions sections of this document. The Contractor shall consult with the project inspector to determine location of meter vaults before installation begins.

4. Cross Connection Control (Backflow Prevention):

   a. Devices shall be installed in accordance with Sunnyslope Backflow Standard Details.

   b. There shall be no connection between the distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water or other contamination materials may be discharged or drawn into the system (R.61-58.4.D.(14)(a)).

   c. No by-passes shall be allowed, unless the bypass is also equipped with an equal, approved back-flow prevention device (R.61-58.4.D.(14)(a)).

   d. High hazard category cross connections shall require an air gap seperation or an approved reduced pressure backflow preventer (R.61-58.7.F.(4)).

   e. Reduced pressure principal backflow prevention assemblies shall not be installed in any area location subject to possible flooding. This includes pits or vaults which are not provided with a gravity drain to the ground’s surface that is capable of exceeding the discharge rate of the relief valve. Generally, if installed in a pit, the drain line shall be 2 times the size of the line entering the backflow prevention device. The drain cannot empty into any ditch, or sewer, which could flood water back into the pit (R.61-58.7.F.(5)).

   f. All piping up to the inlet of the backflow prevention device must be suitable for potable water. The pipe must be AWWA or NSF approved. Black steel pipe cannot be used on the inlet side of the device.

   g. Fire line sprinkler systems and dedicated fire lines, except those in the high hazard category shall be protected by an approved double check valve assembly (R.61-58.7.F.(6)).

J. BACKFILL

All backfill shall be in conformance with the encroachment permit of the controlling agency (ie San Benito County, City of Hollister, CALTRANS). If there is no controlling agency backfill shall be in conformance with the plans.

1. Replacement of Wet Or Unsuitable Material: When the Engineer determines that the material excavated from the trench is unsuitable for backfill because of the material type or because it contains excessive debris, rock, or organics, it shall be removed from the project and replaced with a backfill material approved by the Engineer. When the moisture content of an otherwise suitable material is too high to achieve specified compaction, as determined by a moisture content and density test, the Contractor shall replace the material as necessary to fulfill backfill requirements. The wet material may be dried to optimum moisture content and used for backfill in subsequent phases of the project. Should an otherwise suitable material be found too dry to achieve compaction requirements, water may be added to the material to raise the moisture content to optimum. Borrow material placed at the direction of the Engineer shall be clean earth at optimum moisture content, concord (pit) gravel or ABC stone.

2. Backfilling of Trenches: Trenches shall be backfilled immediately after the pipe is laid..

    a. Backfill of trenches within water main rights-of-way: Trenches excavated outside existing roadway and railway right-of-way shall be backfilled, as specified in the encroachment permit of the controlling agency. If there is no controlling agency, backfill shall be in conformance with the plans.

    b. Backfill of trenches within road and railway rights-of-way: Trenches excavated within existing roadway and railway right-of-way shall be backfilled, as specified in the encroachment permit of the controlling agency. If there is no controlling agency, backfill shall be in conformance with the plans.

K. COMPACTION REQUIREMENTS

Compaction for pipeline and structure excavations shall be attained by the use of mechanical tamps. Each layer of backfill shall be placed loose and thoroughly compacted in place. Heavy rollers, vehicles or other equipment shall not be used for compacting backfill nor allowed to cross over completed work except at points judged capable of adequately protecting the pipeline. Pneumatic tamps, ram type tamps or vibrating tamps with sheepsfoot rollers will be required to meet the specifications of "Mechanical Tamp." In road right of ways compaction shall be as specified in the encroachment permit of the controlling agency. If there is no controlling agency, compaction shall be done in conformance with the plans. If there is no controlling agency,

and there is no compaction specified in the plans, the upper 3 feet shall be compacted at 95% compaction with areas below 3 feet at 90% compaction.

1. Pipeline Connection: Trenches excavated outside existing road and railway rights-of-way shall be backfilled as specified above and tamped thoroughly.

    a. All material shall have an in-place density as specified by the encroachment permit of the controlling agency. If there is no controlling agency, and compaction is not specified in the plans, in-place density shall be a minimum of 95% compaction in the upper 3 feet and 90% compaction below 3 feet.

    b. Should any public or private roadways, service road, drive, etc. be encountered during this construction, the Contractor shall at the Engineer's direction comply with the compaction requirements specified below for work within road and railway rights-of-way.

2. Compaction Within Road and Railway Rights-of-Way: Trenches excavated within existing road and railway rights-of-way, and all structure excavation regardless of location, shall be backfilled as previously specified and thoroughly tamped:

    a. All material shall have an in-place density as specified by the encroachment permit of the controlling agency. If there is no controlling agency, in-place density shall be a minimum of 95% compaction in the upper 3 feet and 90% compaction below 3 feet.

3. Compaction Testing: Moisture content and density testing of backfill will be the done in accordance with the encroachment permit. All compaction testing shall be paid for by the contractor. Tests will be performed within all street, highway and railway rights-of-way to insure that the specified compaction requirements are met. The Contractor will cooperate fully with the soils technician in providing access to backfill at any requested depth for the purpose of performing moisture content/density testing. When requested, the Contractor shall excavate a backfilled ditch to any specified depth for a compaction test and shall insure that the ditch meets all OSHA safety standards before the technician enters to perform the test.

    A "standard proctor curve" which establishes the relationship between moisture content and dry density for soil will be determined by the method described in ASTM D-698 or by AASHTO Method T-99. Field density tests will be performed using either the sand cone method or a nuclear moisture/density gauge. Any backfill, which does not meet the specified compaction, will be re-tamped, or removed and replaced as approved by the Engineer.

L. REMOVAL AND RESTORATION OF PAVEMENT AND ROAD SURFACES

All removal and restoration of pavement and road surfaces will be in accordance with the

encroachment permit of the controlling agency.

All restored bituminous and concrete pavements shall be placed to existing cross-section and ride quality. Restored pavement will in all instances be flush and level with existing pavement at the sawed edges, and at existing gutter lines where applicable unless otherwise approved by the Engineer. When pavement repairs do not meet the above criteria or are not performed in a workmanship manner as determined by the controlling agency, the Engineer, Sunnyslope County Water District Public Works, or California Department of Transportation, whichever applies, the contractor will remove and re-perform the restoration as specified.

Pavement will be replaced as follows. In all pavement cuts either the permanent pavement or a temporary pavement consisting of 1"-1 ½" of black asphaltic concrete (later to be replaced permanently) will be placed immediately upon completion of the subgrade unless otherwise approved by the Engineer.

1. Specifications for Cutting Pavement: Unless otherwise approved or required, concrete pavement shall be removed to the nearest expansion or contraction joint. The Contractor will contact the Public Works Dept. and/or D.O.T.'s District Engineer for a determination of the limits of concrete replacement and location of joints. Where sawed joints are allowed, the depth of the sawed cut shall be at least one (1) inch and shall extend at least 1/5 of the depth of the concrete. More depth may be required if necessary to prevent damage to surrounding pavement.

   Bituminous pavement shall be cut in a smooth and straight line. Sawing is required on asphaltic concrete. The width of pavement left between the edge of the ditch and the existing edge of the pavement or the front line of the gutter, shall be at least 2 feet. Residual strips of pavement less than 2 feet in width must be removed and replaced. Existing pavement shall be removed on each side of the trench for at least 6 inches beyond top of trench.

   The Contractor shall remove and replace pavement, which, in the opinion of the Engineer, has been cracked or displaced by the operation of the Contractor.

2. Specifications for Restoring Concrete Pavement: The concrete used to restore pavement shall have a minimum 28 day compressive strength of 3600 P.S.I. The concrete as placed shall conform to the shape, grade, and finish of the existing pavement and will be one (1) inch deeper than the original pavement including base, but in no instance less than six (6) inches.

3. Specification for Restoring Asphalt Pavement: All material above the sub-base level shall be hot-mix bituminous concrete conforming to California Department of Transportation Standard Specifications for Roads and Structures for both mix design and placement.

   The asphalt pavement as placed shall be equal to the original pavement including base, but in no instance less than twelve (12) inches of class II baserock, and three

(3) inches of asphalt pavement within roadways. The asphalt shall be placed in lifts not greater than 4 inches and shall be hot mix bituminous concrete at least 180 degrees Farenheit. The last two (3) inches in either instance shall be bituminous plant mix suitable to the appropriate controlling agency. Asphalt pavement resurfacing will be placed with paving machines and/or rollers of a size and type currently approved by the California Department of Transportation for use on resurfacing contracts.

If a bituminous surfacing overlays a concrete base, the Contractor, at the option of the Engineer, shall replace the concrete to its original thickness, or to a level 3 inches below the finished surface. The Engineer may direct the Contractor to omit all concrete and to replace the pavement with bituminous materials.
Tack coats shall be employed with each lift. Tack coats shall be placed on both horizontal and vertical surfaces (pavement cuts or face of concrete gutters).
.
Temporary asphalt (cold mix) to seal the trench until permanent asphalt can be placed shall be required on all work in the traveled road.

M. CONCRETE CONSTRUCTION

1. Acceptance of Concrete: Concrete shall be accepted on the basis of its meeting the requirements listed under the Material Specifications and Detail Specifications Section of this contract. The Inspector will accept no ready mix concrete without the plant dispatch ticket.

   The Engineer shall make or require any tests, as he deems necessary to insure that the concrete meets specifications. The Engineer may require the test to be performed by an independent testing laboratory at the Contractor's expense.

2. Placement: Concrete will not be accepted if it cannot be placed within ninety (90) minutes of dispatch time. Time requirements may fluctuate marginally due to temperature. Concrete shall be deposited in such a manner so as to prevent contamination by foreign material and segregation due to rehandling or flowing. Segregated concrete and/or concrete containing foreign material will not be accepted. Depositing will not be permitted when temperature has not exceeded 35° and rising by 10:00 A.M. Depositing shall cease when the descending air temperature in the shade falls below 40° F. It shall not resume until the ascending air temperature rises to 35° F. All concrete shall be kept from freezing by the Contractor. Frozen concrete shall be replaced at the Contractor's expense. Free fall shall not exceed 3 feet in any case.

3. Forms: Forms may be made of wood, plywood, metal, or any other material strong enough to resist noticeable deflection or bulging between supports, and the interior dimensions of the forms shall be such that the finished concrete shall be of the form of the dimensions shown on the Plans. The design of the forms shall take into account the effect of vibration of concrete as it is placed and also the rate of speed at which the forms will be filled. Forms shall be coated with a lubricant

as approved by the Engineer.

Mechanical vibrators, of an approved type, and continuous spading and/or rodding of concrete shall be used to produce proper contact of concrete with forms and reinforcing steel in piers and with forms and pipe in monolithic inverts insuring a compact, dense and impervious artificial stone of uniform texture.

4. Curing: All concrete will be cured for a seven (7) day period after placement according to the following procedure.

   a. Forms will normally be left in place for the entire seven (7) day period. Exposed surfaces not covered by forms will be kept moist continuously for the entire seven day period or will be cured through use of an approved curing compound which will be applied after all surface water has disappeared.

   b. At the discretion of the Engineer, forms may be removed after the initial set and before the end of the seven-day period. In such cases, the areas previously covered by forms shall be cured as described above.

   c. The Engineer may permit backfill of certain structures (e.g. concrete piers) before the end of the curing period. In such cases, the forms shall be stripped and the surfaces that remain exposed after backfill shall be cured as described in (a) above. Curing compound shall not be required for backfilled surfaces except where specified by the plans or Specified Provisions.

5. Finishing: The structure shall have a uniform and textured surface. All form marks exposed to view shall be rubbed off with a stone.

6. Testing: The following tests will be performed by the design engineer to ensure the concrete quality:

   a. Compressive strength in accordance with ASTM C-31 and ASTM C-39. Test cylinders which are formed in the field will be left in the field until compression testing (7 day, 14 day, 28 day) is completed thereby more closely approximately the curing conditions of the field placed concrete.

   b. Slump Test in accordance with ASTM C-143.

   c. Air Content Test in accordance with either ASTM C-173 or ASTM C-231.

N. DRY BORE WITH SHELL ENCASEMENT

Unless otherwise shown on the construction plans, casing pipe installed under State and/or County maintained roadways shall not require a protective coating. Casting pipe

installed within Railroad rights-of-way may require a coal-tar primer coat, followed by a single application of hot coal-tar enamel 3/32 inches ± 1/32 inch plus a bonded 15 lb. Asbestos felt wrap or an approved equal coating.

Unless prohibited by the railroad, uncoated pipe may be used if and only if the wall thickness specified is increased to the next thicker standard size, or a minimum of .0063 inches thicker than standard.

1. Bore Pits (or Tunnel Pits): Bore or tunnel pits shall be safed-up, shored, well marked, lighted, and not left unattended except as approved by the Engineer. Requirements for stabilization and dewatering of bore pits shall be as hereinbefore specified. The angle of repose method (sloping pit walls) for creating a safe working area shall not be used unless specifically allowed or approved by the Engineer.

2. Installation: Smooth wall or spiral weld steel pipe may be jacked through dry bores slightly larger than the pipe, bored progressively ahead of the leading edge of the advancing pipe as spoil is mucked by the auger back through the pipe. As the dry boring operation progresses, each new section of encasement pipe shall be butt-welded to the section previously jacked into place. Continuous checks shall be made as to the elevation, grade and alignment of each successive section of encasement as well as the tracks (rails) upon which the boring rig travels.

   If voids are encountered or occur outside the encasement pipe, grout holes shall be installed in the top section of the encasement pipe at ten (10) foot centers and the voids filled with 1:3 Portland Cement grout at sufficient pressure to prevent settlement in roadway/railway.

   Boring operations shall be continuous to their completion, and unnecessary or prolonged stoppages shall not be allowed.

   In the event an obstruction is encountered during the boring and jacking operations, the auger is to be withdrawn and the excess pipe is to be cut off, capped, and filled with 1:3 Portland Cement Grout at sufficient pressure to fill all voids before reapplying to the Controlling Agency for permission to open cut, bore at an alternate location, or install a tunnel.

   Installation shall be to the limits specified by the Controlling Agency and/or as delineated in their encroachment issued to the County. (Copy of the encroachment agreement must be kept at the site throughout boring operations).

   The completed casing installation shall be such as to prevent the formation of a waterway under the road or railbed.

   The Controlling Agency shall have full authority to require remedial measures and/or to stop all work if, in its opinion, said work will cause any damage to the roadway/railway section or endanger traffic. In all instances the Controlling

Agencies reserve the right to sample, test, and approve all materials and methods used.

The Contractor shall notify the Controlling Agency through the Construction Engineer and acknowledgement shall be received a minimum of five (5) working days prior to beginning any work within roadway or railway rights-of-way. If required, 24-hours notice will be given prior to completion.

O. GUARANTEED CASING INSTALLATION

The casing shall be installed by jacking, with simultaneous removal of spoil. The spoil removal shall not proceed more than 18-inches ahead of the casing. The diameter of the excavated hole shall be no larger than necessary to keep the casing moving feely and lubricant may be used to reduce the jacking forces. Casing sections shall be joined by butt weld.

After the casing is jacked in place, 2-inch grout holes shall be used to pump a 1:3 Portland Cement grout to fill the void outside the casing. Sufficient pressure should be applied to force grout out of the adjacent grout hole. Grout holes shall be a maximum of ten feet apart at the top of the casing.

The casing size and thickness shall be as shown on the Plans or Special Provisions.

P. TUNNELING OPERATIONS USING STRUCTURAL STEEL LINER PLATES

All plates shall be formed to provide circumferential-flanged joints. Longitudinal joints may be flanged or offset lap seam type. All plates shall be punched for bolting on both longitudinal and circumferential seam or joints. Bolt spacing in circumferential flanges shall be in accordance with the manufacturer's standard spacing and shall be multiples of the plate length so that plates having the same curvature shall be interchangeable to permit staggering of the longitudinal seam. Bolt spacing at flanged longitudinal seams shall be in accordance with the manufacturer's standard spacing. For lapped longitudinal seams, bolt size and spacing shall be in accordance with the manufacturer's standard but not less than that required to meet the longitudinal seam strength requirements of the design specifications. All liner plates for the full length of a specified tunnel shall be either flanged or the lapped seam type. The two types shall not be mixed in the same tunnel.

Liner plates shall be assembled in accordance with the manufacturer's instructions. Galvanized and coated plates shall be handled in such a manner as to prevent bruising, scaling, or breaking of the coating. Any plates that are damaged during handling or placing shall be replaced, except that in small areas with minor damage may be repaired to the satisfaction of the Construction Engineer or his representative.

Galvanized surfaces shall be repaired by thoroughly wire brushing the damaged areas and removing all loose cracked coating, after which the cleaned areas shall be painted with two (2) coats of zinc rich paint as approved, and an acceptable bituminous coating

restored.

When tunneling has proceeded a distance sufficient for placing one section of the tunnel liner, that section of liner will be placed before excavating further. Excavation shall be controlled so that the space outside the liner plate shall be held to a minimum. All voids between the liner plate and the tunnel wall shall be filled with 1:3 Portland Cement grout, containing no more water than necessary, placed under sufficient pressure to fill all voids.

Grout shall be placed though the grout holes provided in the top of the tunnel liner plates. Grout holes 2" in diameter shall be provided at not more than 4.5-foot centers or every third ring of plates to permit grouting as the erection of the tunnel liner progresses. At no time will the grouting operations be further than 10" or less. Grout will be forced into each grout hole. If the grout from one hole should flow along the liner plates so as to plug the next hole, the plug shall be opened by punching through the grout so that each may be used for grouting. The grouting operation will be continued until all spaces outside the liner plates are filled and no grout will flow.

The tunnel shall be constructed to the limits, grade and alignment shown on the Construction Plans. Excavation, without the use of jetting, shall be done in such a manner as to protect public and/or private property from damage. Prior to beginning any construction, the Contractor shall submit pit shoring and tunnel liner details for approval, and no tunneling may begin prior to approval of these details, a five (5) day notice to the Controlling Agency, through the Construction Engineer, shall be provided as previously specified..

No blasting will be done without prior written approval of the controlling agency and then only in strict accordance with all Federal, State, and Local laws, ordinances, rules, or regulations governing the storage and use of explosives. Where blasting is required, only small controlled charges of 40% dynamite or plastic explosives shall be used. The depths of the holes for these charges shall not exceed the depth necessary to clear an area sufficient to place one section of tunnel liner.

The charges for the initial series of blasts should be placed in the triangle method. The second series should be placed in the radial method a minimum distance from the desired diameter of the tunnel. The triangular charges shall be set to go off first, with the radial charges to go off following a short interval or using the time-lag method.

Where rock is encountered before approaching the shoulder or pavement, the first four series of charges will be used in determining the amount of controlled blasting to be used before beginning any blasting beneath the railway or shoulders or pavement of the highway as applicable. If rock is encountered after tunneling progresses beneath the pavement or railway, the charges will initially be set at very low levels and increased in small increments until the proper amount of charge is determined. In no case will an overshoot be permitted. If a boulder is encountered and removed by blasting or by other methods, a bulkhead will be formed immediately after removal of the boulder and the area filled with grout before proceeding with the tunneling operations.

If there is an indication of vertical split in the rock formation, or any indication of settlement of the roadway or railway fill, all operations shall be stopped and the Controlling Agency notified immediately. If the vertical split is not determined to be too great a magnitude or too close to the rails/pavement, the split shall be filled with grout at a pressure specified by the Controlling Agency, allowed to set and tunneling operation may be continued. If it is determined that the vertical split is too great of a magnitude or too close to the pavement or railway, the Controlling Agency shall determine the method used to correct the split. If settlement of the roadway or railway occurs, the Controlling Agency will determine the proper steps to be taken to correct the settlement. If deemed necessary by the Controlling Agency, adequate warning devices (signs, flashers, etc.) accompanied by responsible flagmen shall be placed at a distance allowing any and all traffic time to stop safely before reaching the questionable area. At the option of the Controlling Agency, it may provide the necessary flagmen, warning devices, etc., at the Contractor's expense. Traffic shall be allowed over the questionable area only as directed by the Controlling Agency.

The Controlling Agency shall have full authority to inspect entire tunnel operation, require disposition or remedial measures, and to stop all work if, in its opinion, the work will cause any damage to the roadway/railway section or endanger traffic. In all instances the Controlling Agencies reserve the right to sample, test and approve all materials used.

The completed liner shall consist of a series of structural steel liner plates assembled with staggered longitudinal joints. Liner plates shall have been fabricated to fit the cross section of the tunnel. Bolts on both longitudinal and circumferential seams or joints shall connect all plates.

After tunneling operations have been completed the Contractor will install the carrier pipe in a manner approved by the Engineer. Concrete fill (1:3 Portland Cement grout) will then be placed after completing installation of the water pipe within the tunnel liner as directed by the Engineer and end enclosure walls installed as shown on the Construction Plans or Standard Details. Ends of the tunnel liner will sealed with an eight-inch (8") masonry wall on the lower end and a twelve-inch (12") masonry wall on the higher end. Weep holes will be provided on the downstream end for drainage – see Standard Detail #16. The Contractor shall then remove the vertical shoring for pits (if ground conditions allow), surplus spoils, and material from the site.

The site shall then be returned to its original condition, seeded, mulched, or restored as specified and left in a neat and satisfactory condition. Shoring material shall be removed in such a manner so as to avoid collapse and to allow proper backfill. The backfill shall be placed in accordance with these Specifications or the requirements of the Controlling Agency.

The Contractor will notify the Engineering Department, in writing, upon completion of the tunnel liner installation. Notification of completion of the tunnel operation will then be forwarded to the Division Engineer, in writing, by letter with a copy to the attention of

the Encroachment Permit Divison, California Department of Transportation, Division of Highways, 50 Higuera Street, San Luis Obispo, CA 93401-5415.

The Contractor shall reimburse the Engineering Department (Owner) and Sunnyslope County Water District (Owner) shall reimburse the Division of Highways should any settlement or damage result to the roadway within a period of one (1) year after completion of the tunneling operations.

The Contractor and any of his subcontractors performing work on the State's (SCDOT) right-of-way in connection with tunneling operations shall furnish for approval, through the Construction Engineer, to the Department of Transportation, attention State Design Services Engineer, California Department of Transportation, Division of Highways, Columbia, California 29202, a certificate of insurance. An original and one copy of the certificate in the minimum amounts of $500,000 Bodily Injury and $250,000/$500,000 Property Damage shall be submitted for approval as evidence of proper coverage before beginning any work at the site. The certificate is to show explosion, collapse, and underground insurance coverage is provided. The Certificate will also reference the project, county, and the Design Services Unit's file number.

Insurance requirements for work performed on Railroad (CSX, Norfolk-Southern, etc.) property will be as outlined in the Special Provision Section of this contract. The Contractor shall furnish for approval a certificate of Insurance to this office. All required submittals will be sent to the Engineering Department for review and this office with then forward the documentation on to the railroad.

Insurance will remain in full force and effect for one (1) year after acceptance by the owner and the Controlling Agency. The Certificate is to be countersigned by an authorized California Resident Agent with the name and address pf the agent denoted thereon.

Q. BLASTING

Prior to commencing any blasting operations the Contractor shall notify either the local fire department, Fire Prevention Section or the County Fire Administrator as applicable, and obtain blasting permits as required. The Contractor must furnish certification of Insurance specifically covering any and all obligations assumed pursuant to the use of explosives.

All blasting operations shall be conducted in strict accordance with any and all decrees, rules, regulations, ordinances, and laws as may be imposed by any regulatory body and/or agency having jurisdiction over the work relative to handling, transporting, use and storage of explosives. Blasting shall be done only by competent, sober, and experienced personnel whose activities shall be conducted in a workmanlike manner. Satisfactory information must be provided to the Engineer that the blaster meets or exceeds the qualifications enumerated in OSHA Regulations Part 1926, Subpart U, Section 1926.901 – Blaster Qualifications.

All rock, dirt and debris from blasting shall be contained within the excavation by use of weighted mats or undisturbed overburden. The Contractor's blaster shall be fully responsible for determining the method of containment and the weight, size, and placement of material required to contain the charge he is using.

Charges shall be sized such that no damage to houses, structures, roadways etc., outside the limits of the excavation will occur. Where there is a possibility of such damage, the charge will initially be set at a very low level and increased in small increments until the proper charge is determined. The Contractor shall be held responsible for any and all injury to persons or damage to public or private property.

1. Permission to Blast: The Contractor shall not be allowed to blast within any rights-of-way maintained by any agency (D.O.T., R.R., Gas, etc.) other than the County without specific approval of the controlling agency and only in accordance with their respective requirements.

R. TESTING AND INSPECTION

Required testing of pipelines and valves shall be done under the direct supervision of the Project Inspector and must be conducted in accordance with AWWA Standards C600. Field testing shall not negate the requirements for material certifications as contained in the material specification section of this contract. Unless otherwise directed by the Engineer, all testing and disinfection will be completed prior to connection to any existing line. The Contractor shall provide open ventilation of confined spaces. The Contractor shall be responsible for providing all equipment and personnel necessary to comply with OSHA confined spaces regulations.

1. Hydrostatic and Leakage Tests: Pressure and leakage tests must be conducted in accordance with AWWA Standards C600. On completion of the line or sections of the lines, connections and appurtenances, the line shall be filled and hydrostatically tested. The water for this purpose can be taken from existing lines under the supervision of the Engineer's Inspector and leakage will be measured by the Inspector with a meter furnished by the contractor. All leaks and any defective material shall be repaired or replaced to the satisfaction of the Engineer and the tests repeated until the requirements of this specification are met. Any special equipment, pumps, etc. required to make the test shall be furnished and operated by the contractor as directed by the Inspector.

   The Contractor shall use great care to be sure that all air is expelled from each section under test. If fire hydrants or other openings are not available for the purpose of expelling air, the Contractor shall provide air releases of sufficient size (as determined by the Engineer) in accordance with Standard Drawings, at his expense. Specific procedures for testing mains are as follows:

   a. Test pressure will be held for at least two (2) hours at at least 1.5 times the maximum working pressure at the low point of the section under test. When testing against butterfly valves, the differential pressure valve must

not exceed 150 PSI for valves rated at 150 PSI.

If the test cannot be made with differential pressure of 150 PSI, 250 PSI valves will be specified. Differential pressures across gate valves may be up to 200 PSI (R.61-58.4.D.(11)(e)).

b. Allowable leakage will be determined by Table 6, AWWA C-600 (see below) or by the following formulas:

Ductile Iron:

$L = [SD(P)^{1/2}] / (133,200)$

L = allowable leakage (gals/hr)
S = length of the pipeline tested (ft) (ft)
D = diameter of pipe (in.)
P = average test pressure (psig)

PVC:

$L = [ND(P)^{1/2}] / (7,400)$

L = allowable leakage (gals/hr)
N = # of joints in pipeline tested
D = diameter of pipe (in.)
P = average test pressure (psig)

Add .0043gal/hr. for each ¾ inch service and .0057 gal/hr. for each 1-inch service.

TABLE 6

Allowable Leakage per 1000 ft. (305m) of Pipeline - gph†*

Avg. Test Pressure psi (Bar)	Nominal Pipe Diameter -in.															
	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54
450 (31)	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.82	3.82	4.78	5.73	6.69	7.64	8.60
400 (28)	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.60	3.60	4.50	5.41	6.31	7.21	8.11
350 (24)	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	3.37	3.37	4.21	5.06	5.90	6.74	7.58
300 (21)	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	3.12	3.12	3.90	4.68	5.45	6.24	7.02
275 (19)	0.37	0.50	0.75	1.00	1.24	1.47	1.74	1.99	2.24	2.99	2.99	3.73	4.48	5.23	5.98	6.72
250 (17)	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.91	2.14	2.85	2.85	3.56	4.27	4.99	5.70	6.64
225 (16)	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.70	2.70	3.38	4.05	4.73	5.41	6.03
200 (14)	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.55	2.55	3.19	3.82	4.46	5.09	5.73
175 (12)	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	2.38	2.38	2.98	3.58	4.17	4.77	5.36
150 (10)	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	2.21	2.21	2.76	3.31	3.86	4.41	4.97
125 (9)	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	2.01	2.01	2.52	3.02	3.53	4.03	4.53
100 (7)	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.80	1.80	2.25	2.70	3.15	3.60	4.05

* If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage

for each size.

† To obtain leakage in liters/hours, multiply the values in the table by 3.785.

c. Pressure and leakage tests will be run concurrently and for a duration of four hours except as modified below.

d. The Contractor will pressurize the line and verify that it is within allowable leakage before the official test is started.

e. The Inspector will begin the test and remain at the job for the first hour, making sure that the test pressure is maintained within ± 5 PSI. The Contractor is to maintain the pressure within ± 5 PSI for the duration of the test period. At the end of the first hour, with the line pumped to full test pressure, he will read the meter and record the first hour leakage. If the first hour leakage is allowable, he will return at the end of the fourth hour and again read the meter. If the total leakage for the four hour period does not exceed four times the first hour leakage, the test will be terminated. If the total leakage exceeds four times the first hour leakage, but is still within allowable, the test will be held an additional hour. If the fifth hour leakage does not exceed the average hourly leakage for the first four hours, the test will be terminated at the end of the fifth hour. Otherwise, the test will be held until the leakage is non-increasing and within allowable for two consecutive hours. All visible leaks shall be repaired regardless of the amount of leakage.

f. If leakage exceeds allowable for the four hour test, the test will be terminated and re-scheduled after the Contractor has verified that actual leakage is within the allowable leakage, but no earlier than the next work day.

g. If the first hour leakage does not exceed 10% of the allowable, or if the allowable leakage rate does not exceed .4 gal/hr., the test may be terminated at the end of two hours provided the second hour leakage does not exceed the first hour leakage. If the second hour leakage exceeds the first hour leakage, the test will be held for an additional period as described in Paragraph (e) above.

h. The maximum length pipe tested in one test shall be 5,000 feet or as close to 5,000 feet as possible depending on valve spacing.

i. During the last stages of the test and without any reduction in pressure, first the hydrant guard valves will be closed and pressure released to determine if it is holding pressure (minimum 10 minutes per valve closing).

j. Unless otherwise directed by the Engineer, each Butterfly Valve will be tested to 150 PSI for a minimum of 10 minutes after the pipeline has been successfully tested.

k. When testing mains with Contractor installed water services, the Engineer may on a random basis require jumpers in selected meter yokes with full test pressure applied to the property line valve. Such jumpers will be furnished by the Engineer and installed by the Contractor.

2. Disinfection of Mains: All of the water mains installed shall be thoroughly flushed and disinfected before being placed in service. This work shall be done under the direct supervision of the Engineer's Inspector and in accordance with (R.61-58.4.D.(11)(f)) and with current AWWA Standard C651. The Contractor shall supply all labor, equipment and materials necessary for carrying out this work.

a. In general, one approved method referred to as "continuous feed method" is as follows:

i. Before being placed in service, all new mains shall be thoroughly flushed then chlorinated with not less than twenty-five (25) milligrams per liter of available chlorine.

ii. Water from the existing distribution system or other source of supply shall be controlled so as to flow slowly into the newly laid pipeline during the application of chlorine.

iii. The solution shall be retained in the pipeline for not less than twenty-four (24) hours and then flushed thoroughly with a potable water of satisfactory bacteriological quality before starting the sampling program.

b. The contractor or owner shall collect a minimum of two (2) samples from each sampling site for total coliform analysis. The number of sites depends on the amount of new construction, but must include all dead-end lines, be representative of the water in the newly constructed mains, and shall be collected a minimum of every 1,200 linear feet.

c. Prior to sampling, the chlorine residual must be reduced to normal system residual levels or be non-detectable in those systems not chlorinating.

d. These samples must be collected at least twenty-four (24) hours apart and must show the waterline to be absent of total coliform bacteria.

e. The chlorine residual must also be measured and reported.

f. If the membrane filter method of analysis is used for the coliform analysis, non-coliform growth must also be reported.

g. If the non-coliform growth is greater than eighty (80) colonies per one hundred (100) milliliters, the sample result is invalid and must be repeated.

h. All samples must be analyzed by a State certified laboratory.

3. Drainage of Mains: Drainage of mains and disposal of chlorinated water shall be in accordance with all Federal, State and local laws, ordinances and regulations. Mains shall be drained to sanitary sewers, where available. Drainage directly to surface waters (creeks, rivers, streams, lakes, ponds, etc.) will not be allowed. Drainage branches, blowoffs, air vents and appurtenances shall be provided with valves and shall be located and installed as shown on the Plans and Standard Details. Drainage of mains will be accomplished in such a manner as to minimize erosion and siltation to adjoining properties. Water velocity from drainage and/or blow-off will be dissipated as necessary to prevent erosion.

Drainage branches or blowoffs shall not be connected to any sewer, submerged in any streams, or installed in any other manner that will permit back siphonage into the distribution system.

No flushing device shall be directly connected to any sewer (R.61-58.4.D.(7)(f))
.

S. REPAIRS

The Contractor shall make any needed repairs to newly installed unactivated mains. Repairs to existing and/or activated mains will be made by the Sunnyslope County Water District Water/Sewer
Department unless the Contractor is otherwise directed by the Engineer.

1. Repairs to New Mains: Repairs shall be made by cutting out and removing the damaged/defective section and replacing those with new pipe using long pattern solid sleeves to connect plain ends. Bell clamps will not be allowed to repair newly installed mains.

2. Repairs to Existing Mains: The Contractor will not be required to repair existing mains unless specifically directed by the Engineer, or specified elsewhere in these specifications. Repair methods will be considered on a case by case basis.

T. RESTORATION

All surfaces and structures (both public and private) within and adjacent to the construction operations shall be restored to a condition comparable to that existing prior to construction or as specified in the special provisions.

All surplus materials shall be disposed of in a manner acceptable to the Engineer, and the construction area shall be left in a neat condition, with special attention called to proper

drainage, smoothness of surface, and general clean up. No machinery or equipment shall be left or stored on the job site after the project is completed.

Unless otherwise specified, complete restoration to include fertilizing, seeding, and mulching of any and all areas disturbed during construction shall be completed within thirty (30) working days following the initial ground disturbing activity.

1. Water meters, valve boxes, drain pipes, and other structures encountered shall be reset or re-laid to match or clear surface grade and/or water main pipe grade.

2. All shoulder areas shall be restored, stabilized, and maintained to their original condition. Concrete, asphalt, gravel, and dirt walks, drives and roadways are to be replaced to their original shape and serviceability. Unless otherwise approved by the Engineer all areas (shoulders, side streets, drive, parking areas, etc.) which exhibit a gravel surface at the time of construction will be re-graveled with a minimum depth of six (6) inches of C.A.B.C stone compacted-in-place for the width and length of the disturbed area and then feathered gradually into the existing cross section. When a driveway is finished with than C.A.B.C stone, a one inch finish coating to match existing gravel gradation and appearance shall be placed.

   The Contractor should note that all existing side streets and drives which are either dirt or gravel will be restored as specified for graveled areas.

3. Refuse Burial: The Contractor shall not bury rock, broken concrete/asphalt, construction material, timber, etc. within the street or water main right-of-way.

4. Rip-Rap: The Contractor shall place stone rip-rap as specified in those areas subject to severe water action where directed by the Engineer.

   Placement of rip-rap as shown on the Construction Plans shall be considered a guide only, with final determination made at the time of construction by the Engineer. Either the addition or deletion of quantities may be required.

   Stone rip-rap will be placed as indicated on the Standard Details immediately following pipe installation and will be installed no steeper than 2:1 slope except when specifically approved by the Engineer. Grading will be required as necessary to insure continuous even flow.

   The rip-rap installation shall include all earthwork necessary to stabilize the creek bank and to provide cover for the water line.

5. Jute Netting/Erosion Blanket: The Contractor shall install jute netting or Erosion Control Blanket in areas subject to high runoff velocities, areas subject to concentrated runoff and on steep slopes as shown on the plans and/or as directed by the Engineer.

6. Fertilizing, Seeding, and Mulching: Established lawns and landscaped areas damaged by construction shall be restored to their former condition by seeding, unless the type and condition of the existing sod warrants it being cut, removed, preserved, and replaced. All areas, regardless or previous condition, damaged by construction shall be fertilized, seeded, and mulched as outlined below:

   a. Seed Bed Preparation: The seed shall be prepared by pulverizing the soil in an approved manner to a depth of three (3) inches for field conditions or slopes that are 3:1 or flatter and to a depth of three (3) inches, as determined on site for slopes steeper than 3:1. The soil shall be tilled until a well pulverized, firm, reasonably uniform seed bed is prepared conforming substantially to ground elevations as shown on the Plans and/or existed prior to construction. The disturbed area shall blend uniformly into adjacent topography. Good surface drainage must be provided, allowances for settlement made and ground elevations adjusted accordingly. Visible ponding will not be allowed. All stones, roots, sticks, rubbish, and other objectionable material shall be removed.

   b. Soil Improvements: Soil additives shall be incorporated in an approved manner into the top soil at the following rates:

      (1) Fertilizer – 20 pounds per 1000 square feet of 5-10-10 fertilizer generally and 30 pounds per 1000 square feet of 10-10-10 fertilizer for established lawn areas.

      (2) Lime – 100 pounds per 1000 square feet.

      (3) Superphosphate (0-20-0) – 12 pounds per 1000 square feet.

   c. Seeding: Seeding must be done within thirty (30) calendar days after the initial ground disturbing activity.

      (1) The seed bed must be in good, friable condition and not muddy or hard at the time of seeding is performed.

      (2) Seed shall be applied at the rate specified and raked or tilled into the topsoil with the resulting furroughs running across the natural slope of the ground. Under no circumstances will any tilling activity be allowed parallel with said slope. Slopes steeper than 3:1 shall require the use of hydraulic seeding unless otherwise specifically approved by the Engineer.

   d. Mulching: After fertilizing, seeding, and raking, dried straw shall be spread uniformly over the area at a rate of 90 pounds per 1000 square feet. Approximately ¼ of the ground should remain visible to avoid smothering seedlings. The straw shall be sprayed with liquid asphalt to bond it together and anchor it in place within road right-of-way and areas

subject to erosion.

(1) Liquid asphalt, thinned with kerosene, shall be used during freezing weather and shall be either rapid or medium curing. It shall be applied at a rate of 200 gallons per ton of straw or approximately 9 gallons per 1000 square feet.

(2) Emulsified asphalt, thinned with water shall be used when temperature s are less severe, shall be rapid curing only, and shall be applied at a rate of 150 gallons per ton of straw or approximately 7 gallons per 1000 square feet.

e. Maintenance: The Contractor shall maintain the seeded areas until there is uniform growth three (3) inches high. Maintenance shall consist of watering, weed and pest control within established lawns, fertilization, erosion repair, reseeding and all else necessary to establish a vigorous healthy and uniform stand of grass. All areas and spots which do not show a uniform stand of grass, for any reason, shall be treated repeatedly until a uniform stand is attained.

Seasonal seeding mixtures and rates of application shall be as follows. All rates are in pounds per 1000 square feet and any rates listed below may be cut by ½ for temporary erosion control measures only.

SEPTEMBER 15 – MARCH 1

Maintained/Established Lawns or road rights-of-way

6# Kentucky Fescue No. 31
2# Rye Grain
30# Fertilizer (10-10-10)
100# Lime
12# Superphosphate

Open-Field (Anything other than an established lawn)

4# Kentucky Fescue No. 31
2# Rye Grain
20# Fertilizer (5-10-10)
100# Lime
12# Superphosphate

Open-Field For Slopes 2:1 or greater or areas subject to erosion

2# Kentucky Fescue No. 31
4# Sericea Lespedeza (Unscarified)

2# Rye Grain
30# Fertilizer (5-10-10)
100# Lime
12# Superphosphate

FEBRUARY 1 – OCTOBER 15

Maintained/Established Lawns or road rights-of-way

8# Kentucky Fescue No. 31
30# Fertilizer (10-10-10)
100# Lime
12# Superphosphate

Open-Field (Anything other than an established lawn)

6# Kentucky Fescue No. 31
2# Sudangrass (May, June, and July only)
20# Fertilizer (5-10-10)
100# Lime
12# Superphosphate

Open-Field For Slopes 2:1 or greater or areas subject to erosion

2# Kentucky Fescue No. 31
4# Sericea Lespedeza (Scarified)
2# Sudangrass (May, June, and July only)
20# Fertilizer (5-10-10)
100# Lime
12# Superphosphate

The Engineer will be consulted prior to seeding for a determination of appropriate seed mixture. Unless otherwise required by the California Department of Transportation or the Engineer seeding within road rights-of way will be as specified for established lawns.

U. ENCROACHMENT PERMIT

Sunnyslope County Water District has applied for an encroachment permit with San Benito County, Department of Public Works, and paid a fee of _____for the encroachment permit. The contractor shall, upon award of the contract, and prior to the Notice to Proceed, complete all requirements required by San Benito County, Department of Public Works, including a Traffic Control Plan to complete the application and receipt of the encroachment permit. Upon receipt of the encroachment permit, Sunnyslope County Water District will issue a Notice to Proceed, and the contractor shall comply with all provisions of the encroachment permit.

EXHIBIT 3.2
LESSALT 95% DESIGN DRAWINGS AND SPECIFICATIONS, 2013

HOLLISTER WATER TREATMENT AGENCY

CONTRACT DOCUMENTS AND SPECIFICATIONS FOR THE LESSALT WATER TREATMENT PLANT DBP REDUCTION IMPROVEMENTS PROJECT

95% SUBMITTAL – NOT FOR CONSTRUCTION

January 4, 2013

Prepared by:

Kennedy/Jenks Consultants
303 Second Street, Suite 350 South, San Francisco, CA 94107
(415) 243-2150
www.KennedyJenks.com

HOLLISTER WATER TREATMENT AGENCY
LESSALT WATER TREATMENT PLANT
DBP REDUCTION IMPROVEMENTS PROJECT

CONTRACT DOCUMENTS AND SPECIFICATIONS

TABLE OF CONTENTS

DIVISION 0: BIDDING REQUIREMENTS, CONTRACT FORMS, CONTRACT CONDITIONS

BIDDING REQUIREMENTS

00010 Invitation to Bid
00100 Instructions to Bidders
00200 Information Available to Bidders
00300 Bid Form
00410 Bid Security
00411 Designation of Equipment or Material Manufacturers
00414 Security for Compensation Certificate
00420 Bidder's Qualifications
00430 Subcontractor List
00480 Noncollusion Affidavit

CONTRACT FORMS

00500 Agreement
00610 Performance Bond
00620 Payment Bond

CONTRACT CONDITIONS

00700 General Conditions
00800 Supplementary Conditions

SPECIFICATIONS

DIVISION 1: GENERAL REQUIREMENTS

01010 Summary of the Work and Contract Considerations
01040 Coordination and Project Requirements
01140 Environmental Protection
01190 Seismic Requirements
01300 Submittals
01311 CPM Construction Schedule
01500 Construction Facilities and Temporary Controls
01650 Facility Startup
01700 Contract Closeout

© December 2012 Kennedy/Jenks Consultants

DIVISIONS 2 THROUGH 17: TECHNICAL SPECIFICATIONS

DIVISION	SECTION	TITLE
2		**SITEWORK**
	02050	Demolition
	02200	Site Preparation
	02301	Earthwork
	02700	Paving and Surfacing
	02775	Concrete Curb, Gutters and Sidewalks
	02820	Fences and Gates
3		**CONCRETE**
	03100	Concrete Forms and Accessories
	03150	Concrete Joints and Accessories
	03200	Reinforcing Steel
	03300	Cast-In-Place Concrete
	03305	Hot Weather Concreting
	03306	Cold Weather Concreting
	03330	Concrete Curing
	03340	Hydrostatic Testing of Structures
	03350	Concrete Finishes
4		**MASONRY (NOT INCLUDED)**
5		**METALS**
	05090	Structural Metal Fasteners
	05100	Structural Metal Framing
6		**WOOD AND PLASTICS (NOT INCLUDED)**
7		**THERMAL AND MOISTURE PROTECTION (NOT INCLUDED)**
8		**DOORS AND WINDOWS (NOT INCLUDED)**
9		**FINISHES**
	09960	Protective Coatings
10		**SPECIALTIES**
	10400	Identifying Devices
11		**EQUIPMENT**
	11001	General Equipment and Mechanical Requirements
	11002	Electric Motor Drives
	11003	Disinfection
	11211	Centrifugal Water Pumps
	11240	Chemical Feed Equipment
	11357	Greensand Roughing Filters
	11358	GAC Adsorber/Filters

© December 2012 Kennedy/Jenks Consultants

DIVISION	SECTION	TITLE
12		**FURNISHINGS (NOT INCLUDED)**
13		**SPECIAL CONSTRUCTION**
	13211	Welded Steel Tanks
	13416	Chemical Storage Tanks
14		**CONVEYING SYSTEMS (NOT INCLUDED)**
15		**MECHANICAL**
	15050	Piping, Valves and Accessories
16		**ELECTRICAL**
	16010	General Electrical Requirements
	16110	Conduit, Raceways and Fittings
	16120	Low Voltage Wire and Cable
	16124	Signal Cable
	16130	Boxes
	16140	Wiring Devices
	16160	Panelboards
	16180	Protective Devices and Switches
	16402	Underground Electrical Service System
	16405	Switchboard
	16450	Electrical Grounding
	16460	Dry Type Transformers
	16920	Motor Control Center
	16924	Adjustable Frequency Drives
	16955	Control Devices
17		**INSTRUMENTATION AND CONTROLS**
	17010	Instrumentation and Controls, General Requirements
	17110	Analytical Instruments
	17120	Flow Measurement
	17140	Level Measurement
	17150	Pressure Measurement
	17200	Panel Mounted and Miscellaneous Field Instruments
	17330	Programmable Logic Controller
	17330.A	Appendix A – PLC Input/Output
	17330.B	Appendix B – Control Strategies
	17341	Data Acquisition and Control System
	17510	Panels
		APPENDICES

END OF TABLE OF CONTENTS

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

DOCUMENT NUMBER 00010

INVITATION TO BID

1. Notice is hereby given that the Owner

   Hollister Water Treatment Agency
   c/o Sunnyslope County Water District
   3570 Airline Hwy
   Hollister, CA 95023

   will receive sealed bids for performing the construction of the LESSALT Water Treatment Plant DBP Reduction Improvements Project according to the Drawings and Project Manual including Specifications prepared by Kennedy/Jenks Consultants and approved by the Owner and described in general as:

   The work includes improvements to the existing two (2) million gallon per day (MGD) capacity LESSALT Water Treatment Plant (WTP) to add iron and manganese removal pressure filters, granular activated carbon pressure filters, treated water tank, spent washwater tank, and associated pump stations, chemical feed equipment, piping, valves, instrumentation and controls as described within the contract specifications and drawings.

2. Questions regarding the project may be addressed to _____ at the Hollister Water Treatment Agency at phone number (831) 637-4670.

3. A pre-bid conference and site visit will be held on _____ at 2:00 PM at the LESSALT WTP.

4. Sealed bids will be received at:

   _____
   Place

   until:

   _____ _____ 2:00 PM local time.
   Day of Week Date

   Bids received after that time will not be accepted. Bids will be opened in public and read aloud shortly after the specified closing time. Interested parties are invited to attend.

5. Bid security made payable to the Owner is required to accompany each bid. Bid security shall be in the form of a cashier's or certified check or a Bid Bond as required by the Bid Security Document following the Bid Form.

© December 2012 Kennedy/Jenks Consultants

6. Requirements for California Public Works Contracts.

6.1 Wage Rates

The State Director of the Department of Industrial Relations has established the general prevailing rates of per diem wages and rates for overtime and legal holidays in the locality in which the work is to be performed. Not less than said prevailing wages shall be paid for work on this project.

6.2 License Requirements

The Contractor shall possess a valid State of California Class A General Engineering Contractor's License at the time of submitting a bid. The Contractor shall provide its license number classification and expiration date on the Bid Form.

6.3 Security in Lieu of Retainage

Provisions concerning the Contractors' rights to deposit security in lieu of retainage in accordance with California Public Contract Code Sections 10263 and 22300 are covered in the Agreement.

7. No bidder may withdraw its Bid for a period of sixty (60) days after the time fixed for the opening of the bids, within which time an award will be made.

   The Owner reserves the right to reject any and all bids or to waive any irregularities or informalities in any bid or in the bidding.

8. The Project Contract Documents including Drawings and Specifications may be examined at Hollister Water Treatment Agency, c/o Sunnyslope County Water District, 3570 Airline Hwy, Hollister, CA 95023. Phone (831) 637-4670.

9. The Project Contract Documents including Drawings and Specifications may be obtained from the Hollister Water Treatment Agency, c/o Sunnyslope County Water District, 3570 Airline Hwy, Hollister, CA 95023. Phone (831) 637-4670, upon payment of a deposit of _____ dollars ($_____.00) per copy. Make checks payable to [_____].

10. Time Constraints:

    1 Requests for information received less than 5 days prior to Bid opening may not be answered.
    2 Addenda will be issued no later than 3 days prior to Bid opening.
    3 Bids shall remain in effect and subject to acceptance for 60 days after the date of Bid opening. If a contract is awarded, it will be awarded within the period that Bids are subject to acceptance.
    4 The successful Bidder shall sign the required number of counterparts of the Agreement and deliver them together with the required bonds to the Owner within 15 days after the date of the Notice of Award.

© December 2012 Kennedy/Jenks Consultants

5 The Owner will sign the Agreement and deliver a fully-signed counterpart to the Contractor within 10 days after receipt of the required signed counterparts of the Agreement and Satisfactory Bonds from the Contractor.

6 The Owner may issue the Notice-to-Proceed at any time between the time the Agreement is fully signed by all parties and 90 days thereafter.

7 The Contract time shall begin to run on the date stated in the Notice-to-Proceed and the Contractor shall begin construction at the site within 10 days thereafter, but not before submitting required insurance certificates.

8 The Work shall be fully completed within the Contract Time which is three hundred and sixty five (365) days as stated in the Agreement.

9 Progress payments shall be made monthly and shall cover work performed up to the Application for Payment Date which shall be the last day of each month. The Contractor shall submit its Application for Payment at least 5 days prior to the Application for Payment Date. The Owner shall make payment within 30 days after the Engineer issues a Recommendation for Payment.

By order of _____
Hollister Water Treatment Agency

_____
(Date) (Clerk or Secretary)

END OF INVITATION TO BID

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

DOCUMENT NUMBER 00100

INSTRUCTIONS TO BIDDERS

Article 1. General

Bidding Documents containing the Bidding Requirements are provided to prospective bidders to enable them to prepare a bid. Documents that must be submitted with the Bid are listed at the end of the Instructions to Bidders.

Article 2. Defined Terms

2.1 Terms used in these Instructions to Bidders which are defined in the GENERAL CONDITIONS of the Construction Contract have the meanings assigned to them in the General Conditions.

2.2 The term "Addenda" (Addendum) means the written or graphic instruments issued prior to execution of the Agreement which modifies or interprets the Bidding Documents and Contract Documents.

2.3 The term "Bidder" means any person, firm or corporation submitting a Bid directly to Owner, as distinct from a sub-bidder, who submits a bid to a Bidder.

2.4 The term "Successful Bidder" means the lowest, qualified, responsible and responsive Bidder to whom Owner (on the basis of Owner's evaluation as hereinafter provided) makes an award.

2.5 The term "Bid" means the offer or proposal of the Bidder submitted on the prescribed forms setting forth the prices for the work to be performed and furnishing other required information.

2.6 The term "Base Bid" means the amount bid on all of the work required to complete a single Contract as described in the Contract Documents. The Base Bid submitted by the successful bidder combined with any additive or deductive amounts bid on alternates accepted by the Owner and any other modifications becomes the Contract Price.

2.7 The term "Bidding Documents" includes the Invitation to Bid, Instructions to Bidders, Information Available to Bidders, the Bid Form with related documents, the Contract Conditions, Specifications and Drawings (and includes all Addenda issued prior to receipt of Bids.)

2.8 The terms "Contract" and "Project" are defined in the General Conditions paragraph 1.1.

2.9 The term "Notice of Award" is a written notice by the Owner to the Bidder that it is the successful Bidder and upon the Bidders compliance with the Owner's requirements the Owner will execute the Agreement.

© December 2012 Kennedy/Jenks Consultants

Article 3. Copies of Bidding Documents

3.1 Complete sets of Bidding Documents (Project Contract Documents including Drawings and Specifications) may be obtained at the location and time designated in the Invitation to Bid for the non-refundable purchase price stated therein. Make all checks payable to the Owner.

3.2 Complete sets of Bidding Documents must be used in preparing Bids; neither the Owner nor the Engineer assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

3.3 The Owner and the Engineer in making copies of Bidding Documents available on the above terms do so only for the purpose of obtaining Bids on the Work and do not confer or grant a license for any other use.

Article 4. Examination of Contract Documents and Site

4.1 It is the responsibility of each Bidder before submitting a Bid to (a) examine the Bidding Documents thoroughly; (b) visit the site to become familiar with local conditions that may affect cost, progress, performance or furnishing of the Work; (c) dig test pits or drill test holes to further evaluate subsurface soil conditions to the extent the Bidder considers necessary; (d) consider federal, state and local Laws and Regulations that may affect cost, progress, performance or furnishing of the Work; (e) study and carefully correlate Bidder's observations with the Contract Documents; and (f) notify the Engineer of all conflicts, errors or discrepancies in the Contract Documents.

4.2 Additional information available to Bidders, if any, is described in Document Number 00200, Information Available to Bidders.

4.3 Differing Conditions:

.1 General Conditions paragraphs 3.3 through 3.5 limit the extent to which the Contractor may rely on information provided by the Owner or the Design Engineer with regard to: a) subsurface soil conditions, b) existing concealed or underground utilities and underground facilities, and c) existing structures and facilities.

.2 General Conditions paragraphs 3.6 and 3.8 identify the Contractor's responsibility: a) for using care in making excavations and in doing demolition, b) for damage to existing utilities and underground facilities and for loss of use thereof, and c) for the protection of workers and others from known and unknown or concealed hazards.

.3 General Conditions paragraph 3.7 identifies conditions under which the Contractor may be entitled to a change in Contract Time or Price due to differing or unknown conditions.

4.4 The lands upon which the Work is to be performed, rights-of-way and easements for access thereto and other lands designated for use by Contractor in performing the Work are identified in the Contract Documents. All additional lands and access thereto required for temporary construction facilities or storage of materials and equipment are to be provided by Contractor. Easements for permanent facilities or utilities or easements for permanent changes in existing facilities or utilities have been obtained or will be obtained and paid for by Owner unless otherwise provided in the Contract Documents.

© December 2012 Kennedy/Jenks Consultants

4.5 Bidder's Representations. By submitting a bid each bidder represents and warrants:

.1 It has visited the site and has reviewed the Bidding Documents and the Information Available to Bidders; it has made any other investigations, explorations or tests and has obtained any other data it considers necessary for preparation of its Bid; and it has read and understands provisions in the General Conditions relevant to differing and unknown conditions.

.2 It has read, studied and understands the entire set of Bidding Documents including the Construction Drawings, Specifications and General Conditions and finds them fit and sufficient for the purpose of preparing its Bid and constructing the Work required.

.3 Its Bid is based on providing all of the material, labor, equipment and services necessary to complete the Work in full compliance with the Contract Documents without exception.

Article 5. Interpretations and Addenda (Before Contract Award)

5.1 All questions about the meaning or intent of the Contract Documents are to be directed to the Engineer. Interpretations or responses considered necessary by the Engineer in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by the Engineer as having received the Bidding Documents. Questions received less than five days prior to the date for opening of bids may not be answered. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or responses will be without legal effect and are not to be relied upon by the Bidders unless they are integrated into the written Contract Documents.

5.2 Addenda may also be issued to modify the Bidding Documents as deemed advisable by the Owner.

Article 6. Bid Security

Each Bid must be accompanied by Bid Security conforming to the requirements of Document Number 00410, Bid Security.

Article 7. Contract Time

The numbers of days (Contract Time) within which the Work is to be Substantially Completed and Finally Completed and ready for acceptance and final payment are set forth in the Bid Form and the Agreement.

Article 8. Liquidated Damages

Provisions for liquidated damages, if any, are set forth in the Agreement.

Article 9. Substitute or Proposed Equivalent ("Or Equal") Items

The Contract, if awarded, will be on the basis of materials and equipment described in the Drawings or specified in the Specifications without consideration of possible substitute or Proposed Equivalent ("Or Equal") items. Whenever it is indicated in the Drawings or specified in the Specifications that a Proposed Equivalent ("Or Equal") item of material or equipment may be furnished or used by the Contractor if acceptable to the Engineer, such acceptance will not be considered by the Engineer until after the Effective Date of the Agreement. The procedure

© December 2012 Kennedy/Jenks Consultants

for submission of any such Proposed Equivalent ("Or Equal") item by the Contractor for the Engineer's review and consideration is set forth in Article 8 of the GENERAL CONDITIONS under Specified Items/Proposed Equivalents and may be supplemented in Division One.

Article 10. Listing of Subcontractors

The Contractor's Bid must include a listing of subcontractors conforming to the requirements and format of Document Number 00430.

Article 11. Bid Form

11.1 The Bid Form is included with the Bidding Documents; additional copies may be reproduced by the Bidder.

11.2 All blanks on the Bid Form must be completed legibly in ink or by typewriter. Bid amounts must be stated in words and in figures.

11.3 Bids by corporations must be executed in the corporate name by the president or a vice president (or other corporate officer accompanied by evidence of authority to sign) and the corporate seal must be affixed by the secretary or an assistant secretary. The corporate address and state of incorporation must be shown below the signature.

11.4 Bids by partnerships must be executed in the partnership name and signed by a partner, whose title must appear under the signature and the official address of the partnership must be shown below the signature.

11.5 All names must be legibly printed in ink or typed below the signature.

11.6 The Bid shall contain an acknowledgement of receipt of all ADDENDA (the numbers of which must be filled in on the Bid Form). ADDENDA are designated as Document Number 00900.

11.7 The address and telephone number for communications regarding the Bid must be shown.

11.8 When the Bidding Documents include more than one Contract, Bidders may submit a Bid for any of the individual portions of the project defined in Bidding Documents as a separate Contract or any combination of Contracts provided for in the Bid Form.

11.9 Bids must include a single lump sum price for the Base Bid and a separate price or state "no change in price" for each Alternate, if applicable, described in the Specifications and listed on the Bid Form.

Article 12. Submission of Bids

Bids shall be submitted at the time and place indicated in the Invitation to Bid and shall be enclosed in an opaque sealed envelope, marked with the Project title and, when the Project includes more than one Contract, with the designated Contract or portion of the project for which the Bid is submitted. The envelope shall bear the name and address of the Bidder and the Bid shall be accompanied by the Bid security and other required documents. If the Bid is

© December 2012 Kennedy/Jenks Consultants

sent through the mail or other delivery system, the sealed envelope shall be enclosed in a separate envelope with the notation "BID ENCLOSED" on the face of it.

Article 13. Modification and Withdrawal of Bids

13.1 Bids may be modified or withdrawn by an appropriate document duly executed (in the manner that a Bid must be executed) and delivered to the place where Bids are to be submitted at any time prior to the opening of Bids.

13.2 If, within five days after Bids are opened, any Bidder files a duly signed, written notice with the Owner and promptly thereafter demonstrates in detail to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, how the mistake occurred, that the mistake was not due to an error in judgment or to carelessness in inspecting the site or reading the plans or specifications, that Bidder may withdraw its Bid and the Bid Security will be returned. A Bidder who withdraws its Bid will be disqualified from further bidding on the Work to be provided under the Contract Documents. See California Public Contract Code 5103.

Article 14. Opening of Bids

Bids will be opened and (unless obviously non-responsive) read aloud publicly. An abstract of the amounts of the Base Bids and major Alternates (if any) will be made available to Bidders after the opening of Bids.

Article 15. Bids to Remain Subject to Acceptance

All Bids will remain subject to acceptance for sixty (60) days after the day of the Bid opening, but the Owner may, in its sole discretion, release any Bid and return the Bid Security prior to that date.

Article 16. Award of Contract

16.1 The Owner reserves the right to reject any and all Bids and to waive any and all irregularities in Bids not involving price, time or changes in the Work. The Owner reserves the right to reject any nonconforming, nonresponsive, incomplete, unbalanced or conditional Bids. The Owner also reserves the right to reject the Bid of any Bidder that in the Owner's judgment would not be financially or otherwise responsible or that does not meet pertinent minimum experience criteria established by the Owner and stated in the Instructions to Bidders.

16.2 In evaluating Bids, the Owner will consider whether or not the Bids comply with the prescribed requirements, and include such Alternates, unit prices and other data, as may be required in the Bid Form and supplements thereto.

16.3 Discrepancies in the multiplication of units of Work and unit prices, if any, will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between bid amounts stated in words and in figures will be resolved in favor of the amount stated in words.

© December 2012 Kennedy/Jenks Consultants

16.4 The Owner may accept any Alternate without regard to the order in which they are listed and will determine the lowest Bidder on the basis of the Base Bid.

16.5 If the Contract is to be awarded, it will be awarded to the lowest qualified, responsible and responsive Bidder that in the Owner's judgment will be in the best interests of the Project.

16.6 If the Contract is to be awarded, Owner will give the Successful Bidder a Notice of Award within the number of days that Bids are subject to acceptance as stated in Article 15.

Article 17. Contract Security

17.1 The Owner's requirements for performance and payment bonds are set forth in Article 4 of the General Conditions.

17.2 The Successful Bidder shall engage a surety who through binding agreement will assume liability for all debts and responsibility for the acceptable performance of the Work under this Contract if the Contractor defaults.

17.3 When the Successful Bidder delivers the executed Agreement to the Owner, it must be accompanied by the required bonds in the forms contained in the section of the Project Manual titled Contract Forms.

Article 18. Insurance

18.1 The Owner's requirements for insurance are set forth in Article 4 of the General Conditions.

18.2 The Successful Bidder shall purchase insurance from an insurance company or companies who meet the requirements of General Conditions paragraphs 4.3 through 4.5, will provide the required insurance and will furnish insurance certificates.

18.3 The Successful Bidder shall deliver the required insurance certificates to the Owner and Engineer prior to beginning work. In no case will the Notice-to-Proceed be considered as allowing the Work to begin until the insurance certificates are received by the Owner, even though the Contract Time as stated in the Notice to Proceed will commence to run.

Article 19. Signing of Agreement

When Owner gives a Notice of Award to the Successful Bidder, it will be accompanied by the required number of unsigned counterparts of the Agreement with all other written Contract Documents attached. Within fifteen days thereafter the Contractor shall sign and deliver the required number of counterparts of the Agreement together with the required Bonds to the Owner. Within ten days thereafter the Owner will deliver one fully signed counterpart to the Contractor. Each counterpart is to be accompanied by a complete set of the Drawings with appropriate identification which shall be signed by the parties to the Agreement.

Article 20. Limitation of Liability

The Agreement contains a clause limiting the liability of the Owner and the Design Engineer to the Contractor for defects in the Contract Documents.

© December 2012 Kennedy/Jenks Consultants

Article 21. Retainage

The percentage of retainage that will be withheld from each Progress Payment is set forth in the Agreement.

Provisions concerning the Contractor's rights to deposit securities in lieu of retainage in accordance with California Public Contract Code Sections 10263 and 22300 are set forth in the Agreement.

Article 23. Pre-bid Conference

A pre-bid conference will be held at _____ p.m. on the _____ day of _____, 2013 at the LESSALT WTP site. Representatives of the Owner and the Engineer will be present to discuss the Project. Bidders are required to attend and participate in the conference. The Engineer will transmit to all prospective Bidders of record such Addenda as the Engineer considers necessary in response to questions arising at the conference.

Article 24. Pre-Bid Site Visit; Access to Site

A pre-bid site visit will be held at _____ p.m. on the _____ day of _____, 2013 at the LESSALT WTP site. Representatives of the Owner and the Engineer will be present to show Bidders the general location of the Work. Bidders are required to visit the site at the time prescribed.

The Contractor may arrange with the Owner for access to the site at the Owner's convenience for the purpose of digging test pits or drilling test holes to evaluate subsurface soil conditions. The Contractor shall fill all holes and leave site in "as found condition."

Article 25. Not Used

Article 26. Not Used

Article 27. Minimum Experience Requirement

Bidder shall submit Document Number 00420 - Bidder's Qualifications, with its Bid to verify it has the minimum experience qualifications required for bidding.

In the Owner's judgment, the minimum experience requirement for Bidders to Bid on this Contract is the successful completion of at least three projects similar in nature, size, complexity and construction cost to the project being bid at this time.

Article 28. Not Used

Article 29. Documents that Must be Submitted with Bids

Bidders must submit the following signed Documents with their Bids:

© December 2012 Kennedy/Jenks Consultants

Document Number	Title
00300	Bid Form
00410	Bid Security
00411	Designation of Equipment or Material Manufacturers
00414	Security for Compensation Certificate
00420	Bidder's Qualifications
00430	Subcontractor List
00480	Noncollusion Affidavit

END OF INSTRUCTIONS TO BIDDERS

© December 2012 Kennedy/Jenks Consultants

DOCUMENT NUMBER 00200

INFORMATION AVAILABLE TO BIDDERS

Article 1

For the convenience of Bidders, the Owner is providing the items and information listed below which the Owner has in its possession and which may relate to the Work, the Project, or the site. The Owner has not made any independent investigation to determine the accuracy or completeness of any such items and information; and all such items and information are provided or made available to Bidders without any representation or warranty by the Owner whatsoever as to their accuracy, completeness, or relevancy. Bidders are solely responsible for independently evaluating any such items and information; and such items and information shall not be relied upon by the Bidders without careful independent verification.

1.1 Geotechnical Data: Geotechnical data, boring logs, and soils information are provided in the Contract Documents and in the following report: Earth Systems Pacific; *Geotechnical Engineering Report for the Sunnyslope County Water District LESSALT WTP DBP Reduction Project, Fairview Road, Hollister, San Benito County, California.* March 17, 2011.

1.2 Existing Site and Building Data: The original design drawings for the LESSALT WTP facility can be provided for review by the Owner. Kennedy/Jenks Consultants; *Hollister LESSALT Water Treatment Plant Project Contract Documents;* June 2001.

1.3 Existing Underground Facilities and Utilities Data: Underground utilities information is provided in the Contract Documents and also shown on the original design drawings for the LESSALT WTP facility. Kennedy/Jenks Consultants; *Hollister LESSALT Water Treatment Plant Project Contract Documents;* June 2001.

1.4 Contract Documents for Work Under Separate Contracts: The pipeline from the LESSALT WTP to the high pressure zone distribution system is being constructed under a separate contract. The connection point is shown on the Contract Documents. Additional information can be found in the following: Kennedy/Jenks Consultants; *Sunnyslope County Water District Ridgemark Transmission Pipeline Project Contract Documents;* July 2012.

1.5 Access to the Work Site: The site is an active water treatment facility that must remain in operation throughout the construction, except for brief shutdowns for integration of the new facilities. The Contractor shall work with the LESSALT WTP operators to provide access to the existing WTP facilities for continued operation.

1.6 Easements: The Hollister Water Treatment Agency will obtain a construction easement around the perimeter of the property for the duration of the construction. The easement is shown on the civil drawings.

END OF INFORMATION AVAILABLE TO BIDDERS

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

DOCUMENT NUMBER 00300

BID FORM

Project Identification: LESSALT Water Treatment Plant DBP Reduction Improvements Project

Contract Identification and Number:_____

This Bid is Submitted To: Hollister Water Treatment Agency,
c/o Sunnyslope County Water District, 3570 Airline Hwy, Hollister, CA 95023. (831) 637-4670.

The Design Engineer is Kennedy/Jenks Consultants: 303 Second Street, Suite 300 South, San Francisco, CA, 94107. (415) 243-2150.

The Engineer is:

_____
(Name)

_____
(Address)

_____
(Phone Number)

Article 1

The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an agreement with Owner in the form included in the Contract Documents to perform and furnish all Work as specified or indicated in the Contract Documents for the Contract Price and within the Contract Time indicated in this Bid and in accordance with the other terms and conditions of the Contract Documents.

Article 2

Bidder accepts all of the terms and conditions of the Invitation to Bid and Instructions to Bidders, including without limitation those dealing with the disposition of Bid Security. This Bid will remain subject to acceptance for sixty (60) days after the day of Bid opening. Bidder will sign and submit the Agreement with the Bonds and other documents required by the Bidding Requirements within fifteen (15) days after the date of the Owner's Notice of Award.

Article 3

In submitting this Bid, Bidder represents, as more fully set forth in the Agreement, that:

(a) Bidder has examined copies of all the Bidding Documents.

(b) Bidder has examined copies of the following Addenda (receipt of which is hereby acknowledged):

© December 2012 Kennedy/Jenks Consultants

Date	Number
_____	_____
_____	_____
_____	_____

(c) Bidder has familiarized itself with the nature and extent of the Contract Documents, Work, site locality, and all local conditions and laws and regulations that in any manner may affect cost, progress, performance or furnishing of the Work.

(d) Bidder has studied carefully all reports and drawings of subsurface conditions and drawings of physical conditions which are identified in the Contract Documents.

Bidder has read and accepts the provisions in General Conditions paragraphs 3.3 through 3.5 which limit the extent to which the Contractor may rely on information provided by the Owner or the Design Engineer with regard to: a) subsurface soil conditions, b) existing concealed or underground utilities and underground facilities, and c) existing structures and facilities.

(e) Bidder has read and accepts the provisions in General Conditions paragraphs 3.6 and 3.8 identifying the Contractor's responsibility: a) for using care in making excavations and in doing demolition, b) for damage to existing utilities and underground facilities and for loss of use thereof, and c) for the protection of workers and others from known and unknown or concealed hazards.

(f) Bidder has read and accepts the provisions in General Conditions paragraph 3.7 which identifies the limited conditions under which the Contractor may be entitled to a change in Contract Time or Price due to differing or unknown conditions.

(g) Bidder has visited the site and has reviewed the Bidding Documents and the Information Available to Bidders and it has made any other investigations, explorations or tests and has obtained any other data it considers necessary for preparation of its Bid.

Bidder has correlated the results of all such observations, examinations, investigations, explorations, tests, reports and studies with the Contract Documents and Bidder has read and understands provisions in the General Conditions relevant to differing and unknown conditions.

(h) Bidder has given Engineer written notice of all conflicts, errors or discrepancies that it has discovered in the Contract Documents and the written resolution thereof by Engineer is acceptable to Bidder.

(i) Bidder has read, studied and understands the entire set of Bidding Documents including the Construction Drawings, Specifications and General Conditions and finds them fit and sufficient for the purpose of preparing its Bid and constructing the Work required.

(j) Bidder represents that its Bid is based on providing all of the material, labor, equipment and services necessary to complete the Work in full compliance with the Contract Documents without exception.

© December 2012 Kennedy/Jenks Consultants

Article 4

Requirements for California Public Works Contracts.

(a) **DECLARATION OF LICENSE STATUS**. The Bidder declares that it possesses a valid State of California Class A - General Engineering Contractor's license at the time of submitting this Bid.

Bidder shall state its license number, classification and expiration date on its Bid Form.

(b) **TRENCH SHEETING AND SHORING**. Bidder shall list on its Bid as a separate Bid Item costs associated with trench sheeting, shoring and bracing for all trenching and excavation work 5 feet and deeper as required by Section 6707 of the California Labor Code.

(c) **PREVAILING WAGE RATES**. The undersigned agrees that, if awarded the Contract, the undersigned and all of its subcontractors shall pay all laborers, workers, and mechanics employed in the performance of such Contract, or any subcontract thereunder, not less than the general prevailing rate of per diem wages and rates for overtime and legal holidays in the locality in which the work is to be performed, as ascertained and determined, by the statutes and regulations applicable thereto.

(d) **NONCOLLUSION AFFIDAVIT**. In accordance with Public Contract Code Section 7106, Bidders are required to execute and submit with their Bid Document Number 00480 "Noncollusion Affidavit."

(e) **USE OF BID DEPOSITORIES**. The Bidder declares that it has not used subcontractors' bids from a bid depository that in any way attempts to restrict, control, influence or regulate free open price competition among subcontractors in the submission of their bids to prime Bidders.

(f) **SECURITY FOR COMPENSATION CERTIFICATE**. Bidders are required to execute and submit with their Bid Document Number 00414 "Security for Compensation Certificate."

Article 5

Bidder will complete the Work for the following lump sum price(s). Prices shall include sales tax and all other applicable taxes and fees:

BASE BID (Add)

_____($_____)
(words) (figures)

© December 2012 Kennedy/Jenks Consultants

Sheeting, Shoring and Bracing for Trenches

Cost of sheeting, shoring and bracing for all trenching and excavation work 5 feet and deeper in accordance with California Labor Code Section 6707.

Add:_____($_____)
(words) (figures)

The total Contract Price for all work awarded is:

_____ ($_____)
words figures

Article 6

(a) Bidder agrees that the Work will be finally complete and ready for acceptance and final payment in accordance with Article 13 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

(b) Bidder accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work on time.

(c) Bidder accepts the Limitation of Liability Clause contained in the Agreement.

Article 7

The following documents are attached to and made a condition of this Bid:

(a) Required Bid Security in the form of _____
(b) Designation of Equipment or Material Manufacturers
(c) Security for Compensation Certificate
(d) Bidder's Qualifications
(e) Subcontractor List
(f) Noncollusion Affidavit

Article 8

Communications concerning this Bid shall be addressed to: _____

_____

At the following address: Hollister Water Treatment Agency, c/o Sunnyslope County Water District, 3570 Airline Hwy, Hollister, CA 95023.

Telephone Number: (831) 637-4670

© December 2012 Kennedy/Jenks Consultants

Article 9

The terms used in this Bid which are defined in the General Conditions of the Construction Contract included as part of the Contract Documents have the meanings assigned to them in the General Conditions.

Bidder declares that it does possess a contractor's license of the required classification, valid in the appropriate jurisdiction at the time of submitting this bid.

Contractor's license number: _____

License classification: _____

License expiration date: _____

SUBMITTED on _____, 2013.

If Bidder is:

An Individual

By:_____ (SEAL)
Individual's Name

_____
(Signature)

Doing business as:_____

Business Address:_____

_____

Telephone Number:_____

A Partnership

By:_____ (SEAL)
(Firm Name)

_____
(General Partner Name)

_____
(Signature)

_____
(Title)

© December 2012 Kennedy/Jenks Consultants

Business Address:_____

_____

Telephone No.:_____

A Corporation

By:_____
(Corporation's Name)

_____
(State of Incorporation)

By:_____
(Name of Person Authorized to Sign)

_____
(Signature)

_____
(Title)

Attest_____
(Secretary)

Business Address: _____

_____

Telephone No.:_____

Home Office Address (if different from above):_____

_____

A Joint Venture

By:_____
(Name)

_____
(Signature)

Address:_____

_____

Telephone Number:_____

By:_____
(Name)

_____
(Signature)

© December 2012 Kennedy/Jenks Consultants

Address:_____

_____

Telephone No.:_____

Each joint venturer must sign. The manner of signing for each individual, partnership and corporation that is a party to the joint venture shall be in the manner indicated above.

END OF BID FORM

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

DOCUMENT NUMBER 00410

BID SECURITY

1.1 Bid Security, made payable to the Hollister Water Treatment Agency, shall accompany each Bid. Bid Security shall be in the form of a cashier's check or certified check in the amount of not less than ten percent (10%) of the Bidder's maximum price, or in the form of a Bid Bond in said amount (in the form attached). Bid Bond shall be executed by such sureties as are named in the current list of "Certified Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds or Certified Reinsurer Companies Holding Certificates Of Authority As Acceptable Reinsuring Companies" published in Circular 570 (most recent amendment) by the Audit Staff Bureau of Accounts, U.S. Treasury Department (www.fms.treas.gov/c570/index.html) and is admitted to issue bonds in the states in which the Project is located and all Work is performed. All bonds signed by an agent shall be accompanied by a certified copy of the authority to act.

1.2 Bid Security shall remain subject to acceptance for sixty (60) days after the day of the Bid opening, but the Owner may, at its sole discretion, release any Bid and return the Bid Security prior to that date.

1.3 The Bid Security of the successful Bidder will be retained until such Bidder has within fifteen (15) days of issuance of written notice of contract award;

(a) Executed the contract agreement,

(b) Furnished a performance bond and a payment bond fully executed as described in the Contract Forms section.

(c) Furnished certificates of insurance as described in the General Conditions, and

If the successful Bidder fails to deliver the executed documents described above within fifteen days after Notice of Award, the Owner may annul the Notice of Award and the Bid Security of that Bidder will be forfeited.

1.4 The Bid Security of other Bidders whom the Owner believes to have a reasonable chance of receiving the award may be retained by the Owner until the earlier of the seventh day after the effective date of the Agreement or the sixty-first day after the Bid opening, whereupon Bid Security furnished by such Bidders will be returned.

1.5 Bid Security with Bids which are not competitive will be returned within seven days after the Bid.

© December 2012 Kennedy/Jenks Consultants

BID BOND

KNOW ALL PERSONS BY THESE PRESENTS, that we, the undersigned,

_____

as Principal, and _____
as Surety, are hereby held and firmly bound unto _____
as Owner in the penal sum of _____
dollars for the payment of which sum, well and truly to be made, we hereby bind ourselves, our successors and assigns jointly and severally firmly by these presents.

Signed and sealed, this _____ day of _____, 2013.

The Condition of the above obligation is such that where the Principal has submitted a certain Bid, attached hereto and hereby made a part hereof to enter into a contract in writing, for construction of:

_____ Project.

NOW, THEREFORE;

(a) If said Bid shall be rejected, or

(b) If said Bid shall be accepted and the Principal shall execute and deliver a contract in the Form of the Agreement attachment hereto (properly completed in accordance with said Bid) and shall furnish Bonds for Faithful Performance of said contract, and for the Payment of all persons performing labor and furnishing material in connection therewith, and provide certificates and policies of insurance as specified in the Bid documents and shall in all other respects perform the agreement created by the acceptance of said Bid, then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its Bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such Bid; and said Surety does hereby waive notice of any such extension.

© December 2012 Kennedy/Jenks Consultants

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their duly authorized officers, the day and year first set forth above.

_____ (Seal)
Principal

_____

By: _____

END OF BID BOND

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

DOCUMENT NUMBER 00411

DESIGNATION OF EQUIPMENT OR MATERIAL MANUFACTURERS
(To be submitted with Bid)

The Bidder states that the manufacturer of each listed item of equipment or material proposed by the Contractor for use on this project will be as listed below:

Material Item	Description	Equipment or Material Manufacturer (Do not show Dealer or Supplier)
1	Pipe	
	a. Welded Steel, Mortar Lined and Coated	
	b. Ductile Iron Pipe	
2	Greensand Roughing Filters	
3	GAC Adsorbers/Filters	
4	High Zone TW Pumps	
5	Middle Zone TW Pumps	
6	TW Tank	
7	Spent Washwater Equalization Tank	
8	Switchboard	
9	Motor Control Center	
10	Programmable Logic Controller	

The Bidder must include in the space provided, the name of the equipment or material manufacturer he has used in determining his Base Bid which will be used by the Successful Bidder in constructing the project. If the Bidder does not fill in any of the spaces, it will be considered that the Bidder has selected the first-named manufacturer as his selection for those spaces not filled in.

After the opening of Bids, no changes or substitutions from those listed manufacturers will be allowed without the express written approval of the Engineer. If such change is permitted by the Engineer, it will be evaluated in accordance with provisions of the Contract Documents pertaining to Specified Items/Proposed Equivalents.

© December 2012 Kennedy/Jenks Consultants

Circumstances which will justify changes to the above listing are limited to the following:

1. Manufacturer is unable to meet specifications.

2. Manufacturer fails to honor original quotation upon which the Contractor's bid was based.

3. Manufacturer goes out of business or ceases to make the specified product.

It is the responsibility of the Contractor to furnish materials and equipment meeting the requirements of the Specifications, and acceptance of the bid does not constitute nor imply favorable review or approval of items proposed. The Owner reserves the right to deny approval or acceptance of any equipment or materials which do not comply with Specifications even though listed herein.

_____
(Signature)

_____
(Type or Print Name)

_____
(Title)

_____
(Company)

END OF DESIGNATION OF EQUIPMENT OR MATERIAL MANUFACTURERS DOCUMENT

© December 2012 Kennedy/Jenks Consultants

DOCUMENT NUMBER 00414

SECURITY FOR COMPENSATION CERTIFICATE
(To be submitted with Bid)
(Required by Section 1861, California Labor Code)

TO: Hollister Water Treatment Agency
c/o Sunnyslope County Water District
3570 Airline Hwy
Hollister, CA 95023

I am aware of the provisions of Section 3700 of the Labor Code of the State of California which require every employer to be insured against liability for workers' compensation claims or to undertake self-insurance in accordance with the provisions of that Code, and I will comply with such provisions before commencing the performance of the Work of this Contract.

_____
(Signature of Bidder)

_____
(Type or Print Name)

_____
(Title)

_____
(Company)

_____
(Business Address)

_____

_____
(Place of Residence)

END OF SECURITY FOR COMPENSATION CERTIFICATE

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© 2012 Kennedy/Jenks Consultants

DOCUMENT NUMBER 00420

BIDDER'S QUALIFICATIONS
(To be submitted with Bid)

The Bidder (General Contractor) has been engaged in the contracting business, under the present business name for at least 10 years and has successfully completed at least three projects similar in nature, size, complexity and construction cost to the project being bid at this time. Experience in work of a nature similar to that covered in the proposal extends over a period of 10 years. The Bidder shall hold a Class A license.

The Bidder, as a contractor, has never failed to satisfactorily complete a contract awarded to him, except as follows:

_____

The following contracts have been satisfactorily completed in the last ten years for the persons, firm or authority indicated, and to whom reference is made:

Year	Type of Work	Contract Amount	For Whom

Signed _____
(Same signature as on bid form)

END OF BIDDER'S QUALIFICATIONS

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

DOCUMENT NUMBER 00430

SUBCONTRACTOR LIST
(To be submitted with Bid)

Each Bidder shall set forth below:

(a) The name and the location of the place of business of each Subcontractor who will perform work or labor, fabricate a portion of the work or improvement according to detailed drawings in the project Drawings, or render service to the Contractor in or about the construction of the work in excess of one-half of one percent of the Contractor's total.

(b) The portion of the work which will be done by each such Subcontractor. The Contractor shall list only one Subcontractor for each portion of the work.

If the Bidder fails to specify a Subcontractor for any portion of the work as above-stated, or if the Bidder lists more than one Subcontractor for the same portion of the work, he agrees to perform that work himself.

The following is submitted concerning Subcontractors:

Name: Subcontractor	Address Shop, Mill or Office	Class of Work	Portion of Work to be Done	Subcontractor's License Number and Class

© December 2012 Kennedy/Jenks Consultants

SUBCONTRACTOR LIST
(Continued)

Name: Subcontractor	Address Shop, Mill or Office	Class of Work	Portion of Work to be Done	Subcontractor's License Number and Class

List alternate numbers and changes required in Subcontractors due to alternate selection on a separate copy of the second page of this form.

(Signature of Bidder)

END OF SUBCONTRACTOR LIST

© December 2012 Kennedy/Jenks Consultants

DOCUMENT NUMBER 00480

NONCOLLUSION AFFIDAVIT
(To be submitted with Bid)

In accordance with Section 7106 of the State of California Public Contract Code, Bidders are required to execute the following Noncollusion Affidavit.

NONCOLLUSION DECLARATION TO BE SUBMITTED WITH BID

I, _____, declare that I am _____
(Name) (Title)
of _____, the party making the foregoing bid, that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the bidder has not in any manner directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder or fix any overhead, profit, or cost element of the bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract or anyone interested in the proposed contract; that all statements contained in the bid are true; and further, that the bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee, to any corporation, partnership, company association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

Executed on _____, 2013 in _____.

_____
(Signature of Declarant)

END OF NONCOLLUSION AFFIDAVIT

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

DOCUMENT NUMBER 00500

AGREEMENT

THIS AGREEMENT made and entered into this _____ day of _____, 2013 by and between the Hollister Water Treatment Agency, herein called the Owner, and _____, herein called the Contractor.

IT IS AGREED:

Article 1. WORK

In consideration of the agreements herein made by the Owner and the sums of money to be paid to the Contractor by the Owner in the manner and form as provided in the attached Contract Documents, the Contractor agrees to furnish all labor, tools, appliances, equipment, plant and transportation, and any and all other expenses necessary or incidental to the performance of the Work as specified or shown in the Contract Documents. The Work is generally described as follows:

The work includes improvements to the existing two (2) million gallon per day (MGD) capacity LESSALT Water Treatment Plant (WTP) to add iron and manganese removal pressure filters, granular activated carbon pressure filters, a treated water tank, spent washwater tank, and associated pump stations, chemical feed equipment, piping, valves, instrumentation and controls as described within the contract specifications and drawings.

The Work was designed by and the Contract Documents were prepared by Kennedy/Jenks Consultants herein referred to as the Design Engineer.

The Owner's representative during the construction phase will be _____ herein referred to as the Engineer who will assume the duties and responsibilities and will have the rights and authority assigned to the Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

Article 2. CONTRACT TIME AND LIQUIDATED DAMAGES

(a) Time of Performance: In accordance with the Specifications the Contractor further agrees to plan the Work and to prosecute it with diligence and shall commence the Work within ten (10) days after the date established in Notice-to-Proceed from the Owner, and shall Finally Complete the Work within three hundred and sixty five (365) calendar days from date of commencement in the Notice to Proceed.

(b) Liquidated Damages: The Owner and the Contractor recognize that time is of the essence of this Agreement and that the Owner will suffer financial loss if the Work is not completed within the times specified in paragraph (a) above, plus any extensions thereof allowed in accordance with Article 11 of the General Conditions. They also recognize the delays, expense and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by the Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, the Owner and the Contractor agree that as liquidated damages for

© December 2012 Kennedy/Jenks Consultants

delay (but not as a penalty) the Contractor shall pay the Owner Five Hundred dollars ($500) for each day that expires after the time specified in Article 2 (a) for Completion until the Work is fully complete and the Owner issues a notice of Final Completion.

Article 3. CONTRACT PRICE

The Owner shall pay the Contractor for completion of the Work in accordance with the Contract Documents in current funds as follows:

BASE BID (Add)

_____($____ _____)
(words) (figures)

Sheeting, Shoring and Bracing for Trenches

Cost of sheeting, shoring and bracing for all trenching and excavation work 5 feet and deeper in accordance with California Labor Code Section 6707.

Add:_____($_____)
(words) (figures)

The total Contract Price for all work awarded is:

_____ ($_____)
words figures

Article 4. RETAINAGE

(a) The Owner will withhold 10% as retainage from each progress payment due to the Contractor. Retainage shall be paid to the Contractor at the time of Final Payment as set forth in paragraph 13.13 of the General Conditions.

(b) When 50% of the Work has been completed and if the Contractor's work and progress have been satisfactory, the Engineer may recommend to the Owner that as long as the Contractor continues to perform satisfactorily the total amount withheld as retention need not be increased further.

(c) In accordance with California Public Contract Code Sections 10263 and 22300, the Contractor is hereby permitted to substitute securities of the kind listed below in place of the retention withheld in accordance with this section, or any other moneys withheld by the Owner to insure performance of this contract. At the request and expense of the Contractor, securities equivalent to the amount withheld may be deposited directly with a state or federally chartered bank as the escrow agent, who shall pay such moneys to the Contractor at the time of Final Payment and upon satisfactory completion of this contract. The Owner is authorized to execute documents necessary for this purpose. The Contractor shall be the beneficial owner of any securities substituted for moneys withheld and shall be entitled to receive any interest thereon. Securities eligible for investment under this provision shall include those listed in Government

© December 2012 Kennedy/Jenks Consultants

Code, Section 16430, or bank or savings and loan certificates of deposit. The retention or other moneys withheld will not be released to the Contractor until the Owner has satisfied itself that the substitution of securities has been made in accordance with the provisions of this paragraph.

Article 5. PAYMENTS

(a) Payments will be made to the Contractor for work performed at the times and in the manner provided in the Contract Documents. Payment will be made at bid prices for awarded Bid Items, plus amounts of approved Change Orders.

(b) The period covered by each Application for Payment shall be one calendar month ending on the last day of each month. The Owner shall make payment within 30 days after the Engineer issues a Recommendation for Payment.

Article 6. COMPONENT PARTS

This Contract shall consist of the following documents, each of which is on file in the office of the Owner and all of which are incorporated herein and made a part hereof by reference thereto:

(a) This Agreement
(b) Performance Bond
(c) Payment Bond
(d) Notice of Award
(e) General Conditions
(f) Supplementary Conditions
(g) Addenda Numbered _____ through _____ inclusive
(h) General Requirements
(i) Wage Rates
(j) Technical Specifications
(k) Drawings
(l) Executed Change Orders, if any, which may be effective after the date of this Agreement.

There are no Contract Documents other than those listed above.

Article 7. CONTRACT REPRESENTATIONS

In consideration of the Owner entering into this Agreement, the Contractor makes the following representations:

(a) The Contractor has familiarized itself with the nature and extent of the Contract Documents, Work, site, locality, and all local conditions and laws and regulations that in any manner may affect cost, progress, performance or furnishing of the Work.

(b) The Contractor has studied carefully all reports of explorations and tests of subsurface conditions and drawings of physical conditions which are identified in the Contract Documents and accepts the limitations set forth in the General Conditions as to the extent to

© December 2012 Kennedy/Jenks Consultants

which the Contractor may rely on the information contained in such reports and drawings or otherwise provided by the Owner, the Design Engineer or the Engineer.

(c) The Contractor has obtained and carefully studied (or assumes responsibility for obtaining and carefully studying) all such examinations, investigations, explorations, tests, reports and studies (in addition to or to supplement those referred to in paragraph 7 (b) above) which pertain to the subsurface or physical conditions at or contiguous to the site or otherwise may affect the cost, progress, performance or furnishing of the Work as the Contractor considers necessary for the performance or furnishing of the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents, including specifically the provisions of Article 3 of the General Conditions; and no additional examinations, investigations, explorations, tests, reports, studies or similar information or data are or will be required by the Contractor for such purposes.

(d) The Contractor has reviewed and checked all information and data shown or indicated on the Contract Documents with respect to existing facilities, existing utilities, existing underground or concealed utilities and existing underground facilities at or contiguous to the site and accepts the limitations set forth in the General Conditions as to the extent to which the Contractor may rely on such information or on other information provided by the Owner, the Design Engineer or the Engineer. No additional examinations, investigations, explorations, tests, reports, studies or similar information or data in respect to said existing facilities, existing utilities, existing underground or concealed utilities and underground facilities are or will be required by the Contractor in order to perform and furnish the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents, including specifically the provisions of Article 3 of the General Conditions.

(e) The Contractor has correlated the results of all such observations, examinations, investigations, explorations, tests, reports and studies with the terms and conditions of the Contract Documents.

(f) The Contractor has given the Engineer written notice of all conflicts, errors or discrepancies that he has discovered in the Contract Documents and the written resolution therefor by the Engineer is acceptable to the Contractor.

Article 8. CONTRACTOR DECLARATIONS

The Contractor declares the Work will be conducted pursuant to the following additional requirements of the State of California:

(a) Wage Scale: Reference is hereby made to the rate of prevailing wage scale established by the State of California Director of Industrial Relations, a copy of which is available for inspection in the Owner’s office, the provisions of which are hereby specified as the rate of prevailing wage to be paid workers on this project, and the provisions of Article 2, Chapter 1, Part 7, Division 2 (commencing with Section 1770) of the Labor Code shall be complied with.

(b) Hours of Labor: Eight-hour labor constitutes a legal day's work. The Contractor shall forfeit, as penalty to the Owner, twenty-five dollars ($25.00) for each worker employed in the execution of the contract by him or by any subcontractor, for each calendar day during which any worker is required or permitted to labor more than eight (8) hours in any one

© December 2012 Kennedy/Jenks Consultants

calendar day and forty (40) hours in any one calendar week, except as permitted by the provisions of Article 3, Chapter 1, Part 7, Division 2 (commencing with Section 1810) of the Labor Code of the State of California.

(c) Apprentices: In accordance with the provisions of Section 1777.5 of the Labor Code, and in accordance with the regulations of the California Apprenticeship Council, properly registered, apprentices may be employed in the prosecution of the work.

Information relative to number of apprentices, identifications, wages, hours of employment and standards of working conditions shall be obtained from the Director of the Department of Industrial Relations, who is the Administrative Officer of the California Apprenticeship Council.

(d) Prohibited Employment Discrimination: Attention is directed to Section 1735 of the California Labor Code, which reads as follows:

> "No discrimination shall be made in the employment of persons upon public works because of the race, religious creed, color, national origin, ancestry, physical handicap, mental condition, marital status, or sex of such persons, except as provided in Section 12940 of the Government Code, and every contractor for public works violating this section is subject to all the penalties imposed for a violation of this chapter."

(e) Workers' Compensation Insurance: In accordance with the provisions of Article 5, Chapter 1, Part 7, Division 2 (commencing with Section 1860) and Chapter 4, Part 1, Division 4 (commencing with Section 3700) of the California Labor Code, the Contractor is required to secure the payment of compensation to his employees and shall for that purpose obtain and keep in effect adequate Workers' Compensation Insurance.

The undersigned Contractor is aware of the provisions of Section 3700 of the Labor Code, which requires every employer to be insured against liability for Workers' Compensation claims or to undertake self-insurance in accordance with the provisions of that Code, and will comply with such provisions before commencing the performance of the Work in this contract.

(f) Security for Compensation: The Contractor hereby stipulates that the provisions of Section 1775 of the California Labor Code will be complied with. The Contractor further agrees to secure the payment of compensation to his employees in accordance with the provisions of Section 3700 of the California Labor Code.

(g) Contractor Claims Against the City: Effective January 1, 1991, the California Legislature enacted a requirement that all contract claims of $375,000.00 or less on local government public works contracts must be submitted to mediation and judicial arbitration. Article 1.5 (Sections 20104 through 20104.6, inclusive) of Chapter 1 of Part 3 of the Public Contract Code concerning Resolution of Construction Claims, is hereby incorporated into this agreement. See Supplementary Conditions paragraph SC10.1 for a summary of the timing provisions in Section 20104 through 20104.6.

© December 2012 Kennedy/Jenks Consultants

(h) Contractor's License: The Contractor declares that it possesses a valid California Contractor's License of the required class at the time of signing this Agreement. The Contractor shall affirm its license number, classification and expiration date on this Agreement.

The following statement is included in accordance with Section 7030 of the California Business and Professions Code: "Contractors are required by law to be licensed and regulated by the Contractors State License Board. Any questions concerning a Contractor may be referred to the Registrar, Contractors State License Board, P.O. Box 26000, Sacramento, California 95826."

Article 9. LIMITATION OF LIABILITY

The Contractor stipulates that it has carefully reviewed the Contract Documents and finds them fit and sufficient for preparation of its bid and for construction of the Work. The Contractor agrees that neither the Contractor nor any of its employees, subcontractors or suppliers will make a claim against the Owner, the Design Engineer or any of their agents, consultants, officers, employees or shareholders for damages on this project such that the total aggregate liability, including the attorneys fees and costs of Owner, the Design Engineer and all of their agents, consultants, officers, employees or shareholders shall not exceed the greater of fifty thousand dollars ($50,000.00) or five percent of the Contract Price.

Article 10. MISCELLANEOUS

(a) Terms used in this Agreement, which are defined in Article 1 of the General Conditions, will have the meanings indicated in the General Conditions.

(b) No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

The Owner and the Contractor each binds itself, its partners, successors, assigns and legal representatives to the other party hereto, its partners, successors, assigns and legal representatives in respect of all covenants, agreements and obligations contained in the Contract Documents.

IN WITNESS WHEREOF, the Owner has caused these presents to be executed in triplicate by its officers, thereunto duly authorized, and the Contractor has subscribed same, all on the day and year first above written. One counterpart each has been delivered to the Owner, the Contractor and the Design Engineer.

© December 2012 Kennedy/Jenks Consultants

OWNER: Hollister Water Treatment Agency

(SEAL)

By _____
(Signature)

ATTEST:

By_____ Name _____
(Signature)

Name_____ Title _____
(Type or Print)

Title_____

Address for giving notices_____

_____

CONTRACTOR:

_____

By _____
(Signature)

Name _____
(Type or Print)

Title _____

Address _____

_____

_____
(Federal Employer Identification Number)

_____
California Contractor's
License Class, License Number and License Expiration Date

Telephone Number (___)_____

© December 2012 Kennedy/Jenks Consultants

(SEAL)

If the Contractor is a corporation, attach evidence of authority to sign.

ATTEST:

By _____
(Signature)

Name _____

Title _____
(Type or Print)

Address for giving notices _____

_____

_____

© December 2012 Kennedy/Jenks Consultants

CALIFORNIA ALL-PURPOSE ACKNOWLEDGEMENT

State of _____

County of _____

On _____, before me, _____,
Name and Title of Officer

personally appeared _____,
Name of Signer(s)

☐ personally known to me - **OR** - ☐ proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is(are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

WITNESS my hand and official seal.

_____
Signature of Notary Public

----------OPTIONAL----------

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of this form to another document

Description of Attached Document

Title of Type of Document:_____

Document Date: _____ Number of Page:_____

Signers) Other than Named Above: _____

Capacity(ies) Claimed by Signer(s)

Signer's Name: _____	Signer's Name: _____
☐ Individual	☐ Individual
☐ Corporate Officer	☐ Corporate Officer
☐ Title(s):_____	☐ Title(s):
☐ Partner ☐ Limited ☐ General	☐ Partner ☐ Limited ☐ General
☐ Attorney-in-Fact	☐ Attorney-in-Fact
☐ Trustee	☐ Trustee
☐ Guardian or Conservator	☐ Conservator
☐ Other_____	☐ Other_____
☐ Signer is Representing:	☐ Signer is Representing:

END OF AGREEMENT

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

DOCUMENT NUMBER 00610

PERFORMANCE BOND

KNOW ALL PERSONS BY THESE PRESENTS: that, WHEREAS, the Hollister Water Treatment Agency, hereinafter designated as the "Owner", San Benito County, State of California, has awarded to _____, hereinafter designated as the "Principal," a Contract, the terms and provisions of which Contract are incorporated herein by reference, for constructing the _____ Project, and

WHEREAS, said Principal is required under the terms of said Contract to furnish a bond for the faithful performance of said Contract;

NOW, THEREFORE, we, the Principal, and _____, as Surety, are held and firmly bound unto the Owner, Engineer and Design Engineer in the penal sum of _____ Dollars ($ _____), lawful money of the United States, being one hundred percent (100%) of the Contract amount, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that if the above bounden Principal, his or its heirs, executors, administrators, successors or assigns, shall in all things stand to and abide by, and well and truly keep and faithfully perform the covenants, conditions, and agreements in the said Contract and any alterations made as therein provided, on his or their part, to be kept and performed at the time and in the manner therein specified, and in all respects according to their true intent and meaning, and shall indemnify and save harmless the Owner, Engineer, Design Engineer, their officers and agents, as therein stipulated, then this obligation shall be null and void; otherwise it shall be and remain in full force and virtue.

As a condition precedent to the satisfactory completion of the said Contract, the above obligation shall hold good for a period of 4 year(s) after the completion and acceptance of the said work, during which time if the above bounden Principal, his or its heirs, executors, administrators, successors or assigns shall fail to make full, complete and satisfactory repair and replacements or totally protect the said Owner, Engineer, and Design Engineer from loss or damage made evident during said period of 4 year(s) from the date of acceptance of said work, and resulting from or caused by defective materials or faulty workmanship, in the prosecution of the work done, the above obligation shall be and remain in full force and virtue.

And the said Surety, for value received, hereby stipulates and agrees to waive the provisions of California Civil Code Section 2819 regarding consent to change, extension of time, alteration, or addition to the terms of the Contract or to the work to be performed thereunder or the Specifications accompanying the same shall in any wise affect its obligations on this bond; and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract, or to the work, or to the Specifications.

In the event the Owner, Engineer, Design Engineer or their successors or assigns, shall be the prevailing party in an action brought upon this bond, then, in addition to the penal sum herein above specified, we agree to pay to the Owner, Engineer, Design Engineer or their

© December 2012 Kennedy/Jenks Consultants

successors or assigns, all reasonable attorney's fees, costs and expenses incurred, which sum shall be fixed by the court.

IN WITNESS THEREOF, the above bounden parties have executed this instrument under their seals this _____ day of _____, 2013, the name and corporate seal of each corporate party being hereto affixed, and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

ATTEST:

_____	_____
(SEAL)	Principal
_____	By _____ (s)
Witness as to Principal	
_____	_____
(Address)	(Address)
_____	_____
	_____
	(Surety)

ATTEST:

_____	_____
(Witness to Surety)	(Attorney-in-Fact)
_____	_____
_____	_____
(Address)	(Address)

If CONTRACTOR is partnership, all partners must execute BOND.

END OF PERFORMANCE BOND

© December 2012 Kennedy/Jenks Consultants

DOCUMENT NUMBER 00620

PAYMENT BOND

KNOW ALL PERSONS BY THESE PRESENTS:

That we, _____, as Principal, and _____, organized and existing under the laws of the State of _____, and authorized to execute bonds and undertaking as sole surety, as Surety, are held and firmly bound unto any and all persons named in California Civil Code Section 3181 whose claim has not been paid by the Contractor, company or corporation in the aggregate total of _____ Dollars ($_____) (being 100% of the Contract amount) for the payment whereof, well and truly to be made, said Principal and Surety bond themselves, their heirs, administrators, successors, and assigns, jointly and severally, firmly by these presents.

The condition of the foregoing obligation is such that, whereas the above bounden Principal has entered into a Contract dated _____, 2013, with the Hollister Water Treatment Agency to do the following work, to-wit: Construct the LESSALT Water Treatment Plant DBP Reduction Improvements Project.

NOW, THEREFORE, if the above-bounden Principal or his subcontractors fail to pay any of the persons named in Section 3181 of the Civil Code of the State of California, or amounts due under the Unemployment Insurance Code with respect to work or labor performed under the Contract, or for any amounts required to be deducted, withheld, and paid over to the Employment Development Department from the wages of employees of the Contractor and his subcontractor pursuant to Section 13020 of the Unemployment Insurance Code of the State of California, with respect to such work and labor, the surety will pay for the same, in the amount not exceeding the sum specified in this bond, and also, in case suit is brought upon this bond, a reasonable attorney's fee, to be fixed by the Court.

This bond shall inure to the benefit of any person named in Section 3181 of the Civil Code of the State of California so as to give a right of action to them or their assignees in suit brought upon this bond.

This bond is executed and filed to comply with the provisions of the act of Legislature of the State of California as designed in Civil Code Sections 3247 to 3252, inclusive, and all amendments thereto.

And the said Surety, for value received, hereby stipulates and agrees to waive the provisions of California Civil Code Section 2819 regarding consent to change, extension of time alteration, or addition to the terms of the Contract, or to the work to be performed thereunder, or the Specifications accompanying the same, shall in any way affect its obligations on this bond; and it does hereby waive notice of any such change, extension of time, alteration, or addition to the terms of the Contract, or to the work, or to the Specifications.

IN WITNESS WHEREOF, the above bounden parties have executed this instrument under their seals this _____ day of _____, 2013, the name and

© December 2012 Kennedy/Jenks Consultants

corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

ATTEST:

Principal Secretary	Principal
(SEAL)	
	By (s)
Witness as to Principal	(Address)
(Address)	
	(Surety)

ATTEST:

(Witness to Surety)	(Attorney-in-Fact)
(Address)	(Address)

If CONTRACTOR is a partnership, all partners must execute BOND.

END OF PAYMENT BOND

© December 2012 Kennedy/Jenks Consultants

DOCUMENT NUMBER 00700
GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

TABLE OF CONTENTS

ARTICLE 1 - DEFINITIONS 1

ARTICLE 2 - CONTRACT DOCUMENTS 1

Contract Relationships 1
Correlation, Intent 1
Order of Precedence 2
Use of Contract Documents 2

ARTICLE 3 - LAND, EXISTING CONDITIONS, LAYOUTS 2

Land 2
Existing Conditions 2
Subsurface Soil Conditions 2
Existing Utilities and Underground Facilities 2
Existing Structures 2
Contractor Responsible for Damage 3
Differing Conditions 3
Contractor Responsible for Safety Precautions 3
Reference Points, Layout 3

ARTICLE 4 - BONDS AND INSURANCE 3

Performance and Payment Bonds 3
Insurance Requirements 4
Certificates of Insurance 5
Property Insurance: Adjustment of Loss 5

ARTICLE 5 - CONTRACTOR 5

Supervision 5
Contractor Responsible for Means and Methods 6
Labor, Material and Equipment 6
Subcontractors 6
Taxes, Permits, Fees and Notices 6
Patents 6
Documents at the Site, Record Drawings 7
Review of Contract Documents and Field Conditions 7
Contractor's Construction Schedule 7
Safety of Persons and Protection of Property 8
Hazardous Materials 8
Owner's Indemnification for Hazardous Materials 8
Emergencies 9
Indemnification 9

ARTICLE 6 - OWNER 9

Owner's Right to Perform Work and Award Separate Contracts 9
Mutual Responsibility 9
Owner's Right to Stop the Work 9
Owner's Right to Carry Out The Work or Correct Defective Work During Construction 9

ARTICLE 7 - ADMINISTRATION OF THE CONTRACT 10

Communications 10
Requests for Information and Responses 10

ARTICLE 8 - SUBMITTALS 11

Definitions 11
Specified Items, Proposed Equivalents ("Or Equal") 11
Shop Drawings, Product Data, Samples and Proposed Equivalents 12
Intent of Contractor's Review 12
Intent and Limitations on Engineer's Review 12

ARTICLE 9 - CHANGES IN THE WORK 13

Changes 13
Requests for Quotation 13
Change Orders 13
Work Directive Change 13
Information, Interpretations and Minor Changes 14
Determining Cost of Changes 14
Change in Contract Time Due to Changes in the Work 15

ARTICLE 10 - CLAIMS AND DISPUTES 15

Claims 15
Engineer's Decisions 15
Time Limits for Submitting and Deciding Claims 15
Mediation 15
Work Continued During Disputes 16

 © K/J July 2008

ARTICLE 11 - CONTRACT TIME AND DELAYS.....16

Definitions.....16
Computation of Time.....16
Contract Time.....16
Damages for Late Completion.....16
Commencing Work.....16
Accelerated Work If Required to Meet Schedule...16
Excusable Delay.....16
Compensable Delays.....17

ARTICLE 12 - INSPECTION, DEFECTIVE WORK, GUARANTEE.....17

Defective Work.....17
Access to Work and Notice.....17
Tests and Inspections.....17
Reinspection.....17
Uncovering Work.....17
Correction of Defective Work.....17
Acceptance or Use of Defective Work.....18
Guarantee Period.....18
Owner's Right to Correct Defective Work During Guarantee Period.....18
Contractor's Liability for Defective Work Not Limited by Guarantee.....18

ARTICLE 13 - PAYMENT AND COMPLETION.....18

Schedule of Values.....18
Application for Payment.....19
Payment for Items Delivered But Not Installed.....19
Engineer's Recommendation for Payment.....19
Completion and Acceptance.....20
Owner's Right to Partial Use.....20
Contractor's List of Deficiencies.....20
Semi-Final Inspection, Substantial Completion.....20
Final Inspection, Final Completion.....21
Final Payment.....21
Waiver of Claims.....21

ARTICLE 14 - TERMINATION.....21

Termination by the Owner for Cause.....21
Suspension by the Owner for Convenience.....22
Termination by the Owner for Convenience.....22
Contractor May Stop Work or Terminate.....22

ARTICLE 15 - MISCELLANEOUS.....22

Method for Giving Notices.....22
Rights and Remedies.....23
Failure to Act Not a Waiver of Rights.....23
Severability of Provisions.....23
Right to Audit.....23
Governing Law.....23

 © K/J July 2008

DOCUMENT NUMBER 00700
GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1 - DEFINITIONS

1.1 The term "Contract" refers to a single identified portion of the construction which may be the whole or a part of the Project. The Project is the total construction and consists of one or more Contracts performed by the same or separate contractors or by the Owner. A single set of drawings, specifications and contract conditions may include more than one Contract; when combined with the Agreement for an individual Contract they become the Contract Documents for that Contract. The construction performed under a set of Contract Documents is the Work required by an individual Contract.

1.2 The "Contract Documents" consist of the Agreement, General and Supplementary Conditions, Drawings, Specifications, Addenda issued prior to executing the Agreement and modifications issued after executing the Agreement.

1.3 The term "Contract Price" refers to the total monies payable to the Contractor for completion of the Work in accordance with the Contract Documents.

1.4 The term "Design Engineer" refers to the firm that prepared the Contract Documents - Kennedy/Jenks Consultants - and includes all of their officers, directors, shareholders, employees and consultants.

1.5 The term "Drawings" refers to the graphic and pictorial portion of the Contract Documents, showing the design, location, dimensions, details, scope and character of the Work. Drawings may include plans, elevations, sections, schedules, details and diagrams.

The term Plans, Plan, Drawing and similar terms shall have the same meaning as the term "Drawings."

1.6 The term "Engineer" refers to the person or entity designated by the Owner to provide administration of the Contract.

1.7 The term "Notice to Proceed" refers to a written notice by the Owner to the Contractor authorizing it to proceed with the Work and establishing the date of commencement from which the Contract Time is measured.

1.8 The term "Owner" is the person or entity referred to in the Agreement and includes all of its officers, employees, and consultants.

1.9 The term "Work" means the entire construction required by the Contract Documents completed or in progress and includes all labor, materials, equipment and services necessary to fulfill the Contractor's obligations. The Work does not include the Contractor's tools, equipment, scaffolding, shoring, barricades, guardrails or any other temporary construction or safety devices employed by the Contractor to complete the Work.

1.10 Definitions of other terms are included at the beginning of each Article or in Division 1 Section 01010.

ARTICLE 2 - CONTRACT DOCUMENTS

Contract Relationships

2.1 The Contract Documents constitute the entire Agreement between the Owner and the Contractor for the Work and supersede prior agreements written or oral.

2.2 The Contract Documents shall not be construed to create a duty of any kind (1) on behalf of the Design Engineer or the Engineer and toward the Contractor, any subcontractor, worker, or any other party, or (2) on behalf of the Owner and toward any subcontractor, worker, or any other party.

2.3 Provisions in referenced standards, specifications, manuals, publications, installation instructions, operation and maintenance instructions or codes shall not change the duties or responsibilities between any of the parties involved in this work from those described in these General Conditions.

Correlation, Intent

2.4 It is the intent of the Contract Documents to include everything necessary for the proper execution of the Work as a complete functioning facility that serves the intended purpose. The Contractor shall provide all labor, material, equipment and services required by the Contract Documents or that may

reasonably be inferred from the Contract Documents as being required to produce the intended result.

2.5 The Contract Documents are complementary: What is required by one shall be as binding as if required by all. Organization of the Specifications into sections and the arrangement of the Drawings on separate sheets for Mechanical, Electrical, etc. shall not control the Contractor in dividing the Work among subcontractors or among trades.

Order of Precedence

2.6 In case of conflict between different parts of the Contract Documents, the order of precedence shall be as follows:

.1 Supplementary Conditions take precedence over the General Conditions and the Specifications including Division 1;

.2 General Conditions take precedence over the Specifications including Division 1;

.3 Provisions in Division 1 General Requirements apply to all sections of the Specifications.

.4 Specifications take precedence over the Drawings;

.5 Stated dimensions take precedence over scaled dimensions;

.6 Larger scale drawings take precedence over smaller scale drawings;

.7 Detailed drawings take precedence over general or typical drawings;

.8 Specific notes on the Drawings take precedence over schedules; and

.9 Notes, descriptions or schedules take precedence over graphic representations on drawings.

.10 Higher quality takes precedence over lower quality.

.11 Greater number, amount or size takes precedence over lesser number, amount or size.

2.7 The Contractor will be furnished 10 complete copies of the Drawings and the Project Manual and may obtain additional copies at their cost of reproduction.

Use of Contract Documents

2.8 The Drawings, Specifications and other documents prepared by the Design Engineer, are instruments of service to which the Design Engineer retains legal title, including copyright rights. These instruments of service shall not be used on other projects or for subsequent changes to this project without the written permission of the Design Engineer.

ARTICLE 3 - LAND, EXISTING CONDITIONS, LAYOUTS

Land

3.1 The Owner shall furnish access to the land on which the Work is to be performed including rights-of-way and easements for access. The Contractor shall confine its operations to the land furnished or to that portion of the land indicated on the Drawings. The Contractor shall provide all other land that it may require.

Existing Conditions

3.2 Execution of the Agreement by the Contractor is a representation that the Contractor has visited the site and has become familiar with existing and local conditions which may affect the Work and has included all costs associated therewith in its Bid.

Subsurface Soil Conditions

3.3 If information on subsurface soil conditions was obtained for design purposes, the Contractor may rely on the boring logs as a representation of soils that existed at the location of the boring at the time the borings were made but may not rely on the interpretations or opinions contained in the report nor on the completeness or adequacy of the information for the Contractor's construction purposes.

Existing Utilities and Underground Facilities

3.4 Information shown with respect to existing concealed or underground utilities and underground facilities is based on data provided by the utility or facility owners or by others. The Contractor may rely on the information shown in the Contract Documents for purposes of establishing the Scope of Work included in the Contract Price but the Owner and the Design Engineer are not responsible for the adequacy or completeness of such information for the Contractor's construction purposes.

Existing Structures

3.5 Information on existing structures and facilities including concealed utilities was obtained from such records as were available from facility owners and not from exhaustive field investigations. The Contractor may rely on technical data for existing structures and facilities including concealed utilities when such data are shown in the Contract Documents but not on the completeness or adequacy of such data for the Contractor's construction purposes.

Contractor Responsible for Damage

3.6 The Contractor shall be responsible for:

.1 verifying the existence and location of all utilities and underground facilities, including the use of potholing, hand excavations and hand demolition;

.2 coordinating work with utility and facility owners;

.3 protection of concealed and underground utilities and underground facilities from damage;

.4 the repair or replacement of utilities or underground facilities damaged by the Contractor's failure to exercise reasonable care; and

.5 damage to others due to loss of utility service resulting from the Contractor's operations.

Differing Conditions

3.7 If the Contractor encounters: (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inherent in work of the character covered by these Contract Documents, (3) material that the Contractor believes may be hazardous waste as defined by law, the Contractor shall immediately report them to the Engineer. If the Engineer determines that conditions encountered are materially different from those indicated in the Contract Documents or ordinarily encountered in work of the character required and that the differing conditions cause a change in the Contractor's cost or time, it will recommend an equitable adjustment in Contract Price and/or Time. The Contractor's failure to notify the Owner of differing conditions that cause a reduction in the Contractor's cost or time shall not affect the Owner's right to make a Claim for adjustment in Contract Price and/or Time. If either the Contractor or the Owner disagrees with the Engineer's recommendation, they may make a Claim under Article 10.

Contractor Responsible for Safety Precautions

3.8 The Contractor shall take all precautions required to protect workers and others from known and unknown or concealed hazards including verifying the location of concealed and underground utilities and underground facilities with utility and facility owners, potholing, hand excavation and hand demolition and shall not rely on the adequacy, accuracy or completeness of information provided in the Contract Documents or elsewhere by the Owner, the Engineer or the Design Engineer. The Contractor shall be solely responsible for and take all responsibility for safety in, on, or about the site.

Reference Points, Layout

3.9 The Owner shall provide reference points to establish property corners, a baseline and an elevation. The Contractor shall protect reference points provided by the Owner and shall reset any that are damaged. The Contractor shall hire a surveyor licensed in the state where the project is being built to reset and document baseline reference points, elevation bench marks and property corners that are damaged.

3.10 The Contractor shall layout the Work from the reference points provided and shall be responsible for accurate location, alignment, elevation and level of the completed Work.

ARTICLE 4 - BONDS AND INSURANCE

Performance and Payment Bonds

4.1 The Contractor shall furnish Performance and Payment Bonds, each in an amount equal to the Contract Price as security for the faithful performance and payment of the Contractor's obligations under the Contract Documents. The Payment Bond shall remain in effect for at least two (2) years after final acceptance. The Performance Bond shall remain in force the greater of: (a) four (4) years after final completion and final acceptance of all work, or (b) until the expiration of all Warranties and Guarantees as required by the Contract Documents. All Bonds shall be in the forms prescribed by law and by the Contract Documents and be executed by Sureties named in the current list of "Certified Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds or Certified Reinsurer Companies Holding Certificates Of Authority As Acceptable Reinsuring Companies" published in Circular 570 (most recent amendment) by the Audit Staff Bureau of Accounts, U.S. Treasury Department (www.fms.treas.gov/c570/index.html) and is admitted to issue bonds in the states in which the Project is located and all Work is performed. If the Surety is declared bankrupt or becomes insolvent or its right to do business is terminated by the state where the Work is located or if it ceases to meet the foregoing listing requirement, the Contractor shall provide another Bond meeting the stated requirements. All Bonds signed by an agent must be accompanied by a certified copy of the agent's authority to act.

4.2 Sureties shall specifically waive all rights of notice of and consent to change, extension of time, alteration or addition to the terms of the Contract. The Contractor shall be responsible for notifying Sureties of all events that may affect them.

Insurance Requirements

4.3 The Contractor shall, at its sole cost, obtain and maintain, in force and effect for the duration of the Contract, including the Guarantee and Warranty periods, insurance of the following types with limits not less than those set forth below, in a company or companies with a Best's rating of no less than A:VII and admitted to issue insurance in the jurisdiction(s) in which all work is to be performed, where the site is located and where any waste is transported or deposited. The Contractor shall require compliance with these Insurance Requirements by its lower tier subcontractors:

.1 Workers' Compensation Insurance, including occupational illness or disease coverage, in accordance with the laws of the nation, state, territory or province having jurisdiction over the Contractor's employees and Employer's Liability Insurance with limits the greater of the statutory requirements, or $1,000,000 per accident and, for bodily injury by disease, $1,000,000 per employee. Coverage shall include all work covered under the U.S. Longshoreman's and Harbor Workers' Compensation Act and Jones Act. The Contractor shall not utilize occupational accident or health insurance policies, or the equivalent, in lieu of mandatory Workers' Compensation insurance, or otherwise attempt to opt out of the statutory Workers' Compensation system. This insurance shall contain a waiver of subrogation against the Owner, the Engineer, and the Design Engineer and each of their officers, employees, agents and consultants.

.2 Comprehensive General Liability Insurance (Occurrence Form) ISO Form CG 00 01 10 93 with a full defense and indemnity, and unless modified in the Supplementary Conditions, shall include:

(a) a minimum combined single limit of liability of $3,000,000 or the limits required by law, whichever is greater for each occurrence for bodily injury and property damage;

(b) a minimum limit of liability of $3,000,000 each person for personal and advertising injury liability;

(c) a minimum limit of liability of $3,000,000 each occurrence for products/completed operations liability. The products/completed operations liability shall be maintained in full force and effect for not less than 10 years following completion of any of the Contractor's work;

(d) a general aggregate limit of not less than $3,000,000, which shall be provided on a per project basis by means of ISO Endorsement CG 25 03 11 85;

(e) an endorsement that names the Owner, the Engineer, and the Design Engineer and each of their officers, employees, agents and consultants as additional insureds. Such endorsement shall be made upon an ISO Endorsement CG 20 10 11 85, Additional Insured - Owners, Lessees or Contractor (Form B) and shall state "insurance is primary and all other insurance shall be noncontributory" and shall waive all rights of subrogation against the additional insureds;

(f) XCU coverage for claims arising from explosion, collapse and underground damage;

(g) Pollution Impairment Liability coverage of not less than $1,000,000;

(h) Contractual liability coverage for all oral and written contracts including the indemnity provisions contained herein

(i) Deductibles shall not exceed $5,000 per occurrence and shall be the sole responsibility of the Contractor;

(j) Coverage for Cross Liability and coverage for Severability of Interest shall be included;

(k) Claims made policies are not acceptable;

(l) Coverage for Work performed on or within 50 feet of a railroad, by deletion of any limitation or exclusion of coverage on or within 50 feet of a railroad or by a Railroad Protective Liability policy which complies with Article 4.3.2 (a), (d), (e), and (h)-(k).

.3 Automobile Liability Insurance covering use of all owned, non-owned and hired automobiles with a minimum combined single limit of liability for bodily injury and property damage of $3,000,000 per occurrence, and shall include:

(a) An endorsement that names the Owner, the Engineer, and the Design Engineer and each of their officers, employees, agents and consultants as additional insureds, states such "insurance is primary and all other insurance shall be noncontributory", and waives all rights of subrogation against the additional insureds;

(b) Coverage for Cross Liability and coverage for Severability of Interest;

.4 Property Insurance shall be on an all-risk policy form and shall include:

(a) A minimum limit of liability in the amount of the initial Contract Price as well as subsequent modifications thereto for the entire Work at the site

on a replacement cost basis without voluntary deductibles;

(b) The interests of the Owner, the Contractor, the Engineer, and the Design Engineer and each of their officers, employees, agents, consultants, and all tiers of subcontractors, all of whom shall be listed as insureds or additional insureds and the policy shall, by endorsement, waive all rights of subrogation against the insureds and additional insureds and the endorsement shall state: “Subrogation: This insurance shall not be invalidated should the named Insured waive in writing prior to a loss, any right of recovery against any person for loss occurring to the property described.”;

(c) Coverage for the Completed Value. If the Owner is damaged by the failure of the Contractor to maintain such insurance, the Contractor shall bear all reasonable costs properly attributable thereto;

(d) Coverage against the perils of fire and extended coverage and all physical loss or damage including, without limitation or duplication of coverage:

(i) lightning, windstorm, hail, smoke, explosion, riot, riot attending a strike, civil commotion, aircraft and vehicles;

(ii) theft, vandalism, malicious mischief, and water damage;

(iii) collapse, flood including tidal waves or overflow from bodies of water, landslide, water pressure or earth movement and earthquake;

(iv) removal of debris resulting from an insured loss and demolition occasioned by enforcement of any applicable legal requirements;

(v) falsework, temporary buildings and safety devices used by the Contractor to perform the Work;

(vi) portions of the Work stored on and off the site and in transit when such portions of the Work are included in an Application for Payment (including Inland Marine coverage and Installation and Equipment Floater coverage as applicable);

(vii) and shall cover compensation for the services of the Design Engineer and the Engineer required as a result of the insured loss.

(viii) flood and tidal wave insurance coverage shall be for the maximum percentage of the Contract Price permitted by law.

(e) Remaining in full force and effect until the Final Payment has been made to the Contractor. The property insurance policy shall be endorsed to allow for partial use or occupancy by the Owner without permitting a cancellation or lapse of insurance coverage;

(f) Deductibles shall not exceed $5,000 per occurrence with a deductible aggregate of $5,000. The Contractor shall pay for deductible losses at no cost to any other insured or additional insured.

.5 Boiler and Machinery Insurance shall be provided as required by the Supplementary Conditions or by law.

Certificates of Insurance

4.4 Prior to beginning any Work, the Contractor shall file with the Owner, Design Engineer and Engineer, Certificates of Insurance in a form satisfactory to Owner (ACCORD form) along with a copy of all endorsements as required in Article 4.3. The certificates shall name each additional insured required by these General Conditions, shall state "insurance is primary and all other insurance shall be noncontributory", shall waive all rights of subrogation against the additional insureds; and shall also contain a provision that the Owner, Design Engineer and Engineer shall be notified in writing 30 days before the policies may be canceled or allowed to expire or any reduction in coverage. An additional certificate shall be submitted with the final Application for Payment showing required continuation of coverage beyond the Final Payment.

Property Insurance: Adjustment of Loss

4.5 A loss insured under the Contractor's property insurance shall be adjusted with the Contractor and made payable to the Contractor as fiduciary for the insured, as their interests may appear subject to the requirements of any applicable mortgage clause. The Contractor shall deposit the insurance proceeds in a separate account, and shall distribute payment to the parties in proportion to their cost for repairing or replacing the damaged Work. The Contractor shall provide a complete audited accounting of the distribution of insurance proceeds to all parties of interest.

ARTICLE 5 - CONTRACTOR

5.1 The Contractor shall be skilled in the type of work required by the Contract Documents and shall be licensed in accordance with applicable law. The Contractor shall perform at least ten percent of the dollar value of the Work using personnel on its own payroll.

Supervision

5.2 The Contractor shall supervise and direct the Work using its best skill and attention. The Contractor shall employ a competent superintendent

to represent the Contractor at the site at all times work is being performed. The Superintendent shall not be replaced without reasonable cause and notice to the Engineer. Communications given to the Superintendent shall be as binding as if given to the Contractor.

Contractor Responsible for Means and Methods

5.3 The Contractor shall be solely and completely responsible for and have control over construction means, methods, techniques, sequences, procedures and safety and for coordinating all portions of the Work under the Contract Documents. The Owner, the Engineer, and the Design Engineer and each of their officers, employees, agents and consultants shall not be responsible for any construction means, methods, techniques, sequences, nor for safety in, on or about the site, nor for coordinating any part of the Work.

Labor, Material and Equipment

5.4 The Contractor shall provide and pay for labor, material, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, communications, and other facilities and services necessary for the proper execution and completion of the Work.

5.5 The Contractor warrants to the Owner, the Engineer, and the Design Engineer and each of their officers, employees, agents and consultants that materials and equipment furnished under the Contract will be of good quality and new unless otherwise specified, that the Work will be free from defects, that all material, equipment, hardware, software and firmware products provided to the Project will be "Year 2000 Compliant" defined in Article 8.8, and that the Work will conform with the requirements of the Contract Documents. If required by the Engineer, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. Work not conforming to these requirements, including Proposed Equivalents not Favorably Reviewed, may be considered defective. The Contractor's warranty excludes remedy for damage caused by the Owner's abuse, modification, improper maintenance, improper operation, or normal wear.

5.6 The Contractor shall enforce strict discipline and good order among persons performing the Work. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

5.7 The Contractor shall be responsible to the Owner, the Engineer, and the Design Engineer and each of their officers, employees, agents and consultants for the acts and omissions of the Contractor's employees, subcontractors and their agents and employees, and other persons performing portions of the Work under a contract with the Contractor.

Subcontractors

5.8 Unless listing subcontractors at the time of bidding is required by the bidding documents, the Contractor shall furnish a list of all subcontractors whose work amounts to one-half percent or more of the Contract Price prior to beginning construction. The Contractor shall not contract with any subcontractor to whom the Owner or the Engineer has made reasonable and timely objection.

5.9 Contracts between the Contractor and subcontractors shall (1) require each subcontractor to be bound to the Contractor by the terms of these Contract Documents, and to assume toward the Contractor, the Owner, the Engineer, and the Design Engineer and each of their officers, employees, agents and consultants all the obligations and responsibilities including insurance requirements which the Contractor, by these Contract Documents, assumes toward the Owner, the Design Engineer and the Engineer, and (2) at the Owner's option, provide for the assignment of subcontracts to the Owner in the event of Termination of the Contract.

Taxes, Permits, Fees and Notices

5.10 The Contractor shall pay sales, consumer, use, and other similar taxes which are legally enacted when bids are received. The Contractor shall secure and pay for the building permit (less the Plan Review fee) and other permits and governmental fees, licenses and government required inspections necessary for proper execution and completion of the Work including utility connection fees. The Owner will submit the Drawings, Specifications and other required data to the Building Official prior to bidding and will pay for the Plan Review fee. The Owner will pay capital cost assessments such as plant investment fees required by utility owners.

5.11 The Contractor shall give all notices and shall comply with all laws, ordinances, rules, regulations, and lawful orders of public authorities bearing on furnishing and performing the Work.

Patents

5.12 The Contractor shall include in its bid and shall pay royalties and license fees required for the use of all patents. The Contractor shall defend suits

or claims for infringement of patent rights and shall hold the Owner, the Engineer, and the Design Engineer and each of their officers, employees, agents and consultants harmless from loss on the account thereof.

Documents at the Site, Record Drawings

5.13 The Contractor shall keep a complete set of Contract Documents including all modifications and all favorably reviewed submittals at the site. The Contractor shall prepare Record Drawings by neatly adding the following information in ink at least once a week to a set of Contract Drawings: (1) references to Contract modifications including Responses to Request For Information, minor changes and Change Orders; (2) as-built work that differs from work shown on the Contract Drawings; and (3) the dimensioned, as-installed location of major underground and concealed utilities, conduits, piping, tanks, facilities and similar items. Record Drawings shall be made on a clean copy of the Contract Drawings furnished under General Conditions paragraph 2.7 and not used for any other purposes. The Contractor shall make Record Drawings available to the Engineer to verify progress. The Contractor shall submit and obtain favorable review of the Record Drawings prior to Final Acceptance.

Review of Contract Documents and Field Conditions

5.14 Before starting work, the Contractor shall carefully study and compare the Contract Documents with each other and with existing site conditions and field measurements. The Contractor shall immediately report any discovered deficiencies including code violations to the Engineer, in writing. The Contractor is not responsible for finding all deficiencies but will be held responsible for construction required to correct deficiencies or code violations that the Contractor had knowledge of or should reasonably have had knowledge of and did not report to the Engineer in writing.

Contractor's Construction Schedule

5.15 Within 10 days after the date in the Notice to Proceed, Contractor shall submit a temporary construction schedule covering the first 60 days of the Contract Time. The submittal shall be graphic and in electronic form (floppy discs or CD-ROM).

5.16 Within 30 days after beginning construction, the Contractor shall prepare and submit for the Owner's and the Engineer's information a construction schedule for the Work. Unless a specific type of schedule is specified in Division One, the form of schedule may be selected by the Contractor but the schedule shall show the beginning and ending date for each major construction task by each trade and the interdependencies between tasks, and shall identify the critical sequence of tasks (or "Critical Path") that determines the shortest time required to complete the Work. The schedule shall reflect input from the Contractor's subcontractors and suppliers, shall include an allowance for normal unfavorable weather and enough float time to accomplish all clarifications, requests for information or changes required in the Contract Documents, and shall not exceed time limits specified in the Contract Documents. If the Contractor's schedule shows a shorter construction period than provided in the Contract Documents, the Contractor's schedule shall be a Critical Path Method (CPM) type schedule, shall be prepared in sufficient detail to demonstrate the feasibility of early completion and shall be submitted within 30 days after beginning construction. This CPM schedule shall show all required submittals and dates for ordering, shipping and receiving critical materials and equipment. Contractor’s submittals shall be submitted with sufficient time to permit 30 days for a response and not impact Contractor’s schedule. The submittals shall be graphic and in electronic format (floppy discs or CD-ROM).

5.17 It is agreed that the Contract Price includes the Contractor's office and field overhead, profit and related charges for the full Contract Time. The Contractor may, at its option, complete the Work in a shorter period than the Contract Time but the Contractor may not make a claim for extended overhead or other charges for: (1) delays that extended completion beyond the date planned by the Contractor but not beyond the Contract Time, and (2) delays contemplated by the Contractor and the Owner. All float in the schedule shall first be for the benefit of the Owner, the Engineer, the Design Engineer and then for the benefit of the Contractor. To the fullest extent permitted by law, the Contractor on behalf of itself and its subcontractors, waive any and all claims for damages attributable to delays, interference, or acceleration caused by the Owner, the Engineer, the Design Engineer and each of their officers, employees, agents and consultants and the Contractor and its subcontractors shall be entitled to an extension of the Contract Time as their exclusive remedy.

5.18 The construction schedule shall provide for expeditious and practicable execution of the Work and shall be revised and submitted monthly unless excused by the Engineer in writing. The Contractor shall conform to the most recent schedule.

5.19 The Contractor shall prepare and keep current, for the Engineer's information, a schedule of submittals which is coordinated with the Contractor's construction schedule and allows 30 days for the Engineer's review of each submittals and 30 days for review of each resubmittal.

Safety of Persons and Protection of Property

5.20 The Contractor shall be solely and exclusively responsible for construction safety means and methods and for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of this Contract.

5.21 The Contractor shall take all necessary precautions for safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

.1 employees on the Work and other persons who may be affected thereby;

.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's subcontractors or sub-subcontractors; and

.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and underground facilities not designated for removal, relocation or replacement in the course of construction.

5.22 The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

5.23 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, necessary fences and other safeguards for safety and protection of persons and property on and off the site and shall: (1) post danger signs and other warnings against hazards, (2) promulgate safety regulations, and (3) notify owners and users of adjacent sites and utilities when the Contractor's operations may affect them.

5.24 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry out such activities under supervision of properly qualified personnel.

5.25 The Contractor shall promptly remedy damage and loss to property that the Contractor is required to protect caused in whole or in part by the Contractor, a subcontractor, a sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable. The Contractor shall not be responsible for damage or loss resulting solely from the acts or omissions of the Owner or the Engineer or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under the Indemnification clause in this Article 5.

5.26 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's Superintendent unless otherwise designated by the Contractor in writing to the Owner and Engineer.

5.27 The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs required in connection with the Work and shall send copies of all accident, injury or work-related illness reports and of all notices of unsafe conditions to the Engineer.

5.28 The Contractor shall not load or permit heavy weights to be placed on any part of the construction or site so as to endanger its safety.

Hazardous Materials

5.29 If the Contractor encounters material on the site which it reasonably believes may contain asbestos, polychlorinated biphenyl (PCB) or other hazardous material, the Contractor shall stop work in the affected area and shall notify the Owner in writing. The Owner shall have the suspected material tested and if found to contain asbestos, PCB or other hazardous material, the Owner shall have the material removed or rendered harmless. Work in the affected area may be resumed when the Owner gives written notice that the material containing asbestos, PCB or other hazardous material has been removed or made harmless. If halting work in the affected area impacts the Contractor's critical path for construction, the delay will be regarded as an Excusable Delay and the Contract Time will be extended.

Owner's Indemnification for Hazardous Materials

5.30 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Engineer, Design Engineer, and each of

their consultants, agents, employees, officers, and shareholders from and against all claims, damages, losses and expenses, including, but not limited to, attorney's fees, arising out of or resulting from work in areas affected by asbestos, polychlorinated biphenyl (PCB) or other hazardous material, the presence and location of which has not been identified by the Owner in writing.

Emergencies

5.31 In an emergency affecting safety of persons or property, the Contractor shall act as required to prevent threatened damage, injury or loss without instruction or authorization from the Owner or Engineer. Additional compensation or extension of time claimed by the Contractor on account of such an emergency shall be determined as provided under Article 10.

Indemnification

5.32 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, the Engineer and the Design Engineer and each of their agents, consultants, officers, employees, and shareholders from and against all claims, damages, losses and expenses, including but not limited to attorney's fees, caused in whole or in part, or arising out of, connected with, or resulting from the performance of the Work, regardless of whether or not such liability, claim, damage, loss or expense was caused in part by any negligent act or omissions, whether active or passive, by a party indemnified hereunder. The Contractor stipulates that this provision has been negotiated in accordance with applicable law to be fully enforceable.

5.33 The obligation of the Contractor under this indemnity and hold harmless agreement shall not apply to liability for damages arising from the sole negligence or willful misconduct of the Owner, the Engineer, or the Design Engineer or their agents, consultants, employees, officers, shareholders or independent contractors (other than the Contractor).

5.34 The Contractor's liability to the Owner, Engineer and Design Engineer under this Indemnification Clause shall not be limited by any legal limitation on the amount or type of damages, compensation or benefits payable under workers' compensation acts, disability benefit acts or other employee benefit acts.

5.35 The Contractor's liability insurance shall provide coverage for the Contractor's obligations under this Indemnification Clause in accordance with paragraph 4.3.

ARTICLE 6 - OWNER

Owner's Right to Perform Work and Award Separate Contracts

6.1 The Owner reserves the right to perform construction within, related to or adjacent to the Work as a separate activity using its own workers or by contracts with separate contractors under contract conditions similar to those in Article 4 with respect to insurance and subrogation. The Owner shall provide coordination of these separate activities with the Work of the Contractor.

6.2 The Contractor shall cooperate with the Owner's separate contractors and workers and shall afford them access to their work areas and space to store materials, tools and equipment. The Contractor shall adjust its construction schedule to reflect agreed upon interfaces with the Owner's separate activities.

Mutual Responsibility

6.3 If part of the Contractor's work depends on or must interface with work performed by the Owner as a separate activity, the Contractor shall (1) cooperate with the Owner's coordination of the work efforts, (2) inspect work provided by the Owner's separate activities for compatibility with work provided or intended to be provided by the separate contractor, and (3) report to the Owner and the Engineer, prior to proceeding with work that may be affected, any deficiencies in work planned or executed by the Owner that would render it incompatible with work planned or completed by the separate contractor.

6.4 If the Contractor is caused delay or additional cost because of the Owner's separate activities, it may make a Claim as provided under Article 10.

Owner's Right to Stop the Work

6.5 If the Contractor fails to correct defective work or continues to perform defective work, the Owner may issue a signed order directing the Contractor to stop the Work or a portion of the Work until the defective work has been corrected. This right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.

Owner's Right to Carry Out The Work or Correct Defective Work During Construction

6.6 If the Contractor fails to remove and replace or correct Defective Work, or if the Contractor defaults or neglects to carry out the Work in

accordance with the Contract Documents and fails to cure the defect, fault or neglect within 7 days after receipt of written notice from the Owner, the Owner may issue a second notice warning the Contractor that if it does not correct the defect, fault or neglect within the second 7-day period the Owner will, without prejudice to other remedies the Owner may have, correct such deficiencies. In which case, the Owner will deduct the cost of correcting such deficiencies, including compensation for any additional engineering services required, from payments due the Contractor. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. The Owner's right to correct Defective Work during the Guarantee Period is covered in Article 12.

ARTICLE 7 - ADMINISTRATION OF THE CONTRACT

7.1 At the Owner's option, either the Owner or the Engineer designated by the Owner will provide administration of the Contract and will be the Owner's representative (1) during construction, (2) until final payment is due and (3) with the Owner's concurrence, from time to time during the Guarantee Period. If an engineer other than the Design Engineer is appointed to be the Engineer to administer the Contract during construction, the duties and responsibilities of the Engineer and the Design Engineer during construction will be defined in the Supplementary Conditions, in Division One of the Specifications or in a modification to the Contract.

7.2 The Engineer may visit the site at intervals appropriate to the stage of construction to become generally familiar with the progress and quality of the completed Work and to determine in general if the Work is being performed in accordance with the Contract Documents. However, the Engineer will not be required to make exhaustive or continuous on-site inspections to check quality or quantity of the Work. The Contractor shall not rely upon the Engineer’s site visits nor raise as a defense to any claims of defective work, that the Engineer visited the site or observed the site.

7.3 The Engineer shall not have control over or charge of and shall not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's responsibility as provided in Article 5. The Engineer shall not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents.

7.4 The Engineer shall not have the authority to authorize extra work or to change the Contract Time or Price. The Engineer shall not have the authority to stop the Work. The Engineer's duties, responsibilities and limitations of authority are set forth in the Agreement between the Owner and the Engineer and shall not be modified by any action or inaction of any parties and can only be changed by a fully executed Amendment to the Agreement between the Owner and the Engineer.

7.5 The Engineer will have authority to reject Defective Work. The Engineer will have authority to require additional inspection or testing of the Work whether or not such Work is fabricated, installed or completed. Neither this authority of the Engineer nor a decision not to exercise such authority shall give rise to a duty or responsibility of the Engineer to the Contractor, subcontractors, material and equipment suppliers, their agents or employees, or other persons performing portions of the Work.

7.6 The Owner may arrange for the Engineer to provide a full-time on-site Resident Engineer with additional staff as appropriate. The duties, responsibilities and limitations of authority of the Resident Engineer and his staff shall be the same as defined for the Engineer in the Agreement between the Owner and the Engineer.

Communications

7.7 Communications between the Owner or the Design Engineer and the Contractor shall be through the Engineer. Communications between the Contractor and the Design Engineer shall be through the Engineer, and communications between the Contractor and the Design Engineer's consultants shall be through the Engineer and the Design Engineer. Communications between the Engineer and the subcontractors shall be through the Contractor.

Requests for Information and Responses

7.8 The Engineer will endeavor to issue Responses to Requests for Information within 30 days of the date a Request for Information is received by the Engineer unless the Engineer requests more information from the Contractor in which case the Response will be issued 20 days after receipt of the additional information. The Contractor shall use the Request for Information form, attached as Exhibit GC-1. The Engineer's Response to a Request for Information shall not authorize a change in Contract Time or Price. If the Contractor disagrees with the Engineer's interpretation of the Contract Documents, it shall notify the Engineer in writing in accordance

with Article 9. The Engineer shall not be required to answer Requests for Information when the information is contained in the Contract Documents or when the Request for Information form is incomplete or not used.

ARTICLE 8 - SUBMITTALS

Definitions

8.1 Definition of Terms:

.1 "Shop Drawings" are drawings, diagrams, schedules and other data custom prepared by the Contractor or one of its subcontractors or suppliers to illustrate some portion of the Work.

.2 "Product Data" are catalogue pages, brochures, schedules, performance charts, diagrams, instructions and other information which have been highlighted or marked and certified (if required in the Technical Specifications) by the Contractor to indicate the specific items, including options, that are being submitted for some portion of the work.

.3 A "Proposed Equivalent" is an item proposed for use by the Contractor in lieu of the first specified item and warranted by the Contractor as being at least equal in quality, utility, function and appearance to the first specified item. The Contractor shall assume all costs and be fully and solely responsible for the Proposed Equivalent.

.4 "Favorable Review" by the Engineer means that based on information submitted by the Contractor and in consideration of the Contractor's warranty required by General Conditions paragraph 8.8 the Contractor may provide the Favorably Reviewed item or work subject to the limitations in General Conditions Article 8, the General Requirements of Division 1, and the Engineer's review comments.

.5 The term "first specified item" or "first named maker" refers to the first product identified in the Specifications by a model number or trade name and/or by a maker's name for a specified item.

Specified Items, Proposed Equivalents ("Or Equal")

8.2 When the first specified item is followed by a second maker's name and "or equal," the Contractor may submit Proposed Equivalent items for the Engineer's review. Proposed Equivalent items that are in the Engineer's judgment equal to the first specified item in quality, utility, and appearance, will be Favorably Reviewed. Where a product description and first maker's name is followed by "or equal" with no second maker's name, it means the specifier knows of no equivalent product and the Contractor may submit Proposed Equivalent products by other makers for review. Where the term "or equal" is omitted, it means that the named item is required to meet the Owner's needs; no products or makers other than those specified will be considered.

8.3 Proposed Equivalent items must be submitted as required for Product Data submittals on the form attached as Exhibit GC-3 and shall include adequate technical information to fully describe the function and quality of the item. Submittals of Proposed Equivalent items that are not made within 35 days of the Notice to Proceed will be rejected unless the Engineer has agreed in writing to a later submittal date and the Contractor agrees to comply with all conditions of the Engineer for the late submittal. If the Contractor's second attempt to obtain Favorable Review of a Proposed Equivalent item is unsuccessful, the Contractor shall submit the first specified item.

8.4 Inclusion of a second maker's name indicates the maker is acceptable but does not necessarily indicate the maker offers a standard product equal to the first specified item.

.1 Items by the second named maker are subject to the same conditions of review and compatibility as other Proposed Equivalent items.

.2 Inclusion of a maker's name and/or model number after a specification description is not a representation that the maker will furnish an item meeting the Contract requirements at bid time or at time of need. It is the Contractor's sole responsibility to furnish items meeting the Contract requirements.

8.5 Where items are specified with a description followed by a maker's name and trade name or model number, the item shall be provided with all of the custom modifications, special features, accessories and options described even though such things may not normally be included by the maker or provider as part of the model specified. Where there is a conflict between the written description of an item and maker's trade name and/or model number, the written description shall take precedence.

8.6 The design is based on first specified items including all described custom modifications, special features, accessories and options as made by the first named maker. The Contractor shall be responsible for all cost including redesign required to accommodate a Proposed Equivalent item including items by the second named maker.

8.7 The Engineer's review of Proposed Equivalent items is based solely on information provided by the

Contractor and on the Contractor's warranty that the proposed item is at least equal in quality, utility, function and appearance to the first specified item. Favorable Review of a Proposed Equivalent item has the same meaning and is subject to the same limitations that apply to the Favorable Review of Product Data and Shop Drawings described in this Article.

Shop Drawings, Product Data, Samples and Proposed Equivalents

Intent of Contractor's Review

8.8 The Contractor shall make required submittals including Shop Drawings, Product Data, Samples and Proposed Equivalent items in time to allow for the Engineer's review and resubmittal, if required, without causing delay to the Work. The Contractor and appropriate subcontractor shall review, stamp, date and sign submittals before sending them to the Engineer. By making such a submittal, the Contractor makes the following warranty and shall include that warranty statement on its letter of transmittal.

"The Contractor warrants:

1. Work or items submitted are complete, accurate and meet the requirements of the Contract Documents, or else any deviations are identified and described in a separate letter accompanying the submittal form, Exhibit GC-2.

2. Work or items submitted have been coordinated with and meet the requirements of other submittals, field conditions and the Work as a whole and quantities and dimensions are correct.

3. Proposed Equivalent items are at least equal in quality, utility and appearance to the first specified item, or else any deviations are identified in a separate letter accompanying the submittal form, Exhibit GC-3.

4. Adjustments to other work required to accommodate Proposed Equivalent items including second named items have been delineated on the submittal and will be made at the Contractor's expense.

5. This submittal includes all items needed for a particular specification section or assembly for which submittals are required.

6. And represents that all material, equipment, hardware, software and firmware product provided to the Project will be "Year 2000 Compliant". Year 2000 Compliant products will perform without error, loss of data or loss of functionality arising from any failure to process, calculate, compare or sequence date data accurately. In addition, Year 2000 Compliant products and/or services will not cause any associated products or systems in which they may be used to fail in any of the ways described above. This Year 2000 Compliant Warranty will remain in effect through January 1, 2034, not withstanding any other warranty period specified in the Contract Documents."

Intent and Limitations on Engineer's Review

8.9 The Engineer's review of the Contractor's submittals is done solely for the Engineer's and Owner's benefit. The Contractor agrees that the Engineer has no duty to the Contractor or any of its subcontractors or suppliers for the accuracy, completeness or adequacy of the Engineer's review of its submittals.

8.10 The Engineer's review of submittals is for compliance with the design intent and requirements of the Contract Documents and is based solely on information provided by the Contractor and on the Contractor's warranty that the work or items submitted meet the requirements of the Contract Documents, and the Work as a whole. If later information reveals that work or items submitted or furnished do not meet the requirements of the Contract Documents or the Work as a whole, the Engineer's Favorable Review shall be void and the items or work shall be considered Defective. The Engineer's Favorable Review shall not include an examination of methods or means of construction or required safety precautions. The Engineer's Favorable Review: (1) shall not include a review of quantities or dimensions, (2) shall not relieve the Contractor from responsibility for errors or omissions in submittals, (3) shall not relieve the Contractor from responsibility for complying with the requirements of the Contract Documents, (4) shall not constitute a Change Order, and (5) shall not constitute final acceptance of a product, item or portion of the Work.

8.11 The Engineer's Favorable Review of submittals shall not relieve the Contractor from responsibility for deviations from the requirements of the Contract Documents unless the deviations are specifically called to the Engineer's attention in a separate letter accompanying the submittal form, Exhibit GC-2, and the Engineer favorably reviews the specific deviations in writing.

8.12 The Engineer's Favorable Review of a re-submittal does not include a review of changes made by the Contractor to a previous submittal that were not requested by the Engineer unless the Contractor specifically calls the Engineer's attention to the non-

requested changes, in a separate letter accompanying the resubmittal of form Exhibit GC-2.

8.13 Where performance type specifications are used or where pre-engineered or Contractor designed systems, elements, equipment or components are called for, the Owner, the Design Engineer and the Engineer shall have the right to rely on the Contractor's design. Favorable Review of the Contractor's design submittal shall be limited to acknowledgment that the design was prepared with the intent of meeting the specified performance criteria, but the Engineer's review shall not constitute a review of the design itself, of the designer's calculations, or of the effectiveness of the design in actually satisfying the specified criteria.

8.14 The Contractor shall allow 30 days for the Engineer's review of each submittal and 30 days for each resubmittal unless a different period is specified by the Engineer in writing. If the Engineer requests additional information or clarification of a submittal, the 30 days shall be measured from the date the additional information or clarification is received. If the Contractor requires more than two submittals to obtain the Engineer's Favorable Review, the Contractor shall compensate the Owner for the cost of the Engineer's additional review time. The Contractor shall not perform work for which reviewed submittals are required without obtaining Favorable Review of submittals.

8.15 Submittals required for the Owner's or Engineer's information and on which the Engineer shall not be expected to take responsive action are identified in the Contract Documents.

ARTICLE 9 - CHANGES IN THE WORK

Changes

9.1 The Owner may order changes in the Work after executing the Agreement by issuing a written Change Order or Work Directive Change.

9.2 The Contractor expressly agrees that it shall not consider any order, instruction, Clarification, Response to a Request for Information or any other communication either written or oral given intentionally or unintentionally by the Engineer, Owner or any other person as authorization or direction to do work that would cause a change in Contract Time or Price unless it is a Change Order or Work Directive Change signed by the Owner.

Requests for Quotation

9.3 If a change involving Contract Price or Time is being considered, the Engineer will issue a Request for Quotation describing the proposed change. The Contractor shall submit a quotation promptly so not to delay or interfere with the progress of the Work, in accordance with the requirements for determining the cost of changes described in this Article.

Change Orders

9.4 If the Owner and the Contractor agree on the change in Price and Time for a proposed change, a Change Order will be issued and signed by the Engineer, Contractor and the Owner. An executed Change Order shall be conclusive and final settlement of the change in Contract Time and Price for the work covered by the Change Order including the effect of the change on all other portions of the work completed or not and shall include compensation for all related claims for disruption, impact, delay or extended overhead, if any, that may result from the change. Implied in every Change Order, unless expressly reserved by the Owner or Contractor, is a waiver of all known and unknown claims arising out of the Change Order, including a waiver of Section 1542 of the California Civil Code as well as under any other state or federal statute or common law principle of similar effect which provides as follows:

"GENERAL RELEASE CLAIMS EXTINGUISHED.

A general release does not extend to claims which the creditor does not know or suspect to exist in his favor at the time of executing the release, which, if known by him, must have materially affected his settlement with the debtor."

9.5 The Owner reserves the right to have changed work performed by a separate contractor or its own workers if the Contractor and the Owner cannot agree on the change in Price and Time required.

Work Directive Change

9.6 If the Owner and the Contractor have not agreed on the change in Price or Time required for a proposed change, or if time does not permit preparation of a quotation, the Owner may direct the Contractor to proceed with the work on a cost accounting basis by issuing a Work Directive Change.

9.7 All Work Directive Changes must be signed by the Owner and will state the maximum sum the Owner is obligated to pay.

.1 If the Contractor has agreed to do the work on a cost accounting basis and to complete the work for an amount not to exceed the stated maximum sum, the Contractor shall sign the Work Directive Change.

.2 If the Contractor cannot agree to a maximum sum to complete the work, the Contractor shall not sign the Work Directive Change. In that case the maximum sum shall limit the amount the Owner is obligated to pay to the Contractor but shall not obligate the Contractor to complete the work for that sum.

9.8 When the Owner and the Contractor agree on the change in Price and Time for a Work Directive Change, the Work Directive Change shall be converted into a Change Order.

Information, Interpretations and Minor Changes

9.9 The Engineer has the authority to order minor changes in the Work including interpretations which are consistent with the intent of the Contract Documents. The Engineer does not have authority to order any changes which involve:

.1 a change in Contract Price, or

.2 a change in the Contract Time, or

.3 means, methods, techniques or sequence of Work, or

.4 safety in, on or about the site.

If the Contractor considers that any minor changes so ordered causes a change in Contract Price or Time, the Contractor shall notify the Engineer in writing within 15 days of receipt of the order and shall not proceed with the work except in the case of an emergency endangering persons or property.

9.10 If, after reviewing the Contractor's objection to a minor change, the Engineer determines the work is required by the Contract Documents and does not involve a change in Price or Time, the Owner may direct the Contractor, in writing, to proceed with the work. If so directed, the Contractor may (1) accept the Engineer's determination and proceed with the work or (2) give the Engineer written notice 5 days in advance of beginning work stating that it intends to make a claim under Article 10 and will document costs in accordance with paragraphs 9.11 through 9.14.

Determining Cost of Changes

9.11 The Contractor's quotations of cost on proposed changes and cost reported for work performed on a cost accounting basis shall be determined as the sum of the following:

.1 costs of labor including foremen engaged on the work but not of the Superintendent, field engineer, project manager, and other supervisory or support personnel except as provided in paragraph 9.11.5. Labor costs shall include the cost of social security, old age and unemployment insurance, fringe benefits required by labor agreements and workers' or workmen's compensation insurance;

.2 costs of materials, supplies and equipment, including cost of transportation, incorporated in the Work;

.3 rental costs of machinery and equipment, exclusive of portable power or hand tools, supplied by the Contractor or rented from others;

.4 costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the change;

.5 the increased or decreased cost of the Contractor's supervision and field office personnel but only if the change affects the "critical path" of construction activities and requires a change in Contract Time;

.6 the cost of any tier of subcontractors' work computed as required for the Contractor's work. The mark-up charged by a subcontractor for overhead and profit shall be subject to negotiation and shall not exceed 15% for work performed directly by the subcontractor and 5% for work performed by a subcontractor one tier below it, and

.7 for work performed by the Contractor, the mark-up for overhead, profit and all other costs shall be subject to negotiation and shall be the lesser of 15% for work performed directly by the Contractor and 5% for work performed by a subcontractor or the markup included in escrowed bid documents.

Work shall be done making the most effective use of labor; materials shall be purchased at the lowest available price and all discounts shall be passed on to the Owner; equipment shall be rented at the most favorable rate available for the term of use required.

9.12 When both additions and deletions are related and pertain to the same work item and are included in the same Change Order, the mark-up for overhead and profit shall be computed on the net increase, if any. No deductions for overhead and profit will be made on deductive changes except for deductive changes that materially change the scope of the work or deductive changes issued pursuant to the Owner's right to correct defective work, the Owner's right to

remedy the Contractor's default or neglect or the Owner's right to terminate the Contract for cause.

9.13 The Contractor shall keep the Engineer informed as to when and where work is being performed on a cost accounting basis and shall submit complete auditable records of the cost of such work including daily time sheets signed by the Engineer.

9.14 Any work for which the Contractor may wish to make a claim shall be done in accordance with these requirements for work done on a cost accounting basis.

Change in Contract Time Due to Changes in the Work

9.15 If the work required by a Change Order affects the "Critical Path" of construction tasks and is the sole, unavoidable cause for changing the length of time required to complete the Work, the Contract Time will be adjusted accordingly.

ARTICLE 10 - CLAIMS AND DISPUTES

Claims

10.1 A Claim is a written demand by one of the parties to the Contract for an interpretation of Contract terms or an adjustment in Contract conditions including Price or Time and may involve questions of performance under the Contract including acceptability of work, progress of work, the extent to which work has been completed, whether work is included in the Contract, and other matters in question between the Owner and the Contractor.

Engineer's Decisions

10.2 Claims shall be made in writing and shall include complete documentation including:

.1 The Contractor’s certification, by its owner or an officer, under penalty of perjury, that (a) the claim is made in good faith, (b) supporting data are accurate and complete to the best of the Contractor’s and subcontractor’s knowledge and belief, and (c) the amount requested accurately reflects the Contract adjustment for which the Contractor believes the Owner is liable.

.2 Full disclosure of facts and detailed reasons supporting the Claim and citing relevant provisions in the Contract Documents.

.3 Complete documented cost of doing the work for which it is making a Claim and such cost shall be computed in accordance with General Conditions paragraphs 9.11 through 9.14.

The Engineer, as an arbiter of disputes, will make an initial decision on all Claims made prior to the date the final payment is due including Claims alleging an error or omission by the Engineer. The Engineer's decision will be in writing, will be consistent with the intent of the Contract Documents and will cite the basis on which it is made. The Engineer will endeavor to make decisions that are impartial and will not be liable for results of decisions made in good faith. The Engineer's decision is a condition precedent to a demand by either party that a Claim be settled by litigation, or if agreed to in advance by both parties or if required by law, be settled by mediation or arbitration.

Time Limits for Submitting and Deciding Claims

10.3 The Contractor shall give written notice 5 days prior to beginning any work for which it intends to make a Claim for an increase in Contract Time or Price and expressly waives any right to make a Claim if the required notice is not given. All other Claims must be made within 14 days of the time the condition giving rise to the Claim becomes known to the claimant. The Engineer, as an arbiter of disputes, will issue a written decision on the Claim within 30 days after receipt of the Claim unless additional information is requested from the claimant or the claimant amends the Claim and then a decision will be issued within 30 days after receipt of additional information, or an amended Claim.

10.4 A demand to appeal the Engineer's decision and settle a Claim by litigation, mediation or arbitration can only be made after the Engineer has made a written determination, or in the absence of a determination, 7 days after the Engineer's determination became due. If no demand to settle a Claim by litigation, mediation or arbitration is made within 15 days after the Engineer's written decision was issued, the Engineer's decision shall become final and binding on the Owner and the Contractor and if a change in Contract Time or Price is involved, a Change Order shall be signed by both parties.

10.5 Provisions of law notwithstanding, the Owner and Contractor hereby agree that neither the Engineer, the Design Engineer, nor any other third party shall, without its specific written consent, be required to participate as a party in any litigation, arbitration or mediation proceedings between the Contractor and the Owner initiated to resolve disputes under the Contract Documents.

Mediation

10.6 If any dispute, controversy, or Claim (hereinafter referred to as a dispute) arises out of or relates to this Contract, or breach thereof, and if the

dispute cannot be settled through direct discussions, then the parties first agree to try to settle the dispute by mediation before resorting to litigation or some other dispute resolution procedure. The mediator shall be an attorney experienced in mediating construction disputes and shall be chosen by agreement of the parties, but if no agreement then appointed by the Presiding Judge of the Superior Court in the jurisdiction of the site. Each party shall bear its own costs and expenses of the mediation, including attorney's fees. The fees and costs of the mediator shall be borne equally by the parties.

Work Continued During Disputes

10.7 The Contractor shall continue to work in conformance with the requirements of the Contract Documents and the progress schedule during any dispute and when waiting for decisions on Claims by the Engineer or for resolution of Claims by litigation, mediation or arbitration, unless otherwise directed in writing by the Engineer or Owner.

ARTICLE 11 - CONTRACT TIME AND DELAYS

Definitions

11.1 Definitions of Terms:

1 "Contract Time" is the period of time including authorized adjustments allowed for completion of the Work and is measured from the date of commencement in the Notice to Proceed to the date of Final Completion.

.2 "Day" is a calendar day beginning and ending at midnight.

.3 "Unusual Weather" is defined as when either the number of Wet Days or the number of Freezing Days exceeds the most recent published mean number of Wet or Freezing Days for the period of record, for the same month and for the weather observing station closest to the project site as reported in "Comparative Climatic Data" published by the National Oceanic and Atmospheric Administration, Ashville, NC 28801. "Wet Days" are defined as days that have at least 0.01 inch of rainfall unless modified in the Supplementary Conditions. "Freezing Days" are defined as days with a minimum temperature of 32 degrees F or lower.

Computation of Time

11.2 Any period of time referred to in the Contract Documents measured in days shall mean consecutive calendar days and shall exclude the first and include the last day. If the last day falls on a Saturday, Sunday or legal holiday, it shall be omitted from the calculation.

Contract Time

11.3 Time limits stated in the Agreement are the essence of the Contract. The Contractor confirms that the Contract Time is a reasonable period for performing the Work and includes enough float time to allow for normal unfavorable weather and other reasonably anticipated delays.

Damages for Late Completion

11.4 Liquidated damages if applicable are stipulated in the Agreement. If liquidated damages are not stipulated, the Contractor will be assessed actual damages suffered by the Owner as a result of completion after the Contract Time.

Commencing Work

11.5 The Contractor shall not commence work (1) prior to the date in the Notice to Proceed, (2) prior to giving the Engineer 5 days written notice and (3) prior to the effective date of insurance coverage required under Article 4.

Accelerated Work If Required to Meet Schedule

11.6 The Contractor shall proceed expeditiously with adequate forces and shall achieve Final Completion within the Contract Time. If the Contractor's performance falls behind schedule, the Contractor shall accelerate the work as required to get back on schedule at no additional cost to the Owner. Accelerated work shall include air or express delivery of materials and equipment, increasing the number of workers, working overtime, working Saturdays, Sundays, and holidays and working additional shifts. The Contractor shall pay the Owner for any extra cost of inspection made necessary by accelerated work required under this provision.

Excusable Delay

11.7 "Excusable Delay" means unforeseeable delay beyond the Contractor's or Owner's control and not resulting from the Contractor's fault or negligence. Excusable Delay includes labor disputes, fire, Unusual Weather, unavoidable casualties and unusual delays in transportation. The Contractor may make a Claim under Article 10 for an extension of Contract Time due to an Excusable Delay if it can show that the Excusable Delay is the sole and unavoidable cause increasing the time actually needed to complete the Work. The Contractor shall not be entitled to an increase in Contract Price due to an Excusable Delay.

Compensable Delays

11.8 The Contractor may make a Claim under Article 10 for extension of Contract Time due to delays that are not due to the fault or neglect of the Contractor and which could not have been reasonably anticipated, including delays: (1) caused by the Owner or Engineer or by the Owner's separate contractors or workers, (2) resulting from the Owner's failure to provide access to lands or rights-of-way on which the Work is to be performed, or (3) due to suspension of the Work ordered by the Owner. In making such a Claim, the Contractor must demonstrate that the delay was the sole and unavoidable cause for increasing the length of time required to complete the Work. For purposes of settlement of Claims under this paragraph, the Contractor's cost shall be determined in accordance with paragraph 9.11 except that no mark-up for profit will be allowed and therefore, the maximum percentage mark-ups allowed under subparagraphs 9.11.6 and 9.11.7 shall be reduced by one-third.

11.9 Changes in Contract Time associated with changes ordered by the Owner are covered under Article 9.

11.10 An executed Change Order covering changes ordered by the Owner under Article 9 or the resolution of Claims made under Article 10 shall be the final and conclusive settlement of the change in Contract Time and Price for the work or Claim covered by the Change Order including all related costs in accordance with Article 9.4.

ARTICLE 12 - INSPECTION, DEFECTIVE WORK, GUARANTEE

Defective Work

12.1 Defective Work is work that (1) is unsatisfactory, faulty, deficient, or leaks, breaks, fails or does not conform to the Contract Documents; or (2) does not meet the requirements of reference standards, tests or approvals specifically referred to in the Contract Documents; or (3) has been damaged prior to final acceptance; or (4) does not meet applicable industry or trade standards; or (5) a submittal is required and Favorable Review has not been obtained.

Access to Work and Notice

12.2 The Contractor shall provide the Owner, the Engineer and each of their representatives safe access to every part of the Work at all times work is in progress for observation, inspecting and testing. The Contractor shall give 2 days notice of work being ready for required inspection, test or approval or of intent to cover work up.

Tests and Inspections

12.3 Unless otherwise specified, the Contractor shall arrange and pay for tests, inspections and approvals required by laws, ordinances, rules, regulations, orders of public authorities having jurisdiction or by the Contract Documents. All such tests, inspections and approvals shall be performed by an independent testing laboratory or inspection agency acceptable to the Engineer or to the appropriate public authority. Samples to be tested and items of work to be inspected will be selected by the Engineer or the public authority requiring the test or inspection. Test reports, inspection reports and certificates shall be submitted directly to the Engineer by the performing laboratory or agency. The Contractor shall notify the Engineer at least 2 days prior to all tests and inspections to permit observation by the Engineer.

Reinspection

12.4 If the Engineer determines that portions of the Work require additional testing or retesting, the Contractor shall provide material to be tested, safe access to test locations, power, light and other services. The cost of retesting shall be paid for by the Owner, but if the additional tests or retesting indicate that said portion of the Work is Defective, the Contractor shall pay the Owner all costs associated with additional testing or retesting including the cost of the Engineer's additional service.

Uncovering Work

12.5 If work is covered or concealed without giving the Engineer 2 days notice to permit observation, it shall be uncovered or exposed at the Contractor's expense to permit observation if so requested.

12.6 If the Engineer wishes to have work uncovered for observation after having been given the required notice to observe it, the Contractor shall uncover the work on a cost accounting basis. If the work is found to be in accordance with the Contract Documents, the Owner shall pay the cost of uncovering and replacing the work. If the work is found to be Defective, the Contractor shall pay the cost of uncovering and correcting the work and the cost of required additional engineering and testing service.

Correction of Defective Work

12.7 The Contractor shall promptly correct or replace: (1) work rejected by the Engineer as being Defective, and (2) work that is Defective whether or

not rejected by the Engineer. The Contractor shall correct Defective Work prior to installing subsequent related or connected Work. The Contractor's obligation to correct Defective Work applies to latent as well as patent defects and whether or not the work is fabricated, installed or completed and whether observed before or after Substantial Completion. The Contractor shall bear the cost of correcting Defective Work including consequential costs, engineering services and attorneys' fees made necessary thereby.

Acceptance or Use of Defective Work

12.8 The Owner may elect to accept Defective Work in which case a deductive Change Order shall be signed by the Contractor reflecting the decreased value of the Work. If final payment has been made, the Contractor shall pay to the Owner a sum reflecting the decreased value of the Work.

12.9 The Owner may use Defective Work without negating its rejection or decreasing the Guarantee Period which shall commence when the work is finally corrected or replaced and accepted. When all or part of the Work is being used by the Owner, the Contractor shall schedule correction or replacement of Defective Work at the Owner's convenience.

Tests and Inspections Do Not Reduce Contractor's Responsibility for Performance

12.10 Observations by the Engineer or tests, inspections or approvals by others shall not relieve the Contractor from its obligation to perform the Work in accordance with the Contract Documents.

Guarantee Period

12.11 Within 7 days of receipt of written notice from the Owner, the Contractor shall correct or replace work found Defective within one year after the date of Final Completion of the Work and Acceptance by the Owner or such longer period as covered by any Special Guarantee required by the Contract Documents or by law. For work first performed or first made acceptable after the date of Final Completion, the one-year or longer Guarantee Period shall commence to run at the time the Work is completed or made acceptable.

Owner's Right to Correct Defective Work During Guarantee Period

12.12 If the Contractor fails to correct Defective Work within 7 days of receiving notice to do so, the Owner may correct the Work and recover the cost of correction from the Contractor. If the Defective Work creates an emergency where delay would cause unsafe conditions or serious risk of loss or damage, the Owner may proceed to correct the Defective Work without giving the Contractor notice.

12.13 If the Owner corrects Defective Work under this paragraph, the Contractor shall pay the Owner all direct, indirect and consequential cost and all required engineering services and attorney's fees.

12.14 The Contractor shall be responsible for the cost of removing and replacing work provided by the Owner when such removal and/or replacement is necessary to permit correction of Defective Work for which the Contractor is responsible.

Contractor's Liability for Defective Work Not Limited by Guarantee

12.15 Nothing contained in this Article 12 nor in any Special Guarantee required under Division 1 General Requirements shall be construed to limit the period of the Contractor's obligations under the Contract Documents or under law. Establishment of a time period for the Contractor's specific obligation to correct work places no limit on the time within which the Contractor's obligation to comply with the Contract Documents may be enforced nor on the period during which the Contractor may be held liable for the effect of Defective Work.

12.16 Nothing contained in this Article 12 nor in any Special Guarantee required under Division 1 General Requirements shall be construed to limit the Contractor's, subcontractor's, material or equipment supplier's liability for damages sustained as a result of latent or patent defects in equipment or materials furnished or caused by the negligence of the Contractor or his subcontractors or suppliers. The guarantees contained in this Article 12 shall not be a waiver of nor shall they reduce any guarantee or warrantee offered by the suppliers of materials or equipment furnished under this Contract nor shall they reduce any responsibilities imposed on manufacturers or suppliers of such equipment under law.

ARTICLE 13 - PAYMENT AND COMPLETION

Schedule of Values

13.1 At least 20 days prior to the first Application for Payment Date, the Contractor shall submit a Schedule of Values, in a form acceptable to the Engineer, allocating the Contract Price to various trades, types of work, pieces of equipment, and major tasks to assist the Engineer in evaluating the percentage completion for each part of the Work. The Contractor's overhead and profit shall be uniformly

pro-rated over all items in the Schedule of Values. The Schedule of Values shall represent the actual cost of each segment of the work and shall not allocate higher costs, overhead or profit to work items scheduled for early completion. If the Engineer objects to the allocation of cost or the level of detail provided, the Contractor shall revise and resubmit the Schedule of Values.

Application for Payment

13.2 The period covered by each Application for Payment shall be one calendar month. Payment shall be based on work completed as of the Application for Payment Date which shall be the last day of the month unless otherwise stated in the Agreement. Within 7 days after each Application for Payment Date, the Contractor shall meet with the Engineer to review the line item amounts proposed by the Contractor for payment. When the amounts proposed are acceptable to the Engineer, the Contractor shall prepare and submit within 3 days, the Application for Payment form, attached as Exhibit GC-4, and Conditional Lien Releases from the Contractor, each subcontractor, supplier and materialman whose work is included in the Application. The Contractor shall sign and certify on the Application for Payment, subject to penalty of perjury, the following: "The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief, the Work covered by this Application for Payment has been completed in accordance with the Contract Documents and that all Work for which previous payments have been received is free and clear of liens, claims, security interests or encumbrances of any kind. The Contractor further warrants that title to all Work covered by this Application for Payment will pass to the Owner no later than the time of payment."

Payment for Items Delivered But Not Installed

13.3 If recommended by the Engineer, Applications for Payment may include the percentage of value stipulated in the Agreement for major equipment and custom fabricated items that have been delivered, stored and protected at the site providing proof is furnished that title will pass to the Owner upon payment. Payment will not be made for material stored at the site that is not custom fabricated. Payment will not be made for items stored off the site. Payment will not be made for stored or installed items that are not protected from physical, environmental or other damage. Payment for successful submittal of Shop Drawings or Product Data will be made only when specifically provided for in Division 1.

Engineer's Recommendation for Payment

13.4 Within 7 days after receipt of the Contractor's Application for Payment, the Engineer will either issue a Recommendation for Payment for such amount as the Engineer determines is due or will notify the Contractor and the Owner of reasons for withholding recommendation. The Engineer's recommendation will not be an evaluation or interpretation based upon legal theories or principles but will be based upon sound engineering judgment. The Owner will seek independent legal services, if necessary to assist it in determining if withholds are appropriate. Retainage to be withheld by the Owner is stipulated in the Agreement.

13.5 The Engineer's Recommendation for Payment will constitute a representation that to the Engineer's best knowledge, information and belief the Work has progressed to the point indicated and is generally in conformance with the Contract Documents but is subject to re-evaluation during subsequent site visits and upon final completion. The Engineer's Recommendation for Payment shall not be taken as a representation that the Engineer has (1) made exhaustive or continuous onsite inspections to check the quality of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Price, or (5) offered its legal opinion in any respect.

13.6 If, in the Engineer's opinion, the representations in paragraph 13.5 cannot be made or if the Engineer has knowledge of any of the faults listed below, then the Engineer may decline to issue a Recommendation for Payment or may recommend a reduced amount of payment or may rescind previously issued Recommendation for Payment. Faults for which payment may be withheld, reduced or rescinded include:

.1 Defective Work not corrected;

.2 Third party claims filed or reasonable evidence indicating probable filing of such claims;

.3 Failure of the Contractor to make payments properly to subcontractors or suppliers for labor, materials or equipment;

.4 Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Price;

.5 Damage to property, the Work, the Owner, another contractor or a third party;

.6 Reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;

.7 Work performed for which submittals are required prior to obtaining Favorable Review of submittals;

.8 Persistent failure to carry out the Work in accordance with the Contract Documents;

.9 Failure to submit a construction schedule or to update the construction schedule in accordance with General Conditions paragraph 5.18;

.10 Failure to update Record Drawings weekly;

.11 Failure to reinstate required insurance that has been allowed to lapse; or

.12 Non-payment of money owed to the Owner for the extra cost of inspection or engineering services provided for in the General Conditions.

Completion and Acceptance

13.7 Definitions

.1 "Substantial Completion" means the Work has progressed to the point that: (1) the Work is ready for beneficial use and occupancy by the Owner for the intended purpose, (2) all fire and life safety work has been completed, inspected and accepted, (3) all mechanical and process systems and equipment are complete and have been put in automatic operation, (4) the total value of uncompleted work is less than one-half of one percent of the Contract Price and (5) completing the Work will not significantly interfere with the Owner's convenience, use or cost of operation.

.2 "Semi-Final Inspection" determines if the Work is Substantially Complete.

.3 "Final Inspection" determines if the Work has reached Final Completion.

.4 "Final Completion" indicates that the Work has been fully completed in accordance with the Contract Documents and is ready for acceptance and final payment by the Owner.

.5 "The Final Punch List" contains items that remain uncompleted after Substantial Completion but that must be completed prior to Final Completion.

Owner's Right to Partial Use

13.8 When provided for in the Contract Documents or agreed to in writing by the Owner and the Contractor, the Owner may notify the Contractor and begin using a portion of the Work even though it is not Substantially Complete. The Contractor, the Owner and the Engineer shall agree on and document responsibilities for security, operation, safety, maintenance, utilities, insurance, warranties and guarantees for that portion of the Work being used by the Owner. The Owner, the Contractor and the Engineer shall inspect such portion of the Work and shall prepare a list of work to be completed or corrected before final acceptance. The Owner's use of any portion of the Work shall not constitute final acceptance of that portion of the Work prior to Final Completion and acceptance of the Work as a whole. The Owner shall allow the Contractor reasonable access to complete or correct work in areas being used by the Owner. Partial beneficial occupancy shall not relieve the Contractor of Liquidated Damages unless the Contract Documents expressly provide for and identify the portion of Work that may be considered Substantially Complete before the remaining portions of the Work.

Contractor's List of Deficiencies

13.9 When the Contractor considers the Work nearly complete, the Contractor shall review the Contract Documents, inspect the Work and prepare a list of deficiencies (Punch List). The Contractor shall complete or correct the items on the Punch List until, in the Contractor's opinion, the Work is Substantially Complete and ready for occupancy and use by the Owner. The Contractor shall then deliver the Punch List to the Engineer and notify the Engineer in writing that the Contractor believes the Work is Substantially Complete and ready for a Semi-Final Inspection.

Semi-Final Inspection, Substantial Completion

13.10 When the Work is ready and the Contractor so notifies the Engineer in writing, the Engineer will make a Semi-Final Inspection and may add additional items to the Contractor's Punch List. As a result of this inspection, the Engineer may determine that (1) the Work is not sufficiently complete to warrant a Semi-Final Inspection, additions to the Contractor's Punch List, or the preparation of a Final Punch List, (2) the Work is sufficiently complete for the Engineer to prepare a Final Punch List but certain incomplete or Defective Work prohibits use of the Work for its intended purpose and therefore, the Work is not Substantially Complete, or (3) that the Work is Substantially Complete and usable for its intended purpose and the Engineer can prepare a Final Punch list. In preceding cases 1 and 2, the Contractor shall continue the Work and call for a second Semi-Final Inspection when the Work is ready. In case (3), the Engineer will prepare a Final Punch List and a notice of Substantial Completion which shall establish the

date of Substantial Completion and shall state the time agreed to by the Owner and the Contractor (not to exceed 30 days) in which the Contractor shall complete all work ready for Final Inspection. The date of Substantial Completion shall be revised if necessary such that it is no more than 30 days prior to the actual date of Final Completion. The Engineer shall attach a copy of the Final Punch List to the notice of Substantial Completion. If the Contractor does not achieve Substantial Completion on the second attempt, it shall reimburse the Owner the cost of the Engineer's services for additional inspections.

Final Inspection, Final Completion

13.11 When the Contractor has completed or corrected all the items on the Engineer's Final Punch List and has made all required final submittals, the Contractor shall give the Engineer written notice that the Work is ready for Final Inspection and acceptance and upon receipt of a final Application for Payment, the Engineer shall make a Final Inspection. If the Engineer finds the Work is not fully complete, it shall notify the Contractor of items still requiring completion or correction. The Contractor shall immediately correct these deficiencies and call for a reinspection. When the Engineer finds to the best of the Engineer's knowledge, information and belief, and on the basis of the Engineer's observations and inspections, the Work is acceptable and fully complete in accordance with the Contract Documents, and when all final submittals have been made, the Engineer will recommend that the Owner issue and file a Notice of Completion, designating Final Completion, make Final Payment and Accept the Work in accordance with the terms and conditions of the Contract Documents.

13.12 Neither the Engineer's failure to include an item on the Final Punch List, nor making of the Semi-Final or the Final Inspection, nor recommendation of final acceptance shall alter the Contractor's responsibility to complete all Work in accordance with the Contract Documents.

Final Payment

13.13 Within 10 days after the Contractor has delivered to the Owner a complete release of all liens arising out of this Contract or receipts in full covering all labor, materials and equipment for which a lien could be filed, or a bond satisfactory to the Owner to defend and indemnify the Owner against such liens, the Owner shall accept the Work and file a Notice of Completion. Final Payment shall not become due until 60 days after the Owner files a Notice of Completion and there being no liens or stop notices filed. If any lien or stop notice remains unsatisfied, the Contractor shall immediately take all steps necessary to remove all liens or stop notices before Final Payment is made. If any liens are filed or exist after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such liens, including all costs and reasonable attorneys' fees.

Waiver of Claims

13.14 The making of Final Payment shall constitute a waiver of claims by the Owner except those arising from:

.1 Liens, claims, security interests or encumbrances arising out of the Contract and unsettled;

.2 Failure of the Work to comply with the requirements of the Contract Documents; or

.3 Terms of the one-year guarantee period and special warranties required by the Contract Documents.

.4 Any of the Contractor's continuing obligations under the Contract Documents.

13.15 Acceptance of Final Payment by the Contractor, a subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 14 - TERMINATION

Termination by the Owner for Cause

14.1 The Owner may terminate the Contract if the Contractor:

.1 Persistently fails to provide enough workers or materials to properly pursue the Work as required to complete the Work within the Contract Time;

.2 Persistently fails to perform the Work in accordance with the Contract Documents including, but not limited to providing monthly updates to the schedule of Work and monthly updates to Record Drawings, or to correct or replace Defective Work when directed to do so;

.3 Fails to make payment to subcontractors or material suppliers;

.4 Becomes insolvent, commences any form of voluntary bankruptcy proceedings, has any petition or action filed against it under any bankruptcy code or law, makes a general assignment for the benefit of creditors, or if a trustee, receiver or agent is appointed under law to take charge of Contractor's property or operations for the benefit of creditors;

.5 Persistently disregards laws, regulations, rules or orders of public bodies having jurisdiction or persistently disregards the authority of the Engineer or Owner;

.6 Fails to retain a valid Contractor's license of the required class in the applicable jurisdiction; or

.7 Otherwise commits a material breach of the Contract.

14.2 When any of the above reasons exist and without prejudice to any other rights or remedies the Owner may have, and after giving the Contractor and the Contractor's Surety 7 days written notice, the Owner may terminate the employment of the Contractor and, subject to any prior rights of the Surety, the Owner may:

.1 Take possession of the site and of all material, tools and construction equipment on the site owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to paragraph 5.9; and

.3 Complete the Work by any reasonable method the Owner may select.

14.3 When the Owner terminates the Contract for cause, the Contractor shall not be entitled to further payment until the Work has been completed.

14.4 If the cost of completing the Work, including additional engineering services, attorney's fees and administrative expenses made necessary thereby, exceeds the unpaid Contract Price, the Contractor shall pay the difference to the Owner. This obligation for payment shall be binding after termination of the Contract. If the cost of completing the Work including costs for engineering, legal, and administrative services minus the Contractor's unearned overhead and profit computed in accordance with paragraphs 9.11.6 and 9.11.7, is less than the unpaid Contract Price, the difference and other consequential costs shall be paid to the Contractor.

Suspension by the Owner for Convenience

14.5 The Owner, without cause, may issue written order giving the Contractor 7 days notice to suspend, delay or interrupt the Work in whole or in part for any period of not more than 90 consecutive days. The order shall fix the dates on which the work shall cease and resume.

14.6 If a suspension, delay, or interruption of the Work ordered by the Owner for convenience causes an increase or decrease in the cost of performing the Contract, the Contract Price shall be adjusted as agreed by the Owner and the Contractor or in accordance with the method for determining the cost of changes in Article 9. The Contract Price shall not be adjusted if the Contractor's performance would otherwise have been suspended, delayed or interrupted due to causes for which the Contractor is responsible.

Termination by the Owner for Convenience

14.7 The Owner may terminate the Contract without cause by giving the Contractor 7 days written notice. Such termination shall not prejudice any other right or remedy the Owner may have under the Contract. If the Contract is terminated without cause, the Contractor shall be paid for all work executed as of the date of termination plus reasonable termination expenses including direct, indirect and consequential costs but the Contractor shall not be paid for anticipated profit on work not performed.

Contractor May Stop Work or Terminate

14.8 If, through no act or fault of Contractor, the Work is suspended for a period of more than 90 days by the Owner or under an order of court or other public authority, or the Engineer fails to act on any Application for Payment within 30 days after it is submitted, or the Owner fails for 60 days to pay the Contractor any sum finally determined to be due, the Contractor may, upon 7 days' written notice to the Owner and the Engineer, terminate the Agreement and recover from the Owner payment for all Work performed and any expense sustained plus reasonable termination expenses. In addition and in lieu of terminating the Agreement, if the Engineer has failed to act on an Application for Payment or the Owner has failed to make any payment as aforesaid, the Contractor may, upon 7 days' written notice to the Owner and the Engineer, stop the Work until payment of all amounts then due is received. The provisions of this paragraph shall not relieve the Contractor of the obligations to carry on the Work in accordance with the progress schedule and without delay during disputes and disagreements with the Owner.

ARTICLE 15 - MISCELLANEOUS

Method for Giving Notices

15.1 Written notice shall be considered to have been given if delivered in person to the individual, partner of the partnership or joint venture, or officer of the corporation for whom intended or if sent by registered or certified mail to the address given in the Agreement unless amended by written notice. Notice to the Contractor’s superintendent shall be considered notice to the Contractor. Notice to the Resident

Engineer shall be considered notice to the Engineer. Notice to the Owner's Project Representative or Manager shall be considered notice to the Owner.

Rights and Remedies

15.2 Duties, obligations, rights and remedies prescribed by the Contract Documents shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed by or available under law.

Failure to Act Not a Waiver of Rights

15.3 Except as expressly provided in the Contract Documents, no action or failure to act by the Owner, Engineer, Design Engineer or Contractor shall constitute a waiver of a right afforded or duty imposed under the Contract. No such action or failure to act shall constitute approval of or acquiescence in failure to perform in accordance with the Contract Documents or any other breach of contract.

Severability of Provisions

15.4 The finding under law that any one or more provisions or any portion of a provision in the Contract Documents is invalid, unenforceable, or illegal shall not impair the validity or enforceability of any other provision or of the Contract Documents as a whole. In the case of invalidity or enforceability of any provision or portion thereof, the provision shall be rewritten and enforced to the maximum extent permitted by law to accomplish as near as possible the intent of the original provision.

Right to Audit

15.5 The Owner shall have the right to audit the Contractor's accounting records and the accounting records of any tier of subcontractor to verify the cost of work done on a cost accounting basis as provided under Article 9.

Governing Law

15.6 The Contract shall be governed by the law of the place where the project is located.

END OF GENERAL CONDITIONS

From: Company Name
Mailing Address
City, ST Zip
Name

Page: 1 of 2
Date: _____
K/J Job No.: _____
Project Name: _____

Request for Information

Originator: _____ **Drawing Reference:** _____

Requested Date of Response: _____ **Specification Section:** _____

Written requests for information will not be considered without an accompanying completed copy of this RFI. By submission of this form the Contractor represents it has carefully reviewed the Contract Documents, coordinated the Work with the appropriate subcontractors, reviewed the field conditions and hereby certifies that the information requested cannot be determined from such efforts as required by the Contract Documents.

The Contractor requests the following information in accordance with the requirements of the Contract Documents.

Description of Requested Information

Delete or replace this text with your response. Space is limited; attach additional sheets if necessary.

Contractor's Proposed Method of Resolving Issue

Delete or replace this text with your response. Space is limited; attach additional sheets if necessary.

Contractor's Proposed Impact on Project

Estimated Contract Cost will be ☐increased ☐decreased ☐unchanged by: _____

Estimated Contract Time will be ☐increased ☐decreased ☐unchanged by: _____ days.

Attachments

Attach supporting documentation sufficient for Engineer to evaluate Request for Information, including documentation of field conditions. Forms submitted without adequate documentation will be returned without comment for further clarification.

Contractor's signature below signifies acceptance of responsibility for accuracy and completeness of information included in this Request for Information Form.

Authorized Signature: _____ **Title:** _____

Company: _____ **Date:** _____

© K/J July 2008

Response Date: _____ **K/J Job No.:** _____

Specification Section: _____ **Project Name:** _____

Drawing Reference: _____ **Page:** 2 of 2

Response

Notations listed below indicate the response to the Contractor's proposed method to resolve the issue. If the Contractor has not proposed a method of resolution, see remarks below. Modification of costs, project schedule or time shall be processed in accordance with the Contract Documents.

- ☐ No Exceptions Taken (NET)
- ☐ Make Corrections Noted (MCN)
- ☐ Amend and Resubmit (A&R)
- ☐ Rejected, Resubmit (RR)
- ☐ Returned Without Review (NR)

Remarks

Delete or replace this text with your response. Space is limited; attach additional sheets if necessary.

If Contractor estimates an impact on Project time or price based upon Response, submit Reply within 5 working days of receipt.

Respondent: _____ **Signature:** _____

Company: _____ **Date:** _____

Issued for Kennedy/Jenks Consultants by: _____

Contractor's Reply To Response:

Estimated Contract Cost will be ☐increased ☐decreased ☐unchanged by: _____

Estimated Contract Time will be ☐increased ☐decreased ☐unchanged by: _____ Days.

Comments

Delete or replace this text with your response. Space is limited; attach additional sheets if necessary.

Distribution	RFI	Response	Reply
Owner			
Engineer			
Contractor			
File			

© K/J July 2008

From: Company Name
Mailing Address
City, ST Zip
Name

Page: 1 of 2
Submittal Date: _____
K/J Job No.: _____
Project Name: _____

Specification Section: _____ **Prior Submittal:** _____

Submittal

A. Certification of Completeness and Accuracy

We certify that we have reviewed this submittal in detail and that the submittal is:

1. Complete and accurate and in complete compliance with the Contract Documents.
2. Compliant with the requirements of "Material and Equipment" in Section 01040, especially the subparagraph titled "Compatibility of Equipment and Material".
3. Compliant with the paragraph titled "Performance Specifications and Contractor Designed Items" in Section 01040.
4. Without any deviations from the Contract Drawings, except the following (describe deviation) which have the following advantages and disadvantages:

Delete or replace this text with your response. Space is limited; attach additional sheets if necessary.

Signed by Subcontractor: _____ Title: _____ Date: _____

Signed by Contractor: _____ Title: _____ Date: _____

B. Certification of Year 2000 Compliance

We certify that all material, equipment, hardware, software and firmware product submitted is "Year 2000 Compliant". Year 2000 Compliant products perform without error, loss of data or loss of functionality arising from any failure to process, calculate, compare or sequence date data accurately. In addition, Year 2000 Compliant products and/or services will not cause any associated products or systems in which they may be used to fail in any ways described above. We include the manufacturer's Year 2000 Compliance Certification with this submittal.

Signed by Subcontractor: _____ Title: _____ Date: _____

Signed by Contractor: _____ Title: _____ Date: _____

© K/J July 2008

Response Date: _____ **K/J Job No.:** _____

Specification Section: _____ **Project Name:** _____

Page: 2 of 2

Response

Item	K/J Action	Refer to Comment	Manufacturer or Supplier	Title of Submittal / Drawing

A. The action(s) noted above have been taken on the enclosed document(s).

NET = No Exceptions Taken A&R = Amend and Resubmit NR = Not Reviewed
MCN = Make Corrections Noted RR = Rejected, Resubmit

Comment(s):

Delete or replace this text with your response. Space is limited; attach additional sheets if necessary.

B. Corrections or comments made on the shop drawings during this review do not relieve the Contractor from compliance with the requirements of the Drawings and Specifications. This check is only for review of general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. The Contractor is responsible for: confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction, coordinating its work with that of all other trades, and performing its work in a safe and satisfactory manner.

_____
Responder: type name here - sign above

Distribution	Submittal	Encl.	Response
Owner			
Engineer			
Contractor			
File			

© K/J July 2008

From: Company Name
Mailing Address
City, ST Zip
Name

Page: 1 of 3
Submission Date: _____
K/J Job No.: _____
Project Name: _____

Specification Section: _____ **Prior Submittal:** _____

Proposed Equivalent

A. When the first specified item is followed by a second maker's name and "or equal," the Contractor may submit Proposed Equivalent items for the Engineer's review. Proposed Equivalent items that are in the Engineer's judgment equal to the first specified item in quality, utility, and appearance, will be Favorably Reviewed. Where a product description and first maker's name is followed by "or equal" with no second maker's name, it means the specifier knows of no equivalent product and the Contractor may submit Proposed Equivalent products by other makers for review. Where the term "or equal" is omitted, it means that the named item is required to meet the Owner's needs; no products or makers other than those specified will be considered.

B. This request shall include adequate technical information to fully describe the function and quality of the item. Submittals of Proposed Equivalent items that are not made within 35 days of the Notice to Proceed will be rejected unless the Engineer has agreed in writing to a later submittal date and the Contractor agrees to comply with all conditions of the Engineer for the late submittal. If the Contractor's second attempt to obtain Favorable Review of a Proposed Equivalent item is unsuccessful, the Contractor shall submit the first specified item.

C. Inclusion of a second maker's name indicates the maker is acceptable but does not necessarily indicate the maker offers a standard product equal to the first specified item. Items by the second named maker are subject to the same conditions of review and compatibility as other Proposed Equivalent items. Inclusion of a maker's name and/or model number after a specification description is not a representation that the maker will furnish an item meeting the Contract requirements at bid time or at time of need. It is the Contractor's sole responsibility to furnish items meeting the Contract requirements.

D. The Engineer's review of Proposed Equivalent items is based solely on information provided by the Contractor and on the Contractor's warranty that the proposed item is equal in quality, utility, function and appearance to the first specified item. Favorable Review of a Proposed Equivalent item has the same meaning and is subject to the same limitations that apply to the Favorable Review of Product Data and Shop Drawings described in the Contract Documents.

E. Submit with proposal:

1. Description of item being proposed including the Manufacturer's model number.
2. Manufacturer's representation that item is equal to or superior to specified item in all respects.
3. Manufacturer's product data.
4. Information about several recent similar installations, including project name, owner's name, address, telephone number, and name of knowledgeable person to contact for information on performance of the product.
5. Whether a reduction in the Contract Price is being proposed and, if so, how much.
6. Any differences between the product specified and the Proposed Equivalent, including the warranty.

© K/J July 2008

Submission Date:
Project Name:
Specification Section:

F. Certification of Equivalency, Completeness and Accuracy:

We certify that we have reviewed this request in detail and that the item proposed is:

1. Equal to or superior to the specified item
2. Complete and accurate and in complete compliance with the Contract Documents,
3. Compliant with the requirements of "Material and Equipment" in Section 01040, especially the subparagraph titled "Compatibility of Equipment and Material",
4. Compliant with the paragraph titled "Performance Specifications and Contractor Designed Work" in Section 01040,
5. Without any deviations from the Contract Documents, except the following (describe deviation) which have the following advantages and disadvantages:

Delete or replace this text with your response. Space is limited; attach additional sheets if necessary.

We further represent and warrant to be solely responsible for any extra cost or expense necessary to make the proposed item or service fully equivalent to and compatible with the Contract Documents and meet or exceed the design intent.

If we use the Proposed Equivalent, we agree to comply with all additional requirements imposed upon us by the Engineer and Owner.

Signed by Subcontractor: _____ Title: _____ Date: _____

Signed by Contractor: _____ Title: _____ Date: _____

G. Certification of Year 2000 Compliance:

We certify that all material, equipment, hardware, software and firmware product submitted is "Year 2000 Compliant". Year 2000 Compliant products perform without error, loss of data or loss of functionality arising from any failure to process, calculate, compare or sequence date data accurately. In addition, Year 2000 Compliant products and/or services will not cause any associated products or systems in which they may be used to fail in any ways described above. We include the manufacturer's Year 2000 Compliance Certification with this submittal.

Signed by Subcontractor: _____ Title: _____ Date: _____

Signed by Contractor: _____ Title: _____ Date: _____

© K/J July 2008

Response Date: _____ **K/J Job No.:** _____

Specification Section: _____ **Project Name:** _____

Page: 3 of 3

Response

Item	K/J Action	Refer to Comment	Manufacturer or Supplier	Title of Submittal / Drawing / Information

A. The action(s) noted above have been taken on the enclosed document(s).

NET = No Exceptions Taken A&R = Amend and Resubmit NR = Not Reviewed
MCN = Make Corrections Noted RR = Rejected, Resubmit

Comment(s):

Delete or replace this text with your response. Space is limited; attach additional sheets if necessary.

B. Corrections or comments made on the submittal during this review does not relieve the Contractor from compliance with the requirements of the Drawings and Specifications. This check is only for review of general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. The Contractor is responsible for: confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction, coordinating its work with that of all other trades, and performing its work in a safe and satisfactory manner.

_____
Responder: type name here & sign above

Distribution	Proposed Equivalent	Encl.	Response
Owner			
Engineer			
Contractor			
File			

© K/J July 2008

Application for Payment and Engineer's Recommendation No.: **9999** Kennedy/Jenks Consultants

To:	Name MailingAddress CityStateZip	**Date:** **K/J Job No.:** **Project:** **Contract Date:** **Period To:**	Date 000000.00 ProjectName Date Date	**Distribution to:**	
Attn:	Name			☐	Owner
From:	ContractorName Mailing Address CityStateZip	**Reviewed By:**	Kennedy/Jenks Consultants, Inc. MailingAddress CityStateZip	☐ ☐	Engineer Contractor
Prepared By:	Name	**Recommended By:**	Name	☐ ☐	Architect _____

Contractor's Application for Payment

1. Original Contract Sum	
2. Net Change by Change Orders	
3. Contract Sum To Date (Line 1 ± 2)	
4. Total Completed & Stored to Date (Column G on Page 2)	
5. Retainage:	
a. _____ % of Completed Work (Column D + E)	
b. _____ % of Stored Material (Column F)	
Total Retainage (Lines 5a + 5b or Total in Column I)	
6. Total Earned Less Retainage (Line 4 less Line 5 Total)	
7. Less Previous Payments (Line 6 from prior Applications)	
8. Current Payment Due (Line 6 less Line 7)	
9. Balance to Finish, Including Retainage (Line 3 less Line 6)	

Change Order Summary	Additions	Deductions
Total Changes approved by Owner in previous months		
Total approved this month		
Totals		
Net Changes by Change Order		

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief, the Work covered by this Application for Payment has been completed in accordance with the Contract Documents and that all Work for which previous payments have been received is free and clear of liens, claims, security interests or encumbrances of any kind. The Contractor further warrants that title to all Work covered by this Application for Payment will pass to the Owner no later than the time of payment.

By: _____ Date: _____
Contractor

State of: _____ County of: _____
Subscribed and sworn to before me this _____ day of _____

Notary Public: _____

My Commission expires: _____

Engineer's Recommendation for Payment: In accordance with the Contract Documents, the Engineer recommends to the Owner that the Contractor is entitled to payment in the amount recommended, subject to withholds, deductions or credits pursuant to the Contract Documents.

Amount Recommended…… _____

By: _____ Date: _____
Kennedy/Jenks Consultants, Inc.

This Certificate is not negotiable. The amount recommended is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

© K/J July 2008

Contractor's signed certification is attached. In tabulations below, amounts are stated to the nearest dollar. Use Column I on Contracts where variable retainage for line items may apply.

Application No.: #REF!
Application Date: #REF!
Period to: #REF!
K/J Job No.: #REF!

A	B	C	D	E	F	G		H	I
			Work Completed						
Item No.	**Description of Work**	**Scheduled Value**	**From Previous Application** (D+E)	**This Period**	**Materials Presently Stored** (not in D or E)	**Total Completed and Stored to Date** (D+E+F)	**%** (G÷C)	**Balance to Finish** (C-G)	**Retainage (if variable rate)**
Grand Totals									

DOCUMENT NUMBER 00800

SUPPLEMENTARY CONDITIONS

The following supplementary conditions change portions of Document Number 00700, General Conditions, as noted. When any provision is changed, the unaltered provisions shall remain in effect.

SC 10.1 Add the following at the end of existing paragraph 10.1.

"Claims by the Contractor for $375,000 or less shall be resolved in accordance with California Public Contract Code Section 20104-20104.6 which is incorporated herein in full. The timing provisions for making and responding to Claims under Section 20104-20104.6 are summarized in the following subparagraphs 10.1.1 through 10.1.7.

.1 All claims and responses to claims shall be in writing and shall be fully documented in accordance with General Conditions paragraph 10.2

.2 The Owner will respond to Claims of $50,000 or less within 45 days of receipt or may request additional information supporting or refuting the Claim within 30 days of receipt in which case the Owner will respond within the greater of 15 days after receipt of additional information or a period equal to the time taken by the Contractor to furnish additional information.

.3 The Owner will respond to Claims of $375,000 or less but greater than $50,000 within 60 days of receipt or may request additional information supporting or refuting the Claim within 30 days of receipt in which case the Owner will respond within the greater of 30 days after receipt of additional information or a period equal to the time taken by the Contractor to furnish additional information.

.4 If in either size of claim described above more information is required after the additional information was first requested and furnished, it shall be requested and provided pursuant to Public Contract Code Sections 20104-20104.6 and upon mutual agreement of the Owner and the Contractor.

.5 If the Contractor disputes the Owner's response or the Owner fails to respond within the time prescribed, the Contractor may, within 15 days of receipt of the Owner's response or within 15 days of the time prescribed for the Owner's response, demand an informal conference to meet and confer for settlement of the issues in dispute. Upon such a demand the Owner shall schedule a meet and confer conference with the Contractor within 30 days for settlement of the dispute. Mediation pursuant to paragraph 10.6 shall satisfy this requirement.

.6 If following the meet and confer conference the claim or any portion remains in dispute, the Contractor may file a claim pursuant to Chapter 1 (commencing with Section 900) and Chapter 2 (commencing with Section 910) of Part 3 of Division 3.6 of Title 1 of the Government Code. For purposes of those provisions, the running of the period within which a claim must be filed shall be tolled from the time the Contractor first submits its written claim pursuant to this provision until the time that the claim is denied, including any time utilized by the meet and confer process.

© December 2012 Kennedy/Jenks Consultants

.7 Public Contract Code Section 20104.4 establishes procedures for civil actions filed to resolve claims subject to this Section. These procedures include mandatory submission of the matter to nonbinding arbitration followed, if necessary, by mandatory submission to judicial arbitration.

"Claims for more than $375,000 shall be resolved in accordance with General Conditions paragraphs 10.2 through 10.5. Arbitration shall not be used to resolve such claims without the express written agreement of both parties except as required by law."

SC-15.7 Add a new paragraph

"**Assignment of Antitrust Claims**

15.7 The Contractor offers and agrees to assign to the Owner all rights, title and interest in and to causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. Section 15) or under the Cartwright Act [Chapter 2 (commencing with Section 16700) of Part 2 of Division 7 of the California Business and Professions Code], arising from purchasing of goods, services or materials pursuant to this Contract. This assignment shall be made and become effective at the time the Owner tenders final payment to the Contractor, without further acknowledgment by the parties."

END OF SUPPLEMENTARY CONDITIONS

© December 2012 Kennedy/Jenks Consultants

SECTION 01010

SUMMARY OF WORK AND CONTRACT CONSIDERATIONS

1.01 WORK COVERED BY CONTRACT DOCUMENTS

A. The work includes improvements to the existing two (2) million gallon per day (MGD) capacity LESSALT Water Treatment Plant (WTP) to add iron and manganese removal pressure filters, granular activated carbon pressure filters, a treated water tank, spent washwater tank, and associated pump stations, chemical feed equipment, piping, valves, instrumentation and controls as described within the contract specifications and drawings.

1.02 TYPE OF CONTRACT

A. The Work covered by these Contract Documents shall be provided under a single lump sum Contract.

1.03 WORK UNDER OTHER CONTRACTS

A. Work Under Separate Contracts: The pipeline from the LESSALT WTP to the high pressure zone distribution system is being constructed under a separate contract. The connection point is shown on the Contract Documents. Additional information can be found in the following: Kennedy/Jenks Consultants; *Sunnyslope County Water District Ridgemark Transmission Pipeline Project Contract Documents;* July 2012.

1.04 OWNER-FURNISHED AND INSTALLED ITEMS (N.I.C.) (NOT USED)

1.05 OWNER-FURNISHED CONTRACTOR INSTALLED ITEMS (O.F.C.I.)

A. Certain items required for this project will be furnished by the Owner and installed by the Contractor. Such items are referred to as "Owner-Furnished Contractor Installed (O.F.C.I.)." O.F.C.I. items shall be located at the project site at the start of the project and installed by the Contractor.

B. Contractor's installation of O.F.C.I. items shall include attaching or anchoring items, connecting utilities and controls, lubricating and necessary adjustment, startup, testing, placing items in service. If items are new Contractor shall turn over operation and maintenance manuals and equipment warranties to Owner.

1.06 ITEMS ORDERED IN ADVANCE (NOT USED)

1.07 PROVISIONS FOR FUTURE WORK (NOT USED)

1.08 WORK SEQUENCE

A. Construct the work in phases to accommodate the testing and startup of the work with the Owner's continued use and operation of existing facility.

© December 2012 Kennedy/Jenks Consultants

B. The existing LESSALT WTP shall remain in operation during the project construction and while the new facilities are constructed, started up and tested. The existing LESSALT WTP may be shutdown for the period(s) when interties to existing systems are made. Certain portions of the existing LESSALT WTP shall be demolished and certain new facilities shall be constructed, started up, tested and put into operation before other portions of the existing LESSALT WTP can be demolished. The Contractor shall provide temporary piping, pumps, electrical and other equipment, that may be necessary to permit testing and startup of the new facilities along with continued operation of the existing WTP facilities during construction. The Contractor shall coordinate work activities with the Owner and Engineer and ongoing operations, and maintain access for periodic chemical deliveries and plant operations. Work on all project areas may proceed in parallel, but the conditions for startup of portions of the work must be met, as described below. The Contractor may recommend changes for consideration by the Owner and the Engineer. Coordinate the specific construction schedule with the Engineer.

C. The existing LESSALT WTP feed water is high pressure water from the discharge of the San Benito County Water District Pump Station 9L. The pressure from Pump Station 9L provides the motive force to move the water through the existing MF filters and into the middle zone potable water distribution system. The improvements to the LESSALT WTP will add a lower pressure connection to the suction side of Pump Station 9L and pressure filter processes ahead of the MF filters. The improvements will also add a treated water tank and pump stations after the existing MF filters. The Contractor may phase the construction, testing and startup of portions of the new facilities for the LESSALT WTP, or may construct the new improvements, and then test and startup the new and existing facilities together.

D. Facility Improvements Downstream of the Existing LESSALT MF Filters. In accomplishing the construction, testing and startup of the work, the Contractor shall meet the following requirements:
   1. Before the existing electrical service can be demolished, all of the existing plant loads shall be transferred to the new electrical service or to a favorably reviewed temporary electrical service.
   2. Construct, disinfect and test the new Treated Water Tank, high zone pumps, middle zone pumps and washwater supply pump systems before testing and startup of the new pressure filter systems. The Treated Water Tank supplies washwater to the new pressure filter systems.
   3. Provide a temporary supply of potable water to the Treated Water Tank for testing. Provide temporary discharge piping from the high and middle zone pump stations, with throttle valves for pressure control, back to the Treated Water Tank for testing. Alternatively, provide connections to the high zone and middle zone pressure distribution systems that permits the existing facility to continue operations during testing the treated water pump systems.
   4. After the Treated Water Tank and associated pumps have been satisfactorily tested, the Contractor may coordinate with the Engineer and Owner to connect the Treated Water Tank and associated pumps to the existing LESSALT WTP for continuous operation, before the pressure filter facilities are ready for operation. Alternatively, the Contractor may construct, disinfect and test all the

© December 2012 Kennedy/Jenks Consultants

new improvements, and then test and startup the new and existing facilities together.

5. Before the Treated Water Tank and associated pumps are connected to the existing LESSALT WTP for continuous operation, the setpoint for the inlet pressure control valve for the existing MF filters shall be reduced to 35 psi.
6. After the Treated Water Tank and associated pumps are in operation the existing backpressure control valve downstream of the MF filters shall be removed.

E. New Treatment Process Improvements Upstream of the Existing LESSALT MF Filters. The new connection to the suction side of Pump Station 9L can be constructed without initially connecting to the existing higher pressure discharge of side of Pump Station 9L. This can facilitate startup and testing of the chemical systems, pressure vessels and spent washwater systems, while maintaining the existing LESSALT WTP in operation. In accomplishing the construction, testing and startup of the work, the Contractor shall meet the following requirements:

1. Coordinate with the Owner and maintain access for periodic chemical delivery to the existing chemical delivery area shown on the Drawings.
2. Construct, disinfect and test the new SW piping and chemical feed systems, the Greensand Roughing Filters, the GAC Filters, the SWW Tank and SWW pump systems using the source water from the suction side of Pump Station 9L. The production rate of the systems during system testing shall be at approximately 500 gpm and controlled to permit the filtered water from the GAC filters (non-potable water with no chlorine) to be appropriately handled and disposed of. Coordinate with the Owner and Engineer to send the test water to one or more of the following locations: return to the HC using the SWW pumps; discharge to the sewer; discharge to the Treated Water tank through a temporary pipeline; discharge to storm drainage. Note that the full 500 gpm may need to be sent to different discharge points, so as not to overload a single point. Provide temporary connections, as needed to facilitate testing and water handling.
3. After the new treatment processes upstream of the existing LESSALT WTP MF filters have been tested, and after the Treated water tank and pump stations have been tested and are ready to receive potable water, the Contractor shall coordinate with the Owner and Engineer to shut down the LESSALT WTP, and make the piping connection changes at the Pump Station 9L and at the middle zone distribution system piping. The LESSALT WTP may be shut down for a period of 3 weeks to accomplish the connection, testing and startup of the new and existing facilities.
4. Before the Treated Water Tank and associated pumps are connected to the existing LESSALT WTP for continuous operation, the setpoint for the inlet pressure control valve for the existing MF filters shall be reduced to 35 psi.
5. The LESSALT WTP shall initially be started up and tested through the full treatment process up to the Treated Water Tank. After the water from the full treatment process is confirmed by the Owner, to be potable for a period of 4 hours, then the treated potable water may be sent into the high and middle pressure distribution systems. The production rate of the systems during testing shall be at approximately 500 gpm and controlled to permit the filtered water (potable water with chlorine) to be appropriately handled and disposed of for the testing period. Coordinate with the Owner and Engineer to send the test

© December 2012 Kennedy/Jenks Consultants

water to one or more of the following locations: return to the HC using the SWW pumps; discharge to the sewer. Treated water could be manually transferred from the TW Tank to the SWW Tank using the surface wash pumps, through an offline pressure vessel.

6. After the systems have been tested at 500 gpm and potable water can be sent to the distribution system, complete the full testing of the LESSALT WTP at flow rates up to 2.5 mgd.
7. The 30-Day Plant Acceptance Test, described in Section 01650, shall begin after the startup sequences above have been accomplished.

1.09 EARLY PARTIAL OCCUPANCY AND USE BY OWNER (NOT USED)

1.10 CONTRACTOR'S USE OF SITE AND OWNERS CONTINUED OPERATIONS

A. The Contractor shall confine his use of the site for work and storage to the Work Area Limits shown on the contract drawings. The Contractor's use of adjacent lands and roads for access to move onto and off of the site and for daily access of workers, material and equipment shall be arranged and scheduled to minimize interference with the Owner's continued operations.

B. The Owner intends to continue operation of portions of its existing facility during all or most of the construction period. The Contractor shall plan and schedule its work to minimize impacting the Owner's continued operations and shall, at all times, maintain safe access for the Owner's operating personnel and equipment.

C. The Contractor shall be responsible for maintaining safe emergency exiting for the Owner's and Contractor's personnel in all areas affected by the Contractor’s work.

D. If operation of the Owner's existing facility is adversely affected by the Contractor's work, the Owner may suffer a financial loss and may make a claim against the Contractor to recovery its loss.

1.11 DOCUMENTING EXISTING

A. Prior to commencing the Work, tour the site with the Owner and the Engineer. Examine and document photographically and in writing the condition of existing buildings, equipment, improvements, and landscape planting on or adjacent to the site. This record shall serve as a basis for determination of subsequent damage due to the Contractor's operations and shall be signed by all parties making the tour. Record existing conditions by making a minimum of 72 color photographs on 35 mm film. Provide two 4x6 prints of each exposure to the Owner.

1.12 SHUTDOWN OF EXISTING UTILITIES, SERVICES OR OPERATIONS

A. Obtain the Engineer's approval at least seven (7) days prior to the shutdown of any utility, service or operation of any existing facility. Give required notice and make appropriate arrangements with utility owners and other affected parties prior to shutdown of any utility service. Base bids on work performed during normal working hours. The Owner may authorize a Change Order if work must be performed during premium time hours. The Contractor's Bid shall include the cost of premium time to

© December 2012 Kennedy/Jenks Consultants

perform work requiring utility shutdowns on weekends or outside of normal working hours.

B. Schedule utility service or operations shutdowns for periods of minimum use and at the Owner's convenience. Have all required material, equipment and workers on site prior to beginning any work involving a possible shutdown. Perform work as required to reduce shutdown time to the minimum. In some cases, this may require increased numbers of workers and/or premium time night or weekend work.

1.13 ALLOWANCES (NOT USED)

1.14 SCHEDULE OF VALUES

A. Specific provisions are described in Article 13, paragraph 13.1 of the General Conditions.

B. The Contractor's Schedule of Values shall be in a form acceptable to the Engineer and have at least the following level of detail: a separate line item for each technical specification section, for site mobilization, for Construction Scheduling, for bonds and insurance, for final cleanup and for final deliverables. Subdivide final deliverables into: Record Drawings; Operation and Maintenance Manuals with Parts Lists; and Special Guarantees. Include the appropriate specification section and paragraph number for each line item. Subdivide major trades or portions of the work into multiple line items that relate to observable milestones to aid monthly progress evaluations in accordance with the following example:

Concrete Work
Foundations
Slab on grade

1.15 APPLICATION FOR PAYMENT

A. Applications for Payment may be made only on General Conditions Exhibit GC-4, in accordance with General Conditions paragraph 13.2. Line items on the Application for Payment shall be the same as those used on the Schedule of Values. Applications for Payment shall contain the Contractors Certification required by General Conditions paragraph 13.2.

1.16 CONTRACT MODIFICATIONS

A. Methods of modifying the Contract Documents are covered in General Conditions, Article 9.

B. The following documents may be used by the Engineer:
1. Request for Quotation: Issued by the Engineer, a Request for Quotation is used to describe a proposed change and request a cost quotation from the Contractor but does not authorize a change in the Work or in the Contract Time or Price.
2. Change Order: Signed by the Engineer signifying its recommendation, and signed by the Contractor and Owner signifying their acceptance, a Change

© December 2012 Kennedy/Jenks Consultants

Order changes the Scope of Work and possibly the Contract Price and/or Contract Time.

3. Work Directive Change: Signed by the Owner (and in some cases by the Contractor) signifying their acceptance and issued by the Engineer, a Work Directive Change is used: (1) to direct the Contractor to do extra work on a cost accounting basis with a fixed maximum sum when the Owner and Contractor have not agreed on the price and time for the change, and (2) to direct the Contractor to do work that the Contractor contends is not included in the contract scope. Work done under Case 1 will be converted to a Change Order when the Contractor and Owner agree on the change in price and time. The Contractor may make a claim under General Conditions Article 10 for recovery of cost and time extension for work done under case 2; but if the claim is denied because the work is determined to be included in the contract scope, then the Contract Time and Price will not be changed. Work done under both cases 1 and 2 shall be done in accordance with the requirements for work done on a cost accounting basis described in General Conditions paragraphs 9.11 through 9.14.
4. Response to Request for Information: Issued by the Engineer, a Response to Request for Information is used to order or document minor changes in the work consistent with the intent of the Contract Documents and NOT involving a change in price or time. Information issued on a Response to Request for Information shall NOT authorize a change in Contract Price or Contract Time and shall not be considered a Constructive Change Order. If the Contractor considers that a Response to Request for Information would cause a change in Contract Price or Time, it shall notify the Engineer in writing within 15 days of receipt of the Response to Request for Information and shall not proceed with the work. See General Conditions paragraphs 7.8, 9.9 and 9.10.
5. The Contractor hereby expressly waives any claim or right to make a claim for an increase in contract time or price without written notice to the Engineer of the Contractor's intent to make a claim 5 days prior to proceeding to execute the work or portion thereof giving rise to such claim. See General Conditions paragraph 10.3.
6. The Contractor agrees that it shall not consider any Response to Request for Information, order, instruction, clarification, suggestion or any other communication either written or oral, given intentionally or unintentionally by the Engineer, Owner or any other person as authorization or direction to do any work that would cause a change in Contract Time or Price unless it is a formal written Change Order or Work Directive Change signed by the Owner.

1.17 REGULATORY REQUIREMENTS.

A. The codes and regulations adopted by the State and other governmental authorities having jurisdiction shall establish minimum requirements for this project. This project shall comply with the following:
   1. International Building Code (IBC) 2009 edition
   2. Uniform Building Code Standards (UBCS) 2010 edition
   3. Uniform Fire Code (UFC) 2010 edition
   4. Uniform Mechanical Code (UMC) 2010 edition
   5. Uniform Plumbing Code (UPC) 2010 edition
   6. National Electric Code (NEC) 2010 edition

© December 2012 Kennedy/Jenks Consultants

7. California Building Code 2010 edition
8. California Code of Regulations:
    a. Title 8, Industrial Relations: Especially CAL-OSHA and Elevator Safety Orders.
    b. Title 19, Public Safety: Portions of the work regulated by the State Fire Marshal.
    c. Title 24, Building Standards: Regulations applicable to Essential Service Facilities, Energy Conservation, Public Assembly and Handicapped Access.

B. The latest edition of the requirements in effect at the date of submission of bids shall apply.

C. General Conditions paragraph 5.11 covers the Contractor's responsibility to comply with laws and codes applicable to Means and Methods for performing the Work.

D. General Conditions paragraph 5.14 covers the Contractor's responsibility to report code deficiencies in the design to the Engineer prior to proceeding with the Work.

E. Paragraphs addressing Pre-Engineered Systems and Performance Specifications in other Sections cover the Contractor's responsibility to comply with code requirements when (1) performance specifications are used to describe all or portions of Work or items; and (2) when pre-engineered (contractor designed) systems are specified.

F. In cases where the Contract Documents are more restrictive than applicable codes, the Contractor shall comply with the Contract Documents.

1.18 REFERENCE STANDARDS

A. When these specifications state that Work or tests shall conform to specific provisions in a referenced standard, specification, code, recommendation or manual published by an association, organization, society or agency the referenced provisions, as they apply to the Work of the Contractor only shall be considered a part of these specifications as fully as if included in total. When these specifications or applicable codes contain higher or more restrictive requirements than those contained in reference standards these specifications or applicable codes shall govern.

B. The latest edition of a referenced standard published at the time of submission of bids shall apply unless a specific date for the referenced standard is cited in these specifications.

C. General provisions in referenced standards, specifications, manuals or codes shall not change the specific duties and responsibilities between any of the parties involved in this work from those described in the General Conditions Provisions in referenced standards with regard to measurement and payment shall not apply to this Work unless specifically cited. See General Conditions paragraph 2.3.

© December 2012 Kennedy/Jenks Consultants

1.19 SPECIFICATION LANGUAGE AND STYLE

A. Many parts of the Specifications as well as notes on the Drawings are written in the active voice and are addressed to the Contractor.
   1. When words or phrases requiring an action or performance of a task are used, it means that the Contractor shall provide the action or perform the task. For example: provide, perform, install, furnish, erect, connect, test, operate, adjust or similar words mean that the Contractor shall perform the action or task referred to.
   2. When words or phrases requiring selection, acceptance, approval, review, direction, designation or similar actions are referred to, it means that such actions are the Owner's or the Engineer's prerogative and that the Contractor must obtain such action before proceeding.

B. Requirements in the Specifications and Drawings apply to all work of a similar type, kind or class even though the word "all" or "typical" may not be stated.

1.20 DEFINITIONS

A. The following terms, when used in the Contract Documents, shall have the meanings listed:

ACCEPTABLE	"acceptable to the Engineer"
PERFORM	"perform all operations required to complete the work referred to in accordance with the intent of the Contract Documents"
PROVIDE	"furnish and install the work referred to including proper anchorage, connection to required utilities or other work, testing, adjustment and startup ready to put in service and perform the intended function"
REQUIRED	"required by the Contract Documents or required to complete the Work and produce the intended results"
SATISFACTORY	"acceptable to the Engineer"
SHOWN	"as indicated on the Drawings"
SITE	"geographical location of the Project and land within the work area shown on the contract drawings and within which the Work will be installed or built"
SPECIFIED	"as written in the Contract Documents including the Specifications and the Drawings"
SUBMIT	"submit to the Engineer"

1.21 ABBREVIATIONS

A. The following acronyms or abbreviations are used in these specifications for the organizations listed.

Abbreviation	Stands for
AASHTO	American Association of State Highway and Transportation Officials
AAMA	Architectural Aluminum Manufacturers Association

© December 2012 Kennedy/Jenks Consultants

Abbreviation	Stands for
ABMA	American Boiler Manufacturers Association
ACI	American Concrete Institute
ADC	Air Diffusion Council
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AI	Asphalt Institute
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standard Institute (formerly United States of America Standards Institute)
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
AREA	American Railway Engineering Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	ASTM International
AWPA	American Wood-Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
CAGI	Compressed Air and Gas Institute
CAL/OSHA	State of California Department of Industrial Relations, Division of Industrial Safety
CAL TRANS	California Department of Transportation
CBC	California Building Code
CBM	Certified Ballast Manufacturers
CBR	California Bearing Ratio
CI	Chlorine Institute
CISPI	Cast Iron Soil Pipe Institute
CMAA	Crane Manufacturers Association of America
CPSC	Consumer Products Safety Commission
CRA	California Redwood Association
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standards for the U.S. Department of Commerce
CTI	Cooling Tower Institute
DFPA	Douglas Fir Plywood Association
EIA	Electronic Industries Association
EPA	U.S. Environmental Protection Agency
ETL	Electronic Testing Laboratory
FM	Factory Mutual Insurance Company
FPS	Fluid Power Society
FS	Federal Specifications
GO 95	General Order No. 95, California Public Utilities Commission Rules for Overhead Electric Line Construction

© December 2012 Kennedy/Jenks Consultants

Abbreviation	Stands for
GO 128	General Order No. 128, California Public Utilities Commission Rules for Underground Electrical Construction
HI	Hydraulic Institute
HMI	Hoist Manufacturers Institute
IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IGCC	Insulating Glass Certification Council
IPCE	International Power Cable Engineers Association
ISA	Instrument Society of America
NAAMM	National Association of Architectural Metal Manufacturers
NBS	National Bureau of Standards
NCPI	National Clay Pipe Institute
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NETA	International Electrical Testing Association
NFPA	National Fire Protection Association
NGVD	National Geodetic Vertical Datum
NSF	National Sanitation Foundation
NWMA	National Woodwork Manufacturers Association
OSHA	Occupational Safety and Health Act
PCA	Portland Cement Association
REA	Rural Electrification Administration
SAMA	Scientific Apparatus Makers Association
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SSPC	Structural Steel Painting Council
TCA	Tile Council of America
UBC	Uniform Building Code
UFC	Uniform Fire Code
UMC	Uniform Mechanical Code
UPC	Uniform Plumbing Code
USDC	U.S. Department of Commerce
UL	Underwriters Laboratories
WCLIB	West Coast Lumber Inspection Bureau
WIC	Woodwork Institute of California
WQCB	Water Quality Control Board (Regional)
WRCB	Water Resources Control Board

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 01040

COORDINATION AND PROJECT REQUIREMENTS

1.01 PROJECT COORDINATION

A. Coordinate scheduling, submittals and work of various Sections of the Specifications and subcontractors to assure efficient and orderly sequence of interdependent construction. Provide accommodations for items to be furnished and installed by Owner and labeled "NIC" (not in contract) on the Drawings and for Owner Furnished Contractor Installed items.

1.02 MECHANICAL AND ELECTRICAL COORDINATION

A. The Contractor's superintendent or a specially assigned assistant shall be designated the mechanical/electrical coordinator and shall coordinate the exact location, space priorities and sequence of installation of all mechanical and electrical work with each other and with all other trades. The mechanical/electrical coordinator shall assure compliance with the requirements of this paragraph 1.02.

B. The location of mechanical and electrical work may be indicated diagrammatically on the Drawings. Actual locations shall follow locations shown on the Drawings as closely as practicable but shall be altered or adjusted in the field by the mechanical/electrical coordinator as required by the following:
   1. In finished spaces install mechanical and electrical work concealed within the space available.
   2. Organize mechanical and electrical work to make efficient use of space. Combine similar items into groups; make all runs parallel to or at right angles with building lines.
   3. Layout and install work to provide adequate space and access for adjustment, servicing, and maintenance and maximize space available for future installation of additional services or replacement of existing services.
   4. Coordinate location of fixtures, registers, grills, outlets, switches, panelboards, pullboxes, access doors, and other exposed mechanical and electrical items with functional and visual elements. Verify location of questionable items with Engineer before proceeding.

C. Prepare large scale coordinated detailed installation drawings showing the work of all affected trades to coordinate the actual installed location of all equipment and of all mechanical and electrical work for all areas. Review coordination drawings with Engineer and all affected trades before proceeding.

D. Review Shop Drawings and Product Data prior to submission for the Engineer's Review to assure that physical characteristics and service requirements are compatible with contract requirements, field conditions, and other items submitted.

E. Verify that required services such as electrical power characteristics, control wiring, and utility requirements of items and equipment submitted and furnished are compatible with services provided. Notify Engineer of potential problems prior to

© December 2012 Kennedy/Jenks Consultants

ordering items or equipment and prior to installing services or completing construction in areas where services would have to be installed.

F. Schedule installation sequence of various elements of mechanical and electrical work to achieve optimum compliance with requirements under Mechanical and Electrical Coordination in this Section.

G. Conduct regular weekly coordination meetings with affected trades and Engineer to establish and maintain coordination and resolve conflicts or disputes.

1.03 CUTTING, FITTING, AND PATCHING

A. Provide cutting, fitting, or patching required to complete the Work and to make all of its parts fit together properly. Include cutting, fitting, and patching required to:
   1. Fit the several parts together and to integrate with other work.
   2. Uncover work to install or correct ill-timed work.
   3. Provide openings in elements of work for penetrations of mechanical and electrical work.
   4. Remove and replace defective and non-conforming work.
   5. Remove samples of installed work for testing.

B. Request guidance from the Engineer prior to beginning cutting or altering construction, which affects:
   1. Structural integrity of any element.
   2. Functional performance of any element.
   3. Integrity of weather-exposed or moisture-resistant elements.
   4. Efficiency, maintenance, or safety of elements.
   5. Visual qualities of sight-exposed elements.
   6. Work by Owner or separate contractor.

C. Execute cutting and patching using workers that specialize in and are skilled in installing the type of work being cut or patched.

D. Perform work in accordance with the Contract Documents or in the absence of specific requirements comply with best trade practice for the work involved.
   1. Execute work by methods that will avoid damage to other work.
   2. Provide proper support and substrates to receive patching and finishing materials.
   3. Cut concrete materials using masonry saw or core drill. Locate all reinforcing steel, conduits and pipes with electronic detecting devices prior to cutting or core drilling existing concrete.
   4. Replace or patch work with new materials meeting the requirements of these specifications or if not specified matching materials and finishes of existing or adjacent work.
   5. Cut wall, ceiling and floor finishes to fit snugly around pipes, sleeves, ducts, conduit, and other penetrations. Provide fire and/or acoustical caulking as required by code or conditions of use.
   6. Maintain integrity of wall, ceiling, or floor construction; completely seal voids against smoke, fire and water.

© December 2012 Kennedy/Jenks Consultants

7. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.
8. Report any hazardous or unsatisfactory conditions to the Engineer.

1.04 ALTERATION PROJECT PROCEDURES

A. Plan, schedule and perform alteration work as required to minimize impacting the Owner's continued operations. See Section 01010 paragraph titled "Contractor's Use of Site and Owner's Continued Operations."

B. The existing treatment plant must remain in operation during construction. Schedule utility interruptions, piping connections, and interruption of existing plant operations as required to permit continued compliance with regulatory requirements and to meet Owners flow and processing requirements.

C. Perform cutting fitting and patching in accordance with provisions in other paragraphs of this Section. Where new work abuts or aligns with existing work perform a smooth even transition. When a smooth unnoticeable transition is not feasible cut existing surfaces along a straight line at a natural dividing point and provide a groove or cover plate as recommended by the Engineer.

D. Provide new construction in accordance with the technical specifications or if not specified provide new construction matching adjacent or similar existing work in material and finish.

1.05 CONNECTIONS TO UNDERGROUND UTILITIES, CONDUITS OR PROCESS PIPING

A. Obtain best available current information on location, identification and marking of existing utilities, piping and conduits and other underground facilities before beginning any excavation. In areas where utilities that participate in Underground Service Alert may occur, call 800-642-2444 for information at least 48 hours in advance of beginning work. Give Engineer 24 hours notice before beginning work.

B. The location of existing utilities and underground facilities known to the Design Engineer are shown in their approximate location based on information available at the time of preparing the Drawings. The actual location, size type and number of utilities and underground facilities may differ from that shown and utilities or underground facilities may be present that are not shown. See General Conditions Article 3 for the Contractor's responsibilities and for differing conditions that warrant a change in Contract Price.

C. Use extreme care when excavating or working in areas that may contain existing utilities, process piping, conduits or other underground facilities. Use careful potholing, hand digging and probing to determine the exact location of underground installation. Some locations contain multiple pipes or conduits. Prior to performing any subsurface work, investigate, determine and prepare a plan to turn off or disconnect each utility believed to be in the within 100 feet of the subsurface work in the event of an accidental breach of a utility conduit.

© December 2012 Kennedy/Jenks Consultants

D. Where connections to existing utilities or other underground facilities is required or where new piping or conduits may cross or interfere with existing utilities or underground facilities carefully excavate and uncover existing installations to a point 1 foot below the pipe or conduit to determine the actual elevation and alignment. Call the Engineer's attention to differing existing conditions that may require a clarification or change.

E. Shutdown of existing utilities, services or operations shall be done in accordance with Section 01010.

1.06 FIELD ENGINEERING AND LAYOUT

A. See General Conditions, Article 3.9 regarding reference points provided by Owner.

B. General Conditions, Article 3.10 requires the Contractor to accurately layout the Work including the corners of buildings and other structures and the elevation of every floor, deck, roof, tank bottom, and channel.

C. Employ a Land Surveyor or Civil Engineer to layout all detailed dimensions and elevations from reference points. Use recognized engineering survey methods and documentation techniques.

D. Employ a Land Surveyor or Civil Engineer to establish and verify the elevation of all elements effecting the hydraulic gradient of the facility including: Invert of all piping, tank bottoms, weirs, overflows and tank tops. Use recognized engineering surveying methods and documentation techniques.

1.07 PRECONSTRUCTION MEETINGS

A. Prior to beginning the Work, the Contractor and its key personnel and Subcontractors including the Contractor's Superintendent, Project Manager, and Field Engineer shall attend a meeting with the Owner and the Engineer to discuss the following:
   1. Name, Authority, and Responsibilities of Parties Involved
   2. Project Procedures:
      a. Progress meetings
      b. Correspondence
      c. Notification
      d. Submittal of Product Data, Shop Drawing Samples, and Proposed Equivalents
      e. Requests for Information
      f. Response to Requests for Information
      g. Requests for Quotation
      h. Work Directive Change
      i. Change Orders
      j. Engineer's "Items of Concern List"
   3. Temporary Schedule and Contractor's Construction Schedule
   4. Temporary Facilities and Control
   5. Testing During Construction
   6. Contractors Coordination

© December 2012 Kennedy/Jenks Consultants

7. Mechanical/Electrical Coordination
8. Maintenance of Record Drawings
9. Owner Provided Items or Work and Owner Furnished Contractor Installed items
10. Early Beneficial or Partial Occupancy
11. Final Testing, Startup, and Balancing
12. Punch Lists and Project Closeout Procedures
13. Final Deliverables including Record Drawings, Operation and Maintenance Manuals, and Special Guarantees.

1.08 PROGRESS MEETINGS

A. The Engineer will conduct semi-monthly progress meetings with Contractor and Owner at job site. Attendance required by Contractor's project manager, superintendent and affected Subcontractors and suppliers. The Engineer will prepare, maintain and distribute agenda and dated record of: (1) actions required and taken and (2) decisions needed and made.

B. Agenda:
1. Review critical items/action list.
2. Review work progress. Compare actual progress with planned progress shown on Contractors rolling three-week Schedule. Discuss Corrective action required. Compare actual and projected progress with Contractor's Construction Schedule, propose methods to correct deficiencies.
3. Review status of Submittals; review delivery dates and date of need for critical items.
4. Review coordination problems.
5. Schedule needed testing and critical inspections.
6. Review critical requirements for each trade or major piece of equipment prior to beginning work or installation.
7. Discuss Contractor Quality Control.
8. Discuss open items on Engineers "Items of Concern List."
9. Discuss impact of proposed changes on progress Schedule.
10. Other business.

1.09 PERFORMANCE SPECIFICATIONS AND CONTRACTOR DESIGNED WORK

A. Work under this Contract may be specified by a combination of descriptive, performance, reference standard and proprietary specifications. In the event of conflict between any of the various specification methods used to specify a single item the order of precedence shall be the order in which the methods are listed in the preceding sentence. The terms used to describe types of Specifications are taken from the Construction Specification Institute (CSI) Handbook of Practice.

B. Where Specifications are used to define the characteristics of Contractor designed systems, items or components, the Contractor shall be fully responsible to design, engineer, manufacture, and install the systems, items and components to meet the specified functional requirements, performance requirements, quality standards, durability standards and conditions of use as well as all applicable codes, regulations and referenced trade or industry standards. The Contractor shall

© December 2012 Kennedy/Jenks Consultants

perform such design by employing engineers licensed in the State in which the Work is being constructed. The Contractor's design submittals shall include calculations and assumptions on which the design is based and shall be stamped and signed by appropriately licensed engineers.

C. In accordance with General Conditions paragraph 8.13, the Owner and the Engineer shall have the right to rely on the expertise and professional competence of the Contractor's design. Favorable review of the Contractor's design submittal shall not relieve the Contractor from full responsibility for the adequacy of the Contractor design.

1.10 MATERIAL AND EQUIPMENT

A. General:
   1. Verify that products delivered meet requirements of Contract Documents and the requirements for Favorably Reviewed submittals.

B. Compatibility of Equipment and Material:
   1. Similar items, equipment, devices or products furnished under a single specification section shall all be made by the same maker and have interchangeable parts.
   2. In addition, but only if so stated in each affected Specification Section, similar items furnished under two or more Specification Sections shall be made by the same maker and have interchangeable parts.
   3. All similar materials or products that are interrelated or used together in an assembly shall be compatible with each other.

C. Transportation and Handling:
   1. Transport and handle products in accordance with manufacturer's instructions.
   2. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.
   3. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

D. Storage and Protection:
   1. Store and protect products in accordance with manufacturer's instructions. Seals and labels shall be intact and legible.
   2. Store moisture sensitive products including finish woodwork, gypsum products, acoustical products, motors, electrical equipment, instruments and controls in weathertight, humidity and temperature controlled enclosures.
   3. For exterior storage of fabricated products, place items on sloped supports, aboveground.
   4. Cover products subject to deterioration from moisture, dust, or sunlight with opaque watertight but breathable sheet covering. Provide ventilation to avoid condensation.
   5. Provide offsite storage and protection including insurance coverage when site does not permit onsite storage or protection.
   6. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

© December 2012 Kennedy/Jenks Consultants

7. Provide facilities, equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
8. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

E. Installation Standards and Manufacturers' Recommendations:
1. Install all products and materials in strict compliance with the most restrictive of the following:
   a. The manufacturer's or provider's written instructions or recommendations. Follow step-by-step installation procedures.
   b. Recommendations of referenced trade associations or standards.
   c. These specifications and drawings.
2. Where conflicts exist present alternatives with advantages and disadvantages to Engineer for decision.

F. If reference standards or manufacturer's instructions contain provisions that would alter or are at variance with relationships between the parties to the Contract set forth in the Contract Documents, the provisions in the Contract Documents shall take precedence. See General Conditions paragraph 2.3.

1.11 BACKING, SUPPORTS AND FASTENERS

A. Provide backing, supports, bracing, fasteners and other provisions required for the proper support and attachment of all work. Backing, supports, bracing and fasteners shall be sized to resist vertical and horizontal loads including seismic and wind loads required by codes listed under Regulatory Requirements in Section 01010 and in accordance with Seismic Design Requirements in this Section. Where finishes in existing facilities must be removed to install backing or where finishes are installed in new construction prior to installing backing the Contractor shall remove finishes, install backing and reinstall finishes.

B. Use of explosive powder-driven fasteners is NOT PERMITTED.

1.12 SAFETY

A. In accordance with generally accepted construction practice, applicable law and the General Conditions, especially paragraphs 5.3, 5.20 through 5.28 and 7.3, the Contractor shall be solely and exclusively responsible for:
1. Construction means and methods.
2. Safety of employees engaged in the work while on and off the site.
3. Safety of the Owner, the Engineer, the Design Engineer, and others who may visit or be affected by the work.
4. Safety of the work itself including material and equipment to be incorporated therein.
5. Safety of other property at the site or adjacent thereto.
6. Safety programs, equipment and protective devices required to assure the safety of persons and property for whom/which the Contractor is responsible.

© December 2012 Kennedy/Jenks Consultants

B. The duties of the Engineer in conducting review of the Contractor's performance is not intended to include review of the adequacy of the Contractor's work methods, equipment, bracing, scaffolding or safety measures in, on, or near the construction site. See General Conditions, paragraph 7.3.

C. The Contractor is hereby informed that work on this project could be hazardous. The Contractor shall carefully instruct all personnel working in potentially hazardous work areas as to potential dangers and shall provide such necessary safety equipment and instructions as required to prevent injury to personnel and damage to property, and to comply with all applicable laws and regulations including State OSHA, Federal OSHA, and other regulations referenced in these Contract Documents.

D. The Contractor shall, at all times, maintain the job in a condition that is safe for the Owner, the Engineer and their Consultants to make site visits and to conduct construction reviews. If the Owner or the Engineer cannot allow personnel to visit the job because it is not safe, the Contractor is not providing required safe access to the Work as required by General Conditions, paragraph 12.2.

E. The Contractor shall prepare a Safety Plan meeting the requirements of applicable regulations. As a minimum, the Contractors Safety Plan shall set forth definite procedures for informing workers about safety, for instructing workers in safe practices, for assuring that workers are using appropriate safety equipment and safe work practices and for reporting accidents.

1.13 EXCAVATION AND TRENCHING; WORK WITHIN CONFINED SPACES

A. Submit specific plans to the Owner showing details of provisions for worker protection from caving ground in accordance with Section 6705 of the California State Labor Code. The detailed plans shall show the design of shoring, bracing, sloping banks or other provisions and shall be prepared, signed and stamped by a Civil or Structural Engineer licensed in the State in which the Work is performed and retained by the Contractor. The Owner's acceptance of the detailed plans submitted is only an acknowledgment of the submission and does not constitute review or approval of the designs, design assumptions, criteria, completeness, applicability to areas of intended use, or implementation of the plans, which are solely the responsibility of the Contractor and his Registered Engineer.

B. Work Within Confined Spaces: Work within confined spaces is subject to applicable laws, regulations and safety orders including applicable California Tunnel Safety Orders.

C. The foregoing provisions do NOT reduce the requirement for the Contractor to maintain safety in ALL operations performed by the Contractor or its Subcontractors.

© December 2012 Kennedy/Jenks Consultants

1.14 CONTRACTOR'S QUALITY CONTROL

A. The Contractor shall be fully responsible for inspecting the work of its suppliers and Subcontractors to assure that the work when completed will comply with the standards for materials and workmanship required by the Contract Documents. See General Conditions paragraph 13.9.

B. Inspections, periodic observations and testing performed by the Owner or the Engineer are for the Owner's benefit and information only and shall not be construed as partial or incremental acceptance of the work and shall not be deemed to establish any duty on the part of the Owner or the Engineer to the Contractor, its subcontractors or suppliers. See General Conditions paragraphs 7.5 and 12.10.

C. The Contractor shall:
   1. Monitor quality control over suppliers, manufacturer, products, services, site conditions, and workmanship, to produce work of specified quality.
   2. Comply fully with manufacturer's installation instructions, including performing each step in sequence as recommended by the manufacturer.
   3. Submit a Request for Information to Engineer before proceeding with work when manufacturers' instructions or reference standards conflict with Contract Documents.
   4. Comply with specified standards as a minimum quality for the work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
   5. Perform work by persons specializing in the specific trade and class of work required and qualified to produce workmanship of specified quality.
   6. Secure products in place with positive anchorage devices designed and sized to withstand seismic, static and dynamic loading, vibration, and physical distortion or disfigurement.

D. If reference standards or manufacturers' instructions contain provisions that would alter or are at variance with relationships between the parties to the Contract set forth in the Contract Documents, the provisions in the Contract Documents shall take precedence.

E. The Contractor shall provide assistance required by the Engineer to adequately inspect the Work including ladders, scaffolding, lighting, ventilation and other aids to facilitate access and provide a safe working environment.

1.15 TESTING LABORATORY SERVICES AND CERTIFIED LABORATORY REPORTS

A. Provide testing service in accordance with General Conditions Article 12 and specific requirements contained in each technical specification section. Submit Certified Laboratory Reports required by technical specification sections.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 01140

ENVIRONMENTAL PROTECTION

1.01 SCOPE

A. During the progress of the work, keep the work areas occupied by the Contractor in a neat and clean condition and protect the environment both onsite and offsite, throughout and upon completion of the construction project.

1.02 SUBMITTALS

A. Develop an Environmental Protection Plan in detail and submit to the Engineer in the Product Review category within thirty (30) days from the date of the Notice-to-Proceed. Distribute the favorably reviewed plan to all employees and to all subcontractors and their employees. The Environmental Protection Plan shall include, but not be limited to, the following items:
   1. Copies of required permits.
   2. Proposed sanitary landfill site.
   3. Other proposed disposal sites.
   4. Copies of any agreements with public or private landowners regarding equipment, materials storage, borrow sites, fill sites, or disposal sites. Any such agreement made by the Contractor shall be invalid if its execution causes violation of local or regional grading or land use regulations.

1.03 MITIGATION OF CONSTRUCTION IMPACTS

A. Requirements: All operations shall comply with all federal, state and local regulations pertaining to water, air, solid waste and noise pollution.

B. Definitions of Contaminants:
   1. Sediment: Soil and other debris that have been eroded and transported by runoff water.
   2. Solid Waste: Rubbish, debris, garbage and other discarded solid materials resulting from construction activities, including a variety of combustible and non-combustible wastes, such as ashes, waste materials that result from construction or maintenance and repair work, leaves and tree trimmings.
   3. Chemical Waste: Includes petroleum products, bituminous materials, salts, acids, alkalies, herbicides, pesticides, disinfectants, organic chemicals and inorganic wastes. Some of the above may be classified as "hazardous."
   4. Sanitary Wastes:
      a. Sewage: That which is considered as domestic sanitary sewage.
      b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing and consumption of food.
   5. Hazardous Materials: As defined by applicable laws and regulations. Undisclosed hazardous material contamination, if encountered will constitute a changed site condition. The Owner may retain a separate contractor to dispose of undisclosed hazardous material encountered.

© December 2012 Kennedy/Jenks Consultants

C. Protection of Natural Resources:
   1. General: It is intended that the natural resources within the project boundaries and outside the limits of permanent work performed under this Contract be preserved in their existing condition or be restored to an equivalent or improved condition upon completion of the work. Confine construction activities to areas defined by the public roads, easements, and work area limits shown on the Drawings. Return construction areas to their pre-construction elevations except where surface elevations are otherwise noted to be changed. Maintain natural drainage patterns. Conduct construction activities to avoid ponding stagnant water conducive to mosquito breeding.
   2. Land Resources: Do not remove, cut, deface, injure or destroy trees or shrubs outside the work area limits. Do not remove, deface, injure or destroy trees within the work area without permission from the Engineer.
      a. Protection: Protect trees that are located near the limits of the Contractor's work areas which may possibly be defaced, bruised or injured or otherwise damaged by the Contractor's operations. No ropes, cables or guys shall be fastened to or attached to any existing nearby trees or shrubs for anchorages unless specifically authorized. Where such special emergency use is permitted, the Contractor shall be responsible for any damage resulting from such use.
      b. Trimming: Trim and seal tree limbs overhanging the line of the work and in danger of being damaged by the Contractor's operations in accordance with recognized standards for such work. Remove other tree limbs under the direction of the Engineer, so that the tree will present a balanced appearance.
      c. Treatment of Roots: Do not cut roots unnecessarily during excavating or trenching operations. Expose major roots encountered in the course of excavation and do not sever. Wrap them in burlap as a protective measure while exposed. Neatly trim all other roots larger than 1-inch in diameter that are severed in the course of excavation at the edge of the excavation or trench and paint them with a heavy coat of an approved tree seal.
      d. Repair or Restoration: Repair or replace any trees or other landscape features scarred or damaged by equipment or construction operations as specified below. The repair and/or restoration plan shall be favorably reviewed prior to its initiation.
      e. Temporary Construction: Obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, or any other vestiges of construction as directed by the Engineer. Level all temporary roads, parking areas and any other areas that have become compacted or shaped. Any unpaved areas where vehicles are operated shall receive a suitable surface treatment or shall be periodically wetted down to prevent construction operations from producing dust damage and nuisance to persons and property, at no additional cost to the Owner. Keep haul roads clear at all times of any object that creates an unsafe condition. Promptly remove any contaminants or construction material dropped from construction vehicles. Do not drop mud and debris from construction equipment on public streets. Sweep clean turning areas and pavement entrances as necessary.

© December 2012 Kennedy/Jenks Consultants

3. Water Resources: Investigate and comply with all applicable federal, state and local regulations concerning the discharge (directly or indirectly) of pollutants to the underground and natural waters. Perform all work under this Contract in such a manner that any adverse environmental impacts are reduced to a level that is acceptable to the Engineer and regulatory agencies. Refer to the paragraph on control of water in Section 02301 Earthwork, for "dewatering" water disposal requirements.
    a. Oily Substances: At all times, special measures shall be taken to prevent oily or other hazardous substances from entering the ground, drainage areas or local bodies of water in such quantities as to affect normal use, aesthetics or produce a measurable impact upon the area. Any soil or water that is contaminated with oily substances due to the Contractor's operations shall be disposed of in accordance with applicable regulations.
    b. Chlorinated Water: Take special measures to prevent chlorinated water from entering surface waters. Dechlorinate chlorinated water prior to discharge.
4. Fish and Wildlife Resources: Perform all work and take such steps required to prevent any interference or disturbance to fish and wildlife. The Contractor will not be permitted to alter water flows or otherwise significantly disturb native habitat adjacent to the project area which are critical to fish and wildlife except as may be indicated or specified.
5. Cultural Resources: The project does not pass through any known archaeological sites. However, it is conceivable that unrecorded archaeological sites could be discovered during the construction. In the event that artifacts, human remains, or other cultural resources are discovered during excavations at locations of the Work, the Contractor shall protect the discovered items, notify the Engineer, and comply with applicable law.
6. Revegetation of Disturbed Areas:
    a. Tree and Shrubs Replacement: Replace trees and shrubs damaged by the construction or as noted on the Drawings after completion of earthwork in the area. Plant nursery stock of the same species and variety, in 5-gallon cans on a one-for-one basis. If planting is not feasible in early fall, the Engineer will reschedule the tree planting operations.
    b. Planting of Trees and Shrubs:
        1) Selection: Deliver trees and shrubs to the site in the nursery containers, with the nursery tags identifying the species and variety. The trees and shrubs should be selected for shape and symmetrical branching habit, which at maturity will produce strong, full foliated specimens. The specimens shall have grown in the designated size of container for a sufficient length of time for the root system to hold the earth when taken from the container, but not long enough to become rootbound or cause a "hardening off" of the root system. Specimens which are loose in the root ball will be rejected. Remove all rejected specimens from the site and replace with specimens as specified. Specimens shall be sound, healthy, vigorous and free from insects, pests, plant diseases and injuries.
        2) Protection: Specimens which cannot be planted within one day of delivery shall be properly protected and kept moist to prevent drying.
        3) Planting Procedure: Planting hole shall be twice the width of the root ball and at least one and one-half times the height of the root ball. Fill

© December 2012 Kennedy/Jenks Consultants

the planting hole with water and let drain away. Mix excavated soil with a planting mix appropriate for the type and condition of the soil and the species of tree or shrub and place the mixed soil in the planting hole to the depth necessary to bring the root ball slightly higher than the surrounding soil. Remove the specimen from the container carefully so that the root ball remains unbroken. Place in planting hole and fill with mixed soil to one-half the height of the root ball, tamp thoroughly, then water. Set specimens at such a level that after settlement the top of the root ball is level with the surrounding finish grade. Add mixed soil to form watering basin, fill basin twice with water immediately after planting. Water as frequently as required to keep the specimens adequately moist until well established. The Contractor will be responsible for maintaining specimens for a minimum of one year after final acceptance or planting, whichever is later.

4) Staking: Use 2-inch x 2-inch redwood or cedar stakes of length adequate to support each tree. Drive a stake on each side of each specimen outside of the root ball, to a depth of 3 feet. Support tree to stakes using twisted galvanized wire covered with reinforced rubber hose where in contact with the specimen.
5) Mulching: Fill all watering basins of trees and shrubs with a layer of mulch not less than 2 inches thick.

7. Noise Control: The following noise control procedures shall be employed:
   a. Maximum Noise Levels within 1,000 Feet of any Residence, Business, or Other Populated Area: Noise levels for trenchers, pavers, graders and trucks shall not exceed 90 dBA at 50 feet as measured under the noisiest operating conditions. For all other equipment, noise levels shall not exceed 85 dBA at 50 feet.
   b. Equipment: Jack hammers shall be equipped with exhaust mufflers and steel muffling sleeves. Air compressors should be of a quiet type such as a "whisperized" compressor.
   c. Operations: Keep noisy equipment as far as possible from noise-sensitive site boundaries. Machines should not be left idling. Use electric power in lieu of internal combustion engine power wherever possible. Maintain equipment properly to reduce noise from excessive vibration, faulty mufflers, or other sources. All engines shall have mufflers.
   d. Scheduling: Schedule noisy operations so as to minimize their duration at any given location.
   e. Monitoring: To determine whether the above noise limits are being met and whether noise barriers are needed, the Contractor shall use a portable sound level meter meeting the requirements of American National Standards Institute Specification S1.4 for Type 2 sound level meters. If non-complying noise levels are found, the Contractor shall be responsible for monitoring and correction of excessive noise levels.
8. Dust Control, Air Pollution and Odor Control: Employ measures to prevent the creation of dust, air pollution and odors.
   a. Unpaved areas where vehicles are operated shall be periodically wetted down or given an equivalent form of treatment, to eliminate dust formation.
   b. Store all volatile liquids, including fuels or solvents in closed containers.
   c. No open burning of debris, lumber or other scrap will be permitted.
   d. Properly maintain equipment to reduce gaseous pollutant emissions.

© December 2012 Kennedy/Jenks Consultants

9. Construction Storage Areas: Storage of construction equipment and materials shall be limited to the designated Contractor's storage area.
    a. Store and service equipment at the designated Contractor's storage area where oil wastes shall be collected in containers. Oil wastes shall not be allowed to flow onto the ground or into surface waters. Containers shall be required at the construction site for the disposal of materials such as paint, paint thinner, solvents, motor oil, fuels, resins and other environmentally deleterious substances. No dumping of surplus concrete or grout on the site will be permitted.
10. Sanitation: During the construction period, provide adequate and conveniently located chemical sanitation facilities, properly screened, for use of construction crews, the Engineer and visitors to the site. Facilities shall be regularly maintained.
11. Fire Prevention: Take steps to prevent fires including, but not limited to the following:
    a. Provide spark arrestors on all internal combustion engines.
    b. Store and handle flammable liquids in accordance with the Flammable and Combustible Liquids Code, NFPA 30.
    c. Provide fire extinguishers at hazardous locations or operations, such as welding.

1.04 DISPOSAL OPERATIONS

A. Solid Waste Management:
    1. Supply solid waste transfer containers. Daily remove all debris such as spent air filters, oil cartridges, cans, bottles, combustibles and litter. Take care to prevent trash and papers from blowing onto adjacent property. Encourage personnel to use refuse containers. Convey contents to a sanitary landfill.
    2. Washing of concrete containers where wastewater may reach adjacent property or natural water courses will not be permitted. Remove any excess concrete to the sanitary landfill.

B. Chemical Waste and Hazardous Materials Management: Furnish containers for storage of spent chemicals used during construction operations. Dispose of chemicals and hazardous materials in accordance with applicable regulations.

C. Garbage: Store garbage in covered containers, pick up daily and dispose of in a sanitary landfill.

D. Dispose of vegetation, weeds, rubble, and other materials removed by the clearing, stripping and grubbing operations off site at a suitable disposal site in accordance with applicable regulations.

E. Excavated Materials:
    1. Native soil complying with the requirements of Section 02301 Earthwork, may be used for backfill, fill and embankments as allowed by that section.
    2. Spoil Material:
        a. Remove all material which is excavated in excess of that required for backfill, and such excavated material which is unsuitable for backfill, from the site and dispose off site in accordance with applicable regulations at

© December 2012 Kennedy/Jenks Consultants

the disposal site indicated in the Environmental Protection Plan. No additional compensation will be paid to the Contractor for such disposal. Include all such costs in the lump sum prices bid for the project. Remove rubbish and materials unsuitable for backfill immediately following excavation. Remove material in excess of that required for backfill immediately following backfill operations.

b. Rubbish shall consist of all materials not classified as suitable materials or rubble and shall include shrubbery, trees, timber, trash and garbage.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 01190

SEISMIC REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section is applicable to the following secondary structural system elements, non-structural components, and/or equipment supported by structures.
   1. Mechanical, electrical, and plumbing equipment and appurtenances, including, but not limited to:
      a. Welded steel tanks and tank components.
   2. Conduit, piping, cable trays, raceways, ducts and similar systems.
   3. Tanks and vessels (include contents), including support systems, including, but not limited to:
   4. All equipment specifically listed in paragraph 1.08.
   5. Storage racks, suspended ceilings, light fixtures, raised floors, partitions, store-front, windows, louvers, architectural features and other non-structural components.

B. This Section is applicable to the following elements of the primary structural system:
   1. Spent Washwater EQ Tank
   2. Treated Water Tank
   3. GAC Adsorbers/Filters
   4. Greensand Roughing Filters

1.02 REFERENCES

A. American Society of Civil Engineers Standard ASCE 7-05, Minimum Design Loads for Buildings and Other Structures, Chapters 11, 13, 15.

B. International Building Code (IBC) Section 1613.

C. California Building Code, 2010 Edition.

1.03 DEFINITIONS

A. Engineer of Record: The Engineer responsible for the preparation of Contract Documents.

B. Specialty Engineer: Structural or Civil Engineer provided by the Contractor licensed in the State where the project is being built responsible for specific elements of the primary structural system, the secondary structural system, non-structural elements and/or equipment supported by structures.

1.04 GENERAL DESIGN REQUIREMENTS

A. The Contractor is responsible for producing designs that resist the total seismic forces in accordance with the seismic design criteria. The Contractor is responsible for coordinating between the Engineer of Record and the Specialty Engineer.

© December 2012 Kennedy/Jenks Consultants

B. The seismic design for non-structural components and equipment shall be in accordance with the IBC Chapter 16, and the required coefficients and factors for determining the total design seismic forces are shown on the Drawings.

C. Coordinate the layout so that adequate space is provided between items for relative motion. Provide additional supports and restraints between items of different systems when necessary to prevent seismic impacts or interaction.

D. Design non-building structures in accordance with Chapter 15 of ASCE 7-05; all designs utilizing Chapter 15 shall include the design of the entire non-building structure. Design anchorages of all elements of structures, nonstructural components, and equipment supported by structures, to resist static and dynamic operational loads, plus total seismic loads specified in the IBC, ASCE 7-05 Section 13.3.1, and as follows:
   1. For suspended equipment, multiply dead load by 1.2 and add $0.2S_{DS}$ to account for vertical seismic effects in the downward direction.
   2. For anchorage uplift, multiply dead load by 0.9 and subtract $0.2S_{DS}$ if used to reduce vertical seismic effects.
   3. Design anchorages utilizing a Component Coefficient, $R_p = 1.5$, unless supporting documentation for embedment length, showing compliance with Section 13.4.2 of ASCE 7, is provided for expansion anchor bolts, chemical anchors, or cast-in-place anchors.

E. Design Basis and Coordination: Contractor shall note that the layout of the structure and equipment pads is based on the first named manufacturer and model for the equipment to be anchored.
   1. Contractor shall coordinate all attachments and related work and shall provide connections as noted in the favorably reviewed shop drawings.
   2. For all suppliers, If the dimensions required by the contractor's submitted anchorage calculations deviate from those provided on the drawings, contractor shall note the deviation in the submittal for review and provide the favorably reviewed pad at no additional cost to the owner.
   3. If a model or manufacturer other than the first name supplier is submitted for use by the contractor, contractor shall coordinate all related work and deviations from the drawings.

1.05 DESIGN REQUIREMENTS FOR PIPING, CONDUIT, AND DUCTS

A. The Contractor is responsible for producing designs for support of piping, conduit, duct or other systems to resist total seismic forces based on the seismic design criteria coefficients specified above, unless shown on the Contract Documents. Except where the technical specifications give specific exemption from resistance of seismic forces, all supports shall be designed to meet seismic criteria.

B. Where possible, pipes, conduit, and their connections shall be constructed of ductile materials (e.g., copper, ductile iron, steel or aluminum and brazed, welded or screwed connections). Pipes, conduits and their connections, constructed of nonductile materials (e.g., cast iron, no-hub pipe and plastic), shall have the brace spacing reduced to one-half of the spacing allowed for ductile material.

C. Seismic restraints may be omitted for the following conditions, where flexible connections are provided between components and the associated ductwork, piping and conduit:
   1. Fuel piping less than 1-inch inside diameter.

© December 2012 Kennedy/Jenks Consultants

2. All other piping less than 2.5 inches inside diameter or all piping suspended by individual hangers 12 inches or less in length from the top of the pipe to the bottom of the structural support for the hanger or electrical conduit less than 2.5 inches trade size.
3. All rectangular air-handling ducts less than 6 square feet in cross-sectional area or all round air-handling ducts less than 28 inches diameter or all ducts suspended by individual hangers 12 inches or less in length from the top of the duct to the bottom of the structural support for the hanger, where the hangers are detailed to avoid bending of the hangers and their connections.

D. All trapeze assemblies supporting pipes, ducts and conduit shall be braced to resist the total seismic forces considering the weight of the elements on the trapeze. Pipes, ducts and conduit supported by a trapeze where none of those elements would individually be braced need not be braced if connections to the pipe/conduit/ductwork or directional changes do not restrict the movement of the trapeze. If this flexibility is not provided, bracing will be required when the aggregate weight of the pipes and conduit exceed 10 pounds/foot. The weight shall be determined assuming all pipes and conduit are filled with water.

E. As an alternative to designing the supports and anchorage, where an approved national standard provides a basis for the earthquake-resistant design, submit standard, data, and details for piping, conduit, duct or other systems:
1. For ductwork, mechanical piping, process piping and electrical conduits, follow Guidelines for Seismic Restraints of Mechanical Systems by SMACNA modified as follows:
a. Seismically brace piping regardless of size or location. Provide transverse braces at all changes in direction and at the end of all pipe runs. Space transverse braces not more than 20 feet apart. Provide longitudinal braces at 40-foot centers.
b. Seismically brace all ductwork regardless of size or location. Provide transverse braces at all changes in direction and at each end of run. Space braces not over 20 feet apart. Provide longitudinal braces at 40-foot centers.

1.06 DESIGN REQUIREMENTS FOR UNDERWATER ITEMS

A. To allow for water sloshing, design rigid items such as piping or equipment supports for twice the lateral force, computed as if the item were above water.

1.07 DESIGN REQUIREMENTS FOR SUBMERGED EQUIPMENT

A. To allow for water sloshing, design rigid items of equipment for twice the lateral force, computed as if the item were above water.

B. Design flexible items to accommodate sloshing motions without damage to rigid machinery.

C. Provide retainers to hold items from falling and damaging rotating equipment below, if bolted connections will fail because of ground motion displacing the supports.

1.08 SUBMITTALS

A. Submit in accordance with Section 01300.

© December 2012 Kennedy/Jenks Consultants

B. Shop Drawings for non-building structures and contractor designed components: Submit signed and sealed structural calculations and detailed drawings for the following listed elements and where required in Divisions 2 through 17 of the primary structural system and their attachments, the secondary structural system and their attachments, permanent non-structural components and their attachments, and the attachments and anchorage for permanent equipment supported by the structure:
   1. Greensand Roughing Filters
   2. GAC Adsorbers/Filters
   3. Welded Steel Storage Tanks
   4. Main Switchgear Enclosures
   5. Motor Control Center Enclosures.
   6. Any components or equipment where contractor's specialty engineer had designed using Chapter 15 of ASCE 7-05 (i.e. which are non-building structures rather than equipment)

C. Seismic Certification of Equipment: Submit certification for equipment not listed in paragraph B, but included in Divisions 2 through 17 that the equipment itself is designed to resist all internal seismic forces based on the seismic design criteria for the project. Submit Level 1 or Level 2 Certification as noted in the equipment specifications. If no level is indicated, provide Level 1 certification.
   1. Level 1 Certification shall consist of a written certification from the manufacturer that the equipment is capable of resisting the internal seismic loads due to the loading conditions noted herein and meeting the requirements of ASCE 7 Chapter 13.2.1.
   2. Level 2 Certification shall consist of a written certification from the manufacturer, and accompanying test results or experiential evidence, indicating compliance with ASCE 7 Chapter 13.2.2.
   3. For elements designed using Chapter 15, contractor shall submit complete calculations for the element or non-building structure in lieu of seismic certification.

D. Shop Drawings for Anchorage Calculations: Where required in the equipment specifications in Divisions 2 through 17 or listed below, submit signed and sealed structural calculations and detailed drawings from a specialty Structural or Civil Engineer licensed in the State where the project is being built for the attachments and anchorage to the primary structure.
   1. Required anchorage items include:
      a. Chemical Feed Equipment
      b. Chemical Storage Tanks
      c. Panelboards
      d. Switchboards
      e. Motor Control Centers
      f. Adjustable Frequency Drives
      g. Spent Washwater Pumps
      h. Treated Water Pumps
      i. Washwater Supply Pumps
      j. Surface Washwater Booster Pumps

E. Structural calculations and detailed drawings shall be prepared by a Specialty Engineer licensed in the state where the project is being built.

© December 2012 Kennedy/Jenks Consultants

F. Structural calculations and detailed drawings shall clearly show the total design seismic forces which will be transferred from the elements of the structural system, non-structural components, and/or equipment and their attachments to the primary structure. Calculations must be reviewed by Engineer for general conformance with the design criteria and building code and therefore calculations shall include:
   1. Seismic and wind load criteria used to determine design lateral and uplift forces. For external equipment, a statement should be made as to whether wind controls for all equipment.
   2. Derivation of forces used, including at least one complete sample calculation, showing the process used so that engineer may determine general compliance. Printouts of spreadsheets without explanation of calculations used to determine values are not acceptable.
   3. Adequacy of anchorage to concrete and masonry or attachment to the primary structure to transfer the design forces from the element.
   4. Detail drawings of shall note:
      a. Required concrete strength,
      b. Edge distance, embedment depth and substrate thickness for concrete anchors.
      c. Required dimensions of equipment pads based on equipment size and edge distance. The Contractor shall coordinate dimensions of equipment pads, including any revisions required to meet the requirements the favorably reviewed submittal by the Specialty Engineer at no additional cost to the Owner.

G. The Engineer's review of items within a Specification Section cannot be completed until all related items have been coordinated and submitted for review.

H. Quality Assurance Submittals
   1. Test Reports: Submit test reports for tension testing of anchors.
   2. Verification of installation: Submit a letter from the contractor’s specialty engineer verifying that the installation was performed as required by the specialty engineer’s calculations.

1.09 QUALITY ASSURANCE

A. Qualifications: The Contractor is responsible for submitting signed and sealed structural calculations and detailed drawings from a Specialty Structural or Civil Engineer licensed in the State where the project is being built.

B. Regulatory Requirements: Comply with the California Building Code, International Building Code (IBC) Section 1613, the referenced sections of ASCE 7 plus clarifications and additions specified in this Section.

PART 2 - PRODUCTS (NOT USED)

© December 2012 Kennedy/Jenks Consultants

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL

A. Site Tests: Tension testing of expansion or adhesive anchors utilized for anchorage shall be done in the presence of the inspector and a report of the test results shall be submitted. See Specification Section 05090 for additional requirements.

B. Inspection: Special inspection shall be provided for high strength bolting or bolts installed in concrete. See Specification Section 05090 for additional requirements.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 01300

SUBMITTALS

1.01 SUBMITTAL PROCEDURES

A. Accompany each submittal with a Submittal form, General Conditions Exhibit GC-2, which contains the following information:
   1. Contractor's name and the name of Subcontractor or supplier who prepared the submittal.
   2. The project name and identifying number.
   3. Description of the submittal and reference to the Contract requirement or technical specification section and paragraph number being addressed.

B. Submit the number and type of copies for each submittal and follow the procedures described below or in other paragraphs in this Section. Submit four copies of submittals not covered in this Section 01300.
   1. Designation of Superintendent: Submit three copies for information. Include name, address, home telephone number and a brief resume.
   2. List of Subcontractors and Major Suppliers: Submit three copies for information. Include address, telephone number and name of responsible party.
   3. Schedule of Values, in a form acceptable to the Engineer: Submit three copies for information. No copy will be returned. See General Conditions paragraph 13.1.
   4. Subcontractors'/Suppliers'/Manufacturers' Affidavits. Submit three copies for items specified in the Technical Specifications.
   5. Environmental Protection Plan. Submit three copies for information.

1.02 SCHEDULE OF SUBMITTALS

A. Submit three copies for information. No copy will be returned.

B. See General Conditions paragraph 5.19. Within 15 days after the Notice-to-Proceed, submit a Schedule of Submittals showing the date by which each submittal required for Product Review or Product Information will be made. Identify the items that will be included in each submittal (see paragraph 1.05 of this Section) by listing the item or group of items and the Specification Section and paragraph number under which they are specified. Indicate whether the submittal is required for Product Review of Proposed Equivalents, Shop Drawings, Product Data or Samples or required for Product Information only.

1.03 PLAN OF OPERATIONS

A. Submit three copies.

B. Before beginning on site work, submit a plan showing Contractor's intended use of the site assigned to it. Show location of enclosing fence, access points and gates. Show location for Contractor's, Subcontractor's, and Engineer's field office and

© December 2012 Kennedy/Jenks Consultants

parking. Show location of Contractor's and Subcontractor's work areas and storage areas.

1.04 CONSTRUCTION SCHEDULE

A. Submit four copies for information. No copy will be returned. See General Conditions paragraphs 5.15 through 5.19 and Section 01311.

B. The form of Construction Schedule may be selected by the Contractor but the Schedule shall meet the minimum requirements of General Conditions paragraph 5.16.

C. If the Construction Schedule does not reflect the CPM format requirements, the specified work, or the Contract Time, it will be returned to the Contractor for modification.

D. Revise the Construction Schedule and resubmit within seven (7) days following any monthly meeting to review Contractor's Application for Payment when Contractor's work is fifteen (15) days or more behind schedule.

E. Accelerated Work if Required to Meet Schedule: See General Conditions paragraph 11.6. Give Engineer 3 days prior notice of construction that will take place outside of normal work hours or work days. Compensate Owner for extra inspection cost caused by Accelerated Work required to meet Schedule.

F. Give Engineer 3 days prior notice of normal work days on which construction will not take place or of scheduled construction that will not take place. Compensate Owner for extra inspection cost resulting from failure to give notice.

1.05 SHOP DRAWING, PRODUCT DATA AND SAMPLES SUBMITTED FOR PRODUCT REVIEW

A. This paragraph covers submittal of Shop Drawings, Product Data and Samples required for the Engineer's review referred to as Product Review submittals in the Technical Specifications (Division 2 through 17). Submittals required for information only are referred to as Product Information submittals in the Technical Specifications and are covered in paragraph 1.07 of this Section. See General Conditions Article 8.

B. Number and Type of Submittals:
   1. Shop Drawings: Submit one clear, sharp high contrast copy, which will be reviewed, marked and stamped. A single electrostatic copy will be returned to the Contractor. The Contractor shall make and distribute the required number of additional copies to its superintendent, subcontractors and suppliers.
   2. Product Data: Submit four clear copies. One copy will be marked, stamped and returned. The Contractor shall make and distribute the required number of additional copies to its superintendent, subcontractors and suppliers.
   3. Samples: Submit three labeled samples or three sets of samples of manufacturers full range of colors and finishes. Comply with requirements in Technical Specification Sections. One sample will be returned to Contractor.

© December 2012 Kennedy/Jenks Consultants

C. The Contractor shall make all Product Review submittals early enough to allow adequate time for the Engineer's review, for manufacture and for delivery at the construction site without causing delay to the Work. Submittals shall be made early enough to allow for unforeseen delays such as:
   1. Failure to obtain Favorable Review because of inadequate or incomplete submittal or because the item submitted does not meet the requirements of the Contract Documents.
   2. Delays in manufacture.
   3. Delays in delivery.

D. Content of Submittals:
   1. Each submittal shall include all of the items and material required for a complete assembly, system or Specification Section.
   2. Submittals shall contain all of the physical, technical and performance data required by the specifications or necessary to demonstrate conclusively that the items comply with the requirements of the Contract Documents.
   3. Include information on characteristics of electrical or utility service required and verification that requirements have been coordinated with services provided by the Work and by other interconnected elements of the Work.
   4. Provide verification that the physical characteristics of items submitted, including size, configuration, clearances, mounting points, utility connection points, and service access points, are suitable for the space provided and are compatible with other interrelated items that are existing or have or will be submitted.
   5. Label each Product Data Submittal, Shop Drawing and Sample with the information required in paragraph 1.01.A of this Section. Highlight or mark every page of every copy of all Product Data submittals to show the specific items being submitted and all options included or choices offered.
   6. Additional requirements for Product Review submittals are contained in the Technical Specification sections.
   7. Designation of work as "NIC" or "by others," shown on Shop Drawings, shall mean that the work will be the responsibility of the Contractor rather than the subcontractor or supplier who has prepared the Shop Drawings.

E. Compatibility of Equipment and Material: Verify that items contained in the same or in different submittals meet the requirements in the paragraph titled "Material and Equipment in Section 01040 especially the subparagraphs titled "Compatibility of Material and Equipment."

F. Requirements for Contractor Designed Items and for First Specified (Named) Items: Verify that items meet the requirements in the paragraph titled "Performance Specifications and Contractor Designed Items" in Section 01040.

G. Requirements for the Contractor's review and stamping of submittals prepared by the Contractor or by Subcontractors or suppliers prior to submitting them to the Engineer are covered in General Conditions paragraph 8.8.

© December 2012 Kennedy/Jenks Consultants

H. Submittals that contain deviations from the requirements of the Contract Documents shall be accompanied by a separate letter explaining the deviations. See General Conditions paragraphs 8.8 and 8.11. The Contractor's letter shall:
   1. Cite the specific Contract requirement including the Specification Section and paragraph number for which approval of a deviation is sought.
   2. Describe the proposed alternate material, item or construction and explain its advantages and/or disadvantages to the Owner.
   3. State the reduction in Contract Price if any that is offered to the Owner.

I. Engineer's Review Procedure and Meaning:
   1. The Engineer will stamp and mark each Product Review submittal prior to returning it to the Contractor. The stamp will indicate whether or not the review was favorable and what action is required of the Contractor. Review categories" No Exceptions Taken" and "Make Corrections Noted" both indicate Favorable Review.
   2. The Engineer's Favorable Review is contingent on the Contractor's warranties required by General Conditions paragraph 8.8 and is subject to all of the limitations and conditions in General Conditions Article 8. Favorable Review is also contingent on:
      a. The compatibility of items included in a submittal with other related or interdependent items included in previous or future submittals.
      b. Future submittal of items related to or required to be part of this submittal that was not included with this submittal.
   3. Favorable Review of a submittal does not constitute approval or deletion of items required as part of the submittal but not included with the submittal. Favorable Review of items included in the submittal does not constitute deletion of specified features, options or accessories that were not included in the submittal.
   4. The action required by the Contractor for each category of review is as follows:
      a. **NO EXCEPTIONS TAKEN**. NO RESUBMITTAL REQUIRED.
      b. **MAKE CORRECTIONS NOTED**:
         (1) NO RESUBMITTAL REQUIRED. The Contractor shall make corrections noted prior to manufacture.
         (2) PARTIAL RESUBMITTALS REQUIRED. The Contractor shall submit related accessory or optional items as noted which are required but were not included with the submittal and/or shall resubmit unsatisfactory portions or attributes of items as noted. The Contractor may proceed to manufacture those portions of the submittal that will be unaffected by required resubmittals.
      c. **AMEND AND RESUBMIT**. The Contractor shall amend and resubmit the submittal as noted or required to comply with the Contract Documents.
      d. **REJECTED - RESUBMIT**. The item submitted does not comply with the Contract Documents in a major way. Resubmit items that comply with the requirements of the Contract Documents.
   5. The letter of transmittal accompanying the returned Product Review submittal may contain numbered notes. Marking a corresponding number on a Shop Drawing or Product Data submittal shall have the same effect as applying the entire note to the submittal.

© December 2012 Kennedy/Jenks Consultants

J. Re-submittals that contain changes that were not requested by the Engineer on the previous submittal shall be accompanied by a letter explaining the change. See General Conditions paragraph 8.12.

K. Favorable Review Required Prior to Proceeding: Do not proceed with manufacture, fabrication, delivery or installation of items prior to obtaining the Engineers Favorable Review of Product Review submittals. See General Conditions paragraph 12.1.

L. Intent and Limitation on Engineer's Review:
   1. See General Conditions Article 8.
   2. The Contractor has primary responsibility for submitting and providing work that complies with the requirements of the Contract Documents. That responsibility cannot be delegated in whole or in part to subcontractors or suppliers. Neither the Engineer's Favorable Review nor the Engineer's failure to notice or comment on deficiencies in the Contractor's submittals shall relieve the Contractor from the duty to provide work, which complies with the requirements of the Contract Documents.

1.06 PROPOSED EQUIVALENTS

A. Submit Proposed Equivalent submittal form, General Conditions Exhibit GC-3 and comply with the submittal requirements for Shop Drawings, Product Data, and Samples submitted for Product Review in another paragraph of this Section.

B. See General Conditions paragraphs 8.1 through 8.15.

C. Time of Submittal:
   1. General Conditions paragraph 8.3 requires submittal of Proposed Equivalents within 35 days of the Notice to Proceed. The Engineer may agree to a later submittal date if requested in writing within 35 days of the Notice-to-Proceed. The request shall identify the item, give the Specification reference, and proposed manufacturer and model number of the item that will be submitted and the proposed submittal date.
   2. The Engineer's agreement to a later submittal date shall be in writing and shall not be construed as Favorable Review or acceptance of the manufacturer or item proposed.

D. Content of submittals shall be the same as that required for Product Data, Shop Drawings and Samples submitted for Product Review in another paragraph of this Section. In addition, the Contractor shall provide information on several recent similar installations of the item to verify its suitability. The information shall include the project name and location, the Owner's name, address, telephone number and name of a knowledgeable person to contact for information on performance of the product.

E. When the Contractor has listed specific maker's products on Document Number 00411 Designation of Equipment or Material Manufacturers submitted with its Bid no changes will be permitted without submittal of acceptable evidence justifying the change and the Engineer's written approval.

© December 2012 Kennedy/Jenks Consultants

F. If a non-equivalent substitute is submitted for review, it shall be accompanied by a proposed reduction in Contract Price which shall include the increased cost of Engineering service required to evaluate the proposed substitute (which shall be paid to the Owner whether or not the substitute is accepted) plus the greater of: 1) the difference in price between the first specified item and the item submitted; and 2) the difference in value to the Owner between the two items.

1.07 PRODUCT INFORMATION SUBMITTALS

A. Submit three copies. No copies will be returned. See General Conditions paragraph 8.15.

B. Product Information submittals are required for the Owner's permanent records and will be used for future maintenance, repair, modification or replacement work. Product Information submittals will be examined only to verify that the required submittals have been made; they will NOT be reviewed for compliance with the Contract Documents.

B. Make Product Information submittals prior to delivering material, products or items for which Product Information submittals are required.

C. The Contractor has the sole and exclusive responsibility for furnishing products and work that meets the requirements of the Contract Documents.

D. The Engineer reserves the right to comment on any submittal and to reject any product or work delivered, installed or otherwise at any time that the Engineer become aware that it is defective or does not meet the requirements of the Contract Document. See General Conditions paragraph 12.1.

1.08 OPERATION AND MAINTENANCE MANUALS AND PARTS LISTS

A. Submit three complete sets.

B. Provide operation and maintenance manuals and parts list for all equipment furnished under this contract. Comply with the detailed requirements in Technical Specification sections. Include instructions for delivery, storage, assembly, installation, lubrication, adjusting, startup, operation and maintenance.
   1. For all equipment include:
      a. Startup instructions
      b. Normal operation instructions.
      c. Trouble shooting instructions.
      d. Lubrication instructions.
      e. Maintenance and reinstallation instructions.
      f. Parts identification.
      g. List of spare parts recommended to have on hand.
      h. Operator safety instructions.
   2. For all Electrical Equipment, provide the following additional information:
      a. Equipment ratings.
      b. Calibration curves and rating tables if appropriate.

© December 2012 Kennedy/Jenks Consultants

3. For Complex Equipment provide in addition:
   a. Alternate specified operating modes.
   b. Emergency shutdown instructions.
   c. Normal shutdown instructions.
   d. Long-term shutdown instructions.
4. Operation and maintenance manuals for systems composed of separate pieces of equipment shall include a system explanation of Items 1, a, b, and c, and 3a through c, as well as the instructions for each separate piece of equipment.

C. Submit at least 15 days prior to Facility Startup and Training specified in Section 01650, paragraph 1.05.

D. Provide the number of copies specified in paragraph 1.01 of this Section. Bind each copy in one or more 8-1/2 x 11, 3-ring binders with clear view spine and cover, Avery E-Z View Binder; K&M; or equal. Prepare Titles for the spine and cover and a Table of Contents listing each piece of equipment. Organize the contents by Specification Section and paragraph number under which the equipment was specified. Provide labeled tab separators for each major item or group of smaller similar items. When standard manufacturers literature is used highlight or mark all copies to shop specific items and options provided.

1.09 MANUFACTURER'S CERTIFICATES

A. Submit three copies.

B. When specified in Technical Specification section, submit manufacturers' certificate to Engineer for review. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate. Certificates may be recent or previous test results on material or Product, but must be acceptable to the Engineer.

1.10 CONSTRUCTION PHOTOGRAPHS

A. Each month submit photographs to Engineer with Application for Payment.

B. Photographs: Submit two prints; color, glossy; 4 x 6-inch, mounted on 8-1/2 x 11-inch white soft card stock, with left edge punched for 3-ring binder.

C. Take five site photographs from different directions and two interior photographs to show progress of the Work. Make photographs within 5 days of the Application for Payment Date.

D. Identify photographs with date, time, orientation and project identification.

E. With the written consent of the Engineer, digital photographs in JPEG format may be acceptable.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 01311

CPM CONSTRUCTION SCHEDULE

1.01 GENERAL

A. See General Conditions Article 5.15: Submit to the Engineer a Temporary Construction Schedule and a CPM Schedule (along with updates) as described below:

B. Temporary Construction Schedule: Submit to the Engineer, within ten (10) days after date of the Notice to Proceed, a Temporary Construction Schedule covering the Contractor's activities over the first sixty (60) days of the Contract Time. The Temporary Construction Schedule shall schedule the progress within the calendar days set forth above for completion of the work.

C. CPM Schedule: Acceptable Critical Path Method (CPM) scheduling software includes SureTrak; Primavera; or equal. Provide a copy of the selected software to the Engineer. In accordance with General Conditions paragragh 5.16, submit an acceptable CPM Schedule to the Engineer within thirty (30) days after beginning Construction. Subsequent revisions to said schedule shall be submitted as set forth hereinafter. The requirement for the CPM schedule is included to assure adequate planning and execution of the work and to assist the Engineer in appraising the reasonableness of the proposed schedule and evaluating progress of the work. The CPM schedule submitted under this Specification shall utilize a critical path method (CPM) format, either the precedence or arrow diagramming method. Only one progress payment will be made prior to submission and acceptance of the CPM Schedule.

1. The CPM schedule system shall be submitted on paper and on discs or CD-ROM and consist of diagrams and accompanying mathematical analyses. The diagrams shall show elements of the project in detail and an entire project summary. Diagrams shall show the order and interdependence of activities and sequence in which the work is to be accomplished as planned by the Contractor. The basic concept of a network analysis diagram shall be followed to show how the start of a given activity is dependent on the completion of preceding activities and its completion restricts the start of following activities. Detailed network activities shall include, in addition to construction activities, the submittal and approval of samples of material and Shop Drawings, the procurement of critical materials and equipment, fabrication of special material and equipment and their installation and testing. All activities of the Owner and the Engineer that affect progress and required contract dates for completion of all or parts of the work shall be shown. The selection and number of activities shall be subject to favorable review by the Engineer. Summary networks shall be time scaled. Durations shall be in working days and shall not exceed five workdays, except for submittal and delivery items. Where the duration of continuous work exceeds five workdays, work items in the Construction Schedule shall be subdivided by location, approximate stationing or other sub-element of the work.

   The graphic network diagram shall include for each activity, the description, activity number, the estimated duration in work days, and all activity relationship lines. The network diagram shall be drawn for the early start of all activities. If the precedence technique is utilized, the schedule report shall include a

© December 2012 Kennedy/Jenks Consultants

calendar in work days, a network report sorted by early start and a logic table report sorted by preceding work item. If the arrow technique is utilized, the schedule report shall include a calendar in work days, a network report sorted by early start, a network report sorted by I-J numbers, and a network sorted by slack time and I-J numbers.

2. The critical path shall be shown on all reports and on the graphic network diagram. The activities which constitute the critical path shall be identified.
3. The mathematical analysis of the network diagram shall include a tabulation of each activity. The following information shall be furnished as a minimum for each activity:
   a. preceding and following event numbers
   b. activity description and number
   c. estimated duration of activities
   d. earliest start date (by calendar date)
   e. earliest finish date (by calendar date)
   f. actual start date (by calendar date)
   g. actual finish date (by calendar date)
   h. latest start date (by calendar date)
   i. latest finish date (by calendar date)
   j. slack or float
   k. percentage of activity completed
4. The program shall be capable of accepting revised completion dates as modified by approved time adjustments and recomputations of all tabulation dates and float accordingly.
5. Submission and review of the system shall be as follows:
   a. Submit the complete network analysis system, consisting of the detailed network mathematical analysis and network diagrams, within thirty (30) calendar days after receipt of Notice to Proceed.
   b. Participate in a review and evaluation of the proposed network diagrams and analysis by the Engineer. Any revisions necessary as a result of this review shall be resubmitted for review by the Engineer within ten (10) calendar days. When completed, the favorably reviewed schedule shall then be the schedule to be used by the Contractor for planning, organizing and directing the work and for reporting progress. If the Contractor thereafter desires to make significant changes in his method of operating and scheduling, he shall notify the Engineer in writing stating the reasons for the change.
   c. Submit on paper and on floppy disc or CD-ROM at monthly intervals a report of the actual construction progress. Each monthly report shall cover a period of approximately thirty (30) days ending around the 20th of each month. The monthly reports shall be submitted within ten (10) calendar days of the end of the reporting period.
      1) If the project is proceeding on schedule, the monthly update report may consist of a marked-up copy of the graphical network diagram. This submittal shall clearly indicate the status of any minor shifts in sequence or schedule and the estimated completion date or percent complete of all activities currently in progress. The contract completion date shall also be indicated. Submit a narrative report relating to status of construction, the schedule, and factors which may affect the remainder of the schedule. The report shall show the activities or portions of activities completed during the reporting period. The report shall state the percentage of the work actually completed and

© December 2012 Kennedy/Jenks Consultants

scheduled as of the report date and the progress along the critical path in terms of days ahead or behind the allowable dates.

2) If, in the opinion of the Engineer, the project is behind schedule, the monthly report shall include a revised network diagram and/or mathematical analysis showing the Contractor's proposed revised schedule. An analysis of the effect that the delay has on progress along other paths shall also be included in the report. Also submit a narrative report with each updated analysis which shall include but not be limited to a description of current and anticipated problem areas, delaying factors and their impact, and an explanation of corrective actions taken or proposed.

3) Periodic reports shall be submitted in sufficient copies to cover Contractor needs plus three (3) copies to be retained by the Engineer.

6. Any omission of work from the detailed schedule, otherwise required for Contract compliance, will not excuse the Contractor from completing such work within any applicable completion date. The CPM schedule shall be generated by computer methods. If the submitted Construction Progress Schedule does not fully reflect the specified work, the CPM format requirements or time limitation for completion of the work as provided in these Specification, it shall be returned to the Contractor by the Engineer for modification as necessary.

D. Schedule Review: Once each month, on a date mutually agreed upon, but no later than seven (7) working days after the monthly schedule progress report date, a jobsite meeting will be held to review the Construction Schedule and job progress. Also attend weekly meetings scheduled by the Engineer to review the progress of the work in the preceding week and in the subsequent work, coordinate the work with public agencies or other contractors as required, and allow the Engineer to plan his activities for testing, inspection, etc.

E. Schedule Revisions: The conditions under which the Engineer will require revisions of the Construction Schedule include the following:

1. When delay in completion of any work item or sequence of work items results in an estimated extension of project completion by either twenty (20) working days or by five percent (5%) of the remaining duration of time to complete the Contract, whichever is less.
2. When delays in submittals or deliveries make replanning or rescheduling of the work necessary.
3. When the schedule does not represent actual prosecution and progress of the work.
4. When any change to the sequence of activities, the completion date for major portions of the work, or when changes occur which affect the critical path.
5. When Contract modification necessitates schedule revision, the Contractor shall submit a schedule analysis of all change order work with his proposal.

F. Cash Flow Projection: A cash flow projection shall be submitted with the Construction Schedule. This cash flow projection shall be revised and resubmitted when revisions of the Construction Schedule will result in changes to the projected cash flow.

G. Proposed Change Orders: Proposed change orders submitted by the Contractor shall be accompanied by a statement of the time necessary for the work, together with a description of how this time will be incorporated into the current Construction

© December 2012 Kennedy/Jenks Consultants

Schedule. The Contractor shall not be entitled to a time extension for delays in activities on non-critical paths of the favorably reviewed schedule unless the duration of the excusable delay exceeds the total float of the activities being delayed. If the duration of an excusable delay does exceed the total float of the activities affected by the delay, the Contractor shall be entitled to an extension equal to the difference. Except as defined in the Contract Documents, the definitions of "non-critical activities" and "total float" shall be as provided in the Associated General Contractors of America book "CPM In Construction, A Manual For General Contractors."

H. Accelerated Work if Required to Meet Schedule: If the Contractor's performance falls behind schedule, the Contractor shall accelerate the work as required to get back on schedule at no additional cost to the Owner. Accelerated work shall include air or express delivery of materials and equipment, increasing the number of workers, working overtime, working Saturdays, Sundays, and holidays, and working additional shifts.

I. When, in the judgment of the Engineer, it is necessary to accelerate any part of the work ahead of schedule, the Contractor shall, when directed, concentrate his efforts on such part of the work, but maintain sufficient progress on all other areas of the Project required to maintain the schedule which meets the Contract Completion Date.

J. The Engineer shall be advised in advance by the Contractor when construction work will take place. If the Contractor fails to notify the Engineer in advance of the day or days when no construction work will be done, the Contractor will be charged the cost of inspection for that day or days and such changes may be deducted from any payment due the Contractor.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

1.01 TEMPORARY UTILITIES

A. Sanitary Facilities: Provide and maintain self-contained portable sanitary facilities for the Contractor's, and subcontractor's use. Facilities shall comply with applicable regulations and shall be serviced, cleaned and disinfected frequently.

B. Temporary Water, Power, and Telephone Service:
   1. Water and Power: Limited water and electrical service will be available at the project site for the Contractor's use. No charge will be made for this use provided utilities are not wasted. The Contractor shall provide temporary connection and distribution systems and remove them at the end of its work.
      a. Water: The Contractor may make a single 3/4-inch pipe size connection to the Owner's existing potable water system. The Owner's water may be used to serve temporary offices and hose bibs. Use shall be limited to sanitary use, tool clean-up, intermittent concrete cure spraying, and similar minor uses. The temporary connection to the Owner's water system shall be at a location approved by the Engineer and shall conform to requirements for a backflow prevention. The Owner will also provide water for testing of the piping, treatment processes and tanks for the project. The Contractor shall coordinate with the Owner and install temporary connections, as required, to obtain appropriate volumes of test water.
      b. Power: The Contractor may also make connections to the existing electrical system at 120 volts. The Contractor may use reasonable amounts of power for loads not exceeding 20 amps from existing electric service at no charge, but shall provide temporary connection, distribution, ground fault protection and overcurrent protection. The Contractor shall provide a separate temporary electric service, at the Contractor's expense, for all loads over 20 amps, including services to the Contractor's office, and any temporary structures requiring electrical service.
   2. Telephone: Provide separate temporary telephone service and facsimile line service for the Contractor's and Engineer's field offices. Contractor shall pay periodic charges for the telephone service and facsimile line service to the Engineer's office.

C. Temporary Heat: Use Owner's existing heating plant. Supplement with temporary heating equipment as required to maintain conditions necessary for construction operations.

D. Temporary Ventilation: Ventilate enclosed areas to facilitate curing concrete, to dissipate humidity and to prevent accumulation of dust, fumes, or gases. Utilize existing ventilation equipment and supplement with temporary fans to maintain clean air and safe conditions for construction operations. Replace or clean filters on existing or new equipment on completion.

E. Dissipation of Hazardous Fumes Prior to Completion and Occupancy by Owner: Provide high capacity fans and heaters or use existing or new equipment to provide

© December 2012 Kennedy/Jenks Consultants

100% fresh air at elevated temperatures for several days to dissipate hazardous fumes from new construction materials such as paint, adhesives, carpet and wall coverings.

F. Temporary Lighting: Provide and maintain lighting for construction operations to achieve a minimum lighting level of 20-foot candles for rough work and 60-foot candles for finish work.

G. Temporary Fire Protection:
   1. Provide and maintain fire protection equipment, including extinguishers, fire hoses, and other equipment required by law, insurance carriers, or necessary for proper fire protection during the course of the work.
   2. Use fire protection equipment only for fighting fires.
   3. Locate fire extinguishers in field offices, storage sheds, tool houses, temporary buildings, and throughout the construction site.

1.02 TEMPORARY CONSTRUCTION

A. The Contractor is solely and exclusively responsible for the design, construction and maintenance of all temporary construction including forms, falsework, shoring, scaffolding, stairs, ladders and all other similar items. See General Conditions paragraphs 5.3 and 5.20 through 5.28 and Section 01040.

B. Construct adequate and safe forms and falsework, to rigidly support partially completed structures. Provide temporary bridges and decking to maintain vehicular and pedestrian access. Design and construct temporary forms, falsework, bridges and decking in accordance with applicable regulations and codes.

1.03 BARRICADES, FENCES AND ENCLOSURES

A. See General Conditions paragraphs 5.3 and 5.20 through 5.28 and Section 01040.

B. Barricades: Provide temporary guard rails, ladders, stairs, guards, and barricades to protect persons in accordance with applicable regulations, including California Code of Regulations Title 8 and Cal/OSHA.

C. Fences:
   1. Existing fences enclose the present facilities site. The fences are for the protection and security of the present operating facilities. If it is necessary for the Contractor to remove some of the fences for installation of new work, the Contractor shall provide equivalent temporary protection and security. Replace fencing removed by the Contractor with new fencing prior to completion, as shown on the Contract Drawings.

D. Enclosures:
   1. Provide protective dust covering at doors and other openings to contain dust within the construction area.
   2. Provide temporary partitions to prevent dust and moisture from entering Owner-occupied areas and to prevent damage to existing materials and equipment.

© December 2012 Kennedy/Jenks Consultants

Temporary partitions shall be of non-combustible construction such as metal studs and gypsum board.

3. Provide temporary watertight closures for openings in exterior surfaces as required to protect interiors from weather, moisture, humidity and extreme temperature.

1.04 PROTECTION OF INSTALLED WORK

A. Provide temporary and removable protection for installed products. Control activity in immediate work area to minimize damage.

B. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by covering surfaces with nonstaining heavy-duty reinforced moisture-resistant kraft building paper with joints continuously taped with waterproof tape.

C. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is unavoidable provide adequate protection to prevent damage to waterproof membranes and comply with recommendations for protection of the waterproofing or roofing material manufacturer.

D. Provide heavy planking to protect curbs, gutters, culverts, paving and similar surfaces from damage by heavy equipment or vehicles.

1.05 SECURITY

A. Provide security and facilities to protect the Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

1.06 ACCESS ROADS AND PARKING AREAS

A. Access Roads: Use only access roads designated on the Drawings.

B. Parking:
   1. Provide parking areas for construction personnel offsite.

1.07 TEMPORARY CONTROLS

A. Cleaning:
   1. During Construction: Maintain the site and all work in a clean orderly fashion free of waste debris and rubbish. Store debris in covered containers. Pick up and remove debris daily if required, but not less frequently than weekly. Burning debris on site is not permitted. Remove debris from permanently closed spaces prior to enclosing them. Clean mud from vehicles before leaving the site.
   2. If work under this Contract creates dusty, dirty or unsightly conditions in adjacent areas, the Contractor shall immediately cleanup the affected areas.
   3. Final cleanup is specified in Section 01700.

B. Dust Control: Employ measures to prevent the creation of dust which may produce damage or nuisance to property or persons. Be responsible for all damage resulting

© December 2012 Kennedy/Jenks Consultants

from dust produced by construction operations. Periodically wet down unpaved areas where vehicles are operated. See Earthwork specification sections.

C. Erosion and Sediment Control: Employ measures to prevent erosion and trap any sediment created by construction operations before it leaves the site. Prevent sediment from entering streams or other water bodies. Grade any areas damaged by construction or by erosion and hydroseed with grass.

D. Noise Control: Comply with regulations limiting construction noise levels. Use whisper quite air compressors. Use jack hammers with exhaust mufflers. Prevent noise disturbance to the public and adjacent property owners. Employ measures required to limit construction noise to 85 dBA at construction site boundaries.

E. Pest and Rodent Control: Avoid creating conditions conducive to pests and rodents. Comply with regulations governing the use of chemicals to control pests and rodents.

F. Water Control: Maintain excavations free of water. Protect site from puddling or running water See Earthwork specification section.

1.08 PROTECTION OF TREES (NOT USED)

1.09 TRAFFIC REGULATION

A. Conduct operations so as to offer the least possible obstruction and inconvenience to public traffic. Do not overload or damage paved or improved surfaces, sidewalks, curbs or gutters.

B. Provide temporary barricades, lights, flag persons and other means, as appropriate, to safely control pedestrian and vehicular traffic entering and leaving the project site and on the project site.

1.10 PROJECT SIGN

A. Provide an 8-foot-wide by 6-foot-high project sign using ¾-inch exterior grade plywood and braced wood frame construction. Paint all surfaces with two coats of exterior house paint. Employ a professional sign painter to letter sign in accordance with Engineer's small scale design and color selection (two colors).
   1. List project title and names of Owner, Engineer, and Contractor.
   2. Erect the sign where directed by the Engineer. Locate bottom edge of the sign 8 feet above the ground. Maintain sign in good condition and remove it on project completion.

1.11 FIELD OFFICES

A. Contractor's Office at the Site: Maintain a suitable office at the site for the Contractor's Superintendent who shall be authorized to receive submittals, drawings, instructions, or other communications from the Engineer or Owner.

B. Engineer's Office at the Site:

© December 2012 Kennedy/Jenks Consultants

1. Office: Provide a trailer-type temporary structure for the Engineer's use as an office with the following features:
   a. All-metal frame, exterior, sides and roof.
   b. Size: 300 square feet minimum.
   c. Number of Rooms: Two minimum and a toilet room.
   d. Windows: Two minimum per office room with security guard screens.
   e. Lighting: Interior fluorescent ceiling lights with 70-foot candles of uniform lighting at desk level. Outside lights above each door.
   f. Heating, Ventilation and Air Conditioning: Provide at least six air changes per hour in all rooms and provide air conditioning equipment capable of maintaining at least 70°F for heating and 78°F maximum for cooling.
   g. Toilet room with chemical toilet: Monogram Industries Jetomatic; Pyrolet; or equal, wash basin, mirror, toilet paper, and paper towel dispensers.
   h. Doors equipped with automatic retracting deadbolt locks. Provide four keys.
   I. Provide staircase with stair handrail and landing with guardrail at entrances.
   j. Electrical service, disconnect switch and a circuit breaker panel. Provide ground fault protected outlets.
   k. One hundred fifteen (115) volt, 15 amp receptacles, spaced no more than 8 feet apart.
2. Equipment and Furnishings: Provide the following:
   a. Two desks each with two drawer pedestals.
   b. Two swivel chairs.
   c. One 4-drawer filing cabinet.
   d. One 12-stick plan holder.
   e. Two desk lamps.
   f. Two drafting tables and stools.
   g. One paper towel dispenser.
   h. One paper cup dispenser.
   i. One bookcase, 4 feet wide and 3 feet high.
   j. Two wastepaper baskets.
   k. One first-aid kit
   l. Two telephones, one with speaker.
   m. One telephone answering machine.
   n. One electrostatic copier machine with 8-1/2 x 11 and 11 x 17 automatic paper feed trays and 10-bin collator. Cannon NP2020, Sharp, or equal.
   o. One 14A 60 BC dry chemical fire extinguishers
   p. One plain paper facsimile machine.
   q. Water chiller fountain with hot water accessory and refrigerated compartment, EBCO Manufacturing Co. Model ODP8AH Oasis; equivalent by Hawes; or equal.
3. Utilities: Install potable water service. Arrange and pay for telephone and electrical service. The Contractor shall pay for periodic water, sewer, electrical and telephone charges.
4. Installation and Removal: Install the Engineer's office at the location directed by the Engineer within 15 days after the Notice-to-Proceed. Provide rigid level supports and seismic and wind tie downs. Remove the Engineer's office no later than 30 days after recording of the Notice of Completion, but no earlier than the Notice of Completion.

© December 2012 Kennedy/Jenks Consultants

5. Maintenance: Maintain the Engineer's office in good repair. Provide daily cleaning and maintenance service. Replenish paper towels, paper cups, soap, toilet paper, and bottled water daily. Service, pump and clean chemical toilets at least twice weekly. Service the copier and facsimile machine monthly or more frequently if needed.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 01650

FACILITY STARTUP

1.01 FACILITY STARTUP

A. Commission all systems and equipment to verify performance, function, and correct operation by performing procedures to activate, startup, adjust, test, and demonstrate that the work is in operating order in accordance with these general requirements of this Section and the detailed requirements of the technical sections under the system or equipment specified. Note the Work Sequence requirements in Section 01010 for starting up systems and integrating them with the existing facility.

B. To ensure that the work is ready for full-time operation the procedures include verification, balancing, calibration, witness testing, documentation, inspection by equipment manufacturers and operator training where specified.

C. Notification: Notify the Engineer five days prior to starting each system or piece of equipment.

D. Coordination: During the startup period, coordinate the operation of the facility with Engineer, subcontractors, Owner's operators, and manufacturer's representatives.

E. Furnish test equipment, measuring devices and supplies required to conduct tests.

F. Maintain the equipment until acceptance. Provide all lubricants, chemicals, and electricity necessary until acceptance.

G. Furnish all expendable supplies, gas, water, etc., required for startup, demonstration and testing and dispose of all waste or used supplies, water, etc.

H. Favorably Reviewed Draft O&M Manuals are required 30 days before the 30-Day Plant Acceptance Test. See Section 01300.

1.02 SUBMITTALS

A. Startup Plan, Forms, and Schedule: Prepare a facility startup plan and schedule for each major phase of work, as described in the project sequencing in Section 01010. The plans shall include test methods and procedures and sample forms for recording test data.

B. Affidavit.

C. Submit documentation of tests, balancing reports, and the like.

© December 2012 Kennedy/Jenks Consultants

1.03 INITIAL STARTUP AND OPERATION OF FACILITIES

A. The following listing is a general sequence of startup activity steps to be used in placing facility systems into operation:
   1. Perform initial lubrication of equipment and have manufacturers check and adjust equipment. Provide all subsequent lubrication and maintenance, and such staff as required for test operation until the Owner assumes equipment maintenance responsibility after Step 14 below.
   2. Perform satisfactory testing of electrical work required prior to energizing of the electrical system.
   3. After completion of Step 2, perform satisfactory electrical testing required after energizing of the electrical system.
   4. Complete calibration of instruments.
   5. Satisfactorily complete system verification of instrumentation work.
   6. After completion of Steps 1 and 3, perform a rotational test of equipment and correct backward rotating drives.
   7. After completion of Steps 5 and 6, test operate the equipment by manually initiating the operation. Where manual operation bypasses alarm or safety monitoring, provide continuous supervision of such parameters. Perform this step using water in lieu of chemicals or other process liquids. Use dry air or nitrogen in lieu of hazardous gases.
   8. Concurrent with Step 7, perform instrumentation and control testing and adjustments as related to the equipment being tested.
   9. Concurrent with Step 7 and where possible at this stage of startup, complete the performance testing specified for the equipment.
   10. Concurrent with Step 7, perform adjustments of the electrical work as related to the equipment being tested.
   11. Repeat Steps 1 through 10 as required for other equipment items and plant systems until all plant process components and utility systems are ready for total plant operation. It may be necessary for the Contractor to put portions of the newly constructed facility in service before constructing other portions of the facility or completing the Work as a whole. Submit the required documentation of testing, calibration, and equipment affidavits.
   12. Notify the Owner and the Engineer 45 days before total plant operation is to occur so that the Owner may order chemicals and make other arrangements for full time operation. This notification shall have an accuracy of plus or minus 7 days. Notify the Owner and Engineer again, exactly 7 days before total plant operation is to begin.
   13. 30-Day Plant Acceptance Test: Upon completion of all the above steps, the facility shall be started up and operated on a complete full-time basis delivering water to the distribution systems. The Owner will provide operating personnel, chemicals and untreated water. For five consecutive days beginning with the start-up day, the Contractor shall have at the plant site, during the day shift, a mechanic, an electrician and an instrument engineer. Representatives of manufacturers of critical equipment shall also be present for these five days as needed or as required elsewhere in the specifications. The Contractor shall also provide these personnel, on a 24-hour per day, "on call" basis, if necessary, to adjust, repair, and correct deficiencies as required to keep the facilities in continuous operation for a period of 30 days. The Contractor shall train the operators in the proper operation and the control of the new facilities.

© December 2012 Kennedy/Jenks Consultants

The Contractor shall also furnish all such mechanical and electrical workers as required to make adjustments to and perform all required maintenance for the operating equipment until the end of the 30-day initial operation period. Maintenance of operating equipment shall include lubrication, adjustments, replacements, and modifications as required.

14. After successful completion of the 30-Day Plant Acceptance Test, the Owner will take over maintenance duties as well as operation and will begin to provide and pay for lubricants. If continuous process operation is interrupted for a period of eight consecutive hours or more due to a failure of the equipment or work provided by the Contractor, then the counting of the 5-day and/or 30-day periods, described in Step 13 above, shall be restarted at day one if these periods have not reached satisfactory completion.
15. Following the commencement of Step 13, satisfactorily complete equipment performance testing, electrical testing and adjustments, and instrumentation/control testing and adjustments to the extent that such testing and adjustments could not be made prior to full plant operation.
16. Complete the documentation of test, balancing reports, and the like commissioning for submittal during the startup process and before acceptance.

1.04 MANUFACTURER'S FIELD SERVICE AND AFFIDAVITS

A. Field Service: Where specified, manufacturers of equipment shall provide field service. Field service shall be provided by an authorized factory-trained and qualified manufacturer's representative for the specific equipment. Equipment shall not be considered ready for full time operation until after the manufacturer's representative has checked and adjusted the equipment, and certified by written affidavit that the equipment has been properly installed, tested, adjusted, lubricated, and calibrated, and is ready for full time operation.

B. Affidavits: Acceptable affidavits shall be submitted prior to the 30-Day Plant Acceptance Test.
   1. Affidavits shall contain the following specific wording:
      "The *[Name of Equipment]* has been properly installed, tested, adjusted, lubricated, and calibrated, and is ready for full time operation. The installation has been inspected and has been found to be in conformance with our (the manufacturer's) standards and requirements."
   2. No amplification, dilution, or modification of this specific wording will be permitted.

1.05 TRAINING

A. Submit Operation and Maintenance Manuals and Parts Lists specified in Section 01300 at least 30 days prior to the 30-Day Plant Acceptance Test and the first training session.

B. Demonstrate the operation, maintenance and safety procedures for all systems and equipment to personnel designated by the Owner.

C. Provide 16 hours of classroom training and 16 hours of onsite demonstration of systems and equipment.

© December 2012 Kennedy/Jenks Consultants

1. Illustrate classroom training with diagrams, checklists, photographs and other visual aids as appropriate. Use video, slides, or overhead projector to present visual materials.
2. Prepare a course summary illustrated with copies of visual materials. Distribute one copy to each course attendee, four copies to the Owner and two copies to the Engineer.

D. In addition to overall training specified above, provide special demonstration and training for specific pieces of equipment specified in the Technical Specification Sections.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 01700

CONTRACT CLOSEOUT

1.01 FINAL CLEANUP

A. Just prior to Final Inspection, clean the entire construction area including buildings, other structures, and site work included in this Contract as well as all other areas affected by the performance of work under this Contract. Perform cleanup work using personnel specializing in and skilled in building cleaning and maintenance work. Perform cleaning to standards considered normal for commercial janitorial work. Accomplish repair work using personnel specializing in performing and repairing the type of work being repaired. Perform repair work to the highest trade standards applicable to that type of work. Include:
   1. Remove all temporary construction, signs, tools, equipment, excess materials and debris.
   2. Sweep clean and then wash down all exterior pavement surfaces. Avoid washing sediment or hazardous material into drainage systems. Remove all grease and oil stains on pavement caused by Contractor's equipment.
   3. Clean all glass without scratching. Scratched glass shall be replaced.
   4. Remove all lumps, splatters, spots and stains caused by paint, adhesive, asphalt, concrete, mortar, plaster, sealant or other foreign material from all exposed or finished surfaces. Remove all temporary labels.
   5. Repair, patch or replace new or existing work including pavement, sidewalks, curbs, gutters, catch basins, gratings, manholes, covers, landscaping, plant materials and other items that have been damaged, broken, cracked or chipped as a result of performing this Work.
   6. Touch up painted surfaces that are soiled, chipped, spotted or otherwise flawed.
   7. Wash all floors with cleaner recommended by flooring manufacturer.
   8. Remove all dust with treated dust cloth and vacuum.
   9. Polish all hardware and non-ferrous metal.
   10. Clean all lighting fixtures.

1.02 CONTRACTOR'S ACTION LIST OF ITEMS TO BE CORRECTED AND/OR COMPLETED

A. During construction, the Contractor shall maintain an action list of items to be corrected and/or completed. The Contractor shall regularly add items and update the list as information becomes available or as requested by the Engineer. The Contractor shall deliver a current copy of the list to the Engineer at each progress meeting.

1.03 SEMIFINAL INSPECTION/SUBSTANTIAL COMPLETION

A. See General Conditions paragraphs 13.7 through 13.15. When the Contractor considers the Work nearly complete, the Contractor shall review the Contract Documents, inspect the Work, and use the Contractor's action list to prepare a Contractor's Punch List of all deficient or uncompleted items. The Contractor shall

© December 2012 Kennedy/Jenks Consultants

complete or correct items on the Punch List. When the Work is Substantially Complete in accordance with General Conditions paragraph 13.7, the Contractor shall notify the Engineer in writing that the Contractor has reviewed the Contract Documents, inspected the Work and believes that the Work is Substantially Complete and ready for Semifinal Inspection.

B. See General Conditions paragraphs 13.9 through 13.10. On receipt of the Contractor's Punch List and notice that the work is ready for Semifinal Inspection, the Engineer will inspect the Work. The Engineer may add additional items to the Contractor's Punch List, may find that the work is not ready for inspection, is ready for inspection but not Substantially Complete or that the Work is Substantially Complete. When the Engineer finds the Work is Substantially Complete, it will prepare a Final Punch List and a notice of Substantial Complete, which will state the date of Substantial Completion and the time agreed to by the Owner and the Contractor (not to exceed 30 days) in which the Work shall be fully complete and ready for Final Inspection.

1.04 FINAL INSPECTION, FINAL COMPLETION AND FINAL PAYMENT

A. See General Conditions paragraphs 13.11 through 13.15. When the Contractor has completed or corrected all the items on the Engineer's Final Punch List, the Contractor shall give the Engineer written notice that the Work is ready for Final Inspection. When the Engineer finds the Work acceptable and fully complete in accordance with the Contract Documents, and upon receipt of a final Application for Payment and all final submittals, the Engineer will recommend that the Owner issue a Notice of Final Completion, make Final Payment and Accept the Work stating that to the best of the Engineer's knowledge, information and belief, and on the basis of the Engineer's observations and inspection, the Work has been fully completed in accordance with the terms and conditions of the Contract Documents.

B. Final Submittals include:
   1. Operation and Maintenance Manuals and Parts Lists
   2. Record Drawings
   3. Extra Materials
   4. Special Guarantees
   5. Insurance Certificate showing required continuation of coverage beyond Final Payment. See General Conditions paragraph 4.4.
   6. Release of Liens. See General Conditions paragraphs 13.2 and 13.13
   7. Waiver of Claims by Contractor. See General Conditions paragraph 13.14.
   8. And any other submittals required by the Contract Documents and not previously received.

C. The Owner will record the Notice of Final Completion at the County Recorders Office.

D. The Owner will make Final Payment to the Contractor 35 days after recording the Notice of Final Completion.

© December 2012 Kennedy/Jenks Consultants

1.05 RECORD DRAWINGS

A. The Contractor shall maintain on the jobsite, a complete set of Contract Documents and a complete file of all addenda, contract modifications and favorably reviewed submittals. The Contractor shall prepare a set of Record Drawings concurrently with the construction of the Work and in accordance with General Conditions paragraph 5.13 and the following:
   1. Show the invert elevation of all piping and the top of pipe, top of conduit or top of protective concrete encasement for other utilities. Elevations shall be related to a permanent visible elevation benchmark set at the site by the Contractor.
   2. Show the horizontal location of underground utilities measured from permanent visible physical features such as face of building, face of tank, or centerline of manhole.
   3. Comply with detailed requirements in technical specification sections describing the type of information required on Record Drawings. The Contractor's copy of Contract Documents, Contract modifications and Record Drawings shall be available to the Engineer for weekly verification that the records are being currently updated.

B. Submit Record Drawings and obtain acceptance prior to completion.

1.06 EXTRA MATERIALS

A. Deliver specified extra materials and parts to Owner. Itemize all items on a transmittal letter in duplicate and obtain signature of receiving party. Submit copies of signed transmittals for all specified extra materials and parts prior to completion.

1.07 SPECIAL GUARANTEES

A. Article 12.11 of the General Conditions covers the Contractor's responsibility to remedy defects due to faulty workmanship and materials, which appear within one year from the date of Final Completion and acceptance by the Owner.

B. Guarantees for more than one year when called for in various sections of the Specifications shall be evidenced by the Contract Documents and in the form of a special guarantee written on the letterhead of the Contractor, Subcontractor, or Supplier doing the work and/or supplying the item to be guaranteed, and countersigned by the Contractor as follows. Failure to provide the special guarantee on the letterhead shall not relieve the Contractor, Subcontractor, or Supplier from its obligations for the special guarantees.

C. Special Guarantee:

   We hereby guarantee that the _____ which we have provided in the _____, Project, was done in accordance with the Drawings and Specifications, and that the work, as installed, will fulfill the requirements of the guarantee included in Specification Section _____. We agree to repair or replace any or all of our work, together with any other adjacent work which may be damaged or displaced by so doing, that may prove to be defective in workmanship or material (with the exception of defects

© December 2012 Kennedy/Jenks Consultants

due to ordinary wear and tear, and unusual abuse or neglect) within a period of _____ years from the date of acceptance of the above-named facility, without any expense whatsoever to the Owner. In the event of our failure to comply with the above-mentioned conditions within the period set forth in Article 12 of the General Conditions after being notified in writing by the Owner, we, collectively or separately, do hereby authorize the Owner to proceed to have said defects repaired and made good at our expense, and we will honor and pay the costs and charges therefore upon demand. We understand that the provisions of General Conditions paragraphs 12.15 and 12.16 apply to this Special Guarantee.

Signed_____
(Subcontractor or Supplier)

Company_____

Address_____

Telephone Number_____

Countersigned_____
(Contractor)

D. Submit two notarized original signed copies of each required Special Guarantee prior to completion.

1.08 TWELVE-MONTH INSPECTION

A. Thirty (30) days prior to the expiration of the one-year guarantee period described in General Conditions Article 12, the Contractor shall tour the project with the Engineer and/or the Owner to prepare a list of corrective work required under the 12-month guarantee. The Contractor shall correct all items found to be defective within 20 days of receipt of the list of items to be corrected.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 02050

DEMOLITION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide all demolition required to perform the work covered under this contract including without limitation:
   1. Remove existing construction shown to be removed.
   2. Remove and replace existing construction and/or finishes as required to provide access to perform other work included in this contract.
   3. Include removal of mechanical and electrical work that is to be abandoned and is contained in construction to be removed whether or not the mechanical and electrical work is shown. Disconnect and cap off utilities in accordance with applicable codes and safety regulations.
   4. Where utilities that are not shown pass through construction that must be removed and those utilities serve other areas notify the Engineer before disrupting service. If rerouting is required to maintain service, the Owner may issue a Change Order to accomplish the required work.
   5. Store and protect items intended for reuse.
   6. Assume ownership of debris and unwanted materials, remove from the site and dispose of legally.
   7. Include the cost of removing and disposing of hazardous material including without limitation asbestos or asbestos-containing material, lead-containing paint, and PCBs. If the presence of a hazardous material is suspected, have material tested. If material is identified as hazardous, retain qualified and licensed specialist to remove and dispose of it legally.
   8. If illegal electrical wiring is encountered such as “BX” or nonmetallic sheathed cable, notify the Engineer.
   9. Remove all loose items including rubbish, debris, etc.

1.02 NOISE AND DUST CONTROL

A. Perform work in accordance with requirements in Division 1. Particular attention is directed without limitation to paragraphs titled: Owner and Contractor's Use of Premises, Cleanup During Construction, Fire Protection During Construction, Maintenance of Exit Routes for Building Users, Temporary Dust Barriers, Noise Control and Care of Existing Facilities.

B. Provide temporary partitions to control dust and noise and exclude unauthorized persons.

C. Perform work in a manner to cause least disturbance to building occupants and least damage to work to remain.

D. Maintain adequate means of safe, clear egress for building occupants.

© December 2012 Kennedy/Jenks Consultants

E. Employ all available techniques for construction noise abatement. Use remote, well-mufflered air compressors and newest noise suppressed pneumatic and electric tools.

1.03 WARNING

A. The Contractor is advised that work under this Section may be hazardous. The Contractor is to take all necessary precautions to ensure the safety of workers and property. Removal of and/or working in areas containing even minor amounts of hazardous material including without limitation, asbestos, lead-based paint, PCBs or other hazardous materials requires special precautions, knowledge and procedures. If hazardous material is suspected, notify the Engineer.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 REMOVAL OF CONSTRUCTION IN AREAS TO RECEIVE NEW WORK

A. In areas intended to receive new work and/or finishes, remove all unwanted non-structural partitions, furred walls, chases, suspended or furred ceilings, doors, windows and finishes.

B. Remove all unwanted mechanical and electrical work (whether shown or not) that is not wanted and is not needed to serve other areas that is in, on, or concealed behind work being removed. Cap off or terminate all mechanical or electrical work in accordance with the requirements of Divisions 15 and 16.

C. Protect mechanical and electrical work that serves other areas. Relocate concealed mechanical and electrical work that is required to preserve service to other areas.

D. Remove structural work designated for removal. Take precautions not to damage structural work intended to remain. Where temporary shoring is needed, submit a design prepared by an appropriately licensed engineer for review before proceeding.

E. If structural elements are encountered that were not shown, protect them from damage and report their presence to the Engineer.

3.02 REMOVAL OF LIMITED PORTIONS OF EXISTING CONSTRUCTION TO PERMIT MODIFICATIONS

A. Provide careful, selective cutting and removal of existing construction as required to permit relocation or modification of partitions, doors, or openings. Cut and remove the least amount of work possible except when a larger area needs to be removed to permit strengthening existing construction or when required to remove finishes to a natural break line such as a corner or change in material.

B. Protect existing construction to remain with temporary coverings.

© December 2012 Kennedy/Jenks Consultants

C. Treat existing mechanical, electrical or structural work as described in other parts of this Section.

D. When modifications are complete, replace removed work with new construction and finishes to match adjacent existing work. Standards of material and workmanship shall be in accordance with other portions of this Specification or if not covered then in accordance with current practice for this class of work. Salvaged materials may be used for replacement if in good condition.

3.03 REMOVAL OF EXISTING CONSTRUCTION TO PROVIDE ACCESS TO PERFORM WORK

A. Provide careful selective cutting and removal of existing construction where required to permit installation of new concealed mechanical or electrical work, or installation of equipment, fixtures or devices.

B. Treat existing mechanical, electrical or structural work as described in other parts of this Section.

C. Replace and/or patch removed construction and finishes in accordance with other parts of this Section.

3.04 PROTECTION OF WORK TO REMAIN

A. Protect all work to remain. Repair damage with materials, workmanship and finishes matching existing work when new.

B. Most existing floor finishes will not be replaced in this contract. It is essential that these floors be protected from any damage due to impact, dirt, abrasion, paints and solvents.

3.05 CUTTING HOLES IN CONCRETE AND/OR CONCRETE UNIT MASONRY

A. The Contractor is cautioned that electrical conduits and reinforcing that are not shown on drawings may be concealed in concrete CMU construction. Use electronic detection equipment to locate concealed items before cutting holes. Take all required precautions to avoid damage to existing conduits or reinforcing.

B. New openings in existing concrete walls or slabs may be saw cut to opening perimeter lines where drawings do not call for adding reinforcing trim bars to strengthen openings. Do not run saw kerfs past corners of openings. Complete concrete removal at opening corners by chipping and grinding. Take all required precautions to avoid water damage to existing construction or the Owner's property.

C. Where drawings call for adding reinforcing trim bars to strengthen openings, limit saw cutting to a depth of 3/4-inch to avoid cutting existing reinforcing steel. Carefully chip out concrete to avoid damaging existing reinforcing steel which is to remain.

© December 2012 Kennedy/Jenks Consultants

D. Use chipping guns to chip out small holes for pipes or conduits. Proceed carefully to avoid damage to concealed conduits. Core drilling is permitted only at the Contractor's risk and only with the Owner’s permission. If core drilling is used, the Contractor shall: 1) use electronic detection equipment to locate conduit before drilling, 2) take precaution to avoid water damage to existing construction or the Owner's property, and 3) replace, at its own expense, any damaged electrical or signal wiring or conduits.

3.06 REMOVE UNWANTED FIXED EQUIPMENT

A. Remove unwanted lockers, shelving, hoods, fixed and built-in equipment, machinery, machinery bases and similar items whether shown or not. Cut off protruding bolts or attachment devices flush with existing surfaces.

B. If items are designated on the Drawings to be salvaged, remove them carefully without causing damage. Store and protect items to be reused until time of need on jobsite.

3.07 IF HAZARDOUS MATERIALS ARE ENCOUNTERED

A. If hazardous materials are discovered, comply with paragraph 1.01 of this Section and all applicable laws.

3.08 REMOVAL AND DISPOSAL OF MATERIAL

A. Use debris chutes with covered tops emptying into covered containers.

B. Use rubber tired covered buggies with rubber bumpers to transport debris through occupied sections of buildings.

C. Store debris in suitable covered containers located where directed by the Owner and remove from site when full. Burning on the site is not permitted.

E. Removed material (other than material to be reused) shall become the property of the Contractor who shall remove it from the site and dispose of it in a legal manner.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 02200

SITE PREPARATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Site preparation shall consist of all clearing, grubbing, stripping, (demolition), and related work necessary to prepare the project site for construction operations.

   2. No open burning of debris, lumber, or other scrap will be permitted.

   3. Trees and vegetation to be left standing shall be protected from damage incident to site preparation and construction operations by the erection of barriers or by such other means as the circumstances require.

B. Related Sections:
   1. Section 01140: Environmental Protection
   2. Section 02301*:* Earthwork

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

3.01 DEMOLITION

A. Demolish and remove any fences, posts, poles, or other structures from within the project site, areas to be cut or areas to receive fill, and pipeline alignments.

3.02 CLEARING

A. Clearing shall consist of the felling, trimming and cutting of trees, and the removal of downed timber, shrubs, grasses, debris and rubble from the project site which will obstruct or otherwise impede construction operations.

© December 2012 Kennedy/Jenks Consultants

3.03 GRUBBING

A. Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the construction area. This material, together with logs and other organic debris, shall be excavated and removed to a depth of not less than 18 inches below the original surface level of the ground in areas indicated as construction areas under this Contract, such as areas for structures, pavement, fills. Depressions made by grubbing shall be filled with structural backfill material and compacted to make the surface conform with the original adjacent surface of the ground, unless further excavation is required. Grub borrow areas to the extent necessary to obtain material free of stumps and roots.

3.04 STRIPPING

A. Strip the upper 2 inches of soil containing vegetation and root matter from all areas to receive fill and from all areas to be excavated.

3.05 DISPOSAL

A. Strippings: Stockpile stripped material and use it to restore the site.

B. Dispose of remaining vegetation and debris in accordance with Section 01140.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 02301

EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Perform all excavation, shoring, dewatering, backfilling, compaction and grading necessary or required for the construction of the work as covered by these Specifications and indicated on the Drawings. The excavation shall include, without classification, the removal and disposal of all materials of whatever nature encountered, including water and all other obstructions that would interfere with the proper construction and completion of the required work.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM).

B. State of California, Department of Transportation, Standard Specifications, latest edition (Standard Specifications).

C. State of California, Department of Transportation, Manual of Test (California Test).

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Submit the following under the Product Review category.
   1. Sheeting and Shoring Plan: Refer to paragraph 1.08, below and Section 01040, paragraph 1.14.
   2. Potholing Report as described in Paragraph 3.02.
   3. Samples and Test Results: Furnish, without additional cost to the Owner, such quantities of import materials as may be required by the Engineer for test purposes. Cooperate with the Engineer and furnish necessary facilities for sampling and testing of all materials and workmanship. Submit test results for import materials. Tests shall be performed within 60 days of the submission. All material furnished and all work performed shall be subject to rigid inspection, and no material shall be delivered to the site until it has been favorably reviewed by the Engineer, or used in the construction work until it has been inspected in the field by the Engineer.

1.04 QUALITY ASSURANCE

A. Source Quality Control: Test import materials proposed for use to demonstrate that the materials conform to the specified requirements. Tests shall be performed by an independent testing laboratory.

B. Field Quality Control:
   1. The Engineer will:

© December 2012 Kennedy/Jenks Consultants

a. Review materials proposed for use.
b. Observe foundations, site grading and borrow operations.
c. Observe placement and compaction of fill.

2. Contractor shall:
   a. Excavate holes for in-place soil sampling.
   b. Test soils during placement of fill to verify conformance with material requirements defined herein.
   c. Be responsible for costs of additional inspection and re-testing resulting from non-compliance.

C. Testing Methods:
1. Durability Index: Manual of Test, State of California, Department of Transportation.
2. Specific Gravity: ASTM D854
3. Laboratory Compaction: ASTM D1557, Method A or C.
4. In-place Density: ASTM D1556 or ASTM D2922.
5. Particle Size Analysis of Soils: ASTM D422.
6. Plastic Limit and Plasticity Index: ASTM D4318.
7. Soil Classification: ASTM D2487.
8. In-place Moisture Content: ASTM D3017.

D. Definitions
1. Relative Compaction: In-place density divided by the maximum dry density laboratory compaction expressed as percentage.
2. Rock Excavation: Excavation of solid ledge rock that, in the opinion of the Engineer, requires for its removal drilling and blasting, wedging, sledging, barring or breaking up with power-operated tools. The term “Rock Excavation” indicates a method of removal and not a geological formation.

1.05 EXPLOSIVES

A. Do not use explosives unless specifically authorized, in writing, by the Engineer.

1.06 SUBSURFACE INVESTIGATIONS

A. Geotechnical investigations for design purposes for this project were made for the Lessalt WTP DBP Reduction Improvements Project by Earth Systems Pacific in a report dated March 17, 2011.

B. This report is available for examination by bidders from the Owner. While the records of data obtained may be considered by the Contractor to be correct, any conclusions or recommendations made in the reports are for information to the Design Engineer and are not a part of the Contract Documents. Copies of the boring logs are in the Appendix of these Specifications and their locations are shown on the Drawings.

C. The bidders may make additional subsurface investigations at the site prior to the bidding of the project. Prior to making any drillings or excavations, the bidder shall secure permission from the Owner, and property owners if on private property.

© December 2012 Kennedy/Jenks Consultants

1.07 REFERENCE SPECIFICATIONS

A. Whenever the words "Standard Specifications" are referred to, the reference is to the State of California, Department of Transportation, Standard Specifications, latest edition.

1.08 ADDITIONAL SAFETY RESPONSIBILITIES

A. The Contractor shall select, install and maintain shoring, sheeting, bracing, and sloping as necessary to maintain safe excavations. The Contractor shall be responsible for ensuring such measures: (1) comply fully with 29 CFR Part 1926 OSHA Subpart P Excavations and Trenches requirements, (2) provide necessary support to the sides of excavations, (3) provide safe access to the Engineer's sampling and testing within the excavation, (4) provide safe access for backfill, compaction, and compaction testings, and (5) otherwise maintain excavations in a safe manner that shall not endanger property, life, health, or the project schedule. All earthwork shall be performed in strict accordance with applicable law, including local ordinances, applicable OSHA, CalOSHA, California Civil Code, and California Department of Industrial Safety requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Crushed Rock: Class 2, 3/4-inch maximum aggregate base, Standard Specifications Section 26.

B. Pipe Bedding Materials:
   1. Sand: Standard Specifications, Paragraph 19-3.025B.
   2. Permeable Material: Standard Specifications, Paragraph 68-1.025 Class I, Type A.
   3. Pea Gravel: River-run, rounded pea gravel with a maximum dimension no larger than 1/2-inch, and with no more than 10% passing the No. 200 sieve. The material shall have a durability index of 40 or higher.

C. Imported Backfill: Imported nonexpansive soil with liquid limit no greater than 40% and a plasticity index no greater than 15%, free from clods or rocks larger than 2 inches in greatest dimension, and free from organic material.

D. Native Backfill: Native soil prepared as necessary to be free from clods or rocks larger than 2 inches in greatest dimension, and free from organic material.

E. Structural Backfill: Class 2 aggregate base. Moisture conditioned to a level above optimum moisture content and compacted to a minimum of 90 percent of maximum dry density.

F. Landscape Fill: Imported or native backfill free from chemicals, salts or other materials harmful to plant growth.

© December 2012 Kennedy/Jenks Consultants

G. Impervious Material: Clay with a minimum percentage of material passing the No. 200 sieve of 50%. The material shall be free of organics, rocks, or clods greater than 4 inches in diameter.

H. Water: The water used shall be reasonably free of objectionable quantities of silt, oil, organic matter, alkali, salts and other impurities. Water quality must be acceptable to the Engineer.

I. Aggregate Base: Refer to Section 02700.

J. Warning Tape: 3-inch-wide, inert, fade-resistant plastic film resistant to acids, alkalis, and other components likely to be encountered in soil. Tape shall be blue, imprinted with "CAUTION WATER MAIN BELOW", Griffolyn Terra Tape; or equal.

K. Detection Tape: Plastic metallic type consisting of a blue color coded polyethylene or melinex film, a solid core aluminum foil detection layer and other layers as required. The tape shall be resistant to acids, alkalines and other components likely to be encountered in soils. It shall be designed for both conductive and inductive locating procedures. The tape shall be blue, imprinted "CAUTION WATER MAIN BELOW, Terra Tape D" by Griffolyn Company; Detectatape by Allen Systems; or equal.

PART 3 - EXECUTION

3.01 CONTROL OF WATER

A. All excavations shall be kept free from water and all construction shall be in the dry.
   1. It should be presumed that the presence of groundwater will require dewatering operations. Furnish, install, maintain, and operate all necessary pumping and other equipment for dewatering all excavations. At all times have on the project sufficient pumping equipment for immediate use, including standby pumps for use in case other pumps become inoperable.
   2. Provide a sufficient number of pumps so as to hold the groundwater level at an elevation of not less than 1 foot below the lowest elevation of the pipe, duct or other material to be placed.
   3. Dispose of water in such a manner as to cause no injury or nuisance to public or private property, or be a menace to the public health.
   4. The dewatering operation shall be continuous, so that the excavated areas shall be kept free from water during construction, while concrete is setting and achieves full strength, and until backfill has been placed to a sufficient height to anchor the work against possible flotation.
   5. Continue dewatering during backfilling operations such that the groundwater is at least 1 foot below the level of the compaction effort at all times. No compaction of saturated materials will be allowed.
   6. Dewatering devices must be adequately filtered to prevent the removal of fines from the soil.
   7. The Contractor shall be responsible for any damage to the foundations or any other parts of existing structures or of the new work caused by failure of any part of the Contractor's protective works. After temporary protective works are no longer needed for dewatering purposes, they shall be removed by the Contractor.

© December 2012 Kennedy/Jenks Consultants

8. If pumping is required on a 24-hour basis, requiring engine drives, then engines shall be equipped in a manner to keep noise to a minimum. Refer to Section 01140 for noise control requirements.
9. Prevent disposal of sediments from the soils to adjacent lands or waterways by employing whatever methods are necessary, including settling basins.

B. The Contractor shall be responsible for furnishing temporary drainage facilities to convey and dispose of surface water falling on or passing over the site.

3.02 EXISTING UTILITIES

A. General: The known existing utilities and pipelines are shown on the Drawings in their approximate location. The Contractor shall exercise care in avoiding damage to all utilities as he will be held responsible for their repair if damaged. There is no guarantee that all utilities or obstructions are shown, or that locations indicated are accurate. Utilities are piping, conduits, wire, cable, ducts, manholes, pull boxes and the like, located at the project site and adjoining said site.

B. Check on Locations (Potholing): Contact all affected utility owners and request them to locate their respective utilities prior to the start of "potholing" procedures. The utility owner shall be given 7 days written notice prior to commencing potholing. If a utility owner is not equipped to locate its utility, the Contractor shall locate it.

C. Clearly paint the location of all affected utility underground pipes, conduits and other utilities on the pavement or identify the location with suitable markers if not on pavement. In addition to the location of metallic pipes and conduits, non-metallic pipe, ducts and conduits shall also be similarly located using surface indicators and detection tape if present and shall then be similarly marked.

D. After the utility survey is completed, commence "potholing" to determine the actual location and elevation of all utilities where crossings, interferences, or connections to new pipelines or other facilities are shown on the Drawings, marked by the utility companies, or indicated by surface signs. Prior to the preparation of piping shop drawings, or the excavating for any new pipelines or structures, the Contractor shall locate and uncover these existing utilities including services and laterals to a point 1 foot below the utility. Submit a report identifying each underground utility and its depth and location. Any variation in the actual elevations and the indicated elevations shall be brought to the Engineer's attention.

E. Excavations around underground electrical ducts and conduits shall be performed using extreme caution to prevent injury to workmen or damage to electrical ducts or conduits. Similar precautions shall be exercised around gas lines, telephone and television cables.

Excavations shall have a surface dimension of no more than 18" x 18". Air spades and vacuum excavators shall be used to limit the size of the excavation and damage to adjacent facilities. Backfill after completing potholing. In existing streets pave with 1 inch of cold mix asphalt concrete.

F. Interferences: If interferences occur at locations other than shown on the Drawings, the Contractor shall notify the Engineer, and a method for correcting said

© December 2012 Kennedy/Jenks Consultants

interferences shall be supplied by the Engineer. Payment for interferences that are not shown on the plans, nor which may be inferred from surface indications, shall be in accordance with the provisions of the General Conditions, paragraph 3.7. If the Contractor does not expose all required utilities prior to shop drawing preparation, he shall not be entitled to additional compensation for work necessary to avoid interferences, nor for repair to damaged utilities.

G. Any necessary relocations of utilities, whether shown on the Drawings or not, shall be coordinated with the affected utility. The Contractor shall perform the relocation only if instructed to do so in writing from the utility and the Engineer.

H. Shutdowns: Planned utility service shutdowns shall be accomplished during period of minimum use. In some cases this may require night or weekend work. Such work shall be at no additional cost to the Owner. Program work so that service will be restored in the minimum possible time, and shall cooperate with the utility companies in reducing shutdowns of utility systems to a minimum.
   1. Disconnections: No utility shall be disconnected without prior written approval from the utility owner. When it is necessary to disconnect a utility, the Contractor shall give the utility owner not less than 72 hours notice when requesting written approval. The Contractor shall program his work so that service will be restored in the minimum possible time.

I. Overhead Facilities: There may be existing overhead electric and telephone transmission lines at the site. These overhead utilities are not shown on the Drawings. Extreme caution shall be used when working in the vicinity of overhead utilities so as to prevent injury to workmen or damage to the utilities. The Contractor shall be required to comply with the applicable provisions of the California Construction Safety Orders when working anywhere on this project.

3.03 GENERAL CONSTRUCTION REQUIREMENTS

A. Site Access: Access to the site will be over public and private roads. Exercise care in the use of such roads and repair at own expense any damage thereto caused by Contractor's operations. Such repair shall be to the satisfaction of the Owner or agency having jurisdiction over the road. Take whatever means are necessary to prevent tracking of mud onto existing roads and shall keep roads free of debris.

B. Barriers: Barriers shall be placed at each end of all excavations and at such places along excavations as may be necessary to warn all pedestrian and vehicular traffic of such excavations.

C. Demolition of Pavement: Where trenching or excavation occurs in paved areas, the pavement shall be scored and broken ahead of the trenching or excavation operation. The extent of paving removed shall be limited to the minimum necessary for the excavation.

D. Dust Control: Take proper and efficient steps to control dust.

E. Permits: Refer to General Conditions, Paragraph 5.10.

© December 2012 Kennedy/Jenks Consultants

F. Storage of Materials: Neatly place excavated materials far enough from the excavation to prevent stability problems. Keep the materials shaped so as to cause the least possible interference with plant operations and drainage.

G. Existing Facilities: Maintain access to existing facilities to permit continued operation. Maintain access for fire-fighting equipment and to fire hydrants.

3.04 COMPACTION

A. Add water to the backfill material or dry the material as necessary to obtain moisture content within 2% of optimum. Employ such means as may be necessary to secure a uniform moisture content throughout the material of each layer being compacted.

B. After the material has been moisture conditioned, compact it with compaction equipment appropriate for the use to achieve specified compaction.

C. If the backfill material becomes saturated from rains or any other source because it was not compacted to the specified density or was not backfilled and compacted to surface grade, through negligence or otherwise, remove the faulty material and replace it with suitable material compacted to the specified density. No additional payment will be made for doing such work or removal and replacement.

D. Compaction of embankment and backfill materials by flooding, ponding or jetting is not permitted.

E. When densities of compacted materials do not meet the requirements, remove and/or recompact the material until the requirements are met. The Contractor will be backcharged the cost of retesting all failing tests, including the initial retest. Such backcharges will be deducted from the Contractor's Progress Payments.

F. Material Requirements

1. Pipe Bedding Material: Compact to a minimum 95 percent of maximum density, in accordance with AASHTO T-99 unless otherwise specified or shown on the Drawings.
2. Pipe Zone Material: Compact by hand methods under the haunches of the pipe and in areas not accessible to mechanical tampers unless otherwise specified or shown on the Drawings.
3. Imported Backfill: Compact to a minimum 95 percent of maximum density, in accordance with AASHTO T-99 unless otherwise specified or shown on the Drawings.
4. Native Backfill: Compact to a minimum 85 percent of maximum density, in accordance with AASHTO T-99 unless otherwise specified or shown on the Drawings.
5. Foundation Stabilization: Compact to a minimum 95 percent of maximum density, in accordance with AASHTO T-99 unless otherwise specified or shown on the Drawings.
6. Structural Fill: Compact in accordance with the Geotechnical Report/Engineer unless otherwise specified or shown on the Drawings.

© December 2012 Kennedy/Jenks Consultants

7. Landscape Fill: Compact to a minimum 85 percent of maximum density, in accordance with AASHTO T-99 unless otherwise specified or shown on the Drawings.
8. Impervious Material: Compact to a minimum 90 percent of maximum density, in accordance with AASHTO T-99 unless otherwise specified or shown on the Drawings.

G. Testing Frequency:
   a. Trench Backfill: Test every 200 feet of trench.
   b. Earthwork: Test every 500 square feet for each 2 feet of fill.
   c. Structural Backfill:
      1) Sub-base: Test every 200 square feet.
      2) Base:
         i. Test every 200 square feet of building footprint, with no less than 2 tests per structure.
         ii. Test every 200 cubic yards of material placed within 10 feet around the building.

3.05 SITE GRADING

A. Rough Grading: After completion of stripping, rough grade cut areas to the lines, grades and contours shown on the Drawings.

B. Scarifying: *S*carify to a minimum 6-inch depth all areas where fills are required. Moisture condition the scarified surface to within 2% of optimum water content, and compact in accordance with the requirements of Section 3.04 unless otherwise specified or shown on the Drawings.

C. Fills:
   1. Do not place any fill until the Engineer has inspected, tested to his satisfaction, and favorably reviewed the prepared subgrade.
   2. Construct fills as shown on the Drawings, true to line, grade and cross-section. Construct fills of native or imported materials. Organics, debris, and any rock or irreducible material larger than 4 inches in diameter should be removed from the fill to be compacted. Fill material shall have a plasticity index of 20 or less.
   3. Place material in approximately 8-inch-thick horizontal layers measured before compaction, and carried across the entire width to the required slopes. Compact all fills in accordance with the requirements of Section 3.04 unless otherwise specified or shown on the Drawings. Properly moisture condition before compaction.
   3. Where fills are to be made and compacted on sloping ground surfaces, steeper than 5:1, such slopes shall be benched a minimum of 6 feet horizontally as the work is brought up. Recompact material thus removed by benching along with the new embankment material.
   4. It may be necessary to overbuild slopes and trim back to the compacted core to achieve adequate compaction of slope faces.

D. Ditches: Cut ditches accurately to the cross sections and grades shown. Take care not to overexcavate ditches, and backfill excessive excavation to grade. Trim all roots, stumps, rock and other foreign matter from the sides and bottom of the ditches. Compact the surfaces of ditch slopes and bottom.

© December 2012 Kennedy/Jenks Consultants

E. Landscaped Areas: Use Landscape Fill in the top 2 feet of areas to be landscaped, compacted in accordance with the requirements of Section 3.04 unless otherwise specified or shown on the Drawings.

3.06 TRENCH EXCAVATION

A. Excavation for pipe and other utilities such as duct banks shall be in open cut. The trench shall be as wide as necessary for sheeting and bracing and the proper performance of the work up to the maximum width permitted by the typical cross-sections shown on the Drawings. The sides of the trenches shall be vertical in paved areas. The bottom of the trench shall be constructed to the grades and shapes indicated on the Drawings. Should the Contractor desire to use other equivalent methods, he shall submit his method of construction to the Engineer for favorable review prior to its use.

B. Take care not to overexcavate. Accurately grade the bottom of the trenches to provide uniform bearing and support for each section of the pipe or conduit at every point along its entire length, except for the portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints, and as hereinafter specified. Dig bell holes and depressions for joints after the trench bottom has been graded. In order that the pipe rest on the bedding for as nearly its full length as practicable, bell holes and depressions shall be only of such length, depth and width as required for properly making the joint. Remove stones as necessary to avoid point bearing.

C. Backfill and compact overexcavations in accordance with the requirements of Section 3.04 with bedding material. There shall be no additional payment to the Contractor for overexcavations not directed by the Engineer. Remove unsatisfactory material encountered below the grades shown as directed by the Engineer and replace with bedding material. Payment for removal and replacement of such unsatisfactory material directed by the Engineer shall be made in accordance with the provisions of the General Conditions.

D. Grade trenches so that they are uniformly sloped between the pipe elevations shown on the Drawings. If no elevations are shown on the Drawings, provide *[3]* feet of minimum cover. Comply with the minimum and maximum trench widths shown on the Drawings. Notify the Engineer if the trench width exceeds the maximum allowable width for any reason.

E. For all piping or conduits to be placed in any excavated and backfilled area, such as at manholes or for building connections, the structural backfill shall be first compacted to a level at least 3 feet from the top of the piping or conduit elevation and then retrenched to pipe grade.

F. Provide ladders for access to the trench by construction and inspection personnel.

3.07 EXCAVATION FOR STRUCTURES

A. All excavation for structures shall be done to the dimensions and levels indicated on the Drawings or specified herein. Excavate to such width outside the lines of the

© December 2012 Kennedy/Jenks Consultants

structure to be constructed as may be required for proper working methods, the erection of forms and the protection of the work.

B. Take care to preserve the foundation surfaces shown on the Drawings in an undisturbed condition. If the Contractor overexcavates or disturbs the foundation surfaces shown on the Drawings or specified herein, without written authorization of the Engineer, he shall replace such foundations with concrete fill or other material approved by the Engineer in a manner that will show by test an equal bearing value with the undisturbed foundation material. No additional payment will be made for the added quantity of concrete fill or other material used because of overexcavation.

C. Inspection of Excavation: Notify the Engineer when excavation for the structure is complete. No forms, reinforcing steel, concrete, or precast structure shall be placed until the excavation has been inspected by the Engineer.

D. Where unsatisfactory material is encountered below the grades shown for structural excavations, it shall be removed and replaced with selected material as directed by the Engineer and compacted. Payment for removal and replacement of such unsatisfactory material directed by the Engineer shall be made in accordance with the provisions of the General Conditions.

3.08 SUPPORT OF EXCAVATIONS

A. Adequately support excavation for trenches and structures to meet all applicable requirements in the current rules, orders and regulations. Excavation shall be adequately shored, braced and sheeted so that the earth will not slide or settle and so that all existing structures and all new pipe and structures will be fully protected from damage. Keep vehicles, equipment, and materials far enough from the excavation to prevent instability.

B. Take all necessary measures to protect excavations and adjacent improvements from running, caving, boiling, settling, or sliding soil resulting from the high groundwater table and the nature of the soil excavated. Attention is directed to Section 832 of the Civil Code of the State of California relating to lateral subadjacent supports, and wherever structures or improvements adjacent to the excavation may be damaged by such excavation, the Contractor shall comply with this law.

C. The support for excavation shall remain in place until the pipeline or structure has been completed. During the backfilling of the pipeline or structure, the shoring, sheeting and bracing shall be carefully removed so that there shall be no voids created and no caving, lateral movement or flowing of the subsoils.

3.09 TRENCH BACKFILL

A. Place bedding and backfill materials true to the lines, grades, and cross-sections indicated on the Drawings and compacted to the degree specified on the Drawings. Place bedding and backfill materials in horizontal lifts not to exceed 6 inches in thickness measured before compaction. The difference in level on either side of a pipe shall not to exceed 4 inches.

© December 2012 Kennedy/Jenks Consultants

B. Backfill material shall not be placed over the pipe or conduit until after the joints have been completed and inspected by the Engineer.

C. It shall be incumbent upon the Contractor to protect the pipe or conduit from damage during the construction period. It shall be his responsibility to repair broken or damaged pipe at no extra cost to the Owner. Carefully place backfill around and over the pipe. Tamping of backfill over the pipe shall be done with tampers, vibratory rollers and other machines that will not injure or disturb the pipe.

D. Do not allow construction traffic nor highway traffic over the pipe trench until the trench backfill has been brought back even with existing adjacent grade.

3.10 STRUCTURAL BACKFILL

A. Crushed Rock Subgrade: Place a layer of rock, compacted in accordance with the requirements of Section 3.04, under structures to the lines, grades and minimum thicknesses shown on the Drawings. Unless shown specifically otherwise in the Drawings, do not use rock as backfill above the elevation of the highest base slab of the structure.

B. Backfill Adjacent to Structures:
   1. Backfill shall be Class 2 Aggregate Base, as shown on the Drawings, compacted in accordance with the requirements of Section 3.04 unless otherwise specified or shown on the Drawings.
   2. Do not place backfill against structures until the concrete has been patched and cured.
   3. Do not place backfill against structures until at least 28 days after the concrete was placed, or until the concrete has achieved a strength of at least 2,500 psi, whichever is earlier. Concrete strength shall be demonstrated by field cured cylinders tested at the Contractor's cost, prepared and tested in accordance with ASTM C31 and ASTM C39.
   4. Do not place backfill against hydraulic structures until the structure has passed the specified leakage tests.
   5. Place backfill in uniform, level layers, not exceeding 8 inches thick measured before compaction. Bring backfill up uniformly on all sides of the structure, and on both sides of buried walls.

3.11 FINISH GRADING

A. Finish grade the site to the elevations shown on the Drawings. Finish grading shall be uniform and pleasing and shall provide drainage from all areas to collection points. The finished surfaces shall be smooth and compacted.

3.12 DISPOSAL OF EXCAVATED MATERIAL

A. Dispose of unsuitable material or excavated material in excess of that needed for backfill or fill offsite in accordance with the requirements of Section 01140.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 02700

PAVING AND SURFACING

PART 1 - GENERAL

1.01 SUMMARY

A. Furnishing all labor, material, equipment, tools, and services required for the placing and compacting of asphalt concrete pavement for airfields, roadways, parking lots, and walkways to the lines, grades, and dimensions shown on the Drawings and as specified herein.
   1. Also included shall be the repair and resurfacing of existing roadway and area paving damaged or removed during construction.
   2. Also included shall be applying penetration treatment to aggregate base surfaces shown on the Drawings.

B. Related Sections: Repair or replace concrete curbs, gutters and sidewalks damaged by the work in accordance with Section 02775.

1.02 REFERENCE SPECIFICATIONS

A. Whenever the words "Standard Specifications" are referred to, the reference is to the State of California, Department of Transportation, Standard Specifications, latest edition.

B. ASTM International (ASTM):
   1. D422 Test Method for Particle-Size Analysis for Soils
   2. D1556 Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
   3. D2027 Specification for Cutback Asphalt (Medium Curing Type)
   4. D2922 Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

C. California Department of Transportation (CALTRANS):
   1. California Test 216 Method of Test for Relative Compaction of Untreated and Treated Soils and Aggregates
   2. California Test 231 Method of Test for Relative Compaction of Untreated and Treated Soils and Aggregates by the Area Concept Utilizing Nuclear Gauges

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Submit the following under the Product Information category.
   1. Samples: Furnish, without additional cost to the Owner, such quantities of construction materials as may be required by the Engineer for test purposes. The Contractor shall cooperate with the Engineer and furnish necessary facilities for sampling and testing of all materials and workmanship. All materials furnished and all work performed shall be subject to rigid

© December 2012 Kennedy/Jenks Consultants

inspection, and no materials shall be used in the construction work until it has been inspected by the Engineer.

2. Submit a signed verification from each source of supply for each construction material employed on this project indicating that the materials meet the Specification requirements.
3. Mix design for asphalt concrete.
4. Submit manufacturer's certification of the actual volatile organic compound (VOC) content for all pavement paints and bituminous pavement sealers proposed for use on this project. Submit certification of the actual VOC content for coatings manufactured after 1 September 1987. For coatings manufactured before 1 September 1987, submit VOC content and date of manufacture. VOC content shall be measured in grams per liter by weight of coating as applied excluding water and color added to the tint base.
5. Submit verification that bituminous pavement sealers and paint products furnished meet applicable local Air Quality Management District (AQMD) regulations as to allowable VOC content for the time and place of application and use intended.

1.04 QUALITY ASSURANCE

A. Comply with "Standard Specifications" of State of California, Department of Transportation (CALTRANS, latest edition).

B. All pavement stripe painting shall be performed by competent and experienced Equipment operators and painters using proper equipment, tools, stencils, templates, and shields in a workmanlike manner.

1.05 REGULATORY REQUIREMENTS

A. All work, material, procedures and practices under this Section shall conform to requirements of the California Air Resources Board (CARB) and the AQMD.

PART 2 - PRODUCTS

2.01 ASPHALT CONCRETE

A. Asphalt Concrete Type A, Type B, Type C, OR Open Graded 3/4-inch, OR ½-inch OR No. 4 maximum coarse or medium size shall conform to the applicable requirements of Section 39 of the Standard Specifications. Asphalt binder shall be paving asphalt or liquid asphalt (cutback). Mineral filler shall consist of portland cement or mechanically reduced rock. Proportioning shall be as set forth in Paragraph "D" below.

B. Paving asphalt PG 64-16 conforming to the requirements of Section 92 of the Standard Specifications shall be used as the asphalt binder. Bitumen ratio shall be selected by the supplier in accordance with the tests specified in Paragraph 39-3.04 of the Standard Specifications.

C. Liquid asphalt (cutback) MC-800 or SC-800 conforming to the requirements of Section 93 of the Standard Specifications shall be used as the asphalt binder.

D. Mineral filler shall be mechanically reduced rock, conforming to the following gradations when tested in accordance with ASTM D422:

© December 2012 Kennedy/Jenks Consultants

Particle Size	Percentage
Passing No. 200 sieve	75-100
Finer than 0.05 mm	65-100
Finer than 0.02 mm	35-65
Finer than 0.01 mm	26-35
Finer than 0.0005 mm	10-22

E. Mix Design:

Mix	Type	Grade	Binder Content (%)
Normal	A	3/4" max.	4.5 to 6.5
Patching	A or B	No. 4 max.	4.8 to 7.5
Open graded	--	3/8" max.	5.0 to 8.0

2.02 TACK COAT

A. Material for tack coat shall be SS-1, SS-1h or CSS-1 OR CSS-1h grade emulsified asphalt conforming to Section 94 of the Standard Specifications.

2.03 FOG SEAL

A. Fog seal shall be SS-1, SS-1h, CSS-1, or CSS-1h asphaltic emulsion fog seal conforming to the requirements of Sections 37 and 94 of the Standard Specifications.

2.04 PRIME COAT (PENETRATION TREATMENT)

A. Material for prime coat shall be liquid asphalt SC-70, SC-250, MC-70 OR MC-250 conforming to the requirements of Sections 92 and 93 of the Standard Specifications and ASTM D2027.

2.05 SLURRY SEAL

A. Slurry seal shall be SS1h OR CSS1h asphaltic emulsion, cationic quick-setting type, conforming to the requirements of Section 37-2 and Section 94 of the Standard Specifications. Aggregate shall conform to Type II OR Type I OR Type III may be substituted. Asphalt emulsion shall be 14% to 18% of aggregate weight.

2.06 HEADERS

A. At straight sections, wood headers shall be constructed of 2-inch by 6-inch construction heart redwood, held in place by 2-inch by 4-inch stakes, of the same materials, 2 feet long and set at 8-foot centers.

B. At curved sections, wood headers shall be constructed of three ½-inch by 4-inch construction heart redwood bender boards. Boards shall be lapped at one-third of the length of individual boards, with no two boards lapped at the same place. Hold boards in place with stakes same as above.

© December 2012 Kennedy/Jenks Consultants

2.07 AGGREGATE BASE

A. Aggregate base shall conform to the applicable requirements of the Standard Specifications Section 26, for Class 2 or 3 aggregate base. The aggregate base shall conform to that specified for the 1-1/2-inch OR ¾-inch maximum, unless otherwise indicated. Paragraphs 26-1.06 and 26-1.07 are not applicable.

2.08 PARKING STRIPES

A. Parking stripes paint shall be non-reflective Sherwin Williams Series 338-116(W), 338-117(Y) and 338-333(B), or Pervo Paint Company No. 4773-A(W), 4473-4A(Y) and 473-5A(B). Paint shall be stored at the project site in the manufacturer's sealed and labeled containers. Labels shall clearly identify the manufacturer, specification number, batch number, intended use, quantity and contract number.

2.09 TRAFFIC STRIPES AND PAVEMENT MARKINGS

A. Thermoplastic material and glass beads shall comply with paragraphs 84-2.02 and 84-2.03 of the Standard Specifications.

2.10 TEMPORARY PAVEMENT (COLD MIX)

A. Temporary pavement shall consist of No. 4 sieve maximum aggregate size, graded in accordance with Section 39 of the Standard Specifications. The aggregate shall be blended with 5-8% SC-800 liquid asphalt.

2.11 LIQUID ASPHALT DISTRIBUTOR

A. The distributor used in applying all liquid asphalt shall be of the self-propelling type, of sufficient power and capacity to apply the asphalt under pressure uniformly and at the proper rate with not more than 10% variation therefrom. The distributor shall be equipped with tachometer and charts, pressure gauge, thermometer well, and thermometer; and shall have adjustable length spray bars of sufficient length to cover one-half of the roadbed at one time. The spray bars shall be adjustable vertically to permit application of the asphalt at the height above the surface approved by the Engineer and shall be of the full-circulating type with satisfactory cutoff device at each nozzle. The use of trailer-type distributors shall not be permitted.

B. A trough shall be located under the sprays, properly arranged to be swung out of the way after the sprays are operating in a uniform manner at the desired pressure or, in lieu thereof, building paper shall be spread over the treated surface for a sufficient length back so that the sprays are operating properly when the uncovered surface is reached. The building paper shall then be removed and disposed of. If the cutoff is not sufficiently positive, the similar use of paper may be required at the end of the area being covered. The distributor shall be operated in such a manner that liquid asphalt will not be splashed on adjacent guardrails or structures. Any asphalt so splashed may be removed at the expense of and by the Contractor.

© December 2012 Kennedy/Jenks Consultants

PART 3 - EXECUTION

3.01 GENERAL

A. This Specification shall cover newly paved areas as well as existing pavement restoration.

B. Where trenching or other construction activity has resulted in damage to a localized area of pavement, the damaged pavement shall be cut back 6 inches and shall be removed and replaced.

C. Where the damaged area extends over more than 50% of the road width or paved area, as determined by the Engineer, the full pavement width or area shall be cut away, removed and repaired.

D. Structures such as valve boxes, manhole frames and covers, and electrical vaults shall be adjusted to grade as necessary within paved areas.

E. Existing asphalt pavement islands of 50 ft^2 or less and strips 18 inches or less in width shall be removed and replaced.

F. Adjust existing manholes, meter boxes, cleanouts, etc. to match the new grade.

3.02 PAVEMENT CUTTING

A. After backfilling and prior to paving, proper tools and equipment shall be used in marking and breaking so that the pavement shall be cut accurately and on neat lines parallel to the trench. The asphalt pavement shall be saw cut (using a concrete saw) to a minimum depth equal to or greater than one-half the thickness thereof. The pavement shall be cut back 6 inches on each side of the trench or excavation wall. Any pavement damaged outside these lines shall be re-cut and restored at the expense of the Contractor. Should voids develop under existing pavements during construction, those affected pavements shall be neatly saw cut in straight lines and replaced after the voids have been filled.

B. Construct joints between successive runs vertical and at right angles to the line of the improvement. Exercise care in construction of all joints to ensure that the surface of the pavement is true to grade and cross-section. Lapped joints will not be permitted.

3.03 PLACEMENT OF AGGREGATE BASE

A. Subgrade Preparation: The subgrade shall be watered or dried as required to bring the soil, as close as practicable, to the optimum moisture content for proper compacting and then compacted, as specified, to a relative compaction of not less than 95% in the upper 6 inches. When compaction of the subgrade areas on fill and embankments has been properly obtained, only such additional rolling will be required as necessary to obtain a thoroughly compacted subgrade immediately prior to placing the aggregate base thereon.

B. Aggregate Base Tolerance: The aggregate base shall not be placed before the subgrade is approved by the Engineer. The finished aggregate base shall not vary more than 0.05-foot above, nor 0.10-foot below, the planned grade.

C. Aggregate Base Placing: The aggregate base material shall be spread on the prepared subgrade by means of approved spreading devices subject to approval by the Engineer; the aggregate base material may be dumped in piles upon the

© December 2012 Kennedy/Jenks Consultants

subgrade and spread by bulldozing ahead from the dumped material. Each layer shall not exceed 0.50 feet. Segregation of large or fine particles of aggregate shall be avoided, and the material as spread shall be free from pockets of large and fine material.

D. Compaction: The relative compaction of each layer of compacted aggregate base material shall not be less than 95% as determined by California Test 216 or ASTM D1556 (Sand Cone), or California Test 231 or ASTM D2922 (Nuclear method when approved by the Engineer). Compaction shall be in accordance with Section 26-1.05 of the Standard Specifications. Aggregate base, after compaction, shall be watered as provided in Section 17 of the Standard Specifications. Paragraph 17-1.04 is not applicable.

3.04 PRIME COAT APPLICATION

A. Prime Coat: In advance of spreading paving materials, a prime coat of liquid asphalt shall be applied to all base course surface areas to be covered with asphaltic concrete.
   1. Preparation of Base Course: Immediately before applying the prime coat, the area to be surfaced shall be cleaned of all loose material by means of hand brooms.
   2. Application: Liquid asphalt shall be applied by pressure distributors at a temperature between 125 and 200°F. The Engineer reserves the right to require an adjustment of the temperature of the liquid asphalt at the time of placement. The rate of application shall be between 2/10 and 3/10 gallon per square yard. Excess liquid asphalt, which has failed to penetrate the base, shall be covered with fine sand. All loose sand shall be removed from the treated areas before placing any surfacing material thereon. Liquid asphalt shall not be applied when the atmospheric temperature is below 50°F. The prime coat shall be applied at least 24 hours in advance of paving. Immediately in advance of paving asphalt concrete surfacing, additional prime coats shall be applied, as directed by the Engineer, to areas where the prime coat has been damaged.

3.05 TACK COAT APPLICATION

A. Tack Coat: In advance of spreading bituminous material upon an existing bituminous or portland cement concrete surface, a tack coat shall be applied to all areas to be surfaced and to all vertical surfaces of existing pavement, curb, gutters and construction joints in the surfacing against which additional material is to be placed. When two or more lifts of asphaltic concrete are required, a tack coat shall be applied between each lift.
   1. Preparation: Immediately before applying a tack coat, the area to be surfaced shall be cleaned of all loose material.
   2. Application: The tack coat shall be applied by means of pressure distributors by pressure hand-spray equipment. The rate of application shall be 1/20 gallon per square yard. Emulsified asphalt shall not be applied when the atmospheric temperature is below 40°F. If emulsified asphalt Type SS-1 is used, it may be diluted with an equal part of water. The rate of application of the dilution shall be such that the rate of application of undiluted emulsion shall be within the tolerances specified.

© December 2012 Kennedy/Jenks Consultants

3.06 PLACEMENT OF ASPHALT CONCRETE

A. Delivery and Spreading: Bituminous mixtures shall be delivered to the roadbed at temperatures specified in the Standard Specifications. Spreading of the mixture shall be in accordance with Section 39 of the Standard Specifications. Paragraph 39-8 does not apply. All loads shall be covered with tarpaulin or other material during transportation. The top layer of asphalt concrete shall not exceed 0.20 feet in compacted thickness. The next lower layer shall not exceed 0.25 feet in compacted thickness, and any lower layers shall not exceed 0.50 feet in compacted thickness.

B. Compaction: Initial or breakdown rolling and the final rolling of the uppermost layer of the asphalt concrete shall be compacted in accordance with Section 39 of the Standard Specifications. Paragraph 39-8 does not apply. Compaction by vehicular traffic shall not be permitted. The Engineer reserves the right to require an adjustment of the temperature of the asphalt concrete at the time of placement.

C. Pavement Thickness: Pavement shall match the existing adjoining pavement in thickness, or as indicated on the Drawings, or as specified, whichever is greater.

D. Joining Pavement: The joints between old and new pavements or between successive days' work shall be carefully made in such manner as to ensure a continuous bond between old and new sections of the course. Edges of existing pavement shall be exposed and cleaned and edges cut to straight, vertical surfaces. All joints shall be painted with a uniform coat of tack coat before the fresh mixture is applied.

E. Protection of Pavement: After final rolling, no vehicular traffic of any kind shall be permitted on the pavement until it has cooled and hardened and in no case less than 6 hours.

3.07 APPLICATION OF FOG SEAL

A. A fog seal shall be applied to the upper surfaces of all installed asphalt concrete. It shall be applied in accordance with the applicable requirements of Section 37, BITUMINOUS SEALS, of the Standard Specifications, Seal Coats. Subparagraphs 37-1.08 and 37-1.09 are not applicable.

3.08 PAVEMENT RESTORATION

A. Final pavement restoration shall be made as soon as practicable after backfilling. In that period of time between backfilling and final pavement restoration, the trench shall be maintained level with the adjacent pavement and shall be covered with a 1-inch minimum layer of cutback. Prior to placing the final pavement, the temporary pavement shall be removed, the aggregate base excavated to the lines indicated on the Drawings, and the existing pavement edges saw cut as herein specified. The final asphalt pavement shall not be placed before the primed aggregate base surface is approved by the Engineer.

3.09 PENETRATION TREATMENT APPLICATION

A. Preparation of Base Aggregate Surface: Immediately before applying the first coat of the penetration treatment, the area to be treated shall be cleaned of all loose material.

B. Application:

© December 2012 Kennedy/Jenks Consultants

1. The penetration treatment shall be applied in three applications. The first application shall be applied at the rate of 0.5 gallon per square yard, and the second and third applications shall be applied at the rate of 0.25 gallons per square yard. The second and third application shall be placed two to three weeks apart as approved by the Engineer and after the previous applications have thoroughly penetrated the base.
2. Liquid asphalt shall be applied by pressure distributors at a temperature between 140 and 255°F. The Engineer reserves the right to require an adjustment of the temperature of the liquid asphalt at the time of placement. Excess liquid asphalt, which has failed to penetrate the base in the third application, shall be covered with fine sand. Liquid asphalt shall not be applied when the atmospheric temperature is below 50°F.

3.10 SLURRY SEAL APPLICATION

A. A slurry seal shall be applied to the upper surface of all existing asphalt pavement prior to placing of the overlay. If the slurry seal is placed shortly before the overlay, and is cured, a tack coat may not be required. The slurry seal shall be applied in accordance with the applicable requirements of Section 37-2 of the Standard Specifications. Subparagraphs 37-2.07 and 37-2.08 are not applicable.

3.11 HEADERS

A. Install wood headers along pavement edges bordered by soil. Install new headers where existing wood headers are damaged during construction, or removed for construction. Install headers with uniform slope between spot elevation indicated on the Drawings or to conform to existing grades.

3.12 PAVEMENT MARKINGS

A. Preparation: Immediately before applying the paint, the pavement surface shall be thoroughly cleaned of all dust, dirt, scale, curing compound, oil, grease, or other objectionable matter as directed by the Engineer. Solvent material that will damage the pavement shall not be used as a cleaning agent.

B. Tolerances: Marking and striping shall be within 2 inches of the correct alignment. Dimensions of marking and stripings shall be within ½-inch.

C. Mixing: Mechanical mixers shall be used to mix paint. Prior to applying, the paint shall be mixed a sufficient length of time to thoroughly mix the pigment and vehicle together, and shall be kept thoroughly agitated during its application.

D. Application: Pavement marking shall be applied only on dry surfaces and only during periods of favorable weather. Painting shall not be performed when the atmospheric temperature is below 40°F when using solvent-borne paint or below 50°F when using water borne paint; when freshly painted surfaces may become damaged by rain, fog, or condensation; nor when it can be anticipated that the atmospheric temperature will drop below said 40°F or 50°F temperatures during the drying period.
1. Immediately following the preparation of the pavement, the paint shall be applied. The paint shall be applied at the rate of 100 to 110 square feet per gallon of paint. The stripe painting machine shall have a compressor capacity of at least 105 cubic feet per minute and be capable of operating at an air pressure of 125 psi. The paint shall be mechanically agitated while the

© December 2012 Kennedy/Jenks Consultants

machine is in operation. The striping machine shall be equipped with a guide post so designed that the machine will hold exactly to the alignment. The propelling vehicle shall be equipped with a guide post so designed that the machine will hold exactly to the alignment. The propelling vehicle shall be equipped with a speedometer or tachometer, and with a suitable device for determining the quantity of paint in the container. The paint container and spray nozzles on the machine shall be thoroughly cleaned before starting each day's work. The stripe shall be of the required width, with clean, true edges and without sharp breaks.

2. Allow 10 days between the application of a bituminous seal coat and the permanent pavement marking. The paint shall not bleed, curl or discolor when applied to bituminous surfaces. If bleeding or discoloring occurs, apply an additional coat of paint.
3. Remove existing permanent or temporary markings and striping which are to be abandoned or obliterated, by wet sandblasting or other favorably reviewed methods. Dry sandblasting may be used in selected areas only with prior approval of the Engineer and with approval of the air pollution control authority having jurisdiction over the area in which the work will be performed. Obliteration of traffic striping with black paint or light emulsion oil shall be done only with the prior favorable review shall not be used as a removal agent.

E. Provide all warning devices required to protect the painting operation and the finished work. Repaint, to the applicable specifications, any portion of the stripe damaged by any type of traffic within 24 hours after the stripe has been applied. For striping less than 50 feet in length, favorably reviewed portable painting equipment may be used.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 02775

CONCRETE CURB, GUTTERS, AND SIDEWALKS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Provide concrete curbs, curbs and gutters, gutters, and sidewalks as shown on the Drawings and as specified herein.

1.02 REFERENCE SPECIFICATIONS

A. Wherever the words "Standard Specifications" are referred to, the reference is to the State of California, Department of Transportation, Standard Specifications latest edition.

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Submit certificate of compliance indicating that the concrete complies with the specifications as Product Information submittals.

PART 2 - PRODUCTS

2.01 CONCRETE

A. Comply with the Standards Specifications, Paragraph 73-1.01.
   1. Cement: Type II Modified.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with the Standard Specifications, Section 73, Paragraphs 1.02 through 1.06, inclusive.

B. Unless shown otherwise on the Drawings, replace existing curbs, curbs and gutters, gutters and sidewalks in kind.

C. Adjust structures such as valve boxes, manhole frames and covers, and electrical vaults to grade after the curb and gutter or sidewalk has been constructed for a reasonable distance on all sides of the structure. Complete the concrete work after the structure is adjusted.

@ December 2012 Kennedy/Jenks Consultants

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 02820

FENCES AND GATES

PART 1 - GENERAL

1.01 SUMMARY

A. All materials and work required for the furnishing and installation of barbed wire fence, chain link fence, gates, barbed wire and appurtenances, including temporary fence.

B. Related Sections:
   1. Section 03300: Cast-In-Place Concrete

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. A53 Specification for Pipe, Steel Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
   2. A121 Specification for Zinc-Coated (Galvanized) Steel Barbed Wire
   3. A702 Specification for Steel Fence Posts and Assemblies

B. State of California, Department of Transportation, Standard Specification, latest edition (Standard Specification)

1.03 STANDARD SPECIFICATIONS

A. All work and materials shall conform to the requirements of Section 80 of the Standard Specifications, except as modified herein. Paragraphs 80-3.03, 80-3.04, 80-4.03 and 80-4.04 do not apply. In case of any conflict between the Standard Specifications and the Contract Plans and Specifications, the latter shall control.

1.04 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Submit in the Product Information category complete descriptive information and technical specifications on the chain link fence, gates, gate operators, barbed wire and appurtenances.

PART 2 - PRODUCTS

2.01 TEMPORARY FENCING

A. Temporary fencing shall consist of hot-dip galvanized or painted steel, or pretreated or untreated wood posts and braces of suitable length and strength to provide for cantilever support of 5 strands of barbed wire with top strand placed 4 feet above the ground surface. Bottom wire shall be not more than 9-1/2 inches above ground

@ December 2012 Kennedy/Jenks Consultants

surface and the remaining strands between top and bottom strands shall be equally spaced.

B. Materials:
   1. Steel fence posts and assemblies shall conform to ASTM A702. Posts and assemblies shall be T-shape Class B steel with anchor plates, painted or hot-dip galvanized and not less than 7-1/2 feet long. The anchor plate may be omitted if the posts and assemblies are firmly embedded to a minimum depth of 3 feet in a concrete footing with a minimum diameter of 6 inches.]
   2. Pretreated wood posts shall conform to Section 80-3.01B (2) of the Standard Specifications.
   3. Untreated wood posts shall conform to Section 80-3.01B (1) of the Standard Specifications.
   4. Barbed wire shall conform to ASTM A121, Class 3, 12-1/2 gauge wire with 4-point round barbs.

2.02 BARBED WIRE FENCING

A. Barbed wire fencing shall consist of hot-dip galvanized or painted steel, or pretreated wood posts and braces of suitable length and strength to provide for cantilever support of 5 strands of barbed wire with top strand placed 4 feet above the ground surface. Bottom wire shall be not more than 9-1/2-inches above ground surface and the remaining strands between top and bottom strands shall be equally spaced.

B. Materials:
   1. Steel fence posts and assemblies shall conform to ASTM A702. Posts and assemblies shall be T-shape Class B steel with anchor plates, painted or hot-dip galvanized and not less than 7-1/2 feet long. The anchor plate may be omitted if the posts and assemblies are firmly embedded to a minimum depth of 3 feet in a concrete footing with a minimum diameter of 6 inches.
   2. Pretreated wood posts shall conform to Section 80-3.01B (2) of the Standard Specifications.
   3. Barbed wire shall conform to ASTM A121, Class 3, 12-1/2 gauge wire with 4-point round barbs.

2.03 CHAIN LINK FENCING

A. Chain link fence fabric shall be 8 feet high and shall conform to Section 80-4.01B of the Standard Specifications except that larger mesh shall be provided as required to accommodate redwood privacy slats where slats are shown on the Drawings. Fabric shall have twisted top and knuckled bottom selvages.

B. Unless otherwise shown on the Drawings, the fence shall have top and bottom tension wires, and outbound extension arms with three strands of barbed wire.

C. Fence posts, braces and top rails shall be Schedule 40 galvanized steel pipe ASTM A53. Line posts shall be 2 and 1/2 inches in diameter. Corner and end posts shall be 4 inches in diameter. Gate posts shall be a minimum of 6 inches in diameter. Braces and top rails shall be 1-1/4-inches in diameter. Posts shall have galvanized caps to exclude moisture. Truss rods shall be 3/8-inch-diameter

galvanized steel. Turnbuckles, tension wires, tie wires and hog rings shall conform to Section 80-4.01C of the Standard Specifications.

D. Barbed wire shall conform to ASTM A121, Class 3, 12-1/2 gauge wire with 4-point round barbs.

E. Redwood privacy slats shall be installed in the chain link fabric where shown on the Drawings. Slats shall be rough cut 3/8-inch x 2-3/8-inch redwood in lengths to equal the fence height.

F. Concrete foundations for fence posts shall be as detailed on the Drawings and as specified in Section 03300.

2.04 GATES

A. Gates shall be installed in the sizes and at the locations as shown on the Drawings.

B. Unless shown otherwise on the Drawings, gates for temporary fences and barbed wire fences shall be of the "cowboy" type as detailed for barbed wire fence gateways on the State of California, Department of Transportation, Standard Plans, latest edition, Plan A86.

C. Unless shown otherwise on the Drawings, gates in chain link fences, or chain link gates in barbed wire fences, shall be of the same height as the adjacent fence. Fabric shall conform to Section 80-4.01B of the Standard Specifications. Gates shall be in accordance with Section 80-4.01D of the Standard Specifications, except as modified herein. Gate frames shall be of all welded construction and shall be hot-dip galvanized after construction. Top and bottom horizontal rails and vertical end members shall be 1-1/2-inch-diameter Schedule 40 steel pipe. On gates more than 8 feet wide, equally spaced interior vertical members of 1-1/2-inch-diameter Schedule 40 steel pipe shall be added such that no gate frame panel will be more than 8 feet wide. Gate frames shall have 3 strands of barbed wire across the top. Gates shall be furnished complete with all necessary hardware, including hinges, latches and stops.
   1. Swinging Gates: All swinging gate panels shall be cross trussed with 3/8-inch-diameter truss rods with turnbuckles. Gates shall be hinged to swing open 180 degrees. All gates shall be furnished with a keeper and a plunger-bar type latch with provision for a padlock. On double swing gates the plunger-bar shall drop into a buried center stop when the gate is closed. Latches and padlocks shall be accessible from both sides of the gate.
   2. Rolling Gates: All gate frames shall have 1-inch Schedule 40 steel pipe diagonal braces inside each gate panel. Diagonal braces shall be installed such that the high end of the braces shall be toward the forward end of the gate as the gate rolls closed (i.e., high end of the braces toward the end of the gate that rolls on the ground and low end of the braces toward the end of the gate that is supported on the adjacent stationary fence). Gates shall have two wheels that travel on two 1-1/4-inch-diameter Schedule 40 galvanized steel pipe rails attached to the adjacent stationary fence. These rails shall have stops to prevent the gate wheels from rolling off the back end of the rails when the gate is fully opened. The opposite end of the gate shall have a rubber

@ December 2012 Kennedy/Jenks Consultants

wheel on grade and a grooved wheel that travels on a 2-inch by 2-inch steel angle inverted and set in the pavement. A 1-inch by 1-inch galvanized steel angle shall be welded to the back of the gate frame to support the operator drive chain. Coordinate with the gate operator manufacturer.

PART 3 - EXECUTION

3.01 TEMPORARY FENCING

A. Where it is necessary to temporarily remove or alter portions of the existing fence, the Contractor shall install adequate bracing to maintain original tension in the remaining fence. Temporary fencing shall be installed to maintain security. The fencing shall be of adequate design to prevent inadvertent access by either people or livestock. Upon completion of the work, remove the temporary fencing and rebuild and restore all fences to their original position, or revised position as shown on the Drawings, using all new material. Salvaged existing materials may be used if undamaged and if approved by the Engineer.

3.02 REMOVAL AND SALVAGING OF EXISTING FENCING

A. General: Fencing shall be removed as noted on the Drawings. The fencing to be removed is in satisfactory condition to be salvaged and relocated.

B. Salvaging: The Contractor shall remove and stockpile fabric, posts and accessories identified by the Engineer as salvageable in such a manner as to assure that no damage will be incurred. Should the Engineer determine that the salvaged posts have been bent, that the zinc coating on any of the salvaged materials has been scratched, or that the salvaged fencing materials have been otherwise damaged, they shall be replaced by new materials at no cost to the Owner.

3.03 INSTALLATION OF BARBED WIRE FENCING

A. Install barbed wire fencing and gates at the locations shown on the Drawings and in accordance with Section 80-3.02 of the Standard Specifications.

B. Corner, end, gateway and pull post assemblies shall be as detailed on the State of California, Department of Transportation, Standard Plans, latest edition, Plan A86.

C. Barbed wire shall be stretched with mechanical equipment. When attaching barbed wire to wooden line posts, do not drive staples tight. The wire shall always be free to move through the staple at line posts. Do not place staples over or adjacent to barbs at wooden line posts. Drive staples tight at wooden corner, end and pull post assemblies.

D. Allow concrete post footings to cure for seven days before installing fence.

E. Surplus excavated material remaining after the fence has been constructed shall be disposed of as specified in Section 01140.

@ December 2012 Kennedy/Jenks Consultants

3.04 INSTALLATION OF CHAIN LINK FENCING

A. Install chain link fencing and gates at the locations shown on the Drawings and in accordance with Section 80-4.02 of the Standard Specifications. Chain link fabric and barbed wire shall be stretched with mechanical equipment.

B. The area to be fenced shall be uniformly and smoothly finish graded before beginning the fence installation. Fence shall be installed after roadway surfacing has been completed. Except where crossing a drainage ditch, the finish grade shall not deviate from a straight line by more than 3 inches. Where crossing a drainage ditch, a line post shall be provided at the top of slope on each side and the fabric shall follow a straight line between the posts. Within the ditch, short post sections shall be embedded to a depth of 4 feet at a maximum spacing of 12 inches on center across the ditch. Posts shall be long enough to overlap the fabric by 12 inches, and each post shall be fastened to the fabric by a minimum of 3 tie bands.

C. Corner and end post assemblies and the panels on each side of all gates shall be as detailed on the State of California, Department of Transportation, Standard Plans, latest edition, Plan A85. Line posts at 1,000-foot maximum intervals shall have top braces and cross truss rods with turnbuckles as detailed on Standard Plan A85 even though fabric is stretched with mechanical equipment. Top brace shall remain in place after fence is completed.

D. All posts shall be embedded into the ground in concrete footings as shown on the Drawings. Install fence posts at 6-foot maximum spacing in the area of travel of rolling gates. Allow concrete footings to cure for seven days before installing fence.

E. Fence fabric shall be securely fastened to the outward side of the posts with the lower edge at the ground level. Fencing and gates shall be properly braced to prevent sagging. Redwood privacy slats shall be installed vertically.

F. Demonstrate that all gates swing smoothly or roll freely without binding or dragging, that all gates are lockable, and that all gate hardware operates properly. Demonstrate that all automatic gate operators function properly.

G. Surplus excavated material remaining after the fence has been constructed shall be disposed of as specified in Section 01140.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

@ December 2012 Kennedy/Jenks Consultants

SECTION 03100

CONCRETE FORMS AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Permanent and temporary forms and falsework for structural and architectural cast-in-place concrete and formwork accessories including form liners, coatings, and form ties.

B. Related Sections:
   1. Section 03150: Concrete Joints and Accessories
   2. Section 03200: Reinforcing Steel
   3. Section 03300: Cast-in-Place Concrete

1.02 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 117 Standard Tolerances for Concrete Construction and Materials
   2. ACI 301 Specifications for Structural Concrete for Buildings
   3. ACI 306 Guide to Cold Weather Concreting
   4. ACI 318 Building Code Requirements for Structural Concrete
   5. ACI 347 Guide to Formwork for Concrete

B. American Plywood Association (APA):
   1. Material grades and designations as specified in this Section.

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data:
   1. Formwork products:
      a. Forms, if fabricated off construction site.
      b. Form ties or through-bolts.
      c. Form coatings.
   2. Miscellaneous products: Submit technical data including installation instructions, independent laboratory test reports (ICC), handling and storage instructions.
      a. Form release agent.
      b. Form ties.

C. Shop Drawings:
   1. Layout and sequence for reshoring suspended concrete slabs and beams.

1.04 QUALITY ASSURANCE

A. Contractor Qualifications: See Section 03300.

© December 2012 Kennedy/Jenks Consultants

B. Construction Standard: Applicable requirements of the CBC, ACI 301, ACI 318, and ACI 350.

C. Concrete Products and Materials Tests: Certified by independent commercial testing laboratories. Submit certification on cementitious products and aggregates performed within the past 6 months.

1.05 SYSTEM DESCRIPTION

A. As used in this section, exposed concrete is wall, slab, beam or column concrete which will have surfaces exposed to view in the finished work (for treatment of "exposed surfaces" see Specification Section 03350).

B. Design Requirements:
   1. Forms and shoring shall be designed by a professional civil engineer registered in the State of California.
   2. Formwork shall be designed in accordance with the requirements of ACI 301, ACI 318, and ACI 347 and shall comply with all applicable regulations and codes.
   3. The design shall consider any special requirements due to the use of plasticized and/or retarded set concrete. Should satisfactory concrete placement require any changes in concrete mix design, the formwork shall be re-designed and modified as required for the changed mix designs.

C. Performance Requirements: Design forms to construct a flat, uniform concrete surface requiring minimal finishing or repairs. Form design shall accommodate all of concrete mix designs being used by the Contractor.
   1. Furnish all labor, materials, equipment and incidentals required and design, install and remove formwork for cast in place concrete as shown on the Drawings and as specified herein.
   2. Secure to forms as required or set for embedment as required, all miscellaneous metal items, sleeves, reglets, anchor bolts, inserts and other items furnished under other Sections and required to be cast into concrete.

1.06 DELIVERY, STORAGE AND HANDLING

A. Lumber: Store all lumber, including plywood for forms, to prevent direct contact with the ground. Protect the stored lumber from the elements by a suitable covering, such as polyethylene film or waterproof building paper, suitably held in place.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide new materials meeting the requirements referenced in this Section.

2.02 FORMS

A. Forms for cast-in-place concrete shall be made of clean, smooth surfaces of wood, plywood, metal, or other approved material. Construct wood forms of sound lumber or plywood of suitable dimensions and free from knotholes and loose knots. Where used for exposed surfaces, dress and match boards.

© December 2012 Kennedy/Jenks Consultants

B. Provide forms for exposed concrete surfaces with a clean, smooth plywood or metal face. Exposed concrete surfaces include: beams, columns, slabs, interior and exterior walls, and surfaces of tank, chamber and tunnel walls, except those in contact with earth.

C. Furnish plywood with a waterproof, synthetic resin bonded face manufactured for formwork. Furnish steel forms that incorporate reinforcement, inserts, pipe fittings, box-outs, and other details shown on the Contract Drawings without modification to these details.

2.03 FORM TIES

A. General:
   1. Provide commercially manufactured steel rods or through-bolts, Cone-Snap Ties or taper ties capable of withstanding applied pressures.
   2. Other ties shall not be used.
   3. Provide form ties designed that when forms are removed, no metal shall remain within 1-1/2-inch to the finished concrete surface.

B. Cone-Snap Tie:
   1. Furnish ties adjustable in length or of proper fixed length, with no metal closer than 1-1/2-inch to the finished concrete surface.
   2. Use a plastic cone spacer at each end of the form tie to allow a full 1-1/2-inch breakback and part of tie to be removed shall leave a cone shaped depression in the concrete with a minimum diameter of 1-inch at the surface.
   3. Provide ties for walls resisting water or earth pressure with waterstop washers of diameter ¾-inch greater than the rod, bonded to rods at the wall centerline, or with other favorably reviewed water seal devices.

C. Taper Ties or Through Bolts:
   1. Alternatively, provide tapered removable through-bolts at least 1-inch in diameter at smallest end.
   2. Manufactured neoprene or polyurethane tapered plug to be installed at the wall centerline.

2.04 FORM COATING COMPOUNDS

A. Coat all forming surfaces in contact with concrete using an effective, non-staining, non-residual, bond breaking form coating unless otherwise noted.

B. Coating of forms for concrete which will be painted shall meet the same requirements and also not impart any material or residue to the concrete surface detrimental or incompatible with any specified paint, concrete or architectural finish, adhesives, waterproofing system, plaster or coating system to be applied later. Do not use oil-based products on formed surfaces that are to be painted, coated, or bonded to other concrete.

2.05 SOURCE QUALITY CONTROL

A. Forms: Verify that components pre-assembled offsite are satisfactory for the purpose. Verify that designs, products and samples have been submitted for Product Review.

© December 2012 Kennedy/Jenks Consultants

PART 3 - EXECUTION

3.01 FORMS

A. General:
   1. Provide formwork, bracing, and shoring in accordance with ACI 347.
   2. Form concrete unless specified otherwise.
   3. Construct forms conforming to the shape, line and grade required by the Contract Documents.
   4. Provide mortar tight seams or seal with tape.
   5. Brace and shore forms to ensure stability against pressure from any source, without failure of components.
   6. Deflection of wall or slab form sheathing or framing for beams shall not exceed 1/270 of the span. Camber the formwork in designing the supports of beams and slabs if required to maintain deflection.
   7. If inadequate support is provided by the forms, remove placed concrete and replace, as directed by the Engineer.
   8. Account for temporary openings for cleaning out, observation, pouring and vibration of concrete.
   9. Where the concrete mix design includes a high-range water reducing additive, design the forms with enough strength to resist the high liquid concrete pressure without distortion exceeding the tolerances in this section.

B. Chamfers: ¾-inch at exposed outside corners, including the top edges of walls, machinery bases and curbs. Use mill run chamfer strips surfaced all sides. Provide rounded top edges of sidewalks, walkways and where directed.

C. Formed Surfaces:
   1. Ensure that the reinforcement has been favorably reviewed by the special inspector before closing up the wall forms.
   2. Provide exposed, unpainted concrete surfaces that are uniform in appearance and color. Apply non-staining form coating compound before placing the forms. Remove any excess coating with cloths. Scrape and clean any reused forms before coating again.
   3. Provide flush fitting caps over any unused form tie holes.

D. Form Ties and Through-Bolts:
   1. Provide sufficient number and strength to prevent spreading of forms while placing concrete.
   2. Remove the removable portion immediately after stripping the forms. Avoid spalling the exposed concrete surfaces.
   3. Locate tapered ties, if used, with the larger diameter on the water side of the form.
   4. Provide a separate support system for the curtains of reinforcing, with a minimum 1-inch clearance between rebar and form ties or bolts.

E. Construction Joints:
   1. At ends of the first concrete pour, provide forms that positively locate waterstop. Ensure the end forms of walls are removable without releasing the side forms. Provide seals around reinforcement and waterstop to prevent mortar leaks.
   2. Overlap the hardened concrete of the first pour with forms for the second pour. Brace the ends of the forms against the hardened concrete to prevent

© December 2012 Kennedy/Jenks Consultants

joint offsets and mortar leakage. Align exterior features required on the finished surface.

3.02 ALLOWABLE VARIATIONS FOR FORMED SURFACES

A. General:
   1. Tolerances: ACI 301 and as noted below:
   2. Set and maintain concrete forms to ensure that, after removal of the forms and prior to patching and finishing, no portion of the concrete work will exceed the tolerances. Measure variations in floor levels before removal of supporting shores.
   3. The specified variation for one element of the structure will not be applicable when it will permit another element of the structure to exceed its allowable variation.

B. Variations in Size or Thickness:
   1. Footings:
      a. Length and width: ±1/2-inch
      b. Reduction in thickness: 5%
   2. Slabs and walls:
      a. Thickness of 6 inches or less: +1/4-inch, -0-inch
      b. Thickness of more than 6 inches: ±1/4-inch

C. Allowable Tolerances (Location, Lines and Grades):

1. Horizontal misplacement or eccentricity of footings	2% of footing width, but no more than 1-inch
2. Variation of vertical dimensions at all floor levels from specified position:	±1/2-inch per 100-foot
3. Variation of vertical dimensions from specified position:	±1/4-inch
4. Variation from level or from slopes specified for floors, ceilings, water channels and conspicuous lines	±1/4-inch per 20 feet
5. Variation in location from specified position for sleeves, pits, floor, and wall openings:	±1/4-inch

3.03 REMOVAL OF FORMS

A. General: Comply with the recommendations of ACI Committee 347. Remove without damage to the concrete. Ensure that the concrete has hardened sufficiently and the members have attained sufficient strength to support the imposed loads prior to removal of the forms.

B. Form Removal: Minimum duration after completion of concrete placement prior to removal of the form:

1. Walls and wall or slab construction joints	12 hours
2. Sides of beams and girders	12 hours
3. Underside of suspended slabs, walkways, beams and girders	28 days, or 21 days and full design compressive strength verified by data from additional field cured cylinders.

C. Hot Weather: See Section 03305.

© December 2012 Kennedy/Jenks Consultants

D. Cold Weather: See Section 03306.

E. Reshoring: Submit for review, requirement for accelerated partial stripping and reshoring of forms that may be necessary to maintain the construction program.

3.04 REUSE OF FORMS

A. Between concrete placements, inspect all form surfaces and repair to uniform texture for all concrete surfaces to be exposed. Fill all unused holes, cracks and defects.

3.05 PLACING CONCRETE AND GROUT

A. See Section 03300.

3.06 VIBRATION

A. See Section 03300.

3.07 CONCRETE JOINTS

A. See Section 03150.

3.08 REPAIR OF DEFECTIVE CONCRETE

A. See Section 03300.

3.09 CURING AND PROTECTION

A. See Section 03330.

3.10 CONCRETE FINISHES

A. Refer to Section 03350.

3.11 FIELD QUALITY CONTROL

A. Notify Owner when the forms are complete and ready for inspection at least 16 working hours prior to the proposed concrete placement.

B. Concrete Placement:
   1. Verify that forms and reinforcement are accurately placed and secured in position. Confirm that both forms and reinforcement have been favorably reviewed.
   2. Verify that tie wire ends have been bent back away from the forms.
   3. Verify that sleeves, castings, pipes, conduits, bolts, anchors, and other items required, are accurately and securely placed within or on the forms.
   4. Verify waterstop is correctly in place and that splices are watertight.
   5. Verify adequate vibrators are available.
   6. Verify construction and expansion joint faces have been prepared for the next concrete placement.
   7. Check that the mix design is compatible with the method of placement of the concrete, by pump or by batch.
   8. For wall placements, verify that the modified concrete mix required at construction joints is to be delivered.

© December 2012 Kennedy/Jenks Consultants

9. Verify the concrete delivered to site is satisfactory, including checks on the batch tickets, quality assurance tests and direct observation of the batches.

C. Failure of the forms to comply with the requirements specified, or to produce concrete complying with requirements of this Section, shall be grounds for rejection of that portion of the concrete work. Rejected work shall be repaired or replaced as directed by the Engineer at no additional cost to the Owner. Such repair or replacement shall be subject to the requirements of this Section and Section 03300.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 03150

CONCRETE JOINTS AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Concrete joints, waterstops, joint fillers, bond breakers, inserts and manufactured joints.

B. Related Sections:
1. Section 03100: Concrete Forms and Accessories
2. Section 03200: Reinforcing Steel
3. Section 03300: Cast-in-Place Concrete

1.02 REFERENCES

A. American Concrete Institute (ACI):
1. ACI 318 Building Code Requirements for Structural Concrete
2. ACI 350 Environmental Engineering Concrete Structures

B. ASTM International (ASTM) Standard Specification or Test Method:
1. ASTM A167 Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
2. ASTM A675 Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
3. ASTM C881 Epoxy-Resin-Base Bonding Systems for Concrete
4. ASTM C920 Elastomeric Joint Sealants
5. ASTM D1056 Flexible Cellular Materials - Sponge or Expanded Rubber
6. ASTM D1171 Standard Test Method for Rubber Deterioration—Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)
7. ASTM D1751 Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction. (Nonextruding and Resilient Bituminous Types)
8. ASTM D1752 Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
9. ASTM E96 Water Vapor Transmission of Materials

C. Corps of Engineers (COE) Specifications:
1. COE CRD-C-572 Polyvinylchloride Waterstops

D. International Building Code (IBC) 2009 Edition and California Building Code (CBC) 2010 Edition**.**

E. International Code Council (ICC).

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data:

© December 2012 Kennedy/Jenks Consultants

1. Waterstop, including waterstop joints
2. Miscellaneous products: Submit technical data including installation instructions, independent laboratory test reports (ICC), handling and storage instructions.
   a. Preformed Joint filler
   b. Bond breaker
   c. Sealant
   d. Epoxy compounds

C. Shop Drawings:
   1. Construction joint layout, including waterstop placement; coordinate with Section 03100.
   2. Sequence of concrete wall and slab pours.
   3. Program and method of concrete placement.

D. Quality Control Certifications:
   1. Certification that all materials used within the joint system are compatible with each other.

1.04 QUALITY ASSURANCE

A. Contractor Qualifications: See Section 03300.

1.05 DELIVERY, STORAGE AND HANDLING

A. Waterstop: Reject any cracked material, any joints with offsets between ribs or incomplete bond. Protect material from oil, grease and dirt and cover against direct sunlight.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide new materials. All materials used together in a given joint shall be compatible with one another. Coordinate selection of suppliers and products to provide compatibility. Do not use asphaltic bond breakers or asphaltic joint fillers in joints receiving sealant.

2.02 EPOXY BONDING SYSTEM

A. General: ASTM C881:
   1. Provide Type I for bonding hardened concrete to hardened concrete; Type II for bonding freshly mixed concrete to hardened concrete; and Type III as a binder in epoxy mortar or concrete, or for use in bonding skid-resistant materials to hardened concrete.
   2. Provide Grade 1 or 2 for horizontal surfaces and Grade 3 for vertical surfaces.
   3. Provide Class A if placement temperature is below 40°F, but not less than allowed by the manufacturer; Class B if placement temperature is between 40 and 60°F; or Class C if placement temperature is above 60°F, but not more than allowed by the manufacturer.
   4. Provide: Sikadur Epoxy adhesives manufactured by the Sika Chemical Corporation; Concresive compounds manufactured by Master Builders, Inc., or equal.

© December 2012 Kennedy/Jenks Consultants

B. For bonding new to pre-existing concrete, provide Sikadur 32 Hi-Mod (Sikadur 32 Hi-Mod LPL is not allowed for use in contact with potable water) by Sika Chemical Corporation, Concresive Liquid LPL by Master Builders, or equal.

2.03 PREFORMED JOINT FILLER

A. Structures Retaining Water or Earth: ASTM D1056, Type 2, Class C, Grade 5. Neoprene sponge rubber, closed cell, resistant to oil, medium swell, firm. Supply premolded product, Durafoam DK5151; equivalent product by Armacell; or equal.

B. Miscellaneous Structures Above Grade: ASTM D1752 Type 1, 1-inch thick unless indicated otherwise on drawings.

C. Separation joints between structures: Compressible Joint Filler: The joint filler shall be a non extruded watertight strip material used to fill joints between structures. The material shall be capable of being compressed at least 40% for 70 hours at 68°F and subsequently recovering at least 20% of its original thickness in the first ½-hour after unloading. Compressible Joint filler shall be Evazote 380 E.S.P, by E-Poxy Industries, Inc., Ravena, NY; Evazote by Capital Services, Albany, NY; or equal.

2.04 BOND BREAKER

A. Bond breaker tape shall be an adhesive backed glazed butyl or polyethylene tape which will satisfactorily adhere to the preformed joint filler or concrete surface as required. The tape shall be the same width as the joint.

B. Bond breaker for concrete other than where tape is specifically called for on the drawings shall be either bond breaker tape or a nonstaining type bond prevention coating such as Super Bond Breaker WB by Burke Co.; Silcoseal 87, by Nox-crete Inc., or equal.

2.05 SEALANT

A. General: ASTM C920, of type, grade and class appropriate for use.

B. Exterior Exposure: Sikaflex-2c, by Sika Corp., Select Seal U-200 by Select Products Corp., or equal.

C. Prepare surfaces and provide primer and sealants in strict accordance with manufacturer's recommendations.

D. Backing Rod: Extruded, closed cell, polyethylene foam rod, compatible with sealant. Provide 5/8-inch-diameter rod for ½-inch joint, 1-1/4-inch rod for 1-inch joint.

2.06 WATERSTOPS

A. Polyvinyl Chloride (PVC) Waterstops: Provide for construction or expansion joints in new concrete.
   1. Material: Extruded PVC, manufactured from virgin materials.
   2. Physical properties: COE CRD-C-572
   3. Waterstop Types:
      a. Serrated (Ribbed) Flat: Vinylex R6-38; Greenstreak Style 679.
      b. Serrated (Ribbed) with Centerbulb: Vinylex RB9-38H; Greenstreak Style 735.

© December 2012 Kennedy/Jenks Consultants

c. Retrofit (Includes construction joints or expansion joints where new concrete will be placed adjacent to existing concrete.): Vinylex KK610z; Greenstreak Style 581. Provide additional components including epoxy gel, 16-gage grade 304 stainless steel batten bars with holes 6 inches on center, and stainless steel ¼-inch by 2-1/4-inch concrete anchor bolts.

4. Splices:
   a. Provide factory fabricated waterstop intersections, leaving only straight butt-joint splices for the field. Waterstop intersections and directional changes to be miter cut and heat welded with centerbulb and ribs aligned to maintain continuity. Splices to be free from defects.
   b. Tensile Strength: 80% of parent material.
5. Provide factory installed hog rings or grommets, 12 inches on center, ½-inch or less from both edges of the waterstop and tie wire to rigidly locate waterstops in forms.
6. Manufacturers:
   a. Vinylex Corporation
   b. Greenstreak Plastic Products Company, Inc.

2.07 SOURCE QUALITY CONTROL

A. Forms: Verify that components pre-assembled offsite are satisfactory for the purpose. Verify that designs, products and samples have been submitted for Product Review.

PART 3 - EXECUTION

3.01 CONCRETE JOINTS

A. General:
   1. Provide joints:
      a. As shown on the Drawings and as noted below in these Specifications.
      b. As required for constructability.
      c. After favorable review of layout, sequence and concrete placement program.
   2. Provide minimum curing times before the second placement:
      a. 10 days after each adjacent concrete placement for infill pours (i.e. in between two existing sections) or checkerboard (existing concrete on two or more sides) placement patterns.
      b. 2 days after the first concrete placement at the joint.
   3. During placement of the new concrete, ensure there are no interruptions to the 14-day curing time and 14-day load restriction plan for the adjacent pours.

B. Control Joints:
   1. Space typical control joints in slabs on grade or suspended slabs not exceeding 10 feet, or as shown on the Drawings. Control joints shall not be provided in water containment structures.
   2. If cast-in with the concrete, positively locate the preformed joint filler and hold rigidly in place during concreting.
   3. If saw-cut, use a wheeled power saw as soon as the concrete surface is firm enough. Saw-cut control joints must be constructed within 12 hours after concrete placement. Fill the groove with sealant over a backer rod.

© December 2012 Kennedy/Jenks Consultants

C. Construction Joints:
   1. Produce quality concrete, with full continuity of reinforcing and water tightness across the joints.
   2. Space typical slab joints not exceeding 20 feet in the direction of the transverse or secondary reinforcing, typically the smaller reinforcing nearer to the center of the slab thickness. Space typical vertical wall joints no more than 30 feet apart.
   3. Provide all joints in walls and slabs, retaining liquids, or earth with 6-inch ribbed waterstops up to 6-inches below the top of the wall but not including the soffit of the walkways. Continue all reinforcing through the joint unless otherwise noted.
   4. After the first concrete placement at the joint, do not walk on or disturb any reinforcing extending into the second placement area for at least 48 hours.
   5. Before depositing new concrete on or against concrete that has hardened, clean and roughen the entire surface of the joint exposing clean coarse aggregate solidly embedded in mortar matrix. Provide typically ¼-inch roughness or amplitude of the concrete surface measured from the top of the exposed aggregate to the bottom of pockets between stones.
   6. Drench the prepared joint with clean water and remove prior to the concrete pour.
   7. Cover horizontal wall joints and wall-to-slab joints with a minimum thickness of 2 inches and a maximum of 6 inches of the modified concrete mix, consisting of the designated concrete mix with one-half of the coarse aggregate removed.
   8. Use special care in vibrating adjacent to construction joints to ensure thorough consolidation of the concrete around the waterstops and against the hardened portion of the joint. Additional hand tamping may be required.
   9. For joints that are shown on architectural drawings as having a continuous reveal or recess, leave the wood form or pour strip used to create the reveal or recess in place or re-insert before roughening. Prevent the next concrete placement from filling the reveal or recess.

D. Expansion Joints:
   1. Stop all steel reinforcing clear of the joint at each side.
   2. Provide 9-inch ribbed centerbulb waterstop continuously around the joint in walls and slabs retaining liquids or earth up to 6 inches below the top of wall. Prepare a smooth first concrete surface with all voids filled.
   3. Provide preformed joint filler, securely fastened to the existing concrete as directed by the manufacturer.
   4. Install bond breaker and sealant after curing is completed and when directed.

E. Bonding to Pre-existing Concrete: Mechanically roughen the old surface to a ¼-inch amplitude, as defined in construction joint paragraph above. Apply epoxy bonding system material prior to concreting and in accordance with the manufacturer's instructions.

F. Embedded PVC Waterstop:
   1. Uncoil waterstop 24 hours prior to installation for ease of handling and fabrication.
   2. Restrict field splices to butt joints in straight runs. For PVC type, make by heat welding, using a waterstop splicing iron with non-stick surface set to the

© December 2012 Kennedy/Jenks Consultants

correct temperature (per manufacturer's recommendations). Follow the manufacturer's specifications.

3. Positively locate and support waterstop in the forms so that concrete may be placed, consolidated, and vibrated on both sides of the embedded portion without displacement of the waterstop and without causing voids in the concrete (use copper-clad hog rings or grommets at 12-inch maximum on-center to secure waterstop to adjacent reinforcing steel. Crimped hog ring should be located between the last two ribs on waterstop leg). Protect the outstanding portion from damage during the first concrete pour and clean and positively support prior to the second pour. Place, consolidate and vibrate the second pour without displacement of the waterstop and without causing voids in the concrete. After first pour, clean unembedded waterstop leg to ensure full contact of second concrete pour. Remove laitance, spillage, form oil and dirt.
4. For retrofit waterstops between new and existing concrete prepare existing concrete by grinding away irregularities. Clean concrete to ensure good epoxy bond. Apply continuous bed of epoxy to concrete. Embed retrofit waterstop in uncured epoxy. Mechanically fasten waterstop to concrete using stainless steel batten bars and anchor bolts staggered 6 inches on center maximum. Use batten bars on top and bottom. Tool continuous layer of epoxy over batten bars and bolts to protection from corrosion. Use expansion joint filler at moving joints to minimize shear stress (expansion joint filler should be large enough to allow waterstop centerbulb to remain completely unembedded in concrete). Expansion material should cover retrofit hardware reaching all the way to waterstop ribs. Allow retrofit waterstop system to cure for 24 hours before placing new concrete. Follow all manufacturer's preparation and installation instructions.
5. Waterstop Quality Assurance: Edge welding will not be permitted. Centerbulbs shall be compressed or closed when welding to non-centerbulb type. Waterstop splicing defects which are unacceptable include, but are not limited to the following:
    a. Tensile strength not less than 80% of parent sections.
    b. Free lap joints.
    c. Misalignment of centerbulb, ribs, and end bulbs greater than 1/16-inch.
    d. Misalignment which reduces waterstop cross section more than 15%.
    e. Bond failure at joint deeper than 1/16-inch or 15% of material thickness.
    f. Misalignment of waterstop splices resulting in misalignment of waterstop in excess of ½-inch in 10 feet.
    g. Visible porosity in the weld.
    h. Charred or burnt material.
    i. Bubbles or inadequate bonding.
    j. Visible signs of splice separation when cooled splice (24 hours or greater) is bent by hand at sharp angle.

G. Hydrophylic Rubber Waterstop: At splices, butt ends of profile together and glue with manufacturer suggested adhesive. Locate between reinforcement curtains and maintain concrete cover as required by manufacturer. Fasten to concrete with continuous adhesive paste. Allow time for adhesive to cure, prior to concreting. Keep the materials dry until concreting. Follow the manufacturer's specifications.

© December 2012 Kennedy/Jenks Consultants

H. Compressible Joint Filler: Install compressible joint filler in conformance with the manufacturer's recommendations; including surface preparation, adhesive installation, heat welding and set time.

3.02 FIELD QUALITY CONTROL

A. See Sections 03100 and 03300.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 03200

REINFORCING STEEL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Reinforcing work, complete as indicated, specified and required.
   2. Provide all bar and wire fabric steel reinforcing for cast-in-place concrete.

1.02 REFERENCES

A. ASTM International (ASTM) Standard Specifications:
   1. ASTM A185: Steel welded wire fabric, plain, for concrete reinforcement.
   2. ASTM A615: Deformed and plain billet – steel bars for concrete reinforcement.

B. American Concrete Institute (ACI):
   1. Details and Detailing of Concrete Reinforcement (ACI 315).
   2. Building Code Requirements for Reinforced Concrete (ACI 318).

C. Concrete Reinforcing Steel Institute: Manual of Standard Practice (CRSI Manual).

D. International Code Council: Evaluation Reports (ICC Reports).

E. American Welding Society: D1.4 Structural Welding Code – Reinforcing Steel (AWS D1-4).

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data:
   1. Bar supports and chairs.
   2. Mechanical bar connectors, including ICC Reports.
   3. Certified mill test results on reinforcement with recycled material content requirements noted in General Conditions.
   4. Tests on unidentified bars.

C. Shop Drawings:
   1. Bar and wire fabric layouts.
   2. Bar bending diagrams.
   3. Assembly diagrams, including bar lap and splice locations and mechanical connector layout.
   4. Accessories and inserts layout.

1.04 QUALITY ASSURANCE

A. Material Tests: Not required for bars, wire fabric rolls or sheets delivered in bundles from the mill and tagged with valid Identification Certificate.

© December 2012 Kennedy/Jenks Consultants

1. Unidentified Bars: Test samples from each five tons or fraction thereof for each size. If already delivered to site, test additional samples from each day of planned concrete placement. Perform one tension and one bend test from each sample for each size.
2. Test standard: ASTM A615.
3. Testing Laboratory: Selected by Engineer, to take samples and perform tests. Costs paid by Contractor.
4. Unidentified Wire Fabric: Not acceptable.

B. Standard: CRSI Manual, except as otherwise indicated or specified.

1.05 DELIVERY, STORAGE AND HANDLING

A. Bundle reinforcement and tag with suitable identification to simplify sorting and placing. Transport and store at site so material is not damaged. Store reinforcement off ground, place under cover and keep clean. Store welded fabric in flat sheets, not rolls. Keep an adequate supply of reinforcement at site to avoid delays.

PART 2 - PRODUCTS

2.01 REINFORCING BARS

A. General: Deformed bars, ASTM A615, Grade 60.

B. Dowels: All dowels are deformed bars unless shown otherwise on the Drawings.
1. Deformed bars: ASTM A615, Grade 60.
2. Smooth bars: ASTM A615, Grade 60.
3. Threaded bars: ASTM A572, Grade 50.

C. Spiral Reinforcement: Cold-drawn steel wire, plain, ASTM A82, or deformed bars, ASTM A615, Grade 60.

2.02 WELDED WIRE FABRIC

A. Smooth Wire: ASTM A185; sheets.

2.03 TIE WIRE

A. Annealed steel, 16-gauge minimum.

2.04 MECHANICAL CONNECTORS

A. Type: Tension-compression.

B. Strength: Develop 125% of the reinforcing yield strength in tension and compression.

C. Manufacturer:
1. Tension-compression: Lenton by Erico Products, Inc., Dowel Bar Splice Systems by Richmond Screw Anchor Co., or equal.
2. Future Extension Mechanical Butt Splice: Lenton Form Saver by Erico Products, Inc., or equal. Provide plastic taper threaded plugs for “long-term” thread protection.

© 2012 Kennedy/Jenks Consultants

2.05 JOINT SLIP DOWEL SYSTEM

A. Provide Greenstreak two component Speed Dowel System to accept slip dowels of the size shown on the Drawings. The Speed Dowel System is comprised of a reusable base and plastic sleeve. Both pieces shall be manufactured from polypropylene plastic. Do not place concrete directly over the Speed Dowel System.

2.06 SUPPORTS AND ACCESSORIES

A. Conform to CRSI Manual Chapter 3, for Types SB, BB, BC, JC, HC, CHC, and others of standard types as required.

B. Use Class "1" plastic-coated chairs and spacers at waterbearing surfaces, roofs of waterbearing structures, and at all interior or exterior surfaces exposed to view or weather in the completed structure. Precast concrete block supports with embedded wire ties are not acceptable.

C. Use precast concrete block supports with embedded wire ties or dowels for placement on grade or on membranes. Cast the blocks with concrete equal in strength, cement type and aggregate to the parent concrete.

D. Do not use aluminum or stainless steel supports or accessories.

2.07 FABRICATION

A. General: CRSI Manual Chapters 6 and 7, including tolerances.

B. Splice, development and embedment lengths: Furnish bars with lap lengths equivalent to ACI 318, Section 12, Class B splices for the specified concrete strength, bar size and location, unless noted otherwise.

C. Bending and Forming: Fabricate bars of indicated size and accurately form to shapes and lengths indicated and required. Fabricate by methods not injurious to materials. Do not heat reinforcement for bending. Reject bars with kinks or bends not scheduled.

D. Concrete Cover: Detail and fabricate the reinforcement to provide specified cover to outer edge of rebars and other installed items.

E. Dowels:
   1. Provide deformed reinforcing bar dowels at all construction joints, unless noted otherwise.
   2. Provide smooth or threaded dowels where shown on Drawings.
   3. Provide same dowel size and spacing as the reinforcing to which they are spliced, unless noted otherwise.

2.08 SOURCE QUALITY CONTROL

A. Verify bend tolerances are not exceeded.

B. Verify bar end cuts are within tolerance when mechanical connectors are to be used.

© December 2012 Kennedy/Jenks Consultants

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: CRSI Manual Chapter 8 including placement tolerances. No reduction of concrete cover is allowable for bars at concrete surfaces exposed in liquid or water-containing structures.
   1. Cleaning: Before placing reinforcing, and again before concrete is placed, clean reinforcement of loose mill scale, dried concrete, oil, or other coating that might destroy or reduce bond. Do not allow form coatings, release agents, bond breaker, or curing compound to contact reinforcement.
   2. Concrete coverage: Provide coverage to the outer edge of ties, stirrups, bar spacers, hangers, and like items.
   3. Securing in place: Accurately place reinforcement and securely wire tie in position, at an adequate number of points, where bars cross so as to prevent displacement. Tie stirrups to bars at both top and bottom. Bend ends of tie wire inward allowing no encroachment into the concrete cover.
   4. Bar supports: CRSI Manual, Chapter 3.
   5. Field bending: Not permitted, except where specifically shown, or approved.
   6. Bar spacing: Between parallel bars, no less than 1-1/2 times the maximum aggregate size and in no case less than 1-1/2 inches. At splices, bundle and wire together bars to accomplish this.
   7. Welded wire fabric: Install necessary supports and chairs to hold in place during concrete pours. Straighten fabric to lay in flat plane and bend fabric to fit work. Lap 12 inches, minimum. Tie every other wire at laps.
   8. Welding of reinforcing: Proceed after continuous inspection has been authorized. Welding procedure: Satisfy AWS D1.4.

3.02 FIELD QUALITY CONTROL

A. Inspect all reinforcement installations. Provide 48 hours' notice for inspection before concrete placement.

B. Verify placement tolerances are not exceeded.

C. Mechanical Connectors: Install favorably reviewed products, following the Manufacturer's recommendations, under continuous inspection.

D. Welding Reinforcement: Perform only when approved and only under continuous inspection. Notify the Engineer at least 48 hours in advance of any procedure involving welding.

END OF SECTION

© 2012 Kennedy/Jenks Consultants

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Materials and execution for cast-in-place concrete.

B. Related Sections:
   1. Section 02775: Concrete Curb, Gutters and Sidewalks
   2. Section 03100: Concrete Forms and Accessories
   3. Section 03150: Concrete Joints and Accessories
   4. Section 03200: Reinforcing Steel
   5. Section 03305: Hot Weather Concreting
   6. Section 03306: Cold Weather Concreting
   7. Section 03330: Concrete Curing
   8. Section 03340: Hydrostatic Testing of Structures
   9. Section 03350: Concrete Finishes

1.02 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 117 Standard Tolerances for Concrete Construction and Materials
   2. ACI 301 Specifications for Structural Concrete for Buildings
   3. ACI 306 Guide to Cold Weather Concreting
   4. ACI 318 Building Code Requirements for Structural Concrete
   5. ACI 347 Guide to Formwork for Concrete
   6. ACI 350 Environmental Engineering Concrete Structures

B. ASTM International (ASTM) Standard Specification or Test Method:
   1. ASTM C31 Making and Curing Concrete Test Specimens in the Field
   2. ASTM C33 Concrete Aggregates
   3. ASTM C39 Compressive Strength of Cylindrical Concrete Specimens
   4. ASTM C40 Organic Impurities in Fine Aggregates for Concrete
   5. ASTM C42 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
   6. ASTM C87 Effect of Organic Impurities in Fine Aggregate on Strength of Mortar
   7. ASTM C88 Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
   8. ASTM C94 Ready-Mixed Concrete
   9. ASTM C131 Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
   10. ASTM C136 Sieve Analysis of Fine and Coarse Aggregates
   11. ASTM C142 Clay Lumps and Friable Particles in Aggregates
   12. ASTM C143 Slump of Hydraulic-Cement Concrete
   13. ASTM C150 Portland Cement

© December 2012 Kennedy/Jenks Consultants

14. ASTM C156 Water Retention by Concrete Curing Materials
15. ASTM C157 Length Change of Hardened Hydraulic-Cement Mortar and Concrete
16. ASTM C171 Sheet Materials for Curing Concrete
17. ASTM C172 Sampling Freshly Mixed Concrete
18. ASTM C192 Making and Curing Concrete Test Specimens in the Laboratory
19. ASTM C231 Air Content of Freshly Mixed Concrete by the Pressure Method
20. ASTM C260 Air-Entraining Admixtures for Concrete
21. ASTM C289 Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)
22. ASTM C309 Liquid Membrane-Forming Compounds for Curing Concrete
23. ASTM C494 Chemical Admixtures for Concrete
24. ASTM C595 Blended Hydraulic Cements
25. ASTM C618 Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
26. ASTM C827 Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures
27. ASTM C869 Foaming Agents Used in Making Preformed Foam for Cellular Concrete
28. ASTM C881 Epoxy-Resin-Base Bonding Systems for Concrete
29. ASTM C920 Elastomeric Joint Sealants
30. ASTM C1077 Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
31. ASTM C1107 Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
32. ASTM C1240 Use of Silica Fume as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar, and Grout
33. ASTM D882 Tensile Properties of Thin Plastic Sheeting
34. ASTM D1056 Flexible Cellular Materials - Sponge or Expanded Rubber
35. ASTM D1149 Rubber Deterioration-Surface Ozone Cracking in a Chamber
36. ASTM D1752 Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
37. ASTM D2419 Sand Equivalent Value of Soils and Fine Aggregate
38. ASTM E96 Water Vapor Transmission of Materials

C. State of California, Department of Transportation (CALTRANS):
   1. Test 217 Sand Equivalent
   2. Test 227 Evaluating Cleanness of Coarse Aggregate

D. American Association of State Highway and Transportation Officials (AASHTO):
   1. T26 Standard Method of Test for Quality of Water to be Used in Concrete

E. International Building Code (IBC) 2009 Edition and California Building Code (CBC) 2010 Edition**.**

F. International Code Council (ICC).

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data:

© December 2012 Kennedy/Jenks Consultants

1. Concrete mix product certification: Submit certified laboratory test results that the mix proportions and materials comply with these Specifications.
    a. Cementitious materials.
    b. Coarse and fine aggregates.
    c. Admixtures.
    d. Water.
    e. Ready-mix plant certification or ASTM C94 certification documentation.
    f. Mix designs.
    g. Mix test results (see Paragraph 2.05.E for required testing).
2. Concrete repair materials:
    a. Manufacturer's including the manufacture's installation and application instructions.

C. Shop Drawings:
1. After defects are identified and investigation, Contractor to submit design of repair plan specific for each noted defect. See Paragraph 3.10.
2. Repair plan and procedures indicating areas where products are intended for use.

D. Samples: Submit any item of Product Data not fully assembled by a single manufacturer.

1.04 QUALITY ASSURANCE

A. Contractor Qualifications: 10 years of experience on similar facilities.

B. Construction Standard: Applicable quality requirements of the IBC, ACI 301, ACI 318, and ACI 350.

C. Concrete Products and Materials Tests: Certified by independent commercial testing laboratories. Submit certification on cementitious products and aggregates performed within the past 6 months.

D. Concrete Mix Designs: By an independent commercial testing laboratory, complying with ASTM C1077 and favorably reviewed by the Engineer. Concrete mix design proportions shall be established on the basis of field experience and trial mixtures with the materials to be employed in accordance with ACI 318 Chapter 5.

E. Concrete Mix Test Results:
1. Submit in accordance with requirements of Paragraph 2.05.E.
2. Allow time for review of submittals, in accordance with the general conditions, and allow time for additional reviews to provide adjustments to comply with the Specifications.

F. Concrete Tests, as Placed: Performed by the Owner's Representative:
1. Test frequency:
    a. Each mix type placed, each day placed,
    b. One test set per 100 CY
    c. A minimum of five (5) 28-day tests is required for each mix design.
2. Concrete sample: In accordance with ASTM C172. Provide all material required.
3. Compressive strength: A set of four standard 6-inch x 12-inch concrete cylinders shall be cast for each test set for concrete greater than 2,500 psi.

© December 2012 Kennedy/Jenks Consultants

a. Making, storing, initial cure, and final cure of cylinders: ASTM C31. Provide site storage and initial cure, 16 hours minimum and 24 hours maximum.
b. Test of cylinders: ASTM C39. Testing laboratory will transport cylinders from site, cure, test, and provide report. Test two cylinders at age of 7 days, two at 28 days

4. Slump: Test will be performed on each 50 cubic yards or fraction thereof. Test each sample used for strength tests.
a. Testing: ASTM C143.
b. Results outside the limits indicate possible cause for rejection of concrete at the sole discretion of the Engineer.

5. Air content: Test will be performed on concrete samples used for strength tests. Use calibrated equipment required to perform the test.
a. Testing: ASTM C231.

G. Additional Tests:
1. General: Provide and pay for additional material and strength tests on new specimens, when test results fail to meet the specified requirements. Strength tests shall be considered satisfactory if the requirements of ACI 318 Section 5.6.3.3 are satisfied. If in the opinion of the Engineer, results of tests on concrete cylinders indicate the possibility of substandard concrete in the structure, cored samples may be required to be taken from the concrete.
2. Coring and testing: ASTM C42. The Engineer will investigate low-strength test results in accordance with the requirements of ACI 318 Section 5.6.5; however, the requirements of Section 5.6.5.4 are not applicable. If, in the opinion of the Engineer, the results of the core tests indicate that concrete has been placed which does not meet this specification, the Owner may require defective concrete strengthened by means of additional concrete, reinforcing steel or replacement of the defective concrete, all at no additional cost to the Owner.

1.05 DELIVERY, STORAGE AND HANDLING

A. Cementitious Materials: If required to be stored at the site, store immediately after delivery in a dry, weather-tight, properly ventilated structure, with adequate provisions for prevention of moisture absorption and overheating of the cement.

B. Aggregates: If required at site, store in piles which afford good drainage and which are protected to prevent the inclusion of foreign material. Stockpile the various sizes or gradations of aggregates separately. Site stored aggregates shall be tested for moisture content on each day of batching operations.

C. Non-shrink cement-based grouts shall be delivered as preblended, prepackaged mixes requiring only the addition of water.

D. Non-shrink epoxy grouts shall be delivered as premeasured, prepackaged, three component systems requiring only blending as directed by the manufacturer.

PART 2 - PRODUCTS

2.01 GENERAL

A. Obtain materials from an NRMCA certified manufacturer or supplier or one qualified through ASTM C94. Unless allowed otherwise, all materials shall be new.

© December 2012 Kennedy/Jenks Consultants

2.02 CONCRETE MATERIALS

A. Cementitious Materials:
   1. General: Use only one brand of each cementitious material. The color shall not significantly alter the typical grey concrete color.
   2. Portland Cement: ASTM C150, Type V. Comply with the requirements for low alkali cement in ASTM C150 Table 2.
   3. Pozzolan: ASTM C618, Mineral Admixture Class N.
   4. Blended Cement: ASTM C595 Type 1P(MS).
   5. Fly ash: ASTM C618, Class F, with the following restrictions:
      a. Loss on Ignition: 4% maximum
      b. SO3 Content: 3% maximum
      c. Moisture Content: 1% maximum

B. Concrete Aggregates:
   1. General: ASTM C33:
      a. Provide free from organic materials, waste products, clay balls, shale, and mica and thoroughly washed before use.
      b. Provide aggregate meeting the combined gradation requirements below as specified in Paragraph 2.05.B. For thin sections, such as slabs or walls 10 inches thick or less, or for sections that require special placement due to shape, form or congestion of reinforcing, provide 1-inch maximum size.
      c. Provide aggregates that do not deleteriously react with the alkalies in the cement.
      d. Grading: ASTM C136. Submit results of sieve analysis.
      e. Reactivity: ASTM C289. Submit graphical data showing compliance.
   2. Coarse Aggregates:
      a. Provide clean, hard, durable gravel, crushed gravel, crushed rock, or combinations.
      b. Deleterious substances: Submit compliance with ASTM C33, Table 3 and as follows:
         1) Clay lumps and friable particles: ASTM C142. Not more than 5%.
         2) Abrasion: ASTM C131. Not more than 45%.
         3) Soundness: ASTM C88. Not more than 10%.
         4) Cleanness: Caltrans Test 227 For three tests, not less than 70, with an average greater than 75. Max friable/clay materials in coarse aggregate at 2% for exposed architectural concrete, 3% for liquid retaining concrete structures, and 5% for all other structural concrete.
      c. Do not use aggregate containing more than 10% of inferior materials, including: flat or elongated particles, cracked or laminated rock, or rock than can be readily broken after immersion in water for one hour.
   3. Fine Aggregate:
      a. Provide natural sand or a combination of natural and manufactured sand, of siliceous, granitic or igneous origin, hard and durable.
      b. Deleterious substances: Submit compliance with ASTM C33 Table 1 and as follows:
         1) Organic impurities: ASTM C40 and C87. Not less than 95% relative strength by ASTM C87.
         2) Sand equivalent: CALTRANS Test 217. For three tests not less than 70, with an average greater than 75.

© December 2012 Kennedy/Jenks Consultants

C. Combined Aggregates: Provide a mixture of fine aggregate and coarse aggregate uniformly graded between the screen sizes specified below.

Sieve Size	Percentage Passing	
	1-1/2-Inch Maximum	1-inch Maximum
2 inches	100	--
1-1/2 inches	90-100	100
1-inch	50-96	90-100
¾-inch	45-80	55-100
3/8-inch	38-55	45-75
No. 4	30-45	35-60
No. 8	23-38	27-45
No. 16	17-33	20-35
No. 30	10-22	12-25
No. 50	3-10	3-15
No. 100	0-3	0-5
No. 200	0-2	0-2

2.03 WATER

A. Provide water meeting AASHTO T26 for washing aggregates, for mixing concrete, for patching grout and for curing that is free from oil and contains not more than 1,000 parts per million (ppm) of chlorides as Cl, nor more than 1,300 ppm of sulfates as SO_4. Do not allow impurities that will cause a change in the setting time of the Portland Cement of more than 25%, nor a reduction in the compressive strength of mortar at 14 days of more than 5%, when compared to the results obtained with distilled water.

B. Do not allow impurities that cause discoloration of the concrete or produce etching of the surface.

C. The Engineer may require tests of the water should there be a question of the quality. Costs of such tests would be borne by the Owner, unless the quality does not meet the requirements in Paragraph A above.

2.04 ADMIXTURES

A. Air Entraining: ASTM C260, MB AE 90 by BASF or equal. AEA-92 or 92S by Euclid. Daravair by Grace or equal.

B. Accelerating: ASTM C494, Type C or E: POZZOLITH® NC 534 by BASF. Accelguard 80 by Euclid or equal.

C. Retarding: ASTM C494, Type D: Daratard 17 by Grace. Eucon Retarder 75 by Euclid or equal.

D. Water Reducing: ASTM C494, Type A: WRDA 64 by Grace. Pozzolith 200N by BASF, Eucon WR-91 by Euclid or equal.

E. High Range Water Reducing: ASTM C494, Types F or G, second or third generation type. Add at the batch plant, after all other ingredients have been mixed and initial slump has been verified. ADVA 190 by Grace. Glenium 3030 NS by BASF, Eucon 1037 by Euclid or equal.

© December 2012 Kennedy/Jenks Consultants

F. Shrinkage Reducing: ASTM C157. Eclipse by W.R. Grace, Tetraguard AS20 by Master Builders, or equal. Eucon SRA+ by Euclid or equal.

G. Corrosion Inhibition and Permeability Reduction (Silica Fume): ASTM C1240. Force 10,000 or 10,000D (dry) by W.R Grace, Rheomac 222+ by Master Builders, or equal.

H. Controlled Low Strength Material (CLSM) Admixture: See ASTM C869. DaraFill by W.R.Grace, Rheocell by Master Builders, or equal.

I. When two or more admixtures are used, they must be added to the mix separately (through dispensers or manually) and must not be mixed with each other prior to adding to the concrete mix. Add admixtures to concrete mix ingredients in liquid form by a special dispensing unit, approved by the manufacturer of the admixture as suitable for accurately dispensing the admixture. Install an alarm or indicator, which will immediately inform the batch plant operator if the dispensing unit malfunctions. Dispense admixtures uniformly into the mixing water as it is added to the concrete batch.

J. When two or more admixtures are used, manufacturer shall certify that the admixtures are compatible with each other and will not detrimentally impact the performance of other admixtures.

K. Admixtures containing any chloride ions are prohibited.

L. Manufacturers: WR Grace & Co., Master Builders, Inc., or equal.

2.05 CONCRETE MIX DESIGN

A. General:

1. Employ an independent commercial testing laboratory complying with ASTM C1077 and favorably reviewed by the Engineer to design all concrete mixes and carry out all necessary testing. Concrete mix design proportions shall be established on the basis of field experience and trial mixtures with the materials to be employed in accordance with ACI 318 Section 5.3.
2. If the testing laboratory has mix designs meeting the specifications that are available from prior projects, submit test record statistics to demonstrate compliance with the requirements of this Section and ACI 318 Section 5.3. Include calculations for f'cr based on source quality test records.
3. If new mix designs are required, prepare a range of trial batches for each design and submit the mixes that demonstrate satisfactory test results in accordance with ACI 318 Section 5.3.
4. Allow for the variability of concrete strength from test to test by increasing the required average compressive strength over the specified strength as specified in ACI 318 Section 5.3.
5. Design the mixes far enough ahead of concrete placement to allow completion of trial batch testing and submittal of the test results and mix design to the Engineer for review.
6. Take sole responsibility for selection of laboratory, submittal of materials to laboratory in time for all tests, and overall timing of all aspects of testing program, including submittals.
7. Prepare mix designs for concrete placement by the batch process and/or by pumping, as required, and state the process on the design submittal.

© December 2012 Kennedy/Jenks Consultants

8. Allow for the hot or cold weather and the time required to transport the concrete from the mixer to the site and to place within the forms. If accelerating or retarding admixtures will be required for only a proportion of the concrete placements, submit test results that include the full range of options.
9. Do not exceed the water-cementitious material ratios. Vary the water-reducing admixtures to accomplish an increase in slump or workability time.
10. Proportion cementitious materials, aggregates, and water by weight.
11. Check periodically the weight of moisture contained within the stockpiled aggregates. Compensate for this water when proportioning the concrete mix and adjust when change occurs.
12. Do not use chlorides in any concrete mix.
13. Resubmit mix design for review for each class of concrete when modification of the mix design is required by ACI 350 or 318 Chapter 5.3. If a class of concrete requires modification based on low strength tests, contractor shall discontinue use of mix design until corrective action can be taken, and a revised mix design is favorably reviewed.

B. Mix Proportions:

Mix Design Requirements	Concrete Type		
	A	C	E
Specified 28-Day Compressive Strength (lb/in^2)	4,000	4,000	2,500
Maximum Coarse Aggregate Size (in)	1	1	1
Air Content at Point of Placement (%)	6	1	1
Maximum Water-Cementitious Material Ratio	0.45	0.50	0.55
Minimum Cementitious Material Content (lb/yd^3)	570	570	510
Maximum 28-Day Drying Shrinkage (%) – Mix Test	0.05	--	--

C. Cementitious Material: Either Portland Cement, cement with fly ash, cement with natural Pozzolan, blended cement, or cement with slag.

D. Pozzolan, Slag or Fly ash: Optional. Not less than 10%, nor more than 20% of the weight of the cementitious materials. Do not use pozzolan or fly ash as an admixture in concrete made with Portland-Pozzolan cement.

E. Mix Test Requirements:
1. Compression: ASTM C192 for cylinder preparation. ASTM C39 for cylinder tests. Submit 7-day and 28-day curing test results in accordance with Paragraph A above.
2. Slump: ASTM C143. Slump range is 3 to 4 inches. After high-range water reducer added, range is 6 to 9 inches.
3. Air Content: ASTM C231. Air content range is ±1%.
4. Shrinkage: The mix tests requirements shall be in accordance with ASTM C157, except as described below. NOTE: The following requirements

© December 2012 Kennedy/Jenks Consultants

differ from ASTM C157 and must be strictly followed in order to obtain favorable review for a concrete mix design. One set of three test specimens shall be prepared.

a. Moist curing: Specimens shall be removed from molds at 23 ±1 hours after batching and shall be placed in water for at least 30 minutes and shall be measured within 30 minutes to determine original length. Specimens shall be submerged in saturated lime water until 7 days after batching.
b. Measurements: Measurements to determine shrinkage shall be made after 7, 14, 21, and 28 days of drying after 7 days of moist curing. Compare to the preliminary measurement made after 1-day and the basic measurement made after 7 days, which will be used for calculations.
c. Test prism size: 4 by 4 by 11 inches.
d. Report all test results, with the 28-day tests results governing acceptance. Plot the results at other time intervals as a test of validity of the readings.

5. After favorable review of the mix design, no variations of the constituents are permitted during the project without prior submittal and favorable review.

2.06 READY-MIX CONCRETE

A. Supply concrete for the project using one of the following methods:
   1. Supply concrete using truck mixers and a ready-mix plant certified by the National Ready-Mix Concrete Association.
   2. Qualify the supplier according to ASTM C94 Sections 8 through 11, inclusive.

2.07 CEMENT MORTAR

A. For repairs and patching concrete voids as noted in Section 03350.

B. One-part Portland Cement, two-parts fine sand (by weight) and water. Use only the amount of water needed to make the mix workable for the intended use.

C. Provide a mixture of white and regular cements as required to make a mortar that after curing 28 days will match the adjacent concrete in color and texture. Prepare several trial batches and make test samples in an inconspicuous location for review.

D. When a mix has been selected for color match, batch all mortar by weight in accordance with the formula for the selected mix.

2.08 CRACK REPAIR EPOXY ADHESIVE

A. Crack Repair Epoxy Adhesive shall be a two-component, solvent-free, moisture insensitive epoxy resin material suitable for crack grouting by injection or gravity feed. It shall be formulated for the specific size of opening or crack being injected.

B. All concrete surfaces containing potable water or water to be treated for potable use that are repaired by the epoxy adhesive injection system shall be coated with an acceptable epoxy coating approved by the FDA for use in contact with potable water.

© December 2012 Kennedy/Jenks Consultants

C. Products:
   1. For standard applications: Sikadur 35 Hi-Mod LV by Sika Corporation, Lyndhurst, NJ; SCB Concresive 1380 by BASF, Shakopee, MN; or approved equal.
   2. For very thin applications: Sikadur 35 Hi-Mod LV LPL by Sika Corporation, Lyndhurst, NJ; SCB Concresive 1360 by BASF, Shakopee, MN; or approved equal.

2.09 NONSHRINK CEMENTITIOUS GROUT (NON-SHRINK GROUT):

A. Non-shrink cementitious grouts shall meet or exceed the requirements of ASTM C1107, Grades B or C and CRD C-621. Grouts shall be Portland Cement based, contain a pre-proportioned blend of selected aggregates and shrinkage compensating agents and shall require only the addition of water. Non-shrink cementitious grouts shall not contain expansive cement or metallic particles. The grouts shall exhibit no shrinkage when tested in conformity with ASTM C827.
   1. General purpose non-shrink cementitious grout shall conform to the standards stated above and shall be SikaGrout 212 by Sika Corp.; Euco NS by The Euclid Chemical Co.; Five Star Grout by Five Star Products, Inc.; or approved equal.
   2. Flowable (Precision) non-shrink cementitious grout shall conform to the standards stated above and shall be Hi-Flow Grout by the Euclid Chemical Co.; SikaGrout 212 by Sika Corp.; Five Star Grout by Five Star Products Inc.; or approved equal.

2.10 NONSHRINK EPOXY GROUT:

A. Non-shrink epoxy-based grout shall be a pre-proportioned, three-component, 100% solids system consisting of epoxy resin, hardener, and blended aggregate. It shall have a compressive strength of 14,000 psi in 7 days when tested in conformity with ASTM D695 and have a maximum thermal expansion of 30 x 10-6-inch per inch per degree F when tested in conformity with ASTM C531. The grout shall be Five Star HP Epoxy Grout by Five Star Products.; Sikadur 42 Grout-Pak by Sika Corp.; E3-G Epoxy Grout by the Euclid Chemical Co.; or approved equal.

2.11 SOURCE QUALITY CONTROL

A. Concrete:
   1. Provide ready-mix batch plant delivery tickets contain all product information necessary for acceptance of the concrete delivered to site.
   2. Document and record that the mixing and trucking equipment have adequate capacity to deliver the concrete batches to site on time, thoroughly mixed and discharge without segregation.

PART 3 - EXECUTION

3.01 PROPORTIONING CONCRETE MATERIALS

A. Do not place concrete prior to favorable review of submittals for reinforcing steel, materials specified in this Section and the mix proposed. Unfavorable results of actual placements may require a redesign of mixes in addition to corrective work related to any defects.

© December 2012 Kennedy/Jenks Consultants

B. Do not make substitutions to the constituents tested in the design of concrete mixes without favorable review of the revised mix and the new test results.

3.02 BATCHING AND MIXING CONCRETE MATERIALS

A. General:
   1. Deliver completely mixed to the project site.
   2. Do not add water unless approved by the Engineer. Do not add mixing water during hauling. Add water after delivery and only from the “hold-out” volume indicated on the mix ticket. Should water be added, revolve the mixing drum not less than 30 revolutions at mixing speed after adding and before commencing discharge.
   3. Deliver each load at the job site accompanied by a ticket showing mix design number, volume of concrete, the weight of cement in pounds and the total weight of each ingredient in pounds. Also show the time at which the materials were batched and the reading of the revolution counter at the time the truck mixer was charged.
   4. No retempering of partially hardened material is permitted. Do not use partially hardened concrete in the work.

B. Batching in Adverse Weather:
   1. Cold Weather: In accordance with Section 03306.
   2. Hot Weather: In accordance with Section 03305.

3.03 FORMS AND FORMING

A. In accordance with Section 03100.

3.04 PLACING CONCRETE AND GROUT

A. Preliminary Work:
   1. Remove hardened concrete and foreign materials from the inner surface of the mixing and conveying equipment. Remove all debris from the space to be occupied by the concrete.
   2. Remove water from the space to be occupied by the concrete before concrete is deposited. Divert any flow of water into an excavation through proper site drainage to a sump, or by other methods. If required by the Engineer, grout up any water vent pipes and drains after the concrete has thoroughly hardened.
   3. Provide satisfactory redundancy in the delivery system so that work can continue in the event of a breakdown.
   4. Do not use aluminum materials in pumping lines, transfer hoppers or chutes longer than 12 feet. Provide conveyor belts instead of chutes when the distance is longer than 50 feet. Use a storage hopper at the start of the line.
   5. For pumped concrete, provide a hose with an angle-change, to create a back-pressure at the outlet.
   6. Provide illumination if necessary inside the forms, so that the placed concrete will be visible from the deck at top of formwork.
   7. Do not place concrete on frozen subgrade.

B. Embedded Items:
   1. Place equipment, bolts, anchors, sleeves, inserts, structural steel members, angles and similar items which require embedment in the concrete.

© December 2012 Kennedy/Jenks Consultants

2. Hot-dip galvanize ferrous metal sleeves, inserts, anchors, and other embedded ferrous items unless shown otherwise. Set anchor bolts for equipment in templates, carefully plumbed and checked for location and elevation with an instrument, and held in position rigidly by double-nutting to the template to prevent displacement while concrete is being placed.
3. Ensure that aluminum items inserted in the concrete are isolated by a bituminous or asphaltic coating in accordance with Division 5 Specification.
4. Notify engineer where modifications are necessary to avoid interference with reinforcing steel or embedded items.
5. Inspect the installation of embedded items and reinforcing.
6. Unless noted otherwise on the Drawings do not embed conduit or pipe in concrete.

C. Placing:
1. Place concrete without separation or loss of ingredients and without displacement of the reinforcement. Do not deposit partially hardened concrete in the work. Place concrete in the forms as near as practicable in its final position to avoid rehandling. Maintain, until the completion of the placement, a plastic concrete surface, approximately horizontal.
2. Maximum height of free fall for concrete during placement:
   a. Concrete with maximum 4-inch slump: 4 feet
   b. Concrete with high-range water reducing admixture and minimum 6-inch, maximum 9-inch slump: 8 feet
3. Place concrete continuously or in layers 12 to 20 inches in depth so that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously as originally planned, locate construction joints during the placement.
4. Provide a dense, impervious, homogeneous concrete, free from voids or pockets. If honeycomb, air, or rock pockets occur, repair the structure in accordance with Paragraph 3.09, and modify the placing method or mix design, to prevent recurrence of deficient concrete. Provide such repairs and modifications at no additional cost. Honeycomb or large defects may be cause for rejection of the work.

D. Time Limit: Place all concrete in its final position in slab or forms within 1-1/2 hours of batching or before the drum has revolved 300 revolutions, whichever comes first in accordance with ASTM C94. Alternatively, as part of the mix design, provide admixtures that delay the initial set and state the proposed length of time in the submittal.

E. Temperature Limits: Place all concrete in its final position in slab or forms at:
1. Less than 90°F, measured in the mix.
2. More than 40°F, measured both in the mix and in the air, with air temperature predicted to rise above 50°F.
3. More than 50°F, measured in the mix, 40°F measured in the air, with air temperature falling.
4. Temperature measurements above refer to on-site measurements. Refer to the vibration, concrete joints and curing sections for other requirements.
5. When the temperatures are outside these ranges, place concrete in accordance with Sections 03305 and 03306.

© December 2012 Kennedy/Jenks Consultants

F. Precast Items:
   1. Supply and design vaults and manholes in accordance with the Division 2 sections for these items. Comply with additional requirements below.
   2. Items may be cast on or off the site.
   3. Apply all applicable portions of Sections 03300, 03100, 03150, 03330, and 03350, including materials, forms, placement, finish, and curing.
   4. Take particular care when handling and placing the precast items. Lift or move after a minimum of 90% of the specified compressive strength has been attained. Use the average compressive strength of two test cylinders.

3.05 VIBRATION

A. Furnish sufficient vibrators to complete the compaction as specified without causing delay in the depositing of concrete. Provide a minimum of two vibrators, and at least one unit in addition to those planned for active use.

B. Operate vibrators with vibratory element submerged in the concrete, with frequency between 8,000 and 12,000 impulses per minute when submerged.

C. Compact the concrete with high frequency, internal mechanical vibrating equipment, and when required, supplement by hand spading and tamping. Consolidate slabs 6 inches or less in depth by hand tampers, spreading and settling with a heavy leveling straight edge.

D. Vibrate by direct action in the concrete for approximately 10 seconds at approximately 12-inch intervals, not against forms or reinforcements. Do not move concrete horizontally by vibration. Vibrate the concrete around the reinforcement, and around embedded fixtures and into the corners of the forms. Penetrate 6 to 12 inches into previously placed layers as new layers are placed, provided the running vibrator penetrates by its own weight. To secure even and dense surfaces, free from aggregate pockets, honeycomb, or air pockets, supplement vibration when required by forking or spading by hand or hammering the forms lightly opposite the freshly placed concrete. Revibrate the final layer. Stop vibrating when concrete is thoroughly compacted and has ceased to decrease in volume and give off air bubbles.

E. When placing concrete with 8-inch or more slumps, reduce the time of vibration to 5 seconds and follow the admixture manufacturer's recommendations for technique.

3.06 INSTALLATION – CEMENT GROUTS AND NONSHRINK CEMENTITIOUS GROUTS

A. Mix in accordance with manufacturer's recommendations. Do not add cement, sand, pea gravel or admixtures without prior approval by the City Representative.

B. Avoid mixing by hand. Mixing in a mortar mixer (with moving blades) is recommended and will be required if required by the manufacturer. Pre-wet the mixer and empty excess water. Add premeasured amount of water for mixing, followed by the grout. Begin with the minimum amount of water recommended by the manufacturer and then add the minimum additional water required to obtain workability. Do not exceed the manufacturer's maximum recommended water content.

C. Placements greater than 3-inch in depth shall include the addition of clean, washed pea gravel to the grout mix when approved by the manufacturer. Comply with the

© December 2012 Kennedy/Jenks Consultants

manufacturer's recommendations for the size and amount of aggregate to be added.

D. Place grout into the designated areas in a manner which will avoid segregation or entrapment of air. Do not vibrate grout to release air or to consolidate the material. Placement should proceed in a manner which will ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.

E. Place grout rapidly and continuously to avoid cold joints. Do not place cement grouts in layers. Do not add additional water to the mix (retemper) after initial stiffening.

F. Just before the grout reaches its final set, cut back the grout to the substrate at a 45-degree angle from the lower edge of bearing plate unless otherwise approved by the City Representative. Finish this surface with a wood float (brush) finish.

G. Begin curing immediately after form removal, cutback, and finishing. Keep grout moist and within its recommended placement temperature range for at least 24 hours after placement or longer if recommended by the manufacturer. Saturate the grout surface by use of wet burlap, soaker hoses, ponding or other approved means. Provide sunshades as necessary. If drying winds inhibit the ability of a given curing method to keep grout moist, erect wind breaks until wind is no longer a problem or curing is finished.

3.07 INSTALLATION – NONSHRINK EPOXY GROUTS

A. Mix in accordance with the procedures recommended by the manufacturer. Do not vary the ratio of components or add solvent to change the consistency of the grout mix. Do not over mix. Mix full batches only to maintain proper proportions of resin, hardener and aggregate.

B. Monitor ambient weather conditions and contact the grout manufacturer for special placement procedures to be used for temperatures below 60° or above 90° F.

C. Place grout into the designated areas in a manner which will avoid trapping air. Placement methods shall ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.

D. Minimize "shoulder" length (extension of grout horizontally beyond base plate). In no case shall the shoulder length of the grout be greater than the grout thickness.

E. Finish grout by puddling to cover all aggregate and provide a smooth finish. Break bubbles and smooth the top surface of the grout in conformity with the manufacturer's recommendations.

F. Epoxy grouts are self curing and do not require the application of water. Maintain the formed grout within its recommended placement temperature range for at least 24 hours after placing, or longer if recommended by the manufacturer.

3.08 INSTALLATION - CONCRETE GROUT

A. Inspect slabs finished under Section 03350 and scheduled to receive concrete grout. Protect and keep the surface clean until placement of concrete grout.

© December 2012 Kennedy/Jenks Consultants

B. Remove the debris and clean the surface by sweeping and vacuuming of all dirt and other foreign materials. Pressure wash the surface. Do not flush debris into structure drain piping.

C. Saturate the concrete surface for at least 24 hours prior to placement of the concrete grout by use of saturated burlap bags, soaker hoses, or ponding. Remove excess water just prior to placement of the concrete grout. Place a cement slurry immediately ahead of the concrete grout so that the slurry is moist when the grout is placed. Work the slurry over the surface with a broom until it is coated with approximately 1/16 to 1/8-inch thick cement paste. A bonding grout composed of 1-part Portland Cement, 1.5 parts fine sand, an approved bonding admixture and water, mixed to achieve the consistency of thick paint, may be substituted for the cement slurry.

D. Place concrete grout to final grade using the scraper mechanism as a guide for surface elevation and to eliminate high and low spots. Unless specifically approved by the equipment manufacturer, mechanical scraper mechanisms shall not be used as a finishing machine or screed.

E. Provide grout control joints as indicated on the Drawings.

F. Steel trowel finish as specified in Section 03350. Cure the concrete grout as specified for cast-in-place concrete.

3.09 REPAIR OF DEFECTIVE CONCRETE

A. Inspect all concrete surfaces immediately after carefully removing forms. Defective work includes concrete out of line, level or plumb; cracks; poor joints; rock pockets; honeycomb; voids; spalls and exposed reinforcing. Patch all minor defects, including form tie holes, before the concrete is thoroughly dry. Do not interrupt the curing program. Ensure that repairs match the existing surface for color and texture.

B. Minor Defects:
   1. Clean thoroughly, including removal of any curing compound. Cut out to solid concrete but to a depth of not less than 1-inch. Prepare the edges of the cut slightly more than perpendicular to the surface of the concrete, so as to form a key.
   2. Repair with cement mortar. Use minimum water, consistent with the requirements of handling and placing. Thoroughly compact the material into place and screed off to leave the patch flush with the surrounding surface.
   3. Keep the surface damp for at least 48 hours.

C. Major Defects:
   1. Large areas involving voids or rock pockets extending through the section may be cause for rejection of the work.
   2. If acceptable repairs can be made without adversely affecting the structural integrity of the work, cut out the section and either dry pack, or reform and re-pour to match the adjacent concrete. Do not cut the reinforcing, but cut keyways into the adjacent sound concrete to securely fasten the patch to the original work. Prepare edges of the damaged area with a minimum of a 1-inch cut perpendicular to the concrete surface.

© December 2012 Kennedy/Jenks Consultants

3. Coat all surfaces with epoxy bonding compound immediately prior to patching. Place the concrete patch before the epoxy has set. Follow the epoxy bonding manufacturer's recommendations.
4. Provide a patch with strength and modulus of elasticity compatible with the parent concrete. Cure in accordance with the following article.

D. Cracks:
1. All cracks 0.010 inches or wider in waterbearing surfaces and cracks 1/32 inches or wider in other surfaces shall be repaired.
2. Cracks on horizontal surfaces shall be repaired by gravity feeding crack repair epoxy adhesive into cracks per manufacturer’s recommendations. If cracks are less than 1/16-inch in width they shall be pressure injected.
3. Cracks on vertical surfaces shall be repaired by pressure injecting crack repair epoxy adhesive through valves sealed to surface with epoxy paste per manufacturer’s recommendations.

3.10 CONCRETE JOINTS

A. In accordance with Section 03100.

3.11 CURING AND PROTECTION

A. In accordance with Section 03330.

3.12 CONCRETE FINISHES

A. In accordance with Section 03350.

3.13 TESTING OF HYDRAULIC STRUCTURES

A. In accordance with Section 03340.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 03305

HOT WEATHER CONCRETING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Concrete to be placed and cured in hot weather. Hot weather is considered to exist with job-site conditions that accelerate the rate of moisture loss or rate of cement hydration of freshly mixed concrete. These conditions include ambient temperatures above 80°F or any combination of ambient temperature, concrete temperature, low humidity and wind that combine to produce an evaporation rate that exceeds 0.2 lb/ft^2/h.

B. Related Sections:
1. Section 03100: Concrete Forms and Accessories
2. Section 03200: Reinforcing Steel
3. Section 03300: Cast-in-Place Concrete
4. Section 03306: Cold Weather Concreting
5. Section 03330: Concrete Curing
6. Section 03350: Concrete Finishes

1.02 REFERENCES

A. American Concrete Institute (ACI):
1. ACI 301 Specifications for Structural Concrete for Buildings
2. ACI 305 Guide to Hot Weather Concreting
3. ACI 318 Building Code Requirements for Structural Concrete
4. ACI 350 Environmental Engineering Concrete Structures

B. ASTM International (ASTM) Standard Specification or Test Method:
1. ASTM C31 Standard Method of Making and Curing Test Specimens in the Field
2. ASTM C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
3. ASTM C156 Standard Test Method for Water Retention by Concrete Curing Materials
4. ASTM C171 Standard Specification for Sheet Materials for Curing Concrete
5. ASTM C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
6. ASTM C1064 Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete

C. International Building Code (IBC) 2009 Edition and California Building Code (CBC) 2010 Edition**.**

© December 2012 Kennedy/Jenks Consultants

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Shop Drawings:
   1. Program and method of production, transportation, placement, protection, curing and temperature monitoring of concrete during hot weather.

C. Quality Assurance:
   1. Site Condition Logs: Submit a copy of the ambient temperature, concrete temperature, relative humidity and wind velocity logs to the Engineer for inclusion in the construction management records. See FIELD QUALITY CONTROL.

1.04 QUALITY ASSURANCE

A. Contractor Qualifications: 10 years of experience on similar water containment facilities.

B. Construction Standard: Applicable requirements of the IBC, CBC, ACI 301, ACI 305, ACI 318, and ACI 350.

1.05 DELIVERY, STORAGE AND HANDLING

A. During periods of hot weather all materials and equipment required for extended protection of concrete shall be available at the project site before hot weather concreting begins.

PART 2 - PRODUCTS

2.01 GENERAL

A. Refer to Specification Section 03300.

PART 3 - EXECUTION

3.01 PREPARATION BEFORE PLACEMENT

A. Surfaces in contact with concrete shall be within 10°F degrees of the temperature of freshly placed concrete.

B. Do not place concrete against surfaces of dry absorbent materials.

C. Do not place concrete against surfaces that have free water.

3.02 BATCHING AND MIXING

A. Reduce the temperature of the concrete mix by using some combination of iced mixing water, refrigerated mixing water, liquid nitrogen cooled mixing water, water-spray cooled coarse aggregate, or air cooled coarse aggregate.

B. If water cooled aggregate is used to reduce mix temperature the amount of water shall be offset in the batching of the mix so as not to exceed the maximum specified water-cement ratio.

© December 2012 Kennedy/Jenks Consultants

3.03 PLACING, CURING AND PROTECTION

A. Placing:
   1. Temperature of freshly placed concrete shall not exceed 80°F as measured by ASTM C1064.
   2. Should the provisions noted above not be possible or practicable, postpone the batching until favorable weather conditions prevail, consider scheduling placement at other than normal hours.

B. Curing:
   1. General: Refer to Specification Section 03330.
   2. Temperature of concrete shall not exceed 90°F during the specified curing period.
   3. Use water for moist curing that is no more than 20°F cooler than the temperature of the concrete.

C. Protection:
   1. Protect the concrete against thermal shrinkage cracks caused by temperature drops greater than 40°F during the first 24 hours after placement. Means of protection may include insulating blankets, batt insulation with moisture-proof covering, or multiple layers of impervious paper meeting ASTM C171.
   2. Provide shade to concrete surfaces exposed to direct sunlight during the specified wet curing period.
   3. Liquid curing compounds approved for use after the initial wet curing period shall contain white, heat-rejecting, UV-inhibiting pigment meeting the moisture retention requirements of ASTM C309. Liquid curing compounds shall limit moisture loss in a 72-hour period to 9 lb/yd^3 when tested per ASTM C156.

3.04 REMOVAL OF FORMS

A. General: Refer to Specification Section 03100.

B. For systems requiring a specified level of strength before forms and shoring can be removed, such as suspended slabs, girders, and beams, compressive strength shall be verified by additional field cured cylinders, see FIELD QUALITY CONTROL.

3.05 CONCRETE FINISHES

A. General: Refer to Section 03350.

B. Apply an evaporation retarder during the finishing operation following the manufacturer's recommendation.

3.06 FIELD QUALITY CONTROL

A. Protection and Monitoring:
   1. Monitor site conditions (air temperature, humidity, wind speed) beginning no later than 1-hour before the start of concrete placement.
   2. Use the Menzel equation in accordance with ACI 305 to assess the evaporation rate and need for evaporation control measures.
   3. Continue monitoring at intervals of 30 minutes or less until specified curing procedures have been applied. Continue monitoring at hourly intervals during the specified curing period.

© December 2012 Kennedy/Jenks Consultants

4. Instruments for measuring field conditions shall be certified by the manufacturer to be accurate within 2°F, 5% relative humidity, and 1 mph.
5. Monitor the temperature of protected concrete to evaluate the effectiveness of the protection and to ensure excessive heating does not occur.
6. Temperature measuring devices embedded 2 inches below the face are ideal but surface measurements provide satisfactory results.
7. Record the temperature of the concrete at multiple locations, the daily maximum and minimum concrete temperature, location where temperature was taken, ambient temperature, relative humidity, wind speed, weather conditions, and other special conditions.
8. Include a copy of the temperature logs in the permanent job records.
9. Submit a copy of the temperature logs to the Engineer for inclusion in the construction management records.

B. Additional Compressive Strength Testing:
1. During concrete placement in systems requiring a specified level of strength before shoring can be removed (i.e. suspended slabs, girders and beams), cast four (4) additional 6-inch-diameter by 12-inch cylinders to be cured under field conditions in accordance with ASTM C31.
2. Test two (2) cylinders for compressive strength, in accordance with ASTM C39, at 28 days, or the age of interest, hold two (2) cylinders as back-ups.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 03306

COLD WEATHER CONCRETING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Concrete to be placed and cured in cold weather. Cold weather is considered to exist when the temperature has fallen below, or is expected to fall below, 40°F during placement and curing.

B. Related Sections:
   1. Section 03100: Concrete Forms and Accessories
   2. Section 03200: Reinforcing Steel
   3. Section 03300: Cast-in-Place Concrete
   4. Section 03305: Hot Weather Concreting
   5. Section 03330: Concrete Curing
   6. Section 03350: Concrete Finishes

1.02 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 301 Specifications for Structural Concrete for Buildings
   2. ACI 306 Guide to Cold Weather Concreting
   3. ACI 318 Building Code Requirements for Structural Concrete
   4. ACI 350 Environmental Engineering Concrete Structures

B. ASTM International (ASTM) Standard Specification or Test Method:
   1. ASTM C31 Standard Method of Making and Curing Test Specimens in the Field
   2. ASTM C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
   3. ASTM C150 Standard Specification for Portland Cement

C. International Building Code (IBC) 2009 Edition and California Building Code (CBC) 2010 Edition**.**

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data:
   1. Refer to Specification Section 03300.

C. Shop Drawings:
   1. Program and method of production, transportation, placement, protection, curing and temperature monitoring of concrete during cold weather. Include in submittal the procedures to be implemented upon abrupt changes in weather or equipment failure.

©2012 Kennedy/Jenks Consultants

D. Quality Assurance:
   1. Submit a copy of the concrete temperature logs to the Engineer for inclusion in the permanent construction management records. See FIELD QUALITY CONTROL.

1.04 QUALITY ASSURANCE

A. Contractor Qualifications: 10 years of experience on similar water containment facilities.

B. Construction Standard: Applicable requirements of the IBC, ACI 301, ACI 306, ACI 318, and ACI 350.

1.05 DELIVERY, STORAGE AND HANDLING

A. During periods of cold weather all materials and equipment required for extended protection of concrete shall be available at the project site before cold weather concreting begins.

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

A. Refer to Specification Section 03300.

PART 3 - EXECUTION

3.01 PREPARATION BEFORE PLACEMENT

A. Remove snow, ice, and frost from surfaces to be in contact with concrete. Remove any standing water created by the removal of snow and ice. Recompact subgrade disturbed by removal of snow, ice and frost.

B. Subgrade shall be thawed to a minimum depth of 6 inches.

C. Surfaces in contact with concrete shall be within 10°F of the temperature of freshly placed concrete.

D. Formwork, reinforcing, subgrade and embedded items shall be above 32°F.

E. Do not attempt to heat reinforcing, formwork, subgrade, or embedded metal items with a blow torch or by water spray.

3.02 BATCHING AND MIXING

A. Heat the materials before mixing, so that the temperature of the mix at the batch plant shall be between 65° and 80°F. Do not heat the mixing water or the cement over 180°F unless it can be reliably demonstrated that flash set is not a problem. Remove lumps of frozen material and ice from the aggregates before they are placed in the mixer.

B. Should the provisions noted above not be possible or practicable, postpone the batching until favorable weather conditions prevail.

© 2012 Kennedy/Jenks Consultants

3.03 PLACING, CURING AND PROTECTION

A. Provide adequate shelter and equipment for heating the placed concrete during cold weather:
   1. Maintain freshly placed concrete at the temperature listed in Column 2 of the table below for the specified protection period.

1	2	3
Least dimension of section, in.	Minimum temperature of concrete as placed and maintained during protection period ^{o}F	Maximum temperature drop (ΔT) per 24 h period after end of protection ^{o}F
Less than 12	55	50
12 to less than 36	50	40
Greater than 36	45	30

   2. Concrete placement temperature shall not exceed the temperatures in Column 2 by more than 20°F.
   3. Keep the housing, covering, or other protection in place and intact at least 24 hours after the artificial heating is discontinued to allow for a gradual decrease in temperature. The maximum decrease in temperature in a 24-hour period shall not exceed the values shown in Column 3 of the table above. Do not exceed these limits until the concrete is within 20°F of the ambient temperature.
   4. Do not use manure, salt, calcium chloride, or other chemicals on the concrete to prevent freezing.

B. Protection Period:
   1. Keep cold weather protection in place and maintain concrete within the temperature limits specified in Paragraph A for a minimum of:
      a. Footings, foundations, piers — 2 days
      b. Slabs on grade, below grade walls — 3 days
      c. Above grade walls — 6 days
      d. Suspended slabs, girders, beams — Full design compressive strength to be verified by additional field cured cylinders, see FIELD QUALITY CONTROL.
   2. Engineer may increase the protection period if the temperature requirements were not met during the specified protection period.
   3. During periods <u>not</u> defined as cold weather all freshly placed concrete surfaces shall be protected from unexpected freezing for at least the first 24 hours after placement.

C. Heating:
   1. Vent flue gasses to the outside of the enclosure if combustion heaters are used.
   2. Place and direct heaters and ducts to prevent overheating and drying of the concrete surface
   3. For the duration of the protection period, do not expose concrete to air temperatures 20°F greater than those listed in Column 2 of the table above.

©2012 Kennedy/Jenks Consultants

3.04 REMOVAL OF FORMS

A. Forms shall remain in place for the full protection period.

B. Engineer may increase the time for form removal in conjunction with the protection period if the specified temperature and temperature monitoring requirements were not met during the protection period.

3.05 CONCRETE FINISHES

A. Refer to Specification Section 03350.

3.06 FIELD QUALITY CONTROL

A. Protection and Monitoring:
   1. Verify procedures have been submitted and equipment is available for controlling concrete temperature during cold weather conditions.
   2. Verify actual time of application of protection measures for each placement.
   3. Monitor the temperature of protected concrete to evaluate the effectiveness of the protection and to ensure excessive heating does not occur.
   4. Temperature measuring devices embedded 2 inches below the face are ideal but surface measurements provide satisfactory results.
   5. Record at least twice a day, for the specified period of protection, the temperature of the concrete at multiple locations(including both interior and edges with priority given to corners), the daily maximum and minimum concrete temperature, location where temperature was taken, air temperature, weather conditions, and other special conditions.
   6. Include a copy of the temperature logs in the permanent job records.
   7. Submit a copy of the temperature logs to the Engineer for inclusion in the construction management records.

B. Additional Compressive Strength Testing:
   1. During concrete placement in systems requiring a specified level of strength before shoring can be removed (i.e. suspended slabs, girders and beams), cast a set of four (4) additional 6-inch diameter by 12-inch cylinders to be cured under field conditions in accordance with ASTM C31.
   2. Test two (2) cylinders for compressive strength, in accordance with ASTM C39, at 28 days, or the age of interest, hold two (2) cylinders as back-ups.

END OF SECTION

© 2012 Kennedy/Jenks Consultants

SECTION 03330

CONCRETE CURING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Curing compounds, materials, methods and program.

B. Related Sections:
1. Section 03100: Concrete Forms and Accessories
2. Section 03150: Concrete Joints and Accessories
3. Section 03200: Reinforcing Steel
4. Section 03300: Cast-in-Place Concrete
5. Section 03305: Hot Weather Concreting
6. Section 03306: Cold Weather Concreting
7. Section 03350: Concrete Finishes

1.02 REFERENCES

A. American Concrete Institute (ACI):
1. ACI 301 Specifications for Structural Concrete for Buildings
2. ACI 306 Guide to Cold Weather Concreting
3. ACI 318 Building Code Requirements for Structural Concrete
4. ACI 350 Environmental Engineering Concrete Structures

B. ASTM International (ASTM) Standard Specification or Test Method:
1. ASTM C156 Water Retention by Concrete Curing Materials
2. ASTM C171 Sheet Materials for Curing Concrete
3. ASTM D471 Standard Test Method for Rubber Property-Effect of Liquids
4. ASTM D1056 Flexible Cellular Materials - Sponge or Expanded Rubber
5. ASTM E96 Water Vapor Transmission of Materials

C. International Building Code (IBC) 2009 Edition and California Building Code (CBC) 2010 Edition**.**

D. International Code Council (ICC)

E. National Sanitary Foundation (NSF) International Standard 61 – Drinking Water System Components

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data:
1. Curing program, including method selected, materials proposed for use and timing of water and product application, demonstrating compliance with requirements herein.
2. Curing products: Submit technical data including installation instructions, independent laboratory test reports (ICC), handling and storage instructions.

© December 2012 Kennedy/Jenks Consultants

a. Curing materials, including sheet materials and wet blankets if applicable.
b. Liquid applied curing compounds.
c. Evaporation Retardant.

C. Samples: Submit any item of Product Data not fully assembled by a single manufacturer.

1.04 QUALITY ASSURANCE

A. Contractor Qualifications: See Section 03300.

B. Construction Standard: Applicable requirements of the IBC OR CBC, ACI 301, ACI 318, and ACI 350.

C. Preconstruction Meeting: See Section 03300.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store liquid curing compounds in accordance with the manufacturer's recommendations and do not allow to freeze.

PART 2 - PRODUCTS

2.01 GENERAL

A. Obtain materials from an established and experienced manufacturer or supplier. Provide new materials of first-class ingredients guaranteed to perform the service required.

2.02 CURING MATERIALS

A. Cure by fog spray, or by one of the following methods after discontinuance of the fog spray. Slabs shall be continuously wet cured with sheet materials or wet blankets after discontinuance of the fog spray; liquid curing compound alone is insufficient.

B. Liquid Curing Compound: A water-based membrane-forming resin suitable for exterior or interior use as a curing and hardening compound on freshly placed concrete.
1. Provide an emulsion of synthetic resinous solids dispersed in water containing no waxes, paraffins or oils. Provide the fugitive type that will oxidize and disintegrate completely within 60 days when exposed to sunlight in exterior applications or that can be removed by washing with dilute muriatic acid or TSP in interior applications.
2. Water retention requirements: ASTM C309, Type I or II, Class B, when tested in accordance with ASTM C156.
3. Use white pigmented material for exterior applications (exposed to sunlight when applied or within 30 days thereafter) and clear material for interior applications.
4. Comply with the applicable local air quality district.
5. Exterior surfaces: Aqua Resin Cure-White by Dayton-Superior; 1200-White by W.R. Meadows; or equal.

© December 2012 Kennedy/Jenks Consultants

6. Interior surfaces: Spartan-Cote by Dayton-Superior; Vocomp 20 by W.R. Meadows; or equal.
7. Exterior surfaces are surfaces exposed to sunlight during the curing process, which includes portions of structures which will be interior surfaces upon completion of the structure, but do not have shade or sunlight protection during the curing process.

C. Sheet Materials: ASTM C171. Waterproof paper, plastic sheeting or white burlap-polyethylene sheet.
1. Plastic sheeting: fungus-resistant, minimum 4-mil thick, clear and free of defects, having ASTM E96 perm rating of not more than 0.5.
2. Waterproof paper: Two layers of non-staining kraft paper laminated with latex adhesive and reinforced with glass in both directions. Seal joints with 2-inch-wide tape with water-resistant adhesive.

D. Wet Blankets: Clean cotton mats (burlap, except for white burlap-polyethylene sheeting noted above, is unacceptable). Provide material free from any substance that will have a deleterious effect on the concrete. Use a thickness sufficient to retain moisture between programmed applications of water.

E. Evaporation Retardant: Eucobar by the Euclid Chemical Company; E-CON by L&M Construction Chemicals, Inc.; or equal.

PART 3 - EXECUTION

3.01 CURING AND PROTECTION

A. General:
1. Maintain concrete above 50°F and below 90°F in a moist condition and without external loadings for 14 days after placement.
2. Allow building material storage only after conclusion of cure time and only on plywood sheets and wood sleepers that spread the load and protect the finish.

B. Wet Cure:
1. Initial moist cure: Provide uniform spray treatment immediately following final troweling and before the surface can dry out, but after bleeding has stopped. Use clean water and special fog spray nozzles of type and number required to keep entire surface moist. Keep all traffic off floors for 36-hours. After vertical surfaces have hardened forms shall be loosened and water supplied to run down the inside of the form to keep the concrete wet. Curing water shall not be more than 20°F cooler than the concrete.

C. Sheet Material Cure:
1. Cover entire surface with sheet material for 14 days.
2. Place and secure sheet as soon as initial concrete set occurs.
3. Place smoothly upon the moist concrete surface with all joints and edges lapped a minimum of 4 inches and continuously sealed with tape.
4. Securely anchor sheeting to prevent wind and air from lifting the sheeting or entrapping air under the sheet.
5. Repair, replace and reseal, torn or scuffed sheets.
6. Do not use paper that will leave an impression on the finish.

© December 2012 Kennedy/Jenks Consultants

D. Liquid Membrane Cure:
   1. Apply over the entire concrete surface.
   2. Agitate compound thoroughly by mechanical means during use and apply uniformly in a two coat continuous operation by appropriate power-spraying equipment. Apply the two coats at right angles. Apply between 150 and 200 sq. ft. per gallon of undiluted compound, total coverage. Form a uniform, continuous, coherent film that will not check, crack, or peel and free from pinholes or other imperfections. Apply an additional coat immediately to areas where the film is defective.
   3. Keep alternate specified covering readily available for use in the event conditions occur which prevent correct application of the compound at the proper time.
   4. Respray surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied (when slab reaches a moist condition and there is no standing water) with two additional coats of curing compound by the foregoing method and coverage.
   5. Allow foot traffic only after 36 hours of cure time and only when slab is protected with paper or sheeting.
   6. Remove curing compound sprayed on reinforcing steel and construction joints. Remove by sandblasting or other favorably reviewed method after curing is completed, or before placing the next pour. If the cones of tie holes are sprayed with curing compound, lightly ream prior to patching.

E. Curing Method Applications:
   1. Slabs for Water Containment Structures: Provide 36-hour Wet Cure after 36 hours continue curing by continued wet cure or sheet membrane for the balance of 14 days. After 14 days apply a liquid membrane cure.
   2. Structural Slabs (other than water containment): Wet Cure or Sheet Material Cure for 14 days followed by a Liquid Membrane Cure.
   3. Topping and Composite Slabs: Sheet Material Cure for 14 days or Liquid Membrane Cure.
   4. Slabs on Grade and Footings (not used to contain water): Wet Cure or Sheet Material Cure for 14 days followed by Liquid Membrane Cure.
   5. Horizontal Surfaces which will Receive Additional Concrete, Coatings, Grout or Other Material that Requires Bond to the substrate: Wet cure for 14 days.
   6. Formed Surfaces:
      a. None if nonabsorbent forms are left in place 14 days.
      b. Wet Cure for 36 hours followed by a wet cure or sheet membrane cure for the balance of 14 days if absorbent forms including wood are used.
      c. Sheet Material Cure or Liquid Membrane Cure if forms are removed prior to 7 days.
      d. Exposed horizontal surfaces of formed walls or columns shall be Wet Cured for 14 days or until next placement of concrete is made.
   7. Concrete Joints: Wet Cure or Sheet Material Cure for 14 days.

F. Other Surfaces:
   1. Provide a curing program equivalent to either slab or formed system, as appropriate.
   2. Include construction joint surfaces when applying curing compound.
   3. Cover, or protect joint openings, exposed reinforcing, surfaces to be painted and other areas where curing compound may enter and interfere with a special finish.

© December 2012 Kennedy/Jenks Consultants

4. Remove curing compound sprayed on reinforcing or construction joints by sandblasting after curing is completed, or before placing the next pour. If the cones of tie holes are sprayed with curing compound, lightly ream prior to patching.
5. For curing of certain interior and other slabs using hardening or coloring compounds, refer to Section 03350.

G. Cold Weather Requirements: Provide adequate equipment for heating the placed concrete during freezing or near freezing weather:
1. Concrete shall be batched and placed in accordance with the requirements of Specification Section 03306 whenever the surrounding air temperature is below 40°F, or may fall below 40°F within the 24-hour period after placing concrete.

H. Hot Weather Requirements: Concrete shall be batched and placed in accordance with the requirement of specification Section 03305 whenever temperatures rise above 80°F, or low humidity, wind and temperature combine to cause high surface evaporation, over 0.2 lb/sq. ft./hr.

3.02 CONCRETE FINISHES

A. Refer to Section 03350.

3.03 FIELD QUALITY CONTROL

A. Notify Engineer when the forms are complete and ready for inspection at least 6 working hours prior to the proposed concrete placement.

B. Concrete Curing:
1. Verify procedures and equipment is available for controlling concrete temperature during hot and cold weather conditions.
2. Verify actual time of application of evaporation retardant, fog spray and curing materials for each placement.
3. For cold weather applications, record at least twice a day for the six days of special concrete curing and protecting procedures the temperature of the concrete at multiple locations (including surfaces, edges and corners), the daily maximum and minimum concrete temperature, location where temperature was taken, air temperature, weather conditions, and other special conditions. Measure concrete temperature in accordance with ACI 306.

3.04 CLEANUP

A. Upon completion of all work performed under this Section, remove from the site all excess materials, storage facilities and temporary facilities. Smooth and clean of debris all areas that were used or occupied during concrete construction operations and leave in first-class condition.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 03340

HYDROSTATIC TESTING OF STRUCTURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Materials and methods for hydrostatic (leakage) testing of concrete structures.

B. Related Sections:
   1. Section 03300: Cast-in-Place Concrete

1.02 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 350.1-01 Tightness Testing of Environmental Engineering Concrete Structures

B. California Building Code (CBC) 2010 Edition

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Written narrative documenting materials and approach for hydrostatic testing of concrete structures. Document water elevations, air temperature, water temperature, rainfall, duration of testing, and measurements to be recorded.

C. Submit completed test report upon completion, including all information noted in the written narrative.

1.04 QUALITY ASSURANCE

A. Contractor Qualifications: See Section 03300.

B. Preconstruction Meeting: See Section 03300.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 TESTING OF HYDRAULIC STRUCTURES

A. General: Test all concrete reservoirs, hydraulic channels, sumps, basins, chemical containment structures and other structures designed to contain water, after structural elements have been placed for the structure and concrete has reached the design strength, prior to backfilling, and application of any coating system. Test by filling the structure with water. Test adjacent reservoirs separately to confirm no cross leakage between reservoirs. Test in accordance with ACI 350.1-01 as modified herein.

© December 2012 Kennedy/Jenks Consultants

B. Preparation:
   1. Structure shall be complete prior to testing, including all roof slabs and walkway structures, and all structural elements shall have reached their full design strength.
   2. Provide all water necessary for testing, of acceptable quality.
   3. Provide all evaporation and level measuring devices required.
   4. Provide all pumps, power, piping and any other equipment required and make all hook-ups necessary to fill reservoirs for testing.
   5. Dispose of water after testing is complete, including pumping if necessary.
   6. Fill the structure with water to the extreme high operating water surface level or to overflow weir level. Furnish and install temporary bulkheads, if required.
   7. Maintain full for 48 hours before beginning the test period to permit concrete absorption and adjustment of valves, slidegates, or temporary bulkheads.
   8. At completion of tests remove all temporary piping and connections. Dispose of test water without creating a nuisance or damage to adjacent property.

C. Test Period: Five consecutive 24-hour periods totaling five consecutive days. Take daily measurements at the same time of day of the following:
   1. Air temperature.
   2. Water temperature at depth of 18 inches below the water surface.
   3. Rainfall.
   4. Water level at two locations 180-degrees apart.

D. Test Procedure:
   1. After test period, measure water level at each side of the reservoir to determine leakage and loss from evaporation.
   2. Determine evaporation loss, using a pan and level measuring device located adjacent to the reservoir.
   3. Mark all observed damp areas, running or dripping leaks on exposed surfaces that have not healed autogenously during the test. Damp areas includes areas if moisture can be transferred from the exterior surface to a dry hand. Repair all those areas.
   4. If leakage from the structure exceeds that permitted for the types of mechanical equipment providing closure plus 0.075% (HST – 075) of the storage capacity in each 24-hour period over a period of five consecutive days, perform a retest after completing repairs.
   5. If structure does not meet volumetric requirements contractor shall provide a plan to detect and repair leaks.
   6. Submit acceptable procedures for favorable review prior to repairs. Repairs by painting or surface treatment shall not be allowed.
   7. Continue the test and repair procedure until the structure satisfies both the leakage calculation requirement and the visible leakage requirement.

3.02 REPAIR OF DEFECTIVE CONCRETE

A. See Section 03300.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 03350

CONCRETE FINISHES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Concrete finishes for all horizontal and vertical concrete surfaces.
   2. Sealers and hardeners for concrete.

B. Related Sections:
   1. Section 03300: Cast-in-Place Concrete

1.02 REFERENCES

A. American Society of Testing and Materials (ASTM):
   1. ASTM C156 Test Method for Water Retention by Concrete Curing Materials
   2. ASTM C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete
   3. ASTM C1028 Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
   4. ASTM E96 Test Methods for Water Vapor Transmission of Materials

B. International Building Code (IBC)

C. “Evaluation Reports” published by the International Code Council.

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Qualifications: A list of all five projects completed by the proposed subcontractor within the most recent three years that have concrete finishes similar to those specified for this project.

C. Product Data: Describe all products proposed for use.

D. Field Samples:
   1. 2-foot-square job-prepared samples of each finish and color specified for selection and use as Control Samples.
      a. Medium sandblast: One sample each with No. 60 grit and No. 30 grit sand.
         1) On smooth concrete.
         2) On textured concrete.
      b. Fine broom finish.
      c. Coarse broom finish.

© December 2012 Kennedy/Jenks Consultants

2. Samples of mortar for filling voids and form tie holes and grout for all finishes for formed surfaces, applied to an inconspicuous area for selection of color match prior to proceeding with finishes.

1.04 QUALITY ASSURANCE

A. Contractor Qualifications: Use skilled cement finishers to perform all work.

B Regulatory Requirements: Comply with applicable requirements in International Building Code, adopted edition, including without limitation Chapters 10, 11, 11A and 11B.

PART 2 - PRODUCTS

2.01 CURING AND SEALING COMPOUND

A. General:
1. Water-base acrylic curing, sealing and dustproofing compound.
2. Leave a protective clear transparent film on the concrete surface that is non-yellowing and resistant to deterioration due to exposure to ultraviolet light.
3. ASTM C-309, Type I, Class B.
4. AASHTO M-148, Type I, Class B.

B. Manufacturers:
1. First coat Vocomp-20, second coat Vocomp-25-1315 by W. R. Meadows Inc.;
2. Burke Spartan-Cote WB Cure/Seal/Hardener;
3. or equal.

2.02 MORTAR FOR FILLING VOIDS

A. Mortar for Filling Voids: One-part Portland Cement, two-parts sand by volume mixed with only enough water to form a ball when squeezed by hand. A mixture of white and grey Portland Cement is required for color match (approximately 1-part white to 2-parts grey). Add mineral oxide colors as required to match colored concrete. Substitute non-reemulsifiable, acrylic bonding agent for one-third of mixing water. Test several different mixes for color match and obtain favorable review prior to proceeding.

2.03 GROUT FOR A SACKED FINISH ON FORMED SURFACES

A. Grout for a Sacked finish: Conforms to the requirements for mortar for filling voids, except mix one part of cement with 1-1/2 parts fine sand and add water to make a grout having the consistency of thick cream. A mixture of white and grey Portland Cement is required for color match. Add mineral oxide colors as required to match colored concrete. Test samples for color match and obtain favorable review prior to proceeding.

© December 2012 Kennedy/Jenks Consultants

PART 3 - EXECUTION

3.01 CONCRETE SURFACE FINISHES FOR SLABS AND PAVING

A. General:
1. Provide a surface finish on all exterior and interior horizontal concrete slabs that has a coefficient of friction when measured in accordance with ASTM C1028 not less than 0.60 for level surfaces and 0.80 for surfaces sloped 1:20 or more.
2. For all exterior paving surfaces provide a minimum slope of 1% (1/8-inch per foot) to drain surface water to catch basins, drains or edges of pavement adjacent to landscaping and drainage swales. Review grades shown and recommend any adjustments necessary to achieve minimum specified slope.
3. Slope interior floor surfaces containing floor drains to drain water to the drains. Review elevations shown on Drawings for adequate slopes before setting grades. Report any conditions that will not provide adequate drainage or that will produce excessively steep slopes before proceeding.
4. Finish slabs so they do not deviate more than ¼-inch (6.3 mm) in 10 feet from a straight edge. Finish elevations to within 1/8-inch (3.2 mm) elevations shown or required to match adjacent existing conditions. Provide "as-built" slopes for drainage no less than those shown or specified.
5. Allowed Tolerance for individual risers and treads in any flight of stairs:
   a. ¼-inch (6.3 mm) between the lowest and highest riser.
   b. 3/8-inch (9.5 mm) between the deepest and shallowest tread measured in the direction of travel.
6. Slope all treads 1/8-inch (3.2 mm) down toward the nosing for drainage.
7. Finish edges and surfaces smooth, true and clean.
8. Apply finish to slabs as soon as the concrete can support the weight of the workmen.
9. Increase the humidity of the air directly above the concrete surface, prior to and during finishing operations by adding a fine fog mist of water to the air with mist nozzles when atmospheric conditions (temperature, humidity, and wind) are such that rapid evaporation of mixing water from the concrete is likely to occur.

B. Wood or Magnesium Float Finish and Preliminary Steps for Other Finishes:
1. Applies to slab surfaces indicated to have a wood or magnesium Float finish. This finish is also the initial step for all other finishes.
2. Place and consolidate concrete.
3. Screed to grade using a strike-off board guided on accurately set screeds.
4. Work the surface with a bull or darby float to embed large aggregate, consolidate surface mortar and create a smooth true surface.
5. Do not overwork the surface or add dry materials such as sand or cement**.**
6. When surface has taken initial set and bleed water has disappeared work surface with wood floats followed by magnesium floats (if a magnesium float finish is called for) to even out slight irregularities and further consolidate surface.
7. When concrete has set further so that excess water and fine material will not be brought to the surface, either begin the first steel troweling if this is the preliminary step for other finishes or work the surface with magnesium or wood float if this is the final step in a Float finish. Work the surface sufficiently to

© December 2012 Kennedy/Jenks Consultants

consolidate the mortar and produce a finished surface at the proper grade that is free of voids, ripples or other defects. Apply a final swirl texture finish in a fan pattern with the wood or magnesium float. Retool slab edges and control joints. Leave a uniform smooth border around all slab edges and each side of control joints.

C. Trowel Finish:
   1. Applies to all slabs indicated to receive a Trowel finish.
   2. Complete the work required under “Preliminary Steps for Other Finishes.”
   3. Apply a second steel troweling after the concrete has set sufficiently so mortar does not adhere to the edge of the trowel and sufficient pressure can be applied to further consolidate the surface.
   4. Apply a third steel troweling when the concrete has set sufficiently so the trowel produces a ringing sound. Apply sufficient pressure so the trailing edge of the trowel will produce a dense smooth surface without burning.
   5. Apply a fourth troweling and additional trowelings as required to produce a dense smooth finish.

D. Broom Finish:
   1. Applies to all slabs indicated to receive a Broom finish.
   2. Complete work required under “Preliminary Steps for Other Finishes.”
   3. Apply a second and third steel troweling after the concrete has set sufficiently so mortar does not adhere to the edge of the trowel and sufficient pressure can be applied to further consolidate the surface.
   4. Broom texture the surface of the slab at right angles to the normal direction of traffic. Use a stiff fiber bristled broom for Coarse Broom Finish and a fine hair broom for Fine Broom Finish. Match selected control sample.

E. Detail Work: Applies to all concrete flatwork and to exposed top edges of all formed concrete.
   1. Edging Slabs: Tool a 3/8-inch radius on all exposed edges of slabs, curbs and other exposed horizontal edges unless a formed chamfered edge is called for. Repeat tooling with each floating or troweling operation.
   2. Apply a Trowel finish to the top of the formed walls, curbs and machine bases.
   3. Control Joints and Feature Grooves:
      a. Cut 1-inch-deep control joints with rounded edges in all paving slabs where indicated but not more than 8 feet apart in each direction. Repeat tooling with each floating or troweling operation.
      b. Run decorative feature grooves with a ¼-inch-deep rounded tool before the final troweling in paving where shown.

F. Cement Finishers Finish:
   1. Use for curb faces, stair risers and other vertical formed surfaces customarily stripped and finished the same day they are placed and before the concrete fully sets.
   2. Use form work specially designed for removal before the concrete sets.
   3. Remove forms when concrete has achieved initial set and is stiff enough to retain its own shape but before it fully sets.
   4. Work over surface with a moist wood or rubber float and cement paste to fill minor voids and consolidate the surface. Fill holes and larger voids with mortar

© December 2012 Kennedy/Jenks Consultants

but do not build up a coating of mortar over the entire formed surface. Finish with a fine hair brush.

3.02 CONCRETE FINISHES FOR FORMED SURFACES

A. General:
   1. See the Schedule of Concrete Finishes at the end of this Section and notes and schedules on Architectural and Structural Drawings for the location, and extent and type of finish required. Where a specific finish is not called for, finish surfaces to match similar adjacent items.
   2. Complete all patching and finishing within 10 days after curing is completed.

B. Filled Finish:
   1. Remove fins, drips, runs and other projections by scraping. Correct offsets larger than 1/8-inch by power grinding a taper of at least 1:16.
   2. Fill solidly form tie holes and "bug" holes over ½-inch in maximum dimension with cement mortar described in Part 2.
   3. Finish filled holes flush with adjacent surface of the wall.
   4. Keep surface damp for 48 hours.

C. Filled And Rubbed Finish:
   1. Complete work required for a Filled finish.
   2. Remove fins, drips, runs, offsets and other projections by scraping, chipping or grinding as required to produce a smooth, flat surface free of offsets. The maximum permitted deviation from a true plane surface when tested with an 8-foot-long straight edge is 1/8-inch. The minimum taper required to correct offsets is 1:32.

D. Sacked Finish:
   1. Complete all work required for a Filled and Rubbed finish.
   2. Grout fill surface:
      a. Prepare grout in accordance with Part 2.
      b. Wet concrete surfaces and allow surface water to evaporate leaving the concrete damp but surface dry.
      c. Apply grout with rubber floats to the entire surface area to be finished. Work grout into and compress all air bubbles, holes, voids and surface irregularities. Compress grout in voids with cork floats. When grout has become stiff but is still plastic, remove all excess from surface with rubber squeegees or cork floats.
      d. After the surface whitens from drying (about 30 minutes at normal temperature) clean the surface by rubbing vigorously with clean burlap wrapped around wood blocks.
      e. Keep the surface damp for 48 hours.

E. Sandblasted Finish:
   1. Complete work required for a Filled and Rubbed finish.
   2. Lightly sandblast entire surface with No. 60 to 30 grit sand as selected to evenly texture the surface of cement paste and fine aggregate. Match control sample.

© December 2012 Kennedy/Jenks Consultants

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 05090

STRUCTURAL METAL FASTENERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. All anchors, including mechanical and adhesive anchors, adhesive rebar dowels, eye bolts, turnbuckles, cable clamps, bolts, nuts, washers, inserts, and other metal fasteners not specified elsewhere.

B. Related Sections:
   1. Section 03200: Concrete Reinforcement
   2. Section 03300: Cast-in-Place Concrete
   3. Section 05100: Structural Metal Framing

1.02 REFERENCES

A. American Institute of Steel Construction Specifications:
   1. ANSI/AISC 360-05 Specification for Structural Steel Buildings

B. Research Council on Structural Connections:
   1. RCSC Specification for Structural Joints Using ASTM A325 or A490 Bolts, 2004

C. American Iron and Steel Institute (AISI)

D. American National Standards Institute:
   1. ANSI B18-2-1 Square and Hex Bolts and Screws
   2. ANSI B18-2-2 Square and Hex Nuts
   3. ANSI B18-21-1 Lock Washers
   4. ANSI B18-22-1 Plain Washers

E. American Society for Testing and Materials Standard Specifications:
   1. ASTM A123 Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
   2. ASTM A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   3. ASTM A325 Structural Bolts, Steel, Heat-Treated
   4. ASTM A370 Test Methods and Definitions for Mechanical Testing of Steel Products
   5. ASTM A500 Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
   6. ASTM A525 Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
   7. ASTM A563 Carbon and Alloy Steel Nuts
   8. ASTM B633 Electrodeposited Coatings of Zinc on Iron and Steel
   9. ASTM E8 Test Methods for Tension Testing of Metallic Materials
   10. ASTM F436 Hardened Steel Washers

© December 2012 Kennedy/Jenks Consultants

11. ASTM F844 Washers, Steel, Plain (Flat), Unhardened for General Use
12. ASTM F959 Compressible-Washer-Type Direct Tension Indicator for Use with Structural Fasteners
13. ASTM F1554 Anchors Bolts, Steel, 36, 55, and 105-ksi Yield Strength

F. International Code Council (ICC):
1. Evaluation Service Reports
2. AC 193 Acceptance Criteria for Mechanical Anchors in Concrete Elements
3. AC 308 Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements

G. International Building Code (IBC) 2009 Edition and California Building Code (CBC) 2010 Edition.

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data:
1. Adhesive anchors, reinforcing steel dowels and expansion anchors.
2. Insulation between dissimilar metals.

C. Samples: Manufacturer's latest standard product: Specify special or unique products.

D. ICC Evaluation Service Reports for all anchors submitted demonstrating compliance with 2009 IBC and ICC AC 193 or 308 for Mechanical or Adhesive anchors respectively. Reports for concrete anchors shall demonstrate approval for use in cracked concrete in Seismic Design Categories A-F.

E. List of all anchors to be used including:
1. Location, diameter, material type, number and length of anchors
2. Testing plan for anchors, including percentage of anchors to be tested and allowable loads for anchors and testing loads.
3. Certified Verification Testing Report:
a. Certified by an independent testing laboratory or registered professional Engineer.
b. Detailing results of testing required in paragraph 1.04.C.2.

1.04 QUALITY ASSURANCE

A. General:
1. Furnish materials and fabricated items from an established and reputable manufacturer or supplier.
2. Supply all new materials and fabricated items made from first class ingredients and construction and guaranteed to perform the service required.
3. For adhesive anchorage, Contractor shall be trained by anchor product manufacturer representative and be provided with a certificate or card of completion, to be available upon request by the Special Inspector.

© December 2012 Kennedy/Jenks Consultants

B. Codes and Standards:
   1. Bolting:
      a. General: AISC Specifications.

C. Tests:
   1. General: The Owner shall provide Special Inspection, defined by IBC Chapter 17 and as noted in the ICC-ES report for the anchor. The Contractor shall provide and pay for verification testing for mechanical and adhesive anchoring systems described below. Installation inspection shall be periodic special inspection or continuous special inspection as required by the ICC ES report by the Design or Specialty Engineer.
   2. Verification testing for mechanical expansion and adhesive anchoring systems:
      a. Do not begin installation until testing plan has been favorably reviewed by the Engineer. Contractor shall be responsible for all damage, including damage to adjacent structural elements, resulting from use of loads not favorably reviewed by the Engineer.
      b. Test required anchors to the loads in the tables in Section 3.03 for the named anchors. For all other anchors, test to loads, verified in advance by the Engineer, representing twice the allowable load for the anchor, or 0.5 times the maximum strength design (ultimate) load of the anchor:
      c. Expansion and adhesive anchors shall be tested as follows:
         1) Test 10% of anchors used for sill plate bolting applications
         2) Test 50% of anchors used for non-structural applications, such as equipment anchorage.
         3) Test 100% of anchors for applications not listed above.
      d. Undercut anchors that allow visual confirmation of full set need not be tested.
      e. Visual inspection of layout including horizontal location, minimum embedment, minimum cover, minimum spacing, and minimum edge distance.
      f. Test anchors by a calibrated torque wrench, direct pull with a hydraulic jack, or a calibrated spring loaded devices. Testing shall be performed on a single anchor and shall be done in a “confined” manner, where the testing equipment prevents concrete breakout in tension. Torque wrench method shall not be used for screw anchors, or where additional torque will damage the installed condition.
      g. Anchors tested using the torque wrench shall achieve the load within ½ turn of the nut. Prior to testing, the nut shall be snug to the manufacturer’s recommended installation tightness.
      h. Anchors tested using a hydraulic ram shall be tested to the required load for a minimum of 15 seconds and shall not exhibit any discernible movement during the loading, such as loosening of the washer under the nut or an observable gap.
      i. Anchors which do not pass the test shall be considered defective work, and such failures shall be corrected at no additional cost to the Owner, including any indirect costs necessary to relocate or reinstall anchors.

D. Additional Tests: Provide and pay for all necessary additional tests made on welds or bolts required to repair or replace faulty work performed during the original fabrication.

© December 2012 Kennedy/Jenks Consultants

1.05 DELIVERY, STORAGE AND HANDLING

A. Handle, ship, and store material in a manner that will prevent distortion, rust, damage to the shop coat or any other damage.

B. Store material in a clean, properly drained location out of contact with the ground.

C. Ensure that dissimilar metals are not in contact with each other.

D. Replace or repair all damaged material in an approved manner.

PART 2 - PRODUCTS

2.01 METAL FASTENERS

A. General:
   1. For buried, submerged, or conditions where anchors or fasteners will be continuously or intermittently wet, except where otherwise shown or specified, all bolts, anchor bolts, mechanical anchors, adhesive anchors, washers, and nuts shall be 316 stainless steel .
   2. For exterior or exposed conditions provide 316 stainless steel except where otherwise shown or specified.
   3. For all other exposure conditions provide hot dipped galvanized materials, except where otherwise shown or specified.

B . Bolting – Steel:
   1. Bolts: High Strength Bolts: ASTM 325, heavy hex, Type 1 (High Strength Bolts) OR ASTM A307, Grade A (Regular Hexagon Bolts)
   2. Nuts: ASTM A563, heavy hex, Grade DH (High Strength Nuts) OR ASTM A563, Grade A (Regular Hexagon Nuts)
   3. Washers: ASTM F436, Type 1, hardened (High Strength Bolt Washers) OR ASTM F 844 (Regular Bolt Circular Washers)
   4. Lock Washers: ANSI B18.21.1
   5. High Strength Direct Tension Indicators: ASTM F959.
   6. Dimensional Requirements:
      a. Bolts: ANSI B18.2.1.
      b. Nuts: ANSI B18.2.2.

C. Bolting – Stainless Steel:
   1. Stainless Steel Bolts: AISI 316. ASTM A193 or F593.18-8 material is not acceptable.
   2. Stainless Steel Nuts: ASTM A194 or F594.
   3. Washers: AISI 316 washers meeting the dimensional requirements of ASTM F436
   4. Dimensional Requirements:
      a. Bolts: ANSI B18.2.1.
      b. Nuts: ANSI B18.2.2.

© December 2012 Kennedy/Jenks Consultants

D. Cast-in-Place Anchor Bolts:
   1. Headed Anchors: ASTM F1554, Grade 36, unless Grade 55 or 105 is shown on Drawings. High Strength anchors on Drawings shall be Grade 55 minimum.
   2. Threaded and Nutted Anchors: ASTM F1554, Grade 36 with threaded ends and double hex nuts at the anchored end, or with washer between anchoring nuts if shown on the Drawings. Use heavy hex nuts for rods 1¾-inch-diameter or greater. Provide Grade 55 or 105 if shown on the Drawings and use heavy hex nuts. High Strength anchors on Drawings shall be Grade 55 minimum.
   3. Welded Headed Studs or Welded Hooked Studs: AWS D1.1, Grade B, fut = 60 ksi, fy = 50 ksi.
   4. Hooked Anchors (J and L Bolts): Are not allowed unless specifically shown on the Drawings as they do not provide equivalent performance. If shown, provide ASTM F1554, Grade 36, unless Grade 55 or 105 is shown on Drawings. High Strength anchors on Drawings shall be Grade 55 minimum.
   5. Hooked anchor bolts shall not be used in concrete masonry unit construction.
   6. Provide minimum embedment shown on the Drawings, or a minimum of eight bolt diameters.

E. Mechanical Anchoring Systems (friction anchors are not acceptable):
   1. Mechanical Undercut Anchoring Systems (required for overhead applications):
      a. Anchor: Undercut anchor shall be of an undercut style with brazed tungsten carbides on the embedded end that perform the self-undercutting process.
      b. Carbon Steel Bolt and Sleeve:
         1) Bolt: ISO 898, class 8.8, or SAE Grade 5.
         2) Sleeve: AISI 1010.
         3) Nuts: ASTM A563 Grade A and meeting the dimensional requirements of ANSI B18.2.2.
         4) Washers: SAE 1005-1033 or AISI 1040 and meeting the dimensional requirements of ANSI B18.2.2 Type A Plain.
         5) Plating: Zinc plated in accordance with ASTM B633, SC1, Type III Fe/Zn 5.
      c. Stainless Steel Bolt and Sleeve:
         1) Bolt: AISI 316 or 316Ti.
         2) Sleeve: AISI 316 or 316Ti or Type 304 stainless steel.
         3) Nuts: DIN 934, grade 8.
         4) Washers: DIN 6796 or Type 18-8 stainless steel.
      d. Submit a product evaluation report by ICC-ES showing Cracked Concrete testing compliance per A.C.193.
      e. Provide embedment depth, edge distance, and anchor spacing as shown on the Drawings and in accordance with manufacturer's recommendations for published allowable loads.
      f. Manufacturer: Hilti, Inc. HDA Undercut Anchor, Simpson Torq-Cut (pending ICC approval) Atomic+ Undercut by Powers Fasteners or equal.
   2. Mechanical Expansion Anchoring Systems:
      a. Anchor: Expansion anchor shall be preassembled expanding sleeve or wedge type with a single piece three section wedge. Anchors shall meet

© December 2012 Kennedy/Jenks Consultants

the description of Federal Specification A-A 1923A or A-A 1922A, Type 4. Anchor will bear a length identification code that is visible after installation. Provide hex head stud style unless flat or rod coupler styles are noted on Drawings.

b. Carbon Steel Anchors:
   1) Anchor Body: ASTM A510 or AISI 1018 or AISI 12L14 or SAE J403.
   2) Nuts: ASTM A563 Grade A and meeting the dimensional requirements of ANSI B18.2.2.
   3) Washers: SAE 1005-1033 or ASTM F844 and meeting the dimensional requirements of ANSI B18.2.2 Type A Plain.
   4) Plating: Zinc plated in accordance with ASTM B633, SC1, Type III Fe/Zn 5.

c. Stainless Steel Anchors:
   1) Anchor Body and Wedges: ASTM A276 or ASTM A493 with chemical composition of either AISI 304 or 316 or 316L.
   2) Nuts: ASTM F594 with chemical composition of either AISI 304 or 316 or 316L.
   3) Washers: ASTM A240 with chemical composition of either AISI 304 or 316 or 316L.

d. Submit a product evaluation report by ICC-ES showing Cracked Concrete testing compliance per A.C. 193.

e. Provide embedment depth, edge distance, and anchor spacing as shown on the Drawings and in accordance with manufacturer's recommendations for published allowable loads.

f. Manufacturer: Hilti, Inc. Kwik Bolt TZ, Simpson Strong-Bolt, Powers Fasteners, Power-Stud +SD1 or Power-Stud +SD2 (except ¼-inch diameter and not for use in masonry), or equal.

F. Adhesive Anchoring Systems:
   1. Adhesive (Epoxy) Injection Anchoring Systems:
      a. Adhesive: Adhesive consisting of two-component epoxy base resin and hardener material meeting the requirements of ASTM C-881 Types I and IV, Grade 3, Class C. The adhesive shall be supplied in manufacturer's standard side-by-side cartridge and dispensed through a static-mixing nozzle supplied by the manufacturer.
      b. Anchor Rod, Reinforcing Steel or Insert: Threaded Rod or insert with chamfered threaded end for ease of starting nut on one end and 45-degree chisel or cut point on opposite end (where insert is required by manufacturer). Furnish nuts and washers to meet the requirements of the rod or insert. Unless noted otherwise on the Drawings provide hot dip galvanize rods or inserts or stainless steel. Stainless steel rods or inserts shall be provided in buried or submerged locations. Reinforcing Steel shall meet the requirements of Section 03200. All Reinforcing Steel indicated to be embedded in existing concrete shall be embedded using the epoxy injection systems.
         1) ASTM A36 or A307 (standard carbon steel anchor).
         2) ASTM A193 Grade B7 (high strength carbon steel anchor).
         3) Reinforcing bars as specified in Section 03200 with chisel or cut point.

© December 2012 Kennedy/Jenks Consultants

4) AISI 304/ASTM A276 or AISI 316L/ASTM A276 stainless steel meeting the mechanical requirements of ASTM F-593 (Condition CW).

c. Submit a product evaluation report by ICC-ES showing Cracked Concrete testing compliance per A.C. 308.

d. Provide embedment depth, edge distance, and anchor spacing as shown on the Drawings and in accordance with manufacturer's recommendations for published allowable loads.

e. For submerged application in potable water provide NSF/ANSI STD 61 certification.

f. Manufacturer: Hilti HIT RE 500-SD Epoxy Anchoring System, Hilti HIT HY-150 MAX-SD, Simpson Strong-Tie SET-XP Epoxy, PE1000+ by Powers Fasteners or equal.

2.02 MISCELLANEOUS ITEMS

A. Turnbuckles: ASTM F1145 and AISI C-1035.

B. Eye Bolts and Eye Nuts: ASTM F541 and AISI C-1030.

C. Clevises: AISI C-1035.

D. Threaded Rods (Tie Rods): ASTM A36

E. All metal fasteners not specified elsewhere.

2.03 GALVANIZING

A. Hot-dip galvanize all exterior and exposed steel items, except when specified otherwise.
1. Steel hardware, nuts, bolts, washers, anchors, and threaded rods: ASTM A153.
2. Where specified, electroplate nuts, bolts and washers with zinc coating of 0.001-inch minimum thickness in accordance with ASTM B633 Class SC4. Where specified, provide a 4-mil DFT coating of zinc silicate.
3. Size nuts so that they screw on threaded bolts readily after galvanizing or coating.

B. Repair Materials: Gal-Viz by Thermacote Welco, Pasadena, CA; ReGalv by Rotometals, Inc., San Francisco, CA; or equal.

2.04 NON-SHRINK GROUT

A. See Section 03300.

© December 2012 Kennedy/Jenks Consultants

PART 3 - EXECUTION

3.01 ERECTION

A. Structural Steel Work:
   1. Connections:
      a. Provide anchor bolts and other connections between structural steel and foundations.
      b. Set all anchor bolts by template, with provisions to hold bolts rigid and in correct position with respect to plan and elevation.
      c. Install adhesive and expansion anchorages by personnel with satisfactory previous experience using the same Products, following the manufacturer's recommendations and in compliance with the latest ICC-ES report.
      d. Detail any undesigned connections in accordance with the AISC Specification.
      e. Do not increase any hole diameter or slot length without the Engineer's approval.
      f. Washers:
         a) Provide washers for slotted holes. Washers shall be hardened for high-strength bolts (fy > 36 ksi) and shall be 3/8-thick plate washer for long-slotted holes.
         b) Provide washers under the turned element for bolts installed with the Calibrated Wrench Pretensioning method.
         c) Provide washers for bolts installed with the Direct-Tension-Indicator Pretensioning method.
   2. Where metal is fastened to concrete, make the connections by anchor bolts, or by anchors embedded in concrete, such as adhesive, or expansion anchors.
   3. Provide grout pads below base and bearing plates of non-shrink non-metallic grout having a minimum thickness of ¾-inch unless otherwise noted. Do not bear directly on concrete slabs or equipment bases.
   4. Provide leveling nuts on anchor bolts, below base plates, and adjust prior to grouting.
   5. Where anchorage requires drilling into existing concrete, contractor shall locate all reinforcing steel at least 14 days prior to drilling and shall notify the Engineer of any conflicts immediately upon discovery. Contractor shall not drill through or cut any reinforcing steel without express written direction from the Engineer.

B. Mechanical Anchoring Systems: Mechanical anchoring systems shall be installed in accordance with the ICC-ES Evaluation Report for the specific anchor.
   1. Mechanical Undercut Anchoring Systems (required for overhead applications):
      a. Drill a hole in the base material using drill bit diameter and embedment depth in accordance with the manufacturer's instructions.
         CAUTION: Oversized holes in the base material will reduce the anchor's load capacity and cannot be used.
      b. Remove dust from holes with compressed air.
      c. Assemble the anchor with the nut and washer so the top of the nut is flush with the top of the anchor.

© December 2012 Kennedy/Jenks Consultants

d. Place the anchor in the fixture and drive into the hole until washer and nut are tight against the fixture.
e. Install nut and washer and tighten to the required installation torque.

2. Mechanical Expansion Anchoring Systems:
   a. Drill a hole in the base material using drill bit diameter and embedment depth in accordance with the manufacturer's instructions. CAUTION: Oversized holes in the base material will reduce the anchor's load capacity and cannot be used.
   b. Remove dust from holes with compressed air.
   c. Assemble the anchor with the nut and washer so the top of the nut is flush with the top of the anchor.
   d. Place the anchor in the fixture and drive into the hole until washer and nut are tight against the fixture.
   e. Install nut and washer and tighten to the required installation torque.

C. Adhesive Anchoring Systems: Adhesive anchoring systems shall be installed in accordance with the ICC-ES Evaluation Report for the specific anchor. Adhesive anchoring systems <u>are not allowed</u> in overhead applications.

1. Adhesive (Ester or Epoxy) Injection Anchoring Systems:
   a. Drill a hole to the specified depth and diameter.
   b. Clean hole with a wire brush. Remove dust from holes with oil-free compressed air. Jetting holes with water is not permitted.
   c. Install adhesives only in clean holes free of standing water.
      1) Dispense portion of adhesive off to the side to check for proper mixture, and consistent color before using.
      2) Fill hole halfway to 2/3rds, starting from bottom of hole to prevent air pockets. Withdraw nozzle as hole fills up.
      3) Substrate temperature should be kept above the minimum allowed temperature as specified by the manufacturer for the entire curing process.
      4) Insert anchor, turning slowly until the anchor contacts the bottom of the hole. Do not disturb anchor during the specified cure time.
      5) For holes 10 inches and deeper contractor shall use a piston plug for adhesive anchor installation

D. Repair of Connections: The Contractor shall pay for all necessary additional tests made on weld or bolts required to repair or replace faulty work performed during the original fabrication or during erection.

E. Repair of Galvanized Coating:
1. Repair surfaces damaged by cutting or welding by the heated repair method. Repair handrails or other surfaces that will not be painted and that are field welded or damaged by the heated galvanize repair method.
2. Heat substrate to 600°F, or apply hot process touch-up material right after welding before metal has cooled below 600°F.
3. Rub bar of specified galvanize repair material over surface of hot substrate to apply a uniform coating of zinc. Wire brush hot coating with a clean wire brush to smooth out and bond zinc coating to substrate to apply a uniform coating of zinc.

© December 2012 Kennedy/Jenks Consultants

3.02 FIELD QUALITY CONTROL

A. Mechanical and Adhesive Anchoring Systems:
   1. Anchoring systems shall be installed in accordance with the ICC-ES Evaluation Report for the specific anchor. All anchors shall be tested in accordance with paragraph 1.04.C.
   2. Set torque-controlled expansion-type anchors to the recommended installation torque using a calibrated torque wrench. Following attainment of 10% of the specified torque, 100% of the specified torque shall be reached within 7 or fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor shall be removed or abandoned.
   3. Set displacement-controlled expansion-type anchors to the recommended displacement. If the concrete cracks during installation of the anchor, the anchor shall be removed or abandoned.
   4. Anchors should exhibit no discernible movement during load testing.
   5. Holes drilled for anchors that do not set properly or fail in a tension test may not be reused, and shall be filled with non-shrink grout.

B. Erection Sequence: Verify each stage is completed before proceeding to the next.

C. Tolerances: AISC Standard Practice.

3.03 LOAD TESTING TABLES

A. Load Testing Tables below are based on the following assumptions. Testing where these assumptions are not valid could result in damage to the structure or other elements, which shall be repaired by the Contractor at no additional cost to the Owner.
   1. Concrete shall have a minimum compressive strength of 2500 psi
   2. Embedment Depths and Edge distances shall be as noted in the table and shall not be outside the parameters specified by the anchor manufacturer.
   3. Tests shall be performed on a single anchor and no intermediate members shall be placed between the testing apparatus.
   4. All Values are in inches and pounds unless otherwise noted.

© December 2012 Kennedy/Jenks Consultants

Table 1: Test Loading for Simpson Set XP Anchors

Embedment (in)	Edge Distance (in)	Diameter				
		½"	5/8"	¾"	7/8"	1"
he ≥8"	$4>c_{min}\geq1.75$	180	100	140	60	90
	$6\geq c_{min}>4$	1200	800	1000	600	700
	$6\leq c_{min}$	2000	2000	2200	1500	1800
7≤he<8"	$4>c_{min}\geq1.75$	100	100	100	100	Note 1
	$6\geq c_{min}>4$	1200	800	1000	600	Note 1
	$6\leq c_{min}$	200	200	2200	1500	Note 1
6≤he<7"	$4>c_{min}\geq1.75$	100	100	100	Note 1	Note 1
	$6\geq c_{min}>4$	1000	1500	800	Note 1	Note 1
	$6\leq c_{min}$	2100	1500	1900	Note 1	Note 1
5≤he<6"	$4>c_{min}\geq1.75$	100	100	Note 1	Note 1	Note 1
	$6\geq c_{min}>4$	800	600	Note 1	Note 1	Note 1
	$6\leq c_{min}$	1900	1300	Note 1	Note 1	Note 1
4≤he<5"	$4>c_{min}\geq1.75$	100	Note 1	Note 1	Note 1	Note 1
	$6\geq c_{min}>4$	900	Note 1	Note 1	Note 1	Note 1
	$6\leq c_{min}$	2000	Note 1	Note 1	Note 1	Note 1

Note 1: Configuration requires special approval and consideration from the Engineer. Contractor shall not install or test this configuration without favorable review from Engineer.

© December 2012 Kennedy/Jenks Consultants

Table 2: Test Loading for Hilti HY150 MAX SD Adhesive Anchors

Embedment (in)	Edge Distance (in)	Diameter				
		½"	5/8"	¾"	7/8"	1"
he ≥8"	$4>c_{min}\geq 2$	660	Note 1			
	$6\geq c_{min}>4$	1000				
	$6\leq c_{min}$	1000				
7≤he<8"	$4>c_{min}\geq 2$	660	Note 1			Note 1
	$6\geq c_{min}>4$	1000				Note 1
	$6\leq c_{min}$	1000				Note 1
6≤he<7"	$4>c_{min}\geq 2$	660	Note 1		Note 1	Note 1
	$6\geq c_{min}>4$	1000	1670		Note 1	Note 1
	$6\leq c_{min}$	1000			Note 1	Note 1
5≤he<6"	$4>c_{min}\geq 2$	660	Note 1	Note 1	Note 1	Note 1
	$6\geq c_{min}>4$	1000	1390	Note 1	Note 1	Note 1
	$6\leq c_{min}$	1000		Note 1	Note 1	Note 1
4≤he<5"	$4>c_{min}\geq 2$	560	Note 1	Note 1	Note 1	Note 1
	$6\geq c_{min}>4$	1000	945	Note 1	Note 1	Note 1
	$6\leq c_{min}$	1000	Note 1	Note 1	Note 1	Note 1

Note 1: Configuration requires special approval and consideration from the Engineer. Contractor shall not install or test this configuration without favorable review from Engineer.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 05100

STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Structural steel, stainless steel or aluminum, such as beams, channels, angles, tees, bars, pipe, tubing and plates (connection and base plates).
   2. Fabricated metal items, such as pipe supports, brackets, hangers, equipment supports, and lift hooks.
   3. All anchors, eye bolts, turnbuckles, cable clamps, bolts, nuts, washers, inserts, and other metal items not specified elsewhere.
   4. Fabricated tanks, hoppers, and similar structures, if not specified elsewhere.
   5. All structural metal framing.

B. Related Sections:
   1. Section 05090: Structural Metal Fasteners
   2. Section 09960: Protective Coatings

1.02 REFERENCES

A. Aluminum Association:
   1. AA Manual-Aluminum Design Manual

B. American Institute of Steel Construction Specifications:
   1. ANSI/AISC 360-05 Specification for Structural Steel Buildings
   2. ANSI/AISC 341-05 Seismic Provisions for Structural Steel Buildings Including Supplement No.1

C. Research Council on Structural Connections:
   1. RCSC Specification for Structural Joints Using ASTM A325 or A490 Bolts, 2004

D. American Iron and Steel Institute (AISI).

E. American National Standards Institute:
   1. ANSI H35-1 Alloy and Temper Designation Systems for Aluminum

F. ASTM International (ASTM) Standard Specifications:
   1. ASTM A36 Structural Steel
   2. ASTM A53 Pipe, Steel, Black and Hot-dipped, Zinc-coated Welded and Seamless
   3. ASTM A108 Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality
   4. ASTM A123 Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
   5. ASTM A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   6. ASTM A276 Stainless Steel Bars and Shapes

© December 2012 Kennedy/Jenks Consultants

7.	ASTM A370	Test Methods and Definitions for Mechanical Testing of Steel Products
8.	ASTM A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
9.	ASTM A653	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
10.	ASTM A992	Specification for Steel for Structural Shapes for Use in Building Framing
11.	ASTM B633	Electrodeposited Coatings of Zinc on Iron and Steel
12.	ASTM C827	Test Method for Early Volume Change of Cementitious Mixtures
13.	ASTM C1107	Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
14.	ASTM E8	Test Methods for Tension Testing of Metallic Materials
15.	ASTM E165	Practice for Liquid Penetrant Inspection
16.	ASTM E709	Practice for Magnetic Particle Examination
17.	ASTM F2329	Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

G. American Welding Society:

1.	AWS D1.1	Structural Welding Code - Steel
2.	AWS D1.2	Structural Welding Code - Aluminum
3.	AWS D10.4	Recommended Practices for Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing
4.	AWS A4.3-93R	Standard Methods for Determination of the Diffusible Hydrogen Content of Martensitic, Bainitic, and Ferritic Steel Weld Metal Produced by Arc Welding
5.	AWS A5.1	Mild Steel Covered Arc Welding Electrodes
6.	AWS A5.3	Aluminum and Aluminum Alloy Electrodes for Shielded Metal Arc Welding
7.	AWS A5.4	Covered Corrosion-Resisting Chromium-Nickel Steel Welding Electrodes
8.	AWS A5.5	Low Alloy Steel Covered Arc Welding Electrodes
9.	AWS A5.9	Corrosion-Resisting Chromium-Nickel Steel Base and Composite Metal Cored and Stranded Welding Electrodes and Welding Rods
10.	AWS A5.10	Aluminum and Aluminum Alloy Bare Welding Rods and Electrodes
11.	ANSI/AWS B4.0-98	Standard Methods for Mechanical Testing of Welds – U.S. Customary
12.	AWS B5.1-2003	Standard for the Qualification of Welding Inspectors
13.	AWS C4.1	Oxygen Cutting Surface Roughness Gauge and Wall Chart for Criteria Describing Oxygen-Cut Surfaces

H. American Society for Nondestructive Testing (ASNT):

1.	ASNT SNT TC-1a-2001	Recommended Practice for the Training and Testing of Nondestructive Testing Personnel
2.	ANSI/ASNT CP-189-2001	Standard for the Qualification and Certification of Nondestructive Testing Personnel

© December 2012 Kennedy/Jenks Consultants

I. Federal Emergency Management Agency (FEMA):
   1. FEMA 350 Recommended Seismic Design Criteria for New Steel Moment-Frame Buildings, July 2000

J. International Code Council (ICC).

K. International Building Code (IBC) 2009 Edition and California Building Code (CBC) 2010 Edition.

1.03 SUBMITTALS

A. Submit in Accordance with Section 01300.

B. Product Data:
   1. Hangers, pipe and equipment supports (shelf items).
   2. Stainless steel and aluminum items (not fabricated).
   3. Certified mill test results on structural metals.
   4. Electrode manufacturer's data and product data, including electrodes to be used for dissimilar metals.
   5. Insulation between dissimilar metals.
   6. Manufacturer's product data sheets or catalog data for SMAW, FCAW and GMAW composite (cored) filler metals to be used.
   7. Manufacturer's certifications that the filler metal meets the supplemental Charpy V-Notch (CVN) toughness requirements for demand critical welds.
   8. Non-shrink grout.

C. Samples: Manufacturer's latest standard product.
   1. Structural framing.
   2. Connection material specifications.
   3. Locations and dimensions of protected zones.
   4. Gusset and base plates drawn to scale.
   5. Welding requirements as specified in AWS D1.1 Appendix W, Sections W2.2 and W2.3.
   6. Field assembly or erection sequence.

D. Quality Assurance:
   1. Welder performance qualification test records "welder's certification".
   2. Written Welding Procedure Specifications (WPSs) in accordance with AWS D1.1 requirements for each different welded joint proposed for use whether prequalified or qualified by testing.
   3. Procedure Qualification Record (PQR) in accordance with AWS 1.1 for all procedures qualified by testing.
   4. Fabricator's and Erector's AISC Certifications.

1.04 QUALITY ASSURANCE

A. General:
   1. Furnish materials and fabricated items from an established and reputable manufacturer or supplier. Fabricator and Erector shall both be AISC certified for the work that they are performing.
   2. Supply all new materials and fabricated items made from first class ingredients and construction and guaranteed to perform the service required.
   3. The Contractor is responsible for preparing and submitting written WPSs. WPSs for each joint type shall indicate proper AWS qualification and be available where welding is performed. WPSs shall be included with any shop

© December 2012 Kennedy/Jenks Consultants

drawings referencing welds. WPSs shall include the manufacturer and specific electrode.

4. Quality control and quality assurance shall be provided in accordance with AISC 341 Appendix Q.

B. Codes and Standards:
   1. Metalwork:
      a. Steel: AISC Specification.
      b. Aluminum: AA Manual.
   2. Welding:
      a. Steel: AWS D1.1.
      b. Aluminum: AWS D1.2.
      c. Stainless Steel: AWS D10.4.
   3. Welders:
      a. Qualify welders in accordance with AWS D1.1 for each process, position, and joint configuration.
      b. All welding operators are subject to examination for requalification at any time during the progress of the work.

C. Tests:
   1. General: The Owner will provide Special Inspection, defined by CBC Section 1704, for welding and high-strength bolting. Visual welding inspection and nondestructive testing (NDT) shall be conducted in accordance with a written practice by personnel qualified in accordance with AISC 341 Appendix W.
   2. Weld Tests: By a testing laboratory, selected by Engineer and paid by Owner.
      a. Visual inspection:
         1) Check fit-up of joint materials. Verify satisfactory alignment of material. Verify gaps and bevels of penetration welds.
         2) Check during welding. Verify satisfactory technique is used.
         3) Check after welding completed and cleaned by wire brush or chipping hammer.
         4) Inspect with magnification when necessary and under strong, adequate light.
         5) Inspect for the following defects:
            a) Surface cracking.
            b) Porosity.
            c) Excessive roughness.
            d) Unfilled craters.
            e) Gas pockets.
            f) Undercuts.
            g) Overlaps.
            h) Size.
            i) Insufficient throat and concavity.
      b. Nondestructive testing: Ultrasonic testing, except where not feasible due to the type or location of the weld. Magnetic particle, liquid penetrant or radiograph tests when ultrasonic testing is not feasible.
         1) Ultrasonic inspection technique and standards: AWS D1.1 Part C.
         2) Particle inspection method: ASTM E709.
         3) Penetrant inspection method: ASTM E165.
         4) Radiography tests: AWS D1.1, Part B.

© December 2012 Kennedy/Jenks Consultants

5) Charpy V-Notch (CVN):
   a) When they are used as members in the Seismic Resisting Force System, ASTM A6, Group 3 shapes with flanges 1½ inches thick and thicker, ASTM A6 Groups 4 and 5 shapes, and plates that are 1½-inch thick or thicker in built-up cross sections shall have a minimum CVN toughness of 20 ft-lbs. at 70ºF.
   b) All complete joint penetration groove welds used in the Seismic Force Resisting System shall be made with a filler metal that has a minimum CVN toughness of 20 ft-lbs at minus 20ºF, as determined by AWS classification or manufacturer certification Ultrasonic inspection technique and standards: AWS D1.1 Part C.

c. Extent of testing:
   1) Visual inspection of all welds.
   2) Measurement of weld profiles for 25% of all welds at random.
   3) Magnetic particle examination or liquid penetrant examination performed on root pass and on finished welds for 25% of all shear plate, stiffener plate, column base plate, gusset plate, and miscellaneous fillet welds.
   4) Ultrasonic contact examination on all complete joint penetration (CJP) welds. See Drawings for CJP welded beam or girder to column moment connections. Defective welds shall be repaired and costs of retesting defective welds shall be borne by the Contractor.

D. Additional Tests: Provide and pay for all necessary additional tests made on welds or bolts required to repair or replace faulty work performed during the original fabrication.

1.05 DELIVERY, STORAGE AND HANDLING

A. Handle, ship and store material in a manner that will prevent distortion, rust, damage to the shop coat or any other damage.

B. Store material in a clean, properly drained location out of contact with the ground.

C. Ensure that dissimilar metals are not in contact with each other.

D. Replace or repair all damaged material in an approved manner.

PART 2 - PRODUCTS

2.01 STRUCTURAL STEEL MEMBERS

A. W-Shapes and WT-Shapes: ASTM A992, f_y = 50 ksi, f_u = 65 ksi.

B. M-, S-, and HP-Shapes and Channels, Angles, Structural Tees, Plates and Similar Items: ASTM A36, f_y = 36 ksi, f_u = 58 ksi. Except plates for W-Shapes and WT-Shapes ASTM A572, Grade 50.

C. Hollow Structural Sections (HSS): Rectangular and square, ASTM A500, Grade B, f_y = 46 ksi, f_u = 58 ksi. Round, ASTM A500, Grade B, f_y = 42 ksi, f_u = 58 ksi.

D. Steel Pipe: ASTM A53 Type E or S, Grade B, f_y = 35 ksi, f_u = 60 ksi.

© December 2012 Kennedy/Jenks Consultants

2.02 STAINLESS STEEL ARTICLES

A. Material: AISI Type 304, unless Type 316 is specifically specified.

B. Channels, Angles and Structural Tees: ASTM A276.

2.03 FABRICATED ALUMINUM ITEMS

A. Material: ANSI H35-1 Alloy and Temper 6061-T6 with an anodized finish.

B. Surfaces in Contact With Concrete or Masonry: Shop prime with a bituminous mastic or zinc chromate coating.

C. Bolted Connections: Provide stainless steel fasteners.

2.04 METAL FASTENINGS

A. See Section 05090.

2.05 WELDING ELECTRODES, FILLER METALS

A. Steel:
   1. AWS A5.1 or A5.5, E70XX category.
   2. AWS A5.20, A5.29, E7XTX-X except -2, -3, -10, -GS for FCAW.
   3. AWS A5.17 or A5.23, F7XX-EXXX for SAW.

B. Stainless Steel: AWS A5.4 or A5.9.

C. Aluminum: AWS A5.3 or A5.10.

D. For welding dissimilar metals, submit the appropriate electrodes for Product Review.

2.06 GALVANIZING

A. Hot-dip galvanize all exterior and exposed steel items, except when specified otherwise.
   1. Sheet steel, plain or shaped: ASTM A653, coating designation G 90.
   2. Products fabricated from rolled, pressed and forged steel shapes, plates, bars and strip 1/8-inch-thick or heavier: ASTM A123.
   3. Structural tubing and pipe: ASTM A53
   4. Grind smooth fabricated items at welded joints, edges, and corners, and galvanize after fabrication.
   5. Items that are specified to receive paint or a coating after galvanizing shall receive no post treatment baths and shall not be stacked or stored in a wet environment until coated.

B. Repair Materials: Gal-Viz by Thermacote Welco, Pasadena, CA; ReGalv by Rotometals, Inc., San Francisco, CA; or equal.

2.07 NON-SHRINK GROUT

A. See Section 03300.

2.08 MISCELLANEOUS ITEMS

A. Furnish all items required to complete the project, but not specified herein, not specified in Section 05500.

© December 2012 Kennedy/Jenks Consultants

2.09 FABRICATION

A. Structural Steel Work: Comply with the applicable provisions of the AISC Specification, the AISC Standard Practice and AWS D1.1. Weld only in accordance with favorably reviewed WPSs, which are to be available to welders and inspectors during the production process. Provide workmanship equal to standard commercial practice in modern structural shops.
   1. Fabricate and assemble in the shop to the greatest extent possible, and deliver to the project as a unit ready for installation. Coordinate the work, making all provisions necessary for the passage of all applicable work into, and attachment to, the structures. Make joints carefully and neatly, with corners mitered and spliced, bolted, screwed, or welded together.
   2. Make proper allowance for the expansion and contraction of the metals, and of the materials to which they are fastened.
   3. Make completely watertight joints on exterior work.
   4. Shape all members correctly, with no kinks, twists, dents, or other blemishes prior to erection. Evenly spring all curved work.
   5. Make exposed edges free of burrs, sharp edges or corners. Make corners rounded or chamfered. Grind exposed welds smooth when specified.
   6. Include supplementary parts necessary to complete each item, even though such work may not be definitely specified. Provide all such miscellaneous metalwork required by the project in accordance with good accepted standard practice.
   7. Review monorail supports and splices with the hoist manufacturer.
   8. Shop prime all items that are not galvanized or epoxy coated, including connection angles, using a material compatible with the finish coat, as specified in Section 09960. Provide finish paint coats as specified in Section 09960.

B. Stainless Steel Work:
   1. Use the proper type of stainless steel electrodes or welding rods complying with AWS D10.4. Grind all welded joints smooth and polished, using wheels never used on carbon steel. Provide welds that eliminate injury to stainless steel parts in appearance, strength and resistance to corrosion.
   2. Remove by grinding and polishing, all scratches, marks, pits and other blemishes on exposed surfaces incurred during fabrication of the material, until the entire surface possesses the same finish as the adjacent work.

C. Aluminum Work:
   1. Comply with the applicable provisions of the AA Manual and AWS D1.2.
   2. Back painting: When aluminum is in contact, such as with concrete, mortar, masonry, or adsorptive materials subject to wetting, including condensation, give the contact surfaces a brush coat of cut-back asphaltic, or coal tar paint. Submit paint for favorable review.

D. Base and Bearing Plates: Furnish under all columns, pipe supports, including rack type, supports for tanks, equipment frames and cabinets, and similar items. Provide rounded or chamfered corners.

E. Dissimilar Metals: Insulate the faying surfaces with a brush coat of cut-back asphaltic or coal tar paint or by gasketing. Submit for favorable review.

F. Metals in contact with cementitous or other material: Provide finish coating prior to erection.

© December 2012 Kennedy/Jenks Consultants

2.10 SOURCE QUALITY CONTROL

A. Material Tests: Not required for materials identified with valid mill test records.
   1. Unidentified materials: Test samples from each 20 tons of each material, or fraction thereof. Perform tension and bend tests, conforming to ASTM A370 for steel. Perform tension tests conforming to ASTM E8 for aluminum.
   2. Do not provide unidentified stainless steel.

B. Welding:
   1. Qualify welders in accordance with AWS D1.1 for each process, position, and joint configuration.
   2. Weld only in accordance with favorably reviewed WPSs, which are to be available to welders and inspectors during the production process.

C. Tolerances: AISC Standard Practice.

D. Fabrication Tests: Standard and extent: See paragraph 1.04.

PART 3 - EXECUTION

3.01 ERECTION

A. Structural Steel Work:
   1. Erect members in accordance with the AISC Specification, and the AISC Standard Practice except as modified.
   2. Incorrect fabrication or damaged members:
      a. When a condition exists whereby parts cannot be assembled or fitted properly as a result of errors in fabrication, or of deformation due to handling or transportation, report the condition immediately. The method of correction must be approved before any corrective work is done. Make the corrective work in the presence of the Engineer.
      b. Straighten plates and angles or other shapes using approved methods.
      c. Do not heat already heat-treated parts for straightening.
   3. Connections:
      a. Provide anchor bolts and other connections between structural steel and foundations. See Specification Section 05090 for additional connection requirements.
      b. Set all anchor bolts by template, with provisions to hold bolts rigid and in correct position with respect to plan and elevation.
      c. Detail any undesigned connections in accordance with the AISC Specification
      d. Do not increase any hole diameter or slot length without the Engineer's approval.
   4. Install work anchored in sleeves set in concrete with non-metallic non-shrink grout. Allow a ¼-inch minimum clearance between items anchored and the sleeve.
   5. Where metal is fastened to concrete, make the connections by anchor bolts, or by fastenings embedded in concrete, such as adhesive, or expansion anchors, installed in accordance with Specification Section 05090. Contractor shall not substitute post-installed fasteners for cast-in-place bolts without prior written permission from the Engineer.

© December 2012 Kennedy/Jenks Consultants

6. Provide a 4-inch band of coal-tar epoxy applied, half in concrete and half in air, to galvanized or painted steel, partially embedded in concrete and subject to weathering.
7. Provide grout pads below base and bearing plates of non-shrink non-metallic grout having a minimum thickness of ¾-inch unless otherwise noted. Do not bear directly on concrete slabs or equipment bases.
8. Provide leveling nuts on anchor bolts, below base plates, and adjust prior to grouting.
9. Complete the work square, plumb, straight and true, accurately fitted, and with tight joints and intersections.

B. Welding:
1. Weld only in accordance with favorably reviewed WPSs, which are to be available to welders and inspectors during the production process. Perform all welding by the shielded electric arc method in accordance with AWS D1.1.
2. Repair and make additional inspections, at the Contractor's expense, of the weld areas which have been rejected as a result of inspection. Follow this procedure until the welds are acceptable to the Engineer.
3. Qualify welders in accordance with AWS D1.1 for each process, position, and joint configuration.
4. All tack welds shall be of the same quality as the final welds. This includes preheat requirements. All tack welds not incorporated in the final welds shall be removed.

C. Repair of Galvanized Coating:
1. Repair surfaces damaged by cutting or welding by the heated repair method. Repair handrails or other surfaces that will not be painted and that are field welded or damaged by the heated galvanize repair method.
2. Heat substrate to 600°F, or apply hot process touch-up material right after welding before metal has cooled below 600°F.
3. Rub bar of specified galvanize repair material over surface of hot substrate to apply a uniform coating of zinc. Wire brush hot coating with a clean wire brush to smooth out and bond zinc coating to substrate to apply a uniform coating of zinc.

3.02 FIELD QUALITY CONTROL

A. Welding:
1. Qualify welders in accordance with AWS D1.1 for each process, position, and joint configuration.
2. The Owner’s testing agency will inspect shop or field welding for conformance with AWS D1.1 requirements and will verify that welds are made in accordance with favorably reviewed WPSs.

B. Erection Sequence: Verify each stage is completed before proceeding to the next.

C. Tolerances: AISC Standard Practice.

D. Erection Tests: Standard and extent: See paragraph 1.04.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 09960

PROTECTIVE COATINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Coat or paint all facilities and equipment which are part of this Contract, except:
      a. Metal completely embedded in concrete (except aluminum).
      b. Piping buried in ground or encased in concrete.
      c. Chain link fence.
      d. Rubber.
      e. Plastic pipe, including: polyvinyl chloride, polyethylene, and polypropylene piping, except as noted.
      f. Stainless steel.
      g. Bronze, brass.
      h. Nameplates and grease fittings.
      i. Factory finished electrical panels.
      j. Aluminum handrail and aluminum guardrail.
      k. Concrete, except as defined herein, as specified elsewhere, or as shown on the Drawings.
      l. Fiberglass.
      m. Electrical conduit.
      n. Galvanized surfaces, except as defined herein, as specified elsewhere, or as shown on the Drawings.
      o. Factory fusion epoxy coated items (except for field touchup).

B. Related Sections:
   1. Section 01300: Submittals
   2. Section 10400: Identifying Devices
   3. Section 11211: Centrifugal Water Pumps
   4. Section 11357: Greensand Roughing Filters
   5. Section 11358: GAC Adsorber/Filters
   6. Section 15050: Piping, Valves and Accessories

C. The Contractor is to base this bid on using the products specified. If the products specified are not available in formulations that meet applicable regulations on volatile organic compounds (VOC) levels at time of application, the Contractor is to submit for review products of equivalent quality and function that comply with regulations in effect at that time. A reasonable difference in cost of material between the first named items specified and the products that are required to meet regulations that change after the bid date and are in effect at the time of application may be approved for payment by Change Order.

1.02 REFERENCES

A. Where standards of surface preparation are described by citing SSPC specification numbers, reference is made to the “Steel Structures Painting Manual” Volume 2 published by the Steel Structures Painting Council.

© December 2012 Kennedy/Jenks Consultants

B. American Society of Testing and Materials (ASTM):
   1. ASTM D4060 Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
   2. ASTM D2794 Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
   3. ASTM D4541 Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
   4. ASTM F1249 Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor
   5. ASTM D5402 Standard Practice for Assessing the Solvent Resistance of Organic Coating
   6. ASTM D4259 Abrading Concrete

C. American Water Works Association (AWWA):
   1. ANSI/AWWA C213-01 Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.

D. National Sanitation Foundation (NSF)/American National Standards Institute (ANSI)
   1. NSF/ANSI Standard 61: Drinking Water System Components – Health Effects.

1.03 DEFINITIONS

A. Dry Film Thickness (DFT) - The prime coat and the sum of all fully cured applied coats for the paint system.

B. Exterior Surface - Surface that is not inside a building or structure and is exposed to the weather. Epoxy surfaces that are affected by the ultraviolet rays from the sun shall be considered an exterior surface if the sun can shine on the surface.

C. Stripe Coat - Coating applied to the edge, corner, welds or bolts, which is applied prior to application of additional system coats.

D. Submerged - Surfaces that are under water or the vertical extension of those walls or structures that are partly under water during normal operating conditions.

1.04 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Prior to ordering material, submit a complete schedule of materials to be used. Include manufacturer's brand name, product name, and designation number for each coat of each system to be used.

C. Prior to commencing work, submit a detailed list of all surfaces and equipment items upon which the Contractor intends to apply protective coatings.

D. Provide the following information on each paint product:
   1. Abrasion resistance, ASTM D4060, 1 kg load at 1000 cycles, CS-17 wheel.
   2. Impact resistance, ASTM D2794, direct and reverse.
   3. Moisture vapor transmission, ASTM F1249.

© December 2012 Kennedy/Jenks Consultants

4. Adhesion, ASTM D4541.

E. If materials other than those listed are submitted, submit additional information to fully define the proposed substitution. The Engineer may further require the Contractor to furnish additional test results from an independent paint laboratory comparing the proposed substitution with one of the named products, at no additional cost to the Owner. For substituted materials, provide a list of references, including contact person and phone number, where proposed substitute paint system has been used in similar exposures. Provide a minimum of five references (no duplicate owners or agencies).

F. Provide Material Safety Data Sheets (MSDSs) for all products.

G. Manufacturer's Certification: That products furnished meet applicable Air Quality Management District regulations as to allowable volatile organic compound (VOC) content for the place of application and use intended. The protective coating products that will be in contact with water or sludge shall have NSF 61 certification for use with drinking water systems.

H. Submit a full range of the manufacturer's standard and let down finish colors for review and selection by the Engineer. After final colors have been selected, submit two 8-1/2- x 11-inch samples on cardboard of each color indexed as to manufacturer and color designation. Color chips 3/4-inch x 1-1/2-inch may be used for pipe color codes. Colors may require special blending to meet Owner's requirements to match existing color systems.

I. Submit four pipe and equipment color code charts, 11 x 14 inches in size, with typed labels using color chips. Upon favorable review, frame charts and mount under glass or plexiglass, suitable for hanging in work areas. Hang these charts in work areas prior to commencement of coating activities.

J. The Contractor's coating subcontractor shall hold a valid State of California Contractor's Class C-33 Painting and Decorating Contractors license for performing abrasive blast cleaning and industrial coating work. The coating subcontractor shall have a minimum of five years practical experience and successful history in the application of industrial coatings products. Submit qualifications showing at least five years of industrial coating experience on similar projects.

K. The Contractor shall provide a letter from its coating subcontractor verifying that it conducted the required quality assurance (QA) review of the proposed prime coating materials described in paragraph 1.05 A. 4, below, for each of the equipment items specified for the project. The coating subcontractor's letter shall indicate if each equipment supplier's proposed primer system is compatible with the coating subcontractors' coating system products that would be used to repair damaged prime coating material and also with its final coating products. The letter shall indicate what optional corrective actions will be taken (at no additional cost to the Owner) if the equipment supplier's prime coating product is not compatible with the coating subcontractor's protective coating system.

1.05 QUALITY ASSURANCE

© December 2012 Kennedy/Jenks Consultants

A. Environmental Regulatory Requirements:
   1. All work, material, procedures, and practices under this Section shall conform with requirements of the local Air Resources Board or Air Quality Management District having jurisdiction. Prime or finish coat painting done in locations other than the project site shall be in accordance with air quality regulations in effect at the place the coating is applied. Products specified herein are, to the best of the Design Engineer's knowledge, in compliance with the applicable volatile organic compounds (VOC)[1] levels allowable at the date these Specifications were issued for bid.
   2. The Air Resources Board or Air Quality Management District having jurisdiction may prohibit the sale or application of paints and enamels containing more than the stipulated percentages of volatile organic solvents manufactured after a stated date. Provide material meeting applicable regulations effective at the date of manufacture, or if not available, provide top of the line materials developed as replacements for specified materials and meeting applicable regulations as to VOC solvents content.
   3. If the Contractor applies coatings that have been modified or thinned other than as recommended by manufacturer, the Contractor shall be responsible for any fines, costs, remedies or legal actions that may result.
   4. The Contractor shall submit copies of the shop drawings submittals that describe the proposed protective coating system products for each of the Contractor's equipment suppliers that are providing the equipment specified for the project to the protective coating subcontractor for review. The protective coating subcontractor shall review the proposed prime coating product and verify whether the proposed factory-applied prime coating product will be compatible with the protective coatings subcontractor's final coating product(s) and also if the proposed factory-applied prime coating material is compatible with prime coating touchup products that have the approved VOC content required by the Air Resource Board or Air Quality Management District having jurisdiction.

1.06 WARNINGS

A. Be advised that application of paint, epoxy and protective coating materials may be hazardous. Take all necessary precautions to ensure the safety of workers and property.

B. Be advised that as a part of this work abrasive blasting is required. This may require the use of special equipment. Become familiar with the existing site conditions and take all steps necessary to protect public and private property, facilities, equipment and personnel from abrasive balsting, at no additional cost to the Owner.

C. Abrasive blasting and painting is called for in, on or around mechanical equipment, which may be damaged by grit, dust, or painting overspray. Mask, wrap, enclose and provide all protection required to safeguard this equipment at no additional cost to the Owner.

D. Perform abrasive blasting activities in a manner that will not cause a nuisance to plant staff, property and equipment.

[1] Measured in grams per liter by weight of coating as applied, excluding water and color added to be base tint.

© December 2012 Kennedy/Jenks Consultants

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver all coating materials in unopened containers with manufacturer's label, which must include name, batch number and date and VOC content.

B. Store in an assigned area onsite with concurrence from the coating manufacturers. Maintain storage area clean and fire safe. Take all necessary measures to store products in accordance with manufacturer’s instructions.

C. Submerge solvent soaked rags in water.

1.08 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Provide ambient temperatures recommended by manufacturer of material to be applied.
   2. Provide adequate ventilation.
   3. Provide 40- to 50-foot candles of illumination on all surfaces in areas to be painted including floors, walls and ceiling even though they do not require painting.
   4. Use temporary dust barriers to close off areas being painted from areas where other work is being performed and provide special painting areas as required.

1.09 COLORS AND SAMPLES

A. Before starting work, obtain favorably reviewed color schedule.

B. Colors are to be factory mixed, using light-fast colorants proportioned by accurate measurement into proper type base. All coatings must be formulated to perform in the climate and environment to which they will be exposed.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Paints used in each system shall be the product of one manufacturer.

B. Shop applied prime coats shall be compatible with the systems included in these specifications.

C. Substituted coating systems shall be of the same generic type as those specified.

D. Coating systems shall not contain lead.

E. Abrasives shall not be classified a hazardous material under California Title 22.

F. Materials: Paints and protective coatings listed in the Paint Systems and the Schedule in Part 3 of this Section refer to the following manufacturers and are specified as levels of quality. It is understood that the words "or equal" are included herein.

© December 2012 Kennedy/Jenks Consultants

Tnemec Co. (T)
Ameron (A)
Carboline (C)
Roto Metals (RG)
Protecto Wrap (PW)
Tapecoat (TC)
Chemical Products Co. (ZRC)
Thermecoat-Welco (TW)
CRC Industries (CRC)
3M Corrosion Products Division (3M)
DuPont Industrial Coatings (DP)

2.02 PAINT SYSTEMS

The product names and formulations for protective coatings change periodically. For paint systems listed below that have been superseded by an updated formulation or product name, provide the updated product by the named supplier.

System 1: General Ferrous Exposed to Atmosphere

1st Coat – bare metal DFT = 5 to 6 mils	High Solids Epoxy	(T) Series 27WB (C) Carbogaurd 890
Finish Coat(s) DFT = 5 to 7 mils Total DFT = 12 mils	High Solids Epoxy	(T) Series 27WB (C) Carbogaurd 890
Final Coat for Exterior Surfaces DFT = 3-4 mils additional	Aliphatic Polyurethane	(T) Series 1075 (C) Carbothane 134VOC

System 2: Galvanized Metal Surface Repair

One Coat: To be left unpainted:	Eutectic-type repair	(TW) Gal-Viz (RG) ReGalv (C) Galvanox
To be painted: DFT = 2 mils	High zinc content	(ZRC) Cold Galv. Compound (CRC) Zinc It (C) Galvanox

System 3: Submerged Ferrous Metal (for Potable Water)

Three coats at 4 to 6 mils DFT per coat	NSF High Solids Epoxy	(T) Series V140, Pota-Pox Plus or Series V140F (A) Amerlock 400/2

System 4 (Not Used)

System 5: Prefinished Machinery Coating (Other than prime coat)

One Coat DFT = 2-3 mils	Aliphatic Polyurethane	(T) Series 1075 (A) Amershield

© December 2012 Kennedy/Jenks Consultants

System 6: Galvanized Steel and Non-Ferrous Metals (Non-immersion)

1st Coat	High Solids Epoxy	(T) Series 135 (A) Amerlock 400
2nd Coat DFT = 6 mils	High Solids Epoxy	(T) Series V69 (A) Amerlock 400
Finish Coat - exterior surfaces DFT = 2 mils additional	Aliphatic Acrylic Polyurethane	(T) Series 1075 (A) Amercoat 450HS

System 7: Miscellaneous Service Coating

One coat at 5 to 6 mils DFT	Epoxy Mastic	(T) Series 135 (C) Bitumastic 300M

System 8: Buried Valves

One full brush coat DFT = 20 – 30 mils		(C) Bitumastic 300M (PW) 160/160 H Mastic (TC) TC Masti

System 9: Welded Steel Water Tanks

Interior – Three coats At 4 to 6 mils DFT per coat	NSF High Solids Epoxy	(T) Series L140 (A) Amercoat 395FD
Exterior –		
1st Coat at 2.5 to 3.5 mils DFT	Zinc Rich	(T) Series 94H20 (A) Amercoat 68HS
2nd Coat at 3 to 5 mils DFT	High Solids Epoxy	(T) Series L 169 (A) Amerlock 400/2
Finish Coat at 2 to 3 mils DFT	Aliphatic Polyurethane	(T) Series 1075 (A) Americoat 450H

System 10: Heat Resistant (NOT USED)

© December 2012 Kennedy/Jenks Consultants

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. Steel:
   1. Perform surface preparation in accordance with Paragraph 3.02 below and the latest revision of the standards or manufacturer's requirements, whichever is more stringent.
   2. Prime all blasted surfaces within 8 hours of blasting unless the manufacturer recommends otherwise.
   3. Remove all weld spatter by grinding chipping prior to abrasive blast cleaning.

B. Ductile Iron and Cast Iron:
   1. Solvent Cleaning
      a. Inspect all surfaces and preclean with appropriate solvents to remove grease, oil and other soluble contaminants. Thorough scrubbing the surface with stiff bristle brushes soaked in solvent. Prior to evaporation remove solvent by wiping with clean, lint-free cloth rags. Remove rag residue (if any) with dry, oil free compressed air.
   2. Surface Profile:
      a. Measure surface profile (anchor pattern) in accordance with ASTM D 4417, Method C.
         1) If surface profile is less than 1.5 mils then proceed with brush-off blast cleaning in accordance with No. 3 below.
         2) If surface is 1.5 mils or greater then proceed with hand or power tool cleaning in accordance with No. 4 below.
         3) Certain high film thickness coating systems (20 mils DFT and higher) with require a minimum profile greater than 1.5 mils. Comply with manufacture’s recommendation.
   3. Brush-Off Blast Cleaning:
      a. Remove all loose annealing oxides, loose rust, dirt and other foreign matter by compressed air nozzle abrasive blast cleaning using a fine abrasive. Any dust or other contaminants remaining after blasting shall be removed with dry, oil free compressed air or by vacuum cleaning. Recheck surface profile prior to painting. A profile depth of at least 1.5 mils is required.
   4. Hand Or Power Tool Cleaning
      a. Remove all loose annealing oxides, loose rust, dirt and other foreign matter with the use of hand or power tools. Do not use cleaning tools that burnish or smooth the natural roughness (profile) of the cast iron surface. Any dust or other contaminants remaining after hand or power tool cleaning shall be removed with dry, oil free compressed air of vacuum cleaning.
   5. Protect From Moisture:
      a. The cleaned cast iron surfaces shall be protected from conditions of high humidity, rainfall and surface moisture. All surfaces must be dry, clean and at least 5º F above the dew point during application of protective coatings.

3.02 APPLICATION

A. All steel coating application shall be done in accordance with the latest revision of SSPC-PA:

© December 2012 Kennedy/Jenks Consultants

B. When successive coats of paint of the same colors are specified, tint alternate coats sufficiently to produce enough contrast to indicate complete coverage of the surface.

C. Apply all material in strict accordance with manufacturer's instructions. Apply first coat immediately after surface preparation. Keep all paints at a consistency and applied in accordance with the printed directions of the manufacturer. The painting shall be done by hand, spray or roller as approved by the Engineer in conformance to individual paint manufacturer's recommendations. The Engineer and paint supplier will review all surfaces to be painted on the job prior to application of any coatings. Once the Contractor begins undercoating or priming, this will be his guarantee that the surface is acceptable to paint. All painted surfaces are to be free from drips, ridges and brush marks.

The following stipulations also apply:

1. Thinning permitted only when recommended by the manufacturer and only with thinner recommended for use with the particular product.
2. The use of additives to improve working characteristics or to lengthen or shorten set time is prohibited.
3. Items difficult or impossible to paint after installation are to be painted before installation and touched up after installation.
4. Apply each coat to a uniform, even coating; lay material on in one direction and finish at right angles. Allow material to thoroughly dry between coats. Scuff, sand and remove all runs, sags, overspray, surface roughness and other defects between each coat. Dust and wipe surface clean before applying next coat.
5. Cutting in is to be sharp and straight, free from overlaps or fuzzy edges. Redo any imperfect work.
6. Apply not less than the number of coats or dry film thickness specified. Apply additional coats if required for uniform coverage, full hiding, and to achieve film continuity. Finished work to be uniform in color, full coverage, smooth and free of sags and brush marks.
7. Do not apply coating when ambient temperature is below 55°F or when the temperature of the surface to be painted is less than 4°F over the dew point temperature. Perform coating operations only under favorable environmental conditions. Take all steps necessary to protect and completely cure the work. Correct defective work to the full satisfaction of the Engineer.
8. Apply the last finish coat on all work after all major construction is complete and the work areas have been cleaned up and are dust free.
9. No individual coat of paint shall exceed the manufacturer’s recommended maximum thickness. Remove excessive thickness, repair, and recoat as directed in writing by the coating manufacturer.
10. Prior to placing a coating into immersion use and once the manufacturer’s recommended cure times have been met, check for proper curing per ASTM D5402, Standard Practice for Assessing the Solvent Resistance of Organic Coating. Check the coating in multiple areas and at various heights using test coupons coated at the same time as the structure or surface.
11. When applying coatings during cold weather, avoid direct heat from fossil fueled burners, such as propane, and apply in accordance with manufacture’s requirements.

© December 2012 Kennedy/Jenks Consultants

3.03 PIPE AND EQUIPMENT IDENTIFICATION

A. Identify all piping and equipment exposed to the atmosphere, both interior and exterior, including pipe located in concrete pipe trenches, by a combination of color coding, pipe markers, and direction arrows as specified in Section 10400.

B. Identify painted pipe 4 inches in diameter and larger by stenciling identification names and directional arrows. Identify unpainted pipe and pipe less than 4 inches in diameter by color vinyl pressure-sensitive lettered labels and arrows as described in Section 10400. Place names and arrows every 16 feet and wherever a pipe enters or leaves a room or a pipe trench. Provide lettering size as follows:

Pipe Diameter	Lettering Size (Height)
1-1/4" or less	1/2"
1-1/2" to 2"	3/4"
2-1/2" to 6"	1-1/4"
8" to 10"	2"
Over 10"	3-1/2"

C. The Engineer will prepare a color schedule after the protective coatings are favorably reviewed. Notify the Engineer 30 days before the color schedule is needed. Colors may require special mixing. The number of different colors needed will be as indicated by the following schedule.

Process	-	Match existing process pipeline colors
Chemicals	-	Match existing chemical system colors. Provide new colors for new chemical systems.
Water	-	Match existing water pipeline colors
Drainage	-	Match existing drain line coloros
Miscellaneous	-	Match existing pipeline colors

D. Paint equipment in the same color as the pipe to which it is connected, unless directed by Engineer to paint the pressure vessels in a different color than the process piping.

E. Paint conduit and touch up to interior surfaces and ductwork in colors to match adjacent walls/ceilings.

F. The coating system for the steel water tanks shall have a pinhole and continuity test or holiday test, adhesion test, and visual inspections in accordance with AWWA C213-06. Repair any deficient items in accordance with coating manufacturer's recommendations and AWWA C213-01.

© December 2012 Kennedy/Jenks Consultants

3.04 FIELD QUALITY CONTROL

A. Prior to commencing any coatings work, meet with the Engineer to review coatings, and procedures, including surface preparation requirements and manufacturer's instructions.

B. Pinhole and Continuity Testing:
   1. After the application of the prime and finish coats of surface protective coating systems on metal surfaces, perform continuity and pinhole checking by means of a low voltage electrical resistance meter and check thickness with a magnetic thickness gauge to determine that pinhole free condition and specified film thickness of the paint system has been achieved over all of the painted surfaces. Repair all deficiencies in film integrity and thickness in accordance with the manufacturer's instructions.
   2. The Engineer or an independent testing consultant may perform its own continuity and pinhole checking and thickness checks in addition to the Contractor's required tests. The appropriate equipment and necessary support, if requested, is to be provided by the Contractor. Repair any additional deficiencies in film integrity and thickness per the manufacturer's instructions and to the satisfaction of the Engineer.
   3. THE CONTRACTOR'S ATTENTION IS DIRECTED TO THE FACT THAT PAST USE OF THIS INSTRUMENT HAS DEMONSTRATED THAT THE PAINTER MUST APPLY AT LEAST TWO AND USUALLY THREE OR MORE STRIPE COATS ALONG ALL EDGES AND ANGLES AND CREVICES FORMED BY JOINING MEMBERS IN ADDITION TO THE COATS SPECIFIED IN ORDER TO ACHIEVE A PINHOLE FREE SURFACE.

C. Adhesion Testing: Where there is a question of paint or coating adhesion to surfaces, demonstrate to the Engineer's satisfaction that the coating adhesion to the area in question is equal to or greater than that which the paint manufacturer literature states may be achieved by his product. A Portable Adhesion Tensile Strength Instrument (PATSI) is to be used by the Contractor to accomplish this demonstration.

D. Continuity, Pinhole and Adhesion Testing Support: Provide scaffolding, ladders, lighting and labor as required to facilitate the Engineer's check. Repair any areas damaged during and by the testing operation.

3.05 CLEANING AND COMPLETION

A. At the completion of this portion of the work, remove all debris, remove all paint and stains from work for which paint finish is not intended, touchup all marred surfaces, and leave all buildings and structures in a clean condition, ready for use.

B. Refinish all damaged or imperfect painting to the satisfaction of the Engineer prior to final acceptance of the facility.

C. Finish work, except waterproofing mastics, is to present an even, pleasing and uniform color and appearance. Surfaces exhibiting coatings with shadows, streaks, overlap marks, sags, drips, roughness or non-uniform sheen will be considered as improperly applied and will not be considered acceptable.

© December 2012 Kennedy/Jenks Consultants

D. Leave all machinery nameplate data tags clean and readable and all grease fittings clean and usable.

3.06 SPARE PAINT

A. Furnish one-gallon (minimum) container of each type and color of finish product used. Label containers. Each product shall have a minimum of 11 months of shelf life at final acceptance.

3.07 APPLICATION SCHEDULE

A. Provide coatings in accordance with the following exposure schedule:

Exposure	Surface Preparation	Paint System	Note (see below)
General ferrous exposed to atmosphere (interior & exterior)	Bare Metal: SSPC – SP6 or SP15; shop primed: SSPC-SP2 or SP3	1	1
Galvanized metal surface repair	Hand Tool Cleaning	2	2
Submerged ferrous metal	SSPC-SP10	3	3
Bleeding surface	SSPC-SP1 & SSPC-SP7	1	4
Prefinished machinery coating	Hand Tool Cleaning	5	5
Exposed galvanized steel, copper and other non-ferrous metals	Non-ferrous metal solvent clean. Galvanized SSPC-SP1 & SP7, comply with ASTM D6386 Section 5.4.1	6	6
Vent pipes exposed at building roofs and metal mounted in contact with walls	SSPC-SP2 or SP3	7	7
Buried valves, flanges, etc.	SSPC-SP2 or SP3	8	8
Factory finish coated items not requiring field painting	Touchup	-	9
Welded Steel Tanks	SSPC-SP10	9	10

© December 2012 Kennedy/Jenks Consultants

Notes to Application Schedule

1. These surfaces include, but are not limited to: the exterior of the greensand and GAC pressure filters ;general miscellaneous ferrous metal; machinery; pumps; blowers; compressors; supports; valve handwheels and stands; valve bodies; piping systems; structural steel; steel elements; except where other systems in this schedule are more specifically applicable.
2. Use galvanize-repair paint to repair-galvanize surfaces to be painted. Use eutectic-type repair to repair-galvanize surfaces to remain unpainted.
3. Apply this system to both ferrous metal and galvanized metal submerged in or suspended over water or sludge. These surfaces include, but are not limited to machinery parts, piping, valves, brackets and supports, and miscellaneous supports, braces, and pump columns. Do not blast clean galvanized surfaces, instead provide one prime coat of 40 passivator prior to finish painting. Coat inaccessible surfaces prior to erection.
4. All items furnished with asphalt or coal tar (bleeding) shop coats.
5. All piping, valves, pumps, drives, machinery, and equipment that have factory finish coats that will be exposed to atmosphere. This system provides for repair of above named items and color uniformity with the rest of field coat items.
6. Exposed galvanized ducts, exposed metal electric conduit, other galvanized steel items, exposed copper pipe and other non-ferrous metal items as noted on the Drawings.
7. All cast iron soil pipe and associated flashing above the building roof. Also coat metal items, which are surface mounted on exterior, basement or gallery masonry walls, plaster walls and concrete surfaces. Coat such metal items only on the contact surfaces unless otherwise specified; specifically include electrical panels, control cabinets, fixtures and guardrail support brackets.
8. Buried steel and cast-iron valves, operators, steel flanges, and other buried ferrous metals.
9. All panels and equipment with factory finishes identified elsewhere as not requiring field paint, damaged during shipping, storage, or installation: touch-up in the field in a manner compatible with the factory coating with respect to paint type, color, and texture. Touch-up fusion epoxy-coated items only with material provided by the fusion epoxy fabricator. If more than 5% of the surface requires touchup, return the items to the fabricator for recoating.
10. The interior and exterior of the welded steel tanks.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 11001

GENERAL EQUIPMENT AND MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: The general requirements for all of the Equipment and Mechanical work in the scope of the Project, included in Divisions 11, 12, 13, 14 and 15, and elsewhere wherever specifically mentioned in these Specifications.

B. Related Sections:
   1. Section 05100: Structural Metal Framing
   2. Section 09960: Protective Coatings

C. Direct the attention of all subcontractors and suppliers of equipment and related appurtenances for the work to the applicable provisions in the Contract Documents wherever they may occur.

1.02 REFERENCES

A. American Gear Manufacturers Association (AGMA).

B. American Institute of Steel Construction (AISC).

C. California Code of Regulations, Title 8 Industrial Relations (CAL/OSHA).

D. Hydraulic Institute.

E. National Electrical Manufacturers Association (NEMA).

1.03 STANDARDS FOR THE WORK

A. Complete Systems: Provide pipe, fittings, wiring and supports to produce complete, operable systems with all elements properly interconnected. If a specific dimensioned location is not shown for interconnections or smaller system elements, select appropriate locations and show them on Shop Drawing submittals for review.

B. Provide equipment and material new and without imperfections. Erect in a neat and workmanlike manner; aligned, leveled, cleaned and adjusted for satisfactory operation; installed in accordance with the recommendations of the manufacturers and the best standard practices for this type of work so that connecting and disconnecting of piping and accessories can be readily made and so that all parts are easily accessible for inspection, operation, maintenance and repair. Locate oil and lubrication fittings clear of and away from guards, base, and equipment and within reach from the operating floor. Coordinate location of all motor connections in order to properly orient encased electrical conduits. In order to meet these requirements with equipment as furnished, minor deviation from the Drawings may be made as favorably reviewed by the Engineer.

© December 2012 Kennedy/Jenks Consultants

C. The recommendations and instructions of the manufacturers of products used in the work are hereby made part of these Specifications, except as they may be superseded by other requirements of these Specifications.

1.04 SUBMITTALS

A. Submit in accordance with Section 01300.

Shop Drawings: Submit Shop Drawings to the Engineer and receive favorable review prior to fabrication, construction or delivery to the project site in accordance with Section 01300 of these Specifications. Show sizes and arrangement of equipment, foundations and anchor bolts required, performance characteristics, fan curves and pump curves, control diagrams, wiring diagrams, motor data sheets, methods of assembly, pipe hanging details, ductwork layouts and connections to other work. Date and sign drawings as certified for use in construction of this project. The arrangement of mechanical equipment and appurtenant piping shown on the Drawings may be varied as necessary to fit the favorably reviewed certified manufacturer's installation drawings. However, manufacturers' drawings shall not deviate in substance from the Contract Drawings and Specifications as to location, size, type and design of equipment. The following minimum requirements shall accompany all equipment submissions:

1. Overall dimensions.
2. Mounting arrangement and dimensions.
3. Description of materials.
4. Connection sizes and orientation.
5. Capacity and location of lifting eyes.
6. Motor arrangement showing location of electrical connections.
7. Rating data - Mechanical and Electrical as applicable.
8. Detail electrical wiring diagrams, showing component designation and rating.
9. Seismic design certifications and anchorage descriptions as required by Section 01190.
10. Motor data as specified in Section 11002.
11. List of special tools and/or spare parts to be furnished, if any.

B. Each piece of equipment, for which certified witnessed or non-witnessed performance tests are required, shall be accompanied by a completed form containing at least the following information:

1. Owner's name and location of project.
2. Contractor's name and subcontractor if applicable.
3. Name of item being submitted.
4. Specification reference by section, paragraph and page.
5. Data on item (manufacturer, general descriptive data, dimensions, size of connections, speeds, performance curves, serial number). A specific list of the test results plus a list, which shows the values that differ from Specifications.
6. Motor data, type, voltage, frequency, phase, full load amperes, starting method, frame size, enclosure insulation type (NEMA Code letter), dimensions, service factor, serial number.
7. Date and signature of person certifying the performance.

C. Instruction Manuals: Prepare and submit instruction manuals covering installation, operation and maintenance of all equipment and machinery specified in Divisions 11, 12, 13, 14 and 15. Refer to Section 01300, paragraph 1.08.

© December 2012 Kennedy/Jenks Consultants

D. Manufacturers' Affidavits: Where called for in the Specifications, each equipment manufacturer, or his authorized representative, shall submit an affidavit conforming to the requirements of Section 01650, paragraph 1.04.

1.05 RESPONSIBILITY AND CARE OF EQUIPMENT

A. The Contractor shall be responsible for the equipment included in this Contract until it has been finally inspected, tested and accepted in accordance with the requirements of these Specifications.

B. The Contractor shall make his own provisions for properly storing and protecting all material and equipment against theft, injury or damage from any and all causes. Damaged material and equipment shall not be used in the work.

PART 2 - PRODUCTS

2.01 DESIGN

A. General: Design all equipment for the service intended, of rugged construction, of ample strength for all stresses which may occur during fabrication, transportation, erection and during continuous or intermittent operation. Adequately stay, brace and anchor, and install equipment in a neat and workmanlike manner. Give consideration to appearance and safety, as well as utility, in the design of details. Use cathodically compatible materials of construction.

B. Seismic: Refer to Section 01190 of the Specifications for the seismic design criteria.

C. Controls: Unless noted otherwise, the design of the electric control of any equipment system and/or equipment package shall be the responsibility of the manufacturer of the equipment system and/or equipment package. The elementary control diagrams as shown on the Electrical Drawings and the diagrams shown on the Instrumentation Drawings are illustrative of control and monitoring requirements pertaining to various equipment of this project. The manufacturers shall design their own functional electric control devices and circuitry, in consultation with the specific elementary control diagrams and other project specifications, to meet the equipment control requirements. All such systems and package controls shall be furnished by the equipment manufacturer, except that controls shown in motor control centers and process controllers, remote control devices, and their interconnecting wiring shall be provided under Divisions 16 and 17. Provide heating, ventilating and air conditioning controls, both 24-volt and line voltage type, by a HVAC controls specialist.

2.02 MATERIALS AND STANDARD SPECIFICATIONS

A. Materials: Design, fabricate and assemble equipment and systems with new materials and in accordance with acceptable modern engineering and shop practices. Manufacture individual parts to standard sizes and gauges so repair parts can be installed in the field.

B. Uniformity: Unless otherwise specified, equipment or material of the same type or classification used for the same purpose shall be the product of the same manufacturer and shall be the same model.

© December 2012 Kennedy/Jenks Consultants

2.03 LUBRICATION

A. Provide lubricants of types recommended by equipment manufacturers, in quantities sufficient for consumption prior to completion, testing and final acceptance.

2.04 STRUCTURAL METAL FRAMING

A. Details of fabrication shall be in accordance with Section 05100.

B. Weld submerged steel surfaces which butt or bear against each other, to seal the surfaces against the penetration of the liquid. Weld all gaps between adjacent submerged steel surfaces less than 1/32-inch wide to seal the surfaces. Weld size shall be not less than the thickness of the thinnest member of the lapped or joined assembly.

2.05 EQUIPMENT BASES AND BEDPLATES

A. Mount equipment assemblies on a single heavy cast-iron or welded steel bedplate unless otherwise shown or specified. Provide bases and bedplates with machined support pads, tapered dowels for alignment or mating of adjacent items, adequate openings to facilitate grouting, and openings for electrical conduits. Round or chamfer and grind smooth all corners. Continuously weld seams and contact edges between steel plates and shapes, and grind welds smooth. Do not support machinery or piping on bedplates other than that which is factory installed. Provide jacking screws in equipment bases and bedplates to aid in leveling prior to grouting. Mount all equipment bases and baseplates on reinforced concrete pads at least 3 inches high.

2.06 ANCHORS

A. Each equipment manufacturer shall furnish an anchor bolt pattern and the required anchor bolts, nuts and washers of adequate design for securing bases and bedplates to concrete bases. Provide anchor bolts of length to allow for 1-1/2-inch of grout under baseplates and adequate anchorage into structural concrete unless otherwise shown or specified.

B. Provide anchor and assembly bolts and nuts of ample size and strength for the purpose intended. All bolts shall be standard machine bolts, with cold pressed hexagon nuts. Provide suitable degauling compounds for bronze and stainless steel threaded components. Any space wholly or partially underground, or having a wall or ceiling forming part of a water channel, is classified as a moist location. Unless otherwise specified or noted on the Drawings, provide materials as follows:
   1. Bolts and nuts in submerged locations or submerged and embedded in concrete or buried in earth: Type 304 stainless steel.
   2. Bolts and nuts for supports or equipment in dry or moist locations: Galvanized steel (hot-dipped), with oversize nuts.
   3. Use other bolting materials where specifically called for in the Specifications or on the Drawings.

C. Anchor all motor-driven equipment with cast-in-place anchor bolts or drilled-in anchors set with epoxy adhesive. Do not provide expansion type anchors for motor-driven equipment.

© December 2012 Kennedy/Jenks Consultants

D. Anchor all non-motor-driven equipment with cast-in-place anchor bolts or drilled-in anchors set with epoxy adhesive except that, where specifically allowed by note on the Drawing, expansion type anchors may be used.

E. Refer to Section 05090 for technical specification requirements of drilled-in anchors set in epoxy adhesive and for expansion bolt anchors. Refer to Section 05090 for cast-in-place anchors.

2.07 SAFETY GUARDS

A. Cover belt or chain drives, fan blades, couplings, nip points, exposed shafts and other moving or rotating parts on all sides with safety guards conforming to all federal, state, and local codes and regulations pertaining; conform to the most restrictive requirement. Design guards for easy installation and removal, complete with necessary supports, accessories, and fasteners, all hot-dip galvanized. Design guards in outdoor locations to prevent entrance of rain and dripping water. Provide tachometer test opening in line with ends of shafts. Typically guards shall be expanded metal on a structural steel frame except that outdoor guards may be of solid material. Provide hinged doors with latch for service and lubrication access.

B. Cover all pipes, manifolds, heaters, and other surfaces which have a surface temperature sufficient to burn human tissue with a thermal insulating material or otherwise guard against contact.

C. Guards to comply with CAL/OSHA 3940 through 3944.

2.08 LIFTING EYES

A. Supply all equipment weighing over 100 pounds with lifting eyes. Parts of equipment assemblies which are normally serviced separately, such as motors, to have lifting eyes of their own.

2.09 DRIVES

A. General: Provide all drive units with an AGMA rating and service factor suitable for 24 hours per day operation under the operating load.

B. Electric Motors: Conform to the requirements of Section 11002.

C. V-Belt Drives: Equip each V-belt drive with suitable tension adjustment. Provide drives having a service factor of at least 1.6 with arc length correction at maximum torque using nameplate rating of driving motor.

2.10 NAMEPLATES

A. Manufacturer's Nameplate: Furnish each piece of equipment and its driver with a corrosion-resistant metal nameplate fastened to the item in a readily readable position. This nameplate to contain the manufacturer's name, equipment rating, capacity, size, model, serial number, and speed. All information written or printed to be in English.

B. Direction of Rotation: Furnish each piece of rotating equipment with a direction of rotation arrow.

C. Functional Identification: Label each piece of equipment using a plastic laminate label with the functional name and number of the equipment.
   1. Fasten labels to the equipment, its base or other acceptable location:

© December 2012 Kennedy/Jenks Consultants

a. Letters: At least ½-inch high with the border trim on all sides not less than ¼-inch.
b. Color: Green background with white letters.
c. Fasteners: Brass or stainless steel screwed into inserts, anchor shields or tapped holes in equipment or base.

2.11 PROTECTION AGAINST ELECTROLYSIS

A. Where dissimilar metals are used in conjunction with each other, provide suitable insulation between adjacent surfaces so as to eliminate direct contact and any resultant electrolysis. Connections of dissimilar piping materials shall utilize dielectric unions, flanges, couplings or bushings.

2.12 SPECIAL TOOLS

A. For each type of equipment to be furnished, provide a complete set of all special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation and maintenance of such equipment.

2.13 FINISHES

A. Conform to applicable requirements of Section 09960.

B. Factory Painting: On pumps, motors, drives, starters, control panels and other similar self-contained or enclosed components, apply a factory protective paint system unless otherwise noted. Paint or otherwise protect surfaces that are inaccessible after assembly by a method which provides protection for the life of the equipment.

C. Shop Priming: Except where field sandblasting is required, apply one or more shop coats of metal primer on surfaces to be finish painted at the site, of sufficient thickness to protect surfaces until finished. Primer shall be compatible with finish coat.

D. Rust Preventive: Coat machined, polished, other ferrous surfaces, and non-ferrous surfaces which are not to be painted with rust preventive compound.

2.14 NOISE AND VIBRATION

A. Mechanical and electrical equipment, as installed in this project, shall not create sound levels that are in excess of that permitted by CAL/OSHA for 8 hours per day worker exposure unless otherwise noted for the specific piece of equipment involved. If the required sound level cannot be achieved by bare equipment in its designated environment, provide sound attenuating enclosures. Sound attenuating enclosures shall have necessary ventilation to prevent equipment overheating and shall be constructed for easy removal to permit maintenance. Devices necessary for day-to-day operation shall pierce the enclosure or otherwise be accessible without need to remove the enclosure.

B. Equipment which when operating has obvious excessive vibrations shall be repaired or replaced as directed by the Engineer. Baseline vibration measurements shall be made where specified.

© December 2012 Kennedy/Jenks Consultants

2.15 FACTORY TESTS

A. Perform factory tests for each piece of equipment where specifically called for in the section specifying that equipment. Note that factory tests are inherent in many reference standards. The requirement for a factory test in a referenced standard is hereby made a part of these Specifications. Conduct factory tests at the same speeds and other conditions at which the equipment will operate in the field, except as noted.

B. Where specifically noted, performance tests may be witnessed by the Engineer or his representative. Inform the Engineer in sufficient time to allow arrangements to be made for witness of such tests. When non-witnessed tests are performed, supply certified results.

C. Perform factory testing of pumps in accordance with the requirements and standards of the Hydraulic Institute.

D. Tests of other equipment shall conform to the requirements set forth in these Specifications.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect each item of equipment for damage, defects, completeness, and correct operation before installing.

3.02 PREPARATION

A. Prior to installing equipment, ensure that the areas are clean. Maintain the areas in a broom-clean condition during installation operations. Clean, condition, and service equipment in accordance with the approved Instruction Manuals and specific recommendations of the equipment manufacturer.

3.03 INSTALLATION

A. Structural Fabrications: Conform to the AISC Code and Specification referenced in Article "Structural Steel Fabrications," and conform to Section 05100.

B. Equipment: Conform to approved Instruction Manuals. Employ skilled craftsmen experienced in installation of the types of equipment specified. Use specialized tools and equipment, such as precision machinist levels, dial indicators, gauges, and micrometers, as applicable. Produce acceptable installations free of vibration or other defects. Align and pin to common bedplate equipment and drivers connected by flexible couplings.

C. Anchor Bolts: Deliver bolts with templates or setting drawings and verify that bolts are correctly located before structural concrete is placed.

D. Base and Bedplate Grouting: Do not place grout until initial fitting and alignment of connected piping is completed. Level and align equipment on the concrete foundations, then entirely fill the space under base or bedplates with grout. Bevel exposed grout at 45-degree angle, except round exposed grout at horizontal surfaces for drainage. Trowel or point exposed grout to a smooth, dense finish and damp cure with burlap for three days. When grout is fully hardened, remove jacking screws and tighten nuts on anchor bolts. Check the installation for alignment and

© December 2012 Kennedy/Jenks Consultants

level, and perform approved corrective work as required to conform to the tolerances given in the applicable Instruction Manual.

1. Make an allowance of at least 1-1/2 inches for grout under the equipment bases, whether or not shown on the Drawings. Use steel shims to level and adjust the bases. Shims may be left embedded in the grout, in which case they shall be installed neatly and so as to be as inconspicuous as possible in the completed work. Unless otherwise approved, all grout shall be a favorably reviewed non-shrink, non-metallic grout.
2. Grout: Dimensionally stable, inorganic, premixed and resistant to acids, alkalies, and salt water, and unaffected by water and oil. It shall have high strength even when used as a pourable mixture, and shall bond well with steel and cured concrete or be compatible with a suitable bonding agent which shall then be used to affect the bond. Use in strict accordance with the manufacturer's recommendations. Provide Five Star Grout as manufactured by U.S. Grout Corporation, Bonsal Construction Grout as manufactured by Bonsal Company, or equal. Submit for favorable review by the Engineer prior to use.
3. Where practicable, place the grout through the grout holes in the equipment base and work outward and under the edges of the base and across the rough top of the concrete foundation to a peripheral form so constructed as to provide a suitable chamfer around the top edge of the finished foundation.

3.04 EQUIPMENT STARTUP AND ADJUSTMENT

A. Arrange for an authorized factory-trained representative of the company or companies supplying the various items of equipment to check the installation and adjust and test the equipment furnished before the acceptance of the work by the Owner. Said representative shall be experienced and knowledgeable of the equipment being tested. Furthermore, he shall assist and instruct the operating staff in adjusting and operating the equipment during the initial plant operation period.

1. Provide initial lubrication for all equipment.
2. Test and demonstrate to the Engineer that all equipment operates properly and specified performance has been attained. For pumps, include measurement of suction and discharge pressure at the pump and measurement of pumping rate by volumetric means or through a suitably calibrated meter for two points on the performance curve. For adjustable-speed pumps, conduct tests at a minimum of two speeds. Furnish any test equipment or measuring devices required which are not part of the permanent installation.
3. In addition, demonstrate that the entire facility is in full operating condition prior to the acceptance of the work. Should any equipment or part thereof fail to operate as intended, immediately remove and replace it, all at the Contractor's expense. Pay for all tests involved in this Section.
4. Pressure test equipment and connections thereto as required by these Specifications.

3.05 PERFORMANCE TESTS

A. Upon completion of the work, and after all systems are set and balanced, conduct performance tests in accordance with Division 1 and other applicable sections of

© December 2012 Kennedy/Jenks Consultants

these Specifications. Submit test conditions, test data and results to the Engineer for review.

3.06 SOUND LEVEL TESTING

A. Measure the sound level developed by all mechanical and electrical equipment provided. Perform testing in all rooms and spaces containing such equipment during the final operation test program with all equipment operating. Use OSHA approved instrument and record the highest sound level developed when measured according to OSHA Standards in each room and space. Deliver a copy of records to the Owner.

3.07 TOOLS, LOOSE PARTS, AND LUBRICANTS

A. Tools and Loose Parts Supplied: Provide an inventory of tools and loose parts required to be supplied under the project. Turn over inventory and parts to the Owner. The Owner's written acknowledgment of receipt is required for project completion. Loose parts are defined as items such as special tools, keys, safety equipment, and portable equipment. Refer to Section 01700 and relevant technical sections of these Specifications for additional instructions.

B. Recommended Spare Parts: Furnish a complete list of recommended spare parts and supplies for equipment furnished with current prices and a source of supply.

C. Provide a list of all recommended lubricants not listed in the O&M Manuals.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 11002

ELECTRIC MOTOR DRIVES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Provide motors to drive equipment specified in other sections and Divisions, including, but not limited to, Divisions 11, 12, 13, 14, 15, and 16. Refer to driven equipment sections for additional requirements. Requirements of the driven equipment Specifications shall take precedence over the requirements of this Section, where conflict occurs. This Section applies to all electric motors furnished for this project, unless otherwise noted.

B. Related Sections:
   1. Section 11001: General Equipment and Mechanical Requirements
   2. Section 16010: General Electrical Requirements

1.02 REFERENCE STANDARDS

A. National Electrical Manufacturers Association (NEMA) Standard:
   1. MG 1 Motors and Generators

B. Institute of Electrical and Electronics Engineers (IEEE) Standard:
   1. 112 Test Procedure for Polyphase Induction Motors and Generators

C. Underwriters Laboratories (UL) Publication: Recognized Component Directory

1.03 SUBMITTALS

A. Make all submittals in accordance with Specification Section 01300. For each motor, include the following data in the shop drawing submittal for the driven equipment:
   1. Manufacturer's name.
   2. Manufacturer's type and frame designation.
   3. Horsepower output.
   4. Time rating.
   5. Maximum ambient temperature rating.
   6. Insulation system designation.
   7. Rpm at full load.
   8. Voltage, number of phases, frequency and full load amperes.
   9. Code letter for locked rotor kVA.
   10. Service factor at 40°C ambient.
   11. NEMA design letter.
   12. Enclosure type.
   13. Lubrication requirements, including type and frequency.
   14. KW input power and power factor at 75% and 100% of rated horsepower output.
   15. Guaranteed minimum efficiency and nominal efficiency per MG1-12.55.

© December 2012 Kennedy/Jenks Consultants

16. Nominal efficiency.

B. Provide installation, operation and maintenance instructions, and renewal parts list as required for maintenance manuals under Section 01300, Paragraph 1.08.

1.04 COORDINATION

A. General: Coordinate motors with driven equipment requirements. Unless otherwise specified, equipment manufacturers or suppliers shall select and provide motors for their equipment in conformance with these Specifications. Give particular attention to coordination of requirements for:
   1. Power.
   2. Starting torque.
   3. Speed.
   4. Bearing load.
   5. Ambient temperature.
   6. Frequency of starting.
   7. Moisture exposure.
   8. Adjustable speed control, where applicable.

B. Suppliers of motors to be used with adjustable speed systems shall:
   1. Provide all relevant motor data to the adjustable speed control manufacturer for analysis. Provide motors in conformance with and compatible with the adjustable speed control manufacturer's equipment and requirements.
   2. Provide all relevant motor data to the pump manufacturer for vibration, reed critical frequency and other required analyses.

1.05 SPECIFIC REQUIREMENTS

A. The following motor characteristics are specified with the driven equipment in all cases:
   1. Speed.
   2. Horsepower or supplier responsibility to determine.
   3. Horizontal or vertical arrangement.
   4. Indoor or outdoor location.

B. Additional motor characteristics are specified with the driven equipment only where the required motor differs from the typical characteristics described below or where additional properties or characteristics are required that are not specified in this Section.

PART 2 - PRODUCTS

2.01 GENERAL

A. Motors shall be designed, built, and installed in the driven equipment, to provide long, trouble-free life in industrial service and shall be rated in conformance with NEMA MG1. Motors rated 100 horsepower or less and rated 600V or less shall be

© December 2012 Kennedy/Jenks Consultants

listed in UL Recognized Component Directory or shall be listed and labeled by other organizations acceptable to the authority having code enforcement jurisdiction.

B. Unless otherwise specified with the driven equipment, provide motors with the following typical characteristics:
   1. Motors shall be single speed, and designed for continuous duty and full voltage starting. Motors shall provide standard starting torque.
   2. Voltage Ratings:
      a. ½-horsepower or less: 115 volts, single-phase, 60-Hz, capacitor start. Small fan motors may be split phase or shaded pole type if standard for the equipment.
      b. Above ½-horsepower: 460 volts, three-phase, 60-Hz, squirrel cage induction motors.
   3. All motors shall have a service factor of 1.15 in an ambient temperature of 40°C.
      a. Exceptions: Motors, which have special enclosures or winding configurations, may carry a Unity (1.0) Service Factor. Examples are totally enclosed, explosion-proof, or submersible motors.
   4. Windings shall be copper.
   5. Provide ground lug inside the terminal box.
   6. Provide lifting eye on each motor weighing more than 50 pounds.
   7. Each motor shall be suitable for six starts per hour (5 minutes on and 5 minutes off, continuously) when powering the specific driven equipment required for this project.
   8. Each motor shall have an overall sound power level at no load not greater than given in NEMA MG1-12.49.
   9. Motors, which have special operating characteristics such as multi-speed, high torque/high slip, short time intermittent ratings shall be nameplated to show how these characteristics differ from standard design.

C. Motors used with adjustable frequency drives shall have inverter duty complying with NEMA MG-1, Section IV, Part 31.

2.02 NAMEPLATE

A. Provide stainless steel nameplate for each motor, attached to the motor by stainless steel screws or drive pins. Nameplates shall indicate clearly the information required by NEMA MG1, Part 10 and Part 12.

2.03 ENCLOSURE TYPE BY LOCATION

A. Unless otherwise specified with the driven equipment, provide motors with the following typical enclosures:
   1. Indoors: Motors shall be totally enclosed, fan cooled.
   2. Outdoors: Vertical motors shall be weather-protected Type I. Horizontal motors shall be totally enclosed, fan cooled. All motors shall have the following features:
      a. Bearing protection.
      b. Anti-corrosion treatment of external hardware and internal metal parts.
      c. Weatherproof terminal box with gaskets between the motor, terminal box and terminal box cover.

© December 2012 Kennedy/Jenks Consultants

d. Guard screens on ventilation openings.
e. Moderate moisture-resistant insulation, specified hereinafter.
f. Interior and exterior corrosion protection coatings.
g. Special attention to leads into terminal box.

B. When specifically called for in the Specifications for the driven equipment or required by Code, provide the following enclosure types:
1. Submersible: Submersible motors shall comply with the following:
a. Air filled or oil filled squirrel cage induction type.
b. Service factor of 1.15 or better.
c. Class F insulation, Class B temperature rise.
d. Rated for 6 starts per hour.
e. Listed by either UL or FM for Class 1, Division 1, Groups C and D hazardous locations.
f. Suitable for operating in free air continuously (i.e., not submerged in sewage).
g. Bearing B10 life 18,000 hours minimum.
h. Tungsten carbide seals.
i. Lower bearings of either the ball or roller type.
j. If required by the manufacturer to not void the motor warranty, provide a moisture detection system and a motor winding thermostat system. These systems shall be complete, including all necessary interfaces, control panels, conduits, and wires, even though these may not be shown on the Drawings.

2.04 INSULATION

A. Unless otherwise specified with the driven equipment, provide motors with Class B or F insulation, non-hygroscopic. In single phase motors ½-horsepower or smaller, provide Class A insulation or better.

B. Where called for in the Specifications for the driven equipment, provide the following type of insulation:
1. Moderate Moisture-Resistant: Provide extra dip and bake of epoxy or polyester varnish to resist somewhat higher than normal moisture in the atmosphere.

2.05 MOTOR HORSEPOWER

A. The maximum permissible motor loading:
1. Motors with service factor 1.15 or greater: 100% of nameplate horsepower.
2. Motors with service factor less than 1.15: 90% of nameplate horsepower.

© December 2012 Kennedy/Jenks Consultants

TABLE 11002-1

MOTOR NOMINAL EFFICIENCIES AT FULL LOAD

HP	900 RPM	1,200 RPM	1,800 RPM	3,600 RPM
Open Drip-Proof and Weather Protected Type 1 Motors				
1	78.5	78.5	82.5	80.0
1.5	80.0	80.0	84.0	81.5
2	85.5	82.5	82.5	85.5
3	85.5	82.5	82.5	84.0
5	86.5	86.5	85.5	86.5
7.5	87.5	89.5	87.5	88.5
10	90.2	90.2	89.5	86.5
15	90.2	91.7	90.2	89.5
20	91.7	91.7	91.0	90.2
25	91.7	92.4	91.7	90.2
30	92.4	93.0	92.4	92.4
40	91.7	93.0	93.6	93.6
50	93.0	93.0	93.6	93.6
60	93.6	93.6	94.1	94.1
75	94.1	93.6	94.1	93.6
100	94.5	94.5	94.5	94.1
125	94.5	95.0	95.0	94.1
150	95.0	94.5	95.0	94.1
200	95.0	95.0	95.0	94.1
250	94.5	95.0	95.0	94.5
300-500	95.0	95.8	95.8	94.5
Total Enclosed Fan Cooled Motors				
1	78.5	78.5	82.5	80.0
1.5	80.0	80.0	84.0	81.5
2	85.5	82.5	82.5	85.5
3	86.5	86.5	82.5	84.0
5	88.5	87.5	85.5	86.5
7.5	89.5	90.2	87.5	88.5
10	90.2	91.0	89.5	90.2
15	90.2	92.4	91.0	91.7
20	91.7	92.4	91.0	91.7
25	91.7	93.0	92.4	92.4
30	92.4	93.0	93.0	93.0
40	92.4	93.6	94.1	94.1
50	93.6	93.6	94.1	94.1
60	93.6	94.1	94.1	94.1
75	94.1	94.1	94.1	94.5
100	94.5	95.0	95.0	94.5
125	94.5	95.0	95.4	95.0
150	94.5	95.0	95.4	95.4
200	95.0	95.0	95.4	95.4

© December 2012 Kennedy/Jenks Consultants

HP	900 RPM	1,200 RPM	1,800 RPM	3,600 RPM
250	95.0	95.4	95.8	95.8
300-500	95.0	95.8	95.8	95.8

B. Probable motor horsepower ratings have been specified or shown on the Drawings. Changes from the specified horsepower may be accepted, if necessary to assure that motors do not exceed their maximum permissible loading, as defined above, under normal operation. Motor horsepowers shall not be less than those specified in driven equipment sections. If a larger horsepower rating is required by the driven equipment, provide all changes required to motor starting and control equipment and to the conduit and wiring system without any additional cost to the Owner.

2.06 EFFICIENCY

A. For Motors 1 Horsepower and Larger:
   1. Provide premium efficiency motors unless otherwise specified. Premium efficiency motors shall have nominal efficiencies at full load not less than those listed in Table 11002-1.
   2. Guaranteed minimum efficiencies of premium efficiency motors shall correspond to nominal values as tabulated in NEMA MG-1, Table 12-8.

B. Efficiencies shall be determined by using the IEEE 112, Test Method B using segregated loss determination.

C. Single-phase fractional horsepower motors ¼-HP through ¾-HP motors shall be high-efficiency split-capacitor types having minimum efficiency ratings of not less than 64% and power factors of not less than 94.5%.

2.07 LOCKED ROTOR KVA - CODE LETTER

A. Provide motors with locked rotor kVA values less than or equal to those corresponding to the following:

Horsepower	Code Letter
≤5	M
7-1/2-10	H
≥15	G

2.08 THERMAL PROTECTION

A. In each motor to be used with adjustable speed drives, in all motors 60 horsepower and larger, or where called for in the Specifications for the driven equipment, provide integral thermostats or other approved devices to protect the motor from overheating. Thermostats or other devices shall be normally closed and rated 125 Vac, 1 amp.

© December 2012 Kennedy/Jenks Consultants

2.11 FACTORY TESTS

A. Conduct factory tests on all motors in conformance with NEMA MG 1-12.55. All tests shall be made in accordance with IEEE Standard 112.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install motors in driven equipment in conformance with motor manufacturer's recommendations and requirements. Motor nameplate shall be visible when installed on the driven equipment.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 11003

DISINFECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Disinfect all inside surfaces with which water may come in contact in the following structures, pipelines, equipment and accessories:
a. Water storage facilities:
1) Treated Water Tank
b. Filters:
1) Greensand Roughing Filters with filter media
2) GAC Adsorbers/Filters before GAC media is installed
c. Large pipelines:
1) Source water piping
2) Filtered water piping
3) Treated water piping
4) Washwater and surface washwater supply piping
d. Small pipelines:
1) Hot and cold domestic water piping.
2) Sample piping.
2. Dispose of disinfection solution.
3. Flush systems. For the GFW piping, all residual chlorine shall be removed before operating the system to send water to the existing MF filters.

B. Related Sections:
1. Section 01140: Environmental Protection
2. Section 13211: Welded Steel Tank
3. Section 15050: Piping, Valves and Accessories

1.02 REFERENCES

A. American Water Works Association (AWWA):
1. C651 AWWA Standard for Disinfecting Water Mains
2. C652 AWWA Standard for Disinfection of Water Storage Facilities
3. C653 AWWA Standard for Disinfection of Water Treatment Plants

B. National Sanitation Foundation (NSF) / ANSI:
1. NSF/ANSI Standard 60: Drinking Water Treatment Chemicals – Health Effects

1.03 SCHEDULING

A. Schedule and coordinate the work with operating personnel. Once disinfection has been satisfactorily accomplished, no further entry to the interior of the facilities will be allowed unless entry must be made to perform repairs, in which case repeat

© December 2012 Kennedy/Jenks Consultants

disinfection on a localized basis at no additional cost to the Owner. The Contractor shall be responsible for maintaining security of the disinfected facilities.

B. Maintain the existing plant in operation, except that shutdowns in accordance with Section 01010 will be allowed when no alternative exists.

C. Disinfect pipelines following successful pressure testing.

1.04 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Submit a Disinfection Plan in the Product Information category including the procedures, methods, materials and schedules proposed for disinfecting the required surfaces, and method of disposal of chlorinated water.

1.05 QUALITY ASSURANCE

A. Laboratory testing related to disinfection will be performed by and paid for by the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Water: Use Plant Water from the Lessalt Water Treatment Plant.

PART 3 - EXECUTION

3.01 PREPARATION

A. Provide all necessary appurtenances required for the disinfection procedures including taps, temporary piping, connections and shutoff valves. Submit data on appurtenances which will be permanently installed for review by the Engineer.

B. The Contractor is advised that precautions taken to keep surfaces clean during construction and avoiding the entry of deleterious substances on the work during construction will facilitate achieving the disinfection requirements of this project.

C. Prior to disinfecting, thoroughly clean accessible surfaces of dust, dirt, foreign matter and deleterious substances remove any oil by contact with absorbents. Use water sprays, steam cleaning, vacuum cleaning, swabbing, hand brushing or a combination of methods and rinsing to effect the cleaning, but do not use any method that will be detrimental to the finish surfaces. Flush inaccessible surfaces clean.

3.02 APPLICATION

A. After completing all construction activities, disinfect the required surfaces with chlorine solutions in accordance with the following procedures. Following disinfection and flushing, the Owner will take water samples for bacteriological analysis of the water. If the specified bacteriological requirements are not satisfied, repeat disinfection procedure until the requirements are met.

B. Water Storage Facilities:
   1. Standard: AWWA C652 as amended herein.

© December 2012 Kennedy/Jenks Consultants

2. Forms of Chlorine: Use sodium hypochlorite or calcium hypochlorite.
3. Method: 2 (Brush or Spray).

C. Filters:
1. Standard: AWWA C653 as amended herein.
2. Forms of Chlorine: Sodium hypochlorite or calcium hypochlorite.
3. Method:
a. Walls: Method 2 (brush or spray) as discussed in AWWA C652.
b. Media: Soak Method.

D. Large Pipelines:
1. Standard: AWWA C651 as amended herein.
2. Forms of Chlorine: Sodium hypochlorite or calcium hypochlorite
3. Method: Continuous feed.

E. Small Pipelines:
1. Preparation: Provide the system with a 1-inch minimum service cock or valve or other means to inject chlorine solution at a point within 2 or 3 feet of its junction with the supply source. When system is complete, thoroughly flush it by fully opening every outlet until clear water flows from all of them.
2. Disinfecting Agent: Sodium hypochlorite or calcium hypochlorite in sufficient quantities to produce chlorine concentration of at least 50 parts per million in the system.
3. Disinfecting Procedure:
a. Connect a hand-operated pump, or other means of injecting the disinfecting agent, to one-inch minimum service cock or valve or other injection device. Pump must provide a pressure greater than that of supply of system.
b. With system completely full of water and supply valve open, proceed to adjust every outlet of system so that a trickle of water flows from each.
c. Inject disinfectant slowly and continuously at an even rate, not in slugs, until a test at each outlet shows a free chlorine residual concentration of at least 50 parts per million.
d. Close all outlets and valves, including valve connecting to supply line and one-inch minimum service cock on solution injection connection. Maintain condition for 24 hours. After 24 hours, test for residual chlorine at each outlet. The free residual chlorine concentration indicated should be not less than 10 ppm. If the indicated free chlorine concentration is less than 10 ppm, repeat disinfection procedure until an approved result is obtained.
e. When the above procedure has been completed to the satisfaction of the Engineer, flush out entire system with fresh water until tests at all outlets show a residual of not more than 0.5 ppm. For the GFW piping, remove all residual chlorine before sending water to the existing MF filters.

3.03 FIELD QUALITY CONTROL

A. Chlorine Residual Testing: AWWA C651, Appendix A, DPD Drop Dilution Method, except where otherwise specified. Testing shall be performed by the Contractor.

B. Bacteriological Analyses of Water: After the completion of disinfecting procedure, including the final flushing as described in AWWA C651 and heretofore, the

© December 2012 Kennedy/Jenks Consultants

Engineer will obtain water samples from this system for bacteriological analyses. Requirements for satisfactory disinfection of water supply are that bacteriological analyses indicate that water samples are negative for coliform organisms, and that Heterotrophic plate count (standard plate count) is less than 100 colony forming units per milliliter. If bacteriological analyses do not satisfy the above requirements, then repeat disinfection procedure until these requirements are met.

3.04 DISPOSAL OF DISINFECTION SOLUTION

A. Disinfection solution may be dechlorinated to 1 to 2 mg per liter of free chlorine and discharged to the Spent Washwater Equalization Tank, for draining to the sanitary sewer. Take care to assure that chlorinated water is not spilled into storm drains.

3.05 PROTECTION OF DISINFECTED STRUCTURES

A. If required to re-enter a disinfected structure, the work shall be conducted utilizing techniques and work methods as necessary to maintain the disinfected status. This shall include use of disinfected foot coverings, tools, and the like. In the event the Contractor contaminates the facilities, effect decontamination at no additional cost to the Owner.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 11211

CENTRIFUGAL WATER PUMPS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Provide complete, tested and operating water pumps as shown on the Drawings and as specified herein.

B. Related Sections:
   1. Section 01190: Seismic Requirement
   2. Section 01300: Submittals
   3. Section 09960: Protective Coatings
   4. Section 11001: General Equipment and Mechanical Requirements
   5. Section 11002: Electric Motor Drives
   6. Section 15050: Piping, Valves and Accessories
   7. Section 16924: Adjustable Frequency Drives

1.02 REFERENCES

A. ASTM International (ASTM):
   1. A743 Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion-Resistant, for General Application.

B. Anti-Friction Bearing Manufacturers Association (AFBMA).

C. Hydraulic Institute.

1.03 SUBMITTALS

A. Shop Drawings and Product Data: Submit the following as a single complete initial submittal in accordance with Section 01300, Submittals:
   1. Product data to demonstrate that the equipment conforms to the Specifications.
   2. Motor data.
   3. Seismic anchorage certification and related sketch.
   4. Pump layouts and dimensions.
   5. Pump performance curves.
   6. Seismic anchorage calculations for vertical pumps.
   7. Bearing life calculations.

B. Performance Testing: Submit certified non-witnessed factory performance test results in accordance with the Hydraulics Institute. Receive favorable review of test results prior to shipping the equipment.

C. Manuals: Furnish manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and spare parts lists.

D. Submit certification from the manufacturer that the equipment is capable of resisting seismic loads. Loading shall be as described in Section 01190.

© December 2012 Kennedy/Jenks Consultants

E. Affidavits: Submit affidavit from the manufacturer stating that the equipment has been properly installed, adjusted, and tested and is ready for full-time operation.

1.04 QUALITY ASSURANCE

A. Equipment furnished under this Section shall be supplied by a single manufacturer who has been regularly engaged in the design and manufacture of the equipment for at least five years. Demonstrate to the satisfaction of the Engineer that the quality is equal to equipment made by those manufacturers named herein.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Pumps: Aurora; Peerless; Paco; Goulds; or equal.

2.02 PERFORMANCE AND DESIGN REQUIREMENTS

A. Pump Schedule: Pump performance shall be as specified in the Pump Schedule provided at the end of this Section.

B. Pumps shall operate without excessive noise or vibration over the full operating range indicated in the pump schedule. Vibration shall meet Hydraulic Institute standards.

C. Actual tested horsepower of each pump, with final impeller trim, shall not exceed motor nameplate horsepower at any point on the pump curve.

2.03 EQUIPMENT

A. Pump assembly for each application as noted in the Pump Schedule shall be as described below.
   1. Single Stage End Suction pumps shall be horizontally mounted with mechanical seals. Casing shall be end suction and arranged for back pullout. Disassembly shall not require disturbing either suction or discharge piping connections or connections to motor. Suction and discharge piping connections shall be flanged. Mount each pump and motor on a formed steel support base. Connect pump and motor with a heavy-duty flexible coupling complete with galvanized steel shaft/coupling guard.
   2. Multi-Stage Split Case vertical pumps shall be vertically mounted with mechanical seals. Suction and discharge piping connections shall be flanged. Mount each pump and motor on a round cast iron drip-rim ring base plate. Connect pump and motor with a heavy-duty flexible coupling complete with galvanized steel shaft/coupling guard.
      a. Provide casings horizontally split with upper and lower halves bolted together. Locate flanged suction and discharge connections in the lower half casing. Removal of the upper half casing shall permit inspection, maintenance, or removal of the entire rotating element without disturbing suction or discharge piping or pump and driver alignment.
      b. Provide double-hung pump with one bearing housing on each side of the impeller. Support casing on feet integral with the lower half casing.
      c. Provide taps on upper half casing for stuffing box seal piping, priming, and vents. Provide taps on lower half casing for gauges and draining.

© December 2012 Kennedy/Jenks Consultants

d. Provide renewable wear rings on casing and impeller.
e. Provide assembly with a motor bracket to support weight of motor.

3. Multi-Stage Split Case horizontal pumps shall be horizontally mounted with mechanical seals. Suction and discharge piping connections shall be flanged. Mount each pump and motor on a formed steel support base. Connect pump and motor with a heavy-duty flexible coupling complete with galvanized steel shaft/coupling guard.
   a. Provide casings horizontally split with upper and lower halves bolted together. Locate flanged suction and discharge connections in the lower half casing. Removal of the upper half casing shall permit inspection, maintenance, or removal of the entire rotating element without disturbing suction or discharge piping or pump and driver alignment.
   b. Provide double-hung pump with one bearing housing on each side of the impeller. Support casing on feet integral with the lower half casing.
   c. Provide taps on upper half casing for stuffing box seal piping, priming, and vents. Provide taps on lower half casing for gauges and draining.
   d. Provide renewable wear rings on casing and impeller.

B. Construction:
   1. End Suction pumps shall be bronze fitted and shall include the following components made of the indicated materials:
      a. Casing: Close-grained high tensile strength cast iron.
      b. Impeller: Bronze, ASTM B-62.
      c. Shaft: High tensile strength steel.
      d. Shaft sleeve: Bronze.
      e. Wear rings: Renewable, bronze.
   2. Split Case pumps shall be bronze fitted and shall include the following components made of the indicated materials:
      a. Casing: Close-grained high tensile strength cast iron.
      b. Impeller: Bronze, ASTM B-62.
      c. Shaft: High tensile strength steel.
      d. Shaft sleeve: Bronze.
      e. Wear rings: Renewable, bronze.

C. Impeller: Enclosed type, statically and dynamically balanced. Secure against rotation on the shaft by means of a key. The first critical shaft speed shall be at least 125% of full operating speed.

D. Bearings: Oversized, heavy-duty, grease lubricated ball-bearing or roller bearing type. Split Case pumps shall have an AFBMA minimum B-10 life of 50,000 hours. End Suction pumps shall have an AFBMA minimum B-10 life of 20,000 hours.

E. Pump Seal: Pumps shall have single mechanical shaft seals with ceramic or Ni-Resist stationary seat, carbon washer, BUNA elastomer, and stainless steel housing parts and springs. Provide a copper tubing flush water line from a connection at the top of the casing to each seal. At a high point in the line, provide a tee for venting with a bronze valve.

F. Motor: Provide motors for outdoor service, suitable for operation at 480 volts, and conforming to requirements of Section 11002. Nameplate motor horsepower shall not be exceeded at any flow up through the maximum operating point in the Pump Schedule. Motors shall be suitable for operation with an adjustable frequency drive (AFD) over the specified operating range of the pump.

© December 2012 Kennedy/Jenks Consultants

2.04 ACCESSORIES

A. Provide suction and discharge pressure gauges for each pump with features and accessories in accordance with Section 15050. Gauge ranges shall conform to the listing in the Pump Schedule.

2.05 FINISHES

A. Painting: Apply manufacturer’s standard factory paint finish.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install the pump unit(s) in strict conformance with manufacturer's installation instructions. Check pump and motor alignment according to the Standards of the Hydraulic Institute after complete unit has been installed at the site.

3.02 FIELD PAINTING

A. Apply a final color coat of paint to the pump units(s) in accordance with Section 09960.

3.03 FIELD TESTING

A. All pumps shall be field tested and will be witnessed by the Engineer. For further requirements on tests, refer to Section 11001. Prior to performing pumping tests, the following tests shall have been satisfactorily completed.
   1. Piping leakage tests.
   2. Valve control and operation.
   3. Pump seal water systems.
   4. Electrical testing of circuits, controls, and conductors.

B. Perform field testing in accordance with Equipment Startup and Adjustment as required in Section 11001.

3.04 FIELD SERVICE

A. The equipment manufacturer shall supply a competent field service engineer to thoroughly check and inspect the equipment after installation, place the equipment in operation, make necessary adjustments, calibrate instruments, and conduct field tests.

© December 2012 Kennedy/Jenks Consultants

Pump Schedule

Item	Middle Pressure Zone Pumps	High Pressure Zone Pumps	Washwater Supply Pumps	Spent Washwater Pumps	Surface Washwater Booster Pumps
Quantity of Pumps	3	3	3	2	2
Pump Type	Single Stage – End Suction (Horizontal)	Multi Stage – Split Case (Vertical)	Single Stage – End Suction (Horizontal)	Multi Stage – Split Case (Vertical)	By Others**
Primary Point	600 GPM @ 157 ft. TDH	400 GPM @ 274 ft. TDH	2,250 GPM @ 75 ft. TDH	200 GPM @ 195 ft. TDH	By Others**
Maximum Capacity	675 GPM @ 110 ft. TDH ±5 ft.	500 GPM @ 250 ft. TDH ±10 ft.	2,900 GPM @ 60 ft. TDH ±5 ft.	355 GPM @ 130 ft. TDH ±5 ft.	By Others**
Minimum Capacity	350 GPM @ 155 ft. TDH ±5 ft.	150 GPM @ 280 ft. TDH ±10 ft.	800 GPM @ 90 ft. TDH ±5 ft.	80 GPM @ 215 ft. TDH ±5 ft.	By Others**
Maximum NPSH Required @ Maximum Capacity	30 ft.	31 ft.	33 ft.	40 ft.	By Others**
Maximum Speed	1,750 RPM	1,750 RPM	1,175 RPM	1,750 RPM	By Others**
Motor Horsepower	40 HP	50 HP	60 HP	20 HP	By Others**
Motor Drive	VFD	VFD	Fixed Speed	Fixed Speed	By Others**
Manufacturer/Model	Aurora / 344A; *	Aurora / 423; *	Aurora / 360A; *	Aurora / 423; *	By Others**
Minimum Size (Suction x Discharge)	6 inch x 5 inch	4-inch x 3-inch	10 inch x 8 inch	3 inch x 2 ½ inch	By Others**
Minimum Guaranteed Efficiency @ Primary Point	80%	69%	89%	67%	By Others**
Gauge Range:					By Others**
Suction	0-30 psi	0-30 psi	0-30 psi	0-30 psi	By Others**
Discharge	0-100 psi	0-150 psi	0-50 psi	0-150 psi	By Others**

***or equal**

***To be selected by GAC and GRF Supplier (see Specification Sections 11357 and 11358)

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 11240

CHEMICAL FEED EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Provide complete, tested and operating permanganate, coagulant (initially aluminum chlorohydrate (ACH) or potential future ferric chloride), and sodium hypochlorite feed equipment as shown on the Drawings and as specified herein.

B. Related Sections:
   1. Section 09960: Protective Coatings
   2. Section 10400: Identifying Devices
   3. Section 11001: General Equipment and Mechanical Requirements
   4. Section 11002: Electric Motor Drives
   5. Section 13416: Chemical Storage Tanks
   6. Section 15050: Piping, Valves and Accessories

1.02 REFERENCES

A. Uniform Fire Code (UFC).

B. California Building Code (CBC).

C. National Electrical Manufacturers Association (NEMA).

1.03 SUBMITTALS

A. Shop Drawings and Product Data: Submit the following as a complete initial submittal in accordance with Section 01300:
   1. Product data to demonstrate that equipment conforms to the specifications.
   2. Motor data as required in Section 11002.
   3. Pump layouts and dimensions.
   4. Pump performance data.
   5. Materials of construction.
   6. Submit signed and sealed structural calculations and detailed drawings for the attachments and anchorage to the structure of the equipment and appurtenances in this section: Calculations shall conform to the requirements of Section 01190.

B. Manuals: Furnish manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and spare parts lists for each system specified.

C. Affidavits: Furnish affidavits from the manufacturers stating that each system has been properly installed, adjusted and tested and is ready for full-time operation.

D. Material Safety Data Sheets (MSDS) for each chemical to be used during testing of each chemical feed system.

© December 2012 Kennedy/Jenks Consultants

1.04 QUALITY ASSURANCE

A. All products furnished under this section shall be from manufacturers who have been regularly engaged in the manufacture of the pumps specified for at least five years. Demonstrate to the satisfaction of the Engineer that the quality is equal to equipment made by the manufacturers specifically named herein.

B. All components and equipment shall be suitable for bulk (as delivered) chemicals specified as follows in percentage by weight of solution (approximate):

Chemical	Concentration	Approximate Specific Gravity
Permanganate	40%	1.4
Aluminum Chlorohydrate (ACH)	50%	1.3
Ferric Chloride	40%	1.4
Sodium Hypochlorite	12%	1.1

C. Comply with the following regulatory standards:
   1. Uniform Fire Code, especially Article 80, Hazardous Materials with local amendments, if any.
   2. California Building Code, especially Chapter 9, with local amendments, if any.

PART 2 - PRODUCTS

2.01 GENERAL

A. The permanganate and coagulant (ACH or future ferric chloride) chemical feed systems shall each be provided by the manufacture as packaged, skid-mounted systems that include the diaphragm pumps, speed controllers and chemical feed system accessories all on one skid, as described below.

B. The sodium hypochlorite diaphragm pump and chemical feed system accessories shall be provided as separate components, to be installed by the Contractor in the field.

2.02 DIAPHRAGM PUMPS

A. Type: Silicon controlled rectifier (SCR) -driven chemical-metering pumps shall be mechanically-actuated, flat diaphragm type, positive displacement chemical metering pumps. Pumps shall be Pulsafeeder - Pulsatron Series E Plus to match existing pumps; no substitution.

B. Chemical Metering Pump Schedule:

Qty	Service	Capacity GPH Min.	Capacity GPH Max.	Max. HP	Volt/ Phase	Mfrs. Model No.	Drive Type
2	Permanganate	0.02	0.6	1/2	120/1	LPA4SA	SCR
2	Coagulant – ACH (or future Ferric Chloride)	0.2	4.7	1/2	120/1	LPH6SA	SCR
1	Sodium Hypochlorite	0.8	10.0	1/2	120/1	LPH6SA	SCR

© December 2012 Kennedy/Jenks Consultants

C. Construction:
   1. Metering pumps shall be designed to handle the chemicals in the concentrations noted. Metering pumps shall be located as shown on the Drawings.
   2. Each metering pump shall be a complete assembly including head, diaphragm, and integral ball check valves. Each metering pump shall be capable of continuous operation at zero stroke and flow.
   3. Stroke Positioner:
      a. In addition to the variable speed magnetic drive, each SCR-driven metering pump shall have a manual stroke positioner with a minimum 10:1 range, and micrometer indicator reading from 0 to 100%.
   4. Materials: Metering pumps shall use the following materials for wetted parts and seals.
      a. Wetted Parts: Wetted parts include head, diaphragm, ball checks and any other parts in the head assembly which normally are in contact with the pumped chemical.

Chemical	Wetted Parts	Diaphragm
Permanganate	PVC, PVDF, 316 Stainless Steel	Teflon, Viton
Coagulant (ACH or Ferric Chloride)	PVC, PVDF	Teflon, Viton
Sodium Hypochlorite	PVC	Teflon

      b. Seals: All seals shall be made of materials, which are suitable and recommended for the chemical service.

D. Flow Requirements: Metering pump capacity shall be as specified in the schedule. Ratings are specified at 100% controller speed output. Metering pumps shall have a repeatability of 1% of full scale, given constant suction and discharge pressures.

E. Provide a diaphragm leak detector mounted on the pump head that detects diaphragm failure.

F. Motors: Motors for SCR driven pumps shall be DC, supplied with TEFC or TENV enclosures and for operation at 115 volts. Additional construction requirements shall be as specified in Section 11002.

2.03 SPEED CONTROLLERS

A. General: Individually packaged (NEMA 4 or better rated enclosure) SCR speed controllers for the motor driven pump shall be supplied by the chemical pump manufacturer.

B. Type:
   1. SCR Speed Controllers shall be solid state and shall give continuously adjustable feed rate settings over a 20:1 range. The SCR drive shall accept an external 4-20 mA speed signal as shown on the Instrumentation and Electrical Drawings. Power to controller shall be 120 VAC, 1-phase, 60 Hz. DC motors of the specified horsepower shall be used with all SCR controlled motors.

C. Features:
   1. The SCR units and the Electronic Control Modules shall contain a manual rate control adjuster, a hand/off/remote switch, a metering pump running light and a fused on-off power switch. The SCR units and the Electronic Control

© December 2012 Kennedy/Jenks Consultants

Modules shall accept a remote dry contact to start and run the unit, and the SCR units and the Electronic Control Modules shall produce the following dry contacts for remote monitoring:
   a. Pump "Run."
   b. Pump "Ready" which shall indicate that the pump is in the "Remote" position and ready for automatic control.
2. The SCR units and Electronic Control Modules shall provide a 4-20 mA metering pump speed output signal for remote monitoring.

2.04 CHEMICAL FEED SYSTEM ACCESSORIES

A. General: Materials of construction shall be satisfactory for continuous exposure to the hereinbefore-listed chemicals.

B. Calibration Cylinders: Provide a clear PVC graduated calibration cylinder for each pump. The calibration cylinders shall be sized to provide 1-minute drawdown at pump's maximum capacity. Provide anti-splash caps for each calibration cylinder. Install calibration cylinder assemblies on suction side of all metering pumps.

C. Piping Specialties:
1. Provide properly sized pulsation dampeners on the discharge lines of each metering pump as shown on the Drawings.
2. Provide pressure relief and backpressure valves for all services. Valves shall be of PVC for all services. Valves shall be field adjustable and installed where shown on the Drawings and/or as recommended by manufacturer. Valves shall be by ProMinent Fluid Controls, Inc.; Wallace & Tiernan; or equal.

D. Chemical Piping Flex Connections: Provide hoses made from the materials as shown in the table below where shown in the chemical piping systems on the Drawings. Hoses shall be not less than 6 inches long at the suction and discharge connections to the metering pumps. Hoses at tanks shall be not less than 18 inches long. Each chemical metering pump shall have a flex connection in the suction and discharge piping. Each tank shall have a flex connection in all suction piping runs shown on the Drawings.

Chemical System	Flex Connection Hose Material
Permanganate	Neoprene, Teflon, PVDF, PVC (Reinforced)
Coagulant (ACH or Ferric Chloride)	Teflon, PVDF, PVC (Reinforced)
Sodium Hypochlorite	Teflon, PVDF, PVC (Reinforced)

E. Pump Base:
1. Provide chemical feed equipment bases/stands as shown on Drawings.
2. Chemical feed equipment bases shall be concrete pads or fiberglass stands.
3. Each base shall be suitably sized for attachment of the chemical feed equipment shown. The chemical feed equipment shall be positioned on the base/stand such that the pump suction and discharge piping connection extends past the edge of the base/stand.
4. Fiberglass stands shall bolt to the floor.

F. Pre-Engineered Skid:
1. Provide pre-engineered skid for the chemical feed equipment systems.

© December 2012 Kennedy/Jenks Consultants

2. Pre-engineered Skid units shall be manufactured with a ½-inch high-density (HDPE) polyethylene fabricated frame. Skid shall be UV-stabilized and chemically inert.
3. Pre-engineered Skid units shall provide structure for two (2) metering pumps with multi-function valves.
4. Assembly shall include, but not limited to; pulsation dampeners, pressure gauge with isolator and discrete back pressure and pressure-relief valves, calibration column, and isolation valves as shown on the Drawings.

2.05 SPARE PARTS

A. Furnish spare parts that are necessary for continued operation of the equipment and any special tools required for replacement of parts and adjustment of equipment. For each diaphragm pump supplied, spare parts shall include but not be limited to one set of: valve seats, seals, diaphragms, pump seals, bearings, fuses and other parts identified by the information submitted under paragraph 1.03.B.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: The chemical feed system equipment shall be installed in strict conformance with the manufacturer's installation instructions and with favorably reviewed shop drawings. Check out of the final installation, startup, calibration and instruction of operating personnel shall be performed by an authorized representative of the manufacturer.

3.02 FIELD PAINTING

A. Field paint in accordance with Section 09960.

3.03 IDENTIFICATION

A. Identification of the health, flammability, and reactivity of each chemical shall be affixed above each chemical feed area. See Specification Section 10400.

3.04 FIELD TESTING

A. After successfully completing leak tests of the chemical storage tanks (Section 13416), each chemical feed system shall be tested for four hours with water. Each chemical system shall be tested against a closed discharge solution line to test pressure relief valve operation. This shall be performed for each metering pump and shall be witnessed by the Engineer. Only after satisfactory testing with water and complete draining and removal of water from the chemical system, and thorough drying, which may require blowing dry air through the pipelines, may the final test with chemical be allowed to proceed. After draining the test water, hand wipe, dry and blow dry air through chemical feed pipelines to leave the chemical pipelines clean, dry and ready for conveyance of the chemical; then test each chemical feed system in all operational and alarm modes to show conformance with these Specifications. Provide sufficient chemical (approximately 55 gallons each), for the test. The chemicals used shall be favorably reviewed by the Engineer prior to the test. Each chemical metering pump shall be (chemical

© December 2012 Kennedy/Jenks Consultants

solution) calibrated and tested throughout its pumping range. The MSDS for each chemical shall be on hand during the testing of the chemical feed system.

B. The Contractor shall be responsible for the disposal of the test material(s).

3.05 FIELD SERVICES

A. Provide an engineer or technician from the chemical feed equipment supplier(s) to make all adjustments and monitor the testing specified in paragraph 3.04 above.

B. After successful completion of field testing, provide two days (16 hours) of additional service by an engineer or technician from each equipment supplier to train plant personnel in system operation, maintenance, and safety procedures.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 11357

GREENSAND ROUGHING FILTERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Provision and installation of a fully automatic, pressure type, suspended solids, iron and manganese removal filtration system, complete and operable, as indicated on the Drawings and as specified herein. The Greensand Filters and GAC Filters shall be provided by the same supplier.

B. Work Included in this Section:
   1. Horizontal pressure filters and appurtenances
   2. Filter media and media support
   3. Piping and valves
   4. Surface washwater booster pumps

C. Related Sections:
   1. Section 01190: Seismic Requirements
   2. Section 01300: Submittals
   3. Section 01650: Facility Startup
   4. Section 01700: Contract Closeout
   5. Section 09960: Protective Coatings
   6. Section 11001: General Equipment and Mechanical Requirements
   7. Section 11003: Disinfection
   8. Section 11211: Centrifugal Water Pumps
   9. Section 11358: GAC Adsorbers/Filters
   10. Section 15050: Piping, Valves, and Accessories
   11. Section 17330.A: Appendix A PLC Input/Output
   12. Section 17330.B Appendix B Control Strategies

1.02 REFERENCES

A. American Water Works Association (AWWA):
   1. AWWA B100: Standard for Granular Filter Media
   2. AWWA B102: Standard for Manganese Greensand for Filters

B. ASTM International (ASTM):
   1. ASTM A285 Standard Specification for Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength
   2. ASTM A515: Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
   3. ASTM A516: Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service

C. American Society of Mechanical Engineers (ASME):
   1. ASME Boiler and Pressure Vessel Code

D. NSF/ANSI Standard 61: Drinking Water System Components – Health Effects

© December 2012 Kennedy/Jenks Consultants

E. National Association of Corrosion Engineers (NACE):
   1. NACE SP0188: Discontinuity (Holiday) Testing of New Protective Coatings

F. Society of Protective Coatings (formerly the Steel Structures Painting Council):
   1. SSPC Painting Manual, Volume 1, Good Painting Practice
   2. SSPC Painting Manual, Volume 2, Systems and Specifications

1.03 SUBMITTALS

A. Submit the following as a single complete initial product review submittal in accordance with Section 01300:
   1. Provide a list of similar operating iron and manganese removal facilities in conformance with Paragraph 1.04 B. Provide up-to-date list complete with name, current telephone number, and address of the current operator and engineer for each facility.
   2. Shop drawings: Submit shop drawings of the filter, filter media, piping, underdrain, and appurtenances for review. The submittals shall contain sufficient data to show that the equipment conforms to the Specification requirements, including: flow diagrams of systems showing sizes and locations of equipment, devices, and pipe sizes; materials of construction; and pertinent manufacturer's data.
   3. Submit signed and sealed structural calculations and detailed drawings for the attachments and anchorage to the structure of the equipment and appurtenances in this section: Calculations shall conform to the requirements of Section 01190. Anchorage design shall consider thermal expansion and contraction of the vessel.
   4. Submit certification from the manufacturer that the equipment is capable of resisting seismic loads. Loading shall be as described in Section 01190.
   5. Submit ASME Form U-1A certifying the pressure vessel construction prior to delivery of the filters to the site.
   6. Hydraulic calculations: Submit hydraulic calculation of design pressure loss for clean filter bed and backwash conditions, and uniformity of flow for influent distributor/ backwash collector and underdrain piping. Demonstrate conformance to the requirements of this Section. Base the calculations on the actual pipe sizes and configuration, orifice locations, filter media, and support bed, and appurtenant piping.
   7. Submit calculations for sizing the Surface Washwater Booster Pumps. Submit shop drawings, product data and performance test report for the pumps in accordance with Section 11211.
   8. Calculations for sizing of combination air valves.
   9. Provide review comments on filter control strategies and submit pseudo code description (narrative sequential description of the control logic using “IF” “THEN” statements) of the complete filter operating sequences for incorporation into the PLC program.
   10. Provide written warranty in accordance with the General Conditions and Supplementary Conditions.
   11. Provide a written performance guarantee with the warranty.
   12. Provide the resume showing the experience of the pressure filter manufacturer’s trained field representative.

B. Media Samples and Certification: Submit a sample of each size of gravel, anthracite, and manganese greensand or GreensandPlus™ for testing to

© December 2012 Kennedy/Jenks Consultants

determine compliance with the specifications. Submit certification with the samples from the supplier stating that the media conforms to AWWA B100, AWWA B102, and ANSI/NSF Standard 61. Samples shall receive favorable review prior to shipment. Resample media and submit for testing after installation in filters and cleaning and scraping. Manganese greensand or GreensandPlus™ compliance for effective size and uniformity coefficient testing will be determined after the media is backwashed and skimmed.

C. Laboratory Testing: Furnish for all samples and media batches actually being shipped to the site, laboratory size gradation analysis and graphical plots using a log-probability scale of other tests performed as required by this Specification. Test results shall verify media conformance to AWWA B100 and the Specifications. Samples shall be favorably reviewed before installation on this project.

D. Manuals: Furnish manufacturer's installation and operation manuals, bulletins, and spare parts lists in accordance with Section 01300. Manuals are specifically not to be a mere compilation of manufacturer's bulletins. Provide specific step-by-step, plain language instructions for the operation of the filter system in all modes and for extended-period shutdown and maintenance of any filter vessel and combination of vessels. Include a copy of ASME Form U-1A in the manuals.

E. Test Procedure: Submit detailed step-by-step test procedures delineating the methods, equipment, data collection, and chemical analysis methods to be used in verifying conformance with the Performance Test Requirements specified herein.

F. Affidavits: Furnish affidavits from the manufacturer stating that the complete filtration system and associated equipment have been properly sized, installed, seismically restrained, adjusted, and tested, and are ready for full-time operation in accordance with Section 01650.

1.04 QUALITY ASSURANCE

A. All equipment furnished or modified under this Section shall:
   1. Be of a manufacturer who has been regularly engaged in the design and manufacture of the equipment. Manufacturer of filter assembly shall have manufactured the specified filter assemblies for at least ten years.
   2. Be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by those manufacturers specifically named herein.

B. Filter supplier shall provide a list of at least 10 similar iron and manganese removal facilities that were supplied by the filter supplier and have been successfully removing iron and manganese for at least three years. At least two of these installations shall consist of 8- to 10-foot-diameter horizontal pressure filters with surface wash.

C. The filter manufacturer’s trained field representative shall meet the following experience requirements:
   1. Have overseen the installation and startup of not less than five pressure filter systems, including three using surface wash.
   2. Have overseen the filter system startup of not less than three water treatment facilities removing iron and manganese.

D. The filter pressure vessel shall be fabricated in an ASME Code certified manufacturing facility.

© December 2012 Kennedy/Jenks Consultants

1.05 SEISMIC PROTECTION

A. Submit seismic anchorage calculations, certifications, and descriptions in accordance with Section 01190.

1.06 SYSTEM RESPONSIBILITY

A. The filter supplier shall be responsible for furnishing, coordinating, overseeing assembly and installation, testing, and starting up the pressure filter system complete with appurtenant items.

1.07 DESIGN REQUIREMENTS

A. The pressure filter equipment shall be designed for the following requirements:
   1. Design rate of flow per Paragraph 2.01B.
   2. Filter loading rate per Paragraph 2.01B.
   3. Normal maximum operating pressure: 100 psi.

B. Influent water quality ranges as noted below:

Parameter	Historic Average	Influent Water Quality Range
Turbidity	3 NTU	<1 to 20 NTU
Iron	0.06 mg/L	ND to 1.7 mg/L
Manganese	0.04 mg/L	ND to 0.68 mg/L
Arsenic	2.2 ug/L	ND to 3.0 ug/l
pH of raw water	8.3	8.0 to 9.0
Alkalinity	86 mg/L as $CaCO_3$	60 to 150 mg/L as $CaCO_3$
Temperature	15°C	10 - 20°C
Total Dissolved Solids	307 mg/L	240 to 370 mg/l
Color	10 CU	3 to 60 CU

ND = Not Detected

C. Pretreatment Chemicals:
   1. Potassium permanganate will be added upstream of the Greensand Roughing Filters for primary oxidation and to precipitate iron and manganese for removal.
   2. Coagulant (aluminum chlorohydrate) will be added upstream of the Greensand Roughing Filters for coagulation and organics removal.
   3. Sodium hypochlorite will be added upstream of the Greensand Roughing Filters as needed for additional oxidation.

D. Performance Requirements: The pressure filter manufacturer shall review the filter influent source water quality and the specific requirements of these Specifications. The pressure filter manufacturer shall provide a filtration system designed to consistently produce a filtered water having iron and manganese concentrations and operational conditions as noted below:

© December 2012 Kennedy/Jenks Consultants

E. Filtered Water Objectives:

Condition	Maximum
Turbidity	≤ 1 NTU
Iron Concentration in Filtered Water	≤ 0.10 mg/L
Manganese Concentration in Filtered Water	≤ 0.02 mg/L
Filter Clogging Rate at 5.7 gpm/SF	≤ 0.125 ft/hr
Backwash Water Production	<2% of throughput volume

1.08 PERFORMANCE GUARANTEE

A. Submit a performance guarantee as part of the warranty described herein from the filter manufacturer stating that the pressure filter will meet the performance requirements of this Section for hydraulic capacity, iron and manganese removal and other filtered water quality, and backwash water production.

1.09 WARRANTY AND SPECIAL GUARANTEE

A. The warranty for all products and work shall comply with the requirements of the General Contractor's General Warranty and Guarantee described in the General Conditions and Supplementary Conditions.

B. In addition, the filter supplier shall warrant the satisfactory performance of the filter installation for 12 months following system testing and commissioning. In the event there is a difficulty in the operation or failure of the equipment, the filter supplier will be notified by telephone and must provide advice on correction within 24 hours. If the performance or operation condition deficiency continues for more than seven days, a factory trained representative of the filter equipment supplier shall come to the site and correct the condition to the satisfaction of the Owner. This Special Guarantee shall be in accordance with Section 01700.

PART 2 - PRODUCTS

2.01 FILTER

A. Furnish and install horizontal pressure filters complete with filter media and piping as required to remove iron and manganese and suspended solids from the water. Filters and appurtenances shall be as manufactured by Roberts Filter Group; Hungerford & Terry; Loprest; or approved equal.

B. The filter system characteristics and performance requirements shall be as follows:

Parameter	Requirement
Number of Duty Filters	1
Number of Standby Filters	1
Minimum Flow Rate per Filter	370 gpm
Normal Flow Rate per Filter	1,470 gpm
Design Flow Rate per Filter	1,470 gpm
Nominal Surface Area per Filter	264 SF
Typical Surface Loading Rate (2 Filters)	2.8 gpm/SF
Maximum Surface Loading Rate (1 Filter)	5.6 gpm/SF

© December 2012 Kennedy/Jenks Consultants

Parameter	Requirement
Surface Wash Rate (Maximum)	2.0 gpm/SF
Backwash Rate (Minimum)	12.0 gpm/SF
Maximum Dirty Bed Head Loss	10.0 psi
Outside Diameter	10 feet
Straight Side Shell Length	25 feet

C. The filter vessel shall be designed, constructed, welded, pressure tested, and inspected in accordance with Section VIII, Division I of the ASME Boiler and Pressure Vessel Code and shall bear the ASME Code stamp. The design pressure shall be 30% in excess of the normal maximum operating pressure at ambient temperature. Materials of construction shall be ASTM A 285 Grade C, ASTM A 515, or ASTM A 516 carbon steel or better. The vessel head style shall be flanged and dished. All vessel piping connections shall be of Schedule 40 carbon steel with 150-lb fittings.

D. The filter shell shall be supported by two structural steel support saddles welded to the vessel. Seismic loads shall be carried to the concrete foundation with the anchorage system designed by the filter supplier. Design the structural supports to evenly distribute the filter load along the concrete. The supports shall be grouted to the concrete footing as specified in Section 11001.

E. Equip each filter with the following appurtenances:
   1. Two (2) 24-inch (minimum) diameter circular upper manways for media loading and inspection of vessel internals. Provide each manway cover with handles suitable for lifting and a suitably sized davit.
   2. Two (2) 4-inch by 6-inch (minimum) elliptical lower hand holes or 4-inch-diameter flanged nozzles with blind flanges located just above the filter media.
   3. Minimum of two (2) flanged vent connections sized by the filter manufacturer. The vents shall not be less than 3-inch-diameter.
   4. Combination air valves sized by the manufacturer. Nozzles and combination air valves shall be sized by the manufacturer. However, two (2) 3-inch combination air valves shall be provided as a minimum, as specified in Section 15050, installed on the vent connections.
   5. One (1) 14-inch-diameter influent water distribution/backwash waste collection upper interior header and nozzle.
   6. One (1) 14-inch-diameter common filtered water collection/washwater supply interior header and nozzle.
   7. One (1) 6-inch-diameter surface washwater supply nozzle.
   8. One (1) 3-inch-diameter flanged nozzle near the top of the filter for the high-high, high and low level instrument.
   9. Filter supplier shall provide the filter level measuring instrument and transmitter, as appropriate and required for operational control of the pressure filter.
   10. A minimum of four (4) lifting lugs to facilitate placing the vessel.
   11. Other accessories as noted on the Drawings or specified.

© December 2012 Kennedy/Jenks Consultants

F. External Filter Piping: Provide and support the following piping from the filter pressure vessel as described herein and shown on the Drawings.
   1. 6-inch SWS Pipeline
   2. 14" SW/SWW Pipeline

2.02 FILTER INTERNALS

A. The inlet water distribution/backwash waste collection piping shall run from one head to the other and be designed to provide even distribution of flow throughout the filter and prevent formation of currents. The distribution system shall be a perforated header with orifices staggered at 45 degrees along the upper vertical centerline of the header and/or upturned elbow laterals. The distributor shall be factory assembled and adequately supported to withstand operational and seismic loads. Laterals may be field assembled provided that the distributor is provided with couplings welded in factory for attaching laterals in the field. Material of construction shall be Schedule 10 (minimum) Type 316L stainless steel.

B. The common filtered water collection/backwash distribution piping shall be the header lateral type. The distributors shall be arranged for uniform collection of filtered water and uniform distribution of backwash water, and shall not exceed 10 feet of water head loss when backwashing at the rate of 12 gpm/SF. Uniform distribution shall be defined as a flow rate variation of no more than ±5%.
   1. Provide factory assembled Schedule 10 (minimum, but not less than ¼-inch wall if threaded) Type 316L stainless steel headers with Schedule 10 (minimum) Type 316L stainless steel laterals with drilled orifices or slots. In lieu of drilled orifices, provide Type 316 stainless steel Macrobaffle Strainers with Type 316 stainless steel hardware by Roberts Filter or Type 316 stainless steel self-cleaning sand valves by Hungerford & Terry.
   2. Provide a gravel support bed carefully graded to uniformly disperse backwash water across the entire filter area without channeling or excessive wall upflow velocities.
   3. The ratio of the cross-sectional area of the manifold to the total area of the laterals served shall range from 1.45 to 3:1.
   4. The ratio of the cross-sectional area of the lateral to the total area of the orifices/slots served shall range from 2 to 4:1.
   5. The ratio of the total area of the orifice/slots/strainer openings to the surface area of the filter bed shall range from 0.001 to 0.005:1.

C. Surface Wash System:
   1. The surface wash system shall be a header lateral type with nozzles, designed to uniformly distribute surface wash water.
      a. The header shall be constructed of Type 316L stainless steel with Schedule 10 (minimum) Type 316L stainless steel laterals.
      b. The spray nozzles shall be adjustable brass spray nozzles.
   2. Alternately, provide self-propelled rotary media surface agitators.
      a. The surface water supply pipe, agitator body and distributor arm unit shall be Type 304 stainless steel.
      b. Provide non-clogging nozzles threaded into the agitator arm and spaced for uniform water distribution. The nozzles shall be arranged to impart rotation of the distributor arm when water pressure is applied.

D. Gravel Retaining Screen: Provide a gravel retaining screen. The screen shall be Type 316 stainless steel No. 8 mesh with a 0.028-inch wire diameter. The

© December 2012 Kennedy/Jenks Consultants

attachment hardware shall be Type 316L stainless steel. Design the gravel-retaining screen to eliminate upsetting the gravel bed during normal operation and high rate backwash. Securely attach the screen to cross-angle supports and around the perimeter of the vessel at approximately 16 inches on center. Screen laps shall not be less than 3 inches.

E. Hardware: Use 316 stainless steel bolts, nuts, and washers for bolted connections inside the filters.

F. Isolation: Provide dielectric isolation between carbon steel nozzles and stainless steel.

2.03 FILTER MEDIA AND GRAVEL BED

A. The filter manufacturer shall furnish manganese greensand or GreensandPlus™, anthracite filter media, and the gravel support bed. All filter media shall be the product of a company experienced in the production of media for water treatment filtration. Filter media materials, testing, shipment, placement, and preparation of filter for service shall conform to AWWA B100 and AWWA B102 except as specifically modified herein. The filter media shall be generally spherical in shape and conform to the following requirements before and after installation.

Material	Depth (inches)	Effective Size (mm)	Uniformity Coefficient	Specific Gravity
Anthracite	21	0.60 to 0.80	less than 1.60	1.60 ± 0.1
GreensandPlus™	15	0.30 to 0.35	less than 1.60	2.40 ± 0.1

B. Anthracite coal shall be No. 1 grade with a MOH hardness of over 3.0. Not more than 20% of the total weight or number of particles shall be thin or flat as defined by one dimension exceeding three times the other dimension.

C. A gravel support bed is required for the underdrain system. The gravel support bed in the filter shall be a minimum of 12 inches in depth and shall consist of five sizes of gravel, starting with ¾-inch to 1½ inches at the bottom to 1/16-inch to 1/8-inch at the top. The lower layer shall completely cover the underdrain by not less than 3 inches. The ratio of maximum to minimum particle size in a gravel layer shall not exceed 2.0. Between adjoining gravel layers, the ratio of maximum particle size of the coarser layer shall not be greater the 4 times the minimum particle size of the finer layer. The minimum particle size of the top support layer shall be 4 to 4.5 times the effective size of the manganese greensand media. The gravel shall be clean, carefully graded, and free from lime and iron. The gravel in each layer shall have a specific gravity of not less than 2.6. Gravel shall be graded to uniformly disperse backwash water across the entire filter area without channeling or excessive wall upflow velocities.

D. The support gravel, manganese greensand, and anthracite must meet AWWA B100. Manganese greensand must meet AWWA B102. The gravel, manganese greensand, Greensand Plus™, and anthracite must be certified per ANSI/NSF Standard 61.

E. The filter media shall have not less than a 30% or more than 40% rise in media depth during backwash.

© December 2012 Kennedy/Jenks Consultants

F. The filter internals shall be designed so that the filter media (anthracite/manganese greensand) is centered on the filter horizontal centerline, to the extent practical.

G. Wash and screen all anthracite, manganese greensand, and support gravel before shipment.

H. Filter Media Packaging: The filter manufacturer shall furnish filter media in sufficient quantity for initial operation of the filters. Excess media shall be included to account for initial media loss from washing and scraping. All media shall be shipped to the job site double-bagged in one cubic foot sealed bags on pallets or 1,000 to 2,600-lb sealed supersacks, with the contents of each bag plainly marked on the exterior.

I. The filter manufacturer shall have a factory trained on-site representative to supervise the installation of the filter media and support gravel, washing, scraping, and placing the units into service. See Paragraph 3.02 below.

2.04 PAINTING

A. Apply all coatings in strict conformance with the coating manufacturer's instructions and the requirements of Section 09960, as modified herein. Grind all welds and sharp edges smooth and correct any imperfections prior to application of the protective coatings: All welds shall be ground to a radius compatible with the lining and shall be free of porosity.

B. Shop coat the filter tank interiors and all appurtenant metal accessories (other than stainless steel) specified herein within the vessel with the following coating system.
1. Near white sandblast conforming to SSPC-SP10.
2. Prime coat with 2.5 to 3.5 mils dry film thickness (DFT) Tnemec 91H2O Tneme-Zinc.
3. Two coats: Tnemec Series 140 Pota-Pox Plus at 6 to 9 mils DFT per coat.
4. The interior finish paint shall be NSF 61 certified.

C. Shop coat the filter tank exterior and all appurtenant metal accessories (other than stainless steel) specified herein with the following coating system.
1. Commercial sandblast conforming to SSPC-SP6 or better.
2. Prime coat with 2 to 3 mils DFT Tnemec Omnithane Series 1.

D. Test all interior coatings for pinholes with a low voltage electrical resistance meter per NACE SP0188. Check coating thickness with a magnetic thickness gauge. Repair all deficiencies in film integrity and thickness. Certify to the Owner that all deficiencies were corrected prior to shipment.

2.05 FILTER CONTROLS AND OPERATING SEQUENCE

A. Review the Process and Instrumentation Diagrams and Section 17330A. Propose modifications if required for the smooth functioning of the filter system. Provide pseudo code for incorporation into the PLC program covering the complete filter operating sequences.

2.06 NAMEPLATES

A. Provide engraved 316 stainless steel nameplates as specified in Section 11001.

© December 2012 Kennedy/Jenks Consultants

2.07 SURFACE WASHWATER BOOSTER PUMPS

A. Provide two (2) booster pumps, one duty and one standby, to deliver washwater from the Treated Water Tank to the Greensand Roughing Filter and GAC Adsorbers/Filters.

B. The pump shall each be sized to deliver washwater at the required flow rate and pressure to the Greensand Roughing Filters and to the GAC Adsorbers/Filters during the surface wash steps of the respective backwash sequence. Only one filter will be in backwash mode at any time. A throttle valve and flow meter will be used for the surface washwater supply flow rate control.

C. The pumps shall meet the requirements in Section 11211.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Receive shipment, offload, and install the filter vessels in strict conformance with the manufacturer's installation instructions.

B. Internal Coatings: After the filter is installed, inspect the interior. Touch-up or repair any marred or scratched coatings to the satisfaction of the Owner prior to placing media. Spark test all repaired surfaces per NACE SP0188 to verify that they are holiday free.

C. Underdrains:
   1. After the filter is installed, thoroughly clean the underdrain systems of all extraneous material which could later collect in the underdrains.
   2. Place 2,500 psi NSF 61 compliant concrete in the bottom of the filter vessel up to the base of the gravel support bed. Provide concrete tie downs and 6-inch by 6-inch by 10-gauge wire fabric 1½ inches below the surface of the concrete. Isolate wire fabric from stainless steel underdrain.
   3. Test the underdrain systems that have nozzles by backwashing at a rate of 12 gpm/SF to ensure that uniform water distribution is achieved in the filtering and backwash modes. Any irregularities in the height or volume of water jets emitted from distributors shall be corrected by thorough cleaning of underdrain piping and nozzle orifices. A condition of uniform flow shall be attained prior to placement of gravel support material.
   4. Before installation of the support gravel, vacuum clean the underdrain area, all piping, and all surfaces that come into contact with the backwash supply water. This cleaning must be favorably reviewed before beginning placement of the support gravel.
   5. The support gravel shall be placed carefully to avoid damage to the underdrain system and coatings.
   6. After the media is installed, backwash at 12 gpm/SF. Irregularities in the surface elevation of the media greater than 1-inch shall be considered excessive and indicative of a non-uniform flow. Correct any deficiencies until a uniform flow is attained.

D. Media:
   1. Place filter media, wash, scrape, and add makeup media per AWWA B100 and AWWA B102.

© December 2012 Kennedy/Jenks Consultants

2. After the media has been installed and cleaned in the filters, it will be sampled and tested for conformance with this Section. Replace any media found to be in nonconformance to these specifications at no additional cost to the Owner.

E. Disinfect filter media, filter vessel and piping per Section 11003 prior to placing into service.

3.02 FIELD SERVICE

A. Installation Services:
1. The filter manufacturer shall inspect and supervise the installation and certify that the Contractor has installed the filter equipment in the correct manner in accordance with Section 01650.
2. The filter manufacturer shall be responsible for directing placement of filter internals; testing of internal piping for clogging and uniform flow; directing placement of concrete fill, support gravel and filter media, including washing and skimming of media fines; placing the filter system in service; and conducting the performance tests.
3. The filter manufacturer shall be onsite and oversee installation of the first filter, including all internal piping, placement of concrete, verification of underdrain uniform flow conditions, placement of support, filter media placement, including washing and skimming of media fines, and sampling of in situ media.
4. Filter manufacturer shall train the Contractor's representatives in the correct installation procedures. Filter manufacturer shall be available to assist the Contractor at any time during installation of the remaining filters. In the event of any difficulties, filter manufacturer shall return to site to assist the Contractor to correct any deficiencies.
5. Upon completion of installation and prior to testing, filter manufacturer shall return to site and collect filter media samples from each of the remaining filters for laboratory analysis.

B. Training: Comply with the requirements of Section 01650 and this Section. The filter manufacturer shall provide a trained field representative to instruct operating personnel in the proper use and maintenance of the new filters and controls.
1. Provide two (2) training days at startup.
2. It is the responsibility of the Contactor to schedule and arrange for training of all plant shifts. The training shall be videotaped per Section 01650.

C. The filter supplier shall make a field trip within one month of the end of the one year warranty to visit the site and inspect the operation of the system. Within one week after the site visit, submit a report of results of the trip pointing out deficiencies and offering recommendations for unperformed maintenance.

3.03 FIELD PAINTING

A. Coat the exterior of the filter with System 1 in accordance with Section 09960.

3.04 TESTING

A. Comply with the requirements of Section 01650.

B. Furnish all equipment required to complete the filter performance tests.

© December 2012 Kennedy/Jenks Consultants

C. The filter manufacturer shall start up the equipment, make necessary adjustments, and demonstrate to the Owner that all components of the filtration system are in proper operating condition by continuous operation for a period of not less than 96 continuous hours (four full days). Successfully accomplish at least one manual backwash and one automatic backwash events per filter during this period, one of which shall be induced by simulating a high head loss condition. During this period, the manufacturer's representative shall explain and train the Owner's operations personnel on the function, operation and maintenance of the filtration equipment.

D. The filter system shall meet the Performance Requirements previously specified. The system shall meet the required filtered water iron and manganese concentrations for a continuous initial test period of at least 14 days following the 96-hour test noted above. To verify this, water samples shall be taken at the following locations:
   1. Source water.
   2. Roughing filter water outlet.

E. The filter supplier shall be responsible for coordination of all data logging and chemical analysis in a laboratory selected by the Owner. All samples will be taken and preserved in a manner approved by the Owner. The Owner will pay for the costs of the sample analysis. At least two sets of the samples shall be taken every day.

F. If in the Owner’s opinion the system fails to meet the Performance Requirements at any time during the test, the Owner may suspend the test, require the Contractor and Supplier make necessary adjustments or repairs, and repeat the test from the beginning until the 14 consecutive days of data sets document the system’s ability to meet the filtered water requirements. The Contractor will pay the costs for the additional required water quality analysis.

G. The Contractor shall be allowed sufficient time to alter, adjust, add, or replace system components to meet the performance requirements, providing the work is completed within the project contract period. If alterations extend the time of completion, the Owner will incur costs associated with engineering supervision and other related costs. All such additional corrective work, including Owner incurred costs, shall be provided and paid for by the Contractor.

H. Following completion of the performance testing, submit a test report including daily log sheets and the results of the water quality analysis.

I. Measure media depth and replace any media lost during the start-up and performance test period.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

Section 11358

GAC ADSORBERS/FILTERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Provision and installation of a fully automatic, pressure type, turbidity removal filtration system with granular activated carbon (GAC) media for total organic carbon (TOC) reduction, complete and operable, as indicated on the Drawings and as specified herein. The GAC Filters and Greensand Filters shall be provided by the same supplier.

B. Work Included in this Section:
   1. Horizontal pressure filters and appurtenances
   2. GAC filter media and media support
   3. Piping and valves
   4. Surface washwater booster pumps

C. Related Sections:
   1. Section 01190: Seismic Requirements
   2. Section 01300: Submittals
   3. Section 01650: Facility Startup
   4. Section 01700: Contract Closeout
   5. Section 09960: Protective Coatings
   6. Section 11001: General Equipment and Mechanical Requirements
   7. Section 11003: Disinfection
   8. Section 11211: Centrifugal Water Pumps
   9. Section 11357: Greensand Roughing Filters
   10. Section 15050: Piping, Valves, and Accessories
   11. Section 17330.A: Appendix A PLC Input/Output
   12. Section 17330.B Appendix B Control Strategies

1.02 REFERENCES

A. American Water Works Association (AWWA):
   1. AWWA B100: Standard for Granular Filter Media
   2. AWWA B604: Standard for Granular Activated Carbon

B. ASTM International (ASTM):
   1. ASTM A285: Standard Specification for Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength
   2. ASTM A515: Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
   3. ASTM A516: Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service

C. American Society of Mechanical Engineers (ASME):
   1. ASME Boiler and Pressure Vessel Code

© December 2012 Kennedy/Jenks Consultants

D. NSF/ANSI Standard 61: Drinking Water System Components – Health Effects

E. National Association of Corrosion Engineers (NACE):
   1. NACE SP0188: Discontinuity (Holiday) Testing of New Protective Coatings

F. Society of Protective Coatings (formerly the Steel Structures Painting Council):
   1. SSPC Painting Manual, Volume 1, Good Painting Practice
   2. SSPC Painting Manual, Volume 2, Systems and Specifications

1.03 SUBMITTALS

A. Submit the following as a single complete initial product review submittal in accordance with Section 01300:
   1. Provide a list of similar operating pressure filtration facilities in conformance with Paragraph 1.04 B. Provide up-to-date list complete with name, current telephone number, and address of the current operator and engineer for each facility.
   2. Shop drawings: Submit shop drawings of the adsorber/filter, GAC filter media, piping, underdrain, and appurtenances for review. The submittals shall contain sufficient data to show that the equipment conforms to the Specification requirements, including: flow diagrams of systems showing sizes and locations of equipment, devices, and pipe sizes; materials of construction; and pertinent manufacturer's data.
   3. Submit signed and sealed structural calculations and detailed drawings for the attachments and anchorage to the structure of the equipment and appurtenances in this section. Calculations shall conform to the requirements of Section 01190. Anchorage design shall consider thermal expansion and contraction of the vessel.
   4. Submit certification from the manufacturer that the equipment is capable of resisting seismic loads. Loading shall be as described in Section 01190.
   5. Submit ASME Form U-1A certifying the pressure vessel construction prior to delivery of the adsobers/filters to the site.
   6. Hydraulic calculations: Submit hydraulic calculation of design pressure loss for clean filter bed and backwash conditions, and uniformity of flow for influent distributor/ backwash collector and underdrain piping. Demonstrate conformance to the requirements of this Section. Base the calculations on the actual pipe sizes and configuration, orifice locations, GAC filter media, and support bed, and appurtenant piping.
   7. Calculations for sizing of combination air valves.
   8. Provide review comments on filter control strategy and submit pseudo code description (narrative sequential description of the control logic using “IF” “THEN” statements) of the complete adsorber/filter operating sequences for incorporation into the PLC program.
   9. Provide written warranty in accordance with the General Conditions and Supplementary Conditions.
   10. Provide a written performance guarantee with the warranty.
   11. Provide the resume showing the experience of the pressure filter manufacturer’s trained field representative.

B. Media Samples and Certification: Submit a sample of the GAC media for testing to determine compliance with the specifications. Submit certification with the samples from the supplier stating that the media conforms to AWWA B100, AWWA B604, and ANSI/NSF Standard 61. Samples shall receive favorable review prior to

© December 2012 Kennedy/Jenks Consultants

shipment. Resample media and submit for testing after installation in adsorbers/filters and cleaning and scraping.

C. Laboratory Testing: Furnish for all samples and media batches actually being shipped to the site, laboratory size gradation analysis and graphical plots using a log-probability scale of other tests performed as required by this Specification. Test results shall verify media conformance to AWWA B100 and the Specifications. Samples shall be favorably reviewed before installation on this project.

D. Manuals: Furnish manufacturer's installation and operation manuals, bulletins, and spare parts lists in accordance with Section 01300. Manuals are specifically not to be a mere compilation of manufacturer's bulletins. Provide specific step-by-step, plain language instructions for the operation of the adsorber/filter system in all modes and for extended-period shutdown and maintenance of any adsorber/filter vessel and combination of vessels. Include a copy of ASME Form U-1A in the manuals.

E. Test procedure: Submit detailed step-by-step test procedures delineating the methods, equipment, data collection, and chemical analysis methods to be used in verifying conformance with the Performance Test Requirements specified herein.

F. Affidavits: Furnish affidavits from the manufacturer stating that the complete filtration system and associated equipment have been properly sized, installed, seismically restrained, adjusted, and tested, and are ready for full-time operation in accordance with Section 01650.

1.04 QUALITY ASSURANCE

A. All equipment furnished or modified under this Section shall:
   1. Be of a manufacturer who has been regularly engaged in the design and manufacture of the equipment. Manufacturer of adsorber/filter assembly shall have manufactured the specified adsober/filter assemblies for at least ten years.
   2. Be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by those manufacturers specifically named herein.

B. The Adsorber/Filter supplier (hereinafter referred to as filter supplier or manufacturer) shall provide a list of at least five similar pressure filtration facilities that were supplied by the filter supplier and have been successfully reducing turbidity to meet the Long-Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) for at least three years. At least two of these installations shall consist of 12- to 14-foot-diameter horizontal pressure filters with surface wash.

C. The filter manufacturer’s trained field representative shall meet the following experience requirements:
   1. Have overseen the installation and start-up of not less than five pressure filter systems, including three using surface wash.
   2. Have overseen the filter system startup of not less than three water treatment facilities.

D. The filter pressure vessel shall be fabricated in an ASME Code certified manufacturing facility.

© December 2012 Kennedy/Jenks Consultants

1.05 SEISMIC PROTECTION

A. Submit seismic anchorage calculations, certifications, and descriptions in accordance with Section 01190.

1.06 SYSTEM RESPONSIBILITY

A. The filter supplier shall be responsible for furnishing, coordinating, overseeing assembly and installation, testing, and starting up the pressure adsorber/filter system complete with appurtenant items.

1.07 DESIGN REQUIREMENTS

A. The pressure adsorber/filter equipment shall be designed for the following requirements:
   1. Design rate of flow per Paragraph 2.01B.
   2. Filter loading rate per Paragraph 2.01B.
   3. Normal maximum operating pressure: 100 psi.

B. The source water quality ranges are listed in Section 11357. The GAC Adsorber/Filter influent will be water that has been filtered and treated for removal of iron and manganese through the Greensand Roughing Filters, specified in Section 11357.

C. The functions of the GAC Adsorber/Filters are for adsorption of organics that are pre-cursors to disinfection byproduct (DBP) formation and for particle filtration to meet the turbidity and pathogen removal requirements for the LT2ESWTR.

D. Performance Requirements: The pressure filter manufacturer shall review the adsorber/filter influent source water quality, Greensand Roughing Filter Specifications and the specific requirements of these Specifications. The pressure filter manufacturer shall provide a GAC adsorption and filtration system designed to consistently produce filtered water with the operational conditions as noted below:

Condition	Maximum
Individual Filtered Water Turbidity	≤ 0.1 NTU
Combined Filtered Water Turbidity	≤ 0.1 NTU
TOC in Filtered Water	≤ 1.5 mg/L
Filter Clogging Rate at 2.6 gpm/SF	≤ 0.07 ft/hr
Backwash Water Production	≤ 2% of throughput volume

1.08 PERFORMANCE GUARANTEE

A. Submit a performance guarantee as part of the warranty described herein from the filter manufacturer stating that the pressure adsorber/filter will meet the performance requirements of this Section for hydraulic capacity, turbidity reduction in the filtered water quality, and backwash water production.

B. Based on pilot testing of similar GAC media, it is expected that operating at an empty bed contact time of approximately 15 minutes, the GAC will reduce the average TOC levels to less than the objective. The GAC media is expected to be replaced approximately every 6 months, depending on source water quality.

© December 2012 Kennedy/Jenks Consultants

1.09 WARRANTY AND SPECIAL GUARANTEE

A. The warranty for all products and work shall comply with the requirements of the General Contractor's General Warranty and Guarantee described in the General Conditions and Supplementary Conditions.

B. In addition, the filter supplier shall warrant the satisfactory performance of the adsorber/filter installation for 12 months following system testing and commissioning. In the event there is a difficulty in the operation or failure of the equipment, the filter supplier will be notified by telephone and must provide advice on correction within 24 hours. If the performance or operation condition deficiency continues for more than seven days, a factory trained representative of the filter equipment supplier shall come to the site and correct the condition to the satisfaction of the Owner. This Special Guarantee shall be in accordance with Section 01700.

PART 2 - PRODUCTS

2.01 ADSORBERS/FILTERS

A. Furnish and install horizontal pressure filters complete with GAC filter media and piping as required for TOC reduction and for turbidity and pathogen removal to meet the LT2ESWTR. Adsorbers/Filters and appurtenances shall be as manufactured by Roberts Filter Group; Hungerford & Terry; Loprest; or approved equal.

B. The adsorber/filter system characteristics and performance requirements shall be as follows:

Parameter	**Requirement**
Number of Duty Filters	2
Number of Standby Filters	1
Minimum Flow Rate per Filter	365 gpm
Normal Flow Rate per Filter	490 gpm
Design Flow Rate per Filter	735 gpm
Nominal Filtration Area per Unit	286 SF
Typical Surface Loading Rate (3 Filters)	1.7 gpm/SF
Maximum Surface Loading Rate (2 filters)	2.6 gpm/SF
Empty Bed Contact Time at Maximum Flow Rate	14.6 min
Surface Wash Rate (Maximum)	2.0 gpm/SF
Backwash Rate (Minimum)	10.0 gpm/SF
Maximum Dirty Bed Head Loss	10.0 psi
Outside Diameter	12 feet
Straight Side Shell Length	25 feet

C. The adsorber/filter vessel shall be designed, constructed, welded, pressure tested, and inspected in accordance with Section VIII, Division I of the ASME Boiler and Pressure Vessel Code and shall bear the ASME Code stamp. The design pressure shall be 30% in excess of the normal maximum operating pressure at ambient temperature. Materials of construction shall be ASTM A 285 Grade C, ASTM A 515, or ASTM A 516 carbon steel or better. The vessel head style shall be

© December 2012 Kennedy/Jenks Consultants

flanged and dished. All vessel piping connections shall be of Schedule 40 carbon steel with 150-lb fittings.

D. The adsorber/filter shell shall be supported by two structural steel support saddles welded to the vessel. Seismic loads shall be carried to the concrete foundation with the anchorage system designed by the filter supplier. Design the structural supports to evenly distribute the adsorber/filter load along the concrete. The supports shall be grouted to the concrete footing as specified in Section 11001.

E. Equip each adsorber/filter with the following appurtenances:
   1. Two (2) 24-inch (minimum) diameter circular upper manways for media inspection and inspection of vessel internals. Provide each manway cover with handles suitable for lifting and a suitably sized davit.
   2. Two (2) 4-inch by 6-inch (minimum) elliptical lower hand holes or 4-inch-diameter flanged nozzles with blind flanges located just above the GAC filter media.
   3. Minimum of two (2) flanged vent connections sized by the filter manufacturer. The vents shall not be less than 3-inch-diameter.
   4. Combination air valves sized by the manufacturer. Nozzles and combination air valves shall be sized by the manufacturer. However, two (2) 3-inch combination air valves shall be provided as a minimum, as specified in Section 15050, installed on the vent connections.
   5. One (1) 14-inch-diameter influent water distribution/backwash waste collection upper interior header and nozzle.
   6. One (1) 14-inch-diameter common filtered water collection/washwater supply interior header and nozzle.
   7. One (1) 6-inch-diameter flanged surface washwater supply nozzle.
   8. One (1) 4-inch carbon fill nozzle.
   9. Four (4) 4-inch carbon removal nozzles/drains.
   10. One (1) 3-inch-diameter flanged nozzle near the top of the adsorber/filter for the high-high, high and low level instrument.
   11. Filter supplier shall provide the filter level measuring instrument and transmitter, as appropriate and required for operational control of the pressure filter.
   12. A minimum of four (4) lifting lugs to facilitate placing the vessel.
   13. Other accessories as noted on the Drawings or specified.

F. External Adsorber/Filter Piping: Provide and support the following piping from the filter pressure vessel as described herein and shown on the Drawings.
   1. 6-inch SWS Pipeline
   2. 4-inch GAC Fill Pipeline
   3. 14” SW/SWW Pipeline

2.02 ADSORBER/FILTER INTERNALS

A. The inlet water distribution/backwash waste collection piping shall run from one head to the other and be designed to provide even distribution of flow throughout the adsorber/filter and prevent formation of currents. The distributor shall be factory assembled and adequately supported to withstand operational and seismic loads. Laterals shall be may be field assembled provided that the distributor is provided with couplings welded in factory for attaching laterals in the field. Material of construction shall be Schedule 10 (minimum) Type 316L stainless steel.

© December 2012 Kennedy/Jenks Consultants

B. The common filtered water collection/backwash distribution piping shall be the header lateral type. The distributors shall be arranged for uniform collection of filtered water and uniform distribution of backwash water, and shall not exceed 10 feet of water head loss when backwashing at the rate of 12 gpm/SF. Uniform distribution shall be defined as a flow rate variation of no more than ±5%.
   1. Provide factory assembled Schedule 10 (minimum, but not less than ¼-inch wall if threaded) Type 316L stainless steel headers with Schedule 10 (minimum) Type 316L stainless steel laterals with drilled orifices. In lieu of drilled orifices, provide Type 316 stainless steel Microwedge Strainers with Type 316 stainless steel hardware by Roberts Filter.
   2. The ratio of the cross-sectional area of the manifold to the total area of the laterals served shall range from 1.45 to 3:1.
   3. The ratio of the cross-sectional area of the lateral to the total area of the orifices served shall range from 2 to 4:1.
   4. The ratio of the total area of the orifice/strainer openings to the surface area of the adsorber/filter bed shall range from 0.001 to 0.005:1.
   5. The adsorber/filter internals shall be designed to facilitate the regular removal and addition of GAC media.

C. Adsorber/Filter Floor: Provide a NSF 61 compliant concrete subfill to preclude the formation of dead spaces, if required. The concrete subfill shall be slopped to central gullets connected to centrally located media removal outlets to facilitate regular GAC media removal from the bottom of the vessel.

D. Surface Wash System:
   1. The surface wash system shall be a header lateral type with nozzles, designed to uniformly distribute surface wash water.
      a. The header shall be constructed of Type 316L stainless steel with Schedule 10 (minimum) Type 316L stainless steel laterals.
      b. The spray nozzles shall be adjustable brass spray nozzles.
   2. Alternately, provide self-propelled rotary media surface agitators.
      a. The surface water supply pipe, agitator body and distributor arm unit shall be Type 304 stainless steel.
      b. Provide non-clogging nozzles threaded into the agitator arm and spaced for uniform water distribution. The nozzles shall be arranged to impart rotation of the distributor arm when water pressure is applied.

E. Hardware: Utilize 316 stainless steel bolts, nuts, and washers for bolted connections inside the adsorbers/filters.

F. Isolation: Provide dielectric isolation between carbon steel nozzles and stainless steel.

2.03 GAC FILTER MEDIA

A. The filter manufacturer shall furnish the GAC filter media. All GAC filter media shall be the product of a company experienced in the production of media for water treatment filtration. GAC filter media materials, testing, shipment, placement, and preparation of adsorber/filter for service shall conform to AWWA B100 and AWWA B604 except as specifically modified herein. The GAC filter media shall be generally spherical in shape and conform to the following requirements before and after installation.

© December 2012 Kennedy/Jenks Consultants

B. The GAC media shall be a coal based media: Calgon Filtrasorb 300; Norit GAC 300; or equal. The GAC media shall conform to the following requirements before and after installation.

Parameter	Value
Bed depth	60 inches
Standard US Mesh Size	8 x 30
Iodine number	900 mg/g (min)
Abrasion resistance (AWWA)	78%/mm (min)
Moisture, as packed	2% (max)
Effective size	0.8 – 1.0 mm
Uniformity coefficient	2.1 (max)
Apparent density	0.56 g/cc
Ash, weight %	7%

C. The GAC media shall meet AWWA B100 and AWWA B604. The GAC media must be certified per ANSI/NSF Standard 61.

D. The GAC filter media shall have not less than a 10% or more than 30% rise in media depth during backwash.

E. The adsorber/filter internals shall be designed so that the GAC filter media is centered on the adsorber/filter horizontal centerline, to the extent possible.

F. Wash and screen all GAC media before shipment.

G. GAC Filter Media Packaging: The GAC shall be shipped in bags, semibulk containers, or bulk truck. Bag packages shall be protected by an outer package of a resistance nature to avoid tearing the bags. Weather protection shall also be provided for the individual packages or by conveyance. The filter manufacturer shall furnish GAC filter media in sufficient quantity for initial operation of the adsorbers/filters. Sufficient excess media shall be provided to account for media loss from washing.

H. The filter manufacturer shall have a factory trained on-site representative to supervise the installation of the GAC filter media, washing and placing the units into service.

2.04 PAINTING

A. Apply all coatings in strict conformance with the coating manufacturer's instructions and the requirements of Section 09960, as modified herein. Grind all welds and sharp edges smooth and correct any imperfections prior to application of the protective coatings: All welds shall be ground to a radius compatible with the lining and shall be free of porosity.

B. Shop coat the adsorber/filter tank interiors and all appurtenant metal accessories (other than stainless steel) specified herein within the vessel with the following coating system:
   1. Near white sandblast conforming to SSPC-SP10.
   2. Prime coat with 2.5 to 3.5 mils dry film thickness (DFT) Tnemec 91H2O Tneme-Zinc.
   3. Two coats: Tnemec Series 140 Pota-Pox Plus at 6 to 9 mils DFT per coat.

© December 2012 Kennedy/Jenks Consultants

4. The interior finish paint shall be NSF 61 certified.

C. Shop coat the adsorber/filter tank exterior and all appurtenant metal accessories (other than stainless steel) specified herein with the following coating system:
   1. Commercial sandblast conforming to SSPC-SP6 or better.
   2. Prime coat with 2 to 3 mils DFT Tnemec Omnithane Series 1.

D. Test all interior coatings for pinholes with a low voltage electrical resistance meter per NACE SP0188. Check coating thickness with a magnetic thickness gauge. Repair all deficiencies in film integrity and thickness. Certify to the Owner that all deficiencies were corrected prior to shipment.

2.05 ADSORBER/FILTER CONTROLS AND OPERATING SEQUENCE

A. Review the Process and Instrumentation Diagrams and Section 17330.A. Propose modifications if required for the smooth functioning of the adsorber/filter system. Provide pseudo code for incorporation into the PLC program covering the complete adsorber/filter operating sequences.

2.06 NAMEPLATES

A. Provide engraved 316 stainless steel nameplates as specified in Section 11001.

2.07 SURFACE WASHWATER BOOSTER PUMPS

A. See Section 11357 Greensand Roughing Filter and Section 11211 Centrifugal Water Pumps.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Receive shipment, offload, and install the adsorber/filter vessels in strict conformance with the manufacturer's installation instructions.

B. Internal Coatings: After the adsorber/filter is installed, inspect the interior. Touch-up or repair any marred or scratched coatings to the satisfaction of the Owner prior to placing media. Spark test all repaired surfaces per NACE SP0188 to verify that they are holiday free.

C. Underdrains:
   1. After the adsorber/filter is installed, thoroughly clean the underdrain systems of all extraneous material which could later collect in the underdrains.
   2. Place 2,500 psi NSF 61 compliant concrete in the bottom of the adsorber/filter vessel to form the concrete subfill. Provide concrete tie downs and 6-inch by 6-inch by 10-gauge wire fabric 1½ inches inch below the surface of the concrete. Isolate wire fabric from stainless steel underdrain.
   3. Test the underdrain systems that have nozzles by backwashing at a rate of 12 gpm/SF to ensure that uniform water distribution is achieved in the filtering and backwash modes. Any irregularities in the height or volume of water jets emitted from distributors shall be corrected by thorough cleaning of underdrain piping and nozzle orifices. A condition of uniform flow shall be attained prior to placement of gravel support material.
   4. Before installation of the media, vacuum clean the underdrain area, all piping, and all surfaces that come into contact with the backwash supply water.

© December 2012 Kennedy/Jenks Consultants

Disinfect the vessels and system in accordance with Section 11003. This cleaning and disinfection must be favorably reviewed before beginning placement of the media.

5. The media shall be placed carefully to avoid damage to the underdrain system and coatings.
6. After the media is installed, backwash at 12 gpm/SF. Irregularities in the surface elevation of the media greater than 1 inch shall be considered excessive and indicative of a non-uniform flow. Correct any deficiencies until a uniform flow is attained.

D. Media:
   1. Place GAC filter media, wash, and add makeup media per AWWA B100 and AWWA B604.
   2. After the media has been installed and cleaned in the adsorbers/filters, it will be sampled and tested for conformance with this Section. Replace any media found to be in nonconformance to these specifications at no additional cost to the Owner.

E. Disinfect adsorber/filter and piping per Section 11003 prior to installation of the GAC filter media and placing into service.

3.02 FIELD SERVICE

A. Installation Services:
   1. The filter manufacturer shall inspect and supervise the installation and certify that the Contractor has installed the adsorber/filter equipment in the correct manner in accordance with Section 01650.
   2. The filter manufacturer shall be responsible for placement of adsorber/filter internals; testing of internal piping for clogging and uniform flow; placement of concrete fill, GAC filter media including washing and skimming of media fines; placing the adsorber/filter system in service; and conducting the performance tests.
   3. Conduct a GAC media changeout operation on one adsorber/filter to demonstrate complete removal of GAC from vessel. Return GAC media to vessel using GAC fill connections to demonstration proper addition of GAC media.
   4. The filter manufacturer shall be onsite and oversee installation of the first adsorber/filter, including all internal piping, placement of concrete, verification of underdrain uniform flow conditions, placement of support, GAC filter media placement, including washing and skimming of media fines, and sampling of in situ media.
   5. Filter manufacturer shall train the Contractor’s representatives in the correct installation procedures. Filter manufacturer shall be available to assist the Contractor at any time during installation of the remaining adsorbers/filters. In the event of any difficulties, filter manufacturer shall return to site to assist the Contractor to correct any deficiencies.
   6. Upon completion of installation and prior to testing, filter manufacturer shall return to site and collect GAC filter media samples from each of the remaining adsobers/filters for laboratory analysis.

B. Training: Comply with the requirements of Section 01650 and this Section. The filter manufacturer shall provide a trained field representative to instruct operating

© December 2012 Kennedy/Jenks Consultants

personnel in the proper use and maintenance of the new adsorbers/filters and controls.

1. Provide four (4) training days at startup. Assume two separate groups of operators at two (2) days each.
2. It is the responsibility of the Contactor to schedule and arrange for training of all plant shifts. The training shall be videotaped per Section 01650.

C. The filter supplier shall make a field trip within one month of the end of the one year warranty to visit the site and inspect the operation of the system. Within one week after the site visit, submit a report of results of the trip pointing out deficiencies and offering recommendations for unperformed maintenance.

3.03 FIELD PAINTING

A. Coat the exterior of the adsorber/filter with System 1 in accordance with Section 09960.

3.04 TESTING

A. Comply with the requirements of Section 01650.

B. Furnish all equipment required to complete the adsorber/filter performance tests.

C. The filter manufacturer shall start up the equipment, make necessary adjustments, and demonstrate to the Owner that all components of the adsorption/filtration system are in proper operating condition by continuous operation for a period of not less than 96 continuous hours (four full days). Successfully accomplish at least one manual backwash and one automatic backwash events per adsorber/filter during this period, one of which shall be induced by simulating a high head loss condition. During this period, the manufacturer's representative shall explain and train the Owner's operations personnel on the function, operation and maintenance of the adsorption/filtration equipment.

D. The GAC adsorber/filter system shall meet the Performance Requirements previously specified. The system shall meet the required filtered water TOC concentrations for a continuous initial test period of at least 14 days following the 96-hour test noted above. To verify this, water samples shall be taken at the following locations:

1. Roughing filter water outlet.
2. GAC filter water outlet.

E. The filter supplier shall be responsible for coordination of all data logging and chemical analysis in a laboratory selected by the Owner. All samples will be taken and preserved in a manner approved by the Owner. The Owner will pay for the costs of the sample analysis. At least two sets of the samples shall be taken every day.

F. If in the Owner’s opinion the system fails to meet the Performance Requirements at any time during the test, the Owner may suspend the test, require the Contractor and Supplier make necessary adjustments or repairs, and repeat the test from the beginning until the 14 consecutive days of data sets document the system’s ability to meet the filtered water requirements. The Contractor will pay the costs for the additional required water quality analysis.

G. The Contractor shall be allowed sufficient time to alter, adjust, add, or replace system components to meet the performance requirements, providing the work is

© December 2012 Kennedy/Jenks Consultants

completed within the project contract period. If alterations extend the time of completion, the Owner will incur costs associated with engineering supervision and other related costs. All such additional corrective work, including Owner incurred costs, shall be provided and paid for by the Contractor.

H. Following completion of the performance testing, submit a test report including daily log sheets and the results of the water quality analysis.

I. Measure media depth and replace any media lost during the start-up and performance test period.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 13211

WELDED STEEL TANKS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: All labor, material, equipment, tools and services required for the design, fabrication, erection, painting and testing of a ground level, welded steel water storage tanks and accessories.

B. Related Sections:
1. Section 01140: Environmental Protection
2. Section 02301: Earthwork
3. Section 05100: Structural Metal Framing
4. Section 09960: Protective Coatings
5. Section 11003: Disinfection
6. Section 15050: Piping, Valves and Accessories

1.02 REFERENCES

A. American Iron and Steel Institute (AISI).

B. ASTM International Standard Specifications (ASTM):
1. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless
2. ASTM A123 Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
3. ASTM A234 Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
4. ASTM B633 Electrodeposited Coatings of Zinc on Iron and Steel

C. American Welding Society (AWS):
1. AWS D1.1 Structural Welding Code
2. AWS D10.4 Recommended Practices for Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing

D. American Water Works Association Standards (AWWA):
1. AWWA D100 Welded Steel Tanks for Water Storage
2. AWWA D102 Coating Steel Water Storage Tanks
3. AWWA C652 Disinfection of Water Storage Facilities
4. AWWA C200 Steel Water Pipe
5. AWWA C205 Cement-Mortar Protective Lining and Coating for Steel Water Pipe
6. AWWA C207 Steel Pipe Flanges for Waterworks Service
7. AWWA C208 Dimensions for Fabricated Steel Water Pipe Fittings
8. AWWA C213 Fusion Epoxy Lining and Coating for Steel Water Pipe

E. American Society of Mechanical Engineers (ASME):
1. ASME B16.9 Factory-Made Wrought Steel Buttwelding Fittings

© December 2012 Kennedy/Jenks Consultants

F. American Petroleum Institute (API):
   1. API 650 Welded Steel Tanks for Oil Storage

G. California Building Code (CBC) 2010

H. Occupation Safety and Health Standards OSHA 29 CFR Part 1910.

I. California Code of Regulations, Title 8: Industrial Safety (CCR).

1.03 DEFINITIONS

A. Bottom Capacity Level (BCL): The water level in the tank when the tank is emptied through the specified discharge fittings.

B. Capacity: The net volume in gallons based on the bottom capacity level and top capacity level.

C. Top Capacity Level (TCL): The maximum operating level of water in a tank based on the elevation at which water discharges from the tank through the overflow pipe entrance.

D. Contractor: In this Section, the Contractor is responsible to the Owner for all work. This includes work by the tank constructor and the tank manufacturer.

1.04 SYSTEM DESCRIPTION

A. The tank size, including nominal diameter and sidewall height, capacity, freeboard, finished floor elevation, and floor slope shall be as shown on Drawings.

B. Tank Design and Manufacture: AWWA D100, API 650 and CBC. Note also:
   1. If AWWA D100 Section 14 is used in tank design, all provisions must be incorporated.
   2. Copper-bearing steel is not required.

C. Seismic Requirement: Each tank shall be a mechanically anchored tank which has either anchor bolts or anchor straps to anchor the tank to the foundation. Self-anchored tanks that rely on the inherent stability of the self-weight of the tank and contents to resist overturning forces shall not be permitted.

D. Design Requirements: Materials, design, fabrication and erection AWWA D100, latest edition, and the criteria noted on the Drawings.

1.05 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data:
   1. Hangers, pipe and equipment supports.
   2. High-strength bolts.
   3. Stainless steel items.
   4. Manufactured items, including access hatches, vents and safety devices.
   5. Erection Plan.
   6. Electrode manufacturer’s data.

C. Shop Drawings:
   1. Fabrication and erection drawings for steel tanks, foundations and accessories indicating size and thickness of members including anchor bolt layout and embedment and details, assembly drawings, and welding details.

© December 2012 Kennedy/Jenks Consultants

Show detail dimensions and quantities and details of construction and erection as prepared by the tank manufacturer. Detailed drawings for the tanks and accessories signed and stamped by a Civil or Structural Engineer licensed to practice in the state where the tanks will be constructed.

2. Design calculations for tanks and accessories.
3. Depth versus volume calibration table for the tanks in units of inches, feet and gallons.

D. Structural Calculations:
   1. A single complete set of structural calculations for each welded steel tank, ringwall foundation, and roof signed and stamped by a registered professional Civil or Structural Engineer licensed to practice in the state where the tank will be constructed. Submit calculations for tank shell, shell thickness, compressive stress in each ring under wind or earthquake loading combined with dead and water load. Submit calculations for welded joints. Submit calculations for the amount of reinforcement for openings in the tank shell or floor including pipe connections and manholes.

E. Manufacturer's Certifications:
   1. Tank design, including welded joint details and inspection personnel data.
   2. Tank fabrication, including mill tests and shop inspection report.
   3. Tank erection, including field inspection and testing report.

F. Quality Assurance:
   1. Welder performance qualification test records "welders certification".
   2. Written Welding Procedure Specifications (WPSs) in accordance with AWS D1.1 requirements for each different welded joint proposed for use whether prequalified or qualified by testing.
   3. Procedure Qualification Record (PQR) in accordance with AWS 1.1 for all procedures qualified by testing.

1.06 QUALITY ASSURANCE

A. General:
   1. Demonstrate that the tank manufacturer has been regularly designing, fabricating and erecting similar steel tanks for at least 10 years.
   2. Stamp and sign all shop drawings, calculations and welded joint details by a Civil Engineer registered in the state where the tank will be installed.
   3. Supply all new materials and fabricated items.
   4. Verify adequacy of tank foundation.
   5. The Contractor is responsible for preparing and submitting written Welding Procedure Specifications (WPSs). WPSs for each joint type shall indicate proper AWS qualification and be available where welding is performed. WPSs shall be included with any shop drawings referencing welds. WPSs shall include the manufacturer and specific electrode.

B. Codes and Standards:
   1. Tank Manufacture: AWWA D100.
   2. Safety of Access: CCR and CBC.

C. Testing Program:
   1. Qualification of Weld Procedures: AWWA D100.
   2. Qualification of Welders: AWWA D100.

© December 2012 Kennedy/Jenks Consultants

3. Shop and Field Weld Inspection: AWWA D100. If Section 14 applies, retain a Certified Welding Inspector.
4. Weld Inspection Procedures: AWWA D100.
5. Tank Bottom Weld Testing: AWWA D100.
6. Tank Water Tests: AWWA D100.

PART 2 - PRODUCTS

2.01 GENERAL

A. Tank Manufacture: AWWA D100, API 650 and CBC. Note also:
   1. If AWWA D100 Section 14 is used in tank design, all provisions must be incorporated.
   2. Copper-bearing steel is not required.

B. Safety: CCR and CBC.

C. Seismic Requirement: Provide positive anchorage between tank and ringwall. Comply with requirements specified in Section 2.02 and on Drawings.

2.02 DESIGN CRITERIA

A. AWWA D100, CBC, Criteria notes on the Drawings and also:
   1. Seismic design: Determine seismic loads based on the coefficients provided in AWWA D100-05, Section 13, and 2010 CBC, and also site specific response spectra. Refer to Drawings:
      a. Apply horizontal and vertical accelerations simultaneously.
      b. Hoop stress combination: Root mean square method.
      c. Pressure stability: Check with tank full and empty.
   2. Tank anchor system: Resist tension from seismic overturning moment (AWWA D100 equation 13.8), without any reduction for vertical loads.
      a. Design anchors for 1/3 stress increase over basic allowable stress.
      b. Design anchor connections at basic allowable stresses.
   3. Construction loads: Distribute roof concentrated loads so the specified uniform live load is not exceeded. Provide roof shoring where necessary.

2.03 TANK DESIGN

A. Roof:
   1. Minimum thickness 3/16-inch.
   2. Design purlins and rafters for seismic water sloshing where it will occur.
   3. Provide continuous fillet welds all around lapped surfaces at all purlin and rafter connections and beam supports.
   4. Paint contact surfaces between roof plates and rafters.

B. Roof Supports:
   1. Designed in accordance with AISC (ASD).
   2. Pipe or tubular columns, hermetically sealed.
   3. Roof rafters shall be placed above the top capacity level.
   4. Paint contact surfaces between roof plates and rafters.

C. Corrosion Allowance: 1/16-inch.

© December 2012 Kennedy/Jenks Consultants

D. Roof-to-Shell Joint:
   1. For cone roofs with knuckle joint provide butt-welded joint at the base of the knuckle and continuous fillet welded lapped plates, both inside and outside, at the top of the knuckle. The remainder of the roof plates shall be welded on the top-side only with a continuous full-fillet weld on all seams.

E. Shell Circumferential Joints:
   1. Complete penetration butt-welded joints.
   2. Vertical joints in adjacent shell courses shall not be in alignment.

F. Column Bases:
   1. Design to distribute column load plus water pressure on plating without exceeding soil bearing pressure.

G. Bottom Plates:
   1. Bottom plate thickness shall be in accordance with AWWA D100 plus 1/8-inch.
   2. Bottom plate joints shall be lap-welded on the top side only with a continuous full-fillet weld on all seams.

2.04 TANK ACCESSORIES

A. General: Provide each tank complete with all pipe connections, access openings, nozzles, taps, drains and other accessories as shown on the Drawings or required herein. All accessories shall conform to the AWWA D100 and as specified.

B. Stainless Steel Items: Provide AISI Type 304 material, unless Type 316 is specifically specified.

C. Shell Manholes: Two 30-inch-diameter manholes per tank located in the shell and centered 36 inches above the tank bottom. Provide suitable means to hold the manhole covers in the open position. Hinge shall be loose, so that easy bolting is possible. Hot-dip galvanize after fabrication.

D. Piping and Pipe Connections:
   1. Nozzle Connections: (Larger than 2-inch)
      a. Pipe: ASME A53 Schedule 40
      b. Flanges: AWWA C207, Class B
   2. Nozzle connection: (2-inch and larger): Forged steel 3000# Full Coupling, threaded ASME B16.11.
   3. Accessory Piping:
      a. Pipe: ASME A53 Schedule 40
      b. Fittings: Fittings per AWWA C208 fabricated from pipe sections of Item 1, above, except that elbows shall be wrought steel, standard weight, long radius(R=1.5 D) per ASTM A234 unless otherwise noted on drawings.
      c. Flanges: AWWA C207, Class B
   4. Lining: Liquid Epoxy, AWWA C210
   5. Coating
      a. Internal Piping: Liquid Epoxy, AWWA C210.
      b. External Piping: Section 09960.

E. Vents:
   1. Provide 2-foot-diameter, welded steel center roof vent with screened opening, removable top.

© December 2012 Kennedy/Jenks Consultants

2. Design perimeter roof vents for a maximum tank overflow noted on Drawings.
3. Provide screens over all vents. Manufacturer shall verify that adequate venting is provided to equalize pressure and prevent buckling of the tank. Screens shall be designed to pop out into the interior of the tank if the internal tank pressure becomes large enough to cause buckling of the tank shell. Maximum tank in/out flow for venting design is noted on Drawings.
4. The screen shall consist of an 18 x 18 Type 316 stainless steel mesh, 0.017 wire diameter or favorably reviewed equal.

F. Zinc Coatings:
1. Bolts, Washers and Nuts: Electrodeposited zinc-coated to conform to ASTM B633.
2. Other Galvanized Items: Hot-dipped zinc-coated to conform to ASTM A123.

G. Miscellaneous:
1. Provide connection in shell plate for level (pressure) transmitter.

2.05 FABRICATION

A. AWWA D100 and also:
1. Fabricate and assemble in the shop to the greatest extent possible.
2. Shape all members correctly, with no kinks, twists, dents or other blemishes prior to erection. Evenly spring all curved work.
3. Make exposed edges free of burrs and sharp edges. Make corners rounded or chamfered.
4. Shop prime all steel items that are not galvanized or epoxy-coated, with material that is compatible with the finish coat.
5. Stainless Steel Items:
a. Use the proper type of stainless steel electrodes or welding rods complying with AWS D10.4.
b. Remove by grinding and polishing, all scratches, marks, pits and other blemishes on exposed surfaces.
c. Use grinding wheels and other tools that have never been used on carbon steel.

2.06 SOURCE QUALITY CONTROL

A. Material: Verify that satisfactory mill test reports are available on all steel.

B. Welding:
1. Verify welders are qualified.
2. Verify that weld procedures are followed.

C. Report: Provide a shop inspection report including mill tests, radiographs and inspection records, before tank erection is started.

PART 3 - EXECUTION

3.01 PREPARATION

A. Develop a written erection plan and welding sequences for each tank's bottom, side shell and roof plating.

B. Develop this plan and sequences to minimize welding distortions and kinks between plates.

© December 2012 Kennedy/Jenks Consultants

C. Furnish this plan and sequences to the erection crew.

3.02 ERECTION

A. AWWA D100 and also:
   1. Comply with erection plan and welding sequences.
   2. Follow qualified weld procedures.
   3. Use qualified welders.
   4. Provide complete penetration butt welds at all side shell joints.
   5. Remove all evidence of any welding of temporary erection devices.
   6. Stainless steel items:
      a. Use the proper type of stainless steel electrodes or welding rods complying with AWS D10.4.
      b. Remove by grinding and polishing, all scratches, marks, pits and other blemishes on exposed surfaces.
      c. Use grinding wheels and other tools that have never been used on carbon steel.

3.03 FIELD QUALITY CONTROL

A. AWWA D100, and also:
   1. Provide 24 hours notice of all testing to Engineer.
   2. Provide all testing equipment and satisfactory access to the work being inspected.
   3. Perform and evaluate all radiographs promptly, so any repairs can be made and re-evaluated without delay of the erection.
   4. The Engineer will be the sole judge of compliance with the quality of work specified herein or in AWWA D100.
   5. Repair all leaks and retest by the same method that discovered the leak.

B. Tank Welding:
   1. If AWWA D100 Chapter 14, Alternative Design Basis, applies retain a Certified Welding Inspector to be present during all inspections and testing and to specify the test locations.
   2. Inspection by trepanning, air carbon arc gouging and removal of sectional segments will not be permitted.

C. Tank Bottom: Test all joints by the vacuum method after erection and prior to painting.

D. Tank Bottom and Side Shell: Test by the water method, after erection and prior to painting. The Owner will provide the water.

E. Report: Provide a field inspection report, including radiographs and inspection records before acceptance of each tank by the Owner.

3.04 PAINTING

A. Perform interior and exterior cleaning, preparation, and painting in accordance with AWWA D102, Section 09960 and as noted below:
   1. Paint top surfaces of all purlins, rafters, beams and all other roof structural members prior to roof plate installation.
   2. Paint lower side of roof plates prior to installation.
   3. Caulk all unwelded roof plate and structural member lap, prior to painting.

© December 2012 Kennedy/Jenks Consultants

4. Caulking material; polyurethane sealant; PRC permapad RC-270, Vulkem 921, or equal. Apply in accordance with the manufacturer's instructions.
5. Paint the underside of floor plates prior to laying down on the base material.
6. At columns, paint the top side of the floor plates and the underside of the column base plates prior to column erection.

B. Provide a first anniversary inspection of each tank's painting, including testing and any required repair work, at no additional cost to the Owner.

3.05 DISINFECTION

A. After protective coatings have been applied and accepted, disinfect the interior of each tank's surfaces in the presence of the Engineer in accordance with the requirements of AWWA C652 and Section 11003.

3.06 DISPOSAL OF TEST WATER

A. Water used for testing and disinfection procedures shall be disposed of as required by Section 01140.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 13416

CHEMICAL STORAGE TANKS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section describes single and double-walled tanks for indoor and outdoor use. Provide complete, tested and operating tanks as shown on the Drawings and as specified herein, including shipping any "over-sized" loads to the project site.

B. Related Sections:
1. Section 01040: Coordination and Project Requirements
2. Section 01190: Seismic Requirements
3. Section 09960: Protective Coatings
4. Section 10400: Identifying Devices
5. Section 11240: Chemical Feed Equipment
6. Section 15050: Piping, Valves and Accessories
7. Section 17140: Level Measurement

1.02 REFERENCES

A. ASTM International (ASTM):
1. C177 Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties
2. C273 Test Method for Shear Properties in Flatwise Plane of Flat Sandwich Constructions or Sandwich Cores
3. D638 Tensile Properties of Plastics
4. D618 Conditioning Plastics and Electrical Insulating Materials for Testing
5. D746 Impact Brittleness Temperature
6. D790 Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
7. D883 Standard Definitions of Terms Relating to Plastics
8. D1505 Density of Plastics by the Density-Gradient Technique
9. D1525 Test Method for Vicat Softening Temperature of Plastics
10. D1621 Test Method for Compressive Properties of Rigid Cellular Plastics
11. D1622 Test Method for Apparent Density of Rigid Cellular Plastics
12. D1623 Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
13. D1693 ESCR Specification Thickness 0.125-inch F50-10% Igepal
14. D1998 Standard Specification for Polyethylene Upright Storage Tanks
15. D3892 Practice for Packaging/Packing of Plastics
16. E84 Test Method for Surface Burning Characteristics of Building Materials
17. F412 Definitions of Terms Relating to Plastic Piping Systems

B. ANSI Standards: B-16.5, Pipe Flanges and Flanged Fittings

© December 2012 Kennedy/Jenks Consultants

C. OSHA Standards: 29 CFR 1910.106, Occupational Safety and Health Administration, Flammable and Combustible Liquids.

D. CBC: California Building Code 2010.

E. ARM (Association of Rotational Molders) Standards: Low Temperature Impact Resistance (Falling Dart Test Procedure).

1.03 SUBMITTALS

A. Shop Drawings: Submit the following as a single complete initial submittal in accordance with Section 01300. Sufficient data shall be included to show that the product conforms to Specification requirements. Provide the following additional information:

1. Drawings showing tank dimensions and orientation of nozzles and other appurtenances.
2. Details of tank construction and fittings. Indicate wall thicknesses.
3. Submit signed and sealed structural calculations and detailed drawings for the attachments and anchorage to the structure of the equipment and appurtenances in this section: Calculations shall conform to the requirements of Section 01190.
4. Tank manufacturer's corrosion resistance charts for the specified chemicals of the chemical concentrations indicated below, in percentage by weight of solution:

Chemical	Concentration	Approximate Specific Gravity
Sodium Permanganate	40%	1.4
Aluminum Chlorohydrate	50%	1.4
Ferric Chloride	40%	1.3

5. Form of warranty.

B. Submit results of shop testing for review. Do not ship tanks until favorable review of tests is received.

C. Submit results of field testing.

D. Manuals: Furnish manufacturer's installation, operation and maintenance manuals, bulletins, and spare parts lists. Furnish a local 24-hour emergency number for repairs in case of tank damage.

E. Affidavits: Furnish affidavits from the manufacturer stating that the tanks have been installed to the manufacturer’s requirements and are ready for full-time storage of the specified chemicals.

F. Submit chain-of-custody certification.

1.04 ASSURANCE

A. Products of the same material furnished under this Section shall be supplied by a single manufacturer who has been regularly engaged in the design and manufacture of the tanks for a minimum of 10 years. Demonstrate to the satisfaction of the Engineer that the quality is equal to tanks made by the manufacturers named herein.

© December 2012 Kennedy/Jenks Consultants

B. Products shall be manufactured by an ISO 9000 manufacturing facility.

C. Comply with the following Reference Standard: Standard Specification for Polyethylene Upright Storage Tanks, ASTM D 1998 except as modified herein.

D. Comply with the following Regulatory Standards:
   1. Uniform Fire Code, Article 80, Hazardous Materials, with local amendments, if any.
   2. California Building Code, Chapter 3, with local amendments, if any.

E. Tank shall be manufactured from new materials and shall not be stored for more than 3 months prior to delivery.

F. Impact test results must meet the requirements of ASTM D 1998, Section 11 - Test Methods.

1.05 WARRANTY

A. The tank shall be warranted for three (3) years for 100% replacement against defects in materials, workmanship and chemical attack and an additional three (3) years pro-rated warranty for a total warranty of six (6) years. Copy of warranty must be present on tank or on invoice with instruction sheets accompanying fittings.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Tanks shall be as manufactured by Poly Processing; Snyder Industries, Inc; or equal.

2.02 POLYETHYLENE STORAGE TANKS

A. Tanks shall comply with ASTM D 1998 Polyethylene Upright Storage Tanks, except where modified in this specification.

B. Tanks shall be designed in accordance with Section 01190, Seismic Requirements, and other superimposed mechanical conditions as described and, if outdoors, see design requirements on Contract Drawing S-1.

C. In addition to the minimum design requirements as specified, the tanks shall be designed for the stated specific gravity conditions and maximum ambient temperature as listed in the Chemical Storage Tank Schedule in paragraph 2.05. All components shall be compatible with the chemicals specified in paragraph 1.03.A.5.

D. Double-contained chemical storage tank or safe-tank as noted in the Chemical Storage Tank Schedule shall consist of a primary storage tank and a secondary containment tank designed to contain a minimum of 110% of the normal fill capacity of the primary tank.

E. High-Density Cross-linked Polyethylene (XLPE) resin used in the tank manufacture shall be by Exxon Mobil Chemicals or equal and shall contain ultraviolet stabilizer as recommended by resin manufacturer. The resin shall have a carbon black compounded into it. The tank material shall be rotationally molded and meet or exceed the following properties:

© December 2012 Kennedy/Jenks Consultants

Property	Cross-linked Polyethylene Value	ASTM Test
Density, gm/cc	0.938-0.944	D1505
Environmental Stress Cracking Resistance, F50, hours	>1,000	D1693
Tensile Strength, Ultimate psi, 2-inch/minimum	2,800	D638 Type IV Specimen
Elongation at Break, % 2-inch minimum	700	D638 Type IV Specimen
Vicat Softening Point	~248°F	D1525
Impact Brittleness temperature	<-180°F	D746
Flexural Modulus, psi	100,000	D790

F. Resin shall include additional medium density polyethylene (OR-1000) with four times the antioxidant properties of a standard polyethylene bonded to the interior surface during the manufacturing process. Resin shall be certified NSF/ANSI 61 compliant for chemical storage for drinking water applications.

G. Each tank shall have weatherability equal to PAXON 7000 Series for cross-linked polyethylene resin with UV-8 stabilizer. Manufacturer shall have the capability of providing history of tanks made of specified resin with three or more year's exposure to sunlight.

H. Wall thickness for a given hoop stress is to be calculated in accordance with ASTM D 1998. Tanks shall be designed using a hoop stress no greater than 600 psi. Wall thickness calculations shall assume that all tank contents have a specific gravity of not less than 1.4.

I. Manufacturer shall have the capability of issuing gel test results using the method described in ASTM D 1998. The percentage gel level for Cross-link Polyethylene Tanks on the inside 1/8-inch of the wall shall be a minimum of 60%.

J. Tank colors shall be black. When pigments are added they shall not exceed 0.25% (dry blended) of the total weight.

K. Fittings shall be of the following type as suitable for the service:
   1. Fill, overflow, and relief fittings shall be compression type, tank adapters with standard National Pipe Thread to be compatible with associated plumbing. Fittings shall be made vertical on sloping tank tops. Compression type fittings are not permitted for submerged service or below the top head of the tank.
   2. Bolted drain and discharge fittings shall be double flange fittings with two 150-lb flanges. Use bolts with internal polyethylene injection molded encapsulated heads compatible with the chemical stored. Provide gaskets for bolts sealing surface on inner flange.
   3. Drain fitting shall be integrally molded flanged outlets (molded as part of the tank) or unitized molded outlet. Coordinate any concrete tank pad blockout requirements with installer.
   4. Gaskets shall be a minimum of ¼-inch thickness and constructed of 40-50 durometer EPDM.
   5. Fitting, gasket and bolt materials shall be as follows:

© December 2012 Kennedy/Jenks Consultants

Chemical	Fitting Material	Gasket Material	Bolt Material
Potassium Permanganate	PVC	EPDM	316 SS
Aluminum Chlorohydrate	PVC	EPDM	Hastelloy
Ferric Chloride	PVC	EPDM	Hastelloy

6. All tank fitting attachments shall be equipped with flexible couplers designed to deflect based upon tank loading, chemical temperature, and storage time duration. Tank piping flexible couplers shall be designed to allow 4% design movement.
7. Vents:
   a. Shall be compression-type bulkhead fitting with 'U'-bend outlet of PVC pipe construction.
   b. Vents on outdoor tanks shall be equipped with a ¼-inch mesh/polyethylene screen with lock ring.
8. Ultrasonic Level Indicator:
   a. Refer to Specification Section 17140.
9. Access Manway with Pressure Relief Vent:
   a. Manway shall be of HDPE construction with a minimum 24-inch opening and bolt down cover to tank (29-inch bolt circle)
   b. Manway shall include "mushroom-type" emergency vent with relieving volume flow rate capability of 2650 ACFM. Vent shall include polyethylene bug screen. Vent shall have friction-fit to main body of manway.
10. Buttress Cap:
    a. Provide buttress-threaded cap of polyethylene construction with integrally-molded handle.
    b. Provide EPDM gasket pressed into groove molded inside cap.

2.03 TANK ACCESSORIES

A. Insulation - Rigid Cellular Polyurethane Foam with Gel Coat Plastic:
   1. The rigid cellular plastic insulation shall exhibit the following typical properties when sprayed in place:

Property	Value	ASTM Test
Density	2.5 lb/cu ft.	D-1622
Compressive Strength	40 psi	D-1621 (parallel)
Tensile Strength	45 psi	D-1623 (parallel)
Shear Strength	40 psi	C-273 (perpendicular)
Closed Cell Content (%)	90%	-
Water Vapor Transmission	1.9 (perm inches)	-
"K" Factor @ 75°F Initial (as mfg.)	0.11 (BTU/hr) (Ft2) (°F)	C-177
"K" Factor @ 75°F Aged (7 days @ 50% R.H.)	0.13 (BTU/hr) (Ft2)(°F)	C-177
Flammability Characteristics:		
Flame Spread	less than 25	E-84
Smoke Developed	200 to over 500 depending on thickness	E-84

© December 2012 Kennedy/Jenks Consultants

2. After the insulation has been sprayed and allowed to cure, a latex mastic coating shall be applied to the surface of the insulation in such a manner as to seal the insulation from the outside environment. A minimum of two coats shall be provided.
3. The insulation shall be a nominal 2 inches thick over the exposed surface of the tank. Insulation shall be applied at the tank manufacturer's facility.
4. The insulation shall be painted to match the color of the existing Process Building.

2.04 SEISMIC AND WIND RESTRAINT

A. Tank restraint system shall be supplied and the design shall conform to the requirements of Section 01190.

B. The restraint system shall be designed to withstand 115 MPH wind loads. Tie down systems must meet requirements per the latest edition of the CBC.

2.05 CHEMICAL STORAGE TANK SCHEDULE:

A. In the table below, the operational volume shall be the minimum volume in the tank available between 4 inches above the tank outlet and 2 inches below the tank inlet.

Tank Service	T-1 Coagulant (ACH or Ferric Chloride)	T-2 Permanganate
1st Named Manufacturer Tank Model No.	11102750	2000405
Resin Type	XLPE	XLPE
Tank Nominal Listed Capacity (gals)	2750	405
Operational Volume (gals)	2,000	275
Diameter (max.)	8 feet - 2 inches	4 feet, 0 inch
Height	8 feet – 11 inches	6 feet, 2 inches
Type	Single Wall	Double Wall
Connections:		
Fill	2 inches	2 inches
Discharge	1 inch	1 inch
Level Sensor	d	d
Drain	2 inches	2 inches
Vent	N/A	4 inches
Pump Relief	½-inch	½-inch
Overflow	2 inches	2 inches
Manway (min.)	2 feet, e	7 inches, f
Accessory Notes	a	b, c
Ambient Temperature °F (max.)	140	100
Operating Temperature °F (max.)	140	100

Accessory Notes:
a. Provide with insulation.
b. Provide flexible connections on the discharge between the primary and secondary tanks.
c. Provide double-contained tank.

© December 2012 Kennedy/Jenks Consultants

d. Coordinate with level sensor supplier on fitting size and type or method of attachment.
e. Provide Access Manway with Pressure Relief Vent.
f. Provide Buttress thread cap.

2.06 SHOP TESTING

A. Perform gel and impact tests in accordance with ASTM D1998 on samples cut from each polyethylene chemical storage tank.

B. Submit certified shop test results to the Engineer. Do not ship tanks until favorable review of shop testing submittal is received.

PART 3 - EXECUTION

3.01 DELIVERY STORAGE AND HANDLING

A. Provide all shipping and other arrangements required to transport tanks to the project site and ship tanks per manufacturer's recommendations.

B. The tanks shall be marked with adhesive-backed laminated tags or engraved stainless steel tank ID plate to identify the product, date (month and year) of manufacture, capacity, and serial number.

C. All packing, packaging and marking provisions of ASTM Practice D3892 shall apply.

D. All fittings shall be installed and, if necessary, removed for shipping and shipped separately.

E. Upon arrival at the destination, inspect for damage in transit. If damage has occurred, the manufacturer shall be notified prior to tank installation.

3.02 INSTALLATION

A. Install tanks and fittings in strict accordance with the manufacturer's instructions and with favorably reviewed shop drawings.

3.03 IDENTIFICATION

A. Identification of the health, flammability, and reactivity of hazardous materials is required for each tank. See Specification Section 10400.

3.04 FIELD TESTING

A. Notification: Provide the Engineer two (2) working days notice prior to field tests so that the Engineer may elect to witness the testing.

B. Field Testing: Provide a 48-hour static leak test for each tank. The tanks shall be leak tested with water to the overfill level. A passing test result shall be no leakage from the tank. If a leak is detected, the tank shall be repaired or replaced in a manner satisfactory to the Engineer. Such repairs shall be performed only by the tank manufacturer, at no additional cost to the Owner. After repairs, retest the tank until a passing result is achieved. Demonstrate that all tank accessories are working properly.

© December 2012 Kennedy/Jenks Consultants

3.05 FIELD PAINTING

A. Outdoor Polyethylene Tanks shall have the following exterior treatment.
   1. Comply with Section 09960 except that surface preparation and coating shall be as indicated below.
   2. Surface Preparation: Clean and dry.
   3. Coating: Epoxy coating, Tnemec Series 69, prime coat, 4-mils DFT and top coat 4-mils DFT.

3.06 CLEANING

A. After satisfactory completion of field testing, drain the testing water. Rinse the inside of the tanks with clean, potable water. Hand wipe and dry as required to leave the tank interior clean, dry and ready for storage of the chemical. Clean the tank exterior and accessories and leave in good condition.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 15050

PIPING, VALVES AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Provide all piping, including fittings, valves, supports, and accessories as shown on the Drawings, described in the Specifications and as required to completely interconnect all equipment with piping for complete and operable systems, including equipment drains.

B. Related Sections Including Work Provided in this Section:
   1. Section 02301: Earthwork
   2. Section 05100: Structural Metal Framing
   3. Section 05500: Metal Fabrications
   4. Section 09960: Protective Coatings
   5. Section 10400: Identifying Devices
   6. Section 11001: General Equipment and Mechanical Requirements
   7. Section 11003: Disinfection
   8. Certain additional valves, piping, and accessories specified elsewhere:
      a. Section 11240: Chemical Feed Equipment
      b. Section 17120: Flow Measurement
      c. Section 17150: Pressure Measurement

1.02 REFERENCES

A. Air-Conditioning and Refrigeration Institute (ARI)

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

C. ASTM International (ASTM)

D. American Society of Mechanical Engineers (ASME)

E. American National Standards Institute (ANSI)

F. American Water Works Association (AWWA)

G. American Welding Society (AWS)

H. Cast Iron Soil Pipe Institute (CISPI)

I. U.S. Department of Transportation (DOT)

J. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)

K. National Fire Protection Association (NFPA)

1.03 SUBMITTALS

A. Shop Drawings:

© December 2012 Kennedy/Jenks Consultants

1. Verify by excavation, inspection and measurement all installation conditions, including existing utilities and structures, for all pipe before preparation of Shop Drawings. Submit field measurements and photos with Shop Drawings where exposed conditions are significantly different than indicated on the Drawings.
2. Layouts and Schematics: Submit detailed installation drawings of all piping. Schematics may be submitted for piping 4 inches and smaller. The Drawings and schematics shall include: pipe support locations and types, fittings, valves, other appurtenances. (Product Review)
3. Submit data to show that the following items conform to the Specification requirements:
    a. Pipe, fittings and accessories (Product Review).
    b. Fabricated pipe supports and other pipe supports (Product Review).
    c. Pipe couplings and flexible pipe pieces (Product Review).
    d. Valves and Accessories (Product Review).
    e. Thermal insulation (Product Review).
4. Pipe, fittings and joint fabrication details for welded steel pipe (WSP and SSP) (Product Review).
5. Submit reinforcement calculations for WSP to demonstrate compliance with AWWA M11.
6. Submit procedures for welding field joints of welded steel pipe (WSP and SSP) and welder qualifications (Product Review).
7. Submit samples of gaskets and other materials where required by the detailed specifications.
8. Submit certified test reports as required herein and by the referenced standard specifications (Product Information).
9. All items that are submitted for use on water or reclaimed water pipelines, including, but not limited to, pipe and valve linings, solvent cements, welding materials, gaskets and gasket lubricants and additives in concrete or cement mortar shall (in accordance with Section 64591 of the California Water Works Standards) be NSF certified for use in water systems. Submit proof of NSF certification for each item submitted.

B. Samples:
    1. Gaskets for Type PVC-5 pipe.

C. Manuals: Furnish manufacturer's installation and operation manuals, bulletins, and spare parts lists for the following items:
    1. Valves 4 inches and larger and all actuated valves.
    2. Air Valves.
    3. Pneumatic/motorized actuators, including positioners and I/P converters. Include the actuator manuals for the valves requiring them.
    4. Strainers, motorized or automatic washing.
    5. Filters.
    6. Pressure regulators.
    7. Rotameters.

D. Affidavits: Furnish affidavits from the manufacturers for the following equipment:
    1. Valves, motor operated.
    2. All motorized or calibrated equipment.

E. Field test reports as required in Part 3.

© December 2012 Kennedy/Jenks Consultants

1.04 QUALITY ASSURANCE

A. Materials and equipment furnished under this Section shall be of manufacturers who have been regularly engaged in the design and manufacture of the materials and equipment for a period of at least 5 years. Demonstrate to the satisfaction of the Engineer that the quality is equal to the materials and equipment made by the manufacturers specifically named herein, if an alternate manufacturer is proposed.

B. Factory Quality Control: The Contractor shall test all products as noted herein and by the reference specifications.

C. Field Quality Control:
   1. The Owner will:
      a. Inspect field welds and test the welds if it is deemed necessary.
      b. Perform bacteriological analysis for pipelines to be disinfected.
   2. The Contractor shall:
      a. Perform leakage tests.
      b. Be responsible for the costs of additional inspection and retesting by the Owner resulting from noncompliance.

1.05 POTHOLING (CHECK ON LOCATIONS)

A. Do not prepare any shop drawings for, or make final order for, or design any pipe materials for any particular section of pipeline until all utilities in that section of pipeline have been exposed, and until such time as no interferences are found between said existing utilities and the proposed pipeline alignment. If interferences are found in any particular section of pipeline, do not prepare any shop drawings for, or make final order for, or design any pipe materials for that particular section of pipeline until the pipeline alignment has been modified by the Engineer to eliminate all such interferences.

1.06 CONSTRUCTION SCHEDULING/SEQUENCING

A. Construction under this Contract may involve expansion and/or modification of an existing piping system which must continue to provide service to all buildings during construction.

B. Connections and utilities changes must be programmed to provide the least possible interruptions of service. Prior to any shutdown, all materials, fittings, supports, equipment and tools shall be on the site and all necessary labor scheduled prior to starting any connection work. The Contractor shall notify the Engineer in writing at least 7 days in advance of any required shutdowns so that affected customers may be notified. In general, shutdowns shall not exceed four hours in duration unless specifically authorized or indicated in the suggested construction sequence. If a shutdown of more than fours hours is required, the Contractor shall first install temporary service connections to all affected houses and other buildings. All temporary piping shall be disinfected in accordance with Section 11003 before being put into service (water and recycled water piping systems only).

C. All work under this Contract shall be conducted in a manner which will minimize shutdowns, open roadways, or traffic obstructions caused by the construction. Shutdowns causing damage to adjacent public and private property shall not be permitted, and any damage resulting shall be the sole responsibility of the Contractor.

© December 2012 Kennedy/Jenks Consultants

D. Planned utility service shutdowns shall be accomplished during periods of minimum use. In some cases, this will require night or weekend work, which shall be at no additional cost to the Owner. The Contractor shall program his work so that service will be restored in the minimum possible time, and shall cooperate with the Owner in reducing shutdowns of the utility system to a minimum. No utility interruption will be permitted without the prior approval of the Engineer.

1.07 PIPING SYSTEMS

A. The various piping systems are identified by a multi-letter code on the Drawings. Unless otherwise shown on the Drawings, each system shall be constructed using the materials indicated for that system in the Piping Schedule. Piping materials are identified by type designation in the schedule unless otherwise noted, and most valves and accessories are identified by a valve and accessory system unless otherwise noted.

1.08 APPURTENANCES

A. Furnish and install all necessary guides, inserts, anchors and assembly bolts, washers and nuts, hangers, supports, gaskets, couplings and flanges; all other appurtenant items shown on the Drawings, specified or required for the proper installation and operation of the piping; devices included in or on the piping equipment; and piping accessories.

1.09 PIPE SUPPORTS

A. General:

1. Piping 6 Inches and Larger: Pipe supports are shown on the Drawings for piping 6 inches and larger in diameter, where the piping is shown on layout drawings. Each pipe support used is designed to resist seismic loading except where the support is of the sliding type for thermal expansion. Other supports are provided to resist axial seismic loading of pipes designed for thermal expansion. Pipe supports that are considered seismic resistant are so noted on the pipe support detail sheets on the Drawings. The location and types of supports and braces are indicative and may be modified by the Contractor to suit field conditions, provided the modified support system conforms to the design criteria stated herein, and receives the favorable review of the Engineer. Where piping is shown schematically only, it shall be the Contractor's responsibility to support all such piping in accordance with the design criteria stated herein and using support details shown on the Drawings. Pipe supports have been designed assuming flanged joints on ductile iron pipe and steel pipe, unless otherwise indicated on the Drawings. If groove type mechanical couplings are used as an alternative, provide additional supports where required, particularly to resist rotation. Shop drawings of these additional supports shall be favorably reviewed by the Engineer prior to installation.
2. Piping Less Than 6 Inches: Pipe supports are generally not shown for piping less than 6 inches in diameter. Where supports are not shown, it shall be the Contractor's responsibility to support all such piping in accordance with the design criteria stated hereinafter and the support details shown on the Drawings. Piping 2-½ inches and larger and all piping for hazardous chemicals shall be supported with pipe supports designed to resist seismic

© December 2012 Kennedy/Jenks Consultants

loads. Hazardous chemical piping includes hypochlorite, permanganate, and aluminum chlorohydrate (coagulant). Piping smaller than 2-½ inches with non-hazardous contents may be supported with non-seismic resistant supports.

3. Where not detailed or otherwise indicated, pipe support types and spacing shall be in accordance with the Manufacturer's Standardization Society (MSS) Standard Practice No. SP-58 and No. SP-69, except as superseded by the requirements of these Specifications. Hangers and supports used as components of a fire protection system shall comply with NFPA Standard No. 13 and be listed and labeled by UL and FM.

B. Pipe Support System Design:

1. Design Loads: Pipe suspension shall be such as to prevent excessive stress or excessive variation in supporting force while system is in operation. Pipe supports shall support the sum of the weight of the pipe, fittings, appurtenances, and contents. In addition, the pipe shall be anchored to resist internal pressure forces tending to separate any unrestrained joint at pressures 1-½ times the maximum working pressure for the applicable service.
2. Seismic Loads: Seismic loads, expressed as a percentage of the weight of the contributing length of pipe, fittings, appurtenances, and contents, are 120% in any direction within the horizontal plane of the pipe, and 120% up or down within the vertical plane of the pipe.
3. Location: All piping shall be supported in a manner that will prevent undue strain on any valve, fitting, or piece of equipment. In addition, pipe supports shall be provided at changes in direction or elevation, adjacent to flexible couplings, at all nonrigid joints, at hose bibbs, and where otherwise shown. Where piping connects to equipment, it shall be supported by a pipe support and not by the equipment.
   a. Maximum support spacing shall conform to the following table:

Pipe Size Inches	Pipe Material	Maximum Spacing Feet
1-inch and smaller	Iron or Steel Copper Plastic Tubing	6 4-1/2 continuous continuous
1-¼-inch to 2-inch	Iron or Steel Copper or Plastic	8 5
2-½-inch to 4-inch	Iron or Steel Copper or Plastic	10 6
6-inch to 8-inch	Iron or Steel Plastic	12 8
10-inch and larger	Iron or Steel	15

   b. Piping penetrations through concrete walls and slabs are considered to resist seismic loading, provided penetrations for pipes 3 inches in diameter and larger are complete with a wall flange.
   c. Branch piping is not considered to provide resistance to seismic forces.
4. Anchors: Anchors for connecting pipe supports to concrete shall be in accordance with Section 05100.

© December 2012 Kennedy/Jenks Consultants

PART 2 - PRODUCTS

2.01 GENERAL

A. Pipe and valve sizes are nominal inside diameter unless otherwise noted.

B. Construct vents of materials specified for the pipe system for which they serve.

C. All materials delivered to the job site shall be new, free from defects, and marked to identify the material, class, and other appropriate data such as thickness for piping.

D. Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the completed product. Acceptance of installed piping systems shall be based on inspection and leakage tests as specified hereinafter.

E. Cutoff Flanges: Provide at all pipe or sleeve penetrations where cast into wall for pipes 4 inches and greater in nominal diameter, and at all penetrations of 3-inch and smaller nominal diameter pipe in wet or potentially wet locations as indicated on the Drawings. Cutoff flange outside diameter shall be at least a standard connection flange's outside diameter except that for pipe 30-inch-diameter and larger, nominal size, cutoff flange outside diameter may be 6 inches greater than outside pipe diameter. Cutoff flange shall be at least ¼-inch thick and shall be continuously welded (or cast) onto the pipe. Conform to pipe penetration details in paragraph 3.01A and as shown on the Drawings.

2.02 GENERAL MATERIAL REQUIREMENTS

A. Gaskets: Except where specified otherwise, gaskets shall be SBR rubber or NBR (Nitril or Buna-N). Use Hypalon or Viton for hypochlorite service.

B. Bolts and Tie Rods: Unless specified otherwise herein, flange bolts and nuts, coupling bolts and nuts, tie rods and other hardware shall be as follows:
   1. Exposed: Electroplated zinc or cadmium steel.
   2. Submerged: Type 316 stainless steel, minimum tensile strength: 60,000 psi.
   3. Concrete Encased: Steel.
   4. Buried: Fluoropolymer coated carbon steel. Fluoropolymer coating shall be Tripac 2000 Blue; or equal.
   5. Apply an anti-gauling compound to the threads of stainless steel bolts.

C. Flexible Sealant: Flexible sealant for pipe joints, where shown on the Drawings, shall be a two-component polysulfide, non-sag; Sikaflex 2C, or equal.

D. Fusion Epoxy Coating: AWWA C213; except application shall be by fluid bed only unless the greatest dimension of the article to be coated exceeds ten feet, in which case electrostatic spray or flocking application may be used.

2.03 PIPING MATERIALS

A. Pipe and Fitting Designation: Piping materials are identified by a "Type" designation in these Specifications. The "Type" designation identifies not only the pipe itself but the associated fittings and appurtenances and the installation and test procedures described for that "Type." The designation of a particular type shall indicate a complete installation including fittings, joints, cleaning and testing. The pipe and fitting materials for each type designation shall be as specified herein and summarized in the Pipe Type Schedule.

© December 2012 Kennedy/Jenks Consultants

B. Piping Schedule: Piping systems and their corresponding piping and valve systems are listed on the Drawings.

C. Pipe Type Schedule: Pipe material, joints and fittings shall be as summarized below. A detailed specification of each pipe type follows. (The detailed specification supersedes the schedule in case of any conflicts.)

Pipe Type	Pipe Description	Field Joints	Fittings
CUT	Copper Tube	Compression or Solder	Wrought Copper
DIPB	Ductile Iron Bell & Spigot Pipe	B&S	DI
DIPF	Ductile Iron Flanged Pipe	Flange or Mech. Groove Coupling	DI
PVC-1	PVC, Schedule 80	Threaded or Solvent Weld	PVC, Schedule 80
PVC-5	PVC, Sewer	B&S	PVC
PVC-6	PVC, Drain, Waste and Vent	B&S	PVC
SSP	Stainless Steel Pipe	Flanged or Weld	Stainless Steel
WSP	Welded Steel Pipe	Weld (flanged or coupling where shown)	WS

D. CUT Pipe (Tubing):Tubing and Fittings:
1. Tube: Copper, Type DHP, Alloy No. 122, soft annealed, bright seamless, ASTM B68 and B75.
   a. Dimensions: ½-inch outside diameter x 0.035-inch wall
2. Joints: Flared compression or soldered.
3. Fittings:
   a. Soldered: Seamless wrought copper, ASTM B75.
   b. Compression: Brass, Imperial; Swagelok; or equal.

E. DIPB:
1. Pipe: Ductile iron bell and spigot pipe, AWWA C151.
   a. Minimum Pressure Class:

Pipe Size (inches)	Minimum Pressure Class
3 - 12	350
14 - 20	250

2. Joints: Push-on or mechanical, AWWA C111 as modified, except where flanged joints are shown on the Drawings or where making connections to valves.
   a. Gaskets: SBR or NBR (Nitril or Buna-N).
   b. Buried Tee-Head Bolts and Nuts for Mechanical Joints: Fluoropolymer coated carbon steel.
   c. Provide insulating flanges with two cathodic test stations for buried ductile iron to steel connections.
3. Fittings: Ductile iron with push-on joints, or mechanical joints, AWWA C110 and AWWA C153.
4. Restrained joints: Unless noted otherwise on the Drawings, provide restrained joints for pipe and fittings capable of deflection after restraint is installed. Joints shall not separate under an internal pressure of 250 psi. For

© December 2012 Kennedy/Jenks Consultants

push-on joints use TR FLEX or Field Lok by United States Pipe & Foundry Company; equivalent product by American Cast Iron Pipe Company; or equal. For mechanical joints use Megalug restraints by EBAA Iron, or equal.

5. Lining: Standard thickness cement mortar lining for pipe and fittings, AWWA C104, except where noted otherwise in the Drawings or in the Piping Schedule. Cement mortar linings shall be seal coated. Alternatively, fittings may be fusion epoxy lined and coated per AWWA C116.
6. Coating: Buried pipe shall receive asphalt coating per AWWA C151. Exposed or submerged pipe requiring protective coating per Section 09960 shall be shipped bare or shall be factory primed compatible with selected field paint system.
7. Protection for buried pipe: Polyethylene encasement, black, AWWA C105. Provide single-wrap for pipe and double-wrap for flanged fittings, mechanical joints, or other appurtenances with significantly different outside diameters from the pipe. Tape to seal seams and overlaps at least 4 mils thick and at least 2 inches wide.
8. Bonding: Bond ductile iron to provide electrical continuity, except that insulating flanges without bonding shall be provided where shown on the Drawings.
9. Pipe Taps:
   a. Threaded metal pipe branch lines up to 1-inch in diameter from ductile iron pipe may be made with direct threaded taps, provided the ductile iron wall thickness is in excess of the minimum shown in Tables A.1 and A.2 of AWWA C151 for four full threads. Bosses may be used at the taps to provide the required pipe wall thickness, or use service saddles or reducing flanges on tees.
   b. Service Saddles:
      1) Materials: Ductile iron saddle with electro-galvanized straps and hardware for above ground and bronze or 304 stainless steel for buried, and nitrile or neoprene gaskets.
      2) Type: For ductile iron pipe 4 inches and less, single strap saddles may be used. For pipe greater than 4-inch, double-strap saddles can be used.
      3) Manufacturers: Smith-Blair Model 311 or 313; equivalent by Mueller; or equal.
10. Field Closure Connections for Restrained Joints: Pipe cut in the field where necessary and when favorably reviewed by the Engineer shall be connected to adjoining systems using restrained flexible couplings or restrained flanged coupling adapters as specified in Paragraph 2.04.C.

F. DIPF:
   1. Pipe: Flanged or grooved end ductile iron.
      a. Flanged Pipe: AWWA C115 including Appendix A, minimum thickness Class 53.
      b. Grooved End Pipe: AWWA C151 with grooves in accordance with AWWA C606, Table 3, for rigid joints. Provide minimum thickness classes in accordance with AWWA C606.
   2. Joints: Where flanges are shown on the Drawings, provide mechanical rigid grooved couplings up to 24-inch or flanges, at the Contractor's option, except where grooved couplings are required in the Drawings. (See paragraph 1.09.A.1 for special requirements for pipe supports with grooved

© December 2012 Kennedy/Jenks Consultants

couplings.) Provide flanges where required to connect to valves, equipment or certain pipe supports.

3. Flanges: Ductile iron, plain faced, AWWA C115. Submit certification that flanges comply with AWWA C115. Provide insulating flanges with two cathodic test stations for buried ductile iron to steel connections.
4. Fittings:
   a. Flanged: Ductile iron, AWWA C110 or AWWA C153.
   b. Grooved End: Ductile iron, AWWA C110 for materials, dimensions and pressure ratings. Grooves shall be in accordance with AWWA C606, Table 3, for rigid joints.
   c. Special Fittings: Special fittings not available in ductile iron may be fabricated of fusion epoxy lined and coated welded steel pipe with a design pressure of 450 psi. Submit design and wall thickness to the Engineer for review.
   d. Buried bolts and nuts for flanged and grooved end joints shall be Fluoropolymer coated carbon steel.
5. Lining: Standard thickness cement mortar lining for pipe and fittings, AWWA C104, except where noted otherwise in the Drawings or in the Piping Schedule. Cement mortar lining shall be seal coated.
   a. Fusion epoxy lining and coating, where required in the Drawings or Piping Schedule, shall be applied in accordance with paragraph 2.02.D.
6. Coating: Buried pipe shall receive asphalt coating per AWWA C115. Exposed or submerged pipe requiring protective coating per Section 09960 shall be shipped bare or shall be factory primed compatible with selected field paint system.
7. Protection for buried pipe: Polyethylene encasement, black, AWWA C105. Provide single-wrap for pipe and double-wrap for flanged fittings and joints, or other appurtenances with significantly different outside diameters from the pipe. Tape to seal seams and over laps at least 2 inches wide.
8. Bonding: Bond ductile iron to provide electrical continuity, except that insulating flanges without bonding shall be provided where shown on the Drawings.
9. Gaskets:
   a. Flanged: Full face, 1/8-inch-thick SBR rubber or NBR (Nitril or Buna-N), AWWA C115, Appendix A.
10. Flange Bolts: AWWA C115, Appendix A unless stainless steel is required in paragraph 2.02.
11. Pipe Taps:
   a. Threaded metal pipe branch lines up to 1-inch in diameter from ductile iron pipe may be made with direct threaded taps, provided the ductile iron wall thickness is in excess of the minimum shown in Tables A.1 and A.2 of AWWA C151 for four full threads. Bosses may be used at the taps to provide the required pipe wall thickness, or use service saddles or reducing flanges on tees.
   b. Service Saddles:
      1) Materials: Ductile iron saddle with electro-galvanized straps and hardware for above ground and bronze or 304 stainless steel for buried, and nitrile or neoprene gaskets.
      2) Type: For ductile iron pipe 4 inches and less, single strap saddles may be used. For pipe greater than 4-inch, double strap saddles shall be used.

© December 2012 Kennedy/Jenks Consultants

3) Manufacturers: Smith-Blair Model 311 or 313; equivalent by Mueller; or equal.

12. Field Closure Connections: Pipe cut in the field where necessary and when favorably reviewed by the Engineer shall be connected to adjoining system using restrained flexible couplings as specified in Paragraph 2.04.C.

G. PVC-1:

1. Pipe: Schedule 80 polyvinyl chloride (PVC), gray, normal impact, Type 12454 B, ASTM D1784 and ASTM D1785. Pipe shall bear the National Sanitation Foundation (NSF) label.
2. Joints: Solvent weld, except flanged or threaded permitted where required at equipment connections and where required on the Drawings. Use Military Specification T 27730A tape for threaded joints.
3. Fittings: Solvent weld, socket type, of same material as the pipe, Schedule 80, ASTM D2467.
4. Cement: Solvent weld, ASTM D2564, as recommended by the pipe manufacturer for the schedule and size to be joined. Use ASTM F-493, IPS724 CPVC by Harrington Plastics for sodium hypochlorite; no equal.
5. Pipe Cleaner: As recommended by the pipe manufacturer for the schedule and size to be joined.
6. Double containment of piping is required for all buried PVC pipe and tubing so indicated in the pipe schedule or elsewhere in the Plans and Specifications.
   a. Size: Provide Schedule 40 PVC containment pipes as follows:

Carrier Pipe	Containment Pipe
½-inch	4-inch
¾-inch	4-inch
1-inch	4-inch
1-½-inch	4-inch
2-inch	4-inch

   b. Joints: Solvent weld except flanged where required. Use two-piece hinged couplings as specified below where necessary. Do not make-up joints until successful completion of leak tests of primary carrier pipe.
   c. Fittings: Yellow or clear PVC two-piece, hinged, and pregasketed (EPDM) containment fittings. Termination couplings shall be hubless type of PVC rubber with 316 stainless steel clamps. Carrier pipe shall be installed concentrically to the containment using three- or four-legged positioning clips. Fittings shall be Flo-Safe as supplied by Harrington Industrial Plastics, Contain-It by R&G Sloane; or equal.

H. PVC-5:

1. Pipe and Fittings: Polyvinyl chloride sewer pipe:
   a. 4-inch through 15-inch nominal size: ASTM D3034, SDR 26.
   b. 18-inch through 48-inch nominal size: ASTM F679.
2. Joints: Elastomeric gasket joints, ASTM D3212.
3. Gaskets: SBR rubber or NBR (Nitril or Buna-N).

I. PVC-6:

1. Pipe and Fittings: Polyvinyl chloride drain, waste and vent, ASTM D2665. Fitting patterns, ASTM D3311.

© December 2012 Kennedy/Jenks Consultants

2. Joints: Solvent weld.
3. Cement: Solvent cement, ASTM D2564, as recommended by the manufacturer.

J. SSP:
1. Pipe: Stainless steel, ASTM A312 or A778, TP 304L, Schedule 40S.
2. Joints: Butt welded or socket welded, except where screwed or flanged joints are required adjacent to valves or equipment.
3. Fittings: Wrought stainless steel, ASTM A774, TP304L, ANSI B16.9 for dimensions.
4. Flanges: Welding neck or slip-on, raised face, ASTM A182, TP304 ANSI B16.5 for dimensions. Class 150, drilling to match adjacent accessories or valves.
5. Gaskets: Full face gasket per ANSI B16.21, non-asbestos Hypalon or Viton or teflon-bonded EPDM.

K. WSP:
1. Pipe: Cement mortar lined steel cylinder pipe, AWWA C200 except as modified herein. Pipe shall be cement mortar coated where buried, and if required elsewhere by the Drawings or Specifications. Steel shall be ASTM A36.
   a. Dimensions: Nominal inside diameter shall be the minimum net inside clear lined diameter.
   b. Minimum steel cylinder thickness and lining thickness:

Nominal Size (Inches)	Steel Cylinder Minimum Wall Thickness (inches)	Minimum Lining Thickness (inches)
6 – 8	0.135	3/8
10 - 16	0.188	1/2
18 - 48	0.250	3/4

2. Joints: Use welded joints, except flanged or connected with couplings where shown on the Drawings.
   a. Welded joints shall be butt strap, split butt strap, or lap joint. Butt straps and lap joint details shall be submitted to the Engineer for favorable review. The joint shall be designed to withstand all loads associated with installation and operating conditions. Rolled lap joints are not acceptable. The radius of the bell bends shall be greater than 15 times the cylinder wall thickness. Joint configuration and welding shall conform to the requirements of AWWA M-11 and AWWA C206 except Section 6-2 testing, which are modified herein. The size of fillet welds shall be equal to the thickness of the smaller plate being joined. Butt welds shall be full penetration.
   b. For pipe less than 24-inch-diameter, the proceeding described in AWWA C205, paragraph 4.7.2.2.2 utilizing a burlap-covered ball shall be used for applying cement mortar lining to the insides of the joints.
   c. Cement mortar lining shall be patched after joint testing and may be hand applied. Conform to AWWA C205, Appendix A.
3. Fittings: Fittings shall be made of hydrostatically tested cylinders of the same material and minimum thickness as the pipe, except that elbows shall have

© December 2012 Kennedy/Jenks Consultants

greater thickness if necessary to compensate for stress concentrations. They shall be as detailed on the Drawings or, if not detailed on the Drawings, shall be designed by the pipe manufacturer by the method stated in the AWWA Pipe Manual M11 as modified herein, subject to the favorable review of the Engineer. Unless otherwise noted or detailed on the Drawings, fitting dimensions shall conform to AWWA C208. Adding pipe to the fittings does not change the requirement that the fittings conform to AWWA C208 dimensionally, nor does it reclassify the pipe portion as part of the fitting. Use 150 psi for the design pressure P.

a. Provide reinforcement for fittings (outlets, tees and wyes, etc.) in the form of collars, wrappers or crotch plates, in accordance with the current revision of AWWA M11, Table 13-2. Coat buried fitting reinforcement with cement mortar.
b. Crotch plates shall be designed in accordance with AWWA M11, using a minimum plate thickness of 1-inch.
c. Elbow dimensions (unless otherwise noted or detailed on the Drawings):
    1) Minimum number of pieces for mitered elbows:
        a) 68° to 90°: five pieces.
        b) 46° to 67°: four pieces
        c) 23° to 45°: three pieces
        d) Up to 22½°: two pieces
    2) Radius, R, to pipe centerline:
        a) 1.25 pipe diameters for in-plant piping
        b) 2.5 pipe diameters for transmission lines
    3) Wrought steel elbows complying with ANSI B16.9 and ASTM A234 may be substituted for mitered elbows as long as they meet, as a minimum, the radius, wall thickness and internal diameter requirements of this specification.
d. Nozzles 3 inches and less shall be Schedule 40 weld fittings. Wheeling Pipe-O-Lets; Allied Branchlets; or equal. They may be unreinforced.
e. Flares: Flare diameter shall be equal to the flange O.D. for the same size pipe. Fabricate flares from two sections of truncated cones, one angled 22 ½ degrees from pipe axis, the other 45 degrees. Grind all interior welds and edges perfectly smooth before lining.

4. Lining: Cement mortar, ¾-inch thick AWWA C205 except as modified herein. Cement shall be Type II. On pipe 27-inch diameter and larger, the lining shall be reinforced using a plain 2 x 4-inch, 13 x 13 gauge welded wire mesh welded to the inside of the pipe, fitting, or steel plate special. If the cement mortar lining is applied by the centrifugal process, the reinforcement may be omitted. Wire reinforcement shall conform to ASTM A185. Paint interior edges and other unlined surfaces in accordance with System 3 in Section 09960.
5. Coating:
    a. Cement mortar coating (buried pipe, except where noted): ¾-inch thick over the reinforcement, AWWA C205. Cement shall be Type II containing 15% to 20% pozzalan. Reinforcement shall be in accordance with AWWA C205.
    b. Non-cement mortar coating: Pipe without cement mortar coating shall be painted in accordance with Section 09960. Shop prime with products compatible with final coats. Hold back coatings of concrete encased

© December 2012 Kennedy/Jenks Consultants

portions of pipes from a point 2 inches within face of concrete encasement.

c. On buried piping where the cement mortar coating is held back for flexible couplings or other similar connections, edges shall be ground smooth and the exposed pipe shall be painted with System 3 in Section 09960, Protective Coatings, and shall overlap the cement lining and mortar coating. Stripe coat edges between finish coats.

6. Flanges and Bolts:
   a. Steel ring flanges conforming to AWWA C207, Class D with bolt holes drilled in conformance with ANSI B16.1, 125-pound class except as needed to match equipment or other pipeline items. Bolts shall be sized in accordance with ANSI B16.1. Welding shall conform to AWWA C207. The inside diameter of all flanges shall be no more than 3/16-inch greater than the outside diameter of the steel cylinder. Flanges shall be welded to the cylinder without warping and with flange face perpendicular to the longitudinal axis of the cylinder.
   b. Where ductile pipe joins with steel cylinder pipe, the steel flange is to be modified to be compatible, in pressure rating and configuration, with the ductile iron pipe. Provide insulating flanges with two cathodic test stations for buried ductile iron to steel connections.
   c. Exposed metal on the flanges shall be coated in accordance with Section 09960. In addition, buried flanges, couplings and other mechanical connections shall be double-wrapped with polyethylene encasement, AWWA C105 and extended to overlap the cement mortar coating with edges of the encasement taped with PVC tape.
7. Gaskets: SBR rubber, 1/8-inch thick.
8. Interior Bracing: Each section of pipe 24-inch and larger shall have adequate interior bracing to prevent the pipe from being deformed during handling, transportation, storage, and installation. Bracing shall not be removed until construction operations are complete.
9. Factory Testing: Perform hydrostatic pressure tests of pipe and tests of specials in accordance with Section 5.2 of AWWA C200. Test methods are subject to the favorable review of the Engineer.
10. Marking: Cylinders and completed pipe and fittings shall be marked in accordance with AWWA C200-97, Section 6.1. The manufacturer shall maintain records that identify the cylinder used for all completed pipe and fittings. All test results and other documentation required to be furnished to the Engineer shall identify the cylinders and completed pipe and fittings by use of this marking system.
11. Interior Moisture Control: Maintain interior moisture and provide plastic sheet end caps during storage and transportation.

2.04 PIPE COUPLINGS AND FLEXIBLE PIPE PIECES

A. General: For typical pipe joints refer to pipe material specifications. Other joint devices shall be furnished where called for on the Drawings and as specified below.

B. Flexible Couplings and Flange Coupling Adaptors (for WSP):
   1. Sleeve: Cast iron or fabricated steel.
   2. Followers: Cast iron, ductile iron, or steel.

© December 2012 Kennedy/Jenks Consultants

3. Sleeve Bolts: ASTM A325, Type 3; malleable iron; or equivalent, except for buried and submerged, which shall be Type 304 stainless steel and Type 316 stainless steel, respectively.
4. Coating: Fusion epoxy line and coat sleeve and followers.
5. Pressure Rating: The test pressure of the applicable service or 50 psi, whichever is greater.
6. Performance: Longitudinal movement and angular deflection capabilities shall meet AWWA C219.
7. Flanged Coupling Adaptor Flanges: Match mating flanges. If required by connecting valve or other device, provide flanges with inside diameter equal to nominal pipe diameter.
8. Manufacturers:
    a. Flexible Couplings:
        1) Connecting Pipe with Identical Outside Diameters: Smith-Blair 411 or 441; Dresser Style 38 or 138; or equal.
        2) Connecting Pipe with Slightly Different Outside Diameters: Smith-Blair 413 or R441; Dresser Style 62; or equal.
    b. Flange Coupling Adaptors: Smith-Blair 912 or 913; Dresser Style 128-W; or equal.
9. Gaskets: SBR rubber or oil and grease resistant (Nitril or Buna-N).
10. Joint Restraint: Provide joint harnesses (tie rod lug or attachment plate assemblies) designed for the test pressure or 50 psi, whichever is greater, across all flexible couplings and flange coupling adaptors, except where specifically indicated otherwise on the Drawings. For steel pipe the joint harness shall conform to the requirements of Chapter 13 of AWWA M-11, Table 13-4 - Tie Bolt Schedule for Harnessed Joints. Anchor studs may be used on flange coupling adapters for pipe up to 12 inches in diameter.
11. Protection for Buried Couplings and Adaptors:
    a. Double-wrap with polyethylene encasement, AWWA C105 and tape the edges of the encasement with PVC tape.

C. Restrained Flexible Coupling and Flanged Coupling Adapter (for DIPB and DIPF):
1. Sleeve: Carbon steel, meeting AWWA C219.
2. Gland: Ductile iron (ASTM A536).
3. Restraining Wedges: Ductile iron.
4. Actuating Bolts: Ductile iron (ASTM A536).
5. Coating: Fusion epoxy line and coat sleeve and followers.
6. Pressure Rating: The test pressure of the applicable service or 250 psi, whichever is greater.
7. Performance: Longitudinal movement and angular deflection capabilities shall meet AWWA C219.
8. Flanged Coupling Adaptor Flanges: Match mating flanges.
9. Manufacturers:
    a. Flexible Couplings: Smith-Blair 471;Ebaa Iron Series 3800; Romac 400RG; or equal.
    b. Flanged Coupling Adapters: Smith-Blair 911; Ebaa Iron Series 2100; or equal.
10. Gaskets: SBR rubber or oil and grease resistant (Nitril or Buna-N).
11. Protection for Buried Couplings and Adaptors:
    a. Double-wrap with polyethylene encasement, AWWA C105 and tape the edges of the encasement with PVC tape.

© December 2012 Kennedy/Jenks Consultants

D. Mechanical Groove Couplings:
   1. Application: Mechanical couplings (segmental clamp joints) shall be used wherever shown on the Drawings. They may be substituted for flanged joints on steel pipe if 16 inches or smaller in diameter and if favorably reviewed by the Engineer and may be substituted for flanges on ductile iron pipe to the extent permitted under the ductile iron pipe specification.
   2. Type: AWWA C606, pressure rated at least 300 psi.
   3. Joints: Cut groove, except shoulder joints may be used for steel pipe where the wall thickness of the pipe is less than that allowed by Table 4 (AWWA C606). Only Type B, Type C, and Type D special ends are acceptable for shoulder joints.
   4. Grooves:
      a. Ductile Iron Pipe where Mechanical Groove Couplings are shown on the Drawings: Flexible joint, Table 2 (AWWA C606).
      b. Ductile Iron Pipe where Flanges are Shown on the Drawings: Rigid joint, Table 3 (AWWA C606).
      c. Steel Pipe: Table 4 (AWWA C606).
   5. Gaskets: EPDM.

E. Flexible Rubber Spool:
   1. Up to 12-inch-Diameter:
      a. Type: Built-up, single arch (unless otherwise shown on Drawings) rubber expansion joints with full rubber flanges and retainer rings. Provide filled arch-type.
      b. Materials: Neoprene cover over nitrile tube, reinforced with nylon or polyester body and galvanized steel retainer rings. Protect cover with Hypalon paint where exposed outdoors.
      c. Pressure Rating: 190 psi.
      d. Manufacturers:
         1) Standard: Proco Series 230; Holz Type 200; Garlock Style 200HP; or equal.
         2) Concentric Reducers: Proco RC Series; Holz 200TC
         3) Eccentric Reducers: Proco RE Series; Holz 200TE
         4) For connections to plastic piping systems provide connectors with additional flexibility as recommended by the manufacturer. Proco Series 261R; Holz Type 320EZ; or equal.
   2. Larger than 12-inch-Diameter:
      a. Type: Built-up, single arch (unless otherwise shown on Drawings) filled arches with full rubber flanges and retaining rings.
      b. Materials: Neoprene cover over nitrile tube, reinforced with nylon or polyester body and galvanized steel retainer rings. Protect cover with Hypalon paint where exposed outdoors.
      c. Pressure Rating: 80 psi.
      d. Manufacturers:
         1) Standard: Proco Series 230; Holz Type 200, Garlock Style 200HP, or equal.
         2) Concentric Reducers: Proco RC Series; Holz 200TC
         3) Eccentric Reducers: Proco RE Series; Holz 200 TE
         4) For connections to plastic piping systems provide connectors with additional flexibility as recommended by the manufacturer. Proco Series 261R; Holz Type 320EZ; or equal.

© December 2012 Kennedy/Jenks Consultants

3. High Pressure Applications:
    a. Type: Fixed-flange, bellows type with integral flow liner and limit rod lugs.
    b. Materials:
        1) Flanges: Carbon steel conforming to ASTM A36
        2) Bellows: Laminated ASTM A240 Type 304 stainless steel.
        3) Flow Liner: ASTM A240 Type 304 stainless steel.
        4) Limit Rods: ASTM A307 bolts, A563 nuts.
    c. Pressure Rating: 300 psi minimum.
    d. Connections: 300 lb drilled in conformance with ANSI B16.5.
    e. Manufacturer: Hyspan Model 5501R; Microflex; or equal.
4. Restraint: Provide galvanized steel control rod-compression sleeve assemblies for all flexible spools, except where pipelines cross structural expansion joints or where specifically omitted by note in the Drawings. Number and size of control rods shall be as required for the test pressure of the pipe system or 50 psi, whichever is greater.
5. Provide full-size intermediate metal pipe flanges where rubber spool connects with wafer style valves, lug style valves or other pipeline items that do not have full-face metal flanges.

2.05 CONNECTION DEVICES FOR SEWERS

A. Transition Couplings: Transition couplings shall be elastomeric plastic or synthetic rubber-resistant to sewage and grease, chemical and normal sewer gases. Couplings shall be designed to slip over the outside of the pipes being connected with a snug fit. Couplings shall be held in place and sealed with a stainless steel band clamp around each end. Couplings shall be specifically manufactured for making the transition between various types of pipe with different outside diameters. Couplings shall meet the requirements of the Uniform Plumbing Code. Fernco; Indiana Seal; or equal.

B. Transition Donuts: Transition donuts shall be elastomeric plastic resistant to sewage and grease, chemicals and normal sewer gases. They shall be designed to be inserted into the bells of sewer pipe to adapt the bell to accept the spigot of a smaller size pipe. They shall have reversed fins on the inside and outside to grip the bell and spigot. Transition donuts cast or grouted into concrete pipe or manhole sections shall have an outside diameter at least 2 inches greater than the inside diameter. Fernco; Indiana Seal; or equal.

C. Manhole Adaptors: Manhole adaptors shall be SBR rubber manhole waterstops for use with PVC sewer pipe, Fernco, or equal.

D. Flexible Manhole Connectors: ASTM C923.

E. House sewer service lateral connections between existing pipe and cast iron soil pipe replacement pipe shall be made with rubber couplings and elastomeric bushings sealed with stainless steel banks; Calder couplings as manufactured by Joints, Inc.; Fernco; or equal.

F. Other Devices: Other equivalent connection deices will be considered provided that they are made of elastomers resistant to sewage and grease, chemicals and normal sewer gases. Metallic parts shall be stainless steel.

© December 2012 Kennedy/Jenks Consultants

2.06 VALVES AND ACCESSORIES

A. Valve and Accessory System Designation: Most valves and accessories to be furnished and installed are identified by a valve and accessory system designated by a letter symbol in the Piping Schedule.

B. General Requirements for Valves:
   1. All valves of each type shall be the product of one manufacturer.
   2. All exposed valves shall be furnished with operators, handwheels, levers, or other suitable type wrench including handles as specified herein or as shown on the Drawings. Valves 4-inch and larger located more than 7 feet above the floor level shall be furnished with chain operators. Chains shall be galvanized and shall extend to within 3 feet of the floor. Provide hook so that chain may be stored clear of walkways. All buried valves shall be provided with 2-inch-square operating nut and valve boxes.
   3. All threaded stem valves shall open by turning the valve stem counter-clockwise.
   4. All exposed valves and valve operators shall have a non-bleeding shop coat, unless otherwise specified. Buried valves and operators shall be painted with System 8 as specified in Section 09960.
   5. Open-Close Electric Motor Valve Actuators: Comply with AWWA C540.
      a. Valve opening/closing time shall be 60 seconds.
      b. Provide integral electric controls for open-close service including reversing starter, limit switches, torque switch, indicating lights and local-off-remote switch. Comply with AWWA C540. The motor shall be reversible, squirrel cage induction rated for 115 volts, single-phase, 60 Hz with Class "F" insulating system. The motor shall be totally enclosed and nonventilated with all leads terminating within the limit switch compartment. The motor shall be of sufficient size to open or close the valve at 200% of maximum required breakaway torque. The motor shall operate at ±10% of rated voltage and shall be sufficient for one complete cycle without exceeding its temperature rating.
      c. Provide auxiliary contacts for remote monitoring of "open," "close," and "ready" indication. Ready indication shall be indicated when the valve selector is in the "remote" position.
      d. Manufacturer: Auma; Limitorque; Rotork; EIM; or equal.
   6. Modulating Electric Motor Valve Actuators:
      a. Motor operated valve control shall include motorized actuator with motor, solid state modulating controller, electro-mechanical starter, operator unit gearing, limit switch gearing, limit switches, torque switches, declutch lever and auxiliary handwheel as a self-contained unit in a NEMA 4 enclosure. Valve opening/closing time shall be 60 seconds. Valve actuator shall be rated for at least 100 starts per hour.
      b. The motor shall be reversible, squirrel cage induction rated for 115 volts, single-phase, 60 Hz with Class "F" insulating system. The motor shall be totally enclosed and non-ventilated with all leads terminating within the limit switch compartment. The motor shall be of sufficient size to open or close the valve at 200% of maximum required torque. The motor shall operate at ±10% of rated voltage and shall be sufficient for one complete cycle without exceeding its temperature rating.

© December 2012 Kennedy/Jenks Consultants

c. The drive unit shall be a multiple reduction unit with power gearing consisting of spur, helical and worm gearing. The spur/helical gears shall be made of treated steel. The worm shaft shall be of hardened alloy steel with the threads ground after heat treating. The worm gear shall be of alloy bronze accurately cut with a hobbing machine. All power gearing shall be grease lubricated and accurately machine cut. Ball or roller bearings shall be used throughout. Non-metallic or cast gearing shall not be allowed.

d. Limit switches and gearing shall be an integral part of the valve control. The limit switch gearing shall be of the intermittent type, totally enclosed in its own gear case, grease lubricated to prevent dirt and foreign matter from entering the gear train and shall be made of stainless steel. Limit switches shall be of the adjustable type capable of being adjusted to trip at any point between fully opened valve and fully closed valve positions.

e. Each valve control shall be provided with minimum limit switches as shown on the Drawings. Geared limit switches must be geared to the driving mechanism and in step at all times whether in motor or manual operation.

f. Operator shall include a "hand," "remote" selector switch and "open," "close" pushbuttons and indicating lights indicating status as well as a mechanical attachment to indicate valve position.

g. The actuator shall contain an integral modulating controller capable of receiving a 4-20 mA input (command) signal corresponding to a valve position. The modulating controller shall include an integral control power transformer. The actuator shall automatically adjust the position of the valve when the error in the comparison to feedback is greater than the preset or field adjusted deadband of the modulating controller.

h. The modulating controller shall compare the command signal with a position feedback potentiometer and position the actuator to the appropriate position. The modulating controller shall have the following features:
   1) Input signal: 4-20 mA that shall cause a movement of actuator for an adjustable range throughout the fully open to fully closed position. For example, the range should be adjusted from 20% to 80% of full open.
   2) Zero and span adjustment.
   3) At a loss of signal, the actuator shall maintain last position except where designated otherwise in the plans and specifications.
   4) Two-wire position transmitter calibrated 4-20 mA 0-100% travel.
   5) Auxiliary contacts for remote monitoring of "open," "close," and "ready" indication. Ready indication shall be indicated when the valve selector is in the "remote" position.

i. The solid state starter shall be reversing type not susceptible to power line surges and spikes and shall be tested in accordance with IEEE 587. The solid state starter shall be rated for continuous modulating service.

j. A permanently attached handwheel shall be provided for manual operation. The handwheel shall not rotate during electric operation but must be responsive to manual operation at all times except when being electrically operated. The motor shall not rotate during hand operation, nor shall a fused motor prevent manual operation. When in manual operation position, the unit will remain in this position until motor is

© December 2012 Kennedy/Jenks Consultants

energized at which time the valve operation will automatically return to electric operation and shall remain in motor position until handwheel operation is desired. This movement from motor operation to handwheel operation shall be accomplished by a positive declutching lever that will disengage the motor and motor gearing mechanically but not electrically. Hand operation must be reasonably fast. It shall be impossible to place the unit in manual operation when the motor is running.

k. Manufacturer: Limitorque; Auma; Rotork; EIM; or equal.

C. General Requirements for Accessories: Pressure Gauges: Provide shutoff valves for all pressure gauges. Conform to additional requirements in this Section below.

D. Valve and Accessory Systems: See Piping Schedule on Sheet G-2.

1. Valve and Accessory System A: Applicable Service Condition: Clean Water and air in metal piping.
   a. Gate Valves through Size 2-inch:
      1) Rating: 200 psi WOG.
      2) Type: Rising stem, screw in bonnet, solid wedge disc, handwheel operated.
      3) Connections: Threaded.
      4) Materials: All bronze, UNS 83600, ASTM B62, B505 or B584.
      5) Manufacturers: Jenkins Figure 81OJ; Crane No. 428; or equal.
   b. Gate Valves 2-½-inch through 12-inch:
      1) Rating: 200 psi WOG.
      2) Type: Rising stem, O.S. and Y, solid wedge, handwheel operated.
      3) Connections: Flanged, 200 psi WOG.
      4) Materials: Cast iron, UNS 83600, bronze trimmed.
      5) Manufacturers:
         a) Jenkins Figure 651A; Crane No. 465 1/2; or equal.
         b) For system pressure above 200 psi, provide Jenkins Figure 20J; Crane 7-1/2 E; or equal.
   c. Ball Valves through size 4-inch in metal piping:
      1) Rating: 400 psi WOG.
      2) Type: Lever.
      3) Connections: Threaded.
      4) Materials: Bronze body ASTM B584 Alloy 83600 or 84400, chrome-plated ball, teflon seats.
      5) Manufacturers: Apollo 70-100; Watts B-6000; or equal.
   d. Swing Check Valves through size 2-inch:
      1) Rating: 300 psi WOG.
      2) Type: Swing, composition disc.
      3) Connections: Threaded.
      4) Materials: All bronze, ASTM B62 body, ASTM B61 and B584 Alloy 87600 other bronze parts, except disc shall be teflon.
      5) Manufacturers: Jenkins 352; Crane 141; or equal.
   e. Swing Check Valves 2-inch through 12-inch:
      1) Rating: 175 psi
      2) Type: Swing, metal seats, outside spring and lever, AWWA C508.
      3) Connections: Flanged, 125-pound ANSI.
      4) Materials: Cast iron, bronze trim.
      5) Manufacturers: M & H Style 259; equivalent by Clow; or equal.

© December 2012 Kennedy/Jenks Consultants

f. Twin Element Check Valves:
   1) General: Lug type, designed to fit between ANSI flanges. Provide where shown on the Drawings.
   2) Design: Valve shall have two movable elements, called doors, which provide a tight shutoff when there is no flow in the pipe. The twin doors shall be spring loaded by means of a heavy-duty stainless steel torsional spring. The doors shall open when there is flow in the pipe. As the flow is reduced, the doors shall slowly close and shut tight when the flow is reduced to zero velocity. The entire assembly shall be designed to close without slamming.
   3) Materials:
      a) Seat: Buna N rubber, mounted on the body.
      b) Body: Cast steel, ASTM A216 WCB or ductile iron, ASTM A536.
      c) Doors: Cast steel, ASTM A216 WCB; or aluminum bronze, ASTM B148 C95200.
      d) Spring, Hinge Shaft, and Stop Shaft: Type 316 stainless steel.
   4) Manufacturers: Duo-Chek, by TRW Mission Manufacturing Company; Double Door Check Valve, by APCO; or equal.

g. Globe Style Silent Check Valves 3-inch and Larger:
   1) Rating: 200 psi through 12-inch, 150 psi above 12-inch size.
   2) Headloss: Not more than 2.5 ft. at 8 ft./sec. velocity.
   3) Type: Center guided plug with spring operated shut-off.
   4) Connections: Flanged, 125-pound ANSI. If connecting flanges are not full-face metal flanges, provide intermediate flanges where required to retain valve seat.
   5) Materials: Cast iron, bronze trim, stainless steel spring.
   6) Manufacturers: APCO Series 600; Valmatic 1800 Series; or equal.

h. Pressure Gauge Assembly:
   1) Complete assembly shall include isolation valve, pulsation dampeners or snubbers. Provide a support plate to the nearest flange.
   2) Pressure gauges shall have a dial size not less than 4-½ inches, phenolic or polypropylene case, stainless steel movement, phosphor bronze or stainless steel bourdon tube, 0.5% accuracy (ASME B40.100 Grade 2A), friction mounted adjustable pointer, black figures on white dial, glass or acrylic window. Label face of dial to identify unit of measurement. Gauge case shall be liquid filled with glycerin or silicone. Process connection size shall be as shown on Drawings (1/2 NPT recommended). Complete gauge shall be Ashcroft 1279; Trerice Series 450; WIKA Type 222.34; or equal.
   3) Isolation valves shall be Type 316 stainless steel needle valves (unless ball valves are shown on the Drawings); Aschroft 7004L; Trerice 735 or 740; WIKA Type 910.11.200; or equal.
   4) Provide porous pressure snubbers if operating pressure is over 5 psi. Snubbers shall be stainless steel for the specific service involved. Porosity of media shall be suitable for the fill fluid and range of operating pressures. Pressure snubbers shall be

© December 2012 Kennedy/Jenks Consultants

Ashcroft 25-1112S or 50-1112S; Trerice No. 872; WIKA Type 910.12.100 or equal.

i. Solenoid Valves: Valves shall be for 150-psi water pressure, 120-Volt ac service, with a watertight enclosure. Valve body shall be brass, seats Buna-N, with stainless steel plug. Valves shall be normally closed except where noted otherwise. Provide manual override control. Valves shall be ASCO Bulletin 8211; Skinner L or R Series; or equal.

j. Butterfly Valves:
   1) Standard: AWWA C504, except as modified herein.
   2) Type: Short body flanged.
   3) Pressure Class:
      a) 3-inch through 12-inch: 150 psi.
      b) 14-inch through 72-inch: 150 psi, unless shown otherwise on the Drawings.
      c) Valves shall be leak-tight at rated pressure in either direction.
   4) Materials:
      a) Body: Cast Iron; ASTM A126, Class B, or ASTM A48, Class 40.
      b) Disk: Cast or ductile iron with Ni-Chrome or Type 316 stainless steel edge.
      c) Valve Shaft: Type 304 or Type 316 stainless steel.
      d) Seats: Buna-N.
   5) Construction:
      a) Seats: Applied to body. Cartridge type seats with retaining rings are not acceptable.
      b) Disk to Shaft Connection: Stainless steel taper pins or torque plug.
      c) Valve Diameter Limitation: Internal diameter of valve at the throat shall be no less than the nominal diameter of the valve less 1-½ inches.
      d) Bearings shall be self-lubricating and corrosion-resistant.
   6) Finish:
      a) Exposed Exterior: Shop prime compatible with field applied finish coats. Refer to Section 09960.
      b) Buried Exterior: Shop coat with high-solids epoxy, 12 mils minimum.
      c) Interior: Shop line with two-component, high solids epoxy, AWWA C550.
   7) Testing: Test in accordance with AWWA C504, except that leakage test shall be in both directions. Submit certified test results for tests specified in Section 5.2 for valves 24 inches and larger.
   8) Actuators: Refer to Mechanical and Instrumentation Drawings for identification of actuator type for specific valves.
      a) Buried Manual Actuator: Multi-turn, travelling nut, self-locking actuator with AWWA 2-inch square operating nut and extension stem to reach within 6 inches of grade. Actuator shall incorporate stop-limiting devices to prevent overtravel. Provide valve box for protection of valve extension stem. Provide one tee handle to Owner for valve operation.

© December 2012 Kennedy/Jenks Consultants

b) Exposed Manual Actuator (6-inches and smaller): Quarter-turn hand lever actuator, direct-acting, 0-90 degree positioning, lever can be locked into position with wing nut

c) Exposed Manual Actuator (8-inches and larger): Multi-turn, travelling nut, self-locking actuator with handwheel operator. Actuator shall incorporate stop-limiting devices to prevent overtravel. Actuator housing shall include visual position indicator.

d) Motorized Actuator: See Paragraphs 2.06.B.5 and 6.

e) Pneumatic Actuator: Conform to AWWA C504 and AWWA C540 as modified herein. Cylinder bodies, heads, and ends fabricated from plastic, fiberglass, or other non-metallic materials will not be acceptable.

9) Manufacturer:

Size Range (inches)	Service	Type	First Name	Second Name or Equal
3 – 20	Exposed	Flanged	Pratt, 2FII	DeZurik, BAW
24 – 72	Exposed	Flanged	Pratt, XR-70	DeZurik, BAW
6 – 48	Buried	Flanged	Pratt Groundhog	DeZurik, BAW

k. Globe-Style Pressure-Sustaining (Backpressure) Valves:

1) General: Valves shall consist of a main valve of full-port, globe configuration, and diaphragm-actuated stem assembly. Hydraulic control assemblies shall be as described in succeeding paragraphs.

2) Main Valve Construction: Ductile iron body and cover, 175 psi rated, with fusion epoxy lining, stainless trim, stainless steel stem, nut and spring, Buna-N diaphragm and seat disc. Provide valve in globe (straight-thru) configuration with 125-pound flange connections.

3) Control: As upstream pressure exceeds setting of pilot control valve, the diaphragm of the main valve opens to relieve system pressure. When upstream pressure falls below setting of pilot valve, main valve closes.

4) Manufacturers: Cla Val 50-01; Watts 115; or equal

l. Air Valves:

1) Standard: AWWA C512, except as modified herein.

2) Air Release Valves (ARVs):

a) Function: Releases accumulated air under pressure at pipeline high points.

b) Materials: Cast or ductile iron body; stainless steel float.

c) Pressure Rating: 150 psi.

d) Manufacturers: Apco Series 200; equivalent by Valmatic; or equal.

3) Air and Vacuum Valves (AVVs):

© December 2012 Kennedy/Jenks Consultants

a) Function: Exhausts large volumes of air during pipeline filling and allows air back in when pipeline pressure drops below atmospheric pressure.
b) Provide slow closing Surge Check below air valve consisting of a globe style, sliding disc spring return valve.
c) Materials: Cast or ductile iron body; stainless steel float.
d) Pressure Rating: 150 psi.
e) Manufacturers: Apco Series 140 or 150; equivalent by Valmatic; or equal.

4) Combination Air Valves (CAVs):
a) Function: Exhausts large volumes of air during pipeline filling, releases accumulated air under pressure and allows air back in when pipeline pressure drops below atmospheric pressure.
b) Provide slow closing Surge Check below air valve consisting of a globe style, sliding disc spring return valve.
c) Materials: Cast or ductile iron body; stainless steel float.
d) Pressure Rating: 150 psi.
e) Manufacturers: Apco Series 140C or 150C; equivalent by Valmatic; or equal.

2. Valve and Accessory System B: Applicable Service Conditions: GAC fill piping at working pressures to 100 psig.
a. Plug valves 2-inch and larger:
1) Rating: 175 psi through 12-inch, 150 psi 14-inch through 36-inch, 125 psi 42-inch and larger.
2) Type: Resilient faced eccentric plug, worm geared handwheel operated 4-inch and larger. Valves shall provide driptight shutoff in both directions.
3) Connections: Flanged, 125-pound ANSI, except screwed connections may be used for 2-inch valves.
4) Materials: Cast iron body, welded nickel seat, NBR or Buna-N coated plug, NBR or Buna-N packing or U-cup stem seal. Valves shall have interior and exterior metal surfaces other than the plug and valve seat coated with two coats of high-solids epoxy with total dry film thickness 12 mils minimum.
5) Manufacturers: DeZurik PEC, Milliken, Clow Eccentric Plug Valve, or equal.
6) Installation: Unless otherwise necessary for proper installation or permitted by Engineer, all eccentric plug valves shall be installed with shaft horizontal and with plug in upper half of body..

3. Valve and Accessory System C: Applicable Service Condition: Sample water, non-potable water, ferric chloride, aluminum chlorohydrate (coagulant), hypochlorite, permanganate in PVC-1 piping.
a. Ball Valves Through 4-inch Size:
1) Rating: 150 psi at 75°F.
2) Type: Double union.
3) Connections: Socket.
4) Materials: PVC body, teflon seats and EPDM O-ring seals, except Viton O-ring seals with chlorine solution.
5) Manufacturers: R&G Sloane, Asahi/America Pro Block, or equal.
b. Check Valves Double Union Type:

© December 2012 Kennedy/Jenks Consultants

1) Rating: 150 psi at 75°F.
2) Type: Ball for horizontal or vertical service.
3) Connections: Union ends for socket weld.
4) Materials: PVC body, Viton O-ring seals and seats except provide EPDM for caustic service.
5) Manufacturers: Chemtrol True Union BC, Plastiline No. 8611, or equal.

c. Diaphragm Valves:
1) Rating: 150 psi.
2) Type: Weir type diaphragm.
3) Connections: Flanged or true union.
4) Materials: PVC bodies with EPDM/TFE bonded diaphragms.
5) Manufacturers: Asahi/America Type 72, Gemü, or equal.
6) Actuators:
a) Type: Manual, except where specified otherwise, or shown otherwise on Drawings. Provide local, visual, valve position indicators on all actuators. Provide manual override on all motor actuators.
b) Motor Actuators: Provide motor, limit switches and gearing within a NEMA 4 enclosure. Motor shall be reversible for use with 115V single-phase power. Unit shall accept remote open and close dry contacts and shall include position indicating limit switches for remote indication of open and closed positions.

d. Strainers:
1) Rating: 150 psi.
2) Type: Wye-type basket strainers. Strainer screen size as recommended by feed pump supplier.
3) Connections: Threaded.
4) Materials: PVC.
5) Manufacturers: Chemtrol, GF, or equal.
6) Installation: Each to be installed with ball valve blowoff and piping to drain.

e. Pressure gauges shall be as specified for System A. Provide protector body and diaphragm and isolation valve materials appropriate for the chemical solutions to which they will be exposed.

f. Rotameters: Glass tube type as specified for System A except that end fittings shall be Type 316 stainless steel or monel, float shall be Hastelloy C, and retainers shall be Kynar plastic.

g. Refer to Section 11240 for pulsation dampeners, pressure relief valves and backpressure control valves.

E. Miscellaneous Valves and Accessories:
1. Link-Type Seals: Link-type seals shall be interlocking synthetic rubber links connected by stainless steel, zinc dichromate protected steel bolts and nuts to form a continuous belt. Tightening of the bolts shall expand the rubber to form a watertight seal of the annular space between a pipe and the hole or sleeve in the wall.
2. Floor Boxes (Bushing Type): Cast iron, installed with top set at finish grade. Floor boxes shall be suitable for 150 lb/ft^2 live load. Clow Figure F-5695; equivalent product by Mueller; or equal.

© December 2012 Kennedy/Jenks Consultants

3. Valve Boxes for Buried Valves: Adjustable, cast-iron, screw-type, installed with top set at finished grade. All valve boxes and covers shall be suitable for H20 AASHTO wheel load. Clow Figure F-2454 with Figure F-2476 extension; equivalent products by Mueller; or equal.
4. Concrete Vaults and Valve Boxes: Precast reinforced concrete, of the size and orientation shown on the Drawings. Unless otherwise shown or noted, all vaults, boxes and their covers shall be designed for H20 AASHTO wheel loads. Steel lids shall be galvanized. Provide Christy, Brooks, or equal.
5. Valve Tags: Plastic, fiberglass, or plastic material, 2-inch square with grommeted hole. The tags shall be attached to valves with a brass jack chain. For buried installations use a nylon strap. Lettering shall be stamped or cut into the tag at least 3/16-inch high.
6. Quick-Disconnect Assembly: Consists of a diaphragm or ball check valve, diaphragm or ball isolation valve and a male/female coupling with cam seated washer type seal. Valve types shall be consistent with valve and Accessory System C with the exception that horizontal mounting requires use of a diaphragm check valve. The couplings shall be Monel. Couplings shall be "Kamlock" by OPW or equivalent. Coordinate coupling size with Owner for compatibility with local supplier's chemical delivery equipment.
7. Chemical Sample/Flushing Connections: Consist of a ¾-inch NPT male fitting in Type 316 stainless steel (except titanium for ferric chloride and Hastelloy C for hypochlorite) on the outlet side of a ball or diaphragm valve. Provide a 5-foot length of ¾-inch ID wire reinforced, rubber covered teflon hose with crimped ¾-inch couplings, male on one end and female on the other.
8. Static Mixer:
    1) General: Static Mixer shall be the same diameter as the surrounding pipe, with a number of integral mixing elements in a helical pattern to evenly mix two liquids together as they travel through the mixing element.
    2) Material: 316 Stainless Steel
    3) Connections: Flanged
    4) Number of mixing elements: minimum of 4.
    5) Manufacturer: Komax; KM Series by Kenics; or equal.
9. Pipe Escutcheons:
    a. Manufactured wall, ceiling, and floor plates; cast brass, polished chrome plated, with set-screw, deep pattern type where required to conceal protruding fittings and sleeves.
    b. Inside Diameter: Closely fit around pipe, tube and insulation of insulated piping.
    c. Outside Diameter: Completely cover opening.
    d. One-piece design for piping to plumbing fixtures and to equipment in finished spaces.
    e. Split concealed hinge type for piping not serving plumbing fixtures or equipment in finished spaces.

2.07 NOT USED.

2.08 PIPE SUPPORTS

A. Manufacture and Design: Pipe supports shall to the maximum extent possible be standard factory fabricated units conforming to the typical supports and braces

© December 2012 Kennedy/Jenks Consultants

shown in the Drawings and as specified below. Where required support cannot be provided by standard factory fabricated units, and is not detailed on the Drawings, the Contractor shall provide special pipe supports. Supports shall be manufactured or special fabrications or combination as shown on the Drawings or specified. Provide ¾-inch chamfer on corners of all support elements and file or grind smooth. Supports designated to allow axial pipe movement shall have smooth and even contact surfaces.

B. Materials: All support systems shall be galvanized steel except that those that are submerged or that are located within a tank, channel, or other structure designed to hold water, below the top of surrounding walkway elevation or tank wall top, or otherwise called out on the Drawings, shall be Type 316 stainless steel. Trays for continuous support of plastic pipe or tubing shall be made of 20-gauge galvanized steel.

C. Insulation Protection Shields: Provide insulation protection shields at all pipe supports for insulated piping.

D. Provide plastic caps with rounded corners on all exposed ends of channels.

PART 3 - EXECUTION

3.01 PIPING INSTALLATION

A. General Handling and Placing:

1. Exercise great care to prevent injury to or scoring of the pipe lining and coating, as applicable, during handling, transportation or storage. Handle fusion epoxy coated pipe and ceramic epoxy lined pipe in accordance with AWWA C213. Do not store pipe on rough ground and do not roll the pipe on the coating. Any damaged pipe sections, specials, or fittings shall be repaired or replaced at the expense of the Contractor as satisfactory to the Engineer.
2. Carefully inspect each pipe, fitting, valve and accessory before installation to insure there is no defective workmanship or obstructions. Inspect the interior and exterior protective coatings and patch all damaged areas in the field or replace to the satisfaction of the Engineer.
3. Place or erect all piping to accurate line and grade and backfill, support, hang, or brace against movement as specified or shown on the Drawings, or as required for proper installation. Remove all dirt and foreign matter from the pipe interior prior to installation and thoroughly clean all joints before joining.
4. Use reducing fittings where any change in pipe size occurs. Do not use bushings unless specifically noted on the Drawings. Use eccentric reducing fittings wherever necessary to provide free drainage of lines.
5. Cast all metallic pipes and sleeves 6-inch and larger into new concrete walls without blockout. Pipes 5 inches and smaller may be cast in place or installed in a smooth core drilled hole using a link type seal at the Contractor's option. Maintain at least ½-inch clearance between reinforcing steel and metal pipe in penetrations.
6. Cover polyvinyl chloride (PVC) pipe stored outside for more than two months with canvas or other opaque material. Provide for air circulation under the covering.

B. General Buried Piping Installation:

© December 2012 Kennedy/Jenks Consultants

1. Trenching, bedding, and backfill for buried piping shall be as shown on the Drawings and as specified in Section 02301.
2. Where pipe grade elevations are shown on the Drawings, install the pipe with straight grades between the indicated elevations.
3. Where no pipe grade elevations are shown on the Drawings, install buried piping with at least 3 feet of cover to finished grade. Where piping crosses under buried electrical ducts, provide at least 4 feet 6 inches of cover. Provide 12 inches minimum separation between the buried pipes and ducts.
4. Provide each pipe with a firm, uniform bearing for its full length in the trench except at field joints. Do not lay pipe in water or when trench conditions or weather are unsuitable for such work.
5. Protect buried piping against thrust by use of restrained pipe joints and/or thrust blocks. All exposed free pipe ends shall be securely braced. Cap or plug pipe ends that are left for future connections as shown on the Drawings and in a manner favorably reviewed by the Engineer.
6. Where piping leaves a structure or concrete encasement, provide a joint capable of angular deflection within 12 inches of the structure for pipes 12-inch and smaller or as shown on the Drawings for larger pipe sizes. Conform to details on the Drawings where such details are shown.
7. Snake buried PVC pressure pipe from side to side in the trench in long sweeps.
8. Concrete Encasements: All piping and conduits installed under slabs or footings on earth or crushed rock shall be encased in concrete not less than 6-inch thickness on all sides and extending up to the bottom of the slab or footing, unless otherwise specifically noted on the Drawings. Encasement shall extend to within 6 inches of the first pipe joint beyond the slab or footing. Provide concrete encasement whether or not the encasement is shown on the Drawings. Provide encasement under slabs on earth or crushed rock even if the structure is supported on piles, caissons, or footings. Provide continuous concrete cradles where shown.
9. Do not pull bell and spigot, gasketed joints more than 50% of the maximum deflection permitted by the pipe manufacturer.
10. Double Containment for Buried Chemical Tubing: Enclose buried chemical tubing within Type PVC-1 Pipe. Terminate at watertight junction boxes.
11. Coat bolts on buried flanges or other buried appurtenances in accordance with Paint System 8 in Section 09960. Wrap the appurtenance with polyethylene encasement and tape the encasement tightly closed to the pipe.

C. General Exposed Piping Installation:
1. Unless shown otherwise, install piping parallel to building lines, plumb and level.
2. Install piping without springing or forcing the pipe in a manner that would set up stresses in the pipe, valves, or connected equipment.
3. Set all pipe flanges level, plumb, and aligned. All flanged fittings shall be true and perpendicular to the axis of the pipe. All bolt holes in flanges shall straddle vertical centerline of pipes.
4. Flexibility and Expansion: Provide flexible couplings, flexible hose, or flexible spools for all piping connections to motor driven equipment and where otherwise shown. The Contractor may install additional flexible couplings at favorably reviewed locations to facilitate piping installation, provided that he submits complete details describing location, pipe supports, and hydraulic

© December 2012 Kennedy/Jenks Consultants

thrust protection. Anchor piping subject to expansion or contraction in a manner permitting strains to be evenly distributed. Sleeves for branches through walls from adjacent mains shall be of sufficient size to allow for free side motion of covered pipe in sleeves.

5. Install unions or flexible connections where shown on the Drawings, and at all non-motor-driven equipment to facilitate removal of the equipment.
6. Provide valves wherever equipment drain connections are furnished and carry the discharge pipe to the nearest floor drain, drain trench or sump. Where no receptacle for drain exists, install drain piping to 1-inch above the floor. Drain piping and valve materials shall conform to the requirements of the system served.
7. Where piping conveying liquids passes over motor control centers, electrical panels and other electrical devices, install a protective drainage tray below the piping.

D. Water Main Installation:

1. The Contractor is advised that precautions taken to keep the pipeline clean during construction will facilitate achieving the disinfection requirements of this project with a minimum of effort and expense. Compliance with these suggested minimum procedures will not relieve the Contractor of the disinfection requirements.
2. Prior to installation, thoroughly clean the interior of each length of pipe and each fitting or valve and inspect to ensure that no foreign material remains. Cover both ends with plastic and do not uncover them until just prior to completing the joint.
3. Whenever pipe laying is discontinued for short periods, or whenever work is stopped at the end of the day, close the open ends of the pipe with water-tight plugs or bulkheads.
4. Provide adequate trench pumping to ensure against groundwater contacting the inside of the pipeline at any tie. Do to lower any pipe or fitting into a trench where groundwater is present and may enter the pipe. When necessary, pump the water from trenches and keep the trench dry until the joist have been completed and the open ends of the pipe have been closed with a water-tight plug. Do not remove the plug until the trench has again been pumped dry.
5. Keep new pipe sections clean and dry.
6. When making the connection between a new pipeline and an existing pipeline, or when repairing a damaged pipe, take the following extra precautions:
    a. Clean the exterior of the existing pipeline of all dirt and debris, and spray or swab with a standard 5.25% or stronger chlorine solution (as specified) in the immediate vicinity of the work. Clean equipment and materials, including new pipe and fittings, to be used in making these connections of all dirt and debris and disinfect them. Allow at least 30 minutes contact time before the chlorine solution is diluted or rinsed off. Provide sufficient trench pumps to prevent flooding of the trench.
    b. When an old line is opened either by accident or by design, the excavation may be wet or badly contaminated from groundwater. Apply liberal quantities of standard chlorine solution tablets to the open trench areas to lessen the danger from such pollution. Tablets are recommended because they dissolve slowly and continue to release

© December 2012 Kennedy/Jenks Consultants

hypochlorite as water is pumped from the excavation. Scatter liberally around and locate the tablets so that flow entering the work site will contact the disinfecting agent. Trenching application should be done very carefully to avoid contact by skin and clothing with chlorine solution. Minimally, safety dictates wearing safety goggles and rain gear.

c. When excavating a leaking or broken pipeline, “valve-off” the system gradually to less than water-tightness. This is to prevent causing areas of zero pressure which would allow entry of foreign material. A flow should be maintained which is slightly less than trench pump capability. Once the break is exposed and cleaned to disallow site contamination, the valving can then be made water-tight.

E. Pipe Welding:

1. General: Unless specified otherwise, shop and field welding of pipe shall conform to ANSI B31.1 as amended by this paragraph.
2. All field and shop welding shall be done by the electric arc process unless otherwise specified. All field welding shall be done in passes not thicker than ¼-inch. Size and type of electrodes, and current and voltages used, shall be subject to the favorable review of the Engineer. Give particular attention to the alignment of edges to be joined, so that complete fusion and penetration will be effected throughout the bottom of the weld. Welds shall contain no valleys or undercuts in the center or edges of the weld. Thoroughly clean each pass, except the final one, of dirt, slag, and flux before the succeeding bead is applied.
3. Clean completed field welds of pipe joints of dirt, slag and flux, and then visually inspect. Completely chip out all defects in welds discovered during field inspection in a manner that will permit proper and complete repair by welding subject to the favorable review of the Engineer. Under no circumstances will caulking of defective welds be permitted.
4. All welding shall be done by experienced, skilled operators familiar with the methods and materials to be used. Hand welding will be done only by welders qualified under the standard qualification procedure of Section IX of the ASME Boiler and Pressure Vessel Code. The Contractor shall conduct tests of his welders, when required by the Engineer, in accordance with that code and in the presence of the Engineer. An independent testing laboratory, favorably reviewed by the Engineer, shall supervise the testing and determine the quality of the test work. Weld specimens in the same positions as those in which the welder is to qualify his work. The Engineer may require test specimens at any time. Any welder whose work is found unsatisfactory shall not remain employed on this Contract, regardless of the quality of his earlier work. Each hand weld specimen shall be plainly marked with the welder's identifying symbol. The Contractor shall furnish all materials required and pay all costs for qualifying welders.
5. Field welds shall follow as closely as possible to the laying operation. All field welds shall be complete before lining or coating of the joints in steel pipe is begun. Where pipe is fusion epoxy lined and/or coated, follow AWWA C-213 procedures for field welded joints.
6. A single, continuous, watertight, full fillet weld shall be the minimum required at all field joints. Double welded joints are required on all piping specifically noted to be double welded.

© December 2012 Kennedy/Jenks Consultants

7. See also Installation Specifics below for welding of pipe.

F. Installation Specifics:
   1. DIPB:
      a. Install buried pipe in accordance with AWWA C600.
      b. Support and brace encased pipe to support the pipe and to prevent movement during testing and placement of the concrete encasement. The braces and supports shall be erected of materials and by methods that will prevent any future contact of the pipe with the environment surrounding the encasement.
      c. Wrap buried pipe with 8 mil polyethylene film in accordance with AWWA C105. Continuously seal seams and overlaps with tape. Seal circumferential overlaps with two turns of tape, half lapped. Gather excess polyethylene on top of pipe so as not to block backfill material from getting under bottom of pipe. Use caution so as not to rip or cut the polyethylene film. Seal any rips or cuts in the film with tape.
      d. Install restrained joints in accordance with manufacturer's instructions. Pull the slack out of restrained joints after they are made up.
      e. Provide an insulated flanged joint on all buried ductile iron piping 6 inches in diameter and larger within 2 feet of each structure. Provide an electrolysis test station with a pair of leads on each side of the insulated flange.
      f. Wherever a water pipeline crosses over or under a sewer main or house service lateral or a reclaimed water pipeline, center a standard length pipe, 18-foot minimum, on said sewer main or lateral or reclaimed water pipeline so as to have the pipeline joints as far as possible away from sewer. This may require field cutting of some pipe pieces.
   2. DIPF:
      a. Flanged Joints: Flanged joints shall be made up tight with care being taken to avoid undue strain in the flanges, fittings, and other accessories. Bolt holes shall be aligned for each flanged joint. Bolts shall be full size for bolt holes; use of undersize bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Adjoining flange faces shall not be out of parallel to such a degree that the flanged joint cannot be made watertight without overstraining the flange. Any flanged pipe or fitting whose dimensions do not allow the making of a proper flanged joint as specified herein shall be replaced by one of the proper dimensions. Clean flanges prior to making joints. Buried flanged pipe connections shall be made with the smallest practical "bell" hole. After the joint is completed take special care to completely fill the "bell" hole under and around the pipe with compacted backfill.
      b. Mechanical Grooved Couplings: Install in accordance with the manufacturer's instructions.
   3. PVC-1, PVC-5, and PVC-6:
      a. Place PVC pipe within the installation areas at least 24 hours prior to installation to permit temperature equalization.
      b. Cut pipe ends squarely, ream and deburr inside and out.
      c. Solvent Weld Joints: Clean pipe ends and sockets and join in strict conformance with the pipe manufacturer's instructions. Make joints in

© December 2012 Kennedy/Jenks Consultants

accordance with ASTM D2855. Handle solvent cements and primers in accordance with ASTM F402.

d. Containment fittings for chemical and chemical solution lines shall be installed and tested in accordance with manufacturers' instructions. Install containment pipe with position clips at 3-foot centers and at fittings during installation of carrier pipe. Do not make joints until after successful leak tests of carrier pipes.

e. PVC-1: Threaded connections shall use a short nipple, threaded at one end, socket at the other. Provide thread sealant in accordance with the pipe manufacturer's recommendations. Take care not to overtighten the connection.

f. PVC-1: No work shall be performed until the pipe manufacturer provides onsite installation training and certifies the installers are trained per ASTM D-2855. The Owner's inspector shall be present for the training session.

4. SSP:

a. Install and weld in accordance with CGA G-4.4 and ANSI B31.1. Back purge all welds with cover gas. Seal weld all slip-on flanges.

b. Provide anti-seize compound on threaded connections.

c. Temporarily plug or cap all points of connection to exclude moisture, dust or other contaminants or impurities prior to being connected.

5. WSP:

a. Installation of pipe shall be in accordance with AWWA 200.

b. The maximum trench width at the top of the pipe shall be the pipe outside diameter plus 3 feet.

c. Field welding of joints shall be in accordance with AWWA C206. Acceptance of field welds will be based on visual inspection and non-destructive testing by the Engineer while the welds are being made and after they are completed. Hand or power wire brush each weld thoroughly after completion to facilitate the inspection. Correct defects not complying with AWS Code D1.1 Sections 3.6 and 8.15. Determine the cause of defects and take corrective measures to prevent a reoccurrence.

d. Following satisfactory testing of the weld, the interior of all joints shall be cement mortar lined. Joints in pipe 24 inches and less shall be finished using the ball and burlap procedure described in AWWA C-205, paragraph 4.7.2.2.2. The exterior of the joints of buried pipe shall be cement mortar coated in accordance with Appendix A of AWWA C205. Prior to coating the exterior, tack weld one layer of wire mesh to the pipe.

e. Steel edges not encased in concrete or cement mortar shall receive a protective coating of 16 mils of high solids epoxy.

3.02 COUPLING INSTALLATION

A. Flexible Couplings and Flange Coupling Adaptors: Prior to installation, thoroughly clean oil, scale, rust, and dirt from the pipe to provide a clean seat for the gasket. Wipe gaskets clean before they are installed. If necessary, flexible couplings and flanged coupling adapter gaskets may be lubricated with soapy water or manufacturer's standard lubricant before installation on the pipe ends. Install in accordance with the manufacturer's recommendations. Tighten bolts progressively,

© December 2012 Kennedy/Jenks Consultants

drawing up bolt on opposite sides a little at a time until all bolts have a uniform tightness. Workers tightening bolts shall be equipped with torque-limiting wrenches or other favorably reviewed type. Anchor studs on restrained flanged coupling adaptors shall be installed so as to lock into holes drilled through the pipe wall in accordance with manufacturer's recommendation.

B. Tie Rods at Joint Harnesses: Except where double-nutting is required, install the nuts snug. Tighten the nuts gradually and equally at opposite sides of the pipe until snug to prevent misalignment and to ensure that all rods carry equal loads. If double-nutting is required, double-nut each end of each tie rod. The space between the pairs of nuts shall be ½-inch greater than the distance between the lugs. Provide double-nutting at buried locations and where otherwise required on the Drawings.

C. Flexible Rubber Spools:
   1. Install in accordance with manufacturer's instructions. Unless otherwise shown on the Drawings, install flat with one-half the maximum expansion.
   2. Connect rubber spools only to full-face metal flanges.
   3. Install control rod-compression sleeve assemblies with control rod nuts snug, to relieve stress on adjacent pipe, except at buried locations. Comply with manufacturer's instructions.
   4. Paint buried galvanized steel retainer rings, bolts and other appurtenances in accordance with Section 09960.

3.03 INSTALLATION OF VALVES AND ACCESSORIES

A. Wrap buried valve bodies as specified for flexible couplings and flanged coupling adapters.

B. Use reducing fittings where any change in pipe size occurs between valves or accessories and the attached pipeline. Bushings shall not be used, unless specifically noted on the Drawings. Use eccentric reducing fittings wherever necessary to provide free drainage of lines.

C. Install valves and accessories such that all parts are easily accessible for maintenance and operation. Provide valve boxes for buried valves.

D. Where valve handwheels are shown on the Drawings, valve orientation shall be as shown. Where valve handwheels are not shown, orient valves to permit easy access to the handwheels or handles and to avoid interferences.

E. Install pressure gauges and thermometers in a position to permit reading them from a point approximately 5 feet above floor level, except that pump pressure gauges shall be installed close to the pump elevation.

F. Rigidly support pressure switches and connect them to piping and equipment using a suitable flexible linkage that will not permit transmission of vibrations from the piping or equipment to the pressure switches.

G. Provide a union adjacent to each screwed end valve and accessory with additional unions as necessary to facilitate removal.

H. Provide a shutoff valve below each pressure gauge, protective device or air valve unless otherwise specified.

I. Connections between ferrous and non-ferrous piping, valves, accessories or pipe supports shall be made using a dielectric coupling, union, or flange.

© December 2012 Kennedy/Jenks Consultants

J. Where valves or other pipeline items require metal full-face connecting flanges, provide intermediate flanges if the connecting flange is not adequate.

K. All insulated piping passing through walls or slabs shall be sleeved and insulation shall run continuously through the sleeves and shall allow for 1/8-inch annular clearance between outside of insulation and sleeve wall.

L. Provide a suitable chrome plated escutcheon on pipes passing through walls, floors, ceilings and partitions in finished areas.

M. Install link-type seals in cast-in-place metal sleeves or in smooth core drilled holes. Grout both sides flush with non-shrink grout unless otherwise shown on the Drawings.

N. Install butterfly valves in accordance with AWWA C504, Appendix A, Sections A.2 through A.5, inclusive.

O. Install thermometer wells in piping tees in vertical position. Fill with oil. Where wells are in lines 2 inches and smaller, increase line size so that velocity at well section is not increased.

P. Provide test plugs on all closed water systems and condenser water systems located in inlet and outlet of coils, heat exchangers, cooling towers, and where indicated on Drawings. Locate test plugs where they will be easily accessible, have adequate clearance for insertion and removal of gage needles and thermometer stems, and position to allow unobstructed viewing of gages and thermometers.

3.04 NOT USED.

3.05 INSTALLATION OF PIPE SUPPORTS

A. General:
   1. Install and adjust supports for each pipeline such that the pipeline is true to the indicated line and grade.
   2. Locate anchors and braces for any single support on a continuous structure; that is, not on two sides of a structural expansion joint.
   3. Tighten clamps to develop full friction along the pipeline except where loose fitting clamps are called for.

B. Electrolytic Protection: Pipe supports serving copper pipe or tubing shall be dielectrically insulated from the pipe by dielectric sleeves or plastic pipe wrap at the point of contact.

3.06 PIPE AND VALVE IDENTIFICATION

A. General: Identify all exposed piping in this project by painting, banding, system name labels, and direction arrows. The color and banding shall be as selected by the Engineer. Identify all buried and exposed valves with tags as specified below.

B. Exposed Pipe Identification: Before painting, banding and labeling, pipes shall be identified by the Contractor with temporary wired-on cardboard tags showing the proposed marking for review by the Engineer.

C. Piping: Paint all exposed pipes with the appropriate paint system as specified in Section 09960 and provide pipe markers as specified in Section 10400.

© December 2012 Kennedy/Jenks Consultants

D. Valves: Provide each buried valve with a valve tag identifying the pipeline contents, and either its valve number, or the area or item served by the valve for valves without a valve number. Contents shall be as designated in the Piping Schedule.

E. Provide access panel markers for valves and control devices concealed behind access panels and above suspended ceilings. Locate markers on access doors and on ceiling T-bars.
   1. Markers for Ceiling T-bar Installation: Blue, pressure-sensitive, self-adhesive, at least 3 mils thick, 3/8-inch diameter.
   2. Markers for Access Doors: 1/16-inch thick, engraved plastic-laminate, with abbreviated terms and numbers corresponding to the concealed item. Provide 1/8-inch center attachment hole.

3.07 FIELD QUALITY CONTROL

A. The Owner will:
   1. Inspect field welds and test the welds if it is deemed necessary.
   2. Perform bacteriological analysis for pipeline to be disinfected.

B. Factory Quality Control: The Contractor shall test all products as required herein and by the reference specifications.

C. The Contractor shall
   1. Perform leakage tests.
   2. Be responsible for the costs of additional inspection and retesting by the Owner resulting from non-compliance.

3.08 CLEANING

A. Prior to testing, thoroughly clean the inside of each completed piping system of all dirt, loose scale, sand and other foreign material. Cleaning shall be by sweeping, flushing with water or blowing with compressed air or oil-free nitrogen gas, as appropriate for the size and type of pipe. Flushing shall achieve a velocity of at least 3 feet per second. The Contractor shall install temporary strainers, temporarily disconnect equipment or take other appropriate measures to protect equipment while cleaning piping. Cleaning shall be completed after any pipeline repairs.

3.09 FIELD TESTING

A. General: Perform leakage tests on all pipe installed in this project. Furnish all equipment, material, personnel and supplies to perform the tests and make all taps and other necessary temporary connections. The test pressure, allowable leakage and test medium shall be as specified and as shown in the following paragraphs. Test pressure shall be measured at the highest point on the line, except that pressure at lowest point shall not exceed pipe manufacturer's rated test pressure, unless specifically noted otherwise. Leakage tests shall be performed on all piping at a time agreed upon and in the presence of the Engineer. All visible leaks shall be repaired, regardless of the test results. The Contractor may obtain water for construction, cleaning, testing, and disinfection of the pipelines from the Owner at a fire hydrants designated by the Owner. At any connection to the Owner's water system, the Contractor shall provide an air-gap or reduced pressure backflow valve system to prevent backflow into the water source.

© December 2012 Kennedy/Jenks Consultants

B. Buried Piping: The leakage test for buried piping shall be made after all pipes are installed and backfilled. However, the Contractor may conduct preliminary tests prior to backfill. If the Contractor elects to conduct preliminary tests, provide any necessary temporary thrust restraint.

C. Exposed Piping: All supports, anchors and blocks shall be installed prior to the leakage test. No temporary supports or blocking shall be installed for final test.

D. Encased Piping: The leakage test for encased piping shall be made after all pipe is installed and encased, and before any structures are constructed above it. However, the Contractor may conduct preliminary tests prior to encasement. If the Contractor elects to conduct preliminary tests, provide any necessary temporary thrust restraint.

E. Accessories: It shall be the responsibility of the Contractor to block off or remove equipment, valves, gauges, etc., which are not designed to withstand the full test pressure.

F. Testing Apparatus: Provide pipe taps, nozzles and connections as necessary in piping to permit testing including valves to isolate the new system, addition of test media, and draining lines and disposal of water, as is necessary. These openings shall be plugged in a manner favorably reviewed by the Engineer after use. Provide all required temporary bulkheads.

G. Pneumatic Testing: Piping tested by air or another gas shall show no reduction of pressure during the test period after corrections have been made for changes in temperature in conformance with the following relationship:

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

Where T_1 and T_2 are the absolute temperatures of the gas in the pipe and P1 and P2 are the absolute pressures. The subscript "1" denotes the starting conditions and the subscript "2" denotes the final conditions.

H. Precautions for Pneumatic Testing: Where air or another gas is called for as the test medium, the Contractor shall take special precautions to protect personnel. During the initial pressurization of a pipeline to the specified test pressure, personnel shall be protected by suitable barricades or shall remove themselves to locations where portions concrete structures are between them and the pipeline under test.

I. Correction of Defects: If leakage exceeds the allowable, the installation shall be repaired or replaced and leakage tests shall be repeated as necessary until conformance to the leakage test requirements specified herein have been fulfilled. All visible leaks shall be repaired even if the pipeline passes the allowable leakage test.

J. Drying: Gas lines tested with water shall be drained and blown dry with air or oil-free nitrogen gas.

K. Reports: The Contractor shall keep records of each piping test, including:
   1. Description and identification of piping tested.
   2. Test pressure.
   3. Date of test.

© December 2012 Kennedy/Jenks Consultants

4. Witnessing by Contractor and Engineer.
5. Test evaluation.
6. Remarks, to include such items as:
   a. Leaks (type, location).
   b. Repairs made on leaks.
7. Test reports shall be submitted to the Engineer.

L. Venting: Where not shown on the Drawings, the Contractor may install valved "tees" at high points on piping to permit venting of air. Valves shall be capped after testing is completed.

M. Testing Specifics:
1. DIPB:
   a. Duration: Four hours.
   b. Pressure: Test as indicated in the schedule for pipe type DIPF.
   c. Medium: Water.
   d. Allowable Leakage:

$$L = \frac{NDP^{1/2}}{7400}$$

Where:

L = allowable leakage, gal. per hour.
N = number of joints being tested.
P = pressure, psi.
D = nominal pipe diameter, inches.

2. DIPF:
   a. Duration: Four hours.
   b. Pressure: Test as indicated in the following schedule.

System	Test Datum (ft above MSL)	Test Pressure (psig)
Source Water (SW)	409	150
Roughing Filter Filtered Water (RFW)	409	150
GAC Filtered Water (GFW)	409	150
Membrane Filtered Water (MFW)	409	150
Treated Water (TW)	409	150
Washwater Supply (WWS)	409	150
Surface Wash Supply (SWS)	409	150
Spent Washwater (SWW)	409	100
Filter-to-Waste (FTW)	409	150
Filter Drain (FD)	409	100
Process Overflow (OFP)	409	20

   c. Medium: Water.
   d. Allowable Leakage: None.
3. PVC-1:
   a. Liquid Service:
      1) Duration: Four hours.
      2) Pressure: 150 psi.
      3) Medium: Water.
      4) Allowable Leakage: None.

© December 2012 Kennedy/Jenks Consultants
\\SFOCAD\Projects\PW-Proj\2010\1068012.02_Lessalt DBP Final Design\10-EngDesign\10.04-Specs\95% Specs_Final\Division 15\15050_PipingValvesandAccessories.doc

b. Double Containment for chemical and chemical solution pipes.
   1) Duration: 4 hours.
   2) Pressure: 5 psi.
   3) Medium: Air.
   4) Allowable Leakage: None.

4. PVC-5: Water exfiltration test or air pressure test in accordance with Section 306-1.4 of the Standard Specifications for Public Works Construction written by the Southern California Chapter, American Public Works Association, et al.
5. PVC-6:
   a. Duration: One hour.
   b. Pressure: 15 psi.
   c. Medium: Water.
   d. Allowable Leakage: None.
6. SST:
   a. Duration: Four hours
   b. Pressure:
      1) Liquid Service: 150 psi.
      2) Gaseous or Air Service: 300 psi.
   c. Medium:
      1) Liquid Service: Water.
      2) Gaseous or Air Service: Oil-free nitrogen gas or air.
   d. Allowable Leakage: None.
7. WSP:
   a. Duration: Four hours.
   b. Pressure: Test as indicated on the following schedule.

System	Test Datum	Test Pressure
Source Water	404	150 psi

   c. Medium: Potable water.
   d. Presoaking: Fill piping at least four hours before beginning test.
   e. Allowable Leakage: None.

3.10 DISINFECTION OF POTABLE WATER SYSTEMS (SEE SECTION 11003)

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 16010

GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work Included:
   1. Provide all required labor, project equipment and materials, tools, construction equipment, safety equipment, transportation, and test equipment, and satisfactorily complete all electrical work shown on the Drawings, included in these Specifications, or required for a complete and fully operating facility. In addition, provide wiring for the equipment that will be provided under other Divisions of these Specifications.
   2. Provide all conduit for the Instrumentation and Controls specified in Division 17. Provide all Instrumentation and Control wire that is specified in Division 16. All other necessary Instrumentation and Controls wire shall be provided under Division 17. See Section 17010, paragraph 1.01.
   3. Auxiliary Devices: Provide conduit and wire for power and control for all auxiliary devices such as solenoid valves, pressure switches, and instruments that are included as part of a manufacturer's packaged system (i.e., all systems specified in Divisions 11 through 15). Contractor shall be responsible for conduit and wire to these auxiliary devices even if not specifically shown on the Drawings or specified herein.

B. Work Specified in Other Divisions:
   1. Section 11002: Electric Motor Drives - providing electric motors
   2. Division 17: Providing instruments and other equipment specified in Division 17.

C. Work to be Done by Others:
   1. Providing and connecting power company meters and instrument transformers.

D. Safety: Conduct operations in accordance with NFPA 70E, Standard for Electrical Safety Requirements for Employee Workspaces.

1.02 SUBMITTALS

A. Shop Drawings:
   1. General: Submit Product Review or Product information shop drawings for materials and equipment as required under each Specification section.
   2. For Product Review submittals, submit single, complete submittal packages for all items specified within the following Specification groups (i.e., no more than one submittal per group of specification sections):
      a. Sections 16100 through 16199.
      b. Sections 16200 through 16299.
      c. Sections 16500 through 16599.
      d. Sections 16600 through 16699.
      e. Sections 16700 through 16799.

© December 2012 Kennedy/Jenks Consultants

f. Sections 16900 through 16999.

Submit separate, single, complete submittals for all items covered in each Specification section not listed above. Submittal packages shall be organized by Specification section and/or equipment type. Include separators and tabs or other means of identifying each section of the submittal.

B. As-Built Shop Drawings: Revise manufacturer's shop drawings to show any construction changes. Prior to final acceptance, deliver one complete set to the Engineer for his favorable review. After such review, provide copies of all CAD produced drawings on magnetic media satisfactory to the Engineer AutoCAD DWG format.

C. Manuals:
1. Furnish manuals for equipment where Manuals are specified in the equipment Specifications. Submit manuals in accordance with the requirements of Division 1.
2. In each manual, include equipment descriptions, record shop drawings, operation and maintenance instructions, parts ordering data and ratings for the equipment furnished for this project.

D. Spare Parts: For each piece of equipment, submit a list of recommended spare parts. Include part numbers and the name, address, and telephone number of the supplier.

1.03 QUALITY ASSURANCE

A. Codes: Electrical equipment, materials, and installation methods shall conform to all applicable local and state codes as well as the editions of the following in effect on the date of issuance of the Contract Documents.
1. National Electrical Code (NEC)
2. National Electrical Safety Code (NESC)
3. Occupational Safety and Health Act (OSHA) standards
4. Rules For Construction of Underground Electric Supply and Communication Systems, General Order No. 128, Public Utilities Commission of the State of California, (G.O.128)
5. Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, International Electrical Testing Association (NETA)

B. Variances: In instances where two or more codes are at variance, the most restrictive requirements shall apply.

C. Standards: Equipment shall conform to applicable standards of American National Standards Institute (ANSI), Electronics Industries Association (EIA), Institute of Electrical and Electronics Engineers (IEEE), and National Electrical Manufacturers Association (NEMA). The revisions of these standards in effect on the date of issuance of the Contract Documents shall apply.

D. Underwriters Laboratories (UL) listing is required for all equipment and materials where such listing is offered by the Underwriters Laboratories. Safety labeling and listing by other organizations, such as ETL Testing Laboratories, may be substituted

© December 2012 Kennedy/Jenks Consultants

for UL labeling and listing if acceptable to the authority having code enforcement jurisdiction. Provide service entrance labels for all equipment required by the NEC to have such labels.

E. Contractor's Expense: Obtain and pay for all required bonds, insurance, licenses, permits and inspections, and pay all taxes, fees and utility charges that will be required for the electrical construction work.

F. Series short circuit ratings for protective devices are not allowed.

1.04 DRAWINGS

A. Drawings: The Electrical Drawings are diagrammatic; exact locations of electrical products shall be verified in the field with the Engineer. Except where special details are used to illustrate the method of installation of a particular piece or type of equipment or material, the requirements or descriptions in this Specification shall take precedence in the event of conflict.
   1. Locations of equipment, inserts, anchors, motors, panels, pull boxes, manholes, conduits, stub-ups, fittings, lighting fixtures, power and convenience outlets, exterior lighting units and ground wells are approximate unless dimensioned; verify locations with the Engineer prior to installation. Field verify scaled dimensions on Drawings.
   2. Review the Drawings and Specification Divisions of other trades and perform the electrical work that will be required for the installations.
   3. Should there be a need to deviate from the Electrical Drawings and Specifications, submit written details and reasons for all changes to the Engineer for favorable review.
   4. Resolution of conflicting interpretations of the Contract Documents shall conform to Division 1, General Conditions.

B. As-Built Drawings:
   1. Maintain a complete and accurate record set of Drawings for the electrical construction work.
   2. Record all work that is installed differently than shown on the Drawings.
   3. Upon completion of the work, transfer all marked changes to a clean set of full-size Drawings with red ink. Mark the Drawings "AS-BUILT DRAWINGS" and submit them to the Engineer when the electrical work is completed.
   4. Locate all underground conduits by accurate field-measured dimensions from walls and corners, etc., of surrounding structures.

1.05 FACTORY TESTS

A. Submit reports of factory tests and adjustments performed by equipment manufacturers to the Engineer prior to field testing and adjustment of the equipment. These reports shall identify the equipment and show dates, results of tests, measured values and final adjustment settings. Provide factory tests and adjustments for equipment where factory tests are specified in the equipment Specifications.

© December 2012 Kennedy/Jenks Consultants

1.06 INSPECTIONS

A. The Engineer may inspect the fabricated equipment at the factory before shipment to job site. Provide the Engineer with sufficient prior notice so that an inspection can be arranged at the factory.

B. Inspection of the equipment at the factory by the Engineer will be made after the manufacturer has performed satisfactory checks, adjustments, tests and operations.

C. Favorable review of the equipment at the factory only allows the manufacturer to ship the equipment to the project site. The Contractor shall be responsible for the proper installation and satisfactory startup operation of the equipment to the satisfaction of the manufacturer and the Engineer.

1.07 COORDINATION

A. Coordinate the electrical work with the other trades, code authorities, utilities, and the Owner.

B. Where connections must be made to existing installations, properly schedule all the required work, including the power shutdown periods. Schedule and carry out shutdowns so as to cause the least disruption to operation of the plant and privately owned facilities.

C. When two trades join together in an area, make certain that no electrical work is omitted.

1.08 JOB CONDITIONS

A. Operations:
   1. Keep all power shutdown periods to a minimum.
   2. Carry out shutdowns only after the schedule has been favorably reviewed by the Engineer.

B. Construction Power:
   1. Make all arrangements for the required construction power.
   2. When required, provide all equipment, materials and wiring in accordance with the applicable codes and regulations.
   3. Upon completion of the project, remove all temporary construction power equipment, material and wiring from the site as the property of the Contractor.

C. Storage: Provide adequate storage for all equipment and materials which will become part of the completed facility so that it is protected from weather, dust, water, or construction operations.

© December 2012 Kennedy/Jenks Consultants

1.09 ELECTRICAL SERVICES

A. Provide all the equipment and materials not provided by the utility companies for permanent electrical services at the locations shown on the Drawings and described hereinafter. All work shall meet the requirements of the serving utility companies.

B. Coordinate all work with the serving utilities, obtain the required inspections, and notify the respective utility when service is required.

1.10 DAMAGED PRODUCTS

A. Notify the Engineer in writing in the event that any equipment or material is damaged.

B. Obtain prior favorable review by the Engineer before making repairs to damaged products.

1.11 OPTIONAL EQUIPMENT

A. For optional or substituted equipment, refer to Division 1, General Conditions.

1.12 LOCATIONS

A. General: Use equipment, materials and wiring methods suitable for the types of locations in which they are located, as defined in Paragraph B. herein.

B. Definitions of Types of Locations:
   1. Dry Locations: All those indoor areas which do not fall within the definitions below for Wet, Damp, Hazardous, or Corrosive Locations and which are not otherwise designated on the Drawings.
   2. Wet Locations: All locations exposed to the weather, whether under a roof or not, unless otherwise designated on the Drawings.
   3. Corrosive Locations: Areas where chemicals are stored or processed. These include the permanganate, coagulant and hypochlorite areas shown on the Drawings.

PART 2 - PRODUCTS

2.01 STANDARD OF QUALITY

A. Products that are specified by manufacturer, trade name or catalog number establish a standard of quality and do not prohibit the use of equal products of other manufacturers provided they are favorably reviewed by the Engineer prior to installation.

B. It is the intent of these Specifications and Drawings to secure high quality in all materials and equipment in order to facilitate operation and maintenance of the facility. All equipment and materials shall be new and the products of reputable suppliers having adequate experience in the manufacture of these particular items.

© December 2012 Kennedy/Jenks Consultants

For uniformity, only one manufacturer will be accepted for each type of product. All equipment shall be designed for the service intended and shall be of rugged construction, of ample strength for all stresses, which may occur during fabrication, transportation, erection, and continuous or intermittent operation. All equipment shall be adequately stayed, braced and anchored and shall be installed in a neat and workmanlike manner. Appearance and safety, as well as utility, shall be given consideration in the design of details.

C. All components and devices installed shall be standard items of industrial grade, unless otherwise noted, and shall be of sturdy and durable construction suitable for long, trouble-free service. Light-duty, fragile and competitive grade devices of doubtful durability shall not be used.

2.02 NAMEPLATES

A. For each piece of electrical equipment, provide a manufacturer's nameplate showing his name, location, the pertinent ratings and the model designation.

B. Identify each piece of equipment and related controls with a rigid laminated engraved phenolic nameplate. Engrave nameplates with the inscriptions indicated on the Drawings and, if not so indicated, with the equipment name. Securely fasten nameplates in place using two stainless steel screws or, where favorably reviewed by the Engineer, with epoxy cement. Where no inscription is indicated on the Drawings, furnish nameplates with an appropriate inscription furnished by the Engineer upon prior request by the Contractor.

C. Each control device, including pushbuttons, control switches, and indicating lights, shall have an integral legend plate or nameplate indicating the device function. These shall be inscribed as indicated on the Drawings or as favorably reviewed by the Engineer.

2.03 FASTENERS

A. Fasteners for securing equipment to walls, floors and the like shall be either hot-dip galvanized after fabrication or stainless steel. Provide stainless steel fasteners in Corrosive Locations. When fastening to existing walls, floors, and the like, provide capsule anchors, not expansion shields. Size capsule anchors to meet load requirements. Minimum size capsule anchor bolt is 3/8-inch.

2.04 PAINTING

A. Equipment: Refer to each electrical equipment section of these Specifications for painting requirements of equipment enclosures. Repair any final paint finish, which has been damaged or is otherwise unsatisfactory, to the satisfaction of the Engineer.

B. Wiring System: Paint all exposed conduits, boxes and fittings to match the color of the surface to which they are affixed. Paint finishes shall include proper surface preparation, prime coat and a final finish coat, and shall conform to Section 09960.

© December 2012 Kennedy/Jenks Consultants

2.05 ENCLOSURES

A. Unless otherwise noted, provide enclosures as follows:
   1. Dry Locations: NEMA Type 1
   2. Wet Locations: NEMA Type 4 or 4X
   3. Corrosive Locations: NEMA Type 4X
   4. See additional requirements below in paragraph 3.08, Metal Panels.

PART 3 - EXECUTION

3.01 REQUIREMENTS

A. All electrical installations shall conform to the codes and standards outlined in this Section.

3.02 WORKMANSHIP

A. Assign a qualified representative who shall supervise the electrical construction work from beginning to completion and final acceptance.

B. Perform all labor using qualified craftsmen, who have had experience on similar projects. Provide first-class workmanship for all installations.

C. Ensure that all equipment and materials fit properly in their installations.

D. Perform any required work to correct improperly fit installations at no additional expense to the Owner.

3.03 EXCAVATION AND BACKFILL

A. Provide the excavations for electrical equipment foundations and trenches for conduits as shown on the Drawings.

B. Exercise caution during all excavation work and avoid damage to existing underground pipes. Exercise extreme caution when working near existing electrical conduits and facilities. Field verify the location of all electrical facilities before proceeding with any nearby work.

C. Refer to Division 2, Earthwork, of these Specifications for all excavation and backfilling work.

3.04 CONCRETE

A. Where shown on the Drawings or specified, provide the required concrete installations for conduit encasement and equipment foundations.

B. Refer to Division 3, Concrete, of these Specifications for all concrete work.

© December 2012 Kennedy/Jenks Consultants

3.05 CONDUCTOR IDENTIFICATION

A. Identify all wires and cables in conformance with the requirements of Sections 16120 and 16124. This requirement applies to all equipment provided under this contract, regardless of Division, as well as to all conductors provided or worked on during this contract.

3.06 INSTALLING EQUIPMENT

A. Provide the required inserts, bolts and anchors, and securely attach all equipment and materials to their supports.

B. Install all floor-mounted equipment on 3-inch-high reinforced concrete pads. The Contractor, suppliers, and fabricators shall take this requirement into consideration when designing, fabricating, and installing panels, motor control centers, and other enclosures so that height above the floor of the operating handles of electrical devices meets the requirements of these Specifications and applicable codes.

3.07 CUTTING, DRILLING, AND WELDING

A. Provide any cutting, drilling, and welding that is required for the electrical construction work.

B. Structural members shall not be cut or drilled, except when favorably reviewed by the Engineer. Use a core drill wherever it is necessary to drill through concrete or masonry.

C. Provide the required welding for equipment supports. Conduits and fittings shall not be welded to structural steel.

D. Perform patch work with the same materials as the surrounding area and finish to match, as specified in Division 3 of these Specifications.

3.08 METAL PANELS

A. Mount all metal panels which are mounted on or abutting concrete walls in damp locations or any outside walls 1/4-inch from the wall, and paint the back sides of the panels with a high build epoxy primer. Film thickness shall be 10 mils minimum.

3.09 PROTECTIVE DEVICE COORDINATION

A. Provide the services of a recognized independent testing laboratory or coordination analysis consultant for the proper system coordination of the protective devices furnished on this project. Submit the name and the qualifications of the laboratory or consultant for review by the Engineer; qualifications must include professional registration of proposed personnel as electrical engineers.

B. The protective device on the line side closest to the fault or abnormal conditions shall isolate the problem portion of the system and minimize damage in that portion.

© December 2012 Kennedy/Jenks Consultants

The rest of the system shall be maintained in normal service. The coordination shall be in conformance with the recommendations of latest IEEE Standard 242.

C. Submit the analysis that shall include impedance and short circuit calculations, list of any assumptions made in the analysis, the recommended settings of the protective devices, and the system time/current characteristic curves. The submittal shall be made so as to allow time for review and resubmittal, if necessary, before the implementation of final settings and adjustments by the testing laboratory.

3.10 FIELD TESTS

A. Perform tests in accordance with applicable procedures as described in NETA Acceptance Testing Specifications.

B. Give sufficient notice to the Engineer prior to any test to permit witnessing the test.

C. Provide the services of a recognized independent testing laboratory and pay all costs of performing the inspections and tests as specified herein.

D. The testing laboratory shall provide all materials, equipment, labor and technical supervision to perform such tests and inspections. It is the intent of these tests to ensure that all electrical equipment is operational within industry and manufacturer's tolerances and is installed in accordance with the Contract Documents and manufacturer's instructions. The tests and inspections shall determine the suitability for energization.

E. The testing laboratory shall meet federal OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907. Membership in the International Electrical Testing Association (NETA) constitutes proof of meeting such criteria. The testing laboratory shall submit proof of these qualifications to the Engineer for review. Testing laboratory shall be Electrical Testing and Controls, Electro-Test, Power Systems, or equal.

F. The testing laboratory shall have a calibration program, which maintains all applicable test instrumentation within, rated accuracy. The accuracy shall be traceable to the National Bureau of Standards in an unbroken chain. Instruments shall be calibrated in accordance with the following frequency schedule:
   1. Field instruments: 6 months maximum
   2. Laboratory instruments: 12 months
   3. Leased specialty equipment: 12 months
      Date calibration labels shall be visible on all test equipment.

G. Where testing pursuant to NETA requirements is required in these specifications, submit a test report which includes the following:
   1. Name of project, name of person performing test, and date of test.
   2. Description of equipment tested.
   3. Description of test.
   4. List of test equipment used and calibration date.
   5. Test results.
   6. Conclusions and recommendations.

© December 2012 Kennedy/Jenks Consultants

7. Appendix, including appropriate test forms.
   The test report shall be bound and its contents certified. Submit the completed report directly to the Engineer no later than thirty (30) days after completion of the test unless directed otherwise. Number of reports to be submitted for review shall be the same as the number required for shop drawing submittals.

H. Safety practices shall include, but are not limited to, the following requirements:
   1. Occupational Safety and Health Act of 1970, OSHA.
   2. Accident Prevention Manual for Industrial Operations, Seventh Edition, National Safety Council, Chapter 4.
   3. Applicable state and local safety operating procedures.

I. All field tests shall be performed with apparatus de-energized except where otherwise specifically required by Section 7 of the latest Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems published by NETA. The testing laboratory shall have a designated safety representative who shall be present on the project and supervise operations with respect to safety. Circuits operating in excess of 600 volts between conductors shall have conductors shorted to ground by a hot-line grounded device approved for the purpose. In all cases, work shall not proceed until the safety representative has determined that it is safe to do so. The testing laboratory shall have available sufficient protective barriers and warning signs to conduct specified test safely.

J. Electrical equipment and materials furnished and installed by the Contractor, and the testing equipment listed below shall be tested in accordance with the "Inspection and Test Procedures" and "System Function Tests" (Section 7) of the latest Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems published by NETA. Tests shall not include any tests listed as optional in the aforementioned NETA Specifications unless specifically noted in respective equipment specifications for this project.

K. Retesting will be required for all unsatisfactory tests after the equipment or system has been repaired. Retest all related equipment and systems if required by the Engineer. Repair and retest equipment and systems, which have been satisfactorily tested but later, fail, until satisfactory performance is obtained.

L. Putting Equipment and Cables into Service: Submittal and favorable review of the specified factory and field tests shall occur before the Contractor is permitted to place the respective equipment or cable into service.

M. Miscellaneous Tests:
   1. Insulation Resistance, Continuity, Rotation: Perform routine insulation resistance, continuity and rotation tests for all distribution and utilization equipment including all motors ½-horsepower and larger prior and in addition to tests performed by the testing laboratory specified herein. Supply a suitable and stable source of test power to the test laboratory at each test site. The testing laboratory shall specify requirements. Notify the testing laboratory when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling. All testing shall be performed in the presence of the Engineer. The testing laboratory shall be responsible for implementing all

© December 2012 Kennedy/Jenks Consultants

final settings and adjustments on protective devices and tap changes. Any system material or workmanship that is found defective on the basis of acceptance tests shall be reported directly to the Engineer. The testing laboratory shall maintain a written record of all tests and upon completion of project, assemble and certify a final test report.

2. Motor Current: Measure and record current in each phase for each new motor. Include measurement of the motor terminal voltages and motor currents when the motor is being operated at normal operating loads. For motors that are part of variable frequency drive systems, use true-RMS-reading instruments in making the measurements.
3. Operational Tests: Operationally test all circuits to demonstrate that the circuits and equipment have been properly installed, adjusted and are ready for full-time service. Demonstrate the proper functioning of circuits in all modes of operation, including alarm conditions and demonstrate satisfactory interfacing with the data acquisition and alarm systems.

3.11 EQUIPMENT PROTECTION

A. Exercise care at all times after installation of equipment, motor control centers, etc., to keep out foreign matter, dust, dirt, debris, or moisture. Use protective sheetmetal covers, canvas, heat lamps, etc., as needed to ensure equipment protection.

3.12 CLEANING EQUIPMENT

A. Thoroughly clean all soiled surfaces of installed equipment and materials.

B. Clean out and vacuum all construction debris from the bottom of all equipment.

C. Provide and touch-up to original condition any factory painting that has been marred or scratched during shipment or installation, using paint furnished by the equipment manufacturer.

3.13 CLEANUP

A. Upon completion of the electrical work, remove all surplus materials, rubbish, and debris that accumulated during the construction work. Leave the entire area neat, clean, and acceptable to the Engineer.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 16110

CONDUIT, RACEWAYS AND FITTINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 16010 become a part of this Section as if repeated herein.

B. Work specified in other Divisions:
   1. Division 2: Excavation and Backfill of Trenches
   2. Division 3: Concrete Emplacement

1.02 REFERENCE STANDARDS

A. American National Standards Institute (ANSI) Publications:
   1. C80.1 Specification for Zinc Coated Rigid Steel Conduit
   2. C80.3 Specifications for Zinc Coated Electrical Metallic Tubing
   3. C80.5 Specifications for Rigid Aluminum Conduit

B. Federal Specifications (FS):

1.	FS W-C-1094 W-C-1094A	Conduit and Conduit Fittings, Plastic, Rigid
2.	FS WW-C-540 WW-C-540A	Conduit, Metal, Rigid, (Electrical, Aluminum)
	WW-C-540C	Conduit, Metal, Rigid & Coupling, Elbow & Nipple, Electrical Conduit, Aluminum
3.	FS WW-C-566 WW-C-566C	Flexible Metal Conduit

C. National Electrical Manufacturers Association (NEMA) Publications:
   1. RN 1 Polyvinyl Chloride Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing
   2. TC 6 PVC and ABS Plastic Utilities Duct for Underground Installation
   3. TC 14 Filament-Wound Reinforced Thermosetting Resin Conduit

D. Underwriters Laboratories (UL) Standards:
   1. 6 Rigid Metal Electrical Conduit
   2. 360 Liquid-Tight Flexible Steel Electrical Conduit
   3. 651 Electrical Rigid Nonmetallic Conduit
   4. 651A Type EB and A Rigid PVC Conduit and HDPE Conduit

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Information category of the General Conditions and the submittal requirements of Section 16010.

© December 2012 Kennedy/Jenks Consultants

1.04 LOCATIONS

A. Refer to Section 16010 for definitions of types of locations.

PART 2 - PRODUCTS

2.01 CONDUIT, RACEWAYS

A. General:
   1. Rigid steel conduit shall be used in all conduit systems, except where otherwise shown on the Drawings, where flexible conduit is required or where these Specifications require, or allow the use of polyvinyl chloride (PVC) conduit
   2. The minimum size raceway shall be 3/4-inch unless indicated otherwise on the Drawings.

B. Galvanized Rigid Steel Conduit (GRS) shall be hot-dip galvanized after fabrication, conforming to ANSI C80.1 and UL 6. Couplings shall be threaded type. Where PVC coated rigid steel conduit is called for, it shall be hot-dip galvanized, conforming to NEMA RN 1, with factory-applied PVC coating 40 mils thick.

C. Flexible Conduit:
   1. Flexible metal conduit shall be liquid-tight, shall have a moisture- and oil-proof PVC jacket extruded over a galvanized, flexible steel conduit, and shall conform to UL 360.

E. Rigid Nonmetallic Conduit: Rigid nonmetallic conduit shall be PVC Schedule 40 (PVC-40) conduit approved for underground use and for use with 90°C wires, and shall conform to UL 651.

2.02 CONDUIT SUPPORTS

A. Supports for individual conduits shall be galvanized malleable iron one-hole type with conduit back spacer.

B. Supports for multiple conduits shall be hot-dip galvanized Unistrut or Superstrut channels, or equal. All associated hardware shall be hot-dip galvanized.

C. All channels, strut, threaded rods, nuts and clamps in corrosive areas shall be of epoxy resin reinforced fiberglass material. Provide Robroy, Superstrut, or equal.

2.03 FITTINGS

A. Fittings for use with rigid steel shall be hot dipped galvanized steel or galvanized cast ferrous metal; access fittings shall have gasketed cast covers and be Crouse-Hinds Condulets, Appleton Unilets, or equal. Provide threaded-type couplings and connectors; set-screw type and compression-type are not acceptable.

© December 2012 Kennedy/Jenks Consultants

B. Fittings for use with either rigid nonmetallic conduit or duct shall be PVC and have solvent-weld-type conduit connections. If such are not available, then the Specification for PVC coated galvanized rigid steel fittings shall apply.

C. Fittings for flexible conduit shall be Appleton Type ST, O-Z Gedney Series 4Q, or equal.

D. Union couplings for conduits shall be the Erickson type and shall be Appleton Type EC, O-Z Gedney 3-piece Series 4, or equal. Threadless couplings shall not be used.

E. Bushings:
   1. Bushings shall be the insulated type.
   2. Bushings for rigid steel shall be hot dip galvanized insulated grounding type, 0-Z Gedney Type HBLG, Appleton Type GIB, or equal.

2.05 CONDUIT SEALANTS

A. Moisture Barrier Types: Sealant shall be a non-toxic, non-shrink, non-hardening, putty type hand applied material providing an effective barrier under submerged conditions.

B. Fire Retardant Types: Fire stop material shall be a reusable, non-toxic, asbestos-free, expanding, putty type material with a 3-hour rating in accordance with UL 1479. Provide products indicated by the manufacturer to be suitable for the type and size of penetration.

2.06 WARNING TAPE

A. Provide electrical warning tape in duct bank as shown on the Drawings. The tape shall be 6 inches wide, red with black lettering stating "CAUTION BURIED ELECTRIC LINE." The tape shall be made of 6-mil polymer with 36,000-psi tensile strength.

PART 3 - EXECUTION

3.01 CONDUIT, RACEWAY AND FITTING INSTALLATION

A. From pull point to pull point, the sum of the angles of all of the bends and offsets shall not exceed 270 degrees.

B. For power, control and signal circuits, provide conduit per Conduit Use Tables below, unless specifically indicated otherwise on the Drawings:
   1. Exception: For raceways leaving a building above grade and then going below grade, provide PVC-coated GRS from a point 3 feet above grade to a point 5 feet from the building wall.

© December 2012 Kennedy/Jenks Consultants

C. At all boxes and equipment, provide insulated type metallic grounding bushings for metallic conduits. Bond together all conduits to provide continuity of the equipment grounding system. Size bonding conductor per code.

D. Provide flexible conduit in lengths of not more than 18 inches at connections to motors, valves and any equipment subject to vibration or relative movement.

E. Conduits embedded in concrete floors on grade shall be installed between grids of reinforcing steel, or shall be encased below the floors, provided the concrete is thickened in a manner satisfactory to the Engineer. Installation of conduit below the bottom of this slab is not acceptable; embedding or encasing is required.

F. Provide galvanized rigid steel factory ells for GRS raceways. Provide GRS for offsets in GRS raceways.

G. Underground Raceways: Slope all underground raceways to provide drainage; for example, slope conduit from equipment located inside a building to the handhole located outside the building. For additional requirements see Section 16402.

H. Conduit Supports: Properly support all conduits as required by the NEC. Run all conduits exposed except where the Drawings indicate that they are to be embedded in the floor slab, walls, or ceiling, or to be installed underground.
   1. Exposed Conduits:
      a. Support exposed conduits within 1-foot of any outlet and at intervals not exceeding NEC requirements; wherever possible, group conduits together and support on common supports. Support exposed conduits fastened to the surface of the concrete structure by one-hole clamps, or with channels. Use conduit spacers with one-hole clamps. Coordinate conduit locations with piping, equipment, fixtures, and with structural and architectural elements. Conduits attached to walls or columns shall be as unobtrusive as possible and shall avoid windows. Run all exposed conduits parallel to building lines.
      b. Group together exposed conduits in horizontal runs located away from walls and support on trapeze hangers. Arrange such conduits uniformly and neatly. Trapeze hangers shall consist of channels of adequate size, suspended by means of rods or other suitable means from the ceiling or from pipe hangers. Install such runs so as not to interfere with the operation of valves or any other equipment, and keep at least 6 inches clear of any pipe which may operate at more than 100°F. Treat cut surfaces or damaged ends with corrosion-resistant coatings such as "Devcon Z", prepared by Subox Coatings; "Galvanox Type I", prepared by Pedley-Knowles; or equal. Application shall follow manufacturer's recommendation.
   2. Conduits Embedded in Concrete: Provide concrete cover at least equal to that of the reinforcing steel, space at 3 conduit diameters apart except where they cross at angles greater than 45 degrees, and install so as not to reduce the structural integrity of the concrete element.

I. When expansion joints are crossed, whether conduit is embedded or exposed, provide watertight expansion fittings and bonding jumpers. In hazardous locations,

© December 2012 Kennedy/Jenks Consultants

provide Crouse-Hinds UNF/UNV, Appleton, or equal. In unclassified locations, provide Crouse-Hinds XD, Appleton, or equal.

J. Spare Raceways: After completing a conduit run between manholes, handholes, or pullboxes, prove the integrity of the conduit run. Use an air compressor to blow in a pull-line, then use the pull-line to pull a mandrel through the entire conduit run. Install a new 3/16-inch nylon, 800-pound test pull-line which has tape measure marking every foot to indicate length. Plug the ends of the conduit, with conduit cap plugs.

K. All penetrations through walls into or out of corrosive locations, as defined in Section 16010 shall be made gas-tight. In concrete walls, pour concrete after the conduit is in place, if possible. If not, core drill concrete or CMU walls, install conduit and caulk around it with non-shrink grout. Install conduit seal in each conduit near the penetration.

L. All conduit penetrations through interior walls and floors shall be sealed with fire retardant type conduit sealant.

M. Conduit Identification: In each manhole, handhole, pullbox, cabinet, motor control center or other equipment enclosure, identify each conduit using the conduit number shown on the Drawings by means of a stamped brass tag affixed with stainless steel wire; where affixing a tag is not feasible, identify conduits by stenciling. Stencil all exposed conduits for identification at least once in each room.

N. Conduit Seals:
   1. Moisture Seals: Provide in accordance with NEC Paragraph 300-5(g).

O. Conduit shall not be supported from T-bar ceiling suspension wires.

P. Flexible metallic conduit shall have a maximum length of 6 feet. Flexible metallic conduit shall not be considered as a ground conductor. Flexible metallic conduit shall only be installed in exposed or accessible locations.

Q. Rigid PVC conduit shall be stored on a flat surface and shielded from the sun.

© December 2012 Kennedy/Jenks Consultants

CONDUIT USE TABLE

Circuit Type	Exposed	Corrosive	Embedded in Concrete	Buried In Soil	Duct Bank Encased In Concrete	Transition Within 5 Feet of Building or Structure
Power & 120 Vac Control	GRS	PVC Coated GRS	GRS	PVC-40*	PVC-40*	PVC Coated GRS
Signal	GRS	PVC Coated GRS	GRS	PVC-40*	PVC-40*	PVC Coated GRS

* Provide ground wire sized per NEC requirements for all circuits.
** PVC coated GRS in wet wells, etc., that are both hazardous and corrosive, otherwise, GRS.

Notes:
1. Generally, the Conduit Use Tables apply.
2. Signal circuits are those subject to RF interference or induced current. MSPs, TSPs, telephone cable, coaxial cable, and manufacturer's cables specially designed for low level signals are all presumed to be part of signal circuits.
3. Provide fiberglass conduit where indicated on the Drawings.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 16120

LOW VOLTAGE WIRE AND CABLE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provisions: Applicable provisions of Section 16010 become a part of this Section as if repeated herein.

B. Related Work Described Elsewhere: Division 17.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM):
   1. B3-74 Specification for Soft or Annealed Copper Wire
   2. B8-77 Specification for Concentric Lay Stranded Copper Conductors, Hard, Medium-Hard, or Soft
   3. B173-71 Specification for Rope Lay Stranded Copper Conductors Having Concentric Stranded Members

B. Insulated Cable Engineers Association (ICEA):
   1. S-66-524 Cross-Linked Thermosetting Polyethylene Insulated Wire and Cable

C. International Electrical Testing Association (NETA):
   1. ATS Acceptance Testing Specifications

D. Underwriters Laboratories (UL) Standards:
   1. 44 Rubber Insulated Wire and Cable
   2. 62 Flexible Cords and Fixture Wire
   3. 83 Thermoplastic-Insulated Wires and Cables
   4. 510 Insulating Tape
   5. 719 Non-Metallic Sheath Cable
   6. 1063 Stranded Conductors for Machine Tool Wire

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Information category of the General Conditions and the submittal requirements of Section 16010.

1.04 LOCATIONS

A. Refer to Section 16010 for definitions of types of locations.

© December 2012 Kennedy/Jenks Consultants

PART 2 - PRODUCTS

2.01 CONDUCTORS

A. General: All conductors shall be copper. Wire or cable not specifically shown on the Drawings or specified, but required, shall be of the type and size required for the application and in conformance with the applicable code. All insulated conductors shall be identified with printing colored to contrast with the insulation color.

B. Power and Control Conductors, 600 Volts and Below:
   1. Stranded copper wires shall be 600-volt Type THWN, sizes #12 and #10 AWG only.
   2. Stranded copper wire shall be 600-volt Type THWN, Class B stranding, sizes #14 AWG and larger.
   3. Stranded copper wire shall be 600-volt Type XHHW or RHW, Class B stranding, Sizes #8 AWG and larger.
   4. Fixture wire shall be 600-volt, silicone rubber insulated, 200°C, UL Type SF-2, with stranded copper conductors.
   5. Cords shall be 600-volt, 2-conductor plus ground, Type SO, hard service, of adequate length and with grounding type plug attached, rated in amperes as shown on the Drawings.

2.02 SPLICES AND TERMINATIONS OF CONDUCTORS

A. Splices:
   1. Wire and Cable Splicing Materials and Applications:
      a. For Lighting Systems and Power Outlets: Wire nuts shall be twist-on type insulated connectors utilizing an outer insulating cover and a means for connecting and holding the conductors firmly. They shall be UL listed and suitable for connecting two to four solid copper conductors of #14 or #12 AWG size or two or three #10 AWG solid copper conductors.
      b. All Equipment: Crimp type connectors shall be insulated type, suitable for the size and material of the wires and the number of wires to be spliced and for use with either solid or stranded conductors. They shall be UL listed.
      c. Division 16 Equipment and Power Conductors: Bolted pressure connectors shall be suitable for the size and material of the conductors to be spliced. They shall be UL listed and of the split bolt or bolted split sleeve type in which the bolt or set screw does not bear directly on the conductor.
      d. All Equipment: Epoxy splice kits shall include epoxy resin, hardener, and mold, and shall be suitable for use in wet locations and hazardous locations.
   2. Terminal Cabinets: Provide terminal cabinets per Section 17510. Termination system shall include insulated, crimp-type connectors. Coordinate the lug and boards for correct fit. All terminations shall include marker sleeves.

B. Terminations:
   1. Low Voltage Terminations:

© December 2012 Kennedy/Jenks Consultants

a. Crimp type terminals shall be UL listed, self-insulating sleeve type, with ring or rectangular type tongue, suitable for the size and material of the wire to be terminated, and for use with either solid or stranded conductors.
b. Terminal lugs shall be UL listed and of the split bolt or bolted split sleeve type in which the bolt or set screw does not bear directly on the conductor. Tongues shall have NEMA standard drilling.
c. Crimp with manufacturer recommended ratchet-type tool with calibrated dies. Hand crimping tools are not acceptable.

C. Tape used for splices and terminations shall be compatible with the insulation and jacket of the cable and shall be of plastic material. Tape shall conform with UL 510.

D. Wire markers shall be heat shrink type (Raychem; T&B; or equal) or plastic sleeve type. Wire numbers shall be permanently imprinted on the markers.

PART 3 - EXECUTION

3.01 CONDUCTOR INSTALLATION

A. Provide the following types and sizes of conductors for the uses indicated for 600 volts or less:
1. Stranded Copper, Sizes #12 and #10 AWG: As shown on the Drawings for circuits for receptacles, switches and light fixtures with screw-type terminals.
2. Stranded Copper, Size #14 AWG and Larger, Individual Conductors or CC: As shown on the Drawings for the control of motors or other equipment. Size #14 shall not be used for power supplies to any equipment.
3. Stranded Copper, Sizes #12 AWG and Larger: As shown on the drawings for motors and other power circuits.
4. Stranded Copper, #6 AWG and Larger: For power feeders, provide copper, not aluminum, unless specifically indicated otherwise on the Drawings or in the circuit schedule.
5. Fixture Wire: For connections to all fixtures in which the temperature may exceed the rating of branch circuit conductors.

B. Color Coding: Provide color coding for all circuit conductors. Insulation color shall be white for neutrals and green for grounding conductors. An isolated ground conductor shall be identified with an orange tracer in the green body. Ungrounded conductor colors shall be as follows:
1. 120/208-Volt, 3-Phase: Red, black and blue.
2. 277/480-Volt, 3-Phase: Yellow, brown and orange.
3. 120/240-Volt, 1-Phase: Red and black.

C. Color coding shall be in the conductor insulation for all conductors #10 AWG and smaller; for larger conductors, color shall be either in the insulation or in colored plastic tape applied at every location where the conductor is readily accessible (e.g., enclosures, pullboxes, and junction boxes).

D. Exercise care in pulling wires and cables into conduit or wireways so as to avoid kinking, putting undue stress on the cables or otherwise abrading them. No grease

© December 2012 Kennedy/Jenks Consultants

will be permitted in pulling cables. Only soapstone, talc, or UL listed pulling compound will be permitted. The raceway construction shall be complete and protected from the weather before cable is pulled into it. Swab conduits before installing cables and exercise care in pulling, to avoid damage to conductors.

E. Cable bending radius shall be per applicable code. Install feeder cables in one continuous length unless splices are favorably reviewed.

F. Provide an equipment grounding conductor, whether or not it is shown on the Drawings, in any flexible conduit or any raceway in which all or any portion of a run consists of non-metallic duct or conduit. For flexible conduit, an external bonding jumper is an acceptable alternative.

G. In panels, bundle incoming wire and cables, No. 6 AWG and smaller, lace at intervals not greater than 6 inches, neatly spread into trees and connect to their respective terminals. Allow sufficient slack in cables for alterations in terminal connections. Perform lacing with plastic cable ties or linen lacing twine. Where plastic panel wiring duct is provided for cable runs, lacing is not necessary when the cable is properly installed in the duct.

H. For cables crossing hinges, utilize extra flexible stranded wire, make up into groups not exceeding 12, and arrange so that they will be protected from chafing and excess flexing when the hinged member is moved.

3.02 CONDUCTOR SPLICES AND TERMINATIONS

A. Splices: Install all conductors without splices unless necessary for installation, as determined by the Engineer. Splices, when permitted, and terminations shall be in accordance with the splice or termination kit manufacturer's instructions. Splice or terminate wire and cable as follows:
   1. Watertight Splices: Splices in concrete pullboxes, for any type of cable or wire, shall be watertight. Make splices in low voltage cables using epoxy resin splicing kits rated for application up to 600 volts.

B. Terminations:
   1. Terminate stranded #14 wire using crimp type terminals where not terminated in a box lug type terminal. Terminals must be coordinated with type of terminal board where provided.

3.03 CONDUCTOR IDENTIFICATION

A. Except for interior lighting and receptacle circuits, identify each wire or cable at each termination and in each pullbox, junction box, handhole, and manhole using numbered and lettered wire markers. All electrically common conductors shall have the same number. Each electrically different conductor shall be uniquely numbered. Identify panelboard circuits using the panelboard identification and circuit number. Identify motor control circuits using the equipment identification number assigned to the control unit by the motor control center manufacturer and the motor control unit terminal number. Identify other circuits as shown in the circuit schedule or as favorably reviewed by the Engineer.

© December 2012 Kennedy/Jenks Consultants

B. Conductor numbering shall be coordinated with the Interconnection Diagrams specified in Section 17010.

C. Conductors between terminals of different numbers shall have both terminal numbers shown at each conductor end. The terminal number closest to the end of the wire shall be the same as the terminal number.

3.04 FIELD TESTS

A. Insulation Resistance Tests: For all circuits 150 volts to ground or more and for all motor circuits over ½-horsepower, test cables per NETA Paragraph 8.3.1. The insulation resistance shall be 20 megohms or more. Submit results for review. See also Section 16010.

B. Phase Rotation: The phase rotation of all circuits shall be clockwise in sequence. The Contractor shall verify that each three-phase service, feeder and branch circuits meet this requirement. A record shall be kept at each circuit tested and, on completion, given to the Engineer for review.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 16124

SIGNAL CABLE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 16010 become a part of this Section as if repeated herein.

B. Related Work Described Elsewhere:
   1. Section 17010: Instrumentation and Controls, General Requirements

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM):
   1. B8 Concentric Lay Stranded Copper Conductors, Hard, Medium-Hard, or Soft, Specification for

B. Institute of Electrical and Electronic Engineers (IEEE):
   1. 383 Shielded Instrumentation Cable, Specifications for

C. Rural Electrification Administration (REA):
   1. PE-39 Specification for Filled Telephone Cables

D. Underwriters Laboratories Incorporated (UL):
   1. 13 Power Limited Circuit Cable Class 2, Specifications for (Bulletin)
   2. 83 Thermoplastic Insulated Wires and Cables

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Information category of the General Conditions and the submittal requirements of Section 16010.

PART 2 - PRODUCTS

2.01 TWISTED SHIELDED PAIRS (TSP)

A. Cable shall conform to IEEE 383, UL 13, and UL 83 and shall be type PLTC cable suitable for direct burial. Each TSP shall consist of two #16 AWG, 7-strand copper conductors per ASTM B8 with 15 mils PVC insulation. Conductors shall be twisted with 2-inch or shorter lay, with 100% foil shielding and tinned copper drain wires. Each pair shall have a 35-mil-thick outer jacket. Cable shall be rated at 90°C and for operation of 600 volts. Provide Belden, Alpha, Dekoron, or equal.

B.

© December 2012 Kennedy/Jenks Consultants

2.02 SPECIAL CABLES

A. Special cables shall be supplied where shown on the Drawings or as required by the manufacturer or supplier. Deviations must be favorably reviewed by the Engineer

B. Cables for communicating using Ethernet protocol shall be 300-volt rated, Type PLTC, #24 AWG solid, Category 5e.

PART 3 - EXECUTION

3.01 CABLE INSTALLATION

A. Signal cable shall be installed by personnel who have had a minimum of 3 years experience in terminating and splicing twisted shielded conductors and co-axial cables.

B. Adequate care shall be exercised by the installers to prevent cable damage or sheath distortion. Bending radius shall not be less than 10 times the cable O.D.

C. Cables shall be continuous from initiation to termination without splices except where specifically indicated.

D. Cable shielding shall be grounded at one end only of the cable. Bonding shall be to a single ground point only. Bonding from cable to cable in multiple run installations shall not be permitted.

E. Heat shrinkable sleeving shall be installed on all cables to insulate shielding at the ungrounded cable terminations.

F. Where installed in control consoles containing power circuits, cables shall be routed a minimum of 2 inches distant. Color coding shall be strictly observed throughout the installation.

G. Manufacturer's cable pulling tension shall not be exceeded.

3.02 CONDUCTOR SPLICES AND TERMINATIONS

A. Splices: Install all conductors without splices unless necessary for installation, as determined by the Engineer. Splices, when permitted, and terminations shall be in accordance with the splice or termination kit manufacturer's instructions. Splice cables as follows:
   1. Watertight Splices: Splices in concrete pullboxes, for any type of cable or wire, shall be watertight. Make splices in low voltage cables using epoxy resin splicing kits rated for application up to 600 volts.

B. Terminations:
   1. Crimp-type terminals shall be UL listed, self-insulating, sleeve type with ring or rectangular tongue, suitable for size and material of the wire to be terminated

© December 2012 Kennedy/Jenks Consultants

and for use with either stranded or solid wire. Spade type lugs are acceptable with telephone (TC) cable systems only.

2. Crimp with manufacturer's recommended ratchet-type tool with calibrated dyes. Hand crimping tools are not acceptable.
3. Coaxial cable and connectors shall be terminated in accordance with the manufacturer's instructions. Use manufacturer's recommended solder. The Contractor shall prevent misapplication of solder and termination.

3.03 CONDUCTOR IDENTIFICATION

A. Identify each wire or cable at each termination, in each pullbox, and in each handhole using numbered and lettered wire markers. All electrically common conductors shall have the same number. Each electrically different conductor shall be uniquely numbered. Identify panelboard circuits using the panelboard identification and circuit number. Identify motor control circuits using the equipment identification number assigned to the control unit by the motor control center manufacturer and the motor control unit terminal number. Identify other circuits as shown in the circuit schedule or as favorably reviewed by the Engineer. Conductor numbering shall be coordinated with the Interconnection Diagrams specified in Section 17010.

B. Conductors between terminals of different numbers shall have both terminal numbers shown at each conductor end. The terminal number closest to the end of the wire shall be the same as the terminal number.

3.04 FIELD TESTS

A. Insulation Resistance Tests: Perform insulation resistance tests on all circuits. Make these tests before any equipment has been connected. Test the insulation with a 500-Vdc insulation resistance tester with a scale reading 100 megohms. The insulation resistance shall be 20 megohms or more. Submit results for review.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 16130

BOXES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 16010 become part of this Section as if repeated herein.

B. Work Included:
   1. Installation of all necessary outlet boxes for wiring devices, lighting fixtures, and signal equipment as noted on the Drawings.
   2. Installation of junction boxes as required for the consolidation of conduit runs.
   3. Installation of pull boxes as necessary to aid in pulling in conductor.

1.02 REFERENCE STANDARDS

A. ASTM International (ASTM) Publication:
   1. A123 Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products

B. Federal Specifications (FS):
   1. W-C-586 Conduit Outlet Boxes, Bodies, and Entrance Caps, Electrical, Cast Metal
   2. W-J-800 Junction Box, Extension, Junction Box Cover, Junction Box (Steel, Cadmium or Zinc Coated)

C. Underwriters Laboratories, Inc. (UL) Publications:
   1. 50 Electrical Cabinets and Boxes
   2. 514 Outlet Boxes and Fittings

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Information category of the General Conditions and the submittal requirements of Section 16010.

PART 2 - PRODUCTS

2.01 OUTLET, JUNCTION AND PULL BOXES

A. Sheet Metal Boxes: Sheet metal boxes shall conform to UL 50, with a hot-dipped galvanized finish conforming to ASTM A123. Outlet boxes and switch boxes shall be designed for mounting flush wiring devices. Boxes and box extension rings shall be provided with knockouts. Boxes shall be formed in one piece from carbon-steel sheets. Outlet boxes shall not be less than 4 inches square and 1-1/2 inches deep.

© December 2012 Kennedy/Jenks Consultants

Ceiling boxes shall withstand a vertical force of 200 pounds for 5 minutes. Wall boxes shall withstand a vertical downward force of 50 pounds for 5 minutes. Gangable and through-wall types are not acceptable. Boxes shall conform to FS W-J-800D and UL 514.

B. Cast Metal Boxes: Box bodies and cover shall be cast or malleable iron with a minimum wall thickness of 1/8-inch at every point, and not less than 1/4-inch at tapped holes for rigid conduit. Bosses are not acceptable. Mounting lugs shall be provided at the back or bottom corners of the body. Covers shall be secured to the box body with No. 6 or larger brass or bronze flathead screws. Boxes shall be provided with neoprene cover gaskets. Where only cast aluminum is available for certain types of fixture boxes, an epoxy finish shall be provided. Outlet boxes shall be of the FS types. Boxes shall conform to FS W-C-586C and UL 514.

C. Non-metallic Boxes: Non-metallic boxes shall be hot-compressed fiberglass, one-piece, molded with reinforcing of polyester material, with minimum wall thickness of 1/8-inch.

D. Pull Boxes and Junction Boxes: Except where NEMA 4X fiberglass boxes are called for, all boxes shall be fabricated from carbon steel per UL 50. Boxes shall be welded construction with all seams or joints closed and reinforced. Boxes shall be galvanized after construction. Boxes intended for outdoor use shall be cast metal with threaded hubs and neoprene gasketed covers, or shall be of the fiberglass reinforced polyester type of 1/8-inch minimum thickness. Cover retention shall be by corrosion resistant stainless steel screws.
   1. All boxes for wiring operating at 601 volts or higher shall be constructed without hinges and shall be padlockable.
   2. All boxes and cabinets shall be securely fastened to building structural members so as to prevent movement in any direction. Boxes shall not be supported by lighting fixtures, suspended ceiling support wires or freely hanging rods.
      a. Covers of boxes and cabinets mounted in horizontal plane (top or bottom) shall either weigh not more than 40 pounds or shall require not more than 40 pounds of force to open or close.
      b. Covers of boxes and cabinets mounted in vertical plane (front, back, sides) shall either weigh not more than 60 pounds or shall require not more than 60 pounds of force to open or close. All covers over 30 pounds shall be furnished with angle support at bottom to carry weight of cover for assembly.
      c. Covers of boxes and cabinets weighing more than 30 pounds shall be provided with lifting handles or some means of grasping other than edges.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Outlet Boxes:
   1. Provide fixture outlets with proper fixture connectors.
   2. Box mounting height shall be dictated by the wiring device enclosed.

© December 2012 Kennedy/Jenks Consultants

3. Blanking covers shall be installed on all unused openings.
4. Sheet metal boxes shall be used in dry non-corrosive locations where the conduit system is routed concealed in the walls and ceilings.
5. Cast metal or molded non-metallic surface mounted boxes shall be used in exterior and/or in all wet locations.
6. Bonding jumpers shall be used around all concentric or eccentric knockouts.
7. Boxes shall be securely mounted to the building structure independent of conduits entering or exiting the boxes.

B. Junction Boxes and Pull Boxes:
1. Boxes shall be installed where required and where indicated on the Drawings.
2. Boxes shall be readily accessible.
3. Boxes shall not be installed in finished areas.
4. Pull boxes shall be provided at least every 150 feet on long straight conduit runs. Spacing shall be reduced by 50 feet for each 90-degree bend. See Section 16110 for maximum bends in conduit systems.
5. Box dimensions shall be in accordance with size and quantity of conductors and conduits entering and leaving box per NEC Article 370 requirements.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 16140

WIRING DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 16010 become a part of this Section as if repeated herein.

B. Work Included:
   1. Installation, connection and furnishing all single, duplex, GFI and special purpose receptacles complete with wall plates and/or covers as shown on the Drawings.
   2. Installation, connection and furnishing of all single pole toggle switches complete with wall plates and or handle operators as shown on the Drawings.

1.02 REFERENCE STANDARDS

A. American National Standards Institute (ANSI) Publication:
   1. C73 Plugs and Receptacles
   2. C73a Plugs and Receptacles

B. Federal Specifications (FS):
   1. W-C-596 D & E General Specifications for Cable Outlet Electrical Connector
   2. W-S-896 D & E General Specifications for Flush Mounted Toggle and Lock Switches

C. National Electrical Manufacturers Association (NEMA) Publications:
   1. WD 1 General Requirements for Wiring Devices
   2. WD 6 Wiring Devices - Dimensional Requirements

D. Underwriters Laboratories (UL) Standards:
   1. 20 General-Use Snap Switches
   2. 498 Electrical Attachment Plugs and Receptacles
   3. 514 Electrical Outlet Boxes
   4. 943 Class A Ground Fault Receptacle Interrupting Requirements

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Information category of the General Conditions and the submittal requirements of Section 16010.

© December 2012 Kennedy/Jenks Consultants

1.04 LOCATIONS

A. Refer to Section 16010, General Electrical Requirements, for definitions of types of locations.

PART 2 - PRODUCTS

2.01 RECEPTACLES

A. General: Receptacles shall be heavy duty, high abuse, grounding type conforming to NEMA configurations, NEMA WD1 and UL 514 Standards.

B. Single and Duplex Receptacles:
   1. Receptacles shall be of back and side wire design utilizing screw type terminals. Receptacles shall be rated 20 ampere, two-pole, 3-wire, 120-volt, NEMA 5-20 configuration, self-grounding. Color shall be brown in industrial areas. Power contacts shall be a T-type design and shall be brass. Ground contacts shall be brass.
   2. Devices shall have a nylon composition face with a nylon or melamine body. Units shall comply with Federal Specification W-C-596E and meet UL 498 test requirements. Receptacles shall be Hubbell 5362; Daniel Woodhead 5262DW; or equal.

C. Special Purpose Receptacles: Receptacles shall be of the amperage, voltage and NEMA configuration indicated on the Drawing. Compliance to standards and tests shall be as listed in Item B above.

D. GFI Receptacles:
   1. Device shall be rated 20-ampere, 2-pole, 3-wire, 120-volt, conforming to NEMA WD1.10 configuration. Face shall be nylon composition meeting UL 498 test standards. Unit shall have test and reset push buttons. Reset push button shall have a visible indicator band to indicated tripped condition.
   2. GFCI component shall meet UL 498 Class A standards with a tripping time of 1/40 second at 5 milliamperes current unbalance. Operating range shall extend from 31°F to 158°F. Unit shall have transient voltage protection and shall be ceramic encapsulated for protection against moisture.
   3. Provide Hubbell 5362, Daniel Woodhead, or equal.

E. Generator Receptacles: 400-ampere receptacle and backbox shall be rated at 480V and shall be heavy-duty 4-pole type with 4-inch hub. Provide both receptacle and mating plug. Receptacle and plug shall be Crouse Hinds Arktite; Appleton; or equal.

2.02 PLATES

A. General: Plates shall be of the style and color to match the wiring devices, and of the required number of gangs. Plates shall conform with NEMA WD1, UL 514, and ANSI C73. Plates on finished walls shall be non-metallic or stainless steel. Plates

© December 2012 Kennedy/Jenks Consultants

on unfinished walls and on fittings shall be of zinc plated steel or cast metal having rounded corners and beveled edges.

B. Non-Metallic: Plates shall be smooth finish with contoured edges and shall be nylon or fiberglass.

C. Stainless Steel: Plates shall be 0.035 inches thick with beveled edges and shall be manufactured from No. 302 alloy having a brushed or satin finish.

D. Galvanized: Plates shall be galvanized sheet steel raised 1/2-inch, with rounded corners.

E. Cast Metal: Plates shall be cast or malleable iron covers with gaskets so as to be moisture resistant or weatherproof.

F. Blank Plates: Cover plates for future telephone or television outlets shall match adjacent device wall plates in appearance.

G. Wet and Corrosive Locations: Plates shall have weather protective double doors. Material of manufacture shall be die-cast aluminum for metallic plates or nylon for non-metallic plates.

PART 3 - EXECUTION

3.01 INSTALLATION OF WIRING DEVICES

A. Dry Locations: The device shall be installed in flush mounted boxes with washers as required to bring the device mounting strap level with the surface of the finished wall.

B. Wet Exterior Locations: Install only wiring devices approved for outdoor service in these locations.

C. Mounting Heights: Locations of wall outlets shall be measured from the finished floor to the center of the outlet box. Boxes shall be adjusted so that the front edge of the box shall not be further back from the finished wall plane than 1/4-inch. Boxes shall be adjusted so that they do not project beyond the finished wall. Height above the finished floor shall be as shown on the Drawings.

E. Receptacles:
   1. Receptacles shall be grounded by a grounding conductor, not by a yoke or screw contact.
   2. Receptacles shall be oriented so that the grounding slot is located at the top of the outlet.
   3. Receptacles shall be installed with connections pigtailed (spliced) to the branch circuit wiring so that removal of the receptacle will not lose neutral continuity and branch circuit power will not be lost to other receptacles on the same circuit.

© December 2012 Kennedy/Jenks Consultants

3.02 INSTALLATION OF WALL PLATES

A. General: Plates shall match the style of the device and shall be plumb within 1/16-inch of the vertical or horizontal.

B. Interior Dry Locations: Install plates so that all four edges are in continuous contact with the finished wall surfaces. Plaster filling will not be permitted. Do not use oversize plates or sectional plates.

C. Exterior and/or Wet Locations: Install plates with gaskets on wiring devices in such a manner as to provide a raintight weatherproof installation. Cover type shall match box type.

3.03 TESTS

A. Receptacles:
   1. Receptacles shall be tested for blade and ground plug tension prior to installation. Do not install any receptacle having less than 16 ounce individual blade retention.
   2. After installation of receptacles, circuits shall be energized and each receptacle tested for proper ground continuity, reversed polarity, and/or open neutral condition.
   3. GFI receptacles shall be tested with the circuits energized. Devices shall be tested with a portable GFI receptacle tester capable of circulating 7.5 milliamperes of current, when plugged in, between the "hot" line and "ground" to produce tripping of the receptacle. Resetting and tripping shall be checked at least twice at each GFI receptacle.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 16160

PANELBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 16010 become a part of this Section as if repeated herein.

1.02 REFERENCE STANDARDS

A. American National Standards Institute (ANSI) Publication:
   1. Z55.1 Gray Finishes for Industrial Apparatus and Equipment

B. National Electrical Manufacturers Association (NEMA) Publications:
   1. PB 1 Panelboards
   2. 250 Enclosures for Electrical Equipment (1,000 Volt Maximum)

C. Federal Specifications (FS):
   1. W-P-115 Panel, Power Distribution
   2. W-C-375 Circuit Breakers, Molded Case, Branch Circuit and Series Service, Series Trip

D. Underwriters Laboratories (UL) Standards:
   1. 50 Electrical Cabinets and Boxes
   2. 869 Electrical Service Equipment
   3. 869A Reference Standard for Device Equipment

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Review category of the General Conditions and the submittal requirements of Section 16010.

B. Shop Drawings: For each panelboard, submit manufacturer's name and data as required:
   1. Panelboard type.
   2. Main bus and terminal connection sizes.
   3. Location of line connections.
   4. Cabinet dimensions.
   5. Gutter space.
   6. Gauge of boxes and fronts.
   7. Finish data.
   8. Voltage rating.
   9. Breaker types, trip ratings, and interrupting ratings.

© December 2012 Kennedy/Jenks Consultants

1.04 LOCATIONS

A. Refer to Section 16010 for definitions of types of locations.

PART 2 - PRODUCTS

2.01 PANELBOARDS

A. General: All panelboards shall be the automatic circuit breaker type. The number and arrangement of circuits, trip ratings, spares and blank spaces for future circuit breakers shall be as shown on the Drawings. All circuit breakers shall be quick-make, quick-break, thermal magnetic, bolt-on type, and 1, 2 or 3-pole as shown, each with a single operating handle.
   1. Each panelboard shall have a field-mounted identifying plastic nameplate giving the panel identification as shown on the Drawings. In addition, each panelboard shall have a manufacturer's nameplate showing the voltage, bus rating, phase, frequency and number of wires.
   2. For panelboards used in dry locations, finish of doors and trim shall be ANSI 61 or 49, in accordance with ANSI Z55.1. Boxes of all such panelboards shall be galvanized, field finished to match the fronts.
   3. Provide NEMA 1 panelboard enclosure shown on the Drawing.
   4. Panelboards and enclosures shall conform to NEMA PB1 and 250, UL 50 and requirements of all relevant codes. Panelboards used as service equipment shall conform to UL 869.

B. Lighting Panelboards:
   1. General: Lighting panelboards shall be rated as shown on the Drawings. Panelboards shall meet the requirements of Federal Specification W-P-115 for Type I, Class 1 panelboards with circuit breakers.
   2. Lighting panelboards shall have front doors with key latch, common keying and a typed directory card and holder. Panelboard circuits shall be arranged with odd numbers on the left and even numbers on the right.
   3. Circuit Breakers: Circuit breakers shall be the molded case type with ratings as shown on the Drawings. Circuit breakers shall have interrupting ratings of 10,000 RMS symmetrical amperes at 208 volts.
   4. Manufacturer: Panelboards shall be Square D NQOD with Type FA or KA circuit breakers; Cutler-Hammer Pow-R-Line 1 with EHB circuit breakers; or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Panelboards shall be installed in Motor Control Center as indicated on the Drawings and in accordance with the manufacturer's instructions.

© December 2012 Kennedy/Jenks Consultants

3.02 MOUNTING HEIGHTS

A. Lighting and distribution panelboards shall be mounted inside the motor control center specified in Section 16920. The highest breaker operating handle shall not be higher than 72 inches above the floor.

3.03 FIELD TESTS

A. Insulation Resistance Tests: Perform insulation resistance tests on circuits to be energized with a line-to-neutral voltage of 120 volts or more. Make these tests after all equipment has been connected, except that equipment, which may be damaged by the test voltage, shall not be connected. Test the insulation with a 500 Vdc insulation resistance tester with a scale reading 100 megohms. The insulation resistance shall be 20 megohms or more. Submit results for review.

B. Grounding: Panelboard grounding shall conform to Section 16450.

C. Continuity: Panelboard circuits shall be tested for continuity prior to energizing. Continuity tests shall be conducted using a dc device with a bell or buzzer.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 16180

PROTECTIVE DEVICES AND SWITCHES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 16010 become a part of this Section as if repeated herein.

B. Work Included: Provide all necessary labor, tools and material to install circuit protective devices as shown on the Drawings and as described in these Specifications.

1.02 REFERENCE STANDARDS

A. American National Standards Institute (ANSI) Publication:
   1. Z55.1 Gray Finishes for Industrial Apparatus and Equipment

B. National Electrical Manufacturers Association (NEMA) Publications:
   1. ICS 3 Industrial Systems
   2. ICS 6 Enclosures for Industrial Controls and Systems
   3. 250 Type 1 Enclosures for Electrical Equipment (1,000 Volts Maximum)

C. Federal Specifications (FS):
   1. W-C-375 Circuit Breakers, Molded Case, Branch Circuit and Series Service, Series Trip
   2. W-F-1726 Class H Cartridge Fuses

D. Underwriters Laboratories (UL) Standards:
   1. 50 Electrical Cabinets and Boxes
   2. 198C Fuses, High-Interrupting-Capacity-Current Limiting Types
   3. 489 Molded Case Circuit Breakers and Enclosures
   4. 698 Industrial Control Equipment for Use in Hazardous (Classified) Locations
   5. 894 Switches for Use in Hazardous (Classified) Locations

E. National Fire Protection Association (NFPA) Publication:
   1. 70 National Electric Code

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Review category of the General Conditions and the submittal requirements of Section 16010.

1.04 LOCATIONS

A. Refer to Section 16010 for definitions of types of locations.

© December 2012 Kennedy/Jenks Consultants

PART 2 - PRODUCTS

2.01 DISCONNECT SWITCHES

A. Disconnect switches shall be heavy duty safety switches with the voltage ratings, current ratings, and number of poles as indicated by the Drawings. The switches shall be 600-volt type and horsepower rated. Auxiliary contacts shall be provided as indicated on the Drawings. Switches shall be Square D Type HD; Eaton; or equal.

B. Enclosures shall be as follows:
   1. Dry Locations: NEMA Type 1.
   2. Corrosive Locations: NEMA Type 4X.
   3. Wet Locations: NEMA Type 4.

C. Nameplates: Provide an engraved plastic nameplate for each disconnect switch identifying the motorized equipment it controls.

2.02 CONTROL STATIONS

A. Control station shall be of zinc electroplate and aluminum lacquer finish for use with control devices. Unit shall include a lockout on "STOP" button, neoprene covers for front operated pushbuttons, and a lockout on selector switch covers (locks two- or three-position handle in any position). Receptacle housing shall be copper-free aluminum. Insulation shall be diallyl phthalate (DAP) and contacts shall be brass. Rocker handles, push buttons and guards shall be Type 6/6 nylon. Shaft and shaft bushings shall be stainless steel. Control stations shall be Crouse-Hinds, Series DSD; Eaton Type PB-1; or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install units plumb within 1/8-inch of vertical, and in accordance with manufacturer's instructions. Make sure that fuse ratings are as shown on the Drawings.

3.02 FIELD TESTS

A. Insulation Resistance Tests: Perform insulation resistance tests on circuits to be energized with a line-to-neutral voltage of 120 volts or more. Make these tests after all equipment has been connected, except that equipment which may be damaged by the test voltage shall not be connected. Test the insulation with a 500-Vdc insulation resistance tester with a scale reading 100 megohms. The insulation resistance shall be 20 megohms or more. Submit results for review.

B. Continuity Tests: Perform circuit continuity tests from a low powered dc test source to operate a buzzer or bell. Tests shall be made prior to energizing the protected circuit.

© December 2012 Kennedy/Jenks Consultants

C. Operating Tests: Demonstrate that the protected circuit can be manually controlled by the installed equipment.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 16402

UNDERGROUND ELECTRICAL WORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 16010 become a part of this Section as if repeated herein.

1.02 APPLICABLE STANDARDS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. Federal Specifications:
      a. RR-F-621C Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole
      b. RR-G-661D Grating, Metal, Bar Type (Floor, except for Naval Vessels)
   2. American Concrete Institute (ACI) Publication:
      a. 318 Building Code Requirements for Reinforced Concrete
   3. ASTM International (ASTM) Publications:
      a. A36 Structural Steel
      b. A153 Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
      c. A615 Deformed and Plain Billet - Steel Bars for Concrete Reinforcement
      d. C33 Concrete Aggregates
      e. C139 Concrete Masonry Units for Construction of Catch Basins and Manholes, Specification for
      f. C150 Portland Cement
      g. C478 Precast Reinforced Concrete Manhole Sections, Specification for
      h. C857 Recommended Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
      i. C858 Standard Specification for Underground Precast Concrete Utility Structures
   4. American Association of State Highway and Transportation Officials (AASHTO) Publication:
      a. HB-13 Standard Specifications for Highway Bridges
   5. American National Standard Institute (ANSI) Publication:
      a. C2 National Electrical Safety Code
   6. National Fire Protection Association (NFPA) Publication:
      a. 70 National Electrical Code (NEC)
   7. State of California Public Utilities Commission (Cal. PUC) Publication:
      a. G.O.128 Construction of Underground Electric Supply and Communication System, Rule for

© December 2012 Kennedy/Jenks Consultants

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Review category of the General Conditions and the submittal requirements of Section 16010.

B. Manufacturer's Data and Shop Drawings:
   1. Handhole: Include a table of dimensions which shows proposed size of each handhole.
   2. Handhole Frame and Cover
   3. Sealing Material for Precast Handhole Joints

C. Certificates:
   1. Test Reports: Submit for approval 30 days before the materials are used, copies of laboratory test reports for the following:
      a. Arc-proofing test for cable fireproofing materials.

PART 2 - PRODUCTS

2.01 GENERAL

A. Materials and equipment shall conform to the respective specifications and standards and to the specifications herein. Electrical ratings shall be as indicated.

B. Conduit: Provide per Section 16110.

C. Wire and Cable: Provide per Section 16120 and Section 16124.

2.02 HANDHOLES

A. Provide handholes of reinforced precast concrete, or injection molded composite plastic material. Handholes shall include a base, a body, extensions, and a cover. Handholes with a perimeter of 10 feet or more (e.g., 3 feet by 2 feet) shall have both pulling irons and cable racks. All hardware shall be stainless steel, or hot-dip galvanized after fabrication; cable racking hardware, however, shall be non-metallic and corrosion-resistant. If no handhole size is shown on the Drawings, size units per NEC. Structure shall be fabricated in accordance with ACI 318.

B. Aggregate used in pre-cast handholes shall conform to the specifications given in ASTM C33.

C. Cement used shall be Type 11, low alkali Portland cement and shall meet ASTM C150, Type 11.

D. Reinforcing bars shall be intermediate grade billet steel conforming to ASTM A615.

E. Design wheel loads for handhole covers and roof structures shall be HS 20-44 as given in AASHTO HB-13.

© December 2012 Kennedy/Jenks Consultants

PART 3 - EXECUTION

3.01 TRENCHING, BACKFILL, AND COMPACTION

A. See Section 02301.

3.02 WIRE AND CABLE INSTALLATION

A. See Section 16120 and Section 16124.

3.03 UNDERGROUND RACEWAYS WITH CONCRETE ENCASEMENT

A. All underground raceways shall be encased in concrete unless otherwise specifically shown otherwise on the Drawings.
   1. Concrete encasement shall be minimum of 3 inches around outer walls of raceways and minimum of 2 inches between raceways. Conduits shall be PVC Type EB.
   2. Concrete shall be Portland Cement type with 4 sacks cement per cubic yard of concrete, maximum coarse aggregate size of 3/8-inches and shall have minimum strength of 2,000 psi after 28 days. Amount of water shall not exceed slump required for placement. Five pounds red lead oxide shall be added per cubic yard of concrete for medium voltage raceway encasement only.
   3. Where possible, underground raceways shall slope toward pullboxes, etc., at minimum rate of 3 inches per 100 feet unless indicated otherwise on Drawings. Raceway entrances in handholes, etc., shall be by means of bell ends and shall be sealed against entry of silt, debris, rodents, etc., into raceways.
   4. Top of concrete encasement shall be minimum of 24 inches below grade.
   5. Minimum radius of all horizontal bends in underground duct banks shall be 10 times the diameter of the duct. Bends shall be formed of factory made sweeps or continuous assembly of bend segments or curved segments, except that polyvinyl chloride conduits may be field formed. Minimum radius of all vertical bends in underground raceways shall be ten times nominal size of conduit. Vertical bends shall be made of rigid steel or permanently coated aluminum conduit.
   6. Underground raceways within roadways shall be run parallel or perpendicular to road centerline.
   7. Pull wires left in underground raceways shall be 1/8-inch nylon rope or 3/16-inch polypropylene.
   8. Terminate conduits in end-bells where duct lines enter handholes. Provide structural support for concrete encased duct banks at the point where they terminate. Separators shall be of precast concrete, high impact polystyrene, steel, or any combination of these. Stagger the joints of the conduits by rows and layers so as to provide a duct line having the maximum strength. During construction, protect partially completed duct lines from the entrance of debris such as mud, sand and dirt by means of suitable conduit plugs. As each section of a duct line is completed, draw a brush through having the diameter of the duct, and having stiff bristles until the conduit is clear of all particles of earth, sand, and gravel; then immediately install conduit plugs.

© December 2012 Kennedy/Jenks Consultants

B. Connections to Existing Ducts: Where connections to existing duct lines are indicated, excavate the lines to the maximum depth necessary. Cut off the lines and remove loose concrete from the conduits before new concrete encased ducts are installed. Provide a reinforced concrete collar, poured monolithically with the new duct line, to take the shear at the joint of the duct lines. Remove existing cables that constitute interference with the work. Abandon in place those used ducts and cables that do not interfere with the work.

C. Removal of Ducts: Where duct lines are removed from existing manholes, close the openings to waterproof the manhole. Chip out the wall opening to provide a key for the new section of wall.

3.04 UNDERGROUND RACEWAYS WITHOUT CONCRETE ENCASEMENT

A. Provide raceways without concrete encasement only if specifically shown on the Drawings, otherwise, provide concrete encasement as above.

B. Provide sand backfill three inches all around the raceway.

C. Construct raceways per the applicable provisions above for underground raceways with concrete encasement.

3.05 HANDHOLES

A. Provide manholes and handholes complete with all accessories, as indicated provide additional handholes as needed so that the spacing between handholes does not exceed 300 feet. Identify each casting by having the manufacturer's name and address cast into an interior face or permanently attached thereto. Stencil manhole number in the neck with 3-inch-high yellow letters.

B. Handhole or Concrete Pullbox Grounding: Ground rods installed in electrical distribution system handholes or concrete pullboxes shall be properly connected to the cable shielding, metallic sheath, and armor at each cable joint or splice by means of No. 4 AWG or equivalent braided tinned copper wire. Connections to metallic cable sheaths shall be by means of tinned terminals soldered to ground wires and to cable sheaths. Care shall be taken in soldering not to damage metallic cable sheaths or shields. Ground rods shall be protected with a double wrapping of pressure-sensitive plastic tape for a distance of 2 inches above and 6 inches below concrete penetrations. Ground wires shall be protected with a double wrapping of pressure-sensitive plastic tape for a distance of 2 inches above and 6 inches below concrete penetrations. Ground wires shall be neatly and firmly attached to handhole walls and the amount of exposed bare wire shall be held to a minimum.

C. Installation of Cable in Handholes: Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths. Form all cables to closely parallel walls, not to interfere with duct entrances, and support on brackets and cable insulators at a maximum of 18 inches. In existing manholes, handholes and vaults where new ducts are to be terminated or where new cables are to be installed, provide cable supports and grounding as required for a neat and workmanlike installation with all cables

© December 2012 Kennedy/Jenks Consultants

properly arranged and supported. Support cable splices in underground structures by racks, leaving top space open for future cables, except as otherwise indicated for existing installations. Provide one spare three-insulator rack arm for each cable rack in each underground structure. Provide additional cable racks in each existing underground structure through which new cable is run.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 16405

SWITCHBOARD

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 16010 become a part of this Section as if repeated herein.

B. Related Sections:
   1. Section 01040: Coordination and Project Requirements
   2. Section 01190: Seismic Requirements

1.02 APPLICABLE STANDARDS

A. American National Standard Institute (ANSI) Publications:
   1. C57.13 Requirements for Instrument Transformers

B. International Electrical Testing Association (NETA) Publications:
   1. ATS Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems

C. National Electrical Manufacturers Association (NEMA) Publication:
   1. PB2 Deadfront Distribution Switchboards

D. National Fire Protection Association (NFPA) Publication:
   1. 70 National Electrical Code (NEC)

E. Underwriters Laboratories (UL) Publication:
   1. 891 Deadfront Electrical Switchboards

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Review category of the General Conditions and the submittal requirements of Section 16010.

B. Shop Drawings: Submit shop drawings which shall include: complete layout of equipment and devices; front and end elevations and floor plan to scale with major dimensions; structural details and overall weights; complete nameplate data and ratings of all devices; material, sizes, locations, and short circuit bracing rating of all buses; nameplate schedules; and circuit breaker time-current curves.

C. Seismic Anchorage Requirements: Submit in accordance with Section 01300.
   1. Submit signed and sealed structural calculations and detailed drawings for the attachments and anchorage to the structure of the equipment and appurtenances in this section. Calculations shall conform to the requirements of Section 01190.

© December 2012 Kennedy/Jenks Consultants

2. Submit certification from the manufacturer that the equipment is capable of resisting seismic loads. Loading shall be as described in Section 01190.

D. Factory Test Report: Include the results of the applicable production tests as required in NEMA PB2.

E. Manuals: Provide in conformance with Section 16010.

PART 2 - PRODUCTS

2.01 SWITCHBOARD

A. Standards: Design, build and test the switchboard in accordance with applicable portions of NEMA PB2 and UL 891, and comply with the NFPA 70.

B. Switchboard shall be rated 277/480 volts, 2000 amperes, 3-phase, 60 Hz as shown on the Drawings.

C. Structure: The switchboard shall be a NEMA 1 completely self-supporting structure of the required number of vertical sections bolted together to form one metal-enclosed switchboard approximately 90 inches high. Sides, top and rear covers shall be code gauge steel, bolted to the switchboard structure. The frame structure members shall be die-formed 12-gauge steel bolted together and reinforced at external corners with rugged gussets both internal and external to the structure members. The switchboard frame shall be suitable for use as floor sills. Structure shall be for indoor use. Switchboard shall be constructed so that when installed on the concrete pad (see Part 3) the unit complies with the NFPA 70 6'-6" rule. Access shall be from the front.

D. Devices: The switchboard shall include all the devices shown on the Drawings. Devices with operating handles or control knobs or switches shall have the handles, knobs or switches externally accessible without opening any inner doors or covers.

E. Buses:
1. Main buses shall be triplated copper, supported with high impact non-tracking insulation material, and braced to withstand mechanical forces exerted during short circuit conditions of 65,000 RMS symmetrical amperes. The continuous current density of the buses shall not exceed 1,000 amperes per square inch of cross section for copper. Continuous current ratings shall be as shown on the Drawings. Bus arrangement shall be A-B-C (left-to-right, top-to-bottom, front-to-rear) throughout.
2. Bus bar shall be insulated in main and feeder sections.
3. Ground bus shall be copper, not less than 1/4-square-inch in cross section. Secure to the vertical section.
4. Neutral bus shall be copper and not less than 50% of the rating of the main bus. Bus shall be insulated from the structure. Provide removable link between neutral and ground bus.

© December 2012 Kennedy/Jenks Consultants

F. Wiring: Factory install all wiring within the switchboard and neatly cable and secure to supporting surfaces. Provide terminal lugs for all external wiring. Small wire shall be Type SIS.

G. Ambient Temperature: Base device ratings on operation in an ambient temperature not exceeding 40°C.

H. Connections: Cable connectors and device lugs shall be compression type and suitable for use with copper or aluminum cables.

I. Hardware: All hardware used on conductors shall have high tensile strength and suitable protective finish.

J. Handling Means: Provide the switchboard with adequate lifting means and make switchboard capable of being rolled or moved into position and bolted directly to the floor without the use of floor sills.

K. Finish: Chemically clean and treat all steel surfaces, providing a bond between paint and metal surfaces to help prevent the entrance of moisture and the formation of rust under the paint film. Finish the switchboard exterior with ANSI 61 light gray paint, not less than 2 mils thick.

L. Provide individually mounted main and feeder circuit breakers.

M. Main Circuit Breaker:
   1. Insulated or molded case type, 3-pole, manually operated, 600 Vac, 100% rated, 65,000 RMS symmetrical amperes interrupting capacity at 480 volts. Frame and trip ratings shall be as shown on the Drawings. It shall have an integral current sensor in each pole and an integral solid state self-powering programmable trip unit with 3 fault indicators. The trip unit shall provide the following tripping characteristics, all adjustable:
      a. Sensor Rating.
      b. Sensor Setting Range.
      c. Long Time Delay.
      d. Short Time Delay.
      e. Ground fault with ground fault delay.
   2. Manufacturer: Eaton Magnum MDS with Digitrip RMS trip units; Square D PE with Micrologic Trip; or equal.

N. Feeder Circuit Breakers:
   1. Insulated or molded case type, 3-pole, manually operated, 600 Vac, 100% rated, 65,000 RMS symmetrical amperes interrupting capacity at 480 volts. Each breaker shall have an integral current sensor in each pole and an integral solid state self-powering programmable trip unit with 3 fault indicators. The trip unit shall provide the following tripping characteristics, all adjustable:
      a. Sensor Rating.
      b Sensor Setting Range.
      c. Long Time Delay.
      d. Short Time Delay.
      e. Instantaneous.

© December 2012 Kennedy/Jenks Consultants

2. Manufacturer: Ground Fault: Eaton JD, KD and RD Series with Digitrip RMS trip units; Square D PE with Micrologic Trip; or equal.

O. Current Transformers: Provide three current transformers in accordance with ANSI C57.11, 600 volt, 10 kV BIL, with ANSI metering accuracy class of 0.3 at burden B-0.1 and continuous thermal rating factor of 2.0.

P. Utility Metering Sections: Provide pull section for underground service entrance with sealable cover, barrier, and cable terminating facilities, bus or cables from pull section landing lugs to service section, provisions for mounting utility current transformers, and sockets for utility meters, all as shown on the drawings and as required by the utility company.

Q. Surge Suppression (SPD):
1. The transient voltage sure suppression system (TVSS) shall be designed to protect all AC electrical circuits and connected equipment from destructive, damaging or disruptive effects of lightning induced transients normal utility load switching activities and internal generated transients.
2. The suppression device shall be parallel configured, solid state, voltage clamping components demonstrating threshold suppression characteristics. Clamping components shall be metal oxide varistors. All suppression devices shall be encapsulated and mounted in a NEMA 4 enclosure.
3. The TVSS shall have all normal mode (L-L and L-N) and common mode (L-G and N-G) circuit paths protected with suppression components. Each mode shall be rated for minimum 130/65 kA.
4. The TVSS shall be rated for 480/277 V systems.
5. The TVSS shall include a remote alarm form C contact.
6. The TVSS for the facility service entrance shall be installed in accordance with the manufacturer's recommendations.
7. The TVSS manufacturer shall provide a ten-year warranty.
8. The TVSS shall be manufactured by Liebert; Accuvor ACV; or equal.

R. Switchboards shall be listed and labeled as service entrance equipment if the switchboard is used as service entrance.

S. Ground Connections: Provide binding post type lugs for attachment of ground cables to sheet steel enclosures. Lugs shall be of the binding post type, shall accommodate a range of stranded copper cable from #2 AWG to #2/0 AWG, shall have a 1/2 to 13 NC stud size and shall be attached to enclosures using a threaded or tapped boss welded to the sheet steel. These lugs shall be Burndy Type KC, Anderson Type KS, or equal. Provide bolted pressure connectors for all other ground connections. Provide one lug for each outgoing circuit.

T. Nameplates: Nameplates shall be provided for each control component. The nameplate shall be phenolic, black background with white lettering. All nameplates shall be fastened by stainless steel screws.

U. Enclosure: Switchboard shall be housed in a NEMA 3R non-walk-in enclosure.

V. Switchboard shall be Eaton Powerline Series, Square D I-Line Series, or equal.

© December 2012 Kennedy/Jenks Consultants

PART 3 - EXECUTION

3.01 CONDUIT AND WIRE INSTALLATION

A. Install conduit and wire in conformance with Sections 16110 and 16120.

3.02 SWITCHBOARD INSTALLATION

A. Mount the switchboard and anchor to a 3-inch concrete pad. Install level and plumb. Doors shall open and close freely and all manually operated device handles and controls shall operate properly. Repair any damage to the enclosure, components or finish to the satisfaction of the Engineer. Clean switchgear inside and out and all nameplates.

B. Lace conductors to resist short circuit forces. Follow manufacturer's recommendations.

3.03 GROUNDING INSTALLATION

A. Ground in accordance with Section 16450.

3.04 FIELD TESTING

A. Test switchboard and circuit breakers in accordance with NETA Publication ATS Sections 8.1, 8.6, 8.10, and 8.11.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 16450

ELECTRICAL GROUNDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 16010 become a part of this Section as if repeated herein.

B. Work Included: Furnish all labor, material, equipment, tools and services necessary for the installation, connection and testing of all grounding as specified herein and as shown on the Drawings.

1.02 REFERENCE STANDARD

A. ASTM International (ASTM) Publication:
   1. B228 Copper Clad Steel Conductors Specification
   2. D178 Specifications for Rubber Insulating Matting

B. National Fire Protection Association (NEPA):
   1. 70 National Electric Code (NEC)

C. International Electrical Testing Association (NETA) Publication:
   1. ATS Acceptance Testing Specifications for Electrical Equipment for Power Systems

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Information category of the General Conditions and the submittal requirements of Section 16010.

PART 2 - PRODUCTS

2.01 GENERAL

A. The grounding systems shall consist of the ground rods, grounding conductors, ground bus, ground fittings and clamps, and bonding conductors to water piping and structural steel as shown on the Drawings. One system shown provides service and separately derived system grounds. A second system is an electronic ground system to provide for the discharge of static electricity.

2.02 SYSTEM COMPONENTS

A. Ground Rods: Ground rods shall be cone pointed copper clad Grade 40 HS steel rods conforming to ASTM B228. The welded copper encased steel rod shall have a

© December 2012 Kennedy/Jenks Consultants

conductivity of not less than 27% of pure copper. Rods shall be not less than ¾-inch in diameter and 10 feet long, unless otherwise indicated. Rods longer than 10 feet shall be made up of 8-foot units joined together with threaded couplings. The manufacturer's trademark shall be stamped near the top.

B. Ground Conductors: Buried conductors shall be medium-hard drawn bare copper; other conductors shall be soft drawn copper. Sizes over No. 6 AWG shall be stranded. Coat all ground connections except the exothermic welds with electrical joint compound, non-petroleum type, UL listed for copper and aluminum applications.

C. Ground Connections: Connection to ground rods and buried connections shall be by exothermic weld. Lugs for attachment of cables to steel enclosures shall be of the binding post type with a 1/2-13NC stud. Each post shall accommodate cables from #4 AWG to #2/0 AWG.

D. Ground Rod Boxes: Boxes shall be a 9-inch-diameter precast concrete unit with hot-dip galvanized traffic covers. Units shall be 12 inches deep. Covers shall be embossed with the wording "Ground Rod."

E. Ground Bus: Ground bus shall be a high conductivity copper alloy strap measuring 3/16-inch by ¾-inch. Bus shall be predrilled and tapped to accept 8-32 brass machine screws on 12-inch centers.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Ground all equipment for which a ground connection is required per NEC whether or not the ground connection is specifically shown on the Drawings.

B. Provide a ground rod box for each ground rod so as to permit ready access for the connection and/or removal of any pressure connectors to facilitate testing.

C. Where ground rods must be driven to depths over 8 feet, increase rod diameter used, sufficiently to prevent the rod from bending or being damaged.

D. Bond metallic water piping at its entrance into each building. Ground separately derived electrical system neutrals to the metallic water piping in addition to the system driven ground, per NEC requirements.

E. Provide a ground wire in every conduit carrying a circuit of over 150 volts to ground.

F. Make embedded or buried ground connections, taps and splices with exothermic welds. Coat ground connections.

G. Effectively bond structural steel for buildings to the grounding system using exothermic welds.

© December 2012 Kennedy/Jenks Consultants

H. Provide UFER grounding system at main switchboard.

3.02 TESTING

A. Perform testing per NETA Standard ATS paragraph 7.3. Test methods shall conform to NETA Standard ATS using the three electrode method for small systems. Conduct tests only after a period of not less than 48 hours of dry weather.

B. Furnish to the Engineer a test report with recorded data of each ground rod location.

C. Make measurements in conformance with manufacturer's instructions.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 16460

DRY TYPE TRANSFORMERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 16010 become a part of this Section as if repeated herein.

1.02 REFERENCE STANDARDS

A. American National Standards Institute (ANSI) Publications:
   1. 70 National Electrical Code
   2. C2 National Electrical Safety Code

B. National Electrical Manufacturers Association (NEMA) Publication:
   1. ST 20 Dry-Type Transformers for General Applications

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Review category of the General Conditions and the submittal requirements of Section 16010.

B. Shop Drawings: Submit manufacturer's name and data as required:
   1. Nameplate Data:
      a. kVA rating.
      b. Nominal primary voltage.
      c. Tap voltages.
      d. Nominal secondary voltage.
      e. Percent impedance.
      f. Weight.
      g. Physical dimensions and mounting requirements.
   2. Single Submittal: A single complete submittal is required for all products covered by this Section.

1.04 FACTORY TESTING

A. Tests on transformers shall include the manufacturer's standard tests, including winding resistance, ratio, polarity, phase relation, no-load loss, impedance, full load losses, and dielectric tests. Certified copies shall show compliance with all referenced standards.

1.05 LOCATIONS

A. Refer to Section 16010 for definitions of types of locations.

© December 2012 Kennedy/Jenks Consultants

PART 2 - PRODUCTS

2.01 DRY TYPE TRANSFORMERS

A. General Purpose: Transformers for supplying lighting and small power loads shall be dry type, general purpose, two winding, 60-Hertz, copper windings, temperature rise not exceeding 80°C under full load in an ambient of 40°C with Class H, 220°C insulation. Capacity ratings and voltages shall be as shown on the Drawings. Transformers shall comply with all applicable provisions of NEMA Standard ST20 and shall have NEMA Standard taps. Transformers shall be indoor type with sound levels 5 dB below NEMA Standard or outdoor type with NEMA Standard sound levels. Terminal compartment shall have a temperature rise not to exceed 35°C. Outdoor units shall be equipped with weather shields. Transformers 30 KVA and larger, 3-phase, shall be energy efficient type.

PART 3 - EXECUTION

3.01 TRANSFORMER INSTALLATION

A. Transformers shall be installed in the Motor Control Center as indicated on the Drawings.

B. Transformers shall be connected with flexible, liquid-tight metallic conduit to prevent the transmission of sound through the conduit system. Potted non-ventilated types below 30 KVA shall be installed on resilient vibration-isolating mountings.

C. Transformer grounding shall be sized in accordance with NEC requirements for separately derived systems and shall be connected to the nearest cold water pipe or, if available, structural steel member. Ground rod and connections shall be as detailed in Section 16450. Provide conduit and wire for both the ground rod and cold water pipe or structural steel member connections.

D. Lace secondary conductors to resist short circuit forces. Follow manufacturer's recommendations.

3.02 FIELD TESTS

A. Test per NETA Paragraph 7.2. Submit results for review.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 16920

MOTOR CONTROL CENTER

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 16010 become a part of this Section as if repeated herein.

B. Work Included: Provide a motor control center, complete, at the location shown on the Drawings.

C. Related Sections:
1. Section 01040: Coordination and Project Requirements
2. Section 01190: Seismic Requirements
3. Section 16140: Dry Type Transformer
4. Section 16160: Panelboards
5. Section 16924: Adjustable Frequency Drives (AFD)

1.02 REFERENCE STANDARDS

A. National Electrical Manufacturers Association (NEMA) Publications:
1. ICS 1 General Standards for Industrial Controls and Systems
2. ICS 2 Standards for Industrial Control Devices, Controllers and Assemblies
3. ICS 4 Terminal Blocks for Industrial Control Equipment and Systems
4. ICS 6 Enclosures for Industrial Controls and Systems

B. International Electrical Testing Association (NETA) Publication:
1. ATS Acceptance Testing Specifications for Electrical Power and Distribution Equipment and Systems

C. Underwriters Laboratories (UL) Publication:
1. UL 845 Motor Control Centers

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Review category of the General Conditions and the submittal requirements of Section 16010.

B. Shop Drawings: Submit shop drawings as specified under "Submittals" in Section 16010 and include the following: a wiring diagram and an elementary control diagram for each unit; an overall connection diagram for the motor control center; a dimensioned outline drawing to scale showing space for conduits, etc.; complete identification of all electrical components in the control center and their interconnections within the motor control center; all connections to external equipment and controls; bus material and ratings; wire marking scheme; and method of installation to resist seismic forces. Where unit arrangement or wiring

© December 2012 Kennedy/Jenks Consultants

deviates in any way from that shown on the Drawings, provide a complete record and explanation of such deviations.

C. Seismic Anchorage Requirements: Submit in accordance with Section 01300.
   1. Submit signed and sealed structural calculations and detailed drawings for the attachments and anchorage to the structure of the equipment and appurtenances in this section. Calculations shall conform to the requirements of Section 01190.
   2. Submit certification from the manufacturer that the equipment is capable of resisting seismic loads. Loading shall be as described in Section 01190.

D. Arrange submissions in a logical manner and use the device abbreviation identifications and equipment names as shown on the Drawings, in order to expedite and facilitate review by the Engineer.

E. Spare Parts List: Submit a spare parts list showing recommended parts and quantities as well as complete ordering information for replacement components. Provide instruction books for special control devices and special equipment installed in the control center. Submit these to the Engineer prior to installation of the equipment.

F. Manuals: Provide manuals as specified in Section 16010.

PART 2 - PRODUCTS

2.01 MOTOR CONTROL CENTER

A. General: The motor control center shall be a free-standing, completely metal enclosed, dead front, dead rear, grouped motor control center arranged as shown on the Drawings. The motor control center shall be suitable for use on a 480Y/277-volt, 3-phase, 4-wire radial system grounded at the supply, with a short circuit capacity of up to 42,000 amperes without a neutral conductor in the motor control center. The motor control center shall conform to all applicable requirements of current NEMA Standards ICS 1 and ICS 2 and be UL listed. Each MCC section shall bear the UL label. Equipment shall be assembled into standardized drawout units. The motor control center shall be NEMA Class II, Type B construction.

B. Structure and Arrangement:
   1. The motor control center shall consist of NEMA 1 vertical free-standing sections, each at least 20 inches wide, 20 inches deep and 90 inches high, and containing not more than six space units. A space unit shall be the space required for a Size 1 combination starter together with associated control transformer. The motor control center shall be suitable for floor mounting against a wall. Provide a horizontal wireway 6 inches high at the bottom of the motor control center, and a vertical wireway 4 inches wide in each 20-inch-wide structure. Coordinate horizontal wireway dimensions with that of the housekeeping concrete pad (see Part 3) to ensure conformance with the NEC 6'6" rule (NEC 380-8).
   2. Each cubicle shall have an individual door with concealed hinges. Doors shall be part of the structure, shall be readily interchangeable, and shall be

© December 2012 Kennedy/Jenks Consultants

interlocked so that the unit power is off before the door can be opened; provide door hinges on the side of the cubicle which ensures compliance with the 30-inch rule in NEC Paragraph 110-16(a). In addition, each unit shall be padlockable in the off position and in the tilted-out disconnected position.

3. All components shall be within individual control cubicles, except as noted. Control components shall be as specified in Section 16955.
4. "Future" spaces shall be cubicles arranged for future addition of the door and unit of the size indicated on the Drawings. The vertical bus shall extend to but not be exposed within "future" spaces.
5. Arrangement and grouping of cubicles shall be substantially as shown on the Drawings. Avoid deviations from the arrangement shown, if possible; otherwise, submit changes to the Engineer for review. Provide for future extension of the motor control center as shown on the Drawings. The number of vertical free-standing sections shown on the Drawings is the minimum required. If additional sections are needed to house all equipment, including relays and timers, indicated to be located within the motor control center:
   a. Provide such sections at no additional cost to the Owner, and
   b. Provide a sufficient number of additional sections such that the total number of future spaces is at least the number shown on the Drawings or 15% of the total motor control center size, whichever is smaller.

C. Buses:
1. Each motor control section shall have a main 3-phase, 3-wire, horizontal insulated bus rated 600 amperes. Each vertical section shall have a rigid vertical insulated bus rated not less than 300 amperes and extending to all space units; the bus in vertical sections containing either main lugs or main breakers shall have the same ratings as the horizontal bus. Brace buses for 65,000 amperes symmetrical.
2. Provide the motor control center with a ground bus not smaller than 1/4-square-inch in cross-sectional area, copper equivalent, extending to all sections. Provide a solderless connector for copper cable at each end of each ground bus, sized for the grounding conductor shown on the Drawings. All solderless connectors shall be NEMA Standard.
3. All phase and ground buses shall be of copper with silverplated joints and connections, or shall be of aluminum completely tin-plated. If aluminum buses are used, take special precautions at all joints to offset the effects of creep of the aluminum and to minimize effects of contact between dissimilar metals. All terminal lugs shall be suitable for copper conductors.

D. Wiring:
1. All wiring entirely within the motor control center shall be completely factory installed and shall be thermoplastic machine tool wiring rated 600 volts.
2. Provide a control terminal block with identified terminals in each cubicle for external control wiring associated with that cubicle. Terminal blocks, in cubicles and on doors, shall be as specified elsewhere herein under Motor Control Units.
3. Connections of wiring from devices on fixed surfaces to door-mounted devices shall have hinge loops of extra flexible wires securely fastened at each end to permit opening and closing the door without "working" the terminations.
4. Each control or feeder unit in the motor control sections shall be connected to the vertical bus by means of self-aligning, free-floating, silverplated copper alloy, plug-in pressure stab units. All components shall be mounted on a

© December 2012 Kennedy/Jenks Consultants

removable pan secured by quick opening fasteners and aligned by means of guide rails. Units shall be interchangeable.

E. Motor Control Units:
   1. General: Each unit shall consist of a motor circuit protector and a magnetic starter. The combination shall have an interrupting rating of not less than 65,000 amperes symmetrical at 480 volts. Each unit shall have a control terminal board and other components as shown on the Drawings.
   2. Motor circuit protector shall be molded case quick-make, quick-break with magnetic trip only. The motor circuit protector shall be rated 600 volts with adjustable trip settings and interrupting rating of not less than 65,000 RMS symmetrical amperes. The motor circuit protector shall have the rating and trip setting as shown on the Drawings and shall be UL listed. Motor circuit protector shall be Square D MagGard, Eaton HMCP, or equal.
   3. Starter shall be magnetic air-break type complying with NEMA Standards, no smaller than Size 1, each with three ambient compensated type overload elements with externally operable manual reset. Overload relays shall have a field adjustable trip of 85% to 115% of heater rating. Size the overload heaters to protect the motor actually installed. For submersible motors, provide fast-acting overload relays if required by the motor manufacturer. Provide two spare auxiliary contacts, one normally open and one normally closed.
   4. Control power transformers shall be dry type machine tool transformers. These shall be Hevi-Duty SBE Series, Square D Class 9070, or equal. Sizes shall be as required for the inrush and continuous current requirements of the circuits. Primary windings shall be fused in both phases. Secondaries shall be fused and grounded.
   5. Pushbuttons, selector switches, indicating lights, control relays, elapsed time meters, and timing relays shall be as specified in Section 16955.
   6. Terminal blocks shall be rated 600 volts and at least 30 amps. These shall be either the box lug type or isolating switch type, as required. Any circuit within the unit which can be energized when the unit power is off shall have isolating switch type terminals. Provide terminals for all external connections as shown on the Drawings, and, in addition, at least 15% spare terminals. Permanently identify each terminal with the same number as the wire being terminated. Terminal blocks shall conform to NEMA ICS4 and shall be Buchanan NQO, Square D Class 9080, or equal.
   7. Reduced Voltage Starter:
      a. General: Unit shall be solid state soft start type with adjustable current features. Structure shall be 90-inches high by 36-inches wide by 20-inches deep and shall be a part of the NEMA 3 enclosure having a 28-inch overall depth with gasketed front doors. The starter shall be rated as shown on the Drawings in a 40°C ambient temperature environment. Unit shall operate from a 480-volt, 3-phase, 60-Hertz system. Starter shall be equipped with both bypass and series contactors to effectively shutdown the solid state starting components once the controlled motor is up to speed. The starter shall contain a 120-volt, 350 VA minimum control power transformer to power motor space heaters, the starter contactors, and the logic control module. Unit shall have a 1.15 service factor. Unit shall be rated for use without an isolation transformer; if such transformer is recommended by the starter manufacturer, provide the transformer and wiring at no additional cost to the Owner.

© December 2012 Kennedy/Jenks Consultants

b. Power Module: Shall be a six SCR unit having two SCRs per phase. Units utilizing a single SCR and a diode combination per phase are unacceptable. SCRs shall have 1,500-volt PIV ratings with the 3-phase module capable of running at 444 amperes at 55°C continuous. The derated 400-HP module shall be capable of 250% overload for 1 minute, or 600% for 20 seconds. The module shall be protected from voltage transients with metal oxide varistors (MOVs) set to clip at 900 volts. Each SCR shall be equipped with over temperature switches which are wired in series to effectively prevent single phase, phase reversal, or overload operation of the power module. RC snubber circuits shall protect against (dv/dt) occurrences.

c. Logic Module: Unit shall be line noise immune, with start/stop circuits providing filters blocking transients of 12 milliseconds or less. Unit shall provide digital sustained hard gate pulse firing of the SCRs to prevent a high rate of current rise (di/dt). Outputs shall be provided for controller over current, SCR failure and end of current limit. Adjustments shall be provided for starting current, 100% to 400%, the same for current limit. The current ramp 2 to 30 seconds. Diagnostic LED lights shall be provided to indicate various failure conditions., and over or under voltage conditions. Control operation shall be effective over a +10% to -15% range.

F. Main and feeder circuit breakers shall be thermal magnetic and of the size shown on the Drawings. Interrupting rating shall be at least 65,000 amperes symmetrical at 480 volts.

G. For adjustable frequency drives, refer to Section 16924.

H. Lighting Transformer and Panelboard:
1. When indicated on the Drawings, provide a lighting transformer and panelboard built into the motor control center.
2. Lighting transformer shall be as specified in Section 16460.
3. Lighting panelboard shall be as specified in Section 16160, except that the boxes need not be hot-dip galvanized.

I. Provide an air conditioning unit for the motor control center. Air conditioner shall be rated at 120 Vac and shall be sized to provide adequate cooling of AFDs and motor control center in an ambient temperature of 110 degrees F.

J. Nameplates and Identification:
1. Provide the motor control center with manufacturer's nameplate which indicates voltage, phases, number of wires, frequency, and bus ratings.
2. Provide the motor control center with an identifying nameplate inscribed as shown on the Drawings.
3. On each cubicle door in the control center, provide an identifying nameplate inscribed as shown on the Drawings.
4. In those cases where integral legend plates cannot be used, install additional special nameplates on doors to identify selector switches, pushbuttons or other devices, as required by the Drawings or as specified herein. All integral legend plates shall be large size and shall be uniform for all control centers.
5. Identify all internal wiring using a system consistent with the terminal identification system. Each wire at each terminal shall have attached to it

© December 2012 Kennedy/Jenks Consultants

permanent means of identification made of moisture resistant non-fading material.

K. Finish: Paint finish shall be ANSI 61 and the dry film thickness shall be not less than 3 mils.

L. Manufacturer:
   1. The motor control center shall be standard catalog equipment modified as shown on the Drawings or specified herein as normally manufactured by the specified manufacturer.
   2. The motor control center shall be as manufactured by Eaton, Allen-Bradley, Square D, or equal. All shall be factory assembled, except for shipping splits.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install the motor control center level and plumb, and secure to a 3-inch-high housekeeping concrete pad in conformance with the favorably reviewed seismic mounting method. Doors shall swing freely and close tightly.

B. Carefully repair any damage to the structure, components or finish to the satisfaction of the Engineer. Clean all nameplates.

C. Exercise care at all times after installation of motor control center to keep foreign matter, dust, dirt, debris, and moisture out of the control center.

D. Lace incoming and outgoing power conductors to resist short circuit forces. Follow manufacturer's instructions.

3.02 FIELD TEST

A. Test the motor control center per NETA Paragraph 7.16.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 16924

ADJUSTABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Applicable provisions of Section 16010 become a part of this Section as if repeated herein.

B. Work Included: Provide an adjustable frequency drive (AFD) controller for each of those motors so shown on the Drawings.

C. Related Work Specified Elsewhere:
   1. Section 01040: Coordination and Project Requirements
   2. Section 01190: Seismic Requirements
   3. Section 11002: Electric Motor Drives
   4. Section 16924: Motor Control Center
   5. Section 16955: Control Devices

1.02 REFERENCE STANDARDS

A. National Electrical Manufacturers Association (NEMA) Publications:
   1. ICS 1 General Standards for Industrial Controls and Systems
   2. ICS 2 Standards for Industrial Control Devices, Controllers and Assemblies
   3. ICS 3 Industrial Systems
   4. ICS 3.1 Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-speed Drive Systems
   5 ICS 4 Terminal Blocks for Industrial Control Equipment and Systems
   6. ICS 6 Enclosures for Industrial Controls and Systems

B. American National Standards Institute (ANSI) Publication:
   1. C37.90 Relays and Relay Systems Associated with Electric Power Apparatus

C. Institute of Electrical and Electronic Engineers (IEEE) Publication:
   1. 519 Harmonic Control and Reactive Compensation of Static Power Converters

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Review category of the General Conditions and the submittal requirements of Section 16010.

B. Submit shop drawings, including: complete elementary (ladder) diagrams; comprehensive interconnection diagrams for AFD, motor, external control devices and controllers, and other related devices; drawings showing physical arrangement of components; front elevation to scale with overall dimensions, conduit entrance spaces and weights; and Bill of Materials.

© December 2012 Kennedy/Jenks Consultants

C. Submit written descriptions explaining ladder diagram operation, system operation and analog signal processing.

D. Submit comprehensive interconnection diagrams for AFD, motor and other related devices.

E. Within 45 days following Notice to Proceed:
   1. Submit a report documenting the results of computer or factory based voltage distortion and commutation notch area simulations. Obtain all data needed for the report. Contact equipment manufacturers and utility company to obtain independence and fault duty data. Obtain other data from the field as necessary. The simulations shall model the effects of full load AFD operation on the line side of the AFD during both utility and standby generator operation. Simulations shall demonstrate compliance with IEEE 519 for general systems.
   2. If simulations show that compliance with IEEE 519 cannot be achieved with the equipment shown on the Drawings, include in the report the manufacturer's recommended design modifications needed to ensure compliance with IEEE 519. Include additional simulations data for the recommended system demonstrating compliance. Simulations shall include specific filtering or impedance modifications necessary. Perform and submit a report on the results of a power factory analysis and document any special switching requirements necessary to eliminate filter induced leading power factors.
   3. Submit sketches of the revised single line diagram and a revised scale drawing of the equipment layout. Layout shall show location and mounting requirements for filters, reactors, or other devices required. All additional equipment shall meet the seismic anchorage requirements as described in Paragraph F of this Section.
   4. Simulation report, analysis, and design shall be includd in the Contractor's bid price.
   5. Additional filters, reactors, enclosures, conduit, wire, and all other components necessary for a fully functioning system complying with IEEE 519 for general systems shall be included in the Contractor's bid price.

F. Seismic Anchorage Requirements: Submit in accordance with Section 01300.
   1. Submit signed and sealed structural calculations and detailed drawings for the attachments and anchorage to the structure of the equipment and appurtenances in this section. Calculations shall conform to the requirements of Section 01190.
   2. Submit certification from the manufacturer that the equipment is capable of resisting seismic loads. Loading shall be as described in Section 01190.

G. Submit certified factory test report before equipment is shipped.

H. Manuals: Provide in conformance with Section 16010.

I. Submit certification that AFD, motor and driven load are compatible throughout the specified speed range.

J. Submit list of manufacturer's recommended spare parts.

© December 2012 Kennedy/Jenks Consultants

K. Submit certified statement from the manufacturer accepting responsibility for providing a fully functioning installation as specified herein.

L. Submit certified test reports of the AFD field tests.

1.04 COORDINATION

A. Motor: Obtain and review the appropriate data for the driven motor and load over the required speed range, for a complete system analysis. Verify that equipment is mutually compatible and free of resonance over the complete operating range. Coordinate the assignment of any critical frequencies with the motor supplier. Prepare the certificate required under Submittals paragraph in this Section, the certificate shall specifically state whether the AFD equipment is rated for variable torque or constant torque applications.

B. Instrumentation and Controls: Review and coordinate requirements with the instrumentation and controls work of Division 17. Provide all necessary interfacing to produce a complete, fully operational system.

PART 2 - PRODUCTS

2.01 SYSTEM

A. General: Provide integrated, all solid state, AFD complete with incoming line reactors. Provide all additional components necessary to meet IEEE 519 as described below. System shall comply with NEMA ICS 1, 3, 4, 3.1, 4, and 6.

B. Manufacturers: Products of the following manufacturers are acceptable, subject to conformance with these Specifications:
   1. Eaton, SVX-9000
   2. Allen-Bradley, PowerFlex.
   3. Or equal.

C. Operation: Accomplish speed control by adjusting the output frequency according to the desired reference speed. Adjust ac voltage and frequency simultaneously to provide the constant volts/Hertz necessary to operate the motor at the desired speed. The VFD must use pulse width modulation (PWM) technology.

D. Rating:
   1. Line Voltage: 460 volts, -5% continuous, -10% momentary, +10%, 3-phase.
   2. Line Frequency: 60 Hz, 2 Hz
   3. Ambient Temperature: 5°C to 40°C
   4. Altitude: Up to 3,300 feet above sea level.
   5. Service Factor: 1.15
   6. Power Factor: Above 0.92 at full speed and rated load.

E. Performance:
   1. Efficiency: Above 95% at 100% full speed, above 93% at 70% full speed, both for centrifugal pump loads.
   2. VFD Inrush Current: As required to start motor.

© December 2012 Kennedy/Jenks Consultants

3. Duty Cycle: 6 starts per hour.
4. Speed Range: 34% to 100% full speed, with adjustable minimum and maximum speeds.

F. Features:
1. Provisions to accept the following control signals for automatic and manual operation:
   a. Run signal from a single remote contact closure; and
   b. A 4-20 mA dc signal for speed control. The VFD shall provide linear speed control of the motor from minimum speed to maximum speed as the adjustable speed input signal varies from its minimum to maximum. Input impedance shall be 250 ohms resistive.
2. Selector switch for automatic, manual or off.
3. Potentiometer for manual speed control.
4. Motor speed indicator calibrated in percent of full speed.
5. Incoming line circuit breaker.
6. All components necessary to ensure compliance with IEEE 519 for general systems: 5% voltage distortion factor and 22,800 voltmicroseconds commutation notch area. It is the intent of this Specification to achieve a system that operates within the guidelines of IEEE 519 for general systems when operated from the utility and when operated from the standby generator.
7. 120-volt control circuitry.
8. Adjustable time delay for delaying motor drive restart after power failure; timer range shall be 0 to 120 seconds, with initial settings differing by 10 seconds for each drive; provide module which causes multiple attempts to restart.
9. Provision for automatic emergency shutdown in any mode, actuated by the following:
   a. Motor thermal protection (see Section 11002).
   b. Any additional abnormal conditions as shown on the Drawings. Provide for manual restart.
10. Auxiliary contacts for remote indication of "Run", "Motor Fail" and "AFD Fail."
11. AFD able to withstand harmonic distortion and notching a defined in IEEE-519 for dedicated system (10% voltage distortion factor and 36,500-volt microseconds commutation watch area).
12. AFD operable with motor disconnected, in order to test AFD.
13. Linearity and repeatability accuracy of 3-phase output of 1% of analog input control signal regardless of input power voltage fluctuations between 437 and 505 volts.
14. Independent acceleration and deceleration controls, adjustable from 2 to 30 Hz per second.

G. Protection: Protect AFD against the following conditions:
1. Reverse phase sequence and single phasing of input power.
2. Input power failure.
3. Input transient voltages, including peak suppression and snubbers, in accordance with ANSI C37.90.
4. Radio and television interference.
5. Output overcurrent.
6. Input overcurrent (see Item 2.01F.5 above).
7. Motor overtemperature.
8. Cabinet overtemperature.

© December 2012 Kennedy/Jenks Consultants

9. Undervoltage: VFD shall automatically shut down if input voltage falls below 414 volts with automatic restart upon return to a stable 437 volts or more.

H. Construction:
1. Enclosure, housing controller modules and components shall be free-standing, floor-mounted, NEMA ICS Type 1, and fabricated from steel, 12-gauge minimum. The enclosure shall be dead front and dead back construction with all modules, components, load, line, and control terminations fully front accessible. The enclosure shall be completely self-ventilated and have provision for top and bottom entry of wiring and conduits. The controller enclosure shall have gasketed doors mounted on semi-concealed hinges, with lockable door latches.
a. Door-mount the following devices. Some features listed could be part of a door-mounted keypad.
1) Power On indicating light.
2) Manual-Off-Auto selector switch.
3) On-Off switch.
4) Manual Speed potentiometer.
5) Speed Indicator calibrated in percent of full speed.
6) Motor Run indicating light.
7) Motor Overtemperature indicating light.
8) Controller Failure indicating light.
9) External operating handle for the incoming line circuit breaker.
10) Cabinet overheat indicating light.
11) Elapsed time meter.
12) Reset pushbutton.
b. Provide control components as specified in Section 16955.
c. Components: Mount components on circuit cards or modules which can be adjusted or replaced in the field without the use of special tools.

I. Factory Test:
1. Subject AFD and motor control to a complete simulated operational test. Drive a calibrated load at various speeds over the specified speed range to determine AFD efficiency.
2. Submit certified test report to the Engineer before equipment is shipped.

J. Spare Parts: Furnish two sets of spare power fuses for each size and type of fuse used. Furnish a minimum of five fuses of each size and type of control circuit fuse.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation shall be in conformance with Section 16010.

B. Provide 3-inch-high concrete housekeeping pad under each AFD; coordinate dimensions to ensure conformance with the NEC 6'6" Rule (NEC 380-8).

C. Properly level and plumb AFDs so that doors will open and close freely.

D. Clean and repair scratched or damaged surfaces to "new" condition.

© December 2012 Kennedy/Jenks Consultants

E. Coordinate the location of the isolation transformer, the size of the incoming line circuit breaker, and the size of isolation transformer secondary conductor to comply with NEC Articles 240 and 450.

F. Provide the services of a factory trained service technician to inspect and check out each system before energizing.

G. Lace power conductors to resist short circuit forces. Follow manufacturer's instructions.

3.02 FIELD TESTING

A. Provide the services of a factory trained service technician to make final adjustments to equipment and carry out a full operational test in the presence of the Engineer.

B. Replace any failed or damaged parts at no cost to Owner.

C. Following installation and manufacturer's field test, perform a field test under utility and standby operating conditions. Operate the drive from no load to full load and perform a spectrum analysis to verify that the waveform on the line side of the line reactors and filters is in compliance with IEEE 519 for general systems. Submit a complete certified test report for review by the Engineer. If compliance has not been attained, provide additional equipment as specified herein and perform the test again.

3.03 TRAINING

A. Service technician shall instruct operating personnel in the operation, maintenance and adjustment of the system and installation.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 16955

CONTROL DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 16010 become a part of this Section as if repeated herein.

B. Work Included: Furnish and install all control devices complete, including, as applicable, enclosures, engraved escutcheons or nameplates, gaskets, lenses, lamps and mounting provisions.

C. Related Work Specified Elsewhere:
   1. Section 16920: Motor Control Center
   2. Section 16924: Adjustable Frequency Drives
   3. Section 17510: Panels

1.02 REFERENCE STANDARDS

A. National Electrical Manufacturers Association (NEMA) Publications:
   1. ICS1 General Standards for Industrial Controls and Systems
   2. ICS2 Standards for Industrial Control Devices, Controllers and Assemblies
   3. ICS6 Enclosures for Industrial Controls and Systems

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Review category of the General Conditions and the submittal requirements of Section 16010.

PART 2 - PRODUCTS

2.01 GENERAL

A. All control devices shall conform to applicable provisions of NEMA Standards ICS1 and ICS2.

2.02 CONTROL AND TIMER RELAYS

A. General: Relays shall be provided as necessary to perform switching functions required of control panels and other control circuits. Relays shall be of the following types (abbreviations in parentheses correspond to labels on the Drawings):
   1. Size 0 Magnetic Contactors (MS): Provide Size 0 magnetic contactors for driving Size 4 and Size 5 ac operated motor starters. Provide Size 0 contactors of the same type and manufacture as the motor starter contactors.
   2. Relays (CR):
      a. Provide machine tool relays for the following applications:
         1) All relays driving 120 Vac motor starters up to and including Size 3.

© December 2012 Kennedy/Jenks Consultants

2) All relays driving non-motor loads up to 6 amps (or 720 VA).

b. Provide machine tool type relays with convertible contacts rated 10 amperes continuous with NEMA Rating Designation A600 for ac applications and N600 for dc applications. Coils shall be designed for continuous duty and shall have the voltage rating indicated on the Drawings.

c. Relays shall be the magnetically held type unless designated otherwise on the Drawings. For each relay, provide one spare Form C contact over and above the number indicated on the Drawings. In addition, for latching relays, provide coil clearing contacts as necessary.

d. Manufacturer: Square D, Class 8501, Type X; General Electric CR120B; or equal.

3. General Purpose Control (GR) or (AR) Relays (plug-in):

a. Provide plug-in style 2-, 3-, or 4-pole enclosed relays with integral neon or LED indicators for the following applications:

1) Relay logic (relays driving other relays, including machine tool relays) operating at voltages up to 120 Vac.

2) Control power switching.

3) All relays driving non-motor loads up to 2 amps (240 VA) at 120 Vac.

b. Provide relay sockets rated for 10 amp, 240 Vac with screw-type barriered terminals.

c. Manufacturer: Square D, Class 8501, Type R; Allen-Bradley Bulletin 700; or equal.

4. Timing Relays (TR):

a. General: Relays designated TR shall be machine tool industrial relays.

b. Timing Relay (TR): Timing relay shall be machine tool industrial relay with solid-state timer and external adjustment dial. Range shall be 0 to 120 seconds unless indicated otherwise on the Drawings. Relay shall include an LED indicator and instantaneous and time-delay contacts rated at 10 amps, meeting NEMA A600 designation. Timing relay shall be "on delay" or "off delay" as indicated on the Drawings and shall be Allen Bradley Type RT-RTA; Square D; or equal.

5. General Requirements:

a. Provide relays rated for 1 million operations at 10 amp, 120 Vac, at power factor of 0.2.

b. Where timing relays are interfaced to motor starters or adjustable speed motor controllers, provide auxiliary machine-tool relays or Size 0 magnetic contactors. Refer to previous specifications for machine-tool relays and Size 0 magnetic contactors.

c. Where timing relays or control relays require additional contacts, provide auxiliary control relays, properly sized for the application as described previously in this Section.

2.03 CONTROL PANEL ACCESSORIES

A. Relays, timers and other internally mounted equipment shall be of the types specified in other sections of these Specifications.

B. Panel face mounted equipment shall be of the types specified in other sections of these Specifications.

© December 2012 Kennedy/Jenks Consultants

C. Standards: All control devices shall conform to applicable provisions of NEMA Standards ICS 1 and ICS 2.

D. Pushbuttons, Selector Switches and Pilot Lights:
   1. Shall be heavy-duty oil-tight units; each unit shall have an engraved escutcheon plate unless nameplates are indicated on the Drawings or are necessary because of length of identification. Pushbuttons and selector switches shall have contacts rated 10 amperes continuous, Rating Designation A600 in conformance with NEMA ICS 2. Lights shall be LED.
   2. Pushbuttons used as emergency stop devices shall have a padlockable means for maintaining an open circuit. Indicating lights shall be push-to-test transformer type with lenses of the colors shown on the Drawings.

E. Multi-position control switches shall have rotary action, round knurled handle and the number of positions and stages shown on the Drawings. They shall be suitable for panel mounting. Each position shall have a positive detent. Contacts shall have a continuous current rating of 10 amperes at 300 Vac. Switches shall have integral indicator.

F. For 4-20 mAdc and 1 to 5 Vdc signal selector switches, provide oil-tight selector switches with electronic duty gold contact blocks. Provide sliding contacts for reliable operation without benefit of thermal cleaning action.

G. Manufacturer: Provide Eaton (Cutler-Hammer) HT series control devices, no substitution to match existing facilities.

H. Colors and Descriptions:
   1. Indicating Lamps: Unless otherwise noted on the Drawings, the following color code and inscriptions shall be followed for the lenses of all indicating lights.

Indicating Lamp Inscription	Color
ON/START	Green
OFF/STOP	Red
CLOSED	Green
LOW	Amber
FAIL	Red
HIGH	Amber
OPEN	Green
POWER ON	White
RESET	Red
AUTO	Blue

   2. Lettering shall be black on white and amber lenses. Lettering shall be white on red and green lenses.
   3. Pushbuttons: Follow color coding for indicating lamp above.
   4. All unused or non-inscribed buttons shall be black. Lettering shall be black on white and yellow buttons. Lettering shall be white on black, red and green buttons.

© December 2012 Kennedy/Jenks Consultants

I. Nameplates: Unless specified otherwise in the Drawings, nameplates shall be black lamacoid with minimum 3/16-inch-high white letters for major area titles, 5/32-inch for component titles, and 1/8-inch for subtitles, and shall be fastened with a permanent but dissolvable adhesive or by screws.

PART 3 - EXECUTION

3.01 GENERAL

A. Identify all control devices with engraved plastic nameplates or escutcheons, as applicable. Install control devices as recommended by the manufacturer.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 17010

INSTRUMENTATION AND CONTROLS, GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work Included:
1. Provide all tools, equipment, materials, and supplies and be responsible for all labor required to complete the installation, startup and operational testing of a complete and operable Instrumentation and Control (I&C) System as indicated on the Drawings and as specified herein.
2. Provide all the necessary equipment components and interconnections along with the services of manufacturers' engineering representatives necessary to ensure that the Owner receives a completely integrated and operational I&C system as herein specified.
3. Provide all terminations for wiring at field-mounted instruments, equipment enclosures, alarm, and status contacts.
4. Provide all Instrumentation and Control wire required for a fully functioning Instrumentation and Controls System as shown on the Drawings except for wire specifically specified in Division 16. See Section 16010.

B. Work Specified in Other Divisions:
1. Process piping, installation of inline instrumentation, gas monitors, chlorinators and sulfonators, air compressors, main air supply headers, and other mechanical work and equipment as specified in Divisions 11, 13, 14, or 15.
2. Instruments and controls which are not directly used for process control, i.e., those provided as part of a package system, such as a boiler, air compressor, etc. as specified in Divisions 11, 13, 14, 15, or 16.
3. Division 16 work, including all instrumentation and controls conduit, and only that wire specified in Division 16. Refer to Division 16 Specifications for specific requirements for wire, conduit, grounding, and other electrical equipment.
4. Final control elements as specified in Section 15050.
5. General mechanical requirements as specified in Section 11001.

1.02 REFERENCE STANDARDS

A. American National Standard Institute (ANSI) Publications:
1. Y14.15a Drafting Practice
2. C62.1 Surge Arrestors

B. Instrumentation Society of America (ISA) Publications:
1. S5.4 Instrument Loop Diagrams
2. S20 Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves

© December 2012 Kennedy/Jenks Consultants

1.03 I&C SUBCONTRACTOR QUALIFICATIONS

A. An I&C Subcontractor shall be an electrical contractor who has demonstrated experience in purchasing, calibrating, fabricating, installing and testing the I&C products listed in this Specification Section. Normally, the I&C Subcontractor is a systems house regularly engaged in the business of panel fabrication, control component procurement, programmable logic controller and personal computer (PC) application in the process control industry.

B. The I&C Subcontractor has been regularly engaged for a period greater than five years in performing all aspects of the type of work specified in this Section and shown on the Drawings.

1.04 I&C SUBCONTRACTOR SYSTEM RESPONSIBILITIES

A. General: The I&C equipment as specified in this Division shall be considered an integrated system. Entire system installation including calibration, verification, startup, operation testing, and training shall be performed by qualified personnel, possessing all the necessary skills and equipment, and who have had experience performing similar installations. Instrumentation and control systems drawings are diagrammatic only; it is the responsibility of the Contractor to obtain technical data, determine performance requirements, develop instrumentation detail installation designs, and coordinate the selection of specified equipment with Contractor supplied equipment to meet the design conditions stated.

B. System Responsibilities:
   1. Instrumentation and control system drawings are diagrammatic only. Ensure that all components of the instrumentation system, including primary measuring, indicating, transmitting, receiving, recording, totalizing, controlling, and alarming devices and all appurtenances are completely compatible and shall function as outlined and shall furnish and install such additional equipment, accessories, etc., as are necessary to meet these objectives at no cost to the Owner.
   2. Compatibility: See that all components of the instrumentation system, including equipment specified under other Divisions, are completely compatible and function properly as a system. Provide such additional equipment, accessories, etc., as are necessary to meet these objectives at no cost to the Owner.
   3. Coordination: For control components, devices, and systems specified in Divisions 11, 12, 13, 14, 15, 16, and 17 or shown on the Drawings.
      a. Provide technical advice to mechanical and electrical subcontractors as necessary regarding their installation of instruments.
      b. Verify the correctness of installation of all instruments.
      c. Verify that the proper type, size, and number of control wires with their conduits are provided.
      d. Verify that the proper type, size, and number of pneumatic tubes with their conduits are provided.
      e. Verify that proper electric power circuits provided for all components and systems.

© December 2012 Kennedy/Jenks Consultants

f. Resolve all manufacturers' installation discrepancies between requirements and the detail requirements of the Drawings and Specifications.
g. Supervise final signal connections, both electric and pneumatic, to all process instrumentation and control equipment.
h. Adjust, startup, and test all process instrumentation and control equipment.
i. Provide specified documentation and training.

4. Performance: While the Drawings provide sufficient information to establish the form and function of the systems and their relationships, the responsibility for system integration and performance rests solely with the Contractor. The Engineer provides technical instruction and guidance where needed.
5. Site and Instrument Inspection: Inspect site for conformance to Drawings, paying special attention to space allocation and dimensions shown or required on Drawings. Inspect completed work and verify that it is ready for installation of instruments and equipment. Inspect each instrument and piece of equipment for damage, defects, completeness, and correct operation before installing.

1.05 SUBMITTALS

A. Refer to Division 1 for required method of preparation and transmittal, and conform to requirements herein.

B. Shop Drawings: Submit shop drawings (diagrams) for review in complete bound sets indexed by specification number, with exterior tabs marked by subject. Submit manufacturer's catalog cuts for each item for which shop drawings are not required. manufacturer's catalog cuts, specifications or data sheets shall be clearly marked to delineate the options or styles to be furnished. Show dimensions, physical configurations, methods of connecting instruments together, mounting details, and wiring schematics. Drawings shall be complete with device tag numbers, wire numbers and terminal board numbers. Submit fabrication details, nameplate legends, and control panel internal wiring and piping schematic drawings. Submit panel graphic drawings where applicable. Include material lists and/or bills of material.

1. Interconnection Diagrams: Submit point-to-point type interconnection diagrams conforming to ANSI Y14.15a as depicted in Sketch 17010-2. Include each conduit run, with wirefill noted for each run. Include electric panel and circuit numbers for all sources of 120-Vac power. Show conduit and wiring interconnections between each control panel, instrument, multiplexer or telemetry unit, motor control center, motor combination starter, motor, valve actuator, and other field-mounted device. Include all equipment and appurtenances provided in this contract regardless of the Division in which it is specified.
2. Elementary Diagrams: Submit an elementary diagram (also known as a schematic diagram) for control, protection, and monitoring circuits. Elementary diagrams are not required for lighting, communications and those systems clearly defined on the single line diagram. Show all interconnections between power sources, apparatus, and device elements of a particular system or equipment, and all interlocks with other systems in a manner, which fully indicates circuit function and operation. Refer to the Drawings for functional and operational requirements.

© December 2012 Kennedy/Jenks Consultants

C. Specification Forms:
   1. Submit completed Specification Forms per ISA S20, including those instrumentation and control components directly related to process control, but specified in other Divisions of these Specifications.
   2. Include on each form the assigned tag numbers, manufacturer's part numbers, and device data. More than one tag numbered item may be included on a sheet.

D. As-Built Drawings: Submit a revised set of shop drawings that incorporates all change orders and modifications made during performance of the work. In addition to updated loop diagrams, interconnect diagrams and elementary diagrams, submit equipment and device wiring diagrams and other drawings as necessary to depict the "as-built" condition of equipment. Include all installed field and panel conduit and piping/tubing runs and routing, tray systems, supports, mounting details, interconnection diagrams with cable, wire, tube and termination numbers. Coordinate all drawings with the conductor identification requirements in Section 16120 and Section 16124. Submit a copy of CAD produced drawings on magnetic media in AutoCAD DWG format.

E. Operation and Maintenance Manuals: Furnish Operation and Maintenance Manuals, including Instruction Manuals and Part Lists, for equipment provided under Division 17 as required by Division 1. Obtain data from manufacturers, and format and bind as specified. Obtain distribution method instructions from the Owner or his representative.
   1. Schedule: Deliver at least two (2) copies of manuals in 3-ring binders (8-1/2-inch by 11-inch format) not later than the equipment shipment date.
   2. Contents: Include in manuals not less than the following information, as applicable, for each instrument, equipment, subsystem and/or control loop:
      a. General, introduction and overall description, purpose, functions, simplified theory of operations, etc.
      b. Specifications (including equipment specification data sheet as described above under Shop Drawings), sufficiently detailed for reordering exact duplicates of the original items.
      c. Installation instructions, procedures, sequences, tolerances, and precautions.
      d. Operational procedures.
      e. Shutdown procedures.
      f. Maintenance, calibration, and repair instructions.
      g. Parts list and spare parts recommendations.
      h. Calibration curves, rating tables, and any other data showing the relationship of the variable inputs and the calibrated output of all measuring devices and controlled equipment.
      i. Software programs (PLC Ladder Logic) RS-Logix files and hard copies.
      j. Operator Interface screens. HMI program and hard copies.
   3. Format:
      a. Use drawings and pictorials to illustrate the text to the extent necessary to insure a clear, concise presentation. If manuals have been written to cover a family of similar instruments or equipment, strike out inapplicable information in a neat fashion or emphasize applicable portion by heavily

© December 2012 Kennedy/Jenks Consultants

weighted arrows, circles or boxes; whichever provides the clearest and neatest presentation.

b. Group manuals by system control panels, including field instrumentation connected or associated with the panel. Where identical instruments are used in more than one control loop or subsystem, include only one instruction manual, per panel grouping; however, an index by tag number for all instruments shall identify its location in that manual.

c. Provide control loop and/or subsystem operational descriptions to identify the function of each instrument and its relation to the other instruments in the loop.

4. Binding: Bind each manual in a cover which indicates the panel or process area to which it applies, manufacturer's name, local address and telephone number, and year of purchase. Punch and bind manuals in standard three ring binders and include system name and subcontractor's name on binding.

F. Accessory and Maintenance Materials: Submit data for the following items:

1. Special Tools and Accessories: Special tools, instruments, and accessories for maintaining instruments and equipment requiring periodic repair and adjustment as specified elsewhere herein. Also, furnish special lifting and handling devices for equipment requiring such devices.
2. Maintenance Materials and Spare Parts: Submit a list of manufacturer recommended spare parts for each item specified. Refer to other sections of these Specifications.

G. Test Reports: Submit the following test reports as described herein:

1. Instrument Calibration Data Sheets (paragraph 2.11)
2. Factory Testing of Control Panels (paragraph 2.12)
3. Instrument Verification Report (paragraph 3.07.C)
4. Final Operational Testing (paragraph 3.07.D)

H. Submit a construction and Test Plan for implementing the construction sequence described in Section 01010, paragraph 1.07 of the Specification.

I. Demonstration and Final Operation Test Plan and Results: Submit a document that outlines all procedures to be used in final operational testing of instrument and control systems. Include a description of each system, the scope of testing, test methods and materials, testing instruments and recorders, a list of functional parameters to be recorded on each item, and Shop Drawings showing temporary bypasses, jumpers, and devices.

1.06 QUALITY ASSURANCE

A. Standard of Quality: The Contractor shall provide equipment of the types and sizes specified which has been demonstrated to operate successfully. Provide equipment which is new and of recent proven design.

© December 2012 Kennedy/Jenks Consultants

1.07 INSPECTIONS

A. The Engineer may inspect the fabricated equipment at the factory before shipment to job site. Provide the Engineer with sufficient prior notice so that an inspection can be arranged at the factory.

B. Inspection of the equipment at the factory by the Engineer will be made after the manufacturer has performed satisfactory checks, adjustments, tests and operations.

C. Favorable review of the equipment at the factory only allows the manufacturer to ship the equipment to the project site. The Contractor shall be responsible for the proper installation and satisfactory startup operation of the equipment to the satisfaction of the manufacturer and the Engineer.

1.08 DRAWINGS

A. Drawings: The Instrumentation Drawings are diagrammatic; exact locations of instrumentation products shall be determined in the field by the Engineer. Except where special details are used to illustrate the method of installation of a particular piece or type of equipment or material, the requirements or descriptions in this Specification shall take precedence in the event of conflict.
   1. Locations of equipment, inserts, anchors, motors, panels, pull boxes, manholes, conduits, stub-ups, fittings, power and convenience outlets, and ground wells are approximate unless dimensioned; verify locations with the Engineer prior to installation. Field verify scaled dimensions on Drawings.
   2. Review the Drawings and Specification Divisions of other trades and perform the instrumentation work that will be required for the installations.
   3. Should there be a need to deviate from the Instrumentation Drawings and Specifications, submit written details and reasons for all changes to the Construction Manager for favorable review.
   4. Resolution of varying interpretations of the Contract Documents shall conform to Division 0, General and Supplementary Conditions.
   5. The Drawings provide details of installation and supersede the manufacturer's recommendation where a conflict exists.

1.09 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Box, crate, or otherwise enclose and protect instruments and equipment during shipment, handling, and storage. Keep all equipment dry and covered from exposure to weather, moisture, corrosive liquids and gases or any element, which could degrade the equipment. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Notify the Engineer in writing in the event that any equipment or material is damaged. Obtain prior favorable review by the Engineer before making repairs to damaged products.

1.10 INSTRUMENT SCHEDULE

A. See Appendix A for Instrument Schedule.

© December 2012 Kennedy/Jenks Consultants

PART 2 - PRODUCTS

2.01 MATERIALS AND STANDARD SPECIFICATIONS

A. Provide instruments, equipment and materials suitable for service conditions and meeting standard specifications such as ANSI, ASTM, ISA, and SAMA. The intent of this Specification is to secure instruments and equipment of a uniform quality and manufacture throughout the plant. All instruments in the plant of the same type shall be made by the same manufacturer.

2.02 NAMEPLATES

A. For each piece of equipment, provide a manufacturer's nameplate showing his name, location, the pertinent ratings and the model designation.

B. Identify each piece of equipment and related controls with a rigid laminated engraved phenolic nameplate. Engrave nameplates with the inscriptions indicated on the Drawings and, if not so indicated, with the equipment name. Securely fasten nameplates in place using two stainless steel screws or, where favorably reviewed by the Engineer, with epoxy cement. Where no inscription is indicated on the Drawings, furnish nameplates with an appropriate inscription furnished by the Engineer upon prior request by the Contractor.

C. Each control device, including pushbuttons, control switches, and indicating lights, shall have an integral legend plate or nameplate indicating the device function. These shall be inscribed as indicated on the Drawings or as favorably reviewed by the Engineer.

D. Provide CAUTION or SAFETY nameplates to alert operators of special conditions that may result in faulty equipment operations. Devices containing batteries that must be replaced periodically must be clearly identified. Nameplates are not required if the device senses and displays a low battery warning.

2.03 NAME TAGS

A. All instrumentation and equipment items or systems shall be identified by nametags. Field equipment shall be tagged with the assigned instrumentation tag number listed in the Instrument Schedule.

B. Name tags shall be stainless steel with engraved or stamped black characters of 3/16-inch minimum height. Tags shall be attached to equipment with a tag holder and stainless steel band with a worm screw clamping device. Use 20-gauge stainless steel wire where banding is impractical. For field panels or large equipment cases, use stainless steel screws; however, such permanent attachment shall not be on an ordinarily replaceable part.

© December 2012 Kennedy/Jenks Consultants

2.04 FIELD-MOUNTED EQUIPMENT

A. All instrument and control equipment mounted outside of protective structures shall be equipped with suitable surge arresting devices to protect the equipment from damage due to electrical transients induced in the interconnecting lines from lightning discharges or nearby electrical devices. Protective devices used on 120-Vac inputs to field mounted equipment shall be secondary valve surge protectors conforming to the requirements of ANSI C62.1.

2.05 EQUIPMENT OPERATING CONDITIONS

A. All equipment shall be rated for normal operating performance with varying operating conditions over the following minimum ranges:
   1. Electrical Power: 120 Vac ±10%, 60 Hz, unregulated, except where specifically stated otherwise on the Drawings or in the Specifications, or when two-wire, loop-powered devices are specified.
   2. Air: 85 psig, ±5 psig
   3. Field Instruments:
      a. Outdoor Areas:
         1) Ambient Temperature: +15°F to +120°F
         2) Ambient Relative Humidity: 5% to 100%
         3) Weather: Rain, sleet, snow and ice
      b. Indoor Unheated Areas:
         1) Ambient Temperature: +40°F to +120°F
         2) Ambient Relative Humidity: 5% to 95%, non-condensing
      c. Indoor Environmentally Controlled Areas:
         1) Ambient Temperature: +60°F to +104°F
         2) Ambient Relative Humidity: 10% to 90%, non-condensing

2.06 EQUIPMENT LOCATIONS

A. Provide equipment and materials suitable for the types of locations in which they are located as defined under Division 16. All equipment specified for field mounting shall be weatherproof and splash proof as a minimum. If electrical or electronic components are contained within the equipment, they shall be housed in NEMA 3R gasketed cases outside, NEMA 4X in wet, damp or corrosive locations, and NEMA 7 in hazardous locations unless noted otherwise on the Drawings.

2.07 ANALOG SIGNAL INDICATED UNITS

A. For all instruments with local or remote indicators, provide indicators scaled in actual engineering units, i.e., gallons per minute, feet, psi, etc., rather than 0 to 100%, unless noted otherwise on the Drawings or Instrument Schedule.

2.08 SIGNAL TRANSMISSION

A. Analog:
   1. Signal transmission between electric or electronic instruments shall be 4-20 mA and shall operate at 24 Vdc. Signal output from all transmitters and controllers shall be current regulated and shall not be affected by changes in load

© December 2012 Kennedy/Jenks Consultants

resistance within the unit's rating. Where practical, milliampere signals from the field shall be converted to a voltage signal at the external terminals of each panel, and all instruments within a panel shall be parallel wired.

2. Nonstandard transmission systems such as impulse duration, pulse rate, and voltage regulated will not be permitted except where specifically noted in the Instrument Schedule or shown on the Drawings. When transmitters with nonstandard outputs do occur, their output shall be converted to 4-20 mA prior to transmission.

B. Discrete: All alarm and status signals shall be 120 Vac unless specified otherwise on the Instrument Schedule.

C. Proprietary data highway or serial bit transmissions such as RS232C, etc. shall be allowed to the extent shown on the Drawings.

2.09 PAINTING

A. Factory paint all instruments and equipment except where installed in pipelines. Where instrument panels are installed adjacent to electrical control panels provided under Division 16, provide instrument panels of identical color to that of electrical control panels. Paint as required in Division 9 for structural supports, brackets, etc. Repair damaged factory paint to satisfaction of the Engineer. Feathering, priming and painting shall produce a reasonable match to the surrounding paint work.

2.10 FASTENERS

A. Fasteners for securing equipment to walls, floors and the like shall be either hot-dip galvanized after fabrication or stainless steel. Provide stainless steel fasteners in corrosive locations. When fastening to existing walls, floors, and the like, provide capsule anchors, not expansion shields. Size capsule anchors to meet load requirements. Minimum size capsule anchor bolt is 3/8-inch.

2.11 INSTRUMENT CALIBRATION

A. Each field instrument shall be calibrated at 0%, 25%, 50%, 75% and 100% of span using test instruments to simulate inputs and read outputs that are rated to an accuracy of at least 5 times greater than the specified accuracy of the instrument being calibrated. Such test instruments have accuracies traceable to the National Institute of Standards and Technology (NIST).

B. Submit a written report to the Engineer on each instrument. This report shall include a laboratory calibration sheet or the manufacturer's standards calibration sheet on each instrument and calibration reading as finally adjusted within tolerances.

C The Contractor may, at his option, choose to perform calibration on an instrument by acquiring the services of an independent test lab, or by obtaining the required test instruments and performing the calibration.

© December 2012 Kennedy/Jenks Consultants

2.12 FACTORY TESTING OF CONTROL PANELS

A. All fabricated equipment shall be tested before it leaves the factory. At the factory verify wiring continuity and equipment operation by simulating input and output.

B. Factory testing of control panels/devices/equipment shall be accomplished. Refer to individual Specification sections for tests requiring favorable review.

C. Upon completion of factory testing, submit a report certifying the control panels/devices/equipment are operable and meet the Specifications.

PART 3 - EXECUTION

3.01 EQUIPMENT MOUNTINGS

A. Mount and install equipment as indicated. Mount field instruments on pipe mounts or other similar means in accordance with suppliers' recommendation. Where mounted in control panels, mount according to requirements of that section.

B. Equipment specified for field mounting shall be suitable for direct pipe mounting or surface mounting, surface-mounted indicators and equipment with calibration adjustments or requiring periodic inspection shall be mounted not lower than 3 feet 6 inches nor higher than 6 feet above walkways, platforms, catwalks, and the like.

C. Note that applicable specifications require detail drawings showing seismic sway bracing design and anchorage requirements for their equipment. Seismic zone requirements are specified in Division 1.

D. All devices shall be accessible to operators for servicing, operating, reading, etc. Provide permanent platforms to assure devices are continuously accessible.

3.02 PROCESS CONNECTIONS

A. Provide instrument impulse tubing (see Part 2) to meet the intended process service and ambient environmental condition for corrosion resistance, etc. Install impulse tubing with a continuous slope according to service to promote self-draining or venting back to the process. Terminate connection to process lines or vessels in a service rated roof valve, provided under other Divisions that will permit closing off the impulse line or removal of the element without requiring shut down of the process. Include blowdown of drip legs and valves for terminations of impulse lines at the instruments.

B. Process vessels, line penetrations, and root valves shall be furnished and installed under other Divisions of these Specifications. Instrument tubing, valve manifolds, and test taps are installed as part of this Specification.

© December 2012 Kennedy/Jenks Consultants

3.03 FIELD WIRING

A. Ring out signal wiring prior to termination and perform surge withstand tests where required (see Section 16010, Part 3 for methods). Verify wire number and terminations are satisfactory as designated on the Loop and Interconnect Diagrams. Verify all terminations are tight and shields are uniformly grounded at one location.

3.04 ELECTROMAGNETIC INTERFERENCE (EMI)

A. Construction shall proceed in a manner which minimizes the introduction of noise (RFI/EMI) into the I&C System.

B. Cross signal wires and wires carrying ac power or control signals at right angles.

C. Separate signal wires from wires carrying ac power or switched ac/dc control signals within control panels, terminal cabinets, telemetry equipment, multiplexer cabinets, and data loggers as much as possible. Provide the following minimum separations within such equipment unless indicated otherwise on the Drawings:

Power Wiring Capacity	Separation (Inches)
120 Volts AC or 10 amps	12
240 volts ac or 50 amps	18
480 volts ac or 200 amps	24
4,160 volts ac or 800 amps	48

3.05 SIGNAL GROUNDING

A. Proper grounding of equipment and systems in this Division is critical. The Drawings and Division 16, Section 16450, specify safety grounding for all equipment in this Division.

B. A single-point grounding system for instrument signals is required for all instrument panels. This instrument single point grounding system does not use building steel or conduit systems for its ground path.
   1. Ground all signal shields, signal grounds, and power supplies at an isolated signal bus within each instrument panel, rack, or enclosure. See Section 17510 for isolated bus requirements. The shields at the far ends of these signal cables must be disconnected (floated) from any ground to prevent ground loops.
   2. Do not connect the rack or enclosure frames to the signal grounding buses.
   3. Connect each isolated signal ground bus within each panel using a stranded, insulated copper wire of size 6 AWG or larger directly to a system ground rod installed per the Drawings.

C. If more than one instrument panel or rack is installed side-by-side, locate an isolated system grounding plate in one of the panels (see Section 17510 for requirements).
   1. Connect all the isolated signal buses in such instrument panel or rack radially to the system ground plate using a stranded, insulated copper wire of size 8 AWG or larger.

© December 2012 Kennedy/Jenks Consultants

2. Do not use conduit, cable raceways or building steel to distribute the grounding connections; use dedicated wires as specified above. Install a single conduit containing a No. 2 AWG insulated ground wire from the insulated grounding plate directly to a system ground rod installed per the Drawings. See Division 16 for conduit requirements.

3.06 PREPARATION

A. Ensure that installation areas are clean and that concrete or masonry operations are completed prior to installing instruments and equipment. Maintain the areas in a broom-clean condition during installation operations.

B. Panels shall be protected during construction to prevent damage to front panel devices and prevent dust accumulation in the intervals. Other protective measures (lamp, strip heaters, etc.) shall be included as weather conditions dictate.

3.07 FIELD TESTING

A. General: The purpose of the field testing is to verify instruments are calibrated and operationally performing their intended function. Provide the services of factory-trained and experienced engineers to perform verification and operational testing as prescribed below. Since the initial calibration of instruments may not satisfy the final operation of system, perform recalibration or adjust setpoints as required to satisfy the performance requirements of the system. Notify the Engineer in writing a minimum of 48 hours prior to the proposed date for commencing final operational testing and acceptance.

B. System Verification Testing: Verify that each instrument shown on the Instrument Schedule is operating and calibrated as specified in the Instrument Schedule by simulating inputs at the primary element in each system loop and verify performance at loop output devices (i.e. recorder, indicator, alarm, etc., except controllers). Simulate inputs at 0%, 25%, 50%, 75%, and 100% of span or with on-off inputs, as applicable. During system verification:
   1. Make initial or provisional settings on levels, alarms, etc. listed in the Instrument Schedule.
   2. Verify controllers by observing that the final control element moves in the proper direction to correct the process variable as compared to the set point.
   3. Cause malfunctions to sound alarms or switch to standby to check system operation.
   4. Check all loop instruments thoroughly for correct operation.
   5. Immediately correct all defects and malfunctions disclosed by tests.
   6. Submit a report certifying completion of verification of each instrument system. This report shall include a data sheet on each instrument tested that indicates instrument tolerances, instrument calibration verification, data and initial settings made to devices.

C. Final Operational Testing: Upon completion of instrument verification, test all systems under process conditions in the presence of the Engineer. System testing shall be accomplished in accordance with the approved Test Plan (Paragraph 1.05.H). The test for each portion thereof shall be witnessed,

© December 2012 Kennedy/Jenks Consultants

documented and signed off upon completion by the Engineer. The intent of this test is to demonstrate and certify the operational interrelationship of plant instrumentation and control systems. This testing shall include, but not be limited to:

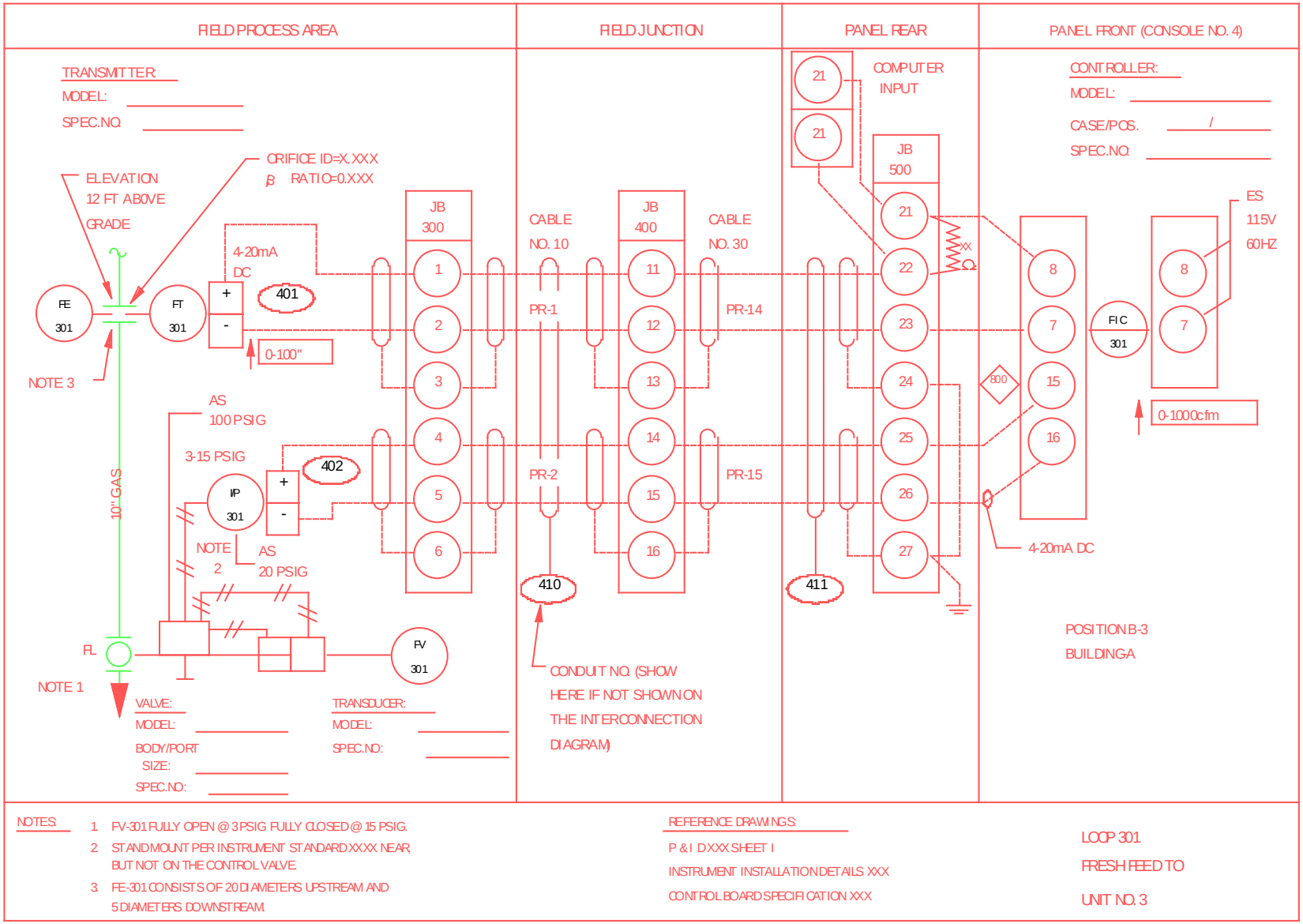
1. Making final adjustments to levels, alarms, etc.
2. Checking all alarms, failure interlocks, and operational interlocks.
3. Immediately correcting all defects and malfunctions and retesting.
4. Submit the witnessed test results and a transmittal letter indicating that all required systems have been tested satisfactorily and the systems meet all the functional requirements of their applicable specifications.

3.08 INSTRUCTION OF OWNER'S PERSONNEL

A. Provide the services of a factory trained and field experienced instrumentation engineer to conduct group training of up to ten of the Owner's designated personnel in the operation of each instrument system. This training shall be for the time period of five working days and shall be performed during the operational testing period. Include instruction covering basic system theory, operating principles and adjustments, routine maintenance and repair, and "hands on" operation. The text for this training shall be the Operation and Maintenance Manuals furnished under these Specifications.

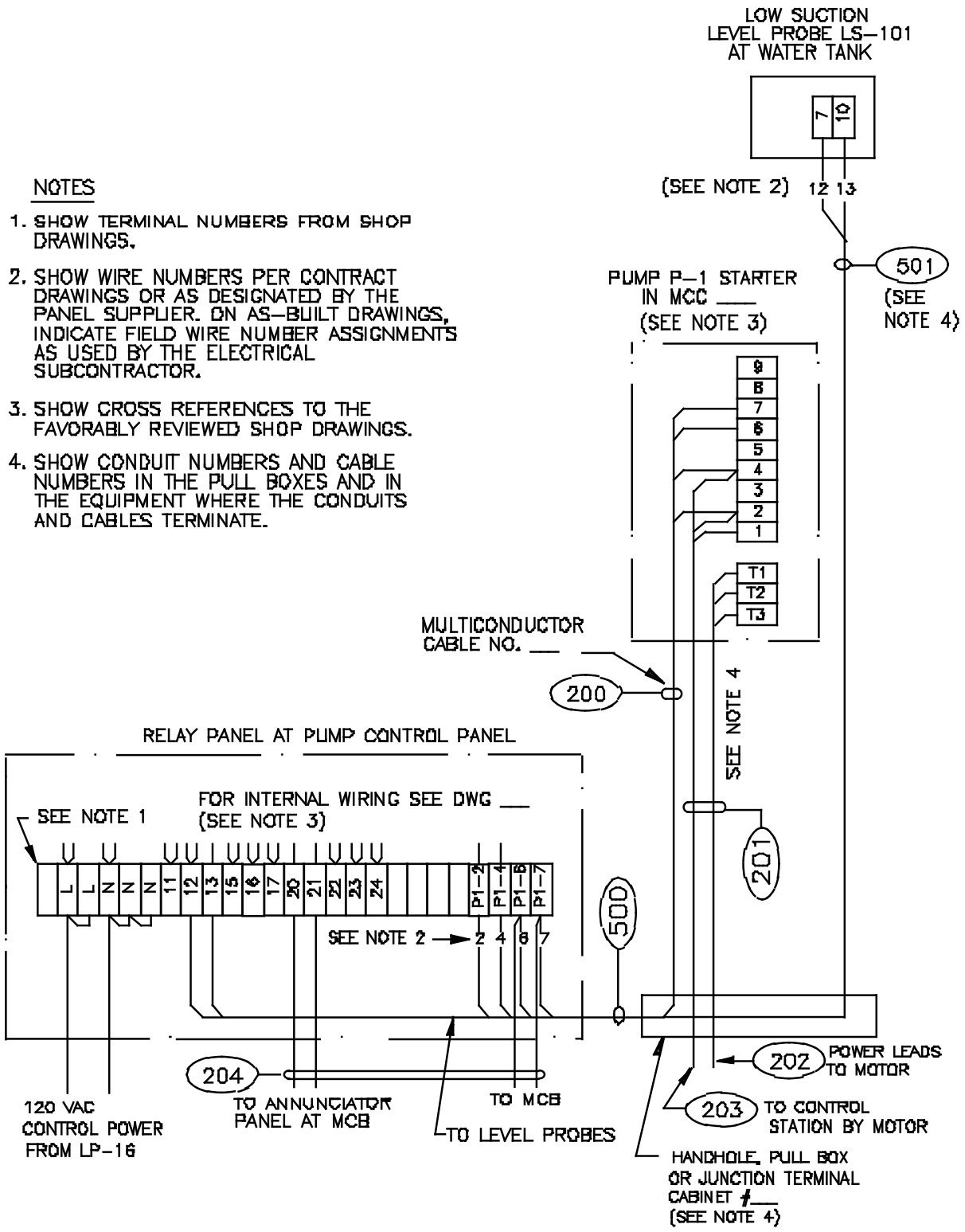
END OF SECTION

© December 2012 Kennedy/Jenks Consultants



SKETCH 17010-1: LOOP DIAGRAM

© December 2012 Kennedy/Jenks Consultants

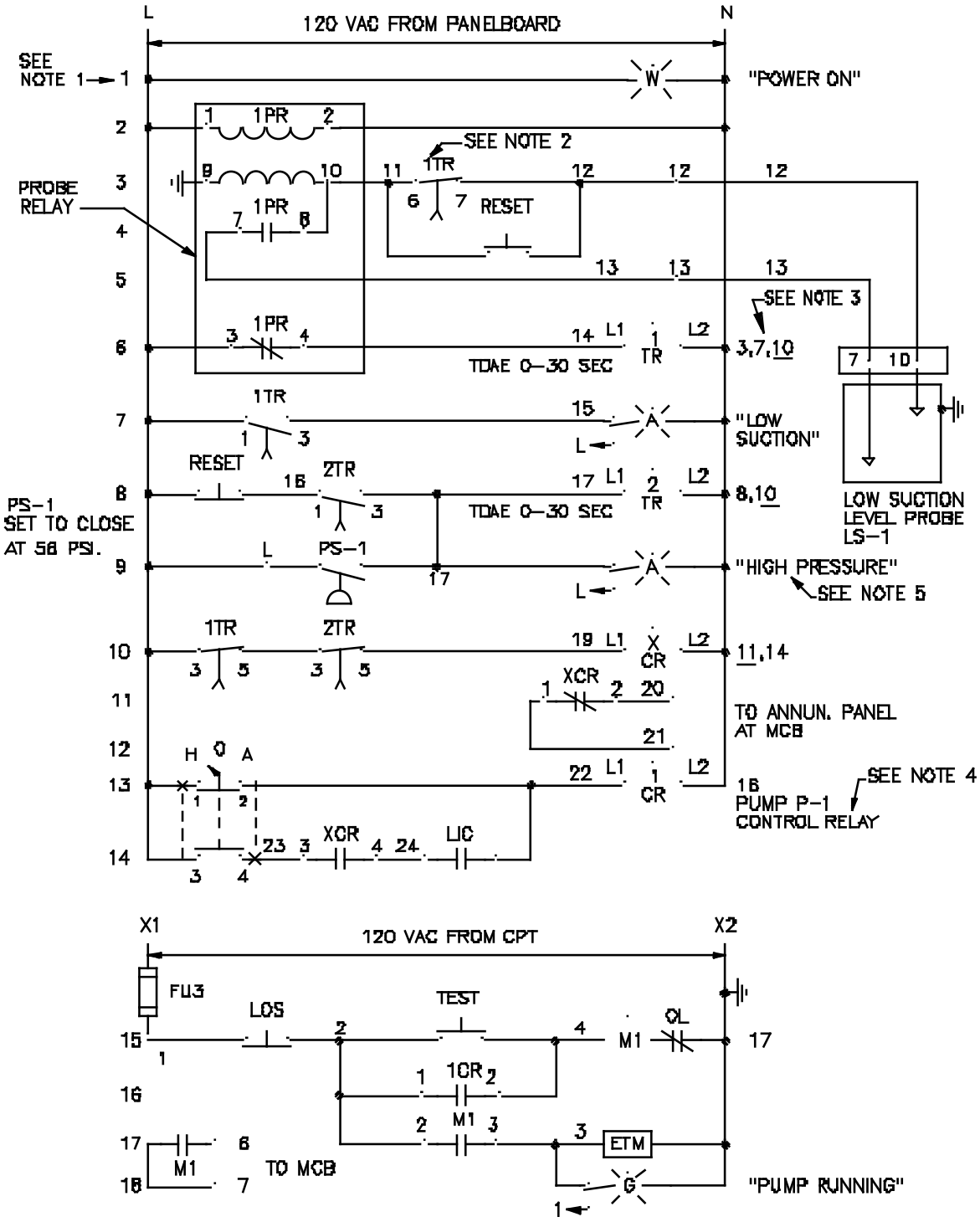


NOTES

1. SHOW TERMINAL NUMBERS FROM SHOP DRAWINGS.
2. SHOW WIRE NUMBERS PER CONTRACT DRAWINGS OR AS DESIGNATED BY THE PANEL SUPPLIER. ON AS–BUILT DRAWINGS, INDICATE FIELD WIRE NUMBER ASSIGNMENTS AS USED BY THE ELECTRICAL SUBCONTRACTOR.
3. SHOW CROSS REFERENCES TO THE FAVORABLY REVIEWED SHOP DRAWINGS.
4. SHOW CONDUIT NUMBERS AND CABLE NUMBERS IN THE PULL BOXES AND IN THE EQUIPMENT WHERE THE CONDUITS AND CABLES TERMINATE.

SKETCH 17010–2
INTERCONNECTION DIAGRAM

© December 2012 Kennedy/Jenks Consultants



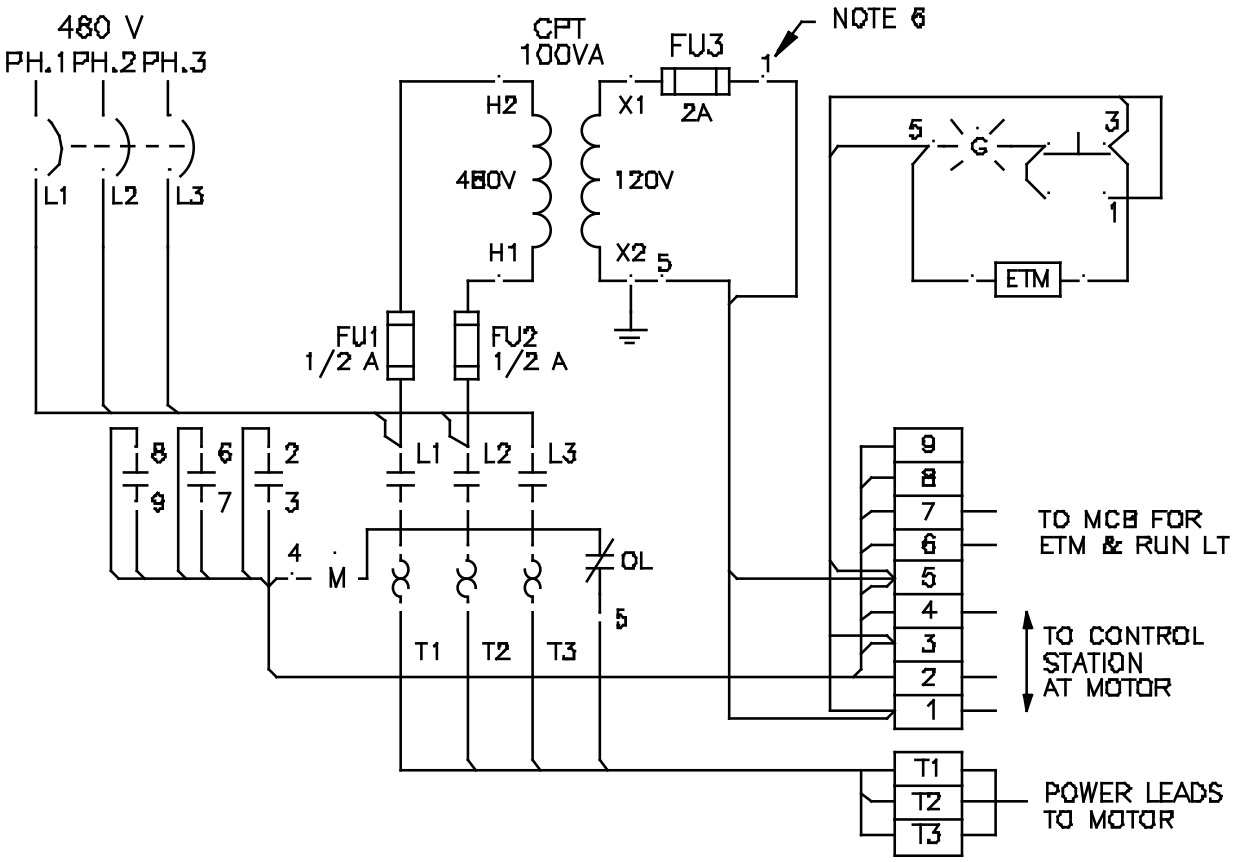
PUMP P-1 ELEMENTARY DIAGRAM

(AS SHOWN ON FAVORABLY REVIEWED SHOP DRAWING)

NOTE: REFER TO NOTES ON SKETCH 17010-4

SKETCH 17010-3
ELEMENTARY DIAGRAMS

© December 2012 Kennedy/Jenks Consultants



STARTER WIRING DIAGRAM

(AS SHOWN ON FAVORABLY REVIEWED SHOP DRAWING)

NOTES FOR SKETCHES 17010–3 AND 17010–4

1. A NUMBER FOR EACH RUNG (1,2,3, ETC.)
2. A NUMBER FOR EACH CONTACT AND DEVICE (101 CR, 104 TR, ETC.)
3. RUNG CROSS REFERENCE NUMBERS FOR ALL RELAY CONTACTS ASSOCIATED WITH EACH RELAY COIL. UNDERLINE RUNG NUMBERS FOR EACH NORMALLY–CLOSED CONTACT (5,7,9,11, ETC.)
4. A FUNCTIONAL ANNOTATION BELOW EACH CONTACT ("PUMP 1 CALL," "SUMP HIGH LEVEL," ETC.)
5. A FUNCTIONAL ANNOTATION TO THE RIGHT OF EACH COIL, LIGHT, AND OTHER DEVICE ("PUMP 1 CALL," "SUMP HIGH LEVEL," ETC.)
6. WIRE NUMBER SHOWN ON ELEMENTARY DIAGRAM.

SKETCH 17010–4
EQUIPMENT WIRING DIAGRAMS

© December 2012 Kennedy/Jenks Consultants

THIS PAGE WAS LEFT INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

APPENDIX A
Instrument Schedule

Type	Loop Number	Description	Range	Setpoint	P&ID	Spec Section	Spec Para.
AE/AIT	107	Source Water ORP Analyzer	0 - __mV		I - 3	17110	2.02
AE/AIT	108	Source Water Dissolved Oxygen Analyzer	0 – 10 ppm		I - 3	17110	2.05
FE/FIT	300	Source Water Flowmeter, 12-inch Magnetic	0 – 3000 gpm		I – 4	17120	2.01
AE/AIT	301	Source Water ORP Analyzer	0 - __ mV		I – 4	17110	2.02
PIT	302	Source Water Pressure Transmitter	0 – 100 psi		I – 4	17150	2.01
AE/AIT	401	Roughing Filter Filtered Water Turbidimeter	0 – 5 NTU		I – 5	17110	2.01
AE/AIT	402	Roughing Filter Filtered Water ORP Analyzer	0 - __ mV		I – 5	17110	2.02
PIT	404	Roughing Filter Filtered Water Pressure Transmitter	0 – 100 psi		I – 5	17150	2.01
AE/AIT	405	GAC Filtered Water/Membrane Filtered Water TOC Analyzer	0 – 10 ppm		I – 5	17110	2.03
AE/AIT	406	GAC Filtered Water ORP Analyzer	0 - __mV		I – 5	17110	2.02
AE/AIT	407	GAC Filtered Water Turbidimeter	0 – 5 NTU		I – 5	17110	2.01
LIT	350	Treated Water Tank Pressure Transmitter (Level Measurement)	0 – 30 ft		I – 6	17150	2.01
FE/FIT	350	Washwater Supply Flowmeter, 8-inch Magnetic	0 – 5000 gpm		I – 6	17120	2.01
TE	351	Treated Water Temperature sensor (measurement from pH probe)	0 – 100 F		I - 6	17110	2.04
AE/AIT	352	Treated Water pH Analyzer			I - 6	17110	2.04
FE/FIT	360	Middle Pressure Zone Treated Water Flowmeter, 8-inch Magnetic	0 – 3000 gpm		I - 6	17120	2.01
PIT	360	Middle Pressure Zone Treated Water Pressure Transmitter	0 – 75 psi		I - 6	17150	2.01
FE/FIT	370	High Pressure Zone Treated Water Flowmeter, 6-inch Magnetic	0 – 2000 gpm		I - 6	17120	2.01
PIT	370	High Pressure Zone Treated Water Pressure Transmitter	0 – 150 psi		I - 6	17150	2.01
LE/LIT	710	Coagulant Storage Tank Level Transmitter	0 – 10 ft		I - 7	17140	2.01
LSH	710	Coagulant Containment Sump Level Switch	0 – 24 in		I - 7	17140	2.02
LE/LIT	720	Permanganate Storage Tank Level Transmitter	0 – 8 ft		I - 7	17140	2.01
LE/LIT	340	Spent Washwater EQ Tank Pressure Transmitter (Level Measurement)	0 – 30 ft		I - 8	17150	2.01
FE/FIT	340	Spent Washwater Flowmeter, 4-inch Magnetic	0 – 300 gpm		I - 8	17120	2.01
FE/FIT	380	Surface Washwater Flowmeter, 4-inch Magnetic	0 – 700 gpm		I - 9	17120	2.01

Notes:

1. Instrument Schedule is not intended to represent a bill of material or a complete list of all required instruments.
2. Settings indicated are considered “Initial Settings.” Final settings shall be accomplished in field to suit actual operating conditions.

© December 2012 Kennedy/Jenks Consultants

THIS PAGE WAS LEFT INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 17110

ANALYTICAL INSTRUMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Requirements of Division 1 and Section 17010 form a part of this Section.

B. Work Included: This Section specifies analytical instruments for process instrumentation, auxiliary equipment and supplies directly related to the installation and operation of these analytical instruments, to perform the required functions in conjunction with information and equipment specified in other sections of Division 17. See Section 17010; this is the Schedule referred to herein. This Schedule shall not be construed as Bills of Material or as a complete listing of all required devices.

1.02 SUBMITTALS

A. Shop drawings to be submitted in this Section shall be made in one package under the Product Review category of Shop Drawings.

B. Shop Drawings: In addition to the requirements of Section 17010, shop drawings shall include for each type of instrument: supply voltage and frequency, electrical load, accuracy, description of operation, operating instructions, and calibration procedure.

C. Installation Method: Provide proposed method of mounting sensors or probes and instruments with submittal.

D. Parts List: Submit a Parts List with current net prices and a list of recommended spares.

E. Manuals: Furnish manufacturer’s installation, lubrication, operation and maintenance manuals, bulletins and spare parts lists.

1.03 QUALITY ASSURANCE

A. Manufacturer: In addition to the requirements of Section 17010, analytical instruments furnished shall be manufactured by firms regularly and currently engaged in the design and manufacture of similar equipment. All equipment furnished shall be new and of current design.

B. Maintainability: All equipment shall be designed for ease of maintenance and repair, and access to critical parts shall not require a major disassembly. Internal field adjustments where permitted or required herein shall be easily accessible upon removal of a panel or cover.

© December 2012 Kennedy/Jenks Consultants

C. Materials and Installation: Materials and installation shall comply with the requirements of the current editions of referenced electrical codes and standards, and the codes and standards referred to shall be used for establishing the minimum quality of the materials and equipment supplied and installed. All equipment of the same type shall be products of the same manufacturer. Capacities of all equipment shall not be less than that indicated on the Drawings or specified.

PART 2 - PRODUCTS

2.01 TURBIDIMETERS - LOW RANGE

A. Turbidimeters for filtered water shall be an EPA approved.

B. Turbidimeters shall be of the continuous flow nephelometer type, complete with calibration kit. The turbidimeter indicator shall be auto ranging from 0.001 to 100 NTU. Accuracy shall not exceed ±2% from 0-30 NTU and 5% up to 100 NTU, 0.001 NTU resolution and ±1%, repeatability. Ranges shall be switch selectable at 0-1/0-10/0-100 NTU.

C. The sensor and instrument shall have a response time of less than 30 seconds to a step change. The unit shall be suitable for a 120-Vac, 60-Hz power supply. Sample flow rate shall not exceed 1 gpm. The unit shall provide a 4-20 mA output signal proportional to the indicated turbidity. Provide high turbidity alarm light and relay contact output. The turbidimeter shall be insensitive to bubbles and signal bursts.

D. The turbidimeter instrument body shall be suitable for wall mounting. The turbidimeter indicator shall be housed in a weather and dustproof enclosure with a NEMA 12 rating and be suitable for wall mounting.

E. Calibration Kit:
   1. Provide calibration kit consisting of a 1-liter PVC calibration cylinder which simulates the turbidimeter body, a digital titrator, a titrator cartridge containing a concentrated (4,000 NTU) stock Formazin solution, and instructions.
   2. Calibration kit shall permit accurate calibration of the turbidimeter over the entire range of indicating turbidities.

F. Manufacturer: Provide Hach Turbidimeter Model 1720E, complete with indicating and standardizing units and Model 1720 Formazin calibration kit, no equal to match existing. Provide SC-100 2-channel controller for use with a second compatible sensor as shown on the Drawings.

2.02 ORP PROBES AND ANALYZERS

A. ORP measuring systems shall consist of the following:
   1. ORP element and extension cord with watertight plug.
   2. Analyzer/transmitter.
   3 ORP element shall be housed in a NEMA 4X enclosure suitable for mounting as noted or shown. Each element shall be provided with a nonelectrolyte

© December 2012 Kennedy/Jenks Consultants

consuming reference electrode or standard, a glass measuring electrode, a thermocompensator, and an integrally mounted preamplifier/signal conditioner. Measuring electrodes shall be suitable for the scale ranges noted. Unit shall provide automatic temperature compensation for stream temperature variations of 0 to 50°C. Preamplifier/signal conditioner shall be encapsulated and suitable for operation in 100% relative humidity.

4. ORP elements shall be in-stream configurations with adequate cable length. In-stream elements shall be provided with stainless steel support pipes as shown unless otherwise noted, complete with watertight cable connection. The in-stream element configuration shall provide adequate stream contact and protection for the electrodes. Unit shall be suitable for complete submersion in the stream.
5. ORP analyzer/transmitters shall be suitable for panel mounting unless otherwise noted. On the face of each unit shall be a 4-inch (minimum) indicating scale with range as noted, and a standardization adjustment. A keypad shall be provided to allow for spand and alarm adjustment. In addition to receiving inputs from the field-mounted elements and locally indicating the measured ORP value, the unit shall generate an electrically isolated 4-20 mAdc signal in linear proportion to ORP. The unit shall operate on 120-volt, 60-Hz power.

B. Manufacturer: ORP elements shall be Hach; or equal. Both ORP elements and analyzer/transmitters shall be the products of the same manufacturer.

C. Spare Parts: Provide the following spare parts:
   1. 1 - ORP probe.

2.03 TOTAL ORGANIC CARBON ANALYZER

A. General: Total organic carbon (TOC) analyzer shall be furnished where specified herein or on the Drawings. The TOC analyzer furnished shall be a proven device and shall automatically measure the TOC in a water sample in essentially three stages:
   1. Removal of inorganic carbon.
   2. Complete oxidation of the remaining organic carbon.
   3. Measurement of the resultant CO_2:
      a. The analyzer shall be completely equipped with the means for precise automatic sample and reagent metering, temperature control, carbon dioxide measurement and the indication and transmission of an electrical signal proportional to the measurement. The analyzer shall be capable of processing a sample through-put of 10 samples per hour as a minimum from a sample stream which is representative of a single or multiple process sample points.
      b. The analyzer shall be housed in a free standing cabinet with a panel for all necessary controls and with storage space for all necessary chemical reagents.
      c. The materials of construction shall be entirely suitable for their purpose and shall be the manufacturer's standard for measuring treated and filtered domestic and industrial wastewater.

© December 2012 Kennedy/Jenks Consultants

d. The measurement technique shall be the manufacturer's standard, except that flame ionization detectors (FID) are not acceptable. Repeatability of measurements shall be within 2% of full scale with a drift rate of not greater than 2% per day.
e. The analyzer shall operate from 120-Vac, 60-Hz power and shall not require connection to other plant utilities other than dry instrument air at 50 to 125 psig, clear process water at 35 psig minimum, and the drain system. If required, inert carrier gas containers shall be provided internal to the housing and shall not require replacement more often than once per week for continuous operation.

B. The measurement system shall output a 4-20 mAdc signal, linear and proportion to the measurement result. The output signal shall be continuous as opposed to a pulse output. A sample and hold amplifier shall be incorporated if required. The analyzer shall be capable of measuring a TOC range as noted in the Instrument Schedule. A panel-mounted meter shall be provided.

C. Manufacturer: The analyzer shall be GE 5310c Inline Analyzer or equal.

2.04 pH/TEMPERATURE PROBES AND ANALYZERS

A. pH and temperature measuring systems shall consist of the following:
1. pH element and extension cord with watertight plug.
2. Analyzer/transmitter, junction box with weathertight receptacle.
3. Receptacle and switch for local calibration.
4. pH element shall be housed in a Ryton, Teflon, or Derakone enclosure suitable for mounting as noted or shown. Each element shall be provided with a nonelectrolyte consuming reference electrode or standard, a glass pH measuring electrode, a thermocompensator, and an integrally mounted preamplifier/signal conditioner. pH measuring electrodes shall be suitable for the scale ranges noted. Unit shall provide automatic temperature compensation for stream temperature variations of 0 to 50°C. Preamplifier/signal conditioner shall be encapsulated and suitable for operation in 100% relative humidity. Overall system accuracy shall be greater than ±0.1 pH unit.
5. pH elements shall be either in-stream or flow-through configurations as noted. Flow-through elements shall be suitable for mounting in-line as shown, with 1-inch NPT connections, and be capable of withstanding 50-psig pressure. Flow-through elements shall be provided with a 5-foot cable with watertight plug.
6. In-stream elements shall be provided with stainless steel support pipes as shown unless otherwise noted, complete with watertight cable connection and a 10-foot cable with watertight plug. The in-stream element configuration shall provide adequate stream contact and protection for the electrodes. Unit shall be suitable for complete submersion in the stream.
7. pH analyzer/transmitters shall be field-mounted in NEMA 4X enclosure unless otherwise noted. Cases shall be thermoplastic (polycarbonate or polypropylene). On the face of each unit shall be a 4-inch (minimum) indicating scale with range as noted, and a standardization adjustment. Where alarms are noted, face of each unit shall contain high and low adjustment knobs and alarm lights. Alarms shall have adjustable deadband. In addition to energizing the two

© December 2012 Kennedy/Jenks Consultants

alarm lights, alarm-equipped units shall make contact closures, rated for 5 amps at 120 Vac. In addition to receiving inputs from the field-mounted elements and locally indicating the measured pH value, the unit shall generate an electrically isolated 4-20 mAdc signal in linear proportion to pH into loads in the range of 0 to 450 ohms without load adjustment. The unit shall operate on 120-volt, 60-Hz power.

8. Each unit shall be provided with a receptacle suitable for panel-face mounting as shown, to receive the watertight plug of a pH element extension cable. A two-position selector switch shall be provided with each analyzer/transmitter to switch from the field receptacle to the local receptacle for element standardization. When in LOCAL, alarm functions shall be disabled.
9. The analyzer shall have a selectable span initially set for a range of from 2 to 14 pH, but shall be continuously adjustable; it shall have full range suppression.
10. Sensor shall include a temperature output signal. Transmitter shall provide a separate 4-20 mA signal for remote monitoring of temperature.

B. Manufacturer:
   1. pH/temperature analyzer/transmitters shall be Hach or equal.
   2. Both pH elements and analyzer/transmitters shall be the products of the same manufacturer.

C. Spare Parts: Provide the following spare parts:
   1. 1 - pH probe.

2.05 DISSOLVED OXYGEN PROBES AND ANALYZERS

A. General:
   1. Dissolved oxygen element shall be of the optical type, provided with probe, transmitter, and probe mounting hardware.
   2. Sensor shall be coated with luminescent material with a light emitting diod (LED) within the probe used to excite the material. Oxygen concentration shall be measured based on the time it takes the LED to emit light to the sensor surface and the time for the material to emit light back to a photo diode in the probe. Elements shall be provided with automatic temperature compensation in the range of 0 to 50°C and shall consistently have zero output at zero dissolved oxygen concentration. Accurate measurement of dissolved oxygen shall be unaffected by the presence of hydrogen sulfide, ammonia, sulfur dioxide, and carbon dioxide.
   3. Transmitter shall be 4-microprocessor-based which will receive the microampere signal from the element, amplify it, provide local indication with a selectable scale range of 0 to 100 mg/l and transmit a 4-20 mAdc signal linearly proportioned to the dissolved oxygen concentration into the loads with impedances in the range of 0 to 750 ohms without load adjustments. Unit shall be temperature compensated over the range of 0 to 50°C. Accuracy shall be ±0.1 mg/l. Transmitter shall be suitable for panel mounting unless otherwise noted and shall operate on 120-volt, 60-Hz power. Transmitter shall include an LCD display and keypad.
   4. Transmitters shall be of NEMA 4X construction.
   5. Each unit shall have a receptacle to receive the dissolved oxygen element extension cable plug, a calibration knob, meter function selector switch, and a

© December 2012 Kennedy/Jenks Consultants

two-position selector switch to switch from field receptacle to local receptacle during calibration. Units shall transmit a 4-20 mAdc signal in linear proportion to measured dissolved oxygen.

B. Manufacturer: Hach LDO probe with SC-100 2-channel controller for use with a second compatible sensor, or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation, testing, calibration, validation, startup and instruction shall be in accordance with Section 17010.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 17120

FLOW MEASUREMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Requirements of Division 1 and Sections 17010 and 11001 form a part of this Section.

B. Work Included: This Section specifies flow measurement devices for process instrumentation, auxiliary equipment and supplies directly related to the installation of and operation of these flow measurement devices, to perform the required functions in conjunction with information and equipment specified in other sections of Division 17.

C. Related Work Specified Elsewhere:
   1. Section 15050: Piping, Valves and Accessories

1.02 QUALITY ASSURANCE

A. Manufacturer: In addition to the requirements of Section 17010, flow measurement devices furnished shall be manufactured by firms regularly and currently engaged in the design and manufacture of similar equipment. All equipment furnished shall be new and of current design.

B. Maintainability: All equipment shall be designed for ease of maintenance and repair, and access to critical parts shall not require a major disassembly. Internal field adjustments where permitted or required herein shall be easily accessible upon removal of a panel or cover.

C. Materials and Installation: Materials and installation shall comply with the requirements of the current editions of referenced electrical codes and standards, and the codes and standards referred to shall be used for establishing the minimum quality of the materials and equipment supplied and installed. All equipment of the same type shall be products of the same manufacturer. Capacities of all equipment shall not be less than that indicated on the Drawings or as specified.

1.03 SUBMITTALS

A. Shop drawings to be submitted in this section shall be made under the Product Review Category of Shop Drawings.

B. Shop Drawings:
   1. In addition to the requirements of Section 17010, shop drawings shall include for each type of instrument: supply voltage and frequency, electrical load, accuracy, description of operation, operating instructions, and calibration procedure.

© December 2012 Kennedy/Jenks Consultants

2. Furnish Shop Drawings for each item of mechanical equipment presenting sufficient data to determine compliance to these Specifications. Submit completed ISA S20 Forms for each device and physical dimensions. Also submit manufacturer's recommended upstream and downstream straight piping lengths, recommended location of any pressure taps, and estimates of pressure losses through the device.

C. Installation Method: The proposed method of mounting sensors and instruments shall accompany all shop drawings.

D. Parts List: Submit a Parts List with current net prices and a list of recommended spares.

E. Factory Testing and Calibration: All meters shall be factory tested. Perform a factory test and/or provide certification of calibration from an independent test laboratory. Calibration curves based on factory and/or laboratory testing (see option below) shall be provided for the Engineer's favorable review. Furnish calibration curves in units of output (inches or rpm/gpm) versus measured flow. Upon receipt of the Engineer's favorable review, the Contractor may have the meters shipped to the job site:
   1. As an option to laboratory testing each meter, the calibration curves of six (6) "like devices" may be substituted provided the calibration data is available from at least one identical device (pipe size, flow range, and type plus accessories such as extension registers).
   2. The flow tube supplier shall provide laboratory calibration data to the transmitter supplier or, where practical, test the flow tube and transmitter as an integral assembly. The integral test shall be accomplished at no extra cost to the customer.

F. Manuals: Furnish manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and spare parts lists.

G. Affidavits: Furnish affidavits from the manufacturers stating that the meters have been properly installed and tested and each is ready for full-time operation.

1.04 SEISMIC PROTECTION

A. Seismic restraint for metering devices that are integral with piping shall be as specified for the piping system in which they are installed. Seismic design certification and anchorage descriptions are required by Section 01190.

1.05 INDICATING UNITS

A. Provide flow indication in GPM, CFS, MGD, etc. Do not use indicators that read 0 to 100%, 4-20 mA, etc.

© December 2012 Kennedy/Jenks Consultants

PART 2 – PRODUCTS

2.01 MAGNETIC FLOWMETER - INDUCTION TYPE

A. General: Magnetic meters shall utilize the principle of electromagnetic induction to produce an output proportional to the rate of fluid flow. A set of pulsed dc, electrically powered coils shall generate a magnetic field, which in turn induces a voltage in the flowing fluid, which is sensed by a pair of electrodes in contact with the fluid.
   1. Protect coils from contact with the fluid. The electrodes shall be made of Type 316 stainless steel. The meters shall be housed in a NEMA 6P enclosure. The metering tube shall be lined with hard rubber. Meters shall be resistant to electrode coating. The electrode shall be designed to be inserted in water pipes and shall not be affected by solids, air bubbles, oil or coating. The electrode wetted parts shall be of Type 316 stainless steel.
   2. The meters shall be designed to operate from a 120-volt ac, 60-cycle, single-phase power supply. A 10% variation in power line voltage or frequency shall not affect the meter output accuracy in excess of 1% of full scale.
   3. Provide magnetic flowmeters suitable for fluids with conductivities as low as 5.0 micromho/cm.
   4. Each magnetic flow meter system shall have an accuracy within 1% of actual for flow velocities between 10% and 100% of full scale. Meters shall have a repeatability within 0.25% of full scale.
   5. Each magnetic flow meter shall be equipped with a signal converter (transmitter) to transmit an analog 4-20 mAdc signal proportional to flowrate. The signal converter shall be microprocessor-based unit with keypad for calibration. Output span and zero shall be manually adjustable. Provide span adjustment capable of producing 100% strength analog at flow rates that are 30% of maximum. Signal shall be linear with flow within the accuracy specified above. The converter shall be a wall-mounted unit.
   6. The signal converter shall have the capability of positive zero return for shutdown conditions.

B. The magnetic flow meters shall have flanged end connections. Field coils shall be either completely encapsulated in the meter lining material or a protective shield shall be provided suitable for withstanding the scouring velocities of the process fluid at the maximum flow rates.

C. Grounding: Provide a grounding circuit for each magnetic meter. Furnish and install grounding rings or protective shield when meter is installed in nonconductive line.

D. Special Tools: Furnish special tools, which are necessary for the replacement of parts and the adjustment of the equipment.

E. Manufacturer: Meters and signal converters shall be Foxboro, Endress Hauser or equal.

© December 2012 Kennedy/Jenks Consultants

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide installation, testing, calibration, verification, and startup instructions in accordance with Sections 15050 and 17010.

3.02 FIELD TESTING

A. All flow devices are to be field-tested against a secondary standard at the normal (or expected) process flow rates.

B. The Contractor may select at his option to either install a second flow device of known calibration in the line to verify flow device calibration or perform fluid capacity tests such as volumetric measurement per unit time.

C. Totalizer tests are not to be performed in the field.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 17140

LEVEL MEASUREMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Requirements of Division 1 and Section 17010 form a part of this Section.

B. Work Included: Level measurement devices for process instrumentation, auxiliary equipment and supplies directly related to the installation of and operation of these level measurement devices, to perform the required functions in conjunction with information and equipment specified in other sections of Division 17. Refer to the Instrument Schedule in Section 17010 for a listing of required devices.

1.02 SUBMITTALS

A. Shop drawings to be submitted in this section shall be made in one package under the Product Review Category of Shop Drawings.

B. Shop Drawings: In addition to the requirements of Section 17010, shop drawings shall include for each type of instrument: supply voltage and frequency, electrical load, accuracy, description of operation, operating instructions, and calibration procedure.

C. Installation Method: The proposed method of mounting sensors and instruments shall accompany all shop drawings.

D. Parts List: Submit a Parts List with current net prices and a list of recommended spares.

1.03 QUALITY ASSURANCE

A. Manufacturer: In addition to the requirements of Section 17010, level measurement devices furnished shall be manufactured by firms regularly and currently engaged in the design and manufacture of similar equipment. All equipment furnished shall be new and of current design.

B. Maintainability: All equipment shall be designed for ease of maintenance and repair, and access to critical parts shall not require a major disassembly. Internal field adjustments where permitted or required herein shall be easily accessible upon removal of a panel or cover.

C. Materials and Installation: Materials and installation shall comply with the requirements of the current editions of referenced electrical codes and standards, and the codes and standards referred to shall be used for establishing the minimum quality of the materials and equipment supplied and installed. All equipment of the

© December 2012 Kennedy/Jenks Consultants

same type shall be products of the same manufacturer. Capacities of all equipment shall not be less than that indicated on the Drawings or specified.

PART 2 - PRODUCTS

2.01 LEVEL TRANSMITTER/ULTRASONIC TYPE SENSOR

A. General: This type of level sensor shall use the following principle. An intense burst of sonic energy is directed toward a target surface of interface. The interface may be air-liquid, air-solid, liquid-solid, and also liquid-liquid if the densities of the two liquids are sufficiently different and provide a clearly definable interface. The return time of the reflected echo is measured and converted into an electrical signal proportional to the distance from the sensor to the interface, or alternatively the distance from another reference level, such as the tank bottom, when the sensor is top mounted. Automatic temperature compensators correct for the change in sound velocity in the transmitting fluid. Temperature sensing may be in the ultrasonic transmitting-receiving probe or in a separate probe when this would provide a more representative temperature for the transmitting medium.

B. Specific Requirements:
   1. Specific applications indicators, switches, and other requirements shall be as shown on the Drawings. Level ranges, output signals and setpoints are specified in the Instrument Schedule.
   2. Sensor and transceiver shall be temperature compensated over a range from +10°F to +120°F. Sensor heaters, if required, shall be powered from the transceiver power circuit.

C. Construction: The level sensing system shall consist of a sensing probe and a separately mounted solid state electronic controller-converter housed in a NEMA 4X case. A level indicator shall be provided and shall be of the type and in the units specified in the Instrument Schedule. All instruments and sensors to be installed in hazardous locations shall be rated for the class, division, and group indicated on the Drawings.

D. Mounting: The probe shall be flange-mounted, unless otherwise shown on the Drawings. The transceiver shall be surface-mounted as shown on the Drawings.

E. Power: The system shall operate from 24 VDC power, and variations of ±10% in voltage shall not affect the accuracy in excess of 0.5%.

F. Manufacturer: Milltronics Hydroranger 200 (Siemens), Endress and Hauser, or equal

2.02 LEVEL SWITCHES - ULTRASONIC TYPE

A. General: This type level switch shall operate on the principle of using the variable attenuation of a sonic signal created by a change in the percent solids in a liquid. A control unit/amplifier shall sense the change in signal strength across a sensor gap

© December 2012 Kennedy/Jenks Consultants

and provide an on-off control signal. The control output shall be a SPDT switch rated for 10 amps at 120 Vac.

B. Construction: The level sensor shall be fabricated of Type 316 stainless steel. The control unit/amplifier shall be housed in a NEMA 4X enclosure suitable with two ¾-inch hubs for connection of the sensor and control/power wiring.

C. Mounting: The sensor shall be provided with a bracket for sump mounting.

D. Manufacturer: Ultrasonic level switches shall be as manufactured by Rosemount; Magnetrol; or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation, testing, calibration, validation, startup and instruction shall be in accordance with Section 17010.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 17150

PRESSURE MEASUREMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Requirements of Division 1 and Section 17010 form a part of this Section. This section specifies pressure measurement devices for process instrumentation, auxiliary equipment and supplies directly related to the installation of and operation of these pressure measurement devices, to perform the required functions in conjunction with information and equipment specified in other sections of Division 17. Refer to the Instrument Schedule in Section 17010 for a listing of required devices.

1.02 SUBMITTALS

A. Shop drawings to be submitted in this section shall be made in one package under the Product Review Category of Shop Drawings.

B. Shop Drawings: In addition to the requirements of Section 17010, shop drawings shall include for each type of instrument: supply voltage and frequency, electrical load, accuracy, description of operation, operating instructions, and calibration procedure.

C. Parts List: Submit a Parts List with current net prices and a list of recommended spares.

1.03 QUALITY ASSURANCE

A. Manufacturer: In addition to the requirements Section 17010, pressure measurement devices furnished shall be manufactured by firms regularly and currently engaged in the design and manufacture of similar equipment. All equipment furnished shall be new and of current design.

B. Maintainability: All equipment shall be designed for ease of maintenance and repair, and access to critical parts shall not require a major disassembly. Internal field adjustments where permitted or required herein shall be easily accessible upon removal of a panel or cover.

C. Materials and Installation: Materials and installation shall comply with the requirements of the current editions of referenced electrical codes and standards, and the codes and standards referred to shall be used for establishing the minimum quality of the materials and equipment supplied and installed. All equipment of the same type shall be products of the same manufacturer. Capacities of all equipment shall not be less than that indicated in the Instrument Schedule.

© December 2012 Kennedy/Jenks Consultants

PART 2 – PRODUCTS

2.01 PRESSURE TRANSMITTERS - ELECTRONIC

A. General:
   1. Electronic indicating-type pressure transmitters shall convert a gauge or absolute pressure measurement to a 4-20 mAdc linear electrical output signal capable of transmission into at least a 600-ohm maximum load at 24 Vdc or less. Signal and power transmission shall be provided on a single pair of wires. Operating ambient temperature limits shall be at least -40° to +82°C.
   2. Range shall be as indicated in the Instrument Schedule. Overrange protection shall be at least 1-1/2 times span without degradation of accuracy. Reference accuracy shall be ±1/2% or better.

B. Construction: The transmitter enclosure shall be NEMA 4X rated. The process connection for clean liquid service shall be 1/4-inch NPT. Enclosure and wetted surface material shall be corrosion resistant and suitable for the process fluid.

C. Manufacturers: Rosemount 3051; Endress and Hauser or equal.

2.02 DIAPHRAGM PRESSURE SEALS

A. General:
   1. Units shall consist of corrosion-resistant lower housing and diaphragm, and instrument mounting upper housing. Lower housing shall have a 1-inch NPT female process and a 3/8-inch flushing connection terminated with a 3/8-inch hose bibb and shall be Type 316 stainless steel. Diaphragm shall be Type 316 stainless steel, unless otherwise noted. Upper housing shall have bleed screw, NPT female instrument connection, and shall be steel, unless otherwise noted. Filling fluid shall be suitable for a temperature range of -17° to +260°F.
   2. Where noted on the Drawings, capillary assembly shall be furnished to connect diaphragm seal to instrument.

B. Manufacturer: Units shall be Mansfield & Green, Type SG; Ashcroft, Type 101; or equal.

2.03 INSTRUMENT MANIFOLDS

A. Provide test valve manifolds for pressure and differential pressure transmitters and pressure switches and pressure/vacuum gauges installed in clean liquid (no entrained solids) service or filtered water. Provide corrosion-resistant test manifolds with integral 2-valve assemblies (or block and bleed assembly) for pressure transmitters and switches and gauges and 3-valve assemblies (block and bypass with manometer ports) for differential pressure transmitter installation.

B. Provide manifold(s) with the following hardware, performance features and ratings:
   1. Traditional mount manifold type. Two-valve or three-valve.
   2. Direct mount manifold type. Two-valve.
   3. Coplaner manifold type. Three-valve integral.
   4. Process connection. 1/2-14 MNPT.

© December 2012 Kennedy/Jenks Consultants

5. Material: Body, Bonnet, Stem, Drain/Vent Plug, 316 SST.
6. Packing material: Grafoil.
7. Calibration tap or adapter.

C. Manufacturer: Provide Rosemount Model 305AT traditional mount, 306AT direct mount, or 305AC coplaner flange; or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. On systems requiring diaphragm seals, the Contractor shall order (or assemble) a completely filled system. The filling fluid shall be silicone oil. Interconnecting piping shall be kept short. The filled system shall retain the same calibration requirements of the individual components.

B. Installation, testing, calibration, validation, startup and instruction shall be in accordance with Section 17010.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 17200

PANEL MOUNTED AND MISCELLANEOUS FIELD INSTRUMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Requirements of Division 1 and Sections 16955, 17010 and 17510 form a part of this Section.

B. Work Included: This Section specifies the panel mounted and miscellaneous field instruments and equipment to perform the required functions in conjunction with information and equipment specified in other sections of Division 17.

C. Unit Responsibility: It shall be the responsibility of the qualified single firm as described in Section 17010 of this Division to ensure that the instruments and equipment furnished under this Section are compatible with the equipment furnished under sections of this Division and other Divisions of these Specifications, and that the signal transmission methods are compatible.

D. Control and Performance Terminology used hereinafter in this Section shall be as defined in SAMA Standard PMC20-2-1970, "Process Measurement and Control Terminology."

E. Cases: Cases of front of panel-mounted instruments shall be of uniform design and color scheme wherever possible. Front of case colors shall be compatible with panel colors, subject to final approval by the Owner. Normally, compatible standard colors of the manufacturer shall be acceptable.

F. Panel Mounted Equipment:
   1. All flush mounted miniature electronic controllers, recorders, and stations shall be a matching style family of instruments utilizing multiple unit mounting cases and back of panel plug-in cable connections. The overall height shall be 6 inches. A nine station multi-unit case shall fit standard 19-inch rack spacing. Each multi-unit case and instrument shall be equipped for standby manual operation.
   2. All front panel mounted instruments shall be capable of withdrawing chassis to all service and test positions without affecting operation, and complete removal by a single plug connection from the front.
   3. All back of panel mounted signal conditioners and auxiliaries shall be mounted in plug-in card files with labeled adjustment and test point at front of card edge.
   4. All instruments shall accept 4-20 mAdc or 1 to 5 Vdc input signals and shall produce 4-20 mAdc or 1 to 5 Vdc output signals as specified in the Schedules. Internal panel signals may be of either type. All signals coming to or leaving the panel shall be 4-20 mAdc.

© December 2012 Kennedy/Jenks Consultants

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Panels: Section 17510.

1.03 SUBMITTALS

A. Shop drawings to be submitted in this section shall be made in one package under the Product Review Category of Shop Drawings.

B. Refer to Section 17010 for additional submittals required for each item herein.

1.04 QUALITY ASSURANCE

A. Manufacturer: In addition to the requirements of Section 17010, instrumentation and control equipment furnished shall be manufactured by firms regularly and currently engaged in the design and manufacture of similar equipment. All equipment furnished shall be new and of the most recent design. Except where specified otherwise, the instruments furnished under this Section shall be as manufactured by Fischer & Porter; Foxboro; or equal. Behind-the-panel equipment shall be as manufactured by the above or by AGM Electronics; Moore Products; or equal.

B. Maintainability: All equipment shall be designed for ease of maintenance and repair, and access to critical parts shall not require a major disassembly. Internal field adjustments where permitted or required herein shall be easily accessible upon removal of a panel or cover.

C. Materials and Installation: Materials and installation shall comply with the requirements of the current editions of referenced electrical codes and standards, and the codes and standards referred to shall be used for establishing the minimum quality of the materials and equipment supplied and installed. All equipment of the same type shall be products of the same manufacturer. Capacities of all equipment shall not be less than that indicated on the Drawings or specified.

PART 2 - PRODUCTS

2.01 CONTROL PANEL ACCESSORIES

A. Relays, timers and other internally mounted equipment shall be of the types specified in other sections of these Specifications.

B. Panel face mounted equipment shall be of the types specified in other sections of these Specifications.

C. Standards: All control devices shall conform to applicable provisions of NEMA Standards ICS 1 and ICS 2.

D. Pushbuttons, selector switches and pilot lights shall be heavy-duty oiltight units conforming to the requirements of Section 16955.

© December 2012 Kennedy/Jenks Consultants

E. Colors and Descriptions:
   1. Indicating Lamps: Unless otherwise noted in the individual Loop Specifications, see Section 16955 for the color code for the lenses of all indicating lights and annunciators. Refer to Elevation and Elementary Drawings for the required inscriptions.
   2. Lettering shall be black on white and amber lenses. Lettering shall be white on red and green lenses.
   3. Pushbuttons: Follow color coding for indicating lamp in Section 16955. All unused or noninscribed buttons shall be black. Lettering shall be black on white and yellow buttons. Lettering shall be white on black, red and green buttons.

F. Nameplates: Unless specified otherwise in the Drawings, nameplates shall be black lamacoid with minimum 3/16-inch-high white letters for major area titles, 5/32-inch for component titles, and 1/8-inch for subtitles, and shall be fastened with a permanent but dissolvable adhesive or by screws.

2.02 INSTRUMENT LOOP POWER SUPPLIES

A. General:
   1. For two-wire transmitters, provide a 24-Vdc regulated 50-mA power supply with 120-Vac input. Output voltage may be 24 Vdc ±5% manufacturing tolerance at no load, but shall hold within 1% from no load to full load at 120 Vac ±10% input.
   2. Line-to-load regulation shall be within 0.1% from no-load to full load. Ripple shall be less than 15 mV peak-to-peak.

B. Manufacturer: Provide Power One, or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation, testing, calibration, verification, startup and instruction shall be in accordance with Section 17010.

B. Wiring: Refer to Section 17510.

C. Control Voltage: When the control voltage is not specified in the schematics, the Contractor may elect to use the 120 Vac power, as supplied from the power panels supplies under Division 16; however, he shall provide a separate low voltage circuit for the indicating lamps or provide individual transformers with lamps. In any event the lamp voltage shall not exceed 30 Vac or dc.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 17330

PROGRAMMABLE LOGIC CONTROLLER

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Requirements of Division 1 and Section 17010 form a part of this Section.

B. Related sections include:
   1. Section 16955: Control Devices - control relays
   2. Section 17010: Instrumentation and Controls, General Requirements
   3. Section 17510: Panels

1.02 SUBMITTALS

A. The following items shall be submitted in this Section shall be made in one package under the Product Review category of Shop Drawings.
   1. Catalog cuts for the central processing unit, input modules, output modules, programmer, magnetic program storage device, interfacing equipment, power line voltage regulation transformer, and power line surge protection device.
   2. Heat load data for the power line voltage regulation transformer.
   3. A layout drawing of the PLC enclosure.
   4. An Input/Output (I/O) record containing a textual description for each item of input and output, connection diagram addressing (rack, module, channel and address numbers), and data table bit and data table word assignments.
   5. A typewritten document containing startup, operation, and maintenance procedures.
   6. The Factory and Field Witnessed Test procedure.
   7. The Factory and Field Witnessed Test results.
   8. Documentation to confirm that the spare memory requirement is complied with.
   9. Parts List: Submit a parts list with current net prices and a list of recommended spares.

1.03 QUALITY ASSURANCE

A. Provide programmable logic controllers (PLCs) which comply with NEMA Standard ICS 3-304. This standard applies to the construction, programming, performance, test, installation, protection, and safety of PLCs.

1.04 UL LABEL

A. Programmable controller enclosures shall bear the UL label. See Section 17510.

© December 2012 Kennedy/Jenks Consultants

1.05 APPENDICES

A. Appendix A: PLC Input/Output Schedule. This schedule is a complete schedule of all I/O. Additional I/O may be configured as required to implement control strategies by first assigning an instrument tag number, description, function and I/O type. Additional I/O added declinates the spare amount required. The Engineer approves use of all instrument tag numbers.

B. Appendix B: Control Strategies. These strategies are to be used to program the PLC. In addition, the Contractor shall use the Drawings and related sections to obtain a full complement of input/outputs and tag numbers.

PART 2 - PRODUCTS

2.01 PROGRAMMABLE LOGIC CONTROLLERS

A. General: Furnish, install, program, configure, test, and place the PLC into satisfactory operation as required by the Drawings and Specifications.

B. Programmable Logic Controller: Provide each PLC with the following hardware.
   1. I/O Chassis: Provide a 13-slot universal I/O chassis to house the processor, power supply and I/O modules. The selection of size slot and number of chassis to achieve a satisfactory complement of I/O modules is the responsibility of the Contractor. For PLC-6, provide DIN-rail mounting.
   2. Power Supply: Provide power supply module to power the processor and local I/O modules. I/O back plane loading shall not exceed 75% of power supply rating amps on any chassis.
   3. Memory Enhancement: The processor shall have 1.5 MB basic memory. Provide memory enhancement if the program exceeds 75% of capacity.
   4. Cables: Provide a full complement of cables for connecting to programming terminal and interface devices.
   5. Central Processing Unit: The Central Processing Unit (CPU) shall be powered by 24 VDC, and shall have the following:
      a. PLC "ladder logic" software with extend math functions and on line/off line programming functions.
      b Local I/O Scanner.
      c. Floating point arithmetic.
      d. PID loop control.
      e. Battery-backed (10-year lithium) CMOS RAM.
      f. CPU shall be ControlLogix 5550 System Model No. 1756-L1.
   6. Input and Output Modules:
      a. Analog inputs (AI) shall meet the following requirements:
         1) 4 to 20 mAdc inputs, 250-ohm impedance maximum, 16 single ended configuration.
         2) Accuracy of ±0.15% of span.
         3) Resolution: 16 bits
         4) Common Mode Rejection of 100 dB at 60 Hz, minimum.
         5) Normal Mode Rejection of 80 dB at 60 Hz, minimum.
         6) Isolation shall meet or exceed surge-withstand test, IEEE-472.

© December 2012 Kennedy/Jenks Consultants

7) Drift shall not exceed 1.5% within a one-year period @ 25°C
8) Modules shall be Allen-Bradley 1756-IF16 for ControlLogix.

b. Discrete inputs (DI) shall meet the following requirements:
1) Unpowered contact inputs or power inputs at 24 Vdc.
2) Input isolation shall meet or exceed IEEE-472. Relay isolation is unacceptable.
3) Provide filtering on a per unit point basis to provide contact bounce protection.
4) Discrete inputs shall be powered by the PLC by a 24-Vdc power supply; shall be current limited to conform with NEC Class 2 remote control and signal wiring circuits.
5) Modules with 16 inputs with common ground terminals. Voltage input modules shall have their channels fully isolated.
6) Modules shall be Allen-Bradley 1756-IB16I for ControlLogix, no equal.

c. Analog outputs (AO) shall meet the following requirements.
1) Output: 4-20 mAdc into a 0 to 500 ohm load; six individually isolated output configurations with separate grounds.
2) Isolation: From the multiplexer ground.
3) Resolution: 13 bits.
4) Accuracy: ±0.1% of 4 to 21 mA
5) Drift: Shall not exceed 1% in a one-year period.
6) Output short circuit protection shall be electronically limited to 21 mA or less with 24 V AC/DC maximum overvoltage protection
7) Modules shall be Allen-Bradley 1756-OF6CI for ControlLogix.

d. Discrete outputs (DO) shall meet the following requirements:
1) Electrically-latched outputs shall require one program command for set and reset. Loss of power shall return the output to a preselected state. Both fail open and fail close contact states shall be provided.
2) Contact configuration shall be N.O.; triac outputs - supply with suppression circuit for inductive load.
3) Provide the following ratings: 2A steady state, 15A make at 30 Vdc inductive load for external relays.
4) Provide arc-suppression for each contact.
5) Provide 16 isolated output configuration.
6) Modules shall be Allen-Bradley 1756-OB16I for ControlLogix.

e. Provide spare inputs and outputs so that a minimum of 15% of each type is spare, functional, and installed in the mounting racks. Permanently label each input and output on each module by the tag number and description given in the Instrument Schedule.

f. Provide at least two spare slots for future modifications/additions.

g. Remote I/O Adapter: Provide a remote I/O adapter for communication between the CPU and other I/O chassis, if required.

h. Provide blank plates for all unused I/O slots.

7. Network Communications: Provide PLCs with Ethernet communications (Ethernet/IP) using TCP/IP protocol.

C. PLC Software:

1. Provide software which compiles programs generated from ladder-logic displays directly to PLC object code. Provide software which permits on-screen

© December 2012 Kennedy/Jenks Consultants

text editing for purposes of documenting the ladder-logic diagrams on standard printer paper with:
    a. Contact and coil numbers.
    b. Contact and coil functional descriptions.
    c. Rung number cross references.
    d. Functional descriptions to the right of the coils.
2. Software shall be Windows-based.
3. The PLC control program shall be entered by a keyboard with mouse corresponding to the commonly used relay ladder diagram symbols.
4. Provide the following real-time functions:
    a. Monitor and display power flow through the logic.
    b. Monitor and display register contents.
    c. The ability to force outputs high or low regardless of the state corresponding to the solved relay-ladder-diagram expression.
5. PLC software for ControlLogix shall be RSLogix 5000.

D. Interfacing Relays, Instruments, and Switches:
1. Provide equipment as required for compliance with the functional requirements.
2. For analog signals, provide relays and switches with gold flashed silver contacts. Provide analog loop isolators where required to eliminate "ground loops." Provide individual loop power supplies for 2-wire transmitters connected to PLC inputs. Common power supplies are not authorized.

E. Programmable Logic Controller Enclosure:
1. The PLC hardware shall be furnished completely assembled and wired in electronic rack enclosures (see Section 17510). Provide for serviceable layout of parts. Provide enclosure finish and color to match the motor control center.
2. Note that certain selector switches, pushbuttons, relays and instruments shall be furnished and installed in addition to the programmable logic controller hardware proper.

F. Uninterruptible Power System (UPS): Provide a UPS unit rated for 200% of PLC load with batteries sized to provide at least two hours of continuous duty. UPS shall have an input and output power of 120 Vac and shall be mounted within as shown on the Drawings.

G. Spare Parts: Provide the following spare parts.
1. One input/output module for each type provided.
2. PLC processor card including memory.
3. PLC input/output communication processor, if applicable.
4. Power supply.
5. Function keypad.

H. Manufacturer: PLCs shall be Allen-Bradley ControlLogix for compatibility with existing facilities.

2.02 OPERATOR INTERFACE

A. Provide a touch screen color operator display panel to allow local control at the PLC control panel. Panel shall consist of a display and keypad to allow for monitoring

© December 2012 Kennedy/Jenks Consultants

and control of process variables. Panel shall be mounted on the PLC panel door. Panel features shall be as follows:

1. Active Matrix: 10.1-inch TFT color screen.
2. 800 x 480 pixel resolution.
3. 32-bit RISC CPU, 400 MHz.
4. Built-in Ethernet port and one USB port.
5. 24 Vdc power
6. Rating: NEMA 4, UL listed.

B. Manufacturer: Allen-Bradley, or equal.

2.03 ETHERNET SWITCH

A. The Contractor shall provide Ethernet network switches where shown on the Drawings. Ethernet switches shall be provide with the following features:

1. Four 10/100 BaseT RJ-45 ports (minimum)
2. Autosensing 10/100 BaseT duplex ports
3. Store-and-forward technology
4. LEDs for link, speed, activity and duplex status
5. Full IEEE 802.3 compliance
6. Management features:
   a) Port trunking
   b) Port mirroring
   c) QoS
   d) OLE for Process Control (OPC) traffic monitoring

B. Manufacturer: N-Tron; Moxa; or equal.

PART 3 - EXECUTION

3.01 WITNESSED TEST

A. Prior to shipment of the PLC to the jobsite, perform a Witnessed Test. This test shall demonstrate full compliance of the PLC with contract requirements. The test shall be witnessed by the Engineer and the Owner or his designated representative.

B. Prepare a detailed written witnessed test procedure to be submitted at least two weeks prior to start of the test. The test procedure shall describe testing methods and provide detailed specification of the input data and data sequences to be used in the test. If, in the opinion of the Engineer, a resubmission of the proposed test procedure is required, the date for the performance of this test shall be set at least six weeks following delivery of the resubmitted test procedure.

C. Perform the witnessed test in accordance with the test procedure. Any deviation in performance from that specified in these Specifications shall be corrected prior to shipment. If the deviation in performance is deemed by the Engineer to be substantial and if it is not corrected within the period allowed for the test, then a second test shall be performed. No extension of Contract time will be allowed in the event that this second test in necessary.

© December 2012 Kennedy/Jenks Consultants

D. Submit the results of the test in a formal document within two weeks following satisfactory performance of the test. The test results shall document all problems encountered in running the test, corrective action taken, and the detailed results of each phase of the test.

3.02 JOBSITE TEST

A. After the PLC has been installed at the jobsite, a demonstration of compliance with all functional objectives shall be made under actual or simulated operating conditions, subject to favorable review by the Engineer.

B. Prepare a detailed written witnessed test procedure to be submitted at least two weeks prior to start of the test. The test procedure shall describe testing methods and provide detailed specification of the input data and data sequences to be used in the test. If, in the opinion of the Engineer, a resubmission of the proposed test procedure is required, the date for the performance of this test shall be set at least six weeks following delivery of the resubmitted test procedure.

C. Perform the witnessed test in accordance with the test procedure. Any deviation in performance from that specified in these Specifications shall be corrected prior to shipment. If the deviation in performance is deemed by the Engineer to be substantial and if it is not corrected within the period allowed for the test, then a second test shall be performed. No extension of Contract time will be allowed in the event that this second test in necessary.

D. Submit the results of the test in a formal document within two weeks following satisfactory performance of the test. The test results shall document all problems encountered in running the test, corrective action taken, and the detailed results of each phase of the test.

3.03 TRAINING

A. General: To familiarize the Owner's personnel with PLC operation, training shall be provided as detailed hereunder. The training course shall be conducted under the direction of a training director who shall design a detailed training plan that complements the experience and skill levels of the Owner's personnel. The training course shall be conducted at the treatment plant. The text for both training courses below shall be the O&M Manual and selected handouts. The Owner may videotape the training at the Owner's expense.

B. PLC Operations Training: A minimum one-day course shall be provided for up to six persons. The level of training shall be sufficient to familiarize the personnel with the operation of the PLC and programming and program storage device. All essential system operating procedures shall be described as required to enable Owner's personnel to observe the controller operation via the programming device displays.

C. PLC Corrective Maintenance Training: A one day course shall be conducted for up to six persons on maintenance of modifications to the PLC. Instruction shall be

© December 2012 Kennedy/Jenks Consultants

given in the use of hardware diagnostic routines, test equipment and test procedures as required to enable the Owner's personnel to detect and isolate system faults to the circuit board or module level and to implement repairs by replacing failed circuit boards or modules. Step-by-step written procedures shall be provided for identifying hardware faults to the circuit board or module level for all items of digital equipment. All equipment corrective maintenance training activities shall be limited to the use of diagnostic routines with the aid of the programming device. If it is necessary to use special purpose test equipment which is only available from the equipment manufacturer, then such test equipment shall be provided as a part of the system and shall become the property of the Owner.

D. Additional PLC Training: If requested by Owner, a portion of the field instrument training required in Section 17010 may be allocated toward a continuation of either training course above or covering a specific topic. The Owner and Contractor must agree to the training content prior to commencing any training.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 17330

APPENDIX A

PLC Input/Output

Device Prefix	Tag	Description	Type	Sheet	PLC No.
ZIO	101	Source Water Emergency Isolation Valve Open	DI	I - 3	3
ZIC	101	Source Water Emergency Isolation Valve Closed	DI	I - 3	3
HS	101	Source Water Emergency Isolation Valve Open/Close Control	DO	I - 3	3
FI	300	Source Water Flow	AI	I - 4	3
AI	301	Conditioned Source Water ORP	AI	I - 4	3
PI	302	Roughing Filter Feed Pressure	AI	I - 4	3
PDIT	310	Greensand Roughing Filter 1 Differential Pressure	AI	I - 4	3
FIT	310	Greensand Roughing Filter 1 Flow	AI	I - 4	3
LI	310	Greensand Roughing Filter 1 Level	AI	I - 4	3
LAL	310	Greensand Roughing Filter 1 Low Level	DI	I - 4	3
LAH	310	Greensand Roughing Filter 1 High Level	DI	I - 4	3
LAHH	310	Greensand Roughing Filter 1 High High Level	DI	I - 4	3
ZIO	311	Greensand Roughing Filter 1 Influent Valve Open	DI	I - 4	3
ZIC	311	Greensand Roughing Filter 1 Influent Valve Closed	DI	I - 4	3
YI	311	Greensand Roughing Filter 1 Influent Valve Ready	DI	I - 4	3
HS	311	Greensand Roughing Filter 1 Influent Valve Open/Close Control	DO	I - 4	3
ZIO	312	Greensand Roughing Filter 1 Spent Washwater Valve Open	DI	I - 4	3
ZIC	312	Greensand Roughing Filter 1 Spent Washwater Valve Closed	DI	I - 4	3
YI	312	Greensand Roughing Filter 1 Spent Washwater Valve Ready	DI	I - 4	3
HS	312	Greensand Roughing Filter 1 Spent Washwater Valve Open/Close Control	DO	I - 4	3
ZIO	313	Greensand Roughing Filter 1 Surface Washwater Valve Open	DI	I - 4	3
ZIC	313	Greensand Roughing Filter 1 Surface Washwater Valve Closed	DI	I - 4	3
YI	313	Greensand Roughing Filter 1 Surface Washwater	DI	I - 4	3

© December 2012 Kennedy/Jenks Consultants

Device Prefix	Tag	Description	Type	Sheet	PLC No.
		Valve Ready			
HS	313	Greensand Roughing Filter 1 Surface Washwater Valve Open/Close Control	DO	I - 4	3
ZIO	314	Greensand Roughing Filter 1 Filtered Water Valve Open	DI	I - 4	3
ZIC	314	Greensand Roughing Filter 1 Filtered Water Valve Closed	DI	I - 4	3
YI	314	Greensand Roughing Filter 1 Filtered Water Valve Ready	DI	I - 4	3
HS	314	Greensand Roughing Filter 1 Filtered Water Valve Open/Close Control	DO	I - 4	3
ZI	314	Greensand Roughing Filter 1 Filtered Water Valve Position	AI	I - 4	3
ZIK	314	Greensand Roughing Filter 1 Filtered Water Valve Position Control	AO	I - 4	3
ZIO	316	Greensand Roughing Filter 1 Washwater Supply Valve Open	DI	I - 4	3
ZIC	316	Greensand Roughing Filter 1 Washwater Supply Valve Closed	DI	I - 4	3
YI	316	Greensand Roughing Filter 1 Washwater Supply Valve Ready	DI	I - 4	3
HS	316	Greensand Roughing Filter 1 Washwater Supply Valve Open/Close Control	DO	I - 4	3
ZIO	317	Greensand Roughing Filter 1 Filter Drain Valve Open	DI	I - 4	3
ZIC	317	Greensand Roughing Filter 1 Filter Drain Valve Closed	DI	I - 4	3
YI	317	Greensand Roughing Filter 1 Filter Drain Valve Ready	DI	I - 4	3
HS	317	Greensand Roughing Filter 1 Filter Drain Valve Open/Close Control	DO	I - 4	3
PDIT	320	Greensand Roughing Filter 2 Differential Pressure	AI	I - 4	3
FIT	320	Greensand Roughing Filter 2 Flow	AI	I - 4	3
LI	320	Greensand Roughing Filter 2 Level	AI	I - 4	3
LAL	320	Greensand Roughing Filter 2 Low Level	DI	I - 4	3
LAH	320	Greensand Roughing Filter 2 High Level	DI	I - 4	3
LAHH	320	Greensand Roughing Filter 2 High High Level	DI	I - 4	3
ZIO	321	Greensand Roughing Filter 2 Influent Valve Open	DI	I - 4	3
ZIC	321	Greensand Roughing Filter 2 Influent Valve Closed	DI	I - 4	3
YI	321	Greensand Roughing Filter 2 Influent Valve	DI	I - 4	3

© December 2012 Kennedy/Jenks Consultants

Device Prefix	Tag	Description	Type	Sheet	PLC No.
		Ready			
HS	321	Greensand Roughing Filter 2 Influent Valve Open/Close Control	DO	I - 4	3
ZIO	322	Greensand Roughing Filter 2 Spent Washwater Valve Open	DI	I - 4	3
ZIC	322	Greensand Roughing Filter 2 Spent Washwater Valve Closed	DI	I - 4	3
YI	322	Greensand Roughing Filter 2 Spent Washwater Valve Ready	DI	I - 4	3
HS	322	Greensand Roughing Filter 2 Spent Washwater Valve Open/Close Control	DO	I - 4	3
ZIO	323	Greensand Roughing Filter 2 Surface Washwater Valve Open	DI	I - 4	3
ZIC	323	Greensand Roughing Filter 2 Surface Washwater Valve Closed	DI	I - 4	3
YI	323	Greensand Roughing Filter 2 Surface Washwater Valve Ready	DI	I - 4	3
HS	323	Greensand Roughing Filter 2 Surface Washwater Valve Open/Close Control	DO	I - 4	3
ZIO	324	Greensand Roughing Filter 2 Filtered Water Valve Open	DI	I - 4	3
ZIC	324	Greensand Roughing Filter 2 Filtered Water Valve Closed	DI	I - 4	3
YI	324	Greensand Roughing Filter 2 Filtered Water Valve Ready	DI	I - 4	3
HS	324	Greensand Roughing Filter 2 Filtered Water Valve Open/Close Control	DO	I - 4	3
ZI	324	Greensand Roughing Filter 2 Filtered Water Valve Position	AI	I - 4	3
ZIK	324	Greensand Roughing Filter 2 Filtered Water Valve Position Control	AO	I - 4	3
ZIO	326	Greensand Roughing Filter 2 Washwater Supply Valve Open	DI	I - 4	3
ZIC	326	Greensand Roughing Filter 2 Washwater Supply Valve Closed	DI	I - 4	3
YI	326	Greensand Roughing Filter 2 Washwater Supply Valve Ready	DI	I - 4	3
HS	326	Greensand Roughing Filter 2 Washwater Supply Valve Open/Close Control	DO	I - 4	3
ZIO	327	Greensand Roughing Filter 2 Filter Drain Valve Open	DI	I - 4	3
ZIC	327	Greensand Roughing Filter 2 Filter Drain Valve Closed	DI	I - 4	3

Device Prefix	Tag	Description	Type	Sheet	PLC No.
YI	327	Greensand Roughing Filter 2 Filter Drain Valve Ready	DI	I - 4	3
HS	327	Greensand Roughing Filter 2 Filter Drain Valve Open/Close Control	DO	I - 4	3
AI	401	Roughing Filter Filtered Water Turbidity	AI	I - 5	3
AI	402	Roughing Filter Filtered Water ORP	AI	I - 5	3
PI	404	Roughing Filter Filtered Water Pressure	AI	I - 5	3
AI	406	Combined GAC Filtered Water ORP	AI	I - 5	3
AI	407	Combined GAC Filtered Water Turbidity	AI	I - 5	3
PDIT	410	GAC Adsorber/Filter 1 Differential Pressure	AI	I - 5	3
FIT	410	GAC Adsorber/Filter 1 Flow	AI	I - 5	3
LI	410	GAC Adsorber/Filter 1 Level	AI	I - 5	3
LAL	410	GAC Adsorber/Filter 1 Low Level	DI	I - 5	3
LAH	410	GAC Adsorber/Filter 1 High Level	DI	I - 5	3
LAHH	410	GAC Adsorber/Filter 1 High High Level	DI	I - 5	3
ZIO	411	GAC Adsorber/Filter 1 Influent Valve Open	DI	I - 5	3
ZIC	411	GAC Adsorber/Filter 1 Influent Valve Closed	DI	I - 5	3
YI	411	GAC Adsorber/Filter 1 Influent Valve Ready	DI	I - 5	3
HS	411	GAC Adsorber/Filter 1 Influent Valve Open/Close Control	DO	I - 5	3
ZIO	412	GAC Adsorber/Filter 1 Spent Washwater Valve Open	DI	I - 5	3
ZIC	412	GAC Adsorber/Filter 1 Spent Washwater Valve Closed	DI	I - 5	3
YI	412	GAC Adsorber/Filter 1 Spent Washwater Valve Ready	DI	I - 5	3
HS	412	GAC Adsorber/Filter 1 Spent Washwater Valve Open/Close Control	DO	I - 5	3
ZIO	413	GAC Adsorber/Filter 1 Surface Washwater Valve Open	DI	I - 5	3
ZIC	413	GAC Adsorber/Filter 1 Surface Washwater Valve Closed	DI	I - 5	3
YI	413	GAC Adsorber/Filter 1 Surface Washwater Valve Ready	DI	I - 5	3
HS	413	GAC Adsorber/Filter 1 Surface Washwater Valve Open/Close Control	DO	I - 5	3
ZIO	414	GAC Adsorber/Filter 1 Filtered Water Valve Open	DI	I - 5	3
ZIC	414	GAC Adsorber/Filter 1 Filtered Water Valve Closed	DI	I - 5	3
YI	414	GAC Adsorber/Filter 1 Filtered Water Valve Ready	DI	I - 5	3

© December 2012 Kennedy/Jenks Consultants

Device Prefix	Tag	Description	Type	Sheet	PLC No.
HS	414	GAC Adsorber/Filter 1 Filtered Water Valve Open/Close Control	DO	I - 5	3
ZI	414	GAC Adsorber/Filter 1 Filtered Water Valve Position	AI	I - 5	3
ZIK	414	GAC Adsorber/Filter 1 Filtered Water Valve Position Control	AO	I - 5	3
ZIO	415	GAC Adsorber/Filter 1 Filter-to-Waste Valve Open	DI	I - 5	3
ZIC	415	GAC Adsorber/Filter 1 Filter-to-Waste Valve Closed	DI	I - 5	3
YI	415	GAC Adsorber/Filter 1 Filter-to-Waste Valve Ready	DI	I - 5	3
HS	415	GAC Adsorber/Filter 1 Filter-to-Waste Valve Open/Close Control	DO	I - 5	3
ZI	415	GAC Adsorber/Filter 1 Filter-to-Waste Valve Position	AI	I - 5	3
ZIK	415	GAC Adsorber/Filter 1 Filter-to-Waste Valve Position Control	AO	I - 5	3
ZIO	416	GAC Adsorber/Filter 1 Washwater Supply Valve Open	DI	I - 5	3
ZIC	416	GAC Adsorber/Filter 1 Washwater Supply Valve Closed	DI	I - 5	3
YI	416	GAC Adsorber/Filter 1 Washwater Supply Valve Ready	DI	I - 5	3
HS	416	GAC Adsorber/Filter 1 Washwater Supply Valve Open/Close Control	DO	I - 5	3
ZIO	417	GAC Adsorber/Filter 1 Filter Drain Valve Open	DI	I - 5	3
ZIC	417	GAC Adsorber/Filter 1 Filter Drain Valve Closed	DI	I - 5	3
YI	417	GAC Adsorber/Filter 1 Filter Drain Valve Ready	DI	I - 5	3
HS	417	GAC Adsorber/Filter 1 Filter Drain Valve Open/Close Control	DO	I - 5	3
PDIT	420	GAC Adsorber/Filter 2 Differential Pressure	AI	I - 5	3
FIT	420	GAC Adsorber/Filter 2 Flow	AI	I - 5	3
LI	420	GAC Adsorber/Filter 2 Level	AI	I - 5	3
LAL	420	GAC Adsorber/Filter 2 Low Level	DI	I - 5	3
LAH	420	GAC Adsorber/Filter 2 High Level	DI	I - 5	3
LAHH	420	GAC Adsorber/Filter 2 High High Level	DI	I - 5	3
ZIO	421	GAC Adsorber/Filter 2 Influent Valve Open	DI	I - 5	3
ZIC	421	GAC Adsorber/Filter 2 Influent Valve Closed	DI	I - 5	3
YI	421	GAC Adsorber/Filter 2 Influent Valve Ready	DI	I - 5	3
HS	421	GAC Adsorber/Filter 2 Influent Valve Open/Close Control	DO	I - 5	3

© December 2012 Kennedy/Jenks Consultants

Device Prefix	Tag	Description	Type	Sheet	PLC No.
ZIO	422	GAC Adsorber/Filter 2 Spent Washwater Valve Open	DI	I - 5	3
ZIC	422	GAC Adsorber/Filter 2 Spent Washwater Valve Closed	DI	I - 5	3
YI	422	GAC Adsorber/Filter 2 Spent Washwater Valve Ready	DI	I - 5	3
HS	422	GAC Adsorber/Filter 2 Spent Washwater Valve Open/Close Control	DO	I - 5	3
ZIO	423	GAC Adsorber/Filter 2 Surface Washwater Valve Open	DI	I - 5	3
ZIC	423	GAC Adsorber/Filter 2 Surface Washwater Valve Closed	DI	I - 5	3
YI	423	GAC Adsorber/Filter 2 Surface Washwater Valve Ready	DI	I - 5	3
HS	423	GAC Adsorber/Filter 2 Surface Washwater Valve Open/Close Control	DO	I - 5	3
ZIO	424	GAC Adsorber/Filter 2 Filtered Water Valve Open	DI	I - 5	3
ZIC	424	GAC Adsorber/Filter 2 Filtered Water Valve Closed	DI	I - 5	3
YI	424	GAC Adsorber/Filter 2 Filtered Water Valve Ready	DI	I - 5	3
HS	424	GAC Adsorber/Filter 2 Filtered Water Valve Open/Close Control	DO	I - 5	3
ZI	424	GAC Adsorber/Filter 2 Filtered Water Valve Position	AI	I - 5	3
ZIK	424	GAC Adsorber/Filter 2 Filtered Water Valve Position Control	AO	I - 5	3
ZIO	425	GAC Adsorber/Filter 2 Filter-to-Waste Valve Open	DI	I - 5	3
ZIC	425	GAC Adsorber/Filter 2 Filter-to-Waste Valve Closed	DI	I - 5	3
YI	425	GAC Adsorber/Filter 2 Filter-to-Waste Valve Ready	DI	I - 5	3
HS	425	GAC Adsorber/Filter 2 Filter-to-Waste Valve Open/Close Control	DO	I - 5	3
ZI	425	GAC Adsorber/Filter 2 Filter-to-Waste Valve Position	AI	I - 5	3
ZIK	425	GAC Adsorber/Filter 2 Filter-to-Waste Valve Position Control	AO	I - 5	3
ZIO	426	GAC Adsorber/Filter 2 Washwater Supply Valve Open	DI	I - 5	3
ZIC	426	GAC Adsorber/Filter 2 Washwater Supply Valve	DI	I - 5	3

© December 2012 Kennedy/Jenks Consultants

Device Prefix	Tag	Description	Type	Sheet	PLC No.
		Closed			
YI	426	GAC Adsorber/Filter 2 Washwater Supply Valve Ready	DI	I - 5	3
HS	426	GAC Adsorber/Filter 2 Washwater Supply Valve Open/Close Control	DO	I - 5	3
ZIO	427	GAC Adsorber/Filter 2 Filter Drain Valve Open	DI	I - 5	3
ZIC	427	GAC Adsorber/Filter 2 Filter Drain Valve Closed	DI	I - 5	3
YI	427	GAC Adsorber/Filter 2 Filter Drain Valve Ready	DI	I - 5	3
HS	427	GAC Adsorber/Filter 2 Filter Drain Valve Open/Close Control	DO	I - 5	3
PDIT	430	GAC Adsorber/Filter 3 Differential Pressure	AI	I - 5	3
FIT	430	GAC Adsorber/Filter 3 Flow	AI	I - 5	3
LI	430	GAC Adsorber/Filter 3 Level	AI	I - 5	3
LAL	430	GAC Adsorber/Filter 3 Low Level	DI	I - 5	3
LAH	430	GAC Adsorber/Filter 3 High Level	DI	I - 5	3
LAHH	430	GAC Adsorber/Filter 3 High High Level	DI	I - 5	3
ZIO	431	GAC Adsorber/Filter 3 Influent Valve Open	DI	I - 5	3
ZIC	431	GAC Adsorber/Filter 3 Influent Valve Closed	DI	I - 5	3
YI	431	GAC Adsorber/Filter 3 Influent Valve Ready	DI	I - 5	3
HS	431	GAC Adsorber/Filter 3 Influent Valve Open/Close Control	DO	I - 5	3
ZIO	432	GAC Adsorber/Filter 3 Spent Washwater Valve Open	DI	I - 5	3
ZIC	432	GAC Adsorber/Filter 3 Spent Washwater Valve Closed	DI	I - 5	3
YI	432	GAC Adsorber/Filter 3 Spent Washwater Valve Ready	DI	I - 5	3
HS	432	GAC Adsorber/Filter 3 Spent Washwater Valve Open/Close Control	DO	I - 5	3
ZIO	433	GAC Adsorber/Filter 3 Surface Washwater Valve Open	DI	I - 5	3
ZIC	433	GAC Adsorber/Filter 3 Surface Washwater Valve Closed	DI	I - 5	3
YI	433	GAC Adsorber/Filter 3 Surface Washwater Valve Ready	DI	I - 5	3
HS	433	GAC Adsorber/Filter 3 Surface Washwater Valve Open/Close Control	DO	I - 5	3
ZIO	434	GAC Adsorber/Filter 3 Filtered Water Valve Open	DI	I - 5	3
ZIC	434	GAC Adsorber/Filter 3 Filtered Water Valve Closed	DI	I - 5	3
YI	434	GAC Adsorber/Filter 3 Filtered Water Valve	DI	I - 5	3

Device Prefix	Tag	Description	Type	Sheet	PLC No.
		Ready			
HS	434	GAC Adsorber/Filter 3 Filtered Water Valve Open/Close Control	DO	I - 5	3
ZI	434	GAC Adsorber/Filter 3 Filtered Water Valve Position	AI	I - 5	3
ZIK	434	GAC Adsorber/Filter 3 Filtered Water Valve Position Control	AO	I - 5	3
ZIO	435	GAC Adsorber/Filter 3 Filter-to-Waste Valve Open	DI	I - 5	3
ZIC	435	GAC Adsorber/Filter 3 Filter-to-Waste Valve Closed	DI	I - 5	3
YI	435	GAC Adsorber/Filter 3 Filter-to-Waste Valve Ready	DI	I - 5	3
HS	435	GAC Adsorber/Filter 3 Filter-to-Waste Valve Open/Close Control	DO	I - 5	3
ZI	435	GAC Adsorber/Filter 3 Filter-to-Waste Valve Position	AI	I - 5	3
ZIK	435	GAC Adsorber/Filter 3 Filter-to-Waste Valve Position Control	AO	I - 5	3
ZIO	436	GAC Adsorber/Filter 3 Washwater Supply Valve Open	DI	I - 5	3
ZIC	436	GAC Adsorber/Filter 3 Washwater Supply Valve Closed	DI	I - 5	3
YI	436	GAC Adsorber/Filter 3 Washwater Supply Valve Ready	DI	I - 5	3
HS	436	GAC Adsorber/Filter 3 Washwater Supply Valve Open/Close Control	DO	I - 5	3
ZIO	437	GAC Adsorber/Filter 3 Filter Drain Valve Open	DI	I - 5	3
ZIC	437	GAC Adsorber/Filter 3 Filter Drain Valve Closed	DI	I - 5	3
YI	437	GAC Adsorber/Filter 3 Filter Drain Valve Ready	DI	I - 5	3
HS	437	GAC Adsorber/Filter 3 Filter Drain Valve Open/Close Control	DO	I - 5	3
LI	350	Treated Water Tank Level	AI	I - 6	3
FI	350	Washwater Supply Flow	AI	I - 6	3
YI	351	Washwater Supply Pump 1 Ready	DI	I - 6	3
XI	351	Washwater Supply Pump 1 Run	DI	I - 6	3
XA	351	Washwater Supply Pump 1 Overload	DI	I - 6	3
HS	351	Washwater Supply Pump 1 Start	DO	I - 6	3
YI	352	Washwater Supply Pump 2 Ready	DI	I - 6	3
XI	352	Washwater Supply Pump 2 Run	DI	I - 6	3
XA	352	Washwater Supply Pump 2 Overload	DI	I - 6	3
HS	352	Washwater Supply Pump 2 Start	DO	I - 6	3

© December 2012 Kennedy/Jenks Consultants

Device Prefix	Tag	Description	Type	Sheet	PLC No.
YI	353	Washwater Supply Pump 3 Ready	DI	I - 6	3
XI	353	Washwater Supply Pump 3 Run	DI	I - 6	3
XA	353	Washwater Supply Pump 3 Overload	DI	I - 6	3
HS	353	Washwater Supply Pump 3 Start	DO	I - 6	3
ZIO	354	Washwater Supply Valve Open	DI	I - 6	3
ZIC	354	Washwater Supply Valve Closed	DI	I - 6	3
YI	354	Washwater Supply Valve Ready	DI	I - 6	3
HS	354	Washwater Supply Valve Open/Close Control	DO	I - 6	3
ZI	354	Washwater Supply Valve Position	AI	I - 6	3
ZIK	354	Washwater Supply Valve Position Control	AO	I - 6	3
FI	360	Middle Pressure Zone Treated Water Flow	AI	I - 6	3
PI	360	Middle Pressure Zone Treated Water Pressure	AI	I - 6	3
YI	361	Middle Pressure Zone Treated Water Pump 1 Ready	DI	I - 6	3
XI	361	Middle Pressure Zone Treated Water Pump 1 Run	DI	I - 6	3
XA	361	Middle Pressure Zone Treated Water Pump 1 Fail	DI	I – 6	3
HS	361	Middle Pressure Zone Treated Water Pump 1 Start	DO	I – 6	3
SI	361	Middle Pressure Zone Treated Water Pump 1 Speed	AI	I – 6	3
SIK	361	Middle Pressure Zone Treated Water Pump 1 Speed Control	AO	I – 6	3
YI	362	Middle Pressure Zone Treated Water Pump 2 Ready	DI	I - 6	3
XI	362	Middle Pressure Zone Treated Water Pump 2 Run	DI	I - 6	3
XA	362	Middle Pressure Zone Treated Water Pump 2 Fail	DI	I – 6	3
HS	362	Middle Pressure Zone Treated Water Pump 2 Start	DO	I - 6	3
SI	362	Middle Pressure Zone Treated Water Pump 2 Speed	AI	I – 6	3
SIK	362	Middle Pressure Zone Treated Water Pump 2 Speed Control	AO	I – 6	3
YI	363	Middle Pressure Zone Treated Water Pump 3 Ready	DI	I - 6	3
XI	363	Middle Pressure Zone Treated Water Pump 3 Run	DI	I - 6	3
XA	363	Middle Pressure Zone Treated Water Pump 3 Fail	DI	I – 6	3

© December 2012 Kennedy/Jenks Consultants

Device Prefix	Tag	Description	Type	Sheet	PLC No.
HS	363	Middle Pressure Zone Treated Water Pump 3 Start	DO	I - 6	3
SI	363	Middle Pressure Zone Treated Water Pump 3 Speed	AI	I – 6	3
SIK	363	Middle Pressure Zone Treated Water Pump 3 Speed Control	AO	I – 6	3
FI	370	High Pressure Zone Treated Water Flow	AI	I - 6	3
PI	370	High Pressure Zone Treated Water Pressure	AI	I - 6	3
YI	371	High Pressure Zone Treated Water Pump 1 Ready	DI	I - 6	3
XI	371	High Pressure Zone Treated Water Pump 1 Run	DI	I - 6	3
XA	371	High Pressure Zone Treated Water Pump 1 Fail	DI	I – 6	3
HS	371	High Pressure Zone Treated Water Pump 1 Start	DO	I – 6	3
SI	371	High Pressure Zone Treated Water Pump 1 Speed	AI	I – 6	3
SIK	371	High Pressure Zone Treated Water Pump 1 Speed Control	AO	I – 6	3
YI	372	High Pressure Zone Treated Water Pump 2 Ready	DI	I - 6	3
XI	372	High Pressure Zone Treated Water Pump 2 Run	DI	I - 6	3
XA	372	High Pressure Zone Treated Water Pump 2 Fail	DI	I – 6	3
HS	372	High Pressure Zone Treated Water Pump 2 Start	DO	I - 6	3
SI	372	High Pressure Zone Treated Water Pump 2 Speed	AI	I – 6	3
SIK	372	High Pressure Zone Treated Water Pump 2 Speed Control	AO	I – 6	3
YI	373	High Pressure Zone Treated Water Pump 3 Ready	DI	I - 6	3
XI	373	High Pressure Zone Treated Water Pump 3 Run	DI	I - 6	3
XA	373	High Pressure Zone Treated Water Pump 3 Fail	DI	I – 6	3
HS	373	High Pressure Zone Treated Water Pump 3 Start	DO	I - 6	3
SI	373	High Pressure Zone Treated Water Pump 3 Speed	AI	I – 6	3
SIK	373	High Pressure Zone Treated Water Pump 3 Speed Control	AO	I – 6	3
LI	710	Coagulant Storage Tank Level	AI	I - 7	3
LAH	710	Coagulant Storage Area Sump High Level	DI	I - 7	3
YI	711	Coagulant Metering Pump 1 Ready	DI	I - 7	3
XI	711	Coagulant Metering Pump 1 Run	DI	I - 7	3
HS	711	Coagulant Metering Pump 1 Start	DO	I - 7	3
SI	711	Coagulant Metering Pump 1 Speed	AI	I - 7	3
FIC	711	Coagulant Metering Pump 1 Pacing Ratio	AO	I - 7	3
YI	712	Coagulant Metering Pump 2 Ready	DI	I - 7	3

© December 2012 Kennedy/Jenks Consultants

Device Prefix	Tag	Description	Type	Sheet	PLC No.
XI	712	Coagulant Metering Pump 2 Run	DI	I - 7	3
HS	712	Coagulant Metering Pump 2 Start	DO	I - 7	3
SI	712	Coagulant Metering Pump 2 Speed	AI	I - 7	3
FIC	712	Coagulant Metering Pump 2 Pacing Ratio	AO	I - 7	3
LI	340	Spent Washwater EQ Tank Level	AI	I - 8	3
FI	340	Spent Washwater Flow	AI	I - 8	3
YI	341	GAC Spent Washwater Pump 1 Ready	DI	I - 8	3
XI	341	GAC Spent Washwater Pump 1 Run	DI	I - 8	3
XA	341	GAC Spent Washwater Pump 1 Overload	DI	I - 8	3
HS	341	GAC Spent Washwater Pump 1 Start	DO	I - 8	3
YI	342	GAC Spent Washwater Pump 2 Ready	DI	I - 8	3
XI	342	GAC Spent Washwater Pump 2 Run	DI	I - 8	3
XA	342	GAC Spent Washwater Pump 2 Overload	DI	I - 8	3
HS	342	GAC Spent Washwater Pump 2 Start	DO	I - 8	3
ZIO	343	SWW-to-Sewer Flow Control Valve Open	DI	I - 8	3
ZIC	343	SWW-to-Sewer Flow Control Valve Closed	DI	I - 8	3
YI	343	SWW-to-Sewer Flow Control Valve Ready	DI	I - 8	3
HS	343	SWW-to-Sewer Flow Control Valve Open/Close Control	DO	I - 8	3
ZI	343	SWW-to-Sewer Flow Control Valve Position	AI	I - 8	3
ZIK	343	SWW-to-Sewer Flow Control Valve Position Control	AO	I - 8	3
ZIO	344	SWW-to-Hollister Flow Control Valve Open	DI	I - 8	3
ZIC	344	SWW-to-Hollister Flow Control Valve Closed	DI	I - 8	3
YI	344	SWW-to-Hollister Flow Control Valve Ready	DI	I - 8	3
HS	344	SWW-to-Hollister Flow Control Valve Open/Close Control	DO	I - 8	3
ZI	344	SWW-to-Hollister Flow Control Valve Position	AI	I - 8	3
ZIK	344	SWW-to-Hollister Flow Control Valve Position Control	AO	I - 8	3
FI	380	Surface Washwater Supply Flow	AI	I - 9	3
ZIO	380	SWS Flow Control Valve Open	DI	I - 9	3
ZIC	380	SWS Flow Control Valve Closed	DI	I - 9	3
YI	380	SWS Flow Control Valve Ready	DI	I - 9	3
HS	380	SWS Flow Control Valve Open/Close Control	DO	I - 9	3
ZI	380	SWS Flow Control Valve Position	AI	I - 9	3
ZIK	380	SWS Flow Control Valve Position Control	AO	I - 9	3
YI	381	Surface Washwater Booster Pump 1 Ready	DI	I - 9	3
XI	381	Surface Washwater Booster Pump 1 Run	DI	I - 9	3
XA	381	Surface Washwater Booster Pump 1 Overload	DI	I - 9	3
HS	381	Surface Washwater Booster Pump 1 Start	DO	I - 9	3
YI	382	Surface Washwater Booster Pump 2 Ready	DI	I - 9	3

© December 2012 Kennedy/Jenks Consultants

Device Prefix	Tag	Description	Type	Sheet	PLC No.
XI	382	Surface Washwater Booster Pump 2 Run	DI	I - 9	3
XA	382	Surface Washwater Booster Pump 2 Overload	DI	I - 9	3
HS	382	Surface Washwater Booster Pump 2 Start	DO	I - 9	3

© December 2012 Kennedy/Jenks Consultants

Existing PLC-2: Inputs and outputs listed below shall be wired to spare I/O points in existing PLC-2 in the Electrical Room. The existing PLC program shall be modified for the new I/O as described in the Control Strategies.

Device Prefix	Tag	Description	Type	Sheet	PLC No.
AI	107	Source Water ORP	AI	I - 3	2
AI	108	Source Water DO	AI	I - 3	2
AI	405	Filtered Water / Source Water TOC	AI	I - 5	2
LI	720	Permanganate Storage Tank Level	AI	I - 7	2
YI	721	Permanganate Metering Pump 1 Ready	DI	I - 7	2
XI	721	Permanganate Metering Pump 1 Run	DI	I - 7	2
HS	721	Permanganate Metering Pump 1 Start	DO	I - 7	2
SI	721	Permanganate Metering Pump 1 Speed	AI	I - 7	2
FIC	721	Permanganate Metering Pump 1 Pacing Ratio	AO	I - 7	2
YI	722	Permanganate Metering Pump 2 Ready	DI	I - 7	2
XI	722	Permanganate Metering Pump 2 Run	DI	I - 7	2
HS	722	Permanganate Metering Pump 2 Start	DO	I - 7	2
SI	722	Permanganate Metering Pump 2 Speed	AI	I - 7	2
FIC	722	Permanganate Metering Pump 2 Pacing Ratio	AO	I - 7	2
YI	370	Hypochlorite Oxidation Pump Ready	DI	I - 9	2
XI	370	Hypochlorite Oxidation Pump Run	DI	I - 9	2
HS	370	Hypochlorite Oxidation Pump Start	DO	I - 9	2
SI	370	Hypochlorite Oxidation Pump Speed	AI	I - 9	2
FIC	370	Hypochlorite Oxidation Pump Pacing Ratio	AO	I - 9	2

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

SECTION 17330

APPENDIX B

CONTROL STRATEGIES

CONTROL STRATEGY 1.1

TITLE: Overall System Configuration

A. General: The components of the programmable logic controller (PLC)-based control system are shown on the supervisory control and data acquisition (SCADA) Block Diagram on the Drawings. The system shall consist of a new PLC that will communicate with the existing plant PLCs and SCADA system. The PLC shall be integrated with the WTP's existing overall SCADA system and Operator Interface Terminal (OIT). The PLC and the existing Plant OIT communicate via an Ethernet network.

B. Control Strategies: These control strategies describe functions to be programmed in the new Plant PLC. Monitoring displays, operator inputs and controls described herein are for integration into the existing OIT. Additionally the new Plant PLC shall be provided with a local operator interface that shall provide local monitoring and control of functions described in these strategies.

C. Programmable Logic Controllers (PLC):
   1. PLC3: New PLC3 shall provide monitoring and controls for the Source Water Valves, Greensand Roughing Filters, GAC Adsorbers/Filters, Treated Water Tank, Treated Water Pumps, Washwater Supply Pumps, Spent Washwater EQ Tank, GAC Spent Washwater Pumps, and new Coagulant System. PLC3 shall communicate through the Ethernet network with the existing Plant PLCs. PLC3 shall be provided with the necessary signals and I/O for a complete and functional plant control system. The PLC shall be installed in an outdoor enclosure next to the new motor control center serving the new process equipment.
   2. PLC2 (Existing): Existing PLC2 shall be modified to provide monitoring and controls for the new Permanganate system and the new Hypochlorite Oxidation Pump to be located in the in existing Process Building. The PLC shall communicate to the new PLC via the existing plant SCADA network.
   3. PLC1, Membrane Master Control Panel (Existing): Existing PLC1 is an existing PLC that provides master control and monitoring of the Membrane Filtration System. The Membrane Filtration System includes individual PLCs for each filter that communicates to PLC1 via the Ethernet network. PLC1 communicates to the existing SCADA network via Ethernet for data transfer to and from PLC2.

D. Field instruments and devices are connected as PLC inputs. While some signals are not processed by the PLC for control, they shall be programmed and monitored at the OIT.

E. Operator Interface:
   1. The Plant OIT shall be configured and programmed to provide the following functions as a minimum. The Plant OIT shall include, but not be limited to, indications of the functions listed. The Plant OIT described in these control strategies refer to the overall plant operator interface for the new treatment system.

© December 2012 Kennedy/Jenks Consultants

a. Indication of equipment status and total running hours.
b. Indication and logging of alarms.
c. Indication and totalization of flows.
d. Indication of process variables such as levels and flows.
e. Adjustment of control settings such as time delay and levels setpoints.
f. Display of alarms and alarm acknowledge system.
g. Display of real time and historical trends.
h. Control of equipment in “Hand” mode at the Plant OIT.

2. The Maintenance Staff Personnel computer at the existing facility shall be provided with operator interface screens similar to those programmed in the Plant OIT. The screens on the computer shall be for monitoring purposes only and will not provide any control functions or historical logging.

F. Local Operator Interface: The PLC shall be provided with a panel-mounted operator interface panel for local monitoring and control. The local operator interface shall include, but not be limited to, indications of the functions listed in paragraph E above.

G. SCADA System: The existing facility SCADA system shall be modified for the addition of the new processes as part of this project. The new PLC shall communicate with the existing SCADA through the Ethernet network connection via ethernet cable. The existing facility SCADA computer shall be modified for the addition of screens to monitor and control the new processes as described in these Control Strategies. The modifications shall also include the functions as listed in paragraph C above. Coordinate with the Owner for requirements for new process screens, alarm annunciation and display, trends and reports.

I. Operator Security Level Protocols: The existing SCADA system workstations include security level protocols that shall be retained when new operator interface screens are added to the Plant OIT. Operator security levels shall be in place as required by the Owner for remote operation of plant equipment and setpoint adjustments.

H. Operator Interface Screens: Provide the following screens developed for the Plant OIT to be incorporated with existing SCADA screens. These exclude any pop-up screens, alarms screens, real-time and historical trend screens, and reports. The screens can be combined where practical. Print outs of the HMI screens shall be submitted to the Engineer for review.

Screen # 1:	System Overview (to replace existing System Overview screen)
Screen # 2:	Water Quality and Treatment Overview
Screen # 3:	Greensand Roughing Filters Overview
Screens # 4-5:	Individual Greensand Roughing Filters Nos. 1 and 2
Screen # 6:	GAC Adsorbers/Filters Overview
Screens # 7-9:	Individual GAC Adsorbers/Filters Nos. 1, 2 and 3
Screen # 10:	Treated Water Tank
Screen # 11:	Treated Water Pumps
Screen # 12:	Washwater Supply Pumps
Screen # 13:	Surface Washwater Booster Pumps
Screen # 14:	Spent Washwater Tank and Spent Washwater to Sewer Valve
Screen # 15:	GAC Spent Washwater Pumps
Screen # 16:	Coagulant System
Screen # 17:	Potassium Permanganate System

© December 2012 Kennedy/Jenks Consultants

Screen # 18: Hypochlorite Oxidation System (Revise existing Hypochlorite Screen)
Screen # 19: Reports & Trends (# as needed)
Screen # 20: (As directed by the Owner)

A listing of the current Plant OIT SCADA screens, and graphical screen shots of the current SCADA screens are attached at the end of this section.

© December 2012 Kennedy/Jenks Consultants

TITLE: General Equipment Interface

A. General: This strategy describes typical interface logic with final control elements such as pumps and other equipment. This control strategy applies to the equipment described in the control strategies on this project. Signals that are required to be indicated shall be displayed on Plant OIT screens.

B. Description: The PLC shall monitor the equipment's related inputs/outputs as follows:
   1. Monitor whether equipment is in AUTO mode before initiating or queuing equipment for control. An "READY" display shall be indicated (YI***).
   2. If equipment is ready, the PLC shall activate a normally open discrete output "DO" to start the equipment.
   3. The PLC shall interrogate the circuit and monitor the input "RUN" discrete input. A “RUN” symbol shall be indicated (XI***).
   4. If the "RUN" input is not activated within an adjustable time of t=0-60 seconds, the PLC shall annunciate a display of equipment "FAIL," (XA***). See paragraph E for additional clarification.
   5. The PLC shall also annunciate equipment "FAIL" if a separate discrete input signal is detected.
   6. The Plant OIT display shall include the equipment "RUN," "READY," and "FAIL" status. The "FAIL" signal shall also be added to the alarm list.
   7. The "RUN" signal shall activate an elapsed time register to monitor the total run time of the equipment.

C. Equipment Alternation: For two pieces of equipment of the same function, the PLC shall alternate their operation in one of the following manners. The selection shall be made manually from the Plant OIT.
   1. Manual: The "LEAD" piece of equipment is assigned and will continue to run until stopped. In the next cycle of operation, the same equipment continues the same assignment unless manually reassigned.
   2. Automatic (Run Time): The equipment alternates between "LEAD" and "STANDBY" based on manually set maximum run time. When the actual run time of a piece of equipment exceeds the set maximum run time, on the next start sequence of the equipment, the PLC places the currently used equipment in "STANDBY", resets the run time and starts the designated "STANDBY" equipment as “LEAD”.
   3. Automatic (Last Off): The equipment alternates based on the process cycle where after each cycle the PLC switches the sequence to equalize the run time.

D. Automatic Valve Interface: The interface includes either controlling and/or monitoring the miscellaneous valves of the types described herein. Other types provided by equipment manufacturer shall be controlled as required by the equipment controls. The PLC shall activate the discrete output when the equipment is in the "AUTO" mode only. When the equipment is put in “MANUAL” mode, the PLC shall de-activate the discrete output.
   1. Motorized Valves: Motorized valves are used for either one or both of open-closed and modulating service. When valve includes both functions and when the valve is in the open-closed mode, the PLC shall first disable the modulating loop function. Upon restoration of the modulating function, the PLC shall position the valve in the

© December 2012 Kennedy/Jenks Consultants

modulating range and, with an adjustable ramp of 0-60 seconds, apply the control loop.

a. PLC shall monitor "READY" status of valve for automatic control.
b. To open or close the valve, the PLC shall issue a command to valve controls.
c. The PLC shall monitor the valve positions for "OPEN" and/or "CLOSED."
d. The PLC shall monitor the valve status after an "OPEN" or "CLOSE" command. If the valve does not achieve the required status after an adjustable delay 0-60 seconds, issue a valve "FAIL" display on the Plant OIT.
e. PLC shall monitor valve position for modulating valves.
f. For each valve, setpoints for valve controls such as deadbands and selected data shall be available on the Plant OIT.

E. Lead-Lag-Standby Operation (typical for tandem pump arrangements):
1. The Lag or Standby Pump starts if the Lead Pump fails.
2. A pump failure shall occur if a pump fails to run after a call to run following a 0-60 second delay, or while called-to-run but fails to continue running,
3. A failed pump shall be locked OFF and prevented from restarting until reset by the operator. A pump is reset from failed condition by a "Reset" icon on the Plant OIT screen.

F. Typical Loop Description (FIC, LIC, PIC, AIC): A typical feedback loop using PID (Proportional Integral and Derivative) shall be implemented in the PLC with displays of various signals on a loop view template on the Plant OIT including settings of tuning parameters. Loop shall include a bumpless transfer feature from Auto to Manual. The loop view shall include:
1. Process variable indicator in engineering units.
2. Setpoint indicator.
3. Setpoint selection: local/remote
4. Output signal: 0-100%.
5. Manual/Auto selection: This allows a manual control of output signal.
6. PI&D tuning monitoring and setting. Provide trends of process variable for proper tuning.

G. Typical Ratio Control Description (FFK): This applies where ratio control-based on a process variable is required.
1. Ratio control shall be implemented in PLC as an open loop proportional control as follows:

Output = K* (process variable) + B

Where:

Output: PLC output (0-100%)
K: an Operator input in %
Process Variable: Controlled Signal (Flow, Level…etc)
B: bias signal: Initially set at 0%

2. A template shall be provided for the following features:
a. Process variable indication: In Engineering Units.
b. Ratio settings (K): in percentage.
c. Output signal: 0-100%

© December 2012 Kennedy/Jenks Consultants

H. Typical Manual Control (SIK, HIC, etc.):

1. A typical manual control station shall allow the PLC output to be set from the Plant OIT. A template shall be provided to indicate a bar graph output from 0-100% and a slider setting from 0-100%, where 0-100% could also be indicated in engineering units such as RPM, etc. Provide numerical values of the displays and setpoints above.

© December 2012 Kennedy/Jenks Consultants

CONTROL STRATEGY 1.3

TITLE: Typical Alarms

A. General: This strategy describes the monitoring and display of alarm conditions. The alarm conditions can be: 1) Discrete input, 2) Derived, and 3) Deviation.

B. Descriptions:
   1. Discrete Input Alarms: Whenever a discrete input alarm is detected, the PLC shall annunciate an alarm after an adjustable delay 0-5 seconds.
   2. Derived Alarms: A derived alarm consists of monitoring of analog inputs and/or logic derivation within control strategies. The PLC monitors these events and annunciates alarms after an adjustable delay of 0-5 seconds. Settings of alarms shall be available from the SCADA screens.
   3. Deviation Alarms: Whenever a process variable deviates from a setpoint value, whether the setpoint is manual or calculated, the PLC shall flag the event and annunciate a "Deviation Alarm". An adjustable time delay of 0-30 minutes shall be provided.

C. Alarm Sequence: The PLC programs shall execute alarms as follows:
   1. Upon the activation of an alarm, a flashing indication and alarm text message shall be displayed on the operator interface.
   2. An “Alarm Reset” touch pushbutton shall remove the alarm message.

D. Plant Shutdowns: Where required by the Control Strategies, specific alarms shall initiate a plant shutdown. Plant shutdown sequence shall occur after an adjustable time delay of 0-30 minutes.

© December 2012 Kennedy/Jenks Consultants

CONTROL STRATEGY 2.1

TITLE: Overall Plant Operation

AREA: P&ID SHEET: I-3

LOOP NUMBERS:

RELATED EQUIPMENT: Greensand Roughing Filters, GAC Adsorbers/Filters, (E) MF Membrane Filters, High Pressure Treated Water Pumps, Middle Pressure Treated Water Pumps

A. General: This control strategy describes the overall operations strategy and operational modes for the Lessalt Water Treatment Plant (WTP). Specific control strategies for process elements within the WTP are presented in the following control strategies. The overall operation of the WTP will be initiated from manual input of setpoints at the OIT by the Lessalt WTP operations staff as described below.

B. Monitoring: The facility signals shall be monitored by the Plant PLC and displayed on the Plant OIT, as described in the specific process control strategies below. Display, at a minimum, the following on the System Overview Screen:
   1. Plant Operational Mode
   2. Plant Flow Rates and Setpoints depending on the plant operational mode
   3. Membrane Filtered Water Turbidity and TOC values
   4. Equipment Operational Status

C. Overall Plant Operational Modes:
   1. The Operator shall select an overall plant Operational Mode from the SCADA Screen at the OIT. The WTP shall have three overall plant Operational Modes:
      a. Offline;
      b. Automatic Mode; and
      c. Manual Mode
   2. **Offline**: All systems are shut down. If the WTP is operating and an operator takes the overall operational mode to Offline, the existing MF system would go into an automatic shutdown sequence specific to that piece of equipment. The other plant components could continue to operate for a short period as they flush and perform the shutdown sequence. The Operator shall also have an Emergency Stop button on the SCADA screen that stops all equipment.
   3. **Automatic Mode**: This mode of operation is the normal mode of operation. In this mode, the Operator enters the plant production flow rate setpoint. The Operator can also enter the desired number of Greensand Roughing Filters, GAC Adsorbers/Filters and MF Membrane Filters to operate, or the default number units will operate based on the plant production flow rate. The Operator also enters the amount of the plant production to be sent to the selected Pressure Zone (typically the High Zone), with the remaining fraction of the plant production being sent to the other Pressure Zone. The SCADA system will operate and automatically set the flow rates for the plant treatment processes, as described in the control strategies below, to produce the plant production flow rate setpoint, and send water to the pressure zones.
   4. **Manual Mode**: This mode of operation is intended for short-term operations and testing of the equipment in the WTP. In this mode of operation, the Operator would

© December 2012 Kennedy/Jenks Consultants

initiate operation of each process system by entering a flow setpoint for each system. The systems would operate without automatic control until stopped by the Operator, by emergency stop, or by an external signal(s) to the SCADA system based on system safety conditions.

D. Setpoints: The following setpoints shall be adjustable at the Plant OIT, depending on the plant Operational Mode:
   1. Plant Production Flow Rate (combined MF product water flow)
   2. Number of MF Membrane Filters in Operation
   3. Number of Greensand Roughing Filters in Operation
   4. Number of GAC Adsorbers/Filters in Operation
   5. Plant Production Flow Rate to Middle Pressure Zone
   6. Plant Production Flow Rate to High Pressure Zone

E. Alarms: The following alarms shall be associated with this control strategy:
   1. Equipment failure shutdown
   2. Low flow alarms
   3. Equipment status

© December 2012 Kennedy/Jenks Consultants

CONTROL STRATEGY 2.2

TITLE: Source Water Valves

AREA: P&ID SHEET: I-3

LOOP NUMBERS:

RELATED EQUIPMENT: Source Water Flow Control Valves (FCV-100, -101)
Plant Pressure Control Valve (PCV-200)
MF System Influent Pressure Indicating Transmitter (PIT-101)
Plant Production Flow Indicating Transmitter (FIT-231)

A. General: The source water flow control valves (FCV-100, -101) control where the source water is taken from. When there is sufficient pressure in the Hollister Conduit to provide the operator-entered plant production flow rate, the source water will be taken from the Fairview Pump Station (FVPS) suction header. When the pressure in the Hollister Conduit is insufficient, as indicated by a lower actual plant production flow rate (FIT-231) than the operator-entered plant production flow rate and by a low MF feed pressure (PIT-101), the source water will be taken from the FVPS discharge header. A pressure control valve (PCV-200) will partially close to maintain the MF System influent pressure (PIT-101) below an operator-adjustable setpoint to protect the MF Filters from over-pressurization.

B. Monitoring: The following signals shall be monitored by the existing PLCs and PLC-3 and displayed on the Plant OIT.
   1. MF System Influent Pressure (PIT-101)
   2. Source Water Flow Control Valves (FCV-100, -101) Status (Open/Close)
   3. Plant Pressure Control Valve (PCV-200) Position

C. Valve Controls:
   1. Manual Operation: Manual operation of the Source Water Valves shall be from the SCADA OIT or at the Flow Control Valves.
   2. Automatic Operation: In automatic operation,
      a. Source Water from FVPS Suction Header: To operate the plant with the source water taken from the FVPS suction header, the Operator shall close FCV-100 from Plant OIT.
      b. Source Water from FVPS Discharge Header: If the MF System Feed Pressure (PIT-101) is below 35 psi, and plant production is below setpoint (FIT-231) for operator adjustable time of 0 to 15 minutes (excluding time when MF is in backwash), then FCV-100 shall slowly open to provide high pressure source water to the plant. A check valve in the water line from the FVPS Suction Header prevents reverse flow back to the Hollister Conduit.
   3. Emergency Shutdown: Valves FCV-100 and -101 are plant emergency isolation valves that shut upon receipt of plant emergency shutdown signal.

D. Setpoints: The following setpoints shall be adjustable at the Plant OIT:
   1. MF System Influent Pressure (initial setpoint 35 psi)
   2. Hollister Conduit Pressure Setpoint (initial setpoint 55 psi)

© December 2012 Kennedy/Jenks Consultants

E. Alarms: The following setpoints shall be adjustable at the Plant OIT:
   1. Low Plant Production Flow Rate
   2. Low MF System Influent Pressure
   3. Low Hollister Conduit Pressure (existing PIT-254)

© December 2012 Kennedy/Jenks Consultants

CONTROL STRATEGY 3

TITLE: Greensand Roughing Filter System

AREA: P&ID SHEET: I-4

LOOP NUMBERS:

RELATED EQUIPMENT: Greensand Roughing Filter Nos. 1 and 2
Washwater Supply Pump Nos. 1, 2, and 3
Surface Wash Booster Pump Nos. 1 and 2
Source Water and RFW Turbidity, ORP and TOC Analyzers

A. General: There are two Greensand Roughing Filters (GRFs). Each filter has a set of valves with actuators, a differential pressure transmitter, level switches, and a magnetic flow meter. The Plant OIT displays equipment status and provides the Operator with remote control of the GRF system.
   1. There is an GRF feed pressure transmitter on the GRF influent header (PIT-302)
   2. Each filter vessel has a differential pressure transmitter (PDIT-3x0).
   3. Each filter has a level transmitter and low, high and high-high level switches (LIT-3x0, LSL-3x0, LSH-3x0, LSHH-3x0).
   4. Each filter has motorized valves as shown in the following table. The valve actuators include LOCAL/REMOTE switches to operate the valves in LOCAL mode. There is a contact to indicate REMOTE mode to the PLC. There are open and close discrete inputs that will be energized by the PLC outputs to operate the valve in REMOTE mode. In addition, there are open, close, and fault actuator outputs to indicate actuator status to the PLC.

Valve	GRF No. 1	GRF No. 2
Influent Valve	FV-311	FV-321
Spent Washwater Valve	FV-312	FV-322
Surface Washwater Supply Valve	FV-313	FV-323
Filtered Water Valve	FCV-314	FCV-324
Washwater Supply Valve	FV-316	FV-326
Filter Drain Valve	FV-317	FV-327

   5. Each filter has magnetic flow meter at the outlet from each filter (FIT-3x0) that measures the filtered water and filter-to-waste flow rate. The flow meter measures, displays and transmit flow rate to the PLC.

B. Monitoring: The following signals shall be monitored by the PLC and displayed on the Plant OIT, including but not limited to:
   1. GRF Nos. 1 and 2 Status: Offline, Ready, Filtering, Backwash, Filter Drain
   2. FV Status: Open, Close
   3. FCV Position: Open, Close, Position
   4. Instrumentation:
      a. GRF Feed Pressure
      b. Individual GRF Level
      c. Individual GRF Influent/Filtered Water Differential Pressure

© December 2012 Kennedy/Jenks Consultants

d. Individual GRF Filtered Water Flow Rate
e. Source Water Turbidity (AIT-105), ORP (AIT-107) and TOC (AIT-405)
f. RFW turbidity (AIT-401), ORP (AIT-402), and TOC (AIT-405)

C. GRF System Controls:
1. Overall Status: The GRF unit status shall be displayed on the Plant OIT. The individual unit status and the associated valve positions are shown in the table below.

STATUS	GRF Influent Valve	GRF Filtered Water Valve	GRF Filter Drain Valve	GRF Surface Washwater Supply (SWS) Valve	GRF Washwater Supply (WWS) Valve	GRF Spent Washwater (SWW) Valve
OFFLINE	Closed	Closed	Closed	Closed	Closed	Closed
READY	Opened	Closed	Closed	Closed	Closed	Closed
FILTERING	Opened	Opened (Modulating)	Closed	Closed	Closed	Closed
BACKWASH	See Backwash Sequence					

2. Modes of Operation: The Operator can select one of the three following modes of operation for GRF unit at the Plant OIT:
a. Offline: When a GRF unit is taken Offline, PLC-3 performs the shutdown sequence to take the unit offline. The shut down sequence involves closing the filtered water valve, and then closing the influent valve and verifying that all valves are closed. If the filter is in Backwash or Filter-To-Waste mode, the filter will continue backwashing until it completes the sequence before beginning the shutdown sequence.
b. Manual Operation: In "Manual Operation," an Operator can operate the GRF from the Plant OIT. The Operator shall be able to select the number of GRF units to run and set the individual flow rate through each GRF unit. The permissible filtered water flow rate range shall be operator adjustable and initially set at 300 gpm to 1,470 gpm for each GRF unit in operation. The Operator shall be able to manually initiate backwash of the unit at the Plant OIT. The Operator shall also be able to cancel a backwash at the Plant OIT.
c. Automatic Operation: In "Automatic Operation," the PLC shall place one or more of the GRFs in Filtering mode according to the selected plant production listed in the table below. The PLC shall set the individual flow rate through each GRF unit by evenly dividing the operator selected plant production flow rate setpoint by the number of units in operation.

Selected Plant Production Flow Rate	**Number of GRF Units in Operation**
300 to 1,470	1 unit (1 filters ready or offline)
1,470 to 2,200	2 units filtering

3. Automatic Operation Status:
a. READY: In READY, the filter has been backwashed is pressurized, and is ready for operation.
b. Filtering:
1. Filtered water valve opens in a slow, controlled rate and modulates to maintain the individual filter flow setpoint. As solids build up in the filter (DPIT rises), the filtered water valve opens to maintain the flow setpoint. When an

© December 2012 Kennedy/Jenks Consultants

MF unit goes into backwash, the PLC shall maintain the GRF filtered water valve position for the duration of the MF backwash period.

2. When a backwash of GRF is called for and permissive conditions are met (see below), the PLC shall evaluate the number of filters in operation and status of all filters.
    a. If a filter(s) is in READY status, the PLC shall change the filter's status from READY to FILTERING and shall adjust the filter's individual flowrate setpoint for the filter to be in FILTERING mode. Then the PLC shall start the backwash of the formerly operating filter. The PLC shall adjust the individual filter flowrate setpoints of the filter in FILTERING mode to meet the plant production.
    b. If all available filters are FILTERING, then the PLC shall permit the filter to go to backwash and adjust flow of individual filters up to the maximum permissible flow.
3. If the sum of the remaining filter flows is less than the plant production setpoint, the PLC shall notify the operator and reduce the plant production setpoint to the sum of the maximum permissible filter flows for the duration of the filter backwash.
4. After filter backwash is complete, the backwashed filter shall resume FILTERING if all filters were previously operating; the plant production setpoint shall reset to operator selected setpoint; and PLC shall reset individual filter flow rates. If a READY filter was put into operation to allow the filter backwash, then the backwashed filter goes into READY mode.

4. Backwash Sequence:
    a. Three operator selectable options shall be provided for the initiation of a backwash: 1) the total volume of flow treated by the unit exceeds an operator-adjustable setpoint; 2) the pressure drop across the unit exceeds an operator-adjustable setpoint; 3) the total run time exceeds an operator-adjustable setpoint. The Operator shall be able to select one, two or all options to be in effect. The Operator shall also be able to manually initiate a filter backwash. The Operator shall be able to cancel a backwash that has been automatically initiated at the Plant OIT or manually initiated.
    b. Control Interlocks: A GRF unit will queue for backwash when a condition that triggers backwash occurs. If the PLC receives one or more backwash requests from individual units, the PLC shall queue the requests in the order they were received. No more than one unit (either GRF or GAC filter) shall be backwashed at a time. After the backwash cycle is completed and the clean unit is returned to service, the next unit in the backwash queue shall be backwashed, provided that the conditions listed below are met. The PLC shall check for these conditions before beginning backwash of the next unit.
        1) The level in the Treated Water Tank is above the operator-adjustable Minimum Treated Water Tank Water Level for GRF Wash setpoint.
        2) The level in the Spent Washwater EQ Tank is below the operator-adjustable Maximum Allowable SWW EQ Tank Water Level for GRF Wash setpoint.
        3) The GAC SWW Discharge timer is at zero.
    c. Cancel: The CANCEL command will stop an in-progress backwash or delete the GRF unit from the backwash queue. If the condition calling for a backwash still exists or the backwash has started, the unit will return to the backwash queue. If an in-progress backwash is cancelled, the unit will go into OFFLINE mode. If the Operator brings the OFFLINE unit back online, the backwash

© December 2012 Kennedy/Jenks Consultants

sequence will commence for that unit at the beginning of the backwash step at which it was stopped before it returns to FILTERING status.

d. Backwash Cycle: When a GRF unit queued for backwash starts the backwash cycle, it follows the steps in the table below. The valve positions associated with each step is also shown on the table below. As the backwash proceeds, the backwash step shall be shown on the SCADA display to indicate the backwash status to the Operator. Valve positions shall be monitored during backwash and an alarm shall be activated if a valve malfunctions.

Step	GRF Influent Valve	GRF Filtered Water Valve	GRF Filter Drain Valve	GRF SWS Supply Valve	GRF WWS Valve	GRF SWW Valve	SWS Control Valve	WWS Control Valve
START BW	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
DRAIN FILTER	Closed	Closed	Opened	Closed	Closed	Closed	Closed	Closed
SURFACE WASH	Closed	Closed	Closed	Opened	Closed	Opened	Opened/ Mod	Closed
SURFACE WASH/ BACKWASH	Closed	Closed	Closed	Opened	Opened	Opened	Opened/ Mod	Opened/ Mod
BACKWASH	Closed	Closed	Closed	Closed	Opened	Opened	Closed	Opened/ Mod
REFILL	Closed	Closed	Closed	Closed	Opened	Closed	Closed	Opened/ Mod
SETTLE	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
READY	Opened	Closed	Closed	Closed	Closed	Closed	Closed	Closed

e. Backwash Settings: The Operator shall be able to enter and adjust the settings for the backwash steps on the SCADA display. These settings shall be on a password protected screen. The initial settings are summarized in the following table. The settings shall be confirmed with the selected GRF filter supplier:

BW Setting	Duration	Initial Setting	Flow Rate	Initial Setting	Level	Initial Setting
DRAIN FILTER	Max. Duration (minutes)	10	--	--	Low Water Level (ft)	Provided by Filter Supplier
SURFACE WASH	Duration (minutes)	4	SWS Flow Rate (GPM)	540 GPM (2 gpm/ft^2)	--	--
SURFACE WASH/ BACKWASH	Duration (minutes)	1	SWS Flow Rate (GPM) WWS Flow Rate (GPM)	540 GPM (2 gpm/ft^2) 3,500 GPM (14 gpm/ft^2)	--	--
BACKWASH	Duration (minutes)	8	WWS Flow Rate (GPM)	3,500 GPM (14 gpm/ft^2)	--	--
REFILL	Max. Duration (minutes)	5	WWS Flow Rate (GPM)	1,000 GPM (4 gpm/ft^2)	High Water Level (ft)	Provided by Filter Supplier
SETTLE	Duration (minutes)	2	--	--	--	--

f. Backwash Description: Filter backwashing shall be PLC controlled at all steps. The sequence of events for GRF backwashing is as follows. The PLC shall actuate alarms on any abnormal or unverified conditions.

© December 2012 Kennedy/Jenks Consultants

1. Take the filter offline by closing the GRF filtered water valve (FCV-3x4). Verify that the filtered water valve is closed. Then close GRF influent valve (FV-3x1). Verify that the influent valve is closed.
2. Begin filter drain down by opening the filter drain down valve (FV-3x7). The unit shall be drained to just above the top of the filter media as determined by the filter low level probe (LAL-3x0). A PLC timer loop, adjustable from 0-900 seconds, shall be activated at the start of drain down. If the water drain down level is not reached before the timer times out, an alarm shall be activated. After the filter water level reaches the low level, close the drain down valve (FV-3x7).
3. Begin the surface wash step by opening the GRF spent washwater valve (FV-3x2) and verify that the valve is fully open. Open the GRF surface washwater supply valve (FV-3x3) and verify that the valve is fully open. Partially open the surface washwater supply control valve (FCV-380) at the booster pump. Start the surface washwater booster pump and verify that the booster pump is operating. The surface washwater supply control valve shall modulate to provide the required washwater flow rate to the GRF unit for the surface wash step. Verify that the surface washwater supply flow rate matches the setpoint. Continue the surface wash step for a preset time period, adjustable from 0 and 600 seconds.
4. After surface wash step timer runs out, open the GRF washwater supply valve (FV-3x6) and verify that the valve is open. Partially open the washwater supply control valve (FCV-354) at the pump. Start the lead and lag washwater supply pump and verify that the pumps are on. Slowly adjust the washwater supply control valve position to provide the required flow for the surface wash/backwash step. Verify that the washwater supply flow rate matches the setpoint. Continue the surface wash/backwash step for a preset time period, adjustable from 0 and 600 seconds.
5. After surface wash/backwash step timer runs out, stop the surface washwater booster pump, close the surface washwater supply valve (FV-3x3), and close the surface washwater supply control valve (FCV-380). Verify that the valves are closed and that the booster pump has stopped.
6. Start the backwash timer and adjust the washwater supply control valve (FCV-354) to adjust the washwater supply flow rate to the flow rate setpoint for the backwash step. Verify that the washwater supply flow rate matches the backwash step washwater flow rate setpoint. Continue the backwash step for a preset time period, adjustable from 0 and 600 seconds.
7. When the backwash step timer runs out, slowly close the washwater supply control valve (FCV-354) to reduce the washwater supply flow rate to the refill flow rate setpoint. Verify that the refill flow rate matches the setpoint. When the water level in the GRF unit reaches the high water level probe, stop the washwater supply pump, close the washwater supply control valve (FCV-354), and close the GRF washwater supply valve (FV-3x6). Verify that the valves are closed and the pump is off. Close the GRF spent washwater valve (FV-3x2) and verify that the valve is closed.
8. Verify that all GRF valves are closed. Allow the media to settle for a period adjustable from 0 to 120 seconds.
9. Open the GRF influent valve (FV-3x1). Verify that the valve is open. Change the GRF unit status to READY.
10. At the conclusion of the backwash sequence, reset the filter run time timer. Reset the operator adjustable GRF Spent Washwater Discharge timer. The

© December 2012 Kennedy/Jenks Consultants

timer shall be reset to the approximate time it takes to discharge GRF SWW volume to the sewer. The initial setpoint shall be 4 hours.

11. The timer shall not start until the SWW-to-Sewer Discharge Flow Control Valve (FCV-342) is opened. See the SWW EQ Tank Control Strategies.

D. Setpoints:
   1. Backwash on Total Treated Flow (initially set at 2,500,000 gallons)
   2. Backwash on Headloss (initially set at 10 psi)
   3. Backwash on Run Time (initially set at 1,440 minutes)
   4. Maximum Individual Filter Flowrate (Initially set at 1,800 gpm).
   5. GRF SWW Discharge Timer (initially set at 4 hours)
   6. Backwash Settings (see table in paragraph C.3.d)

E. Alarms:
   1. High GRF Feed Pressure (>100 psi)
   2. Low GRF Feed Pressure (<10 psi)
   3. High Individual GRF Differential Pressure (20 psi)

© December 2012 Kennedy/Jenks Consultants

CONTROL STRATEGY 4

TITLE: GAC Adsorber/Filter System

AREA: Filter Area

P&ID SHEET: I-5

LOOP NUMBERS:

RELATED EQUIPMENT: GAC Adsorber/Filter Nos. 1, 2 and 3
Washwater Supply Pump Nos. 1, 2 and 3
Surface Washwater Booster Pump Nos. 1 and 2
RFW, GAC Filter and Combined GFW Turbidity, ORP and TOC Analyzers

A. General: There are three GAC Adsorbers/Filters (GAC filters). Each filter has a set of valves with actuators, a differential pressure transmitter, level switches, and a magnetic flow meter. The Plant OIT displays equipment status and provides the Operator with remote control of the GAC Filter system.
   1. There is a GAC filter feed pressure transmitter (PIT-404)
   2. Each filter vessel has a differential pressure transmitter (PDIT-4x0).
   3. Each filter has a level transmitter and low, high and high-high level switches (LIT-4x0, LSL-4x0, LSH-4x0, LSHH-4x0).
   4. Each filter has motorized valves as shown in the following table. The valve actuators include LOCAL/REMOTE switches to operate the valves in LOCAL mode. There is a contact to indicate REMOTE mode to the PLC. There are open and close discrete inputs that will be energized by the PLC outputs to operate the valve in REMOTE mode. In addition, there are open, close, and fault actuator outputs to indicate actuator status to the PLC.

Valve	GAC No. 1	GAC No. 2	GAC No. 3
Influent Valve	FV-411	FV-421	FV-431
Spent Washwater Valve	FV-412	FV-422	FV-432
Surface Washwater Supply Valve	FV-413	FV-423	FV-433
Filtered Water Valve	FCV-414	FCV-424	FCV-434
Filter-to-Waste Valve	FCV-415	FCV-425	FCV-435
Washwater Supply Valve	FV-416	FV-426	FV-436
Filter Drain Valve	FV-417	FV-427	FV-437

   5. Each filter has magnetic flow meter at the outlet from each filter (FIT-4x0) that measures the filtered water and filter-to-waste flow rate. The flow meter measures, displays and transmit flow rate to the PLC.

B. Monitoring: The following signals shall be monitored by the PLC and displayed on the Plant OIT, including but not limited to:
   1. GAC Filter Nos. 1, 2 and 3 Status: Offline, Ready, Filtering, Backwash, Filter-to-Waste
   2. FV Status: Open, Close
   3. FCV Position: Open, Close, Position

© December 2012 Kennedy/Jenks Consultants

4. Instrumentation:
    a. RFW turbidity (AIT-401), ORP (AIT-402), TOC (AIT-405)
    b. GAC Filter Feed Pressure (PIT-404)
    c. Individual GAC Filter Level (LIT-410, LIT-411, LIT-412)
    d. Individual GAC Filter Influent/Filtered Water Differential Pressure (PDIT-410, PDIT-411, PDIT-412)
    e. Individual GRF Filtered Water Flow Rate (FIT-410, FIT-411, FIT-412)
    f. Individual GAC Filter turbidity (future)
    g. Individual GAC Filter TOC (AIT-405)
    h. Combined GFW turbidity (AIT-407), ORP (AIT-406) and MFW TOC (AIT-405)

C. GAC Filter System Controls:
1. Overall status: The GAC Filter status shall be displayed on the Plant OIT. The individual filter status and the associated valve positions are shown in the table below.

STATUS	GAC Influent Valve	GAC Filtered Water Valve	GAC Filter Drain Valve	GAC Surface Washwater Supply (SWS) Valve	GAC Washwater Supply (WWS) Valve	GAC Spent Washwater (SWW) Valve	GAC Filter-to-Waste (FTW) Valve
OFFLINE	Closed	Closed	Closed	Closed	Closed	Closed	Closed
READY	Opened	Closed	Closed	Closed	Closed	Closed	Closed
FILTERING	Opened	Opened (Modulating)	Closed	Closed	Closed	Closed	Closed
BACKWASH	See Backwash Sequence						
FILTER-TO-WASTE	Opened	Closed	Closed	Closed	Closed	Closed	Opened (Modulating)

2. Modes of Operation: The Operator can select one of the three following modes of operation for GAC filter at the Plant OIT:
    a. Offline: When a GAC filter is taken Offline, PLC-3 performs the shutdown sequence to take the filter offline. The shut down sequence involves closing the filtered water valve, and then closing the influent valve and verifying that all valves are closed. If the filter is in Backwash or Filter-To-Waste mode, the filter will continue backwashing until it completes the sequence before beginning the shutdown sequence.
    b. Manual Operation: In “Manual Operation,” an Operator can operate the GAC filter system from the Plant OIT. The Operator shall be able to select the number of GAC filters to run and set the individual flow rate through each filter. The permissible filtered water flow rate range shall be operator adjustable and initially set at 300 to 1,000 gpm for each GAC filter in operation. The Operator shall be able to manually initiate backwash of the filter at the Plant OIT. The Operator shall also be able to cancel a backwash at the Plant OIT.
    c. Automatic Operation: In “Automatic Operation,” the PLC shall place one or more of the GAC filters in Filtering mode according to the table below. The PLC shall set the individual flow rate through each GRF unit by evenly dividing the operator selected plant production flow rate setpoint by the number of units in operation.

© December 2012 Kennedy/Jenks Consultants

Selected Plant Production Flow Rate	Number of GAF Filters in Operation
300 to 800	1 unit (2 filters ready or offline)
800 to 1,600	2 units (1 filter ready or offline)
1,600 to 2,200	3 units filtering

4. Automatic Operation Status:
   a. READY: In READY, the filter has been backwashed and is pressurized, has completed a filter-to-waste cycle, and is ready for operation.
   b. FILTERING:
      1. Filtered water valve opens in a slow, controlled rate and modulates to maintain the individual filter flow setpoint. As solids build up in the filter (DPIT rises), the filtered water valve opens to maintain the flow setpoint. When an MF unit goes into backwash, the PLC shall maintain filtered water valve position for the duration of the MF backwash period.
      2. When a backwash of a GAC filter is called for and permissive conditions are met (see below), the PLC shall evaluate the number of filters in operation and status of all filters.
         a. If a filter(s) is in READY status, the PLC shall change the filter's status from READY to FILTERING and shall adjust the filter's individual flowrate setpoint for the filter to be in FILTERING mode. Then the PLC shall start the backwash of the formerly operating filter. The PLC shall adjust the individual filter flowrate setpoints of the filters in FILTERING mode to meet the plant production.
         b. If all available filters are FILTERING, then the PLC shall permit the filter to go to backwash and adjust flow of individual filters up to the maximum permissible flow.
      3. If the sum of the remaining filter flows is less than the plant production setpoint, the PLC shall notify the operator and reduce the plant production setpoint to the sum of the maximum permissible filter flows for the duration of the filter backwash.
      4. After filter backwash is complete, the backwashed filter shall resume FILTERING if all filters were previously operating; the plant production setpoint shall reset to operator selected setpoint; and PLC shall reset individual filter flow rates. If a READY filter was put into operation to allow the filter backwash, then the backwashed filter goes into READY mode.
3. Backwash Sequence:
   a. In Automatic Mode, four operator selectable options shall be provided for the initiation of a backwash: 1) the total volume of flow treated by the filter exceeds an operator-adjustable setpoint; 2) the pressure drop across the filter exceeds an operator-adjustable setpoint; 3) the total run time exceeds an operator-adjustable setpoint; 4) the individual GAC filtered water turbidity exceeds a setpoint (this would be used in the future if needed). The Operator shall be able to select one, two, three or all options to be in effect. The Operator shall be able to cancel a backwash that has been automatically initiated at the Plant OIT.
   b. Control Interlocks: A GAC filter will queue for backwash when a condition that triggers backwash occurs. If the PLC receives one or more backwash requests from individual filters, the PLC shall queue the requests in the order they were received. No more than one filter (either GAC filter or GRF) shall be backwashed at a time. After the backwash cycle is completed and the clean filter is returned to service, the next filter in the backwash queue shall be

© December 2012 Kennedy/Jenks Consultants

backwashed, provided that the conditions listed below are met. The PLC shall check for these conditions before beginning backwash of the next filter.

1. The level in the Treated Water Tank is above the operator-adjustable Minimum Treated Water Tank Water Level for GAC Wash setpoint.
2. The level in the Spent Washwater EQ Tank is below the operator-adjustable Maximum Allowable SWW EQ Tank Water Level for GAC Wash setpoint.
3. The GRF SWW Discharge timer is at zero.

c. Cancel: The CANCEL command will stop an in-progress backwash or delete the GAC filter from the backwash queue. If the condition calling for a backwash still exists or the backwash has started, the unit will return to the backwash queue. If an in-progress backwash is cancelled, the unit will go into OFFLINE mode. If the Operator brings the OFFLINE unit back online, the backwash sequence will commence for that unit at the beginning of the backwash step at which it was stopped before it returns to FILTERING status.

d. Backwash Cycle: When a GAC filter queued for backwash starts the backwash cycle, it follows the steps in the table below. The valve positions associated with each step is also shown on the table below. As the backwash proceeds, the backwash step shall be shown on the SCADA display to indicate the backwash status to the Operator. Valve positions shall be monitored during backwash and an alarm shall be activated if a valve malfunctions.

STEP	GAC Influent Valve	GAC Filtered Water Valve	GAC Filter Drain Valve	GAC SWS Supply Valve	GAC WWS Valve	GAC SWW Valve	GAC FTW Valve	SWS Supply Control Valve	WW Supply Control Valve
START BW	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
DRAIN FILTER	Closed	Closed	Opened	Closed	Closed	Closed	Closed	Closed	Closed
SURFACE WASH	Closed	Closed	Closed	Opened	Closed	Closed	Closed	Opened/ Mod	Closed
SURFACE WASH/ BACKWASH	Closed	Closed	Closed	Opened	Opened	Opened	Closed	Opened/ Mod	Opened/ Mod
BACKWASH	Closed	Closed	Closed	Closed	Opened	Opened	Closed	Closed	Opened/ Mod
REFILL	Closed	Closed	Closed	Closed	Opened	Closed	Closed	Closed	Opened/ Mod
SETTLE	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
FILTER-TO-WASTE	Opened	Closed	Closed	Closed	Closed	Closed	Opened	Closed	Closed
READY	Opened	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed

e. Backwash Settings: The Operator shall be able to enter and adjust the settings for the backwash steps on the SCADA display. These settings shall be on a password protected screen. The initial settings are summarized in the following table. The settings shall be confirmed with the selected GAC filter supplier:

© December 2012 Kennedy/Jenks Consultants

BW Setting	Duration	Initial Setting	Flow Rate	Initial Setting	Level	Intial Setting
DRAIN FILTER	Max. Duration (minutes)	10	--	--	Low Water Level (ft)	Provided by Filter Supplier
SURFACE WASH	Duration (minutes)	4	SWS Flow Rate (GPM)	600 GPM (2 gpm/ft^2)	--	--
SURFACE WASH/ BACKWASH	Duration (minutes)	1	SWS Flow Rate (GPM) WWS Flow Rate (GPM)	600 GPM (2 gpm/ft^2) 3,500 GPM (15 gpm/ft^2)	--	--
BACKWASH	Duration (minutes)	8	WWS Flow Rate (GPM)	3,500 GPM (15 gpm/ft^2)	--	--
REFILL	Max. Duration (minutes)	5	WWS Flow Rate (GPM)	1,200 GPM (4 gpm/ft^2)	High Water Level (ft)	Provided by Filter Supplier
SETTLE	Duration (minutes)	2	--	--	--	--
FILTER-TO-WASTE	Duration (minutes)	5	FTW Flow Rate (GPM)	600 GPM (1.5 gpm/ft^2)	--	--

f. Backwash Description: Filter backwashing shall be PLC controlled at all steps. The sequence of events for GAC filter backwashing is as follows. The PLC shall actuate alarms on any abnormal or unverified conditions.

1) Take the filter offline by closing the GAC filtered water valve (FCV-4x4). Verify that the filtered water valve is closed. Then close GAC influent valve (FV-4x1). Verify that the influent valve is closed.

2) Begin filter drain down by opening the filter drain down valve (FV-4x7). The filter shall be drained to just above the top of the filter media as determined by the filter low level probe (LAL-4x0). A PLC timer loop, adjustable from 0-900 seconds, shall be activated at the start of drain down. If the water drain down level is not reached before the timer times out, an alarm shall be activated. After the filter water level reaches the low level, close the drain down valve (FV-4x7).

3) Begin the surface wash step by opening the GAC spent washwater valve (FV-4x2) and verify that the valve is open. Open the GAC surface washwater supply valve (FV-4x3) and verify that the valve is fully open. Partially open the surface washwater supply control valve (FCV-380) at the booster pump. Start the lead surface washwater booster pump and verify that the booster pump is operating. The surface washwater supply control valve shall modulate to provide the required washwater flow rate to the GAC filter for the surface wash step. Verify that the surface washwater flow rate matches the setpoint. Continue the surface wash step for a preset time period, adjustable from 0 and 600 seconds.

4) After surface wash step timer runs out, open the GAC washwater supply valve (FV-4x6) and verify that the valve is open. Partially open the washwater supply control valve (FCV-354) at the pump. Start the lead and lag washwater supply pump and verify that the pumps are on. Slowly adjust the washwater supply control valve position to provide the required flow for the surface wash/backwash step. Verify that the washwater supply flow rate matches the setpoint. Continue the surface wash/backwashwater wash step for a preset time period, adjustable from 0 and 600 seconds.

© December 2012 Kennedy/Jenks Consultants

5) After surface wash/backwash step timer runs out, stop the surface washwater booster pump, close the GAC surface washwater supply valve (FV-4x3), and close the surface washwater supply control valve (FCV-381). Verify that the valves are closed and that the booster pump has stopped.

6) Start the backwash timer and adjust the washwater supply control valve (FCV-354) to adjust the washwater supply flow rate to the flow rate setpoint for the backwash step. Verify that the washwater supply flow rate matches the setpoint. Continue the backwash step for a preset time period, adjustable from 0 and 600 seconds.

8) When the backwash step timer runs out, slowly close the washwater supply control valve (FCV-354) to reduce the washwater supply flow rate to the refill flow rate setpoint. Verify that the refill flow rate matches the setpoint. When the water level in the GAC filter reaches the high water level probe, stop the washwater supply pump. Close the GAC spent washwater valve (FV-4x2) and verify that the valve is closed. Close the washwater supply control valve (FCV-354), and close the GAC washwater supply valve (FV-4x6). Verify that the valves are closed and the pump is off.

9) Verify that all GAC valves are closed. Allow the media to settle for a period adjustable from 0 to 120 seconds.

10) Open the GAC influent valve (FV-4x1). Verify that the valve is open. Start to slowly open the GAC filter-to-waste valve (FCV-4x5). Change the GAC filter status to FILTER-TO-WASTE. Modulate the valve to the filter-to-waste flow rate setpoint. Verify that the filter-to-waste flow rate matches the setpoint.

11) After a preset time period, close the filter-to-waste valve (FCV-4x5) and verify that the valve is closed. Change the GAC filter status to READY.

12) The Operator shall be able to select either: 1) Return GAC SWW to Hollister Conduit, or 2) Discharge GAC SWW to Sewer. In either case, at the conclusion of the backwash sequence, the adjustable GAC Spent Washwater Discharge timer shall be reset. The timer shall be reset to the approximate time it takes to return the GAC SWW volume to the Hollister Conduit, or discharge to the sewer. The timer shall initially be set to 6 hours.

    The timer shall not start until either FCV-344 or FCV-342 is opened.

D. TOC Analyzer Operation.

1. The TOC analyzer (AIT-405) shall measure the TOC from six different sample locations by means of a sample flow control panel. The TOC analysis shall rotate through the six different samples over an operator adjustable period of time (initially set to 2 hours), so that each sample location is monitored for approximately 20 minutes, during a 2-hour period.
2. The SCADA Screen shall show the measured TOC values from all six sample locations. The last TOC value shall be maintained on the screen until a new value is updated from the TOC analyzer (approximately every 20 minutes).
3. The SCADA system shall calculate and display the percentage TOC removal values on the SCADA screen, as compared to the source water TOC value.

© December 2012 Kennedy/Jenks Consultants

E. Setpoints:
   1. Backwash on Total Treated Flow (initially set at 4,000,000 gallons)
   2. Backwash on Headloss (initially set at 15 psi)
   3. Backwash on Run Time (initially set at 5,760 minutes)
   4. Backwash on High Individual Filter Turbidity (initially set at 0.2 NTU) (Future)
   5. Maximum Individual Filter Flowrate (initially set at 1000 gpm)
   6. GAC SWW Discharge Timer (initially 6 hours)
   7. Backwash Settings (see table in paragraph C.3.d)

F. Alarms:
   1. High GAC Feed Pressure (>95 psi)
   2. Low GAC Feed Pressure (<10 psi)
   3. High Individual GAC Filter Differential Pressure (20 psi)

© December 2012 Kennedy/Jenks Consultants

CONTROL STRATEGY 5.1

TITLE: Treated Water Tank

AREA: Treated Water Tank and Pump Facilities

P&ID SHEET: I-6

LOOP NUMBERS:

RELATED EQUIPMENT: Middle Pressure Zone Treated Water Pump Nos. 1, 2 and 3
High Pressure Zone Treated Water Pump Nos. 1, 2 and 3
Washwater Supply Pump Nos. 1, 2 and 3
Treated Water Tank Temperature (TE-351), pH (AE-352) and Chlorine Residual Analyzers (AE-353)

A. General: The Treated Water Tank provides storage volume for the washwater supply and operational volume for balancing the treated water production with the delivery of treated water to the distribution system by the Treated Water Pumps. A level transmitter (LIT-350) is used to monitor the water level in the Treated Water Tank and to indicate whether the water supply is adequate to perform a Greensand Roughing Filter (GRF) or GAC Adsorber/Filter (GAC Filter) backwash. In the future, the tank could also provide disinfection volume for additional disinfection contact time. Future Treated Water Tank temperature, pH and chlorine residual will be monitored at the tank outlet for the disinfection CT calculation.

B. Monitoring:
   1. The following signals shall be monitored by the PLC and displayed on the Plant OIT:
      a. Water Level in Treated Water Tank (LIT-350)
      b. Treated Water Tank Outlet Temperature (TIT-351)
      c. Treated Water Tank Outlet pH (AIT-352)
      d. Treated Water Tank Outlet Chlorine Residual (AIT-353), measured by an Owner-furnished analyzer
      e. Alarms (see paragraph E)

C. Tank Level Controls:
   1. The table below summarizes the treated water amount allocated for the different design volumes and the associated tank levels. The Treated water tank holds approximately 6,800 gallons per foot of water depth.

Design Volume	Amount (gallons)	Tank Level Setpoints (ft)
Disinfection Volume (for Future)	50,400	--
Washwater Supply Volume for GAC Wash	45,000	12
Washwater Supply Volume for GRF Wash	35,000	12
Operational Volume	17,500	--
Total Tank Maximum Volume	114,000	--
Low Level Setpoint	N/A	4
Low-Low Level Setpoint	N/A	2

© December 2012 Kennedy/Jenks Consultants

Design Volume	Amount (gallons)	Tank Level Setpoints (ft)
High Level Setpoint	N/A	18
High-High Level Setpoint	N/A	19.5

2. When tank water level drops below the Washwater Supply level setpoint, the PLC shall reduce the speed of both sets of the treated water pumps by an operator-adjustable percent (initially set at 10%). See the Treated Water Pump Control Strategies.
3. When tank water level drops below the Low-Level setpoint, the PLC shall notify the Operator and reduce the speed of the treated water pumps by an operator-adjustable percent (initially set at 10%). See the Treated Water Pump Control Strategies.
4. When tank water level drops below the Low-Low level setpoint, alarm and stop the treated water pumps. See the Treated Water Pump Control Strategies.
5. When the tank water level exceeds the high level setpoint, the PLC shall notify the Operator and increase the speed of the treated water pumps flow rate by an operator-adjustable percent (initially set at 10%). See the Treated Water Pump Control Strategies.
6. When Tank level reaches the High-high level setpoint, alarm and stop the production from the facility. The MF system isolation vales will shut, stopping flow through the facility.
7. If a GRF wash is initiated, the PLC shall check the level in the Treated Water Tank to verify that the water level is above an operator-adjustable minimum water level setpoint required for a GRF wash. See the GRF System Control Strategies.
8. If a GAC Filter wash is initiated, the PLC shall check the level in the Treated Water Tank to verify that the water level is above an operator-adjustable minimum water level setpoint required for a GAC Filter wash. See the GAC Filter System Control Strategies.

D. Setpoints: The following setpoints are adjustable at the Plant OIT:
   1. Treated Water Tank Low-low Level Alarm
   2. Treated Water Tank Low Level Alarm
   3. Treated Water Tank High Level Alarm
   4. Treated Water Tank High-high Level Alarm
   5. Minimum Treated Water Tank Level for GRF Wash
   6. Minimum Treated Water Tank Level for a GAC Filter Wash
   7. High Treated Water pH Alarm
   8. High Treated Water Chlorine Residual Alarm
   9. Low Treated Water Chlorine Residual Alarm

E. Alarms: The following alarms shall be displayed at the Plant OIT when activated:
   1. Treated Water Tank Low-low Level Alarm
   2. Treated Water Tank High-high Level Alarm
   3. Treated Water High pH Alarm
   4. Treated Water High Chlorine Residual Alarm
   5. Treated Water Low Chlorine Residual Alarm

© December 2012 Kennedy/Jenks Consultants

CONTROL STRATEGY 5.2

TITLE: Middle Pressure Zone Treated Water Pumps

AREA: Treated Water Tank and Pump Facilities

P&ID SHEET: I-6

LOOP NUMBERS:

RELATED EQUIPMENT: Treated Water Tank

A. General: There are three pumps that deliver treated water from the Treated Water Tank to the Middle Pressure Zone (MPZ) in the distribution system. Normally, two of the three pumps operate in lead/lag configuration and the third pump is on standby. The pumps alternate operation to allow for use of all three pumps. The pumps are VFD controlled to maintain a flow rate setpoint as described below.

B. Monitoring: The following signals shall be monitored by the PLC and displayed on the Plant OIT.
   1. MPZ Pumps: Ready, Run, Control, Speed
   2. MPZ Treated Water Flow Rate (FIT-360)
   3. Treated Water Tank Levels (LIT-350)
   4. Alarms (see paragraph E)

C. Pump Controls:
   1. Pump Alternation: MPZ Treated Water Pump Nos. 1, 2 and 3 will operate in Lead/Lag/Standby configuration. The lead pump will rotate based on the last pump to run and one pump will remain as a standby.
   2. Manual Operation: Manual operation of the pumps shall be from the SCADA OIT or through the local pump control panel. In manual operation at the SCADA OIT, the operator shall be able to select the lead and lag pumps, or all three pumps to run, enter the desired MPZ treated water flow rate and start the pumps. The pump(s) shall stop if the water level in the Treated Water Tank falls below the low-low level alarm setpoint.
   3. Automatic Pump Operation: In automatic operation, the Operator enters the production rate (portion of plant production flow rate) to be delivered to the MPZ, and the MPZ Treated Water Pumps will start when called to run by the PLC. Depending on the required flow rate, the SCADA system will start one or two of the pumps, as shown in the table below. The standby pump could be operated to meet peak demands, as shown in Table 3. The pump(s) shall start at minimum speed, and the PLC shall adjust the pump speed to provide the desired flow rate to the MPZ distribution system. Multiple pumps running together will run at the same speed.

MPZ Treated Water Flowrate	Pump Operations
350 to 600 gpm	1 pump operating
600 to 1,200 gpm	2 pumps operating
1,200 to ~1,800 gpm	3 pumps operating

© December 2012 Kennedy/Jenks Consultants

4. When first called to operate, the MPZ pumps shall start when the Treated Water Tank level is above the Washwater Supply setpoint (initially 12 feet). The PLC shall increase or decrease the pump speed, and/or stop the pumps, as described in the Treated Water Tank control strategy.

D. Setpoints: The following setpoints shall be adjustable at the Plant OIT:
   1. Production flow rate to be delivered to the MPZ
   2. Percent pump speed reduction at Treated Water Tank level setpoint activation
   3. Percent pump speed increase at Treated Water Tank level setpoint activation

E. Alarms: The following alarms shall be displayed at the Plant OIT when activated:
   1. Pump Fail (XA-361, XA-362, XA-363)
   2. Treated Water Tank Low-low Level Alarm (LAL-350)
   3. Treated Water Tank Low Level Alarm (LAL-350)
   4. Treated Water Tank High Level Alarm (LAH-350)
   5. Treated Water Tank High-High Level Alarm (LAHH-350)

© December 2012 Kennedy/Jenks Consultants

CONTROL STRATEGY 5.3

TITLE: High Pressure Zone Treated Water Pumps

AREA: Treated Water Tank and Pump Facilities

P&ID SHEET: I-6

LOOP NUMBERS:

RELATED EQUIPMENT: Treated Water Tank

A. General: There are three pumps that deliver treated water from the Treated Water Tank to the High Pressure Zone (HPZ) in the distribution system. Normally, two of the three pumps operate in lead/lag configuration and the third pump is on standby. The pumps alternate operation to allow for use of all three pumps. The pumps are VFD controlled to maintain a flow rate setpoint as described below.

B. Monitoring: The following signals shall be monitored by the PLC and displayed on the Plant OIT.
   1. HPZ Pumps: Ready, Run, Control, Speed
   2. HPZ Treated Water Flow Rate (FIT-370)
   3. Treated Water Tank Level (LIT-350)
   4. Alarms (see paragraph E)

C. Pump Controls:
   1. Pump Alternation: HPZ Treated Water Pump Nos. 1, 2 and 3 will operate in Lead/Lag/Standby configuration. The lead pump will rotate based on the last pump to run and one pump will remain as a standby.
   2. Manual Operation: Manual operation of the pumps shall be from the SCADA OIT or through the local pump control panel. In manual operation at the SCADA OIT, the operator shall be able to select the lead and lag pumps, or all three pumps, enter the desired HPZ treated water flow rate and start the pumps. The pump(s) shall stop if the water level in the Treated Water Tank falls below the low-low level alarm setpoint.
   3. Automatic Pump Operation: In automatic operation, the Operator enters the production rate (portion of plant production flow rate) to be delivered to the HPZ, (the remainder of the plant production flow rate is to be delivered to the MPZ). The HPZ Treated Water Pumps will start when called to run by the PLC. Depending on the required flow rate, the SCADA system will start one or two of the pumps, as shown in the table below. The third pump may also be run for peaking. The pump(s) shall start at minimum speed, and the PLC share adjust the pump speed is to provide the desired flow rate to the HPZ distribution system. Multiple pumps running together will run at the same speed.

HPZ Treated Water Flowrate	Pump Operations
200 to 400 gpm	1 pump operating
400 to 800 gpm	2 pumps operating
800 to ~1,200 gpm	3 pumps operating

© December 2012 Kennedy/Jenks Consultants

4. When first called to operate, the HPZ pumps shall start when the Treated Water Tank level is above the Washwater Supply setpoint (initially 12 feet). The PLC shall increase or decrease the pump speed, and/or stop the pumps, as described in the Treated Water Tank control strategy.

D. Setpoints: The following setpoints shall be adjustable at the Plant OIT:
   1. Production flow rate to be delivered to the HPZ
   2. Percent pump speed reduction at Treated Water Tank level setpoint activation
   3. Percent pump speed increase at Treated Water Tank level setpoint activation

E. Alarms: The following alarms shall be displayed at the Plant OIT when activated:
   1. Pump Fail (XA-371, XA-372, XA-373)
   2. Treated Water Tank Low-low Level Alarm (LAL-350)
   3. Treated Water Tank Low Level Alarm (LAL-350)
   4. Treated Water Tank High Level Alarm (LAH-350)
   5. Treated Water Tank High-High Level Alarm (LAHH-350)

© December 2012 Kennedy/Jenks Consultants

CONTROL STRATEGY 6.1

TITLE: Washwater Supply (WWS) Pumps

AREA: Treated Water Tank and Pump Facilities

P&ID SHEET: I-6

LOOP NUMBERS:

RELATED EQUIPMENT: Greensand Roughing Filter Nos. 1 and 2
GAC Adsorber/Filter Nos. 1, 2 and 3
Treated Water Tank
WWS Flow Control Valve (FCV-354)

A. General: There are three pumps that deliver water from the Treated Water Tank to the Greensand Filters (GRFs) and GAC Adsorbers/Filters (GAC Filters) for backwash. During the filter backwash sequence backwash step, two of the three pumps are normally in operation, and the third pump is on standby. The pumps alternate operation to allow for use of all three pumps. A throttle valve and flow meter are used to provide the washwater at the flow rate setpoint for the filter backwash.

B. Monitoring: The following signals shall be monitored by the PLC and displayed on the Plant OIT:
   1. WWS Pumps: Ready, Run, Control,
   2. WWS Flow Rate (FIT-350)
   3. WWS FCV Position: Open, Close, Position (ZSC-354, ZSO-354, ZIT-354)
   4. Treated Water Tank Level (LIT-350)
   5. Alarms (see paragraph E)

C. Pump Controls:
   1. Pump Alternation: WWS Pump Nos. 1, 2 and 3 will operate in Lead/Lag/Standby configuration. When called to run, the previous lead pump will be rotated in the standby position; the previous lag pump will be rotated into the lead position; and the previous standby pump will be rotated into the lag position.
   2. Manual Operation: Manual operation of the pumps shall be from the SCADA OIT or through the local pump control panel. In manual operation at the SCADA OIT, the operator shall be able to select the lead and lag pumps and start and stop the pumps. The operator shall also be able to enter a flow rate, and the PLC will adjust the WWS flow control valve to provide the entered flow rate. The PLC shall stop the pumps if the water level in the Treated Water Tank falls below the low level alarm setpoint.
   3. Automatic Operation: In automatic operation, the lead and lag pumps are called to run when a GRF or GAC Filter backwash sequence is initiated and the backwash step begins. Both the lead and lag pumps operate to deliver the WWS to the filter, and the PLC automatically adjusts the WWS flow control valve to provide the required backwash water flow rate in the backwash settings. The PLC shall stop the pumps if the water level in the Treated Water Tank falls below the low level alarm setpoint.

D. Setpoints: (See the backwash settings in Control Strategies 3 and 4.)

© December 2012 Kennedy/Jenks Consultants

E. Alarms: The following alarms shall be displayed at the Plant OIT when activated:
   1. Pump Fail (XA-351, XA-352, XA-353)
   2. Treated Water Tank Low Level Alarm (LAL-350)

© December 2012 Kennedy/Jenks Consultants

CONTROL STRATEGY 6.2

TITLE: Surface Washwater (WW) Booster Pumps

AREA: Spent Washwater EQ Tank and Pump Facilities

P&ID SHEET: I-9

LOOP NUMBERS:

RELATED EQUIPMENT: Greensand Roughing Filter Nos. 1 and 2
GAC Adsorber/Filter Nos. 1, 2 and 3
Washwater Supply Pump Nos. 1, 2 and 3
Treated Water Tank
SWS Flow Control Valve (FCV-380)

A. General: There are two pumps (P-381, P-382), one duty and one standby, that deliver water from the Treated Water Tank to the Greensand Filters (GRFs) and GAC Adsorbers/Filters (GAC Filters) for surface wash step in the filter backwash sequence. The pumps alternate operation to allow use of both pumps. A throttle valve and flow meter are used control the surface washwater supply (SWS) flow rate.

B. Monitoring: The following signals shall be monitored by the PLC and displayed on the Plant OIT.
   1. Surface WW Booster Pumps: Ready, Run, Control,
   2. SWS Flow Rate (FIT-380)
   3. SWS FCV Position: Open, Close, Position (ZSC-380, ZSO-380, ZIT-380)
   4. Treated Water Tank Level (LIT-350)
   5. Alarms (see paragraph E)

C. Pump Controls:
   1. Pump Alternation: Surface WW Booster Pump Nos. 1 and 2 will operate in Lead/Standby configuration. When the pumps are called to run, the last pump to run will be rotated into the standby position, and the previous standby pump will be rotated into the lead position.
   2. Manual Operation: Manual operation of the pumps shall be from the SCADA OIT or through the local pump control panel. In manual operation at the SCADA OIT, the operator shall be able to select the lead pump and start and stop the lead pump. The operator shall also be able to enter a flow rate, and the PLC will adjust the SWS flow control valve to provide the entered flow rate. The pump shall stop if the water level in the Treated Water Tank falls below the low level alarm setpoint.
   3. Automatic Operation: In automatic operation, the lead pump is called to run when a GRF or GAC Filter backwash sequence is initiated and the surface wash step begins. The lead pump operates to deliver the SWS to the filter, and the PLC automatically adjusts the SWS flow control valve to provide the required surface washwater flow rate in the backwash settings. The PLC shall stop the pump if the water level in the Treated Water Tank falls below the low level alarm setpoint.

D. Setpoints: (See the backwash settings in Control Strategies 3 and 4.)

© December 2012 Kennedy/Jenks Consultants

E. Alarms: The following alarms shall be displayed at the Plant OIT when activated:
   1. Pump Fail (XA-381, XA-381)
   2. Treated Water Tank Low Level Alarm (LAL-350)

© December 2012 Kennedy/Jenks Consultants

CONTROL STRATEGY 7.1

TITLE: Spent Washwater EQ Tank

AREA: Spent Washwater EQ Tank and Pump Facilities

P&ID SHEET: I-8

LOOP NUMBERS:

RELATED EQUIPMENT: Greensand Roughing Filter Nos. 1 and 2
GAC Adsorber/Filter Nos. 1, 2 and 3
Spent Washwater Pump Nos. 1 and 2
SWW-to-Sewer Flow Control Valve (FCV-343)

A. General: The Spent Washwater (SWW) EQ Tank stores and equalizes the SWW and filter-to-waste (FTW) flows from the Greensand Roughing Filter (GRF) and GAC Adsorber/Filter (GAC Filter) backwashes. The SWW in the SWW EQ Tank from a GRF backwash is slowly released into the sewer. SWW in the SWW EQ Tank from a GAC Filter backwash is typically pumped back into the Hollister Conduit via the Spent Washwater Pumps. The Operator may also select to drain a GAC WW to the sewer from the OIT. A throttle valve and flow meter are used control the SWW flow rate to the sewer.

B. Monitoring: The following signals shall be monitored by the PLC and displayed on the Plant OIT.
   1. Water Level in the SWW EQ Tank (LIT-340)
   2. SWW Flow Rate (FE-340)
   3. Type of Washwater in the SWW EQ Tank (GRF WW or GAC WW). Provide different colors in the SWW EQ tank display to help differentiate the two waters.
   4. Status of Discharge to Sewer (for GRF WW)
   5. Status of Return to HC or Discharge to Sewer (for GAC WW)
   6. Alarms (see paragraph E)

C. Tank Level Controls:
   1. The Spent Washwater tank holds approximately 2,800 gallons per foot of water depth. The table below summarizes the SWW volumes and the associated tank levels:

Design Volume	Amount (gallons)	Tank Level Setpoints (ft)
GRF SWW Volume Available	35,000	3
GAC Filter SWW Volume Available	50,000	3
Total Tank Maximum Volume	60,000	--
Low Level Setpoint	N/A	1
High Level Setpoint	N/A	21
High-High Level Setpoint	N/A	22

   2. If a GRF wash is requested, the PLC shall check the level in the SWW EQ Tank to verify that the water level is below an operator-adjustable GRF SWW Volume

© December 2012 Kennedy/Jenks Consultants

Available level setpoint to ensure that there is sufficient storage for the SWW from a GRF wash. See the GRF System Control Strategies.

3. If a GAC Filter wash is requested, the PLC shall check the level in the SWW EQ Tank to verify that the water level is below an operator-adjustable GAC Filter SWW Volume Available level setpoint, to ensure that there is sufficient storage for the SWW and FTW water. See the GAC Filter System Control Strategies.
4. For a GRF Backwash, the SWW-to-Sewer FCV (FCV-343) shall open at the beginning of a GRF backwash. The FCV shall modulate to provide the operator-entered SWW discharge-to-sewer flow rate (initially set at 200 gpm). The SWW-to-Sewer FCV shall close when the level in the tank falls below an operator-adjustable low water level setpoint.
    a. The OIT shall display the Type of washwater (GRF Washwater) being sent to the SWW Tank and the status of the time for draining.
    b. The Operator shall also be able to manually open, close the valve and set the SWW discharge-to-sewer flow rate at Plant OIT.
    c. The GRF SWW Discharge timer shall timer shall be re-set to zero if the level in the SWW EQ Tank falls below the GRF SWW Volume Available level setpoint and the timer has not yet reached zero.
5. For a GAC Filter Backwash where discharge to sewer has been selected, the SWW-to-Sewer FCV (FCV-343) shall open at the beginning of a GAC backwash. The FCV shall modulate to provide the operator-entered SWW discharge-to-sewer flow rate (initially set at 200 gpm). The SWW-to-Sewer FCV shall close when the level in the tank falls below an operator-adjustable low water level setpoint.
    a. The OIT shall display the Type of washwater (GAC Washwater) being sent to the SWW Tank and the status of the time for draining.
    b. The Operator shall also be able to manually open, close the valve and set the SWW discharge-to-sewer flow rate at Plant OIT.
    c. The GAC SWW Discharge timer shall be re-set to zero if the level in the SWW EQ Tank falls below the GAC SWW Volume Available level setpoint and the timer has not yet reached zero.
6. If the SWW Pump is operating and the level in the SWW EQ Tank falls below an operator-adjustable low water level setpoint, the PLC shall automatically stop the SWW Pump and close the SWW-to-Hollister Conduit FCV (FCV-344).
7. If the high-high water level alarm is activated and a GRF or GAC Filter is in backwash mode, the PLC shall stop the backwash sequence and stop the WWS and SWS booster pumps if they are operating.

D. Setpoints: The following setpoints are adjustable at the Plant OIT:
    1. GRF SWW Discharge-to-Sewer Time Delay
    2. GAC SWW Discharge-to-Sewer Time Delay
    3. SWW-to-Sewer Flow Rate
    4. SWW-to-Hollister Conduit Flow Rate
    5. SWW EQ Tank Low Level
    6. SWW EQ Tank High Level Alarm
    7. SWW EQ Tank High-High Level Alarm

E. Alarms: The following alarms shall be displayed at the Plant OIT when activated:
    1. SWW High Level Alarm (LAH-340)
    2. SWW High-High Level Alarm (LAHH-340)

© December 2012 Kennedy/Jenks Consultants

CONTROL STRATEGY 7.2

TITLE: GAC Spent Washwater Pumps

AREA: Spent Washwater EQ Tank and Pump Facilities

P&ID SHEET: I-8

LOOP NUMBERS:

RELATED EQUIPMENT: GAC Adsorber/Filter Nos. 1, 2 and 3
Spent Washwater EQ Tank
SWW-to-Hollister Conduit Flow Control Valve (FCV-344)

A. General: There are two pumps (P-341, P-342), one duty and one standby, that transfers GAC Filter spent washwater (SWW) from the SWW EQ Tank to the Hollister Conduit. The pumps alternate operation to allow use of both pumps. A throttle valve and flow meter are used control the SWW flow rate.

B. Monitoring: The following signals shall be monitored by the PLC and displayed on the Plant OIT.
   1. Spent Washwater Pumps: Ready, Run, Control
   2. SWW Flow Rate (FIT-340)
   3. SWS FCV Position: Open, Close, Position (ZSC-344, ZSO-344, ZIT-344)
   4. SWW EQ Tank Level (LIT-340)
   5. Alarms (see paragraph E)

C. Controls:
   1. Pump Alternation: GAC SWW Pump Nos. 1 and 2 will operate in Lead/Standby configuration. When the pumps are called to run, the last pump to run will be rotated into the standby position, and the previous standby pump will be rotated into the lead position.
   2. Manual Operation: Manual operation of the pumps shall be from the SCADA OIT or through the local pump control panel. In manual operation at the SCADA OIT, the operator shall be able to select the lead pump and start and stop the lead pump. The operator shall also be able to enter a flow rate, and the PLC will adjust the SWW flow control valve to provide the entered flow rate. The pump shall stop if the water level in the Treated Water Tank falls below the low level alarm setpoint.
   3. Automatic Operation: In automatic operation, the lead pump is called to run when a GAC Filter backwash has commenced, after an operator-adjustable time delay. The SWW-to-Hollister Conduit (FCV-344) shall open and modulate to provide the operator-entered SWW discharge-to-Hollister Conduit flow rate (initially set at 140 gpm). The SWW-to-Hollister Conduit FCV shall close and the SWW Pump shall stop when the level in the tank falls below an operator-adjustable low water level setpoint.
   4. GAC SWW Discharge Timer: The GAC SWW Discharge timer shall stop if the SWW-to-Hollister Conduit FCV is closed before the level in the SWW EQ Tank falls below the low level setpoint. The timer shall resume if the SWW-to-Hollister Conduit FCV is re-opened. The timer shall be set to zero if the level in the SWW EQ Tank falls below the low level setpoint and the timer has not yet reached zero.

© December 2012 Kennedy/Jenks Consultants

F. Setpoints: The following setpoints are adjustable at the Plant OIT:
   1. GRF SWW Discharge-to-Hollister Conduit Time Delay
   2. SWW-to-Hollister Conduit Flow Rate
   3. SWW EQ Tank Low Level

D. Alarms: The following alarms shall be displayed at the Plant OIT when activated:
   1. Pump Fail (XA-341, XA-342)
   2. SWW High Level Alarm (LAH-340)
   3. SWW High-High Level Alarm (LAHH-340)

© December 2012 Kennedy/Jenks Consultants

CONTROL STRATEGY 8.1

TITLE: Coagulant System

AREA: Spent Washwater EQ Tank and Pump Facilities

P&ID SHEET: I-7

LOOP NUMBERS:

RELATED EQUIPMENT: Coagulant Storage Tank (T-1)
Coagulant Metering Pump Nos. 1 and 2
Coagulant Storage Tank Isolation Valve (FV-710)

A. General: The Coagulant System includes a Coagulant Storage Tank and duplex, skid-mounted Coagulant Metering Pumps. There is a level sensor (LE-710) in the Coagulant Storage Tank, and a high level switch (LSH-710) in the coagulant secondary containment area sump is used to provide leak detection in the containment area. The Coagulant Metering Pump delivers coagulant (aluminum chlorohydrate) to the source water pipeline. The Coagulant Metering Pump feed rate is flow paced from the source water flow rate.

B. Monitoring: The following signals shall be monitored by the PLC and displayed on the Plant OIT.
   1. Coagulant Metering Pumps: Ready, Run, Pacing Ratio
   2. Source Water Flow Rate (FIT-300)
   3. Coagulant Storage Tank Level (LIT-710)
   4. Coagulant Tank Isolation Valve Status: Open, Close (ZSC-710, ZSO-210)
   5. Alarms (see paragraph E)

C. Controls:
   1. Coagulant Storage Tank: The tank level is monitored by an ultrasonic level indicator/transmitter (LIT-710). A low level warning and low-low level alarm shall be provided. If the low-low level alarm is activated, the PLC shall stop the operation of the Coagulant Metering Pump. The level warnings and alarm setpoints shall be operator-adjustable.

   2. Coagulant Storage Tank Isolation Valve: The Coagulant Storage Tank Isolation Valve (FV-710) shall normally be open. The Operator has the ability to remotely close the isolation valve and stop the operation of the Coagulant Metering Pump.

   3. Coagulant Metering Pumps:
      a. Manual Operation: The operator shall be able to control the metering pump at its local control panel or at SCADA. In manual control at SCADA, the operator shall be able to select the lead metering pump and adjust the pump feed rate by adjusting the pump speed.
      b. Automatic Operation: In automatic operation, the PLC starts the lead metering pump and controls the coagulant feed rate.
         1) Pump Sequence: The PLC shall alternate metering pump operation based on run time. When starting the metering pump, the PLC shall designate the metering pump with the shortest run time as the lead pump.

© December 2012 Kennedy/Jenks Consultants

If the lead metering pump fails to start or run after and adjustable time delay (0-60 seconds, initially set at 30 seconds), the PLC shall alarm this condition as a metering pump failure. Upon failure of the lead metering pump, the PLC shall start the standby metering pump and proceed with similar monitoring of pump start and run conditions.

2) Coagulant Feed Control: The operator shall enter the desired coagulant dose (ppm) and the coagulant concentration (lb/gal). The PLC shall compute the pump feed rate required to provide the desired dose:

feed rate (gph) = [dose (ppm) x plant flow rate (FIT-300) (MGD) x 8.34] / [24 hr/day x coag. concentration (lb/gal)]

The PLC shall adjust the pump speed to provide a feed rate that matches the feed rate computed from the desired coagulant dose. The pump speed to provide the desired feed rate can be computed from the desired feed rate, pump capacity (gph) and stroke length (%):

pump speed (%) = feed rate (gph) / [pump capacity (gph) x stroke length (%)]

The actual metering pump's feed rate shall be calculated based on the metering pump capacity (gph), the metering pump speed (10-100%) and the pump stroke length (10-100%):

actual feed rate (gph) = pump capacity (gph) x stroke length (%) x pump speed (%)

The actual coagulant feed rate shall be displayed, recorded, totalized and trended.

D. Setpoints:
   1. Coagulant Dose (initially 15 mg/l)
   2. Coagulant Concentration (from chemical supplier)
   3. Coagulant Tank Low Level Alarm Setpoint (initially set at 2.5 feet)
   4. Coagulant Tank Low Low Level Alarm Setpoint (initially set at 1.0 feet)
   5. Coagulant Containment Area Sump High Level Alarm Setpoint

E. Alarms: The following alarms shall be displayed at the Plant OIT when activated:
   1. Coagulant Metering Pump Fail (XA-711, XA-712)
   2. Coagulant Storage Tank Low Level Warning (LAL-710)
   3. Coagulant Storage Tank Low Low Level Alarm (LALL-710)
   4. Coagulant Containment Area Sump High Level Alarm (LAH-710)

© December 2012 Kennedy/Jenks Consultants

CONTROL STRATEGY 8.2

TITLE: Permanganate System

AREA: Membrane Building

P&ID SHEET: I-7 PLC: 2 (Existing)

LOOP NUMBERS:

RELATED EQUIPMENT: Permanganate Storage Tank (T-2)
Permanganate Metering Pump Nos. 1 and 2
Permanganate Storage Tank Isolation Valve (FV-720)
ORP Analyzer (AE-301)

A. General: The Permanganate System includes a Permanganate Storage Tank and duplex, skid-mounted Permanganate Metering Pumps. There is a level sensor (LE-720) in the Permanganate Storage Tank, and a high level switch (LSH-720) in the permanganate secondary containment area sump is used to provide leak detection in the containment area. The Permanganate Metering Pump delivers permanganate to the source water pipeline. The Permanganate Metering Pump feed rate is flow paced from the source water flow rate. The ORP analyzer reading provides indication of whether the permanganate is under or over-dosed and feedback control. The Permanganate System shall be monitored and controlled by existing PLC-2 located in the Electrical Room of the existing Process Building.

B. Monitoring: The following signals shall be monitored by the PLC and displayed on the Plant OIT.
   1. Permanganate Metering Pumps: Ready, Run, Pacing Ratio
   2. Source Water Flow Rate (FIT-300)
   3. ORP Analyzer Reading (AE-301)
   4. Permanganate Storage Tank Level (LIT-720)
   5. Permanganate Tank Isolation Valve Status: Open, Close (ZSC-720, ZSO-720)
   6. Alarms (see paragraph E)

C. Controls:
   1. Permanganate Storage Tank: The tank level is monitored by an ultrasonic level indicator/transmitter (LIT-720). A low level warning and low-low level alarm shall be provided. If the low-low level alarm is activated, the PLC shall stop the operation of the Permanganate Metering Pump. The level warnings and alarm setpoints shall be operator-adjustable.
   2. Coagulant Storage Tank Isolation Valve: The Permanganate Storage Tank Isolation Valve (FV-720) shall normally be open. The Operator shall have the ability to remotely close the isolation valve and stop the operation of the Permanganate Metering Pump.
   3. Permanganate Metering Pumps:
      a. Manual Operation: The operator shall be able to control the metering pump at its local control panel or at SCADA. In manual control at SCADA, the operator shall be able to select the lead metering pump and adjust the pump feed rate by adjusting the pump speed.

© December 2012 Kennedy/Jenks Consultants

b. Automatic Operation: In automatic operation, the PLC starts the lead metering pump and controls the permanganate feed rate.

1) Pump Sequence: The PLC shall alternate metering pump operation based on run time. When starting the metering pump, the PLC shall designate the metering pump with the shortest run time as the lead pump. If the lead metering pump fails to start or run after and adjustable time delay (0-60 seconds, initially set at 30 seconds), the PLC shall alarm this condition as a metering pump failure. Upon failure of the lead metering pump, the PLC shall start the standby metering pump and proceed with similar monitoring of pump start and run conditions.

2) Permanganate Feed Control: The Operator shall select either flow control only or flow control with ORP feedback. The operator shall enter the desired permanganate dose (ppm) and the permanganate concentration (lb/gal). The PLC shall compute the pump feed rate required to provide the desired dose:

feed rate (gph) = [dose (ppm) x plant flow rate (FIT-300) (MGD) x 8.34] / [24 hr/day x coag. concentration (lb/gal)]

The PLC shall adjust the pump speed to provide a feed rate that matches the feed rate computed from the desired coagulant dose. The pump speed to provide the desired feed rate can be computed from the desired feed rate, pump capacity (gph) and stroke length (%):

pump speed (%) = feed rate (gph) / [pump capacity (gph) x stroke length (%)]

The actual metering pump's feed rate shall be calculated based on the metering pump capacity (gph), the metering pump speed (10-100%) and the pump stroke length (10-100%):

actual feed rate (gph) = pump capacity (gph) x stroke length (%) x pump speed (%)

The actual permanganate feed rate shall be displayed, recorded, totalized and trended.

For ORP Feedback control, the source water ORP analyzer (AIT-301) shall provide feedback control to the permanganate dose rate based on an operator adjustable setpoint. If the ORP drops below the setpoint, the permanganate dose rate shall be increase by an operator adjustable percentage, up to a maximum dose rate setpoint (initially 1.5 mg/l).

If the source water ORP analyzer (AIT-301) remains below the operator adjustable setpoint for a adjustable period of time, the SCADA system shall notify the Operator and start the oxidation Hypochlorite Pump. See Control Strategy 8.2.

D. Setpoints:

1. Permanganate Dose

© December 2012 Kennedy/Jenks Consultants

2. Permanganate Concentration
3. Permanganate Tank Low Level Alarm Setpoint
4. Permanganate Tank Low Low Level Alarm Setpoint
5. Permanganate Containment Area Sump High Level Alarm Setpoint

E. Alarms: The following alarms shall be displayed at the Plant OIT when activated:
1. Permanganate Metering Pump Fail (XA-721, XA-722)
2. Permanganate Storage Tank Low Level Alarm (LAL-720)
3. Permanganate Storage Tank Low Low Level Alarm (LALL-720)
4. Permanganate Containment Area Sump High Level Alarm (LAH-720)

© December 2012 Kennedy/Jenks Consultants

CONTROL STRATEGY 8.3

TITLE: Hypochlorite Oxidation System

AREA: Membrane Building

P&ID SHEET: I-9

LOOP NUMBERS:

RELATED EQUIPMENT: (E) Hypochlorite Storage Tank
Hypochlorite Oxidation Metering Pump No. 1
(E) Hypochlorite Storage Tank Isolation Valve (FCV-671)
ORP Analyzer (AE-301)

A. General: The Hypochlorite Oxidation System delivers sodium hypochlorite from the (E) Sodium Hypochlorite Storage Tank to the source water at a point upstream of the coagulation-oxidation pipeline contactor. Normally, hypochlorite will not used for oxidation. However, hypochlorite can be added upstream of the main treatment processes for additional oxidation to assist the permanganate system during periods of high iron and manganese. The Hypochlorite Oxidation System shall be monitored and controlled by existing PLC-2 located in the Electrical Room of the existing Process Building.

B. Monitoring: The following signals shall be monitored by the PLC and displayed on the Plant OIT.
   1. Hypochlorite Oxidation Metering Pump: Ready, Run, Pacing Ratio
   2. Source Water Flow Rate (FIT-300)
   3. ORP Analyzer Reading (AE-301)
   4. (E) Hypochlorite Storage Tank Level (LIT-670)
   5. (E) Hypochlorite Tank Isolation Valve Status: Open, Close (ZSC-671, ZSO-671)
   6. Alarms (see paragraph E)

C. Controls:
   1. Hypochlorite Oxidation Metering Pumps:
      a. Manual Operation: The operator shall be able to control the metering pump at its local control panel or at SCADA. In manual control at SCADA, the operator shall be able to select the lead metering pump and adjust the pump feed rate by adjusting the pump speed.
      b. Automatic Operation: In automatic operation, if the source water ORP analyzer (AIT-301) remains below the operator adjustable “Start Hypochlorite Oxidation” setpoint for an adjustable period of time, the SCADA system shall notify the Operator and start the oxidation Hypochlorite Pump. The PLC starts the metering pump and controls the hypochlorite feed rate based on flow and the dose setpoint. The operator shall enter the desired hypochlorite dose (ppm) and the hypochlorite concentration (lb/gal). The PLC shall compute the pump feed rate required to provide the desired dose:

feed rate (gph) = [dose (ppm) x plant flow rate (FIT-300) (MGD) x 8.34] /
[24 hr/day x hypochlorite concentration (lb/gal)]

© December 2012 Kennedy/Jenks Consultants

The PLC shall adjust the pump speed to provide a feed rate that matches the feed rate computed from the desired coagulant dose. The pump speed to provide the desired feed rate can be computed from the desired feed rate, pump capacity (gph) and stroke length (%):

pump speed (%) = feed rate (gph) / [pump capacity (gph) x stroke length (%)]

The actual metering pump's feed rate shall be calculated based on the metering pump capacity (gph), the metering pump speed (10-100%) and the pump stroke length (10-100%):

actual feed rate (gph) = pump capacity (gph) x stroke length (%) x pump speed (%)

The actual hypochlorite feed rate shall be displayed, recorded, totalized and trended.

If the source water ORP analyzer (AIT-301) remains above the operator adjustable "Stop Hypochlorite Oxidation" setpoint for an adjustable period of time, the SCAD system shall notify the Operator and stop the oxidation Hypochlorite Pump.

D. Setpoints:
   1. Hypochlorite Dose
   2. Hypochlorite Concentration
   3. Start Hypochlorite Oxidation Setpoint
   4. Stop Hypochlorite Oxidation Setpoint

E. Alarms: The following alarms or notices shall be displayed at the Plant OIT when activated:
   1. Hypochlorite Oxidation Metering Pump Fail (XA-370)
   2. Start Hypochlorite Oxidation
   3. Stop Hypochlorite Oxidation

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 17341

DATA ACQUISITION AND CONTROL SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Provide all labor, materials, equipment and incidentals required, and install complete, ready for operation, and test the Data Acquisition and Control System referred to herein as SCADA, as shown on the Drawings and/or specified herein. The work shall include but not be limited to the following:
   1. Program Programmable Logic Controller (PLC).
   2. Providing software and programming specified herein.
   3. Providing testing, training, documentation and other requirements specified herein.

B. Related Work Specified Elsewhere:
   1. Section 17010: Instrumentation and Controls, General Requirements
   2. Section 17330: Programmable Logic Controller
   3. Section 17510: Panels

C. Provide all configuration services necessary to provide a fully debugged and operating SCADA including PLC. The configuration services required shall consist of the programming and loading of all PLC ladder logic and/or program statements required to implement the data acquisition requirements as detailed on the electrical diagrams and/or the P&IDs or referenced herein and as required to implement the specialized reports, process graphic displays, and other data acquisition/display functions specified.

D. Provide complete system documentation as specified herein.

1.02 QUALIFICATIONS

A. It is the intent of these Specifications that the PLC and other components specified herein and in Section 17330 shall be supplied by an Instrumentation and Controls (I&C) subcontractor. The subcontractor must show proof of experience in selecting, furnishing, programming, customizing, debugging, supervising, installing, and placing into operation all hardware and software specified within this Section.

B. The I&C subcontractor shall be either a manufacturer or a "system house," with service facilities, regularly engaged in the design and the installation of digital system and their associated subsystems as they are applied to the municipal water or wastewater industry. The I&C subcontractor shall satisfy the following criteria:
   1. Employs an experienced professional Control Systems Engineer or Electrical Engineer to supervise or perform the work required by this specification section.
   2. Has performed work of similar or greater complexity on at least three previous projects.

© December 2012 Kennedy/Jenks Consultants

3. Has been actively engaged in the type of work specified in this specification section for a minimum of five years.
4. Has specific and current configuration experience with the hardware including Programmable Logic Controllers (see Section 17330) selected for the project.
5. Refer to Section 17010 for additional qualification submittal requirements.

C. The I&C subcontractor shall furnish equipment that is the product of one manufacturer to the maximum practical extent. Where this is not practical, all equipment of a given type shall be the product of one manufacturer.

1.03 SYSTEM DESCRIPTION

A. The SCADA hardware configuration is an existing system as shown on the Drawings. The existing hardware shall be provided with new Operating System software. The SCADA software shall be modified to add new processes as described in the Control Strategies in Section 17330.

B. The following description is not intended to be a comprehensive list of the system's features, but will help summarize the major functions of the system. The SCADA specified here shall be designed to perform the following generalized functions:
1. Collect and store accurate, reliable operating information of each process system and pump station for present and future uses.
2. Assist plant operating personnel by recording and displaying off-normal operating conditions and equipment failures.
3. Perform calculations based on automatically acquired sensor data and manually entered data.
4. Accumulate and store equipment running times.
5. Provide color process graphic displays and summary reports for use by the plant operating and supervisory personnel.
6. Provide system configuration tools including database, display and report generators.
7. Flexibility for adding workstations and PLCs without replacing existing software.
8. Provide process graphics and overall SCADA functions at the workstations indicated on the Drawings and specified herein.

C. The new PLC shall be connected via an Ethernet cable to the existing SCADA system. The workstation shall perform multi-task processes, real-time data transfer, and serve as the human-machine interface indicated on the Drawings.

D. System Capacity: The SCADA shall have the I/O capacity as shown on the Drawings plus an additional 100% I/O capacity.

1.04 QUALITY CONTROL

A. The I&C subcontractor shall allow the Owner and Engineer to inspect and witness the testing of the PLC hardware at the factory acceptance test. Suitable notice shall be provided to allow this inspection before any shipments are made.

© December 2012 Kennedy/Jenks Consultants

1.05 QUALITY ASSURANCE

A. All material shall be new, of current manufacture, free from defects, and of the quality specified or shown. Each type of material shall be of the same manufacturer throughout the work. All material shall be the product of established, reputable manufacturers normally engaged in the production of the particular item being furnished.

B. Equipment shall be suitably packaged by the manufacturer to protect it during shipment, storage and after installation.

C. Electronic equipment shall be all solid state construction, unless otherwise specified. Components shall be de-rated to assure dependability and long-term stability. Printed circuit boards shall be glass epoxy of sufficient thickness to prevent warping. Printed circuit boards in field-mounted equipment shall be suitable for the specified environmental conditions. Alignment and adjustment shall be non-critical, stable with temperature changes or aging and accomplished with premium grade potentiometers. Components of specially selected values shall not be inserted into standard electronic assemblies in order to meet the performance requirements of this Specification. All parts shall be indicated in the instruction manuals and shall be replaceable with standard commercial components of the same description without degrading the performance of the completed assembly.

1.06 CODES AND STANDARDS

A. Codes: All SCADA equipment and materials, including their installation, shall conform to the following applicable codes and requirements:
   1. National Electrical Code, (Title 8 of the California Electrical Code).
   2. National Electrical Safety Code.
   3. Occupational Safety and Health Act standards.
   4. Federal Communications Commission regulations Title 47, Part 90 of the Code of Federal Regulations.
   5. Any applicable local electrical and/or safety codes.

B. Variances: In instances where two codes conflict, the more restrictive requirements shall apply.

C. Standards: Equipment shall conform to the applicable EIA, IEEE, ISA, NEMA, and SAMA Standards. The revisions of these standards, in effect on the date of issuance of the Contract Documents, shall apply unless a specific edition is referenced.

D. Underwriters Laboratories listing shall be required for all equipment and materials where such listings are offered by the Underwriters Laboratories.

1.07 SUBMITTALS

A. The I&C subcontractor shall furnish within six weeks of the Contractor's Notice to Proceed and before Shop Drawing submittals, a Specification Section Compliance List consisting of a sequential list of each numbered paragraph within this

© December 2012 Kennedy/Jenks Consultants

specification section followed by the words "Compliance", "Deviation", or "Noncompliance". Accompanying the list shall be all backup documentation the I&C subcontractor desires to submit as substantiation of his request for either a Deviation or Noncompliance. The terms "Compliance", "Deviation", and "Noncompliance" shall have the following meanings:

1. Compliance: Furnish the hardware or software function specified without exception.
2. Deviation: A hardware item or software function that is different from what is specified is proposed. Deviations shall be fully described.
3. Noncompliance: The hardware or software item specified is not provided. Noncompliance items shall be fully described.

B. Submittals shall include those items set forth in Section 17010 and the following additional requirements. Each submittal shall be bound in three-ring binders(s) and shall contain an index and sectional dividers. All drawings or sketches shall be folded or reduced for inclusion within the binder. The submittal shall include the following:
   1. Project Overview
   2. System Hardware (PLC System)
   3. Specific System Applications
   4. Work Plan and Sequencing

C. Project Overview: This submittal shall provide an overview of the proposed system including system configuration (block) diagrams, the approach to the work the proposed work, details of factory testing and field acceptance testing, and details of training programs.

D. System Hardware:
   1. This submittal shall provide complete documentation of the hardware proposed including:
      a. ISA S20 Specification Forms for each major hardware component listing all model numbers, optional, auxiliary and ancillary devices that are being provided.
      b. Descriptive literature for each hardware component, which fully describes the unit being provided.
      c. Complete block diagram showing the interconnections between major hardware components and a complete input signal listing.
      d. Complete to-scale drawings of all cabinets, panels and consoles including internal and external layouts.
      e. A list of all hardware to be furnished and its electrical, environmental, and performance characteristics.
   2. The System Hardware submittal shall also contain all planning information, site preparation instructions, grounding and bonding procedures, cabling diagrams, plug identifications, safety precautions or guards, and equipment layouts in order to enable the I&C subcontractor to proceed with the detailed site preparation for all equipment.
   3. Submit a site plan with diagrams showing the cable routing including the PLC data highway and any Local Area Network (LAN) cables.

© December 2012 Kennedy/Jenks Consultants

E. Specific System Applications:
   1. This submittal shall cover the specific details of the plant reports and process graphic displays that the I&C subcontractor has previously developed through meetings with the Owner.
   2. The specifics of the logs, reports, and process graphic displays shall be developed by the I&C subcontractor in conjunction with the Owner. The types and quantities are described in the Specification. The specifics of what shall appear on each and what calculations are required to support them shall be developed and submitted in final printed form for approval.

F. Work Plan and Sequencing: This submittal shall cover the specific details of programming implementation in correlation with construction activities and plant shutdowns. The submittal shall include a schedule for Factory Testing of the PLC and SCADA programming, Installation, Field Testing and Startup. The I&C Subcontractor shall coordinate the sequence of work with the overall construction and plant shutdown schedule. Field testing and startup work shall be coordinated with the Owner so as to not interrupt current plant operation.

1.09 FINAL DOCUMENTATION

A. The I&C subcontractor shall submit the following final documentation prior to final acceptance of the system:
   1. As-built documentation of the system.
   2. Hardware Maintenance Documentation
   3. Operator's manual.

B. The I&C subcontractor final documentation shall be new documentation written specifically for this project, but may include standard and modified standard documentation. Modifications to existing hardware or software manuals shall be made on the respective pages or inserted adjacent to the modified pages. All standard documentation furnished shall have all portions that apply clearly indicated. All portions that do not apply shall be lined out.

C. The manuals shall contain all illustrations, detailed drawings, wiring diagrams, and instructions necessary for installing, operating, and maintaining the equipment. The illustration parts shall be numbered for identification. All information contained therein shall apply specifically to the equipment furnished and shall only include instructions that are applicable. All such illustrations shall be incorporated within the printing of the page to form a durable and permanent reference book.

D. If the I&C subcontractor transmits any documentation or other technical information, which he considers proprietary, such information shall be designated. Documentation or technical information that is designated as being proprietary will be used only for the design, construction, operation, or maintenance of the SCADA and, to the extent permitted by law, will not be published or otherwise disclosed.

E. The requirements for the Contractor's final documentation are as follows:
   1. As-built documentation shall include all previous submittals, as described in this Specification, updated to reflect the as-built system. Any errors in or

© December 2012 Kennedy/Jenks Consultants

modifications to the SCADA resulting from the factory and/or field acceptance tests shall be incorporated in this documentation.

2. The Hardware Maintenance Documentation shall describe the detailed preventive and corrective procedures required to keep the SCADA in proper operating condition. Within the complete Hardware Maintenance Documentation, all hardware maintenance manuals shall make reference to appropriate diagnostics, where applicable, and all necessary diagnostics, where applicable, and all necessary timing diagrams shall be included. A maintenance manual or a set of manuals shall be furnished for all delivered hardware, including peripherals. The Hardware Maintenance Documentation shall include, as a minimum, the following information:
    a. Operation information: This information shall include a detailed description of how the equipment operates and a block diagram illustrating each major assembly in the equipment.
    b. Preventative maintenance instructions: These instructions shall include all applicable visual examinations, hardware testing and diagnostic routines, and the adjustments necessary for periodic preventive maintenance of the SCADA.
    c. Corrective maintenance instructions: These instructions shall include guides for locating malfunctions down to the card replacement level. These guides shall include adequate details for quickly and efficiently locating the cause of an equipment malfunction and shall state the probable source(s) of trouble, the symptoms, probable cause, and instructions for remedying the malfunction.
    d. Parts information: This information shall include the identification of each replaceable or field repairable module. All parts shall be identified on a list in a drawing; the identification shall be of a level of detail sufficient for procuring any repairable or replaceable part. Cross references between System Supplier's part number and manufacturer's part numbers shall be provided.
    e. Retrofit documentation: The Engineer recognizes that not all possible problems related to real-time events, software interlocks, flags, active tasks, and hardware utilization can be discovered during the Acceptance Tests. Therefore, the I&C subcontractor shall investigate, diagnose, repair, update, and distribute all pertinent documentation of the deficiencies, which become evident during the warranty period. All such documentation shall be submitted to the Engineer within 30 days of solving the problem.

1.10 GROUNDING

A. Grounding of the SCADA shall be done in accordance with the NEC, as described in these specifications and as shown on the Drawings.

B. Provide a logic ground bus bar in each PLC equipment rack. The bus bar shall be electrically isolated from the rack chassis. The 120 VAC neutral, green ground wire and other chassis or safety grounds shall not be connected to the isolated logic ground.

© December 2012 Kennedy/Jenks Consultants

C. DC power supplies used to power instrumentation digital electronics and field transmitters shall be referenced to the logic ground in the associated equipment racks.

D. Signal returns shall not be grounded anywhere along their length except where the final connection is made to the power supply common in the rack.

E. Cable shields must be grounded at one end only. Shields shall be grounded in the rack where signal power is supplied. The data highway shield shall be grounded at the isolated bus bar associated with the workstations.

1.11 SPARE PARTS AND TEST EQUIPMENT

A. Provide a list of recommended spare parts and test equipment including prices for favorable review for the systems specified herein and in Section 17330.

B. The type and quantity of spare parts and test equipment will be determined by the Owner after reviewing the Contractor submittal of recommended spares and test equipment with published list pricing data.

C. All spare parts and test equipment shall be furnished in moisture-proof boxes designed to protect their contents. All boxes shall be labeled to clearly identify contents and purpose.

PART 2 - PRODUCTS

2.01 GENERAL

A. The SCADA workstations hardware, including computers, monitors, laptop computer and printer are all existing components. The Contractor shall provide the new PLC as specified in Section 17330.

B. The Contractor shall provide equipment and cabling for the Ethernet network and interface from the PLCs to the HMI as specified herein and in Division 16 and Section 17330. The Contractor shall coordinate requirements with the Engineer.

C. PLC software and ladder logic programming shall be provided by the I&C Subcontractor. The I&C subcontractor shall also provide new Operating System software for the SCADA workstations and shall provide the programming for the workstations to include screens for monitoring and control of new plant processes.

2.02 DATA HIGHWAY

A. The data highway system shall link the PLC with SCADA as shown on the Drawings. The data highway use TCP/IP protocol for Ethernet communications and Modbus for serial communications.

© December 2012 Kennedy/Jenks Consultants

2.08 SOFTWARE

A. Operator Interface Software:
   1. The following specification describes the capabilities of the complete software system as a whole, without being definitive as to where particular functions are resident or implemented. The I&C Subcontractor shall make the appropriate modifications to the existing operator interface programming, integrating new programming and operator interface screens to the existing system.
   2. The I&C Subcontractor shall furnish all programming necessary to provide a fully debugged and operating system. The software required shall consist of those programs necessary for the SCADA to efficiently perform the functions specified herein, plus enable convenient and efficient preparation of new programs. All programs shall be completely debugged and operable prior to delivery of the SCADA.
   3. Configuration programming standards shall establish the conventions to follow when the process control database is defined, graphic displays are built, and reports are configured. They shall also apply to other table or file building procedures. The specifics of these standards depend largely upon the features of the configuration tools. Any existing standards shall be maintained for ease of operation by the Owner. If no current standards are in place, establish standards for:
      a. Formatting of data base entries to keep documentation and listings of data base readable and easy to interpret.
      b. Graphic screen layout to allow ease of understanding when paging from one display to another.
      c. Report generator statement usage to enhance readability and maintainability.
   4. All software shall be designed such that specified process system growth can be accomplished without the need for additional computer hardware. Allocate sufficient space in the software to allow for 50% spare input/output points, for future sequence control and regulatory control programs and for at least five additional HMI.
   5. All software shall be designed such that anticipated system growth can be accomplished without the need for system regeneration. In general, the design shall be such that the process control and process information databases may be modified without taking the control system off line. Scan points may be added, deleted and/or changed at any time, as may be HMI displays, log formats and all other online modifications. Future control strategies may be modified, added to or deleted from the system as necessary without system regeneration.
   6. The existing operator interface software is Wonderware FactorySuite. New operator interface screens shall be developed using software compatible with the existing system.

B. Real-Time Operating System: Provide new operating system software upgrades to the existing SCADA workstations. The real time operating system shall be the most current Microsoft Windows operating system and shall be compatible with the workstation's Wonderware software.

© December 2012 Kennedy/Jenks Consultants

C. Personal productivity software: Provide new personal productivity software upgrades to the existing SCADA workstations. Software shall be the most current Microsoft Office Professional Edition.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

A. Refer to Section 17010, Part 3.

3.02 APPLICATIONS PROGRAMMING

A. The I&C Subcontractor shall provide the following HMI screens as a minimum. The Contractor shall assist the I&C Subcontractor in facilitating coordination with package system suppliers for screens for packaged system controls. Screens shall be designed so that all operator actions, including setpoint changes, can be accomplished with the mouse without using the keyboard. Screens shall be designed to match the color resolution of the existing screens. Color conventions and button styles shall match those of the existing screens. See Control Strategy 1.1 in Appendix B of Section 17330 for listing of new screens to be provided.

B. Display: The use of displays that convey three-dimensional look, such as pumps, piping, tanks, valves and others shall be used. Third party symbols or icons can be used. The Engineer shall review available symbols or icons with the Owner to select those for use on this Project. The symbols and icons shall utilize the following as a minimum. This is not intended to be a complete list.
   1. Pump and valves: Change in color and/or flash in the "Run," "Ready," and "Fail" modes. Colors will be selected by the Owner.
   2. Pipe segments: These shall change color when related valves are open or where pumps are running. Colors for "Flow" or "No Flow" will be selected by the Owner.
   3. Tank levels: Animated with digital or bar graph indicating units.
   4. Pressures: Digital or bar graph indication as selected by the Owner.
   5. Analysis measurement: Same as Item 4 above.
   6. Menus: Provide display menus of operation, etc. The layouts of such menus shall be selected by the Owner.
   7. Switches and buttons: For pumps, valves, etc., these can be preformatted icons to be selected by the Owner.
   8. Alarms: An alarm window at the bottom of each screen shall appear to indicate the recent three alarms. All other alarms will be displayed on alarm summary screen. Alarms shall also appear on screens where alarms are related, such as tanks, pumps, etc.
   9. Trends: Real time trends and historical trends shall be provided. Grouping of trends shall be selected by the Owner.
   10. Reports: Formats and data shall be selected by the Owner.
   11. Main Menu: Provide an overall "Main Menu" to allow selection of screens. Format and content shall be selected by the Owner.

© December 2012 Kennedy/Jenks Consultants

3.02 FACTORY TEST PLAN

A. A factory test plan shall be submitted after all hardware and software submittals have been approved by the Engineer and at least six weeks in advance of the test date. The test plan shall have sign-off and date blocks for the I&C Subcontractor and the Engineer.

B. The complete test plan shall include descriptions for the following as a minimum:
   1. System hardware and software summary.
   2. A schedule for the testing describing the specific tasks to be performed and the time allotted for each.
   3. Hardware simulation of all process inputs from the PLCs to the workstation displays.
   4. Demonstration of reports produced by the system.
   5. Demonstration of graphic screens developed.

3.03 FACTORY TEST

A. A formal system test shall be performed by the I&C Subcontractor and witnessed by the Engineer at the I&C Subcontractor's factory, prior to shipment. The purpose of the test shall be to verify the functionablilty, performance, and stability of the hardware and software. The system must operate continually for 100 hours without failure before the test shall be judged successful. Successful completion of this test shall be the basis for approval of the system to be shipped to the site.

B. I&C Subcontractor shall determine through his own tests and quality assurance programs that the equipment is ready for shipment. The I&C Subcontractor's internal test procedures for hardware shall be equal to or exceed the requirements set forth in ANSI Standard RP55.1, "Recommended Practice - Hardware Testing of Digital Process Computer," in so far as they apply.

C. Where hardware items are of standard manufacture, and in current production, the manufacturer shall certify that applicable tests have been performed, and met in accordance with said Standard, and be prepared to supply copies of data to Engineer upon request. Any assemblage of devices together with operating programs shall be tested together as provided herein.

D. The various tests performed during the Engineer-witnessed factory test shall be designed to demonstrate that hardware and software fulfill all the requirements of the Specifications. The test conditions shall resemble, as closely as possible, the actual installed conditions. Any additional hardware or software that may be required to successfully verify system operation shall be supplied at no cost to the Owner.

E. Tests to be performed shall included, but not be limited to the following.
   1. Building and loading the system data base.
   2. Conduct online modifications to the data base.
   3. Demonstrate operability of the interfaces (hardware and software).
   4. Demonstrate operability of the data communication network.
   5. Demonstrate all system software functions specified.

© December 2012 Kennedy/Jenks Consultants

6. Simulate all PLC process input points using a simulator panel and verify that the points are correctly mapped on associated displays and reports.
7. Simulate selected operating condition to verify the response time performance of the SCADA workstation.
8. Generate reports using test data.

F. During the test, the Engineer shall have unrestricted access to the system, and all faults identified during this period shall be corrected and retested prior to completion of factory test. All test data and procedures followed during testing shall be logged, and certified copies of logs shall be provided to the Engineer.

G. The supplier shall notify the Engineer in writing a minimum of 30 days in advance of this proposed starting date for the Engineer-witnessed factory test. At the time of notification, the I&C Subcontractor shall submit any revisions to the detailed test procedure previously approved by the Engineer in the factory test plan.

3.04 FIELD TEST

A. General: Perform field testing to verify the operation of the SCADA system. Sequence and organized field testing by plant area. Provide area testing and include loop checkout and maintenance/support demonstrations. Test all functions and equipment at the server/workstation level. Perform an integrated system test to verify the operation of the entire SCADA system.

B. Subsystem Testing:
1. Loops:
   a. Check each loop from the primary element to the respective workstation displays.
   b. Document and submit all loop checks to the Engineer. Documentation shall include loop number and description, termination information, loop drawing reference, type of test(s) performed, signature of tester, signature of Engineer and date, and problem description, if any.
2. Workstation:
   a. Fully check out all workstation displays and data base linkages, user entry functions and all other specified functions.
   b. Demonstrate configuration capability, system backup and reloading, system status displays and use, diagnostics and power fail/restart.
   c. Document and submit all demonstrations to the Engineer, including description of function, signature of tester and date, signature of Engineer and date, and problem description, if any.
   d. Test all data handling and access functions. Use live data from the plant and include the plant-wide data base, workstation displays, and user entry functions.

C. Integrated System Testing:
1. Perform integrated system testing to verify the operation of the complete SCADA. Integrated system testing shall not begin until all subsystem testing has been completed. Testing shall include, but not be limited to, data communication, both normal and failure modes; system response times with all hardware operational and its respective application and configuration software

© December 2012 Kennedy/Jenks Consultants

running; impact of component failures on system operation; report generation, and any other test reruns the Engineer may elect to perform.

2. The Engineer will conduct the test. Provide full time, onsite assistance for the test duration. Run the test for two days. Promptly correct any deficiencies found whenever possible. If deficiencies remain uncorrected at the end of the test period, the test period will be extended on a day-to-day basis until proper operation can be demonstrated.
3. Upon successful completion of the integrated system test and subsequent review and approval of complete system final documentation, the system shall be considered substantially complete and the one year warranty period shall commence.

3.05 SERVICES TO BE PROVIDED DURING WARRANTY PERIOD BY I&C SUBCONTRACTOR

A. For a period of one year following substantial completion, the I&C Subcontractor shall repair, replace, adjust and/or service all defective work in accordance with the General Conditions of this Contract. In addition, for this same one year period, the I&C Subcontractor shall provide the following maintenance of the work of this Specification Section only.
   1. Provide onsite response to emergency calls within 24 hours after receipt.
   2. Provide a minimum of 12 monthly preventive maintenance visits by a qualified service man of the I&C Subcontractor's permanent employ who is familiar with the type of equipment and software provided for this project. Each preventive maintenance visit shall include routing adjustment, calibration, cleaning, and lubrication of system equipment and verification of correct software operation. Emergency maintenance procedures or plant visits may coincide with a preventive maintenance visit; however, they shall not replace the work intended to be performed during a preventive maintenance visit. The I&C Subcontractor shall have full responsibility for the system hardware and software preventive corrective maintenance. The I&C Subcontractor shall provide all necessary maintenance parts, supplies, and/or tolls during the one-year warranty period.
   3. Observe and instruct Owner designated maintenance personnel (maximum of five at any one time) in the details of the maintenance work being performed on each and every preventive maintenance visit.

B. The costs for the above services shall be included in the Contract Price.

3.06 MAINTENANCE CONTRACT

A. The I&C Subcontractor shall submit to the Owner, prior to final payment and acceptance as a closeout submittal, a signed and executable maintenance contract. The maintenance contract shall include all labor, parts (including major pieces and/or components of the system), and emergency calls necessary to provide complete system maintenance for a period of two years commencing exactly one year after the date of substantial completion or at the end of the one-year warranty period previously mentioned.

B. The maintenance services to be provided under the maintenance contract shall be identical to those provided under Paragraph 3.05 above.

© December 2012 Kennedy/Jenks Consultants

C. The costs for this two year maintenance contract, including delayed commencement, shall not be included in the Contract Price.

3.08 TRAINING

A. The cost of training shall be included in the Contract Price, to be conducted with designated Owner's personnel, covering configuration, operation, and maintenance of the system as specifically set forth hereinafter. The training and instruction shall be directly related to the system being supplied hereunder.

B. Training for the PLC shall be provided as described in Section 17330.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

SECTION 17510

PANELS

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Section 16955: Control Devices

B. Section 17200: Panel Mounted and Miscellaneous Field Instruments:

1.02 DESCRIPTION

A. Provisions: Requirements of Division 1 and Section 17010 form a part of this Section.

B. Work Included: This Section covers control panels, instrument enclosures, and electrical enclosures shown on the Electrical or Instrumentation Drawings, or as specified in either Division 16 or 17, and sets minimum standards for all packaged unit panels specified in Divisions 11 to 15, unless modified under those sections.

1.03 REFERENCE STANDARDS

A. National Electrical Manufacturers Association (NEMA) Publications:
   1. ICS 1 General Standards for Industrial Controls and Systems
   2. ICS 2 Standards for Industrial Control Devices, Controllers and Assemblies
   3. ICS 4 Terminal Blocks for Industrial Control Equipment and Systems
   4. ICS 6 Enclosures for Industrial Controls and Systems

B. Underwriters Laboratories (UL) Publication:
   1. 508 Industrial Control Equipment

1.04 SUBMITTALS

A. Shop drawings to be submitted in this Section shall be made in one package under the Product Review Category of Shop Drawings.

B. Shop Drawings: Submit shop drawings for all control panels, including details for the following items:
   1. Electric power wiring schematics.
   2. Electric signal wiring schematics.
   3. Elementary control diagram.
   4. Air supply piping schematics.
   5. Pneumatic signal tubing schematics.
   6. Fabrication drawings, including a dimensioned outline drawing to scale, showing space for conduits, etc.
   7. Details of seismic restraints (refer to Division 1, General Conditions, for requirements).
   8. Details of all panel accessories.

© December 2012 Kennedy/Jenks Consultants

9. A detailed Bill of Materials.
10. Panel layouts and nameplate inscriptions.
11. Connections to external equipment.
12. Wire marking scheme.
13. Arrange submissions in a logical manner and on the shop drawings use the device abbreviation identifications and equipment names as shown on the Drawings, in order to expedite and facilitate review by the Engineer.
14. Where unit arrangement or wiring deviates in any way from that shown on the Drawings, provide a complete record and explanation of such deviations.

C. Spare Parts List: Include a spare parts list showing recommended parts and quantities as well as complete ordering information for replacement components. Provide instruction books for special control devices and special equipment installed in the control panels. Submit these to the Engineer prior to installation of the equipment.

D. Manuals: Provide manuals as specified in Section 17010.

1.05 UL LABEL

A. UL Label:
1. Each control panel and terminal cabinet shall bear the UL label except as noted in the following paragraph. The UL label shall apply to the enclosure, the specific equipment supplied with the enclosure, and the installation and wiring of the equipment within and on the enclosure. If required for UL labeling, provide ground fault interrupters, isolation transformers, fuses, and any other necessary equipment, even though such equipment is not indicated on the Drawings. The fabricator shall be an approved UL listed manufacturer.
2. Control panel enclosures containing instruments mounted through the enclosure walls or door shall meet all requirements for UL labeling as above, but no UL label is required. This exception applies only if UL Recognized instruments for the intended purpose are not made.

1.06 PRODUCT DELIVERY AND HANDLING

A. Ship assembled control panels in sections that facilitate handling and field installation.

PART 2 - PRODUCTS

2.01 CONSTRUCTION

A. General:
1. Provide panels as shown on the Drawings. Panels shall conform to the requirements of NEMA Standards ICS 1 (General Standards for Industrial Controls and Systems) and ICS 2 (Standards for Industrial Control Devices, Controllers and Assemblies). The panels shall be wall-mounted or freestanding floor mounted, as shown. Provide sufficient access to the panels.
2. The enclosures shall be code gauge steel of adequate strength, when complete, to withstand seismic forces equivalent to those noted in Division 1,

© December 2012 Kennedy/Jenks Consultants

General Conditions, Paragraph 1-71. Enclosures shall conform to requirements of NEMA Standard ICS 6 (Enclosures for Industrial Controls and Systems).

3. The enclosures shall have vertically hinged front doors; provide hinge on side of panel that ensures compliance with the 30-inch rule in NEC Paragraph 110-16(a). Freestanding enclosures shall have doors secured by keyed three point latches, except in corrosive locations. Mount the devices through the doors or on recessed plates. Provide nameplates indicated on the Drawings. Each component within the panel shall be securely mounted and arranged for easy servicing, such that all adjustments and component removal can be accomplished without disturbing other components. No fastening devices shall project through the outer surfaces of the cabinet and all components and terminals shall be mounted on mounting pans within the panels.
4. Construction requirements on a specific type of panel are provided in subsequent paragraphs.

B. Safety Requirements: The electrical supply to each control panel shall be arranged to be disconnected by a single switch or circuit breaker, except for necessary foreign circuits. Any live parts within the control panel fed from foreign control or signal circuits shall be covered or arranged to be disconnected by one of the following methods:
   1. Enclosed relays, which are automatically de-energized when the main disconnecting switch is opened.
   2. Door-operated enclosed disconnect switches; or
   3. Clearly identified enclosed manually operated disconnect switches, which may be located inside the control panel door, provided the operating handles are isolated or barriered from all open live parts. Each control panel shall be arranged so that adjustments to timing relays or replacement of fuses can be done without exposure to live parts.

C. Piping and Wiring: Factory wire and pipe control panels. Cable all panel wiring by securing to the panel surfaces with plastic cable ties. Permanently identify each wire at each termination by means of a heatshrink numbered sleeve. Number all electrically common wires the same, and number each electrically different wire uniquely. Provide red wire color for ac wiring, with white neutral and green ground. Provide blue wiring for dc wiring. Wiring shall be 14-gauge, Type MTW or THHN, 600 volt, stranded copper wire. Where wiring crosses hinged surfaces, provide an 18-inch "U" shaped hinge loop of extra flexible wires secured at both ends. Provide ring-type lugs for all panel wiring; spade-type lugs are unacceptable. Use ratchet type crimping tools, which do not release until proper crimp pressure has been applied.

D. Terminal Blocks: Terminal blocks shall be rated 600 volts for signals greater than 30 V and 300 volts for signals less than 30 V, and shall conform to requirements of NEMA Standard ICS 4 (Terminal Blocks for Industrial Control Equipment and Systems). The terminal block and terminal lug shall be compatible. Provide disconnecting terminals for any circuit within the control panel, which can be energized when the branch circuit feeding the control panel, if any, is off. Provide terminals for all external (field) connections and provide at least 15% spare terminals. Identify each terminal permanently with the same number as the wire

© December 2012 Kennedy/Jenks Consultants

being terminated. Terminals shall be Allen-Bradley 1492 Series; Buchanan; or equal.

E. Nameplates: Provide nameplates as shown on the Drawings, and as specified in Section 17010. A "CAUTION" nameplate shall be attached to the outside of access doors warning of foreign voltages inside the panel (see "Safety Requirements").

F. Finish:
   1. After fabrication all external welds shall be ground smooth. The entire unit shall be thoroughly degreased, then filled and sanded. All metal surfaces shall be given a rust-inhibiting treatment or passivator, then one coat of synthetic primer, followed by two coats of synthetic enamel. The average overall finish shall be at least 3 mils in thickness. All damage to the finish during installation shall be touched up at the jobsite as approved.
   2. Exterior panel color shall complement adjacent panels and shall be approved by the Owner. Sharp angled horizontal front edges of panels shall be protected by brushed and coated stainless steel angled strip with concealed fasteners.

G. Size and Supports:
   1. Panels shall be of sufficient size to adequately enclose all instruments designated as "panel-mounted" plus ample interior clearance to allow for installation, general servicing, and maintenance of the instruments. Weight of instruments shall be supported by Unistrut; Famet; Caine; or equal, channel supports. Panel size shall be as indicated on the Drawings.
   2. Provide rigid supports for all devices. Supports shall not cause warping or bowing sides or mounting plates.

H. Mounting:
   1. Attachment methods shall be detailed on panel fabrication drawing submittals. Heavy panels shall be attached by anchor bolts embedded in beams supporting the floor. See the Structural Drawings for location of beams. Seismic restraints shall be installed as specified by the manufacturer.
   2. Mounting pans of rigid sheet steel shall be provided for interior components and accessories as required. A steel divider shall separate pneumatic sections from electrical sections. Devices having both electric and pneumatic connections shall be in the pneumatic section and connected to the electric section with waterproof flexible conduit.

I. Arrangement:
   1. The instruments mounted in the panels shall have the nominal size and general arrangement shown. Panel layouts and nameplates shall conform to the approved submittal.
   2. Space shall be provided for instruments indicated as furnished by others to be mounted and wired by the control panel manufacturer. These units shall be shipped to the control panel manufacturer in sufficient time for wiring. Coordination of instrument delivery shall be the responsibility of the Contractor. The instruments and controls to be located on each panel are shown on the instrumentation drawings, electrical schematics, and/or in the individual Specification.

© December 2012 Kennedy/Jenks Consultants

J. Ventilation:
   1. Ventilation shall be provided to prevent internal panel temperatures from exceeding 140°F.
   2. Louvers shall be provided, when required for cooling, near the bottoms and tops on the rear doors and side of panels. 80-mesh screens shall cover the insides of louvers.
   3. Provide a thermostatically controlled fan in each enclosure when louvers cannot dissipate heat adequately or cause sufficient flow to all panel areas. Ventilation fans shall be low acoustic type suitable for control rooms. Provide removable cleanable or disposable dust filter for each remote site enclosure.
   4. Provide heaters and circulating fans in all outdoor panels to prevent condensation.
   5. Provide air control cooling system for panels requiring less than 1,500 Btu/hr heat dissipation.
   6. Provide air conditioning for panels requiring high heat removal.

K. Cable Entry Plates:
   1. For top entry panels, a gasketed 10-gauge steel cover plate shall be cut that is suitable for the number of conduits. Cable entry plates are not required for bottom, side, or back conduit entry unless the Contractor must specifically control the position, size, and location of cutouts.
   2. Cable entry plates shall mount to and be fastened along panel stiffeners and framing segments. Tee nut fasteners are preferred.

L. Signal Ground Buses:
   1. Provide each panel with at least one isolated signal ground bus. Provide a bus 1-inch wide by 1/4-inch thick, running from top to bottom. Provide the bus with tapped holes to accommodate ground connections from various devices in the rack. Provide separate ground buses for analog and discrete/digital signals.
   2. Connect all signal shield grounds within the panel to the ground bus(es) with ring-tongue connectors that bolt to the bus(es).

M. Signal Ground Plate: For rack, multiple enclosure, or bay systems provide a separate 1/4-inch-thick isolated copper system ground plate. Mount this plate in a location central to all system components.

N. Panel Lights and Receptacles: Panels shall be internally lighted by fluorescent lamps, provided with guards and a toggle switch located convenient to each access door. One duplex GFI type receptacle shall be provided in each panel section. The lights and receptacles shall be wired to outgoing terminal blocks for 120-volt, 60-Hz, single-phase supply.

2.02 PANEL HARDWARE

A. All doors shall be set flush with three-point vault-type key-locking latches in addition to any required screw clamps. A minimum of two sets of keys supplied. Doors shall be labeled with "AUTHORIZED PERSONNEL ONLY" in 1-inch letters.

B. Hinges shall be piano type. All hardware and handles shall be stainless steel.

© December 2012 Kennedy/Jenks Consultants

C. Leveling adjustments on each panel section shall be provided on freestanding panels.

D. Status lights, selector switches, and pushbuttons shall be as specified in Section 16955.

E. Provide a copy of the elementary control diagram for the control panel, enclosed in plastic and mounted inside the panel.

F. Control panels and electronic racks shall be supplied with door-operated switches (for control circuit interlocking) and accessories as required by Sections 17200 and 16955.

G. Where noted on the Drawings, provide rack-out devices and access plates to make panel access easier and safer. Panel fabricators shall add full extension drawer guides and adjust width of front access plates to assure access to all components and hardware.

H. Floor stand kits shall not exceed 24 inches in height nor cause the panel to exceed 84 inches in overall height.

2.03 MANUFACTURER

A. Manufacturers of the control panels and terminal cabinets enclosure shall be Hoffman; or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation, testing, calibration, validation, startup and instruction shall be in accordance with Section 17010.

B. Install each control panel level and plumb, and secure by the favorably reviewed seismic mounting method. Doors shall swing freely and close tightly.

C. Provide a 3-inch-high concrete pad for each field-mounted, freestanding control panel. Provide a 3-1/2-inch-high I-beam kick panel for each control-room mounted, freestanding panel.

D. Carefully repair any damage to the structure, components or finish to the satisfaction of the Engineer. Clean all nameplates.

E. Exercise care at all times after installation of control panels to keep out foreign matter, dust, dirt, debris, or moisture. Use protective sheet metal covers, canvas, heat lamps, etc., as needed to ensure equipment protection.

F. For all metal panels mounted on concrete walls or floors, install 1/8-inch shims, and paint the back sides and bottom of the panels with Mobil Hi-Build Bituminous

© December 2012 Kennedy/Jenks Consultants

Coating 35-J-10; Koppers Bitumastic Super Tank Solution; or equal. Film thickness shall be 10-mils minimum.

END OF SECTION

© December 2012 Kennedy/Jenks Consultants

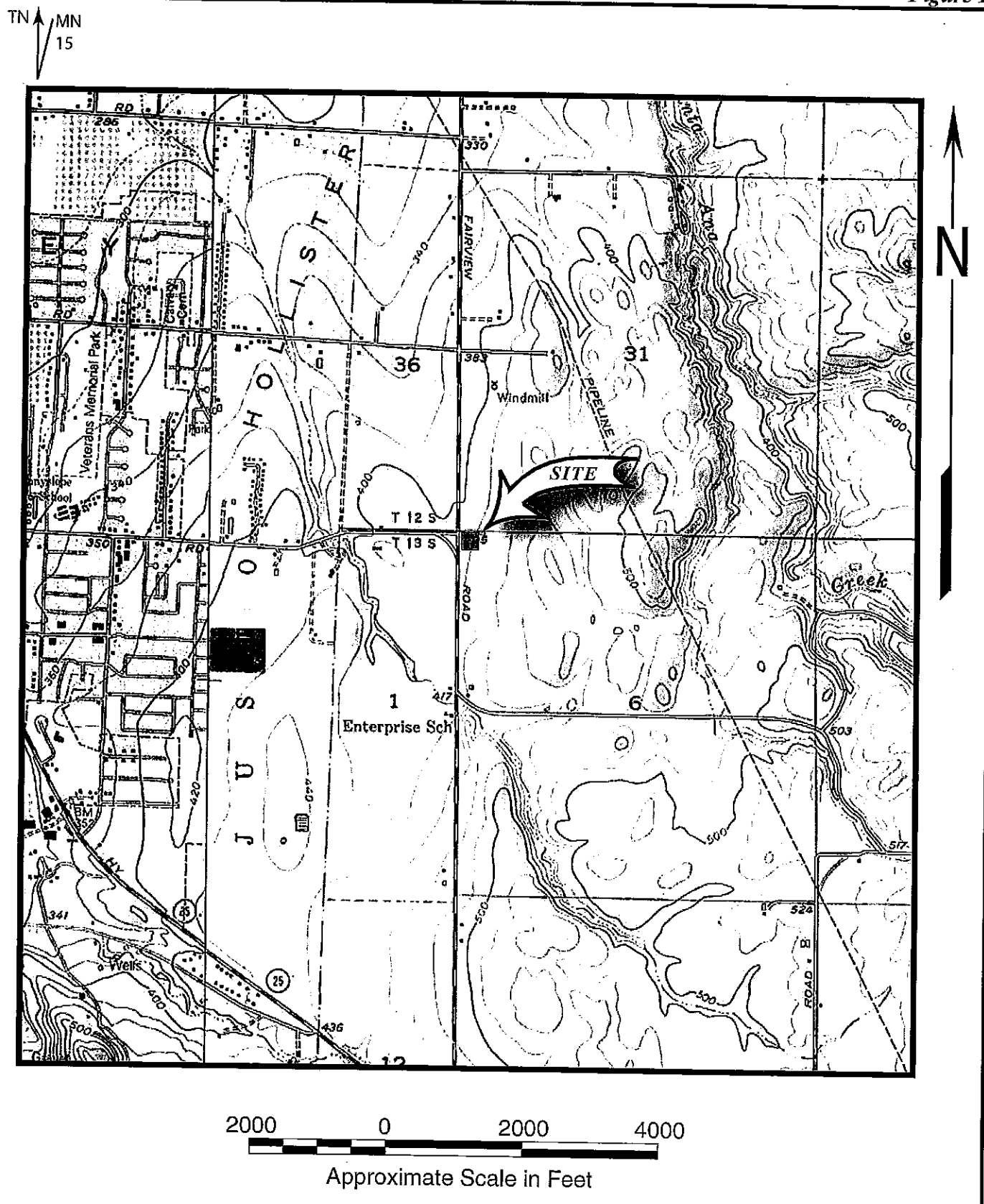
THIS PAGE INTENTIONALLY BLANK

© December 2012 Kennedy/Jenks Consultants

APPENDIX A

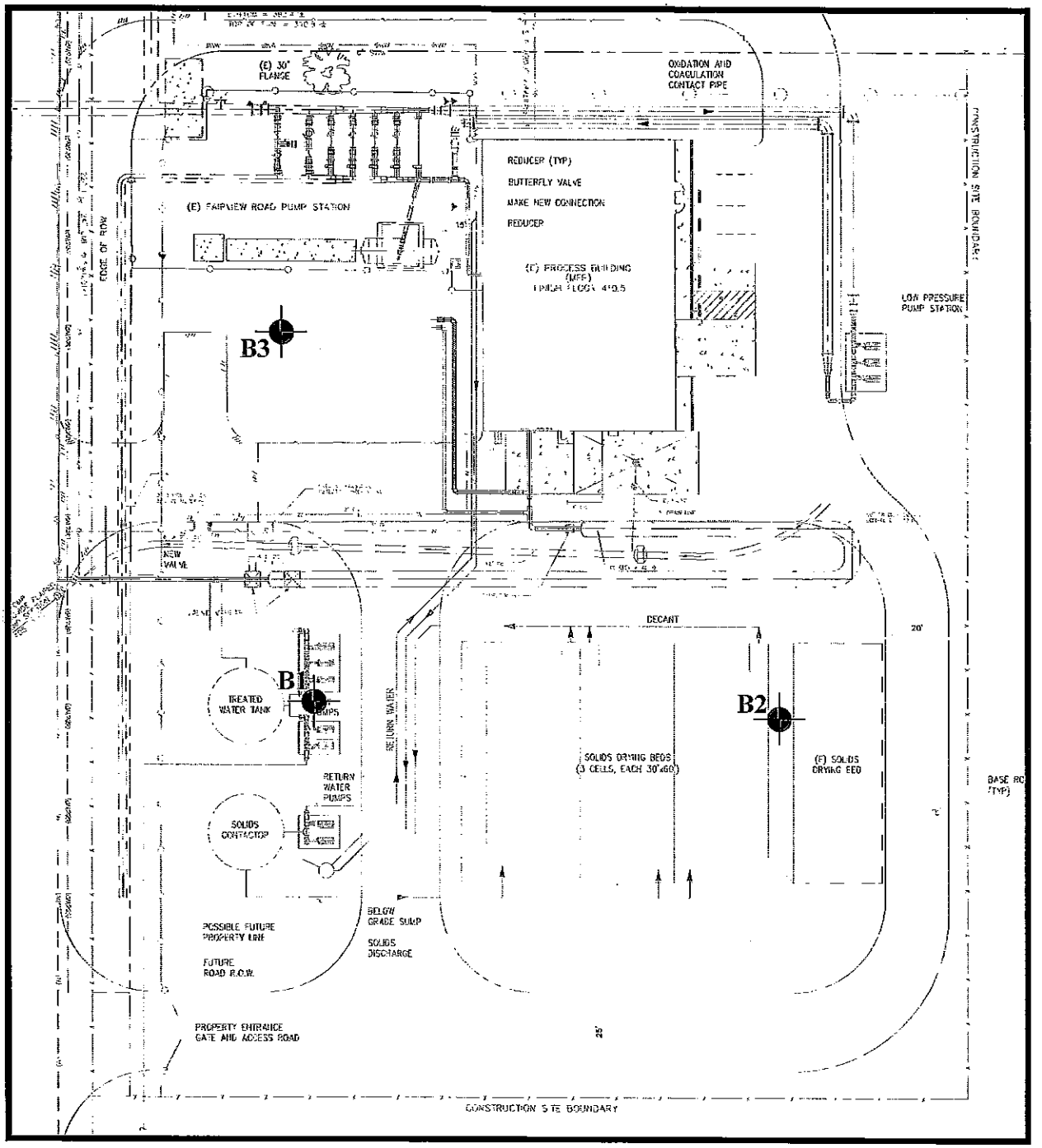
Site Location Map
Boring Location Map
Boring Logs

Figure 1



Map created with Topo!" © 2003 National Geographic (www.nationalgeographic.com/topo)

Earth Systems Pacific	Lessalt Water Treatment Plant Sunnyslope Rd at Fairview Rd Hollister, California	**Site Location Map** **SH-11111-SB**



50 0 50 150

Approximate Scale in Feet

B3 Approximate boring location

Base: Kennedy/Jenks Consultants, 2011

Earth Systems Pacific	Lessalt Water Treatment Plant Sunnyslope Rd and Fairview Rd Hollister, California	**Boring Location Map** **SH-11111-SB**

Earth Systems Pacific

Boring No. 1
PAGE 1 OF 1

LOGGED BY: C. Cecile
DRILL RIG: Simco 2400 SK-1
AUGER TYPE: 4" Solid Stem

JOB NO.: SH-11111-SB
DATE: 02/14/11

SUNNYSLOPE COUNTY WATER DISTRICT
LESSALT WTP DBP REDUCTION PROJECT
Fairview Road east of Sunnyslope Road
Hollister, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 12 IN.
0	SC		Light brown clayey SAND with gravel, moist, loose	0.0–1.5	■	111.6	15.2	12
1	SW		Gray well graded GRAVEL with sand, rounded gravel in sandy matrix, moist, dense					
2	CH		Brown FAT CLAY with sand, moist, hard					
3	CL		Yellow brown sandy lean CLAY with lithics, moist, hard	1.5–3.0	■	110.6	11.4	43
4								
5								
6	SC		Yellow brown clayey SAND, moist, medium dense to dense					
7								
8				8.5–10.0	■			32
9								
10			–trace fine rounded gravel					
11								
12	GC		Grayish brown clayey GRAVEL with sand, moist, very dense	13.0	■			50/1"
13			End of Boring @ 13.0' No subsurface water was encountered					
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

LEGEND: ■ Ring Sample ◯ Bulk Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 2

LOGGED BY: C. Cecile
DRILL RIG: Simco 2400 SK-1
AUGER TYPE: 4" Solid Stem

JOB NO.: SH-11111-SB
DATE: 02/14/11

SUNNYSLOPE COUNTY WATER DISTRICT
LESSALT WTP DBP REDUCTION PROJECT
Fairview Road east of Sunnyslope Road
Hollister, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 12 IN.
0	SC		Yellow brown clayey SAND with rounded fine to coarse gravel, moist, loose to medium dense	1.5–3.0	■	107.0	12.4	15
3	CL/CH		Brown sandy lean to FAT CLAY, moist, stiff to very stiff, porous with roots	3.5–5.0	■	–	8.7	66
5	SC		Medium brown clayey SAND with gravel, moist, with caliche, dense					
6	SP		Light brown poorly graded SAND with chert fragments, slightly moist, dense					
8	SW		Yellow brown well graded SAND with trace gravel, moist, medium dense to dense, medium sand to medium gravel, gravels well rounded	8.5–10.0	■			37
12			–very dense					
13			–Grayish brown, less gravel, gravel subrounded	13.5–15.0	■			77
15			End of Boring @ 15.0' No subsurface water was encountered					

LEGEND: ■ Ring Sample ◯ Bulk Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 3

LOGGED BY: C. Cecile
DRILL RIG: Simco 2400 SK-1
AUGER TYPE: 4" Solid Stem

PAGE 1 OF 1
JOB NO.: SH-11111-SB
DATE: 02/14/11

SUNNYSLOPE COUNTY WATER DISTRICT
LESSALT WTP DBP REDUCTION PROJECT
Fairview Road east of Sunnyslope Road
Hollister, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 12 IN.
0	CH		Brown FAT CLAY with sand, moist, very stiff	0.0–3.0	○			
1				1.5–3.0	■	112.2	11.5	22
2			–hard					
3				3.5–5.0	■	116.2	13.7	50/4"
4	SC		Yellow brown clayey SAND, moist, very dense, with lithics and trace charcoal					
5								
6								
7								
8			–dense	8.5–10.0	■	100.7	7.4	48
9								
10			–charcoal flecks					
11								
12	SW		Orange brown well graded SAND, slightly moist, very dense					
13				13.5–14.5	■			111
14								
15			End of Boring @ 14.5'					
16			No subsurface water was encountered					
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

LEGEND: ■ Ring Sample ○ Bulk Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

LESSALT MEMBRANE FILTRATION PLANT

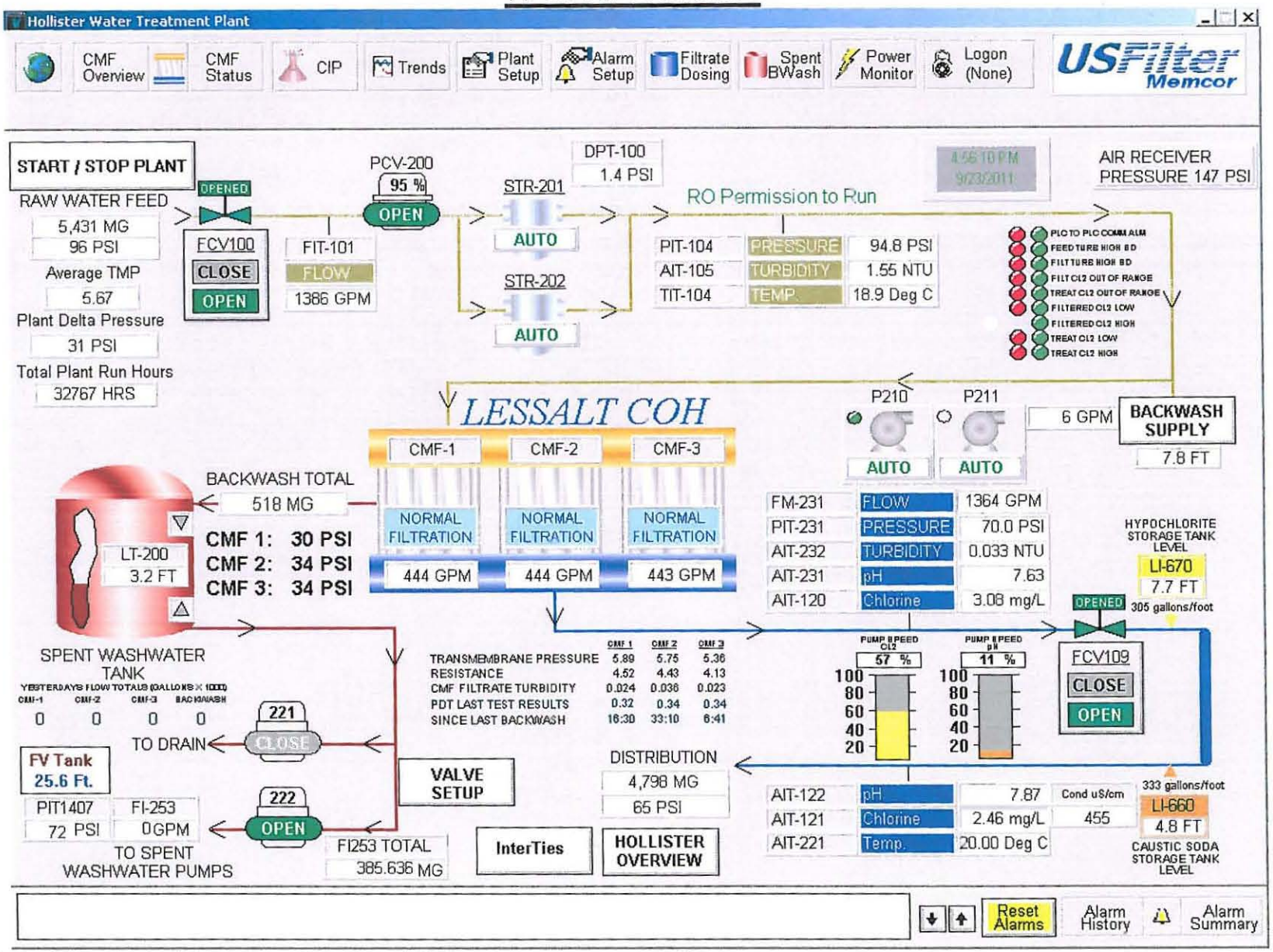
OPERATIONS MANUAL

APPENDIX E

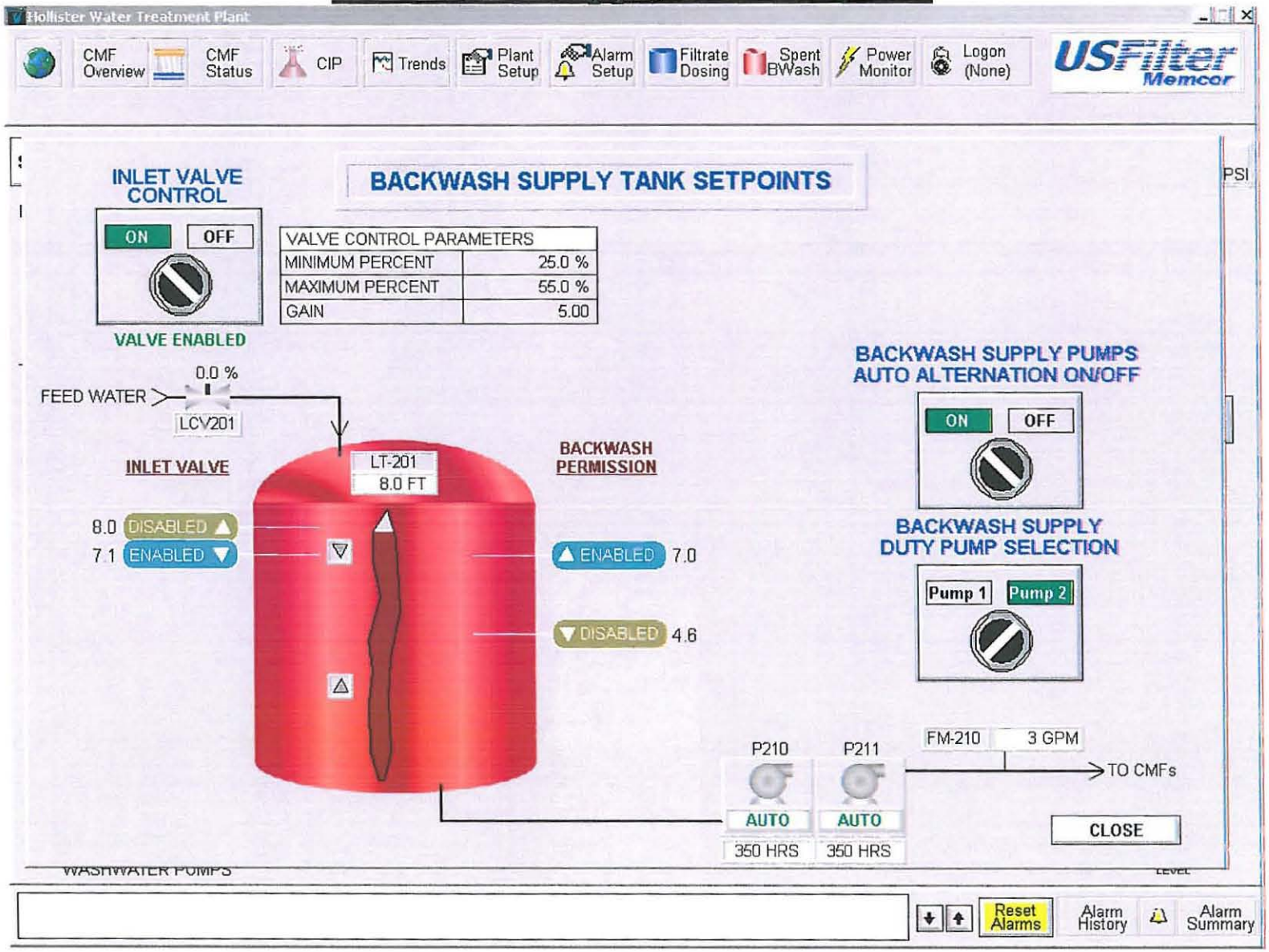
SCADA SCREENS

- World Screen
- Backwash Supply Screen
- C M F Overview Screen
- C M F Status Screen
- C M F Status Overview Screen
- C M F Status RT Trend Screen
- C I P Screen
- C I P Caustic Dosing Screen
- C I P Caustic Tank Neutralization Screen
- C I P Acid Dosing Screen
- C I P Acid Tank Neutralization Screen
- C I P Dosing Pumps Screen
- Trends Historical Plant Trends Screen
- Trends Historical C M F Trends Screen
- Trends Historical Trends Screen
- Trends Real-time Trends Screen
- Trends Create File Trends Screen
- Plant Setup Screen
- Alarms Screen 0 – 47
- Alarms Screen 48 - 95
- Alarms Screen 96 - 143
- Alarms Screen 144 - 191
- Filtrate Dosing Hypochlorite Screen
- Filtrate Dosing Hypochlorite PID Control Screen
- Filtrate Dosing Hypochlorite Alarm Set Points Screen
- Filtrate Dosing Caustic Screen
- Filtrate Dosing Caustic PID Control Screen
- Filtrate Dosing Caustic Soda Set Points Screen
- Spent Back Wash Pumps Screen
- Spent Back Wash Pumps Set Points Screen
- Power Monitor Screen
- US Filter Memcor Screen
- US Filter Memcor Analog 1 Screen
- US Filter Memcor Analog 2 Screen
- US Filter Memcor Backwash Setup Screen
- Alarm History Screen

Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
World Screen

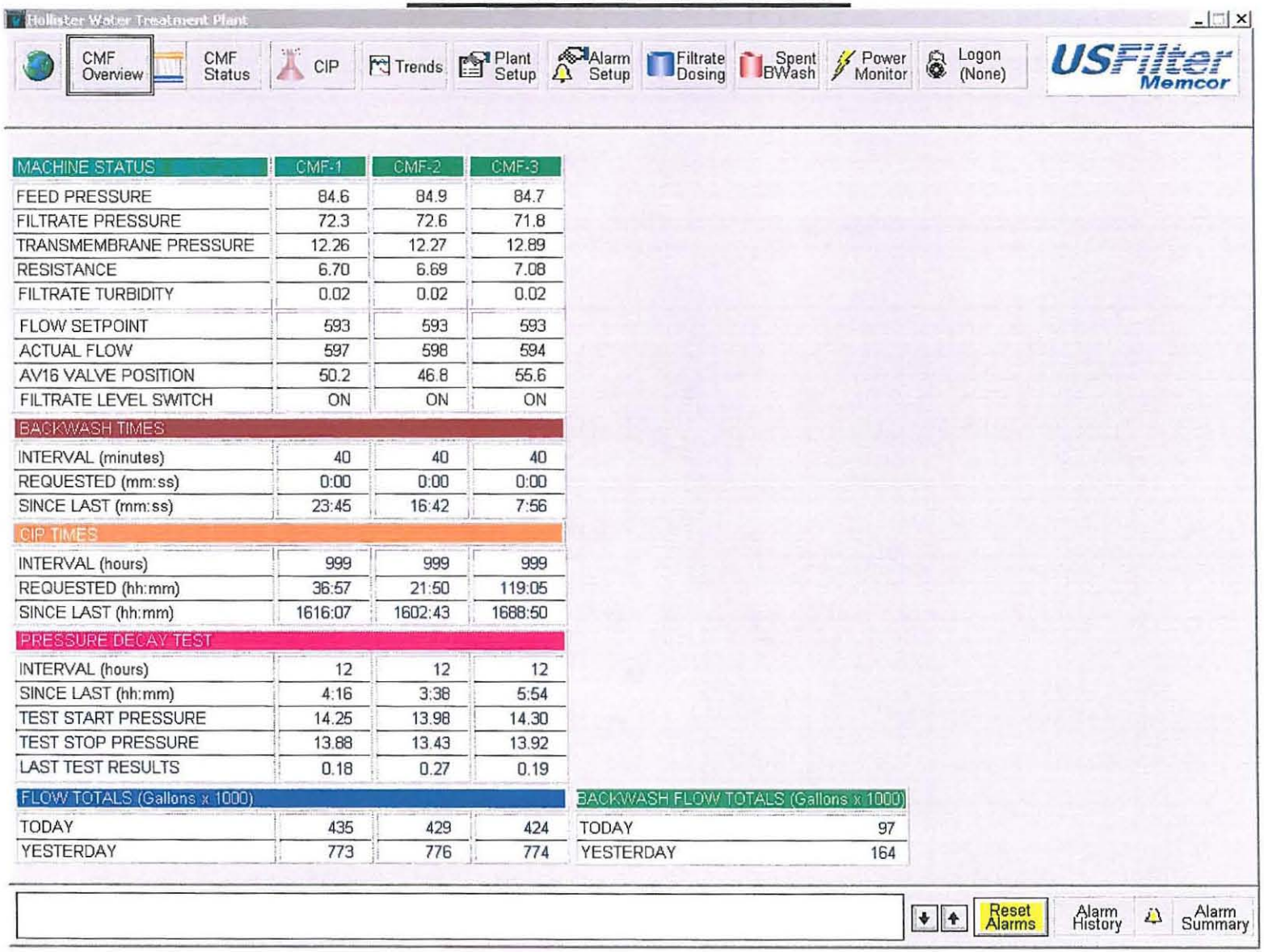


Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
Backwash Supply Tank Screen



Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant

CMF Overview Screen

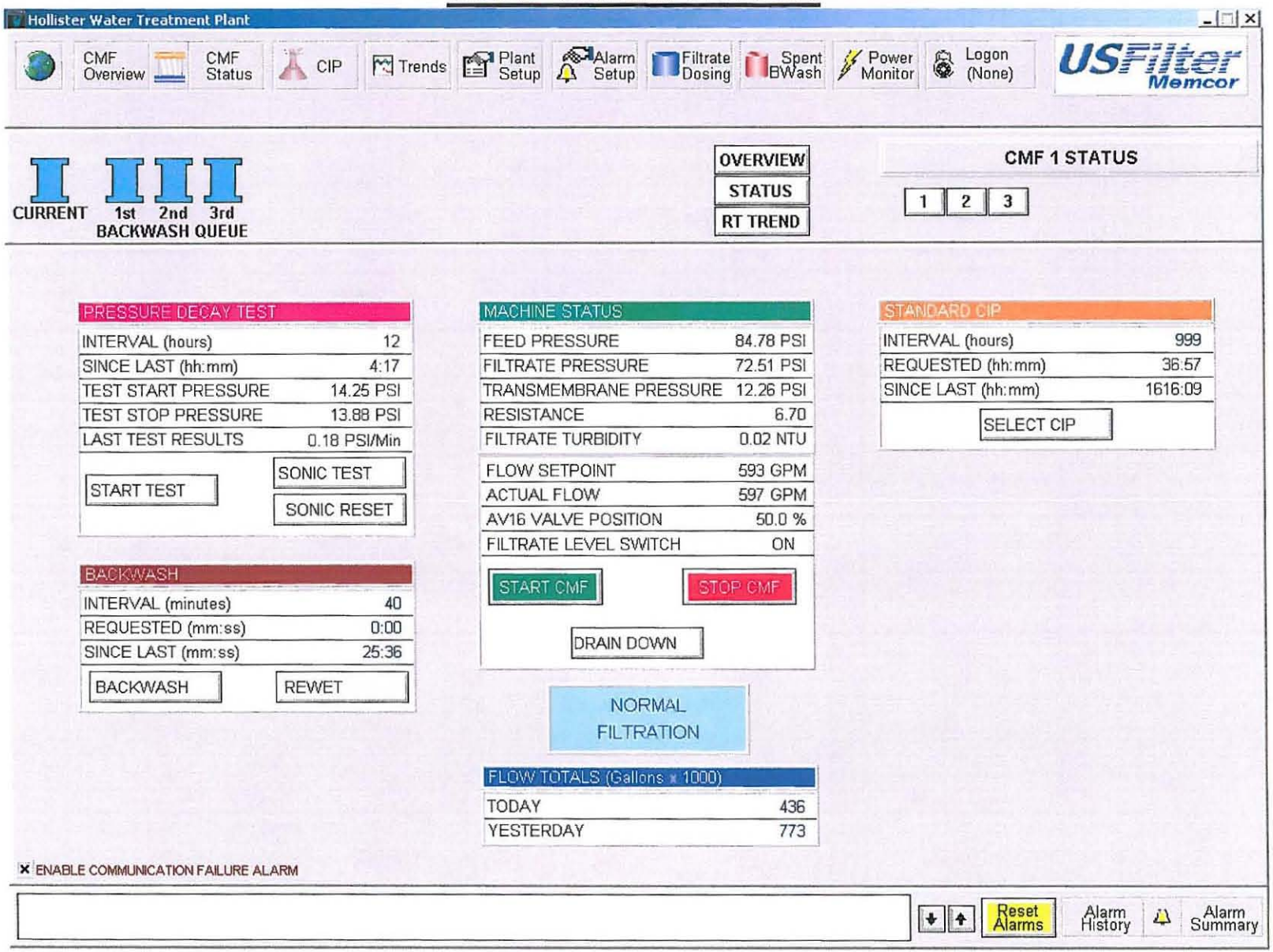


MACHINE STATUS	CMF-1	CMF-2	CMF-3
FEED PRESSURE	84.6	84.9	84.7
FILTRATE PRESSURE	72.3	72.6	71.8
TRANSMEMBRANE PRESSURE	12.26	12.27	12.89
RESISTANCE	6.70	6.69	7.08
FILTRATE TURBIDITY	0.02	0.02	0.02
FLOW SETPOINT	593	593	593
ACTUAL FLOW	597	598	594
AV16 VALVE POSITION	50.2	46.8	55.6
FILTRATE LEVEL SWITCH	ON	ON	ON
BACKWASH TIMES			
INTERVAL (minutes)	40	40	40
REQUESTED (mm:ss)	0:00	0:00	0:00
SINCE LAST (mm:ss)	23:45	16:42	7:56
CIP TIMES			
INTERVAL (hours)	999	999	999
REQUESTED (hh:mm)	36:57	21:50	119:05
SINCE LAST (hh:mm)	1616:07	1602:43	1688:50
PRESSURE DECAY TEST			
INTERVAL (hours)	12	12	12
SINCE LAST (hh:mm)	4:16	3:38	5:54
TEST START PRESSURE	14.25	13.98	14.30
TEST STOP PRESSURE	13.88	13.43	13.92
LAST TEST RESULTS	0.18	0.27	0.19

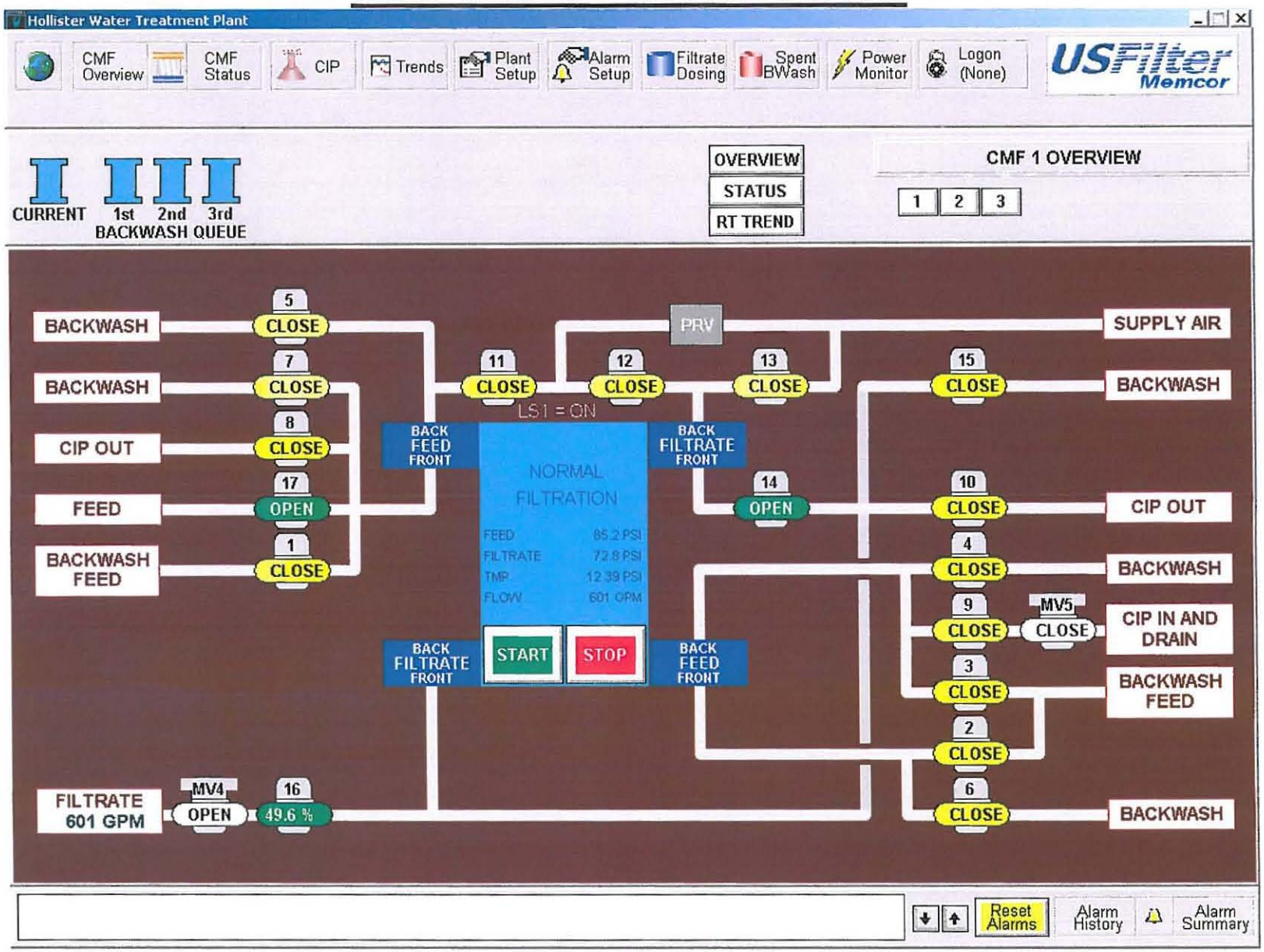
FLOW TOTALS (Gallons x 1000)			
TODAY	435	429	424
YESTERDAY	773	776	774

BACKWASH FLOW TOTALS (Gallons x 1000)	
TODAY	97
YESTERDAY	164

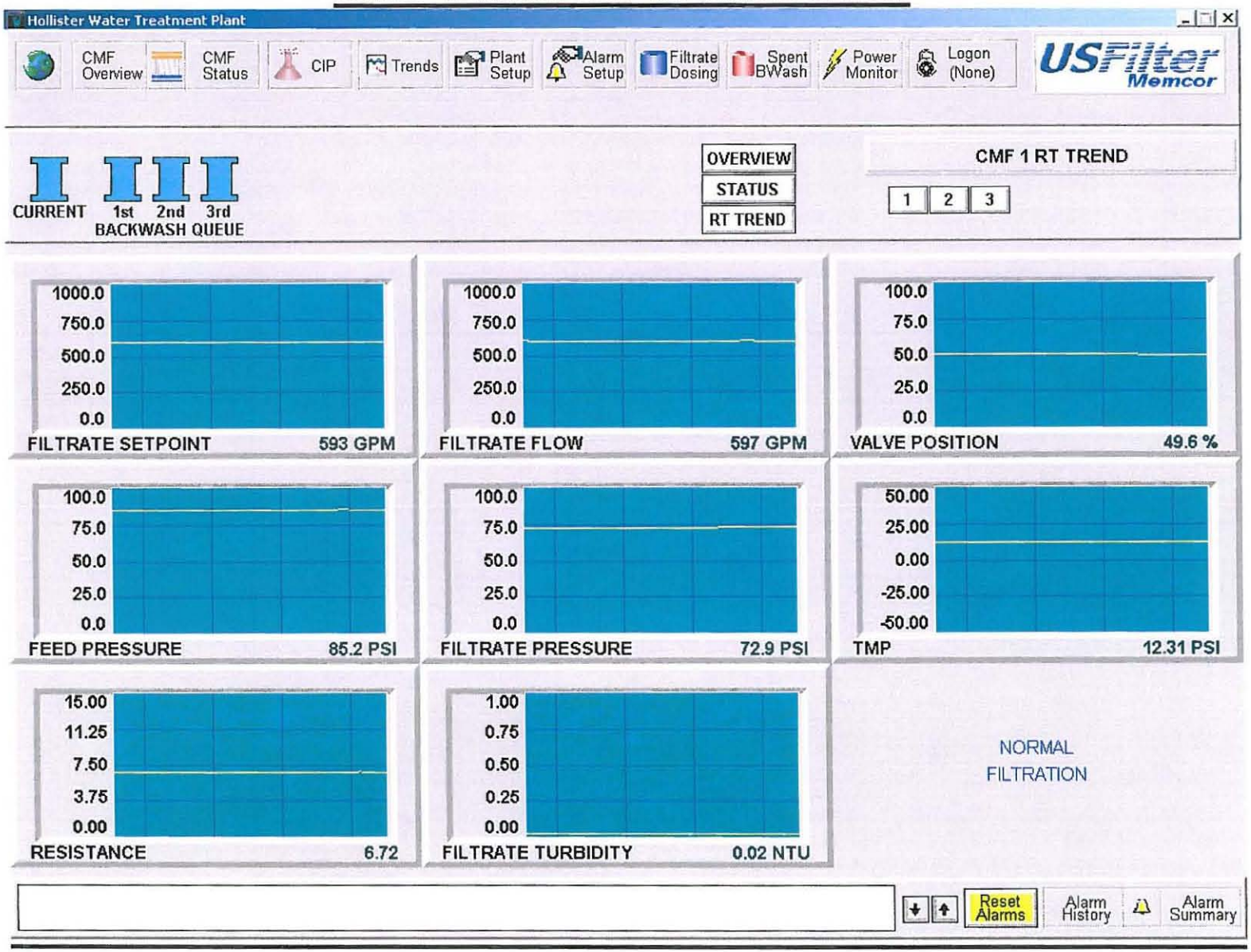
Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
CMF Status Screen



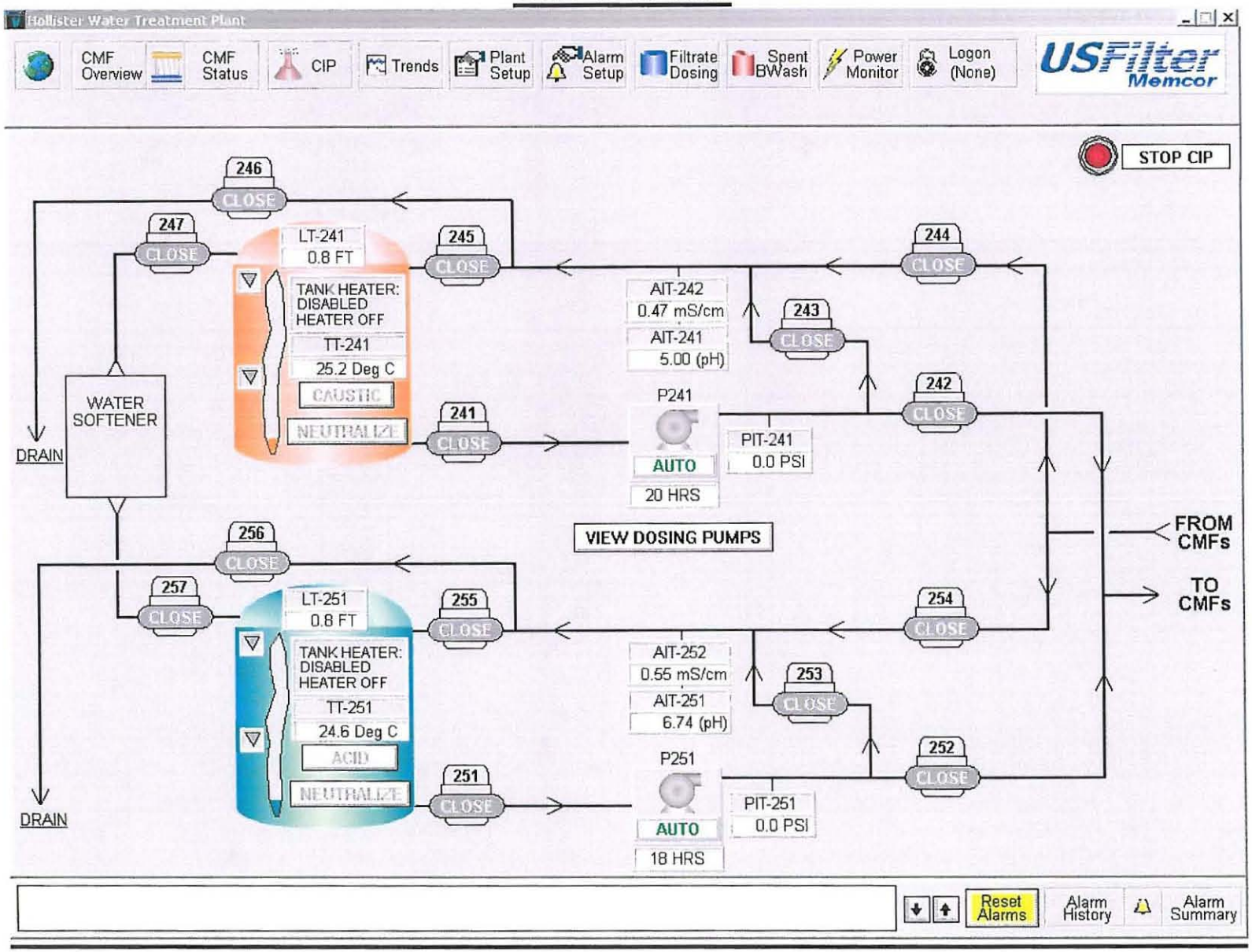
Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
CMF Status Overview Screen



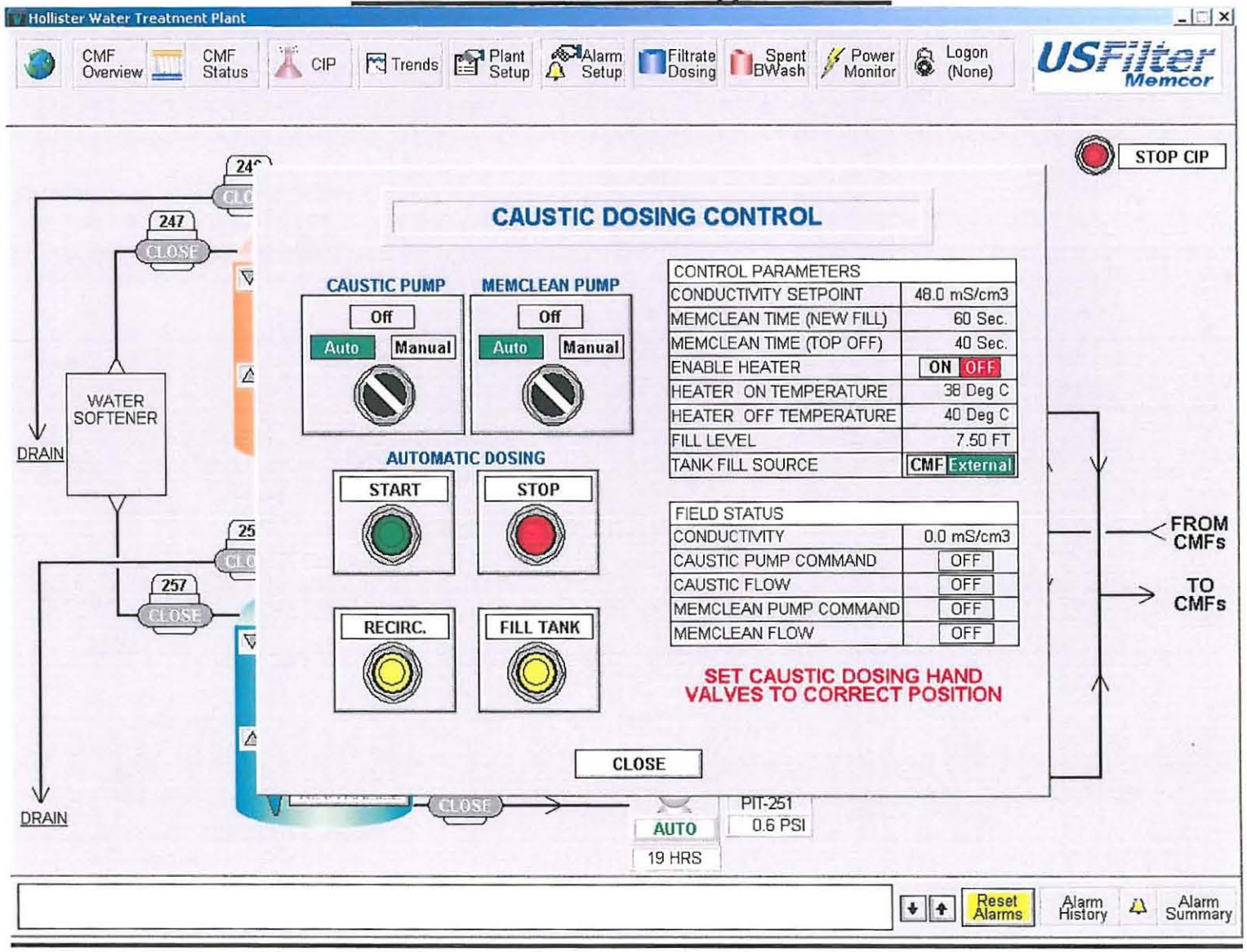
Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
CMF Status RT Trend Screen



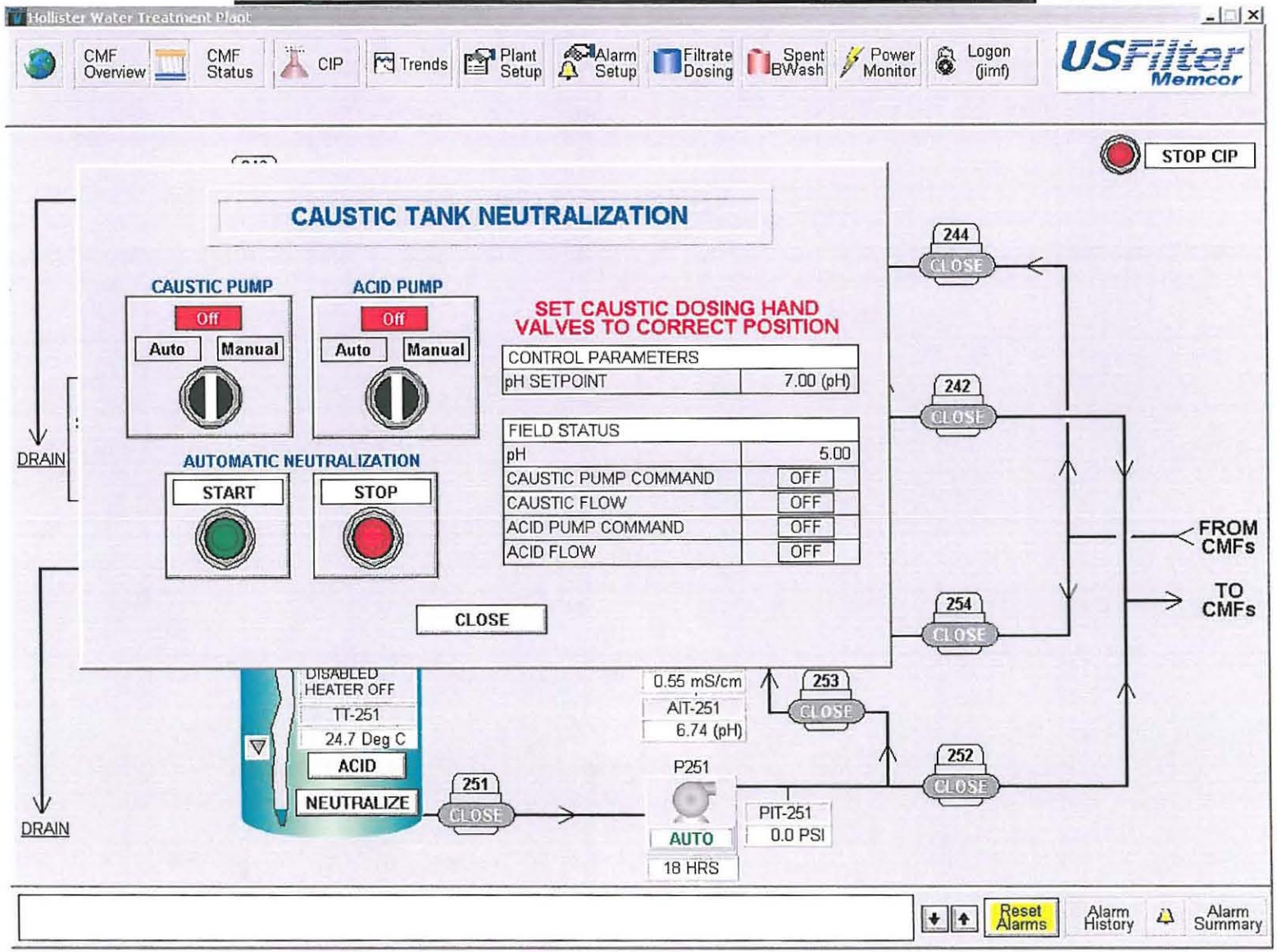
Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
CIP Screen



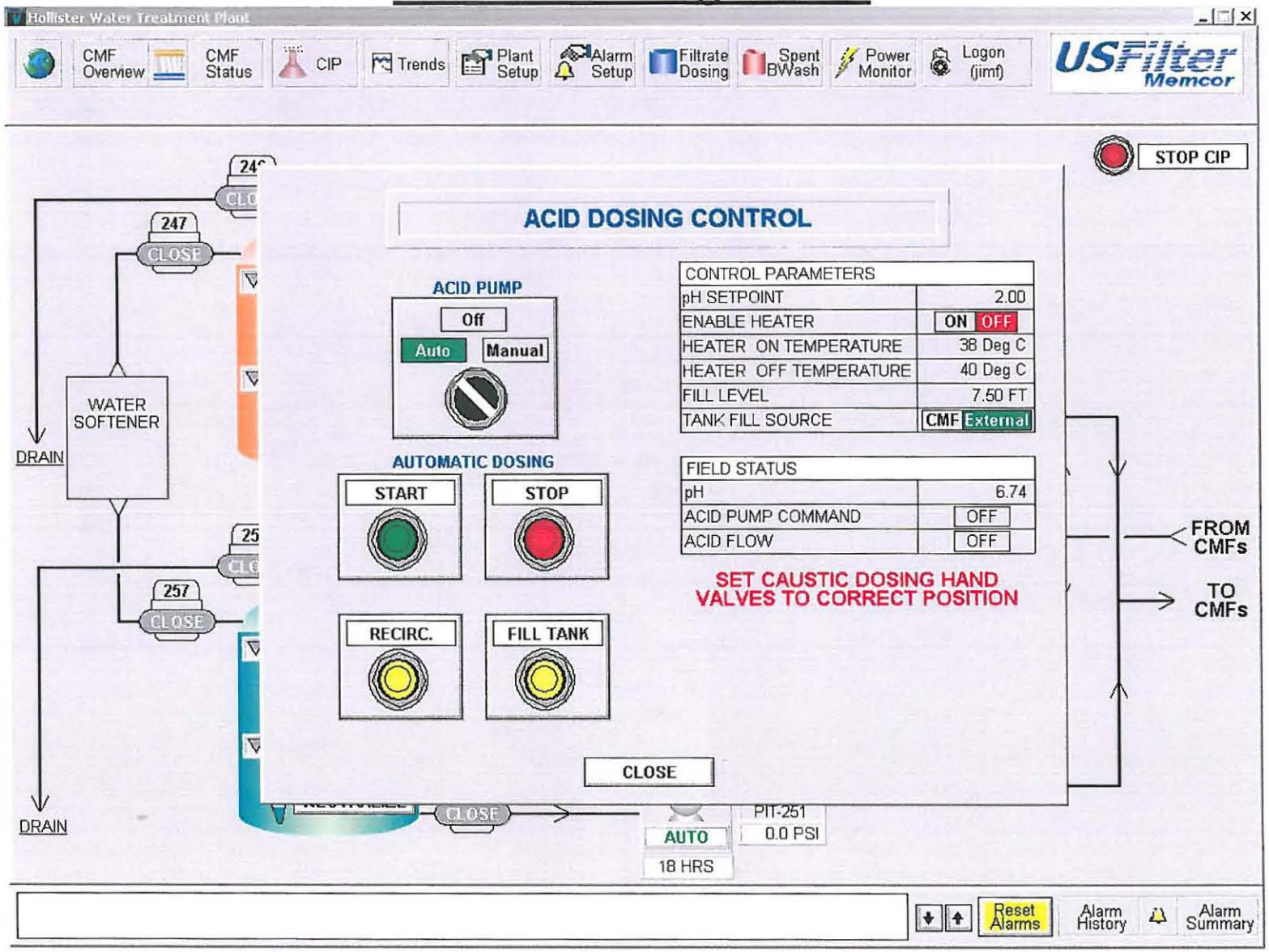
Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
CIP Caustic Dosing Screen



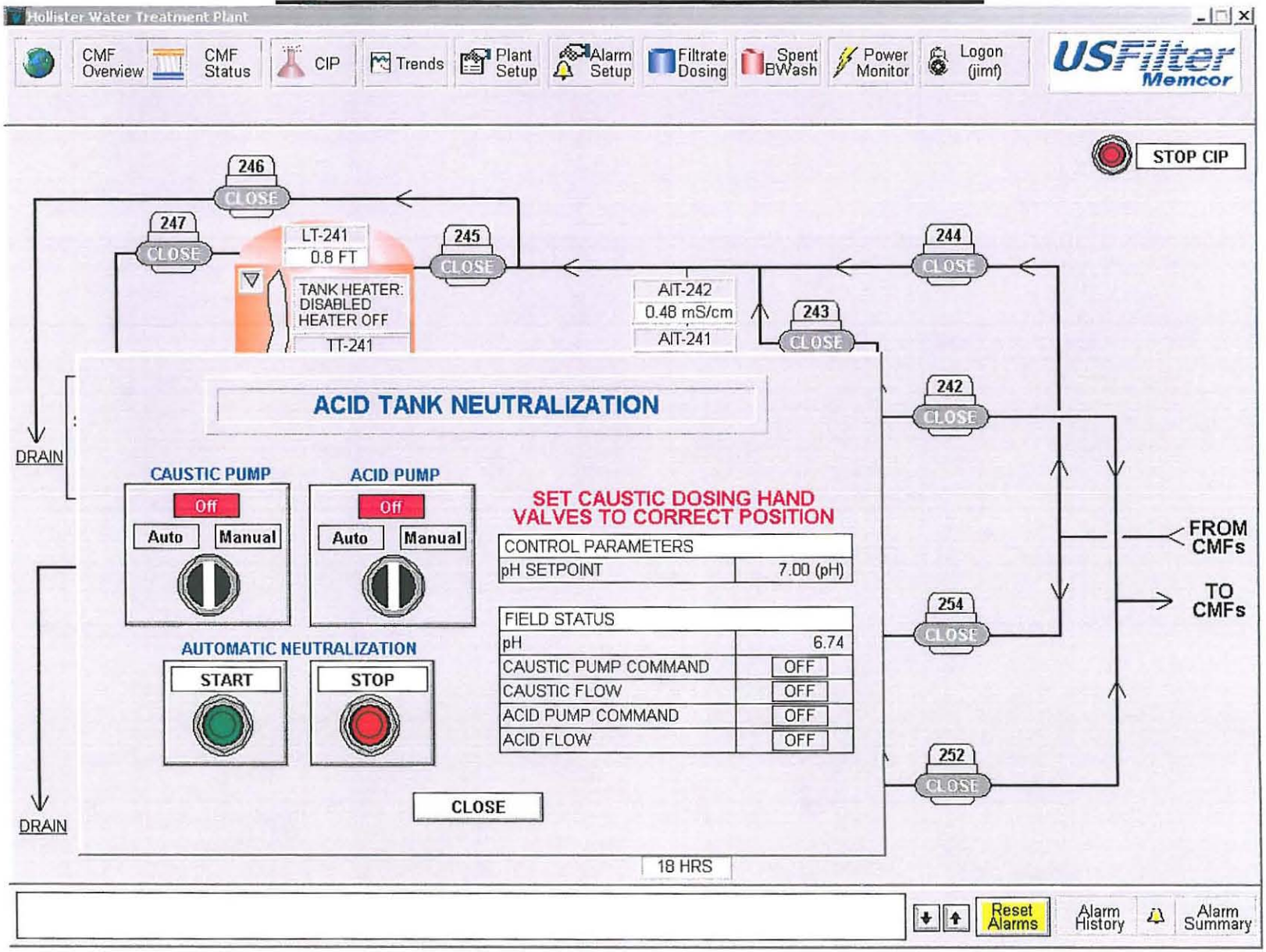
Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
CIP Caustic Tank Neutralization Screen



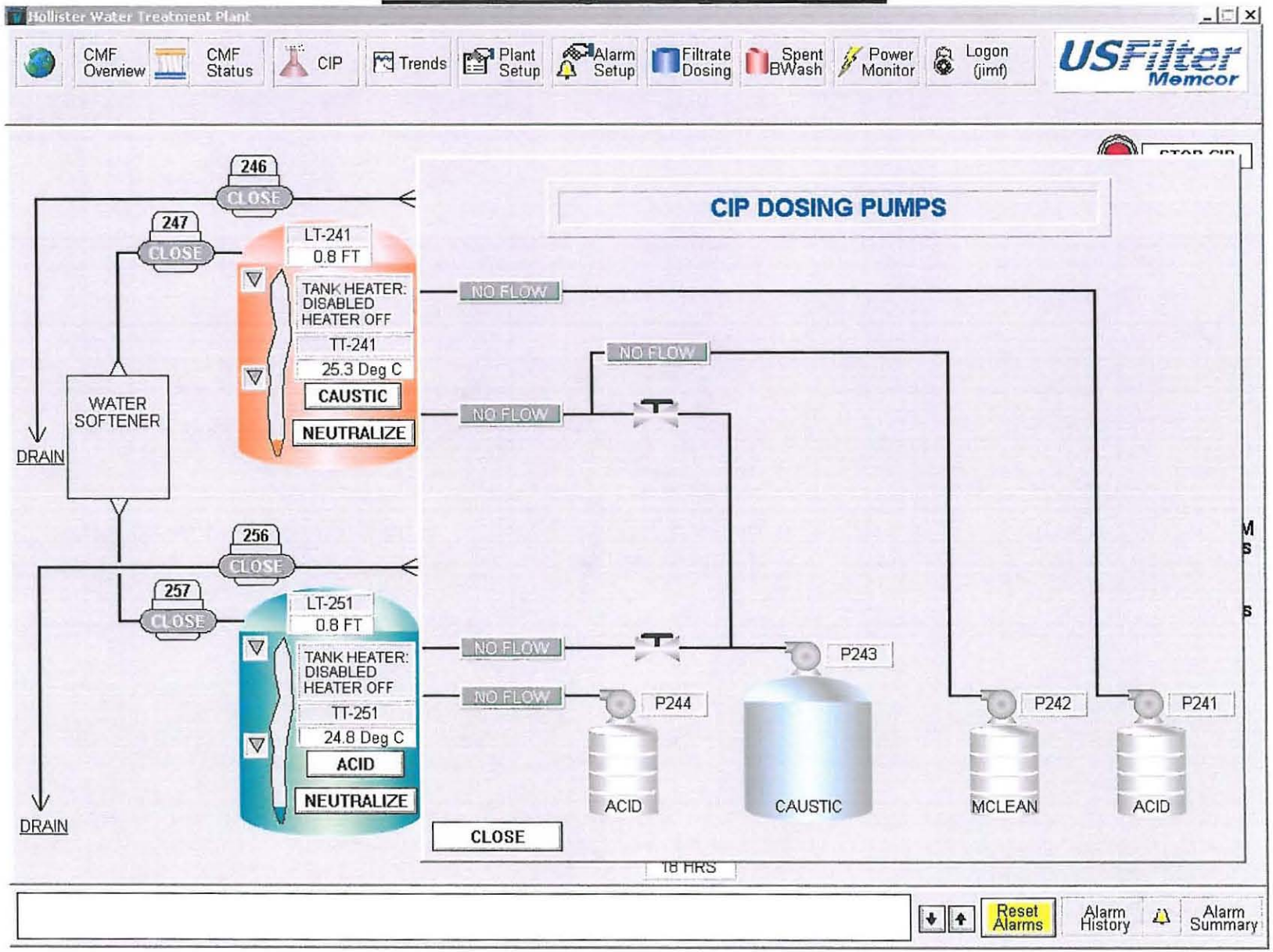
Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
CIP Acid Dosing Screen



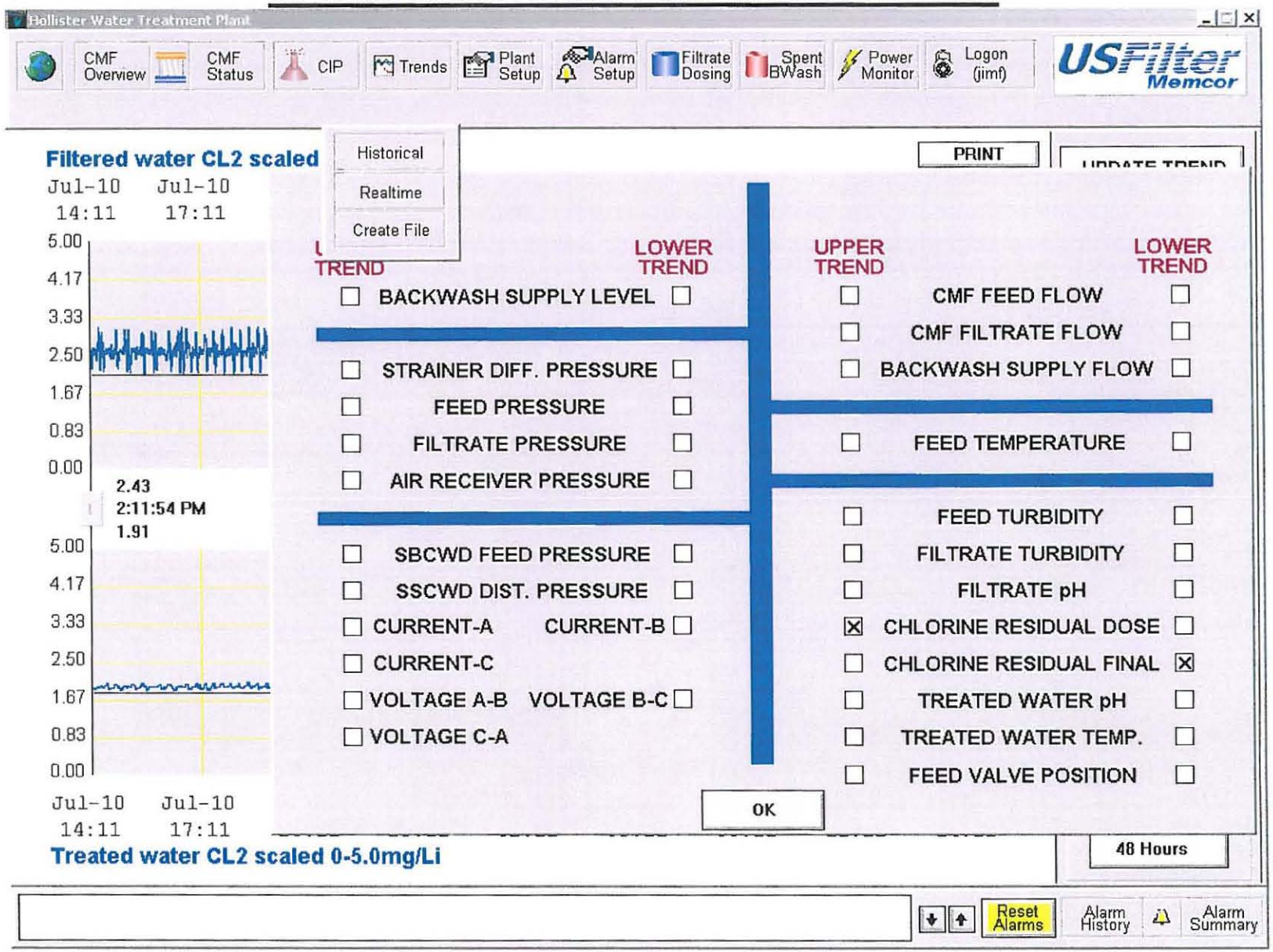
Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
CIP Acid Tank Neutralization Screen



Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
CIP Dosing Pumps Screen

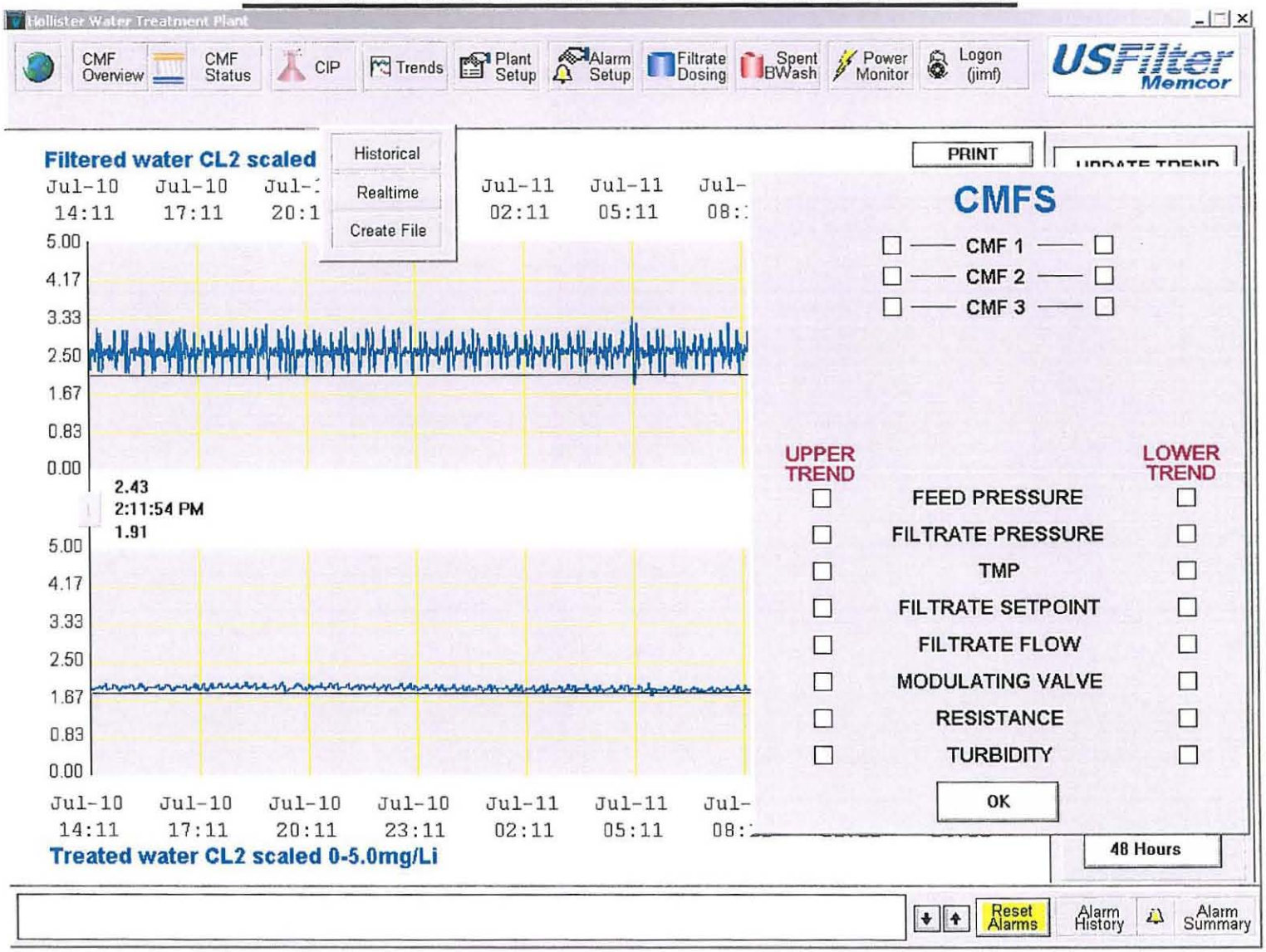


Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
Trends Historical Plant Trends Screen

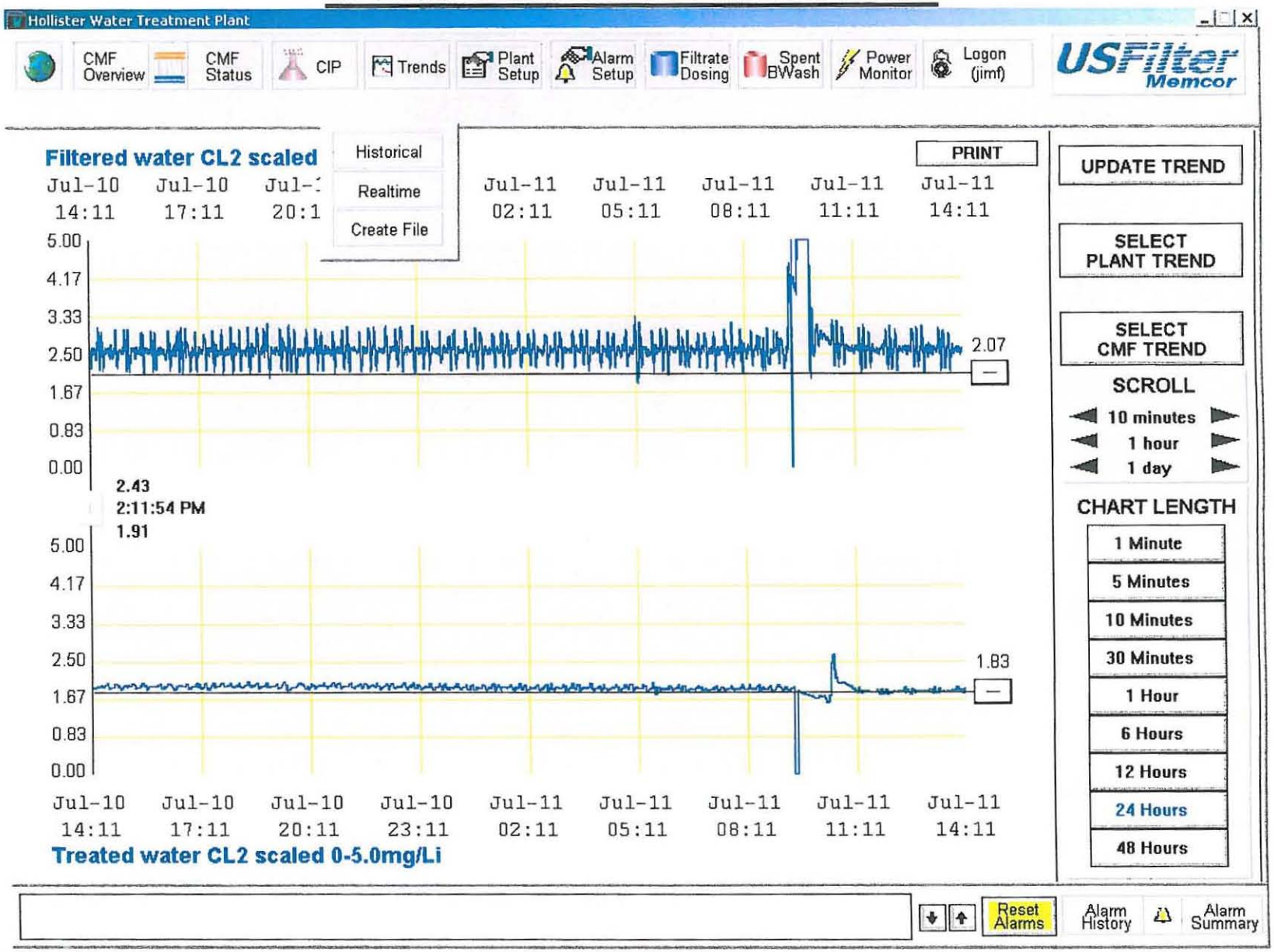


Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant

Trends Historical CMF Trends Screen

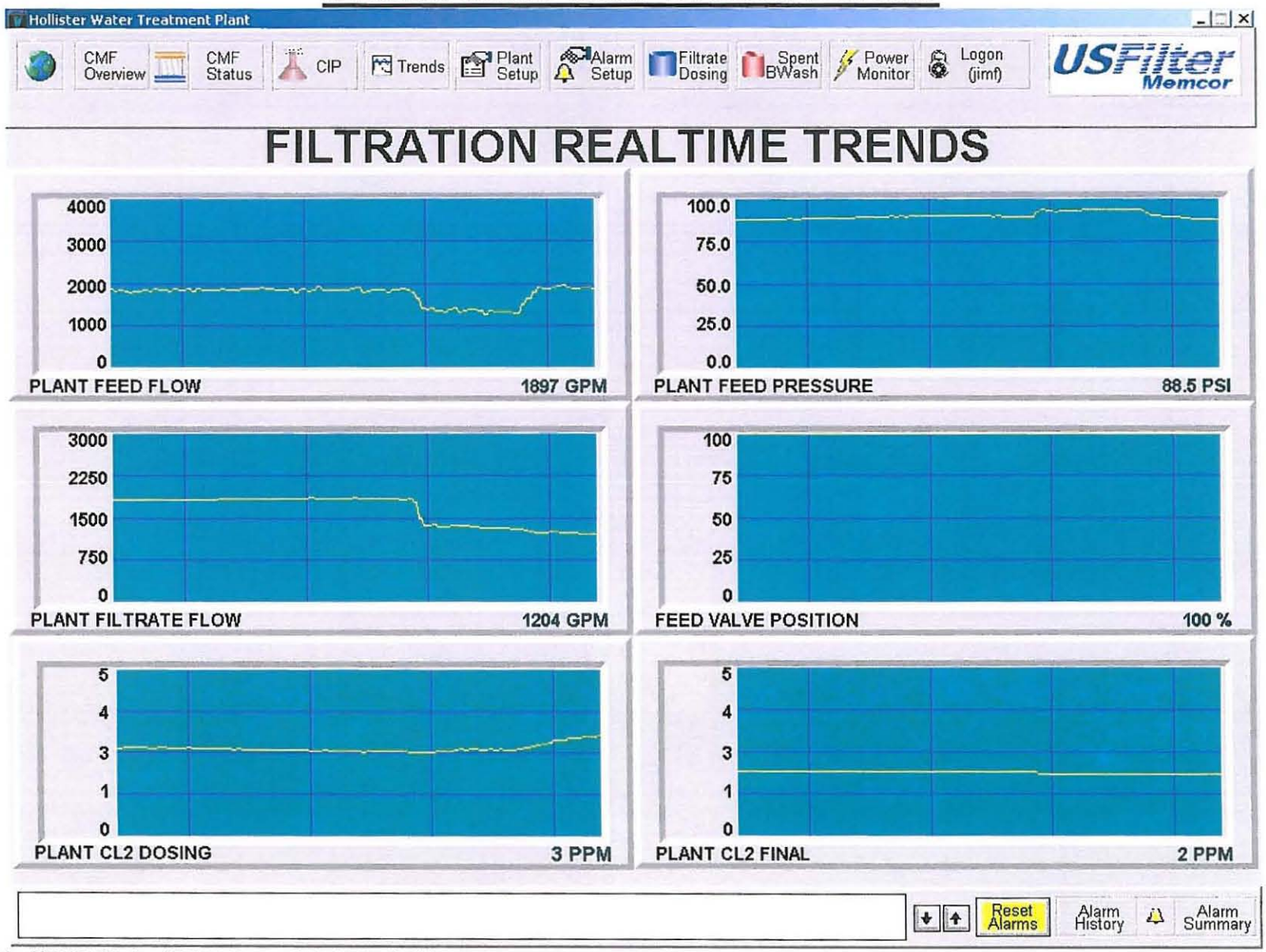


Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
Trends Historical Trends Screen

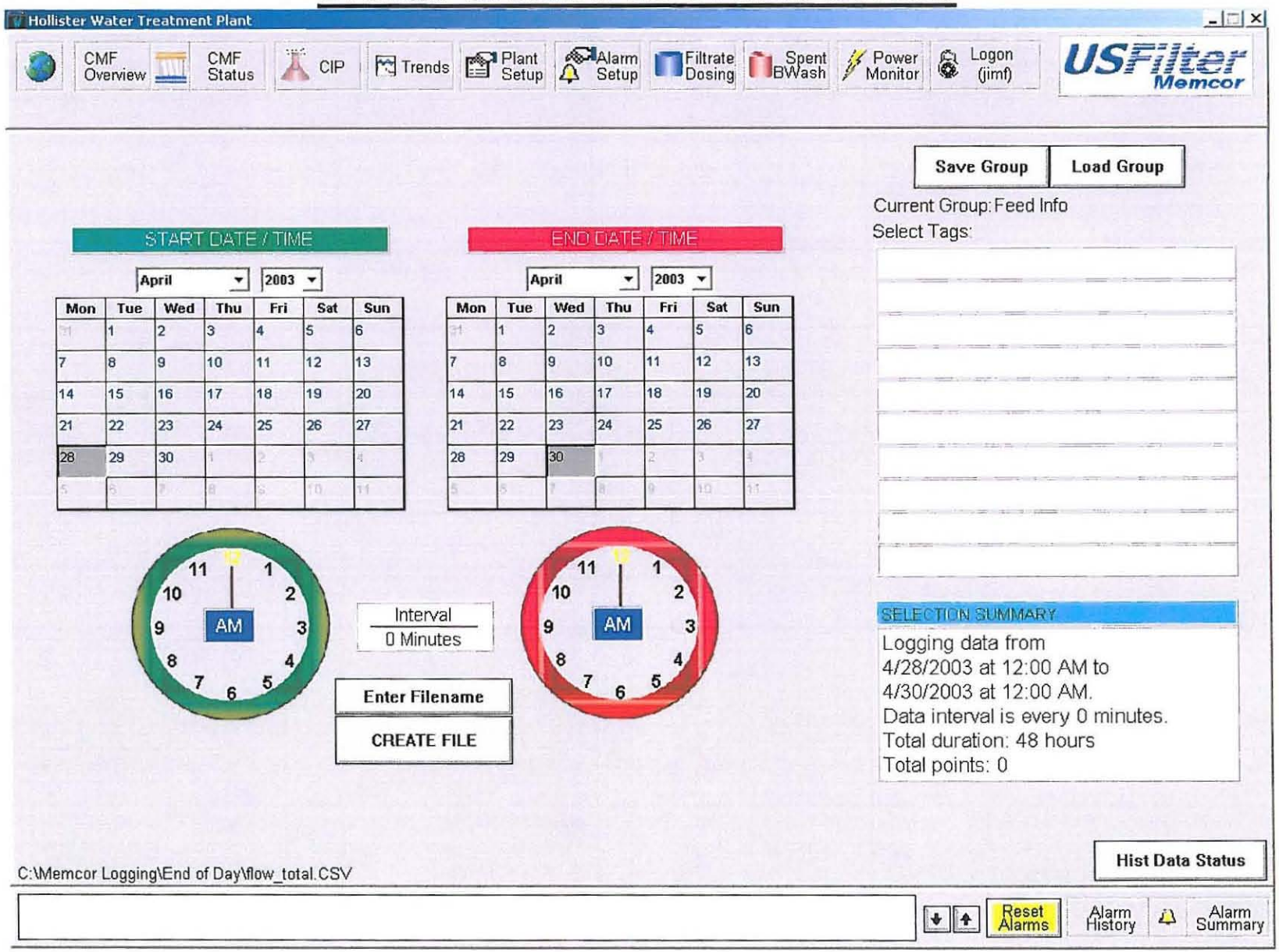


Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant

Trends Real-time Trends Screen

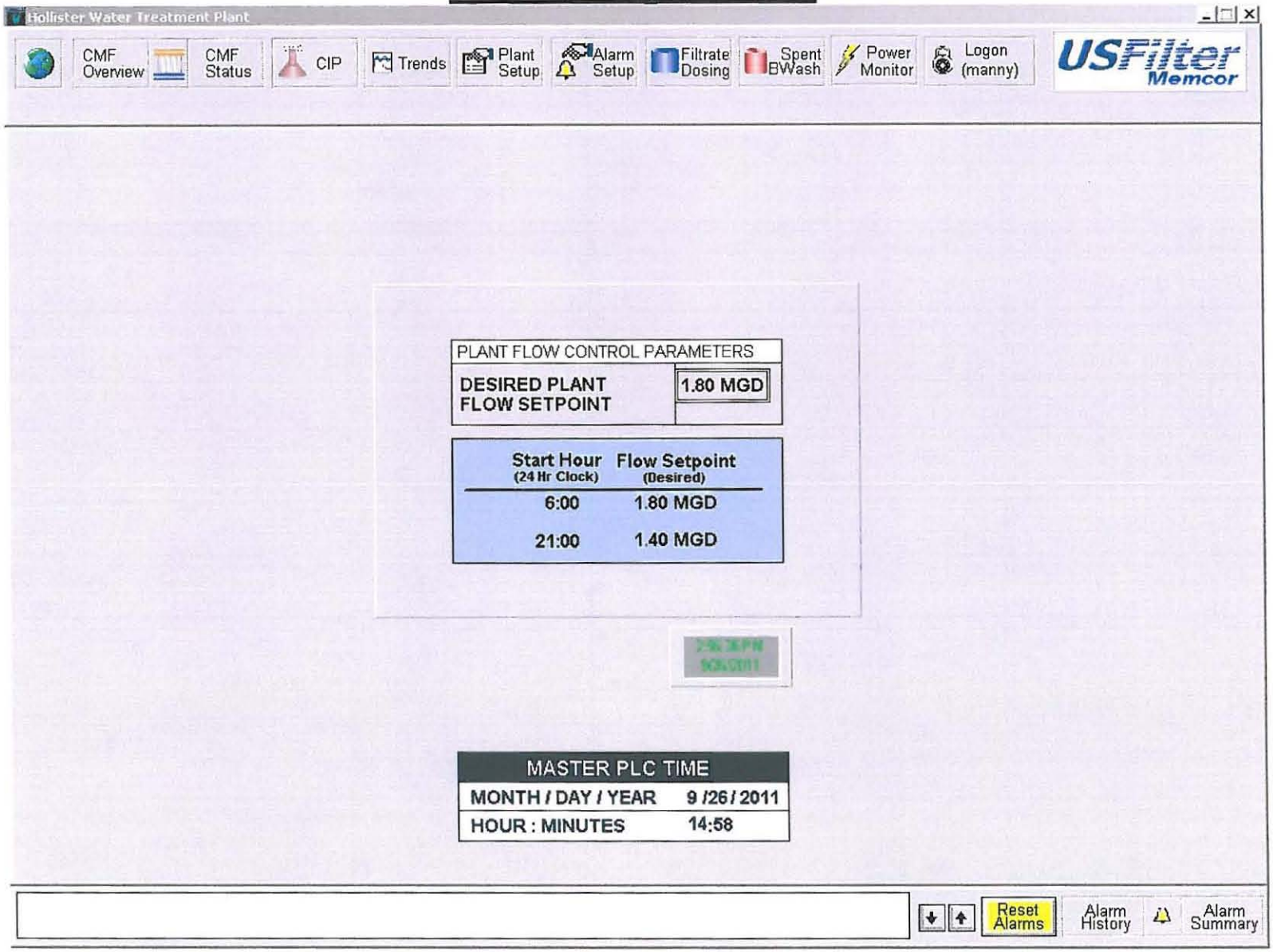


Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
Trends Create File Trends Screen

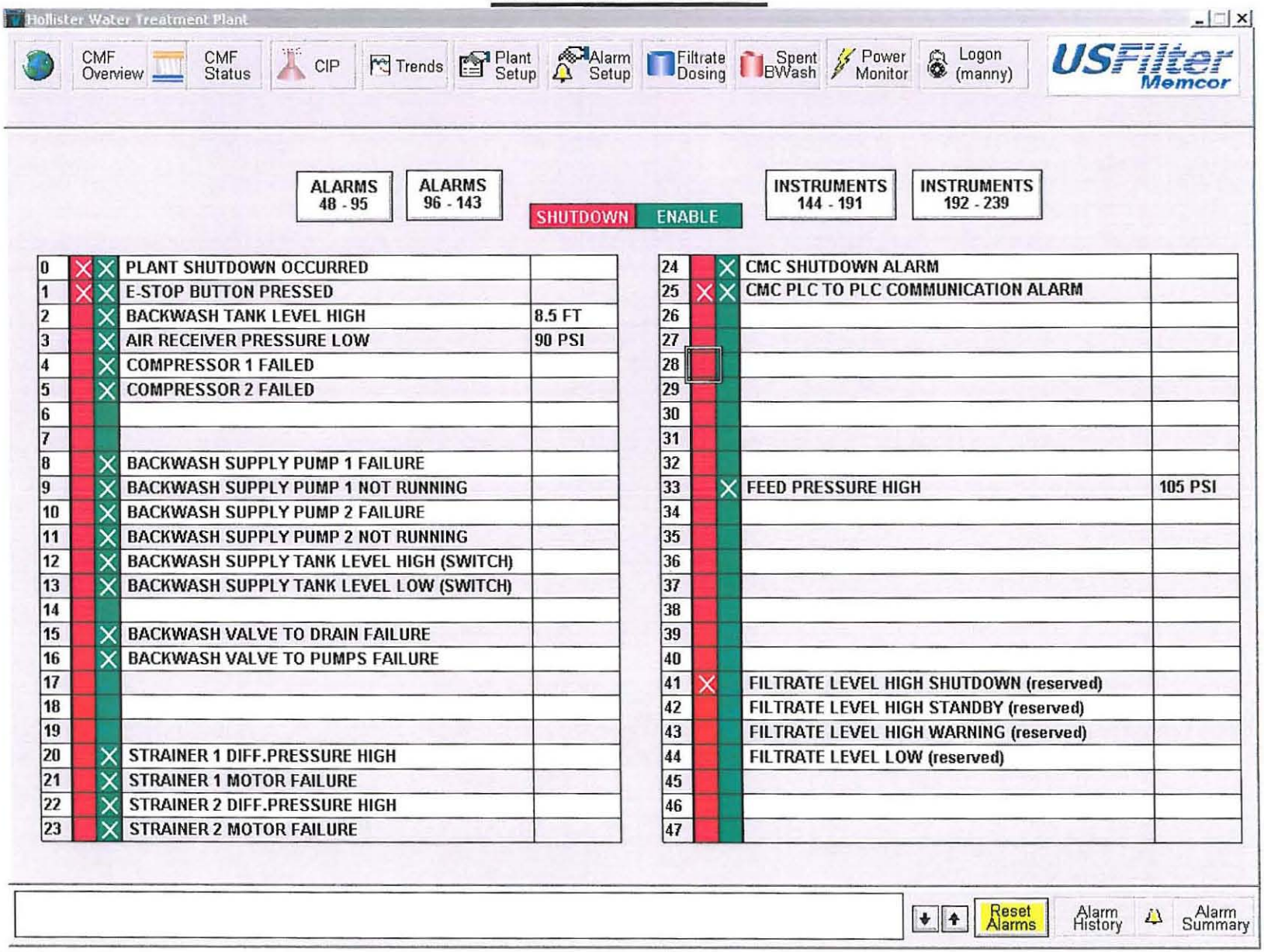


Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant

Plant Setup Screen

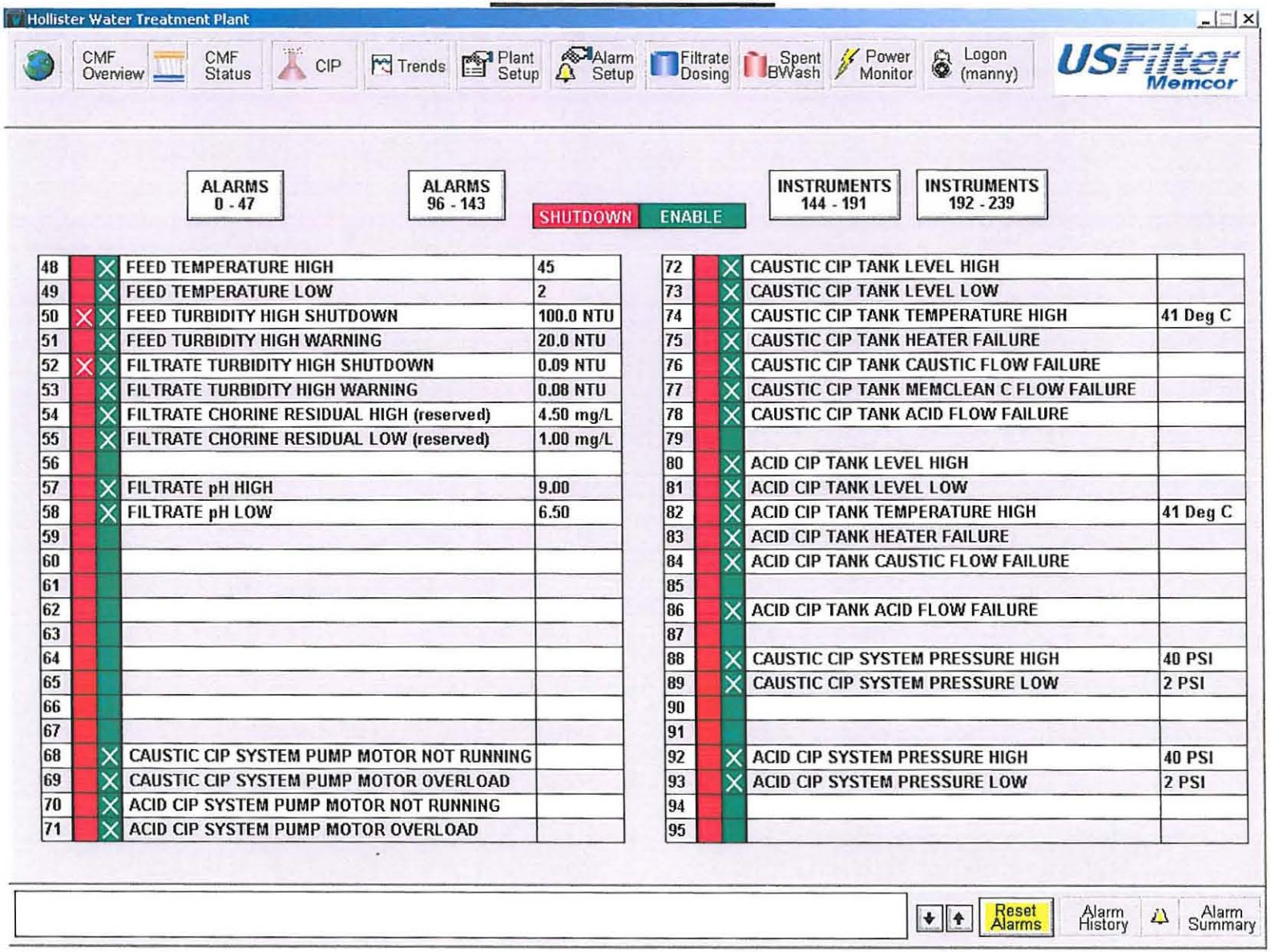


Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
Alarms Screen

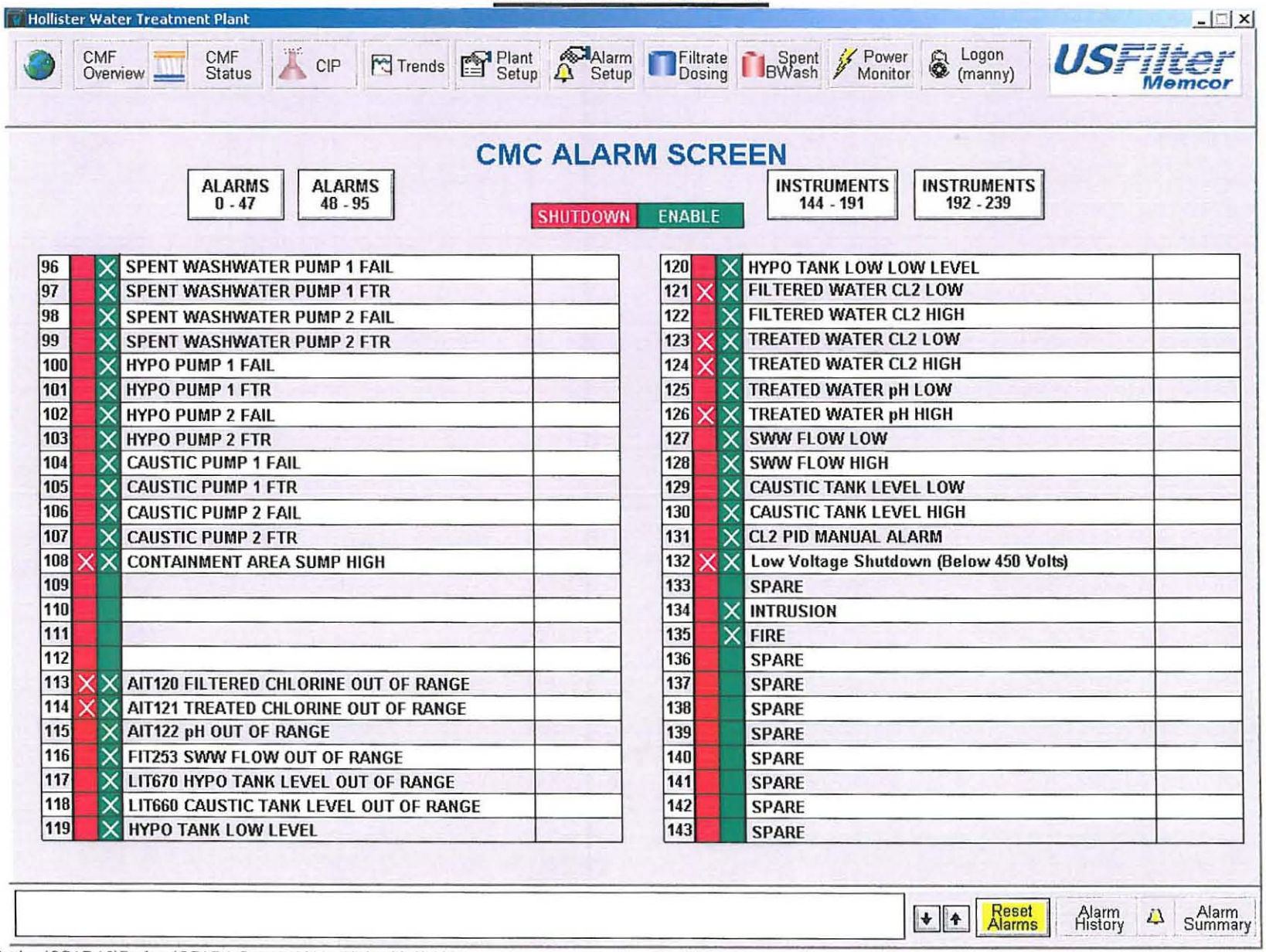


Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant

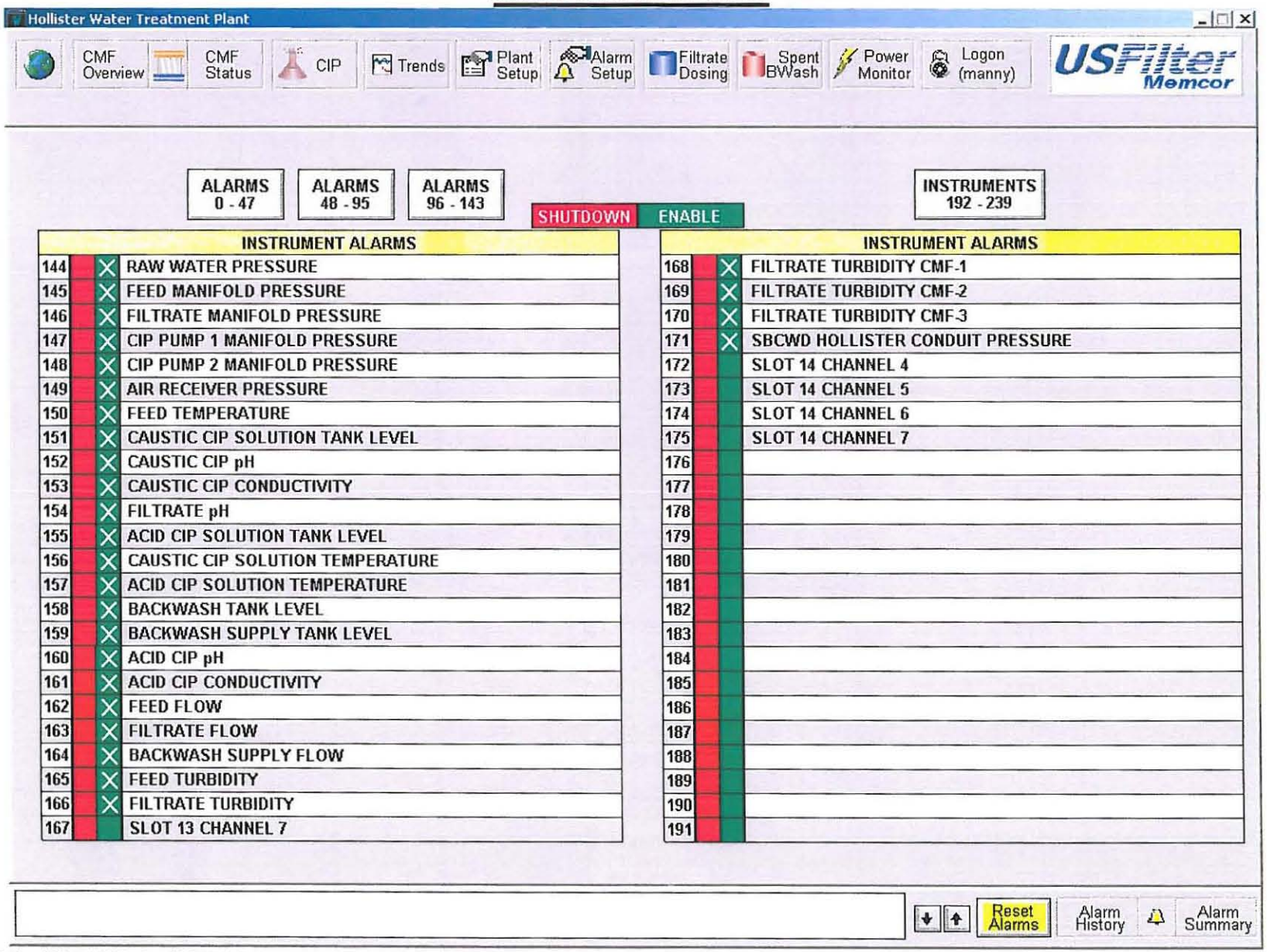
Alarms Screen



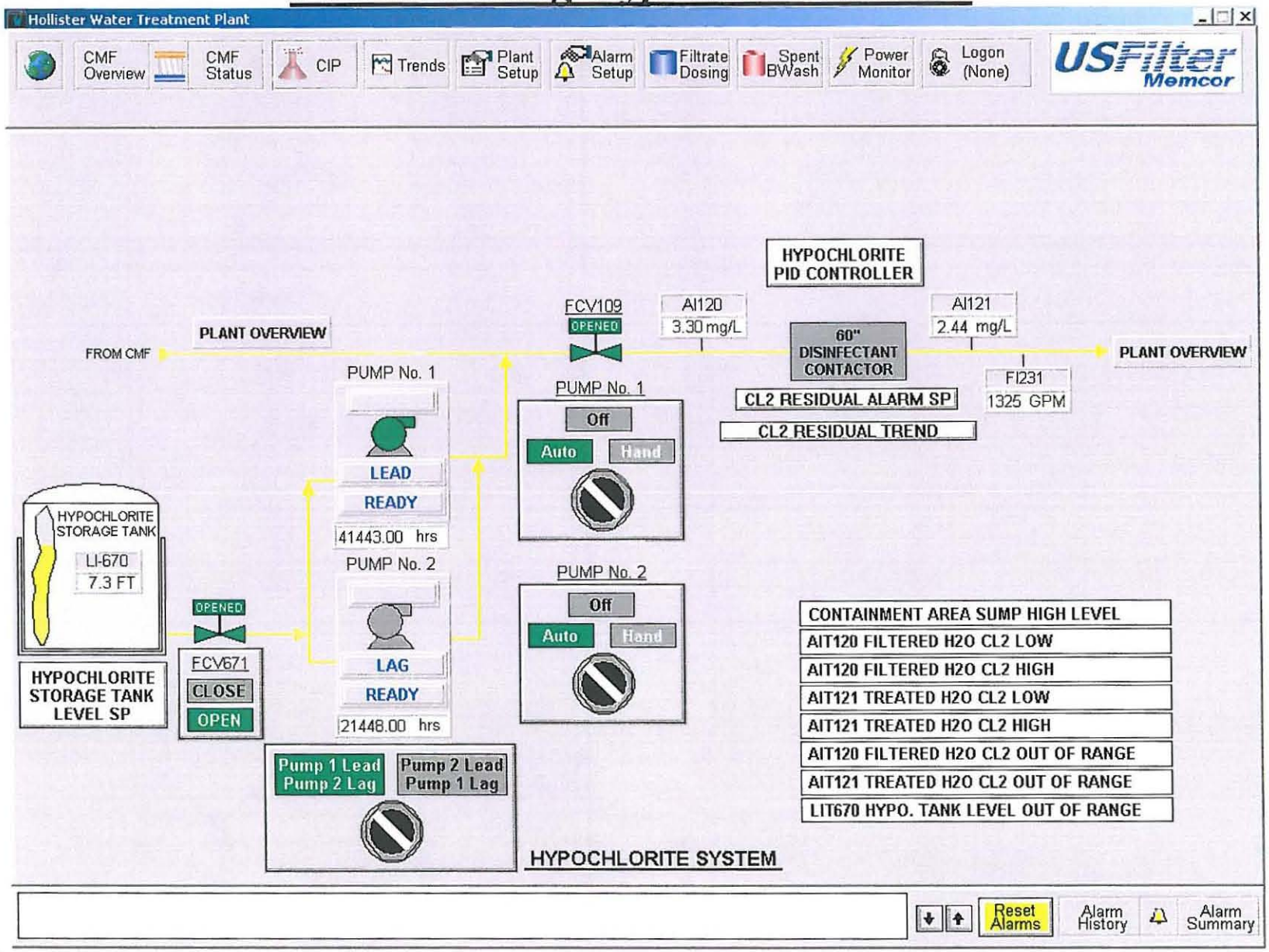
Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
Alarms Screen



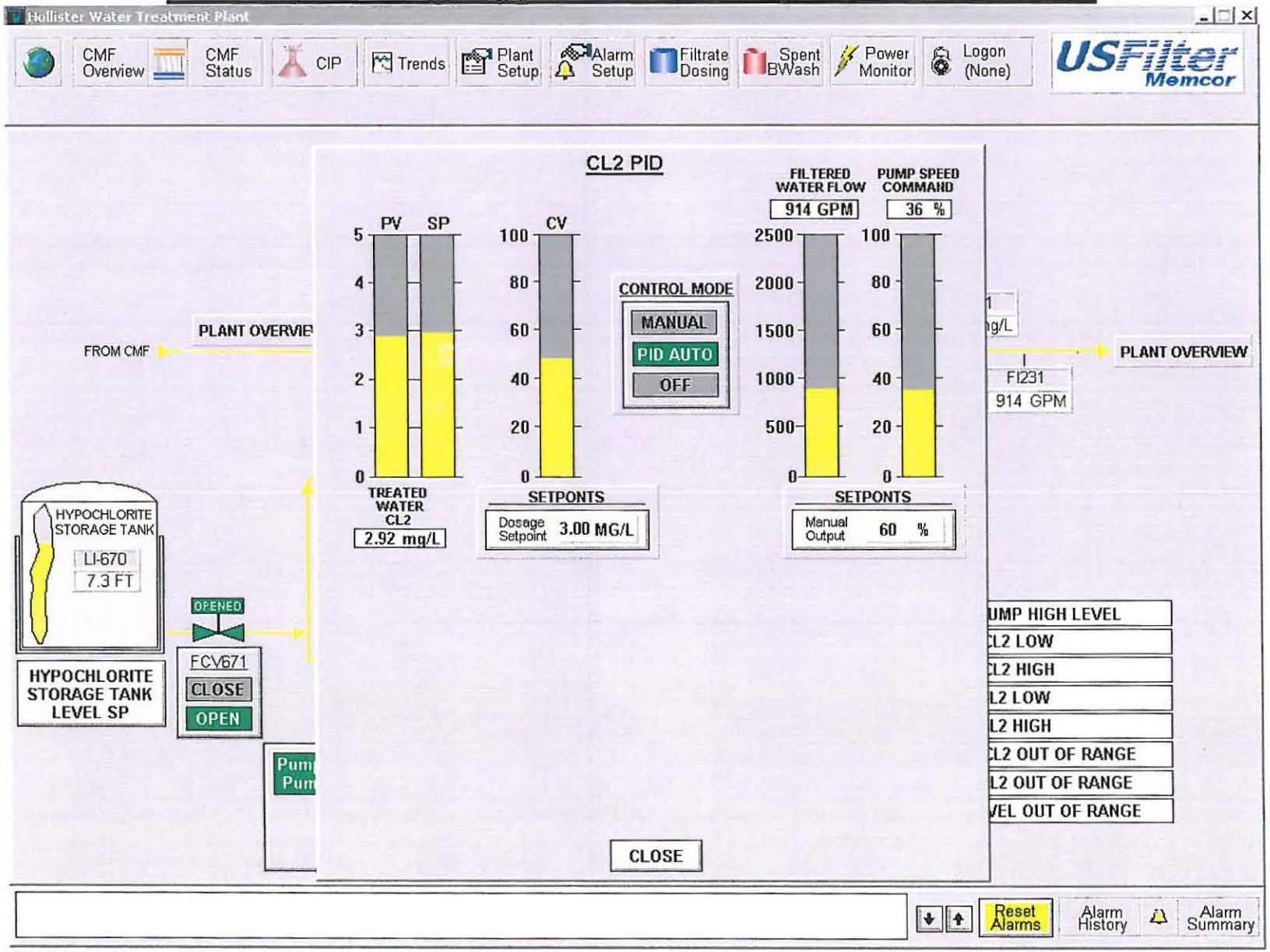
Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
Alarms Screen



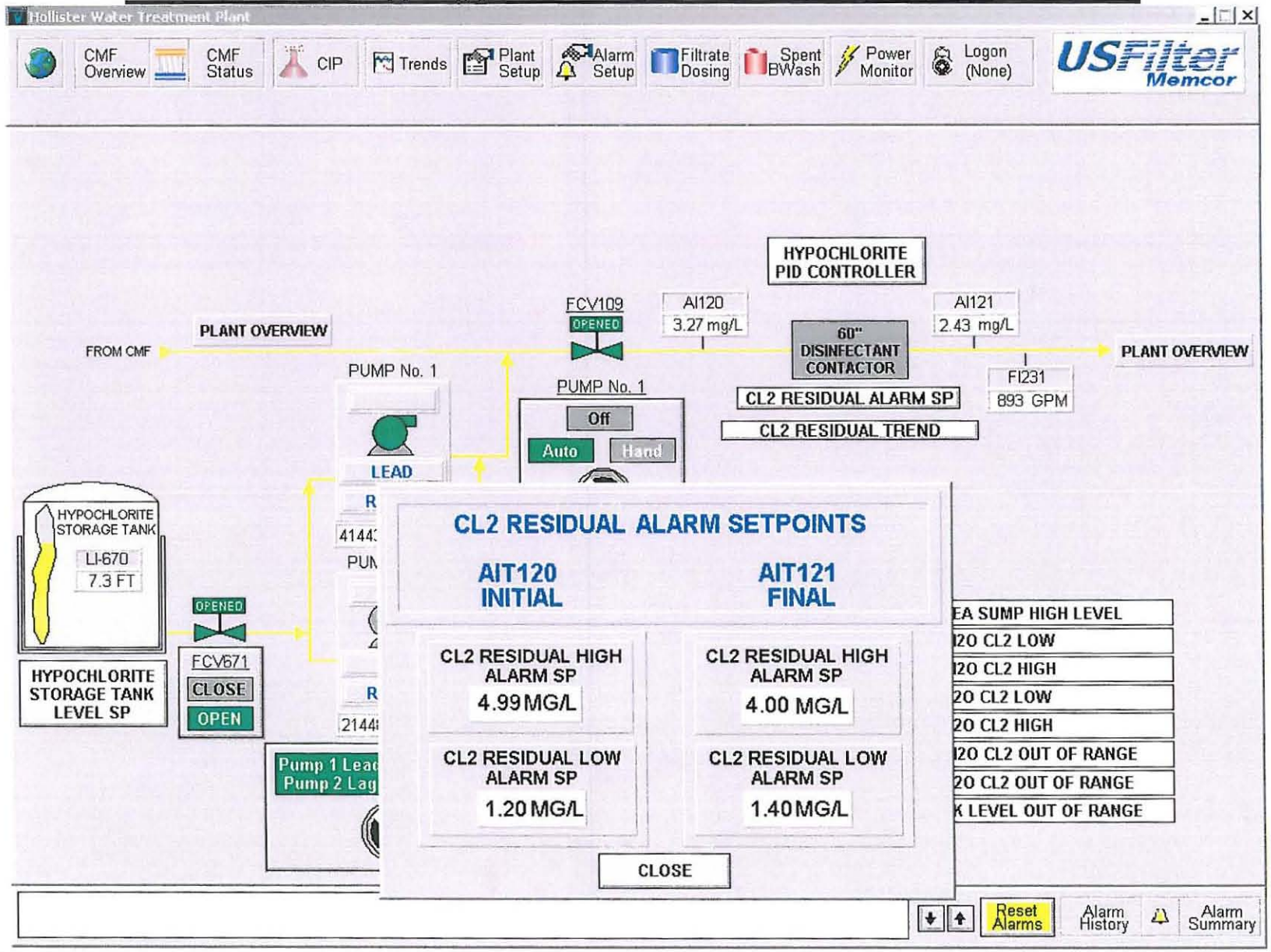
Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
Filtrate Dosing Hypochlorite Screen



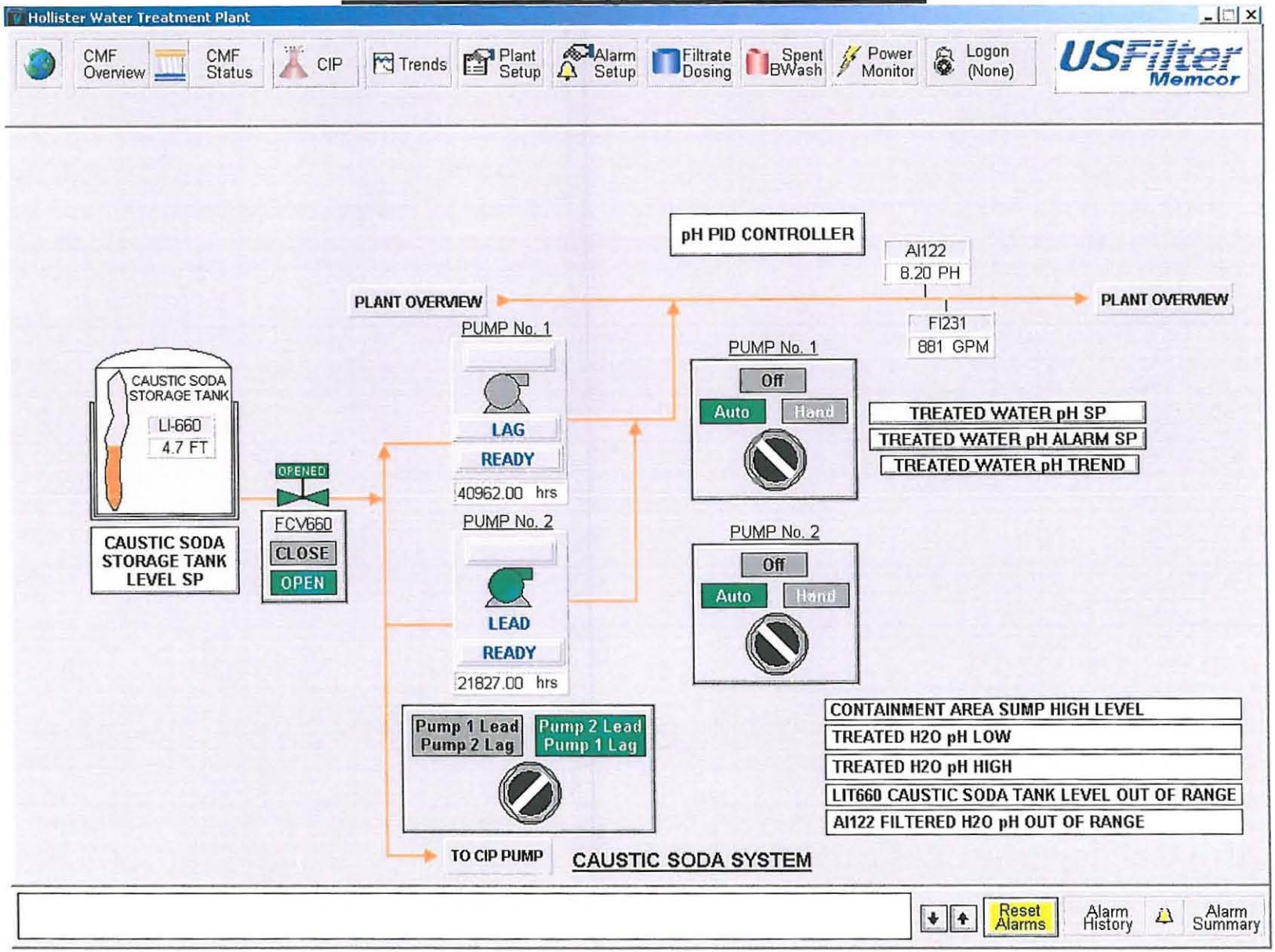
Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
Filtrate Dosing Hypochlorite PID Control Screen



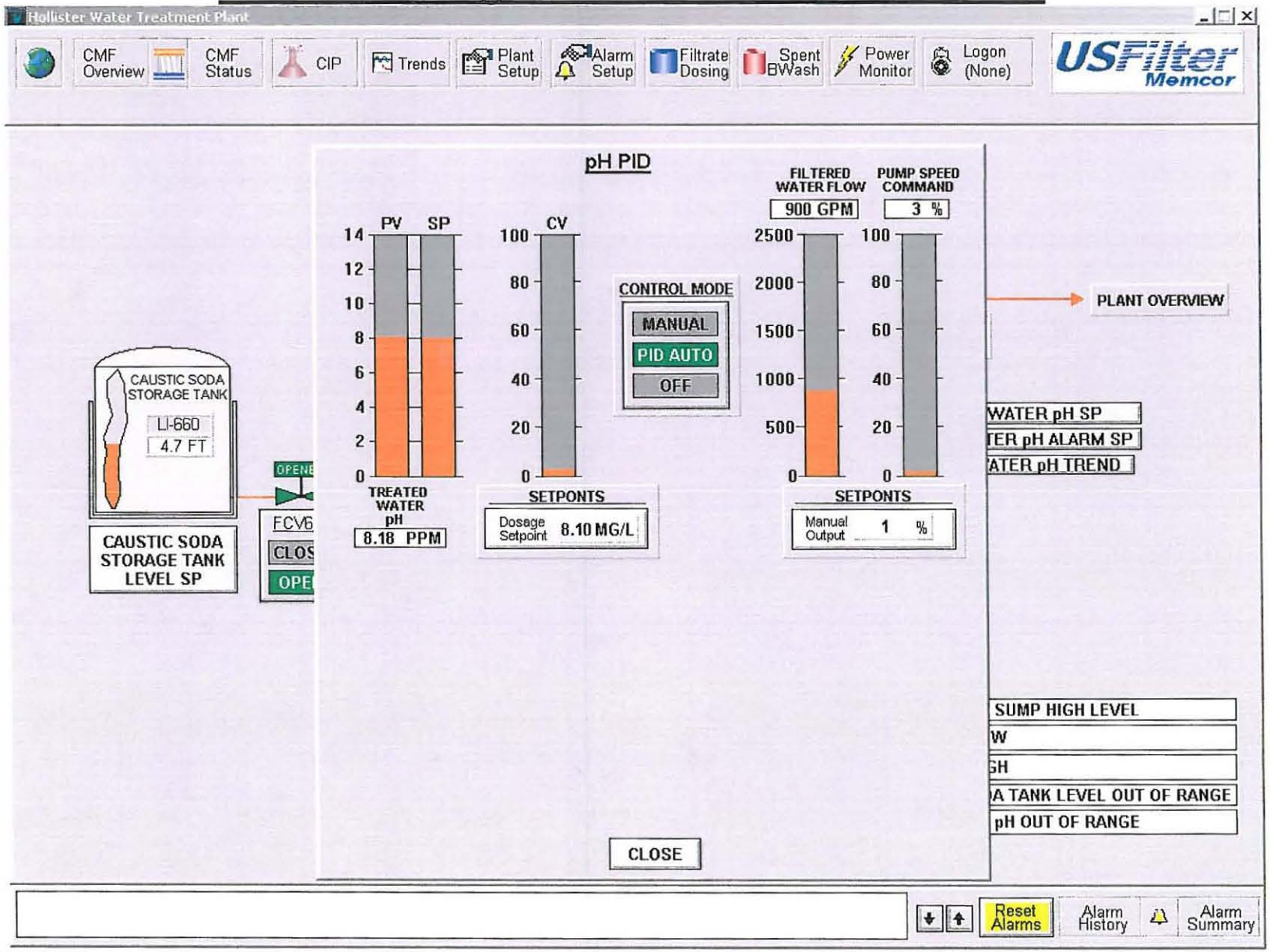
Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
Filtrate Dosing Hypochlorite Alarm Set Points Screen



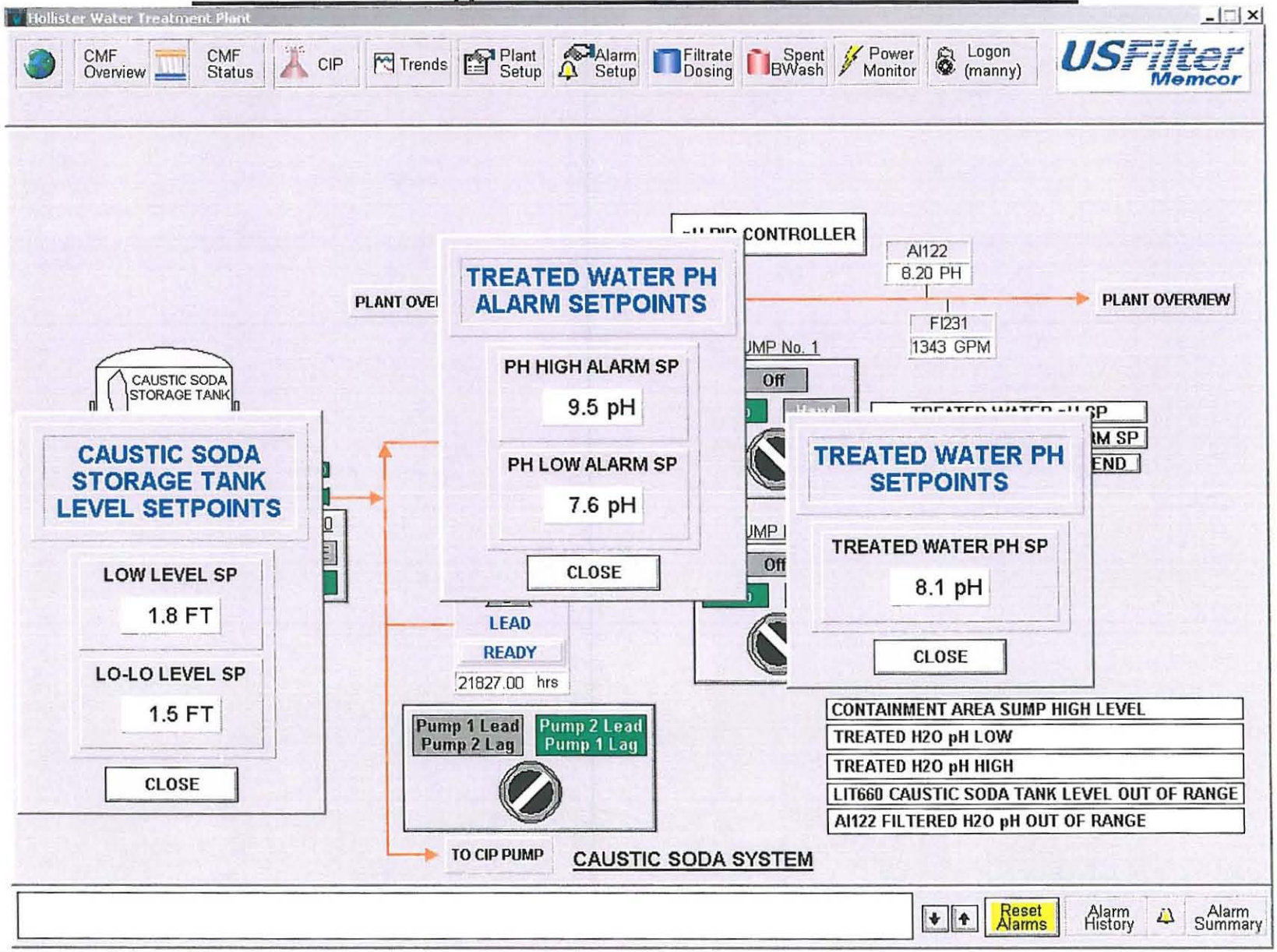
Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
Filtrate Dosing Caustic Screen



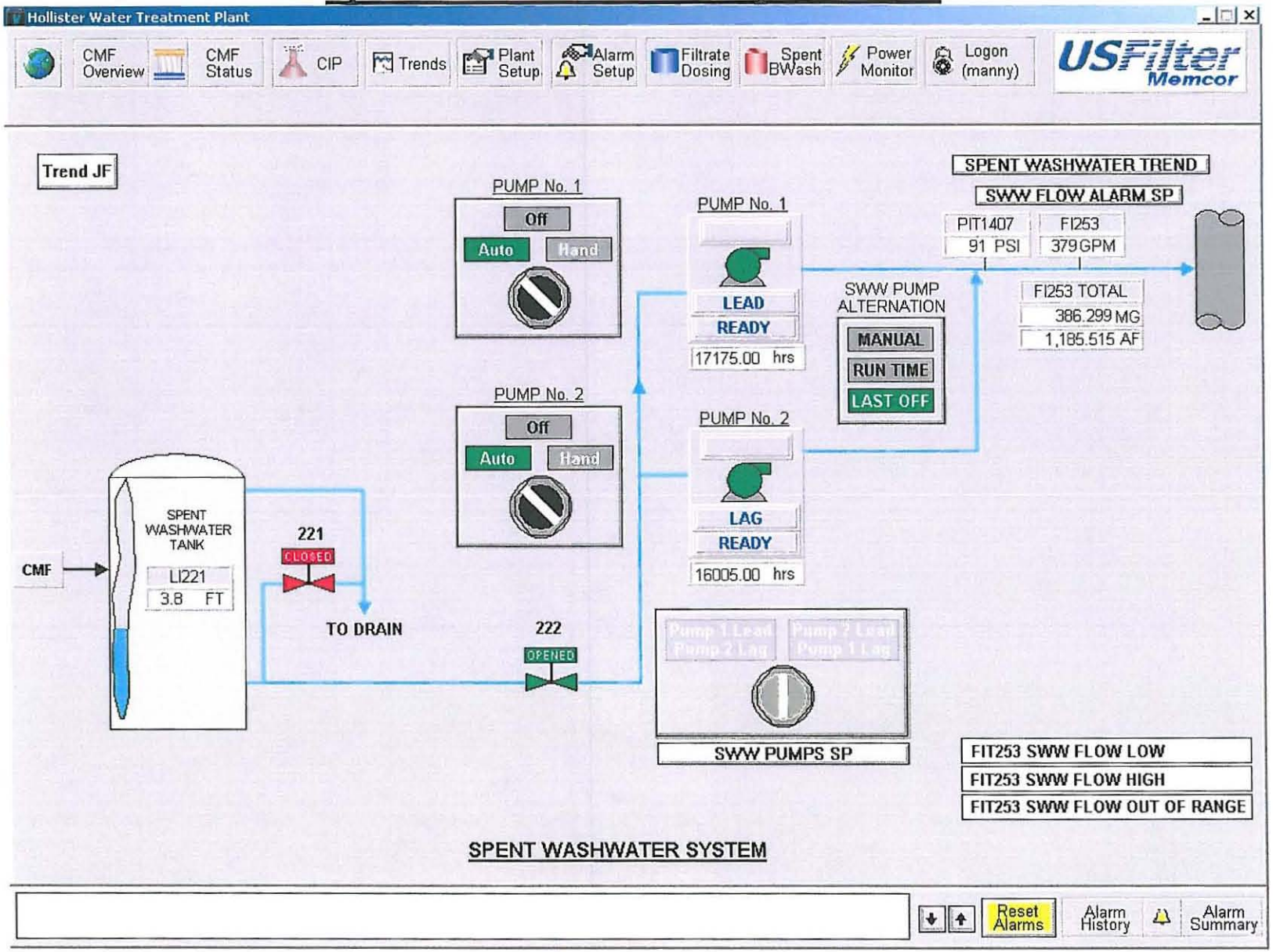
Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
Filtrate Dosing Caustic PID Control Screen



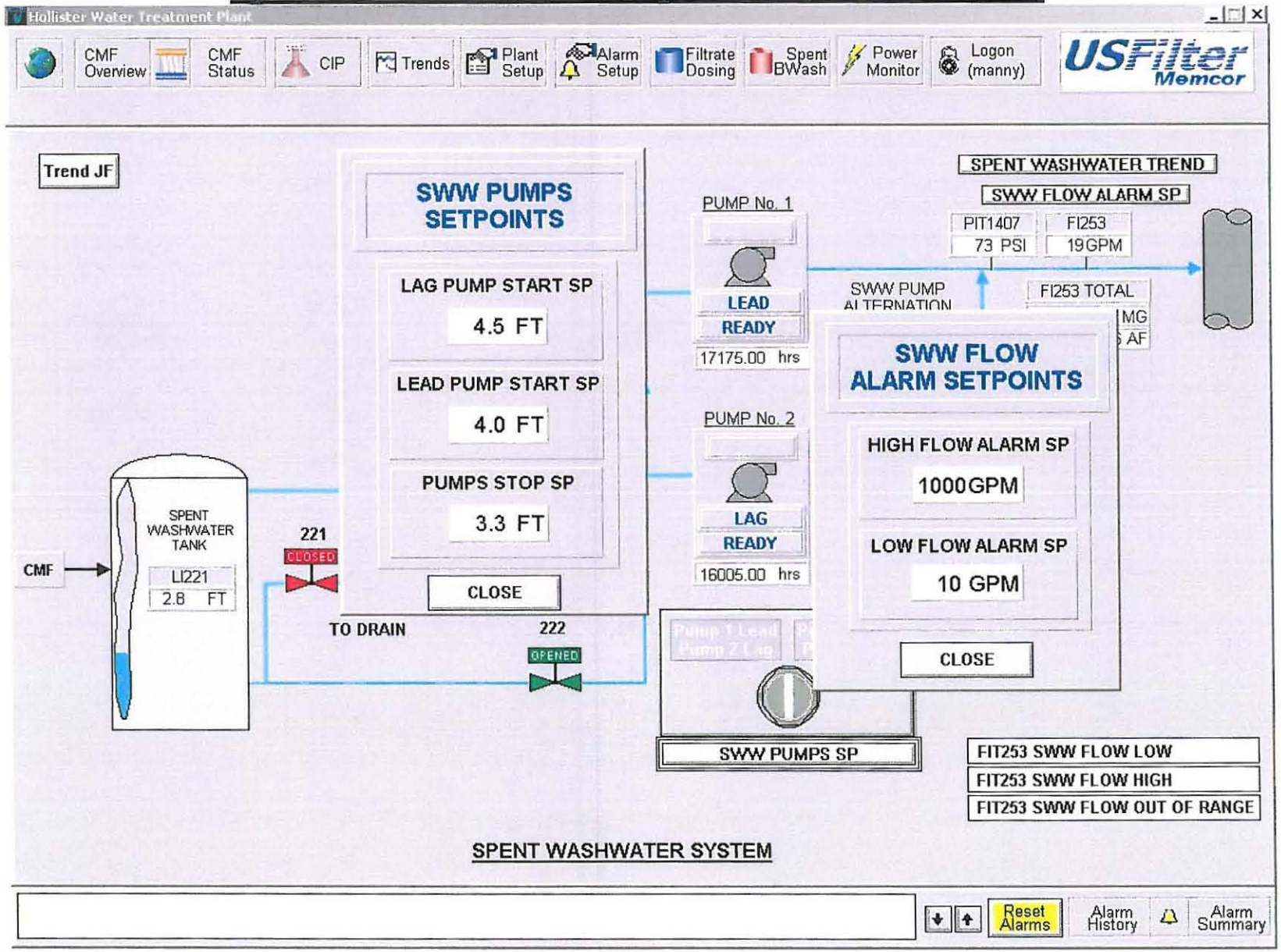
Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
Filtrate Dosing Caustic Soda Set Points Screen



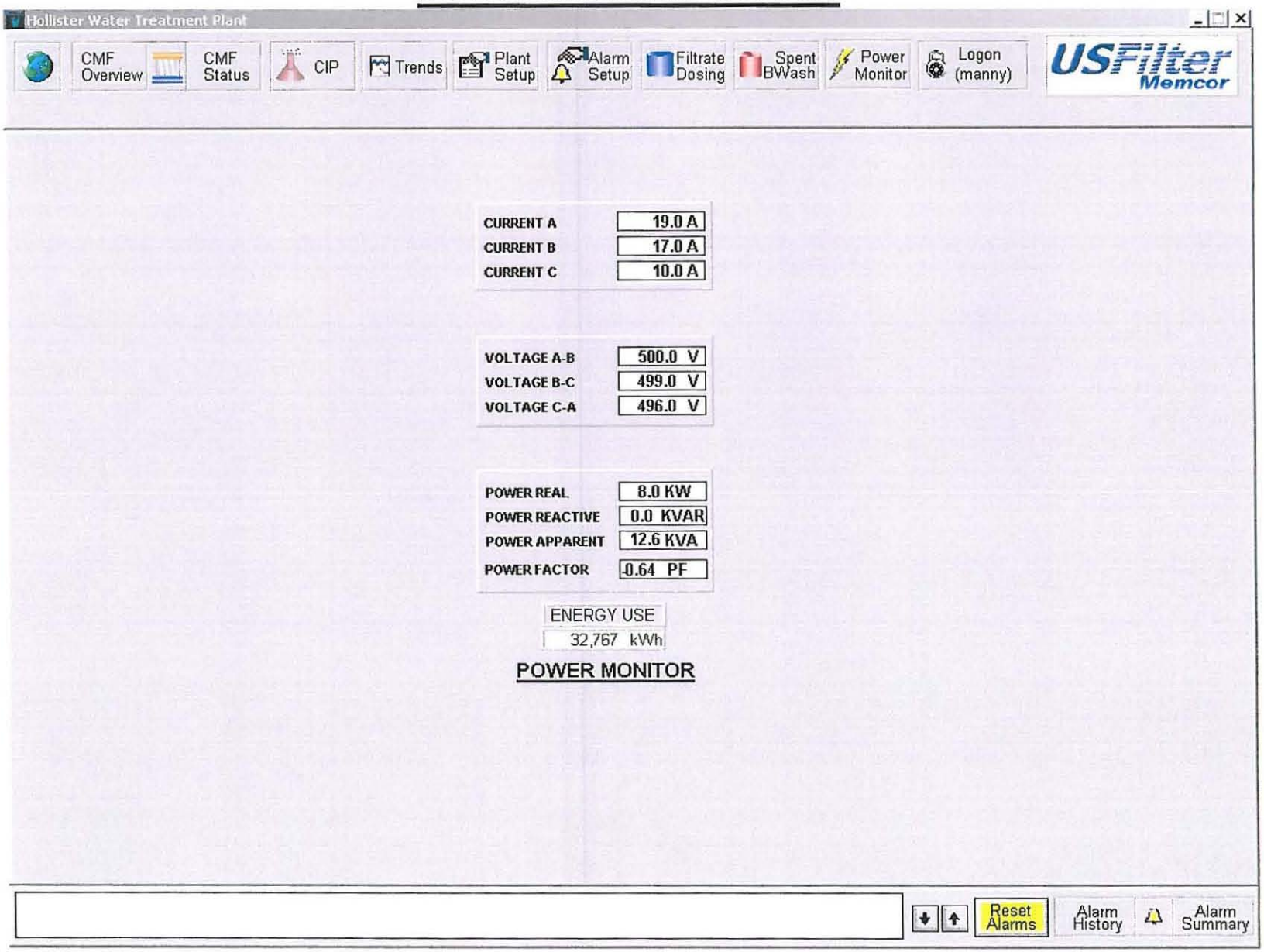
Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
Spent Back Wash Pumps Screen



Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
Spent Back Wash Pumps Set Points Screen

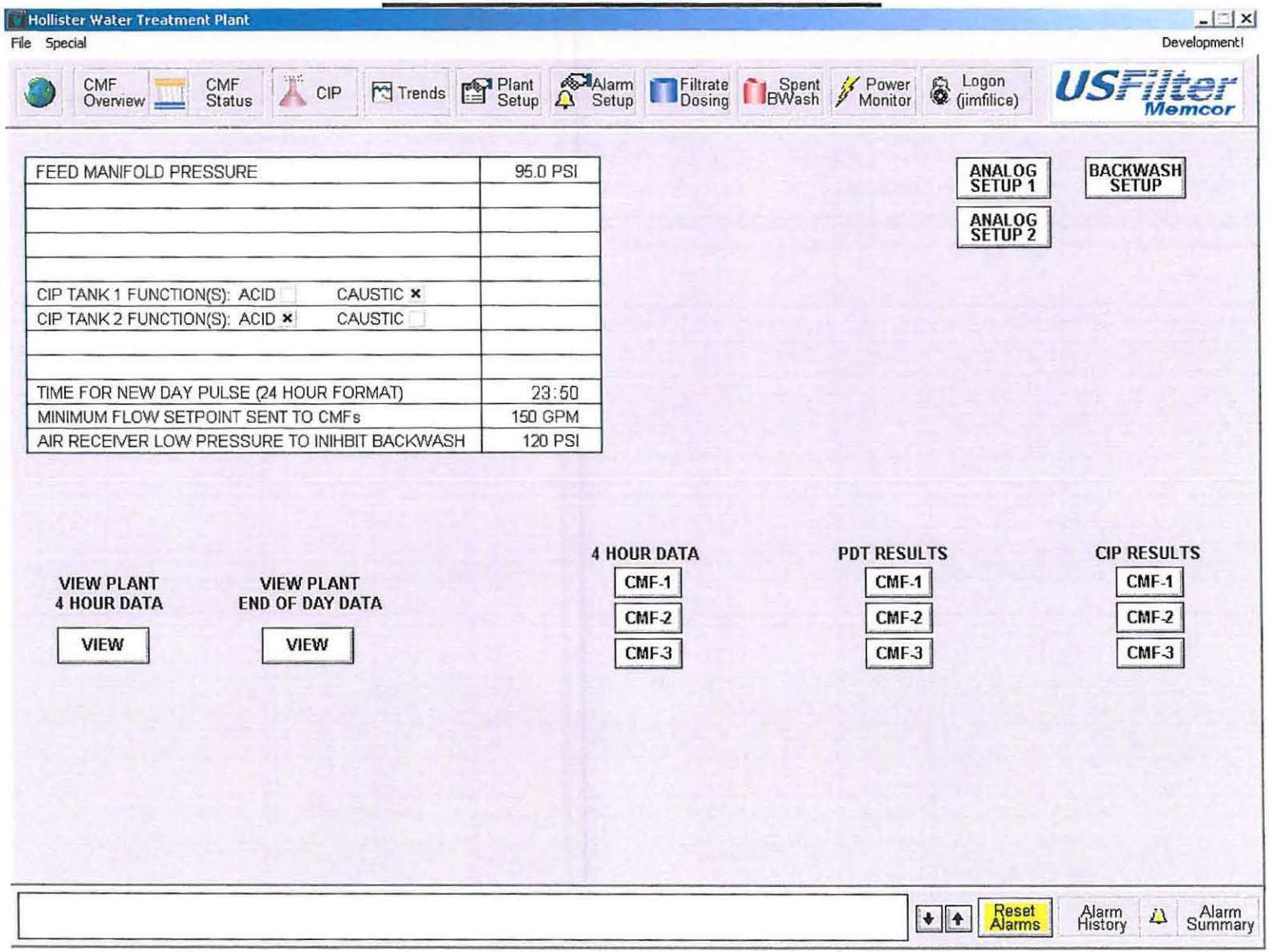


Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
Power Monitor Screen



Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant

US Filter Memcor Screen



Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
US Filter Memcor Analog 1 Screen

Hollister Water Treatment Plant

File Special Development!

CMF Overview | CMF Status | CIP | Trends | Plant Setup | Alarm Setup | Filtrate Dosing | Spent BWash | Power Monitor | Logon (jimfilice) | USFilter Memcor

MASTER PANEL ANALOG SCALING

PLC.ADDRESS	SLOT.CH	DESCRIPTION	INPUT	SIGNAL	SCALED	MIN	MAX
MASTER.F93:43	11.0	STRAINER DIFFERENTIAL PRESSURE	3917	4.78 ma	8.6	0.00	150.00
MASTER.F93:03	11.1	FEED MANIFOLD PRESSURE	14925	18.22 ma	89.0	0.00	100.00
MASTER.F93:04	11.2	FILTRATE MANIFOLD PRESSURE	12202	14.90 ma	68.1	0.00	100.00
MASTER.F93:23	11.3	CIP PUMP 1 MANIFOLD PRESSURE	3277	4.00 ma	0.0	0.00	100.00
MASTER.F93:24	11.4	CIP PUMP 2 MANIFOLD PRESSURE	3277	4.00 ma	0.0	0.00	100.00
MASTER.N11:12	11.5	AIR RECEIVER PRESSURE	9499	11.60 ma	143	0.00	300.00
MASTER.F93:09	11.6	FEED TEMPERATURE	7726	9.43 ma	17.0	0.00	50.00
MASTER.F93:15	11.7	CAUSTIC CIP SOLUTION TANK LEVEL	3962	4.84 ma	0.8	0.33	8.66
MASTER.F93:22	12.0	CAUSTIC CIP pH	7946	9.70 ma	5.0	0.00	14.00
MASTER.F93:21	12.1	CAUSTIC CIP CONDUCTIVITY	3399	4.15 ma	0.5	0.00	50.00
MASTER.F93:42	12.2	FILTRATE pH	10658	13.01 ma	7.9	0.00	14.00
MASTER.F93:18	12.3	ACID CIP SOLUTION TANK LEVEL	3998	4.88 ma	0.8	0.33	8.66
MASTER.F93:16	12.4	CAUSTIC CIP SOLUTION TEMPERATURE	10014	12.22 ma	25.8	0.00	50.00
MASTER.F93:19	12.5	ACID CIP SOLUTION TEMPERATURE	9914	12.10 ma	25.3	0.00	50.00
MASTER.F10:15	12.6	BACKWASH TANK LEVEL	7626	9.31 ma	3.1	0.33	8.66
MASTER.F93:36	12.7	BACKWASH SUPPLY TANK LEVEL	15314	18.69 ma	8.0	0.33	8.66
MASTER.F93:41	13.0	ACID CIP pH	9565	11.68 ma	6.7	0.00	14.00
MASTER.F93:40	13.1	ACID CIP CONDUCTIVITY	3423	4.18 ma	0.6	0.00	50.00
MASTER.F93:07	13.2	FEED FLOW	9330	11.39 ma	1864.8	0.00	4000.00
MASTER.F93:08	13.3	FILTRATE FLOW	11231	13.71 ma	1822.5	0.00	3000.00
MASTER.F93:37	13.4	BACKWASH SUPPLY FLOW	3291	4.02 ma	2.6	0.00	2000.00
MASTER.F93:05	13.5	FEED TURBIDITY	3511	4.29 ma	1.8	0.00	100.00
MASTER.F93:06	13.6	FILTRATE TURBIDITY	3367	4.11 ma	0.03	0.00	4.00
	13.7	spare	0	-0.00 ma		0.00	0.00

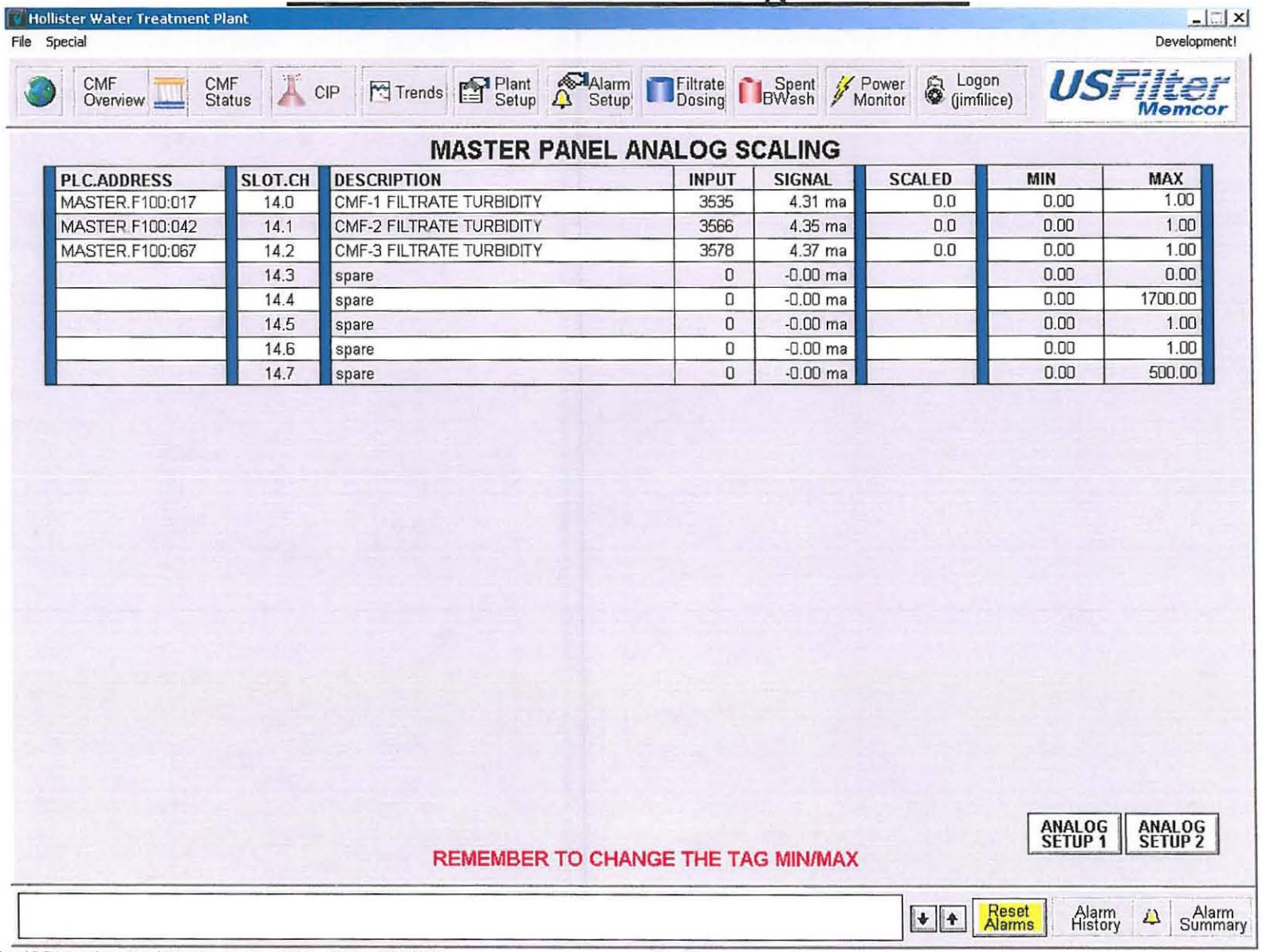
ANALOG SETUP 1 | ANALOG SETUP 2

REMEMBER TO CHANGE THE TAG MIN/MAX

Reset Alarms | Alarm History | Alarm Summary

Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant

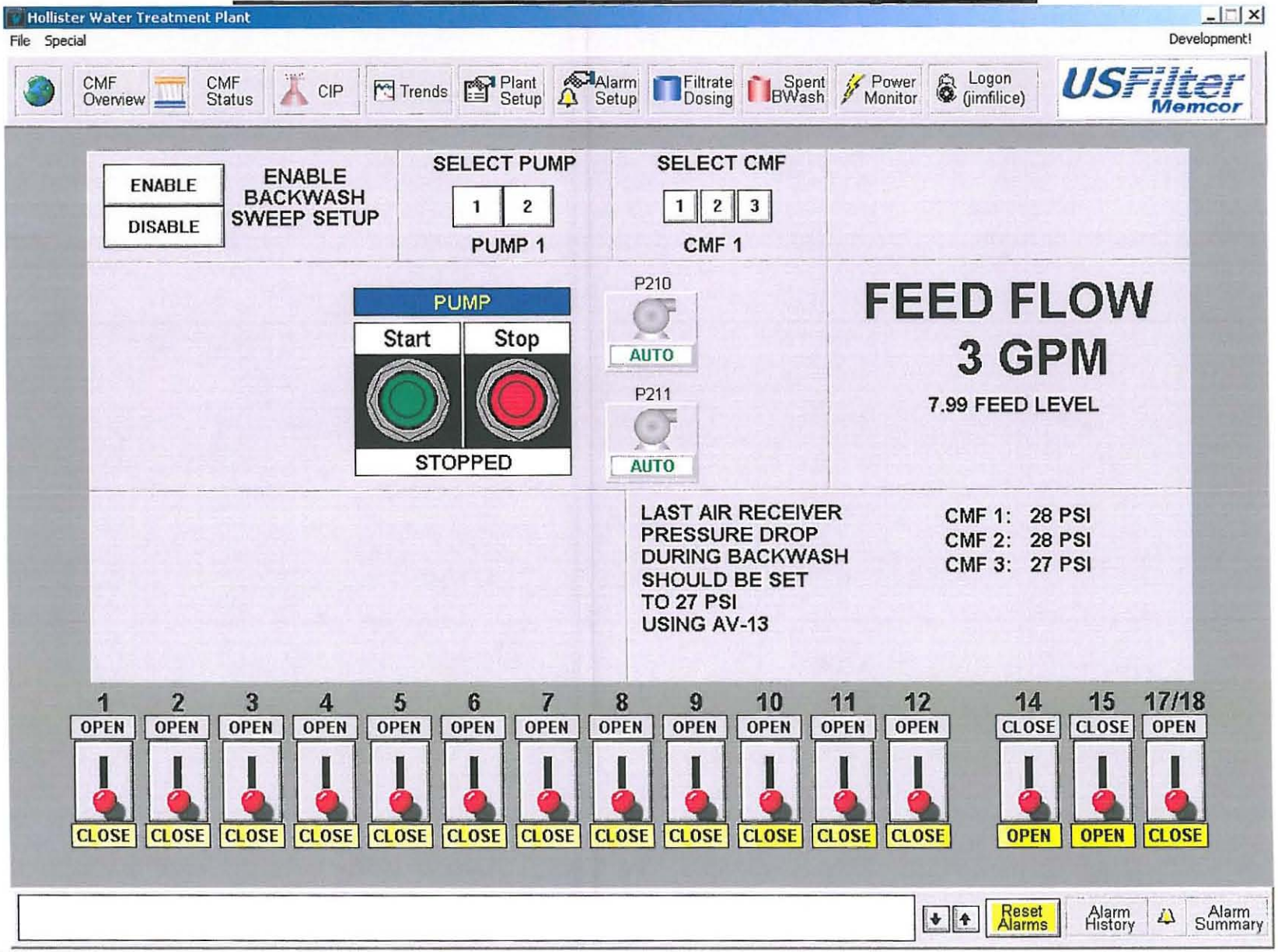
US Filter Memcor Analog 2 Screen



MASTER PANEL ANALOG SCALING

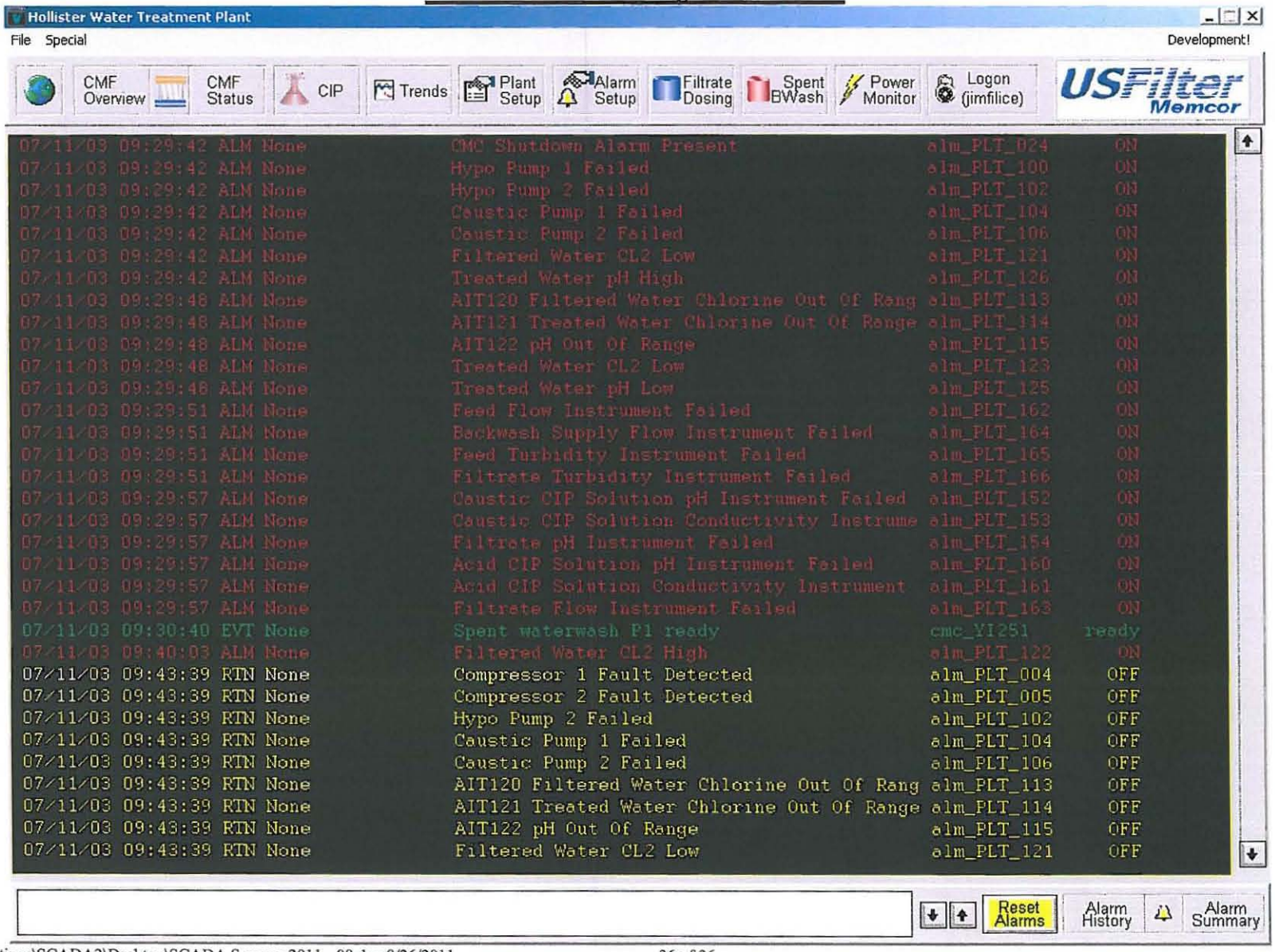
PLC.ADDRESS	SLOT.CH	DESCRIPTION	INPUT	SIGNAL	SCALED	MIN	MAX
MASTER.F100:017	14.0	CMF-1 FILTRATE TURBIDITY	3535	4.31 ma	0.0	0.00	1.00
MASTER.F100:042	14.1	CMF-2 FILTRATE TURBIDITY	3566	4.35 ma	0.0	0.00	1.00
MASTER.F100:067	14.2	CMF-3 FILTRATE TURBIDITY	3578	4.37 ma	0.0	0.00	1.00
	14.3	spare	0	-0.00 ma		0.00	0.00
	14.4	spare	0	-0.00 ma		0.00	1700.00
	14.5	spare	0	-0.00 ma		0.00	1.00
	14.6	spare	0	-0.00 ma		0.00	1.00
	14.7	spare	0	-0.00 ma		0.00	500.00

Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant
US Filter Memcor Backwash Setup Screen



Hollister/Sunnyslope Water Treatment Agency
LESSALT Water Treatment Plant

Alarm History Screen



LESSALT MEMBRANE FILTRATION PLANT

OPERATIONS MANUAL

APPENDIX F

PLC CONTROL STRATEGIES

Control Strategy 1 – General Equipment Interface
Control Strategy 1.2 – Typical Alarms
Control Strategy 2 – Inlet & Treated Water Valve Isolation
Control Strategy 3 – Spent Washwater Pumps 1 & 2
Control Strategy 4 – Electrical Control
Control Strategy 5 – Hypochlorite System
Control Strategy 6 – Caustic Soda System

AREA: All SHEET: All **PLC**: All

LOOP NUMBER: All

RELATED EQUIPMENT: All

A. General: This strategy describes typical interface logic with final control elements such as pumps, blowers, and other equipment. This control strategy applies to all control strategies on this project. Signals required to be indicated shall be displayed on HMI screens.

B. Description: The PLC shall monitor the equipment's related inputs/outputs as follows:
   1 Monitor whether equipment is in "READY" mode before initiating or queuing equipment for control. A "READY" display shall be indicated (YI***).
   2 If equipment is ready, the PLC shall activate a normally open discrete output "DO" to start the equipment. A "RUN" symbol shall be indicated (XI***).
   3 The PLC shall interrogate the circuit and monitor the input "RUN" discrete input.
   4 If the "RUN" input is not activated within an adjustable time of t=0-60 seconds, the PLC shall annunciate a CRT display of equipment "FAIL," (XA***). See paragraph E for additional clarification for tandem pumps.
   5 The PLC shall also annunciate equipment "FAIL" if a separate discrete input signal is detected.
   6 CRT display shall include the equipment "RUN," "READY," and "FAIL" status. The "FAIL" signal shall also added to the alarm list.
   7 The "RUN" signal shall activate an elapsed time register to monitor the total run time of equipment.

C. Equipment Alternation: For two pieces of equipment of the same function, the PLC shall alternate their operation in one of the following manners. The selection shall be made manually from the CRT.
   1 Manual: The "LEAD" piece of equipment is assigned and will continue to run unless it fails or process conditions require the "STANDBY" equipment to run. In the next cycle of operation, the same equipment continues the same assignment unless manually reassigned.
   2 Automatic (Run Time): The equipment alternates between "LEAD" and "STANDBY" based on manually set maximum run time. When the actual run time of a piece of equipment exceeds the set maximum run time, the PLC places the currently used equipment in "STANDBY" starts the "STANDBY" equipment.
   3 Automatic (Last Off): The equipment alternates based on the process cycle where after each cycle the PLC switches the sequence to equalize the run time.

D. Lead-Lag Standby Operation (typical for tandem pump arrangements):

1 The Lag or Standby pump starts if the Lead Pump fails.

2 A pump failure shall occur if a pump fails to run after a call to run following a 0-60 second delay,
- or while called-to-run but fails to continue running,
- or the Standby pump has been selected but the Lead pump is OFF.
- or upon receipt of a low pressure signal in the discharge of an operating pump, following an adjustable time delay.

3. A failed pump shall be locked OFF and prevented from restarting until reset by the operator. A pump is reset from failed condition when both HOA (HAND-OFF-AUTO) selectors are placed in OFF, or by a "Reset" icon on the CRT.

E. Typical Loop Description: (FIC, LlC, PIC, AIC):

1. A typical feedback loop using PID (Proportional Integral and Derivative) shall be implemented in the PLC with displays of various signals on a loop view template on the CRT including settings of tuning parameters. Loop shall include a bumpless transfer feature from Auto to Manual. The loop view shall include:
   a. Process variable indicator in engineering units.
   b. Set point indicator.
   c. Set point selection: local/remote
   d. Output signal: 0-100%.
   e. Manual/Auto selection: This allows a manual control of output signal.
   f. PI&D tuning monitoring and setting.

F. Typical Ratio Control Description: (FFK):

1. Ratio control shall be implemented in PLC as an open loop proportional control as follows:

   Output = K* (process variable) + b

   Where:

   Output: PLC output (0-100%)
   K: a CRT input in % Process Variable: Controlled Signal (Flow, ...)
   B: bias signal: Initially set at 0%

2. A CRT template shall be provided for the following features:
   a. Process variable indication: In Engineering Units.
   b. Ratio settings: (K) in percentage %.
   c. Output signal: 0-100%

G. Typical Manual Control: (SIK), (HIC), etc.

1. A typical manual control station shall allow the PLC output to be set from the CRT. A CRT template shall be provided to indicate a bar graph output from 0-100% and a slider setting from 0-100%, where 0-100% could also be indicated in engineering units such as RPM, etc.

TITLE: Typical Alarms **AREA: All** **SHEET: All**

PLC: All

LOOP NUMBER: All

RELATED EQUIPMENT: All

A. General: This strategy describes the monitoring and display of alarm conditions. The alarm conditions can be 1) Discrete input, 2) Derived, and 3) Deviation.

B. Descriptions:

1 Discrete Input: Whenever a discrete input alarm is detected, the PLC shall annunciate an alarm after an adjustable delay 0-5 seconds.

2 Derived Alarms: A derived alarm consists of monitoring of analog inputs and/or logic derivation within control strategies. The PLC monitors these events and annunciate alarms after an adjustable delay of 0-5 seconds. Settings of alarms shall be available from the CRT.

3 Deviation Alarms: Whenever a process variable deviates from a set point value, whether the set point is manual or calculated, the PLC shall flag the event and annunciate a "Deviation Alarm." An adjustable time delay of 0-30 minutes shall be employed to alarm this event.

CONTROL STRATEGY 2

TITLE: Inlet and Treated Water Valve Isolation **SHEET:**

1-3

PLC: 2 **LOOP NUMBER:** 100, 109 **RELATED EQUIPMENT:** FCV100,

FCV 109

A. General: This control strategy directs the operation of FCV100 and FCV 109, the inlet and treated water isolation valve for the Facility.

B. Description: Valves are normally open unless stopped by emergency condition or by operator from CRT.

C. Emergency Shutdown:
1 U.S. Filter system emergency shutdown .
2 Filtered water low CI2 residual; AIT-120.
3 Treated water low CI2 residual; AIT-121
4 Power loss to Facility. (Power solenoid valves ahead of UPS power.)

TITLE: Spent Washwater Pumps 1, 2 **SHEET**: 1-8 **PLC**: 2

LOOP NUMBER: 251, 252

RELATED EQUIPMENT: SWW Pumps P251 and P252, LlT-221, LSL-221, FIT-253

A. General: This strategy describes the operation of the SWW Pump controls.

B. The SWW Pumps can be started by one of three ways:
1 Manually: at motor control center.
2 Hand Control (HCxxx): At the CRT.
3 Automatically: By PLC as described below. Provide lead/lag operation.

C. Description: "Lead" pump shall start based on an operator setpoint from CRT. If level continues to rise, "Lag" pump shall start. Both pumps shall stop on an operator setpoint from CRT.

D. Low Level LSL-221 causes stopping of pumps.

E. Flow signal FIT-253 is indicated, totalized and trended.

CONTROL STRATEGY 4

TITLE: Electrical Control

SHEET: 1-2, E-2 **PLC: 2**

LOOP NUMBER:

RELATED EQUIPMENT: Electrical MCC

A. General: This strategy describes the monitoring for electrical energy and status of the Motor Control Center. In addition, the control strategy shall automatically sequence the restart of major equipment after a restoration of power. Signals are available through a serial interface with power monitor.

B. Description: The PLC shall perform the following:

1 Monitoring: Voltage current, power feeder, kW and kWH.

2 Alarm: Voltage unbalance, low voltage, phase loss or reversal.

3 Energy Monitoring: The Plant's power shall be monitored. Parameters include real power (kW) and reactive power (kVAR), kW, and power factor.

The PLC can calculate the power factor (PF) as follows:

The PLC can calculate the power factor (PF) as follows:

$$PF = 100 * COS\left[\ \text{TAN-1}\ \frac{KVAR}{KW}\ \right]$$

Power Failure Management: Upon opening of the main breaker, the PLC will stop all equipment. Restart loads configured for automatic operation in the following sequence. Stagger start loads in an adjustable 20-second increments.

4. Electrical Distribution Layout: Provide a CRT display showing the essential layout of the main distribution single line shown on the Drawings.

SHEET: 1-6 **PLC: 2**

LOOP NUMBER: 670

RELATED EQUIPMENT: P675. P676. LlT670

A. General: This control strategy regulates sodium hypochlorite chemical addition to the Filtered and the Treated Water.

B. Description:

1 Storage Tank and Leak Detection System: Ultrasonic level sensor LlT678 measures the level in the storage tank. Level alarm detection set points LSL670 and LSLL670 and corresponding level alarms LAL670 and LALL670 activate and alarm on low and very low level conditions. respectively. Tank level is displayed on Ll670. The hypochlorite tank outlet valve. FCV671 . closes and all hypochlorite metering pumps stop when liquid is detected at the pump area containment sump (LSH670) and the corresponding alarm (LAH670) is activated. This alarm can be set for Plant Shutdown. Liquid in the storage area sump (LSH 670) activates alarm (LAH 670).

2 Pumps: Metering pump (P675 or P676) injects hypochlorite into the filtered water. Metering pumps No.1 and 2 (P675 and P676) serve to inject hypochlorite. Typically one pump is needed. Each metering pump includes a SCR variable speed drive to pace hypochlorite injection rate.

3 Residual Chlorine Analyzers (AIT120. AIT121): Residual chlorine analyzers are located downstream of the injection point. The range of measured residual for AIT110 will be 0 to 10 *mg/L*. The range of measured residual for AIT120 and AIT121 will be 0 to 5 *mg/L*.

4 Chlorination Feed Control: The chlorination feed control consists of source water and filtered water.

a. Metering Pump No. 1: The compound loop control. which includes a feedback control loop consisting of PI controller AIC675 and Inlet Flow Signal 231. AIC675 compares the operator adjustable residual set point AK675 to the measured residual signal from CI, analyzer AIT120 or AIT121 . The output of AIC675 is then multiplied by the inlet water flow signal (FIT231) to compute the required chlorine dosage in gph to pace the metering pump AK675. The initial parameters are as follows:

Inlet water (FIT1 00): Range 0-300 gpm.
Set Point: 1.0 *mg/L*.
Flow Ratio (FFK675): 1.0

The Operator Adjustable Chlorine Residual alarm (AAH/L 110) shall initially be set as follows:

Low Residual: 0.5 *mg/L*
High Residual: 3.0 *mg/L*

b. Residual Signals: typically AIT-120 is used but AIT-121 can also be used as a backup. Selection shall be made from CRT.

c. Alarms: High and low residual for both analyzers shall be displayed.

CONTROL STRATEGY 6

TITLE: Caustic Soda System

SHEET: 1-6 **PLC**: 2

LOOP NUMBER: 660,661

RELATED EQUIPMENT: LlT660, P661, P662, LSH678, AIT-122, FIT-231

A. General: Caustic Soda will be added to increase the treated water pH for corrosion control. The control strategy includes the Caustic Soda pump controls and monitoring equipment, and consists of the following :

1. Storage Tank and Leak Monitoring System
2. Metering Pump Sequence and Control

B. Description:

1 Storage Tank and Leak Monitoring System: Ultrasonic level sensor LlT660 measures the level in the caustic soda storage tank. Provide level alarm set points LSL660 for LSLL660 for corresponding low and low low level alarms LAL660 and LALL660 activate and alarm on low and very low level conditions, respectively. Tank level is displayed on Ll660. The caustic soda tank outlet valve, FCV660, closes and both pumps (P661, P662) stop when a liquid is detected in the secondary containment pump area (LSH678). This alarm can also be set to shutdown the Plant.

2 Pump Sequence: The "lead" caustic soda metering pump is started either by hand with HC66X, or by the PLC when HC66X is in the "AUTO" position and filtered water flow (FIT231) is detected. If no "RUN" signal (XI66X) is received from the "lead" pump after an adjustable time delay of 0-30 seconds, the PLC shall alarm this condition as a pump "FAIL" (XA66X), and start the "standby" Caustic Soda pump.

3 Pump Control: Each pump is provided with a SCR adjustable speed pump drive (SC66X). The feedback loop is controlled by a PI controller (AIC660) (0-100% speed) that compares an operator adjustable AK-660 set point of filtered water pH to the process variable as measured by (AIT 430). The manipulated variable paces the automatic stroke positioners (FIC66X).

a. Injection filtered water pH set point shall be operator adjustable and initially set to 8.0 pH units.

EXHIBIT 3.3
PRELIMINARY GEOTECHNICAL STUDY, 2013

FUGRO CONSULTANTS, INC.

1000 Broadway, Suite 440
Oakland, California 94607
Tel: (510) 268-0461
Fax: (510) 268-0137

March 10, 2013
Project No. 04.72130011

Carollo Engineers
2700 Ygnacio Valley Rd., Suite 300
Walnut Creek, California 94598

Attention: Mr. Paul Friedlander

Subject: Preliminary Geotechnical Study, Recycled Water Storage Project, Watsonville Treatment Plant in Watsonville, California

Dear Mr. Friedlander:

Fugro Consultants, Inc., (Fugro) is pleased to submit this preliminary geotechnical study letter for the proposed increased Recycled Water Storage at the Watsonville Treatment Plant in Watsonville, California. Based on a review of project information provided by your office, we understand that consideration is being given to adding 2.0 MG of capacity to store recycled water. This added capacity would be placed south of the existing Clearwell Storage Tank. Fugro performed a geotechnical study for the Recycled Water Facility and the results were presented in our report titled, "Geotechnical Study, Watsonville Recycled water Facility, Watsonville, California," dated April 6, 2006. In addition, Fugro performed additional services for the Operations and Laboratory Buildings as well as an investigation for the expansion of the existing treatment plant.

PROJECT DESCRIPTION

The project site is located at 401 Panebaker Lane, in Watsonville, California, as shown on the Vicinity Map, Plate 1. We understand that two (2) new Clearwell Storage Tanks are proposed to be constructed at the eastern portion of the site in the area between the recently constructed Operations Center and an existing Clearwell Storage Tank. The proposed tanks are estimated to add a combined two million gallons recycled water storage capacity. Based on our previous studies for the existing Clearwell Storage Tank, we anticipate that with excavations on the order of about 15 to 21 feet, due to the large amount of soils excavated from these sites, the maximum induced net bearing pressure is estimated to be on the order of about 600 psf.

SCOPE OF SERVICES

The purpose of our geotechnical field survey was to obtain information on existing surface conditions and performance of surrounding structures in order to evaluate the geotechnical, geologic hazard and seismology aspects of the project. The scope of our services performed included the following tasks:

DRAFT

- Compiling and reviewing available geotechnical and geologic data contained in our files and pertinent to the project;
- Conducting a field survey to provide a description of physical properties and characteristics of subsurface soils including groundwater level;
- Discussion of the corrosion potential of subsurface soils;
- General site geology, seismicity, and seismic design parameters in accordance with the 2010 California Building Code;
- Recommendations for excavation and site earthwork, including procedures for subgrade preparation and proper placement of fill and backfill;
- Recommendations for site dewatering during construction;
- Foundation design recommendations for the water storage facilities, including applicable shallow and deep foundation bearing capacities, passive resistance of soil against the foundation, coefficient of friction between the soil and foundations for seismic design;
- Discussion of probable total and differential settlements of the new facility; and
- Appendix with our relevant previous logs of the test borings and a summary of the subsurface conditions found by us and others.

FIELD EXPLORATION

Field Exploration

For our current preliminary study, Fugro visited the site of the proposed additional tanks to assess the effects of the previous surcharging of the site for the constructed Operations Center building. A field reconnaissance involved inspection the surface conditions around the existing tank, the conditions of the concrete pathways to and from the tank, the surrounding asphalt pavement roadways around the perimeter of the planned expansion area and the existing grade of the soil in the area of the planned expansion.

Logs of the previous borings and details regarding the previous field exploration are included in Appendix A. The boring locations are shown on the Site Plan/Site Geologic Map - Plate 2. The subsurface conditions encountered in the borings are summarized in the following sections.

Corrosion Testing

Previous corrosion testing at the plant were performed on representative for soluble suflate, chloride ion concentration, galvanic corrosion potential, and redox and sulfides. The results and analyses are as follow.

Soluble sulfate concentrations of 68 and 59 parts per million (ppm) and chloride ion concentrations of 19 and 28 ppm were measured. Based on guidelines presented by the

DRAFT

Portland Cement Association in publication, “Design and Control of Concrete Mixtures,” these sulfate levels indicate that cement used to construct below grade structures will be subjected to a negligible degree of sulfate exposure. Therefore, Type II Portland Cemenet can be used in concrete construction.

Resistivity and pH test were performed with resistivities of 1868 and 1929 ohm-cm and pH values of 7.8 and 7.5 were measured. These tests indicate that the onsite soils would present a moderately corrosive environment for steel pipes.

Redox levels of +16 and +14 millivolts were measured from onsite samples. Negative and trace levels of sulfides were measured in the samples as well.

CURRENT SITE CONDITIONS

Surface Conditions

The project site is situated near the west corner of the Recycled Water Facility in Watsonville, California. The planned location of the proposed Clearwell tank project addition is shown on the *Vicinity Map*, Plate 1, and *Site Plan*, Plate 2.

At the location of the proposed Clearwell tank project, the site is currently covered with grass landscaping, perimeter trees and bushes, and has a storm water basin and drainage channel from south to north. The ground surface elevation within the project area slopes slightly from north to south with a low point occupying approximately the southern 1/3 portion of the expansion area. An asphalt concrete paved access road bounds the site on the west and east, an asphalt concrete paved parking lot bounds the site to the south, and an existing Clearwell storage tank to the north.

Subsurface Conditions

At the location of our previous exploratory Boring B-3 and CPT’s 1A, 3 and 4, we generally encountered firm silty clay of medium plasticity that extended to depths of about 6 to 10 feet below the existing ground surface. The upper 2 to 3 feet of this near-surface silty clay is generally stiff and dry. The lower silty clay is moist with consistencies of soft to firm. These soils are relatively weak and potentially compressible. Below the surface clay, we encountered firm to still, highly plastic fat clay, with a Plasticity Index of 36 that extended to a depth of about 52 feet. These clays are moderately compressible. Below the fat clay, medium dense to dense silty and clayey sand was encountered to a depth of about 58 feet. The sand was underlain by stiff to very stiff silty to fat clay that extended to the maximum depths explored of about 71 ½ feet in Boring B-1 (south west of the proposed site).

The previous boring logs and related information depict the depth at which specific subsurface conditions were encountered during our field investigation and can be found in the attached Appendix A. The approximate locations of the borings were determined by using a measuring tape and should be considered accurate only to the degree implied by the method used.

DRAFT

Groundwater

Free groundwater was encountered in all of the borings at depths of approximately 8 to 20 feet at the time of drilling. Prior to backfilling, the groundwater level was measured at depths of approximately 7 feet in Boring B-3. All borings were backfilled immediately. We note that the borings may not have been left open for a sufficient period of time to establish equilibrium groundwater conditions. In addition, fluctuations in the ground water level could occur due to changes in seasons, variations in rainfall, and other factors.

Due to the fluctuation of seasonal groundwater levels at the project site, we recommend that the groundwater level be designed at a depth of 3 feet below the existing ground surface. The potential high groundwater level may impact the types of shoring and dewater methods during construction of the proposed below-grade structures.

Regional Geology

The site is located within Pajaro Valley in the Coast Ranges Geomorphic Province of California. The valley is bordered by mountains to the north, south, and east, and extends to Monterey Bay to the west. The valley has been in-filled with fluvial and alluvial deposits derived from the surrounding mountains.

The site is underlain by deep alluvial deposits associated with the Pajaro River adjacent to the site. The deepest available boring performed by others in a previous study near the site extended to a depth of about 150 feet and bedrock was not encountered. The soils at the site generally consist of older flood plain deposits consisting primarily of clays with medium to high plasticity and inter-lenses of sand and silt within the upper 100 feet, and silty to gravelly sand below 100 feet.

Seismicity

The project site is located in the Monterey Bay Area, which is considered one of the most seismically active regions in the United State. Significant recent earthquakes have occurred in the Monterey Bay Area and are believed to be associated with crustal movements along a system of subparallel fault zones that generally trend in a northwesterly direction.

DRAFT

The approximate distance of the site from the six closest known mapped faults[1] is summarized in the table below. The project site is not located within an Alquist-Priolo Earthquake Fault Zone.

Fault name	Distance to fault trace (mi)[a]	Distance to fault trace (km)[a]	Compass Direction from fault	Maximum eq. mag. (Mw)[b]	UBC Fault class[c]
Zayante-Vergeles	4.5	7.2	NE	6.8	B
San Andreas	7.1	11.3	NE	7.9	A
Sargent	9.9	15.8	NE	6.8	B
Monterey Bay-Tularcitos	13.4	21.6	SW	7.1	B
Rinconada	14.6	23.3	SE	7.3	B
Calaveras (South of Calaveras Reservoir)	18.5	29.6	NE	6.2	B

a. Active faults as given by Peterson et al. (1998).
b. Maximum earthquake moment magnitude calculated by Peterson et al. (1998) based on fault geometry.
c. Uniform Building Code (1997) fault classes by Peterson et al. (1998).

Earthquakes on these or other smaller, more distant, or unmapped faults could cause strong ground shaking at the site. Earthquake intensities vary throughout the Monterey Bay Area depending upon the magnitude of the earthquake, the distance of the site from the causative fault, the type of materials underlying the site, and other factors.

CONCLUSIONS

We believe that the project is feasible from a geotechnical and engineering geologic standpoint, provided that the conclusions and recommendations presented in this report are incorporated into the project design and specifications. The primary geotechnical considerations are discussed in the following sections.

Expansive Soils

The near surface silty clayey soils encountered at the project site are moderately expansive, with a Plasticity Index of 18. These materials could be subjected to volume changes during seasonal fluctuations in moisture content. In order to reduce the potential impact of expansive soils, resulting from swelling and shrinkage of these materials, we recommend that all exterior slab, including slabs-on-grade be supported on a minimum of 12 inches of imported non-expansive fills, such as Class 2 Aggregate Base, provided an adequate reinforcement is provided in the slab to minimize the impact of expansion pressures.

Compressible Clayey Soils

The near surface silty clayey soils encountered at depths of 3 to 10 feet below ground surface are relatively weak and potentially compressible. Similarly, the ‘fat clay” below the surface clays that extended to a depth of about 50 feet is also moderately compressible. These

[1] According to the Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada, prepared by California Department of Conservation, Division of Mines and Geology (1998).

DRAFT

soils will consolidate when they are subjected to loads due to the placement of new fills or overlying foundation loads. As a result, we recommend excavation and removal of these soils on the order of 15 to 21 feet below ground surface.

High Groundwater

We anticipate that relatively high groundwater level will be encountered at the general WTP site. Where groundwater is encountered, temporary groundwater control will be required to lower the groundwater level. Due to potential settlement as a result of area dewatering, we recommend the dewatering be limited to 2 feet below the bottom of excavation. For the proposed Clearwell storage tank areas, where excavations will extend to a depth of about 15 to 21 feet below ground surface, it is viable to utilize a temporary shoring such as internally braced steel sheet pile that could act as a cut-off wall. This cut-off wall would minimize the impact of water drawdown that may potentially jeopardize the existing nearby facilities. To observe fluctuations of groundwater level, we recommend that piezometers be installed on both the inside and outside of the excavations prior to beginning of excavations.

In addition, all below-grade walls and floor slabs should be waterproofed and be designed to resist both lateral and uplift hydrostatic pressure. We recommend that a design groundwater level of 3 feet be used. For trench excavation, in order to reduce the potential for settlements, we recommend that construction to be performed in a continuous manner to reduce the time that excavation remains open so as to reduce dewatering time to a minimum.

Deep Excavation

For excavations on the order of about 15 to 21 feet in the proposed Clearwell Circular areas, we recommend a temporary shoring such as an internally braced sheet pile system. The sheet pile should be extended deep enough, such that it could act as a cut-off wall to reduce the amount of groundwater flow into the bottom of the excavation area.

The contractor should incorporate all appropriate requirements of OSHA into the design of the temporary construction slopes and shoring system. If a temporary construction slope will be used, appropriate groundwater control should be performed to achieve a relatively dry working subgrade.

It should be noted that the performance of the temporary shoring and groundwater control or dewatering is highly dependent on the construction methods and procedures employed. The design and maintenance of all necessary shoring and dewatering systems, if any, as well as the protection of existing site improvements and utilities should be the responsibility of the contractor. The project geotechnical and structural engineers should review the proposed shoring system prior to installation.

DRAFT

RECOMMENDATIONS

Seismic Design

The proposed structures should be designed to resist the lateral forces generated by earthquake shaking in accordance with local design practice. This section presents seismic design criteria for use with the 2010 California Building Code (CBC).

The site seismic design criteria were determined based on the site latitude and longitude using the USGS public domain computer software. Based on the subsurface conditions encountered at the site and the "Site Class Definitions" per the 2010 CBC, Site Class "B" (rock) should be assumed for design for the proposed buildings. If the project structures are to be designed in accordance with the 2010 CBC, the design parameters shown in Table 4 should be used.

Table 1. Seismic Design Parameters

LATITUDE: 36.8871 LONGITUDE: -121.7830	ASCE 7-05 TABLE/FIGURE	FACTOR/COEFFICIENT	VALUE
Short-Period MCE at 0.2s	Figure 22-3	S_s	1.50g
1.0s Period MCE	Figure 22-4	S_1	0.66g
Soil Profile Type	Table 20.3-1	Site Class	D
Site Coefficient	Table 11.4-1	F_a	1.00
Site Coefficient	Table 11.4-2	F_v	1.50
Adjusted MC Spectral Response Parameters	Equation 11.4-1	S_{MS}	1.50
	Equation 11.4-2	S_{M1}	0.99
Design Spectral Acceleration Parameters	Equation 11.4-3	S_{DS}	1.0
	Equation 11.4-4	S_{D1}	0.66

DRAFT

Structural Slab

We recommend that the moderately loaded below-grade structures for the Clearwell tanks be supported on a structural slab foundation bearing on 12 inches of compacted Class 2 Aggregate Base over undisturbed native subgrade.

The allowable bearing pressure is a total value; therefore, the weight of the structural slab and the weight of Class 2 Aggregate Base should be considered for design purposes. Live loads applied continuously for a long duration should be considered as dead loads. Settlements of the structural slab or mat foundations for the anticipated loads bearing on native soils and designed in accordance with the recommendations presented above are anticipated to be on the order of 1 inch.

For the proposed Clearwell tanks with excavations on the order of about 15 to 21 feet, due to the large amount of soils excavated from these sites, the maximum induced net bearing pressure is estimated to be on the order of about 600 psf. The computed settlement that may occur to these below-grade structures is on the order of 1/2 to 1 inch; therefore, no site surcharging is required.

Soil subgrade should be lightly moistened just prior to placing the concrete. Slab reinforcing should be provided in accordance with the anticipated use and loading of the slab. Subgrade surfaces for slab-on-grade should be proof-rolled to provide a smooth, unyielding surface for slab support. Slabs located adjacent to other foundations should bear below an imaginary 1.5:1 plane projected upward from the bottom edge of the adjacent footings or utility trench.

We recommend that we observe the structural slab or mat foundation excavations prior to placing the Class 2 Aggregate Base over native subgrade to confirm that the foundations are founded on appropriate material.

Below-Grade Walls

Below-grade walls must be designed to resist both lateral earth pressures and any additional lateral loads caused by surcharging and seismic.

We recommend that unrestrained walls be designed to resist an equivalent fluid pressure of 45 and 85 pcf for soils above and below groundwater level, respectively. Restrained walls should be designed to resist an equivalent fluid pressure of 65 and 95 pcf, respectively, for soils above and below design groundwater level. These pressures have included hydrostatic pressure for soils below the design groundwater level. Walls with inclined backfill should be designed for an additional equivalent fluid pressure of 1 pcf for every 2 degrees of slope inclination.

In addition, we also recommend that a uniform seismic pressure of 15H and 10H be applied for all below-grade walls under unrestrained and restrained conditions, respectively, where H is the height of backfill above the top of the wall footing, in feet. Walls subjected to surcharge loads should be designed for an additional uniform lateral pressure equal to one-third and one-half the anticipated surcharge load for unrestrained and restrained walls, respectively.

Surcharge loads from adjacent structures need to be considered if the proposed below-grade walls extend below the zone of influence of adjacent foundations. The zone of influence of adjacent foundations can be defined as the area below an imaginary 1.5:1 line extending downwards from the bottom of the footing nearest the new below-grade wall.

Below-grade wall backfill less than 5 feet deep should be compacted to at least 90 percent relative compaction using light compaction equipment. Backfill greater than 5 feet deep should be entirely compacted to at least 95 percent relative compaction. If heavy compaction equipment is used, the walls should be appropriately designed to withstand loads exerted by the heavy equipment, and/or temporarily braced.

DRAFT

Lateral Load Resistance

Lateral load resistance for the proposed structures can be developed by friction between the foundation bottom and the supporting subgrade. A friction coefficient of 0.35 is considered applicable, for the below-grade structures supported on structural slab foundation. For the below-grade structures, additional lateral load resistance can be developed by friction between the below-grade walls and surrounding soil. For the portions of below-grade walls above the design ground water level, a uniform frictional resistance of 25H1 psf, where H1 equals the height of the wall above the design ground water level, is considered applicable. For the portions of below-grade walls below the design ground water level, a uniform frictional resistance of 13H2, where H2 equals the height of the wall below the design ground water level, is considered applicable. In addition to frictional resistance, lateral load resistance can be developed from soil passive resistance on below-grade walls. A passive resistance equal to an equivalent fluid weighing up to 300 pcf acting against the vertical face of the below-grade walls could be used. The walls should be appropriately designed for these passive pressures. A deflection of 1/2 inch would be required to mobilize full passive resistance. Full values of frictional resistance on the foundation bottom and walls and the passive resistance can be used in combination to resist lateral forces.

Distribution of the equivalent fluid passive resistance should be taken from the adjacent ground surface level. The total passive resistance acting on the upper two feet should be ignored unless it is confined by slab or pavement. Under seismic loading, the ultimate passive resistances given above can be increased by 50 percent to account for strain rate effects.

SITE PREPARATION AND GRADING

Site Preparation

The site should be cleared of all obstructions, including utility lines, debris and grass roots. Holes resulting from the removal of underground obstructions extending below the proposed finish grade should be cleared and backfilled with suitable material compacted to the specified requirements. We recommend backfilling operations for any excavations to remove deleterious material be carried out under the observation of the geotechnical engineer.

After clearing, the portions of the site containing surface vegetation or organic laden topsoil should be stripped to an appropriate depth to remove these materials, if encountered. At the time of our field investigation, we estimated that a stripping depth of approximately 6 to 12 inches would be required. The amount of actual stripping should be determined in the field by the geotechnical engineer at the time of construction. Stripped materials should be removed from the site, or stockpiled for later use in landscaping, if approved by the owner.

Subgrade Preparation

After the completion of clearing, and stripping, soil exposed in areas to receive structural fill should be scarified to a minimum depth of 6 inches, moisture conditioned to slightly above optimum water content and compacted to the requirements for structural fill.

DRAFT

Excavation for the proposed below-grade structures will extend below the ground water level, and the resulting subgrade may be disturbed and potentially becomes unstable and difficult to achieve the recommended compaction. In this event, it is recommended that the subgrade be rolled with light equipment rather than scarifying to a depth of 6 inches prior to placing fills. If standing water is encountered during site grading, the water should be controlled by dewatering or localized sump pumps. To provide a stable working surface, it is recommended that these excavations be extended to a minimum of 12 inches below the bottoms of the structures. A geotextile, such as Mirafi 500X or equivalent, should be placed on the resulting subgrade and backfilled with a minimum of 12 inches of Class 2 aggregate base. If the unstable subgrade covers a relatively large area, it is often more cost-effective to perform chemical (lime) stabilization in lieu of mechanical stabilization discussed above.

Groundwater Control

Excavation for the proposed below-grade structures will extend below the design ground water level and thus, may require appropriate groundwater control to provide dry working conditions and help prevent instability of the bottom of excavation during construction. However, to minimize the potential ground settlement induced by the lowering of groundwater level and to provide a dry and stable subgrade at the bottom of excavation, we recommend that the groundwater level be drawn down only to a maximum of two feet below the bottom of excavation. We also recommend that a temporary, interlocking sheet pile be considered during construction. The sheet pile should be driven well below the bottom of excavation, such that it could act as a cut-off shoring wall. Under this condition, only minor groundwater control would be required to achieve a relatively dry working pad. This could be accomplished by providing localized sumps to collect the entrapped groundwater and discharged by using submersible pumps. To observe fluctuations of groundwater level, we recommend that piezometers be installed on both the inside and outside of the excavations prior to beginning of excavations.

The dewatering system should be designed by a specialty contractor who is familiar with similar subsurface conditions. We recommend the geotechnical engineer review the dewatering plans.

Temporary Shoring

Construction for below-grade structures require a maximum excavation of approximately 21 feet below the existing grade, and temporary shoring will be necessary. The contractor should incorporate all appropriate requirements of OSHA into the design of the temporary shoring systems. High groundwater level may be encountered during the excavation; therefore, temporary dewatering and/or groundwater control may be required during construction for the below-grade structures. To reduce the potential for differential settlements created by dewatering, the dewatering operations should be minimized outside of the excavated areas and retrievable, interlocking sheet pile should be used to shore the excavation. The sheet pile should be extended below the base of the excavation and into impermeable soil layers, so that it would function as a cut-off wall to reduce the amount of water seepage into the excavation area. To observe fluctuations of groundwater level, we recommend that piezometers be installed on both the inside and outside of the excavations prior to beginning of excavations. In addition, the

DRAFT

shoring system should be sufficiently rigid to minimize damage to the adjacent existing buildings due to deflection of the sides of the excavation.

We recommend that the contractor or a specialty subcontractor design and install the temporary shoring. The contractor or a specialty subcontractor should also become familiar with the subsurface conditions presented in this report when designing the shoring system. We recommend that the geotechnical and structural engineers review the final temporary shoring plan to ensure its compliance with the anticipated soil conditions encountered at the site. The contractor should incorporate all appropriate requirements of OSHA into the design of the temporary shoring system.

Special Considerations-Shoring, Excavations, and Dewatering

All work of excavating, shoring and dewatering must be performed in a manner to minimize settlement and ground loss. The project specifications should require the contractor to monitor ground movements at or near critical structures adjacent to their work and to maintain ground movements to permissible tolerances. Surface settlement and heave monitoring points should be surveyed at frequent intervals during construction, with the vertical and horizontal location of each point being reported to the construction manager. Any deviations greater than 3/8-inch vertical or 1/2-inch horizontal should trigger implementation of a corrective action plan by the contractor.

CLOSING

The above recommendations presented in this letter are meant to supplement and revise as applicable the recommendations presented in Fugro's April 6, 2006 report and were made in accordance with generally accepted local and current (i.e., at the date of this letter) geotechnical engineering principles and practices. We make no warranty, either express or implied. Should you have any questions or require additional information, please contact us.

Sincerely,

FUGRO WEST, INC.

Ronald L. Bajuniemi, P.E., G.E.
Principal Geotechnical Engineer

MB/RLB

Copies Submitted: (PDF) Addressee

Attachments: Plate 1. Vicinity Map
Plate 2. Site Plan
Appendix A - Field Explorations
Plate A-1. Key and Symbols Used on Boring Logs
Boring Logs B-3

DRAFT

DRAFT

PLATES

BASE MAP SOURCE: Based on an image downloaded from Google Earth Pro.

NORTH

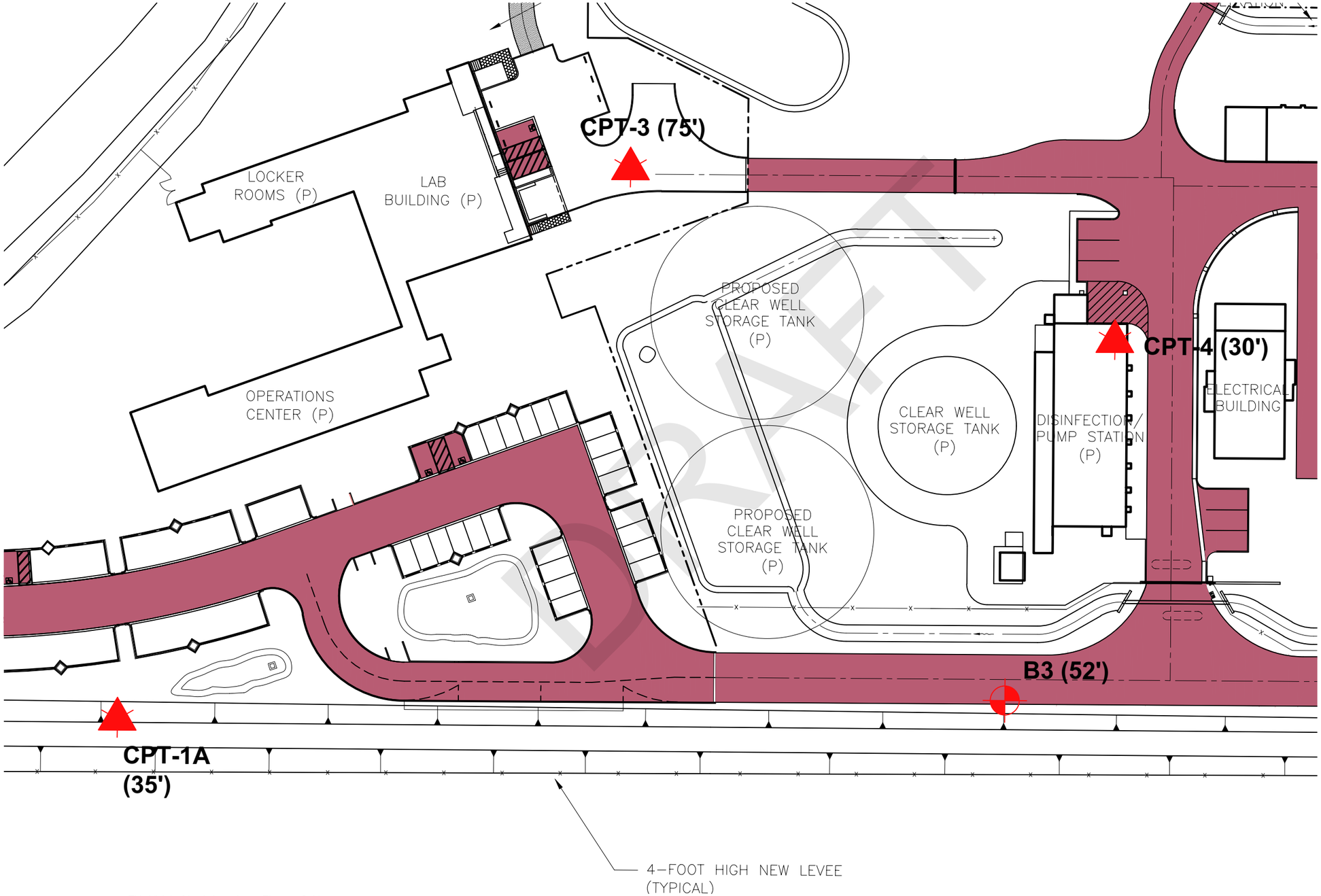
0 4000

FEET

VICINITY MAP
Watsonville RWF
Watsonville, California

PLATE 1

G:\jobdocs\04.72120008 DGS Retainer\TO 6 Cal Fire Garden Valley Station\Drawings\Drawing1.dwg 03-08-2013 - 7:18pm



LEGEND

B-3 Approximate previous boring loca

CPT-4 Approximate previous CPT locati

NORTH

0 50 100

FEET

TITLE
Subtitle

BASE MAP SOURCE: This Vicinity Map is based on a Thomas Guide Map for San Francisco, Alameda and Contra Costa Counties, California, Map 791, Year 2000

DRAFT

G:\jobdocs\04.72130011 Recycled WSP Preliminary_WatsonvilleIDrawings\ID1626_001_02.dwg 03-10-2013 - 12:38pm

DRAFT

APPENDIX A
FIELD EXPLORATIONS

CLASSIFICATION AND MATERIAL SYMBOLS

MAJOR DIVISIONS PER ASTM D2488-06			MAJOR GROUP NAMES AND MATERIAL SYMBOLS		
COARSE-GRAINED SOILS (More than 50% retained on the No. 200 sieve)	GRAVELS (MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE)	Clean gravels less than 5% fines	**GW**		Well-Graded GRAVEL
			GP		Poorly Graded GRAVEL
		Gravels with more than 12% fines	**GM**		SILTY GRAVEL
			GC		CLAYEY GRAVEL
	SANDS (MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE)	Clean sand less than 5% fines	**SW**		Well-Graded SAND
			SP		Poorly Graded SAND
		Sands with more than 12% fines	**SM**		SILTY SAND
			SC		CLAYEY SAND
FINE-GRAINED SOILS (50% or more passes the No. 200 sieve)	SILTS AND CLAYS (Liquid Limit Less than 50%)		**ML**		SILT
			CL		Lean CLAY
			OL		ORGANIC SILT
	SILTS AND CLAYS (Liquid Limit Greater than 50%)		**MH**		Elastic SILT
			CH		Fat CLAY
			OH		ORGANIC CLAY
HIGHLY ORGANIC SOILS			**PT**		Peat or Highly Organic Soils

Notes:
Classification of soils on the boring logs is in general accordance with ASTM D2488, or D2487 if appropriate laboratory data are available.
The geologic formation is noted in bold font at the top of interpreted interval on the boring logs.

OTHER MATERIAL SYMBOLS

- Debris or Mixed Fill
- Pavement with Aggregate Base

SAMPLER TYPE

- SPT (Driven) 1-3/8" ID 2" OD
- Modified California (Driven) 2-3/8" ID 3" OD
- Modified California (Driven) 1-7/8" ID 2-1/2" OD
- Shelby Tube (Pushed) 2-7/8" ID 3" OD
- Pitcher Barrel (Rotary-cut) 2-7/8" ID
- Osterberg (Piston) 2-7/8" ID
- 101 Geobarrel (Rotary-cut) 2-7/8" ID
- Rock Core (Rotary-cut) See log for size
- Vibracore (Vibrated) See log for size
- Push-core (Pushed) See log for size
- Collected from Auger
- Other See log for details

Note: Refer to text of report for additional details or other sampler types.

BLOW COUNT

Number of blows required to drive sampler each of three 6-in. intervals, as measured in the field (uncorrected). An SPT hammer (140 lb., falling 30-in.) was used unless otherwise noted on the boring log. For example:

Blow Count	Description
5 7 8	5, 7, and 8 blows for first, second, and third interval, respectively.
35 50/3"	35 blows for the first interval. 50 blows for the first 3 inches of the second interval. Lack of third value implies that driving was stopped 3 inches into the second interval.
WOH WOH 5	"WOH" indicates that the weight of the hammer was sufficient to advance the sampler over the first two intervals. 5 blows were required to advance the sampler over the third interval.

N-VALUE

The N-Value represents the blowcount for the last 12 inches of the sample drive if three 6-inch intervals were driven. N-value presented is independant of impact energy. If 50 hammer blows were insufficient to drive through either the second or the third interval, the total number of blows and total length driven are reported (excluding the first interval). "ref" (refusal) indicates that 50 blows were insufficient to drive through the first 6-inch interval.

Parenthesis indicate that an approximate correction has been applied for non-SPT drive samplers. For example, a factor of 0.63 is commonly used to adjust blow counts obtained using a 3-inch outside diameter modified California sampler to correspond to Standard Peneteration Test.

UNDRAINED SHEAR STRENGTH

A value of undrained shear strength is reported. The value is followed by a letter code indicating the type of test that was performed, as follows:

U - Unconfined Compression
Q - Unconsolidated Undrained Triaxial
T - Torvane
P - Pocket Penetrometer
M - Miniature Vane
F - Field Vane
R - R-value

OTHER TESTS

Field or laboratory tests without a dedicated column on the boring log are reported in the Other Tests column. A letter code is used to indicate the type of test. For certain tests, a value representing the test result is also provided. Typical letter codes are as follows. Additional codes may be used. Refer to the report text and the laboratory testing results for additional information.

k - Permeability (cm/s)
Consol - Consolidation
Gs - Specific Gravity
MA - Particle Size Analysis
EI - Expansion Index
OVM - Organic Vapor Meter

WATER LEVEL SYMBOLS

- Initial water level
- Final water level
- Seepage encountered

INCREASING MOISTURE CONTENT

Dry
Moist
Wet

CONSISTENCY OF COHESIVE SOIL

CONSISTENCY	UNDRAINED SHEAR STRENGTH (KIPS PER SQUARE FOOT)
Very Soft	< 0.25
Soft	0.25 to 0.50
Medium Stiff	0.50 to 1.0
Stiff	1.0 to 2.0
Very Stiff	2.0 to 4.0
Hard	> 4.0

Note: In absence of test data, consistency has been estimated based on manual observation.

APPARENT DENSITY OF COHESIONLESS SOIL

APPARENT DENSITY	N-VALUE
Very Loose	0 to 4
Loose	5 to 9
Medium Dense	10 to 29
Dense	30 to 49
Very Dense	> 49

DRAFT

TERMS AND SYMBOLS USED ON BORING LOGS PLATE A-1

LOCATION:

See Site Plan, Plate 2

SURFACE EL: 111.0 ft +/- (rel. City of Watsonville datum)

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
			4/ 5/ 5/	6		CLAY (CL): firm to stiff, dark brown to brown, silty, trace fine-grained sand, dry							
			1/ 3/ 2/	5								1.3 P	
			2/ 3/ 4/	4									
5						grades to moist at 3 feet	89	29				0.6 U	
												0.6 T	
			2/ 3/ 4/	4		CLAY (CH): firm to stiff, light brown, silty, trace fine-grained sand, moist							
10							84	38				0.6 T 0.1 U	
			1/ 1/ 1/	2		grades to some sand (fine-grained) at 13½ feet and becoming soft							
15													
			3/ 5/ 5/	6									
20			350 psi	6"/24" rec.			93	33				0.9 U	
			0/ 0/ 7/	7									
25						grades to light gray and some sand at 25½ feet	86	36				0.5 U 0.7 T	

Continued

BORING DEPTH: 51.5 ft
BACKFILL: Cuttings
DEPTH TO WATER: 7.0 ft
FIELDWORK DATE: April 2, 2004
DRILLING METHOD: 8-in. dia. Hollow Stem Auger

HAMMER TYPE: Automatic Trip
RIG TYPE: CME-75
DRILLED BY: Fugro Geosciences, Ron and Mike
LOGGED BY: A Lau
CHECKED BY:

DRAFT

FCLP STANDARD LOG G:\ENGINEER\GINT\PROJECTS\1626.001_V110402.GPJ OGEM_LIB_JAN2012.GLB 3/8/13 06:52 p

LOG OF BORING NO. B-3
Geotechnical Study: Watsonville RWF Project
Watsonville, California

LOCATION:
See Site Plan, Plate 2
SURFACE EL: 111.0 ft +/- (rel. City of Watsonville datum)

DEPTH, ft	MATERIAL SYMBOL	SAMPLER TYPE	BLOW COUNT OR PRESSURE, psi	N VALUE OR RQD%	RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX	UNDRAINED SHEAR STRENGTH, S_u, ksf	OTHER TESTS
						CLAY (CH) continued							
30			8/ 12/ 10/	14									
35			5/ 3/ 3/	6		CLAY (CH): firm to stiff, gray, silty, trace fine-grained sand silty sand lense at 35 to 37 feet							
40			3/ 5/ 7/	8		interbedded clayey/silty sand layers between 40 to 50 feet						1.0 P	
45			0/ 0/ 2/	2		becomes soft							
50			4/ 6/ 9/	9		becomes stiff							

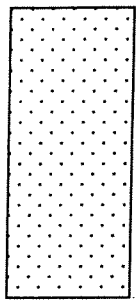
NOTES:
1. Terms and symbols defined on Plate A-1.

DRAFT

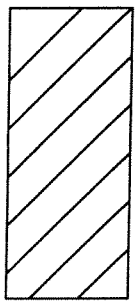
FCLP STANDARD LOG G:\ENGINEER\GINT\PROJECTS\1626.001_V110402.GPJ OGEM_LIB_JAN2012.GLB 3/8/13 06:52 p

LOG OF BORING NO. B-3
Geotechnical Study: Watsonville RWF Project
Watsonville, California

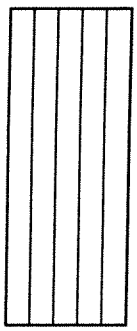
KEY TO SOIL BEHAVIOR TYPE



SAND AND SANDY SOIL

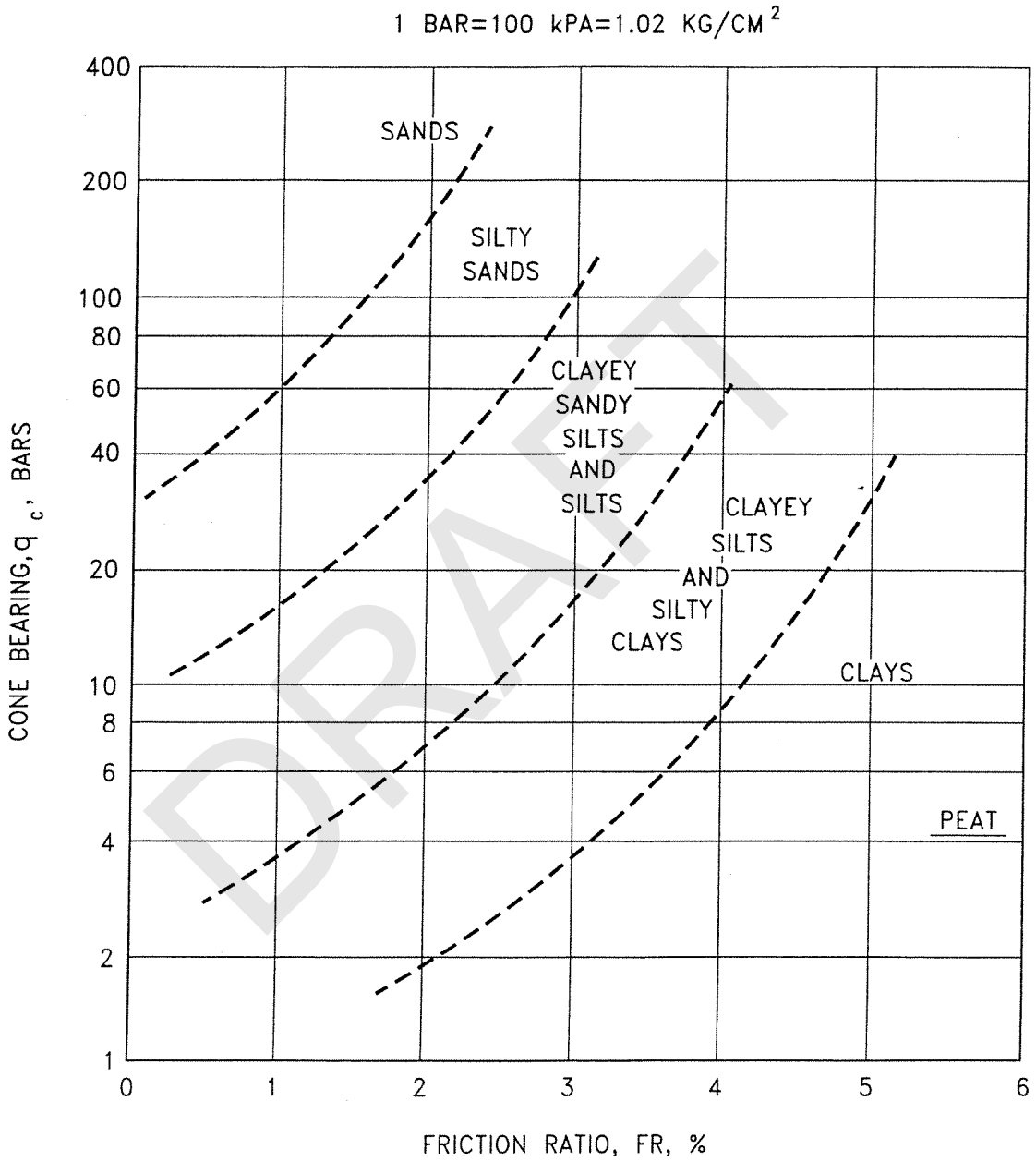


CLAY AND CLAYEY SOIL



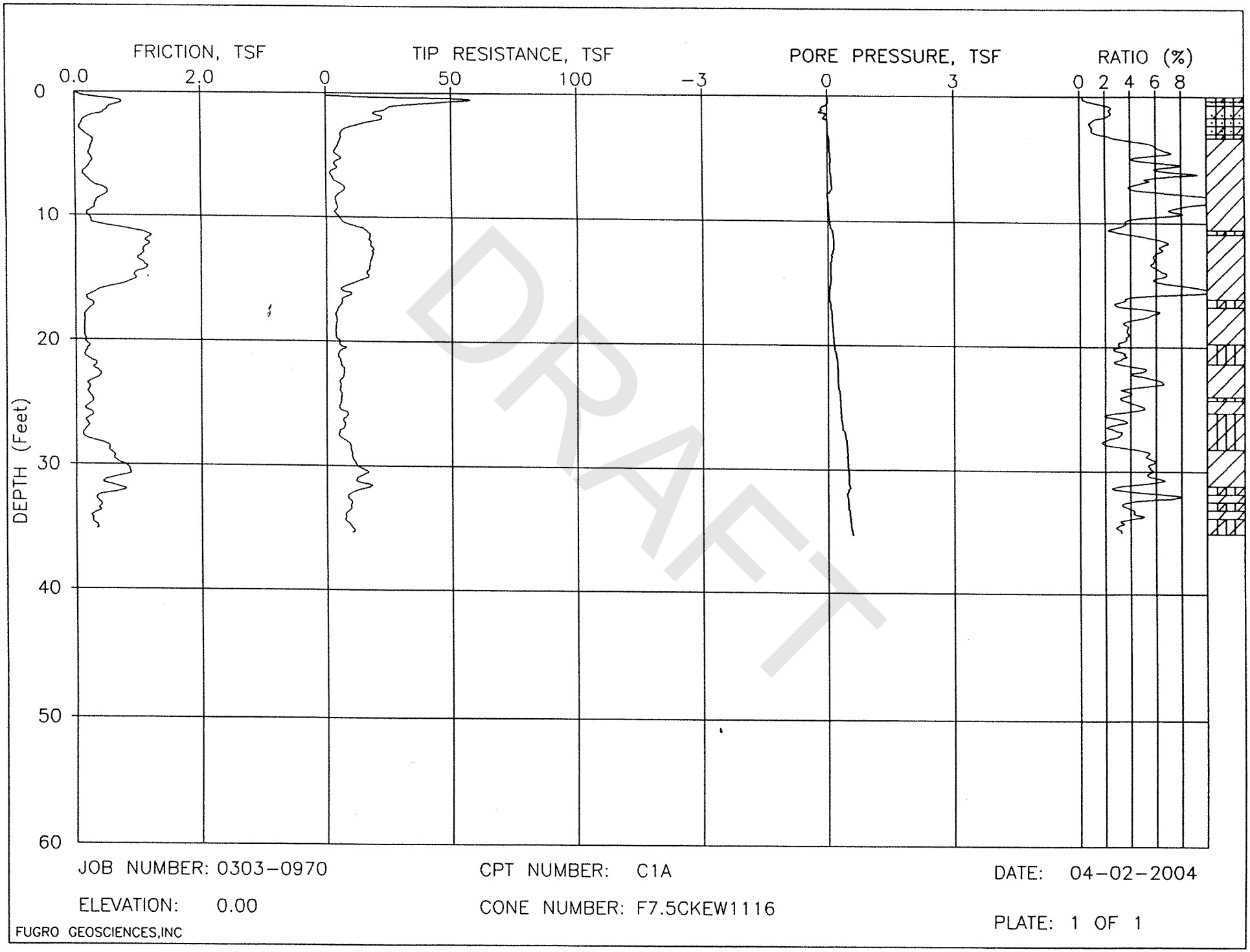
SILT AND SILTY SOIL

DRAFT



DRAFT

MODIFIED CAMPANELLA AND ROBERTSON SOIL BEHAVIOR CHART (1983)



JOB NUMBER: 0303−0970

CPT NUMBER: C1A

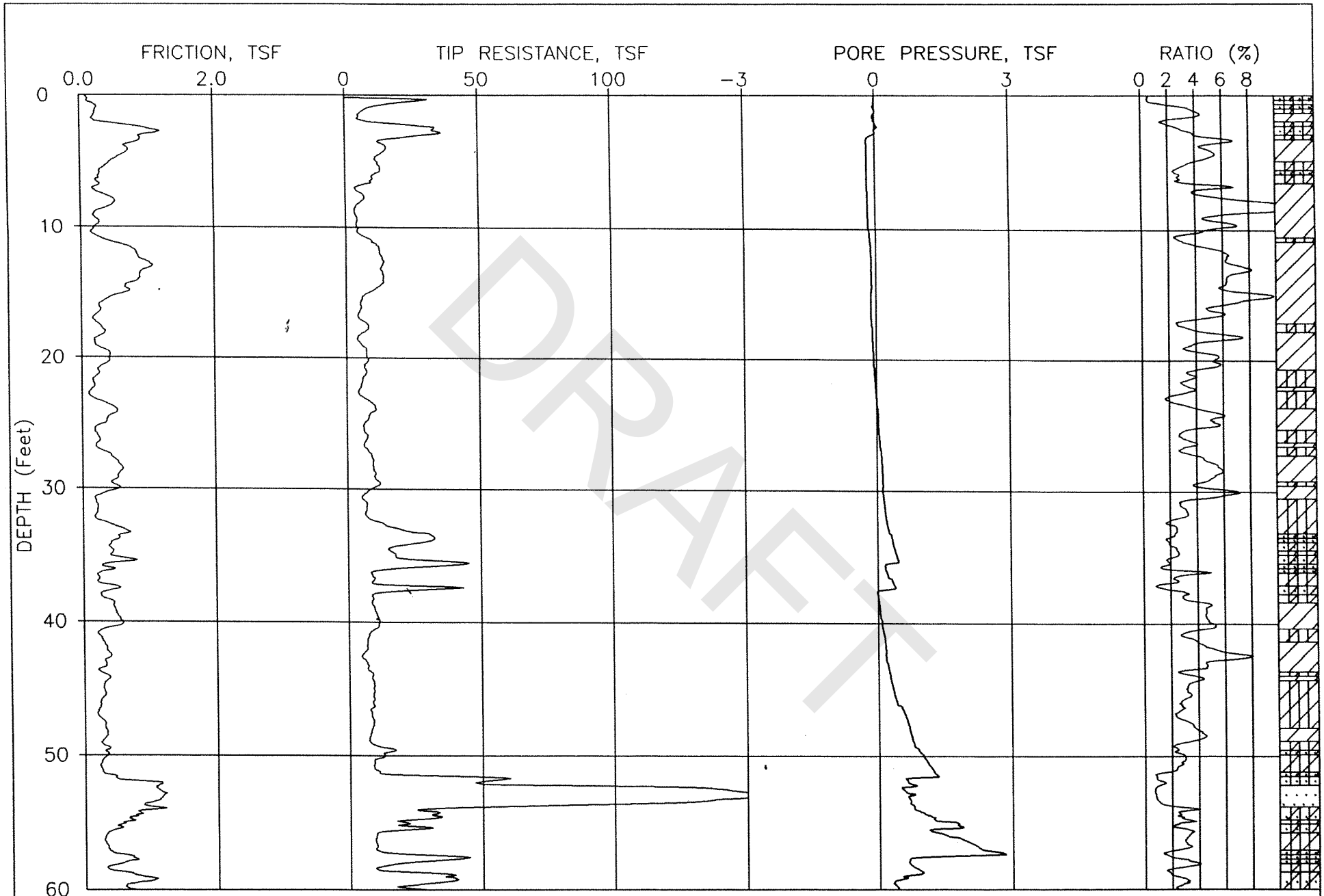
DATE: 04−02−2004

ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1116

PLATE: 1 OF 1

FUGRO GEOSCIENCES,INC



JOB NUMBER: 0303−0970

CPT NUMBER: C3

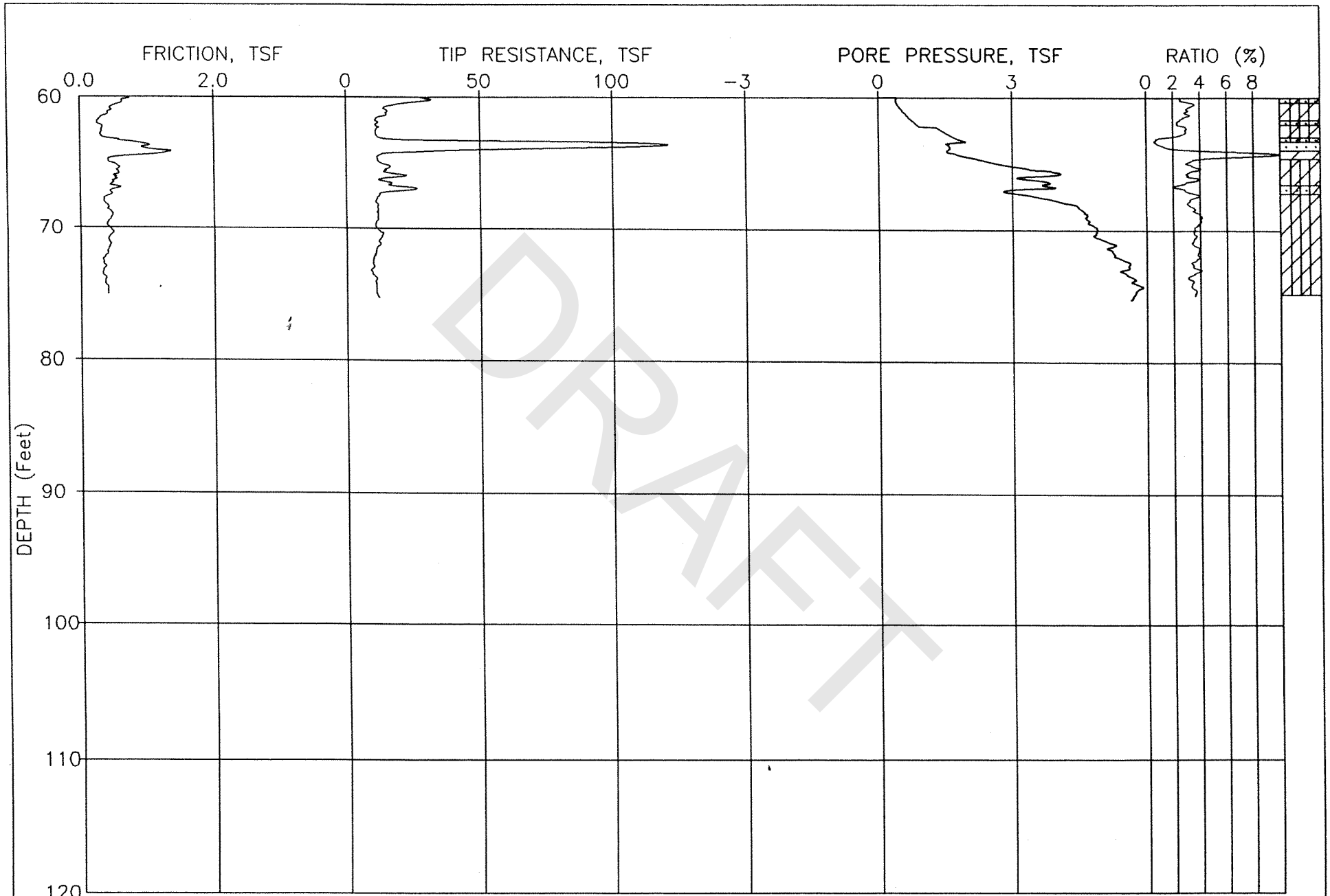
DATE: 04−02−2004

ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1116

PLATE: 1 OF 2

FUGRO GEOSCIENCES,INC



JOB NUMBER: 0303−0970

CPT NUMBER: C3

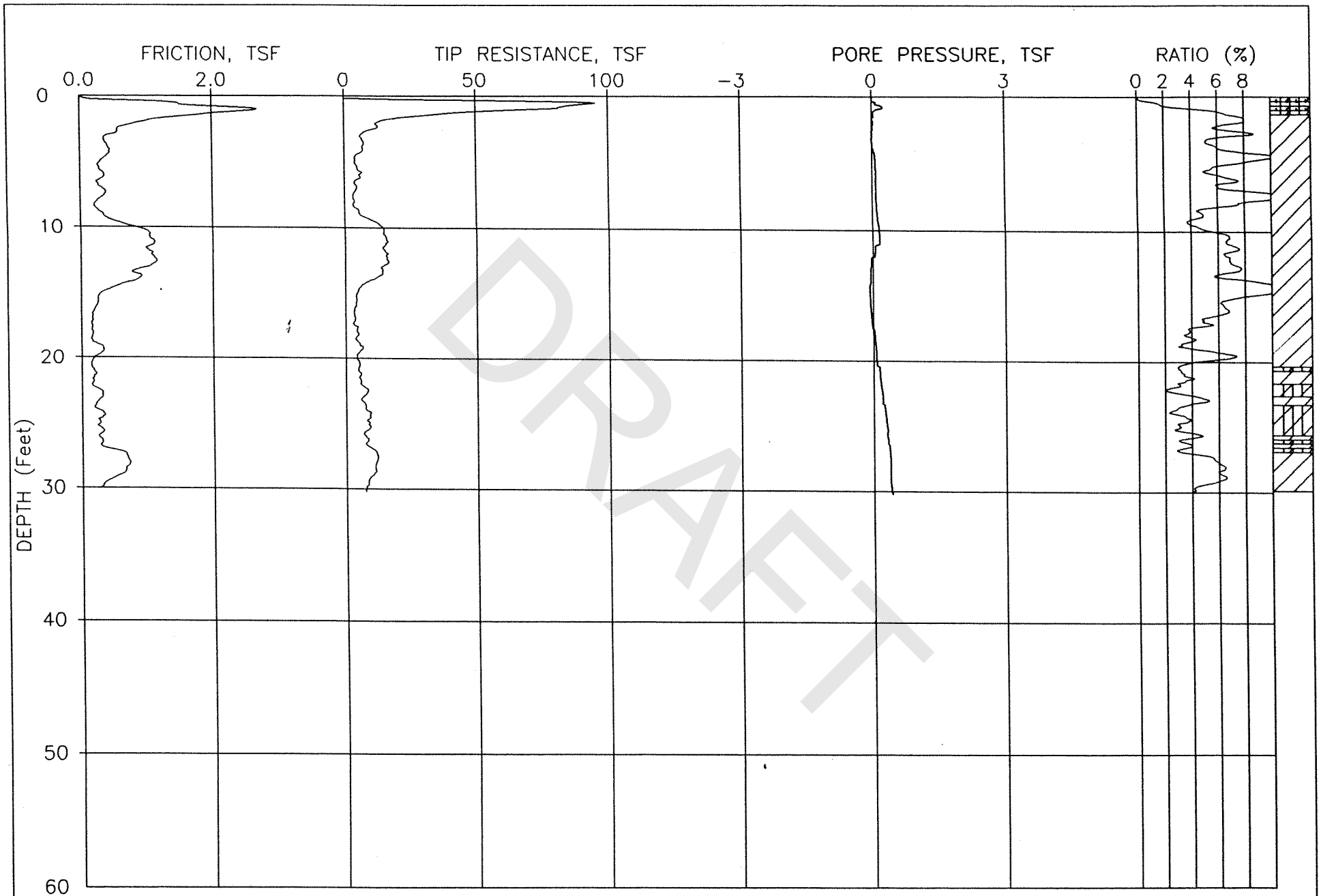
DATE: 04−02−2004

ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1116

PLATE: 2 OF 2

FUGRO GEOSCIENCES,INC



JOB NUMBER: 0303−0970

CPT NUMBER: C4

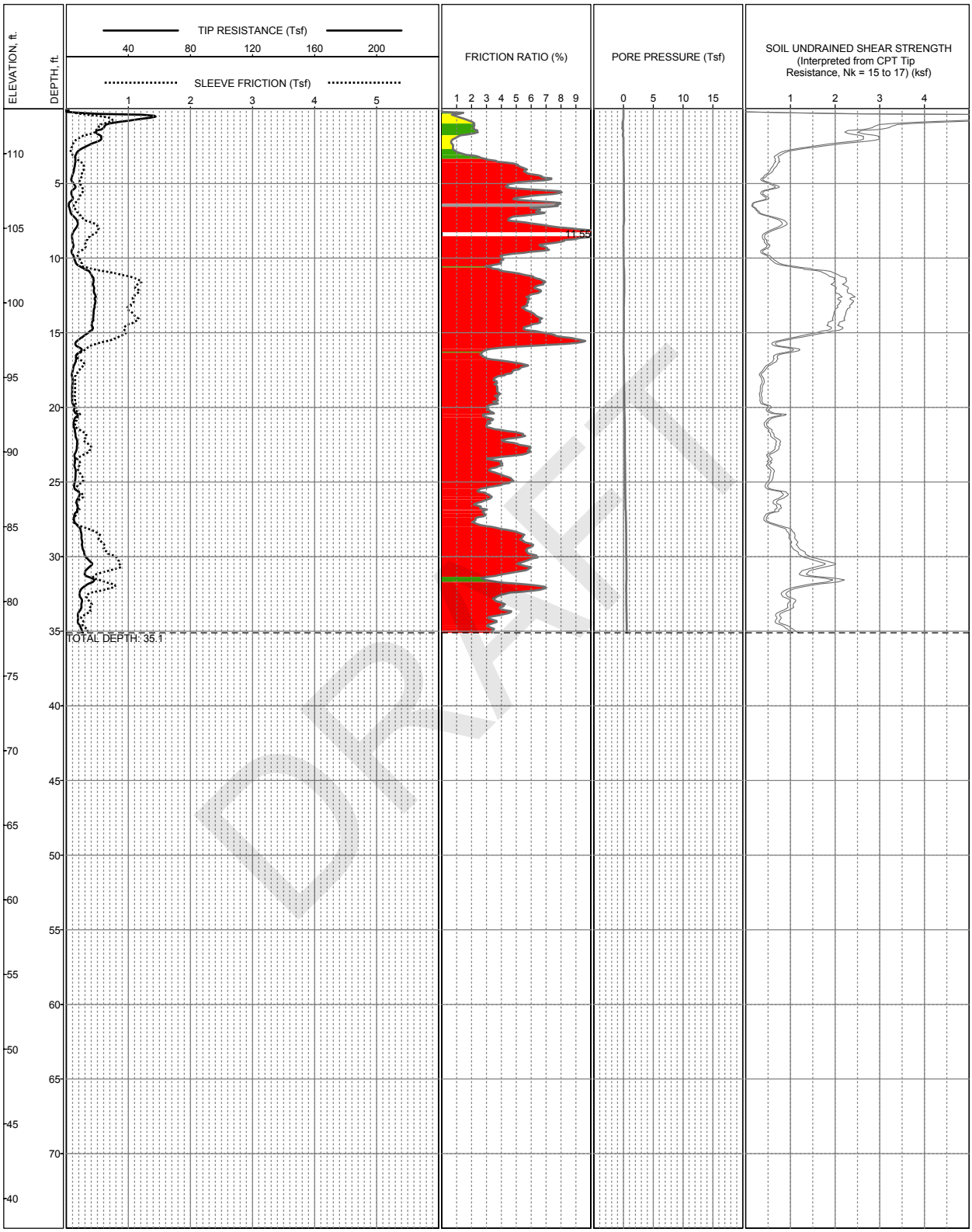
DATE: 04−02−2004

ELEVATION: 0.00

CONE NUMBER: F7.5CKEW1116

PLATE: 1 OF 1

FUGRO GEOSCIENCES,INC

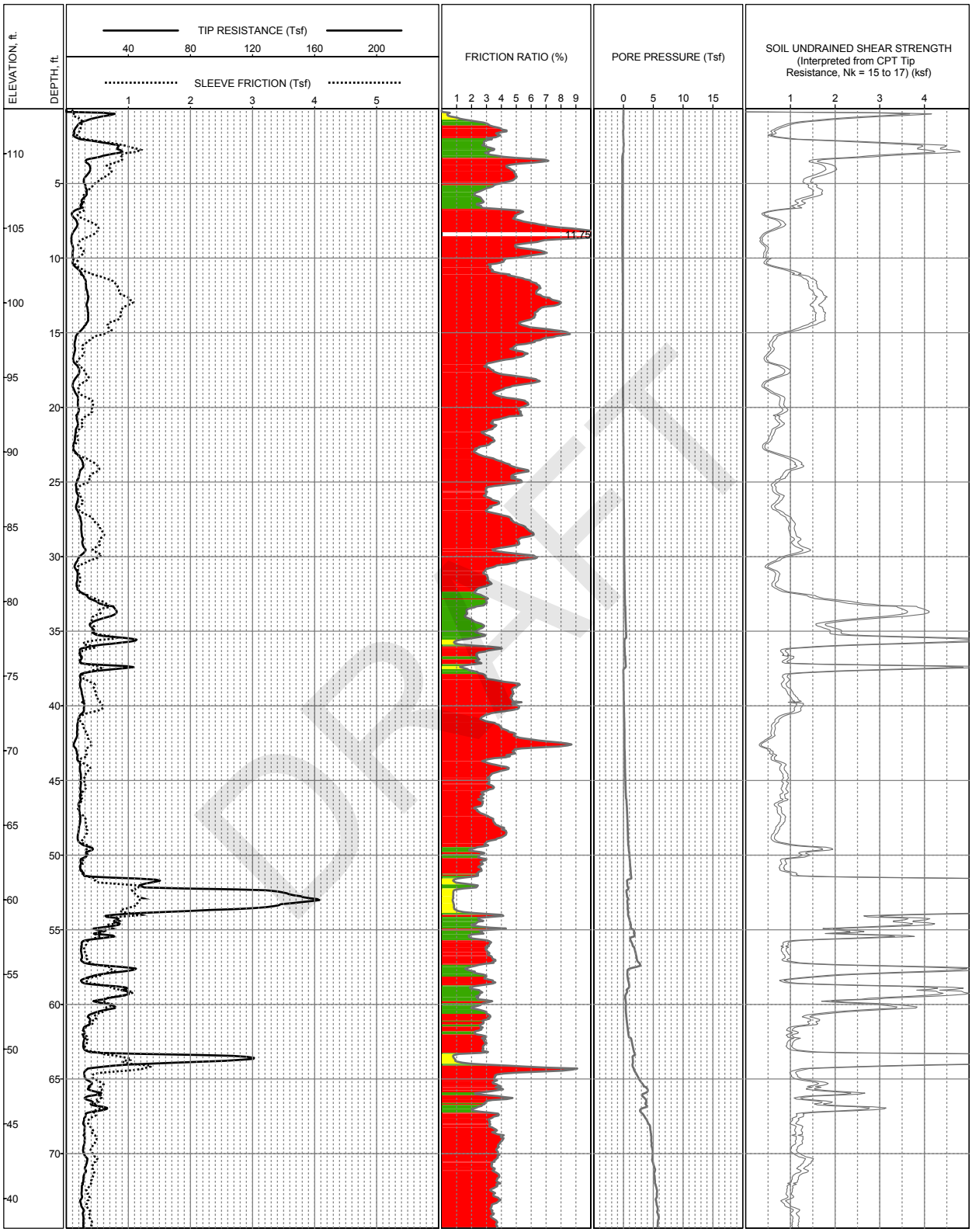


LOCATION:
SURFACE EL: 113ft +/- (MLLW)
COMPLETION DEPTH: 35.1ft
TESTDATE: 4/2/2004

EXPLORATION METHOD: CPT
PERFORMED BY: Fugro Geosciences
REVIEWED BY: Sindhu Rudianto

LOG OF CPT - 1A

Geotechnical Study - Watsonville RWF Project
Watsonville, CA

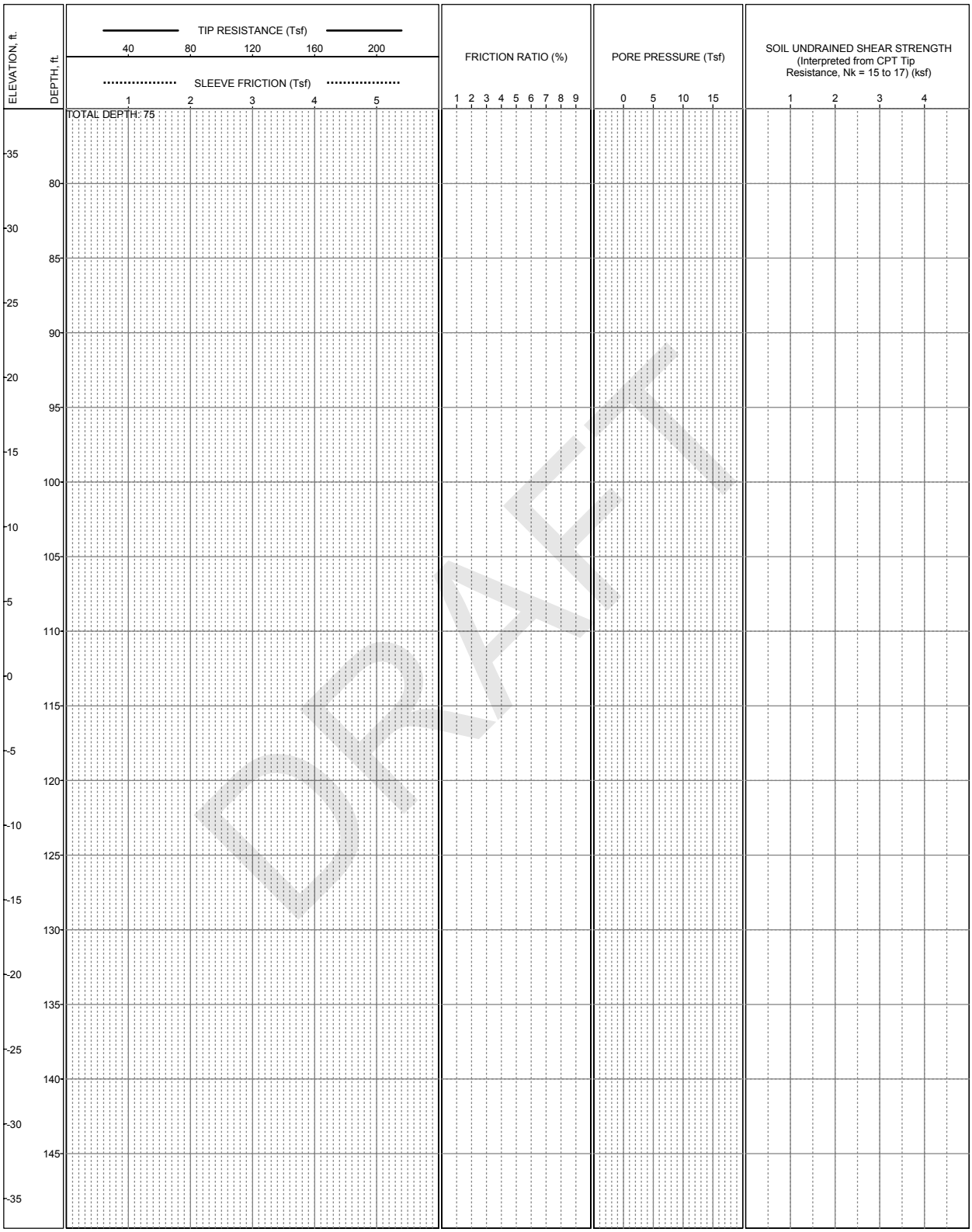


LOCATION:
SURFACE EL: 113ft +/- (MLLW)
COMPLETION DEPTH: 75ft
TESTDATE: 4/2/2004

EXPLORATION METHOD: CPT
PERFORMED BY: Fugro Geosciences
REVIEWED BY: Sindhu Rudianto

LOG OF CPT - 3

Geotechnical Study - Watsonville RWF Project
Watsonville, CA



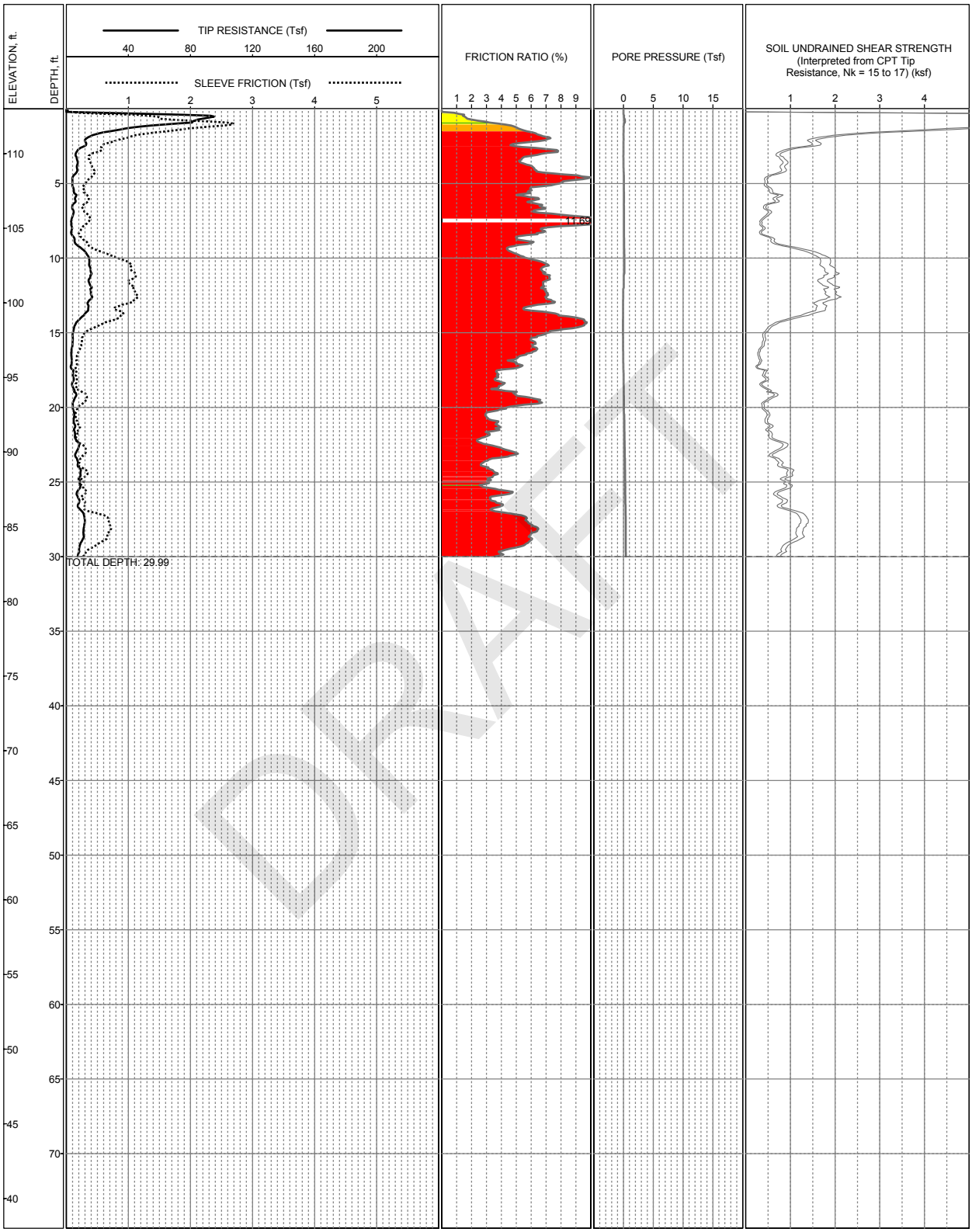
DRAFT

LOCATION:
SURFACE EL: 113ft +/- (MLLW)
COMPLETION DEPTH: 75ft
TESTDATE: 4/2/2004

EXPLORATION METHOD: CPT
PERFORMED BY: Fugro Geosciences
REVIEWED BY: Sindhu Rudianto

LOG OF CPT - 3

Geotechnical Study - Watsonville RWF Project
Watsonville, CA



LOCATION:
SURFACE EL: 113ft +/- (MLLW)
COMPLETION DEPTH: 29.99ft
TESTDATE: 2/4/2004

EXPLORATION METHOD: CPT
PERFORMED BY: Fugro Geosciences
REVIEWED BY: Sindhu Rudianto

LOG OF CPT - 4

Geotechnical Study - Watsonville RWF Project
Watsonville, CA

EXHIBIT 3.4
PUMP CURVE AND CUT SHEETS, 2013

PACIFIC
Water Resources
1499 Bayshore Boulevard, Suite 201
Burlingame, California 94010-1741
(650) 259-0320 • Fax (650) 259-0322
www@pacificwaterresources.com

March 13, 2013

TO: Carollo Engineers

Attention: Paul Friedlander
PFriedlander@carollo.com

RE: City of Watsonville/Flowserve Pumps

Paul:

Please find a curve for the Flowserve 12 EHL-5 stage.

We would use a 100 hp. motor.

If we can be of further assistance, please call.

Very truly yours,

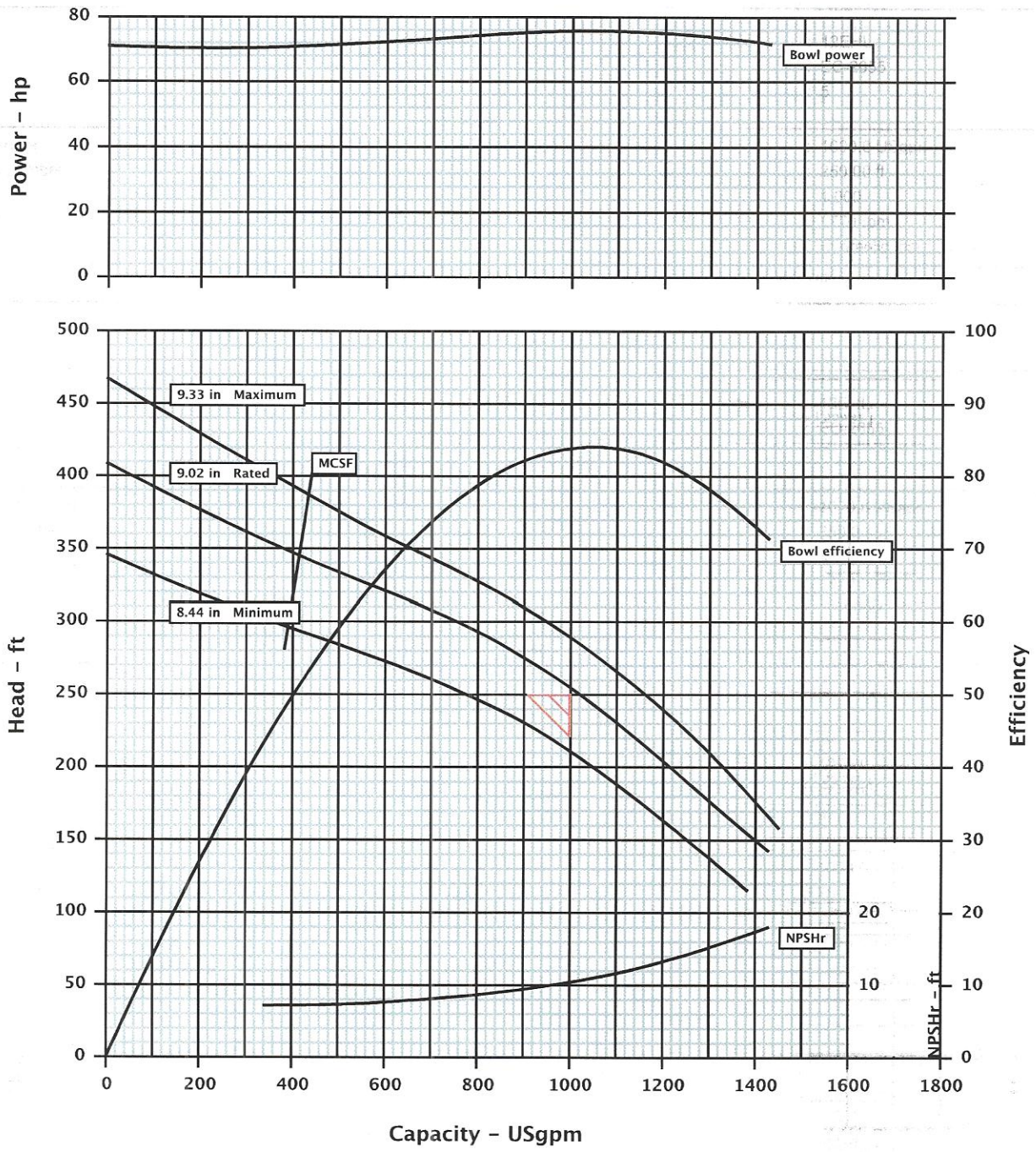
Alan Bonkowski

Ab:ss

FLOWSERVE		Pump size & type	: 12EHL
		Based on curve no.	: EC-2655
		Number of stages	: 5
Customer	: Pacific Water Resources	Capacity	: 1000.0 USgpm
Item number	: -	Head	: 250.00 ft
Service	:	Specific gravity	: 1.000
Flowserve reference	: Default 0.1	Pump speed	: 1770 rpm
Date	: March 13, 2013	Test tolerance	: Hydraulic Institute Level A

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.

Bowl performance shown below is corrected for materials, viscosity and construction.



Bowl head of 255.33 ft corresponds with 250.0 ft head at discharge flange adjusted for elevation and friction losses.

Copyright © 2009 Flowserve. All rights reserved.

FlowSelex v2.2

FLOWSERVE

Hydraulic Datasheet

Customer	: Pacific Water Resources	Pump / Stages	: 12EHL / 5
Customer reference	: Default	Based on curve no.	: EC-2655
Item number	: -	Flowserve reference	: Default 0.1
Service	:	Date	: March 13, 2013

Operating Conditions

Capacity	: 1000.0 USgpm
Water capacity (CQ=1.00)	: -
Normal capacity	: -
Total Developed Head	: 250.00 ft
Water head (CH=1.00)	: -
NPSH available (NPSHa)	: Ample
NPSHa less NPSH margin	: -
Maximum suction pressure	: Not applicable
Rated suction pressure	: Not applicable

Liquid

Liquid type	: Other
Liquid description	:
Temperature / Spec. Gravity	: 60 F / 1.000
Viscosity / Vapor pressure	: 1.0 cSt / -

Materials / Specification

Material column code	: B30

Other Requirements

Hydraulic selection : No specification
Construction : No specification
Test tolerance : Hydraulic Institute Level A
Driver Sizing : Max Power(MCSF to EOC)with SF

Performance

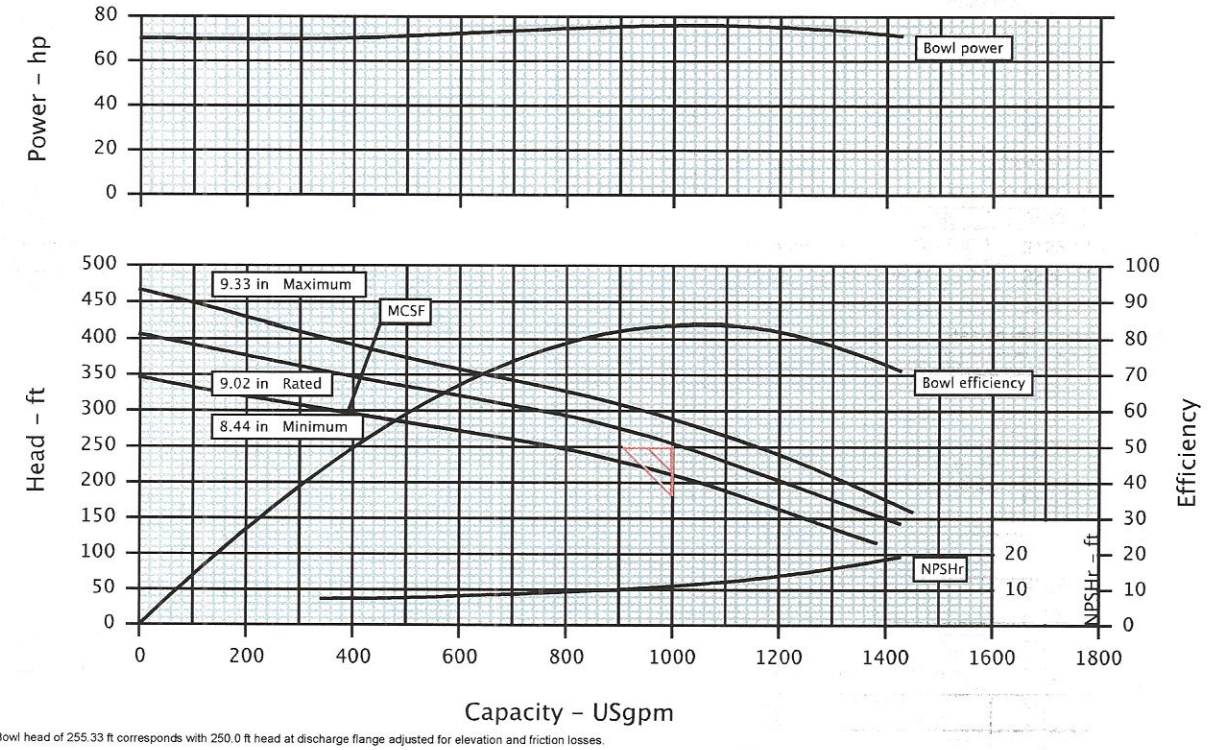
Pump speed	: 1770 rpm		
NPSH required (NPSHr)	: 10.0 ft		
Minimum submergence	: 24.00 in		
Hydraulic power	: 64.4 hp		
Efficiency (CE=1.00)	: 83.8 %		
Power: (Rated / Max)	: 76.9 hp / 77.0 hp		
Driver power	: 100.0 hp / 74.6 kW		
Bowl Pressure	: 176.7 psig		
(based on shut off and Rated specific gravity @ Cut dia)			
Maximum allowable	: 175.0 psig		
Bowl & column hydrotest	: 220.9 psig		
Dischg Head Dischg Region MAWP	: 175.0 psig		

Impeller diameter	: Rated	/ Maximum	/ Minimum
	: 9.02 in	9.33 in	8.44 in
Impeller dia ratio (rated/max)	: 96.7 %		
Maximum head @ rated dia	: 408.25 ft		
Head rise to shut off	: 59.9 %		
Total head ratio (rated/max)	: 88.1 %		
Flow at BEP	: 1048.4 USgpm		
Flow as % of BEP	: 95.4 %		
Minimum continuous flow	: 416.3 USgpm		
Suction specific speed	: 9660 US units		
Rated thrust (at Rated flow)	: 2125.1 lbf		
Maximum thrust (at Shut off flow)	: 3306.6 lbf		
Minimum thrust (at Runout flow)	: 1246.9 lbf		

(A negative thrust value indicates an upthrust condition)

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.

Bowl performance shown below is corrected for materials, viscosity and construction.



Bowl head of 255.33 ft corresponds with 250.0 ft head at discharge flange adjusted for elevation and friction losses.

Copyright © 2009 Flowserve. All rights reserved.

Customer	: Pacific Water Resources	Pump / Stages	: 12EHL / 5
Customer reference	: Default	Based on curve no.	: EC-2655
Item number	: -	Flowserve reference	: Default 0.1
Service	:	Date	: March 13, 2013

Construction

Bowl construction / lined	: Flanged - Std Wall / Lined bowls
Impeller type	: Enclosed
Impeller fastening	: Colleted
Suction strainer	: Basket
Column construction	: Threaded
Column flange spec'n	: Taneytown Specification
Column dia (nominal)	: 10.00 in
Column pipe length	: 0.50 ft
Column section length	: 120.00 in
Lineshaft brg spacing	: 120.00 in
Lineshaft diameter	: 1.69 in
Lineshaft coupling type	: Threaded coupling
Lineshaft bearings, qty	: 1
Lineshaft construction	: Open
Lineshaft lubrication	: Pumpage
Enclosing tube diameter	: -
Disch size/rating/face	: 10 inch / 125# ANSI / FF
Pump/driver coupling	: No coupling - hollow shaft motor

"W" - Cast Above grade Discharge

Driver Information

Manufacturer	: Flowserve Choice	
Power / SF (Req' / Act')	: 100.0 hp / 74.6 kW	/ 1.0
Vertical shaft type	: Hollow	
Hollow shaft coupling		
Driver Type	: Electric motor	
Frame size / Base dia	: -	
Enclosure	: -	
Duty type		
Efficiency type		
Hazardous area class	: -	
Explosion 'T' rating	: -	
Volts / Phase / Hz	: -	/ - / -
Amps-full load/locked rotor	: -	/ -
Motor starting	: Direct on line (DOL)	
Insulation	: -	
Temperature rise	: -	
Bearings / Lubrication	: -	/ -
Motor mounted by	: Customer	
Motor Thrust rating down/up	: -	/ -

Materials

Bowl	: Cast iron (A48 CL30)
Impeller	: Bronze
Bowl bearing	: Bronze (C84400)
Bowl shaft	: 416SS (A582 Gr 416)
Bowl wear ring	: None supplied
Impeller wear ring	: None supplied
Suction strainer	
Column	: Steel A53 Type E GrB
Lineshaft	: 416 stainless steel
Lineshaft bearing	: Rubber (Buna-N)
Lineshaft sleeve	
Discharge head	: Cast iron (A48 CL30)
Support plate	: None supplied

Seal Information

Arrangement	: Packed Box	
Size	: -	
Manufacturer / Type	: -	/ Packing
Material code (Man'f/API)	: -	/ -
Gland material	: -	
Auxiliary seal device	: -	
Seal flush plan	: -	
Seal flush construction	: -	

Paint and Package

Pump paint	: -
Support plate paint	: -
Shipment type	: -

Additional information

Pit / sump depth	: 7.04 ft
Pump length	: 6.88 ft
mounting surface to bell/strainer bottom	
Available well diameter	: 100.00 in
Max dia below mtg surface	: 15.50 in

Weights (Approx.)

Complete pump	: -
Mounting plate	: -
Driver(nett)	: -

Testing

Hydrostatic test	: None
Performance test	: None
NPSH test	: None

Notes

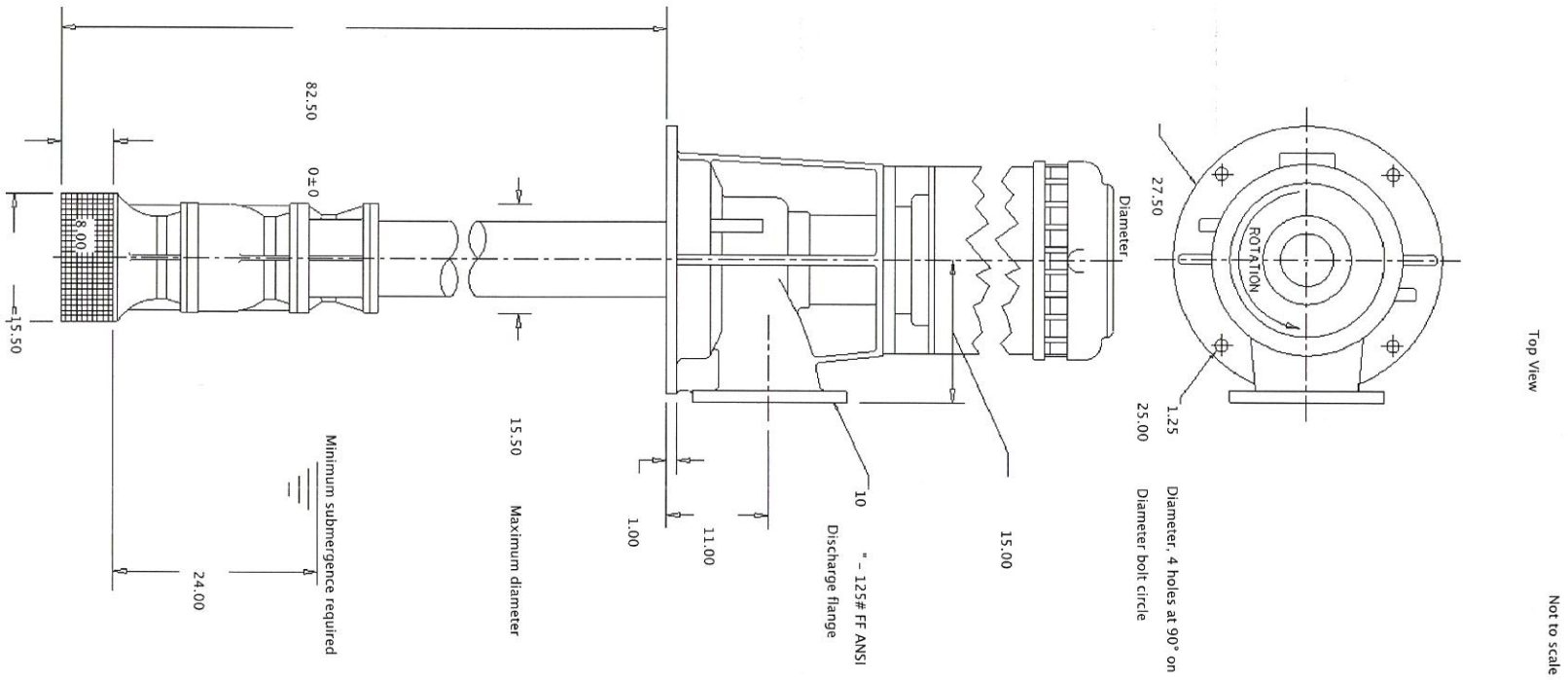
-

Discharge flange is designed only to bolt up to an ANSI 125# flange but is not fully ANSI compliant.

-

-

Copyright © 2009 Flowserve. All rights reserved.

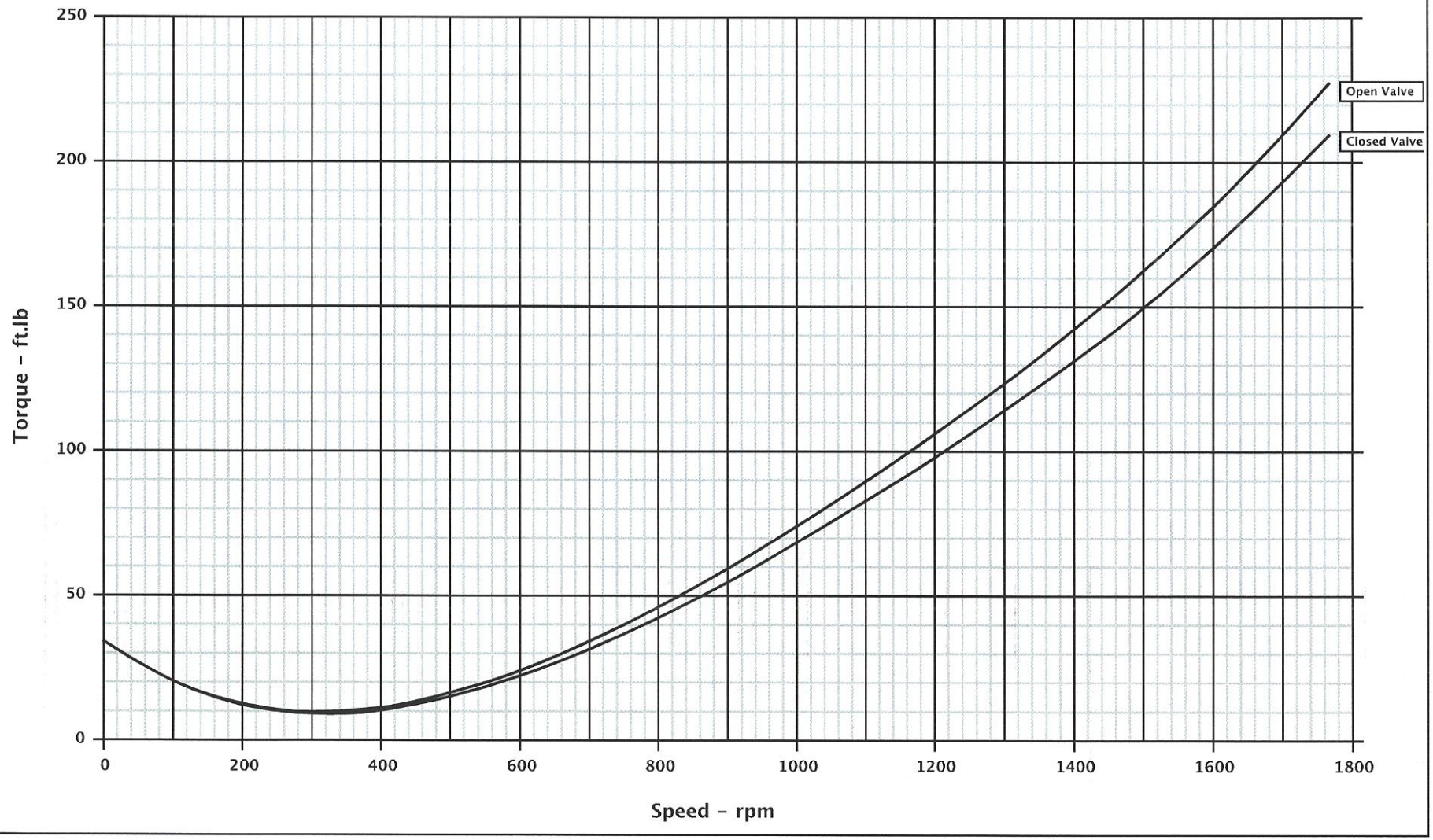


All dimensions are in inches unless otherwise specified

Customer	: Pacific Water Resources	Pump size & type	: 12EHL	Drawing number	: -
Item number	: -	Pump speed / Stages	: 1770 rpm / 5	Date	: March 13, 2013
Service	:	Flow / Head	: 1000.0 USgpm / 250.00 ft	Certified by / Date :	: -
Customer PO #	: -	Driver power / Frame	: 100.0 hp / 74.6 kW /	Seal type	: Packing
Flowserve reference	: Default 0.1	Volts / Phase / Hz	: - / - / -	Seal flush plan	: -

Copyright © 2009 Flowserve. All rights reserved.

Customer	: Pacific Water Resources			Pump size & type	: 12EHL
Item Number	: -			Based on curve no.	: EC-2655
Service	:			Number of stages	: 5
Flowserve Reference	: Default 0.1				
Date	: March 13, 2013				
		Capacity	: 1000.0 USgpm	Specific gravity	: 1.000
		Head	: 250.00 ft	Pump speed	: 1770 rpm



Copyright © 2009 Flowserve. All rights reserved.

FlowSelex v2.2

EXHIBIT 3.5
2002 BMP EIR

Pajaro Valley Water Management Agency

Draft

PAJARO VALLEY WATER MANAGEMENT AGENCY REVISED BASIN MANAGEMENT PLAN

Environmental Impact Report

SCH# 2000062030

October 2001

Prepared for

Pajaro Valley Water Management Agency

ESA Environmental Science Associates

This page left
intentionally blank

Draft

PAJARO VALLEY WATER MANAGEMENT AGENCY REVISED BASIN MANAGEMENT PLAN

Environmental Impact Report

SCH# 2000062030

October 2001

Prepared for

Pajaro Valley Water Management Agency

700 University Avenue, Suite 130
Sacramento, California 95825
(916) 564-4500

1000 Broadway, Suite 410
Oakland, California 94607
(510) 839-5066

225 Bush Street, Suite 1700
San Francisco, California 94104
(415) 896-5900

4221 Wilshire Boulevard, Suite 480
Los Angeles, California 90010
(323) 933-6111

2685 Ulmerton Road, Suite 102
Clearwater, Florida 33762
(727) 572-5226

700 Fifth Avenue, Suite 4120
Seattle, Washington 98104
(206) 206-0900

ESA Environmental Science Associates

200179

This page left
intentionally blank

TABLE OF CONTENTS

REVISED BASIN MANAGEMENT PLAN
ENVIRONMENTAL IMPACT REPORT

		Page
	ACRONYMS	**vii**
	SUMMARY	**S-1**
1.	**INTRODUCTION**	**1-1**
	1.1 Purpose of the EIR	1-1
	1.2 CEQA EIR Process	1-2
	1.3 Project Approval and Permitting Process	1-8
	1.4 Organization of the Draft EIR	1-8
2.	**PROJECT DESCRIPTION**	**2-1**
	2.1 Project Overview and Background	2-1
	2.2 Need for Project and Project Objectives	2-6
	2.3 BMP 2000 Alternative	2-12
	2.4 Local-Only Alternative	2-27
	2.5 Required Permits and Approvals	2-38
	2.6 Project Schedule and Cost	2-41
3.	**REGIONAL SETTING**	**3-1**
	3.1 Land Use and Planning	3.1-1
	3.2 Geology, Soils, and Seismicity	3.2-1
	3.3 Hydrology and Water Quality	3.3-1
	3.4 Vegetation, Fish, and Wildlife	3.4-1
	3.5 Cultural Resources	3.5-1
	3.6 Traffic and Circulation	3.6-1
	3.7 Air Quality	3.7-1
	3.8 Noise	3.8-1
	3.9 Public Services	3.9-1
	3.10 Visual/Aesthetic and Recreational Resources	3.10-1
4.	**BMP 2000 ALTERNATIVE – ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION MEASURES**	**4.A.1-1**
	4.A Water Recycling	
	4.A.1 Land Use and Planning	4.A.1-1
	4.A.2 Geology, Soils, and Seismicity	4.A.2-1
	4.A.3 Hydrology and Water Quality	4.A.3-1
	4.A.4 Vegetation, Fish, and Wildlife	4.A.4-1
	4.A.5 Cultural Resources	4.A.5-1

Page

4. BMP 2000 ALTERNATIVE – ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION MEASURES (Continued)

4.A Water Recycling (continued)

4.A.6	Traffic and Circulation	4.A.6-1
4.A.7	Air Quality	4.A.7-1
4.A.8	Noise	4.A.8-1
4.A.9	Public Services	4.A.9-1
4.A.10	Visual/Aesthetic and Recreation Resources	4.A.10-1

4.B Groundwater Banking

4.B.1	Land Use and Planning	4.B.1-1
4.B.2	Geology, Soils, and Seismicity	4.B.2-1
4.B.3	Hydrology and Water Quality	4.B.3-1
4.B.4	Vegetation, Fish, and Wildlife	4.B.4-1
4.B.5	Cultural Resources	4.B.5-1
4.B.6	Traffic and Circulation	4.B.6-1
4.B.7	Air Quality	4.B.7-1
4.B.8	Noise	4.B.8-1
4.B.9	Public Services	4.B.9-1
4.B.10	Visual/Aesthetic and Recreation Resources	4.B.10-1

4.C Change in Place of Use **4.C-1**

5. LOCAL-ONLY ALTERNATIVE – ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION MEASURES **5.A.1-1**

5.A Water Recycling

5.A.1	Land Use and Planning	5.A.1-1
5.A.2	Geology, Soils, and Seismicity	5.A.2-1
5.A.3	Hydrology and Water Quality	5.A.3-1
5.A.4	Vegetation, Fish, and Wildlife	5.A.4-1
5.A.5	Cultural Resources	5.A.5-1
5.A.6	Traffic and Circulation	5.A.6-1
5.A.7	Air Quality	5.A.7-1
5.A.8	Noise	5.A.8-1
5.A.9	Public Services	5.A.9-1
5.A.10	Visual/Aesthetic and Recreation Resources	5.A.10-1

5.B Expanded College Lake

5.B.1	Land Use and Planning	5.B.1-1
5.B.2	Geology, Soils, and Seismicity	5.B.2-1
5.B.3	Hydrology and Water Quality	5.B.3-1
5.B.4	Vegetation, Fish, and Wildlife	5.B.4-1
5.B.5	Cultural Resources	5.B.5-1
5.B.6	Traffic and Circulation	5.B.6-1
5.B.7	Air Quality	5.B.7-1
5.B.8	Noise	5.B.8-1
5.B.9	Public Services	5.B.9-1
5.B.10	Visual/Aesthetic and Recreation Resources	5.B.10-1

Page

5. LOCAL-ONLY ALTERNATIVE – ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION MEASURES (Continued)

5.C Corralitos Creek and Pinto Lake Diversions

5.C.1	Land Use and Planning	5.C.1-1
5.C.2	Geology, Soils, and Seismicity	5.C.2-1
5.C.3	Hydrology and Water Quality	5.C.3-1
5.C.4	Vegetation, Fish, and Wildlife	5.C.4-1
5.C.5	Cultural Resources	5.C.5-1
5.C.6	Traffic and Circulation	5.C.6-1
5.C.7	Air Quality	5.C.7-1
5.C.8	Noise	5.C.8-1
5.C.9	Public Services	5.C.9-1
5.C.10	Visual/Aesthetic and Recreation Resources	5.C.10-1

5.D Aquifer Storage and Recovery

5.D.1	Land Use and Planning	5.D.1-1
5.D.2	Geology, Soils, and Seismicity	5.D.2-1
5.D.3	Hydrology and Water Quality	5.D.3-1
5.D.4	Vegetation, Fish, and Wildlife	5.D.4-1
5.D.5	Cultural Resources	5.D.5-1
5.D.6	Traffic and Circulation	5.D.6-1
5.D.7	Air Quality	5.D.7-1
5.D.8	Noise	5.D.8-1
5.D.9	Public Services	5.D.9-1
5.D.10	Visual/Aesthetic and Recreation Resources	5.D.10-1

6. OTHER ALTERNATIVES **6-1**

6.1	CEQA Requirements for Alternatives Evaluations	6-1
6.2	Alternatives Formulation	6-2
6.3	Comparison of Alternatives	6-19
6.4	Alternatives Not Evaluation in This EIR	6-25

7. GROWTH INDUCEMENT POTENTIAL **7-1**

7.1	Overview of Growth Inducement Evaluation	7-1
7.2	Setting	7-2
7.3	Impacts and Mitigation Measures	7-6

8. IMPACT OVERVIEW **8-1**

8.1	Significant Environmental Effects That Cannot Be Avoided if the Proposed Project is Implemented	8-1
8.2	Cumulative Impacts	8-2
8.3	Socioeconomic Effects	8-9
8.4	Significant Irreversible Environmental Changes Which Would Be Involved in the Proposed Action Should It Be Implemented	8-14

9. REPORT PREPARERS **9-1**

Page

MAP APPENDICES

A1-A4 Proposed Pipeline Alignment; Seismic Hazards in the Project Area
B1-B4 Proposed Pipeline Alignment; Habitat Characterization in the Project Area

APPENDICES (Bound Separately)

A. Plant Species Observed in the Study Area A-1
B. Bird Species Observed During Breeding Surveys B-1
C. Fisheries Resources of the Lower Pajaro River and its Tributaries C-1
D. Determination of the Minimum Bypass Flow in Corralitos Creek for the Expanded College Lake Project D-1
E. Alternative Alignments to the Import Pipeline E-1
F. Technical Memorandum 2.2 – Hydrologic Analysis and Modeling F-1

LIST OF FIGURES

2.1 PVWMA Service Area 2-4
2.2 Seawater Intrusion Areas of Elevated Chloride Levels (100 mg/l or Greater), 1951 and 2000 2-7
2.3 Groundwater Recharge vs. Pumping/Demand 2-8
2.4 BMP 2000 Alternative Facilities 2-13
2.5 Water Recycling Component of the BMP 2000 Alternative 2-16
2.6 Recycled Water Facility Conceptual Site Plan – City of Watsonville 2-20
2.7 Tertiary Treatment Process Schematic 2-21
2.8 Local-Only Alternative - Proposed Facilities 2-28
2.9 North Dunes Recharge Basin 2-31
2.10 Expanded College Lake Facilities 2-33
3.1-1 Existing Land Use in the PVWMA Service Area 3.1-2
3.1-2 Recreational and Sensitive Land Uses in the Project Area 3.1-3
3.2-1 Regional Fault Map 3.2-2
3.3-1 Hydrologic Variability in the Pajaro River Basin 3.3-2
3.3-2 Clay Layers in the Pajaro Groundwater Basin 3.3-6
3.3-3 Chloride Concentrations in the PVWMA Service Area 3.3-10
3.3-4 Nitrate Concentrations in the PVWMA Service Area 3.3-12
3.6-1 Major Roadways in the Project Area 3.6-2
3.8-1 Effect of Noise on People 3.8-2
3.10-1 Photographs of the Project Area 3.10-2
3.10-2 Photographs of the Project Area 3.10-3
4.A.4-1 Wildlife Habitats Associated with Proposed Water Recycling Facilities 4.A.4-2
4.B.3-1 Agricultural Crop Mix 4.B.3-4
4.C.3-1 Land Uses in the PVWMA Service Area 4.C-4
4.C.3-2 Irrigated Agricultural Lands in the PVWMA Service Area 4.C-9
4.C.3-3 Existing Irrigated Agricultural Lands with Import Pipeline and Inland and Coastal Distribution Systems 4.C-11
5.A.3-1 Conceptual Site Plan – Title 22 plus Groundwater Recharge Treatment Facilities 5.A.3-6
6.1 Modified BMP 2000 Alternative Flow Schematic 6-6
6.2 Modified Local-Only Alternative Flow Schematic 6-11

Page

LIST OF TABLES

S.1	Comparison of Local-Only and 2000 BMP Alternatives	S-2
S.2	Summary of Impacts and Mitigation Measures	S-14
S.3	Comparison of Alternatives—Distinguishing Environmental Issues	S-8
1.1	Summary of Issues Raised During Scoping	1-3
2.1	Comparison of Local-Only and BMP 2000 Alternatives	2-2
2.2	Existing and Future Water Supplies, Required Supplemental Supplies	2-10
2.3	Water Quality Concentrations of Candidate Water Supply Sources	2-18
2.4	Potential Permits and Approvals	2-39
2.5	Costs Associated with the Local-Only and BMP 2000 Alternatives	2-41
3.2.1	Primary Faults in the Project Site Vicinity	3.2-4
3.2.2	Modified Mercalli Intensity Scale	3.2-5
3.3.1	Average Summary Statistics for Chloride in all Wells	3.3-9
3.3.2	Average Summary Statistics for Nitrate in all Wells	3.3-11
3.3.3	Average Summary Statistics for Boron in all Wells	3.3-13
3.3.4	Summary of Title 22 Treatment Requirements for Recycled Water	3.3-18
3.3.5	Impaired Water Bodies	3.3-20
3.4.1	Comparison of Terminology for Vegetation Types in Wildlife Habitat Relationships and Natural Communities Occurring in the Study Area	3.4-2
3.4.2	Special-Status Plant Species Known to from the Region of the Pajaro Valley Water Management Agency Local Water Supply Distribution Facilities Project	3.4-4
3.4.3	Name, Status, Habitat, Known Localities and Likelihood of Occurrence in the Study Area for Special-Status Wildlife Species	3.4-6
3.6.1	Existing Daily Traffic Volumes on Roadways in Vicinity of Project Area	3.6-4
3.6.2	Reported Roadway Accident Rates in the Project Area	3.6-6
3.6.3	Planned Transportation Improvement Projects in the Project Area	3.6-8
3.7.1	Salinas Air Pollutant Summary, 1995-1997	3.7-4
4.A.2-1	Soils in the Watsonville Wastewater Treatment Plant Area and Along Proposed Facilities	4.A.2-2
4.A.3-1	WWTF Recycled Water Quality	4.A.3-2
4.A.3-2	WWTF Water Quality (Metals) Summary	4.A.3-2
4.B.1-1	Land Uses Along the Import Pipeline Alignment	4.B.1-1
4.B.2-1	Soil Properties Along the Proposed Pipeline	4.B.2-3
4.B.2-2	Areas of Unstable Slopes Along the Proposed Pipeline Alignment	4.B.2-8
4.B.2-3	Locations of Fault Crossings	4.B.2-10
4.B.2-4	Areas Subject to Settlement and Expansive Soils	4.B.2-14
4.B.2-5	Locations of Soils with High Corrosivity	4.B.2-15
4.B.3-1	Estimated End-of Simulation Groundwater Elevations in the Alluvium Aquifer	4.B.3-7
4.B.3-2	Estimated Seawater Intrusion Rates and Subsurface Outflow to Monterey Bay	4.B.3-8
4.B.4-1	Estimated Extent of Habitat Loss resulting from the Proposed Project	4.B.4-6
4.B.6-1	Roadways Affected by Import Pipeline Construction	4.B.6-8
4.B.8-1	Typical Construction Equipment Noise Levels	4.B.8-2
4.C-1	PVWMA Population Projections and Urban Water Use	4.C-6
4.C-2	Summary of Potential Impacts Within a Willing Seller Service Area Associated with CVP Contract Assignment to PVWMA	4.C-15
5.A.2-1	Summary of Geologic Conditions Water Recycling Project Components	5.A.2-2

Page

LIST OF TABLES (Continued)

5.A.2-2	Soils in the Watsonville Wastewater Treatment Plant Area and Along the Proposed Facilities	5.A.2-3
5.B.2-1	Soils in the College Lake Area and Along Proposed Facilities	5.B.2-2
5.C.2-1	Soils in the Corralitos Creek and Pinto Lake Area	5.C.2-2
5.D.2-1	Summary of Geologic Conditions Water Recycling Project Components	5.D.2-2
5.D.2-2	Soils in the Aquifer Storage and Recovery Project Area and Along Proposed Facilities	5.D.2-3
5.D.3-1	Water Quality Summary Surface Water Supply Features	5.D.3-3
6.1	Basin Management Plan Projects Considered	6-3
6.2	Comparison of Alternatives—Distinguishing Environmental Issues	6-21
7.1	AMBAG Population Projections	7-3
8.1	Planned and Approved Projects in the Project Area and Vicinity	8-3
8.2	Acreage Removed From Agricultural Production	8-5
8.3	Costs Associated With the Local-Only and BMP 2000 Alternatives	8-11

LIST OF ACRONYMS

af – acre-foot (feet)
afy – acre-feet per year
AMBAG – Association of Monterey Bay Area Governments
APCD – Air Pollution Control District
AQMP – Air Quality Management Plan
ASR – Aquifer Storage and Recovery
bgs – below ground surface
BMP – Basin Management Plan
BOD – biological oxygen demand
CAA – (California) Clean Air Act
Caltrans – California Department of Transportation
CARB – California Air Resources Board
CCR – California Code of Regulations
CCRWQCB – (Central Coast) Regional Water Quality Control Board
CDFG – California Department of Fish and Game
CDMG – California Division of Mines and Geology
CDS – Coastal Distribution System
CEQA – California Environmental Quality Act
CEQA – California Environmental Quality Act
CESA – California Endangered Species Act
CFR – Code of Federal Regulations
cfs – cubic feet per second
CHP – California Highway Patrol
CIMIS – California Irrigation Management Information Service
CMA – Congestion Management Agency
CMP – Congestion Management Program
CNDDB – California Natural Diversity Data Base
CNEL – Community Noise Equivalent Level
CNPS – California Native Plant Society
CO – carbon monoxide
Corps – U.S. Army Corps of Engineers
CPOU – Consolidated Place of Use
CPUC – California Public Utilities Commission
CVP – Central Valley Project
CVPIA – Central Valley Project Improvement Act
CWA – Clean Water Act
CWC – California Water Commission
CY – cubic yards
dB – decibels
dBA – A-weighted decibels.
DEIR – Draft Environmental Impact Report
DHS – (California) Department of Health Services
DMS – Data Management System
DOF – (California) Department of Finance
DSOD – Division of Safety of Dams
DWR – (California) Department of Water Resources
EA/FONSI – Environmental Assessment and Findings of No Significant Impact
EC – electrical conductivity
EIR – Environmental Impact Report
EPA – U.S. Environmental Protection Agency
ERNS – Emergency Response Notification System
ESA – Environmental Science Associates
ESU – South-central Coast Evolutionarily Significant Unit
FEMA – Federal Emergency Management Agency
FESA – Federal Endangered Species Act
FIRM – Flood Insurance Rate Maps
ft – foot (feet)
FWS – U.S. Fish and Wildlife Service
GIS – geographic information system
gpm – gallons per minute
GPS – Global positioning system
H:V – horizontal-to-vertical
HC – hydrocarbons
HRG – Habitat Restoration Group
ICBO – International Conference of Building Officials

IDS – Inland Distribution System
LCP – Local Coastal Program
Ldn – Noise level descriptor
Leq – energy equivalent noise level (or "average" noise level)
LOA – Local-Only Alternative
LOS – level-of-service
LUP – Land Use Plan
MBUAPCD – Monterey Bay Unified Air Pollution Control District
MCFC &WCD – Monterey County Flood Control and Water Conservation District
MCL – Maximum Containment Level
MCWRA – Monterey County Water Resources Agency
MG – million gallons
mg/L – milligram per liter
mgd – million gallons per day
mg-N/L – milligrams nitrogen per liter
MOA – Memorandum of Agreement
mph – miles per hour
MPWMD – Monterey Peninsula Water Management District
msl – mean sea level
MSWD – Mercy Springs Water District
MVMT – Million Vehicle Miles Traveled
Mw – maximum moment magnitude
NA – not applicable
NAAQS – National Ambient Air Quality Standards
NaOCl – sodium hypochlorite
NCCAB – North Central Coast Air Basin
NEPA – National Environmental Policy Act
NH_4-N – Ammonia as Nitrogen
NMFS – National Marine Fisheries Service
NO_2 – nitrogen dioxide
NO_3 – nitrate
NO_3-N – nitrate as nitrogen
NOAA – National Oceanic and Atmospheric Administration
NOP – Notice of Preparation
NOx – nitrogen oxides
NPDES – National Pollutant Elimination Discharge System
NPL – National Priority List
NTU – Nephelometric Turbidity Units
O & M – operation and maintenance
O_3 – ozone
OSHA – (California) Occupational Safety and Health Administration
PCBs – polychlorinated biphenyls
PCSD – Pajaro Community Services District
PEIR – Programmatic Environmental Impact Report
PEIS – Programmatic Environmental Impact Statement
PG&E – Pacific Gas and Electric
PM_{10} – inhalable particulate matter
ppb – parts per billion
ppm – parts per million
psi – pounds per square inch
PVIGSM – Pajaro Valley Integrated Groundwater Surface Water Model
PVUSD – Pajaro Valley Unified School District
PVWMA – Pajaro Valley Water Management Agency
R/W – right-of-way
RCRA – Resource Conservation and Recovery Act
RMPP – Risk Management and Prevention Plan
RO – Reverse Osmosis
ROG – reactive organic gases
RWC – Recycled Water Contribution
RWF – Recycled Water Facility
RWQCB – Regional Water Quality Control Board
SAAQS – State Ambient Air Quality Standards
SAR – Sodium Adsorption Ratio
SBCWD – San Benito County Water District
SCAQMD – South Coast Air Quality Management District
SCCEPD – Santa Cruz County Environmental Planning Department
SCCFC & WCD – Santa Cruz County Flood Control and Water Conservation District
SCS – U.S. Soil Conservation Service
SCVWD – Santa Clara Valley Water District
SCWD – Soquel Creek Water District
SDWA – Safe Drinking Water Act
SIP – State Implementation Plans

SO_2 – sulfur dioxide
SOI – Sphere of Influence
SPRR – Southern Pacific Railroad
SR – State Route
SWITRS – Statewide Integrated Traffic Reporting System
SWPPP – Stormwater Pollution Prevention Plan
SWRCB – (California) State Water Resources Control Board
TAC – Technical Advisory Committee
TCM – Transportation Control Measures
TDS – Total Dissolved Solids
TMDL – Total Maximum Daily Loads
TRO – Trip Reduction Ordinances
TSS – Total Suspended Solids
TU – turbidity units
TUC R/W – Transportation and Utility Corridor right-of-way
UPRR – Union Pacific Railroad
USBR – United States Bureau of Reclamation
USDA – U.S. Department of Agriculture
USDI – U.S. Department of the Interior
USFWS – United States Fish and Wildlife Service
USGS – U.S. Geological Survey
USSCS – U.S. Soil and Conservation Service
UTM – Universal Transverse Mercator
Valley – Pajaro Valley
vpd – vehicles per day
WC-2000 – Water Conservation Plan 2000
WDR – Waste Discharge Requirements
WHR – Wildlife Habitat Relationships
WWD – City of Watsonville Water Department
WWTF – City of Watsonville Wastewater Treatment Facility
yr – year

This page left
intentionally blank

SUMMARY

S.1 INTRODUCTION

This Environmental Impact Report (EIR) assesses the potential environmental impacts of the draft Revised Basin Management Plan (Revised BMP) proposed by the Pajaro Valley Water Management Agency (PVWMA). This document has been prepared in accordance with the California Environmental Quality Act (CEQA) statutes and guidelines. PVWMA is the lead agency for this CEQA process. Inquiries about the project and the CEQA process should be directed to:

Charles McNiesh, General Manager
Pajaro Valley Water Management Agency
36 Brennan Street
Watsonville, California 95076
(831) 722-9292

S.2 PROJECT DESCRIPTION

PVWMA has prepared the Revised BMP to address water resources management issues in the Pajaro Valley. The Revised BMP provides a review and update of previous water supply studies to outline the extent of the Pajaro Valley's groundwater over-pumping and seawater intrusion problems. The Revised BMP identifies available options and evaluates alternative strategies to meet the agency's objectives, two of which are evaluated in detail in the EIR: the BMP 2000 Alternative and the Local-Only Alternative. **Table S.1** indicates the projects comprising these alternatives. Also evaluated are two variants of these alternatives: the Modified BMP 2000 Alternative and the Modified Local-Only Alternative, as well as a "No Project" alternative. PVWMA has not yet identified a preferred alternative.

S.3 PROJECT OBJECTIVES

The objective of this project stems from the need to augment Pajaro Valley water supplies to address problems of groundwater overdraft and seawater intrusion. These concerns were first documented in 1953. A 1964 Bureau of Reclamation (Reclamation) San Felipe Division feasibility study also confirmed overdraft and seawater intrusion problems in the PVWMA service area.

Overdraft occurs when the amount of groundwater withdrawn from a basin exceeds the amount of water replenishing the basin. In the Pajaro Valley Basin, groundwater levels have declined as

TABLE S.1
COMPARISON OF LOCAL-ONLY AND BMP 2000 ALTERNATIVES

Parameter	Local-Only Alternative	BMP 2000 Alternative
Average Project Yield[a]	14,400 acre-feet per year (afy)	17,000 afy
Conservation Required	10,000 afy	5,000 afy
Project Elements[b]	▪ Recycled Water (approximately 7,700 afy) ▪ Coastal Distribution System ▪ Expanded College Lake with Corralitos Creek and Pinto Lake diversion facilities, Watsonville Slough Diversion, and Harkins Slough Diversion and Aquifer Storage and Recovery Project (6,700 afy)[c]	▪ Recycled Water (4,000 afy) ▪ Coastal Distribution System ▪ CVP Import Pipeline (10,300 afy) with Inland Distribution System ▪ Harkins Slough (1,100 afy) ▪ Murphy Crossing (1,600 afy) ▪ Supplemental wells (for supply, reliability, and peaking) (17 wells)[d]
Water Quality	Total Dissolved Solids (TDS) – 400-900 mg/L	TDS – less than 500 mg/L
Capital Cost of Facilities	**$128 million**[d]	**$162 million**[d]

a Refer to Section 2.2.3, Ability of the Alternatives to Meet the Objectives of the Revised BMP, regarding the differences in average project yield and conservation associated with the two alternatives. Does not include increase in groundwater sustainable yield.

b The following project elements were evaluated in detail in the *Pajaro Valley Water Management Agency Local Water Supply and Distribution Environmental Impact Report* and therefore are not evaluated in this EIR, except as the projects contribute to cumulative impacts: Harkins Slough, Murphy Crossing, Coastal Distribution System, and Inland Distribution System.

c Reflects an estimated 1,500 afy reduction in yield due to mitigation and facility limitations.

d The number of wells required is a function of the reliability of the water supplies selected and is expected to range from two wells (for a strategy that assumes 100-percent reliable surface water supplies) to 17 wells (for a strategy that assumes minimal surface water deliveries during drought years).

e PVWMA is seeking federal funding pursuant to Title XVI for planning, design, and construction of water recycling facilities and facilities that would provide blend water. These costs reflect a $20 million credit for Title XVI funding. PVWMA is also exploring cost-saving opportunities with the U.S. Army Corps of Engineers for the potential expansion of College Lake.

SOURCE: RMC Engineers, 2001; adapted by Environmental Science Associates.

the groundwater pumping rate has exceeded the rate of natural replenishment. These overdraft conditions result in increased pumping costs and land subsidence that in turn can cause building settlement and increased flooding. In the coastal areas overdraft conditions have caused groundwater levels to drop below sea level, creating a landward pressure gradient that causes seawater to move inland, displacing fresh groundwater. The density difference between seawater and fresh water causes the fresh water to stratify above the sea water. As seawater encroaches into the fresh groundwater basin, water quality degrades, limiting its use for irrigation and domestic use. Eventually the wells may have to be abandoned. These conditions are not expected to stabilize without a combination of water resources management options that will balance water use with recharge.

The proposed project seeks to address the seawater intrusion problem by providing a cost-effective and environmentally sound solution to meet both current and future needs.

S.4 ROLE OF THE EIR

In 1993, PVWMA adopted a Basin Management Plan (BMP) to identify a preferred water supply alternative for meeting supply needs. A Programmatic Environmental Impact Report (PEIR) was developed for the BMP, which addressed the water import and local supply concepts at a programmatic level (PVWMA, 1993).

This EIR is (a) intended to serve as a Project EIR and provides detailed, project-level impact and mitigation analysis for proposed projects and (b) to support discretionary approvals and implementation. The level of detail in which the impacts of the projects are evaluated reflects the level of design that has occurred to date; consequently, the evaluation for some components (e.g., the Import Pipeline) is necessarily more detailed than for other components (e.g., the injection/extraction wells associated with the Aquifer Storage and Recovery Project). In the absence of specific design details, for the purposes of characterizing the magnitude of impacts, certain assumptions as to the size and location of smaller facilities have been made, as noted in the Project Description. No specific sites have been identified for the following components:

- *BMP 2000 Alternative*: supplemental wells. For the purposes of this EIR, these wells are assumed to be located on prime agricultural land.

- *Local-Only Alternative*: injection/extraction wells associated with the Aquifer Storage and Recovery Project and Watsonville Slough filtration facilities. For the purposes of this EIR, these facilities are assumed to be located on prime agricultural land.

The CEQA Guidelines require that for project-level EIRs the location of a project be specified. After specific sites have been identified for these facilities, PVWMA will determine the additional environmental review needed in accordance with CEQA.[1]

This document also will assist the PVWMA Board of Directors in determining which projects to approve. The Board of Directors may approve the BMP 2000 or Local-Only alternative (or the modified version of either one), or a combination of projects associated with each alternative. The format of this document is intended to facilitate project-by-project consideration of the options available for meeting the objectives of the Revised BMP.

S.5 SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION

Table S.2, presented at the end of this chapter, summarizes the impacts of the proposed project. For each impact considered to be significant or potentially significant, the table summarizes the recommended mitigations. **Table S.2** is only intended to provide a summary of the impacts and mitigation measures described in detail in Chapters 4, 5 and 6.

SIGNIFICANT AND UNAVOIDABLE IMPACTS

The following impacts were determined to be significant and unavoidable:

LOSS OF PRIME AGRICULTURAL LAND

The BMP 2000 Alternative would result in the permanent removal of approximately 8.5 acres of prime agricultural land from production. The facilities associated with the Local-Only Alternative would result in the permanent removal of approximately 42 acres of farmland. In addition, the Pajaro Valley Integrated Groundwater Surface Water Model (PVIGSM) indicates that approximately 2,200 acres of agricultural land would need to be fallowed to meet the objectives of the Local-Only Alternative, and that additional acreage would need to be fallowed in the future.

CONSTRUCTION FACILITIES ACROSS ACTIVE FAULT TRACES

Portions of the Import Pipeline alignment cross the active San Andreas and Sargent faults. A major displacement of either fault could result in pipeline rupture. The EIR identifies a number of measures to mitigate this impact (pipe specifications at fault crossings, special construction techniques and instrumentation, isolation valves, et al.); however, these measures cannot eliminate the chance that the pipe would rupture in a major earthquake.

[1] CEQA Guidelines Sections 15162, 15163, and 15164 address the requirements for preparing subsequent EIRs and Negative Declarations, Supplemental EIRs, and Addenda to EIRs.

GENERATION OF CRITERIA AIR POLLUTANTS DURING CONSTRUCTION (PM_{10})

Grading, excavation and fill for construction of the following projects would generate particulate matter (PM_{10}) in excess of standards established by the Monterey Bay Unified Air Pollution Control District:

- Import Pipeline (BMP 2000 Alternative)
- Expanded College Lake (Local-Only Alternative)
- Corralitos Creek and Pinto Lake Diversions (Local-Only Alternative)
- Aquifer, Storage and Recovery (Local-Only Alternative)

The EIR identifies a number of standard measures to reduce fugitive dust from construction (watering construction sites daily, covering loads of soil, et al.), but for these projects, PM_{10} emissions would remain above the significance threshold of 82 pounds per day.

SECONDARY EFFECTS OF GROWTH

Implementation of the BMP Project (either alternative) would reduce a constraint to growth: groundwater supply reliability. The project could accommodate an amount of growth that is consistent with regional growth projections, but that could indirectly result in potentially significant secondary effects of growth. Some of these secondary effects of growth could be significant and unavoidable, while others are significant but mitigable. Significant unavoidable impacts that could occur as a result of planned growth include: loss of agricultural land and open space, increase demand on groundwater resources, and changes in visual character.

PVWMA does not have the authority to make land use and development decisions. It does not approve growth but does have a responsibility to manage and protect the groundwater resources in the service area. PVWMA does have the ability and responsibility to mitigate the impacts of growth on groundwater resources by implementing management actions that keep the basin in balance and prevent/reduce salt water intrusion. Implementation of the BMP 2000 program will serve to mitigate the secondary effects of planned growth on the groundwater resources.

Authority to implement such measures rests with the land use jurisdictions – City of Watsonville, Monterey County, Santa Cruz County, and San Benito County – which enforce local, state, and federal regulations and mitigation requirements through the development approval and permit process. Through the CEQA process and the development permit process, these local land use agencies impose mitigation requirements on development projects to address the secondary effects of growth and identify measures that must be implemented by other agencies, such as the Regional Water Quality Control Board, the California Department of Fish and Game, and Air Quality District, among others. PVWMA finds that mitigation of the secondary effects of growth is primarily within the authority and jurisdiction of other public agencies and looks to those agencies to implement such measures as appropriate and consistent with their authorities.

SIGNIFICANT IMPACTS THAT CAN BE MITIGATED

The remaining impacts identified for the two alternatives can be mitigated to less-then-significant levels, as indicated in **Table S.2**. Many of the measures identified to mitigate these impacts are standard approaches to reducing impacts (e.g., dust control plans), although some may require project redesign or place a constraint on operations that alters a particular project or alternative. Examples of the latter include:

- *Advanced Water Treatment*. Two aspects of the Local-Only Alternative, recharge of recycled water and injection of water from local supplies into the groundwater basin, would require advanced treatment. Implementing advanced treatment of recycled water would require additional facilities and processes at the Recycled Water Facility, and a larger (19-acre instead of 8-acre) site. Implementation of this measure could, in turn, generate additional environmental impacts not fully assessed in this EIR.

- *Steelhead Mitigation*. In order to maintain sufficient streamflow in Corralitos Creek for steelhead, the following mitigation would be required: a minimum bypass flow for Corralitos Creek of 15 cubic feet per second (cfs), a maximum instantaneous diversion rate of 6 cfs and restricts diversions to December 15 through March 31. These measures in turn affect the yield and operating characteristics of the Corralitos Creek Diversion project, which is part of the Local-Only Alternative. In addition, the design of facilities proposed for the Expanded College Lake project would have to be modified to facilitate fish passage.

S.6 OTHER ALTERNATIVES

Chapter 6 describes other alternatives that were presented in the Revised BMP. Alternatives discussed therein include:

- **No Project Alternative.** Required by CEQA. Evaluates continuation of existing conditions and likely consequences.

- **Modified BMP 2000 Alternative.** Injection of CVP water into the groundwater basin for temporary storage and subsequent extraction; no Murphy Crossing project; no Inland Distribution System; smaller diameter Import Pipeline.

- **Modified Local Alternative.** Supplements Local-Only Alternative with CVP water; blends recycled water prior to recharge; adds another recharge basin for recycled water.

S.7 ALTERNATIVES COMPARISON AND ENVIRONMENTALLY SUPERIOR ALTERNATIVE

Consistent with the CEQA Guidelines (Section 15126.6[a]), the comparison of alternatives and determination of the environmentally superior alternative is based on the ability of the alternative to meet the basic objectives of the project while avoiding or substantially lessening any significant impacts. Consequently, this section presumes implementation of mitigation measures

identified in the EIR. The key summary points regarding the impacts associated with the alternatives are:

- All of the four "action" alternatives—the BMP 2000 Alternative, the Local-Only Alternative, the Modified BMP 2000 Alternative, and the Modified Local-Only Alternative—are environmentally superior to the No Project Alternative. The No Project Alternative would allow for continued degradation of the groundwater basin from overdraft and seawater intrusion, and does not satisfy any of the project objectives.

- The Local-Only Alternative does not satisfy the primary objective of the project without fallowing farmland, while the other three action alternatives meet the project's basic objectives.

- Most of the impacts result from construction activities. To a great extent, these impacts can be mitigated to less-than-significant levels with measures identified in this EIR.

- The four action alternatives present different combinations of the same or similar components and, consequently, have many of the same or similar impacts.

- The alternatives that involve more construction generally result in more (greater magnitude) impact. However, traffic, air quality, and construction noise impacts do not substantially differ from one alternative to the next. Any of the action alternatives would result in a significant unavoidable temporary increase in PM10 emissions; traffic and noise impacts would be similar and could be mitigated to less-than-significant levels.

- The BMP 2000, Modified BMP 2000, and Modified Local-Only Alternative all include a version of the Import Pipeline. The difference in pipeline diameter would not materially affect the scope and magnitude of the impacts of constructing and operating an Import Pipeline. The construction corridor (which determines the scope of impacts to surface features—vegetation and wildlife habitat, agricultural land, stream crossings, et al) essentially would be same under any of these alternatives.

- Growth inducement potential is the same for all of the alternatives.

The distinction among the alternatives is the ability to meet the basic objectives of the project while reducing environmental impacts, and the degree of impact relative to the following environmental issues: water quality, land use (permanent loss and fallowing of prime farm land), seismic hazards, and biological resource impacts. These issues are discussed below. **Table S.3** presents a comparison of the distinguishing environmental effects of the alternatives. Significant and unavoidable impacts listed in the table are denoted by an asterisk; all other impacts could be mitigated to a less-than-significant level.

S.7.1 GROUNDWATER HYDROLOGY AND WATER QUALITY

The primary issues that distinguish the alternatives relate to groundwater hydrology and water quality. Most notable is the inability of the Local-Only Alternative to achieve the primary

TABLE S-3
COMPARISON OF ALTERNATIVES—IDENTIFICATION OF THE ENVIRONMENTALLY SUPERIOR ALTERNATIVE[a]

IMPACT	CHARACTERIZATION OF IMPACTS FOR EACH ALTERNATIVE			
	BMP 2000 Alternative	**Modified BMP 2000 Alternative**	**Local-Only Alternative**	**Modified Local-Only Alternative**
Groundwater Management[b]	Yes	Yes	No	Yes
Water Quality - Groundwater	Less Adverse	Least Adverse	Most Adverse	More Adverse
Permanent Conversion of Agricultural Land	Least Adverse*	Least Adverse*	Most Adverse*	More Adverse*
Land Fallowing	No Impact	No Impact	Most Adverse*	No Impact
Geology, Soils and Seismicity	Most Adverse*	Most Adverse*	Least Adverse	Most Adverse*
Aquatic Habitat	Less Adverse	No Impact	Most Adverse	More Adverse
Wetlands/Waters of the US/Riparian Habitat	Most Adverse, Temporary	Least Adverse, Temporary	More Adverse, Temporary[c]	More Adverse, Temporary
Upland Species—Plants	No Impact	No Impact	Most Adverse	Most Adverse
Upland Species—Wildlife	Most Adverse, Temporary	Most Adverse, Temporary	No Impact	Most Adverse, Temporary
Visual Quality	Least Adverse	Least Adverse	Most Adverse	More Adverse
RANKING[d,e]	**2**	**1**	**4**	**3**

[a] This comparison table considers the major environmental issues that distinguish the four alternatives. Impacts related to other environmental issues, such as traffic, air quality and noise, would be temporary construction impacts that would be similar for all the alternatives and therefore they are not presented in this table.
[b] Evaluation of alternative's ability to achieve primary project objective.
[c] Involves less than one acre of permanent impact to wetlands and waters of the U.S.
[d] This ranking considers environmental factors only; other factors, such as cost and feasibility, were not considered in this ranking. This ranking assumes that the mitigation measures identified in this EIR will be implemented.

[e] Alternative Ranking

4 – Alternative with the most adverse environmental impacts
1 – Environmentally Superior Alternative

* Denotes a significant unavoidable impact.

objective of balancing the basin and arresting seawater intrusion without fallowing more than 2,200 acres of land. All other alternatives provide sufficient water to meet the project's objectives.

With respect to water quality impacts, those alternatives with more CVP water relative to local supplies have better water quality and, consequently, lesser magnitude impacts. (For an overview of source water quality, refer to Table 2.3 in Chapter 2.) The Local-Only Alternative would have the worst impacts relative to water quality because of source water quality problems for injection/extraction of surface water, and the direct use and recharge of unblended recycled water. This alternative would require advanced water treatment, the implementation of which would create additional environmental impacts (additional facilities would impact more prime agricultural land). The BMP 2000 and Modified BMP 2000 alternatives have the highest quality water (between the two, the Modified BMP Alternative would have incrementally better source water quality because it includes more CVP water and no water from the Pajaro River at Murphy Crossing).

S.7.2 LOSS OF PRIME AGRICULTURAL LAND

Each of the four alternatives would result in the loss of prime agricultural land. For the BMP 2000 Alternative, construction of the Recycled Water Facility and 17 supplemental well sites would result in the permanent conversion of up to 8.5 acres of prime farmland. The Import Pipeline and the Inland and Coastal distribution systems would disrupt agricultural operations along the alignment temporarily during construction, but would not result in a permanent conversion of agricultural land.

The Modified BMP 2000 Alternative also would permanently convert up to 8.5 acres of prime agricultural land for construction of the Recycled Water Facility and 17 supplemental wells. The Import Pipeline would not result in permanent conversion of agricultural land.

Under the Local-Only Alternative, up to 41.6 acres of prime farmland would be permanently converted due to construction of the Recycled Water Facility, Expanded College Lake, Corralitos Creek Pump Station, and Aquifer Storage and Recovery (ASR) components. The Local-Only Alternative also would require the fallowing of more than 2,200 acres of irrigable prime farmland.

For the Modified Local-Only Alternative, the Harkins Slough, Pinto Lake Diversion, Watsonville Slough Diversion, Import Pipeline, Recycled Water Facility, College Lake, North Dunes recharge basin, and Southeast Dunes recharge basin components would result in the permanent conversion of 30.7 acres of farmland. No land fallowing would be required under this alternative.

S.7.3 GEOLOGY, SOILS AND SEISMICITY

Portions of the Import Pipeline alignment proposed under the BMP 2000 Alternative, the Modified BMP 2000 Alternative, and the Modified Local-Only Alternative cross the active

San Andreas and Sargent faults. A major displacement of either fault would result in pipeline rupture. The EIR identifies a number of measures to mitigate this impact (pipe specifications at fault crossings, special construction techniques and instrumentation, isolation valves, et al.); however, these measures cannot eliminate the chance that the pipe could rupture in a major earthquake. (Surface fault rupture hazard zones are shown on Maps A1 and A2 in the Map Appendix.)

The dam structures included in the Expanded College Lake component of the Local-Only Alternative also could be subject to damage from surface fault rupture, but this impact could be mitigated to a less-than-significant level through engineering design. The College Lake facilities proposed under the Modified Local-Only Alternative could also be damaged by large earthquakes; however, the potential flooding and erosion hazards that could potentially result from such damage would be less adverse than that which would occur under the Local-Only Alternative, which would involve dam structures and increased water storage in the lake.

S.7.4 EFFECTS ON AQUATIC HABITAT

Impacts to aquatic habitat would be more adverse under the Local-Only Alternative than under the BMP 2000 Alternative. Spawning and rearing habitat for south-central California coast steelhead is present in the upper reaches of Corralitos Creek, upstream of College Lake. Conditions for steelhead passage to and from spawning and rearing habitats are the primary fish habitat factors potentially affected. The presence of sufficient stream flows for down-migration of smolts is critical. Constructing and operating a water diversion facility in Corralitos Creek would directly affect steelhead spawning and rearing habitat. Implementation of the Expanded College Lake project would impede migration of the species. There is a cumulative effect on flows to Salsipuedes Creek for the various components of the Local-Only Alternative. The EIR identifies measures to reduce these impacts to less-than-significant levels; these measures would reduce the yield of the Local-Only Alternative.

With the Modified Local-Only Alternative, impacts to steelhead would be of lesser magnitude, since the there would be no diversion from Corralitos Creek; however, impacts associated with College Lake would still occur.

Although the Murphy Crossing component of the BMP 2000 Alternative also would adversely affect steelhead, it would affect migratory habitat (the Pajaro River), and would not affect spawning or rearing habitat.

The Modified BMP 2000 Alternative would avoid impacts to aquatic habitat and steelhead.

S.7.5 EFFECTS ON WETLANDS/WATERS OF THE US AND RIPARIAN HABITAT

There are a number of special status species in the project area that are associated with wetlands and riparian habitat, including red-legged frog, Santa Cruz long-toed salamander, western pond turtle, and a number of bird species (refer to **Table 3.4.2**).

Assuming implementation of bore and jack construction at stream and river crossing, impacts to potentially jurisdictional wetlands/water of the US and riparian habitat and wildlife would be significantly reduced under all alternatives. Implementation of the BMP 2000 Alternative potentially would result in disturbance of up to 1.4 acres (0.2 acre for the Import Pipeline, assuming that Pajaro River crossings would be constructed using bore and jack methods, and 1.4 acres for the Murphy Crossing project). Under the Local-Only Alternative, about one acre of potentially jurisdictional wetlands/waters of the US (assuming bore and jack for crossings of Watsonville Slough, Corralitos Creek, and Harkins Slough).[2]

Under the Modified Local-Only Alternative, approximately one-half acre of potentially jurisdictional wetlands/waters of the US would be disturbed, assuming bore and jack crossings of streams.

Under the Modified BMP 2000 Alternative, construction activities would disturb up to 0.2 acre of potentially jurisdictional wetlands/waters of the U.S (Import Pipeline).

S.7.6 UPLAND SPECIES

One of the largest remaining populations of Santa Cruz tarplant, a species that has been proposed for listing as federally threatened and is currently listed by the State as endangered, occurs on the Watsonville Airport property and likely occurs on the private property to the west of the airport as well. The population at the airport may be important to the survival of the species. Under either the Local-Only Alternative or the Modified Local-Only Alternative there would be direct impacts to Santa Cruz tarplant. Relocating the pipeline alignment to Airport Boulevard would avoid impacts to tarplant, but would result in adverse impacts on traffic and circulation due to the temporary closure of traffic lanes and the subsequent increase in traffic congestion and safety hazards.

Construction of the Import Pipeline (BMP 2000, Modified BMP 2000, and Modified Local-Only alternatives) could disturb sensitive species found in annual grassland habitat. The special status animal species associated with this habitat that have the potential to occur in the study area include the San Joaquin kit fox and western burrowing owl. Direct impacts to the species would be avoided or mitigated through measures identified in the EIR, and no permanent impacts

[2] PVWMA has committed to implementing pipeline construction techniques (bore and jack) that avoid direct impacts to waterways for crossings of Pajaro River and Watsonville slough (thereby avoiding wetland/waters of the US-related impacts for some components).

would occur. This impact would be associated with all alternatives except the Local-Only Alternative.

S.7.7 VISUAL QUALITY

The BMP 2000 Alternative and the Modified BMP 2000 Alternative would have less adverse impacts on visual quality than the other alternatives. The BMP and Modified BMP alternatives include the Import Pipeline, which would temporarily disturb lands within the pipeline alignment. Once the pipeline is buried, land within the alignment would be restored to its previous condition, and farming would continue over the pipeline easement in agricultural areas. The Recycled Water Facility, which would result in the most adverse visual quality impacts, would be constructed under all four alternatives. Both the Local-Only and Modified Local-Only alternatives would construct a larger Recycled Water Facility that would include advanced water treatment facilities, as required by Mitigation Measure 5.A.3-4a in Chapter 5. These facilities could increase adverse impacts on views from scenic roads, including Highway 1, Beach Road and San Andreas Road. Additionally, both the Local-Only and Modified Local-Only alternatives would construct the North Dunes Recharge Basin, and the Modified Local-Only Alternative would construct the Southeast Dunes Recharge Basin. The Local-Only Alternative would be considered to result in more adverse visual quality impacts because it would also construct dam structures at College Lake that would be visible from Highway 152 and Holohan Road. The College Lake facilities proposed under the Modified Local-Only Alternative would be smaller in scale and therefore would be less visible.

S.7.8 ENVIRONMENTALLY SUPERIOR ALTERNATIVE

Based on the comparison presented above, the Modified BMP and BMP 2000 alternatives are environmentally superior to the Local-Only and Modified Local-Only alternatives. The Local-Only Alternative fails to meet the project's primary objective while lessening environmental impacts. The Modified BMP Alternative is environmentally preferable to the BMP 2000 Alternative in that it would reduce or eliminate impacts to aquatic habitat and steelhead, and would have least impact on wetlands/waters of the US and riparian species habitat. The Modified BMP 2000 Alternative includes fewer facilities, and would result in less construction while providing the highest quality source water.

S.8 ISSUES TO BE RESOLVED

The primary issues to be resolved are the selection of projects to be implemented and a means to fund those projects. The PVWMA Board of Directors is empowered to select the projects to be implemented, once this EIR has been certified as complete and adequate. Depending on the approach selected, PVWMA may need to obtain voter approval before project implementation. Several approaches are under consideration (refer to discussion of Socioeconomic Issues in Chapter 8 of this report).

For a summary of potential areas of controversy regarding implementation of the project, refer to **Table 1.1** in Chapter 1, Introduction. **Table 1.1** summarizes issues raised during the scoping process for this Draft EIR.

TABLE S.2
SUMMARY OF IMPACTS AND MITIGATION MEASURES

IMPACTS AND MITIGATION MEASURES[a]	BMP 2000 Alternative		Local-Only Alternative			
	4A. Water Recycling	4B. Groundwater Banking	5A. Water Recycling	5B. Expanded College Lake	5C. Corralitos Creek Pinto Lake Diversions	5D. Aquifer Storage and Recovery
Land Use and Planning						
Impact: Disturbance of adjacent land uses during construction.	LS	LS	LS	SM	LS	LS
▪ Advance notification of construction activities. (Recommended)	✓	✓	✓	✓	✓	✓
▪ Compensate St. Francis Church for relocation of graves.				✓		
▪ Implement measures to reduce traffic, noise, and air quality impacts.	✓	✓	✓	✓	✓	✓
Impact: Loss of Prime Farmland.	SU	--	SU	SU	SU	SU
▪ Remove and store topsoil separately, and replace following construction.				✓		
Impact: Disruption to farming practices during construction.	LS	LS	LS	--	LS	LS
Geology, Soils and Seismicity						
Impact: Construction could result in erosion and loss of soil resources.	SM	SM	SM	SM	SM	SM
▪ Conform to requirements of the Santa Cruz County Grading Ordinance.	✓	✓	✓	✓	✓	✓
▪ Expose as little new ground surface as possible and leave vegetation cover intact.	✓	✓	✓	✓	✓	✓
▪ Grading activities in non-cropped areas will be limited to the period between April 1 and October 15.	✓	✓	✓	✓	✓	✓
▪ Implement best construction practices at all grading sites.	✓	✓	✓	✓	✓	✓

[a] Impacts and Mitigation Measures are summarized; please see Chapter 4 and 5 for details.

-- Indicates that the impact does not apply
SM = Significant and Mitigable
SU = Significant and Unavoidable
LS = Less than Significant
CBD = Indicates that impact significance cannot be determined without additional design and environmental analysis.
✓ = Indicates to which project components the mitigation measure applies.

TABLE S.2 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES

IMPACTS AND MITIGATION MEASURES[a]	BMP 2000 Alternative		Local-Only Alternative			
	4A. Water Recycling	4B. Groundwater Banking	5A. Water Recycling	5B. Expanded College Lake	5C. Corralitos Creek Pinto Lake Diversions	5D. Aquifer Storage and Recovery
Geology, Soils and Seismicity (cont.)						
▪ Following construction, loose soils will be removed and all areas will be re-soiled and reseeded.	✓	✓	✓	✓	✓	✓
▪ Prepare and implement an inspection and maintenance program for the right-of-way and all facility sites.	✓	✓	✓	✓	✓	✓
Impact: Earthquake damage to proposed facilities.	SM	SU	SM	SM	SM	SM
▪ Conduct geologic investigations and incorporate protective measures into the project design.	✓	✓	✓	✓	✓	✓
▪ All facilities will comply with applicable policies and appropriate engineering investigation practices.	✓	✓	✓	✓	✓	✓
▪ Comply with DSOD standards where applicable.				✓		
Impact: Potential damage to facilities as a result of underlying soil properties.	SM	SM	SM	SM	SM	SM
▪ All facilities will comply with applicable policies and appropriate engineering investigation practices as necessary.	✓	✓	✓	✓	✓	✓
Impact: Unstable slopes and slope failure could interfere with construction, operations, or damage facilities.	--	SM	--	SM	--	--
▪ A design-level geotechnical report that includes a slope stability evaluation will be completed and stability recommendations implemented.		✓				

[a] Impacts and Mitigation Measures are summarized; please see Chapter 4 and 5 for details.

-- Indicates that the impact does not apply
SM = Significant and Mitigable
SU = Significant and Unavoidable
LS = Less than Significant
CBD = Indicates that impact significance cannot be determined without additional design and environmental analysis.
✓ = Indicates to which project components the mitigation measure applies.

TABLE S.2 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES

IMPACTS AND MITIGATION MEASURES[a]	BMP 2000 Alternative		Local-Only Alternative			
	4A. Water Recycling	4B. Groundwater Banking	5A. Water Recycling	5B. Expanded College Lake	5C. Corralitos Creek Pinto Lake Diversions	5D. Aquifer Storage and Recovery
Geology, Soils and Seismicity (cont.)						
▪ A detailed hydraulic and scour analysis will be conducted and recommendations will be incorporated into the project design.		✓				
▪ Periodic inspection of the shoreline area and corrective actions				✓		
Hydrology and Water Quality						
Impact: Affect crop yields and degradation of surface or groundwater quality from irrigation with reclaimed water.	SM	--	SM	--	--	--
▪ Above-ground irrigation systems will be operated in accordance with relevant regulations and permits.	✓		✓			
▪ Monitor crop productivity.	✓					
▪ Implement advanced treatment of recycled water			✓			
Impact: Recycled water recharge would degrade groundwater water quality.	--	--	SM	--	--	--
▪ Implement additional advanced treatment processes at the Recycled Water Facility to avoid significant impacts to water quality.			✓			

[a] Impacts and Mitigation Measures are summarized; please see Chapter 4 and 5 for details.

-- Indicates that the impact does not apply
SM = Significant and Mitigable
SU = Significant and Unavoidable
LS = Less than Significant
CBD = Indicates that impact significance cannot be determined without additional design and environmental analysis.
✓ = Indicates to which project components the mitigation measure applies.

TABLE S.2 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES

IMPACTS AND MITIGATION MEASURES[a]	BMP 2000 Alternative		Local-Only Alternative			
	4A. Water Recycling	4B. Groundwater Banking	5A. Water Recycling	5B. Expanded College Lake	5C. Corralitos Creek Pinto Lake Diversions	5D. Aquifer Storage and Recovery
Hydrology and Water Quality (cont.)						
▪ Locate an additional source of water supply to allow for the blending of recycled water with other (ambient) water.			✓			
▪ Recommended water quality goal of a maximum of 500 mg/L TDS be maintained at all times.			✓			
Impact: Expose people and structures to flood hazards.	SM	--	SM	LS	--	--
▪ Design facilities to comply with relevant requirements.	✓		✓			
Impact: Dewatering of shallow groundwater resources and contamination of surface water from construction.	--	SM	--	SM	SM	SM
▪ Obtain and implement conditions of an NPDES permit for construction dewatering.		✓				✓
▪ Prepare and implement a Storm Water Pollution Prevention Plan.				✓	✓	✓
Impact: Construction activities could compromise the structural integrity or water quality of active wells.	SM	SM	SM	--	SM	SM
▪ Wells will be capped.	✓	✓	✓		✓	✓
▪ Correct damage to wells and/or reimburse well owners.	✓	✓	✓		✓	✓
Impact: Increased erosion and sedimentation, and degradation to water quality during construction.	SM	SM	SM	SM	SM	SM
▪ Development and implementation of a Storm Water Pollution Prevention Plan (SWPPP).	✓	✓	✓	✓	✓	✓

[a] Impacts and Mitigation Measures are summarized; please see Chapter 4 and 5 for details.

-- Indicates that the impact does not apply
SM = Significant and Mitigable
SU = Significant and Unavoidable
LS = Less than Significant
CBD = Indicates that impact significance cannot be determined without additional design and environmental analysis.
✓ = Indicates to which project components the mitigation measure applies.

TABLE S.2 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES

IMPACTS AND MITIGATION MEASURES[a]	BMP 2000 Alternative		Local-Only Alternative			
	4A. Water Recycling	4B. Groundwater Banking	5A. Water Recycling	5B. Expanded College Lake	5C. Corralitos Creek Pinto Lake Diversions	5D. Aquifer Storage and Recovery
Hydrology and Water Quality (cont.)						
▪ Employ standard construction-related water quality management practices.	✓	✓	✓	✓	✓	✓
▪ Riparian areas may be avoided entirely by using bore and jack construction. (Mitigation Measure 4.A.4-1a).	✓	✓	✓		✓	✓
▪ Implement Standard Protective Measures to Maintain Water Quality and Control Erosion and Sedimentation (Mitigation Measure 4.A.4-1b)	✓	✓	✓		✓	✓
▪ Implement revegetation measures developed as part of a revegetation plan approved by CDFG. (Mitigation Measure 4.A.4-1c)	✓	✓	✓		✓	✓
Impact: Change historical water level patterns and pumped discharges, potentially affecting downstream water quality.	--	--	--	LS	--	--
Impact: Surface and groundwater contamination from spills and non-point source runoff of chemicals from the treatment plant.	--	--	--	SM	--	--
▪ Prepare a Stormwater Pollution Prevention Plan for the treatment plant.				✓		
Impact: Without land fallowing, the objectives of the Local-Only Alternative could not be achieved and conditions of overdraft would continue, allowing seawater intrusion to advance inland.	--	--	--	--	--	SM
▪ Implement a program to fallow cultivatable farm lands, as needed, to reduce the demand on groundwater.						✓

[a] Impacts and Mitigation Measures are summarized; please see Chapter 4 and 5 for details.

-- Indicates that the impact does not apply
SM = Significant and Mitigable
SU = Significant and Unavoidable
LS = Less than Significant
CBD = Indicates that impact significance cannot be determined without additional design and environmental analysis.
✓ = Indicates to which project components the mitigation measure applies.

TABLE S.2 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES

IMPACTS AND MITIGATION MEASURES[a]	BMP 2000 Alternative		Local-Only Alternative			
	4A. Water Recycling	4B. Groundwater Banking	5A. Water Recycling	5B. Expanded College Lake	5C. Corralitos Creek Pinto Lake Diversions	5D. Aquifer Storage and Recovery
Hydrology and Water Quality (cont.)						
Impact: Increase impermeable surfaces and reduce long-term infiltration at the well pads.	--	--	--	--	--	LS
Impact: Initial operation of injection/extraction wells could adversely affect the receiving surface waters.	--	--	--	--	--	SM
▪ All groundwater discharges will be conducted in accordance with NPDES permits.						✓
Impact: Poor quality surface water could enter the groundwater through injection and adversely affect the groundwater quality.	--	--	--	--	--	SM
▪ Compliance with relevant policies.						✓
▪ Prepare and implement a monitoring and treatment plan and comply with federal and state drinking water standards.						✓
Impact: Groundwater injection/extraction can adversely affect groundwater levels, overlying geologic structures, groundwater flow regimes, and adjacent groundwater aquifers.	--	--	--	--	--	SM
▪ Complete hydrogeologic analysis and testing. Conduct technical feasibility studies.						✓

[a] Impacts and Mitigation Measures are summarized; please see Chapter 4 and 5 for details.

-- Indicates that the impact does not apply
SM = Significant and Mitigable
SU = Significant and Unavoidable
LS = Less than Significant
CBD = Indicates that impact significance cannot be determined without additional design and environmental analysis.
✓ = Indicates to which project components the mitigation measure applies.

TABLE S.2 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES

IMPACTS AND MITIGATION MEASURES[a]	BMP 2000 Alternative		Local-Only Alternative			
	4A. Water Recycling	4B. Groundwater Banking	5A. Water Recycling	5B. Expanded College Lake	5C. Corralitos Creek Pinto Lake Diversions	5D. Aquifer Storage and Recovery
Vegetation, Fish and Wildlife						
Impact: Impacts to potentially jurisdictional wetlands/waters of the U.S. and streambed during construction.	SM	SM	SM	SM	--	SM
▪ Implement standard protective measures to maintain water quality and control erosion and sedimentation.	✓	✓	✓	✓	✓	✓
▪ Avoid wetlands. If complete avoidance is infeasible, implement measures below.	✓	✓	✓	✓	✓	✓
-- Restore Pajaro River riparian forest.						
-- Special construction techniques for pipeline stream crossings.						
-- Locate and design spoil sites so they do not drain directly into the waterways.						
-- Prepare and implement spill prevention plan for potentially hazardous materials.						
-- Store equipment and materials at least 50 feet from waterways.						
-- Provide proper and timely maintenance for vehicles and equipment.						
-- For unavoidable impacts to coastal riparian forest, develop a revegetation plan approved by CDFG.						
-- Implement revegetation measures for impacts to riparian forest.						
▪ Implement off-site wetland creation and/or enhancement for wetland impacts at Salsipuedes Creek.				✓		

[a] Impacts and Mitigation Measures are summarized; please see Chapter 4 and 5 for details.

-- Indicates that the impact does not apply
SM = Significant and Mitigable
SU = Significant and Unavoidable
LS = Less than Significant
CBD = Indicates that impact significance cannot be determined without additional design and environmental analysis.
✓ = Indicates to which project components the mitigation measure applies.

TABLE S.2 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES

IMPACTS AND MITIGATION MEASURES[a]	BMP 2000 Alternative		Local-Only Alternative			
	4A. Water Recycling	4B. Groundwater Banking	5A. Water Recycling	5B. Expanded College Lake	5C. Corralitos Creek Pinto Lake Diversions	5D. Aquifer Storage and Recovery
Vegetation, Fish and Wildlife (cont.)						
Impact: Temporary impacts to special status animal species habitat during construction.	SM	SM	SM	SM	SM	SM
▪ Avoidance of habitat. If complete avoidance is infeasible, implement measures below.	✓	✓	✓	✓	✓	✓
▪ Minimize habitat loss by crossing river on the east side of Highway 1.	✓					
▪ Avoid disturbance to riparian vegetation.				✓		
▪ Implement survey, consultation and protection measures for California red-legged frog.		✓		✓		
▪ Survey and protection of raptor and passerine nesting sites.	✓	✓		✓		
▪ Implement construction protection measures for steelhead.	✓			✓		
▪ Implement survey, consultation, and protection measures for special status fish and wildlife species.	✓		✓	✓	✓	
▪ To protect migrating steelhead, construction in the riparian habitat in the Pajaro River will occur after June 1, and cease before November 1. During construction, all flow in the Pajaro River will be diverted around the zone of construction.		✓				
▪ Conduct surveys and consultation for, and implement protection measures for, California red-legged frog.		✓				
▪ Pre-construction surveys within the construction zone will be conducted by a qualified biologist between May 1 and November 1.	✓	✓				

[a] Impacts and Mitigation Measures are summarized; please see Chapter 4 and 5 for details.

-- Indicates that the impact does not apply
SM = Significant and Mitigable
SU = Significant and Unavoidable
LS = Less than Significant
CBD = Indicates that impact significance cannot be determined without additional design and environmental analysis.
✓ = Indicates to which project components the mitigation measure applies.

TABLE S.2 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES

IMPACTS AND MITIGATION MEASURES[a]	BMP 2000 Alternative		Local-Only Alternative			
	4A. Water Recycling	4B. Groundwater Banking	5A. Water Recycling	5B. Expanded College Lake	5C. Corralitos Creek Pinto Lake Diversions	5D. Aquifer Storage and Recovery
Vegetation, Fish and Wildlife (cont.)						
▪ The aquatic structure of the river channel to be disturbed will be documented and monitored for three years following construction to ensure stabilization and restoration.	✓	✓				
▪ Fence creekside construction boundary to prevent frogs from entering area, and to control siltation and disturbance to riparian habitat. Revegetate following construction.	✓	✓				
▪ All construction adjacent to riparian vegetation will be regularly monitored to ensure habitat loss is consistent with this assessment.	✓	✓				
▪ Implement coffer dams.	✓					
▪ A biological monitor will provide an environmental protection workshop and will be on site at all times when construction takes place in aquatic or riparian habitat.	✓	✓				
▪ Perform western pond turtle surveys prior to construction.		✓				
Impact: Impacts to special status plant species.	--	--	--	--	--	SM
▪ Take of Santa Cruz tarplant will be avoided by rerouting the pipeline alignment through this area.						✓
▪ Where adverse impacts to Santa Cruz tarplant cannot be avoided, develop a revegetation plan approved by CDFG.						✓

[a] Impacts and Mitigation Measures are summarized; please see Chapter 4 and 5 for details.

-- Indicates that the impact does not apply
SM = Significant and Mitigable
SU = Significant and Unavoidable
LS = Less than Significant
CBD = Indicates that impact significance cannot be determined without additional design and environmental analysis.
✓ = Indicates to which project components the mitigation measure applies.

TABLE S.2 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES

IMPACTS AND MITIGATION MEASURES[a]	BMP 2000 Alternative		Local-Only Alternative			
	4A. Water Recycling	4B. Groundwater Banking	5A. Water Recycling	5B. Expanded College Lake	5C. Corralitos Creek Pinto Lake Diversions	5D. Aquifer Storage and Recovery
Vegetation, Fish and Wildlife (cont.)						
Impact: Construction facilities could disturb raptors in coastal oak woodland habitat.	--	SM	--	--	--	--
▪ Realign the proposed pipeline to the north, outside of the drip line of the oaks.		✓				
▪ If avoidance is infeasible, conduct construction outside the nesting season.		✓				
▪ Plant replacement coastal live oak seedlings. Details of the revegetation plan, including coast live oak woodland, will be approved by CDFG.		✓				
Impact: Construction facilities at select project sites could disturb sensitive species found in annual grassland habitat.	--	SM	--	--	--	--
▪ Conduct pre-construction survey and implement avoidance and protective measures for San Joaquin kit fox.		✓				
▪ Conduct pre-construction survey and implement avoidance measures during the nesting season for burrowing owl. During the non-breeding season, mitigation procedures would be developed in consultation with the CDFG.		✓				
▪ Trees with unoccupied nests of other raptor species may only be removed prior to March 1 or after September 1. Requires pre-construction survey and avoidance during the breeding season.		✓				

[a] Impacts and Mitigation Measures are summarized; please see Chapter 4 and 5 for details.

-- Indicates that the impact does not apply
SM = Significant and Mitigable
SU = Significant and Unavoidable
LS = Less than Significant
CBD = Indicates that impact significance cannot be determined without additional design and environmental analysis.
✓ = Indicates to which project components the mitigation measure applies.

TABLE S.2 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES

IMPACTS AND MITIGATION MEASURES[a]	BMP 2000 Alternative		Local-Only Alternative			
	4A. Water Recycling	4B. Groundwater Banking	5A. Water Recycling	5B. Expanded College Lake	5C. Corralitos Creek Pinto Lake Diversions	5D. Aquifer Storage and Recovery
Vegetation, Fish and Wildlife (cont.)						
Impact: Operation of the proposed project would reduce streamflows for steelhead passage in Salsipuedes Creek, particularly for down-migrating smolts in the spring months.	--	--	--	SM	SM	--
▪ Provide minimum bypass flows during the steelhead smolt migration period.				✓	✓	
▪ Passage for migrating adult and smolt steelhead will be facilitated through the installation of a fish ladder with sufficiently high bypass flow.				✓	✓	
▪ The intake structure will be designed to ensure that smolts are not entrained.				✓		
Impact: Disturbance of streamside vegetation, and indirect effects on biological resources.	--	--	--	--	SM	--
▪ Restore Corralitos Creek riparian forest and include in revegetation plan.					✓	
▪ Implement standard protective measures to maintain water quality and control erosion and sedimentation.					✓	
Impact: Construction and operation impacts to special status animal species dependent on wetland habitats.	--	--	--	--	--	SM
▪ Avoid disturbance to wetland habitat. If wetland habitat will not be entirely avoided, implement Mitigation Measure 5.D.4-2b.						✓

[a] Impacts and Mitigation Measures are summarized; please see Chapter 4 and 5 for details.

-- Indicates that the impact does not apply
SM = Significant and Mitigable
SU = Significant and Unavoidable
LS = Less than Significant
CBD = Indicates that impact significance cannot be determined without additional design and environmental analysis.
✓ = Indicates to which project components the mitigation measure applies.

TABLE S.2 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES

IMPACTS AND MITIGATION MEASURES[a]	BMP 2000 Alternative		Local-Only Alternative			
	4A. Water Recycling	4B. Groundwater Banking	5A. Water Recycling	5B. Expanded College Lake	5C. Corralitos Creek Pinto Lake Diversions	5D. Aquifer Storage and Recovery
Vegetation, Fish and Wildlife (cont.)						
▪ Implement survey, consultation, and protection measures for California red-legged frog, California tiger salamander, and Santa Cruz long-toed salamander.						✓
▪ Survey and protection of raptor and passerine nesting sites.						✓
▪ Conduct hydrologic studies for Watsonville Slough. Recommendations made by the study would constitute mitigation.						✓
Cultural Resources						
Impact: Potential impacts to unknown cultural resources at well sites.	SM	--	--	--	--	SM
▪ Conduct archaeological surveys of well sites.	✓					✓
Impact: Impacts to unknown prehistoric and historic cultural resources.	SM	SM	SM	SM	SM	SM
▪ Should any as yet undiscovered cultural resources be encountered, the find will be mitigated according to appropriate guidelines.	✓	✓	✓	✓	✓	✓
Impact: Impacts to identified cultural resources.	--	SM	--	SM	SM	SM
▪ Conduct archaeological surveys of the project area.						✓
▪ Locate facilities and pipeline alignments away from identified sites. A qualified cultural resource specialist will assist in identifying the extent of important cultural resource sites to be avoided.		✓		✓	✓	✓

[a] Impacts and Mitigation Measures are summarized; please see Chapter 4 and 5 for details.

-- Indicates that the impact does not apply
SM = Significant and Mitigable
SU = Significant and Unavoidable
LS = Less than Significant
CBD = Indicates that impact significance cannot be determined without additional design and environmental analysis.
✓ = Indicates to which project components the mitigation measure applies.

TABLE S.2 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES

IMPACTS AND MITIGATION MEASURES[a]	BMP 2000 Alternative		Local-Only Alternative			
	4A. Water Recycling	4B. Groundwater Banking	5A. Water Recycling	5B. Expanded College Lake	5C. Corralitos Creek Pinto Lake Diversions	5D. Aquifer Storage and Recovery
Cultural Resources (cont.)						
▪ If important cultural resource sites cannot be avoided, PVWMA will coordinate with agencies in the development of an appropriate mitigation plan.		✓		✓	✓	✓
Impact: Potential indirect impacts to cultural resources, primarily vandalism, could result from the increased access to, and use of, the general area during construction.	--	SM	--	SM	SM	SM
▪ The resource boundaries should be marked as exclusion zones.		✓		✓	✓	✓
▪ Construction supervisory personnel should be notified of the existence of these resources and be required to keep personnel and equipment away from these areas.		✓		✓	✓	✓
▪ Monthly monitoring of the cultural resources to be avoided should occur. If damage is detected a guard will be posted to patrol the site and adjacent important resources.		✓		✓	✓	✓
Traffic and Circulation						
Impact: Temporary increase in traffic during construction.	LS	LS	LS	LS	LS	LS
▪ Schedule truck trips outside of peak commute hours. (Recommended)	✓	✓	✓	✓	✓	✓
▪ Use haul routes that minimize truck traffic on local roadways. (Recommended)	✓	✓	✓	✓	✓	✓

[a] Impacts and Mitigation Measures are summarized; please see Chapter 4 and 5 for details.

-- Indicates that the impact does not apply
SM = Significant and Mitigable
SU = Significant and Unavoidable
LS = Less than Significant
CBD = Indicates that impact significance cannot be determined without additional design and environmental analysis.
✓ = Indicates to which project components the mitigation measure applies.

TABLE S.2 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES

IMPACTS AND MITIGATION MEASURES[a]	BMP 2000 Alternative		Local-Only Alternative			
	4A. Water Recycling	4B. Groundwater Banking	5A. Water Recycling	5B. Expanded College Lake	5C. Corralitos Creek Pinto Lake Diversions	5D. Aquifer Storage and Recovery
Traffic and Circulation (cont.)						
Impact: Wear and tear on area roadways during construction.	SM	SM	SM	SM	SM	SM
▪ Conduct a preconstruction survey of road conditions, monitor during construction, and repair following construction.	✓	✓	✓	✓	✓	✓
Impact: Potential traffic safety hazards for vehicles and pedestrians in the construction area.	SM	SM	SM	SM	SM	SM
▪ Traffic safety and control plans to show methods for maintaining traffic flows.	✓		✓			
▪ Advanced public notification of construction activity and roadway/access closures.	✓	✓	✓	✓	✓	✓
▪ Traffic control plans will include detours for bicyclists.	✓	✓	✓	✓	✓	✓
Impact: Project construction would generate a demand for parking spaces.	LS	LS	LS	LS	LS	LS
Impact: Traffic delays for vehicles traveling past the construction zone.	--	SM	SM	--	SM	SM
▪ Construction hours will be limited to off-peak traffic periods on commute streets.		✓	✓		✓	✓
▪ Traffic control plans to show methods for maintaining traffic flows.		✓	✓		✓	✓
Impact: Temporary lack of access to adjacent land uses for both general and emergency access.	--	SM	SM	--	SM	SM
▪ Maintain steel trench plates to restore access across open trenches.		✓	✓		✓	✓
▪ Request that affected jurisdictions identify detours to be posted by contractor.		✓	✓		✓	✓

[a] Impacts and Mitigation Measures are summarized; please see Chapter 4 and 5 for details.

-- Indicates that the impact does not apply
SM = Significant and Mitigable
SU = Significant and Unavoidable
LS = Less than Significant
CBD = Indicates that impact significance cannot be determined without additional design and environmental analysis.
✓ = Indicates to which project components the mitigation measure applies.

TABLE S.2 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES

IMPACTS AND MITIGATION MEASURES[a]	BMP 2000 Alternative		Local-Only Alternative			
	4A. Water Recycling	4B. Groundwater Banking	5A. Water Recycling	5B. Expanded College Lake	5C. Corralitos Creek Pinto Lake Diversions	5D. Aquifer Storage and Recovery
Traffic and Circulation (cont.)						
▪ Notify the appropriate emergency services of the timing, location, and duration of construction activities and the locations of detours and lane closures.		✓	✓		✓	✓
Impact: Cumulative traffic and roadway disruptions.	--	--	SM	SM	SM	SM
▪ The traffic control plan will include consideration of any other planned traffic detours related to nearby and concurrent construction projects.			✓	✓	✓	✓
Impact: The Expanded College Lake project could conflict with a new Paulsen-Whiting Road bridge connection planned by Santa Cruz County.	--	--	--	LS	--	--
▪ Coordinate closely with the Santa Cruz County Public Works Department. (Recommended)				✓		
Air Quality						
Impact: Temporary generation of criteria air pollutants during construction.	SM	SU	SM	SU	SU	SU
▪ The construction contractor will implement a dust control program.	✓	✓	✓	✓	✓	✓
Impact: Operation and maintenance vehicle trips would generate air emissions.	LS	LS	LS	LS	LS	LS
Impact: Construction lane closures and detours could temporarily increase vehicular emissions.	--	LS	LS	--	LS	LS

[a] Impacts and Mitigation Measures are summarized; please see Chapter 4 and 5 for details.

-- Indicates that the impact does not apply
SM = Significant and Mitigable
SU = Significant and Unavoidable
LS = Less than Significant
CBD = Indicates that impact significance cannot be determined without additional design and environmental analysis.
✓ = Indicates to which project components the mitigation measure applies.

TABLE S.2 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES

IMPACTS AND MITIGATION MEASURES[a]	BMP 2000 Alternative		Local-Only Alternative			
	4A. Water Recycling	4B. Groundwater Banking	5A. Water Recycling	5B. Expanded College Lake	5C. Corralitos Creek Pinto Lake Diversions	5D. Aquifer Storage and Recovery
Noise						
Impact: Construction activities would intermittently and temporarily generate noise.	SM	SM	SM	SM	SM	SM
▪ Incorporate standard noise control measures into contract specifications.	✓		✓	✓	✓	✓
▪ Construction will be limited to the hours of 7:00 a.m. to 7:00 p.m., Monday through Sunday.		✓				
Impact: Operation of proposed project would result in noise increases.	SM	LS	SM	SM	SM	SM
▪ Incorporate acoustical treatments and/or building enclosures into contract specifications.	✓		✓	✓	✓	✓
Public Services						
Impact: Construction of could result in disruption to utility services.	SM	SM	SM	SM	SM	SM
▪ Conduct a detailed study identifying utilities and include utilities considerations in project design. Provide notification of utilities disruption.	✓	✓	✓	✓	✓	✓
Impact: Construction could temporarily impede access to emergency services, as well as to collection and delivery services.	--	SM	SM	LS	SM	SM
▪ Construction trenches will be covered by steel trench plates to allow access.		✓	✓		✓	✓
▪ Work with affected jurisdictions (Santa Cruz County or City of Watsonville) to identify detours.		✓	✓		✓	✓

[a] Impacts and Mitigation Measures are summarized; please see Chapter 4 and 5 for details.

-- Indicates that the impact does not apply
SM = Significant and Mitigable
SU = Significant and Unavoidable
LS = Less than Significant
CBD = Indicates that impact significance cannot be determined without additional design and environmental analysis.
✓ = Indicates to which project components the mitigation measure applies.

TABLE S.2 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES

IMPACTS AND MITIGATION MEASURES[a]	BMP 2000 Alternative		Local-Only Alternative			
	4A. Water Recycling	4B. Groundwater Banking	5A. Water Recycling	5B. Expanded College Lake	5C. Corralitos Creek Pinto Lake Diversions	5D. Aquifer Storage and Recovery
Public Services (cont.)						
▪ Notify emergency services of the timing, location, and duration of construction activities and the locations of detours and lane closures.		✓	✓		✓	✓
Impact: Construction activities could require short-term police and fire protection services.	--	LS	--	--	--	--
▪ Implement traffic mitigation measures. (Recommended)		✓				
Impact: Pump station operations would increase demand for electrical service.	--	--	SM	SM	SM	SM
▪ Design of facilities with substantial electrical demand will be coordinated with PG&E to ensure adequate electricity service is available.			✓	✓	✓	✓
Visual/Aesthetic and Recreation Resources						
Impact: Development of the project would alter the visual character of, and views of, the project area.	SM	SM	SM	SM	SM	SM
▪ Revegetate disturbed natural areas to minimize textural contrasts.	✓	✓	✓	✓	✓	✓
▪ Use design elements to enhance visual integration of the project.	✓		✓	✓	✓	✓
▪ Restore disturbed areas to their pre-project condition.	✓		✓		✓	✓

[a] Impacts and Mitigation Measures are summarized; please see Chapter 4 and 5 for details.

-- Indicates that the impact does not apply
SM = Significant and Mitigable
SU = Significant and Unavoidable
LS = Less than Significant
CBD = Indicates that impact significance cannot be determined without additional design and environmental analysis.
✓ = Indicates to which project components the mitigation measure applies.

TABLE S.2 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES

IMPACTS AND MITIGATION MEASURES[a]	BMP 2000 Alternative		Local-Only Alternative			
	4A. Water Recycling	4B. Groundwater Banking	5A. Water Recycling	5B. Expanded College Lake	5C. Corralitos Creek Pinto Lake Diversions	5D. Aquifer Storage and Recovery
Visual/Aesthetic and Recreation Resources (cont.)						
▪ Restore the topography of disturbed areas to a visually unobtrusive condition.		✓				
▪ Submit a revegetation plan to CDFG.		✓				
Impact: Development of the proposed pipeline would temporarily disrupt recreational uses along designated recreational bicycle trails and reduce the aesthetic quality of bicycle recreation.	LS	LS	LS	LS	LS	LS
Impact: The project could introduce new sources of light and increase ambient light.	LS	LS	LS	LS	LS	LS
▪ Position lighting to prevent glare. If necessary, landscaping will be provided. Highly reflective building materials and/or finishes will not be used. (Recommended)	✓	✓	✓	✓	✓	✓
Change in Place of Use						
Impact: Potential indirect effect: future land use changes (e.g., conversion of native lands).	--	SM				
▪ CEQA compliance required for future water service.		✓				
▪ Endangered Species Act compliance required for future water service on native lands.		✓				
Growth Inducement Potential						
Impact: Project would accommodate future growth and indirectly results in secondary impacts.	SM/SU	SM/SU	SM/SU	SM/SU	SM/SU	SM/SU

[a] Impacts and Mitigation Measures are summarized; please see Chapter 4 and 5 for details.

-- Indicates that the impact does not apply
SM = Significant and Mitigable
SU = Significant and Unavoidable
LS = Less than Significant
CBD = Indicates that impact significance cannot be determined without additional design and environmental analysis.
✓ = Indicates to which project components the mitigation measure applies.

TABLE S.2 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES

IMPACTS AND MITIGATION MEASURES[a]	BMP 2000 Alternative		Local-Only Alternative			
	4A. Water Recycling	4B. Groundwater Banking	5A. Water Recycling	5B. Expanded College Lake	5C. Corralitos Creek Pinto Lake Diversions	5D. Aquifer Storage and Recovery
Growth Inducement Potential (cont.)						
▪ Responsible agencies have authority to implement mitigation.	✓	✓	✓	✓	✓	✓

[a] Impacts and Mitigation Measures are summarized; please see Chapter 4 and 5 for details.

-- Indicates that the impact does not apply
SM = Significant and Mitigable
SU = Significant and Unavoidable
LS = Less than Significant
CBD = Indicates that impact significance cannot be determined without additional design and environmental analysis.
✓ = Indicates to which project components the mitigation measure applies.

CHAPTER 1
INTRODUCTION

1.1 PURPOSE OF THE EIR

The Pajaro Valley Water Management Agency (PVWMA) has prepared this Draft Environmental Impact Report (DEIR) to provide the public, and Responsible and Trustee Agencies reviewing this project, with information about the potential effects of implementation of the Revised Basin Management Plan (Revised BMP) on the local and regional environment. This EIR was prepared in compliance with the California Environmental Quality Act (CEQA) of 1970 (as amended), the CEQA Guidelines, and California Administrative Code, Title 14, Chapter 3.

The EIR primarily addresses the environmental impacts of two alternatives developed through the Revised BMP: the Local-Only Alternative and the BMP 2000 Alternative. Both alternatives are intended to address groundwater overdraft and sea water intrusion conditions in the Pajaro Valley Basin. Components of the BMP 2000 Alternative include water conservation measures; a Groundwater Banking program, which includes construction of a 23-mile-long pipeline to convey water from the Central Valley Project (CVP) to the PVWMA service area for agricultural uses; the existing Harkins Slough project; Murphy Crossing and the Coastal and Inland Distribution Systems projects; and implementation of a water recycling facility at the Watsonville Wastewater Treatment Facility. Components of the Local-Only Alternative include water conservation and other demand management options; a water recycling facility; expansion of College Lake; new diversions at Corralitos Creek, Pinto Lake, and Watsonville Slough; and an aquifer storage and recovery project. The potential environmental impacts of these alternatives are evaluated in this EIR.

The EIR also addresses two variants of these alternatives: the Modified BMP 2000 and Modified Local-Only alternatives, as well as a "No Project" alternative.

The impact analyses in this report are based on a variety of sources, including agency consultation, the EIR completed on PVWMA's Local Water Supply and Distribution Project ("Local Projects" EIR), archaeological reports on the project area, and field surveys completed by Environmental Science Associates staff. The General and Specific Plans for the City of Watsonville and Santa Cruz, Monterey, San Benito, and Santa Clara counties also were used.

1.2 CEQA PROCESS

1.2.1 BACKGROUND

PVWMA adopted its first Basin Management Plan in 1993. This plan described and evaluated a wide variety of options for water supply and its management. Through the analysis of the BMP and the development of a Programmatic EIR (PEIR) on the BMP, a preferred Water Supply Project was identified and adopted by the PVWMA Board of Directors (Resolution No. 93-18) for further consideration and development. The Local Water Supply and Distribution Project (evaluated in the Local Projects EIR, 1999) was developed as part of the recommended program of the 1993 BMP. The Revised BMP updates the 1993 BMP. Implementation of the Revised BMP meets the definition of a "project" and therefore is subject to CEQA. The PVWMA serves as the lead agency for development of the EIR for the project, with input and coordination provided by other responsible agencies and local jurisdictions.

1.2.2 INITIAL STUDY AND NOTICE OF PREPARATION

In accordance with Sections 15063 and 15082 of the CEQA Guidelines, the PVWMA, as Lead Agency, prepared a Notice of Preparation (NOP) and an Initial Study for this EIR. These were circulated to local, state, and federal agencies and other interested parties in June 2000. A second revised NOP was published in 2001 to add consideration of the Local-Only Alternative to the EIR. The NOPs provided a general description of the proposed project and a preliminary list of potential environmental impacts. Additional coordination with public agencies was provided through informal consultation and telephone interviews conducted throughout the EIR process.

Two public scoping meetings were held on PVWMA's Revised BMP, in Watsonville (June 22, 2000 and March 29, 2001), to present the proposed project to interested parties to solicit their input as to the scope and content of the EIR. Public notices were placed in local newspapers informing the general public of the scoping meetings.

ISSUES RAISED DURING SCOPING

Table 1.1 summarizes many of the issues raised during the scoping periods for the EIR.

1.2.3 DRAFT EIR

The Draft EIR focuses on the potentially significant environmental effects of the project. Significance criteria (indicating what constitutes a significant impact) have been developed for each environmental issue analyzed in this EIR, and are defined at the beginning of each impact analysis section. Impacts are categorized as follows:

1) significant, unavoidable

TABLE 1.1
SUMMARY OF ISSUES RAISED DURING SCOPING

Issues Raised	Section Addressing These Issues
Project costs and economic effects in Pajaro Valley	PVWMA is currently developing a rate study to establish a stable revenue stream to fund the capital debt and operating costs of the proposed facilities. Refer to Chapter 8 of this EIR (Socioeconomic Effects)
Effect on biological and agricultural resources	Chapters 4 and 5, Land Use and Vegetation, Fish and Wildlife sections
Growth inducement in Pajaro Valley	Chapter 7
Water quality standards of recycled water and groundwater (specifically nitrate contamination)	Section 3.3
Wetland preservation and enhancement	Impacts and mitigation measures addressing wetlands are presented in the Vegetation, Fish and Wildlife sections of Chapters 4 and 5.
Cultural resources impacts	Sections 4.A.5, 4.B.5, 5.A.5, 5.B.5, 5.C.5, and 5.D.5
Cumulative impact analysis of the present and future groundwater overdraft	Section 8.2 and Chapter 6 (No Project Alternative)
Rubber dam in the Pajaro River	Chapter 6 (River Conveyance discussion)
Bureau of Reclamation CVP contract	Chapter 2
Pumping by Granite Rock Quarry	The quarry is outside the PVWMA service area. PVWMA has no jurisdiction over pumping by Granite Rock Quarry.
Impacts to steelhead at College Lake	Section 5.B.4
Use most recent data for projections of average annual supply to be provided by each alternative.	The average annual supply provided by each alternative is from the draft Revised BMP.
Consider permit issues; encroachment permit required to tunnel under Highway 1.	Section 2.5
Impacts of surface water withdrawals on area hydrology and the City of Watsonville water supply; level and consistency of surface water quality.	Sections 5.C.3, Section 8.2. The alternatives are designed to have a beneficial effect on the groundwater basin, which supplies the City of Watsonville. See also Section 8.2.

TABLE 1.1 (Continued)
SUMMARY OF ISSUES RAISED DURING SCOPING

Issues Raised	Section Addressing These Issues
Groundwater extraction on surface water-groundwater interactions; nitrate contamination; impacts of well deepening.	The proposed project includes deeper wells and includes mitigation to address those wells (refer to Hydrology Sections). Sections 4.B.3 and 5.D.3 pertain to groundwater extraction. The Hydrology and Water Quality sections in Chapters 3, 4, and 5 address nitrate. See also Section 8.2.
Impacts of injecting Central Valley Project water on groundwater quality; injecting recycled wastewater; impacts of potentially high salt levels in recycled water on agriculture.	Chapter 6; injection of recycled water is not proposed; Sections 4.B.3 and 5.A.3.
Potential increase of mosquito habitat/breeding areas if surface waters are improperly managed.	PVWMA will comply with mosquito abatement guidance provided by the local abatement district.
Capacity, size, and depth of the College Lake well field; impacts of the well field on existing wells and water rights. Impacts of the extraction area on the slough system.	Wells would be located along ASR Pipeline. Sections 4.B.3 and 5.D.3.
Impacts, including cost and loss of prime agricultural land, of farm reservoirs; allocation of costs of constructing and responsibility for having farm reservoirs. Use (and loss) of agricultural resources compared with using less valuable land off-site. Adequacy of impact analysis if it is done before location and size of farm reservoirs is determined.	The farm reservoir component of the Local-Only Alternative has not been developed in enough detail to analyze in this EIR; additional CEQA analysis would be required prior to approval and implementation of this component.
Project impacts with respect to Total Maximum Daily Loads (TMDLs) that are yet to be established; potential constraints on project implementation when the TMDLs are established.[1]	Section 3.3.2, Regulatory Setting and Section 8.2, Cumulative Impacts (Hydrology and Water Quality discussion).
Impacts on endangered species; need for biological resource surveys; impacts on fisheries of the project in conjunction with TMDLs.	Sections 4.A.4, 4.B.4, 5.A.4, 5.B.4, 5.C.4, 5.D.4
Impacts on cultural resources in or near the project area; need for archaeological surveys.	Sections 4.A.5, 4.B.5, 5.A.5, 5.B.5, 5.C.5, 5.D.5

[1] This comment pertains to recently enacted federal regulations addressing contaminant loading from nonpoint sources in water bodies (e.g., run-off from farms).

TABLE 1.1 (Continued)
SUMMARY OF ISSUES RAISED DURING SCOPING

Issues Raised	Section Addressing These Issues
Impacts on air quality; identification of mitigation measures for any significant impacts; consistency with the 1997 Air Quality Management Plan; applicability of federal General Conformity rule, if required. Permit(s) for stationary sources will be needed from the Monterey Bay UAPCD.	Sections 4.A.7, 4.B.7, 5.A.7, 5.B.7, 5.C.7, 5.D.7. Conformity rule applies and determination will be addressed in the forthcoming EIS.
Methodology and assumptions underlying the selection of the proposed pipeline route; analyze alternative pipeline routes.	Section 2.3.3, Groundwater Banking
Compare the effectiveness of project alternatives in solving the basin's water problems while sustaining existing agriculture.	Section 2.2.3, Ability of the Alternatives to Meet Project Objectives
Impacts on agricultural lands in terms of types of crops affected and extent or value of lost agricultural productivity.	Discussed in general terms in Chapter 8 (Socioeconomic Issues).
Installation of tertiary treatment components at areas with less productive soils as an alternative to expanding the Watsonville Wastewater Treatment Facility.	It would be impractical to locate the Recycled Water Facility remote from the WWTF. The WWTF is surrounded by prime agricultural land on three sides and the Pajaro River on the fourth.
Consider the economic and cumulative costs of the No Project Alternative.	Chapter 6
Evaluate appropriate alternatives to any injection component.	Chapter 6. The BMP 2000 Alternative does not have an injection component; the Local-Only Alternative does.
Add to BMP 2000 the joint management of the Aromas Red Sands aquifer with Soquel Creek Water District.	Chapter 6
The growth-inducing impacts on air quality, particularly ozone precursor emissions; growth-inducing impacts of the Local-Only Alternative.	Chapter 7.
Impacts of fallowing prime farmland, and explanation of how land to be fallowed will be determined.	Discussed generally in Chapter 8 (Socioeconomic Issues). PVWMA likely would lease land on an annual basis.

TABLE 1.1 (Continued)
SUMMARY OF ISSUES RAISED DURING SCOPING

Issues Raised	Section Addressing These Issues
Reliance of Local-Only Alternative on an aggressive conservation program; the level, extent, and location of land to be fallowed and the associated environmental, economic, and social effects. Effectiveness, cost, and impacts on agriculture of reliance on conservation. Need for effective enforcement of conservation restrictions.	Section 2.2.3, Ability of the Alternatives to Meet Project Objectives. Socioeconomic issues are discussed in general terms in Chapter 8.
Baseline water use data is needed to measure the effectiveness of conservation measures.	Refer to draft Revised BMP for a discussion of effectiveness of conservation measures.
Define any proposed drought contingency plan and the objective of such a plan.	Modeling for the project incorporates periods of drought in the hydrologic sequence.
Effects of agricultural chemicals and groundwater use from agriculture on hydrology, water quality, and biological resources on land and in the Monterey Bay Sanctuary.	The practice of agriculture is not the project evaluated in this EIR. The project's effect on water quality and biological resources are described in Chapters 4 and 5.
Cumulative impact analysis	Chapter 8

2) significant, but can be mitigated to a less-than-significant level
3) less than significant (mitigation is not required under CEQA, but may be recommended)
4) no impact
5) cannot be determined (project design information needed to determine impact significance has not been developed)

CEQA requires that a lead agency shall neither approve nor carry out a project as proposed unless the significant environmental effects have been reduced to an acceptable level (CEQA Sections 15091 and 15092) or the project objectives outweigh the unavoidable significant impacts (requiring the Lead Agency to make a Statement of Overriding Considerations) (CEQA Section 15093). An acceptable level is defined as eliminating, avoiding, or substantially lessening the significant effects.

The scope of the EIR was determined by preliminary screening of possible environmental impacts in an Initial Study, the written responses to the NOPs, and issues raised at the public scoping meetings. The mitigation measures identified as "Mitigation Identified in this EIR" are measures identified during the EIR process that could be implemented to mitigate project impacts. At the discretion of the PVWMA Board, these mitigation measures may or may not be incorporated into the project's design, construction, and/or operation.

The BMP 2000 Alternative and Local-Only Alternative both include water conservation. The proposed water conservation measures would not involve construction of any new facilities and would not result in direct physical changes to the environment. The Initial Study that was included with the Notice of Preparation determined that the water conservation measures would not result in significant environmental impacts. For this reason, the water conservation component of the Recommended Program is described in Chapter 2, Project Description, of this EIR, but it is not addressed in the impact analyses. The proposed local water supply projects at Harkins Slough and Murphy Crossing and the Coastal and Inland Distribution Systems were evaluated in the Local Water Supply and Distribution EIR, which was certified by the PVWMA Board of Directors on May 6, 1999; consequently, the impacts specific to the construction and operation of those components are not evaluated in this EIR.

1.2.4 PUBLIC REVIEW OF THE DRAFT EIR

This document is being circulated to local, state and federal agencies, and to interested organizations and individuals wishing to comment on the EIR. Publication of this Draft EIR marks the beginning of a 45-day public review period, during which written comments may be sent to PVWMA, 36 Brennan Street, Watsonville, California, 95076.

During this 45-day review period, the PVWMA will hold a formal public meeting on the Draft EIR to receive oral comments on the contents of the EIR. Comments should be focused on the adequacy and accuracy of the content of the EIR.

1.2.5 FINAL EIR CIRCULATION

Written and public hearing comments received in response to the Draft EIR will be addressed in a Response to Comments addendum document that, together with the Draft EIR, will constitute the Final EIR. The Final EIR will contain responses to comments solely on the content of the Draft EIR. The Final EIR will be circulated for public review, and the PVWMA will hold a public hearing on the Final EIR to consider EIR certification. The PVWMA Board of Directors will then consider a resolution for EIR certification (i.e., a finding that the EIR complies with the requirements of CEQA). Following EIR certification, the PVWMA may proceed with consideration of project approval actions, including selection of one of the alternatives evaluated in this EIR or a combination thereof, and adoption of any environmental mitigation requirements.

1.2.6 MITIGATION MONITORING AND REPORTING

CEQA requires lead agencies to adopt a reporting and mitigation monitoring program for the changes to adopt the project which it has adopted or made a condition of project approval in order to mitigate or avoid significant effects on the environment. A specific "reporting or monitoring" program will be developed at the time PVWMA makes findings on the project. All mitigation measures adopted by the PVWMA as conditions for approval of the project will be included in the Mitigation Monitoring and Reporting Program.

1.3 PROJECT APPROVAL AND PERMITTING PROCESS

Before the project could be constructed, it would require the certification of this EIR as described above, approval of the project and filing of the Notice of Determination. CEQA requires that if a Lead Agency is approving a project for which an EIR has identified one or more significant effects, the Agency must produce written findings describing these effects (CEQA Section 15091). As implementation of the Revised BMP would have a significant effect on the environment as described in this EIR, the PVWMA Board of Directors will be required to make findings. Possible findings include the following:

1. a description of changes in the project or mitigations that have been required which avoid or lessen the significant effect;

2. a description of those responsible for carrying out mitigation, and under what jurisdiction; and

3. a description of considerations that could make mitigation measures or project alternatives identified in the EIR more feasible.

If the lead agency approves the project, even though significant impacts identified by the EIR cannot be mitigated to a less-than-significant level, the agency must state in writing the reasons for approving the project, termed Statement of Overriding Considerations. All findings must be included in the record of the project approval and mentioned in the Notice of Determination (CEQA Guidelines Section 15093.c).

PVWMA will hold a public hearing on the proposed project. This hearing will be a separate public hearing from that held for EIR certification and will specifically serve to receive public comment about whether or not the project should be adopted. Public comment on the findings may be made at that time.

Following these actions PVWMA could proceed with engineering design. Implementation would require PVWMA to secure permits and approvals from several local, regional and State agencies. Depending on final design, permits may be required from various agencies. These potential permits and approvals are presented toward the end of Section 2, Project Description.

1.4 ORGANIZATION OF THE DRAFT EIR

The other chapters of this Draft EIR are as follows:

S. **Summary**. This chapter summarizes the contents of the Draft EIR.

2. **Project Description**. This section provides an overview of the project, describes the need for and objectives of the project, and provides detail on the characteristics of the BMP 2000 Alternative and Local-Only Alternative.

3. **Regional Setting**. This chapter presents a description of the physical and regulatory setting of the project by environmental issue area (land use and planning, geology, et al).

4. **BMP 2000 Alternative – Environmental Setting, Impacts and Mitigation Measures**. This chapter describes the environmental setting and identifies impacts and measures to mitigate those impacts for the projects comprising the BMP 2000 Alternative. This chapter is divided into the following sections: 4.A, Water Recycling, 4B, Groundwater Banking, and 4C, Change in Place of Use. Each section is further divided by environmental issue area (land use and planning, geology, et al).

5. **Local-Only Alternative – Environmental Setting, Impacts and Mitigation Measures**. This chapter describes the environmental setting and identifies impacts and measures to mitigate those impacts for the projects comprising the Local-Only Alternative. This chapter is divided into the following sections: 5.A, Water Recycling, 5.B, Expanded College Lake, 5.C, Corralitos Creek and Pinto Lake Diversions, and 5.D, Aquifer Storage and Recovery. Each section is further divided by environmental issue area (land use and planning, geology, et al).

6. **Other Alternatives**. This chapter presents an overview of the alternatives development process and describes other alternatives considered, including the Modified BMP 2000 Alternative and Modified Local-Only Alternative.

7. **Growth Inducement Potential**. This chapter describes the potential for the project to induce development.

8. **Impact Overview**. This chapter presents a summary of impacts identified in the EIR, identifies cumulative impacts, and describes socioeconomic issues related to project funding.

9. **Report Preparers**. This chapter identifies those involved in preparing this Draft EIR.

This page left
intentionally blank

CHAPTER 2
PROJECT DESCRIPTION

2.1 PROJECT OVERVIEW AND BACKGROUND

2.1.1 PROJECT OVERVIEW

The Pajaro Valley Water Management Agency (PVWMA) has prepared the draft Revised Basin Management Plan (Revised BMP) to address water resources management issues in the Pajaro Valley. The purpose of the Revised BMP is to review and update the water supply planning information presented in previous studies and to outline the water supply planning objectives and a plan to meet these objectives clearly.[1] Various well monitoring and data collection efforts, including those of the U.S. Geological Survey, have provided input to the updated groundwater model. Updated groundwater modeling runs have refined the agency's understanding of existing (baseline) conditions and focused efforts to develop specific feasible alternatives. The Revised BMP formulates groundwater management objectives and recommends structural and nonstructural elements to use the basin's groundwater efficiently, economically, and equitably.

The Revised BMP evaluated numerous alternatives that included combinations of key elements, including development of local surface water projects, water conservation, land retirement, recycled water, supplemental surface water supplies, and seawater desalination.[2] Two alternatives from the draft Revised BMP have been selected for detailed evaluation in this EIR, the BMP 2000 Alternative and Local-Only Alternative. **Table 2.1** presents a comparison of the BMP 2000 and Local-Only alternatives. Two variations of these alternatives, the Modified BMP and Modified Local-Only alternatives, also have been included in this EIR and are described and evaluated in Chapter 6 of this document.

PVWMA would implement three core elements under any alternative: water conservation, water recycling, and development of additional surface water supplies (from within the basin or imported Central Valley Project [CVP] water). There are several components of one or both of the alternatives that have already been evaluated in the *Pajaro Valley Water Management Agency Local Water Supply and Distribution Environmental Impact Report* (Local Projects EIR, certified 1999). These include the following:

- *Harkins Slough Project.* This project has already been constructed and is a component of both alternatives. Under the Local-Only Alternative, the facilities would be changed and expanded. These potential changes are evaluated in this Revised BMP EIR.

[1] The Revised BMP is currently in draft form and will be finalized following certification of the Revised BMP EIR.
[2] Refer to Chapter 6 - Other Alternatives for a description of other alternatives considered in the Revised BMP report.

TABLE 2.1
COMPARISON OF LOCAL-ONLY AND BMP 2000 ALTERNATIVES

Parameter	Local-Only Alternative	BMP 2000 Alternative
Average Project Yield[a]	14,400 acre-feet per year (afy)	17,000 afy
Conservation Required	10,000 afy	5,000 afy
Project Elements[b]	▪ Recycled Water (approximately 7,700 afy) ▪ Expanded College Lake with Corralitos Creek and Pinto Lake diversion facilities, Watsonville Slough Diversion, and Harkins Slough Diversion and Aquifer Storage and Recovery Project (6,700 afy)[c] ▪ Coastal Distribution System	▪ CVP Import Pipeline (10,300 afy) with Inland Distribution System ▪ Recycled Water (4,000 afy) ▪ Harkins Slough (1,100 afy) ▪ Murphy Crossing (1,600 afy) ▪ Supplemental wells (for supply, reliability, and peaking) (17 wells)[d] ▪ Coastal Distribution System
Capital Cost of Facilities[e]	**$128 million**	**$162 million**

a Refer to Section 2.2.3, Ability of the Alternatives to Meet the Objectives of the Revised BMP, regarding the differences in average project yield and conservation associated with the two alternatives. Does not include increase in groundwater sustainable yield.

b The following project elements were evaluated in detail in the *Pajaro Valley Water Management Agency Local Water Supply and Distribution Environmental Impact Report* and therefore are not evaluated in this EIR, except as the projects contribute to cumulative impacts: Harkins Slough, Murphy Crossing, Coastal Distribution System, and Inland Distribution System.

c Reflects an estimated 1,500 afy reduction in yield due to mitigation and facility limitations.

d The number of wells required is a function of the reliability of the water supplies selected and is expected to range from two wells (for a strategy that assumes 100-percent reliable surface water supplies) to 17 wells (for a strategy that assumes minimal surface water deliveries during drought years).

e PVWMA is seeking federal funding pursuant to Title XVI for planning, design, and construction of water recycling facilities and facilities that would provide blend water. These costs reflect a $20 million credit for Title XVI funding. PVWMA is also exploring cost-saving opportunities with the U.S. Army Corps of Engineers for the potential expansion of College Lake.

SOURCE: RMC Engineers, 2001; adapted by Environmental Science Associates.

- *College Lake*. This project has not been implemented and is not part of the BMP 2000 Alternative. The Local-Only Alternative includes an Expanded College Lake project that is larger than that evaluated in the Local Projects EIR. Consequently, this Revised BMP EIR re-evaluates this component.

- *Murphy Crossing/Inland Distribution System*. These projects have not been implemented and are part of the BMP 2000 Alternative. Both were already evaluated in the Local Projects EIR.

- *Coastal Distribution System*. This project is currently being implemented and is part of both alternatives. The project was already evaluated in the Local Projects EIR.

2.1.2 PROJECT BACKGROUND

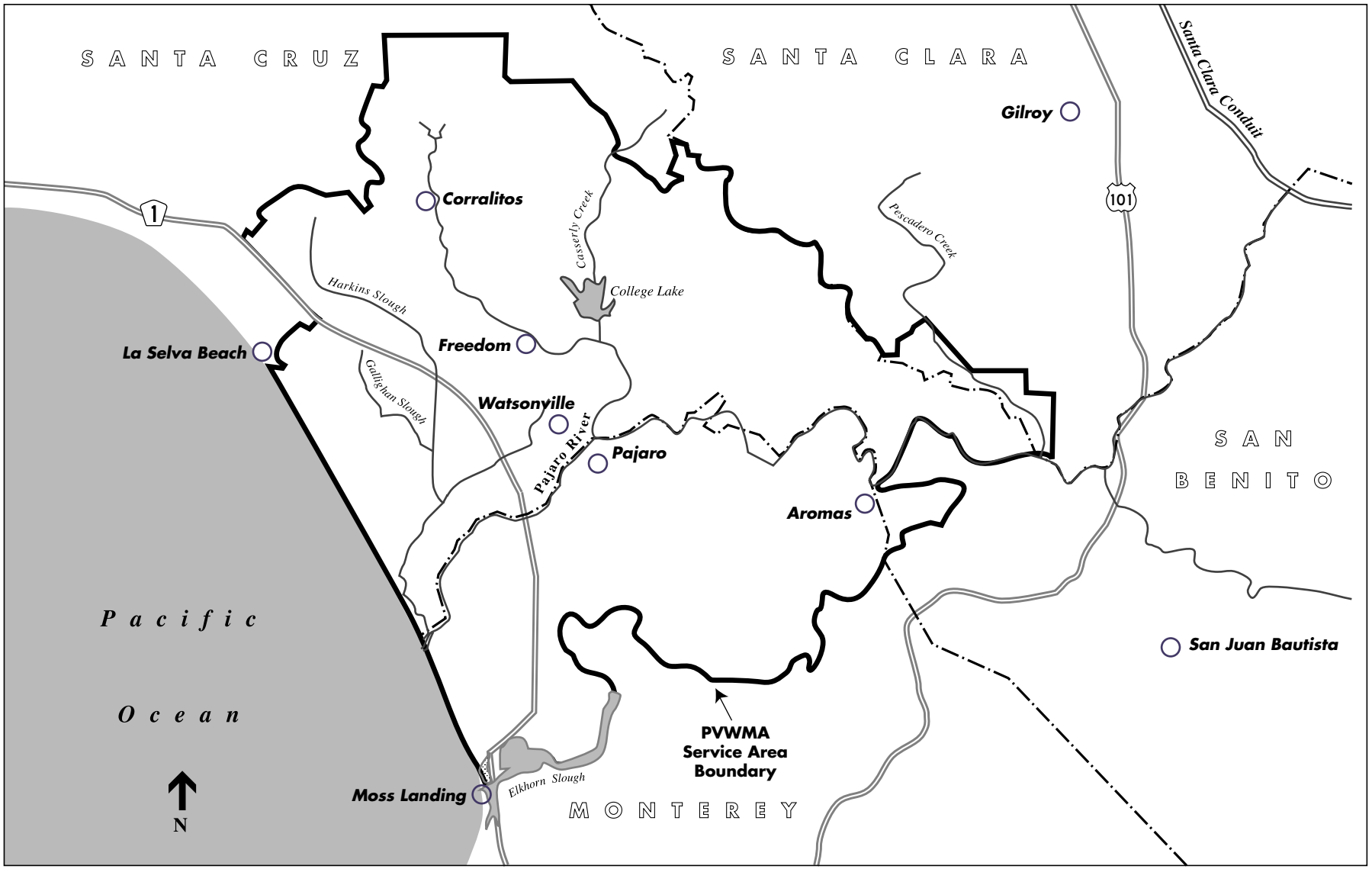
PAJARO VALLEY WATER MANAGEMENT AGENCY

In 1984, the PVWMA was formed and given the responsibility of managing groundwater resources within the Pajaro Valley. **Figure 2.1** indicates the boundaries of the PVWMA service area. The geographic boundaries of the agency approximately correspond to the topographic and hydrologic boundaries of the valley. The PVWMA service area encompasses approximately 79,600 acres of irrigated agricultural lands, native and nonirrigated lands in the hillside areas, the City of Watsonville, and the unincorporated communities of Pajaro, Freedom, Corralitos, and Aromas. The Pajaro Valley is home to over 80,000 residents, all of whom, to a great degree, rely on the existing groundwater supply. Agriculture is the most significant economic industry in the valley. High-value crops include strawberries, bush berries, apples, flowers, lettuce, artichokes, and a variety of other vegetables.

PREVIOUS STUDIES

In 1975, the U.S. Bureau of Reclamation (Reclamation) indicated its intent to deliver CVP water through the San Felipe Division to Santa Cruz and Monterey Counties to help solve seawater intrusion problems, and committed 19,900 acre-feet per year (afy) of federal CVP water to the Pajaro Valley, for which PVWMA holds an entitlement. Studies conducted by the Association of Monterey Bay Area Governments (AMBAG) from 1978 through 1984 further evaluated groundwater conditions, recharge areas, and other possible water supply solutions (AMBAG, 1978, 1983, and 1984).

The PVWMA's 1993 BMP, developed in conjunction with Reclamation, identifies a preferred water supply alternative for meeting supply needs. This preferred alternative called for bringing out-of-basin CVP water through an import pipeline and enhancing use of local surface water supplies as key water sources. The basin would be managed by decreasing pumping during wet years and relying on banked groundwater in dry years. Other components of the 1993 BMP include conservation programs, an irrigation distribution system, and, to the extent feasible, use of local recycled water. A Programmatic Environmental Impact Report (PEIR) was developed for the BMP, which addressed the water import and local water supply concepts (PVWMA, 1993).



PVWMA Revised BMP EIR / 200179 ■

Figure 2.1
PVWMA Service Area

PVWMA has initiated the first phase of the proposed water supply program, which includes the construction of facilities to utilize local surface water supplies available from Harkins Slough and the construction and operation of pipelines, pumping, treatment, and diversion facilities for this supply. These projects, along with other local water supply projects listed at the end of Section 2.1.1, were evaluated in the Local Projects EIR. PVWMA deferred evaluation of an important part of its Revised BMP, the importation of surface water into the valley and construction of an import pipeline, pending completion of the updated BMP (the Revised BMP). The passage of Measure D in 1998 by voters within PVWMA, among other things, prohibited the construction of an imported water pipeline and limited the maximum PVWMA augmentation charge to $50 per acre-foot. Construction of an import pipeline prior to 2008 would require either a judicial decision on the validity of Measure D, or another election to amend certain provisions in Measure D.

While preparing the Local Projects EIR, PVWMA sought and eventually obtained, on a willing seller basis, an assignment of a portion of a CVP water supply contract from the Mercy Springs Water District. Reclamation approved the agreement in 1999, making PVWMA a CVP contractor. This assignment is for up to approximately 6,260 afy of water. Due to dry-year cutbacks to CVP contractors, the assignment is likely to provide an average yield of 3,760 acre-feet per year, assuming an average yield of 60 percent. Previous deliveries of CVP water to Mercy Springs ranged from 25 percent to 100 percent; consequently, the potential water supply is expected to range up to 6,260 afy. PVWMA and Reclamation completed evaluation of the Mercy Springs contract assignment pursuant to the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA) in 1999.

In 2000, PVWMA initiated the update of the original 1993 Basin Management Plan: the Revised BMP. As discussed in the preceding section, PVWMA has conducted extensive groundwater modeling that has been used to quantify the extent, magnitude, and character of the overdraft conditions since completion of the 1993 BMP. The draft Revised BMP builds on strategies presented in the 1993 BMP. The four strategies presented in the draft Revised BMP (the BMP 2000 and Local-Only alternatives, and modified versions of both) are evaluated in this EIR. The public has been encouraged to comment on the draft Revised BMP so that PVWMA can select a preferred strategy that responds to the concerns and needs of its water users. PVWMA will hold a series of public workshops and other outreach efforts with the objective of determining a recommended alternative that will have wide community support. These activities will parallel public review of this Draft EIR. Upon receipt of public input, the PVWMA Board of Directors will identify a recommended alternative. Following this action, PVWMA will finalize and certify the EIR and adopt a recommended alternative.

2.2 NEED FOR THE PROJECT AND PROJECT OBJECTIVES

2.2.1 NEED FOR THE PROJECT

OVERDRAFT AND SEAWATER INTRUSION

The State Water Resources Control Board Bulletin 5 first documented the need to augment Pajaro Valley water supplies in 1953. A 1964 Reclamation San Felipe Division feasibility study confirmed water supply concerns, primarily overdraft and seawater intrusion problems in the PVWMA service area along Monterey Bay. Overdraft occurs when the amount of groundwater withdrawn from a basin exceeds the amount of fresh water replenishing the basin. In the Pajaro Valley Basin, groundwater levels have declined as the groundwater pumping rate has exceeded the rate of natural replenishment. These overdraft conditions result in increased pumping costs and land subsidence, which in turn can cause building settlement and increased flooding.

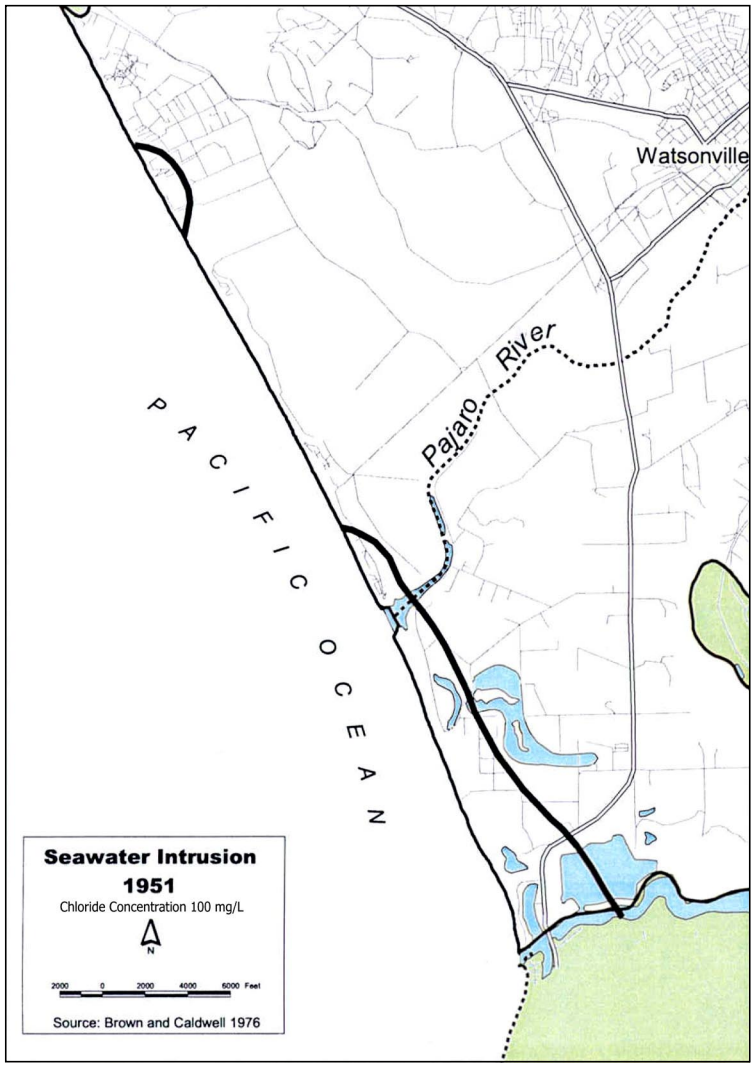
In the coastal areas and throughout much of the basin, overdraft conditions have caused groundwater levels to drop below sea level, creating a landward pressure gradient that causes seawater to move inland, mixing with fresh groundwater. The density difference between seawater and fresh water causes the fresh water to stratify above the seawater. As seawater encroaches into the fresh groundwater basin, water quality degrades, limiting the usability of groundwater for irrigation and domestic purposes, and the wells have to be abandoned. Seawater intrusion creates a progressive increase in the concentrations of chloride, magnesium, and/or other constituents in groundwater. Chloride is used as an indicative constituent for seawater intrusion; increasing chloride concentrations in well water samples are an indication of seawater intrusion. The average concentration of chloride in seawater is 19,000 milligrams per liter (mg/L). Water is likely to result in increasing problems for agricultural irrigation when chloride levels exceed 142 mg/L. **Figure 2.2** presents estimated movement of seawater intrusion (PVWMA, 2000b). The actual process of seawater intrusion is irregular, with seawater moving into different freshwater aquifers at different times. These conditions are not expected to improve without the following:

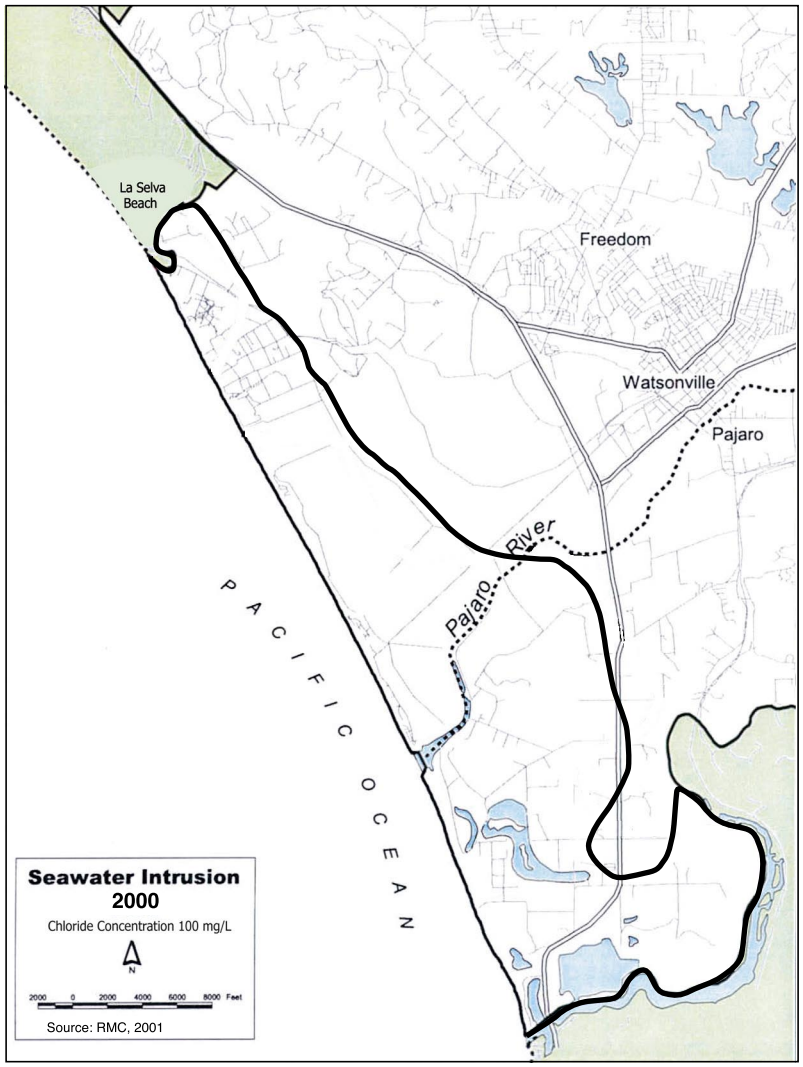
- elimination of coastal groundwater pumping, and
- development and delivery of additional water supplies.

WATER DEMAND AND WATER AVAILABILITY

Historic Patterns of Recharge and Pumping in the Groundwater Basin

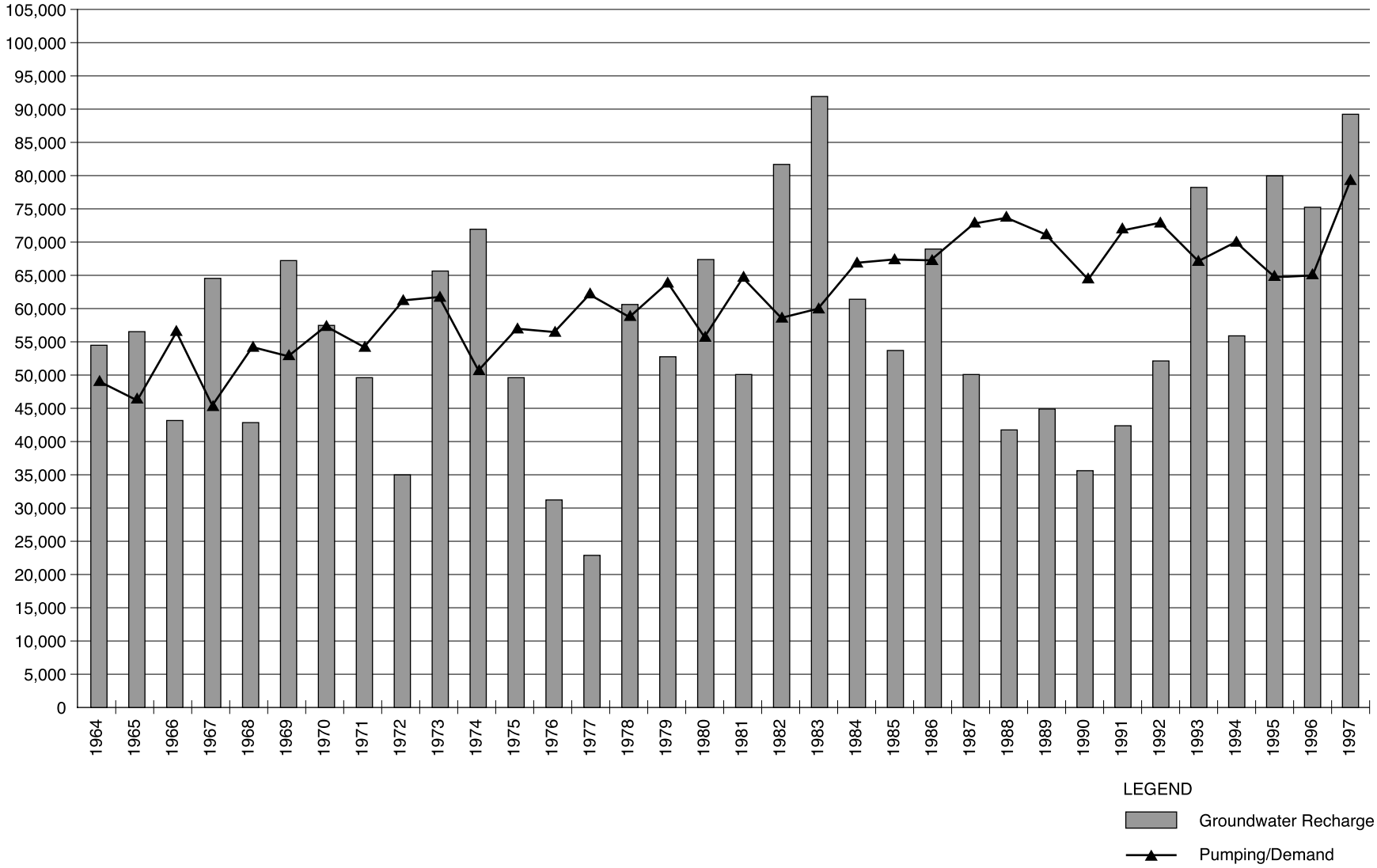
Figure 2.3 illustrates historic patterns of groundwater recharge and pumping in the Pajaro Valley. Deep percolation of rainfall, stream recharge, irrigation recharge, and (to a much lesser extent) the inflow of groundwater from outside the area recharge the valley's groundwater basin. The graph indicates the combined annual recharge from these sources for the years 1967 through 1997. The graph indicates that limited recharge that occurred during drought years (1976-1977, and 1987-1992). The line across the graph illustrates the change in groundwater demand





SOURCE: PVWMA, 1993; RMC, 2001

Figure 2.2
Seawater Intrusion Areas of
Elevated Chloride Levels (100 mg/l or Greater),
1951 and 2000



SOURCE: State of the Basin Report, 2000

Figure 2.3

Groundwater Recharge vs Pumping/Demand
Pajaro Valley Water Management Agency

(pumping) over time. When demand exceeds available recharge, overdraft of the groundwater basin occurs. Demand exceeded available recharge during drought years as well as during many years with normal rainfall.

Existing and Future Water Use[3]

Table 2.2 indicates existing and projected future water use in the PVWMA service area [NAT comment: have we previously defined PVWMA service area?]. The table indicates the following:

- Groundwater represents over 95 percent of water use in the PVWMA service area.
- The Revised BMP projects a 9,000-afy increase in water use by 2040. Urban demand represents about 3,900 afy of the projected increase, while agricultural demand represents about 5,100 afy of the increase.

For the purposes of determining baseline and future water use in the PVWMA service area, land use is divided into two categories: agriculture (irrigation water only) and urban (municipal, commercial, and industrial water users). PVWMA determined historic water use from data for the urban category (City of Watsonville groundwater production records, adjusted to include urban acreage in unincorporated areas) and groundwater basin modeling (the Pajaro Valley Integrated Groundwater Surface Water Model [PVIGSM]) for the agricultural category. PVWMA estimated baseline (current) urban water use by averaging monthly urban water use during the 1994 through 1997 hydrologic period. Future urban water use was estimated based on population projections provided by AMBAG and a water use factor of 131 gallons per day per capita.[4] For baseline agricultural water use, the basic inputs and assumptions used in modeling the groundwater basin included the following:

- California Department of Water Resources (DWR) land use survey data (1997) for cropping patterns;
- Historic hydrologic data, including average, wet, and dry years (to determine the amount of water provided by the natural hydrologic cycle versus pumping); and
- Water use factors (based on application rates by crop type, irrigated acreage, effective rainfall, minimum soil moisture, crop evapotranspiration, irrigation efficiency, cultural practices such as crop rotation, and marketing factors).

For future agricultural water use, the draft Revised BMP assumed that the total acreage of land under cultivation would remain constant, but that historic shifts in crop type—from deciduous crops to nursery, berry, and vine crops—would persist. The Revised BMP assumes that approximately 2,000 acres of deciduous crops would be converted to berry crops and that future

[3] This section presents a summary of the complex land use and water consumption information developed for the draft Revised BMP. For further information on these issues, refer to Sections 2.6 and 2.7 in the draft Revised BMP, and to Chapter 7 of this Draft EIR.

TABLE 2.2
EXISTING AND FUTURE WATER SUPPLIES,
REQUIRED SUPPLEMENTAL SUPPLIES

Demand	Current Conditions (afy)[a]	Future (2040) Conditions (afy)[a]
Agricultural Uses	59,300	64,400
Urban Uses	12,200	16,100
Total Demand	**71,500**	**80,500**
Corralitos Creek Diversion by City of Watsonville	(1,100)	(1,100)
Other Surface Water Diversions	(1,000)	(1,000)
Total Groundwater Pumping	**69,000**	**78,000**
Basin Sustainable Yield assuming implementation of the Coastal Distribution System and 100 percent reliable supplemental supply	(48,000)	(48,000)
Required Additional Water Supplies	**21,000**	**30,000**

[a] Numbers may not total due to rounding.

SOURCE: RMC, Inc., *Revised BMP (draft*), August 2001.

agricultural water use would increase commensurately. (Deciduous crops use approximately 0.7 acre-feet per acre [af/acre]), compared to approximately 2.8 af/acre for strawberries and 3.7 af/acre for raspberries.)

Sustainable Yield

Sustainable yield is defined as the level of pumping that the groundwater basin can sustain without inducing seawater intrusion and/or lowering groundwater elevations. Groundwater modeling results indicate that seawater intrusion is not uniform throughout the basin; some areas are more affected than others. Modeling results indicate that under current basin-wide pumping conditions, groundwater pumping would have to be reduced by 45,000 afy (65 percent) in order to eliminate seawater intrusion throughout the coastal area. Therefore, assuming pumping reductions throughout the basin, the sustainable yield is approximately 24,000 afy (equal to the difference between existing pumping levels—69,000 afy—and a 45,000-afy reduction in pumping needed to eliminate seawater intrusion).

Groundwater modeling indicates that the elimination of pumping along the coast would reduce seawater intrusion more efficiently than a reduction in pumping throughout the basin. The

[4] AMBAG provides forecasts of population growth in five-year increments through 2020. The BMP performance period is through 2040. The draft Revised BMP assumed that the growth rate from 2020 to 2040 would be consistent with the AMBAG growth rate assumed for the years 2015 to 2020.

elimination of coastal pumping would create a hydrostatic freshwater barrier between Monterey Bay and inland pumping areas. Consequently, the strategies developed in the Revised BMP (the BMP 2000 and Local-Only alternatives and modified versions of both) all assume a curtailment of pumping in the coastal zone, and development of supplemental water supplies and the Coastal Distribution System to meet this demand. The Coastal Distribution System is currently in design. Assuming that pumping ceases in the coastal area and that the supplemental water supply is 100 percent reliable, the basin sustainable yield increases to 48,000 afy. Consequently, additional water supplies totaling 21,000 afy are needed to meet current requirements, and 30,000 afy are needed to meet future requirements (refer to **Table 2.2**).

2.2.2 PROJECT OBJECTIVES

The specific objectives of the project are:

- To prevent long-term seawater intrusion, groundwater overdraft, land subsidence, and water quality degradation;
- To manage existing and supplemental water supplies to control overdraft and to provide for present and future water needs;
- To create a reliable, long-term water supply, which has been identified as an important cornerstone of the long-term economic vitality of the Pajaro Valley;
- To develop water conservation programs; and
- To recommend a program that is cost effective and environmentally sound.

2.2.3 ABILITY OF THE ALTERNATIVES TO MEET THE OBJECTIVES OF THE REVISED BMP

As indicated in the preceding section, with the elimination of pumping in the coastal area, the basin's sustainable yield after construction of new water supply projects is approximately 48,000 afy, meaning that the shortfall of water supply will be approximately 30,000 afy by 2040. The objectives of the Revised BMP entail eliminating this shortfall through development of additional water supply sources and reduction of demand through conservation. The Local-Only Alternative and BMP 2000 Alternative differ with respect to estimated average project yield, conservation required, and water quality (see **Table 2.1**). As proposed, the yield provided by the Local-Only Alternative is insufficient to prevent long-term groundwater overdraft, land subsidence, and water quality degradation. The water supplies proposed under the Local-Only Alternative, even with ambitious conservation, would still result in a supply shortfall. Consequently, if implemented as proposed, the Local-Only Alternative would necessitate an approximately 3,000-afy reduction in agricultural irrigation. The draft Revised BMP indicates that this reduction would likely be realized through the fallowing of agricultural land.

2.3 BMP 2000 ALTERNATIVE

The components of the BMP 2000 Alternative are:

- Water Conservation
- Water Recycling
- Groundwater Banking[5] (In-Lieu Recharge) with Import Pipeline
- Other (not discussed in this chapter; evaluated in Local Projects EIR)
  - Harkins Slough and Murphy Crossing projects
  - Coastal and Inland Distribution Systems

Figure 2.4 indicates the location of the components of this alternative. PVWMA became a CVP contractor when it was assigned the Mercy Springs contract for 6,260 afy in 1999. Since PVWMA is already a CVP contractor, it is entitled to delivery of other CVP water into its service area. PVWMA also may acquire additional assignments similar to Mercy Springs or purchase water transfers from other CVP contractors on a year-to-year basis.

2.3.1 WATER CONSERVATION

LOCATION

Water conservation measures would be implemented throughout the basin.

WATER CONSERVATION 2000

The PVWMA Board of Directors adopted the Water Conservation 2000 report (WC 2000) on February 16, 2000. The WC 2000 presents conservation practices that are currently implemented and identifies opportunities for additional urban and agricultural water conservation alternatives within the Pajaro Valley.

The objective of the WC 2000 is to review and evaluate existing data sources and reports prepared by the PVWMA and other parties and to identify opportunities for increased levels of urban and agricultural water conservation within the Pajaro Valley. The WC 2000 evaluates many possibilities for water conservation for both urban and agricultural use and suggests feasible alternatives that can be practicably and economically implemented. An additional goal of the WC 2000 is to develop a water conservation program that conforms to the Association of

[5] Groundwater Banking is the storage of surface water in a groundwater basin for subsequent retrieval. Conjunctive use refers to the coordinated use of surface water and groundwater. Under the proposed project, PVWMA would implement a banking program wherein water would be banked by virtue of not being pumped, possibly in addition to injection into the groundwater basin for later retrieval.

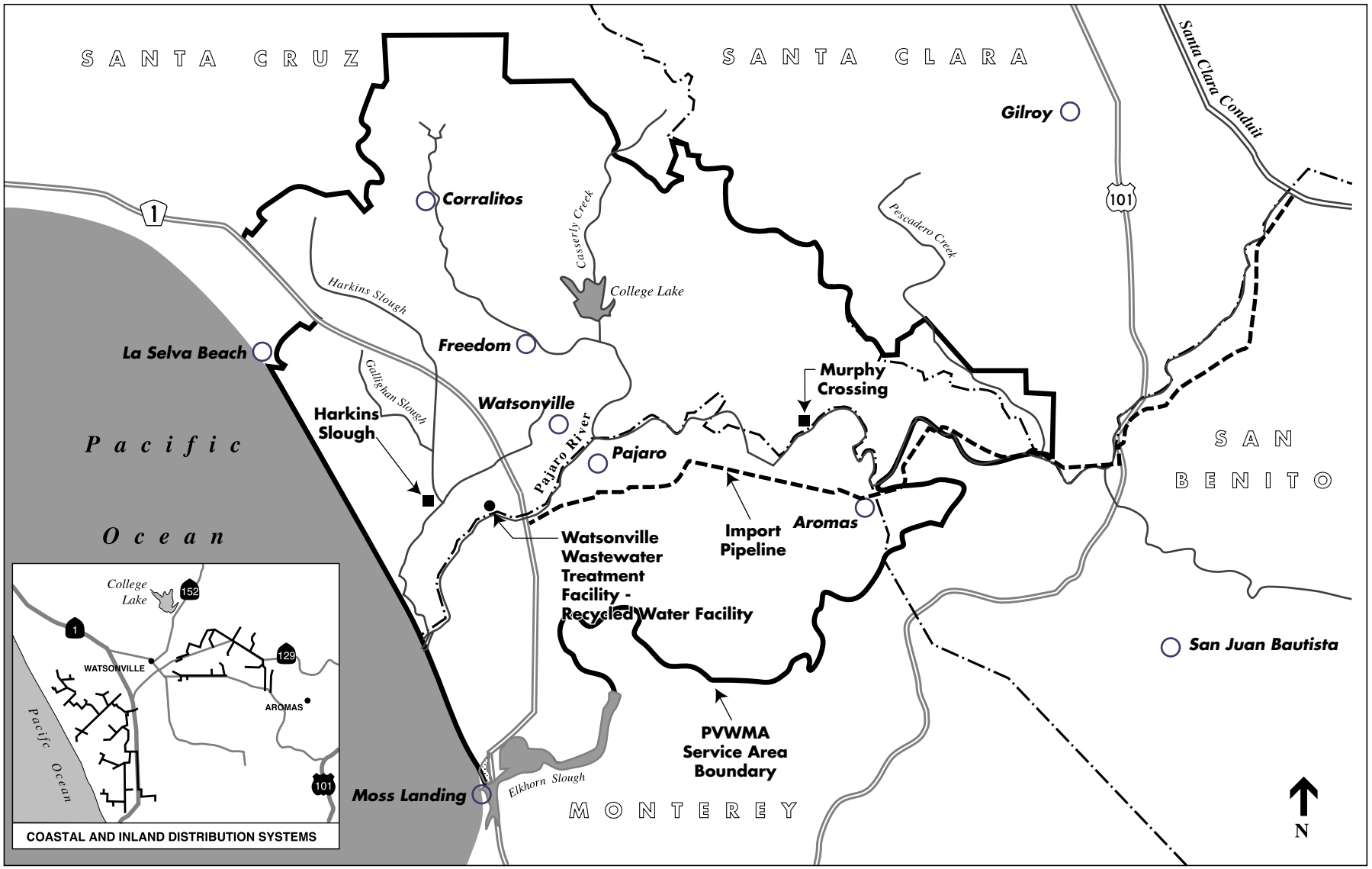


Figure 2.4
BMP 2000 Alternative Facilities

California Water Agencies (ACWA) certification process under their Water Management Awareness Program. (The purpose of the ACWA certification is to assist water agencies like PVWMA in the development of urban and agricultural water management and conservation plans.) Descriptions of both currently implemented and proposed water conservation measures are presented below. As stated in the Initial Study included in the Notice of Preparation for an EIR for the Revised BMP, implementation of the water conservation measures included in the BMP 2000 Alternative would not result in significant environmental impacts (PVWMA, 2000a). Therefore, the water conservation component of the project is described in this chapter but is not analyzed further in this EIR.

Water Metering Program

The PVWMA Water Metering Program requires meters on all water extraction facilities pumping more than 10 afy. Presently, approximately 800 extraction facilities are metered. The PVWMA Water Metering Program serves several purposes:

- To quantify annual water use in the Pajaro Valley;
- To provide data necessary to develop long-term comprehensive water management plans; and
- To provide water use data to growers to facilitate improvements in water use efficiency.
- Measure water use for application of augmentation charge.

Agricultural Water Conservation

The proposed agricultural water conservation program is intended to improve irrigation efficiency in the Pajaro Valley. Data from mobile lab evaluations conducted from 1990 to 1994 and 1999 to 2001 indicate that irrigation efficiency seems to vary considerably. Properly designed, maintained, and managed irrigation systems have inherent maximum ranges of achievable irrigation efficiencies. In 2000, PVWMA instituted a requirement that all growers annually submit plans summarizing irrigation and conservation practices. The program will help the agency track implementation of the water conservation program. As the program gains acceptance among Pajaro Valley growers, observed irrigation efficiencies are assumed to move toward these achievable ranges, although irrigation efficiency can vary considerably among different irrigation events. Assuming all growers participate in the program, the agricultural water conservation program could result in agricultural water savings averaging approximately 4,500 afy. Data developed for the Revised BMP groundwater modeling effort were analyzed to develop a planning-level estimate of potential water savings that could be expected from the proposed agricultural water conservation program. The Revised BMP developed estimates of crop acreage, water use by crop type, and range of irrigation method by crop type. Each irrigation method has a range of inherent achievable irrigation efficiencies based on the assumption of proper engineering design and good to excellent management practices. This range of inherent irrigation efficiencies is generally from 70 to 90 percent, depending on irrigation method.

Agricultural Conservation Program Implementation

According to the elements of the proposed agricultural water conservation program, approximately 7 to 10 years will be required before the potential average annual water conservation savings of approximately 4,500 acre-feet (af) can be achieved. Because of limitations associated with the number of mobile laboratory evaluations that can be performed, it will take several years before necessary on-farm irrigation system improvements can be identified. Identifying and improving irrigation systems with low distribution uniformity is an important consideration in improving irrigation efficiency. Implementing improved irrigation scheduling techniques using CIMIS weather data and computerized irrigation scheduling approaches also will facilitate improvements in irrigation efficiency. Implementing the proposed agricultural water conservation program elements, identifying and correcting on-farm irrigation system deficiencies, and learning to apply new technology for irrigation management will take time. Add to these considerations the funding requirements to improve existing systems or to install more efficient irrigation systems, and the assumed 7- to 10-year period appears reasonable.

Urban Water Conservation

Urban conservation measures that could be implemented by the City of Watsonville, rural domestic water users, and the PVWMA include plumbing measures (water audits and rebate programs for installation of water-saving devices), landscaping measures (audits and retrofits for large landscaped areas), and educational and financial measures. The draft Revised BMP indicates that implementation of these urban water conservation measures could result in a potential water savings of 500 afy.

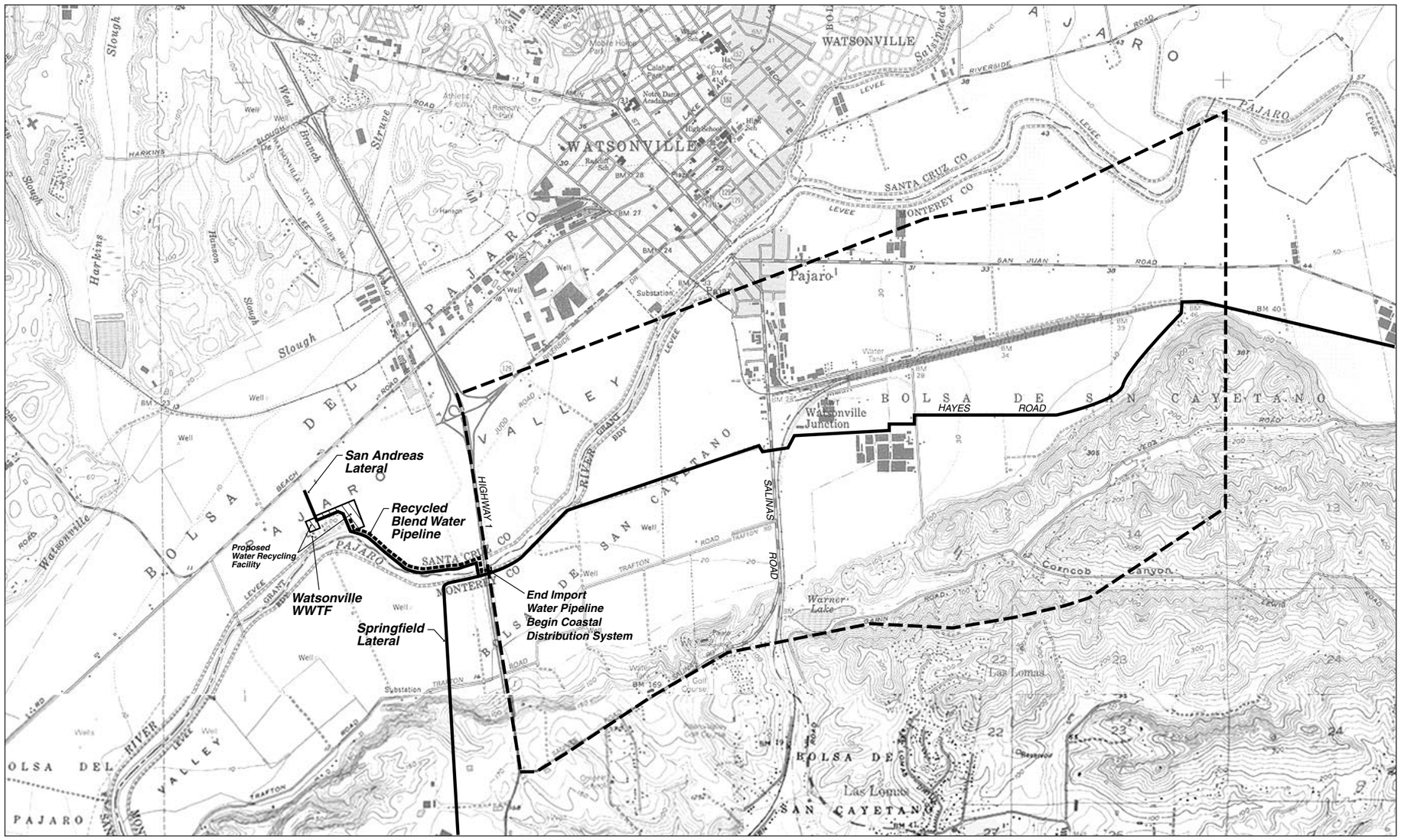
2.3.2 WATER RECYCLING

The recycling component of the BMP 2000 Alternative would involve construction of tertiary treatment facilities at the Watsonville Wastewater Treatment Facility (WWTF) and pumping, blending, storage, and distribution facilities. The recycled water would be used to offset a portion of the irrigation demands in the coastal area during the irrigation season.

LOCATION

- *Watsonville Wastewater Treatment Facility – Recycled Water Facility*. The WWTF is located at 401 Panabaker Lane in the City of Watsonville (see **Figure 2.5**). Access to the WWTF is via Beach Road and Panabaker Lane. Construction of tertiary treatment, pumping, storage, and associated facilities (the Recycled Water Facility) would require acquisition of eight acres of land from adjacent agricultural areas.

- *Pipeline Connection to Import Pipeline, Coastal Distribution System*. This component of the BMP 2000 Alternative also includes approximately 4,200 feet of 24-inch-diameter pipeline to connect the Recycled Water Facility to the Import Pipeline and to the San Andreas and Springfield laterals of the Coastal Distribution System. The San Andreas Lateral will be located in unincorporated Santa Cruz County in the following roads: Beach Road, San Andreas Road, Highway 1, Sunset Beach Road, and farm roads. The Springfield Lateral will be in unincorporated Monterey County in the following roads: Trafton Road, Jensen



SOURCE: RMC Engineering

Figure 2.5
Water Recycling Component of the BMP 2000 Alternative

Road, Bluff Road, Springfield Road, Giberson Road, Highway 1, Struve Road, and various farm roads. The pipelines would require a construction corridor of approximately 20 feet in width.

- *Supplemental (Recovery and Peaking) Wells, Laterals.* **Figure 2.5** indicates the area within which up to 17 wells to produce blending water would be sited. Wells would be spaced approximately 2,000 feet apart, within a boundary extending 1,000 feet on each side of the Import Pipeline, extending four miles east from Highway 1. These wells would be located within unincorporated areas in Santa Cruz and Monterey Counties. The total area anticipated for each well would be approximately 30 feet by 40 feet. Lateral pipelines would connect the wells to the Import Pipeline.

WATER QUALITY

Table 2.3 indicates water quality data for recycled water as well as all other candidate water supply sources.

The recycled water would meet water quality standards for unrestricted reuse contained in Title 22 of the California Code of Regulations. The recycled water would have a projected total dissolved solids (TDS) level generally ranging between 780 and 1,100 mg/L, which may be too high for certain crops in the Pajaro Valley; thus, the recycled water would need to be blended with water containing lower TDS levels to produce a water with less than 500 mg/L of TDS. Potential blending sources include imported CVP water and groundwater (refer to the discussion under the Groundwater Banking component described in Section 2.3.3, for a description of the proposal to import CVP water). Blending with CVP water would require a ratio of about 2:1 to 3:1 (CVP water to recycled water) to meet the 500 mg/L TDS goal. The use of groundwater for blending would require up to 17 groundwater extraction wells—referred to herein as the supplemental wells—with lateral pipelines connecting to a main pipeline to the blending facilities. These wells also would be used to supply groundwater to irrigators during the dry-year periods.

WATSONVILLE WASTEWATER TREATMENT FACILITY

Design Capacity

The WWTF has a current average dry-weather flow of approximately 7.4 million gallons per day (MGD).[6] The permitted design capacity is 12 MGD. Under current conditions, the WWTF could provide approximately 600 to 700 af per month during the six- to seven-month Pajaro Valley irrigation period (April through October), for a total of approximately 4,000 af (note that the ability to use water is limited both by water availability and blended water quality). These values are based on a 90 percent recovery of influent to the WWTF and account for water loss in solids, facility downtime, outfall maintenance, and evaporation.

6 One acre-foot equals 325,850 gallons.

TABLE 2.3
WATER QUALITY CONCENTRATIONS OF CANDIDATE WATER SUPPLY SOURCES

Parameter	Units	Harkins Slough[a]	Pajaro River[b,c,d]	College Lake[e,f]	Corralitos Creek[g,h,i]	Watsonville Slough[j,k]	CVP Water[l,m]	Recycled Water[n,o]
Conductivity								
Range	µmhos/cm	0.2-0.9	0.27-3.15	0.16-1.04	375-440	0.3-1.2	0.36-0.77	1.2-1.7
Expected	µmhos/cm	0.39	1.4	0.52	415	0.56	0.54	1.4
Total Dissolved Solids								
Range[p]	mg/L	130-570	262-2,120	110-750	160-406	190-760	194-420	780-1,100
Expected	mg/L	250	926	343	322	380	299	900
Phytophthora	-	Present	ND	Present	Present	Present	ND	ND
Chloride (Expected)	mg/L	25	170	28.6	9.1	32	86.2	133
Sodium (Expected)	mg/L	23	162	24.4	18.3	29	60	166
Sodium Adsorption Ratio	-	0.6	NA	NA	NA	NA	NA	4.3
pH								
Minimum	-	7.2	7.2	6.7	7.9	7.2	7.0	6.9
Maximum	-	7.9	8.4	8.5	8.2	8.9	9.0	7.9
Dissolved Oxygen (minimum)	mg/L	NA	5.8	NA	NA	NA	NA	NA
Boron (maximum)	mg/L	0.13	2.6	NA	NA	0.45	0.2	0.51
Nitrogen								
Ammonia[q]	mg-N/L	-	0.09	NA	NA	NA	0.1-6.3	1.8-13
Nitrate[q]	mg-N/L	<0.5	0.01-0.35	0.3-20.3	0.5-9.7	1.3	3.0	7.7
Bicarbonate (maximum)[q]	mg/L	90	460	103	150	NA	79	331
Turbidity								
Range	NTU	90-200	0.7-740	8.1-1,440	1.0-3.4	40-460	1.0-12.0	NA
Expected	NTU	150	36	344	2	70	2	NA
Total Suspended Solids (TSS)								
Range	mg/L	15-110	2-710	13-175	0.6-180	30-120	NA	NA
Expected	mg/L	55	91	60.9	9.8	70	NA	NA

[a] Harkins Slough Construction Design Criteria, Montgomery Watson, March 2000.
[b] Data from the U.S. Geological Survey National Stream Water Quality Monitoring Networks.
[c] Nitrate data from AMBAG, *Pajaro River Watershed Water Quality Management Plan*, June 1999.
[d] Station Number 1115900 - Pajaro River at Chittenden 1973-1991.
[e] Samples taken at College Lake headgate.
[f] PVWMA Sampling Program (October 1994 - April 2000).
[g] TDS and TSS data from the Corralitos Filter Plant were collected monthly (1998-2001). Limited data are available for other constituents.
[h] City of Watsonville Sampling Point - Eureka Canyon (Corralitos Creek).
[i] Watsonville Slough Data 1994-1997.
[j] Samples collected approximately 100 yards upstream of confluence with Harkins Slough.
[k] Water quality data collected from DWR Operations from 1990 to 1999.
[l] Sampling Point No. 005000 Pacheco Pumping Plant Trash Racks.
[m] Data collected by City of Watsonville weekly between 11/07/2000 and 05/22/2001, and analyzed by the Soil Control Laboratory.
[n] All total alkalinity is a result of bicarbonate, due to the pH concentration.
TDS is approximately equal to electrical conductivity x 640.
[o] Recycled water conductivity is calculated from TDS.
[p] TDS for Watsonville and Harkins sloughs are calculated.
[q] Ammonia, nitrate, and bicarbonate for Watsonville and Harkins sloughs are maximum values.

mg/L – milligrams/liter; mg-N/L – milligrams nitrogen per liter; µmhos/cm – micromhos/centimeter; NTU – nephelometric turbidity units; ND – nondetect; NA – not available.
SOURCE: RMC, Inc., *Revised BMP (draft*), August 2001.

Existing Operations

The current process train at the WWTF includes primary sedimentation, biological filtration (trickling filters), solids contact aeration, secondary clarification, disinfection with sodium hypochlorite, and dechlorination with sodium bisulfite. Typically, the disinfection and dechlorination steps are bypassed, since the coliform standards are usually met without disinfection.

Recycled Water Facility

Figure 2.6 presents the site layout for the Recycled Water Facility.

Design Capacity

The proposed Recycled Water Facility would produce tertiary-level recycled water and would be sized to treat 8 MGD of secondary effluent, which is the average dry-weather flow rate projected for 2005.[7]

Proposed Operations

The Recycled Water Facility includes the following sequential processes:

- Flow equalization
- Filtration
- Disinfection
- Storage
- Distribution pumping and blending

Figure 2.7 presents a schematic flow diagram for tertiary treatment.

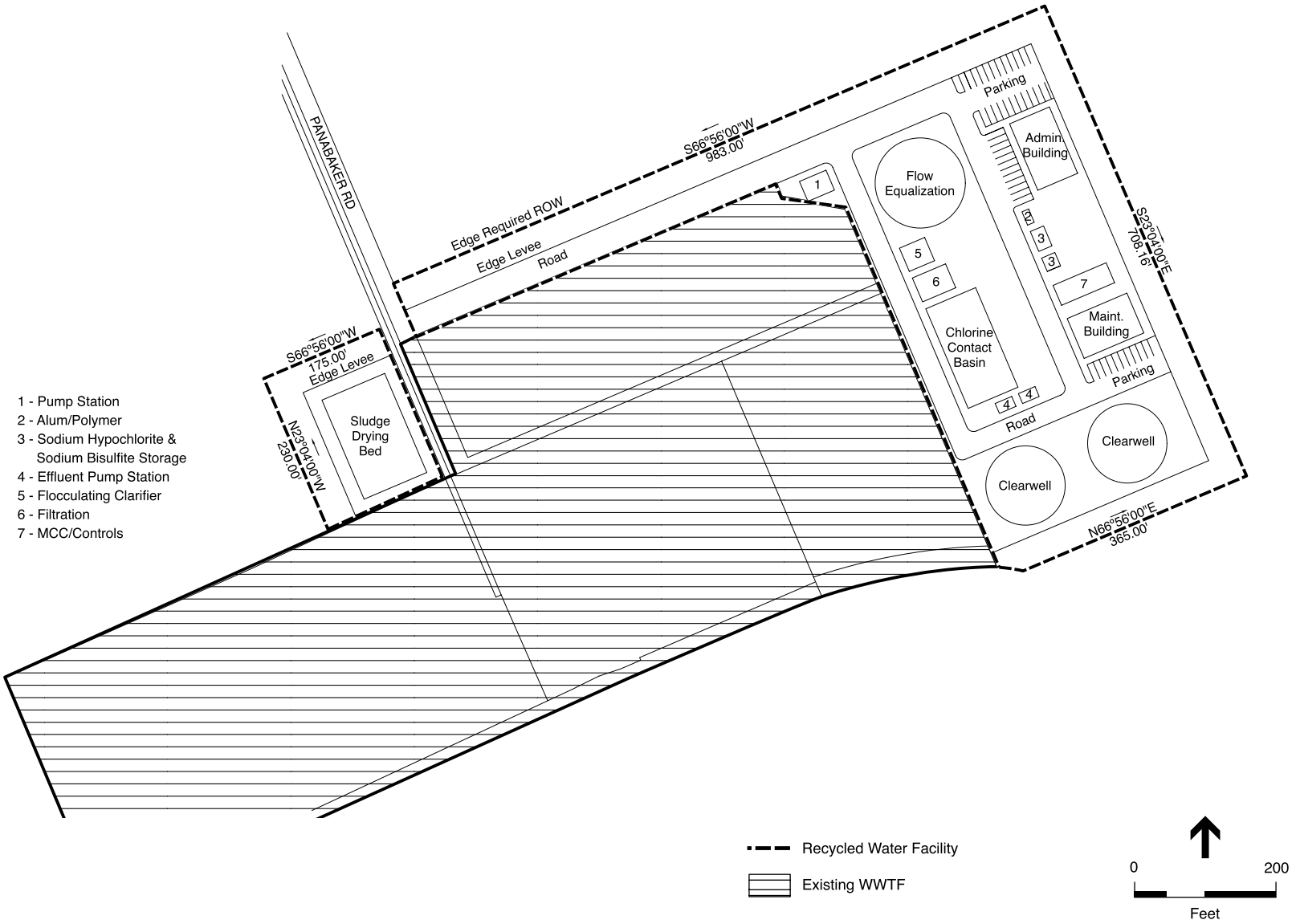
Flow Equalization[8]

The WWTF has substantial diurnal variations in the flow rate of secondary effluent. The Recycled Water Facility design includes flow equalization basins to overcome the operational problems caused by these variations, to improve the performance and reliability of the tertiary treatment facilities, and to reduce the size and cost of the tertiary facilities. The equalization basins would have a volume of 1 million gallons (MG), equal to 12.5 percent of the average dry-weather flow.

---

7 Initially, the Recycled Water Facility would operate mainly when water demand is greatest, with the facility maximizing recycled water production during the peak demand periods of the summer months and minimizing production during the winter. The Recycled Water Facility would consist of two modules of 4 MGD capacity each. By adding additional modules, the Recycled Water Facility could be upgraded in the future to a total capacity of 16 MGD, which would allow for the entire projected dry-weather flow to receive tertiary treatment (this may be required in the future as wastewater discharge standards become increasingly stringent). However, this EIR analyzes only the provision of 8 MGD of recycled water. Future upgrades of either the WWTF or the tertiary treatment facilities would require supplemental environmental review, if and when they are proposed.

8 Flow equalization is the damping of flow rate variations so that a constant or nearly constant flow rate is achieved.



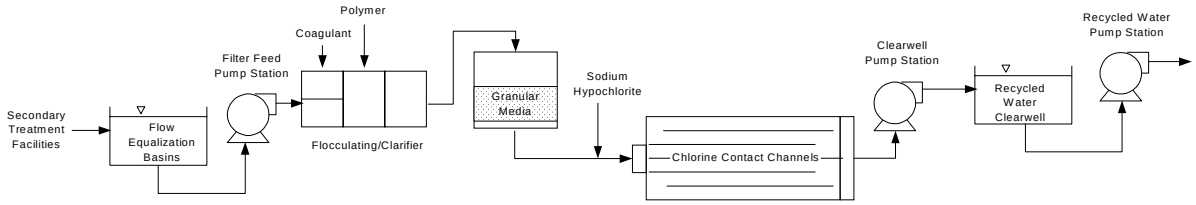
SOURCE: RMC Engineering

PVWMA Revised BMP EIR / 200179 ■

Figure 2.6

Recycled Water Facility

Conceptual Site Plan-City of Watsonville



Pajaro Valley Water Management Agency – Revised BMP Draft EIR / 200179 ■

Figure 2.7
Tertiary Treatment Process Schematic
(assuming conventional filtration)

Filtration

Two alternative processes are under consideration for filtration: conventional filtration and pressurized membrane filtration.[9] Both processes are capable of meeting the existing Title 22 water quality requirements, based on current secondary effluent quality.

Conventional Filtration. Conventional filtration includes chemical coagulation, flocculation, sedimentation, and granular-medium filtration. The coagulation, flocculation, and sedimentation steps could be achieved using a flocculating clarifier. The flocculating clarifier utilizes a coagulant and polymer for coagulation and flocculation of material and includes the addition of microsand to produce a rapidly settling dense floc during the sedimentation step. Microsand is separated from the sludge and returned to the clarifier. The filtration process removes the remaining part of the suspended material agglomerated by the flocculation process.

The facilities associated with the conventional filtration process would include chemical storage and feed facilities, tanks, pumps, and a support building. New chemical storage and feed facilities would be required to supply coagulant (e.g., aluminum sulfate) and polymer prior to filtration. New pumps would be required to provide influent to the unit at adequate pressure. The filter feed pump station would consist of two 25-horsepower pumps capable of lifting 5,600 gallons per minute (gpm) up 20 feet. Additionally, approximately 3,000 to 4,000 pounds of solids per day would be produced. This number might vary depending on the coagulant and polymer dosage requirements.

Membrane Filtration. The membrane filtration process uses membrane technologies instead of a granular-medium filter for filtration. At the heart of the system are hollow fiber micro-porous membranes. These membranes are approximately 0.5 millimeters in diameter and are encapsulated into a bundle to form a filter module. During normal operation, the feed water passes from the outside of the membrane into the center and exits as filtrate. Suspended solids and microorganisms

[9] Although pressurized membrane filtration capital costs are more than double those of conventional filtration, membrane filtration would produce a higher quality effluent and would have a modular buildup capacity.

are collected on the outside surface of the hollow fiber. There are two major categories of membrane filtration systems: pressurized membranes and submerged membranes.

Pressurized Membrane Filtration. This process is based on a low-pressure feed water system driving the feed water from the outside of the membrane to the inside, where filtered water exits as filtrate. New pumps would be required to provide feed water at adequate pressure to the unit. Compressed air is used to perform a backwash, with air being introduced into the filtrate side of the system and released through the walls of the hollow fiber. Accumulated solids are flushed from the membrane surface using permeate at low pressure. The backwash is typically returned back to the headworks for additional treatment. However, this could result in solids buildup in the primary and secondary treatment processes through the introduction of a difficult-to-remove solids stream to the treatment plant unit processes. Provisions to treat the backwash prior to return to the headworks might be required.

The membrane filtration unit would be installed in a new building that would cover approximately 8,000 square feet. No chemicals are used during normal microfiltration treatment process operation, though citric acid is used to clean the membranes periodically. This method results in substantially less sludge production than a conventional filtration process. Preliminary estimates have shown that a maximum of 1,400 pounds of solids would be produced per day (RMC, 2001).

Submerged Membrane Filtration. In the Watsonville context, the submerged membrane filtration process is based on the concept of locating microfiltration facilities within secondary treatment tanks. The membranes would be submerged; water would flow from outside of the membrane to the inside and exit through the membrane to the disinfection process. A vacuum would be created within the membrane fibers by a permeate pump that would force the water into the membrane. Membrane cleaning by backpulsing would be achieved by reversing the inflow and backwashing the membrane surface using feed water at low pressure. Accumulated solids would be flushed from the membrane surface using feed water.

For this process, one clarifier would be converted to a full-time submerged membrane filtration unit. All dry-weather flows would be treated through the tank. The tank would operate similar to an extension of the existing solids contact process. Flow equalization basins would not be required for this process. During the wet season, the two remaining wet-weather clarifiers would be put back on-line and would operate in parallel to the submerged membranes.

The submerged membranes would be able to operate under a slight vacuum instead of the high pressure utilized by pressurized membranes. Vacuum pumps with 110 horsepower would likely be required. Additional pumping equipment (backpulse pumps, membrane air scour blowers, air compressors, cleaning system pumps, etc.) would be equivalent to a 30-horsepower pump running 24 hours per day. Part of the sludge would be recycled back into the aeration tanks.

Disinfection

Following the filtration process, the filtered effluent would be disinfected by either a chlorination process or ultraviolet (UV) disinfection process.

Chlorination. The chlorination process would treat filtered effluent in long, narrow chlorine contact channels sized to retain the design flow for a minimum modal contact time of 90 minutes. This process would likely use sodium hypochlorite as the disinfecting agent. The disinfecting agent addition and mixing would occur immediately upstream of the channel. The chlorination facilities would cover approximately 10,500 square feet and would be sized to disinfect an average dry-weather flow of 8 MGD. Chlorine analyzers would be located at the effluent channel of the basin to continuously record residual chlorine and to provide feedback for adjustment of the sodium hypochlorite dosage. Chlorine dosage would be adjusted to keep the chlorine residual in the distribution system at less than 5 mg/L to address prospective recycled water users' concerns.

UV Disinfection. With the UV disinfection process, filtered tertiary effluent would flow through channels containing UV lamps. The lamps would irradiate the water with light to meet Title 22 disinfection requirements for coliform and virus. A chlorine residual would likely need to be added to the disinfected effluent to minimize regrowth in the distribution system. The UV disinfection facilities would cover approximately 900 square feet. The UV disinfection process would not require any chemical addition that could affect recycled water suitability for agricultural use.

Storage

The Recycled Water Facility includes 4 million gallons of clearwell[10] storage to provide operational reliability and flexibility for the recycled water distribution system. The clearwell storage would consist of two 2-million-gallon above-ground tanks. A new pump station with two 30-horsepower pumps would be required to pump water from the disinfection facilities into the clearwell.

Distribution Pumping and Blending

As described in the subsequent section, the recycled water would be blended with groundwater or imported surface water. The blending would be achieved by in-line mixing either at the Recycled Water Facility or at a point near the western terminus of the Import Pipeline. Consequently, the recycled water pumping station either would pump recycled water to the western terminus of the Import Pipeline or would pump blended water directly into the Coastal Distribution System. The pump station hydraulic capacity would be 5,600 gpm to meet maximum-day recycled water demand. The recycled water pump station would require a combined capacity of 500 horsepower.

BLEND WATER OPTIONS

As mentioned previously, the recycled water would likely have a TDS level too high for certain crops in the Pajaro Valley. Thus, a source of lower-TDS water is necessary, which would be blended with the recycled water to achieve an overall goal of 500 mg/L TDS. The two potential sources of blending water are groundwater and imported surface (CVP) water, as described below.

[10] A clearwell is a reservoir used to hold treated water prior to its release into the distribution system.

Groundwater

Up to 17 wells are projected to be necessary to provide sufficient groundwater for blending with the recycled water to achieve the goal of 500 mg/L TDS. Some existing wells may be converted to this purpose, and some new wells would be constructed. **Figure 2.5** indicates the general area within which the wells would be located. The total area anticipated for each well would be on the order of 30 feet by 40 feet. New wells most likely would be sited in areas currently used for agricultural production, although other land uses exist within the siting area. New wells would be sited so as not to affect nearby wells that are expected to remain in operation. Lateral pipelines would also be necessary to connect these supplemental wells to the Import Pipeline. The blend water would be transported to the WWTF, where it would be blended with the recycled water and then routed to the Coastal Distribution System; alternatively, the recycled water would be routed to a point near the end of the Import Pipeline, where the blending would occur and the blended water would then be routed to the Coastal Distribution System. The blending facility would likely be located at the intersection of Highway 1 and the Pajaro River. Blending would be achieved by in-line mixing.

CVP Water

CVP water would be available for blending with recycled water after construction of the Import Pipeline is completed. CVP water would be available in wet and normal years, although groundwater would need to be utilized during dry periods to offset reductions in CVP water deliveries. Section 2.3.3 describes procurement and delivery of CVP water.

2.3.3 GROUNDWATER BANKING

The Groundwater Banking component of the BMP 2000 Alternative involves importing surface water into the valley and using it in lieu of groundwater whenever it is available, allowing for natural recharge of the groundwater basin. During droughts and dry periods when little or no surface water may be available, Pajaro Valley would then pump the groundwater that was "saved" or "banked" during wet periods. The Groundwater Banking component of the BMP 2000 Alternative includes construction of an inland distribution system and a pipeline (the Import Pipeline) to link the Pajaro Valley with the Santa Clara Conduit of the San Felipe Division facilities. Potential future delivery of water to Pajaro Valley was incorporated into the design of the San Felipe Division pumping and transmission facilities. The design capacity available to PVWMA in the Santa Clara Conduit is 75 cubic feet per second (PVWMA, 2001). The facilities associated with the Groundwater Banking component include the Import Pipeline, supplemental wells, and Inland Distribution System. The Inland Distribution System was evaluated in the Local Projects EIR, certified in 1999.

LOCATION

The Import Pipeline would connect to the Santa Clara Conduit just east of Gilroy and would extend westward approximately 23 miles, terminating near Highway 1 in the Pajaro Valley.

Maps A1 through **A4** in the Map Appendix show the proposed alignment for the Import Pipeline.[11] The recommended alignment begins at the Watsonville turnout on the Santa Clara Conduit and continues in a southwesterly direction parallel to and south of the Pajaro River in San Benito County. The alignment continues parallel to and south or east of the Pajaro River to Bolsa Road, where it follows a property boundary to a power line easement. The route then follows the power line easement west toward the Pajaro River and parallels the river to a crossing of Highway 101. The route parallels the westerly boundary of Highway 101 for about 4,000 feet before crossing the Pajaro River and Sergeant Hills to the Southern Pacific Railroad (SPRR) tracks. The recommended route follows the north side of the SPRR tracks to just upstream of the SPRR-Pajaro River crossing, where it crosses to the south side of the Pajaro River; it then parallels the SPRR tracks through Aromas and on toward the community of Pajaro, where it turns south and follows Hayes Road south of Watsonville Junction, continuing west to the Pajaro River and along the river to Highway 1.

See **Figure 2.5** for the location of the siting area for supplemental wells.

WATER SUPPLY

The surface water supply imported to the valley would be made up of CVP water from the Mercy Springs Water District contract assignment, which has already been assigned to PVWMA by Reclamation, and additional CVP water sufficient to meet the project's objectives of effectively managing the groundwater basin.

CVP Contract

Reclamation has reserved a CVP entitlement for PVWMA. In 1975, Reclamation requested and received a reservation commitment from the San Felipe Committee of the CVP for 19,900 afy for the Watsonville Subarea (now encompassed by the PVWMA service area boundary), to which PVWMA now holds entitlement. PVWMA wishes to negotiate a long-term water service contract with Reclamation for this entitlement. However, with the passage of the Central Valley Project Improvement Act (CVPIA) in 1992 (Public Law 102-575), Congress prohibited Reclamation from entering into new contracts for water supply until an environmental analysis (the PEIS) was completed. Reclamation signed the Record of Decision for the CVPIA PEIS in January 2001. Reclamation expects that all of the environmental review implementation requirements in the Record of Decision will not be completed for several years, at which point PVWMA could negotiate a contract with Reclamation. As part of this contract authorization, the State Water Resources Control Board (SWRCB) must add PVWMA to the Place of Use described in current CVP permits on file with SWRCB. Reclamation has already petitioned the

[11] A recommended pipeline alignment was identified through an evaluation of alternative route segments that considered engineering, environmental, social, and financial impacts. Route alternatives were developed using aerial surveys and field visits with initial investigations focusing on alignment characteristics, physical features, and social, environmental, and economic constraints. Alignments with apparent significant implementation problems, potential fatal flaws, or serious negative characteristics were eliminated from further consideration. Evaluation of the remaining route segments considered agricultural, community, environmental, infrastructure, system compatibility, and constructibility issues. The identification of potential utility conflicts was considered in arriving at a preferred alignment.

SWRCB to expand the Place of Use to include PVWMA. Section 4.A of this EIR evaluates the change in place of use associated with the proposed import of CVP water into the Pajaro Valley.

CVP contractors experience supply reductions during dry years. The yield in any given year could range from 10 percent to 100 percent of PVWMA's contract entitlement because of dry-year reductions. Due to legal restrictions, such as future implementation of the CVPIA and requirements established by CALFED with regard to fisheries and water quality in the Sacramento-San Joaquin Delta, and to fluctuations in weather conditions, it has been predicted that agricultural contractors in the Delta Division and San Luis Unit of the CVP may receive only 60 percent of their contract allocations on a long term average (this delivery figure, while subject to various considerations, is explained further in the CVPIA PEIS).

Cooperative Agreements with Other CVP Contractors

Although the CVPIA prohibits Reclamation from issuing new contracts at present, Reclamation can authorize assignments and transfers of existing water entitlements.

In 1998, PVWMA entered into a joint agreement for the assignment of 6,260 afy of CVP water from the Mercy Springs Water District, located in northern Fresno County. The assignment was made to PVWMA under a joint agreement with the Santa Clara Valley Water District and Westlands Water District. The agreement also stipulates the basis for PVWMA acquisition of all or a portion of the assignment between 2008 and 2017. If PVWMA does not develop the facilities to deliver this water (the Import Pipeline) by 2017, Santa Clara Valley Water District and Westlands Water District would be the sole recipients of the assignment.[12]

In order to offset the anticipated shortfall in CVP water supplies due to dry-year reductions and/or if PVWMA cannot secure its CVP contract for 19,900 afy, PVWMA might enter into additional purchase agreements for water from other water agencies to obtain sufficient CVP water to balance basin demand. Under this scenario, PVWMA would purchase excess CVP water entitled to other CVP-contracting districts during wet years (and possibly normal years), thereby reducing pumping and allowing the groundwater basins in the Pajaro Valley to recharge naturally. During dry years, PVWMA would rely on groundwater resources within the basin. This scenario would allow the groundwater basin to recover and bank groundwater for use in dry years. Water could potentially be sold or otherwise delivered to PVWMA on a schedule that is similar to the delivery schedule that PVWMA would receive if it had a direct contract with Reclamation.

WATER QUALITY

Table 2.3 presents water quality data for CVP water as well as other candidate water supply sources. The quality of CVP water is suitable for direct use.

[12] The assignment of a CVP contract to deliver water from Mercy Springs Water District to PVWMA was evaluated in *CVP Water Supply Contract Assignment from Mercy Springs Water District (Contract No. 14-06-200-3365A) to Pajaro Valley Water Management Agency Final Environmental Assessment and Final Finding of No Significant Impact* (EA/FONSI). The EA/FONSI was approved by the U.S. Department of the Interior, Bureau of Reclamation, on November 6, 1998 (FONSI No. 02-99 1106 (210).

WATER CONVEYANCE FACILITIES

San Felipe Division

The San Felipe Division of the CVP supplies water to Santa Clara Valley, the northern portion of San Benito County, the southern portion of Santa Cruz County, and the northern edge of Monterey County. Water from San Luis Reservoir is transported to the Santa Clara-San Benito service area by way of the Pacheco Tunnel, 48.5 miles of closed conduits, two pumping plants, and one small reservoir. Water is initially transferred from the Sacramento-San Joaquin Delta through the Delta-Mendota Canal to O'Neill Forebay, where it is pumped into the San Luis Reservoir and diverted through the Pacheco Tunnel to the Pacheco Pumping Plant. The water then flows through the Pacheco Conduit to the Santa Clara Conduit. The Santa Clara Tunnel and Conduit are 22.1 miles long and have a capacity of 330 cubic feet per second (cfs). This conduit transfers water from the Pacheco Conduit to the Coyote Pumping Plant. The proposed PVWMA Import Pipeline would connect to the Watsonville turnout of the Santa Clara Conduit. **Figure 2.1** indicates the location of the Santa Clara Conduit. The design capacity available to the PVWMA in the Santa Clara Conduit is 75 cfs, equal to approximately 4,500 to 4,600 af per month.

Except for the connection to the Santa Clara Conduit, no construction or physical modifications to CVP facilities are anticipated.

Pipeline Description

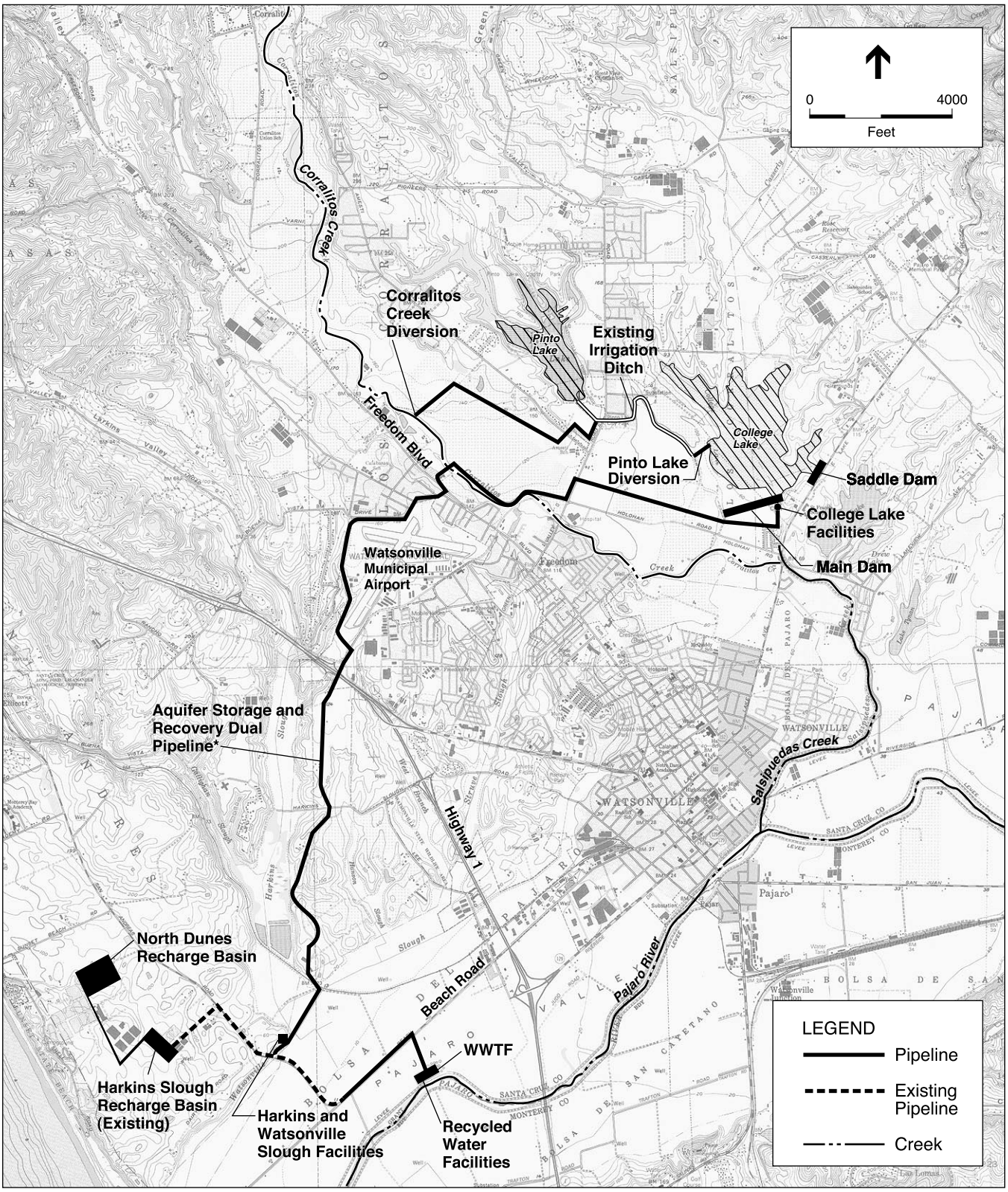
Concepts previously evaluated for conveyance of water from the Santa Clara Conduit included pipeline-canal and pipeline-river combinations as well as alternative pipe sizes. River conveyances included diversion structures or collector wells to take water from the river. The concept recommended for development is a pipeline extending 23 miles from the existing Watsonville turnout on the Santa Clara Conduit to the Coastal Distribution System at Highway 1. The pipe diameter would be approximately 60 inches. Refer to the discussion under Location, above, for a narrative description of the pipeline alignment, and to the Map Appendix.

SUPPLEMENTAL WELLS

The supplemental wells are described in the previous section (2.3.2), under Blend Water Options.

2.4 LOCAL-ONLY ALTERNATIVE

The Local-Only Alternative is intended to eliminate seawater intrusion through the implementation of local water supply projects and demand management measures, without importing water from outside the basin. The Local-Only Alternative would implement some of the projects that are proposed under the BMP 2000 Alternative, including recycled water and water conservation, in addition to other local water supply projects. **Figure 2.8** shows the locations of the components of this alternative, which include the following:



* Injection/extraction wells would be sited within 1,000 feet of the centerline of the ASR dual pipeline.

SOURCE: Environmental Science Associates; USGS

Figure 2.8

Local-Only Alternative-Proposed Facilities

- Intensified Water Conservation
- Water Recycling and Storage
- Expanded College Lake with Corralitos Creek, Pinto Lake, Watsonville Slough, and Harkins Slough Diversion with Aquifer Storage and Recovery Program
- Other (not analyzed in this EIR)
  - Coastal Distribution System (evaluated in Local Projects EIR)
  - Farm Reservoirs (no information available)

2.4.1 INTENSIFIED WATER CONSERVATION

As stated above in Section 2.3.1, the PVWMA developed the WC 2000 plan as a guidance document to achieve cost-effective water conservation. The plan identifies approximately 4,500 afy of agricultural conservation and 500 afy of urban conservation. Agricultural conservation can be achieved through correcting on-farm irrigation system deficiencies, improving irrigation scheduling techniques, and mobile laboratory evaluations. Urban conservation can be achieved through water audits, landscape water conservation ordinance, and toilet and washing-machine rebate programs. Section 2.3.1 presents the components of the agricultural and urban conservation programs proposed in the WC 2000.

Under the Local-Only Alternative, higher levels of water conservation would be required within the Pajaro Valley. Agricultural conservation of approximately 9,000 afy would have to be achieved through programs identified in the WC 2000 and through additional conservation efforts, including land fallowing. Approximately 1,000 afy of urban conservation would have to be achieved. High levels of urban and agricultural conservation potentially could be achieved with a tiered water pricing structure that promotes conservation.(refer to Section 2.4.7 for more information).

LOCATION

The above-described water conservation measures would be implemented throughout the basin.

2.4.2 WATER RECYCLING AND STORAGE

Like the BMP 2000 Alternative, the Local-Only Alternative includes construction of an 8-mgd tertiary treatment facility to develop recycled water as an alternative to groundwater. The design of the Recycled Water Facility at the WWTF generally would be as described for the BMP 2000 Alternative, including the size of the site (eight acres). However, under the Local-Only Alternative, the Recycled Water Facility would differ as follows:

- *Year-Round Treatment*. Recycled water would be produced throughout the year (under the BMP 2000 Alternative, recycled water would be produced only during the six- to seven-month irrigation period from April through October). Consequently, although the design capacity is the same for both alternatives (8 mgd), the total yield differs (4,000 afy versus 7,700 afy).

- *Storage During Low-Demand Periods*. Demand for irrigation water occurs predominantly during the summer agricultural season. Recycled water produced during the agricultural season would be used directly, while recycled water produced during the off-season would be stored in the groundwater basin via percolation in basins. The basins would include the existing Harkins Slough basin and a new "North Dunes" basin.

LOCATION

Figure 2.8 shows the location of facilities proposed as part of the Local-Only Alternative Water Recycling component.

- *Watsonville Wastewater Treatment Facility – Recycled Water Facility*. The WWTF is at 401 Panabaker Lane in the City of Watsonville.

- *Pipeline – Recycled Water Facility to Harkins Slough Pipeline*. The proposed location of the 36-inch-diameter, 8,300-foot-long pipeline would be in farm fields in unincorporated Santa Cruz County, adjacent to the following roadways: Panabaker Road, Beach Road, and San Andreas Road.

- *Harkins Slough Recharge Basin (Existing), Extraction Wells*. The Harkins Slough Recharge Basin is located west of Highway 1, approximately one-half mile northeast of the intersection of Beach Road and San Andreas Road in unincorporated Santa Cruz County.

- *North Dunes Recharge Basin, Extraction Wells*. The North Dunes Recharge Basin would be approximately 1,500 feet southwest of the Sunset Beach Road/San Andreas Road intersection in unincorporated Santa Cruz County, shown in **Figure 2.9**. The extraction wells would be around the basin.

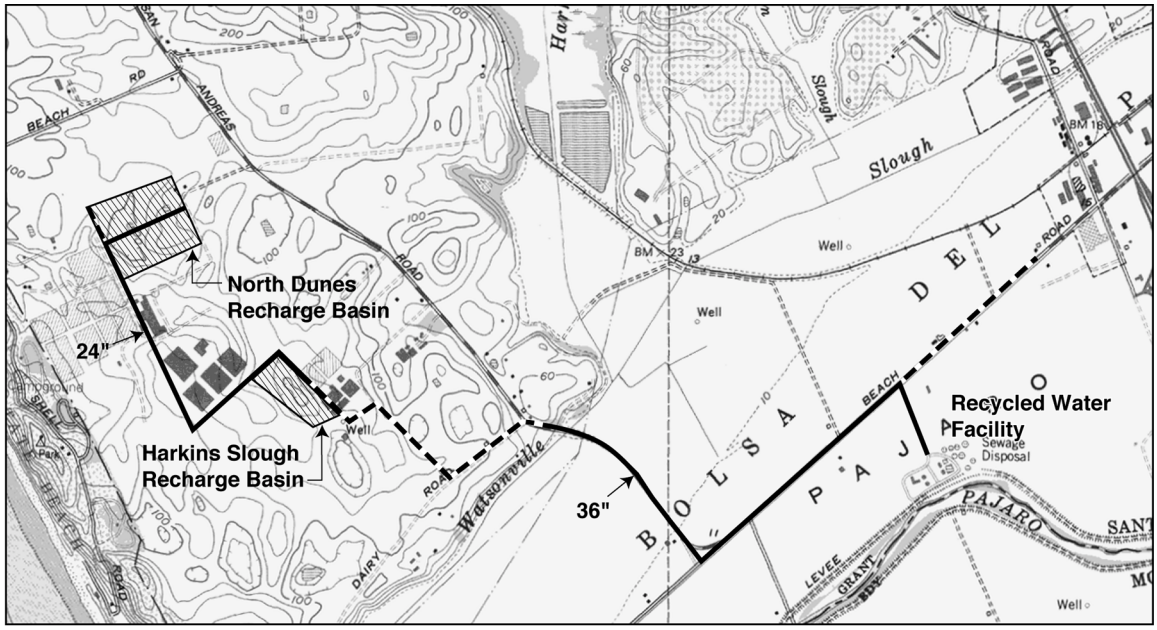
- *Pipeline from Harkins Slough Recharge Basin to North Dunes Recharge Basin*. This 24-inch-diameter, 5,800-foot-long pipeline would be constructed in a farm road and across a farm field between the existing and proposed basins.

WATER QUALITY PARAMETERS

Table 2.3 presents water quality data for recycled water. The recharge of recycled water is regulated by the California Department of Health Services (DHS). As proposed, the recharge of recycled water would not meet recent draft criteria published by DHS. Consequently, the ability to recharge recycled water may be limited, unless significant treatment is undertaken. Refer to Section 5.A.3 for additional information.

WATSONVILLE WASTEWATER TREATMENT FACILITY – RECYCLED WATER FACILITY

Except as noted in this section, facilities and operations associated with the Recycled Water Facility would be as described in Section 2.3.3. Refer to Section 5.A.3 for additional information.



Source: RMC Engineering

Pajaro Valley Water Management Agency – Revised BMP Draft EIR / 200179 ■

Figure 2.9
North Dunes Recharge Basin

CONVEYANCE AND DISTRIBUTION OF RECYCLED WATER

This component includes a pump station (at the Recycled Water Facility) and pipeline to convey recycled water to an existing pipeline in San Andreas Road near the Harkins Slough Facility. During the middle of the agricultural season, recycled water would be blended with surface water, creating a higher-quality blended supply.

PERCOLATION AND EXTRACTION OF RECYCLED WATER

Harkins Slough Recharge Basin and North Dunes Recharge Basin

Currently, water diverted from Harkins Slough is piped to the Harkins Slough Recharge Basin for percolation. Water diverted from Harkins Slough and, if the Local-Only Alternative were implemented, from Watsonville Slough, would be piped to College Lake instead of the Harkins Slough Recharge Basin. The Harkins Slough Recharge Basin would then be used to percolate recycled water. (The Watsonville Slough Diversion is described as part of the Aquifer Storage and Recovery project in Section 2.4.5.)

The existing Harkins Slough Recharge Basin has a basin bottom of approximately 10 acres and an average design flow of 3,100 gpm. The Recycled Water Facility would produce approximately 4,900 gpm of supply that would be diverted to the recharge basins during the winter months.

Consequently, the design flow proposed for the North Dunes recharge site is 1,800 gpm. The North Dunes Basin would occupy about 29.5 acres. The basin itself would be about 28 acres (the bottom would be 25 acres and the side slopes would be about three acres, assuming a 3:1 slope and a depth of 10 feet). An additional 1.5 acres would be needed for a service road around the basin. The basin size is based on an estimated long-term percolation rate of 0.32-foot per day (CH2M Hill, 1999). The basin bottoms would be available for farming during the agricultural season.

A recycled water pipeline would convey water from the WWTF to San Andreas Road at Watsonville Slough, where it would connect into the existing Harkins Slough pipeline, which extends to the Harkins Slough Basin. Additional piping would connect the Harkins Slough Basin to the North Dunes Basin. In addition, monitoring wells, extraction wells, associated pipelines, and appurtenances would be constructed at the North Dunes Basin.

This project would recycle nearly all available flow from the WWTF. Consequently, flows to the plant's ocean outfall would be minimized, requiring modifications to the outfall diffusers (to prevent marine incrustation) and possibly the effluent pump station at the WWTF. No information has been developed on these modifications.

2.4.3 EXPANDED COLLEGE LAKE

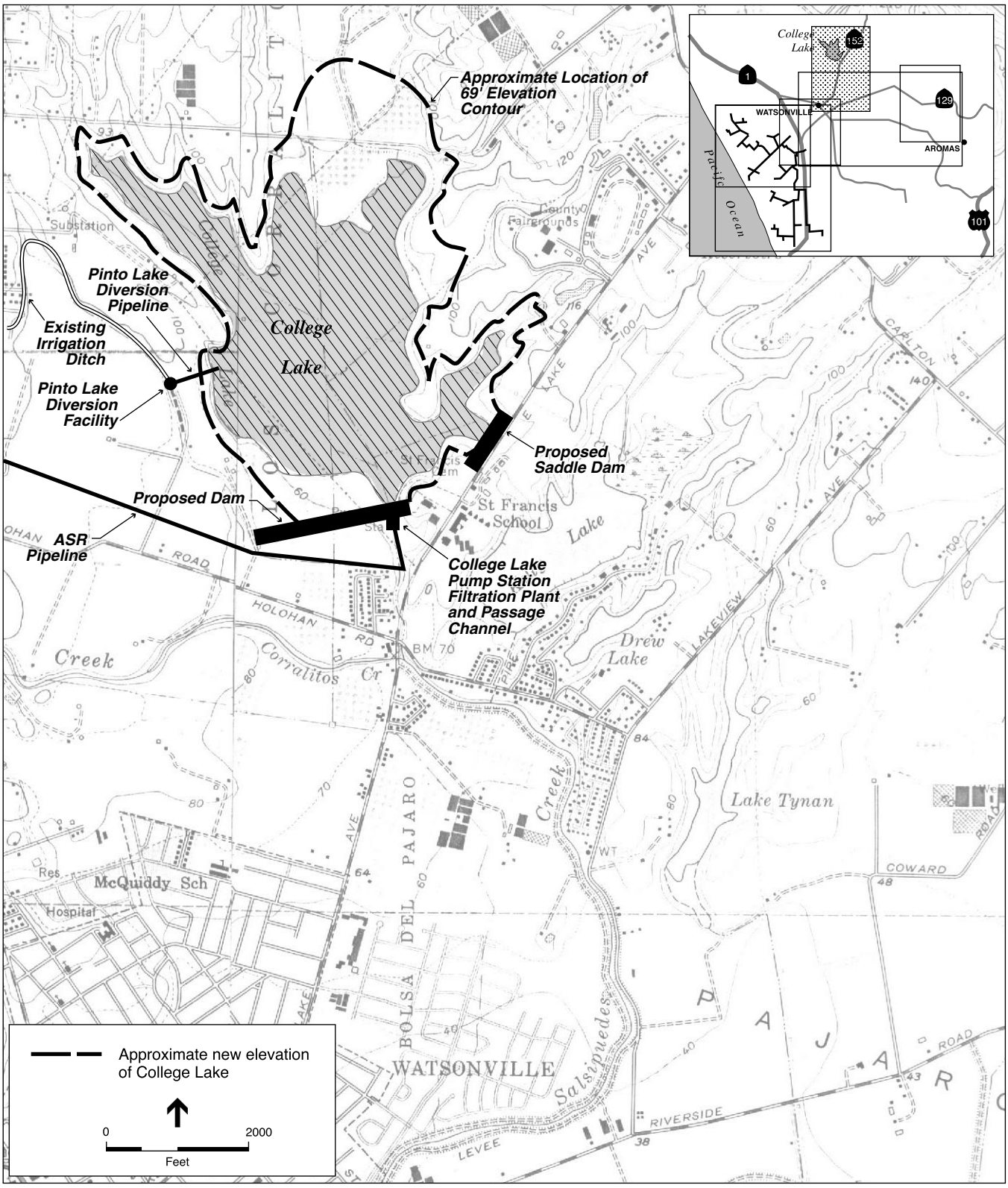
College Lake is a seasonally occurring water body that collects water from an 11,000-acre watershed during the rainy season. Currently, College Lake is pumped dry in the spring, and the lakebed is farmed and harvested before winter runoff begins filling the lake (typically in November). The existing headgate and weir elevation results in the inundation of approximately 260 acres of land, and results in a total storage capacity of 1,400 af. In the spring, the lake is pumped dry to allow for farming of the lakebed during the dry season. The Expanded College Lake project proposes to increase the total storage capacity of College Lake to 4,600 af. Water diverted from Harkins and Watsonville sloughs, Corralitos Creek, and Pinto Lake would be stored at College Lake and subsequently conveyed to the Coastal Distribution System or injected into the groundwater basin for temporary storage.

LOCATION

Figure 2.10 shows the location of College Lake (which lies north of the City of Watsonville in unincorporated Santa Cruz County), the existing reservoir elevation, the approximate water elevation of the proposed expansion, and proposed facilities (main dam, saddle dam, pump station, pretreatment and filtration facilities).

PROJECT CHARACTERISTICS

The project would involve the construction of a main earth dam, saddle dam, outlet works, spillway, pump station, pretreatment facilities (coagulation), and filtration facilities. The project would increase the lake elevation from 60 feet to 69 feet and would lead to inundation of approximately 420 acres of land, an increase of 160 acres from existing conditions (King, 2000).



SOURCE: Environmental Science Associates

Figure 2.10
Expanded College Lake Facilities

The pump station, filtration facilities, and pretreatment facilities would be south of the dam adjacent to Salsipuedes Creek, with an approximate footprint of 150 feet by 250 feet.

The main dam would extend from the edge of the St. Francis Cemetery to the west ridge of the College Lake embankment. The main dam would be constructed primarily on farmland and would have an approximate footprint of 225 feet by 2,200 feet and a height of 22 feet. The saddle dam has an approximate footprint of 225 feet by 600 feet. The conceptual design of the main dam consists of a 40-foot-wide crest at an elevation of 79 feet and embankment slopes at 3:1 (horizontal:vertical). The conceptual design of the saddle dam consists of a 25-foot-wide berm at 74 feet and embankment slopes at 3:1 to the existing grade.

The crest elevation of 79 feet provides 10 feet of freeboard above the normal maximum water surface. The dams would require approximately 160,000 cubic yards (cy) of borrow material from the lake bottom (100,000 cy) and a local rock quarry (60,000 cy). Filter zones, drain zones, and riprap in the dam would be constructed with material from a local rock quarry.

The outlet works and spillway would be on the easterly abutment near St. Francis Cemetery. The spillway would consist of a 50-foot-wide by 165-foot-long ogee crest structure and a spillway crest that conforms to the natural shape of flowing water, set at an elevation of 69 feet (King, 2000). The outlet works would consist of a 4.5-foot by 4.5-foot hydraulically operated slide gate; a 4.5-foot-diameter, steel-lined, reinforced-concrete conduit; a 4.5-foot by 4.5-foot power-operated control gate, and an outlet channel (King, 2000).

On the basis of hydrologic modeling conducted for the Local-Only Alternative, the expanded College Lake typically would be empty between June/July and October/November. Consequently, if suitable soils were present,[13] College Lake would be available for one crop rotation per year. The modeling assumed that diversions from surface water storage would occur when demand exceeded the recycled water supply.

2.4.4 CORRALITOS CREEK AND PINTO LAKE DIVERSIONS

LOCATION

Figures 2.8 and 2.10 show the location of the Pinto Lake Diversion and associated pipeline alignment in unincorporated Santa Cruz County. Pinto Lake is a recreational area used for trailer camping, fishing, and boating.

- *Corralitos Creek Diversion Facility, Pipeline*. The Corralitos Creek Diversion facility would be along the creek approximately 1,500 feet northeast of the Freedom Boulevard/Bowker Road intersection. The 24-inch, 8,500-foot-long pipeline would traverse agricultural fields between Corralitos Creek and the existing Pinto Lake drainage channel.

[13] Approximately 100,000 cy of soil would be removed from the lake bottom for construction of the dams. Refer to Section 5.B.1 for an evaluation of the effects of the Expanded College Lake project on prime farmland and agriculture.

- *Pinto Lake Diversion, Pipeline*. The Pinto Lake Diversion facility would be on the existing Pinto Lake drainage channel west of College Lake. The 24-inch, 1,200-foot-long pipeline would extend between the Pinto Lake drainage ditch and College Lake.

The Corralitos Creek and Pinto Lake diversion projects would divert water into College Lake. The Corralitos Creek Diversion would be west of College Lake and north of the Watsonville Airport (see **Figure 2.4**). Corralitos Creek water would be diverted into the Pinto Lake drainage channel near Green Valley Road and then conveyed from the channel by the Pinto Lake Diversion. Currently, the Pinto Lake drainage channel drains into Salsipuedes Creek. The diversion projects include associated pipelines and a pump station. The diversion facilities within Corralitos Creek or the Pinto Lake drainage channel are assumed to have a 50-foot by 50-foot footprint, although no specific characteristics of facility design are available. The Corralitos Creek Diversion would require a pump station adjacent to the diversion facilities; the total area affected by the diversion and pumping facilities would be 50 feet by 100 feet. Water from the Pinto Lake drainage channel would flow by gravity into College Lake.

Based on hydrologic modeling, the estimated yield of the diversions is 1,200 afy. A total minimum-flow contingency of 5 cfs for the two diversions was built into the PVIGSM model for assumed fishery and water quality requirements. However, the model did not take into account the 7.5 cfs minimum flow required during the steelhead smolt migration period (March 15 through May 31) that was determined after the model was run. Therefore, the estimated yield is expected to be less than 1,200 afy. (Refer to Section 5.C.4 for the evaluation of fisheries impacts for this component.)

2.4.5 AQUIFER STORAGE AND RECOVERY

Aquifer Storage and Recovery (ASR) is a means of providing temporary storage of surface water supplies and would supplement storage at College Lake. Under the ASR project, water from Harkins and Watsonville sloughs, Corralitos Creek, and Pinto Lake would be diverted to College Lake. All of the surface water supplies (except recycled water) would be collected and stored at College Lake. Water would be pumped from College Lake to proposed treatment facilities near the main dam for coagulation and filtration. Following treatment, water would be conveyed to an injection/extraction well field (ASR) located along the pipeline alignment between College Lake and Harkins Slough. PVWMA would inject surface water into the groundwater aquifer during winter months and then extract that water during the agricultural season and pipe it into the Coastal Distribution System.

LOCATION

Figure 2.8 shows the location of facilities associated with the ASR component. This component is located entirely within unincorporated Santa Cruz County.

- *Pipelines (Two) between College Lake and Harkins Slough Facilities*. The seven-mile-long alignment would extend from the filtration facility at Harkins and Watsonville sloughs along existing field roads to Airport Boulevard and Highway 1. From Airport Boulevard, the alignment is within and follows the northern boundary of the Watsonville Airport

property to Freedom Boulevard (this area of the airport is currently undeveloped open space), then parallels Corralitos Creek and Holohan Road to College Lake. This route would include microtunneling sections at both ends of the airport property to cross under Highway 1 and streets and houses at Freedom Boulevard. Bore-and-jack construction would be used to cross beneath Harkins Slough, railroad tracks, Harkins Slough Road, and Green Valley Road.

- *Injection/Extraction Wells.* The approximately 30 injection/extraction wells would be sited generally within 100 to 200 feet of the centerline of the pipelines between the proposed College Lake and Harkins Slough facilities. The wells would be spaced at least 2,000 feet apart. Specific well locations would be determined by further hydrologic field investigation and site assessments, if the Board of Directors approves this component of the Local-Only Alternative, as part of detailed project design. Well sites would dictate the location of pipelines connecting the wells to the dual pipelines.

- *Watsonville Slough Diversion.* The proposed Watsonville Slough Diversion and pumping facilities would be adjacent and to the southwest of the existing Harkins Slough Diversion facilities, the latter of which would be expanded as part of the Local-Only Alternative.

AQUIFER STORAGE AND RECOVERY WELLS AND PIPELINES

The ASR wells would be used for injection and extraction. The injected water is expected to have limited vertical and horizontal movement within the aquifer and, consequently, would be available for later recovery (PVWMA, 2001). The volume of water to be injected into each well and percentage of the total 5,400 afy would depend on the recharge characteristics of a given site, to be determined through detailed hydrologic investigations if this component of the Local-Only Alternative is approved. This description is preliminary; consequently, only a general, programmatic evaluation of the ASR component of the Local-Only Alternative is possible. If the Board of Directors selects the ASR component for implementation, further environmental review could be needed once detailed well siting, design, and operating criteria were developed.[14]

[14] A preliminary assessment for a concentrated ASR well field near College Lake showed unacceptable levels of mounding and drawdown, leading project engineers to propose a well field along the ASR pipeline (CH2M Hill, 2000). The evaluation of ASR included layout of the 30 injection and extraction wells, development of an operations plan, review of the 1995 pilot study of an injection and extraction well, and THEIS and MODFLOW modeling to characterize mounding and drawdown in the wells. An ASR pilot test conducted in 1995 located a productive aquifer at 122 to 232 feet below ground surface (bgs). Results from the pilot study were fitted to a THEIS-type curve to estimate mounding and drawdown of the ASR project near College Lake. The ASR project was also evaluated using MODFLOW to determine mounding and drawdown. A preliminary layout was developed for an ASR well field at College Lake to estimate mounding and drawdown effects. The average depth to groundwater in the area is 60 feet bgs. The ASR project would include average injection of approximately 5,800 af of water into the groundwater aquifer from December to March. A proposed 500-gpm injection rate would be used for injection. The wells would then be used for extraction from April to October at rates of 500 to 1,000 gpm. The results of the modeling investigation showed unacceptable levels of mounding and drawdown due to the tight configuration of wells. High levels of mounding are likely to cause hydrofracturing, which would lead to groundwater springs. Drawdown is likely to result in water cascading in the aquifer that would cause adverse operating conditions. That ASR project was not feasible under the current well field layout and operation plan. To address the problems found with the above-described injection/extraction field, the injection and extraction wells would be located along the pipeline alignment from the sloughs to College Lake. The new layout would likely eliminate the mounding and drawdown effects from well interference. Subsurface characteristics along the pipeline need to be investigated to determine project feasibility. The proposed layout would increase the area influenced by injection and extraction activities.

Each injection/extraction well would require construction of one well that would be approximately 150 to 250 feet below ground surface. Each well site would require an approximately 40-foot by 50-foot fenced area (2,000 square feet). Pumping following conventional filtration would be sufficient to move the surface water down the well and into the groundwater aquifer. An 80-horsepower extraction pump would be located either in the main well bore or in a side casing to provide for extraction, well maintenance, and backwashing needs. The lateral pipelines would generally be 16 inches in diameter. Pipeline routing would depend on the exact locations of the injection well sites selected.

The ASR component would have pipelines to carry untreated water to College Lake for treatment and storage and to carry treated water to the wells and the Coastal Distribution Center. The larger (30-inch) pipeline would be dual purpose, conveying water from the Harkins and Watsonville sloughs to College Lake during winter months and conveying water from the ASR wells to the Coastal Distribution System. The smaller pipeline (diameter would vary) would be dedicated for transmission of water from the College Lake filter facility to the ASR wells. All injection water would undergo coagulation and filtration to meet turbidity specifications for injection.

WATSONVILLE SLOUGH DIVERSION

The Watsonville Slough project would divert Watsonville Slough water during the rainy season (generally December to May) for use during high demand periods in the Coastal Distribution System. Required facilities include construction of a new 7,500 gpm pump station and increase in capacity of Harkins Slough filtration plant, along with a diversion structure in Watsonville Slough. The actual diversion structure has not been designed. The pump station would be constructed on the north bank of Watsonville Slough just west of the Harkins Slough confluence. Diverted water from Watsonville Slough would be filtered, then stored in College Lake for subsequent injection in the ASR wells. Raw water from Watsonville Slough typically exhibits total suspended solids (TSS) and turbidity concentrations higher than those normally required for direct injection or percolation. To avoid clogging the aquifer, filtration would be needed to reduce the TSS to acceptable levels. For analysis purposes, it is assumed that the new filtration facility would occupy a footprint similar in size to existing facilities at Harkins Slough (0.5 acre of prime farm land).

WATER QUALITY

Table 2.3 presents water quality data for College Lake, other surface water supplies that would be stored at College Lake under the Local-Only Alternative, and other candidate supply sources. As discussed in Section 2.4.3, College Lake water would undergo filtration and coagulation prior to injection into the groundwater basin. Injection water for ASR would consist of a blend of tributary runoff and the aforementioned surface water supplies. Consequently, water quality would be a function of the proportion of water from each source, timing of diversions, and other operating characteristics. The Central Coast Regional Water Quality Control Board (CCRWQCB) and DHS regulate injection of surface water into potable groundwater basins. Refer to Chapter 5, Section 5.D.3 for further information.

2.4.6 FARM RESERVOIRS IN THE COASTAL AREA

The Local-Only Alternative proposes the construction of farm reservoirs to capture storm runoff and to promote groundwater recharge in the coastal region. Neither reservoir locations nor construction or operating characteristics were determined as part of the Revised BMP. Consequently, farm reservoirs are not evaluated in this EIR due to lack of information. If this component of the Local-Only Alternative were developed, additional environmental review would be required.

2.4.7 DEMAND MANAGEMENT OPTIONS

LAND FALLOWING

If PVWMA approves the Local-Only Alternative, land fallowing would likely be accomplished by obtaining annual leases. Model analyses indicate that the most effective location for fallowing land, from the standpoint of managing the groundwater basin, would be within the coastal area. Eliminating coastal area pumping would allow for formation of a hydraulic groundwater barrier adjacent to the Pacific Ocean, optimizing the sustainable groundwater yield of the basin.

The amount of land fallowing required to balance the basin depends on the reliability and quantity of supply, demand, and other factors. The Pajaro Valley Integrated Groundwater Surface Water Model (PVIGSM) was used to determine land fallowing requirements under the Local-Only Alternative, and indicated that approximately 2,200 acres of agricultural land would have to be followed to meet the objectives of the Local-Only Alternative. However, that model run addressed baseline conditions only and did not account for projected increases in pumping demand (refer to Section 5.D.3).

TIERED WATER PRICING

Tiered water pricing is an additional management mechanism that can promote conservation and/or alter water use practices. Tiered pricing could encourage additional water conservation through simple market forces or could promote conversion to crop types that require less water. The plan would set water prices to correspond with water application rates for the various crop types. Crops such as apples and other deciduous crops have a low application rate and would fall into the lowest pricing tier, while crops with higher application rates, such as strawberries and raspberries, would fall into the higher tiers. Under the tiered structure, conservation is promoted by potential cost savings. This option could reduce water use if construction of additional water supplies is either too costly or is not feasible. PVWMA is currently investigating a tiered pricing plan.

2.5 REQUIRED PERMITS AND APPROVALS

Table 2.4 lists the permits and approvals required for the project and approving agencies.

TABLE 2.4
POTENTIAL PERMITS AND APPROVALS

Action Requiring Permit/Consultation	Alternative (L-O/BMP)[a]	Agency/Organization	Permit or Approval
Federal			
CVP water deliveries; connection to Santa Clara Conduit.	BMP	U.S. Bureau of Reclamation	Acquire additional CVP supplies; compliance with National Environmental Policy Act
Impacts to wetlands / waters of the United States.	BMP	U.S. Army Corps of Engineers	Section 404 Permit
Construction in wetland and upland areas where federally listed species may be present.	L-O/BMP	U.S. Fish and Wildlife Service; National Marine Fisheries Service	Consultation and Coordination under Endangered Species Act
State			
Development of water supplies.	L-O/BMP	State Water Resources Control Board	Water Rights Permits [b]
Alteration of streambeds during Construction.	BMP	California Department of Fish and Game	1601 Streambed Alteration Agreement
Projects west of Highway 1.		Coastal Commission	Coastal Development Permits
Potential for water quality impairment from sediment discharge to waterways during construction.	L-O/BMP	Regional Water Quality Control Board	401 Certification
Construction under Highways 1, 25, 101, and 129.	BMP/L-O	Caltrans	Encroachment Permits
Change in place of use, purpose of use for CVP water.	BMP	State Water Resources Control Board	
Protection of water courses from erosion, sediment, and pollutant discharge during construction.	L-O/BMP	State Water Resources Control Board	National Pollutant Discharge Elimination System Permit for Construction; Stormwater Pollution Prevention Plan
Construct new dams at College Lake.	L-O	Division of Safety of Dams	Approval

TABLE 2.4 (Continued)
POTENTIAL PERMITS AND APPROVALS

Action Requiring Permit/Consultation	Alternative (L-O/BMP)[a]	Agency/Organization	Permit or Approval
Local			
Pipeline construction in Santa Clara County.	BMP	Santa Clara County Planning Department	Grading Permit
Pipeline construction in San Benito County.	BMP	San Benito County Planning Department	Grading Permit
Construction in County-maintained roadways.	BMP	San Benito County Public Works	Encroachment Permit
Construction and excavation activities in Monterey County.	BMP	Monterey County Planning Department	Grading Permit; Coastal Development Permit; Development Permit (inland areas)
Construction in County-maintained roadways.	BMP	Monterey County Public Works	Encroachment Permit
Construction affecting Pajaro River levees and drainage ditches.	BMP	Monterey County Water Resources Agency Flood Control	Encroachment Permit Approval
Construction and excavation activities in Santa Cruz County.	L-O/BMP	Santa Cruz County Planning	Grading Permit; Riparian Exception; Coastal Development Permit
Construction in County-maintained roadways.	L-O/BMP	Santa Cruz County Public Works	Encroachment Permit
Private Industry			
Cross railroad tracks, parallel tracks; conduct surveys, enter the railroad right-of-way.	BMP/L-O	Union Pacific Railroad / Southern Pacific Railroad	License Agreement or Easement; Right of Entry
Construction within PG&E right of way for overhead electrical wires and potentially under buried pipelines.	BMP/L-O	PG&E	Encroachment Permit
Construction near or crossing buried U.S. Sprint communication lines.	BMP/L-O	U.S. Sprint	Request review of plans and notification prior to construction.

[a] L-O =Local-Only Alternative; BMP = BMP 2000 Alternative
[b] For the BMP 2000 Alternative, SWRCB would need to authorize a change in the place of use of CVP water specified in a number of existing Reclamation water rights permits.

2.6 PROJECT SCHEDULE AND COST

2.6.1 SCHEDULE

PVWMA has initiated compliance with NEPA for those aspects of the alternatives requiring federal approval or federal funding: use of CVP water, connection to CVP facilities, and water recycling. Full implementation of either the BMP 2000 Alternative or Local-Only Alternative is expected within 10 years.

2.6.2 COST

Table 2.5 indicates the estimated costs of the Local-Only and BMP 2000 alternatives. PVWMA is presently undertaking an evaluation of revenue requirements necessary to finance the BMP project, described in Chapter 8 (socioeconomics issues section). The projects that have been or are currently being implemented, Harkins Slough and the Coastal Distribution System, are being financed based on two components: the water sales or delivery charge, and the PVWMA augmentation charge. In addition, debt funding will be required to fund all of the capital expenditures involved with the major project components. Federal and state grants and low-interest loans will be used to the extent possible. The PVWMA financial strategy will optimize the different revenue and debt funding sources to minimize the financial impacts on basin residents. Refer to Chapter 8 for information on project funding.

TABLE 2.5
COSTS ASSOCIATED WITH THE LOCAL-ONLY AND BMP 2000 ALTERNATIVES

	Local-Only Alternative	BMP 2000 Alternative
Capital Costs of Facilities	$128 million[a]	$162 million[a]
Annual Operating and Maintenance Costs	$6.6 million[b]	$4.4 million
Total Annualized Cost	$15.9 million	$16.2 million

[a] PVWMA is seeking federal funding pursuant to Title XVI for planning, design, and construction of water recycling facilities and facilities that would provide blend water. These costs reflect a $20 million credit for Title XVI funding. PVWMA is also exploring cost-saving opportunities with the U.S. Army Corps of Engineers for the potential expansion of College Lake.

[b] Land leases are assumed to account for land fallowing. Cost of lease is $1,500 per acre annually and is added to annual operation and maintenance and capital costs.

SOURCE: RMC Consultants, 2001.

REFERENCES – Project Description

Association Monterey Bay Area Governments, *Pajaro Basin Ground Water Management Study*, 1978, 1983, and 1984.

California Department of Health Services, *Draft Groundwater Recharge Reuse Regulations*, April 23, 2001.

CH2MHill, *Final Technical Memorandum No. 1.1A-Import Pipeline Alignment- Preliminary Engineering*, 22 September 1997.

CH2MHill, *Impact of Revised Flow Criterion for Pajaro River on Murphy Crossing Project*, 1999.

CH2MHill. 2000. Aquifer Storage and Recovery Well Field Near College Lake. December 2000.

Earles, Jim, *Balancing Solution for Pajaro Valley Overdraft* (Action Pajaro Valley Plan), 2000.

EIP Associates, *Final Program EIR for the Pajaro Valley Water Basin Management Plan*, for the Pajaro Valley Water Management Agency, 1993.

Environmental Science Associates, *Environmental Assessment – CVP Water Supply Contract Assignment from Mirey Springs Water District to Pajaro Valley Management Agency*, 1997.

John Carollo Engineers, *City of Watsonville Reclamation Feasibility Report*, 1994.

King, Kenneth B., P.E., *Evaluation of College Lake and Bolsa de San Cayetano Projects*, 2000.

Pajaro Valley Water Management Agency (PVWMA), *Final Program EIR for The Pajaro Valley Water Basin Management Plan*, 1993.

Pajaro Valley Water Management Agency (PVWMA), *PVWMA Local Water Supply and Distribution Final EIR*, 1999.

Pajaro Valley Water Management Agency (PVWMA), *Water Conservation 2000*, 2000.

Pajaro Valley Water Management Agency, *PVWMA BMP Update Recommended Program - Notice of Preparation for an Environmental Impact Report*, 2 June 2000, 2000a.

Pajaro Valley Water Management Agency, *State of the Basin Report*, August 2000b.

Pajaro Valley Water Management Agency, *Draft Revised Basin Management Plan*, 2001.

RMC, *Technical Memorandum – Recycled Water Treatment Alternatives Report*, 5 March 2001.

State Water Resources Control Board, *Bulletin 5*, 1953.

United States Bureau of Reclamation (Reclamation), Central Valley Project: San Felipe Division, California, 2000. http://dataweb.regis.do.usbr.gov/html/sanfelipe.html

Whitley, Burchett and Associates, *Separation Processes, Use of Reverse Osmosis to Reclaim Municipal Wastewater - A Feasibility Study*, April 1995; Separation Processes, Inc., Fax communication, July 26, 1996.

CHAPTER 3
REGIONAL SETTING

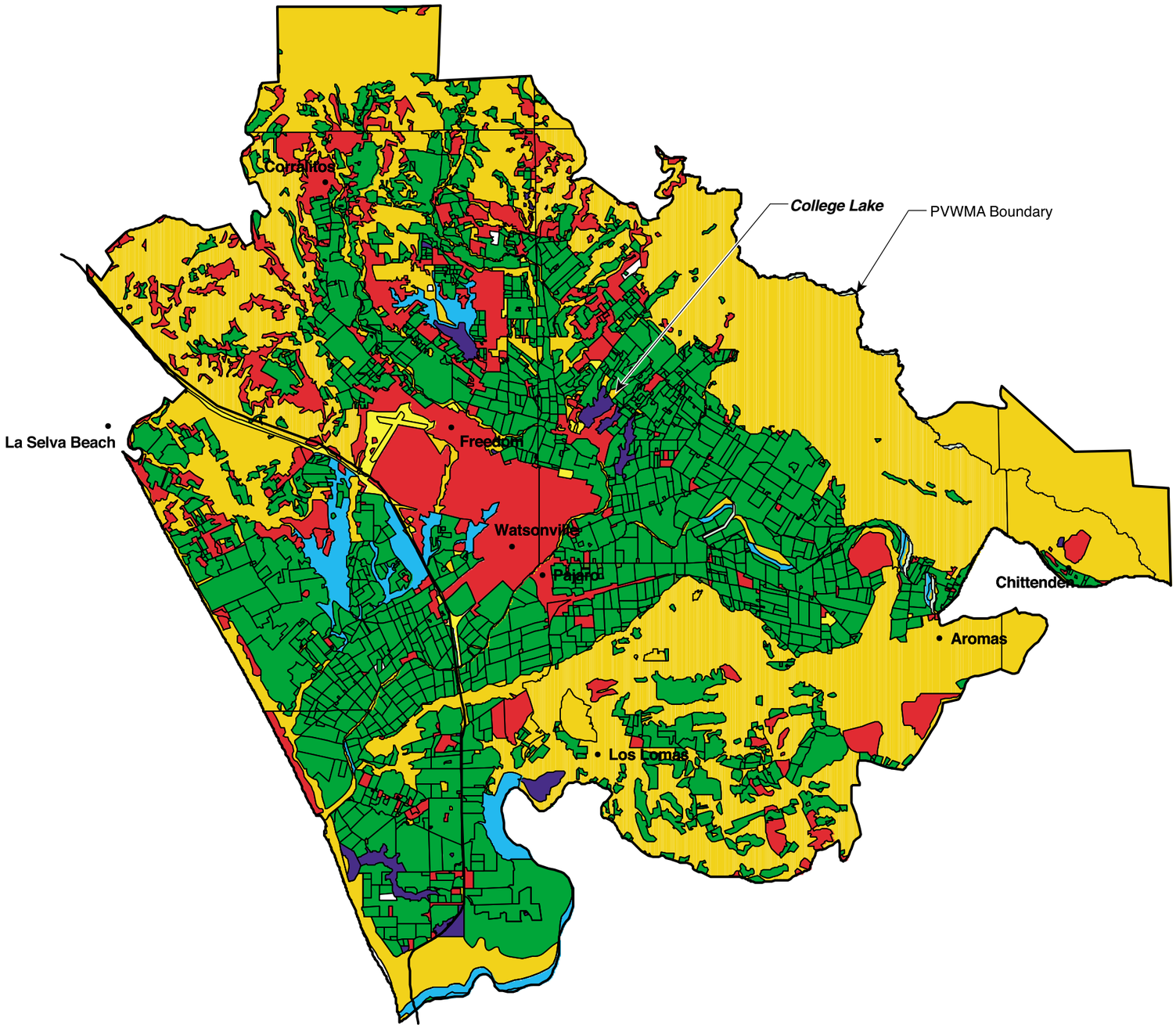
3.1 LAND USE AND PLANNING

3.1.1 REGIONAL SETTING

The proposed water supply facilities in the Revised BMP are within five land use jurisdictions, each with separate land use definitions and requirements. The proposed Import Pipeline of the BMP 2000 Alternative would extend through unincorporated areas of San Benito, Santa Cruz, and Monterey counties along its 23-mile-long alignment. The proposed site of the Water Recycling Facilities adjacent to the WWTF is within the incorporated City of Watsonville. The Aquifer Storage and Recovery pipeline and well field extend through unincorporated Santa Cruz County as well as portions of the incorporated City of Watsonville, but the entire alignment is within the Watsonville planning area. The Expanded College Lake facilities, the Corralitos Creek and Pinto Lake diversion facilities, and the Harkins and Watsonville Slough facilities proposed under the Local-Only Alternative would be located in unincorporated Santa Cruz County within the Watsonville planning area, as designated in the City of Watsonville General Plan. **Figure 2.1** in Chapter 2, Project Description, shows the county boundaries within the PVWMA service area.

EXISTING LAND USES

Land uses in the vicinity of the proposed water supply facilities were identified through field reconnaissance, inspection of aerial photographs, and surveys conducted by the California Department of Water Resources. As shown in **Figure 3.1-1**, open space and agriculture are the predominant land uses in the Pajaro Valley. Crops grown in the valley include strawberries, bush berries, apples, flowers, lettuce, artichokes, and other vegetables. While farmhouses are scattered throughout the Pajaro Valley, residential areas within the project area are primarily located near urban centers, such as the City of Watsonville and the neighboring community of Freedom, in inland foothill areas, and along the coast. Rural residential development is also occurring in inland foothill areas. Commercial uses, schools and parks are also concentrated in the City of Watsonville (see **Figure 3.1-2**).



Legend

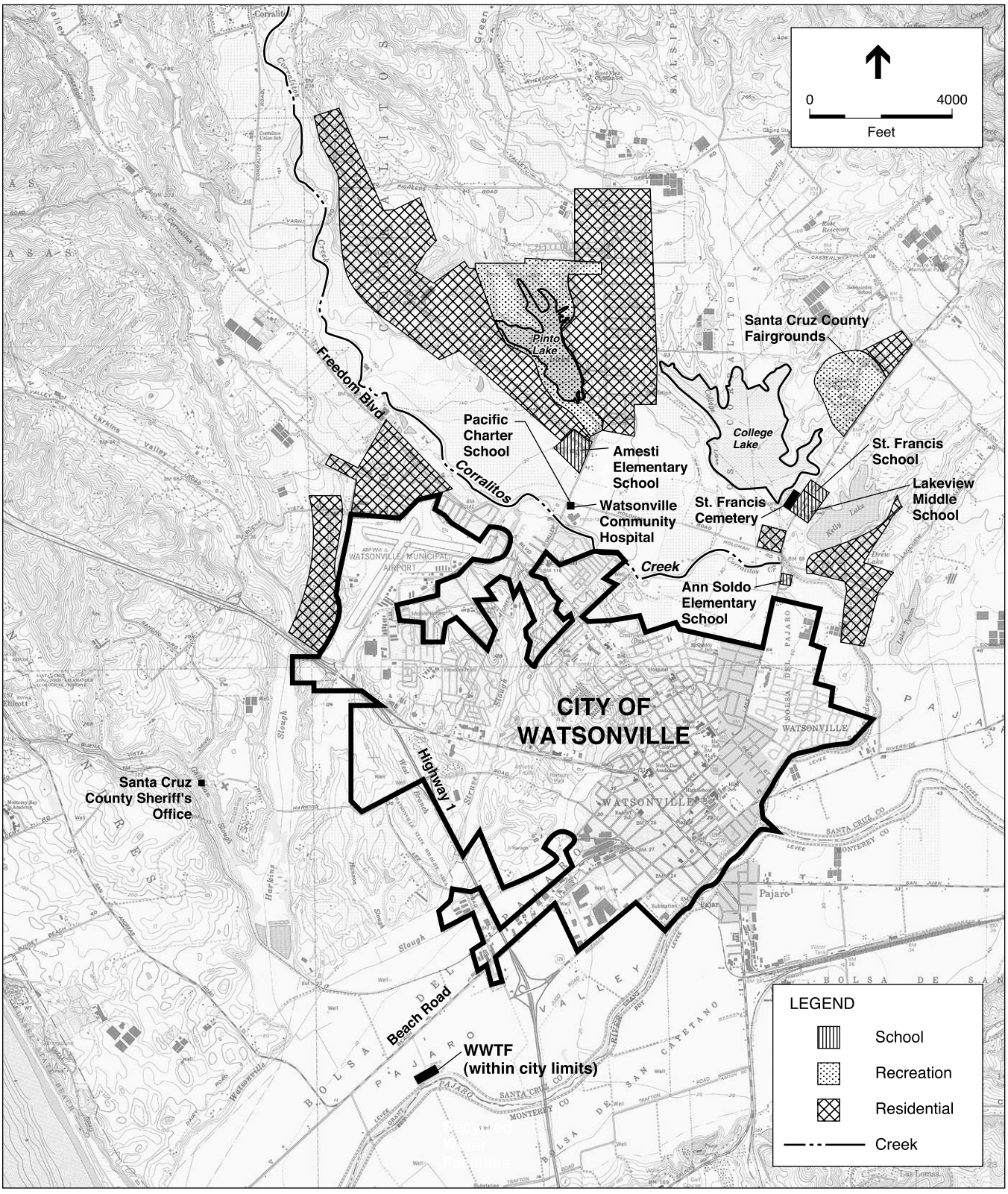
- Agriculture / Semi-Agriculture
- Idle
- Native Riparian
- Native Vegetation
- Water Surface
- Urban
- Urban Vacant / Airport
- Urban Centers

N

SOURCE: Department of Water Resources, 1997; adapted by Environmental Science Associates

Figure 3.1-1

Existing Land Uses in the PVWMA Service Area



SOURCE: Environmental Science Associates; USGS

PVWMA Revised BMP EIR / 200179 ■

Figure 3.1-2
Recreational and Sensitive Land Uses in the Project Area

IMPORTANT FARMLAND DESIGNATIONS

The California Department of Conservation, Office of Land Conservation, maps important farmland throughout California. Important farmlands are divided into the following four categories based on their suitability for agriculture:

- *Prime Farmland* is land that has the best combination of physical and chemical characteristics for crop production. It has the soil quality, growing season and moisture supply needed to produce sustained high yields of crops when treated and managed.
- *Farmland of Statewide Importance* is land other than Prime Farmland that has a good combination of physical and chemical characteristics for crop production.
- *Unique Farmland* is land that does not meet the criteria for Prime Farmland or Farmland of Statewide importance which has been used for the production of specific high economic value crops.
- *Farmland of Local Importance* is either currently producing crops, or has the capability of production, and does not meet the criteria of the categories above.

San Benito County

According to the Important Farmland Map for San Benito County, the Import Pipeline alignment extends through lands designated as Prime Farmland and Farmland of Statewide Importance between Stations 0+00 and 320+00 (Department of Conservation, 1996). Prime Farmlands are also located along the alignment on the west side of U.S. 101, and between Stations 680+00 and 715+00 near Aromas.

Santa Clara County

According to the Important Farmland Map for Santa Clara County, lands along the pipeline alignment between Stations 400+00 and 494+00 are designated Grazing Land (Department of Conservation, 1996). This designation is for land on which the existing vegetation is suited to the grazing of livestock. These lands are not considered prime farmlands.

Santa Cruz County

The Santa Cruz County General Plan identifies commercial agricultural lands within the County. Commercial agricultural lands are divided into seven categories. Four of these categories, which are described below, are applicable to the study area for this EIR.

> **Type 1A - Viable Agricultural Land.** Type 1A agricultural lands comprise areas of known high productivity which are not located in any utility assessment district for which bonded indebtedness has been incurred. These lands essentially meet the U.S. Department of Agriculture Soil Conservation Service and the California Department of Food and Agriculture criteria for “prime” and “unique” farmland and “prime” rangeland.

Type 1B – Viable Agricultural Land in Utility Assessment Districts. This type includes viable agricultural lands, as defined above, which are within a utility assessment district for which bonded indebtedness has been incurred, except Agricultural Preserves.

Type 2C – Limited Agricultural Land in Utility Assessment Districts. This type includes agricultural lands with limiting factors which are in a utility assessment district, as of 1979, which has incurred bonded indebtedness.

Type 3 - Viable Agricultural Land within the Coastal Zone. This category includes all of the following lands outside the Urban Services Line and the Urban Rural Boundary, and within the Coastal Zone in Santa Cruz County:

- Land which meets the U.S. Department of Agriculture Soil Conservation or California Department of Food and Agricultural Service criteria for prime farmland or rangeland soils and which is physically available for agricultural use.

- Land which meets the California Department of Food and Agriculture criteria for unique farmland of statewide importance and which is physically available for agricultural use.

According to the Santa Cruz County Agricultural Resources Map, lands along the Pajaro River and the Import Pipeline alignment of the BMP 2000 Alternative are designated as Type 1A lands or Type 1A, Agricultural Preserve. The Agricultural Preserve designation identifies lands that are currently under Williamson Act contract (see discussion on page 3.1-14). The proposed water recycling facilities adjacent to the WWTF would be located on Type 3 lands. As stated above, agricultural lands designated as Type 1A or 3 lands meet the USDA Natural Resources Conservation Service (formerly the Soil Conservation Service) criteria for prime and unique farmlands.

The facilities proposed under the Local-Only Alternative would be constructed on several types of commercial agricultural lands. At College Lake, the earth dam and the expanded inundation area would be located on Type 1A lands, the saddle dam would be located on Type 2C lands, and the proposed pump station, pretreatment, and filtration facilities would be located on Type 1B lands. The Aquifer Storage and Recovery pipeline would extend through areas with Type 1A and Type 3 agricultural lands. The Corralitos Creek and Pinto Lake diversion facilities would be located on Type 1A lands, and the proposed North Dunes Recharge Basin and the facilities at Watsonville and Harkins Sloughs would be constructed on Type 3 lands. As stated above, the proposed water recycling facilities at the WWTF would be located on Type 3 lands.

Monterey County

According to the North County Planning Area Important Farmlands Map, virtually all of the lands along the Pajaro River and the pipeline alignment, from Highway 1 to the eastern edge of Monterey County, are designated as prime farmlands (County of Monterey, 1994).

3.1.2 REGULATORY FRAMEWORK

Applicable goals and policies from the San Benito County, Santa Clara County, Santa Cruz County, Monterey County, and the City of Watsonville general plans and local coastal plans are presented below.

SAN BENITO COUNTY GENERAL PLAN

Land Use Element (1994)

Goal 1: To retain the County's rural atmosphere.

Objective 1.a: To protect prime agricultural areas in order to preserve them for the present and future agricultural production vital to the County.

Objective 1.c: To protect hillsides and grazing lands with grades over 30 percent.

Objective 5.b: To protect agriculture as a major industry in the County.

Policy 2: The type of uses allowed within agriculturally designated areas shall be related to the suitability of the soil resources, climate and water supply. The types of uses allowed on most agriculturally designated areas within the County include agriculture, agricultural processing, grazing, land in its natural state, wildlife refuges, and low intensity residential. Uses subject to permit approval include low intensity recreational facilities, mineral extraction and processing, and also institutional uses and uses that, by their nature, should be located in undeveloped areas.

Policy 3: Grade 1 soils as defined in the Soils Survey of San Benito County shall be the highest priority for protection of soil resources.

Action 3a: Development proposals in the following locations will be exempt from Policy 3.

i. Grade 1 soils located within the Sphere-of-Influence of a public sewer and water district.

iii. Grade 1 soils in the Soils Survey of San Benito County that have been determined to be Grade 2 or less from an on-site soils test performed by a soils engineer.

iv. Grade 1 soils in the Soils Survey of San Benito County that do not have a historical agricultural use.

Policy 4: Development proposals adjacent to Grade 1 agricultural lands and soils suitable for the production of row crops, flowers, or orchards shall be required to mitigate potential land use conflicts with agricultural operations.

Action 4a: Development proposals shall provide a nondevelopment buffer beginning at the property line of the proposed development.

Action 4b: Development proposals shall not be allowed to increase the volume or velocity of storm water runoff to adjoining agricultural lands.

Action 4c: Landscaping plans for the nondevelopment buffer areas shall be reviewed to ensure that vegetation will not create intrusive shade, a habitat for pests, or other nuisance to the agricultural operator.

Open Space Element (1995)

Goal 6: Agricultural Resources. To continue agriculture as an industry in the County and to preserve present agricultural resources for future generations.

Objective 1: To encourage and protect agriculture as a viable industry in the County.

Objective 2: To provide financial incentives to protect the most productive soils resources.

Objective 3: Stabilize land values for persons interested in purchasing agricultural land while providing economic incentives to land owners to avoid conversion of row crop and orchard land.

Policy 26: Support agricultural industry. It is the policy of San Benito County to promote and support the location of new agriculture-related business and industry and support programs that promote local agricultural products and increase marketing opportunities.

COUNTY OF SANTA CLARA GENERAL PLAN (1994)

The following policies of the Santa Clara County General Plan have pertinence with regard to the proposed pipeline.

Resource Conservation Element – Countywide

Policy C-RC 14: Reforms of the state-wide system of water allocation and distribution should be encouraged which facilitate the ability of urban area water suppliers to purchase needed supplies through market mechanisms.

Policy C-RC 17: Drought contingency plans and groundwater basin management programs should be reviewed and updated to prepare for the likelihood of future periods of short-term drought and to minimize:

a. the potential adverse impacts of drought upon households, business, and industry, and

b. the possibility of groundwater overdraft and land subsidence.

Policy C-RC 40: Long term land use stability and dependability to preserve agriculture shall be maintained and enhanced by the following general means:

a. limiting the loss of valuable farmland from unnecessary and/or premature urban expansion and development.

Resource Conservation Element – Rural Unincorporated Area

Policy R-RC 57: Agriculture shall be encouraged and prime agricultural lands retained for their value to the overall economy and quality of life of Santa Clara County, including:

a. local food production capability;

b. productive use of lands not intended or suitable for urban development; and

c. preservation of a diminishing natural resource, prime agricultural soils.

Policy R-RC 61: Allowable land uses in exclusive agricultural areas shall be limited to:

a. Agriculture and ancillary uses,

b. Uses necessary to directly support local agriculture, and

c. Other uses compatible with agriculture which clearly enhance the long term viability of local agriculture and agricultural lands.

Land Use Element

Policy R-LU 11: Allowable land uses shall be limited to:

a. Agriculture and ancillary uses;

b. Uses necessary to directly support local agriculture; and

c. Other uses compatible with agriculture which clearly enhance the long term viability of local agriculture and agricultural lands.

COUNTY OF SANTA CRUZ GENERAL PLAN AND LOCAL COASTAL PROGRAM

The Santa Cruz County General Plan and Local Coastal Program contains goals, policies, and implementation measures to guide land use decisions within the County. Relevant policies pertaining to land use and agricultural resources are presented below. Policies related to vegetation and wildlife resources, drainage and flood control, and public facilities and services are discussed in the corresponding sections of the EIR.

Conservation and Open Space Element

Objective 5.5a: Watershed Protection. To protect and manage the watersheds of existing and future surface water supplies to preserve the quality and quantity of water produced and stored in these areas to meet the needs of County residents, local industry, agriculture, and the natural environment.

Objective 5.8b: To act directly and coordinate and work with relevant water purveyors and agencies to eliminate long-term groundwater overdraft in all water basins where overdraft has been documented.

Program C: Work with water purveyors and water management agencies to augment natural groundwater recharge where it is environmentally and fiscally acceptable.

Program H: Continue to work with the Pajaro Valley Water Management Agency to eliminate overdraft and salt water intrusion through implementation of their Basin Management Plan.

Policy 5.13.6: Conditional Uses on Commercial Agricultural (CA) Zoned Lands. All conditional uses shall be subject to standards which specify siting and development criteria; including size, location and density. Allow conditional uses on CA zoned lands based upon the following conditions:

a. The use constitutes the principal agricultural use of the parcel; or

b. The use is ancillary incidental, or accessory to the principal agricultural use of the parcel; or

c. The use consists of an interim public use which does not impair long term agricultural viability; and

d. The use is sited to avoid conflicts with principal agricultural activities in the area; and

e. The use is sited to avoid, where possible, or otherwise minimize the removal of land from agricultural production.

Policy 5.13.8: Location of Agricultural Support Facilities. Require agricultural support facilities, where permitted on designated Agricultural lands, to locate either off good agricultural soils, or when this is not feasible, on the perimeter of good agricultural soils.

Policy 5.13.17: Division Must Not Hamper Long Term Agriculture. No proposed division shall be approved except where it is shown that such division will not hamper or discourage long-term commercial agricultural operations.

Program F: Ensure a continued sustainable supply of water for agricultural use through conservation, protection and development of surface and groundwater, utilization of excess domestic water, utilization of recycled wastewater, or importation of water from outside the County.

COUNTY OF MONTEREY - NORTH COUNTY AREA PLAN

Land use planning in northern Monterey County is directed by two documents, the North County Area Plan and the North County Land Use Plan (LUP) segment of the Local Coastal Program (LCP). Land use activities within the coastal zone, which encompasses about half of the North County Planning Area, are covered by the North County LUP/LCP, while the North County Area Plan has jurisdiction over the rest of the planning area. In addition, land use planning is guided by the overall Monterey County General Plan, which is discussed below.

No land use policies have been identified in the North County Area Plan that relate to the expansion or use of water supply infrastructure, such as the proposed water recycling facilities at

the WWTF and the Import Pipeline. However, the Area Plan recognizes that groundwater pumping has caused seawater intrusion, which will lead to increasingly widespread economic impacts. Policy 6.2.2 of the Area Plan states that "the County shall place a high priority on water development projects that can offer a viable water supply to water-deficient areas in North County" (County of Monterey, 1994).

NORTH COUNTY LAND USE PLAN - LOCAL COASTAL PROGRAM

The North County Land Use Plan / Local Coastal Program (North County LUP/LCP) provides policies to guide land use decisions within the coastal zone in northern Monterey County. Policies related to development in agricultural areas are presented below.

> **Policy 2.6.1:** The County shall support the permanent preservation of prime agricultural soils exclusively for agricultural use. The County shall also protect productive farmland not on prime soils if it meets State productivity criteria and does not contribute to degradation of water quality. Development adjacent to prime and productive farmland shall be planned to be compatible with agriculture.
>
> **Policy 2.6.1.4:** The County shall continue its agricultural preserve (Williamson Act) program and promote the inclusion of prime and productive land. Eligible landowners should be assisted by the County in becoming aware of Williamson Act benefits, preparing contracts, and securing tax benefits. Scenic or resource conservation easements will be encouraged as a suitable means for protecting agricultural lands of high scenic value adjacent to populated areas and where agricultural land does not qualify for the agricultural preserve program.
>
> **Policy 2.6.2.1:** Prime and productive farmland designated for Agricultural Preservation and Agricultural Conservation land use shall be preserved for agricultural use to the fullest extent possible as consistent with the protection of environmentally sensitive habitats and the concentration of development.
>
> **Policy 2.6.3.1:** A three-level system of land use categories shall be applied to prime and productive agricultural lands:
>
> a. An agricultural land use designation for prime and productive agricultural lands, Agricultural Preservation, shall be applied to all parcels containing prime and productive agricultural soils (SCS Class I-IV), and other lands in cultivated agriculture of less than 10 percent average slope. Emphasis is placed on including large contiguous areas in this designation in order to restrict the encroachment of land uses that may threaten the agricultural viability of these lands.
>
> b. An agricultural land use designation, Agricultural Conservation, shall be applied to: 1) relatively small pockets of prime agricultural soils (SCS Class I and II) that are not within or adjacent to the more extensive agricultural areas designated under the Agricultural Preservation land use category, 2) other productive agricultural lands generally characterized by slopes over 10 percent with erodible soils once an agricultural management plan has been approved, and 3) grazing lands where such a low-intensity agricultural use is the most compatible use of an area. The Agricultural Conservation category shall also be applied to lands not in areas designated under the Agricultural Preservation land use category that are placed into

Williamson Act agricultural preserve contracts. Emphasis shall be placed on preserving the most viable agricultural areas of a parcel for agricultural use.

c. A very low-density residential land use designation that encourages agricultural use, Rural Residential, shall be applied to areas of mixed residential and agricultural uses and areas suitable for very low-density residential use and characterized by topographical and soil conditions generally posing greater erosion, water quality, and public safety hazards when under cultivation. Agricultural management plans as described in Specific Recommendations shall be encouraged for existing cultivated agriculture uses and required for new or expanded cultivation. Upon application and approval of an agricultural management plan and agricultural preserve contract, lands will be re-categorized for Agricultural Conservation land use.

Policy 2.6.3.2: Development of Agricultural Preservation lands shall be limited to accessory buildings, including farm residences, and uses required for agricultural activities on that parcel. Subdivision shall be allowed for agricultural use only with a minimum parcel size of 40 acres.

Policy 2.6.3.3: Development of Agricultural Conservation lands shall be allowed for agriculture-related facilities and very low-density residential use at a density of one unit per 40 acres. These uses shall be located, where possible, on the least agriculturally viable area of the parcel. The minimum parcel size for land divisions is 40 acres.

Policy 2.6.3.4: Development of Rural Residential lands shall be allowed for agriculture-related facilities and very low density residential use. These uses shall be located, where feasible, to conserve lands suitable for cultivation. The minimum density and parcel size is one unit per 40 acres or more to one unit per 5 acres as determined upon application and evaluation of site and area conditions.

Policy 2.6.3.5: Conversion of Agricultural Conservation lands to nonagricultural uses shall be allowed only if such conversion is necessary to:

a) establish a stable boundary between agriculture and adjacent urban uses or sensitive habitats; or

b) accommodate agriculture-related or other permitted uses which would economically enable continuation of farming on the parcel and adjacent lands.

Policy 2.6.3.6: For new development adjacent to agricultural areas, well-defined buffer zones shall be established within the area to be developed to protect agriculture from impacts of new residential or other incompatible development and mitigate against the effects of agricultural operations on the proposed uses. Subdivisions, rezoning, and use permit application for land adjacent to areas designated on the plan map for Agricultural Preservation or Agricultural Conservation shall be conditioned to require dedication of a 200-foot-wide open space easement, or such wider easement as may be necessary, to avoid conflicts between the proposed use and the adjacent agricultural lands. For development adjacent to agricultural areas not designated for exclusive agricultural use, a reduced easement of not less than 50 feet shall be required. These easements shall extend the full length of the boundaries between the property to be developed and adjacent agricultural lands. Permanent roads may serve as part of this easement. Land within the easement shall be maintained in open space. Minor storage buildings or sheds associated with the residential uses, may be permitted as a conditioned use. The open space easement shall not be used for recreational areas as part of housing projects or public facilities.

COUNTY OF MONTEREY GENERAL PLAN

As stated above, lands within the North County Area Plan are also subject to the policies of the Monterey County General Plan. Applicable policies of the County General Plan are presented below.

Goal 4: To preserve and enhance all viable agricultural lands.

Goal 5: To conserve and enhance the water supplies in the county and adequately plan for the development and protection of these resources and their related resources for future generations.

Goal 6: To promote adequate, replenishable water supplies of suitable quality to meet the County's various needs.

Goal 30: To protect all viable farmlands designated as prime, of statewide importance, unique, or of local importance from conversion to and encroachment of nonagricultural uses.

Goal 33: To encourage the use of the county's major inland water bodies for multiple purposes such as water supply, flood control, recreation, and hydroelectric generation.

Objective 6.1: Eliminate long-term groundwater overdrafting in the County as soon as practicably possible.

Objective 6.2: Explore and implement measures to supply additional water to critically deficient areas.

Policy 4.1.3: All farmlands designated as prime, or statewide importance, unique, or of local importance shall be protected from incompatible uses on adjacent lands.

Policy 6.1.1: Increased uses of groundwater shall be carefully managed, especially in areas known to have groundwater overdrafting.

Policy 6.1.2: Water conservation measures for all types of land uses shall be encouraged.

Policy 6.2.1: The County shall pursue development of suitable water supplies in keeping with broad conservation goals.

Policy 21.1.8: The County shall cooperate with state and federal agencies in identifying seawater intrusion problems and shall seek available state or federal assistance in solving these conditions.

Policy 21.1.10: The County shall implement a program to prevent further seawater intrusion by developing supplemental sources of water for the North County. This may include water importation, water conservation, and wastewater reclamation.

Policy 30.0.4: The County shall make every effort to preserve, enhance, and expand viable agricultural land uses on farmland designated as prime, of statewide importance, unique, or of local importance through application of "agricultural" land use designations and encouragement of large lot agricultural zoning.

CITY OF WATSONVILLE GENERAL PLAN

The City of Watsonville General Plan, which was adopted in 1994, has a timeframe that extends to the year 2005. The Watsonville General Plan considers the agricultural heritage of the City and the Pajaro Valley to be an important aspect of the City's character, but recognizes that the preservation of agricultural land alone will not ensure preservation of the agricultural economy. Other factors, such as availability of irrigation water and facilities for support industries, are also important in preserving agriculture. (City of Watsonville, 1994)

No land use policies have been identified in the Watsonville General Plan that relate to the expansion of use of public utility infrastructure, such as the proposed water recycling facilities at the WWTF. However, the General Plan recognizes that groundwater overdraft is a major concern in the Pajaro River Basin (City of Watsonville, 1994).

The Watsonville 2005 General Plan indicates that all lands that lie outside of the City's urban limit line, but within its planning area, are designated Agriculture, regardless of its size or actual use. The site of the proposed water diversion and treatment facilities at College Lake lie outside of this line and are designated Agriculture in the Land Use Diagram. Lands designated as Agriculture are to be preserved for the production of food, fiber, flowers and other agricultural products, including the growing of crops and/or animal or poultry husbandry and grazing.

Policies pertaining to agricultural lands and water supply are presented below.

Growth and Conservation Element

Goal 3.3: Agricultural Land Use. Foster the continuation of agriculture in the Pajaro Valley.

Policy 3.F: Agricultural Land Conservation. The City shall plan for the preservation and enhancement of important agricultural soils by encouraging the County and LAFCO to prohibit continued urbanization of lands beyond the urban limit line and by encouraging the retention of land beyond the urban limit line for long term agricultural purposes.

Implementation Measure 3.F.4: Agricultural Support – The City shall encourage the retention of the following: agricultural support industries in Watsonville, suitable housing for agricultural labor, the management of water resources, and the provision of transportation infrastructure to support the agricultural base of the Pajaro Valley.

STATE LANDS COMMISSION

The State Lands Commission has "exclusive jurisdiction and authority over all ungranted tidelands, submerged lands, and the beds of navigable rivers, sloughs, lakes, etc." (Public Resources Code Section 6301). The use of sovereign lands, particularly within the Pajaro River, could be restricted by the existence of a public trust easement. The public trust easement would limit the allowable uses of the lands to commerce, navigation, fisheries, open space, preservation of natural resources, and other water dependent or water-oriented public uses. The proposed

Import Pipeline, which would construct a pipeline across the Pajaro River at two locations (at Stations 400+00 and 595+00), may be subject to approval by the State Lands Commission.

CALIFORNIA COASTAL COMMISSION

The California Coastal Commission has jurisdiction over the coastal zone, which generally extends from Monterey Bay inland to the City of Watsonville in Santa Cruz County, and from Monterey Bay to Highway 1 and east of Elkhorn Slough in Monterey County. The proposed water recycling facilities at the WWTF are located within the coastal zone. Santa Cruz and Monterey Counties hold the responsibility for implementing their Local Coastal Programs, including permit authority in the coastal zone. Actions taken by the Counties within the coastal zone may be appealed to the Coastal Commission only under defined circumstances (specified in Public Resources Code Section 30603). The California Coastal Commission retains permit authority in certain limited areas, such as tidelands and submerged lands (Coastal Act Section 30519(b)) (County of Santa Cruz, 1994; County of Monterey, 1987).

WILLIAMSON ACT CONTRACT

Several areas within the PVWMA boundaries are under Williamson Act (Land Conservation Act of 1965) contracts for the preservation of land in agriculture. Under a Williamson Act contract, the landowner agrees to limit the use of the land to agriculture and compatible uses for a period of at least ten years. In return, the land is taxed at a rate based on the agricultural production of the land, rather than its real estate market value, protecting landowners against tax increases caused by inflation. The tax advantage of a landowner holding a Williamson Act contract is substantial. Cancellation of Williamson Act contracts is allowed; however, the landowner is assessed penalty charges and the cancellation takes up to ten years to complete. The proposed project would locate facilities on or near agricultural land. The location of these facilities would not be likely to require cancellation of Williamson Act contracts. While the proposed Import Pipeline would likely extend through lands under Williamson Act contract, cancellation of contracts would not be required because the pipeline would not result in the permanent conversion of agricultural land.

REFERENCES – Land Use and Planning

City of Watsonville, *Watsonville 2005 General Plan*, adopted May 24, 1994.

County of Monterey, *General Plan*, adopted September 30, 1982, amended 1995.

County of Monterey, *North County Area Plan*, updated November 29, 1994.

County of Monterey, *North County Land Use Plan / Local Coastal Program*, amended May 19, 1987.

County of San Benito, *Open Space and Conservation Element Update of the San Benito County General Plan*, February 7, 1995.

County of San Benito, *San Benito County General Plan, Scenic Roads and Highways Element*, 1980.

County of Santa Clara, *Santa Clara County General Plan*, updated 1994.

County of Santa Cruz, *General Plan and Local Coastal Program*, adopted May 24, 1994.

Department of Conservation, Important Farmland Maps for San Benito and Santa Clara Counties, 1996.

3.2 GEOLOGY, SOILS, AND SEISMICITY

This section describes the geology, soils, and seismic conditions in the area of the proposed Import and water recycling facilities. This discussion is based on a review of reports and geologic maps including:

- The Final Program EIR for the Pajaro Valley Water Management Agency's (PVWMA) Basin Management Plan (1993);
- The Final EIR for the PVWMA Local Water Supply and Distribution Project (1999);
- Reports published by the U.S. Geological Survey (USGS) and the California Division of Mines and Geology (CDMG);
- County general plan elements; and
- U.S. Department of Agriculture soil surveys for Santa Cruz and Monterey counties.

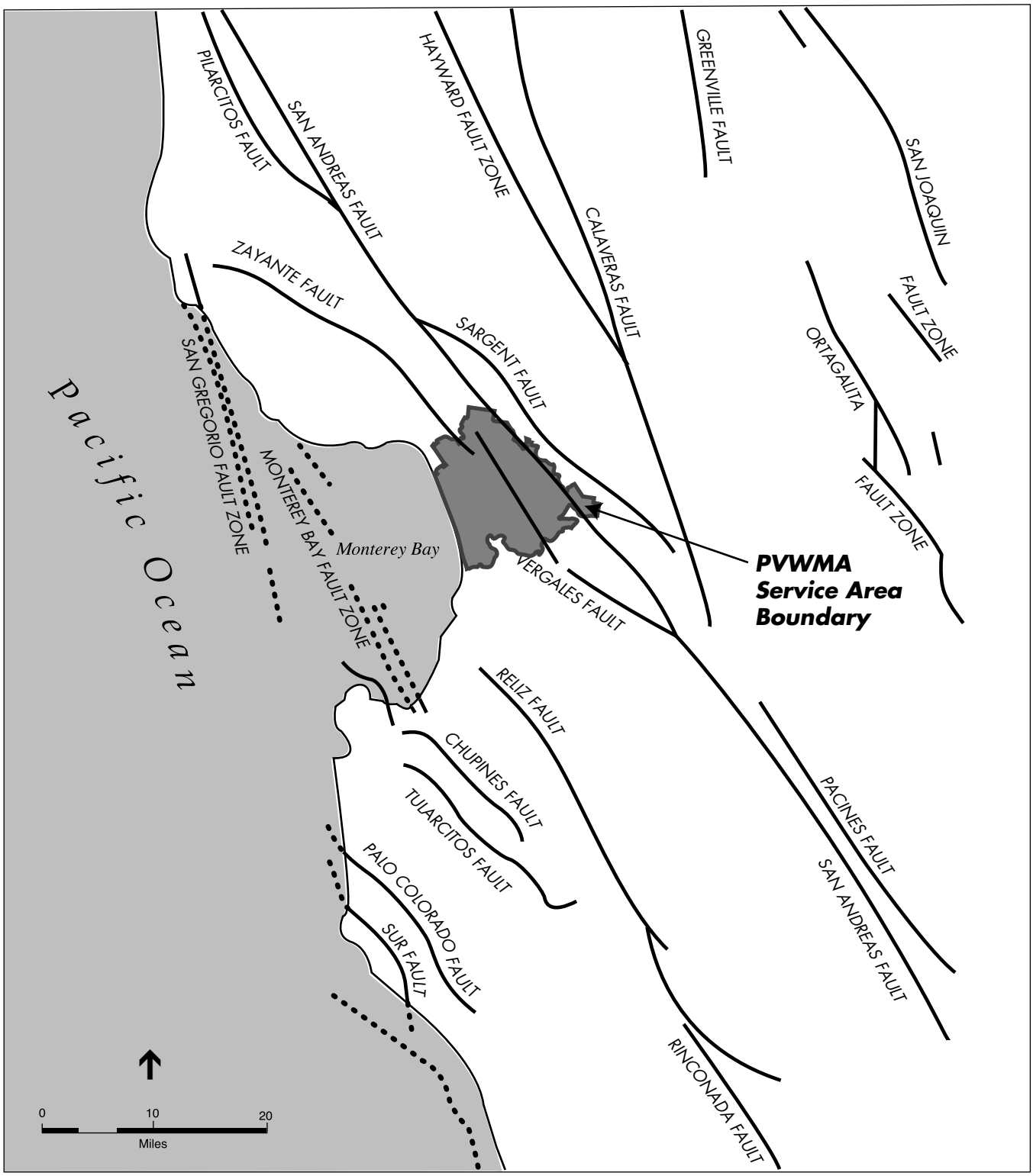
3.2.1 REGIONAL SETTING

GEOLOGY

The project area is in the Pajaro Valley, a wide plain between the Coast Ranges and Monterey Bay. Northwest-trending mountains and valleys that are often defined by active faults characterize the Coast Ranges. The southern Santa Cruz Mountains, from the vicinity of Highway 101 westward through the Chittenden Pass, consist of Middle and/or Lower Pliocene (5 million years ago) marine sedimentary rocks and Early Miocene (23.5 million years old) marine deposits. A sliver of Mesozoic granite from the Salinian block occurs south of Highway 129 (at the Granite Rock quarry) in the San Andreas rift zone. The Pajaro Valley is underlain by Quaternary alluvium from Aromas to Monterey Bay. The Pajaro Valley separates the southern Santa Cruz Mountains to the north from the Gabilan Range to the south. The Gabilan Range is underlain partly by Pleistocene nonmarine sedimentary rocks.

SEISMICITY

The region is characterized by high seismic activity. The San Andreas Fault System, forming the boundary between the North American and Pacific crustal plates, is expressed as a series of northwest-trending faults (Jennings, 1994). These faults include the San Andreas, San Gregorio, Monterey Bay, Hayward, Calaveras, Sargent, Vergales, and Zayante faults (**Figure 3.2-1**). Many individual faults of the San Andreas Fault System have produced strong earthquakes in the past and are expected to do so in the future. The 1989 Loma Prieta earthquake, which was centered in the Santa Cruz Mountains to the northeast of the Pajaro Valley, resulted in deaths, injuries, and widespread damage in the project area.



SOURCE: Environmental Science Associates

Figure 3.2-1
Regional Fault Map

Table 3.2.1 lists the location of regionally significant active faults that could affect project facilities, and the location of the faults relative to these facilities, activity status, date of most recent motion, and maximum moment magnitude earthquake (Mw). The Mw is related to the physical size of a fault rupture and movement across a fault. Moment magnitude provides a physically meaningful measure of the size of a faulting event (CDMG, 1997). The following text provides a summary of primary faults most likely to adversely affect the project area.

San Andreas Fault

The San Andreas fault is a major northwest-trending, right-lateral, strike-slip fault. The fault extends for about 600 miles from the Gulf of California in the south to Cape Mendocino in the north. The San Andreas is not represented by a single trace, but by a system of active faults that diverge from the main fault south of San Jose. Regional faults that are subparallel to the San Andreas fault, such as the Hayward, Calaveras, and San Gregorio, are within the broader San Andreas Fault System (**Figure 3.2-1**).

The San Andreas fault has produced numerous large historic earthquakes including the 1906 San Francisco earthquake. That event had an estimated Richter magnitude of 8.3 and was associated with up to 21 feet of displacement and widespread ground failure (Lawson, 1908). In the Watsonville area and to the east, reports of strong groundshaking, toppled chimneys, ground cracks, broken pipes, and twisted and sunken railroad tracks (Lawson, 1908) indicate that groundshaking intensities reached IX on the Modified Mercalli scale (**Table 3.2.2**).

Numerous moderate-sized earthquakes (Richter magnitude 5.2) occurred in Watsonville in 1954 and again in 1964 and 1969, causing breakage of irrigation lines, rupture of water mains, and cracking of plaster and stucco (PVWMA, 1993). The Richter magnitude 7.1 Loma Prieta earthquake of October 1989 caused strong groundshaking and ground failure across a wide region. Major damage occurred in downtown and residential Watsonville, Castroville, Gilroy, and Hollister (Wagner, 1990). The Loma Prieta earthquake produced a peak ground acceleration of 0.39g (gravitational acceleration), which was accompanied by groundshaking established at Modified Mercalli intensity VIII in the project area (McNutt and Toppozada, 1990).

The San Andreas fault has repeatedly provided evidence of large surface fault rupture events and is designated as an earthquake fault zone under the Alquist-Priolo Act. The Peninsula segment of the San Andreas fault is estimated to have a 15 percent probability of producing a Richter magnitue 6.7 earthquake in the period between 2000 and 2030 (USGS, 1999). Because a significant amount of stress was released during the 1989 Loma Prieta earthquake, the Santa Cruz Mountains segment is assigned a 10 percent probability of producing a similar magnitude earthquake in the same 30-year period.

TABLE 3.2.1
PRIMARY FAULTS IN THE PROJECT SITE VICINITY

Fault	Approximate Distance and Direction from Downtown Watsonville (Miles)	Recency of Movement	Fault Classification[a]	Historical Seismicity[b]	Maximum Moment Magnitude (Mw)[c]
San Andreas	4.8 Northeast	Historic (1906; 1989 ruptures)	Active	M7.1, 1989 M8.25, 1906 M7.0, 1838 Many <M6	7.9
San Gregorio	24 Southwest	Holocene	Active	M5.5-5.9 1869-1931	7.3
Monterey Bay	18 East	Holocene	Active	Microseismicity[d]	7.1
Calaveras (southern)	18 Northeast	Historic (creep, 1861 rupture north of the project) Holocene	Active	M5.6-M6.4, 1861 M4 to M4.5 swarms 1970, 1990	6.2
Sargent	7 Northeast	Historic (creep 1989, triggered by Loma Prieta)	Active	Microseismicity	6.8
Zayante-Vergeles	2.4 Northeast	Holocene	Segments zoned both active and potentially active	Data Limited	6.8

[a] An active fault is defined by the State of California as a fault that has had surface displacement within Holocene time (approximately the last 10,000 years). A potentially active fault is defined as a fault that has shown evidence of surface displacement during the Quaternary (last 1.6 million years), unless direct geologic evidence demonstrates inactivity for all of the Holocene or longer. This definition does not, of course, mean that faults lacking evidence of surface displacement are necessarily inactive. Sufficiently active is also used to describe a fault if there is some evidence that Holocene displacement occurred on one or more of its segments or branches (Hart, 1997).

[b] Richter magnitude (M) and year for recent and/or large events. Richter magnitude scale reflects the maximum amplitude of a particular type of seismic wave.

[c] Moment magnitude is related to the physical size of a fault rupture and movement across a fault. Moment magnitude provides a physically meaningful measure of the size of a faulting event (CDMG, 1997). The maximum moment magnitude earthquake (Mw), derived from the joint CDMG/USGS Probabilistic Seismic Hazard Assessment for the State of California, 1996 (CDMG OFR 96-08 and USGS OFR 96-706).

[d] Microseismicity refers to small earthquakes typically not felt by humans, with a moment magnitude <4.

SOURCES: Jennings, 1994; Hart, 1997

TABLE 3.2.2
MODIFIED MERCALLI INTENSITY SCALE

I	Not felt except by a very few under especially favorable circumstances.
II	Felt only by a few persons at rest, especially on upper floors on buildings. Delicately suspended objects may swing.
III	Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration like passing of truck. Duration estimated.
IV	During the day felt indoors by many, outdoors by few. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Felt by nearly everyone, many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.
VI	Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.
VII	Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motor cars.
VIII	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motor cars disturbed.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.
XI	Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.
XII	Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Lines of sight and level are distorted. Objects are thrown upward into the air.

SOURCE: B. A. Bolt, 1988

San Gregorio Fault

The San Gregorio Fault Zone is made up of several shorter faults and extends roughly parallel to the coast of California, about 270 miles from the vicinity of Bolinas Bay south to Monterey Bay. The Palo Colorado fault mapped by Jennings (1994) to extend from the center of Monterey Bay about 24 miles to Big Sur may be a segment of the San Gregorio Fault Zone. The San Gregorio continues south through Big Sur and eventually connects with the Hosgri Fault Zone in the south-central portion of the state.[1] Except for two small segments that pass through land, the San Gregorio Fault Zone remains offshore from San Francisco to Santa Cruz, and is about 18 miles offshore at La Selva Beach.

Calaveras Fault

The Calaveras fault, a major right-lateral, strike-slip fault, extends for about 100 miles from Dublin to Hollister, where it merges with the San Andreas fault. The Calaveras fault is most active on the southern segment. The Richter magnitude 6.2 Morgan Hill earthquake (April 1984) originated on the Calaveras fault. Creep has been documented along the fault in the vicinity of Hollister.[2] The Calaveras fault is designated as an earthquake fault zone under the Alquist-Priolo Act.

Sargent Fault

The Sargent fault branches from the San Andreas fault and extends for about 34 miles from the Lexington Reservoir in the north to just north of Hollister in the south. The Sargent fault is a reverse fault that dips steeply to the west and is seismically active (Wagner, 1990). The fault is considered to be capable of surface rupture and is designated as an Alquist-Priolo earthquake fault zone.

Zayante-Vergeles Fault

The Zayante-Vergeles faults are subparallel and about five miles west of the San Andreas fault. The Zayante fault is considered to be a potentially active, Quaternary fault (Jennings, 1994). The Vergeles fault displaces granitic basement rock against Pleistocene-age Aromas sand, but has not been found to display Holocene movement. Some portions of the Zayante fault may be active and some scientists believe its southern section may be indirectly connected to the San Andreas Fault Zone. The connection between these faults in the subsurface beneath the Pajaro River floodplain is inferred in the absence of specific evidence. Recent investigations on the Vergeles fault have resulted in the CDMG designating portions of the fault as a fault rupture hazard zone (USGS Watsonville East and Watsonville West 7.5-minute Topographic Map). However, other portions of the Vergeles are classified as potentially active and are not designated under the Alquist-Priolo Act.

---

1 The San Gregorio Fault Zone is sometimes referred to as the San Gregorio-Hosgri Fault Zone to include the system of northwest trending faults that parallel the coast from Lopez Point near Lucia to Point Sal near San Luis Obisbo.

2 Tectonic creep is the slow, apparently continuous movement on a fault (Bates and Jackson, 1980).

SOILS

Soils form in a particular location in response to the characteristics of underlying rock formations, slope, drainage, and climate. Soils within the project areas vary from rich agricultural soils in the low-lying, gentle slopes of the southern Santa Clara Valley and Pajaro Valley to thin, eroded soils in the steep slopes of the Santa Cruz Mountains. Some soils contain clay minerals that have expansive properties. These soils expand when wet and shrink when dried.

Soils may also have low pH or high sulfate concentration or other chemical characteristics that can create a corrosive environment to uncoated steel or concrete. Soils within the project area could be moderately to highly corrosive.

The southern Santa Clara Valley is underlain by alluvium, from which good agricultural soils have formed.[3] The southern portion of the valley is currently in agricultural use, supporting a variety of crops and orchards. Soils in the Santa Cruz Mountains are variable. Upland soils are thin and generally do not support agriculture, except for rangeland. Locally flat, alluvial areas within the mountains are cultivated. Soils that have formed within the alluvium of the Pajaro Valley are rich, highly productive agricultural soils that support a variety of vegetable crops as well as berries, flowers, and orchards.

3.2.3 LOCAL SETTING

TOPOGRAPHY AND GEOLOGY

The Pajaro Valley plain is a low-lying topographic area that ranges in elevation from sea level to about 200 feet mean sea level (msl) along the perimeter, at the foot of the Coast Ranges. Flat to gently sloping landforms characterize most of the topography, with some moderate to steep slopes along the edges of wide reentrant valleys cut into old marine terraces (e.g., Harkins Slough and Corralitos Creek) and in the coastal dune areas. Moderate slopes are also present in the Cayetano Range, a dissected low range of hills at the southern edge of the valley.

Geologic Units

The geologic units mapped in the PVWMA service area consist of marine sedimentary bedrock and unconsolidated deposits of alluvial, aeolian, and marine origin. Important differentiations exist among areas underlain by bedrock and areas underlain by various types of sediments. The properties of bedrock and sediments that need to be considered during the planning, design, and construction phases of the project facilities are strength, compressibility, and liquefaction potential (bedrock is not subject to liquefaction). These properties (discussed in the next section) vary for different geologic units and affect their seismic responses and construction uses.

[3] Alluvium is the general term for clay, silt, and gravel or similar unconsolidated detrital material deposited during comparatively recent geologic time by a stream or other body of running water.

Young Sediments

The beach dunes, basin deposits, and floodplain deposits are the youngest geologic units in the PVWMA service area, being less than about 10,000 years old (the Holocene epoch of the Quaternary geologic period). The dune and beach deposits generally are fine to medium sand with local concentrations of pebbles and cobbles in the beach sands, ranging in thickness from 5 to 80 feet. The basin and floodplain deposits consist of clay, silty clay, and fine sand ranging in thickness from less than 5 to more than 100 feet. The dune sands consist of unconsolidated, well-sorted, fine- to medium-grained quartz sand. The predominantly unsaturated dune sands provide small quantities of water where saturated. The high porosity and permeability of the sands allow for rapid recharge of the lower coastal aquifers. Historically, this condition created a groundwater mound that acted as a natural barrier against seawater intrusion.

Older Alluvial Sediments

The majority of the PVWMA service area is underlain by sedimentary deposits of late Tertiary to Pleistocene age, with some deposits of marine or mixed origin near the coast. These deposits include the Quaternary-aged terrace deposits and the older terrace deposits of Watsonville. The terrace deposits consist of unconsolidated basal gravel, sand, silt, and clay. These terrace deposits represent material eroded from the older rocks and redeposited by ancient streams and/or wind, or reworked by ocean wave action and longshore drift. The thicknesses of individual types of deposits vary from less than 10 feet to more than 200 feet. These deposits are collectively referred to as the alluvial formation in the PVWMA Basin Plan and are a water-bearing strata underlain by and in good hydrologic connection with the Aromas Red Sands Formation, discussed below (PVWMA, 2001).

The alluvial deposits are a highly variable mixture of unconsolidated sand, gravel, and clay that are present in the Pajaro River floodplain and in adjacent smaller river valleys. In the floodplain, a 50-foot-thick basal gravel grades upward into a confining blue clay marker bed. The blue clay is discontinuous for four miles west of the Pajaro Gap before becoming an apparently nearly continuous unit that thickens as it extends to the coast. The basal gravel is hydrologically connected with the Aromas Red Sands and is a major source of water for shallow wells within the Pajaro River floodplain.

Aromas Red Sands Formation

The Aromas Red Sands Formation has a thickness that ranges from 100 feet in the foothills to over 800 feet in the center of the basin. The Aromas Red Sands are also of Pleistocene age, but are older than the overlying alluvial formation. The Aromas Red Sands consist of older fluvial and younger aeolian sand deposits with discontinuous lenses of clay, silt, and gravel. The sands are moderately well-sorted and commonly have a red-brown color. The Aromas Formation is considered to be the primary water-bearing unit of the Pajaro Basin.

Throughout the Aromas Red Sands, thick expanses of sand are separated by discontinuous confining layers of clay that separate the formation into the Lower Aromas (primarily fluvial deposits) and the Upper Aromas (primarily eolian deposits). The confining layer consists of

interbedded clay and silty clay in the fluvial part of the Aromas Red Sands. The clay layers tend to be thicker in the west and thin toward the east. Previous investigations suggest the source of the Aromas Red Sands as the granitic rock formations of either the Coast Ranges or the Sierra Nevada.

Purisima Formation

The Purisima Formation underlies the Aromas Red Sands and consists of interbedded sands, silts, clays, and shales of marine origin of Pliocene age (about 2 to 6 million years old). The formation outcrops around the periphery of the basin in the north and the east. Beneath the central Pajaro Valley the Purisima is 1,000 to 2,000 feet thick and grows thinner as it extends to the southeast. East of Corralitos, the Purisima is approximately 4,000 feet thick in the down-dropped block between the Zayante-Vergales fault and the San Andreas fault. The San Andreas fault separates the Purisima from older rocks to the east.

Previous investigations divide the Purisima into three units. The upper unit is a very fine to fine sand with silt and clay interbeds. The middle unit is a fine to medium sand with clay and silt interbeds and some gravel. The lower unit is a sand with clay and shale interbeds. The middle and lower units tend to have a bluish appearance in freshly exposed sediments. Approximately 600 feet below the top of the lower unit is a 150-foot-thick shale marker bed that is continuous throughout the Pajaro Valley.

SOILS

A variety of soil types are present within the project area. These soil associations are Elder-Conejo, Clear Lake, Watsonville-Elkhorn Pinto, Diablo-Cropley, and Baywood-Pfeiffer and are discussed below.

Soils on alluvial plains and fans and in basin-like areas were developed on unconsolidated deposits derived mainly from sedimentary rocks. Their topography ranges from nearly level to strongly sloping. They are very deep and are well to poorly drained. They occur along the Pajaro River, in the valley of Corralitos Creek, and in Harkins and Elkhorn sloughs, at elevations ranging from about +5 feet msl (5 feet above sea level) to about +300 feet msl. Soil Associations 1 and 2 are in this group.

- The Elder-Conejo soils (Association 1) are generally confined to the valley of the Pajaro River east of Watsonville, and to the valley of Corralitos Creek. These soils are well drained, very deep sandy loams, loams, and clay loams, with nearly level to strongly sloping topography. The principal use of these soils is for irrigated crops, but they also are suitable for building site development. About 95 percent of the Association 1 soils meet the criteria for Prime Farmland as outlined in the U.S. Department of Agriculture's Land Inventory and Monitoring Project for the Santa Cruz and Monterey County Soil Surveys (see Section 3.1, Land Use). Another 3 percent meet the criteria for Farmlands of Statewide Importance.

- Soils of the Clear Lake Association (Association 2) occur along the Pajaro River downstream from Watsonville. These soils are poorly drained, consisting of very deep

clays in basin-like areas on nearly level topography. These soils are used mainly for irrigated crops, but also support some minor industrial development. About 95 percent of the Association 2 soils meet the criteria for Prime Farmland. Another 3 percent meet the criteria for Farmlands of Statewide Importance.

Soils on marine terraces, old alluvial fans, and hills generally were developed on marine deposits, old alluvium, or weathered shale. These deep to very deep soils range from nearly level to moderately steep topography, and from well drained to somewhat poorly drained. They occur in an arc from west of Aptos, through Corralitos, south through the lakes, to the Tarpy Road area, and on terraces adjacent to Harkins and Elkhorn sloughs, at elevations ranging from about +20 to about +600 feet msl. Soil Associations 3 and 4 are in this group.

- Soils of the Watsonville-Elkhorn-Pinto Association (Association 3) are well drained to somewhat poorly drained, very deep loams and sandy loams on marine terraces and old alluvial fans, with nearly level to moderately steep topography. These soils occur mainly along the terraces, in the lower foothills of the Santa Cruz Mountains, and on dissected terraces closer to the coast. They are generally used for irrigated crops and have limited potential as Prime Farmland. Another 45 percent meet the criteria for Farmlands of Statewide Importance. An additional 5 percent of the soils are classified as Unique Farmland.

- The Diablo-Cropley soils (Association 4) occur west and south of Watsonville. They are well drained, deep, and very deep clays on alluvial fans or hills, with gently sloping to hilly topography. These soils are used mainly for rangeland, with some minor housing development. About 15 percent of the Association 4 soils meet the criteria for Prime Farmland. Another 65 percent meet the criteria for Farmlands of Statewide Importance.

Soils on sand dunes, hills, and mountains were formed in aeolian deposits or in residuum derived from sandstone, marine deposits, or granitic rock. These deep or very deep soils range from gently sloping to very steep topography and are well drained or somewhat excessively drained. They occur in the hills west of Corralitos Creek and east of Elkhorn Slough, at elevations ranging from about +100 to about +700 feet msl. Soil Association 5 is in this group.

- The Baywood-Pfeiffer soils (Association 5) occur south of Aptos to Sunset Beach State Park, and east to Freedom Boulevard. These soils are well drained to somewhat excessively drained, very deep and deep loamy sands and gravelly sandy loams on sand dunes, with gently sloping to steep topography. The principal uses are for strawberries, watershed, recreation, and rangeland. About 30 percent of the Association 5 soils meet the criteria for Prime Farmland. Another 10 percent meet the criteria for Farmlands of Statewide Importance.

SEISMICITY AND HAZARDS

Active traces of the San Andreas and Vergales faults have been mapped crossing the PVWMA service area. A discussion of these faults is presented in Section 3.2.1, Regional Setting, above. Seismic hazards from local and regional faults are discussed below.

Groundshaking

Earthquakes in the Monterey Bay area could produce strong groundshaking in the Pajaro Valley. Groundshaking intensity is partly related to the size of an earthquake, the distance to the project facility, and the response of the geologic materials that underlie the site. As a rule, the greater the earthquake magnitude and the closer the fault rupture to the site, the greater the intensity of groundshaking. Violent groundshaking is generally expected at and near the epicenter of a large earthquake. Throughout the Pajaro Valley, intensity of groundshaking reached a Modified Mercalli scale VIII in the 1989 Loma Prieta earthquake and likely reached a similar level in a large earthquake affecting the area in October 1865 (McNutt and Toppozada, 1990). Aftershocks also produced damage following the earthquakes. An intensity of VIII, with average peak ground accelerations of 0.25g to 0.30g (peak ground surface acceleration), is expected throughout the northern part of the Pajaro Valley; an intensity of IX or higher, and with average peak ground acceleration at 0.50 to 0.55g, is expected in the southern and coastal parts of the valley (McCrory, et al., 1977). However, geologic materials respond differently to earthquake waves. Deep unconsolidated materials amplify earthquake waves. Even when an earthquake epicenter is distant from a site, it can induce strong groundshaking and wave amplification, with severe hazards to people and property. This probably accounted for the severity of damage in Watsonville in the 1989 earthquake as well as associated ground failures, primarily from liquefaction. Besides general intensity of earthquakes, peak ground acceleration is an important consideration in the response of structures to earthquake movements. Considering all potential earthquake sources in the region, the maximum credible ground acceleration in the entire valley is estimated at 0.5g (gravitational acceleration), which is as high a level of acceleration as may be expected in any part of California (Greensfelder, 1974). Because the depths of overlying soils are variable, ground accelerations at the surface are varied. As noted, deep soils may amplify ground movements in some areas.

Secondary Earthquake Hazards

Liquefaction is a phenomenon whereby unconsolidated and/or near saturated soils lose cohesion and are converted to a fluid state as a result of severe vibratory motion. The relatively rapid loss of soil shear strength during strong earthquake shaking results in the temporary fluid-like behavior of the soil, and occassionally ground failure. Soils that are most susceptible to liquefaction are clean, loose, uniformly graded, saturated, fine-grained sand, usually at depths of less than 50 feet. In general, upland areas have a low liquefaction potential, except where significant alluvium occurs in creek bottoms or swales. Liquefaction was recorded in areas scattered throughout the Pajaro Valley in the 1989 Loma Prieta earthquake (McNutt and Toppozada, 1990). It is expected that areas bordering the entire Pajaro River in the valley are subject to ground failures in large earthquakes (McCrory et al., 1977). Four kinds of ground failure commonly result from liquefaction: lateral spread, flow failure, ground oscillation, and loss of bearing strength (Association of Bay Area Governments, 1996). A *lateral spread* is a horizontal displacement of surficial blocks of sediments resulting from liquefaction in a subsurface layer. Lateral spread occurs on slopes ranging between 0.3 and 3 percent and commonly displaces the surface by several meters to tens of meters. Lateral spreads of only a few feet damaged every major pipeline that broke during the 1906 San Francisco earthquake.

Flow failures occur on slopes greater than 3 degrees and are primarily liquefied soil or blocks of intact material riding on a liquefied subsurface zone. *Ground oscillation* occurs on gentle slopes when liquefaction occurs at depth and no lateral displacement takes place. Soil units that are not liquefied may pull apart from each other and oscillate on the liquefied zone. Ground fissures can accompany ground oscillation and sand boils. The *loss of bearing pressure* can occur beneath a structure when the underlying soil loses strength and liquefies. When this occurs, the structure can settle, tip, or even become buoyant and "float" upwards.

Coastal areas of the Pajaro Valley also are subject to tsunamis (often incorrectly referred to as tidal waves). A tsunami may be generated by nearby earthquakes, or earthquakes occurring hundreds of miles from the affected coastline. A 1946 earthquake in the Alaskan Trench of the north Pacific Ocean produced two 12-foot tsunamis in Monterey Bay. A probable wave run-up for the area between Sunset State Beach and Moss Landing has been estimated between 6.7 feet for the 100-year tsunami and 13.2 feet for the 500-year tusnami (Garcia and Houston, 1975).

Geologic Hazards

Settlement is a function of the compressibility of loose deposits (such as some unconsolidated sands or uncompacted fill) and the weight of overlying fill or structures. For example, the loose and semifluid nature of slough deposits render them subject to compression when loads are placed on them. The load (such as fill or other support structures) will settle, sometimes differentially, during a period of several years before a state of equilibrium is reached. The amount of settlement will vary, depending on the thickness of the deposit, the weight of the load, and rate of loading.

Landslides, earthslips, mudflows, and soil creep are all expressions related to the instabilities created by steep slopes, shallow soil development, the presence of an excessive amount of water, or the lack of shear strength in the soil or at the soil/rock interface. Earthquake activity induces some landsliding in soils, but most slippage results from the weight of rain-saturated soil and/or rock exceeding the shear strength of the underlying material. Erosion of supporting material at the toe of a slope further contributes to instability. Static slope instability is the major cause of landslides throughout coastal California. Although existing soil materials may form the basis of an unstable condition, natural processes and human activities can initiate landslides in otherwise stable areas.

3.2.4 REGULATORY FRAMEWORK

ALQUIST PRIOLO EARTHQUAKE FAULT ZONING ACT

The Alquist-Priolo Earthquake Fault Zoning Act (formerly the Alquist-Priolo Special Studies Zone Act), signed into law December 1972, requires the delineation of zones along active faults in California. The purpose of the Alquist-Priolo Act is to regulate development on or near active fault traces to reduce the hazard of fault rupture and to prohibit the location of most structures for

human occupancy across these traces.[4] Although surface fault rupture is not necessarily restricted to areas within an Alquist-Priolo Fault Hazard Zone, cities and counties must regulate certain development projects within the zones, which includes withholding permits until geologic investigations demonstrate that development sites are not threatened by future surface displacement (Hart, 1997).

SEISMIC HAZARDS MAPPING ACT

The Seismic Hazards Mapping Act was developed to protect the public from the effects of strong groundshaking, liquefaction, landslides, or other ground failure, and from other hazards caused by earthquakes. This act requires the State Geologist to delineate various seismic hazard zones and requires cities, counties, and other local permitting agencies to regulate certain development projects within these zones. Before a development permit is granted for a site within a seismic hazard zone, a geotechnical investigation of the site must be conducted and appropriate mitigation measures incorporated into the project design. The CDMG has completed seismic hazard mapping for portions of California most susceptible to liquefaction, groundshaking and landslide, such as the Los Angeles Basin and the portions of the San Francisco Bay Area. The CDMG has not completed mapping for the Watsonville West and Watsonville East 7.5-minute quadrangles, which include the project location.

CALIFORNIA BUILDING CODE

The California Building Code is another name for the body of regulations known as the California Code of Regulations (CCR), Title 24, Part 2, which is a portion of the California Building Standards Code (CBSC, 1995). The CBSC applies to new construction. CCR Title 24 is assigned to the California Building Standards Commission, which, by law, is responsible for coordinating all building standards. Under state law, all building standards must be centralized in CCR Title 24 or they are not enforceable (Bolt, 1988). Published by the International Conference of Building Officials, the Uniform Building Code (UBC) is a widely adopted model building code in the United States. The CBSC incorporates by reference the UBC with necessary California amendments. About one-third of the text within the California Building Code has been tailored for California earthquake conditions (ICBO, 1997).

COUNTY AND LOCAL REGULATIONS, GOALS, AND POLICIES

San Benito County General Plan

The San Benito Seismic Safety/Safety Element (1980) of the General Plan contains the following policies that provide guidelines for the construction of the project components:

> **Policy 2:** Except for utility lines and transportation links, critical facilities and occupancies should not be located in High Hazard Areas.

[4] A "structure for human occupancy" is defined by the Alquist-Priolo Act as any structure used or intended for supporting or sheltering any use or occupancy that has an occupancy rate of more than 2,000 person-hours per year.

Policy 6: It will be the County's goal to explore means of providing additional geotechnical information to both the public and the County staff in an effort to properly assess seismic hazards. In addition, the County desires to maintain and improve the geotechnical database and will take positive steps to do so.

Santa Clara County General Plan

The Health and Safety section of the Santa Clara General Plan (1995-2010) contains the following policies and implementation measures that pertain to the proposed project components:

C-HS 18: Local government, business, and community organizations should cooperate in preparing the most effective emergency response plans and procedures feasible.

Santa Cruz County General Plan

The Public Safety and Noise section of the General Plan and Local Coastal Program for the County of Santa Cruz (1994) includes numerous policies relating to the construction of residential, commercial, and critical structures within geologic hazard zones. The following policies pertain to the placement of public facilities within Santa Cruz County:

Policy 6.1.3: Engineering Geology Report for Public Facilities in Fault Zones. Require a full engineering geology report by a certified engineering geologist whenever a significant potential hazard is identified by a Geologic Hazards Assessment or Preliminary Geologic Report, and prior to the approval of any new public facility or critical structures within the designated fault zone.

Policy 6.1.8: Design Standards for New Public Facilities. Require all new public facilities and critical structures to be designed to withstand the expected groundshaking (specified in design standards) during an earthquake on the San Andreas fault.

Policy 6.3.5: Installation of Erosion Control Measures. Require the installation of erosion control measures consistent with the Erosion Control Ordinance, by October 15, or the advent of significant rain, or project completion, whichever occurs first. Prior to October 15, require adequate erosion control to be provided to prevent erosion from early storms. For development activities require protection of exposed soil from erosion between October 15 and April 15 and require vegetation and stabilization of disturbed areas prior to completion of the project. For agricultural activities, require that adequate measures be taken to prevent excessive sediment from leaving the property.

North Monterey County Area Plan (1994)

Policy 15.1.1 (NC) of the North County Area Plan (County of Monterey, 1994) states that the North County Seismic Hazard Map shall be used to delineate high seismic hazard areas addressed by policies in the General Plan. According to the Seismic Hazard Map, the portion of the project that extends through Monterey County is designated as an area of moderately high to high seismic hazards.

County of Monterey General Plan (1995)

Natural Resources Element

Objective 3.1: Establish procedures for the prevention of soil erosion and the repairing of erosion damage in critical areas on both public and private lands.

Policy 3.1.1: Erosion control procedures shall be established and enforced for all private and public construction and grading projects.

Policy 3.2.3: Lands having a high erosion potential as identified in the Soil Survey shall require adequate erosion control methods for agricultural uses.

Goal 15: To minimize loss of life, injury, damages to property, and economic and social dislocations resulting from seismic and other geologic hazards.

Objective 15.1: Reduce the risks resulting from earthquakes to an acceptable level by regulating the type, density, location, and/or design and construction of development in seismic hazard areas.

Policies 15.1.1: The following areas described in the General Plan should be defined as high hazard areas:

- Zones 1/8 mile each side of active or potentially active faults (Figure 3, page 30)[5];
- Areas of tsunami hazard (Figure 3, page 30);
- Areas on the Potential Seismic and Geologic Hazards Map (Figure 5, page 33) designated as "high hazard"; and
- Areas designated as Zones IV, V, and VI on the geotechnical evaluation maps of the County's 1975 Seismic Safety Element (page 17).

Policy 15.1.2: Faults classified as "potentially active" shall be treated the same as "active faults" until geotechnical information demonstrating that a fault is not "active" is accepted by the County.

Policy 15.1.3: The lands within 1/8 mile of active or potentially active faults shall be treated as a fault zone until accepted geotechnical investigations indicate otherwise.

Policy 15.1.8: The County should require a soils report on all building permits and grading permits within areas of known slope instability or where significant potential hazard has been identified.

Policy 15.1.11: For high hazard areas, the County should condition development permits based on the recommendations of a detailed geological investigation and soils report.

Policy 15.1.12: The County shall require grading permits to have an approved site plan which minimizes grading and conforms to the recommendations of a detailed soils or geology investigation where required.

Policy 15.1.13: The County shall require septic leachfields and drainage plans to direct runoff and drainage away from unstable slopes.

---

5 Figure and page number references are to the Monterey County General Plan.

Policy 15.1.14: The County shall require wave action and erosion information to be submitted by a qualified oceanographer before an application is considered in areas identified as having a tsunami hazard; approval of development shall be conditioned on the recommendations of the oceanographic information.

REFERENCES – Geology, Soils and Seismicity

Association of Bay Area Governments (ABAG), *Manual of Standards for Erosion and Sediment Control Measures*, May 1995.

Association of Bay Area Governments (ABAG), *Excerpts from CDMG DRAFT Study Guidelines* http://www.abag.ca.gov/Bayarea/eqmaps/liquefac/lqguide.html, 1996.

Bates, R.L. and J.A. Jackson, *Glossary of Geology*, 2nd Edition, 1980.

Bolt, B. 1988. Earthquakes. W.H. Freeman Company: New York, New York.

California Division of Mines and Geology (CDMG), *How Earthquakes Are Measured*, CDMG Note 32, 1997.

California Building Standards Commission (CBSC), *California Building Code, Title 24, Part 2,* 1995.

County of Monterey, *North County Area Plan*, updated 1994.

County of San Benito, *Seismic Safety/Safety Elements General Plan Revision*, 1980.

County of San Benito, *Open Space and Conservation Element Update of the San Benito County General Plan*, 1995.

County of Santa Clara, *General Plan*, updated 1995.

County of Santa Cruz, *General Plan and Local Coastal Program*, updated 1994.

Garcia, A.W., and J.R. Houston. 1975. Type 16 Flood Insurance Study: Tsunami Predictions for Monterey and San Francisco Bays and Puget Sound. Hydraulics Laboratory, U.S. Army Engineer Waterways Experiment Station, Technical Report H-75-17, November 1975.

Greensfelder, R.W. 1974. Maximum Credible Rock Accelerations from Earthquakes in Califdonia. Dalifonia Divison of Mines and Geology.

Hart, E. W., *Fault-Rupture Hazard Zones in California: Alquist-Priolo Special Studies Zones Act of 1972 with Index to Special Studies Zones Maps*, California Division of Mines and Geology, Special Publication 42, 1990, revised and updated 1997.

Important Farmland Mapping Program. 1994. *Important Farmland Maps for San Benito, Santa Clara, Santa Cruz and Monterey Counties.*

International Conference of Building Officials (ICBO), *Uniform Building Code, ICBO, Whittier, California*, 1997.

Jennings, C.W. 1994. Fault Activity Map of California and Adjacent Areas with Locations and Ages of Recent Volcanic Eruptions. CDMG Geologic Data Map No.6.

Lawson, A.C. 1908. The California Earthquake of April 18, 1906, Report of the State Earthquake Investigation Commission.

McCrory, P.A., Greene, H.G., and K.R. Lajoie, *Map showing earthquake Intensity Zonation and Distribution of Quaternary Deposits, San Mateo, Santa Curz, and Monterey Counties, California*, U.S. Geological Survey Miscellaneous Field Studies, Map MF-903, scale 1:250,000, 1977.

McNutt, S.R. and T.R., Toppozada. 1990. Seismological Aspects of the 17 October 1989 Earthquake of 17 October 1989. California Division of Mines and Geology, Special Publication 104.

Nilsen, T. H., Wright, R.H. 1979. Relative Slope Stability And Land-Use Planning in the San Francisco Bay Region, California. U.S. Geological Survey Professional Paper 944.

Pajaro Valley Water Management Agency, *Final Program EIR for the Pajaro Valley Water Basin Management Plan*, 1993.

Pajaro Valley Water Management Agency (PVWMA), *Technical Memorandum 2.3 for Water Supply Project: Project Definition Report*, pp. 11-13, February 6, 1997, prepared by Montgomery Watson.

Pajaro Valley Water Management Agency (PVWMA), *Final Technical Memorandum No. 1.1A-Import Pipeline Alignment -Preliminary Engineering*, 22 September.

Pajaro Valley Water Management Agency (PVWMA), *Final EIR for the PVWMA Local Water Supply and Distribution Project*, 1999.

Pajaro Valley Water Management Agency (PVWMA), *Draft Revised Basin Management Plan*, 2001.

Steinbrugge, K.V., Bennett, J.H., Lagorio, H.J., Davis, J.F., Borchardt, G, and Toppozada, T.R. 1987. Earthquake Planning Scenario for a Magnitude 7.5 Earthquake on the Hayward Fault in the San Francisco Bay Area. Special Publication 78.

U.S. Department of Agriculture, Soil Conservation Service, *Soil Survey of San Benito County California*, 1969.

U.S. Department of Agriculture, Soil Conservation Service, *Soil Survey of Eastern Santa Clara Area, California*, 1974.

U.S. Department of Agriculture, Soil Conservation Service, *Soil Survey of Monterey County*, 1978.

U.S. Department of Agriculture, Soil Conservation Service, *Soil Survey of Santa Cruz County, California*, 1980.

U.S. Geological Survey (USGS) Working Group on California Earthquake Probabilities, Earthquake Probabilities in the San Francisco Bay Region: 2000-2030 – A Summary of Findings, Open-File Report 99-517, 1999.

Wagner, D.L. 1990. Loma Prieta Earthquake in California Geology, California Division of Mines and Geology. November.

3.3 HYDROLOGY AND WATER QUALITY

This section describes the existing hydrologic and water quality resources conditions in the Pajaro Valley. The section draws information from the draft Basin Management Plan 2000 (BMP) and the State of the Basin report (PVWMA, 2001).

3.3.1 REGIONAL SETTING

SURFACE WATER

Precipitation

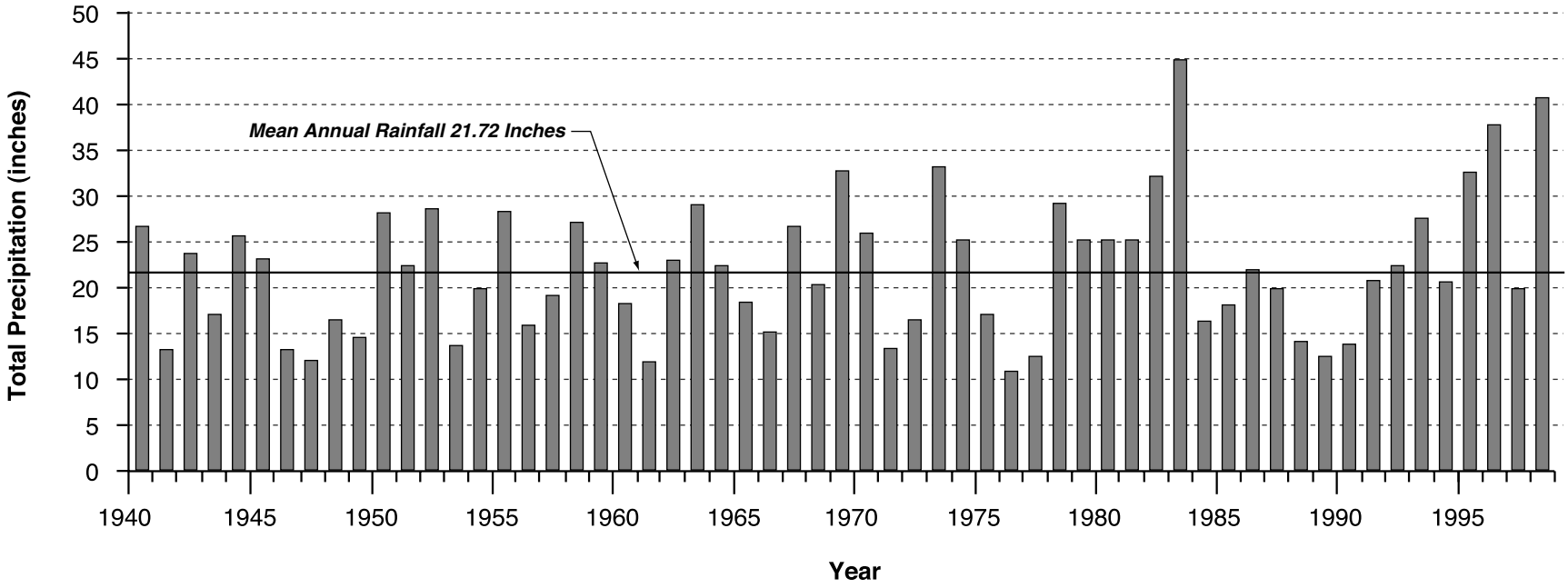
The climate in the Pajaro Valley is mild, with dry summers and wet winters. Temperatures rarely drop below freezing. Nearly 90 percent of the precipitation falls between November and April. Coastal fog is common in the summer and fall months. The mean annual precipitation varies within the project area due to the influence of the coastal mountains, which receive the majority of the rainfall. Precipitation in the region is generally greater at higher elevations, and decreases from north to south. The mean annual precipitation in Watsonville is approximately 22 inches, but varies substantially from year to year, with the minimum recorded precipitation occurring in 1977 (9.7 inches, or 45 percent of normal) and the maximum in 1998 (46.7 inches, or 215 percent of normal). **Figure 3.3-1** shows annual rainfall patterns during the 57-year hydrologic sequence.

Hydrology

The Pajaro Valley is part of the Central Coastal Basins area that extends from Santa Cruz to Santa Barbara. Mountainous terrain and rolling hills generally characterize the Central Coastal Basins.

The boundaries of the Pajaro Valley divide drainage between the Pajaro River and Elkhorn Slough (defined by the Los Carneros Hills) to the south, and the Santa Cruz Mountains to the east and north. The western boundary of the basin is Monterey Bay (the Pacific Ocean). The Pajaro River is the largest stream in the Pajaro Valley, draining approximately 1,190 square miles above the gauge at Chittenden. Streams tributary to the Pajaro River include the Corralitos, Salsipuedes, Brown's Valley, Green Valley, Casserly, and Pescadero creeks, which drain the southern slopes of the Santa Cruz Mountains in the area. Tributaries to the Pajaro River that are outside of the Pajaro Valley include the Uvas and Llagas creeks (draining the eastern slope of the Santa Cruz Mountains), and Pacheco Creek, and the San Benito River in San Benito County.

The U.S. Geological Survey (USGS) has recorded daily streamflows for the mainstem Pajaro River at Chittenden since October 1939. Median daily streamflows for the Pajaro River are greater than 40 cubic feet per second (cfs) from about February 1 through the first week in April (1956-1991). Median daily flows have historically declined to less than 20 cfs after early May



SOURCE: R.M.C., Inc.

Figure 3.3-1

Hydrologic Variability in the Pajaro River Basin
Based on Annual Rainfall at
Watsonville Station, for 1940-1999

and less than 10 cfs after mid-June. Flows then begin to increase in early November, becoming greater than 20 cfs after mid-January.

Streamflows in the Pajaro River show a much greater variability than does rainfall, ranging from nearly zero to over 500 percent of normal. Streamflow averaged 124,640 acre-feet per year (afy) for the period of record, with a minimum of 766 afy in 1977 and a maximum of over 653,900 afy in 1983. The last 20 years included some of the wettest and some of the driest years on record. In addition, data analysis indicates that multiple dry years are a regular occurrence over the period of record.

Other surface water resources in the Pajaro Valley include Carneros Creek and Elkhorn Slough in the southern portion of the valley, and the Watsonville, Harkins, Struve, and McCluskey sloughs in the west. Several lakes are north of the City of Watsonville: Kelly and Tynan lakes are private, year-round reservoirs used for recreation; Pinto Lake also provides for recreational uses; Drew Lake is a seasonal lake that only is filled after periods of rainfall; and College Lake exists during winter and spring months, while the lakebed is farmed during dry periods of the year.

Water Quality

Surface water quality data are limited. The USGS has monitored water quality in Pajaro River at Chittenden since the 1950s. Total salt loads have varied between 200 and 3,100 milligrams per liter (mg/L). Increased salt loads have been attributed to natural, agricultural, and urban sources. Boron levels have been measured at 0.2 to 2.6 mg/L, and average sulfate and nitrate concentrations have increased over time. Both nitrate and boron levels typically increase as river flow increases, suggesting a surface runoff source. At low river flows, total dissolved solids (TDS) are high, and at these times concentrations of heavy metals, including mercury, lead, chromium, and cadmium, have been measured in excess of municipal drinking water standards.

Water quality data for other streams in the valley are limited and vary according to land use in the surrounding watershed. For example, in areas where agricultural uses are adjacent to a stream, runoff into the stream likely contains sediments and contaminate nutrients (from fertilizers, pesticides, and livestock). In areas characterized by urban development (residential, commercial, and industrial uses, roadways, parking lots, and landscape areas), runoff likely contains elevated levels of oil, grease, nutrients, sediments, and heavy metals.

Phytophthora

Phytophthora root rot is caused by several related species of soilborne fungi belonging to the genus *Phytophthora*. To date, *P. megasperma, P. cryptogea, P. citriocola, P. cactorum*, and additional, unidentified *Phytophthora* species have been implicated in this disease. *Phytophthora* diseases can affect many vegetable crops, including pepper, berries, tomato, melon, squash, pumpkin, eggplant, cucumber, and carrot. The soilborne fungus is favored by high humidity and temperature, standing water, and soil compaction and can survive in infested debris, soil, and seed. Disease management involves crop rotation, clean seed and transplants,

proper seedbed preparation, cultivation practices, irrigation procedures, fungicides, and other production guidelines that reduce plant stress. Removal of *Phytophthora* from surface water can be achieved by percolation of water through soil. The consistent removal of *Phytophthora* with filtration facilities is unproven.

Agricultural Runoff Quality

Chemical constituents found in agricultural runoff vary during a storm event, from event to event at a given site, and from site to site within a given area. Variances in constituent levels can be the result of differences in rainfall intensity and occurrence, geographic features, and the land use of a site. Runoff from disturbed lands can contribute sediments, pesticides, fertilizers, and other pollutants to receiving waters. Other sources of nonpoint-source pollutants to receiving waters within the Pajaro Valley include City of Watsonville urban runoff and sediment from the Granite Rock quarry.

GROUNDWATER

Groundwater Hydrology

Nearly 100 percent of water supplies for agricultural and municipal use within the Pajaro Valley come from groundwater sources. The boundaries of the Pajaro Valley groundwater basin are approximately (but not entirely) the same as the Pajaro Valley described above. The service area boundary of the PVWMA does not coincide precisely with either the groundwater basin boundaries or the surface drainage boundaries of the Pajaro River, but it corresponds approximately to both. The entire Pajaro Valley basin is quite complex and composed of many hydrogeologic units, but is geologically interconnected and functions as a single basin. The groundwater aquifers are primarily composed of continental and marine deposits and are the principal aquifers found throughout Santa Cruz and northern Monterey counties. Three major water-bearing strata exist in the basin:

- Alluvium formation, consisting of terrace deposits, alluvium deposits, and dune sands;
- Aromas Red Sands Formation; and
- Purisima Formation.

The Aromas Red Sands and Purisima water-bearing formations are overlain by layers of blue clay which act as a confining layer, inhibiting the free vertical movement of the groundwater. The groundwater basin can store great quantities of water, but it is also hydraulically connected to the ocean, with no physical barriers to the landward migration of seawater. The following discussion summarizes the three major water-bearing formations.

- *Alluvium Formation*. The alluvium formation consists of terrace deposits, alluvial deposits, and dune sands that average approximately 50 to 300 feet in thickness. Terrace deposits consist of unconsolidated basal gravel, sand, silt, and clay. The alluvium deposits consist of unconsolidated sand, gravel, and clay deposited from the Pajaro River floodplain and adjacent river valleys. A 50-foot-thick basal gravel bed deposit is located in the

floodplain and in the blue clay layer. The blue clay is discontinuous for approximately four miles west of the Pajaro Gap, before becoming a continuous unit that thickens as it extends to the coast (see **Figure 3.3-2**). The basal gravel and sands appear to have a good hydrologic connection (water movement between formations) with the underlying Aromas Red Sands, and are a major source of water for the shallow wells in the Pajaro River floodplain.

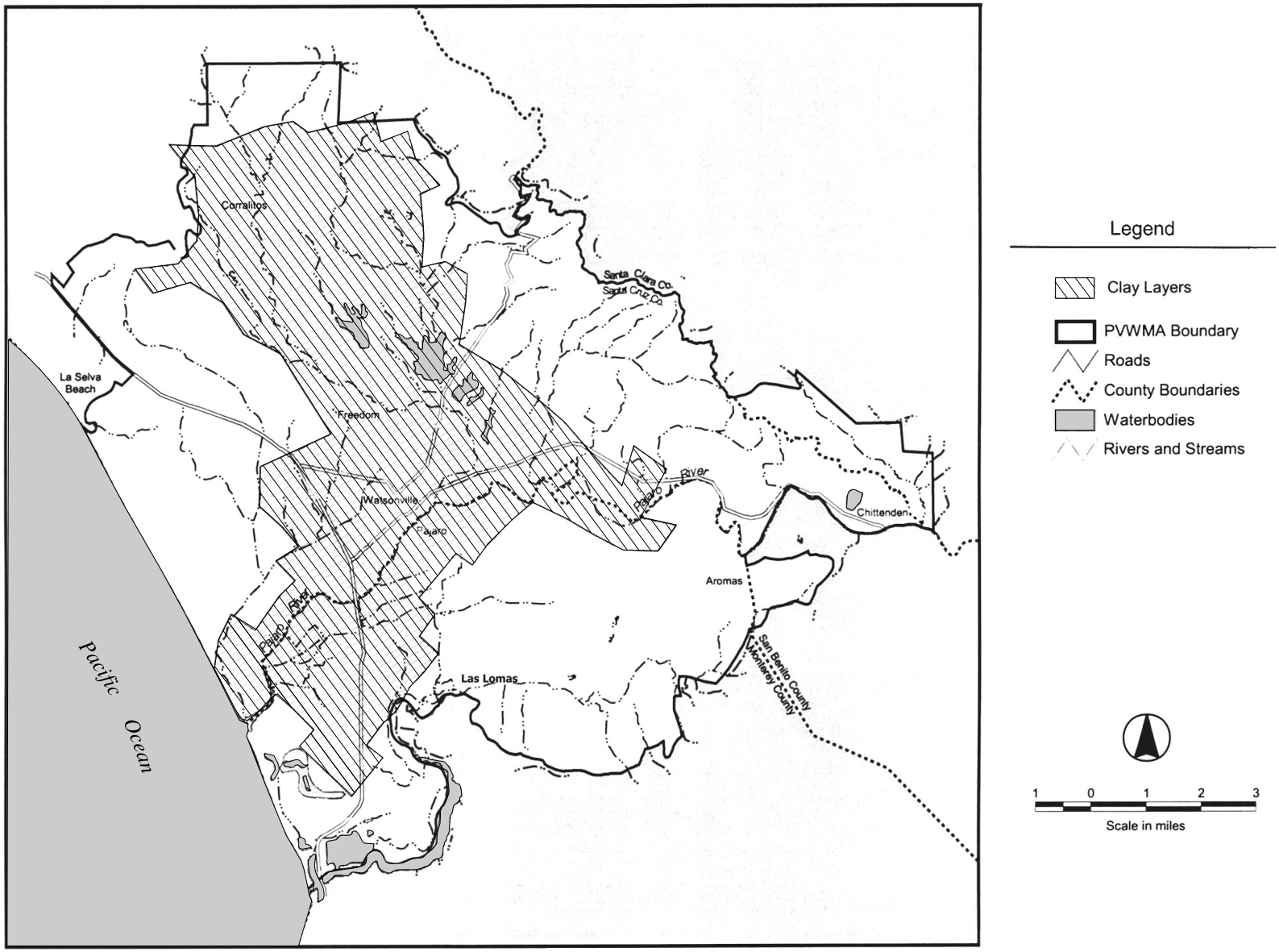
- *Aromas Red Sands Formation*. Underlying the alluvium formation are the older Aromas sands, which are thought to have originated from the granitic rock formations of either the Coastal Range or the Sierra Nevada. The Aromas Red Sands Formation is considered to be the primary water-bearing unit of the basin. It ranges in thickness from 100 to 800 feet and consists of fluvial and aeolian sand deposits with discontinuous layers of clay, silt, and gravel. The upper portion of the Aromas Red Sands Formation is approximately 100 to 200 feet below sea level, and the lower portion extends to approximately 900 feet below sea level. The confining clay can be found primarily in the fluvial part of the Aromas sands. The clay layers tend to be thicker in the west and thinner towards the east.

- *Purisima Formation*. The Purisima Formation underlies the Aromas Red Sands and consists primarily of three units of marine origin. The upper unit is a very fine to fine sand with silt and clay interbeds. The middle unit is a fine to medium sand, with clay and silt interbeds and gravel. The lower unit is a sand with clay and shale interbeds. Approximately 600 feet below the top of the lower unit is a 150-foot-thick shale bed that is continuous throughout the valley. The formation can be seen on the surface at the northern and eastern boundaries of the basin. Beneath the central Pajaro Valley, the formation is 1,000 to 2,000 feet thick, and it thins to the southeast. East of Corralitos, the formation is 4,000 feet thick in the down-dropped block between the Zayante-Vergales fault and the San Andreas fault.

Groundwater Recharge

Aquifer recharge within the basin occurs through natural mechanisms, including infiltration of streamflow through bed and channel deposits, direct percolation of rainfall, and irrigation return flows. There are no major upstream reservoirs on the Pajaro River to regulate winter flows, and thus the system depends on natural runoff processes. The rate of recharge varies greatly from year to year, based on both the seasonal distribution of rainfall and the total annual precipitation. Generally, mild storms of extended duration or relatively frequent storms provide the greatest opportunity for groundwater recharge.

The capability of an overlying formation to provide a pathway for recharge depends on numerous factors. For example, recharge from direct percolation depends on the characteristics of the overlying soil, and on the presence of near-surface confining and semiconfining clay layers that can impede the downward flow of water. A clay layer near the Pajaro River and the lower portion of Corralitos Creek impedes recharge of the alluvium aquifer in that area, as do the semiconfining or confining clay layers in the upper terrace deposits to the west of Watsonville. An area with high recharge potential includes the coastal dunes (located north and south of the Pajaro River), where sands exist and there is no confining clay layer. The Corralitos Creek streambed down to north of the Watsonville Airport also has high recharge potential due to alluvial deposits and the absence of a clay layer.



SOURCE: State of the Basin Report, 2000

Figure 3.3-2

Clay Layers in the Pajaro Groundwater Basin

Most recharge occurs during the wet winter months and is highly variable, while most of the demand occurs during the summer and is relatively constant. This seasonal offset of supply and demand means that groundwater storage is depleted in the summer, potentially lowering the groundwater table to below sea level, thereby creating the circumstances for the inland migration of the freshwater/seawater interface. In addition, there has historically been more water withdrawn from the basin on an annual basis than is replaced, which has resulted in an overdraft condition.

Groundwater Levels and Flow

A groundwater basin is much like a surface water reservoir: when water is removed from storage, the water level drops until the supply can be replenished by inflow or recharged by rainfall or streamflow. Much like a stream, groundwater generally flows downhill from areas of high elevation (or pressure) to areas of low elevation; when water is extracted from the basin, the system attempts to restore its equilibrium by drawing new water into the groundwater reservoir.

Before extensive pumping began in the Pajaro Valley, the regional water table sloped from inland areas toward the coast. Since the 1940s, hydrogeologic studies have shown a regional decline in the water table during the summer months, with a recovery during the winter recharge months. Many wells in the valley show relatively stable water levels, recovering to near sea level. However, the Pajaro Valley is hydraulically connected to the ocean, thus providing a constant source of both pressure and direct recharge. Therefore, if the groundwater table drops to elevations below sea level, seawater will be drawn in until equilibrium is restored. Pumping in the entire basin has an effect on seawater intrusion, but the adverse effects associated with seawater intrusion are most noticeable in the coastal portion of the basin.

In the coastal and central portion of the Pajaro Valley, groundwater elevations are regularly below sea level during the summer season, and some wells are chronically below sea level throughout the year. Water-level data collected from Pajaro Valley wells indicate that the direction of groundwater flow is from the ocean to inland areas. The drought conditions from 1987 to 1992 lowered the water table further, thereby resulting in an increased rate and volume of seawater intrusion. The general pattern of water levels across the basin has remained stable over the past few years.

Groundwater Quality

Seawater Intrusion

The greatest and most immediate threat to groundwater supplies in the Pajaro Valley is from seawater intrusion in the coastal areas. Other groundwater quality issues to be addressed include nitrate contamination and elevated boron concentrations.

The nature and extent of seawater intrusion in coastal areas of the Pajaro Valley region have been extensively evaluated since the problem was first detected in the late 1940s. These investigations indicate that the majority of seawater intrusion in the region is occurring in two

aquifers associated with alluvium formation gravels in the interval between 100 and 200 feet below sea level and within the Aromas sands in the 300- to 600-foot interval (see **Figure 2.2**).

Groundwater quality within the Pajaro Valley is influenced by several factors, including hydrology, geochemistry, well construction, groundwater pumping patterns, and land use. In general, groundwater in the Pajaro Valley is of high quality and suitable for agricultural and municipal use, with some degradation resulting from agricultural activities, landfills, and septic tanks, as well as seawater intrusion caused by groundwater overdraft.

The interpretation of water quality data from existing production wells is complicated by the fact that the production wells were constructed to maximize water production, not to monitor conditions in specific aquifers. Many wells are constructed and screened through multiple aquifers. Thus, water quality measurements reflect a composite of many aquifers, complicating data interpretation. In addition, many wells that were historically used to evaluate water levels and quality have been abandoned due to seawater intrusion, resulting in the loss of the well as a monitoring location and a lack of continuity in the data.

Chloride concentrations in groundwater are commonly used to monitor seawater intrusion, because chloride in seawater is chemically stable and moves at the same rate as the intruding water. The average chloride concentration in seawater is about 19,000 mg/L; chloride levels exceeding approximately 100 mg/L in coastal wells indicate that seawater is present in the aquifer. High-quality drinking water generally contains chloride concentrations below 50 mg/L, and irrigation water quality guidelines suggest chloride concentrations should not exceed 142 mg/L. Water with over 250 mg/L of chloride is generally unsuitable for use. Potential routes for inland seawater intrusion include:

- Horizontal inland migration through the layered aquifers;
- Leakage between geologic layers through natural gaps in the confining layers or through wells that are improperly sealed between formations or are improperly abandoned;
- Vertical leakage downward from the Pajaro River estuary or Elkhorn Slough; and
- Upward migration from lower aquifers where seawater has been trapped for many years.

Previous investigators have documented the presence of seawater intrusion in both the shallow alluvial aquifer and the lower Aromas sands aquifer and described the complexity of analyzing the distribution of seawater throughout discrete layers of the different aquifer units. Recent (1998) data generally indicate that inland saline conditions are more extensive than previously reported. In the La Selva Beach area, the size of the existing intruded area is larger than in 1979, extending approximately 0.75 miles inland and 2 miles in width. The intrusion zone north of the Pajaro River extends inland approximately 1.5 miles and is 3 miles wide. A number of deeper wells show recent substantial increases in chloride concentrations, indicating that the volume of fresh water displaced in the intruded aquifer is increasing. Chloride levels are generally highest in the deeper Aromas sand aquifer, with chloride values ranging from 200 to 8,500 mg/L;

shallow wells generally contain lower chloride levels (50 to 500 mg/L), with a number of neighboring wells showing marked differences in chloride levels. **Table 3.3.1** presents summary statistics for chloride concentrations in all wells for pre-drought (1979-1986), drought (1987-1992), and post-drought (1993-1998) periods. As can be seen from the data, average values are similar for drought and post-drought periods. **Figure 3.3-3** shows current chloride concentrations in the PVWMA service area.

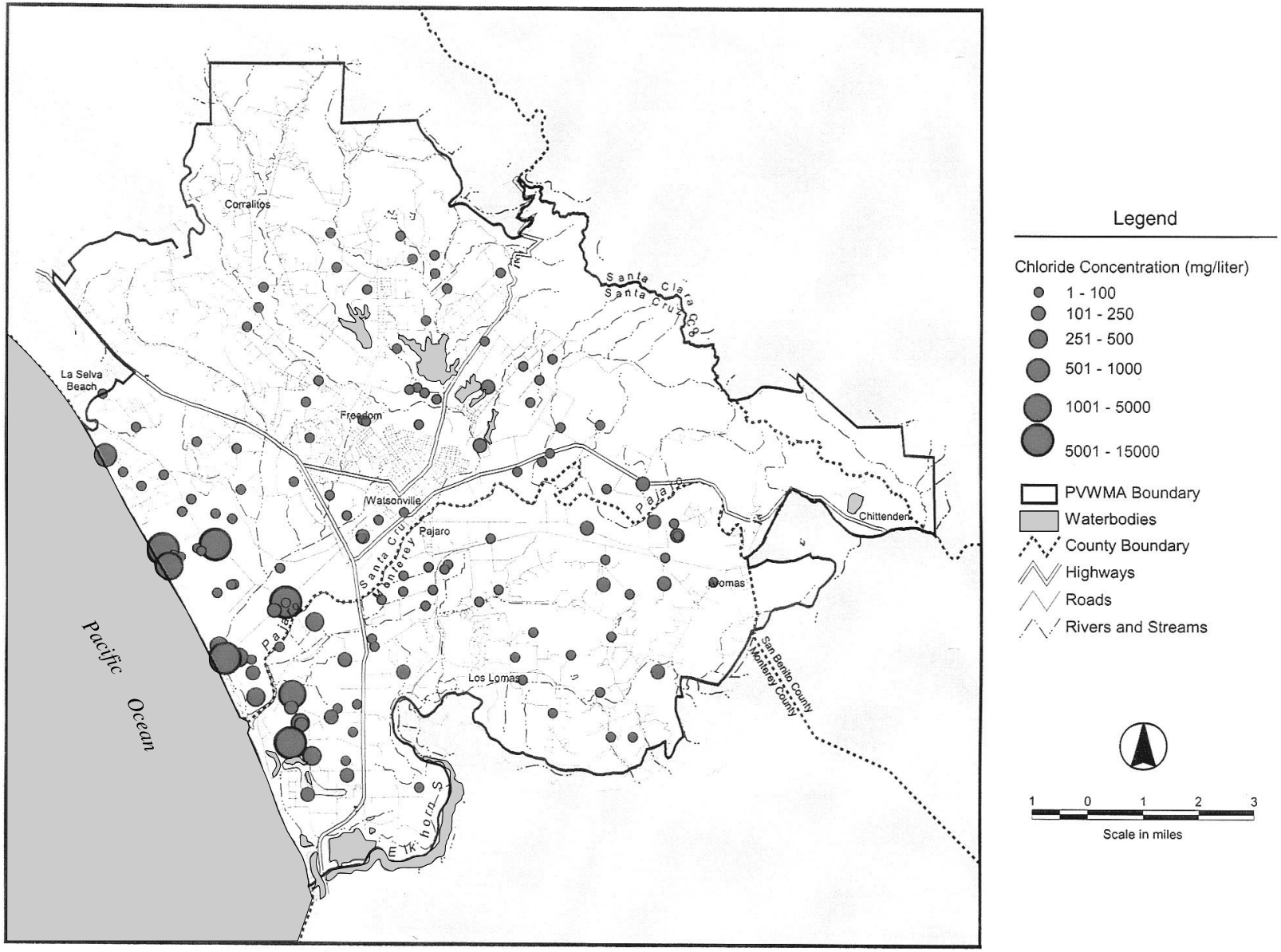
TABLE 3.3.1
AVERAGE SUMMARY STATISTICS FOR CHLORIDE IN ALL WELLS

Period	Well Count	Chloride Concentration, mg/L		
		Average Minimum	Average	Average Maximum
Pre-drought (1979-1986)	166	60	70	80
Drought (1987-1992)	186	330	420	500
Post-drought (1993-1998)	198	370	450	550

SOURCE: PVWMA Basin Management Plan 2000

Nitrates

Nitrates are common groundwater contaminants in many agricultural areas. Nitrate sources include agriculture, septic tanks, urban runoff, and percolation from surface sources. Nitrates can also occur in groundwater through the conversion of naturally occurring or introduced organic nitrogen or ammonia. Nitrate contamination is a major concern in drinking water sources because it is a threat to human and animal health, as it can cause acute illness and can have adverse long-term health impacts resulting from prolonged exposure (RMC, 2001). The primary drinking and food-canning water quality standard for nitrate is 45 mg/L NO_3-N. Nitrates are converted to nitrites in the intestines and inhibit the body's ability to absorb oxygen. Ingestion of nitrates in high concentrations causes methemoglobinemia in infants (the "blue baby" syndrome). Nitrate is generally expressed as NO_3 (nitrate) or NO_3-N (nitrate-nitrogen). The U.S. Environmental Protection Agency (EPA) has set a Maximum Contaminant Level (MCL) of 10 mg/L NO_3-N, or the equivalent 45 mg/L NO_3 (EPA website).



SOURCE: State of the Basin Report, 2000

Figure 3.3-3
Chloride Concentrations in the PVWMA Service Area

Most fertilizers contain high concentrations of nitrogen, so basin soils in agricultural areas such as the Pajaro Valley can contain nitrate. Nitrates are highly soluble and can leach into groundwater or can travel with surface waters from agricultural runoff. Transport of nitrates in groundwater is generally limited by aquitards that separate the aquifer levels.

Elevated nitrate concentrations are commonly found in shallow wells. The large majority of deep wells in the Pajaro Valley (those screened at least 125 feet below the water table), including city wells, contain nitrate concentrations that do not exceed the drinking water standard. **Table 3.3.2** presents summary data of nitrate concentrations during pre-drought, drought, and post-drought periods. Average values from the post-drought period are over 10 mg/L higher than those during drought and pre-drought periods. **Figure 3.3-4** shows current nitrate concentrations in the PVWMA service area.

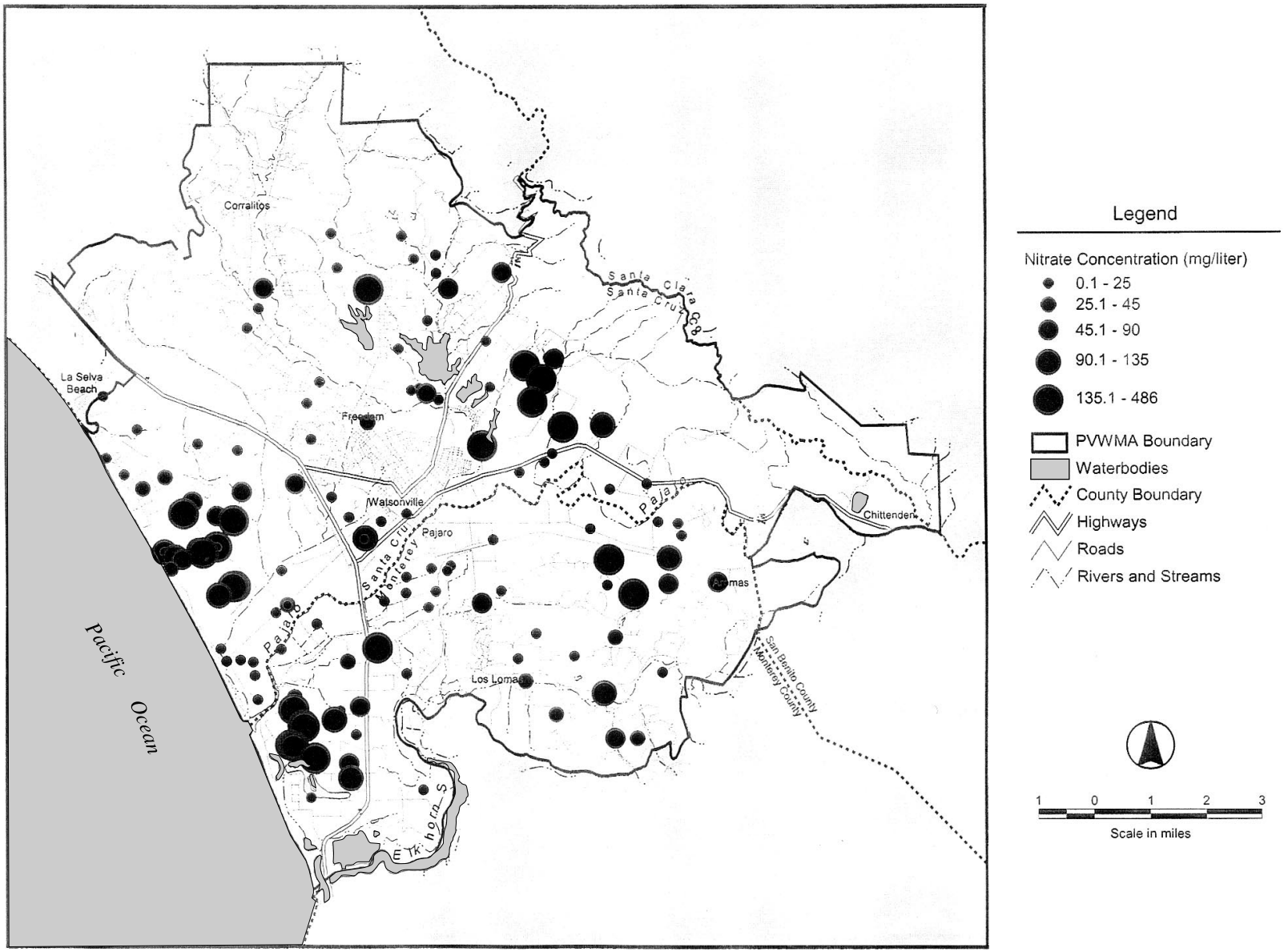
TABLE 3.3.2
AVERAGE SUMMARY STATISTICS FOR NITRATE IN ALL WELLS

Period	Well Count	Nitrate Concentration (mg/L NO_3)		
		Average Minimum	Average	Average Maximum
Pre-drought (1979-1986)	134	14	23	34
Drought (1987-1992)	183	15	25	37
Post-drought (1993-1998)	196	26	36	47

SOURCE: PVWMA Basin Management Plan 2000

Boron

Boron can be toxic to crops if present in sufficiently elevated concentrations. Recommended irrigation water quality guidelines for boron are below 0.5 mg/L, while concentrations greater than 2.0 mg/L are considered to pose severe restrictions. **Table 3.3.3** presents summary data for boron; these data indicate that there is no readily apparent increasing or decreasing trends over time, and average values are well within the range considered suitable for irrigation. Values are generally higher in the eastern portion of the basin, resulting from local recharge of Pajaro River water into the shallow aquifer. Average maximum values have historically exceeded irrigation water quality guidelines; however, the average maximum values during the post-drought period have decreased to within the lower range of acceptable concentrations.



SOURCE: State of the Basin Report, 2000

Figure 3.3-4
Nitrate Concentrations in the PVWMA Service Area

TABLE 3.3.3
AVERAGE SUMMARY STATISTICS FOR BORON IN ALL WELLS

Period	Well Count	Boron Concentration (mg/L)		
		Average Minimum	Average	Average Maximum
Pre-drought (1979-1986)	59	0.1	0.2	0.7
Drought (1987-1992)	52	0.1	0.3	0.9
Post-drought (1993-1998)	24	0.1	0.2	0.4

SOURCE: PVWMA Basin Management Plan 2000

Groundwater Budget

A groundwater budget helps to explain how the basin operates as an integrated unit on a continuous basis during the period of record. The groundwater basin is an interrelated combination of many pieces that function as a whole, and the water budget describes how these many factors interact.

Preparation of a groundwater budget through analysis of available data allows for the preparation of a numerical model to account for and describe how components of the hydrologic system interact over time and space. Models account for all system inputs and outputs, and use mathematical equations that track how water moves through the system over time and throughout the basin. The Pajaro Valley groundwater basin is a dynamic system, and its water budget (or water balance) is best understood by using and applying the groundwater model. There is a degree of inherent uncertainty in any model, but modeling is the only way to represent the entire physical system, and to examine probable future conditions or analyze a range of potential management alternatives.

Modeling results indicate that more freshwater has been removed from storage than has been put back into storage in the groundwater basin during the past 25 years. Even in years when more freshwater was put back into the system than was taken out (during wet periods), seawater still intruded into the basin, because the aquifers are connected to the ocean and the recharge for pumping at the coast comes from the nearest available source, which is the ocean. Over the past 25 years, over 150,000 acre-feet (af) of mixed fresh and seawater are estimated to have migrated inland across the coast, resulting in seawater replacing freshwater in the aquifer. Unless corrective steps are taken, this situation is expected to worsen in the future.

Water Use and Overdraft Estimate

The total current demand (groundwater pumping) in the Pajaro Valley groundwater basin is estimated at approximately 69,000 acre-feet per year (afy), consisting of 59,300 afy of agricultural pumping and 12,200 afy of urban pumping, minus the Corralitos Creek Diversion (by the City of Watsonville) and other surface water diversions of 2,100 afy.

While a 45,000 afy reduction in groundwater pumping would be needed to eliminate the annual overdraft in the basin, 48,000 afy would be needed to maintain the basin sustainable yield. Thus, the resulting net change or current overdraft in basin groundwater storage is about 21,000 afy (PVWMA, 2001). The basin sustainable yield is defined as the long-term amount of groundwater pumping from the aquifer system that can be maintained without causing an adverse impact on the quantity and/or quality of water in the groundwater basin. In an integrated groundwater and surface water system, the sustainable yield of the basin is the amount of withdrawal from the system that can be maintained without causing adverse impact on the groundwater and/or surface water system. The interaction between the groundwater basin and Monterey Bay is quite complex, and flow from the groundwater basin (outflow) varies along the coast, as does flow from the bay into the groundwater basin (intrusion). Seawater intrusion can only be stopped by reducing pumping and/or increasing recharge to the extent that it will result in an increase in groundwater elevations.

3.3.2 REGULATORY SETTING

WATER QUALITY REGULATION

Regulatory authorities exist on both the state and federal levels for the control of water quality in California. The EPA is the federal agency, governed by the Clean Water Act, responsible for water quality management. A regional office (EPA Region IX) is located in San Francisco and delegates authority for waste discharge permitting to the State Water Resources Control Board (SWRCB).

The SWRCB, located in Sacramento, is the agency with jurisdiction over water quality issues in the State of California. The SWRCB is governed by the Porter-Cologne Water Quality Act (Division 7 of the California Water Code), which establishes the legal framework for water quality control activities by the SWRCB. Much of the implementation of the SWRCB's responsibilities is delegated to nine regional boards.

REGIONAL WATER QUALITY CONTROL BOARD

The primary responsibility for the protection and enhancement of water quality in California has been assigned by the California legislature to the SWRCB, and the nine regional water quality control boards (RWQCBs). The SWRCB provides state-level coordination of the water quality control program by establishing statewide policies and plans for the implementation of state and federal laws and regulations. The regional water boards adopt and implement water quality

control plans (basin plans) that recognize the unique characteristics of each region with regard to natural water quality, actual and potential beneficial uses, and water quality problems.

RWQCB Regulations, Goals, and Policies

The project area lies within the jurisdiction of the Central Coast RWQCB (Region 3), which is responsible for the protection of beneficial uses of water resources within the Central Coast region. The RWQCB uses planning, permitting, and enforcement authorities to meet this responsibility and has adopted the Water Quality Control Plan for the Central Coast region (Basin Plan) to implement plans, policies, and provisions for water quality management. Beneficial uses of surface waters are described in the Basin Plan and are designated for major surface waters and their tributaries. Treated water from the Watsonville Wastewater Treatment Facility (WWTF) is discharged through an outfall into Monterey Bay. The beneficial uses of coastal waters in the vicinity of the discharge include:

- Water Contact Recreation (REC-1)
- Noncontact Water Recreation (REC-2)
- Industrial Service Supply (IND)
- Navigation (NAV)
- Marine Habitat (MAR)
- Shellfish Harvesting (SHELL)
- Commercial and Sport Fishing (COMM)
- Rare, Threatened, or Endangered Species (RARE)
- Wildlife Habitat (WILD)

For this project, the RWQCB is responsible for construction activities and for permitting the discharge and reuse of treated water to ensure the protection of beneficial uses. Each of these permit responsibilities is described below.

NPDES Permit for Discharge

The City of Watsonville, together with the Freedom County Sanitation District, the Pajaro County Sanitation District, and the Salsipuedes Sanitary District, is allowed to discharge water treated to secondary levels to the Pacific Ocean under the terms and conditions of a National Pollutant Discharge Elimination System (NPDES) permit (No. CA0048216) issued by the RWQCB. The permit conditions include discharge prohibitions, treated water limitations, receiving water limitations, pretreatment specifications, infiltration/inflow and spill prevention program requirements, and other provisions intended to protect the beneficial uses of the receiving water body. Monitoring and reporting requirements are also detailed for influent, effluent, receiving waters, pretreatment, and biosolids.

Ocean Plan

Water quality and discharges are also subject to regulation by the *Water Quality Control Plan, Ocean Waters of California* ("Ocean Plan") prepared by the SWRCB. The Ocean Plan regulates point-source discharges to the ocean, with the goal of protecting beneficial uses. The RWQCB

takes the provisions of the Ocean Plan (as well as the Basin Plan) into account when establishing permit conditions for the WWTF.

Construction Activity Permitting

The RWQCB also administers the NPDES stormwater-permitting program in the Central Coast region. Construction activities on five acres or more are subject to the permitting requirements of the NPDES General Permit for Discharges of Storm Water Runoff Associated with Construction Activity (General Construction Permit). The General Construction Permit requires the preparation and implementation of a Storm Water Pollution Prevention Plan (SWPPP). The plan would include specifications for best management practices (BMPs) that would be implemented during project construction to control degradation of surface water through measures to prevent the potential erosion of sediments or discharge of pollutants from the construction area. Additionally, the plan would describe measures to prevent or control runoff after construction is complete and identify a plan to inspect and maintain these facilities or project elements.

Title 22 Recycled Water Regulation

The major federal legislation governing the water quality aspects of the proposed project is the Clean Water Act, as amended by the Water Quality Act of 1987. The State of California's Porter-Cologne Water Quality Control Act (Division 7 of the California Water Code) provides the basis for water quality regulation within California. The SWRCB administers water rights, water pollution control, and water quality functions throughout the state, while the RWQCB conducts planning, permitting, and enforcement activities. The Porter-Cologne Water Quality Control Act designates the SWRCB responsible for formulating and adopting state policy for water reclamation, while the California Department of Health Services (DHS) is responsible for establishing uniform statewide reclamation criteria to ensure that the use of recycled water would not be detrimental to public health.

There are no federal standards governing wastewater reclamation and reuse in the United States, although the EPA has sponsored the preparation of *Guidelines for Water Reuse*. Many states, including California, have developed wastewater reclamation regulations. In all cases, the regulations have been established with the objective of protecting public health and allowing for the safe use of recycled wastewater. The DHS established water quality criteria, treatment process requirements, and treatment reliability criteria for reclamation operations, which are set forth in Title 22, Division 4, Chapter 3, of the California Code of Regulations (CCR) Water Recycling Criteria. The RWQCB has responsibility for reviewing proposed recycled water projects and for issuing water recycling requirements through the waste discharge permit process. DHS has the responsibility for reviewing proposed water recycling projects and for providing comments and/or recommendations to the RWQCB.

The existing Water Recycling Criteria address treatment requirements for three main types of recycled water uses: landscape irrigation, recreational impoundments, and industrial uses. The treatment requirements are based on the expected degree of human contact with recycled

wastewater under each type of use. Treatment requirements are expressed as treatment process requirements (e.g., bio-oxidation, coagulation) as well as performance standards (e.g., disinfection standards and contaminant reduction).

The existing Title 22 standards are among the most stringent standards for public health protection and can be more stringent than comparable standards established by the World Health Organization. Since the adoption of Title 22 in 1978, the use of recycled water for nonpotable uses has expanded throughout the state and is projected to continue to grow over the next several decades. Title 22 Water Recycling Criteria are shown in **Table 3.3.4**. Under Title 22, the proposed use of recycled water for agricultural irrigation would fall under the guidelines for "landscape irrigation with high public contact." To be used as a supply source for this designation, the recycled water must be at all times adequately oxidized, coagulated, clarified, filtered, and disinfected wastewater; this process requirement constitutes the most stringent treatment practicable. To be considered adequately disinfected, the median number of coliform organisms in the wastewater may not exceed a Most Probable Number (MPN) of 2.2 per 100 milliliters (mL) over a seven-day period.

The DHS has also produced *Guidelines for Use of Reclaimed Water*, which apply to recycled water use areas receiving water that meets Title 22 Water Recycling Criteria. The guidelines focus on application and management specifications for various recycled water uses, including general use requirements, landscape irrigation requirements, impoundment requirements, and agricultural reuse area guidelines.[1] General requirements include:

- Posting signs to inform the public in areas where recycled water is in use;
- Confining recycled water to authorized use areas;
- Use of purple recycled water distribution and transmission system piping to indicate that it contains recycled water; and
- Other requirements designed to ensure that recycled water use does not adversely affect public health.

Specific requirements established by Title 22 that are applicable to the proposed project are contained in Article 4, Section 60310 – Use Area Requirements. This section restricts irrigation of disinfected tertiary recycled water within 50 feet of any domestic water supply well, unless specific technical analyses are conducted.

[1] State of California, Department of Health Services, Environmental Management Branch, *Guidelines for Use of Reclaimed Water*, June 10, 1988.

TABLE 3.3.4
SUMMARY OF TITLE 22
TREATMENT REQUIREMENTS FOR RECYCLED WATER

Potential Uses	Title 22 Criteria
Landscape Irrigation	
With High Public Contact	Bio-oxidation, coagulation, clarification, filtration, disinfection to limit coliforms to 2.2 MPN/100 mL.
With Low Public Contact	Bio-oxidation, disinfection to limit coliforms to 23 MPN/100 mL.
Recreational Impoundments	
Nonrestricted	Bio-oxidation, coagulation, clarification, filtration, disinfection to limit coliforms to 2.2 MPN/100 mL.
Restricted	Bio-oxidation, disinfection to limit coliforms to 2.2 MPN/100 mL.
Landscape Impoundments	Bio-oxidation, disinfection to limit coliforms to 23 MPN/100 mL.
Industrial Uses	
Construction/Dust Control/Soil Compaction	Bio-oxidation, disinfection to limit coliforms to 23 MPN/100 mL.
Groundwater Recharge/Seawater Intrusion Barrier	This use shall be considered by DHS and RWQCB on an individual case basis where the use of recycled water involves a potential risk to public health; guidelines for this use have been proposed.
Cleaning, Dual Water System (Toilet Flushing and Landscape Irrigation), Firefighting, Wetlands Creation/Restoration	No criteria are listed for any of these uses in existing Title 22. Currently, each of these uses is considered as criteria set by the RWQCB and DHS on an individual case basis. Uses anticipated to be addressed in future revisions to Title 22, which have been circulated for public comment.

MPN = Most Probable Number

SOURCE: Title 22, Division 4, California Code of Regulations, 1978, amended 1998.

TOTAL MAXIMUM DAILY LOAD (TMDL)

Section 303d of the Clean Water Act

California has identified waters that are polluted and need further attention to support their beneficial uses. These water bodies are listed under the Clean Water Act Section 303(d) list, which requires States to identify these polluted waters. Specifically, Section 303d requires that each state identify water bodies or segments of water bodies that are "impaired" i.e. not meeting one or more of the water quality standards established by the state. Approximately 500

waterbodies or segments have been listed in California. Once the water body or segment is listed, the state is required to establish "Total Maximum Daily Load" or TMDL for the pollutant causing the conditions of impairment. The TMDL is the quantity of a pollutant that can be safely assimilated by a water body without violating water quality standards. The EPA estimates that within the next 15 years 40,000 TMDLs must be developed. At this time, the EPA has finalized only about 8 TMDLs and 4 have been approved. Listing of a water body as impaired does not necessarily suggest that the pollutants are at levels considered hazardous to humans or aquatic life or that the water body segment can not support the beneficial uses. The intent of the 303d list is to identify the water body as requiring future development of a TMDL to maintain water quality and reduce the potential for continued water quality degradation.

In accordance with Section 303d of the Water Code, the Central Coast Regional Water Quality Control Board has identified impaired water bodies in its jurisdiction, the pollutant or stressor impairing water quality, and prioritized the urgency for developing a TMDL. Within the proposed project area, Monterey Bay South, Watsonville Slough, and the Pajaro River have been designated as impaired water bodies. **Table 3.3.5** lists pollutants causing an impairment to water quality within these water bodies and associated TMDL priorities.

PVWMA REGULATIONS

The PVWMA operates under the authority of the Pajaro Valley Water Management Agency Act of 1984. The act has several objectives that are relevant to surface water and groundwater management and the proposed project. These are described below.

Section 102. Water resource management activities carried out under this act in the public interest shall recognize the following objectives:

(d) Conservation and economically efficient management of water resources are necessary to meet the needs of agriculture, industry, and urban communities. Economic efficiency requires that water users pay their full proportionate share of the costs of developing and delivering water. Property taxes shall not be used for payment of these costs. Agricultural uses shall have priority over other uses under this act within the constraints of state law.

(e) Water conservation programs appropriately include the ability of a water management agency to recognize existing beneficial uses, and to acquire, buy, and transfer water and water rights in the furtherance of its purpose.

(f) The purpose of this agency is to efficiently and economically manage existing and supplemental water supplies in order to prevent further increase in, and to accomplish continuing reduction of, long-term overdraft and to provide and insure sufficient water supplies for present and anticipated needs within the boundaries of the agency.

(g) It is anticipated that long-term overdraft problems may not be solved unless supplemental water supplies are provided. The water management agency should, in an efficient and economically feasible manner, utilize supplemental water and available underground storage and should manage the groundwater supplies to meet the future needs of the basin.

TABLE 3.3.5
IMPAIRED WATER BODIES

Type[a]	Name	Hydrologic Unit[b]	Pollutant / Stressor	Source	Priority	Size Affected
C	Monterey Bay South	309.500	Metals	Surface Mining	Low	10 miles
			Pesticides	Agriculture		
E	Watsonville Slough	305.100	Metals	Agriculture Urban runoff/storm sewers	Medium	300 acres
			Oil and Grease	Urban runoff/storm sewers Nonpoint source	Medium	
			Pathogens	Urban runoff/storm sewers Source unknown Nonpoint source	Medium	
R	Pajaro River	305.000	Nutrients	Agriculture Irrigated crop production Agriculture-storm runoff Agriculture-subsurface drainage Agriculture-irrigation tailwater Agricultural return flows Urban runoff/storm sewers Wastewater-land disposal Channelization Removal of riparian vegetation Nonpoint source	High	49 miles
			Sedimentation and Siltation	Agriculture Irrigation crop production Range land Upland grazing Agriculture-storm runoff Hydromodification Channelization Dredging Habitat modification Removal of riparian vegetation Streambank modification/ destabilization Channel erosion Natural sources Erosion/siltation Nonpoint source	Medium	

[a] Water Body Type
C = Coastal Shorelines
E = Estuaries
R = Rivers/Streams

[b] Hydrologic Unit is the State Water Resources Control Board hydrologic subunit area.

SOURCE: Central Coast Regional Water Quality Control Board

Section 704. Right to restore, recapture, distribute, and sell supplemental water. The agency or other persons pursuant to an agreement with the agency shall have the sole right to store, recapture, distribute, and sell supplemental water in the groundwater basin, subject to subdivisions (d), (f), and (g) of Section 102.

Section 711. Improvement and protection of water quality; Right to control extractions. The agency, in order to improve and protect the quality of water supplies may treat, inject, extract, or otherwise control water, including, but not limited to, control of extractions, and construction of wells and drainage facilities. These powers shall include the right to regulate, limit, or suspend extractions from extraction facilities, the construction of new extraction facilities, the enlarging of existing facilities, or the reactivation of abandoned extraction facilities.

Section 714. Power to replenish and augment water supply. The agency shall have the power to take all affirmative steps necessary to replenish and augment the water supply within its territory. In the event the agency imposes restrictions on the operation of extraction facilities, the agency shall purchase, or capture, and distribute supplemental water at the earliest date possible, subject to subdivisions (d), (f), and (g) of Section 102.

REFERENCES – Hydrology and Water Quality

California Regional Water Quality Control Board, *Water Quality Control Plan for the Central Coast Region*, 1999.

County of Monterey, *North County Area Plan*, 1994.

County of Santa Cruz, *General Plan and Local Coastal Program*, 1994.

Jennings, C.W., *Fault Activity Map of California and Adjacent Areas with Locations and Ages of Recent Volcanic Eruptions*, CDMG Geologic Data Map No.6, 1994.

Pajaro Valley Water Management Agency, *Draft Revised Basin Management Plan*, 2001.

Pajaro Valley Water Management Agency, *Final Program EIR for the Pajaro Valley Water Basin Management Plan*, 1993.

Pajaro Valley Water Management Agency, *Pajaro Valley Water Management Agency State of the Basin Report*, prepared by Jones & Stokes, May 2000.

Raines, Melton and Carella, Inc. (RMC), *Revised Basin Management Plan Report*, 9 July 2001.

U.S. Department of Agriculture, Soil Conservation Service, *Soil Survey of Monterey County*, 1978.

U.S. Department of Agriculture, Soil Conservation Service, *Soil Survey of Santa Cruz County*, California, 1980.

3.4 VEGETATION, FISH, AND WILDLIFE

This section describes the biological resources within and surrounding the proposed project components of both the BMP 2000 and Local-Only alternatives, and the potential project-related impacts upon those resources. Discussion and analysis of impacts are based on available environmental impact reports, studies of regional biological resources, recent biological surveys, field reconnaissance, and discussions with responsible and trustee agencies. A wildlife habitat assessment was done by combining field observations and mapping from aerial photographs.

3.4.1 METHODS

APPROACH TO DESCRIBING STUDY AREA AND HABITATS

For the assessment of biological resources, the "project area" is defined as 500 feet surrounding any proposed facilities (see Project Description). A larger area (the "study area"; see below) was investigated where potential impacts could extend beyond this corridor or where special-status resources may be present near the project area.

"Special-status resources" are defined as animal species, plant species, or natural communities that have some rarity, endangerment, or protection status conferred by a state, federal, or statewide conservation organization (see Regulatory Framework section, below).

Wildlife habitats are the primary focus of the resource descriptions and impact assessments. The description of biological resources presented herein is based on the California Department of Fish and Game's (CDFG) Wildlife Habitat Relationships (WHR) System (Mayer and Laudenslayer, 1988). This classification system uses a set of 48 terrestrial and aquatic habitats in California and models the distribution, life history, and habitat needs for individual wildlife species. This EIR also relies on the California Natural Diversity Database (CNDDB) (2001) and *Preliminary Descriptions of the Terrestrial Natural Communities of California* (Holland, 1986), which maintains a more detailed inventory of terrestrial natural communities based on the dominant plant species present. This system describes 250 different natural communities and is used as a basis for inventorying rare as well as common habitat types in California. A cross-reference table (**Table 3.4.1**) was created to link the WHR System to the CNDDB for resources found in the study area.

The EIR process has involved several opportunities to solicit approach and impact information from the relevant resource agencies. An interagency coordination meeting was held February 12, 1997 to solicit agency concerns. More specific informal consultation was held with U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and CDFG to discuss particular issues regarding special-status species and fisheries.

TABLE 3.4.1
COMPARISON OF TERMINOLOGY FOR
VEGETATION TYPES IN WILDLIFE HABITAT RELATIONSHIPS AND
NATURAL COMMUNITIES OCCURRING IN THE STUDY AREA

California Department of Fish and Game Wildlife Habitat Relationships (Mayer and Laudenslayer, 1988)	**California Natural Diversity Database Natural Communities** (Holland, 1986)
Valley foothill riparian	Central coast riparian forest
Coastal oak woodland	Coast live oak woodland
Coastal scrub	Central coastal scrub
Annual grassland	Non-native grassland
Fresh emergent wetland	Coastal and valley freshwater marsh Coastal brackish marsh
Vernal pool	Hardpan/claypan vernal pool (undetermined)
Cropland, orchard, and vineyard	n/a
Urban/developed	n/a

SOURCE: Environmental Science Associates, 2001

LITERATURE REVIEW

Sources used in the preparation of this assessment include information gained from previous field surveys and records from the biological literature (e.g., Munz and Keck, 1970; Hickman, 1993; Holland, 1986; Skinner and Pavlik, 1994; Jennings and Hayes, 1994), federal and state-listed species for each county (CDFG, 1997), and the CDFG CNDDB (2001). CNDDB reports occurrences of special-status species using U.S. Geological Survey (USGS) 7.5-minute topographic quadrangles. The area potentially affected by this project is located on parts of five USGS 7.5-minute quadrangles: Watsonville West, Watsonville East, Moss Landing, Chittenden, and San Felipe. U.S. Department of Agriculture, Natural Resources Conservation Service (formerly Soil Conservation Service) soil surveys were reviewed for potential wetland areas (SCS, 1976, 1978). The CNDDB was consulted for a five-mile envelope surrounding these five quadrangles, an area of approximately 500 square miles referred to as the study area.

Based on the review of these information sources, a list was compiled of the special-status resources known to occur in the study area. During the habitat assessment, habitats that potentially contain special-status species were surveyed using field techniques appropriate for the particular species. Further habitat-specific surveys were conducted to clarify presence or absence of species of particular interest, including a site assessment for the California red-legged frog (*Rana aurora draytonii*).

VEGETATION, WILDLIFE, AND FISHERIES SURVEYS

Wildlife Habitat Assessment

The Habitat Restoration Group (HRG) and ESA conducted a habitat assessment of the entire study area from March 23 through May 5, 1997 to identify habitat types. Several subsequent site assessments were performed by ESA, including in September 1997, March 1999 (ESA, 1997a; ESA, 1999a), and June and July 2001. Global positioning system (GPS) receivers were used to locate approximate habitat type center points, which were recorded using Universal Transverse Mercator (UTM) coordinates. For each mapped unit, four types of information were recorded: (1) presence of special-status species, either as breeding residents or regular winter visitors; (2) presence of suitable habitat for these species; (3) occurrence of other unique or important biological resources; and (4) WHR habitat types present, as well as notes on predominant plant species present. The information was recorded on standardized data sheets, and ESA photographed specific areas and collected plant samples as needed to supplement the data sheet information.

Vegetation Surveys

Table 3.4.2 lists the species, habitat, distribution, and flowering period of special-status plant species known to occur in the study area.

All of the proposed facility locations were visited. Areas of natural habitat (classified as nonurban and nonagricultural) in the study area were covered on foot during the survey period, and all plant species present were recorded. Any plants belonging to a genus containing a special-status plant known from the region was identified to species. Appendix A lists the plant species observed within the study area.

Natural communities were mapped as part of the habitat assessment. These habitats were recorded as WHR habitat units (see preceding section). In addition, any natural communities listed by CNDDB as "sensitive" were considered a special-status natural community. The location, extent, and condition of these resources were specifically noted and mapped.

Wetlands

Areas within the study area that might meet the criteria for "wetlands" or "waters of the United States" were mapped as part of the habitat assessment. (See the Regulatory Framework, below, for definitions of these terms.) A preliminary wetland delineation was prepared in 1999 and submitted to the U.S. Army Corps of Engineers for verification (ESA, 1999b). However, this wetland delineation did not cover all aspects of the currently proposed project components.

Wildlife Surveys

Table 3.4.3 lists the species, habitats, and distribution of special-status wildlife known to occur or to potentially occur in the study area.

TABLE 3.4.2
SPECIAL-STATUS PLANT SPECIES KNOWN FROM THE REGION OF THE PAJARO VALLEY WATER MANAGEMENT AGENCY LOCAL WATER SUPPLY DISTRIBUTION FACILITIES PROJECT

***Scientific* and Common Name**[a]	**Listing Status USFWS/ CDFG/CNPS**[b]	**Habitat**	**County Distribution**[c]	**Flowering Period**	**Suitable Habitat Present in Study Area**
Arctostaphylos andersonii Santa Cruz manzanita	SC/--/1B	Openings, edges, hardwood and conifer forests, chaparral	SCL, SCR, SMT	Nov-Apr	No
Arctostaphylos hookeri ssp. *hookeri* Hooker's manzanita	--/--/1B	Sandy soils, coastal scrub, chaparral, closed-cone conifer forests	MNT, SCR	Feb-Apr	No
Arctostaphylos pajaroensis Pajaro manzanita	SC/--/1B	Sandy soils in chaparral	MNT, SCR*	Dec-Mar	No
Atriplex joaquiniana San Joaquin saltbush	FSC/--/1B	Chenopod scrub, alkali meadow, valley and foothill grassland	SBC	Apr-Oct	Unlikely
Chorizanthe pungens var. *pungens* Monterey spineflower	FT/--/1B	Coastal dunes and coastal scrub	MNT, SCR	Apr-Jun	Unlikely
Chorizanthe robusta var. *robusta* Robust spineflower	FE/--/1B	Coastal dunes, coastal scrub, openings in hardwood forest	ALA*, MNT, SCL*, SCR, SMT*	May-Sep	Unlikely
Erisimum ammophilum Coast wallflower	FSC/--/1B	Sandy openings in maritime chaparral, coast dunes, coastal scrub	SCR, MNT	Feb-June	No
Gilia tenuiflora ssp. *arenaria* Sand gilia	FE/CT/1B	Coastal dunes, coastal scrub, in sand	MNT	Apr-May	No
Hemizonia parryi ssp. *congdonii* Congdon's tarplant	C1/--/1B	Alkaline places in valley foothill grasslands	ALA*, CCA*, MNT, SCL(*?), SCR*, SLO, SOL*	Jun-Nov	Unlikely; suitable habitat eliminated
Holocarpha macradenia Santa Cruz tarplant	FT/CE/1B	Coastal prairie, valley and foothill grassland, in clay soils with coastal influence	ALA*, CCA, MNT, MRN*, SCR	Jun-Oct	Large population exists at Watsonville Airport
Horkelia cuneata ssp *sericea* Kellog's horkelia	--/--/1B	Coastal scrub and closed cone pine forests	SCR, MNT	April-Sept	Unlikely; suitable habitat largely eliminated
Penstemon rattanii var *kleei* Santa Cruz Mountains beardtongue	--/--/1B	Chaparral and lower montane conifer forest, sometimes in transition zone, sandy shale slopes	SCR, SCL	April-Sept	No

TABLE 3.4.2 (Continued)
SPECIAL-STATUS PLANT SPECIES KNOWN FROM THE REGION OF THE PAJARO VALLEY WATER MANAGEMENT AGENCY LOCAL WATER SUPPLY DISTRIBUTION FACILITIES PROJECT

***Scientific* and Common Name**[a]	**Listing Status USFWS/ CDFG/CNPS**[b]	**Habitat**	**County Distribution**[c]	**Flowering Period**	**Suitable Habitat Present in Study Area**
Piperia yadonii Yadon's piperia (= Yadon's rein orchid)	FE/--/1B	Endemic to Monterey County; on sandstone and sandy soil in coastal bluff scrub, chaparral, and closed-cone conifer forest	MNT	May-Aug	No
Plagiobothrys glaber Hairless popcorn flower	--/--/1A	Meadows, seeps, marshes, swamps	SBC	Mar-May	No. Presumed extinct in California.
Streptanthus albidus ssp *peramoenus* Most beautiful jewel-flower	FSC/--/1B	Chaparral, valley and foothill grassland, cismontane woodland; serpentine outcrops	SCL	Apr-Jun	Unlikely; suitable habitat largely eliminated

NOTES:

[a] Abbreviations are as follows: ssp. = subspecies; var. = variety.

[b] Listing status codes are as follows:

USFWS=U.S. Fish and Wildlife Service
FE=Listed as Endangered by the Federal Government
FT=Listed as Threatened by the Federal Government
FPE=Proposed for Listing as Endangered
FC=Candidate for Federal listing
FSS=Former Category 2 Candidate for Federal listing
FSC=Federal Species of Concern

CDFG=California Department of Fish and Game
CE=Listed as Endangered by the State of California
CT=Listed as Threatened by the State of California
SC=California species of concern

CNPS=California Native Plant Society
List 1A=Plants presumed extinct in California
List 1B=Plants rare, threatened, or endangered in California and elsewhere
List 2= Plants rare, threatened, or endangered in California but more common elsewhere
List 3= Plants about which more information is needed
List 4= Plants of limited distribution

[c] County Distribution: County codes follow California Department of Transportation three-letter abbreviations, as follows: ALA = Alameda; CCA = Contra Costa; MNT = Monterey; MRN = Marin; SCL = Santa Clara; SCR = Santa Cruz; SLO = San Luis Obispo; SMT = San Mateo; SOL = Solano; SBC = San Benito.

Asterisk after county code indicates species is presumed extirpated in that county.

SOURCE: Environmental Science Associates, 1997, 2001

TABLE 3.4.3
NAME, STATUS, HABITAT, KNOWN LOCALITIES AND LIKELIHOOD OF OCCURRENCE IN THE STUDY AREA FOR SPECIAL-STATUS WILDLIFE SPECIES

Scientific Name	Common Name	USFWS/ CDFG Status[a]	Habitat	Localities Reported by CNDDB in the Region of the Project[b]	Likelihood of Occurrence in Study Area
			FEDERAL OR STATE THREATENED OR ENDANGERED SPECIES		
Cicindela ohlone	Ohlone tiger beetle	FE/--	Coastal terraces supporting remnant patches of native grassland habitat in Santa Cruz County.	No reported occurrences in study area.	Low due to lack of suitable habitat in study area
Ambystoma macrodactylum croceum	Santa Cruz long-toed salamander	FE/SE	Wet meadows near sea level in a few restricted locales in Santa Cruz and Monterey counties. Aquatic larvae prefer shallow (<12 inches) freshwater, using clumps of vegetation or debris for cover. Adults use mammal burrows.	Ellicott Pond and vicinity, 4 mi W of Watsonville; Bennett Slough/Struve Slough, 1.5 mi NNE of Moss Landing; McClusky Slough, 2 mi N of Moss Landing; 1.25 mi N of Moss Landing adj. Elkhorn Slough	Moderately high due to appropriate habitat in various sloughs and location of reported individuals
Charadrius alexandrinus nivosus	Western snowy plover	FT/CSC	Sandy beaches, shores of alkali lakes, other areas of sandy, gravelly, friable soil.	Pajaro River mouth and Palm/Sunset State Beach; Salinas River State Beach; Zmudowski State Beach; Salinas River mouth; Salinas River just s. of Moss Landing; Moss Landing State Beach; Moss Landing Salt Works.	Low due to lack of suitable habitat in study area
Eucyclogobius newberryi	Tidewater goby	FE[c]/CSC	Occurs in shallow waters of bays and estuaries	Pajaro R., Salinas R., and Elkhorn Slough, all from mouth to 1 mi upstream	Present only near and downstream from Highway 1

TABLE 3.4.3 (Continued)
NAME, STATUS, HABITAT, KNOWN LOCALITIES AND LIKELIHOOD OF OCCURRENCE IN THE STUDY AREA FOR SPECIAL-STATUS WILDLIFE SPECIES

Scientific Name	Common Name	USFWS/ CDFG Status[a]	Habitat	Localities Reported by CNDDB in the Region of the Project[b]	Likelihood of Occurrence in Study Area
Onchorhynchus mykiss	South-central California coast steelhead	FT/CSC	Rivers and creeks with permanent water for spawning and rearing; other habitats may serve as migration routes	Pajaro River, Salsipuedes and Corralitos creeks watersheds.	Known to occur in Pajaro River along the length of the project; also in Salsipuedes and Corralitos creeks
Rallus longirostris obsoletus	California clapper rail	FE/SE	Salt water marshes traversed by tidal sloughs, associated with abundant growths of pickleweed, but feeds in open areas on molluscs obtained from mud-bottomed sloughs.	Elkhorn Slough	Moderately low due to lack of habitat within the study area
Rana aurora draytonii	California red-legged frog	FT/CSC	Mostly in lowlands and foothills in/near permanent sources of deep freshwater, but will disperse far during and after rain. Prefers shorelines with extensive vegetation. Requires 11-20 weeks of permanent water for larval development.	Just east of Zmudowski Beach State Park, 2 mi NNW of Moss Landing; East branch of Hanson Slough, 2 mi W of Watsonville; near crossing of Zils and San Andreas Rds., west branch Struve Slough at Harkins Slough Rd; Harkins Slough at SPRR tracks; S side SPRR tracks between Watsonville Slough and Beach Rd.	High due to the proximity of reported occurrences and the presence of suitable habitat within the study area
Riparia riparia	Bank swallow	--/CT	Colonial nester; nests primarily in riparian and other lowland habitats. Requires vertical banks or cliffs with fine-textured/sandy soils near streams, rivers, lakes, ocean to dig nesting hole.	Mouth of Pajaro River, near Bluff and Trafton Roads; Moss Landing; Betabel Rd., Santa Clara Co.	Low due to lack of suitable habitat within the study area

TABLE 3.4.3 (Continued)
NAME, STATUS, HABITAT, KNOWN LOCALITIES AND LIKELIHOOD OF OCCURRENCE IN THE STUDY AREA FOR SPECIAL-STATUS WILDLIFE SPECIES

Scientific Name	**Common Name**	**USFWS/ CDFG Status**[a]	**Habitat**	**Localities Reported by CNDDB in the Region of the Project**[b]	**Likelihood of Occurrence in Study Area**
Vireo bellii pusillus	Least Bell's vireo	FE/CE	Low riparian, either near water or in dry river bottoms	LLagas Creek between Hwy 152 and its confluence with the Pajaro River east of Gilroy	Moderate – this species mostly found in S. Calif., but could be found in riparian habitats near the eastern portion of the project
Vulpes macrotis mutica	San Joaquin kit fox	FE/CT	Annual, open grasslands, sometimes with shrubby vegetation	Area surrounding Hollister north to Gilroy; south past Pacines	Moderate, especially in the grassland areas on the eastern end of the project
Agelaius tricolor	Tricolored blackbird	FSC/CSC	Nest in tule, sedges, or willows. Thistles, large enough to provide cover from predators, have also been used in upland areas. A site large enough for a minimum number of 50 pairs is required.	Sargent Creek, 1.5 mi N and 1.5 mi N of confluence of San Benito River and Pajaro River; Sargent Creek, west bank of Struve Slough, just west of Hwy. 1, one mi south of Hwy. 152 junction; Hanson Slough, 1.1 mi NW of Hwy. 1 Jct. with Hwy. 129 west of Watsonville	Low due to lack of suitable habitat within the study area
Ambystoma californiense	California tiger salamander	--/CSC	Annual grasslands and grassy understory of valley-foothill hardwood habitats in central and Northern California. Needs underground refuges, especially ground squirrel burrows and vernal pools or other seasonal water sources for breeding.	Ellicott Pond and vicinity, 4 mi W of Watsonville; 1.25 mi N Moss Landing, adjacent to Elkhorn Slough; just West of Route 156, 0.25 South of the Barnheisel Road jct., approximately 4.5 mi NNE of Hollister Municipal Airport.	Moderate; known to occur near study area.

TABLE 3.4.3 (Continued)
NAME, STATUS, HABITAT, KNOWN LOCALITIES AND LIKELIHOOD OF OCCURRENCE IN THE STUDY AREA FOR SPECIAL-STATUS WILDLIFE SPECIES

Scientific Name	**Common Name**	**USFWS/ CDFG Status**[a]	**Habitat**	**Localities Reported by CNDDB in the Region of the Project**[b]	**Likelihood of Occurrence in Study Area**
Anniella pulchra nigra	Black legless lizard	--/CSC	Sand dunes and sandy soils in the Monterey Bay and Morro Bay regions. Inhabits sandy soil/dune areas with bush lupine and mock heather as dominant plants.	Reported on Moss Landing, Watsonville West quads; location information suppressed	Low due to lack of suitable habitat within the study area
Asio flammeus	Short-eared owl	--/CSC 3503.5	Nests in marshes, grasslands, and irrigated pastures, particularly tall grasses and tules.	Mouth of Salinas River (0.2 mi. S of Moss Landing)	Generally low due to lack of suitable habitat within the study area, but could be found in grasslands areas, esp. in the eastern part of the study area
Athene cunicularia	Burrowing owl	--/CSC 3503.5 (burrow sites)	Low vegetation in grasslands, scrublands, and deserts. Nests in small mammal burrows, esp. those of California ground squirrel.	Dolan Road, approx. 2 mi. n. of Castroville.	Moderate; habitat in study area is limited, but could be found in grasslands areas, esp. in the eastern part of the study area
Danaus plexippus	Monarch butterfly	--/--	Roosts in groves of eucalyptus, Monterey pine, and cypress where protected from wind and where sources of water and nectar are near	Manresa State Beach; Palm/Sunset State Beach; Elkhorn Slough Ecological Reserve e. of Moss Landing; La Selva Beach; Moss Landing 1.5 mi n. of Elkhorn Slough	Low due to lack of suitable habitat in study area
Dendroica petechia brewsteri	Yellow warbler	--/CSC	Nests in riparian woodlands and forests, consisting of cottonwoods, willows, and/or alders, as well as in montane chaparral habitats with substantial amounts of brush or understory.	Not reported by CNDDB	Observed on Pajaro River near Betabel Road, and near Murphy Crossing

TABLE 3.4.3 (Continued)
NAME, STATUS, HABITAT, KNOWN LOCALITIES AND LIKELIHOOD OF OCCURRENCE IN THE STUDY AREA FOR SPECIAL-STATUS WILDLIFE SPECIES

Scientific Name	Common Name	USFWS/ CDFG Status[a]	Habitat	Localities Reported by CNDDB in the Region of the Project[b]	Likelihood of Occurrence in Study Area
Ictera virens	Yellow-breasted chat	--/CSC	Nests in low riparian thickets and tangled vegetation, esp. willow, blackberry and wild grape.	Not reported by CNDDB	Moderate; requires low, dense riparian habitat, habitat found in study area is generally narrow or sparse
Clemmys marmorata	Western pond turtle	FSC/CSC	Thoroughly aquatic turtle of freshwater ponds, marshes, rivers, streams and irrigation ditches with aquatic vegetation. Need basking sites and sandy banks or grassy open fields for egg-laying.	Pinto Lake County Park (N portion of Pinto Lake), Watsonville Slough at Pajaro Dunes, Pajaro R. downstream from McGowan Rd. bridge; Watsonville (vicinity Brewington Ave. and Crestview Dr.)	High within freshwater emergent sloughs; the Pajaro River; and Pinto Lake
Coelus globosus	Globose dune beetle	FSC/--	Inhabitant of undisturbed coastal sand dune habitat, from Bodega Head in Sonoma County south to Ensenada, Mexico. Inhabits foredunes and sand hummocks, burrowing beneath the sand surface and is most common beneath dune vegetation.	Palm Beach access, at the end of Beach Road, Sunset State Beach, 1 mile N of the mouth of the Pajaro River; Potrero Road access point to Salinas River State Beach.; Manresa State Beach	Low due to lack of suitable habitat within the study area
Reithrodontomys megalotis distichlis	Salinas harvest mouse	--/--	Fresh and brackish wetlands near mouth of Salinas R., probably also associates uplands; known only Monterey Bay region	Mouth of Salinas River	Low due to lack of suitable habitat in study area; area is outside known range of species
Tryonia imitator	Mimic tryonia (= California brackishwater snail)	--/--	Coastal lagoons, estuaries, and salt marshes	Bennetts, Moro Cojo, Parsons, and Elkhorn Sloughs	Moderately low due to lack of brackishwater habitat in study area

TABLE 3.4.3 (Continued)
NAME, STATUS, HABITAT, KNOWN LOCALITIES AND LIKELIHOOD OF OCCURRENCE IN THE STUDY AREA FOR SPECIAL-STATUS WILDLIFE SPECIES

Scientific Name	Common Name	USFWS/ CDFG Status[a]	Habitat	Localities Reported by CNDDB in the Region of the Project[b]	Likelihood of Occurrence in Study Area
	Nesting raptors	3503.5	Nest in oak woodland, riparian forest and isolated trees	Not reported by CNDDB	High in areas with suitable trees, including riparian areas, also the upland habitats for burrowing owl and short-eared owl (see Appendix B)

a **STATUS CODES:**

USFWS: (U.S. Fish and Wildlife Service)
FE=Listed as Endangered by the Federal Government
FT=Listed as Threatened by the Federal Government
FPE=Proposed for Listing as Endangered
FC=Candidate for Federal listing
FSC=Former Category 2 Candidate for Federal listing

CDFG: (California Department of Fish and Game)
CE=Listed as Endangered by the State of California
CT=Listed as Threatened by the State of California
CSC=California species of concern
3503.5= Protected under Fish and Game Code 3503.5

b CNDDB: California Natural Diversity Database

c Currently proposed for delisting north of Orange County (Federal Register, 2001).

SOURCE: Environmental Science Associates, 1997, 2001

Most of the project areas are thoroughly cultivated and contain limited natural habitat. Surveys for special-status nesting bird species were carried out during the spring of 1997 in a variety of habitats elsewhere in the PVWMA service area (ESA, 1997b). A site assessment was conducted within the study area for the California red-legged frog (a federal threatened species) using methods required by the February 18, 1997 USFWS survey protocol for this species (ESA, 1997a; ESA, 1999a). The site assessment also included the Santa Cruz long-toed salamander (*Ambystoma macrodactylum croceum*), a state and federal endangered species (ESA, 1999a). This species has been located in McClusky Slough (CNDDB, 1997, 2001) and is thus presumed to be present in this location. Other species included in the site assessment were the western pond turtle (*Clemmys marmorata pallida*) and the California tiger salamander (*Ambystoma californiense*).

Fisheries Surveys

Pajaro River and Salsipuedes Creek

Passage conditions for steelhead constitute the primary habitat factor for fisheries resources potentially affected by the proposed project. Passage conditions were evaluated in 1997 (HRG, 1997) by establishing depth transects in Salsipuedes Creek and in the Pajaro River at shallow riffles (rocky shoal or sandbar lying just below the water surface) that were most likely to impede steelhead upstream or downstream migration. It should be noted that these same riffles and their configurations may not exist from year to year, but were probably typical of riffles that present the most difficulty for steelhead migration in most years. (For a detailed discussion of these fishery passage surveys and results, see Appendix C).

Transects were established at three riffles on Salsipuedes Creek in April 1997. Smolts typically migrate to the Pacific Ocean in April and May. Depths at one of the riffles (a "typical" rather than a critical/difficult passage riffle) were recorded at 1-foot increments across the riffle three times between April 25 and May 9, at flows of 15.1, 4.7, and 2.0 cubic feet per second (cfs). Depths at two other riffles, which represented very difficult "critical" passage, were recorded five times between April 25 and May 29 (measurements were taken with the above flows and with flows of 0.9 and 0.4 cfs). The last two flows were far below those needed for passage, but provided information on how depth changed with flow and with algal growth. The two critical riffles were the only difficult riffles in the creek in 1997, and both had wide, diagonal gravel bars producing the riffles. The most difficult riffle stretched over 80 feet across, where the main channel was about 30 feet wide. The upstream to downstream length of each riffle was short; the length of difficult passage was less than 5 feet.

Transects were placed at four riffles on the Pajaro River: one immediately upstream of Murphy Crossing; two within 1.4 miles downstream of Murphy Crossing; and one 4.1 miles downstream of the Murphy Crossing. The three upstream riffles were diagonal riffles formed in broad portions of the channel that are usually dry in summer or have very little streamflow. The downstream riffle was the only true riffle in the portion of the channel with regular summer surface water, dense streambed vegetation, and a generally narrower low-flow channel (due to the vegetation). Depths were measured at the transects downstream of Murphy Crossing five times

from April 18 to June 12, at flows of 65 to 7.6 cfs. Transects were measured twice upstream of Murphy Crossing, on April 25 and May 9, at flows of 50.5 and 21.7 cfs; construction of the crossing inundated this most critical riffle. Substrates at the riffles were predominantly sand and fine gravel deposited by the high January flows. The configurations were not stable, and the deepest portions of the sandy riffles were gradually scoured deeper over the study period. Because of the channel instability, the transects were not a strict test of the relationship between streamflow and riffle depth; 20 cfs in April would not have provided the passage conditions that 20 cfs in late May would have provided.

Corralitos Creek

Passage criteria for steelhead migrating through Corralitos Creek were evaluated in July 2001, using a somewhat different methodology than that described above. This new methodology, based on historic hydrologic data and advocated by the NMFS and the State Water Resources Control Board (SWRCB) Division of Water Rights, was used for estimating bypass flow criteria and maximum instantaneous diversion rates. Although the details of this methodology have not been finalized (SWRCB, 2001; Bybee, 2001), enough information exists to apply this methodology, which will soon become the norm for determining fisheries protection measures for water diversion projects in California.

The new methodology, which in its final version will become the water diversion regulations adopted by the various responsible regulatory agencies (NMFS, CDFG, SWRCB), is based on the following three guidelines:

- The season of diversion is limited to the period of December 15 to March 31.
- The minimum bypass is set equal to the unimpaired median discharge for the wettest month of the year. For this region, February was determined to be the wettest month.
- The maximum instantaneous diversion rate is set equal to 15 percent of the 20 percent winter exceedence discharge.

These guidelines limit diversions to periods of sufficiently high stream flows and allow diversions to occur only above a specific streamflow, so as to prevent the loss of migratory and spawning habitat for anadromous salmonids. Furthermore, the maximum instantaneous diversion rate guideline is aimed at preserving the natural hydrograph of the creek (i.e., preserving natural flow peaks above the specified minimum bypass flow). The application of these guidelines to the proposed Corralitos Creek Diversion resulted in a minimum bypass flow of 15 cfs and a maximum instantaneous diversion rate of 6 cfs. For further details about this methodology and the results, refer to Appendix D.

3.4.2 REGIONAL SETTING

Historically, the Pajaro Valley supported a variety of vegetation communities, including extensive riparian forests along waterways, valley oak savanna intermixed with grasslands in the bottomlands, mixed hardwood forests on hillsides, coastal dunes near the ocean, and coastal scrub on rocky sites. Although remnants of these habitats can be seen in isolated patches, much of the valley is now in agriculture.

Regional Habitat Classification Units

Vegetation and Wildlife Habitats

The study area supports eight WHR units (Mayer and Laudenslayer, 1988) that might be adversely affected by project elements. These WHR units are described in the paragraphs that follow. (**Table 3.4.1** provides a comparison between the WHR units and terminology used by CNDDB for natural communities.)

Valley Foothill Riparian. Valley foothill riparian includes a range of habitats associated with permanent (nonseasonal) water. It may be a dense, multilayered forest of trees and shrubs, or a thicket of dense shrubs. In a natural state, it may span the entire floodplain of a river, giving way to oak savannas or grasslands on adjacent uplands. On the Pajaro River, valley foothill riparian habitat often consists of a dense growth of willows (*Salix* spp.), black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), and boxelder (*Acer negundo* var. *californica*), with an understory of poison-oak (*Toxicodendron diversilobum*), mugwort (*Artemisia douglasiana*), California blackberry (*Rubus ursinus*), and stinging nettle (*Urtica* sp.). Under a dense canopy or where stream scouring and/or siltation are significant influences, the understory may be sparse.

The coastal streams and tributaries of the Pajaro River also support valley foothill riparian habitat, but most habitat is limited by narrow waterways, and the intermittent presence of flowing water or near-surface water. Corralitos Creek is an unleveed tributary to the Pajaro River; it supports a well-developed band of valley foothill riparian habitat, especially in its upper reaches. Salsipuedes Creek is bounded by levees, and the woody vegetation between the levees is regularly cleared for flood control. As a result, its riparian habitat is very limited.

Wildlife Attributes. Riparian areas provide nesting habitat and diverse insects that are attractive to a variety of migratory birds. Foliage, bark, and ground substrates provide a variety of foraging areas. Birds that forage for insects in the foliage include Bewick's wren (*Thryomanes bewickii*), northern oriole (*Icterus galbula*), and black-headed grosbeak (*Pheuticus melanocephalus*). Bark-insect foraging species occur here, such as downy woodpecker (*Picoides pubescens*), Nuttall's woodpecker (*Picoides nuttallii*), and white-breasted nuthatch (*Sitta carolinensis*). There are a few species that are adapted to foraging for insects in flight, such as black phoebe (*Sayornis nigricans*), western wood pewee (*Contopus sordidulus*), and tree swallows (*Tachicyneta bicolor).*

Coastal Oak Woodland. This habitat is typically comprised of a dense to sparse cover of coast live oak (*Quercus agrifolia*) with a partial understory of shrubs and grasses similar to the annual

grassland type. Within the study area, coastal oak woodland may once have been more extensive on the deeper and more level soils, but is presently limited to sheltered, often north-facing slopes too steep to cultivate. The predominant tree species is coast live oak, although occasionally other species may be found, such as madrone (*Arbutus menziesii*) and California bay (*Umbellularia californica*). The understory includes poison-oak, monkey flower (*Mimulus aurantiacus*), and California blackberry, while the herbaceous understory includes vetch (*Vicia* sp.), mustard (*Brassica* sp.), and bracken fern (*Pteridium aquilinum*).

Wildlife Attributes. Coastal oak woodland provides food and shelter for a variety of bird species, including insect eaters such as chestnut-backed chickadee (*Parus rufescens*), white-breasted nuthatch, and warbling vireo (*Vireo gilvus*). Other species attracted to this habitat include song sparrow (*Melospiza melodia*), quail, rufous-sided towhee (*Pipilo erythrophthalmus*), and brown towhee, which glean insects from the foliage on the ground. Stellar's jay (*Cyanocitta stelleri*) and squirrels (*Sciurus* sp.) are dependent on the acorns during the winter. Anna's hummingbirds (*Calypte anna*) use vines growing around trees for nectar and for insects that are attracted to the nectar. Other species, such as the great horned owl (*Bubo virginianus*), use the trees for roosting and foraging perches. The western gray squirrel (*Sciurus griseus*) and gray fox (*Urocyon cinereoargenteus*) both feed on truffles, mushrooms, fruits, and nuts within the forest. Unlike the riparian habitat, oak forests have a higher density of wintering birds than nesting birds.

Coastal Scrub. This shrub-dominated habitat occupies a rather limited area within the study area. Coastal scrub tends to grow on steep rocky slopes, grading into oak woodland on deeper soils or moister sites. Depending on site-specific factors, including soil depth and slope aspect, coastal scrub in the study area can consist of shrublands dominated by either California sage (*Artemisia californica),* poison-oak, monkey flower, and black sage (*Salvia mellifera*) or by coyote brush (*Baccharis pilularis*) and poison-oak growing in dense thickets.

Wildlife Attributes. The sandy soils often associated with coastal scrub habitat provide ideal habitat for reptiles such as western fence lizards (*Sceloporus occidentalis*), which are common in the warm, dry scrub community. Coastal scrub habitat, often interspersed with other habitats, provides foraging and nesting habitat for species that are attracted to edges of plant communities. Bird species that use the scrub canopy for catching insects include dusky flycatcher (*Empidonax oberholseri*) and wrentit (*Chamaea fasciata*). Besides insects, flowering scrub vegetation (e.g., ceanothus) attracts nectar drinkers such as Anna's hummingbird. Mammals, including striped skunk (*Mephitis mephitis*), use this habitat for protection and foraging grounds, feeding off new shoots of plants. Black-tailed deer (*Odocoileus hemionius californicus*) often feed on scrub, but this habitat supports a lower density of deer than occurs in oak savannas. Small mammals that are expected to occur within the scrub include brush rabbits (*Sylvilagus audubonii*), Botta's pocket gophers (*Thomomys bottae*), and deer mice (*Peromyscus maniculatus*). Small mammals attract predators such as long-tailed weasel (*Mustela frenata*), gray fox, and bobcat (*Felix rufus*).

Annual Grassland. This community typically comprises a dense to sparse cover of annual grasses, often associated with numerous species of annual and perennial forbs. These grasslands grow actively during winter and spring and remain dormant during summer and early fall. The presence of this assemblage of non-native, annual grasses originating in the Mediterranean region

is a consequence of permanent alterations to the once widely distributed pristine perennial grasslands of California. In the project area, California annual grassland is generally found on fine-textured, clay-rich soils that are too steep to cultivate. This habitat is common and widespread in California and in the project region.

Plant species typical of the area include annual grasses such as farmer's foxtail (*Hordeum murinum* ssp. *leporinum*), soft chess (*Bromus hordeaceus*), ripgut grass (*Bromus diandrus*), foxtail brome (*Bromus rubens*), and wild oat (*Avena barbata*). A number of non-native herbs such as filaree (*Erodium* sp.), field bindweed (*Convolvulus arvensis*), burclover (*Medicago polymorpha*), and cut-leaved geranium (*Geranium dissectum*) frequently occur as subdominants. As is typical of soils with a high clay content, some areas are strongly dominated by mustards, such as London rocket (*Sisymbrium irio*), black mustard (*Brassica nigra*), and wild radish (*Raphanus sativus*). Native forbs commonly interspersed among the grasses include lupine species (*Lupinus* sp.), tarweeds (*Hemizonia* sp.), California poppy (*Eschscholzia californica*), popcorn flower (*Plagiobothrys* sp.), owl's clover (*Orthocarpus* sp.), common fiddleneck (*Amsinckia intermedia*), and blue dicks (*Dichelostemma pulchellum*).

Wildlife Attributes. Grassland habitat, such as non-native grasslands, attract reptiles and amphibians, such as southern alligator lizard (*Gerrhonotus multicarinatus*), western fence lizard (*Sceloporus occidentalis*), and Pacific slender salamander (*Batrachoseps attenuatus*), which feed on invertebrates found within and underneath decaying vegetation within the community. This habitat also attracts seed- and insect-eating birds. California quail, mourning dove (*Zenaida macroura*), and meadowlarks (*Sturnella neglecta*) are seed eaters that nest in grasslands. Insect eaters such as scrub jays (*Aphelocoma coerulescens*), barn swallows (*Hirundo rustica*), and mockingbirds (*Mimus polyglottus*) use the habitat for foraging only. Grasslands are important foraging grounds for aerial and ground-foraging insect eaters such as bats and a wide variety of small rodents. These in turn attract raptors (birds of prey) such as red-tailed hawks (*Buteo jamaicensis*) and red-shouldered hawks (*Buteo lineatus*). A pair of red-tailed hawks was observed nesting in two coast live oak trees in the Sargent Hills. Black-tailed deer (*Odocoileus hemionus californicus*) use grassland for grazing and, if the grass is tall enough, for bedding at night.

Fresh Emergent Wetland. There are various types of fresh emergent wetlands within the project area, ranging from wetlands dominated by species typical of brackish water environments, such as frankenia (*Frankenia grandiflora*) and pickleweed (*Salicornia virginica*) in man-made drainage ditches, to freshwater ponds with cattails (*Typha* sp.), bulrushes (*Scirpus* spp.), and willows (*Salix* spp.) as dominant species.

Wildlife Attributes. Wildlife that depend on free (open) water visit wetlands regularly, such as coyotes, foxes, raccoons, most rabbits, hares, rodents and many species of birds. A number of species require standing or flowing water for breeding, including all amphibians, such as red-legged frogs (*Rana aurora*), western toads (*Bufo boreas*), and Pacific tree frogs *(Hyla regilla),* as well as western pond turtles (*Clemmys marmorata*), garter snakes (*Thamnophis couchii),* red-winged blackbirds (*Agelaius phoeniceus*), and marsh wrens (*Cystothorus palustris*). In

seasonally arid climates as is found in coastal California, the species richness of fresh emergent wetland is very high.

Vernal Pools. Within the annual grassland habitat, vernal pools are surface depressions with a slowly permeable substratum that holds water after winter and spring rains. Claypan pools have a slowly permeable clay layer that holds winter rains, while hardpan vernal pools develop where chemical processes allow for the accumulation of a cemented subsoil layer.

Plants occurring in vernal pools are predominantly native, low-growing, ephemeral annual herbs, but some are perennial. Germination and early growth occur in winter and early spring, often while plants remain submerged. As pools dry out in spring, flowering occurs in bands at the margins of the pools following the receding water level.

A suite of native plant species is typical within vernal pools. These are species adapted to the periodic but somewhat variable cycles of inundation and drying. Unlike the surrounding non-native annual grasslands, intact, undisturbed vernal pools are dominated almost entirely by native taxa.

Due to its patchy distribution and historic habitat loss, this community is considered a high priority for inventory by CDFG (see Regulatory Framework, Section 3.4.1). In addition, vernal pools typically qualify as wetlands and as such may be protected under Section 404 of the Clean Water Act.

Wildlife Attributes. Vernal pools provide one of the most diverse habitats within California, providing winter foraging for waterbirds, including gulls (*Larus* spp.) and snowy egret, and shorebirds, such as western sandpipers (*Calidris mauri*) and black-necked stilt (*Himantopus mexicanus*). Several endangered and threatened vernal pool shrimp species occur only within the seasonal vernal pool habitat. However, the vernal pool within the project alignment is too small to provide habitat for larger organisms such as birds, and it is doubtful that vernal pool shrimp species occur in the area, based on review of CNDDB records.

Cropland/Orchard/Vineyard. The deep alluvial soils along the floodplain of the Pajaro River and coastal areas support a variety of row crops as well as vineyards and orchards. The very mild climate in the project area makes it suitable for row crops such as strawberries, bush berries, lettuce, broccoli, cauliflower, and cut flowers. Agricultural habitats are subject to periodic discing, planting, harvesting, and the application of herbicides, pesticides, and fertilizers which prevent the establishment of natural plant species and communities. A number of weedy plant species, including bristly ox-tongue (*Picris echioides*), curly dock (*Rumex crispus*), and bull thistle (*Cirsium vulgare*), are associated with cultivated lands; many of these are non-native species, and all are adapted to open, bare ground, rapid maturity, and high seed production.

Wildlife Attributes. Agricultural lands of this type may provide occasional habitat for transient mammals, reptiles, and amphibians, and have some value to birds. Small mammals, such as rabbits and rodents, forage on the leaves and grasses and, in turn, may attract small predators,

such as hawks or feral cats. Row crops with leveled fields, as are predominant in the study area, are used as travel corridors but support no resident wildlife.

Urban/Developed. Urban development is scattered in the project area. These areas consist of homes, buildings associated with farming, and towns, of which Watsonville is the largest.

Urban and developed areas tend to be landscaped with non-native ornamental plant species, thus displacing native plants. Residential parks and disturbed areas provide little habitat for wildlife except for those species adapted to human habitation, such as skunks, opossum (*Didelphis marsupialis*), starlings, golden-crowned sparrows (*Zonotrichia atricapilla*), and rock pigeons (*Columbia livia*). These areas do not provide habitat for larger mammalian species nor for predators, except possibly raccoons (*Procyon lotor*).

Critical Habitat for California Red-Legged Frogs

The project area is within the boundaries of final designated critical habitat for the California red-legged frog (USFWS, 2001). The final designation states that red-legged frogs can use "virtually any aquatic system" provided that a permanent water source is nearby. Upland and riparian habitat associated with breeding sites is also considered essential for the maintenance of red-legged frog populations. These frogs can be found in streams more than 1.8 miles from their breeding sites, have been found in riparian habitat more than 100 yards from water, and can travel 2.25 miles across upland habitats from nonbreeding to breeding habitat (USFWS, 2001). Thus, critical habitat will include any portion of the project area close to water.

Specifically, within the critical habitat boundaries, three elements must co-occur for an area to qualify as critical habitat: suitable aquatic habitat, associated uplands, and suitable dispersal habitat connecting aquatic habitats (USFWS, 2001). The aquatic habitat must consist either of (1) two or more breeding sites, at least one of which is a permanent water source, within 1.25 miles of each other; or (2) two or more breeding sites and a permanent water source, all within 1.25 miles of each other if none of the breeding sites is a permanent water source (USFWS, 2001). Suitable upland habitat consists of all upland areas within 500 feet of the edge of suitable aquatic habitat. If the watershed boundary is less than 500 feet from the aquatic habitat edge, then the watershed boundary forms the edge of suitable habitat (USFWS, 2001). Suitable dispersal habitat must provide connectivity between aquatic habitats; it must be at least 300 feet wide and free of barriers to dispersal. These barriers include roads with more than 30 cars per hour as well as "moderate to high" density urban or industrial development (USFWS, 2001).

Aquatic Habitats and Resources

The Pajaro River Valley is an agricultural area drained by the Pajaro River and two of its major tributaries, Salsipuedes Creek and Corralitos Creek, as well as by Watsonville Slough. Portions of these watercourses are bounded by levees to control periodic winter flooding. Smaller drainages also are found in the immediate vicinity of the Pacific Ocean. The following descriptions of the major reaches of the Pajaro River are based on Swanson et al. (1992).

The lowest reach of the Pajaro River, Reach A, extends 2.4 miles from the mouth of the river, at the Pajaro Lagoon, to the Thurwachter Bridge site. This reach is mostly bounded by levees and has a U-shaped channel with steep earthen banks. Riparian plant species growing here are tolerant of brackish water conditions. Reach B extends upstream to the Highway 1 crossing. It has a wide, clear channel, with densely vegetated river terraces and grassy levee slopes. Although there is some brackish water influence in the channel, a dense growth of willow and cottonwood trees grows on the terraces. Reach C extends from Highway 1 to the railroad crossing at Watsonville. This area has a dense overstory and undergrowth of woody species, primarily cottonwood and willow. The channel is significantly narrower than the downstream reaches, often less than 100 feet wide compared to over 250 feet wide in some areas downstream. A long-sweeping curve in this reach has experienced erosion and has been armored with riprap. Reach D extends through Watsonville from the railroad crossing to the confluence with Salsipuedes Creek. This area is wider between the levees than upstream and downstream reaches, but shows the effects of repeated vegetation clearing, as the riparian vegetation is mostly grasses and low in tree and shrub cover. Reach E extends from the confluence of Salsipuedes Creek to Murphy Crossing. The channel morphology and vegetation cover are highly variable, but the flow is generally intermittent and the channel bed is dry in the summer months. The sediment in the channel bed and banks is unconsolidated coarse sands and gravels and is easily erodible.

Salsipuedes Creek is a perennial stream flowing in a series of high grassy terraces contained by levees. The stream bottom is generally grassy, due to repeated clearing of woody vegetation. There is a sparse tree cover outside the levees.

Corralitos Creek is a major tributary of the Pajaro River. It joins Salsipuedes Creek below College Lake; Salsipuedes Creek then joins the Pajaro River about two miles farther downstream. The watershed for Corralitos Creek extends for a number of miles to the north-northwest of Watsonville. Although Salsipuedes Creek is contained by levees, Corralitos Creek is not, and it supports a band of natural riparian vegetation along much of its length.

To the southwest of Corralitos Creek are the drainages of Watsonville and Harkins sloughs. The watershed of these two drainages is mostly west of the city of Watsonville and Highway 1. The confluence of Harkins Slough and Watsonville Slough is near San Andreas Road. From this point, Watsonville Slough flows west for about 1.5 miles, then turns south for about 1.2 miles, where it empties into the Pajaro Lagoon.

Fishery Resources in the Pajaro River and the Eastern Watershed. The Pajaro River provides habitat for several fish species. The Pajaro River watershed is one of the major components of the South-central California Coast Evolutionarily Significant Unit (ESU) of steelhead (*Oncorhynchus mykiss*) and includes the entire watershed of the Pajaro River, as defined by NMFS (Federal Register, 1997). Coastal steelhead are anadromous fish, spawning in coastal ocean tributaries but migrating to ocean waters as one- to two-year-old juveniles (smolts). Most of their adult life is spent in ocean waters, but they return to coastal tributaries to spawn. Steelhead in this ESU have been listed as a federal threatened species and a California species of special concern.

The Pajaro River serves as a migration pathway for adult steelhead migrating upriver to spawning and nursery habitat in the upper watershed, and for steelhead smolts migrating downriver from that habitat to the ocean. Adult steelhead enter the river from late December through April, with spawning taking place from January through April. Most smolts migrate to the Pacific Ocean in April and May (HRG, 1997). Studies from the 1960s report steelhead runs in the Pajaro River ranging from 1,000 to 2,000 individuals (Federal Register, 1997). Current runs are undoubtedly smaller due to habitat quality declines stemming from water quality changes in the wake of land development along the watershed and loss of vegetation and channelization along riparian corridors. Habitat was also affected by the 1987-1991 drought.

The Pajaro River serves as a migration pathway for adult steelhead migrating to spawning and nursery habitat in the upper watershed and for steelhead smolts migrating from that habitat to the ocean. In the upper watershed, Pescadero, Uvas, Llagas, and Pacheco creeks and their tributaries provide potential spawning and rearing habitat. Pescadero and Uvas creeks provide access, spawning, and rearing in all but extreme drought years. Llagas and Pacheco creeks tend to be drier, and use of those streams is less frequent and less extensive.

During periods of lower flows beginning in late spring, the water temperatures of local streams increase. Part of this increase is due to the seasonal increase in day length and air temperatures, and part is due to the reduced temperature buffering provided by the reduced streamflows. Smolts can suffer from heat stress at higher temperatures; however, since smolts travel mostly at night when water temperatures are cooler, heat stress probably is minor for short migrations. Migrating smolts travel relatively quickly; therefore, temperature probably is not a problem at times when the flows are sufficient to allow easy passage through riffles. No steelhead spawning or rearing occurs in the Pajaro River downstream of Murphy Crossing because of the lack of spawning gravels and low and warm summer streamflows.

Fresh/brackish water fish species present in the Pajaro River downstream of Murphy Crossing and in Salsipuedes Creek include Sacramento sucker (*Catostomus occidentalis*), Sacramento squawfish (*Ptychochielus grandis*), hitch (*Lavinia exilicauda*), Sacramento blackfish (*Orthodon microlepidotus)*, prickly sculpin (*Cottus asper*), and threespine stickleback (*Gasterosteus aculeatus*). None of these species require April to June streamflows for passage, spawning, or rearing in excess of those required for steelhead smolt passage. The Pacific lamprey (*Lampetra tridentata*) is an anadromous fish that, like the steelhead, migrates into freshwater to spawn. Lamprey juveniles later migrate downstream to the ocean to mature. Adult migration times for lamprey tend to occur somewhat later than the peak of the steelhead adult migration (March and April). However, lamprey adults are able to negotiate relatively shallow riffles. Juvenile lampreys migrate to the ocean with peak winter flows, and rarely suffer migration blockage.

Although once present in this area, the coho salmon (*O. kisutch*), a federally and state-listed anadromous species north of the project area, has not been present in the Pajaro River system since at least the late 1960s. Occasional sightings in the 1960s may have been due to fish released from a hatchery in the San Lorenzo River to the north that inadvertently strayed into the Pajaro River as adults (HRG, 1997). Scarcity of suitable cool, low-gradient rearing habitat and lack of regular access preclude sustaining runs of coho in the watershed.

Fishery Resources in the Salsipuedes Creek Watershed. Steelhead regularly use the watershed of Corralitos Creek, which joins Salsipuedes Creek immediately downstream of College Lake. Diversion dams on Corralitos and Browns creeks and wells downstream of their confluence (operated by the City of Watsonville) affect springtime streamflows and fish passage in lower Corralitos Creek and in Salsipuedes Creek.

Two tributaries to College Lake and Salsipuedes Creek may also be used by steelhead for spawning and rearing. Adult access is good to Casserly Creek, and fish with smolt coloration were captured in spring 1997, confirming its continued use by steelhead. Passage is more difficult on Green Valley Creek, and the size of fish sampled in spring 1997 and the lack of smolted fish indicate that a major portion of the "rainbow trout" in the perennial portion of the stream are resident, rather than migratory steelhead. Although no dams or major diversions occur on the two streams, springtime streamflows are relatively low, probably blocking and trapping late-migrating smolts in average or dry years. On May 2, 1997, streamflows in both streams were insufficient for fish passage to College Lake, even though smolts were still apparently down-migrating through Corralitos Creek.

College Lake is quite turbid in winter and spring, because much of its stored water is turbid storm runoff and because the bare, fine-grained soils of the shallow lakebed are easily stirred up by wind and wave action. The turbid conditions and probable lack of abundant food due to turbid water and the seasonal nature of the lake indicate that steelhead smolts migrating through the lake from Green Valley or Casserly creeks probably spend little time (less than one week) in the lake (HRG, 1997).

College Lake has historically been pumped dry in late spring to allow agricultural use of the lakebed. The water stored in College Lake for flood control in winter is pumped into Salsipuedes Creek in spring. These pumped water flows help to provide passage flows for steelhead from tributaries upstream of College Lake and also for those from the Corralitos Creek watershed.

Fishery Resources in the Pajaro River Lagoon. Pajaro River and Salsipuedes Creek streamflows can provide for steelhead passage and also supply freshwater to the Pajaro River estuary. In spring, the freshwater inflow provides a surface wedge of lighter freshwater on top of the salt water in the Pajaro River estuary. This freshwater wedge allows steelhead smolts to move up and down in the water column to aid in gradually adjusting to seawater. When flows are sufficient for passage to the estuary, the inflows are probably sufficient to provide a good freshwater to saltwater transition zone. Migrating smolts may spend several weeks feeding in the estuary and adjusting to seawater. This transition may not be required, as many central California streams lack good transitional estuaries while sustaining steelhead populations. However, the transition may improve survival of smolts, especially smaller smolts, upon their entering the ocean.

A sandbar forms across the mouth of the Pajaro River in most years. Bar formation is primarily a function of beach-building processes produced by low-energy summer waves. Spring and early summer freshwater inflows are not an important factor in bar formation in a large estuary like that of the Pajaro River (Smith, 1990). Tidal flux through the mouth is substantially higher than

freshwater inflows; even after the sandbar forms, seepage through the large sandbar probably is sufficient to prevent overtopping and sandbar breaching.

After sandbar formation, freshwater inflows lower the salinity of the summer lagoon and may be important to lagoon ecology (Smith, 1990). However, at the Pajaro River, even in most years when the sandbar forms, the formation is usually in mid- to late summer. This is much later than the period of steelhead smolt passage and estuary adjustment and is also later than the present practice of pumping water from College Lake. Tidewater gobies (*Eucyclogobius newberryi*), a federal endangered species currently proposed for delisting (Federal Register, 2001), are present in the Pajaro River estuary and up to a mile upstream. Sandbar formation is important for providing the calmer lagoon conditions favored by tidewater gobies (Smith, 1990), but the salinity of the lagoon generally is not important to goby viability. Tidewater gobies in central California maintain highly localized populations in lagoons ranging from freshwater (Soquel Creek in 1988 and Pescadero Creek in 1985) to ocean salinities (Corcoran and Moran lagoons in 1996). After partial sandbar formation in late spring and summer, lagoon height increases, backing brackish water upstream to above Highway 1. Tidewater gobies possibly can be found that far upstream in years of high abundance; however, in years of heavy winter floods, this species probably is confined to the downstream portion of the Pajaro River estuary and to Watsonville Slough (Smith, 1990).

Critical Habitat for South-central California Coast Steelhead

The NMFS designated critical habitat for South-central California coast steelhead in 2000. The designation covers "all waterways, substrate, and adjacent riparian zones below longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years)," as well as some major dams (Federal Register, 2000). Thus, all waterways within the various project areas fall under this designation.

3.4.3 REGULATORY FRAMEWORK

SPECIAL-STATUS SPECIES

As discussed below, several species known to occur on or in the vicinity of the project site are accorded "special-status" because of their recognized rarity or vulnerability to various causes of habitat loss or population decline. Some of these receive specific protection defined in federal or state endangered species legislation. Others have been designated as "sensitive" on the basis of adopted policies and expertise of the CDFG or organizations with acknowledged expertise, such as the California Native Plant Society. These species are referred to collectively as "special-status species" in this EIR, following a convention that has developed in practice, but that has no official sanction. The various categories encompassed by the term, and the legal status of each, are summarized below.

REGULATION OF SPECIAL-STATUS SPECIES

Federal Endangered Species Act

Under the Federal Endangered Species Act (FESA), the Secretary of the Interior and the Secretary of Commerce have joint authority to list a species as threatened or endangered (16 United States Code [USC] 1533[c]). Pursuant to the requirements of FESA, an agency reviewing a proposed project within its jurisdiction must determine whether any federally listed threatened or endangered species may be present in the project area and determine whether the proposed project will have a potentially significant impact on such species. In addition, the agency is required to determine whether the project is likely to jeopardize the continued existence of any species proposed to be listed under FESA or result in the destruction or adverse modification of critical habitat proposed to be designated for such species (16 USC 1536[3], [4]). Therefore, project-related impacts to these species or their habitats would be considered significant.

The USFWS also publishes a list of candidate species. Species on this list receive special attention from federal agencies during environmental review, although they are not protected otherwise under FESA. The candidate species are taxa for which the USFWS has sufficient biological information to support a proposal to list as endangered or threatened. Project impacts to such species would be considered significant in this EIR.

Species listed under FESA that are known to occur in the study area and that may be affected by this project include the Santa Cruz long-toed salamander, the tidewater goby, the South-central California coast steelhead, and the California red-legged frog (**Table 3.4.3**).

California Endangered Species Act

Under the California Endangered Species Act (CESA), CDFG has the responsibility for maintaining a list of threatened species and endangered species (Cal. Fish and Game Code 2070). The CDFG also maintains a list of "candidate species," which are species that the CDFG has formally noticed as under review for addition to the threatened or endangered species lists. The CDFG also maintains lists of "species of special concern," which serve as watch lists. Pursuant to the requirements of CESA, an agency reviewing a proposed project within its jurisdiction must determine whether any state-listed endangered or threatened species may be present in the project area and determine whether the proposed project will have a potentially significant impact on such species. In addition, CDFG encourages informal consultation on any proposed project that may impact a candidate species. Project-related impacts to species on the CESA endangered list and threatened list would be considered significant. Impacts to species of concern would be considered significant under certain circumstances, discussed below.

Species listed under CESA that are known to occur in the study area and that may be affected by the proposed project include the Santa Cruz long-toed salamander. Species considered "of special concern" by CDFG that may be affected by the proposed project include the South-central California coast steelhead, the California tiger salamander, the yellow warbler, and the western pond turtle (**Table 3.4.3**).

CEQA Guidelines Section 15380

Although threatened and endangered species are protected by specific federal and state statutes, CEQA Guidelines Section 15380(b) provides that a species not listed on the federal or state list of protected species may be considered rare or endangered if the species can be shown to meet certain specified criteria. These criteria have been modeled after the definition in FESA and the section of the California Fish and Game Code dealing with rare or endangered plants or animals. This section was included in the guidelines primarily to deal with situations in which a public agency is reviewing a project that may have a significant effect on, for example, a candidate species that has not yet been listed by either the USFWS or CDFG. Thus, CEQA provides the ability to protect a species from potential project impacts until the respective government agencies have an opportunity to designate the species as protected, if warranted.

CEQA also calls for the protection of other locally or regionally significant resources, including natural communities. Although natural communities do not at present have legal protection of any kind, CEQA calls for an assessment of whether any such resources would be impacted, and requires a finding of significance if there will be substantial losses. Natural communities listed by CNDDB as sensitive are considered by CDFG to be significant resources and fall under the CEQA Guidelines for addressing impacts. Local planning documents such as general plans often identify these resources as well.

Resources covered under this protection that occur in the PVWMA project area include riparian forests and wetlands.

Other Statutes, Codes, and Policies Affording Limited Species Protection

Migratory Bird Treaty Act

The federal Migratory Bird Treaty Act (16 USC, Sec. 703, Supp. I, 1989) prohibits killing, possessing, or trading in migratory birds, except in accordance with regulations prescribed by the Secretary of the Interior. This act encompasses whole birds, parts of birds, and bird nests and eggs. Birds of prey are protected in California under the State Fish and Game Code, Section 3503.5, 1992. Section 3503.5 states that it is "unlawful to take, possess, or destroy any birds in the order Falconiformes or Strigiformes (birds of prey) or to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by this code or any regulation adopted pursuant thereto." Construction disturbance during the breeding season could result in the incidental loss of fertile eggs or nestlings, or otherwise lead to nest abandonment. Disturbance that causes nest abandonment and/or loss of reproductive effort is considered "taking" by the CDFG. Any loss of fertile eggs, nesting raptors, or any activities resulting in nest abandonment would constitute a significant impact. Project impacts to these species would not be considered significant unless they are known or have a high potential to nest in the project area or to rely on it for primary foraging. ESA's spring birding surveys in the project area established the presence of, and potential impact to these species (ESA, 1997b). These species are listed in **Table 3.4.3**.

Plants

Vascular plants listed as rare or endangered by the California Native Plant Society (CNPS) (Skinner and Pavlik, 1994), but which have no designated status or protection under federal or state endangered species legislation, are defined as follows:

List 1A. Plants Believed Extinct.

List 1B. Plants Rare, Threatened, or Endangered in California and elsewhere.

List 2. Plants Rare, Threatened, or Endangered in California, but more numerous elsewhere.

List 3. Plants About Which More Information is Needed - A Review List.

List 4. Plants of Limited Distribution - A Watch List.

In general, plants appearing on CNPS List 1 or 2 are considered to meet CEQA's Section 15380 criteria and impacts to these species are considered significant in this EIR.

Although there are a number of special-status plants meeting these criteria that are known to occur within the PVWMA service area, the Santa Cruz tarplant is the only species known to occur within a project area or that could be affected by the proposed project.

WETLANDS

Wetlands are ecologically productive habitats that support a rich variety of both plant and animal life. The importance and sensitivity of wetlands have increased as a result of their value as recharge areas and filters for water supplies and widespread filling and destruction to enable urban and agricultural development. In a jurisdictional sense, there are two definitions of a wetland, one definition adopted by federal agencies and a separate definition adopted by the State of California. Both are presented below.

Federal Wetland Definition

Wetlands are a subset of "waters of the United States" and receive protection under Section 404 of the Clean Water Act (CWA). The term "waters of the United States" as defined in Code of Federal Regulations (33 CFR 328.3[a]; 40 CFR 230.3[s]) includes:

1. All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

2. All interstate waters including interstate wetlands. (Wetlands are defined by the federal government [CFR, Section 328.3(b), 1991] as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.);

3. All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mud flats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or

natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce;

4. All impoundments of waters otherwise defined as Waters of the United States under the definition;

5. Tributaries of waters identified in paragraphs (1) through (4);

6. Territorial seas; and

7. Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (1) through (6).

8. Waters of the United States do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other federal agency, for the purposes of the CWA, the final authority regarding CWA jurisdiction remains with EPA [328.3(a)(8) added 58 CFR 45035, Aug. 25, 1993].

California Wetland Definition

Unlike the federal government, CDFG has adopted the Cowardin et al. (1979) definition of wetlands:

> Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface of the land or is covered by shallow water. For purposes of this classification, wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes (at least 50 percent of the aerial vegetative cover); (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year.

Under normal circumstances, the federal definition of wetlands requires all three wetland identification parameters to be met, whereas the Cowardin definition requires the presence of at least one of these parameters. For this reason, identification of wetlands by CDFG consists of the union of all areas that are periodically inundated or saturated, or in which at least seasonal dominance by hydrophytes may be documented, or in which hydric soils are present.

Regulation of Activities in Wetlands

The regulations and policies of various federal agencies (e.g., U.S. Army Corps of Engineers [Corps], USDA Natural Resources Conservation Service [NRCS], U.S. Environmental Protection Agency [EPA], USFWS, NMFS) mandate that the filling of wetlands be avoided unless it can be demonstrated that no practicable alternatives exist. The Corps has primary federal responsibility for administering regulations that concern waters and wetlands for this project. In this regard, the Corps acts under two statutory authorities, the Rivers and Harbors Act (Sections 9 and 10), which governs specified activities in "navigable waters," and the Clean Water Act (Section 404), which governs specified activities in "waters of the United States," including wetlands. The Corps requires that a Section 10 permit be obtained if a project proposes placing structures within navigable waters and/or alteration of waters of the U.S. below the ordinary high-water mark in

nontidal waters. The Pajaro River is considered a navigable water under Corps Section 10 only for that section lying downstream of the Watsonville Water Treatment Facility. EPA, USFWS, NMFS, and several other agencies provide comment on Corps permit applications. The EPA provides the primary criteria for evaluating the biological impacts of Corps permit actions in wetlands.

The state's authority in regulating activities in wetlands and waters in the project area resides primarily with the CDFG and the State Water Resources Control Board (SWRCB). The CDFG provides comment on Corps permit actions under the Fish and Wildlife Coordination Act. CDFG is also authorized under the State Fish and Game Code Sections 1600-1607 to develop mitigation measures and enter into a Streambed Alteration Agreement (SAA) with applicants that propose a project that would obstruct the flow or alter the bed, channel, or bank of a river or stream in which there is a fish or wildlife resource, including intermittent and ephemeral streams. The SWRCB, acting through the nine Regional Water Quality Control Boards (RWQCB), must certify that a Corps permit action meets state water quality objectives (Section 401, Clean Water Act). The Central Coast Region RWQCB will be reviewing this project.

APPLICABLE PLANS AND POLICIES

Consistency with existing plans and policies can determine whether an impact is significant (see Section 4.A.4.2). Relevant local standards are summarized below.

Monterey County General Plan

The Monterey North County Area Plan was approved in 1995 (County of Monterey, 1995). Its natural resource element provides guidance on the protection and management of biological resources within this county. Specific objectives and policies are presented below.

> **Objective 7.1:** To preserve the diversity and conserve the extent of the County's native vegetation by conducting an inventory, as feasible, of the extent and acreages of the County's most threatened or limited plant communities, including coastal strand, wetland, riparian, and maritime chaparral; and promote conservation of these communities.
>
> **Policy 7.1.1:** Development shall be carefully planned in, or adjacent to, areas containing limited or threatened plant communities, and shall provide for the conservation and maintenance of the plant communities.
>
> **Policy 7.1.2:** The County shall encourage the protection of limited or threatened plant communities through dedications of permanent conservation easements and other appropriate means.
>
> **Objective 8.2:** Encourage conservation of native trees as a component for attaining broad conservation and open space goals by conserving the abundance and diversity of the county's wildlife.
>
> **Objective 9.1:** Promote the conservation of large, continuous expanses of native vegetation as the most suitable habitat for maintaining abundant and diverse wildlife.

Policy 9.1.1: Development shall be carefully planned in areas known to have particular value for wildlife and, where allowed, shall be located so that the reasonable value of the habitat for wildlife is maintained.

Policy 9.1.2: Development shall be carefully planned in areas having high value for fish and wildlife reproduction.

Objective 9.2: Assure quality freshwater habitats through cooperation with the California Department of Fish and Game and other public and private conservation organizations.

Policy 9.2.1: Land use practices which could result in siltation and pollution of inland and marine waters shall be carefully managed in order to assure a clean and productive habitat.

Policy 9.2.2: Projects that modify or otherwise impact inland waters and waterways shall be referred to appropriate agencies for review, recommendations, and appropriate conditional permits.

Objective 11.1: To conserve natural habitats for native plant and animal species and to promote preservation of rare and endangered plant and animal species by establishing protective measures for areas of particular environmental sensitivity or concern.

Policy 11.1.1: The California Native Plant Society shall be consulted and appropriate measures shall be taken to protect rare and endangered plant species and their habitats.

Policy 11.1.2: The California Department of Fish and Game shall be consulted and appropriate measures shall be taken to protect Areas of Special Biological Importance.

Policy 11.1.3: Land uses shall be carefully controlled and waste discharges shall be prohibited in order to protect water quality in state designated Areas of Special Biological Significance, such as the South County Slough System which includes Watsonville and Harkins sloughs.

Policy 11.1.4: The outstanding features of natural areas identified by the California Natural Areas Coordinating Council and the Department of the Interior's Heritage Conservation and Recreation Service shall be carefully managed.

Policy 11.1.5: The County shall support efforts to obtain and preserve natural areas of particular biologic, scientific, or educational interest and restrict incompatible uses from encroaching upon them.

Objective 11.2: Maintain and regularly update information regarding areas of particular environmental sensitivity or concern, and coordinate these efforts with the appropriate resource agencies.

Santa Cruz General Plan

The Santa Cruz General Plan, adopted in 1994 (County of Santa Cruz, 1994), identifies sensitive habitats and provides objectives and policies for their management.

Objective 5.1: To maintain the biological diversity of the County through an integrated program of open space acquisition and protection, identification and protection of habitat and wildlife corridors and habitats, low-intensity and resource-compatible land uses in sensitive habitats and mitigations on projects and resource extraction to reduce impacts on plant and animal life.

Policy 5.1.1: The following areas are among those designated as sensitive habitat:

a) Areas which provide habitat for locally unique biotic species/communities, including, but not limited to, coastal scrub.

b) Areas adjacent to essential habitats or rare, endangered or threatened species as defined below.

c) Areas which provide habitat for Species of Special Concern as listed by California Department of Fish and Game in the Special Animals List, Natural Diversity Data Base.

d) Areas which provide habitat for rare or endangered species which meet the definition of Section 15380 of the California Environmental Quality Act.

e) Areas which provide habitat for rare, threatened or endangered species as designated by the State Fish and Game Commission, U.S. Fish and Wildlife Service or the California Native Plant Society.

f) All lakes, wetlands, estuaries, lagoons, streams and rivers.

g) Riparian corridors.

Policy 5.1.4: Implement the protection of sensitive habitats by maintaining the existing Sensitive Habitat Protection ordinance. The ordinance identifies sensitive habitats, determines which uses are allowed in and adjacent to sensitive habitats, and specifies required performance standards for land in or adjacent to those areas. Any amendments to this ordinance shall require a finding that sensitive habitats shall be afforded equal or greater protection by the amended language.

Policy 5.1.6: Sensitive habitats shall be protected against any significant disruption of habitat values: and any proposed development within or adjacent to these areas must maintain or enhance the functional capacity of the habitat. Reduce in scale, redesign, or if no other alternative exists, deny any project which cannot sufficiently mitigate significant adverse impacts on sensitive habitats unless approval of a project is legally necessary to allow a reasonable use of the land.

Policy 5.1.11: For areas which may not meet the definition of sensitive habitat, yet contain valuable wildlife resources (such as migration corridors or exceptional diversity), protect these wildlife habitat values and species and use other mitigation measures identified through environmental review process.

Policy 5.1.12: Require as a condition of development approval, restoration of any areas of the subject property which is identified as degraded sensitive habitat, with the magnitude of restoration to be commensurate with the scope of the project. Such conditions may include

erosion control measures, removal of non-native or invasive species, planting with characteristic native species, diversion of polluting run-off, water impoundment, and other appropriate means. The object of habitat restoration activities shall be to enhance the functional capacity and biological productivity of the habitat(s) and whenever feasible, to restore them to a condition which can be sustained by natural occurrences, such as tidal flushing of lagoons.

Objective 5.2: To preserve, protect and restore all riparian corridors and wetlands for the protection of wildlife and aquatic habitat, water quality, erosion control, open space, aesthetic and recreational values and conveyance and storage of flood waters.

Policy 5.2.1: Designate the following areas as Riparian Corridors:

a) 50 feet from the top of a distinct channel or physical evidence of high water mark on perennial stream;

b) 30 feet from the top of a distinct channel or physical evidence of high water mark of an intermittent stream as designated from the General Plan maps and through field inspection of undesignated intermittent and ephemeral streams;

c) 100 feet of the high water mark of a lake, wetland, estuary, lagoon, or natural body of standing water;

d) The landward limit of a riparian woodland community;

e) Wooded arroyos within urban areas.

Transitional areas between terrestrial and aquatic systems are where the water table is usually at or near the surface, or the land is covered by shallow water. Under a unified methodology now used by all federal agencies, wetlands defined as "those areas meeting certain criteria for hydrology, vegetation, and soils." Examples of wetlands are saltwater marshes, freshwater marshes, open or closed brackish water marshes, swamps, mudflats, and fens.

Policy 5.2.2: Implement the protection of Riparian Corridors and Wetlands through the Riparian Corridor and Wetland Protection ordinance. The ordinance identifies and defines riparian corridors and wetlands, determines the uses which are allowed in and adjacent to these habitats, and specifies required buffer setbacks and performance standards for land in and adjacent to these areas. Any amendments to this ordinance shall require a finding that riparian corridors and wetlands shall be afforded equal or greater protection by the amended language.

Policy 5.2.3: Development activities, land alteration and vegetation disturbance within riparian corridors and wetlands and required buffers shall be prohibited unless an exception is granted per the Riparian Corridor and Wetlands Protection Ordinance.

Policy 5.2.4: Require a buffer setback from riparian corridors in addition to the specified distances found in the definition of riparian corridor. This setback shall be identified in the Riparian Corridor and Wetland Protection ordinance and established based on stream characteristics, vegetation and slope. Allow reductions to the buffer setback only upon approval of a riparian exception. Require a 10-foot separation from the edge of the riparian

corridor buffer to any structure. For wetlands, the buffer setback is included in the riparian corridor which surrounds the wetland.

Policy 5.2.5: Prohibit development within the 100-foot riparian corridor of all wetlands. Require measurements to prevent water quality degradation from adjacent land uses, as outlined in the Water Resources section.

Policy 5.2.7: Allow compatible uses in and adjacent to riparian corridors that do not impair or degrade the riparian plant and animal systems, or water supply values, such as non-motorized recreation and pedestrian trails, parks, interpretive facilities and fishing facilities.

Policy 5.2.9: Require development in or adjacent to wetlands to incorporate the recommendations of a management plan which evaluates: migratory waterfowl use December 1 to April 30; compatibility of agricultural use and biotic and water quality protection; and the protection of adjoining lands.

Policy 5.3.5: Require new water diversions, dams, and reservoirs which are constructed on anadromous fish streams to be designed to protect fish populations and to provide adequate flow levels for successful fish production.

Policy 5.6.1: Pending a determination based on a biological assessment, preserve perennial stream flows at 95 percent of normal levels during summer months and at 70 percent of the normal winter baseflow levels. Oppose new water rights which would diminish the instream flows necessary to maintain anadromous fish runs and riparian vegetation below the 97 percent/70 percent standard.

City of Watsonville General Plan

The City of Watsonville General Plan, approved in 1994 (City of Watsonville, 1994), has a planning area that includes the city limits plus a large planning envelope around it. The planning boundaries are from Carleton Road on the east to San Andreas Road on the west, and from Corralitos, Pioneers, and Casserly roads on the north to the Pajaro River and southward a short distance into Monterey County on the south.

The plan states that the important biological resources in Watsonville and the vicinity are largely associated with water resources, including marshes, creeks, rivers, lakes, and sloughs. Wetland habitat preservation is an important planning issue, particularly when the natural setting provides protective cover for endangered or threatened species. The plan identifies the South County Slough System (which includes Watsonville Slough, Struve Slough, Hansen Slough, and Harkins Slough) as the largest and most significant wetland habitat between Pescadero Marsh to the northwest and Elkhorn Slough to the south. This area is designated as an Area of Significant Biological Importance by CDFG, and as a Significant Biotic Resource in the County's Growth Management Plan.

Objective 9.B: The City shall designate land necessary for the preservation of natural resources and to avoid conflicts with urban land uses.

Policy 9.B.2: The City shall require implementation of environmental mitigation on projects that may destroy or impair the future use or existence of natural resources.

Current Management of the Pajaro Lagoon to Protect Tidewater Goby Habitat

The 1993 Pajaro River Lagoon Management Plan (Management Plan) was prepared for Santa Cruz County to address flooding and sandbar breaching activities (Mitchell Swanson and Associates, 1993). In that plan, sandbar breaching protocols were developed to avoid adverse water quality conditions (including severe changes in salinity) in the lagoon in order to protect fish species. The Management Plan recommended the following considerations when artificially breaching the sandbar:

- Delay artificial breaching in the fall (September to early December) as long as safely possible to avoid situations where the sandbar is breached in response to a brief, early storm.

- To the extent possible, do not breach the sandbar until seasonal rains are sufficient to maintain an open sandbar during the winter.

- In the event of high lagoon water levels after sandbar formation in late spring (April to June), allow the sandbar to remain when safely possible, to prevent prolonged stratification after the bar re-forms and to prevent a delay in conversion to freshwater.

- If a late spring artificial breach of the sandbar becomes necessary, attempt a "controlled" breach. Attempt to partially open the bar to lower the lagoon water level and close the opening to prevent substantial tidal inflow. This will lessen the opportunity for lagoon stratification.

REFERENCES – Vegetation, Fish, and Wildlife

Bybee, James, Habitat Manager, National Marine Fisheries Service, Southwest Region, Santa Rosa, CA, Letter to Mr. Harry Schueller, State Water Resources Control Board, dated April 18, 2001.

California Department of Fish and Game (CDFG*), Federal and State Listed Threatened and Endangered Plants and Animals By County*, 1997.

California Natural Diversity Data Base (CNDDB), California Natural Diversity Data Base printout for U.S.G.S. 7.5 Minute Topographic Quadrangles: Watsonville East, Watsonville West, and Moss Landing, 1997.

California Natural Diversity Data Base (CNDDB), California Natural Diversity Data Base printout for U.S.G.S. 7.5 Minute Topographic Quadrangles: Watsonville East, Watsonville West, and Moss Landing, 2001.

City of Watsonville, *Watsonville 2005 General Plan*, 1994

County of Santa Cruz, *General Plan and Local Coastal Program Land Use Plan*, 1994.

County of Monterey, *North County Area Plan*, 1995

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe, *Classification of Wetlands and Deepwater Habitats of the United States*, U.S. Fish and Wildlife Service, Office of Biological Services, Washington, D.C. Publ. No. FWS/OBS-79/31, 1979.

Environmental Science Associates, *Red-Legged Frog Site Assessment, Pajaro Valley Water Management Agency Import Pipeline*, prepared for the Pajaro Valley Water Management Agency, Watsonville, 1997a.

Environmental Science Associates, Pajaro Valley Water Management Agency Import Pipeline investigations, prepared for the Pajaro Valley Water Management Agency, Watsonville, 1997b.

Environmental Science Associates, *Pajaro Valley Water Management Agency Local Water Supply and Distribution Pipeline Project California Red-legged Frog and sensitive Amphibian and Reptile Species Site Assessment*, prepared for the Pajaro Valley Water Management Agency, Watsonville, 1999a.

Environmental Science Associates, *Preliminary Delineation of Wetlands and Other Waters of the U.S., Pajaro Valley Water Management Agency Local Supply and Distribution Pipeline Project*, prepared for the Pajaro Valley Water Management Agency, Watsonville, 1999b.

Federal Register, *Listing of Several Evolutionary Significant Units (ESU's) for West Coast Steelhead: Final Rule*, FW081897.2, 1997.

Federal Register, *Endangered and Threatened Wildlife and Plants; Proposed Rule to Remove the Northern Population of the Tidewater Goby from the List of Endangered and Threatened Wildlife*, Vol. 64, No. 121, June 24, 1999; 2001.

Federal Register, *Designated Critical Habitat: Critical Habitat for 19 Evolutionarily Significant Units of Salmon and Steelhead in Washington, Oregon, Idaho, and California – Final Rule*, Vol. 65, No. 32, February 16, 2000.

Habitat Restoration Group (HRG), *Fisheries Report for the Pajaro Valley Water Management Agency Water Supply Project*, prepared for Environmental Science Associates, San Francisco, 1997.

Hickman (editor), *The Jepson Manual of Higher Plants of California*, University of California Press, Berkeley, California, 1993.

Holland, R.F., *Preliminary Descriptions of the Terrestrial Natural Communities of California*, Department of Fish and Game, Sacramento, CA, 1986.

Jennings, M. and M. Hayes, *Amphibian and Reptile Species of Special Concern in California*, California Department of Fish and Game, Rancho Cordova, CA, 1994.

Mayer, K.E. and W.F. Laudenslayer (eds.), *A Guide to Wildlife Habitats of California*, California Department of Fish and Game, Sacramento, CA. 1988.

Mitchell Swanson and Associates, *Pajaro River Management Lagoon*, prepared for Santa Cruz County Public Works Department and the California State Coastal Conservancy, 1993.

Munz, P.A. and D.D. Keck, *A California Flora with Supplement*, University of California Press, Berkeley, CA, 1970.

Skinner, M.W. and B.M. Pavlik (eds.), *California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California*, Special Publication No. 1 (Fifth Edition), California Native Plant Society, Sacramento, California, 1994.

Smith, J., *The Effects of Sandbar Formation and Inflow on Aquatic Habitat and Fish Utilization in Pescadero, San Gregorio, Waddell and Pomponio Creek Estuary/Lagoon Systems, 1985-1989*, Report to the California Department of Parks and Recreation, 1990.

Soil Conservation Service (SCS), *Soil Survey of Santa Cruz County, California*, 1976.

Soil Conservation Service (SCS), *Soil Survey of Monterey County, California*, 1978.

State Water Resources Control Board (SWRCB), *Staff Report – Assessing Site Specific and Cumulative Impacts on Anadromous Fisheries in Coastal Watersheds in Northern California*, January 23, 2001.

Swanson, Mitchell, and Kathleen Lyons, *Final Pajaro River Corridor Management Plan*, prepared for Santa Cruz County Public Works Department and California State Coastal Conservancy, 86 pp., 1992.

U.S. Fish and Wildlife Service, *Endangered and Threatened Wildlife and Plants; Final Determinations of Critical Habitat for the California Red-Legged Frog; Final Rule*, 50 CFR Part 17, pages 14626-14674, 2001.

3.5 CULTURAL RESOURCES

3.5.1 REGIONAL SETTING

This section summarizes the information from a cultural resources survey and literature review for prehistoric and historic resources conducted by Pacific Legacy, Inc. Because of the sensitivity of cultural resources, specific details regarding the location and nature of identified cultural resources is kept confidential.

ARCHAEOLOGY

Archaeological context for project components is derived from research in the southern Santa Clara Valley region and the Monterey Bay region. Prehistoric characteristics of these areas are described below.

Southern Santa Clara Valley Region

Research and investigations performed by King and Hickman (1973) and Hildebrandt and Mikkelsen (1993) provide a general description of prehistoric habitation characteristics in the southern Santa Clara Valley region of the project area. Based on a database of approximately 50 prehistoric sites, King and Hickman identified the following sequence for subsistence and settlement patterns for the prehistoric inhabitants of the region:

> **Millingstone Period (7000-4000 years before the present [B.P.]):** This period consists of initial settlement of the project area.
>
> **Middle Period (4000-1500 B.P.):** This period is considered the peak of sedentary settlement development with reliance on a subsistence economy, using storage of foods such as acorns, and with interregional exchange, warfare, and population pressure.
>
> **Protohistoric Period (1500-400 B.P.):** The Protohistoric Period consists of an adaptive shift to more mobile settlement patterns and the dissemination of population concentrations.

Recent research performed by Hildebrandt and Mikkelsen (1993) has resulted in the general development of the following cultural chronology:

> **Early Period (4500-2500 B.P.):** This period is characterized by a high degree of mobility and a wide array of faunal remains in the coast and inland areas.
>
> **Middle Period (2500-850 B.P.):** The Middle Period is identified by a lower degree of mobility with fewer marine shells, more structures and indications of year-round occupation, and a higher variety of tools.
>
> **Late Period (post 850 B.P.):** This period is characterized by a reduction in territorial base, a lack of marine shell, and more usage of local resources.

Monterey Bay Region

Breschini and Haversat (1992) have proposed two archeological population patterns within the Middle Period for the Monterey Bay region: the Sur Pattern (appears by 3000 B.P.) and the Monterey Pattern (after 2450 B.P.). The Sur Pattern is thought to correspond with "Hokan" ancestors of the Esselen and represents an early "forager" subsistence strategy. The Monterey Pattern corresponds with "Penutian" ancestors of historic Costanoan and represents a "collector" subsistence strategy pursued by Costanoan speakers.

In addition, investigations by Dietz and Jackson (1981) identified the existence of two different subsistence strategies. The first population was identified as foragers that utilized the project area approximately 4,000 years ago. The second population was identified as collectors that utilized temporal and seasonal residential bases and camps. Archaeologically, the two populations represent a distinct shift in settlement, subsistence, and use of the region through time.

ETHNOGRAPHY

The ethnographically documented aboriginal inhabitants of the project area were part of the Ohlone, or Costanoan, language group, which extended from the San Francisco Bay area south to the southern Monterey Bay and lower Salinas River areas. Ethnographic information regarding people in this group is obtained from records of early Spanish explorers, documents maintained at missions, the works of ethnographs and linguists, and from Native American descendants.

The Ohlone/Costanoan languages belong to the Utian family, of the Penutian language stock (Shipley, 1978). Ohlone/Costonoan languages were spoken in a large area extending from the San Francisco Bay area, southward along the coast to Point Sur, and inland to the Diablo Range and portions of the northern San Joaquin Valley. Four groups are noted within the project area: Tiuvta, Unijaima, Motsun, and Ausaima (Milliken et al., 1993). The Tiuvta were a tribelet within the Calendruc tribe that occupied the Pajaro River, Elkhorn Slough, and lower Salinas River areas. The Unijaima lived in the mountains and plains of southwestern Santa Clara Valley, north of the Pajaro River, while the Motsun lived in the San Juan Valley and in the mountains southwest of the valley. The Ausaima lived in the eastern portion of the San Felipe Sink and the hills on the west side of Pacheco Pass.

HISTORICAL OVERVIEW

The history of the Monterey Bay and the southern Santa Clara Valley regions can be divided generally to three periods: Spanish arrival and colonization, Mexican independence and the ranchos, and Anglo-American expansion.

Spanish Arrival and Colonization

Colonization by the Spanish in what was then known as Alta California occurred in the late 1700s. Captain Gaspar de Portola led the earliest land expedition along the coast in 1769 (Hoover et al., 1990), followed by Pedro Fages in 1770 and 1772, Fernando Javier de Rivera in

1774, and Juan Bautista de Anza in 1776. All except Portola's expedition traveled on the east side of the Santa Cruz Mountains, along a route later to become known as El Camino Real.

Soon after the first of these expeditions, Missions San Carlos de Borromeo (1770), Santa Clara (1777), and Santa Cruz (1791) were founded. The mission closest to the project area, San Juan Bautista, was founded in 1797. The mission system was an important institution in the colonization process of Alta California. The purposes of the system were to Christianize native people and inculturate them into the Hispanic lifeways of the colonizers. A process of culture change occurred that brought most of the native peoples in the area into the mission system by 1810. At the expense of traditional skills, the neophytes were taught the horticultural and pastoral skills of the Hispanic tradition.

Mexican Independence and Ranchos

A process of land granting was instituted soon after the mission system began (the first grant was made in 1775) (Hoover et al., 1990). Granting of land, called ranchos, continued throughout the Spanish Period and created the beginning of the cattle industry in California. Within a few years, ranchos occupied large tracts in the vicinity of the missions, and a pastoral economy involving the missions, the rancheros, and the neophytes was established.

With the declaration of Mexican independence in 1821, Spanish control of Alta California ceased. Political change did not begin in earnest until mission secularization in 1834, when the native peoples were freed from missionary control, and mission lands were granted to private individuals.

During this time period, cattle hides and tallow were the medium of exchange in local business transactions and with international trading ships. The Mexican population continued to grow and the native population continued to decline. Anglo-Americans began to settle in Alta California, often marrying into Mexican families, becoming Mexican citizens, and receiving land grants.

Anglo-American Expansion

After the Mexico-U.S. War, the 1848 Treaty of Guadelupe Hidalgo formalized Mexico's capitulation, and Alta California was annexed by the United States. News of the gold strike in the Sierra Nevada mountains that same year sparked a huge migration into California, beginning the Anglo-American occupation of California. Due to a combination of Gold Rush-related immigration and land ownership disputes resulting from the transition from Mexican to U.S. authority, the project area began to change rapidly.

The latter half of the 19th century saw a continued Anglo-American immigration into the project area, and consequent changes in the culture and economy of the area. Anglo-American culture steadily became the predominant culture in California, though the Hispanic culture continued to exist. Dispersed farmsteads slowly replaced the immense Mexican ranchos. The farming of wheat, sugar beets, and other specialized crops slowly replaced cattle ranching as the primary economic activity in the project area.

With the coming of the railroad to the project area in the late 1800s and the mechanization of farming with steam-driven machinery, agricultural activities in the region were altered. Larger tracts of land were farmed, often on land reclaimed from the sloughs and lowlands adjacent to the Pajaro River. Tar and asphalt were commercially exploited during the 1860s, while granite mining was started in 1900 in the Pajaro Gap area. By the 20th century, farming activities predominated both the Pajaro Valley and southern Santa Clara Valley.

REFERENCES – Cultural Resources

Breschini and Haversat, *Baseline Archaeological Studies at Rancho San Carlos, Carmel Valley, Monterey County, California, Archives of California Prehistory 36,* Coyote Press, Salinas, 1992.

Dietz, S.A., and T.L. Jackson, *Report of Archaeological Investigations at Nineteen Archaeological Sites for the Stage I Pacific Grove Monterey Consolidation Project of the Regional Sewage System*, 1981.

Hildebrandt and Mikkelsen, *Archaeological Test Excavations at Fourteen Sites Along Highways 101 and 152, Santa Clara and San Benito Counties, California, Volume 1*, 1993.

Holson, John, Pacific Legacy, Incorporated, Written Correspondence, November 14, 1997.

Hoover, M.B., H.E. Rensch, E.G. Rensch, and W.N. Abeloe, *Historic Spots in California*, Stanford, California: Stanford University Press, 1990.

King, T.F., and P.P. Hickman, The Southern Santa Clara Valley: *A General Plan for Archaeology, San Felipe Division, Central Valley Project*, Report S-5222, On file Northwest Information Center, Sonoma State University, Rohnert Park, California, 1973.

Milliken R.T., J.G. Costello, C. Johnson, G.A. Laffey, A. Sayers, and P. Orozco, *Archaeological Test Excavations at Fourteen Sites Along Highways 101 and 152, Santa Clara and San Benito Counties, California, Volume 2: History, Ethnohistory, and Historic Archeology*, Report S-15442, on file Northwest Information Center, Sonoma State University, Rohnert Park, California, 1993.

Pacific Legacy, Incorporated, *Cultural Resources Survey for the Pajaro Valley Water Management Agency Distribution Pipeline, Draft Final Report,* Berkeley, California, October, 1997.

Shipley, W. F., Native Languages of California, in California, R.F. Heizer, ed. *Handbook of North American Indians*, Vol. 8, pp. 80-90, Washington, D.C.: Smithsonian Institution, 1978.

3.6 TRAFFIC AND CIRCULATION

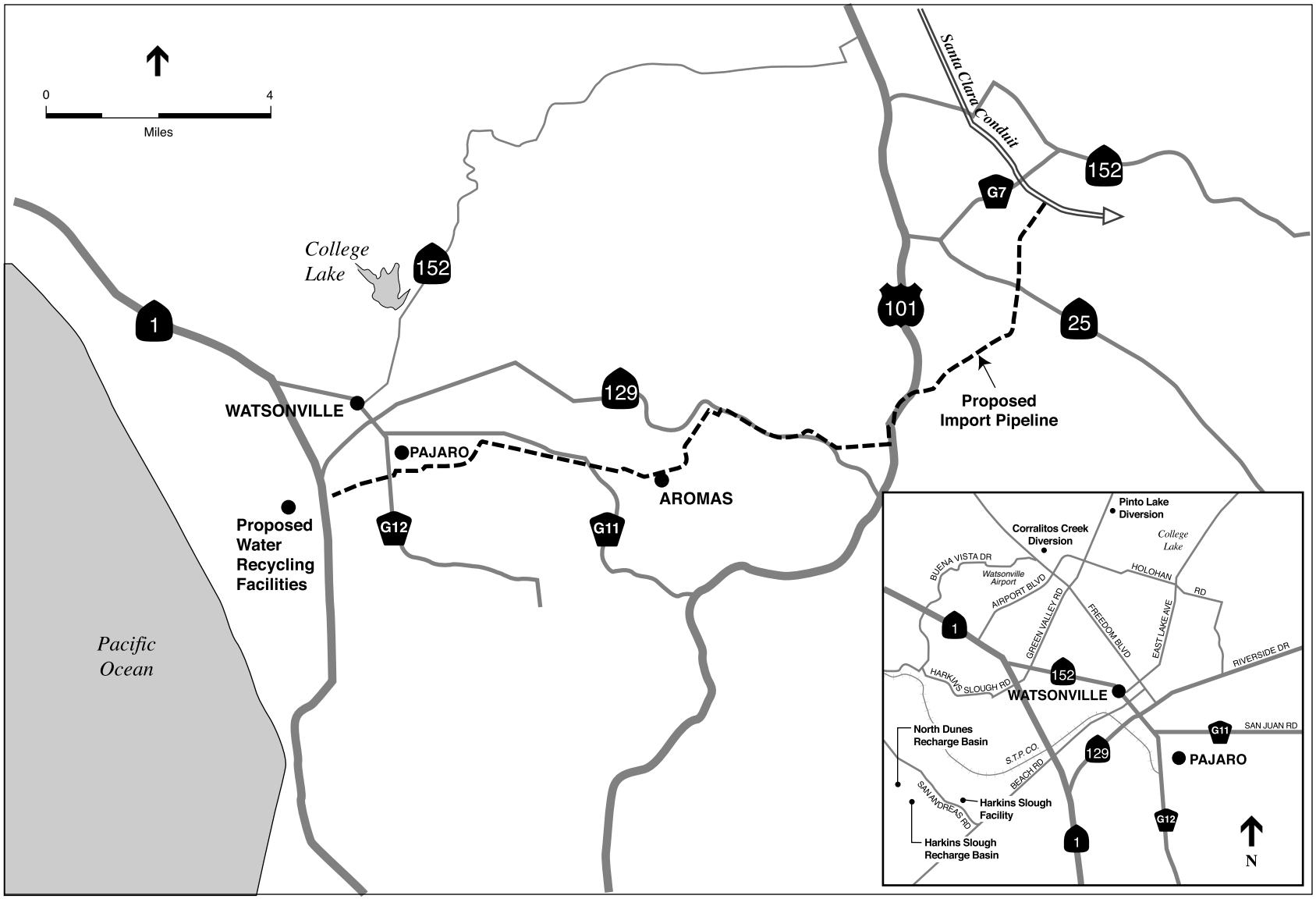
3.6.1 REGIONAL SETTING

The project area is served by a roadway network of state highways (including freeways) and county and local roads. **Figure 3.6-1** and **Maps A1** through **A4** in Map Appendix A illustrate the primary regional roadways. Highway 101 serves as the primary north-south regional route to the project area, providing connection north to the San Francisco Bay Area and south to the Salinas Valley and beyond. Highway 101 is a four-lane divided freeway throughout the project area. The posted speed limit on Highway 101 in the project area is 65 miles per hour (mph). Highway 1 (Cabrillo Highway) provides coastal access through the project area, providing connection to the cities of Watsonville and Santa Cruz to the north, and Monterey and other central coast destinations to the south. In the project area, Highway 1 is a four-lane divided freeway to approximately one mile south of the Santa Cruz-Monterey county line, where it narrows to two lanes. The posted speed limit on Highway 1 in the project area ranges from 55 to 65 mph.

Direct access to Highway 101 and/or Highway 1 is provided by Highway 129 and Highway 152. Highway 129 (Riverside Drive/Chittenden Road) provides east-west access through the project area, providing connection between Highway 1 (in Watsonville) and Highway 101. In the vicinity of the Pajaro Gap (near Granite Construction Company quarry and Chittenden Pass), Highway 129 is characterized by numerous curves, frequent changes in elevation, and narrow shoulders. In winter, rockfalls and mudslides commonly result in temporary closure of Highway 129 in the gap. The posted speed limit on Highway 129 ranges from 40 to 55 mph. The majority of Highway 129 is two lanes, except in downtown Watsonville, where it is four lanes.

Highway 152 provides east-west access through the project area, stretching east from Highway 1 to the Central Valley. In the west portion of the project area, Highway 152 runs through Watsonville (along Main Street, East Beach Street, Lincoln Street, and East Lake Avenue) to Hecker Pass and Santa Clara County. Due to the winding nature of Highway 152 over Hecker Pass, signs are posted prohibiting trucks over 45 feet in length from using that portion of the highway. The majority of Highway 152 is two lanes, except in downtown Watsonville, where it is four lanes. The posted speed limit on Highway 152 ranges from 25 to 35 mph in Watsonville, and 50 to 55 mph outside this urbanized area.

In addition to the regional roadways described above, the Union Pacific Railroad (UPRR) maintains tracks that extend through the project area. A UPRR line winds south through Santa Cruz County and Monterey County to Watsonville and Pajaro, continuing south through Monterey County. A connecting UPRR line extends east from Pajaro to Aromas, and further east into San Benito and Santa Clara counties.



SOURCE: Environmental Science Associates

Figure 3.6-1
Major Roadways in the Project Area

TRAFFIC VOLUMES

Table 3.6.1 presents daily traffic volumes on study area roadways. Weekday traffic on the freeways and major arterials within the project area consists primarily of commute traffic within the peak traffic periods, and a mix of residential, commercial, and industrial trips throughout the day. Daily traffic in the project vicinity is generally highest on roadways leading to and from Highway 101 and Highway 1. Some of the minor project roadways are rural in nature, serving a high percentage of agricultural-related traffic.

EXISTING TRUCK TRAFFIC ON ROADWAYS

The highways assessed in this EIR are County-designated truck routes. In addition, Quarry Road and Aromas Road are designated truck routes in San Benito County and Monterey County, respectively.

Truck traffic as a percentage of total traffic on the state routes in the project area is heaviest on Highway 101 and Highway 129. Truck traffic on Highway 101 in the project vicinity accounts for between 10 to 19 percent of total daily traffic. Truck traffic on Highway 129 accounts for approximately 20 percent of total daily traffic in the Chittenden Pass / Pajaro Gap vicinity, decreasing to between 12 and 15 percent in Watsonville (Caltrans, 1998).

Truck traffic on Highway 1 accounts for approximately 5 percent of total daily traffic north of Highway 152 in Watsonville, increasing to approximately 10 percent south of Salinas Road, in Monterey County. Truck traffic on Highway 152 accounts for less than 5 percent near Watsonville (Caltrans, 1998).

ACCIDENT HISTORY

Available accident data from accident reports maintained by Caltrans and Monterey County Public Works Department were compiled for the three-year period between 1994/1995 and 1996/1997. Santa Cruz County considers accident data confidential and does not release accident reports. **Table 3.6.2** presents traffic accident rates in terms of number of accidents per million vehicle-miles traveled (MVMT) for the major roadways in the project area. These rates have been examined to determine if these roads exhibit any unusual safety problems or accident statistics. Accident characteristics along the study roadways are summarized below.

Highway 1

As shown in **Table 3.6.2,** both the two-lane segment within Monterey County and the four-lane segment mostly within Santa Cruz County experienced a slightly lower three-year average accident rate than the statewide average for roadways of this type. Of the 209 accidents reported on the study segment within the three-year period, approximately 43 percent involved injuries, and 3 percent involved fatalities.

TABLE 3.6.1
EXISTING DAILY TRAFFIC VOLUMES ON ROADWAYS IN VICINITY OF PROJECT AREA

Roadway	Number of Lanes[a]	Location	Daily Traffic (vpd)[a]
Santa Clara County			
Highway 101	4D	n/o Highway 152 East	75,000
		s/o Highway 152 East	55,000
		s/o Highway 25	45,500
Highway 25 (Bolsa Road)	2	s/o Highway 101	20,000
Highway 152 (Pacheco Pass Highway)	2	w/o County Road G7	15,800
County Road G7 (Bloomfield Ave.)	2	e/o and w/o Frazier Lake Road	650
Frazier Lake Road	2	s/o County Road G7	2,840
San Benito County			
Highway 101	4D	n/o Highway 129 West	44,500
		s/o Highway 129 West	45,000
Highway 25 (Bolsa Road)	2	s/o San Benito-Santa Clara county line	18,700
Highway 129 (Chittenden Road)	2	w/o Highway 101	9,600
Frazier Lake Road	2	At San Benito-Santa Clara county line	3,380
Santa Cruz County			
Highway 1 (Cabrillo Hwy)	4D	n/o Highway 129	38,000
		s/o Highway 129	36,000
Highway 129 (Riverside Dr.)	2	e/o Carpenteria Rd. (Rogge Ln.)	9,600
		w/o Carpenteria Rd. (Rogge Ln.)	8,800
		e/o Lakeview Road	10,500
		e/o Main Street	23,500
		e/o Highway 101	17,300
Highway 152 (East Lake Ave.)	2	s/o Holohan Road	12,500
		n/o Holohan Rd./College Rd.	11,000
		s/o Carlton Road	9,200
Highway 152 (Main St./	2/4[b]	Main St., e/o Highway 1	24,500
E. Lake Ave./E. Beach St. /Lincoln St.)		E. Beach St./E. Lake Ave. couplet	15,600
Lakeview Road	2	s/o College Road	4,480
College Road	2	e/o Highway 152	6,635
Holohan Road	2	e/o Green Valley Road	14,890
Green Valley Road	2	n/o Holohan Road	18,112
Amesti Road	2	w/o Green Valley Road	4,420
Freedom Boulevard	2	n/o Buena Vista Drive	7,970
	2	s/o Buena Vista Drive	17.910
Buena Vista Drive	2	w/o Freedom Boulevard	6,765
Harkins Slough Road	2	e/o Buena Vista Drive	1,190
San Andreas Road	2	n/o Beach Road	7,555
Beach Road	2	e/o San Andreas Road	7,050

TABLE 3.6.1 (Continued)
EXISTING DAILY TRAFFIC VOLUMES ON ROADWAYS
IN VICINITY OF PROJECT AREA

Roadway	Number of Lanes[a]	Location	Daily Traffic (vpd)[a]
Monterey County			
Highway 1 (Cabrillo Highway)	2/4D	s/o Monterey-Santa Cruz co. line	32,500
		s/o Jensen Road	36,500
County Road G11 (San Juan Road)	2	e/o Murphy Road	8,200
		w/o San Miguel Canyon Road	9,500
County Road G12 (Salinas Road)	2	s/o Porter Drive	18,000
Aromas Road	2	w/o Carpenteria Road	2,400
Carpenteria Road	2	s/o Aromas Road/Quarry Road	2,300
Murphy Road	2	n/o San Juan Road	4,900
Murphy Road	2	S/o Murphy Crossing	3,200
San Miguel Canyon Road	2	s/o San Juan Road	1,700
Hayes Road	2	e/o Lewis Road	250
Lewis Road	2	e/o Salinas Road	1,400
Trafton Road	2	w/o Salinas Road	1,100
		e/o Bluff Road	1,200
Bluff Road	2	n/o Jensen Road	1,300

a D = divided roadway; vpd = vehicles per day
b East Lake Avenue and East Beach Street serve as couplet for Highway 152 between Main Street and Lincoln Street in downtown Watsonville.

SOURCES: Caltrans, 2000; San Benito County Public Works Department, 2000; Santa Clara County Roads and Airports Department, 1997; Santa Cruz County Regional Transportation Commission, 2001; Monterey County Department of Public Works, 2000.

Highway 129

The segment of Highway 129 within Santa Cruz County (Riverside Drive) experienced a higher average accident rate than the statewide average for the three-year reporting period. In particular, the Highway 129 segment passing through the Pajaro Gap between the San Benito-Santa Cruz county line and Rogge Lane experienced a markedly higher accident rate (over 1½ times) than the statewide average for roadways of this type. On this 1.4-mile-long segment, a total of 180 accidents occurred within the three-year reporting period, with approximately 24 percent of those accidents resulting in injuries, and no fatalities.

TABLE 3.6.2
REPORTED ROADWAY ACCIDENT RATES IN THE PROJECT AREA[a]

Roadway	Reported Accidents/ MVMT[b,c]			3-Year Average Rate	Expected Rate (Statewide Average)
	94/95	95/96	96/97		
Highway 101					
Between Highway 152 East and Santa Clara-San Benito County line	0.73	0.75	0.81	0.77	0.74
Between Santa Clara-San Benito County line and Highway 129 West	0.28	0.48	0.46	0.41	0.52
Highway 1 (Cabrillo Highway)					
2-lane segment, from 0.6 miles south of Highway 129 to Dolan Road	0.63	0.87	0.84	0.78	0.91
4-lane segment, from Highway 152 to 0.6 miles south of Highway 129	0.51	0.61	0.45	0.52	0.56
State Route 25 (Bolsa Road)					
Between Highway 101 and San Benito-Santa Clara county line	1.53	1.24	1.14	1.29	0.92
Highway 129 (Chittenden Road)					
Between Highway 129 West and Santa Cruz-San Benito county line	1.47	1.15	0.83	1.13	1.45
Highway 129 (Riverside Drive)					
Between Santa Cruz-San Benito county line and Aromas Road (Rogge Lane)	4.16	4.02	3.97	4.05	2.51
Between Aromas Road (Rogge Lane) and Lakeview Road	1.84	2.26	1.45	1.85	1.63
Between Lakeview Road and Highway 1	1.83	1.75	2.07	1.89	1.45
State Route 152 (Pacheco Pass Highway)					
Between Highway 101 and Bloomfield Avenue	1.23	1.30	0.83	1.12	1.25
Highway 152 (E. Lake Ave./Main St./ E. Beach St./Lincoln Avenue)					
Between Holohan Road and Highway 1	6.32	4.91	5.22	5.48	2.32
County Road G7 (Bloomfield Avenue)					
Between Highway 152 and Highway 25	8.43	0	0	2.81	1.23
County Road G11 (San Juan Road)					
Between Porter Drive and Aromas Road	2.43	1.96	1.53	1.98	1.23
Salinas Road (a portion is County Road G12)					
Between Highway 1 and San Juan Road	2.65	1.62	2.49	2.24	1.76

[a] Estimated and expected accident rates on state routes obtained from Caltrans, District 4. Estimated and expected accident rates on county roads based on information from the Statewide Integrated Traffic Reporting System (SWITRS), obtained from the Monterey County Department of Public Works; and *1995 Accident Data on California State Highways*, Caltrans, 1996.

[b] Accident data on state routes is for the reporting periods: June 1, 1994 through May 31, 1995; June 1, 1995 through May 31, 1996; and June 1, 1996 through May 31, 1997, respectively. Accident data obtained from SWITRS data are for the reporting periods: January 1 through December 31, 1994, January 1 through December 31, 1995, and January 1 through December 31, 1996.

[c] MVMT = million vehicle-miles traveled.

SOURCE: Environmental Science Associates, 1997

Highway 152

The segment of Highway 152 located within the City of Watsonville (East Lake Avenue/East Beach Street/Lincoln Avenue/Main Street) reported a markedly higher three-year average accident rate (over two times) than the statewide average for roadways of this type. On this segment, a total of 423 accidents occurred within the three-year reporting period, with approximately 35 percent of those accidents resulting in injuries, and one fatality.

The two-lane segment of Highway 152 between College Road and Carlton Road (East Lake Avenue) experienced a lower average accident rate than the statewide average, with a total of 32 accidents occurring within the three-year reporting period.

San Juan Road (County Road G11)

San Juan Road (between Porter Drive and Aromas Road) experienced an approximately 60 percent higher three-year average accident rate than the statewide average for roadways of this type. Of the 96 accidents reported on the study segment within the three-year reporting period, approximately 25 percent involved injuries, and there was one fatality.

Salinas Road

Salinas Road (between Highway 1 and San Juan Road), a portion of which is County Road G12, experienced a higher three-year average accident rate than the statewide average. Of the 94 accidents reported on the study segment within the three-year reporting period, approximately 25 percent involved injuries, and there was one fatality.

ROADWAY IMPROVEMENT PROJECTS

As presented in **Table 3.6.3,** a number of transportation improvement projects are planned by the affected jurisdictions to help improve future traffic flow and circulation in the project area.

3.6.2 REGULATORY CONTEXT

PERMITS

Encroachment permits would be required from the counties of Monterey and Santa Cruz for construction within or across county public roadways; an encroachment permit from Caltrans would be required for construction within or across state routes.

GENERAL PLANS

The circulation elements of general plans serve to guide the maintenance and improvement of the circulation system at the county and city level. A description of applicable goals (typically stated as level-of-service [LOS] designations) from applicable circulation elements is provided below.

TABLE 3.6.3
PLANNED TRANSPORTATION IMPROVEMENT PROJECTS
IN THE PROJECT AREA

Roadway	Planned Improvements
San Benito County[a, b]	
State Route 25 (between Santa Clara-San Benito county line to San Felipe Road)	Widen to four-lane rural highway, including one bridge.
State Route 25 Bypass (between San Felipe Road and Sunnyslope Road)	Construct four-lane arterial, Park Street extension to Prospect Avenue.
Santa Cruz County[c,d]	
State Route 152	Widen to three lanes from City of Watsonville to College Road.
Harkins Slough Road Interchange	Widen overcrossing from two to three lanes, add northbound on-ramps and southbound off-ramps.

a Council of San Benito County Governments, *San Benito County Traffic Impact Fee Update*, 1997.
b Snyder, John, San Benito County Public Works, personal communication, January 8, 2001.
c Santa Cruz County, *1994 General Plan and Local Coastal Program for the County of Santa Cruz, California*, 1994.
d Santa Cruz County Regional Transportation Commission, Capital Improvement Program from *1996 Santa Cruz County Congestion Management Program*, 1996.
e DiGrazia, Steve, California Department of Transportation, District 5, personal communication, January 8, 2001.

SOURCE: Environmental Science Associates, 2001.

Santa Cruz County

Policy 3.12.1 of the *1994 General Plan and Local Coastal Program for the County of Santa Cruz* states that LOS C is considered the objective, but LOS D is the minimum acceptable level of service (where costs, right-of-way requirements, or environmental impacts of maintaining LOS are excessive, capacity enhancement may be considered infeasible). Projects that would cause LOS at an intersection or on an uninterrupted highway segment to fall below LOS D during the weekday peak hour will be required to mitigate their traffic impacts (County of Santa Cruz, 1994).

Policy 3.94 of the *1994 General Plan and Local Coastal Program for the County of Santa Cruz* requires that contractors and utility companies doing roadside work maintain the road edge in the best possible condition during construction and, upon project completion, improve the road shoulder to the preconstruction condition or better (County of Santa Cruz, 1994).

Monterey County

The transportation section of the *North County Area Plan* states that LOS C or better is the objective for all roads in the County (County of Monterey, 1994). However, no minimum acceptable LOS standards are identified.

City of Watsonville

Policy 10.C of the *Watsonville 2005 General Plan* states that City shall maintain a minimum LOS D on all arterial and collector streets serving the City, except for those accepted to operate at less than LOS D in the *1998-2005 Major Streets Master Plan*, as updated in 1992 (City of Watsonville, 1994).

CONGESTION MANAGEMENT PROGRAM

The passage of Proposition 111 in 1990 required urban counties to prepare and periodically update a Congestion Management Program (CMP); these include Santa Cruz and Monterey counties. The purpose of the CMP is to reduce congestion on selected segments of county roadways (CMP system). The CMPs are prepared by the county Congestion Management Agency (CMA). Responsibilities of the CMA include preparing and implementing the CMP and coordinating transportation planning for the counties.

Monterey County

The Transportation Agency for Monterey County serves as Monterey County's CMA. The CMP roadway system in Monterey County includes Highway 1, County Roads G11 and G12, Aromas Road, and Carpenteria Road within the project area. The *Traffic Congestion Management Program* for Monterey County identifies LOS C as a goal for the entire network (although the program recognizes this may not be feasible for all roadways and identifies the need for re-evaluation), LOS D as the minimum level for those urban roads operating at LOS D or better as of the 1991 monitoring, LOS C for rural roads operating at LOS D or better as of the 1991 monitoring, and the existing LOS as of the 1991 monitoring for all other roads (Transportation Agency for Monterey County, 1994).

Santa Cruz County

The Santa Cruz County Regional Transportation Commission serves as Santa Cruz County's CMA. The CMP roadway system in Santa Cruz County includes Highway 101, Highway 1, and Highway 152 within the project area. The *1996 Santa Cruz County Congestion Management Program* states that the level-of-service standard for each CMP intersection and freeway segment is LOS D or the current level of service, whichever is worse (Santa Cruz Regional Transportation Commission, 1996).

REFERENCES – Traffic and Circulation

California Department of Transportation (Caltrans), *1995 Accident Data on California State Highways*, Caltrans, 1996.

California Department of Transportation (Caltrans), *1999 Traffic Volumes on California State Highways*, June 1997.

California Department of Transportation (Caltrans), *1995 Annual Average Daily Truck Traffic on the California State Highway System*, 1998.

City of Watsonville, *Watsonville 2005 General Plan*, adopted May 24, 1994.

County of Monterey, *North County Area Plan*, amended 1994.

County of Santa Cruz, *1994 General Plan and Local Coastal Program for the County of Santa Cruz*, 1994.

Santa Cruz County Regional Transportation Commission, *1996 Santa Cruz County Congestion Management Program*, June 1996.

Transportation Agency for Monterey County, *Traffic Congestion Management Program*, 1994.

3.7 AIR QUALITY

3.7.1 REGIONAL SETTING

The primary factors that determine air quality are the locations of air pollutant sources and the amounts of pollutants emitted. Meteorological and topographical conditions, however, are also important. Atmospheric conditions such as wind speed, wind direction, and air temperature gradients interact with the physical features of the landscape to determine the movement and dispersal of air pollutants.

The project site is in the North Central Coast Air Basin (NCCAB). The NCCAB is comprised of Monterey, Santa Cruz, and San Benito counties. The Pajaro Valley Water Management Agency (PVWMA) lies within the northern portion of the NCCAB. The PVWMA service area is bounded by the Santa Cruz range to the north and northeast, the Pacific Ocean to the west, and the Salinas Valley to the south.

The semipermanent high-pressure cell over the eastern Pacific Ocean is the basic controlling factor in the climate of the air basin. In the summer, the high pressure cell is dominant and causes persistent west and northwest winds over the entire California coast. The onshore air currents pass over cool ocean waters and bring fog and relatively cool air into the coastal valleys. The warmer air aloft acts as a lid to inhibit vertical air movement.

The generally northwest-southeast orientation of mountainous ridges tends to restrict and channel the summer onshore air currents. Typically during the fall, when surface winds become weak, north or east winds develop and transport pollutants from either the San Francisco Bay Area or the Central Valley into the NCCAB.

During the winter, the Pacific high-pressure area has less influence on the air basin. Air frequently flows in a southeasterly direction out of the Salinas and San Benito valleys, especially during night and morning hours. Northwest winds are still dominant in the winter, but easterly flow is more frequent. The absence of deep, persistent inversions and the occasional storm systems usually result in good air quality for the basin as a whole in winter and early spring.

3.7.2 REGULATORY CONTEXT

Regulation of air quality is achieved through implementation of national and state ambient air quality (concentration) standards and enforcement of emissions limits for individual sources of air pollutants. The federal Clean Air Act required the U.S. Environmental Protection Agency (EPA) to identify national ambient air quality standards (NAAQS) to protect public health and welfare. NAAQS have been established for ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, suspended particulate matter (PM_{10}), and lead. These pollutants are called “criteria” air pollutants because the corresponding ambient standards satisfy criteria specified under the

Clean Air Act. The State of California has established its own ambient air quality standards (SAAQS), which are generally more stringent than their national counterparts.

The federal Clean Air Act required U.S. EPA to designate air basins, or portions thereof, as either "attainment" or "nonattainment" for each criteria air pollutant, based on whether or not the national standards have been achieved. The California Clean Air Act, patterned after the federal Clean Air Act, also required that areas be designated as "attainment" or "nonattainment," but with respect to the state standards rather than the national standards. The NCCAB is currently designated as "nonattainment" for state ozone and PM_{10} standards (California Air Resources Board [CARB], 2000). Based on monitoring data from the 1970s and 1980s, the NCCAB was designated as "nonattainment" for the national ozone standard, but has been redesignated as "attainment" for the national ozone standard based on more recent monitoring data (CARB, 2000). The NCCAB is "attainment" or "unclassified" with respect to the other state and national ambient air quality standards.

Under the federal Clean Air Act, air basins designated as "nonattainment" were required to prepare air quality plans that set forth a strategy to attain the standards. The plans and programs developed for a given state are referred to as State Implementation Plans (SIPs). California's SIP is comprised of plans developed at the regional or local level. Since the NCCAB had once been designated "nonattainment" for the national ozone standard, a regional air quality plan for the NCCAB was prepared. Under the federal Clean Air Act Amendments of 1990, the regional air quality agencies (Monterey Bay Unified Air Pollution Control District, Association of Monterey Bay Area Governments, and San Benito County Council of Governments) prepared a "Maintenance Plan" in anticipation of U.S. EPA's recognition that the NCCAB has attained (and now must maintain) the national ozone standard.

Under the California Clean Air Act, air basins designated as "nonattainment" with respect to the state standards must prepare plans to achieve the standards or that, at a minimum, implement all feasible measures. Therefore, the Monterey Bay Unified Air Pollution Control District (MBUAPCD) prepared and adopted the 1991 *Air Quality Management Plan for the Monterey Bay Region* (1991 AQMP). The 1991 AQMP addressed planning requirements related to the state ozone standard and recommended adoption of 20 measures to control emissions of reactive organic gases (ROG) from stationary sources, 5 measures for stationary sources of nitrogen oxides (NO_X), and 8 transportation control measures. In 1994, the AQMP was updated to include a revised design value that reduced emission reductions needed to obtain the state ozone standard from 30 percent to 20 percent. The 1997 AQMP update includes current air quality data, current population forecasts, revised emission inventory and emission forecasts, and revised Transportation Control Measures (TCM).

The 1991 and 1994 AQMPs relied on implementation of Trip Reduction Ordinances (TROs) to meet California Clean Air Act requirements to reduce the rate of increase in passenger vehicle trips and miles traveled per trip in particular urbanized areas. Since mandatory TROs are now prohibited by law and must be removed, the remaining TCMs no longer meet this requirement and have been updated in the AQMP. Although it has surpassed the CARB's 20 percent reduction in ROG and NO_X, the District continues to exceed the state ozone standard. To

progress toward attainment of the standard, the AQMP outlines a list of programs for implementation. These programs include enforcement of existing rules and regulations, improvements to existing regulations, implementation of updated TCMs, review of all environmental documents, evaluation of data, and implementation of public education programs.

The CARB, California's state air quality management agency, regulates mobile emissions sources and oversees the activities of air pollution control districts and air quality management districts. CARB indirectly regulates local air quality by having established state ambient air quality standards and vehicle emission standards, by conducting research activities, and by planning and coordinating activities.

The MBUAPCD is the regional agency empowered to regulate air pollution emissions from stationary sources in the NCCAB. MBUAPCD regulates air quality through its permit authority over most types of stationary emission sources and through its planning and review activities. MBUAPCD operates air quality monitoring stations that provide information on ambient concentrations of criteria air pollutants.

The Association of Monterey Bay Area Governments (AMBAG) does not regulate emissions directly, but develops transportation control measures and employment and population forecasts that are used in developing the AQMP. For projects that would lead directly or indirectly to an increase in population in Monterey, Santa Cruz, or San Benito counties, AMBAG determines whether the increase in population would be consistent with the population assumptions that were used to develop the AQMP. If consistent with those assumptions, a project is regarded as included in the AQMP, and as such, is consistent with the strategies included in the AQMP to improve regional ozone concentrations. If not consistent, then the project is deemed to contribute to a significant adverse cumulative effect on regional ozone concentrations. This project, as described in this document, has been determined to be consistent with the AQMP (AMBAG, 1998).

EXISTING AIR QUALITY

MBUAPCD's air quality monitoring stations provide information on ambient concentrations of criteria air pollutants. **Table 3.7.1** is a five-year summary of the highest annual criteria air pollutant concentrations. The ozone data shown in **Table 3.7.1** are a compilation of data from all of the monitoring stations in the NCCAB, since ozone is a regional pollutant. Pollutant data for carbon monoxide (CO) and PM_{10} were collected at the air quality monitoring station at 1270 Natividad Road in Salinas. CO and PM_{10} are more local in character than ozone, and the Salinas monitoring station is the closest station to the project site where both CO and PM_{10} are monitored. In **Table 3.7.1**, air pollutant concentrations are compared with the state ambient air quality standards, which are generally more stringent than the corresponding national standards. The major criteria air pollutants are described below.

TABLE 3.7.1
SALINAS AIR POLLUTANT SUMMARY, 1995-1997[a]

Pollutant	Standard[b]	1995	1996	1997	1998	1999
Ozone						
Highest one-hour average, ppm[c]	*0.09*	**0.14**	**0.12**	**0.11**	**0.12**	**0.11**
Number of standard violations[d]		8	16	1	10	3
Carbon Monoxide						
Highest eight-hour average, ppm	*9.0*	2.1	2.6	1.8	2.2	1.8
Number of standard violations		0	0	0	0	0
Particulate Matter (PM_{10})						
Highest 24-hour average, $\mu g/m^3$ [c]	*50*	50	50	**59**	**52**	50
Number of standard violations[e]		0	0	1	1	0
Annual Geometric Mean, $\mu g/m^3$	*30.0*	17.7	17.2	19.6	16.1	18.1

a As a regional pollutant, ozone data represent basinwide values based on data from all of the monitoring stations. During the 1995-1997 period, ozone exceedances were recorded at the following monitoring stations: Pinnacles, Scotts Valley, Hollister, Watsonville, Monterey, and Carmel Valley. Pollutant data for CO and PM_{10} were collected at MBUAPCD's Salinas monitoring station, 1270 Natividad Road.
b State standard, not to be exceeded.
c ppm - parts per million; $\mu g/m^3$ - micrograms per cubic meter.
d Refers to the number of days (in a given year) during which violations of the applicable standard were measured.
e Typically measured every sixth day.

NOTE: Values in **bold type** are in excess of applicable standard.

SOURCE: California Air Resources Board, *Air Quality Data Summaries,* 1995-1999.

OZONE

Ozone is not emitted directly into the atmosphere, but is a secondary air pollutant produced in the atmosphere through a complex series of photochemical reactions involving ROG and NO_x. ROG and NO_x are referred to as precursors to ozone. Significant ozone production generally requires about three hours in a stable atmosphere with strong sunlight. Ozone is a regional air pollutant because its precursors are transported and diffused by wind concurrently with ozone production, and high ozone concentrations can occur miles away from the source of the precursors. Motor vehicles are generally the major source of ozone precursors.

Short-term exposure to ozone can damage the lungs, decrease pulmonary function, and impair immune mechanisms (MBUAPCD, 2000). These changes have been implicated in the development of chronic lung disease as the result of longer-term exposure. Symptoms of ozone irritation include shortness of breath, chest pain when inhaling deeply, wheezing, and coughing. In addition, effects on vegetation have been documented at concentrations below the standards.

On-road motor vehicles contribute approximately 30 to 40 percent of the ROG and NO_X emitted in the NCCAB (CARB, 1995).

As shown in **Table 3.7.1**, the state standard for ozone is violated on an average of approximately eight days per year within the region. During the 1995 to 1999 period, exceedances of the state ozone standard were recorded at the following monitoring stations: Pinnacles, Hollister, Scotts Valley, Watsonville, Monterey, and Carmel Valley. Approximately 69 percent of the station-hours over the state standard that were recorded in the air basin over the 1995 to 1999 period were recorded at the Pinnacles monitoring station. The monitoring stations at Scotts Valley and Hollister account for the remaining 31 percent of the exceedances. No exceedances of the state standard have been recorded at the Watsonville, Monterey, and Carmel Valley monitoring stations since 1995.

CARBON MONOXIDE

CO is an odorless, invisible gas usually formed as the result of incomplete combustion of organic substances. Ambient CO concentrations normally correspond closely to the spatial and temporal distributions of vehicular traffic. CO concentrations also are influenced by wind speed and atmospheric mixing. Under inversion conditions, CO concentrations may be distributed more uniformly over an area out to some distance from vehicular sources.

When CO combines with hemoglobin in the blood, the oxygen-carrying capacity of the blood is reduced and the release of oxygen is inhibited or slowed (MBUAPCD, 2000). This condition places fetuses, angina patients, persons with other cardiovascular diseases or with chronic obstructive lung disease, asthma, or anemia at risk. Symptoms of exposure may include headaches, dizziness, sleepiness, nausea, vomiting, confusion, and disorientation. The state standards for CO have not been violated at the monitoring station in Salinas over the past five years.

PARTICULATE MATTER

PM_{10} consists of particulates 10 microns (a micron is one one-millionth of a meter) or less in diameter, which can be inhaled and cause adverse health effects. Particulates in the atmosphere result from many kinds of dust- and fume-producing industrial and agricultural operations, combustion, and atmospheric photochemical reactions. Agricultural activities, such as tilling, disking and field burning, are major sources of particulates in rural areas, while vehicle/equipment travel and demolition and construction activities are major sources of particulates in urban areas. Natural sources of particulates include wind erosion from exposed surfaces. Particulate concentrations near residential sources generally are higher during the winter, when more fireplaces are in use and meteorological conditions prevent the dispersion of directly emitted contaminants. Very small particles of certain substances (e.g., sulfates and nitrates) can cause lung damage directly or can contain adsorbed gases (e.g., chlorides or ammonium) that may be injurious to health. Particulates also can damage materials and reduce visibility. State 24-hour PM_{10} standards have been violated on rare occasions over the past five years at the monitoring station in Salinas.

3.7.3 SENSITIVE RECEPTORS

Land uses such as schools, hospitals, and convalescent homes are considered to be relatively sensitive to poor air quality because infants and children, the elderly, and people with health problems, especially respiratory ailments, are more susceptible to respiratory infections and other air-quality-related health problems than the general public. Residential areas are also considered to be sensitive to air pollution because residents (including children and the elderly) tend to be at home for extended periods of time, resulting in sustained exposure to any pollutants present. **Figure 3.1-2** in Section 3.1, Regional Setting – Land Use and Planning, indicates sensitive land uses in the PVWMA service area.

Industrial and commercial districts are less sensitive to poor air quality because exposure periods are shorter and workers in these districts are, in general, the healthier segment of the public. Recreational land uses are moderately sensitive to air pollution. Although exposure periods are generally short in such places, vigorous exercise associated with recreation places a high demand on the human respiratory functions, which air pollution can impair. Noticeable air pollution also detracts from the recreational experience.

REFERENCES – Air Quality

Association of Monterey Bay Area Governments, letter to Eric Brown (ESA) with copy sent to PVWMA, April 20, 1998.

Brennan, Janet, Senior Planner, Monterey Bay Unified Air Pollution Control District, telephone conversation, July 23, 1997.

California Air Resources Board, *Air Quality Data Statistics* (http://www.arb.ca.gov/adam/), 2000.

California Air Resources Board, *Air Quality Data Summaries*, 1991-1995.

California Air Resources Board, *Proposed Amendments to the Area Designations for State Ambient Air Quality Standards*, November 1996.

Monterey Bay Unified Air Pollution Control District, *Air Quality Management Plan*, 1997 (on-line version).

Monterey Bay Unified Air Pollution Control District, *CEQA Air Quality Guidelines*, October 1995.

Monterey Bay Unified Air Pollution Control District, *CEQA Air Quality Guidelines*, September 2000.

United States Environmental Protection Agency (EPA), *Compilation of Air Pollutant Emission Factors, Volume I: Stationary, Point, and Area Sources*, AP-42, 5th Edition, January 1995.

3.8 NOISE

3.8.1 INTRODUCTION TO NOISE PRINCIPLES AND DESCRIPTORS

Environmental noise is usually measured in A-weighted decibels (dBA).[1] Environmental noise typically fluctuates over time, and different types of noise descriptors are used to account for this variability. Typical noise descriptors include the energy-equivalent noise level (Leq)[2], the day-night average noise level (Ldn), and the Community Noise Equivalent Level (CNEL). The Ldn and CNEL are commonly used in establishing noise exposure guidelines for specific land uses. In general, a change of 3 dBA is a noticeable change, and a change of 10 dBA is perceived as a doubling of noise. **Figure 3.8-1** shows some representative sounds and sound pressure levels.

The noise experienced at a receptor depends on the distance between the source and the receptor, the presence or absence of noise barriers and other shielding features, and the amount of noise attenuation (lessening) provided by the intervening terrain. For line sources, such as vehicular traffic, noise decreases by about 3.0 to 4.5 dBA for every doubling of the distance from the roadway. For point or stationary sources, such as electric motors, a noise reduction of 6.0 to 7.5 dBA is experienced for each doubling of the distance from the source.

3.8.2 REGIONAL SETTING

EXISTING NOISE LEVELS

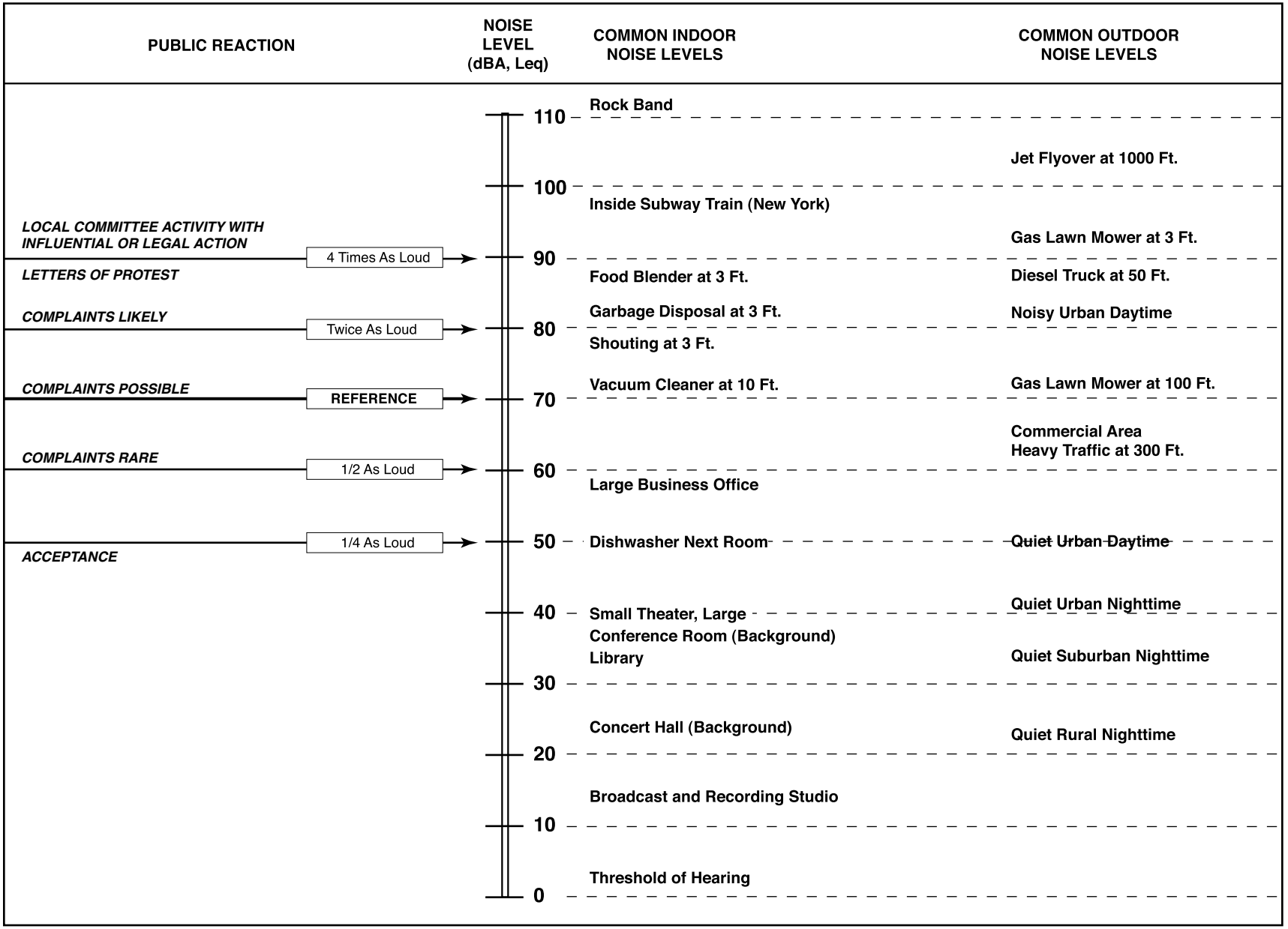
Most of the facilities associated with the BMP 2000 and Local-Only alternatives generally are located in open areas characterized by ambient noise levels of less than 60 dBA, Ldn. Ambient noise levels in excess of 60 dBA, Ldn are encountered in areas that are adjacent to major roadways such as Highway 101, Highway 129 (Riverside Drive), Highway 1, and Bolsa Road, as well as near the Granite Rock Quarry.

Because the majority of the project area is in agricultural use, tractors and other farm equipment and machinery also generate noise during the daytime.

---

1 A decibel (dB) is a logarithmic unit of sound energy intensity. Sound waves exert a sound pressure (commonly called "sound level"), measured in decibels. An A-weighted decibel (dBA) is a decibel corrected for the variation in frequency response of the human ear at commonly encountered noise levels. The highest dBA reported in a given period of time is known as the maximum noise level (Lmax). All of the noise levels reported herein are A-weighted unless stated otherwise.

2 Leq, the energy equivalent noise level (or "average" noise level), is the equivalent steady-state continuous noise level which, in a stated period to time, contains the same acoustical energy as the time-varying sound level actually measured during the same period. Ldn, the day-night average noise level, is a weighted 24-hour average noise level. With the Ldn descriptor, noise levels between 10:00 p.m. and 7:00 a.m. are adjusted upward by 10 dBA to take into account the greater annoyance of nighttime noise as compared to daytime noise. The CNEL is calculated in a similar way, but an additional 5 dBA are added to the noise levels in the evening hours between 7:00 p.m. and 10:00 p.m.



SOURCE: Caltrans Transportation Laboratory Noise Manual, 1982; and Modification by Environmental Science Associates

Figure 3.8-1
Effect of Noise on People

SENSITIVE RECEPTORS

Some land uses are considered more sensitive to ambient noise levels than others, due to the amount of noise exposure (in terms of both duration and insulation from noise) and the types of activities typically involved. Residential areas, schools, and hospitals generally are more sensitive to noise than commercial and industrial land uses.

The majority of project construction would occur in open agricultural areas, with few noise-sensitive receptors nearby. With the exception of the Import Pipeline, all project construction would occur within the PVWMA service area. **Figure 3.1-2** in Section 3.1, Regional Setting – Land Use and Planning, identifies residential areas and other sensitive land uses in the PVWMA service area. The only noise-sensitive receptors along the Import Pipeline alignment are the Betabel R.V. Resort, located approximately 100 feet east of the pipeline alignment between Stations 370+00 and 400+00; the Aromas School, approximately 500 feet south of Station 720+00; and several residences in River Oaks, approximately 600 feet south of the pipeline between Stations 500+00 and 520+00 (refer to map appendices for detailed maps of the Import Pipeline Alignment).

3.8.3 NOISE REGULATIONS, PLANS, AND POLICIES

Noise is regulated in the project area through implementation of local general plan policies and noise ordinance standards, as described below. Local general plans identify general principles intended to guide and influence development plans, and noise ordinances set forth specific standards and procedures for addressing particular noise sources and activities.

San Benito County

The San Benito County Amended Noise Element contains noise/land use compatibility guidelines for development in San Benito County. For noise-sensitive land uses such as residences, hospitals, schools, and churches, a noise level of up to 60 dBA, Ldn is considered acceptable (County of San Benito, 1984). The Amended Noise Element contains the following goals and policies related to construction noise:

> **Goal 4:** To reduce construction-related noise impacts.
>
> **Policy 1:** It will be the County's continuing policy to control the operation of construction equipment at specific sound intensities and frequencies during specified hours.
>
> **Policy 2:** The County will encourage the use of barriers or enclosures for equipment having high noise emission.
>
> **Policy 3:** The County will encourage use of the Environmental Protection Agency Equipment Noise Standards as specifications for the modification of old County equipment and the purchase of new equipment.

Santa Clara County

The health and safety chapter of the Santa Clara County General Plan addresses noise issues in Santa Clara County. The health and safety chapter indicates that a noise level of up to 55 dBA, Ldn is considered satisfactory for residential and commercial land uses. A noise level of up to 60 dBA, Ldn is considered satisfactory for schools, libraries, churches, and hospitals (County of Santa Clara, 1994).

The health and safety chapter of the Santa Clara County General Plan does not contain policies that specifically address construction noise.

Monterey County

Chapter II of the North County Area Plan and Chapter II of the Monterey County General Plan identify noise sources in northern Monterey County. Neither the Area Plan nor the General Plan contain policies that specifically address construction noise.

Santa Cruz County

The Public Safety and Noise Element of the Santa Cruz County General Plan identified noise/land use compatibility guidelines for development in Santa Cruz County (County of Santa Cruz, 1994). For noise-sensitive land uses (residences, schools, churches, hospitals, etc.), the compatibility guidelines indicate that noise levels up to 60 dBA, Ldn are clearly acceptable.

Policy 6.9.7 of the Public Safety and Noise Element requires mitigation of construction noise as a condition of future project approvals. Program F of this element calls for an amendment of the County Code to limit the allowed hours of construction activities near residential areas.

REFERENCES – Noise

Cornett, Lawrence C. and Charles E. Hina, *Methods for Predicting Noise and Vibration Impacts*, January 31, 1979.

County of Monterey, *General Plan*, updated 1995.

County of Monterey, *North County Area Plan*, amended November 29, 1994.

County of San Benito, *Amended Noise Element*, 1984.

County of San Benito, *General Plan*, amended 1992.

County of Santa Clara, *General Plan*, adopted 1994.

County of Santa Cruz, *General Plan and Local Coastal Program*, adopted May 24, 1994.

3.9 PUBLIC SERVICES

3.9.1 REGIONAL SETTING

WATER

The City of Watsonville (Watsonville Water District) provides water to Watsonville and surrounding areas, including the areas of Freedom, Corralitos, Green Valley Road, Salispuedes, and Pajaro Dunes (Koch, 1997). Approximately 90 percent of Watsonville Water District's water supply is obtained from the operation of 12 City-owned groundwater wells within the Pajaro Basin. The remaining 10 percent is obtained from the surface supply of the Corralitos and Browns Valley Creeks. In the past, the City of Watsonville provided water service for the community of Pajaro's 330 connections. However, deterioration of this service and inadequate fire flows prompted the establishment of the Pajaro Community Services District (PCSD) in the mid-1980s. The PCSD has upgraded essential infrastructure and now serves Pajaro and the surrounding communities of Sunny Mesa and Hillcrest Bay Farms (Perez, 1997). PCSD currently operates four wells that pump groundwater from the Pajaro Basin.

Several other providers of water service within the project area are described in the following summaries (County of Monterey, 1994; County of Santa Cruz, 1994; Soquel Creek Water District, 2001). The Monterey County Water Resources Agency (MCWRA) manages groundwater and surface water in Monterey County and overlaps jurisdiction in the southern portion of the Pajaro Valley Water Management Agency (PVWMA) service area. MCWRA has a Memorandum of Understanding (MOU) with PVWMA (and Monterey Peninsula Water Management Agency south of the project area) that includes consistency approval of projects undertaken by each MOU signatory (Molholland, 1997). MCWRA has completed a seawater intrusion correction project in the Castroville area using recycled water to deliver alternate sources of water to artichoke farmers in this area.

The Aromas Water District (AWD) serves approximately 17 square miles of noncontiguous area around the town of Aromas. AWD provides approximately 240 acre-feet per year (afy) to 640 rural and residential users. In addition, it is under pressure to expand its service area into adjacent San Benito County and Monterey County areas. AWD currently manages groundwater only; however, the PVWMA Act allows Central Valley Project (CVP) water to go to AWD (through the CVP San Felipe Unit) if available (West, 1997).

The Soquel Creek Water District (SCWD) serves the unincorporated areas of southern Santa Cruz County and overlaps with the PVWMA service area in the La Selva area. It shares groundwater resources in the Aromas Red Sands aquifer with PVWMA. The SCWD provides potable water service to approximately 45,000 people in Santa Cruz County. The District's service area includes the City of Capitola and the unincorporated communities of Aptos, La Selva Beach, Rio Del Mar, Seascape, Seacliff, and Soquel. The District currently purveys approximately 5,400 afy, all of which is developed from two groundwater aquifer systems beneath the District. The Purisima Formation provides approximately two-thirds of the District's

annual production (3,600 af) in the western portion of the District's service area. The Aromas Red Sands provides the remainder (1,800 af) of the District's annual production in the eastern portion of the service area. Preliminary results from an ongoing Integrated Resources Plan suggest that water supplies will have to be augmented by a combination of water conservation, surface water, and possible water exchanges. The District is presently conducting planning studies regarding the procurement of up to 2,000 afy of supplemental supply and is examining both local and regional alternatives. Adjacent providers of water include the San Benito County Water District (SBCWD) and the Santa Clara Valley Water District (SCVWD). Both of these water districts pump water from the San Felipe Unit of the CVP.

WASTEWATER

Septic tanks are the most prevalent means of sewage disposal within the outlying areas of the PVWMA service area. The Watsonville Water Treatment Facility (WWTF) (operated by the City of Watsonville) collects and treats wastewater for the southern portion of Santa Cruz County (Garrett, 1997). The plant contracts with the Pajaro County Sanitation District, the Salsipuedes Sanitary District, and the Freedom County Sanitary District. The area served by the plant ranges radially from Watsonville to Freedom to the north, College Road area to the east, and the Pajaro Dunes to the west. The WWTF provides secondary treatment and has a capacity of 12.5 million gallons per day, which is anticipated to accommodate future demand. The plant discharges to an ocean outfall over a mile offshore (Wagoner, 2001).

SOLID WASTE

Solid waste generated during construction of the proposed project would primarily be soils generated during grading, excavation, and filling. Soils would generally be used for backfill.

Santa Cruz Waste Management has a contract with Santa Cruz County to provide solid waste collection and disposal in unincorporated areas of the county (Ortiz, 1997). The City of Watsonville has its own solid waste management company. Waste is disposed at the Buena Vista and Ben Lomond Landfills.

The Monterey Regional Waste Management District owns and operates the Marina Solid Waste Landfill, which is two miles north of the town of Marina and, as of 2000, has an estimated 90-year lifespan (Shedden, 2001). This site contains 315 disposal acres and has a permitted capacity of 49,700,000 cubic yards. At this time, the landfill has a remaining available capacity of 33,082,000 cubic yards. The Marina Landfill is permitted to receive 1,200 tons per day of solid waste, but the average peak disposal volume is 820 tons per day (Integrated Waste Management Board, 2001).

Solid wastes in northern Monterey County are disposed of by USA Waste at the Lewis Road disposal site (County of Monterey, 1994). The site, which is owned by the County but operated under contract, contains 135 acres and accepts about 73 tons of solid waste per day. The site has the potential to accept wastes for the next 30 years.

SCHOOLS

The project area is primarily served by the Pajaro Valley Unified School District (PVUSD). The District consists of 15 elementary schools, 5 middle schools, 2 high schools, 4 charter schools, and 1 alternative high school (Sims, 2001). PVUSD plans to build a new elementary and high school, and also plans to convert an adult school into an elementary school. PVUSD includes the southern portion of Santa Cruz County (extending as far north as Aptos) (serving the towns of Aromas and Pajaro and surrounding areas) and a small section of northern Monterey County. Schools in the District are currently over capacity. Northern Monterey County is also served by two other school districts, the Lagunita and North Monterey County Unified Districts (County of Monterey, 1994). The Lagunita School District services the southeastern portion of the northern county. The North Monterey County Unified School District serves the Castroville, Moss Landing, and Prunedale areas.

Some of the project components are located near schools. The Aromas School is on Aromas Road immediately south of the Import Pipeline alignment near Station 715+00. Amesti Elementary School is located at the intersection of Amesti Road and Green Valley Road and is just east of the proposed Corralitos Creek Diversion pipeline. Pacific Coast Charter School is located on Green Valley Road just south of the intersection with Holohan Road, along which the Aquifer Storage and Recovery (ASR) pipeline alignment runs. Lakeview Middle School and St. Francis Central Coast Catholic School are located on E. Lake Avenue, 0.4 mile north of the intersection of Holohan Road, and are just east of the proposed Saddle Dam at College Lake. In addition, the City of Watsonville has approved building permits for a new high school near Harkins Slough, across Beach Road from the proposed water recycling facilities at the WWTF. However, the decision has been appealed to the California Coastal Commission.

FIRE PROTECTION

Fire protection services within the project area are provided primarily through special districts (County of Monterey, 1994). These districts include the Aromas Tri-County and North County Fire Protection Districts. The Pajaro Community Services District contracts with the North County Fire Protection District to provide fire protection in Pajaro. All fire protection districts and city fire departments in Monterey County now participate in a countywide mutual-aid agreement.

The Department of Forestry and Fire Protection (Santa Cruz County Fire Department) serves primarily the unincorporated PVWMA service areas of Santa Cruz County (Edge, 1997). The Aromas Tri-County Fire Protection District serves the northeast portion of the project area as well as parts of San Benito and Santa Cruz counties with its station in Aromas. The City of Watsonville Fire Department provides fire services within city limits (Norwood, 1997). No fire stations are located near any of the project components.

LAW ENFORCEMENT

The Santa Cruz County Sheriff's Department provides police services to the unincorporated areas of Santa Cruz County (Mardesich, 1997). The City of Watsonville Police Department provides police services within city limits (Aluffi, 1997). Police protection in northern Monterey County is provided by the Monterey County Sheriff's Department (County of Monterey, 1994). The Santa Cruz County Sheriff's Office is located on Rountree Lane, 0.5 mile south of the intersection of Harkins Slough Road and Buena Vista Drive, and is just east of the proposed ASR pipeline.

The California Highway Patrol (CHP) has jurisdiction and law enforcement powers on all County roads and state highways outside the incorporated cities. The CHP services the project area through two substations in Aptos and Salinas. No CHP stations are located along the proposed pipeline alignment.

OTHER UTILITIES

The counties of Santa Cruz and Monterey and the City of Watsonville maintain utilities within the proposed project area (PVWMA, 1997). U.S. Sprint maintains fiber-optic lines parallel to the Union Pacific Railroad (UPRR) tracks. Pacific Bell, Pacific Gas and Electric Company, Caltrans, and UPRR maintain utilities within the PVWMA service area.

PARKS AND RECREATION

There are a number of state parks, state beaches, and county park facilities in Santa Cruz County within the PVWMA service area, including Manresa State Beach, Sunset State Beach, and Pinto Lake County Park.

Several state parks in northern Monterey County are categorized as state beaches: Zmudowski State Beach, Moss Landing State Beach, and the Elkhorn Slough National Estuarine Reserve (County of Monterey, 1994). County parks provide the largest portion of recreational space in this area. One such space is the Manzanita Regional Park.

Several County roads within the project area serve as bike routes and/or trails. These are discussed in Section 3.6, Traffic and Circulation, and Section 3.10, Visual/Aesthetic and Recreational Resources.

REFERENCES – Public Services

Aluffi, Michael, Captain, City of Watsonville Police Department, telephone communication, October 20, 1997.

CH2MHill, *Final Technical Memorandum No. 1.1A-Import Pipeline Alignment -Preliminary Engineering*, 22 September 1997.

County of Monterey, *North County Area Plan*, pp. 33-38, amended November 29, 1994.

County of Santa Cruz, *General Plan and Local Coastal Program*, adopted May 24, 1994.

Edge, Stacy, Inspector, Department of Forestry and Fire Protection, telephone communication, October 16, 1997.

Garrett, Dewey, Collection Systems Manager, telephone communication, October 17, 1997.

Integrated Waste Management Board, California Waste Facilities, Sites, & Operations Database, Monterey Regional Waste Management District/Marina Land Fill, January 5, 2001. www.ciwmb.ca.gov/swis/swisres.asp

Koch, David, Director of Public Works and Utilities, City of Watsonville, telephone communication, October 17, 1997.

Mardesich, Lisa, Secretary, Santa Cruz County Sheriff's Department, telephone communication, October 17, 1997.

Molholland, Al, Monterey County Water Resources Agency, telephone communication, December 19, 1997.

Norwood, Jim, Captain, City of Watsonville Fire Department, telephone communication, October 17, 1997.

Ortiz, Carlos, Customer Service Representative, telephone communication, October 17, 1997.

Pajaro Valley Water Management Agency (PVWMA), *Technical Memorandum 2.3 for Water Supply Project: Project Definition Report*, pp. 11-13, February 6, 1997, prepared by Montgomery Watson.

Perez, Monica, Pajaro Community Services District, telephone communication, December 16, 1997.

Shedden, Rick, Monterey Regional Waste Management District, telephone communication, January 1, 2001.

Sims, Barbara, Secretary for Construction Office, Pajaro Valley Unified School District, Transmittal, January 8, 2001.

Soquel Creek Water District, Letter in response to Pajaro NOP, 2001.

Wagoner, Mike, Watsonville Wastewater Treatment Facility, telephone communication, January 5, 2001.

West, George, Aromas Water District, telephone communication, December 17, 1997.

3.10 VISUAL/AESTHETIC AND RECREATIONAL RESOURCES

The following discussion is based on information obtained during field investigations as well as from the County of San Benito General Plan (1995), the County of Santa Clara General Plan (1994), the County of Santa Cruz General Plan / Local Coastal Program (LCP) (1994), the County of Monterey General Plan (1995), the North County Area Plan (1994), the North County Land Use Plan / Local Coastal Program (1987), and the City of Watsonville General Plan (1994).

3.10.1 REGIONAL SETTING

The project area contains visual resources representative of California's northern coast range and inland valley landscapes. **Figures 3.10-1** and **3.10-2** present photographs of the project area. Visual elements in the project area include expansive croplands, rolling terrain, and meandering creeks and drainages. Peaks and ridgelines of the Coast Ranges are visually prominent landform features to the east, and Monterey Bay provides a scenic background feature to the west. The prominence of these landforms provides visual contrast to the relatively flat topography of the floor of the Pajaro Valley. The City of Watsonville is an urbanized area situated on the valley floor, with agricultural lands surrounding the City limits.

SCENIC ROAD AND HIGHWAY DESIGNATIONS

San Benito County

The San Benito County General Plan Scenic Roads and Highways Element identifies U.S. 101 and Highway 129 as County-designated scenic highways within the project area. The Scenic Roads and Highways Element also designates a scenic corridor along all scenic roads and highways. A scenic corridor is defined as the visible land area outside of a transportation corridor (road) right-of-way and generally described as the "view from the road". Along U.S. 101, the scenic corridor extends 400 feet along either side of the centerline of the road. Along Highway 129, the scenic corridor is identified as all land within 340 feet of the centerline of the road.

The proposed Import Pipeline alignment is visible in close-range views from U.S. 101 between Stations 320+00 and 375+00. Close-range views of the alignment are also available from Highway 129 between Stations 590+00 and 600+00, where the alignment crosses Chittenden Pass.

Santa Clara County

The proposed Import Pipeline alignment extends through a small portion of southern Santa Clara County. While several highways within the County are either officially designated state scenic highways or eligible for official designation, none of these roadways are located within or near the project area.

Watsonville Wastewater Treatment Facility from Panabaker Road Looking South

Agricultural Lands within the Pipeline Alignment near U.S. 101 Looking West

SOURCE: Environmental Science Associates

Figure 3.10-1
Photographs of the Project Area

Highway 129 at Pajaro Gap Looking Northwest

Granite Rock Company Quarry Railroad Tracks near Aromas Looking Southwest

SOURCE: Environmental Science Associates

Figure 3.10-2
Photographs of the Project Area

Santa Cruz County

Policy 5.10.10 of the Santa Cruz County General Plan/LCP identifies designated scenic roads within the County that are valued for their vistas. According to the General Plan/LCP, a scenic road is defined as a road which has unusual or outstanding scenic qualities.

Within the project area, the following roadways are designated scenic roads that are valued for their vistas: Highway 1; Highway 152 (East Lake Avenue) from Highway 1 to Santa Clara County; Highway 129 from Highway 1 to San Benito County; Beach Road from Highway 1 to Palm Beach; San Andreas Road from Highway 1 to Beach Road; Buena Vista Drive from San Andreas Road to Larkin Valley Road; Sunset Beach Road; and Shell Road. These roads are valued for their vistas and afforded the highest level of protection in the General Plan/LCP. (County of Santa Cruz, 1994)

Monterey County

According to the Monterey County General Plan, the North County Area Plan, and the North County Land Use Plan / Local Coastal Program, Highway 1 is the only designated scenic route that is within the project area and the North County Area of Monterey County. (County of Monterey, 1987 and 1994)

City of Watsonville

Highway 1, Highway 152, Airport Boulevard, Holohan Road, and Harkins Slough Road are the designated scenic routes within the City of Watsonville planning area (Watsonville General Plan, 1994).

State of California

Highway 1 and Highway 152 are considered eligible for Official State Scenic Highway designation by Caltrans.

RECREATIONAL FACILITIES

San Benito County

The San Benito County portion of the project area is primarily in agricultural use. No recreational facilities are located within the San Benito County portion of the project area. However, playfields at Aromas School are located to the south of the alignment near Station 720+00.

Santa Clara County

The proposed pipeline alignment extends through a small portion of southern Santa Clara County that is primarily ranchlands. No recreational facilities are located within the Santa Clara County portion of the project area.

Santa Cruz County

As stated in Section 3.1, Land Use, the southern portion of Santa Cruz County is primarily in agricultural use, with the residential population concentrated in and around the City of Watsonville. As a result, recreational facilities on unincorporated County lands are limited. Existing facilities include Sunset State Beach and Campground, the Santa Cruz County Fairgrounds along Highway 152 near College Lake, and Pinto Lake City and County Park. Sunset Beach State Park is a popular recreation area that had an estimated attendance of 460,103 visitors in the fiscal year 1991-1992 (County of Santa Cruz, 1994). The following project area roadways are part of the Master Plan of Santa Cruz County bicycle trail system: Highway 129, San Andreas Road, Sunset Beach Road, Beach Road, Westgate Drive, Airport Boulevard, Buena Vista Drive, Freedom Boulevard, Amesti Road and Green Valley Road. San Andreas Road currently contains signs and striping as a coastal bike route (County of Santa Cruz, 1994).

Monterey County

Like southern Santa Cruz County, northern Monterey County is primarily in agricultural use. Because the area has a low resident population, recreational facilities are limited. The Pajaro Valley Golf Course is located on Salinas Road near Highway 1. The Recreational Trails Plan in the North County Area Plan and the Shoreline Access/Trails map in the North County Land Use Plan/Local Coastal Program present the locations of recreational trails within northern Monterey County.

City of Watsonville

The City of Watsonville is the primary population center within the project area. Various neighborhood parks and schools within the City's planning area provide recreational opportunities for residents. The City's park system consists of numerous neighborhood and community parks as well as passive open space, including the natural drainage network provided by the Watsonville, Struve, and West Branch Struve Sloughs. None of these parks or recreational areas is located near the proposed facilities. Airport Boulevard and Green Valley Road are designated bikeways within the City planning area.

3.10.2 REGULATORY FRAMEWORK

The following present's policies related to visual and recreational resources in the area.

SAN BENITO COUNTY GENERAL PLAN

Open Space and Conservation Element (1995)

> **Policy 7:** Grading, erosion, and native tree removal. It is the policy of the County to minimize erosion resulting from grading and cutting and native tree removal for all development proposals.

Action 7.2: Topsoils shall be stockpiled and reapplied after grading to enhance revegetation, and sedimentation shall be retained on-site and outside of water features (including seasonal).

Action 7.3: Measures shall be taken to reduce erosion of stockpiled topsoil.

Action 7.4: A revegetation plan shall be submitted with the grading plans detailing the type of plants to be re-established, details of the preparatory measures, and methods of planting and maintenance. The plan shall include provisions for remedial action in the event the revegetation plan fails.

Scenic Roads and Highways Element (1980)

Objective: Protect the visual characteristics of the landform as well as the viewshed from disruption by grading operations.

Policy 2: Because the County recognizes the valuable resources of soil and the need for the preservation of natural environments and because the County recognizes that grading can have significant adverse impacts within scenic areas, it is the County's policy to carefully review all projects involving grading within Scenic Corridors.

Action 2.1: Grading in the Scenic Corridor and on scenic roads or highways shall be reviewed for compliance with the objectives of this element, by County staff.

Final contour and landscaping recommendations shall be made to minimize the visual impact of the grading on the scenic corridor, in conformance with the County's grading requirements.

Vegetative cover, preferably native to the area, and other screening devices should be provided to hide grading scars, blend with the natural landscape, and provide erosion control.

Objective: Enhance the visual character of the corridor through appropriate landscaping.

Policy 4: It will be the policy of the County to enhance the visual character of the Scenic Corridor where appropriate.

Action 4.1: Landscaping in the scenic corridors should be compatible with local vegetation and ground forms. Indigenous plants and grasses should be used where appropriate and possible as a means of reestablishing the natural landscape.

Ornamental landscaping around buildings and plants such as row cropping, fruit trees and other agricultural species, are desired and acceptable uses in the Scenic Corridor. Also included within the acceptable landscaped uses are grasses and fairway trees of parks and golf courses.

COUNTY OF SANTA CLARA GENERAL PLAN (1994)

Resource Conservation Element

Policy R-RC 95: The scenic and aesthetic qualities of both the natural and built environments should be preserved and enhanced for their importance to the overall quality of life for Santa Clara County.

Policy R-RC 98: Hillsides, ridgelines, scenic transportation corridors, major county entryways, stream environments, and other areas designated as being of special scenic significance should receive utmost consideration and protection due to their prominence, visibility, and overall contribution to the quality of life in Santa Clara County.

Policy R-RC 101: Roads, building sites, structures and public facilities shall not be allowed to create major or lasting visible scars on the landscape.

COUNTY OF SANTA CRUZ GENERAL PLAN / LOCAL COASTAL PROGRAM (1994)

Open Space and Conservation Element

Objective 5.10a: Protection of Visual Resources. To identify, protect and restore the aesthetic values of visual resources.

Objective 5.10b: New Development in Visual Resource Areas. To ensure that new development is appropriately designed and constructed to have minimal to no adverse impact upon identified visual resources.

Policy 5.10.2: Development within Visual Resource Areas. Recognize that visual resources of Santa Cruz County possess diverse characteristics and that the resources worthy of protection may include, but are not limited to, ocean views, agricultural fields, wooded forests, open meadows, and mountain hillside views. Require projects to be evaluated against the context of their unique environment and regulate structure height, setbacks and design to protect these resources consistent with the objectives and policies of this [visual resources] section.

Policy 5.10.3: Protection of Public Vistas. Protect significant public vistas as described in policy 5.10.2 from all publicly used roads and vista points by minimizing disruption of landform and aesthetic character caused by grading operations, timber harvests, utility wires and poles, signs, inappropriate landscaping and structure design. Provide necessary landscaping to screen development which is unavoidably sited within these vistas.

Policy 5.10.4: Preserving Natural Buffers. Preserve the vegetation and landform of natural wooded hillsides, which serve as a backdrop for new development.

Policy 5.10.5: Preserving Agricultural Vistas. Continue to preserve the aesthetic value of agricultural vistas. Encourage development to be consistent with the agricultural character of the community. Structures appurtenant to agricultural uses on agriculturally designated parcels shall be considered to be compatible with the agricultural character of surrounding areas.

Policy 5.10.8: Significant Tree Removal Ordinance. Maintain the standards in the County's existing ordinance, which regulates the removal of significant trees and other major vegetation in the Coastal Zone, and provide appropriate protection for significant trees and other major vegetation in areas of the County located within the Urban Services Line.

Policy 5.10.9: Restoration of Scenic Areas. Require on-site restoration of visually blighted conditions as a mitigating condition of permit approval for new development. The type and amount of restoration shall be commensurate with the size of the project for which the permit is issued. Provide technical assistance for restoration of blighted areas.

Policy 5.10.11: Development Visible from Rural Scenic Roads. In the viewsheds of rural scenic roads, require new discretionary development, including development envelopes in proposed land divisions, to be sited out of public view, obscured by natural landforms and/or existing vegetation. Where proposed structures on existing lots are unavoidably visible from scenic roads, identify those visual qualities worthy of protection and require the siting, architectural design and landscaping to mitigate the impacts on those visual qualities.

Policy 5.10.13: Landscaping Requirements. All grading and land disturbance projects visible from scenic roads shall conform to the following visual mitigation conditions:

a) Blended contours of the finished surface with the adjacent natural terrain and landscape to achieve a smooth transition and natural appearance; and

b) Incorporate only characteristic or indigenous plant species appropriate for the area.

Parks, Recreation and Public Facilities

Policy 7.13: Parks, Recreation and Open Space Uses. Allow low intensity uses which are compatible with the scenic values and natural setting of the county for open space lands which are not developable; and allow commercial recreation, County, State and Federal parks, preserves, and biotic research stations, local parks and passive open space uses for park lands which are developable.

Policy 7.1.5: Access to Recreation Facilities. Provide physical access to all recreation facilities through provision of public transportation, trail system development, protection of prescriptive rights to beach access trails, and recreation programs.

COUNTY OF MONTEREY GENERAL PLAN (1995)

Natural Resources Element

Goal 1: Open Space Conservation: To retain the character and natural beauty of Monterey County by the preservation, conservation, and maintenance of open space within constitutional constraints.

Objective 1.1: Designate open space where its use will preserve, conserve, and maintain the natural resources and physical features of Monterey County.

Policy 1.1.1: Open space land use designations shall be used, as needed for compliance with the goals, objectives, and policies of this Plan.

Policy 1.1.2: Open space land use designations shall be used as needed to preserve the physical and natural features contributing to the County's outstanding natural beauty.

Policy 1.1.3: Landowners shall be encouraged voluntarily to restrict the development potential of property through grants of conservation easements, Williamson Act contracts, or other appropriate protections in areas designated for open space uses such as agriculture and resource conservation.

Goal 40: To maintain and enhance a system of scenic roads and highways through areas of scenic beauty without imposing undue restrictions on private property or constricting the normal flow of traffic.

Objective 40.2: Employ a cooperative planning effort among all public and private interests to implement appropriate land use techniques and controls for maintaining the scenic beauty and atmosphere of the scenic corridor.

Policies 40.2.1: Additional sensitive treatment provisions shall be employed within the scenic corridor, including placement of utilities underground, where feasible; architectural and landscape controls; outdoor advertising restrictions; encouragement of area native plants, especially on public lands and dedicated open spaces; and cooperative landscape programs with adjoining public and private open space lands.

Policy 40.2.2: Land use controls shall be applied or retained to protect the scenic corridor and to encourage sensitive selection of sites and open space preservation. Where land is designated for development at a density which, should maximum permissible development occur, would diminish scenic quality, the landowner shall be encouraged to voluntarily dedicate a scenic easement to protect the scenic corridor.

NORTH COUNTY LAND USE PLAN / LOCAL COASTAL PROGRAM (1987)

Policy 2.2.1: In order to protect the visual resources of North County, development should be prohibited to the fullest extent possible in beach, dune, estuary, and wetland areas. Only low intensity development that can be sited, screened, or designed to minimize visual impacts, shall be allowed on scenic hills, slopes, and ridgelines.

Policy 2.2.2.1: Views to and along the ocean shoreline from Highway 1, Molera Road, Struve Road and public beaches, and to and along the shoreline of Elkhorn Slough from public vantage points, shall be protected.

Policy 2.2.2.5: Structures should be located to minimize tree removal and grading for the building site and access road. Disturbed slopes should be restored to their previous visual quality. Landscape screening and restoration should consist of plant and tree species complementing the native growth of the area.

Policy 2.2.2.6: Agricultural uses on flat or rolling land should be preserved as a productive and visual resource. Agricultural uses on highly erodible slopes should be discouraged due to the visual degradation that results from runoff problems and resultant erosion scars.

Policy 2.2.3.3: Structures shall generally be sited so as not to block public views of the shoreline; development proposals shall be revised if necessary to accomplish this goal.

Necessary structures in public view between the road and shoreline (such as agricultural buildings) shall be functionally designed, and sited so as to protect the maximum possible open views. Other development in public view between the road and shoreline (such as residential or commercial structures) shall be designed with materials, colors, landscaping and fencing appropriate to the rural setting.

CITY OF WATSONVILLE GENERAL PLAN (1994)

Goal 5.1: Visual Resources. Preserve and enhance the built and natural visual resources within Watsonville.

Goal 5.2: Community Appearance. Blend new development with recognized values of community appearance and scenic qualities, and ensure that new development enhances, rather than detracts from, its surroundings.

Goal 5.5: Viewscape. Preserve scenic rural qualities surrounding the urbanized portions of the Planning Area.

Goal 5.9: Scenic Corridors. Protect and enhance the views of and from the scenic streets and highways in Watsonville and the Planning Area.

Goal 5.10: Natural Scenic Resources. Conserve and enhance natural resources that contribute to the visual, recreational, and educational aesthetics of Watsonville. Such resources include: wetlands, sloughs, rivers, lakes, hillsides and stands of vegetation.

Policy 5.A.5: Scenic Resources. The City shall, through its design review process, consider the impact of the development on both the visual quality of the built environment and the scenic quality of natural features including sloughs, wetland, rivers, lakes, hillsides and stands of vegetation.

Policy 5.E: Viewscape Protection. The City shall use the General Plan Land Use chapter and the design review process to ensure that major new development projects do not impact scenic vistas now enjoyed throughout the city.

Policy 5.J: Scenic Natural Resources. The City shall conserve and enhance natural resources that contribute to the visual, recreational, and educational aesthetics of Watsonville. Such resources include: wetlands, sloughs, rivers, lakes, hillsides and stands of vegetation.

Policy 9.A.2: Landscape Restoration. The City shall require landscape restoration with native plants from regional seed stocks on sites disturbed by urban development.

REFERENCES – Visual/Aesthetic and Recreational Resources

City of Watsonville, *Watsonville 2005 General Plan*, adopted May 24, 1994.

County of Monterey, *General Plan*, adopted September 30, 1982, amended 1995.

County of Monterey, *North County Area Plan*, amended November 29, 1994.

County of Monterey, *North County Land Use Plan / Local Coastal Program*, amended May 19, 1987.

County of San Benito, *Open Space and Conservation Element Update of the San Benito County General Plan*, February 7, 1995.

County of San Benito, *San Benito County General Plan, Scenic Roads and Highways Element*, 1980.

County of Santa Clara, *Santa Clara County General Plan*, updated 1994.

County of Santa Cruz, *General Plan and Local Coastal Program*, adopted May 24, 1994.

CHAPTER 4

BMP 2000 ALTERNATIVE – ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION MEASURES

4.A WATER RECYCLING

4.A.1 LAND USE AND PLANNING

4.A.1.1 SETTING

Existing Land Uses and General Plan and Zoning Designations

The site of the proposed Recycled Water Facility adjacent to the WWTF is located within the Watsonville city limits. The predominant land use in the vicinity of the WWTF and the proposed Recycled Water Facility is agriculture, primarily fruit and vegetable croplands. The lands adjacent to the WWTF are considered *Prime Farmland*, specifically Type 3 agricultural lands, which are prime agricultural lands located within the Coastal Zone. The proposed site for the Recycled Water Facility is zoned "Commercial Agriculture" (CA).

The WWTF is designated as a Public Facility in the Santa Cruz County General Plan/Local Coastal Program. The Public Facility designation includes schools, fire stations, churches, hospitals, cemeteries, sanitary landfills, and water supply and treatment facilities. The Recycled Water Facility site is designated Agriculture in the Santa Cruz County General Plan/LCP.

The proposed Recycled Water Facility site at the WWTF is within the City of Watsonville planning area, and it is designated Agriculture in the Land Use Diagram of the Watsonville 2005 General Plan. Lands designated as Agriculture are to be preserved for the production of food, fiber, flowers and other agricultural products, including the growing of crops and/or animal or poultry husbandry and grazing. The General Plan indicates that all lands that lie outside of the City's urban limit line, but within its planning area, are designated Agriculture, regardless of its size or actual use.

The siting area for the supplemental wells, shown in Figure 2.5 in Chapter 2, includes lands designated Agriculture in the Santa Cruz County General Plan/LCP.

Sensitive Land Uses

The nearest sensitive land uses are residences located approximately 300 feet west-northwest of, and approximately 1,500 feet north-northeast of, the proposed Recycled Water Facility site.

Residences are also approximately 1,000 feet east of the proposed North Dunes Recharge Basin. The recycled and blended water would be applied to agricultural crops in the Coastal Zone.

Consistency with General Plan Policies and Zoning Designations

The water supply generated by the proposed Recycled Water Facility would be used to offset a portion of the irrigation demands in the coastal area during the irrigation season. This recycled water would support agriculture and would help to balance the groundwater basin. While the facility is not technically an agricultural use, it is intended to support long-term agricultural operations by supplying water for irrigation. As a result, it would be consistent with Goal 3.3 and Implementation Measure 3.F.4 of the Watsonville General Plan, as well as with Objective 5.8b, Programs C and H, Policy 5.13.6, Policy 5.13.17, and Program F of the Santa Cruz County General Plan/LCP's Conservation and Open Space Element. The Recycled Water Facility may be inconsistent with Policy 5.13.8 of the Santa Cruz County General Plan/LCP, which requires that agricultural support facilities be located off good agricultural soils, or on the perimeter of good agricultural soils. However, the proposed site is adjacent to the existing WWTF. The responsibility for determining consistency with general plan policies rests with the City of Watsonville and Santa Cruz County.

The proposed pipelines would not result in a long-term loss of agricultural land because they would be located underground, and farming as occurs at present would resume within the construction corridor following pipeline installation. Therefore, these facilities are considered to be consistent with Policies 5.13.6 and 5.13.22 and Program F of the Santa Cruz County General Plan/LCP, and Goal 3.3, Policy 3.F, and Implementation Measures 3.F.1, 3.F.2, and 3.F.4 of the Watsonville General Plan. As stated above, the responsibility for determining consistency with general plan policies rests with the City of Watsonville and Santa Cruz County.

The lands adjacent to the WWTF and the lands within the siting area for the supplemental wells are zoned CA, Commercial Agriculture. The Recycled Water Facility and the supplemental wells are not an explicitly permitted uses within areas zoned CA. The principal permitted land uses within the CA zone are agricultural pursuits for the commercial cultivation of plant crops and the commercial raising of animals. In addition to these principally permitted uses, other uses are allowed for "dams, canals and aqueducts of any public water project" (Section 13.10.312 [b] of the Santa Cruz County Code). Although the proposed facilities do not include a dam, canal or aqueduct, they are part of a public water project with the overall goal of developing a sustainable water supply, and thereby preserving and enhancing agriculture in the Pajaro Valley. In addition, there are no available, feasible sites for the Recycled Water Facility within the basin that are not zoned agricultural land. The responsibility for making a conclusive determination of project consistency with zoning rests with the Santa Cruz County Planning Commission.

4.A.1.2 SIGNIFICANCE CRITERIA

For the purpose of this EIR, a significant impact would result if the project would: convert prime agricultural land to nonagricultural use or impair agricultural resources or operations; disrupt or

divide the physical arrangement of an established community; or be incompatible with existing land uses in the project vicinity.

4.A.1.3 IMPACTS AND MITIGATION MEASURES

Impact 4.A.1-1: Construction of the proposed Recycled Water Facility and the supplemental wells would result in short-term disturbance of adjacent land uses. Less than Significant. Implementation of recommended mitigation measures identified in this EIR, while not required, would assist in ensuring that the impact would remain at a less-than-significant level.

The proposed Recycled Water Facility would not alter surrounding land uses, and would not disrupt or divide the community. Construction disturbance related to pipelines could constrain access to adjacent farmlands along Highway 1 and Panabaker Road by temporarily blocking roadways and driveways. However, this would be a temporary impact that results more in inconvenience to motorists than a substantial impact and, therefore, would not be expected to substantially impair agricultural operations. Because the pipeline alignment extends along the Pajaro River levee and not along a roadway, impacts on roadways and driveways would be limited.

Similarly, the pipelines connecting the supplemental wells to the Import Pipeline could temporarily constrain access to adjacent farmlands along roadways. The precise locations of construction disturbance are not known since the well sites have not been identified; however, they would occur within the siting area identified in Figure 2.5. As stated above, these disruptions would be temporary and would not be expected to substantially impair agricultural operations.

Typical construction activities would be expected to last approximately one week at any given location along the pipeline alignments. Mitigation measures presented in Sections 4.A.6 (Traffic and Circulation), 4.A.7 (Air Quality), and 4.A.8 (Noise) would reduce the potential impacts of construction to nearby residents to less-than-significant levels.

> **Measure 4.A.1-1 (Recommended):** Advance notification of construction activities should be provided to all property owners, residents, and businesses in the vicinity of construction areas.
>
> See also mitigation measures in Sections 4.A.6, Traffic and Circulation, 4.A.7, Air Quality, and 4.A.8, Noise, of this EIR.

Impact 4.A.1-2: Construction of the proposed Recycled Water Facility and supplemental wells would result in the loss of up to approximately 8.5 acres of Prime Farmland. Significant and Unavoidable.

Construction of the proposed Recycled Water Facility would result in the conversion of approximately eight acres of Prime Farmland from agricultural use to water treatment and storage facilities, thereby precluding farming on the project site. Because all surrounding lands are considered Prime Farmland, no feasible alternative site is available that would reduce or avoid the conversion of Prime Farmland. Development of the site would therefore contribute to the cumulative loss of Prime Farmland in the region. This would be considered a significant impact.

The 17 supplemental wells would result in the conversion of 20,400 square feet (approximately 0.5 acre) of agricultural land. Figure 2.5 indicates the general area where these wells would be located. The siting area includes both prime and nonprime agricultural land. Because the specific well sites have not been identified, this analysis assumes a worst-case scenario in which all the wells would be sited on Prime Farmland, resulting in a permanent loss of 0.5 acre of prime farmland.

The proposed pipelines would not result in a long-term loss of agricultural land because they would be located underground, and farming as occurs at present would resume within the construction corridor following pipeline installation.

Measure 4.A.1-2: None available; this impact would be significant and unavoidable.

4.A.2 GEOLOGY, SOILS, AND SEISMICITY

4.A.2.1 SETTING

The area encompassing the Watsonville Wastewater Treatment Facility (WWTF) and the associated proposed project facilities and pipeline alignments is entirely low-lying flat to gently sloping topography. The area is the floodplain of the Pajaro River. To the north and south, the land slopes gently toward the river. The levees along the river provide the local topographic relief in the area.

The area has deep alluvial soils comprised of younger (Holocene) flood plain deposits consisting of unconsolidated, relatively fine-grained, heterogeneous deposits of sand and silt and commonly including relatively thin, discontinuous layers of clay (Dupre and Tinsley, 1980). Gravel is locally abundant. The geologic materials have moderate porosity and permeability and the depth to the water table is generally less than 2 meters (m).

Earthquake groundshaking is the primary seismic hazard affecting the area. The entire area is expected to experience groundshaking intensity IX in a major earthquake (McCrory et al., 1977) and associated peak ground accelerations of 0.50g - 0.55g.[1] Liquefaction is a hazard with a 'very high' potential immediately at the river channel and 'moderate' in the adjoining area. The liquefaction hazard is rated 'moderate' at the treatment plant and along the San Andreas lateral, and 'moderate' to 'high' along the alignment of the proposed recycled water pipeline (Dupre and Tinsley, 1980).[2]

No part of the area with proposed project facilities lies within a tsunami hazard area.

Soils

The soils in the area of the treatment plant and near to Highway 1, as described in **Table 4.A.2-1,** are fluvaquentic Haploxerolls-Aquic Xerofluvents complex on 0-15 percent slopes, and San Emigdio Variant sandy loam on 0-2 percent slopes along much of the proposed recycled water pipeline (Soil Conservation Service, 1980). These are generally highly productive soils and almost entirely under cultivation.

No part of the area is within a designated zone of mineral, aggregate, oil and gas or geothermal resources.

---

1 Please refer to **Table 3.2.2** in Section 3.2 for a description of the Modified Mercalli Scale.

2 Very High Liquefaction Susceptibility - Sediments for which engineering testing and the presence of a shallow water table confirm the susceptibility for liquefaction in addition to historical evidence of liquefaction and failure during the 1906 earthquake. Sediments in this category are quite likely to liquefy and fail in an earthquake. Moderate Liquefaction Susceptibility – Sediments classed may liquefy in the event of a nearby earthquake and include those with high susceptibility but where historical evidence of liquefaction is absent.

TABLE 4.A.2-1
SOILS IN THE WATSONVILLE WASTEWATER TREATMENT PLANT AREA AND ALONG PROPOSED FACILITIES

Soil	Slope	Capability Class	Storie Index	Erosion Hazard
San Emidgio Variant sandy loam	0 - 2%	I irrigated III nonirrigated	90	slight
Fluvaquentic Haploxeroll-Aquic Xerofluvent complex	0 to 15%	III	30 - 69	slight

SOURCE: Soil Conservation Service, Soil Survey of Santa Cruz County, California 1980

4.A.2.2 SIGNIFICANCE CRITERIA

The CEQA Guidelines (amended 2000) indicate that a proposed project may have potentially significant geologic impacts if it exposes people to potential impacts involving: fault rupture, intense groundshaking, liquefaction, seiche or tsunami, landslides or mudslides, unstable soil conditions from excavation or filling, land subsidence, or disruption of unique geologic features.

For the purposes of this analysis, the project would result in potentially significant impacts if:

- Project facilities were located within a Alquist-Priolo Earthquake Hazard Zone or other active fault designated by a qualified professional.
- The site contains landslides, mudflows, or unstable slopes identified by the resources agencies or qualified professional, unless otherwise determined to be inactive features.
- Project facilities are located within an area that is underlain by granular soils and shallow groundwater that may be susceptible to liquefaction.
- Soil conditions are described as weak, moderately to highly expansive, or corrosive to uncoated steel or concrete by the Natural Resources Conservation Service (formerly the Soil Conservation Service).
- Project facilities would involve construction in soils with a high or very high erosion hazard as identified by the Natural Resources Conservation Service.
- The project would result in the extraction of groundwater or oil and gas deposits in an area affected by historically documented land subsidence.

- The project would create land use conflicts that would preclude the protection of mineral resources at the site.

- The project would alter or destroy a unique geologic feature such as an unusual rock formation (with limited distribution), fossil location, geologic structure (such as a cave) or a significant mineral occurrence.

Refer to Section 4.A.1, Land Use, regarding the loss of Prime Farmland that would result from implementation of the Recycled Water Facility.

4.A.2.3 IMPACTS AND MITIGATION MEASURES

Impact 4.A.2-1: Construction of the proposed facilities could result in accelerated erosion and attendant loss of soil resources and effects on sediment discharges in water courses. The impact would be significant on slopes over two percent and in areas with soils having moderate or greater erosion hazard. Proposed facilities could incur damage as a result of underlying soil properties (subsidence, high shrink-swell potential, and corrosivity). Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The Recycled Water Facility and pipelines would be in flat areas or areas with soils having low erosion hazard. However, the operation of construction equipment and vehicles, trench excavation, and soil stockpiling would expose loose soils to erosion if construction occurs in the rainy season. Soils exposed by construction operations have a tendency to be dislodged and transported by rain, surface watering, or temporary construction discharges. Soil erosion and loss of topsoil during a large construction project that extends over several months can be significant and result in project delays due to required soil restabilization, regrading, and soil removal from drainage structures.

The soil types at the Recycled Water Facility and along the pipeline route vary relative to the location. Each soil type in the project area possesses characteristics that could limit development of building structures or other facilities. These limitations include the shrink-swell capability (expansive behavior) and corrosivity. One or more of these soil properties could impact portions of the proposed project.

Measure 4.A.2-1a: Implement Measures 5.A.2-3a through 5.A.2-3f.

Measure 4.A.2-1b: Implement Measures 5.A.2-2.

Impact 4.A.2-2: Large earthquakes would be expected to damage the proposed facilities, impairing and/or disrupting their intended operations. Significant. With mitigation identified in this EIR, the impact would be reduced to an acceptable level of risk through engineering design, and therefore, reduced to a less-than-significant level.

As described in the Setting, the potential exists for large magnitude earthquakes to result in high intensity groundshaking and secondary earthquake effects, notably liquefaction. Intense groundshaking and high ground accelerations would affect the entire area around the treatment plant and associated pipelines. Groundshaking and liquefaction could cause loosening of pipeline joints, resulting in leaks and, possibly, breaking of a pipeline. The most severe impacts of this type would result from liquefaction of the soil, which could induce both vertical and lateral displacement of the soil that would bend, weaken and break pipelines. Broken pipelines could result in soil wash-out and sinkholes.

There is a potential for large magnitude earthquakes to result in groundshaking of considerable intensity and secondary earthquake effects, notably liquefaction. Intense groundshaking and high ground acceleration would affect the entire area of the WWTF. The primary and secondary effects of groundshaking could damage structural foundations, distort pipelines and other water conveyance structures, and cause failure of concrete. Damage to these features would cause temporary service disruption and possibly loss of water due to leakage and pipe rupture. Pumps could be rendered inoperable. The most severe impacts of this type would result from liquefaction of the soil, which could induce both vertical and lateral displacement of the soil that would bend, weaken and break conveyance structures and structural foundations. Broken pipelines could result in soil washout and sinkholes.

Locating and repairing damaged pipelines and the pumps could require a temporary cessation of operation of the facilities for a significant period of time.[3] The loss of the water supply, in turn, could temporarily affect agricultural operations. It is assumed that if water supply were reduced due to earthquake damage, the reductions would be restored within reasonable time frame not to require users to seek permanent, alternative sources.

> **Measure 4.A.2-2:** Conduct geologic investigations of all project facilities and pipeline alignments prior to the final design, and implement design recommendations. The investigations will specify hazards related to ground movements and co-seismic effects, especially liquefaction. The recommendations of an engineering geologist will be incorporated into the design and specifications and shall be implemented by the construction contractor. The construction manager will conduct inspections and certify that all design criteria have been met. While these measures would not eliminate the potential for damage to the facilities, they would ensure that the hazards have been reduced to an acceptable level of risk and, therefore, the impact would be reduced to a less-than-significant level.

[3] The 1987 Earthquake scenario prepared by the CDMG for a major earthquake on the Hayward fault predicted that water supply facilities could go off-line for a period of 24 to 72 hours and that pipelines that cross major faults could be damaged resulting in a 10 to 30 percent reduction in service (CDMG, 1987).

REFERENCES – Geology, Soils, and Seismicity

Dupre, W.R., J.C. Tinsley, *Maps Showing Geology and Liquifaction Potential of Northern Monterey and Southern Santa Cruz Counties, California*. U.S. Department of the Interior, U.S. Geological Survey, Map MF-1199, 1980

McCrory, P.A., Greene, H.G., and K.R. Lajoie, *Map showing earthquake Intensity Zonation and Distribution of Quaternary Deposits, San Mateo, Santa Cruz, and Monterey Counties, California*, U.S. Geological Survey Miscellaneous Field Studies, Map MF-903, scale 1:250,000, 1977.

U.S. Department of Agriculture, Soil Conservation Service, *Soil Survey of Santa Cruz County, California*, 1980.

4.A.3 HYDROLOGY AND WATER QUALITY

4.A.3.1 SETTING

The Pajaro Basin is in a current condition of overdraft. Under this condition, groundwater withdrawal exceeds replenishment and leads to a decline in groundwater elevations. Reduced groundwater elevations result in seawater intrusion along the coastal areas and the eventual degradation of fresh groundwater resources. The Water Recycling element of the BMP 2000 Alternative would provide a portion (4,000 acre-feet per year [afy]) of the water needed to offset irrigation demands and increase the sustainable yield of the basin.

Watsonville Wastewater Treatment Facility (WWTF)

The WWTF includes full secondary treatment. The WWTF discharges treated wastewater to the Pacific Ocean via a 7,350-foot outfall/diffuser system that terminates in approximately 64 feet of water. The WWTF is adjacent to the north bank of the Pajaro River, as shown in **Figure 2.5**. Facilities that would be required to provide recycled water for crop irrigation would include tertiary treatment facilities and a pumping plant adjacent to the WWTF and pipeline. The added facilities would be outside the flood protection levees but within the floodplain of the Pajaro River.

The pipeline would convey recycled water to the proposed Import Pipeline located south of the Pajaro River for blending and for access to the Springfield and San Andreas laterals of the Coastal Distribution System. The pipeline crosses from the north side to the south side of the river at Highway 1 and would be constructed outside the flood protection levees within the floodplain of the river.

Flood Hazards

The location of the proposed Recycled Water Facility and the associated pipelines is within the Federal Emergency Management Agency's (FEMA) 100-year flood hazard zone for the Pajaro River.

Water Quality

Table 4.A.3-1 shows the quality of the water from the WWTF, with the current advanced secondary treatment process. Recycled water from the WWTF is estimated to have the same electrical conductivity (EC) value of 1.4 micromhos per centimeter (μmhos/cm) as is currently discharged, with an average total dissolved solids (TDS) concentration of 900 mg/L. **Table 4.A.3-2** presents water quality data for metals in the secondary effluent from the WWTF. The WWTF is in compliance with the applicable effluent limitations, and metals levels generally are within drinking water maximum contaminant levels (MCLs). The City of Watsonville has an effective industrial pretreatment program that limits the introduction of metals into the sewer system. Metals levels in recycled water would be lower than levels shown in **Table 4.A.3-2** due to the additional (tertiary) treatment process.

TABLE 4.A.3-1
WWTF RECYCLED WATER QUALITY

Constituent	Value (milligrams per liter mg/L)	Constituent	Value (milligrams per liter mg/L)
pH (units)	6.9 - 7.9	Bicarbonate	331 (maximum)
EC (µmhos/cm)	1.2 – 1.7 (range) 1.4 (expected)	Sodium	166 (expected)
Total Dissolved Solids	780 – 1,100 (range) 900 (expected)	Boron	0.51 (maximum)
Ammonia (mg-N/L)	1.8 – 13 (maximum)	Chloride	133 (expected)
Nitrate (mg-N/L)	7.7 (maximum)	Sodium Adsorption Ratio (units)	4.3

Values are in milligrams per liter (mg/L), except where noted.
mg-N/L = milligrams nitrogen per liter.

SOURCE: RMC, Inc., *Revised BMP (Draft*), August 2001

TABLE 4.A.3-2
WWTF WATER QUALITY (METALS) SUMMARY (mg/L)

Element	Daily Maximum[a]	Drinking Water MCL	Average Conc.[b]
Arsenic	2.74	0.05	0.022
Cadmium	0.34	0.005	0.0023
Chromium (total)	0.68	0.05	0.0079
Copper	0.86	1.0	0.0089
Lead	0.68	0.015	0.021
Mercury	0.0136	0.002	N/D (0.0003)
Nickel	1.7	0.10	0.034
Selenium	5.1	0.05	N/D (0.023)
Silver	0.225	0.10	N/D (0.00083)
Zinc	6.13	5.0	0.025

a As contained in the City's Waste Discharge Requirements (WDRs)
b "N/D" = Not Detected; the detection limit was assumed for averaging. Samples collected 10/5/98, 4/20/99, 10/19/99, 4/17/00, and 10/24/00. For values "N/D" in all five samples, the average of the detection limits is presented.

SOURCE: City of Watsonville, 1998, 1999, and 2000; RWQCB, 1998.

4.A.3.2 SIGNIFICANCE CRITERIA

The project would result in a significant effect on hydrology or water quality if it would cause a substantial change in any of the following criteria:

- Violate any water quality standards or waste discharge requirements.
- Substantially deplete groundwater supplies or substantially interfere with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level.
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site.
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner, which would result in flooding on- or off-site.
- Otherwise substantially degrade water quality.
- Place within a 100-year flood hazard area structures which would impede or redirect flood flows.
- Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam.

Impacts of the project would be considered significant if the project would cause a Regional Water Quality Control Board (RWQCB) surface water or groundwater quality objective to be exceeded; would cause substantial erosion and sedimentation problems; would cause a flood hazard or exacerbate an existing flood hazard; or would cause or exacerbate a groundwater overdraft condition.

4.A.3.3 IMPACTS AND MITIGATION MEASURES

Overview

The Recycled Water Facility would operate only during the irrigation season, at which time the recycled water would be blended with either groundwater or imported water to achieve a maximum TDS level of 500 mg/L to protect sensitive agricultural crops. The Recycled Water Facility would have a design capacity of 8 mgd and would produce an estimated 4,000 afy during the nine-month irrigation season.

Impact 4.A.3-1: Construction of proposed water recycling facilities and associated pipelines could result in increased erosion and subsequent sedimentation, with adverse impacts to water quality. Additionally, release of fuels or other hazardous materials associated with construction activities could degrade water quality. Significant. With mitigation identified in the EIR, the impact would be reduced to a less-than-significant level.

Recycled Water Facility Site

Construction of proposed facilities would involve earthmoving activities such as excavation, grading, and soil stockpiling. All project construction would occur within the relatively flat areas adjacent to the existing WWTF, which eventually drain to the Pajaro River. Project construction could result in soil erosion and subsequent discharge of suspended sediments to nearby surface waters or drainages. Sedimentation to the waterways could degrade water quality for beneficial uses by increasing channel sedimentation and suspended sediment levels (turbidity), reducing the flood-carrying capacity, and adversely affecting associated aquatic and riparian habitats. Without mitigation, these impacts would be considered potentially significant.

Hazardous materials associated with construction activities, such as fuels, oils, antifreeze, coolants, paints, solvents, and other substances, could adversely affect water quality if released to surface waters. The required National Pollutant Elimination Discharge System (NPDES) permit would mandate the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP) identifying best management practices (BMPs) to reduce erosion of disturbed soils and release of hazardous materials into watercourses. Implementation of BMPs as required in the SWPPP would reduce potential impacts to less-than-significant levels.

Pipelines

Construction of the pipelines would be done primarily by open-trench construction. Excavated spoils would be stockpiled along the trench, then utilized for backfill, and excess or unsuitable materials would be transported from the alignment, as necessary. County permit requirements state that no excavated materials would be sidecast. Large-scale stockpiling of spoil materials is not anticipated. Construction activities would include implementation of BMPs for erosion control along the pipeline routes. Incorporation of standard BMPs, as required under the project SWPPP and identified in Measure 4.A.3-1, would reduce potential impacts to less-than-significant levels.

Pipeline installation primarily would require open-trench construction techniques, and jack-and-bore tunneling could be used to cross larger sections of the Pajaro River. Potential impacts associated with open-trench construction techniques could include sedimentation of the channels outside of the construction area during trenching activities, with subsequent downstream water quality impacts such as increased turbidity and sediment deposition. Pipeline construction crossing the Pajaro River could require a Section 404 permit from the U.S. Army Corps of Engineers, and 1601/03 Streambed Alteration Agreement from the California Department of Fish and Game (CDFG). Typically, a 401 Water Quality Certification from the RWQCB would also be required. The proposed action could likely be authorized under a Corps of Engineers

Section 404 Nationwide 12 – Utility Line Discharges permit. This permit authorizes utility pipeline installation across "waters of the U.S." in compliance with permit requirements. This Nationwide Permit authorizes mechanized land clearing necessary for the installation of utility lines, provided the cleared area is kept to the minimum necessary and preconstruction contours are maintained. Installation would occur during the dry season or low-flow season and would comply with permit requirements; potential impacts to water quality would be reduced to a less-than-significant level. This is discussed in additional detail in Section 4.A.4, Vegetation, Fish, and Wildlife.

Measure 4.A.3-1a–Storm Water Pollution Prevention Plan: The PVWMA shall require contractors to develop a SWPPP for construction of proposed facilities, as required by the RWQCB. The objectives of the SWPPP are to identify pollutant sources that may affect the quality of stormwater discharge and to implement BMPs to reduce pollutants in stormwater discharges. The SWPPP for this proposed action would include the implementation, at a minimum, of the following elements:

- Source identification;
- Preparation of a site map;
- Description of construction materials, practices, and equipment storage and maintenance;
- List of pollutants likely to contact stormwater;
- Estimate of the construction site area and percent impervious area;
- Erosion and sedimentation control practices, including soils stabilization, revegetation, and runoff control to limit increases in sediment in stormwater runoff, such as detention basins, straw bales, silt fences, check dams, geofabrics, drainage swales, and sandbag dikes;
- Proposed construction dewatering plans and
- List of provisions to eliminate or reduce discharge of materials to stormwater;
- Description of waste management practices; and
- Maintenance and training practices.

Measure 4.A.3-1b: Refer to Measures 4.A.4-1a, 4.A.4-1b, and 4.A.4-1c in Section 4.A.4, Vegetation and Wildlife, regarding pipeline construction within potentially jurisdictional wetlands/waters of the U.S. and streambeds and at the Pajaro River.

Impact 4.A.3-2: Without proper management, irrigation with recycled water could affect crop yields and result in a degradation of surface water or groundwater quality. Significant. With mitigation identified in the EIR, the impact would be reduced to a less-than-significant level.

Irrigation with recycled water could contribute to loading of specific constituents to groundwater supplies in the vicinity of irrigation sites. Typical groundwater quality concerns regarding the use of recycled water include TDS, metals, microorganisms, salts, and nitrates.

The proposed action would result in the irrigation of agricultural lands with a blend of recycled water and either groundwater or surface water, with the goal of limiting the TDS concentration to a maximum of 500 mg/L. The recycled water alone would have a TDS level of approximately 900 mg/L, and would be blended with either groundwater (2.7:1, assuming 350 TDS water) or imported water (2.7:1, assuming 350 TDS water) to achieve a blended TDS level of 500 mg/L. The target value of 500 mg/L was selected because it is considered the upper limit of suitability for irrigation of strawberries, which are the most salt-sensitive crop grown in the vicinity. Other crops grown in the area (in order of decreasing sensitivity to salinity) are lettuce, celery, cabbage, broccoli, and artichokes. Thus, irrigation with water containing a maximum of 500 mg/L would be considered protective of strawberry yields, and therefore would have no adverse effects on other crop yields. The TDS level in the recycled water mix would be below 500 mg/L, which is the secondary drinking water MCL; therefore, a less-than-significant impact to TDS levels in local groundwater is anticipated as a result of irrigating with the blended water. Monitoring of crop yields following initiation of recycled water irrigation is recommended in Measure 4.A.3-2b.

Metals would not be expected to adversely affect groundwater quality, because all metals in the recycled water are expected to be below their respective drinking water MCLs (see **Table 4.A.3-2**). In addition, metals are removed from water in soils through a complex process of adsorption, precipitation, ion exchange, and complexation (USEPA, 1981).

Microorganisms, including bacteria and viruses, are removed from water through filtration, adsorption (adherence to solids), desiccation (drying out of microorganisms), predation (loss of microorganisms to predators), and exposure to other adverse conditions. Bacteria, including coliform, are removed by filtration through the soil; in general, there is greater filtration of bacteria in fine-grained material than in course-grained material. Studies of wastewater application indicated that coliform are normally removed after 5 feet of percolation through the soil (USEPA, 1981).

Nitrate would be present in the recycled water at an average concentration of approximately 7.7 mg/L; the nitrate level in applied irrigation water (blended with either imported water or groundwater) would be lower. The drinking water MCL for nitrate (as nitrogen) is 10 mg/L. Nitrate is absorbed by plants and is readily immobilized in the unsaturated zone through absorption. However, once in the groundwater, nitrate is relatively stable and mobile. Typically, the levels of nitrate present in Watsonville's recycled water are less than the nitrate requirement of crops, and would be expected to be readily absorbed. Therefore, the potential for nitrate

loading to affect groundwater quality within the area of irrigation is considered low. The potential for nitrate migration through the root zone of crops would be further reduced by avoiding the over-application of irrigation water (see Measure 4.A.3-2a).

The primary mechanism for reducing nitrate levels in groundwater is through dilution. Thus, assuming a small percentage of the applied nitrate were to migrate to groundwater, a measurable but relatively low increase in nitrate concentrations is predicted in local groundwater.

Extensive analyses of nitrate loading was conducted as part of the City of Santa Rosa's Subregional Long-Term Wastewater Project EIR/EIS (City of Santa Rosa, 1996). Nitrate levels were monitored by sampling monitoring wells located upgradient, midgradient (in the central portion of irrigated areas), and downgradient of areas irrigated with recycled water. That analysis indicated an overall decrease in nitrate levels in a downgradient direction. If irrigation with recycled water were a significant source of nitrate input to groundwater, the opposite trend would be expected. Possible explanations include the denitrification and off-gassing of nitrogen gas, or that upgradient land use practices provide a greater input of nitrate to groundwater than the land use practices associated with irrigation using recycled water. Thus, while these studies were somewhat inconclusive, they did indicate that irrigation with recycled water would not be expected to result in a significant increase in the nitrate levels in groundwater.

The over-application of recycled water would have the potential to affect surface water quality if it resulted in surface ponding or direct runoff to local creeks or other water bodies. As required by state regulation, the following mitigation measure requires that recycled water be applied according to the evapotranspiration requirements of the crop being irrigated, and would prohibit the over-application of recycled water (and subsequent ponding or surface runoff). Recycled water should also not be applied within 50 feet of creeks or wells (Article 60310, Water Code). Implementation of these measures would ensure that Title 22 requirements are met, that surface waters are protected, and that potential impacts to surface or groundwater quality would be less than significant.

> **Measure 4.A.3-2a:** Above-ground irrigation systems shall be operated in accordance with the requirements of Title 22 of the California Code of Regulations and any reclamation permits issued by the RWQCB, Central Coast Region. Title 22 requires that irrigation rates match the evapotranspiration rates of the plants or crops being irrigated, and that application of reclaimed water be prohibited within 50 feet of creeks or wells.
>
> **Measure 4.A.3-2b:** Monitoring of crop productivity should be performed, and if adverse impacts to the yields of sensitive crops (e.g., strawberries) occurs, the blending ratio should be adjusted to decrease the fraction of recycled water in the applied irrigation water.

Impact 4.A.3-3: Development at the project site may expose people and structures to flood hazards. Significant. With mitigation identified in the EIR, this impact would be reduced to a less-than-significant level.

The additions to the WWTF site and the associated pipelines are within FEMA's 100-year flood hazard zone for the Pajaro River; as such, floodproofing of the facilities would be required. Placing the facilities within the 100-year floodplain would not be expected to exacerbate downstream flood conditions because of the proximity of the site to the ocean.

> **Measure 4.A.3-3:** The facilities shall be designed to comply with FEMA and County of Santa Cruz requirements to floodproof the facilities and not increase upstream or downstream flood hazards.

Impact 4.A.3-4: Construction activities associated with the conveyance pipelines included in this alternative could potentially compromise the structural integrity or water quality of active agricultural, production, or domestic wells located within proposed pipeline alignments. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Excavation, soil stockpiling activities, or construction equipment associated with pipeline construction may damage production, agricultural or domestic supply well structures, especially sanitary seals of wells or disturb well mounts, pump equipment, piping systems or enclosures. Certain damage that would expose the well casing could lead to the introduction of contaminants such as sediments or chemicals into the groundwater. Damage to the well system, pump equipment, piping or enclosures could temporarily stop proper well operation and interrupt water delivery.

> **Measure 4.B.3-4a:** Implement measures to ensure that construction activities do not damage existing wells. Wells shall be capped in an appropriate manner to prevent soil and other contaminants from entering groundwater aquifers.

> **Measure 4.B.3-4b:** PVWMA or its contractor shall correct any damage to wells and/or reimburse well owners for any loss of use of the well during construction.

REFERENCES – Hydrology and Water Quality

California Regional Water Quality Control Board, Central Coast Region, *Waste Discharge Requirements Order No. 98-19 for the City of Watsonville*, October 30, 1998.

City of Santa Rosa, *Santa Rosa Subregional Long-Term Wastewater Project EIR/EIS*, July 1996.

City of Watsonville Wastewater Treatment Facility, *POTW Annual Report*, submitted to RWQCB, Central Coast Region, 1998, 1999, and 2000.

RMC Inc., *Revised Basin Management Plan* (Internal Draft), July 2001.

U.S. Environmental Protection Agency (USEPA), *Process Design Manual, Land Treatment of Municipal Wastewater*, October 1981.

4.A.4 VEGETATION, FISH, AND WILDLIFE

4.A.4.1 SETTING

Please refer to Section 3.4 for a description of methods used during investigation of the project area for biological resources.

The proposed Recycled Water Facility would be constructed next to the existing Watsonville Wastewater Treatment Facility (WWTF) and would be located in a fully developed, primarily agricultural area. Portions of the property are undeveloped, and contain weedy vegetation typical of disturbed sites. Nearby is the lowest reach of the Pajaro River with a floodplain fully contained by levees.

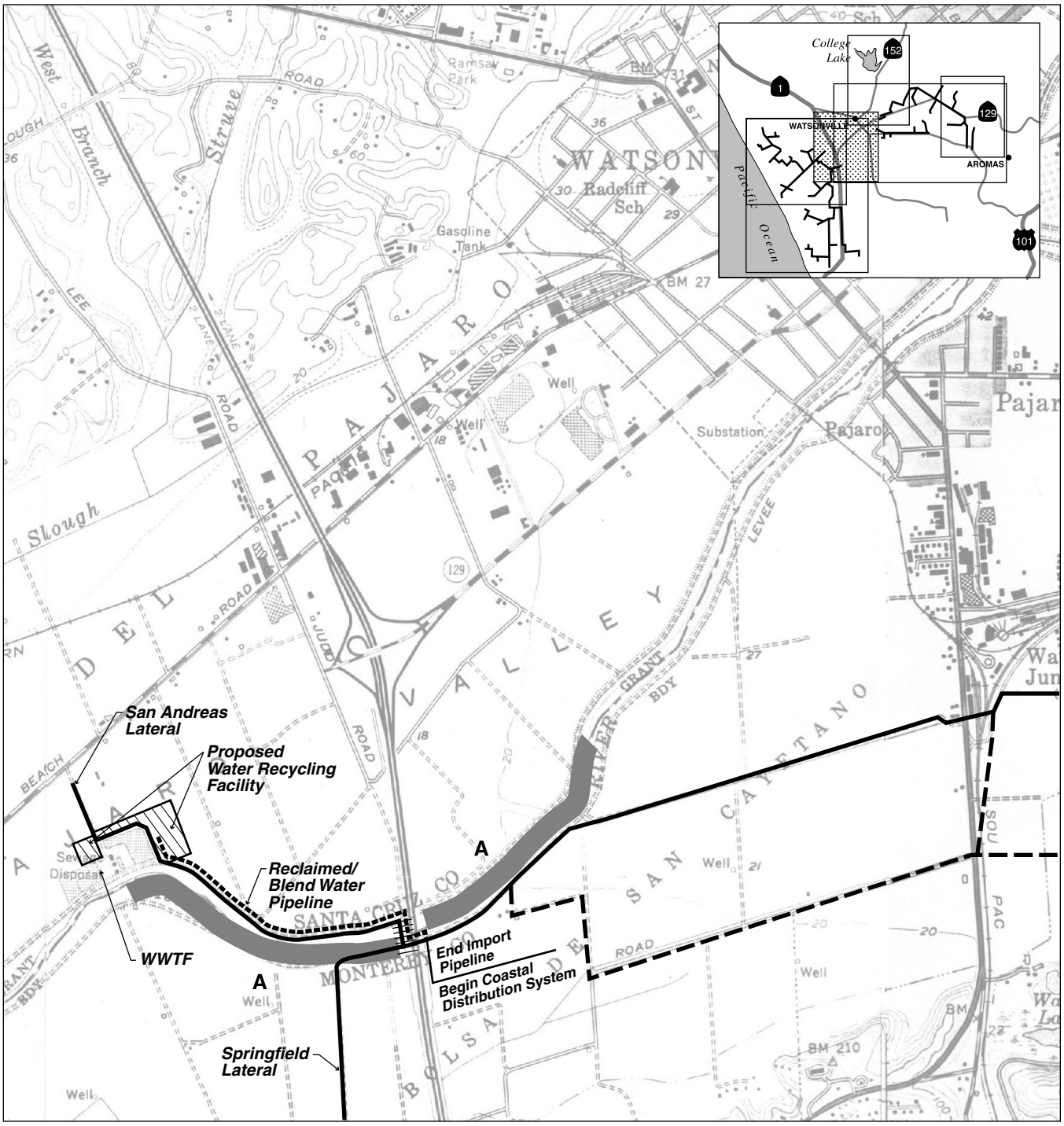
The Recycled Water Facility would require approximately eight acres of primarily agricultural land adjacent to the WWTF. For the BMP 2000 Alternative, a pipeline would be required to connect the Recycled Water Facility to the Import Pipeline (part of the Groundwater Banking component) south of the Pajaro River, and a pipeline to connect to the Coastal Distribution System. From the proposed Recycled Water Facility, the pipeline would pass through agricultural lands parallel to and north of the Pajaro River levees. The pipeline would cross the Pajaro River near the Highway 1 crossing. Except for the Pajaro River crossing, all of the proposed locations for facilities are in agricultural or weedy, disturbed areas. Natural vegetation in the vicinity of Highway 1 and the Pajaro River consists of Valley Foothill Riparian habitat that has been somewhat degraded due to agriculture and river channeling activities (see **Figure 4.A.4-1)**.

Other than the vegetation within the Pajaro River riparian corridor only two native plant species (coyote brush and poison oak) were observed in the vicinity of the WWTF. Maintenance of the facility and surrounding cropland appears to include aggressive weed control that precludes the establishment of most native plant species as well.

Common wildlife species were observed in the vicinity of the WWTF, including gulls, blackbirds and sparrows. In the nearby riparian forest of the Pajaro River, there were a large number and variety of birds, including the yellow warbler, a species of concern. Raptors are also present in the project area. The California red-legged frog and western pond turtle are likely present in the Pajaro River.

South-central California coast steelhead pass through this portion of the Pajaro River en route to spawning areas farther upstream in the Salsipuedes Creek and upper Pajaro River watersheds. Further downstream, the Pajaro Lagoon supports a population of the federally endangered tidewater goby.[1]

[1] Tidewater goby populations north of Orange County have been proposed for delisting by the U.S. Fish and Wildlife Service (USFWS) because more recent data collected on the species suggests that the original listing rule overestimated the species' risk of extinction.



NOTES:
- Habitat types are based on Mayer and Laudenslayer Wildlife Habitat Relationships (1988)
- Areas not designated are either crop/orchard/vineyard or urban/developed habitat type.

Habitat crossed by the proposed alignment

Habitat adjacent to proposed alignment

Habitat Types

A Valley Foothill Riparian

SOURCE: Environmental Science Associates

PVWMA Revised BMP EIR / 200179 ■

Figure 4.A.4-1
Wildlife Habitats Associated with Proposed Water Recycling Facilities

4.A.4.2 SIGNIFICANCE CRITERIA

The California Environmental Quality Act (CEQA) *Guidelines* specifies that projects are considered significant if one or more of the following occur:

- Section 15065 (Mandatory Findings of Significance): "…substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of an endangered, rare or threatened species,…"

- Section 15206 (b) (5) (Projects of Statewide, Regional, or Areawide Significance): "…substantially affect sensitive wildlife habitats including but not limited to riparian lands, wet lands, bays, estuaries, marshes, and habitats for endangered, rare, and threatened species as defined by Section 15380…"; Section 15380 (Endangered, Rare or Threatened Species); and

- Section 15382 (Significant Effect on the Environment): "…a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance."

These criteria are related to definitions and policies under the Federal Endangered Species Act (FESA) and California Endangered Species Act (CESA). Project-related impacts to species on the CESA and FESA endangered list and threatened lists would be considered "significant" in this EIR. Impacts to "species of concern" would be considered "significant" under certain circumstances.

Based on policy and guidance provided by CEQA (Public Resources Code Section 21001 and CEQA Guidelines), the project would have a significant impact on vegetation, fish and wildlife if it causes one or more of the following impacts:

- Adverse substantial effect to any species identified as a threatened, endangered, candidate, sensitive, or special-status species in local or regional plans, policies, regulations or by lists of species of concern from the CDFG, the USFWS or as defined by Section 15380 of CEQA Guidelines;

- Adverse substantial effect to habitat (including habitats for rare and endangered species as defined by CDFG Code Section 2050 *et seq.*) or other sensitive natural community identified in local or regional plans, policies, regulations or by lists compiled by CDFG or USFWS;

- Adverse substantial effect to federally protected wetlands (including but not limited to marshes and riparian areas) as defined by Section 404 of the Clean Water Act, or riparian and marsh areas under the jurisdiction of CDFG as defined by CDFG Code Sections 1601–1603;

- Substantial interference with movement of any native resident or migratory fish or wildlife species or with established migration or dispersal corridors;

- Removal or damage to any tree meeting the significant resource criteria set forth under local plan or ordinance; or

- Damage to a resource that is subject to USACOE permit requirements under Section 404 of the federal Clean Water Act and that may provide valuable wildlife habitat, such as habitat for special status plant or animal species.

Local Plans and Policies

A project will normally have a significant impact on the environment if it would adversely affect communities or species protected by adopted environmental plans and goals of the community(ies) where it is located. Objective 9.2 of the Monterey County General Plan assures protection of quality freshwater habitats through cooperation with the California Department of Fish and Game and other public and private conservation organizations. Policy 5.2.5 of the Santa Cruz General Plan prohibits land development within the 100 foot riparian corridor of all wetlands. Policy 9.B.2 of the City of Watsonville General Plan calls for implementation of environmental mitigation on projects that may destroy or impair the future use or existence of natural resources.

Less-than-Significant Impacts

Impacts are generally considered less than significant if the habitats and species affected are common and widespread in the region and the state.

For the purposes of this EIR, three principal components of the guidelines outlined above were considered:

- Magnitude of the impact (e.g., substantial/not substantial)
- Uniqueness of the affected resource (rarity)
- Susceptibility of the affected resource to disturbance (sensitivity)

The evaluation of significance must consider the interrelationship of these three components. For example, a relatively small magnitude impact (e.g., disturbing a nest) to a State or Federally listed species would be considered significant because the species is at low population levels and is presumed to be susceptible to disturbance. Conversely, a common habitat such as Mixed Chaparral is not necessarily rare or sensitive to disturbance. Therefore, a much larger magnitude of impact (e.g., removal of extensive vegetation) would be required to result in a significant impact.

4.A.4.3 IMPACTS AND MITIGATION MEASURES

Impact 4.A.4-1: Construction of the proposed pipeline to the blending facility component could result in temporary impacts to up to 0.6 acre of potentially jurisdictional wetlands/waters of the U.S. and streambeds and banks under the jurisdiction of the California Department of Fish and Game at the Pajaro River crossing near Highway 1. Potential impacts include sedimentation of the channels outside of the construction area during trenching activities, loss of riparian vegetation and stream function as wildlife and fishery habitat, and loss of a special status natural community. Significant. With mitigation identified in the EIR, the impact would be reduced to a less-than-significant level.

As shown in **Figure 4.A.4-1**, the pipeline connecting the Import Pipeline and the Recycled Water Facility must cross the Pajaro River. Coastal riparian forest (Holland, 1986) is a special status natural community (see Section 3.4). Loss of such a natural community along the Pajaro River is an unavoidable adverse impact. Since full development of a riparian forest takes places over decades, loss of riparian habitat, although temporary, would require many years to replace.

Measure 4.A.4-1a--Wetlands Avoidance: Wetlands and riparian habitat at the Highway 1 crossing of the Pajaro River may be avoided entirely by using bore and jack construction.

Implementation of this measure would reduce the impact to a less-than-significant level. If complete avoidance is infeasible, implement Measures 4.A.4-1b and 4.A.4-1c, below. Implementation of the following measures would reduce the impact, but it would remain significant.

Measure 4.A.4-1b--Implement Standard Protective Measures to Maintain Water Quality and Control Erosion and Sedimentation: Standard measures to maintain water quality and to control erosion and sedimentation shall be implemented. These measures include:

- Restrict trenching across all waterways to low-flow periods.
- Exclude water from around the section of trench that is within the actively flowing channels. This will further reduce the potential for sediment or other pollutants to enter the waterways and to impact downstream resources. The diversion will consist of water pillows, rock, sandbags, or other structural methods deemed most effective by the project engineer.
- Place sediment curtains downstream of the construction zone to prevent sediment disturbed during trenching activities from being transported and deposited outside of the construction zone.
- Locate spoil sites so they do not drain directly into the waterways. If a spoil site drains into the creek, catch basins will be constructed to intercept sediment before it reaches the channels. Spoil sites will be graded to reduce the potential for erosion.

- Prepare and implement spill prevention plan for potentially hazardous materials. The plan will include the proper handling and storage of all potentially hazardous materials, as well as the proper procedures for cleaning up and reporting of any spills. If necessary, containment berms will be constructed to prevent spilled materials from reaching the creek channels.

- Store equipment and materials at least 50 feet from waterways, but within the pipeline right-of-way. No debris such as trash and spoils will be deposited within 100 feet of wetlands.

- Provide proper and timely maintenance for vehicles and equipment used during construction to reduce the potential for mechanical breakdowns leading to a spill of materials into or around the creeks. Maintenance and fueling will be conducted in an area that meets the criteria set forth in the spill prevention plan (i.e., away from the creeks).

Measure 4.A.4-1c--Restore Pajaro River Riparian Forest: Where unavoidable impacts to coastal riparian forest occur at crossings of the Pajaro River, revegetation measures will be developed as part of a revegetation plan approved by CDFG.

These measures will include: stockpiling and conserving surface soil for spreading following construction; use of locally obtained and locally indigenous plant materials; use of site preparation and planting methods known to be effective for riparian habitats and the species to be used in revegetation; after-installation care; implementation of effective weed control measures; development of success criteria; and identification of corrective measures if the success criteria are not met. The revegetation plan will use materials of the same species as existing vegetation, and will use planting ratios to allow for some mortality during the years when the vegetation is small.

Impact 4.A.4-2: Construction of facilities at the Pajaro River crossing near Highway 1 would result in temporary impacts to up to 0.6 acre of habitat for special status animal species. Impacts could occur due to risk of increased sedimentation in streams, dewatering of pools, habitat loss through vegetation removal, destruction of nests and burrows and construction disturbance. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The special status animal species that have the potential to occur near this project include:

- California red-legged frog (federal Threatened and California Species of Special Concern)
- Western pond turtle (federal Species of Concern and California Species of Special Concern)
- Least Bell's vireo (federally and State listed as endangered)
- Yellow warbler (California Species of Special Concern)
- Yellow-breasted chat (California Species of Special Concern)
- South-central California coast steelhead (federal Threatened)

- Raptors (California Species of Concern)
- Tidewater goby (Federal Endangered, proposed for delisting)

California Red-legged Frog, Yellow Warbler, Least Bell's Vireo, Yellow-breasted Chat, Western Pond Turtle, Raptors. Breeding habitat for these species may be present in the Pajaro River, especially west of Highway 1. Construction in this area would result in loss of approximately 0.6 acre of potential habitat for these special status species.

South-central California Coast Steelhead. Steelhead spawn in the upper Pajaro River and Salsipuedes Creek watersheds, both upstream from the Highway 1 crossing. Therefore, these populations of steelhead rely on enough flow and sufficient water quality for adults to pass upstream past Highway 1 during winter and for smolts to migrate downstream in spring.

Tidewater Goby. Tidewater goby are present in the estuary at the mouth of the Pajaro River and may occur upstream of Highway 1 in summer. Mitigation Measures discussed below for this species are only required if the species remains listed as a federal Endangered species at the time of project implementation (see footnote on page 4.A.4-1).

Measure 4.A.4-2a--Avoidance of Habitat: Removal or damage to riparian vegetation within the levees of the Pajaro River may be avoided by constructing the pipeline crossing with bore and jack methods.

If the use of bore and jack methods is feasible, implement Measures 4.A.4-2b and 4.A.4-2c below.

Measure 4.A.4-2b--Survey, Consultation, and Protection Measures for Special Status Wildlife Species: Potential habitat for the California red-legged frog was found as part of the site assessment. Thus, the following measures shall be implemented to avoid construction-related impacts to the species:

- **Pre-construction surveys for the red-legged frog within the construction zone shall be conducted by a qualified biologist.** A search shall be completed for juvenile and adult red-legged frogs that may occur within the project area. If no individuals of these species are detected during these surveys, then construction-related activities may proceed. If red-legged frogs are found within the construction disturbance zone they will immediately be moved passively, or captured and moved, to suitable sites by an appropriately permitted biologist.

- **Fencing shall be erected around the construction areas to exclude frogs from the sites.** Bore pits and pipeline segments shall be covered during the night to avoid accidental trapping of frogs.

- **A biological monitor shall be on site during construction activities.** The monitor shall be appropriately permitted to relocate frogs if necessary.

Measure 4.A.4-2c— Survey and Protection of Raptor and Passerine Nesting Sites: To avoid conflicts with nesting raptors and with riparian-dependent songbirds, including least Bell's vireos, yellow warblers, and yellow-breasted chats, construction activities within

500 feet of riparian habitat shall be performed prior to March 15 or after August 15 (July 15 for passerines), unless pre-construction surveys show that no special status birds are nesting within 500 feet of the construction zone. If the survey indicates that nesting birds are present, suitable avoidance measures would be developed in coordination with the California Department of Fish and Game (CDFG). Current CDFG avoidance guidelines require a minimum 500-foot buffer zone around raptor nests, and a 250-foot zone around the nests of other birds.

If complete avoidance is infeasible, implement Measures 4.A.4-2d through 4.A.4-2g, below.

Measure 4.A.4-2d--Minimize Habitat Loss: If complete avoidance of the riparian areas is not possible, then the river crossing shall be designed to cross the Pajaro River on the east side of Highway 1 where the riparian vegetation has already been largely removed.

Measure 4.A.4-2e--Survey, Consultation, and Protection Measures for Special Status Wildlife Species: Because the South-central California coast steelhead and tidewater goby are known to be present, and potential habitat for the California red-legged frog was found as part of the site assessment, reasonable and prudent measures for protection of the California red-legged frog contained in the Programmatic Biological Opinion for this species (USFWS, 1999) shall be implemented if the U.S. Army Corps of Engineers finds that impact to this species is likely. If impacts to the South-central California coast steelhead or tidewater goby may occur as a part of this project, a formal consultation and Biological Opinion must be prepared for USFWS and the National Marine Fisheries Service (NMFS) under the Endangered Species Act.

Because the steelhead are known to be present, and the tidewater goby and California red-legged frog, as well as other special status wildlife species are presumed present at the Pajaro River crossing, the following mitigation measures are proposed:

- **Pre-construction surveys for the red-legged frog, steelhead, and the tidewater goby within the construction zone shall be conducted by a qualified biologist.** A search shall be completed for all life cycle stages of the red-legged frog (e.g., egg masses, tadpole, juveniles, adults), steelhead, and the tidewater goby that may occur within the project area. If no individuals of these species are detected during these surveys, then construction-related activities may proceed. If adult red-legged frogs or tadpoles, steelhead, or tidewater gobies are found within the construction disturbance zone they will immediately be moved passively, or captured and moved, to suitable sites by an appropriately permitted biologist.

- **The aquatic structure of channel areas to be disturbed shall be documented before and after construction by qualified personnel.** Such personnel will also be capable of assessing relative suitability as red-legged frog, steelhead, and tidewater goby habitat. The stream flow, profile and percent vegetative cover shall be measured no more than four weeks before construction begins. For three years after construction, the aquatic structure shall be photo-documented and measured to ensure that the channel has been restored to its original condition to the extent practicable.

- **The creekside construction boundary will be fenced to prohibit the movement of frogs into or out of the construction area and control creek siltation and disturbance to riparian habitat.** Following installation of fencing, its proper location shall be verified by a biologist. The monitor shall ensure that at no time during construction is vegetation removed outside of the fenced area. If variance in construction requires removal of vegetation outside the fence, the monitor shall determine if additional mitigation is warranted.

- **In-channel construction shall be conducted between two coffer dams, with stream flow bypassed in a culvert installed at grade in the stream bed.** To the extent possible, construction shall be conducted during periods when streamflow is very low.

- **During construction, a biological monitor shall be on site at all times when construction takes place within the levees of the Pajaro River.** A biologist with the appropriate permits shall be available to relocate frogs, steelhead, and/or tidewater gobies, and for consultation as needed. The monitor and biologist shall provide an environmental protection workshop for workers prior to the start of construction activities.

- **All construction adjacent to riparian vegetation shall be regularly monitored to ensure that impacts do not exceed the maximum of 70 feet width.**

Measure 4.A.4-2f--Survey and Protection of Western Pond Turtles: Prior to construction activities, a qualified biologist shall perform pond turtle surveys within 300 feet of the construction area within the Pajaro River levees. Surveys will include nests as well as individuals. The project biologist will be responsible for the survey and for relocating adult turtles that move into the construction zone after construction has begun. Construction will not proceed until the area is determined to be free of turtles or their nests. If a nest is located within a work area, a biologist with the appropriate permits from CDFG may move the eggs to a suitable facility for incubation, and release hatchlings into the creek system in late fall.

Measure 4.A.4-2g--Protection of Steelhead Migratory Habitat: Impacts to steelhead migration passage shall be minimized by carrying out construction in the Pajaro River after June 1 and prior to November 1, during which time adults and smolts do not migrate through the area.

Impact 4.A.4-3: Construction of facilities at the Highway 1 crossing would not adversely affect special status plant species. Less than Significant.

Except for the Pajaro River pipeline crossing near Highway 1, the Recycled Water Facilities are located in agricultural or other non-natural habitat. No suitable habitat for special status plants were found to be present in the study area for this project element, either at the river crossing or elsewhere. As a result, no impacts to special status plants are expected to occur and no mitigation is proposed.

Mitigation: None required or recommended.

REFERENCES – Vegetation, Fish, and Wildlife

California Department of Fish and Game (CDFG), *Federal and State Listed Threatened and Endangered Plants and Animals by County*, 1997.

Federal Register, *Endangered and Threatened Wildlife and Plants; Proposed Rule to Remove the Northern Population of the Tidewater Goby from the List of Endangered and Threatened Wildlife*, Vol. 64, No. 121, June 24, 1999; 2001.

Holland, R.F., *Preliminary Descriptions of the Terrestrial Natural Communities of California*, Department of Fish and Game, Sacramento, CA, 1986.

U. S. Fish and Wildlife Service (USFWS), Programmatic Formal Endangered Species Act Consultation on Issuance of Permits under Section 404 of the Clean Water Act or Authorizations under the Nationwide Permit Program for Projects that May Affect the California Red-legged Frog, Letter to U.S. Army Corps of Engineers district offices, dated January 26, 1999.

4.A.5 CULTURAL RESOURCES

4.A.5.1 SETTING

Archaeology of the Project Area

Section 3.5 provides archaeological/prehistoric data on the project area. Archaeological surveys of the area around the Watsonville Wastewater Treatment Facility (WWTF) and the siting area for the supplemental wells were conducted by Pacific Legacy in November 1997 and March 1999. No cultural resources were identified or recorded in or near these areas. However, based on surveys completed in the general project area, construction activities could reveal presently unknown cultural resource sites.

Ethnography of the Project area

Section 3.5 provides ethnographical data on the project area.

Historical Overview

Section 3.5 provides an historical overview of the project area.

4.A.5.2 SIGNIFICANCE CRITERIA

In accordance with Section 15064.5(b) of the CEQA Guidelines, a significant effect would normally occur if a project would cause a substantial adverse change (destruction, relocation, etc.) in the significance of a historical resource. Historical resources[1] include:

1. A resource listed in the California Register of Historical Resources, or determined to be eligible by the State Historical Resources Commission.

2. A resource included in a local register of historical resources.

3. Any object, building, structure, site, area, record, or manuscript which a lead agency determines to be "historically significant" or significant in the annals of California may be considered a historical resource, provided the lead agency's determination is supported by substantial evidence. Generally, a resource shall be considered to be historically significant if the resource meets the criteria for listing in the California Register of Historical Resources.[2]

When a project would adversely affect an archaeological site, a lead agency shall first determine whether the site is a historical resource, as defined above. If it is determined that the

[1] The fact that a resource does not meet the definition of "historical resources" does not preclude a lead agency from determining that the resource may be a historical resource.

[2] Resources that meet the criteria for listing in the California Register of Historical Resources include resources that: (a) are associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage; (b) are associated with the lives of persons important in our past; (c) embody the distinctive characteristics of a type, period, region, or method of construction, or represent the work of an important creative individual, or possess high artistic values; or (d) have yielded, or may be likely to yield, information important in prehistory or history.

archaeological site is a historical resource, the provisions of Public Resources Code Section 21084.1 (Historical Resources) apply. If an archaeological site does not meet the criteria, but does meet the definition of a "unique archaeological resource" in Public Resources Code Section 21083.2 (Archaeological Resources), the site must be treated in accordance with the provisions of Section 21083.2. Section 21083.2(g) defines a unique archaeological resource as "an archaeological artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria:

1. Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.

2. It has a special and particular quality, such as being the oldest of its type or the best available example of its type.

3. Is directly associated with a scientifically recognized important prehistoric or historic event or person."

While Section 21083.2 of the CEQA Guidelines provides criteria for assessing archaeological "uniqueness," CEQA lacks specific criteria for assessing the significance of historic structures that are not archaeological resources (i.e., standing structures). Criteria used for assessing historic significance are these developed and used by the U.S. Department of the Interior for the National Register of Historic Places pursuant to 36CFR Part 800:

- "The quality of significance in American history, archaeology, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

    A. that are associated with events that have made a significant contribution to the broad patterns of our history; or

    B. that are associated with the lives of persons significant in our past; or

    C. that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

    D. that have yielded, or may be likely to yield, information important in prehistory or history."

In addition to the provisions of CEQA and the eligibility criteria of the National Register of Historic Places, there are laws, acts, and regulations specific for the protection of Native American resources. These generally include Native American participation if Native American resources are affected or if human remains are encountered, and consultation with the Native American Heritage Commission.

For this project, an impact on cultural resources would be considered potentially significant if cultural resource features are identified in the project area, and the identified features or sites meet any of the criteria for the National Register of Historic Places or CEQA. A significant impact would result if the project as proposed would result in the degradation or destruction of an important archaeological or historic resource, or if human activity resulting from project development had the potential to disrupt the integrity of an identified resource.

4.A.5.3 IMPACTS AND MITIGATION MEASURES

Impact 4.A.5-1: Ground-disturbing activities associated with the proposed Recycled Water Facility and associated pipelines could reveal unknown buried or otherwise obscured prehistoric and historic cultural resources. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

While no known or previously recorded cultural resources sites were identified in the project area, significant unknown cultural resources may be buried or obscured by vegetation, and therefore construction of the proposed project could result in degradation and destruction of undiscovered cultural resources.

> **Measure 4.A.5-1:** Should any as yet undiscovered cultural resources, such as structural features, or unusual amounts of bone or shell, artifacts, human remains, or architectural remains be encountered during any development activities, work will be suspended and PVWMA staff will be contacted. A qualified cultural resource specialist shall be retained and will perform any necessary investigations to determine the significance of the find. PVWMA will then implement any mitigation deemed necessary for the recordation and/or protection of the cultural resources. In addition, pursuant to Sections 5097.97 and 5097.98 of the State Public Resources Code and Section 7050.5 of the State Health and Safety Code, in the event of the discovery of human remains, all work must be halted and the County Coroner shall be immediately notified. If the remains are determined to be Native American, guidelines of the Native American Heritage Commission shall be adhered to in the treatment and disposition of the remains.

Impact 4.A.5-2: Supplemental wells could potentially be sited in areas with underlying cultural resources. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Specific locations of supplemental wells have not yet been identified, and therefore no site-specific investigation has been done for supplemental wells.

> **Measure 4.A.5-2:** As part of the siting study for wells, PVWMA will retain an archaeologist to conduct archival research and surface reconnaissance of potential sites. The findings of the investigations will be incorporated into the selection of specific locations for wells and connecting pipelines such that PVWMA will avoid siting wells and attendant connecting pipelines at or through any significant cultural resources.

4.A.6 TRAFFIC AND CIRCULATION

4.A.6.1 SETTING

Project Area Roadways

Figure 3.6.1 in Section 3.6 depicts roadways in the project area. *Highway 1* (Cabrillo Highway) provides coastal access through the project area, providing connection to the Cities of Watsonville and Santa Cruz to the north, and Monterey and other central coast destinations to the south. In the project area, Highway 1 is a four-lane divided freeway to approximately one mile south of the Santa Cruz - Monterey county line, where is narrows to two lanes. The maximum posted speed limit on Highway 1 in the project area ranges from 55 to 65 mph.

Beach Road, a two-lane roadway, extends west from Highway 1 to Palm Beach, north of the project area. Vehicles traveling to and from the WWTF could access the plant's entry road from West Beach Road.

Existing Truck Traffic on Roadways

Section 3.6 presents existing truck traffic on study area roadways.

Accident History

Section 3.6 presents an accident history for study area roadways.

Roadway Improvement Projects

Section 3.6 describes roadway improvement projects planned in the study area.

Applicable Plans and Policies

Section 3.6 presents applicable plans and policies for jurisdictions in the study area.

4.A.6.2 SIGNIFICANCE CRITERIA

A project would have significant traffic impacts if it would cause a substantial increase in traffic relative to the existing traffic load and capacity of the street system. Construction of the Import Pipeline and its long-term operation would not generate a substantial increase in traffic, but would cause short-term disruption of traffic flow and increased congestion. For the purposes of this EIR, a project that would cause an increase in traffic that is substantial in relation to the existing traffic load and capacity of the street system is considered to have a significant impact on the environment. The project would be considered to have a significant impact where construction of project pipelines would occur within roadways or across major streets that are important to local circulation. Furthermore, the project is also considered to have a potentially significant impact if:

- construction activities substantially impede access to local adjacent land uses, including emergency access;
- movement of heavy vehicles would cause substantial damage or wear of public roadways;
- construction activities pose a traffic safety hazard to motor vehicles, bicyclists, or pedestrians in areas where there is a history of accident problems (i.e., a high number of accidents and/or an accident rate higher than the statewide average for similar roads); or
- construction substantially affects parking availability, causing traffic safety/operational problems.

These latter criteria do not lend themselves to quantitative thresholds of significance, and the determination of significance will be based on professional traffic engineering judgment.

4.A.6.3 IMPACTS AND MITIGATION MEASURES

Construction Trip Generation

Construction activities that would generate traffic would consist of trucks hauling equipment and materials to the WWTF site and associated pipeline alignments, the hauling of excavated spoils from, and delivery of materials and backfill to the work sites, and the daily arrival and departure of construction workers to and from the work sites. It is estimated that the earthwork component of construction of the tertiary treatment facilities would generate the greatest number of off-site truck trips. It is anticipated that approximately 14,300 cubic yards of materials, and import of approximately 4,800 cubic yards of material would occur during this phase.

Truck trips to and from the water recycling facility are preliminarily estimated at an average of approximately 11 round-trips per day over the 18-month construction period. During peak excavation periods, up to 10 round-trips per hour could occur as spoils are trucked off-site for disposal or import of new materials are delivered. The proposed pipeline construction would involve an estimated 40 round-trips (80 one-way trips) occurring per day at the typical construction site.

In addition to the heavy truck trips described above, construction workers would be commuting to and from the project sites, most likely in personal automobiles or small trucks. An estimated 20 workers would be expected to commute to and from the WWTF site on a daily basis, while construction crews of 10 workers would be expected for pipeline construction.

Construction Trip Distribution

It is not known at this time what would be the specific destination(s) for hauling of excavated materials from the construction areas, or originating location(s) for delivery of imported fill and other materials to the work sites. However, a number of construction materials sources (e.g., quarries, manufacturers) and excess soil re-use options (e.g., farms) are located in the

surrounding rural areas and urban centers. Construction worker trips are assumed to originate from the major urban areas in the project region and nearby communities.

Based on the existing roadway network serving the project area, it is assumed project trucks and construction workers traveling to and from the alignment would primarily use a combination of highways (e.g., Highway 1), county roads and designated truck routes in the project vicinity to reach other local points and/or regional locations.

Impact 4.A.6-1: Traffic on area roadways would temporarily increase as a result of project-generated vehicle trips by construction workers and construction vehicular activities. Less than Significant. Implementation of recommended mitigation measures identified in this EIR, while not required, would assist in ensuring that the impact would remain at a less-than-significant level.

Because project construction-generated traffic would be temporary, it would not result in any long-term degradation in operating conditions or level of service for any project-area roadways. The primary off-site impacts from the movement of construction trucks would include short-term and intermittent lessening of roadway capacities due to slower movements and larger turning radii of the trucks compared to passenger vehicles.

The project would temporarily increase traffic on roadways providing access to the work sites and roadways providing connection to regional routes; this would mainly affect Highway 1 via Beach Road. Although the specific estimated off-site construction vehicle trips are preliminary, (see Construction Trip Generation, above), given the expected type and scope of facility and pipeline construction, construction-generated traffic would be expected to be at a level that would not significantly disrupt traffic flow on these freeways and arterials. Given the pace of construction, the duration that haul trucks would be required to use any given local roadway would be relatively brief.

Most project-related hauling and deliveries would be expected to be dispersed throughout the day, thus lessening the effect on peak-hour traffic. Project truck traffic occurring during the hours of 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. would coincide with peak-hour traffic, and therefore have the greatest potential to impede traffic flow during these time periods. Restricting truck traffic during the a.m. and p.m. peak periods would further minimize disruption of the general traffic flow on affected roadways.

Although this impact would be less than significant, the following mitigation measures are recommended to further reduce the less-than-significant impact.

> **Measure 4.A.6-1a (Recommended):** Schedule truck trips outside of peak commute hours.
>
> **Measure 4.A.6-1b (Recommended):** Use haul routes that minimize truck traffic on local roadways to the extent possible.

Impact 4.A.6-2: Project construction would increase wear and tear on area roadways used by construction vehicles. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The use of heavy trucks to transport equipment and material to and from the project sites could affect road conditions by increasing the rate of road wear or cause direct damage to roads and bridges. The degree to which this impact would occur depends on the project-generated traffic and the design (pavement type and thickness) and existing condition of the roadways. The project's impact is assumed to be minimal on major arterials (e.g., highways, including Highway 1) which are designed to accommodate a mix of vehicle types, including heavy trucks. Beach Road (the main access route to the WWTF) is scheduled to be repaved starting in August , 2001, before the project would commence, and will therefore will meet current structural standards.

Other local-serving roads, such as San Andreas Road, may not be built with a pavement thickness that would withstand considerable heavy truck volumes. The projected increase in use of this or other local roadways by heavy trucks could result in significant wear on these roadways.

> **Measure 4.A.6-2:** Conduct a preconstruction survey of road conditions on key access routes to the project sites (e.g., San Andreas Road). The pavement conditions of local streets judged to be in good condition for use by heavy truck traffic shall be monitored. Roads damaged by construction shall be repaired to a structural condition equal to, or better than, that which existed prior to construction activity.

Impact 4.A.6-3: Project construction would increase potential traffic safety hazards for vehicles and pedestrians in the construction area. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The temporary increase in construction-generated trucks on project area roadways would interact with other vehicles, including other large trucks, slow moving agricultural vehicles, and recreational traffic (e.g., from nearby beaches). This area receives substantial summer tourist traffic. Potential conflicts also could occur between construction traffic and bicyclists and pedestrians. Beach Road is part of the Master Plan of Santa Cruz County bikeways (County of Santa Cruz, 1994).

> **Measure 4.A.6-3a:** The construction contractor shall prepare traffic safety and control plans to show specific methods for maintaining traffic flows. This shall include identifying roadway locations where special trenching techniques would be used to minimize impacts to traffic flow and operations. The traffic control plans prepared by the contractor shall include recommended detours for bicyclists. The traffic control plan shall be reviewed for appropriateness, and approved by the governing Public Works Department.

Measure 4.A.6-3b: The contractor shall provide advanced public notification of construction activity and roadway/access closures.

Impact 4.A.6-4: Project construction would generate a demand for parking spaces for construction worker vehicles. Less than Significant.

The project would generate a need for parking for construction workers and construction vehicles, as well as areas to store equipment and supplies. The location of staging areas has not been identified at this point; however, it is expected that providing space for staging areas could be easily accommodated at the WWTF site and along any associated pipeline routes. The demand for new parking would be met by the proposed construction staging areas. No public on-street parking would be eliminated during project construction.

Mitigation: None required or recommended.

REFERENCE – Traffic and Circulation

County of Santa Cruz, *1994 General Plan and Local Coastal Program for the County of Santa Cruz*, 1994.

4.A.7 AIR QUALITY

4.A.7.1 SETTING

Section 3.6, Regional Setting – Traffic and Circulation, describes the major roadways in the vicinity of the Recycled Water Facility. Sensitive receptors located near the Recycled Water Facility include residences located within 300 feet of the project site; the area is otherwise sparsely populated agricultural land.

4.A.7.2 SIGNIFICANCE CRITERIA

For the purposes of this EIR, the project would have a significant air quality impact if it causes the violation of air quality standards; contributes substantially to existing or projected air quality violations; or exposes sensitive receptors to substantial concentrations of air pollutants. In addition, the project would be considered to have a significant air quality impact if it exceeds the significance threshold criteria established by the Air Pollution Control Districts (APCD) for the region(s) where the project is located. Operation of the Recycled Water Facility and associated pipelines would not result in any new operational emission sources; the potential for air quality impacts is limited to project construction and cumulative service-area-wide impacts.

Site-specific impacts would relate primarily to combustion emissions from use of construction equipment and fugitive dust emissions from earth movement and vehicle travel over unpaved surfaces during construction of the Recycled Water Facility and associated pipelines. Long-term operation of the Recycled Water Facility would have negligible emissions. The Recycled Water Facility and attendant pipelines are in the North Central Coast air basin. Consequently, the methods and thresholds contained in Monterey Bay Unified Air Pollution Control District's (MBUAPCD's) *CEQA Air Quality Guidelines* are used.

According to the MBUAPCD, construction activities (e.g., excavation, grading, on-site vehicles) that directly generate 82 pounds per day or more of PM_{10} would have a significant impact on local air quality when they are located nearby, and upwind of, sensitive receptors. Construction activities temporarily emit precursors of ozone; however, these emissions are accounted for in the emissions inventories of state- and federally-required air plans, and therefore would not have a significant impact on the attainment and maintenance of ozone ambient air quality standards (MBUAPCD, 2000). Cumulative impacts will be determined based on the project's consistency with the MBUAPCD's Air Quality Management Plan.

In addition, the project would have a significant impact if it would conflict with local air quality plans and policies. Section 3.1, Land Use and Planning, summarizes county and local plans and policies that are relevant to the proposed project, such as Objective 5.18 of the Santa Cruz County General Plan, which seeks to "improve the air quality of Santa Cruz County by meeting or exceeding state and federal ambient air quality standards, protect County residents from the health hazards of air pollution, protect agriculture from air pollution-induced crop losses and

prevent degradation of the scenic character of the air." In general, the goals, objectives, and policies of local plans are largely focused on traffic-related air quality impacts.

4.A.7.3 IMPACTS AND MITIGATION MEASURES

Impact 4.A.7-1: Construction of the Recycled Water Facility components would temporarily generate criteria air pollutants, particularly PM_{10}, over the duration of the construction period. Significant. With mitigation measures identified in this EIR, the impact would be reduced to a less-than-significant level.

Construction of the project would generate fugitive dust (including PM_{10}), and other criteria air pollutants from exhaust emissions. A large portion of the total construction dust emissions would result from site grading and excavation activities. Dust emissions would vary from day to day, depending on the phase of construction, the silt content of the soil, and the weather. Daily emissions would depend greatly upon whether construction of the various project components (e.g., Recycled Water Facilities and associated pipelines) would occur simultaneously. Construction-related impacts that are individually less than significant may have a significant impact if construction occurs on two or more components simultaneously. Additionally, PM_{10} as well as some exhaust emissions would add to the cumulative air pollutant emissions of the valley. In an agricultural region, soil tilling is a source of PM_{10}, which in total far exceeds what the project construction would generate at individual site locations, and larger particles of dust from construction would fall out relatively close to construction sites and could cover crops with a coating of dust. This could be injurious to plants, particularly seedlings and plants in their early growth stages.

According to MBUAPCD CEQA Guidelines, construction projects that emit precursors of ozone (i.e., ROG and NO_x) are accommodated in the emission inventories of the Air Quality Management Plans and would not have a significant impact on the attainment and maintenance of ozone AAQS. For this reason, emissions of ROG and NO_x from construction equipment will not be quantified, and will be considered a less-than-significant impact. The MBUAPCD Guidelines also state that PM_{10} emissions from construction activities are considered significant if they would generate 82 pounds per day or more of PM_{10} when the activities are located nearby and upwind of sensitive receptors.

The EPA has developed a PM_{10} emission factor for construction-related emissions of approximately 51 pounds per acre per day (EPA, 1995). Therefore, assuming that approximately 3 acres of the 8-acre project site would be disturbed at a given time during this phase, construction of the Recycled Water Facility, including excavation for the pipelines supplying blending water and connecting to the distribution system, would result in PM_{10} emissions from construction activities of approximately 150 pounds per day.

The EPA emission factors for PM_{10} emissions do not specifically apply to fugitive dust from excavation and handling of soil. In lieu of this information, emission factors from the South Coast Air Quality Management District (SCAQMD) were used (SCAQMD, 1993). Assuming an

average soil excavation of 150 cubic yards per day, pipeline installation would result in emission of approximately 330 pounds of PM_{10} per day.

If the treatment facilities and pipeline are constructed simultaneously, this would result in emission of approximately 480 pounds of PM_{10} per day. Without mitigation, PM_{10} emissions from the construction of the recycled water component would result in a significant impact.

Measure 4.A.7-1: The construction contractor shall implement a dust control program that includes the following elements:

- Water all active construction sites at least twice daily.
- Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least two feet of freeboard.
- Pave, apply water three times daily, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites.
- Sweep daily (with water sweepers) all paved access roads, paved parking areas and paved staging areas at construction sites.
- Sweep streets daily (with water sweepers) if visible soil material is carried onto adjacent public streets.
- Hydroseed or apply (non-toxic) soil binders to inactive construction areas. However, do not apply these measures in operating agricultural fields under cultivation unless requested by the grower.
- Enclose, cover, water twice daily or apply (non-toxic) soil binders to exposed stockpiles (dirt, sand, etc.).
- Limit traffic on unpaved roads to 15 mph.
- Install sandbags or other erosion control measures to prevent silt runoff to public roadways.
- Replant vegetation in disturbed areas as quickly as possible.

The effectiveness of the above dust control measures in reducing PM_{10} emissions ranges from 34 percent (for sweeping streets) to 90 percent (for covering haul trucks and inactive storage piles) (MBUAPCD, 2000). Implementation of all applicable measures would be expected to reduce PM_{10} emissions to below 82 pounds per day (the threshold of significance). With implementation of the above mitigation measures, construction-generated emissions would be less than significant.

Impact 4.A.7-2: Vehicle trips resulting from operation and maintenance of the various components of the project would generate emissions of criteria air pollutants and odors. Less than Significant.

Operation of the Recycled Water Facilities would require periodic maintenance and inspection by PVWMA employees. Emissions generated by employee vehicle trips would be negligible and would not exceed MBUAPCD significance thresholds. Pumps would be powered by electricity, rather than diesel, and would not generate criteria air pollutants.

Residences are located within 300 feet of the Recycled Water Facility site. The proposed Recycled Water Facility would include storage tanks (clearwells) that would contain treated effluent. Because the stored supplies would be highly treated recycled water, the potential for odor generation is considered low. Effluent treated to the tertiary stage would not contain biosolids or other organic material that would be likely to generate odors.

REFERENCES – Air Quality

Monterey Bay Unified Air Pollution Control District (MBUAPCD), *CEQA Air Quality Guidelines*, September 2000.

United States Environmental Protection Agency (EPA), *Compilation of Air Pollutant Emission Factors*, Volume I: Stationary, Point, and Area Sources, AP-42, 5th Edition, January 1995.

South Coast Air Quality Management District (SCAQMD), *CEQA Air Quality Handbook*, April 1993.

4.A.8 NOISE

4.A.8.1 SETTING

Please refer to Section 3.8 for a discussion of regional noise conditions and definitions of noise descriptors. Proposed facilities under this component include construction of a Recycled Water Facility (RWF) that would produce tertiary-level recycled water at the Watsonville Wastewater Treatment Facility (WWTF), a pumping plant, approximately 3,900 feet of distribution pipeline to connect the Recycled Water Facility to the western terminus of the proposed Import Pipeline, and groundwater extraction wells and associated piping.

The proposed locations for the RWF and pipelines are in agricultural or weedy, disturbed areas, with the exception of the Pajaro River crossing. Residences are located approximately 300 feet west-northwest of the RWF site; otherwise, the area around the WWTF site is a sparsely populated agricultural area. The pipeline would cross the Pajaro River near the Highway 1 to connect with the surface water pipeline. The pipeline would then pass parallel to, and north of, the Pajaro River levees, generally through vegetable croplands.

4.A.8.2 SIGNIFICANCE CRITERIA

For the purposes of this EIR, the project would normally have a significant adverse impact on the environment if it would increase substantially the ambient noise levels of adjoining areas. Operation of the proposed RWF and associated pipelines would not result in the development of significant new noise-generating sources. Instead, project-related noise effects would be limited to construction noise and construction-related traffic. Short-term construction noise impacts of a project would be considered significant if:

- construction activities were to affect noise-sensitive receptors for a substantial amount of time;
- expected noise levels would endanger the hearing of receptors near the construction site; or
- construction activities would affect receptors during noise-sensitive periods.

An example of a sensitive noise receptor would be the mobile home park located along the pipeline alignment near Highway 101. Construction noise would also be considered significant if it conflicted with any adopted city or county construction noise standards, policies or ordinances. With temporary noise impacts, identification of "substantial increases" depends upon the duration of the impact, the temporal daily nature of the impact, as well as the absolute change in dBA levels. For assessment of temporary construction noise impacts in this EIR, "substantially greater" means an increase of more than five dBA (hourly L_{eq} or L_{dn}) above the ambient noise environment.

4.A.8.3 IMPACTS AND MITIGATION MEASURES

Impact 4.A.8-1: Construction activities associated with the project would intermittently and temporarily generate noise levels above existing ambient noise levels in the project vicinity. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Construction-related noise levels along the Import Pipeline alignment would fluctuate depending on the particular type, number, and duration of use of various pieces of construction equipment, and the location of sensitive receptors. The effect of construction noise would depend on how much noise would be generated by the equipment, the distance between construction activities and the nearest noise-sensitive uses, and the existing noise levels at those sensitive uses.

Construction activities would be expected to last approximately 18 months at the WWTF, two weeks at any given location along the pipeline alignment. Residences are located within 300 feet of the RWF site; therefore, noise associated with construction activity would be considered a significant effect for this component. There is also a potential for construction noise to affect nearby receptors at the locations of the proposed extraction wells. Because the locations of the extraction wells have not been determined, there is a potential for construction activities to affect sensitive receptors based on their siting. Implementation of the mitigation measures below, which limit the timing of construction and use of equipment, would reduce potentially significant impacts to less-than-significant levels.

> **Measure 4.A.8-1:** PVWMA shall incorporate into contract specifications the following measures:
>
> - Comply with all local sound control and noise level rules, regulations, and ordinances.
>
> - Equipment and trucks used for project construction shall utilize the best available noise control techniques (including mufflers, use of intake silencers, ducts, engine enclosures and acoustically attenuating shields or shrouds) in order to minimize construction noise impacts.
>
> - Impact equipment (e.g., jack hammers, pavement breakers, and rock drills) used for project construction shall be hydraulically- or electrically-powered wherever possible to avoid noise associated with compressed air exhaust from pneumatically powered tools. However, where use of pneumatically powered tools is unavoidable, an exhaust muffler on the compressed air exhaust shall be used; this muffler can lower noise levels from the exhaust by up to about 10 dBA. External jackets on the tools themselves would be used where feasible, and this could achieve a reduction of 5 dbA. Quieter procedures shall be used (such as drilling rather than impact equipment) whenever feasible.
>
> - Stationary noise sources shall be located as far from sensitive receptors as possible. If they must be located near existing receptors, they shall be adequately muffled.
>
> - Temporary walls may be erected at some locations to reduce noise impacts to residences adjacent to construction sites.

Impact 4.A.8-2: Operation of proposed RWF and pumping facilities associated with Blending Facilities would result in noise increases in the vicinity of project facilities. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The RWF would result in an increase in noise-generating equipment at the plant. Operation of a pumping plant would be consistent with the types of noise-generating sources currently operating at the WWTF. The additional noise-generating sources would represent an incremental increase in ambient noise levels; however, given the above considerations, noise increase associated with the RWF would not significantly affect the noise environment in the project vicinity. The pumping facilities associated with blending facilities have the potential to affect nearby sensitive receptors, depending on the siting and design of the pumping facility. Implementation the Mitigation Measures below would reduce potential impacts to a less-than-significant level.

Measure 4.A.8-2: PVWMA shall incorporate into contract specifications the following measures:

- The pumping facilities shall be designed with acoustical treatments (building enclosures, louvered vents, noise walls, etc.) that are adequate to maintain potential noise generation to levels at or below ambient levels.

- The blending facilities shall be built with enclosures that provide maximum feasible noise attenuation, to ensure that sensitive receptors would not be affected.

4.A.9 PUBLIC SERVICES

4.A.9.1 SETTING

Please refer to Section 3.9 for a discussion of public services and utilities serving the area.

4.A.9.2 SIGNIFICANCE CRITERIA

Under CEQA, a project would normally have a significant adverse impact on public services or utilities if it would contaminate a public water supply, interfere with emergency services, extend a sewer trunk line with capacity to serve new development, interfere with emergency response plans or emergency evacuation plans, or breach published, national, state, or local standards relating to solid waste. For the purposes of this EIR, if the project would breach any of the above referenced standards, or disrupt utilities service such as to create a public health hazard or extended service disruption, it would be considered to have a significant impact.

4.A.9.3 IMPACTS AND MITIGATION MEASURES

Demand during construction for public services such as water (for dust control), solid waste disposal, and schools will not be large enough to cause significant impacts. (Solid waste generated by the project would be sent to the Marina Landfill in Monterey County.)

Impact 4.A.9-1: Construction of pipelines associated with the Recycled Water Facility could result in temporary, planned or accidental disruption to utility services provided by underground lines. Significant. With mitigation identified in this EIR the impact would be reduced to a less-than-significant level.

Construction activities adjacent to the WWTF are not expected to encounter any utilities; however, utility services could be potentially disrupted as a result of pipeline construction. Disruptions to major utility lines would be considered significant, but mitigable. Impacts to utilities and services involve temporary disruption, which in most cases, would not exceed one day. Any utility lines and cables that could be disrupted during pipe installation would be identified during preliminary design. As a condition of approval for a utility excavation permit, a detailed engineering and construction plan, which thoroughly describes construction techniques and protective measures for minimizing impacts to utilities, would be prepared by PVWMA contractors. This plan requires review by the appropriate special service districts or utility services in the project area.

> **Measure 4.A.9-1:** A detailed study identifying utilities along the proposed alignment shall be done during the pre-design stages of the project.
>
> The following mitigations are required for segments identified in final design as having potential conflict with significant utilities.
>
> a. Utility excavation and encroachment permits would be required from the appropriate agencies, including the Public Works Departments of Santa Cruz and Monterey

Counties, City of Watsonville, Caltrans, and Union Pacific Railroad. These permits include measures to minimize utility disruption. PVWMA and its contractors shall comply with permit conditions. Permit requirements shall be included in construction contract specifications.

b. Utility locations would be verified through field survey (potholing) and use of an underground locating service.

c. A detailed engineering and construction plan shall be prepared as part of the design plans and specifications. This plan shall include procedures for the excavation, support, and fill of areas around utility cables and pipes. All affected utility services would be notified of PVWMA's construction plans and schedule. Arrangements would be made with these entities regarding protection, relocation, or temporary disconnection of services.

d. In areas where the pipeline would parallel wastewater mains, engineering and construction plans shall include trench wall support measures to guard against trench wall failure, and possible resulting loss of structural support for the wastewater main.

e. Residents and businesses in the project area shall be notified in writing by the contractor of planned utility service disruption two to four days in advance, in conformance with County and State standards.

4.A.10 VISUAL/AESTHETIC AND RECREATIONAL RESOURCES

4.A.10.1 SETTING

The proposed Recycled Water Facility would be on agricultural land adjacent to the Watsonville Wastewater Treatment Facility (WWTF). Views of this site would be available from Beach Road, approximately 500 feet to the north; San Andreas Road, approximately 2,500 feet to the west; and from Highway 1, approximately 3,000 feet to the east. Beach Road and San Andreas Road are designated scenic roads in the Santa Cruz County General Plan/LCP. Highway 1 is a designated scenic road in the City of Watsonville General Plan and the Santa Cruz County General Plan/LCP, and it is eligible for official State Scenic Highway designation by Caltrans.

The proposed pipelines connecting the WWTF to the coastal distribution system and the Import Pipeline would be placed along Highway 1 and the Pajaro River.

Long-range views across the project area include Monterey Bay to the west, the Santa Cruz Mountains to the north, and the PG&E electric generation plant at Moss Landing to the south.

Consistency with Applicable Plans and Policies

Development of the recycled water component generally would be consistent with the applicable policies of the Santa Cruz County General Plan/LCP and the City of Watsonville General Plan presented in Section 3.10 of this EIR. The project area, which contains expansive croplands and little urban development, exhibits a rural visual landscape; however, the existing WWTF is a dominant industrial feature.

4.A.10.2 SIGNIFICANCE CRITERIA

For the purposes of this EIR, a project would normally be considered to have a significant impact if it would:

- have a substantial, adverse effect on a scenic vista;
- substantially damage scenic resources, including but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway;
- substantially degrade the existing visual character or quality of the site and its surroundings; or
- create a new source of substantial light or glare which would adversely affect day or nighttime views in the area.

For the purposes of this EIR, a significant impact would result from a noticeable change in the visual landscape that produces a high level of contrast visible in the short-term and/or long-term in the foreground view from a key observation point. These may include contrasts created by removing existing landscape elements that comprise a substantial basis of the landscape

character, or by changing landscape patterns. A change in the visual landscape that is noticeable in the middleground or background view from a scenic road or vista would be considered a less-than-significant impact.

A significant impact on the visual environment would result from a noticeable change in any one (or combination of) landscape attribute in the short-term or the long-term along a designated or candidate Scenic Highway (e.g., Highway 1), or at any designated vista point or visually protected area accessible to the public. The Santa Cruz County General Plan/LCP also protects significant public vistas from all publicly used roads and vista points, and recognizes the importance of views of agricultural fields, meadows, and mountain hillside views. Santa Cruz County requires discretionary review for all development within the visual resource area of Highway 1, or outside of the County's Urban Rural Boundary.

A significant impact on the visual environment would result from any landscape alteration that would conflict with an adopted visual quality objective and visual management plan of a public agency, such as may be included in a General Plan. For example, the Monterey County and Santa Cruz County General Plans call for the preservation of existing terrain and natural vegetation in visually sensitive areas. Installation of the distribution systems would require the removal of natural vegetation, and thus is potentially inconsistent with this policy.

Use of reflective building materials and/or exterior light fixtures on proposed facilities could create new sources of light and glare and would result in potentially significant impacts.

4.A.10.3 IMPACTS AND MITIGATION MEASURES

Impact 4.A.10-1: Development of the proposed Recycled Water Facility would alter the visual character of, and views of, the project area. Significant. With mitigation identified in the EIR, the impact would be reduced to a less-than-significant level.

Construction of the Recycled Water Facility would change the existing visual appearance of the WWTF. The proposed placement of two, two million-gallon above-ground storage tanks, or clearwells, on agricultural lands adjacent to the WWTF would increase the visual prominence of the industrial facility from nearby scenic roads, including Beach Road, San Andreas Road, and Highway 1. The cylindrical tanks would be approximately 300 feet in diameter with a maximum height of 30 feet, which is equivalent to the height of the tallest facilities at the existing WWTF. While the tanks would be the same height as existing facilities at the WWTF, their large volume would make them dominant industrial features in the visual landscape. Since the tanks would be on open agricultural land, no screening vegetation is available to help integrate the tanks with the surrounding area. Given the industrial appearance of tanks with no visual mitigation and the open, rural terrain of the siting area, this could be a significant impact. As shown in Figure 2.6 in Chapter 2, the clearwells would be set back from nearby roads, close to the Pajaro River. Other structures within the Recycled Water Facility site would visible in the foreground in views from Beach Road, San Andreas Road and Highway 1. These structures, which include filtration, disinfection, and pumping facilities, would be smaller in scale than the storage tanks, but they

would be visible from nearby roads. While the clearwells would be dominant visual features, they would not substantially alter the visual character of the area because they would be adjacent to the existing WWTF, which represents a prominent industrial feature in the visual landscape. The Recycled Water Facility would extend this existing feature, and would not introduce a new feature to the area. Similarly, views of the project area would be altered by the Recycled Water Facility, but they would be altered by extending an existing industrial feature in the viewshed onto adjacent lands. The Recycled Water Facility would not affect a pristine view. Furthermore, it is not uncommon for industrial features to appear in rural landscapes.

The filtration, disinfection, storage, and pumping facilities at the WWTF would contribute to the visual dominance of the WWTF. While these facilities would be compatible with the existing WWTF, their size and industrial character would increase visual contrast with the surrounding rural landscape. This would be a significant impact. Measures 4.A.10-1a and 4.A.10-1b would reduce the visual contrast of the tanks.

Pipeline construction would tear up roadways and remove native vegetation and crops along the alignments. This would be a temporary impact, since cropping would be allowed to occur on agricultural lands within the alignment following installation of the pipelines. For this reason, the construction disturbance for the pipelines to and from the Recycled Water Facility is considered a less-than-significant impact. During construction, excavated trenches and stockpiled soils, pipe, and other materials within the construction easement would constitute negative aesthetic features along the pipeline alignments. This would be a temporary adverse impact. Following construction, the proposed pipelines would be located entirely below grade and would be unobtrusive. No long-term visual impacts would result from development of the pipelines.

> **Measure 4.A.10-1a:** The PVWMA shall revegetate disturbed natural areas to minimize textural contrasts with the surrounding vegetation using grasses, shrubs and trees typical of the immediately surrounding area.
>
> **Measure 4.A.10-1b:** The PVWMA shall use design elements to enhance visual integration of the proposed above-ground facilities with their surroundings. Proposed facilities shall be painted low-glare earth-tone colors that blend with the surrounding terrain.
>
> **Measure 4.A.10-1c:** The PVWMA shall ensure that its contractors restore disturbed areas along the pipeline alignment to their pre-project condition such that short-term construction disturbance does not result in long-term visual impacts.

Impact 4.A.10-2: Development of the Water Recycling component would introduce new sources of light onto the project site and increase ambient light in the project area. Less than Significant. Implementation of recommended mitigation measures identified in this EIR, while not required, would assist in ensuring that the impact would remain at a less-than-significant level.

While no exterior lighting is currently proposed as part of this component, exterior security lighting (if implemented) at the Recycled Water Facility could introduce light and create nighttime impacts. The new facilities would be located within 300 feet of existing residences. While exterior lighting could be visible from these residences, it would not be expected to substantially increase ambient light in the project area.

> **Mitigation Measure 4.A.10-2 (Recommended):** The PVWMA shall ensure that all exterior lighting if used is directed downward and oriented to insure that no light source is directly visible from neighboring residential areas. If necessary, landscaping shall be provided around proposed facilities. This vegetation shall be selected, placed, and maintained to minimize off-site light and glare onto surrounding areas. In addition, highly reflective building materials and/or finishes shall not be used in the designs for proposed structures.

Impact 4.A.10-3: Development of the water recycling component could temporarily disrupt designated recreational bikeways in the project area. This would be a less-than-significant impact.

Construction of the proposed pipelines could disrupt bicycle traffic along San Andreas Road and Beach Road, which are included in the Santa Cruz County bikeway system. Construction activities and related truck traffic could damage the bikeways, creating minor inconvenience to bicyclists. This would be a temporary impact during project construction. Implementation of Measures 4.A.6-2, 4.A.6-3a and 4.A.6-3b would ensure that damaged roads would be repaired to pre-construction conditions, and that detours would be provided for bicyclists and motorists during the construction period. Therefore, this impact would be less than significant.

> **Mitigation:** None required.

4.B GROUNDWATER BANKING

4.B.1 LAND USE AND PLANNING

4.B.1.1 SETTING

Land Uses Along the Proposed Import Pipeline Alignment

Land uses along the Import Pipeline alignment are primarily agricultural, as indicated in **Table 4.B.1-1**. Between Stations 0+00 and 320+00, the pipeline alignment extends through generally flat, irrigated cropland and is parallel to, and south of, the Pajaro River in San Benito County. Little development exists along this segment of the alignment (see Map A1 in Map Appendix A). At Station 120+00, the alignment crosses Miller's Canal, an irrigation ditch, and at Station 140+00 it crosses Highway 25 (Bolsa Road) and the Union Pacific Railroad (UPRR) tracks. The alignment enters a Pacific Gas and Electric (PG&E) power line easement at Station 192+00 and continues along this easement to Station 285+00. Between Stations 273+00 and 320+00, the alignment is bordered on the south by grassland within the Lomerias Muertas foothills.

TABLE 4.B.1-1
LAND USES ALONG THE IMPORT PIPELINE ALIGNMENT

Between (Stationing)	Land Uses
0+00 and 400+00	Agricultural Rangeland
400+00 and 494+00	Ranchlands
494+00 and 595+00	Agriculture
595+00 and 620+00	Agricultural Rangeland
620+00 and 690+00	Rural
690+00 and 715+00	Heavy Industrial
715+00 and 1127+00	Agriculture

SOURCE: Environmental Science Associates

At Station 320+00, the alignment crosses U.S. 101 and remains within the Caltrans right-of-way to Station 373+00 (see Map A2 in Map Appendix A). Within this area, undeveloped grassland borders the alignment on the west. Between Stations 373+00 and 400+00, the alignment leaves the Caltrans right-of-way and extends between the Betabel R.V. Park and the Pajaro River. At Station 400+00, the alignment crosses the Pajaro River and the Santa Clara County line, and

extends along the UPRR right-of-way. Little development is present along this portion of the alignment, which is bordered by the UPRR tracks to the south and grass-covered Sargent Hills to the north. At Station 480+00, the alignment leaves the UPRR right-of-way and ascends a steep portion of the Sargent Hills, and crosses the Santa Cruz County line near Station 493+00. The community of River Oaks is located south of the alignment, across the UPRR tracks and Highway 129. The alignment enters the Highway 129 right-of-way near Station 530+00. Land uses in this area include irrigated croplands and scattered houses in the community of Chittenden across Highway 129 and the UPRR tracks to the south, and undeveloped grassland and Soda Lake to the north.

At Station 600+00, the alignment crosses the Pajaro River and the San Benito County line. Between Stations 600+00 and 640+00, the alignment extends through Pajaro Gap and skirts the northern boundary of the Granite Rock Company property (see Map A3 in Map Appendix A). The alignment extends along the quarry railroad tracks and Quarry Road between quarry lands and irrigated croplands. The community of Aromas is located to the south of the alignment near Station 710+00. Greenhouses and the Aromas School playfields are located across the UPRR tracks from the alignment. The alignment crosses the Monterey County line at Station 714+00.

The remainder of the pipeline alignment extends through generally flat agricultural lands. Other uses include the Bolsa de San Cayetano Hills south of the alignment between Stations 900+00 and 960+00, and industrial development at Watsonville Junction near Station 1030+00 (see Map A4 in Map Appendix A). The western terminus of the alignment is located on the East Side of Highway 1.

General Plan Land Use Designations Along the Proposed Pipeline Alignment

Applicable General Plan land use designations within San Benito, Santa Clara, Santa Cruz, and Monterey counties are presented below.

San Benito County

The proposed Import Pipeline alignment extends through northeastern San Benito County between Stations 0+00 and 400+00 and Stations 595+00 and 715+00. Between Stations 0+00 and 400+00 and Stations 595+00 and 620+00, the alignment is located on lands designated as AR, Agricultural Rangeland, on the General Plan Land Use Map. This designation is assigned to remote hillsides, watershed areas and rangeland. Between Stations 620+00 and 690+00, lands along the alignment are designated R, Rural. The Rural designation applies to areas which are not primarily suited for agricultural uses, but due to the lack of services or geographical reasons are unsuited for urban uses. Between Stations 690+00 and 715+00, lands along the alignment are designated M2, Heavy Industrial. These lands are located within the Granite Rock Company property.

Santa Clara County

The pipeline alignment extends through Santa Clara County between Stations 400+00 and 494+00. Lands along this portion of the alignment are designated R, Ranchlands, on the Santa Clara County General Plan Land Use Map. This designation is intended to maintain the existing conditions of very low intensity uses, rural lifestyle, and limited public access.

Santa Cruz County

A portion of the Import Pipeline, between Stations 494+00 and 595+00, would extend through southern Santa Cruz County. Lands along this portion of the alignment are designated Agriculture in the County General Plan/LCP. This designation is intended to preserve lands for the production of food, fiber and ornamental crops (County of Santa Cruz, 1994).

Monterey County

Stations 715+00 to 1127+00 of the Import Pipeline alignment would extend through northern Monterey County. The alignment would be located on lands designated for agricultural uses in the North County Area Plan. Most of these lands are designated Agricultural Preservation. This designation is intended to preserve large, continuous areas of agricultural land capable of long-term productivity in order to protect its viability from encroaching conflicting land uses. The Agricultural Preservation designation is applied to the prime and productive agricultural lands where the area does not generally exceed an average 10 percent slope. Development on Agricultural Preservation lands is restricted to residences, accessory buildings and uses required for agricultural activities. A minimum parcel size of 40 acres is allowed for land divisions for agricultural purposes (County of Monterey, 1994).

Other lands along the pipeline alignment are designated Agricultural Conservation, which is applied a) to relatively small pockets of prime agricultural soils that are not within or adjacent to the more extensive agricultural areas designated under the Agriculture Preservation category; or b) to other soils after an agricultural management plan has been approved; and c) grazing lands where such a low intensity agricultural use is the most compatible use of an area. The Agricultural Preservation category is also applied to lands not in areas designated under the Agricultural Preservation land use category that are placed into agricultural preserve contracts (Williamson Act). Agriculture-related uses and very low density residential uses at one unit per 40 acres are allowed on the less agriculturally viable areas of the parcel. A minimum parcel size of 40 acres is required for subdivision.

According to the North County Area Plan, all of the flat bottom lands of the Pajaro Valley, excluding the community of Pajaro, are designated as Agricultural Farmland.

Consistency with General Plan Policies

Development of the proposed pipeline would be consistent with applicable policies of the San Benito General Plan, the Santa Clara General Plan, the Santa Cruz County General Plan/LCP, the Monterey County General Plan, and the North County Area Plan, which are presented in

Section 3.1 of this EIR. The proposed pipeline would transport water to agricultural lands east and west of Highway 1 for irrigation purposes. This would reduce groundwater overdraft and seawater intrusion problems and ensure long-term continuation of agriculture in the project area. Therefore, the pipeline would be consistent with Policy C-RC 17 of the Santa Clara County General Plan, and Objectives 5.5a and 5.8b and Programs C, H, and F of the Conservation and Open Space Element of the Santa Cruz County General Plan/LCP, which encourage cooperation with water management agencies to augment natural groundwater recharge and to eliminate seawater intrusion, and to seek to ensure that a sustainable supply of water is available for agricultural use. The project would also be consistent with Policy 6.2.2 of the North County Area Plan, which encourages water development projects that can offer a viable water supply to the North County Area; and Goal 5 and Policies 21.1.8 and 21.1.10 of the Monterey County General Plan, which encourage water development projects to increase the water supply and improve seawater intrusion problems in the North County Area.

The proposed pipeline would be located within road rights-of-way as well as on agricultural land. The pipeline would not result in a long-term loss of agricultural land because it would be located underground, and farming as occurs at present would resume within the construction corridor following pipeline installation. Since no permanent conversion of agricultural land would occur, the project would be consistent with applicable policies of the San Benito County General Plan, the Santa Clara County General Plan, the Santa Cruz County General Plan/LCP, and the Monterey County General Plan that identify the need to protect and preserve agricultural land. These include Objective 5.b of the San Benito County General Plan Land Use Element, Objective 1 and Goal 6 of the San Benito County General Plan Open Space Element, Policies C-RC 40, R-RC 57 and R-RC 66 of the Santa Clara County General Plan, Policies 5.13.6 and Program F of the Santa Cruz County General Plan/LCP; and Policies 4.1.3, 30.0.4, and Goal 30 of the Monterey County General Plan.

The proposed pipeline would deliver water that would help to eliminate groundwater overdraft and seawater intrusion. By delivering this water, the pipeline would support agriculture in the Pajaro Valley, and would be consistent with policies of the San Benito County General Plan, the Santa Clara County General Plan, the Santa Cruz County General Plan/LCP, and the Monterey County General Plan and North County Area Plan, which encourage cooperation with water management agencies to augment natural groundwater recharge and eliminate seawater intrusion, and seek to ensure that a sustainable supply of water is available for agricultural use.

4.B.1.2 SIGNIFICANCE CRITERIA

See Section 4.A.1.2 for a discussion of significance criteria.

4.B.1.3 IMPACTS AND MITIGATION MEASURES

Impact 4.B.1-1: Project construction would result in short-term disturbance of adjacent land uses. Less than Significant. Implementation of mitigation identified in this EIR, while not required, would assist in ensuring that the impact would remain at a less-than-significant level.

The proposed Import Pipeline would not alter surrounding land uses, which include agricultural uses, the Betabel R.V. Park (between Stations 373+00 and 400+00), and the Granite Rock Company quarry (at Stations 600+00 to 640+00), and would not disrupt or divide any established community. It also would not be incompatible with existing uses in the vicinity. Construction disturbance could temporarily constrain access to these and other uses along Betabel Road, Highway 129, Murphy Road, Quarry Road / Aromas Road, and Hayes Road by blocking roadways and access driveways. However, this would be a temporary impact resulting more in inconvenience to motorists than a substantial impact and, therefore, would not be expected to substantially impair agricultural or mining operations. Typical construction activities would be expected to last approximately one week at any given location along the pipeline alignment. Therefore, this impact would be considered less than significant. Implementation of Measures 4.B.1-1 below would minimize construction disturbance.

In addition, construction of proposed facilities would generate noise, dust, and traffic that could disrupt adjacent land uses. These impacts are presented in Section 4.B.6, Traffic and Circulation, Section 4.B.7, Air Quality, and Section 4.B.8, Noise, of this EIR. With proper mitigation, temporary construction impacts would have a less-than-significant effect on adjacent land uses.

> **Measure 4.B.1-1 (Recommended):** Implement Measure 4.A.1-1.
>
> See also mitigation measures in Section 4.B.6, Traffic and Circulation, Section 4.B.7, Air Quality, and Section 4.B.8, Noise, of this EIR.

Impact 4.B.1-2: Construction of the Import Pipeline would temporarily disrupt farming practices in San Benito, Santa Clara, Santa Cruz and Monterey Counties. Less than Significant.

The proposed pipeline would not result in the permanent conversion of agricultural land; however, pipeline construction activities would affect agricultural production. While the proposed pipeline alignment is located primarily within public rights-of-way, it crosses agricultural land between Stations 0+00 and 192+00, Stations 480+00 and 530+00, Stations 748+00 and 772+00, and Stations 928+00 and 955+00. In addition, in some areas where the alignment remains in the public right-of-way the construction easement would affect adjacent agricultural uses. Project construction could disrupt agricultural production within the alignment for at most one cropping season, depending on the timing of construction. The pipeline extends

through prime farmlands in parts of San Benito, Santa Cruz, and Monterey Counties. In addition, the pipeline would extend through land under Agricultural Preserve or Williamson Act contracts. Construction disturbance would be temporary, and operation of the pipeline, once installed, would not preclude agricultural production. The pipeline would not result in a permanent conversion of these lands. However in agricultural areas, the pipeline may limit some types of crop selections, specifically deep-rooted trees along the alignment of the pipeline. Deep roots could damage the pipeline and its cover. This is not considered a significant impact because other agricultural uses could continue on the alignment. Therefore, this would not be considered a significant impact.

Mitigation: None required or recommended.

REFERENCES – Land Use and Planning

County of Monterey, *General Plan*, adopted September 30, 1982, amended 1995.

County of Monterey, *North County Area Plan*, amended November 29, 1994.

County of San Benito, *Open Space and Conservation Element Update of the San Benito County General Plan*, February 7, 1995.

County of San Benito, *San Benito County General Plan, Scenic Roads and Highways Element*, 1980.

County of Santa Clara, *Santa Clara County General Plan*, updated 1994.

County of Santa Cruz, *General Plan and Local Coastal Program*, adopted May 24, 1994.

Department of Conservation, *Important Farmland Maps for San Benito and Santa Clara Counties*, 1996.

4.B.2 GEOLOGY, SOILS, AND SEISMICITY

4.B.2.1 SETTING

Topography and Geology

Southern Santa Clara Valley

The proposed Import Pipeline alignment begins at the Watsonville turnout of the Santa Clara Conduit, located in the southeastern portion of the Santa Clara Valley, about three quarters of a mile west of San Felipe Lake. The start elevation in this area is about 150 feet above mean sea level (msl) and the topography is gently sloping. Creeks, drainage channels, levees, railroad and roadway grades provide the few topographic features in this area. The valley is underlain by Quaternary Alluvium derived from surrounding mountains. Slopes are flat to gently sloping and are generally stable. Steep slopes occur only along creek banks and may be susceptible to slumping and sliding.

Santa Cruz Mountains

The southern Santa Cruz Mountains in the vicinity of U.S. 101 westward through the Chittenden Pass consist of Middle and/or Lower Pliocene (5 million years ago) marine sedimentary rocks and Middle Miocene (23.5 million years old) marine deposits. A sliver of Mesozoic granite from the Salinian block crops out south of Highway 129 in the San Andreas rift zone. The San Andreas fault zone traverses the project area, passing through the Pajaro Gap area (see **Figure 3.2-1** in Section 3.2).

The portion of the pipeline alignment that extends through the Santa Cruz Mountain foothills follows in an area of gentle slope along Highway 129 and the SPRR right-of-way. Elevations along the alignment vary from about 100 to 200 feet msl. Elevations at the Pajaro Gap in the vicinity of the pipeline range from 100 to 600 feet msl. Slopes in the Santa Cruz Mountain foothills along the pipeline alignment range in steepness from gently sloping to moderately steep. Slope stability ratings range from generally marginally stable to unstable (Nilsen and Wright, 1979).

Pajaro Valley

The Pajaro Valley is a low-lying topographic plain that ranges in elevation from sea level to about 200 feet above msl along the perimeter at the foot of the Coast Ranges. The valley is composed of deep alluvium. The pipeline would be buried only in the upper sediments of Quaternary age approximately 5 to 20 ft deep. Most of the topography is characterized as flat to gently sloping landforms, with some moderate to steep slopes located along the edges of wide valley cut into old marine terraces, e.g., Harkins Slough and Corralitos Creek, and in the coastal dunes areas. Moderate slopes also are present in the Cayetano Range, a dissected low range of hills at the southern edge of the valley.

The proposed pipeline alignment traverses the Pajaro Valley from the Pajaro Gap west to Highway 1. Elevations range from about 100 feet above msl at the head of the valley near Chittenden Pass to about 25 feet above msl at the end point of the pipeline at Highway 1. The terrain is gently sloping, with locally steep slopes along the banks of creeks and irrigation channels. Slopes in the Pajaro Valley in the vicinity of the pipeline alignment are generally stable. Moderately steep slopes also occur along the edges of the Cayetano Range, which are generally located south of the pipeline alignment, with the exception of the segment from about Stations 745+00 to 771+00, which traverses a portion of the hills. The Cayetano Range is underlain by Pleistocene non-marine sedimentary rocks that are moderately to marginally stable.

Soils

The proposed pipeline alignment traverses several geographic areas in which a variety of soils have developed. The United States Department of Agriculture (USDA) Natural Resources Conservation Service (formerly the Soil Conservation Service) Soil Surveys were reviewed for San Benito County (1969), Eastern Santa Clara County (1974), Santa Cruz County (1980), and Monterey County (1978). Soil classification and nomenclature may vary among counties. Soils that occur along the pipeline alignments are listed in **Table 4.B.2-1**. The **Map Appendix** (map series A) presents the soils that occur in each county along the pipeline alignment. The following text summarizes the distribution of soil types and their engineering properties within the project area.

Southern Santa Clara Valley

Soils in the southern Santa Clara Valley in the vicinity of the eastern portion of the pipeline consist of Willows clay, Willows sandy loam, and Clear Lake clay. These soils have formed on flood plains and alluvium derived from sedimentary rocks. Slopes are low and the risk of erosion ranges from none to slight (see **Table 4.B.2-1**). Slopes may be locally steep along river channels and bank erosion and severe gullying may occur. These soils have a high shrink-swell potential and are highly corrosive to uncoated steel (USDA, 1969). The pipeline alignment in Santa Clara Valley is in a predominately agricultural area. The major portion of soils in this area are considered to be prime agricultural soils by the Important Farmland Mapping Program (1994).

In the vicinity of U.S. 101, the pipeline approaches the foothills of the Santa Cruz Mountains. Soils on low-lying land in this area consist of the Sorrento silty clay loam, which have a moderate shrink-swell potential and are moderately corrosive to uncoated steel. Erosion hazard is slight to moderate.

TABLE 4.B.2-1
SOIL PROPERTIES ALONG THE PROPOSED PIPELINE

Approximate Pipeline Location (Station or description)	Soil Symbol	Soil Type	Slope	Shrink/ swell potential	Corrosivity	Erosion Hazard
0+00 to 120+00	Wc	Willows clay	0-2%	high	moderate	none
120+00 to 140+00	GuE	Gullied land	variable	N/A	N/A	very severe
Alt. Route near Pajaro River	Wc	Willows clay	0-2%	high	moderate	none
	Ch	Clear Lake clay	0-2%	high	high	non-slight
140+00 to 160+00	Wc	Willows clay	0-2%	high	moderate	none
160+00 to 180+00	Ws	Willows sandy loam	0-2%	high	high	none
180+00 to 240+00	Wc	Willows clay	0-2%	high	moderate	none
240+00 to 285+00	Ch	Clear Lake clay	0-2%	high	high	non-slight
285+00 to 315+00	CyC	Cropley silty clay loam	2-9%	high	high	none-slight
315+00 to 370+00	SrA	Sorrento silty clay loam	0-2%	moderate	moderate	slight
370+00 to 390+00	SrC	Sorrento clay loam	2-9%	moderate	moderate	slight-moderate
390+00 to 400+00	SrA	Sorrento silty clay loam	0-2%	moderate	moderate	slight
400+00 to 410+00	AuG	Azule clay loam	30-75 %	moderate	moderate	high-very high
410+00 to 415+00	YaB	Yolo loam	2-5%	moderate	low	slight
415+00 to 418+00	CrC	Cropley clay	2-9%	high	high	slight-moderate
418+00 to 430+00	ZbA	Zamora clay loam	0-2%	moderate	moderate	none-slight
430+00 at Sargent Creek	ZeC3	Zamora and Cropley soils	2-9%	moderate	moderate	severe
430+00 to 445+00	YaA	Yolo loam	0-2%	moderate	low	none-slight

TABLE 4.B.2-1 (Continued)
SOIL PROPERTIES ALONG THE PROPOSED PIPELINE

Approximate Pipeline Location (Station or description)	Soil Symbol	Soil Type	Slope	Shrink/ swell potential	Corrosivity	Erosion Hazard
445+00 to 458+00	AuE2	Azule clay loam	15-30%	moderate	moderate	moderate -high
458+00 to 493+00	ZeC3	Zamora and Cropley soils	2-9%	moderate	moderate	severe
493+00 to 495+00	100	Aptos loam	15-30%	low-moderate	high	moderate
495+00 to 505+00	102	Aptos loam	50-75%	low-moderate	high	very high
505+00 to 545+00	147	Los Osos	15-30%	high-moderate	high	moderate
545+00 to 560+00	166	San Emigdio variant sand loam	0-2%	low	high	slight
560+00 to 565+00	122	Conejo clay loam	0-2%	moderate	high	slight
565+00 to 570+00	133	Elkhorn sandy loam	2-9%	low-moderate	moderate	slight-moderate
570+00 to 595+00	120	Conejo loam	0-2%	moderate	high	slight
595+00 to 645+00	MnG	Mine pits and dumps	variable	N/A	N/A	N/A
645+00 to 715+00	SnA	Sorrento silty loam	0-2%	moderate	moderate	slight
715+00 to 728+00	SbA	Salinas clay loam	0-2%	low-moderate	high	none
728+00 to 745+00	Cg	Clear Lake clay, moderately wet	0-2%	high	high	none
745+00 to 765+00	EeE	Elkhorn fine sandy loam	15-30%	low-moderate	variable	high
765+00 to 771+00	EeD	Elkhorn fine sandy loam	5-15%	low-moderate	variable	moderate
771+00 to 776+00	Ba	Badlands	variable	N/A	N/A	severe

TABLE 4.B.2-1 (Continued)
SOIL PROPERTIES ALONG THE PROPOSED PIPELINE

Approximate Pipeline Location (Station or description)	Soil Symbol	Soil Type	Slope	Shrink/ swell potential	Corrosivity	Erosion Hazard
776+00 to 900+00	SbA	Salinas clay loam	0-2%	low-moderate	high	none
Murphy crossing	SaA	Salinas loam	0-2%	low	high	slight
Alt. Route San Juan Rd.	SaA	Salinas loam	0-2%	low	high	slight
Alt. Route San Juan Rd.	SbC	Salinas clay loam	2-9%	low-moderate	high	slight
900+00 to 915+00	AkD	Arnold loamy sand	9-15%	low	moderate	moderate
915+00 to 932+00	SbA	Salinas clay loam	0-2%	low-moderate	high	none
932+00 to 995+00	AkD	Arnold loamy sand	9-15%	low	moderate	moderate
965+00 to 985+00	SbA	Salinas clay loam	0-2%	low-moderate	high	none
985+00 to 1052+00	Cg	Clear Lake clay, moderately wet	0-2%	high	high	none
1052+00 to 1127+00 (end)	Pa	Pacheco clay loam	0-2%	moderate	high	none
Alt Route between SPRR to Hayes Rd.	Cg	Clear Lake clay, moderately wet	0-2%	high	high	none
Alt Route Lewis Rd.	Cg	Clear Lake clay, moderately wet	0-2%	high	high	none
Alt. Route Trafton Rd.	Pa	Pacheco clay loam	0-2%	moderate	high	none

NOTES: N/A, information not available

SOURCE: USDA Natural Resources Conservation Service (formerly the Soil Conservation Service):
San Benito County (1969)
Eastern Santa Clara County (1974)
Santa Cruz County (1980)
Monterey County (1978)

Santa Cruz Mountains

In southeastern Santa Clara County, the pipeline traverses portions of the Sargent Hills. Soils on low-lying terraces consist of Yolo loam, Cropley clay, and Zamora clay. These soils have formed on alluvium of mixed origin, such as alluvial fans or river terraces. Soils within the pipeline alignment in this area generally have low to moderate slopes and the erosion hazard is none to moderate, shrink-swell potential is moderate to high, and corrosivity of low to moderate (USDA, 1980). Upland portions of the Sargent Hills are moderately steep and shallow landslides and soil erosional features are visible. Alternative pipeline alignments that cross the Sargent Hills would traverse Azule clay loam soils, which have moderate shrink-swell potential, are moderately corrosive, and have a high to very high erosion potential.

In southern Santa Cruz County in the upland portions of the Sargent Hills, soils consist of the Aptos and Los Osos loams. Slopes are moderate to steep and erosion hazard is moderate to very high. The shrink-swell potential depends on the clay content of the soil and varies with depth from low to high. These soils are highly corrosive to uncoated steel (USDA, 1980).

In northwestern San Benito County, in the vicinity of the Granite Rock Company quarry, soils have been disturbed by mine pits and dumping. West of the Pajaro Gap the pipeline alignment enters the Pajaro Valley and soils of the Sorrento silty loams that have formed on alluvium derived from calcereous sandstone and shale. These soils have a moderate shrink-swell potential, are moderately corrosive to uncoated steel and have a slight erosion hazard (UDSA, 1980).

Pajaro Valley

In the Pajaro Valley, in Monterey County, soils generally consist of Salinas clay loam, Salinas loam, Arnold loamy sand, and Pacheco clay loam. Slopes are level to gently sloping and the erosion hazard is slight. These soils typically have a low to moderate shrink-swell potential and are highly corrosive to uncoated steel (USDA, 1978). Clear Lake clay soils occur in the vicinity of Watsonville Junction and in the area to the east (alternative alignments along Lewis Road and between the SPRR and Hayes Road). Clear Lake clay soils have a high shrink-swell potential (USDA, 1978). Local variation in soil type occurs along the pipeline alignment between Stations 745+00 and 771+00 where upland soils of the Elkhorn series occur. In this area the erosion hazard is moderate to high. The pipeline alignment traverses the rich agricultural soils of the Pajaro Valley. The major portion of the pipeline in Monterey County is within soil types that are considered to be prime agricultural soils by the Important Farmland Mapping Program (1994).

Seismicity and Hazards

Potentially active traces of the San Andreas and the Vergeles faults have been mapped crossing the PVWMA service area (see **Figure 3.2-1**). A discussion of these faults and seismic hazards from local and regional faults are discussed in Section 3.2, Geology and Soils, of this EIR.

4.B.2.2 SIGNIFICANCE CRITERIA

See Section 4.2.2 for a discussion of significance criteria.

4.B.2.3 IMPACTS AND MITIGATION MEASURES

The project would not result in impacts related to substantial changes in topography because post construction grading and revegetation would restore topography to approximately pre-construction conditions. The project would not involve long-term extraction of large quantities of groundwater. Temporary seasonal fluctuation in groundwater levels would typically not result in subsidence of the ground surface. Subsidence occurs as a result of gradual, consistent, decline in groundwater levels over many years. There is no evidence of the presence of unique geologic features, unusual rock formations, fossils or special geologic structures in the area with potential effects of the proposed local water supply and distribution facilities. Therefore, these impact criteria will not be evaluated further in this EIR.

The proposed pipeline traverses a large crushed rock quarry near Pajaro Gap in San Benito County. Pipeline construction would affect a mined-out portion of the quarry and would not adversely affect important mineral resources.

Pipeline Construction

The project description identifies pipeline installation methods that could include open cut trenching, bore-and-jack, and tunneling. In general, the alignment is located in open areas where conventional excavation methods can be used for open-cut pipeline installation. In areas where the alignment crosses roads, creeks, dense vegetation, or other conditions where surface disturbance should be minimized, other methods of installation such as boreand-jack or tunneling may be used (PVWMA, 1997). At major highway and railroad crossings, where stiff cohesive soils occur, and where shallow groundwater would not affect construction, bore-and-jack techniques, open-face shield with mechanical cutter, or a shield with a backhoe digger can be used.

Open-cut pipeline installation with water bypass diversion would be used at crossings of intermittent streams that have no or very low flow during the dry season (PVWMA, 1997). Tunneling methods may be more appropriate for larger volume stream crossings. For this technique a large-diameter tunnel is constructed beneath the streambed at a depth sufficient to preclude scour, or channel bottom erosion, from affecting the tunnel. The pipeline is then constructed within the tunnel (PVWMA, 1997).

Impact 4.B.2-1: Segments of the proposed Import Pipeline would be located in areas of unstable slopes and slope failure that could interfere with project construction or damage facilities. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

In several areas along the pipeline alignment, locally steep slopes may occur along riverbanks and drainage channels (see **Table 4.B.2-2**). Stream bank erosion may undercut slopes and result in slumping and sliding. West of U.S. 101, dense vegetation and steep embankments on the west side of the Pajaro River and UPRR crossing at Station 397+00 indicate that this area has potentially unstable slopes. However, the proposed alignment was located here based on field investigations that determined that the river banks are less steep and riparian vegetation is less dense at this location than at Stations 360+30 and 368+50, where it was determined that pipeline crossings would not be feasible (PVWMA, 1997). These alternative pipeline alignments are shown as dashed lines on **Maps A1 through A4** in the Map Appendix. (For further discussion of the alternative alignments, please see Section 6, Alternatives to the Project).

TABLE 4.B.2-2
AREAS OF UNSTABLE SLOPES ALONG THE PROPOSED PIPELINE ALIGNMENT

Station	Location	Slope Stability Issue	Relevant Mitigation
397+00	Crossing of Pajaro River at UPRR	Moderately steep river banks and moderately dense vegetation – potentially unstable slope	Conduct a hydraulic and scour analysis to ensure that pipelines are installed at an adequate depth to prevent scour.
590+00	Crossing of Pajaro River at UPRR crossing	Steep southwest bank – potentially unstable slope	Use bore-and-jack techniques under UPRR and open-cut installation across river channel.
440+00 to 680+00	Sargent Hills	Unstable slope	Bank erosion and channel stability evaluation – install pipeline within existing railroad or road rights-of-ways that have been graded to a stable configuration.
745+00 and 771+00	Within Cayetano Hills	Moderately steep slopes, weak sedimentary rocks – potentially unstable slope	Bank erosion and channel stability evaluation

The alternative pipeline crossing of the Pajaro River near Pajaro Gap (approximately Station 571+75) is deeply incised. Both sides of the river channel are steep and vegetation is dense at this location. As shown in **Map A3** in the Map Appendix, the alternative pipeline alignment would follow Lower Quarry Road on the south bank of the Pajaro River. Evidence of flood-induced landsliding was documented in this area during a field reconnaissance (PVWMA, 1997). For this reason, the proposed pipeline alignment was located about 200 feet to the southwest at Station 590+00 (Pajaro River and UPRR crossing). The pipeline would be installed using bore-and-jack techniques under the UPRR tracks on the northeast bank of the river, with bore and jack across the river channel. The pipeline would be buried by 10 feet of cover over the channel bottom (PVWMA, 1997). The southwest bank of the Pajaro River is very steep in this area and slope instability could adversely affect pipeline installation and/or long-term maintenance of facilities.

Portions of the proposed alignment and the alternative alignment traverse the Sargent Hills in the foothills of the Santa Cruz Mountains (alternative alignments between Stations 360+00 and 444+00 and the proposed alignment from Stations 440+00 to 680+00), an area that is landslide prone. The major portion of the pipeline, however, would be installed within existing railroad or road rights-of-ways that have been graded to a stable configuration. Between approximately Stations 745+00 and 771+00, where the alignment traverses open country within the Cayetano Hills, slopes are moderately steep and consists of weak sedimentary rocks where slope stability would be a consideration during construction.

Pipeline construction could be affected by unstable slopes in the areas discussed above. In addition, post-construction slope failure triggered by earthquakes or channel erosion during flooding could damage the pipeline in the future. However, slope failure is not expected to result in catastrophic damage to the pipeline.

> **Measure 4.B.2-1a:** For pipeline segments that traverse the Sargent Hills in the foothills of the Santa Cruz Mountains or portions of the Cayetano Hills, a design-level geotechnical report that includes a slope stability evaluation shall be completed prior to construction. Pipeline installation specifications should incorporate all slope stability recommendations contained in the geotechnical evaluation. Slope stabilization measures may include drainage, slope benching, buttresses, and vegetation restoration.
>
> **Measure 4.B.2-1b:** For pipeline segments at stream crossings, a detailed hydraulic and scour analysis shall be conducted to ensure that pipelines and tunnels are installed at an adequate depth to prevent scour during flood flows. Bank erosion and channel stability should also be evaluated in the vicinity of Station 590+00 (Pajaro River and UPRR crossing). Recommendations of the hydraulic and scour analysis shall be incorporated into the project design and specifications.

Impact 4.B.2-2: The proposed transmission pipeline would extend across two active fault traces and could be damaged by surface fault rupture. Significant and Unavoidable.

Portions of the proposed pipeline alignment cross the active San Andreas and Sargent faults (see **Table 4.B.2-3**). The alternative pipeline alignment also crosses the fault trace to the northwest (see **Map A1** in the Map Appendix). The Earthquake Hazard Zone for the Sargent fault is about 1,000 feet wide in the vicinity of the pipeline alignment. The alignment crosses the mapped fault trace at about Station 274+00.

TABLE 4.B.2-3
LOCATIONS OF FAULT CROSSINGS

Approximate Pipeline Location (Station)	Fault Name
274+00	Sargent
593+00	San Andreas
602+00 to 620+00	San Andreas

The Earthquake Hazard Zone for the San Andreas Fault is about 3,000 feet wide in the vicinity of the proposed pipeline alignment. The alignment follows the mapped trace of the fault in two places: from about Stations 602+00 to 620+00 and at about Station 593+00 (see **Map A2 and Map A3** in the Map Appendix).

Surface fault rupture associated with seismic activity on these faults could result in pipeline damage. During the 1906 earthquake, horizontal movement of about four to five feet occurred in the southern Santa Cruz Mountains and railroad alignments at the Granite Rock Company quarry shifted approximately 16 feet (PVWMA, 1997). A large earthquake on the San Andreas Fault could result in significant surface fault rupture and pipeline damage. Pipeline rupture would result in the release of water and could cause substantial erosion at the discharge point. In addition, pipeline rupture and washout would probably damage nearby roadways, including Highway 129, a major link to U.S. 101.

The proposed project includes installation of isolation valves on both sides of the San Andreas Fault zone and Sargent fault to isolate water flow in the event of pipeline damage (see **Map A3** in the Map Appendix).

The following mitigation measure would reduce the impact of a pipeline rupture due to earthquake fault surface rupture, but not to a less-than-significant level. A major displacement of either fault would result in pipeline rupture. Therefore, this impact would remain significant and unavoidable.

> **Measure 4.B.2-2:** For pipeline segments that cross the San Andreas and Sargent faults, incorporate the following elements into the design and construction of the proposed pipeline:

- Use ductile-grade steel pipe in conjunction with increased pipe wall thickness throughout the fault zones as depicted in **Maps A1, A2, and A3** in the Map Appendix. These materials are more flexible and can tolerate some deformation caused by ground failure.

- Install welded joints at the joints through the fault zones.

- Where possible, install pipelines across faults in a perpendicular direction.

- Install water-pressure-sensitive or pipe-movement-sensitive instruments linked to the isolation valves to shut down the system in the event of failure. The isolation valves could be automatically closed during a large earthquake.

- Construct a contingency route for pipe flow drainage in case of failure. Drainage of pipe flows to a culvert under the railroad track to the river or a detention basin should be considered.

- Design the water conveyance system to facilitate rapid or emergency repair.

Impact 4.B.2-3: The proposed pipeline would extend through areas that are susceptible to liquefaction and could damage project facilities in the event of a major earthquake. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Pipeline installation in areas underlain by clean, granular soil where shallow groundwater is present would be vulnerable to liquefaction. Relatively thick Quaternary alluvial deposits in the southern Santa Clara Valley in the vicinity of the proposed pipeline would be susceptible to ground failure by liquefaction (see **Maps A1 through A4** in the Map Appendix). Most of the proposed alignment located in the Pajaro Valley is within a high or very high seismic hazard zone designated by the North County Area Plan (Monterey County, 1994). However, actual liquefaction hazards can only be determined through a site-specific geologic investigation.

Liquefaction can cause pipes to bend, crack and/or rupture and may disrupt the alignment of pipes. Pipeline installed in low-lying areas could be subject to liquefaction during a large earthquake. Pipeline segments that traverse the Santa Cruz Mountain foothills are underlain by bedrock and are not at risk of liquefaction.

> **Measure 4.B.2-3:** For pipeline segments located in low-lying areas (Stations 0+00 to about 450+00 and Stations 650+00 to 1127+00) a design-level geotechnical investigation, including collection of subsurface data shall be completed prior to construction of facilities. The geotechnical evaluation should include identification of density profiles, determination of maximum shallow groundwater levels, and characterization of the vertical and lateral extent of saturated sand/silt layers that could undergo liquefaction during strong ground shaking. When facility-specific testing indicates that conditions are present that could result in liquefaction and damage to project facilities, appropriate, feasible measures should be included in the site-specific soil analysis and incorporated into the project

design. These measures could include the following, unless the site-specific soils analysis dictates otherwise:

- Densification or dewatering of surface or subsurface soils.
- Construction of concrete foundations to support pipelines or pile foundations to support buildings.
- Removal of material that could undergo liquefaction in the event of an earthquake and replacement with stable material.

Impact 4.B.2-4: Strong ground shaking could damage project facilities or result in long-term service interruptions. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Construction of the Import Pipeline would occur in a region of high seismic activity, and thus the pipeline would be subject to strong ground shaking that could damage facilities. However, since the surface water supply is for agricultural use and not municipal use, loss of service would not jeopardize public health by adversely affecting drinking water supply, fire-fighting capabilities or other emergency response.

Specific portions of the pipeline are at high risk for surface fault rupture (refer to Impact 4.B.2-2 and **Table 4.B.2-3**, above) and ground failure from liquefaction (refer to Impact 4.B.2-3, above). However, strong ground shaking (IX or greater on the Modified Mercalli Scale--see **Table 3.2.2**) could cause damage to the pipeline in other areas. The majority of the pipeline alignment is expected to experience ground shaking of Modified Mercalli IX or greater as a result of a large earthquake on the San Andreas Fault.

Measure 4.B.2-4: PVWMA shall develop and implement an earthquake preparedness and emergency response program. The program should be detailed and should include, at a minimum, the following elements:

- Identify specific pipeline locations, through site-specific geologic studies, that would be vulnerable to damage in an earthquake and define priorities for system repairs.
- Provide appropriate PVWMA facilities staff, sheriff and fire departments with emergency response training.
- Conduct practice drills, using simulated earthquake scenarios, of emergency response procedures annually.

Impact 4.B.2-5: The proposed pipeline would extend through areas with soils subject to settlement and expansive soils that could damage the proposed facilities. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Settlement, caused by consolidation of saturated, fine-grained, subsurface soils, could occur along the proposed pipeline alignment. Areas of high shrink/swell potential are listed in **Table 4.B.2-4**. The proposed pipeline could be damaged by differential settlement due to consolidation. The magnitude of the potential settlement cannot be estimated without subsurface exploration and laboratory testing. Plastic, potentially expansive soils with a high shrink-swell potential occur throughout the project area, as shown below. Expansive soils could cause pipeline damage.

Measure 4.B.2-5a: A site-specific investigation shall be conducted by a geotechnical engineer to determine the presence and characteristic of potentially compressible and/or expansive soils, the depth and thickness of soil layers, and the depth to groundwater. Soils shall be sampled and laboratory tested to determine the expansion potential. The results of the investigation shall include mitigation measures that would reduce settlement to a less-than-significant level. Feasible mitigation measures could include removal and replacement of soil or deep mixing of compressible soils with stabilizing agents, as identified below:

- Expansive soils can be excavated and replaced with non-expansive materials. The required depth of excavation should be specified by a registered civil engineer based on actual soil conditions.

- Expansive soils may be treated in place by mixing them with lime. Lime-treatment alters the chemical composition of the expansive clay minerals such that the soil becomes non-expansive.

Measure 4.B.2-5b: Any native or imported backfill shall be selected, placed, compacted, and inspected in accordance with plans and specifications prepared by a licensed civil engineer.

Impact 4.B.2-6: The proposed pipeline would extend through areas with corrosive soils that could damage the pipeline. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Portions of the proposed pipeline alignment are underlain by a variety of soil types that are highly corrosive to uncoated steel; potential areas with high corrosive soils are summarized in **Table 4.B.2-5** below. These soils are distributed throughout the project area and include the Willows, Clear Lake clay, Cropley, Aptos, Los Osos, San Emigdio, Conejo, Salina, and Pacheco. Corrosive conditions can rapidly deteriorate ordinary concrete and uncoated steel. Corrosion of buried water facilities could result in system leakage, equipment failure and the need for excavation and maintenance.

TABLE 4.B.2-4
AREAS SUBJECT TO SETTLEMENT AND EXPANSIVE SOILS

Approximate Pipeline Location (Station)	Shrink/ swell potential
0+00 to 120+00	high
Alt. Route near Pajaro River	high
140+00 to 160+00	high
160+00 to 180+00	high
180+00 to 240+00	high
240+00 to 285+00	high
285+00 to 315+00	high
315+00 to 370+00	moderate
370+00 to 390+00	moderate
390+00 to 400+00	moderate
400+00 to 410+00	moderate
410+00 to 415+00	moderate
415+00 to 418+00	high
418+00 to 430+00	moderate
430+00 at Sargent Creek	moderate
430+00 to 445+00	moderate
445+00 to 458+00	moderate
458+00 to 493+00	moderate
505+00 to 545+00	high-moderate
560+00 to 565+00	moderate
570+00 to 595+00	moderate
645+00 to 715+00	moderate
728+00 to 745+00	high
985+00 to 1052+00	high
1052+00 to 1127+00 (end)	moderate
Alt Route between SPRR to Hayes Rd.	high
Alt Route Lewis Rd.	high
Alt. Route Trafton Rd.	moderate

SOURCE: USDA Natural Resources Conservation Service (formerly the Soil Conservation Service):
San Benito County (1969)
Eastern Santa Clara County (1974)
Santa Cruz County (1980)
Monterey County (1978)

Measure 4.B.2-6a: A site-specific soil corrosion survey shall be conducted by a engineer certified to evaluate soils conditions along the pipeline. The investigation shall define the need for, and the location of, insulating couplings, electrolysis test stations, and hot spot areas where there should be either galvanic or impressed current cathodic protection. This will assure a high degree of corrosion suppression to cement and uncoated steel or ductile iron pipes. All buried structures should be designed and constructed to withstand corrosive subsurface conditions.

TABLE 4.B.2-5
LOCATIONS OF SOILS WITH HIGH CORROSIVITY

Alt. Route near Pajaro River
160+00 to 180+00
240+00 to 285+00
285+00 to 315+00
415+00 to 418+00
493+00 to 495+00
495+00 to 505+00
505+00 to 545+00
545+00 to 560+00
560+00 to 565+00
570+00 to 595+00
715+00 to 728+00
728+00 to 745+00
776+00 to 900+00
Murphy crossing
Alt. Route San Juan Rd.
Alt. Route San Juan Rd.
915+00 to 932+00
965+00 to 985+00
985+00 to 1052+00
1052+00 to 1127+00 (end)
Alt Route between SPRR to Hayes Rd.
Alt Route Lewis Rd.
Alt. Route Trafton Rd.

NOTES: N/A, information not available

SOURCE: USDA Natural Resources Conservation Service (formerly the Soil Conservation Service):
San Benito County (1969)
Eastern Santa Clara County (1974)
Santa Cruz County (1980)
Monterey County (1978)

Measure 4.B.2-6b: To maintain and extend the life of the pipeline, bonding jumpers shall be provided at all joints to facilitate periodic corrosion testing.

Impact 4.B.2-7: Construction of proposed pipeline could increase soil erosion during the pipe installation phase. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Slope gradients along the majority of the proposed alignment (about 80 percent) are less than five percent. One exception is the portion of the pipeline alignment that traverses the Sargent Hills (between Stations 480+00 and 510+00), where slopes in some areas approach 30 percent. Water erosion hazards for undisturbed soils are low in flat-lying agricultural settings to severe in some sloped areas or in Zamora and Cropley soils in Santa Clara County. However, erosion hazards increase where soils are disrupted by excavation for pipeline installation.

Measure 4.B.2-7: The PVWMA shall design and implement a Temporary Erosion and Sediment Control Plan for the excavation and construction phase of the project that would, at a minimum, meet the following objectives, consistent with the Final Program EIR for the Pajaro Valley Water Basin Management Plan (PVWMA, 1993):

- The Temporary Erosion and Sediment Control Plan would be prepared by a registered civil engineer or a certified erosion and sediment control specialist using the concepts such as those developed by the Association of Bay Area Governments' Manual of Standards for Erosion and Sediment Control Measures (1995).

- The Plan would be based on the specific erosion and sediment transport control needs of each pipeline segment.

- The Plan would specify the means to reduce the velocity of water leaving the pipeline alignment.

- The elements of the Plan would be maintained in working condition during the excavation, grading, and construction phases.

- The Plan would be required, submitted, reviewed, implemented, and inspected as part of a general grading plan for the project.

Other erosion and sediment control measures include:

- Confine grading and excavation to the dry season (April 15 through October 15), whenever possible. If grading is scheduled for the wet season, ensure that erosion and sediment control structures are in place prior to the onset of the first major storm of the season.

- Keep disturbed areas (from grading and related activities) to the minimum necessary for demolition or construction.

- Direct runoff away from disturbed areas during grading and related activities.

- Locate staging areas and spoil sites outside major stream and drainage ways and such that they do not drain directly into the waterways. If a spoil site drains into the creek, temporary catch basins will be constructed to intercept sediment before it reaches the channels. Spoil sites will be graded to reduce the potential for erosion.

- Place sediment curtains upstream and downstream of the construction zone to prevent sediment disturbed during trenching activities from being transported and deposited outside of the construction zone.

- Prevent runoff from flowing over unprotected slopes. Place sediment traps on downhill slopes whenever construction activities such as trenching, grading, etc. occur on slopes along rivers or streams.

- Following construction, creek banks will be covered with erosion control blankets and replanted with locally indigenous species using locally collected materials (seed, plugs, willow or cottonwood wattles). These will be planted according to a revegetation plan approved by the resource agencies.

REFERENCES – Geology, Soils and Seismicity

Association of Bay Area Government (ABAG), *Manual of Standards for Erosion and Sediment Control Measures*, May 1995.

County of Monterey, *North County Area Plan*, 1994.

County of San Benito, *Open Space and Conservation Element Update of the San Benito County General Plan*, 1995.

County of San Benito, *Seismic Safety/Safety Elements General Plan Revision*, 1980.

County of Santa Clara, *General Plan*, updated 1995.

County of Santa Cruz, *General Plan and Local Coastal Program*, updated 1994.

Important Farmland Mapping Program, Important Farmland Maps for San Benito, Santa Clara, Santa Cruz and Monterey Counties, 1994.

Jennings, C.W., *Fault Activity Map of California and Adjacent Areas with Locations and Ages of Recent Volcanic Eruptions*, CDMG Geologic Data Map No.6, 1994.

Lawson, A.C., *The California Earthquake of April 18, 1906*, Report of the State Earthquake Investigation Commission, 1908.

McNutt, S.R. and T.R., Toppozada, *Seismological Aspects of the 17 October 1989 Earthquake of 17 October 1989*, California Division of Mines and Geology, Special Publication 104, 1990.

Nilsen, T. H., Wright, R.H., *Relative Slope Stability And Land-Use Planning in the San Francisco Bay Region, California*, U.S. Geological Survey Professional Paper 944, 1979.

Pajaro Valley Water Management Agency, *Final Program EIR for the Pajaro Valley Water Basin Management Plan*, 1993.

Pajaro Valley Water Management Agency (PVWMA), *Final Technical Memorandum No. 1.1A-Import Pipeline Alignment -Preliminary Engineering*, 22 September.

Steinbrugge, K.V., Bennett, J.H., Lagorio, H.J., Davis, J.F., Borchardt, G, and Toppozada, T.R. 1987. Earthquake Planning Scenario for a Magnitude 7.5 Earthquake on the Hayward Fault in the San Francisco Bay Area. Special Publication 78.

U.S. Department of Agriculture, Soil Conservation Service, *Soil Survey of San Benito County California*, 1969.

U.S. Department of Agriculture, Soil Conservation Service, *Soil Survey of Eastern Santa Clara Area, California*, 1974.

U.S. Department of Agriculture, Soil Conservation Service, *Soil Survey of Monterey County*, 1978.

U.S. Department of Agriculture, Soil Conservation Service, *Soil Survey of Santa Cruz County, California*, 1980.

U.S. Geological Survey (USGS) Working Group on California Earthquake Probabilities, Earthquake Probabilities in the San Francisco Bay Region: 2000-2030 – A Summary of Findings, Open-File Report 99-517, 1999.

Wagner, D.L. 1990. Loma Prieta Earthquake in California Geology, California Division of Mines and Geology. November.

U.S. Department of Agriculture, Soil Conservation Service, Soil Survey of Eastern Santa Clara Area, California, 1974.

U.S. Department of Agriculture, Soil Conservation Service, Soil Survey of Monterey County, 1978.

U.S. Department of Agriculture, Soil Conservation Service, Soil Survey of Santa Cruz County, California, 1980.

4.B.3 HYDROLOGY AND WATER QUALITY

4.B.3.1 SETTING

Please see Section 3.3, Regional Setting – Hydrology and Water Quality, for a comprehensive discussion of the local regional hydrologic setting.

Groundwater withdrawal exceeds groundwater replenishment in the Pajaro Valley basin. This condition of overdraft was first documented about 50 years ago. Long-term overdraft conditions cause groundwater levels to decline, which, in turn, initiates the intrusion of seawater. As the groundwater elevation drops in the basin, a horizontal flow gradient is formed between the sea level and the basin groundwater, causing the seawater/freshwater interface to advance inland. The landward advancement is reversed seasonally, depending on the aquifer pumping rate and groundwater elevations. The Groundwater Banking element of the BMP 2000 Alternative will alter the existing hydrogeologic condition by increasing the elevation of groundwater.

Seawater intrusion can adversely impact groundwater resources. According to the California Department of Health Services, drinking water that is mixed with seawater is considered below taste and odor thresholds if chloride concentrations are below 250 milligrams per liter (mg/L). Chloride concentrations in irrigation water depend on the salinity tolerance of particular crops. For example, chloride concentrations exceeding 100 mg/L may require dilution to reduce salt leaching. Previous study indicates that seawater intrusion in the basin has advanced over time. Chloride concentrations exceeding 100 mg/L have been identified, since 1951, in the southwest corner and along the western boundary of the PVWMA (Springfield area). In 1992, an estimated 8,000 acres of land in the basin were affected by seawater (chloride concentrations exceeding 100 mg/L).

4.B.3.2 SIGNIFICANCE CRITERIA

Refer to Section 4.A.3.2.

4.B.3.3 APPROACH TO ANALYSIS

Computer modeling is often used to evaluate surface water and groundwater response in a basin affected by an altered hydrologic system. Modeling provides the analyst an opportunity to estimate hydrologic response, based on historic hydrologic data, for a defined set of assumptions and predicted scenarios. Analysis of potential impacts from the proposed BMP 2000 Alternative incorporated output of the Pajaro Valley Integrated Groundwater and Surface Water Model (PVIGSM). The PVIGSM provides data to evaluate the surface water and groundwater impacts resulting from the project, in combination with other existing and proposed actions affecting these water resources. The following impact analysis and discussion presents an overview of the computer modeling, the assumptions, and the simulation cases used to formulate the future project. Results of the analysis form the basis of the impacts and mitigation discussion. The

sections that follow describe the modeling parameters and assumptions used in the impact analysis.

Hydrologic Computer Model

PVIGSM is a comprehensive hydrologic model of the Pajaro Valley and incorporates an extensive database, including information on geologic conditions, current and historical hydrologic conditions, and land and water use within the Pajaro Valley. PVIGSM was developed as a basin planning tool to analyze various groundwater and surface water management scenarios. PVIGSM incorporates the primary components of the hydrologic system, including groundwater levels and groundwater movement, seawater intrusion, streamflows, and recharge from stream seepage and soil percolation. It is not possible to predict the hydrologic conditions in the future. However, by analyzing the actual long-term historical record of water year types, it is possible to predict how the proposed project would perform and the basin would respond to various hydrologic scenarios. The model was originally developed in 1990 and was updated in 1993 and again in 1997 as part of the BMP 2000 effort.

Simulation Period

A long-term hydrologic period that contains a sequence of various rainfall conditions was required to provide a reasonable basis for evaluating the state of the basin during both drought and wet conditions. The 34-year hydrologic period (1964 to 1997) used during model calibration contains a distribution of normal, above-normal, and below-normal water year conditions. Streamflow conditions for this simulation period are represented by historical records from 1964 to 1997, which include various sequences of hydrologic events ranging from flood to extended periods of drought. This period covers a range of hydrologic conditions, including a prolonged drought (1987 to 1992), a short-term drought (1976 to 1977), and periods of above-normal precipitation (1967 to 1971, 1982 to 1983, and 1985 to 1986). Although the model period of record extends from 1964 to 1997, PVMWA is able to extrapolate the model results to provide estimates of water use for years 1998, 1999, and 2000. These extrapolations assume the same cropping, land use, and cultural practices (i.e., irrigation efficiencies and crop rotations) as used in 1997 (PVWMA, 2001).[1]

In order to allow enough time for the PVIGSM simulation model to adjust to changes in the water supply scenarios, the 1964 to 1967 monthly hydrologic cycle is repeated to develop a historical 68-year hydrologic record. The 68-year simulation period was used to represent varied hydrologic conditions in the basin. Hence, the historical hydrologic period is considered to be representative of future hydrologic conditions.

[1] Integrated groundwater and surface water models, such as the PVIGSM, are typically calibrated to a period of hydrologic record that is considered representative of long-term regional hydrology. Most hydrologic records used in models span a period of about 20 to 70 years. Models periodically can be recalibrated to include recent hydrologic data when it becomes available, but it is not a standard practice to recalibrate basinwide models following each water year.

Pajaro Valley Water Year Hydrologic Classification

Each year within the 68-year hydrologic sequence used in PVIGSM corresponds to a particular hydrologic water year type. The water year types include: below normal, normal, and above normal. These water year types were defined for the purpose of this study, since no official water year classifications have been defined by the State Water Resources Control Board (SWRCB) for the Central Coast hydrologic basins. Within the 68-year hydrologic sequence, 10 years (15 percent) are classified as below normal, 46 years (67 percent) are classified as normal, and 12 years (18 percent) are classified as above normal.

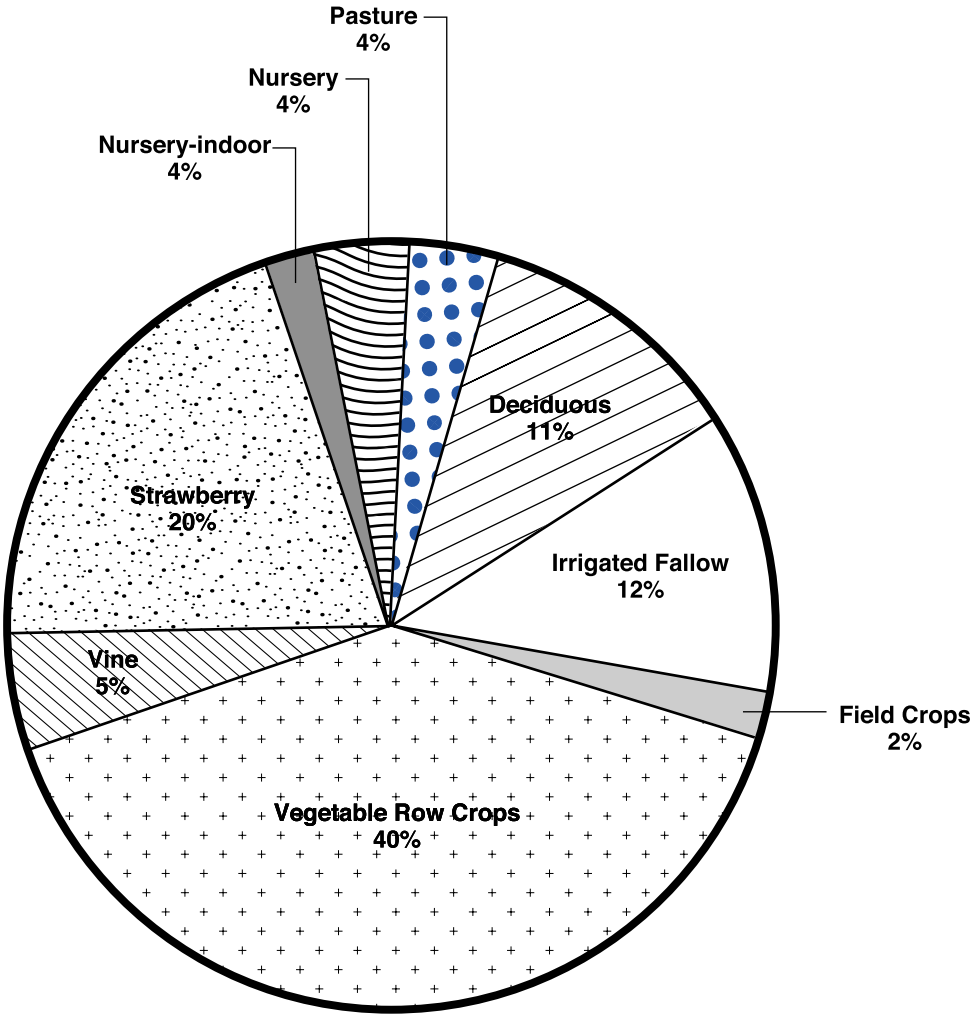
Modeling Assumptions

In order to perform impact analysis through modeling, certain assumptions must be formulated and incorporated into the computer model to represent current and future scenarios.

Land Use and Agricultural Crop Mix. The land use and corresponding crop mix acreage data in the PVIGSM are used to estimate the agricultural crop water requirements and the groundwater pumping and surface water supplies necessary to meet these requirements. The land use distribution data also are used to define the geographic distribution of rainfall runoff and irrigation applied water. The latter affects the distribution of infiltration and deep percolation of water into the groundwater system.

Land use in the model area is divided into three major categories: agricultural, urban, and native vegetation. The land use distribution for the Baseline Conditions is assumed to be that for the 1997 land use survey conducted by the California Department of Water Resources (DWR). Of the total land area of approximately 96,500 acres within the Pajaro Valley model area, approximately 36 percent (34,650 acres) is assumed to be used for agricultural purposes, 13 percent (12,860 acres) for urban and suburban, and the remaining 51 percent (48,996 acres) is native vegetation and undeveloped land. The total modeled area is approximately 146,700 acres of which approximately 96,500 acres are onshore lands (the balance extends into Monterey Bay). The model boundary follows hydrogeologic boundaries. The PVWMA service area is approximately 79,600 acres and generally lies within the onshore area of the model, with the exception of the PVWMA's eastern boundary. Refer also to **Figure 2-1** in the draft Revised BMP.

The agricultural crop mix affects the assumptions for evapotranspiration, irrigation efficiencies, and agricultural water use. The crop acreage under conditions considered as the Baseline Conditions is assumed to be the same as that in the 1997 land use survey. The largest crop acreage is vegetable row crops, followed by strawberries and deciduous trees (see **Figure 4.B.3-1**). Field crops, vineyards, pastures, and nurseries constitute between 2 and 5 percent of the agricultural acreage.



NOTE: Reflects modeled groundwater basin area, which is greater than PVWMA service area.

SOURCE: Draft Revised Basin Management Plan, 2001

Figure 4.B.3-1
Agricultural Crop Mix

Simulation Cases – Future Water Use Scenarios

On the basis of the assumed land use, agricultural crop mix, and water supply conditions, project engineers used the model to simulate surfacewater and groundwater conditions. The simulation cases developed for the model include Baseline Conditions, Sustainable Yield conditions, the BMP 2000 Alternative, and the Local-Only Alternative. The discussion below addresses the first three scenarios (refer to Section 5.D for discussion of modeling for the Local-Only Alternative).

Baseline Conditions. The Baseline Conditions case allows comparison of current conditions to the Basin Yield and BMP 2000 Alternative and was developed to represent existing conditions in the Pajaro Basin. The Baseline Conditions scenario assumes that the existing water demand and supply mix (based on 1997 data) will remain unchanged over the 68-year hydrologic cycle and all of the PVWMA's water supply is supplied from local groundwater by pumping. The average annual groundwater pumping under the Baseline Conditions scenario would be an estimated 69,000 acre-feet per year (afy) in the PVWMA area.

The long-term average annual agricultural water use in the PVWMA area under the Baseline Conditions is estimated to be 59,300 afy. The urban water use for the Baseline Conditions is estimated based on the monthly average urban water use during the 1994 to 1997 hydrologic period. It is assumed that the 1994 to 1997 period represents a reasonable estimate of the current level of urban water use in the basin. The long-term urban water use in the PVWMA area under the Baseline Conditions is estimated to be 12,200 afy. No additional conservation measures are assumed for the agricultural and/or urban sectors. As such, the rate of groundwater pumping is estimated to be that needed to meet the total agricultural and urban water needs, less annual surface water diversions of approximately 1,100 afy from Corralitos Creek for the Corralitos Filter Plant and 1,000 afy by others.

Basin Sustainable Yield Scenario. Basin Sustainable Yield is defined as the long-term amount of groundwater pumping from the aquifer system that can be maintained without causing an adverse impact on the quantity and/or quality of water in the groundwater basin. In an integrated groundwater and surface water system, the sustainable yield of the basin is the amount of withdrawal from the system that can be maintained without causing adverse impact on the groundwater and/or surface water system. The interaction between the groundwater basin and Monterey Bay is quite complex, and flow from the groundwater basin into the Bay (outflow) varies along the coast, as does flow from the Bay into the groundwater basin (intrusion).

Reducing pumping and/or increasing recharge to the extent that it would result in an increase in groundwater elevations can reduce or eliminate seawater intrusion. In this regard, raising the groundwater levels in the coastal area is possibly the most effective means of stopping and/or reversing the movement of seawater, as opposed to raising groundwater elevations throughout the valley.

BMP 2000 Alternative. The BMP 2000 Alternative relies on recycled water from the WWTF and implementation of Groundwater Banking (which includes the Import Pipeline) to meet the water supply needs of the Pajaro Valley. This alternative assumes PVWMA will acquire a

Central Valley Project (CVP) water supply (the Mercy Springs contract assignment supplemented with CVP water from other sources, as described in the Project Description). The variability of annual supply requires additional supplies be provided to meet the needs of Pajaro Valley. **Table 2.1** in the Project Description shows the estimated yield of each component of this alternative.

4.B.3.4 IMPACTS AND MITIGATION MEASURES

Groundwater Banking/Conjunctive Use

Impact 4.B.3-1: Implementation of the BMP 2000 Alternative would alter existing groundwater conditions in the basin by allowing groundwater levels to increase to normal conditions. Reduction of groundwater pumping would reverse conditions of groundwater overdraft and significantly reduce or eliminate the rate of seawater intrusion. Therefore, the project would not result in significant adverse impacts to the groundwater supply and hydrogeologic system of the basin and would be considered beneficial to maintaining an adequate sustainable yield for the basin.

PVWMA proposes to construct an Import Pipeline to link the Pajaro Valley with the Santa Clara Conduit of the San Felipe water system. This would allow water to be transported from the San Felipe system into the Pajaro Valley, providing PVWMA an opportunity to transport water from the CVP into its service area. Water deliveries from the CVP vary each year depending on water availability within its system. However, it is feasible to transport more than the average annual amount necessary in normal years, and through a conjunctive-use program that stores the surplus in the groundwater basin, rely on "banked" groundwater during dry years. Banked groundwater is groundwater that has not been pumped and that is in excess of the sustainable yield of the groundwater basin.

The effects of the BMP 2000 Alternative on groundwater elevations and seawater intrusion are discussed below. Impacts associated with the Baseline Conditions and Basin Sustainable Yield scenarios are presented for comparison.

Baseline Conditions

The Baseline Conditions scenario represents the base case for comparison with the project to determine the long-term groundwater impacts of the project through the end of the PVIGSM 68-year simulation period. The Baseline Conditions case assumes that the existing (1997) water demand and supply mix will remain unchanged over the 68-year hydrologic cycle. Under the Baseline Conditions scenario, PVWMA would not implement any groundwater pumping restrictions or develop additional water supplies. Groundwater pumping would continue at current (1997) rates throughout the Pajaro Basin.

Table 4.B.3-1 presents the estimated end-of-simulation groundwater elevations for the Baseline Conditions scenario. Groundwater elevations would remain below sea level, and therefore would continue to allow seawater to penetrate into the fresh groundwater basin. If groundwater levels

TABLE 4.B.3-1
ESTIMATED END-OF-SIMULATION GROUNDWATER ELEVATIONS IN THE ALLUVIUM AQUIFER

Groundwater Well Location	Baseline Conditions Ending Elevation (ft)	Basin Sustainable Yield Ending Elevation (ft)	BMP 2000 Alternative Ending Elevation (ft)
Coast	6	10	11
Beach Road	-22	4	10
Watsonville Slough	-17	2	8
Corralitos Creek	-3	2	12
College Lake	-16	-8	3
Watsonville Junction	-10	3	11
Center of Inland Distribution Area	10	13	24

SOURCE: PVWMA Hydrologic Analysis and Modeling Technical Memorandum 5 for Subtask 6.1, prepared by Montgomery Watson, May 30, 2000.

continue to decline, this "saltwater wedge" would continue to migrate landward until groundwater elevation equilibrium is achieved between the intruding seawater and the fresh groundwater. The advancing seawater then continues to degrade the freshwater source.

Table 4.B.3-2 summarizes seawater intrusion and subsurface outflow to Monterey Bay for the Baseline Conditions case. The modeling results estimate that the average annual seawater intrusion rate from the Monterey Bay into the coastal area (west of Highway 1) is 10,200 afy and the average annual subsurface outflow to the Bay is 400 afy (gross value). Therefore, the net seawater intrusion would be an estimated 9,800 afy and is considered an adverse condition.

Basin Sustainable Yield

The Basin Sustainable Yield scenario assumes that all agricultural pumping in the coastal area would be eliminated and would not be replaced with another source. The resulting average annual pumping would be 48,000 afy. **Table 4.B.3-1** presents the estimated end-of-simulation groundwater elevations for the Basin Sustainable Yield scenario. Groundwater elevations would be higher in the Basin Sustainable Yield case than in the Baseline Conditions case. Groundwater elevations would be above sea level in the Basin Sustainable Yield scenario and would not represent groundwater overdraft conditions.

TABLE 4.B.3-2
ESTIMATED SEAWATER INTRUSION RATES AND SUBSURFACE OUTFLOW TO MONTEREY BAY

Model Scenario	Average Total Seawater Intrusion (afy)[a]	Subsurface Outflow to Bay (afy)[b]	Net Model Subsurface Flow (afy)[c]
Baseline Conditions	10,200	400	-9,800
Basin Sustainable Yield (no pumping in coastal area)	700	3,200	2,500
Preferred Alternative (water recycling and CVP entitlement)	200	6,700	6,500

Intrusion and subsurface flow rates are estimates based on modeling results.

[a] Seawater intrusion represents total volume of seawater leaving the Monterey Bay subregion and entering the San Andreas, Pajaro River and Springfield Terrace subregions or the Coastal Distribution Area.

[b] Subsurface outflow to Bay represents total volume of fresh groundwater entering the Monterey Bay subregion from the San Andreas, Pajaro River, and Springfield Terrace subregions or the Coastal Distribution Area.

[c] Net values represent the difference between subsurface freshwater outflow and seawater intrusion. A negative number represents seawater intrusion.

SOURCE: PVWMA Hydrologic Analysis and Modeling Technical Memorandum 5 for Subtask 6.1, prepared by Montgomery Watson, May 30, 2000.

With the increased groundwater elevations, seawater intrusion would be substantially less than the Baseline Conditions case. As shown in **Table 4.B.3-2**, average annual seawater intrusion would decrease to 700 afy and the average annual subsurface outflow would increase to 3,200 afy, thereby reversing the seawater intrusion.

BMP 2000 Alternative

Table 4.B.3-2 presents the estimated end-of-simulation groundwater elevations for the BMP 2000 Alternative. Modeling results show that under this scenario, groundwater elevations would be substantially higher than the Baseline Conditions case, and slightly higher than the Basin Sustainable Yield case. Groundwater elevations would be above sea level and therefore would impede the landward advance of seawater intrusion.

With the increased groundwater elevations, seawater intrusion would be substantially less than the Baseline Conditions case. As shown in **Table 4.B.3-2**, the BMP 2000 Alternative would result in an average seawater intrusion rate of 200 afy, much less than the Baseline Conditions average seawater intrusion rate of 10,200 afy, and slightly less than the Basin Sustainable Yield rate of 700 afy. The subsurface outflow to the Bay is 6,700 afy with the BMP 2000 Alternative, compared to 300 afy in the Baseline Conditions case and 3,200 afy in the Basin Sustainable Yield case. Therefore, the proposed project would meet PVWMA's objectives to allow groundwater

elevations to recover, thereby reducing the conditions of overdraft and significantly reducing, if not eliminating, seawater intrusion.

Impact 4.B.3-2: Construction of the proposed pipelines could disturb potential jurisdictional wetlands/waters of the U.S. and streambeds and banks under the jurisdiction of the U.S. Army Corps of Engineers and California Department of Fish and Game. Potential impacts include adverse effects on water quality related to sedimentation of the channels outside of the construction area during trenching activities. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Please refer to discussion under **Impact 4.A.3-1** regarding construction impacts related to open-trench and jack-and-bore pipeline construction.

> **Measure 4.B.3-2a:** Implement Measure 4.A.3-1 (Storm Water Pollution Prevention Plan).
>
> **Measure 4.B.3-2b:** Implement Measures 4.A.4-1a, 4.A.4-1b, and 4.A.4-1c (construction within potentially jurisdictional wetlands/waters of the U.S. and streambeds).

Impact 4.B.3-3: Construction activities along the Import Pipeline alignment could result in the dewatering of shallow groundwater resources and contamination of surface water. Less than Significant.

Excavation of open trenches may intercept shallow or perched groundwater, requiring temporary localized dewatering to facilitate construction. The groundwater is pumped and discharged to the local drainage system. As the impact would be local and temporary, it is considered less than significant. The discharge for construction dewatering could potentially contaminate downstream surface water if the discharge fluids are contaminated.

This impact would be less than significant and thus would not require mitigation; however, the following measure would be implemented in accordance with the Regional Water Quality Control Board (RWQCB) water quality regulations:

> **Measure 4.B.3-3:** Obtain an National Pollutant Elimination Discharge System (NPDES) permit for construction dewatering and implement conditions of the permit. An NPDES permit will be required from the RWQCB for all discharges for construction dewatering. Discharges must meet all applicable water quality objectives. The RWQCB may require certain conditions of the permit, such as treatment of the flows prior to discharge.

Impact 4.B.3-4: Construction activities associated with the Import Pipeline could potentially compromise the structural integrity or water quality of active wells located within the proposed pipeline alignment. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Two active wells are located along the proposed pipeline alignment, at Stations 800+00 and 1030+00. Excavation and soil stockpiling activities may damage well structures or inadvertently introduce sediments into the groundwater.

> **Measure 4.B.3-4a:** Implement measures to ensure that construction activities do not damage existing wells. Wells shall be capped in an appropriate manner to prevent soil and other contaminants from entering groundwater aquifers.
>
> **Measure 4.B.3-4b:** PVWMA or its contractor shall correct any damage to wells and/or reimburse well owners for any loss of use of the well during construction.

REFERENCES – Hydrology and Water Quality

County of Monterey, *North County Area Plan*, 1994.

County of San Benito, *San Benito County General Plan*, amended 1992.

County of Santa Clara, *Santa Clara County General Plan*, 1994.

County of Santa Cruz, *1994 General Plan and Local Coastal Program for the County of Santa Cruz*, 1994.

Montgomery Watson, *PVWMA Hydrologic Analysis and Modeling Technical Memorandum 5 for Subtask 6.1*, 2000.

Pajaro Valley Water Management Agency, *Final Program EIR for the Pajaro Valley Water Basin Management Plan*, 1993.

Pajaro Valley Water Management Agency, *Draft Revised Basin Management Plan*, 2001.

4.B.4 VEGETATION, FISH, AND WILDLIFE

4.B.4.1 SETTING

Please refer to Section 3.4 for a description of methods used during the investigation of the project area for biological resources.

Vegetation and Wildlife Habitats

The project area supports eight different Wildlife Habitat Relationships units (WHR) (Mayer and Laudenslayer, 1988). Please refer to Section 3.4.1 for a general description of each habitat. **Maps B1** through **B4** in Map Appendix B present the habitat locations identified within the study area (a 250-foot-wide corridor centered on the proposed Import Pipeline alignment). As noted in the map legend, the two wildlife habitats with the least value, Urban/Developed and Cropland/Orchard/Vineyard, are not shown in these figures; however, the six identified natural habitats are noted where each occurs within the surveyed corridor.

Aquatic Habitats and Fisheries Resources

Please refer to Section 3.4 for a discussion of aquatic habitats and fisheries resources of the proposed project area.

Description of Terrestrial Wildlife Habitats along the Import Pipeline Alignment

The following is a brief description of vegetation and wildlife habitats occurring along the proposed pipeline alignment and within the survey corridor.

The eastern terminus of the proposed pipeline alignment is about 0.5 mile west of Highway 152, just south of the Santa Clara-San Benito County line. From this point the alignment extends approximately 2.7 miles south-southwest through cultivated fields. Between Stations 00+00 to 41+00, the alignment parallels a narrow, unnamed agricultural drainage ditch that supports a highly degraded example of alkaline-affected Fresh Emergent Wetland. It crosses this ditch as well as a small tributary ditch, which also supports Fresh Emergent Wetland. The alignment continues through agricultural lands from Stations 41+00 to 143+00. The surveyed corridor includes several curves of the Pajaro River, which supports Valley Foothill Riparian habitat, but the alignment itself remains in the agricultural lands. At Station 143+00, where the alignment crosses Bolsa Road, a short stretch of weedy, uncultivated vegetation is mapped Annual Grassland.

From Station 143+00 at Bolsa Road, the proposed alignment extends southward and parallels the Union Pacific Railroad (UPRR) tracks for about a mile, then turns southwest and skirts the Lomerias Muertas Hills to cross Highway 101 at Station 320+00. This segment lies entirely within agricultural lands with scattered houses and a network of roads and tracks. From Station 270+00 to Highway 101, Annual Grassland is on the western side of the proposed alignment, on the steep sideslopes of the hills. In this area, the proposed alignment closely

parallels the unpaved road at the base of the hills. Just to the east of this road is a small gully that supports willow-dominated Valley Foothill Riparian habitat. West of the road, near Station 313+00, is a small and highly degraded vernal pool, which is mapped within the Annual Grassland habitat type.

After crossing Highway 101, the proposed alignment runs west-southwest, bordered by Betabel Road to the east and row crops to the west. Some Valley Foothill Riparian habitat extends into the study area, but the proposed alignment remains on farmland. At Station 372+00, the alignment turns west and then closely parallels the Pajaro River to its crossing at approximately Station 392+00. Valley Foothill Riparian habitat covers about the western half of the study area, near the proposed centerline. On the northwest side of the Pajaro River, the proposed alignment follows the UPRR tracks to Station 480+00. The north side of the railroad corridor is Annual Grassland, except for a narrow crossing of Sargent Creek, which supports a narrow stringer of coastal oak woodland. Coastal Scrub habitat extends along the south side of the tracks to Station 420+00, where the habitat changes to Valley Foothill Riparian.

From Stations 480+00 to 509+00, the proposed alignment leaves the UPRR right-of-way and crosses a steep portion of the Sargent Hills. These hills are vegetated with Coastal Scrub, mostly dominated by coyote brush and poison-oak. On the lower portions of the slope, the proposed alignment passes through Annual Grassland to Station 528+00, where it joins Highway 129. Between Stations 528+00 and 572+00, the proposed alignment parallels Highway 129, with Annual Grassland to the north and agricultural lands to the south. From this point to Station 592+00, both sides of the proposed alignment are agricultural, with low-density homes.

Between Stations 592+00 and 596+00, the alignment extends across the Pajaro River through riparian habitat. This is one of the widest crossings of this major waterway. From this point, the alignment parallels the river on the south side through the Granite Rock Company property, which ends at Station 578+00. From Stations 578+00 to 747+00, the proposed alignment parallels the UPRR track, Quarry Road and Aromas Road. Although the alignment passes through highly disturbed quarry lands, Valley Foothill Riparian habitat is present in the nearby Pajaro River bed and its tributary, and Coastal Scrub occurs on the slopes.

A short segment of the proposed alignment, from Stations 747+00 to 773+00, crosses some low hills to the north of the UPRR tracks. At the foot of the hills on the eastern side is a modified drainage containing some water and emergent vegetation. Most of the hillside is vegetated with Annual Grassland, but the alignment crosses two small areas that support Coastal Oak Woodland. The foothills on the east side appear to have some low-lying, somewhat moist places that support rushes (*Juncus* spp.), but the upper slopes and all of the western slopes are rather dry and somewhat weedy. Throughout the area, the soils are rather sandy.

For approximately three miles, from Stations 773+00 to 928+00, the proposed alignment again follows the UPRR tracks in a generally westerly direction through agricultural lands. In the last 2,000 feet, the alignment skirts the Cayetano Hills, which are vegetated with Coastal Scrub and Coastal Oak Woodland. From Stations 928+00 to 962+00, the alignment skirts the western foot

of these slopes, following farm roads. The alignment then follows Hayes Road and unnamed farm roads west through agricultural lands to Watsonville Junction. After crossing Salinas Road, the alignment follows farm roads through agricultural lands west-southwest to the Pajaro River. The final segment of the pipeline alignment, from Station 1102+00 to the western terminus, parallels the southern levees of the Pajaro River. This portion of the alignment is bordered by agricultural lands on the south and Valley Foothill Riparian habitat on the north.

Special Status Resources Within the Project Area

The special status biological resources found in the vicinity of the project area are discussed below. Section 3.4.1, Regulatory Framework, describes the criteria for inclusion as a special status resource.

Plants

No special-status plants were found in the study area, and no habitats were identified as supporting potentially suitable habitat for any of the special-status plants known to occur in the region. California has a wealth of native plant species, some highly localized or restricted to unusual combinations of soils, exposure, and hydrologic regime. The study area was notable for its near-complete conversion to agriculture, obliterating most natural plant habitat, and the prevalence of fairly neutral soils that typically support the widespread and common species of plants.

Wetlands

Several types of wetlands were found along the proposed alignment. The most prominent wetlands area was identified along the Pajaro River, which the proposed alignment closely parallels for a considerable distance. The alignment also parallels agricultural drainages, such as the unnamed ditch at the beginning of the alignment. Although manmade, they support the characteristics of wetlands, and in some cases are regulated as wetlands by the Army Corps of Engineers. The third type of wetland, vernal pools, were encountered only in one area, at the base of the Lomerias Muertas Hills within the grasslands to the south of the proposed alignment.

Fish

South-central California coast steelhead *(Onchorhynchus mykiss)* are present in the Pajaro River, with upstream migration occurring from late December through April, and spawning from January through April. The south-central California coast steelhead ESU is a federally listed threatened species and a California species of concern. Furthermore, critical habitat for this and other steelhead ESUs has been designated and includes all waterways within the Pajaro River watershed below the Chesbro and North Fork Pacheco reservoirs (Federal Register, 2000). Steelhead are known to spawn in the Pajaro River upstream of Murphy Crossing only. According to Smith (Habitat Restoration Group, 1997), one of the most difficult passages for the smolt is the series of riffles at Murphy Crossing, where the stream becomes quite shallow and the best route is difficult for smolt to find.

The tidewater goby *(Eucyclogobius newberryi)*, a federally listed endangered species currently proposed for delisting (Federal Register, 1999), is known to occur at the mouth of the Pajaro River. It does not extend as far upstream as the terminus of the Import Pipeline, and thus does not occur in the immediate vicinity of the proposed project.

Wildlife

A number of special status wildlife species known to occur in the region are also known in the project area. The California red-legged frog *(Rana aurora draytonii)*, a federally listed threatened species, occurs in the vicinity of permanent water bordered with vegetation. This species has been reported along the Pajaro River between Highway 101 and Betabel Road and upstream (Westphal, 1997). Habitat assessments carried out as part of this study showed that suitable habitat is present along much of the Pajaro River and its major tributaries. Variations in streambed and vegetation attributes may allow these animals to occupy habitats along the entire length of the Pajaro River, and all such habitat is considered potential habitat for this species. In addition, the Highway Fish and Wildlife Service considers all agricultural ponds and reservoirs to be suitable habitat for red-legged frog (U.S. Fish and Wildlife Service, 2001).

During the nesting bird surveys several occurrences of yellow warbler (*Dendroica petechia brewsteri*) were recorded along the Pajaro River between Stations 360+00 and 410+00. This is considered a species of special concern by California Department of Fish and Game. They also were observed in the Pajaro River just downstream from the terminus of the Import Pipeline at Highway 1. Potentially suitable habitat is present along the entire Pajaro River, although the best habitat is where the riparian habitat is the most dense. Potentially suitable habitat is also present along the lower portions of Pescadero Creek.

A pair of nesting red-tailed hawks (*Buteo jamaicensis*) were observed in the Sargent Hills near Station 420+00 during surveys by Environmental Science Associates biologists. Individual red-tailed hawks were observed at other times in the vicinity. Suitable nesting habitat may be present along Pescadero Creek and Sargent Creek. This species is protected under Section 3503 of the California Fish and Game Code.

The yellow-breasted chat *(Ictera virens)*, a California species of concern, occurs in dense riparian vegetation. Although potential habitat may be present along the most well-vegetated portions of the Pajaro River, no evidence of this species was found during the nesting bird surveys.

The length of the Pajaro River is considered potentially suitable habitat for western pond turtles *(Clemmys marmorata)*. However, the best habitat for this species, which requires permanent water, would be where pools remain throughout the summer and the banks are well vegetated. The western pond turtle is a former candidate for federal listing and a California species of concern.

No suitable habitat was found within the proposed project area for several of the wildlife species of concern known to occur in the region. The Santa Cruz long-toed salamander *(Ambystoma macrodactylum croceum)*, a federally and state listed endangered species known from Ellicott

Pond, lives in permanent ponds near the coast. No such habitat was found in the vicinity of the proposed pipeline alignment. The bank swallow *(Riparia riparia)*, although reported from a sighting on Sargent Creek, has not been seen in the project area for several decades. The bank swallow is a state listed threatened species. High, extensive eroding riverbanks, the necessary nesting habitat for this species, are not present in the project area. The black legless lizard *(Anniella pulchra nigra)*, a California species of concern that is proposed for federal listing as endangered, requires stabilized sand dunes. Although known to occur in the vicinity of Moss Landing, no suitable habitat was present in the more inland project area. The California tiger salamander *(Ambystoma californiense)*, a California species of concern, requires the burrows of grassland animals such as California ground squirrels for estivation and several months of ponded water for breeding. The upland areas containing Annual Grassland were surveyed carefully to determine whether they might be suitable for this species, but none had nearby ponds of sufficient depth to hold water long enough for breeding habitat for this species. Marshlands, the required habitat for the short-eared owl, the tricolored blackbird and the California clapper rail, were not present in the project area. Sand dune habitat known to support the globose dune beetle was present in the study area.

Natural Communities

Natural communities occurring in the project area that are considered "sensitive" by CNDDB are considered special status in this study. They include riparian forest and vernal pools. Valley Foothill Riparian, which includes riparian forest, is found along the Pajaro River and its major tributaries, including Pescadero Creek. A highly degraded example of the vernal pool natural community was found near Station 313+00.

4.B.4.2 SIGNIFICANCE CRITERIA

See Section 4.A.4.2 for discussion of significance criteria.

4.B.4.3 IMPACTS AND MITIGATION MEASURES

An analysis of the loss of habitat to biological resources from the proposed project was made by examining the project description prepared by PVWMA, and a 1:6,000 scale rectified aerial photo of the project (PVWMA, 1997) on which the WHR habitat types were mapped. The length of each mapped unit along the pipeline alignment was estimated by using stations. The acreage of habitat loss was then calculated using the assumptions of temporary and permanent construction easements under three different conditions: open country (140 feet), river crossings (70 feet), and the Granite Rock Company quarry, where hard rock substrate allows vertical trenching (40 feet). It is assumed that surface disturbance will occur in the full width of the easement. Where the alignment rounds the steep base of the Sargent Hills next to the UPRR tracks, the analysis assumed a disturbance width of 200 feet to allow for cut into the hillside. **Table 4.B.4-1** presents the results of this analysis.

TABLE 4.B.4-1
ESTIMATED EXTENT OF HABITAT LOSS
RESULTING FROM THE PROPOSED PROJECT

Habitat type	Permanent habitat loss (ac)	Temporary habitat loss (ac)
Valley Foothill Riparian	2.3	--
Coastal Oak Woodland	1.6	--
Coastal Scrub	--	7.4
Annual Grassland	--	56.1
Fresh Emergent Wetland	--	0.2
Crop/Orchard/Vineyard	--	259.8
Urban/Developed	--	10.0
TOTAL	3.9	333.5

Where natural vegetation such as Valley Foothill Riparian habitat is located within the study area but does not cross it, this assessment assumes that impacts to these resources will be avoided. For example, in several areas the proposed alignment east of Highway 101 passes near the Pajaro River. Although the 250-foot-wide study area includes a segment of the Pajaro River, the centerline of the alignment is in Crop/Orchard/Vineyard and there is sufficient width within the agricultural lands to accommodate all construction activities.

The impacts of all activities associated with the project, especially in areas of natural habitat, generally would be temporary, because revegetation would be conducted for these areas. However, loss of forested habitat is considered permanent because of the long period of time required for regrowth, even when revegetation is carried out as project mitigation. The mitigation measures below provide details on revegetation procedures. Where project implementation would involve a permanent commitment of Urban/Developed or Crop/Orchard/Vineyard habitat, this represents no change or a permanent conversion from one relatively low-value habitat type to another.

Impact 4.B.4-1: Construction of the proposed project could disturb up to 2.5 acres of potential jurisdictional wetlands/waters of the U.S. and streambeds and banks under the jurisdiction of the California Department of Fish and Game. Potential impacts include sedimentation of the channels outside of the construction area during trenching activities, loss of riparian vegetation and stream function as wildlife and fishery habitat, and loss of special status natural communities. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Habitat Loss

Jurisdictional wetlands along the alignment are comprised of two habitat types: Fresh Emergent Wetland and Valley Foothill Riparian habitat. The proposed project would make two crossings of Fresh Emergent Wetland within the first mile of the pipeline, for an estimated habitat loss of 0.2 acre for this type. These examples of Fresh Emergent Wetland are constructed drainage channels surrounded by agriculture. Since the jurisdiction in this case is determined by whether the ditches were excavated in dry land or whether they serve to drain wetland soils to allow agriculture, PVWMA will need to determine the history of these lands to ascertain whether these wetlands are jurisdictional. For the purposes of this impact analysis, these lands are presumed to be jurisdictional.

Two crossings of the Pajaro River, one near Betabel Road and one near Chittenden Pass, would result in a loss of a total of 2.3 acres of Valley Foothill Riparian habitat. For this analysis, a worst-case scenario of trenching across all creek crossings for pipeline installation is assumed. However, direct impacts to creek channels would be minimized by constructing across the shortest distance feasible during the dry season. Following pipeline installation, the channels would be restored to original grade. However, original grade may not be reestablished if CDFG or flood control agencies have jurisdiction and request channel improvements or stabilization. Revegetation would be carried out using locally indigenous plant materials (see Measure 4.B.4-1c below).

Loss of Significant Natural Communities

Coastal riparian forest (Holland, 1986) is the natural community represented along the Pajaro River. This community is listed as "high priority for inventory" by the Natural Heritage Section of CDFG and is considered a special status natural community here. Although the areas proposed for impact are small, any additional loss of riparian forest is an adverse impact.

The other two examples of wetlands, the drainage ditches mapped as the Fresh Emergent Wetland habitat type and the vernal pool found at Station 313+00 are too small and degraded to be considered examples of special status natural communities.

> **Measure 4.B.4-1a:** Crossings of Corps jurisdictional areas shall be avoided by project construction. All facilities and construction activities shall be maintained outside the jurisdictional area defined by riparian vegetation. Bore and jack methods shall be used to install the pipeline under the Pajaro River. These methods also would avoid impacts to special status species and natural communities occurring in the Pajaro River.

Impact 4.B.4-2: Construction of facilities within the zone of riparian vegetation in the Pajaro River could result in impacts to special status animal species. Impacts could occur due to increased sedimentation in streams, dewatering of pools, habitat loss through vegetation removal, destruction of nests and burrows, and construction disturbance. Significant. With mitigation identified in this EIR, the impact would be reduced to a-less than-significant level.

Habitat for special status animals is present in Valley Foothill Riparian habitat along the Pajaro River. The special status animal species associated with this habitat that have the potential to occur in the study area include:

- South-central California coast Steelhead (federal Threatened and California Species of Concern; Critical Habitat designation)
- California red-legged frog (federal Threatened and California Species of Special Concern; Critical Habitat Designation)
- Western pond turtle (federal Species of Concern and California Species of Special Concern)
- Least Bell's vireo (Federally and State listed as endangered)
- Yellow warbler (California Species of Special Concern)
- Yellow-breasted chat (California Species of Special Concern)
- Nesting raptors (Protected under California Fish and Game Code 3503.5)

For analysis of impacts to these resources, trenching is assumed at all crossings. Actual creek crossing methods may vary, ranging from bore and jack (lowest impact) to trenching (greatest impact), depending upon site conditions and engineering constraints. Thus, this analysis considers a worst-case scenario for each of the species and impacts described.

South-central California coast Steelhead. Since steelhead migrate past the proposed Pajaro River crossings for spawning, sedimentation and alteration of flows during construction could block or kill either up-migrating adults (December-April) or down-migrating smolts (March-May).

California Red-Legged Frog. The streambed of the Pajaro River provides breeding and foraging habitat for the California red-legged frog. Up to 2.3 acres (the total combined extent of riparian vegetation from bank to bank) of riparian habitat could be disturbed by project construction activities. The temporary impact to breeding habitat, limited to standing or flowing water, would be minor because construction in these areas would occur in the dry season. Construction within the riparian habitat could result in mortality or disturbance of individuals.

Western Pond Turtle. Areas of permanent water, including pools within the Pajaro River, provide potential habitat for the western pond turtle. Project construction activities in these areas could result in direct mortality, or habitat degradation due to increased erosion and siltation into creek waters.

Least Bell's vireo. Riparian habitat at both crossings of the Pajaro River contained potentially suitable habitat. Construction in these areas could result in the temporary loss of breeding habitat, as well as the potential for reproductive failure if construction occurred during the breeding season for this species.

Yellow warbler. Yellow warblers were observed in several areas of the Pajaro River during 1997 surveys, and potentially suitable habitat exists at both proposed crossings. Construction in these areas during the nesting season could cause reproductive failure, and removal of trees within the construction zone of impact could temporarily reduce breeding habitat of up to a combined total of 2.3 acres.

Yellow-breasted chat. Riparian habitat at both crossings of the Pajaro River contained suitable habitat for this species. Construction in these areas could result in the temporary loss of breeding habitat, as well as the potential for reproductive failure if construction occurred during the breeding season for this species.

Raptors. Raptor species, such as red-tailed hawk and white-tailed kite, the latter a species protected under Fish and Game Code 3511, nest in dense riparian habitats between February and July. Potential nesting areas for these species occur along the Pajaro River. Nesting red-tailed hawks were observed in the vicinity of the project area, west of the Pajaro River near Highway 101. Activities near nesting raptor sites could result in reproductive failure due to loss of habitat or cause abandonment of the nest.

> **Measure 4.B.4-2a--Avoidance of Habitat:** Removal or damage to riparian vegetation adjacent to the Pajaro River may be avoided by constructing the pipeline crossing with bore and jack methods. Also implement Measures 4.A.4-2b and 4.A.4-2c.

Impact 4.B.4-3: Construction of the Import Pipeline could disturb raptors that nest in coastal oak woodland habitat, as well as reduce the amount of available nesting habitat. Significant. With mitigation proposed in this EIR, this impact would be reduced to a less-than-significant level.

Raptors, including red-tailed hawks and white-tailed kite, are known to nest in oak woodlands near Stations 465+00, 480+00 and 752+00. Nesting and roosting habitat for these species occurs in the vicinity of the proposed alignment between Stations 400+00 and 490+00 and Stations 740+00 and 780+00. Construction in these areas would cause loss of nesting and foraging habitat, and construction activities during the breeding season could cause reproductive failure for that year.

Measure 4.B.4-3a: Implement Measure 4.A.4-2c (survey and protection of raptor and passerine nest sites).

Measure 4.B.4-3b: To eliminate the need to fell most oaks in the stand of coastal oak woodland, realign the proposed pipeline along Stations 740+00 and 770+00 to the north so that the southern boundary of the pipeline easement is outside of the drip line of the oaks. If this is infeasible, implement Measure 4.B.4-c, below.

Measure 4.B.4-3c: Trees with unoccupied nests of raptor species may only be removed prior to March 1 or after September 1. Any loss of coastal oak woodland shall be followed by replacement plantings of coastal live oak seedlings at a ratio of 10 seedlings per mature tree lost. This measure would be consistent with applicable policies of local general plans, including Policy 5.1.12 of the Santa Cruz County General Plan/LCP, Policy C-RC 34 and Objective 3 of the Santa Clara County General Plan, and Policy 5 of the San Benito County General Plan Open Space and Conservation Element. Pipe installation shall include wire screens or other protective devices, regular inspection and maintenance, and eventually removal of all hardware. Details of the revegetation of coast live oak woodland, including monitoring, maintenance, and remedial actions, will be developed as part of a revegetation plan approved by CDFG.

Impact 4.B.4-4: Construction facilities at select project sites could disturb sensitive species found in annual grassland habitat. Significant. With mitigation proposed in this EIR, this impact would be reduced to a less-than-significant level.

Habitat for special status animals is present in Annual Grassland habitat in the eastern portion of the study area (see Maps B1-B3 in the Map Appendix; the letter "C" denotes annual grassland habitat). The special status animal species associated with this habitat that have the potential to occur in the study area include the San Joaquin kit fox and western burrowing owl.

Measure 4.B.4-4a: San Joaquin kit fox: Within 60 days prior to the commencement of construction activities, a qualified biologist shall survey all construction areas within kit fox habitat. During these surveys dens likely to be inhabited by kit fox shall be flagged for avoidance. Disturbance to all known San Joaquin kit fox dens shall be avoided to the maximum extent possible. Limited destruction of dens may be allowed if avoidance is not a reasonable option, provided the following procedures are implemented:

- Occupied natal or pupping dens will not be destroyed until the pups and adults have vacated and then only after consultation with the USFWS.

- Flagged dens occurring within the construction area shall be monitored for three days with tracking medium or an infra-red beam camera to determine current usage. If no kit fox activity is observed during this period, the den should be destroyed immediately to preclude subsequent use. If kit fox activity is observed, the den shall be monitored for at least five consecutive days from the time of observation to allow any resident kit fox to move to another den. Use of the den can be discouraged during this period by partially plugging its entrance(s) with soil in such a manner that any resident animal can escape easily. Only when the den is determined to be unoccupied may the den be excavated under the direction of a qualified biologist. If

the kit fox is still present after five or more consecutive days of plugging and monitoring, the den may have to be excavated when, in the judgment of a qualified biologist, it is temporarily vacant (e.g., during normal foraging period). Hand excavation is the preferred method, however, excavating equipment may be required due to soil conditions. Destruction of the kit fox den shall be accomplished by careful excavation until it is certain that no kit foxes are inside. The den shall be fully excavated and filled with dirt and compacted to ensure that kit foxes cannot reenter or use the den during the construction period. If a kit fox is observed to reenter an excavated den, construction activity in the vicinity shall cease and monitoring activities as described above shall be implemented until the biologist has determined that the kit fox has escaped.

- If a take authorization / permit has not been obtained from the USFWS, potential dens shall be treated in the same manner as known kit fox dens, as described above.

- During construction, project related vehicles will observe a 20 mph speed limit in habitat areas, except as posted on County roads and State and Federal highways. To the extent possible, nighttime construction is prohibited on UP ROW and will be minimized elsewhere. Off-road traffic outside the designated project area will be prohibited.

- To prevent accidental entrapment of kit fox or other animals during construction, all excavated or deep-walled holes or trenches greater than two feet will be covered at the end of each work day by plywood or similar materials, or provided with escape routes constructed of earth fill or wooden planks. Before such holes are filled they will be thoroughly inspected for trapped animals. If trapped animals are discovered, the procedures below will be followed.

- Kit fox are attracted to den-like structures such as pipes and may enter stored pipe and become trapped or injured. All construction pipes, culverts, or similar structures with a diameter of four inches or greater that are stored at construction sites for one or more overnight periods will be thoroughly inspected for kit foxes before the pipe is subsequently buried, capped, or other wise used or moved in any way. Other pipes or casings located in the trench will be inspected each morning prior to construction. If a kit fox is discovered inside a pipe, that section of pipe shall not be moved until the USFWS has been consulted. If necessary, and under the direct supervision of a qualified biologist, the pipe may be moved once to remove it from the path of construction activity, until the fox has escaped.

- All food-related trash items such as wrappers, cans, bottles, and food scraps shall be disposed of in closed containers and removed at least once a week from the project site.

- No firearms will be allowed on the project site.

- To prevent harassment, mortality of kit foxes or destruction of dens, no pets will be allowed on project sites.

- In the case of trapped animals, escape ramps or structures will be installed immediately to allow the animal(s) to escape, or the USFWS should be contacted for advice.

- Any contractor, employee, or agency personnel who inadvertently kills or injures a San Joaquin kit fox shall immediately report the incident to the USFWS Sacramento Field Office and CDFG will be notified in writing within three working days of the accidental death or injury to a San Joaquin kit fox during project related activities.

- After construction, all areas subject to temporary ground disturbances, including storage and staging areas, temporary roads, pipeline corridors, etc. will be recontoured if necessary, and revegetated to promote restoration of the area to pre-project conditions. An area subject to "temporary" disturbance means any area that is disturbed during the project, but that after project completion will not be subject to further disturbance and has the potential to be revegetated. Appropriate methods and plant species used to revegetate such areas will be determined on a site-specific basis in consultation with the USFWS, CDFG, and revegetation experts.

Measure 4.B.4-4b: Burrowing owl: No more than two weeks before construction in any given milepost, a survey for burrowing owls and occupied burrows shall be conducted by a qualified biologist within 500 feet of the ROW (access permitting). The survey will conform to the protocol described by the California Burrowing Owl Consortium (1997) which includes up to four surveys on different dates if there are suitable burrows present.

- If occupied owl burrows are found within the survey area, a determination shall be made by a qualified biologist in consultation with CDFG whether or not construction will impact the occupied burrows or disrupt reproductive behavior.

- If it is determined that construction will not impact occupied burrows or disrupt breeding behavior, construction will proceed without any restriction or mitigation measures.

- If it is determined that construction will physically impact occupied burrows or disrupt reproductive behavior during the nesting season (March through August) then avoidance is the only mitigation available (California Burrowing Owl Consortium 1993; CDFG 1995). Construction will be delayed within 300 feet of occupied burrows until it is determined that the owls are not nesting or until a qualified biologist determines that juvenile owls are self-sufficient or are no longer using the natal burrow as their primary source of shelter.

- If it is determined that construction will impact occupied burrows during August through February, mitigation procedures will be developed in consultation with the CDFG. These measures may include passively relocating owls from the occupied burrow(s) using one-way doors. Under current practice, prior to undertaking this procedure, there shall be at least two unoccupied burrows suitable for burrowing owls within 300 feet of the occupied burrow prior to installation of the one-way doors. The unoccupied burrows can be natural burrows or artificial burrows constructed according to currently accepted designs (e.g. as shown at www.ucsc.edu/~scpbrg). Artificial burrows shall be in place at least one-week before one-way doors are installed on occupied burrows. One-way doors will be in place for a minimum of 48 hours before burrows are excavated.

REFERENCES – Vegetation, Fish, and Wildlife

California Burrowing Owl Consortium, *Burrowing Owl Survey Protocol and Mitigation Guidelines*, available online from the Santa Cruz Predatory Bird Research Group, Santa Cruz, CA, 1997. *www2.ucsc.edu/~scpbrg*

CDFG, Staff Report on Burrowing Owl Mitigation, California Department of Fish and Game, Sacramento, CA., September 25, 1995.

Federal Register, *Endangered and Threatened Wildlife and Plants; Proposed Rule to Remove the Northern Population of the Tidewater Goby from the List of Endangered and Threatened Wildlife*, Vol. 64, No. 121, June 24, 1999.

Federal Register, *Designated Critical Habitat: Critical Habitat for 19 Evolutionary Significant Units of Salmon and Steelhead in Washington, Oregon, Idaho, and California – Final Rule*, Vol. 65, No. 32, February 16, 2000.

Habitat Restoration Group, *Existing Conditions, Fisheries, of the Pajaro River Drainage*, Report to Environmental Science Associates, San Francisco, 1997.

Holland, R.F., *Preliminary Descriptions of the Terrestrial Natural Communities of California*, Department of Fish and Game. Sacramento, CA, 1986.

Mayer, K.E. and W.F. Laudenslayer (eds.), *A Guide to Wildlife Habitats of California*, California Department of Fish and Game, Sacramento, CA, 1988.

PVWMA, *Technical Memo No. 1.1A, Prepared by Montgomery Watson and CH2M Hill*, Memo to Mark Windsor, Environmental Science Associates, San Francisco, 1997.

U.S. Fish and Wildlife Service (USFWS), *The California Clapper Rail: Turning the Tide?, Tideline, Summer 1993*, Volume 13(2), 16 pp., 1993.

U.S. Fish and Wildlife Service, *Endangered and Threatened Wildlife and Plants; Final Determinations of Critical Habitat for the California Red-Legged Frog; Final Rule*, 50 CFR Part 17, pages 14626-14674, 2001.

Westphal, M., Biologist, U.S. Fish and Wildlife Service, personal communication, July 1, 1997.

4.B.5 CULTURAL RESOURCES

4.B.5.1 SETTING

Cultural Resource Findings in the Project Vicinity

An archaeological survey of the project area was conducted by Pacific Legacy in July 1997, which included surveys of areas that would be affected by the proposed Import Pipeline (Pacific Legacy, 1997). The archaeological survey identified seven cultural resources sites. One of these sites is potentially important under CEQA Guidelines but formal evaluation has not been completed.

For purposes of the cultural resource analysis, the proposed Import Pipeline alignment was divided into the following reaches described below.

Reach 1 (Stations 0+00 to 140+00)

Reach 1 consists of a portion of the proposed pipeline alignment extending from the existing Watsonville turnout of the Santa Clara Conduit of the CVP San Felipe Division (Station 0+00) west to Bolsa Road/Highway 25 (Station 140+00). The survey identified the presence of one cultural resource site (CA-SBN-191H) along Reach 1. CA-SBN-191H consists of an unlined historic canal between San Felipe Lake and the Pajaro River. The historic canal possibly served as a water source for cattle driven from the San Joaquin Valley to the Santa Cruz Valley in the late 1800s. CA-SBN-191H has been determined to be ineligible for the National Register of Historic Places (Pacific Legacy, 1997).

Reach 2 (Stations 140+00 to 444+00)

Reach 2 extends along the Pajaro River from Bolsa Road/Highway 25 southwest to an area north of Chittenden Road. Five cultural resource sites (CA-SBN-23, CA-SBN-149H, CA-SBN-187, CA-SBN-188, and CA-SCL-579) were identified along Reach 2. CA-SBN-23, CA-SBN-187, CA-SBN-188, and CA-SCL-579 consist of prehistoric sites with sparse to moderate density chert debitage scatters, with ground and flaked stone tools. None of these sites are likely to be eligible for the National Register of Historic Places (Pacific Legacy, 1997). CA-SBN-149H is a historic site known as the Sanchez Adobe Site. This property has been evaluated and determined ineligible for the National Register of Historic Places (Pacific Legacy, 1997).

Reach 3 (Stations 444+00 to 528+00)

Reach 3 extends west along the north side of the Pajaro River to just east of Soda Lake. One cultural resource site (CA-SCR-318H) has been recorded in the Reach 3 area. CA-SCR-318H consists brick scatter, wood timber, concrete foundation with associated oil-saturated soils, and three large Portland concrete blocks with threaded steel studs and two blocks of mortared brick (State of California, 1995). This site was newly discovered during this survey, and therefore its eligibility for listing on the National Register has not yet been determined.

Reach 4 (Stations 528+00 to 715+00)

Reach 4 extends from just east of Soda Lake west to the Monterey / San Benito County line. No cultural resource sites were identified along this reach.

Reach 5 (Stations 715+00 to 926+00)

Reach 5 extends from the Monterey / San Benito County line west to an area just south of San Juan Road. No cultural resources were identified in the survey along Reach 5.

Reach 6 (Stations 926+00 to 1127+00)

Reach 6 extends from an area just south of San Juan Road west to Highway 1. No cultural resources were identified in the survey along Reach 6.

4.B.5.2 SIGNIFICANCE CRITERIA

See Section 4.A.5.2 for a discussion of significance criteria.

4.B.5.3 IMPACTS AND MITIGATION MEASURES

Impact 4.B.5-1: Construction activities associated with the proposed Import Pipeline may result in the alteration or destruction of identified cultural resources. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Seven cultural resource sites (CA-SBN-23, CA-SBN-149H, CA-SBN-187, CA-SBN-188, CA-SBN-191H, CA-SCR-318H, and CA-SCL-579) have been identified adjacent to and/or within the pipeline corridor. Construction of the proposed pipeline may directly affect (alter or destroy) these sites. It is not known whether these sites are considered "important archaeological resources" as defined by the CEQA Guidelines because detailed investigations have not been conducted. Therefore, this would be a potentially significant impact.

As stated in Measures 4.B.5-1a and 4.B.5-1b below, the identified cultural resources sites will be avoided to the extent possible. A mitigation plan will be prepared for any cultural resource site that cannot be avoided.

CA-SBN-191H has been identified as not being eligible for the National Register of Historic Places and is not considered "important" as defined by CEQA (Pacific Legacy, 1997). Therefore, no significant cultural resource impacts are anticipated to CA-SBN-191H.

> **Measure 4.B.5-1a:** Final pipeline and facility plans shall locate facilities and pipeline alignments away from identified cultural resource sites. A qualified cultural resource specialist shall be retained to assist in identifying the extent of important cultural resource sites to be avoided, which may include the preparation of detailed cultural resource evaluation reports and consultation with local, state, and federal agencies as well as the local Native American community and the Native American Heritage Commission.

Measure 4.B.5-1b: If important cultural resource sites cannot be avoided, PVWMA will coordinate with local, state, and federal agencies in the development of an appropriate mitigation plan for the cultural resource. Possible mitigation measures for important cultural resources may include documentation and recordation of the resource, relocation, or stabilization of the resource.

Impact 4.B.5-2: Ground-disturbing activities associated with the proposed Import Pipeline could reveal previously unknown buried or otherwise obscured significant prehistoric and historic cultural resources. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Significant unknown cultural resources may be buried or obscured by vegetation along the proposed pipeline alignment, and therefore construction of the proposed project could result in degradation and destruction of undiscovered cultural resources.

Measure 4.B.5-2: Implement Measure 4.A.5-1.

Impact 4.B.5-3: Potential indirect impacts to cultural resources, primarily vandalism, could result from the increased access to, and use of, the general area during construction. Such disturbance could adversely affect the integrity of important cultural resources. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Construction activities associated with the proposed Import Pipeline may provide increased accessibility to existing cultural resource sites in the project area. This could result in looting and vandalism of important cultural resources.

Measure 4.B.5-3a: The resource boundaries should be marked as exclusion zones both on the ground and on construction maps.

Measure 4.B.5-3b: Construction supervisory personnel should be notified of the existence of these resources and be required to keep personnel and equipment away from these areas. During construction and operations, personnel and equipment will be restricted to the surveyed corridor.

Measure 4.B.5-3c: Monthly monitoring of the cultural resources to be avoided should be completed to insure that no inadvertent damage to the resources occurs as a result of construction or construction-related activities. If damage is detected a guard will be posted to patrol the site and adjacent important resources (such as gravestones and churches).

REFERENCES – Cultural Resources

Breschini and Haversat, *Baseline Archaeological Studies at Rancho San Carlos, Carmel Valley, Monterey County, California, Archives of California Prehistory 36*, Coyote Press, Salinas, 1992.

Dietz, S.A., and T.L. Jackson, *Report of Archaeological Investigations at Nineteen Archaeological Sites for the Stage I Pacific Grove Monterey Consolidation Project of the Regional Sewage System*, 1981.

Hildebrandt and Mikkelsen, *Archaeological Test Excavations at Fourteen Sites Along Highways 101 and 152, Santa Clara and San Benito Counties, California*, Volume 1, 1993.

Hoover, M.B., H.E. Rensch, E.G. Rensch, and W.N. Abeloe, *Historic Spots in California, Stanford*, California: Stanford University Press, 1990.

King, T.F., and P.P. Hickman, *The Southern Santa Clara Valley: A General Plan for Archaeology, San Felipe Division, Central Valley Project*, Report S-5222, on file Northwest Information Center, Sonoma State University, Rohnert Park, California, 1973.

Milliken R.T., J.G. Costello, C. Johnson, G.A. Laffey, A. Sayers, and P. Orozco, *Archaeological Test Excavations at Fourteen Sites Along Highways 101 and 152, Santa Clara and San Benito Counties, California, Volume 2: History, Ethnohistory, and Historic Archeology*, Report S-15442, on file Northwest Information Center, Sonoma State University, Rohnert Park, California, 1993.

Pacific Legacy, Incorporated, *Cultural Resources Survey for the Pajaro Valley Water Management Agency Import Pipeline, Draft Final Report*, Berkeley, California, November 1997.

Shipley, W. F., Native Languages of California, in California, R.F. Heizer, ed. *Handbook of North American Indians*, Vol. 8, pp. 80-90. Washington, D.C.: Smithsonian Institution, 1978.

State of California, State of California, The Resources Agency, Department of Parks and Recreation, CA-SCR-318H Primary Record, January 1995.

4.B.6 TRAFFIC AND CIRCULATION

4.B.6.1 SETTING

Project Area Roadways

Figure 3.6-1 in Section 3.6 and **Map A1** through **A4** in Map Appendix A illustrate project area roadways. Highway 25, Highway 129, and Highway 152 provide direct access to Highway 101 and/or Highway 1. Highway 25 (Bolsa Road) extends southeast from Highway 101 into San Benito County. Highway 25 is a two-lane roadway, with a maximum posted speed limit of 55 mph. Highway 129 (Riverside Drive/Chittenden Road) provides east-west access through the project area, providing connection between Highway 1 (in Watsonville) and Highway 101. In the vicinity of the Pajaro Gap (near the Granite Rock quarry) and Chittenden Pass, Highway 129 is characterized by numerous curves, frequent changes in elevation, and narrow shoulders. The maximum posted speed limit on Highway 129 ranges from 40 to 55 mph. The majority of Highway 129 is two lanes, except in downtown Watsonville, where it is four lanes.

Highway 152 provides east-west access through the project area, stretching east from Highway 1 to the Central Valley. In the west portion of the project area, Highway 152 winds through Watsonville (along Main Street, East Beach Street, Lincoln Street and East Lake Avenue) east to Hecker Pass (via Hecker Pass Road) and Santa Clara County. Due to the winding nature of Highway 152 over Hecker Pass, signs are posted prohibiting trucks over 45 feet in length from using that portion of Highway 152. In the east portion of the project area, Highway 152 (Pacheco Pass Highway) extends east from Highway 101 providing access through southeast Santa Clara County. The majority of Highway 152 is two lanes, except in downtown Watsonville, where it is four lanes. The maximum posted speed limit on Highway 152 ranges from 25 to 35 mph in Watsonville, and 50 to 55 mph outside this urbanized area.

County Roads G7, G11 and G12 also serve the project area. County Road G7 (Bloomfield Avenue) is a two-lane roadway providing connection between Highway 152 and Highway 25 in Santa Clara County. County Road G11 (San Juan Road), extends east from County Road G12 in Pajaro to Highway 101 in Monterey County. County Road G11 is a two-lane roadway west of Aromas Road, widening to four lanes south of Aromas Road. County Road G12 extends south from the Santa Cruz-Monterey county line through Pajaro. Salinas Road (north of Elkhorn Road) serves as part of County Road G12, at which point Salinas Road then diverges west, providing access to Highway 1. Salinas Road is a two-lane roadway in downtown Pajaro (with a posted speed limit of 25 mph through downtown), widening to four lanes south of Pajaro.

A number of local two-lane roadways that may be affected by the project include Frazier Lake Road (in Santa Cruz / San Benito Counties); Quarry Road and Betabel Road (in San Benito County), Carpinteria Road, Aromas Road, San Miguel Canyon Road, Lewis Road, Hayes Road and Trafton Road (in Monterey County); Murphy Road (in Santa Cruz/Monterey Counties); and Rogge Lane (Santa Cruz County). Frazier Lake Road extends north from Highway 25 to Highway 152. Quarry Road and Aromas Road extend east and west from Aromas, respectively;

both are designated truck routes (serving the Granite Rock Company quarry). Carpinteria Road / Rogge Lane extend north from Aromas, providing connection to Highway 129. Betabel Road serves as a north-south frontage road to Highway 101. Murphy Road provides north-south access between Highway 129 and County Road G11. San Miguel Canyon Road extends south from County Road G11. Lewis Road, Hayes Road and Trafton Road are rural roadways located near Pajaro serving primarily agricultural uses.

In addition to the regional and local roadways described above, Union Pacific Railroad (UPRR) maintains tracks that extend through the project area. A UPRR line winds south through Santa Cruz County and Monterey County through Watsonville and Pajaro, continuing south through Monterey County. A connecting UPRR line extends east from Pajaro to Aromas, and further east into San Benito and Santa Clara Counties.

Traffic Volumes

Table 3.6.1 (Section 3.6) presents daily traffic volumes on study area roadways. Weekday traffic on the freeways and major arterials within the project area consists primarily of commute traffic within the peak traffic periods (generally weekdays between the hours of 7:00 a.m. and 9:00 a.m., and 4:00 p.m. and 6 p.m.), and a mix of residential, commercial and industrial generated trips throughout the day. Daily traffic on roadways in the project vicinity is generally highest on roadways leading to and from Highway 101 and Highway 1. Some of the minor project roadways are rural in nature, serving a high percentage of agricultural-related traffic.

Existing Truck Traffic on Roadways

The highways assessed in this EIR are County-designated truck routes. In addition, Quarry Road and Aromas Road are designated truck routes in San Benito County and Monterey County, respectively.

Many of the major roadways in the project area currently carry a high percentage of trucks, with the highest truck percentages occurring on Highway 101 and the east portion of Highway 129. Truck traffic on Highway 101 in the project vicinity accounts for approximately ten percent of total daily traffic north of Highway 152 East (in Gilroy), increasing to almost 19 percent south of Highway 25, and decreasing to approximately 15 percent south of Highway 129 West, in San Benito County. Truck traffic on Highway 129 accounts for approximately 20 percent of total daily traffic in the Chittenden Pass/Pajaro Gap vicinity, decreasing to between 12 and 15 percent in Watsonville. Truck traffic on Highway 25 in the project vicinity accounts for approximately six percent of total daily traffic east of Highway 101, in Santa Clara County (Caltrans, 1998).

Truck traffic on Highway 1 accounts for approximately five percent of total daily traffic north of Highway 152 in Watsonville, increasing to approximately 10 percent south of Salinas Road, in Monterey County. Truck traffic on Highway 152 east of Highway 101, in Santa Clara County, accounts for approximately 10 to 14 percent of total daily traffic, decreasing to less than five percent in Watsonville (Caltrans, 1998).

Accident History

Available accident data from accident reports maintained by Caltrans, and the Santa Clara, San Benito and Monterey County Public Works Departments were compiled for the three-year period between 1994/1995 and 1996/1997. **Table 3.6.2** presents traffic accident rates in terms of number of accidents per Million Vehicle Miles Traveled (MVMT) for the major roadways in the project area. These rates have been examined to determine if these roads exhibit any unusual safety problems or accident statistics. Accident characteristics along the study roadways are summarized below.

Highway 101

As shown in **Table 3.6.2**, the freeway segment within Santa Clara County (between the county line and Highway 152 East) experienced a slightly higher three-year average accident rate than the statewide average for freeways of this type. Of the 225 accidents reported on the study segment within the three-year period, approximately 36 percent involved injuries, and three percent involved fatalities. The freeway segment within San Benito County (between the county line and Highway 19 West) exhibited a lower average accident rate than the statewide average.

Highway 1

As shown in **Table 3.6.2**, both the two-lane segment within Monterey County and the four-lane segment mostly within Santa Cruz County experienced a slightly lower three-year average accident rate than the statewide average for roadways of this type. Of the 209 accidents reported on the study segment within the three-year period, approximately 43 percent involved injuries, and three percent involved fatalities.

Highway 25

This two-lane segment experienced an approximately 40 percent higher three-year average accident rate than the statewide average for roadways of this type. Of the 59 accidents reported on the study segment within the three-year reporting period, approximately 25 percent involved injuries, and five percent involved fatalities.

Highway 129

The segment of Highway 129 within Santa Cruz County (Riverside Drive) experienced a higher average accident rate than the statewide average for the three-year reporting period. In particular, the Highway 129 segment passing through the Pajaro Gap (between the San Benito-Santa Cruz county line and Rogge Lane) experienced a markedly higher accident rate (over 1 ½ times) than the statewide average for roadways of this type. On this winding, 1.4-mile long segment, a total of 180 accidents occurred within the three-year reporting period, with approximately 24 percent of those accidents resulting in injuries, and no fatalities. The segment of Highway 129 within San Benito County (Chittenden Road) experienced a lower average accident rate than the statewide average.

Highway 152

The segment of Highway 152 located within the City of Watsonville (East Lake Avenue/East Beach Street/Lincoln Avenue/Main Street) reported a markedly higher three-year average accident rate (over two times) than the statewide average for roadways of this type. Along this segment, a total of 423 accidents occurred within the three-year reporting period, with approximately 35 percent of those accidents resulting in injuries, and one fatality.

The two-lane study segment of Highway 152 located east of Highway 101 (Pacheco Pass Highway, between Highway 101 and County Road G7) experienced a lower average accident rate than the statewide average, with 101 accidents occurring within the three-year reporting period.

County Road G7

County Road G7 (Bloomfield Avenue) experienced a higher three-year average accident rate than the statewide average. A review of the accident data revealed that this was attributable to a high number of accidents that occurred in 1994 at the intersection of County Road G7 with Frazier Lake Road. There were no reported accidents in 1995 and 1996.

County Road G11

San Juan Road (between Porter Drive and Aromas Road) experienced an approximately 60 percent higher three-year average accident rate than the statewide average for roadways of this type. Of the 96 accidents reported on the study segment within the three-year reporting period, approximately 25 percent involved injuries, and there was one fatality.

Salinas Road

Salinas Road (between State Route 1 and San Juan Road), a portion of which is County Road G12, experienced a higher three-year average accident rate than the statewide average. Of the 94 accidents reported on the study segment within the three-year reporting period, approximately 25 percent involved injuries, and there was one fatality.

Roadway Improvement Projects

As presented in **Table 3.6.3** (Section 3.6), a number of transportation improvement projects are planned by the affected jurisdictions to help improve future traffic flow and circulation in the project area.

4.B.6.2 SIGNIFICANCE CRITERIA

See Section 4.A.6.2 for a discussion of significance criteria.

4.B.6.3 IMPACTS AND MITIGATION MEASURES

Construction Trip Generation

Construction of the Import Pipeline is expected to begin in 2001 and to be completed in four years. Construction activities that would generate traffic are trucks hauling equipment and materials to the work site; the hauling of excavated trench spoils from, and import of new fill to, each work site; and the daily arrival and departure of construction workers to each work site.

Maps A1 through A4 in Map Appendix A depict the proposed pipeline alignment. The proposed 23-mile pipeline would consist of pipe segments 16 to 18 feet in length. The maximum pipe diameter would be 60 inches. The majority of the proposed alignment follows open areas, where conventional excavation methods would be used for open-cut pipeline installation. Special construction techniques would be used for crossing major roads, creeks, dense vegetation, or other conditions where surface disturbance may need to be minimized. These may include bore and jack (e.g., for roadways and railroad crossings) and open cut and cover with diversion, bridge, or tunneling (e.g., for river crossings).

All open areas are assumed to be constructed with a minimum of five feet of cover over the pipe, one foot of bedding below the pipe, and 2:1 trench sideslopes. New fill would be imported, as needed, to replace some of the excavated soil; however, it is expected the excavated soil would be retained for the top layer of soil, especially in agricultural and environmentally sensitive areas (Rude, 1997). Pipe stringing and fill materials would be stockpiled on one side of the trench, and equipment and excavated material on the opposite side. The contractor would install up to an estimated 100 feet of pipe each workday, on average, depending on location and conditions.

The largest truck-generating activity would be associated with the hauling of trench spoils away from the construction easement, and the import of new fill. Using the above assumptions, at one construction spread it is estimated that up to 620 cubic yards (CY) of trench spoils would be hauled away daily, and up to approximately 440 CY of new fill would be imported daily. Using an average haul load of 10 cubic yards per truck, and assuming no backhauling, this would amount to up to approximately 110 truck haul round trips (220 one-way trips) generated per work day. Accounting for the delivery of pipe and other construction components (which would be shipped on demand to the project site throughout the construction period), the total number of construction truck trips would be up to 125 round trips (250 one-way trips) per work day.

The number of workers at any one location along the pipeline alignment would vary depending upon location and the specific type of construction activity proposed. Based on estimates of manpower per task, there would be approximately six to ten workers per crew on an average day (Rude, 1997). Assuming that each worker would travel in his own vehicle to and from the site, and that some midday trips would occur, this would result in up to about 15 worker vehicle round trips per day (30 one-way trips).

Construction Trip Distribution

The specific destination(s) for hauling of excavated materials from the construction easement is not known at this time, nor is the originating location(s) for imported fill or other materials delivered to the work site. However, a number of construction materials sources (e.g., quarries, manufacturers) and excess soil re-use options (e.g., farms) are located in the surrounding rural areas and urban centers. Construction worker trips are assumed to originate from the major urban areas in the project region and nearby communities. The Marina landfill is located two miles north of the town of Marina on Del Monte Boulevard. The construction haul route from the project area to the Marina Landfill would include the use of Highway 1 south, Reservation Road, and Del Monte Boulevard.

Based on the existing roadway network serving the project area, project trucks and construction workers traveling to and from the alignment likely would primarily use a combination of state routes (i.e., Highway 101, Highway 1, Highway 25, Highway 129 and Highway 152), county roads (i.e., County Roads G7, G11 and G12) and other designated truck routes (e.g., Quarry Road, Aromas Road) along the pipeline alignment to reach other local points and/or regional locations.

The contractor presumably would access the construction easement using the shortest possible route from existing roadways and would move equipment and materials within the construction easement. Simple blading of new roads would occur where existing roads do not provide direct access to the construction easement (PVWMA, 1997).

Impact 4.B.6-1: Traffic on area roadways would temporarily increase as a result of project-generated vehicle trips by construction workers and construction vehicular activities. Less than Significant. Implementation of recommended mitigation measures identified in this EIR, while not required, would assist in ensuring that the impact would remain at a less-than-significant level.

Project construction-generated traffic would be temporary, and therefore, would not result in any long-term degradation in operating conditions or level of service for any project roadways. The primary off-site impacts from the movement of construction trucks would include short-term and intermittent lessening of roadway capacities due to slower movements and larger turning radii of the trucks compared to passenger vehicles.

Under the construction scenario outlined above, it is estimated that up to 125 daily truck round trips (250 one-way trips) and about 15 daily construction worker round trips (30 one way trips) could occur at a typical construction spread. Construction-generated vehicular trips would mostly occur on the roadways providing access to the work site, as well as the roadways providing connection to regional routes.

The temporary increase in daily vehicular trips from the movement of equipment and materials to and from the project site, as well as construction workers, would account for less than a one percent increase in daily traffic volumes on Highway 101 and Highway 1; a two percent or less increase in daily traffic volumes on Highway 25 and Highway 152; and a four percent or less increase in daily traffic volumes on Highway 129 (Chittenden Road/Riverside Drive), County Road G11 (San Juan Road), and County Road G12 (Salinas Road). This increase in daily vehicle trips would fall within the daily fluctuations of traffic, and therefore, would not significantly disrupt daily traffic flow on these freeways and arterials.

The effect of project traffic on roadways with lower traffic volumes, including County Road G7 (Bloomfield Avenue), Frazier Lake Road, Betabel Road, Carpinteria Road/Rogge Lane, Quarry Road, Murphy Road, San Miguel Canyon Road, Hayes Road, Lewis Road would be greater. However, given the anticipated pace of construction, the duration that project haul trucks would be required to use any given local roadway would be relatively brief.

Most project-related hauling and deliveries would be dispersed throughout the day, thus lessening the effect on peak-hour traffic. Project truck traffic occurring during the hours of 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. would coincide with peak-hour traffic, and therefore, have the greatest potential to impede traffic flow during these time periods. Restricting truck traffic during the morning and afternoon peak periods would further minimize disruption of the general traffic flow on affected roadways.

Although this impact would be less than significant, the following mitigation measures are recommended to further reduce the less-than-significant impact.

Measure 4.B.6-1 (Recommended): Implement Measures 4.A.6-1a and 4.A.6-1b.

Impact 4.B.6-2: Project construction would increase traffic delays for vehicles traveling past the construction zone. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The majority of the 23-mile Import Pipeline alignment would not involve installation within roadways. However, the proposed Import Pipeline alignment would follow adjacent to, within, or across the roadways listed in **Table 4.B.6-1**.

The proposed temporary construction easement width that would be required is 110 feet through open country, 40 feet at river crossings, and 15 feet in the railroad right-of-way in the vicinity of the Granite Rock Company quarry. The specific alignments of installation of pipeline adjacent to, within or crossing roadways would be identified during the design phase of the project. Open trench activities would be expected to proceed at an average rate of 100 feet per day; thus identified impacts would be brief at any one location along the pipeline alignment. Special construction techniques (e.g., bore and jack, tunneling) would be utilized to install pipelines

TABLE 4.B.6-1
ROADWAYS AFFECTED BY IMPORT PIPELINE CONSTRUCTION

Pipeline Construction Easement Adjacent to/Within Roadway	Pipeline Crossing Roadway
State Route 129 (Riverside Drive)	Highway 101
County Road G11 (San Juan Road)	State Route 1 (Cabrillo Highway)
Betabel Road	State Route 25 (Bolsa Road)
Murphy Road	State Route 129 (Riverside Drive)
Hayes Road	County Road G12 (Salinas Road)
Lewis Road	County Road G11(San Juan Road)
	Frazier Lake Road
	Storm Road
	Carpinteria Road
	Kortright Lane
	San Miguel Canyon Road

SOURCE: Environmental Science Associates, 2001

under Highway 101, Highway 1, Highway 25, and Highway 129, and County Roads G11 (San Juan Road) and G12 (Salinas Road).

Existing transportation and circulation patterns in the vicinity of the proposed pipeline alignment would be temporarily disrupted by construction activities and heavy equipment use in the roadways. Impacts related to pipeline construction would include direct disruption of traffic flows and roadway operations. Lane blockages or roadway closures during pipeline installation would result in a reduction in travel lanes, and could result in the need for traffic re-routing. Most prominently, potential construction along Highway 129 and County Road G11 (San Juan Road) could significantly impact traffic flow and operations at these locations.

Measure 4.B.6-2a: Limit construction hours to off-peak traffic periods on commute streets.

Measure 4.B.6-2b: The contractor shall be required to prepare traffic control plans to show specific methods for maintaining traffic flows. This shall include identifying roadway locations where special trenching techniques would be used to minimize impacts to traffic flow and operations. The traffic control plan shall be reviewed for appropriateness, and approved by Caltrans and the governing Public Works Departments.

Impact 4.B.6-3: Project construction would temporarily affect access to adjacent land uses for both general and emergency access. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Since the majority of project construction would not involve installation within roadways, but rather within open country and rail right-of-way, minimal impacts to access to properties along the construction route due to trenching, and materials and equipment storage would be expected. However, potential temporary blockage or reduction in travel lanes of major roadways (as described in Impact 4.B.6-2) could result in a significant delays to emergency services. In addition, a temporary inconvenience to local commercial (e.g. Granite Rock Company quarry) and agricultural businesses, and residences could result.

Measure 4.B.6-3a: To minimize disruption of emergency vehicle access and maintain access to driveways to adjacent land uses, PVWMA would require the contractors to maintain steel trench plates at the construction sites to restore access across open trenches. Construction trenches shall not be left open after work hours.

Measure 4.B.6-3b: To minimize disruption of emergency vehicle access, affected jurisdictions will be asked to identify detours to be posted by contractor.

Measure 4.B.6-3c: The contractor will notify the appropriate police, fire, and emergency services of the timing, location, and duration of construction activities and the locations of detours and lane closures prior to beginning construction in the immediate vicinity of affected roadways.

Impact 4.B.6-4: Project construction would increase wear and tear on area roadways used by construction vehicles. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The use of heavy trucks to transport equipment and material to and from the project site could affect road conditions by increasing the rate of road wear. The degree to which this impact would occur depends on the project-generated traffic and the design (pavement type and thickness) and existing condition of the roadways. The project's impact is assumed to be minimal on major arterials (e.g., state routes, including Highway 101, Highway 1, Highway 25, Highway 129 and Highway 152; County roads, including County Roads G7, G11, and G12) and designated truck routes (including Quarry Road and Aromas Road), which are designed to accommodate a mix of vehicle types, including heavy trucks.

Other local-serving roads, such as Betabel Road (in San Benito County), Carpinteria Road, San Miguel Canyon Road, Lewis Road, Hayes Road and Trafton Road (in Monterey County); Murphy Road (in Santa Cruz/Monterey Counties); and Rogge Lane (Santa Cruz County), may not be built with a pavement thickness that will withstand considerable truck volumes. The projected increase in use of these roads, or other local roadways, by heavy trucks could result in significant roadwear on these roadways.

Measure 4.B.6-4: Implement Measure 4.A.6-2.

Impact 4.B.6-5: Project construction would increase potential traffic safety hazards for vehicles and pedestrians in the construction area. Significant. With mitigation identified in this EIR, this impact would be reduced to a less-than-significant level.

The temporary increase in construction-generated trucks on project area roadways would interact with other vehicles, including other large trucks (e.g., in vicinity of Granite Rock Company quarry), slow-moving agricultural vehicles (in farm areas), and recreational traffic (along scenic routes and routes providing connection to recreational facilities). Potential conflicts also could occur between construction traffic and bicyclists and pedestrians, particularly in and near residentially dense areas, such as Watsonville, Pajaro, Aromas, and River Oak. In addition, lane blockages or roadway closures during pipeline installation could increase hazards for bicyclists and pedestrians, and result in temporary alterations in bicycle and pedestrian circulation.

As discussed in Section 4.B.6.1, Setting, a number of study roadway segments currently exhibit higher accident rates than the statewide average for similar roadways. These roadways includes Highway 101 (between Santa Clara - San Benito county line and Highway 152 East), Highway 25 (between Highway 101 and Santa Clara - San Benito County line), Highway 129 in Santa Cruz County and Watsonville, Highway 152 (through Watsonville), County Road G7 (between Highway 152 and Highway 25), County Road G11 (between Porter Drive and Aromas Road), and Salinas Road (between Highway 1 and San Juan Road). However, these arterials are already used heavily by trucks (as discussed in Section 4.B.6.1, Setting). In addition, the state and county routes would still be the safest, and in virtually all locations, the only desirable routes for project traffic to use.

Measure 4.B.6-5: Implement Measures 4.A.6-3a and 4.A.6-3b.

Impact 4.B.6-6: Project construction would generate a demand for parking spaces for construction worker vehicles. Less than Significant.

The project would generate a need for parking for construction workers and construction vehicles, as well as areas to store equipment and supplies. The location of staging areas has not been identified at this point, however, given the pipeline alignment, it is expected that providing space for staging areas could be easily accommodated. The demand for new parking would be met by the proposed construction staging areas. No public on-street parking would be eliminated during project construction.

REFERENCES – Traffic and Circulation

California Department of Transportation (Caltrans), *1995 Annual Average Daily Truck Traffic on the California State Highway System*, 1998.

California Department of Transportation (Caltrans), *1995 Accident Data on California State Highways*, Caltrans, 1996.

California Department of Transportation (Caltrans), *1999 Traffic Volumes on California State Highways*, June 2000.

County of Monterey, *North County Area Plan*, amended 1994.

County of San Benito, *San Benito County General Plan*, amended 1992.

County of Santa Clara, *Santa Clara County General Plan*, 1994.

County of Santa Cruz, *1994 General Plan and Local Coastal Program for the County of Santa Cruz*, 1994.

PVWMA, *Pajaro Valley Water Management Agency Water Supply Project Definition Report III, Technical Memorandum 1.1A*, September 22, 1997.

Rude, Peter, Civil Engineer, CH2M Hill, telephone conversation, October 9, 1997.

Santa Clara County Transportation Agency, *1995 Congestion Management Program for Santa Clara County*, 1995.

Santa Cruz County Regional Transportation Commission, *1996 Santa Cruz County Congestion Management Programs*, 1996.

Transportation Agency for Monterey County, *Traffic Congestion Management Program*, 1994.

Watsonville, City of, *Watsonville 2005 General Plan*, 1994.

4.B.7 AIR QUALITY

4.B.7.1 SETTING

Existing Emissions Along the Import Pipeline Alignment

The proposed pipeline alignment extends from the existing Watsonville turnout of the Santa Clara Conduit of the CVP San Felipe Division to the Pajaro River south of Watsonville. Land uses along the alignment are predominantly agricultural and rangeland. Existing emissions sources include tilling (fugitive dust), windblown dust (fugitive dust), pesticide application (fugitive reactive organic gases [ROG]), and combustion of fuel by farm equipment (ROG, nitrogen oxide [No_X], and particulate matter [PM_{10}]). Emissions from agricultural practices on the pipeline alignment would cease during construction; however, the acreage of the alignment is miniscule in comparison to the very large area where agricultural operations would continue to occur. After construction of the pipeline is completed, the land would return to previous uses, including agricultural crops. Since reduction of existing emissions would be temporary, existing emissions were not quantified for this analysis.

Sensitive Receptors

Land uses such as schools, hospitals, and convalescent homes are considered to be relatively sensitive to poor air quality because infants and children, the elderly, and people with health afflictions, especially respiratory ailments, are more susceptible to respiratory infections and other air quality-related health problems than the general public. Residential areas are also considered to be sensitive to air pollution because residents (including children and the elderly) tend to be at home for extended periods of time, resulting in sustained exposure to any pollutants present.

Industrial and commercial districts are less sensitive to poor air quality because exposure periods are shorter and workers in these districts are, in general, the healthier segment of the public.

Recreational land uses are moderately sensitive to air pollution. Although exposure periods are generally short in such places, vigorous exercise associated with recreation places a high demand on the human respiratory functions, which air pollution can impair. Noticeable air pollution also detracts from the aesthetics of the recreational experience.

4.B.7.2 SIGNIFICANCE CRITERIA

See Section 4.A.7.2 for a discussion of significance criteria associated with activities in the North Central Coast air basin, and local air quality plans and policies.

Because the proposed pipeline crosses two air basins, the methods and thresholds contained in Monterey Bay Unified Air Pollution Control District's (MBUAPCD's) *CEQA Air Quality Guidelines* will be used for all project activities in the NCCAB and the Bay Area Air Quality

Management District's (BAAQMD's) methods and thresholds will be used for the proposed pipeline construction within Santa Clara County, which is located within the San Francisco Bay Area Air Basin.

According to the BAAQMD, which regulates air emissions in Santa Clara County, construction-related emissions are generally short-term in duration, but may still cause adverse air quality impacts. PM_{10} is the pollutant of greatest concern with respect to construction activities. Construction-related emissions can cause substantial increases in localized concentrations of PM_{10}. BAAQMD has identified a set of feasible PM_{10} control measures for construction activities. From BAAQMD's perspective, if these control measures are implemented, emissions from construction activities would be considered a less-than-significant impact (BAAQMD, 1996). Cumulative impacts will be determined based on the project's consistency with the BAAQMD's Clean Air Plan.

4.B.7.3 IMPACTS AND MITIGATION MEASURES

Impact 4.B.7-1: Construction activities would temporarily generate criteria air pollutants, particularly PM_{10}, over the expected three-year construction period. Significant and Unavoidable. Implementation of mitigation identified in this EIR would reduce the impact, but it would remain significant.

Construction of the Import Pipeline would generate fugitive dust (including PM_{10}) and other criteria air pollutants from exhaust emissions. A large portion of the total construction dust emissions would result from excavation and grading activities and heavy equipment travel over temporary roads along the proposed alignment. Dust emissions would vary from day to day, depending on the amount of pipeline installed each day, the silt content of the soil, and the weather. Equipment and vehicles used for the construction of the project would generate criteria air pollutants from engine exhausts.

Pipeline construction is expected to be completed at an average rate of 100 feet per day per pipeline heading. As stated above in Section 4.B.6, Traffic and Circulation, an average of 620 cubic yards of trench spoils would be hauled away and 440 cubic yards of new fill would be imported. Heavy duty construction equipment used in pipeline construction would include trenchers, front loaders, cranes, dump trucks, and compressors. Criteria pollutant emission sources would include exhaust from construction emissions and construction worker vehicle trips.

Fugitive dust emissions from soil excavation would be substantial. In an agricultural region, soil tilling is a source of PM_{10}, which in total far exceeds what could be generated by project construction activities. Larger particles of dust from construction would fall out relatively close to construction sites and could cover immediately adjacent crops with a coating of dust. This could be injurious to plants, particularly seedlings and plants in their early growth stages. However, as the duration of construction at any given site would be brief, a significant impact on plant growth from dust fall out is unlikely.

According to the MBUAPCD CEQA Guidelines, construction projects which emit precursors of ozone (i.e., ROG and NO_X) are accommodated in the emission inventories of the Air Quality Management Plans and would not have a significant impact on the attainment and maintenance of ozone ambient air quality standards. Similarly, the BAAQMD CEQA Guidelines state that carbon monoxide and ozone precursor emissions are included in the emissions inventory and are not expected to impede attainment or maintenance of ozone and carbon monoxide standards in the Bay Area. For this reason, emissions of carbon monoxide (CO), ROG and NO_X from construction equipment will not be quantified and will be considered a less-than-significant impact.

In regards to PM_{10} emissions, the BAAQMD CEQA Guidelines states that if control measures such as those identified in the following mitigation measure are implemented, then PM_{10} emissions from construction activities would be considered a less-than-significant impact. The BAAQMD Guidelines would apply to the portion of the alignment that is located within Santa Clara County. The MBUAPCD Guidelines, which would apply to the majority of pipeline construction, state that PM_{10} emissions from construction activities are considered significant if they would generate 82 pounds per day of more of PM_{10} when the activities are located nearby, and upwind of, sensitive receptors.

Neither the MBUAPCD nor the BAAQMD CEQA Guidelines contain emission factors for PM_{10} emissions from the handling of soil. In lieu of this information, emission factors from the South Coast Air Quality Management District (SCAQMD) were used for pipeline construction (SCAQMD, 1993). Assuming an combined soil import and export of 1,060 cubic yards per day, the project would result in emissions of approximately 2,349 pounds of PM_{10} per day.

> **Measure 4.B.7-1:** Implement dust control program described in Measure 4.A.7-1.
>
> The effectiveness of the dust control measures in reducing PM_{10} emissions ranges from 34 percent (for sweeping streets) to 90 percent (for covering haul trucks and inactive storage piles) (MBUAPCD, 1995). With implementation of Measure 4.A.7-1, construction-generated PM-10 emissions would remain significant and unavoidable.

Impact 4.B.7-2: Lane closures and detours necessitated by construction of the project could temporarily increase vehicular emissions. Less than Significant.

The majority of pipeline installation would occur in open areas and would not require lane closures or detours. The only roadways along the proposed pipeline alignment that would be affected by project construction are Betabel Road in San Benito County and Hayes and Lewis Roads in Monterey County. These roads are local, two-lane roads with relatively low volumes of traffic. Closure or detour of these roads could result in increased emissions from increased traffic congestion. However, increased emissions directly caused by lane closures would not be

likely to exceed MBUAPCD significance criteria of 150 pounds per day of ozone precursors (ROG or NO_X) or 550 pounds per day of CO.

Impact 4.B.7-3: Vehicle trips resulting from maintenance and operation of the pipeline would generate emissions of criteria air pollutants. Less than Significant.

Maintenance of the pipeline would include inspections by PVWMA employees. Since the pipeline would be buried, inspection would be infrequent, most likely on an annual basis. Inspections would be conducted by walking or driving along portions of the alignment. Emissions of criteria pollutants related to inspection trips would be negligible and would not exceed MBUAPCD significance thresholds. As a gravity pipeline, no pumps are proposed; consequently there are no emissions related to that source.

REFERENCES – Air Quality

Bay Area Air Quality Management District (BAAQMD), *BAAQMD CEQA Guidelines*, April 1996.

Brennan, Janet, Senior Planner, Monterey Bay Unified Air Pollution Control District, telephone conversation, July 23, 1997.

California Air Resources Board (CARB), *Air Quality Data Summaries*, 1991-1995.

California Air Resources Board (CARB), *Proposed Amendments to the Area Designations for State Ambient Air Quality Standards*, November 1996.

Governors' Office of Planning and Research, *CEQA: California Environmental Quality Act Statues and Guidelines*, December 1994.

Monterey Bay Unified Air Pollution Control District (MBUAPCD), *CEQA Air Quality Guidelines*, October 1995.

South Coast Air Quality Management District (SCAQMD), *CEQA Air Quality Handbook*, April 1993.

4.B.8 NOISE

4.B.8.1 SETTING

Existing Noise Levels

The majority of the Import Pipeline alignment passes through open areas characterized by ambient noise levels of less than 60 dBA, Ldn. Environmental noise usually is measured in A-weighted decibels (dBA).[1] Environmental noise typically fluctuates over time, and different types of noise descriptors are used to account for this variability. Typical noise descriptors include the energy-equivalent noise level (Leq)[2], the day-night average noise level (Ldn), and the Community Noise Equivalent Level (CNEL). The Ldn and CNEL are commonly used in establishing noise exposure guidelines for specific land uses. Ambient noise levels in excess of 60 dBA, Ldn are encountered in portions of the alignment that are adjacent to, or cross major roadways such as U.S. 101, Highway 129 (Riverside Drive), Highway 1, and Bolsa Road, as well as near the Granite Rock Quarry. Because the majority of the project area is in agricultural use, tractors and other farm equipment and machinery generate noise during the day time.

Sensitive Receptors

Some land uses are considered more sensitive to ambient noise levels than others, due to the amount of noise exposure (in terms of both duration and insulation from noise) and the types of activities typically involved. Residential areas, schools, and hospitals generally are more sensitive to noise than commercial and industrial land uses.

The majority of pipeline construction would occur in open agricultural areas, with no noise-sensitive receptors in close proximity to the alignment. The only noise-sensitive receptors along the proposed alignment are the Betabel R.V. Resort, located approximately 100 feet east of the Import Pipeline alignment between Stations 370+00 and 400+00; the Aromas School, approximately 500 feet south of Station 720+00; and several residences in River Oaks, approximately 600 feet south of the pipeline between Stations 500+00 and 520+00.

4.B.8.2 SIGNIFICANCE CRITERIA

See Section 4.A.8.2 for a discussion of significance criteria.

---

1 A decibel (dB) is a logarithmic unit of sound energy intensity. Sound waves exert a sound pressure (commonly called "sound level"), measured in decibels. An A-weighted decibel (dBA) is a decibel corrected for the variation in frequency response of the human ear at commonly-encountered noise levels. The highest dBA reported in a given period of time is known as the maximum noise level (Lmax). All of the noise levels reported herein are "A-weighted" unless stated otherwise.

2 Leq, the energy equivalent noise level (or "average" noise level), is the equivalent steady-state continuous noise level which, in a stated period to time, contains the same acoustical energy as the time-varying sound level actually measured during the same period. Ldn, the day-night average noise level, is a weighted 24-hour average noise level. With the Ldn descriptor, noise levels between 10:00 p.m. and 7:00 a.m. are adjusted upward by ten dBA to take into account the greater annoyance of nighttime noise as compared to daytime noise. The CNEL is calculated in a similar way, but an additional 5 dBA are added to the noise levels in the evening hours between 7:00 p.m. and 10:00 p.m.

4.B.8.3 IMPACTS AND MITIGATION MEASURES

Impact 4.B.8-1: Construction of the pipeline would temporarily increase noise levels in the project vicinity. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Construction of the pipeline would require the use of cranes, backhoes/trenchers, loaders, dump trucks, and compressors presents noise levels generated by common pieces of construction equipment (**Table 4.B.8-1**). Construction noise would fluctuate depending on construction phase, equipment type and duration of use, distance between noise source and receptor, and presence or absence of barriers between noise source and receptor. Noise from construction activities generally attenuates at six to nine dBA per doubling of distance. Assuming an attenuation of six dBA per doubling of distance, the noisiest piece of construction equipment identified in **Table 4.B.8-1** would generate 91 dBA at 50 feet, 85 dBA at 100 feet, and 79 dBA at 200 feet. These noise levels would be comparable to a gas lawn mower at three feet, a diesel truck at 50 feet, and shouting at three feet, respectively. As shown in **Figure 3.8-1**, these noise levels would be sufficiently loud that complaints would be likely from nearby sensitive receptors. For residences near the Import Pipeline alignment, interior noise levels would be about 10 dBA (open windows) to 20 dBA (closed windows) less than exterior noise levels (Cornett, 1979).

TABLE 4.B.8-1
TYPICAL CONSTRUCTION EQUIPMENT NOISE LEVELS

Equipment	Noise Level (dBA, Leq)[a]
Front Loaders	79
Compressors	81
Cranes	83
Trucks	91
Pavers	89
Backhoes	85

[a] Average noise level 50 feet from the source.

SOURCE: Bolt, Beranek, and Newman, Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances, December 1971.

The increase in ambient noise levels during construction would be noticeable by nearby receptors along the pipeline alignment. Project construction would generate approximately 85 dBA at the Betabel R.V. Resort, located approximately 100 feet east of the pipeline alignment between Stations 370+00 and 400+00. Aromas School, located approximately 500 feet south of Station 720+00, would experience noise levels of 72 dBA. Residences within the community of River Oaks, approximately 600 feet south of the pipeline between Stations 500+00 and 520+00,

would experience noise levels of 70 dBA. Given the pace of pipeline construction of approximately 100 feet per day, noise sources would move along the alignment as portions of the pipeline are completed. Any given receptor along the alignment would experience elevated ambient noise levels for approximately three to four weeks. If pipeline construction would occur during evening or nighttime hours, this would be a significant impact of the project. The following mitigation measure would reduce noise impacts from construction to a less-than-significant level.

Measure 4.B.8-1: Implement Measure 4.A.8-1.

Impact 4.B.8-2: Operation and maintenance of the pipeline would not increase noise levels in the project vicinity. Less than Significant.

The water transported by the proposed pipeline would flow under pressure, so no pumps would be necessary. Pressure controls installed along the pipeline would not generate noise. Periodic maintenance activities on the pipeline would not affect nearby sensitive receptors. This would be a less-than-significant impact of the project.

REFERENCES – Noise

Cornett, Lawrence C. and Charles E. Hina. 1979. Methods for Predicting Noise and Vibration Impacts. January 31.

Governor's Office of Planning and Research, *CEQA: California Environmental Quality Act Statutes and Guidelines,* 1994.

County of Monterey, *General Plan*, updated 1995.

County of Monterey, *North County Area Plan*, amended November 29, 1994.

County of San Benito, *General Plan*, amended 1992.

County of Santa Clara, *General Plan,* adopted 1994.

County of Santa Cruz, *General Plan and Local Coastal Program*, adopted May 24, 1994.

4.B.9 PUBLIC SERVICES

4.B.9.1 SETTING

Figure 2.1 in Section 2, Project Description, shows the PVWMA service area. Section 3.9 describes public services and utilities in the project area.

4.B.9.2 SIGNIFICANCE CRITERIA

Please refer to Section 4.A.9.2 for a discussion of significance criteria.

4.B.9.3 IMPACTS AND MITIGATION MEASURES

During construction, demand for public services such as water (for dust control), solid waste disposal, and schools will not be large enough to cause significant impacts. Solid waste generated during construction of PVWMA's project primarily would be soils generated during pipeline construction. Soils will generally be used for backfill. Solid waste capacity at the Marina Landfill in Monterey County (the proposed disposal site) is sufficient to accommodate waste from project construction activities. The Marina Landfill's remaining capacity is 33,082,000 cubic yards of solid waste with an estimated lifespan of 90 years (Integrated Waste Management Board, 2001) (Shedden, 2001).

Crews required for pipeline construction would not affect local schools as they would be relatively small crews (approximately ten or less), and if sufficient local labor is not available crews likely will commute without moving or relocating families.

Impact 4.B.9-1: Pipeline construction could result in temporary, planned or accidental disruption to utility services provided by underground lines. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Utility services potentially could be disrupted as a result of project construction. Disruptions to major utility lines would be considered significant, but mitigable. Impacts to utilities and services involve temporary disruption that, in most cases, would not exceed one day. Any utility lines and cables that could be disrupted during pipe installation will be identified during preliminary design. As a condition of approval for a utility excavation permit, PVWMA's contractor(s) would prepare a detailed engineering and construction plan that thoroughly describes construction techniques and protective measures for minimizing impacts to utilities. This plan would be reviewed by the appropriate special service districts or utility services in the project area.

> **Measure 4.B.9-1a:** A detailed study identifying utilities along the proposed alignment will be prepared during the pre-design stages of the project.

Measure 4.B.9-1b: The following measures are required for segments identified in final design as having potential conflict with significant utilities:

- Utility excavation and encroachment permits would be required from the appropriate agencies, including the Public Works Departments of San Benito, Santa Clara, Santa Cruz and Monterey Counties, Pacific Bell, U.S. Sprint, PG&E, City of Watsonville, and UPRR. These permits include measures to minimize utility disruption. PVWMA and its contractors would comply with permit conditions. Permit requirements would be included in construction contract specifications.

- Utility locations would be verified through field survey (potholing) and use of an underground locating service.

- A detailed engineering and construction plan would be prepared as part of the design plans and specifications. This plan should include procedures for the excavation, support, and fill of areas around utility cables and pipes. All affected utility services would be notified of PVWMA's construction plans and schedule. Arrangements would be made with these entities regarding protection, relocation, or temporary disconnection of services.

- In areas where the pipeline would parallel wastewater mains, engineering and construction plans will include trench wall support measures to guard against trench wall failure and possible resulting loss of structural support for the wastewater main.

- Residents and businesses in the project area would be notified by the contractor in writing of planned utility service disruption two to four days in advance in conformance with County and State standards.

Impact 4.B.9-2: Pipeline construction could temporarily impede vehicle access to emergency services as well as to collection and delivery services. This could affect sheriff's departments, fire departments, emergency services (e.g., ambulance companies), delivery and collection services. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Pipeline construction could temporarily impede vehicle access to police, fire or emergency services. Since construction will proceed at a general rate of about 100 feet per day, vehicle access to an individual residence or business would be impeded for one to two days. PVWMA will employ construction methods described in the assessment of traffic impacts (Section 3.6) which would reduce this impact to a less-than-significant level. No public facilities, such as hospitals or police or fire stations, are located along the alignment that would be directly affected by project construction.

Measure 4.B.9-2: Implement Measures 4.B.6-3a through 4.B.6-3c in Section 4.B.6, Traffic and Circulation.

Impact 4.B.9-3: Construction activities for all facilities could require short-term police and fire protection services to assist in traffic management and to respond to construction accidents and other service requests. Less than Significant. Implementation of recommended mitigation measures identified in this EIR, while not required, would assist in ensuring that the impact would remain at a less-than-significant level.

The proposed project has the potential to generate a short-term increase in demand for police and fire services if an accident occurs as a result of public hazards associated with the project. Such hazards could result from traffic congestion and rough road conditions, open trenches, and operation of heavy construction equipment. In addition, public services may be requested for non-emergency situations, such as theft and vandalism and nuisance complaints. Such activities may require response from fire units (Norwood, 1997).

As stated in Measure 4.B.6-2a in Section 4.B.6, Traffic and Circulation, project construction would be limited to off-peak hours on commute streets to minimize traffic delays. In addition, traffic control plans would be prepared and implemented to maintain traffic flow during construction, as noted in Measure 4.B.6-2b. Implementation of these measures, combined with the relatively short duration of project construction, would reduce demand for police and fire services to a less-than-significant level.

> **Measure 4.B.9-3 (Recommended):** Implement Measures 4.B.6-2a and 4.B.6-2b in Section 4.B.6, Traffic and Circulation.

REFERENCES – Public Services

Aluffi, Michael, Captain, City of Watsonville Police Department, telephone communication, October 20, 1997.

Bush, Larry, Plant Manager, City of Watsonville Wastewater Treatment Plant, telephone communication, December 16, 1997.

County of Monterey, *North County Area Plan*, pp. 33-38, amended November 29, 1994.

Edge, Stacy, Inspector, Department of Forestry and Fire Protection, telephone communication, October 16, 1997.

Gailey, Jeff, Soquel Creek Water District, telephone communication, December 19, 1997.

Garrett, Dewey, Collection Systems Manager, telephone communication, October 17, 1997.

Gregg, John, San Benito County Water District, telephone communication, December 17, 1997.

Integrated Waste Management Board, California Waste Facilities, Sites, & Operations Database, Monterey Regional Waste Management District/Marina Land Fill, January 5, 2001. www.ciwmb.ca.gov/swis/swisres.asp

Koch, David, Director of Public Works and Utilities, City of Watsonville, telephone communication, October 17, 1997.

Mardesich, Lisa, Secretary, Santa Cruz County Sheriff's Department, telephone communication, October 17, 1997.

Molholland, Al, Monterey County Water Resources Agency, telephone communication, December 19, 1997.

Norwood, Jim, Captain, City of Watsonville Fire Department, telephone communication, October 17, 1997.

Ortiz, Carlos, Customer Service Representative, telephone communication, October 17, 1997.

Pajaro Valley Water Management Agency (PVWMA), *Technical Memorandum 2.3 for Water Supply Project: Project Definition Report*, pp. 11-13, February 6, 1997, prepared by Montgomery Watson.

Perez, Monica, Pajaro Community Services District, telephone communication, December 16, 1997.

Shedden, Rick, Monterey Regional Waste Management District, telephone communication, January 1, 2001.

Sims, Barbara, Secretary for Construction Office, Pajaro Valley Unified School District, telephone communication, October 20, 1997.

Swain, Gayland, Senior Utilities Engineer, City of Watsonville, telephone conversation, May 15, 1998.

West, George, Aromas Water District, telephone communication, December 17, 1997.

4.B.10 VISUAL/AESTHETIC AND RECREATIONAL RESOURCES

4.B.10.1 SETTING

Visual Characteristics Along the Proposed Import Pipeline Alignment

The visual character of the proposed pipeline alignment varies from flat, open agricultural fields to densely vegetated hills to industrial features. A detailed description of the visual character along the proposed alignment is presented below.

Stations 0+00 to 282+00

Between Stations 0+00 and 282+00, the pipeline alignment extends through generally flat agricultural lands located between the Santa Clara Conduit of the Central Valley Project and U.S. 101. With the exception of a few buildings related to agricultural activities, no structures are located within, or in the vicinity of, the alignment. The landscape is rural with few roads and little development. Man-made features include Miller's Canal, which intersects the alignment at Station 120+00; Bolsa Road (Highway 25) and the UPRR tracks, which intersect the alignment at Station 140+00; and a Pacific Gas & Electric (PG&E) power line easement, which the pipeline alignment follows between Stations 192+00 and 282+00. The alignment does not have distinct visual boundaries and thus is not distinguishable from surrounding agricultural lands. No scenic features are located along the alignment.

Bolsa Road (Highway 25) and U.S. 101 provide the primary viewing opportunities within the viewshed, include close-in views of the alignment where it crosses the roadways. The Lomerias Muertas Hills are a prominent background feature in views to the southwest.

Stations 270+00 to 590+00

Between Stations 270+00 and 320+00, the alignment continues across agricultural land and skirts the base of the Lomerias Muertas Hills. Views of and from this segment of the pipeline alignment are limited by the hills to the south as well as by a hill located across the Pajaro River to the north.

Between Stations 320+00 and 400+00, the alignment crosses U.S. 101 and extends along the West Side of the freeway, where the landscape is predominantly rural except for the Betabel RV Park between Stations 370+00 and 400+00. While the alignment is still within the relatively flat river valley, the surrounding area consists of undeveloped, hilly terrain within the Sargent Hills across the Pajaro River to the west, and the Lomerias Muertas Hills across U.S. 101 to the east. Views of this segment of the pipeline alignment are available from U.S. 101, a major transportation corridor, and Betabel Road.

At Station 480+00, the alignment enters the Sargent Hills and reaches an elevation of approximately 400 feet above mean sea level (msl) near Station 490+00. The landscape in this area is rural, with undeveloped grassy slopes. This segment of the alignment is visible from the

community of River Oaks along Highway 129 (Chittenden Road) to the south. Between Stations 490+00 and 590+00, the alignment proceeds downhill and generally parallels the UPRR tracks and Highway 129. On the north side of the alignment, the lack of development and the presence of open grassland and Soda Lake maintain the rural landscape. To the south across Highway 129, scattered development is visible within the community of Chittenden.

Stations 590+00 to 1127+00

Between Stations 590+00 and 650+00, the alignment extends through Pajaro Gap along the Pajaro River, which parallels the UPRR tracks and Highway 129 (Chittenden Pass). In this area the Pajaro River lies within a narrow canyon with steep slopes. Although the alignment extends through highly disturbed lands, vegetation in the form of trees, shrubs and groundcover is present within the riparian corridor and on the slopes. The pipeline alignment occurs along the riparian corridor and the quarry railroad tracks and would not be visible from Highway 129. The surrounding terrain limits views of this portion of the alignment. Between Stations 625+00 and 650+00, the pipe would be located above ground on piers. Large mining equipment within the Granite Rock Company property is a prominent visual feature along the southern side of Highway 129 and the Pajaro River.

Between Stations 650+00 and 710+00, the hills to the west of the alignment are replaced with relatively flat agricultural land, while rolling hills are located to the east. Near Station 710+00, greenhouses and a school within the community of Aromas are visible to the south of the alignment. West of Aromas, the alignment extends through relatively flat agricultural lands, with little development or other dominant visual features in the immediate project area. The alignment itself would extend along the UPRR right-of-way. This segment of the alignment is visible from San Juan Road. The Bolsa de San Cayetano Hills are a dominant background feature in views to the south. The alignment skirts these hills between Stations 900+00 and 970+00.

From Stations 970+00 to 1127+00 (the western terminus of the pipeline), the alignment continues to extend through generally flat agricultural lands. The only prominent visual features are industrial looking structures in Watsonville Junction near Station 1040+00. The alignment is visible from Salinas Road, which intersects the alignment at Station 1045+00, and from Highway 1 at the alignment's western terminus.

Scenic Road and Highway Designations

San Benito County

The San Benito County General Plan Scenic Roads and Highways Element identifies U.S. 101 and Highway 129 as County-designated scenic highways within the project area. The Scenic Roads and Highways Element also designates a scenic corridor along all-scenic roads and highways. A scenic corridor is defined as the visible land area outside of a transportation corridor (road) right-of-way and generally described as the "view from the road". Along U.S. 101, the scenic corridor extends 400 feet along either side of the centerline of the road.

Along Highway 129, the scenic corridor is identified as all land within 340 feet of the centerline of the road.

The proposed pipeline alignment is visible in close-range views from U.S. 101 between Stations 320+00 and 375+00. Close-range views of the alignment are also available from Highway 129 between Stations 590+00 and 600+00, where the alignment crosses Chittenden Pass.

Santa Clara County

The proposed pipeline alignment extends through a small portion of southern Santa Clara County. While several highways within the County are either officially designated state scenic highways or eligible for official designation, none of these roadways are located within or near the project area.

Santa Cruz County

Policy 5.10.10 of the Santa Cruz County General Plan/LCP identifies designated scenic roads within the County that are valued for their vistas. According to the General Plan/LCP, a scenic road is defined as a road, which has been designated as having unusual or outstanding scenic qualities.

Within the project area, Highway 1 and Highway 129 are County-designated scenic roads. These roads are valued for their vistas and afforded the highest level of protection in the General Plan/LCP. (County of Santa Cruz, 1994)

Within Santa Cruz County, close-range views of the pipeline alignment between Stations 520+00 and 590+00 are available from Highway 129.

Monterey County

According to the Monterey County General Plan and the North County Area Plan, Highway 1 is the only designated scenic route that is within the project area and the North County Area of Monterey County. (County of Monterey, 1995; 1994)

Highway 1 has both close- and middle-range views of the pipeline alignment, from its western terminus to approximately Station 1050+00.

State of California

Within the project area, Highway 1 is considered eligible for Official State Scenic Highway designation by Caltrans.

Recreational Facilities

San Benito County

The San Benito County portion of the project area is primarily in agricultural use. No recreational facilities are located within the San Benito County portion of the project area. However, playfields at Aromas School are located to the south of the alignment near Station 720+00.

Santa Clara County

The proposed pipeline alignment extends through a small portion of southern Santa Clara County that is primarily ranchlands. No recreational facilities are located within the Santa Clara County portion of the project area.

Santa Cruz County

No recreational facilities are located in the vicinity of the pipeline alignment in Santa Cruz County. However, as stated in Section 3.6, Highway 129 is a County-designated bicycle trail.

Monterey County

Like southern Santa Cruz County, northern Monterey County is primarily in agricultural use. Because the area has a low resident population, recreational facilities are limited. The Pajaro Valley Golf Course is located on Salinas Road near Highway 1. In addition, a recreational hiking, bicycle, and equestrian trail is located along the Pajaro River through the project area.

4.B.10.2 SIGNIFICANCE CRITERIA

See Section 4.A.10.2 for a discussion of significance criteria.

4.B.10.3 IMPACTS AND MITIGATION MEASURES

Impact 4.B.10-1: Installation of the proposed Import Pipeline would tear up roadways and remove crops and vegetation, temporarily altering the visual landscape. Significant. With implementation of measures in this EIR, this impact would be mitigated to a less-than-significant level.

Construction of the proposed Import Pipeline would tear up roadways and remove native vegetation and crops along the alignment creating short-term noticeable visual contrast with the surrounding landscape including areas within public vistas and near scenic highways. During construction, excavated trenches and stockpiled soils, pipe, and other materials within the construction easement would constitute negative aesthetic features in the pipeline alignment. Disturbed construction areas would be visible in close-range views from designated scenic roadways, including U.S. 101 and Highway 1, which are considered eligible for State Scenic Highway designation, and Highway 129.

Following construction, most of the proposed pipeline would be located below grade and would be unobtrusive. Cropping would be allowed to resume on agricultural lands within the alignment following installation of the pipeline. Implementation of the mitigation measures presented below, which would require the PVWMA to revegetate disturbed natural areas and contractors to restore disturbed areas to pre-construction conditions, would minimize adverse visual effects on lands within the alignment. Incorporation of these measures into the project would also ensure that the project would be consistent with applicable policies and objectives of the general plans presented above, including policies that require preparation of a revegetation plan (Action 7.4 of the San Benito County General Plan Open Space and Conservation Element), replacement of topsoils (Action 7.2 of the San Benito County General Plan Open Space and Conservation Element), and use of native or characteristic landscaping (Actions 2.1 and 4.1 of the San Benito County General Plan Scenic Roads and Highways Element, and Policy 5.10.13 of the Santa Cruz County General Plan/LCP). Therefore, no long-term visual impacts would result from development of the pipeline.

Measure 4.B.10-1a: PVWMA will revegetate disturbed natural areas to minimize textural contrasts with the surrounding vegetation using grasses, shrubs and trees typical of the immediately surrounding area. No trees will be planted above the pipeline. Topsoils will be stockpiled and reapplied after grading to enhance revegetation.

Measure 4.B.10-1b: PVWMA will ensure that its contractors shall restore the topography of disturbed areas along the pipeline alignment to a visually unobtrusive condition such that short-term construction disturbance does not result in long-term visual impacts.

Measure 4.B.10-1c: PVWMA will submit a revegetation plan to CDFG detailing the type of plants to be re-established, details of the preparatory measures, and methods of planting and maintenance. The plan shall include provisions for remedial action in the event the revegetation plan fails.

Impact 4.B.10-2: Development of the Groundwater Banking component would introduce new sources of light onto the project site and increase ambient light in the project area. Less than Significant. Implementation of recommended mitigation measures identified in this EIR, while not required, would assist in ensuring that the impact would remain at a less-than-significant level.

While no exterior lighting is currently proposed as part of the Groundwater Banking component, exterior security lighting (if implemented) at the well facilities could introduce light and create nighttime impacts. The new facilities would be located in the vicinity of existing residences. While exterior lighting could be visible from these residences, it would not be expected to substantially increase ambient light in the project area.

The proposed pipeline would be underground and would not introduce new sources of light or glare.

Mitigation Measure 4.B.10-2 (Recommended): Implement Measure 4.A.10-2.

Impact 4.B.10-3: Development of the proposed Import Pipeline would temporarily disrupt recreational uses along designated recreational bicycle trails in Santa Cruz and Monterey Counties and reduce the aesthetic quality of bicycle recreation in these areas. Less than Significant.

Construction of the Import Pipeline would disrupt bicycle traffic along Highway 129, which is included in the Santa Cruz County bikeway system. Construction activities and related truck traffic could damage this bikeway, and segments of the bikeway with active construction areas would be temporarily closed during trench excavation and pipeline installation, creating minor inconvenience to bicyclists. This impact would be temporary during project construction. Implementation of Measures 4.A.6-2, 4.A.6-3a and 4.A.6-3b would ensure that damaged roads would be repaired to pre-construction conditions, and that detours would be provided for bicyclists and motorists during the construction period.

Mitigation: None required.

REFERENCES – Visual/Aesthetic and Recreational Resources

County of Monterey, *General Plan*, adopted September 30, 1982, amended 1995.

County of Monterey, *North County Area Plan*, amended November 29, 1994.

County of San Benito, *Open Space and Conservation Element Update of the San Benito County General Plan*, February 7, 1995.

County of San Benito, *San Benito County General Plan, Scenic Roads and Highways Element*, 1980.

County of Santa Clara, *Santa Clara County General Plan*, updated 1994.

County of Santa Cruz, *General Plan and Local Coastal Program*, adopted May 24, 1994.

4.C CHANGE IN PLACE OF USE

4.C.1 BACKGROUND

The State Water Resources Control Board (SWRCB) issues water rights permits for diversion and use of the surface waters within California. The USBR holds permits from the SWRCB for the Central Valley Project (CVP), which diverts surface waters from several river systems for storage and use throughout a broad service area. Through the water right permits the SWRCB defines the allowable point of diversion, place of use and purpose of use, and establishes conditions on the amount and timing of diversion for each authorized diversion. PVWMA is not currently within the designated place of use for the CVP. To implement the proposed BMP 2000 Alternative, PVWMA would need to be added to the CVP place of use. No other SWRCB permit changes would be required for the PVWMA project; there would be no change in the point of diversion, purpose of use or conditions on the amount and timing of diversion. The SWRCB must approve any changes to the terms of USBR's CVP water rights permits.

For USBR CVP uses, a water right permit generally specifies an outer district boundary (gross acres) within which water may be used, as well as a total number of acres that may be irrigated within that boundary (net acres). The geographic area of the net acres may change in accordance with the terms of a district's CVP contract, without SWRCB approval as long as the net acres remain within the boundaries defined by the gross acres and the amount of water does not exceed those allowed by the water right permit. The term *Place of Use* refers to the outer boundary.

In 1999, the SWRCB approved Revised Water Right Decision 1641 (revised in 2000). The Decision (1) implements flow objectives for the San Francisco Bay/Sacramento-San Joaquin Delta, (2) conditionally approves a petition to change points of diversion of the CVP and State Water Project (SWP), and (3) conditionally approves a petition to change places of use and purposes of use of the CVP. The third action responds to USBR petitions requesting the SWRCB to change the terms in permits governing the CVP to be consistent with the way the CVP is actually operated, and to ensure that all water appropriated by USBR under its permits is used within the authorized place of use. The CVP is one of the largest water projects in the world, and includes 20 dams and reservoirs, 500 miles of major canals and aqueducts, and various other facilities. Because the various CVP reservoirs and diversion works facilities are operated as an integrated project, water from various USBR facilities gets commingled, whereas the separate water right permits for each CVP facility had different requirements pertaining to where and how the water could be used—i.e., the place of use and purpose of use. Decision 1641 included conforming the purposes of use and expanding and consolidating the place of use specified in permits. These actions were addressed in the *Environmental Impact Report for the Consolidated and Conformed Place of Use* (SCH#97122042; SWRCB, 1999).

PVWMA is not in the consolidated and conformed place of use for the CVP, although it is currently a CVP contractor through the contract assignment from the Mercy Springs Water District. USBR filed an application petitioning the SWRCB to modify the CVP authorized place of use to include PVWMA's gross acres in 1996. Reclamation requested changes in the

referenced permits to include irrigation "of 30,000 acres of land within the 70,000 acre PVWMA service area" (USBR, 1996). Subsequent more accurate GIS mapping of the PVWMA service area confirmed that the service area is approximately 79,600 acres and the area of irrigated agricultural land is approximately 30,200 acres. The maps in this EIR reflect the correct acreage. USBR requested no additional diversion of water from the Delta, and none would be authorized if SWRCB were to approve the petition. The petition includes no change in points of diversion, rediversion, or purposes of use of CVP water.

SWRCB approval of adding the PVWMA service area to the CVP place of use is subject to CEQA. This EIR is intended to provide the environmental evaluation of the proposed change in place of use and to support the findings SWRCB which, as a responsible agency on this project, would need to add the PVWMA service area to the consolidated place of use in USBR permits. In considering approval of the proposed change in place of use, SWRCB must consider the following areas of potential effect:

- The environmental effects within the PVWMA service area of bringing CVP water into PVWMA.
- The effects on any other legal users of water, including other CVP system users.

With respect to potential effects within the PVWMA service area of importing CVP water, this discussion focuses on potential land use changes and related effects. For a discussion of the direct effects of importing CVP on the groundwater basin see Section 4.B.3, Hydrology and Water Quality, for the Groundwater Banking component and for the evaluation of the effects of constructing and operating the Import Pipeline see other sections in 4.B. Note that this discussion applies only to the BMP 2000 Alternative, since the Local-Only Alternative does not include CVP water.

4.C.2 LAND USE TRENDS IN THE PROJECT AREA

For the Revised BMP, PVWMA updated the land use distribution and agricultural crop acreage database used in the Pajaro Valley Integrated Ground and Surface water Model (PVIGSM).[1] PVWMA based the update on the California Department of Water Resources (DWR) land use surveys. The DWR conducts detailed land use surveys throughout the state primarily to determine changes in patterns of water use. The land use data for agriculture is more detailed (nine categories, such as vineyard and pasture) than for urban (five categories) or native (two categories: native riparian and native vegetation).[2] The agency conducts the surveys for every county in California, and updates the data every seven years on average. DWR develops the surveys from aerial photography and field inspection to confirm and compliment the aerial surveys.

---

1 The PVIGSM uses the land use and attendant crop mix acreage to estimate crop water requirements, groundwater pumping and surface water supplies to meet these requirements. Land use distribution data are also used to define the geographic distribution of rainfall runoff and irrigation applied water (the latter affects the geographic distribution of infiltration and deep percolation of water into the groundwater system (Montgomery Watson, 1999).

2 A detailed explanation of the land use categories used by DWR can be found at http://wwwdpla.water.ca.gov/cd/landwateruse/1998legend.html.

Original modeling done for the 1993 BMP was based on DWR surveys for 1966, 1975, and 1982. For the updated modeling effort, PVWMA included surveys data for 1989 and 1997. The land use data used in the model illustrates historic land use trends in the region, although the boundaries of the modeled area are not identical to the boundaries of the PVWMA service area.[3] **Appendix E** of this Draft EIR is a technical memorandum summarizing these updates, and indicates the following trends in the PVIGSM modeled area from 1966 to 1997 (Montgomery Watson, 1999):

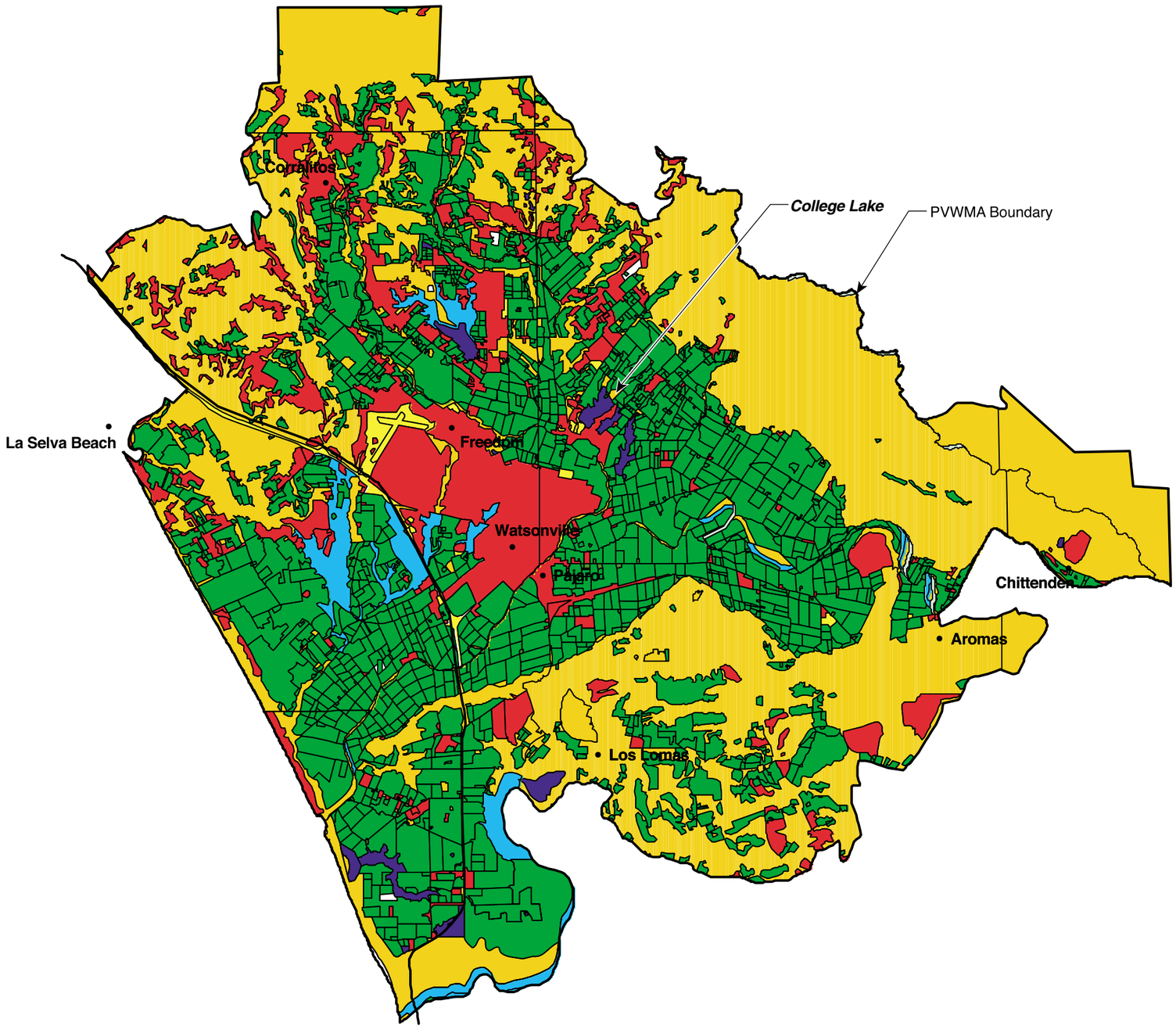
- The majority of land is categorized as native vegetation. As a category, native vegetation has decreased from 76 percent (approximately 61,300 acres) to 67 percent (approximately 49,000 acres).
- Agricultural land (all categories) increased from approximately 30,500 acres to 34,650 acres, an increase of 14 percent. That increase primarily occurred between 1966 and 1989; from 1989 to 1997, total irrigated land increased by only 187 acres.
- Urban land use increased from approximately 4,800 acres to approximately 12,900 acres, an increase of 170 percent.
- Urban land development has occurred mainly in previously undeveloped areas classified as native vegetation rather than through conversion of agricultural land.

Figure 4.C-1 presents the results of the most current DWR land use survey for the area. Section 3.1 of this EIR describes current land uses throughout the Pajaro Valley based on the DWR land use data, field reconnaissance, and inspection of aerial photographs conducted for this EIR. Of approximately 79,600 acres in the Pajaro Valley, there are about 30,200 acres or about 38 percent under irrigation and 35,900 acres or 45 percent in native riparian, native vegetation, and water surface. Irrigated cropland represents 38 percent of the total acreage within the PVWMA. As **Figure 4.C-1** indicates, most existing urban development in the PVWMA service area is in and around the City of Watsonville and the unincorporated community of Freedom.

PVWMA PROJECTIONS FOR WATER USE

Studies conducted for the draft Revised BMP estimate current (baseline) groundwater use within PVWMA at 71,500 afy, of which 59,300 afy is agricultural use (irrigation water) and 12,200 afy is urban use (see **Table 2.2** in Chapter 2). The Revised BMP assumes no net change in the total number of acres under irrigation in the PVWMA, although water use in the agricultural sector is expected to increase somewhat due to a shift in crop types. This discussion summarizes information in Revised BMP Sections 2.6 and 2.7.

[3] Refer to Figure 2-1 in the draft Revised Basin Management Plan (August, 2001). The total modeled area is approximately 146,700 acres, of which 96,500 acres are on-shore lands. The PVWMA service area is 79,600 acres and generally is within the on-shore area, except for a mountainous area on the eastern boundary with little arable land (Revised BMP, Section 2.1).



SOURCE: Department of Water Resources, 1997; adapted by Environmental Science Associates

Pajaro Revised BMP EIR / 200179 ■

Figure 4.C.3-1
Land Uses in
PVWMA Service Area

Urban Water Use

The purpose of future water use projections conducted for the Revised BMP was to estimate future conditions in the groundwater basin in order to formulate basin management measures and alternatives. PVWMA is not proposing to treat and distribute potable water for domestic use. The City of Watsonville, which operates groundwater wells and a limited amount of surface water diversion, would supply water for future domestic uses in the Watsonville/Freedom area.

For the draft Revised BMP, PVWMA estimated future urban water use based on future population in the service area (**Table 4.C-1**). Key assumptions and baseline information are as follows:

- *Baseline Population*. PVWMA used US Census data for the City of Watsonville/Sphere of Influence (SOI), year 2000 and projections from the 1993 Basin Management Plan for unincorporated Santa Cruz and Monterey counties (excludes the Watsonville SOI).

- *Growth Rates*. PVWMA applied the AMBAG annual growth rates to these baseline populations. AMBAG projections are through year 2020; the proposed project is to balance the groundwater basin through year 2040. PVWMA applied the growth rate specified for 2015-2020 to years 2020-2040.

- *Current and Future Water Use*. PVWMA estimated baseline (current) urban water use by averaging monthly urban water use during the 1994 through 1997 hydrologic period. PVWMA calculated projected urban water use based on a use factor of 131 gallons per day per capita. The projected annual urban water use is 16,118 afy.

- *Water Conservation (Urban)*. Under the BMP 2000 Alternative, urban demand would be reduced by approximately 500 afy through implementation of programs in the Water Conservation 2000. Refer to Chapter 2, Project Description, for discussion of proposed urban and agricultural conservation measures.

Although the AMBAG and PVWMA horizon years differ, projections for year 2020 can be compared. The PVWMA population projection for year 2020 (approximately 94,300) is about four percent lower than the AMBAG projection for the service area for same year (approximately 98,200).

Agricultural Water Use

PVWMA determined future agricultural water use on the basis of future agricultural land use (total number of acres under irrigation and crop patterns). Key assumptions and baseline information are as follows (see also **Appendix E**):

- *Projected Irrigated Acreage*. Agricultural land use in terms of total irrigated acres was assumed to remain constant (as indicated above, DWR surveys indicate little change in the total number of irrigated acres from 1989 to 1997).

TABLE 4.C-1
PVWMA POPULATION PROJECTIONS AND URBAN WATER USE

Year	AMBAG Watsonville[a]	PVWMA Population[b,c,d]	Urban Water Use[e] (acre feet/year)
2000	43,620	82,921	12,200
2005	50,495	85,197	12,535
2010	51,881	87,536	12,879
2015	53,816	90,800	13,359
2020	55,875	94,274	13,870
2025	No data	97,881	14,401
2030	No data	101,626	14,952
2035	No data	105,514	15,524
2040	No data	109,551	16,118

a *1997 Regional Population and Employment Forecast for Monterey, San Benito and Santa Cruz Counties,* AMBAG 1997.

b The annual growth rate was calculated based on AMBAG projections and applied to the projected PVWMA Population. Growth rate for 2020 to 2040 was assumed to be equivalent to the change from 2015 to 2020.

c The year 2000 PVWMA population estimated was based on 2000 Census Data from the U.S. Census Bureau (Watsonville pop. 44,265) and estimated population of unincorporated areas from the 1993 Basin Management Plan (Montgomery Watson, 1993).

d The relatively large increase in AMBAG population estimate from 2000 to 2005 is a result of annexed areas by the City of Watsonville. Therefore the 5-year growth rate of the PVWMA population from 2000 to 2005 was estimated according to the AMBAG 2005 to 2010 growth rate.

e Urban water use factor of 131 gpd per capita was used to determine urban water use.

SOURCE: draft Revised BMP (Table 2-4: PVWMA Population Projections and Urban Water Use)

- *Current Water Use*. PVWMA determined historic water use from data for agricultural lands using groundwater basin modeling (the PVGSIM model). For baseline agricultural water use, the basic inputs and assumptions used in modeling the groundwater basin included the following:
  - California Department of Water Resources (DWR) land use survey data (1997) for cropping patterns;
  - Historic hydrologic data, including average, wet, and dry years (to determine the amount of water provided by the natural hydrologic cycle versus pumping); and
  - Water use factors (based on application rates by crop type, irrigated acreage, effective rainfall, minimum soil moisture, crop evapotranspiration, irrigation efficiency, cultural practices such as crop rotation, and marketing factors).
- *Shift in Crop Type*. The Revised BMP assumes that approximately 2,000 acres of deciduous crops would be converted to berry crops and that future agricultural water use would increase commensurately. DWR data indicate that a shift in the types of crops grown in the PVWMA service area has occurred over time, with an increase in nursery,

strawberry, and vine crops and a decrease in vegetable row crops and deciduous (**Appendix E**).

- *Future Water Use*. The projected annual agricultural water use is 64,400 afy. The increase over baseline water use in the agricultural sector is associated with the change in crop type. Deciduous crops use approximately 0.7 acre-feet per acre (af/acre), compared to approximately 2.8 af/acre for strawberries and 3.7 af/acre for raspberries.

- *Water Conservation (Agriculture)*. Under the BMP 2000 Alternative, agricultural demand would be reduced by an estimated 4,500 acre-feet per year through implementation of programs in the Water Conservation 2000. Refer to Chapter 2, Project Description, for discussion of proposed urban and agricultural conservation measures.

4.C.3 IMPACTS AND MITIGATION MEASURES

4.C.3.1 USE OF CVP WATER IN THE PVWMA SERVICE AREA

Impact 4.C-1: Including PVWMA within the CVP Place of Use and importing and using CVP water within the PVWMA service area is designed to serve, and would support existing agricultural activities on existing agricultural acreage. The project would not require nor result in direct land use changes with associated significant environmental effects, such as the conversion of undeveloped, "native" lands that might affect biological resources. However, the proposed Place of Use includes the entire PVWMA service area, which does include non-agricultural lands. Thus, although not proposed as part of the BMP 2000 project, with approval of the proposed CVP Place of Use, it would be possible in the future, and authorized within the water rights permit, for PVWMA to extend CVP water service to currently non-agricultural lands. This raises the potential for land use changes to occur in the future, such as conversion of native lands to agricultural uses, which could have potentially significant environmental impacts. Significant. With mitigation identified in the EIR, the impact would be reduced to a less-than-significant level.

Summary

The proposed import and use of CVP water within the PVWMA service area would not require or result in direct changes in current land use activities. The amount of supplemental surface water supply proposed for import via the CVP system would support existing agricultural irrigation activity. Under the BMP 2000 Alternative, no agricultural land would have to be fallowed nor is the project designed to support the expansion of agricultural activities within the PVWMA service area beyond the current acreage that could result in the conversion of undeveloped, "native" lands. As a result, there would be no direct land use changes associated with the project nor environmental impacts associated with land use changes as a result of the proposed project.

Because the proposed Place of Use for CVP water includes the entire PVWMA service area, it would be possible in the future for PVWMA to consider extending CVP water to non-agricultural acreage; which could have significant environmental effects. This potential future impact could be mitigated to less than significant through incorporation of standard language in the USBR CVP permit to PVWMA, as provided below in Measure 4.C-1.

The proposed project could have indirect, growth inducement potential as a result of improving the overall state of the groundwater basin. The growth inducement potential of the project is addressed in Chapter 7.0 of this EIR.

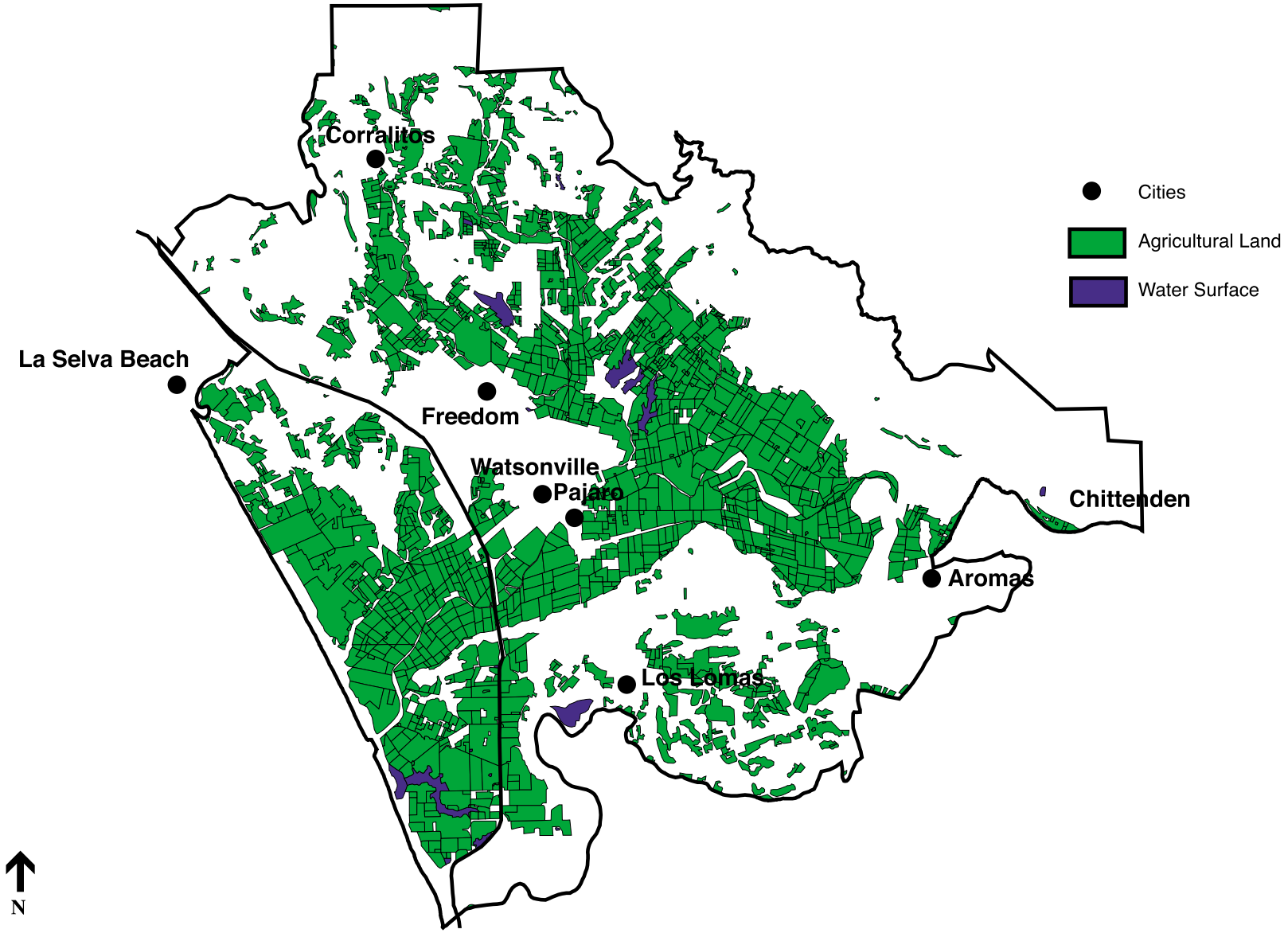
No Direct Land Use Changes or Associated Impacts

As described in Chapter 2, CVP water would be used in place of groundwater to irrigate farm land in the PVWMA service area to help balance the groundwater basin, to stop groundwater overdraft and to halt seawater intrusion. As discussed in Section 4.C.2, above, the PVWMA has carefully reviewed the current and historic DWR land use information and finds that irrigated agricultural acreage within the service area has remained relatively constant at about 30,200 acres, representing approximately 38 percent of the service area. Water demand projections to assess the supplemental surface water supply needs are focused on existing irrigated agriculture and do not predict or provide for expansion of this irrigated acreage. **Figure 4.C-2** shows the irrigated acreage within PVWMA. Under the BMP 2000 Alternative, the area where PVWMA proposes to use CVP water has already been developed as irrigated agricultural land. The only anticipated change is in crop patterns (2,000 acres of deciduous agriculture anticipated to convert to more water-intensive crops—strawberries and bush berries, based on historic trends in cropping patterns).

The demand projections include an assessment of current and future urban development in order to have a comprehensive understanding of groundwater basin demands and water balance requirements. However, the BMP 2000 Alternative does not propose importation of CVP water to serve any urban (municipal and industrial [M&I]) uses.

Of the 30,200 irrigated acres within the PVWMA service area, the BMP Alternative proposes installation of distribution pipeline infrastructure that would serve only a portion of this irrigated area. **Figure 4.C-3** shows the layout of Coastal Distribution System and Inland Distribution System within the irrigated acreage. As shown on this figure, the distribution systems will not deliver water to all of the 30,200 acres of irrigated agriculture. Although the proposed place of use boundary is contiguous with PVWMA service area boundaries, PVWMA currently has no plans to extend service beyond what is shown in **Figure 4.C-3** because it is not needed to achieve the objectives of the BMP. As discussed in Chapter 2, curtailing pumping and using surface water for irrigation in the coastal area would build a hydrostatic barrier to seawater intrusion, which raises the sustainable yield of the basin. The limits of the proposed distribution system further support the conclusion that the proposed use of CVP water within the PVWMA service area will not result in any direct changes in land uses.

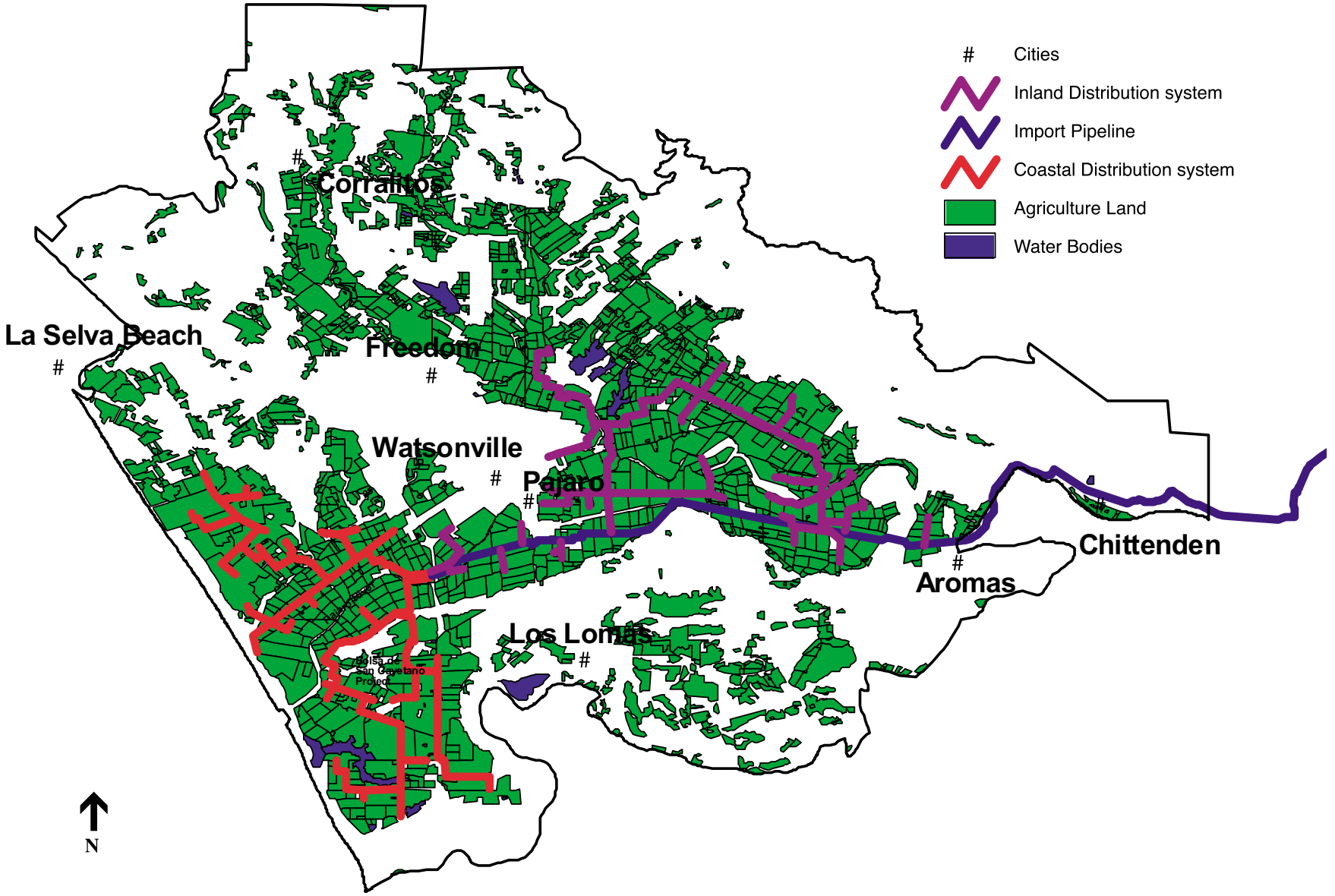
The application to the SWRCB to add PVWMA to the CVP place of use area describes the area to be added as the PVWMA service area, and specifically the 30,200 acres of irrigated agricultural land within the service area. Although the BMP Alternative does not provide for distribution of imported CVP water to all of the existing irrigated acreage, it is possible that under the proposed place of use change, PVWMA could in the future provide service to other irrigated areas beyond those served by the Coastal or Inland Distribution Systems. Such service to other irrigated agricultural lands would be allowed under the proposed place of use conditions, and



SOURCE: DWR; adapted by Environmental Science Associates

Figure 4.C.3-2
Irrigated Agricultural Lands in the PVWMA Service Area

This page is intentionally left blank.



SOURCE: DWR; adapted by Environmental Science Associates

Figure 4.C.3-3

Existing Irrigated Agricultural Lands with Import Pipeline and Inland and Coastal Distribution Systems

subject to the provisions of the Agency's CVP contract, and would not result in land use changes or associated environmental impacts.

Potential Indirect Impacts

The proposed place of use for CVP water includes the entire PVWMA service area, which does include non-agricultural lands. Thus, although not proposed as part of the BMP 2000 project, with approval of the proposed CVP Place of Use, it would be possible in the future, and authorized within the water rights permit, for PVWMA to extend CVP water service to currently non-agricultural lands. This raises the potential for land use changes to occur in the future, such as conversion of native lands to agricultural uses, which could have potentially significant environmental impacts. This potential future impact could be mitigated to less than significant through incorporation of standard language in the USBR CVP permit to PVWMA, as provided below in Measure 4.C-1.

The proposed importation of CVP water is one program element that would help balance the now overdrafted groundwater basin and help provide adequate water supply for existing agricultural water demands. Relieving the groundwater overdraft conditions and balancing the groundwater basin will improve the groundwater supply reliability within the basin. While the BMP 2000 Alternative does not propose to provide water supply for M&I uses or to support new development, indirectly, the overall improvement of the groundwater basin conditions achieved by the BMP program would reduce concerns over groundwater supply reliability. Groundwater supply reliability is noted as one potential constraint to planned development growth in the region. Indirectly then, this alternative would have some level of growth inducement potential. The growth inducement potential of this project is discussed in Chapter 7 of this EIR.

> **Measure 4.C-1**: **CEQA Compliance.** Delivery of CVP water for use in areas beyond the 30,200 acres of agricultural lands shown in **Figure 4.C-2** shall be permitted only in accordance with the terms for delivery to Contractor's Service Area pursuant to any contract for the delivery of CVP water between Reclamation and PVWMA, and in accordance with any and all laws, including CEQA and NEPA. The appropriate local land use agency will be the lead agency for preparation of an environmental document for any proposed land use changes; PVWMA will be the lead agency for any actions specific to water system improvements or other PVWMA actions needed to provide CVP water to areas beyond those shown in **Figure 4.C-2**.
>
> **Measure 4.C-2: Endangered Species Act Compliance**. PVWMA will not deliver water for the purpose of converting any native lands to agriculture uses unless and until the project sponsor has complied with the Endangered Species Act and has determined that such conversion will not likely affect listed species or that appropriate mitigation has been provided. PVWMA intends to provide CVP water to existing irrigated agricultural lands. PVWMA currently is not proposing to provide any CVP water for M&I purposes, nor is it proposing to provide CVP water outside of the approximately 30,200 acres of agricultural lands shown in **Figure 4.C-2**. If PVWMA is the lead agency for development of water system improvements and construction or operation of those improvements or any other PVWMA actions that could adversely affect threatened or endangered species, PVWMA will consult with the appropriate resource agency (California Department of Fish and Game, US Fish and Wildlife Service, and/or National Marine Fisheries Service) pursuant to

all applicable laws, including CEQA and NEPA. PVWMA will implement project-specific mitigation measures and permit conditions as appropriate.

4.C.3.2 EFFECTS ON OTHER WATER USES/USERS

Impact 4.C-2: Under the BMP 2000 Alternative, PVWMA would pursue acquisition of CVP water through willing seller assignments and annual transfers. CVP contract assignment would not increase or alter current diversion characteristics for the CVP system. There is available capacity in the CVP/San Felipe Division reserved for PVWMA, thus the proposed importation of CVP water would not displace system capacity for other CVP users. It is expected that there would be no impacts to other CVP contractors and no change in CVP diversions that would impact other water users as a result of this project. Additional NEPA/CEQA analysis will be conducted for any CVP contract assignment and/or contracting with USBR for the reserved entitlement proposed by PVWMA.

Section 4.C.3.3, below, reviews potential environmental effects of contract assignment within a willing seller service area.

CVP System Capacity

As discussed in the Chapter 2, Project Description, CVP water would be made available to PVWMA through assignments and annual transfers. The water imported to the PVWMA service area would be made up of CVP water from the already approved Mercy Springs Water District contract assignment (6,250 afy) and potential future assignments and annual transfers through agreements with existing CVP contractors. The proposed Import Pipeline would link the Pajaro Valley with the Santa Clara Conduit of the San Felipe Division of the CVP. Water assigned from the Mercy Springs Water District and other future potential willing sellers would be diverted into the San Luis Reservoir from the Sacramento-San Joaquin River through the existing Delta Mendota Canal. Potential future delivery of water to Pajaro Valley was incorporated into the design of the San Felipe Division pumping and transmission facilities. The design capacity available to PVWMA in the Santa Clara Conduit is 75 cubic feet per second (PVWMA, 2000a). PVWMA anticipates that sufficient capacity exists in CVP facilities to accommodate proposed deliveries to the Pajaro Valley. Therefore the proposed importation of CVP water is not expected to affect other CVP contractors by displacing system capacity.

Contract Assignment Effect on Other Water Users

CVP contract assignments to PVWMA would not increase or alter CVP system water diversion characteristics. PVWMA would receive CVP water that is currently delivered to another CVP contractor and would be redirected to PVWMA. With no change to the CVP system water diversions, there would be no impact to other water users or to the Delta system as a result of the project. Additional NEPA/CEQA review and documentation will be conducted for each CVP

contract assignment proposed by PVWMA to address at a more detailed level the potential impacts to the willing seller agency and to the CVP system and other CVP users.

USBR-PVWMA Contract for Existing Entitlement

Once subsequent environmental documentation for the *Central Valley Project Improvement Act Final Programmatic Environmental Impact Statement* is complete and authority to contract has been restored to USBR, PVWMA intends to enter into contract negotiations with USBR for the existing entitlement of 19,900 afy. USBR cannot process any new contracts until the conditions in Section 3404(b) of the Central Valley Project Improvement Act (CVPIA) are satisfied. Once the authority to contract has been restored, USBR will notify PVWMA, and PVWMA will have two years from the date of notification to request a contract for the 19,900 afy.

The CVPIA amends previous authorizations of the CVP to include protection, restoration, and mitigation of fish and wildlife as project purposes with equal priority with irrigation and domestic water use, and fish and wildlife enhancement having equal priority with power generation. Implementation of the CVPIA was evaluated in the *Central Valley Project Improvement Act Final Programmatic Environmental Impact Statement*. The CVPIA Record of Decision indicates that insufficient information currently exists to allow implementation of new contracts (Section 3404[a]). Consequently, USBR is precluded from entering into new contracts until it conducts further NEPA analysis to consider the CVP-wide or site-specific effects of executing new contracts. Environmental evaluation of whether authorization of a contract between PVWMA and USBR for the 19,900 afy would affect diversions from the Delta or could adversely affect other water right holders must be deferred until PVWMA is able to pursue the contract, when/if that occurs.

4.C.3.3 EFFECTS WITHIN THE SERVICE AREAS OF WILLING SELLERS

PVWMA has already secured a CVP contract assignment from the Mercy Springs Water District (MSWD) for up to 6,260 acre-feet per year (afy) of water. USBR completed NEPA compliance on this action through preparation of the Environmental Assessment and Draft Finding of No Significant Impact - CVP Water Supply Contract Assignment from MSWD to PVWMA (EA/FONSI, April 1999) and approved the contract assignment to PVWMA. That EA/FONSI describes the environmental impacts that would result from CVP contract assignment. The EA/FONSI for this contract assignment is incorporated by reference and is available for review at PVWMA administrative offices.

Currently there are no other formal proposals to assign CVP water from a willing seller to PVWMA that can be evaluated in detail in this EIR. Additional NEPA/CEQA documentation will be completed in the future on each proposed contract assignment, tiering from this EIR. For purposes of providing disclosure of the potential effects of such contract assignments in this EIR, this section provides a summary of the types of impacts that could occur within a willing seller service area and potential mitigation strategies, based on findings of the EA/FONSI for the Mercy Springs Water District assignment as well as on other environmental review documents (see **Table 4.C.2**). There are potential significant environmental impacts that could occur within

TABLE 4.C-2
SUMMARY OF POTENTIAL IMPACTS WITHIN A WILLING SELLER SERVICE AREA ASSOCIATED WITH CVP CONTRACT ASSIGNMENT TO PVWMA

Impact Issue	Mitigation Strategy / Options
Increased use of groundwater ▪ could contribute to groundwater levels reductions and overdraft if there is insufficient sustainable yield to accommodate increased pumping ▪ could lower near-surface water table and move soluble salts away from crop root zone ▪ could concentrate salts and minerals in the groundwater	Groundwater pumping in accordance with applicable management plans. Land fallowing to reduce overall water demand.
Loss of source of good quality water that could be used to flush salts and prevent accumulation that will eventually degrade groundwater quality to a level that affects crop suitable and, ultimately the feasibility of agriculture.	Land fallowing to reduce salt load buildup. Shift in crop patterns to more salt tolerant plants.
Increased reuse of drainage water ▪ could reduce drainage water ▪ could reduce selenium concentrations through application to salt-tolerant grasses	Benefit
Crop changes to more salt tolerant plants, including grasses could attract nesting birds, which could be impacted by agricultural operations or build up of selenium in grass seed.	Bird hazing activities implemented in the spring. Mowing prior to grass maturation to prevent selenium accumulation in the seed.
Crop changes to more salt tolerant grasses could reduce application of agricultural chemicals, reducing water quality effects and the handling of hazardous materials.	Benefit
Expansion of cattle grazing operations that could compact and expose soils to wind and water erosion leading to air quality and water quality effects.	Implementation of livestock Best Management Practices including erosion control measures.

willing seller service agencies, but it is speculative to determine these now, beyond framing potential impacts based on other contract assignments that have been processed. Again, subsequent NEPA and CEQA analysis will be completed to address site-specific impacts of any proposed contract assignment.

REFERENCES – Change in Place of Use

California Department of Water Resources, 1997 Land Use Survey for Monterey and Santa Cruz Counties.

James M. Montgomery Consulting Engineers, Inc., Pajaro Valley Water Management and Augmentation Study, July 1990, pp. 3-6

California Center for Applied Research, *Pajaro Valley Water Augmentation Study Social Analysis Component*, May 1990, p. 36

California Center for Applied Research, *Pajaro Valley Water Augmentation Study Social Analysis Component*, May 1990

Association of Monterey Bay Area Governments, 1997 Regional Population Forecast for Monterey, San Benito, And Santa Cruz Counties Final Report, November 1997.

PVWMA, Basin Management Plan.

Santa Cruz County Planning Department, General Plan and Local Coastal Program Land Use Plan, adopted by the Board of Supervisors May 24, 1994.

EIP Associates, Final Program Environmental Impact Report, PVWMA Basin Management Plan, October, 1993.

Environmental Science Associates, CVP Water Supply Contract Assignment from Mercy Springs Water District to PVWMA (Contract No. 14-06-200-3365A), Final Environmental Assessment and Final Finding of no Significant Impact, November 6, 1998.

CH2MHill, Environmental Impact Report for the Consolidated and Conformed Place of Use, prepared for the State Water Resources Control Board.

Montgomery Watson, Technical Memorandum 2.2 for Subtask 6.2, PVIGSM Land Use and Agricultural Crop Mix, June 11, 1999.

Monterey County General Plan prepared in 1982 and amended periodically through 1996.

Monterey County 21st Century General Plan Update website: http://www.co.monterey.ca.us/gpu/

North County Area Plan, a part of the Monterey County General Plan adopted by the Board of Supervisors, July 2, 1985.

Watsonville 2005 General Plan, Adopted May 24, 1994.

This page left
intentionally blank

CHAPTER 5

LOCAL-ONLY ALTERNATIVE – ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION MEASURES

5.A WATER RECYCLING

5.A.1 LAND USE AND PLANNING

5.A.1.1 SETTING

Existing Land Uses and General Plan and Zoning Designations

The site of the proposed Recycled Water Facility at the WWTF is located within unincorporated Santa Cruz County. The predominant land use in the vicinity of the WWTF and the proposed Recycled Water Facility is agriculture, primarily fruit and vegetable croplands. The lands adjacent to the WWTF are considered *Prime Farmland*, specifically Type 3 agricultural lands, which are prime agricultural lands located within the Coastal Zone. The Recycled Water Facility is zoned "Commercial Agriculture" (CA).

The WWTF is designated as a Public Facility in the Santa Cruz County General Plan/Local Coastal Program. The Public Facility designation includes schools, fire stations, churches, hospitals, cemeteries, sanitary landfills, and water supply and treatment facilities. The Recycled Water Facility site is designated Agriculture in the Santa Cruz County General Plan/LCP.

The proposed Recycled Water Facility at the WWTF, the North Dunes Recharge Basin, and associated pipelines are within the City of Watsonville planning area, and they are designated Agriculture in the Land Use Diagram of the Watsonville 2005 General Plan. Lands designated as Agriculture are to be preserved for the production of food, fiber, flowers and other agricultural products, including the growing of crops and/or animal or poultry husbandry and grazing. The General Plan indicates that all lands that lie outside of the City's urban limit line, but within its planning area, are designated Agriculture, regardless of its size or actual use.

Sensitive Land Uses

The nearest sensitive land uses are residences located approximately 300 feet west-northwest of the proposed Recycled Water Facility site. Residences are also approximately 1,000 feet east of the proposed North Dunes Recharge Basin. The recycled and blended water would be applied to agricultural crops in the Coastal Zone.

Consistency with General Plan Policies and Zoning Designations

The water supply generated by the proposed Recycled Water Facility would be used to offset a portion of the irrigation demands in the coastal area during the irrigation season. This recycled water would support agriculture and would help to balance the groundwater basin. While the facility is not technically an agricultural use, it is intended to support long-term agricultural operations by supplying water for irrigation. As a result, it would be consistent with Goal 3.3 and Implementation Measure 3.F.4 of the Watsonville General Plan, as well as with Objective 5.8b, Programs C and H, Policy 5.13.6, Policy 5.13.17, and Program F of the Santa Cruz County General Plan/LCP's Conservation and Open Space Element. The Recycled Water Facility may be inconsistent with Policy 5.13.8 of the Santa Cruz County General Plan/LCP, which requires that agricultural support facilities be located off good agricultural soils, or on the perimeter of good agricultural soils. However, the proposed site is adjacent to the existing WWTF. The responsibility for determining consistency with general plan policies rests with the City of Watsonville and Santa Cruz County.

The proposed pipelines would not result in a long-term loss of agricultural land because they would be located underground, and farming as occurs at present would resume within the construction corridor following pipeline installation. Therefore, these facilities would be consistent with Policies 5.13.6 and 5.13.22 and Program F of the Santa Cruz County General Plan/LCP, and Goal 3.3, Policy 3.F, and Implementation Measures 3.F.1, 3.F.2, and 3.F.4 of the Watsonville General Plan.

The lands adjacent to the WWTF and at the North Dunes Recharge Basin site are zoned CA, Commercial Agriculture. The proposed facilities are not explicitly permitted uses within areas zoned CA. The principle permitted land uses within the CA zone are agricultural pursuits for the commercial cultivation of plant crops and the commercial raising of animals. In addition to these principally permitted uses, other uses are allowed for "dams, canals and aqueducts of any public water project" (Section 13.10.312 [b] of the Santa Cruz County Code). Although the proposed recycling facilities do not include a dam, canal or aqueduct, they are part of a public water project with the overall goal of expanding the available water supply, and thereby preserving and enhancing agriculture in the Pajaro Valley. The responsibility for making a conclusive determination of project consistency with zoning rests with the Santa Cruz County Planning Commission.

5.A.1.2 SIGNIFICANCE CRITERIA

See Section 4.A.1.2 for a discussion of significance criteria.

5.A.1.3 IMPACTS AND MITIGATION MEASURES

Impact 5.A.1-1: Construction of the proposed Recycled Water Facility and supplemental wells would result in short-term disturbance of adjacent land uses. Less than Significant.

Implementation of mitigation identified in this EIR, while not required, would assist in ensuring that the impact would remain at a less-than-significant level.

The proposed Recycled Water Facility would not alter surrounding land uses, and would not disrupt or divide the community. Construction disturbance related to pipelines could temporarily constrain access to adjacent farmlands along Panabaker Road, Beach Road and San Andreas Road by blocking roadways and driveways. However, this would be a temporary impact that results more in inconvenience to motorists than a substantial impact and, therefore, would not be expected to substantially impair agricultural operations. Typical pipeline construction activities would be expected to last approximately one week at any given location along the pipeline alignments. Mitigation measures are presented in Sections 5.A.6 (Traffic and Circulation), 5.A.7 (Air Quality), and 5.A.8 (Noise) would reduce the potential impacts of construction to nearby residents to less-than significant levels. Therefore, this impact would be considered less than significant.

Measure 5.A.1-1 (Recommended): Implement Measure 4.A.1-1.

See also mitigation measures in Sections 5.A.6, Traffic and Circulation, 5.A.7, Air Quality, and 5.A.8, Noise, of this EIR.

Impact 5.A.1-2: Implementation of the proposed Recycled Water Facility and the North Dunes Recharge Basin would result in the permanent conversion of up to 23.5 acres of Prime Farmland. Significant and Unavoidable.

The Local Only Alternative (LOA) would require a total of 2,200 acres of prime farmland to be fallowed. Construction of the proposed Recycled Water Facility at the WWTF, as a part of the LOA, would result in the conversion of approximately eight acres of Prime Farmland from agricultural use to water treatment and storage facilities, thereby precluding farming on the project site. Additionally, implementation of Mitigation Measure 5.A.3-4a in Section 5.A.3, Hydrology and Water Quality, would result in the conversion of an additional 11 acres of Prime Farmland near the WWTF for advanced water treatment facilities. Because all surrounding lands are considered Prime Farmland, no feasible alternative site is available that would reduce or avoid the conversion of Prime Farmland. Development of the site would therefore contribute to the cumulative loss of Prime Farmland in the region. This would be considered a significant impact.

Construction of the North Dunes Recharge Basin would result in the permanent loss of approximately 4.5 acres of Prime Farmland (3 acres for the side slopes of the basin, and 1.5 acres for the service road extending around the basin). The basin bottom (25 acres) would be available for farming during the summer and fall of each year for the life for the project. The total amount of Prime Farmland that would be permanently removed from agricultural production for the life of the project as a result of the Recycled Water Facility, the advanced water treatment facilities identified in Mitigation Measure 5.A.3-4a, and the North Dunes Recharge Basin is 23.5 acres.

The proposed pipelines would not result in a long-term loss of agricultural land because they would be located underground, and farming as occurs at present would resume within the construction corridor following pipeline installation.

Measure 5.A.1-2: None available; this impact would be significant and unavoidable.

5.A.2 GEOLOGY, SOILS, AND SEISMICITY

5.A.2.1 SETTING

Please refer to Section 3.2 for a discussion of regional geologic conditions, soils, and seismicity.

The area encompassing the Watsonville Wastewater Treatment Facility (WWTF) and the associated proposed project facilities and pipeline alignments is primarily low-lying, flat to gently sloping topography. To the north and south, the land slopes gently toward the river. The levees along the river provide the local topographic relief in the area.

Geology

The proposed project area includes young floodplain desposits adjacent to the Pajaro River, terrace deposits on the north side of Watsonville Slough and the eolian (sand) deposits that comprise the North Dunes recharge area. The area has deep alluvial soils comprised of younger (Holocene) floodplain deposits consisting of unconsolidated, relatively fine-grained, heterogeneous deposits of sand and silt and commonly including relatively thin, discontinuous layers of clay (Dupre and Tinsley, 1980). The Watsonville Slough and Pajaro floodplain contains locally abundant gravel deposits. The geologic materials have moderate porosity and permeability and the depth to the water table is generally less than 2 meters (m). **Table 5.A.2-1** summarizes geologic conditions, soil types, and seismic response at the locations of each component of the water recycling and storage components.

Soils

Tables 5.A.2-1 and **5.A.2-2** list the soils underlying the components of this project and their general characteristics. These are generally highly productive soils and almost entirely under cultivation. No part of the area is within a designated zone of mineral, aggregate, oil and gas, or geothermal resources.

Seismicity

Table 5.A.2-1 also summarizes seismic characteristics of the proposed project area. Earthquake groundshaking is the primary seismic hazard affecting the area. The entire area is expected to experience groundshaking intensity IX in a major earthquake (McCrory et al., 1977) and associated peak ground accelerations of 0.50g - 0.55g.[1] Floodplain deposits would tend to amplify ground movement to a greater extent than more consolidated terrace deposits. No part of the area with proposed project facilities lies within a tsunami hazard area.

[1] Please refer to **Table 3.2.2** in Section 3.2 for a description of the Modified Mercalli scale.

TABLE 5.A.2-1
SUMMARY OF GEOLOGIC CONDITIONS
WATER RECYCLING PROJECT COMPONENTS

Project Component	Underlying Geology	Overlying Soils[a]	Potential Groundshaking Amplification[b]	Liquefaction Potential[c]
Watsonville Wastewater Treatment Facility - Recycled Water Facility	Floodplain deposits with sand silt and gravel	Fluvaquentic Haploxeroll	High to Very high. Groundshaking amplification likely.	Moderate (MMI
Recycled Water Pipeline	Floodplain deposits, terrace deposits, eolian deposits with sand silt and gravel	Fluvaquentic Haploxeroll, Clear Lake Clay, Baywood Loam, Baywood Loamy sand, Elder Sandy Loam,	Moderate to high	High to very high in floodplain, Low on terrace deposits and eolian deposits
North Dune Extraction Wells	Eolian sand deposits	Elder sandy Loam	High	Low to Moderate
Pipeline from Harkins Slough recharge basin to North Dunes recharge basin.	Terrace and eolian deposits	Baywood Loam, Baywood Loamy sand, Elder Sandy Loam,	Moderate	Low

a Refer to Section 3.2 and **Table 5.A.2-2** in this section for further disacussion of soil types.
b Based on general geologic characteristics and the ability for the particular deposit to amplify groundshaking in an earthquke. For example, saturated loose sand would amplify the ground movement considerably more than bedrock.
c *Very High Liquefaction Susceptibility* – Sediments for which engineering testing and the presence of a shallow water table confirm the susceptibility for liquefaction in addition to historical evidence of liquefaction and failure during the 1906 earthquake. Sediments in this category are quite likely to liquefy and fail in an earthquake. *High Liquefaction Susceptibility* – Sediments for which engineering testing and the presence of a shallow water table suggests the susceptibility for liquefaction but no historical evidence of liquefaction has been reported. Sediments in this category are likely to liquefy in an earthquake. *Moderate Liquefaction Susceptibility* – Sediments may liquefy in the event of a nearby earthquake and include those with high susceptibility but where historical evidence of liquefaction is absent. *Low Liquefaction Susceptibility* – Sediments that are unlikely to liquefy, even in the event of a major earthquake.

According to the Division of Safety of Dams (DSOD) jurisdictional structures are artificial barriers, together with appurtenant works, that are 25 feet or more in height or have an impounding capacity of 50 acre-feet or more. Any artificial barrier not in excess of six feet in height, regardless of storage capacity, or that has a storage capacity not in excess of 15 acre-feet, regardless of height, is not considered jurisdictional (DSOD, 2001). Therefore, DSOD would have jurisdiction over the recharge basin proposed for the North Dunes area (but the Expanded College Lake project is a DSOD jurisdictional facility).

TABLE 5.A.2-2
SOILS IN THE WATSONVILLE WASTEWATER TREATMENT PLANT AREA AND ALONG PROPOSED FACILITIES

Soil	Slope	Capability Class	Storie Index	Erosion Hazard	Other
Conejo loam	0 - 2 %	I irrigated III nonirrigated	62	slight - moderate	
Clear Lake clay	0 - 2 %	II irrigated III nonirrigated	43	slight	high shrink-swell, low strength
Elder sandy loan	0 - 2%	I irrigated II nonirrigated	90	slight	
San Emidgio Variant sandy loam*	0 - 2%	I irrigated III nonirrigated	90	slight	
Fluvaquentic Haploxeroll-Aquic Xerofluvent complex	0 to 15%	III	30 - 69	slight	
Baywood Variant loamy sand	0 - 2%	III	51	slight	
Baywood loamy sand	0 - 2%	III	72	slight, subject to blowing	

SOURCE: *Soil Conservation Service, Soil Survey of Santa Cruz County, California, 1980

Regulatory Framework

Please refer to Section 3.2 for information regarding regulatory framework.

5.A.2.2 SIGNIFICANCE CRITERIA

Please see Section 4.A.2.2 for a discussion of significance criteria.

5.A.2.3 IMPACTS AND MITIGATION MEASURES

Impact 5.A.2-1: Seismic groundshaking and its secondary effects, including localized liquefaction and related ground failure from a major earthquake in the in Santa Cruz County or the Monterey Bay region, could cause structural damage to pipelines, diversion facilities, extraction pumps and recycled water system equipment. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Groundshaking is an unavoidable hazard for facilities in the San Francisco Bay and Monterey Bay region. The degree of hazard depends, in part, on the seismic hazards of the site and partly on the type of structure, its materials, and construction quality. Groundshaking at the Recycled Water Facility could cause structural damage to the facility structures or unsecured objects, such as equipment and machinery. Damage of the structural elements of the facility buildings (or to the machinery) from a seismic event could result in temporary cessation of facility operations. Because the recycled water pipelines are underground, structural damage to the actual pipe and pipe joints is expected to be less than damage to aboveground structures. The effects of groundshaking on specific soil types along the pipeline alignments would determine the behavior of the pipeline during an earthquake. Earthquake groundshaking likely will occur at some time over the life of the project and damage to some systems, as well as service disruptions, should be expected. This damage probably would consist of nonstructural and aesthetic damage considering the type of proposed components (pipelines, equipment), the nature of the underlying geology, and modern earthquake engineering design. Temporary service disruption would be anticipated to last between 24 and 72 hours while facility maintenance managers identify, isolate, and repair damaged or malfunctioning systems. Groundshaking hazards are unavoidable but through adequate mitigation, as discussed below, the risk of injury and loss of life due to an earthquake can be reduced to a less-than-significant level. The purpose of the mitigation is to reduce the potential for injury and the length of service interruptions during and after a seismic event.

> **Measure 5.A.2-1:** All facilities will comply with applicable policies and appropriate engineering investigation practices necessary to reduce the potential detrimental effects of groundshaking and liquefaction. Construction shall be in accordance with applicable City and County ordinances and policies regarding mitigation of seismic and geologic hazards, including applicable safety goals and policies presented in the Public Safety Element of the Santa Cruz County Plan. Appropriate geotechnical studies will be conducted using generally accepted and appropriate engineering techniques for determining the susceptibility of the sites to liquefiable soils and related ground failures. A licensed geotechnical engineer will prepare recommendations applicable to foundation design, earthwork, and site preparation prior to or during the project design phase. Recommendations will address mitigation of site-specific, adverse soil and bedrock conditions that could hinder development. Project engineers will implement these recommendations. Geotechnical design and design criteria will comply with applicable codes and requirements of the 1994 or 1997 UBC with California additions (CCR Title 24), applicable City construction and grading ordinances.

Impact 5.A.2-2: Proposed pipeline, diversion facilities and water filtration systems could incur damage as a result of underlying soil properties (subsidence, high shrink-swell potential, and corrosivity). Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The soil types at the Recycled Water Facility and along the pipeline route vary relative to the location. Each soil type in the project area possesses characteristics that could limit development of building structures or other facilities. These limitations include the shrink-swell capability (expansive behavior) and corrosivity. One or more of these soil properties could impact portions of the proposed project.

Soils with high potential for shrink-swell are found in various locations throughout the proposed project area (see **Table 5.A.2-2**). Soils that underlie each of the pipeline alignments exhibit expansive qualities to depths of up to five feet below the surface. Shrink-swell behavior in soils could adversely impact subsurface pipelines buried up to five feet below the surface and foundations of above ground facilities.

Unless properly mitigated, shrink-swell soils could exert additional pressures on below-grade facilities, producing shrinkage cracks that allow water infiltration and compromise the integrity of backfill material. Depending on the depth of buried pipelines, soil in expansion or contraction could lead to undue lateral pipeline stress and stress of structural joints. Lateral stresses could, over time, lead to pipeline rupture or leaks in the coupling joints. Shrinkage cracks could form in native soils adjacent to the pipeline trench or in backfill material if expansive soils are used. If shrinkage cracks extend to sufficient depths, groundwater can infiltrate into the trench, causing piping (progressive erosion of soil particles along flow paths) or settlement failure of the backfill materials. Settlement failure can also occur if expansive soils are used in backfill and undergo continued expansion and contraction. Over time these soils could settle, resulting in misalignment or damage to buried facilities.

The effects of shrink-swell soils could damage foundations of aboveground structures, paved service roads, and concrete slabs. Surface structures with foundations constructed in expansive soils would experience expansion and contraction depending on the season and the amount of surface water infiltration. The expansion and contraction could exert enough pressure on the structures to result in cracking, settlement, and uplift.

The conductivity of soils may be high enough in the project area to corrode underground metal pipes and electrical conduits. Over time, pipe corrosion could lead to pipeline failure, resulting in localized surface flooding of water or localized settlement of surface soils in the location of the failure. Failed subsurface electrical conduits could result in electrical short-circuiting. This would reduce power temporarily to the facility and possibly result in temporary shutdown of operations.

> **Measure 5.A.2-2:** All diversion and pipeline facilities will comply with applicable policies and appropriate engineering investigation practices necessary to reduce the potential detrimental effects of expansive soils, and corrosivity. Appropriate geotechnical

studies will be conducted using generally accepted and appropriate engineering techniques for determining the susceptibility of the sites to unstable, weak or corrosive soils. A licensed geotechnical engineer will prepare recommendations applicable to foundation design, earthwork, and site preparation prior to or during the project design phase. Recommendations will address mitigation of site-specific, adverse soil and bedrock conditions that could hinder development. Project engineers will implement the recommendations. Geotechnical design and design criteria will comply with applicable codes and requirements of the 1994 or 1997 UBC with California additions (CCR Title 24), applicable City construction and grading ordinances.

Impact 5.A.2-3: Construction of the proposed facilities could result in accelerated erosion and attendant loss of soil resources and effects on sediment discharges in water courses. The impact would be significant on slopes over two percent and in areas with soils having moderate or greater erosion hazard. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The Recycled Water Facility and pipelines would be in flat areas or areas with soils having low erosion hazard. However, the operation of construction equipment and vehicles, trench excavation, and soil stockpiling would expose loose soils to erosion if construction occurs in the rainy season. Soils exposed by construction operations have a tendency to be dislodged and transported by rain, surface watering, or temporary construction discharges. Soil erosion and loss of topsoil during a large construction project that extends over several months can be significant and result in project delays due to required soil restabilization, regrading, and soil removal from drainage structures.

Measure 5.A.2-3a: All grading and construction will conform to requirements of the Santa Cruz County Grading Ordinance.

Measure 5.A.2-3b: Site grading and construction work areas will expose as little new ground surface as possible. Vegetation cover should be left intact to the extent practical.

Measure 5.A.2-3c: To the extent possible, grading activities in noncropped areas will be limited to the period between April 15 and October 15. If dry conditions persist after October 15, one-week extensions of grading activities will be obtained from the County Public Works Department. In areas where the soil is tilled, grading activities will be coordinated with the local farmers to ensure consistency between their erosion control and farming practices and construction disturbance.

Measure 5.A.2-3d: Implement best construction practices at all grading sites, regardless of soil erodibility hazard.

Measure 5.A.2-3e: Upon completion of construction at all sites, loose soils shall be removed or spread and all areas shall be re-soiled and reseeded to ensure that a stable soil cover will remain.

Measure 5.A.2-3f: PVWMA will prepare and implement an inspection and maintenance program for the right-of-way and all facility sites. The plan will include routine inspection

plans and reporting, and prescriptive methods for correcting erosion or soil instability problems.

REFERENCES – Geology, Soils and Seismicity

Dupre and Tinsley, 1980.

McCrory et al., 1977.

U.S. Department of Agriculture, Soil Conservation Service, Soil Survey of Santa Cruz County, California, 1980.

5.A.3 HYDROLOGY AND WATER QUALITY

5.A.3.1 SETTING

Overview

This alternative would be similar to the Water Recycling project component under the BMP 2000 Alternative presented in Section 4.A.3, except that the proposed Recycled Water Facility would operate year-round (as opposed to during the irrigation season only). During the nonirrigation season, the recycled water would be percolated to the shallow groundwater aquifer via the Harkins Slough recharge basin and a new North Dunes recharge basin for storage and subsequent recovery via new extraction wells during the subsequent irrigation season.

The other key difference between this element and the BMP 2000 Alternative is that no blending is proposed to maintain total dissolved solids (TDS) levels at or below 500 milligrams per liter (mg/L) during low-demand periods. When agricultural demand is high, blending would be achieved at the Recycled Water Facility and additional water would be added to meet the demand, which would consequently lower TDS levels. In terms of hydrology and water quality, the key differences between this alternative and the BMP 2000 Alternative analyzed in Section 4.A.3 are the quality of the irrigation water and the percolation of recycled water into the shallow aquifer. This section focuses on these issues. Please refer to Section 3.3 for information on the regional setting and overall regulatory context associated with the water recycling component of the Local-Only Alternative.

Regulatory Setting

California Department of Health Services (DHS)

The Regional Water Quality Control Board (RWQCB) would be responsible for issuing Waste Discharge Requirements (WDRs) for the proposed percolation of recycled water (see Section 3.3 for additional detail); however, the DHS also would be consulted to assure the protection of public health. The DHS issued draft regulations regarding the recharge of groundwater with recycled water in April 2001.[1] The key relevant portions of these regulations are presented below.

- All recycled water shall be from a wastewater collection system operating under a comprehensive industrial pretreatment and pollutant source control program, approved by the RWQCB for the control of discharge of toxic wastes from point sources.
- The wastewater must be filtered, disinfected tertiary recycled water.

[1] To see the complete text of these draft regulations, please refer to: http://www.dhs.ca.gov/ps/ddwem/publications/regulations/recycleregs_/index.htm

- For a surface spreading project, the applied recycled water shall be retained underground for a minimum of six months prior to extraction for use as a drinking water supply, and shall not be extracted within 500 feet of a point of recharge.

- Total nitrogen concentration of the recycled water shall not exceed "X" mg/L ("X" has not yet been defined, but could be anywhere from 1 to 10 in the final criteria).

- The recycled water shall be in compliance with primary and secondary maximum contaminant levels.

- The total organic carbon of the filtered wastewater shall not exceed 16 mg/L for more than two consecutive days.

- The average Recycled Water Contribution[2] shall not exceed 0.50.

Numerous other requirements relating to monitoring, reporting, and compliance procedures are described in the regulations and related statutes, adopted June 2001, and contained in the publication titled *California Health Laws Related To Recycled Water (The Purple Book)*. The Purple Book contains excerpts from the California Health and Safety Code, Water Code, and Titles 22 and 17 of the California Code of Regulations.

State Water Resource Control Board (SWRCB)

Resolution 68-16 of the SWRCB addresses maintenance of water quality in California, and states:

> Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.

This Antidegradation Policy has been the policy of California since 1968 and is a critical regulatory constraint of the RWQCB that is likely to regulate the quality of water stored in the groundwater basin. This in turn will impact the degree of treatment that may have to be provided to any water stored in the groundwater basin.

5.A.3.2 SIGNIFICANCE CRITERIA

Please refer to Section 4.A.3.2 for a discussion of significance criteria.

2 The Recycled Water Contribution is the fraction of the total recharge water that is of recycled water origin.

5.A.3.3 IMPACTS AND MITIGATION MEASURES

Impact 5.A.3-1: Construction of proposed water recycling facilities and associated pipelines could result in increased erosion and subsequent sedimentation, with adverse impacts to water quality. Additionally, release of fuels or other hazardous materials associated with construction activities could degrade water quality. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

As discussed in greater detail under Impact 4.A.3-1, construction activities could have a significant adverse effect on water quality; thus, a Storm Water Pollution Prevention Plan (SWPPP) would be required for the treatment facility, pipelines, and the proposed North Dunes recharge basin. Construction activities capable of impacting erosion rates and water quality include excavation dewatering, and soil stockpiling. Excavation dewatering can produce high volumes of water containing silts that when introduced to surface water bodies or storm drain systems, can cause excessive sedimentation and high turbidity. Runoff from stockpiled soils can increase sediment loads in stormwater discharges that increase sedimentation and impact surface water quality.

> **Measure 5.A.3-1a:** Refer to Measure 4.A.3-1 regarding implementation of the SWPPP.
>
> **Measure 5.A.1-1b:** Refer to Vegetation and Wildlife section, Measures 4.A.4-1a, 4.A.4-1b, and 4.A.4-1c regarding pipeline construction within potentially jurisdictional wetlands/waters of the U.S. and streambeds and at the Pajaro River.

Impact 5.A.3-2: Irrigation with recycled water could affect crop yields and result in a degradation of surface or groundwater quality. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The discussion of this impact presented under Impact 4.A.3-2 also applies to this alternative. An additional impact to agricultural operations from the quality of the recycled water would be expected as a result of this alternative because, as proposed, no blending would occur during the early and late portions of the irrigation season, when agricultural demand is equal to or less than the available supply of recycled water. This would result in an irrigation water supply consisting of 100 percent recycled water during these portions of the irrigation season. Additional water would be added to the Coastal Distribution System only when the irrigation demand exceeded the available supply of recycled water; the additional water added would be from local wells, which would result in an overall reduction in the TDS of the applied irrigation water. Considering that the recycled water would have a TDS level of approximately 900 mg/L, and that adverse impacts on the yields of sensitive crops would be expected during the periods when the TDS of the irrigation supply was over 500 mg/L, this would be considered a significant impact. Mitigation of this impact could only occur through a substantial redesign of the project, including additional treatment such as reverse osmosis.

Agricultural irrigation with recycled water is discussed under Impact 4.A.3-2; management of the system in accordance with Title 22 requirements would reduce other potential water quality impacts to a less-than-significant level.

> **Measure 5.A.3-2a:** Above-ground irrigation systems shall be operated in accordance with the requirements of Title 22 of the California Code of Regulations and any reclamation permits issued by the RWQCB, Central Coast Region. Title 22 typically requires that irrigation rates match the evapotranspiration rates of the plants or crops being irrigated, and that application of recycled water be prohibited within 50 feet of creeks or wells.
>
> **Measure 5.A.3-2b:** Implement the advanced recycled water treatment processes described in Measure 5.4.3-4.

Impact 5.A.3-3: Development at the project site may expose people and structures to flood hazards. Less than Significant with Mitigation.

The additions to the Watsonville Wastewater Treatment Facility site and the associated pipelines are within the Federal Emergency Management Agency's (FEMA) 100-year flood hazard zone for the Pajaro River; as such, floodproofing of the facilities would be required. Placing the facilities within the 100-year floodplain would not be expected to exacerbate downstream flood conditions because of the proximity of the site to the ocean.

The following mitigation measure would be required to reduce this potential impact to a less-than-significant level.

> **Measure 5.A.3-3:** The facilities shall be designed to comply with FEMA and County of Santa Cruz requirements to floodproof the facilities and not increase upstream or downstream flood hazards.

Impact 5.A.3-4: As proposed, groundwater recharge with recycled water would degrade water quality. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

As proposed, the Recycled Water Facility would operate year-round and, during periods of low or no irrigation demand, the recycled water would be routed to recharge basins for percolation to the local shallow aquifer for later retrieval. This action would not comply with DHS policy standards, as described in the draft regulations (see Section 5.A.3.1). Although the aquifer where the recharge basins would be sited is perched, shallow, and of poor quality (and therefore not used as a source of potable water supply), it is assumed that DHS and RWQCB rules and regulations would still apply.

According to Title 22, Section 60320, DHS would provide recommendations to the RWQCB during the permitting process to ensure that a proposed project fully protects public health. The draft regulations would form the basis of DHS recommendations; these recommendations from DHS would likely be at least as stringent as the draft regulations (Setoodeh, 2001). Specifically, the project as proposed would exceed the following parameters:

- TDS of the recycled water, at 900 mg/L, would degrade the salinity of the existing groundwater basin, thereby violating California's "Antidegradation Policy."
- The total nitrogen in the wastewater is approximately 28 mg/L, while the maximum allowable would be 10 mg/L.
- As proposed, the recharge water would be 100 percent recycled water, while the DHS regulations limit the recharge water to 50 percent recycled water and 50 percent other water.

As described in the significance criteria (Section 4.A.3.2), the violation of any water quality standard would be considered a significant impact. Because the proposed action would violate several water quality standards, the impact to water quality would be considered a significant impact.

In addition, this alternative would result in the delivery of irrigation water with a TDS of up to 900 mg/L, which, together with other water quality parameters, could adversely affect crop yields (please refer to the discussion under Impact 5.A.3.2).

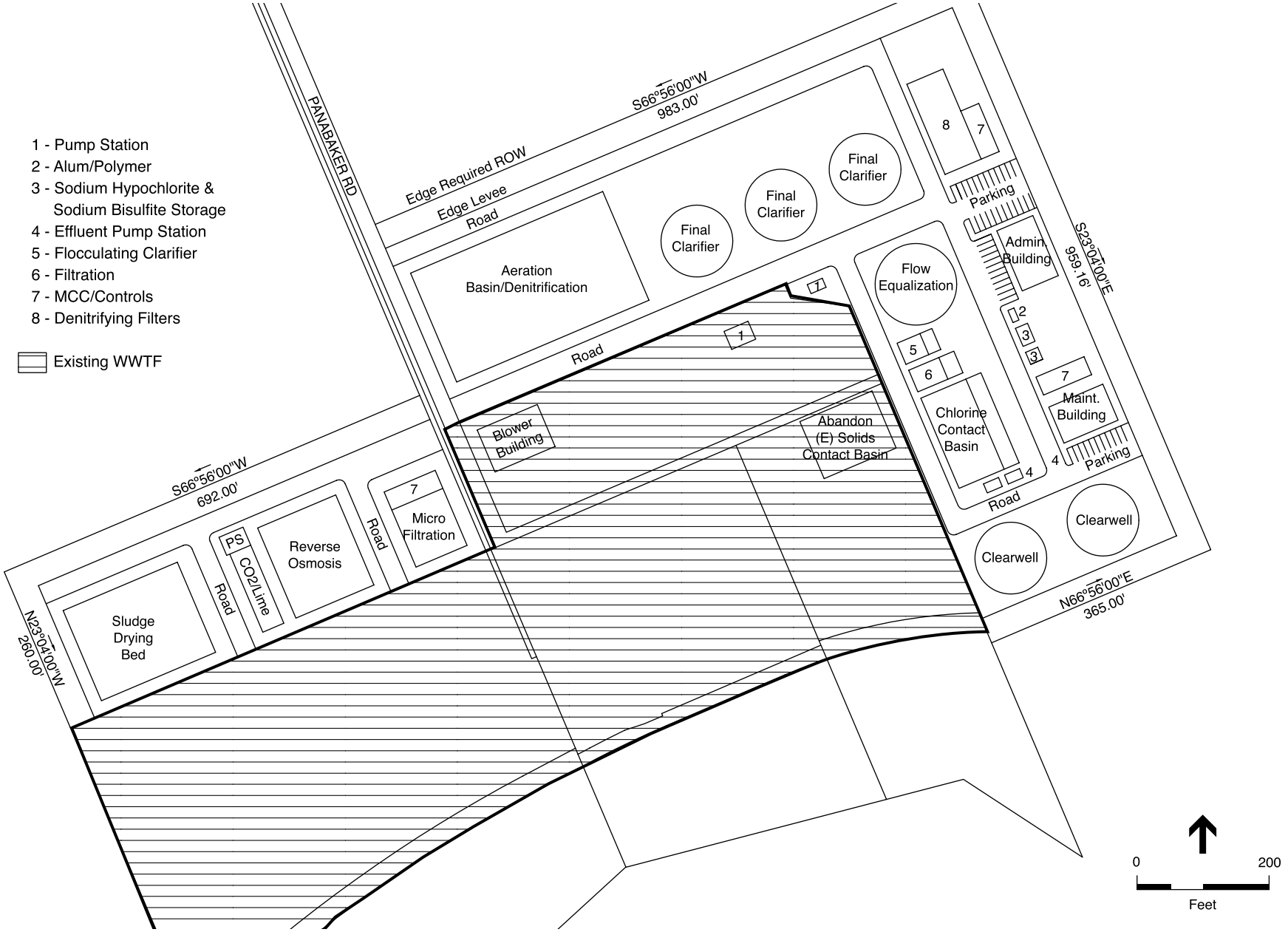
The proposed action would increase the volume of groundwater in storage and thus, in terms of groundwater quantity, would be a beneficial impact.

Measure 5.A.3-4a: PVWMA and the City of Watsonville will implement additional advanced treatment processes at the Recycled Water Facility to avoid significant impacts to water quality. In addition to the proposed Title 22 treatment facilities (described in Section 2.3.2), the following processes would be required to maintain compliance with DHS recommendations and SWRCB requirements:

- *Biological Nutrient Removal (BNR)*. This process would reduce the total nitrogen concentration in the recycled water to an allowable level, and would involve the construction of a new activated sludge tank, clarifiers, denitrifying filters, and other ancillary facilities.
- *Reverse Osmosis (RO)*. RO would be required to reduce the salinity of the recycled water in order to prevent the degradation of existing groundwater quality. Microfiltration would also be necessary as part of the RO treatment process.

A preliminary site plan for these additional unit processes is presented in **Figure 5.A.3-1**.

Measure 5.A.3-4b: In addition to these advanced treatment components, the PVWMA and City of Watsonville shall locate an additional source of water supply to allow for the blending of recycled water with other (ambient) water in order to achieve a maximum of 50 percent recycled water in the water applied for groundwater recharge. This



SOURCE: RMC Engineering

PVWMA Revised BMP EIR / 200179 ■

Figure 5.A.3-1

Conceptual Site Plan-title 22 plus
Groundwater Recharge Treatment Facilities

supplemental source of water has not yet been identified, but likely would be from local groundwater, which would require the installation of new wells and associated pipelines; alternatively, other sources of supply could be located, including the Harkins Slough and College Lake projects.

Measure 5.A.3-4c: If this alternative were selected for implementation, it is recommended that the goal of a maximum of 500 mg/L TDS be maintained at all times (refer to the discussion under Impact 5.A.3-2). This could be accomplished by routing a portion of the recycled water through the RO process so that the delivered irrigation water would have a TDS level less than or equal to 500 mg/L. Alternatively, the recycled water could be blended with other (ambient) water during low irrigation demand periods; this other water would need to be located to provide a source of blending water for groundwater recharge, as described above.

If the PVWMA and City of Watsonville were to implement the additional advanced treatment processes described above (BNR and RO), additional environmental impacts would be expected to result from these actions, as outlined below:

- *Additional Loss of Prime Farmland*. As proposed, the treatment facilities needed to meet Title 22 requirements would result in the loss of approximately eight acres of prime farmland in the vicinity of the WWTF; by implementing the mitigation measures described above (BNR and RO processes), an additional 11.1 acres of prime farmland would be lost, for a total of approximately 19.1 acres. This additional loss of prime farmland would be a significant and unavoidable result of implementing these additional treatment processes.

- *RO Reject Brine Disposal*. The RO process produces a reject stream that contains concentrated levels of salts and other materials removed from the recycled water. This reject brine would be discharged to the Pacific Ocean through the existing outfall. Further study would be necessary to determine whether significant impacts to water quality or marine life would occur from this discharge, and whether the outfall diffusers and/or effluent pump station would need to be modified to preserve outfall performance and prevent marine encrustation of the outfall.

- *Additional Energy and Chemical Consumption*. Both the RO process and the BNR process would require the consumption of electrical energy and chemicals.

- *Identification of Supplemental Water Supply for Blending*. In order to maintain compliance with DHS recommendations and water quality goals for irrigation supply, an additional source of ambient water supply would need to be located. The likely source of this supply would be either local groundwater or through a reconfiguration of other local projects.

- *More Adverse Visual Quality Impacts*. The additional advanced treatment facilities would have a greater visual impact on this largely agricultural area.

PVWMA has not committed to implementing these measures. If Measure 5.A.3-4a is implemented, additional environmental review would be required.

Impact 5.A.3-5: Construction activities associated with the conveyance pipelines included in this Alternative could potentially compromise the structural integrity or water quality of active agricultural, production, or domestic wells located within proposed pipeline alignments. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Excavation, soil stockpiling activities, or construction equipment associated with pipeline construction may damage production, agricultural or domestic supply well structures, especially sanitary seals of wells or disturb well mounts, pump equipment, piping systems or enclosures. Certain damage that would expose the well casing could lead to the introduction of contaminants such as sediments or chemicals into the groundwater. Damage to the well system, pump equipment, piping or enclosures could temporarily stop proper well operation and interrupt water delivery.

> **Measure 5.B.3-5a:** Implement measures to ensure that construction activities do not damage existing wells. Wells shall be capped in an appropriate manner to prevent soil and other contaminants from entering groundwater aquifers.
>
> **Measure 5.B.3-5b:** PVWMA or its contractor shall correct any damage to wells and/or reimburse well owners for any loss of use of the well during construction.

Impact 5.A.3-6: Operation of the Recycled Water Facility would reduce the volume of treated wastewater discharged to the Pacific Ocean. Beneficial.

Operation of the Recycled Water Facility would result in the reclamation of approximately 7,700 acre-feet per year (afy) of wastewater that would otherwise be discharged to the nearshore waters of the Pacific Ocean via the City of Watsonville's 7,350-foot outfall/diffuser system. This would essentially eliminate the discharge, except during emergency and routine maintenance conditions. This would have a beneficial effect on ocean water quality.

> **Mitigation:** None required or recommended.

REFERENCES – Hydrology and Water Quality

California Department of Health Services, *Draft Groundwater Recharge Reuse Regulations*, April 23, 2001.

Setoodeh, Steve, DHS District Engineer, Monterey District Office, personal communication, August 3, 2001

State Water Resources Control Board, *Resolution No. 68-16, Statement of Policy with Respect to Maintaining High Quality Waters in California*, October 1968.

5.A.4 VEGETATION, FISH, AND WILDLIFE

5.A.4.1 SETTING

Please refer to Section 3.4 for a description of methods used during investigation of the project area for biological resources.

The Recycled Water Facility at the WWTF would be located in an agricultural area. The pipeline connecting the Recycled Water Facility to the Harkins Slough area, the North Dunes Recharge Basin and pipeline connecting to the Harkins Slough Basin would be along existing roads or in agricultural areas.

A number of common wildlife species were observed in the vicinity of the WWTF, including gulls, blackbirds and sparrows. In the nearby riparian forest of the Pajaro River, there were a large number and variety of birds, including Wilson's warblers, Swainson's thrushes, California towhees, robins, and chestnut-backed chickadees. Nesting surveys found the yellow warbler, a species of concern, and raptors are also present in the project area. In addition, the California red-legged frog and western pond turtle are likely to be present in the Pajaro River.

The pipeline from Recycled Water Facility to the Harkins Slough facility would run primarily along roads that pass through agricultural fields; the segment along the San Andreas would cross Watsonville Slough. The agricultural areas provide only very low quality wildlife habitat, and Watsonville Slough is confined to a narrow channel where it would be crossed by the alignment.

An agricultural drainage ditch runs along the northwest side of Beach Road and may potentially be considered a jurisdictional wetlands/waters of the U.S. due to the fact that wetland indicator species, including common horsetail (*Equisetum arvense*) and cattail (*Typha latifolia*) were observed growing within and along its banks. There are no intact native communities remaining in the area of the Watsonville Slough alignment crossing. Riparian vegetation along the slough includes eucalyptus (*Eucalyptus globulus*) and degraded willow riparian scrub, with an understory that includes stinging nettle and an assortment of non-native species, such as hemlock (*Conium maculatum*) and cape ivy (*Delairia odorata*). The vicinity of the proposed North Dunes Recharge Basin consists of agricultural fields and farm roads; no sensitive biological resources are present.

South-central California coast steelhead pass through this portion of the Pajaro River en route to spawning areas farther upstream in the Salsipuedes Creek and upper Pajaro River watersheds. Further downstream, the Pajaro Lagoon supports a population of the federally endangered tidewater goby[1]. While both species may access the lower portion of Watsonville Slough, they are not present in the vicinity of the Harkins Slough Filtration Facility or the pipeline crossing of

[1] Tidewater goby populations north of Orange County have been proposed for delisting by the U.S. Fish and Wildlife Service (USFWS) because more recent data collected on the species suggests that the original listing rule overestimated the species' risk of extinction (Federal Register, 1999).

Watsonville Slough. Tide gates located at Shell Road preclude these species from reaching the confluence of Harkins and Watsonville sloughs.

5.A.4.2 SIGNIFICANCE CRITERIA

Please refer to Section 4.A.4.2 for discussion of significance criteria.

5.A.4.3 IMPACTS AND MITIGATION MEASURES

The proposed pipeline from the Recycled Water Facility to the existing pipeline near the Harkins Slough facilities would cross Watsonville Slough. For the purposes of analyzing this impact, bore and jack construction to cross the Slough is assumed. Permanent loss of wetlands is not anticipated.

Pipeline construction would also modify or eliminate agricultural drainage ditches along Beach and San Andreas roads, potentially affecting red-legged frog migration habitat. Mitigation measures for the red-legged frog given below (under Measure 5.A.4-2c) shall be implemented for this construction segment where applicable.

Impact 5.A.4-1: Construction of the proposed pipeline component could result in temporary impacts to up to 0.6 acre of potentially jurisdictional wetlands/waters of the U.S. and streambeds and banks under the jurisdiction of the Department of Fish and Game at the Watsonville Slough crossing along San Andreas Road. Potential impacts could occur due to sedimentation of the channels outside of the construction area during trenching activities, and loss of riparian vegetation and stream function as wildlife and fishery habitat. Significant. With mitigation identified in the EIR, the impact would be reduced to a less-than-significant level.

> **Measure 5.A.4-1a--Wetlands Avoidance:** Wetlands at the crossing of Watsonville Slough would be avoided entirely by using bore and jack construction. If complete avoidance is not feasible, Measures 4.A.4-1b and 4.A.4-1b should be adopted.

Impact 5.A.4-2: Construction of facilities at the Watsonville Slough crossing near San Andreas Road would result in temporary impacts to up to 0.6 acre of habitat for special status animal species. Impacts could occur due to risk of increased sedimentation in streams, dewatering of pools, habitat loss through vegetation removal, and construction disturbance. Significant. With mitigation identified in this EIR, the impact would be reduced to less than significant.

The special status animal species that have the potential to occur near this project include:

- California red-legged frog (federal Threatened and California Species of Special Concern; Critical Habitat designation);

- Western pond turtle (federal Species of Concern and California Species of Special Concern).

Habitat for these species may be present in Watsonville Slough. Construction in this area would result in loss of approximately 0.6 acre of potential habitat for these special status species.

> **Measure 5.A.4-2a--Avoidance of Habitat:** Disturbance of sensitive species habitat within Watsonville Slough may be avoided using jack and bore construction methods.
>
> If the bore and jack method is feasible, implement Measure 4.A.4-2b.
>
> If complete avoidance is infeasible, implement Measures 4.A.4-2d (portions related to California red-legged frog) and 4.A.4-2f.

REFERENCES – Vegetation, Fish, and Wildlife

Federal Register, *Endangered and Threatened Wildlife and Plants; Proposed Rule to Remove the Northern Population of the Tidewater Goby from the List of Endangered and Threatened Wildlife*, Vol. 64, No. 121, June 24, 1999.

U.S. Fish and Wildlife Service (USFWS), *Programmatic Formal Endangered Species Act Consultation on Issuance of Permits under Section 404 of the Clean Water Act or Authorizations under the Nationwide Permit Program for Projects that May Affect the California Red-legged Frog*, Letter to U.S. Army Corps of Engineers district offices, dated January 26, 1999.

5.A.5 CULTURAL RESOURCES

5.A.5.1 SETTING

Archaeology of the Project Area

Section 3.5 provides archaeological/prehistoric data on the project area. Archaeological surveys of the area around the Watsonville Wastewater Treatment Facility (WWTF) and supplemental wells were conducted by Pacific Legacy in November 1997 and March 1999. A cultural resources records search for the North Dunes Recharge Basin site was conducted by the Anthropological Studies Center at Sonoma State University in September 2001. No cultural resources were identified or recorded near these sites. However, based on surveys completed in the general project area, construction activities could reveal presently unknown cultural resource sites.

Ethnography of the Project Area

Section 3.5 provides ethnographical data on the project area.

Historical Overview

Section 3.5 provides an historical overview of the project area.

5.A.5.2 SIGNIFICANCE CRITERIA

See Section 4.A.5.2 for a discussion of significance criteria.

5.A.5.3 IMPACTS AND MITIGATION MEASURES

Impact 5.A.5-1: Ground-disturbing activities associated with the proposed Recycled Water Facility, the North Dunes Recharge Basin, and associated pipelines could reveal unknown buried or otherwise obscured prehistoric and historic cultural resources. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Significant unknown cultural resources may be buried or obscured by vegetation on the project site, and therefore construction of the proposed project could result in degradation and destruction of undiscovered cultural resources.

Measure 5.A.5-1: Implement Measure 4.A.5-1.

5.A.6 TRAFFIC AND CIRCULATION

5.A.6.1 SETTING

Project Area Roadways

Figure 3.6.1 in Section 3.6 depicts roadways in the project area. *Highway 1* (Cabrillo Highway) provides coastal access through the project area, providing connection to the Cities of Watsonville and Santa Cruz to the north, and Monterey and other central coast destinations to the south. In the project area, Highway 1 is a four-lane divided freeway to approximately one mile south of the Santa Cruz - Monterey county line, where it narrows to two lanes. The maximum posted speed limit on Highway 1 in the project area ranges from 55 to 65 mph.

Beach Road, a two-lane roadway, extends west from Highway 1 to Palm Beach, north of the project area. Vehicles traveling to and from the WWTF could access the plant's entry road from West Beach Road via *Panabaker Road*, a two-lane roadway terminating at the WWTF.

San Andreas Road, a two-lane roadway, follows north from Beach Road, and is designated as a Coast Bike Route.

Existing Truck Traffic on Roadways

Section 3.6 presents existing truck traffic on study area roadways.

Accident History

Section 3.6 presents an accident history for study area roadways.

Roadway Improvement Projects

Section 3.6 describes roadway improvement projects planned in the study area.

Applicable Plans and Policies

Section 3.6 presents applicable plans and policies for jurisdictions in the study area.

5.A.6.2 SIGNIFICANCE CRITERIA

See Section 4.A.6.2 for a discussion of significance criteria.

5.A.6.3 IMPACTS AND MITIGATION MEASURES

Construction Trip Generation

Construction activities that would generate traffic would consist of trucks hauling equipment and materials to the WWTF site and associated pipeline alignments, the hauling of excavated spoils

from, and delivery of materials and backfill to the work sites, and the daily arrival and departure of construction workers to the work sites. Construction truck trips associated with the construction of the tertiary treatment facilities under the Local-Only Alternative would be similar to that estimated in Construction Trip Generation in Section 4.A.6 (the traffic impact section for the Local-Impact Alternative).

In addition, the Local-Only Alternative would involve construction of an additional recharge basin, construction of a 36-inch, 8,300-foot pipeline from the WWTF to the Harkins Slough area, and construction of a 5,800-foot-long pipeline between the recharge basins. The construction of the North Dunes Recharge Basin would require an estimated 26,000 cubic yards of material to be hauled off site. During peak excavation periods, up to 10 round-trips per hour could occur as spoils are trucked off-site for disposal. In addition, construction workers would be commuting to and from the project sites, most likely in personal automobiles or small trucks. An estimated 10 workers would be expected to commute to and from the recharge basin site on a daily basis during construction.

Figure 2.9 depicts the alignments of the proposed pipeline from the WWTF to Harkins Slough and from the Harkins Slough Recharge Basin to the North Dune Recharge Basin. The majority of the proposed alignment follows open areas, where conventional excavation methods would be used for open-cut pipeline installation. The following assumptions were made as a conservative estimate of construction impacts from the proposed pipeline installation: a trench five feet wide by nine feet deep, new fill replacing excavated soil, an average of 100 feet of pipe laid per work day, an average truck haul load of 10 cubic yards per truck, and no backhauling. Using these assumptions, it is estimated approximately 170 cubic yards would be excavated per day, with approximately the same amount of new fill imported. This would amount to up to approximately 34 daily truck haul round trips (68 one-way trips).

The number of workers at any one location along the pipeline alignment would vary depending upon location and the specific type of construction activity proposed. Based on estimates of workforce per task, there would be approximately six to ten workers per crew on an average day. Assuming that each worker would travel in his own vehicle to and from the site, and that some midday trips would occur, this would result in up to about 15 worker vehicle round trips per day (30 one-way trips). Accounting for construction material delivery and worker trips, there would likely be a total of less than 60 round trips (120 one-way trips) occurring per day at a typical construction spread.

Construction Trip Distribution

The specific destination(s) for excavated materials hauled from the construction areas is currently unknown, as is the originating location(s) for delivery of imported fill and other materials. However, a number of construction materials sources (e.g., quarries, manufacturers) and excess soil re-use options (e.g., farms) are located in the surrounding rural areas and urban centers. Construction worker trips are assumed to originate from the major urban areas in the project region and nearby communities.

Based on the existing roadway network serving the project area, it is assumed project trucks and construction workers traveling to and from the alignment primarily would use a combination of highways (e.g., Highway 1), county roads and designated truck routes in the project vicinity to reach other local points and/or regional locations.

Impact 5.A.6-1: Traffic on area roadways would temporarily increase as a result of project-generated vehicle trips by construction workers and construction vehicular activities. Less than Significant. Implementation of mitigation identified in this EIR, while not required, would assist in ensuring that the impact would remain at a less-than-significant level.

Because construction-traffic generated by the project would be temporary, it would not result in any long-term degradation in operating conditions or level of service for any project-area roadways. The primary off-site impacts from the movement of construction trucks would include short-term and intermittent lessening of roadway capacities due to slower movements and larger turning radii of the trucks compared to passenger vehicles.

The project would temporarily increase traffic on roadways providing access to the work sites and roadways providing connection to regional routes; this would mainly affect Highway 1 via Beach Road and San Andreas Road. Although the specific estimated off-site construction vehicle trips are preliminary, (see Construction Trip Generation, above), given the expected type and scope of facility and pipeline construction, construction-generated traffic would be expected to be at a level that would not significantly disrupt traffic flow on these freeways and arterials. Given the pace of construction, the duration that haul trucks would be required to use any given local roadway would be relatively brief.

Most project-related hauling and deliveries would be expected to be dispersed throughout the day, thus lessening the effect on peak-hour traffic. Project truck traffic occurring during the hours of 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. would coincide with peak-hour traffic, and therefore would have the greatest potential to impede traffic flow during these time periods. Restricting truck traffic during the a.m. and p.m. peak periods would further minimize disruption of the general traffic flow on affected roadways.

Although this impact would be less than significant, the following mitigation measures are recommended to further reduce the less-than-significant impact.

Measure 5.A.6-1 (Recommended): Implement Measures 4.A.6-1a and 4.A.6-1b.

Impact 5.A.6-2: Project construction would increase traffic delays for vehicles traveling past the construction zone. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Project engineers indicate that the majority of the pipeline alignment would not involve installation within roadways. However, the proposed alignment would follow adjacent to, or within a portion of, and/or cross Panabaker Road, West Beach Road, and San Andreas Road. The specific alignments of installation of pipeline would be identified during the design phase of the project. Assuming open trench activities proceeding at an average rate of 100 feet per day, impacts would be brief at any one location along the pipeline alignment.

Existing transportation and circulation patterns in the vicinity of the proposed pipeline alignment would be temporarily disrupted by construction activities and heavy equipment use in the roadways. Impacts related to pipeline construction would include direct disruption of traffic flows and roadway operations. Lane blockages or roadway closures during pipeline installation would result in a reduction in travel lanes, and could result in the need for traffic re-routing.

Measure 5.A.6-2: Implement Measures 4.B.6-2a and 4.B.6-2b.

Impact 5.A.6-3: Project construction would affect access to adjacent land uses for both general and emergency access. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Since the majority of project construction would not involve installation within roadways, but rather within adjacent agricultural fields, minimal impacts to access to properties along the construction route due to trenching, and materials and equipment storage would be expected. However, potential temporary blockage or reduction in travel lanes could result in a significant delays to emergency services. In addition, a temporary inconvenience to local commercial and agricultural businesses and residences could result.

Measure 5.A.6-3: Implement Measures 4.B.6-3a through 4.B.6-3c.

Impact 5.A.6-4: Project construction would increase wear and tear on area roadways used by construction vehicles. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The use of heavy trucks to transport equipment and material to and from the project sites could affect road conditions by increasing the rate of road wear or cause direct damage to roads and bridges. The degree to which this impact would occur depends on the project-generated traffic and the design (pavement type and thickness) and existing condition of the roadways. The project's impact is assumed to be minimal on major arterials (e.g., highways, including Highway 1) which are designed to accommodate a mix of vehicle types, including heavy trucks.

Other local-serving roads, such as Panabaker and Beach Roads (the main access route to the WWTF), may not be built with a pavement thickness that would withstand considerable heavy

truck volumes. The projected increase in use of this or other local roadways by heavy trucks could result in significant wear on these roadways.

Measure 5.A.6-4: Implement Measure 4.A.6-2.

Impact 5.A.6-5: Project construction would increase potential traffic safety hazards for vehicles and pedestrians in the construction area. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The temporary increase in construction-generated trucks on project area roadways would interact with other vehicles, including other large trucks, slow moving agricultural vehicles, and recreational traffic (e.g., from nearby beaches). This area receives substantial summer tourist traffic. Potential conflicts also could occur between construction traffic and bicyclists and pedestrians. Beach Road is part of the Master Plan of Santa Cruz County bikeways (Santa Cruz County, 1994).

Measure 5.A.6-5: Implement Measures 4.A.6-3a and 4.A.6-3b.

Impact 5.A.6-6: Project construction would generate a demand for parking spaces for construction worker vehicles. Less than Significant.

The project would generate a need for parking for construction workers and construction vehicles, as well as areas to store equipment and supplies. The location of staging areas has not been identified at this point; however, it is expected that providing space for staging areas could be easily accommodated at the WWTF site and along any associated pipeline routes. The demand for new parking would be met by the proposed construction staging areas. No public on-street parking would be eliminated during project construction.

Mitigation: None required or recommended.

Impact 5.A.6-7: Project construction could coincide with other construction projects under the Revised BMP, or other potential construction projects in the area, contributing to cumulative traffic and roadway disruptions. Significant. With mitigation identified in this EIR the impact would be reduced to a less-than-significant level.

Construction associated with the proposed project could occur at the same time as construction of other components identified under the Revised BMP occurs, in addition to other potential cumulative construction projects in the project area. The projects would share some of the same construction access routes (including Beach Road, Highway 1 and Highway 129), particularly for pipeline construction. Consequently, cumulative traffic and roadway disruptions could occur.

The implementation of mitigation measures identified in this section would reduce this project's contribution to cumulative impacts. The following measures would further reduce this project's contribution to this impact to a less-than-significant level.

> **Measure 5.A.6-7:** The traffic control plan shall include consideration of any other planned traffic detours related to nearby and concurrent construction projects.

REFERENCE – Traffic and Circulation

Santa Cruz County, *1994 General Plan and Local Coastal Program for the County of Santa Cruz*, 1994.

5.A.7 AIR QUALITY

5.A.7.1 SETTING

Section 3.6, Regional Setting – Traffic and Circulation, describes the major roadways in the vicinity of the WWTF. Aside from automobile and agricultural emissions there are no major air emission sources in the vicinity of this project component.

5.A.7.2 SIGNIFICANCE CRITERIA

Please refer to Section 4.A.7.2 for a description of the significance criteria used in analyzing potential project impacts related to air quality.

5.A.7.3 IMPACTS AND MITIGATION MEASURES

Impact 5.A.7-1: The Local-Only Alternative project component would include construction of the Recycled Water Facility, which would temporarily generate criteria air pollutants, particularly PM_{10}, over the duration of the construction period. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Construction of the project would generate fugitive dust (including PM_{10}), and other criteria air pollutants from exhaust emissions. A large portion of the total construction dust emissions would result from site grading and trench excavation activities. Dust emissions would vary from day to day, depending on the phase of construction, the silt content of the soil, and the weather. Daily emissions would depend greatly upon whether construction of the various supply components and distribution systems would occur simultaneously. Construction-related impacts which are individually less than significant may have a significant impact if construction occurs on two or more components simultaneously. Additionally, PM_{10} as well as some exhaust emissions would add to the cumulative air pollutant emissions of the valley. In an agricultural region, soil tilling is a source of PM_{10}, which in total far exceeds what the project construction could generate at individual site locations. Larger particles of dust from construction would fall out relatively close to construction sites and could cover crops with a coating of dust. This could be injurious to plants, particularly seedlings and plants in their early growth stages.

According to MBUAPCD *CEQA Guidelines,* construction projects which emit precursors of ozone (i.e., ROG and NO_x) are accommodated in the emission inventories of the Air Quality Management Plans and would not have a significant impact on the attainment and maintenance of ozone AAQS. For this reason, emissions of ROG and NO_x from construction equipment will not be quantified and will be considered a less-than-significant impact. The MBUAPCD Guidelines also state that PM_{10} emissions from construction activities are considered significant if they would generate 82 pounds per day or more of PM_{10} when the activities are located nearby and upwind of sensitive receptors.

The EPA has developed a PM_{10} emission factor for construction-related emissions of approximately 51 pounds per acre per day (EPA, 1995). Therefore, assuming that approximately 3-acres of the 8-acre project site would be disturbed at a given time during this phase, construction of the Recycled Water Facility, including excavation for the pipelines supplying blending water and connecting to the distribution system, would result in PM_{10} emissions from construction activities of approximately 150 pounds per day.

A limited amount of excavation would also be required for preparation of the North Dunes Recharge Basin. Although this basin consists of a 30 acre site, because the site is proposed to continue to be farmed, top soil removal would be approximately 54,000 cubic yards based on excavated material volumes removed from Harkins Slough (RMC, 2001). Daily excavation activity would increase PM_{10} emissions by 62 pounds per day, assuming 8-hours per day of activity.

Measure 5.A.7-1: Implement dust control program described in Measure 4.A.7-1.

The effectiveness of the dust control measures in reducing PM_{10} emissions ranges from 34 percent (for sweeping streets) to 90 percent (for covering haul trucks and inactive storage piles) (MBUAPCD, 2000). Implementation of all applicable measures would reduce PM_{10} emissions to below 82 pounds per day.

Impact 5.A.7-2: Lane closures and detours necessitated by construction of the project could temporarily increase vehicular emissions. Less than Significant.

Construction of the various treatment facilities would not require lane closures or detours. Installation of pipeline sections required by the various components of the project would involve crossing roadways. Roadways will be maintained to allow one-lane passage at all times. For one-lane or narrow roadways, construction would be completed by closing the road for the shortest period of time, and traffic control plans submitted by the contractor will ensure minimal lane closures and detours. Vehicular emissions would be temporarily increased from autos taking detours or queuing on narrow roadways. However, increased emissions directly caused by lane closures would result only from changes to vehicles speeds and operation modes and would not result in new vehicle trips. Consequently, increased emissions would not be likely to exceed MBUAPCD significance criteria of 150 pounds per day of ozone precursors (ROG or NO_x) or 550 pounds per day of CO.

Impact 5.A.7-3: Vehicle trips resulting from operation and maintenance of the various components of the project would generate emissions of criteria air pollutants and odors. Less than Significant.

Operation of the treatment facilities and pipelines would require periodic maintenance and inspection by PVWMA employees. Emissions generated by employee vehicle trips would be

negligible and would not exceed MBUAPCD significance thresholds. Pumps would be powered by electricity, rather than diesel, and would not generate added criteria air pollutants.

The North Dunes Recharge Basin is located over 1,000 feet from the nearest sensitive receptors. Residences are located within 300 feet of the Recycled Water Facility site. The proposed Recycled Water Facility would include storage tanks (clearwells) that would contain treated water. Because the stored supplies would be highly treated recycled water, the potential for odor generation is considered low. Water treated to the tertiary stage would not contain biosolids or other organic material that would be likely to generate odors.

REFERENCES – Air Quality

Monterey Bay Unified Air Pollution Control District, *CEQA Air Quality Guidelines*, September 2000.

Raines, Melton, and Carella, Inc., *Technical Memorandum – Local-Only Water Supply Alternatives Evaluation*, 5 May 2001.

United States Environmental Protection Agency (EPA), *Compilation of Air Pollutant Emission Factors*, Volume I: Stationary, Point, and Area Sources, AP-42, 5th Edition, January 1995.

5.A.8 NOISE

5.A.8.1 SETTING

Please refer to Section 3.8 for a discussion of regional noise conditions. Proposed facilities under this component include construction of a Recycled Water Facility (RWF) that would produce tertiary-level recycled water at the Watsonville Wastewater Treatment Facility (WWTF), a pumping plant, approximately 14,000 feet of pipeline, and groundwater extraction wells and associated piping.

The proposed locations for the RWF and pipelines are in agricultural or weedy, disturbed areas. Residences are located approximately 300 feet west-northwest of, and approximately 1,500 feet north-northeast of, the RWF site; otherwise, the area around the WWTF site is a sparsely populated agricultural area. The North Dunes Recharge Basin is approximately 1,000 feet from the nearest residence.

5.A.8.2 SIGNIFICANCE CRITERIA

For the purposes of this EIR, the project would normally have a significant adverse impact on the environment if it would increase substantially the ambient noise levels of adjoining areas. Operation of the proposed RWF and associated pipelines would not result in the development of significant new noise-generating sources. Instead, project-related noise effects would be limited to construction noise and construction-related traffic. Short-term construction noise impacts of a project would be considered significant if:

- construction activities were to affect noise-sensitive receptors for a substantial amount of time;
- expected noise levels would endanger the hearing of receptors near the construction site; or
- construction activities would affect receptors during noise-sensitive periods.

An example of a sensitive noise receptor would be the mobile home park located along the pipeline alignment near U.S. Highway 101. Construction noise would also be considered significant if it conflicted with any adopted city or county construction noise standards, policies or ordinances. With temporary noise impacts, identification of "substantial increases" depends upon the duration of the impact, the temporal daily nature of the impact, as well as the absolute change in dBA levels. For assessment of temporary construction noise impacts in this EIR, "substantially greater" means an increase of more than five dBA (hourly L_{eq} or L_{dn}) above the ambient noise environment.

5.A.8.3 IMPACTS AND MITIGATION MEASURES

Impact 5.A.8-1: Construction activities associated with the project construction would intermittently and temporarily generate noise levels above existing ambient noise levels in

the project vicinity. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Construction-related noise levels along the pipeline alignment would fluctuate depending on the particular type, number, and duration of use of various pieces of construction equipment, and the location of sensitive receptors. The effect of construction noise would depend on how much noise would be generated by the equipment, the distance between construction activities and the nearest noise-sensitive uses, and the existing noise levels at those sensitive uses.

The North Dunes Recharge Basin is located over 1,000 feet from the nearest sensitive receptors and construction activities at the basin are not expected to result in significant noise impacts.

Construction activities would be expected to last approximately 18 months at the WWTF, and two weeks at any given location along the pipeline alignment, and 4 months at the location of the Recharge Basin. Residences are located within 300 feet of the RWF site; therefore, noise associated with construction activity would be considered a significant effect for this component. There is also a potential for construction noise to affect nearby receptors at the locations of the proposed extraction wells. Because the location of the extractions have not been determined, there is a potential for construction activities to affect sensitive receptors based on their siting. Implementation of the mitigation measures below, which limit the timing of construction and use of equipment, would reduce potentially significant impacts to a less-than-significant level.

Measure 5.A.8-1: Implement Measure 4.A.8-1.

Impact 5.A.8-2: Operation of proposed RWF and pumping facilities associated with extraction wells would result in noise increases in the vicinity of project facilities. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The RWF would result in an increase in noise-generating equipment at the plant. Operation of a pumping plant would be consistent with the types of noise-generating sources currently operating at the WWTF. The additional noise-generating sources would represent an incremental increase in ambient noise levels; however, given the above considerations, noise increase associated with the RWF would not significantly affect the noise environment in the project vicinity. The pumping facilities associated with extraction wells have the potential to affect nearby sensitive receptors, depending on the siting and design of the pumping facility. Implementation the Mitigation Measures below would reduce potential impacts to a less-than-significant level.

Measure 5.A.8-2: Implement Measure 4.A.8-2.

5.A.9 PUBLIC SERVICES

5.A.9.1 SETTING

Please refer to Section 3.9 for a discussion of public services and utilities serving the area.

5.A.9.2 SIGNIFICANCE CRITERIA

Please refer to Section 4.A.9.2 for a discussion of significance criteria.

5.A.9.3 IMPACTS AND MITIGATION MEASURES

Demand during construction for public services such as water (for dust control), solid waste disposal, and schools will not be large enough to cause significant impacts. (Solid waste generated by the project would be sent to the Marina Landfill in Monterey County.)

Impact 5.A.9-1: Construction of pipelines associated with the Recycled Water Facility could result in temporary, planned or accidental disruption to utility services provided by underground lines. Significant. With mitigation identified in this EIR the impact would be reduced to a less-than-significant level.

Construction activities adjacent to the WWTF, at the proposed North Dunes Recharge Basin, and along farm roads are not expected to encounter any utilities. However, pipeline construction across public roads (e.g., Beach Road) potentially might disrupt existing utility lines. Refer to Impact 4.A.9-1 for further discussion of this impact.

Measure 5.A.9-1: A detailed study identifying utilities along the proposed alignment shall be done during the pre-design stages of the project.

The following mitigations are required for segments identified in final design as having potential conflict with significant utilities.

a. Utility excavation and encroachment permits would be required from the appropriate agencies, including the Public Works Departments of Santa Cruz County, and the City of Watsonville. These permits include measures to minimize utility disruption. PVWMA and its contractors shall comply with permit conditions. Permit requirements shall be included in construction contract specifications.

b. Utility locations would be verified through field survey (potholing) and use of an underground locating service.

c. A detailed engineering and construction plan shall be prepared as part of the design plans and specifications. This plan shall include procedures for the excavation, support, and fill of areas around utility cables and pipes. All affected utility services would be notified of PVWMA's construction plans and schedule. Arrangements would be made with these entities regarding protection, relocation, or temporary disconnection of services.

d. In areas where the pipeline would parallel wastewater mains, engineering and construction plans shall include trench wall support measures to guard against trench wall failure, and possible resulting loss of structural support for the wastewater main.

e. Residents and businesses in the project area shall be notified in writing by the contractor of planned utility service disruption two to four days in advance, in conformance with County and State standards.

Impact 5.A.9-2: Pipeline construction temporarily could impede vehicle access to emergency services, as well as to collection and delivery services. This impact could affect Counties' Sheriff's Departments, fire departments, emergency services (e.g. ambulance companies), delivery and collection services. Significant. With mitigation identified in this EIR the impact would be reduced to a less-than-significant level.

Pipeline construction could temporarily impede vehicle access to police, fire or emergency services as it would cross public roads. Vehicle access to an individual residence or business would normally be impeded for one to two days, maximum. PVWMA would employ construction methods described in the assessment of traffic impacts (see Section 5.A.6) that would reduce this impact to a less-than-significant level.

Measure 5.A.9-2a: Construction trenches shall be covered by steel trench plates to allow access to driveways.

Measure 5.A.9-2b: To minimize disruption of emergency vehicle access, contractors shall work with affected jurisdictions (Santa Cruz County or City of Watsonville) to identify detours during construction.

Measure 5.A.9-2c: Police, fire, and emergency services shall be notified of the timing, location, and duration of construction activities and the locations of detours and lane closures.

Impact 5.A.9-3: Pump station operations for the project would increase demand for electrical service at the project site. Significant. With mitigation identified in this EIR the impact would be reduced to a less-than-significant level.

The proposed project would generate demand for electricity and could require the extension of new, or expansion of existing electricity lines to serve the proposed project. The specific electricity requirements would be reviewed by PG&E after PVWMA submits a formal application for service.

Measure 5.A.9-3: Design of facilities at the WWTF with substantial electrical demand will be coordinated with PG&E to ensure adequate electricity service is available to serve the site.

REFERENCE – Public Services

Norwood, Jim, Captain, City of Watsonville Fire Department, telephone communication, October 17, 1997.

5.A.10 VISUAL/AESTHETIC AND RECREATIONAL RESOURCES

5.A.10.1 SETTING

The proposed Recycled Water Facility would be located on agricultural land adjacent to the Watsonville Wastewater Treatment Facility. Views of this site would be available from Beach Road, approximately 500 feet to the north; San Andreas Road, approximately 2,500 feet to the west; and from Highway 1, approximately 3,000 feet to the east. Beach Road and San Andreas Road are designated scenic roads in the Santa Cruz County General Plan/LCP. Highway 1 is a designated scenic road in the City of Watsonville General Plan and the Santa Cruz County General Plan/LCP, and it is eligible for official State Scenic Highway designation by Caltrans.

The proposed pipelines connecting the WWTF to the coastal distribution system at Harkins Slough would be placed along Panabaker Road, Beach Road, and San Andreas Road.

The site of the North Dunes Recharge Basin and attendant pipeline is currently open, agricultural land with rolling terrain, approximately 2,000 feet west of San Andreas Road. The site is within a natural topographic depression and is not visible from any public or designated scenic roads.

Long-range views across the project area include Monterey Bay to the west, the Santa Cruz Mountains to the north, and the PG&E electric generation plant at Moss Landing to the south.

Consistency with Applicable Plans and Policies

Development of the recycled water component would be generally consistent with the applicable policies of the Santa Cruz County General Plan/LCP and the City of Watsonville General Plan presented in Section 3.10 of this EIR. The project area, which contains expansive croplands and little urban development, exhibits a rural visual landscape; however, the existing WWTF is a dominant industrial feature.

5.A.10.2 SIGNIFICANCE CRITERIA

Please see **Section 4.A.10.2** for a discussion of significance criteria.

5.A.10.3 IMPACTS AND MITIGATION MEASURES

Impact 5.A.10-1: Development of the proposed Recycled Water Facility would alter the visual character of, and views of, the project area. Significant. With mitigation identified in this EIR for the Recycled Water Facility, pipelines, and North Dunes Recharge Basin, the impact would be reduced to a less-than-significant level. Impacts of the advanced treatment facilities at the Recycled Water Facility required by Mitigation Measure 5.A.3-4a could be mitigated or could be unavoidable, depending on the design of the facilities.

Construction of the Recycled Water Facility would change the existing visual appearance of the WWTF. The proposed placement of two, two million-gallon above-ground storage tanks, or

clearwells, on agricultural lands adjacent to the WWTF would increase the visual prominence of the industrial facility from nearby scenic roads, including Beach Road, San Andreas Road, and Highway 1. The cylindrical tanks would be approximately 300 feet in diameter with a maximum height of 30 feet, which is equivalent to the height of the tallest facilities at the existing WWTF. While the tanks would be the same height as existing facilities at the WWTF, their large volume would make them dominant industrial features in the visual landscape. Since the tanks would be on open agricultural land, no screening vegetation is available to help integrate the tanks with the surrounding area. Given the industrial appearance of tanks with no visual mitigation and the open, rural terrain of the siting area, this could be a significant impact. As shown in Figure 2.6 in Chapter 2, the clearwells would be set back from nearby roads, close to the Pajaro River. Other structures within the Recycled Water Facility site would visible in the foreground in views from Beach Road, San Andreas Road and Highway 1. These structures, which include filtration, disinfection, and pumping facilities, would be smaller in scale than the storage tanks, but they would be visible from nearby roads. While the clearwells would be dominant visual features, they would not substantially alter the visual character of the area because they would be adjacent to the existing WWTF, which represents a prominent industrial feature in the visual landscape. The Recycled Water Facility would extend this existing feature, and would not introduce a new feature to the area. Similarly, views of the project area would be altered by the Recycled Water Facility, but they would be altered by extending an existing industrial feature in the viewshed onto adjacent lands. The Recycled Water Facility would not affect a pristine view. Furthermore, it is not uncommon for industrial features to appear in rural landscapes.

The filtration, disinfection, storage, and pumping facilities at the WWTF would contribute to the visual dominance of the WWTF. While these facilities would be compatible with the existing WWTF, their size and industrial character would increase visual contrast with the surrounding rural landscape. This would be a significant impact. Measures 4.A.10-1a and 4.A.10-1b would reduce the visual contrast of the tanks.

Pipeline construction would tear up roadways and remove native vegetation and crops along the alignment. This would be a temporary impact, since cropping would be allowed to occur on agricultural lands within the alignment following installation of the pipeline. For this reason, the construction disturbance for the pipelines to and from the Recycled Water Facility is considered a less-than-significant impact. During construction, excavated trenches and stockpiled soils, pipe, and other materials within the construction easement would constitute negative aesthetic features along the pipeline alignment. This would be a temporary adverse impact. Following construction, the proposed pipelines would be located entirely below grade and would be unobtrusive. No long-term visual impacts would result from development of the pipelines.

Creation of a recharge basin would not be considered an adverse visual impact, since waterways are aesthetically pleasing to many people, and the recharge basin would not alter the rural character of the area. Additionally, no change in the visual landscape would be apparent in the summer and fall, when crops would be planted in the recharge basin. The recharge basin would not alter views from nearby San Andreas Road, which is a designated scenic road in the Santa

Cruz County General Plan/LCP and the City of Watsonville General Plan. Therefore, this would not be considered a significant visual impact.

If PVWMA were to implement the advanced treatment processes at the Recycled Water Facility that are identified in Mitigation Measure 5.A.3-1a in Chapter 5.A.3, Hydrology and Water Quality, additional facilities would be constructed at the site that would increase impacts on visual quality. These facilities would be expected to further increase the visual prominence of the WWTF in views from nearby scenic roads. Because detailed designs of these facilities are not available, the significance of the visual quality impacts cannot be determined. Further environmental review of the advanced treatment facilities would be required when designs are available.

Measure 5.A.10-1a: Implement Measures 4.A.10-1a through 4.A.10-1c.

Impact 5.A.10-2: Development of the Water Recycling component would introduce new sources of light onto the project site and increase ambient light in the project area. Less than Significant. Implementation of recommended mitigation measures identified in this EIR, while not required, would assist in ensuring that the impact would remain at a less-than-significant level.

While no exterior lighting is currently proposed as part of this component, exterior security lighting (if implemented) at the Recycled Water Facilities could introduce light and create nighttime impacts. The new facilities would be located within 300 feet of existing residences. While exterior lighting could be visible from these residences, it would not be expected to substantially increase ambient light in the project area.

Mitigation Measure 5.A.10-2 (Recommended): Implement Measure 4.A.10-2.

Impact 5.A.10-3: Development of the water recycling component could temporarily disrupt designated recreational bikeways in the project area. Less than Significant.

Construction of the proposed pipelines could disrupt bicycle traffic along San Andreas Road and Beach Road, which are included in the Santa Cruz County bikeway system. Construction activities and related truck traffic could damage the bikeways, creating minor inconvenience to bicyclists. This would be a temporary impact during project construction. Implementation of Measures 4.A.6-2, 4.A.6-3a and 4.A.6-3b would ensure that damaged roads would be repaired to pre-construction conditions, and that detours would be provided for bicyclists and motorists during the construction period. Therefore, this impact would be less than significant.

Mitigation: None required.

5.B EXPANDED COLLEGE LAKE

5.B.1 LAND USE AND PLANNING

5.B.1.1 SETTING

College Lake, approximately one mile north of the Watsonville city limits, is a seasonal lake that receives water from an 11,000-acre watershed during the rainy season. For many years its accumulated water has been pumped into Salsipuedes Creek in the spring, thus allowing farming to take place on the lake bed during the dry season. Remnants of the former natural hydrology are evident in the persistence of groves of willows along the lowest reaches of Casserly Creek just before it empties into College Lake. The remainder of College Lake is primarily agricultural, and contains vegetable and strawberry crops, flowers, and apple orchards. Surrounding agricultural lands produce vegetables, flowers, raspberries, and grapes. Residential uses are to the north of College Lake and to the south along Holohan Road and East Lake Avenue (Highway 152). St. Francis Church and cemetery, and St. Francis School and Lakeview Middle School are southeast of the lake along East Lake Avenue, and the Santa Cruz County Fairgrounds is to the east. **Figures 3.1-1 and 3.1-2** present existing land uses in the vicinity of College Lake.

The proposed pump station, pretreatment, and filtration facilities at College Lake are on vegetable cropland south of the existing pumps and headgate, in close proximity to residential uses along East Lake Avenue.

As stated in Section 3.1, the proposed College Lake facilities would be located in unincorporated Santa Cruz County, but lie within the City of Watsonville planning area.

According to the Santa Cruz County Agricultural Resources Map, the sites of the proposed water diversion and treatment facilities, dams, and the increased reservoir elevation at College Lake are located on Type 1A, 1B, and 2B agricultural lands. Please refer to Section 3.1 for definitions of these classifications.

Consistency with General Plan Policies and Zoning Designations

Development of the Expanded College Lake facilities would be consistent with applicable policies of the Santa Cruz County and City of Watsonville general plans presented in Section 3.1 of this EIR. The proposed facilities would provide a new source of irrigation water for adjacent agricultural lands, which in turn would reduce the need for groundwater pumping. Therefore, the College Lake component would increase groundwater recharge, and thus would be consistent with Objectives 5.5a and 5.5b, and Programs C and H of the Conservation and Open Space Element of the Santa Cruz County General Plan/LCP.

This component would increase the area of inundation at College Lake onto adjacent agricultural lands (from 260 acres to 420 acres), and would construct a pump station and related facilities on

land designated as Agriculture. However, this would not be inconsistent with General Plan policies that call for preservation of agricultural land, because the expansion would not result in the permanent conversion of agricultural lands. As stated above, College Lake is a seasonal water body that is filled by winter rains and is drained each spring. While the project would increase the size of the lake, the annual filling and draining of the lake would still occur. Therefore, inundated lands would still be farmed substantially as at present following development of the College Lake component.

Approximately 100,000 cubic yards of material would be excavated from the lakebed and used for construction of the proposed dams. Excavation of the lakebed would remove the topsoil, which would adversely affect the quality of the land for agriculture. This would be potentially inconsistent with General Plan policies that call for preservation of agricultural land. Implementation of Measure 5.B.1-2, below, would require that the topsoil be preserved and replaced following construction to allow farming to continue on the lakebed during the dry season.

The proposed pumping, pretreatment and filtration facilities would not be inconsistent with General Plan policies calling for preservation of agricultural land because they would provide water to replace groundwater for irrigation purposes. This would increase groundwater recharge and minimize saltwater intrusion, which would ensure long-term continuation of agriculture in the area. The proposed pump station would be compatible with the existing pumping facilities at College Lake, and therefore would not be inconsistent with Policy 4.D.2 of the Watsonville General Plan.

As stated in Section 3.1, the Watsonville General Plan recognizes that the preservation of agricultural land alone will not ensure preservation of the agricultural economy, and that other factors, such as availability of irrigation water and facilities for support industries, are also important in preserving agriculture. Therefore, while development of proposed facilities on agricultural lands would be inconsistent with specific policies, it would not contradict the overall intent of the general plans.

The lands within and adjacent to College Lake are zoned CA, Commercial Agriculture. Construction of the proposed facilities may be inconsistent with allowable land uses within areas zoned CA. The principal permitted land uses within the CA zone are agricultural pursuits for the commercial cultivation of plant crops and the commercial raising of animals. In addition to these principally permitted uses, other uses are allowed for “dams, canals and aqueducts of any public water project” (Section 13.10.312 [b] of the Santa Cruz County Code). The proposed Expanded College Lake facilities include construction of two dams as part of a public water project with the overall goal of expanding the available water supply, and thereby preserving and enhancing agriculture in the Pajaro Valley. The responsibility for making a conclusive determination of project consistency rests with the Santa Cruz County Planning Commission.

5.B.1.2 SIGNIFICANCE CRITERIA

Please see Section 4.A.1.2 for a discussion of significance criteria.

5.B.1.3 IMPACTS AND MITIGATION MEASURES

Impact 5.B.1-1: Construction of the College Lake facilities would result in short-term disturbance of adjacent land uses. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

With the exception of the earthen dam, the proposed facilities at College Lake would not alter surrounding land uses, which include St. Francis Church, St. Francis School, Lakeview Middle School, and residences, and would not disrupt or divide the community. The proposed earthen dam, shown in **Figure 2.10** in Chapter 2, Project Description, would require the relocation of many of the graves at the St. Francis cemetery. The graves would be relocated to another part of the cemetery to allow construction of the dam. As stated in Mitigation Measure 5.B.1-1a below, PVWMA would compensate St. Francis Church for the relocation of the graves, and St. Francis Church would be consulted to ensure that the graves are relocated in a proper and respectful manner.

Construction of the Expanded College Lake facilities would not be incompatible with existing uses in the vicinity. Construction disturbance, particularly that related to the proposed dams, could temporarily constrain access to these and other uses along Highway 152. Construction activities related to the proposed saddle dam could constrain operations of St. Francis Church and nearby schools. School operations could be adversely affected if roadways or driveways were blocked or restricted on weekday mornings and afternoons during the school year, while church activities would be affected if construction work restricted access during services. However, this would be a temporary impact that results more in inconvenience to motorists than a substantial impact and, therefore, would not be expected to substantially impair school and church operations. Construction of proposed pumping, pretreatment and filtration facilities would not involve construction within area roadways and thus would not disrupt access to, or use of, adjacent lands. Therefore, this impact would be considered less than significant. Implementation of Measures 5.B.6-1a, 1b, 3a and 3b would minimize construction disturbance.

In addition, construction of proposed facilities would generate noise, dust, and traffic that could disrupt adjacent land uses. Traffic and air quality impacts are presented in Sections 5.B.6, Traffic and Circulation, 5.B.7, Air Quality, and 5.B.8, Noise, of this EIR. With proper mitigation, temporary construction impacts would have a less-than-significant effect on adjacent land uses.

> **Measure 5.B.1a:** PVWMA shall compensate St. Francis Church for costs associated with relocation of the graves to another area of the cemetery. St. Francis Church shall be consulted to ensure that the graves are relocated in a proper and respectful manner.
>
> **Measure 5.B.1-1b:** Implement Measure 4.A.1-1.

See also mitigation measures in Sections 5.B.6, Traffic and Circulation, 5.B.7, Air Quality, and 5.B.8, Noise, of this EIR.

Impact 5.B.1-2: Development of the Expanded College Lake facilities would result in the permanent loss of up to sixteen acres of agricultural lands. Significant and Unavoidable. Implementation of mitigation identified in this EIR would reduce the impact, but it would remain significant.

The proposed pump station, pretreatment and filtration facilities at College Lake would convert approximately one acre of agricultural land to water distribution uses that would preclude farming on the site. According to the Santa Cruz County Agricultural Resources Map, development of the facilities site would convert vegetable crops that are designated as Type 1B agricultural lands. The proposed dam structures would convert an additional 14.5 acres of land designated as Type 1A and 2B agricultural lands. As stated in Section 3.1, these lands meet the U.S. Department of Agriculture Soil Conservation Service criteria for prime and unique farmland. Therefore, development of these facilities would contribute to the cumulative loss of prime farmlands in the region. This would be considered a significant impact.

The proposed increased area at College Lake would not result in the permanent conversion of agricultural land; however, it would affect agricultural production. The proposed reservoir elevation would reduce agricultural production on 160 acres of Type 1A agricultural lands (prime farmland) during the winter and spring, but would not result in a permanent conversion of these lands.

Approximately 100,000 cubic yards of material would be excavated from the lake bottom to construct the two dams, which would affect the agricultural productivity of the land. This would be a significant impact. Implementation of Mitigation Measure 5.B.1-2 would require replacement of removed topsoil to allow farming to continue on the lakebed. However, this impact would remain significant since the feasibility of this mitigation measure is not known.

Measure 5.B.1-2: During excavation of material from the lakebed, the topsoil shall be removed separately, stored, and replaced following construction to allow farming to continue on the lakebed during the dry season.

5.B.2 GEOLOGY, SOILS, AND SEISMICITY

5.B.2.1 SETTING

Geology

College Lake is located in an alluvial area bordered by gentle to moderate slopes along the upper-lying northern edge of the Pajaro Valley plain. The lake is located in an area comprised of Quaternary alluvium. The lake bottom is classified as Quaternary Basin deposits, consisting of unconsolidated plastic clay and silty clay with high organic content. Locally, thin-bedded silt and sandy silt deposits are contained within the clays. The soils have high susceptibility to liquefaction in an earthquake (Dupre and Tinsley, 1980).

The adjacent uplands are comprised of Quaternary nonmarine terrace deposits classified as Watsonville terrace deposits and subdivided into fluvial and alluvial fan facies (Dupre and Tinsley, 1980). These terrace deposits are semiconsolidated, moderately to poorly sorted silts, sand, silty clay, and gravel. They have low susceptibility to liquefaction. There are no mapped areas of soil instability such as landslides in the College Lake area. Areas with moderate and steep slopes along the edge of College Lake may have some instability hazard and would be subject to erosion.

The area immediately south of College Lake is alluvium classified as Older Flood Plain Deposits consisting of unconsolidated, relatively fine-grained, heterogeneous deposits of sand and silt and commonly including lenses of clay (Dupre and Tinsley, 1980).

Soils

The soils in College Lake are mostly the Conejo loam on 0 to 2 percent slopes (see **Table 5.B.2-1**) (SCS, 1980). The soils are flooded during winter by the formation of College Lake, and drained in the springtime for cultivation. The capability for cultivation is high and this is highly productive soil with a capability subclass I irrigated and capability unit IIIc-1 non-irrigated; the Storie index is 95 (SCS, 1980). Erosion hazard is slight. The clay content creates a moderate hazard of shrink swell and low strength that make the soil unsuitable for construction materials, embankments and levees and problematic for some types of construction.

The perimeter areas of College Lake are comprised of a variety of soil types including the Danville loam, Diablo clay, Elder sandy loam, Tierra-Watsonville complex, and Watsonville loam (see **Table 5.B.2-1**). A western arm of the lake is comprised of Clear Lake clay, 0 to 2 percent slopes.

The area near College Lake, including the site of the main dam and water diversions, and proposed treatment facilities, is Baywood Variant loamy sand, 0 to 2 percent slopes. No part of the College Lake area is within a designated zone of mineral, aggregate, oil and gas or geothermal resources.

TABLE 5.B.2-1
SOILS IN THE COLLEGE LAKE AREA AND ALONG PROPOSED FACILITIES

Soil	Slope	Capability Class	Storie Index	Erosion Hazard	Other
Conejo loam	0 - 2 %	I irrigated III non-irrigated	62	slight - moderate	
Clear Lake clay	0 - 2 %	II irrigated III non-irrigated	43	slight	high shrink-swell, low strength
Danville loam	2 - 9%	III	62	slight to moderate	
Diablo clay	9 to 15%	IV irrigated II non-irrigated	44	moderate	
Elder sandy loan	0 - 2%	I irrigated II non-irrigated	90	slight	
Tierra-Watsonville complex	15-30%	VI	14	high	
Watsonville loam	2 - 15%	IV	36	slight to moderate	
Baywood Variant loamy sand	0 - 2%	III	51	slight	
Baywood loamy sand	0 - 2%	III	72	slight, subject to blowing	
Cropley silty clay	2 -9%	III	57	slight	shrink-swell

SOURCE: Soil Conservation Service, Soil Survey of Santa Cruz County, California 1980

Seismicity

Please refer to Section 3-2 for a discussion of the regional seismicity.

Earthquake ground shaking is the primary seismic hazard affecting the College Lake area with existing and proposed facilities. The Zayante fault (see Section 3-2 for additional discussion), is designated in sections as an active fault, is zoned under the Alquist-Priolo Earthquake Fault Zoning Act within the area of the proposed College Lake dam and structures. The entire area is expected to experience ground shaking intensity VIII in a major earthquake and associated peak ground accelerations of 0.25g - 0.30g. Liquefaction is a hazard with a 'high' potential to affect

all of College Lake (Dupre and Tinsley, 1980).[1] The proposed pumping facilities site at College Lake is located in an area rated having 'moderate' liquefaction susceptibility.[2] No part of the College Lake area is within a tsunami hazard area. In a major earthquake, small seiche waves could form in College Lake.[3] Given the size and depth of the temporary water body in College Lake, the hazard is likely to relatively minor.

Regulatory Framework

Refer to Section 3-2 for a general discussion of regulations pertaining to geology, soils, and seismicity.

Reservoir and Dam Regulations

Since 1929, the State of California has supervised the construction and operation of dams to prevent failure to safeguard life and protect property. The California Department of Water Resources, Division of Safety of Dams (DSOD) supervises the construction, enlargement, alteration, repair, maintenance, operation, and removal of dams and reservoirs. The DSOD has jurisdiction over all non-U.S. owned dams in the State that are 25 feet or higher (regardless of storage capacity) and dams for impoundments with a storage capacity of 50 acre-feet of water (16.3 MG) or greater (regardless of height). As proposed, the Expanded College Lake project would fall under DSOD jurisdiction. (Dams six feet or less in height [regardless of storage capacity] or dams for impoundment with a storage capacity of 15 acre-feet or less [regardless of height] are not under DSOD Jurisdiction.)

The DSOD reviews permit applications to evaluate the safety of dams and reservoirs. DSOD staff provides independent review of facilities design and safety calculations. The DSOD requires data concerning subsoil, foundation conditions, availability of construction materials, and geologic hazards to assess the potential for seepage, earth movement, and other conditions that may occur in the vicinity of a dam or reservoir. Investigations usually include exploratory pits, trenches, drilling, coring, geophysical survey, tests to determine leakage rates, and physical tests to measure properties of foundation materials. During construction or repair of a dam or reservoir, the DSOD is required to make continuous and periodic inspections to verify that construction is proceeding in accordance with approved plans.

California Office of Emergency Services

The California Office of Emergency Services requires that inundation maps be prepared to show areas susceptible to flooding following a partial or complete collapse of a dam structure. These maps are used to develop procedures for assistance and evacuation by local emergency services departments for the impacted areas. The OES shall review the procedures to determine whether

[1] High Liquefaction Susceptibility - Sediments for which engineering testing and the presence of a shallow water table suggests the susceptibility for liquefaction but no historical evidence of liquefaction has been reported. Sediments in this category are likely to liquefy in an earthquake.

[2] Moderate Liquefaction Susceptibility – Sediments classed may liquefy in the event of a nearby earthquake and include those with high susceptibility but where historical evidence of liquefaction is absent.

[3] A seiche is a wave-like phenomenon in a water body that is formed by earth movements, such as earthquake ground shaking or landsliding, that is similar to the sloshing water in a bathtub.

adequate public safety measures are developed for evacuation and control of the populated areas impacted by dam failures. Some of the public safety measures include evacuation areas, evacuation routes, traffic control measures, and emergency care for evacuees.

5.B.2.2 SIGNIFICANCE CRITERIA

Please see Section 4.A.2.2 for discussion of significance criteria.

The Pajaro Valley has no record of land subsidence related to groundwater or oil withdrawal, and the proposed project includes no proposals for increased use of groundwater or oil extraction. There is no evidence of the presence of unique geologic features, unusual rock formations, fossils or special geologic structures in the area with potential effects of the proposed local water supply and distribution facilities. Therefore, these impact criteria will not be evaluated further in this EIR.

5.B.2.3 IMPACTS AND MITIGATION MEASURES

Impact 5.B.2-1: Large earthquakes on the regional active faults, or the less likely occurrence of activity on a regional potentially active fault, would be expected to damage the proposed dam structures, outlet works spillway, pump station, and filtration facilites. Ground motion or surface rupture on the Zayante fault, zoned by the CDMG as active in the College Lake area, could cause extreme damage to water conveyance structures and/or partial failure of the earthen dam. Damage could also be caused by ground movement or secondary ground failure such as liquefaction. Damage could temporarily impair and/or disrupt their intended operations. Significant. With mitigation identified in this EIR, the impact would be reduced to an acceptable level of risk through engineering design, and therefore, reduced to a less-than-significant impact.

The project area is expected to experience ground shaking effects from at least one major earthquake (greater than moment magnitude 7) within the next 30 years. The intensity of such an event would depend on the causative fault and the distance to the epicenter, the moment magnitude, and the duration of shaking. The highest probability of seismic activity and the maximum amount of ground shaking is expected to occur from a characteristic earthquake in the San Andreas Fault Zone, the San Gregorio Fault Zone or on the nearby Zayante fault. Earthquakes on the active traces of the Zayante-Vergeles faults could occur and generate seismic motion or surface fault rupture. However, earthquakes within the San Andreas Fault Zone or other regional active faults have the highest likelihood for activity and could generate substantial ground motion. The segments of the Zayante fault zoned as active have exhibited movement in the last 10,000 years and if this fault caused an earthquake, surface expression as rupture could occur at the surface.

As described in the Setting, the potential exists for large magnitude earthquakes to result in ground shaking of considerable intensity and secondary earthquake effects, notably liquefaction. Intense ground shaking and high ground acceleration would affect the entire area of College Lake. The primary and secondary effects of ground shaking could damage structural foundations, distort pipelines and other water conveyance structures, and cause failure of

concrete. Damage to these features would cause temporary service disruption and possibly loss of water due to leakage and pipe rupture. Pumps could be rendered inoperable. The most severe impacts of this type would result from liquefaction of the soil, which could induce both vertical and lateral displacement of the soil that would bend, weaken and break conveyance structures and structural foundations. Broken pipelines could result in soil washout and sinkholes.

Locating and repairing damaged pipelines and the pumps could require a temporary cessation of operation of the facilities for a significant period of time.[4] The loss of the water supply, in turn, could temporarily affect agricultural operations. It is assumed that if water supply were reduced due to earthquake damage, the reductions would be restored within reasonable time frame not to require users to seek permanent, alternative sources.

College Lake itself has a high liquefaction hazard. The hazard could result in substantial damage to the headgate facilities, dams, outlet works, spillway structures and filtration facilities. In an unlikely and worst case scenario, this could result in rapid draining of some lake waters, with resultant flood hazards and erosion of downstream areas. The likelihood of a massive sudden failure and resultant flood is low. Given that the lake is a shallow water body and is emptied for much of the year in most years, the overall hazard of this type of failure is low. To the extent that increasing the storage capacity of the lake would result in a greater volume of water in the lake, it could contribute to increasing the hazard.

> **Measure 5.B.2-1a:** Where DSOD jurisdictional criteria apply, proposed Expanded College Lake will be under the jurisdiction of the DSOD and comply to their standards for design, construction, and inspection. The DSOD would require that dams be designed to withstand a seismic event with an earthquake magnitude considerably higher than the maximum magnitude of the active regional fault closest to the dam site. The DSOD will require necessary site evaluation methods, review plans and specifications, make recommendations on design, require fault investigations when deemed necessary, and will monitor dam construction. Compliance with DSOD design and construction requirements could potentially create new environmental impacts, or make impacts disclosed in this EIR substantially more adverse. Additional environmental review pursuant to CEQA could be required.
>
> **Measure 5.B.2-1b:** All non-DSOD jurisdictional facilities will comply with applicable policies and appropriate engineering investigation practices necessary to reduce the potential detrimental effects of groundshaking and liquefaction. Construction shall be in accordance with applicable City and County ordinances and policies regarding mitigation of seismic and geologic hazards, including applicable safety goals and policies presented in the Public Safety Element of the Santa Cruz County Plan. Appropriate geotechnical studies will be conducted using generally accepted and appropriate engineering techniques for determining the susceptibility of the sites to liquefiable soils and related ground failures. A licensed geotechnical engineer will prepare recommendations applicable to foundation design, earthwork, and site preparation prior to or during the project design phase. Recommendations will address mitigation of site-specific, adverse soil and bedrock conditions that could hinder development. Project engineers will implement these recommendations. Geotechnical design and design criteria will comply with applicable

[4] The 1987 Earthquake scenario prepared by the CDMG for a major earthquake on the Hayward fault predicted that water supply facilities could go off-line for a period of 24 to 72 hours and that pipelines that cross major faults could be damaged resulting in a 10 to 30 percent reduction in service (CDMG, 1987).

codes and requirements of the 1997 UBC with California additions (CCR Title 24), applicable City construction and grading ordinances.

Impact 5.B.2-2: Construction of the proposed facilities at College Lake would result in accelerated erosion and attendant loss of soil resources and effects on sediment discharges in water courses. The impact would be significant on slopes over 2 percent and in areas with soils having moderate or greater erosion hazard. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Most of the College Lake facilities would be located on flat areas or areas with soil having low erosion hazard. However, the operation of construction equipment and vehicles, trench excavation, grading, and soil stockpiling would expose loose soils to erosion if construction occurs in the rainy season. Soils exposed by construction operations have a tendency to be dislodged and transported by rain, surface watering, or temporary construction discharges. Soil erosion and loss of topsoil during a large construction project that extends over several months can be significant and result in project delays due to required soil restabilization, regrading, and soil removal from drainage structures.

Measure 5.B.2-2a: All grading and construction shall conform to requirements of the Santa Cruz County Grading Ordinance.

Measure 5.B.2-2b: Site grading and construction work areas shall expose as little new ground surface as possible. Vegetation cover should be left intact to the extent practical.

Measure 5.B.2-2c: To the extent possible, grading activities in non-cropped areas shall be limited to the period between April 15 and October 15. If dry conditions persist after October 15, one-week extensions of grading activities will be obtained from the County Public Works Department. In areas where the soil is tilled, grading activities will be coordinated with the local farmers to ensure consistency between their erosion control and farming practices and construction disturbance.

Measure 5.B.2-2d: Implement best construction practices at all grading sites, regardless of soil erodibility hazard.

Measure 5.B.2-2e: Upon completion of construction at all sites, loose soils shall be removed or spread and all areas shall be re-soiled and reseeded to ensure that a stable soil cover will remain.

Measure 5.B.2-1f: PVWMA will prepare and implement an inspection and maintenance program for the right-of-way and all facility sites. The plan will include routine inspection plans and reporting, and prescriptive methods for correcting erosion or soil instability problems.

Impact 5.B.2-2: The proposed increase in the storage capacity of College Lake would expand the lake's reservoir elevation, which could result in exposure of soils to erosion and minor slumping of the reservoir rim face in connection with reservoir operations. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Under the proposal to increase storage capacity in College Lake, a wider perimeter area subject to inundation would be denuded, thereby subjecting the soils to erosion. Wave action would further erode these soils, which in some areas have moderate erodibility hazard. Most of the proposed reservoir footprint occurs in areas of gradual slope and/or areas having soils with low erosion hazard. However, certain areas of the expanded shoreline are underlain with soil exhibiting moderate erosion hazard and areas with steeper slopes. Because these constitute a relatively small area of the shoreline, the loss of soil in these areas is not expected to result in significant erosion features such as rilling and gullies.

> **Measure 5.B.2-2:** Periodic inspection of the shoreline area is recommended to identify if soil losses in the expanded reservoir elevation of College Lake are resulting in noticeable soil losses and erosion of the adjacent slopes. If enhanced erosion conditions were identifed, corrective actions for slope and soil stabilization would be undertaken.

Impact 5.B.2-3: The project would result in a less than significant loss of prime agricultural soils.

Construction of the proposed water diversion and treatment facilities at College Lake would permanently remove agricultural soils. These soils have low capability ratings and moderate Storie index ratings, and therefore their removal from production is not regarded as a significant loss of high quality crop production soils. However, as stated above in Section 3.1, the California Department of Conservation designates this land as prime farmland. Since all of the surrounding lands are also designated prime agricultural lands, no alternative site is available that would reduce or avoid the conversion of prime farmland. Please see Impact 5.B.1-3 in Section 5.B.1, Land Use.

> **Mitigation:** No mitigation is required.

Impact 5.B.2-4: Proposed sites for the main dam and saddle dam are situated in areas with weak soils subject to settlement, expansive soils and potentially corrosive soils that could damage the proposed facilities. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Soils with high organic content are subject to hazards of settlement and expansion and in some areas, may be corrosive to pipe. These soils may also cause settlement of concrete structures, weaken joints in the pipelines, cause lateral pipeline distortions in water conveyance facilities and eventually bend or break pipelines. Soils with high clay content are subject to shrink-swell

behavior that can result in damage to pipe joints, structural concrete, and foundations. These effects could impair operation of the facilities and result in costly repairs and their associated impacts. The proposed project includes a commitment to conformance with requirements for placement of buried pipelines in trenches with engineered soils that would reduce or eliminate the hazards for the most part. In the long term, settlement proposed facilities is an anticipated effect and design requirements can be established to allow settlement within acceptable levels.

> **Measure 5.B.2-4:** Implement Mitigation Measures for Impacts 5.B.2-1 and 5.B.2-2, above.

REFERENCES – Geology, Soils and Seismicity

Bolt, B. 1988. Earthquakes. W.H. Freeman Company: New York, New York.

California Building Standards Commission. 1995. California Building Code, Title 24, Part 2.

Dupre, W.R., J.C. Tinsley. 1980. Maps Showing Geology and Liquifaction Potential of Northern Monterey and Southern Santa Cruz Counties, California. U.S. Department of the Interior, U.S. Geological Survey. Map MF-1199.

Hart, E. W., *Fault-Rupture Hazard Zones in California: Alquist-Priolo Special Studies Zones Act of 1972 with Index to Special Studies Zones Maps,* California Division of Mines and Geology, Special Publication 42, 1990, revised and updated 1997.

International Conference of Building Officials. 1994. Uniform Building Code, ICBO, Whittier, California.

U.S. Department of Agriculture, Soil Conservation Service, Soil Survey of Santa Cruz County, California, 1980.

5.B.3 HYDROLOGY AND WATER QUALITY

5.B.3.1 SETTING

Local Hydrology

College Lake is a seasonal water body in a natural depression formed by inflow from a 11,000-acre watershed drained by Green Valley, Casserly, Salsipuedes, and Hughes creeks. The elevation of the lakebed is approximately 55 feet above sea level. These natural drainages generally flow from north to south to the confluence at College Lake. The lake has been drained annually since the early 1900s to create farmland on the lake bottom by pumping lake water to the creek in springtime. Outflows from the lake naturally flow downstream to Salsipuedes Creek in the winter months. Downstream from College Lake, Corralitos Creek joins Salsipuedes Creek, which subsequently flows into the Pajaro River and the Pacific Ocean. Both sides of Salsipuedes Creek and the Pajaro River are bounded by flood protection levees downstream of College Lake. During certain water level and flow conditions, Corralitos Creek flows back into Salsipuedes Creek and College Lake. A headgate is used to prevent backflows when stream levels are less than 60.2 feet in elevation. Pumping begins in early spring to fully drain College Lake and allow for agriculture during the summer months.

Flood Hazards

The Federal Emergency Management Agency (FEMA) provides information on flood hazard and frequency for cities and counties on its Flood Insurance Rate Maps (FIRM). FEMA designates zones to indicate flood hazard potential. In general, flooding occurs along waterways, and in low-lying areas adjacent to water bodies. Infrequent localized flooding in urban areas occurs when excessive runoff from large storm events cannot be accommodated due to reduction of available infiltration area, undersized conveyance facilities, or constrictions of storm drain systems.

The 100-year flood zone designated for College Lake is mainly concentrated in the southern and northern area where topography allows floodwater to flow toward Corralitos Creek. Floodwaters from College Lake, Corralitos Creek, and Kelly Lake would coalesce and flow southward towards Riverside Avenue, eventually entering the floodplain of the Pajaro River. The low relief of the lake's northern end would allow 100-year floodwaters to flow north, resulting in an extensive inundation area along Green Valley Creek.[1]

Surface Water Quality

Available water quality data for College Lake suggest that constituent concentrations vary seasonally due to the seasonal nature of the lake itself. During the first storm events of the season, runoff collected in College Lake exhibits high values of total dissolved solids (TDS), nitrates, and other pollutants. High nitrate concentrations typically are observed during the

[1] The base flood elevations and flood flows could not be determined with available FEMA information.

beginning of the rainy season, with dilution occurring throughout the rainy season. Water quality data indicate that the nitrate concentrations in College Lake range from 0.3 to 20.3 milligrams per liter (mg/L) NO_3-N. Thus, there are times when College Lake water has nitrate concentrations exceeding the drinking water standard of 10 mg/L NO_3-N. College Lake collects runoff from several nearby farm fields; consequently, the presence of *Phytophthora* is an additional water quality parameter of concern. Refer to Section 5.D.3, Hydrology and Water Quality, for additional discussion of College Lake surface water quality, including constituents of concern and their concentrations.

Groundwater

Local groundwater conditions are generally as described in Section 3.3, Regional Setting – Hydrology and Water Quality.

Groundwater underlying the College Lake area is confined within alluvial deposits between an upper and lower clay unit. The upper clay unit extends from the surface to a depth of about 100 feet. The lower clay unit at a depth of approximately 400 feet, separates the water-bearing strata of the alluvial and Upper Aromas sands aquifers from the Lower Aromas sands aquifer. The Purisima Formation begins about 700 feet below the surface (PVWMA, 2000)

To improve data collection and allow better analysis of groundwater trends, PVWMA constructed a dedicated monitoring well (PV-12) in the Salsipuedes/College Lake area in 1988. PV-12 was designed to specifically monitor the Aromas Sands Formation. Water levels in production wells in this area declined rapidly during the drought of the mid-1980s and stabilized or even rebounded somewhat during the wet years of the mid-1990s, but remain low compared to historical conditions (PVWMA, 2000).

Regulatory Setting

A discussion of the regulatory setting as it applies to surface water and groundwater is provided in Section 3.3, Regional Setting – Hydrology and Water Quality. The following regulatory discussion and local plans and policies specifically apply to the College Lake expansion.

California Department of Water Resources, Division of Safety of Dams

The California Department of Water Resources, Division of Safety of Dams (DSOD) oversees the construction of dams that are over 25 feet high and impound over 15 acre-feet (af) of water, or over 6 feet high and impound over 50 af of water. A dam failure can cause loss of life, damage to property, and displacement of people who reside within the dam's inundation zone. Dam failure can occur from internal erosion caused by embankment and foundation leakage, and from inadequate spillway capacity that can lead to overtopping and erosion.

The requirements for siting, engineering, construction, and monitoring of dams are continually improved as knowledge increases as to how and why dams fail. Damage to earthen dams in California is often associated with poor operation and maintenance of dam facilities, or with

strong earthquake-induced groundshaking that affects older dams that have not been designed to modern standards. The risk of dam failure is highest in older dams constructed to lower design standards that have not been upgraded for seismic safety, or when dams are poorly designed, constructed, operated, or maintained. The potential for catastrophic dam failure is considered low, based on past performance of the DSOD jurisdictional dams and DSOD inspection requirements.

Local Plans and Policies

All of the proposed facilities for the Expanded College Lake project component are within Santa Cruz County. The County has the following policies and objectives relevant to the project:

> **Policy 5.7.3:** For all new and existing development and land disturbances, require the installation and maintenance of sediment basins, and/or other strict erosion control measures, as needed to prevent siltation of streams and coastal lagoons.
>
> **Objective 5.8a:** To protect the quantity and quality of the County's groundwater resources through an integrated program of land use regulation and runoff management in groundwater recharge areas, careful water quality monitoring and management of extractions consistent with long-term sustainable water supply yields.
>
> **Objective 5.8b:** To act directly and coordinate and work with relevant water purveyors and agencies to eliminate long-term groundwater overdraft in all water basins where overdraft has been documented.

5.B.3.2 SIGNIFICANCE CRITERIA

Refer to Section 4.A.3.2 for a discussion of significance criteria.

5.B.3.3 IMPACTS AND MITIGATION MEASURES

Impact 5.B.3-1: Construction of the main dam, saddle, dam, pump station, filtration facilities, and pretreatment facilities would increase soil erosion and might transport other contaminants to downstream receiving waters, including the Pajaro River. Additionally, construction activities at the proposed project sites could result in dewatering of shallow groundwater resources and contamination of surface water. Potentially Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Construction activities at the project sites involving soil disturbance, including excavation, cutting/filling, stockpiling, and grading activities, could result in increased erosion and sedimentation to surface waters. In addition, water quality may be impaired due to the accidental release of chemicals such as oil, grease, or fuel from construction equipment. Pipeline construction would require excavation of trenches and temporary stockpiling of soils. Construction at the pump station sites would involve basic earthwork activities to level the site and prepare building foundations. Although the amount of erosion at the project site is projected to be low due to the flat topography, the sediment and adhered substances are sources of

pollution in receiving waters. The General Construction Permit issued by the Regional Water Quality Control Board (RWQCB) requires the preparation of a Stormwater Pollution Prevention Plan (SWPPP). The plan would include specifications for best management practices (BMPs) that would be implemented during project construction to control contamination of surface flows and prevent the discharge of pollutants from the construction area during and following construction.

Excavation and construction of structures with subsurface foundations or open trenches, such as dam abutments, key trenches, and subsurface water conveyance, often can intercept shallow groundwater, requiring dewatering to lower local groundwater levels in order to dry the area for construction. The groundwater is pumped and discharged to the local drainage system. The area of groundwater reduction generally is in the immediate construction area, and the effect on groundwater conditions would be expected to be temporary and minor. Depending on the quality of the groundwater, the discharge could potentially contaminate downstream surface water sources.

Measure 5.B.3-1: Employ construction stormwater quality management practices.

The agency shall prepare a SWPPP as part of the construction activities associated with the National Pollutant Discharge Elimination System (NPDES) stormwater permit required by the RWQCB. At a minimum, this plan shall include the following requirements:

1. Plan excavation and grading activities for the dry season only (April 15 to October 31) to the extent possible. This reduces the chance of severe erosion from intense rainfall and surface runoff, as well as the potential for soil saturation in swale areas.

2. If excavation occurs during the rainy season, storm runoff from the construction area shall be regulated by temporary on-site silt traps and/or basins with multiple discharge points to natural drainages and energy dissipaters. Stockpiles of loose material shall be covered and all runoff shall be diverted away from exposed soil material. If work is stopped due to rains, a positive grading away from slopes shall be provided to carry the surface runoff to areas where flow can be controlled, such as the temporary silt basins. Sediment basin/traps shall be located and operated to prevent off-site sediment transport. Any trapped sediment shall be removed from the basin or trap and placed at a suitable on-site location away from concentrated flows, or removed to an approved disposal site.

3. Temporary erosion control measures shall be provided until perennial revegetation or landscaping is established and can prevent discharge of sediment into nearby waterways. For construction within 500 feet of a water body, straw bales shall be placed upstream adjacent to the water body.

4. After completion of grading, erosion protection shall be provided on all cut-and-fill slopes. Revegetation shall be facilitated by mulching, hydroseeding, or other methods and should be initiated as soon as possible after completion of grading and prior to the onset of the rainy season (by November 1).

5. Permanent revegetation/landscaping shall emphasize drought-tolerant perennial ground coverings, shrubs, and trees to improve the probability of slope and soil stabilization without adverse impacts to slope stability due to irrigation infiltration and long-term root development.

6. BMPs selected and implemented for the project shall be in place and operational prior to the onset of major earthwork on the site. The construction-phase facilities shall be maintained regularly and cleared of accumulated sediment as necessary.

7. Hazardous materials such as fuels and solvents used on the construction sites shall be stored in covered containers and protected from vandalism. A stockpile of spill cleanup materials shall be readily available at all construction sites. Employees shall be trained in spill prevention and cleanup and individuals shall be designated as responsible for prevention and cleanup activities.

Impact 5.B.3-2: Operation of the project would change historical water levels in College Lake and discharges to Salsipuedes Creek. Reduction of flow to Salsipuedes Creek would reduce its ability to dilute contaminants such as TDS and electrical conductivity (EC), thus resulting in an overall increase in those contaminants. Less than Significant.

Preliminary hydrologic modeling of this project component included an analysis of water use and pumping from the reservoir. The preliminary modeling was performed using a minimum bypass flow of 5 cubic feet per second (cfs) and a maximum diversion rate of 7 cfs. Diversions of surface storage from the Expanded College Lake were assumed to begin when irrigation demand exceeds recycled water supply. Model results indicate that College Lake typically would be empty most of the summer and fall under the proposed operating conditions of the Local-Only Alternative. Using the preliminary modeling input assumptions for minimum bypass flow and maximum diversion rate, the supplemental projects would produce an average annual water supply of 6,700 afy. College Lake may be available for one crop season during this period, assuming suitable soil conditions remain after excavation for dam construction. College Lake does not provide recreational opportunities, and the lake would be near empty or dry during most of the summer and fall. Because a change in lake levels would not affect recreational uses and the lake would be dry for extended periods, the change in water levels would be less than significant.

The project would pump water from the lake to the Coastal Distribution System for delivery to irrigation users. Timing of water diversions would depend on rainfall occurrences, but would be expected to occur primarily in mid-January through mid-May. Diversions may be limited by irrigation demand. The net effect of the project would be to divert flows to the irrigation system that would normally be pumped from College Lake to Salsipuedes Creek to dry up the lakebed for seasonal farming. This would cause water to reside in the lake for either longer or shorter durations than were allowed historically, depending on the irrigation demand, and less water would be discharged to Salsipuedes Creek. Excess flows would still be allowed to flow out of College Lake to Salsipuedes Creek. The effect on hydrology is that less water would flow in the

creek and downstream watercourses to the Pacific Ocean, which would reduce annual flows. Significant reduction of annual flows can lessen a river's ability to dilute naturally occurring contaminants such as TDS and EC. Considering that the reduction of flows from College Lake is only a fraction of the total flows that constitute the supply conveyed by Salispuedes Creek and Pajaro River, the reduction of flow resulting from the project would not significantly contribute to increases in contaminate loads within the Salsipuedes Creek/Pajaro River system. Section 5.B.4 describes the reduction of flows associated with fishery protection impacts and required mitigation.

Mitigation: None required.

Impact 5.B.3-3: Catastrophic failure of the proposed impoundment as a result of improper design, construction, or operation would expose the public to a flooding hazard. Less than Significant.

The design and construction of dams is required to adhere to standards set by the DSOD; adherence to these design and construction standards greatly reduces the probability of dam failure, and therefore adequately protects public safety. During operation, College Lake Dam would be visually inspected on a regular basis to ensure that the embankments, control structures, access roads, and monitoring instrumentation are maintained. All impediments would be removed from the spillway and other control structures as soon as they are observed.

Although the probability of dam failure is extremely remote, the California Office of Emergency Services requires the preparation of an inundation map and the development of a downstream evacuation plan for areas within the potential inundation area (California Water Code Section 6002, and California Government Code Section 8589.5).

Mitigation: None required.

Impact 5.B.3-4: The project may result in surface and groundwater contamination from spills and nonpoint-source runoff of chemicals from the treatment plant. Potentially Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Chemical treatment agents typically stored onsite at treatment plants such as the proposed plant include alum and polymers. These are not hazardous substances, but they can cause contamination if spilled and allowed to enter surface waters. Fuels may also be stored at the facility.

Measure 5.B.3-4: Prepare a SWPPP for the treatment plant. Although a NPDES Industrial Stormwater Permit is not required for water treatment plants, the PVWMA should address the potential for spills and nonpoint-source runoff contamination from the

treatment plant and pump station that could affect water quality in College Lake. At a minimum, the SWPPP or equivalent shall provide for secondary containment of treatment plant chemicals (such as alum or polymers) and fuels, if stored at the plant.

Impact 5.B.3-5: The Expanded College Lake project would convey water, which normally would flow to the ocean, to agricultural lands for irrigation, thereby decreasing the need to pump groundwater. Beneficial.

The Expanded College Lake project, in combination with other supplemental projects, would yield up to 6,700 af annually, water for irrigation that would replace water currently pumped from the groundwater basin. This would in part reduce the current overdraft of the basin and reduce seawater intrusion, and therefore is a beneficial impact on groundwater quality and flow.

REFERENCES – Hydrology and Water Quality

Environmental Science Associates, Inc., *Pajaro Valley Water Management Agency Local Water Supply and Distribution, Environmental Impact Report*, May 7, 1999.

FEMA Flood Hazard Maps, FEMA, in cooperation with ESRI, online FEMA Mapping for the City of Watsonville, 2001.

FEMA Flood Insurance Rate Maps (FIRM), Santa Cruz County, California, No. 385 and 395, April 15, 1986.

King, Kenneth B., P.E., *Evaluation of College Lake and Bolsa de San Cayetano Projects*, prepared for Raines, Melton, and Carella, Inc., January 2000.

Pajaro Valley Water Management Agency, *Pajaro Valley Water Management Agency State of the Basin Report*, prepared by Jones & Stokes, May 2000.

Raines, Melton, and Carella, Inc., *Revised Basin Management Plan for PVWMA, Internal Draft*, July 2001.

5.B.4 VEGETATION, FISH, AND WILDLIFE

5.B.4.1 SETTING

Please refer to Section 3.4 for a description of methods used during investigation of the project area for biological resources.

For a description of the Expanded College Lake project, refer to Section 2.4.3 in Chapter 2, Project Description. College Lake is a seasonal lake that receives water from an 11,000-acre watershed during the rainy season. Currently, College Lake is pumped dry in the spring and the lakebed is farmed and harvested before winter runoff begins filling the lake (typically in November). Remnants of the former natural hydrology are evident in the persistence of well-developed willow-dominated riparian forest along the lowest reaches of Casserly Creek and, to a lesser extent, several smaller tributaries, just before they empty into College Lake. The remainder of College Lake is entirely agricultural, and surrounding land uses are residential and agricultural.

The Expanded College Lake Project proposes to increase the total storage capacity of College Lake to 4,600 af. **Figure 2.10** in Chapter 2 shows the approximate locations proposed for the main earth dam, the saddle dam, and the pumping and filtration facilities.

Several special status wildlife species are known to occur or may have potentially suitable habitat in the vicinity of the proposed College Lake project. Aquatic habitat for the California red-legged frog and the western pond turtle is present in Corralitos and Salsipuedes creeks. However, upland habitat is marginal because little natural vegetation remains in these areas. Suitable nesting habitat for raptors such as red-shouldered hawks and white-tailed kites is present in the riparian vegetation along the northern side of the lake, and particularly in the area of Casserly Creek. An adult red-shouldered hawk was observed in this area during a 2001 survey. In addition, the area undoubtedly provides nesting habitat for numerous smaller birds.

No special status plants were observed in the project area. There are historic records for two special status plants in this area, Congdon's tarplant (*Hemizonia parryi* ssp. *congdonii*) and Santa Cruz tarplant (*Holocarpha macradenia*). However, careful surveys in 1977 and 1986 by Rex Palmer and Randall Morgan, two authorities on the rare plants in the region, could not relocate these populations. Both concluded that these plants had been eliminated because of residential development in the area. Supporting this conclusion, neither species was observed in the College Lake area by Environmental Science Associates botanists.

With respect to fisheries resources, the Pajaro River and Corralitos and Salsipuedes Creeks support a variety of common fish species, and all three support a threatened run of south-central California coast steelhead. Spawning and rearing habitat for this species is present in the upper reaches of Corralitos Creek, and the upper tributaries of Salsipuedes Creek above College Lake. Conditions for steelhead passage to and from spawning and rearing habitats are the primary fish habitat factor potentially affected by the proposed project. The presence of sufficient stream

flows for down-migration of smolts is critical. These conditions were surveyed in the spring of 1997 (Habitat Restoration Group, 1997; Smith, 1999; Appendix C).

Most riffles on Salsipuedes Creek downstream of College Lake were narrow, straight, and easily passable, requiring as little as 1.0 - 2.0 cubic feet per second (cfs) for smolt passage. However, two measured diagonal riffles required an estimated 3.0 and 7.5 cfs for smolt passage. Smolts were observed to have migrated down Corralitos Creek to Salsipuedes Creek at 1.0 cfs in May 1997 (probably with great difficulty). Surveyed flows in Salsipuedes Creek included flow from Corralitos Creek, as well as from College Lake. The analysis concluded that during the period of March 15 through May 31 (the primary smolt migration period), a minimum flow of 7.5 cfs would be required in Salsipuedes Creek at its confluence with Corralitos Creek for steelhead smolts to be able to reach the Pajaro River. Furthermore, at least 2.0 cfs of the total 7.5 cfs would need to be provided by the reach of Salsipuedes Creek upstream of the confluence, that is, from College Lake. After informal consultations with CDFG and the National Marine Fisheries Service (NMFS), it was agreed that this 2.0 cfs bypass flow from College Lake would be provided through June 1, a more conservative estimate of the end of the smolt down-migration period (Environmental Science Associates, 1999).

5.B.4.2 SIGNIFICANCE CRITERIA

Please refer to Section 4.A.4 for a description of the significance criteria used in analyzing potential project impacts related to biological resources.

5.B.4.3 IMPACTS AND MITIGATION MEASURES

For the analysis of impacts for this component of the project, the outlet works structure for the main dam were assumed to be constructed downstream of the existing headgate on Salsipuedes Creek and that the existing headgate would be removed.

Impact 5.B.4-1--Wetlands: Construction of the main dam and associated facilities could result in temporary impacts on up to 0.7 acre of potential jurisdictional wetlands/waters of the U.S. and streambeds and banks under the jurisdiction of the CDFG. Potential impacts include sedimentation in Salsipuedes Creek during construction activities, temporary loss of wetland-associated vegetation, stream function as wildlife and fishery habitat, and loss of special status natural communities. Construction of the main dam would also result in the permanent loss of approximately 0.1 acre of wetland in Salsipuedes Creek. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

This project would require the construction of the main dam, outlet works, diversion pump station, and treatment facilities within or in the immediate vicinity of Salsipuedes Creek. Raising the storage elevation of College Lake by nine feet would result in the flooding of an additional 160 acres of land when the lake is filled to the proposed 69-foot elevation. Within the 420 acres of land flooded at the new lake elevation, the flooding would result in deeper and longer flooding. The pumping of College Lake is currently completed by May; in some years under the

proposed scenario, pumping might continue through July. As is the existing condition, flooding and pumping would occur during the winter and spring months.

No natural wetlands would be created as a result of this alternative. Some small areas of Valley Foothill Riparian habitat consisting primarily of willows is located on Casserly Creek and several smaller tributaries to College Lake. Willows are the most flood-tolerant genus of California trees, especially during their dormant period in the winter (USFWS, 1980). However, an increase in the depth of flooding by nine feet and an extension of the period of inundation by several weeks in late spring in some of the higher rainfall years might adversely affect this habitat and could result in the loss of individual willows or the entire habitat.

Increased short-term flooding of riparian and disturbed grassland habitats would have a neutral or beneficial impact on habitat for three special status animals: California red-legged frogs, western pond turtles, and California tiger salamanders. These species depend on standing water, emergent vegetation, and woody vegetation associated with standing water. An increased water regime could enhance habitat characteristics for these species.

Construction of the pumping facilities would for the most part be located in Cropland/Orchard/ Vineyard and Urban/Developed habitats, and would have insignificant impacts to biological resources. However, outlet works construction in and near Valley Foothill Riparian habitat could result in erosion, sedimentation, and reduction in water quality that would adversely affect the biological resources that depend on these habitats.

The banks of Salsipuedes Creek where the main dam is proposed is vegetated with blackberries and a variety of weedy species. However, a small part of the main dam would permanently fill up to 0.1 acre of Salsipuedes Creek.

Measure 5.B.4-1a--Implement Standard Protective Measures to Maintain Water Quality and Control Erosion and Sedimentation:

- Restrict all in-channel construction activities in Salsipuedes Creek to low-flow periods (i.e., after College Lake has been emptied).
- Place sediment curtains downstream of the construction zone to prevent sediment disturbed during trenching activities from being transported and deposited outside of the construction zone.
- Locate spoil sites so they do not drain directly into the waterways. If a spoil site drains into a channel, catch basins will be constructed to intercept sediment before it reaches the channels. Spoil sites will be graded to reduce the potential for erosion.
- Prepare and implement a spill prevention plan for potentially hazardous materials. The plan will include the proper handling and storage of all potentially hazardous materials, as well as the proper procedures for cleaning up and reporting of any spills. If necessary, containment berms will be constructed to prevent spilled materials from reaching the creek channels.

- Store equipment and materials away from the waterways, outside existing levees or at least 50 feet from waterways, but within the pipeline right-of-way. No equipment or materials shall be deposited within 100 feet of wetlands.

- Provide proper and timely maintenance for vehicles and equipment used during construction to reduce the potential for mechanical breakdowns leading to a spill of materials into or around the creeks. Maintenance and fueling will be conducted in an area that meets the criteria set forth in the spill prevention plan (i.e., away from the creeks).

Measure 5.B.4-1b--Revegetation Measures in Riparian Forest: Where adverse impacts to Valley Foothill Riparian forest occur at College Lake, revegetation measures will be developed as part of a revegetation plan approved by CDFG. These measures will include: stockpiling and conserving surface soil for spreading following construction; use of locally obtained and locally indigenous plant materials; use of site preparation and planting methods known to be effective for riparian habitats and the species to be used in revegetation; after-installation care; implementation of effective weed control measures; development of success criteria; and identification of corrective measures if the success criteria are not met. The revegetation plan will use materials of the same species as existing vegetation, and will use planting ratios to allow for some mortality during the years when the vegetation is small.

Measure 5.B.4-1c--Implement off-site wetland creation and/or enhancement to compensate for up to 0.1 acre of permanently filled wetland where the main dam will fill Salsipuedes Creek. Compensation may consist of nearby wetland creation, such as allowing a small portion of College Lake to dry naturally instead of withdrawing all the water, or wetland enhancement, such as restoration of riparian areas on Salsipuedes Creek downstream of the proposed dam.

This mitigation measure would reduce significant impacts to wetlands and riparian habitat impacted by this project component to a less-than-significant level.

Impact 5.B.4-2: Construction of facilities in and near wetlands could result in temporary impacts to special status animal species and their habitats. Impacts could occur due to increased sedimentation in streams, dewatering of pools, habitat loss through vegetation removal, destruction of nests and burrows and construction disturbance. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Habitat for special status animals is present in Valley Foothill Riparian and Fresh Emergent Wetland habitats in the project area at College Lake and Salsipuedes Creek. Environmental Science Associates qualitatively evaluated the habitat condition of each area. The special status animal species associated with these habitats that have the potential to occur on project sites include:

- California red-legged frog (federal Threatened and California Species of Special Concern; Critical Habitat designation);
- Red-shouldered hawk, white-tailed kite, and other raptors and nesting passerine birds;
- Western pond turtle (federal Species of Concern and California Species of Special Concern);
- South-central California coast steelhead (federal Threatened, California Species of Special Concern; Critical Habitat designation).

California Red-Legged Frog. Fresh Emergent Wetlands provide breeding habitat for California red-legged frog. Potential habitat for this species occurs in Salsipuedes Creek. Temporary habitat disturbance would result from facility construction activities. Impact to habitat is estimated at 0.7 acre for the main dam. This impact could result in mortality or disturbance to individuals.

Raptors and Nesting Passerine Birds. Raptor and passerine species nest in dense riparian habitats between March and July. Potential nesting areas for these species occur in the stand of willows on the eastern arm of College Lake and on Salsipuedes creeks. CDFG Code Sections 3503 and 3503.5, and the Migratory Bird Treaty Act protect raptors and passerines and their nests and eggs from take. Disturbance due to construction could result in reproductive failure for raptors nesting in the vicinity.

South-Central California Coast Steelhead. The proposed project could cause construction-related impacts to migrating steelhead, such as sedimentation and degradation of water quality. Operation of the project would cause additional impacts, discussed in Impact 5.B.4-3 (below).

Western Pond Turtle. Any project areas with permanent water, including Salsipuedes Creek, provide potential habitat for the western pond turtle. Project construction activities in these wetlands could result in direct mortality, or habitat degradation due to increased erosion and siltation into creek waters.

The following measures apply whether or not construction would take place within the banks of the creeks; however, if construction would occur within the bed and bank of the creeks, protection measures for other species would also limit timing of construction. For example, if construction were planned within a creek supporting a steelhead run, construction may occur during June 1 through November 1 (Measure 5.B.4-2e). Construction in an area with California red-legged frog habitat is allowed only during April 1 through November 1 (Measure 5.B.4-2b). Combining these, construction in riparian areas with habitat for all three, steelhead, California red-legged frogs, and raptors and passerines, would be limited to August 1 through November 1.

> **Measure 5.B.4-2a--Avoid Disturbance to Riparian Vegetation:** Avoid removal or damage to all riparian vegetation within the project corridor. Erect exclusion fencing during construction along the edge of riparian vegetation where the construction area is

within 25 feet of the riparian zone. If complete avoidance is infeasible, implement Measure 5.B.4-2b.

The above measure is also applicable to the construction of the outlet works on Salsipuedes Creek.

Measure 5.B.4-2b--Survey, Consultation and Protection Measures for Special Status Wildlife Species: Since South-central California coast steelhead are known to be present, and potential habitat for the California red-legged frog was found as part of the site assessment, reasonable and prudent measures for protection of the California red-legged frog contained in the Programmatic Biological Opinion for this species (USFWS, 1999) shall be implemented if the U.S. Army Corps of Engineers finds that impact to this species is likely. If impacts to the South-central California coast steelhead or tidewater goby may occur as a part of this project, a formal consultation and Biological Opinion must be prepared for USFWS and the National Marine Fisheries Service (NMFS) under the Endangered Species Act.

Since steelhead, California Red-legged frogs, and other special status species are known or presumed present in the project area, Measures 4.A.4-2e through 4.A.4-2g shall be implemented.

Impact 5.B.4-3: Operation of the proposed project would reduce streamflows for steelhead passage in Salsipuedes Creek, particularly for down-migrating smolts in the spring months. Installation of the outlet works at College Lake could present a barrier to up-migrating adult steelhead as well as down-migrating smolts. Significant. The impact would be reduced to a less-than-significant level with mitigation identified in this EIR.

Steelhead use the Pajaro River, Salsipuedes Creek, Corralitos Creek, and the upper tributaries to College Lake. Diversion of most of the College Lake water currently pumped down Salsipuedes Creek could reduce this population, which depends on the current pumping regime to provide enough flow for breeding and smolt migration. Unless flows are managed to allow continued migration of adult and juvenile steelhead, the steelhead run in this portion of the Pajaro River watershed could be significantly reduced. Operation of the intake structure at College Lake also presents a risk to down migrating smolts, which could become entrapped or entrained. Raising the elevation of the lake by nine feet through the installation of the main dam and outlet works also presents a potential impact to up-migrating adult steelhead, which would be unable to negotiate such a tall barrier. The measures presented below should be implemented in conjunction with Measure 5.C.4-3a for the Corralitos Creek and Pinto Lake Diversion projects.

Measure 5.B.4-3a--Maintenance of Streamflow for Steelhead: Impacts to steelhead smolt passage by altering College Lake storage and/or reducing the pumping of College Lake water into Salsipuedes Creek can be avoided by providing minimum bypass flows during the steelhead smolt migration period. Bypass flows should be:

- From 15 March through 1 June: 7.5 cfs in Salsipuedes Creek at its junction with Corralitos Creek, with a minimum bypass flow of 2.0 cfs from College Lake and a minimum bypass flow of 0.5 cfs from Corralitos Creek to provide passage to the confluence.

- After 1 May no Salsipuedes bypass flow would be required if Corralitos Creek is dry at Highway 152.

Minimum passage flows in Salsipuedes Creek are no longer needed after Corralitos Creek has dried at Highway 152 after 1 May, since smolts would no longer be coming down Corralitos Creek and restoration of flow by storm would be unlikely that late in spring. Green Valley and Casserly Creeks tend to dry before Corralitos Creek, so maintenance of minimum passage flows through the full migration period on Corralitos Creek would also adequately protect smolt migration on these smaller streams.

Measure 5.B.4-3b--Protection of Migrating Adult and Smolt Steelhead at College Lake main dam: Fish passage past the new main dam and outlet works at College Lake shall be constructed and maintained so that upstream steelhead passage is no more difficult than the present conditions. Passage shall be facilitated through the installation of a fish ladder, the design of which will need to be approved by CDFG and NMFS. The design shall include a sufficiently high bypass flow to allow fish to travel through the passage structure. This flow shall be no less than 2.0 cfs in order to comply with Measure 5.B.4-3a (above).

Measure 5.B.4-3c--Protection of Down-Migrating Steelhead Smolts at College Lake Intake Facilities: The current pumping facilities move water out of College Lake and directly into Salsipuedes Creek and are entirely unscreened, potentially resulting in the entrainment of steelhead. With the construction of a diversion pipeline for the proposed project, the intake structure shall be designed to ensure that smolts are not entrained, since the diverted water will be used for irrigation or recharge. The intake facilities design must result in no entrapment or entrainment of steelhead smolts (NMFS, 1997).

REFERENCES – Vegetation, Fish, and Wildlife

Environmental Science Associates (ESA), *Pajaro Valley Water Management Agency Local Water Supply and Distribution Project Sensitive Species Habitat Assessment*, prepared for the Pajaro Valley Water Management Agency, Watsonville, 1999.

Habitat Restoration Group (HRG), *Fisheries Report for the Pajaro Valley Water Management Agency Water Supply Project*, prepared for Environmental Science Associates, San Francisco, Appendix C, 1997.

National Marine Fisheries Service (NMFS), *Fish Screening Criteria for Anadromous Salmonids. National Marine Fisheries Service Southwest Region*, 10 pp., 1997.

Smith, J. J., *Fish Passage on the Pajaro River at Murphy's Crossing*, Technical Memorandum prepared for Environmental Science Associates, Appendix C, March 15, 1999.

U.S. Fish and Wildlife Service, *Impact of Water Level Changes on Woody Riparian and Wetland Communities*, Vol. VIII, Pacific Northwest and Rocky Mountain Regions, U.S. Fish and Wildlife Service Office of Biological Services Program Report FWS/OBS-78/94, 1980.

U.S. Fish and Wildlife Service (USFWS), *Programmatic Formal Endangered Species Act Consultation on Issuance of Permits under Section 404 of the Clean Water Act or Authorizations under the Nationwide Permit Program for Projects that May Affect the California Red-legged Frog*, Letter to U.S. Army Corps of Engineers district offices, dated January 26, 1999.

5.B.5 CULTURAL RESOURCES

5.B.5.1 SETTING

Archaeology of the Project area

Section 3.5 provides archaeological/prehistoric data on the project area.

Ethnography of the Project area

Section 3.5 provides ethnographic data on the project area.

Historical Overview

Section 3.5 provides an historical overview of the project area.

Cultural Resource Findings in the College Lake Area

Archaeological surveys of the College Lake area were conducted by Pacific Legacy in November 1997 and March 1999 which included surveys of areas that would be affected by proposed College Lake improvements (Holson, 1997). A cultural resources records search for the College Lake area was conducted by the Anthropological Studies Center at Sonoma State University in September 2001. The archaeological surveys and records search identified five cultural resource sites, described below.

Three existing previously recorded archaeological sites were identified adjacent to College Lake, which include CA-SCR-44/H, CA-SCR-104H, and CA-SCR-150. The CA-SCR-44/H site is approximately 40 acres in size and consists of a historic component (Saint Francis Church and School complex) and two prehistoric components that include human remains. CA-SCR-104H consists of flaked stone debris, faunal shell, bone, and groundstone artifacts. Historic components of this site include two houses and two barns dating from the 1890s to the early 1900s. CA-SCR-150 consists of a large area of flaked stone debris and faunal bone and shell. One new archaeological site was identified in the 1997 surveys. This site (identified as CL-2) was found to contain shell, groundstone, and chert flakes.

In addition to the cultural resource mentioned above, another archaeological site (CA-SCR-295) was identified adjacent to College Lake in the 2001 records search by the Anthropological Studies Center. The site is approximately 0.5 acre in size and consists of historic components including Monterey and Franciscan chert debitage and shatter, chert cobbles and pebbles.

5.B.5.2 SIGNIFICANCE CRITERIA

See Section 4.A.5.2 for a discussion of significance criteria.

5.B.5.3 IMPACTS AND MITIGATION MEASURES

Impact 5.B.5-1: Construction activities associated with the proposed College Lake Expansion and associated facilities could result in the alteration or destruction of identified cultural resources. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Five cultural resources (prehistoric and historic) sites were identified near, or adjacent to, College Lake. Construction activities associated with the water diversion and filtration facilities and dam facilities would encroach into an historic site, CA-SCR-44/H. In addition, cultural resource sites CL-2, CA-SCR-104, CA-SCR-295 and CA-SCR-150 could be adversely affected. These sites could be altered or destroyed by construction activities and/or flooding from lake capacity expansion. Flooding could cause erosion and/or deterioration of cultural materials at these sites.

Measure 5.B.5-1: Implement Measures 4.B.5-1a and 4.B.5-1b.

Impact 5.B.5-2: Ground-disturbing activities associated with the proposed facilities and excavation of the lake bottom could reveal previously unknown buried or otherwise obscured significant prehistoric and historic cultural resources. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Significant unknown cultural resources may be buried or obscured by vegetation on the project site, and therefore construction of the proposed project could result in degradation and destruction of undiscovered cultural resources.

Measure 5.B.5-2: Implement Measure 4.A.5-1.

Impact 5.B.5-3: Potential indirect impacts to cultural resources, primarily vandalism, could result from the increased access to, and use of the general area during construction. Such disturbance could result in the loss of integrity of important cultural resources. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Construction activities associated with proposed expansion of College Lake might provide increased accessibility to existing cultural resource sites adjacent to College Lake. This could result in looting and vandalism of important cultural resources

Measure 5.B.5-3: Implement Measures 4.B.5-3a through 4.B.5-3c.

REFERENCES – Cultural Resources

Holson, John, Pacific Legacy, Incorporated, Written Correspondence, November 14, 1997.

5.B.6 TRAFFIC AND CIRCULATION

5.B.6.1 SETTING

Project Area Roadways

Figure 3.6-1 illustrates, and Section 3.6 (Regional Setting – Traffic and Circulation) describes project area roadways in the discussion of Regional Setting. *Highway 152* provides east-west access through the project area, stretching east from Highway 1 to the Central Valley. In the west portion of the project area, Highway 152 runs through Watsonville (along Main Street, East Beach Street, Lincoln Street and East Lake Avenue) to Hecker Pass (via Hecker Pass) and Santa Clara County.

A number of local two-lane roadways that might be affected by the project include Holohan Road, College Road and Lakeview Road. *Holohan Road* extends west from Highway 152 south of College Lake to Freedom. *College Road* extends east from Highway 152, south of Kelly and Drew Lakes. *Lakeview Road* extends north from Highway 129 providing connection to College Road.

Traffic Volumes

Section 3.6.1 presents daily traffic volumes on study area roadways.

Existing Truck Traffic on Roadways

Section 3.6.1 presents existing truck traffic on study area roadways.

Accident History

Section 3.6.1 presents an accident history for study area roadways.

Roadway Improvement Projects

Section 3.6.1 describes roadway improvement projects planned in the study area.

Applicable Plans and Policies

Section 3.6.1 presents applicable plans and policies for jurisdictions in the study area.

5.B.6.2 SIGNIFICANCE CRITERIA

See Section 4.A.6.2 for a discussion of significance criteria.

5.B.6.3 IMPACTS AND MITIGATION MEASURES

Construction Trip Generation

Construction activities that would generate traffic would consist of trucks hauling equipment and materials to the dam site, the hauling of excavated spoils, and the daily arrival and departure of construction workers to and from the work sites. Materials delivery likely would generate the greatest number of off-site truck trips associated with the expanded College Lake project. An estimated 60,000 cubic yards of materials, including riprap and concrete, would be delivered to the site. During peak delivery periods, up to 10 round-trips per hour could occur as these materials are delivered to the dam sites.

Approximately 100,000 cubic yards of material would be excavated from the bottom of College Lake to be used in the construction of the dams. All hauling of this material between the lake and the dam site is assumed to occur on private farm roads; consequently, there would be no increase in construction trips on public roads associated with this element of the project.

A comparatively smaller number of construction truck trips (less than 10 truck trips per day) would be associated with the construction of the pump station, filtration and pretreatment facilities to be located south of College Lake along the west bank of the Salsipedes Creek.

Construction workers would be commuting to and from the project sites, most likely in personal automobiles or small trucks. An estimated 20 workers would be expected to commute to and from the site on a daily basis during the construction period.

Construction Trip Distribution

The Granite Construction Quarry, located in Aromas off Highway 129, likely serve as the source of the concrete and rip rap for the expanded College Lake project. Construction worker trips are assumed to originate from the major urban areas in the project region and nearby communities.

Based on the existing roadway network serving the project area, project trucks and construction workers traveling to and from the alignment are assumed to use a combination of highways (e.g., Highway 101, Highway 152), county roads and designated truck routes in the project vicinity to reach other local points and/or regional locations. Railroad lines and railroad right-of-ways would not be affected by this project component.

Impact 5.B.6-1: Traffic on area roadways would temporarily increase as a result of project-generated vehicle trips by construction workers and construction vehicular activities. Less than Significant. Implementation of mitigation identified in this EIR, while not required, would assist in ensuring that the impact would remain at a less-than-significant level.

Because project construction-generated traffic would be temporary, it would not result in any long-term degradation in operating conditions or level of service for any project roadways. The

primary off-site impacts from the movement of construction trucks would include short-term and intermittent lessening of roadway capacities due to slower movements and larger turning radii of the trucks compared to passenger vehicles.

The project would temporarily increase traffic on roadways providing access to the work site and roadways providing connection to regional routes; this would include Highway 152, Highway 129, Highway 1, Holohan Road and Lakeview Road. Although the specific estimated off-site construction vehicle trips are yet not determined for all components of this project (see Construction Trip Generation, above), given the expected type of facilities construction, construction-generated traffic would be expected to be at a level that would not significantly disrupt traffic flow on these freeways and arterials.

Most project related hauling and deliveries would be expected to be dispersed throughout the day, thus lessening the effect on peak-hour traffic. Project truck traffic occurring during the hours of 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. would coincide with peak-hour traffic, and therefore, have the greatest potential to impede traffic flow during these time periods. Restricting truck traffic during the morning and evening peak periods would further minimize disruption of the general traffic flow on affected roadways during the peak traffic hours.

Although this impact would be less than significant, the following mitigation measures are recommended to further reduce this less-than-significant impact.

Measure 5.B.6-1 (Recommended): Implement Measures 4.A.6-1a and 4.A.6-1b.

Impact 5.B.6-2: Project construction would increase wear-and-tear on area roadways used by construction vehicles. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The use of heavy trucks to transport equipment and material to and from the project site could affect road conditions by increasing the rate of road wear or causing direct damage to roads and bridges. The degree to which this impact would occur depends on the project-generated traffic and the design (pavement type and thickness) and existing condition of the roadways. The project's impact is assumed to be minimal on major arterials (e.g., highways, including Highways 1, 101, 129, and 152) which are designed to accommodate a mix of vehicle types, including heavy trucks.

Other local-serving roads, such as Lakeview Road and College Road, may not be built with a pavement thickness that would withstand considerable heavy truck volumes. The projected increase in use of these or other local roadways by heavy trucks could result in significant roadwear on these roadways.

Measure 5.B.6-2: Implement Measure 4.A.6-2.

Impact 5.B.6-3: Project construction would increase potential traffic safety hazards for vehicles and pedestrians in the construction area. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The temporary increase in construction-generated trucks on project area roadways would interact with other vehicles, including other large trucks, slow-moving agricultural vehicles (in farm areas), and other local traffic. Potential conflicts also could occur between construction traffic and bicyclists and pedestrians, particularly in and near residentially dense areas, such as the residential neighborhood near College Road, and in Watsonville. Highway 152, Holohan Road, College Road, and Lakeview Road (south of College Road) are part of the Master Plan of Santa Cruz County bikeways (Santa Cruz County, 1994).

As discussed in Section 3.6.1, Setting, a number of major study roadway segments currently exhibit higher accident rates than the statewide average for similar roadways. These roadways include Highway 152 (through Watsonville) and Highway 129 (in Santa Cruz and Watsonville). However, these arterials are already used heavily by trucks (as discussed in Section 3.6.1, Setting). In addition, the state and county routes would still be the safest, and in virtually all locations, the only desirable routes for project traffic to use.

Measure 5.B.6-3: Implement Measures 4.A.6-3a and 4.A.6-3b.

Impact 5.B.6-4: Project construction would generate a demand for parking spaces for construction worker vehicles. Less than Significant.

The project would generate a need for parking for construction workers and construction vehicles, as well as areas to store equipment and supplies. The location of staging areas has not been identified at this point; however, given the size of the site, it is expected that providing space for staging areas could be easily accommodated. The demand for new parking would be met by the proposed construction staging areas. No public on-street parking would be eliminated during project construction.

Mitigation: None required.

Impact 5.B.6-5: Project construction could coincide with other construction projects under the Revised BMP, or other potential construction projects in the area, contributing to cumulative traffic and roadway disruptions. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Construction associated with the proposed project could occur at the same time construction of other components identified under the Revised BMP occurs, in addition to other potential

cumulative construction projects in the project area. The projects would share some of the same construction access routes (including Highway 1, Highway 129 and Highway 152). Consequently, cumulative traffic and roadway disruptions could occur. The implementation of mitigation measures identified in this section would reduce this project's contribution to cumulative impacts. The following measures would further reduce this project's contribution to this impact to a less-than-significant level.

Measure 5.B.6-5: Implement Measure 5.A.6-7.

Impact 5.B.6-6: The Expanded College Lake project could conflict with a new Paulsen-Whiting Road bridge connection planned by Santa Cruz County. Less than Significant. Implementation of recommended mitigation measures identified in this EIR, while not required, would assist in ensuring that the impact would remain at a less-than-significant level.

Development of the expanded College Lake project would increase the lake elevation from 60 to 69 feet and would lead to inundation of approximately 420 acres of land, an increase of 160 acres from existing conditions. Part of the inundation area would be located in the area of a new Paulsen-Whiting Road bridge connection planned by Santa Cruz County. This road was destroyed by flooding during Winter 1996. The County is currently considering preliminary design for a new bridge connection along the alignment as the previous road (Williamson, 2001). If the proposed College Lake project were not closely coordinated with the planned bridge connection project, the proposed project could conflict with the proposed design, construction, operation and maintenance of such bridge connection.

Measure 5.B.6-6 (Recommended): The PVWMA shall coordinate closely with the Santa Cruz County Public Works Department to ensure the planning, design, construction, operation and maintenance of the Expanded College Lake project and new Paulsen-Whiting Road project are compatible.

REFERENCE – Traffic and Circulation

Santa Cruz County, *1994 General Plan and Local Coastal Program for the County of Santa Cruz*, 1994.

Williamson, Bill, Santa Cruz County Department of Public Works, telephone conversation, August 6, 2001.

5.B.7 AIR QUALITY

5.B.7.1 SETTING

Section 3.6, Regional Setting – Traffic and Circulation, describes the major roadways in the vicinity of College Lake. Aside from automobile and agricultural emissions there are no major air emission sources in the vicinity of this project component.

5.B.7.2 SIGNIFICANCE CRITERIA

Please refer to Section 4.A.7.2 for a description of the significance criteria used in analyzing potential project impacts related to air quality.

5.B.7.3 IMPACTS AND MITIGATION MEASURES

Impact 5.B.7-1: Construction of this Local-Only Alternative project component would temporarily generate criteria air pollutants, particularly PM_{10}, over the duration of the construction period. Significant and Unavoidable. Implementation of mitigation identified in this EIR would reduce the impact, but it would remain significant.

Construction of the project would generate fugitive dust (including PM_{10}), and other criteria air pollutants from exhaust emissions. A large portion of the total construction dust emissions would result from site grading and trench excavation activities. Dust emissions would vary from day to day, depending on the phase of construction, the silt content of the soil, and the weather. Daily emissions would depend greatly upon whether construction of the various supply components and distribution systems would occur simultaneously. Construction-related impacts which are individually less than significant may have a significant impact if construction occurs on two or more components simultaneously. Additionally, PM-10 as well as some exhaust emissions would add to the cumulative air pollutant emissions of the valley. In an agricultural region, soil tilling is a source of PM-10, which in total far exceeds what the project construction could generate at individual site locations. Larger particles of dust from construction would fall out relatively close to construction sites and could cover crops with a coating of dust. This could be injurious to plants, particularly seedlings and plants in their early growth stages.

According to MBUAPCD *CEQA Guidelines,* construction projects which emit precursors of ozone (i.e., ROG and NO_x) are accommodated in the emission inventories of the Air Quality Management Plans and would not have a significant impact on the attainment and maintenance of ozone AAQS. For this reason, emissions of ROG and NO_x from construction equipment will not be quantified and will be considered a less-than-significant impact. The MBUAPCD Guidelines also state that PM-10 emissions from construction activities are considered significant if they would generate 82 pounds per day or more of PM_{10} when the activities are located nearby and upwind of sensitive receptors.

The EPA emission factors for PM_{10} emissions do not specifically apply to excavation and handling of soil. In lieu of this information, emission factors from the South Coast Air Quality

Management District (SCAQMD) were used (SCAQMD, 1993) for dam construction. Assuming an average soil excavation of 800 cubic yards per day based on 80 incoming trucks per day, dam construction would result in particulate emission of approximately 1,887 pounds of PM_{10} per day.

Measure 5.B.7-1: Implement dust control program described in Measure 4.A.7-1.

The effectiveness of the dust control measures in reducing PM-10 emissions ranges from 34 percent (for sweeping streets) to 90 percent (for covering haul trucks and inactive storage piles) (MBUAPCD, 2000). However, implementation of all applicable measures would not reduce PM-10 emissions to below 82 pounds per day. Assuming an average reduction of 75 percent, PM10 emissions would be 472 pounds per day with identified mitigation measures. With implementation of Measure 4.A.7-1, construction-generated PM-10 emissions would remain significant and unavoidable.

Impact 5.B.7-2: Vehicle trips resulting from operation and maintenance of the various components of the project would generate emissions of criteria air pollutants. Less than Significant.

Operation of the dams would require periodic maintenance and inspection by PVWMA employees. Emissions generated by employee vehicle trips would be negligible and would not exceed MBUAPCD significance thresholds. Pumps would be powered by electricity, rather than diesel, and would not generate criteria air pollutants.

REFERENCE – Air Quality

Monterey Bay Unified Air Pollution Control District, *CEQA Air Quality Guidelines*, September 2000.

South Coast Air Quality Management District (SCAQMD), *CEQA Air Quality Handbook*, April 1993.

5.B.8 NOISE

5.B.8.1 SETTING

Please refer to Section 3.8 for a discussion of regional noise conditions. Proposed facilities under this component include construction of a earth dam, saddle dam, outlet woks, spillway, pump station, and pretreatment and filtration facilities.

The proposed locations for the pump station and pretreatment and filtration facilities are south of the dam adjacent to Salsipuedes Creek. Residences are located approximately 500 feet south of the main dam and facility structures. St. Francis School is located about 1,000 feet from the main dam and structure site.

5.B.8.2 SIGNIFICANCE CRITERIA

See Section 4.A.8.2 for a discussion of significance criteria.

5.B.8.3 IMPACTS AND MITIGATION MEASURES

Impact 5.B.8-1: Construction activities associated with the project construction would intermittently and temporarily generate noise levels above existing ambient noise levels in the project vicinity. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Construction-related noise levels in the vicinity of the College Lake project would fluctuate depending on the particular type, number, and duration of use of various pieces of construction equipment, and the location of sensitive receptors. The effect of construction noise would depend on how much noise would be generated by the equipment, the distance between construction activities and the nearest noise-sensitive uses, and the existing noise levels at those sensitive uses.

Construction activities would be expected to last approximately 23 months at the dam and filter plant locations. Residences are located within 500 feet of the dam and filter plant locations; therefore, noise associated with construction activity would be considered a significant effect for this component. Implementation of the mitigation measures below, which limit the timing of construction and use of equipment, would reduce potentially significant impacts to a less-than-significant level.

Measure 5.B.8-1: Implement Measure 4.A.8-1.

Impact 5.B.8-2: Operation of proposed filtration plant and pumping facilities would result in noise increases in the vicinity of project facilities. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The College Lake expansion would result in an increase in noise-generating equipment in the vicinity of the pump station. Operation of a pump station would require three booster pumps while the filter plant would require three filter pumps. Generally, a 150-horsepower pump generates a noise level of 75 dBA at a distance of 50 feet. Assuming a distance of 500 feet to the nearest sensitive receptors, noise from six pumps would be reduced to 63 dBA at a distance of 500 feet. While this noise level likely would not be significant during daytime hours, it would be noticeable during quieter nighttime hours. Assuming 24-hour operation of the six pumps, the resulting Ldn at local receptors would be 69 dBA, which falls within the conditionally acceptable land use category for residential land uses within the General Plan. Because the proposed pump station would have the potential to increase local noise levels at nearby residences in excess of a normally acceptable residential land use environment as established in the General Plan, the project would result in a potential significant operational noise impact. The pumping facilities associated with the College Lake Expansion element have the potential to affect nearby sensitive receptors, depending on the siting and design of the pumping facility. Implementation the Mitigation Measures below would reduce potential impacts to a less-than-significant level.

Measure 5.B.8-2: PVWMA shall incorporate into contract specifications the following measures:

- The pumping facilities shall be designed with acoustical treatments (building enclosures, louvered vents, noise walls, etc.) that are adequate to maintain potential noise generation to levels at or below ambient levels.

5.B.9 PUBLIC SERVICES

5.B.9.1 SETTING

Please refer to Section 3.9 for a discussion of public services and utilities serving the area.

5.B.9.2 SIGNIFICANCE CRITERIA

Please refer to Section 4.A.9.2 for a discussion of significance criteria.

5.B.9.3 IMPACTS AND MITIGATION MEASURES

Demand during construction for public services such as water (for dust control), solid waste disposal, and schools will not be large enough to cause significant impacts. (Solid waste generated by the project would be sent to the Marina Landfill in Monterey County.)

Impact 5.B.9-1: Expansion of College Lake could result in temporary, planned or accidental disruption to utility services provided by underground or above-ground lines. Significant. With mitigation identified in this EIR the impact would be reduced to a less-than-significant level.

An above-ground electric line passes through the main dam site. Expansion of College Lake likely would not affect underground utilities, as the project would not be located on public roads or other utility corridor; however, Paulsen Road would be displaced by the higher reservoir elevation, and the proposed saddle dam site is adjacent to Lake Avenue. Refer to Impact 4.A.9-1 for further discussion of the potential disruption of underground utilities.

Accidental disruption of smaller utility lines and cables is possible along all segments. Temporary and accidental impacts to smaller utility lines would be considered adverse, but not significant, because the affected area and duration of the impacts would be limited.

The above-ground utility line would be relocated as appropriate, in coordination with PG&E. PG&E would be responsible for designing and implementing the relocation of the utility line; the California Public Utilities Commission would be the lead agency for any follow-up CEQA compliance. Because no alternative route for the utility line has been identified, the environmental impacts are currently unknown.

> **Measure 5.B.9-1:** A detailed study identifying utilities crossing facility sites will be done during the pre-design stages of the project.
>
> The following mitigations are required for segments identified in final design as having potential conflict with significant utilities.
>
> a. Utility excavation and encroachment permits would be required from the appropriate agencies, potentially including the Public Works Departments of Santa Cruz County, and the City of Watsonville. These permits include measures to minimize utility

disruption. PVWMA and its contractors would comply with permit conditions. Permit requirements would be included in construction contract specifications.

b. Utility locations would be verified through field survey (potholing) and use of an underground locating service.

c. A detailed engineering and construction plan would be prepared as part of the design plans and specifications. This plan should include procedures for the excavation, support, and fill of areas around utility cables and pipes. All affected utility services would be notified of PVWMA's construction plans and schedule. Arrangements would be made with these entities regarding protection, relocation, or temporary disconnection of services.

d. Residents and businesses in the project area would be notified by the contractor in writing of planned utility service disruption 2 to 4 days in advance in conformance with County and State standards.

e. PVWMA would coordinate with PG&E to relocate the overhead utility line that traverses through the main dam project, as appropriate.

Impact 5.B.9-2: Expansion of College Lake could temporarily impede vehicle access to emergency services as well as to collection and delivery services. This impact could affect Counties' Sheriff's Departments, fire departments, emergency services (e.g., ambulance companies), delivery and collection services. Less than Significant.

Expansion of College Lake would not impede access, as it would not directly affect surface streets and is not located in areas of sensitive land uses. (Paulsen Road has been washed out for several years.

Mitigation: None required or recommended.

Impact 5.B.9-3: Pump station operations for the project would increase demand for electrical service at the project site. Significant. With mitigation identified in this EIR the impact would be reduced to a less-than-significant level.

The proposed project would generate demand for electricity and could require the extension of new, or expansion of existing electricity lines to serve the proposed project. The specific electricity requirements would be reviewed by PG&E after PVWMA submits a formal application for service.

Measure 5.B.9-3: The design of the pump station and any other facilities with substantial electricity demand will be coordinated with PG&E to ensure adequate capacity is available.

5.B.10 VISUAL/AESTHETIC AND RECREATIONAL RESOURCES

5.B.10.1 SETTING

College Lake is a seasonal lake located in a natural depression that, when dry, produces vegetable and flower crops during the summer and fall months. Agricultural uses, particularly vegetable crops, dominate the surrounding area, which includes the proposed expanded reservoir and facilities sites. During summer and fall, the farmed lakebed blends in with surrounding expansive agricultural lands to the north, west, and south.

The proposed increased area of inundation around College Lake is not visually prominent due to its elevation relative to the surrounding area, and intervening vegetation. Motorists traveling along Highway 152, a designated scenic road in the Santa Cruz County General Plan/LCP and the City of Watsonville General Plan, and Holohan Road, a designated scenic road in the City of Watsonville General Plan, currently have views of College Lake and adjacent agricultural lands that are partially obstructed by intervening terrain, vegetation and structures. Existing visual features along these roadways include residences, Lakeview Middle School, and St. Francis School, Church and Cemetery. Views of the proposed increased area of inundation also would be visible from existing residences northwest of the lake.

The proposed water diversion and filtration facilities site is located along Highway 152 and is clearly visible to motorists travelling along the roadway. Views of the proposed facilities are also available from the residences south of the lake. Existing water pumping facilities are located at the south end of the lake near the facilities site, and are partially visible from Highway 152.

The proposed dams would be constructed on agricultural lands along the perimeter of College Lake. The saddle dam would be adjacent to Highway 152, and the main dam would be on agricultural lands south of the lake as well as on the site of the existing headgate and filtration facilities. The main dam would be visible from Holohan Road.

Long-range views across College Lake include Mt. Madonna and the Santa Cruz Mountains to the north, croplands to the west and south, and the City of Watsonville to the south.

Consistency with Applicable Plans and Policies

Development of the College Lake component would be generally consistent with the applicable policies of the Santa Cruz County General Plan/LCP and the Watsonville General Plan presented in Section 3.10 of this EIR. While this component would expand the size of College Lake, it would not alter the rural visual character of the area. Under the proposed project, with implementation of **Measure 5.B.1-3** that requires topsoil to be replaced to allow farming to continue on the lakebed during the dry season, agricultural fields within the expansion area would continue to be visible during summer and fall. Although these fields would be inundated during winter and spring, the expansion would not be distinguishable from the existing lake in

views from nearby roadways, and this would be consistent with General Plan policies that call for the protection of visual and agricultural resources. Additionally, the proposed lake expansion would not noticeably alter views from Highway 152 and Holohan Road, both designated scenic routes.

The proposed pumping and filtration facilities would be housed in industrial structures along Highway 152, a designated scenic route in both the Santa Cruz County General Plan/LCP and the Watsonville General Plan. Within the project area, the visual landscape along Highway 152 includes rural features, such as cropland, as well as urban development, including residences, schools, a church and a cemetery. Development of the proposed facilities would create visible features along Highway 152 that could contrast with adjacent agricultural uses. While the proposed pumping facilities would be visible from Highway 152, they would be located in an urbanized area and would be similar in size and scale to existing pumping facilities at College Lake. Therefore, these facilities would not change the fundamental rural character of the area, and would not substantially alter views from scenic routes. The project would not be inconsistent with General Plan policies that encourage preservation of scenic rural qualities and protection of views from designated scenic routes.

5.B.10.2 SIGNIFICANCE CRITERIA

Please see **Section 4.A.10.2** for a discussion of significance criteria.

5.B.10.3 IMPACTS AND MITIGATION MEASURES

Impact 5.B.10-1: Development of the Expanded College Lake component would alter the visual character of, and views of, the project area. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The proposed Expanded College Lake component would expand the reservoir elevation of College Lake onto 160 acres of adjacent agricultural lands for water storage purposes. This expansion of the lake would be visible from viewpoints along Highway 152 and Holohan Road, both of which are designated scenic routes in the Watsonville General Plan. Highway 152 is also a designated scenic route in Santa Cruz County General Plan/LCP.

According to the project description, the lake currently inundates approximately 260 acres during the rainy season. The expanded reservoir elevation would increase the size of the lake by approximately 60 percent, to 420 acres. The lake also would store water longer each year. Water features generally are regarded as positive aesthetic elements of a visual landscape. Additionally, the expanded reservoir elevation would not have any effect on the visual landscape during the summer and fall, when crops would be planted in the lake if topsoil is replaced on the lakebed, per **Measure 5.B.1-3**. Therefore, this would not be considered a significant adverse change of the visual landscape.

New structures housing the proposed pumping and filtration facilities would be constructed along Highway 152. While no designs are available, these structures likely would be box-shaped, concrete buildings with an industrial appearance. Such structures would be similar to the existing pumps to the south of College Lake that would be removed for construction of the main dam, as well as with varied development along the roadway that includes residential, school and church uses. The proposed facilities would be visible in foreground views from Highway 152, a designated scenic route. These facilities would not constitute a substantial change in the visual landscape, in which such facilities are common. They could contrast with their surrounding landscape if they are not designed to blend with the color, vegetation, texture and topography of the immediately adjacent uses that are dominant features in foreground views from Highway 152; however, this would not be considered a significant impact. Implementation of Measure 5.B.10-1a below would minimize contrast with the surrounding landscape.

Construction of the saddle dam along Highway 152 would remove native vegetation and crops. These features contribute to the scenic quality of Highway 152, which is a City- and County-designated scenic route. The conceptual design of the saddle dam consists of a 25-foot wide berm at 79 feet, approximately 14 feet above the current water level of the lake. Views from Highway 152 would be altered by the saddle dam, which would screen views of agricultural lands within the interior of College Lake. Since views of College Lake currently are obstructed by existing vegetation and development along Highway 152, this would not be considered a significant impact. However, the saddle dam would introduce an unnatural visual feature along the scenic roadway. Implementation of Measure 5.B.10-1b would reduce this impact by planting vegetation along the dam to visually integrate it into the surrounding landscape.

The conceptual design of the main dam consists of a 40-foot-wide crest at an elevation of 79 feet, approximately 19 feet above the current water level of the lake. The main dam would be visible from Holohan Road, a designated scenic road, and would screen views of agricultural lands within the interior of College Lake from this road. Views of College Lake from Holohan Road are currently obstructed by existing residential development. While the dam would obstruct views of the interior of the lake, agricultural lands south of the main dam would remain visible from Holohan Road. Since the rural character of views from Holohan Road would not change, this would not be considered a significant impact. However, the main dam would introduce an unnatural visual feature along the scenic roadway. Implementation of Measure 5.B.10-1b would reduce this impact by planting vegetation along the dam to visually integrate it into the surrounding landscape.

> **Measure 5.B.10-1a:** The PVWMA shall use design elements and landscaping to enhance visual integration of the pumping and filtration facilities with their surroundings. Proposed facilities shall be painted low-glare earth-tone colors that blend closely with the surrounding terrain. Vegetation shall be planted at proposed facilities to provide screening from views of the facilities from Highway 152.

Measure 5.B.10-1b: The PVWMA shall vegetate the saddle dam and main dam to minimize textural contrasts with the surrounding vegetation using grasses, shrubs and trees typical of the immediately surrounding area.

Impact 5.B.10-2: Development of the Expanded College Lake component would introduce new sources of light onto the project site and increase ambient light in the project area. Less than Significant. Implementation of recommended mitigation measures identified in this EIR, while not required, would assist in ensuring that the impact would remain at a less-than-significant level.

While no exterior lighting is currently proposed as part of this component, exterior security lighting (if implemented) at the pump station, pretreatment, filtration, and dam facilities could introduce light and create nighttime impacts. The new facilities would be located in the vicinity of existing residences. While exterior lighting could be visible from these residences, it would not be expected to substantially increase ambient light in the project area.

The proposed diversion pipeline would be underground and would not introduce new sources of light or glare.

Mitigation Measure 5.B.10-2 (Recommended): Implement Measure 4.A.10-2.

Impact 5.B.10-3: Development of the Expanded College Lake component would temporarily disrupt designated recreational bikeways in the project area. Less than Significant.

Construction of the College Lake component would disrupt bicycle traffic along Highway 152 and Holohan Road, which are included in the Santa Cruz County bikeway system. Construction activities and related truck traffic could damage the bikeways, and segments of the bikeways in active construction areas would be temporarily closed during trench excavation and pipeline installation, creating minor inconveniences to bicyclists. However, implementation of Measures 5.B.6-2, 5.B.6-3a and 5.B.6-3b would ensure that damaged roads would be repaired to pre-construction conditions, and that detours would be provided for bicyclists and motorists during the construction period. Therefore, this impact would be less than significant.

Mitigation: None required.

5.C CORRALITOS CREEK AND PINTO LAKE DIVERSIONS

5.C.1 LAND USE AND PLANNING

5.C.1.1 SETTING

The Pinto Lake and Corralitos Creek diversion facilities are within unincorporated Santa Cruz County and within the City of Watsonville planning area. Pinto Lake is within Pinto Lake Park, a joint city and county park with access from Green Valley Road. Pinto Lake Park includes a playground, picnic areas, recreational vehicle parking, and boating facilities. The predominant land use in the vicinity of the Pinto Lake and Corralitos Creek Diversion facilities is agriculture, primarily apple orchards. Residences are located near both the east and west ends of the Corralitos Creek Diversion pipeline. The Pinto Lake diversion pipeline is surrounded by farmland (see **Figure 2.8**). According to the Santa Cruz County Agricultural Resources Map, the lands adjacent to the proposed Pinto Lake and Corralitos Creek diversion facilities are designated Type 1A agricultural land, which is considered prime farmland. Please refer to Section 3.1 for a definition of this classification.

According to the Watsonville 2005 General Plan Land Use Diagram, the sites of the proposed facilities are zoned Agriculture. Lands designated as Agriculture are to be preserved for the production of food, fiber, flowers and other agricultural products, including the growing of crops and/or animal or poultry husbandry and grazing. Please refer to Section 3.1 for a description of policies relating to agricultural lands within the General Plan.

Consistency with General Plan Policies and Zoning Designations

Development of the Pinto Lake and Corralitos Creek diversion facilities would be consistent with applicable policies of the Santa Cruz County and City of Watsonville general plans presented in Section 3.1 of this EIR. The proposed facilities would provide a new source of irrigation water for adjacent agricultural lands which in turn would reduce the need for groundwater pumping. Therefore, these facilities would increase groundwater recharge, and thus would be consistent with Objectives 5.5a and 5.5b, and Programs C and H of the Conservation and Open Space Element of the Santa Cruz County General Plan/LCP.

This component would construct a pump station on land designated as Agriculture. This would be potentially inconsistent with General Plan policies that call for preservation of agricultural land. However, this would not be inconsistent with General Plan policies calling for preservation of agricultural land because the pump station would provide water to replace groundwater for irrigation purposes. This would increase groundwater recharge and minimize saltwater intrusion, which would ensure long-term continuation of agriculture in the area.

The proposed Corralitos Creek and Pinto Lake diversion pipelines would not result in a long-term loss of agricultural land because they would be located underground, and farming as occurs at present would resume within the construction corridor following pipeline installation.

Therefore, these facilities would be consistent with Policies 5.13.6 and 5.13.22 and Program F of the Santa Cruz County General Plan/LCP, and Goal 3.3, Policy 3.F, and Implementation Measures 3.F.1, 3.F.2, and 3.F.4 of the Watsonville General Plan.

As stated in Section 3.1, the Watsonville General Plan recognizes that the preservation of agricultural land alone will not ensure preservation of the agricultural economy, and that other factors, such as availability of irrigation water and facilities for support industries, are also important in preserving agriculture. Therefore, while development of the pump station on agricultural land would be inconsistent with specific policies, it would not contradict the overall intent of the general plans. The responsibility for making a conclusive determination of project consistency rests with the Santa Cruz County Planning Commission.

5.C.1.2 SIGNIFICANCE CRITERIA

Please see Section 4.A.1.2 for a discussion of significance criteria.

5.C.1.3 IMPACTS AND MITIGATION MEASURES

Impact 5.C.1-1: Construction of the Pinto Lake and Corralitos Creek diversion facilities would result in short-term disturbance of adjacent land uses. Less than Significant. Implementation of mitigation identified in this EIR, while not required, would assist in ensuring that the impact would remain at a less-than-significant level.

The proposed facilities would not alter surrounding land uses, which include residences, Pinto Lake Park, and agricultural lands, and would not disrupt or divide the community. It also would not be incompatible with existing uses in the vicinity. Construction disturbance, particularly that related to the Corralitos Creek pipeline, could temporarily constrain access to driveways along Green Valley Road and the entrance to Pinto Lake Park. Park operations could be adversely affected if roadways or driveways were blocked or in the daytime when people visit the park. However, this would be a temporary impact that results more in inconvenience to motorists than a substantial impact and, therefore, would not be expected to substantially impair park operations. Construction of proposed pumping and diversion facilities would not involve construction within area roadways and thus would not disrupt access to, or use of adjacent lands. Therefore, this impact would be considered less than significant. Implementation of Measures 5.C.6-3a through 5.C.6-3c would minimize construction disturbance.

In addition, construction of proposed facilities would generate noise, dust, and traffic that could disrupt adjacent land uses. Traffic and air quality impacts are presented in Sections 5.C.6, Traffic and Circulation, 5.C.7, Air Quality, and 5.C.8, Noise, of this EIR. With proper mitigation, temporary construction impacts would have a less-than-significant effect on adjacent land uses.

Measure 5.C.1-1 (Recommended): Implement Measure 4.A.1-1.

See also mitigation measures in Sections 5.C.6, Traffic and Circulation, 5.C.7, Air Quality, and 5.C.8, Noise, of this EIR.

Impact 5.C.1-2: Development of the pump station at the Corralitos Creek Diversion would result in the permanent loss of up to 2,500 square feet of agricultural land. Significant and Unavoidable.

The proposed pump station at the Corralitos Creek Diversion would convert approximately 2,500 square feet, or 0.06 acre, of agricultural land to water distribution uses that would preclude farming on the site. According to the Santa Cruz County Agricultural Resources Map, development of the facilities site would convert Type 1A agricultural lands to water facility use. As stated in Section 3.1, these lands meet the U.S. Department of Agriculture Soil Conservation Service criteria for prime and unique farmland. Therefore, development of this site would contribute to the cumulative loss of prime farmlands in the region. This would be considered a significant and unavoidable impact.

The proposed pipelines would not result in the permanent conversion of agricultural land; however, these activities would affect agricultural production. Installation of the pipelines could disrupt agricultural production within the alignment for at most one cropping season, depending on the timing of construction. The pipelines extend through prime farmlands. Because construction disturbance would be temporary, and operation of the pipeline, once installed, would not preclude agricultural production, this would not be considered a significant impact. Therefore, this would be a less-than-significant impact.

Measure 5.C.1-2: None available; this impact would be significant and unavoidable.

5.C.2 GEOLOGY, SOILS, AND SEISMICITY

5.C.2.1 SETTING

Please refer to Section 3.2 for a discussion of Regional Geology, Soils and Seismicity.

Geology

The proposed Corralitos Creek pipeline would traverse 11,000-year old floodplain deposits consisting of heterogeneous, unconsolidated fine–grained sand, silt, and clay. Liquefaction hazard in the materials outside the Corralitos Creek floodplain are considered moderate while those within the floodplain are considered to have a very high liquefaction hazard (Dupre and Tinsley, 1980).[1]

The proposed Pinto Lake diversion and facilities would traverse upland terrace deposits classified as Watsonville terrace deposits and subdivided into fluvial and alluvial fan facies (Dupre and Tinsley, 1980). These terrace deposits are semiconsolidated, moderately to poorly sorted silts, sand, silty clay, and gravel.

Soils

A variety of soil types, that have developed on unconsolidated alluvial floodplain deposits and marine terrace sediments, are present within the project area, as shown on **Table 5.C.2-1**. Soils on alluvial plains and fans and in basin-like areas were derived mainly from sedimentary rocks. They occur in the valley of Corralitos Creek. The Elder-Conejo soils are generally confined to the valley of the Pajaro River east of Watsonville, and to the valley of Corralitos Creek. These soils are well-drained, very deep sandy loams, loams, and clay loams, with nearly level to strongly sloping topography. The principal use of these soils is for irrigated crops, but they also are suitable for building site development. About 95 percent of the these soils meet the criteria for Prime Farmland as outlined in the United States Department of Agriculture's Land Inventory and Monitoring Project for the Santa Cruz and Monterey County Soil Surveys (see Section 3.1, Land Use). Another 3 percent meet the criteria for Farmlands of Statewide Importance.

Seismicity

Please refer to Section 3.2 for a discussion of regional seismicity.

Earthquake ground shaking is the primary seismic hazard affecting the existing and proposed facilities in the Corralitos Creek and Pinto Lake area. The entire area is expected to experience

[1] Very High Liquefaction Susceptibility - Sediments for which engineering testing and the presence of a shallow water table confirm the susceptibility for liquefaction in addition to historical evidence of liquefaction and failure during the 1906 earthquake. Sediments in this category are quite likely to liquefy and fail in an earthquake. Moderate Liquefaction Susceptibility – Sediments classed may liquefy in the event of a nearby earthquake and include those with high susceptibility but where historical evidence of liquefaction is absent.

TABLE 5.C.2-1
SOILS IN THE CORRALITOS CREEK AND PINTO LAKE AREA

Soil	Slope	Capability Class	Storie Index	Erosion Hazard	Other
Conejo loam	0 - 2 %	I irrigated III non-irrigated	62	slight - moderate	
Clear Lake clay	0 - 2 %	II irrigated III non-irrigated	43	slight	high shrink-swell, low strength
Elder sandy loan	0 - 2%	I irrigated II non-irrigated	90	slight	
Watsonville loam	2 - 15%	IV	36	slight to moderate	
Baywood Variant loamy sand	0 - 2%	III	51	slight	
Baywood loamy sand	0 - 2%	III	72	slight, subject to blowing	

SOURCE: Soil Conservation Service; Soil Survey of Santa Cruz County, California 1980

ground shaking intensity VIII in a major earthquake and associated peak ground accelerations of 0.25g - 0.30g. Ground shaking intensities could be higher in unconsolidated sediments due to ground movement amplification during an earthquake. Compared with seismic response in floodplain deposits, ground shaking intensities would likely be less in the consolidated terrace deposits due to their more consolidated conditions.

Regulatory Framework

Refer to Section 3.2 for a discussion of regulations related to geology, soils, and seismicity.

5.C.2.2 SIGNIFICANCE CRITERIA

Please see Section 4.A.2.2 for discussion of significance criteria.

The Pajaro Valley has no record of land subsidence related to groundwater or oil withdrawal, and the proposed project includes no proposals for oil extraction. There is no evidence of the presence of unique geologic features, unusual rock formations, fossils or special geologic structures in the area with potential effects of the proposed local water supply and distribution facilities. Therefore, these impact criteria will not be evaluated further in this EIR.

5.C.2.3 IMPACTS AND MITIGATION MEASURES

Impact 5.C.2-1: Seismic groundshaking and its secondary effects including localized liquefaction and related ground failure, from a major earthquake in the in Santa Cruz County or the Monterey Bay region, could cause structural damage or structural collapse of water diversion facilities proposed under the project. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Ground shaking is an unavoidable hazard for facilities in the San Francisco Bay and Monterey Bay region. The degree of hazard depends, in part, on the seismic hazards of the site and partly on the type of structure, its materials, and construction quality. Ground shaking at the diversion facility could cause structural damage to the facility structures or unsecured objects, such as equipment and machinery. Damage of the structural elements of the facility, or to the machinery from a seismic event could result in temporary cessation of facility operations. Because the pipelines are underground, structural damage to the actual pipe and pipe joints is expected to be less than damage to aboveground structures. The affects of groundshaking on specific soil types along the pipeline alignments would determine the behavior of the pipelines during an earthquake.

These hazards are unavoidable, but mitigation to reduce the hazard to an acceptable level of risk would be implemented. The purpose of the mitigation is to reduce the potential for injury and the length of service interruptions during and after a seismic event.

> **Measure 5.C.2-1:** All diversion and pipeline facilities will comply with applicable policies and appropriate engineering investigation practices necessary to reduce the potential detrimental effects of ground shaking and liquefaction. Construction will be in accordance with applicable City and County ordinances and policies regarding mitigation of seismic and geologic hazards, including applicable safety goals and policies presented in the Public Safety Element of the Santa Cruz County Plan. Appropriate geotechnical studies will be conducted using generally accepted and appropriate engineering techniques for determining the susceptibility of the sites to liquefiable soils and related ground failures. A licensed geotechnical engineer will prepare recommendations applicable to foundation design, earthwork, and site preparation prior to or during the project design phase. Recommendations will address mitigation of site-specific, adverse soil and bedrock conditions that could hinder development. Project engineers will implement these recommendations. Geotechnical design and design criteria will comply with applicable codes and requirements of the 1994 or 1997 UBC with California additions (CCR Title 24), applicable construction and grading ordinances.

Impact 5.C.2-2: Proposed pipeline and diversion facilities could incur damage as a result of underlying soil properties (subsidence, high shrink-swell potential, and corrosivity). Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The soil types vary along the pipeline routes and at the proposed diversion facility sites. Each soil type in the project area possesses characteristics that could limit development of building structures or other facilities. These limitations include the shrink-swell capability (expansive behavior) and corrosivity. One or more of these soil properties could adversely affect portions of the proposed project.

Soils with high potential for shrink-swell are found in various locations throughout the proposed project area (see **Table 5.C.2-1**). Soils that underlie each of the pipeline alignments exhibit expansive qualities to depths of up to five feet below the surface. Shrink-swell behavior in soils could adversely impact subsurface pipelines buried up to five feet below the surface and foundations of above ground facilities.

Unless properly mitigated, shrink-swell soils could exert additional pressures on buried pipelines, producing shrinkage cracks that allow water infiltration and compromise the integrity of backfill material. Depending on the depth of the buried pipeline, soil in expansion or contraction could lead to undue lateral pipeline stress and stress of structural joints. Lateral stresses could, over time, lead to pipeline rupture or leaks in the coupling joints. Shrinkage cracks could form in native soils adjacent to the pipeline trench or in backfill material if expansive soils are used. If shrinkage cracks extend to sufficient depths, groundwater can infiltrate into the trench, causing piping (progressive erosion of soil particles along flow paths) or settlement failure of the backfill materials. Settlement failure can also occur if expansive soils are used in backfill and undergo continued expansion and contraction. Over time these soils could settle, resulting in misalignment or damage to buried pipelines.

The effects of shrink-swell soils could damage foundations of aboveground structures, paved service roads, and concrete slabs. Surface structures with foundations constructed in expansive soils would experience expansion and contraction depending on the season and the amount of surface water infiltration. The expansion and contraction could exert enough pressure on the structures to result in cracking, settlement, and uplift.

The conductivity of soils may be high enough in the project area to corrode underground metal pipes and electrical conduits. Over time, pipe corrosion could lead to pipeline failure, resulting in localized surface flooding of water or localized settlement of surface soils in the location of the failure. Failed subsurface electrical conduits could result in electrical short-circuiting. This would temporarily reduce power to the facility and possible result in temporary shutdown of operations.

> **Measure 5.C.2-2:** All diversion and pipeline facilities will comply with applicable policies and appropriate engineering investigation practices necessary to reduce the potential detrimental effects of expansive soils, and corrosivity. Appropriate geotechnical studies

will be conducted using generally accepted and appropriate engineering techniques for determining the susceptibility of the sites to unstable, weak or corrosive soils. A licensed geotechnical engineer will prepare recommendations applicable to foundation design, earthwork, and site preparation prior to or during the project design phase. Recommendations will address mitigation of site-specific, adverse soil and bedrock conditions that could hinder development. Project engineers will implement these recommendations. Geotechnical design and design criteria will comply with applicable codes and requirements of the 1994 or 1997 UBC with California additions (CCR Title 24), applicable City construction and grading ordinances.

Impact 5.C.2-3: Construction of the proposed water diversion facilities and associated pipelines could result in accelerated erosion and attendant loss of soil resources and effects on sediment discharges in water courses. The impact would be significant on slopes over two percent and in areas with soils having moderate or greater erosion hazard. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Most of the proposed pipeline and diversion facilities would be located on flat areas or areas with soils having low erosion hazard. However, the operation of construction equipment and vehicles, trench excavation, and soil stockpiling would expose loose soils to erosion if construction occurs in the rainy season. Soils exposed by construction operations have a tendency to be dislodged and transported by rain, surface watering, or temporary construction discharges. Soil erosion and loss of topsoil during a large construction project that extends over several months can be significant and result in project delays due to required soil restabilization, regrading, and soil removal from drainage structures.

Measure 5.C.2-3a: All grading and construction shall conform to requirements of the Santa Cruz County Grading Ordinance.

Measure 5.C.2-3b: Site grading and construction work areas shall expose as little new ground surface as possible. Vegetation cover should be left intact to the extent practical.

Measure 5.C.2-3c: To the extent possible, grading activities in non-cropped areas shall be limited to the period between April 15 and October 15. If dry conditions persist after October 15, one-week extensions of grading activities will be obtained from the County Public Works Department. In areas where the soil is tilled, grading activities will be coordinated with the local farmers to ensure consistency between their erosion control and farming practices and construction disturbance.

Measure 5.C.2-3d: Implement best construction practices at all grading sites, regardless of soil erodibility hazard.

Measure 5.C.2-3e: Upon completion of construction at all sites, loose soils shall be removed or spread and all areas shall be re-soiled and reseeded to ensure that a stable soil cover will remain.

Measure 5.C.2-3f: PVWMA will prepare and implement an inspection and maintenance program for the right-of-way and all facility sites. The plan will include routine inspection plans and reporting, and prescriptive methods for correcting erosion or soil instability problems.

REFERENCES – Geology, Soils and Seismicity

Bolt, B. 1988. Earthquakes. W.H. Freeman Company: New York, New York.

California Building Standards Commission. *California Building Code, Title 24, Part 2*, 1995.

Dupre, W.R., J.C. Tinsley. 1980. Maps Showing Geology and Liquifaction Potential of Northern Monterey and Southern Santa Cruz Counties, California. U.S. Department of the Interior, U.S. Geological Survey. Map MF-1199.

Hart, E. W., *Fault-Rupture Hazard Zones in California: Alquist-Priolo Special Studies Zones Act of 1972 with Index to Special Studies Zones Maps,* California Division of Mines and Geology, Special Publication 42, 1990, revised and updated 1997.

International Conference of Building Officials, *Uniform Building Code, ICBO, Whittier, California*, 1994.

U.S. Department of Agriculture, Soil Conservation Service, *Soil Survey of Santa Cruz County, California*, 1980.

5.C.3 HYDROLOGY AND WATER QUALITY

5.C.3.1 SETTING

The Corralitos Creek and Pinto Lake diversions are proposed to yield approximately 1,200 acre-feet per year (afy) for temporary storage at College Lake. Water diverted from College Lake would then be used for irrigation, thereby replacing water currently pumped from the groundwater basin. This would contribute a portion of the supply required to replenish the aquifer, in part reducing the current overdraft of the basin and reducing seawater intrusion.

Local Hydrology

Corralitos Creek

Corralitos Creek drains the southern end of the Santa Cruz Mountains. Its headwaters lie along the San Andreas Rift Zone at an approximate elevation of 1,800 feet. Below College Lake, near the intersection of East Lake Avenue and Holohan Road, Corralitos Creek drains into Salsipuedes Creek at an approximate elevation of 60 feet, and eventually into the Pajaro River. Gauged records have been maintained by the U.S. Geological Survey (USGS) since 1957. The gauge is located on the right bank of Corralitos Creek at Freedom, just upstream from the Green Valley Road bridge, near the intersection of Green Valley Road and Airport Boulevard. The USGS gauge is approximately 1.8 miles upstream from the confluence with Salsipuedes Creek. USGS records indicate that the average annual runoff, for the 45-year period of record from 1957 to present, is 12,260 acre-feet (af), ranging from 123 af in 1977 to 40,800 af in 1983. The maximum discharge recorded was 5,610 cubic feet per second (cfs) on January 4, 1982 at a peak stage[1] of 16.66 feet. The flows measured at the USGS gauge represent approximately 28 square miles of watershed area (Jackson, 2001).

The section of Corralitos Creek between the Browns Valley Road Bridge and Varni Road (approximately 1.7 miles) is typically dry in the summer, with isolated pools. The creek goes dry sometime between June and August, depending on the rainfall total of the previous winter. Flow in the creek returns somewhere above Green Valley Road. Local residents report that the creek started to dry up in the summer about 20 years ago. During the last two or three years, monitoring wells have shown decreasing water table surface, and there has been a noticable increase in the number of permit applications to deepen wells in the area. This may be evidence that the water table surface in the area is lower than its historic level (Jackson, 2001).

The City of Watsonville obtains its water from Corralitos Creek and from groundwater wells. At certain times of the year, Watsonville diverts up to 1.8 million gallons per day (mgd) from Corralitos Creek upstream of its confluence with Browns Valley Creek. The City also diverts

[1] River stage refers to the elevation above some arbitrary zero datum of the water surface at a station, often slightly below the point of zero flow of the stream. Peak stage is the maximum elevation occurring for the water year and usually coincides with the peak discharge.

about 0.22 mgd from Browns Valley Creek. In addition, Watsonville obtains some of its water supply from wells near the confluence of Corralitos Creek and Browns Valley Creek.

Corralitos Creek is listed as habitat for a federally threatened run of South-central California coast steelhead (see Section 5.B.4).

Water rights appropriations on Corralitos Creek are located primarily upstream of the confluence of Corralitos Creek and Browns Valley Creek, near Diablo Canyon and Shingle Mill Creek in the headwaters. Corralitos Creek near Diablo Canyon has been declared "fully appropriated" from May 1 to November 30 (State Water Resources Control Board Decision 1471). The total direct diversion for appropriations covered by this diversion is 0.49 cfs, and total storage is 127 af, excluding the appropriations to the City of Watsonville (Jackson, 2001).

Pinto Lake

Pinto Lake, owned by the City of Watsonville, is located north of the town of Freedom and northeast of College Lake. It is the site of both Pinto Lake County Park and Pinto Lake City Park and provides for a variety of recreational activities. The lake is an ancient, natural lake, fed by runoff from the surrounding foothills and by groundwater underflow. Pinto Lake covers about 90 acres and is about 25 feet deep throughout (McQuade, 2001**)**. The lake drains through a storm drain under the park and into the Pinto Lake drainage channel. The drainage channel drains into Salsipuedes Creek about 500 feet below the College Lake dam.

Flood Hazards

The 100-year flood hazard zone, as defined by the Federal Emergency Management Agency, includes portions along the banks of Corralitos Creek (to an approximate elevation of 120 feet in the vicinity of the diversion facility) as well as the perimeter of Pinto Lake to an elevation of about 140 feet.

Surface Water Quality

Corralitos Creek water quality data were collected from the Corralitos Filter Plant as part of the PVWMA sampling program conducted from October 1994 through April 2000. Water quality data are limited, though monthly total dissolved solids (TDS) and total suspended solids (TSS) are available between 1998 and 2001. *Phytophthora* in Corralitos Creek has been identified as the major constituent of concern for the agricultural community in the area.

Based on PVWMA samples collected between 1994 and 1999, the average TDS of Pinto Lake water is expected to be in the range of 280 milligrams per liter (mg/L) after an initial flushing of the drainage channel. Additionally, Pinto Lake supports bird populations that may affect surface water quality in the lake by increasing fecal bacterial concentrations.

Groundwater

Local groundwater conditions are generally as described in Section 3.3, Regional Setting – Hydrology and Water Quality. In the Corralitos area, there is a more pronounced difference in water levels between the upper alluvium/terrace deposits and the lower Aromas Sands Formation. The difference is more pronounced than in the Salsipuedes-College Lake area. The shallow wells are measuring perched water above clay layers (PVWMA, 2000). The water levels in deeper wells are significantly lower than wells completed in the shallow zone. The difference is most likely related to the clay layers that separate the two formations and allow for perched water in the upper alluvium and terrace deposits to be much higher than those in the Aromas Sands Formation. The water levels in the lower zone are at or near sea level even this far inland (PVWMA, 2000).

Regulatory Setting

A discussion of the regulatory setting as it applies to surface water and groundwater is provided in Section 3.3, Regional Setting – Hydrology and Water Quality. The following local plans and policies specifically apply to the Corralitos Lake/Pinto Lake Diversion project.

Local Plans and Policies

All of the proposed facilities for the Expanded College Lake project component are within Santa Cruz County. The County has the following policies and objectives relevant to the project:

> **Policy 5.7.3:** For all new and existing development and land disturbances, require the installation and maintenance of sediment basins, and/or other strict erosion control measures, as needed to prevent siltation of streams and coastal lagoons.
>
> **Objective 5.8a:** To protect the quantity and quality of the County's groundwater resources through an integrated program of land use regulation and runoff management in groundwater recharge areas, careful water quality monitoring and management of extractions consistent with long-term sustainable water supply yields.
>
> **Objective 5.8b:** To act directly and coordinate and work with relevant water purveyors and agencies to eliminate long-term groundwater overdraft in all water basins where overdraft has been documented.

5.C.3.2 SIGNIFICANCE CRITERIA

See Section 4.A.3.2 for a discussion of significance criteria.

5.C.3.3 IMPACTS AND MITIGATION MEASURES

Impact 5.C.3-1: Construction activities to build the diversion facilities on Corralitos Creek and at the Pinto Lake drainage channel would increase soil erosion and may transport other contaminants to downstream receiving waters, including Salispuedes Creek, the Pajaro River, and the Pacific Ocean. Additionally, construction activities at the proposed project sites could result in dewatering of shallow groundwater resources and contamination of surface water. Potentially Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Construction activities at the diversion facility sites involving soil disturbance, including excavation, cutting/filling, stockpiling, and grading activities, would result in increased erosion and sedimentation to surface waters. In addition, water quality may be impaired due to the accidental release of chemicals such as oil, grease, or fuel from construction equipment. Pipeline construction would require excavation of trenches and temporary stockpiling of soils. Construction at the pump station sites would involve basic earthwork activities to level the site and prepare building foundations. Although the amount of erosion at the project site is projected to be low due to the flat topography, the sediment and adhered substances are sources of pollution in receiving waters. The General Construction Permit issued by the Regional Water Quality Control Board (RWQCB) requires the preparation of a Storm Water Pollution Prevention Plan (SWPPP). The plan would include specifications for best management practices (BMPs) that would be implemented during project construction to control contamination of surface flows and prevent the potential discharge of pollutants from the construction area during and following construction.

Excavation and construction of structures with subsurface foundations or open trenches such as building foundations or pipelines often can intercept shallow groundwater requiring dewatering to lower local groundwater levels to dry the area for construction. The groundwater is pumped and discharged to the local drainage system. The area of groundwater reduction is generally in the immediate construction area and the effect on groundwater conditions would be expected to be temporary and minor. Depending on the quality of the groundwater, the discharge could potentially contaminate downstream surface water sources. Potential impacts associated with construction techniques necessary in or adjacent to Corralitos Creek could include sedimentation of the channels outside of the construction area during trenching activities, with subsequent downstream water quality impacts, such as increased turbidity and sediment deposition.

Measure 5.C.3-1: Employ construction stormwater quality management practices.

The agency shall prepare a SWPPP as part of the construction activities National Pollutant Discharge Elimination System (NPDES) stormwater permit required by the RWQCB. At a minimum, this plan shall include the following requirements:

1. Plan excavation and grading activities for the dry season only (April 15 to October 31) to the extent possible. This reduces the chance of severe erosion from intense rainfall and surface runoff, as well as the potential for soil saturation in swale areas.

2. If excavation occurs during the rainy season, storm runoff from the construction area shall be regulated by temporary on-site silt traps and/or basins with multiple discharge points to natural drainages and energy dissipaters. Stockpiles of loose material shall be covered and all runoff shall be diverted away from exposed soil material. If work is stopped due to rains, a positive grading away from slopes shall be provided to carry the surface runoff to areas where flow can be controlled, such as the temporary silt basins. Sediment basin/traps shall be located and operated to prevent off-site sediment transport. Any trapped sediment shall be removed from the basin or trap and placed at a suitable on-site location away from concentrated flows, or removed to an approved disposal site.

3. Temporary erosion control measures shall be provided until perennial revegetation or landscaping is established and can prevent discharge of sediment into nearby waterways. For construction within 500 feet of a water body, straw bales shall be placed upstream adjacent to the water body.

4. After completion of grading, erosion protection shall be provided on all cut-and-fill slopes. Revegetation shall be facilitated by mulching, hydroseeding, or other methods and should be initiated as soon as possible after completion of grading and prior to the onset of the rainy season (by November 1).

5. Permanent revegetation/landscaping shall emphasize drought-tolerant perennial ground coverings, shrubs, and trees to improve the probability of slope and soil stabilization without adverse impacts to slope stability due to irrigation infiltration and long-term root development.

6. BMPs selected and implemented for the project shall be in place and operational prior to the onset of major earthwork on the site. The construction-phase facilities shall be maintained regularly and cleared of accumulated sediment as necessary.

7. Hazardous materials such as fuels and solvents used on the construction sites shall be stored in covered containers and protected from vandalism. A stockpile of spill cleanup materials shall be readily available at all construction sites. Employees shall be trained in spill prevention and cleanup and individuals shall be designated as responsible for prevention and cleanup activities.

8. Implement Standard Protective Measures to Maintain Water Quality and Control Erosion and Sedimentation.

Measure 5.C.3-1: Please refer to Mitigation Measures 4.A.3-1 and 4.A.3-2 regarding pipeline and other construction within potentially jurisdictional wetlands/waters of the U.S.

Impact 5.C.3-2: Construction activities associated with the conveyance pipelines included in this Alternative could potentially compromise the structural integrity or water quality of active agricultural, production, or domestic wells located within proposed pipeline alignments. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Excavation, soil stockpiling activities, or construction equipment associated with pipeline construction may damage production, agricultural or domestic supply well structures, especially sanitary seals of wells or disturb well mounts, pump equipment, piping systems or enclosures. Certain damage that would expose the well casing could lead to the introduction of contaminants such as sediments or chemicals into the groundwater. Damage to the well system, pump equipment, piping or enclosures could temporarily stop proper well operation and interrupt water delivery.

> **Measure 5.C.3-2a:** Implement measures to ensure that construction activities do not damage existing wells. Wells shall be capped in an appropriate manner to prevent soil and other contaminants from entering groundwater aquifers.
>
> **Measure 5.C.3-2b:** PVWMA or its contractor shall correct any damage to wells and/or reimburse well owners for any loss of use of the well during construction.

REFERENCES – Hydrology and Water Quality

California Department of Fish and Game website, http://www.dfg.ca.gov/title/dlc3a3ad.html for an alphabetical list of waters with special fishing requirements.

Environmental Science Associates, Inc., *Pajaro Valley Water Management Agency Local Water Supply and Distribution, Environmental Impact Report*, May 7, 1999.

FEMA Flood Hazard Map website, http://www.esri.com/hazards.

Jackson, Dennis, *Determination of the Minimum Bypass Flow in Corralitos Creek for the Expanded College Lake Project*, July 2001.

King, Kenneth B., P.E., *Evaluation of College Lake and Bolsa de San Cayetano Projects*, prepared for Raines, Melton, and Carella, Inc., January 2000.

McQuade, Patricia (pmcquade@pintolake.com), personal communication, July 16, 2001.

Pajaro Water Management Agency (PVWMA), *State of the Basin Report*, prepared by Jones and Stokes, August 2000.

Raines, Melton, and Carella, Inc., *Revised Basin Management Plan for PVWMA*, Internal Draft, July 2001.

United State Geologic Survey website, http://water.wr.usgs.gov/data/00/11159200.html for Water Year 2000 California Hydrologic Report on Corralitos Creek at Freedom, CA.

5.C.4 VEGETATION, FISH, AND WILDLIFE

5.C.4.1 SETTING

Please refer to Section 3.4 for a description of methods used during investigation of the project area for biological resources.

The Corralitos Creek and Pinto Lake diversion projects, shown in **Figure 2.8** in Chapter 2, would divert water from these two sources into College Lake. Water would be diverted from Corralitos Creek at a point west of College Lake and north of the Watsonville Airport. A pipeline would then carry water from the diversion point to the existing Pinto Lake drainage channel, meeting the channel near Green Valley Road north of its intersection with Holohan Road. The Pinto Lake drainage channel currently drains into Salsipuedes Creek. The water in the drainage channel, consisting of both Corralitos Creek and Pinto Lake water, would be diverted into College Lake at the Pinto Creek diversion via a pipeline north of Holohan Road and west of the lake.

The Corralitos Creek Diversion would require diversion facilities and an adjacent pump station. The diversion facilities and the pump station are each assumed to have a 50-foot by 50-foot footprint. The Pinto Creek Diversion would require only diversion facilities; again, a 50-foot by 50-foot footprint is assumed. The pipeline from the Corralitos Creek Diversion to the existing Pinto Lake drainage channel would run primarily across agricultural land, as would the pipeline from the Pinto Creek diversion to College Lake.

Wildlife habitat in the area of the Corralitos Creek Diversion consists of a dense riparian area on both sides of the creek; to the south is a developed area. On the north side of the creek, where the diversion pipeline would be placed, is an extensive area of agricultural fields, with some weedy patches of willows adjacent to the riparian area and just west of the diversion point. Wildlife seen in this area during a survey in 2001 included an adult red-tailed hawk, mourning doves, California quail, robins, Wilson's warblers, barn swallows, Swainson's thrushes, and California thrashers. All are relatively common species of agricultural edges and of riparian areas. The area is likely to provide nesting habitat for all or most of these species, as well as others. Habitat in the areas of the proposed pipeline and drainage channel primarily consists of agricultural land, with some urbanized areas in the vicinity of South Green Valley Road. This habitat is of low quality for wildlife.

As noted in Section 3.4, the area is within designated critical habitat for the California red-legged frog, listed as Threatened by the federal government. Any area of permanent water could provide breeding habitat for this frog, and drainage ditches provide potential dispersal habitat. Both the California red-legged frog and the western pond turtle may occur in Corralitos Creek.

Natural vegetation in the project area exists almost exclusively in the Corralitos Creek riparian corridor. However, riparian vegetation here cannot be considered an intact natural community. The corridor overstory is dominated by red alder, willow, and black cottonwood, with non-native

acacia also occurring. A dense understory is comprised of a mix of native and non-native species, including California blackberry, hemlock, and curly dock. Suitable habitat does not exist for the special status plant species listed as occurring in the region and no special status plants were found during the 2001 Environmental Science Associates survey.

With respect to fisheries resources, the Pajaro River and Corralitos and Salsipuedes Creeks support a variety of common fish species, and all three support critical habitat for a threatened run of south-central California coast steelhead. Spawning and rearing habitat for this species is present in the upper reaches of Corralitos Creek, and in the upper tributaries of Salsipuedes Creek above College Lake. Pinto Lake is a warmwater lake containing recreational sport fishery (Smith, 2001). The drainage ditch that currently connects the lake to Salsipuedes Creek acts as a winter overflow for the lake and does not provide any salmonid habitat (Smith, 2001).

Conditions for steelhead passage to and from spawning and rearing habitats are the primary fish habitat factors potentially affected by the proposed project. The presence of sufficient stream flows for down-migration of smolts is critical. These conditions were analyzed in the spring of 1997 (Habitat Restoration Group, 1997; Smith, 1999; Appendix C) and the summer of 2001 (Jackson, 2001; Appendix D).

As discussed in Section 5.B.4, a minimum bypass flow of 7.5 cubic feet per second (cfs) was established for Salsipuedes Creek at its confluence with Corralitos Creek, with at least 2.0 cfs required from College Lake (HRG, 1997). However, the riffle transects used for estimating the minimum bypass flows necessary for steelhead migration were only established on Salsipuedes Creek and the Pajaro River. Therefore, a separate minimum flow analysis was performed for the proposed Corralitos Creek Diversion (Jackson, 2001; Appendix D). The methodology used was based on guidelines for establishing minimum bypass flows, maximum diversion rates, and total period of diversion. These guidelines currently are being finalized by NMFS and the State Water Resources Control Board Division of Water Rights (SWRCB) for future use in water rights permit applications. The application of these guidelines to the proposed Corralitos Creek Diversion established a minimum bypass flow of 15 cfs and a maximum instantaneous diversion rate of 6 cfs. The permitted diversion period under the proposed NMFS and SWRCB guidelines is limited to December 15 through March 31. Please refer to Appendix D for further details about this methodology and the results.

Preliminary hydrologic modeling conducted by project engineers for the proposed Expanded College Lake project used a minimum bypass of 5 cfs and a maximum diversion rate of 7 cfs which resulted in an estimated average annual diversion of about 650 acre-feet (af). However, a minimum bypass of 5 cfs does not conform to the NMFS guidelines since it is about only one-half of the estimated February median discharge at the point of diversion. The total average annual yield from the Corralitos Creek diversion under the NMFS guidelines would be between 430 and 530 af (Jackson, 2001).

The preliminary models also resulted in a total average annual of yield of 1,200 af for the combined Corralitos Creek and Pinto Lake diversion (650 af from Corralitos Creek and 550 af

from Pinto Lake). Minimum flow criteria and maximum diversion rates were not established for the Pinto Lake diversion since neither the lake nor the current drainage channel provides steelhead habitat. Therefore, the full 550 af can be diverted, resulting total average annual yield of 980 to 1,080 af for the combined project.

5.C.4.2 SIGNIFICANCE CRITERIA

Please refer to Section 4.A.4 for a description of the significance criteria used in analyzing potential project impacts related to biological resources.

5.C.4.3 IMPACTS AND MITIGATION MEASURES

Impact 5.C.4-1: Construction of the diversion facilities in Corralitos Creek would require the disturbance of at least 2,500 square feet (the actual facility footprint) of streamside vegetation, and could indirectly affect biological resources by affecting water quality and sedimentation levels. Significant. The impact would be reduced to a less-than-significant level with the mitigation identified in this EIR.

> **Measure 5.C.4-1a--Restore Corralitos Creek riparian forest.** Where adverse impacts to riparian forest occur, revegetation measures will be developed as part of a revegetation plan approved by CDFG: Measure 4.A.4-1c shall be implemented.
>
> **Measure 5.C.4-1b--Implement Standard Protective Measures to Maintain Water Quality and Control Erosion and Sedimentation:** Measure 4.A.4-1b shall be implemented.

Impact 5.C.4-2: Construction of the diversion facilities at Corralitos Creek and Pinto Lake, as well as the pipelines from Corralitos Creek to the existing Pinto Lake drainage channel and from the channel to College Lake, could adversely affect special status wildlife species. Significant. The impact would be reduced to a less-than-significant level with the mitigation identified in this EIR.

The special status animal species with the potential to occur near this project include:

- California red-legged frog (federal Threatened and California Species of Special Concern; Critical Habitat Designation);
- Nesting red-tailed hawks, red-shouldered hawks, white-tailed kites, and other raptors and nesting passerine birds;
- Western pond turtle (federal Species of Concern and California Species of Special Concern); and
- South-central California coast steelhead (federal Threatened, California Species of Special Concern; Critical Habitat Designation).

Measure 5.C.4-2a--Survey, Consultation, and Protection Measures for Special Status Wildlife Species: Since South-central California coast steelhead are known to be present, and potential habitat for the California red-legged frog was found as part of the site assessment, reasonable and prudent measures for protection of the California red-legged frog contained in the Programmatic Biological Opinion for this species (USFWS, 1999) shall be implemented if the U.S. Army Corps of Engineers finds that impact to this species is likely. If impacts to the South-central California coast steelhead or tidewater goby may occur as a part of this project, a formal consultation and Biological Opinion must be prepared for USFWS and the National Marine Fisheries Service (NMFS) under the Endangered Species Act.

Since steelhead, California Red-legged frogs, and other special status species are known or presumed present in the project area, Measures 4.A.4-2e through 4.A.4-2h shall be implemented.

Impact 5.C.4-3: Operation of the proposed project would reduce streamflows for steelhead passage in Corralitos Creek and Salsipuedes Creek below its confluence with Corralitos Creek, particularly for down-migrating smolts in the spring months. Operation of the Corralitos Creek Diversion could also result in entrainment or impingement of adult and juvenile steelhead. Significant. The impact would be reduced to a less-than-significant level with mitigation identified in this EIR.

Steelhead regularly use the watershed of Corralitos Creek, which joins Salsipuedes Creek downstream of College Lake. Unless flows are managed to allow continued migration of adult and juvenile steelhead, the steelhead run in this portion of the Pajaro River watershed could be significantly reduced. Operation of the intake structure at Corralitos Creek also presents a risk to smolts, which could become entrapped or entrained. The mitigation measures presented below should be implemented in conjunction with Measure 5.B.4-3 for the expanded College Lake project.

Measure 5.C.4-3a--Maintenance of Streamflow for Steelhead: Impacts to steelhead adults and smolt passage in Corralitos Creek resulting from the proposed diversion can be avoided by providing minimum bypass flows during the steelhead migration and spawning period. The following operational restrictions for the Corralitos Creek should be applied:

- Diversions are to only occur during the high flow period of December 15 through March 31.
- No diversions shall occur when streams flows measured in the immediate vicinity of the proposed diversion site are 15.0 cfs or less. A stream gauge will need to be installed and calibrated frequently to allow for accurately flow determinations.
- The maximum diversion rate shall not exceed 6.0 cfs.

Measure 5.C.4-3b--Protection of Down-Migrating Steelhead Smolts at the Corralitos Creek Intake Facilities: The intake structure shall be designed to ensure that smolts are not

entrained, since the diverted water will be used for irrigation or recharge. The intake facilities design must result in no entrapment or entrainment of steelhead smolts (NMFS, 1997).

REFERENCES – Vegetation, Fish, and Wildlife

California Department of Fish and Game, *List of California Terrestrial Natural Communities Recognized by the California Natural Diversity Database*, available from the World Wide Web: http://www.dfg.ca.gov/whdab/natcom2000.pdf. Accessed 2001, July 20, 1999.

Environmental Science Associates (ESA), *Pajaro Valley Water Management Agency Local Water Supply and Distribution Project Sensitive Species Habitat Assessment*, prepared for the Pajaro Valley Water Management Agency, Watsonville, 1999.

Habitat Restoration Group (HRG), *Fisheries Report for the Pajaro Valley Water Management Agency Water Supply Project*, prepared for Environmental Science Associates, San Francisco, Appendix C, 1997.

Jackson, D., *Determination of the Minimum Bypass Flow in Corralitos Creek for the Expanded College Lake Project*, prepared for Environmental Science Associates, San Francisco, Appendix D, July 10, 2001.

National Marine Fisheries Service (NMFS), *Fish Screening Criteria for Anadromous Salmonids. National Marine Fisheries Service Southwest Region*, 10 pp., 1997.

Smith, J. J., *Fish Passage on the Pajaro River at Murphy's Crossing*, Technical Memorandum prepared for Environmental Science Associates, San Francisco, Appendix C, March 15, 1999.

Smith, J. J., Ph.D., Fisheries Biologist, San Jose State University, personal conversation on January 12, 2001.

U.S. Fish and Wildlife Service, *Impact of Water Level Changes on Woody Riparian and Wetland Communities*, Vol. VIII, Pacific Northwest and Rocky Mountain Regions, U.S. Fish and Wildlife Service Office of Biological Services Program Report FWS/OBS-78/94, 1980.

U. S. Fish and Wildlife Service (USFWS), *Programmatic Formal Endangered Species Act Consultation on Issuance of Permits under Section 404 of the Clean Water Act or Authorizations under the Nationwide Permit Program for Projects that May Affect the California Red-legged Frog*, Letter to U.S. Army Corps of Engineers district offices, dated January 26, 1999.

5.C.5 CULTURAL RESOURCES

5.C.5.1 SETTING

Archaeology of the Project Area

Section 3.5 provides archaeological/prehistoric data on the project area.

Ethnography of the Project Area

Section 3.5 provides ethnographic data on the project area.

Historical Overview

Section 3.5 provides an historical overview of the project area.

5.C.5.2 SIGNIFICANCE CRITERIA

See Section 4.A.5.2 for a discussion of significance criteria.

Cultural Resource Findings in the Corralitos Creek and Pinto Lake Area

Archaeological surveys of the College Lake area were conducted by Pacific Legacy in November 1997 and March 1999, which included surveys of areas that would be affected by proposed Pinto Lake Diversion pipeline (Holson, 1997). The surveys identified one existing previously recorded archaeological site that could be affected by this pipeline, CA-SCR-104. This site consists of flaked stone debris, faunal shell, bone, and groundstone artifacts. Historic components of this site include two houses and two barns dating from the 1890s to the early 1900s. This site is potentially important under CEQA Guidelines but formal evaluations have not been completed.

A records search for known cultural resources in area surrounding the Corralitos Creek Diversion was conducted by the Anthropological Studies Center at Sonoma State University in September 2001. No cultural resources were identified or recorded near the diversion facilities. However, based on surveys completed in the general project area, construction activities could reveal unknown cultural resource sites.

5.C.5.3 IMPACTS AND MITIGATION MEASURES

Impact 5.C.5-1: Construction activities associated with the proposed Corralitos Creek and Pinto Lake diversion facilities may result in the alteration or destruction of identified cultural resources. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

One cultural resource site (CA-SCR-104) was identified near the Pinto Lake Diversion pipeline, adjacent to College Lake. Construction activities associated with the diversion facilities could adversely affect this resource.

Measure 5.C.5-1: Implement Measures 4.B.5-1a and 4.B.5-1b.

Impact 5.C.5-3: Ground-disturbing activities associated with the proposed pipelines and facilities could reveal previously unknown buried or otherwise obscured significant prehistoric and historic cultural resources. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Significant unknown cultural resources may be buried or obscured by vegetation on the project site, and therefore construction of the proposed project could result in degradation and destruction of undiscovered cultural resources.

Measure 5.C.5-3: Implement Measure 4.A.5-1.

Impact 5.C.5-4: Potential indirect impacts to cultural resources, primarily vandalism, could result from the increased access to, and use of, the general area during construction. Such disturbance could result in the loss of integrity of important cultural resources. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Construction activities associated with the Corralitos Creek Diversion and Pinto Lake Diversion facilities might increase accessibility to existing cultural resource sites. This could result in looting and vandalism of important cultural resources.

Measure 5.C.5-4: Implement Measures 4.B.5-3a through 4.B.5-3c.

REFERENCES – Cultural Resources

Holson, John, Pacific Legacy, Incorporated, written correspondence, November 14, 1997.

5.C.6 TRAFFIC AND CIRCULATION

5.C.6.1 SETTING

Project Area Roadways

Project area roadways are illustrated in **Figure 3.6-1** in the discussion of Regional Setting. *Highway 152* provides east-west access through the project area, stretching east from Highway 1 to the Central Valley. In the west portion of the project area, Highway 152 runs through Watsonville (along Main Street, East Beach Street, Lincoln Street and East Lake Avenue) to Hecker Pass (via Hecker Pass Road) and Santa Clara County.

A number of local two-lane roadways that might be affected by the project include Freedom Boulevard, Amesti Road, Holohan Road and Green Valley Road. *Freedom Boulevard* extends in a northwest-southeast direction providing access through Freedom, terminating at Highway 152. *Amesti Road* extends in a northwest-southeast direction, terminating at Highway 152. *Holohan Road* extends west from Highway 152 south of College Lake, terminating at Green Valley Road. *Green Valley Road* extends in a northeast-southwest direction, providing connection to Highway 152 and Highway 1 in Freedom.

Traffic Volumes

Section 3.6.1, Regional Setting – Traffic and Circulation, presents daily traffic volumes on study area roadways.

Existing Truck Traffic on Roadways

Section 3.6.1 presents existing truck traffic on study area roadways.

Accident History

Section 3.6.1 presents an accident history for study area roadways.

Roadway Improvement Projects

Section 3.6.1 describes roadway improvement projects planned in the study area.

Applicable Plans and Policies

Section 3.6.1 presents applicable plans and policies for jurisdictions in the study area.

5.C.6.2 SIGNIFICANCE CRITERIA

See Section 4.A.6.2 for a discussion of significance criteria.

5.C.6.3 IMPACTS AND MITIGATION MEASURES

Construction Trip Generation

Construction activities that would generate traffic consists of trucks hauling equipment and materials to the diversion facility sites and pipeline alignments, the hauling of excavated spoils from, and delivery of backfill to the work sites, and the daily arrival and departure of construction workers to the work sites.

Under the Corralitos Creek and Pinto Lake diversion projects, approximately 9,700 linear feet of 24-inch diameter pipeline would be installed. **Figure 2.8** depicts the alignments of the pipelines. The majority of the proposed alignment is through agricultural fields, where conventional excavation methods would be used for open-cut pipeline installation. The following assumptions were made to estimate construction impacts from the proposed pipeline installation: a trench five feet wide by six feet deep, new fill would be replace excavated soil, an average of 100 feet of pipe would be laid per work day, an average truck haul load would be 10 cubic yards per truck, and there would be no backhauling. Using these assumptions, an estimated 110 cubic yards would be excavated per day, with approximately the same amount of new fill imported; this would amount to approximately 22 daily truck haul round trips (44 one-way trips).

The number of workers at any one location along the pipeline alignment would vary depending on location and the specific type of construction activity underway. Based on estimates of workforce per task, there would be approximately six to ten workers per crew on an average day. Assuming that each worker would travel in his own vehicle to and from the site, and that some midday trips would occur, this would result in up to about 15 worker vehicle round trips per day (30 one-way trips). Accounting for construction material delivery and worker trips, there would likely be a total of less than 50 round trips (100 one-way trips) occurring per day at a typical construction spread.

Additional construction trips would be generated by construction of the diversion facilities. No construction details (e.g., required earthwork, construction duration) are currently available for these facilities; thus, the volume traffic that would be generated by construction of these facilities also is not yet known.

Construction Trip Distribution

The specific destination(s) for hauling of excavated materials from the construction areas, or originating location(s) for delivery of imported fill and other materials to the work sites is currently unknown. However, a number of construction materials sources (e.g., quarries, manufacturers) and excess soil re-use options (e.g., farms) are in the surrounding rural areas and urban centers. Construction worker trips are assumed to originate from the major urban areas in the project region and nearby communities.

Based on the existing roadway network serving the project area, project trucks and construction workers traveling to and from the alignment would likely use a combination of highways (e.g.,

Highway 1, Highway 152), county roads and designated truck routes in the project vicinity to reach other local points and/or regional locations.

Impact 5.C.6-1: Traffic on area roadways would temporarily increase as a result of project-generated vehicle trips by construction workers and construction vehicular activities. Less than Significant. Implementation of mitigation identified in this EIR, while not required, would assist in ensuring that the impact would remain at a less-than-significant level.

Because project construction-generated traffic would be temporary, it would not result in any long-term degradation in operating conditions or level of service for any project-area roadways. The primary off-site impacts from the movement of construction trucks would include short-term and intermittent lessening of roadway capacities due to slower movements and larger turning radii of the trucks compared to passenger vehicles.

The project would temporarily increase traffic on roadways providing access to the work sites and roadways providing connection to regional routes; this would mainly affect Highway 1 and Highway 152 via Holohan Road, Freedom Boulevard and Green Valley Road. Although the specific estimated off-site construction vehicle trips are preliminary, (see Construction Trip Generation, above), given the expected type and scope of facility and pipeline construction, construction-generated traffic would be expected to be at a level that would not significantly disrupt traffic flow on these freeways and arterials. Given the pace of construction, the duration that haul trucks would be required to use any given local roadway would be relatively brief.

Most project-related hauling and deliveries would be expected to be dispersed throughout the day, thus lessening the effect on peak-hour traffic. Project truck traffic occurring during the hours of 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. would coincide with peak-hour traffic, and therefore have the greatest potential to impede traffic flow during these time periods. Restricting truck traffic during the a.m. and p.m. peak periods would further minimize disruption of the general traffic flow on affected roadways.

Although this impact would be less than significant, the following mitigation measures are recommended to further reduce the less-than-significant impact.

Measure 5.C.6-1 (Recommended): Implement Measures 4.A.6-1a and 4.A.6-1b.

Impact 5.C.6-2: Project construction would increase traffic delays for vehicles traveling past the construction zone. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Project engineers indicate that the majority of pipeline associated with this component would be installed in agricultural fields, not roadways. However, the proposed alignment would follow adjacent to, or within a portion of, and/or cross Green Valley Road. Assuming open trench

activities proceeding at an average rate of 100 feet per day, impacts would be brief at any one location along the pipeline alignment.

Existing transportation and circulation patterns in the vicinity of the proposed pipeline alignment would be temporarily disrupted by construction activities and heavy equipment use in the roadways. Impacts related to pipeline construction would include direct disruption of traffic flows and roadway operations. Lane blockages or roadway closures during pipeline installation would result in a reduction in travel lanes, and could result in the need for traffic re-routing.

Measure 5.C.6-2: Implement Measures 4.B.6-2a and 4.B.6-2b.

Impact 5.C.6-3: Project construction would affect access to adjacent land uses for both general and emergency access. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Since the majority of project construction would not involve installation within roadways, but rather within open country, minimal impacts to access to properties along the construction route due to trenching, and materials and equipment storage would be expected. However, potential temporary blockage or reduction in travel lanes could result in a significant delays to emergency services. In addition, a temporary inconvenience to local commercial and agricultural businesses and residences could result.

Measure 5.C.6-3: Implement Measures 4.B.6-3a through 4.B.6-3c.

Impact 5.C.6-4: Project construction would increase wear-and-tear on area roadways used by construction vehicles. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The use of heavy trucks to transport equipment and material to and from the project site could affect road conditions by increasing the rate of road wear or causing direct damage to roads and bridges. The degree to which this impact would occur depends on the project-generated traffic and the design (pavement type and thickness) and existing condition of the roadways. The project's impact is assumed to be minimal on major arterials (e.g., highways, including Highway 1 and Highway 152) which are designed to accommodate a mix of vehicle types, including heavy trucks.

Other local-serving roads, such as Green Valley Road, may not be built with a pavement thickness that will withstand considerable heavy truck volumes. The projected increase in use of these or other local roadways by heavy trucks could result in significant roadwear on these roadways.

Measure 5.C.6-4: Implement Measure 4.A.6-2.

Impact 5.C.6-5: Project construction would increase potential traffic safety hazards for vehicles and pedestrians in the construction area. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The temporary increase in construction-generated trucks on project area roadways would interact with other vehicles, including other large trucks, slow-moving agricultural vehicles (in farm areas), and other local traffic. Potential conflicts also could occur between construction traffic and bicyclists and pedestrians, particularly in and near densely populated areas, such as the residential neighborhood near College Road, and in Watsonville. Highway 152, Holohan Road, College Road, and Lakeview Road (south of College Road) are part of the Master Plan of Santa Cruz County bikeways (County of Santa Cruz, 1994).

As discussed in Section 3.6.1, Setting, a number of major roadway segments in the area exhibit higher accident rates than the statewide average for similar roadways. These roadways include Highway 152 (through Watsonville) and Highway 129 (in Santa Cruz and Watsonville). However, these arterials are already used heavily by trucks (as discussed in Section 3.6.1, Setting). In addition, the state and county routes would still be the safest, and in virtually all locations, the only desirable routes for project traffic to use.

Measure 5.C.6-5: Implement Measures 4.A.6-3a and 4.A.6-3b.

Impact 5.C.6-6: Project construction would generate a demand for parking spaces for construction worker vehicles. Less than Significant.

The project would generate a need for parking for construction workers and construction vehicles, as well as areas to store equipment and supplies. The location of staging areas has not been identified at this point; however, given the relatively remote location of the pipeline alignments, staging areas could be accommodated easily. The demand for new parking would be met by the proposed construction staging areas. No public on-street parking would be eliminated during project construction.

Mitigation: None required.

Impact 5.C.6-7: Project construction could coincide with other construction projects under the Revised BMP, or other potential construction projects in the area, contributing to cumulative traffic and roadway disruptions. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Construction associated with the proposed project could occur at the same time construction of other components identified under the Revised BMP occurs, in addition to other potential cumulative construction projects in the project area. The projects would share some of the same construction access routes (including Highway 1 and Highway 152), particularly for pipeline construction. Consequently, cumulative traffic and roadway disruptions could occur. The implementation of mitigation measures identified in this section would reduce this project's contribution to cumulative impacts. The following measures would further reduce this project's contribution to this impact to a less-than-significant level.

Measure 5.C.6-7: Implement Measure 5.A.6-7.

REFERENCE – Traffic and Circulation

County of Santa Cruz, *1994 General Plan and Local Coastal Program for the County of Santa Cruz*, 1994.

5.C.7 AIR QUALITY

5.C.7.1 SETTING

Section 3.6, Regional Setting – Traffic and Circulation, describes the major roadways in the vicinity of the Corralitos Creek and Pinto Lake Diversion Facilities. Aside from automobile and agricultural emissions there are no major air emission sources in the vicinity of this project component.

5.C.7.2 SIGNIFICANCE CRITERIA

Please refer to Section 4.A.7.2 for a description of the significance criteria used in analyzing potential project impacts related to air quality.

5.C.7.3 IMPACTS AND MITIGATION MEASURES

Impact 5.C.7-1: Construction of the Corralitos Creek and Pinto Lake Diversion projects would temporarily generate criteria air pollutants, particularly PM_{10}, over the duration of the construction period. Significant and Unavoidable. Implementation of mitigation identified in this EIR would reduce the impact, but it would remain significant.

Construction of this project component would generate fugitive dust (including PM_{10}), and other criteria air pollutants from exhaust emissions. A large portion of the total construction dust emissions would result from site grading and trench excavation activities. Dust emissions would vary from day to day, depending on the phase of construction, the silt content of the soil, and the weather. Daily emissions would depend greatly upon whether construction of the distribution systems would occur simultaneously. Construction-related impacts which are individually less than significant may have a significant impact if construction occurs on two or more components simultaneously. Additionally, PM_{10} as well as some exhaust emissions would add to the cumulative air pollutant emissions of the valley. In an agricultural region, soil tilling is a source of PM_{10}, which in total far exceeds what the project construction could generate at individual site locations. Larger particles of dust from construction would fall out relatively close to construction sites and could cover crops with a coating of dust. This could be injurious to plants, particularly seedlings and plants in their early growth stages.

According to MBUAPCD *CEQA Guidelines*, construction projects which emit precursors of ozone (i.e., ROG and NO_x) are accommodated in the emission inventories of the Air Quality Management Plans and would not have a significant impact on the attainment and maintenance of ozone AAQS. For this reason, emissions of ROG and NO_x from construction equipment will not be quantified and will be considered a less-than-significant impact. The MBUAPCD Guidelines also state that PM_{10} emissions from construction activities are considered significant if they would generate 82 pounds per day or more of PM_{10} when the activities are located nearby and upwind of sensitive receptors.

Pipeline construction is expected to be completed at an average rate of 100 feet per day per pipeline heading. As stated above in Section 5.6, Traffic and Circulation, an estimated 110 cubic yards would be excavated per day, and approximately the same amount of new fill would be imported. Heavy-duty construction equipment used in pipeline construction would include trenchers, front loaders, cranes, dump trucks, and compressors. Criteria pollutant emission sources would include exhaust from construction emissions and construction worker vehicle trips.

If the diversion pipelines are constructed simultaneously, this would result in emission of approximately 975 pounds of PM_{10} per day. Without mitigation, PM_{10} emissions from the construction of all components would result in a significant impact.

Measure 5.C.7-1: Implement dust control program described in Measure 4.A.7-1.

The effectiveness of the dust control measures in reducing PM_{10} emissions ranges from 34 percent (for sweeping streets) to 90 percent (for covering haul trucks and inactive storage piles) (MBUAPCD, 2000). However, implementation of all applicable measures would not reduce PM_{10} emissions to below 82 pounds per day. With implementation of Measure 4.A.7-1, construction-generated PM_{10} emissions would remain significant and unavoidable.

Impact 5.C.7-2: Lane closures and detours necessitated by construction of the project could temporarily increase vehicular emissions. Less than Significant.

Construction of the various treatment facilities would not require lane closures or detours. Installation of pipeline sections required by the various components of the project would involve crossing roadways. Roadways will be maintained to allow one-lane passage at all times. For one-lane or narrow roadways, construction would be completed by closing the road for the shortest period of time, and traffic control plans submitted by the contractor will ensure minimal lane closures and detours. Vehicular emissions would be temporarily increased from autos taking detours or queuing on narrow roadways. However, increased emissions directly caused by lane closures would not be likely to exceed MBUAPCD significance criteria of 150 pounds per day of ozone precursors (ROG or NO_x) or 550 pounds per day of CO.

Impact 5.C.7-3: Vehicle trips resulting from operation and maintenance of the various components of the project would generate emissions of criteria air pollutants. Less than Significant.

Operation of the diversion facilities and pipelines would require periodic maintenance and inspection by PVWMA employees. Emissions generated by employee vehicle trips would be negligible and would not exceed MBUAPCD significance thresholds. Pumps would be powered by electricity, rather than diesel, and would not generate added criteria air pollutants.

REFERENCE – Air Quality

Monterey Bay Unified Air Pollution Control District, *CEQA Air Quality Guidelines*, September 2000.

5.C.8 NOISE

5.C.8.1 SETTING

Please refer to Section 3.8 for a discussion of regional noise conditions. Proposed improvements under this component include construction of diversion pipelines from Corralitos Creek to the Pinto Lake drainage and from Pinto Lake drainage to College Lake. The Corralitos Creek Diversion would include a pump station.

The proposed locations for the pipelines are in agricultural or weedy, disturbed areas, with the exception of the a portion of the Corralitos diversion pipeline that crosses Amesti Road and terminates near residences at Green Valley Road and Behler Road. Residences are located approximately 800 feet southwest of the Corralitos Creek Diversion facilities, which include a pump station.

5.C.8.2 SIGNIFICANCE CRITERIA

See Section 4.A.8.2 for a discussion of significance criteria.

5.C.8.3 IMPACTS AND MITIGATION MEASURES

Impact 5.C.8-1: Construction activities associated with the project construction would intermittently and temporarily generate noise levels above existing ambient noise levels in the project vicinity. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Construction-related noise levels at project construction sites would fluctuate depending on the particular type, number, and duration of use of various pieces of construction equipment, and the location of sensitive receptors. The effect of construction noise would depend on how much noise would be generated by the equipment, the distance between construction activities and the nearest noise-sensitive uses, and the existing noise levels at those sensitive uses.

Construction activities would be expected to last approximately 23 months and one week at any given location along pipeline alignments. Residences are located within 800 feet of the pump station and within 300 feet of the easterly segments of the Corralitos Creek Diversion; therefore, noise associated with construction activity would be considered a significant effect for this component. Implementation of the mitigation measures below, which limit the timing of construction and use of equipment, would reduce potentially significant impacts to a less-than-significant level.

Measure 5.C.8-1: Implement Measure 4.A.8-1.

Impact 5.C.8-2: Operation of proposed pumping facilities associated with the Corralitos Creek Diversion would result in noise increases in the vicinity of project facilities.

Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The Corralitos Creek Diversion would result in an increase in noise-generating equipment in the vicinity of the pump station. Operation of a pump station would require three booster pumps. Generally, a 150-horsepower pump generates a noise level of 75 dBA at a distance of 50 feet. Assuming a distance of 800 feet to the nearest sensitive receptors, noise from a three pumps would be reduced to 56 dBA at a distance of 800 feet. While this noise level would likely not be significant during daytime hours, it would be noticeable during quieter nighttime hours. Assuming 24-hour operation of three pumps, the resulting Ldn at local receptors would be 62 dBA, which falls within the conditionally acceptable land use category for residential land uses within the General Plan. Because the proposed pump station would have the potential to increase local noise levels at nearby residences in excess of a normally acceptable residential land use environment as established in the General Plan, the project would result in a potential significant operational noise impact. The pumping facilities associated with the Corralitos Creek Diversion have the potential to affect nearby sensitive receptors, depending on the siting and design of the pumping facility. Implementation the Mitigation Measures below would reduce potential impacts to a less-than-significant level.

Measure 5.B.8-2: Implement Measure 5.B.8-2.

5.C.9 PUBLIC SERVICES

5.C.9.1 SETTING

Please refer to Section 3.9 for a discussion of public services and utilities serving the area.

5.C.9.2 SIGNIFICANCE CRITERIA

Please refer to Section 4.A.9.2 for a discussion of significance criteria.

5.C.9.3 IMPACTS AND MITIGATION MEASURES

Demand during construction for public services such as water (for dust control), solid waste disposal, and schools will not be large enough to cause significant impacts. (Solid waste generated by the project would be sent to the Marina Landfill in Monterey County.)

Impact 5.C.9-1: Construction of the proposed water diversion facilities could result in temporary, planned or accidental disruption to utility services provided by underground lines. Significant. With mitigation identified in this EIR the impact would be reduced to a less-than-significant level.

The proposed pipelines primarily would traverse agricultural fields and would not likely encounter utility lines except where public roads are crossed (i.e., Green Valley Road). For further discussion of this impact refer to Impact 4.A.9-1.

> **Measure 5.C.9-1:** A detailed study identifying utilities along the proposed alignments shall be done during the pre-design stages of the project.
>
> The following mitigations are required for segments identified in final design as having potential conflict with significant utilities.
>
> a. Utility excavation and encroachment permits would be required from the appropriate agencies, potentially including the Public Works Departments of Santa Cruz County, and the City of Watsonville. These permits include measures to minimize utility disruption. PVWMA and its contractors shall comply with permit conditions. Permit requirements shall be included in construction contract specifications.
>
> b. Utility locations would be verified through field survey (potholing) and use of an underground locating service.
>
> c. A detailed engineering and construction plan shall be prepared as part of the design plans and specifications. This plan shall include procedures for the excavation, support, and fill of areas around utility cables and pipes. All affected utility services would be notified of PVWMA's construction plans and schedule. Arrangements would be made with these entities regarding protection, relocation, or temporary disconnection of services.

d. In areas where the pipeline would parallel wastewater mains, engineering and construction plans shall include trench wall support measures to guard against trench wall failure, and possible resulting loss of structural support for the wastewater main.

e. Residents and businesses in the project area shall be notified in writing by the contractor of planned utility service disruption two to four days in advance, in conformance with County and State standards.

Impact 5.C.9-2: Pipeline construction could temporarily impede vehicle access to emergency services, as well as to collection and delivery services. This impact could affect Counties' Sheriff's Departments, fire departments, emergency services (e.g., ambulance companies), delivery and collection services. Significant. With mitigation identified in this EIR the impact would be reduced to a less-than-significant level.

Pipeline construction could temporarily impede vehicle access to police, fire or emergency services at Green Valley Road. Vehicle access to an individual residence or business would normally be impeded for one to two days, maximum. PVWMA would employ construction methods described in the assessment of traffic impacts (see Section 5.A.6) that would reduce this impact to a less-than-significant level.

Measure 5.C.9-2a: Construction trenches shall be covered by steel trench plates to allow access to driveways.

Measure 5.C.9-2b: To minimize disruption of emergency vehicle access, contractors shall work with affected jurisdiction (Santa Cruz County) to identify detours during construction.

Measure 5.C.9-2c: Police, fire, and emergency services shall be notified of the timing, location, and duration of construction activities and the locations of detours and lane closures.

Impact 5.C.9-3: Pump station operations for the project would increase demand for electrical service at the project site. Significant. With mitigation identified in this EIR the impact would be reduced to a less-than-significant level.

The proposed project would generate demand for electricity and could require the extension of new, or expansion of existing electricity lines to serve the proposed pump station. The specific electricity requirements would be reviewed by PG&E after PVWMA submits a formal application for service.

Measure 5.C.9-3: The design of all pump facilities with a potential to exceed the capacity of existing PG&E systems will be coordinated with PG&E to ensure adequate capacity is available.

REFERENCE – Public Services

Norwood, Jim, Captain, City of Watsonville Fire Department, telephone communication, October 17, 1997.

5.C.10 VISUAL/AESTHETIC AND RECREATIONAL RESOURCES

5.C.10.1 SETTING

Both the Pinto Lake and Corralitos Creek project areas occur on agricultural lands north of the Watsonville city limits. The Corralitos Creek Diversion structure and pump station site is on the north bank of Corralitos Creek, within the riparian corridor. The 24-inch, 8,500-foot long pipeline would traverse open agricultural fields between Corralitos Creek and the existing Pinto Lake drainage channel. This area exhibits a rural visual character, with some development visible along Green Valley Road. Views of the Corralitos Creek Diversion project area are available from Freedom Boulevard, Amesti Road and Green Valley Road. Since the proposed Corralitos Creek Diversion pipeline would be within the Green Valley Road right-of-way and across the Amesti Road right-of-way, it would be clearly visible to motorists travelling along these roads.

The Pinto Lake Diversion facility would extend from an existing irrigation ditch 2,250 feet north of Holohan Road through agricultural lands to College Lake. This area also exhibits a rural visual character, with the nearest development being the residences at the intersection of Holohan Road and Highway 152. Views of the Pinto Lake Diversion are available from Holohan Road and Cottage Road.

Consistency with Applicable Plans and Policies

Development of the Corralitos Creek and Pinto Lake diversions project generally would be consistent with the applicable policies of the Santa Cruz County General Plan/LCP presented in Section 3.10 of this Report. The pipeline alignments would be underground and would not be visible following installation. During construction, excavated trenches and stockpiled soils, pipe, and other materials within the construction easement would constitute negative aesthetic elements in the visual landscape that would directly affect, or be visible from City-designated scenic roads, including Airport Boulevard, Freedom Boulevard, Holohan Road and Green Valley Road. However, these effects would be temporary during project construction. Since this component would not result in any long-term impacts on views or the visual landscape, it would not be inconsistent with General Plan policies that encourage preservation of scenic rural qualities and protection of views from designated scenic routes.

5.C.10.2 SIGNIFICANCE CRITERIA

Please see **Section 4.A.10.2** for a discussion of significance criteria.

5.C.10.3 IMPACTS AND MITIGATION MEASURES

Impact 5.C.10-1: Installation of the Corralitos Creek and Pinto Lake diversion facilities would disturb roadways and remove crops and vegetation, temporarily altering the visual landscape. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Construction of the pipelines temporarily would remove native vegetation and crops along the alignment and disturb roadways. Cropping would continue on agricultural lands within the alignment following installation of the pipeline. For this reason, the construction disturbance is considered a less-than-significant impact. During construction, excavated trenches and stockpiled soils, pipe, and other materials within the construction easement would constitute negative aesthetic features to the pipeline alignment. This would be a temporary adverse impact and would be considered less than significant.

Following construction, the proposed pipelines would be entirely below grade and would be unobtrusive. Implementation of Measure 4.A.10-1a, requiring that PVWMA revegetate disturbed natural areas, and Measure 4.A.10-1c, requiring contractors to restore disturbed areas to pre-construction conditions, would minimize visual impacts. No long-term visual impacts would result from development of the pipeline.

Measure 5.C.10-1: Implement Measures 4.A.10-1a through 4.A.10-1c.

Impact 5.C.10-2: Development of the Corralitos Creek and Pinto Lake Diversions component would introduce new sources of light onto the project site and increase ambient light in the project area. Less than Significant. Implementation of recommended mitigation measures identified in this EIR, while not required, would assist in ensuring that the impact would remain at a less-than-significant level.

While no exterior lighting is currently proposed as part of this component, exterior security lighting (if implemented) at the new pump station could introduce light and create nighttime impacts. The new facilities would be located in the vicinity of existing residences. While exterior lighting could be visible from these residences, it would not be expected to substantially increase ambient light in the project area.

The proposed pipeline would be underground and would not introduce new sources of light or glare.

Mitigation Measure 5.C.10-2 (Recommended): Implement Measure 4.A.10-2.

Impact 5.C.10-3: Development of the Corralitos Creek Diversion pipeline would temporarily disrupt recreational uses along designated recreational bicycle trails in Santa Cruz County. Less than Significant.

Construction of the Corralitos Creek Diversion pipeline would disrupt bicycle traffic along Amesti Road and Green Valley Road, which are both included in the Santa Cruz County bikeway system. Construction activities and related truck traffic could damage these bikeways, and segments of the bikeways with active construction areas would be temporarily closed during trench excavation and pipeline installation, creating minor inconvenience to bicyclists. This impact would be temporary during project construction. Implementation of Measures 4.A.6-2, 4.A.6-3a and 4.A.6-3b would ensure that damaged roads would be repaired to pre-construction conditions, and that detours would be provided for bicyclists and motorists during the construction period. Therefore, this impact would be less than significant.

Mitigation: None required.

5.D AQUIFER STORAGE AND RECOVERY

5.D.1 LAND USE AND PLANNING

5.D.1.1 SETTING

Facilities for the Aquifer Storage and Recovery component of the Local-Only Alternative would include a seven-mile-long dual pipeline between College Lake and the Harkins Slough pump station (refer to **Figure 2.8** in Chapter 2, Project Description), as well as approximately 30 injection/extraction wells within 100 to 200 feet of the pipeline alignment. The project also includes the construction of a pump station and diversion structure on the north bank of Watsonville Slough just west (downstream) of Harkins Slough. The existing Harkins Slough filtration plant also would be expanded to accommodate the proposed Watsonville Slough Diversion of up to 1,100 acre-feet per year.

Land uses along the proposed dual pipeline alignment are primarily agricultural. Between the Harkins Slough filtration facility and the Watsonville Airport, the alignment extends through strawberry and vegetable crops as well as pasture. Northeast of Highway 1, the alignment extends within and along the western edge of the Watsonville Airport property. At the north end of the airport, the alignment follows Buena Vista Drive with residences to the north of the alignment and the airport to the south. Residences are on both the east and west sides of the alignment as it approaches Freedom Boulevard. Northeast of Freedom Boulevard, the alignment crosses Corralitos Creek and its riparian corridor and continues east along the north side of the creek approximately 3,000 feet through apple orchards and vegetable crops. The alignment follows Green Valley Road approximately 500 feet north and then extends one mile east to the College Lake filtration facilities across agricultural lands containing blackberries, apple orchards, and vegetable crops. Residences are located south of the alignment near the College Lake filtration facilities.

The proposed pipeline alignment would extend through lands designated as Type 1A and 3 agricultural lands on the Santa Cruz County Agricultural Resources Map. The proposed facilities at Harkins and Watsonville Sloughs would be constructed on Type 3 agricultural lands. For a definition of these classifications, please refer to Chapter 3.1.

Consistency with General Plan Policies and Zoning Designations

Development of the Aquifer Storage and Recovery facilities would be consistent with applicable policies of the Santa Cruz County and City of Watsonville general plans presented in Section 3.1 of this EIR. The proposed facilities would provide a new source of irrigation water for adjacent agricultural lands which in turn would reduce the need for groundwater pumping. Therefore, these facilities would increase groundwater recharge, and thus would be consistent with Objectives 5.5a and 5.5b, and Programs C and H of the Conservation and Open Space Element of the Santa Cruz County General Plan/LCP.

This component would involve construction of a pump station and filtration facilities on land designated as Agriculture. This would be potentially inconsistent with General Plan policies that call for preservation of agricultural land. However, this would not be inconsistent with General Plan policies calling for preservation of agricultural land because the facilities would provide water to replace groundwater for irrigation purposes. This would increase groundwater recharge and minimize saltwater intrusion, which would ensure long-term continuation of agriculture in the area.

The proposed dual pipeline would not result in a long-term loss of agricultural land because it would be underground, and farming as occurs at present would resume within the construction corridor following pipeline installation. Therefore, the pipeline would be consistent with Policies 5.13.6 and 5.13.22 and Program F of the Santa Cruz County General Plan/LCP, and Goal 3.3, Policy 3.F, and Implementation Measures 3.F.1, 3.F.2, and 3.F.4 of the Watsonville General Plan.

As stated in Section 3.1, the Watsonville General Plan recognizes that the preservation of agricultural land alone will not ensure preservation of the agricultural economy, and that other factors, such as availability of irrigation water and facilities for support industries, are also important in preserving agriculture. Therefore, while development of the pump station on agricultural land would be inconsistent with specific policies, it would not contradict the overall intent of the general plans.

5.D.1.2 SIGNIFICANCE CRITERIA

Please see Section 4.A.1.2 for a discussion of significance criteria.

5.D.1.3 IMPACTS AND MITIGATION MEASURES

Impact 5.D.1-1: Construction of the Aquifer Storage and Recovery facilities would result in short-term disturbance of adjacent land uses. Less than Significant. Implementation of mitigation identified in this EIR, while not required, would assist in ensuring that the impact would remain at a less-than-significant level.

The proposed facilities would not alter surrounding land uses, which include residences, Watsonville Airport, St. Francis Church and School, and agricultural lands, and would not disrupt or divide the community. The project would not be incompatible with existing uses in the vicinity. Construction disturbance temporarily could constrain access to driveways along Buena Vista Drive, Freedom Boulevard, and Green Valley Road. However, this would be a temporary impact that results more in inconvenience to motorists than a substantial impact and, therefore, would not be expected to substantially impair operation of, or access to surrounding land uses. Construction of proposed pumping and diversion facilities would not involve construction within area roadways and thus would not disrupt access to, or use of adjacent lands. Therefore, this impact would be considered less than significant. Implementation of Measures 5.D.6-3a through 5.D.6-3c would minimize construction disturbance.

In addition, construction of proposed facilities would generate noise, dust, and traffic that could disrupt adjacent land uses. Sections 5.D.6, Traffic and Circulation, 5.D.7, Air Quality, and 5.D.8, Noise, of this EIR present traffic and air quality impacts. With proper mitigation, temporary construction impacts would have a less-than-significant effect on adjacent land uses.

Measure 5.D.1-1 (Recommended): Implement Measure 4.A.1-1.

See also mitigation measures in Sections 5.D.6, Traffic and Circulation, 5.D.7, Air Quality, and 5.D.8, Noise, of this EIR.

Impact 5.D.1-2: Development of the Aquifer Storage and Recovery facilities would result in the permanent loss of up to two acres of agricultural lands. Significant and Unavoidable.

The proposed pump station and filtration facilities at Watsonville Slough would convert approximately one-half acre of agricultural land to water distribution uses that would preclude farming on the site**.** According to the Santa Cruz County Agricultural Resources Map, development of the facilities would convert vegetable crops that are designated as Type 3 agricultural lands. As stated in Section 3.1, these lands meet the U.S. Department of Agriculture Soil Conservation Service criteria for prime and unique farmland. In addition, the 30 injection/extraction wells would convert approximately 1.5 acres of land along the dual pipeline alignment. Depending on the locations of these wells, an additional 1.5 acres of Type 1A or 3 prime farmland could be converted. Therefore, development of this site would contribute to the cumulative loss of prime farmlands in the region. This would be considered a significant and unavoidable impact.

The proposed pipelines would not result in the permanent conversion of agricultural land; however, these activities would affect agricultural production. Installation of the pipelines could disrupt agricultural production within the alignment for at most one cropping season, depending on the timing of construction. The pipelines extend through prime farmlands. Because construction disturbance would be temporary, and operation of the pipeline, once installed, would not preclude agricultural production, this would not be considered a significant impact. Therefore, this would be a less-than-significant impact.

Measure 5.D.1-2: None available; this impact would be significant and unavoidable.

5.D.2 GEOLOGY, SOILS, AND SEISMICITY

5.D.2.1 SETTING

Please refer to Section 3-2 for a discussion of regional geologic conditions, soils, and seismicity.,

The region supporting the proposed Aquifer Storage and Recovery (ASR) project include low floodplain areas in the Watsonville Slough, upland terrace areas along the between Hanson and Harkins Sloughs, and the flat lowlands of the Corralitos Creek Valley. The topography consists of flat lying, alluviated valleys, and hilly , dissected upland terraces. Elevations in the Watsonville Slough at the Watsonville facilities is about 10 feet above mean sea level (amsl). The pipeline alignment extending north from the Watsonville facilities ranges from 60 to 100 feet amsl. Along Corralitos Creek the elevations range from 120 feet amsl near Pinto Lake to 80 feet amsl near College lake pump station and filter plant.

Geology

Geologic conditions underlying the individual elements of the proposed Aquifer Storage and Recovery (ASR) project vary considerably depending on location. The proposed project area includes young floodplain deposits adjacent to the Pajaro River, terrace deposits west of the city of Watsonville and older floodplain deposits through the Corralitos Valley. The project area is primarily underlain by unconsolidated to semi-consolidated alluvial deposits comprised of younger (Holocene) floodplain sediments consisting of unconsolidated, relatively fine-grained, heterogeneous deposits of sand and silt and commonly including relatively thin, discontinuous layers of clay (Dupre and Tinsley, 1980). The older silts and gravel deposits occurring as uplands are terraces referred to as the Terrace Deposits of Watsonville (Brabb, 1989). Overlying these deposits are soil profiles that vary in depth and structure. **Table 5.D.2-1** below summarizes geologic conditions, soil types and seismic response at the locations of each component of the water recycling and storage components.

Soils

The soils underlying the components of this project are listed in **Table 5.D.2-1** and their general characteristics are summarized in **Table 5.D.2-2**. These are generally highly productive soils and almost entirely under cultivation. No part of the area is within a designated zone of mineral, aggregate, oil and gas or geothermal resources.

Seismicity

Table 5.D.2-1 summarizes seismic characteristics of the proposed project area. Earthquake ground shaking is the primary seismic hazard affecting the area. The entire area is expected to experience groundshaking intensity IX in a major earthquake (McCrory et al., 1977) and

TABLE 5.D.2-1
SUMMARY OF GEOLOGIC CONDITIONS
WATER RECYCLING PROJECT COMPONENTS

Project Component	Underlying Geology	Overlying Soils[1]	Potential Groundshaking Amplification[2]	Liquefaction Potential[3]
Harkins Slough Facility	Floodplain deposits with sand silt and gravel	Clear Lake Clay	High to Very High. Ground shaking amplification likely.	Moderate
Recycled Water Pipeline	Floodplain deposits, Terrace deposits, Older floodplain deposits;	Clear lake Clay; Tierra Watsonville; Watsonville Loam; Soquel Loam; Elder Sandy Loam.	Very high in unconsolidated, saturated alluvuim; Moderate in floodplain areas, and somewhat lower on terraces.	High to very high in floodplain and along Corralitos Creek, Low on terrace deposits
Injection/extraction Well Corridor	Floodplain deposits, Terrace deposits, Older floodplain deposits	Clear lake Clay, Tierra Watsonville; Watsonville Loam; Soquel Loam; Elder Sandy Loam; Baywood Loam; Fluvaquentic; Haploxeroll.	Very high in unconsolidated, saturated alluvuin; Moderate in floodplain areas, and somewhat lower on terraces.	High to very high in floodplain and along Corralitos Creek, Low on terrace deposits
College lake Pump Station.	Recent and Older Floodplain deposits	Baywood Loamy sand,	Moderate	Moderate

1 Refer to Section 3-2 and table 5.A.2-2 in this section for further disacussion of soil types.
2 Based on general geologic characteristics and the ability for the particular deposit to amplify ground shaking during an earthquke. For example, saturated loose sand would amplify the ground movement considerably more than bedrock.
3 Very High Liquefaction Susceptibility - Sediments for which engineering testing and the presence of a shallow water table confirm the susceptibility for liquefaction in addition to historical evidence of liquefaction and failure during the 1906 earthquake. Sediments in this category are quite likely to liquefy and fail in an earthquake. High Liquefaction Susceptibility - Sediments for which engineering testing and the presence of a shallow water table suggests the susceptibility for liquefaction but no historical evidence of liquefaction has been reported. Sediments in this category are likely to liquefy in an earthquake. Moderate Liquefaction Susceptibility – Sediments classed may liquefy in the event of a nearby earthquake and include those with high susceptibility but where historical evidence of liquefaction is absent. Low Liquefaction Susceptibility – Sediments that are unlikely to liquefy, even in the event of a major earthquake.

associated peak ground accelerations of 0.05g - 0.6g.[1] Saturated floodplain deposits would tend to amplify ground movement to a greater extent than consolidated terrace deposits. No part of the area with proposed project facilities lies within a tsunami hazard area.

1 Please refer to **Table 3.2.2** in Section 3.2 for a description of the Modified Mercalli Scale.

TABLE 5.D.2-2
SOILS IN THE AQUIFER STORAGE AND RECOVERY PROJECT AREA AND ALONG PROPOSED FACILITIES

Soil	Slope	Capability Class	Storie Index	Erosion Hazard	Other
Conejo loam	0 - 2 %	I irrigated III non-irrigated	62	slight - moderate	
Soquel Loam	0 – 2 %	I – irrigated IIInonirrigated	90	moderate	Poor for homesites
Watsonville loam	2 - 15%	IV	36	slight to moderate	
Tierra-Watsonville complex	15-30%	VI	14	high	
Clear Lake clay	0 - 2 %	II irrigated III non-irrigated	43	slight	high shrink-swell, low strength
Elder sandy loan	0 - 2%	I irrigated II non-irrigated	90	slight	
San Emidgio Variant sandy loam*	0 - 2%	I irrigated III non-irrigated	90	slight	
Fluvaquentic Haploxeroll-Aquic Xerofluvent complex	0 to 15%	III	30 - 69	slight	
Baywood Variant loamy sand	0 - 2%	III	51	slight	
Baywood loamy sand	0 - 2%	III	72	slight, subject to blowing	

SOURCE: *Soil Conservation Service, Soil Survey of Santa Cruz County, California 1980

Regulatory Framework

Please refer to Section 3.2 for information regarding the regulatory framework associated with this alternative.

5.D.2.2 SIGNIFICANCE CRITERIA

Please see **Section 4.A.2.2** for discussion of Significance Criteria.

5.D.2.3 IMPACTS AND MITIGATION MEASURES

Impact 5.D.2-1: Seismic groundshaking and its secondary effects including localized liquefaction and related ground failure, from a major earthquake in the in Santa Cruz County or the Monterey Bay region, could cause structural damage to the proposed ASR pipelines, diversion facilities, injection/extraction pumps other related conveyance equipment. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Ground shaking is an unavoidable hazard for facilities in the San Francisco Bay and Monterey Bay region. Please refer to **Impact 5.A.2-1** for further discussion of this impact and its effects on the pipeline, facilities, and equipment associated with the proposed ASR project component.

Measure 5.D.2-1: Implement Measure 5.A.2-1.

Impact 5.D.2-2: Proposed ASR pipeline, injection/extraction wells and associated facilities could incur damage as a result of underlying soil properties (subsidence, high shrink-swell potential, and corrosivity). Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Each soil type in the proposed ASR project area possesses characteristics that could limit development of building structures or other facilities. These limitations include the shrink-swell capability (expansive behavior) and corrosivity. One or more of these soil properties could impact portions of the proposed project. Please refer to **Impact 5.A.2-2** for further discussion of the potentially adverse effects of the underlying soil properties on the proposed ASR project elements.

Measure 5.D.2-2: Implement Measure 5.A.2-2.

Impact 5.C.2-3: Construction of the proposed ASR pipeline, injection/extraction well system, and associated equipment could result in accelerated erosion and attendant loss of soil resources and effects on sediment discharges in water courses. The impact would be significant on slopes over 2 percent and in areas with soils having moderate or greater erosion hazard. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Please refer to **Impact 5.A.2-3** for further discussion of this impact and its effects on the proposed ASR project component.

Measure 5.D.2-2: Implement Measure 5.A.2-3a through 5.C.2-3f.

REFERENCES – Geology, Soils and Seismicity

Bolt, B.. Earthquakes. W.H. Freeman Company: New York, New York, 1988.

Brabb, E.E., *Geologic Map of Santa Cruz County, California.* U.S. Geological Survey, Miscellaneous Investigative Series, Map I-1905, 1:62,500, 1989.

California Building Standards Commission, *California Building Code, Title 24, Part 2*, 1995.

Dupre, W.R., J.C. Tinsley, Maps Showing Geology and Liquifaction Potential of Northern Monterey and Southern Santa Cruz Counties, California. U.S. Department of the Interior, U.S. Geological Survey. Map MF-1199, 1980.

Hart, E. W., *Fault-Rupture Hazard Zones in California: Alquist-Priolo Special Studies Zones Act of 1972 with Index to Special Studies Zones Maps,* California Division of Mines and Geology, Special Publication 42, 1990, revised and updated 1997.

International Conference of Building Officials, *Uniform Building Code, ICBO, Whittier, California*, 1994.

McCrory, P.A., Greene, H.G., and K.R. Lajoie, *Map showing earthquake Intensity Zonation and Distribution of Quaternary Deposits, San Mateo, Santa Cruz, and Monterey Counties, California*, U.S. Geological Survey Miscellaneous Field Studies, Map MF-903, scale 1:250,000, 1977.

U.S. Department of Agriculture, Soil Conservation Service, *Soil Survey of Santa Cruz County, California*, 1980.

5.D.3 HYDROLOGY AND WATER QUALITY

5.D.3.1 SETTING

Please refer to Section 3.3 for a description of regional hydrology, water quality, and regulatory setting.

The Aquifer Storage and Recovery (ASR) project, as discussed in Section 2.4.5, would inject surface water into the groundwater aquifer during winter months and then extract that water during the summer agricultural season. Surface water supply sources would include Harkins and Watsonville sloughs, Corralitos Creek, Pinto Lake, and Expanded College Lake.

Hydrologic Features

ASR Pipeline Corridor

The ASR pipeline terminates at the existing Harkins Slough facilities. Harkins Slough originates north of the City of Watsonville and flows south to its confluence with Watsonville Slough, draining Larkins Valley and Gallighan Slough. Harkins Slough is partially channelized and is considered ephemeral (RMC, 2001).[1]

The pipeline alignment crosses Harkins Slough at the Watsonville confluence and ascends the upland area to the north. The pipeline route roughly parallels Corralitos Creek between Freedom Boulevard and Green Valley Road. Corralitos Creek flows in a southeast direction and drains into Salsipuedes Creek below College Lake, which eventually drains into the Pajaro River. The northern terminus of the ASR pipeline is the College Lake pump station and filter plant. College Lake is a seasonal water body in a natural depression formed by inflow from a 11,000-acre watershed drained by Green Valley, Casserly, Salsipuedes, and Hughes creeks.

Injection/Extraction Wells

The well field boundary is 100 to 200 feet wide on either side of the proposed pipeline and parallels the pipeline for its entire route between the Harkins Slough facilities and College Lake. Specific locations of the injection/extraction wells would be determined based on specific hydrogeologic investigations, but would be located within the well field boundary at least 2,000 feet apart. Between Freedom Boulevard and Lake Road, the well field boundary includes sections of Corralitos Creek and the southernmost end of College Lake.

Harkins Slough/Watsonville Slough Diversions

The Watsonville Slough diversion and pumping facilities would be adjacent to the confluence point of Watsonville Slough and Harkins Slough.

[1] Ephemeral streams flow briefly, only in response to precipitation. The channel of an ephemeral stream is above the water table.

Flood Zones

The Federal Emergency Management Agency (FEMA) flood insurance maps identify the location of the 100-year floodplain areas in the proposed project area. These areas are susceptible to inundation during a 100-year flood[2] and include Harkins Slough, Watsonville Slough, and Corralitos Creek. The pipeline would cross Harkins Slough at its confluence with Watsonville Slough, where the mapped floodplain is 2,000 feet wide, extending from the Southern Pacific Railroad to the upland terraced area to the north. Flooding in Harkins Slough has historically inundated railroad tracks and roads during the winter, and the Santa Cruz County Public Works Department operates flood control at the confluence of Watsonville Slough and Harkins Slough (RMC, 2001). Pumps at Harkins Slough convey water over a barrier wall into Watsonville Slough, which prevents backflow into Harkins Slough to reduce flood impacts.

The 100-year floodplain for Corralitos Creek between Green Valley Road and Freedom Boulevard ranges from 200 to 300 feet wide. The 500-year floodplain includes the intersection of Holohan Road and Green Valley Road.

The well field boundary enters areas of both 100-year and 500-year flood hazard zones mapped for Harkins Slough and along Corralitos Creek. The eastern side of the well field boundary from the Watsonville facilities to Harkins Slough Road is almost entirely within the 100-year flood zone.

The Watsonville Slough diversion and pumping facilities are proposed to be located in areas outside the 100-year and 500-year flood zones.

Surface Water Quality

Table 5.D.3-1 presents water quality data for the surface water features associated with the ASR component. Pinto Lake water quality data, with the exception of total dissolved solids (TDS), were not available. Based on the parameters listed below, the water quality of College Lake, Harkins Slough, and Watsonville Slough appear relatively similar, with the exception of Corralitos Creek. The average TDS concentration in Corralitos Creek is similar to the other water features, but the average conductivity is comparatively elevated. Chloride, turbidity, and total suspended solids (TSS) are lower in Corralitos Creek than in the other hydrologic features. *Phytophthora* is present at College Lake, Harkins and Watsonville sloughs, and Corralitos Creek, and boron is present at detectable concentrations in the two sloughs. Poor water quality can affect the operational success of the injection system. The injectate (injected water) must not only have acceptable water chemistry to be permitted for injection under state and federal water quality standards, but also to allow successful injection with minimal operational problems. Water quality parameters that can hinder the performance of a water injection program include turbidity (suspended solids) and the presence of some metals. In certain instances, the difference

[2] The 100-year flood is referred to as the peak flows that have a 1 percent chance of being equaled or exceeded in any given year. If a 100-year flood event occurs, the following year still has the same probability of a 100-year event.

TABLE 5.D.3-1
WATER QUALITY SUMMARY
SURFACE WATER SUPPLY FEATURES

Parameter	College Lake	Harkins Slough	Corralitos Creek	Watsonville Slough	Pinto Lake
Conductivity (avg.) µmhos/cm (expected)	0.52	0.39	415	0.56	--
Total Dissolved Solids (expected)	343 mg/L	250 mg/L	322 mg/L	380 mg/L	250 mg/L
Phytophthora	Present	Present	Present	Present	--
Chloride (expected)	28.6 mg/L	25 mg/L	9.1mg/L	32 mg/L	--
pH	6.7 – 8.5	7.2-7.9	7.9 – 8.2	7.2 – 8.9	--
Boron (maximum)	ND	0.13 mg/L	ND	0.45 mg/L	--
Dissolved Oxygen (minimum)	ND	ND	ND	ND	--
Nitrate (maximum)	19.1 mg-N/L	<0.5 mg-N/L	<1 mg-N/L	1.3 mg-N/L	--
Turbidity (expected)	344 NTU	150 NTU	2 NTU	70 NTU	--
Total Suspended Solids (average)	60.9 mg/L	55 mg/L	9.8 mg/L	70 mg/L	--

µmhos/cm – micromhos per centimeter
mg/L – milligrams per liter
mg-N/L – milligrams of nitrogen per liter
NTU – nephelometric turbidity units
-- – Data Not Available
SOURCE: *Revised Basin Management Plan*, RMC, 2001

in water chemistry, temperature, and dissolved oxygen content between the injectate and the groundwater can create precipitates and/or gases that can plug the interface between the aquifer and the injection well (Feeney, 2001).

Groundwater

Please refer to Section 3.3 for a discussion of regional groundwater conditions.

Groundwater occurs beneath the pipeline corridor and injection/extraction well field (described in Section 2.4.5) in the uppermost, unconfined aquifer and in areas where the overlying confining layer is present within the confined alluvial aquifer. The Upper and Lower Aromas Formations,

separated from the alluvial aquifers by a confining layer, underlie the alluvial aquifers and represent the primary productive aquifer in this region. The Aromas Formations range in depth to about 700 feet below sea level, and the Lower Aromas extends to approximately 900 feet below sea level.

Groundwater Quality

Please refer to Section 3.3 for a discussion of regional groundwater quality. The three parameters of concern for water quality are chloride, electrical conductivity, and nitrates.

- *Chloride*. As discussed in Section 3.3, high-quality drinking water typically has chloride levels less than 50 mg/L, and drinking water becomes less palatable when chlorides range from 50 to 250 mg/L (DWR in Jones and Stokes, 2000). At concentrations exceeding 250 mg/L chloride, water generally requires treatment.[3] The proposed ASR injection/ extraction area is outside the area affected by seawater. Groundwater testing data collected in 1998 from the alluvial and Aromas Formation aquifers indicate that groundwater in the area between the Harkins Slough facilities and College Lake range between 1 and 100 milligrams per liter (mg/L) chloride (Jones and Stokes, 2000). Groundwater in areas affected by seawater intrusion can range from 50 to 15,000 mg/L.

- *Electrical Conductivity (EC)*. EC is directly related to total concentration of charged ions and can be a good indicator of TDS. Groundwater intended for beneficial uses, including agriculture, industry, or municipal drinking water, can be adversely affected by water with elevated conductivity. EC levels in the groundwater aquifers underlying the ASR project area are generally below 750 micromhos/centimeter (Jones and Stokes, 2000). The state secondary drinking water standard for EC is 900 micromhos/centimeter. The state secondary drinking water standard for TDS is 500 mg/L, which is approximately 830 micromhos/centimeter (DWR in Jones and Stokes, 2000).

- *Nitrate*. The state and federal primary drinking water standard for nitrates in groundwater is 10 mg/L NO_3. Nitrate concentrations in the groundwater aquifer beneath the ASR project range from 0.1 to 10 mg/L.

5.D.3.2 SIGNIFICANCE CRITERIA

Please refer to Section 4.A.3 for a discussion of significance criteria.

Plans and Policies

Federal

As a component to the Safe Drinking Water Act, the U.S. Environmental Protection Agency (EPA) Underground Injection Control (UIC) program regulates underground injection of water supplies. Underground injection is prohibited under the UIC unless authorized by rule or permit. Until further regulations become applicable, injection wells are currently authorized by rule. This rule exempts injection wells from permitting procedures, although the EPA may require a

[3] The secondary drinking water standard for chloride is 250 mg/L.

permit on a case-by-case basis. However, all owners of injection wells authorized by rule must submit inventory information to the EPA (Fugro West, 1995).

State of California

The State Water Resources Control Board (SWRCB) has far-reaching authority over discharges to waters of the state and has regulatory authority over water injection. The SWRCB requires that native groundwater not be degraded and that injected water meet both primary and secondary Title 22 standards. California's "Antidegradation Policy" for state waters prohibits degradation of state waters. The Regional Water Quality Control Board (RWQCB), in this case the Central Coast Region, oversees the policy of nondegradation, but does not have permit authority over injection/extraction activities. The RWQCB would, however, review proposed injection/extraction projects to ensure groundwater quality standards are met. The RWQCB requires that water intended for injection meet Title 22 standards, which include the provisions of the Surface Water Treatment Rule. These provisions require that conventional water treatment or filtration systems be used to remove particulates and destroy pathogenic bacteria and viruses (Feeney, 2001). Regulation of drinking water quality, hazardous waste, and use of reclaimed water is the responsibility of the California Department of Health Services (DHS). The DHS may advise the RWQCBs on discharge requirements (Fugro West, 1995).

County of Santa Cruz

All of the proposed facilities for the ASR project component are within Santa Cruz County. The County has the following policies and objectives relevant to the project:

> **Policy 5.6.3:** Ensure the development of new major water supply projects are adequately conditioned to protect beneficial instream uses and riparian habitat.
>
> **Policy 5.8.6:** Require new and rehabilitated wells to comply with state and local construction standards as specified in the County well ordinance to prevent contamination of groundwater supplies.
>
> **Policy 5.8.7:** Designate the area west of San Andreas Road from the Pajaro River to Manresa State Beach as the Pajaro groundwater protection zone. Apply special testing and construction standards to identify strata containing poor quality water and to prevent the movement of such water into other aquifers.
>
> **Policy 5.7.3:** For all new and existing development and land disturbances, require the installation and maintenance of sediment basins, and/or other strict erosion control measures, as needed to prevent siltation of streams and coastal lagoons.
>
> **Objective 5.8a:** To protect the quantity and quality of the County's groundwater resources through an integrated program of land use regulation and runoff management in groundwater recharge areas, careful water quality monitoring and management of extractions consistent with long-term sustainable water supply yields.
>
> **Objective 5.8b:** To act directly and coordinate and work with relevant water purveyors and agencies to eliminate long-term groundwater overdraft in all water basins where overdraft has been documented.

5.D.3.3 IMPACTS AND MITIGATION MEASURES

Impact 5.D.3-1: Implementation of the water supply projects and demand management plan included in the Local-Only Alternative would result in a reduction of groundwater withdrawal and would increase groundwater levels, reversing conditions of groundwater overdraft and thereby significantly reducing or eliminating the rate of seawater intrusion. Demand management elements of this alternative depend on the fallowing of agricultural land. Without land fallowing, the objectives of the Local-Only Alternative could not be achieved and conditions of overdraft would continue, allowing seawater intrusion to advance inland. Significant. With mitigation, this impact would be reduced to a less-than-significant level.

Initial groundwater evaluation of the Local-Only Alternative employed the Pajaro Valley Integrated Groundwater Surface Water Model (PVIGSM) model and used a predictive long-term scenario that assumed implementation of local water supply projects and demand management measures that produce an average annual yield of 14,400 afy. As discussed in Section 4.B.3.3, the PVIGSM model provides data to evaluate the surface water and groundwater impacts resulting from the project, in combination with other existing and proposed actions that affect these water resources through the life of project. The initial model scenario assumed the proposed water supply projects and management demand measures, with the exception of land fallowing. Isolation of the land fallowing measure from the model scenario provided analysis of whether fallowing agricultural land was necessary and, if it was, to what extent it would be required to achieve the objectives of the alternative. PVIGSM model results for the initial scenario indicated that an annual yield of 14,400 afy would not allow the basin to equilibrate, nor would it allow groundwater levels to increase while providing a sufficient supply. Rather, this modeling scenario predicted that, without land fallowing, the basin would be brought to a state of imbalance (i.e., demand on the aquifer would not allow for an adequate sustainable yield). Under this scenario, seawater intrusion would still occur due to insufficient water supply, reduced infiltration of surface water, and the consequential impacts to surface water supplies.

A second PVIGSM model scenario was constructed that assumed the required level of land fallowing necessary to meet the objectives of the alternative. Modeling indicated that to reach an equilibrium within the groundwater basin, the Local-Only Alternative would require the equivalent of 2,200 acres of basinwide agricultural land fallowing (or approximately 1,000 acres of coastal area agricultural land fallowing) in addition to the assumed 14 percent conservation within the PVWMA area. According to the PVIGSM basin model, land fallowing reduces the overall basin water demand by approximately 3,000 afy. In conjunction with the increase in sustainable yield due to the local water supply projects and groundwater management, it appears that the addition of land fallowing achieves the objective of the Local-Only Alternative.

Over the long term, as groundwater demand increases with groundwater withdrawal, initial fallowed acreage may not be adequate to maintain the hydrologic balance within the basin. As future demand increases, the conditions of overdraft, lower groundwater levels, and seawater intrusion would reoccur, and fallowing of additional acreage would likely be necessary to maintain equilibrium in the basin's groundwater system.

Measure 5.D.3-1: PVWMA will implement a program to fallow cultivatable farm lands, as needed, to reduce the demand on groundwater to levels sufficient to achieve a water supply-and-demand balance under the Local-Only Alternative.

As a management measure, fallowing involves the acquisition or leasing of agricultural land and taking it out of production for a required period of time. Acquiring or leasing the land parcels would eliminate groundwater withdrawal from that parcel. Groundwater modeling indicates that the most effective area on which to impose land fallowing would be along the coastal area, where the reduction of groundwater withdrawal for agriculture would allow groundwater levels to recover. As demand increases, land fallowing requirements would likely increase to maintain a hydrologic balance within the basin.

As a result of this mitigation, an increase in groundwater levels would form a hydraulic groundwater barrier that would reduce or eliminate groundwater intrusion. Land fallowing under the Local-Only Alternative, as a measure to reduce groundwater withdrawal and place the basin in supply/demand equilibrium, would reduce this impact to less than significant.

Impact 5.D.3-2: The ASR injection/extraction well sites would create impermeable surfaces and reduce long-term infiltration at the well pads. Reduction in infiltration could reduce natural groundwater recharge of precipitation. Because the total surface area occupied by the well pads is relatively minor compared to the available infiltration area, this impact is considered less than significant.

The ASR project would require the construction of 30 injection/extraction wells; each would occupy an approximately 40-foot by 50-foot area (2,000 square feet). A portion of the area would contain covered pump equipment mounted on concrete pads. These features could decrease permeable surface area available for infiltration of precipitation, thereby potentially increasing localized runoff to the ground surface adjacent to the monitoring well pads and locally reducing the natural recharge to the groundwater aquifers. Assuming the 30 injection/extraction wells each occupy a 2,000-square-foot concrete pad (or other impermeable material), the total increase in impermeable surface would be approximately 1.4 acres. These wells would not be clustered in a single area, but spaced at regular intervals along the seven-mile ASR pipeline. Although the available infiltration area would be reduced by 1.4 acres, the impermeable surfaces would be distributed over a large area; therefore, the well pads would not be expected to alter long-term or short-term infiltration rates and groundwater levels.

Mitigation: None required.

Impact 5.D.3-3: Groundwater pumped from the injection/extraction wells during well development, initial well operation, and backwashing could generate substantial discharge volumes that could be released to Harkins Slough, Watsonville Slough, or Corralitos Creek. These discharges could contain a significant sediment load, high salts, or high electrical conductivity that could adversely affect the receiving surface waters. Prior to such discharges, PVWMA would be required to obtain a National Pollution Discharge Elimination System (NPDES) permit that requires compliance with water quality parameters established by the RWCB. Significant. With mitigation identified in this EIR, the impact associated with potential water quality impacts of surface discharge would be reduced to a less-than-significant level.

Injection/extraction wells require ongoing maintenance to remove excess sediment and well construction materials, clear the well casing screens, and to initiate flow through the sand and gravel filter packs that surround the well casing. Typically, several well volumes (amount of standing water in well) are pumped until the discharge is relatively free of sediment. Prior to conveying water from an extraction well into the pipelines, the initial flows are diverted to the ground surface to ensure that low sediment levels are entering the pipelines. Well development and standard maintence backwashing can generate well discharges that typically are diverted to the ground surface.[4] Water generated during the development, initial pumping, and backwashing can contain high sediment, high TDS, and elevated electrical conductivity and can vary in temperature. Discharge of this water can adversely affect the quality of the receiving surface water by altering its chemistry, adding sediment, or increasing TDS. Although the groundwater quality underlying the proposed ASR project is generally good, discharges from the injection/extraction well development and maintenance could contain high sediment levels and require sediment removal prior to surface discharge.

> **Measure 5.D.3-3:** All groundwater discharges associated with injection/extraction well development, initial pumping, and backwashing as well as long-term operational maintenance shall be conducted in accordance with NPDES permit issued through the RWQCB to ensure that degradation of surface water does not occur.

The PVWMA would be required to obtain the necessary NPDES permit from the RWQCB before any one of the aformentioned discharges could occur. The NPDES permit would establish specific parameters for discharge quantity and quality and would require regular monitoring through a Reporting and Monitoring Program implemented as part of the permit. Parameters set forth by the NPDES permit would ensure that proper sediment levels are achieve and maintained.

---

[4] Backwashing is the surging effect or reversal of water in a well. The backwashing procedure removes fine-grained material from the formation surrounding the borehole and, thus, can enhance well yield.

Impact 5.D.3-4: Poor quality water from a surface water source could enter the groundwater through injection (injectate) and adversely affect groundwater quality. Water quality constituents, such as precipitated salts or high TDS, could plug injection wells and adversely impact their performance, resulting in inefficient injection and extensive maintainence. Significant. With mitigation identified in this EIR, impacts associated with introduction of contaminants to the groundwater and subsequent degradation of groundwater sources could be reduced to a less-than-significant level.

Water quality degradation of potable groundwater supplies is a concern, considering that the injected water will consist of a blend of different surface water sources (RMC, 2001). The quality of surface water injected into the ASR well field would be a function of the surface water supply sources. Surface water could contain contaminants that, if injected, could adversely affect otherwise good-quality groundwater. Depending on the source of the injected surface water, degradation of groundwater from nitrates, salinity, or TDS could occur.

The PVWMA has collected water quality data at College Lake since 1994 in a testing program that includes analysis for general mineral constituents, inorganic metals, turbidity, nitrate ion, bacteria, biological oxygen demand, and pesticides/herbicides. Generally, the water at College Lake is of good quality, but contains several constituents of concern when considering groundwater injection. Particularly, College Lake water contains elevated turbidity, which can clog the well and reduce its performance. The turbidity of College Lake water ranges from 8 NTU to 1,440 NTU, and 344 NTU is expected on average (see **Table 2.3**).[5] The turbidity level required by the Surface Water Treatment Rule is less than 0.2 NTU, and, comparatively, an injection well can experience operational problems when turbidity is greater than 2 NTU (Feeney, 2001). Several dissolved constituents that exceed the drinking water standards and require treatment include nitrate, arsenic, aluminum ion concentrations, iron, and manganese ion concentrations. In addition, the fungus *Phytophthora*, which has been detected in the surface water sources, could enter the groundwater system via injection.

Groundwater degradation by injection of low-quality surface water would occur over the long-term, with the effects likely not evident for several years. Even though (a) the injected water would have limited vertical and horizontal movement within the aquifer zone, and (b) the injected water would be recovered during the summer irrigation season, it is not guaranteed that extraction would thoroughly remove previously injected low-quality water from the aquifer formations. The extracted water would be used for agricultural purposes; therefore, there is a potential that groundwater contaminants, including *Phytophthora*, high TDS water, and additional nitrate, would be applied to agricultural fields, adversely altering soil chemistry (with the introduction of *Phytophthora*) and permeability (with the addition of salts from high TDS).

> **Measure 5.D.3-4a:** The PVWMA will operate the proposed project in compliance with the Surface Water Treatment Rule, Safe Drinking Water Act, where applicable, the SWRCB's Antidegradation Policy, and applicable DHS regulations regarding drinking water quality. Water injected into the groundwater aquifers from surface sources would be required to comply with federal and state water quality standards for drinking water and

[5] A nephelometric turbidity unit (NTU) is a measure of the light that passes through a water sample.

those set forth by SWRCB's Antidegradation Policy. The RWQCB has regulatory authority over injection and will require that groundwater degradation not occur and that injectate water meet both primary and secondary Title 22 standards. Federal and state drinking water standards, developed by EPA and DHS, dictate acceptable concentrations for many constituents, including fecal coliform, heavy metals, TDS, and nitrates.

Measure 5.D.3-4b: The PVWMA will prepare and implement a treatment and monitoring program to ensure that surface water intended for injection is monitored and adequately treated so that applicable federal and state drinking water standards are not exceeded. Proposed injectate will require treatment to meet Surface Water Treatment Rule provisions and to remove, among other potential constituents, nitrate, iron, manganese, and potentially aluminum and arsenic. Treatment of the water to meet regulatory requirements could require multiple treatment technologies. Given the variable and sometimes high levels of turbidity in the College Lake injectate, compliance with the Surface Water Treatment Rule could require conventional treatment, consisting of coagulation, flocculation, sedimentation, filtration, and disinfection. Removal of dissolved constituents, including metals that exceed primary and secondary Title 22 standards, will require additional treatment technologies, such as reverse osmosis and ion exchange. The PVWMA will prepare and implement a plan that addresses regular monitoring of surface water sources and defines adequate treatment methods to reduce concentrations of contaminant, if present, to levels below the federal and state drinking water standards.

Implementation of advanced treatment of injectate would require design and construction of additional treatment facilities, potentially creating new environmental impacts, or making impacts disclosed in this EIR substantially more adverse. Additional environmental review pursuant to CEQA could be required.

Impact 5.D.3-5: Groundwater injection/extraction can adversely affect groundwater levels, overlying geologic structures, groundwater flow regimes, and adjacent groundwater aquifers. Changes to the geologic and hydrogeologic conditions underlying the project area could permenantly alter the regional or local groundwater availability, recharge, and accessibility. Significant. With mitigation identified in this EIR, this impact would be reduced to a less-than-significant level.

When water is injected under pressure into a aquifer, hyrogeologic effects such as "groundwater mounding" can occur as the underlying aquifer accommodates the additional water. Injection causes the localized mounding that allows for extraction of the additional groundwater from the same well when needed. Depending on the underlying geology, the mounding can increase groundwater elevations, reduce pumping lifts, and alter the lateral and verical underflow of groundwater by locally altering the groundwater flow gradients. Altered groundwater flow regimes attributable to mounding can reduce groundwater supply to users located within the injection/extraction area of influence. Increased groundwater levels due to mounding can also result in increased groundwater discharges to surface creeks.

Injection/extraction can reduce the water quality in an overlying, underlying, or adjacent aquifer by changing the migration pattern of low-quality groundwater and altering the vertical groundwater gradients. For example, head reduction due to extraction of groundwater could increase a vertical downward flow gradient, causing lower-quality groundwater to enter and degrade an underlying confined aquifer.

Pressures generated during injection can cause "hydrofracturing" of confining or water-bearing strata adjacent to the subject aquifer. Hydrofracturing could lead to loss of water from the confined aquifer and potential formation of springs and seeps at the surface. The pressures that cause hydrofracturing must exceed the overburden pressure at the depth of the affected aquitard unit (Fugro West, 1995). High levels of groundwater mounding resulting from injection of water are likely to cause hydrofracturing. At considerable depth, hydrofracturing may not cause noticeable surface effects; however, hydrofracturing becomes a concern when strata close to the surface are fractured, causing changes in the conductivity of shallow aquifers, surface seepage with possible flooding, and water to enter subterranean structures such as basements.

A preliminary assessment for ASR with a concentrated well field near College Lake indicated unacceptable levels of mounding and drawdown, leading project engineers to propose a well field along the ASR pipeline. A preliminary layout was developed for an ASR well field at College Lake to estimate mounding and drawdown effects, with the average depth to groundwater in the area assumed at 60 feet below the ground surface (bgs). The results of the modeling evaluation showed unacceptable levels of mounding and drawdown and the possibility that water cascading in the aquifer could cause adverse operating conditions. That ASR project was deemed not feasible under the current well field layout and operation plan.

To address the problems found with the above-described injection/extraction field, the injection/ extraction wells would be located along the pipeline alignment from the sloughs to College Lake. The new layout would likely eliminate the mounding and drawdown effects from well interference. The proposed layout would increase the area influenced by injection/extraction activities.

> **Measure 5.D.3-5:** PVWMA will complete a hydrogeologic feasibility study and testing for the proposed injection/extraction well field prior to design. PVWMA will develop a groundwater monitoring plan to monitor the groundwater elevations in the vicinity of the injection/extraction wells. The program will include procedures to adjust, if necessary, the injection/extraction rates to avoid adverse aquifer response such as mounding or drawdown.

As with other programs implemented by the PVWMA to extract groundwater, technical feasibility studies would be conducted prior to program implementation to address concerns such as groundwater well location, water conveyance, well spacing, and pumping rates. For instance, groundwater extraction from multiple wells would not be concentrated in a particular area if studies indicated that the resulting drawdown would lower groundwater levels below the minimum required pumping levels. Appropriate well siting would avoid placement of groundwater injection wells in concentrated areas, thus limiting drawdown that would decrease

local groundwater levels. Similarly, groundwater injection tests would be conducted to assess appropriate injection pressures, extent of mounding, and potential for hydrofracturing.

Impact 5.D.3-6: Construction activities at the proposed Watsonville facilities and along the proposed pipeline could increase soil erosion and may transport other contaminants to downstream receiving waters. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Construction at the project sites would involve soil-disturbing activities such as vegetation removal, grading, and excavation, exposing soils to erosion and potentially resulting in the transportation of sediment downstream and subsequent deposition. Pipeline construction would require excavation of trenches and temporary stockpiling of soils. Construction at the filtration facility and pump station sites would involve basic earthwork activities to level the site and to prepare building foundations. Wind and rainfall could cause erosion of stockpiles and sedimentation downstream. Although the amount of erosion at the project site is projected to be low due to the flat topography, the sediment and adhered substances are sources of pollution in receiving waters. Sediment from erosion would increase turbidity, which could adversely affect fish and wildlife habitat, reduce the efficiency and life of pumps and pipelines conveying water for the project, increase costs for treating water for various uses, increase flood hazards from reduced channel capacities, and impair recreation and aesthetic values. Fuels, solvents, and/or other chemicals used in construction activities could be spilled, dumped, or discarded and ultimately seep or leak into waterways draining the project site.

The proposed pipeline crosses Corralitos Creek shortly after crossing Freedom Boulevard. Pipeline installation would require primarily open-trench construction techniques. Potential impacts associated with open-trench construction techniques could include sedimentation of the channels outside of the construction area during trenching activities, with subsequent downstream water quality impacts such as increased turbidity and sediment deposition (refer to Impact Statement 4.A.3-1 for additional discussion of pipeline construction and permitting).

> **Measure 5.D.3-6:** PVWMA shall employ standard construction-related water quality management practices to reduce and eliminate excessive erosion, sediment-laden groundwater dewatering discharges, and contaminated runoff during the short-term construction activities. The agency shall prepare a Storm Water Pollution Prevention Plan as part of the construction activities NPDES stormwater permit required by the RWQCB.
>
> **Measure 5.D.3-6:** Please refer to Measures 4.A.3-1 and 4.A.3-2 regarding pipeline construction within potentially jurisdictional wetlands/waters of the U.S.

Impact 5.D.3-7: Construction activities associated with the conveyance pipelines included in this Alternative could potentially compromise the structural integrity or water quality of active agricultural, production, or domestic wells located within proposed pipeline alignments. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Excavation, soil stockpiling activities, or construction equipment associated with pipeline construction may damage production, agricultural or domestic supply well structures, especially sanitary seals of wells or disturb well mounts, pump equipment, piping systems or enclosures. Certain damage that would expose the well casing could lead to the introduction of contaminants such as sediments or chemicals into the groundwater. Damage to the well system, pump equipment, piping or enclosures could temporarily stop proper well operation and interrupt water delivery.

> **Measure 5.D.3-7a:** Implement measures to ensure that construction activities do not damage existing wells. Wells shall be capped in an appropriate manner to prevent soil and other contaminants from entering groundwater aquifers.
>
> **Measure 5.D.3-7b:** PVWMA or its contractor shall correct any damage to wells and/or reimburse well owners for any loss of use of the well during construction.

REFERENCES – Hydrology and Water Quality

CH2M Hill, *Aquifer Storage and Recovrey Well Field near College Lake*. December 2000.

Environmental Science Associates, Inc., *Pajaro Valley Water Management Agency Local Water Supply and Distribution, Environmental Impact Report*, May 7, 1999.

FEMA Flood Hazard Map website http://www.esri.com/hazards.

Feeney, M. Letter to Ms. Mary Bannister at the PVMWA regarding *PVMWA Supplemental Wells/Injection Wells Water Quality Study – College Lake Injection Source Water Assessment/Treatment – Preliminary Findings.* 2001.

Fugro West. *Final Program Environmental Impact Report for the Las Posas Basin Aquifer Storage and Recovery Project*, SCH: 94091028, prepared for Calleguas Municipal Water District, April 1995.

Jones and Stokes, *Pajaro Valley Water Management Agency State of the Basin Report*. 17 December 17, 2000.

King, Kenneth B., P.E., *Evaluation of College Lake and Bolsa de San Cayetano Projects*, prepared for Raines, Melton, and Carella, Inc., January 2000.

Raines, Melton, and Carella, Inc. (RMC), *Revised Basin Management Plan for PVWMA*, Internal Draft, July 2001.

5.D.4 VEGETATION, FISH, AND WILDLIFE

5.D.4.1 SETTING

Please refer to Section 3.4 for a description of methods used during investigation of the project area for biological resources.

Section 2.4.5 describes the Aquifer Storage and Recovery (ASR) project, which includes a dual pipeline between College Lake and the Harkins Slough Pump Station, injection/extraction wells, a pump station and diversion structure on the north bank of Watsonville Slough just west (downstream) of Harkins Slough, and expansion of the existing Harkins Slough filtration plant (see **Figure 2.8** in Chapter 2).

Vegetation

Since the pipeline would traverse primarily agricultural lands there is little native vegetation remaining along the alignment. No intact natural communities occur in the project area, and the probability of occurrence for special status plant species is low in most areas. There are, however, two areas of concern along the alignment: the Watsonville Airport and the alignment crossing of the Corralitos Creek riparian corridor.

- *Watsonville Airport Property*. One of the largest remaining populations of Santa Cruz tarplant (*Holocarpha macradenia*), a species that has been proposed for listing as federally threatened and is currently listed by the State as endangered, occurs on the Watsonville Airport property and likely occurs on the private property to the west of the airport as well. Section 5.C.4 describes the Corralitos Creek riparian corridor.

- *Corralitos Creek Crossing*. Sections 3.4 and 5.C.4 describe fisheries resources in Corralitos Creek. Tide gates and a pump station located on Watsonville Slough at Shell Road (downstream of the proposed project site) exclude any special status fish species, such as steelhead and tidewater gobies, from the vicinity of the project site. The lower portion of Watsonville Slough below the tide gates may support the federal endangered tidewater goby (proposed for delisting, see Section 3.4) (Habitat Restoration Group, 1997).

Wildlife Habitat

With the exception of the pipeline crossing of Corralitos Creek, all areas along the alignment have very low wildlife habitat value. Wildlife habitat in the area of the proposed Corralitos Creek crossing consists of a dense riparian area. On the north side of the creek is an extensive area of agricultural fields, with some weedy patches of willows adjacent to the riparian area. Habitat on the south side of the crossing area includes both a developed area to the southwest and agricultural land to the southeast. The agricultural land from Harkins Slough to just west of Watsonville Airport has very low value as wildlife habitat. From the intersection with Buena Vista Drive to the proposed dam at College Lake, the alignment runs through urban areas, following Buena Vista Drive, then returns to agricultural fields from the north side of Corralitos to College Lake.

Harkins Slough/Watsonville Slough Facilities

Vegetation

Harkins Slough is a channelized waterway beginning in an area of small residential properties, then flowing through agricultural land to its confluence with Watsonville Slough. The floodplain of Harkins Slough is largely in agriculture, although there are annual grasslands and stands of coast live oak on its steep sideslopes; the site of the recently-constructed Harkins Slough Filtration Facility is just west of the confluence of the two sloughs. Harkins Slough does not sustain perennial flow.

Watsonville Slough is also channelized. East of San Andreas Road it is narrow and has only weedy annual vegetation growing on its levees. West of San Andreas Road, however, the levees encompass a floodplain up to 200 feet wide. Watsonville Slough supports Fresh Emergent Wetland habitat which contains willows, cattails and other emergent vegetation in the upper reaches, and in the lower portion is a more brackishwater example containing pickleweed, saltgrass, and alkali-heath (*Frankenia grandiflora*). At the Shell Road crossing, there are tide gates on Watsonville Slough. These limit the extent of the tidal influence upstream, although the vegetation is indicative that the tide gates admit some brackish water. From Shell Road, Watsonville Slough turns southward parallel to the coastline, and eventually empties into the Pajaro Lagoon.

No special status plants were observed in the project area; however, there are known localities for Santa Cruz tarplant on the grassy eastern sideslopes of Harkins Slough near Harkins Road, and for robust spineflower (*Chorizanthe robusta* var. *robusta*) in stabilized sand dunes west of Shell Road (CNDDB, 1997).

Wildlife

Potential suitable habitat for several special status wildlife species is present in the project area. The brackish water portions of Watsonville Slough within one-fourth mile east of Shell Road appear too saline to support habitat for red-legged frog, Santa Cruz Long-toed salamander and California tiger salamander, but the freshwater portions upstream may contain habitat for these species. The CNDDB reports a known record for the tiger salamander from the east branch of nearby Hanson Slough. A 1990 report on file with the CNDDB speculates that suitable habitat for red-legged frog may be present in Harkins and Watsonville sloughs as well (CNDDB, 1997). A site assessment carried out by Environmental Science Associates in 1999 (Environmental Science Associates, 1999a) noted that the lack of vegetative cover along Harkins Slough and Watsonville Slough resulted in low-quality habitat conditions for California red-legged frog, Santa Cruz long-toed salamander, California tiger salamander and western pond turtle.

There are no anadromous fishery resources reported from the Watsonville or Harkins sloughs. As noted in the regional setting, the federally endangered tidewater goby is found in the Pajaro Lagoon which receives water from the Watsonville Slough. Suitable habitat for tidewater goby

extends for some distance up Watsonville Slough, but detailed surveys have not been carried out to determine how far they range up the slough.

5.D.4.2 SIGNIFICANCE CRITERIA

Please refer to Section 4.A.4 for a description of the significance criteria used in analyzing potential project impacts related to biological resources.

5.D.4.3 IMPACTS AND MITIGATION MEASURES

Areas potentially affected by the construction of the pipeline consist primarily of agricultural and urban areas, both of which provide low quality wildlife habitat. Other than the known population of Santa Cruz tarplant, no special status species are expected to occur in the area, and no significant impacts to wildlife would be expected. However, the construction and operation of the proposed diversion facilities at Harkins Slough and Watsonville Slough facilities, as well as the pipeline crossings of Harkins Slough and Corralitos Creek, could adversely affect the habitat of sensitive species. Construction through the Watsonville Airport could adversely affect individuals and habitat of the Santa Cruz tarplant.

Impact 5.D.4-1: Construction of the proposed project could result in temporary impacts of up to 1.1 acres of potential jurisdictional wetlands/waters of the U.S. and streambeds and banks under the jurisdiction of the CDFG at Harkins Slough and Corralitos Creek. Potential impacts include sedimentation of the channels adjacent to the construction area during trenching activities, and temporary loss of wetland-associated vegetation, stream function as wildlife and fishery habitat, and loss of special status natural communities. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

This project would require additional filtration capacity at Harkins Slough, the construction of a new diversion facility at Watsonville Slough, and the construction of a dual pipeline to convey water between College Lake and the Harkins Slough facilities. A temporary disturbance corridor 70 feet in width is assumed.

Construction of the pumping facilities and pipeline would for the most part be located in Urban/Developed habitats and, consequently, would have insignificant impacts on biological resources. However, construction in and near Valley Foothill Riparian and Fresh Emergent Wetland habitat could result in erosion, sedimentation, and reduction in water quality that would adversely affect the biological resources that depend on these habitats.

Central coast riparian forest (Holland, 1986) is the natural community represented along Corralitos Creek. This community is listed as a sensitive habitat by the Natural Heritage Section of CDFG (see Section 3.4.2 of this EIR). Although the areas proposed for development are small and are part of already diminished riparian forests, additional loss of riparian forest is an adverse impact.

Measure 5.D.4-1a--Wetlands Avoidance: Wetlands and riparian habitat at the Corralitos Creek and Harkins Slough Crossings may be avoided entirely be using bore and jack construction methods. If complete avoidance is infeasible, implement Measures 4.A.4-1b and 4.A.4-1c.

This mitigation measure would avoid significant impacts to wetlands at Corralitos Creek and Harkins Slough.

Impact 5.D.4-2: Construction and operation of the proposed water diversion facility at Watsonville Slough would result in impacts to special status animal species dependent on wetland habitats. Impacts could occur due to increased sedimentation in waterways, dewatering of pools, habitat loss through changes in salinity in Lower Watsonville Slough, vegetation removal, destruction of nests and burrows and construction disturbance. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Collection of high stormwater flows from Watsonville Slough would have no impact on vegetation, wildlife and fishery resources upstream from this point, since the pattern of diversion would remain the same as at present. However, the existing pumping system diverts stormwater flows from Watsonville Slough at Shell Road and places it into Watsonville Slough below the tide gates. With implementation of the diversion from Watsonville Slough, there would be a loss of 1,100 acre-feet per year of freshwater input into Watsonville Slough within the tidal portion below Shell Road. According to a water budget analysis conducted for the Association of Monterey Bay Area Governments (AMBAG), approximately 7,510 acre-feet are pumped past the Shell Road pump station during an average year (Questa Engineering, 1995). Thus, the proposed combined diversion of 2,200 acre-feet per year (existing Harkins Slough diversion plus proposed Watsonville Slough diversion) constitutes approximately 30% of the freshwater input to the tidal portion of Watsonville Slough. This might potentially result in higher winter salinity concentrations in both lower Watsonville Slough and the Pajaro Lagoon.

Habitat for special status animals is present in the Fresh Emergent Wetland habitat in Watsonville Slough near San Andreas Road, and downstream in the Saline Emergent Wetland of lower Watsonville Slough. The riparian corridor of Corralitos Creek could provide nesting habitat for raptors, including the red-shouldered hawk, as well as habitat for the western pond turtle. The special status animal species with potential to occur in the area of potential impact include:

- Santa Cruz long-toed salamander (federal Endangered and California Endangered);
- California red-legged frog (federal Threatened and California Species of Special Concern; Critical Habitat designation);
- Western pond turtle (federal Species of Concern and California Species of Special Concern);

- California tiger salamander (California Species of Special Concern);
- nesting raptors and passerines, including the yellow warbler, yellow-breasted chat, and least Bell's vireo.

There are no known records for these species at Watsonville Slough. However, the project area lies within the known distributional range for these species, and suitable habitat may be present in Watsonville Slough. No adverse hydrologic impacts would affect the habitat for these species, since the pattern of diversion of water from Harkins Slough at its confluence with Watsonville Slough would be the same as the existing environment, and the present re-entry of this water into the tidal portion of Watsonville Slough is below the areas suitable for these species.

Tidewater Goby. The tidewater goby inhabits the Pajaro Lagoon and lower portions of its tributary streams and sloughs. Although detailed surveys in the lower portions of Watsonville Slough have not been carried out, suitable habitat for this species is present. Diversion of high stormwater flows from Watsonville Slough would reduce the inflow of freshwater into the Pajaro Lagoon. Although the species was believed to be restricted to low-salinity waters (Federal Register, 1994), tidewater gobies are capable of living in saline waters reaching over 50 parts per thousand (ppt) (Moyle *et al*., 1995). Large populations have been observed in lagoons ranging from freshwater (e.g., Soquel Creek and Pescadero Creek) to ocean salinities (Corcoran Lagoon and Moran Lagoon) (Smith, 1999). Thus, tidewater gobies are not expected to be adversely affected by reduced freshwater inflows to the lower portion of Watsonville Slough or the Pajaro Lagoon.

> **Measure 5.D.4-2a—Avoidance of Habitat:** Removal or damage to riparian vegetation in the vicinity of the stream crossings may be avoided by constructing the pipeline crossing with bore and jack methods.
>
> If the use of bore and jack methods is feasible, implement Measures 4.A.4-2b (including surveys for Santa Cruz long-toed salamander and California tiger salamander) and 4.A.4-2c.
>
> If complete avoidance is not feasible, implement Measure 4.A.4-2d and Measures 4.A.4-2e (including surveys for Santa Cruz long-toed salamander and California tiger salamander) through 4.A.4-2g.
>
> **Measure 5.D.4-2b--Conduct hydrologic studies of the potential effects of reduced freshwater inflow to the tidal portion of Watsonville Slough.** Potential impacts to the tidal portion of Watsonville Slough may include loss of habitat for species intolerant of changes in salinity concentrations. Recommendations made by the hydrologic study would constitute mitigation measures for this impact.

Impact 5.D.4-3: Impacts on Special Status Plant Species--Pipeline construction through the Watsonville Airport and adjacent property would potentially result in the take of

individual plants and would adversely affect habitat of Santa Cruz tarplant. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

A large population of Santa Cruz tarplant occurs on the Watsonville Airport grounds. This population may also extend throughout the property to the west of the airport. Although subject to a high degree of disturbance, the airport and adjacent grasslands provide a large part of the remaining habitat for this species in the area and this population may be important to the survival of the species. Steps to avoid this population and habitat or to minimize impacts should be taken.

> **Measure 5.D.4-3a--Avoidance: Take of Santa Cruz tarplant shall be avoided by rerouting the pipeline alignment through this area.** In consultation with the Airport and CDFG, the pipeline alignment shall be rerouted through the Airport and/or neighboring properties so as to avoid concentrations of Santa Cruz tarplant. Alternatively, the pipeline alignment could be re-routed onto Airport Boulevard. Construction in or adjacent to the Boulevard would avoid impacts to tarplant, but would result in adverse impacts on traffic and circulation due to the temporary closure of traffic lanes and the subsequent increase in traffic congestion and safety hazards.
>
> **Mitigation Measure 5.D.4-3b--Revegetation Measures: Where adverse impacts to Santa Cruz tarplant cannot be avoided, revegetation measures will be developed in the form of a revegetation plan approved by CDFG.** The plan will include specific details for the revegetation of impacted Santa Cruz tarplant habitat, and for restoration of nearby grassland habitat, as appropriate. Revegetation measures will include the use of locally obtained plant materials, detailed descriptions of installation methods, weed control measures, success criteria, and corrective measures if the success criteria are not met.

REFERENCES – Vegetation, Fish, and Wildlife

California Natural Diversity Data Base (CNDDB), California Natural Diversity Data Base printout for U.S.G.S. 7.5 Minute Topographic Quadrangles: Watsonville East, Watsonville West, and Moss Landing, 1997.

Environmental Science Associates, *Pajaro Valley Water Management Agency Local Water Supply and Distribution Pipeline Project California Red-legged Frog and sensitive Amphibian and Reptile Species Site Assessment*, prepared for the Pajaro Valley Water Management Agency, Watsonville, 1999a.

Federal Register, *Determination of Endangered Status for the Tidewater Goby: Final Rule*, February 4, 1994.

Habitat Restoration Group (HRG), *Fisheries Report for the Pajaro Valley Water Management Agency Water Supply Project*, prepared for Environmental Science Associates, San Francisco, Appendix C, 1997.

Holland, R.F., *Preliminary Descriptions of the Terrestrial Natural Communities of California*, Department of Fish and Game, Sacramento, CA, 1986.

Moyle, P. B., R. M. Yoshiyama, J. E. Williams, and E. D. Wikramanayake, *Fish Species of Special Concern in California*, Second Edition, prepared for the California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, CA, 1995.

Questa Engineering Corporation, *Water Resources Management Plan for Watsonville Slough System, Santa Cruz County*, prepared for the Association of Monterey Bay Area Governments (AMBAG), November 6, 1995.

Smith, Jerry, Fisheries Biologist, San Jose State University, personal communication, March 11 and 12, 1999.

5.D.5 CULTURAL RESOURCES

5.D.5.1 SETTING

Archaeology of the Project Area

Section 3.5 provides archaeological/prehistoric data on the project area.

Ethnography of the Project Area

Section 3.5 provides ethnographic data on the project area.

Historical Overview

Section 3.5 provides an historical overview of the project area.

A cultural resources records search for the Aquifer Storage and Recovery project area was conducted by the Anthropological Studies Center at Sonoma State University in September 2001. The records search identified two previously recorded cultural resource sites that could be affected by the ASR pipeline, CA-SCR-334H and CA-SCR-154. CA-SCR-334H is a historic-period highway (Highway 1), where old highway segments (adopted into the state highway system in 1933) can be found adjacent to the existing highway. CA-SCR-154 is a severely disturbed prehistoric habitation site consisting of flaked-stone scatter with shell deposits. The historic component of this site consists of a trash scatter. This site is potentially important under CEQA Guidelines but formal evaluations have not been completed.

5.D.5.2 SIGNIFICANCE CRITERIA

See Section 4.A.5.2 for a discussion of significance criteria.

5.D.5.3 IMPACTS AND MITIGATION MEASURES

Impact 5.D.5-1: Construction activities associated with the proposed Aquifer Storage and Recovery facilities could result in the alteration or destruction of identified cultural resources. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Two cultural resource sites were identified in the ASR project area (CA-SCR-334H and CA-SCR-154). These sites could be altered or damaged during construction. A cultural resources survey of the ASR project area shall be conducted by a qualified archaeologist to identify any other cultural resources that also may be present and potentially subject to damage or alteration.

> **Measure 5.D.5-1a:** Prior to construction, PVWMA shall retain a qualified archaeologist to conduct archival research and archaeological surveys of the project area. The findings of the investigations will be incorporated into the selection of specific locations for the

ASR pipelines and wells such that PVWMA will avoid siting wells and attendant connecting pipelines at or through any significant cultural resources.

Measure 5.D.5-1b: Implement Measures 4.B.5-1a and 4.B.5-1b.

Impact 5.D.5-2: Ground-disturbing activities associated with the proposed pipelines and facilities could reveal previously unknown buried or otherwise obscured significant prehistoric and historic cultural resources. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Significant unknown cultural resources may be buried or obscured by vegetation on the project site, and therefore construction of the proposed project could result in degradation and destruction of undiscovered cultural resources.

Measure 5.D.5-2: Implement Measure 4.A.5-1.

Impact 5.D.5-3: Potential indirect impacts to cultural resources, primarily vandalism, could result from the increased access to, and use of, the general area during construction. Such disturbance could result in the loss of integrity of important cultural resources. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Construction activities associated with the ASR Dual Pipeline and injection/extraction wells could increase accessibility to existing cultural resource sites. This could result in looting and vandalism of important cultural resources.

Measure 5.D.5-3: Implement Measures 4.B.5-3a through 4.B.5-3c.

5.D.6 TRAFFIC AND CIRCULATION

5.D.6.1 SETTING

Project Area Roadways

Figure 3.6-1 (Regional Setting – Traffic and Circulation) illustrates project area roadways.

Highway 1 (Cabrillo Highway) provides coastal access through the project area, providing connection to the Cities of Watsonville and Santa Cruz to the north, and Monterey and other central coast destinations to the south. In the project area, Highway 1 is a four-lane divided freeway to approximately one mile south of the Santa Cruz - Monterey county line, where is narrows to two lanes. The maximum posted speed limit on Highway 1 in the project area ranges from 55 to 65 mph.

Highway 152 provides east-west access through the project area, stretching east from Highway 1 to the Central Valley. In the west portion of the project area, Highway 152 runs through Watsonville (along Main Street, East Beach Street, Lincoln Street and East Lake Avenue) to Hecker Pass (via Hecker Pass) and Santa Clara County.

Local two-lane roadways that project implementation might affect include Beach Road, San Andreas Road, Harkins Slough Road, Airport Boulevard, Buena Vista Drive, Freedom Boulevard, Green Valley Road and Holohan Road. *Beach Road*, a two-lane roadway, extends west from Highway 1 to Palm Beach, south of the project area. *San Andreas Road,* a two-lane roadway, follows north from Beach Road, and is designated as a Coast Bike Route.

Harkins Slough Road extends east-west through the project area, connecting Highway 1 with Buena Vista Road. *Airport Boulevard* extends northeast from the Highway 101 along the Watsonville Municipal Airport boundary, terminating at Green Valley Road. *Buena Vista Road* extends along the airport is northern boundary, provides connection to Highway 1 and Freedom Boulevard, and terminates to the northeast at Green Valley Road.

Freedom Boulevard extends in a northwest-southeast direction, provides access through Freedom, and terminates at Highway 152. *Holohan Road* extends west from Highway 152 south of College Lake, terminating at Green Valley Road. *Green Valley Road* extends in a northeast-southwest direction, providing connection to Highway 152 and Highway 1 in Freedom.

Traffic Volumes

Section 3.6.1 presents daily traffic volumes on study area roadways.

Existing Truck Traffic on Roadways

Section 3.6.1 presents existing truck traffic on study area roadways.

Accident History

Section 3.6.1 presents an accident history for study area roadways.

Roadway Improvement Projects

Section 3.6.1 describes roadway improvement projects planned in the study area.

Applicable Plans and Policies

Section 3.6.1 presents applicable plans and policies for jurisdictions in the study area.

5.D.6.2 SIGNIFICANCE CRITERIA

See Section 4.A.6.2 for a discussion of significance criteria.

5.D.6.3 IMPACTS AND MITIGATION MEASURES

Construction Trip Generation

Construction activities that would generate traffic consist of trucks hauling equipment and materials to the pump station sites and pipeline alignments, the hauling of excavated spoils from, and delivery backfill to the work sites, and the daily arrival and departure of construction workers to the work sites.

Under the Aquifer Storage and Recovery project, approximately seven miles of dual 30-inch diameter pipelines would be installed. **Figure 2.8** depicts the pipeline alignment. The majority of the proposed alignment follows open areas (farm roads, agricultural fields, and open space on the airport property), where conventional excavation methods would be used for open-cut pipeline installation. The following assumptions were made to estimate construction impacts from the proposed pipeline installation: the trench five feet wide by eight feet deep, new fill would replace excavated soil, an average of 100 feet of pipe would be laid per work day, an average truck haul load would be 10 cubic yards per truck, and no backhauling would occur. Using these assumptions, up to approximately 150 cubic yards would be excavated per day, with approximately the same amount of new fill imported. This would amount to approximately 30 daily truck haul round trips (60 one-way trips).

The number of workers at any one location along the pipeline alignment would vary depending upon location and the specific type of construction activity proposed. Based on estimates of workforce per task, there would be approximately six to ten workers per crew on an average day. Assuming that each worker would travel in his own vehicle to and from the site, and that some midday trips would occur, this would result in up to about 15 worker vehicle round trips per day (30 one-way trips). Accounting for construction material delivery and worker trips, there would likely be a total of less than 55 round trips (110 one-way trips) occurring per day at a typical construction spread.

Additional construction trips would be generated by construction of the injection/extraction wells, pipelines connecting the wells to the dual pipelines, and facilities near the confluence of Harkins Slough and Watsonville Slough (expansion of the existing filtration facility and construction of a new pump station and diversion facility for Watsonville Slough). Construction details currently are unavailable for these facilities (e.g., required earthwork, construction duration); thus, the volume of traffic that would be generated by construction of these facilities also is not yet known.

Construction Trip Distribution

The specific destination(s) for excavated materials hauled from, and the originating location(s) of imported fill and other materials delivered to the work sites currently are unknown. However, a number of construction materials sources (e.g., quarries, manufacturers) and excess soil re-use options (e.g., farms) are located in the surrounding rural areas and urban centers. Construction worker trips are assumed to originate from the major urban areas in the project region and nearby communities.

Based on the existing roadway network serving the project area, project trucks and construction workers traveling to and from the alignment likely would use a combination of highways (e.g., Highway 1, Highway 129, Highway 152), county roads and designated truck routes in the project vicinity to reach other local points and/or regional locations.

Impact 5.D.6-1: Traffic on area roadways would temporarily increase as a result of project-generated vehicle trips by construction workers and construction vehicular activities. Less than Significant. Implementation of mitigation identified in this EIR, while not required, would assist in ensuring that the impact would remain at a less-than-significant level.

Because project construction-generated traffic would be temporary, it would not result in any long-term degradation in operating conditions or level of service for any project-area roadways. The primary off-site impacts from the movement of construction trucks would include short-term and intermittent lessening of roadway capacities due to slower movements and larger turning radii of the trucks compared to passenger vehicles.

The project would temporarily increase traffic on roadways providing access to the work sites along the pipeline alignment and roadways providing connection to regional routes; this would mainly affect Highway 1 and Highway 152 via Beach Road, San Andreas Road, Harkins Slough Road, Holohan Road, Airport Boulevard, Buena Vista Road, Freedom Boulevard, and Green Valley Road. Although the specific estimated off-site construction vehicle trips are preliminary, (see Construction Trip Generation, above), given the expected type and scope of facility and pipeline construction, construction-generated traffic would be expected to be at a level that would not significantly disrupt traffic flow on these freeways and arterials. Given the pace of construction, the duration that haul trucks would be required to use any given local roadway would be relatively brief.

Most project-related hauling and deliveries would be dispersed throughout the day, thus lessening the effect on peak-hour traffic. Project truck traffic occurring during the hours of 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. would coincide with peak-hour traffic, and therefore have the greatest potential to impede traffic flow during these time periods. Restricting truck traffic during the a.m. and p.m. peak periods would further minimize disruption of the general traffic flow on affected roadways.

Although this impact would be less than significant, the following mitigation measures are recommended to further reduce this less-than-significant impact.

Measure 5.D.6-1 (Recommended): Implement Measures 4.A.6-1a and 4.A.6-1b.

Impact 5.D.6-2: Project construction would increase traffic delays for vehicles traveling past the construction zone. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Project engineers have indicated that the majority of the approximately 40,000 linear feet of dual pipelines would not involve installation within roadways. However, the proposed alignment would follow adjacent to, or within a portion of, and/or cross Highway 101, Harkins Slough Road, Airport Boulevard, Larkin Valley Road, Buena Vista Drive, Freedom Boulevard and Green Valley Road. The specific alignments of installation of pipeline would be identified during the design phase of the project. Assuming open-trench activities proceeding at an average rate of 100 feet per day, impacts would be brief at any one location along the pipeline alignment.

Existing transportation and circulation patterns in the vicinity of the proposed pipeline alignment would be temporarily disrupted by construction activities and heavy equipment use in the roadways. Impacts related to pipeline construction would include direct disruption of traffic flows and roadway operations. Lane blockages or roadway closures during pipeline installation would result in a reduction in travel lanes, and could result in the need for traffic re-routing.

Measure 5.D.6-2: Implement Measures 4.B.6-2a and 4.B.6-2b.

Impact 5.D.6-3: Project construction would affect access to adjacent land uses for both general and emergency access. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Temporary disruption of access to properties along the construction route due to trenching, and materials and equipment storage would be expected. However, potential temporary blockage or reduction in travel lanes could result in significant delays to emergency services. In addition, a temporary inconvenience to local commercial and agricultural businesses and residences could result.

Measure 5.D.6-3: Implement Measures 4.B.6-3a through 4.B.6-3c.

Impact 5.D.6-4: Project construction would increase wear-and-tear on area roadways used by construction vehicles. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The use of heavy trucks to transport equipment and material to and from the project site could affect road conditions by increasing the rate of road wear or by causing direct damage to roads and bridges. The degree to which this impact would occur depends on the project-generated traffic and the design (pavement type and thickness) and existing condition of the roadways. The project's impact is assumed to be minimal on major arterials (e.g., highways, including Highway 1 and Highway 152) which are designed to accommodate a mix of vehicle types, including heavy trucks. Other local-serving roads, such as Green Valley Road, may not be built with a pavement thickness that will withstand considerable heavy truck volumes. The projected increase in use of these or other local roadways by heavy trucks could result in significant roadwear on these roadways.

Measure 5.D.6-4: Implement Measure 4.A.6-2.

Impact 5.D.6-5: Project construction would increase potential traffic safety hazards for vehicles and pedestrians in the construction area. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The temporary increase in construction-generated trucks on project area roadways would interact with other vehicles, including other large trucks, slow-moving agricultural vehicles, and other local traffic. Potential conflicts also could occur between construction traffic and bicyclists and pedestrians, particularly in and near the more densely populated areas, such as the residential neighborhood near College Road, and in Watsonville. Highway 152, Holohan Road, College Road, and Lakeview Road (south of College Road) are part of the Master Plan of Santa Cruz County bikeways (County of Santa Cruz, 1994).

As discussed in Section 3.6.1, a number of major study roadway segments currently exhibit higher accident rates than the statewide average for similar roadways. These roadways include Highway 152 (through Watsonville) and Highway 129 (in Santa Cruz and Watsonville). However, these arterials are already used heavily by trucks (as discussed in Section 3.6.1). In addition, the state and county routes would still be the safest, and in virtually all locations, the only desirable routes for project traffic to use.

Measure 5.D.6-5a: Implement Measures 4.A.6-3a and 4.A.6-3b.

Impact 5.D.6-6: Project construction would generate a demand for parking spaces for construction worker vehicles. Less than Significant.

The project would generate a need for parking for construction workers and construction vehicles, as well as areas to store equipment and supplies. The location of staging areas has not been identified at this point; however, given the pipeline alignment, providing space for staging areas could be easily accommodated. The demand for new parking would be met by the proposed construction staging areas. No public on-street parking would be eliminated during project construction.

Mitigation: None required.

Impact 5.D.6-7: Project construction could coincide with other construction projects under the Revised BMP, or other potential construction projects in the area, contributing to cumulative traffic and roadway disruptions. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Construction associated with the proposed project could occur at the same time construction of other components identified under the Revised BMP occurs, in addition to other potential cumulative construction projects in the project area. The projects would share some of the same construction access routes (including Beach Road, Highway 1, Highway 129 and Highway 152), particularly for pipeline construction. Consequently, cumulative traffic and roadway disruptions could occur. The implementation of mitigation measures identified in this section would reduce this project's contribution to cumulative impacts. The following measures would further reduce this project's contribution to this impact to a less-than-significant level.

Measure 5.D.6-7: Implement Measure 5.A.6-7.

REFERENCE – Traffic and Circulation

County of Santa Cruz, *1994 General Plan and Local Coastal Program for the County of Santa Cruz*, 1994.

5.D.7 AIR QUALITY

5.D.7.1 SETTING

Section 3.6, Regional Setting – Traffic and Circulation, describes the major roadways in the vicinity of the Aquifer Storage and Recovery project. Aside from automobile and agricultural emissions there are no major air emission sources in the vicinity of this project component.

5.D.7.2 SIGNIFICANCE CRITERIA

Please refer to Section 4.A.7.2 for a description of the significance criteria used in analyzing potential project impacts related to air quality.

5.D.7.3 IMPACTS AND MITIGATION MEASURES

Impact 5.D.7-1: Construction of this Local-Only Alternative project component would temporarily generate criteria air pollutants, particularly PM_{10}, over the duration of the construction period. Significant and Unavoidable. Implementation of mitigation identified in this EIR would reduce the impact, but it would remain significant.

Construction of the project would generate fugitive dust (including PM_{10}), and other criteria air pollutants from exhaust emissions. A large portion of the total construction dust emissions would result from site grading and trench excavation activities. Dust emissions would vary from day to day, depending on the phase of construction, the silt content of the soil, and the weather. Daily emissions would depend greatly upon whether construction of the various supply components and distribution systems would occur simultaneously. Construction-related impacts which are individually less than significant may have a significant impact if construction occurs on two or more components simultaneously. Additionally, PM_{10} as well as some exhaust emissions would add to the cumulative air pollutant emissions of the valley. In an agricultural region, soil tilling is a source of PM_{10}, which in total far exceeds what the project construction could generate at individual site locations. Larger particles of dust from construction would fall out relatively close to construction sites and could cover crops with a coating of dust. This could be injurious to plants, particularly seedlings and plants in their early growth stages.

According to MBUAPCD *CEQA Guidelines,* construction projects which emit precursors of ozone (i.e., ROG and NO_x) are accommodated in the emission inventories of the Air Quality Management Plans and would not have a significant impact on the attainment and maintenance of ozone AAQS. For this reason, emissions of ROG and NO_x from construction equipment will not be quantified and will be considered a less-than-significant impact. The MBUAPCD Guidelines also state that PM_{10} emissions from construction activities are considered significant if they would generate 82 pounds per day or more of PM_{10} when the activities are located nearby and upwind of sensitive receptors.

Pipeline construction is expected to be completed at an average rate of 100 feet per day per pipeline heading. As stated above in Section 5.6, Traffic and Circulation, an average of

220 cubic yards of trench spoils and clean fill would be hauled daily. Heavy duty construction equipment used in pipeline construction would include trenchers, front loaders, cranes, dump trucks, and compressors. Criteria pollutant emission sources would include exhaust from construction emissions and construction worker vehicle trips.

If the treatment facilities and pipeline are constructed simultaneously, this would result in emission of approximately 488 pounds of PM_{10} per day. PM_{10} emissions from the construction of all components would result in a significant impact.

Measure 5.D.7-1: Implement dust control program described in Measure 4.A.7-1.

The effectiveness of the dust control measures in reducing PM_{10} emissions ranges from 34 percent (for sweeping streets) to 90 percent (for covering haul trucks and inactive storage piles) (MBUAPCD, 2000). However, implementation of all applicable measures would not reduce PM_{10} emissions to below 82 pounds per day. With implementation of Measure 4.A.7-1, construction-generated PM_{10} emissions would remain significant and unavoidable.

Impact 5.D.7-2: Lane closures and detours necessitated by construction of the project could temporarily increase vehicular emissions. Less than Significant.

Construction of the various treatment facilities would not require lane closures or detours. Installation of pipeline sections required by the various components of the project would involve crossing roadways. Roadways will be maintained to allow one-lane passage at all times. For one-lane or narrow roadways, construction would be completed by closing the road for the shortest period of time, and traffic control plans submitted by the contractor will ensure minimal lane closures and detours. Vehicular emissions would be temporarily increased from autos taking detours or queuing on narrow roadways. However, increased emissions directly caused by lane closures would not be likely to exceed MBUAPCD significance criteria of 150 pounds per day of ozone precursors (ROG or NO_x) or 550 pounds per day of CO.

Impact 5.D.7-3: Vehicle trips resulting from operation and maintenance of the various components of the project would generate emissions of criteria air pollutants. Less than Significant.

Operation of the injection/extraction wells would require periodic maintenance and inspection by PVWMA employees. Emissions generated by employee vehicle trips would be negligible and would not exceed MBUAPCD significance thresholds. Pumps would be powered by electricity, rather than diesel, and would not generate added criteria air pollutants.

REFERENCE – Air Quality

Monterey Bay Unified Air Pollution Control District (MBUAPCD), *CEQA Air Quality Guidelines*, September 2000.

5.D.8 NOISE

5.D.8.1 SETTING

Please refer to Section 3.8 for a discussion of regional noise conditions. Proposed improvements under this component include construction of a pipeline from College Lake to Harkins Slough and construction of 30 injection/extraction wells along the pipeline alignment.

The proposed locations for the pipelines are in agricultural or weedy, disturbed areas, with the exception of pipeline segments that run along Buena Vista Drive and across Freedom Boulevard. Residences are located along Buena Vista Drive near the pipeline alignment.

5.D.8.2 SIGNIFICANCE CRITERIA

See Section 4.A.8.2 for a discussion of significance criteria.

5.D.8.3 IMPACTS AND MITIGATION MEASURES

Impact 5.D.8-1: Construction activities associated with the project construction would intermittently and temporarily generate noise levels above existing ambient noise levels in the project vicinity. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Construction-related noise levels along the pipeline alignment would fluctuate depending on the particular type, number, and duration of use of various pieces of construction equipment, and the location of sensitive receptors. The effect of construction noise would depend on how much noise would be generated by the equipment, the distance between construction activities and the nearest noise-sensitive uses, and the existing noise levels at those sensitive uses.

Construction activities would be expected to last approximately 23 months and one week at any given location along the pipeline alignment. Residences are located within 200 feet of some of the pipeline segments; therefore, noise associated with construction activity would be considered a significant effect for this component. Implementation of the mitigation measures below, which limit the timing of construction and use of equipment, would reduce potentially significant impacts to a less-than-significant level.

Measure 5.D.8-1: Implement Measure 4.A.8-1.

Impact 5.D.8-2: Operation of proposed well pumps would result in noise increases in the vicinity of project facilities. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

The injection/extraction wells would each have an 80 horsepower pump. While the exact locations of the wells are not known at this time, generally, a 50-horsepower pump generates a noise level of 63 dBA at a distance of 50 feet. Assuming a distance of 100 feet to the nearest sensitive receptors, noise from well pumps would be reduced to 57 dBA at a distance of 100 feet. While this noise level would likely not be significant during daytime hours, it would be noticeable during quieter nighttime hours. Assuming 24-hour operation of three pumps, the resulting Ldn at local receptors would be 62 dBA, which falls within the conditionally acceptable land use category for residential land uses within the County of Santa Cruz General Plan. Because the proposed well pumps would have the potential to increase local noise levels if located near a residence in excess of a normally acceptable residential land use environment as established in the General Plan, the project would result in a potential significant operational noise impact. Implementation the Mitigation Measures below would reduce potential impacts to a less-than-significant level.

Measure 5.D.8-2: Implement Measure 5.B.8-2.

5.D.9 PUBLIC SERVICES

5.D.9.1 SETTING

Please refer to Section 3.9 for a discussion of public services and utilities serving the area.

5.D.9.2 SIGNIFICANCE CRITERIA

Please refer to Section 4.A.9.2 for a discussion of significance criteria.

5.D.9.3 IMPACTS AND MITIGATION MEASURES

Demand during construction for public services such as water (for dust control), solid waste disposal, and schools will not be large enough to cause significant impacts. (Solid waste generated by the project would be sent to the Marina Landfill in Monterey County.)

Impact 5.D.9-1: Construction of pipelines associated with the Aquifer Storage and Recovery (ASR) project could result in temporary, planned or accidental disruption to utility services provided by underground lines. Significant. With mitigation identified in this EIR the impact would be reduced to a less-than-significant level.

The pipeline alignment crosses Highway 1, the Union Pacific Railroad, Freedom Boulevard, Harkins Slough Road, Green Valley Road, and existing field roads. Micro-tunneling and bore-and-jack construction at these crossings would reduce, but not eliminate potential conflicts with existing utility lines. Refer to the discussion following Impact 4.A.9-1 for further information.

Measure 5.D.9-1: A detailed study identifying utilities along the proposed alignment shall be done during the pre-design stages of the project.

The following mitigations are required for segments identified in final design as having potential conflict with significant utilities.

a. Utility excavation and encroachment permits would be required from the appropriate agencies, including the Public Works Departments of Santa Cruz County, and the City of Watsonville. These permits include measures to minimize utility disruption. PVWMA and its contractors shall comply with permit conditions. Permit requirements shall be included in construction contract specifications.

b. Utility locations would be verified through field survey (potholing) and use of an underground locating service.

c. A detailed engineering and construction plan shall be prepared as part of the design plans and specifications. This plan shall include procedures for the excavation, support, and fill of areas around utility cables and pipes. All affected utility services would be notified of PVWMA's construction plans and schedule. Arrangements would be made with these entities regarding protection, relocation, or temporary disconnection of services.

d. In areas where the pipeline would parallel wastewater mains, engineering and construction plans shall include trench wall support measures to guard against trench wall failure, and possible resulting loss of structural support for the wastewater main.

e. Residents and businesses in the project area shall be notified in writing by the contractor of planned utility service disruption two to four days in advance, in conformance with County and State standards.

Impact 5.D.9-2: Pipeline construction could temporarily impede vehicle access to emergency services, as well as to collection and delivery services. This impact could affect Counties' Sheriff's Departments, fire departments, emergency services (e.g., ambulance companies), delivery and collection services. Significant. With mitigation identified in this EIR the impact would be reduced to a less-than-significant level.

Pipeline construction could temporarily impede vehicle access to police, fire or emergency services although major road crossings would be maintained by using non-open trench construction techniques. Vehicle access to an individual residence or business would normally be impeded for one to two days, maximum. PVWMA would employ construction methods described in the assessment of traffic impacts (see Section 5.A.6) that would reduce this impact to a less-than-significant level.

Measure 5.D.9-2a: Construction trenches shall be covered by steel trench plates to allow access to driveways.

Measure 5.D.9-2b: To minimize disruption of emergency vehicle access, contractors shall work with affected jurisdictions (Santa Cruz County or City of Watsonville) to identify detours during construction.

Measure 5.D.9-2c: Police, fire, and emergency services shall be notified of the timing, location, and duration of construction activities and the locations of detours and lane closures.

Impact 5.D.9-3: Pump operations for injection/extraction wells at the Watsonville Slough would increase demand for electric services. Significant. With mitigation identified in this EIR the impact would be reduced to a less-than-significant level.

Operation of the pump station at the Watsonville Slough Diversion facility and operation of the injection/extraction wells could require the extension of new or expansion of existing electricity lines to serve the proposed project. The specific electricity requirements would be reviewed by PG&E after PVWMA submits a formal application for service.

Measure 5.D.9-3: The design of all pump facilities with a potential to exceed the capacity of existing PG&E systems will be coordinated with PG&E to ensure adequate capacity is available.

5.D.10 VISUAL/AESTHETIC AND RECREATIONAL RESOURCES

5.D.10.1 SETTING

The Aquifer, Storage and Recovery (ASR) project area, which extends from Harkins Slough around the Watsonville Airport to College Lake, exhibits a primarily rural visual character. The site of the proposed facilities at Harkins and Watsonville Sloughs occurs on open agricultural lands with native vegetation visible along the sloughs. The existing Harkins Slough filtration facility is a visible industrial feature in the surrounding rural landscape. Views of this site are available from San Andreas Road, a County-designated scenic road, and to a lesser extent from Beach Road (also a County-designated scenic road).

The ASR Pipeline alignment extends from the Harkins Slough site across Harkins Slough Road, open agricultural lands and rolling terrain to Highway 1, a designated scenic road. Between Highway 1 and Freedom Boulevard, the pipeline alignment extends through the open lands along the western edge of the Watsonville Airport and suburban residential development along Buena Vista Drive. From Freedom Boulevard to College Lake, the alignment crosses Corralitos Creek and extends through open agricultural lands. Views of the ASR Pipeline alignment and siting area for injection/extraction wells extending 100 to 200 feet on either side of the pipeline alignment) are available from several designated scenic roads, including Harkins Slough Road, Highway 1, Airport Boulevard, and Holohan Road. Since the proposed alignment is within, or adjacent to these road rights-of-way, pipeline construction would be clearly visible to motorists travelling along these roads.

Consistency with Applicable Plans and Policies

Development of the ASR facilities generally would be consistent with the applicable policies of the Santa Cruz County General Plan/LCP and City of Watsonville General Plan presented in Section 3.10 of this Report. The proposed facilities at Watsonville and Harkins Sloughs would be visually compatible with existing facilities at Harkins Slough and would not substantially alter views from San Andreas Road. The proposed pipeline would be located underground and would not be visible following installation. During construction, excavated trenches and stockpiled soils, pipe, and other materials within the construction easement would constitute negative aesthetic elements in the visual landscape that would directly affect, or be visible from, designated scenic routes, including Highway 1, Harkins Slough Road, Airport Boulevard, and Holohan Road. However, these effects would be temporary during project construction. Since this component would not result in any long-term impacts on views or the visual landscape, it would not be inconsistent with General Plan policies that encourage preservation of scenic rural qualities and protection of views from designated scenic routes.

Construction of up to 30 injection/extraction wells could potentially affect views in scenic areas within the siting area for the wells. During construction, excavation soils, pipe, and other materials would introduce negative aesthetic features to the well siting area.

5.D.10.2 SIGNIFICANCE CRITERIA

Please see **Section 4.A.10.2** for a discussion of significance criteria.

5.D.10.3 IMPACTS AND MITIGATION MEASURES

Impact 5.D.10-1: Construction of the ASR facilities would disturb roadways and remove crops and vegetation, which would temporarily alter the visual landscape. Significant. With mitigation identified in this EIR, the impact would be reduced to a less-than-significant level.

Construction of the proposed facilities at Harkins and Watsonville Sloughs would alter the visual character of the area and affect views from San Andreas Road. These facilities would be visually compatible with the existing Harkins Slough filtration facilities, but they would increase the visual prominence of industrial facilities in views from San Andreas Road, a designated scenic route. Implementation of Mitigation Measures 4.A.10-1a and 4.A.10-1b, above, would reduce this impact to a less-than-significant level.

Construction of the ASR Pipeline would temporarily disturb roadways and remove native vegetation and crops along the alignment. Cropping would continue on agricultural lands within the alignment following installation of the pipeline. For this reason, the construction disturbance is considered to be a less-than-significant impact. During construction, excavated trenches and stockpiled soils, pipe, and other materials within the construction easement would constitute negative aesthetic features to the pipeline alignment. This would be a temporary adverse impact.

Following construction, the proposed pipeline would be located entirely below grade and would be unobtrusive. Implementation of Measure 4.A.10-1a, which would require that the PVWMA revegetate disturbed natural areas, and Measure 4.A.10-1c, which would require contractors to restore disturbed areas to pre-construction conditions. No long-term visual impacts would result from development of the pipeline.

Approximately 30 injection/extraction wells would be constructed within the siting area for the wells (within 100 to 200 feet of the ASR Pipeline alignment). Each well facility would have a footprint of approximately 2,000 square feet and would be connected to the ASR Pipeline by a lateral. During construction, excavated wells and stockpiled soils, pipe, and other materials would constitute negative aesthetic features. This would be a temporary adverse visual impact.

Measure 5.D.10-1: Implement Measure 4.A.10-1a through 4.A.10-1c.

Impact 5.D.10-2: Development of the ASR component would introduce new sources of light onto the project site and increase ambient light in the project area. Less than Significant. Implementation of recommended mitigation measures identified in this EIR,

while not required, would assist in ensuring that the impact would remain at a less-than-significant level.

While no exterior lighting is currently proposed as part of the ASR component, exterior security lighting (if implemented) at the new pump station and diversion structure (at Watsonville Slough), and well facilities could introduce light and create nighttime impacts. The new facilities would be located in the vicinity of existing residences. While exterior lighting could be visible from these residences, it would not be expected to substantially increase ambient light in the project area.

The proposed pipeline would be underground and would not introduce new sources of light or glare.

Mitigation Measure 5.D.10-2 (Recommended): Implement Measure 4.A.10-2.

Impact 5.D.10-3: Development of the Aquifer Storage and Recovery pipeline would temporarily disrupt recreational uses along designated recreational bicycle trails in Santa Cruz County and the City of Watsonville. Less than Significant.

Construction of the pipeline would disrupt bicycle traffic along Airport Boulevard, Buena Vista Drive, Freedom Boulevard and Green Valley Road, all of which are included in the Santa Cruz County and/or Watsonville bikeway systems. Construction activities and related truck traffic could damage these bikeways, and segments of the bikeways with active construction areas would be temporarily closed during trench excavation and pipeline installation, creating minor inconvenience to bicyclists. This impact would be temporary during project construction. Implementation of Measures 4.A.6-2, 4.A.6-3a and 4.A.6-3b would ensure that damaged roads would be repaired to pre-construction conditions, and that detours would be provided for bicyclists and motorists during the construction period. Therefore, this impact would be less than significant.

Mitigation: None required.

CHAPTER 6
OTHER ALTERNATIVES

6.1 CEQA REQUIREMENTS FOR ALTERNATIVES EVALUATION

The California Environmental Quality Act (CEQA) Guidelines require EIRs to describe and evaluate a range of reasonable alternatives to a project, or to the location of a project, that would feasibly attain most of the basic project objectives and avoid or substantially lessen significant project impacts. The Guidelines set forth the following criteria for selecting alternatives:

1. "An EIR shall describe a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project . . . ." An EIR must consider "a reasonable range of potentially feasible alternatives that will foster informed decision-making and public participation. An EIR is not required to consider alternatives which are infeasible. The lead agency is responsible for selecting a range of project alternatives for examination and must publicly disclose its reasoning for selecting those alternatives." (§15126.6[a])

2. "The specific alternative of 'no project' shall also be evaluated along with its impact." (§15126.6[e])

The CEQA Guidelines also state that where a previous EIR has sufficiently analyzed a range of reasonable alternatives for projects with the same basic purpose, the lead agency should review the previous document and may rely on it in assessing potential project alternatives (Section 15126.6[f]). This EIR relies on two previous EIRs: the *Local Water Supply and Distribution Final Environmental Impact Report* ("Local Projects" EIR, PVWMA, certified in May 1999), and the *Basin Management Plan Final Program Environmental Impact Report* (1993 BMP PEIR, PVWMA, certified December 1993), parts of which are incorporated herein by reference, as noted.[1]

Currently, there is no preferred alternative. The PVWMA Board of Directors could approve any of the alternatives evaluated in this chapter in lieu of either the Local-Only Alternative or BMP 2000 Alternative if they believe the alternative would be more appropriate. The Board of Directors also may select some components of one alternative and some components from another alternative, or they may select some basic project components (e.g., Water Recycling) and defer action on other components.

[1] Both EIRs are available for review at the Pajaro Valley Water Management Agency offices, 36 Brennan Street, Watsonville, CA 95076.

6.2 ALTERNATIVES FORMULATION

The draft Revised Basin Management Plan (BMP) presents a number of projects that could be undertaken by PVWMA in order to stop seawater intrusion and to balance water demand with sustainable water supplies in the agency's service area. These projects were then combined into alternative strategies to achieve the agency's objectives. Most of these projects have been considered in the two previous EIRs mentioned above: the Local Projects EIR and the 1993 BMP PEIR. **Table 6.1** lists all of the projects considered in the draft Revised BMP, indicates whether the project is evaluated in this EIR, and whether the project was evaluated in the Local Projects EIR or BMP Program EIR. The projects that comprise the Local-Only Alternative and BMP 2000 Alternative are described in detail in Chapter 2 of this document and evaluated in Chapters 4 and 5. The alternatives described and evaluated in this chapter include the following:

- **No Project Alternative.** Required by CEQA. Evaluates continuation of existing conditions and likely consequences.
- **Modified BMP 2000 Alternative.** Injection of CVP water; no Murphy Crossing project; no Inland Distribution System; smaller diameter Import Pipeline.
- **Modified Local-Only Alternative.** Supplements Local-Only Alternative with CVP water; blends recycled water prior to recharge; adds another recharge basin for recycled water.

The following projects were considered in either the draft BMP 2000 or draft Revised BMP and have been eliminated from further consideration at this time: Desalination and River Conveyance of Central Valley Project (CVP) Water. Section 6.4, at the end of this chapter, describes these projects and the reasons each was rejected, as well as other alternatives that were eliminated from consideration in this EIR.

6.2.1 NO PROJECT ALTERNATIVE

DESCRIPTION

This EIR incorporates by reference the No Project Alternative presented in the 1993 BMP EIR, summarized below.

The No Project Alternative is defined as no remedial action. By definition it includes no plans, policies, programs, or projects that would be undertaken by the PVWMA or any other party in the basin relative to the Revised BMP. Groundwater would continue to be the source of water for agricultural irrigation, industrial and commercial use, and domestic residential use. Groundwater extraction would increase to meet higher future water demand.

Given the consequences of continued pumping and failure of PVWMA to implement a BMP, it is possible that state intervention by the State Water Resources Control Board would occur or that basinwide adjudication would be initiated by a lawsuit filed by an aggrieved landowner (i.e., owner of a parcel where seawater intrusion has occurred). Without a supplemental water supply project, the options available for bringing the basin into balance and curtailing seawater intrusion

TABLE 6.1
BASIN MANAGEMENT PLAN PROJECTS CONSIDERED

	Evaluated in this EIR					
	BMP 2000 Alternative	**Local-Only Alternative**	**Discussed in this Chapter**	**Evaluated in "Local Projects" EIR**	**Evaluated in 1993 BMP Program EIR**	**Eliminated from further Consideration**
Optimizing Current Water Supplies						
Water Conservation	X	X			X	
Tiered Water Pricing		X				
Land Retirement		X				
Pumping Management	X	X	X		X	
Water Supply Projects						
Harkins Slough	X	X		X		
Murphy Crossing	X			X		
Pinto Lake, Corralitos Creek Diversions		X				
Watsonville Slough		X				
Import CVP Water (quantity varies)	X		X		X	
Recycled Water	X	X		X	X	
Seawater Desalination			X			
Supplemental Wells	X					
Water Storage Projects						
College Lake (size varies)		X		X	X	
Bolsa de San Cayetano, Corn Cob, Pescadero Reservoirs					X	X
Aquifer Storage and Recovery		X			X	
North Dunes recharge basin		X				
Southeast Dunes recharge basin			X			
Out-of-Basin Banking			X			X
Groundwater Injection of CVP Water			X			
Regional Project			X		X	

are limited to mandatory pumping controls or land fallowing in the coastal area. Under such a scenario, the state, by statutory adjudication, or the court, through litigation, might establish pumping limits. Predicting the allocation of water between agricultural users or urban users in the event of an adjudication would be speculative.

ENVIRONMENTAL IMPACTS

Under the No Project Alternative, the basin's overdraft condition would worsen. Seawater intrusion would continue to advance beneath the coastal lands at the current rate of 10,000 acre-feet per year (afy) or higher. Irrigation with groundwater would continue along the coast area until the salt content in the soils builds up to the point where existing agricultural crops typical of the area could not grow. Production of more salt-tolerant crops may occur to some degree; however, the economy of the area may change and some land may be fallowed. Over the long term, this would eventually remove 10,000 acres or 33 percent of the basin's agricultural acreage by the end of the planning period in year 2040 due to continued irrigation with salt-contaminated groundwater. A 33 percent reduction in agricultural productivity would amount to hundreds of millions of dollars in lost economic production annually and the elimination of thousands of jobs.

6.2.2 MODIFIED BMP 2000 ALTERNATIVE

DESCRIPTION

This alternative was developed based on input from local stakeholders. The Modified BMP 2000 Alternative involves the injection of CVP water into the groundwater basin for storage. This alternative includes the following components: an Import Pipeline (smaller in diameter than the pipeline proposed under the BMP 2000 Alternative), injection/extraction wells for CVP water, and modified local water supply projects, including recycled water facilities and the Harkins Slough project. The Modified BMP 2000 Alternative consists of the following:

- Coastal Distribution System;
- Conservation: Seven-year Plan (5,000 afy);
- Harkins Slough project with Harkins Slough recharge basin and supplemental wells and connection (1,100 afy);
- Recycled Water Facility (4,000 afy); and
- 54-inch Import Pipeline Project with injection/extraction wells for CVP water (11,900 afy).

The sustainable yield of the groundwater basin following implementation of the Modified BMP 2000 Alternative is estimated to be approximately 47,000 afy. With construction of the Recycled Water Facility plus the existing Harkins Slough local supplies, the estimated average annual CVP water required to balance the basin is 11,900 afy. Assuming an average CVP annual delivery of 60 percent, the PVWMA would need to secure CVP water contracts (or annual transfers) of approximately 19,800 afy to meet this need. Although 17,000 afy is the total quantity of supplemental supply required to balance the basin, approximately 18,500 afy of water must be delivered to the Coastal Distribution System in order to develop a hydrostatic barrier resulting in sustainable groundwater pumping of 47,000 afy. Therefore, on average at least 1,500 afy would

be pumped from supplemental wells east of Highway 1 and delivered to the Coastal Distribution System.

In average years, CVP deliveries plus water from the Harkins Slough extraction wells and Recycled Water Facility would provide water required to meet peak Coastal Distribution System demands. The injection/extraction wells would be available to balance peak demands. During above-normal rainfall years, CVP allotments plus supplies extracted from the Harkins Slough recharge basin and recycled water would be expected to meet or exceed demand within the Coastal Distribution System. Therefore, CVP water *above current demands* would be injected into the groundwater basin using wells located along the Import Pipeline alignment. The exact locations of the injection/extraction wells have not been identified. Recycled water would be blended with recovered water from injection/extraction wells and CVP water to create a uniform water supply for the Coastal Distribution System that meets or exceeds the water quality objectives.

This alternative would replace the Murphy Crossing and Inland Distribution System project components with injection/extraction of CVP water and avoid the environmental impacts and permitting and design issues related to Murphy Crossing.

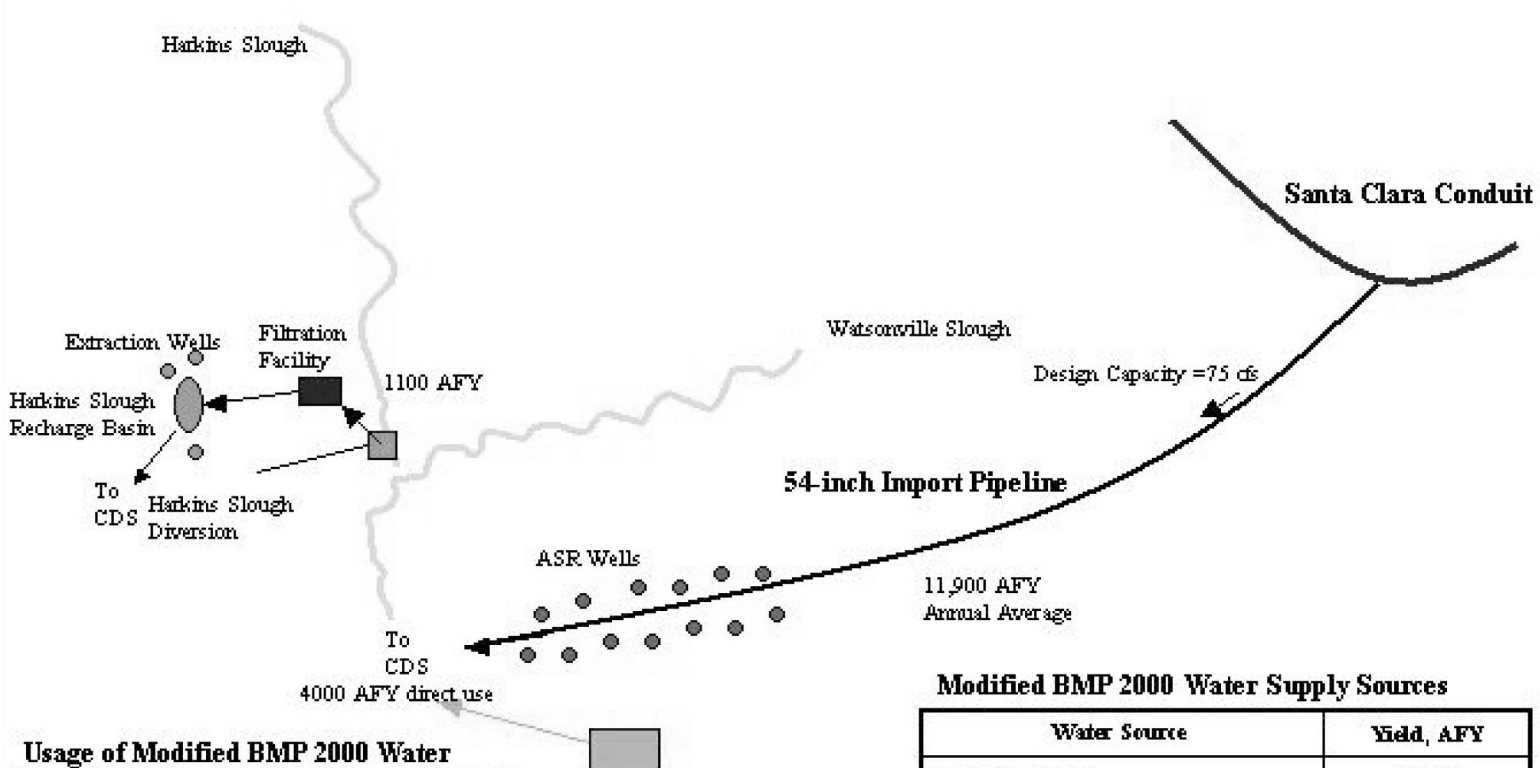
LOCATION

Figure 6.1 presents a schematic of the facilities associated with the Modified BMP 2000 Alternative. **Figure 2.5** indicates the area within which up to 17 wells to product blending water would be sited. Wells would be spaced approximately 2,000 feet apart. These wells would be located within both unincorporated Santa Cruz and unincorporated Monterey counties. The total area anticipated for each well would be approximately 30 feet by 40 feet. Lateral pipelines would connect the wells to the Import Pipeline.

ENVIRONMENTAL IMPACTS

This discussion focuses on the differences between this alternative and the BMP 2000 Alternative, which essentially is a tradeoff of impacts between the injection/extraction of CVP water and the Murphy Crossing and Inland Distribution System projects.

With one exception, all of the Modified BMP 2000 Alternative components are evaluated in Chapters 3 through 5 of this EIR or in the Local Water Supply and Distribution System EIR (PVWMA, 1999). General impacts associated with typical well construction and operation (e.g., pump noise) are described in Chapters 4 and 5. Impacts associated with the injection/extraction of CVP water are discussed below. Impacts associated with the Murphy Crossing and Inland Distribution System, which would be avoided under this alternative, also are discussed.



Usage of Modified BMP 2000 Water

Use/Storage	AFY
Direct Use or ASR Wells	15,900
Percolation ponds & Recovery	1,100
Total	**17,000**

Modified BMP 2000 Water Supply Sources

Water Source	Yield, AFY
Recycled Water	4,000
Harkins Slough	1,100
CVP – Import Water	11,900
Total	**17,000**

SOURCE: RMC

Figure 6.1
Modified BMP 2000 Alternative Flow Schematic

Hydrology and Water Quality

Like the BMP Alternative, this alternative would meet the project objectives by balancing the groundwater basin without the need to fallow land. This alternative has the highest overall source water quality among other alternatives (total amount of CVP water, for direct use and injection, would be 11,900 afy, compared with the BMP 2000 Alternative [10,300 afy]).

Mr. Martin Feeney completed an assessment of the water quality issues related to the injection of CVP water under the BMP 2000 Alternative[2]. His assumptions for the water quality evaluation were as follows:

> The alternative includes the storage of up to 10,000 af of CVP water in wet years. Storage would be achieved through the use of 12 injection/recovery wells. The proposed injection and recovery rates are 1,000 and 2,000 gallons per minute (gpm), respectively. At the proposed rates, injection period would be approximately 190 days.

Based on what is known of the Pajaro basin hydrogeology, the Aromas Red Sands aquifer appears suitable for an injection project such as the one proposed under the BMP 2000. Although the deposits are extremely heterogeneous, i.e., their composition and grain-size can vary as does their transmissivity (ability to transmit water), the Aromas Red Sands can provide adequate hydrogeologic conditions for injection considering their geologic characteristics, depth and extent. In regards to hydraulics, the aquifer must have adequate transmissivity and a sufficient depth to water. Depth to water is of particular concern. Injecting water into an already shallow aquifer can cause intolerable mounding conditions and can reduce the desired injection pressures thereby reducing the capacity of the injection project. Based on current hydrogeologic information regarding the Pajaro Valley, it appears that areas within the basin adequately satisfy minimum requirements for water injection. These areas would be characterized as those with sufficiently deep groundwater levels underlain by the Aromas sands.

Determining the location of the injection/extraction wells would be done on a regional basis rather than completing localized, site specific hydrogeologic assessment at each proposed well location. As long as the geology is known to be relatively consistent in a particular area, the injection well can be installed and once complete, the injection and extraction rates are adjusted for the individual well. Information obtained from the installed wells would assist in the design and placement of subsequent wells. Extensive groundwater modeling is not easily accessible nor would it be done in this case because (a) the existing PVIGSM does not have the sensitivity to identify local groundwater reaction caused by a single well, (b) it is not necessary considering that there is data on the formation already available and (c) the best way to test the reaction of an aquifer is to observe the response of an actual well after installation and pumping.

Groundwater injection/extraction can adversely affect groundwater levels, overlying geologic structures, groundwater flow regimes, and adjacent groundwater aquifers. Changes to the geologic and hydrogeologic conditions underlying the project area could permanently alter the

[2] Mr. Feeney assumed for his analysis an injection rate of 1,000 gpm and recovery rate of 2,000 gpm. However, the project proposes injection rates of 500 gpm and recovery rates of 1,000 gpm.

regional or local groundwater availability, recharge, and accessibility. As with other proposed groundwater extraction projects, the PVWMA would perform a feasibility and monitoring study, as described in the Mitigation Measure 5.D.3-5, to evaluate hydrogeologic issues related to implementation of the Modified BMP 2000 Alternative. The study would address issues including underlying geology, groundwater depth, groundwater well location, water conveyance, well spacing, and pumping rates.

Water quality of the CVP water was Mr. Feeney's main focus in his August 2001 evaluation of injection of CVP water. Injection well success depends of the quality of the water injected (injectate). Poor water quality will result in plugging of the injection well that will temporarily or permanently impact well performance. The maintenance of well performance can be costly and time consuming. The primary hydrologic impacts related to surface water injection is poor water quality water entering the groundwater through injection and adversely affecting the groundwater quality. Similar to requirements of Measure 5.D.3-4b, the PVWMA would prepare and implement a monitoring and treatment plan to ensure that surface water intended for injection is adequately treated and monitored and so that applicable federal and state drinking water standards are not exceeded. Proposed injectate would require treatment to meet Surface Water Treatment Rule provisions and to remove, among other potential constituents, nitrate, iron, manganese, and potentially aluminum and arsenic.

Murphy Crossing and Inland Distribution System

Under the Modified BMP 2000 Alternative, none of the impacts associated with Murphy Crossing or the Inland Distribution System would occur. These impacts are disclosed in the Local Water Supply and Distribution Project EIR (PVWMA, 1999), which is incorporated by reference. The following is a summary of those impacts:

- *Air Quality.* Installation of the pipeline would result in dust emissions from excavation and soil handling activities, which could adversely affect nearby sensitive receptors.

- *Wetlands and Special-Status Species Habitat.* Construction of facilities at the Pajaro River crossings would result in temporary impacts to up to 1.4 acres of potentially jurisdictional wetlands/waters of the U.S. that is considered habitat for special-status animal species such as California red-legged frog, western pond turtle, and central California coast steelhead.

- *Cultural Resources*. Ground-disturbing activities associated with the proposed Murphy Crossing facilities and Inland Distribution System could reveal unknown buried or otherwise obscured significant prehistoric and historic cultural resources. Potential indirect impacts to cultural resources, primarily vandalism, could result from the increased access to and use of the general area during construction. Such disturbance could result in the loss of integrity of important cultural resources, including three known cultural resources sites in the project area.

- *Geology*. Construction of the proposed pipelines would result in accelerated erosion and attendant loss of soil resources and effects on sediment discharges in water courses. Almost the entire project area is characterized by soils with slight erosion hazard.

- The proposed pipelines pass through some areas with weak soils subject to settlement and expansive soils that could damage the proposed facilities.
- Large earthquakes would be expected to damage the proposed facilities, impairing and/or disrupting their intended operations.
- *Hydrology and Water Quality*. Construction activities would increase soil erosion and may transport other contaminants to downstream receiving waters.
- Construction activities at the proposed project site could result in dewatering of shallow groundwater resources and contamination of surface water.
- The proposed pipelines would be constructed adjacent to two wells. Construction activities could damage the wells or block access to the wells.
- *Land Use*. Construction of the Inland Distribution System would result in short-term disturbance of adjacent land uses.
- *Traffic*. Traffic on area roadways would temporarily increase as a result of project-generated vehicle trips by construction workers and construction vehicular activities.
- Project construction would increase traffic delays for vehicles traveling past the construction zone.
- Project construction would affect access to adjacent land uses for both general and emergency access.
- Project construction would increase potential traffic safety hazards for vehicles and pedestrians in the construction area.
- *Visual Quality*. Installation of the Inland Distribution System lateral lines would disturb lands within the alignments, which would temporarily alter the visual landscape.
- *Recreation*. Development of the inland and Murphy Crossing facilities and the Inland Distribution System would temporarily disrupt recreational uses along Highway 129, a designated bikeway in Santa Cruz County.

As stated above, the Murphy Crossing and Inland Distribution System facilities were originally proposed as part of the PVWMA's Local Water Supply and Distribution Project, which was evaluated in 1999. Many of these impacts, such as traffic disruption, noise, and dust, would result from construction and would be temporary. Other impacts, such as disturbance of jurisdictional wetlands and waters of the U.S. at the Pajaro River crossings, would require detailed mitigation plans that would be developed in consultation with the permitting agencies (California Department of Fish and Game, National Marine Fisheries Service, and U.S. Army Corps of Engineers). The Murphy Crossing and Inland Distribution System facilities have not yet been implemented because the mitigation that would be required reduce impacts to fisheries was determined to be problematic following initial consultation with the permitting agencies.

6.2.3 MODIFIED LOCAL-ONLY ALTERNATIVE

DESCRIPTION

This alternative addresses the fundamental shortcoming of the Local-Only Alternative, that it requires fallowing a significant amount of agricultural land. This alternative adds another new recharge basin for recycled water, referred to as the Southeast Dunes recharge basin (the site is southeast of the existing Harkins Slough recharge basin). The specific water supply, transmission, and storage projects comprising this alternative are shown in **Figure 6.2** and include:

- *Harkins Slough Facilities*. Water diverted from Harkins Slough would be conveyed westward and operationally mixed with recycled water and Watsonville Slough water (described below). The Harkins Slough recharge basin would percolate recycled water, slough water, or operationally blended water.

- *Pinto Lake Diversion*. This component would be as described in Chapter 2. There would be no diversion from Corralitos Creek.

- *Watsonville Slough Diversion*. This component essentially would be as described in Chapter 2, except the water would be operationally mixed prior to recharge in the three basins (no slough water would be conveyed to College Lake). In addition, an independent 7,500-gpm filter facility would be constructed for water treatment.

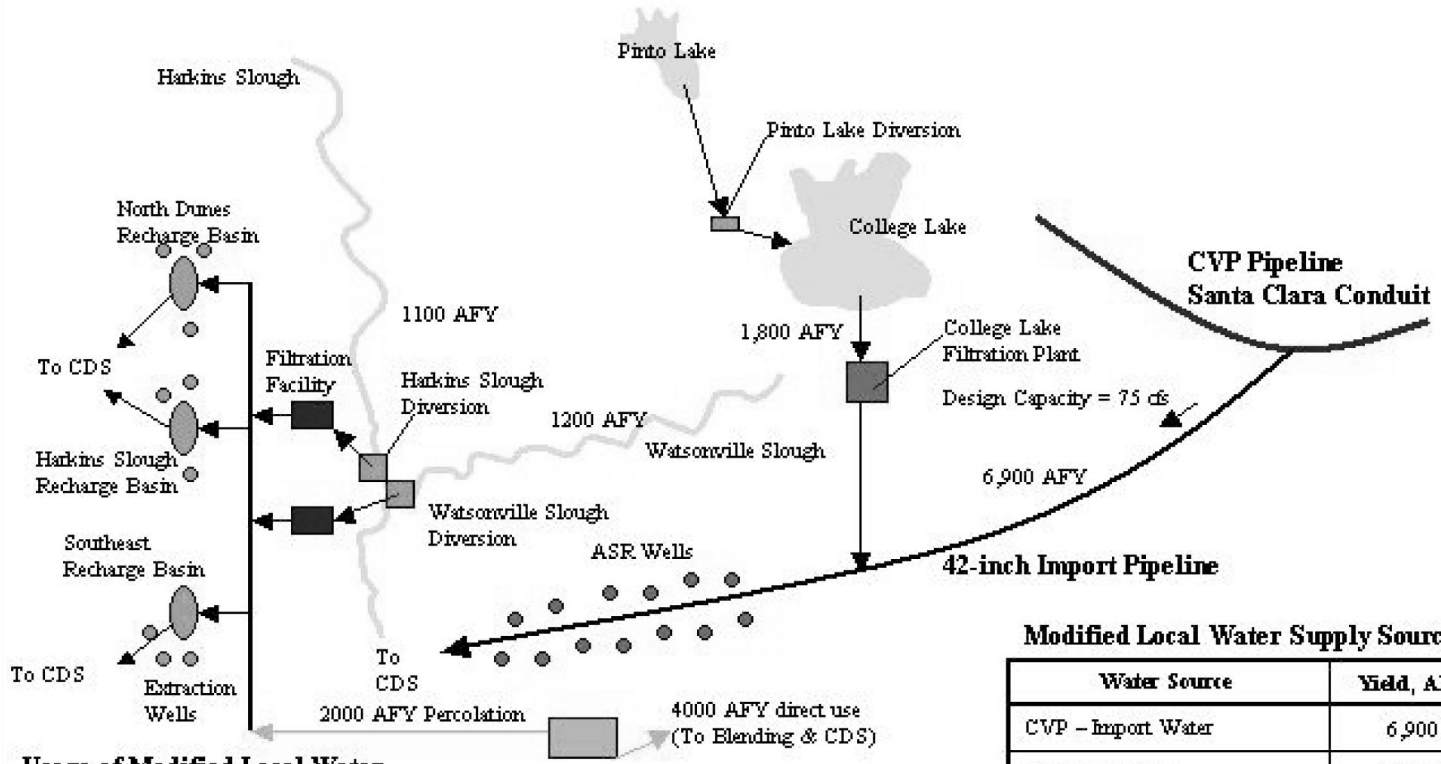
- *Import CVP Water*. This project would be as described for the BMP 2000 Alternative, except that the quantity of imported water (and, consequently, the size of the pipe diameter) would be smaller. There would be an in-line blending facility at the pipeline's terminus near Highway 1.

- *Recycled Water Facility*. Proposed facilities located adjacent to the WWTF would be as described in Chapter 2. For this alternative, there would be pipelines from the Recycled Water Facility to the Harkins Slough area and to the western terminus of the surface water pipeline (these are elements of the Local-Only and BMP 2000 alternatives, respectively). The pipelines would convey water from the slough diversion projects and the Recycled Water Facility westward to the three basins. Upon recovery, water from the basins would be conveyed eastward to an in-line blending facility at the highway 1 near the Pajaro River. Blending of all supplemental supplies would occur at this location prior to delivery in the Coastal Distribution System.

- *College Lake*. This project would be the same as that evaluated for the College Lake project in the Local Projects EIR. The project includes a pipeline from College Lake to the Import Pipeline (the CVP Import Pipeline) as evaluated under the Local Projects EIR. In addition, water from the College Lake watershed and Pinto Lake Diversion project would thus be piped southward and blended (via an in-line blending facility) with imported CVP water prior to distribution for subsequent use.

- *North Dunes recharge basin*. This component would be as described in Chapter 2, except that blended water would be percolated into the basin.

- *Southeast recharge basin*. This component is described below.



Usage of Modified Local Water

Use/Storage	AFY
Direct Use & ASR	12,700
Percolation ponds+ Recovery	4,300
Total	**17,000**

Modified Local Water Supply Sources

Water Source	Yield, AFY
CVP – Import Water	6,900
Harkins Slough	1,100
Watsonville Slough	1,200
College Lake & Pinto Lake	1,800
Recycled Water Project	6,000
Total	**17,000**

SOURCE: RMC

Figure 6.2

Modified Local-Only Alternative Flow Schematic

With the Modified Local-Only Alternative, recycled water and water from local surface supplies would be blended with CVP water prior to direct use, injection, or recharge (percolation). Consequently, the potential adverse water quality impacts associated with direct application of recycled water, injectate, and percolation of recycled water all would be less under the Modified Local-Only Alternative relative to the Local-Only Alternative. Advanced treatment (reverse osmosis) likely would not be required. However, direct use of water from College Lake may still lead to *Phytophthora* problems. Unlike the Local-Only Alternative, this alternative would have sufficient water supplies to halt seawater intrusion without requiring land fallowing.

All but two of the components of the Modified Local-Only Alternative are evaluated in Chapters 3 through 5 of this EIR. The two components are the pipeline between College Lake and the Import Pipeline (the College Lake Pipeline), and the Southeast Dunes recharge basin. These components are described below. The College Lake Pipeline was addressed in the Local Water Supply and Distribution EIR (PVWMA, 1999). Impacts associated with the two components are discussed below.

College Lake Pipeline

The College Lake Pipeline ties the College Lake pump station to the Import Pipeline. The College Lake Pipeline is comprised of the College Lake lateral and a portion of the connecting pipeline, both of which were addressed in the Local Water Supply and Distribution EIR (PVWMA, 1999). The 24-inch College Lake Pipeline extends south and west from the College Lake pump station across private property, then continues south across Corralitos Creek and Holohan Road. The pipeline extends east and south across private property, crosses Highway 152, and proceeds in a generally southeastern direction across private property to Salsipuedes Creek. The pipeline extends south along the outside of the west levee of Salsipuedes Creek, and then turns east, crossing under Salsipuedes Creek and Lakeview Road. From this point, the College Lake Pipeline continues south across private property, proceeds west along Highway 129, south to the Pajaro River, west along the outside of the north levee of the Pajaro River, and then south across the river and private property where it joins the Import Pipeline.

Southeast Dunes Recharge Basin

The Southeast Dunes recharge basin would be 17.1 acres including sideslopes of 3:1 (horizontal to vertical), a depth of 10 feet, and a 12-foot-wide service road around the perimeter. The percolation rate is assumed to be 0.6 feet per day and the required percolation area is 13.9 acres assuming 2,000 AF are percolated in an assumed eight-month period. Approximately 2,000 afy of water would be recharged. Water from Harkins Slough and Watsonville Slough would be mixed with the recycled water and then percolated into the three recharge basins (Harkins Slough, North Dunes, and Southeast Dunes recharge basins). Upon extraction of water from the recharge area water would be conveyed back via the same pipeline to a blending point at Highway 1. The blending point is assumed to be inline (in the pipeline) blending that would be within the buried pipeline south of the Pajaro River and west of Highway 1. Water would then be delivered to the Coastal Distribution System.

ENVIRONMENTAL IMPACTS

This alternative is environmentally preferable to the Local-Only Alternative in that it would reduce or eliminate several impacts associated with the latter, as follows:

- This alternative does not warrant the fallowing of agricultural land.
- Recycled water would be blended with local surface water and CVP water prior to direct application and recharge.
- Impacts to fisheries in Corralitos Creek would not occur.
- Impacts associated with surface water injection (the ASR project), including the ASR pipeline construction.
- Impacts associated with the College Lake dam would be substantially less than under the Local-Only Alternative. The Modified Local-Only Alternative would result in the conversion of up to one-half acre of agricultural land, while the Local-Only Alternative would convert up to 16 acres of agricultural land.

However, this alternative essentially combines many of the impacts attributable to the Local-Only Alternative with those of the BMP 2000 Alternative. The difference in the magnitude of impacts associated with construction of the smaller diameter Import Pipeline are incremental. Below is a discussion of the construction and operation-phase impacts associated with the College Lake Pipeline and Southeast Dunes recharge basin components.

College Lake Pipeline

The following discussion is based on analyses presented in the Local Water Supply and Distribution EIR (PVWMA, 1999).

Land Use. Construction disturbance related to the proposed pipeline could temporarily constrain access to uses along Holohan Road, Lakeview Road, and Highways 129 and 152. These uses include St. Francis Church, St. Francis School, Lakeview Middle School, farmlands, and residences. Although pipelines will be installed through bore and jack methods, construction activities within these roadways could constrain operations of St. Francis Church and nearby schools and could impede access to adjacent farmlands. School operations could be adversely affected if roadways or driveways were blocked or restricted on weekday mornings and afternoons during the school year, while church activities would be affected if construction work restricted access during services. However, this would be a temporary impact that results more in inconvenience to motorists than a substantial impact and, therefore, would not be expected to substantially impair school and church operations. Typical construction activities would be expected to last approximately one week at any given location along the pipeline alignment.

Geology and Soils. Construction of the proposed pipeline and water diversion and treatment facilities would result in accelerated erosion and attendant loss of soil resources and effects on sediment discharges in water courses. The impact would be significant on slopes over 2 percent and in areas with soils having moderate or greater erosion hazard.

The pipeline would pass through some areas with weak soils subject to settlement, expansive soils and potentially corrosive soils that could damage the proposed facilities. Soils with high organic content are subject to hazards of settlement and in some areas may be corrosive to pipe. These soils may weaken joints in the pipelines, displace them, and eventually bend or break the pipelines. Soils with high clay content are subject to shrink-swell behavior that can result in damage to pipe joints and displacements. These effects could impair operation of the facilities and result in costly repairs and their associated impacts. The proposed project includes a commitment to conformance with requirements for placement of buried pipelines in trenches with engineered soils that would reduce or eliminate the hazards for the most part. In the long term, settlement of the pipeline is an anticipated effect and design requirements can be established to allow settlement within acceptable levels.

Large earthquakes would be expected to damage the proposed facilities, impairing and/or disrupting their intended operations. The potential exists for large magnitude earthquakes to result in high intensity groundshaking and secondary earthquake effects, notably liquefaction. Intense groundshaking and high gravitational acceleration would affect the entire area of College Lake. This could cause loosening of pipeline joints resulting in leaks and possibly also breaking of a pipeline. Pumps could be rendered inoperable. The most severe impacts of this type would result from liquefaction of the soil, which could induce both vertical and lateral displacement of the soil that would bend, weaken, and break pipelines. Broken pipelines could result in soil wash-out and sinkholes.

Locating and repairing damaged pipelines and the pumps could require a substantial effort and cost, and result in cessation of operation of the facilities for a significant period of time. The loss of the water supply, in turn, could affect agricultural operations. It is assumed that under a scenario of loss of the water supply from an earthquake (or other maintenance functions), growers temporarily would increase their use of groundwater, providing that their wells are operable following an earthquake. Therefore, pumping of groundwater would mean that no significant loss in agricultural production would be expected.

Hydrology and Water Quality. Construction activities would increase soil erosion and may transport other contaminants to downstream receiving waters. Construction at the project sites would involve soil disturbing activities such as vegetation removal, grading, and excavation which would expose soils to erosion and may result in the transportation of sediment downstream where deposition would occur. Pipeline construction would require excavation of trenches and temporary stockpiling of soils. Wind and rainfall could cause erosion of stockpiles and sedimentation downstream. Although the amount of erosion at the project site is projected to be low due to the flat topography, the sediment and adhered substances are sources of pollution in receiving waters. Sediment from erosion would increase turbidity which could have adverse effects on fish and wildlife habitat, reduce the efficiency and life of pumps and pipelines conveying water for the project, increase costs for treating water for various uses, increase flood hazards from reduced channel capacities, and impair recreation and aesthetic values.

Fuels, solvents and/or other chemicals used in construction activities could be spilled, dumped, or discarded and ultimately seep or leak into waterways draining the project site.

Construction of the College Lake Pipeline could result in dewatering of shallow groundwater resources and contamination of surface water. Excavation and construction of open trenches often can intercept shallow groundwater requiring dewatering to lower local groundwater levels to dry the area for construction. The groundwater is pumped and discharged to the local drainage system. The area of groundwater reduction is generally in the immediate construction area and the effect on groundwater conditions would be expected to be temporary and minor. Depending on the quality of the groundwater, the discharge could potentially contaminate downstream surface water sources.

Impacts related to construction projects are typically associated with soil erosion and subsequently, sedimentation entering surface waters. Discharge of water removed from excavations and discharged into surface water sources can also degrade otherwise unimpacted water bodies. Similar to Mitigation Measure 5.B.3-1, the agency would prepare a SWPPP as part of the construction activities associated with the National Pollutant Discharge Elimination System (NPDES) stormwater permit required by the RWQCB. At a minimum, this plan would include guidelines and requirements intended to reduce erosion, control runoff, protect surface waters and regulate dewatering activities.

The College Lake project would convey water that normally would flow to the ocean, to agricultural lands for irrigation, thereby decreasing the need to pump groundwater. The College Lake project would provide a water supply for irrigation that would replace water currently pumped from the groundwater basin. This would in part reduce overdraft of the basin and reduce seawater intrusion and therefore is a beneficial impact on groundwater quality and flow.

Vegetation and Wildlife. Pipeline crossings could result in temporary impacts on potential jurisdictional wetlands/waters of the U.S. and streambeds and banks under the jurisdiction of the CDFG. Potential impacts include sedimentation of the channels adjacent to the construction area during trenching activities, and temporary loss of wetland-associated vegetation, stream function as wildlife and fishery habitat, and loss of special-status natural communities.

Construction of facilities in and near wetlands could result in temporary impacts to special-status animal species and their habitats. Impacts could occur due to increased sedimentation in streams, dewatering of pools, habitat loss through vegetation removal, destruction of nests and burrows and construction disturbance. These impacts could be reduced to less-than-significant levels by designing facilities to avoid habitat areas, or by conducting surveys for special-status animal species and implementing protection measures identified in the 1999 Local Water Supply and Distribution EIR.

Cultural Resources. Construction activities associated with the proposed College Lake Pipeline alignment and associated facilities may result in the alteration or destruction of identified cultural resources. Two cultural resources (prehistoric and historic) were identified adjacent to and/or within the pipeline alignment.

Significant unknown cultural resources may be buried or obscured by vegetation along the pipeline alignment, and therefore construction of the proposed pipeline could result in degradation and destruction of undiscovered cultural resources.

Air Quality. Construction of the project would generate fugitive dust (including PM_{10}), and other criteria air pollutants from exhaust emissions. A large portion of the total construction dust emissions would result from trench excavation activities. Dust emissions would vary from day to day, depending on the phase of construction, the silt content of the soil, and the weather. Daily emissions would depend greatly upon whether construction of the various supply components and distribution systems would occur simultaneously. Implementation of a dust abatement program would reduce this impact to a less-than-significant level.

Traffic. The proposed alignment would follow adjacent to, or within a portion of, Highway 152, and cross Highway 152, Highway 129, Holohan Road, and Lakeview Road. The specific alignments of installation of pipeline would be identified during the design phase of the project. Assuming open trench activities proceeding at an average rate of 100 feet per day, impacts would be brief at any one location along the pipeline alignment. Special construction techniques (e.g., bore and jack) would be utilized to install pipelines under Highway 152, Holohan Road, San Juan Road, and Highway 129.

Existing transportation and circulation patterns in the vicinity of the proposed pipeline alignment would be temporarily disrupted by construction activities and heavy equipment use in the roadways. Impacts related to pipeline construction would include direct disruption of traffic flows and roadway operations. Lane blockages or roadway closures during pipeline installation would result in a reduction in travel lanes, and could result in the need for traffic rerouting. Most prominently, potential construction along Highway 152 could significantly impact traffic flow and operations at this location.

Public Services. Pipeline and/or facility construction could result in temporary, planned or accidental disruption to utility services provided by underground lines. Impacts to utilities and services involve temporary disruption, which in most cases, would not exceed one day. All utility lines and cables, which would be disrupted during pipe installation, will be identified during preliminary design. As a condition of approval for a utility excavation permit a detailed engineering and construction plan, which thoroughly describes construction techniques and protective measures for minimizing impacts to utilities would be prepared by PVWMA contractors. This plan requires review by the appropriate special service districts or utility services in the project area.

Pipeline construction could temporarily impede vehicle access to police, fire, or emergency services. Since construction will proceed at a rate of about 100 feet per day, vehicle access to an individual residence or business would be impeded for a maximum of one to two days. PVWMA will employ construction methods described in the assessment of traffic impacts which would reduce this impact to a less than significant level.

Visual Quality and Recreational Resources. Construction of the pipeline could tear up roadways and remove small areas of native vegetation and crops along the alignment. These features contribute to the scenic quality of Highway 152 and Holohan Road, both of which are City-designated scenic routes. This would be a temporary impact, since cropping would be allowed to occur on agricultural lands within the alignment following installation of the pipeline. For this reason, the construction disturbance is considered a less than significant impact. During construction, excavated trenches and stockpiled soils, pipe, and other materials within the construction easement would constitute negative aesthetic features to the pipeline alignment. This would be a temporary adverse impact and would be considered less than significant. Following construction, the proposed pipeline would be located entirely below grade and would be unobtrusive.

Construction of the College Lake Pipeline would disrupt bicycle traffic along Highway 152, Holohan Road, and Lakeview Road, all of which are included in the Santa Cruz County bikeway system. Construction activities and related truck traffic could damage the bikeways, and segments of the bikeways in active construction areas would be temporarily closed during trench excavation and pipeline installation, creating minor inconveniences to bicyclists. However, damaged roads would be repaired to preconstruction conditions, and detours would be provided for bicyclists and motorists during the construction period. Therefore, this impact would be less than significant.

Southeast Dunes Recharge Basin

Land Use. Construction of the 17.1-acre Southeast Dunes recharge basin would result in the permanent loss of approximately 4.7 acres of Prime Farmland (3.2 acres for the side slopes of the basin, and 1.5 acres for the service road extending around the basin). The basin bottom (13.9 acres) would be available for farming during the summer and fall of each year for the life for the project. This would be a significant unavoidable impact. However, it is recommended that the topsoil from areas to be excavated and graded be removed, and spread over areas within the Pajaro Valley containing agricultural soils of lesser productivity. This would allow for a partial recovery of the loss of this valuable resource.

Hydrology and Water Quality. Construction of proposed Southeast Dunes recharge basin could result in increased erosion and subsequent sedimentation, with impacts to water quality. Additionally, release of fuels or other hazardous materials associated with construction activities could degrade water quality. PVWMA would prepare and implement a Storm Water Pollution Prevention Plan to reduce this impact. Impacts related to construction projects are typically associated with soil erosion and subsequently, sedimentation entering surface waters. Similar to Mitigation Measure 5.B.3-1, the agency would prepare a SWPPP as part of the construction activities associated with the National Pollutant Discharge Elimination System (NPDES) stormwater permit required by the RWQCB. At a minimum, this plan would include guidelines and requirements intended to reduce erosion, control runoff, protect surface waters.

Groundwater recharge with recycled water would degrade water quality. The Recycled Water Facility would operate year-round, and during periods of low or no irrigation demand the

recycled water would be routed to the recharge basins for percolation to the shallow aquifer. This action could conflict with DHS policy, as described in the draft regulations. According to Title 22, Section 60320, DHS would provide "recommendations" to the RWQCB during the permitting process to ensure that a proposed project fully protects public health.

Cultural Resources. Construction activities associated with the proposed Southeast Dunes recharge basin could result in the degradation and destruction of undiscovered cultural resources.

Air Quality. Construction of the project would generate fugitive dust (including PM_{10}), and other criteria air pollutants from exhaust emissions. A large portion of the total construction dust emissions would result from trench excavation activities. Dust emissions would vary from day to day, depending on the phase of construction, the silt content of the soil, and the weather. Daily emissions would depend greatly upon whether construction of the various supply components and distribution systems would occur simultaneously. Implementation of a dust abatement program would reduce this impact to a less-than-significant level.

Visual Quality and Recreational Resources. Creation of a recharge basin would not be considered an adverse visual impact, since waterways are aesthetically pleasing to many people, and the recharge basin would not alter the rural character of the area. Additionally, no change in the visual landscape would be apparent in the summer and fall, when crops would be planted in the recharge basin. The recharge basin would not alter views from nearby San Andreas Road, which is a designated scenic road in the Santa Cruz County General Plan/Local Coastal Program and the City of Watsonville General Plan. Therefore, this would not be considered a significant visual impact.

6.2.4 REGIONAL SERVING ALTERNATIVE

DESCRIPTION

This is a discussion of the potential future development of an alternative; currently, no regional-serving project has been developed.

In its letter responding to the Notice of Preparation for this EIR, Soquel Creek Water District (SCWD) requested consideration of a joint water supply project between SCWD and PVWMA. PVWMA has since continued discussions with SCWD, and a conceptual Memorandum of Agreement (MOA) has been approved by both agencies. The purpose of this MOA is to set forth the parties' intent to work together toward developing a potential project in which PVWMA would acquire and distribute a water supply of approximately 2,000 afy to SCWD in order to meet its long-term water supply needs, and provide a net gain of water to the Pajaro Valley. If the agencies determine that a viable project may be developed between them, the agencies can enter into a binding agreement in the future.

As described in Section 3.9, Public Services, SCWD serves unincorporated areas of southern Santa Cruz County and shares groundwater resources in the Aromas Red Sands aquifer with PVWMA. In order to plan for a sustainable water supply into the future, SCWD initiated the

Integrated Resource Planning (IRP) process. The IRP examined projected future water demands, potential savings from conservation, and alternatives for supplementing groundwater supplies to achieve and maintain sustainable water supply. The key conclusion of the IRP process was that without a supplemental source of water supply, the SCWD would not be able to achieve its groundwater management objectives of keeping coastal groundwater levels above sea level while meeting existing and projected water demands. Thus, the SCWD is presently conducting planning studies regarding the procurement of a supplemental source of supply of up to 2,000 afy. The SCWD is examining both local and regional alternatives, in proposed partnership with the PVWMA and/or City of Santa Cruz.

Should PVWMA and SCWD choose to pursue a regional water project in the future, supplemental environmental review pursuant to CEQA would be required.

6.2.5 ALTERNATIVE ALIGNMENTS TO THE IMPORT PIPELINE

Several pipeline local route variations were considered by the PVWMA for specific segments of the Import Pipeline. These alternative routes are represented by dotted lines on Maps A1 through A4 in the Map Appendix. The alternative routes were proposed because of engineering design considerations (e.g., availability of easements) and flexibility in final site selection, and are not complete alternatives to the project as their implementation would still involve construction of the Import Pipeline to bring water into the PVWMA service area.

A discussion of the environmental impacts associated with the alternative pipeline alignments is presented in Appendix E, Alternative Alignments. In summary, the impacts associated with the preferred alignment would either be similar to, or lesser in magnitude than, those associated with these alternative alignment segments. The environmentally superior alignment would combine the preferred alignment with the alternative alignment described in Mitigation Measure 4.B.4-3b, which requires rerouting of the pipeline to avoid mature oaks trees that provide habitat for raptor species.

6.3 ALTERNATIVES COMPARISON AND ENVIRONMENTALLY SUPERIOR ALTERNATIVE

The purpose of this section is to present a comparison of the alternatives and to identify the environmentally superior alternative. Consistent with the CEQA Guidelines (Section 15126.6[a]), the comparison of alternatives and determination of the environmentally superior alternative is based on the ability of the alternative to meet the basic objectives of the project while avoiding or substantially lessening any significant impacts. Consequently, this section presumes implementation of mitigation measures identified in the EIR. The key summary points regarding the impacts associated with the alternatives are:

- All of the four "action" alternatives—the BMP 2000 Alternative, the Local-Only Alternative, the Modified BMP 2000 Alternative, and the Modified Local-Only Alternative—are environmentally superior to the No Project Alternative. The No Project Alternative would allow for continued degradation of the groundwater basin from overdraft and seawater intrusion, and does not satisfy any of the project objectives.

- The Local-Only Alternative does not satisfy the primary objective of the project without fallowing farmland, while the other three action alternatives meet the project's basic objectives.

- Most of the impacts result from construction activities. To a great extent, these impacts can be mitigated to less-than-significant levels with measures identified in this EIR.

- The four action alternatives present different combinations of the same or similar components and, consequently, have many of the same or similar impacts.

- The alternatives that involve more construction generally result in more (greater magnitude) impact. However, traffic, air quality, and construction noise impacts do not substantially differ from one alternative to the next. Any of the action alternatives would result in a significant unavoidable temporary increase in PM10 emissions; traffic and construction noise impacts would be similar and could be mitigated to less-than-significant levels.

- The BMP 2000, Modified BMP 2000, and Modified Local-Only Alternative all include a version of the Import Pipeline. The difference in diameter would not materially affect the scope and magnitude of the impacts of constructing and operating an Import Pipeline. The construction corridors (which determines the scope of impacts to surface features—vegetation and wildlife habitat, agricultural land, stream crossings, et al) essentially would be same under any of these alternatives.

- Growth inducement potential is the same for all of the alternatives.

The distinction among the alternatives is the ability to meet the basic objectives of the project and the degree of impact relative to the following environmental issues: water quality, land use (permanent loss and fallowing of prime farm land), seismic hazards, and biological resource impacts. These issues are discussed below. **Table 6.2** presents a comparison of the distinguishing environmental effects of the alternatives. Significant and unavoidable impacts are denoted by an asterisk; all other impacts could be mitigated to a less-than-significant level.

6.3.1 GROUNDWATER HYDROLOGY AND WATER QUALITY

The primary issues that distinguish the alternatives relate to groundwater hydrology and water quality. Most notable is the inability of the Local-Only Alternative to achieve the primary objective of balancing the basin and arresting seawater intrusion without fallowing more than 2,200 acres of land. All other alternatives provide sufficient water to meet the project's objectives.

TABLE 6-2
COMPARISON OF ALTERNATIVES—IDENTIFICATION OF THE ENVIRONMENTALLY SUPERIOR ALTERNATIVE[a]

IMPACT	CHARACTERIZATION OF IMPACTS FOR EACH ALTERNATIVE			
	BMP 2000 Alternative	**Modified BMP 2000 Alternative**	**Local-Only Alternative**	**Modified Local-Only Alternative**
Groundwater Management—Balancing Supply and Demand[b]	Yes	Yes	No	Yes
Water Quality – Groundwater	Less Adverse	Least Adverse	Most Adverse	More Adverse
Permanent Conversion of Agricultural Land	Least Adverse*	Least Adverse*	Most Adverse*	More Adverse*
Land Fallowing	No Impact	No Impact	Most Adverse*	No Impact
Geology, Soils and Seismicity	Most Adverse*	Most Adverse*	Least Adverse	Most Adverse*
Aquatic Habitat	Less Adverse	No Impact	Most Adverse	More Adverse
Wetlands/Waters of the US/Riparian Habitat	Most Adverse, Temporary	Least Adverse, Temporary	More Adverse, Temporary[c]	More Adverse, Temporary
Upland Species—Plants	No Impact	No Impact	Most Adverse	Most Adverse
Upland Species—Wildlife	Most Adverse, Temporary	Most Adverse, Temporary	No Impact	Most Adverse, Temporary
Visual Quality	Least Adverse	Least Adverse	Most Adverse	More Adverse
RANKING[d,e]	**2**	**1**	**4**	**3**

[a] This comparison table considers the major environmental issues that distinguish the four alternatives. Impacts related to other environmental issues, such as traffic, air quality and noise, would be temporary construction impacts that would be similar for all the alternatives and therefore they are not presented in this table.
[b] Evaluation of alternative's ability to achieve primary project objective.
[c] Involves less than one acre of permanent impact to wetlands and waters of the U.S.
[d] This ranking considers environmental factors only; other factors, such as cost and feasibility, were not considered in this ranking. This ranking assumes that the mitigation measures identified in this EIR will be implemented.

[e] Alternative Ranking

4 – Alternative with the most adverse environmental impacts
1 – Environmentally Superior Alternative

* Denotes a significant unavoidable impact.

With respect to water quality impacts, those alternatives with more CVP water relative to local supplies have better water quality and, consequently, lesser magnitude impacts. (For an overview of source water quality, refer to Table 2.3 in Chapter 2.) The Local-Only Alternative would have the worst impacts relative to water quality because of source water quality problems for injection/extraction of surface water, and the direct use and recharge of unblended recycled water. This alternative would require advanced water treatment, the implementation of which would create additional environmental impacts (additional facilities would impact more prime agricultural land). The BMP 2000 and Modified BMP 2000 alternatives have the highest quality water (between the two, the Modified BMP Alternative would have incrementally better source water quality because it includes more CVP water and no water from the Pajaro River at Murphy Crossing).

6.3.2 LOSS OF PRIME AGRICULTURAL LAND

Each of the four alternatives would result in the loss of prime agricultural land. For the BMP 2000 Alternative, construction of the Recycled Water Facility and 17 supplemental well sites would result in the permanent conversion of up to 8.5 acres of prime farmland. The Import Pipeline and the Inland and Coastal distribution systems would disrupt agricultural operations along the alignment temporarily during construction, but would not result in a permanent conversion of agricultural land.

The Modified BMP 2000 Alternative also would permanently convert up to 8.5 acres of prime agricultural land for construction of the Recycled Water Facility and 17 supplemental wells. The Import Pipeline would not result in permanent conversion of agricultural land.

Under the Local-Only Alternative, up to 41.6 acres of prime farmland would be permanently converted due to construction of the Recycled Water Facility, Expanded College Lake, Corralitos Creek Pump Station, and Aquifer Storage and Recovery (ASR) components. The Local-Only Alternative also would require the fallowing of more than 2,200 acres of irrigable prime farmland.

For the Modified Local-Only Alternative, the Harkins Slough, Pinto Lake Diversion, Watsonville Slough Diversion, Import Pipeline, Recycled Water Facility, College Lake, North Dunes recharge basin, and Southeast Dunes recharge basin components would result in the permanent conversion of 30.7 acres of farmland. No land fallowing would be required under this alternative.

6.3.3 GEOLOGY, SOILS AND SEISMICITY

Portions of the Import Pipeline alignment proposed under the BMP 2000 Alternative, the Modified BMP 2000 Alternative, and the Modified Local-Only Alternative cross the active San Andreas and Sargent faults. A major displacement of either fault would result in pipeline rupture. The EIR identifies a number of measures to mitigate this impact (pipe specifications at fault crossings, special construction techniques and instrumentation, isolation valves, et al.); however, these measures cannot eliminate the chance that the pipe could rupture in a major earthquake. (Surface fault rupture hazard zones are shown on Maps A1 and A2 in the Map Appendix.)

The dam structures included in the Expanded College Lake component of the Local-Only Alternative also could be subject to damage from surface fault rupture, but this impact could be mitigated to a less-than-significant level through engineering design. The College Lake facilities proposed under the Modified Local-Only Alternative could also be damaged by large earthquakes; however, the potential flooding and erosion hazards that could potentially result from such damage would be less adverse than that which would occur under the Local-Only Alternative, which would involve dam structures and increased water storage in the lake.

6.3.4 EFFECTS ON AQUATIC HABITAT

Impacts to aquatic habitat would be more adverse under the Local-Only Alternative than under the BMP 2000 Alternative. Spawning and rearing habitat for south-central California coast steelhead is present in the upper reaches of Corralitos Creek, upstream of College Lake. Conditions for steelhead passage to and from spawning and rearing habitats are the primary fish habitat factors potentially affected. The presence of sufficient stream flows for down-migration of smolts is critical. Constructing and operating a water diversion facility in Corralitos Creek would directly affect steelhead spawning and rearing habitat. Implementation of the Expanded College Lake project would impede migration of the species. There is a cumulative effect on flows to Salsipuedes Creek for the various components of the Local-Only Alternative. The EIR identifies measures to reduce these impacts to less-than-significant levels; these measures would reduce the yield of the Local-Only Alternative.

With the Modified Local-Only Alternative, impacts to steelhead would be of lesser magnitude, since the there would be no diversion from Corralitos Creek; however, impacts associated with College Lake would still occur.

Although the Murphy Crossing component of the BMP 2000 Alternative also would adversely affect steelhead, it would affect migratory habitat (the Pajaro River), and would not affect spawning or rearing habitat.

The Modified BMP 2000 Alternative would avoid impacts to aquatic habitat and steelhead.

6.3.5 EFFECTS ON WETLANDS/WATERS OF THE US AND RIPARIAN HABITAT

There are a number of special status species in the project area that are associated with wetlands and riparian habitat, including red-legged frog, Santa Cruz long-toed salamander, western pond turtle, and a number of bird species (refer to **Table 3.4.2**).

Assuming implementation of bore and jack construction at stream and river crossing, impacts to potentially jurisdictional wetlands/water of the US and riparian habitat and wildlife would be significantly reduced under all alternatives. Implementation of the BMP 2000 Alternative potentially would result in disturbance of up to 1.4 acres (0.2 acre for the Import Pipeline, assuming that Pajaro River crossings would be constructed using bore and jack methods, and 1.4 acres for the Murphy Crossing project). Under the Local-Only Alternative, about one acre of

potentially jurisdictional wetlands/waters of the US (assuming bore and jack for crossings of Watsonville Slough, Corralitos Creek, and Harkins Slough).[3]

Under the Modified Local-Only Alternative, approximately one-half acre of potentially jurisdictional wetlands/waters of the US would be disturbed, assuming bore and jack crossings of streams.

Under the Modified BMP 2000 Alternative, construction activities would disturb up to 0.2 acre of potentially jurisdictional wetlands/waters of the U.S (Import Pipeline).

6.3.6 UPLAND SPECIES

One of the largest remaining populations of Santa Cruz tarplant, a species that has been proposed for listing as federally threatened and is currently listed by the State as endangered, occurs on the Watsonville Airport property and likely occurs on the private property to the west of the airport as well. The population at the airport may be important to the survival of the species. Under either the Local-Only Alternative or the Modified Local-Only Alternative there would be direct impacts to Santa Cruz tarplant. Relocating the pipeline alignment to Airport Boulevard would avoid impacts to tarplant, but would result in adverse impacts on traffic and circulation due to the temporary closure of traffic lanes and the subsequent increase in traffic congestion and safety hazards.

Construction of the Import Pipeline (BMP 2000, Modified BMP 2000, and Modified Local-Only alternatives) could disturb sensitive species found in annual grassland habitat. The special status animal species associated with this habitat that have the potential to occur in the study area include the San Joaquin kit fox and western burrowing owl. Direct impacts to the species would be avoided or mitigated through measures identified in the EIR, and no permanent impacts would occur. This impact would be associated with all alternatives except the Local-Only Alternative.

6.3.7 VISUAL QUALITY

The BMP 2000 Alternative and the Modified BMP 2000 Alternative would have less adverse impacts on visual quality than the other alternatives. The BMP and Modified BMP alternatives include the Import Pipeline, which would temporarily disturb lands within the pipeline alignment. Once the pipeline is buried, land within the alignment would be restored to its previous condition, and farming would continue over the pipeline easement in agricultural areas. The Recycled Water Facility, which would result in the most adverse visual quality impacts, would be constructed under all four alternatives. Both the Local-Only and Modified Local-Only alternatives would construct a larger Recycled Water Facility that would include advanced water treatment facilities, as required by Mitigation Measure 5.A.3-4a in Chapter 5. These facilities could increase adverse impacts on views from scenic roads, including Highway 1, Beach Road

[3] PVWMA has committed to implementing pipeline construction techniques (bore and jack) that avoid direct impacts to waterways for crossings of Pajaro River and Watsonville slough (thereby avoiding wetland/waters of the US-related impacts for some components).

and San Andreas Road. Additionally, both the Local-Only and Modified Local-Only alternatives would construct the North Dunes Recharge Basin, and the Modified Local-Only Alternative would construct the Southeast Dunes Recharge Basin. The Local-Only Alternative would be considered to result in more adverse visual quality impacts because it would also construct dam structures at College Lake that would be visible from Highway 152 and Holohan Road. The College Lake facilities proposed under the Modified Local-Only Alternative would be smaller in scale and therefore would be less visible.

6.3.8 ENVIRONMENTALLY SUPERIOR ALTERNATIVE

CEQA requires that an EIR identify an environmentally superior alternative (Guidelines Section 15126.6[e][2]). For this project, all alternatives are considered environmentally superior to the No Project Alternative, which allows for continued degradation of the groundwater basin from overdraft and seawater intrusion and would result in land fallowing. Based on the comparison presented in the preceding section, the Modified BMP and BMP 2000 alternatives are environmentally superior to the Local-Only and Modified Local-Only alternatives. The Local-Only Alternative fails to meet the project's primary objective while lessening environmental impacts. The Modified BMP Alternative is environmentally preferable to the BMP 2000 Alternative in that it would reduce or eliminate impacts to aquatic habitat and steelhead, and would have least impact on wetlands/waters of the US and riparian species habitat. The Modified BMP 2000 Alternative includes fewer facilities, and would result in less construction while providing the highest quality source water.

6.4 ALTERNATIVES NOT EVALUATION IN THIS EIR

A number of potential alternatives to the project were considered by the PVWMA but are not evaluated in this EIR because initial consideration indicated one or more of the following: lack of feasibility; lack of environmental advantages; and/or inability to satisfy the basic objectives of the project. Section 2.2 of this report summarizes the PVWMA's objectives for the BMP. Refer also to the 1993 BMP EIR and Local Projects EIR for discussions of other alternatives eliminated from further consideration, as listed in **Table 6.1**.

6.4.1 RIVER CONVEYANCE OF CVP WATER

Two options exist for transmission of water from the Santa Clara Conduit to the Pajaro Valley – construction of the Import Pipeline (as described for the BMP 2000 Alternative) or use of the Pajaro River for conveyance. For Pajaro River conveyance, water would be obtained from the existing turnout located on the Santa Clara Conduit east of Gilroy. A pipeline would be constructed along the Import Pipeline alignment to a location in the vicinity of Bolsa Road (Highway 25), where water would be discharged to the Pajaro River. Water would then flow in the Pajaro River to a point within the Pajaro Valley where it would be diverted and pumped into the proposed water distribution system.

The Pajaro River discharge would include a simple structure designed to reduce the water velocity to minimize erosion in the river. The downstream diversion structure would either be an expansion of the proposed Murphy Crossing infiltration gallery, or more likely, a combination of the infiltration gallery and a small surface diversion that would be created by an inflatable structure. If the inflatable structure were utilized, it would be operated to minimize its impacts on migratory fisheries, particularly steelhead. It is anticipated that an inflatable diversion structure could not be used during any months when natural migratory flows are present, and the diversion during these migratory periods would have to be made through an infiltration gallery only. Therefore, agricultural water deliveries could begin as early as April, and would last until October.

A major concern related to this alternative is the degradation of water quality and loss of water as it flows in the Pajaro River. The Pajaro River electrical conductivity and total dissolved solids concentrations are often much higher than those acceptable for agricultural irrigation use. Through blending, the overall concentrations would be reduced during most months of the year, and the water quality could be at acceptable levels for irrigation use. However, it may not be possible to reach acceptable levels during periods when river lows are in the 50 cubic feet per second (cfs) to 100 cfs range, due to electrical conductivities during such periods, resulting in water quality that could reduce yields of strawberry and other crops in the Pajaro Valley.

A second concern is the potential water losses that could occur along the river through riverbed seepage, riparian vegetation use, or adjacent landowner use. Seepage losses that occur downstream of Aromas should provide some direct recharge to the groundwater aquifer and benefit those paying for the CVP water. However, seepage that occurs upstream of where the Pajaro River crosses the San Andreas Fault Zone would benefit areas outside of the Pajaro Valley. In addition, the variability in seepage from month to month and year to year would make operating rules regarding releases to the river and diversion from the river facilities more difficult. In addition, some flow would be lost to evaporation along the river, particularly during the summer months.

The listing of steelhead as an endangered species has resulted in minimum flow requirements and a minimum flow depth of 0.75 feet is required in the Pajaro River for the passage of migrating steelhead. The migration of steelhead occurs between January 1 and May 31, which the period when the flows are higher and natural flow diversions occur. In that case, the diversion from the river could be limited to the period ranging from May to September, which is generally consistent with irrigation requirements.

There are several other concerns related to the River Conveyance Alternative, including:

- The effects of flow regime variability on instream conditions and aquatic ecology.
- The ability for steelhead to “fingerprint” the water quality of the Pajaro River for successful identification of a water body used for migration. Altering the water quality with imported water flow could affect the ability for steelhead to imprint the Pajaro River.
- The potential water quality effects, described above, on river-related biological resources.

- Introduction of non-native species into the watershed and the introduction of new diseases via water and/or organisms.

6.4.2 OUT-OF-BASIN BANKING

Out-of-basin banking is an alternative means of storing CVP water. Implementation of an Out-of-Basin Water Banking program would allow the PVWMA to partner with another CVP contractor to transfer excess CVP water supplies from the PVWMA to the CVP contractor during wet or normal years. During dry years, the CVP contractor would transfer CVP water back to PVWMA. For PVWMA, out-of-basin banking increases the reliability of the CVP supply, and minimizes the need for additional storage facilities and the size of delivery pipelines. Provisions of a water banking agreement typically require that the contractor acting as the water bank keeps a portion of this water, which is estimated to be approximately 10 percent of the total banked water supply. This 10 percent accounts for seepage, evaporation, and unaccounted for losses.

PVWMA may, in the future, investigate out-of-basin banking storage options if the BMP 2000 Alternative (or the Modified BMP 2000 Alternative) is selected for implementation.

6.4.3 DESALINATION

SEAWATER DESALINATION

Seawater desalination would provide a reliable supply of water for the Pajaro Valley by converting seawater or other high TDS water into potable water. Currently, reverse osmosis (RO) treatment is the most cost-effective and feasible treatment option for desalination. Because a desalination plant can be sized and operated to provide a continuous source of supply, this alternative requires less supplemental supply to meet the valley's needs. Additionally, the continuous nature of the desalinated water supply eliminates the need for development of the Inland Distribution System or ASR component. Therefore, only a Coastal Distribution System is required.

Because of the high TDS concentration of seawater (~35,000 mg/L), the RO membranes reject more than 50 percent of the feedwater during the treatment process. Therefore, if 10,000 afy of desalinated water is needed, the treatment plant must be sized for a flow of 20,000 afy. As such, the high feed pressure and need to "double-size" the treatment capacity results in a high electric power requirement.

The BMP evaluated the construction of a reverse osmosis desalination plant to treat Monterey Bay seawater for agricultural irrigation. The quality of the desalinated water would require blending with either recycled water or groundwater prior to irrigation. One option would be to size the plant to supply 16 to 27 million gallons per day (mgd) to the Pajaro Valley during irrigation months. Another option is a regional desalination plant that would provide irrigation as well as augmenting drinking water supplies for both Santa Cruz and Monterey Water Districts; the overall plant capacity would be 30 to 65 mgd. Two sites were evaluated: (1) adjacent to the

proposed WWTF recycled water plant; and (2) adjacent to the existing thermal electric generating facility at Moss Landing. Siting the desalination plant at the WWTF could take advantage of proposed water facilities, and the brine from the desalination facility would be discharged via the existing WWTF outfall. The advantages of the Moss Landing site result from the coupling of a desalination plant with an existing power generation facility. The existing thermal electricity facility cycles approximately 800 mgd of seawater as cooling water. Other advantages include elevated feed water temperature, which reduces energy needs; existing land and storage plants; and potential to partner with other agencies for a regional facility.

A desalination project would consist of an RO plant, as described above, an onshore pumping station and chemical treatment unit, a seawater intake structure, an onshore/offshore seawater supply pipeline between the onshore pump station and offshore seawater intake, pipelines to transport seawater and chemicals between the desalination plant and onshore pump station/chemical treatment area, and a pipeline to transport concentrated seawater brine from the desalination plant site to an ocean outfall (or use of the WWTF's existing outfall). A desalination project could also require construction of a power substation. Additional infrastructure would be required if groundwater was selected for blending with desalinated water. The infrastructure would include construction of a Recycled Water Facility, pump station, and 5,000 feet of pipeline or three groundwater extraction wells, three pump stations, and 2,500 feet of pipelines for the recycled or groundwater components, respectively.

There are a number of reasons why PVWMA has rejected desalination. There are high energy costs associated with this alternative in addition to the costs for land acquisition, seawater intake, and potentially a brine water discharge line and brine water outfall. The extremely high cost for desalination, coupled with its large dependency on large quantities of power, prevented this type of project from being carried forward. The Monterey Bay is a protected marine sanctuary. Discharge of waste brine would be dispersed by ocean currents, affecting temperature, nutrients, and turbidity and, therefore, the abundance and diversity of marine organisms. Areas of potential concern in relation to oceanography and marine water quality include potential seawater quality parameters such as temperature, dissolved oxygen, or salinity; possible localized changes in currents or in turbidity, due to the presence of intake pipes on the ocean bottom or due to the pumping/discharge of effluents from the desalination plant; and possible changes in dispersion of sewage plume effluent due to added discharge of brine effluent from the desalination plant. As such, a desalination project would require a baseline study to establish offshore conditions prior to desalination plant startup; and perform quarterly marine water quality/biological monitoring in accordance with RWQCB requirements during operational phase. Locating the desalination plant at the existing WWTF would allow brine discharge via the existing WWTF outfall, and would require water quality consistent with the WWTF's discharge permit.

DESALINATION OF NON-OCEANIC WATER

Additional water supply could be developed by desalination of non-oceanic saline water. The most likely source of this water would be perched, saline shallow groundwater in San Benito County. Since the salinity of this water would be less than oceanic water, costs associated with

the reverse osmosis treatment process would be less. PVWMA has had preliminary discussions regarding the possibility of implementing this alternative, but it has not been thoroughly studied. If this project were implemented, the treated water would still need to be transported into the Pajaro Valley. Therefore, this project could be a potential add-on or enhancement of the basic import project (the BMP 2000 Alternative or the Modified BMP 2000 Alternative).

6.4.4 OTHER

One commenter suggested that PVWMA implement the following alternative:

> SCWD and SCMU (Santa Cruz Municipal Utilities) should be included in a regional long-term water solution, in a public trust ownership of the 10,000-acre "coastal distribution area." SCWD and SCMU have each allocated funds for future water supply projects. This money should be pooled, and augmented by Prop. 12, Prop. 13, and foundation funding, to purchase the coastal distribution area. These lands could then be fallowed, which would recharge the groundwater basin and stop intrusion, and preserve critical land and aquatic habitat. SCWD participation in a pumping management program would help cumulatively increase yield of groundwater and reduce the problem of saltwater intrusion into the Pajaro basin. PVWMA should then send water to SCWD. PVWMA could then use its funding (via its augmentation charge) to pay for the Import Pipeline and Distribution System. Again, the CVP supply could support 100 percent of SCWD's water needs. Once CVP water has been brought to the Pajaro basin, conversion of lands back to agriculture could be considered where appropriate. In addition, an additional 1,000 acres of the coastal area (to the north) should be included in the coastal distribution area.

The fallowing of 10,000 acres of prime farmland, approximately one-third of farmland in the Pajaro valley, would have a substantial adverse effect on the economy in the region. This is inconsistent with PVWMA's objective "to create a reliable, long-term water supply, an important cornerstone of the long-term economic vitality of the Pajaro Valley." The provision of water to SCWD is a goal of that agency and apparently this commenter, but is not an objective of the BMP project. As discussed in this chapter, PVWMA and SCWD are considering potential future joint projects, but no projects have been developed yet. The exact meaning of "SCWD participation in a pumping management program" is unclear. The Agency is currently subject to certain restrictions on the exportation of water outside the Agency's boundaries.

REFERENCES – Other Alternatives

CEQA Guidelines, 2000.

Feeney, Martin, Memo regarding Evaluation of the injection/extraction issues associated with the CVP Import Pipeline, August 2001.

PVWMA, Local Water Supply and Distribution Final Environmental Impact Report ("Local Projects" EIR), certified in May 1999.

PVWMA, Basin Management Plan Final Program Environmental Impact Report ("1993 BMP PEIR"), certified December 1993.

CHAPTER 7
GROWTH INDUCEMENT POTENTIAL

7.1 OVERVIEW OF GROWTH INDUCEMENT EVALUATION

The CEQA *Guidelines* define a growth-inducing impact as follows:[1]

> [T]he ways in which a proposed project could foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment. Included in this are projects [that] would remove obstacles to population growth (a major expansion of a wastewater treatment plant might, for example, allow for more construction in the service areas)…. Also discuss the characteristics of some projects, which may encourage and facilitate other activities that could significantly affect the environment, either individually or cumulatively. It must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment.

On the basis of the CEQA definition above, assessing the growth inducement potential of the BMP project involves answering the question, *would construction and/or operation of BMP projects directly or indirectly support more economic or population growth or residential construction?* As discussed later in this section, local and regional planning agencies have identified groundwater basin overdraft and seawater intrusion conditions as constraints to growth in the area, although these agencies also maintain policies to preserve non-urban (agriculture and open space) uses. The intent of the proposed project is to balance the groundwater basin through the provision of water to agricultural uses through year 2040. Insofar as the existing conditions of the groundwater basin are an obstacle to growth, the project would, by definition, induce growth.[2]

A variety of factors influence business and residential or population growth in the project area, e.g., the general plans and policies of the City of Watsonville and the counties, the availability of sewer service, public schools, and transportation services. The availability of water is one of the primary public services needed to support urban development, and a service capacity deficiency could constrain future development. Conversely, a single factor could serve as an impetus to development by providing the necessary incentive to resolve other constraints.

Growth inducement may constitute an adverse impact if the growth is not consistent with the land use and growth management policies for the affected area. The City and county land use and growth management plans and policies guide land use development patterns and provide for the orderly expansion of urban development supported by adequate urban public services, such as

---

1 CEQA *Guidelines* Section 15126.2[d].

2 The physical construction and operation of BMP facilities is not expected to generate a substantial number of permanent new jobs in the area (a means of *directly* increasing growth).

sewer service, roadway infrastructure, and solid waste service. A project that would induce "disorderly" growth in conflict with local land use plans could indirectly cause additional adverse environmental impacts to other public services. Thus, it is important to assess the degree to which the growth accommodated by a project would or would not be consistent with applicable land use plans.

The environmental effects of economic or population growth facilitated by a project are referred to herein as the secondary effects of growth. Secondary effects of growth inducement include, but are not limited to, increased traffic, degradation of air quality, loss of biological resources, and increased demand on public services. A project that would induce "disorderly" growth (exceeding projected growth) could indirectly cause additional adverse environmental impacts and other public services impacts not previously envisioned by local jurisdictions (e.g., the City of Watsonville and the counties of Santa Cruz, Monterey and San Benito). Local population forecasts and land use plans (e.g., general plans) provide land use development patterns and growth policies that allow for the orderly expansion of urban development supported by adequate urban public services, such as water supply, roadway infrastructure, sewer service, and solid waste service.

7.2 SETTING

7.2.1 PROJECTED GROWTH IN THE PVWMA SERVICE AREA

REGIONAL POPULATION GROWTH PROJECTIONS

The Association of Monterey Bay Governments (AMBAG) prepares and periodically updates population and employment forecasts for Monterey, Santa Cruz and San Benito counties. Public agencies use the AMBAG forecasts to assist in planning for adequate transportation and other infrastructure (including water and wastewater service), as well as air quality management. AMBAG relies on data from the national census, State Department of Finance, and planning agencies in preparing population and employment forecasts for the counties and the incorporated cities within each county. The *1997 Regional Population and Employment Forecast for Monterey, San Benito and Santa Cruz Counties Final Report* (AMBAG, 1997) is the agency's most recent set of projections; no update is expected until at least 2002. The report requests that any documents using AMBAG forecasts include the following statement:

> *These forecasts, which have been guided by approved general plans, are prepared as planning tools and are not an exact prediction of the course of future events. Experience shows that these forecasts are most reliable at the county level and less so for smaller areas like cities and census tracts. Caution should be exercised in relying on these forecasts for such sub-county level areas.*

The Final Report (page 145) contains a set of projections specifically for the PVWMA service area. The report identifies water supply as a constraint to growth in the PVWMA service area. Other constraints to growth identified in the report include: for north Monterey County – septic system capacity, highway capacity, and schools capacity; and for south Santa Cruz County –

schools capacity and landfill capacity. Although the report describes constraints to growth, the baseline population forecasts were not lowered due to the existence of potential resource constraints because "these types of constraints are potentially removable through future policy action" (page 5).

As shown in **Table 7.1**, the AMBAG forecasts for the PVWMA service area indicate that the population could increase from approximately 71,300 (1990) to approximately 98,200 (2020), reflecting an average annualized increase of about one percent per year. Also shown for comparison are the population forecasts for all of Santa Cruz and Monterey counties and the City of Watsonville and Sphere of Influence (SOI). The AMBAG forecasts indicate that population growth within the City of Watsonville/SOI represents approximately 92 percent of total growth projected for the PVWMA service area.[3] Part of this growth reflects the inclusion of the town of Freedom in the City's SOI, which is reflected in the 2000 to 2005 AMBAG forecasts.

TABLE 7.1
AMBAG POPULATION PROJECTIONS

Year	Monterey County	Santa Cruz County (includes Watsonville)	City of Watsonville	PVWMA Service Area
1990[a]	355,660	229,734	31,099	71,268
1995[b]	362,874	241,935	33,695	75,747
2000	400,907	257,737	43,620	82,421
2005	435,453	270,060	50,495	87,411
2010	472,562	281,714	51,881	90,926
2015	503,669	292,988	53,816	94,442
2020	536,609	303,646	55,875	98,172

a 1990 US Census
b 1995 State Department of Finance, adjusted for April 1, 1995.

SOURCE: *1997 Regional Population and Employment Forecast for Monterey, San Benito, and Santa Cruz Counties*, Association of Monterey Bay Area Governments.

Comparison of AMBAG Projections with 2000 Census Data

There is less than two percent difference between the AMBAG forecasts for year 2000 for Santa Cruz and Monterey counties and the City of Watsonville compared with the US Census results. As **Table 7.1** indicates, the AMBAG year 2000 population projection for Monterey County is 400,907; the population recorded for U. S. Census 2000 was 401,762, a difference of 0.2 percent.

3 Refer to Table 26, page 145 in the *1997 Regional Population and Employment Forecast for Monterey, San Benito and Santa Cruz Counties Final Report* (AMBAG, 1997).

The AMBAG 2000 population projection for Santa Cruz County is 257,737; the population recorded for U. S. Census 2000 was 255,602, a difference of 0.8 percent. The AMBAG year 2000 population projection for the City of Watsonville and Sphere of Influence is approximately 43,620; the population recorded for U. S. Census 2000 was 44,265, a difference of 1.5 percent.

7.2.2 GROWTH MANAGEMENT AUTHORITY AND POLICIES

As indicated in the preceding section, population forecasts for the region project future urban growth in the PVWMA section area, particularly in and around Watsonville. Determining the specific location and timing of future development through the year 2040, and the extent to which that development would be infill or would result in the conversion of native or agricultural lands, would be speculative. Similarly, determining future growth patterns in the event that none of the Revised BMP alternatives was implemented involves speculation, although current county policies that link development and water supply likely would persist, resulting in less overall growth. For further discussion of this issue, refer to the discussion of the No Project Alternative presented in Chapter 6.

The Counties and the City of Watsonville have jurisdiction over development in the PVWMA service area. The growth management policies of these agencies are summarized below. Refer also to Section 3.1, Regional Land Use and Planning, which identify the goals, policies and objectives that guide land use planning in the PVWMA service area. Refer also to Section 3.4, Vegetation, Fish and Wildlife, for county and City polices protective of those resources.

CITY OF WATSONVILLE

The Watsonville General Plan identifies the preservation of the agricultural base in the Pajaro Valley as important, and addresses the issue of land use balance by recognizing the value of agricultural land and proposing minimal conversion of agricultural lands, high densities on those lands converted, and an urban limit boundary beyond which Watsonville is not proposed to grow, while allowing for an adequate supply of land for affordable housing and the creation of living-wage jobs. Landowners outside the urban limit line are encouraged to maintain agricultural production and the City further encourages retention of agricultural use on those lands beyond the urban limit line by restricting the extension of urban services to those areas.

The Watsonville General Plan allows for an increase of 5,300 housing units over the 1992-2005 planning period for Watsonville and Freedom. The General Plan estimated that about 835 acres of land outside of the (then) existing Sphere of Influence would be needed meet this demand, as well as the additional acreage needed for parkland and commercial/industrial land use. In order to meet the projected need, the General Plan anticipated annexation in order to avoid development on agricultural land.

MONTEREY COUNTY

The 1982 Monterey County General Plan stated as its intent "to maintain and enhance the County's rural character, natural resources, and economic base by providing for adequate residential and industrial growth in areas best suited for development while restricting urban sprawl and indiscriminate development (Monterey County, 1982)." On August 9, 2000 the Monterey County Board of Supervisors passed an interim ordinance adding Chapter 16.75 to the Monterey County Code to limit development and prohibit the approval of any discretionary or ministerial application for any development project located in the North Monterey County Hydrogeologic Study Area that proposes to use water. Minor exceptions to this ordinance are included for remodeling existing residences or commercial or industrial use requiring no more than 0.4 af per year. The ordinance expires eighteen months from August 9, 2000, unless extended by the Monterey County Board of Supervisors.

The Monterey County Planning Department is currently in the process of developing an updated General Plan (Monterey County 21st Century program/General Plan Update). In 1982, the County General Plan made the preservation of agricultural land a high priority. The priorities for growth in Monterey County are given first to infilling within existing urban areas. The next priority is for development on lands adjacent to existing and densely settled urban areas where necessary services and facilities are available, except where this impacts prime and productive agricultural lands.

SANTA CRUZ COUNTY

The Policies and Objectives of the General Plan (2.1.8, 2.1.9, 7.18b, and 7.18.2) generally indicate that development should take place where public services are adequate, ensure that the level of development permitted is supportable within the limits of the County's available water supplies, and require the obtainment of written commitments confirming water service availability prior to project approval.

The County establishes growth goals on a year-to-year basis. From 1991 to 1998, the growth goal was 1.0 percent; in 1998 and 1999 it was 0.75 percent; in 2001, it was 0.5 percent. The growth rate is based on population growth, translated into housing units and implemented by limiting the number of new residential building permits. County staff indicate that based on the 2000 Census, the County has met the intent of the voter-mandated Measure J (to limit county growth to a fair share of the State's growth) with an 11.3 percent increase in population versus the State's 13.8 percent increase (Deming, 2001).

SAN BENITO COUNTY

The 1994 San Benito County General Plan includes land use goals and objectives for growth management. In the General Plan, the County identifies the objective of developing a Growth Management Program to help stabilize the rate of population growth in the County. At

publication of this Draft EIR (October 2001), the Growth Management Program was expected to be approved shortly (Goodrich, 2001).

Approximately one year ago, San Benito County adopted a Growth Management Urgency Ordinance limiting growth in all unincorporated areas to one percent per year, or approximately 60 building permits. This Ordinance effectively halted all land subdivisions, except for commercial, industrial, affordable or senior housing uses. The County passed this Ordinance in response to insufficient infrastructure to support growth, especially having to do with wastewater treatment, water quality, and increasing traffic. (Goodrich, 2001)

7.3 IMPACTS AND MITIGATION MEASURES

IMPACTS

Impact 7.1: Implementation of the BMP Project would reduce groundwater supply reliability as a constraint to growth. The project could accommodate an amount of growth that is consistent with regional growth projections, but that could indirectly result in potentially significant secondary effects of growth. Some of these secondary effects of growth could be significant and unavoidable, while others are significant but mitigable. Significant unavoidable impacts that could occur as a result of planned growth include: loss of agricultural land and open space, increase demand on groundwater resources, and change in visual character.

Implementation of either the BMP 2000 Alternative or the Local Only Alternative would remove an obstacle to growth by increasing the water supply and the reliability of existing groundwater resources in the PVWMA Service area. As part of either the BMP 2000 Alternative or the Local-Only Alternative, PVWMA would develop new surface water supplies and distribute that water to agricultural land that is currently irrigated with groundwater. This would reduce pumping of the groundwater basin and, over time, allow stabilization of the groundwater basin and reduction of the overdraft conditions that allow seawater intrusion. By replacing agricultural pumping with surface water supplies, the project would improve the reliability of the groundwater basin for non-agricultural, urban uses as well. Improving the reliability of the urban water supply would facilitate urban growth.

Under these two project alternatives, the provision of irrigation water to areas served by the proposed Coastal Distribution System and Inland Distribution System would not induce urbanization of lands receiving the water. These lands are in agricultural use and the proposed water supply is expressly intended to support continuation of that agricultural use. Thus, the project, under either alternative, does not have direct growth inducement potential; the project does not provide water supply for municipal and industrial uses that would support growth of residential, commercial or industrial uses. PVWMA's enabling act includes provisions indicating that no water shall be imported for purposes other than agricultural use. The limitation does not apply to lands within the Aromas County Water District.

The BMP 2000 Alternative and the Local-Only Alternative address future water demand for developed uses within the PVWMA Service Area differently. The BMP 2000 Alternative was developed based on projections of existing and future municipal and industrial demand. While the BMP 2000 Alternative only provides water to agricultural uses and does not provide water to municipal and industrial uses, it is PVWMA objective and responsibility to implement a plan that balances the groundwater basin and prevents further overdraft and seawater intrusion in the long-term. Therefore, it is necessary to account for the potential future urban water demands in order to plan long-term groundwater basin management. The future population projections and associated demand projections for PVWMA used to develop the BMP 2000 Alternative are presented in Chapter 4.C, **Table 4.C-1**. These population projections incorporate several of the AMBAG assumptions and through the year 2020 are fairly similar to the AMBAG projections, shown on Table 7.1. By the year 2020 AMBAG projects a population with the PVWMA Service Area of 98,172 people, while the analysis used to develop the BMP 2000 Alternative projects a population of 94,274. The amount of growth accommodated by the BMP 2000 Alternative through the year 2020 is consistent with AMBAG's regional population forecasts for the area, which rely on the general plans and growth management policies of planning areas in the region. Because PVWMA must consider and manage for the long-term health of the groundwater basin resources, it extended a projection of future demand for urban and agricultural uses to the year 2040 in order to develop the BMP 2000 Alternative. The population growth projected over the 20 years between 2020 and 2040 tiers from AMBAG assumptions about the local annual growth rates and yields a potential population increase of 11.5 percent. Thus, while the BMP 2000 Alternative does not require or directly result in increased population growth and urban development, it does accommodate potential growth that might be planned and approved by jurisdictions in the service area through the year 2040.

The Local-Only Alternative does not provide sufficient water to meet existing demand without the fallowing of 2,200 acres of agricultural land and, consequently, would not provide sufficient water to meet future demand without overdraft and seawater intrusion conditions persisting. This would not meet PVWMA objectives and requirements to protect the long-term health of the groundwater resources. PVWMA has no authority to make land use decisions or to approve or deny future urban growth, but it is responsible for protecting and providing adequate groundwater resources within its service area. Consequently, for the Local-Only Alternative this EIR identifies the need for additional fallowing of agricultural land beyond 2,200 acres in order to provide adequately for the long-term demand on the groundwater basin, including the potential future urban demand in the service area. **Impact 5.D.3-1** in Section 5.D.3 addresses this issue. Further reduction of agricultural demand through increased land fallowing would then accommodate the demands of planned urban development without worsening the saltwater intrusion problem in the groundwater basin.

Although the current condition of seawater intrusion has affected groundwater resource reliability and this is noted by AMBAG as a potential constraint to future growth, this condition has not halted development in the area. Under the Local-Only Alternative it is expected that additional future growth would continue, partly as a result of the relief on the groundwater supplies this alternative would provide. Although this alternative as proposed would not fully provide for

future urban development, it would improve the overall reliability of the groundwater supply that could encourage continued planned development. Without additional land fallowing to reduce agricultural demand, the seawater intrusion problem would not be fully controlled under this alternative as increasing urban demand would continue to rely on the groundwater basin. Additional treatment might be needed for potable supplies to address the saline intrusion. Under this alternative, implementation of planned growth might be slowed as groundwater conditions in some areas would continue to have problems and developers seek solutions to provide a reliable, potable water supply.

The land use planning agencies with jurisdiction in the PVWMA service area, the City of Watsonville and the counties of Monterey, Santa Cruz and San Benito, are responsible for planning and approving future urban development projects. These agencies are obligated under CEQA to evaluate the potential for new development projects to adversely affect to environment, to identify measures to mitigate those impacts, and to notify responsible trustee agencies with jurisdiction over any potentially affected resources. Project developers would be obligated to comply with state and federal laws related to environmental protection, including compliance with the state and federal endangered species acts.

As a water management agency, PVWMA has no authority to make land use decisions or to approve or deny future urban growth, or to impose measures to mitigate the adverse environmental effects of new development projects, unless the agency were called upon to provide water service to that development. PVWMA would be obligated under CEQA to consider the direct and indirect environmental impacts of any proposal to extend water service to new areas.

SECONDARY EFFECTS OF GROWTH

As described above, over 90 percent of the projected increase in population in the PVWMA service area is predicted to occur in City of Watsonville and the City's Sphere of Influence (including Freedom). The following documents were reviewed in order to identify representative significant impacts associated with future growth in the area:[4]

- *Watsonville 2002 General Plan Update and Sphere of Influence Amendment Environmental Impact Report (1993)*
- *Seaview Ranch Project Environmental Impact Report*

A summary of the impacts and measures identified to mitigate these impacts is presented below.

Land Use/Agricultural Resources

The City of Watsonville General Plan Update EIR indicated that development could result in the significant and unavoidable conversion of up to 580 acres of prime agricultural land to urban use. The DEIR indicated that no mitigation was feasible for this potential impact. The Sea View

[4] Copies of the City of Watsonville general plan and these EIRs are available for review at the City of Watsonville.

Ranch Project DEIR indicates that the project site does not contain prime agricultural land and that the project would not result in a significant loss of agricultural land for the City of Watsonville. However, the project would result in the conversion of approximately 44 acres from open space to urban use. The loss of open space was identified as significant and unavoidable impact and the EIR did not include mitigation measures for this impact.

The City of Watsonville General Plan Update EIR also identified significant but mitigable impacts related to changes in the distribution of some land uses, changes in development patterns, and the potential for incompatible land use development. Mitigation for these impacts was included in the policies and implementation measures of the General Plan Update.

The Sea View Ranch Project EIR also identified significant but mitigable land use impacts related to temporary, construction-related nuisance to adjacent existing residential land use and the compatibility of the proposed residential land use with existing agricultural operations, industrial operations, sloughs (odor and mosquito outbreaks), and airport flight paths. Mitigation for these impacts includes implementation of the City's Grading Ordinance, compliance with the City's Right to Farm ordinance, easements, and notification procedures.

Transportation and Circulation

The City of Watsonville General Plan Update DEIR indicated that traffic generated by General Plan development could degrade traffic operation on several of the City's roadway segments. However, the policies and implementation measures of the General Plan Update include improvements that would reduce impacts to less-than-significant levels. The Sea View Ranch Project EIR identified increased traffic effects at intersections and areas of potential safety conflicts as a significant impact that could be reduced to less-than-significant levels through improvement of the affected intersections as part of the project.

Air Quality

The City of Watsonville General Plan Update EIR identified air quality impacts resulting from development construction as a significant impact that could be mitigated to less-than-significant levels by General Plan policies and implementation measures. The Sea View Ranch Project EIR identified short-term construction air quality impacts as a significant impact that would be mitigated to less-than-significant levels, primarily through implementation of standard dust control measures.

Noise

The City of Watsonville General Plan Update EIR identified noise impacts resulting from development construction and potential ambient noise impacts on additional residential and employee populations. The EIR indicated General Plan Update policies and implementation measures would reduce these impacts to less-than-significant levels. The Sea View Ranch Project DEIR indicated that some portions of the project site would be exposed to noise levels that could be reduced to less-than-significant levels through project design features. In addition, the EIR identified significant but mitigable construction noise impacts.

Public Services

The City of Watsonville General Plan Update EIR identified potentially significant impacts related to increased demands on police, fire protection, schools, libraries, solid waste services, sewer/wastewater services, and water supply/water quality services. The EIR indicated General Plan Update policies and implementation measures would reduce these impacts to less-than-significant levels.

Open Space, Recreation, and Scenic Resources

The City of Watsonville General Plan Update EIR indicated that General Plan development would convert existing agricultural and open space uses, removing the scenic and recreational resources these lands provide. Development could also degrade other existing scenic resources within the city. General Plan development would also result in increased demand for park land and recreation facilities. The DEIR indicated General Plan Update policies and implementation measures would reduce these impacts to less-than-significant levels.

The Sea View Ranch Project EIR indicated that the project would result in a significant and unavoidable impact by substantially changing in the visual character of the project area by converting a rural area into an urban use. In addition, the DEIR identified the visibility of the projects graded areas from adjacent land uses to be a significant unavoidable impact. The EIR did not include mitigation measures to reduce these impacts.

The Sea View Ranch Project EIR also indicated that the project would result in a new source of nighttime light in the area that could be reduced to less-than-significant levels through project design features.

Geology and Soils

The City of Watsonville General Plan Update EIR identified potentially significant impacts from the exposure of additional population and new structures to seismic hazards and related soil effects, as well as to existing unstable soil conditions. The EIR indicated that policies and implementation measures included in the General Plan Update would reduce impacts to less-than-significant levels. The Sea View Ranch Project EIR identifies impacts to future development from unstable soil conditions, and from seismic hazards and related effects as potentially significant impacts. The EIR includes mitigation measures that would reduce these impacts to less-than-significant levels through removal of unstable soil, design features that improve soil conditions, and implementation of the recommendations/requirements of geotechnical reports and the Uniform Building Code.

Hydrology, Flooding, and Drainage

The City of Watsonville General Plan Update EIR indicated that development could subject persons and property to potential flooding impacts, increase surface runoff, and require the construction of new or improvements to drainage facilities. The EIR also indicated that General Plan Update policies and implementation measures would reduce impacts to less-than-significant

levels. The Sea View Ranch Project EIR indicated that construction activities and project operation would result in non-point source pollution to local waterways that could be reduced to less-than-significant levels through conformance with NPDES permit requirements and with the City's Grading Ordinance.

Vegetation and Wildlife

The City of Watsonville General Plan Update EIR indicated that development could significantly impact special-status species, riparian vegetation, historic trees, and wetlands. However, General Plan Update policies and implementation measures would reduce these impacts to less-than-significant levels. The Sea View Ranch Project EIR identified significant but mitigable impacts related to construction and project operation effect on nesting raptors, red-legged frogs, tiger salamanders, aquatic habitat, wetlands, upland habitat, migration corridors, and bats. DEIR mitigation measures included construction buffer areas, species management plans, habitat protection measures, and project design features.

Health and Safety

The City of Watsonville General Plan Update EIR indicated that development could expose additional people to potential hazards from the use, storage, and transport of hazardous materials, and from agricultural chemicals that could cause water pollution. The EIR identified General Plan Update policies and implementation measures that would reduce impacts to less-than-significant levels. The Sea View Ranch Project EIR identified significant impacts related to existing on-site soil contamination, and to future exposure of a residential population to existing industrial uses and mosquito populations capable of transmitting disease. EIR mitigation measures included excavation of contaminated soils, implementation of proper hazardous materials handling procedures, and management of on-site detention basins.

Cultural Resources

The City of Watsonville General Plan Update EIR identified potentially significant impacts to cultural resources related to ground disturbance from development construction. In addition, the EIR indicated that the intensity of development may allow for potential alterations to the historic character of land uses or structures. The EIR indicated that General Plan Update policies and implementation measures would reduce impacts to less-than-significant levels. The Sea View Ranch Project EIR indicated that the project had the potential to significantly impact archaeological resources, but that the impact could be reduced to less-than-significant levels through implementation of an archaeological monitoring program during project construction.

Cumulative Impacts

The Sea View Ranch Project EIR indicated that the project would significantly and unavoidably contribute to cumulative traffic, air quality, vegetation and wildlife, loss of open space, visual, and public services impacts. The EIR did not identify any measures would fully reduce cumulative near-term regional air quality, vegetation and wildlife, loss of open space, and visual impacts to a less-than-significant level.

Growth Inducing Impacts

The City of Watsonville General Plan Update EIR growth projections associated with implementation of the General Plan Update and indicated that growth could result in increased density within existing City limits. The EIR determined that the changes in population, housing, and employment represent beneficial social and economic effects that outweigh the unavoidable adverse environmental effects related to growth under the General Plan Update.

The Sea View Ranch Project EIR indicates that some growth would result, but that growth would occur within the City's urban service area, accommodating inevitable regional population growth and the project could reduce growth in out-lying non-urban areas. The projects participation in an associated roadway extension is not expected to result in substantial growth beyond what is already planned.

MITIGATION MEASURES

Measure 7-1: PVWMA does not have the authority to make land use and development decisions. It does not approve growth but does have a responsibility to manage and protect the groundwater resources in the service area. PVWMA does have the ability and responsibility to mitigate the impacts of growth on groundwater resources by implementing management actions that keep the basin in balance and prevent/reduce salt water intrusion. Implementation of the BMP 2000 program will serve to mitigate the secondary effects of planned growth on the groundwater resources. Beyond this, PVWMA does not have the authority or jurisdiction to implement mitigation measure necessary to address the potentially significant secondary effects of planned growth. Authority to implement such measures lies with the land use jurisdictions – City of Watsonville, Monterey County, Santa Cruz County, and San Benito County, which enforce local, state, and federal regulations and mitigation requirements through the development approval and permit process. Through the CEQA process and the development permit process, these local land use agencies impose mitigation requirements on development projects to address the secondary effects of growth and identify measures that must be implemented by other agencies, such as the Regional Water Quality Control Board, the Air Quality District, California Department of Transportation, California Department of Fish and Game, and the State Department of Health services, among others. PVWMA finds that mitigation of the secondary effects of growth is primarily within the authority and jurisdiction of other public agencies and looks to those agencies to implement such measures as appropriate and consistent with their authorities.

For the BMP 2000 Alternative Only

See Measure 4.C-1, which deals with processing CEQA and NEPA on any future proposals to extend CVP surface water supply to areas beyond those proposed as part of this alternative.

See Measure 4.C-2, which deals with Endangered Species Act compliance for any future proposals to extend CVP surface water supply to areas beyond those proposed as part of this alternative.

REFERENCES – Growth Inducement Potential

California Department of Water Resources, 1997 Land Use Survey for Monterey and Santa Cruz Counties.

Deming, Mark, Planner, County of Santa Cruz, email correspondence, August 17, 2001.

James M. Montgomery Consulting Engineers, Inc., Pajaro Valley Water Management and Augmentation Study, July 1990, pp. 3-6

California Center for Applied Research, *Pajaro Valley Water Augmentation Study Social Analysis Component*, May 1990, p. 36

California Center for Applied Research, *Pajaro Valley Water Augmentation Study Social Analysis Component*, May 1990

Association of Monterey Bay Area Governments, 1997 Regional Population Forecast for Monterey, San Benito, And Santa Cruz Counties Final Report, November 1997.

PVWMA, Basin Management Plan

Santa Cruz County Planning Department, General Plan and Local Coastal Program Land Use Plan, adopted by the Board of Supervisors May 24, 1994.

EIP Associates, Final Program Environmental Impact Report, PVWMA Basin Management Plan, October, 1993.

Environmental Science Associates, CVP Water Supply Contract Assignment from Mercy Springs Water District to PVWMA (Contract No. 14-06-200-3365A), Final Environmental Assessment and Final Finding of no Significant Impact, November 6, 1998.

CH2MHill, Environmental Impact Report for the Consolidated and Conformed Place of Use, prepared for the State Water Resources Control Board.

Montgomery Watson, Technical Memorandum 2.2 for Subtask 6.2, PVIGSM Land Use and Agricultural Crop Mix, June 11, 1999.

Monterey County General Plan prepared in 1982 and amended periodically through 1996.

Monterey County 21st Century General Plan Update website: http://www.co.monterey.ca.us/gpu/

North County Area Plan, a part of the Monterey County General Plan adopted by the Board of Supervisors, July 2, 1985.

Goodrich, Fred, Planner, San Benito County Planning Department, personal communication, October 15 2001.

Watsonville 2005 General Plan, Adopted May 24, 1994.

This page left
intentionally blank

CHAPTER 8

IMPACT OVERVIEW

8.1 SIGNIFICANT ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED IF THE PROPOSED PROJECT IS IMPLEMENTED

In accordance with Section 21083 of the California Environmental Quality Act (CEQA), and with Sections 15064 and 15065 of the State CEQA Guidelines, the purpose of this section is to identify impacts that could not be eliminated or reduced to a less-than-significant level by mitigation measures included as part of the proposed project, or by other mitigation measures that could be implemented, as described in Chapters 4 and 5. The findings of significant impact are subject to determination by PVWMA's Board of Directors as part of its determination process for the EIR. This section in the Final EIR will be revised, if necessary, to reflect the PVWMA Board of Directors' findings. This EIR identifies the following significant unavoidable adverse impacts that would result from implementation of the BMP 2000 Alternative and/or Local-Only Alternative:

Permanent Loss of Prime Agricultural Land

- BMP 2000 Alternative – Recycled Water Facility
- Local-Only Alternative – Recycled Water Facility
- Local-Only Alternative – Expanded College Lake
- Local-Only Alternative – Corralitos Creek Diversion
- Local-Only Alternative – Aquifer, Storage and Recovery

Construct Facilities Across Active Fault Traces

- BMP 2000 Alternative – Import Pipeline

Daily Emissions of Criteria Air Pollutants (PM_{10}) in Excess of Monterey Bay Unified Air Pollution Control District Standards

- BMP 2000 Alternative – Groundwater Banking (Import Pipeline)
- Local-Only Alternative – Expanded College Lake
- Local-Only Alternative – Corralitos Creek and Pinto Lake Diversions
- Local-Only Alternative – Aquifer, Storage and Recovery

- Secondary Effects of Growth Accommodated by the Project (both alternatives)

Please refer to Chapters 4, 5 and 7 for detailed discussion of these significant unavoidable impacts.

Some of the measures identified to mitigate impacts would prolong the construction schedule by restricting either the time of day (for traffic mitigation measures) or the time of year (restrictions for grading and for special status species) during which construction could occur. In some cases, this attenuation of the construction schedule offset by construction techniques (i.e., multiple crews for pipeline construction).

8.2 CUMULATIVE IMPACTS

8.2.1 APPROACH TO ANALYSIS

For impacts related to secondary effects of growth potentially induced by the project, refer to Chapter 7. Examples of secondary effects of growth include the traffic and air quality impacts caused by future development that would occur in the PVWMA service area.

A cumulative impact is created as a result of the combination of the projects evaluated in an EIR together with other projects causing related impacts. The purpose of this analysis is to disclose significant cumulative impacts resulting from implementation of the BMP 2000 Alternative or Local-Only Alternative in combination with other projects or conditions, and to indicate the severity of the impacts and their likelihood of occurrence. The CEQA Guidelines require that EIRs discuss the cumulative impacts of a project when the project's incremental effect is "cumulatively considerable," meaning that the project's incremental effects are considerable when viewed in connection with the effects of past, current, and probable future projects. According to the CEQA Guidelines, a project's contribution to a significant cumulative impact may be determined to be *de minimis*, and thus not significant, if the environmental conditions would essentially be the same whether or not the proposed project is implemented.[1] This analysis considers projects that are reasonably foreseeable and that could have cumulative effects in combination with the BMP 2000 or Local-Only Alternatives.

8.2.2 POTENTIAL PROJECTS WITH RELATED OR CUMULATIVE EFFECTS

Table 8.1 lists the projects that were considered in the evaluation of cumulative impacts. These projects were identified by the City of Watsonville Community Development Department, the Monterey County Planning and Building Inspection, and the planning departments of Santa Cruz County, San Benito County, and Santa Clara County. This evaluation considers cumulative impacts related to all components of the BMP 2000 and Local-Only Alternatives based on the geographic scope of the affected environmental resource.

[1] CEQA *Guidelines* Section 15130.

TABLE 8.1
PLANNED AND APPROVED PROJECTS IN THE PROJECT AREA AND VICINITY

Project	Status
Santa Cruz County	
99-unit Pajaro Lane Affordable Housing Project	Approved
60-unit affordable housing apartment complex with commercial uses and a child care center on Freedom Boulevard	Pending
Northern Monterey County	
17-lot residential subdivision on Salinas Road	Pending
6-unit Tanglewood subdivision	Pending
Pajaro Valley Golf Course expansion	Pending
Agricultural distribution center expansion (72,000 to 195,000 square feet)	Pending
Northwestern San Benito County	
140-unit Rancho Larios residential subdivision	Approved
15-unit Highland Meadows residential subdivision	Approved
City of Watsonville	
140-unit Sunset Cove residential subdivision	Under Construction
114-unit Bay Breeze residential subdivision	Approved
390-unit Vista Montana residential development	Approved
Pajaro Valley Unified School District high school	Approved; Appeal Pending
16-unit residential subdivision on Airport Blvd.	Approved
27,405 square-foot industrial building complex at 547 Airport Blvd.	Approved
300-unit Seaview Ranch residential subdivision	Pending
16-unit townhouse development at 108 Green Valley Road	Pending
16 affordable housing units at 55 Ross Avenue	Approved
Home Depot store	Pending

SOURCES: Boyle, 2001; Monterey County Planning and Building Inspection website (http://www.co.monterey.ca.us/pbi/index.htm)

8.2.3 IMPACTS AND MITIGATION MEASURES

Both the BMP 2000 and Local-Only Alternatives would result in land use compatibility, noise, air quality, traffic, and visual quality impacts during construction. These impacts, in combination with other development projects listed in **Table 8.1**, would contribute to cumulative construction impacts in the PVWMA service area. These would be temporary impacts. Construction of the project components would be contingent on the issuance of permits from local agencies. Through the permitting process, construction projects near the BMP 2000 or Local-Only Alternative projects would be identified and coordinated to avoid conflicts.

As stated in Chapter 2, Project Description, either the BMP 2000 or Local-Only Alternative is expected to be fully implemented within 10 years, with construction of various project components staggered throughout the 10-year period. It is not known whether the timing of any of the planned projects listed in **Table 8.1** would coincide with construction of components under the BMP 2000 or Local-Only Alternatives. If project construction did happen simultaneously, impacts would fall within the categories of temporary environmental impacts related to increased truck and worker traffic as well as increased noise and air emissions, and increased sedimentation to local waterways. Construction impacts are expected to be mitigable to a less-than-significant level through the standard measures identified in this EIR (e.g., preparation of Stormwater Pollution Prevention Plans and traffic control plans), with the exception of PM_{10} emissions, which likely will be significant and unavoidable for many of the projects listed in **Table 8.1**.

The schedules of construction projects frequently change due to various factors (e.g., permit processing, project funding). PVWMA will coordinate with the appropriate departments of the City of Watsonville, Santa Cruz County, Monterey County, San Benito County, and Santa Clara County regarding the timing of construction projects that would occur near BMP 2000 Alternative or Local-Only Alternative project sites. Such coordination will help to minimize multiple disruptions to the same areas. The PVWMA will also submit plans related to, and comply with the requirements of, encroachment permits, which will provide further opportunity for coordination of multiple projects.

The following discussion addresses long-term cumulative impacts associated with operation of the BMP 2000 Alternative and/or Local-Only Alternative.

Land Use

Construction of the components proposed under the BMP 2000 and Local-Only Alternatives would contribute to the cumulative loss of prime farmland in the PVWMA service area. The geographic area for consideration of cumulative impacts is the PVWMA service area. **Table 8.2** identifies the acreage of prime farmland that would be removed from production under the BMP 2000 and Local-Only Alternatives. For the BMP 2000 Alternative, construction of the Recycled Water Facility would result in the permanent conversion of approximately eight acres of prime farmland adjacent to the existing WWTF. The Import Pipeline would disrupt agricultural operations along the alignment temporarily during construction, but would not result in a permanent conversion of agricultural land. For the Local-Only Alternative, the Recycled Water Facility, Expanded College Lake, Corralitos Creek Pump Station, and Aquifer, Storage and Recovery components would result in the permanent conversion of approximately 42 acres of prime farmland. The Local-Only Alternative also would require the fallowing of more than 2,200 acres of irrigable prime farmland (refer to discussion under Impact 5.D.3-1).

The conversion of agricultural lands under the proposed alternatives would contribute to the cumulative loss of agricultural lands throughout the PVWMA service area, a significant and unavoidable impact. The total amount of prime agricultural land that would be lost due to the

TABLE 8.2
ACREAGE REMOVED FROM AGRICULTURAL PRODUCTION

Project Component	Prime Farmland Removed from Production (acres)	
	BMP 2000 Alternative	Local-Only Alternative
Recycled Water Facilities	8	19[a]
North Dunes Recharge Basin		4.5
Pipeline construction	Temporary disruption of land uses along pipeline route	Temporary disruption of land uses along pipeline route
Supplemental wells	0.5	--
Expanded College Lake	--	16
Corralitos Creek Pump Station	--	0.06
Aquifer Storage and Recharge Facilities	--	1.5
Watsonville Filtration Facility		0.5
Subtotal, Facilities Only	**8.5**	**41.56**
Farm Reservoirs[b]	--	Unknown
Land Fallowing	--	2,200+

[a] Reflects acreage required for advanced treatment.
[b] No information is available on this component; consequently, its impacts cannot be analyzed.

projects listed in **Table 8.1** is unknown. The BMP 2000 and Local-Only Alternatives' contribution to this cumulative effect is considered cumulatively considerable. No mitigation is available for this impact.

Geology, Soils and Seismicity

Construction of the projects listed in **Table 8.1** and the BMP 2000 Alternative or the Local-Only Alternative would result in potentially significant short-term cumulative erosion hazards. As a major construction project in the Pajaro Valley, the selected alternative would be one of the major sources of short-term erosion combined with that of the other projects. Implementation of erosion and sedimentation control measures (specified in Sections 4.A.3, 4.B.3, 5.A.3, 5.B.C, 5.C.3, and 5.D.3) would reduce the project's contribution to this cumulative impact to a less-than-significant level.

Construction of the planned and approved residential development projects listed in **Table 8.1** would result in the exposure of residents to the earthquake hazards of the region. This long-term impact is significant given the large population increase anticipated for both the service area and the region as a whole.

Hydrology and Water Quality

Construction of the planned and approved projects and the selected alternative would result in potentially significant short-term cumulative soil erosion, sedimentation, and construction-related contaminant accumulation and runoff. Project construction would be the major new source of potential water quality degradation because unmanaged, silt and other contaminants from the cumulative impact area could be transported by surface water into surface streams, sloughs and the Pajaro River. Best Management Practices such as revegetation and stabilization of construction areas would control and eliminate the sources of sedimentation and surface water contaminants. Implementation of the measures cited above under Geology, Soils and Seismicity would reduce the project's contribution to this cumulative impact to a less-than-significant level.

The draft Revised BMP identifies a number of watershed management issues, which are addressed below in the context of cumulative hydrology and water quality impacts. Refer to Section 3.4 in the draft Revised BMP for additional information.

Recharge

Cumulative development in the Pajaro River watershed would increase impermeable surfaces thereby decreasing surface infiltration, decreasing groundwater recharge from natural streams and altering natural drainage by conveying and redirecting stormwater flows.

Section 3.3, Regional Setting—Hydrology and Water Quality, describes groundwater recharge characteristics in the region (page 3.3-3). **Figure 3.3-2** indicates the areas underlain by clays of very low permeability. These clay layers inhibit deep percolation through much of the central and western portions of the watershed, whereas the deeper aquifers rely on surface water infiltration and rainfall in the eastern portions of the watershed. Implementation of development projects in the eastern portion of the watershed that would displace undeveloped lands and agriculture would increase impervious surface areas and decrease infiltration and recharge. Neither the BMP 2000 nor Local-Only alternative would increase impervious surfaces in the eastern portion of the watershed due to the limited ground area covered by the required facilities. In effect, implementation of either alternative would actually facilitate recharge by decreasing groundwater withdrawal while providing alternative surface water sources. PVWMA recognizes the protection of areas serving to recharge the groundwater aquifers as critical to ensuring reliable, long-term water supplies. The draft Revised BMP indicates that basin-wide management measures could be implemented to enhance groundwater stability and groundwater equilibrium within the basin through the protection of key areas of recharge, and identifies implementation of a public outreach program as an initial step toward protecting groundwater recharge areas.

Existing surface water diversions in the watershed are estimated at 2,100 acre-feet per year--approximately 1,000 afy by farmers and 1,100 afy by the City of Watsonville at the Corralitos Creek Filter Plant. None of the projects listed in **Table 8.1** directly involve increases in surface water diversions. The City of Watsonville has initiated a feasibility study to evaluate treating water from Corralitos Creek year-round and examining opportunities for current and future expansion of the Corralitos Creek Filter Plant's treatment capacity, as well as increasing the capacity of the intake pipelines. As part of the City's project, they will be designing a screening system for the intakes. Increasing diversions from Corralitos Creek could reduce the quantity of water recharged to the groundwater aquifers (Watsonville, 2001). This project has recently been initiated and, consequently, impacts to Corralitos Creek cannot be fully characterized at this time.

The Local-Only Alternative includes proposed diversions from Corralitos Creek, Pinto Lake drainage channel and College Lake, reducing flows into Salsipuedes Creek. Implementing measures to protect steelhead (minimum bypass flows), would reduce the project's effects on reducing surface water flows and surface water recharge. The draft Revised BMP recommends that PVWMA develop a monitoring program to track and meter all surface water diversions to gain a full understanding the basin's response to such diversions, which would enable the agency to efficiently and equitably manager water supply in the basin.

Water Quality

Overall, the proposed project is beneficial to the water quality within the Pajaro Basin because essentially, it reduces groundwater extraction from the critical aquifers, allows the groundwater levels to increase, and establishes a barrier to inhibit seawater intrusion. Without this project, cumulative development in the basin area would continue to tax the aquifers, reduce groundwater levels, and degrade groundwater quality by allowing seawater to intrude into the fresh groundwater resources.

Section 3.3 generally describes existing conditions of nitrate contamination in the groundwater basin. Although correcting existing groundwater degradation from nitrate contamination is not an explicit objective of the projects evaluated in this EIR, the draft Revised BMP indicates that more detailed monitoring is necessary to better understand the extent of the contamination, and proposes the formation of a cooperative effort with Monterey, Santa Cruz, and San Benito counties to increase monitoring in the groundwater aquifers in the groundwater basin. Methods to control nitrate contamination in the Pajaro Basin could be developed over time to include altering cropping patterns to increase nitrate uptake at the surface. The specific water quality issues associated with implementing the Local-Only Alternative are addressed in Chapter 5; implementation of measures specified in Chapter 5 (advanced treatment) would reduce that alternative's contribution to nitrate loading in the groudnwater basin to a less-than-significant level. In addition, increasing groundwater levels to reduce seawater intrusion could serve to limit vertical downward migration of high-nitrate groundwater from the surface sources.

Section 3.3—Regional Hydrology and Water Quality presents a discussion of surface water quality, as related to Total Maximum Daily Loads (TMDLs). As described therein, Monterey Bay south, Watsonville Slough and segments of the Pajaro River are designated as impaired water bodies for several pollutants (see **Table 3.3.5** in that section) by the California State Water Resources Control Board. In the future, the TMDLs will be used to initiate basin-wide corrective actions to reduce pollutant loading to impaired water bodies from non-point source pollutants including pesticides, metals and sediment..

Vegetation and Wildlife Habitat

Approved and planned development would result in the disturbance of a significant amount of natural vegetation and wildlife habitat in the PVWMA service area and its vicinity. Construction of the proposed facilities under the BMP 2000 Alternative or the Local-Only Alternative would contribute significantly to these impacts. PVWMA has committed to implementing bore and jack construction at pipeline crossings of the Pajaro River and Watsonville Slough, thereby avoiding direct impacts to riparian and aquatic habitat at those locations. Implementation of the Local-Only Alternative would incrementally contribute to the cumulative permanent loss of wetlands/waters of the U.S. as well as loss of riparian habitat due to the Expanded College Lake and Corralitos Creek diversion projects. Implementation of off-site wetland creation and/or enhancement for permanent loss of wetlands from construction in Salsipuedes Creek (Expanded College Lake, Measure 5.B.4-1c) and restoration of the riparian forest along Corralitos Creek (Measures 5.C.4-1a and 5.C.4-1b) would reduce the project's contribution to this cumulative impact to a less-than-significant level.

The project would contribute incrementally to the cumulative losses of more common habitats in the project area, notably agricultural lands and grassland. Most of the pipeline alignments and other construction areas could be recolonized by native species, although trees likely would be removed from pipeline alignments during regular maintenance to keep rights-of-way clear.

Water Resources and Aquatic Habitat

The combined operation of the Corralitos Creek, Pinto Lake, and College Lake diversions will reduce streamflows in downstream portions of Salsipuedes Creek and the Pajaro River. Although the combined operation of these three water diversions would result in reduced winter flows downstream of the diversion sites, the cumulative impact on steelhead migration is considered less than significant since minimum bypass flows have been established for the Salsipuedes Creek below the Corralitos Creek confluence. Compliance with all minimum flow criteria will ensure that sufficient downstream flows are maintained regardless of the amount of water diverted at each of the withdrawal sites. No additional mitigation is required.

As discussed above under Hydrology and Water Quality, the City of Watsonville is proposing to screen its diversion at Corralitos Creek to reduce impacts to fisheries. While screening the intake would have a beneficial effect on aquatic resources, the City may also increase diversions from Corralitos Creek. The cumulative effects of the diversion from Corralitos Creek proposed under

the Local-Only Alternative and the increased diversion that the City may pursue cannot be determined until the City's proposed project is further developed.

Visual Impacts

Implementation of the components proposed under the BMP 2000 or Local-Only Alternative could, in conjunction with other projects, adversely affect the existing visual character of the project area. The geographic scope of cumulative impacts to visual quality are the viewsheds that could be affected by project implementation, specifically, the views from designated scenic routes identified in Section 3.10 (State Highways 1, 129, and 152; U.S. Highway 101; and Beach Road, San Andreas Road, Airport Road, and Holohan Road).

As discussed in Section 4.A.10, the Recycled Water Facility site is located next to the WWTF on flat, open agricultural land with nearby development limited to scattered farmhouses and agricultural buildings. The only development planned for this area west of Highway 1 is the proposed high school listed in **Table 8.1**. The clearwell storage tanks, together with the proposed high school development, could result in a cumulatively considerable visual impact that would affect views from Highway 1, Beach Road and San Andreas Road by incrementally increasing the presence of urban and industrial structures into a rural agricultural landscape. This would be a significant impact. However, the proposed facility would be constructed adjacent to the existing WWTF, so it would expand, not introduce, an industrial feature in the rural landscape. Measures 4.A.10-1a through 4.A.10-1c would minimize visual contrast of the facilities with the surrounding rural landscape.

The Expanded College Lake, Corralitos Creek Pump Station, and Aquifer Storage and Recovery Facilities under the Local-Only Alternative would involve construction of dams and pumping, filtration, and diversion facilities. The Expanded College Lake facilities would be visible from Highway 152 and Holohan Road, both of which are designated scenic roads. However, they would viewed in the context of surrounding urban development, and given their size and location, they would not be considered to have cumulatively considerable visual impacts. The Corralitos Creek Diversion and ASR facilities would be relatively unobtrusive and would not result in cumulatively considerable visual impacts.

8.3 SOCIOECONOMIC EFFECTS

While economic or social effects per se are not to be treated as significant effects on the environment under CEQA, the Guidelines state that economic and social information may be included in an EIR or may be presented in whatever form the agency desires. The following discussion provides an overview of potential socioeconomic impacts that could result from implementation of the BMP 2000 or Local-Only Alternative and is presented for informational purposes.

8.3.1 PROJECT COST AND FUNDING

There are a number of possible costing structures that could be adopted to finance the selected project alternative. The PVWMA Board of Directors will determine the cost structure to be implemented. Depending on the structure selected, PVWMA may need to obtain voter approval before implementation. Until a final cost structure is adopted, specific socioeconomic impacts cannot be determined. However, it is possible to predict in general terms the socioeconomic impacts that could result from the project.

Table 8.3 indicates the estimated costs of the Local-Only and BMP 2000 Alternatives, and shows that the total annual costs for these two alternatives are similar. The BMP 2000 would involve higher capital costs, for constructing the Import Pipeline and associated facilities, whereas the Local-Only Alternative would involve higher operating and maintenance costs because of the annual leasing of land to be fallowed. These costs do not include the cost of implementing the mitigation measures identified in this EIR. For example, these costs do not reflect the addition of advanced treatment processes that would substantially increase both the capital and operating costs of water recycling under the Local-Only Alternative.

The PVWMA projects that have been or are currently being implemented, Harkins Slough and the Coastal Distribution System, are being financed by two components: the water sales or delivery charge, and the PVWMA augmentation charge. In addition to these existing strategies, debt funding will be required to finance all of the capital expenditures involved with the major project components. Federal and state grants and low interest loans will be used to the extent possible. The PVWMA financial strategy will optimize the different revenue and debt funding sources to minimize the financial impacts on the Basin residents.

PVWMA will need to recover approximately up to $14.6 million annually from its water users. PVWMA is currently undertaking a study to evaluate the revenue requirements necessary to finance the various projects. The goal of the study is to develop a stable revenue stream to fund the capital debt and operating costs of the proposed facilities. Accomplishing this goal requires compliance with the law as well as meeting the financial needs of local farmers and other water users. The study is seeking to identify the appropriate and legal distribution of costs, recognizing the varying degrees of benefits and costs involved. The study is evaluating the appropriate allocation of costs and benefits, taking into account such issues as zones of benefit and zones of responsibility, and considering potential rate structures. The revenue stream ultimately could stem from a rate structure of fixed charges, assessments on land, flat price rates (levying the same price per acre-foot on all water sales), tiered or volumetric rates (levying higher costs for using more water), and various combinations of water rates and land assessment. The study also is examining legal and regulatory mechanisms for implementing the revenue plan, potentially including the use of ordinances, contracts, assessments, or any combination thereof. Numerous combinations are being evaluated in order to develop a funding program that will meet the goals

TABLE 8.3
COSTS ASSOCIATED WITH THE LOCAL-ONLY AND BMP 2000 ALTERNATIVES

	Local-Only Alternative	BMP 2000 Alternative
Capital Costs of Facilities	$128 million[a]	$162 million[a]
Annual Operating and Maintenance Costs	$6.6 million[b]	$4.4 million
Adjusted Total Annualized Costs[c]	$14.6 million	$14.5 million

a PVWMA is seeking federal funding pursuant to Title XVI for planning, design and construction of water recycling facilities and facilities that would provide blend water. These costs reflect a $20 million credit for Title XVI funding. PVWMA is also exploring cost-saving opportunities with the U.S. Army Corps of Engineers for the potential expansion of College Lake.

b The way that land fallowing would probably occur is that PVWMA would take out annual leases on the land to be fallowed. The cost of leases is expected to run from $1,000 to $2,000 per acre annually, and is added in to annual operation and maintenance costs.

c The adjusted annualized costs include annualized capital cost, operations and maintenance costs, and delivery charge.

SOURCE: draft Revised BMP, August 2001.

of financing project implementation while maintaining the economic integrity of the agricultural community and municipal and industrial users. In order for the project to be financially feasible, the revenues generated will have to be reliable and stable. Future investors in the project (bondholders) will want assurances that their investment will be repaid in full.

Tiered Water Pricing

As noted above, tiered water pricing is being evaluated as a rate structure that may apply to any of the project alternatives. (Due to the level of water conservation that would be required for the Local-Only Alternative, it is assumed this alternative definitely would require tiered pricing; PVWMA also is currently investigating the greater implications associated with a tiered pricing plan for this alternative.) Tiered water pricing is a management mechanism that can promote conservation and/or alter water use practices. Tiered pricing can encourage additional water conservation through simple market forces and can promote conversion to crops that use less water. Crops such as apples and other deciduous crops have a low application rate and would fall into the lowest pricing tier while crops with higher application rates such as strawberries and raspberries would fall into the higher tiers. Under the tiered structure, conservation is promoted by potential cost savings. This option could be utilized to reduce water use if construction of additional water supplies is either too costly or not feasible.

8.3.2 SETTING

As described in Section 3.1, Land Use, agriculture is the predominant land use in the Pajaro Valley, and much of the agricultural land in the valley meets the criteria for prime and unique farmland.[2] Farms in the Pajaro Valley produce high-revenue crops, many of which can be grown in only a few other areas of California or the United States (PVWMA, 1993). Small farms and owner-operated farms are common (PVWMA, 1993). While data showing the percent of rented acreage versus that owned by growers are not readily available, a 1998 study of socioeconomic impacts concluded that the majority of acreage in the valley is rented (M.Cubed, 1998).

8.3.3 POTENTIAL SOCIOECONOMIC EFFECTS

BOTH ALTERNATIVES

According to an analysis of the impact of augmentation charges on farm production costs and net returns to land and management conducted for the PVWMA (M.Cubed, 1998), an increase in the cost of water would likely have the following effects:

- The increase in water costs would result in a modest to negligible increase in unit production costs. The 1998 study noted, however, that for operations with a small profit margin, even a minor increase in unit production can result in a non-negligible change in net income.

- Initially, assuming no adjustments in farm operations or the land rental market, the effects of increased water costs would be a net decrease in returns to land and management (that is, the amount of revenue available for rent and management expenses after all other expenses have been paid). The decrease in net return would be three to four times higher for the vegetable rotation that was evaluated than for strawberry production, due to the much narrower profit margins for vegetables compared to strawberries. These initial impacts, especially to vegetable producers, are not expected to be sustainable, and would lead to adjustments in production and in rental markets.

- On-farm adjustments such as water conservation would significantly mitigate the impacts to net returns if water savings could be realized at low cost. According to the 1998 study, discussions with farm managers suggested that a 15 percent improvement in irrigation efficiency was "highly feasible" (M.Cubed, 1998). Because metering of wells and an augmentation charge program have previously been instituted, however, it is likely that the most-easily implemented or most cost-effective conservation measures have already been implemented by many of the Valley's water users. On the other hand, because the size of the current augmentation charge has been limited it is also likely that additional water conservation measures are quite feasible for many valley growers.

- Over time land rental rates would be adjusted to reflect the lower grower profit potential due to increased water costs. The 1998 analysis indicated that a 10 percent reduction in the baseline average rents would reduce impacts to net returns by approximately 50 percent under the local-import option that was evaluated in that study.

[2] For a description of criteria for designating agricultural land refer to Section 3.1.

- Impacts to net returns would not be evenly distributed. Impacts would be greatest for marginally profitable operations, while larger-scale operations would be expected to be more able to absorb the additional costs. In addition, impacts would be less for growers that are able to minimize production costs; consistently achieve above-average yields; and produce high quality produce and command a price premium. Thus, some marginally profitable farms could fail, and other agricultural operations would either shift to more profitable crops or less water intensive crops, or both.

- Although some reduction in local economic activity would occur, because agricultural income previously reinvested in the region would be diverted to import engineering and construction services or water supply development, the regional impacts of an augmentation charge would not be substantial.

BMP 2000 ALTERNATIVE

Facilities required for this alternative would take approximately eight acres of agricultural land out of production (see **Table 8.2**). This alternative meets a fundamental goal of PVWMA to eliminate the existing and projected shortfall of water supply without fallowing productive agricultural land. Because the total cost of the BMP 2000 Alternative is similar to the total annual costs of the Local-Only Alternative, the increase in water costs will be similar for both. The potential impacts of the BMP 2000 would be similar to those discussed above.

LOCAL-ONLY ALTERNATIVE

As discussed above, total annual costs for this alternative would be similar to the BMP 2000 Alternative, due in part to the cost for PVWMA to seasonally lease the land that would need to be fallowed (approximately $1,000 to $2,000 per acre annually). Therefore, the impacts of increased water costs alone would be similar to those described above for both alternatives.

As shown in **Table 8.2**, facilities required for this alternative would permanently remove a significantly greater amount of agricultural land from production. More significantly, because this alternative would fail to meet existing water demand, land would need to be taken out of production to meet the central objectives of PVWMA of avoiding or mitigating the adverse impacts of overdraft and seawater intrusion. As discussed under Impact 5.D.3-1 (Section 5.D), more than 2,200 acres of land would need to be fallowed under the Local-Only Alternative This represents over 7.3 percent of the land in agricultural production in the Pajaro Valley.

Therefore, in addition to the impacts of increased water cost, taking such a substantial amount of prime agricultural land out of production would have impacts that would ripple through the local and regional economy. Land fallowing would result in the loss of agriculture jobs and reduction in agricultural revenues locally, leading to reduced demand for non-agricultural goods and services with a corresponding decrease in revenues and employment in other sectors of the valley economy. Considering the high value of Valley agricultural lands, the removal of a significant amount of land from production likely would be felt well beyond Pajaro Valley.

The Local-Only Alternative also includes the use of farm reservoirs for percolation. Because details on this component have not been developed, it is not evaluated in this EIR. However, construction of farm reservoirs are also likely to entail (at least a seasonal) loss of additional agricultural acreage.

8.4 SIGNIFICANT IRREVERSIBLE ENVIRONMENTAL CHANGES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

The California Environmental Quality Act (CEQA) states that impacts associated with a proposed project development may be considered to be significant and irreversible if:[3]

- The project would involve a large commitment of non-renewable resources (such as fossil fuels or lumber).
- The primary and secondary impacts of a project would generally commit future generations to similar uses (such as a highway improvement that provides access to a previously inaccessible area).
- The project involves uses in which irreversible damage could result from potential environmental accidents associated with the project.

Construction of the BMP 2000 or Local-Only Alternatives would result in short-term but irretrievable and irreversible commitment of natural resources through direct consumption of fossil fuels and through use of materials for construction. These short-term uses would not be significant.

Implementation of the either the BMP 2000 or Local-Only Alternatives would not commit future generations to undesirable uses. The alternatives would not involve uses that could involve accidents that could cause irreversible damage.

Both alternatives would improve the water resources of the region in the long term.

REFERENCES – Impact Overview

City of Watsonville, Request for Proposals, Filter Plant Upgrade Feasibility Study and Preparation of Plans and Specifications for Surface Water Intakes, June, 2001.

M Cubed, Pajaro Valley Water Supply Augmentation Fees; An Analysis of Impacts to Costs and Net Returns to Production for Selected Corps, April 1988.

[3] CEQA Guidelines Section 15126.2(c).

CHAPTER 9

REPORT PREPARERS

REPORT AUTHORS

PAJARO VALLEY WATER MANAGEMENT AGENCY

36 Brennan Street
Watsonville, California 95076

Charles McNiesh, General Manager

EIR CONSULTANTS

Environmental Science Associates, Inc.
225 Bush Street, Suite 1700
San Francisco, California 94104

Project Director:	Leslie Moulton	
Project Manager:	Jill Hamilton	
Deputy Project Manager:	Marie Galvin	
Staff:	Suet Chau	Chris Mueller
	Michelle Kondo Murray	Mike Podlech
	Arnold Gerstell	Tom Roberts
	Peter Hudson	Chris Sanchez
	Paul Mitchell	David Friedland

FISHERIES ANALYSIS

Dr. Jerry Smith
The Habitat Restoration Group
P.O. Box 4006
6180 Highway 9
Felton, California 95018

Dennis Jackson
708 14th Avenue
Santa Cruz, California 95062

CULTURAL RESOURCES ANALYSIS

Tom Jackson
Pacific Legacy, Inc.
1288 Ninth Street
Berkeley, California 94710

Mike Newland
Anthropological Studies Center
1801 E. Cotati Ave., Bldg. 29
Rohnert Park, California 94928-3609

This page left
intentionally blank

Pajaro Valley Water Management Agency

Draft Appendices

PAJARO VALLEY WATER MANAGEMENT AGENCY REVISED BASIN MANAGEMENT PLAN

Environmental Impact Report

SCH# 2000062030

October 2001

Prepared for

Pajaro Valley Water Management Agency

ESA Environmental Science Associates

Draft
Appendices

PAJARO VALLEY WATER MANAGEMENT AGENCY REVISED BASIN MANAGEMENT PLAN

Environmental Impact Report

SCH# 2000062030

October 2001

Prepared for

Pajaro Valley Water Management Agency

700 University Avenue, Suite 130
Sacramento, California 95825
(916) 564-4500

1000 Broadway, Suite 410
Oakland, California 94607
(510) 839-5066

225 Bush Street, Suite 1700
San Francisco, California 94104
(415) 896-5900

4221 Wilshire Boulevard, Suite 480
Los Angeles, California 90010
(323) 933-6111

2685 Ulmerton Road, Suite 102
Clearwater, Florida 33762
(727) 572-5226

700 Fifth Avenue, Suite 4120
Seattle, Washington 98104
(206) 206-0900

ESA Environmental Science Associates

200179

TABLE OF CONTENTS

REVISED BASIN MANAGEMENT PLAN
DRAFT ENVIRONMENTAL IMPACT REPORT--APPENDICES

Page

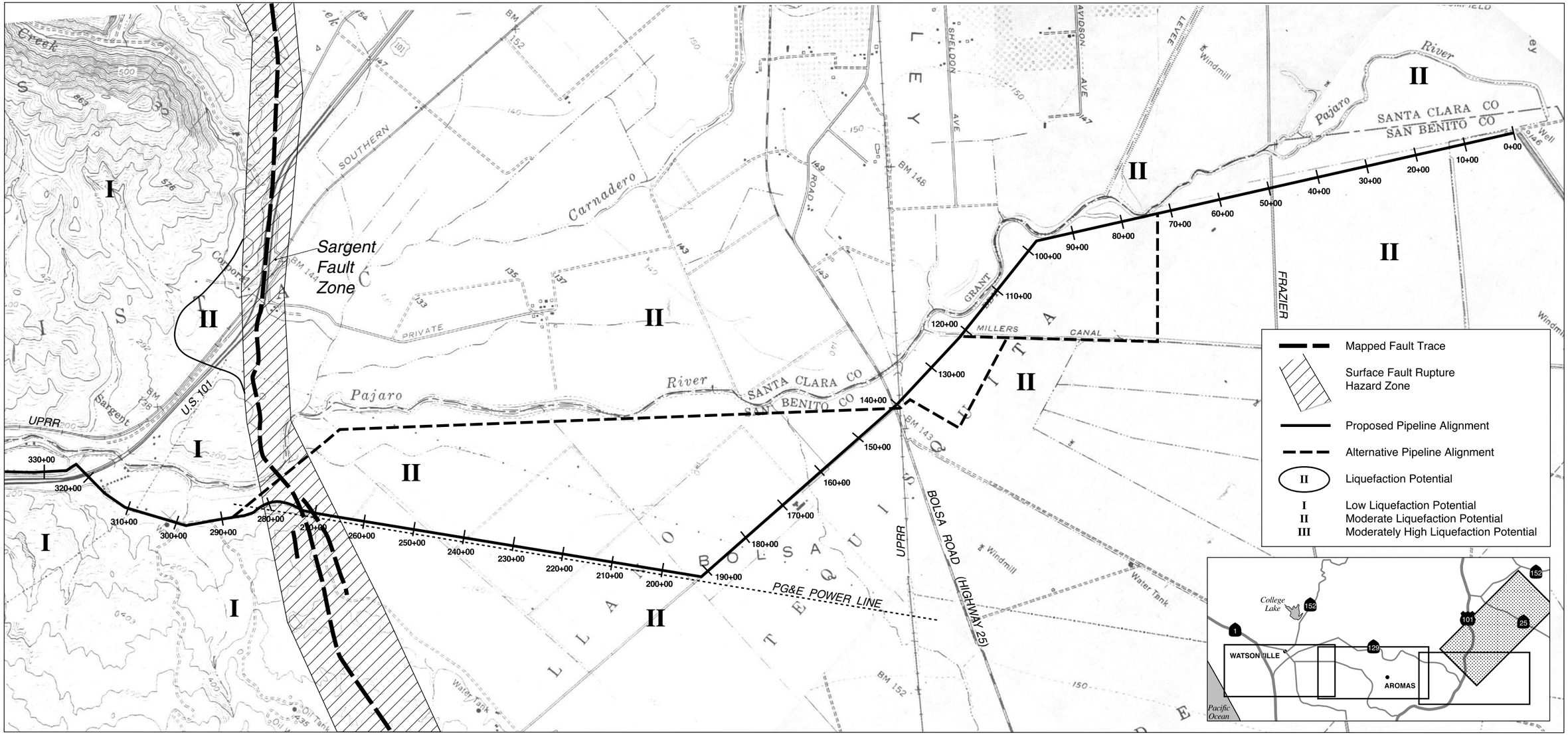
MAP APPENDIX

A1-A4 Proposed Pipeline Alignment; Seismic Hazards in the Project Area
B1-B4 Proposed Pipeline Alignment; Habitat Characterization in the Project Area

APPENDICES

A.	Plant Species Observed in the Study Area	A-1
B.	Bird Species Observed During Breeding Surveys	B-1
C.	Fisheries Resources of the Lower Pajaro River and its Tributaries	C-1
D.	Determination of the Minimum Bypass Flow in Corralitos Creek for the Expanded College Lake Project	D-1
E.	Alternative Alignments to the Import Pipeline	E-1
F.	Technical Memorandum 2.2 – Hydrologic Analysis and Modeling	F-1

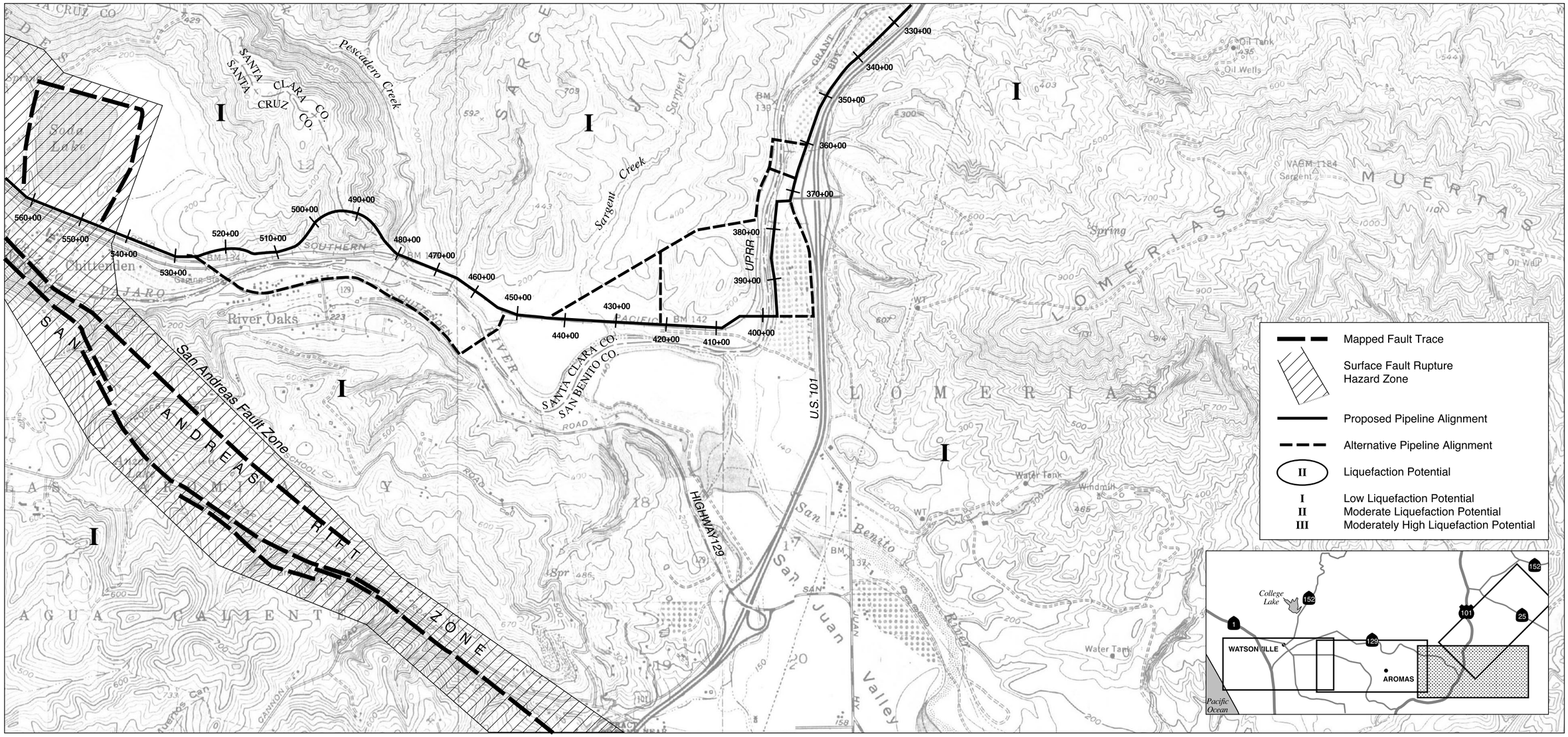
MAP APPENDIX



SOURCES: Alquist-Priolo Maps, California Division of Mines and Geology, 1982;
Watsonville East and Chittenden Quadrangles, U.S. Geological Survey;
Liquefaction Potential Map, ABAG 1980;
North County Area Plan, Monterey County, 1994;
PVWMA.

Map A1

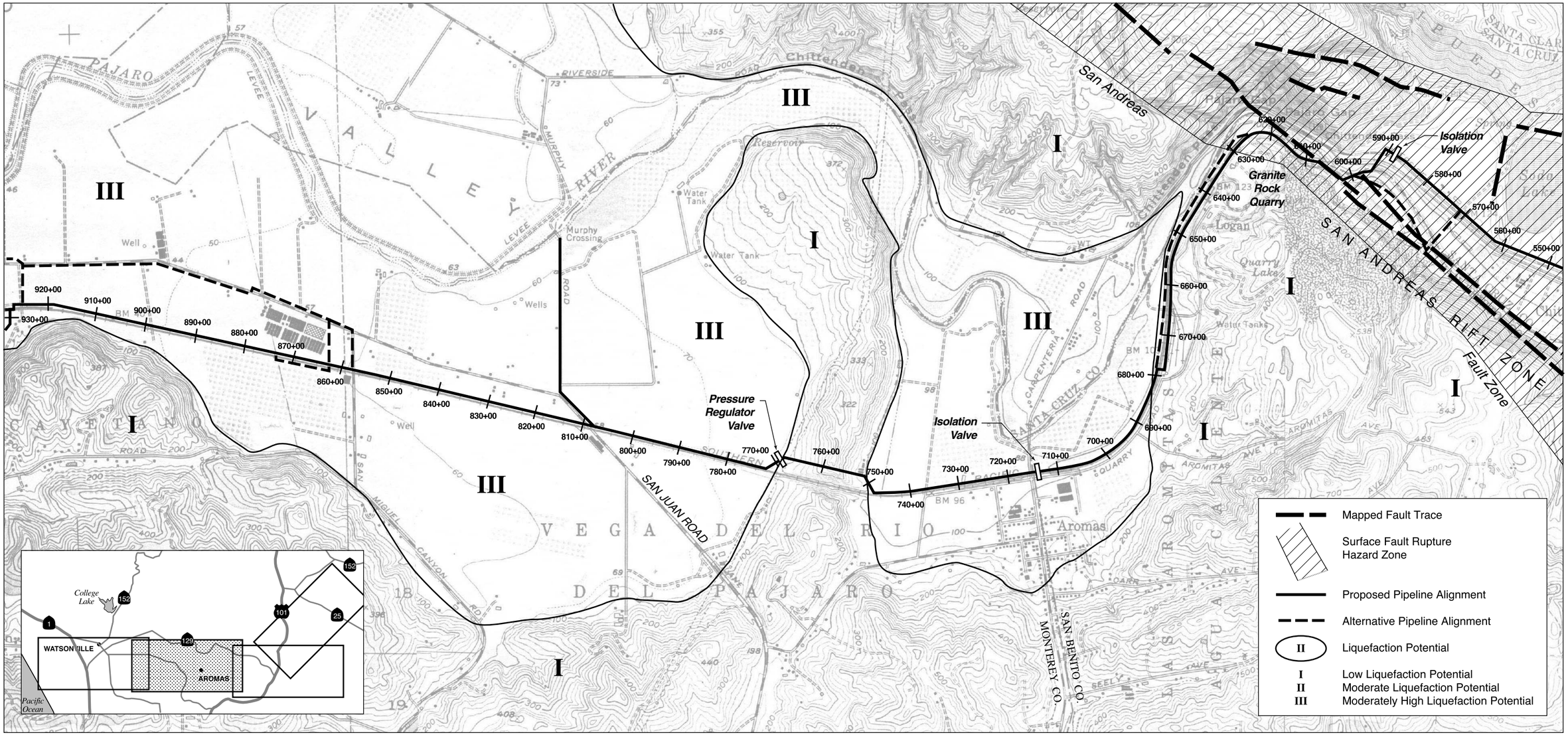
Proposed Pipeline Alignment;
Seismic Hazards in the Project Area



SOURCES: Alquist-Priolo Maps, California Division of Mines and Geology, 1982;
Watsonville East and Chittenden Quadrangles, U.S. Geological Survey;
Liquefaction Potential Map, ABAG 1980;
North County Area Plan, Monterey County, 1994;
PVWMA.

Map A2

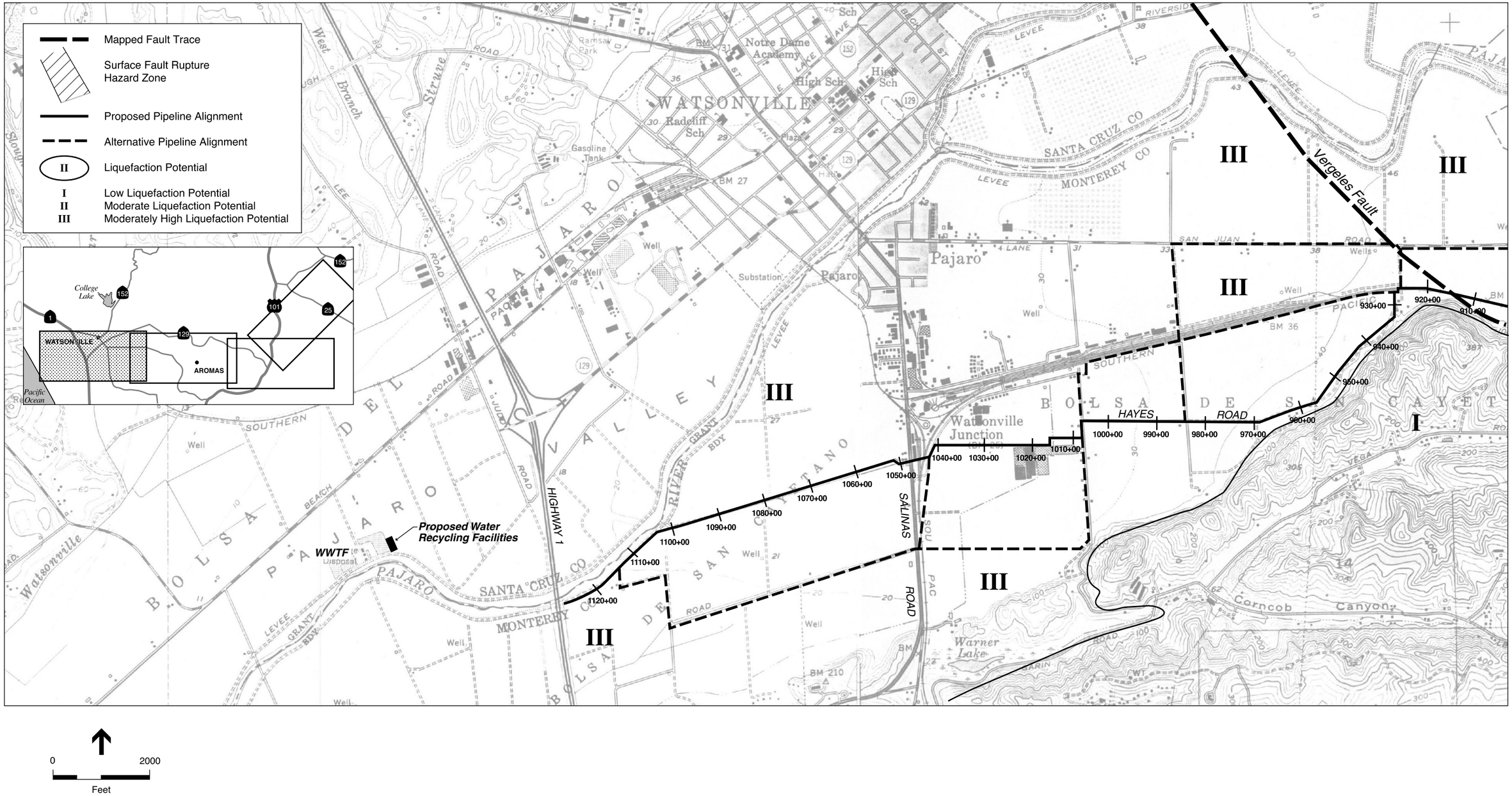
Proposed Pipeline Alignment;
Seismic Hazards in the Project Area



SOURCES: Alquist-Priolo Maps, California Division of Mines and Geology, 1982;
Watsonville East and Chittenden Quadrangles, U.S. Geological Survey;
Liquefaction Potential Map, ABAG 1980;
North County Area Plan, Monterey County, 1994;
PVWMA.

Map A3

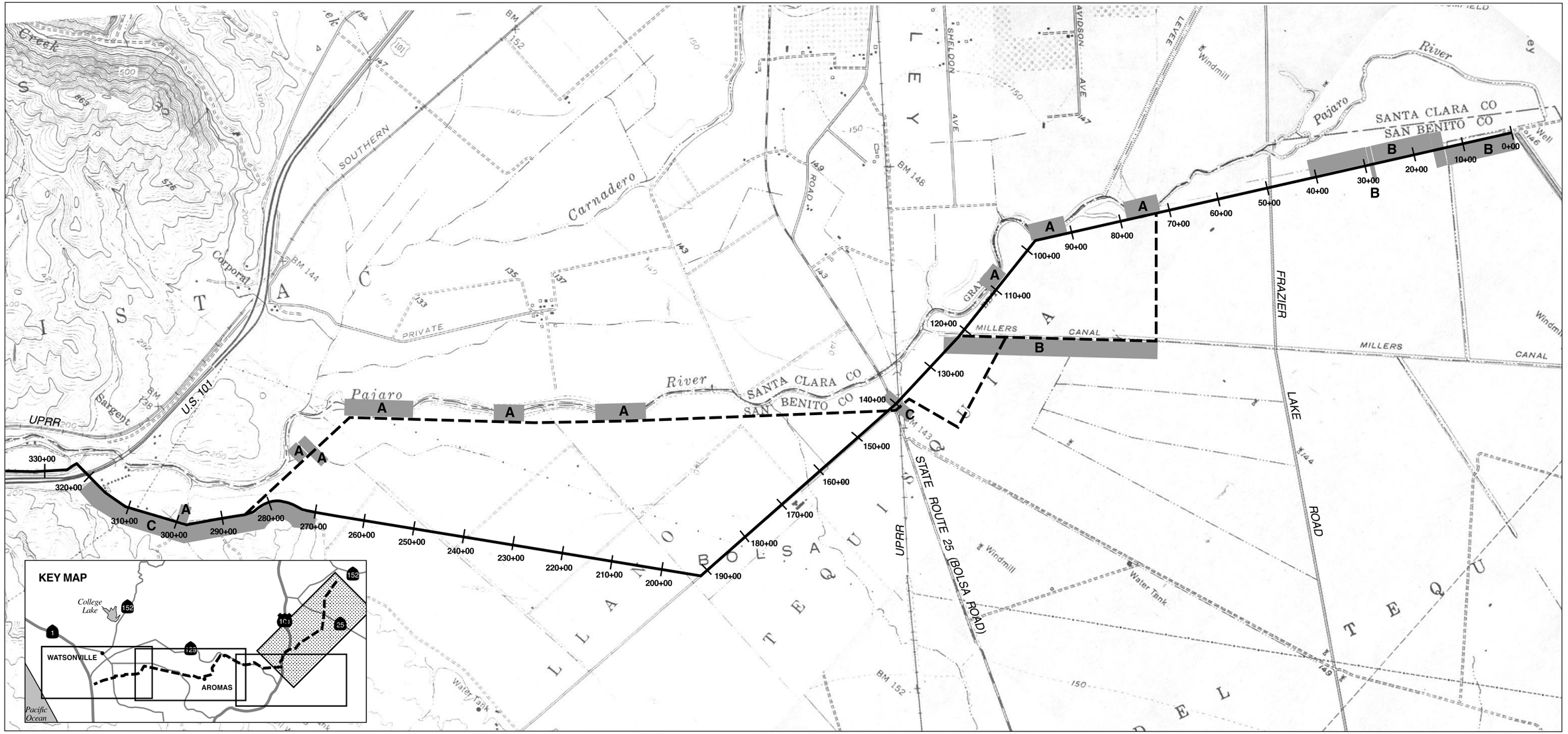
Proposed Pipeline Alignment;
Seismic Hazards in the Project Area



SOURCES: Alquist-Priolo Maps, California Division of Mines and Geology, 1982;
Watsonville East and Chittenden Quadrangles, U.S. Geological Survey;
Liquefaction Potential Map, ABAG 1980;
North County Area Plan, Monterey County, 1994;
PVWMA.

Map A4

Proposed Pipeline Alignment;
Seismic Hazards in the Project Area



Habitat identified within the survey corridor
Proposed Pipeline Alignment
Alternative Pipeline Alignment

A Valley Foothill Riparian
B Freshwater Emergent Wetland
C Annual Grassland
D Coastal Scrub
E Coastal Oak Woodland

NOTES

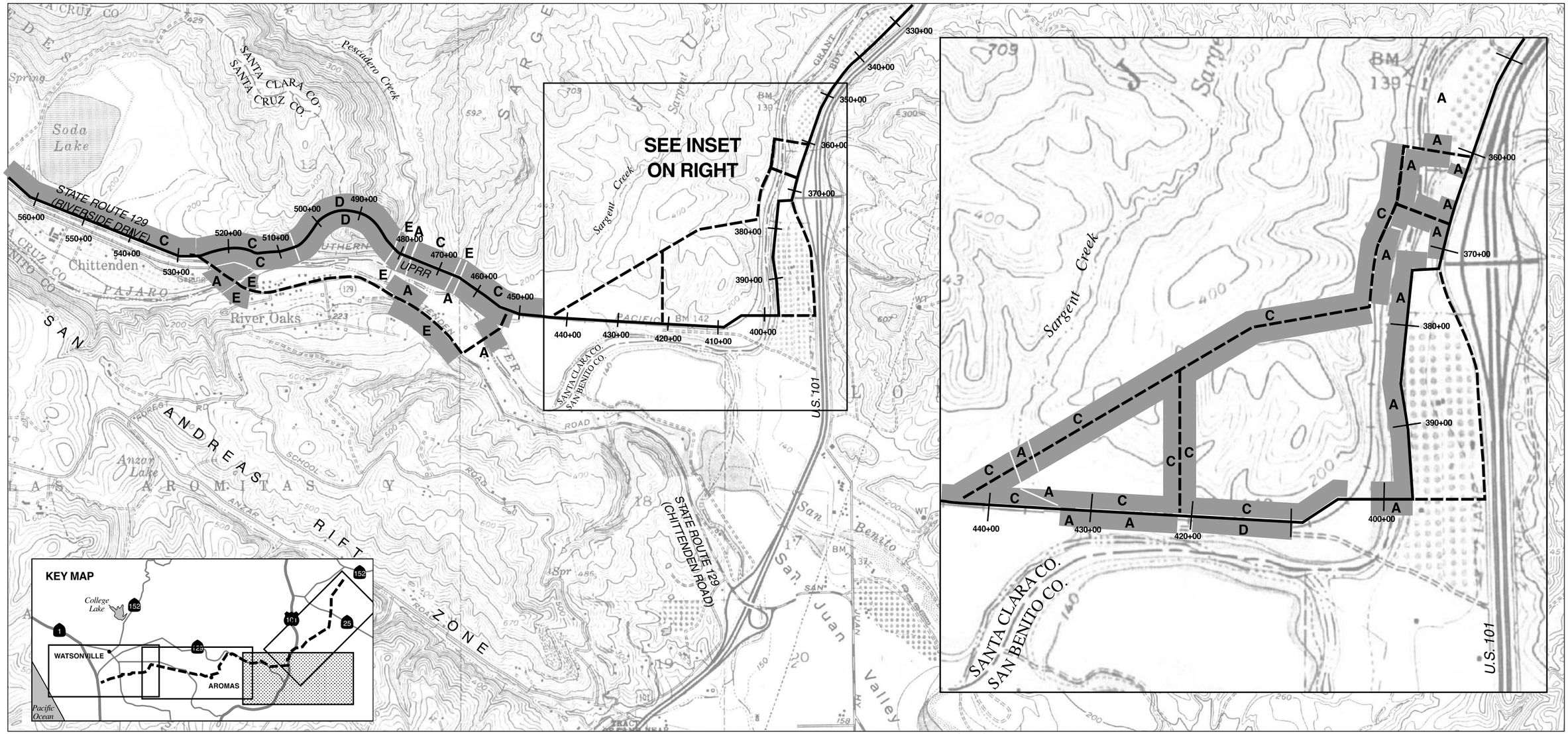
Unless noted by a letter, habitat is cropland/orchard/vineyard or urban/developed.

Habitat areas are enlarged to enhance visibility and are not to scale (see text).

Survey corridor width is 250 feet.

SOURCE: Environmental Science Associates

Map B1
Proposed Pipeline Alignment; Habitat Characterization of the Project Area



Habitat identified within the survey corridor
Proposed Pipeline Alignment
Alternative Pipeline Alignment

0 2000
Feet

A Valley Foothill Riparian
B Freshwater Emergent Wetland
C Annual Grassland
D Coastal Scrub
E Coastal Oak Woodland

NOTES

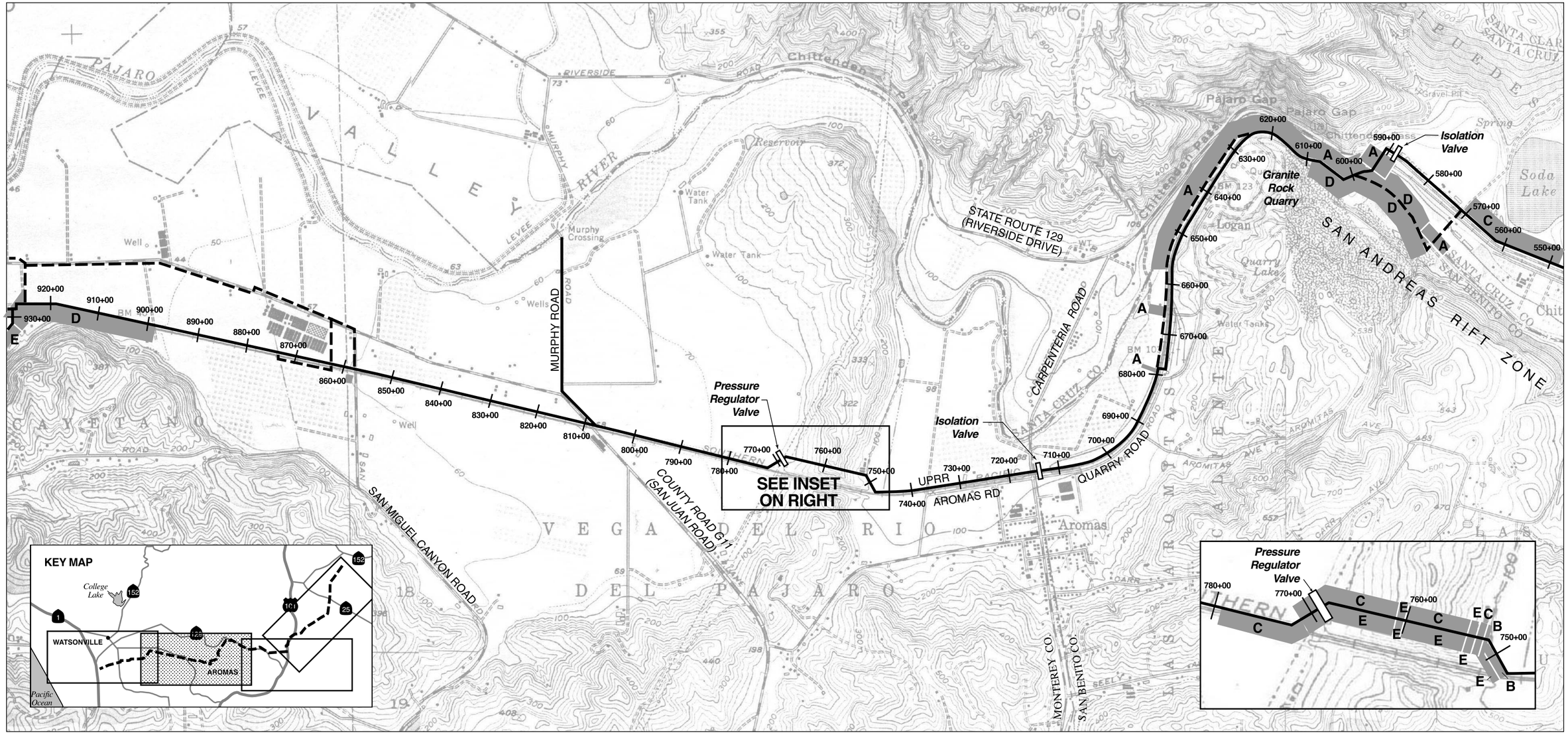
Unless noted by a letter, habitat is cropland/orchard/vineyard or urban/developed.

Habitat areas are enlarged to enhance visibility and are not to scale (see text).

Survey corridor width is 250 feet.

SOURCE: Environmental Science Associates

Map B2
Proposed Pipeline Alignment; Habitat Characterization of the Project Area



0 2000
Feet

Habitat identified within the survey corridor
Proposed Pipeline Alignment
Alternative Pipeline Alignment

A Valley Foothill Riparian
B Freshwater Emergent Wetland
C Annual Grassland
D Coastal Scrub
E Coastal Oak Woodland

NOTES

Unless noted by a letter, habitat is cropland/orchard/vineyard or urban/developed.

Habitat areas are enlarged to enhance visibility and are not to scale (see text).

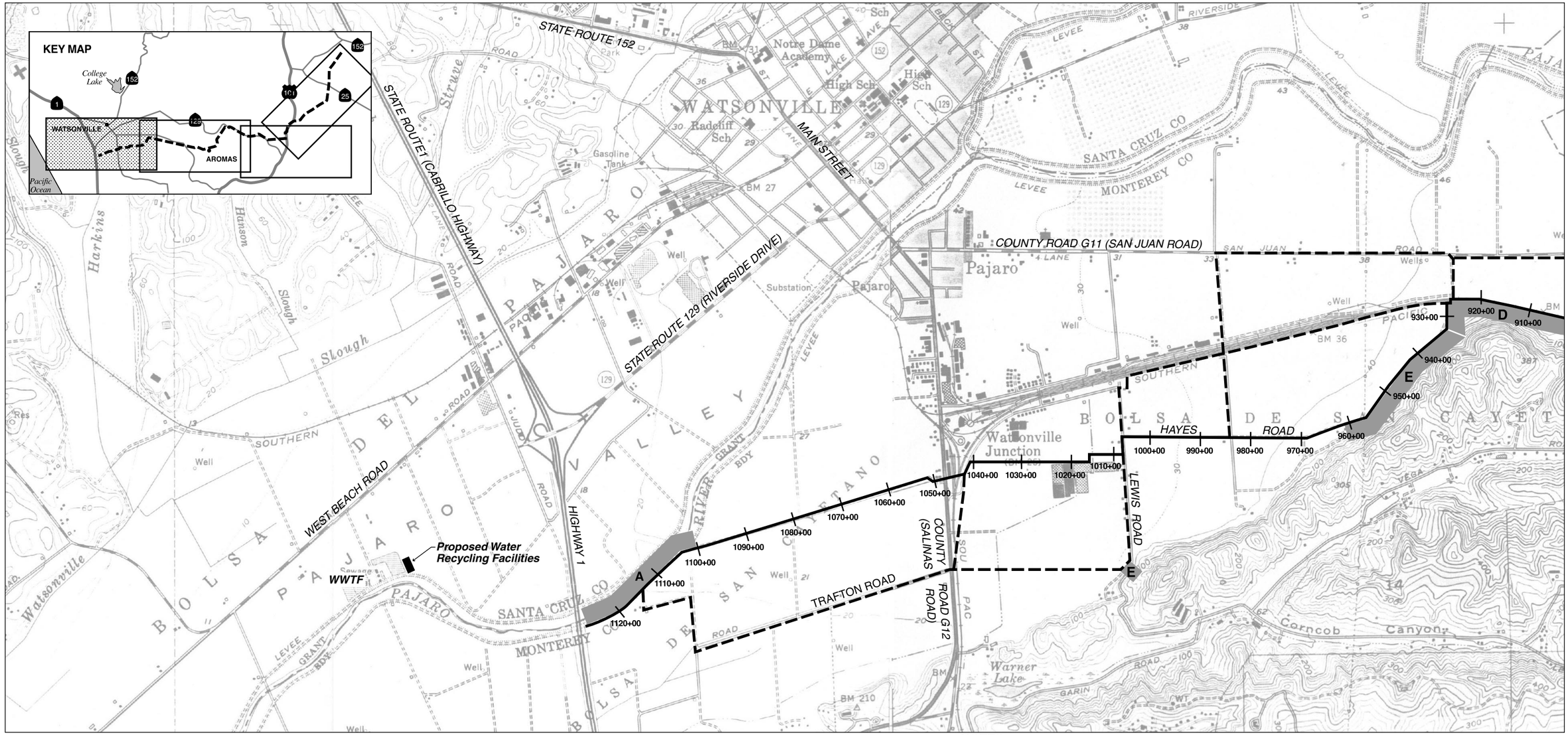
Survey corridor width is 250 feet.

SOURCE: Environmental Science Associates

PVWMA Revised BMP EIR / 200179

Map B3

Proposed Pipeline Alignment; Habitat Characterization of the Project Area



0 2000 Feet

Habitat identified within the survey corridor
Proposed Pipeline Alignment
Alternative Pipeline Alignment

A Valley Foothill Riparian
B Freshwater Emergent Wetland
C Annual Grassland
D Coastal Scrub
E Coastal Oak Woodland

NOTES

Unless noted by a letter, habitat is cropland/orchard/vineyard or urban/developed.

Habitat areas are enlarged to enhance visibility and are not to scale (see text).

Survey corridor width is 250 feet.

SOURCE: Environmental Science Associates

Map B4
Proposed Pipeline Alignment; Habitat Characterization of the Project Area

APPENDICES

APPENDIX A

PLANT SPECIES OBSERVED IN THE STUDY AREA

SCIENTIFIC NAME	COMMON NAME
Acacia sp.	Acacia
Acer negundo var. *californica**	California box-elder
*Achillea millefolium**	Yarrow
Aira caryophyllea	Hairgrass
Amaranthus deflexus	Amaranth
*Amsinckia intermedia**	Fiddleneck
Anagallis arvensis	Scarlet pimpernel
*Arbutus menziesii**	Madrone
Arundo donax	Giant reed
Avena barbata	Slender oats
Avena fatua	Wild oats
*Baccharis pilularis**	Coyote brush
Brassica nigra	Mustard
Brassica rapa	Field mustard
Briza minor	Little quaking grass
Brodiaea sp.*	Brodiaea
Bromus diandrus	Ripgut brome
Bromus hordeaceus	Soft chess
*Calandrinia ciliata**	Red maids
Capsella bursa-pastoris	Shepherd's purse
Cardaria chalepense	Lens-podded hoary cress
Carduus pycnocephalus	Italian thistle
Carex sp.	Sedge
Carpobrotus chilensis	Sea fig
*Centaurium muehlenbergii**	Monterey centaury
Cerastium glomeratum	Mouse-ear chickweed
Chamomilla suaveolens	Pineapple weed
*Chenopodium rubrum**	Lamb's quarters
Cirsium sp.	Thistle
Cirsium vulgare	Bull thistle
*Claytonia perfoliata**	Miner's lettuce
Conium maculatum	Poison hemlock
Convolvulus arvensis	Bindweed
Conyza bonariensis	Hairy fleabane
Cornus sp.*	Dogwood
Cynodon dactylon	Bermuda grass
*Dichelostemma pulchella**	Blue dicks
*Distichlis spicata**	Saltgrass
*Eleocharis acicularis**	Spikerush
*Epilobium brachycarpum**	Annual fireweed
*Equisetum arvense**	Common horsetail
Erodium brachycarpum	Filaree
Erodium cicutarium	Red stem filaree
Erodium moschatum	Filaree
*Eschscholzia californica**	California poppy
Eucalyptus globulus	Blue gum eucalyptus

SCIENTIFIC NAME	COMMON NAME
Foeniculum vulgare	Fennel
Geranium dissectum	Cut-leaved geranium
Gnaphalium luteo-album	cudweed
*Heterotheca grandiflora**	Telegraph weed
*Holocarpha macradenia**	Santa Cruz tarplant
Hordeum leporinum	Farmer's barley
Hordeum marinum ssp. *gussoneanum*	Mediterranean barley
Hypochaeris glabrata	Smooth cat's ear
Juglans regia	English walnut
*Juncus bufonius**	Toad rush
Lactuca serriola	Prickly lettuce
Lolium multiflorum	Italian ryegrass
Lotus corniculatus	Birdfoot trefoil
*Lotus micranthus**	Least trefoil
*Madia sativa**	Coast tarweed
Malva nicaeensis	Bull mallow
Malva parviflora	cheeseweed
Marrubium vulgare	Horehound
Medicago polymorpha	Bur-clover
Melilotus alba	White sweet clover
Melilotus indica	Yellow sweet clover
Mentha pulegium	Pennyroyal
*Mimulus aurantiacus**	Bush monkey flower
*Nasella lepida**	Small needlegrass
*Navarretia squarrosa**	Skunkweed
Nicotiana attenuata	Tree tobacco
Oxalis pes-caprae	Oxalis
Paspalum dilatatum	Dallis grass
Picris echioides	Bristly ox-tongue
*Pinus radiata**	Monterey pine
Plantago coronopus	Plantain
*Platanus racemosa**	Western sycamore
Poa annua	Annual bluegrass
Polygonum arenastrum	Knotweed
Polypogon monspeliensis	Rabbitfoot grass
Populus balsamifera ssp. *trichocarpa**	Black cottonwood
Potentilla sp.	Cinquefoil
*Pteridium aquilinum**	Bracken fern
*Quercus agrifolia**	Coast live oak
Raphanus sativus	Wild radish
*Rosa californica**	California rose
Rubus discolor	Himalayan blackberry
*Rubus ursinus**	California blackberry
Rumex acetosella	Sheep sorrel
Rumex crispus	Curly dock
*Salicornia virginica**	Pickleweed

SCIENTIFIC NAME	COMMON NAME
*Salix coulteri**	Coulter willow
*Salix hindsiana**	Sandbar willow
*Salix lasiolepis**	Arroyo willow
*Salvia mellifera**	Black sage
*Sambucus mexicana**	Elderberry
Scirpus sp.*	Bulrush
Senecio mikanioides	German ivy
Senecio vulgaris	Common groundsel
Silene gallica	Windmills
*Sisyrhinchium bellum**	Blue-eyed grass
Sonchus oleraceus	Sow thistle
Stellaria media	Chickweed
*Toxicodendron diversilobum**	Poison oak
Trifolium angustifolium	Clover
Typha sp.*	Cattail
Urtica dioica ssp. *holosericea*	Hoary nettle
Vulpia bromoides	Annual fescue
Vulpia *myuros*	Rattail fescue

APPENDIX B

BIRD SPECIES OBSERVED DURING BREEDING SURVEYS

Common Name	Scientific Name	Reach and Option Observed
Family *Podicipedidae*		
Pied-billed grebe	*Podilymbus podiceps*	R2 A1
Family *Anatidae*		
Mallard	*Anas platyrhynchos*	R 2 O A3; R2 A1
Family *Charadriidae*		
Killdeer	*Charadrius vociferus*	R2 OA3
Family Accipitridae		
Red-tailed hawk	*Buteo jamaicensis*	R2 OA3
Family Phasianidae		
California quail	*Callipepla californica*	R2 OA3; R2 A1; R3 B1
Family Columbidae		
Mourning dove	*Zenaida macroura*	R2 OA3; R6 B8/C1, OB7; R2 A1; R3 B1
Family *Trochilidae*		
Anna's hummingird	*Calypte anna*	R2 OA3; R6 B8/C1, OB7; R3 B1; R2 A1;
Family *Alcedinidae*		
Belted kingfisher	*Ceryle alcyon*	R2 A1
Family *Picidae*		
Northern flicker	*Colaptes auratus*	R2 OA3
Downy woodpecker	*Picoides pubescens*	R2 OA3
Hairy woodpecker	*Picoides villosus*	R2 O A1
Nuttall's woodpecker	*Picoides nuttallii*	R2 OA3
Family *Tyrannidae*		
Western wood pewee	*Contopus sordidulus*	R2 A1
Ash-throated flycatcher	*Myiarchus tyrannulus*	R2 OA3;
Black phoebe	*Sayornis nigricans*	R2 OA3; R3 A2; R2 A1
Pacific-slope flycatcher	*Empidonax difficilis*	R2 OA3; R6 B8/C1, OB7; R2 A1
Ash-throated flycatcher	*Myiarchus cinerascens*	R2 OA3
Family *Hirundinidae*		
Tree swallow	*Tachycineta bicolor*	R2 OA3, R6 B8/C1, OB7
Violet-green swallow	*Tachycineta thalassina*	R2 OA3; R2 A1
Cliff swallow	*Hirundo pyrrhonota*	R2 OA3; R6 B8/C1, OB7
Barn swallow	*Hirundo rustica*	R3 B1
Family *Corvidae*		
Scrub jay	*Aphelocoma coerulescens*	R2 OA3; R3 A2; R2 A1
Stellar's Jay	*Cyanocitta stelleri*	R2 OA3; R3 A2
American crow	*Corvus brachyrhynchos*	R2 A1
Common raven	*Corvus corax*	R2 OA3
Family *Paridae*		
Plain titimouse	*Parus inornatus*	R2 OA3; R2 A1; R3 B1
Chestnut-backed chickadee	*Parus rufescens*	R2 OA3; R2 A1
Family *Aegithalidae*		
Bushtit	*Psaltriparus minimus*	R2 OA3; R6 B8/C1, OB7; R3 A2; R2 A1; R3 B1

Common Name	Scientific Name	Reach and Option Observed
Family *Sittidae*		
Red-breasted nuthatch	*Sitta canadensis*	R3 A2
Family *Troglodytidae*		
Bewick's wren	*Thryomanes bewickii*	R2 OA3; R3 B1
Family *Muscicapidae*		
Wrentit	*Chamaea fasciata*	R2 OA3
Golden-crowned kinglet	*Regulus satrapa*	R2 OA3
Swainson's thrush	*Catharus ustulatus*	R2 OA3; R3 B1
American robin	*Turdus migratorius*	R2 OA3; R6 B8/C1, OB7; R2 A1
Family *Mimidae*		
Northern mockingbird	*Mimus polyglottos*	R6 B8/C1, OB7
California thrasher	*Toxostoma redivivum*	R3 A2
Family *Bombycillidae*		
Cedar waxwing	*Bombycilla cedrorum*	R2 OA3
Family *Sturnidae*		
European starling	*Sturnus vulgaris*	R2 OA3; R2 A1; R3 B1
Family *Vireonidae*		
Hutton's vireo	*Vireo huttoni*	R2 OA3;
Warbling vireo	*Vireo gilvus*	R2 OA3
Family *Emberizidae*		
Orange-crowned warbler	*Vermivora celata*	R2 OA3; R6 B8/C1, OB7
Yellow warbler	*Dendroica petechia*	R2 OA3; R6 B8/C1, OB7
Wilson's warbler	*Wilsonia pusilla*	R2 OA3; R2 A1
Common yellowthroat	*Geothlypis trichas*	R3 A2
Black-headed grosbeak	*Pheucticus melanocephalus*	R2 OA3; R2 A1
Rufous-sided towhee	*Pipilo erythrophthalmus*	R2 OA3; R3 A2; R2 A1
Brown towhee	*Pipilo fuscus*	R2 OA3; R6 B8/C1, OB7; R2 A1
Song sparrow	*Melospiza melodia*	R2 OA3; R6 B8/C1, OB7; R3 A2; R2 A1; R3 B1
White-crowned sparrow	*Zonotrichia leucophrys*	R2 OA3
Red-winged blackbird	*Agelaius phoeniceus*	R2 OA3; R6 B8/C1, OB7; R2 A1
Brown-headed cowbird	*Molothrus ater*	R6 B8/C1, OB7; R2 A1; R3 B1
Hooded-oriole	*Icterus cucullatus*	R2 OA3
Family *Passeridae*		
House sparrow	*Passer domesticus*	R3 B1
Family *Fringillidae*		
American goldfinch	*Carduelis tristis*	R6 B8/C1, OB7
House finch	*Carpodacus mexicanus*	R6 B8/C1, OB7; R3 B1

NOTE: R2 OA3 = Reach 2 Option A3

APPENDIX C

FISHERIES RESOURCES OF THE LOWER PAJARO RIVER AND ITS TRIBUTARIES

FISHERIES RESOURCES OF THE LOWER PAJARO RIVER AND ITS TRIBUTARIES

Prepared for Environmental Science Associates
225 Bush St., Suite 1700
San Francisco, CA 94104
by
The Habitat Restoration Group
P.O. 4006
Felton, CA 95018

September, 1997

INTRODUCTION

This report is an assessment of existing conditions for fisheries resources, particularly for Central Coast steelhead (*Onchorhynchus mykiss*) and the tidewater goby (*Eucyclogobius newberryi*), in the lower Pajaro River and its tributary watershed of Salsipuedes Creek. Tidewater gobies are found only in the lowest one mile of the Pajaro River and in Watsonville Slough, while the steelhead migrates to the upper portions of these watersheds to spawn. The purpose of this report is to present sufficient information to assess the potential effects of development of the Pajaro Valley Water Management Agency's proposed import and local distribution pipeline projects on fishery resources.

Inventories of riffle conditions were carried out in two areas critical for steelhead passage, the Pajaro River at Murphy Crossing, and Corralitos and Salsipuedes creeks near College Lake. Recommendations to reduce adverse impacts to steelhead are included as well.

EXISTING CONDITIONS: FISHERIES

Pajaro River and the Eastern Watershed

The Pajaro River serves as a migration pathway for adult steelhead (*Oncorhynchus mykiss*) migrating to spawning and nursery habitat in the upper watershed and for steelhead smolts (1-2 year old juveniles) migrating from that habitat to the ocean. In the upper watershed Pescadero, Uvas, Llagas and Pacheco creeks, and their tributaries, provide potential spawning and rearing habitat. Pescadero and Uvas creeks provide access, spawning and rearing in all but extreme drought years. Use of Llagas and Pacheco creeks by steelhead is less frequent and less extensive. Coho salmon (*O. kisutch)* have not been present in the Pajaro River system since at least the late 1960's, and occasional sightings in the 1960s may have been due to hatchery strays from the San

Lorenzo River. Scarcity of suitable cool, low gradient rearing habitat and lack of regular access preclude sustaining runs of coho in the watershed.

Chesbro Reservoir on Llagas Creek and Uvas Reservoir on Uvas Creek, which are operated by the Santa Clara Valley Water District, regulate late spring through fall stream flows in those two streams. Normally, reservoir releases are adjusted to the percolation capacity of the middle reaches of the two streams, and steelhead passage through the lower reaches is blocked by dry streambeds by May to early June (with flows persisting longer in Uvas Creek than in Llagas Creek). Flows in Pacheco Creek are partially regulated by a dam on the North Fork of Pacheco Creek (operated by the Pacheco Water District). Flow regulation by the dam, and the generally dry nature of the watershed, usually block smolt outmigration by late April to May. Storage capacity of the reservoirs in the upper watershed is relatively low compared to average annual runoff, and unregulated tributaries are present in the Llagas Creek, Uvas Creek and Pacheco Creek watersheds. Except in severe drought years, adult upstream access is provided by reservoir spill and tributary runoff during the winter storms of January through March or April.

No studies of adult and smolt steelhead migration timing have been conducted for the Pajaro River system, but, despite drier watershed conditions in the Pajaro, migration periods are probably similar to those of streams in Santa Cruz County. Adult steelhead upmigration in Waddell Creek (Shapovalov and Taft 1954) and the San Lorenzo River (Monterey Bay Salmon and Trout Project trapping records) is in late December through early April, with most of the run occurring in January through March. The migration of waiting adults can be triggered by storms, and even in drier years the majority of adults may be able to migrate during the infrequent storms. Smolt outmigration in Waddell Creek (Shapovalov and Taft 1954; Smith unpublished trapping records from 1992-4) and the San Lorenzo River (Smith, unpublished trapping records for 1987-89) is primarily during late March through the end of May. Three characteristics of smolt migration make it more precarious than adult migration: 1) it occurs in late spring, when streamflows are naturally low and declining, rather than during the high flows of winter; 2) it does not appear to occur much earlier in dry years, despite the more rapid decline in spring streamflows; and 3) it is a more continuous, prolonged migration, rather than an episodic dash. The relatively fixed, prolonged migration period is apparently due to the importance of size of emigrating smolts; larger juveniles migrate earlier, and many later fish apparently require spring growth to achieve a size sufficient to successfully enter the ocean. The relatively fixed late spring migration means that in dry years a large portion of late-migrating steelhead smolts may be blocked from migration. Avoiding predation is also apparently an important factor in smolt migration, as almost all migration occurs at night (Smith, unpublished San Lorenzo River trapping results).

During periods of lower flows in late spring the water temperatures of streams increase. Part of this increase is due to the seasonal increase in day length and air temperatures, and part is due to the reduced temperature buffering provided by the reduced streamflows.

Since smolts travel mostly at night, when water temperatures are cooler, the temperature problem is probably minor for short migrations. Migrating smolts travel relatively quickly, and the distance from Murphy Crossing to Salsipuedes Creek is short (6 miles); temperature is probably not a problem at times when the flows are sufficient to allow easy passage through riffles.

No steelhead spawning or rearing occur in the Pajaro River downstream of Murphy Crossing. Other fish species are present in the Pajaro River downstream of Murphy Crossing and in Salsipuedes Creek, including Sacramento sucker (*Catostomus occidentalis*), Sacramento squawfish (*Ptychochielus grandis*), hitch (*Lavinia exilicauda*), Sacramento blackfish *(Orthodon microlepidotus*), prickly sculpin (*Cottus asper)* and threespine stickleback (*Gasterosteus aculeatus*). None of these species require April to June streamflows for passage, spawning or rearing in excess of those required for steelhead smolt passage. Pacific lamprey (*Lampetra tridentata*) is an anadromous fish, which, like the steelhead, migrate into freshwater to spawn and rear and with juveniles which migrate to the ocean to mature. Adult migration times for lamprey tend to occur somewhat later than than the peak of the steelhead adult migration (March and April). However, lamprey adults are able to negotiate relatively shallow riffles. Juvenile lampreys migrate to the ocean with peak winter flows, and rarely suffer migration blockage.

Salsipuedes Creek Watershed

Steelhead regularly use the watershed of Corralitos Creek, which joins Salsipuedes Creek immediately downstream of College Lake. Diversion dams on Corralitos and Browns creeks and wells downstream of their confluence (operated by the City of Watsonville) affect spring streamflows and fish passage in lower Corralitos Creek and in Salsipuedes Creek.

Two tributaries to College Lake and Salsipuedes Creek may also be used by steelhead for spawning and rearing. Adult access is good to Casserly Creek, and fish with smolt coloration were captured in spring 1997, confirming its continued use by steelhead. Passage is more difficult on Green Valley Creek, and size structure of fish in spring 1997 and lack of smolted fish may indicate that a major portion of the "rainbow trout" in the perennial portion of the stream are resident, rather than migratory steelhead in many years. Although no dams or major diversions occur on the two streams, spring streamflows are relatively low, probably blocking late-migrating smolts in average or dry years; on 2 May 1997 streamflows in both streams were insufficient for fish passage to College Lake, even though smolts were still apparently coming down Corralitos Creek.

College Lake is quite turbid in winter and spring, because much of its stored water is turbid storm runoff and because the bare, fine-grained soils of the shallow lake bed are easily stirred up by wind and wave action. The turbid conditions and probable lack of

abundant food due to turbid water and the seasonal nature of the lake) indicate that steelhead smolts migrating through the lake from Green Valley or Casserly creeks probably spend little time in the lake (less than 1 week).

College Lake is presently pumped dry in late spring to allow agricultural use of the lake bed. The pumped water provides passage flows for steelhead from College Lake tributaries and also for those from the Corralitos Creek watershed.

The Pajaro River Lagoon

Pajaro River and Salsipuedes Creek streamflows can provide for steelhead passage and also supply fresh water to the Pajaro River estuary. In spring the freshwater inflow provides a surface wedge of lighter fresh water on top of the salt water in the Pajaro River estuary. This freshwater wedge allows steelhead smolts to move up and down in the water column to aid in gradually adjusting to sea water. When flows are sufficient for passage to the estuary the inflows are also probably sufficient to provide a good fresh to saltwater transition zone. Migrating smolts may spend several weeks feeding in the estuary and adjusting to sea water. This transition may not be required, as many central California streams lack good transitional estuaries. However, the transition may improve survival of smolts, especially smaller smolts, upon entering the ocean.

A sand bar forms across the mouth of the Pajaro River in many years. Bar formation is primarily a function of beach-building processes produced by low-energy summer waves. Spring and early summer freshwater inflows are not an important factor in bar formation in a large estuary like that of the Pajaro River (Smith 1990). Tidal flux through the mouth is substantially higher than inflows, and even after the sand bar forms seepage through the large sand bar should be sufficient to prevent overtopping and sand bar breaching.

After sand bar formation freshwater inflows freshen the summer lagoon and may be important to lagoon ecology (Smith 1990). However, at the Pajaro River, even in most years when the sand bar forms, the formation is usually in mid to late summer. This is much later than the period of steelhead smolt passage and estuary adjustment, and is also later than the present practice of pumping water from College Lake. Tidewater gobies (*Eucyclogobius newberryi*), a federally-listed endangered species, are present in the Pajaro River estuary. Sand bar formation is important for providing the calmer lagoon conditions favored by tidewater gobies (Smith 1990), but the salinity of the lagoon is generally not important to goby success. Tidewater gobies in central California maintain large populations in lagoons ranging from fresh water (Soquel Creek in 1988 and Pescadero Creek in 1985) to ocean salinities (Corcoran and Moran Lagoons in 1996) (Smith, unpublished).

STEELHEAD PASSAGE CONDITIONS

Methods

Conditions for steelhead passage are the only fish habitat factor potentially impacted by the proposed water management plans. Passage conditions were evaluated by establishing depth transects in Salsipuedes Creek and in the Pajaro River at shallow riffles that were most likely to impede steelhead upstream or downstream migration. These same riffles and their configurations may not exist from year to year, but the riffles chosen are probably typical of the worst riffles present in most years.

Transects were established at three riffles on Salsipuedes Creek in April 1997. Depths at one of the riffles (a "typical", rather than a critical/difficult passage riffle) were recorded at 1 foot increments across the riffle 3 times between 25 April and 9 May, at flows of 15.1, 4.7 and 2.0 cubic feet per second (cfs). Depths at 2 other riffles, which represented very difficult "critical" passage were recorded 5 times between 25 April and 29 May, with the above flows and with flows of 0.9 and 0.4 cfs. The last two flows were far below those needed for passage, but provided information on how depth changed with flow and with algal growth. The two critical riffles were the only difficult riffles in the creek in 1997, and both had wide, diagonal gravel bars producing the riffles. The most difficult stretched over 80 feet across a bankfull channel about 30 feet wide. The upstream to downstream length of each riffle was short; the length of difficult passage was less than 5 feet.

Four riffles were transected on the Pajaro River: 1 immediately upstream of Murphy Crossing, 2 within 1.4 miles downstream of the crossing, and one 4.1 miles downstream of the crossing. The 3 upstream riffles were diagonal riffles formed in broad portions of the channel that are usually dry in summer or have very little streamflow. The downstream riffle was the only true riffle in the portion of the channel with regular summer surface water, dense streambed vegetation, and a generally narrower low flow channel (due to the vegetation). Depths were measured at the transects downstream of Murphy Crossing 5 times from 18 April to 12 June, at flows of 65 to 7.6 cfs. Transects were measured twice upstream of Murphy Crossing, on 25 April and 9 May, at flows of 50.5 and 21.7 cfs; construction of the crossing inundated this most critical riffle. Substrates at the riffles were predominantly sand and fine gravel deposited by the high January flows. The configurations were not stable, and the deepest portions of the sandy riffles were gradually scoured deeper over the study period. Because of the channel instability, the transects were not a strict test of the relationship between stream flow and riffle depth; 20 cfs in April would not have provided the passage conditions that 20 cfs in late May would have provided.

Passage Criteria

Steelhead adults can pass through riffles if they can easily find a continuous route through and if that route offers depths and velocities that allow them to easily swim upstream. The length of the shallow portion of the riffle is also a factor for both swimming and route-finding; a very short riffle is more easily passed (with a brief burst of effort) than a long riffle offering similar conditions. Because of the multi-factored nature of fish passage, passage criteria are somewhat of a judgment call. However, passage standards should allow migrating fish to pass through a riffle without repeated attempts or delay and without injury or excessive exertion; they should not be set at levels that "well-motivated" fish can negotiate, with difficulty, most of the time.
Smolts can pass downstream through riffles if there is a continuous route that is deep and wide enough to attract them and allow them swim through. Routes that become too shallow as the fish pass downstream may not only block downstream passage, but may prevent the fish from retreating upstream against the current to seek an alternate route.

In both the Pajaro River and Salsipuedes Creek shallow riffles are infrequent and short, reducing the cumulative effect of riffles on upstream or downstream passage. All riffles were relatively flat, so velocities were relatively slow, and therefore not considered a problem for upstream passage.

For this evaluation routes through riffles were considered minimal passage for upmigrating adult fish if 0.45 feet deep, or about the body and tail depth of a large (2 years in the ocean) steelhead. Such a depth would allow the body and tail to be fully submerged so that tail and body swimming action was efficient; many adult steelhead in the Pajaro River are smaller and could migrate with less depth. At 0.6 feet deep the depth would be more than sufficient to prevent interference from the substrate with the swimming action of a large fish; depth was judged fully passable. The route was considered acceptable if it was in the thalweg or passed 20% of the streamflow or was at the upstream portion of a diagonal riffle (where the diagonal configuration would funnel the fish to the route). Minimum route width was 3 feet and the total width of all routes through the riffle had to be at least 10 percent of riffle width (with at least 1/2 of that at 0.6 feet or deeper) and carry approximately 15% of the flow through the riffle. If the route(s) were much deeper and/or migrating fish were funneled to the route by the riffle configuration or channel thalweg, then less total width or flow was required.

For evaluating smolt downstream passage the minimum depth used was 0.15 feet (as deep as the body depth of large smolts). A depth of 0.2 feet was judged fully passable. Minimum route width was 2 feet, and total width of the route(s) had to equal 25% of the riffle width and normally carry about 50% of the flow through the riffle. As with adult passage, routes that were deeper or likely to funnel fish because of riffle configuration were judged passable with less total route width.

No flow passage requirements were estimated for downstream passage of spent adult steelhead, as most would have outmigrated prior to the late spring smolt migration.

Depth distribution across the Pajaro River riffles changed progressively over the study period, as the deepest portions of the unstable, sandy riffles gradually scoured deeper and carried a greater proportion of the flow. Under those conditions a lesser flow later in the season provided passage conditions equivalent to a much greater flow early in the study. For this evaluation the greater early season flow was judged necessary for passage. This conservative approach guarantees that the flow used will provide passage under the most difficult of conditions throughout the migration period.

Results

Adult Passage in the Pajaro River. The 4 Pajaro River riffles were estimated to be passable to adult steelhead at 16 to 45 cfs (Table 1; Appendix A). The most difficult passage was at the very wide diagonal riffle immediately upstream of Murphy Crossing (riffle 4). However, because the passage route was at the upstream end of the diagonal riffle, upstream migrating fish would be funneled to the route. That riffle was estimated to be passable at about 45 cfs, based upon conditions observed at 50.5 cfs. The other two diagonal riffles (riffles 2 and 3) were estimated to be passable at 25-35 cfs. At riffle 3 passage conditions were similar at 21.7 and 43.0 cfs, due to scour of the route between the sample days. Although the route was at the downstream end of the riffle, the remainder of the riffle was very shallow and migrating fish would be attracted to, or quickly find, the route. The most easily passable riffle (riffle 1) was not a diagonal riffle, most of the channel was relatively deep, and the route was in the thalweg. In general, the stream channel in the portion of the river near riffle 1 had relatively easy passage, because the streamside vegetation (primarily Salix spp.) confined and deepened the low flow channel.

Smolt Passage in the Pajaro River. The 4 riffles on the Pajaro River were judged passable to smolts migrating downstream at 12 to 20 cfs (Table 2). Again, the most difficult riffle for passage was riffle 4, the very wide diagonal riffle at Murphy Crossing. Although the multiple routes occupied about 30% of the riffle width at 21.7 cfs, the largest route was at the upstream end of the diagonal riffle, and some smolts might funnel to the shallower downstream portion of the riffle, even at 20 cfs. Smolts might also have similar problems at Riffle 2.

Smolt Passage in Salsipuedes Creek. Most riffles on this stream were narrow, straight, and easily passable, requiring as little as 1.0 - 2.0 cfs for passage (Riffle 1). However, the two measured diagonal riffles required an estimated 3.0 and 7.5 cfs for passage (Table 3). The configuration of Riffle 3, a wide, diagonal riffle, spread much of the flow across shallow portions of the riffle at 4.7 cfs. Downmigrating smolts would have difficulty

"route-finding" and might be trapped in shallower portions; several dead, stranded smolts were observed at 4.7 cfs.

Smolts were observed to have migrated down Corralitos Creek to Salsipuedes Creek at 1 cfs in May 1997 (probably with great difficulty). The flow in Salsipuedes Creek would include flow from Corralitos Creek, as well as from College Lake. The contribution from Corralitos Creek would be at least 1/2 cfs during smolt migration.

MITIGATING PROJECT IMPACTS TO STEELHEAD PASSAGE

Pajaro River

The impact to steelhead passage by diversion of Pajaro River water near Murphy Crossing can be avoided by providing minimum bypass flows during the steelhead migration period. Bypass flows should be:

1 January through 31 March (adult upstream passage): 45 cfs

1 April through 31 May (smolt downstream passage):

20 cfs from 7:00 PM to 7:00 AM (during the nighttime migration period)

12 cfs from 7:00 AM to 7:00 PM (when little migration is likely)

Salsipuedes Creek

Impact to steelhead smolt passage by altering College Lake storage and/or reducing the pumping of College Lake water into Salsipuedes Creek can be avoided by providing minimum bypass flows during the steelhead smolt migration period. Bypass flows should be:

15 March through 31 May: 7.5 cfs in Salsipuedes Creek at its junction with Corralitos Creek, with a minimum of 2 cfs from College Lake to provide passage to the confluence.

1. Only 7 cfs would have to be provided from College Lake water, as Corralitos Creek flow of at least 1/2 cfs would be necessary to allow Corralitos Creek smolts to reach Salsipuedes Creek.

2. From 7:00 AM to 7:00 PM only 4.5 cfs is necessary in Salsipuedes Creek, as few smolts migrate during daylight.

3. After 1 May no Salsipuedes bypass flow would be required if Corralitos Creek is dry at Highway 152.

The reduction of daytime smolt bypass flows in the Pajaro River and in Salsipuedes Creek to 60% of nighttime passage flows is because few smolts apparently migrate in daytime. The few smolts migrating in daytime would also have an easier time route finding and could probably easily pass all but 1 riffle in each stream. The fluctuating flows may also act to speed smolt passage, similar to the effect of small spring storms (Smith, unpublished smolt trapping records for Waddell Creek).

The lack of a requirement for passage flows in Salsipuedes Creek after Corralitos Creek has dried at Highway 152 is because smolts would no longer be coming down Corralitos Creek; smolts would also no longer be coming down Green Valley or Casserly creeks, which tend to dry before Corralitos Creek.

College Lake

If the outlet structure for College Lake is modified to increase the capacity of the lake, the new structure should provide for adult steelhead upstream passage at least equivalent to present conditions.

TABLE 1
RIFFLE CONDITIONS AND ADULT PASSAGE REQUIREMENTS FOR 4 RIFFLES IN THE PAJARO RIVER

Riffle Location	Configuration	Route	Route Width % / est. % flow	@Flow	Passage Flow
Riffle 1					
4.1 Miles < Murphy Crossing	straight	thalweg	17% / 25%	21.7	16
Riffle 2					
1.4 Miles < Murphy Crossing	Diagonal	multiple upstream diagonal	25% / 35%	43.0	25
			12% / 20%	21.7	
Riffle 3					
0.7 miles < Murphy Crossing	Diagonal	downstream diagonal	10% / 25%	43.0	35
			10% / 25%	21.7	
Riffle 4					
Above Murphy Crossing	Diagonal	upstream diagonal very wide	9% / 15	50.5	45

TABLE 2
RIFFLE CONDITIONS AND SMOLT PASSAGE FLOWS FOR 4 RIFFLES IN THE PAJARO RIVER

Riffle	Configuration	Route	Route Width % / est. % flow	@Flow	Passage Flow
Riffle 1	straight	thalweg	21% / 50%	15.1	15
			24% / 57%	7.6	
Riffle 2	diagonal	multiple upstream middle	39% / 60%	15.1	12
			45% / 65%	7.6	
Riffle 3	diagonal	downstream	12% / 60%	21.7	
			85% / 95%	15.1	12
Riffle 4	diagonal wide	upstream multiple	30% / 45%	21.7	20

TABLE 3
RIFFLE CONDITIONS AND SMOLT PASSAGE FLOWS
FOR 3 RIFFLES IN SALSIPUEDES CREEK

Riffle	Configuration	Route	Route Width % / est. % flow	@Flow	Passage Flow
Riffle 1	straight	thalweg	77% / 95%	2.0	1.0
Riffle 2	diagonal	multiple downstream	31% / 55%	4.7	3.0
		single downstream	25% / 55%	2.0	
Riffle 3	diagonal	multiple	60% / 75%	15.1	7.5
		multiple	12% / 30%	4.7	

LITERATURE CITED

Shapovalov, L. and A. C. Taft. 1954. The life histories of the steelhead rainbow trout (*Salmo gairdneri gairdneri)* and silver salmon (*Oncorhynchus kisutch*). California Department of Fish and Game Bulletin 98. 275 pp.

Smith, J. 1990. The effects of sandbar formation and inflow on aquatic habitat and fish utilization in Pescadero, San Gregorio, Waddell and Pomponio Creek estuary/lagoon systems, 1985-1989. Report to the California Department of Parks and Recreation. 96 pp.

APPENDIX D

DETERMINATION OF THE MINIMUM BYPASS FLOW IN CORRALITOS CREEK FOR THE EXPANDED COLLEGE LAKE PROJECT

Determination of the Minimum Bypass Flow in Corralitos Creek for the Expanded College Lake Project

Prepared for:
Environmental Science Associates
225 Bush Street, Suite 1700
San Francisco, CA 94104

by:

Dennis Jackson
708 - 14th Avenue
Santa Cruz, CA 95062

July 10, 2001

Determination of the Minimum Bypass Flow in Corralitos Creek for the Expanded College Lake Project

College Lake is a seasonal water body. Currently, College Lake is pumped dry in the spring and the lakebed is used for farming. Approximately 260 acres of land are inundated each year resulting in the storage of 1,400 acre-feet of water. The expanded College Lake project would construct earth dams to increase the storage in the seasonal lake to 4,600 acre-feet. The expanded lake would inundate an additional 160 acres of land.

Water would be diverted from Pinto Lake and Corralitos Creek. The diversion from Corralitos Creek would be west of College Lake and north of the Watsonville airport. Water diverted from Corralitos Creek would be sent to the Pinto Lake diversion near to South Green Valley Road. Figure 1 shows the location of the Corralitos diversion.

Since steelhead, a federally listed species, use Corralitos Creek the diversion will have to be constructed and operated in a manner to avoid harming the steelhead population.

NMFS Diversion Conditions to Protect Salmonids

The State Water Resources Control Board Division of Water Rights (DWR) has been working to develop conditions on water development projects to protect federally listed salmonid species. The DWR has made several proposals to the National Marine Fisheries Service (NMFS) and the California Department of Fish and Game (DFG). The DWR submitted a proposal in January 2001 to NMFS and DFG. In April 2001, NMFS sent a letter to DWR stating that the DWR proposal contained, "…a number of unresolved issues" but, that agreement on the remaining issues was expected.

The exchange of letters, referenced above, shows that there is still disagreement between the DWR and the state and federal resource agencies. Therefore, it is difficult to predict the exact conditions that DWR would impose on the Corralitos project. Therefore, the most conservative approach at this time appears to be to apply the conditions (guidelines) favored by the NMFS. The discussion between NMFS, DFG and DWR has been focused on coastal watersheds north of San Francisco. However, the NMFS is still formulating its recommendations for watersheds south of San Francisco.

The NMFS guidelines recommend that:

1. the season of diversion be limited to the period December 15 to March 31
2. the minimum bypass flow be set equal to the unimpaired February median discharge
3. the maximum instantaneous diversion rate should be set equal to 15% of the 20% winter exceedence discharge (unimpaired).

The NMFS is considering using the March median discharge as the minimum bypass flow south of San Francisco since their studies show that the March median tends to be higher than the February median discharge. However, review of United States Geological Survey (USGS) records for gauging stations in the Santa Cruz Mountains shows that the February median tends to be greater than the March median. Therefore, the February median discharge is used as the minimum bypass flow in this study.

Two of the NMFS guidelines require estimating the long-term discharge record at the location of the diversion.

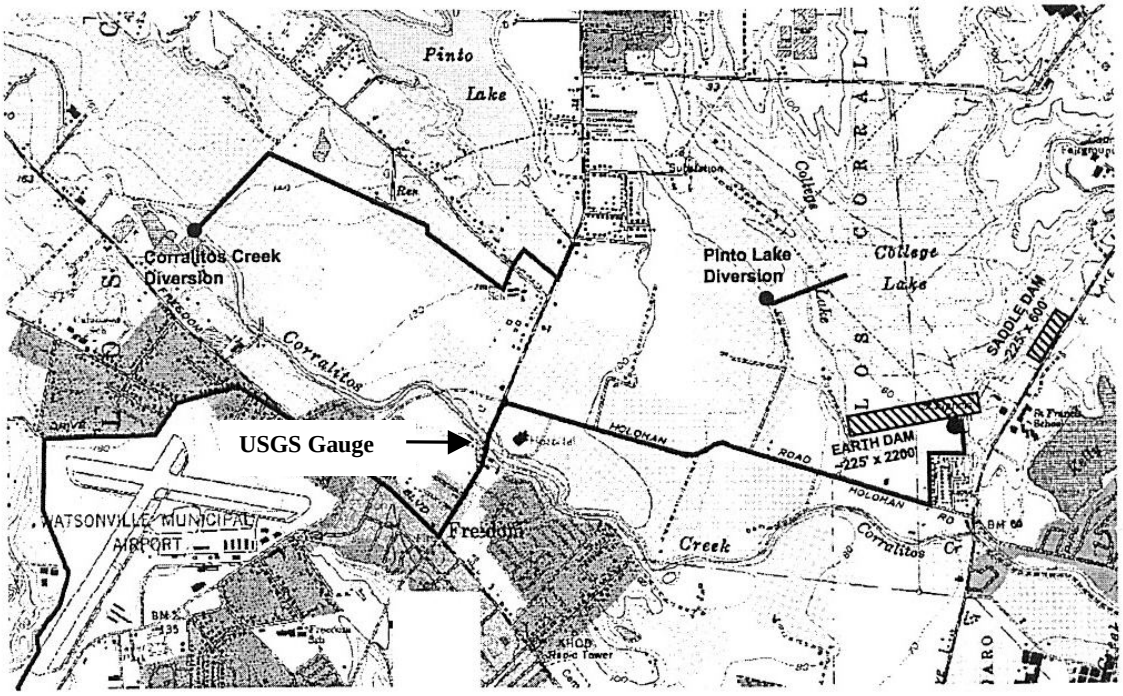


Figure 1. Location of the proposed Corralitos Creek diversion is about 1.3 miles upstream of Green Valley Road. A USGS stream gauge with 45-years of record is located at Green Valley Road.

Physical Setting

Corralitos Creek drains the southern end of the Santa Cruz Mountains. Its headwaters lie along the San Andreas Rift Zone. The creek flows through Eureka Canyon for a few miles. The creek leaves Eureka Canyon about 0.25 miles above Browns Valley Creek, the largest tributary of Corralitos Creek. The community of Corralitos lies about 0.6 miles downstream of the confluence of Browns Valley Creek and Corralitos Creek. The discontinued USGS stream gauge, *Corralitos Creek near Corralitos*, was located about 1.2 miles upstream of the community of Corralitos. After the creek leaves Eureka Canyon, it flows across an alluvial valley until it ends by joining Salsipuedes Creek.

Corralitos Creek joins Salsipuedes Creek at Highway 152 (Lake Avenue). The USGS operates a stream gauge at Green Valley Road called *Corralitos Creek at Freedom*, approximately 1.8 miles upstream from the confluence with Salsipuedes Creek.

The Purisima Formation is exposed in the headwaters of Corralitos Creek. In the lower portion of Eureka Canyon the creek begins to traverse alternating exposures of the Aromas Red Sands and alluvium down to Varni Road (about 2.3 miles downstream of Browns Valley Creek). Downstream of Varni Road the creek flows through alluvium (Greene, 1977).

A geologic cross section in the Pajaro Valley Water Management Agency's 1993 *Basin Management Plan* (BMP) suggests that a confining layer underlies the creek starting somewhere within about one mile downstream of Varni Road. The confining layer is roughly 200 feet below the ground surface (Figures 2-3 and 2-5, PVWMA BMP, 1993).

The BMP notes that the Purisima, Aromas Red Sands and the alluvium are three distinct water bearing formations in the area. The Purisima Formation is the lies below the Aromas Red Sands and the alluvium. The Aromas Red Sands is divided into an upper and lower unit. Discontinuous confining layers of clay separate the upper and lower units. The upper unit is mostly older fluvial deposits. The lower unit is mostly wind blow deposits. The alluvium overlies the Aromas Red Sands. The alluvium has a basal gravel layer, about 50 feet thick, that serves as a major source of water for shallow levels (PVWMA BMP, 1993).

The section of Corralitos Creek between the Browns Valley Road bridge and Varni Road (approximately 1.7 miles), is typically dry in the summer, with isolated pools (phone conversation, Kristian Schoeder, Santa Cruz County Planning, 6/27/01). The creek goes dry sometime between June and August depending on the rainfall total of the previous winter. Flow in the creek returns somewhere above Green Valley Road. According to Schoeder, some local residents report that the creek started to dry up in the summer about twenty years ago. Historically, the seasonally dry section may have supported coho salmon.

Bruce Laclergue, Water Resource Manager for Santa Cruz County, notes that the ground water, near the seasonally dry section of creek, is unconfined and so it is hydraulically connected to the creek. It is unknown if the seasonally dry section dries up because of ground water pumping or if there has been significant deposition in the reach. Mr. Laclergue reports that, during the last two or three years, there has been a noticeable increase in the number of applications to deepen wells in the area (personal communication, Bruce Laclergue, 7/5/01). The reported increase in the deepening of wells is indirect evidence suggesting that the water table surface is lower than its historic level.

City of Watsonville Diversion

The City of Watsonville (City) obtains its water supply from Corralitos and from ground water. The City diverts about 1.8 million gallons per day (MGD) from Corralitos Creek upstream of its confluence with Browns Valley Creek. The City also diverts about 0.22 MGD from Browns Valley Creek. In addition, the City obtains some of its water supply from wells near the confluence of Corralitos Creek and Browns Valley Creek. The City's water treatment plant is located in the community of Corralitos.

The City first began diverting water from Corralitos Creek in the late 1800's. The City's water treatment plant was damaged by the October 17, 1989 Loma Prieta earthquake. The plant was closed from the day of the earthquake until March 26, 1997. During 1996, the plant was being tested so water was diverted from the creek but it was returned to the channel about 1.5 miles downstream, at the Browns Valley Road Bridge.

Since 1997, the water treatment plant has been shut down when the turbidity in the creek exceeds 10 NTU. For example, the water treatment plant was shut down from February 12, 1998 to May 25, 1998 (personal communication, phone call, Keith Kimes, 6/27/01). Table 1 shows the average daily diversion, by month, since the water treatment plant re-opened in 1996. The City Water Department is reviewing its diversion records for the period prior to the 1989 earthquake and hence, it is not available for this study.

Table 1. Watsonville Water Department monthly water net diversions from Corralitos Creek for 1996-2000. Net diversions are in cubic feet per second (cfs). MGD is millions of gallons per day.

	1996	1997	1998	1999	2000	Average Daily Diversion cfs	Average Daily Diversion MGD
January	0.00	0.00	0.30	0.00	0.87	0.29	0.19
February	0.00	0.00	0.02	0.00	0.00	0.01	0.00
March	0.00	0.08	0.00	0.00	0.00	0.02	0.01
April	0.00	0.76	0.00	0.40	1.18	0.58	0.38
May	0.00	2.34	0.12	2.16	2.36	1.75	1.13
June	0.00	2.33	2.21	2.54	2.73	2.45	1.58
July	0.00	2.07	2.50	2.69	2.76	2.51	1.62
August	0.00	2.50	2.52	2.37	2.56	2.49	1.61
September	0.00	2.54	2.46	2.28	2.10	2.34	1.51
October	0.00	1.67	2.21	2.38	2.17	2.11	1.36
November	0.00	1.20	1.78	2.00	2.51	1.87	1.21
December	0.00	1.22	1.38	2.42	2.28	1.82	1.18

Source: City of Watsonville Water Department.

Other Corralitos Creek Diversions

The State Water Resource Control Board (SWRCB) records for appropriative water rights in Santa Cruz County were downloaded from their web-site. The records referencing Corralitos Creek were consolidated. A total of 19 applications and statements-of-use were found on Corralitos Creek. All of these appropriations are upstream of the confluence of Corralitos Creek and Browns Valley Creek. The majority of these appropriations are located near Diablo Canyon and Shingle Mill Creek in the headwaters. Corralitos Creek near Diablo Canyon has been declared *Fully Appropriated* from May 1 to November 31 (SWRCB Decision 1471). The total direct diversion for these appropriations is 0.49 cfs and 127 acre-feet of storage, excluding the Statements-of-Use filed by the City of Watsonville.

The SWRCB records do not contain any information on the number of riparian diversions or the total amount of riparian diversions.

Methods to Estimate the Unimpaired Discharge

Figure 1 shows the location of the proposed diversion from Corralitos Creek. The proposed diversion is located about 1.29 miles upstream of USGS *Corralitos at Freedom, Ca* gauging station located at Green Valley Road.

There are three simple ways to estimate the impaired daily discharge record at the diversion site. The first method would be to use the observed discharge record for the USGS *Corralitos at Freedom, Ca* gauging station as a first approximation of the discharge at the diversion site. The actual flows at the diversion site probably would be less then the flows observed at the USGS gauge since a significant portion of the total watershed area (about 23%) lies between the gauge and the proposed diversion site.

The second method of estimating the discharge at the proposed diversion site would be to prorate the discharge record of the *Corralitos Creek at Freedom* stream gauge based on the watershed

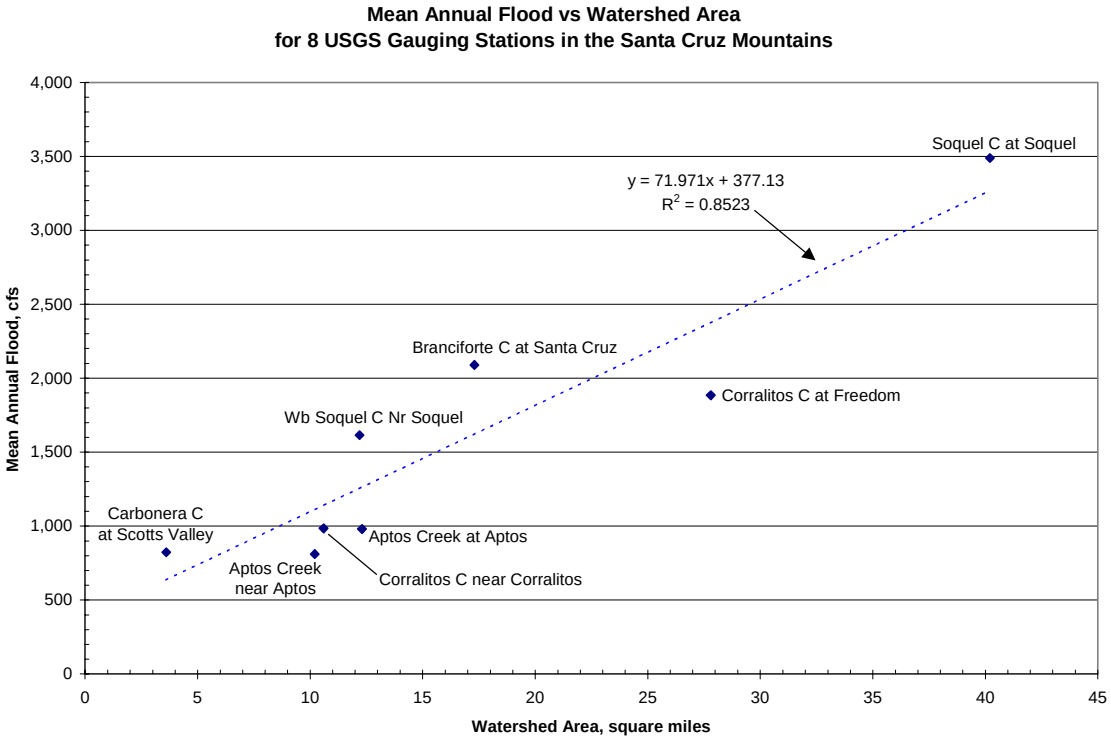


Figure 2. Regional relationship between mean annual flood and watershed area developed from eight USGS stream gauges in the southern Santa Cruz Mountains.

area above the diversion. The watershed area above the stream gauge is 27.8 square miles. So, 77.34% of the watershed area of the gauge lies above the proposed diversion site. Thus, an estimate of the daily average discharge at the diversion site could be obtained by multiplying each daily discharge value from the record for the Corralitos Creek at Freedom gauge by 0.77.

A third method to estimate the impaired discharge record at the diversion site would be to prorate the discharge record at the USGS gauge by the estimated mean annual flood. This method requires developing the relationship between the mean annual flood and watershed area. There are eight USGS stream gauges in the Santa Cruz Mountains with a sufficiently long annual maximum flood record to estimate the mean annual flood (see Table 2). Figure 2 shows the relationship between the mean annual flood and watershed area for the eight USGS stations. The ratio between the mean annual flood at the diversion site and at the USGS gauge could be used to prorate the discharge record from the USGS gauge.

These three methods can be partially corrected for the affect of the City's surface diversions by adding the City's average daily diversion to the observed discharge record at the USGS gauge prior to estimating the discharge at the diversion site. However, the City's diversion record, prior to the Loma Prieta earthquake, was not available for this study. So, the correction for the City's diversion can only be approximate.

None of these three methods provide a way to correct the observed USGS discharge record for the riparian diversions or the change in the water table level near Varni Road. One method to adjust for these affects is to use a regional dimensionless-flow-duration curve.

Table 2. USGS gauging Stations in the Santa Cruz Mountains, south of the San Lorenzo River. The length of record for the average daily discharge for the first eight stations in the table is 14 years or more.

USGS No.	Station Name	Start	End	Length of Record Years	Area sq mi
11159150	Corralitos C near Corralitos	10/1/57	10/11/72	15	10.6
11159200	Corralitos C at Freedom [1]	10/1/56	5/31/01	45	27.8
11159690	Aptos Creek near Aptos	10/1/71	9/30/85	14	10.2
11159700	Aptos Creek at Aptos	10/1/58	10/6/72	14	12.3
11159800	West Branch Soquel C near Soquel	10/1/58	10/6/72	14	12.2
11160000	Soquel C at Soquel [1]	5/1/51	9/30/00	49	40.2
11161300	Carbonera C at Scotts Valley [1]	2/7/85	6/6/01	16	3.6
11161500	Branciforte C at Santa Cruz	4/1/40	9/30/68	28	17.3
11153790	Uvas C at Sveadal	10/1/72	10/1/74	2	2.88
11153800	Alec Canyon near Morgan Hill	11/7/69	5/3/72	2	0.91
11159400	Green Valley near Corralitos	10/1/63	9/30/67	4	7.05
11159940	Soquel C near Soquel	10/1/68	9/30/72	4	32

[1] Active USGS stations.

Figure 3 shows the regional winter (December 15 to March 31) dimensionless-flow-duration curve for first eight USGS stream gauges, located in the southern Santa Cruz Mountains, shown in Table 2. All of these eight stations have 14 years or more of daily discharge records. The other four stations have no more than four years observed daily discharges and so were not used in this study. None of the curves in Figure 3 have been adjusted for upstream diversions.

The y-axis (vertical) of Figure 3 is the ratio of the daily discharge to the winter 20% exceedence discharge for each gauging station. The winter 20% exceedence discharge is the discharge that is equaled or exceeded 20% of the time between December 15 and March 31. Dividing all of the daily discharges for a gauging station by the winter 20% exceedence discharge provides a way of comparing the flow duration curves of different gauging stations.

The x-axis of Figure 3 is in the z-score of the probability of exceeding the dimensionless discharge (ratio of daily discharge to the winter 20% exceedence discharge). The use of the z-score axis is a way of simulating the use of normal probability paper. There is a non-linear relationship between the exceedence probability and the z-score. A z-score of zero corresponds to the median (50% of the dimensionless discharges are greater than the indicated y-value). Positive z-scores indicate that the exceedence probability of the dimensionless discharge is greater than 50%. For example, a z-score of 1.0 corresponds to an exceedence probability of 84.135%. A z-score of -1.0 corresponds to an exceedence probability of 15.865%. The z-score of the winter 20% exceedence discharge is -0.84.

The shape of the flow duration curve indicates how the streamflow declines over time. A curve that tends to become horizontal with higher z-scores (exceedence probabilities) indicates that the winter dry weather flows are approaching a constant value, indicating a steady ground water input. Four of the USGS gauges; *Aptos Creek at Aptos*; *West Branch of Soquel Creek near*

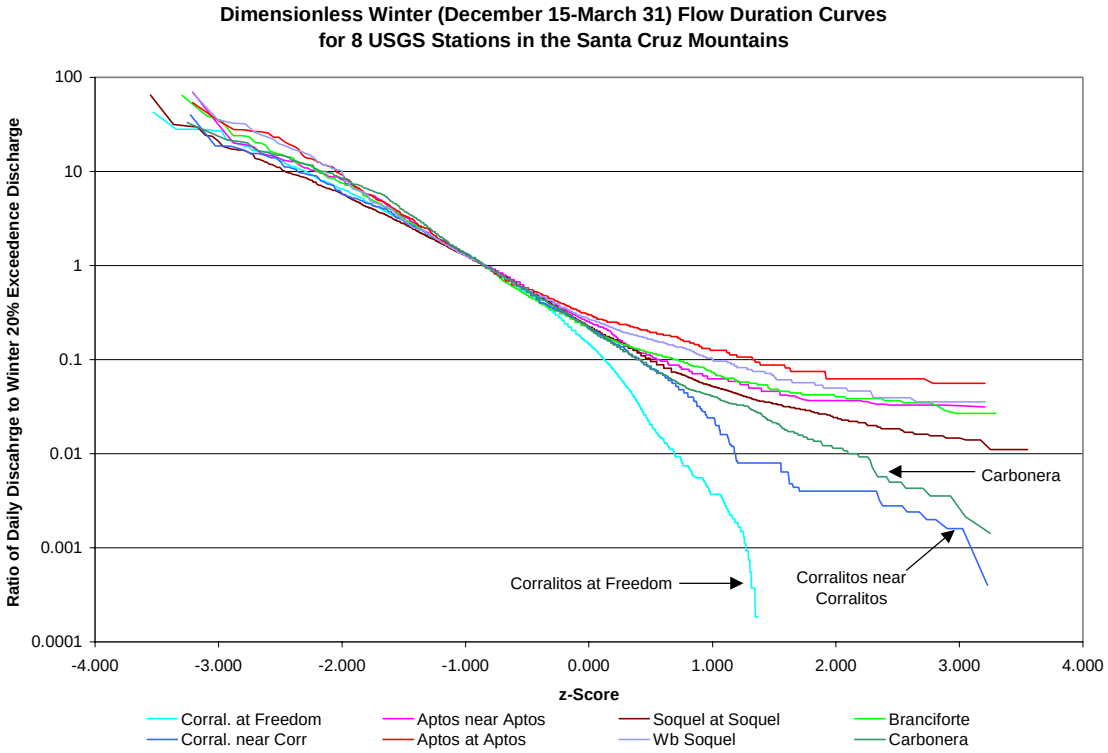


Figure 3. Dimensionless winter flow duration curves for eight USGS gauging stations in the southern Santa Cruz Mountains. The x-axis is the z-score of the probability of exceedence. An exceedence probability of 50% has a z-score of 0.0. Curves that tend to become horizontal indicate that dry weather flows approach a constant value. A sharply declining curve indicates that dry weather winter flows tend to continue to decline or even go to zero.

Soquel; *Aptos Creek near Aptos* and *Branciforte Creek at Santa Cruz* exemplify near constant dry weather flows.

A curve that declines sharply with increasing z-score (exceedence probability) indicates that the winter dry weather discharge continues to decline and possibly goes to zero. The *Corralitos Creek at Freedom* stream gauge exemplifies a stream whose winter dry weather discharge tends to go to zero. The *Corralitos Creek at Freedom* stream gauge recorded a discharge of zero during the winter on 412 days out of 4,816 days (8.55%) over the 45 years of record. In dry years, streamflow from the upper watershed soaks into the ground above Varni Road so flow at the gauge is provided only by the local ground water system. The streamflow at the gauge is impaired by the upstream diversions and by ground water pumping upstream of Varni Road.

The flow duration curves for *Corralitos Creek near Corralitos, Carbonera Creek at Scotts Valley, and Soquel Creek at Soquel* lie in between the curves for *Corralitos at Freedom* and the four stations with near constant winter dry weather discharge. Surface diversions or ground water pumping affects all three of these stations. The City of Watsonville diverts water just upstream of the *Corralitos Creek near Corralitos* gauge. A well just upstream (USGS Water Resource Data for the 2000 Water Year) may affect the Carbonera Creek at Scotts Valley gauge. The Soquel Creek station is affected by many surface diversions (USGS Water Resource Data for the 2000 Water Year).

The unimpaired dimensionless winter flow duration curve for the *Corralitos Creek at Freedom* gauge was estimated by creating an unimpaired regional winter dimensionless-flow-duration curve. The regional flow duration curve was created by averaging the flow duration curves for the four USGS gauges with near constant winter dry weather discharge and the *Soquel Creek at Soquel* station. The two stations on Corralitos Creek and the station on Carbonera Creek were excluded from the averaging process because diversions and ground water pumping have impacted them. The winter flow duration curve for the Soquel Creek station appeared to more similar to the four stations with near constant winter dry weather flow than to the other three impacted stations.

It was assumed that discharges above the winter 20% exceedence discharge were not significantly affected by diversions or to ground water pumping. The data from the Watsonville Water Works indicate that their monthly average daily diversion is less than 3 cfs. The winter 20% exceedence discharge for the Corralitos at Freedom gauge is 54 cfs. So, the Watsonville diversion is about 5% of the winter 20% exceedence discharge which, is about the accuracy of the discharge record. So, the assumption that discharges above the winter 20% exceedence discharge are not significantly affected by diversions appears justified. Finally, there are no significant reservoirs to seriously alter the higher discharges.

The unimpaired dimensionless winter flow duration curve for the *Corralitos Creek at Freedom* gauge was estimated by replacing the portion of the curve below the winter 20% exceedence discharge with the unimpaired regional winter flow duration curve.

The estimated unimpaired discharge record for the *Corralitos Creek at Freedom* gauge was then created by multiplying each point on the unimpaired dimensionless flow duration curve by the winter 20% exceedence discharge for the station (54 cfs). The discharges were then sorted by date to obtain the discharge record in chronological order.

Results

The NMFS method to estimate the bypass flow requires estimates of the unimpaired February median discharge and an estimate of the unimpaired winter 20% exceedence discharge. The minimum bypass flow is set equal to the unimpaired February median discharge. The maximum diversion rate is set equal to 15% of the unimpaired winter 20% exceedence discharge.

Table 3 shows the February median, March median and winter 20% exceedence discharges for the USGS gauge, *Corralitos Creek at Freedom.* The observed (impaired) discharge record at the *Corralitos Creek at Freedom* stream gauge was used to calculate the February and March median discharge and the winter 20% exceedence discharge. The "area ratio" estimates the corresponding discharges at the point of diversion (POD) by multiplying the ratio of watershed area above the POD to the area above the gauge. The "flood ratio" estimates the corresponding discharges at the point of diversion (POD) by multiplying the ratio of estimated mean annual flood at the POD (1,930-cfs) to the estimated mean annual flood at the gauge (2,380-cfs).

The unimpaired discharge record at the *Corralitos Creek at Freedom* stream gauge was estimated by the flow duration method as described in the previous section. The unimpaired discharge record at the POD was estimated by applying the area ratio to unimpaired discharge record at the gauge. The flood ratio method was not used to prorate the unimpaired discharge record since the results of the are ratio and flood ratio method differ by only about 5%.

Table 3. Estimates of the February median, March median and winter 20% exceedence discharges for the *Corralitos Creek at Freedom* stream gauge and the proposed diversion site. The impaired condition is the observed discharge record.

	February Median Discharge cfs	**March Median Discharge** cfs	**Winter 20% Exceedence Discharge** cfs
Impaired Condition			
USGS Gauge - Observed	14.0	14.0	54.0
Diversion Site - Area Ratio	10.8	10.8	41.8
Diversion Site - Flood Ratio	11.3	11.3	43.8
Unimpaired Condition			
USGS Gauge	19.2	19.1	54.0
Diversion Site - Area Ratio	14.8	14.8	41.8

The minimum bypass flows and maximum diversion rates were calculated from the information in Table 3. A spreadsheet was prepared to apply the NMFS bypass guidelines to the:

(1) the observed USGS discharge record;

(2) the observed USGS discharge record prorated by watershed area;

(3) the observed USGS discharge record prorated by the ratio of the mean annual flood at the POD and at the USGS gauge;

(4) the estimated unimpaired discharge record - prorated by watershed area.

Table 4 shows the estimated average annual diversion for each of the four methods. Table 4 also shows the annual maximum, minimum and median diversions that would have been allowed over the period of record (the 1957-2001 water years).

Table 4. Comparison of the estimated average annual diversion for the Corralitos Creek diversion to College Lake calculated by four methods. The column labeled "Adopted" gives the estimated average annual diversions obtained by rounding the estimated unimpaired bypass flow up and rounding the maximum diversion rate down.

	At USGS Station acre-feet	**Area Ratio** acre-feet	**Flood Ratio** acre-feet	**Unimpaired** acre-feet	**Adopted** acre-feet
Average	656	508	531	456	436
Maximum	1,497	1,159	1,213	1,069	1,022
Minimum	6	5	5	0	0
Median	670	519	543	454	434
Bypass Flow	14.0	10.8	11.3	14.8	15.0
Max Diversion Rate	8.1	6.3	6.6	6.3	6.0

The estimated unimpaired discharge record at the POD indicates that the unimpaired February median discharge at the POD is 14.8 cfs. This estimate was rounded up to 15 cfs and adopted as the minimum bypass flow for the POD. The maximum diversion rate at the POD was estimated to be 6.3 cfs from the estimated unimpaired discharge record at the POD. This estimate was rounded down to 6 cfs and adopted as the maximum diversion rate. The adopted minimum bypass flow and maximum diversion rates were also applied to the estimated unimpaired discharge record at the POD.

The flood ratio method produced the highest estimate of the total average annual diversion at the POD, which was about 530 acre-feet.

This scenario assumes a minimum bypass of 11.3 cfs and a maximum diversion rate of 6.6 cfs. The method to estimate the unimpaired discharge gave the lowest estimate of the total average annual diversion, which was about 430 acre-feet. This scenario assumes a minimum bypass of 15 cfs and a maximum diversion rate of 6 cfs. The estimated total annual average diversion from these two methods differs by only 14%.

Preliminary hydrologic modeling for the proposed Expanded College Lake project used a minimum bypass of 5 cfs and a maximum diversion rate of 7 cfs which resulted in an estimated average annual diversion of about 650 acre-feet. However, a minimum bypass of 5 cfs does not conform to the NMFS guidelines since it is about only one-half of the estimated February median discharge at the POD.

In conclusion, it is expected that a minimum bypass flow of 15 cfs and a maximum diversion rate of 6 cfs would be accepted by NMFS.

References

State Water Resources Control Board staff report, *Assessing Site Specific and Cumulative Impacts on Anadromous Fishery Resources in Coastal Watersheds in Northern California*, January 23, 2001.

Bybee, James, National Marine Fisheries Service letter to Mr. Harry Schueller, State Water Resources Control Board, dated April 18, 2001.

Greene, Gary H., *Geology of the Monterey Bay Region*, USGS Open-File Report 77-718, 1977. U.S. Geological Survey.

Pajaro Valley Water Management Agency, *Basin Management Plan*, 1993.

Webster, M.D. S.W. Anderson, M.F. Friebel, L.A. Freeman, J.R. Smithson, Water Resource Data, California, Water Year 2000, vol. 2, Pacific Slope Basins, Arroyo Grande to the Oregon State line Except for the Central Valley, U.S. Geological Survey, Water Resources Division, 2000.

USGS, Water Resource Data, California, Water Year 1972, vol. 2, Pacific Slope Basins, Arroyo Grande to the Oregon State line Except for the Central Valley, U.S. Geological Survey, Water Resources Division, 2000.

Personal Communications

Bruce Laclergue, Water Resource Manager for Santa Cruz County, 6/26/01, face-to-face discussion.

Bruce Laclergue, Water Resource Manager for Santa Cruz County,

Kristian Schoeder, Santa Cruz County Planning, 6/27/01, phone conversation.

Keith Kimes, Operations Supervisor, Watsonville Water Department, 6/27/01, phone call,

APPENDIX E

ALTERNATIVE ALIGNMENTS TO THE IMPORT PIPELINE

ALTERNATIVE ROUTES FOR IMPORT PIPELINE SEGMENTS

Several pipeline local route variations were considered by the PVWMA for specific segments of the Import Pipeline. These alternative routes are represented by dotted lines on Maps A1 through A4 in the Map Appendix. The alternative routes were proposed because of engineering design considerations (e.g., availability of easements) and flexibility in final site selection, and are not complete alternatives to the project as their implementation would still involve construction of the Import Pipeline to bring water into the PVWMA service area. In some cases, however, the alternative pipeline routes would result in environmental impacts that would be more adverse than would occur with the proposed pipeline alignment. For example, the alternative pipeline route between Stations 452+00 and 528+00 would require two additional crossings of the Pajaro River, resulting in additional impacts to riparian plant and animal species and their habitat. The proposed alignment would avoid these two river crossings and extend along public rights-of-way in these areas.

A discussion of the environmental impacts associated with the alternate pipeline alignments is presented below. In summary, the impacts associated with the preferred alignment would either be similar to, or lesser in magnitude than, those associated with these alternative alignment segments.

EVALUATION OF ALTERNATIVE PIPELINE ALIGNMENTS

The alternative alignments are identified by their station locations along the proposed pipeline alignment.

Station 73+00 along Miller's Canal to Station 121+00. This alternative alignment extends south from Station 73+00 of the preferred alignment across cropland to Miller's Canal, then extends west along Miller's Canal and joins the preferred alignment at Station 121+00. Development of this alternative alignment would have environmental impacts similar to those that would occur with the proposed pipeline alignment.

Stations 73+00 to 140+00. This route extends south from Station 73+00 of the proposed Import Pipeline alignment across cropland, extends westerly along Miller's Canal, and then extends south across cropland to Station 140+00 of the preferred alignment. Development of this alternative alignment would have environmental impacts similar to those that would occur with the proposed alignment.

Stations 140+00 to 288+00. This route extends southwest from Station 140+00 across cropland along the south side of the Pajaro River to Station 288+00 of the preferred alignment. Development of this alternative alignment would have environmental impacts similar to those that would occur with the proposed alignment. However, the alternative alignment would extend through cropland, while the proposed alignment in this area would be located within an existing PG&E easement. Therefore, this alternative alignment would result in the temporary disruption of a greater amount of agricultural land during construction.

Stations 360+00 to 421+00. This alternative alignment extends from the west side of U.S. 101 across the Pajaro River and the UPRR tracks, and then turns west up the eastern slope of the Sargent Hills, where it reaches an elevation of approximately 300 feet mean sea level (msl). From this point, it turns south downhill where it joins Station 421+00 of the proposed alignment. This alternative alignment would have environmental impacts similar to those that would occur with the proposed alignment. However, nesting red-tailed hawks were observed along this alternative alignment. Activities near nesting raptor sites could result in reproductive failure due to loss of habitat, or cause abandonment of the nest.

Stations 367+00 to 443+00. This alternative alignment follows the previous alternative alignment across the Pajaro River and the UPRR tracks, and continues up the eastern slope of the Sargent Hills to an elevation of approximately 300 feet msl. From this point the alternative alignment extends southwest, crossing Sargent Creek before it joins the proposed alignment at Station 443+00. This alternative alignment would have environmental impacts similar to those that would occur with the proposed alignment. However, nesting red-tailed hawks were observed along this alternative alignment. Activities near nesting raptor sites could result in reproductive failure due to loss of habitat, or cause abandonment of the nest. This alternative alignment would traverse Azule clay loam soils in the Sargent Hills that have moderate shrink-swell potential, are moderately corrosive, and have a high to very high erosion potential.

Stations 452+00 to 527+00. This alternative alignment extends across the UPRR tracks and the Pajaro River, then follows Highway 129 past residential development within the community of River Oaks. The alternative alignment crosses the Pajaro River and the UPRR tracks a second time and joins the proposed alignment at Station 527+00. Development of this alternative alignment would result in substantially more adverse environmental impacts than would occur with the proposed pipeline. The two additional river crossings would increase impacts on riparian habitat and associated special status species, including central coast steelhead, California red-legged frog, Western pond turtle, yellow warbler, yellow-breasted chat, and nesting raptors. The two additional river crossings also could result in increased soil erosion, downstream sedimentation, and stream channel alterations. In addition, residential land uses along Highway 129 in River Oaks would experience traffic, air quality, and noise impacts during project construction. These impacts would not occur with development of the proposed pipeline alignment.

Stations 571+00 to 600+00. This alternative alignment extends across Highway 129 and the Pajaro River, and extends along the river to Station 600+00 of the proposed alignment. Evidence of flood-related landsliding was documented along this alternative alignment during a field reconnaissance. Slope instability could adversely affect pipeline installation and/or long-term maintenance of facilities.The proposed alignment is located approximately 200 feet east of this alternative alignment and would not be subject to landslide hazards. With the exception of landslide hazards, this alternative alignment would have environmental impacts similar to those that would occur with the proposed alignment.

Stations 625+00 to 679+00. This alternative alignment parallels the proposed alignment closely along the UPRR tracks. It would have environmental impacts similar to those that would occur

with the proposed alignment. However, the alternative alignment would be located within a narrow riparian corridor between the Pajaro River and the UPRR tracks, while the proposed alignment would be located between the four sets of Granite Rock railroad tracks that parallel the UPRR tracks. Development of the alternative alignment would disturb riparian vegetation, while the proposed alignment would avoid this impact.

Stations 858+00 to 925+00, and Stations 872+00 to 925+00. These alternative alignments extend north of the UPRR tracks and the proposed alignment, and include two crossings of San Juan Road. These alternative alignments would have environmental impacts similar to those that would occur with the proposed alignment. However, the two additional highway crossings would result in adverse traffic impacts that could be avoided with the proposed alignment.

Stations 862+00 to 872+00. This alternative alignment would extend along the south side of the UPRR tracks, parallel to the proposed alignment. It would also be located within the UPRR right-of-way and would have environmental impacts similar to those that would occur with the proposed alignment.

Stations 925+00 to 984+00. This alternative alignment would extend along San Juan Road north of the proposed alignment, and would include two crossings of San Juan Road plus a UPRR crossing. Additional traffic impacts associated with the highway crossings would result from development of this alternative alignment that would not occur with the proposed alignment. Clear Lake clay soils, which have a high shrink-swell potential, occur along the portion of the alternative alignment between the UPRR tracks and Hayes Road.

Stations 925+00 to 1005+00. This alternative alignment would extend along the UPRR right-of-way and Lewis Road. Because it would be located entirely within rights-of-way, it would not affect any sensitive environmental resources. Clear Lake clay soils, which have a high shrink-swell potential, occur along the portion of the alternative alignment that extends along Lewis Road. This alternative alignment would have environmental impacts similar to those that would occur with the proposed alignment.

Stations 1005+00 to 1115+00 and Stations 1040+00 to 1115+00. These alternative alignments would extend along local roads and would cross the UPRR tracks and Salinas Road. With the exception of the segment that extends from Station 1040+00 to the Salinas Road crossing, these alternative alignments would be located within roadways and would have minimal environmental impacts. These alternative alignments would have environmental impacts similar to those that would occur with the proposed alignment.

APPENDIX F

TECHNICAL MEMORANDUM 2.2 – HYDROLOGIC ANALYSIS AND MODELING

PAJARO VALLEY WATER MANAGEMENT AGENCY
HYDROLOGIC ANALYSIS AND MODELING

TASK:	Technical Memorandum 2.2 for Subtask 6.2
SUBJECT:	PVIGSM Land Use and Agricultural Crop Mix
SUBMITTED BY:	David Lindow / Montgomery Watson
PREPARED BY:	S. Ali Taghavi / AT Associates Chris Smith / Montgomery Watson
REVIEWED BY:	Lyndel Melton, / RMC Roger Putty / Montgomery Watson
COPIES:	Randy Hanson / USGS Pete Rude / CH2M HILL
DATE:	June 11, 1999

Introduction

The purpose of this memorandum is to describe the updates to the land use distribution and agricultural crop acreage database in the Pajaro Valley Integrated Ground and Surface water Model (PVIGSM). This update is based on the California Department of Water Resources (DWR) land use surveys.

The land use and corresponding crop mix acreage data in the PVIGSM are used to estimate the agricultural crop water requirement, groundwater pumping and surface water supplies to meet these requirements. The land use distribution data are also used to define the geographic distribution of the rainfall runoff and irrigation applied water. The latter impacts the geographic distribution of infiltration and deep percolation of water into the ground water system.

The land use data used in the previous model are based on the DWR 1962, 1975, and 1982 surveys. The updated data will include two additional land use surveys: the 1989 and 1997 DWR Land Use Surveys.

The California Department of Water Resources (DWR) conducts land use surveys for each county throughout the state. DWR is the primary organization that performs these comprehensive surveys. The surveys are developed from aerial photography, followed by field inspection to confirm and complement the aerial surveys. Surveys are updated for each county approximately every seven years.

The DWR land use surveys are generally reported as on 7 ½ quadrangle topographic maps, which report various parcels with specific crop types. In addition, the DWR reports the acreage for each crop category by Detailed Analysis Units (DAU) in tabular form. In the past, surveys were publicly available 2 to 3 years after the survey year. With advances in technology, this turn-around-time has been reduced to less than 1 year. Table 1 shows the land use surveys that DWR has performed for the Pajaro Valley in the Santa Cruz and Monterey Counties.

In addition to DWR, the County Agricultural Commissioner office also reports annual crop production in each county. This data is generally reported by tonnage of crop produced, and may not necessarily correspond to the farm acreage under production. This is especially the case for crops with multiple cropping practice, such as vegetable row crops.

For modeling purposes, the DWR crop types are combined into specific categories, as shown in Table 2.

Table 1

Recent Land Use Surveys in the Monterey and Santa Cruz Counties

Survey Year	Monterey County	Santa Cruz County
1966	Available in hard copy maps and Tables	Available in hard copy maps and Tables
1975	Available in hard copy maps and Tables	Available in hard copy maps and Tables
1982	Available in hard copy maps and Tables	Available in hard copy maps and Tables
1989/91	Available in electronic form and Tables	Available in hard copy maps and Tables
1997	Available electronically, in provisional status.	Available in electronic form.

The 1966, 1975, 1982, and 1989/91 surveys were included in the original PVIGSM and the 1996 update. The 1989 DWR land use survey for Monterey County was updated and refined by the Monterey County Water Resources Agency (MCWRA), based on additional surveys made in 1991 by the Bureau of Reclamation. Subsequently, the MCWRA updated the 1989 GIS coverage with the 1991 survey, and released it as the 1989/91 land use coverage. This coverage was obtained from the MCWRA in electronic form in ArcInfo™ format. The crop acreage in the PVIGSM for 1989/91 was then adjusted to reflect the 1991 updates. No modifications were made to the 1989/91 land use distribution data.

Table 2
DWR Crop Classifications used in the PVIGSM

PVIGSM Crop Type	DWR Classifications
Strawberry	Strawberries
Strawberry Fallow	Strawberries (Fallow)
Vine (bushberries, grape, etc)	Bushberries, Table Grapes, Wine Grapes, Raisin Grapes
Vegetable Row Crops	Artichokes, Asparagus, Green Beans, Cole Crops, Carrots, Celery, Lettuce, Melons, Squash, Cucumbers, Onions, Garlic, Peas, Potatoes, Sweet Potatoes, Spinach, Tomatoes, Mixed Peppers, Broccoli, Cabbage, Cauliflower, Brussel Sprouts
Field Crops	Cotton, Safflower, Flax, Hops, Sugar Beets, Corn, Grain Sorghum, Sudan, Castor Beans, Dry Beans, Sunflowers, Barley, Wheat, Oats, Hay
Deciduous	Apples, Apricots, Cherries, Peaches, Nectarines, Pears, Plums, Prunes, Figs, Almonds, Walnuts, Pistachios, Grapefruit, Lemons, Oranges, Dates, Avocados, Olives, Kiwis, Jojoba, Eucalyptus
Pasture	Alfalfa, Clover, Mixed Pasture, Native Pasture, Grasses, Turf Farms
Nursery	Nursery
Nursery-indoor	Nursery (indoor)

Three surveys (March, June, and August) were conducted by DWR in 1997 for Monterey County. These surveys were made at the request of the MCWRA in order to evaluate seasonal changes in Salinas Valley agricultural land use and irrigation practices. Since MCWRA and DWR are continuing to evaluate the 1997 land use surveys, the June 1997 survey was released in a provisional form. This survey was released electronically from the MCWRA in an ArcView™ format. The 1997 DWR land use survey for Santa Cruz County was released electronically from DWR in an AutoCAD® format.

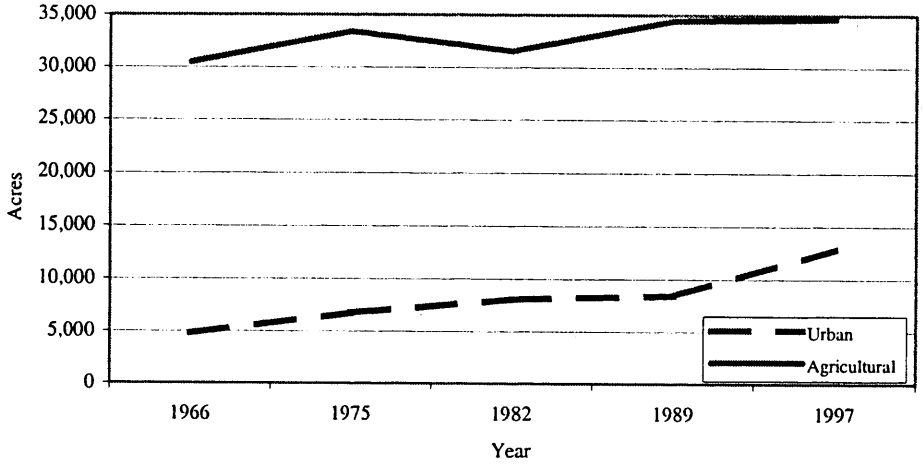
Information from the 1997 surveys was incorporated into the PVIGSM land use database. This database is used to generate two PVIGSM input files. These files are 1) the land use distribution file, and 2) the agricultural crop acreage file.

Land Use Distribution

The land use distribution primarily defines the percentage of each finite element that is covered by agricultural land, urban land, native vegetation, and riparian vegetation (where applicable, and data is available). Since the agricultural and urban development in the Pajaro Valley have been significant in the past three decades, it is important to accurately distribute the land use types.

Figure 1 shows the trends in the agricultural and urban development in the Pajaro Valley from 1966 to 1997. This figure indicates that the agricultural land has increased from about 30,500 in 1966 to 34,700 acres in 1997 (approximately 4,200 acres or 14 percent increase). During the same period, the urban area has increased from about 4,800 to 12,900 acres (approximately 8,100 acres, or 170 percent), with a corresponding reduction in native vegetation.

Figure 1
Pajaro Valley Land Use Development



The land use surveys indicate that urban acres have mostly been primarily added in the previously undeveloped areas that are classified as native vegetation. Figures 2A & 2B show the distribution of agricultural, urban and native vegetation in the Pajaro Valley in 1966 and 1997. The total model area is approximately 142,500 acres. Figure 2A indicates that in 1966 approximately 21% and 3% of this area was under agricultural and urban development, respectively. In 1997, the agricultural and urban development areas have grown to be 24% and 9% of total land area, respectively. Correspondingly, native vegetation has decreased from 76 to 67 percent of the model area.

The land use survey maps were electronically overlaid onto the finite element grid, and the percentage of land use for each finite element was determined for model input.

Figure 2A
Pajaro Valley Land Use - 1966

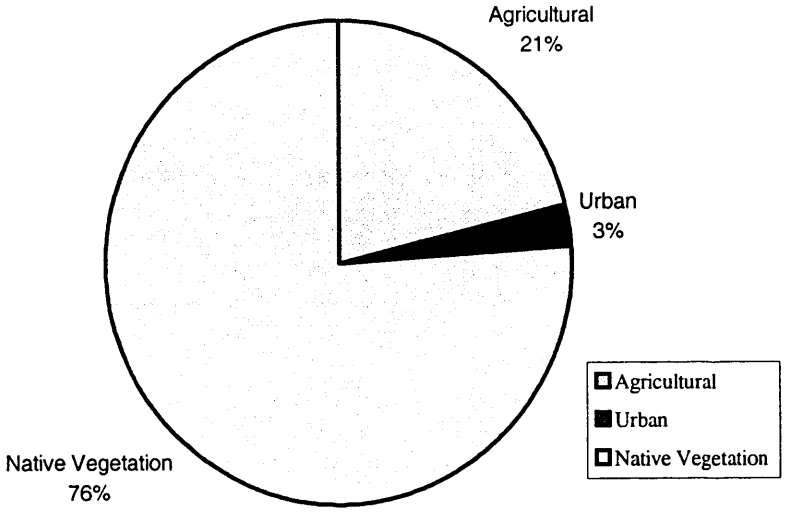
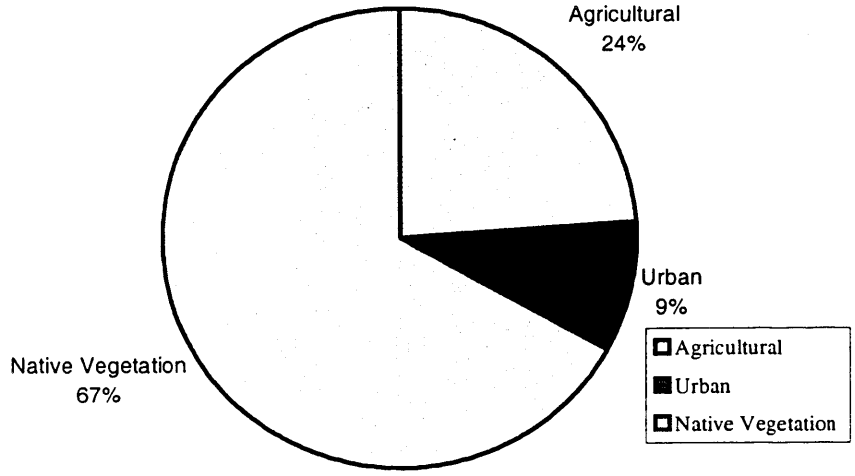


Figure 2B
Pajaro Valley Land Use - 1997



Agricultural Crop Mix

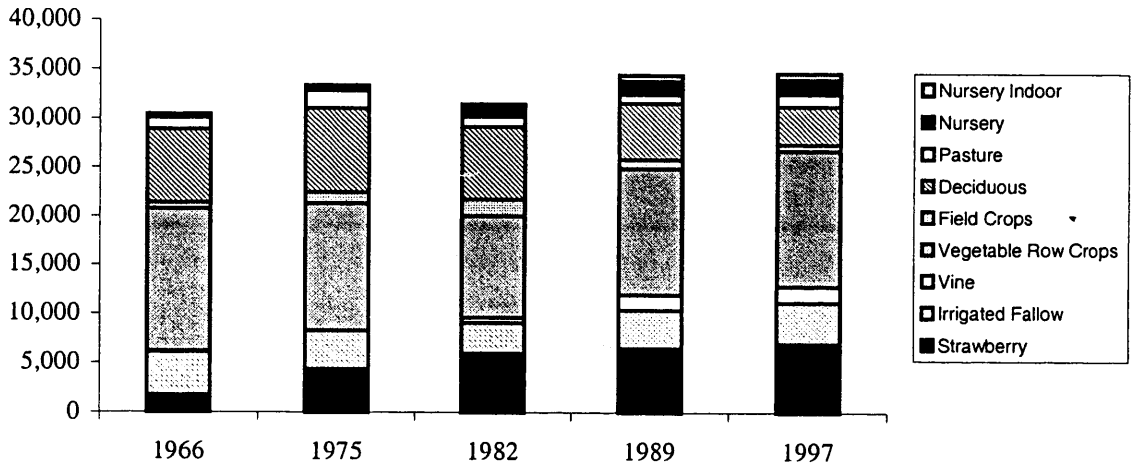
Agricultural water use is a function of multiple variables within the PVIGSM, including crop type. Therefore, it is important to understand the distribution of crop types within the total agricultural acreage to form a sound estimate of total agricultural water use. Thus, the various crop classifications reported in the DWR land use surveys have been aggregated into the crop types (groups) shown in Table 2, for hydrologic modeling purposes. In general, crops are grouped into categories having similar crop consumptive use requirements, and to a lesser extent crops with similar farming practices.

A wide variety of crops have been grown in the Pajaro Valley over the past 3 decades. Table 3 presents the crop mix acreage in the model area as reported by the DWR surveys. The DWR crop mix acreage tables are reported by the DWR Detailed Analysis Units (DAU). The model area generally covers parts of the DAU 58 in the Monterey County, most of DAU 59 in the Santa Cruz County, and a very small portion of DAU 61 in the foothill areas. The crop mix acreages in the model area are developed based on the geographic coverage of the model area and the DAUs. Table 3 and Figure 3 show the crop mix acreage over time. Figures 4A and 4B show the 1966 and 1997 crop mix conditions in the Pajaro Valley.

Table 3
Crop Mix Acreage for DWR Land Use Surveys in the Model Area

PVIGSM Crop Type	1966	1975	1982	1989	1997
Strawberry	1,754	4,372	5,974	6,514	7,004
Irrigated Fallow	4,384	3,911	3,133	3,906	4,182
Vine (Bushberries, Grape, etc)	22	0	505	1,512	1,652
Vegetable Row Crops	14,612	13,038	10,442	13,020	13,940
Field Crops	647	1,170	1,724	908	644
Deciduous	7,516	8,578	7,434	5,729	3,892
Pasture	1,175	1,780	1,004	894	1,227
Nursery	237	392	910	1,386	1,476
Nursery-indoor	101	168	390	594	633
Total Crop Acreage	30,448	33,409	31,516	34,463	34,650

Figure 3
Crop Mix Acreage Over Time



As indicated in Table 3 and Figures 3, 4A and 4B, there has been an increasing acreage in vegetable row crops and strawberries within the Pajaro Valley. On the other hand, growing and production of deciduous trees and field crops have been declining in acreage over time. In addition, since the 1980s, nurseries and greenhouses have experienced an increase in acreage.

Figure 4A
Crop Mix Acreage - 1966

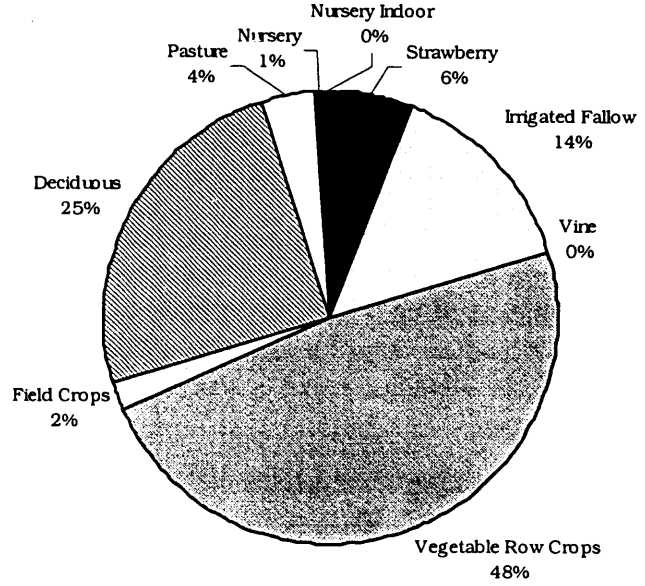
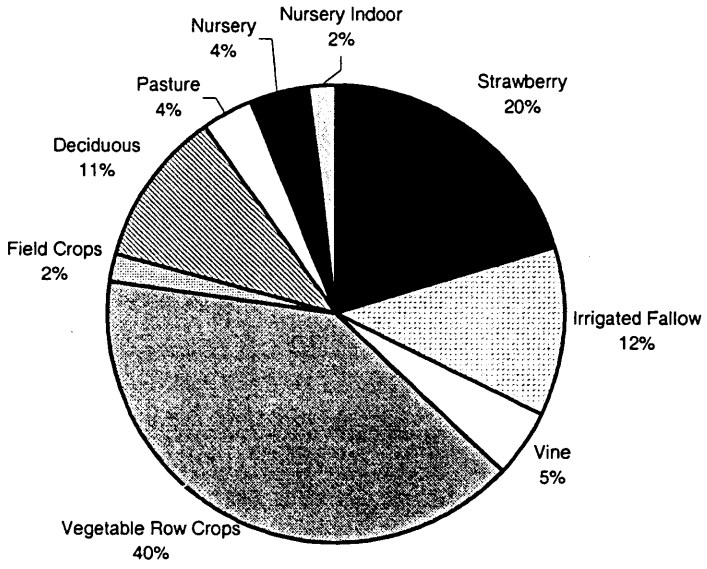


Figure 4B
Crop Mix Acreage - 1997



It is noteworthy that multiple cropping practices are quite common on the vegetable row crops. Often a parcel of land is tilled and prepared for the next crop rotation within a period of two to three weeks. Very little irrigation water is required during this land preparation period. In the Pajaro Valley, two to three rotations of vegetable crop are typically planted per irrigation season. When a long irrigation season and good climatic and market conditions are available to the growers, four rotations of lettuce have been observed on some fields. Therefore, for purposes of modeling this complex irrigation practice, approximately 30 percent of the vegetable row crop acreage is assumed fallow at some time during the irrigation season. That is at any time during the irrigation season, approximately 30 percent of the land categorized as vegetable row crop is not planted and is being prepared for the next rotation. Based on the information available from Salinas Valley agricultural practices, the 30 percent fallow assumption for vegetable row crops is reasonable. However, this number will be refined during the pumping estimation and model recalibration effort.

Since the PVIGSM requires crop mix acreage for each year of the historic record utilized in the model, the annual crop mix acreage has been estimated by linear interpolation between each survey year. The distribution of crop mix acreages between the model subregions is based on the manual overlay of land use maps for the 1966, 1975, and 1982 survey years. This distribution is made to each model subregion based on electronic overlay using GIS coverages for the 1989 and 1997 survey years.

Summary

The land use and crop mix acreage for the PVIGSM has been updated to include the 1997 DWR land use survey. The land use surveys indicate that both agricultural and urban land use increased in the Valley. This increase in agricultural land continued until approximately 1989. Since then, the total acreage dedicated to agricultural land use has been essentially constant

(34,463 acres in 1989 versus 34,650 acres in 1997). Over the past three decades, the agricultural land use has increased by approximately 4,200 acres (14 percent), from about 30,500 acres in 1966 to about 34,650 acres in 1997. During the same period, the urban land use in the Pajaro Valley has increased by approximately 8,100 acres (170 percent), from about 4,800 acres in 1966 to about 12,900 acres in 1997. The increased urban acreage has been mostly in-fill and new development on previously undeveloped land.

Over the past three decades, there has also been a shift in the agricultural crop mixes. Over this period, there has been a general decreasing trend in growing pasture, alfalfa, field crops, and deciduous trees. On the other hand, there has been an increasing trend in growing vegetable row crops, strawberries, vines, and bushberries. There has also been an increasing land area dedicated to nurseries and greenhouses. To account for the multiple cropping practices on the vegetable row crops, a 30 percent fallow acreage is assumed on the vegetable row crops. This percentage, although reasonable, may be adjusted during the recalibration of PVIGSM and pumping estimation.

The PVIGSM land use and crop acreage input data files have been updated and revised to include the data from the latest DWR surveys.