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Nipomo Waterline Intertie Project

CONCEPT DESIGN REPORT

Volume 1 of 3

April 2009

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Concept Design Report
Volume 1 of 3

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VOLUME I – CONCEPT DESIGN REPORT

EXECUTIVE SUMMARY

Introduction and Background

Currently, the Nipomo Community Services District (District) relies on groundwater as the sole source of water for their customers, approximately 12,000 people (Urban Water Management Plan 2005 Update, SAIC). The groundwater is pumped from the Nipomo Mesa Management Area (NMMA) of the Santa Maria Groundwater Basin, an aquifer that has been the subject of ongoing litigation since 1997. Due to the diminishing source and competing claims, the California State Superior Court of Santa Clara County approved a Settlement Stipulation on August 3, 2005 containing a requirement that the District import a minimum of 2,500 acre-feet of supplemental water to the NMMA each year.

The District has investigated multiple sources of supplemental water and, as a result, signed a Memo of Understanding (MOU) with the City of Santa Maria (City) to pursue the Waterline Intertie Project. The 2005 MOU established a basis for purchase and delivery of water from the City to the District. Subsequently, the District commissioned a preliminary design study. After the Draft Waterline Intertie Project Preliminary Engineering Memorandum (Boyle, November 2006), the District Board of Directors requested additional study to establish a basis for comparison to other supplemental water alternatives. Boyle Engineering (now AECOM) submitted the Evaluation of Supplemental Water Alternatives in June 2007 which investigated the costs and constraints associated with several alternative water supplies. The evaluation indicated the preferred supplemental water sources are the Santa Maria Waterline Intertie and desalination, which met the criteria for reliability, quality, and availability. The revised Waterline Intertie Project Preliminary Engineering Memorandum was submitted in May 2008 (Boyle/AECOM).

The Waterline Intertie Project summarized in this Concept Design Report consists of the “Phase I” and “Phase II” projects described in the Waterline Intertie Project Environmental Impact Report (Douglas Wood and Associates, April 22, 2009). The project is designed to deliver 3,000 AFY at 2,000 gpm. Water delivery will be phased based on system demands and conditions to be established in the contract with the City. The water delivery rate is anticipated to be constant and to be adjusted by the District daily. District wells are to be used during peak demand months and for emergency water if the Project is out of service.

Project Components

The Waterline Intertie Project consists of over 27,000 linear feet (LF) of pipeline, a 0.5 million gallon (MG) storage tank, a 2,000 gallon per minute (gpm) pump station, and chloramination systems at the pump station and at four wells, as well as the related back-up power, controls, and electrical instrumentation. Volume 1 of this report presents the technical findings and design considerations for the project. Volume 2 consists of the appendices with background information, studies, and a preliminary outline of technical specifications for project construction documents. The 30% design plans are included as Volume 3 of this Report.

Figure ES-1 displays a summary of the transmission facilities. The Intertie design begins at the north end of the City of Santa Maria water distribution system at the intersection of Blosser Road and West Taylor Street with a new 18-inch waterline. The waterline runs north along Blosser Road to Atlantic Place, crossing underneath the Santa Maria River levee and transitioning to a 24-inch waterline. The 24-inch line will be jacked and bored underneath the levee and will cross under the Santa Maria River utilizing horizontal directional drilling, ending atop the Nipomo Mesa.

On the Nipomo Mesa, the 24-inch piping will connect to a 500,000-gallon, pre-stressed concrete reservoir. The reservoir will be mostly buried to assist the delivery of water via City system pressures (without pumping). Vertical turbine pumps will draw water from the reservoir and deliver it to an existing 12-inch waterline on Santa Maria Vista Way at 2,000 gallons per minute (gpm). Traveling northwest, to Joshua Street and Orchard Road, water will be pumped along Orchard Road (in the existing 12-inch waterline) and connect to the main District system at Orchard Road and Southland Street. The preliminary design for the pump station and reservoir is discussed in Chapter 5 and is included as part of Bid Package 4.

Dedicated 12-inch waterlines will be installed to deliver water to the system's back-bone transmission mains in order to protect smaller existing waterlines and users from high pressures. These dedicated mains will be in five areas: 1) along Orchard Road, from Southland Street to Grande Street; 2) along Southland Street, from Orchard Road to Frontage Road; 3) along Frontage Road from Southland Street to Grande Street; 4) from Grande Street, northeast underneath Highway 101 (via jack-and-bore) to Darby Lane, continuing on Darby Lane to South Oakglen Avenue; and 5) along South Oakglen Avenue from Darby Lane to Tefft Street. The dedicated mains will connect to the existing system at Orchard Road and Grande Street, Frontage Road and Grande Street, and South Oakglen Avenue and Tefft Street.

Pressure-reducing-valve (PRV) stations will protect downstream users from high pressures required for the supplemental water delivery. Five PRV stations will be installed throughout the District's system. One will be placed on Santa Maria Vista Way near the connection to the existing 12-inch waterline, lowering pressure for the Maria Vista Development. Three stations will be placed downstream of the connection points, which will create a separate pressure zone in the southwest region of the District's system. The fifth PRV station will be installed on Southland Street between the dedicated main and an existing waterline to assist the flow of water into the new pressure zone during an emergency (low pressure) situation. The pipeline alignment, materials, and design considerations are further discussed in Chapter 4 and the proposed pipeline alignments are included with Bid Package 2.

The project also includes conversion of four production wells from chlorination to chloramination systems (Figure ES-2). The Preliminary Engineering Memorandum (Boyle/AECOM, May 2008) contains a detailed discussion of disinfection and water quality issues. Disinfection alternatives, as discussed in the Section 4 of the Memorandum, consists of uncontrolled blending of City and District water without changes in treatment process, converting City water disinfection to free chlorine residual, and converting NCSD groundwater disinfection to chloramine residual. The Memorandum recommends converting NCSD groundwater disinfection to chloramine at the main wellheads and including a chloramine booster at the pump station. Chapter 6 describes the preliminary design of the wellhead chloramination systems and the chloramine booster station is discussed in Chapter 5.

Project Bidding Strategy

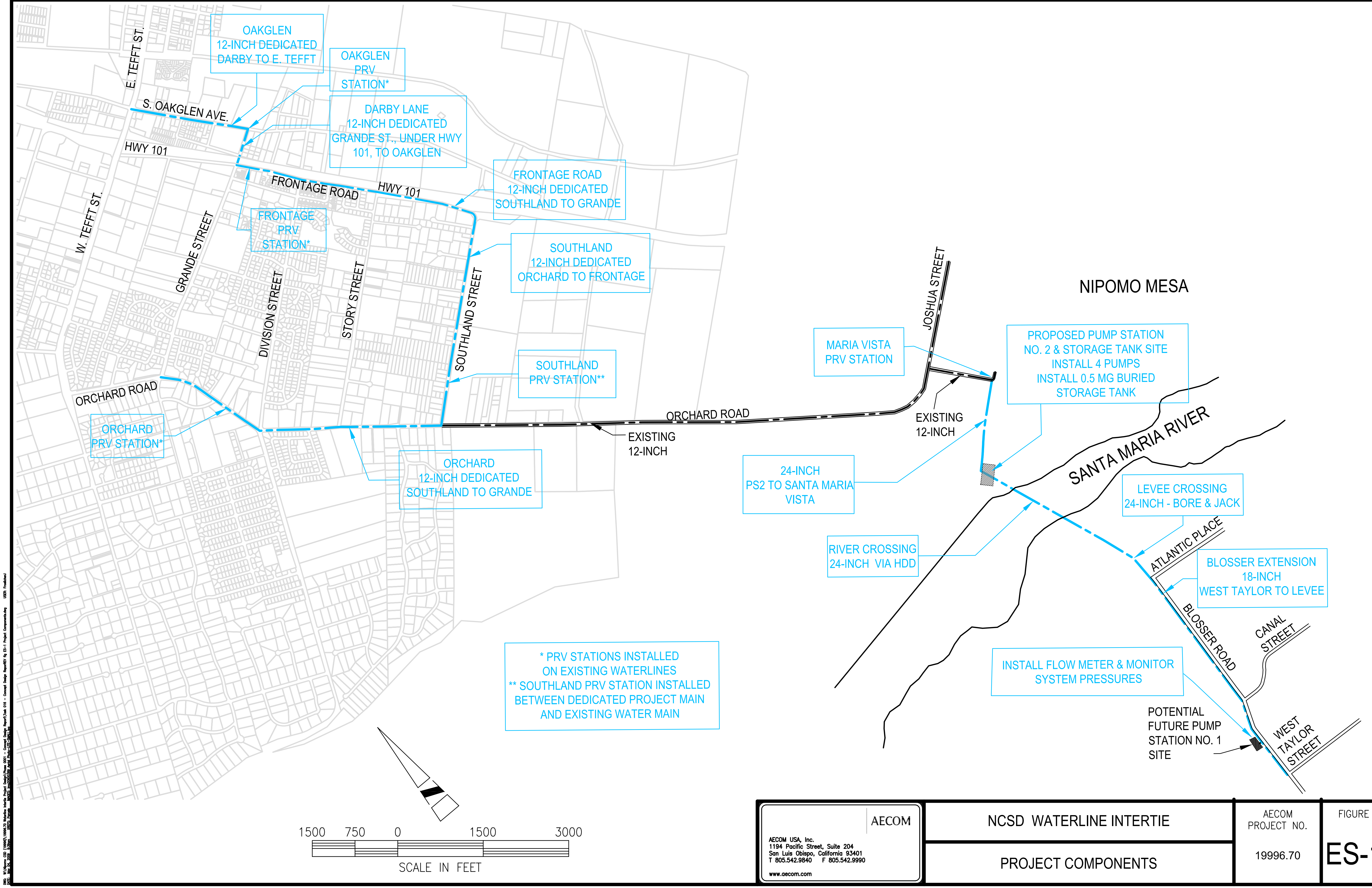
Technical Memorandum No. 2 summarizes recommendations for bidding the Waterline Intertie Project, including recommendations for multiple bid packages and optimizing the bid climate through press releases, workshops, and timing of the bid release.

Project components were grouped into bid packages based on proximity of work items to each other, unique equipment and experience required for performance of the river crossing, need to provide as few points of coordination and responsibility as possible for each project site, and desire to standardize new chloramination systems at each wellhead. Based on these criteria, AECOM recommends the project be divided into four bid packages as follows:

- Bid Package 1: Santa Maria River Water Main Crossing
- Bid Package 2: Nipomo Area Pipeline Improvements
- Bid Package 3: Blosser Road Water Main and Flow Meter

- Bid Package 4: Joshua Road Pump Station and Reservoir, and Wellhead Chloramination Improvements

AECOM recommends prequalifying only the river crossing contractors. Chapter 2 further describes the work items included in each bid package and other bidding strategies.



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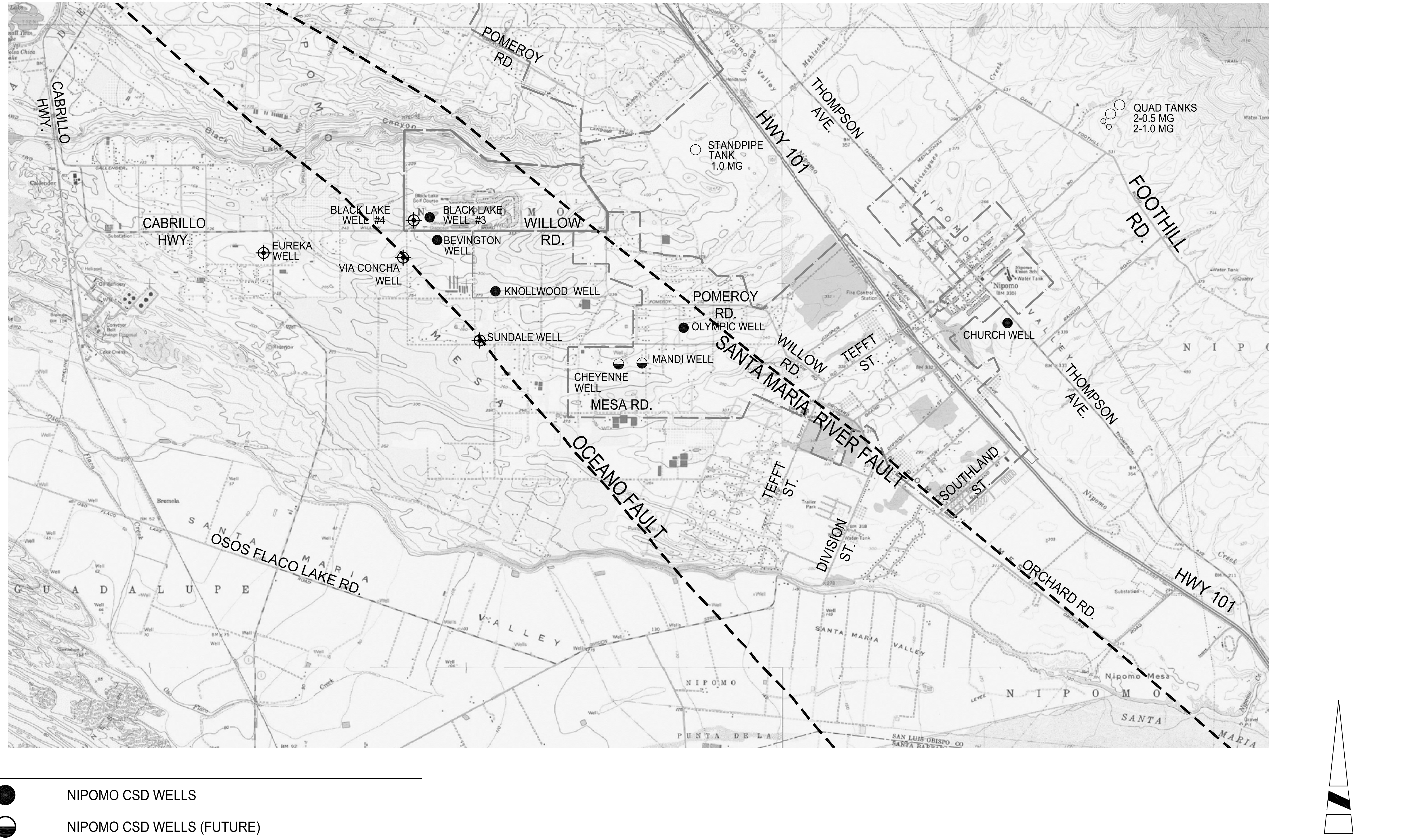
NCSD WATERLINE INTERTIE

PROJECT COMPONENTS

AECOM PROJECT NO. 19996.70

FIGURE ES-1



LEGEND

- NIPOMO CSD WELLS
- NIPOMO CSD WELLS (FUTURE)
- NIPOMO CSD TANKS
- EXISTING WATER SYSTEM SERVICE AREA BOUNDARY
- APPROXIMATE FAULT LINE
- WELLS SELECTED FOR CHLORAMINE CONVERSION

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NCSD WATERLINE INTERTIE

PROJECT COMPONENTS

BEC PROJECT NO. 19996.70

FIGURE ES-2

Opinion of Probable Construction Cost

The detailed opinion of probable construction costs are presented in Chapter 8. Table ES-1 is a summary.

Table ES-1. Opinion of Probable Project Costs

Item	Description	Budgeted Amount May 2008 Preliminary Engineering Memo.		Updated Amount 22-Apr-09 Concept Design Report	
	Construction Subtotal	$13,860,800		$15,577,000	
1	Contingency	$3,643,000		$3,115,400	(5)
	Construction Subtotal + Contingency	**$17,503,800**		**$18,692,400**	
2	Property Allowance	*not included*	(3)	$500,000	(3)
3	Design-Phase Engineering				
	Original Agreement (July 2008)			$744,993	
	Budget Revision 1 - Pressure Reduction			$132,798	
	Budget Revision 2 - Biological Survey for HDD			$4,050	
	Budget Revision 3 - Modeling for GSW/Woodlands Turnouts			$8,380	
	Budget Revision 4 - Additional Survey Services			$9,900	
4	Office Engineering during construction			$175,837	
5	Estimated Construction Management (2)	$2,428,000	(1)	$1,507,170	(4)
6	Permitting Fees To Date	--		$1,573	
7	Non-Final Design Funds Spent To Date	*not included*		$1,402,879	(6)
8	Estimated Other Costs (Assessment, etc)	*not included*		$415,420	(6)
	PROJECT TOTAL (Rounded to 1000)	**$19,932,000**		**$23,596,000**	

Notes: ENR CCI: March 2008 = 8109; March 2009 = 8534

(1) Engineering and Construction Management were originally presented as a "lump sum" amount

(2) Includes material testing, construction staking, and environmental monitoring

(3) Estimate only. Item not included in previous construction cost opinions, but was added to the Concept Design Report to provide a complete assessment of anticipated project costs.

(4) To be provided by CM team - Has not been revised to reflect additional work for construction management of Oakglen, Darby, and Orchard extensions.

(5) Contingency was modified to 20% which is more appropriate for 30% design phase.

(6) Provided by District staff.

not included = Item was not included in previous construction cost opinions, but was added into the Concept Design Report to provide a complete assessment of anticipated project costs.

1.0 INTRODUCTION

The Nipomo Community Services District (NCSD) serves approximately 12,000 people over an area of approximately 4,650 acres (Urban Water Management Plan 2005 Update, SAIC Engineering). The service area is currently served by groundwater from the Nipomo Mesa Management Area (NMMA) of the Santa Maria Groundwater Basin. The NMMA is at the northwestern part of the basin, and encompasses approximately 27.5 square miles.

1.1 Project Background

The 2005 Urban Water Management Plan states that "since July 1997, the Santa Maria Groundwater Basin has been the subject of ongoing litigation between nearly 800 parties with competing claims to pump groundwater, collectively called the Santa Maria Groundwater Litigation (Santa Maria Valley Water Conservation District vs. City of Santa Maria, et al. Case No. 770214)".

The California Superior Court, County of Santa Clara, approved a Settlement Stipulation on August 3, 2005, which requires that the District import a minimum of 2,500 acre-feet of Supplemental Water to the NMMA each year. The need for additional source(s) of water has been well-established; and a history of investigations has led the District to pursue imported water from the City of Santa Maria (City) through the Waterline Intertie Project. Some of these studies are summarized in the following documents:

- Preliminary Engineering Memorandum (Boyle/AECOM, May 2008)
- Supplemental Water Evaluation (Boyle, June 2007)
- Supplemental Water Alternatives Environmental and Permitting Constraints Analysis (Padre Associates, May 2007)
- Urban Water Management Plan 2005 Update (SAIC, January 2006)
- Santa Maria Inter-Tie: Project Schedule and Probable Cost (Cannon Associates, June 2005)
- Waterline Feasibility Study: Santa Maria River Crossing Alternatives (Cannon Associates, April 2005)
- Santa Maria Inter-Tie: Route and Site Alternatives (Cannon Associates, June 2005)
- Resource Capacity Study, Water Supply in the Nipomo Mesa Area (S.S. Papadopoulos & Associates, November 2004)
- Final Report, Evaluation of Water Supply Alternatives (Kennedy/Jenks Consulting, October 2001)
- Evaluation of Alternative Supplemental Water Supplies (Bookman-Edmonston Engineering, Inc, July 1994)
- Engineering Considerations of Groundwater Yields and Rights on the Nipomo Mesa Sub-Area, San Luis Obispo County, CA (Lawrence, Fisk, & McFarland, Inc, October 1993)

The 2005 Memorandum of Understanding (MOU) between the District and the City of Santa Maria became the basis for the Waterline Intertie Project. According to paragraph 2.10 of the MOU, "NCSD shall be responsible for constructing and operating an interconnection with the City's retail distribution system". Location, plans, and specifications of this connection must be approved by the City. All costs for regulatory and environmental permits, licenses, and other approvals must be paid by NCSD.

The water is intended to be the City's "municipal mix", including both City groundwater and State Water Project supplies.

The District and the City of Santa Maria are currently negotiating the terms of the water supply agreement.

In November 2006, Boyle Engineering (now AECOM) completed the Draft Waterline Intertie Preliminary Engineering Memorandum. Two general project alignments were evaluated for crossing the Santa Maria River: one near Highway 101 and one due north from the north end of Blosser Road in Santa Maria. The report also included a preliminary hydraulic analysis, water quality analysis, disinfection study, review of reservoir storage options, siting evaluation for two pump stations, environmental and permitting considerations, and a conceptual cost comparison. The hydraulic analysis was a preliminary effort and intended to be merged with the updated water model being produced as part of the District's Water Master Plan.

After the draft Memorandum was released, Carollo Engineers completed a hydraulic analysis of the City of Santa Maria's distribution system in order to evaluate impact of various delivery rates on the City's system pressures. Two connection points were compared: at Atlantic Place and Blosser Road, existing 10-inch pipelines in a residential area, and at the end of a theoretical dedicated 18-inch pipeline from Taylor Street to the south side of the Santa Maria River. Although analyses showed that connection to the existing network did not create an unacceptable pressure drop in the residential area for a continuous supply to the NCSD, the report concluded that this connection point should not be considered because other variables, such as effects of a pump station or a flow control facility, may cause the results to change. The dedicated 18-inch pipeline was recommended for water delivery to the NCSD.

After the Preliminary Engineering Memorandum for the Waterline Intertie Project was completed, the District Board of Directors commissioned an evaluation of supplemental water alternatives with which to form a basis of comparison. In order to determine the cost and constraints associated with other water supply alternatives, and provide context for evaluating cost and constraints of the Waterline Intertie Project, in June of 2007 Boyle evaluated options for supplemental water supplies. The alternative sources included:

- Santa Maria Waterline Intertie
- Santa Maria groundwater
- Desalination
- Surface water from Oso Flaco Lake
- State water from a regional interconnection
- Nacimiento pipeline
- Recycled wastewater recharge and/or reuse

The evaluation indicated the preferred supplemental water sources are the Santa Maria Waterline Intertie and desalination, which meet the criteria for availability, quality, and reliability. These sources also have an added advantage of lower salts concentrations (such as sulfates, boron, chloride, and total dissolved solids) than the Nipomo groundwater. The potential to increase salt concentrations in the groundwater through disposal of treated wastewater is a current concern for the District. This has become a more pressing issue as the Southland Wastewater Treatment Facility approaches its permitted effluent limit for maximum flow. The District plans to prepare a salts management program to reduce this potential for impact. A water supply with lower salts concentration is an important component of this program, as it will help mitigate future impact to the groundwater.

The District was interested in purchasing State Water, but significant constraints were identified in the report and were further explored in meetings with staff from the District, San Luis Obispo County Public Works Department, and City of Santa Maria.

In May 2008, the Waterline Intertie Project Preliminary Engineering Memorandum was finalized. The Waterline Intertie Project Preliminary Engineering Memorandum summarized the preliminary hydraulic analysis for the District's and the City's distribution systems and the intertie pipeline; examined water quality and disinfection alternatives; and evaluated pipeline alignment, storage, and pumping options. Three main pipeline alignments were compared based on apparent constructability, potential environmental impact, easements required, existing utilities, intertie pipeline length, cost, and geotechnical considerations. The Board of Directors selected a final alignment based primarily on environmental issues and river crossing challenges associated with the eastern alignment. Refer to Figure 1-1 for the selected alignment. The project consisted of the components summarized in Table 1-1.

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NCSD WATERLINE INTERTIE PROJECT

PROJECT ALIGNMENT - SANTA MARIA TO NIPOMO MESA

AECOM PROJECT NO.	FIGURE
19996.70	1-1

DWG: W:\Nipomo CSD (19996)\19996.70 Waterline Intertie Project Design\Phase 0001 - Concept Design Report\Task 016 - Concept Design Report\Final Concept Design Report\Figures\Figure 1-1.dwg Layout Name: Figure 1-1 - Plotted by: Froelicher, Jim Date: 5/4/2009 - 9:37 AM
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Table 1-1. Waterline Intertie Project from Preliminary Engineering Memorandum

Component	Description
Blosser Road Water Main	– 5,000 lineal feet (lf) of 18" water main, valves, and appurtenances from West Taylor Street to Atlantic Place – Flow meter
Santa Maria River Crossing	3,700 lf of 24" water main from the north end of Blosser Road to the Horizontal Directional Drill (HDD) staging area, including: – 300 lf of bore-and-jack crossing underneath the south levee – 900 lf of open trench to the south HDD staging area – 2,500 lf of water main from the south HDD staging area across the river to the north HDD staging area
Nipomo System Pipeline Improvements	– 2,500 lf from the north side of the river (at the north HDD staging area) to the pump station site near Joshua Street – 3,200 lf of 12" main along Orchard Avenue between Southland Street and Division Street – 3,900 lf of 12" main along Southland Street between Orchard Road and Frontage Road – 6,470 lf of 12" main along Frontage Road from Southland Street to Tefft Street – 340 lf of 12" main along Division Street between Allegre Road and Meridian Road – Approximately 150 pressure regulating valves for water services (to protect homeowners from higher pressures due to the new booster station) – Pressure reducing valve station on Joshua Street between the pump station and the Maria Vista development
Booster Pump Station and Reservoir	– 1,830 to 2,000 gallon per minute (gpm) booster pumping station – Chloramination system – 500,000 gallon reservoir
Wellhead Chloramination System	Conversion of four production wells from chlorination to chloramination systems

One of the concerns with the project is an increase in distribution system pressure for existing customers near the Waterline Intertie Project connection on Joshua Road (see Figure 1-2 [Area A]). Many of these customers currently experience pressures in the 90- to 100-psi range and would experience pressures around 110 psi without pressure reducers. The Preliminary Engineering Memorandum recommended installation of 150 pressure regulating valves as shown Table 1-1. This was considered a low cost approach to protecting homeowners from higher pressure.

In Technical Memorandum 9 (included as Appendix A), AECOM developed an alternative to installation of regulating valves, as directed by the District. This alternative included additional pressure reducing valve stations, isolation valves, and dedicated pipelines (instead of pipeline replacements, as originally described in the Preliminary Engineering Memorandum) to create a pressure zone (see Figure 1-3 [Area B]) that would not be affected by the booster station.

Figure 1-2: NCSD System Improvements from May 2008 Preliminary Engineering Memorandum

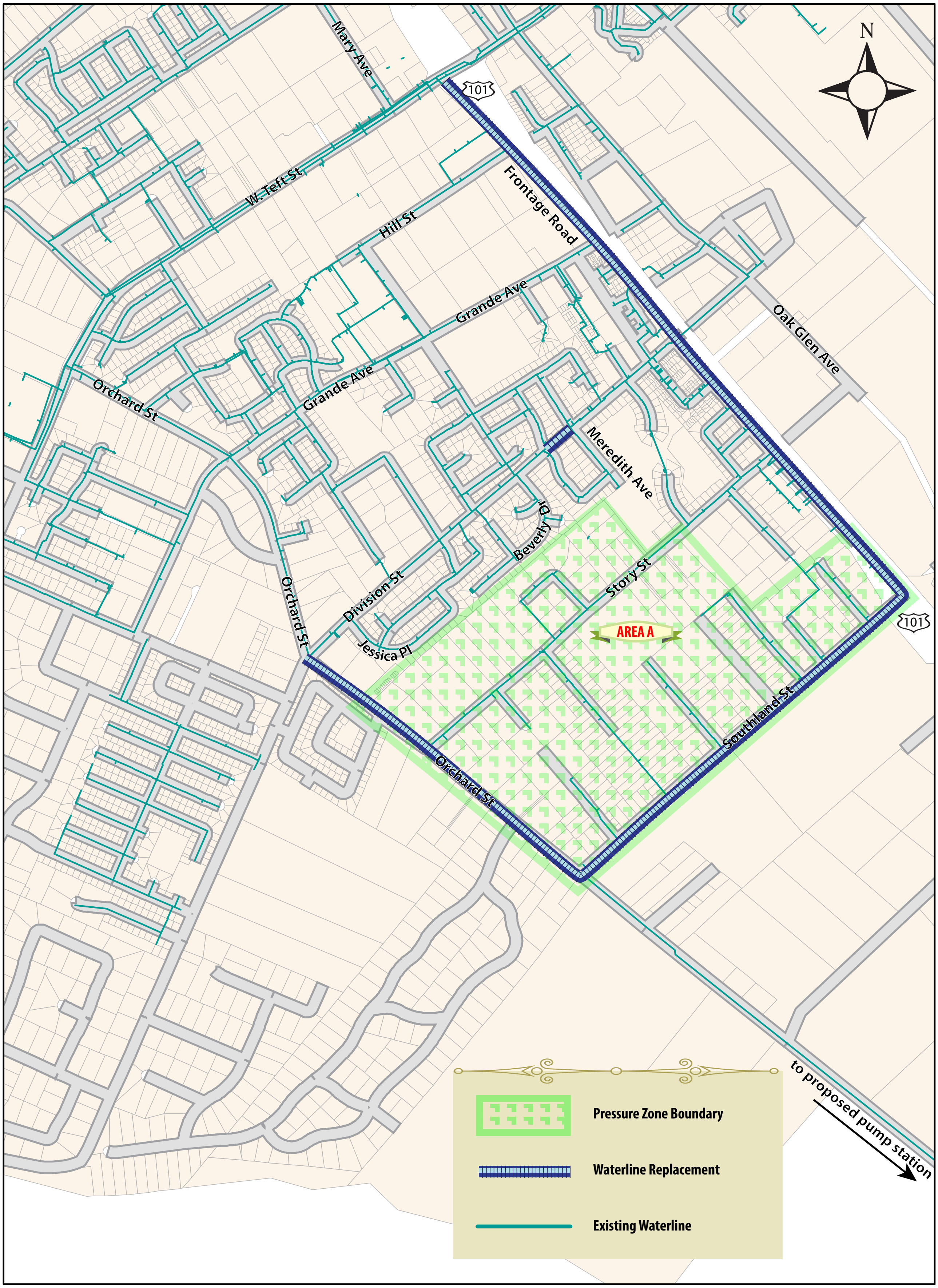
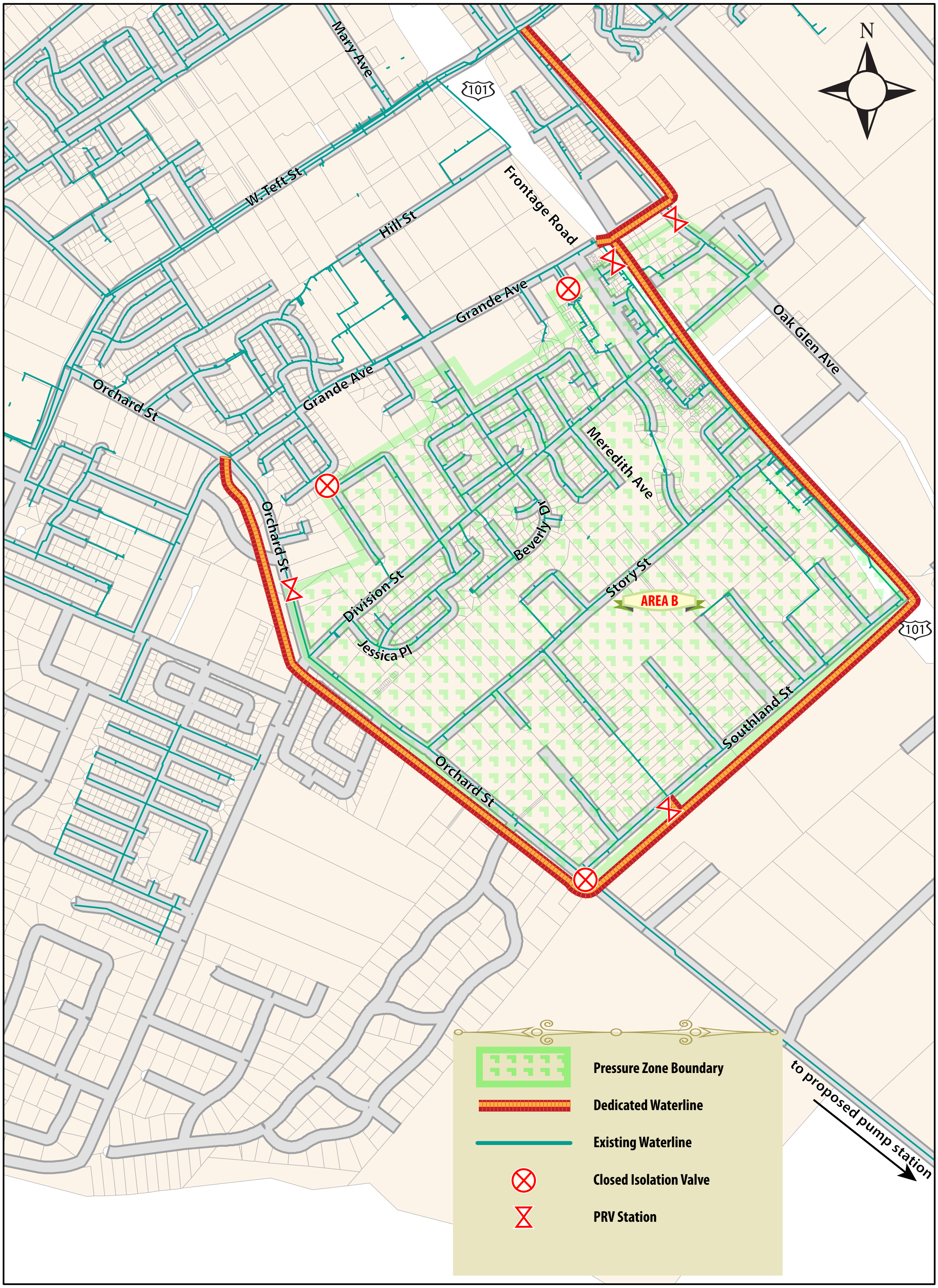


Figure 1-3: Selected NCSD System Improvements



Creating the low pressure zone and utilizing dedicated pipelines provide a project flow rate capacity of 2,000 gpm, in effect combining the "Phases I and II" as described in the Waterline Intertie Project Environmental Impact Report (EIR) (Douglas Wood and Associates, April 22, 2009). In addition, the pipeline segment along Division was not required because the current size is 10-inch, not 6-inch as shown in the District's Water and Sewer Master Plan Update. The recommendations for project components are discussed in Section 1.2.

1.2 Project Components

The Waterline Intertie Project is designed to deliver 3,000 AFY at a rate of 2,000 gpm. The project consists of a combined "Phase I" and "Phase II" components as described in the project EIR and as summarized in Table 1-2. In order to reduce the potential for future reconstruction underneath the levee and across the Santa Maria River, the River and levee crossing pipelines are designed to handle up to 6,300 AFY at a flow rate of 5,570 gpm.

Table 1-2. Revised Waterline Intertie Project

Component	Description
Blosser Road Water Main	5,000 lineal feet (lf) of 18" water main, valves, and appurtenances from West Taylor Street to Atlantic Place Flow meter
Santa Maria River Crossing	3,250 lf of 24" water main from the north end of Blosser Road to the Horizontal Directional Drill (HDD) staging area, including: – 300 lf of bore-and-jack crossing underneath the south levee – 900 lf of open trench to the south HDD staging area – 2,050 lf of water main from the south HDD staging area across the river to the north HDD staging area
Nipomo System Pipeline Improvements	– 2,500 lf from the north side of the river (at the north HDD staging area) to the pump station site near Joshua Street – 5,200 lf of dedicated main along Orchard Road between Southland Street and Grande Street – 3,900 lf of 12" dedicated main along Southland Street between Orchard Road and Frontage Road – 4,400 lf of 12" dedicated main along Frontage Road from Southland Street to Grande Street – 220 lf of 12" dedicated main with bore and jack crossing at Highway 101 from Grande Street to Darby Lane – 500 lf of 12" main along Darby Lane to South Oakglen Avenue – 2,100 lf of 12" main along South Oakglen Avenue from Darby Lane to Tefft Street – Five Pressure Reducing Valve Stations • Southland Street between Drumm Lane and Honeygrove • Orchard Road between Division Street and Apricot Lane • Frontage Road south of Grande Street • South Oakglen Avenue, south of Darby Lane • Between the pump station and the Maria Vista development
Booster Pump Station and Reservoir	2,000 gallon per minute (gpm) booster pumping station Chloramination system 500,000 gallon reservoir
Wellhead Chloramination System	Conversion of four production wells from chlorination to chloramination systems

Water delivery will remain constant, but may be adjusted daily by the District. Water delivery will be phased as demands increase per the agreement between the City and the District. District wells will be utilized for peak demand months and for emergency water delivery if the waterline intertie is out of service.

1.3 Scope of Work

In July of 2008, the District contracted with AECOM to perform the design work for the Waterline Intertie Project as summarized in Table 1-2. To present the preliminary design decisions and identify potential design challenges, the scope of work includes a Concept Design Report to be submitted with the 30% Plans. The 30% Plans are included as Volume 3 of this Report. (Volume 2 consists of the Appendices). An outline of technical specifications to be included with the Contract Documents is included as Appendix F.

This Concept Design Report is submitted in accordance with Task 113 under the project scope of work. The key components of the project design were evaluated and presented in a series of technical memoranda. The memoranda were used to compile this Draft Concept Design Report, incorporating comments received from the District staff. Descriptions and status of memoranda are summarized in Table 1-3. The current project schedule is attached as Appendix B.

Table 1-3. Technical Memoranda

Tech Memo No.	Title	Description	Submittal Status	Location in Concept Design Report
1	Geotechnical Report for HDD	A specific feasibility study of HDD for the River Crossing. Detailed geotechnical evaluation along the proposed River crossing (Fugro). Evaluation of soil requirements and design details of HDD, recommendations regarding feasibility and direction for the project (AECOM/Jacobs).	Final Submitted 3/25/09	Contained in Chapter 3
2	Project Bidding Strategy	Overview of recommendations for bidding the project, including recommendations for multiple bid packages and for optimizing the bid climate through press releases, workshops, and timing of bid release.	Final Submitted 11/19/08	Contained in Chapter 2
3	Pipeline Alignment	Preliminary pipeline design, utility research, and identification of locations and area requirements for easement acquisition.	Draft Submitted 3/3/09 Errata Letter Submitted 3/11/09	Contained in Chapter 4

Tech Memo No.	Title	Description	Submittal Status	Location in Concept Design Report
4	Pump Station and Reservoir Design	Preliminary Pump Station & Reservoir design. Building material & foundation, reservoir footprint & dimensions, site layout, pump control points, pump & motor configuration, controls/ instrumentation & power requirements, pump station layout, preliminary cost opinions.	Draft Submitted 3/20/09	Contained in Chapter 5
5	Reservoir Design	Combined with Tech Memo #4. See above.	See above	See above
6	Permitting Strategy	Strategy for obtaining required permits, recommended environmental monitoring/studies prior to and during construction, and recommended environmental mitigation measures	Draft Submitted 03/27/09	Not Included
7	Chloramination Systems	Identification of wells for chloramination, storage requirements, chemical feed system, valves and meters, controls and instrumentation, permitting and code requirements, preliminary cost opinion.	Tech Memo 7 Submitted 7/16/08 & Tech Memo 7b Submitted 11/21/08	Contained in Chapter 6
8	Back-up Power, Controls, and Instrumentation	Identify system components for back-up power, electrical controls, and instrumentation for the pipeline, tank, pump station, and chloramination systems.	Draft Submitted 3/16/09	Contained in Chapter 7
9	System Pressure Reduction Study	Review available waterline information, perform hydraulic analysis, and prepare conceptual cost opinions to compare the installation of new water mains to the proposed installation of residential pressure regulating valves.	Final Submitted 9/23/08	Attached as Appendix A
10	Frontage Road Sewer Replacement	Define proposed alignment, identify potential challenges, summarize preliminary pipeline and manhole design parameters, and prepare preliminary cost opinion.	Draft Submitted 03/19/09	Contained in Chapter 10

2.0 Project Bidding Strategy

The Project Bidding Strategy Technical Memorandum (Technical Memorandum No. 2) was submitted for Task Group 1, Task 102, as contained in this Chapter. The scope of work is to provide an overview of recommendations for bidding the project, including recommendations for multiple bid packages and optimizing the bid climate through press releases, workshops, and timing of the bid release.

2.1 Bid Packages

The following criteria were considered in establishing discrete bid packages for this project:

- Location of the work items in relation to each other
- Unique equipment and experience required for performance of the river crossing
- Need to provide as few points of coordination and responsibility as possible for each project site
- Desire to standardize new chloramination systems at each wellhead

In order to best meet these criteria, AECOM recommends dividing the project as follows:

Table 2-1. Proposed Bid Packages

Bid Package	Title	List of Work Items
1	Santa Maria River Water Main Crossing	River crossing pipeline and casing pipe (if required)
2	Nipomo Area Pipeline Improvements	– Frontage Road water main – Southland Road water main – Oakglen Avenue water main – Darby Lane water main – Orchard Avenue water main – Highway 101 Crossing at Darby & Grande – Pressure reducing valve stations (5 total) including valves, telemetry, controls, and instrumentation (system integration to be performed in Bid Package 4) – Isolation valves

Bid Package	Title	List of Work Items
3	Blosser Road Water Main and Flow Meter	– Blosser Road water main (between Taylor and Atlantic) – Flowmeter and telemetry – Water main to the Santa Barbara County Flood Control levee – Jack and bore underneath the levee – Water main to the south end of the river crossing (across existing agricultural land)
4	Joshua Road Pump Station and Reservoir; Wellhead Chloramination Improvements	– Water main from north end of river crossing to Joshua Road Reservoir – Reservoir – Pump station building and mechanical equipment – Landscaping – Onsite piping and valves, including piping between reservoir and pump station and discharge piping from pump station to Joshua Road – Chloramination equipment including chemical storage tanks, feed pumps, and instrumentation – Onsite electrical systems, instrumentation, and controls – Wellhead Improvements: – Upgrade existing chlorination storage and chemical feed pumping systems at Black Lake #4, Sundale, Via Concha, and Eureka wells – Electrical, controls, and instrumentation for new metering pumps and automated feed systems – New chemical storage buildings – System integration with pressure reducing valve and flowmeter telemetry (equipment to be installed by others)

2.2 Prequalification of Contractors

AECOM recommends prequalifying only the river crossing contractors (whether the project is HDD or open trench) and not requiring prequalification for the other bid packages since many contractors are capable of performing the other work items.

The prequalification process for the river crossing contractors will include development and issuance of a Request for Qualifications (RFQ); and a field review and mandatory prequalification conference.

The RFQ will include a 30% plan set, preliminary technical specifications, and project references. Attached as Appendix C is a similar RFQ prepared for another horizontal directional drilling (HDD) project for the District's consideration. If the format and requirements are acceptable, AECOM anticipates following a similar approach for this project.

After the prequalification process is completed, the number of contractors will be narrowed to a short-list for issuance of the final contract documents.

It is assumed the prequalification work will begin after the final Concept Report is submitted and accepted by the Board.

2.3 Press Releases and Contact

In the current construction climate, many contractors around the state will be interested in the project. In addition, the potential HDD contractors from around the country are likely to closely follow this project.

AECOM recommends sending the Project Narrative and a project schedule to the Ventura County and San Luis Obispo County Builders Exchange and the Santa Barbara County and Santa Maria Valley Contractors Association after the final Concept Design Report is completed. Interested contractors should be directed toward the District to provide contact information. This contact information will be collected and used for sending notices of preproposal meetings and bid advertisements.

All notices and announcements should be kept on the District's webpage. AECOM recommends putting this information under a "Contractors" tab that is shown prominently on the District's home page.

2.4 Bid Process

As project design proceeds, AECOM will work with District staff and the Construction Management Team to determine the appropriate time to bid the project. At this time, it appears the project should be bid as soon as design plans are completed. Bid packages should be provided at the Santa Maria Valley Contractors Association and SLO County Builders Exchange for review by contractors.

AECOM recommends scheduling one preproposal meeting for Bid Packages 2 through 4. Bid Package 1 will follow a separate prequalification procedure, as described in this Section. Many of the contractors are likely to propose on multiple packages and many vendors will be on several teams. This will give the contractors a general project understanding and comprehension of the relationship between the individual bid packages.

It is assumed the bid process for each package (other than Bid Package 1 – River Crossing) would follow this general schedule:

	Weeks											
	1	2	3	4	5	6	7	8	9	10	11	12
Bid Advertisement												
Bid Analysis and Recommendation												
Bid Award and Contract Finalization												

In the latest Project Schedule (see Appendix B), notification, bidding, and award of bids is scheduled to require approximately 3 ½ months for Bid Packages 2 through 4. Bid Package 1 (Santa Maria River Crossing) will require approximately 5 ½ months for prequalification, notification, bidding, and award of bids. In order to facilitate review by District staff and consulting team members, AECOM recommends staggering the bid opening dates by one to two weeks. The general timeline described in the latest Project Schedule is adequate.

The schedule for bid packages will be developed after the Concept Design Report is finalized. AECOM will perform the following bid-phase services to support the District:

- Provide plans and specifications for Electronic Clearinghouse and 20 copies of construction documents per bid package;
- Organize and attend the prebid meeting
- Maintain a list of bidders for distributing addenda
- Respond to inquiries from bidders
- Prepare, issue, and circulate addenda
- Assist the District in bid review and provide recommendations for award

3.0 HDD SANTA MARIA RIVER CROSSING

3.1 Background

The WIP Preliminary Engineering Memorandum (Boyle | AECOM 2008) recommended construction of a 24-inch nominal diameter Santa Maria River crossing via horizontal directional drilling (HDD) to reduce impacts to environmentally sensitive areas, avoid construction on the bluff, and streamline permitting for the project. This chapter summarizes the design basis for the HDD Santa Maria River Crossing including summaries of the site specific geotechnical evaluation performed by Fugro West, Inc., as well as the HDD evaluation performed by Jacobs Associates. The bore-and-jack and open-trench segments of the river crossing are discussed in Chapter 4.

3.2 HDD River Crossing Description

As shown on the 30% concept plans (See Volume 3 of this Report), the HDD River Crossing alignment begins within the riverbed at the HDD Entry Point located approximately 880-feet northwest of the levee crossing. From this point, the alignment extends northward towards the south facing bluff of the Nipomo Mesa, traversing approximately 2,100 feet of riverbed and gaining approximately 110 feet in elevation as it rises to the top of the bluff. At the top of the bluff, the alignment extends an additional 500 feet northward towards the HDD Exit Point near the proposed reservoir and pump station site. The carrier pipe vertical alignment (profile) includes a broadly sweeping inverted arc with a radius of 5,000-feet. There is no separate curve in the horizontal plane. Section 3.7 provides further detail regarding the HDD profile geometry.

3.3 Existing Utilities

Existing utilities were investigated as part of the preliminary design for the HDD River Crossing. Aboveground utilities, visible surface features of underground utilities, and utility easements were mapped as part of the topographic survey mapping effort. Available utility records were also reviewed and incorporated into the project base mapping where appropriate.

As shown on the 30% concept plans, there are no known utilities between the proposed HDD entry point and the base of the Nipomo bluff. As shown on Site Plan – North (Dwg C-102), there are multiple overhead electrical lines at the top of the bluff. There is also an irrigation pipeline near the HDD exit point (STA 33+75). The approximate horizontal location of an existing 10-inch petroleum pipeline was defined by mapping of a 10-feet wide oil easement including surface mounted petroleum pipeline placards. As shown on Site Plan – North, the 10-inch petroleum pipeline alignment is approximately 1,000-feet due east of the HDD alignment.

Based on this utility investigation, there appear to be no major utility conflicts. However, the existing irrigation pipelines near the HDD exit point may need to be relocated prior to construction. The need for irrigation pipeline relocation will be further assessed as the design progresses. Utility relocation logistics will be addressed during the right-of-way acquisition process.

3.4 Geotechnical Evaluation – Horizontal Directional Drilling

AECOM prepared and submitted Technical Memorandum No. 1 – Geotechnical Report for HDD to NCSD at the end of January 2009 following completion of the Draft Geotechnical Report prepared by Fugro West, Inc. This section summarizes the findings and recommendations as submitted in Technical Memorandum No. 1 (TM#1); including geotechnical considerations and recommendations for HDD project design.

The geotechnical evaluation did not identify "fatal flaws" with the proposed HDD river crossing. Furthermore, the Final Geotechnical Report indicated that the field exploration performed along the HDD alignment was successful, and provided suitable characterization of the subsurface conditions that should be anticipated along the alignment. Based on the results of the geotechnical evaluation as presented in TM#1, AECOM recommended that the District proceed with preliminary design of the HDD River Crossing.

The following conclusions regarding geologic conditions along the HDD river crossing were included in TM#1 and were based on the Geotechnical Report:

- The presence of seismic faults does not pose a significant fault rupture hazard to the pipeline project.
- There is a low potential for liquefaction to impact the pipe along the proposed river crossing.
- The potential exists for caving ground near the HDD entrance and exit locations.
- The HDD alignment transitions from Older Alluvium "OA" into Paso Robles Formation (QTp) near the vicinity of CPT C-14 and boring B-7 resulting in a potential tendency for the alignment to deflect at the QTp contact.
- HDD pipe installation at the Santa Maria River crossing will likely be relatively difficult as a result of variable subsurface conditions encountered. These conditions may include: shallow groundwater, wet soil conditions, coarse sand and gravel layers, cobbles, possible boulders, and firm to hard silt and clay layers.

The following recommendations regarding geologic conditions along the HDD river crossing were included in TM#1 and were based on the Geotechnical Report. Italicized text indicates how each measure is addressed in the 30% concept design.

- The design of the pipeline should consider the potential for the site to be subject to strong ground motion in response to nearby or regional earthquakes. *(Noted; as indicated above, the presence of seismic faults does not pose a significant "fault-rupture hazard" to the HDD river crossing. The use of relatively flexible HDPE carrier pipe material with fusion-welded joints will provide a continuous flexible buried conduit installation. Joint separation should not be an issue.)*
- Surface casings are likely needed to maintain HDD alignment, support boreholes, and to prevent ground caving near entry/exit locations. *(The use of surface conductor casings are addressed in the Jacobs Horizontal Directional Drilling Evaluation)*
- Shallow clearances and drilling pressures should be considered to prevent blowout during HDD operations. *(The minimum cover required to provide sufficient confinement against slurry pressure is addressed in the Jacobs HDD Evaluation. The 30% concept profile shows minimum cover that exceeds that required for confinement against slurry pressure)*
- Variable groundwater conditions and the potential to encounter perched groundwater when drilling through the base of dune sand deposits below the Nipomo Mesa (just beyond the bluff) should be considered. Reconditioning of drilling fluid may be needed to address changing

ground and groundwater conditions. *(Reconditioning of drilling fluid to address changing ground and groundwater will be addressed in the Technical Specifications.)*

- The HDD heading, alignment, and drilling fluids should be monitored during the HDD installation. Adjustment of HDD heading may be needed to maintain alignment. *(The HDD tracking and guidance is addressed in the Jacobs HDD Evaluation. Minimum requirements and tolerances will be addressed in the Technical Specifications)*

Following review and comment of the Draft Geotechnical Report, Fugro West, Inc. submitted the Final Geotechnical Report (dated March 02, 2009). A few additional clarifications and recommendations were made in the Final Report as follows:

- The field exploration performed along the HDD alignment was successful, and provides suitable characterization of the subsurface conditions that the contractor should anticipate along the alignment.
- The use of a "wash casing" is recommended to stabilize the borehole behind the HDD heading.

Figures 3-1 and 3-2 (on the following pages) depict the approximate Fugro soil boring locations as well as the anticipated subsurface soil profile along the HDD River Crossing as interpreted by Fugro West, Inc. Note, both the alignment stationing and pipeline profile have been revised in the Concept Design Report. Refer to Dwg No. C-201 (HDD Profile) of Bid Package No. 1 for the current pipeline profile.

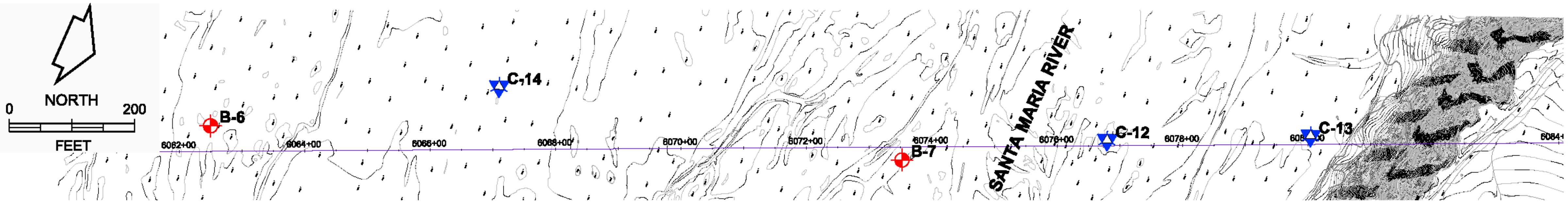
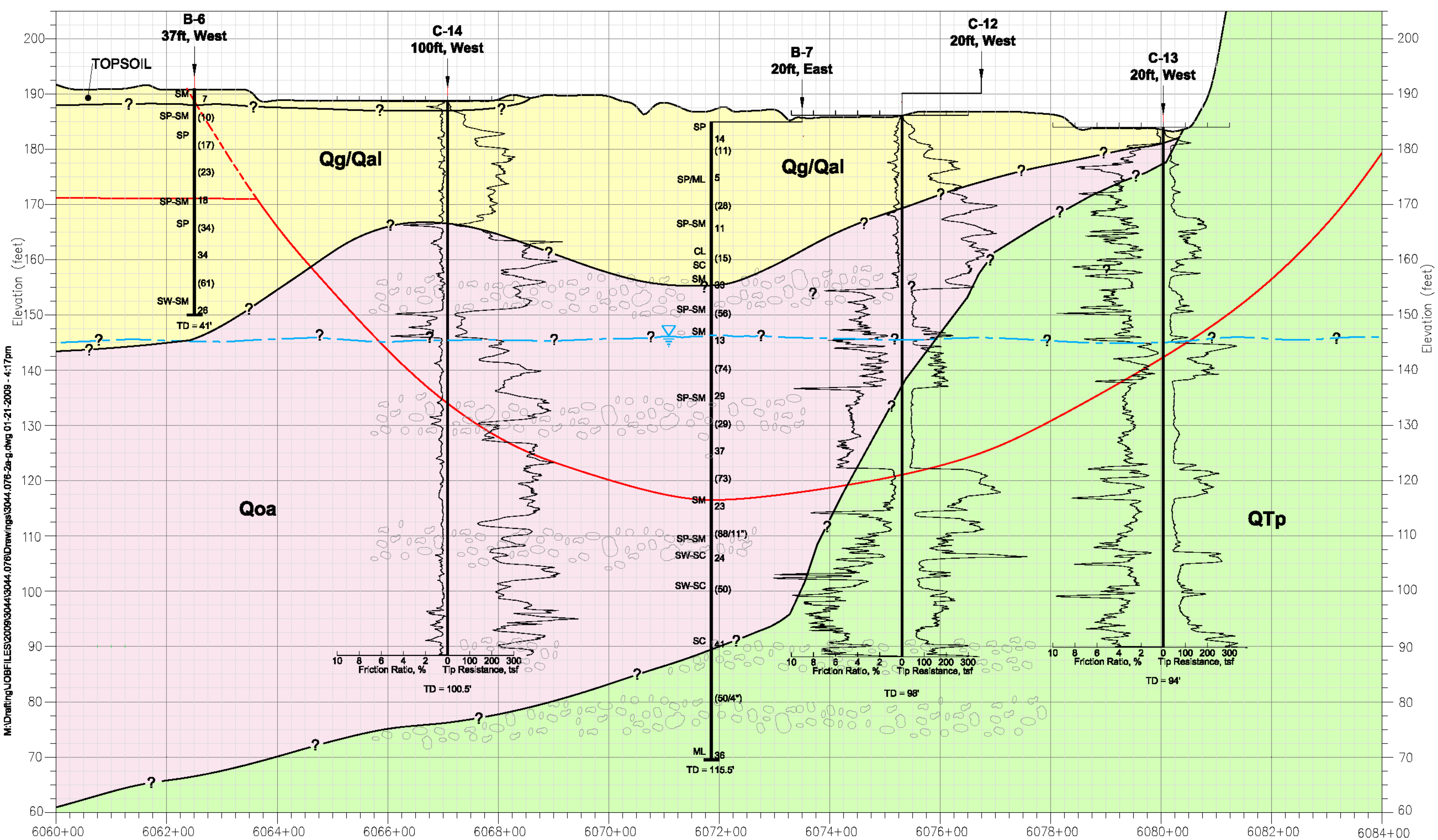
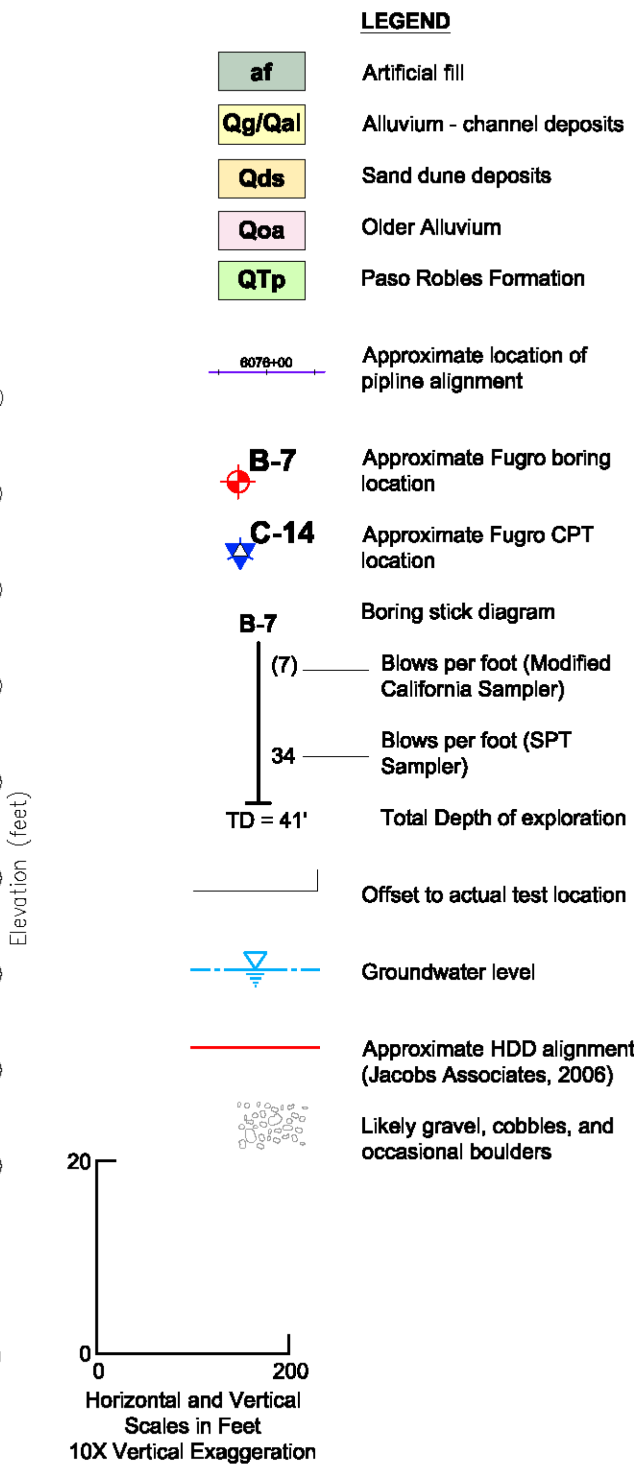


Figure Source: This figure is based on Plate 2d of project Geotechnical Report prepared by Fugro West, Inc. Project stationing and profile were revised in Concept Design Report.





BORING LOCATION PLAN AND SUBSURFACE PROFILE

Nipomo - Santa Maria Intertie

Nipomo, California

Figure 3-1

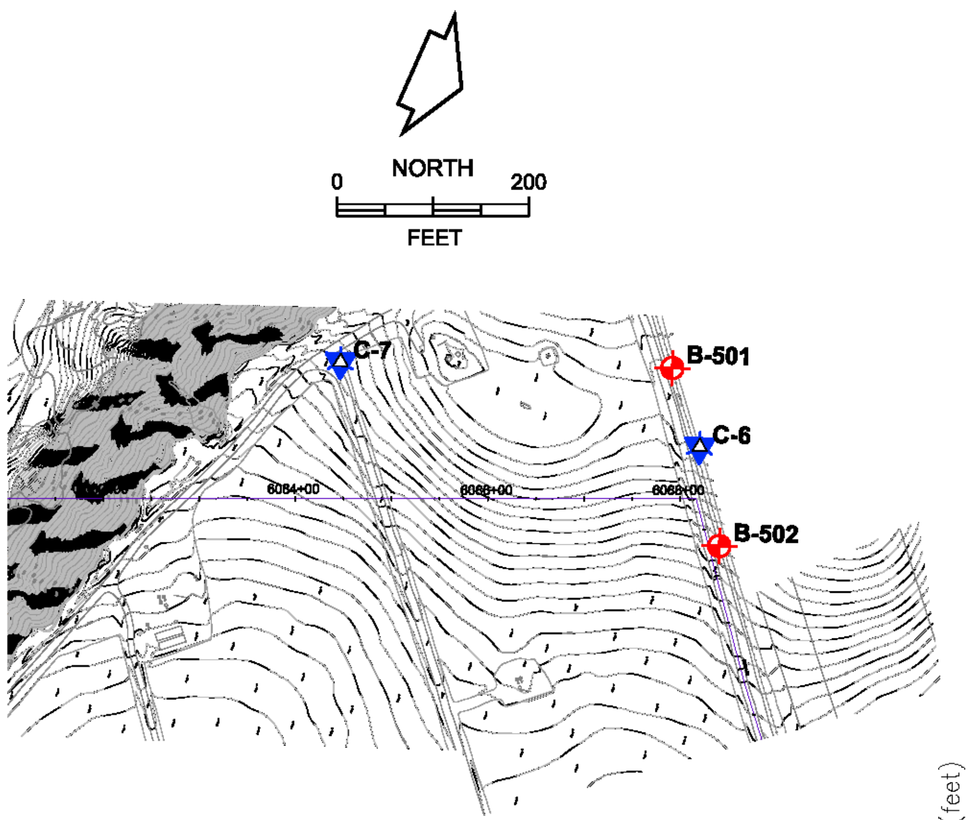
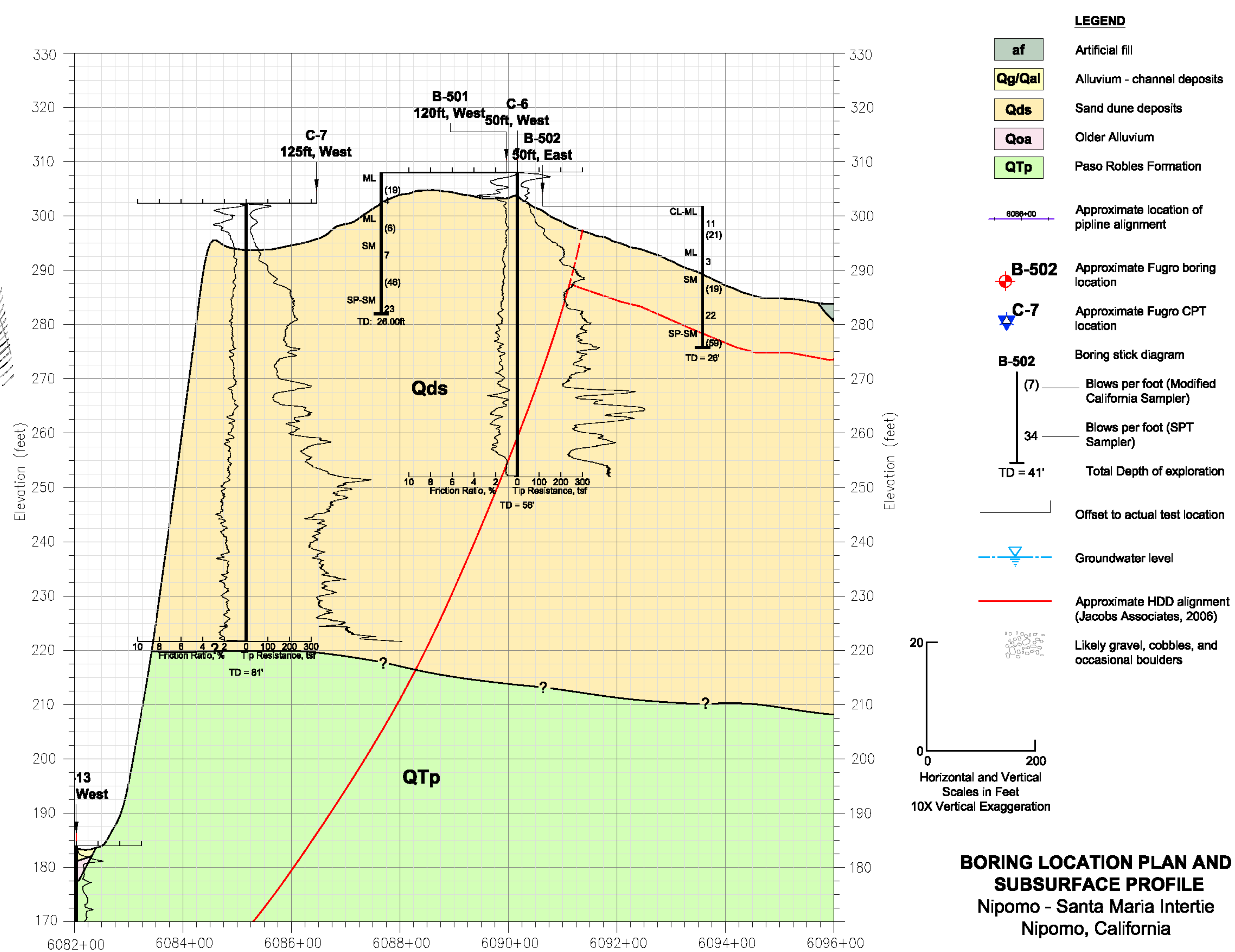


Figure Source: This figure is based on Plate 2e of project Geotechnical Report prepared by Fugro West, Inc. Project stationing and profile were changed in Concept Design Report.



BORING LOCATION PLAN AND SUBSURFACE PROFILE
Nipomo - Santa Maria Intertie
Nipomo, California

Figure 3-2

3.5 Carrier Pipeline Design Criteria

3.5.1 Hydraulics

Chapter 4 – Pipeline Alignment summarizes the anticipated maximum working pressures for the proposed WIP pipeline improvements along Blosser Road and within the Nipomo area, including the segment from Blosser Road to the HDD entry point. Based on this evaluation, AECOM performed a preliminary hydraulic analysis of the 24-inch HDD carrier pipeline to establish both the anticipated maximum working and surge pressures along the conduit.

As indicated in Chapter 4, the carrier pipeline near the HDD entry point is anticipated to have a maximum working pressure of 100 psi. For the purposes of this analysis, it is assumed this pressure is near the ground surface. Accounting for the maximum depth of 110-feet reached at the pipe low point (See Dwg C-201, HDD Profile), the maximum anticipated working pressure at the deepest point along the HDD alignment is approximately 150 psi as shown in Table 3-1.

In order to evaluate the maximum potential surge pressure along the HDD carrier pipeline, AECOM performed a preliminary surge analysis. A hydraulic transient (also known as water hammer or surge) is a temporary flow and pressure condition that occurs in a hydraulic system following a rapid velocity change in response to the operation or shut-down of a flow-control device (for instance, a rapid valve closure). The objective of this analysis was to simulate and estimate the worst-case theoretical transient response (pressure increase over time) of the proposed carrier pipeline following rapid closure of an isolation valve along the Blosser Road transmission pipeline.

Based on the preliminary analysis, and assuming the future maximum flow of 5,570 gpm, the maximum change in pressure due to surge is estimated to be 70 psi, resulting in a total maximum pressure of 220 psi at the deepest point along the HDD alignment. The carrier pipeline material shall have sufficient internal pressure capacity to accommodate the estimated maximum pressure including surge of 220 psi as well as the design test pressure. Pipe Material is discussed below in Section 3.6.

Table 3-1. 24-inch Carrier Pipeline Hydraulics[1]

Location	Design Flow (gpm)	Design Velocity (ft/sec)	Anticipated Maximum Working Pressure (psi)	Anticipated Maximum Pressure including surge (psi)
Entry Point @ STA 7+73	2,000 gpm[2]	1.6 ft/sec	110 psi	135 psi
Centerline EL of 163.75-ft	5,570 gpm[3]	4.3 ft/sec	110 psi	180 psi
Low Point @ STA 18+75)	2,000 gpm[2]	1.6 ft/sec	150 psi	175 psi
Centerline EL of 75-ft	5,570 gpm[3]	4.3 ft/sec	150 psi	220 psi
Exit/High Point @ STA 33+75	2,000 gpm[2]	1.6 ft/sec	60 psi	85 psi
Centerline EL of 274-ft	5,570 gpm[3]	4.3 ft/sec	60 psi	130 psi

Table 3-1 Notes:

1. Assumes an average inside diameter of 22.933 inches based on selected pipe material and dimension ration (DR) discussed below in Section 3.6.
2. WIP project design flow as defined in Section 1.3.
3. Future maximum instantaneous flow rate required to deliver up to 6,300 AFY through the pipeline. The maximum flow rate of 5,570 gpm is the flow required to meet the July demand at master plan buildout as stated in Section 12.0 of the WIP Preliminary Engineering Memorandum (May 2008, Boyle|AECOM).

3.5.2 Minimum Pipeline Cover / Embedment

Multiple design criteria govern the minimum vertical ground cover required above the HDD pipeline crossing as follows:

- Slurry Confinement: Cover above the pipeline must be sufficient for confinement against drilling slurry pressure, which varies with distance along the drill hole from the entry point. As discussed below in the HDD Evaluation, ground cover for confinement is the governing condition for the proposed profile.

- Scour Protection: Pipeline cover shall be below the estimated scour elevation. This is critical within the Santa Maria Riverbed near the HDD Entry Point (STA 7+73) and near the base of the bluff (STA 26+75) where the groundcover above the carrier pipeline is at its shallowest. As discussed in Chapter 4, scour considerations within the riverbed were evaluated based on the report "Evaluation of Channel-Bed Scour at Proposed Coastal Aqueduct Crossing of Santa Maria River (Chang, 1995)". In the Chang Report the top of the CCWA State Water Pipeline was recommended to have a minimum embedment of approximately 25 feet below the active riverbed, to account for the maximum estimated general scour plus a factor of safety for potential local scour. Therefore, the pipeline should be installed below the estimated scour depth, which is anticipated to be approximately 25 ft below the existing river bottom surface.

- Surface Mining: Pipeline embedment shall consider the potential for surface mining activities (above the HDD river crossing) mentioned in the NCSD WIP EIR. Surface mining operations within the riverbed could impact scour and require deeper minimum pipeline embedment for scour protection where cover is at its shallowest. The surface mining claim mentioned in the NCSD WIP EIR was further investigated by AECOM in order to confirm its current status including site boundary limits within the Santa Maria River bed. Based on our review of the San Luis Obispo County Planning Department files, it is our understanding that there may be a potential for future surface mining to occur over the HDD river crossing. The available records indicate that the maximum mining depth (as measured from the existing river bed) is 15-feet. As a worst case, the depth of cover above the pipeline near the HDD entry point will need to be increased from 25 to 40 feet to account for the potential mining of up to 15-feet of surface material.

AECOM recommends that the District consult with legal counsel to determine the best way to proceed with this issue. It is also recommended that the District meet with SLO County planning staff for further coordination and to discuss the County's position on the potential for the full Troesh site to be mined. At NCSD Staff's request, AECOM is currently pursuing further information from SLO County Planning Department staff regarding the status of the mining claim in question.

3.5.3 Installation and Operating Loads

Pipe strength and wall thickness requirements for HDD-installed pipelines are determined by consideration of installation and operating loads. HDD pipelines are subjected to high loads and stresses during the installation process including tension, bending, and external pressure stresses. Operating loads include internal pressure (as discussed above in Section 3.5.1), bending, thermal effect, and external pressure. Jacobs Associates' HDD Evaluation (See Appendix D) discusses these loads in detail and the method of their evaluation.

3.6 Pipe Material Selection:

AECOM recommends that the 24-inch nominal carrier pipe be AWWA C906-07 High-Density Polyethylene (HDPE) pressure pipe with a standard PE code designation of PE-3408. Pipeline joints shall be butt-fusion welded. Based on the preliminary design discussed in this Chapter, AECOM recommends a standard dimension ratio of DR-9 with a corresponding pressure class/maximum working pressure rating of 200 psi. According to AWWA C906-07, DR-9 pipe has a recurring surge capacity of 100 psi (in addition to working pressure rating of 200 psi) which is more than sufficient to handle the estimated maximum pressure including surge of 220 psi. HDPE is inert to corrosive elements in water and soil and does not require corrosion protection.

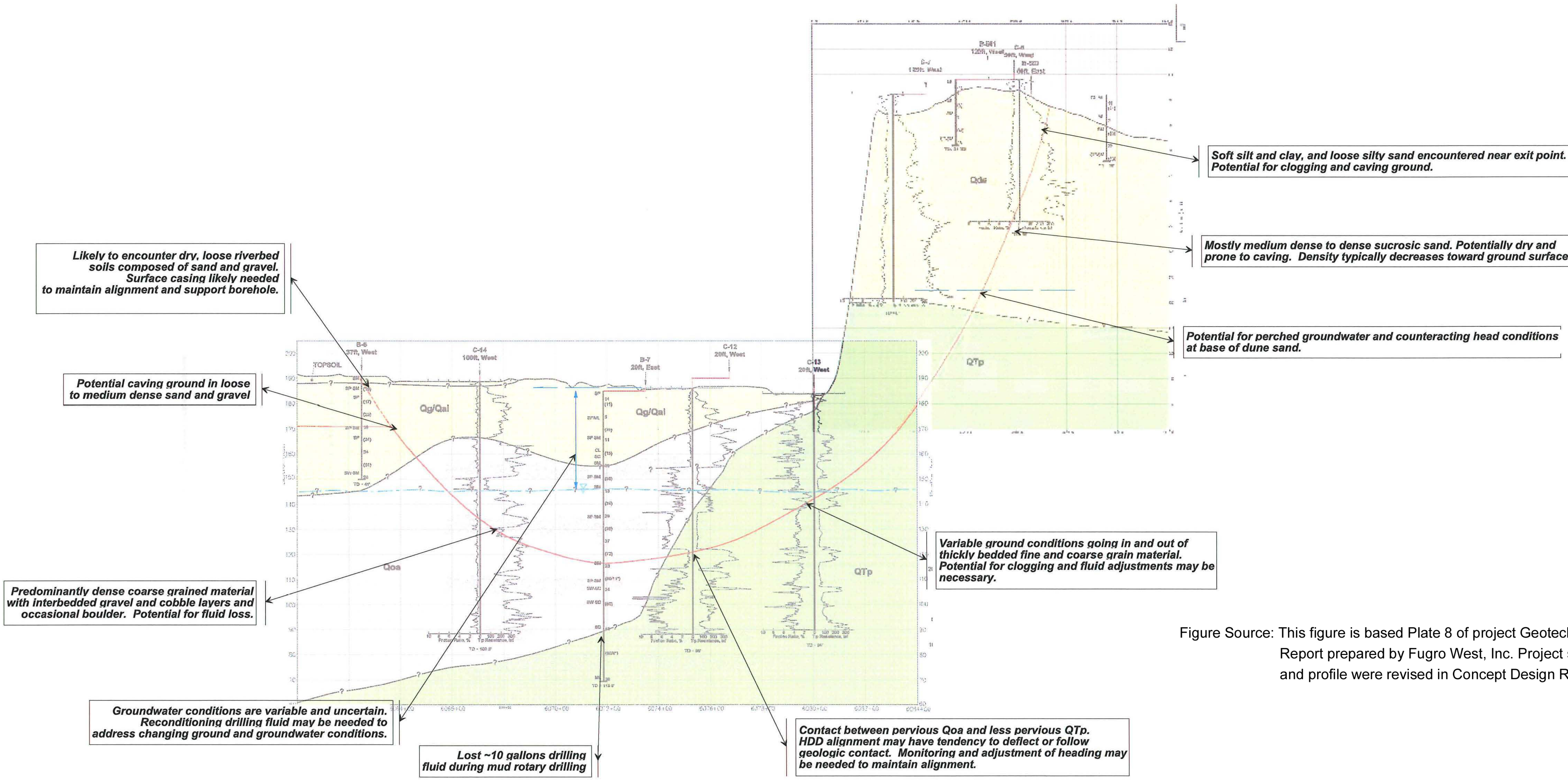
Hydrostatic field leak test pressure will not exceed 220 psi at the HDD low point. Due to profile, test pressure will vary along pipeline alignment.

3.7 Horizontal Directional Drilling Evaluation

The Jacobs Associates' Preliminary Design Report (see Appendix D) evaluates the horizontal directional drilling requirements for the Santa Maria River Crossing. The Jacobs Associates' PDR provides a favorable evaluation of the viable HDD river crossing. It identifies potential HDD risk factors and mitigation measures, sets forth key design criteria, provides minimum staging area considerations, and evaluates anticipated ground behavior during HDD as well as other construction considerations.

3.7.1 Geotechnical Considerations for HDD Design

Section 3.4 provides a summary of the geotechnical evaluation performed by Fugro West, Inc., along the proposed HDD River Crossing. Geotechnical conclusions and recommendations are discussed and figures showing the anticipated soil profile along the HDD alignment are included. Figure 3-3 (below) presents geotechnical considerations for design of the HDD River Crossing based on the project Geotechnical Report prepared by Fugro West, Inc. Note, both the alignment stationing and pipeline profile have been revised in the Concept Design Report. Refer to Dwg No. C-201 (HDD Profile) of Bid Package No. 1 for the current pipeline profile. The following evaluation further interprets geotechnical considerations shown on Figure 3-3, incorporates key geotechnical recommendations from Section 3.4, and discusses anticipated ground behavior during drilling operations based on data from the Geotechnical Report.



TYPICAL PROFILE VIEW of HDD CROSSING LOOKING WEST
Approximate Scale: 1 in. = 40 ft. vertical
1 in. = 400 ft. horizontal
(see profile and legend on Figures 3-1 and 3-2)

Figure Source: This figure is based Plate 8 of project Geotechnical Report prepared by Fugro West, Inc. Project stationing and profile were revised in Concept Design Report.

GEOTECHNICAL CONSIDERATIONS FOR HDD CROSSING
Nipomo-Santa Maria Intertie
Santa Maria, California

Figure 3-3

3.7.2 Subsurface Conditions and Anticipated Ground Behavior During HDD

The existing geotechnical information along the alignment indicates that the soils generally consist of alluvium derived from the Paso Robles Formation and dune sand. The geotechnical report also states that groundwater levels vary significantly seasonally and as such the HDD construction should take place during periods of low flow because the HDD entry point is within the active river bed.

The alluvium, including stream channel deposits within the riverbed, appears to be clean sand. The alluvial stream channel deposit is anticipated to exhibit running behavior when dry, as defined in the Tunnelman's Ground Classification (Jacobs' Appendix A) and flowing behavior when wet. The ground will require the drilling mud to help stabilize the excavation. The alluvium will tend to have high frictional forces during carrier pipe installation due to the sand content and anticipated ground behavior. A surface casing or a shored pit may be required to stabilize the soils at the entry and exit points during drilling. The use of drilling mud will also reduce frictional forces during carrier pipe installation.

The alluvium, located outside of the river channel, appears to be sand with an increased silt and clay content. This alluvium is anticipated to exhibit raveling behavior when dry and flowing behavior when wet. The ground will require the drilling mud to help stabilize the excavation. The alluvium will tend to have moderate frictional forces during carrier pipe installation due to the sand content and anticipated ground behavior. The use of drilling mud will reduce frictional forces during carrier pipe installation.

The older alluvium that underlies the alluvium is similar to the alluvium located outside of the river channel. The older alluvium includes clay and silt and is distinguished from the alluvium by an increase in gravel and cobble frequency and increased density. There is a possibility of boulders within this deposit. The older alluvium is anticipated to exhibit raveling behavior when dry and flowing behavior when wet. The ground will require drilling mud to help stabilize the excavation. The older alluvium will tend to have high frictional forces during carrier pipe installation due to the sand content and anticipated ground behavior. The use of drilling mud will reduce frictional forces during carrier pipe installation.

The Paso Robles Formation is a formational rock comprised of weakly cemented clay, silt, and sand. The formation is anticipated to exhibit firm behavior and will tend to contain the drilling mud and provide stability to the excavation. The Paso Robles Formation will tend to have low frictional forces during carrier pipe installation due to the stability of the excavation when lubricated and higher frictional forces when the drilling mud is not in the excavation. The contact line between the riverbed alluvium and the Paso Robles Formation is anticipated to project downward at the same angle as the surface topography to an elevation of 95 ft and then transition into a gentle slope to the south.

The dune sand deposits that form the Nipomo Mesa are anticipated to exhibit running behavior when dry and flowing behavior when wet. The ground will require the drilling mud to help stabilize the excavation. Since this is at a higher elevation than the entrance point, a surface casing or a shored pit may be required to prevent over-excavation and to stabilize the hole as the drilling mud may not remain in the hole. The sand dune deposits will tend to have moderate frictional forces during carrier pipe installation due to the sand

3.7.3 HDD Installation Process

A detailed discussion of the HDD method and installation process is provided in Section 5 of the Jacobs HDD PDR.

3.7.4 30% HDD Design Profile

Table 3-2, below, summarizes the preliminary geometry of the HDD profile. The 30% concept plans are attached as Volume 3 of this Report.

Table 3-2. HDD Profile Geometry

Description	Design Value
HDD Entry Angle: Santa Maria River	9 degrees (15.8%)
Entry Elevation	190 ft
Straight Length/Tangent	277 ft
Vertical Bend Radius	5,000 ft
Curve (arc) Length	2,123 ft
Minimum Elevation	75 ft
Horizontal Bend Radius	N/A
Maximum Depth at River	110 ft
HDD Exit Angle: Nipomo Mesa	14.5 degrees (25.9%)
Straight Length/Tangent	216 ft
Exit Elevation	300 ft

3.7.5 Construction Considerations

The use of a mid-path intercept may reduce risk on this project. A midpath intercept is performed by drilling with two HDD rigs, one from each end. This method may reduce risk by allowing for the entire pilot hole to be drilled with drilling mud and increasing hole stability. Other advantages of the method include:

- Fluid pressures in each drilled hole are better controlled, reducing the risk of an inadvertent return (frac-out).
- Mud return line is not required as the mud is pumped across the reach within the drill steel.
- Drill steel continuously occupies the hole until the carrier pipe is installed. Having drill steel occupy the hole reduces the risk of losing the hole due to hole collapse.

Curvature: The minimum radius of curvature during installation for a 30-in. OD HDPE pipe is approximately 30 times the pipe outside diameter, or about 100 ft (based upon dimensional information only). The actual radius of curvature is determined using critical HDPE properties, operating pressure, static pressure, surge pressure, and external loads, in addition to the induced bending stresses from the curvature. The drill steel is also a factor determining the radius of curvature. The minimum drill steel diameter is anticipated to be at least 8 in. The safe minimum radius of curvature for the drill string is approximately 1,200 times the drill steel diameter, or 800 to 1,000 ft for this project. A tighter radius or significantly thicker drill steel would require the use of shorter lengths of drill steel. The geometry dictated by the layout parameters for this project greatly exceeds the minimum radius of curvature established by constructability and pipe-material considerations.

Length: A pipe string of about 40 ft longer (20 ft on each end) than the drill path is needed to accommodate for the pipe shrinkage that occurs after the pipe is placed (the pipe is elongated approximately 10 ft due to pulling forces and temperature). The pipe shrinkage occurs as a result of cooler temperatures in the hole and the release of tension developed in the pipe (during pipe pullback) once the pullback is complete. Verification that the HDPE has shrunk will be made before the ends are cut and capped. A maximum HDPE length of about 2,655 ft is anticipated.

Pipeline Buildup: For this project, the pipeline is anticipated to be built up as one continuous string of pipe for pullback to mitigate risk of the excavation collapsing during pullback. The HDPE joints will be welded by creating a bead on the inside and outside of each joint. The inner welded bead shall be removed due to system hydraulic requirements. The outer bead may need to be removed to reduce skin friction and the probability of the pipe string becoming unable to be advanced during pullback.

3.8 Easements and Right-of-Way

Temporary Construction and Permanent Utility Easement requirements along the Santa Maria River Crossing are discussed in Table 4-5 of Chapter 4. Additional Temporary Access Easements may be required for site access to the HDD lay down and work areas shown on the 30% level HDD Plans (see Volume 3 of this Report). The need for access easements will be addressed as the design progresses.

3.9 HDD Risk Management

HDD and underground construction, in general, carry many risks which can impact the success of the project including unforeseen conditions that may arise in the field during construction. The risks typically include impacts to schedule, cost, environment, system operations, and safety.

As discussed above in the Geotechnical and HDD Evaluation Sections, HDD carrier pipe installation at the Santa Maria River crossing will likely be relatively difficult as a result of variable subsurface conditions encountered. As a risk management approach, AECOM will work with the District and the selected HDD contractor to prepare and implement an HDD Contingency Plan as part of the drilling program to systematically identify and mitigate known risks to the HDD installation.

AECOM recommends the use of the mid-path intercept method which may reduce the risk on this project. AECOM will work with Jacobs to determine the best strategy for defining this method as either a requirement or option in the Contract Documents.

In accordance with Task 303 – Geotechnical Baseline Report (GBR), a GBR will be prepared by Jacobs Associates to identify the geotechnical baseline anticipated during the HDD. The Final Geotechnical Report prepared by Fugro West, Inc., will be the basis for the GBR. The purpose of the GBR will be to establish a contractual basis for the anticipated ground conditions and ground responses during the HDD installation. This document will: 1) facilitate resolution of potential disputes regarding underground conditions and 2) provide clear indications of the risks associated with actual ground conditions and ground response. Changes from the baselines will be handled in accordance with provisions stated in the Contract Documents. The GBR will be included with the Contract Documents.

In accordance with Task 201 – Permit Applications of the authorized Scope of Work, an HDD Frac-Out Monitoring, Response, and Clean-Up Plan will also be prepared and included with the Contract Documents.

4.0 PIPELINE ALIGNMENT

4.1 Introduction

The Draft Pipeline Alignment Technical Memorandum was submitted for Task Group 1, Task 103 on March 3, 2009. Comments were received from District Staff and responded to in an errata letter dated March 11, 2009. This Chapter consists of the Draft Technical Memorandum updated per the District staff comments. AECOM's scope of work is to define the proposed alignment and identify potential challenges. Preliminary pipeline design parameters such as diameter, length, material, valve type, anticipated working pressures and pressure classes, corrosion control (if required), thrust restraint, connections to the existing system, and air/vacuum valve type and placement are presented herein. The 30% plan submittal presents many of these elements (included as Volume 3 of this Concept Design Report).

This Chapter addresses only the pipeline components of the project. AECOM is also assisting the District with development of construction plans for the Frontage Road Sewer Upgrade project on Frontage Road between the Southland Wastewater Treatment Facility and Division Street. The sewer line will need to be installed prior to installing the new waterline on Frontage Road, which (along with the potential for cost savings) is the reason for combining these projects into the same construction documents. The Frontage Road sewer design was described in the Draft Technical Memorandum #10 - Frontage Road Sewer Replacement and is contained in Chapter 9.0 of this report.

4.2 Hydraulic Design Criteria

The basis for sizing the pipes, valves, and appurtenances presented herein is the result of hydraulic modeling described in Technical Memorandum No. 9 (System Pressure Reduction Study), attached as Appendix A.

4.3 Geotechnical Design Recommendations

The Geotechnical Report by Fugro (January, 2009) presented soil parameters that are important for pipeline design. These are summarized in this Section:

The site is located within a seismically active region of Central California that is prone to moderate to large earthquakes. The design of the pipeline and associated structures should consider the potential for the site to be subject to strong ground motion in response to earthquakes. Structures should be designed to resist the forces generated by earthquake shaking in accordance with the building code and local design practice.

Based on the subsurface conditions encountered in the geotechnical investigation borings, the majority of the on-site soil should not be considered suitable for use as pipe bedding or backfill in the pipe zone. The southern portion of the Blosser Road alignment is underlain by sandy material that may be suitable for use as pipe bedding or pipe zone backfill. If the on-site soils are to be used for these purposes, the contractor will likely need to exercise care during excavation such that potentially suitable materials are not contaminated or mixed with the overlying or interbedded finer grained soils. The excavated materials can likely be used for compacted backfill above the pipe zone. Moisture conditioning of the soils and control of compaction layer thickness will be needed to achieve the recommended compaction.

The soils expected to be encountered at the site within the anticipated depth of excavation generally consist of sandy soils. The onsite soils can likely be excavated with conventional backhoe or excavator type equipment typically used for pipeline construction. Vertical cuts in sandy soils should not be considered stable unless properly shored or sloped in accordance with the requirements of OSHA. Temporary slopes and shoring will need to comply with OSHA requirements.

4.4 Blosser Road Extension

Groundwater was not encountered along the alignment. However, groundwater levels will depend on the time of year of construction and the water level in the Santa Maria River and adjacent Blosser drainage channel.

Trench depths are expected to be less than 10 feet. The bottom of the trench excavation is expected to expose loose to medium dense sand. The trench subgrade should be moisture conditioned and compacted prior to placing bedding material for the pipe.

4.5 Santa Maria River Levee Jack and Bore

Asphalt, concrete, and road base materials overlaying sand with varying amounts of silt and gravel were encountered in the borings. Groundwater was not encountered in the borings performed north and south of the levee. However, groundwater levels will depend on the time of year of construction and water level in the Santa Maria River. The rock slope protection for the levee (Fugro, 2008a) likely extends to a depth of approximately 20 feet below the top of the levee.

Jacking and boring and excavations for the jacking and receiving pits will likely encounter loose to medium dense sand with varying amounts of silt and gravel. Procedures should be followed that reduce the potential for caving of loose sands that can occur as a result of advancing the auger beyond the casing. There is a potential for the process to result in heaving or settlement of the levee. Recommendations are included in the geotechnical report for monitoring heave or settlement during construction.

4.6 Santa Maria River Crossing

Alluvium, older alluvium, and Paso Robles Formation were encountered in the soils explorations in the Santa Maria River. The alluvium and older alluvium generally consist of loose to very dense sand with varying amounts of silt, clay, and gravel. The Paso Robles Formation generally consists of dense to very dense sand with varying amounts of silt, clay, and gravel and stiff to hard silt and clay. Varying amounts of gravel, cobbles, and possibly boulders were encountered at various depths within the alluvium and Paso Robles Formation. Groundwater was encountered at a depth of approximately 38 feet below the existing ground surface in the borings in the Santa Maria River.

In the cut and cover section of the pipeline alignment, trench excavation will likely expose loose to medium dense sand with varying amounts of silt, clay, and gravel. The trench subgrade should be moisture conditioned and compacted prior to placing bedding material for the pipe. Moisture conditions at the bottom of trench excavation could change if construction is performed during the wet season or during release from Twitchell Dam. Coordination of the construction schedule to river flow conditions may reduce the need for dewatering.

4.7 Nipomo Mesa Pipelines

Artificial fill and dune sand deposits were encountered along the pipeline alignment and generally consisted of asphalt concrete, base materials, very loose to very dense sand, and local soft to stiff silt. Groundwater was encountered in borings B-102 and B-405 near the Highway 101 crossing at a depth of approximately 27.5 feet below the existing ground surface. The groundwater encountered is below the anticipated pipe depths. Various concrete, rubble, and unidentified buried objects were encountered along the alignment below the asphalt pavements. These area will be defined during potholing activities. The concrete appears to be associated with old concrete pavement in the area. We expect the bottom of the trench excavation will expose very loose to medium dense sand. The trench subgrade will likely need to be moisture conditioned and compacted prior to placing bedding material for the pipe.

4.8 Highway 101 Jack and Bore

Asphalt, concrete, road base materials, and dune sand deposits were encountered near the Highway 101 crossing and generally consist of asphalt concrete, base materials, and very loose to dense sand with varying amounts of silt. Depending on the groundwater levels during construction, groundwater may be encountered at the bottom of the jacking and receiving pits. Procedures should be followed that reduce the potential for caving of loose sands that can occur as a result of advancing the auger beyond the casing. There is a potential for the process to result in heaving or settlement of the Highway 101. Recommendations are included in the geotechnical report for monitoring heave or settlement during construction – and will be incorporated into the bid documents.

4.9 Materials and Sizes

The pipeline sizes and materials shown in the 30% design plans (Volume 3 of this Report) are summarized in Table 4-3. The Nipomo CSD requires C900 PVC for buried water mains 12” and smaller and ductile iron pipe (DIP) for buried water mains greater than 12”.

Table 4-3. Pipe Materials and Sizes

Location	Material and Size (including casing pipe if required)	Anticipated Maximum Working Pressure (psi)	Pressure Class
Blosser Road	18” DIP	100	CL 250
South Santa Maria River Levee Crossing	36” Steel casing with 24” DIP carrier pipe	N/A	Extra Strong (0.500” wall thickness)
South Riverside Alignment (levee to South HDD Staging Area Pump Station)	24” DIP	100	CL 250
Between Pump Station and Santa Maria Vista Road	24” DIP	150	CL 250
Southland Street	12” C900 PVC	110	CL 200
Frontage Road	12” C900 PVC	110	CL 200
Orchard Road	12” C900 PVC	110	CL 200
Oakglen Avenue	12” C900 PVC	100	CL 200
Darby Lane	12” C900 PVC	100	CL 200
Highway 101 Crossing	30” Steel casing with 12” C900 PVC carrier pipe	N/A	Extra Strong (0.500” wall thickness)

4.10 Fittings

Valves, pipe joints, and thrust restraints will be designed for the test pressure. The test pressure will be at least 150% of the anticipated working pressures listed in the above table.

Restrained, push-on, or mechanical joints will be specified for installation of carrier pipes in the jacked steel casings and other locations along the pipeline alignment as needed. Hydrostatic thrusts at the test pressures will be the basis for sizing thrust blocks or other means of resisting thrusts.

4.11 Valves and Appurtenances

Gate valves will be used for buried installations. Butterfly valves will be used in the PRV vaults because they require less space than gate valves, resulting in a smaller vault footprint. Valves will be flanged and equipped with 2” AWWA operating nuts for buried valves and hand wheel operated valves in vaults or above ground. Valves will be placed at all pipeline intersections (3 valves at tees, and 4 valves at crosses) and are shown on the plans at approximately every 500 feet along straight lengths of pipe for isolation purposes. Spacing should be discussed by District staff and the project team.

4.12 PRV Stations

Pressure reducing valves (PRVs) will be Cla-Val model 90-01 or approved equal. Each PRV station will be a buried vault with two valves. The smaller PRV is intended to regulate pressures during relatively low flows (average day for example). The larger PRV will regulate pressures during higher flows when the smaller valve cannot supply enough water to meet demand at the PRV pressure setting (during a fire for example) in the regulated pressure zone (see Figure 1-3). Flanged fittings will be specified for installation in the new PRV vault.

Vaults will be pre-cast structures with traffic-rated access hatches, telemetry and controls for connection to the SCADA system. Instrumentation and controls are addressed in Chapter 7.

Initial pressure valve settings are summarized in Table 4-4. Settings are based on the hydraulic modeling summarized in Technical Memorandum No. 9 (Appendix A). The PRV settings can be adjusted in the field as necessary.

Table 4-4. PRV Settings

Location	Station	High-Flow PRV Nominal Size/Downstream Pressure Setting (psi)	Low-Flow PRV Nominal Size/Downstream Pressure Setting (psi)
Southland St.	2020+00	6” / 89	2.5” / 94
Orchard Rd.	1043+00	6” / 73	2.5” / 78
Frontage Rd.	3041+00	6” / 77	2.5” / 82
S. Oakglen Ave.	4011+00	6” / 77	2.5” / 82
Santa Maria Vista Rd.	118+50	6” / 90	2.5” / 95

4.13 Air/Vacuum and Air Release Valves

Air/vacuum and air release valve (ARV) construction details will be consistent with the latest versions of the Nipomo CSD standard details for all locations. The plans show potential locations for ARVs in the profile at all local high points; actual locations will be evaluated once the pipeline profile is finalized. The physical locations for the ARV cans will be determined once the pipeline alignment plan and profile is completed to the 60% progress level.

4.14 Pigging Facilities

Pigging facilities will be considered for the transmission main between the point-of-connection in Santa Maria and the reservoir in Nipomo. Where appropriate, facilities will be incorporated and shown in the 60% design submittal. Compatibility of pigging with valves and other appurtenances will be considered.

4.15 Corrosion Control

Linings and coatings designed to protect against corrosion will be utilized to negate the need for cathodic protection. Polyethylene “baggies” and wrapping will be used for DIP and at fittings, valves, etc. per AWWA specifications.

4.15 Blosser Road Flowmeter

AECOM recommends the use of a magnetic meter which offers a high degree of accuracy and reliability, as well as requiring little maintenance. These types of meters can provide flow readings within 0.5 percent of actual flow. The meter will be installed in a precast vault with a traffic-rated access hatch, buried bypass piping, valves for shutoff, and will be connected to both the Santa Maria and NCSD SCADA systems. It will be designed so that both agencies will be able to read data from the flowmeter with no remote control capability. A pressure transducer is recommended at this location to monitor the pipeline pressure. The pressure will be SCADA monitorable for trending and troubleshooting. Instrumentation and controls are addressed in Chapter 7.

4.16 Pavement Repair

It is assumed pavement will be replaced at either the thickness specified below (from the Geotechnical Report, ibid) or at the existing thickness, whichever is greater. Pavement Repair in San Luis Obispo County will be coordinated with the County of San Luis Obispo Public Works Department, at this time one traffic lane width is anticipated to be repaved after pipeline installation is completed. Similar requirements have been assumed for the pavement in the City of Santa Maria. Final pavement repair conditions will be incorporated into the bid documents.

4.17 Easement Requirements

NCSD will be responsible for acquiring easements north of Blosser Road, across the levee and river, through the Linda Vista Farms area, and to the existing pipeline easement between Joshua Road and Maria Vista Estates. Both permanent easements and temporary construction easements will be required. Locations and widths are summarized in Table 4-5, although they are considered approximate until negotiations are finalized with the existing property owners. The width of the temporary construction easement represents the entire width during construction. The permanent utility easement width will remain.

Table 4-5. Easement Widths and Locations

Location	Assessor Parcel Numbers (APNs)	Stations	Temporary Construction Easement Width (ft)	Permanent Utility Easement Width (ft)
Blosser Road	017-030-019	Unknown (15+00 & 18+00)	30	10
South Santa Maria River Levee Crossing	090-341-019	50+91 to 53+71	100	30
South Riverside Alignment (levee to South HDD Staging Area)	090-341-019	53+71 to 56+99	100	30
Linda Vista Farms Area	090-291-042	100+00 to 105+00	100	30
	090-291-043	105+00 to 112+50	--	30
	090-291-044	112+50 to 118+40	--	30

4.18 Bore and Jack Crossings

Crossing the south Santa Maria River levee and Highway 101 at Grande/Darby will both require the use of trenchless technologies. Both the traditional bore-and-jack and guided-auger-boring methods are well suited for these installations. The traditional bore-and-jack method consists of removing the soil ahead of a steel casing pipe that is simultaneously jacked behind the cutting head of an auger. The auger is placed within the steel casing. A bore-and-jack installation will require a jacking pit (approx. 40’ x 12’), a receiving pit (approx. 10’x10’), and surface access for equipment and personnel.

The guided-auger-boring method (auger boring with pilot tube guidance, including a jacked steel casing) is another trenchless process that includes elements from the conventional bore-and-jack method. This method first requires the installation of a pilot tube using a laser-guided steering head. Using this pilot tube for guidance, an auger head is then advanced behind the pilot tube to bore the required opening for the steel casing. Simultaneously, the steel casing is jacked behind the cutting head auger. Like the bore-and-jack method, this process will require a jacking pit (approx. 35’ x 12’), a receiving pit (approx. 20’x10’), and surface access for equipment and personnel. This method is applicable for casing sizes up to 48 inches outside diameter.

For either method, the carrier pipe is installed inside the casing.

4.18.1 Santa Maria River Crossing

The Santa Maria River crossing will include the following sections:

1. 280 feet of bored and jacked 36 inch steel casing with 24 inch DIP;
2. 900 feet of "cut and cover" construction for 24 inch DIP;
3. 2,600 feet of HDD construction (design of HDD is covered in Chapter 3).

Both the Santa Barbara County Flood Control & Water Conservation District (SBCFC&WCD) and the United States Army Corps of Engineer (USACE) were contacted to determine design requirements for the levee crossing.

The USACE has requirements for how deep to construct a pipeline under a river levee. The Corps indicated they were in the process of preparing design documents for repairs to the levee and provided preliminary requirements. The Corps plans to extend levee improvements to 15 feet below the low flow channel elevation which is about 30 feet below the top of the existing levee. The Corps' preliminary requirement is for the top of the casing be three feet lower than the bottom of the levee. Note that these requirements may be subject to change pending the USACE's completion of design documents for the levee upgrades currently scheduled for completion by May 29, 2009. Modifications to the levee crossing depth, length, and other USACE requirements may need to be incorporated at that time.

A second criterion for determining the elevation of the top of the casing under the river is scour protection. Scour considerations were evaluated based on the report *Evaluation of Channel-Bed Scour at Proposed Coastal Aqueduct Crossing of Santa Maria River* (Chang, 1995) [1]. In the Chang Report the top of the CCWA State Water Pipeline was recommended for constructed at approximately 25 feet below the active riverbed, to account for the maximum estimated general scour plus a factor of safety for potential local scour.

The calculations shown below were used to assess the worst case for determining the elevation of the top of the casing under the levee and the uncased pipe under the river between the levee crossing and the start of the HDD section. The lower elevation of the two methods will be used to determine the depth of the casing.

Check Depth Based on Levee Repairs:

(Top of Levee Elevation) – (Depth of Levee Repairs) – (Minimum Clearance) = (Top of Casing Elevation)

202 ft – 30 ft – 3 ft = 169 ft

Check Depth Based on Scour Protection:

(Channel Elevation) – (Scour Protection Depth) = (Top of Casing)

190 ft – 25 ft = <u>165 ft</u>

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[1] Howard H. Chang Consultants, "Evaluation of Channel-Bed Scour at Proposed Coastal Aqueduct Crossing of Santa Maria River", Prepared for Fugro West, Inc., April 1995

Since the scour protection depth is lower than the required clearance for the levee repairs, use 165 feet as the elevation for the top of the casing and the top of the uncased pipe under the river. In conformance with recommendations made in the Geotechnical Report (Fugro, 2009), provisions will be included in the project technical specifications that will require the contractor to monitor the ground surface above the steel casing for settlement and/or heave prior to and during boring and jacking operations. If the heave or settlement exceeds the maximum allowable then mitigation measures such as grouting and/or repair to the levee will be required.

4.18.2 Highway 101 Crossing

The pipeline will cross the Caltrans Highway Right-Of-Way between Frontage/Grande Street and Darby Lane via a bore and jack installation aligned perpendicular to the highway. The highway crossing will include approximately 220-lf of 12-inch ductile iron carrier pipe within a 30-inch steel casing pipe. Based on Chapter 600 – Utilities Permits of the Caltrans Encroachment Permits Manual, the following design criteria are assumed in the 30% design:

- Required thickness for steel casing pipe will be ½-inch thick
- Encasement shall extend, at a minimum, to the highway right-of-way lines.
- The recommended minimum depth of cover for pipelines or casings 25-inches to 48-inches shall be 15-feet.

Based on a top of roadway elevation of 338-ft at Highway 101 (see DWG C-139), the recommended top of pipe elevation for casing placement is 338 – 15 = 323-feet. Pending outcome of the Caltrans encroachment permit submittal and review process, modifications to the design may be required to satisfy any additional State requirements and/or conditions that may arise.

In conformance with recommendations made in the Geotechnical Report (Fugro, 2009), provisions will be included in the project technical specifications that will require the contractor to monitor the ground surface above the steel casing for settlement and/or heave prior to and during boring and jacking operations. If the heave or settlement exceeds the maximum allowable then mitigation measures such as grouting and repair to the roadway will be required.

4.19 Traffic Control

It is assumed the contractor will be responsible for preparing and submitting traffic control plans along Blosser Road, Orchard Avenue, Frontage Road, Joshua Road, Southland Road, and Darby Lane.

5.0 PUMP STATION & RESERVOIR

Draft Technical Memorandum No. 4 – Booster Pump Station No 2 – was submitted to the District on March 20, 2009. Comments have been received and incorporated, as contained in this Chapter. The pump station and reservoir site layout are included with the 30% Plans, contained in Volume 3 of this Report. This Chapter will identify and evaluate facilities required to provide capacity to deliver 2,000-gpm of supplemental water to the NCSD distribution system.

5.1 Background

The Waterline Intertie Project Preliminary Engineering Memorandum (PEM – Boyle/AECOM, May 2008), recommended a buried storage tank (approximately 0.5 MG storage capacity) and a pump station (Pump Station #2) to pump water from the WIP storage to the NCSD distribution system. In the PEM, AECOM anticipated designing a phased booster pump station with three 75-hp pumps with two capable of pumping 1,300-gpm at 300-ft of head, or four 75-hp pumps with three capable of pumping 1,860-gpm at 325-feet of head. Subsequent discussion with the City of Santa Maria and further evaluation of the District's water supply and demand needs have resulted in AECOM recommending a maximum project delivery rate of 2,000-gpm.

5.2 Water Storage Facility

The purpose of the storage facility is to provide operational and emergency storage of Santa Maria water prior to transmission to the Nipomo CSD system. The District selected a partially-buried, prestressed concrete design based on a review of lifecycle costs and aesthetic concerns for both steel and concrete designs.

5.2.1 Reservoir Size

Reservoir volume (1 tank with 500,000 gallon storage capacity) was selected in the PEM.

5.2.2 Aesthetics

The primary reason for a partially buried tank is to meet system hydraulics (discussed in Section 5.2.10). However, a positive secondary benefit to the partially buried tank design is that it will reduce visual impacts. The partially buried tank is designed with the bottom of the tank at an elevation of 278 feet (approximately 22 feet below grade). Approximately 3 to 4 feet of tank wall will be visible above grade. "Native" colors will be evaluated for the tank surface.

5.2.3 Structural

The materials of construction for the proposed reservoir will include reinforced concrete foundations, columns and roof slab. The perimeter ring wall will consist of a cast-in-place concrete wall prestressed by post-tensioned high-strength steel strand. The structural design of the reservoir will be based upon current engineering standards including the American Water Works Association (AWWA) D110-04, entitled "Wire and Strand Wound, Circular, Prestressed Concrete Water Tanks," the current Uniform Building Code, the American Concrete Institute (ACI) 318, and geotechnical criteria relative to foundation materials and site-specific seismic data.

5.2.4 Seismic

The seismic design criteria will be based upon the project site location in seismic Zone 4. The data developed by the geotechnical engineer establishes site ground accelerations based upon native subgrade formations. This project-specific seismic data will also be used for the estimate of hydrodynamic forces on the reservoir perimeter wall associated with seismic ground motions.

5.2.5 Geotechnical

Fugro performed exploratory borings in the area and prepared a soils report for the project site, including recommendations for the design of the buried reservoir. Dune sand deposits were encountered from the ground surface to depths of up to approximately 80 feet below the existing ground surface, the depth to refusal in boring C-7 (see Fugro Report). The dune sand deposits consisted of 8 to 15 feet of soft silt (ML) and loose silty sand (SM) overlying medium dense to dense silty sand (SM) and poorly-graded sand with varying amounts of silt (SP, SP-SM).

Groundwater was not encountered in the borings and CPT soundings performed at the tank and pump station site to the maximum depth explored, which was approximately 80 feet below the existing ground surface. Moist soil was encountered on the tip of the CPT after one of the soundings; however, standing water was not encountered in the sounding. Evaporate minerals and lush vegetation observed on the bluff face, near the contact between the dune sand deposits and the Paso Robles Formation, suggest that groundwater commonly perches on the finer-grained Paso Robles Formation and groundwater may be present at that depth. Variations in groundwater levels and soil moisture conditions will occur depending on changes in precipitation, runoff, irrigation schedules for agriculture, the water elevation in the Santa Maria River, and other factors.

Layers of loose sand and soft silt encountered within the upper 8 to 15 feet are prone to seismic settlement and/or potentially compressible. Grading recommendations provided by Fugro are incorporated into the typical tank cross section shown in the attached drawings. Site preparation and grading to provide uniform support and limit post construction settlements of the proposed structures will be performed according to the recommendations of the geotechnical report.

5.2.6 Site Preparation Recommendations

Fugro recommends removal of existing soil to bottom of soft to firm silt and loose sand or 2 feet below the bottom of the tank, whichever is greater, to expose medium dense to dense dune sand deposits. At least 6 inches of drainage material should be placed below the tank to help stabilize the sandy subgrade. The limits of excavation depicted on the plans incorporate clearance for the prestressing equipment.

5.2.7 Access Openings

A 4' x 6' Bilco-type roof hatch will be placed on the western side of the reservoir, with handrails in the immediate vicinity of the manway. To minimize visual impact, handrails will not extend around the entire roof.

An aluminum ladder outside the reservoir will be provided on the western side of each reservoir to access the roof hatch. A stainless-steel ladder inside the reservoir will also be provided and will incorporate "Safe-T-Climb" type fall protection devices for safety.

5.2.8 Air Vent

An air vent will be located at the center of the reservoir to prevent pressure fluctuations as the water level rises and falls. The vent will be approximately 3 feet in diameter. The vent will incorporate an insect screen to prevent insects and debris from entering the reservoir.

5.2.9 Inlet-Outlet

The tank will have a dedicated 24-inch inlet pipe, and a dedicated 24-inch outlet. The inlet and outlet will penetrate the bottom of the reservoir. A 24x12 inch reducer will increase inlet velocity to facilitate the circulation of water within the tank. The reducer will be accessible to divers should future replacement be required. At the project design flow the tank turnover will occur in approximately 4 hours. A flexible connection between the tank and inlet/outlet piping will be evaluated prior to completion of the 60% design submittal.

5.2.10 Need for Buried Tank

The system hydraulics require that the maximum operating water surface elevation of the tank be at 300 feet or less in order for the tank to fill by gravity from the Santa Maria Reservoirs. If the maximum water surface elevation is established at an elevation of higher than 300 feet Pump Station #1 in Santa Maria would be required.

The maximum operating water surface elevation in the tank was calculated based on hydraulic modeling performed by the City of Santa Maria (Nipomo Community Services District Potable Water Supply Delivery Scenarios, Carollo, 2006). The analysis estimates that an operating pressure range of 60 – 89 psi is anticipated at the connection point in Santa Maria. The pressure at the point of connection is equivalent to a hydraulic grade of 334 feet to 401 feet. Head loss through the transmission main due to friction at 2,000-gpm was estimated using the Hazen Williams equation with a roughness coefficient (C-value) of 135. Based on these calculations and a low pressure of 60 psi at the Santa Maria connection, the maximum operating water surface elevation at the tank was designed at 300 feet to allow for head losses through the transmission main, and to provide sufficient residual pressure for the operation of the flow control valve. Figure 5-1 shows the project Hydraulic Profile.

In the event of an emergency, an 18-inch overflow pipe connected to a 36-inch diameter weir inside the tank will serve as an emergency overflow. The overflow will be set at 301 feet, which is 1 foot higher than the maximum operating water surface elevation of 300 feet. And will allow for approximately 2 feet of freeboard between the roof of the tank (with an inside elevation of 302 feet) and the maximum operating water surface elevation. The overflow will drain to the onsite detention basin.

5.2.11 Reservoir Drain

The configuration of the buried reservoir and the surrounding topography prevents the use of a traditional tank drain line. However, the tank can be emptied by pumping the water level in the tank to within 1 or 2 feet of the floor (depending on the amount of sediment in the tank) and removing the remaining water by using a portable pump. Sumps will be designed into the reservoir floor to facilitate cleaning.

5.2.12 Reservoir Underdrain

A wall drain and slotted PVC underdrain will be installed to prevent water from collecting under or around the reservoir. Underdrains will be arranged such that leaks in the reservoir can be located by observing which underdrain carries water to the drainage vault. The underdrains will drain to an onsite sump that can be pumped out to the onsite detention basin.

5.2.13 Wall Drain

Wall drains convey any water that may accumulate against the outside wall of the reservoir (below grade) to the drainage vault.

5.2.14 Tank Bypass

A bypass will be constructed to allow water to flow directly from the river crossing pipeline into the pump station suction piping, allowing the tank to be taken offline for maintenance while the pump station continues to transfer City water. Operational procedures for this will need to be established between the City and Nipomo.

DWG: W:\Nipomo CSD (19996)\19996.70 Waterline Intertie Project Design\Phase 0001 – Concept Design Report\Task 016 – Concept Design ReporFig 5–1.dwg USER: FroelicherJ
DATE: Apr 27, 2009 3:27pm XREFS: IMAGES:

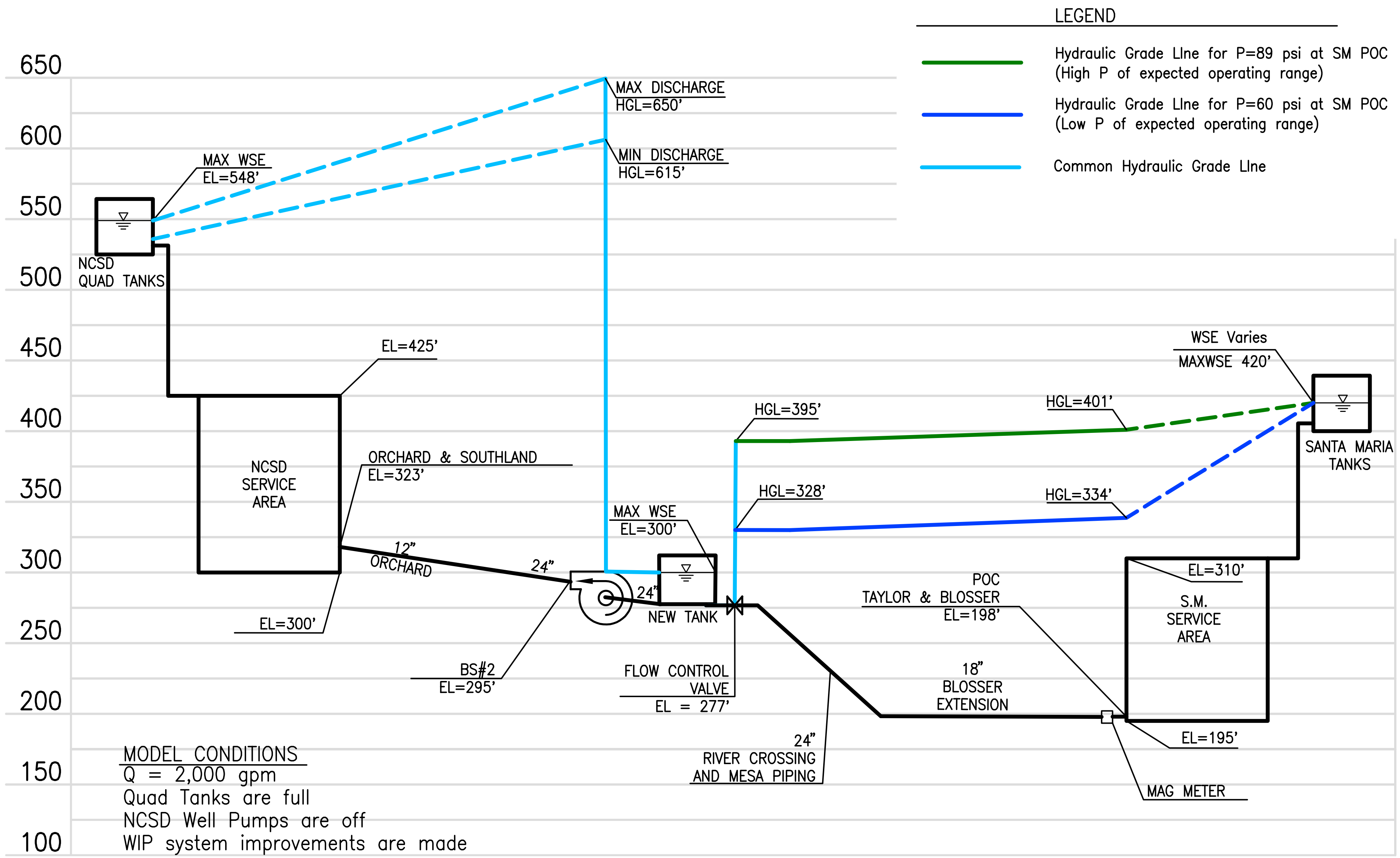

FIGURE 5-1

NCSD WATERLINE INTERTIE

HYDRAULIC PROFILE

AECOM PROJECT NO. 19996.12

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5.3 Site Access Considerations

The site will require routine access by a variety of vehicles including maintenance trucks, chemical supply trucks, and fuel trucks. The site will also require occasional access by a crane to pull the vertical turbine pumps from their cans (the pumps are greater than 25-ft in length). The flow control valve vault may require access by a boom truck. The site has been designed to accommodate these vehicles.

Access to the site is across active farmland in an offered road dedication. At this time the road is an unimproved dirt road. AECOM recommends the District construct a 10 foot wide all weather access road inside the existing road easement. Final alignment and design of the road will need to be discussed and negotiated with the property owner(s).

5.4 Flow Control

AECOM recommends that a detailed operations plan be prepared by NCSD and the City to outline the procedures that will govern operations of the Waterline Intertie Project, including items such as flow control, shutdown, start up, rate of delivery, changes to the delivery rate, and emergency procedures. The recommended option for flow control is an electronic flow control valve. The valve allows the operator to input a desired flow rate, and the flow control valve will throttle flow to maintain the set rate. In addition to controlling the rate of flow through the interconnect, the flow control valve will act to protect the buried tank from overflow by closing in the event that the tank reaches a preset high water level.

5.5 Variable Speed Pumping

The need to handle constant incoming flow rate against varying downstream pressure is an appropriate application for variable speed pumps. Although there are numerous methods for achieving variable speed pumping, variable frequency drives (VFDs) have been selected for the booster station. VFDs are reasonably priced, reliable, and are the most common method of achieving variable speed pumping. Alternatives to VFDs such as internal combustion engine driven pumps, slip couplings, belt drives, and pump control valves[2] are not well-suited for an application that requires high efficiency and reliability and the need to operate for an extended period.

Since the flow out of the tank through the booster station into the District's system will need to match the flow into the tank, the booster station output will be adjusted based on the buried tank level, with the pumps attempting to keep the buried tank level static. The volume of the tank allows for some variance between the flow into the tank and the flow out of the booster station, which will inherently result in the pump station adapting to downstream pressure variations in a controlled manner. The pumps need to match the inflow as closely as possible in order to maintain the tank volume for use during outages, and by keeping the tank level high the pump inlet pressure will be higher allowing the pumps to run more efficiently.

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(1) [2] Pump control valves do not change the pump speed. A pump control valve is placed downstream of the pump, and hydraulic pressure opens and closes the valve to vary flow rate. Pump control valves are effective, and generally reliable, however they are inefficient since the pump's operating point is always greater than needed, with the excess pressure (and electrical energy) being "burned off" by the valve.

5.5.1 Pump Selection

AECOM recommends vertical turbine pumps for the booster pump station. Vertical turbine pumps generally feature steep pump curves (resulting in better modulation of flow rate by VFD) and typically feature higher efficiencies. Most importantly, the pumps can be placed in pump cans which can be at or below the floor elevation of the buried tank, thereby allowing full use of the buried storage tank volume.

5.5.2 System Hydraulics

AECOM prepared Technical Memorandum No. 9: System Pressure Reduction Study in September 2008 (TM 9). TM 9 (attached as Appendix A) investigated the creation of a reduced pressure zone in Nipomo. The system pressure required to fill the Quad Tanks from Joshua & Orchard was determined during the course of that evaluation (Table 2 of TM 9). The required pressure at the intersection of Joshua & Orchard at 10% Average Day Demand (ADD) was determined to be 151 psi and 147 psi at Peak Hour Demand (PHD). Since the Booster station is not located at Joshua & Orchard, the losses were calculated in the proposed pipeline between Orchard & Joshua and the actual tank site. This information, along with the high and low Quad Tank water elevations, resulted in a required hydraulic grade line (HGL) elevation that varies between 615 feet and 650 feet. Since the pumps and pump cans are buried at an elevation of approximately 271 feet the required head from the pumps is between 344 feet (149 psi) and 379 feet (379 psi).

Figure 5-2 shows the likely range of system curves and an appropriate pump curve for the booster station based on the hydraulic grade of the system. The upper system curve, the “worst case scenario”, represents the scenario when the Quad Tanks are full, the buried reservoir is at low water elevation, and 10% ADD flow conditions are occurring in the distribution system. In the worst case scenario the pumps are producing the least amount of flow. The lower system curve represents the Quad Tanks at a low water level, the buried reservoir full and the system experiencing PHD, which is the “best case scenario”. In this scenario the pumps will produce their maximum flow.

5.5.3 Expected Range of Flow

The project design flow is 2,000 gpm but the booster station will be capable of delivering a range of flows from 600-gpm up to 2,000-gpm. Figure 5-2 shows the system curve with a suitable 100-hp vertical turbine pump curve. The pump curves are only shown at full speed in this figure. At full speed, three pumps will operate at about 2,050-gpm during the worst case scenario and a single pump is capable of about 700-gpm at the worst case scenario. However, when system conditions are more favorable the single pump will produce in excess of 900-gpm, which is more than required. The use of VFDs will allow the performance of this pump to be reduced to meet demand conditions, as shown in Figure 5-3.

By using VFDs to reduce the pump speed to 1670-rpm (an 8% reduction in speed) the pump is capable of delivering approximately 600-gpm. The best efficiency capacity (BEC) of this pump is 840-gpm; therefore it should not be operated at less than 590-gpm or about 30% less than the BEC. Individual pump manufacturers will have varying requirements for low flow limitations to prevent low flow cavitation from damaging the pump.

The 100 horsepower Fairbanks Morse pump shown on these curves meets the requirements of the pump station, and is used as the basis for laying out the pump station cans and manifolding; however, other pumps are available, and the pumps will not be sole-sourced in the plans and specifications.

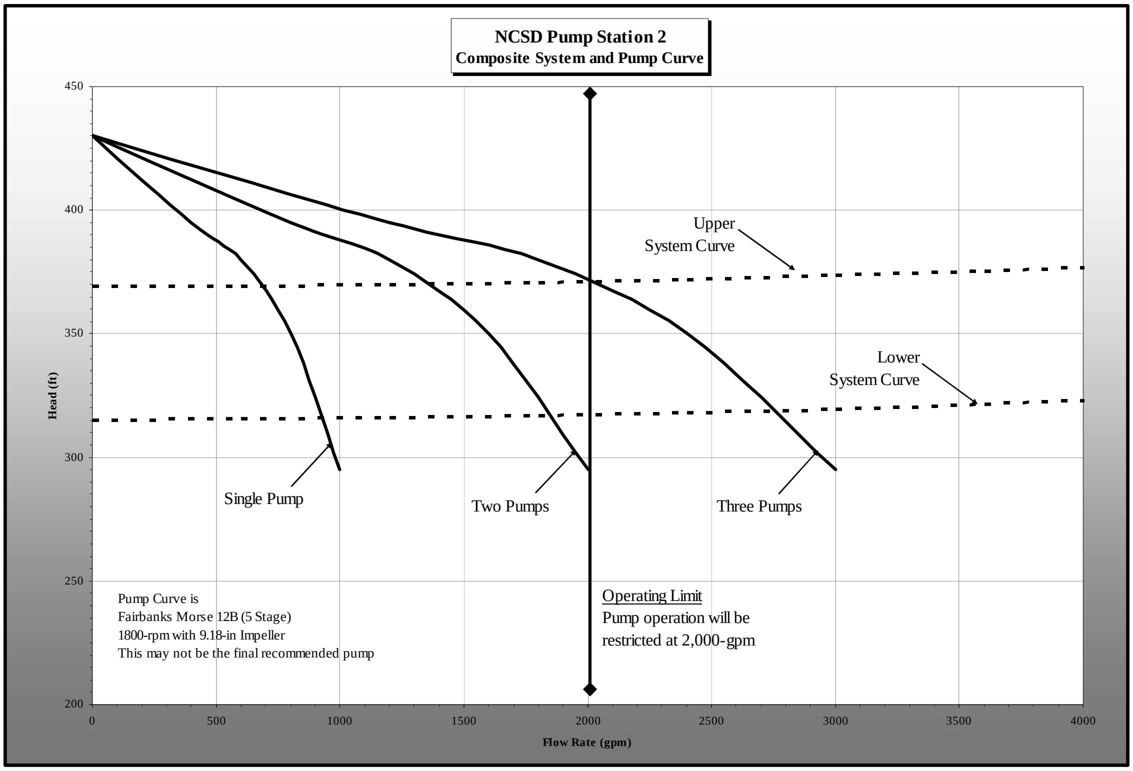


Figure 5-2. Composite System Curve and Full Speed Pump Curves

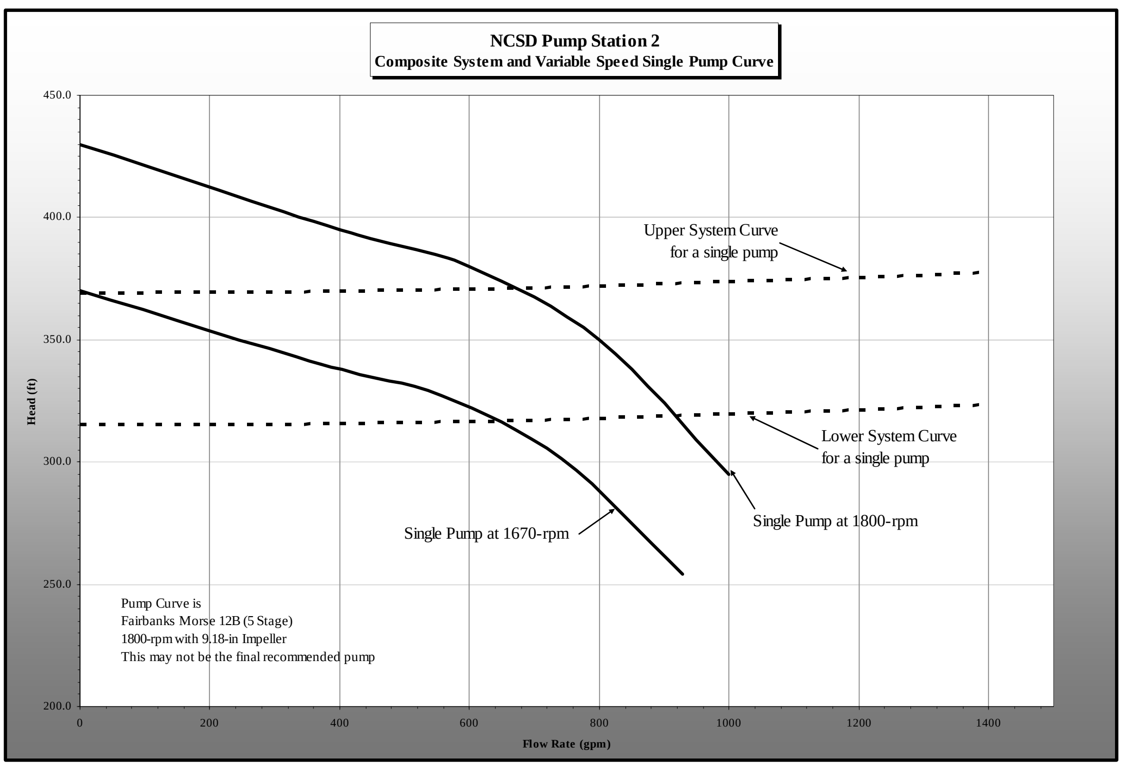


Figure 5-3. Composite System Curve and Variable Speed Pump Curve

5.5.4 Control of Pumps

The booster station will be designed to match the flow entering the buried tanks. To accomplish this, the level in the buried reservoir will be used to pace the pumps. A pressure transducer in the tank will be read by the programmable logic controller (PLC) and SCADA system, and the change of the tank level over time will be used to increase or decrease speed of the pumps and to call additional pumps as required. Since the inflow to the booster station tank will be set in advance and will remain constant, the pumps will vary flow by responding to fluctuation of the level in the buried reservoir thereby accommodating to changes in demand and fluctuating levels in the Quad Tanks. These changes in speed will be made gradually to prevent surge or other abnormal pressure and flow fluctuations.

The Quad Tanks level will be used to send an emergency “off” signal to the booster station in the even that a high water level alarm is detected at the Quad Tanks. A low water level in the buried reservoir will shut the booster pumps off to prevent cavitation in the pumps. Prior to reaching either of the “off” signals, a warning alarm will be sent to the District Operations Staff.

A magnetic flow meter will be installed downstream of the booster station as a check against the magnetic flow meter installed in Santa Maria (the official meter for determining water use). The meter at the booster station site will be used to monitor the flow rate of the booster station and as a verification of water delivery.

5.6 Pump Station Design Features

Additional design features that will be incorporated into the design are listed below:

5.6.1 Trouble shooting considerations

- Manual pressure gauges on suction and discharge piping
- Easy access to Motor Control Center (MCC) and VFDs when working on pumps and motors
- Chemical dosing pumps and residual meters located in the same room as the MCC and booster pumps
- Doors allowing easy access between the MCC, residual meters, and flow meter/ residual vault
- Access to PLC to make set point changes and/or examine trends over several days (stand alone and redundant)

5.6.2 Piping and Pump Can Layout

- Adequate clearance to access the check valves, valves, or motors
- Ability to lift a 27-ft long pump through the ceiling

- A rollup door that will allow easy access to the motors and pump cans
- MCC clearance

5.6.3 Other Items

- Chemical Storage should be isolated from the electrical and mechanical rooms
- Drainage of incidental water will be provided
- The building will be ventilated

5.7 Hydraulic Transient Analysis

In order to evaluate the potential hydraulic transients resulting from the proposed booster station, AECOM performed a preliminary surge analysis of the WIP including elements of NCSD's existing potable water distribution system. The objective of this analysis was to simulate and estimate the worst-case theoretical transient response (pressure increase / decrease over time) of the proposed booster station, new transmission pipelines, and elements of the NCSD's existing water distribution system following simultaneous stopping of pumps due to power failure.

A hydraulic transient (also known as water hammer or surge) is a temporary flow and pressure condition that occurs in a hydraulic system following a rapid velocity change in response to the operation or shut-down of a flow-control device (for instance, pump shut down following power failure). When velocity changes rapidly at the onset of a surge event, the compressibility of the liquid and the elasticity of the pipeline cause a transient pressure wave to propagate throughout the system. If the magnitude of this transient pressure wave and the resulting transient flow variation is great enough and adequate transient-control measures are not in place, a transient can cause system hydraulic components, including pipelines, to fail.

The preliminary surge analysis was performed using Bentley's HAMMER V8 XM Edition software. To serve as the starting point for the surge model, the NCSD's existing water distribution model was imported into the Hammer program from WaterCAD. Once imported, the model was updated to include the proposed WIP Improvements and skeletonized to provide a manageable representation of both the existing and proposed system elements.

The following assumptions were made to define initial conditions and the modeled surge event:

5.7.1 Initial Conditions

- Proposed Buried Reservoir and Quad Tanks at 50% water levels
- Existing wells not active
- Proposed Booster Station is active
    - o All three (3) pumps operating; 2,000 gpm total flow at 330 ft, 1800 rpm.

5.7.2 Modeled Surge Event

Two (2) scenarios were run to evaluate the potential system surge response with and without surge protection. In order to characterize the surge envelope for each scenario, it was determined that each scenario needed to be run with a range of flows to estimate the potential surge behavior under different system demand conditions. To provide the required range of results, both scenarios were run under existing system Peak Hour Demand (PHD); and at 10% Average Day Demand (10% ADD). The following conditions were simulated for each surge scenario:

- Scenario 1 – System with no surge protection at both 10% ADD and PHD
  - Power failure at booster station – three (3) duty pumps simultaneously stop following power failure at time T = 0
  - Pump discharge check valves close when reverse flow is first sensed
  - Reverse pump spin not allowed
  - No surge protection
- Scenario 2 – System with surge protection at pump station discharge both 10% ADD and PHD
  - Power failure at booster station - three (3) duty pumps simultaneously stop following power failure at time T = 0
  - Pump discharge check valves close when reverse flow is first sensed
  - Reverse pump spin not allowed
  - Surge protection = 1,000-gallon bladder hydro-tank set at 50-psi initial pre-charge pressure

5.7.3 Surge Analysis Results

Surge analysis results at select locations along the transmission route are summarized below in Table 5-1. Detailed *HAMMER* Transient Reports are not attached to this memo due to size, but can be provided on DVD if requested. The range of values presented in the tables are based on combined results from runs at PHD and 10%ADD

Table 5-1. Surge Analysis Results for Scenario 1 - System with no surge protection

Location	Elevation (ft)	Steady-state HGL (ft)	Up Surge HGL (ft)	Down Surge HGL (ft)
WIP Pump Discharge Header	300	616 - 633	648 - 659	267 – 360 **(-14 psi min)**
Connect to Ex. @ Santa Maria Vista Rd (node J-5298)	302.3	614 - 631	614 - 646	288 – 364 **(-6 psi min)**
Connect to Ex. @ Orchard & Southland (node J-8539)	323	546 - 574	546 - 599	405 - 438
Connect to Ex. @ Oakglen & Tefft (node J-3411)	333.3	534 - 558	534 -575	459 - 470
Connect to Ex. @ Orchard & Grande (node J-3004)	374.4	534 - 564	534 - 580	441 - 477

Table 5-2. Surge Analysis Results for Scenario 2 - System with 1,000-gallon bladder hydro-tank

Location	Elevation (ft)	Steady-state HGL (ft)	Up Surge HGL (ft)	Down Surge HGL (ft)
WIP Pump Discharge Header	300	616 - 633	655 - 677	420 – 441 (52 psi min)
Bladder Hydro-Tank (node J-8599)	300	616 - 633	628 - 646	421 – 443 (52 psi min)
Connect to Ex. @ Santa Maria Vista Rd (node J-5298)	302.3	614 - 631	621 - 631	425 - 443
Connect to Ex. @ Orchard & Southland (node J-8539)	323	546 - 574	549 - 581	468 - 486
Connect to Ex. @ Oakglen & Tefft (node J-3411)	333.3	534 - 558	534 - 567	492 - 512
Connect to Ex. @ Orchard & Grande (node J-3004)	374.4	534 - 564	538 - 578	479 - 497

As shown in Table 5-1, potential vacuums (negative gauge pressures) may develop between the proposed booster station discharge header and part of the existing 12-inch PVC pipeline near Santa Maria Vista Rd/Orchard Rd. In comparison, pressure increases resulting from the upsurge are within 50-ft (22 psi) at the locations shown. Table 5-2 demonstrates that the inclusion of a bladder hydro-tank at the booster station discharge could be an effective means of attenuating the potential vacuum that can develop within the discharge pipeline during a down surge. Furthermore, this surge mitigation device reduces the spike in pressure resulting from upsurge as graphically represented in the figures below.

In order to graphically depict the surge analysis results, surge profiles were prepared for both scenarios showing the pressure variation along the primary transmission route (from the booster station to Southland/Frontage to Quad Tanks) and are included on the following pages. These profiles include the theoretical “steady state” HGL, Max Surge HGL, and Min Surge HGL as calculated by *HAMMER*. The Vacuum Lower Limit HGL is also included to represent the theoretical limits for “full vacuum”.

Figure 5-4 is the surge analysis profile for Scenario 1 (System with no surge protection). Figure 5-5 is the surge analysis profile for Scenario 2 (System with surge protection at pump station discharge).

Figure 5-4 depicts a potential downsurge vacuum (approaching full vacuum at -14 psi) that may develop between the proposed booster station and the first 2,000-lf of existing 12” PVC along Orchard Rd. Pressure spikes resulting from upsurge are within 50-ft. The maximum pressure along the profile is 160 psi (located downstream of the new pump station).

Figure 5-5 depicts a potential downsurge resulting in elevated minimum pressures in excess of 50 psi downstream of the booster station. Pressure spikes resulting from upsurge are reduced when compared to Figure 5-4 and approximate the Steady State HGL. The maximum pressure along the profile is 170 psi (located downstream of the proposed booster station).

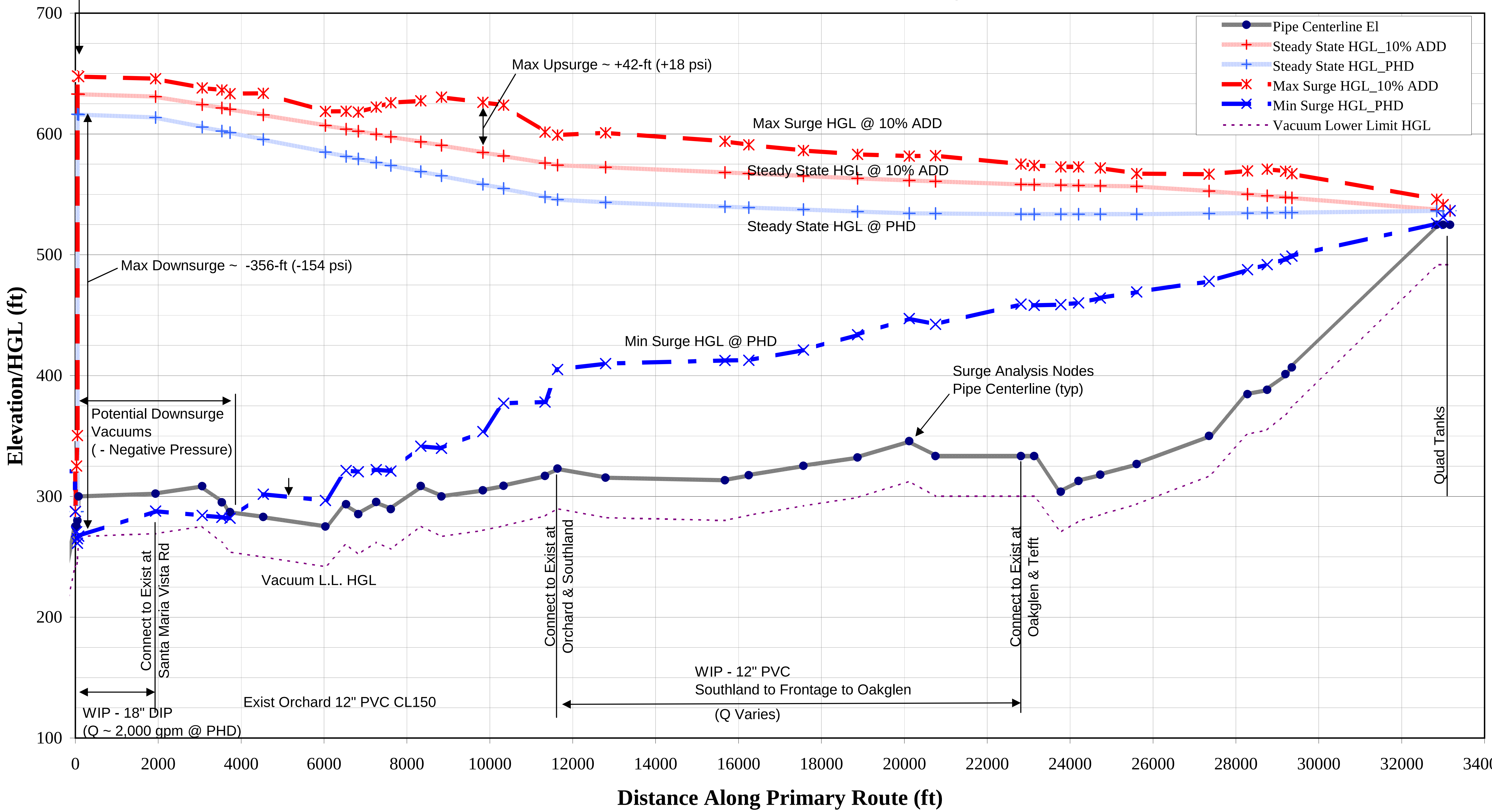
5.7.4 Surge Control Recommendations

Based on this analysis, a surge control system including a bladder hydro-tank is recommended for the proposed booster station. Further analysis is required during the next stage of design in order to determine the optimum bladder hydro-tank size, bladder pre-charge pressure, and configuration. The drawings show a 1,000 gallon tank connected to the booster station discharge piping.

During review of the Draft Concept Design Report, a question was raised about the potential for surge in the case where the reservoir is offline and water is being delivered directly to the pump station. If hydraulic analysis of this scenario reveals the need for additional surge control measures, some options include a surge control valve or a surge tank located upstream of the pump station. AECOM will address this question in a Technical Memorandum prior to the 60% project design submittal.

Client: NCSD
Job Title: WIP
Job #: 60061295

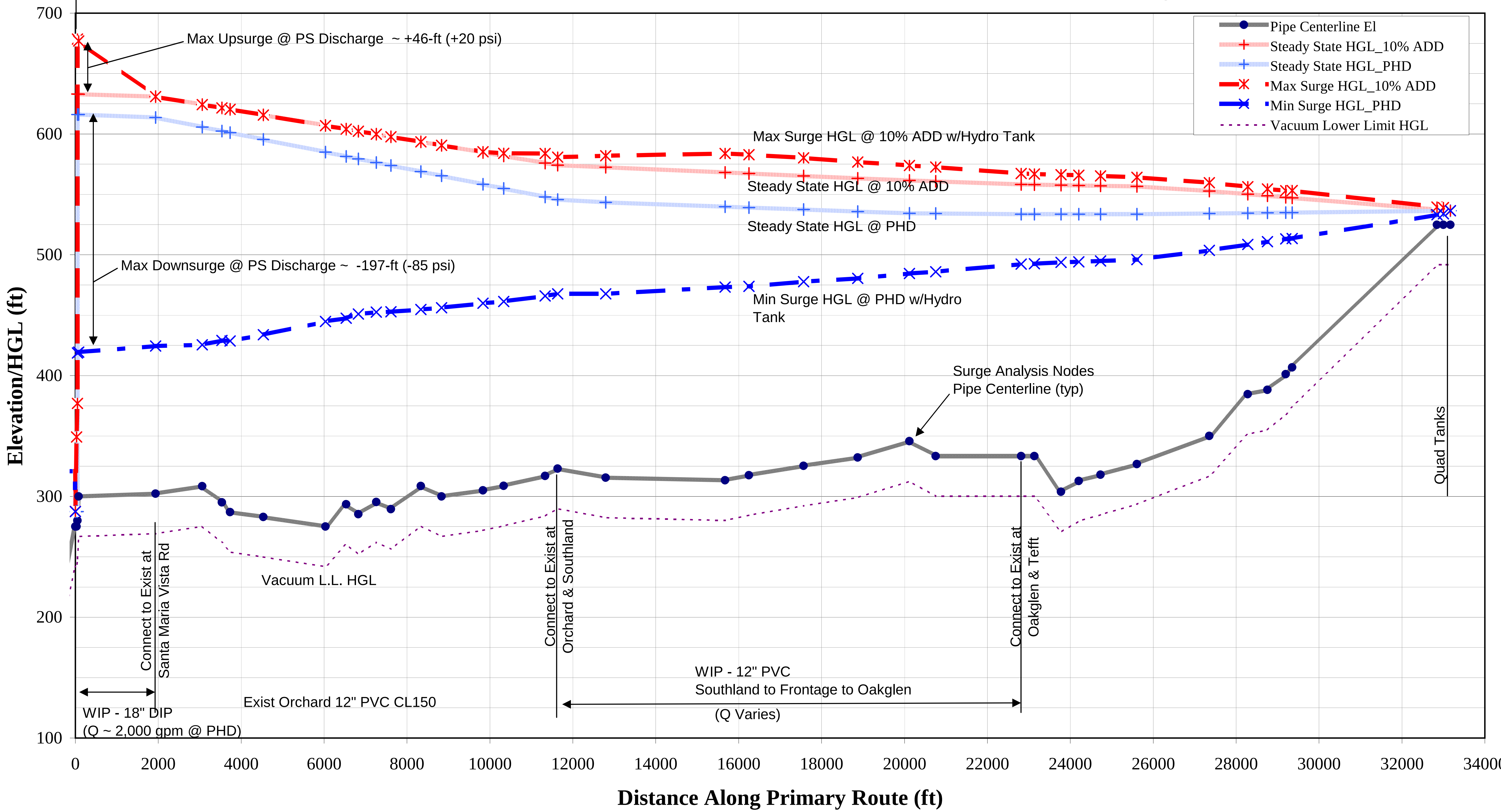
Figure 5-4 - Surge Analysis Profile
WIP Pump Station to Southland/Frontage to Quad Tanks
Scenario 1: Power Failure at WIP Pumps w/no Surge Protection



AECOM

Figure 4_Scenario 1_Surge Profile.xls

Figure 5-5 - Surge Analysis Profile
WIP Pump Station to Southland/Frontage to Quad Tanks
Scenario 2: Power Failure at WIP Pumps w/1,000-Gallon Hydro Tank @ 50-psi precharge



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5.8 Chloramine Boosting at Intertie

Chloramine boosting will allow addition of chloramine to Intertie Water to provide adequate chloramine residual at the farthest reaches of the distribution system. The chloramine booster facilities will be located at the booster station site and will inject sodium hypochlorite and ammonia into the water. Influent flow rate is assumed to be constant (approximately 1,000 gpm to 2,000 gpm), and may vary daily.

5.8.1 Sodium Hypochlorite Storage

AECOM recommends double-walled high density polyethylene containment vessels for sodium hypochlorite storage. Typical chloramine residuals should be above 1.0 mg/l at the end of the distribution system, and may be as high as 3.0 mg/l at the point of treatment.[3] For facility sizing, it was assumed that the chloramine residual of the water entering the booster station has been declined to 1.0 mg/L and will be boosted to 2.5 mg/L. We have therefore assumed a required chlorine dosage (as hypochlorite ion (OCl)) of 1.5 mg/l to achieve an initial chloramine residual of 2.5 mg/l (as OCL), and assuming a 1:4 ratio of NH_3 to OCl by weight to prevent formation of di- and tri-chloramines.

A standard tank size was selected to provide suitable storage capacity of 12.5% sodium hypochlorite solution. At 12.5% concentration, sodium hypochlorite is unstable and will deteriorate in strength with time. The rate at which the solution loses strength is accelerated by exposure to high temperatures and sunlight. It is therefore recommended that no more than 14 days of supply be kept on hand. Also, the tank level should be as low as possible before it is replenished. Recommended tank sizes and approximate maximum storage capacities are shown in Table 5-3.

Table 5-3. Recommended Sodium Hypochlorite Tank Size (12.5% Solution)

Design Flow Rate (gpm)	2000
Approximate NaOCL Usage (gal/day)	36
Recommended NaOCl Storage (gal)	1000
Maximum Tank Capacity (days)	27

5.8.2 Ammonia Storage

For ammonia storage, AECOM recommends the “Ultratainer” intermediate bulk container from Snyder Industries. These polyethylene containers are rugged, relatively inexpensive, and can resist the vapor pressure of ammonia, thereby eliminating the need for a scrubber.[4] The Ultratainer would be fitted with a pressure relief valve to prevent over pressurization of the tank.

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[3] “Waterline Intertie Project – Disinfection Alternatives Evaluation,” Boyle Engineering Corporation, November 2006.

[4] Ammonia volatizes easily at room temperatures and must either be refrigerated, contained in a pressure vessel, or vented to a scrubber which consists of a volume of water through which the ammonia vapor passes. A scrubber would require maintenance, connection to a fresh water supply, and connection to sanitary sewer.

Since the Ultratainer is a single-walled tank, a containment curb will be provided in the chemical storage building.

Table 5-4. Recommended Tank Size for Saturated Ammonium Sulfate Solution

Design Flow Rate (gpm)	2000
Approximate Ammonium Sulfate Solution Usage (gal/day)	8
Recommended NH_3 Tank Size (gal)	220
Maximum Tank Capacity (days)	28

AECOM has assumed that the District will mix dry ammonium sulfate with water at the booster pump station on an as-needed basis. We have also assumed that a saturated solution of ammonium sulfate (14% ammonia) will be used.[5] Assuming a 1:4 ratio of NH_3 to OCl by weight for chloramine production, ammonia storage requirements were calculated. Maximum storage capacity is shown in Table 5-4, but actual chemical volume may be reduced in practice to avoid degradation of chemical strength.

5.8.3 Chemical Delivery Equipment

Technical specifications will be provided for materials, testing, and installation of a packaged, skid-mounted chemical feed system for sodium hypochlorite and aqueous ammonia. Components will include:

- Electronic actuated diaphragm metering pumps to pump the chemical from the storage tank to the point of application. Equipment will be designed with fully redundant duplex metering pumps. Pumps will be designed to supply the maximum required chemical dose with only one of the two pumps operating.
- Pulsation damper, pressure gauges, flow switch, isolation, backpressure, pressure relief, solenoid, and control valves within the on-skid piping.
- Electrical power and control wiring and conduit between the above components.

The design will include a control panel for local control of the feed system and junction boxes and terminals for terminating alarm and control signal to or from an external control system.

Input terminals will be provided for the following:

1. Connecting to external power
2. 4– to 20-mA flow-pacing signals to metering pumps

[5] A saturated solution of ammonium sulfate contains approximately 138 mg of ammonia per liter of water at 20 degrees C (approximately 14% solution),

3. Metering pumps on/off signal

Output terminals will be provided for:

1. Sending alarm and control signals to an external PLC
2. Metering pump running (separate signal for each pump)
3. Flow switch in each metering pump discharge piping enabled/disabled
4. High pressure in metering pump discharge
5. Liquid level detected in drain pan

The design will include specifications for ammonia injection quills on process piping, and will feature a Westfall static mixer.

Pacing of the sodium hypochlorite and ammonia feed pumps will be accomplished manually. Adjustments to the metering pump stroke frequency and stroke length will be made at the metering pump local controls. The feed pumps will require regular adjustment based on measured values of the total chlorine residual, free chlorine residual, monochloramine residual, and free ammonia residual. The frequency of metering pump adjustment will depend on the consistency of intertie flow rate, the consistency of the intertie water characteristics, and the drift in the pump set point.

5.8.4 Chloramine Residual Monitoring Equipment

To monitor chloramine residual, AECOM recommends use of two Hach CL-17 colorimetric chlorine analyzers. With one meter utilizing reagent to measure Free Chlorine, and one meter utilizing reagent to measure Total Chlorine, the chloramine residual can be calculated (Total Chlorine - Free Chlorine = Combined Chlorine (chloramine)). This method requires careful monitoring of the dosage ratio of hypochlorite to ammonia, as the calculation of combined chlorine cannot distinguish between monochloramine, di and trichloramine, or free chlorine in Zone 3 of the breakpoint curve. Staff will need to ensure that the dosage ratio is kept between 4:1 and 5:1 (chlorine : free ammonia) to ensure that the measured value of Combined Chlorine represents monochloramine concentration. Each meter will have an associated waste stream. Since there are no sewer connections at the site, AECOM will include design of a small drywell for disposal.

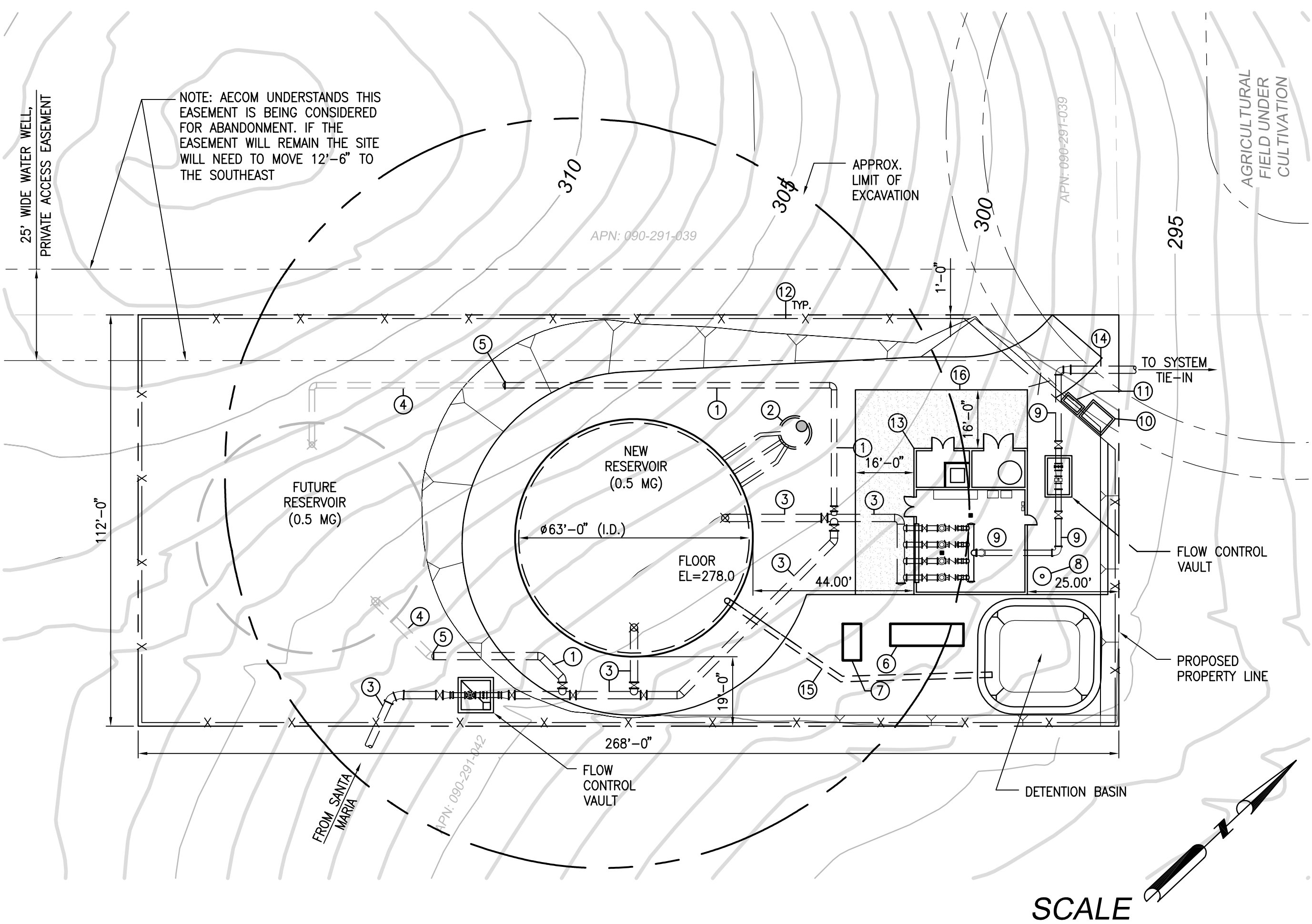
Two sets of meters will be provided, one set to monitor water received from the City, and one set to monitor water being delivered to the District's distribution system. The dual set of meters will allow a high level of control over the settings of the chemical feed pumps and control over the quality of water delivered to the system. The source water meters will also ease troubleshooting and establishment of the proper set point(s).

Meters are available that measure chloramine concentration directly. However, in our experience, these meters (such as the Hach APA 6000 ($10,000), or the ChemScan UV-2150/S ($25,000-$30,000)) are expensive and are marginally reliable. AECOM does not recommend these types of meters for NCSD.

5.9 Pump Station Building

AECOM recommends split-faced masonry block construction for the pump station building. Preliminary layouts indicate a required building size of approximately 28 feet by 45 feet to accommodate the chemical storage and pump station layout (see Figure 5-6). The contract documents will require the contractor to submit color swatches and coordinate color selection with District staff.

Storage buildings will feature two isolated rooms to provide separation between treatment chemicals. Proposed locations for the chemical storage buildings can be seen in the preliminary tank site drawings (included with the 30% Design Plans in Volume 3 of this Report).



SCALE

0 25 50 100

1 INCH = 50 FEET

NOTES:

1. FOR DETAILED INFORMATION SEE BP–4, SHEET C–114.
2. GRADING IS PRELIMINARY, TO BE REVISED IN 60% SUBMITTAL

CONSTRUCTION NOTES:

1. 18"ø PIPE
2. DRAINAGE MANHOLE
3. 24"ø PIPE
4. FUTURE 18"ø PIPE
5. 18" BLIND FLANGE
6. EMERGENCY GENERATOR
7. GENERATOR FUEL TANK
8. SURGE TANK
9. 18"ø PIPE
10. PG&E PAD MOUNTED TRANSFORMER
11. METERING SWITCHBOARD
12. 6'–0" HIGH CHAIN LINK FENCE WITH THREE STRANDS OF BARBED WIRE
13. PUMP STATION AND CHLORAMINE BOOSTER BUILDING
14. 24"ø PIPE
15. 18"ø DIP TANK OVERFLOW
16. ASPHALT APRON

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WATERLINE INTERTIE PROJECT

PUMP STATION AND RESERVOIR LAYOUT

AECOM PROJECT NO. 19996.70

FIGURE 5-6

6.0 CHLORAMINATION SYSTEMS

Technical Memorandum No. 7 – Chloramination Systems, submitted on July 16, 2008, made recommendations for the selection of wells for chloramination conversion. Subsequently, Technical Memorandum 7b, submitted on November 21, 2008, provided a summary of the preliminary design considerations and made recommendations for the design of the chloramination facilities at the selected wells. This Chapter combines information from the technical memoranda to summarize the Concept Design for the wellhead chloramination systems. The chloramination system for the booster station is discussed in Chapter 5.0 with the pump station and reservoir.

6.1 Identification of wells for chloramination

Because the supplemental water will contain chloramines, the District will convert its existing free chlorination treatment process to a chloramination system. This change in treatment will require the addition of ammonia injection at the wells, and the redesign of the chlorine feed systems because of the higher total chlorine residual typically maintained. This change will also require larger chlorine solution tanks and chemical feed pumps with greater capacities. Each well that is converted to chloramines will need online monitoring equipment to provide dosage control, as well as a building sized large enough to hold the two solution tanks and four chemical feed pumps (two primary and two backup).

In order to reduce costs, and because the introduction of supplemental water will reduce the need to pump groundwater, it may be possible to convert some of the District's wells to chloramine disinfection and reduce the use of the other wells. These other wells could be retired from service until such time as they were needed, or they could be operated periodically, using a portable chloramination system. At this time the District has budgeted to construct four chloramination facilities and one portable system. Findings from the 2007 Water Master Plan Update and from recent pumping records are summarized in Table 6.1 below.

Table 6-1. NCSD Production Well Information

Location	Rated Capacity	2007 Production	Other Features
Eureka	820 - 965 gpm	761 AF	Well Building
Via Concha	700 - 800 gpm	750 AF	Well Building
Bevington	330 - 405 gpm	358 AF	Well Building
Olympic	110 - 150 gpm	17 AF	
Church	130 - 160 gpm	12 AF	inactive
Sundale	800 - 1,200 gpm	374 AF	Well Building Natural Gas Powered
Knollwood	210 - 270 gpm	259 AF	
Blacklake #3	120 – 210 gpm	90 AF	
Blacklake #4	300 - 450 gpm	233 AF	Recently refurbished
Mandi	n/a		(construction incomplete)
Cheyenne	n/a		(construction incomplete)

6.1.1 Need to Meet Maximum Day Demand

It is recommended that wells be selected for conversion to chloramination to meet the maximum daily demand of the District. In this way, the District will be able to provide water to its customers during times that the Intertie may be inoperative due to emergency operations in the City of Santa Maria, or due to maintenance or repair of the Intertie itself.

The maximum daily demand was estimated (in the 2007 Water Master Plan update) to be 4.53 MGD (3,152 gpm) in 2007, and is projected to grow to 9.47 MGD (6,575 gpm) in 2030.

6.1.2 Well Capacity used to select Wells

The District has budgeted to install chloramination facilities at four wells, plus one portable unit, for a total of five wells. To determine which wells should receive the permanent chloramination equipment the wells were ordered from largest to smallest, based on the mid-value of their reported capacity, as shown in Table 6-2.

Table 6-2. NCSD Production Well Capacity Ranges

Location	Minimum reported Capacity (gpm)	Maximum Reported Capacity (gpm)	Average Reported Capacity (gpm)	Cumulative Minimum Capacity (gpm)	Cumulative Maximum Capacity (gpm)
Sundale	800	1200	1000	800	1200
Eureka	820	965	893	1620	2165
Via Concha	700	800	750	2320	2965
Blacklake #4	300	450	375	**2620**	**3415**
Bevington	330	405	368	2950	3820
Knollwood	210	270	240	3160	4090
Blacklake #3	120	210	165	3280	4300
Church	130	160	145	3410	4460
Olympic	110	150	130	3520	4610

Under this approach, Sundale, Eureka, Via Concha, and Blacklake #4 wells would be recommended for permanent chloramination facilities (Figure ES-2). Together these wells would produce between 2620 and 3415 gpm. With a portable unit operating at Bevington or Knollwood, between 2950 and 3090 gpm would be produced. It is very likely that this approach would produce sufficient water to meet the year 2007 maximum daily demand of 3,152 gpm.

In order to meet the existing maximum day demand (3,152 gpm), AECOM recommends that the District install chloramination equipment at Sundale, Eureka, Via Concha, and Blacklake #4 wells.

6.2 Selected Wells

As recommended the District has selected four wells for conversion to chloramination. It was recommended that the selected wells have adequate capacity to meet the maximum daily demand.[6] In this way, the District would be able to provide water to its customers during times that the Intertie may be inoperative due to emergency operations in the City of Santa Maria, or due to maintenance or repair of the Intertie itself. The selected wells and production rates are shown in Table 6-4.

---

[6] The maximum daily demand was estimated (in the 2007 Water Master Plan update) to be 4.53 MGD (3,152 gpm) in 2007, and is projected to grow to 9.47 MGD (6,575 gpm) in 2030.

Table 6-4. District Wells Selected for Chloramination Facilities

Location	Minimum reported Production Rate (gpm)	Maximum Reported Production Rate (gpm)	Average Reported Production Rate (gpm/MGD)
Sundale	800	1200	1000 / 1.4
Eureka	820	965	893 / 1.3
Via Concha	700	800	750 / 1.1
Blacklake #4	300	450	375 / .54

These four wells, along with the Bevington or Knollwood Well (if a chloramination system is installed in the future) would likely produce sufficient water to meet the year 2007 maximum daily demand of 3,152 gpm (4.5 MGD).

6.3 Sodium Hypochlorite Storage

AECOM recommends double-walled high density polyethylene containment vessels for sodium hypochlorite storage. Based on the 2007 Water Master Plan Update, we have assumed that chlorine demand at each of the wells is low (0.5 mg/l). Typical chloramine residuals should be above 1.0 mg/l at the end of the distribution system, and may be as high as 3.0 mg/l at the point of treatment.[7] We have therefore assumed a required chlorine dosage (as hypochlorite ion (OCl)) of 3.5 mg/l to achieve an initial chloramine residual of 3.0 mg/l (as OCL), and assuming a 1:4 ratio of NH_3 to OCl by weight to prevent formation of di- and tri-chloramines.

Standard tank sizes were selected to provide suitable storage capacity of 12.5% sodium hypochlorite solution. Sodium hypochlorite, at a 12.5% concentration, is unstable and will deteriorate in strength with time. The rate at which the solution loses strength is accelerated by exposure to high temperatures and sunlight. For this reason, we are locating storage tanks within buildings. It is also recommended that no more than 14 days of supply be kept on hand. Also, the tank level should be as low as possible before it is replenished. Recommended tank sizes and approximate maximum storage capacities are shown in Table 6-5.

[7] "Waterline Intertie Project – Disinfection Alternatives Evaluation," Boyle Engineering Corporation, November 2006.

Table 6-5. Recommended Sodium Hypochlorite Tank Sizes (12.5% Solution)

	Sundale	Via Concha	Blacklake 4	Eureka
Max Flow Rate	1200	800	450	965
Existing NaOCl Storage (gal)	500	45	10	45
Recommended NaOCl Storage (gal)	1000	500	360	500
Tank Manufacturer	Poly Processing	Snyder Industries	Snyder Industries	Snyder Industries
Approximate Storage Max (days)	19	14	18	12

6.4 Ammonia Storage

For ammonia storage, AECOM recommends the “Ultratainer” intermediate bulk container from Snyder Industries. These polyethylene containers are rugged, relatively inexpensive, and can resist the vapor pressure of ammonia, thereby eliminating the need for a scrubber.[8] The Ultratainer would be fitted with a pressure relief valve to prevent over pressurization of the tank. Since the Ultratainer is a single-walled tank, a containment curb will be provided in the chemical storage building.

We have assumed that the District will mix dry ammonium sulfate with water at the well sites on an as-needed basis. We have also assumed that a saturated solution of ammonium sulfate (14% ammonia) will be used.[9] Assuming a 1:4 ratio of NH_3 to OCl by weight for chloramine production, ammonia storage requirements were calculated for each site. The smallest Ultratainer (220 gal) was selected for each site. Maximum storage capacities are shown in Table 6-6, but actual chemical volume may be reduced in practice to avoid degradation of chemical strength.

Table 6-6. Recommended Ammonia Solution Tank Sizes

	Sundale	Via Concha	Blacklake 4	Eureka
Max Flow Rate	1200	800	450	965
Recommended NH_3 Tank Size (gal)	220	220	220	220
Maximum Storage (days)	20	30	>30 (53 days)	24

[8] Ammonia volatizes easily at room temperatures and must either be refrigerated, contained in a pressure vessel, or vented to a scrubber which consists of a volume of water through which the ammonia vapor passes. A scrubber would require maintenance, connection to a fresh water supply, and connection to sanitary sewer.

[9] A saturated solution of ammonium sulfate contains approximately 138 mg of ammonia per liter of water at 20 degrees C (approximately 14% solution),

6.4 Chemical Delivery Equipment

Technical specifications will be provided for materials, testing, and installation of packaged, skid-mounted chemical feed systems for sodium hypochlorite and aqueous ammonia. Components will include:

- Electronic actuated diaphragm metering pumps to pump the chemical from the storage tank to the point of application. All chloramination sites will be designed with fully redundant "duplex" metering pumps. Pumps will be designed to supply the maximum required chemical dose with only one of the two pumps operating.
- Pulsation damper, pressure gauges, flow switch, isolation, backpressure, pressure relief, solenoid, and control valves within the on-skid piping.
- Electrical power and control wiring and conduit between the above components.

Our design will include a control panel for local control of the feed system and junction boxes and terminals for terminating alarm and control signal to or from an external control system.

Input terminals will be provided for the following:

- Connecting to external power
- 4– to 20-mA flow-pacing signals to metering pumps
- Metering pumps on/off signal

Output terminals will be provided for:

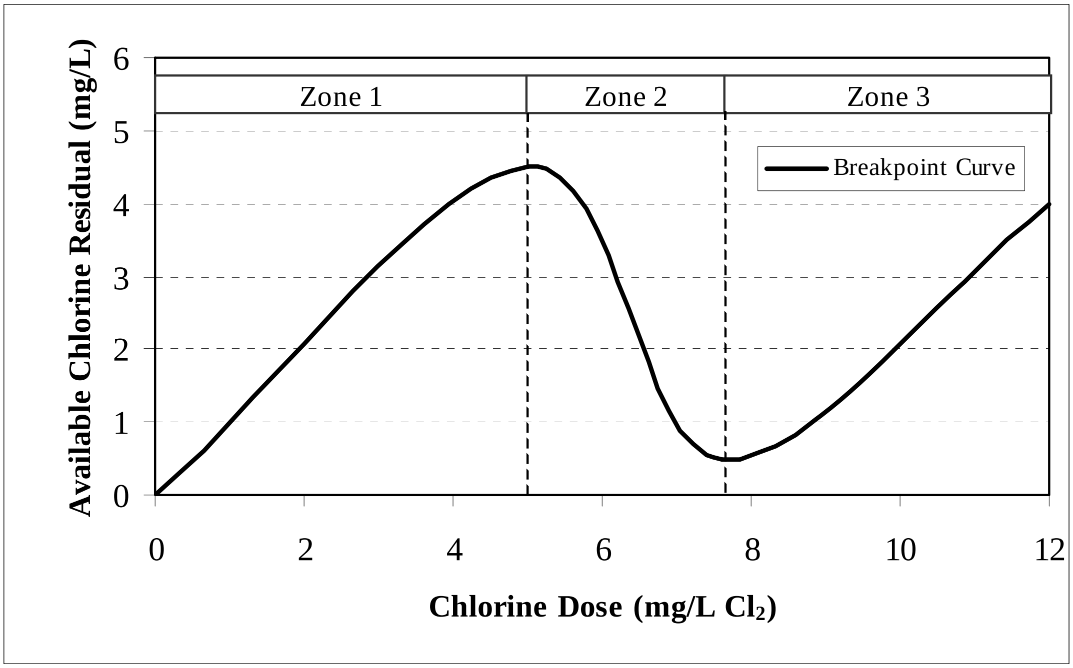
- Sending alarm and control signals to an external PLC
- Metering pump running (separate signal for each pump)
- Flow switch in each metering pump discharge piping enabled/disabled
- High pressure in metering pump discharge
- Liquid level detected in drain pan

The design will include specifications for ammonia injection quills on process piping, and will feature Westfall static mixers (or approved equal).

6.5 Chloramine Residual Monitoring Equipment

To monitor chloramine residual, AECOM recommends use of two Hach CL-17 colorimetric chlorine analyzers. With one meter utilizing reagent to measure Free Chlorine, and one meter utilizing reagent to measure Total Chlorine, the chloramine residual can be calculated (Total Chlorine - Free Chlorine = Combined Chlorine (chloramine)). This method requires careful monitoring of the dosage ratio of hypochlorite to ammonia, as the calculation of combined chlorine cannot distinguish between monochloramine, di and trichloramine, or free chlorine in Zone 3 of the breakpoint curve (See Figure 7-1). Staff will need to ensure that the dosage ratio is kept between 4:1 and 5:1 (chlorine : free ammonia) to ensure that the measured value of Combined Chlorine represents monochloramine concentration.

Figure 6-1. Theoretical Breakpoint Chlorination Curve



The primary and secondary chemical species, which are present in solution during each segment of the breakpoint curve are as described below.

Zone	Chlorine : Ammonia-N Ratio (mg Cl_2 : mg NH_3-N)	Primary Species	Secondary Species
1	<5:1	Monochloramine	Dichloramine (trace)
2	5:1 to 7.6:1	Monochloramine Nitrogen Chloride	Dichloramine Nitrate
3	>7.6:1	Free Chlorine Nitrogen Chloride	Trichloramine Nitrate

Meters are available that measure chloramine concentration directly. In our experience, these meters (such as the Hach APA 6000 ($10,000), or the ChemScan UV-2150/S ($25,000-$30,000)) are very expensive and are marginally reliable. At this time, Hach requires a service contract that includes a monthly visit from a service technician with every APA 6000 unit. Due to the expense and reliability issues, AECOM does not recommend these types of meters for NCSD.

Each meter will have an associated waste stream. Since there are no sewer connections at the District wells, AECOM will include design of a small drywell at each site for disposal.

6.6 Chemical Storage Buildings

AECOM recommends split-faced masonry block construction with a slab roof for the chloramination buildings. Storage buildings will feature two isolated rooms to provide separation between treatment chemicals. Preliminary layouts indicate a required building size of approximately 17 feet by 9 feet for Eureka, Via Concha and Blacklake 4. Eureka will require a building approximately 19 feet by 11 feet. Table 6-7 summarize chemical storage building sizes and Figures 6-2 and 6-3 provide proposed building layouts. The contract documents will require the contractor to submit color swatches and coordinate color selection with District staff.

Table 6-7. Approximate Chemical Storage Building Sizes

	Sundale	Via Concha	Blacklake 4	Eureka
Recommended NaOCl Storage (gal)	500	500	275	500
Recommended NH_3 Storage (gal)	220	220	220	220
Approximate Building Size (ft x ft)	19 x 11	17 x 9	17 x 9	17 x 9

Figure 6-2. Proposed Chloramination Building Layout (Eureka, Via Concha and Blacklake)

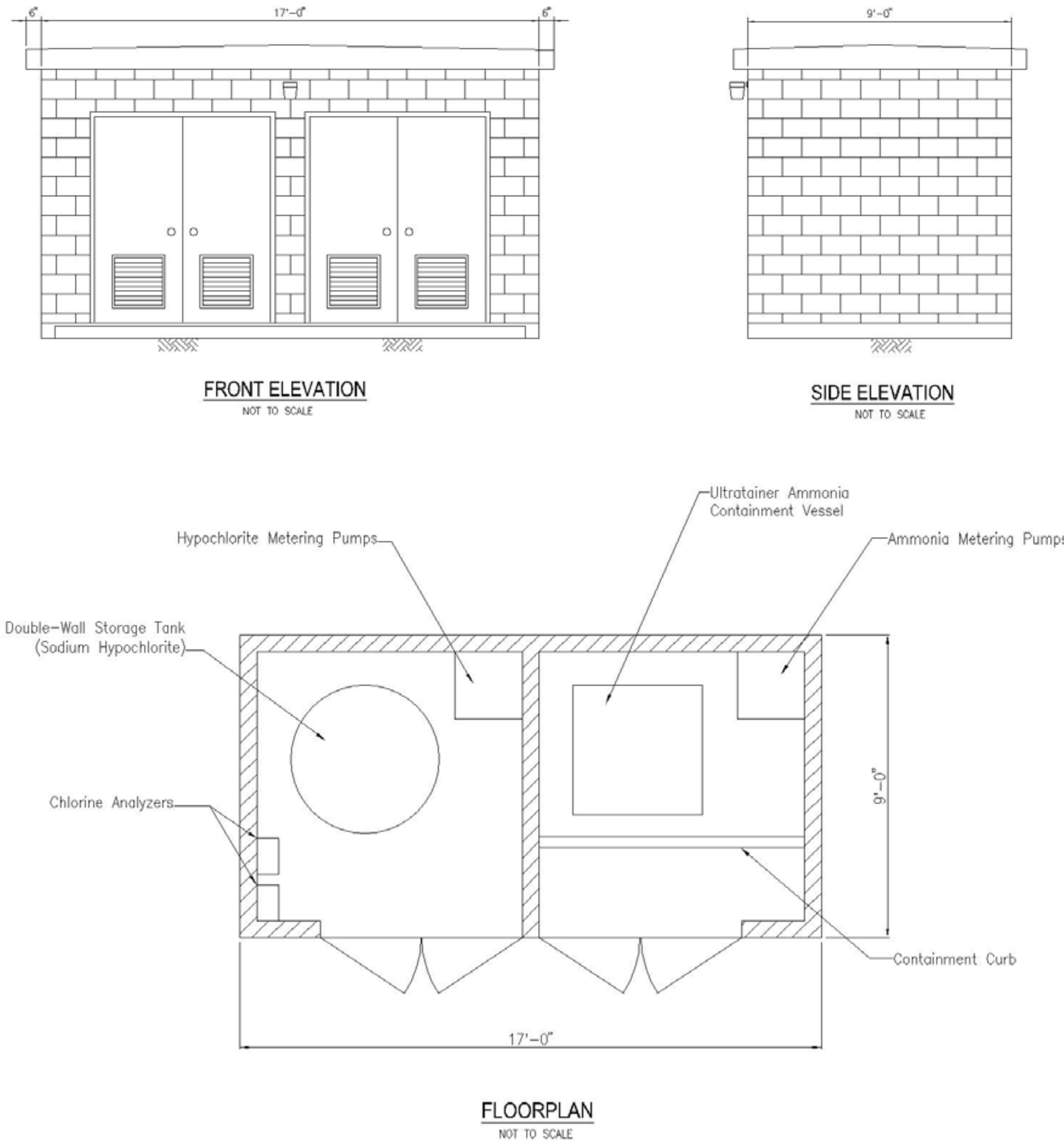
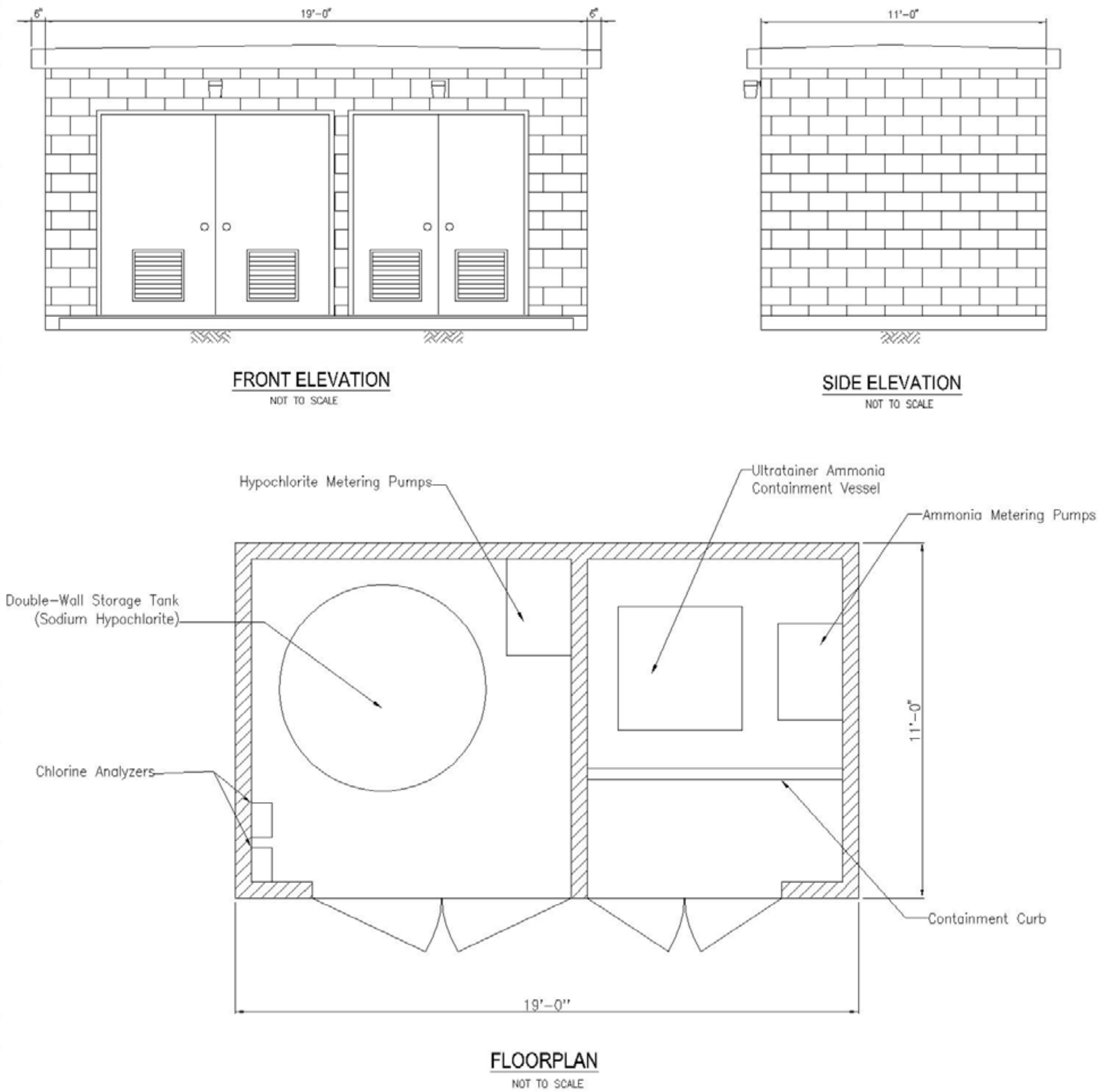


Figure 6-3. Proposed Chloramination Building Layout (Sundale)



Proposed site layouts can be seen in Figures 6-4 through 6-7.

Figure 6-4. Proposed Site Plan - Sundale

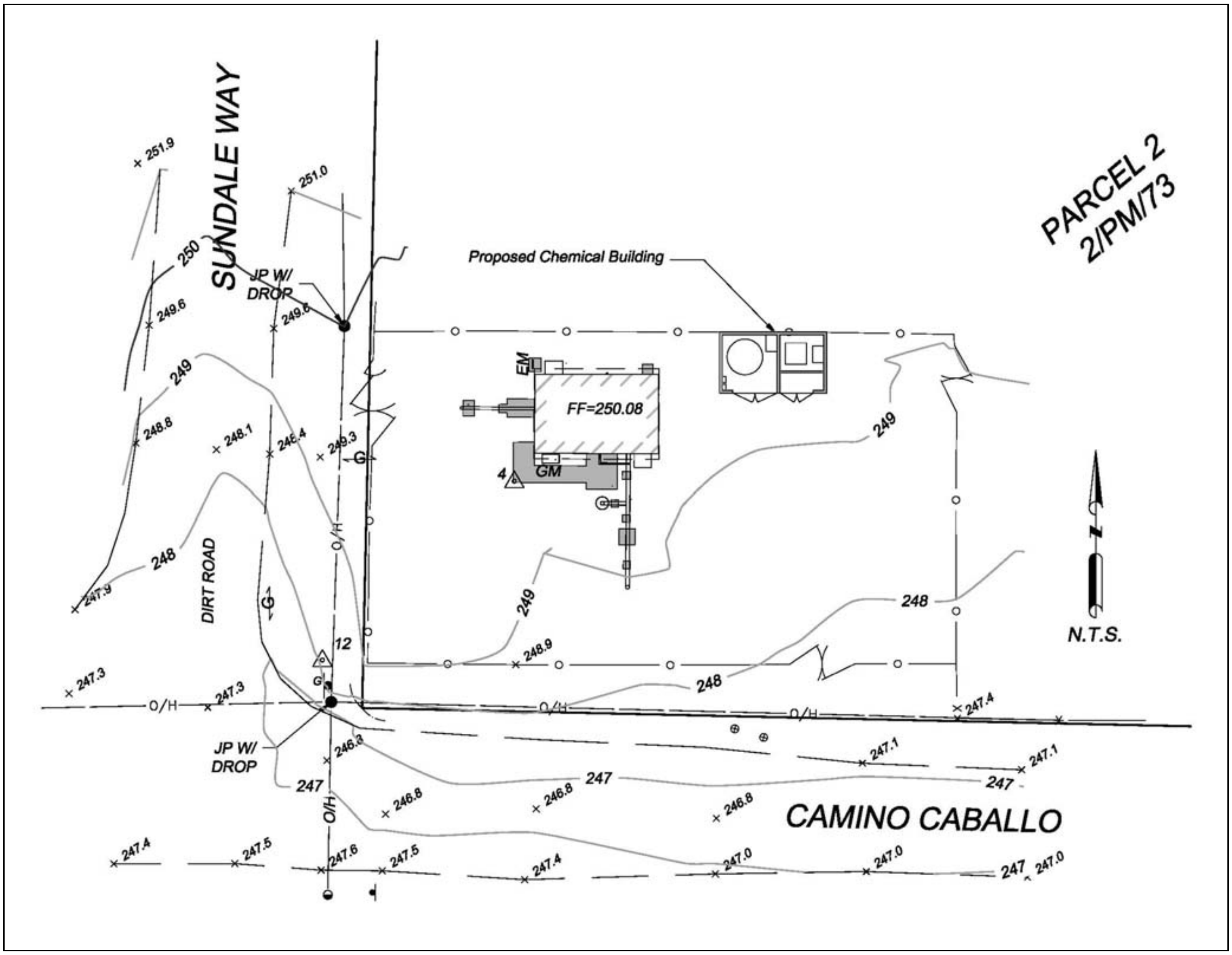


Figure 6-5. Proposed Site Plan - Eureka

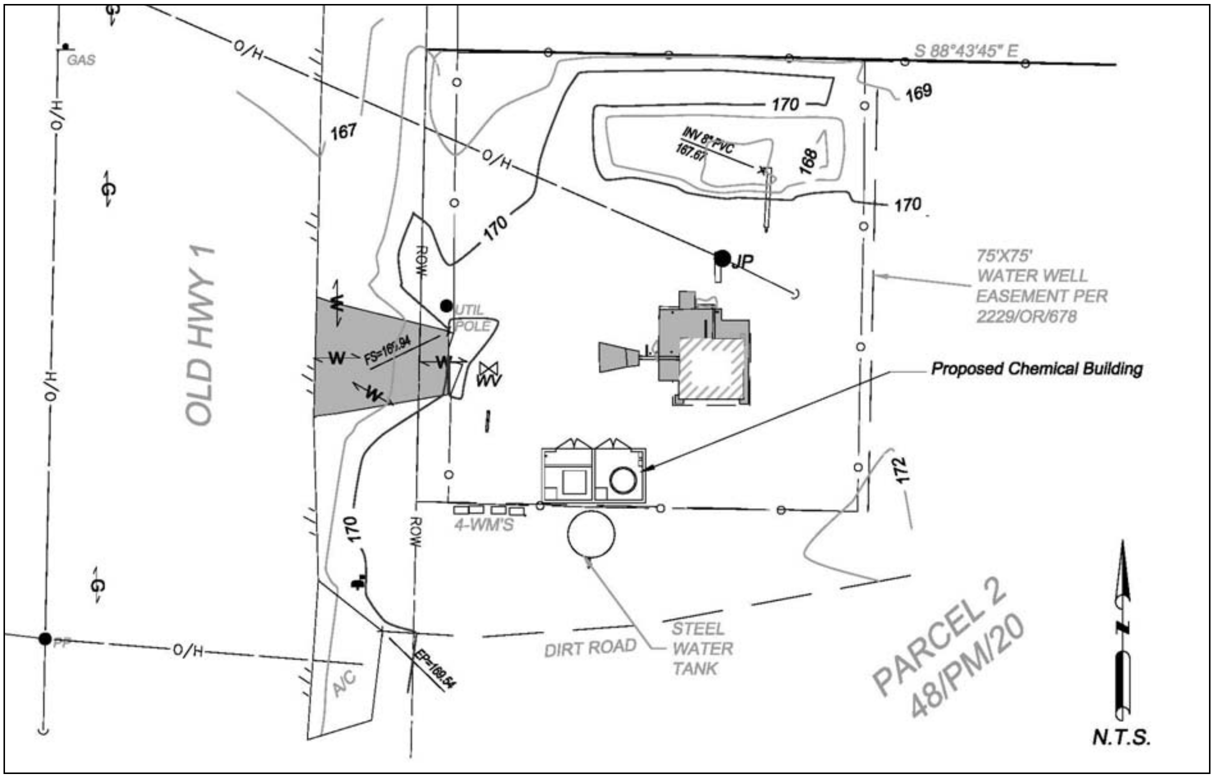


Figure 6-6. Proposed Site Plan – Via Concha

During the site visit, AECOM and District staff discussed the limited project site area, and explored the possibility of constructing a new building to enclose the existing wellhead (replacing the existing building) and the proposed treatment chemicals. Upon review of the site constraints, it is our opinion that although possible, replacing the existing building would add significant cost and complexity to the project. AECOM recommends installing a new chemical building and leaving the existing pump house and electrical panels intact, as shown on Figure 6-6. The waterline from the well to the street may have to be relocated away from the proposed chemical building, and the access gates at the front of the property will need to be reconfigured.

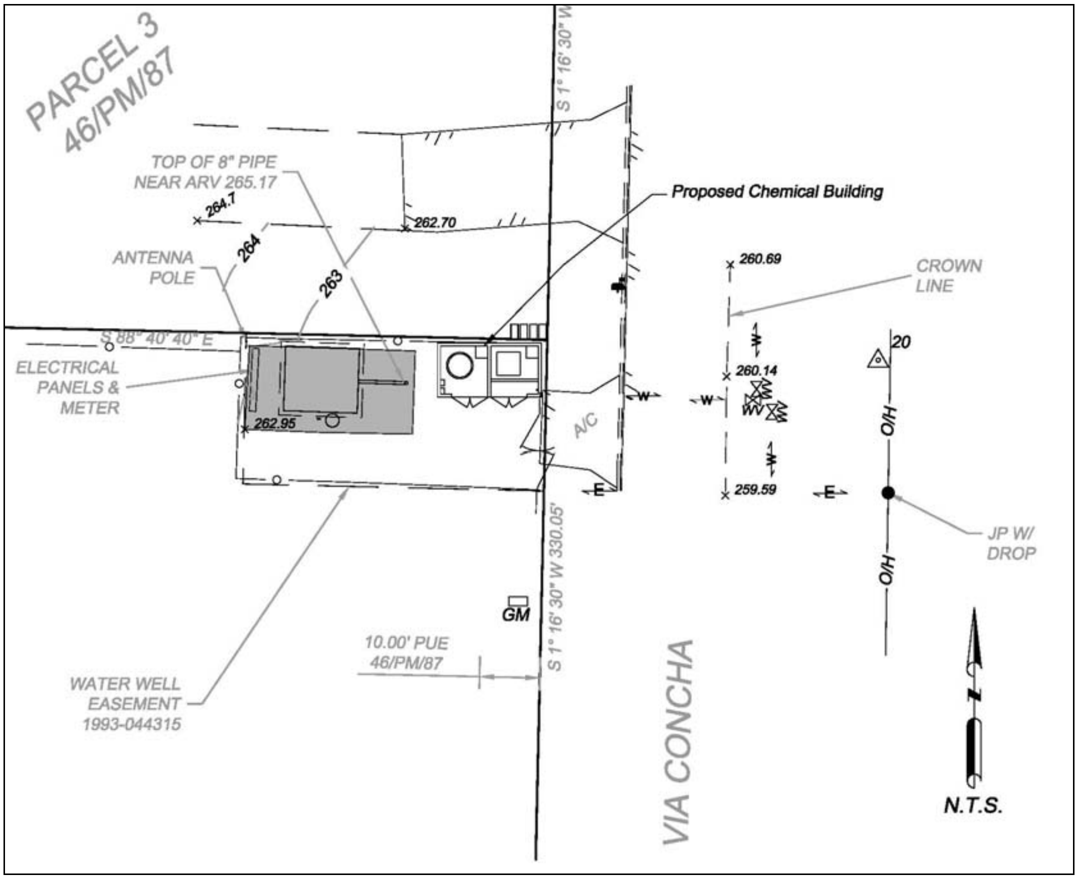
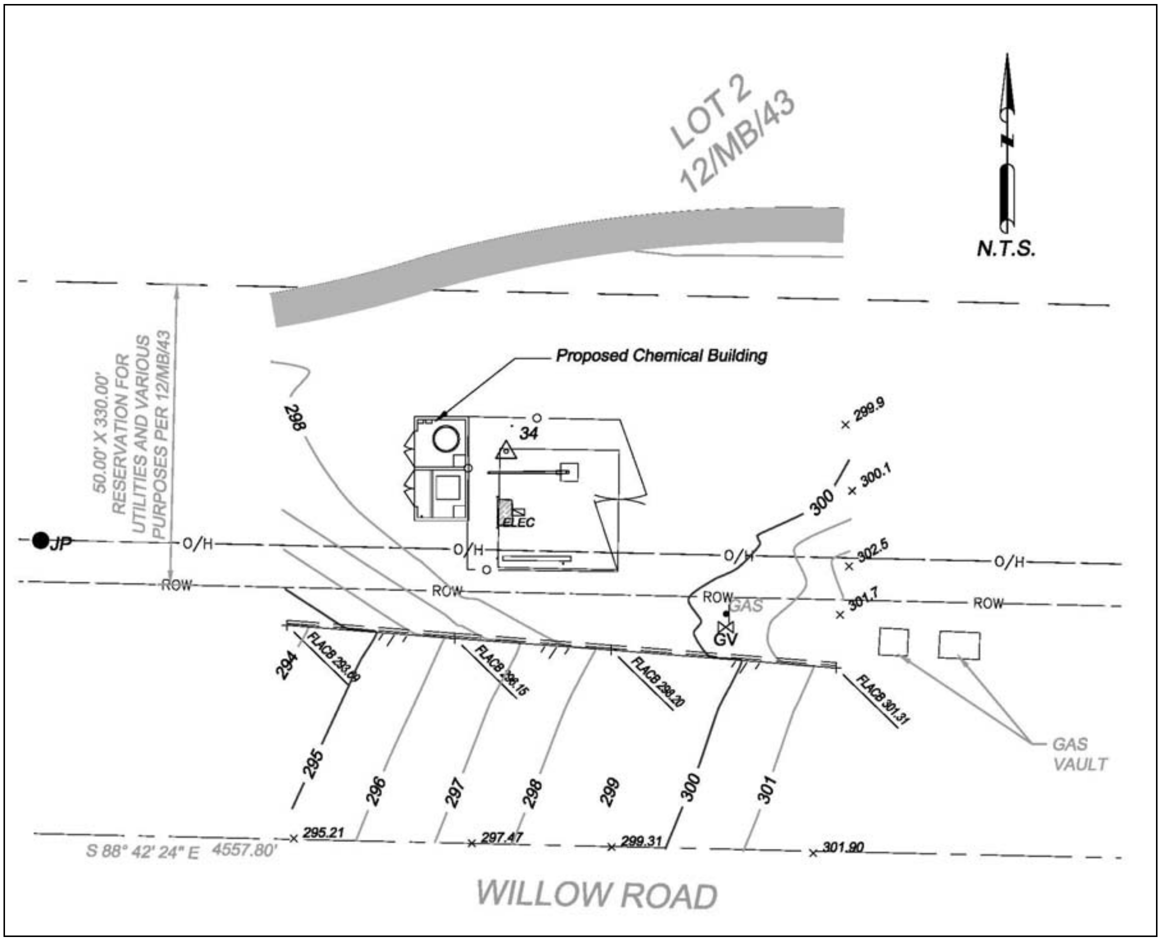


Figure 6-7. Proposed Site Plan –Blacklake 4

This site does not have adequate space to construct the proposed chemical building within the existing fence line. AECOM recommends placing the chemical building outside of the fence line as shown on Figure 6-7. This may require acquisition of additional property. District staff should determine if expansion of the project site is feasible.



6.7 Safety

The hazards at the chloramine treatment sites are primarily electrical and chemical handling. Chemicals in use at the treatment sites include sodium hypochlorite (12.5%), dry ammonium sulfate, and aqueous ammonium sulfate solution.

Caution: It is critical that ammonium sulfate and sodium hypochlorite solutions not be mixed. The undiluted mixing of these chemicals will result in the generation of a poisonous and potentially explosive gas. Special care must be taken during chemical deliveries to ensure that these chemicals are not delivered into the wrong tank.

An emergency eyewash and shower will be provided at each well site. Since some of the treatment sites are located in sparsely populated areas, it is recommended that operations staff always have a readily-available means of communicating with headquarters when working at the treatment sites.

6.8 Emergency or Temporary Chloramination Facilities

Chemical containment vessels, packaged chemical delivery systems, residual meters, and various appurtenances necessary to convert a wellhead to chloramines on an emergency basis are readily available through a wide variety of sources such as USA Bluebook. We do not recommend that this equipment to be purchased in advance and stored unused, until a need arises. It is our opinion that these emergency facilities could be purchased and assembled very rapidly if a need is identified. In our design of permanent chloramination facilities at the four wellheads, we will include technical specifications for skid-mounted, packaged chemical delivery systems that District staff can use to quickly convert a well (such as Bevington) to chloramines in an emergency.

6.9 SCADA, Telemetry and Operation

Each well facility will be equipped with remote monitoring capabilities. The District will be able to monitor the settings of the chemical feed pumps and the chlorine residual from a remote location; however, pacing of the sodium hypochlorite and ammonia feed pumps will be accomplished manually. Adjustments to the metering pump stroke frequency and stroke length will be made at the metering pump local controls. The feed pumps will require regular adjustment based on measured values of the total chlorine residual, free chlorine residual, monochloramine residual, and free ammonia residual. The frequency of metering pump adjustment will depend on the consistency of the well flow rate, the consistency of the well water characteristics, and the drift in the pump set point.

A detailed discussion of controls and instrumentation at the well sites and at Booster Pump Station #2 is included in Chapter 8 (Technical Memorandum No 8).

6.10 Preliminary Opinion of Probable O&M Cost for Water Treatment at District Wells

Table 6-8 shows the estimated monthly chemical consumption at each well. This estimate was based on a chlorine dosing rate of 3.5 mg/l (as hypochlorite ion), and a 4:1 chlorine to ammonia ratio. Average reported well capacity was used, and monthly costs were based on a 30 day month.

Table 6-8. Average Monthly Chemical Usage

Location	Average Reported Production Rate (gpm/MGD)	Monthly 12.5% Sodium Hypochlorite Usage (Gallons)	Monthly Dry Ammonium Sulfate Usage (lbs)
Sundale	1000 / 1.4	1260	1290
Eureka	893 / 1.3	1140	1152
Via Concha	750 / 1.1	960	967
Blacklake #4	375 / 0.54	480	484
	Total	3840	3893

According to the District's chemical supplier (Brenntag Pacific, Inc.), the District currently pays $1.65/gallon for 12.5% sodium hypochlorite solution. Using this rate, the average monthly cost for hypochlorite would be approximately $6400 (based on continuous operation at average production rate).

According to Brenntag Pacific, Inc., dry ammonium sulfate is supplied on pallets at $.65/lb. Using the assumptions stated above, the average monthly cost for dry ammonium sulfate would be approximately $2,530/mo (based on continuous operation at average production rate).

Table 6-9. Estimated Average Monthly Chemical Costs at District Wells

Estimated Monthly Sodium Hypochlorite Costs (Based on $1.65/gal)	$6,400
Estimated Average Monthly Dry Ammonium Sulfate Costs (Based on $.65/lb)	$2,530
Total	$8,930

It is assumed that chloramination facilities will also be installed and operated at Booster Pump Station #2. Estimated O&M costs associated with water treatment at this site is discussed separately in Chapter 5.

7.0 BACKUP POWER, CONTROLS, AND INSTRUMENTATION

7.1 General

This chapter consists of Technical Memorandum No 8, which proposes requirements for electrical power, controls, and instrumentation for the pipeline, tank, pump station, and chloramination systems. The memorandum uses the recommendations of Technical Memoranda 3, 4, and 7 as a basis for design.

7.2 Pump Station/Reservoir Power

Utility power for the site will be from a new PG&E pad-mounted transformer and will be 480 volts, 3 phase. The transformer will feed a metering switchboard that will contain the PG&E revenue meters and facility main breaker. To permit PG&E access to their transformer and meters, the transformer and metering switchboard will be located outdoors near the property line with District access from the pump station site and PG&E access from the access road. The metering switchboard will be in a weatherproof enclosure with interior lights and space heaters.

The metering switchboard will feed a motor control center (MCC) within the pump station building. The MCC will include a main breaker, transient voltage surge suppressor, automatic transfer switch, variable frequency drives for pump motors, starters for building ventilation, breakers for chloramination equipment, and station transformer and panelboard for 120-volt loads. The MCC will have a NEMA 1 gasketed enclosure and will be a standard design of a major manufacturer such as Allen Bradley, Square D, or Cutler Hammer.

The automatic transfer switch transfers the station loads from utility to the on-site generator upon loss of utility power. It will have a time-delay neutral position which will de-energize all loads prior to connection to the other power source. This prevents a transfer from one live source to another live source that is out of sync which could cause damaging voltage transients. Alternative methods of preventing these transients, such as in-phase monitors and synchronous transfer switches, are more expensive and their additional complexity is not warranted. The transfer switch will also output a contact to each variable frequency drive (VFD) to ramp down on shutoff prior to transferring, thereby eliminating pipeline pressure surges. Other features of the transfer switch will include the manufacturer's standard features and will be in accordance with National Fire Protection Association (NFPA).

An on-site diesel generator will be provided for standby power. The generator will be sized to power all non-standby pumps (three of the four), all chloramination equipment, and all auxiliary equipment at the site. Estimated generator rating is 300 kw. The generator will be in a weatherproof enclosure. A separate aboveground, double containment fuel tank sized for 24 hours of normal demand operation will be provided adjacent to the generator. Because the site is in an industrial area and not within a mile of a school, a sound-attenuated enclosure and special emission controls will not be specified outside of local Air Pollution Control District requirements. No load bank will be provided because the pump motors should provide sufficient load to exercise the generator.

7.3 Pump Station Controls

The pumps will be controlled with VFDs to enable variable speed pumping. One VFD will be provided for each pump motor. VFDs were selected over other types of variable speed equipment because of their higher efficiency and high reliability.

The VFDs will not be equipped with a bypass starter for constant speed operation in case the VFD has failed. If a VFD does fail, the standby pump can be utilized. In addition, a complete set of spare VFD parts will be specified to minimize down time.

The VFDs will be specified to comply with the harmonic requirements of IEEE 519 so that excessive harmonics are not transmitted back to the PG&E grid. Specification will allow either 18-pulse inputs or harmonic filters with isolation contactors.

Safety features for pump or motor protection will be wired to the VFD in lieu of the SCADA system so that the safety features are active when in local manual control. Safety features will include a pump discharge high/low pressure switch and a motor winding high temperature switch.

The VFD will also power the motor space heaters when the motor is not running to prevent condensation within the motor. The motor will be specified as suitable for inverter duty.

The VFD will be specified to be a standard product from a major manufacturer such as Allen Bradley, ABB, Toshiba, Cutler Hammer, or Square D.

7.4 Pump Station Security Lighting

High-pressure sodium wall-pack lights will be provided above each building door and will be controlled by a photoelectric cell.

Approximately three pole-mounted high-pressure sodium floodlights (similar to street lights) will be provided for area lighting. One floodlight at the facility entry will be controlled from the building photoelectric cell and the other floodlights will be controlled from a manual switch within the building. No motion sensor switched lights are proposed for immediate use. Conduit runs for future lighting installation flexibility are recommended.

7.5 Pump Station Security

No closed-circuit television (CCTV) or perimeter detection systems are proposed for immediate use. Conduit runs for potential future security installations are recommended. Each building door and the metering switchboard doors will be monitored with intrusion switches and connected to the SCADA system.

7.6 Pressure-Reducing Stations (PRVs)

A low-profile combination meter and SCADA panel will be provided at each PRV site. PG&E service of 120/240 volts will be provided. No provisions for standby power will be provided, with the exception of the backup battery for SCADA. Pedestal will be by Tesco or equal.

7.7 Chloramination System Monitoring and Control

7.7.1 Well Sites

The sodium hypochlorite and the ammonia feed pumps will be ratio paced on the well discharge flow. The operator will enter the desired ratio between well flow and chlorine feed in the programmable logic controller (PLC). The PLC will automatically adjust the feed of the chemical feed pumps to maintain the ratio between the well flow to chlorine feed . Hach CL-17 Chlorine residual analyzers will be utilized to measure Total chlorine and Free chlorine at each well site. The chlorine residual signals will be monitored by the PLC and sent to the SCADA computer system. The PLC will compute and record the Combined Chlorine (Chloramine) level as follows; Total Chlorine – Free Chlorine = Combined Chlorine. The SCADA system will monitor and alarm these water quality signals.

7.7.2 Booster Pump Station Site

The sodium hypochlorite feed pump will be paced on the pump station discharge flow and trimmed based on the total chlorine residual using a compound control loop system. The pump station programmable logic controller (PLC) will be programmed to provide the compound control loop and output a 4-20ma signal to control the speed of the chlorine feed pump.

A Hach CL-17 Total Chlorine residual analyzer will be utilized to measure Total chlorine and Free chlorine at the booster pump station site. The chlorine residual signals will be monitored by the PLC and sent to the SCADA computer system. The PLC will compute and record the Combined Chlorine (Chloramine) level as follows; Total Chlorine – Free Chlorine = Combined Chlorine. The SCADA system will monitor and alarm these water quality signals.

The operator will decide when ammonia feed is required based on the computed chloramine level. When it is decided that ammonia feed is required, the operator will allow the ammonia feed pump to run. The feed pump will be ratio paced on the booster discharge flow. The operator will enter the desired ratio between booster pump flow and ammonia feed in the programmable logic controller (PLC). The PLC will automatically adjust the speed of the chemical feed pump to maintain the ratio between the booster pump flow and ammonia feed.

7.8 Controls and Instrumentation

The District presently utilizes iPAAC Supervisory Control and Data Acquisition (SCADA) System for monitoring and controlling the Districts' water and wastewater systems. Our understanding is the iPAAC system is a Web based application provided by a remote access system provider.

Additionally, the District utilizes two models of Automation Direct Remote Terminal Units (RTU) at each remote site. The Direct Logic 06 model for monitoring and control requirements and the Direct Logic 05 model to provide a means to communicate with the iPAAC system and the MDS radios.

The District is in the process of finalizing the SCADA system upgrade requirements for future implementation. A radio survey should be performed for the new project sites (flow meter, PRVs, and booster station). The Waterline Intertie Project control and instrumentation system will be designed with the capability to interface to the new SCADA System Upgrade package. The instrumentation and control system subcontractor, as part of Bid Package 4 will closely review the above requirements and provide the appropriate design features to satisfy those constraints.

The Direct Logic 06 PLC will be utilized at the Booster Pump Station and the five PRV sites for monitoring and control purposes. It is anticipated that the Booster Pump Station will be controlled to maintain the level of the 0.5 million gallon storage tank. Level and pressure transmitter equipment will be provided to match District standards. Magnetic flow meters will be provided at the sites requiring flow monitoring. We will specify the Direct Logic PLC systems to be provided with a 12 hour battery back-up Uninterruptable Power Supply (UPS). The PLC will also be specified to be provided with an Operator Interface Terminal (OIT) (Panelview or equal) at Booster Pump Station site. The OIT will be specified with sufficient memory to store a minimum of 72 hours each of three analog values (pressure, flow, level) for trending displays on the OIT. The chloramination systems at the four well sites (see Chapter 6) and at the booster pump station (see Chapter 5) will incorporate a control panel for local control of the feed systems and for sending and receiving alarms and control signals to the PLC at the District's Southland office.

Communication between the remote sites and NCSD Southland office will be via radio communication utilizing the District's current unlicensed 900 MHz radio frequency and MDS INET radios. A radio path analysis is required for the booster pump station and PRV sites to verify line of site communication between the remote sites and the District's Standpipe, which then relays the signal to the Southland office. This will be provided by the SCADA Upgrade design engineering firm. It is also our understanding that the Quad Tanks are utilized as a radio repeater site and a backup access point. Additionally, radio communication is required from the Santa Maria flow meter site to the District's Southland Operations center possibly routed via the Booster Pump Station site. This will be verified by the SCADA Upgrade design engineer.

The flow from the Santa Maria connection to the ½ million gallon tank requires having flow control features. Our plan is to provide a hydraulically controlled valve (Cla-Val Model 631 or equal) at the tank site. The valve will be furnished with solenoid valves that will give the District the ability control the valve locally from the PLC or remotely from the SCADA computer. The PLC will be programmed to maintain an operator entered flow set point and will pulse the open/close solenoid valves to maintain the desired flow. The magnetic flow meter monitoring flow into the tank will provide the flow feedback to the PLC flow control loop. A separate flow orifice plate will not be required to be furnished with the Cla-Val, since the magnetic flow meter provides the required flow signal used for flow control.

8.0 PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

This opinion of probable construction cost represents judgment as a design professional and is supplied for the general guidance of the District. Since AECOM has no control over the cost of labor and materials, over delays in project bidding or award, over competitive bidding or market conditions, AECOM does not guarantee the accuracy of such opinions as compared to contractor bids or actual cost to the District. Refinements to this preliminary opinion of cost will be provided with subsequent design package submittals. The project cost opinion for construction, design, and other applicable costs are summarized in Table 8-1, below, and compared to the cost opinion from the May 2008 Preliminary Engineering Memorandum. As recommended in Chapter 2, it is anticipated that the project will be split into four bid packages for construction. More detailed construction cost tables are included for each bid package in the following pages.

Table 8.1 – Opinion of Probable Project Costs

Item	Description	Budgeted Amount May 2008 Preliminary Engineering Memo.		Updated Amount 22-Apr-09 Concept Design Report	
1	Mobilization	$580,000		$607,000	
2	Blosser Extension (18-in)	$1,247,000		$1,129,000	-
3	Pump Station No. 1 turnout & meter (Blosser Rd)	$61,000		$158,000	
4	River Crossing (24-in HDD & levee jack & bore)	$6,135,000		$5,462,500	
5	24-in Pipeline to Joshua	$656,000		$400,000	
6	Reservoir (0.5-MG)	$1,361,000		$1,365,000	
7	Pump Station No. 2	$603,000		$1,572,500	
8	Pressure Regulators (200 homes)	$30,000		--	
9	Pressure Reducing Valve Stations	$18,000		$243,000	
10	Chloramination (Joshua & 5 wellheads)	$707,000		$739,500	
11	Upgrade Southland to 12-in	$799,500	(1)	$849,000	(7)
12	Upgrade Frontage to 12-in	$1,101,300	(1)	$957,000	(7)
13	Upgrade Orchard to 12-in	$509,000		$1,103,500	(8)
14	Upgrade Division to 10-in between Allegre and Meridian (6)	$53,000		--	
15	Oakglen Avenue 12-in main (5)	--		$457,000	
16	Darby Lane 12-in main (5)	--		$153,000	
17	HWY 101 Bore & Jack (5)	--		$241,000	
18	Isolation Valves (5)	--		$12,000	
19	Pump Station All Weather Access Road	--		$128,000	
	Construction Subtotal	**$13,860,800**		**$15,577,000**	
20	Contingency	$3,643,000		$3,115,400	(10)
	Construction Subtotal + Contingency	**$17,503,800**		**$18,692,400**	
21	Property Allowance	*not included*	(4)	$500,000	(4)
22	Design-Phase Engineering				
	Original Agreement (July 2008)			$744,993	
	Budget Revision 1 - Pressure Reduction			$132,798	
	Budget Revision 2 - Biological Survey for HDD			$4,050	
	Budget Revision 3 - Modeling for GSW/Woodlands Turnouts			$8,380	
	Budget Revision 4 - Additional Survey Services			$9,900	
23	Office Engineering during construction			$175,837	
24	Estimated Construction Management (3)	$2,428,000	(2)	$1,507,170	(9)
25	Permitting Fees To Date	--		$1,573	
26	Non-Final Design Funds Spent To Date	*not included*		$1,402,879	(11)
27	Estimated Other Costs (Assessment, etc)	*not included*		$415,420	(11)
	PROJECT TOTAL (Rounded to 1000)	**$19,932,000**		**$23,596,000**	

Table 8.1 Notes:

ENR CCI: March 2008 = 8109; March 2009 = 8534

(1) Costs are from the December 2007 Water and Sewer Master Plan (Cannon).

(2) Engineering and Construction Management were originally presented as a "lump sum" amount

(3) Includes material testing, construction staking, and environmental monitoring

(4) Estimate only. Item not included in previous construction cost opinions, but was added to the Concept Design Report to provide a complete assessment of anticipated project costs.

(5) These work items were added to relieve high pressures on Mesa as an alternative to service pressure regulating valves (See Tech Memo 9). One PRV station at Maria Vista was required initially. Four are recommended for revised project. This was design Budget Revision #1.

(6) Based on review of record drawings, this pipeline is already a 10-in main

(7) Initial estimate incorporated Master Plan project costs. Revised estimate includes higher unit costs to reflect paving 1 traffic lane, per County standards

(8) Updated unit costs include higher costs to reflect paving 1 traffic lane, per County standards

(9) To be provided by CM team - Has not been revised to reflect additional work for construction management of Oakglen, Darby, and Orchard extensions.

(10) Contingency was modified to 20% which is more appropriate for 30% design phase.

(11) Provided by District staff.

not included = Item was not included in previous construction cost opinions, but was added into the Concept Design Report to provide a complete assessment of anticipated project costs.

Table 8-2. Bid Package 1: Santa Maria River Crossing

Item	Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$210,000	$210,000
2	Sheeting and Shoring	1	LS	$50,000	$50,000
3	24-inch CL 250 DIP Pipeline Open Trench (Deep)	290	LF	$650	$188,500
4	24-inch Fusion-welded HDPE DR-9 Carrier Pipeline including HDD bore	2,670	LF	$1,500	$4,005,000
5	42" Minimum Diameter Surface Steel Casing at HDD Entry Point	200	LF	$1,000	$200,000
6	Combination Air/Vacuum Valve at HDD Exit (Mesa)	1	LS	$15,000	$15,000
7	Site Restoration (Grading/Earthwork Only)	1	LS	$25,000	$25,000
8	Provide necessary permits and temporary fencing around laydown/work areas	1	LS	$50,000	$50,000
9	Traffic Control During HDPE laydown and buildup	1	LS	$25,000	$25,000
10	Pressure Test and Disinfection	1	LS	$15,000	$15,000
11	Allowance for Environmental Mitigation Measures	1	LS	$100,000	$100,000
	Sub Total				$4,884,000
	Contingency	20%			$977,000
	Total				**$5,861,000**

Table 8-3. Bid Package 2: NCSD Pipeline Improvements

Item	Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$123,000	$123,000
2	Traffic Control and Regulation	1	LS	$189,000	$189,000
3	Sheeting and Shoring	1	LS	$245,000	$245,000
4	12-in CL 200 PVC Water Main & Appurtenances	16,300	LF	$131	$2,132,000
5	Hwy 101 Crossing from Frontage Rd to Darby Ln.	250	LF	$964	$241,000
6	Asphalt Pavement Removal & Restoration	81,500	SF	$9	$751,000
7	2.5-in Blow-offs	19	EA	$2,660	$51,000
8	1-in Combination Air / Vacuum Release Valves	19	EA	$3,192	$61,000
9	12-in Gate Valves	42	EA	$3,625	$153,000
10	Pressure-Reducing Valve Stations	5	EA	$50,958	$255,000
11	Sampling Stations	2	EA	$2,400	$5,000
	Sub Total				$4,206,000
	Contingency	20%			$841,000
	Total				**$5,047,000**

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Table 8-4. Bid Package 3: Blosser Road Water Main and Flow Meter

Item	Description	Quantity	Unit	Unit Price	Amount
1	Mobilization		LS	$58,000	$58,000
2	Traffic Control and Regulation	1	LS	$37,000	$37,000
3	Sheeting and Shoring	1	LS	$78,000	$78,000
4	18-in CL 250 DIP Water Main and Appurtenances	5,200	LF	$145	$753,000
5	Concrete Asphalt Pavement Removal and Restoration	26,000	SF	$9	$234,000
6	Flow Metering Station	1	EA	$106,000	$106,000
7	1.5-in Blow-offs	6	EA	$2,000	$12,000
8	2-in Combination Air / Vacuum Release Valves	6	EA	$2,400	$15,000
9	18-in Butterfly Valves	13	EA	$4,000	$52,000
10	Jack & Bore under the levee - install 36-in steel casing & 24-in DI carrier pipe	220	LF	$1,085	$239,000
11	24-in CL 250 DIP Watermain (Deep Trench)	770	LF	$650	$501,000
	Sub Total				$2,085,000
	Contingency	20%			$417,000
	Total				**$2,502,000**

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Table 8-5. Bid Package 4: Pump Station and Reservoir and Chloramination Systems

Item	Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$207,000	$207,000
2	Booster Station Site Clearing, Stripping, Grubbing	25,000	SF	$3	$75,000
3	Protection and Restoration of Farmland	19,000	CY	$6	$114,000
4	Sheeting and Shoring	1	LS	$25,000	$25,000
5	24-in CL 250 DIP Watermain (Deep Trench)	75	LF	$650	$49,000
6	24-in CL 250 DIP Watermain (Normal Trench)	1,700	LF	$235	$400,000
7	24-in Gate Valve	3	EA	$6,500	$20,000
8	General Site Earthwork, Excavation and Non-structural Backfill	1	LS	$85,000	$85,000
9	Partially Buried Prestressed Concrete Tank (includes 15% Contractor Markup)	500,000	GAL	$2.0	$1,000,000
10	Reservoir Foundations and Subgrade Preparation	1	EA	$50,000	$50,000
11	Reservoir Structural Backfill	3,865	CY	$40	$155,000
12	Reservoir Appurtenances	1	EA	$46,000	$46,000
13	Site Piping, FCV Vault, and Appurtenances	1	LS	$284,000	$284,000
14	Pumps (100-HP, vertical turbine "barrel" pump, w/ can)	4	EA	$85,000	$340,000
15	100-HP Variable Frequency Drives	4	EA	$30,000	$120,000
16	Piping, Valves, Mag Meter & Appurtenances	1	LS	$95,000	$95,000
17	Site Paving	1,500	SF	$9	$14,000
18	Surge Control System	1	LS	$75,000	$75,000
19	Pump Station Building	1	LS	$378,360	$379,000
20	Electrical, Emergency Generator, Switchgear	1	LS	$175,000	$175,000
21	SCADA	1	LS	$45,000	$45,000
22	Visual Screening	1	LS	$30,000	$30,000
23	Wellhead Chloramination Systems	4	LS	$87,500	$350,000
24	Pump Station Chloramination System	1	LS	$200,000	$200,000
25	10-ft Wide All Weather Access Road	1,700	LF	$75	$128,000
	Sub Total				$4,461,000
	Contingency	20%			$892,000
	Total				**$5,353,000**

9.0 FRONTAGE ROAD SEWER REPLACEMENT

9.1 Introduction

The Draft Technical Memorandum No 10 – Frontage Road Sewer Replacement was submitted for Task 1 of the Frontage Road Sewer Replacement Project. This Chapter consists of a revised Draft Technical Memorandum based on comments received from the District staff, the Peer Reviewers, and the Construction Management Team. The Draft Technical Memorandum describes the preliminary design for the Frontage Road Sewer Replacement from the Southland WWTF to the intersection of Frontage Road and Division Street. The length of influent trunk main that continues onto the WWTF property to the influent lift station was to be upgraded as part of the Southland WWTF Upgrades Project. However, the District is considering combining the Frontage Road Sewer Upgrades into one construction set in order to expedite design and construction and reduce construction mobilization costs. Should this occur, the Frontage Road Sewer Upgrade alignment from Division Street to the Southland WWTF influent lift station will be included with the 60% design submittal.

This Chapter will define the proposed alignment, identify potential challenges, and summarize preliminary pipeline and manhole design parameters such as design flow, diameter, length, material, and depth. The 30% plans (included as Volume 3 of this Report) present many of these elements. Potential challenges pertaining to water main improvements, conflicting utilities, connections to the existing system, and maintaining sewer service during construction are considered.

9.2 Background

The Southland Wastewater Treatment Facility (WWTF) Master Plan (AECOM, 2009) recommended that the District upgrade the existing 12-inch Frontage Road sewer main between the WWTF and Division Street, consistent with the Water and Sewer Master Plan Update (Cannon, 2007). The District authorized AECOM to prepare construction documents for the Frontage Road Sewer Main Replacement Project in conjunction with design of Nipomo System Pipeline Improvements on Frontage Road (part of the NCSD Waterline Intertie Project).

9.3 Flow Projection and Hydraulic Capacity

An analysis of hydraulic capacity was performed for the existing Frontage Road sewer main from Division Street to the WWTF as part of the Southland WWTF Master Plan (AECOM, 2009). Wastewater flow in the existing Frontage Road sewer main was approximated between the WWTF and Division Street by counting the number of dwelling units served by the main and applying a per-dwelling unit flow factor. The flow was then divided between three tributary mains along the Frontage Road sewer (the tributary mains are located at Southland, Story Street, and Division Street). Current and projected flows for the resulting three segments of the Frontage Road main are summarized in Table 9-1.

Table 9-1. Southland WWTF Master Plan Update Frontage Road Estimated Flow Rates

Frontage Road Trunk Main Segment	Current Estimated Flow*		Projected Future Flow (2030)*	
	Average Annual Flow (AAF)	Peak Hour Flow (PHF)	Future AAF	Future PHF
Division to Story:	0.39 mgd	1.17 mgd	1.09 mgd	3.25 mgd
Story to Southland:	0.57 mgd	1.71 mgd	1.59 mgd	4.75 mgd
Southland to WWTF:	0.60 mgd	1.80 mgd	1.67 mgd	5.00 mgd

* Southland WWTF Master Plan (AECOM, 2009) hydraulic analysis, Figures 5-2 and 5-4.

The hydraulic analysis indicates current peak flow conditions may exceed design capacity in multiple segments of the trunk main and that projected 2030 peak flows would exceed capacity of the majority of the trunk main.

The Frontage Road trunk main was also recommended for upgrade in the 2007 Water and Wastewater Master Plan Update (WWMP, Cannon Associates). In the WWMP, neither current nor projected future wastewater loads were provided for individual tributary areas.

9.3.1 Design Flows

The proposed sewer upgrade is designed to accommodate build-out (2030) peak and average flow conditions presented in the Southland WWTF Master Plan. Assumptions from the WWTF Master Plan were applied to distribute flow from mains connecting to the Frontage Road main (Table 9-1).

9.3.2 Hydraulic Capacity and Pipe Sizing

Pipe diameter was determined based on design flows and according to District design standards for gravity sewer, as summarized in Table 9-2.

Table 9-2. Summary of NCSD Design Standards for Gravity Sewer

Design Parameter	Value
Manning roughness coefficient	n = 0.011 for plastic pipe
Peaking factor	3.0
Peak flow maximum design depth, d/ D	< 15-inch diameter, $d/D_{max} = 0.50$ ≥ 15-inch diameter, $d/D_{max} = 0.75$
Minimum slope	8-inch diameter 0.0035 ft/ft 10-inch 0.0025 ft/ft 12-inch 0.0020 ft/ft 15-inch 0.0015 ft/ft 18-inch 0.0012 ft/ft 21-inch 0.0010 ft/ft

Pipeline diameters of 18 and 21-inches were analyzed for the proposed Frontage Road sewer replacement alignment using the design flows presented in Table 9-1. The Manning roughness coefficient for plastic pipe (n = 0.011) was used in the analysis. Slopes of the replacement sewer range from 0.005 to 0.009 ft/ft. Table 10-3 summarizes the pipe flow depth to pipe diameter ratio (d/D) for 18 and 21-inch diameter sewers as calculated using Manning's Equation for open channel flow. Detailed calculations are included as Appendix E.

Table 9-3. Summary of Depth to Diameter Ratios for 18-inch and 21-inch Pipeline Diameters

		Current flow conditions		Buildout flow conditions	
		AAF	**PHF**	**Average Flow**	**Peak Flow**
18" PVC	d/D	0.2	0.37	0.36	*0.70* [a]
21" PVC	d/D	0.16	0.29	0.27	0.52

(a) Near design limit d/D of 0.75—not recommended.

AECOM recommends construction of a 21-inch PVC sewer for the Frontage Road sewer main replacement to accommodate current and projected peak flows and allow a factor of safety to account for inherent uncertainty in long range sewer flow projections[10]. The 21-inch sewer will provide adequate capacity for buildout and sufficient performance at current flow rates. Hydraulic parameters for the proposed 21-inch PVC sewer upgrade are tabulated in Appendix E. Velocities at current minimum flow conditions (0.3 x $Q_{ave.}$) were also evaluated to confirm sufficient velocity.

[10] Although calculations show that an 18-inch diameter replacement sewer would meet the peak flow design standard (d/D < 0.75), 21-inch diameter pipe is recommended because an 18-inch diameter sewer would be near design capacity at future peak flow conditions, and an increase in flow of 7% would exceed the design peak hour flow maximum depth-to-diameter criteria.

9.4 Pipeline Design

The following project elements and criteria were considered in design of the replacement sewer main on Frontage Road and are discussed in the following sections in further detail.

- Connection to the existing Southland WWTF influent main
- Connection to the existing 12" main at Division Street
- Tie-in to existing "side" gravity mains
- Geotechnical recommendations
- Standards for pipeline materials and separation requirements from underground utilities
- Construction phasing and Waterline Intertie Project improvements on Frontage Road

Open trench construction is recommended for the sewer replacement. Pipe reaming was considered but not recommended for the Frontage Road sewer replacement (see Section 9.11).

9.4.1 Connection to the Southland WWTF Influent Main

Connection to the WWTF influent main at the manhole immediately north of the WWTF (Sheet 1816 MH 2) is planned for the Frontage Road sewer replacement. Connection at this location will require temporary bypass of the 8-inch Southland Street main and a short section of the existing 12-inch Frontage Road main. The replacement sewer alignment encroaches on the drip line of the existing tree near the proposed connection manhole (#1816-2).

The Southland WWTF Master Plan (ibid) recommended increasing capacity of the Southland WWTF influent main, from Southland Street to the WWTF influent lift station. AECOM recommends incorporating improvement of the Southland WWTF influent main with the Frontage Road Sewer Replacement Project since there is potential for construction cost savings. The recommended alignment for the replacement influent main would cross the WWTF yard/ parking area and continue toward the headworks near the existing detention basin and drainage swale before converging on the existing alignment north of the headworks. This alternative influent trunk main alignment would increase separation from the 16-inch high pressure gas main located north-east of the WWTP, and would allow the existing influent main to remain in operation during construction, reducing the need for bypass pumping. For this alignment, the connection between the Frontage Road replacement sewer and the improved influent main would be made with a new manhole installed near manhole #1816-2, and would not require trenching within the drip line of the existing tree. Additional survey data for the WWTF and influent manholes, and geotechnical evaluation would be needed for design of influent main improvements.

9.4.2 Connection to existing 12-inch Frontage Road Main near Division Street

The replacement Frontage Road sewer is designed to extend to Division Street where a connection will be made at manhole #1915-3. A new precast manhole channeled for straight-through and branched flow will be installed on the new 21-inch sewer in the intersection of Division and Frontage. The new branched manhole will accept flow from existing manhole #1915-3 and will be installed with a stub upstream in anticipation of future upgrade to the sewer, along the path of the replacement alignment (see plan sheet C-138). The existing manhole #1915-3 will be cored and rechanneled to direct flow into the new manhole.

9.4.3 Connection to Mains and Laterals

Existing side gravity sewer mains and service laterals connecting to the 12-inch Frontage Road sewer main will be connected to the replacement sewer main. The following side main line connections are anticipated and will be shown in construction plans:

- Southland Street main
- Side-street main serving the business park at Story Street
- Story Street mains (approaching from east and west)
- Margie Place main
- Division Street main

These existing mains determine the locations and invert elevations of tie-in manholes along the replacement alignment. Approximate slopes for side mains were assumed based on information in District as-built drawings and were used to estimate maximum invert elevations on the new alignment. The need for additional surveying is not currently anticipated since intermediate manholes are being used; however, the need for additional surveying will be evaluated as the design progresses to the 60% level.

Reconnection of side mains is proposed via installation of new intermediate manholes. Short, temporary sewage bypasses would be necessary during each main connection. An alternative to constructing an intermediate manhole for each side main reconnection is to extend the existing side main with an inline coupling, however this would only be feasible if the slope of the existing main can be maintained to match the crown of the new 21-inch sewer. Its assumed all connections will be made with intermediate manholes.

A video inspection should be performed and reviewed to determine if there are additional lateral connections. AECOM recommends that the video inspection be performed during the design phase to reduce the potential for change orders during the construction phase. AECOM will coordinate this with the District.

9.4.4 Geotechnical Design Recommendations

The Geotechnical Report by prepared by Fugro (March, 2009) presents soil parameters and recommendations for pipeline design. Geotechnical findings pertaining to improvements planned for Frontage Road are summarized in the following paragraphs.

Based on the subsurface conditions encountered during the geotechnical evaluation, the majority of the on-site soil should not be considered suitable for use as pipe bedding or backfill to at least 12 inches above the top of the pipe but may be used for compacted backfill higher than 12 inches above the top of the pipe. The excavated materials can likely be used for compacted fill or trench backfill material. Moisture conditioning of the soils and control of compaction layer thickness will be needed to achieve the recommended compaction. The soils encountered within the anticipated depth of excavation are expected to consist of sandy soils. Onsite soils can likely be excavated with conventional backhoe or excavator type equipment typically used for pipeline construction. Vertical cuts in sandy soils should not be considered stable unless properly shored or sloped in accordance with the requirements of OSHA. Temporary slopes and shoring will need to comply with OSHA requirements.

Artificial fill and dune sand deposits were encountered along the pipeline alignment and generally consist of asphalt concrete, base materials, very loose to very dense sand, and local soft to stiff silt. Groundwater was encountered in boring B-102 (At Grande Avenue, approximately 1,200 ft north of the proposed replacement sewer, near the proposed) at a depth of approximately 27.5 feet below the existing ground surface. Groundwater encountered at B-102 is below the anticipated sewer pipeline depths. Groundwater was not encountered in boring B-103 (Frontage Road, near Story Street). Various concrete, rubble, and unidentified buried objects were encountered along the alignment below the asphalt pavement. The soils report states that the trench subgrade may need to be moisture conditioned and compacted prior to placing bedding material for the pipe. This recommendation will be incorporated into the plans as an additive bid item.

9.4.5 Pipe Material

Solid wall bell and spigot PVC is recommended for sewer main improvements on Frontage Road. The light weight of PVC sewer pipe allows easier open-trench installation compared to vitrified clay or reinforced concrete pipe, and PVC has minimal potential for hydrogen sulfide corrosion. Closed wall PVC pipe is not recommended due to potential for creep under load and greater effort required for trench design and inspection. Closed wall PVC is generally more expensive than solid wall PVC pipe of the same diameter.

AECOM anticipates solid wall PS 46 PVC (ASTM F679) pipe will adequately support trench and vehicular loads on the proposed pipeline. Pipe loads are discussed in Section 9.9.

9.4.6 Manholes

Depths of replacement manholes range from 11 to 20 ft below existing grade. Precast 60-inch I.D. manholes with 24-inch diameter (nominal) covers and grade rings are planned for the replacement sewer. Manhole base thickness will depend on site-specific conditions but will not be less than 9 inches. To account for energy losses and prevent stagnant conditions in manholes, the flow line will drop 0.1 feet across each manhole, invert to invert.

The sewer manhole interiors will be lined with either an epoxy or polyurethane coating system in conformance with District Standards. Sewer manhole frames and covers will also conform to District standards.

Six of the twelve proposed manholes on the replacement sewer alignment will serve as side sewer main tie-in points. As noted in Section 9.4.3, it is assumed that one intermediate manhole will be needed at each of the six tie-in locations, to allow for a change in slope for each of the approaching side mains.

9.4.7 Pipe Loads

The pipeline will be designed to resist loads resulting from the trench backfill and applicable surface loads (i.e. vehicular live loads). The magnitude of the load supported by the pipe depends on the depth of backfill, width of trench, unit weight of backfill soil, and frictional characteristics of backfill material. Design procedures outlined in the AWWA M23 Manual (PVC Pipe - Design) will be followed for evaluating flexible pipe trench loads and horizontal pipe deflection. Based on the Geotechnical Report prepared by Fugro (March, 2009) and preliminary calculations, solid-wall PS 46 PVC pipe is expected to adequately support loads. Pipe loads will be analyzed in detail prior to the 60% submittal.

9.4.8 Alignment/ Utilities

The proposed alignment of the Frontage Road replacement sewer main has been designed to minimize potential for conflicts with known underground utilities, provide space for future water pipeline improvements (Waterline Intertie Project 12-inch PVC water main), and maximize separation from existing water mains and valves. Minimum separation between the installed 21-inch sewer and the 16-inch high pressure gas main will be approximately 12 feet. No less than 8.5 feet of separation from the gas main should be maintained throughout construction activities (including manhole excavations). A minimum of 1 foot of vertical clearance will be provided between the sewer and utility crossings. California Department of Public Health (CDPH) pipeline separation criteria between existing water and sewer will be maintained where possible. Special construction measures will be specified where separation criteria can not be met. The Contractor will be responsible for confirming locations of existing utilities and protecting utilities in-place (in conformance with the respective utility's requirements).

The greatest potential for utilities conflicts are at locations where side main tie-ins and installation of connection manholes are planned. Connection of existing mains to the new sewer main may require progressive abandonment of the existing 12-inch sewer, allowing downstream mains to remain in operation while the upstream side main is connected to the new sewer. An existing storm drain crossing near Station 5011+17 should be investigated to confirm depth near on the Frontage Road replacement sewer alignment. AECOM recommends subsurface utilities exploration (potholing) for the storm drain crossing near Margie Place is performed during design phase to reduce the potential for change orders during construction. AECOM will coordinate this with the District.

9.4.9 Consideration of Pipe Reaming for Sewer Replacement

Pipe reaming is a trenchless method for replacing existing pipes using a modified back-reaming directional drilling method. Pipe reaming typically involves the insertion of a pilot line into the existing pipe, connecting a special reaming tool, then pulling the reaming head through the existing pipe. The reaming head grinds the existing pipe and simultaneous installs a replacement pipe behind the head. The ground pipe and other material are rejected in a drilling slurry. Metal fittings on the existing pipe or buried material near the pipe zone that cannot be ground are significant obstacles for pipe reaming.

Sufficient area is available for relocation of the Frontage Road sewer with minimal anticipated conflicts along the new alignment. Relocation of the sewer improves separation from the existing water mains and service valves along Frontage Road and allows continued operation of the existing 12-inch sewer while the replacement sewer is constructed. Finally, the significantly larger replacement sewer diameter (up-sizing) and inability of the pipe reaming method to match existing invert elevations at the proposed tie-in points may add further complexity to design and construction of the Frontage Road sewer upgrade. Therefore trenchless construction is not recommended for this project.

9.5 Construction Phasing and Waterline Intertie Improvements

The Waterline Intertie Project improvements on Frontage Road include a 12-inch water main near the alignment of the existing 12-inch sewer. The proposed Frontage Road replacement sewer main will be constructed along a new alignment approximately 16 feet east of the existing 12-inch sewer. This parallel alignment will allow the existing 12-inch sewer main to remain in operation during construction, thereby reducing the need for long duration bypass pumping, associated risk and project costs. Once the 21-inch replacement sewer is installed and tested, bypass pumping will be required to construct the tie-ins near the WWTF and at Division Street. Following connection of the replacement sewer, temporary diversion and/ or bypass pumping could be used for connecting side sewer mains and laterals, starting at Division Street and working downstream toward the WWTF. As connections are made, the 12-inch sewer will be abandoned in place. Once the existing 12-inch sewer and existing manholes are abandoned, waterline improvements could then be constructed on the proposed WIP alignment.

In summary, the following phasing is anticipated:

1. Construct the of 21-inch Frontage Road replacement sewer main while maintaining flow in the existing 12-inch sewer main

2. Connect the 21-inch sewer at the WWTF and Division Street

3. Connect side mains and lateral(s) and progressively abandon existing 12" sewer main

4. Install Waterline Intertie 12-inch potable water main

Sewer bypasses should be coordinated with project traffic control and will be the responsibility of the Contractor. A technical specification for temporary sewage bypass will be included in construction documents to specify the minimum requirements including anticipated flows and Contractor responsibilities. The technical specification will require the Contractor to submit a sewage bypass plan for District review/ approval.

It is assumed the contractor will be responsible for preparing and submitting traffic control plans along Frontage Road and on side streets, as necessary, for main connections and other construction activities.

9.6 Coordination with Southland WWTF Upgrades

Since the District is initiating design of the Southland WWTF with AECOM as the design engineer, there is an opportunity to reduce construction cost by packaging the planned WWTF influent sewer upgrade with the Frontage Road Sewer Replacement Project. As described in this memorandum, the current Frontage Road sewer replacement will end just outside the Southland WWTF. A contractor selected for the Southland WWTF upgrade project would begin construction of the influent main upgrade from that point. Due to the similar type of construction, necessary equipment and construction materials, obtaining a single contractor for the Frontage Road Sewer Replacement Project and the WWTF influent sewer main upgrade is expected to reduce net construction cost. Depending on the timeline for the Southland WWTF Upgrade Project, scheduling conflicts pertaining to construction of the influent sewer could also arise between contractors for the separate construction projects. AECOM will discuss combining the Frontage Road sewer replacement and the WWTF influent main upgrade further with the District. Although additional surveying and geotechnical evaluation will be necessary prior to initiating design of WWTF influent main improvements, incorporating design of the influent sewer man with the Frontage Road Sewer replacement is not expected to impact the WIP schedule.

9.7 Preliminary Plans and Technical Specifications

Preliminary drawings (30% planset) showing plan and profile views of the proposed 21-inch sewer replacement are included in Volume 3 of this Report. An outline of Technical Specifications is included in Appendix F.

9.8 Opinion of Probable Construction Cost

This opinion of probable construction cost represents judgment as a design professional and is supplied for the general guidance of the District. Since AECOM has no control over the cost of labor and materials, over delays in project bidding or award, over competitive bidding or market conditions, AECOM does not guarantee the accuracy of such opinions as compared to contractor bids or actual cost to the District. Refinements to this preliminary opinion of cost will be provided with subsequent design package submittals. The project construction cost opinion is summarized in Table 9-4, below.

Table 9-4. FRONTAGE ROAD REPLACEMENT

Item	Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$23,750	$23,750
2	Traffic Control and Regulation	1	LS	$45,000	$45,000
3	Sheeting and Shoring	1	LS	$80,000	$80,000
4	Asphalt Pavement Removal & Restoration	17,050	SF	$9	$157,000
5	Furnish and install 21-inch PS 46 PVC sewer	3,100	LF	$192	$594,000
6	Furnish and install 60" sewer manhole (15 - 20 ft deep)	6	EA	$12,000	$72,000
7	Furnish and install 60" sewer manhole (10 - 14 ft deep)	5	EA	$10,000	$50,000
8	Abandon existing 12-inch sewer and remove MHs	1	LS	$30,000	$30,000
9	Connect 21-inch sewer to existing MH at Division	1	LS	$7,000	$7,000
10	Temporary sewage bypass	1	LS	$60,000	$60,000
11	Remake 8" SDR 35 Sewer lateral	1	EA	$3,000	$3,000
12	Sewer main replacement (8" SDR 35 PVC)	90	LF	$175	$15,750
13	Sewer main replacement (12" SDR 35 PVC)	30	LF	$200	$6,000
14	Connect side mains	6	EA	$3,500	$21,000
15	Pre-cast 48" sewer manhole (10 - 14 ft deep)	4	EA	$8,000	$32,000
Additive Bid Items					
A1	Scarify, condition, compact trench subgrade for 21-in Sewer	3,300	LF	$13	$43,000
	Sub Total				$1,239,500
	Contingency	20%			$247,900
	Total				**$1,488,000**

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Nipomo Waterline Intertie Project

CONCEPT DESIGN REPORT APPENDICES

Volume 2 of 3

April 2009

AECOM

Nipomo Waterline Intertie Project

Concept Design Report Appendices
Volume 2 of 3

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District Engineer	Peter Sevcik, PE
Utilities Superintendent	Tina Grietens

Nipomo Community Community Services District

Board of Directors

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Appendix A
Technical Memorandum #9: System Pressure Reduction Study

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Memorandum

Date:	September 23, 2008
To:	Peter Sevcik, PE
	Bruce Buel, General Manager
From:	Josh Reynolds, PE
	Eileen Shields, EIT
Subject:	NCSD Waterline Intertie Project Technical Memorandum No. 9: System Pressure Reduction Study

Introduction

The Waterline Intertie Project Preliminary Engineering Memorandum (PEM) (Boyle, May 2008) evaluates project alternatives for the transport and delivery of supplemental water from the City of Santa Maria to Nipomo's water distribution system. Two improvement phases were developed based on supplemental water inflow rates. Phase I improvements provide capacity for 1,300 gpm, and Phase II improvements were developed for 1,860 gpm (the maximum allowance from the City of Santa Maria per the 2005 Memo of Understanding).

Figure 1 displays the recommended Phase I and Phase II improvements as presented in the PEM. These improvements will afford the system capacity to handle 1,860 gpm. However, the introduction of supplemental water at the recommended point-of-connection (POC) (Orchard Road and Southland Street) increases already high pressures in the area.

To improve capacity and reduce pressures in the NCSD system, the PEM recommends improvements including upgrading the following water lines to a 12-inch diameter line: Southland Street, Orchard Street from Southland to Division, and Frontage Road from Southland to Tefft. To isolate customers from increased pressures, pressure regulators on individual service connections in the southern portion of Nipomo's water distribution system (Area A) are also recommended. For the purposes of this memorandum, this set of recommended improvements will be referred to as Option 1 (Figure 2).

Alternative Improvement Plan for NCSD System

As requested, Boyle has performed a preliminary hydraulic analysis to investigate an alternative improvement approach for reducing pressures in Area A. A separate pressure zone was evaluated instead of individual pressure regulators on the Area A service connections and the pipeline improvements recommended in the PEM were reevaluated with the new pressure zone in place. The same NCSD WaterCAD model as used for the Preliminary Engineering Memorandum was utilized to evaluate the feasibility of the new pressure zone. Two alternative boundaries for the pressure zone were developed and modeled separately as Option 2 and Option 3. Two additional alternatives, Options 4 and 5, utilize dedicated pipelines in addition to a new pressure zone.

Option 2. A parallel waterline along Orchard Road from Southland to Division Streets and four valves were added to the model to isolate Area B (Figure 3). An isolation valve was placed on Orchard and Southland to close the connection between the parallel and existing waterline. Two pressure reducing valve (PRV) stations were positioned: 1) on Frontage Road between Division Street and Martita Place, and 2) on the existing Orchard Road waterline between Story and Grande. Both PRV stations were set at a hydraulic grade of 520 ft (83 psi and 87 psi, respectively). A closed isolation valve was placed along the 6-inch waterline that runs across Belanger Dr. and Avenida Montecito Verde between Division and Story Streets.

Option 3. This option uses a parallel waterline along Orchard Road, running from Southland to Grande Avenue, with three PRV stations and three isolation valves to isolate Area C (Figure 4). The PRV stations were placed in the following locations: 1) on the existing Orchard Road waterline, north of Division Street 2) on Frontage Road South of Grande, and 3) on South Oakglen, between Darby Lane and Amado Street. The PRV stations were set to a hydraulic grade of 532 feet (78, 82, and 82 psi, respectively). Isolation valves were placed in the following positions: 1) at Orchard and Southland to close the connection between the parallel and existing waterline, 2) on Nopal Way, between Harrier Lane and Fir Place, and 3) on Avenida de Amigos.

Option 4. Option 4 utilizes the same improvements as Option 3, along with two 12-inch dedicated pipelines, a waterline improvement along Frontage Road from Grande to Tefft, and a fourth PRV station (Figure 5). One dedicated 12-inch pipeline runs parallel to the existing waterline in Southland Street. The second dedicated pipeline runs parallel to the existing Frontage Road waterline and ties in to the system at Grande Avenue. Both new pipelines were modeled to operate outside the new pressure zone (Area C). An existing 8-inch waterline in Frontage Road between Hill St and Tefft St will be replaced with a 12-inch pipeline, extending to Grande Avenue. A PRV station was added between the existing and dedicated lines along Southland, between Drumm Lane and Honey Grove Lane. All PRV stations were modeled at a hydraulic grade setting of 532 feet (78, 82, 82, and 94 psi, respectively).

Option 5a. Option 5a is similar to Option 4, but uses a different route to tie into the Tefft St waterline (Figure 6) and delays the Frontage Street waterline replacement from Grande Ave to Tefft St. Instead, dedicated lines will run along Southland and Frontage Rd to Grande. From the intersection of Division and Frontage a dedicated line crosses Highway 101 to Amado Street, runs along Amado St to South Oakglen and follows South Oakglen to the 16-inch waterline in Tefft Street. PRV stations and isolation valves are modeled in the same locations and settings as in Option 4 to create the Area C pressure zone.

Option 5b. Option 5b is the same as 5a, but takes a different route between Frontage Road and South Oakglen (Figure 7). Instead of crossing Highway 101 at Division, the alignment crosses at the intersection of Grande Ave and Frontage Rd and runs along Darby Lane to South Oakglen. It then follows South Oakglen to the 16-inch waterline in Tefft.

Model Conditions

All system improvement options were modeled under steady-state conditions with all wells off and tanks 75 % full. Two demand scenarios were run: average day demands[1] (2.67 mgd) for typical conditions, and 10 % of average day demands (0.27 mgd) to mimic low flow periods when pressures in the system are highest. Since NCSD system pressures are typically lower during times of higher demands, maximum and peak demand scenarios were not evaluated for this study. Based on recent correspondence between NCSD and the City of Santa Maria, a supplemental water inflow rate of 2,000-gpm was modeled. All Options were modeled with the existing water system infrastructure, except for the addition of the improvements discussed (i.e., no Master-planned improvements were added).

Model Results

The improvement options were evaluated based on resultant pressures in the PRV Zone and near Joshua and Orchard which is where the supplemental water pipeline from the pump station would connect to the existing line in Orchard Road. Pressure at Joshua and Orchard is indicative of the pressure required at the Waterline Intertie Project pump station.

For Option 1, service-side pressures in Area A will be dictated by the settings on the individual service pressure regulators. Options 2, 3, and 4 provide the advantage of also protecting pipelines within the separate pressure zones from elevated pressures.

Results indicate that Options 2 and 3 required higher pressures at Joshua and Orchard to deliver flow into the system than required for Option 1. The existing 12-inch pipeline - along Orchard Road between Joshua and Southland Streets - was designed to be constructed with Pressure Class 150 AWWA C900 PVC pipe. Option 2 increased the required pressure at Joshua and Orchard from 146 to 153 psi. In addition, Option 2 increased pressures in the residential area between Division Street, Jessica Place, and Beverly Drive by approximately 10 psi to levels between 96 and 105 psi. Option 3 reduced the pressures in the residential area, but required 160 psi at Joshua and Orchard to deliver flow into the system. The additional dedicated pipelines in Option 4 cause a reduction in pressure at Joshua and Orchard to 144 psi, near what is required in Option 1, and maintained residential area pressures to levels near or below existing. Options 5a and 5b provide similar residential pressures as with Option 4, and a slightly higher pressure requirement at Joshua and Orchard (147 instead of 144 psi). Table 1 summarizes the model results for each improvement scenario under ADD conditions and Table 2 summarizes results for 10 % ADD conditions. Resultant pressures are the same for Options 5a and 5b.

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[1] Average day demands as defined in the Water and Sewer Master Plan Update (Cannon, December 2007).

Table 1. Comparison of Pressure Ranges (psi)
for NCSD Water System Improvement Options under existing ADD

	Existing (Static Pressures)	Option 1 Individual pressure regulators	Option 2 PRV Zone B	Option 3 PRV Zone C	Option 4 PRV Zone C + dedicated lines & 4th sta.	Options 5a & 5b PRV Zone C + 4th sta. & dedicated lines to Tefft
Area A	93 – 100	98 – 107	–	–	–	–
Area B	85 – 100	–	77 – 91	–	–	–
Area C	64 – 100	–	–	61 – 97	61 – 97	61 – 97
Joshua & Orchard	105	146	153	160	144	147

Notes:

Option 1: Service-side pressures would be dictated by individual pressure regulator settings.
Option 2: Pressures calculated with PRVs set at hydraulic grade of 520 ft (83 & 87 psi).
Option 3: Pressures calculated with PRVs set at hydraulic grade of 532 ft (78, 82, & 82 psi).
Options 4 & 5: Pressures calculated with PRVs set at hydraulic grade of 532 ft (78, 82, 82, & 94 psi).

Table 2. Comparison of Pressure Ranges (psi)
for NCSD Water System Improvement Options under 10% existing ADD

	Existing Static Pressures	Option 1 Individual pressure regulators	Option 2 PRV Zone B	Option 3 PRV Zone C	Option 4 PRV Zone C + dedicated lines	Options 5a & 5b PRV Zone C + 4th sta. & dedicated lines to Tefft
Area A	96 – 103	100 – 109	–	–	–	–
Area B	88 – 103	–	77 – 91	–	–	–
Area C	66 – 103	–	–	61 – 98	61 – 98	61 – 98
Joshua & Orchard	107	148	158	165	150	151

Notes:

Option 1: Service-side pressures would be dictated by individual pressure regulator settings.
Option 2: Pressures calculated with PRVs set at hydraulic grade of 520 ft (83 & 87 psi).
Option 3: Pressures calculated with PRVs set at hydraulic grade of 532 ft (78, 82, & 82 psi).
Options 4 & 5: Pressures calculated with PRVs set at hydraulic grade of 532 ft (78, 82, 82, & 94 psi).

Fire Flow Analysis

A fire flow analysis was run to compare the fire flow availability under the preferred improvement options (Option 1, Option 4, and Option 5), with existing fire flow availability, and with the availability under improvements as recommended in the Water and Sewer Master Plan Update (Cannon Associates, December 2007). The analysis was conducted on the nodes contained in the new pressure zone created in Options 4 and 5 (Area C). The minimum required fire flow for the area is 1,500 gpm. A minimum residual pressure criterion of 20 psi was applied to the entire system except the nodes immediately adjacent to the Quad Tanks. Each scenario was modeled under steady-state conditions with maximum day demands[2] (4.53 mgd), all wells off, no supplemental water inflow, and tanks 75% full.

Fire Flow Results

The fire flow analysis indicated that during existing conditions 7 out of the 128 nodes tested in Area C fail to meet fire flow criteria. Under the Master-planned improvement scenario, one node failed to meet fire flow criteria. Under Option 1, three nodes failed. Under Options 4 and 5a, five nodes failed, and 4 nodes failed under Option 5b. Since available fire flows were within a few percentage points for 5a and 5b, they are considered to be equivalent within the expected accuracy of the model. These results are summarized in Table 3, below. All nodes failing fire flow criteria are at dead-ends.

Table 3. Summary of Fire Flow Availability for Nodes Failing to meet Fire Flow Criteria

Nodes with Fire Flow Availability Under 1500 gpm		Fire Flow Availability (gpm)					
		NCSD Water Distribution System Improvement Scenario					
WaterCAD Node Label	Location	Existing System	Master-Planned	Option 1	Option 4	Option 5a	Option 5b
J-610	January St & Juno Ct	**1,497**	1,637	1,521	**1,485**	**1,487**	1,501
J-1325	Ashland Ln	**1,348**	1,646	1,628	**1,451**	**1,459**	**1,464**
J-1586	End of Drumm Ln	**1,446**	1,966	1,992	1,791	1,809	1,811
J-4457	End of Juno Ct	**1,383**	1,503	**1,403**	**1,373**	**1,375**	**1,387**
J-5200	Division St @ January St	**1,391**	1,508	**1,411**	**1,381**	**1,383**	**1,395**
J-5277	End of Ashland Ln	**1,252**	**1,484**	**1,464**	**1,333**	**1,340**	**1,344**
J-6138	End of Widow Ln	**1,488**	2,059	2,076	1,833	1,851	1,854

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[2] Maximum day demands as defined in the Water and Sewer Master Plan Update (Cannon, December 2007).

Conclusions

The introduction of supplemental water to the southern region of NCSD water distribution system increases already high pressures. One mitigation option is to add pressure regulators to approximately 200 individual services, as recommended in the Preliminary Engineering Memorandum. Another option is to isolate the high pressure area using valves and create a separate pressure zone. Though Option 2 effectively reduces pressures within the separate pressure zone, it causes an increase in pressures (to levels greater than 100 psi) between the northern zone boundary and Division Street. Therefore Option 3 was investigated as an expanded pressure zone to include Area B and the influenced area to the north. Because Options 2 and 3 require higher pump discharge pressures at Orchard and Joshua, the fourth Option included two dedicated waterlines along Southland and Frontage and an additional PRV station. Option 5a was investigated as a means to delay improvements along the section of Frontage between Division and Tefft, until plans to realign Frontage Road are formalized. Option 5b requires less new pipeline along South Oakglen Avenue.

The modeling indicates that a separate pressure zone is feasible and has the potential to protect infrastructure from increased pressures due to the inflow of supplemental water at Orchard and Southland. Under Option 1, the pressure at Orchard and Joshua ranges from 146 - 148 (when modeled with conditions as described). Pressures at Orchard and Joshua are increased with Options 2 and 3 (153 – 165 psi), causing increased electricity requirements at the pump station and high pressures for the existing Orchard Road waterline, which is rated for 150 psi[3]. The improvements modeled as Options 4 and 5 reduce pressures at Orchard and Joshua (144 – 151 psi) and protect services from high pressures, similar to the Option 1 improvements recommended in the PEM. However, the fire flow analysis indicates a higher number of nodes failing fire flow criteria under Options 4 and 5 improvements, than under Master-planned or Option 1 improvements. Five nodes under Options 4 and 5a, and four nodes under Option 5b have less than 1,500 gpm fire flow available, as opposed to three nodes under Option 1, or one node under master-planned improvements. All of these nodes are located at the ends of 6-inch water lines. When 8-inch pipe is added to the model to loop these dead ends, results indicate that all nodes in Area C meet minimum fire flow criteria for Options 1, 4, 5a, and 5b. Less than 800-feet total of 8-inch pipe to loop these dead ends would be required, but is not included in the cost opinion. Since the nodes are close to meeting the fire flow requirements, the District needs to determine if the projects are warranted. An opinion of probable construction cost for improvements under Options 1, 4, 5a, and 5b is summarized in Table 4, attached. Life-cycle costs would be similar because of the similar pressure conditions experienced at the pump station under all four Options (Tables 1 and 2).

Attachments: Figure 1. Project Components and Phasing (Preliminary Engineering Memorandum)
Figure 2. NCSD System Improvements Option 1
Figure 3. NCSD System Improvements Option 2
Figure 4. NCSD System Improvements Option 3
Figure 5. NCSD System Improvements Option 4
Figure 6. NCSD System Improvements Option 5a
Figure 7. NCSD System Improvements Option 5b
Table 4. Opinion of Probable Construction Cost

REGISTERED PROFESSIONAL ENGINEER
JOSHUA H. REYNOLDS
No. 65400
Exp. 9/30/09
CIVIL
STATE OF CALIFORNIA

[3] The Orchard Road waterline pressure rating is based on Record Drawings for Orchard Road and Santa Maria Vista Waterlines (12-12-05). The pressure rating should be reevaluated, and perhaps tested, to ensure the Orchard Road waterline can sustain increased pressures from the supplemental water.

DWG: W:\Nipomo CSD (19996)\Waterline Intertie Project 19996.12\Phase 4 - UPDATE to Draft Prelim Engr Memo\CAD\Exhibits\Figure ES-1-rev.dwg USER: eshields
DATE: Aug 26, 2008 3:08pm XREFS: IMAGES: img20600389 Aerial Photo-LITE-SMALL.jpg

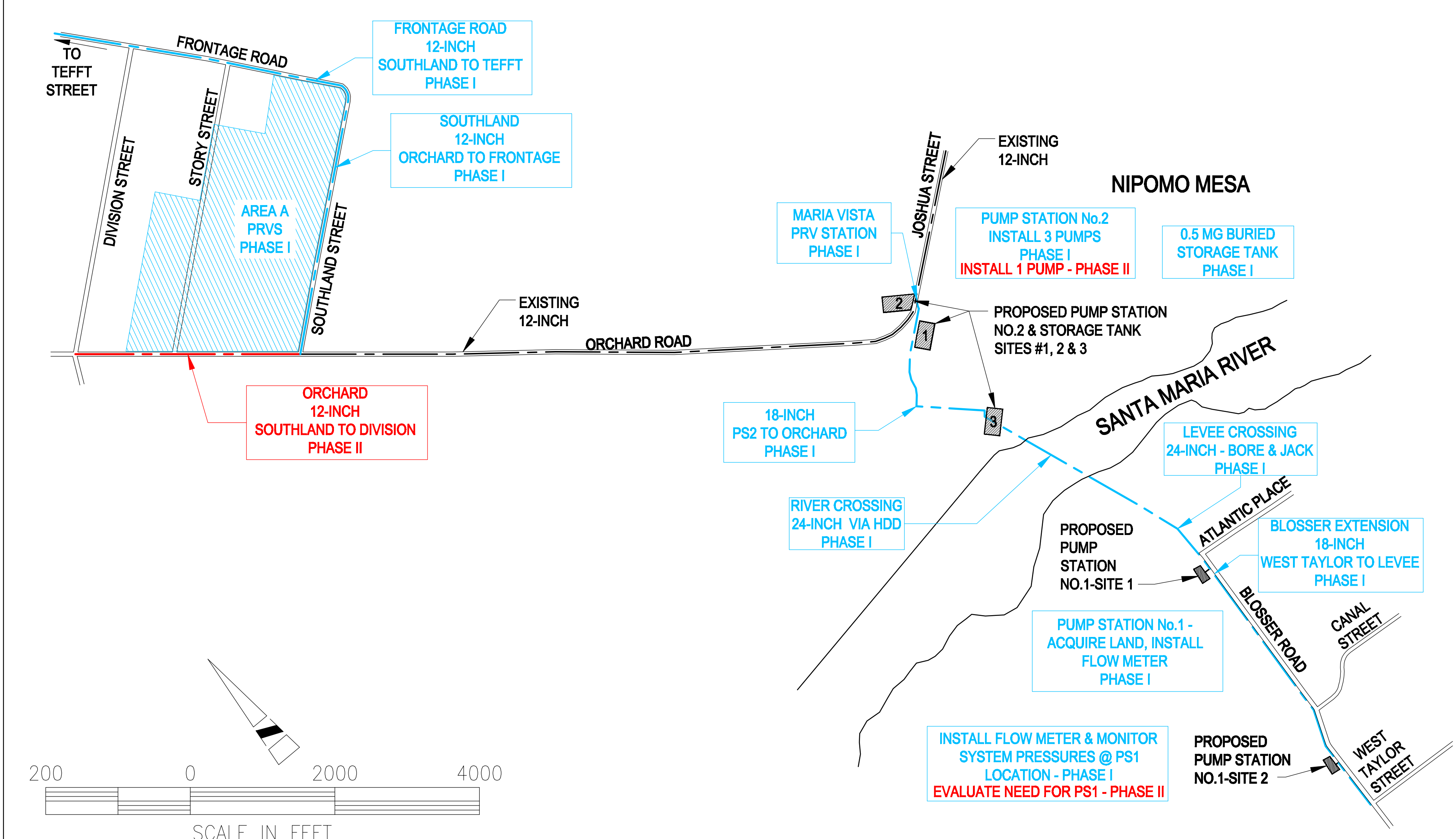


FIGURE 1

NCSD WATERLINE INTERTIE

PROJECT COMPONENTS AND PHASING

BEC PROJECT NO. 19996.12

BOYLE ENGINEERING CORPORATION

Figure 2: NCSD System Improvements Option 1

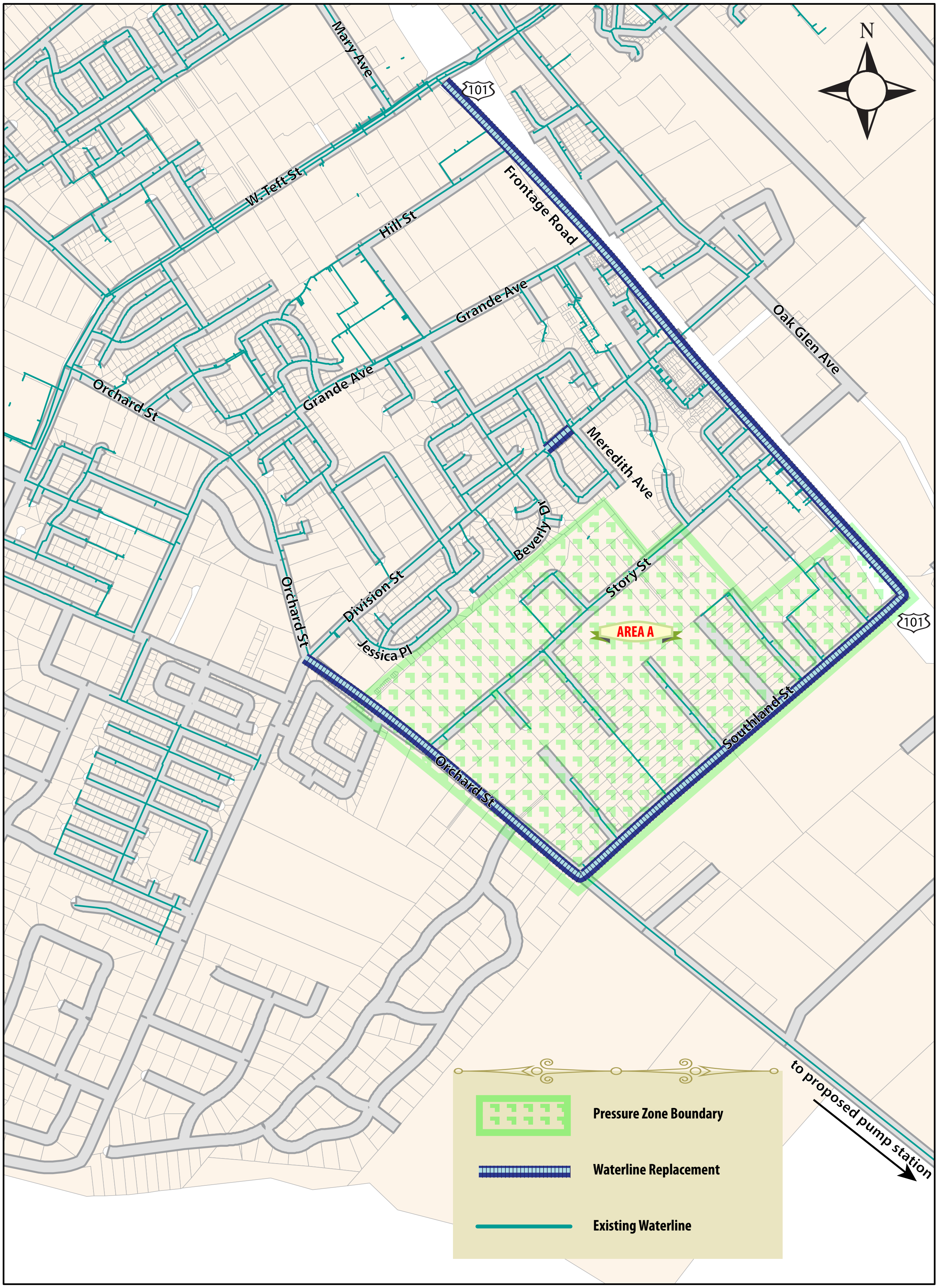


Figure 3: NCSD System Improvements Option 2

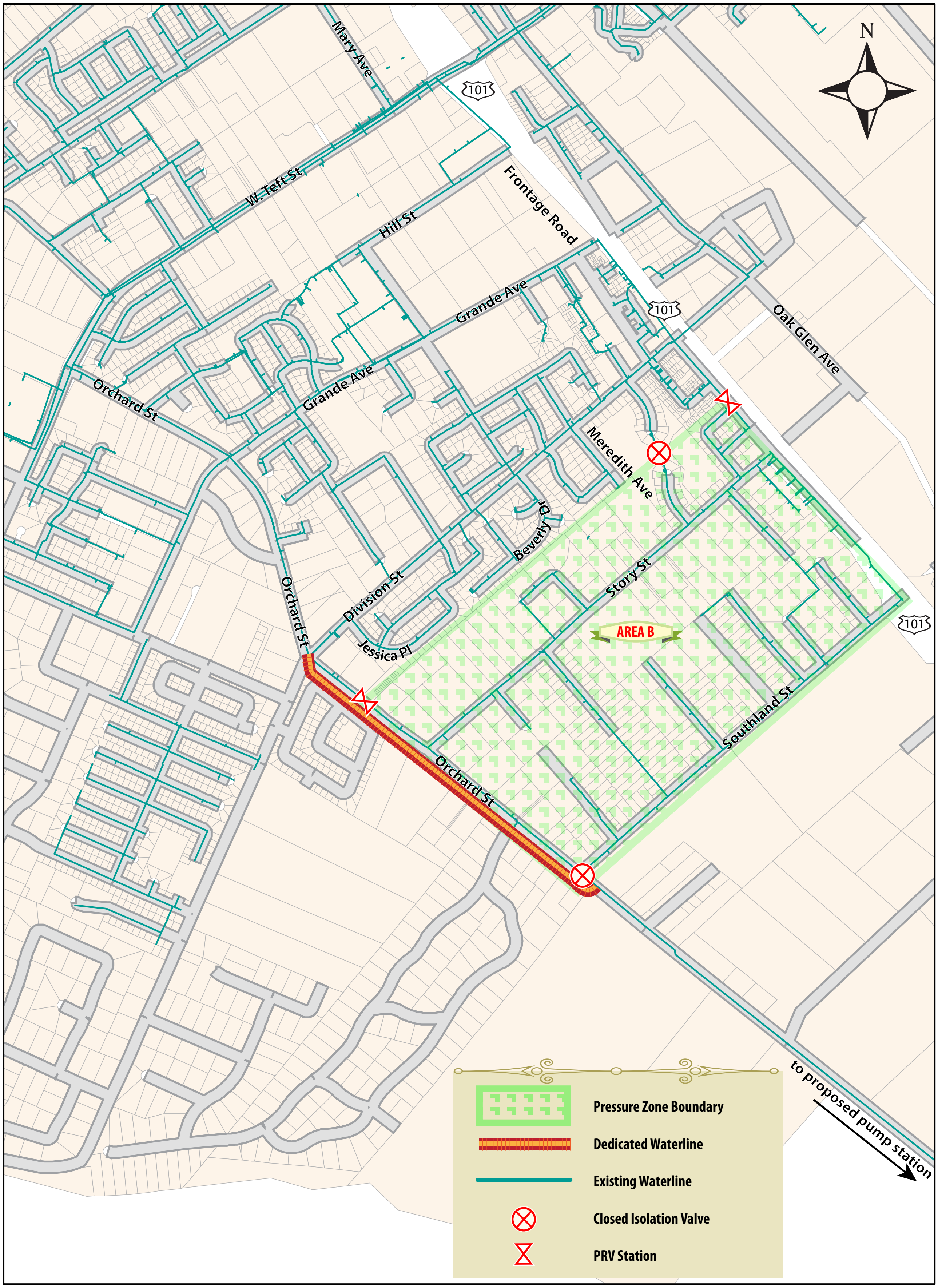


Figure 4: NCSD System Improvements Option 3

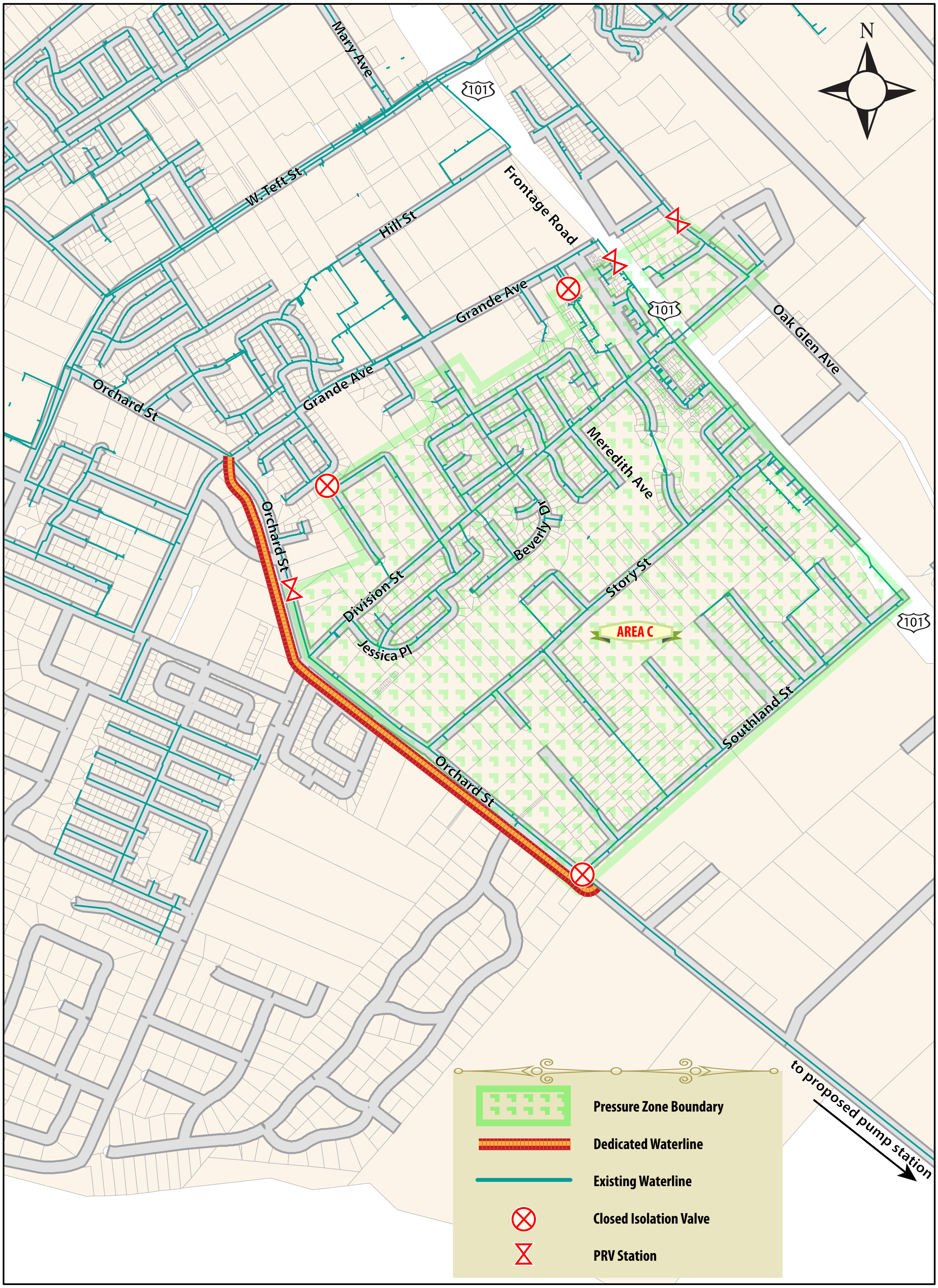


Figure 5: NCSD System Improvements Option 4

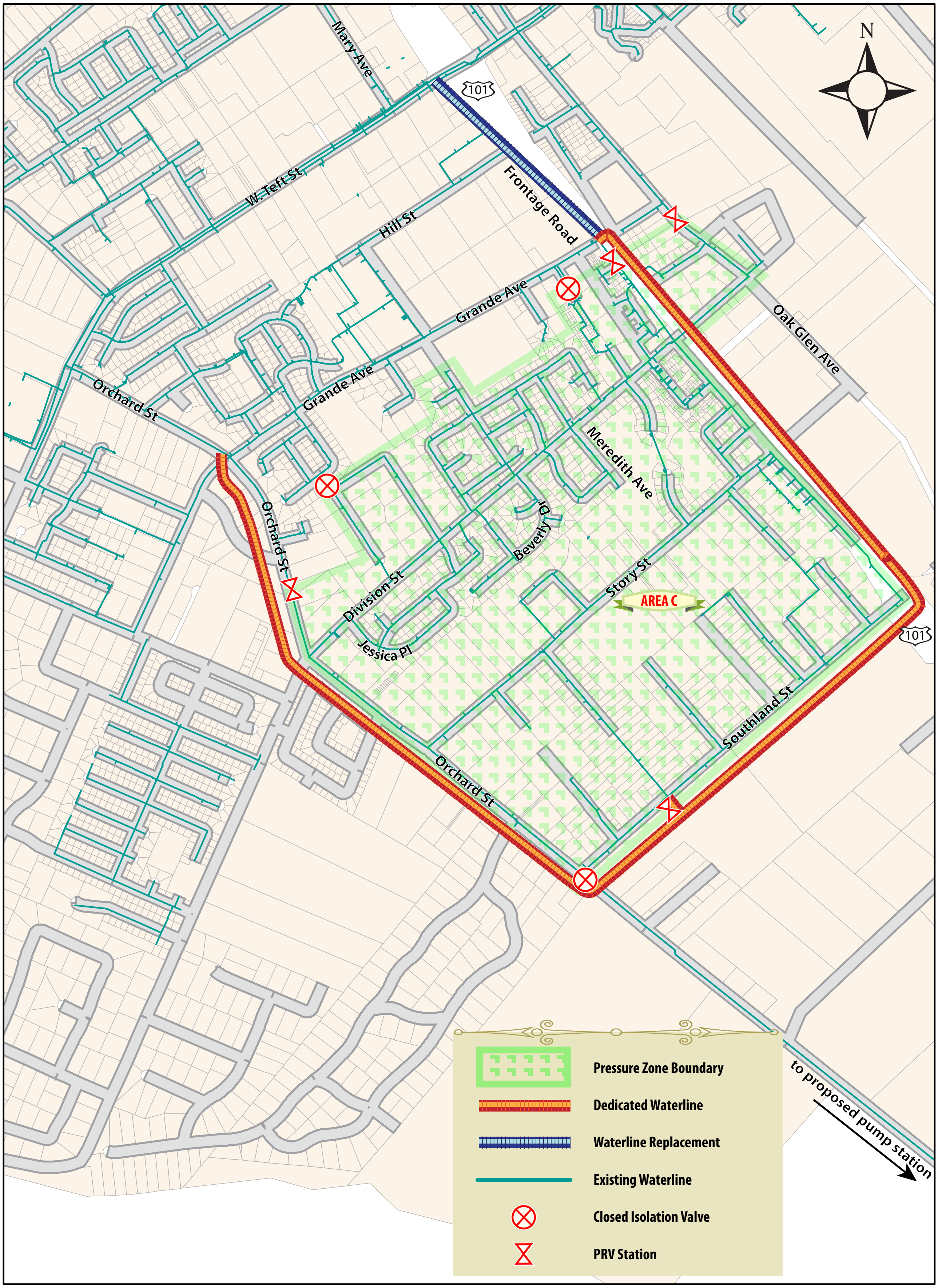


Figure 6: NCSD System Improvements Option 5a

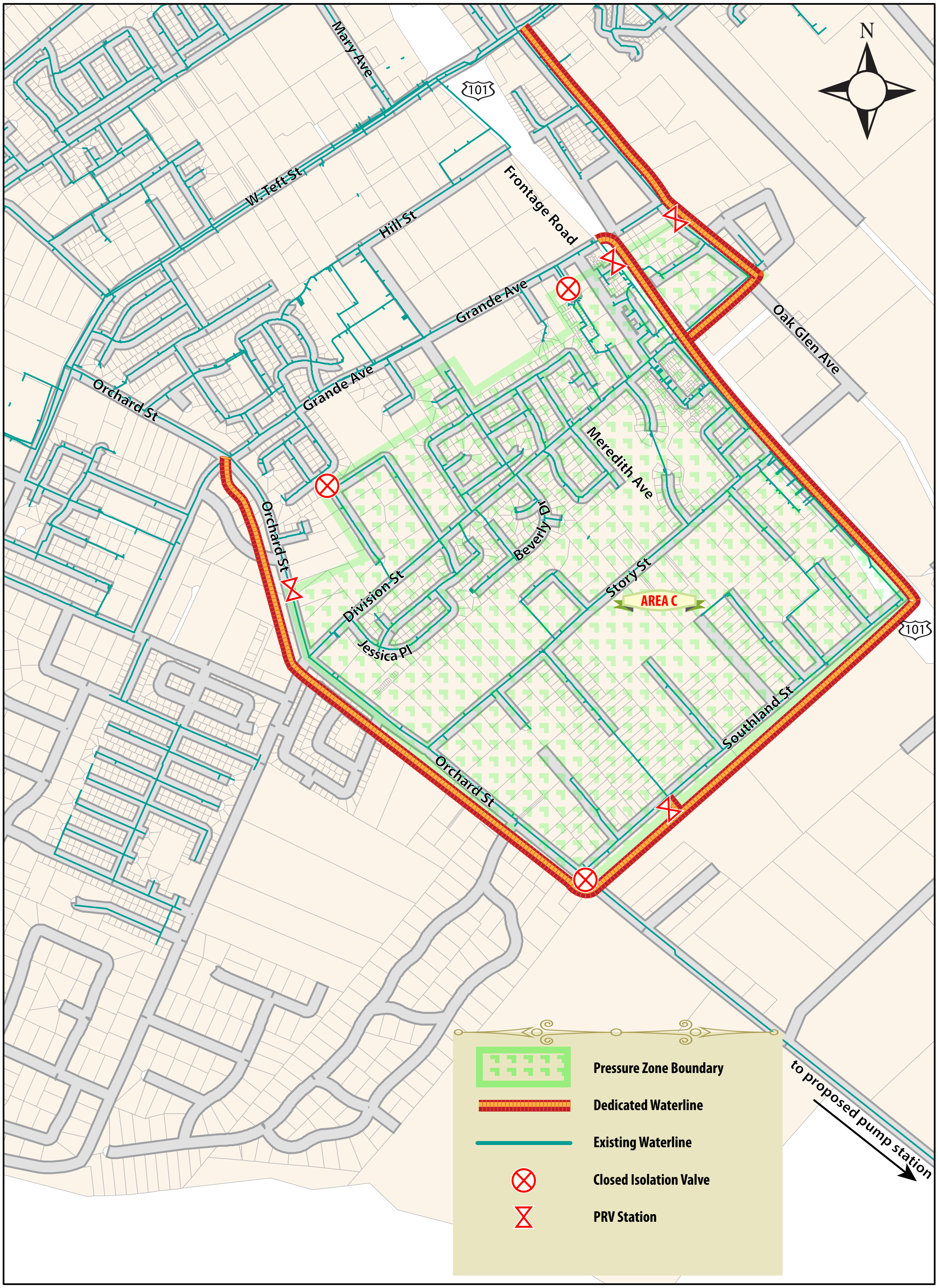


Figure 7: NCSD System Improvements Option 5b

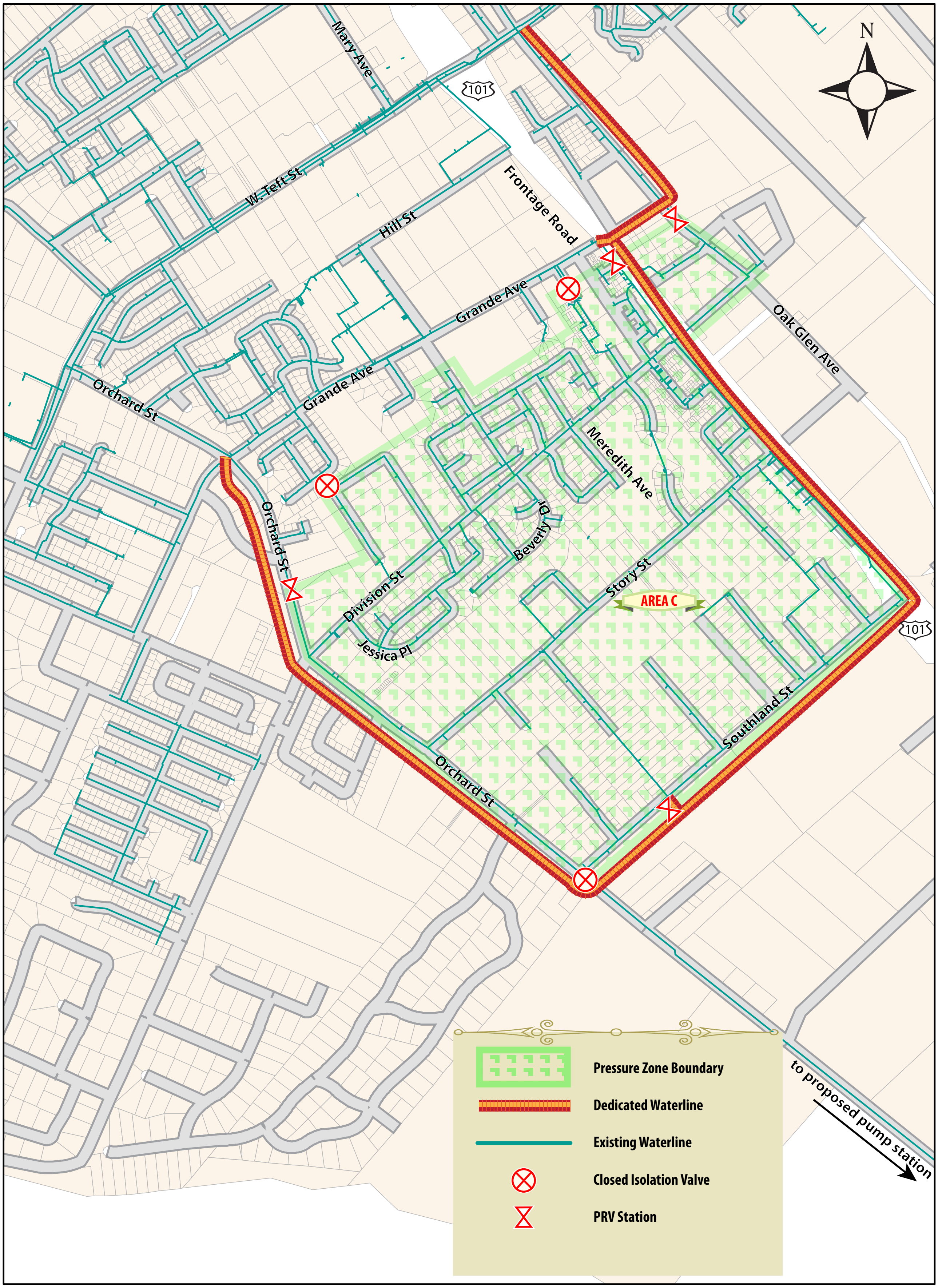


Table 4
Nipomo Community Services District
WATERLINE INTERTIE PROJECT
NCSD Water Distribution System Improvements
OPINION OF PROBABLE CONSTRUCTION COST

Item	Description	Quantity	Unit	Unit Price	Amount
	Supplemental Inflow Rate = 2,000 gpm				
Option 1. As recommended in Preliminary Engineering Memorandum (Boyle, May 2008)					
1	Pressure regulators on individual services in Area A	200	EA	$200	$40,000
2	Southland St Incremental Upgrade 10" to 12"	3900	LF	$40	$156,000
3	Orchard Rd 12" Upgrade (Southland to Division)	3200	LF	$145	$464,000
4	Traffic Control for Orchard Rd	3200	LF	$7	$22,400
5	AC Pavement Overlay on Orchard Rd (assume 12-ft lane)	4267	YD^2	$36	$153,600
	Option 1 Subtotal				$836,000
	Master Planned Improvements *				
7	Southland St 10" Upgrade (Frontage to Orchard) *	3900	LF	$160	$624,000
8	Frontage Rd 12" Upgrade (Southland to Tefft) *	6470	LF	$200	$1,294,000
	Master planned Improvements Subtotal				$1,918,000
	Option 1 Adjusted Subtotal				$2,754,000
	Contingency	30%			$826,200
	Option 1 Total				$3,580,200

Item	Description	Quantity	Unit	Unit Price	Amount
Option 4. PRV Zone with Dedicated Lines and Frontage Rd Improvements					
1	Parallel Orchard Rd waterline 12" (Southland to Grande)	5200	LF	$145	$754,000
2	Traffic Control	5200	LF	$7	$36,400
3	AC Pavement Overlay (assume 12-ft lane)	6933	YD^2	$36	$249,600
4	Parallel Southland St waterline 12"	3900	LF	$145	$565,500
5	Traffic Control	3900	LF	$7	$27,300
6	AC Pavement Overlay (assume 12-ft lane)	5200	YD^2	$36	$187,200
7	Parallel Frontage Rd waterline 12" (Southland to Tefft)	6470	LF	$145	$938,150
8	Traffic Control	6470	LF	$7	$45,290
9	AC Pavement Overlay (assume 12-ft lane)	8627	YD^2	$36	$310,560
10	Pressure Reducing Valve Station to isolate zone	4	EA	$18,000	$72,000
11	Isolation Valves to isolate zone	3	EA	$4,000	$12,000
	Option 4 Subtotal				$3,198,000
	Contingency	30%			$959,400
	Option 4 Total				$4,157,400

Notes:
Costs not included: Engineering and administration, mobililzation, pipeline to loop dead-end waterlines
Division Street upgrade (from Preliminary Engineering Memorandum) removed from Option 1, as determined already complete
* The Master Planned project costs presented in this table have been modified from the Master Plan and the Preliminary Engineering Memorandum to reflect Boyle's opinion of costs and to be consistent with the unit costs used in this comparative analysis. These unit costs include traffic control and pavement overlay for these Master Plan projects, whereas these items are separate in the other opinions.

Table 4
Nipomo Community Services District
WATERLINE INTERTIE PROJECT
NCSD Water Distribution System Improvements
OPINION OF PROBABLE CONSTRUCTION COST

Supplemental Inflow Rate = 2,000 gpm

Item	Description	Quantity	Unit	Unit Price	Amount
Option 5a. PRV Zone with Dedicated Lines (limited Frontage Rd. Improvements, cross Hwy 101 @ Amado)					
1	Parallel Orchard Rd waterline 12" (Southland to Grande)	5200	LF	$145	$754,000
2	Traffic Control	5200	LF	$7	$36,400
3	AC Pavement Overlay (assume 12-ft lane)	6933	YD^2	$36	$249,600
4	Parallel Southland St waterline 12"	3900	LF	$145	$565,500
5	Traffic Control	3900	LF	$7	$27,300
6	AC Pavement Overlay (assume 12-ft lane)	5200	YD^2	$36	$187,200
7	Parallel Frontage Rd waterline 12" (Southland to Grande)	4400	LF	$145	$638,000
8	Traffic Control	4400	LF	$7	$30,800
9	AC Pavement Overlay (assume 12-ft lane)	5867	YD^2	$36	$211,200
10	Highway crossed with jacked casing & 12" carrier pipe	220	LF	$600	$132,000
11	Parallel Amado (cross Hwy 101) waterline 12"	680	LF	$145	$98,600
12	Traffic Control	680	LF	$7	$4,760
13	AC Pavement Overlay (assume 12-ft lane)	907	YD^2	$36	$32,640
14	Parallel S. Oakglen Ave waterline 12"	3200	LF	$145	$464,000
15	Traffic Control	3200	LF	$7	$22,400
16	AC Pavement Overlay (assume 12-ft lane)	4267	YD^2	$36	$153,600
17	Pressure Reducing Valve Station to isolate zone	4	EA	$18,000	$72,000
18	Isolation Valves to isolate zone	3	EA	$4,000	$12,000
	Option 5a Subtotal				$3,692,000
	Contingency	30%			$1,107,600
	Option 5a Total				$4,799,600

Item	Description	Quantity	Unit	Unit Price	Amount
Option 5b. PRV Zone with Dedicated Lines (limited Frontage Rd. Improvements, cross Hwy 101 @ Darby)					
1	Parallel Orchard Rd waterline 12" (Southland to Grande)	5200	LF	$145	$754,000
2	Traffic Control	5200	LF	$7	$36,400
3	AC Pavement Overlay (assume 12-ft lane)	6933	YD^2	$36	$249,600
4	Parallel Southland St waterline 12"	3900	LF	$145	$565,500
5	Traffic Control	3900	LF	$7	$27,300
6	AC Pavement Overlay (assume 12-ft lane)	5200	YD^2	$36	$187,200
7	Parallel Frontage Rd waterline 12" (Southland to Grande)	4400	LF	$145	$638,000
8	Traffic Control	4400	LF	$7	$30,800
9	AC Pavement Overlay (assume 12-ft lane)	5867	YD^2	$36	$211,200
10	Highway crossed with jacked casing & 12" carrier pipe	220	LF	$600	$132,000
11	Parallel Darby (cross Hwy 101) waterline 12"	500	LF	$145	$72,500
12	Traffic Control	500	LF	$7	$3,500
13	AC Pavement Overlay (assume 12-ft lane)	667	YD^2	$36	$24,000
14	Parallel S. Oakglen Ave waterline 12"	2100	LF	$145	$304,500
15	Traffic Control	2100	LF	$7	$14,700
16	AC Pavement Overlay (assume 12-ft lane)	2800	YD^2	$36	$100,800
17	Pressure Reducing Valve Station to isolate zone	4	EA	$18,000	$72,000
18	Isolation Valves to isolate zone	3	EA	$4,000	$12,000
	Option 5b Subtotal				$3,436,000
	Contingency	30%			$1,030,800
	Option 5b Total				$4,466,800

Notes:
Costs not included: Engineering and administration, mobililzation, pipeline to loop dead-end waterlines
Division Street upgrade (from Preliminary Engineering Memorandum) removed from Option 1, as determined already complete
* The Master Planned project costs presented in this table have been modified from the Master Plan and the Preliminary Engineering Memorandum to reflect Boyle's opinion of costs and to be consistent with the unit costs used in this comparative analysis. These unit costs include traffic control and pavement overlay for these Master Plan projects, whereas these items are separate in the other opinions.

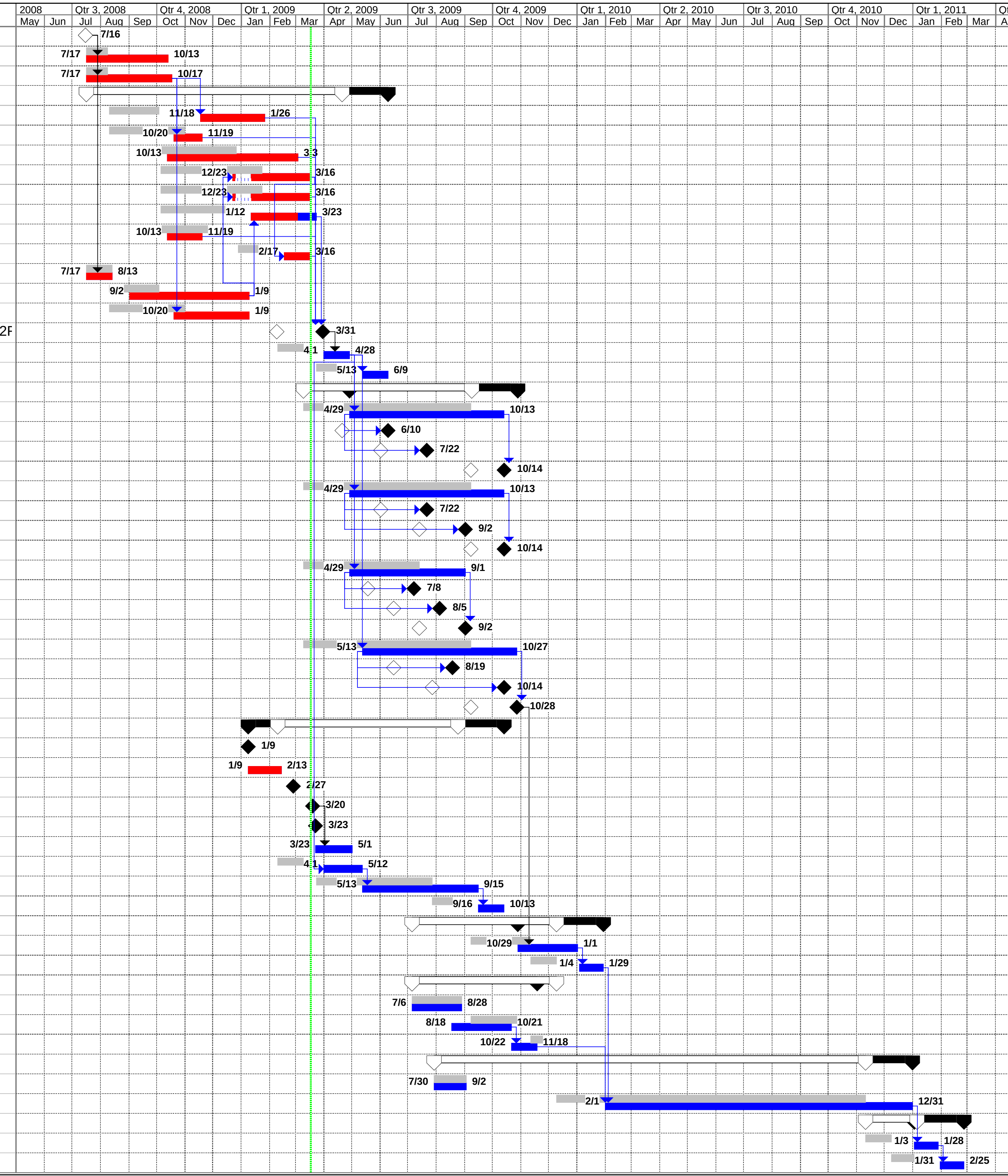
Appendix B
Project Schedule
(3/17/09)

AECOM

Print Date: Tue 3/17/09

NCSD WATERLINE INTERTIE PROJECT - Tue 3/17/09

ID	Task Name	Duration	Start	Finish	Predecessors
1	Kickoff meeting	1 day	Wed 7/16/08	Wed 7/16/08	
2	Right of Entry Agreements and Coordination	63 days	Thu 7/17/08	Mon 10/13/08	1
3	Permitting and Approvals for Field Work at River	67 days	Thu 7/17/08	Fri 10/17/08	1
4	**Concept Design Report**	**234 days**	**Thu 7/17/08**	**Tue 6/9/09**	
5	101 - Geotechnical Report for HDD Technical Memorandum	2.5 mons	Tue 11/18/08	Mon 1/26/09	3
6	102 - Project Bidding Strategy Technical Memorandum	1.15 mons	Mon 10/20/08	Wed 11/19/08	3
7	103 - Pipeline Alignment Technical Memorandum	102 days	Mon 10/13/08	Tue 3/3/09	
8	104 - Pump Station Design Technical Memorandum	2.45 mons	Tue 12/23/08	Mon 3/16/09	14
9	105 - Reservoir Design Technical Memorandum	2.45 mons	Tue 12/23/08	Mon 3/16/09	14
10	106 - Permitting Strategy Technical Memorandum	2.55 mons	Mon 1/12/09	Mon 3/23/09	14
11	107 - Chloramination Systems Technical Memorandum	1.4 mons	Mon 10/13/08	Wed 11/19/08	
12	108 - Back-up Power, Controls, and Instrumentation Technical Memorandum	1 mon	Tue 2/17/09	Mon 3/16/09	8FS-20 days
13	109 - Pressure Reduction Study	1 mon	Thu 7/17/08	Wed 8/13/08	1
14	110 - Survey and Base Map (by Wallace Group)	4.7 mons	Tue 9/2/08	Fri 1/9/09	
15	111 - Geotechnical Report (by Fugro)	3 mons	Mon 10/20/08	Fri 1/9/09	3
16	Draft Concept Report	1 day	Tue 3/31/09	Tue 3/31/09	5,6,7,8,9,10,11,12F
17	113 Review and Finalize Concept Design Report	1 mon	Wed 4/1/09	Tue 4/28/09	16
18	114 - Narrative Report	1 mon	Wed 5/13/09	Tue 6/9/09	17FS+10 days
19	**Construction Plans and Specifications**	**131 days**	**Wed 4/29/09**	**Wed 10/28/09**	
20	Bid Package 1 - HDD	6 mons	Wed 4/29/09	Tue 10/13/09	17
21	60% Submittal	1 day	Wed 6/10/09	Wed 6/10/09	20SS+1.5 mons
22	90% Submittal	1 day	Wed 7/22/09	Wed 7/22/09	20SS+3 mons
23	100% Submittal	1 day	Wed 10/14/09	Wed 10/14/09	20
24	Bid Package 2 - NCSD System Pipeline Improvements	6 mons	Wed 4/29/09	Tue 10/13/09	17
25	60% Submittal	1 day	Wed 7/22/09	Wed 7/22/09	24SS+3 mons
26	90% Submittal	1 day	Wed 9/2/09	Wed 9/2/09	24SS+4.5 mons
27	100% Submittal	1 day	Wed 10/14/09	Wed 10/14/09	24
28	Bid Package 3 - Blosser Road Water Main and Flow Meter	4.5 mons	Wed 4/29/09	Tue 9/1/09	17
29	60% Submittal	1 day	Wed 7/8/09	Wed 7/8/09	28SS+2.5 mons
30	90% Submittal	1 day	Wed 8/5/09	Wed 8/5/09	28SS+3.5 mons
31	100% Submittal	1 day	Wed 9/2/09	Wed 9/2/09	28
32	Bid Package 4 - Pump Station, Reservoir, and Chloramination Systems	6 mons	Wed 5/13/09	Tue 10/27/09	17
33	60% Submittal	1 day	Wed 8/19/09	Wed 8/19/09	32SS+3.5 mons
34	90% Submittal	1 day	Wed 10/14/09	Wed 10/14/09	32SS+5 mons
35	100% Submittal	1 day	Wed 10/28/09	Wed 10/28/09	32
36	**Permitting**	**198 days**	**Fri 1/9/09**	**Tue 10/13/09**	
37	End of EIR Public Review Period	1 day	Fri 1/9/09	Fri 1/9/09	
38	Preparation of Administrative Final EIR/Responses to Comments	1.3 mons	Fri 1/9/09	Fri 2/13/09	
39	Receipt of Comments from District on Final EIR	1 day	Fri 2/27/09	Fri 2/27/09	
40	Completion of Final EIR	1 day	Fri 3/20/09	Fri 3/20/09	
41	Completion of Findings of Fact	1 day	Mon 3/23/09	Mon 3/23/09	
42	Public Hearings/EIR Certification	1.5 mons	Mon 3/23/09	Fri 5/1/09	40
43	Complete and submit permit applications	30 days	Wed 4/1/09	Tue 5/12/09	17FS-1 mon
44	Coordinate with regulatory agencies	90 days	Wed 5/13/09	Tue 9/15/09	43
45	Acquire permits and incorporate in final design plans	20 days	Wed 9/16/09	Tue 10/13/09	44
46	**Standard Bid-Construct Process for Underground/Storage Work**	**67 days**	**Thu 10/29/09**	**Fri 1/29/10**	
47	Solicit Bids	2.35 mons	Thu 10/29/09	Fri 1/1/10	35
48	Award Bids	1 mon	Mon 1/4/10	Fri 1/29/10	47
49	**Turnkey Design-Build Process for HDD Work**	**98 days**	**Mon 7/6/09**	**Wed 11/18/09**	
50	Pre-Qualify Contractors	2 mons	Mon 7/6/09	Fri 8/28/09	
51	Solicit Bids	2.35 mons	Tue 8/18/09	Wed 10/21/09	
52	Award Bids	1 mon	Thu 10/22/09	Wed 11/18/09	51
53	**Construction**	**372 days**	**Thu 7/30/09**	**Fri 12/31/10**	
54	Retain Design Firm to Perform Engineering Services During Construction	5 wks	Thu 7/30/09	Wed 9/2/09	
55	Construct	12 mons	Mon 2/1/10	Fri 12/31/10	48,52
56	**Startup and Testing**	**40 days**	**Mon 1/3/11**	**Fri 2/25/11**	
57	Startup	1 mon	Mon 1/3/11	Fri 1/28/11	55
58	Testing	1 mon	Mon 1/31/11	Fri 2/25/11	57



Project: WIP Design Schedule
Date: Tue 3/17/09

Task	Milestone	Rolled Up Task	Rolled Up Baseline	Split	Project Summary
Progress	Baseline Milestone	Rolled Up Milestone	Rolled Up Baseline Milestone	Baseline Split	Group By Summary
Baseline	Summary	Baseline Summary	Rolled Up Progress	External Tasks	Deadline

AECOM

Appendix C
Example Request for Qualifications:
RFQ for Inverted Siphon No. 7 Replacement Project

AECOM

RFQ for Inverted Siphon No. 7 Replacement Project

Ojai Sanitary District (AECOM, 2005)

Notice Inviting Pre-Qualification

Notice is hereby given that pre-qualification questionnaires to "pre-qualify" for the right to bid the Inverted Siphon No. 7 Replacement Project will be received by the Ojai Valley Sanitary District at their office located at 1072 Tico Road, Ojai, California before September 23, 2005, 4:00 p.m. The Inverted Siphon No. 7 Replacement Project includes construction of an inverted siphon beneath the San Antonio Creek to replace the previous siphon that was damaged/destroyed during the winter storms of 2005. The construction of the crossing will consist of Horizontal Directional Drilling (HDD) approximately 1650-feet across the San Antonio Creek and along Old Creek Road. The pipeline will be approximately 100-feet deep at the low point in the siphon. The estimate project cost is in the $2-3 M range. The anticipated schedule includes bids in mid-October 2005, award in October 2005, commence construction in early November 2005, and complete construction before January 1, 2006.

Pre-qualification questionnaires can be obtained from the District. Pre-qualification questionnaires shall be completed and enclosed in an envelope, sealed and clearly labeled with project title and name of contractor. Contractors seeking "pre-qualification" shall be Class A licensed within the state of California and shall be qualified with a minimum of 10 years experience in the installation of pipelines using Horizontal Directional Drilling as the method of installation. In order to be considered for "pre-qualification" on this project, contractors shall include the following information within the pre-qualification questionnaires:

- A list of at least five (5) Horizontal Directional Drilling Projects, each with a minimum length of 1000 L. F. of installed pipe with a minimum bore diameter of 24 inches using HDD as the method of installation.
- Said reference projects shall have been completed by the proposed contractor within the last ten (10) years.
- One of the referenced projects shall have utilized driven steel casing material.
- One of the referenced projects shall have been in comparable ground conditions to those anticipated on the project (gravelly alluvium between 25 and 75 feet deep and bedrock below 75 feet deep).
- The proposed project superintendent shall have at least 10 years of HDD experience and shall have managed at least 3 HDD projects in similar ground with drill lengths of 1000 feet of more.
- The proposed HDD operator and locator instrument operator shall have at least 10 years experience in the installation of pipelines using HDD as the method of installation. The operators shall have successfully completed a minimum of 5 pipeline projects each with a minimum of 1000 feet of installed pipe with a minimum bore diameter of 24 inches.
- The list of projects shall include:
    - The name and location of the project, the owner's name, address, contact person and telephone number.
    - The Architect and/or Engineer's name, address, contact person and telephone number.
    - The Construction Manager's name, address, contact person and telephone number.
    - A description of the project, scope of work performed, total value of construction, total value of change orders, construction duration, time extensions granted.
    - The name of the proposed project superintendent and proposed HDD operator and locator instrument operator and their resumes.

The District will apply a uniform system of rating pre-qualification respondents on objective criteria consistent with Department of Industrial Relations recommendations, on the basis of the completed questionnaires and financial statements to determine the qualified bidders list.

The District may refuse to grant pre-qualification where the requested information is incomplete or not received by September 23, 2005, 4:00 p.m. There is no appeal from a refusal for an incomplete or late application.

Where a timely and completed application results in a rating below that necessary to pre-qualify, an appeal can be made. An appeal is begun by the Contractor delivering notice to the District of its appeal of the decision with respect to its pre-qualification rating, no later than ten business days after the Notice of Determination is issued. Without a timely appeal, the Contractor waives any and all rights to challenge to decision of the District, whether by administrative process, judicial process, or any other legal process or proceeding.

If the Contractor gives the required notice of appeal and requests a hearing, the hearing shall be conducted so that it is concluded within fourteen business days after the District's receipt of the notice of appeal. The hearing shall be an informal process conducted by a panel to which the District has delegated responsibility to hear such appeals (the "Appeals Panel"). At or prior to the hearing, the Contractor will be advised of the basis for the District's pre-qualification determination. The Contractor will be given the opportunity to present information and present reasons in opposition to the rating. After the conclusion of the hearing, the Appeals Panel will render its decision. It is the intention of the District that the date for the submission and opening of bids will not be delayed or postponed to allow for completion of an appeal process.

The questionnaires and financial statements shall not be public records and shall not be open to public inspection; however, records of the names of the contractors applying for pre-qualification status shall be public records subject to disclosure.

The information given by contractors seeking pre-qualification is provided with the understanding that the intentional providing of false information is grounds for disqualification.

To request a Pre-Qualification questionnaire, contact Bob Stein of Boyle Engineering Corporation at (805) 644-9704.

Dated this 1st day of September 2005.

Ojai Valley Sanitary District, California

John K Correa

John K. Correa, General Manager

Ojai Valley Sanitary District
Inverted Siphon No. 7 Replacement

Project Information

Ojai Valley Sanitary District owns and operates the wastewater collection system for the Ojai Valley and adjacent areas. During the heavy winter storms of 2005 portions of the sewer system were severely damaged. On January 9, 2005 portions of pipeline downstream of Siphon No. 7 were washed out or severely damaged due to flooding on San Antonio Creek. This pipeline conveys essentially all of the sewage from the Town of Ojai. Within a short time, temporary pipelines were installed and service was restored. Currently, a temporary pipeline is buried on the east side of Old Creek Road, replacing the pipelines that were damaged or destroyed in the flooding.

The Ojai Valley Sanitary District (OVSD) plans to replace the damaged and destroyed portions of pipeline, and construct a new inverted siphon beneath the creek, installing the facilities at sufficient depth and with other protective measures to protect it from future flood events. Siphon No. 7 (prior to damage) conveyed sewer flows from Manhole 26 to Manhole 25; the new siphon will transmit sewer flows a greater distance.

The start point is just downstream of existing Manhole 27 and will convey flows under the creek and return to gravity flow near Manhole 22 (see Exhibit 2). The total project, including both siphon and gravity-flow pipelines, will extend for approximately 1800 feet starting from existing Manhole 27 (located on Creek Road, approximately 3200 feet northeast of the Creek Road/Hwy 33 intersection) to just downstream of existing Manhole 22 (located in Old Creek Road to the south-southwest).

Construction of the siphon portion of the project will be performed using the horizontal directional drilling (HDD) process. At the low point, the pipeline may be more than 100 feet deep, founded in the bedrock of the Monterey Foundation. On the southern end of the siphon, loose sandy-gravelly material will be encountered, which may necessitate the driving of a larger casing to prevent the HDD from caving and to prevent the excess loss of drilling fluid.

At the upstream side of the siphon, there will be a hydraulic structure capable of diverting flows to the various carrier pipes. This structure will also include provisions for launching cleaning "pigs" into the siphon pipes from inside the structure.

At the downstream side of the siphon, another hydraulic structure will be used to channel the flows from the various carrier pipes into a single gravity flow pipe.

The anticipated project schedule is completion of design in September 2005, bid in mid October 2005, commence construction November 1, 2005, and complete construction prior to January 1, 2006.

HDD contractors interested in the project will need to complete the District's prequalification requirements to become eligible to submit a bid for the project.

Subsurface Conditions

Materials encountered by the drill holes advanced at the OVSD Siphon No. 7 site consisted of artificial fill materials, alluvial sediments, and bedrock of the Monterey Formation.

Artificial Fill (af)

The artificial fill materials observed in the vicinity of the proposed crossing project consisted of asphalt concrete and base materials along Old Creek Road and loose fine- to coarse-grained soil materials with cobbles, rock fragments, organics, and construction debris associated with backfill of low areas eroded by storm flows south and east of San Antonio Creek. The fill materials appeared to have been dumped and loosely spread about the site. Also, OVSD has indicated that a buried rock-filled gabion structure is located creek-side of Old Creek Road.

Artificial fill materials were encountered in all of the drill holes advanced for the Siphon No. 7 crossing study south of San Antonio Creek (DH-1 through DH-3, DH-5, and DH-6). Artificial fill materials were not encountered by DH-4 advanced on the northern side of the creek. The artificial fill materials encountered in the drill holes consisted of about 3 to 7 feet of loose silty sand with gravel and sand with gravel with varying amounts of cobbles, rocks, organic material, and debris.

Alluvium (Qal)

The alluvial sediments encountered by the drill holes consisted predominately of loose granular sediments that caved readily during open-hole (mud-rotary) drilling. ODEX (casing advance) drilling techniques were subsequently employed to alleviate caving alluvial soil conditions.

Thickness of the alluvium interpreted from the drill holes and geophysical survey data ranges from less than 10 feet near the valley walls to about 70 feet (+/- 20%) near the active channel. The granular materials sampled and interpreted from the drill cuttings and drilling characteristics consisted of sand, clayey sand, silty sand, sandy silt, gravel, cobbles, and boulders. Alluvial sediments observed in the creek channel consisted of sand with gravel and cobbles to greater than 3 feet in diameter.

Monterey Formation (Tm)

The Monterey Formation bedrock consists of highly weathered, highly to extensively fractured, thinly interbedded siltstone and diatomaceous siltstone with lesser amounts of siliceous (well indurated) siltstone and sandstone. The project vicinity is characterized by north to northeast-trending geologic structure (synclines, anticlines, and faults) with bedrock that dips primarily to the southeast at about 30 to 65 degrees.

The Monterey Formation is a hydrocarbon-bearing/producing formation. Hydrocarbon and sulfur odors were noted and oil staining/seeps were observed in samples recovered during drilling.

Groundwater

San Antonio Creek was flowing at the time of the August 2005 field exploration. Groundwater was encountered in each of the 6 drill holes advanced for the study at depths of between about 7 to 10 feet. The creek level and groundwater conditions will vary seasonally due to changes in runoff, storm conditions, rainfall and other factors. Groundwater should be anticipated during construction of the project.

Ojai Valley Sanitary District

Inverted Siphon No. 7 Replacement

Pre-Qualification Questionnaire
For Horizontal Directional Drilling Specialty Contractors

CONTACT INFORMATION

Firm Name: ________________________ Check One: ☐ Corporation
(as it appears on license) ☐ Partnership
☐ Sole Prop.

Contact Person: ____

Address: ____

Phone: ________________________ Fax: ________________________

If firm is a sole proprietor or partnership:

Owner(s) of Company: ____

Contractor's License Number(s):

____

____

____

PART I. ESSENTIAL REQUIREMENTS FOR PRE-QUALIFICATION

1. Contractor possesses a valid and current California Contractor's license for the project or projects for which it intends to submit a bid.
☐ Yes ☐ No

2. Contractor has a liability insurance with a combined single policy limit per occurrence of $2,000,000 for both Comprehensive and Broad Form General Liability.
☐ Yes ☐ No

3. Contractor has current workers' compensation insurance policy as required by the Labor Code or is legally self-insured pursuant to Labor Code section 3700 et. seq.
☐ Yes ☐ No ☐ Contractor is exempt from this requirement, because it has no employees

4. Have you attached your latest copy of a reviewed or audited financial statement with accompanying notes and supplemental information. [1 3]
☐ Yes ☐ No

NOTE: A financial statement that is not either reviewed or audited is not acceptable. A letter verifying availability of a line of credit may also be attached; however, it will be considered as supplemental information only, and is not a substitute for the required financial statement.

5. Have you attached a notarized statement from an admitted surety insurer (approved by the California Department of Insurance) and authorized to issue bonds in the State of California, which states: (a) that your current bonding capacity is sufficient for the project for which you seek pre-qualification if you are seeking pre-qualification for a single project; or (if you are seeking pre-qualification valid for a year) (b) your current available bonding capacity? [4]
☐ Yes ☐ No

NOTE: Notarized statement must be from the surety company, not an agent or broker.

6. Has your contractor's license been revoked at any time in the last five years? [2]
☐ Yes ☐ No

---

[1] A "no" answer to question 4 will not be disqualifying if the contractor is exempt from complying with question 4, for reasons explained in footnote 3.

[2] A contractor disqualified solely because of a "yes" answer given to question 6, 7, or 9 may appeal the disqualification and provide an explanation for the relevant circumstances during the appeal procedure.

[3] Public contract Code section 20101(3) exempts from this requirement a contractor who has qualified as a small business pursuant to Government Code section 14837(d)(1), if the bid is "no more than 25 percent of the qualifying amount provided in section 14837(d)(1)." As of January 1, 2001, the qualifying amount is $10 million, and 25 percent of that amount, therefore, is $2.5 million.

[4] An additional notarized statement from the surety may be requested by *Public Entity* at the time of submission of a bid, if this pre-qualification package is submitted more than 60 days prior to submission of the bid.

7. Has a surety firm completed a contract on your behalf, or paid for completion because your firm was default terminated by the project owner within the last five (5) years? [2]

☐ Yes ☐ No

8. At the time of submitting this pre-qualification form, is your firm ineligible to bid on or be awarded a public works contract, or perform as a subcontractor on a public works contract, pursuant to either Labor Code section 1777.1 or Labor Code section 1777.7?

☐ Yes ☐ No

If the answer is "Yes," state the beginning and ending dates of the period of debarment:

____

9. At any time during the last five years, has your firm, or any of its owners or officers been convicted of a crime involving the awarding of a contract of a government construction project, or the bidding or performance of a government contract? [2]

☐ Yes ☐ No

[2] A contractor disqualified solely because of a "yes" answer given to question 6, 7, or 9 may appeal the disqualification and provide an explanation for the relevant circumstances during the appeal procedure.

PART II PRE-QUALIFICATION QUESTIONS

Questions about History of the Business and Organizational Performance
(16 questions)

1. How many years has your organization been in business in California as a contractor under your present business name and license number? ______ Years

2. Is your firm currently the debtor in a bankruptcy case?
☐ Yes ☐ No

3. Was your firm in bankruptcy any time during the last five years? (This question refers only to a bankruptcy action that was not described in answer to question 7, above).
☐ Yes ☐ No

4. Has any CSLB license held by your firm or its Responsible Managing Employee (RME) or Responsible Managing Officer (RMO) been suspended within the last five years?
☐ Yes ☐ No

5. At any time in the last five years, has your firm been assessed and paid liquidated damages after completion of a project, under a construction contract with either a public or private owner?
☐ Yes ☐ No

6. In the last five years has your firm, or any firm with which any of your company's owners, officers or partners was associated, been debarred, disqualified, removed or otherwise prevented from bidding on, or completing, any government agency or public works project for any reason?
☐ Yes ☐ No

NOTE: "Associated with" refers to another construction firm in which an owner, partner or officer of your firm held a similar position, and which is listed in response to question 1c or 1d on this form.

7. In the last five years, has your firm been denied an award of a public works contract based on a finding by a public agency that your company was not a responsible bidder?
☐ Yes ☐ No

NOTE: The following two questions refer only to disputes between your firm and the owner of a project. You need not include information about disputes between your firm and a supplier, another contractor, or subcontractor. You need not include information about "pass-through" disputes in which the actual dispute is between a sub-contractor and a project owner. Also, you may omit reference to all disputes about amounts of less than $50,000.

8. In the past five years, has any claim **against** your firm concerning your firm's work on a construction project, been **filed in court or arbitration**?
☐ Yes ☐ No

9. In the past five years, has your firm made any claim against a project owner concerning work on a project or payment for a contract, and **filed that claim in court or arbitration**?

☐ Yes ☐ No

10. At any time during the past five years, has any surety company made any payments on your firm's behalf as a result of a default, to satisfy any claims made against a performance or payment bond issued on your firm's behalf in connection with a construction project, either public or private?

☐ Yes ☐ No

11. In the last five years, has any insurance carrier, for any form of insurance, refused to renew the insurance policy for your firm?

☐ Yes ☐ No

12. Has your firm, or any of its owners, officers, or partners ever been found liable in a civil suit, or found guilty in a criminal action, for making any false claim or material misrepresentation to any public agency or entity?

☐ Yes ☐ No

13. Has your firm, or any of its owners, officers or partners ever been convicted of a crime involving any federal, state, or local law related to construction?

☐ Yes ☐ No

14. Has your firm or any of its owners, officers or partners ever been convicted of a federal or state crime of fraud, theft, or any other act of dishonesty?

☐ Yes ☐ No

15. If your firm was required to pay a premium of more than one per cent for a performance and payment bond on any project(s) on which your firm worked at any time during the last three years, state the percentage that your firm was required to pay. You may provide an explanation for a percentage rate higher than one per cent, if you wish to do so.

__________________%

16. During the last five years, has your firm ever been denied bond credit by a surety company, or has there ever been a period of time when your firm had no surety bond in place during a public construction project when one was required?

☐ Yes ☐ No

Questions about compliance with safety, workers compensation, prevailing wage and apprenticeship laws.
(11 questions)

1. Has CAL OSHA cited and assessed penalties against your firm for any "serious," "willful" or "repeat" violations of its safety or health regulations in the past five years?

☐ Yes ☐ No

Note: If you have filed an appeal of a citation and the Occupational Safety and Health Appeals Board has not yet ruled on your appeal, you need not include information about it.

2. Has the federal Occupational Safety and Health Administration cited and assessed penalties against your firm in the past five years?

☐ Yes ☐ No

If yes, attach a separate signed page describing each citation.

Note: If you have filed an appeal of a citation and the appropriate appeals Board has not yet ruled on your appeal, you need not include information about it.

3. Has the EPA or any Air Quality Management District or any Regional Water Quality Control Board cited and assessed penalties against either your firm or the owner of a project on which your firm was the contractor, in the past five years?

☐ Yes ☐ No

NOTE: If you have filed an appeal of a citation and the Appeals Board has not yet ruled on your appeal, or if there is a court appeal pending, you need not include information about the citation.

4. How often do you require documented safety meetings to be held for construction employees and field supervisors during the course of a project?

____

5. List your firm's Experience Modification Rate (EMR) (California workers' compensation insurance) for each of the past three premium years:

Current year: ____________________

Previous year: ____________________

Year prior to previous year: ____________________

If your EMR for any of these three years is or was 1.00 or higher, you may, if you wish, attach a letter of explanation.

NOTE: An Experience Modification Rate is issued to your firm annually by your workers' compensation insurance carrier.

6. Within the last five years, has there ever been a period when your firm had employees but was without workers' compensation insurance or state-approved self-insurance?

☐ Yes ☐ No

7. Has there been more than one occasion during the last five years on which your firm was required to pay either back wages or penalties for your own firm's failure to comply with the **state's** prevailing wage laws?

☐ Yes ☐ No

NOTE: This question refers only to your own firm's violation of prevailing wage laws, not to violations of the prevailing wage laws by a subcontractor.

8. During the last five years, has there been more than one occasion on which your own firm has been penalized or required to pay back wages for failure to comply with the **federal** Davis-Bacon prevailing wage requirements?

☐ Yes ☐ No

9. Provide the **name, address and telephone number** of the apprenticeship program sponsor(s) (approved by the California Division of Apprenticeship Standards) that will provide apprentices to your company for use on any public work project for which you are awarded a contract by *[Public Entity]*.

____

____

10. If your firm operates its own State-approved apprenticeship program:

    a. Identify the craft or crafts in which your firm provided apprenticeship training in the past year.

    b. State the year in which each such apprenticeship program was approved, and attach evidence of the most recent California Apprenticeship Council approval(s) of your apprenticeship program(s).

    c. State the number of individuals who were employed by your firm as apprentices at any time during the past three years in each apprenticeship and the number of persons who, during the past three years, completed apprenticeships in each craft while employed by your firm.

11. At any time during the last five years, has your firm been found to have violated any provision of California apprenticeship laws or regulations, or the laws pertaining to use of apprentices on public works?.

☐ Yes ☐ No.

If yes, provide the date(s) of such findings, and attach copies of the Department's final decision(s).

NOTE: You may omit reference to any incident that occurred prior to January 1, 1998 if the violation was by a subcontractor and your firm, as general contractor on a project, had no knowledge of the subcontractor's violation at the time they occurred

Part III PROJECT EXPERIENCE (Project 1)

Questions concerning recent construction projects completed:

1. Contractor shall provide information about five (5) Horizontal Directional Drilling projects completed within the last 10 years, each of which shall incorporate a minimum drilling length of 1000-feet and a minimum diameter of 24-inches. Names and references must be current and verifiable. Use separate sheets of paper that contain all of the following information:

Project Name: ______________________________
Location: ______________________________
Owner:
Owner Contact (name and current phone number):

____
____

Architect or Engineer: ______________________________
____
____

Architect or Engineer Contact (name and current phone number):

____
____

Construction Manager (name and current phone number):

____
____

Total Value of Construction: ______________________________

Total Value of Change Orders: ______________________________

Original Construction Contract Duration: ______________________________

Original Contract Completion Date: ______________________________

Actual Date of Completion: ______________________________

Scope of Work Performed:

Provide a description of the work performed including the following work items. Include equipment manufacturers and suppliers, sub-contractors, special construction methods, etc.

Horizontal Directional Drilling Length:

____
____
____

Horizontal Directional Drilling Diameter

____
____
____

Casing Material

____
____
____

Ground Conditions

____
____
____

Superintendent

____
____
____

HDD Operator

____
____
____

Part III PROJECT EXPERIENCE (Project 2)

Questions concerning recent construction projects completed:

1. Contractor shall provide information about five (5) Horizontal Directional Drilling projects completed within the last 10 years, each of which shall incorporate a minimum drilling length of 1000-feet and a minimum diameter of 24-inches. Names and references must be current and verifiable. Use separate sheets of paper that contain all of the following information:

Project Name: ________________________________

Location: ________________________________

Owner:

Owner Contact (name and current phone number):

____

____

Architect or Engineer: ________________________________

____

____

Architect or Engineer Contact (name and current phone number):

____

____

Construction Manager (name and current phone number):

____

____

Total Value of Construction: ____________________

Total Value of Change Orders: ____________________

Original Construction Contract Duration: ____________________

Original Contract Completion Date: ____________________

Actual Date of Completion: ____________________

Scope of Work Performed:

Provide a description of the work performed including the following work items. Include equipment manufacturers and suppliers, sub-contractors, special construction methods, etc.

Horizontal Directional Drilling Length:

____

____

____

Horizontal Directional Drilling Diameter

Casing Material

Ground Conditions

Superintendent

HDD Operator

Part III PROJECT EXPERIENCE (Project 3)

Questions concerning recent construction projects completed:

1. Contractor shall provide information about five (5) Horizontal Directional Drilling projects completed within the last 10 years, each of which shall incorporate a minimum drilling length of 1000-feet and a minimum diameter of 24-inches. Names and references must be current and verifiable. Use separate sheets of paper that contain all of the following information:

Project Name: ______________________________

Location: ______________________________

Owner:

Owner Contact (name and current phone number):

____

____

Architect or Engineer: ______________________________

____

____

Architect or Engineer Contact (name and current phone number):

____

____

Construction Manager (name and current phone number):

____

____

Total Value of Construction: ______________________________

Total Value of Change Orders: ______________________________

Original Construction Contract Duration: ______________________________

Original Contract Completion Date: ______________________________

Actual Date of Completion: ______________________________

Scope of Work Performed:

Provide a description of the work performed including the following work items. Include equipment manufacturers and suppliers, sub-contractors, special construction methods, etc.

Horizontal Directional Drilling Length:

____

____

____

Horizontal Directional Drilling Diameter

Casing Material

Ground Conditions

Superintendent

HDD Operator

Part III **PROJECT EXPERIENCE (Project 4)**

Questions concerning recent construction projects completed:

1. Contractor shall provide information about five (5) Horizontal Directional Drilling projects completed within the last 10 years, each of which shall incorporate a minimum drilling length of 1000-feet and a minimum diameter of 24-inches. Names and references must be current and verifiable. Use separate sheets of paper that contain all of the following information:

Project Name: ______________________________

Location: ______________________________

Owner:

Owner Contact (name and current phone number):

____

____

Architect or Engineer: ______________________________

____

____

Architect or Engineer Contact (name and current phone number):

____

____

Construction Manager (name and current phone number):

____

____

Total Value of Construction: ______________________________

Total Value of Change Orders: ______________________________

Original Construction Contract Duration: ______________________________

Original Contract Completion Date: ______________________________

Actual Date of Completion: ______________________________

Scope of Work Performed:

Provide a description of the work performed including the following work items. Include equipment manufacturers and suppliers, sub-contractors, special construction methods, etc.

Horizontal Directional Drilling Length:

____

____

____

Horizontal Directional Drilling Diameter

____
____
____

Casing Material

____
____
____

Ground Conditions

____
____
____

Superintendent

____
____
____

HDD Operator

____
____
____

Part III PROJECT EXPERIENCE (Project 5)

Questions concerning recent construction projects completed:

1. Contractor shall provide information about five (5) Horizontal Directional Drilling projects completed within the last 10 years, each of which shall incorporate a minimum drilling length of 1000-feet and a minimum diameter of 24-inches. Names and references must be current and verifiable. Use separate sheets of paper that contain all of the following information:

Project Name: ____________________

Location: ____________________

Owner:

Owner Contact (name and current phone number):

____

____

Architect or Engineer: ____________________

____

____

Architect or Engineer Contact (name and current phone number):

____

____

Construction Manager (name and current phone number):

____

____

Total Value of Construction: ____________________

Total Value of Change Orders: ____________________

Original Construction Contract Duration: ____________________

Original Contract Completion Date: ____________________

Actual Date of Completion: ____________________

Scope of Work Performed:

Provide a description of the work performed including the following work items. Include equipment manufacturers and suppliers, sub-contractors, special construction methods, etc.

Horizontal Directional Drilling Length:

____

____

____

Horizontal Directional Drilling Diameter

Casing Material

Ground Conditions

Superintendent

HDD Operator

EXHIBIT-2

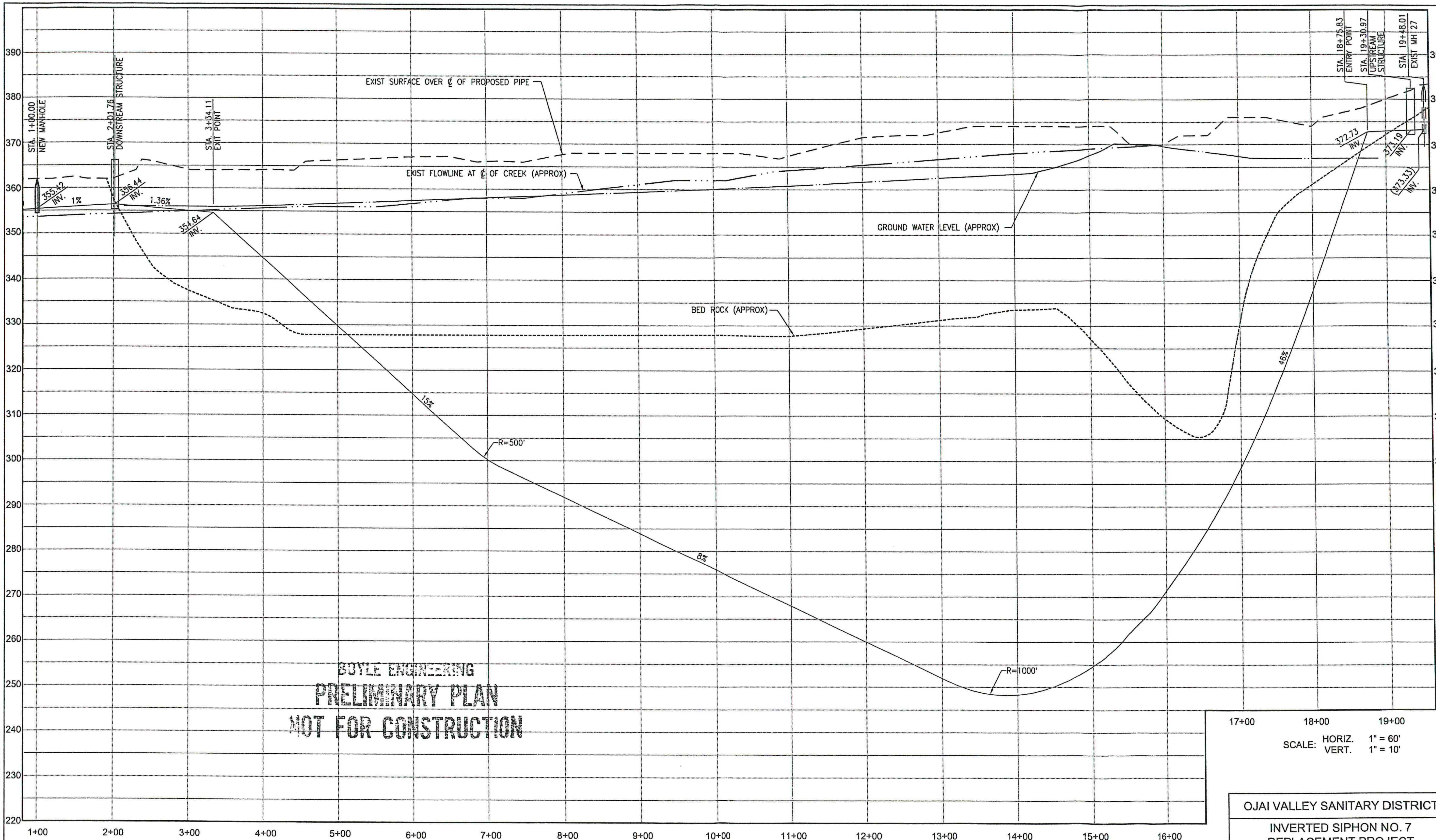
OJAI VALLEY SANITARY DISTRICT

"INVERTED SIPHON #7 REPLACEMENT"

BOYLE ENGINEERING
PRELIMINARY PLAN
NOT FOR CONSTRUCTION

BOYLE

9-1-05



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REGISTERED PROFESSIONAL ENGINEER ROBERT D. ELLISON NO. C 38094 EXP. 3/31/07 CIVIL STATE OF CALIFORNIA

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OJAI VALLEY SANITARY DISTRICT

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

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OJAI VALLEY SANITARY DISTRICT

INVERTED SIPHON NO. 7 REPLACEMENT PROJECT

SIPHON PROFILE

DESIGN	DRAWN	CHECKED	R.C.E.	DATE	SHEET
RDE	AJR		C.A. NO.	DRAWING NO.	C-2

Appendix D
Santa Maria River Crossing
Preliminary Design Report (Jacobs)

AECOM

JACOBS ASSOCIATES

Engineers/Consultants

April 24, 2009

Cesar Romero, PE
AECOM
11194 Pacific Street, Suite 204
San Luis Obispo, CA 93401

SUBJECT: Nipomo Community Services District (CSD) Pipeline
Santa Maria River Crossing
Final Preliminary Design Report

Dear Mr. Nunley:

The attached final report is our deliverable for the preliminary design of the Nipomo Community Services District (CSD) Pipeline Santa Maria River Crossing as stated in Task 3 of our contract dated December 23, 2008. The final report incorporates the comments received and updates our design and construction recommendations for the river crossing utilizing horizontal directional drilling (HDD) and discusses potential issues that may arise during design or construction in order to assist the Owner in making informed decisions.

If you have any questions or comments, please give us a call at 619-528-2292.

Very truly yours,

JACOBS ASSOCIATES

Glenn M. Boyce

Glenn M. Boyce, PhD, PE
Senior Associate

Craig Camp / GMB

Craig Camp
Senior Trenchless Engineer

Enclosure: Final Preliminary Design Report dated 04/24/2009
JA Project #4003.1

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Page

REGISTERED PROFESSIONAL ENGINEER
GLENN MARKLAND BOYCE
No. C47082
EXP. 12-31-09
CIVIL
STATE OF CALIFORNIA

Attachment:

A: Tunnelman's Ground Classification

List of Drawings:

1: Vicinity and Location Map, 1 of 11

2: HDD Plan, C-101 and 102

3: HDD Profile, C-201 and 202 and G-002

4: HDD Laydown Area Arrangement

1. OVERVIEW

The Nipomo Community Services District (NCSD) is planning to construct a new 24-in. inside diameter potable water interconnect with the City of Santa Maria to create a second source of water and handle anticipated growth. The pipeline needs to connect with an existing pipeline on the north side of Santa Maria, immediately south of the Santa Maria River and west of Highway 101, and within the Blosser Road right-of-way. The pipeline crosses the river and gains approximately 100 ft in elevation as it rises to the Nipomo Mesa. The Santa Maria River, at the time of the site visit, was dry. It is understood that the river carries water within a subterranean riverbed with surface flows only during large storm events. The river channel falls under the jurisdiction of the U.S. Army Corps of Engineers (USACOE).

This preliminary design report presents an evaluation of horizontal directional drilling (HDD) requirements for the crossing. It also sets forth key design criteria, staging area considerations, and construction impacts.

2. PROJECT LOCATION

The project is located between the community of Nipomo in San Luis Obispo County and the City of Santa Maria in Santa Barbara County (Drawing 1). The crossing (Drawing 2) of the Santa Maria River is approximately 2,615 ft long. The horizontal directional drilled (HDD) crossing makes an entrance north of the field that lies within the Santa Maria River levy and approximately one mile west of Highway 101. The HDD exit point is approximately 100 ft higher than the HDD entrance and within an area dominated with agricultural fields. This HDD reach, as currently anticipated, is straight and does not include a horizontal curve.

3. TOPOGRAHY AND SURFACE FEATURES

3.1 Surface Conditions

The general topography in the vicinity of the HDD crossing includes a broad river valley south of the Nipomo Mesa. The City of Santa Maria lies on this broad river valley. The levee crests are approximately 8 ft higher than the ground on either side of the levy. The Nipomo Mesa is approximately 100 ft above the river valley.

The Santa Maria River levy is bordered by residential properties on the southeast and by vacant farmland on the southwest. The dry riverbed is either agricultural fields or unimproved land. The land north of the river and on the mesa is sparsely populated farmland.

3.2 Pipeline Cover Requirements

Two HDD design criteria govern the vertical cover required over the pipeline crossing. First, a minimum of 40 ft of groundcover will be provided within the river channel. This dimension is critical at the toe of the north riverbank, where there is the least amount of cover over the profile. Currently, the design has a minimum of 43 ft of separation. The separation is a minimum dimension of elevation and horizontal distance.

The second criterion is to provide sufficient confinement against slurry pressure, which varies with distance along the drill hole from the entry point. The drilling of the pilot hole typically requires an increase in slurry pumping pressure of approximately 1 psi for every 30 ft of drill steel to push the drill cuttings through the borehole. This increase in slurry pressure holds true until the drill path attains an elevation above the entrance elevation. At that point, gravity will provide the energy for the slurry (referred to herein as “drilling mud”) to return to the entrance point. The risk of an inadvertent return, where the drilling mud flows to the surface or into a body of water (also known as a “frac-out”), is reduced. The risk of a frac-out remains low until the drill path exits the ground. The industry standard to approximate the hydrostatic head of the drilling mud at the point of excavation is as follows: half of the hydrostatic pressure is exerted on the outside of the drill steel at the point of excavation, and half of the hydrostatic pressure is frictional head loss inside the drill steel. Utilizing this relationship and a typical estimated soil unit weight of 125 lb/ft^3 for the alluvium, approximately 37 ft of ground cover is required at the toe of the north riverbank. Ground cover for confinement is a governing condition for the proposed profile. A “frac-out” could prevent the project from being completed because the HDD construction method requires the circulation of the fluid for excavation and hole stability.

Other design criteria to consider include scour depth and flood elevation. The pipeline is to be installed below the scour depth, which is anticipated to be approximately 25 ft below the existing river bottom surface. According to the latest FEMA Firm map No. 06079C1902F (date 8/28/08), the Santa Maria River is within Zone “A” of the 100-year flood zone where “No Base Flood Elevations are Determined.”. The drill path is discussed later in section 12.

4. SUBSURFACE CONDITIONS

The existing geotechnical information along the alignment indicates that the soils generally consist of alluvium derived from the Paso Robles Formation and dune sand. The geotechnical report also states that groundwater levels vary significantly seasonally and as such the HDD construction should take place during periods of low flow because the HDD entry point is within the active river bed.

The alluvium, stream channel deposits within the riverbed, appears to be clean sand. The alluvial stream channel deposit is anticipated to exhibit running behavior when dry, as defined in the Tunnelman's Ground Classification (Appendix A) and flowing behavior when wet. The ground will require the drilling mud to help stabilize the excavation. The alluvium will tend to have high frictional forces during carrier pipe installation due to the sand content and anticipated ground behavior. A surface casing or a shored pit may be required to stabilize the soils at the entry and exit points during drilling. The use of drilling mud will also reduce frictional forces during carrier pipe installation.

The alluvium, located outside of the river channel, appears to be sand with an increased silt and clay content. This alluvium is anticipated to exhibit raveling behavior when dry and flowing behavior when wet. The ground will require the drilling mud to help stabilize the excavation. The alluvium will tend to have moderate frictional forces during carrier pipe installation due to the sand content and anticipated ground behavior. The use of drilling mud will reduce fictional forces during carrier pipe installation.

The older alluvium that underlies the alluvium is similar to the alluvium located outside of the river channel. The older alluvium includes clay and silt and is distinguished from the alluvium by an increase in gravel and cobble frequency and increased density. There is a possibility of boulders within this deposit. The older alluvium is anticipated to exhibit raveling behavior when dry and flowing behavior when wet. The ground will require drilling mud to help stabilize the excavation. The older alluvium will tend to have high frictional forces during carrier pipe installation due to the sand content and anticipated ground behavior. The use of drilling mud will reduce frictional forces during carrier pipe installation.

The Paso Robles Formation is a formational rock comprised of weakly cemented clay, silt, and sand. The formation is anticipated to exhibit firm behavior and will tend to contain the drilling mud and provide stability to the excavation. The Paso Robles Formation will tend to have low frictional forces during carrier pipe installation due to the stability of the excavation when lubricated and higher frictional forces when the drilling mud is not in the excavation. The contact line between the riverbed alluvium and the Paso Robles Formation is anticipated to project downward at the same angle as the surface topography to an elevation of 95 ft and then transition into a gentle slope to the south.

The dune sand deposits that form the Nipomo Mesa are anticipated to exhibit running behavior when dry and flowing behavior when wet. The ground will require the drilling mud to help stabilize the excavation. Since this is at a higher elevation than the entrance point, a surface casing or a shored pit may be required to prevent over-excavation and to stabilize the hole as the drilling mud may not remain in the hole. The sand dune deposits will tend to have moderate frictional forces during carrier pipe installation due to the sand content and anticipated ground behavior. The drilling mud, if present, will reduce fictional forces during carrier pipe installation.

The drill path is anticipated to enter at 9 degrees at a surface elevation of 190 ft. The drill path then commences a 5,000-ft-radius vertical curve and passes from the relatively softer riverbed alluvium into older alluvium near El. +150. The drill path will enter the gentle sloping Paso Robles Formation near El. +80. The drill path attains its greatest depth of El. +78 in the Paso Robles Formation. The drill path then progresses towards the surface, where it transitions out of the Paso Robles Formation near El, +220 and into the sand dune deposits. The drill path then ends its radius and progresses to the surface near El. +300, where it exits at 14.5 degrees (Drawing 3).

5. HORIZONTAL DIRECTIONAL DRILLING (HDD) CROSSING

The Owner has tentatively selected a pipe size and material. This report assumes installation of a 30-in. OD 24-in. ID DR 9.0 fusion-bonded high-density polyethylene (HDPE) carrier pipe.

According to the preliminary hydraulic analysis provided by AECOM, the carrier pipe is anticipated to have a maximum operating pressure of 100 psi at the southern end near the HDD entry point, a maximum operating pressure of approximately 148 psi at the deepest point in the HDD alignment. The maximum change in pressure due to surge is estimated to be 70 psi, resulting in a total maximum pressure of 218 psi at the deepest point.

5.1 Horizontal Directional Drilling Method Description

HDD’s distinguishing features include a guided and steerable drill tool used to excavate the ground. Spoils are typically washed to the surface through the excavated opening utilizing slurry (drilling mud). The process is completed from the surface in several passes to obtain the final constructed diameter, followed by the installation of a completed pipeline in one continuous operation. During this process, the excavated opening is filled with drilling mud to support the ground. The excavated opening is oversized approximately 50% by volume (30% by diameter) to accommodate the carrier pipe. The HDD method installs pipelines or conduits in an inverted arc profile.

HDD is typically a three-stage construction method with the first stage consisting of pilot hole excavation, the second stage consisting of reaming the hole to the required size, and the third stage consisting of pulling the pipe into the stabilized hole. The pilot hole is excavated using a steerable guided drilling method that follows a prescribed path. The pilot hole starts at the ground surface with an entry angle, most typically between 8 and 20 degrees. It traverses to depth following a large radius vertical curve. After completion of the vertical curve, the hole is drilled horizontally until the designed path progresses to the ground surface, at which time a second vertical curve commences and the drill path intercepts the surface. The drill path exit angle is most typically between 5 and 12 degrees. After the hole has been enlarged to the required size, the carrier pipeline is pulled into the hole. The annular space in the hole can be grouted with a cement grout, but it is more common with the HDD process to leave the drilling mud as the final backfill.

The use of a midpath intercept may reduce risk on this project. A midpath intercept is performed by drilling with two HDD rigs, one from each end. Table 1 summarizes the midpath intercept method as practiced by two contractors since 1999. For this project, one HDD rig would start from the Nipomo Mesa and one HDD rig would start from the dry Santa Maria Riverbed. The larger pull-back rig would be located on the Nipomo Mesa. The two HDD rigs advance the pilot hole along the same drill path from opposite ends until the drill tools are within feet of touching. From this point the HDD drill located in the dry Santa Maria Riverbed reverses direction or withdraws its drill steel while the rig located on the Nipomo Mesa continues to advance the pilot hole. The advancing drill steers to the withdrawing drill, and eventually the drill paths merge into one. The two rigs continue simultaneously withdrawing and advancing until the withdrawing rig's drill steel exits the hole and the advancing rig's drill steel exits at the dry Santa Maria Riverbed location. The Nipomo Mesa rig's drill steel occupies the entire drill path, completing the pilot hole. The drill steel can be connected to both drill rigs and they can be operated in a push-pull arrangement, or one drill rig can perform the remaining operations. The push-pull arrangement allows the excavation to be advanced in either direction and the slurry to be processed at either or both ends. The midpath intercept method may reduce risk by allowing for the entire pilot hole to be drilled with drilling mud and increasing hole stability. Other advantages of the midpath intercept method are:

- Fluid pressures in each drilled hole are better controlled, reducing the risk of an inadvertent return (frac-out).
- Mud return line is not required as the mud is pumped across the reach within the drill steel.
- Drill steel continuously occupies the hole until the carrier pipe is installed. Having drill steel occupy the hole reduces the risk of losing the hole due to hole collapse.

Table 1
Summary of Projects Using the Midpath Intercept Method

California Projects					
Year	Project Owner	Contact	Pipe	Reach	Location
2007	PG&E (Pacific Gas & Electric)	ARB Contractors PG&E	24" Steel	6,779 Feet	Old River, Sacramento, CA
2007	PG&E	ARB Contractors PG&E	24" Steel	5,899 Feet	Middle River, Sacramento, CA
2007	PG&E	ARB Contractors PG&E	24" Steel	6,418 Feet	Latham Slough, Sacramento, CA
2007	City of Coronado, CA	City of Coronado	30" HDPE	3,086 Feet	San Diego Bay, San Diego, CA
2008	PG&E	Southwest Contractors	24" Steel	6,518 Feet	Stone Lakes NWR, Walnut Grove, CA

North American Projects					
Year	Project Owner	Contact	Pipe	Reach	Location
1999	Allinance Pipeline	Universal Ensco	24NPS 1,084.17M	3,557 Feet	Peace River 4&6, Taylor, BC, Canada
2000	North Carolina Gas	U.S. Pipeline	30" Steel	1,280 Feet	Rock Creek/Hendrix Swamp, Concord, NC
2002	Williams Gas Pipeline	Associated Pipeline	20" Steel	4,212 Feet	McClane Parks, Tumwater, WA
2003	WE Energies	WE Energies	30" Steel	2,070 Feet	Little Oconomowoc River, North Lake, WI
2003	WE Energies	WE Energies	30" Steel	2,391 Feet	Mason Creek, Waukesha, WI
2005	Gaz Metropolit	Michels Directional Crossings	20" Steel	7,455 Feet	ST. Lawrence Seaway, Trois-Rivieies, Quebec, Canada
2006	Okaloosa Gas District	Patterson & Wilder Construction	10" Steel	8,400 Feet	Walton County, Okaloosa, FL
2006	Conoco Phillips	Same	18" Steel	4,585 Feet	Wapiti River & hill, Beaver Lodge, Alberta, Canada
2006	Conoco Phillips	Same	18" Steel	2,700 Feet	Wapiti River & hill, Beaver Lodge, Alberta, Canada
2006	Dominion Pow	UTEC Constructors Corp.	10" Steel	7,400 Feet	Elizabeth River, Norfolk Navy Base VA
2006	Dominion Pow	UTEC Constructors Corp.	8" Steel	7,400 Feet	Elizabeth River, Norfolk Navy Base VA
2006	Dominion Pow	UTEC Constructors Corp.	2" Steel	7,400 Feet	Elizabeth River, Norfolk Navy Base VA
2006	Duke Energy	Same	20" Steel	4,200 Feet	LaBiche River, Yukon,. Canada

2006	Keyera	Same	Two-6" Stee	7,218 Feet	Buckinghorse & Daniels, BC, Cana
2006	Keyera	Same	3" Steel	5,512 Feet	Buckinghorse & Daniels, BC, Cana
2007	King County Washington	King County	28" HDPE	3,947 Feet	High School SE6th St., Bellvue, WA
2007	King County Washington	King County	32" Steel	1,063 Feet	Interstate-405, Bellvue, WA
2007	Enbridge Pipeline	Global Pipeline Partne	20" Steel	2,280 Feet	Flambeau River, Ladysmith, WV
2007	Niu Valley	Michels Corporation	20" HDPE	3,250 Feet	Niu Stream/Kalaniaaole Hwy, Honolulu, Oahu, HI
2008	Enbridge Pipeline		42" Steel	2,564 Feet	Kishwaukee River Belvidere, IL
2008	Brunswick Pipeline	Louisbourg Pipelines	30" Steel	4,272 Feet	St. Johns River, St. Johns, New Brunswick, Canada
2008	Gulfstream Natural Gas	Sheehan Pipeline Construction	30" Steel	2,739 Feet	Couse Midden, Port Mayaca, FL
2008	Guardian Pipeline	Price Gregory	20" Steel	2,407 Feet	Fox River Wrightstown, WI
2008	Guardian Pipeline	Price Gregory	30" Steel	3,078 Feet	Rock River, Dodge County, WI
2008	EXXONMOBI	Sheehan Pipeline Construction	42" Steel	4,975 Feet	Indian Bayou, Port Arthur, TX
2008	EXXONMOBI	Sheehan Pipeline Construction	42" Steel	6,017 Feet	Old River Port Arthur, TX
2008	EXXONMOBI	Sheehan Pipeline Construction	42" Steel	4,378 Feet	Taylor Bayou, Port Arthur, TX
2009	PSE&G (Publi Service Electri & Gas)	Napp Grecco	16" Steel	6,230 Feet	Newark Bay, Elizabeth, NJ
2009	Florida Power & Light	Same	9" Steel	5,821 Feet	Miami, FL
2009	Florida Power & Light	Same	9" Steel	5,200 Feet	Miami, FL
2009	Florida Power & Light	Same	9" Steel	5,200 Feet	Miami, FL

5.2 HDD Tracking Methods

Guiding the drill tool over the length, depth, and through the anticipated subsurface conditions is likely to require the use of an electromagnetic guidance system. The guidance system utilizes a source on the surface comprised of a loop, single wire, or solenoid antenna to establish the magnetic field. A walk-over unit is not capable of providing accurate information at the depths required for this project. The field-generating source is surveyed and the location(s) and field strength provided to the processing computer. The sonde, which is a specialized receiver and positional sensor system, is located approximately 10 ft behind the drill tool and receives the magnetic signal. The signal is transmitted to the surface through an insulated wire within the hollow center of the drill steel. A computer on the surface analyzes the information and provides three-dimensional positional information to the HDD operator, who reads the information and directs the steering action. Steering is accomplished by the drill tool, which has a designed bend in the drill tool, known as a bent sub. Steering is accomplished by aligning the bent sub to the desired direction and pushing without rotation. Once the direction has been established, the drill tool is advanced by rotating the drill steel. The maximum steering deflection is limited by the drill tool, drill steel, carrier pipe, ground conditions, and measurement tolerances. Steering tolerances are discussed later in section 12. Line and grade tolerance is typically a function of the contractor’s selected guidance system, depth, ground conditions, and drill path, and is typically expressed as a percentage of the drill path depth. The line and grade tolerance for this project is expected to be on the order of 10%, or 10 ft at depth of 100 ft. It may be necessary to pull back and redrill a portion of the hole to achieve this tolerance.

It may not be possible to monitor the location of the drill tool over the full length of the alignment due to environmental considerations. While it is possible to use field generators for water crossings, doing so requires that the field generator be located and secured in the riverbed. If this is not permissible, the directional control system must be established on both banks of the river, thereby limiting the ability to track the location of the drill tool while drilling under the river.

The contractor will require access over the entire length of the drill path to lay out and survey the field generator wire and to inspect for frac-outs. The width of the easement needs to be at least 100 ft wide, centered over the drive to accommodate the field generator wire. The width of the field generator wire centered over the drill path is the same as the depth of the drill path, or for a 100-ft-deep drill path, 50 ft on either side of the drill path. The contractor needs to be able to clear and grub the path so as to survey the field generator wire and ensure the field generator wire is in close contact with the ground.

5.3 Drilling Mud

Drilling mud is an engineered fluid that consists of water and bentonite, a naturally occurring clay. The mud may include additives that are used to modify specific engineering properties. The bentonite, when mixed with water, becomes a dense fluid with properties that help support the ground, reduce friction, and transport the spoils out to the surface. The drilling mud is pumped through the hollow center of the drill steel to the drill tool. Once the fluid exits the drill tool, it mixes with the excavated materials and is transported back to the drill rig through the annular space of the drilled hole.

The hydraulic pressure required for the drill path varies in proportion to the excavated opening length and depth, and the elevation change. As depth increases, the ground load increases and confines the fluid. Care must be taken to avoid the loss of fluid (an inadvertent return), which may result from fracturing of the ground by the fluid pressure or upon encountering more permeable ground. In the case of the former, the construction of an exit pit may assist in channeling the fluid loss.

Drilling mud is used during pilot-hole excavation, reaming, swabbing, and pullback operations. These HDD operations are defined later in section 5.7.

5.4 Drilling Fluid Management

A shallow drilling pit, approximately 8 ft wide by 20 ft long and sloping downward along the drill path to an 8-ft depth, will be required at each end of the drill path. This pit may need to be shored to prevent collapse due to the existing soil conditions. The drill pit will be used for launching the surface casing, if required, and the pilot and reaming tools, and for the collection of slurry. On this project, the exit point is approximately 100 ft higher than the entry point. The drilling fluids containment pit on the south side needs to be sized to accommodate slurry flowing to the low side once the enlarged hole breaks through during the reaming process. The contractor will be required to capture and contain the excess slurry in Baker tanks. Slurry pits to capture the excess fluids are not permitted. The contractor may also elect to perform forward reaming, pushing the reamer from the entrance to exit side. The contractor is unlikely to perform forward reaming because of the weak cementation anticipated in the Paso Robles Formation and pulling the reamer provides for more efficient excavation. The use of a midpath intercept may reduce the risk of an inadvertent return occurring at the point of minimum cover, reduce the risk of hole collapse as the hole is filled with drilling mud, and improve the ground conditioning on the uphill portion of the reach.

Displaced drilling fluid will flow into the entry drill pit. The simplest method for handling the drilling mud at the exit pit is to run a mud return line back to the entry pit. In the absence of a mud return line, the slurry can be pumped from the exit pit and transported back to the entry pit in vacuum tanker trucks. Another alternative is to set up an additional HDD rig at the exit pit to handle the slurry. A mud return line would require permission from the USACOE and the landowners. The USACOE would likely require a double containment wall if it were to grant permission.

The HDD rig is anticipated to pull the carrier pipe in from south to north from the Nipomo Mesa and displace the drilling mud to the exit pit. The contractor will need to capture and process this displaced drilling mud and may elect to use Baker tanks or vacuum trucks to capture the excess fluids.

5.5 Slurry Separation

The drilling mud is returned to the surface containing suspended solids. The solids are removed through the use of screening plants, desanding cones, and desilting cones, with the cleaned drilling mud being reused in the excavation process. A centrifuge may be required to remove fine silt and clay particles. If a slurry separation plant is not used, then the spoils are typically loaded into a vacuum truck and hauled off-site for dewatering and drying before disposal in order to reduce disposal costs.

For this project, the primary spoils-handling operation is anticipated to be located within the existing construction right-of-way in the Santa Maria River. The volume of drilling mud will vary depending on its formulation, contractor’s method, and physical properties of the excavated ground.

5.6 Typical HDD Profile

For this project, the drill path comprises a broadly sweeping inverted vertical arc. A separate sweeping arc in the horizontal plane or a compound curve is not anticipated.

5.7 HDD Installation Process

HDD is a multistep process. Some of the following steps may not be required on this project, and are noted as optional:

Step 1: Install surface casing (Optional)

A surface casing may be used to support the near-surface soils so as to prevent hole collapse and may be used to insure against inadvertent returns at drilling startup or exiting. A surface casing, comprising a steel casing, may be set into a trench excavation at the predetermined entry angle and then backfilled, pipe rammed into the soil at a predetermined entry angle, or a combination of the two. A surface casing is typically used when the ground is anticipated to have flowing, raveling, or running behavior (see table in Appendix A). The surface casing may also be required by a property owner such as the USACOE.

When the surface casing is installed by pipe ramming, the spoils inside the casing are typically removed with an auger mounted on the HDD drill rig after the ramming has been completed or stopped. The auger is rotated into the casing until the auger is full; rotation is then stopped and the auger extracted. Once the auger section is retrieved to the top of the surface casing, the auger is rotated to remove the spoils. The auger extraction of spoils is repeated until the surface casing is cleared of spoils. The ramming of the casing and spoil removal steps are repeated until the surface casing is installed to the required depth. Surface casings have been installed to lengths of 200 ft. If the surface casing seizes, the normal process is to stop, remove the hammer, clear some of the spoils, replace the hammer, and resume the driving of the casing.

Once the casing is installed and free of spoils, a smaller diameter pipe with centralizers is installed in the casing to hold the drill steel in the center of the casing. This pipe is later removed, after the pilot-hole excavation has been completed, to permit the hole reamer to be inserted or extracted.

Step 2: Drill pilot hole

The HDD drill rig is set up aboveground and the platform inclined between 8 and 15 degrees from horizontal. A 4-to-12-in. diameter hollow steel pipe drill string with a drill tool at the lead end is pushed forward along the designed pilot bore path. Drilling mud is pumped into the drill steel under pressure. The drilling mud exits through the cutting nozzles or through the mud motor on the drill tool, assisting with the excavation of the pilot hole. The drilling mud under pressure returns to the surface and in doing so carries earth spoils back to the drill rig through the annular space of the excavated pilot hole. The pilot hole is extended to the “exit side” or “pipe side” of the HDD installation.

During pilot-hole excavation, the drill path may have difficulty maintaining line and grade when encountering the relatively shallow contacts between softer and harder materials, specifically when transitioning into the weathered and unweathered Paso Robles Formation from the older alluvium. The transition is anticipated to be located below the riverbed near the bottom of the HDD curve.

Step 3: Ream pilot hole

Assuming the slurry is recycled, Step 3 will require the use of a slurry return line or vacuum trucks if only one HDD rig is used. A slurry line would be routed from the exit pit to the HDD rig within the Santa Maria River. If a permit can be obtained for routing the return slurry line across the river, the permitting agency will likely require that the slurry return line be double-contained over its entire length.

Once the pilot hole excavation exits the ground at the intended location, a reamer is attached to the drill string. Drilling mud is again pumped to jets on the reamer from the drill-rig side. As the reamer is pulled back to the drill rig, additional pieces of drill string may be added to the tail end of the reamer on the exit (pipe) side of the installation, or the excavated opening is left without drill steel. The number of reaming passes is dependant on the size of the opening and ground characteristics. For this project, it is expected that it will take a maximum of four reaming passes to accommodate the carrier pipe.

Table 2 summarizes the maximum anticipated excavation based upon pipe dimensions.

Table 2
HDPE Pipe Diameters

Pipe ID Inches nominal	Dimensional Ratio (DR)	AWWA C906-07 Pressure Class PSI	HDPE ID Inches	HDPE OD Inches	Pounds per Linear Foot	Maximum Excavation Diameter Inches
24	9.0	200	22.934	30.0	121.62	45.0

Step 4: Swab reamed hole (Optional)

The reamed hole opening may be “swabbed” using a tool that transports large soil particles out of the opening while encouraging “caking” of the sidewalls by forcing mud into and against the excavated sidewall.

Step 5: Build-up of pipeline

During steps 1 through 4, a separate crew assembles the entire length of carrier pipe that is to be pulled back into the excavated hole. It is assembled and left on rollers or blocks until needed. The pipe handling and assembly are completed in one location, and the pipeline is not pulled until completely assembled. The pipe is anticipated to be laid out along the Blosser Road right-of-way within the City of Santa Maria.

The fusion process creates a small double bead at the joint on the inside and outside of the pipe. The bead protrudes approximately 3/16-in. from the sidewall. The internal bead may affect pipe hydraulics, and the external bead may affect the pipe installation process. Therefore, if the bead must be removed, it needs to be done as part of the fusion process while the pipe is hot; otherwise, subsequent bead removal will likely cause damage to the pipe.

Step 6: Pullback

The pipe string is attached with a swivel head to the drill string and a swab optionally placed in front of the swivel and pipe string. The pipe is then pulled from the pipe side to the drill side in one continuous smooth operation. The swivel head minimizes the rotational forces on the carrier pipe, reducing friction stresses. In some cases, the carrier pipe cannot be laid out in one continuous string, and the pullback must be stopped until the next section is added. The longer and more frequent the shutdown, the more unfavorable for completion of the pullback. The carrier pipe will be filled with water in order for the pipeline to approximate neutral buoyancy in the ground and reduce the installation frictional stress on the pipeline. Since this project is for potable water, the pipe should be filled with potable water.

For this project, the pullback of a single continuous pipe string could be completed within eight hours. However, it would be prudent to allow a longer period, on the order of 24 hours, in the event that problems occur in the field.

Borehole instability is a risk factor for this project due to the excavated diameter, clean sand in the river channel, and dune sands on the Nipomo Mesa. This risk can be minimized by using proper drilling fluid design and continuous quality and quantity monitoring of the fluid. In addition, special reaming tools can be used to help maintain the stability of the borehole. An example of a special reamer is a combination fly cutter and barrel reamer. The fly-cutter component cuts and mixes the ground with the drilling mud, and the barrel component helps pack bentonite into the wall of the borehole to stabilize the hole and reduce the flow of drilling mud from the uphill side (the Nipomo Mesa) to the downhill side (the Santa Maria River).

Pipe friction is a risk factor due to the presence of sand, weight of the pipe, and a potentially dry hole. The risk can be minimized by:

- Reducing friction through the use of pipe rollers on the surface,
- Approximating neutral buoyancy during pullback by incrementally filling the pipe with water during pullback,
- Allowing air to enter the leading end of the pipe string, and
- Performing the pullback in one continuous pull without stopping for incremental welds.

An air line that allows air to flow to the leading edge of the carrier pipe needs to be installed inside the carrier pipe during pullback to avoid creating a vacuum and lifting the water filled carrier pipe above the river elevation.

Upon completion of the pullback, both ends of the carrier should be capped and the pipe filled with water and left to relax and rebound from the installation process at least 24 hours before any additional work is performed.

6. SURFACE CONSTRUCTION REQUIREMENTS

The HDD process creates temporary construction impacts at both ends of the alignment due to access and construction lay-down area requirements. The minimum component area dimensions given exclude truck turnaround areas. Allowing the contractor to use the entire width of the right-of-way and to extend the work areas may allow for a more efficient work area. Lay-down areas are required at four locations:

1. Pipe lay down is anticipated to be in order of preference: 30 ft wide × 2,800 ft long for a continuous string, or 35 ft wide × 1,400 ft long for two strings with one weld during pullback. This area extends from the HDD lay-down area away from the drill path. If necessary, the area may include a slight bend to facilitate a continuous pipe string.
2. North side: approximately 75 ft wide × 250 ft long (Drawing 4).
3. South side: approximately 75 ft wide × 250 ft long (Drawing 4).
4. Equipment storage is anticipated to accommodate eight full tractor trailers with access for unloading select items, as needed, during the project.

Both sides of the proposed crossing require truck access to import equipment, pipe, supplies, and construction materials; and export spoils. Accommodations for workers to cross from one side of the river to the other may be required. Both ends need to accommodate the setup since the contractor should be allowed to select the entrance and exit ends of the drill path. The pullback is required to be from the Nipomo Mesa as there is no easement at this end for the pipe buildup and because of the steep exit angle. For the midpath intercept method, both sides will be continuously occupied for the duration of the project.

7. PIPE MATERIAL AND GEOMETRY

The proposed pipe material for the pressure pipeline is high-density polyethylene (HDPE). HDPE is a common pipe material that is compatible with the HDD installation method. As discussed above, HDPE for HDD applications is typically butt fusion welded. The ends of the pipe are trimmed, heated, and then pressed together. The entire process is measured and monitored to ensure a watertight bond that is structurally capable of withstanding the anticipated installation and operating forces. Once the operating requirements are determined and the alignment configuration and anticipated installation forces calculated, the pipe is checked for operating requirements.

Thrust blocks may be required at the connection of the HDD installed pipe with the open-trench pipeline.

8. HDD PIPE DESIGN CRITERIA

8.1 Corrosion

HDPE is inert to corrosive elements in water and soil and does not require corrosion protection.

8.2 Pipe Wall Thickness Determination

In HDD installations, the pipe strength and wall thickness requirements are determined by the installation and operation loads, which are discussed in more detail below.

8.2.1 Installation Design Evaluation

HDD pipelines differ from conventionally buried pipelines, mainly due to the high loads and stresses that it is subjected to during the installation. The installation process induces tension, bending, and external pressure stresses on the pipe. Jacobs Associates' will perform a preliminary evaluation and the Contractor's engineer will submit a design calculation package before commencing the work.

a. **Tension Stress** is composed of the following stresses (ASCE 2005):

- **Frictional drag between the pipe and the wall of the excavated opening**. The frictional coefficient between the pipe and soil is multiplied by the bearing force around the excavated opening induced by the pulling load.

- **Fluidic drag due to the drilling fluid around the pipe.** Fluidic drag is calculated by multiplying the surface area of the pipe by the frictional coefficient between the drilling fluid and the pipe.

- **Effective weight of the pipe**. The effective weight of the pipe is equal to the difference between the weight of the section of pipe being pulled and the weight of the drilling fluid displaced by the pipe. Note that the weight of the pull section includes the weight of the external coatings and the pipe contents as well as the weight of the product pipe itself. The effective weight is usually expressed in pounds per foot.

  Note that the frictional and fluidic drag always retards the pipe movement underground, thus increasing the tension stress. On the other hand, the effective weight may increase or reduce the tension stress, depending on the buoyancy and pulling direction of the pipe. There are additional factors that affect the pulling load, including drilling fluid, subsurface properties, and removal of cuttings (ASCE 2005). Since these factors are difficult to account for in design calculations, HDD design requires engineering judgment to interpret the numerical results. The maximum allowable tensile stress is based on Pipeline Research Committee (1995).

b. **Bending Stress** is induced as the pipe advances through the curved section of the drill path due to the rigidity of the HDPE pipe. It is a result of the pipe being forced to bend to the curvature of the excavated opening. The design limits for the tubular members in offshore structures are applied to the HDD pipe design. This is due to the similarities between these two loading cases (ANSI / API 1993).

c. **External Hoop Stress** is a result of the following factors:

- Hydrostatic pressure on the pipe due to the weight of the surrounding drilling fluid,
- Hydrokinetic pressure due to the flow of the drilling fluid within and out of the drilled path,
- Hydrokinetic pressure as a result of the pulling of the pipe in the excavated opening, and
- Bearing pressure of the pipe against the excavated opening wall as it is advanced through the curvatures of the drilled path (ASCE 2005).

Hydrostatic pressure equals the height of the drilling fluid column multiplied by the drilling fluid density. The hydrokinetic pressure due to drilling fluid flow can be estimated utilizing annular flow pressure loss formulas. No formulas exist to estimate the hydrokinetic pressure due to pulling of the pipe into the excavated opening and it is purely assessed based on engineering judgment. Similar to bending, external hoop stress design criteria for tubular members in offshore structures are valid for HDD pipe design (ANSI / API 1993).

d. **Combined Installation Stresses**. It is necessary to consider the locations along the HDD pipe, where tensile, bending, and external hoop stresses occur simultaneously. HDD pipe locations with tight radius of curvature, high tension, and high hydrostatic head are checked for serviceability. Design limitations are obtained from ANSI / API 1993.

8.2.2 HDPE Pipe Operating Design Evaluation

The design calculations used to evaluate the HDPE pipe are typically performed in accordance with AWWA M55. The pipe stresses caused by operating conditions on HDD are very similar to the pipe stresses for a conventional trench pipeline, with the addition of flexural stresses caused by elastic bending inherent in HDD pipe. The four sources of the operating load are:

a. **Internal Pressure.** The internal pressure is caused by the fluid within the pipe and results in circumferential tension stress (namely, the hoop stress). The minimum wall thickness is selected in accordance with AWWA M55 and ASME / ANSI 1986. In design, different hydraulic conditions, including static, operating, maximum surge, and transient, are considered.

b. Bending. The elastic bends caused during installation remain in the pipe during operation and thus induce flexural stress on the pipe. These bends are approximated as a circular curve with the same radius of curvature as in the pilot hole data. Calculations and limitations are the same as the bending stresses induced during installation.

c. Thermal Effect. The stress caused by thermal expansion is a result of varying temperatures during construction and operation while the pipe is fully restrained by the surrounding medium. Although the pipe is not restrained by the surrounding soil during construction, this calculation is based on the assumption that soil tends to return to its natural state after installation. The degree to which the pipe will be constrained by the soil depends on the subsurface conditions, and it is hard to predict. It is calculated in accordance with ASME / ANSI 1986.

d. External Pressure. The external pressure is the larger of the load applied by the height of the drilling fluid or the sum of the earth and groundwater load at the lowest elevation of the HDD. The earth load calculation is performed in accordance with ASTM F 1962–99 (ASTM 1999).

e. Pipe Joint Design: Butt-fusion weld joints will be utilized to connect segments of the HDPE pipe for the HDD pipe. A joint efficiency factor is used to lower the strength of the joint in order to account for the type of joint.

In pipe joint design, the combined effect of the stresses due to temperature change and Poisson's effect are considered. The pipe undergoes temperature change since the temperature at which the joints are welded is higher than the temperature of the water as it starts flowing within the pipe. The temperature difference results in axial stress in the joint since the axially constrained pipe has a tendency to contract.

In addition to the stresses due to temperature change, Poisson's effect of the hoop stress is taken into consideration for joint design due to internal pressure and restrained ends. It is our understanding that AECOM will perform this analysis.

9. SCOUR DEPTH CONSIDERATIONS

The design scour depth for the river crossing was not considered in the preliminary design of the river crossing, since scour depth is not considered a deciding factor in the selection of HDD construction methods. HDD construction is a flexible system, and the pipeline can be installed at a deeper depth if the scour analysis so dictates. Any adjustments to the HDD pipeline profile are anticipated to be addressed as the design progresses. Normally, for a deeper alignment, the changes may include increasing the entrance and exit angles or setting back the additional footage that permits the increased depth. This analysis is not included in Jacobs Associates' scope.

10. PERMIT CONSIDERATIONS

Previous experience with HDD projects indicates that several permits may be required on this project. Permits likely to be required are the U.S. Army Corps of Engineers' (USACOE) stream alteration permit for the river crossings, the California Division of Occupational Safety and Health's (CalOSHA) underground classification as a result of the underground construction, a U.S. Environmental Protection Agency stormwater pollution prevention plan (SWPPP), and a regional air quality permit due to the use of diesel equipment. During construction, the contractor may request a permit from the regional air quality board for nongeneration classification of the slurry plant. The nongeneration classification is for equipment that does not generate air pollution through the use of engines and does not release fumes during its operation due to processing materials that contain odorous products. Obtaining this permit may prevent shutdowns during construction due to public complaints if odors are released during the slurry recycling process. Obtaining permits is not included in Jacobs Associates' scope.

11. ALTERNATIVE MATERIALS

Permitting the use of alternative pipe materials will tend to increase the competitiveness of bids. Alternative pipe materials that the Owner may include are:

- Welded steel pipe (WSP) with acceptable lining and coating,
- Permalok™ with T-7 joint for HDD applications with acceptable lining and coating, or
- Ductile iron pipe (DIP).

The current selected material is HDPE—PE 3408.

Permalok™ is a steel pipe with machined mechanical joints that provide thrust restraint without welding. The T-7 joint has two "O-rings" that provide a water-tight joint for pressure systems. The HDD variant provides more surface area for the transfer of tensile forces between pipe segments. Permalok™ joints also transfer thrust loads, which would allow thrust forces without damaging the pipe.

All pipe materials would need to be specifically designed and manufactured for HDD application. WSP would require every welded pipe joint to have the lining and coating patched across the welded joint. All linings would need to be approved for potable water and be flexible enough to accommodate the flexing of the pipe during installation. Possible lining products include fusion bonded epoxy (FBE) and polyurethane. FBE limits the pipe joint length to 20 ft due to the manufacturers not having ovens that can accommodate longer pipe segments. Polyurethane linings do not require ovens and can be supplied in 40-ft segments, reducing the number of welds and joint repair cost.

Permalok does not require welding or joint patching, further reducing the field welding and patching cost over WSP. All coatings would need to meet corrosion and abrasion-resistance requirements and be flexible enough to accommodate the flexing of the pipe during installation. Possible products include polymer concrete (Powercrete™).

12. CONSTRUCTION CONSIDERATIONS

12.1 Curvature Criteria

The minimum radius of curvature during installation for a 30-in. OD HDPE pipe is approximately 30 times the pipe outside diameter, or about 100 ft (based upon dimensional information only). The actual radius of curvature is determined using critical HDPE properties, operating pressure, static pressure, surge pressure, and external loads, in addition to the induced bending stresses from the curvature. The drill steel is also a factor determining the radius of curvature. The minimum drill steel diameter is anticipated to be at least 8 in. The safe minimum radius of curvature for the drill string is approximately 1,200 times the drill steel diameter, or 800 to 1,000 ft for this project. A tighter radius or significantly thicker drill steel would require the use of shorter lengths of drill steel.

The geometry dictated by the layout parameters for this project greatly exceeds the minimum radius of curvature established by constructability and pipe-material considerations.

12.2 Length

A pipe string of about 40 ft longer (20 ft on each end) than the drill path is needed to accommodate for the pipe shrinkage that occurs after the pipe is placed (the pipe is elongated approximately 10 ft due to pulling forces and temperature). The pipe shrinkage occurs as a result of cooler temperatures in the hole and the release of tension developed in the pipe (during pipe pullback) once the pullback is complete. Verification that the HDPE has shrunk will be made before the ends are cut and capped. A maximum HDPE length of about 2,655 ft is anticipated.

12.3 Pipeline Buildup

For this project, the pipeline is anticipated to be built up as one continuous string of pipe for pullback to mitigate risk of the excavation collapsing during pullback.

The HDPE joints will be welded by creating a bead on the inside and outside of each joint. The inner welded bead may need to be removed due to system hydraulic requirements. The outer bead may need to be removed to reduce skin friction and the probability of the pipe string becoming unable to be advanced during pullback.

12.4 Pipeline Design Summary

Table 3 summarizes the preliminary geometry of the HDD profile.

Table 3
General HDD Profile Geometry

Description	Measurement
Entry Angle: Santa Maria River	9 degrees
Entry Elevation	190 ft
Straight Length	277 ft
Vertical Bend Radius	5,000 ft
Curve Length	2123 ft
Invert Elevation	78 ft
Horizontal Bend Radius	N/A
Minimum Depth at River	110 ft
Exit Angle: Nipomo Mesa	14.5 degrees
Straight Length	216 ft
Exit Elevation	300 ft

12.5 Pipe Termination

It is anticipated that the crossing pipeline will be connected to open-cut sections at a later date since open trench construction should not be performed within 100 ft of a pipeline until after the HDD installation is completed. Each end of the pipeline will extend 10 to 20 ft beyond the entry and exit points. The ends will be laid flat in a trench and sealed with an end cap or blind flange. The trench will be backfilled with telltale post and trench tape in order to locate the ends of the pipe during follow-on open-cut construction.

12.6 Preliminary Pullback Calculations

Preliminary pullback calculations were performed utilizing the selected HDPE pipe sizes given in Table 2 and the profile given in Table 3. These calculations were based on the following assumptions: (1) during the installation process, the carrier pipe is backfilled with water as the carrier is pulled into the excavation, and (2) the portion of the carrier pipe that is below the entrance elevation is filled with water and remains filled with water for the life of the facility. Any changes to these will affect the calculations and, hence, the pullback forces, and may cause the carrier pipe to collapse. Table 4 summarizes the anticipated machine installation requirements.

12.7 HDD Rig Size

HDD rig size determination is based on two separate requirements. The first is the pullback force required to pull the carrier pipe into the excavation. The estimated pullback force is summarized in Table 4. The second is the torque required to complete the excavation in a timely and cost efficient manner. The minimum estimated machine torque is included in Table 4.

Table 4
Summary of Preliminary Machine Requirements

Description (unit)	24-in. ID DR 9
Safe Pullback Force (lb)	893,000
Factor of Safety	2.0
Allowable Pullback Force (lb)	446,000
Maximum Required Pullback Force (lb)	357,000
Minimum HDD Machine Pullback Capacity (lb)	700,000
Suggested HDD Machine Pullback Capacity (lb)	1,000,000
Suggested Torque (ft-lb)	100,000

In the event that a contractor elects to use a midpath intercept, the smaller rig would be located on the Santa Maria River side to excavate the pilot hole, recirculate the drilling mud, provide torque assistance during the reaming process, and assist with pullback. If two rigs are used, the pullback force needs to be met by the larger rig. The two machines are required to operate during reaming operations for this exception to apply. If two rigs are used, the combined torque needs to meet 110% of the minimum torque requirements. The smaller rig would need to supply the lesser of a maximum of 20% of the suggested torque or its rated capacity, and the larger rig would need to supply a minimum of 80% of the suggested torque. These requirements are the minimum unless the contractor can demonstrate otherwise.

13. ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COSTS

The Engineer's estimate of probable construction costs with schedule will be submitted under separate cover. The cost estimate will be based upon using a 24-in. ID carrier pipe.

14. REFERENCES

ANSI / API (1993). *Recommended practice for planning, designing and constructing fixed offshore platforms – Working stress design.* 20th Ed. RP 2A-WSD-93, Washington, D.C.

ASCE (2005). *Pipeline design for installation by horizontal directional drilling.* ASCE, Reston, Va.

ASME / ANSI (1986). *Liquid transportation systems for hydrocarbons, liquid petroleum gas, anhydrous ammonia, and alcohols.* ANSI B31.4, New York.

ASTM (1999). *Standard guide for use of maxi-horizontal directional drilling for placement of polyethylene pipe or conduit under obstacles, including river crossings.* F 1962–99, ASTM, West Conshohocken, Pa.

AWWA (2005). *PE pipe – Design and installation.* M55, AWWA, Denver.

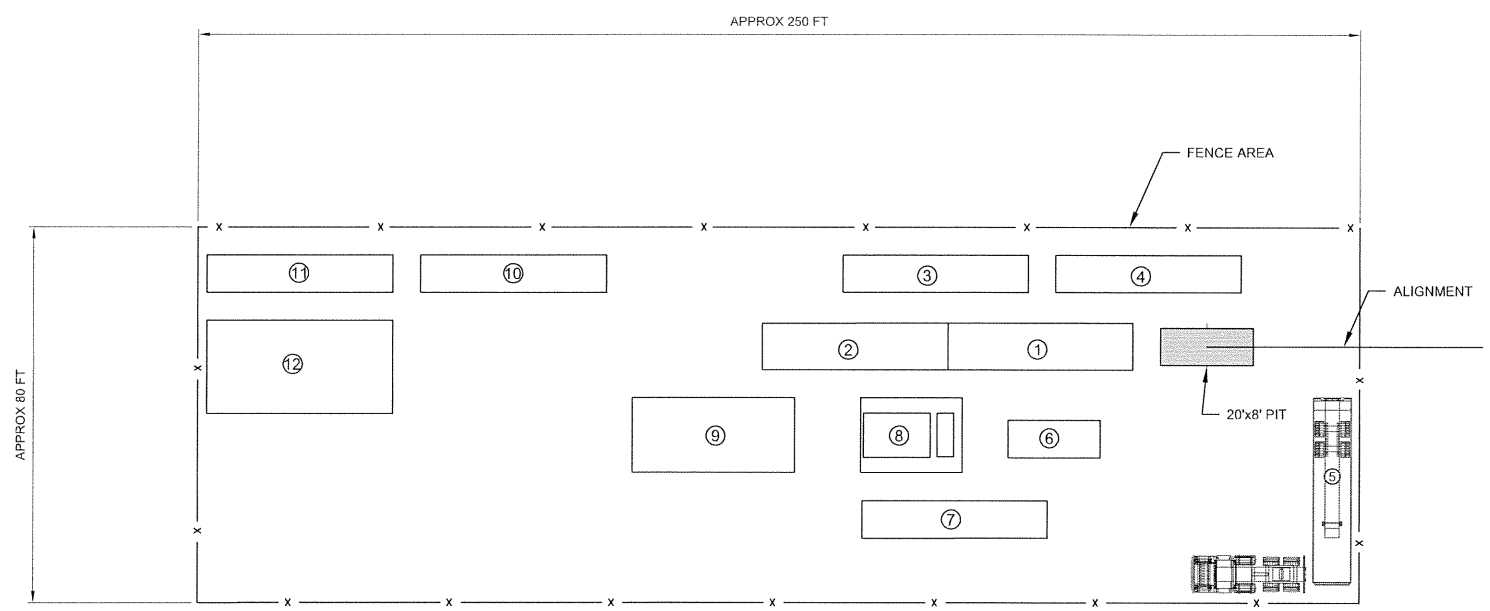
AWWA (2007). *Polyethylene (PE) pressure pipe and fittings, 4 in. (100 mm) through 63 in. (1,575 mm) for water distribution and transmission.* C906, AWWA, Denver.

Pipeline Research Committee (PRC). (1995). *Installation of pipelines by horizontal directional drilling, an engineer's design guide.* American Gas Association, Washington, D.C.

Tunnelman's Ground Classification for Soils
(after Heuer, 1974)

Classification		Behavior	Typical Soil Types
Firm		Heading can be advanced without initial support and final lining can be constructed before ground starts to move.	Loess above water table; hard clay, marl, cemented sand, and gravel when not highly overstressed.
Raveling	Slow Raveling Fast Raveling	Chunks or flakes of material begin to drop out of the arch or walls sometime after the ground has been exposed, due to loosening or to overstress and "brittle" fracture (ground separates or breaks along distinct surfaces, opposed to squeezing ground). In fast raveling ground, the process starts within a few minutes, otherwise the ground is slow raveling.	Residual soils or sand with small amounts of binder may be fast raveling below the water table; slow raveling above. Stiff fissured clays may be slow or fast raveling depending upon degree of overstress.
Squeezing		Ground squeezes or extrudes plastically into tunnel, without visible fracturing or loss of continuity, and without perceptible increase in water content. Ductile, plastic yield and flow due to overstress.	Ground with low frictional strength. Rate of squeeze depends on degree of overstress. Occurs at shallow to medium depth in clay of very soft to medium consistency. Stiff to hard clay under high cover may move in combination of raveling at execution surface and squeezing at depth behind surface.
Running	Cohesive Running Running	Granular materials without cohesion are unstable at a slope greater than their angle of repose (±30-35 degrees). When exposed at steeper slopes they run like granulated sugar or dune sand until the slope flattens to the angle of repose.	Clean, dry granular materials. Apparent cohesion in moist sand or weak cementation in any granular soil may allow the material to stand for a brief period of raveling before it breaks down and runs. Such behavior is cohesive-running.
Flowing		A mixture of soil and water flows into the tunnel like a viscous fluid. The material can enter the tunnel from the invert as well as from the face, crown, and walls, and can flow for great distances completely filling the tunnel in some cases.	Below the water table in silt, sand, or gravel without enough clay content to give significant cohesion and plasticity. May also occur in highly sensitive clay when such material is disturbed.
Swelling		Ground absorbs water, increases in volume, and expands slowly into the tunnel.	Highly preconsolidated clay with plasticity index in excess of about 30, generally containing significant percentages of montmorillonite clay.

Attachment A



LAYDOWN AREA 1 / -

NOTE:

1. THE LAYDOWN AREA SHOWN IS ARRANGED FOR THE WEST SIDE OF THE ALIGNMENT. FOR THE EAST SIDE, THE ARRANGEMENT CAN BE MIRRORED/REVERSED.

CONCEPTUAL MAJOR EQUIPMENT LIST	
1	HORIZONTAL DIRECTION DRILL (HDD) RIG (2 PCS)
2	HORIZONTAL DIRECTION DRILL (HDD)
3	HYDRAULIC POWER PACK (2 REQD)
4	HYDRAULIC POWER PACK
5	VACUUM TRUCK
6	HDD CONTROL CABIN
7	DRILL STEEL TRUCK
8	EXCAVATOR
9	DRILL STEEL STORAGE
10	SPOILS SEPARATION PLANT (2 REQD)
11	SPOILS
12	SPOILS HANDLING AREA

JACOBS ASSOCIATES Engineers/Consultants 1843 Hotel Circle S., Suite 350 San Diego, CA 92108	NIPOMO COMMUNITY SERVICE DISTRICT	PROJECT NO. 4003	REV -
	CONCEPTUAL LAYDOWN AREA ARRANGEMENT	DATE: 06/01/06	FIGURE NO. 4

Appendix E
Frontage Road Sewer Replacement
Preliminary Hydraulic Calculations

Frontage Road Sewer Replacement Preliminary Hydraulic Calculations

Gravity Sewer

Manhole	Design Sta.	Calc'd Inv. El on New Align	Invs.	Notes on Inv. Adj.	Rims
Southland	-76.87		297.15		
F.0 = ~6066	**-74.37**	297.20	**297.20**	Matching i	308.01
	-71.87		297.25		
	47.50		297.86418		
F.1	50.00		**297.914**		310.05
	52.50		297.96418		
	267.50		299.07038		
F.2	270.00		**299.120**		310.84
	272.50		299.17038		
	667.50		301.20272		
F.3	670.00		**301.253**		312.91
	672.50		301.30272		
Luggage	1050.97		303.25	*303.25*	
F.4 = 486b	**1053.47**	**303.30**	**303.30**		317.33
	1055.97		303.35		
	1279.12		304.68569		
F.5	1281.62		**304.736**		321.35
	1284.12		304.78569		
Story	1679.12		307.15	*307.15*	
F.6 = 514b	**1681.62**	**307.28**	**307.20**	**Manually a**	327.01
	1684.12		307.25		
Story	1692.10		307.3		
F.7 = 515b	**1694.60**	**307.35**	**307.35**	Matching i	327.19
	1697.10		307.4		
	2114.58		311.12679		
F.8	2117.08		**311.177**		328.07
	2119.58		311.22679		
Margie	2536.66		314.95	*314.95*	
F.9 = 533b	**2539.16**	**318.095**	**315.0**	**Manually d**	329.2
	2541.66		315.05		
Near Division	3034.66		318.49626		
F.10	3037.16		**318.546**		329.72
	3039.66		318.59626		
Division	3054.50		318.70	*318.70*	
F.11 = 549	**3057.00**	318.75	**318.75**	Matching i	329.33
	3059.50		318.80		

Segment Length	Critical MH ave slope	Design slope	Rise DS Inv to US Inv, ft	Check segment Slope	Manning Velocity: Replace. Diameter (in)	Diameter (ft)	n	Area (ft^2)	Velocity (fps)	Qave (gpd)[1]	Capacity: Qave (cfs)	Peak Flow (gpd)	Peak Flow (cfs)	Max Capacity (50%)	Qfull (cfs)	Qavg/ Qfull	Qpeak/ Qfull	d/D avg flow	d (in) avg flow	d/D peak flow	d (in) peak flow	Velocity Avg Flow	Velocity Peak Flow
119.37	0.00541	0.00515	0.614176235	0.00515	21	1.750	0.011	2.4053	5.599	Future: 1,590,000	2.3850	4,770,000	7.379	6.734	13.468	0.177	0.548	0.270	5.670	0.516	10.836	4.099	5.644
					21	1.750	0.011	2.4053	5.599	Current: 570,000	0.8550	1,710,000	2.645	6.734	13.468	0.063	0.196	0.163	3.423	0.290	6.090	2.979	4.278
215.00			1.106206672	0.00515	21	1.750	0.011	2.4053	5.599	Future: 1,590,000	2.3850	4,770,000	7.379	6.734	13.468	0.177	0.548	0.270	5.670	0.516	10.836	4.099	5.644
					21	1.750	0.011	2.4053	5.599	Current: 570,000	0.8550	1,710,000	2.645	6.734	13.468	0.063	0.196	0.163	3.423	0.290	6.090	2.979	4.278
395.00			2.032333189	0.00515	21	1.750	0.011	2.4053	5.599	Future: 1,590,000	2.3850	4,770,000	7.379	6.734	13.468	0.177	0.548	0.270	5.670	0.516	10.836	4.099	5.644
					21	1.750	0.011	2.4053	5.599	Current: 570,000	0.8550	1,710,000	2.645	6.734	13.468	0.063	0.196	0.163	3.423	0.290	6.090	2.979	4.278
378.47			*1.9472839*	0.00515	21	1.750	0.011	2.4053	5.599	Future: 1,590,000	2.3850	4,770,000	7.379	6.734	13.468	0.177	0.548	0.270	5.670	0.516	10.836	4.099	5.644
					21	1.750	0.011	2.4053	5.599	Current: 570,000	0.8550	1,710,000	2.645	6.734	13.468	0.063	0.196	0.163	3.423	0.290	6.090	2.979	4.278
223.15	0.00621	0.00599	1.335687131	0.00599	21	1.750	0.011	2.4053	6.039	Future: 1,590,000	2.3850	4,770,000	7.379	7.263	14.527	0.164	0.508	0.260	5.460	0.500	10.500	4.324	6.039
					21	1.750	0.011	2.4053	6.039	Current: 570,000	0.8550	1,710,000	2.645	7.263	14.527	0.059	0.182	0.150	3.150	0.280	5.880	3.080	4.421
395.00			*2.36431287*	0.00599	21	1.750	0.011	2.4053	6.039	Future: 1,590,000	2.3850	4,770,000	7.379	7.263	14.527	0.164	0.508	0.260	5.460	0.500	10.500	4.324	6.039
					21	1.750	0.011	2.4053	6.039	Current: 570,000	0.8550	1,710,000	2.645	7.263	14.527	0.059	0.182	0.150	3.150	0.280	5.880	3.080	4.421
7.98	0.01156	na	0.092218798	0.00627	21	1.750	0.011	2.4053	6.179	Future: 1,590,000	2.3850	4,770,000	7.379	7.431	14.863	0.160	0.496	0.260	5.460	0.494	10.374	4.424	6.117
					21	1.750	0.011	2.4053	6.179	Current: 570,000	0.8550	1,710,000	2.645	7.431	14.863	0.058	0.178	0.150	3.150	0.270	5.670	3.151	4.523
417.48	0.00906	0.00893	3.726785372	0.00893	21	1.750	0.011	2.4053	7.376	Future: 1,090,000	1.6350	3,270,000	5.059	8.870	17.740	0.092	0.285	0.202	4.242	0.364	7.644	4.573	6.284
					21	1.750	0.011	2.4053	7.376	Current: 360,000	0.5400	1,080,000	1.671	8.870	17.740	0.030	0.094	0.110	2.310	0.202	4.242	2.950	4.573
417.08			*3.72321463*	0.00893	21	1.750	0.011	2.4053	7.376	Future: 1,090,000	1.6350	3,270,000	5.059	8.870	17.740	0.092	0.285	0.202	4.242	0.364	7.644	4.573	6.284
					21	1.750	0.011	2.4053	7.376	Current: 360,000	0.5400	1,080,000	1.671	8.870	17.740	0.030	0.094	0.110	2.310	0.202	4.242	2.950	4.573
493.00	0.00724	0.00699	3.446262602	0.00699	21	1.750	0.011	2.4053	6.527	Future: 1,090,000	1.6350	3,270,000	5.059	7.849	15.699	0.104	0.322	0.215	4.515	0.392	8.232	4.151	5.796
					21	1.750	0.011	2.4053	6.527	Current: 360,000	0.5400	1,080,000	1.671	7.849	15.699	0.034	0.106	0.110	2.310	0.215	4.515	2.611	4.151
14.84			*0.1037374*	0.00699	21	1.750	0.011	2.4053	6.527	Future: 1,090,000	1.6350	3,270,000	5.059	7.849	15.699	0.104	0.322	0.215	4.515	0.392	8.232	4.151	5.796
					21	1.750	0.011	2.4053	6.527	Current: 360,000	0.5400	1,080,000	1.671	7.849	15.699	0.034	0.106	0.110	2.310	0.215	4.515	2.611	4.151

Manhole diameter, ft: 5

Drop across MHs, conservative: 0.1 ft

Flow multiplier: 1.00

Peak Factor 3.000

Conditional formating Criteria: Max peak d/D = 0.75, Max avg d/D = 0.5, v min (fps) = 2, v max (fps) = 10

(1) Current and future flows and distribution of flows to connecting mains are based on the Southland WWTF Master Plan (AECOM 2009) analysis.

Appendix F
Preliminary Outline of Technical Specifications

Outline of Technical Specifications

This is a draft outline and is subject to change.

BID PACKAGE 1
SANTA MARIA RIVER CROSSING

007300 COORDINATION OF WORK, PERMITS, AND REGULATIONS
012000 MEASUREMENT AND PAYMENT
013300 SUBMITTALS
015100 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS
017410 CLEANING DURING CONSTRUCTION AND FINAL CLEANING
020120 PROTECTING EXISTING UNDERGROUND UTILITIES
030500 GENERAL CONCRETE CONSTRUCTION
099000 PAINTING AND COATING
311100 CLEARING, GRUBBING, AND STRIPPING
312300 EARTHWORK
312316 TRENCHING, BACKFILLING, AND COMPACTING
330521 PIPE RAMMING OF STEEL SURFACE CASING
330525 HORIZONTAL DIRECTIONAL DRILLING
330526 INSTALLATION OF CARRIER PIPE INTO HDD COMPLETED BOREHOLE
330527 ANNULAR BACKFILL GROUTING
331300 DISINFECTION OF PIPING
400515 PRESSURE TESTING OF PIPING
402097 HIGH DENSITY POLYETHYLENE (HDPE) CARRIER PIPE

BID PACKAGE 2
NIPOMO AREA PIPELINE IMPROVEMENTS & FRONTAGE ROAD SEWER REPLACEMENT

07300 SUPPLEMENT TO GENERAL PROVISIONS

011100 COORDINATION OF WORK, PERMITS, AND REGULATIONS

012000 MEASUREMENT AND PAYMENT

013216 CPM CONSTRUCTION SCHEDULE REQUIREMENTS

013233 PRECONSTRUCTION DIGITAL AUDIO-VIDEO DOCUMENTATION

013300 SUBMITTALS

015210 TEMPORARY FIELD OFFICE BUILDING

015526 TRAFFIC REGULATION

015725 STORM WATER RUNOFF CONTROL PROGRAM

017410 CLEANING DURING CONSTRUCTION AND FINAL CLEANING

019310 OPERATION AND MAINTENANCE MANUALS

020120 PROTECTING EXISTING UNDERGROUND UTILITIES

020130 CONNECTIONS TO EXISTING BURIED PIPELINES

023219 SUBSURFACE UTILITY LOCATING (POTHOLING)

033000 CONCRETE

034210 PRECAST CIRCULAR CONCRETE MANHOLES

260500 GENERAL ELECTRICAL REQUIREMENTS

260519 WIRES AND CABLES LESS THAN 600 VOLTS
260526 GROUNDING AND BONDING

260534 CONDUITS, BOXES, AND FITTINGS

260573 ARC-FLASH HAZARD ANALYSIS

099000 PAINTING AND COATING

099752 COLD-APPLIED WAX TAPE COATING

099754 POLYETHYLENE SHEET ENCASEMENT (AWWA C105)

311100 CLEARING, STRIPPING, AND GRUBBING

312300 EARTHWORK

312316 TRENCHING, BACKFILLING, AND COMPACTING

312323 GRAVEL AND CRUSHED ROCK BASE FOR STRUCTURES

313219 FILTER FABRIC

317216 JACKED STEEL CASING

321216 ASPHALT CONCRETE PAVING

321313 PORTLAND CEMENT CONCRETE PAVING

321540 GRAVEL ROADWAY CONSTRUCTION

321613 CONCRETE CURBS, GUTTERS, AND SIDEWALKS

321723 TRAFFIC SIGNING, STRIPING, AND MARKINGS

323112 STEEL CHAIN LINK FENCES AND GATES

330130 LEAKAGE AND INFILTRATION TESTING

330131 SANITARY SEWER SYSTEM TELEVISION INSPECTION

331300 DISINFECTION OF PIPING AND STRUCTURES

333112 PVC GRAVITY SEWER PIPE

344113 TRAFFIC SIGNALS AND INTERSECTION LIGHTING

400500 GENERAL PIPING REQUIREMENTS

400515 PRESSURE TESTING OF PIPING

400520 MANUAL, CHECK, AND PROCESS VALVES

400560 AIR-RELEASE AND VACUUM-RELIEF VALVES

402040 DUCTILE-IRON PIPE

402092 PVC DISTRIBUTION PIPE (AWWA C900)

099720 CHEMICAL-RESISTANT COATINGS FOR CONCRETE

099722 PLASTIC LINER SHEET FOR CONCRETE

BID PACKAGE 3
BLOSSER ROAD WATERLINE AND FLOW METER

07300 SUPPLEMENT TO GENERAL PROVISIONS

011100 COORDINATION OF WORK, PERMITS, AND REGULATIONS

012000 MEASUREMENT AND PAYMENT

013216 CPM CONSTRUCTION SCHEDULE REQUIREMENTS

013233 PRECONSTRUCTION DIGITAL AUDIO-VIDEO DOCUMENTATION

013300 SUBMITTALS

015210 TEMPORARY FIELD OFFICE BUILDING

015526 TRAFFIC REGULATION

015725 STORM WATER RUNOFF CONTROL PROGRAM

017410 CLEANING DURING CONSTRUCTION AND FINAL CLEANING

019310 OPERATION AND MAINTENANCE MANUALS

020120 PROTECTING EXISTING UNDERGROUND UTILITIES

020130 CONNECTIONS TO EXISTING BURIED PIPELINES

023219 SUBSURFACE UTILITY LOCATING (POTHOLING)

033000 CONCRETE

099000 PAINTING AND COATING

099752 COLD-APPLIED WAX TAPE COATING

099754 POLYETHYLENE SHEET ENCASEMENT (AWWA C105)

260500 GENERAL ELECTRICAL REQUIREMENTS

260519 WIRES AND CABLES LESS THAN 600 VOLTS

260526 GROUNDING AND BONDING

260534 CONDUITS, BOXES, AND FITTINGS

260573 ARC-FLASH HAZARD ANALYSIS

311100 CLEARING, STRIPPING, AND GRUBBING

312300 EARTHWORK

312316 TRENCHING, BACKFILLING, AND COMPACTING

312323 GRAVEL AND CRUSHED ROCK BASE FOR STRUCTURES

313219 FILTER FABRIC

317216 JACKED STEEL CASING

321216 ASPHALT CONCRETE PAVING

321313 PORTLAND CEMENT CONCRETE PAVING

321540 GRAVEL ROADWAY CONSTRUCTION

321613 CONCRETE CURBS, GUTTERS, AND SIDEWALKS

321723 TRAFFIC SIGNING, STRIPING, AND MARKINGS

323112 STEEL CHAIN LINK FENCES AND GATES

331300 DISINFECTION OF PIPING AND STRUCTURES

344113 TRAFFIC SIGNALS AND INTERSECTION LIGHTING

400500 GENERAL PIPING REQUIREMENTS

400515 PRESSURE TESTING OF PIPING

400520 MANUAL, CHECK, AND PROCESS VALVES

400560 AIR-RELEASE AND VACUUM-RELIEF VALVES

402040 DUCTILE-IRON PIPE

402092 PVC DISTRIBUTION PIPE (AWWA C900)

409115 MAGNETIC FLOWMETERS

BID PACKAGE 4
JOSHUA STREET PUMP STATION AND RESERVOIR, AND CHLORAMINATION SYSTEMS

07300 SUPPLEMENT TO GENERAL PROVISIONS
011100 COORDINATION OF WORK, PERMITS, AND REGULATIONS
012000 MEASUREMENT AND PAYMENT
013216 CPM CONSTRUCTION SCHEDULE REQUIREMENTS
013233 PRECONSTRUCTION DIGITAL AUDIO-VIDEO DOCUMENTATION
013300 SUBMITTALS
015210 TEMPORARY FIELD OFFICE BUILDING
015526 TRAFFIC REGULATION
015725 STORM WATER RUNOFF CONTROL PROGRAM
017410 CLEANING DURING CONSTRUCTION AND FINAL CLEANING
019310 OPERATION AND MAINTENANCE MANUALS
020120 PROTECTING EXISTING UNDERGROUND UTILITIES
020130 CONNECTIONS TO EXISTING BURIED PIPELINES
023219 SUBSURFACE UTILITY LOCATING (POTHOLING)
031510 CONCRETE JOINTS, WATER STOPS, AND SEALANTS
032100 CONCRETE REINFORCEMENT
033000 CONCRETE
033500 CONCRETE FINISHING AND CURING
042223 CONCRETE UNIT MASONRY
050520 BOLTS, WASHERS, ANCHORS, AND EYEBOLTS
055100 LADDERS, STAIRS, AND STAIR NOSINGS
055200 HANDRAILS AND SAFETY CHAINS
055300 GRATING, COVER PLATES, AND ACCESS HATCHES
081110 METAL DOORS AND FRAMES
099000 PAINTING AND COATING
099752 COLD-APPLIED WAX TAPE COATING
099754 POLYETHYLENE SHEET ENCASEMENT (AWWA C105)
099761 FUSION-BONDED EPOXY LININGS AND COATINGS
238110 HEATING AND AIR-CONDITIONING EQUIPMENT
260500 GENERAL ELECTRICAL REQUIREMENTS
260519 WIRES AND CABLES LESS THAN 600 VOLTS
260526 GROUNDING AND BONDING
260534 CONDUITS, BOXES, AND FITTINGS
260548 SEISMIC RESTRAINT FOR ELECTRICAL EQUIPMENT
260573 ARC-FLASH HAZARD ANALYSIS
261219 PAD-MOUNTED TRANSFORMERS
262650 ELECTRIC MOTORS
262923 VARIABLE FREQUENCY DRIVE (VFD)
263212 STANDBY ENGINE-GENERATORS (LARGER THAN 100 KW)
263710 GENERATOR CONTROL SWITCHGEAR
264213 CATHODIC PROTECTION AND JOINT BONDING
311100 CLEARING, STRIPPING, AND GRUBBING
312300 EARTHWORK
312316 TRENCHING, BACKFILLING, AND COMPACTING
312323 GRAVEL AND CRUSHED ROCK BASE FOR STRUCTURES
313219 FILTER FABRIC
317216 JACKED STEEL CASING
321216 ASPHALT CONCRETE PAVING
321313 PORTLAND CEMENT CONCRETE PAVING
321540 GRAVEL ROADWAY CONSTRUCTION
321613 CONCRETE CURBS, GUTTERS, AND SIDEWALKS
321723 TRAFFIC SIGNING, STRIPING, AND MARKINGS
323112 STEEL CHAIN LINK FENCES AND GATES
329010 LANDSCAPE PLANTING
331300 DISINFECTION OF PIPING AND STRUCTURES
331620 PRESTRESSED CIRCULAR CONCRETE RESERVOIRS
344113 TRAFFIC SIGNALS AND INTERSECTION LIGHTING
400500 GENERAL PIPING REQUIREMENTS
400515 PRESSURE TESTING OF PIPING
400520 MANUAL, CHECK, AND PROCESS VALVES
400560 AIR-RELEASE AND VACUUM-RELIEF VALVES
400722 FLEXIBLE PIPE COUPLINGS AND EXPANSION JOINTS
402040 DUCTILE-IRON PIPE
402057 FUSION EPOXY-LINED AND -COATED STEEL PIPE
402092 PVC DISTRIBUTION PIPE (AWWA C900)
409115 MAGNETIC FLOWMETERS
409715 PRESSURE GAUGES AND PRESSURE SWITCHES
432150 VERTICAL TURBINE PUMPS
433280 PACKAGED CHEMICAL FEED SYSTEM
434117 SURGE TANK SYSTEMS
434127 POLYETHYLENE STORAGE TANKS
444249 IN-LINE STATIC INJECTION RING MIXERS

NIPOMO COMMUNITY SERVICES DISTRICT

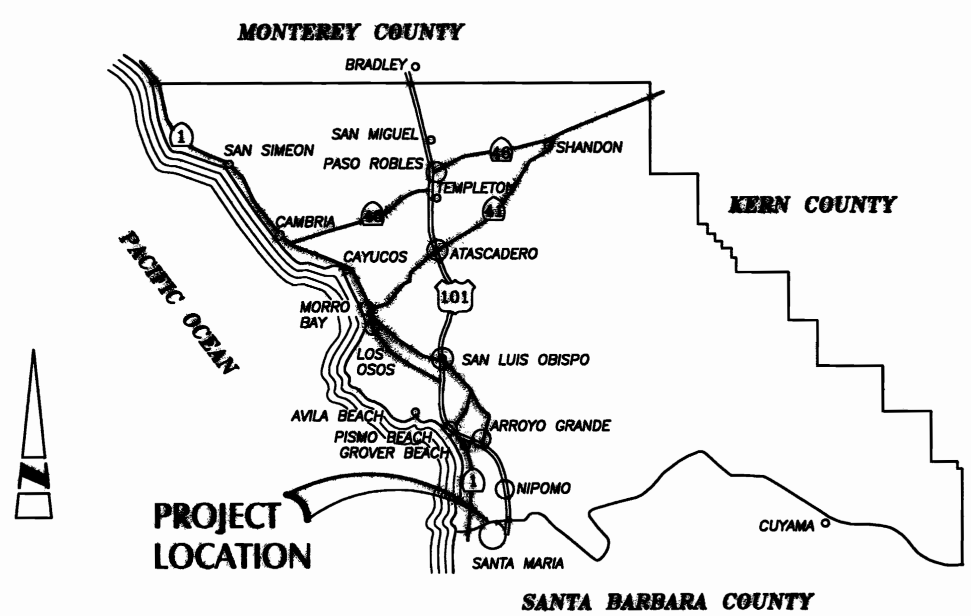
Construction Plans for

WATERLINE INTERTIE PROJECT

Bid Package 1 (BP-1)

Santa Maria River Crossing

MARCH 2009



VICINITY MAP

LOCATION MAP

SHEET INDEX

811 Know what's below. Call before you dig.

**30% PRELIMINARY PLANS - NOT FOR CONSTRUCTION

AECOM

PROJECT: WATERLINE INTERTIE PROJECT - BP1

CLIENT: NIPOMO COMMUNITY SERVICES DISTRICT

APPROVED BY:

DATE

DATE

PROJECT MANAGER: MICHAEL NUNLEY, PE — DATE: 2/2009

CESAR ROMERO, PE — DATE: 2/2009

60061295

SHEET NUMBER 1 OF 11 SHEETS

AECOM
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1194 Pacific Street, Suite 204
San Luis Obispo, California 93401
T 805.542.9840 F 805.542.9990
www.aecom.com

PIPELINE NOTES

HDD NOTES

ABBREVIATIONS

LEGEND

30% DESIGN

AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
1			
2			
3			
4			

PROJECT ENGINEER: CESAR ROMERO
REG NUMBER: C69166
EXP DATE: 06/30/2010

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP1

INDEX AND GENERAL NOTES

DESIGNED: CR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

G-002
SHEET 2 OF 11

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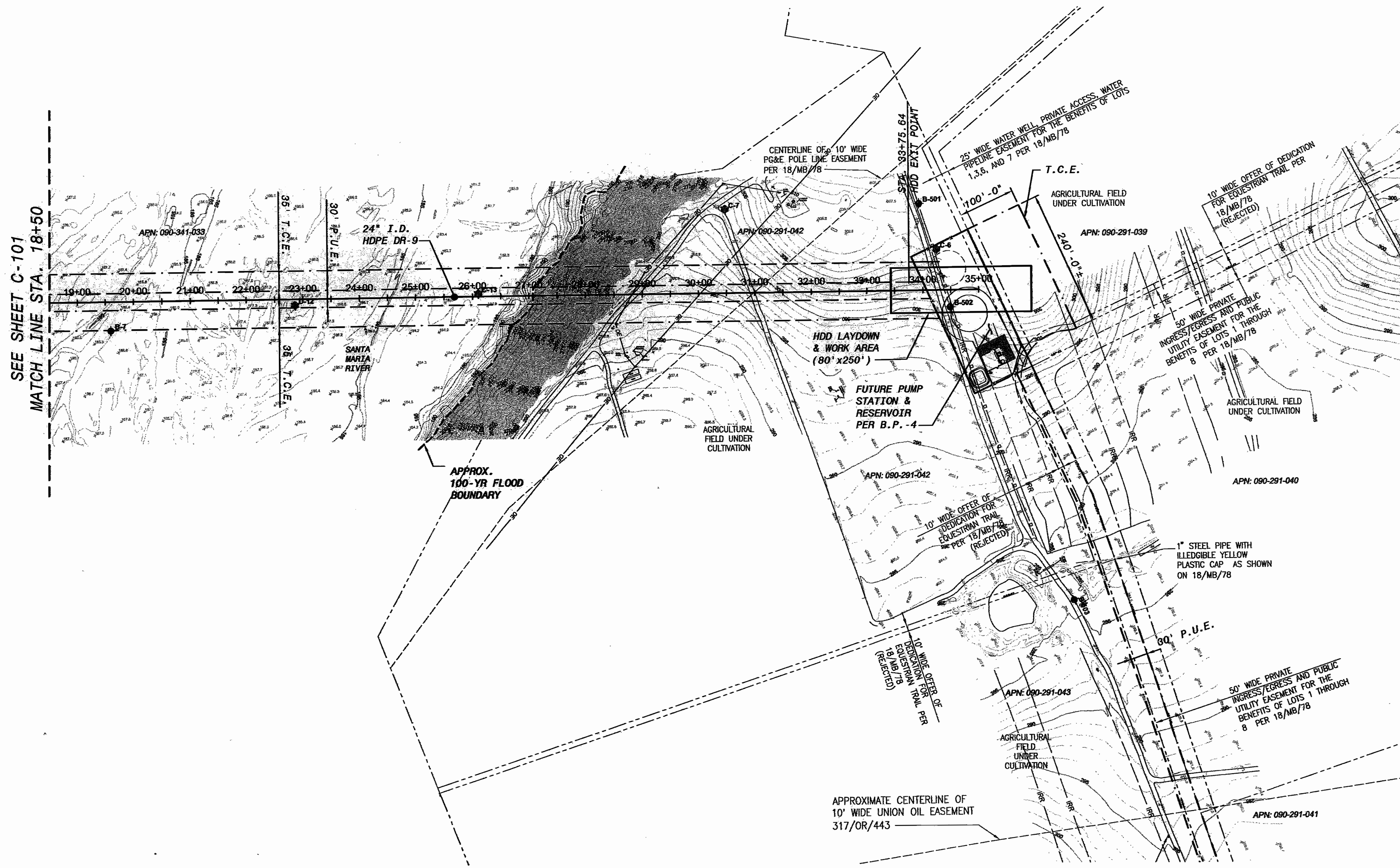

SCALE
0 50 100 200
1 INCH = 100 FEET

30% DESIGN

AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

811 Know what's below. Call before you dig.

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
CESAR ROMERO		C69166	06/30/2010

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NIPOMO

NIPOMO COMMUNITY SERVICES DISTRICT WATERLINE INTERTIE PROJECT - BP1

SITE PLAN - NORTH STA. 18+50 to STA. 40+42

DESIGNED: CR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-102
SHEET 4 OF 11

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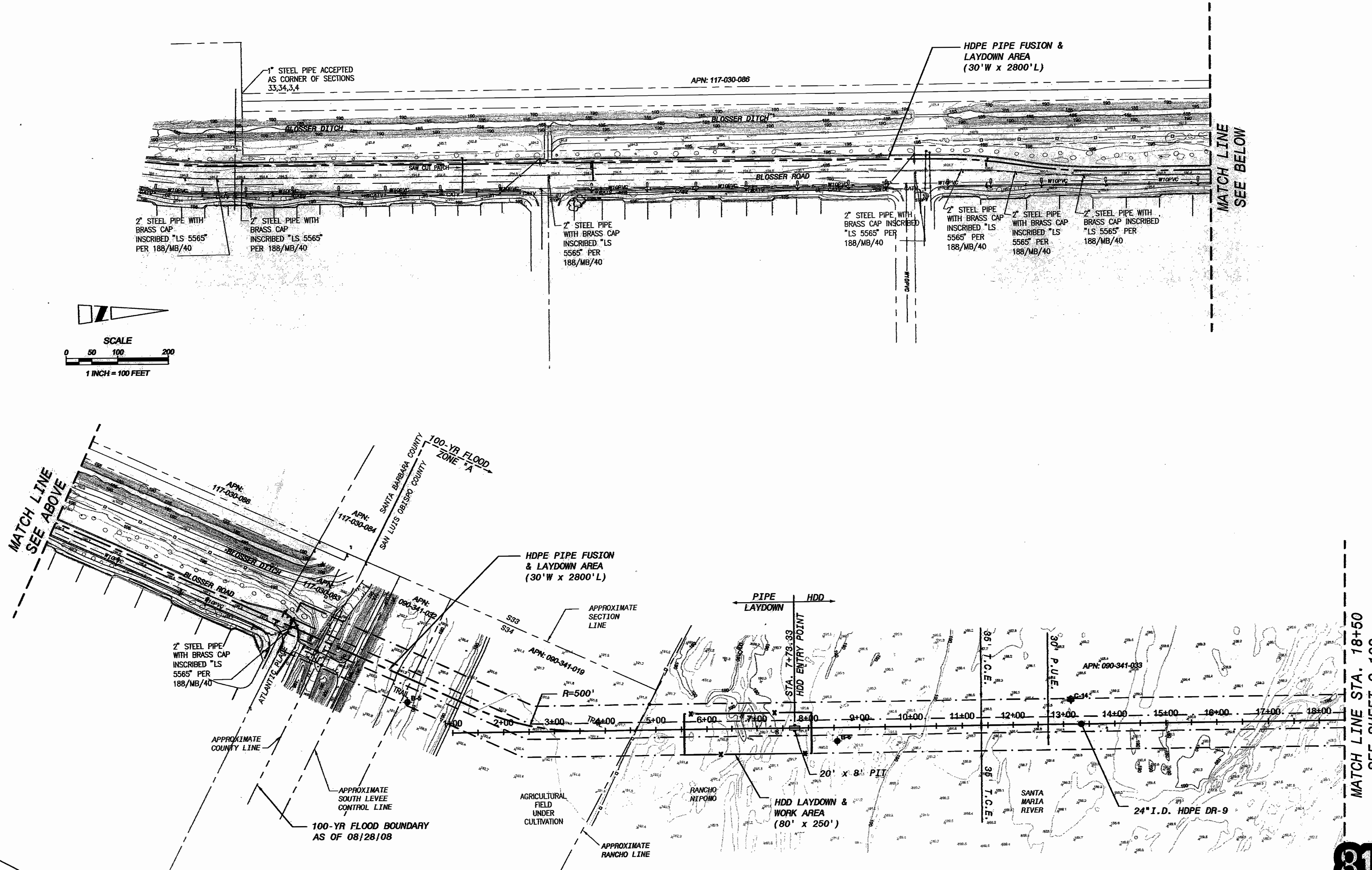

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30% DESIGN

AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

811 Know what's **below.** **Call** before you dig.

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
	PROJECT ENGINEER	REG NUMBER	EXP DATE
	CESAR ROMERO	C69166	06/30/2010

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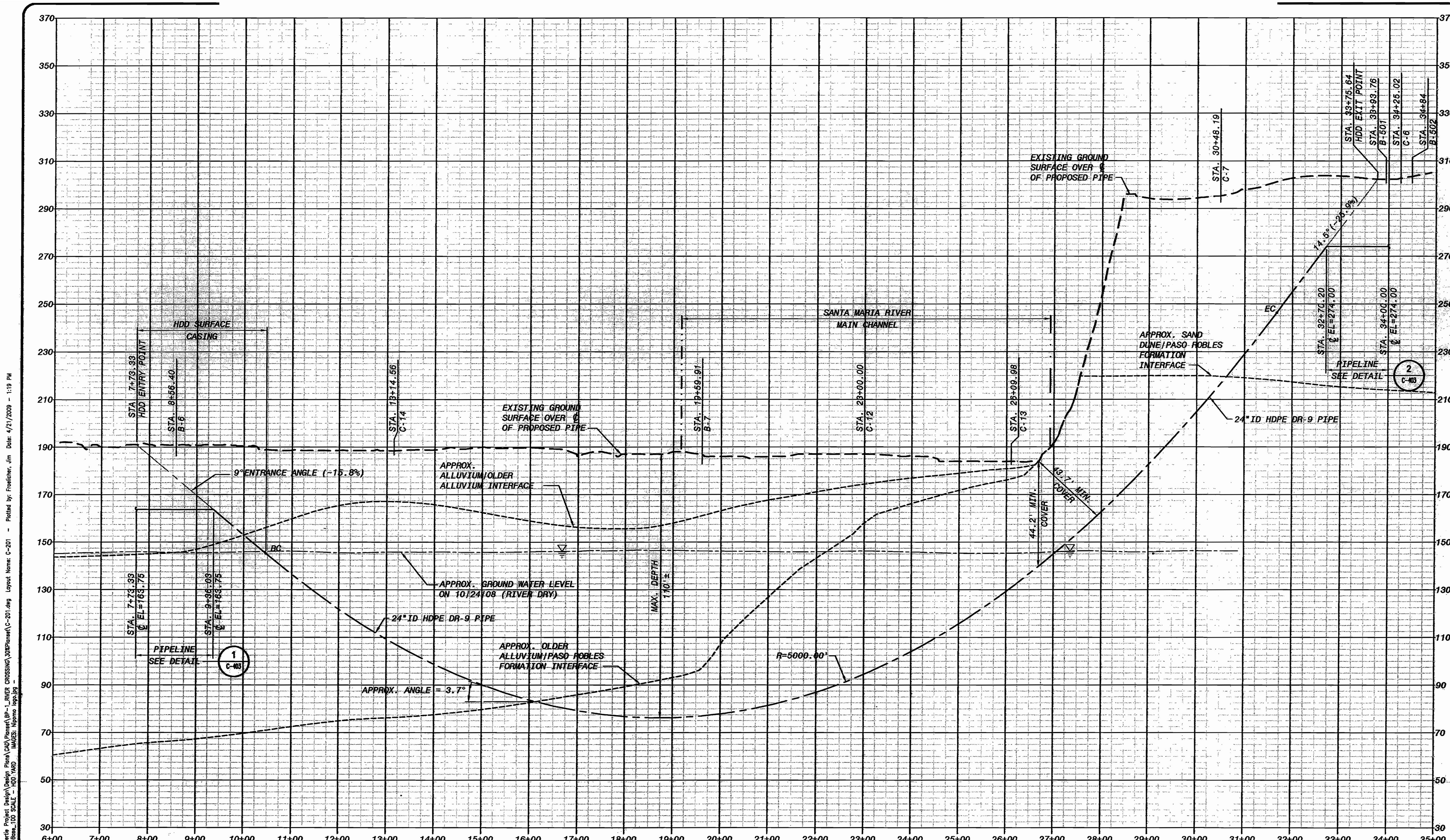
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP1

SITE PLAN - SOUTH
STA. 1+00 to STA. 18+50

DESIGNED: CR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-101
SHEET 3 OF 11



VERTICAL CURVE DATA				
CURVE	RADIUS	DELTA	LENGTH	TANGENT
1	5000.00'	24° 23' 48"	2122.93'	1086.22'

STATION LENGTH = 2602.31'

HDD PATH LENGTH = 2632.16'

PROFILE SCALE
HORIZONTAL 1"=100'
VERTICAL 1"=20'

30% DESIGN

AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
CESAR ROMERO		C69166	06/30/2010

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP1

HDD PROFILE
STA. 6+00 to STA. 35+00

DESIGNED: CR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-201
SHEET 5 OF 11

NIPOMO COMMUNITY SERVICES DISTRICT

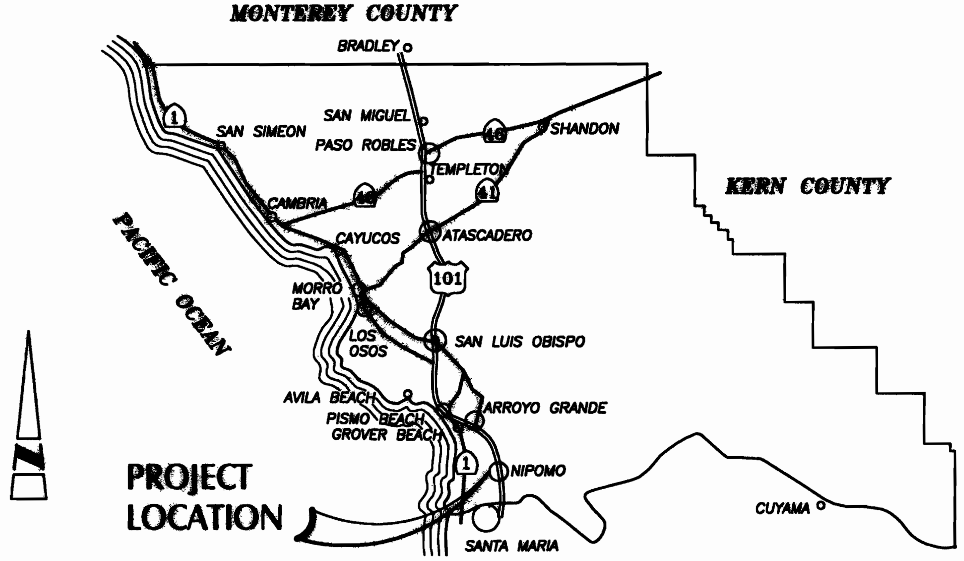
Construction Plans for

WATERLINE INTERTIE PROJECT

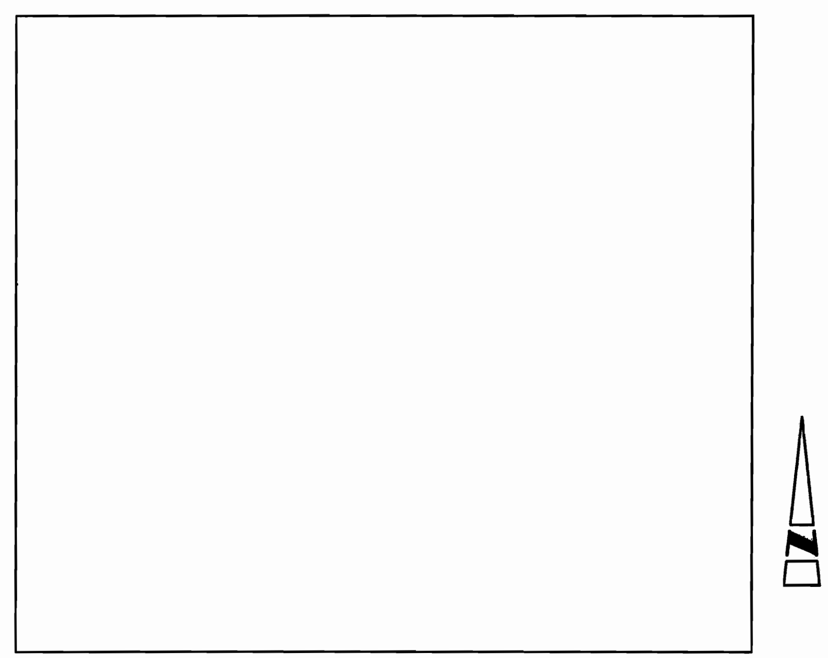
Bid Package 2

Nipomo Area Pipeline Improvements

March 2009



VICINITY MAP



LOCATION MAP

**PRELIMINARY PLANS FOR ALIGNMENT REVIEW - NOT FOR CONSTRUCTION

811 Know what's below. Call before you dig.

AECOM

PROJECT: WATERLINE INTERTIE PROJECT - BP2

CLIENT: NIPOMO COMMUNITY SERVICES DISTRICT

APPROVED BY:

GENERAL MANAGER — DATE

DISTRICT ENGINEER — DATE

PROJECT MANAGER: MICHAEL NUNLEY, PE — DATE: 2/2009

ENGINEER OF RECORD: JOSHUA REYNOLDS, PE — DATE: 2/2009

PROJECT NUMBER: 60061295 — FILE NUMBER

SHEET NUMBER 1 OF 64 SHEETS

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DWG: W:\Nipomo CSD (19996)\19996.70 Waterline Intertie Project Design\Design Plans\CAD\Planset\BP-2_NIPOMO PIPELINE\30% Planset\G-001.dwg Layout Name: G-001 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 2:45 PM
XREFS: IMAGES: Nipomo logo.jpg -

AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR

PROJECT ENGINEER	REG NUMBER	EXP DATE
JOSHUA H REYNOLDS	C65400	09-30-2009

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NIPOMO COMMUNITY SERVICES DISTRICT WATERLINE INTERTIE PROJECT - BP2

GENERAL NOTES

DESIGNED: JR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009

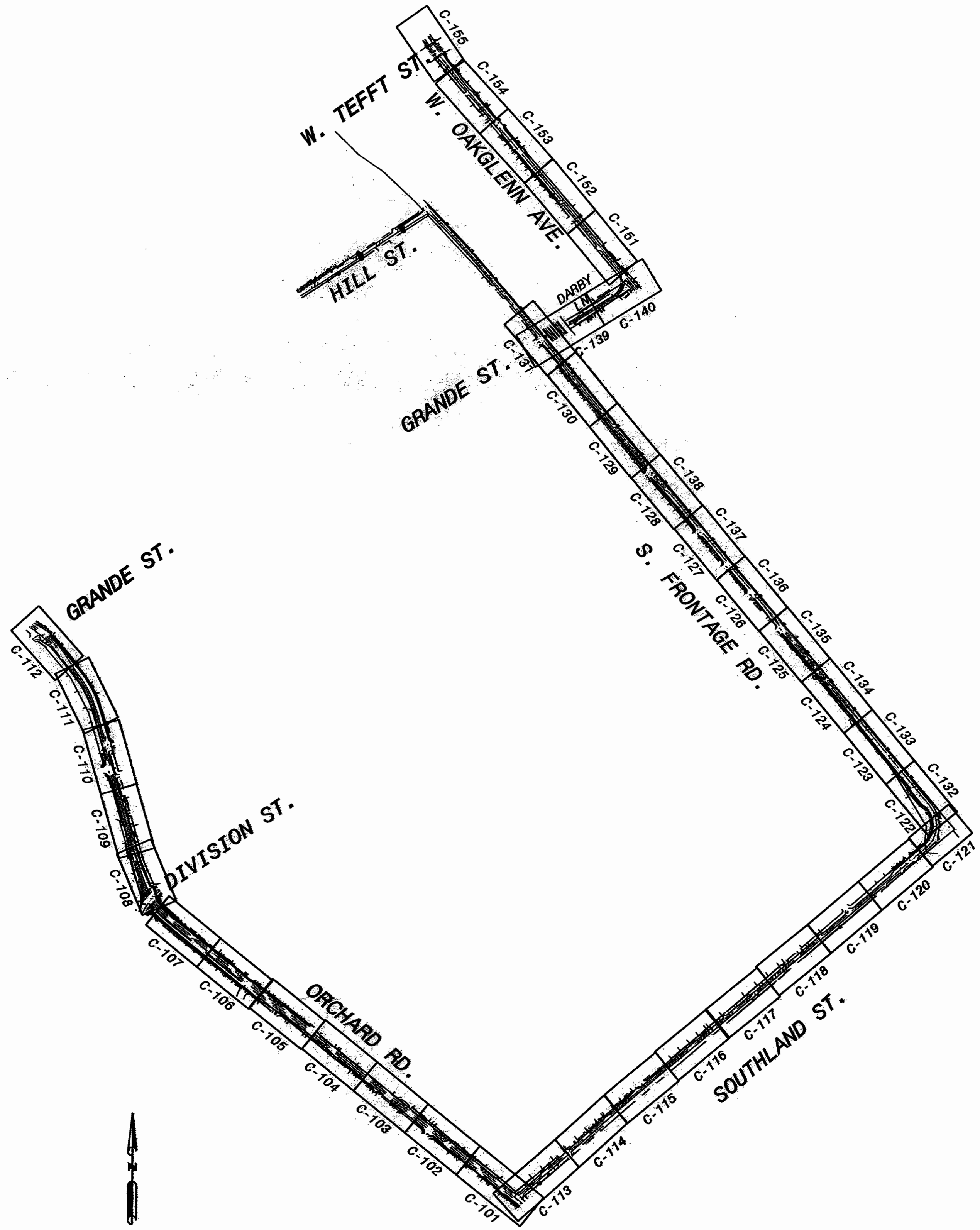
AECOM PROJECT NO. 60081295.0001

NCSD PROJECT NO.

CADD STDS. BOYLE

G-002

SHEET 2 OF 64



SHEET INDEX

SCALE: 1" = 500'

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2	G-002	GENERAL NOTES
3	G-003	SHEET INDEX
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4	C-102	ORCHARD RD. PLAN & PROFILE-STA. 1004+00 to 1009+00
5	C-103	ORCHARD RD. PLAN & PROFILE-STA. 1009+00 to 1013+50
6	C-104	ORCHARD RD. PLAN & PROFILE-STA. 1013+50 to 1018+00
7	C-105	ORCHARD RD. PLAN & PROFILE-STA. 1018+00 to 1022+50
8	C-106	ORCHARD RD. PLAN & PROFILE-STA. 1022+50 to 1027+00
9	C-107	ORCHARD RD. PLAN & PROFILE-STA. 1027+00 to 1031+50
10	C-108	ORCHARD RD. PLAN & PROFILE-STA. 1031+50 to 1036+00
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12	C-110	ORCHARD RD. PLAN & PROFILE-STA. 1040+50 to 1045+00
13	C-111	ORCHARD RD. PLAN & PROFILE-STA. 1045+00 to 1049+50
14	C-112	ORCHARD RD. PLAN & PROFILE-STA. 1049+50 to 1053+00
15	C-113	SOUTHLAND ST. PLAN & PROFILE-STA. 2001+00 to 2004+50
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19	C-117	SOUTHLAND ST. PLAN & PROFILE-STA. 2018+00 to 2022+50
20	C-118	SOUTHLAND ST. PLAN & PROFILE-STA. 2022+50 to 2027+00
21	C-119	SOUTHLAND ST. PLAN & PROFILE-STA. 2027+00 to 2031+50
22	C-120	SOUTHLAND ST. PLAN & PROFILE-STA. 2031+50 to 2036+00
23	C-121	SOUTHLAND ST. PLAN & PROFILE-STA. 2036+00 to 2039+00
24	C-122	S. FRONTAGE RD WATER PLAN & PROFILE-STA. 3001+00 to 3004+50
25	C-123	S. FRONTAGE RD. WATER PLAN & PROFILE-STA. 3004+50 to 3009+00
26	C-124	S. FRONTAGE RD. WATER PLAN & PROFILE-STA. 3009+00 to 3013+50
27	C-125	S. FRONTAGE RD. WATER PLAN & PROFILE-STA. 3013+50 to 3018+00
28	C-126	S. FRONTAGE RD. WATER PLAN & PROFILE-STA. 3018+00 to 3022+50
29	C-127	S. FRONTAGE RD. WATER PLAN & PROFILE-STA. 3022+50 to 3027+00
30	C-128	S. FRONTAGE RD. WATER PLAN & PROFILE-STA. 3027+00 to 3031+50
31	C-129	S. FRONTAGE RD. WATER PLAN & PROFILE-STA. 3031+50 to 3036+00
32	C-130	S. FRONTAGE RD. WATER PLAN & PROFILE-STA. 3036+00 to 3040+50
33	C-131	S. FRONTAGE RD. WATER PLAN & PROFILE-STA. 3040+50 to 3043+00
34	C-132	S. FRONTAGE RD. SEWER PLAN & PROFILE-STA. 5001+00 o 5004+50
35	C-133	S. FRONTAGE RD. SEWER PLAN & PROFILE-STA. 5004+50 to 5009+00
36	C-134	S. FRONTAGE RD. SEWER PLAN & PROFILE-STA. 5009+00 to 5013+50
37	C-135	S. FRONTAGE RD. SEWER PLAN & PROFILE-STA. 5013+50 ti 5018+00
38	C-136	S. FRONTAGE RD. SEWER PLAN & PROFILE-STA. 5018+00 to 5022+50
39	C-137	S. FRONTATE RD. SEWER PLAN & PROFILE-STA. 5022+50 to 5027+00
40	C-138	S. FRONTAGE RD. SEWER PLAN & PROFILE-STA. 5027+00 to 5031+00
41	C-139	HIGHWAY 101 CROSSING PLAN & PROFILE-STA. 4000+00 to 40004+50
42	C-140	DARBY LANE PLAN & PROFILE-STA. 4004+50 to 4008+50
43	C-151	S. OAKGLEN AVE. PLAN & PROFILE-STA. 4008+50 to 4013+00
44	C-152	S. OAKGLEN AVE. PLAN & PROFILE-SAT. 4013+00 to 4017+50
45	C-153	S. OAKGLEN AVE. PLAN & PROFILE-STA. 4017+50 to 4022+00
46	C-154	S. OAKGLEN AVE. PLAN AND PROFILE-STA. 4022+00 to 4026+50
47	C-155	S. OAKGLEN AVE. PLAN & PROFILE-STA. 4026+50 to 4029+00
48	C-401	ORCHARD RD. PRV STATION PLAN & SECTIONS
49	C-402	SOUTHLAND ST. PRV STATION PLAN & SECTIONS
50	C-403	S. FRONTAGE RD. PRV STATION PLAN & SECTIONS
51	C-404	S. OAKGLENN AVE. PRV STATION PLAN & SECTIONS
52	C-405	ISOLATION VALVE LOCATIONS & DETAILS
53	C-406	PRV DETAILS
54	C-501	ORCHARD DETAILS
55	C-502	SOUTHLAND RD. DETAILS
56	C-503	S. FRONTAGE RD. WATER DETAILS
57	C-504	S. FRONTAGE RD. SEWER DETAILS - 1
58	C-505	S. FRONTAGE RD. SEWER DETAILS - 2
59	C-506	BORE AND JACK DETAILS
60	C-507	S. OAKGLENN AVE. DETAILS
61	C-508	GENERAL WATER PIPELINE DETAILS - 1
62	C-509	GENERAL WATER PIPELINE DETAILS - 2
63	C-510	GENERAL SEWER SYSTEM DETAILS - 1
64	C-511	GENERAL SEWER SYSTEM DETAILS - 2

AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV | DATE | DESCRIPTION | APPR

PROJECT ENGINEER: JOSHUA H. REYNOLDS | REG NUMBER: C65400 | EXP DATE: 09/30/2009

AECOM

NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

SHEET INDEX

DESIGNED: JHR
DETAILED: JPG
CHECKED:
APPROVED:
DATE: MARCH 2009

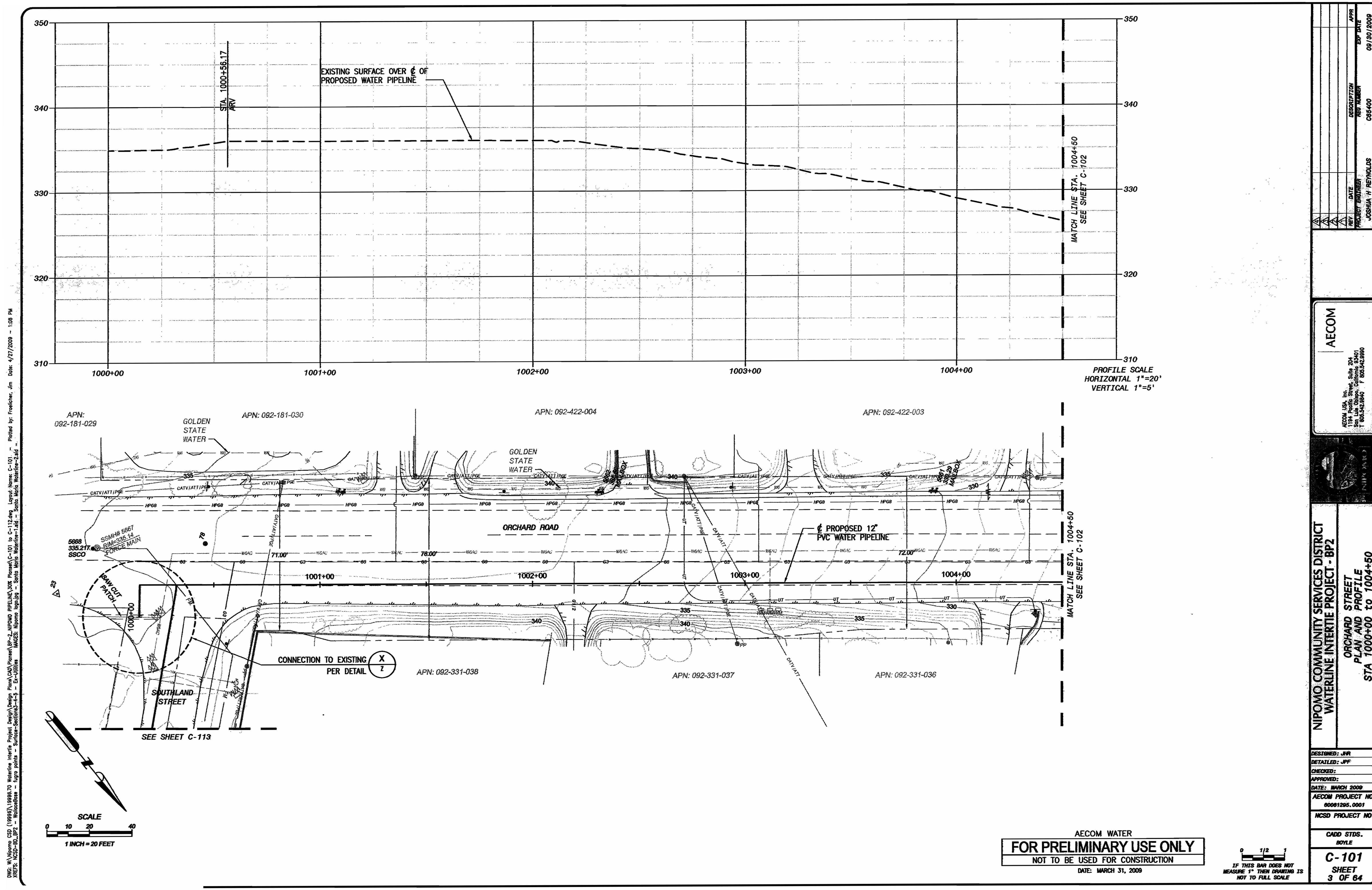
AECOM PROJECT NO. 60061295.0001

NCSD PROJECT NO.

CADD STDS. BOYLE

G-003

SHEET 3 OF 64


EXISTING SURFACE OVER ℄ OF PROPOSED WATER PIPELINE
STA. 1000+56.17 ARV
MATCH LINE STA. 1004+50 SEE SHEET C-102
1000+00
1001+00
1002+00
1003+00
1004+00
PROFILE SCALE
HORIZONTAL 1"=20'
VERTICAL 1"=5'
APN: 092-181-029
APN: 092-181-030
APN: 092-422-004
APN: 092-422-003
GOLDEN STATE WATER
ORCHARD ROAD
℄ PROPOSED 12" PVC WATER PIPELINE
5668 335.217 SSCO
SSMH# 5667 RIM=336.14 FORCE MAIN
SAW CUT PATCH
CONNECTION TO EXISTING PER DETAIL
SOUTHLAND STREET
SEE SHEET C-113
APN: 092-331-038
APN: 092-331-037
APN: 092-331-036
SCALE
0 10 20 40
1 INCH = 20 FEET
AECOM WATER
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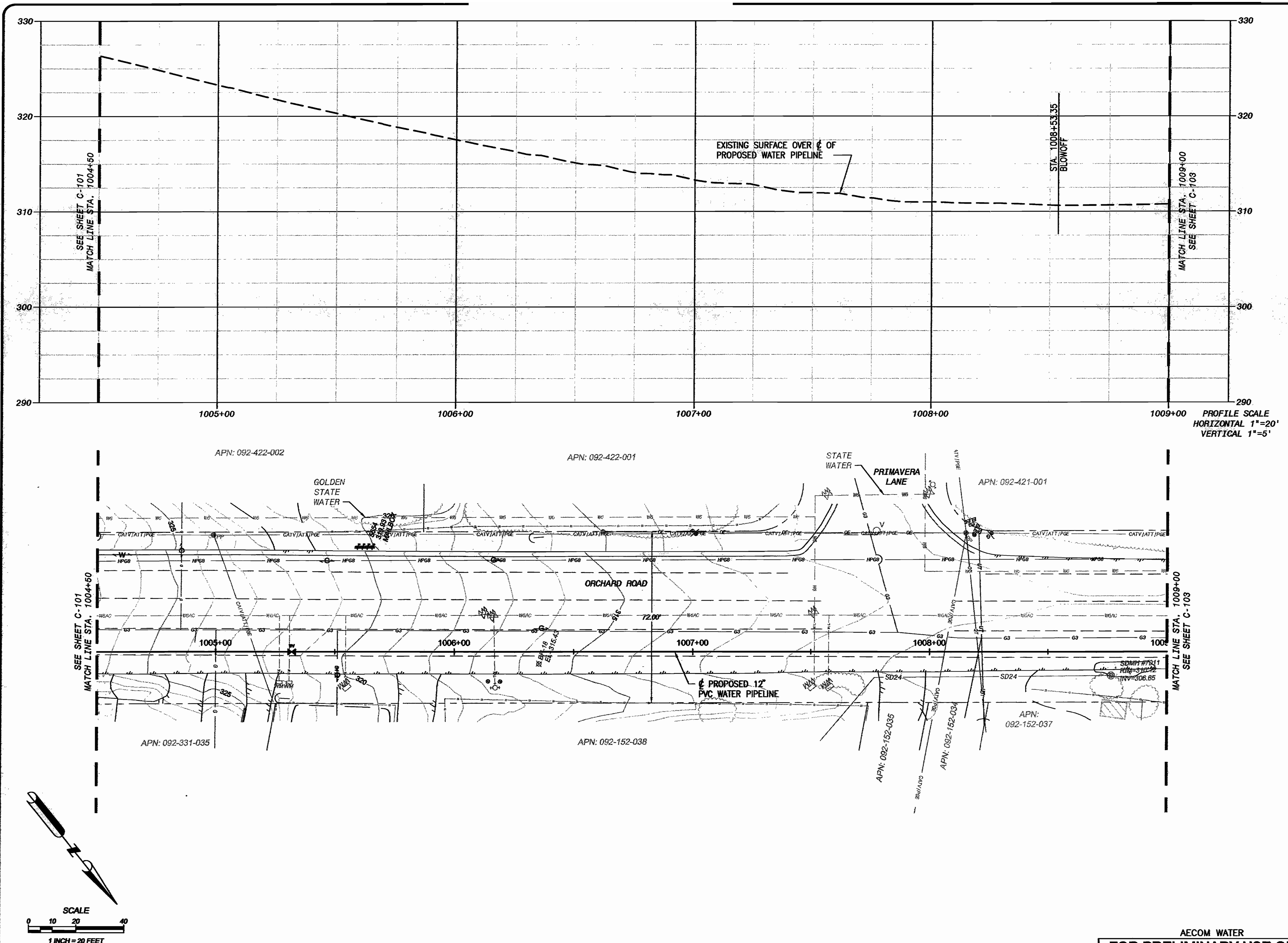
NOT TO BE USED FOR CONSTRUCTION
DATE: MARCH 31, 2009
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE
REV DATE DESCRIPTION APPR
PROJECT ENGINEER JOSHUA H REYNOLDS
REG NUMBER C65400
EXP DATE 09/30/2009
AECOM
AECOM USA, Inc. 1194 Pacific Street, Suite 204 San Luis Obispo, California 93401 T 805.542.9840 F 805.542.9990 www.aecom.com
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2
ORCHARD STREET
PLAN AND PROFILE
STA 1000+00 to 1004+50
DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE
C-101
SHEET 3 OF 64



AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV.	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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NIPOMO COMMUNITY SERVICES DISTRICT WATERLINE INTERTIE PROJECT - BP2

ORCHARD STREET PLAN AND PROFILE STA 1004+50 to 1009+00

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009

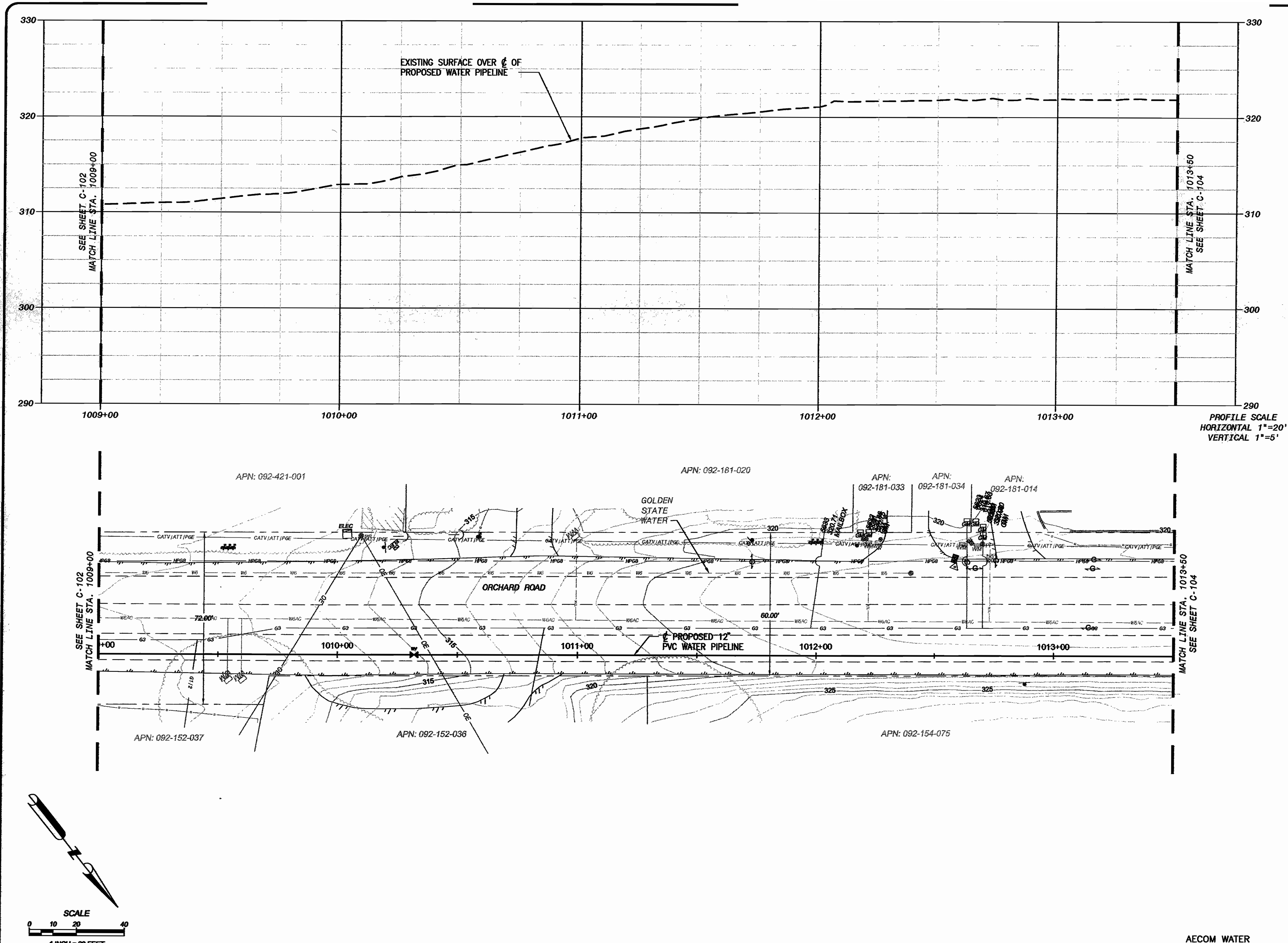
AECOM PROJECT NO. 60061295.0001

NCSD PROJECT NO.

CADD STDS. BOYLE

C-102

SHEET 4 OF 64



AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

ORCHARD STREET PLAN AND PROFILE
STA 1009+00 to STA. 1013+50

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009

AECOM PROJECT NO. 60061295.0001

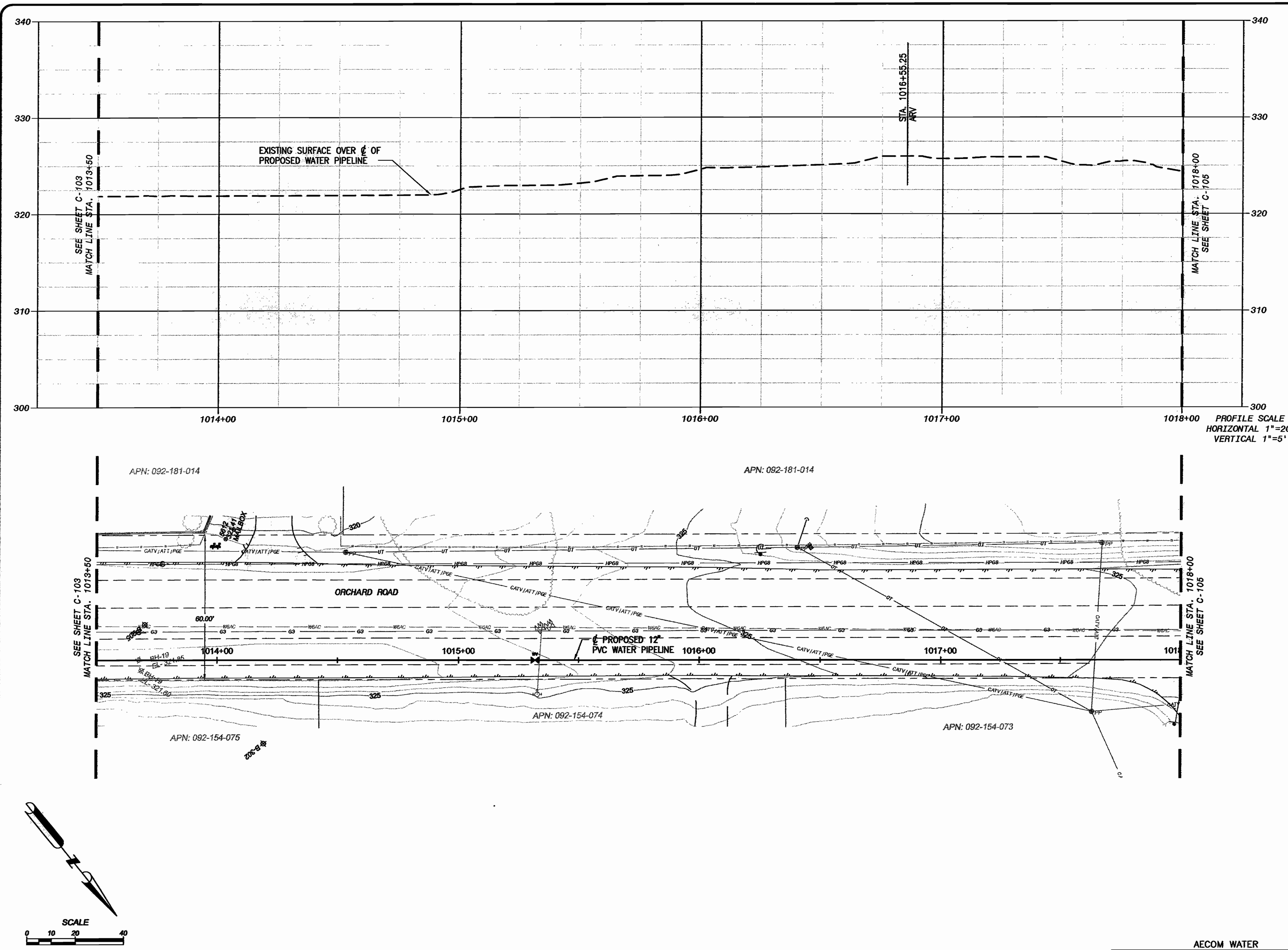
NCSD PROJECT NO.

CADD STDS. BOYLE

C-103

SHEET 5 OF 64

Layout Name: C-103 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 1:09 PM



AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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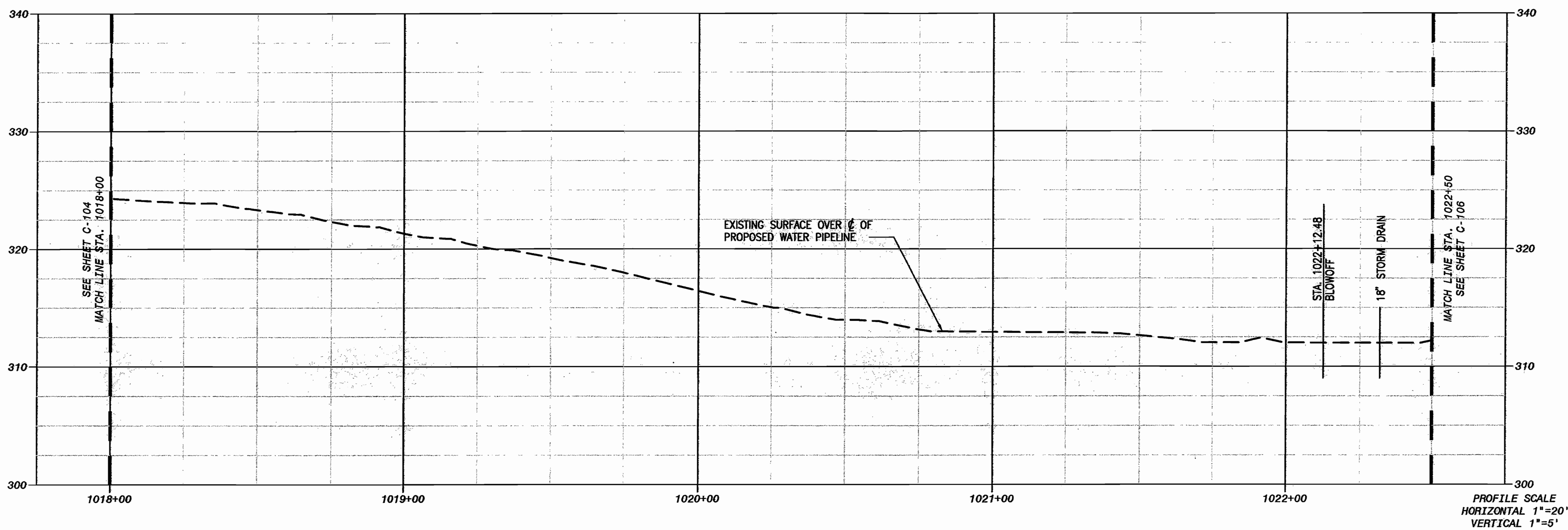
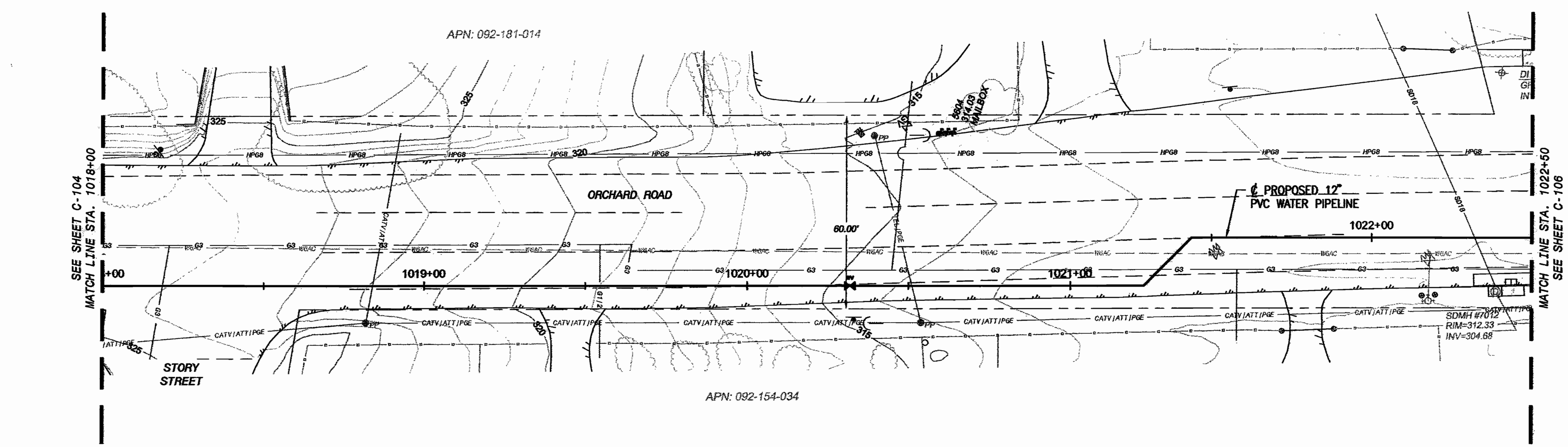
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

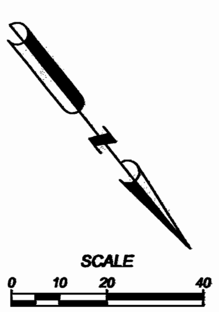
ORCHARD STREET
PLAN AND PROFILE
STA 1013+50 to STA. 1018+00

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-104
SHEET 6 OF 64







DWG: W:\Nipomo CSD (19998)\19998.70 Waterline Intertie Project Design\Design Plans\CAD\Planset\BP-2_NIPOMO PIPELINE\30% Planset\C-101 to C-112.dwg Layout Name: C-105 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 1:10 PM

AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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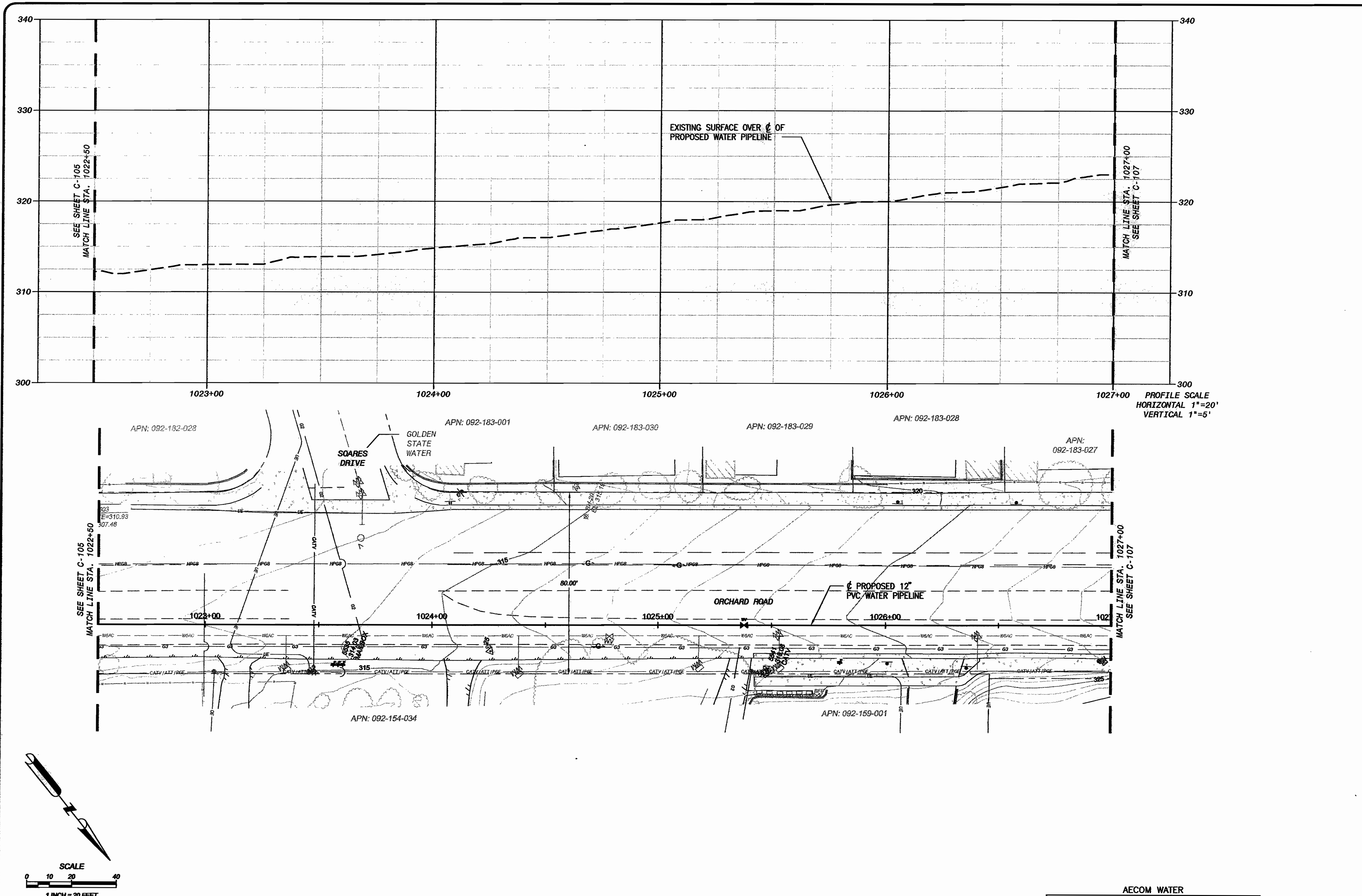
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

ORCHARD STREET
PLAN AND PROFILE
STA 1018+00 to STA. 1022+50

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-105

SHEET 7 OF 64



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REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

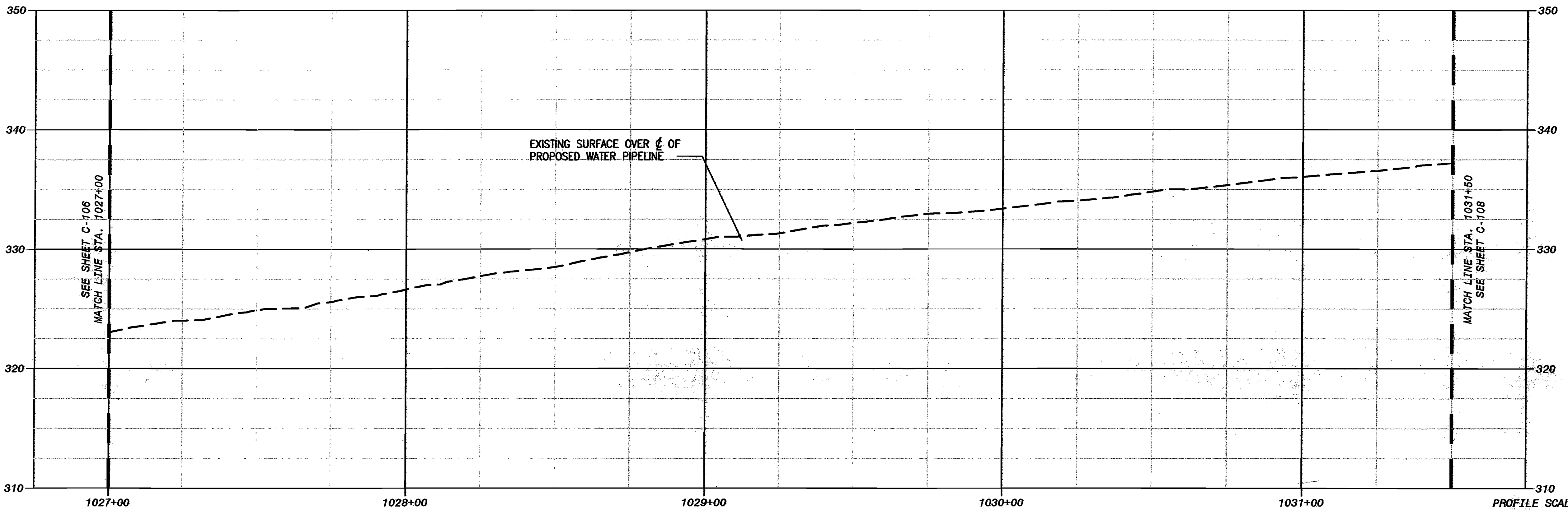
ORCHARD STREET
PLAN AND PROFILE
STA 1022+50 to STA. 1027+00

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

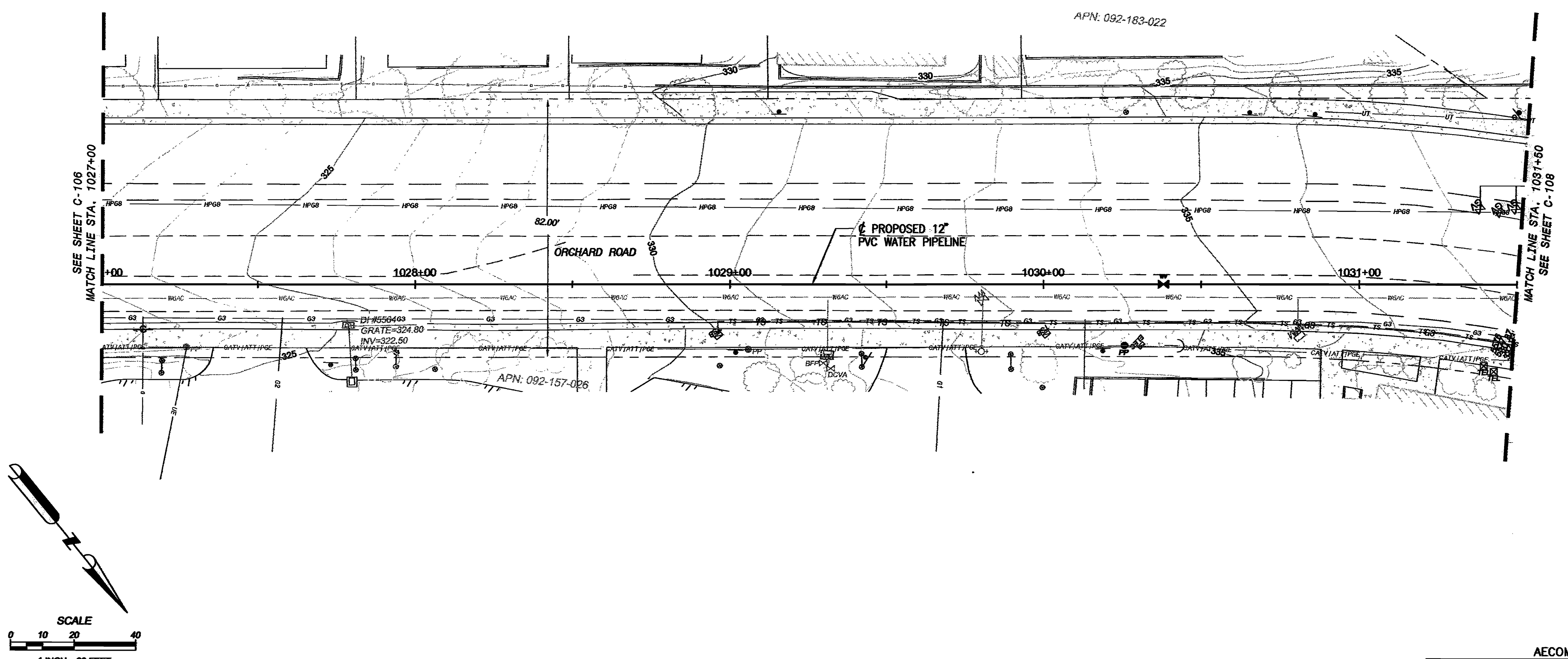
AECOM WATER
FOR PRELIMINARY USE ONLY
NOT TO BE USED FOR CONSTRUCTION
DATE: MARCH 31, 2009

0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

C-106
SHEET
8 OF 64



PROFILE SCALE
HORIZONTAL 1"=20'
VERTICAL 1"=5'



AECOM WATER
FOR PRELIMINARY USE ONLY
NOT TO BE USED FOR CONSTRUCTION
DATE: MARCH 31, 2009

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

ORCHARD STREET
PLAN AND PROFILE
STA 1027+00 to STA. 1031+50

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-107
SHEET 9 OF 64

DWG: W:\Nipomo CSD (19998)\19998.70 Waterline Intertie Project Design\Design Plans\CAD\Plansets\BP-2_NIPOMO PIPELINE\30% Plansets\C-101 to C-112.dwg Layout Name: C-107 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 1:12 PM
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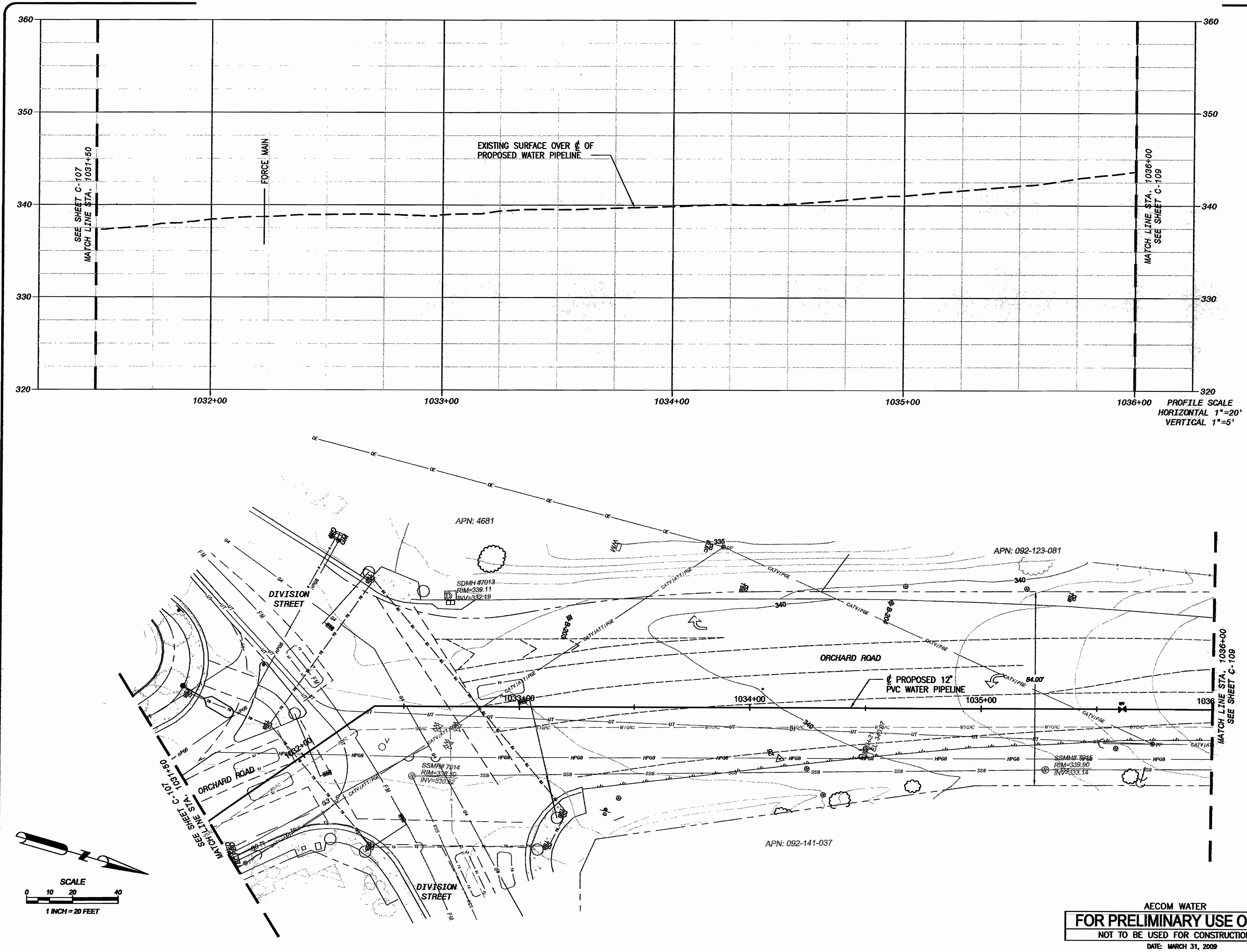

AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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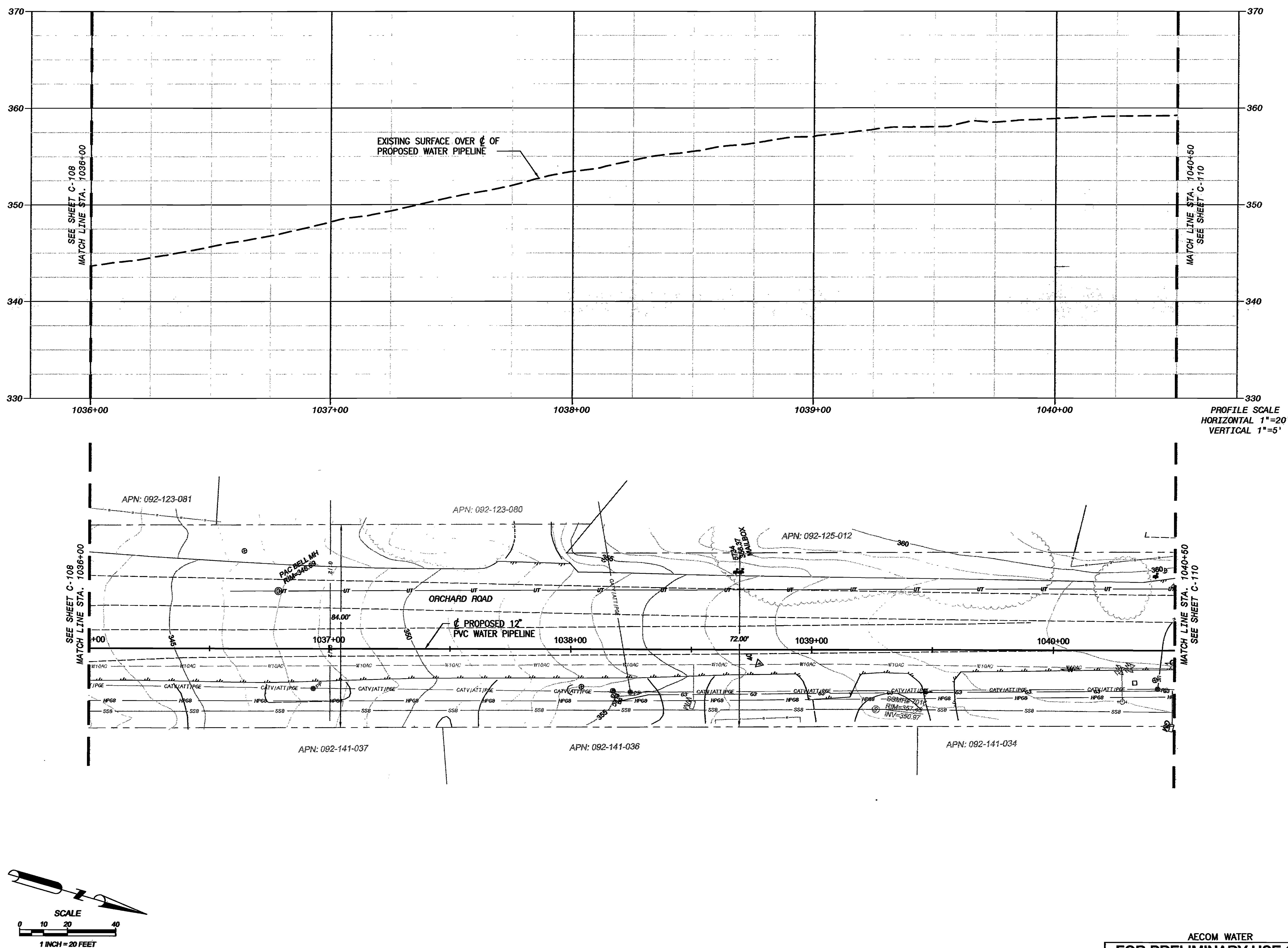
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

ORCHARD STREET PLAN AND PROFILE
STA 1031+50 to STA. 1036+00

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-108

SHEET 10 OF 64



AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV | DATE | DESCRIPTION | APPR

PROJECT ENGINEER: JOSHUA H REYNOLDS | REG NUMBER: C65400 | EXP DATE: 09/30/2009

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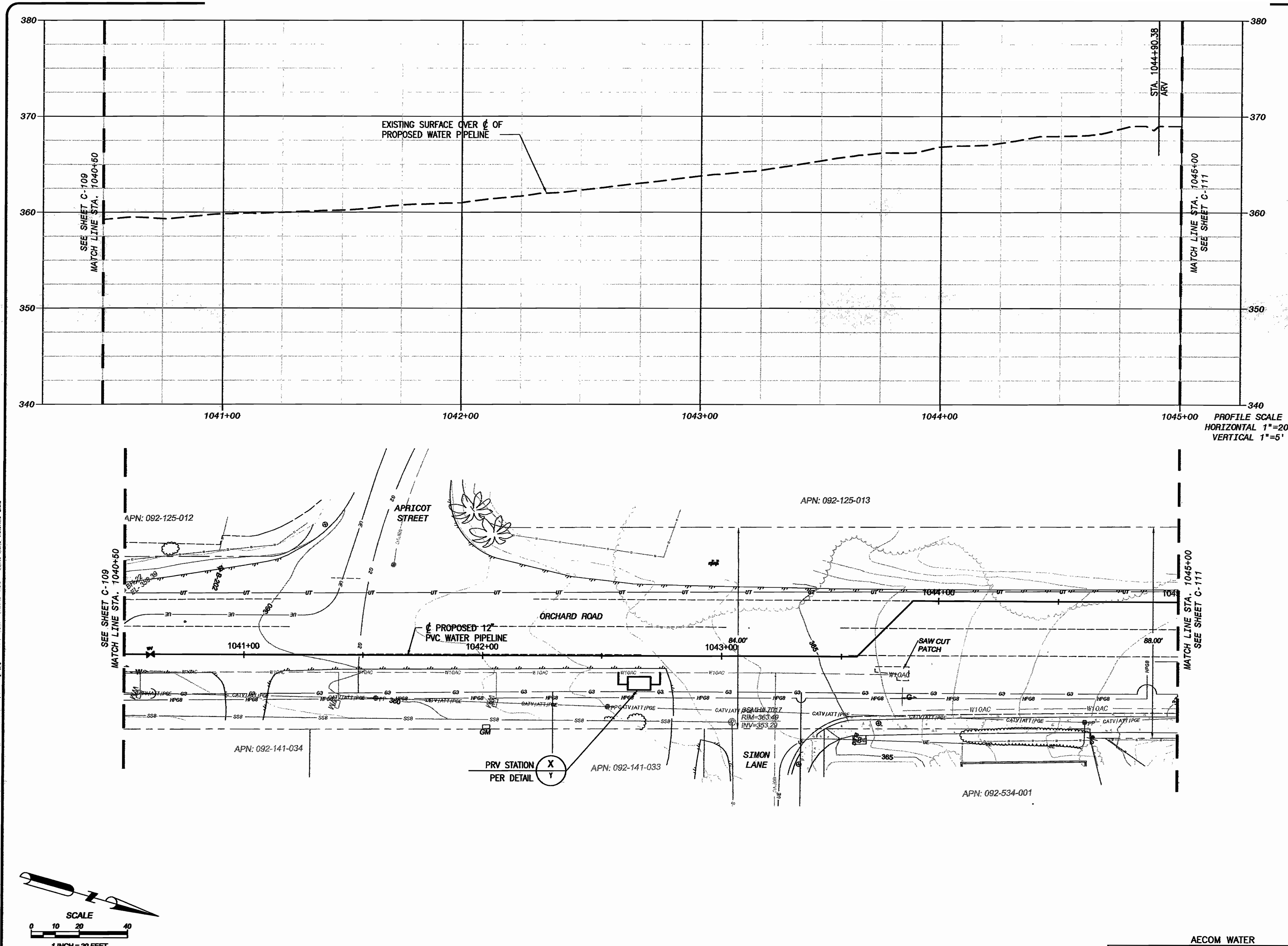
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

ORCHARD STREET
PLAN AND PROFILE
STA 1036+00 to STA. 1040+50

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-109
SHEET 11 OF 64



AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

DWG: W:\Nipomo CSD (19996)\19996.70 Waterline Intertie Project Design\Design Plans\CAD\Planset\BP-2_NIPOMO PIPELINE\30% Planset\C-101 to C-112.dwg Layout Name: C-110 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 1:14 PM
XREFS: NCSD-BD_BP2 - WallaceBase - fugro points - Surface-Sections3-4-5 - Ex-Utilities IMAGES: Nipomo logo.jpg - Santa Maria Waterline-1.sid - Santa Maria Waterline-2.sid -

REV	DATE	DESCRIPTION	APPR
4			
3			
2			
1			

PROJECT ENGINEER: JOSHUA H. REYNOLDS — REG NUMBER: C65400 — EXP DATE: 09/30/2009

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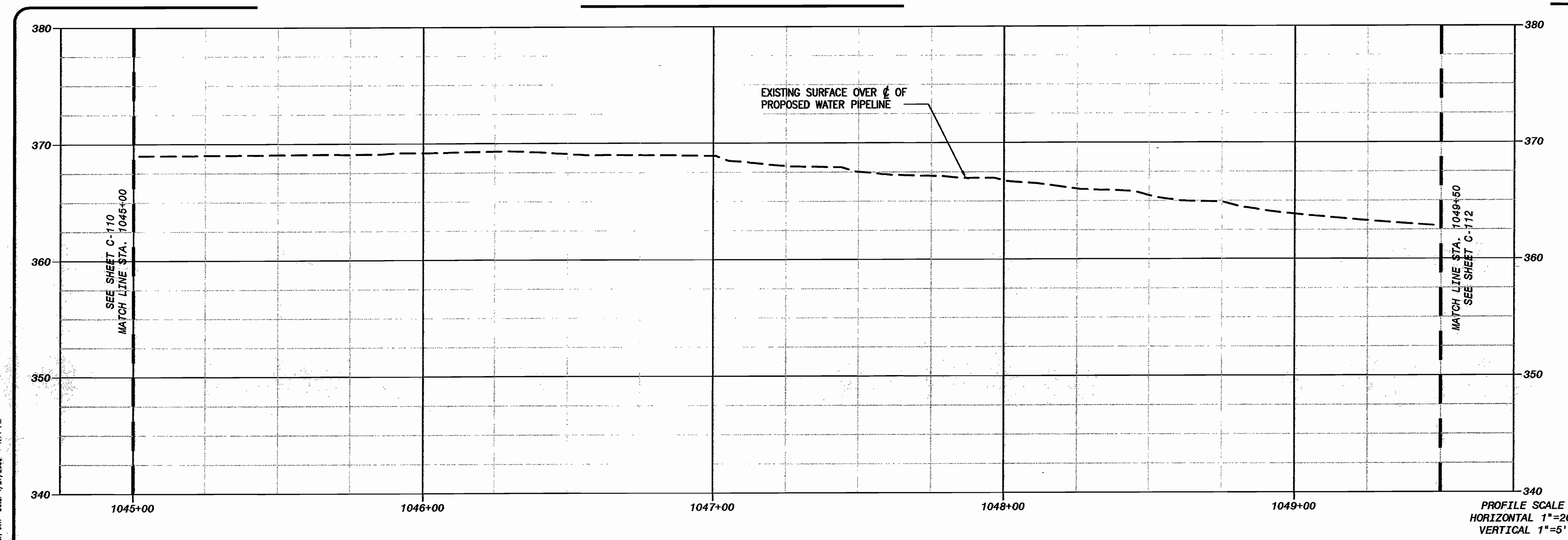
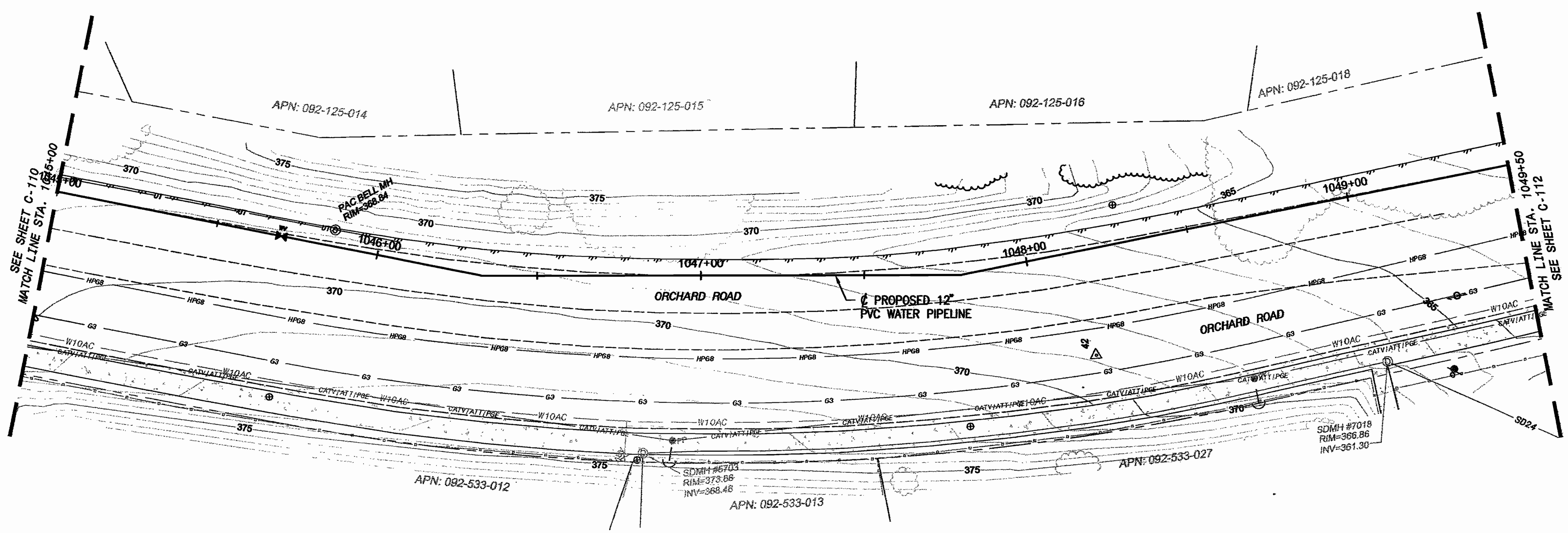
NIPOMO COMMUNITY SERVICES DISTRICT WATERLINE INTERTIE PROJECT - BP2

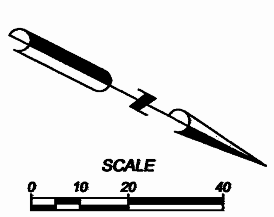
ORCHARD STREET PLAN AND PROFILE STA 1040+50 to STA. 1045+00

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-110







AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV.	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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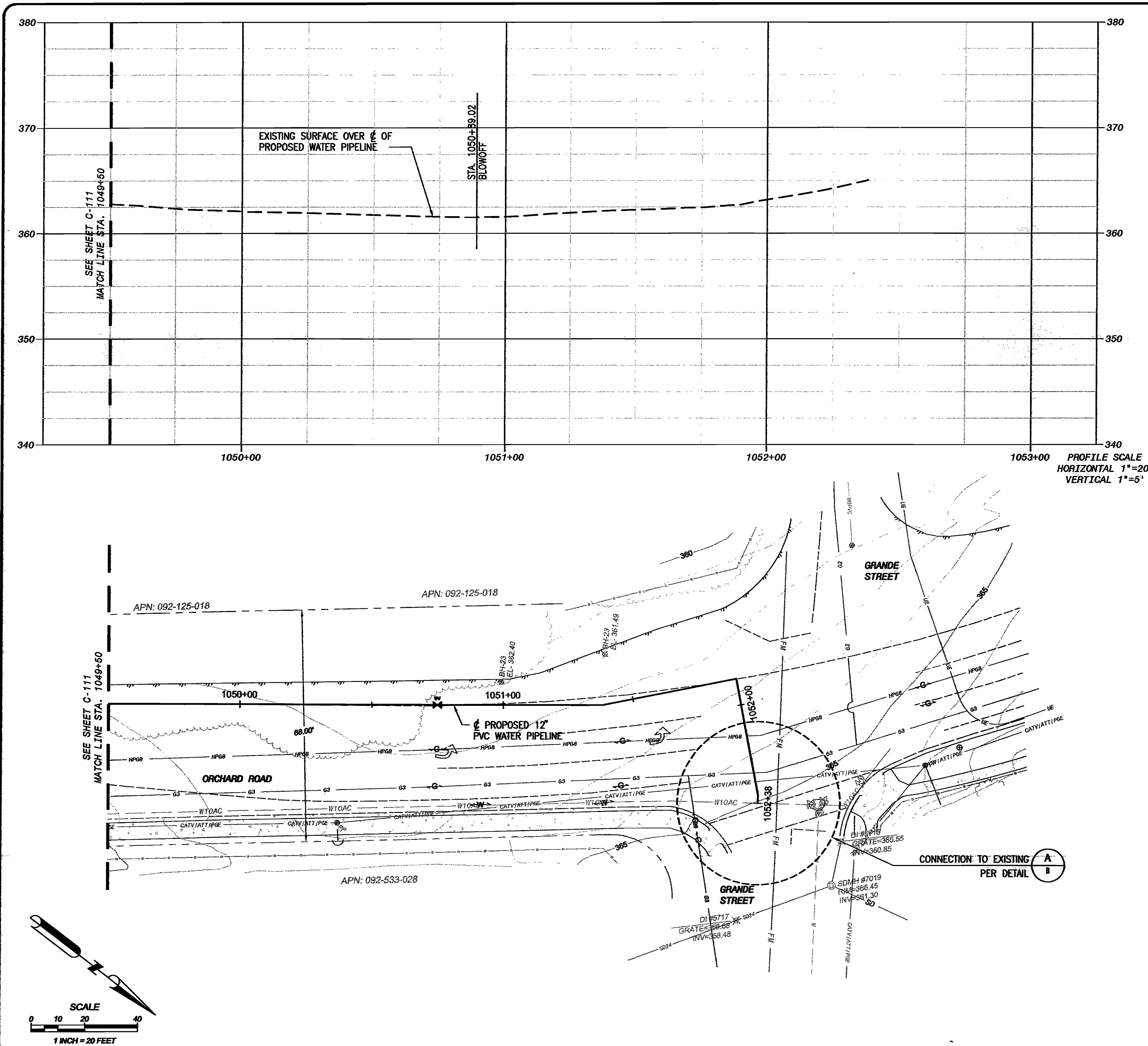
NIPOMO COMMUNITY SERVICES DISTRICT WATERLINE INTERTIE PROJECT - BP2

ORCHARD STREET PLAN AND PROFILE STA 1045+00 to STA. 1049+50

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-111
SHEET 13 OF 64

DWG: W:\Nipomo CSD (19998)\19998.70 Waterline Intertie Project Design\Design Plans\CAD\Planset\BP-2_NIPOMO PIPELINE\30% Planset\C-101 to C-112.dwg Layout Name: C-111 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 1:14 PM



NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

ORCHARD STREET
PLAN AND PROFILE
STA 1049+50 to STA. 1053+00

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www.aecom.com

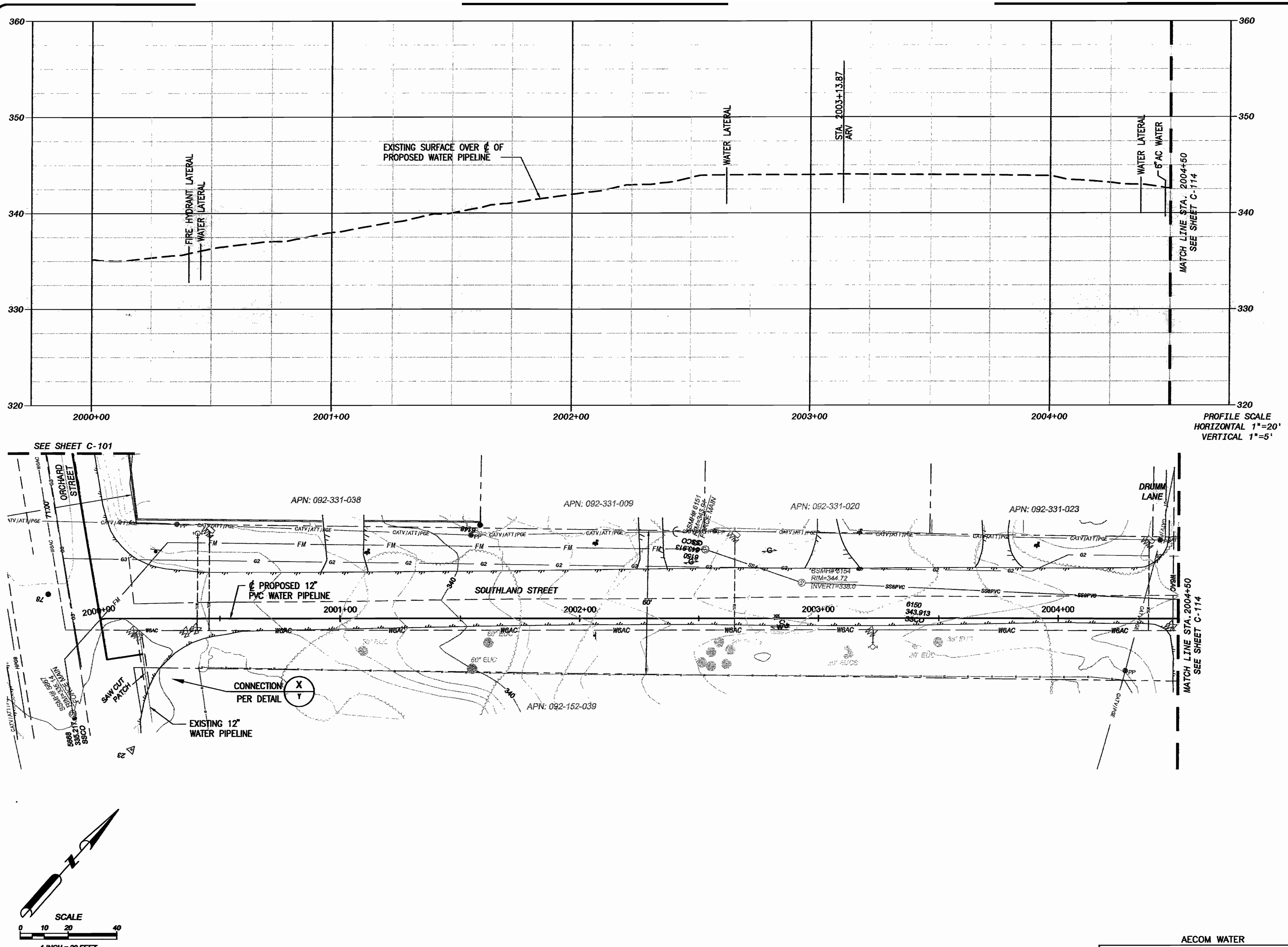
PROJECT ENGINEER: JOSHUA H REYNOLDS
REG NUMBER: C65400
EXP DATE: 09/30/2009

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

AECOM WATER
FOR PRELIMINARY USE ONLY
NOT TO BE USED FOR CONSTRUCTION
DATE: MARCH 31, 2009

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

C-112
SHEET 14 OF 64



AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

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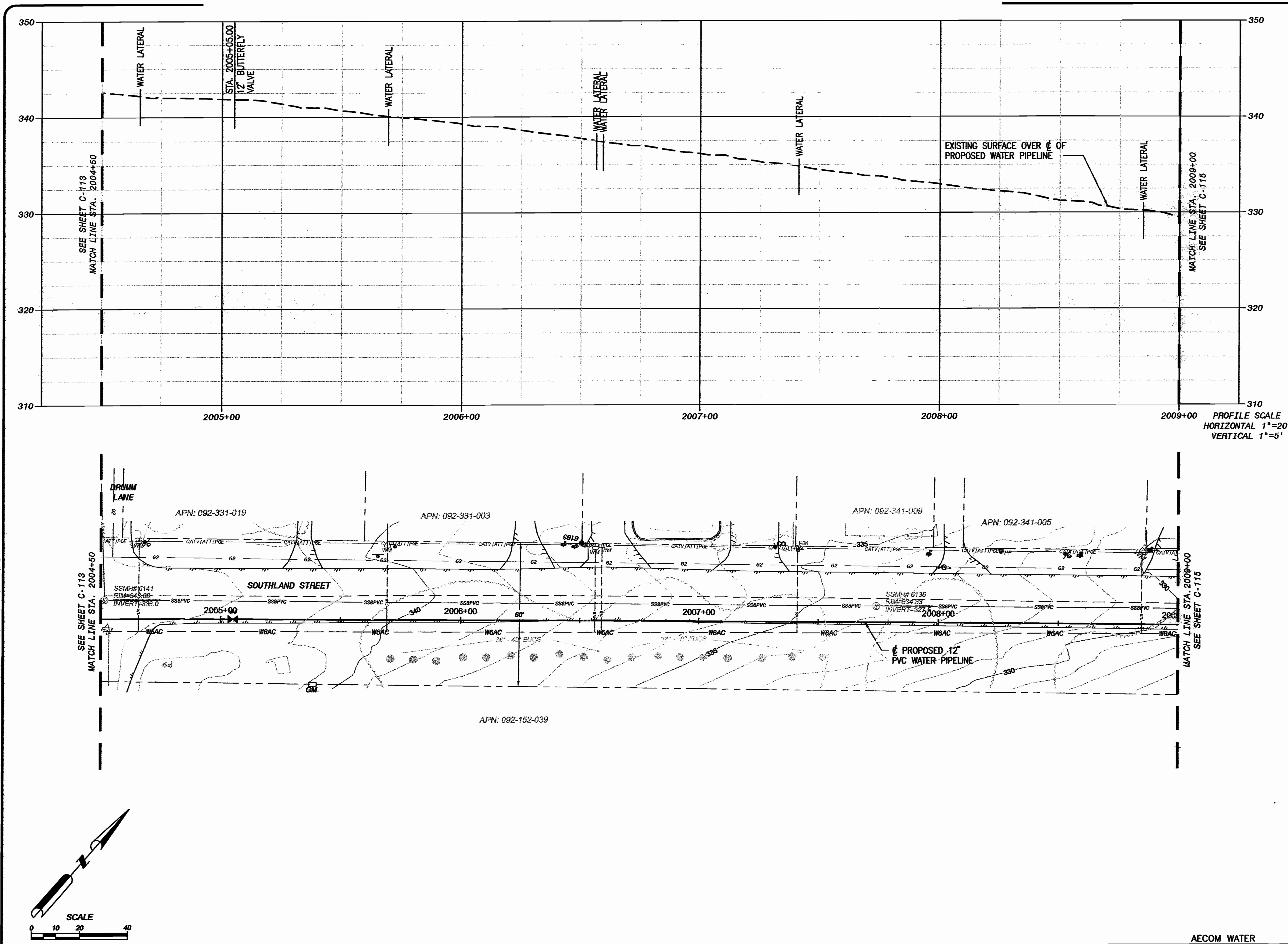
PROJECT ENGINEER: JOSHUA H REYNOLDS
REG NUMBER: C65400
EXP DATE: 09/30/2009

NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

SOUTHLAND STREET
PLAN AND PROFILE
STA 2000+00 to 2004+50

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-113
SHEET 15 OF 64



AECOM WATER

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NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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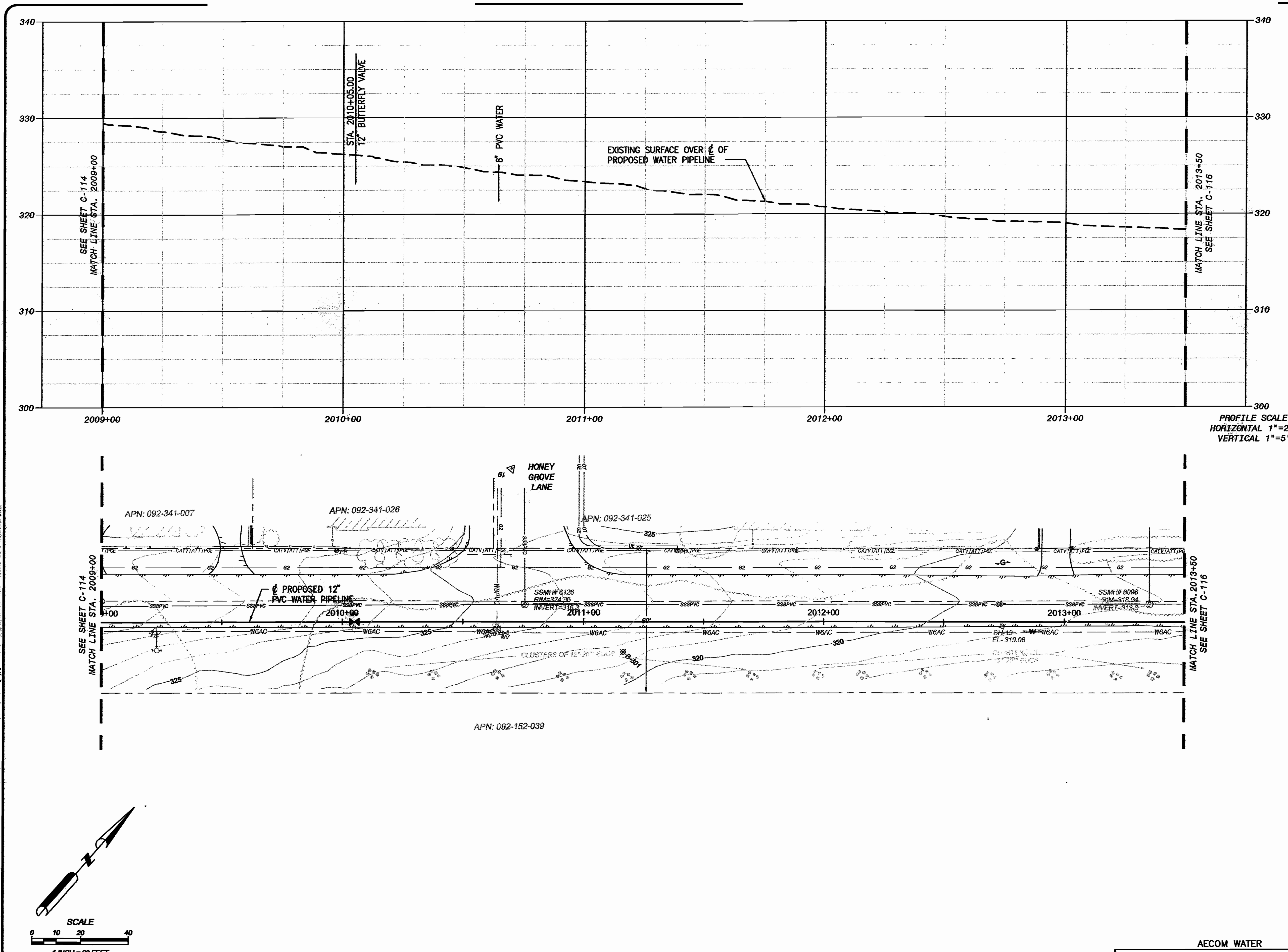
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

SOUTHLAND STREET
PLAN AND PROFILE
STA 2004+50 to 2009+00

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-114

SHEET 16 OF 64



AECOM WATER

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NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR

PROJECT ENGINEER	REG NUMBER	EXP DATE
JOSHUA H REYNOLDS	C65400	09/30/2009

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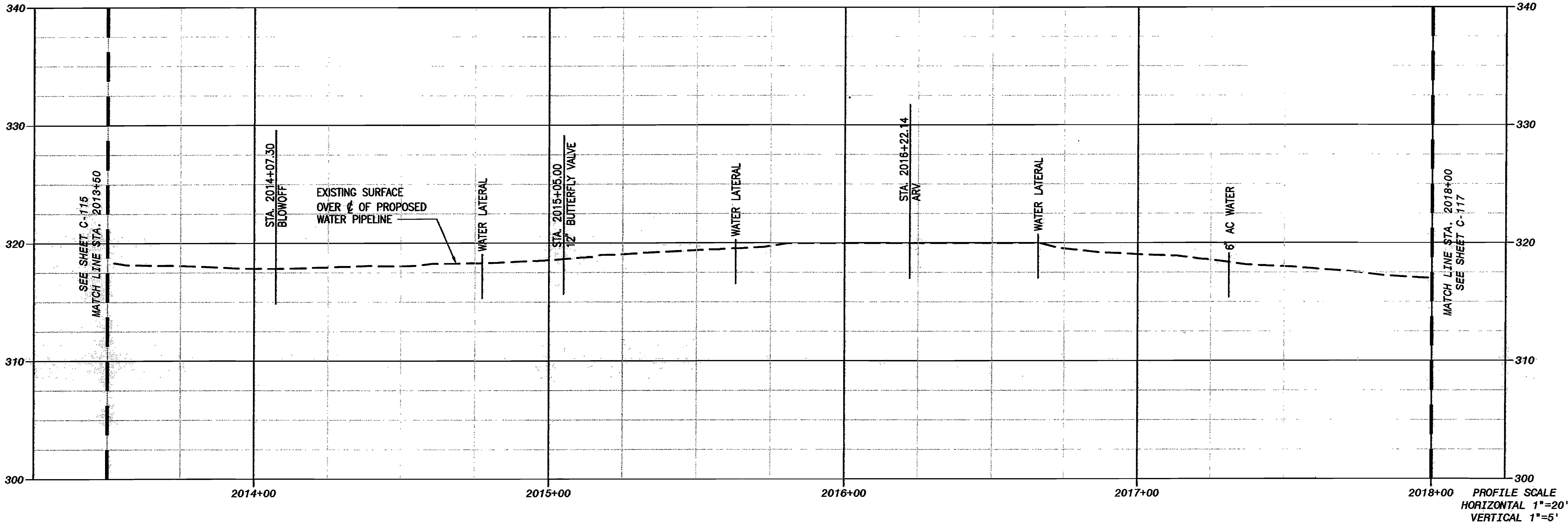
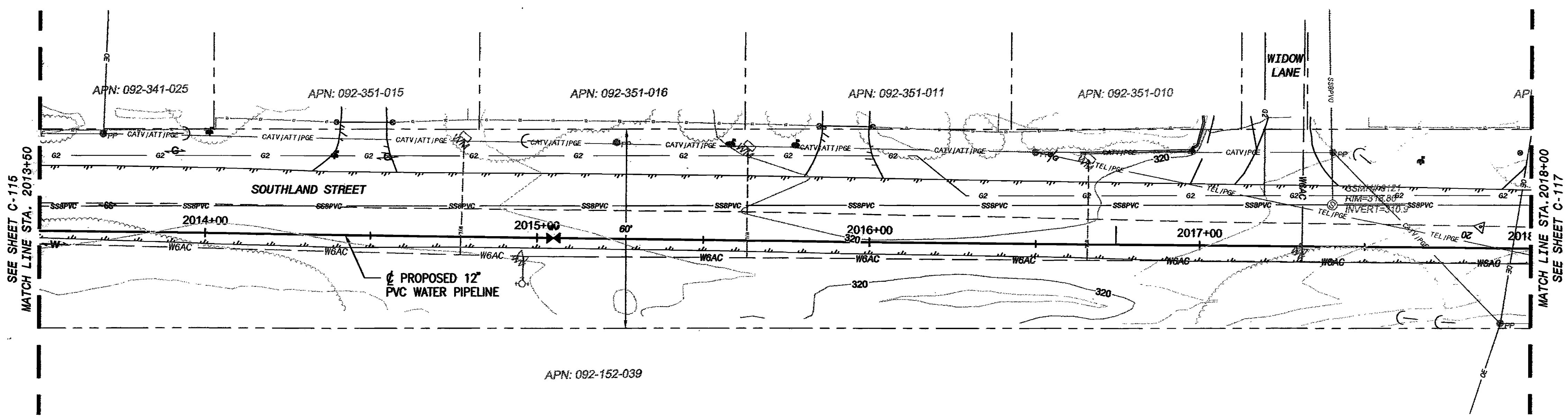
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

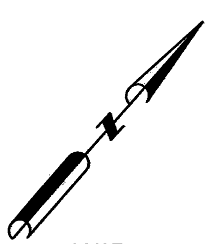
SOUTHLAND STREET
PLAN AND PROFILE
STA 2009+00 to 2013+50

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-115







SCALE

0 10 20 40

1 INCH = 20 FEET

AECOM WATER

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NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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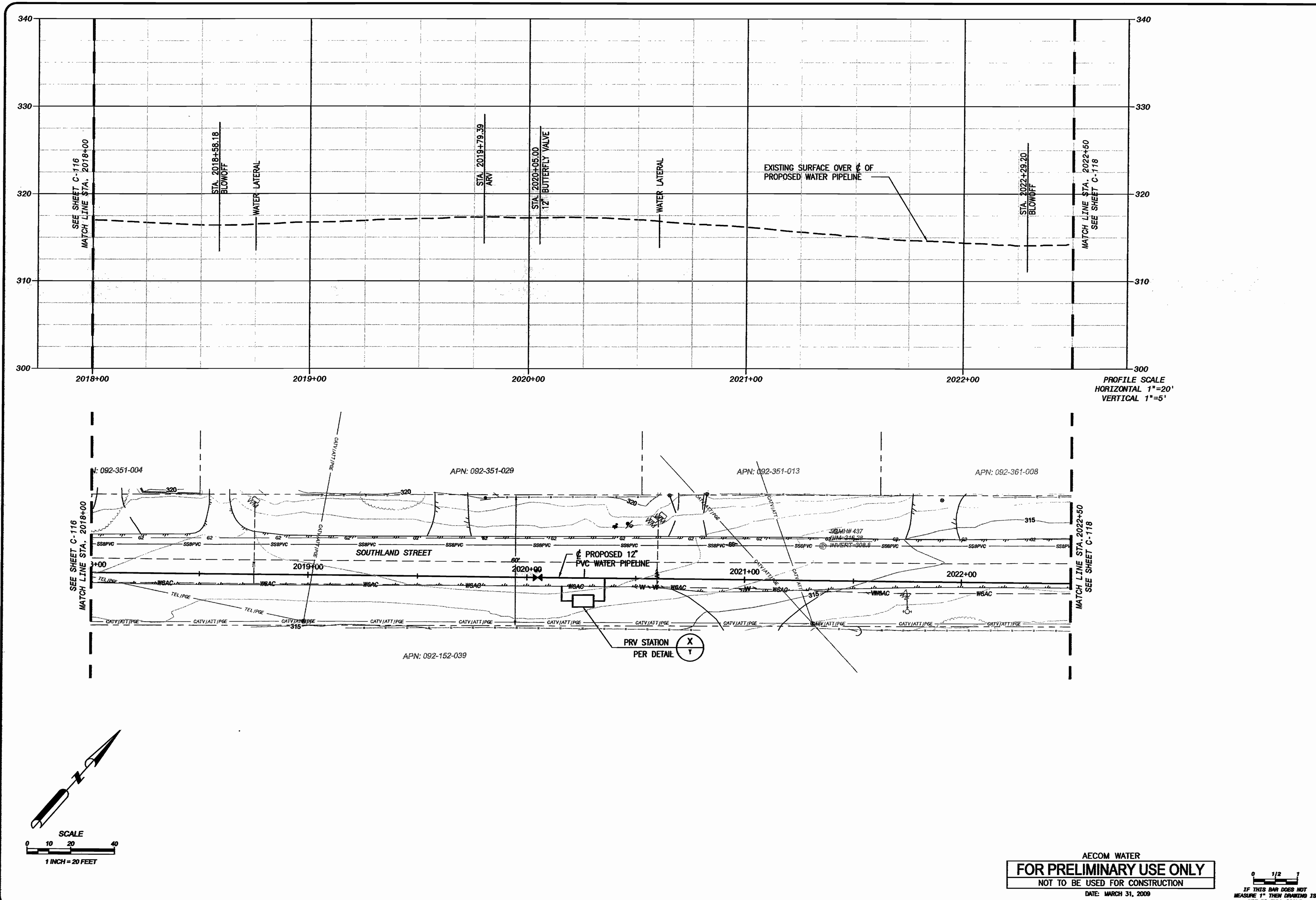
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

SOUTHLAND STREET
PLAN AND PROFILE
STA 2013+50 to 2018+00

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-116
SHEET 18 OF 64

DWG: W:\Nipomo CSD (19996)\19996.70 Waterline Intertie Project Design\Design Plans\CAD\Planset\BP-2_NIPOMO PIPELINE\30% Planset\C-113 to C-121.dwg Layout Name: C-116 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 1:37 PM
XREFS: NCSD-BD_BP2 - fugro points - WellsiceBase - Surface-Sections1-4-5 - Ex-Utilities IMAGES: Nipomo logo.jpg - Santa Maria Waterline-1.sid - Santa Maria Waterline-2.sid -



AECOM WATER

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DATE: MARCH 31, 2009

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

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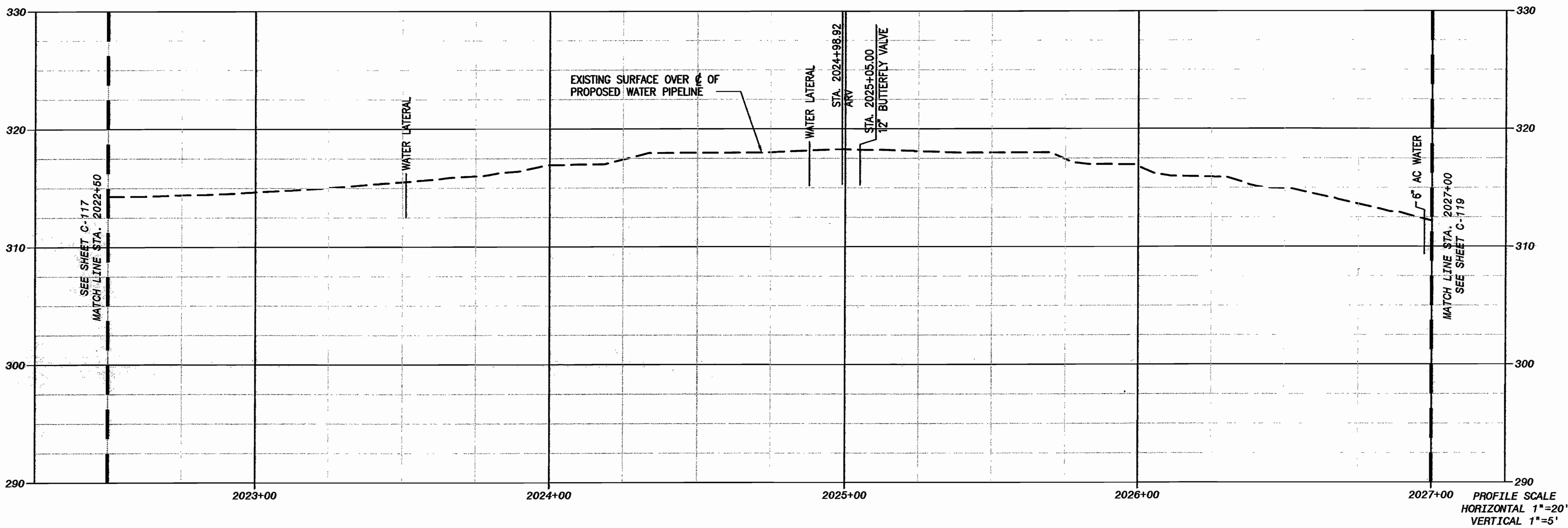
PROJECT ENGINEER: JOSHUA H REYNOLDS
REG NUMBER: C65400
EXP DATE: 09/30/2009

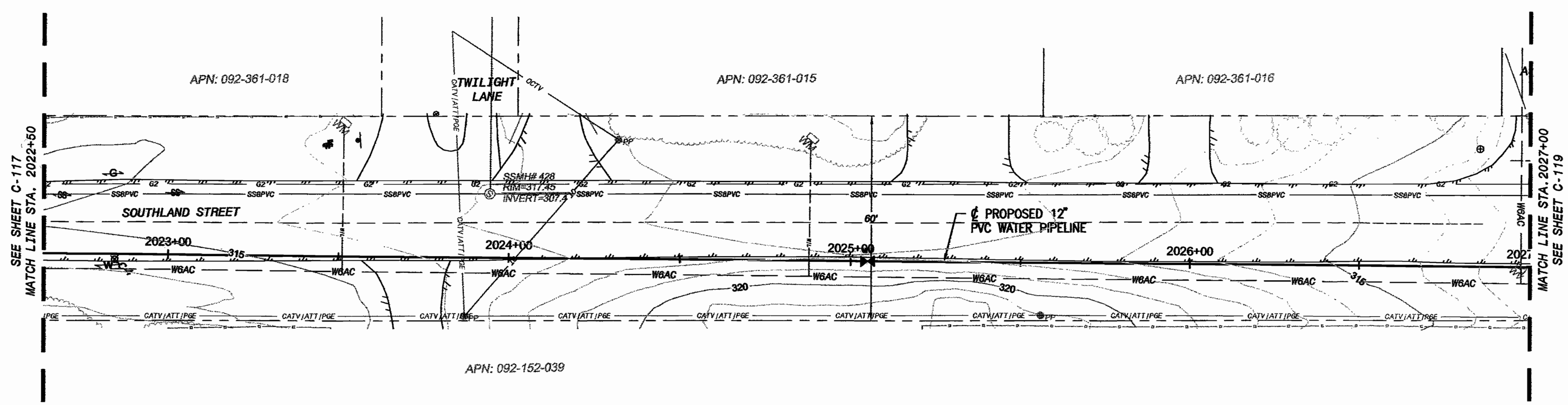
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

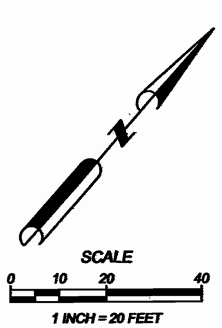
SOUTHLAND STREET
PLAN AND PROFILE
STA 2018+00 to 2022+50

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-117
SHEET 19 OF 64







AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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NIPOMO COMMUNITY SERVICES DISTRICT WATERLINE INTERTIE PROJECT - BP2

SOUTHLAND STREET PLAN AND PROFILE STA 2022+50 to 2027+00

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009

AECOM PROJECT NO. 60081295.0001

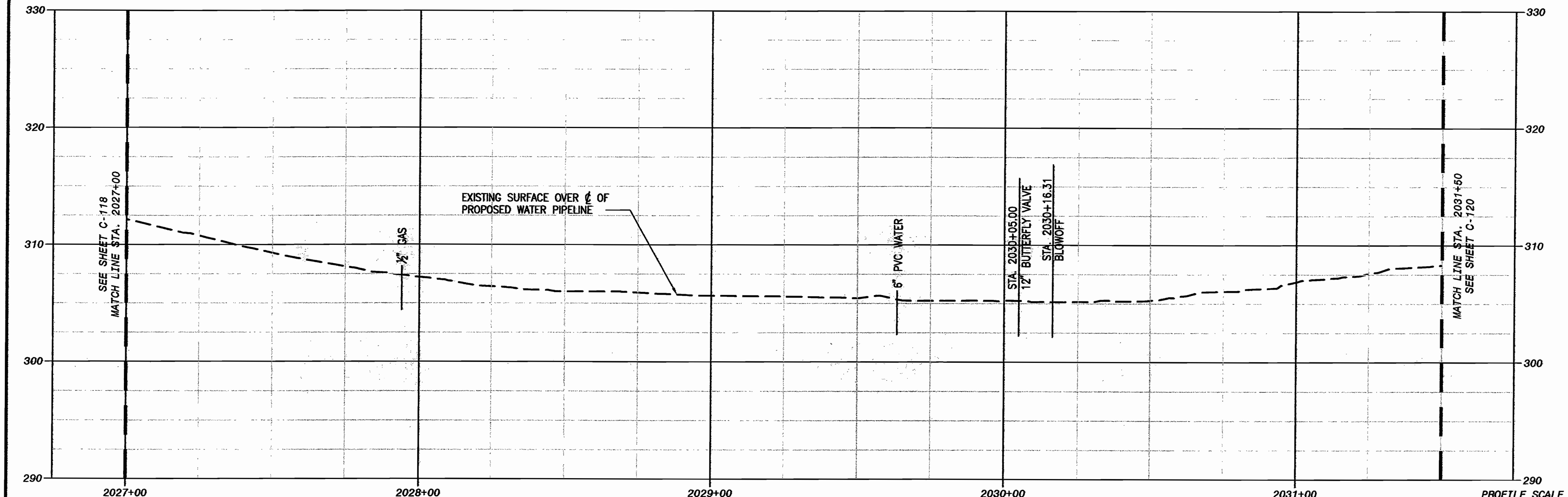
NCSD PROJECT NO.

CADD STDS. BOYLE

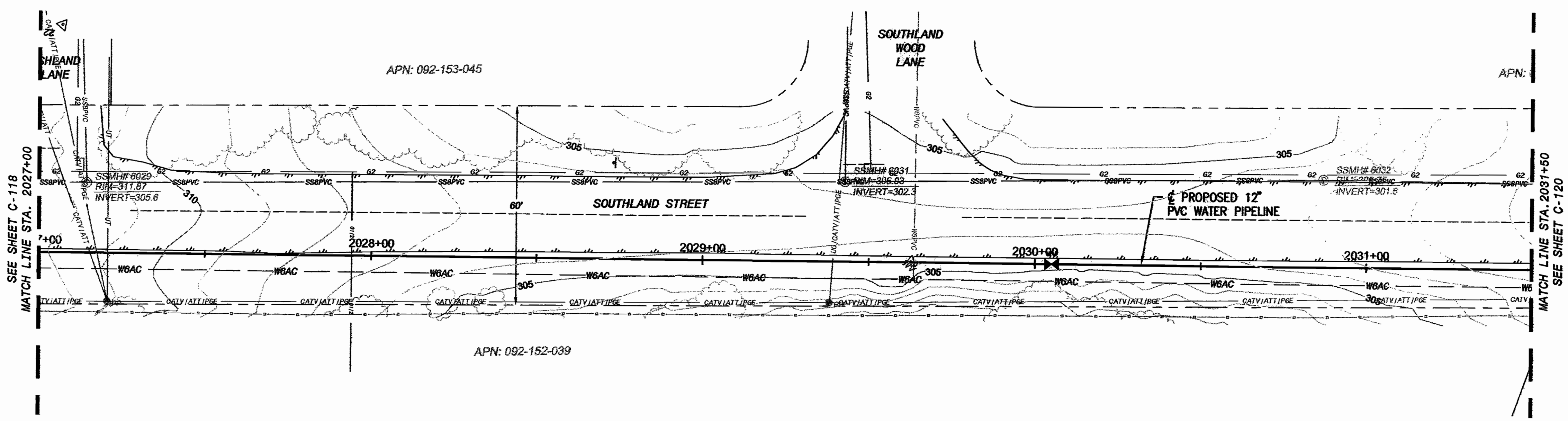
C-118

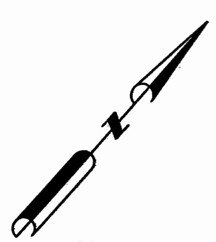
SHEET 20 OF 64

Plotted by: Froelicher, Jim Date: 4/27/2009 - 1:38 PM



PROFILE SCALE
HORIZONTAL 1"=20'
VERTICAL 1"=5'





SCALE
0 10 20 40
1 INCH = 20 FEET

AECOM WATER
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NOT TO BE USED FOR CONSTRUCTION
DATE: MARCH 31, 2009

0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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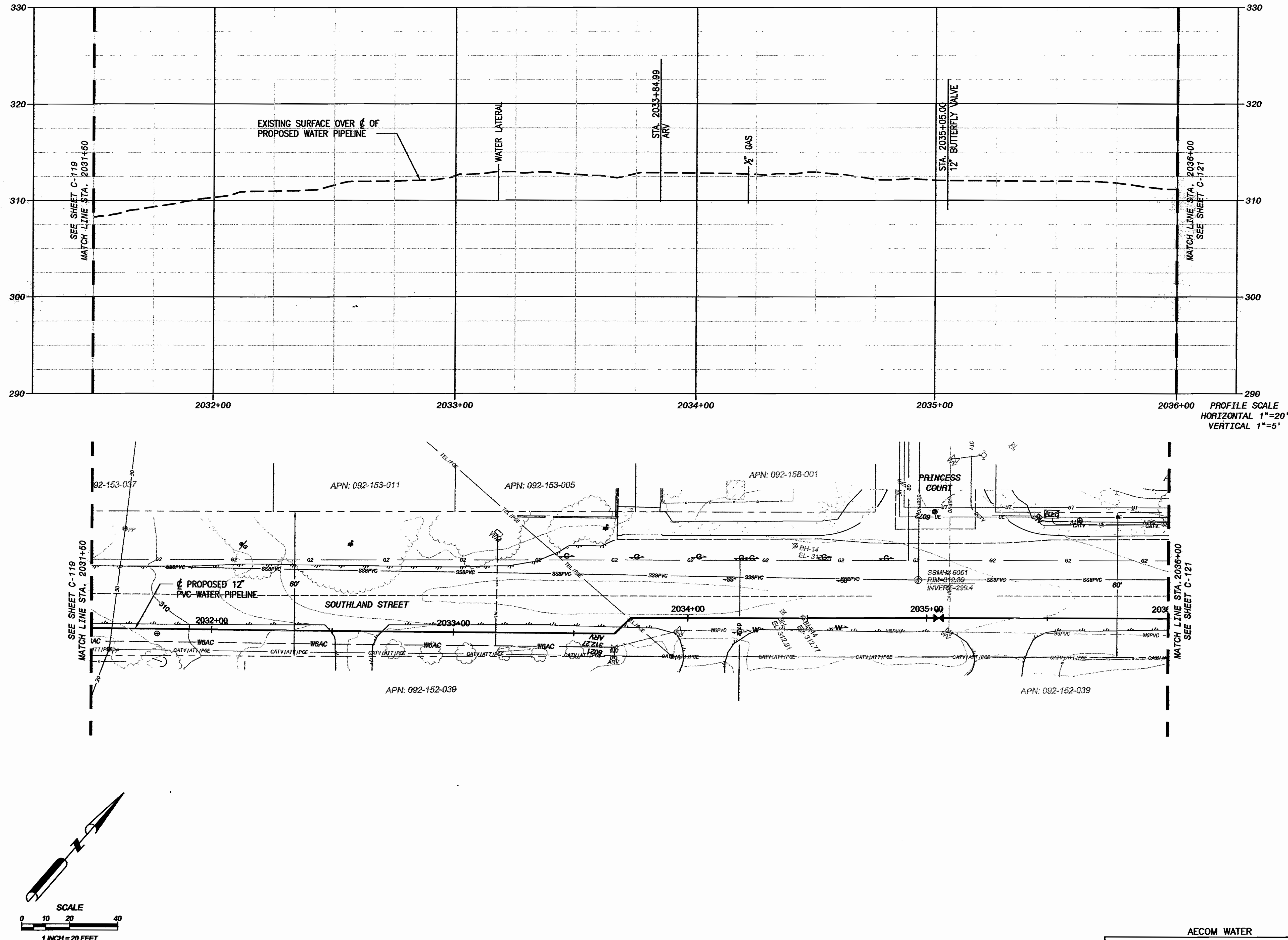
NIPOMO COMMUNITY SERVICES DISTRICT WATERLINE INTERTIE PROJECT - BP2

SOUTHLAND STREET PLAN AND PROFILE STA 2027+00 to 2031+50

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-119
SHEET 21 OF 64

DWG: W:\Nipomo CSD (19996)\19996.70 Waterline Intertie Project Design\Design Plans\CAD\Plansets\BP-2_NIPOMO PIPELINE\30% Plansets\C-113 to C-121.dwg Layout Name: C-119 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 1:39 PM
XREFS: NCSD-BD_BP2 - fugro points - WallaceBase - Surface-Sections[1-4-5 - Ex-Utilities IMAGES: Nipomo logo.jpg - Santa Maria Waterline-1.sid - Santa Maria Waterline-2.sid -



AECOM WATER

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DATE: MARCH 31, 2009

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR

PROJECT ENGINEER: JOSHUA H REYNOLDS — REG NUMBER: C65400 — EXP DATE: 09/30/2009

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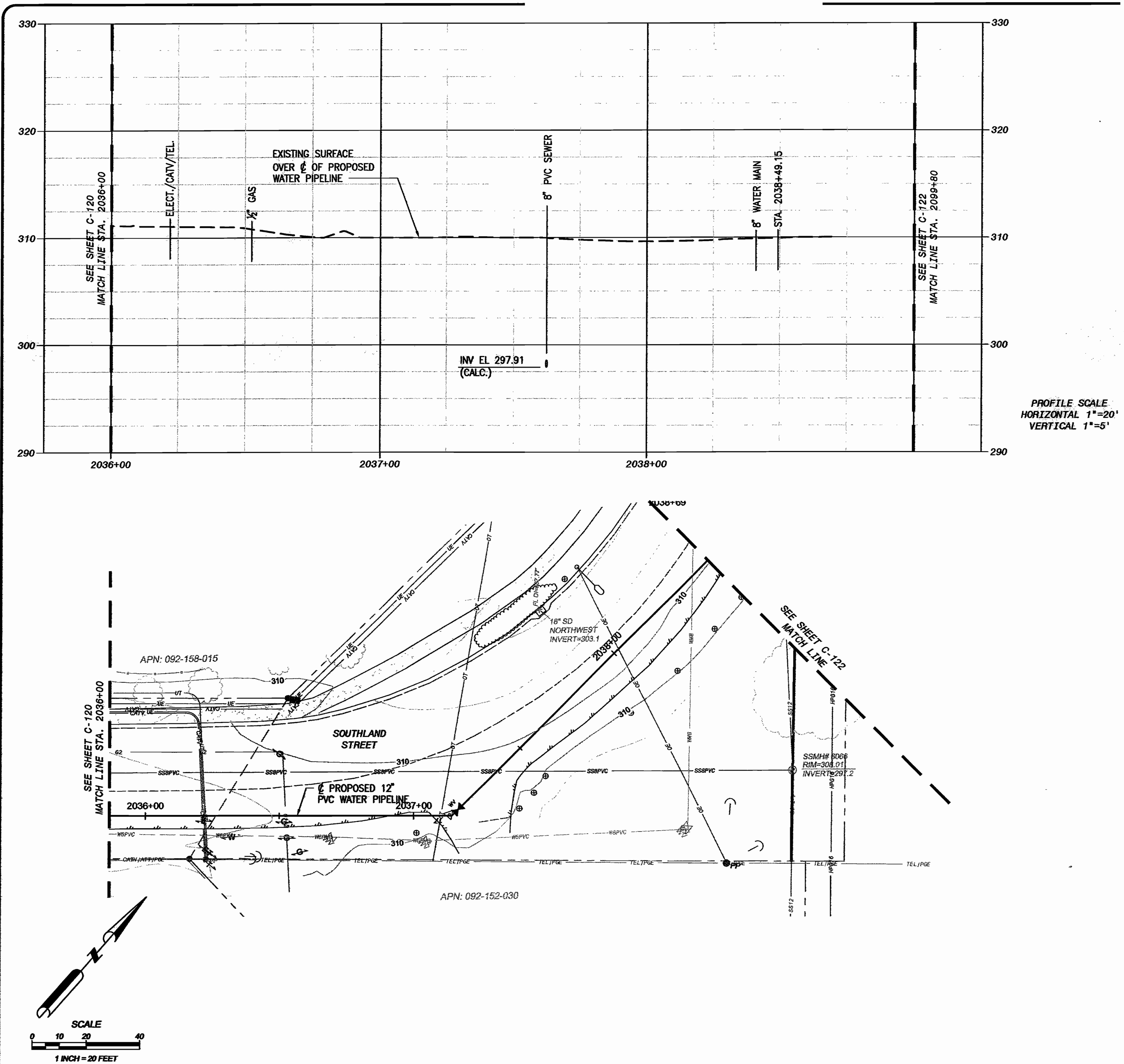
NIPOMO COMMUNITY SERVICES DISTRICT WATERLINE INTERTIE PROJECT - BP2

SOUTHLAND STREET PLAN AND PROFILE STA 2031+50 to 2036+00

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-120

SHEET 22 OF 64



AECOM WATER

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NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C85400	09/30/2009

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

SOUTHLAND STREET PLAN AND PROFILE STA 2036+00 to 2038+49

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009

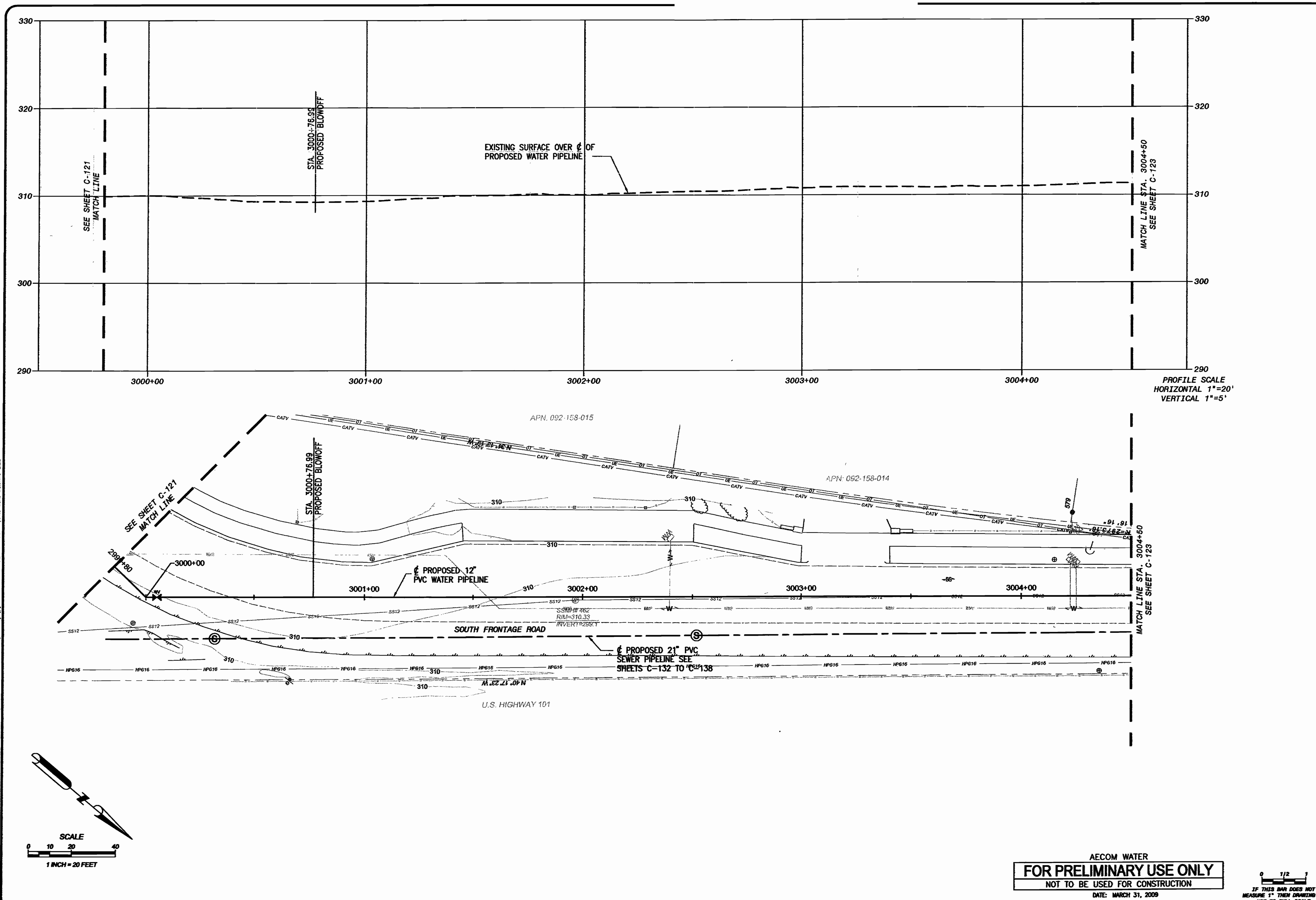
AECOM PROJECT NO. 60061295.0001

NCSD PROJECT NO.

CADD STDS. BOYLE

C-121

SHEET 23 OF 64



AECOM WATER

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DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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NIPOMO COMMUNITY SERVICES DISTRICT WATERLINE INTERTIE PROJECT - BP2

SOUTH FRONTAGE WATER PLAN AND PROFILE STA 3000+00 to 3004+50

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009

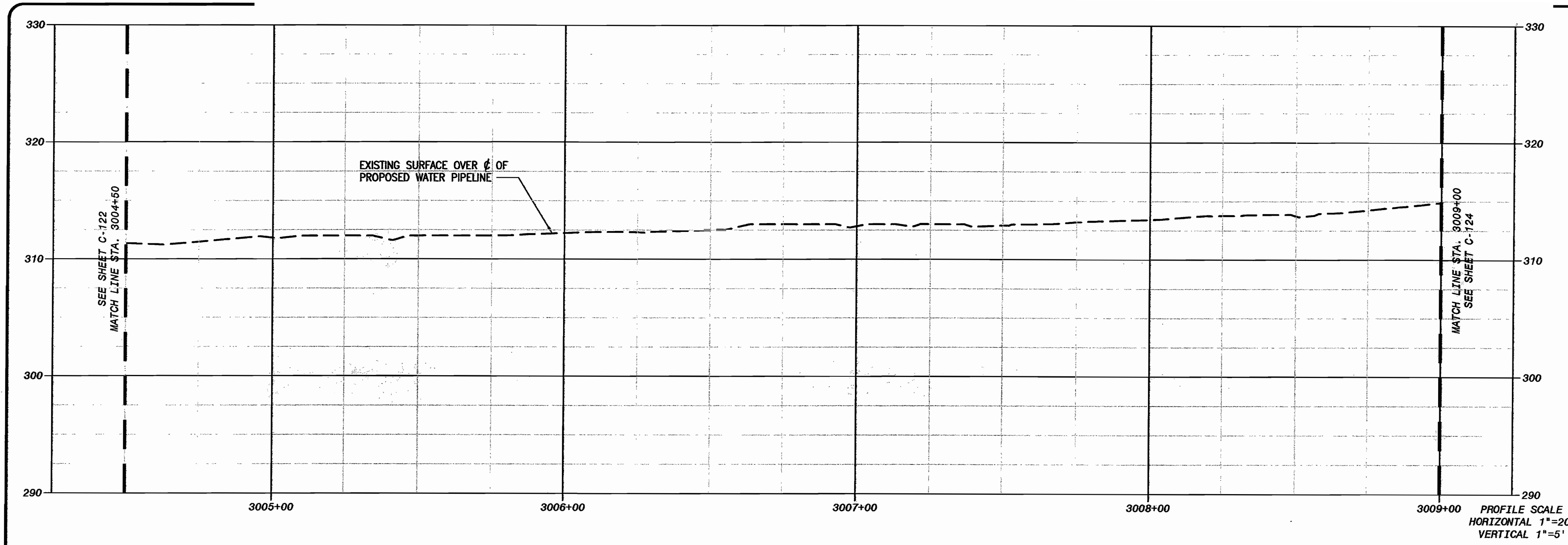
AECOM PROJECT NO. 60081295.0001

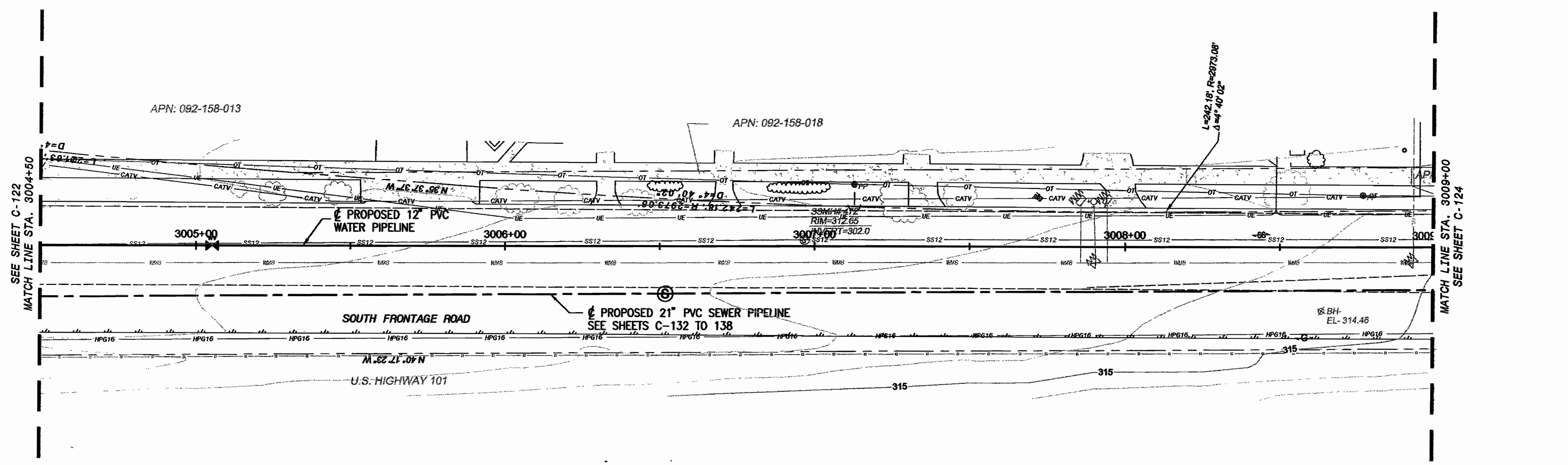
NCSD PROJECT NO.

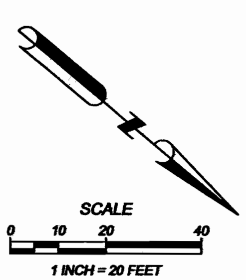
CADD STDS. BOYLE

C-122

SHEET 24 OF 64







AECOM WATER
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NOT TO BE USED FOR CONSTRUCTION
DATE: MARCH 31, 2009

0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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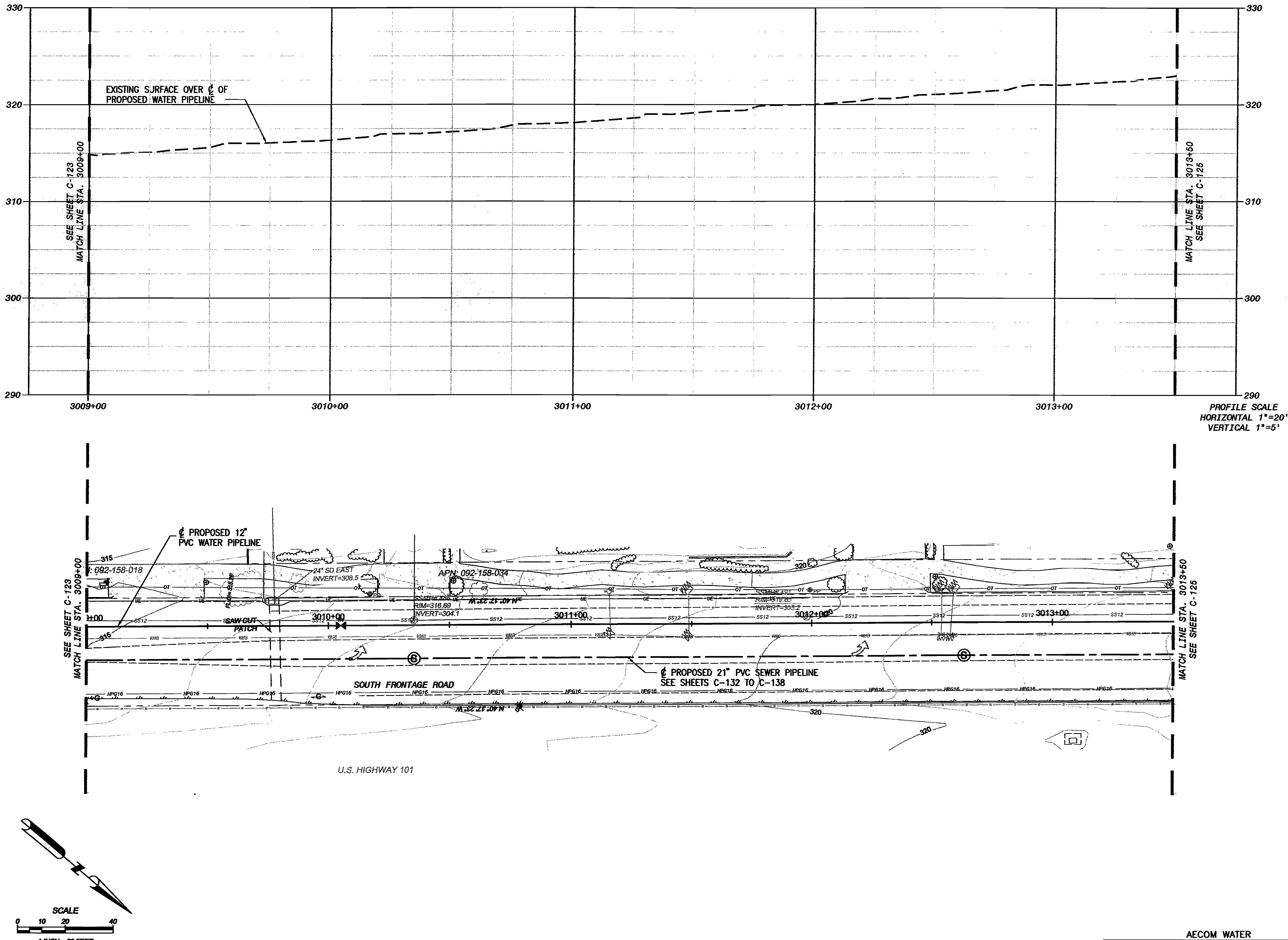
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

SOUTH FRONTAGE WATER
PLAN AND PROFILE
STA 3004+50 to 3009+00

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-123
SHEET 25 OF 64

DWG: W:\Nipomo CSD (19996)\19996.70 Waterline Intertie Project Design\Design Plans\CAD\Plansets\BP-2_NIPOMO PIPELINE\30% Planset\C-122 to C-131.dwg Layout Name: C-123 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 1:58 PM
XREFS: Surface-Sections3-4-5 - fugro points - NCSD-BD_BP2 - WaterBase - Ex-Utilities IMAGES: Nipomo logo.jpg - Santa Maria Waterline-1.sid - Santa Maria Waterline-2.sid -



AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER	REG NUMBER	EXP DATE	
JOSHUA H REYNOLDS	C65400	09/30/2009	

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

SOUTH FRONTAGE WATER
PLAN AND PROFILE
STA 3009+00 to 3013+50

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009

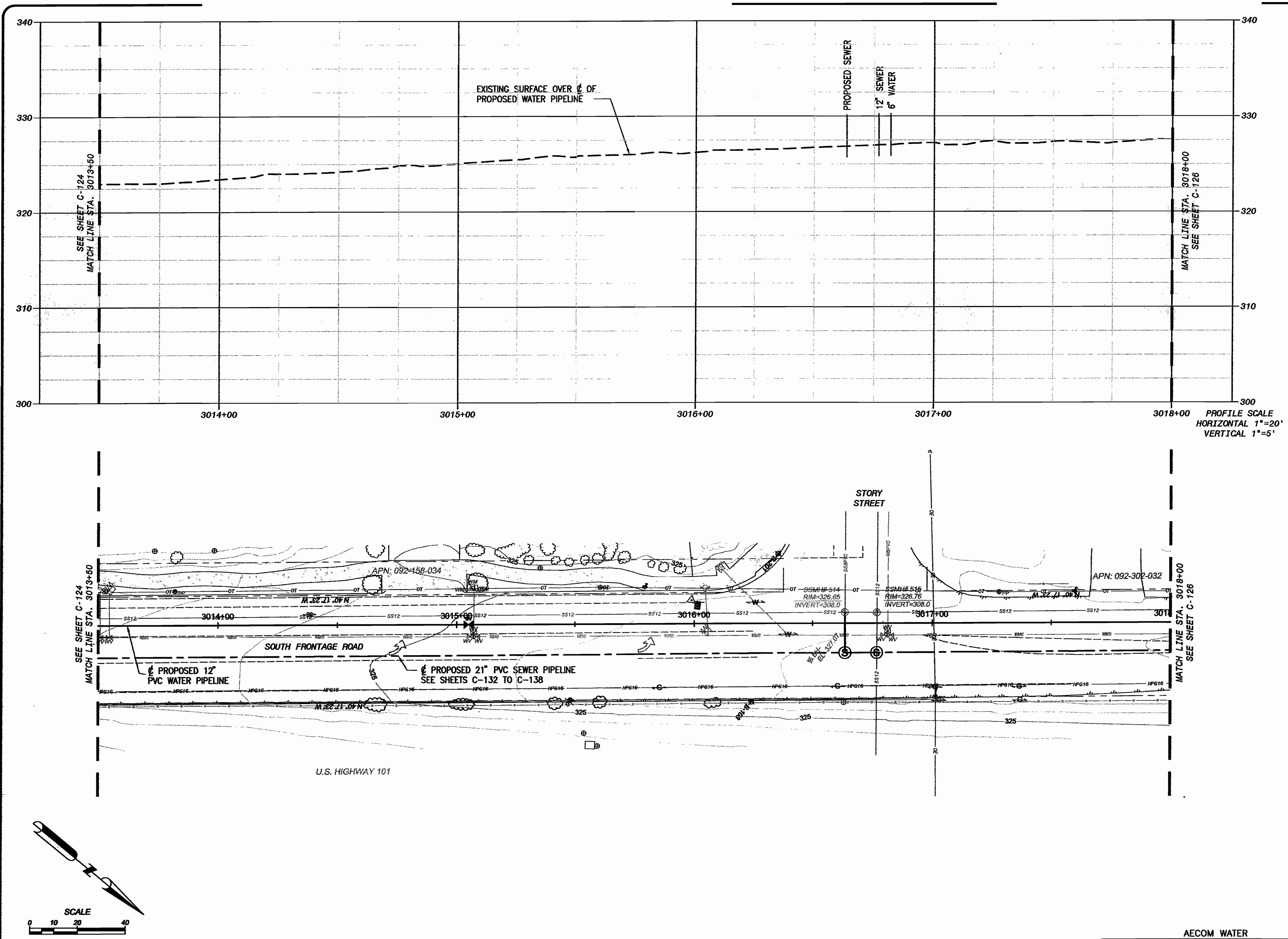
AECOM PROJECT NO.
60061295.0001

NCSD PROJECT NO.

CADD STDS.
BOYLE

C-124

SHEET
26 OF 64



DWG: W:\Nipomo CSD (19996)\19996.70 Waterline Intertie Project Design\Design Plans\CAD\Planset\BP-2_NIPOMO PIPELINE\30% Planset\C-122 to C-131.dwg Layout Name: C-125 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 1:59 PM

AECOM WATER

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DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

SOUTH FRONTAGE WATER
PLAN AND PROFILE
STA 3013+50 to 3018+00

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009

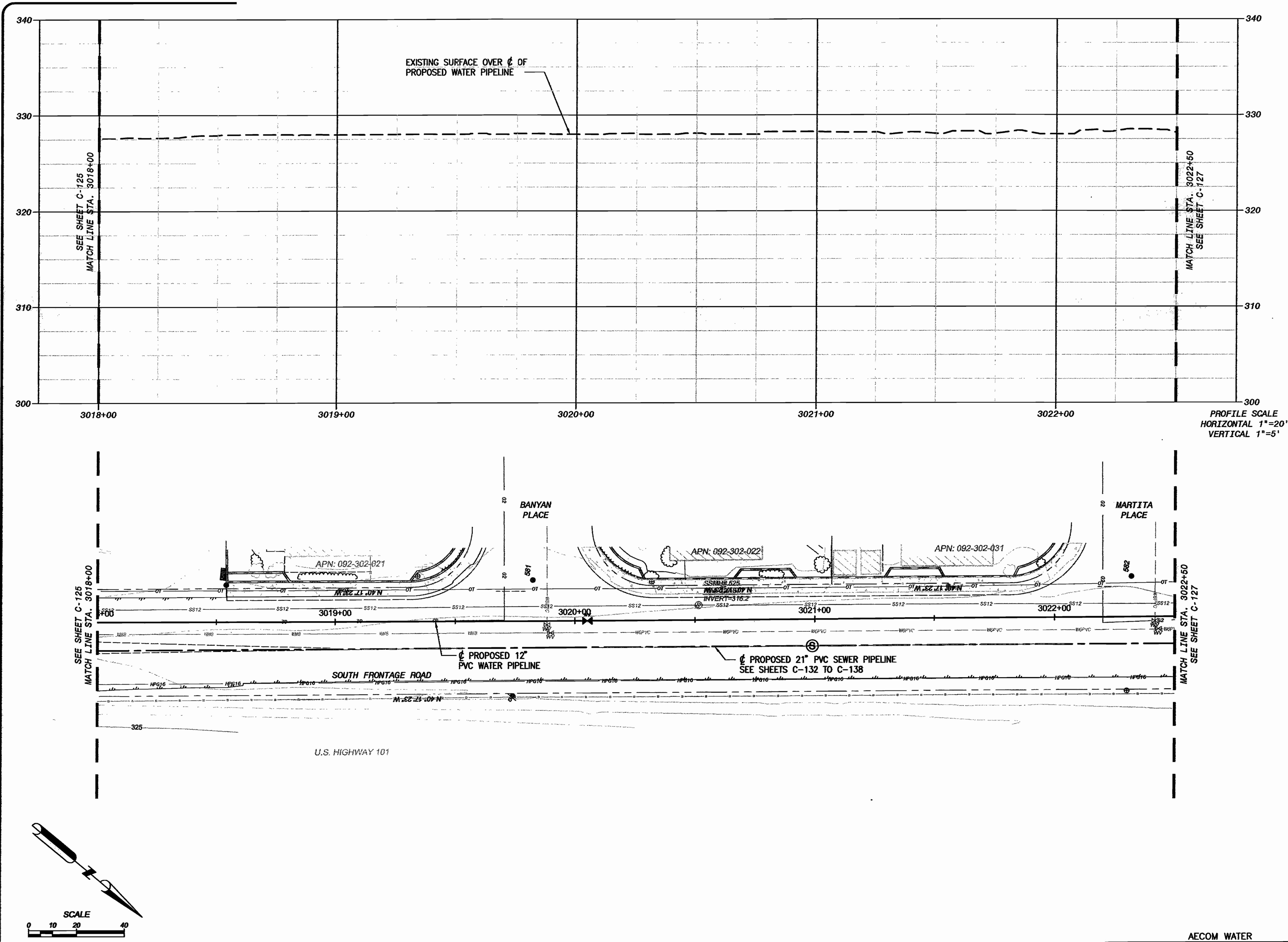
AECOM PROJECT NO. 60061295.0001

NCSD PROJECT NO.

CADD STDS. BOYLE

C-125

SHEET 27 OF 64



AECOM WATER

FOR PRELIMINARY USE ONLY

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DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

SOUTH FRONTAGE WATER
PLAN AND PROFILE
STA 3018+00 to 3022+50

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009

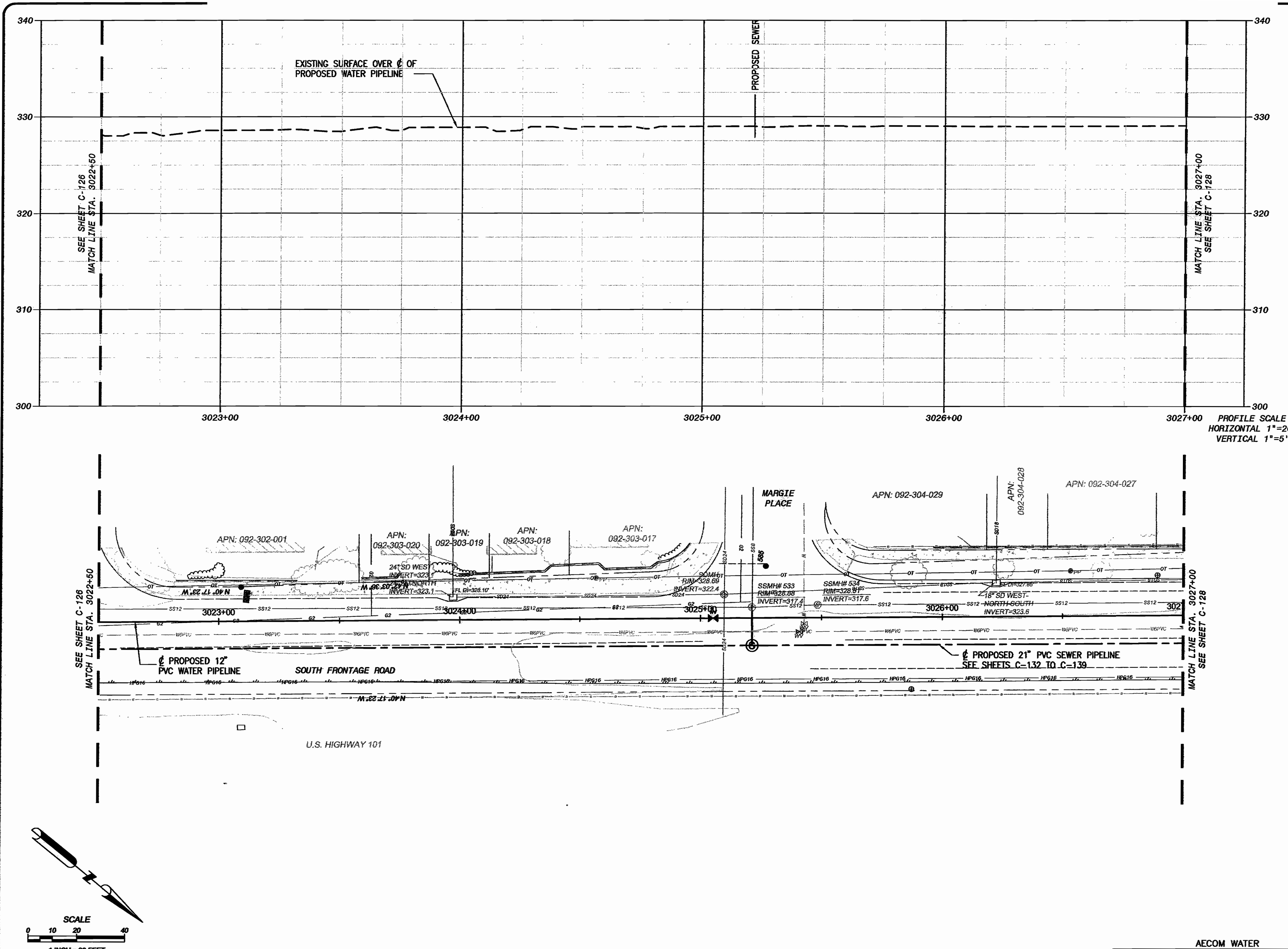
AECOM PROJECT NO. 60081295.0001

NCSD PROJECT NO.

CADD STDS. BOYLE

C-126

SHEET 28 OF 64



DWG: W:\Nipomo CSD (19996)\19996.70 Waterline Intertie Project Design\Design Plans\CAD\Planset\BP-2_NIPOMO PIPELINE\30% Planset\C-122 to C-131.dwg Layout Name: C-127 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 2:00 PM

AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER	JOSHUA H REYNOLDS	REG NUMBER C65400	EXP DATE 09/30/2009

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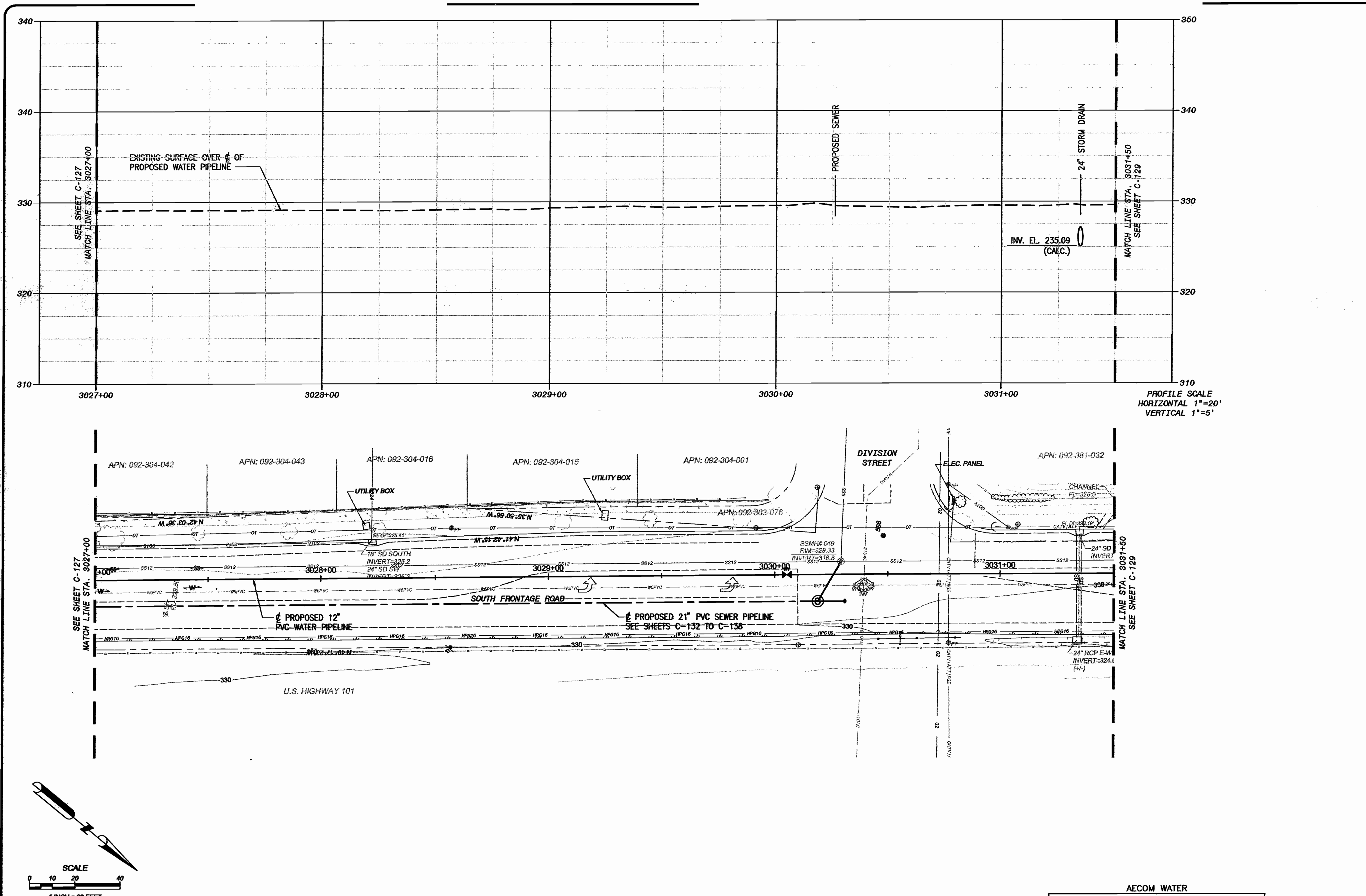
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

SOUTH FRONTAGE WATER
PLAN AND PROFILE
STA 3022+50 to 3027+00

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-127

SHEET 29 OF 64



AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

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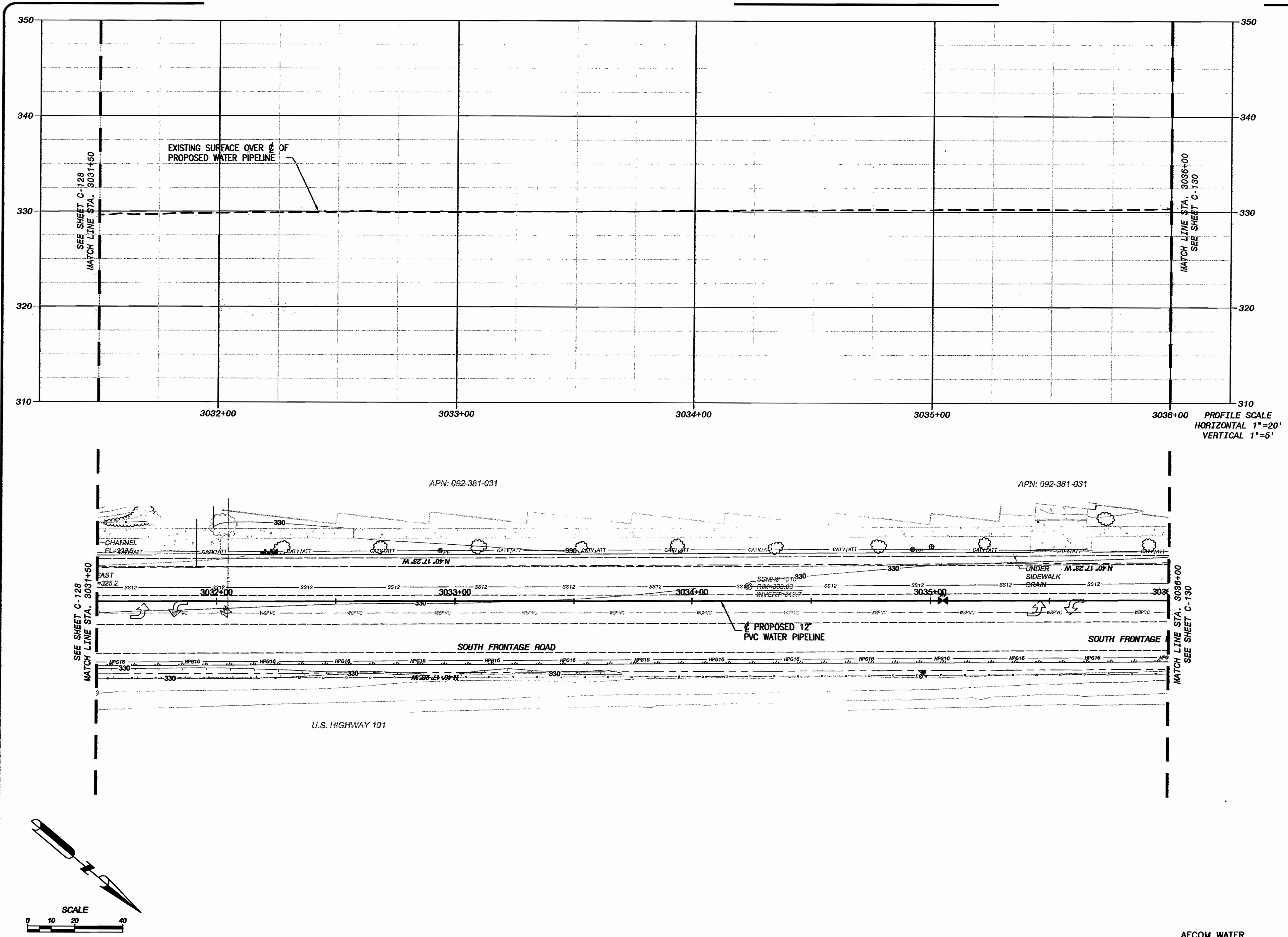
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

SOUTH FRONTAGE WATER PLAN AND PROFILE STA 3027+00 to 3031+50

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-128
SHEET 30 OF 64



DWG: W:\Nipomo CSD (19990)\19996.70 Waterline Intertie Project Design\Design Plans\CAD\Pioneer\BP-2_NIPOMO PIPELINE\30% Pioneer\C-122 to C-131.dwg Layout Name: C-129 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 2:02 PM
XREFS: Surface-Sections3-4-5 - fygro points - NCSD-PD_BP2 - WallaceBase - Ex-Utilities IMAGES: Nipomo logo.jpg - Santa Maria Waterline-1.sid - Santa Maria Waterline-2.sid -

AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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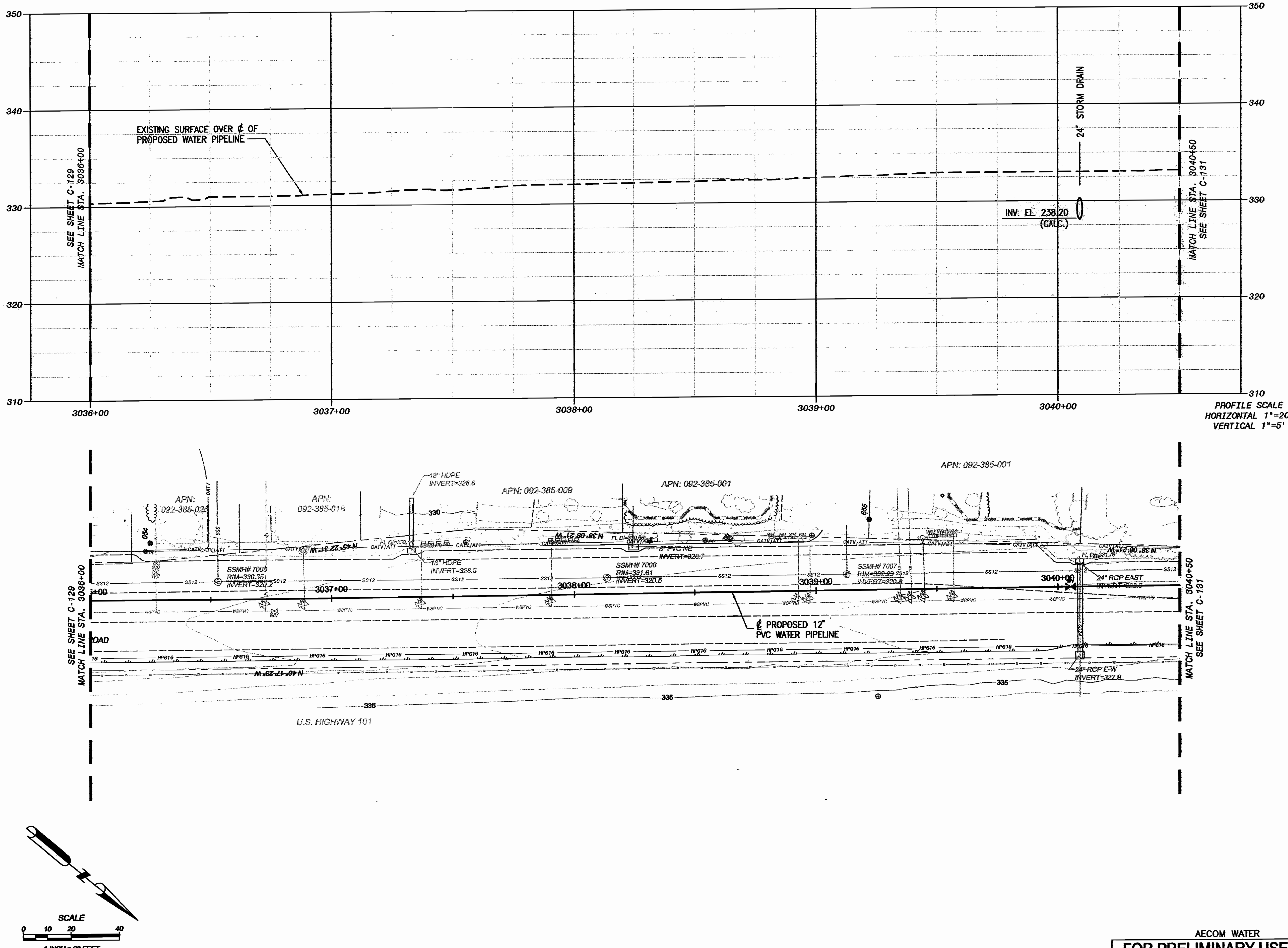
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

SOUTH FRONTAGE WATER PLAN AND PROFILE STA 3031+60 to 3036+00

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-129
SHEET 31 OF 64



NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

SOUTH FRONTAGE WATER
PLAN AND PROFILE
STA 3036+00 to 3040+50

AECOM WATER

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DATE: MARCH 31, 2009

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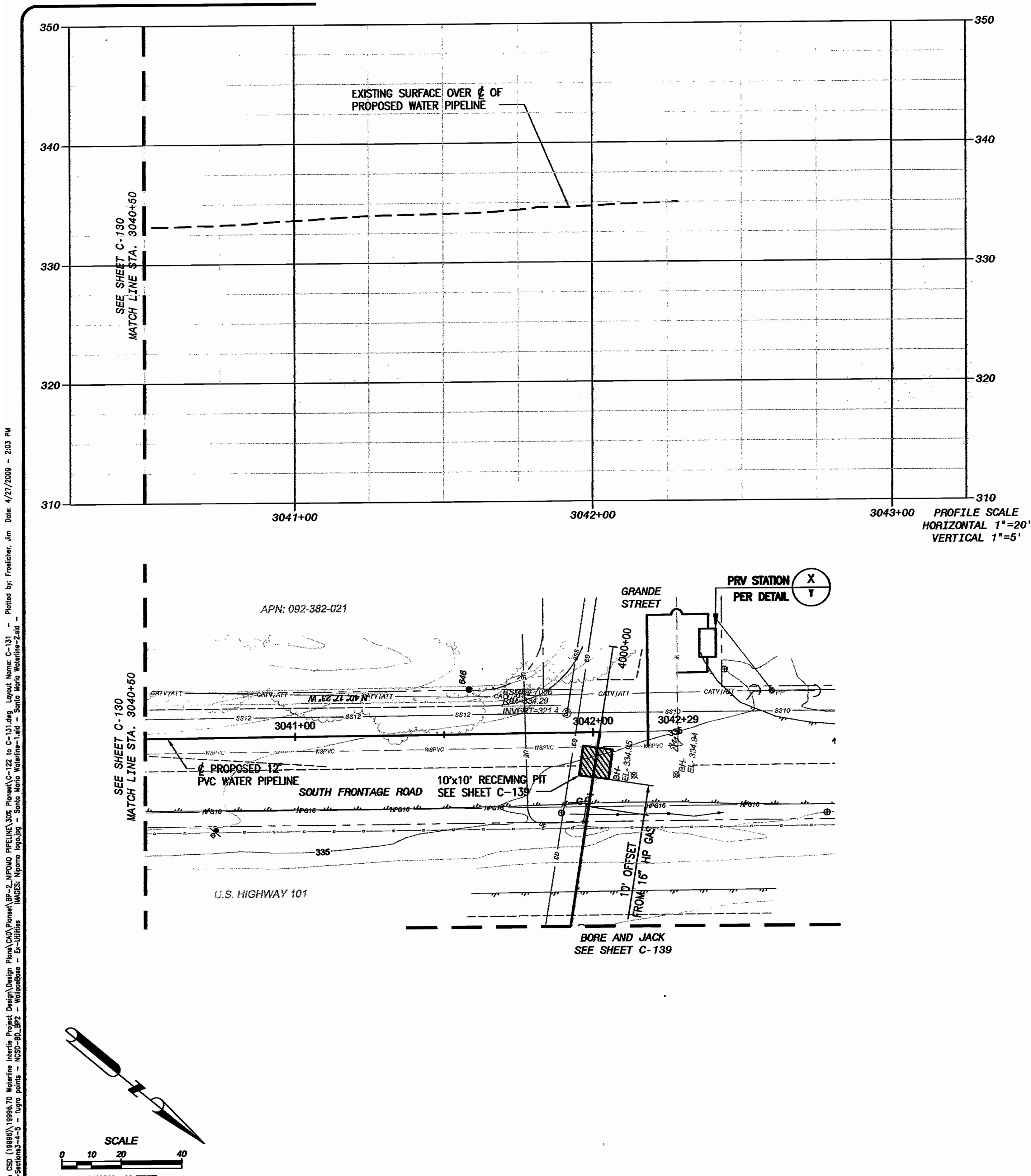
REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-130
SHEET 32 OF 64

DWG: W:\Nipomo CSD (19998)\19998.70 Waterline Intertie Project Design\Design Plans\CAD\Planset\BP-2_NIPOMO PIPELINE\30% Planset\C-122 to C-131.dwg Layout Name: C-130 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 2:02 PM
XREFS: Surface-Sections3-4-5 - fugro points - NCSD-BD_BP2 - Waterbase - Ex-Utilities IMAGES: Nipomo logo.jpg - Santa Maria Waterline-1.sid - Santa Maria Waterline-2.sid -



AECOM WATER

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DATE: MARCH 31, 2009

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NIPOMO COMMUNITY SERVICES DISTRICT WATERLINE INTERTIE PROJECT - BP2

SOUTH FRONTAGE WATER PLAN AND PROFILE STA 3040+50 to 3043+00

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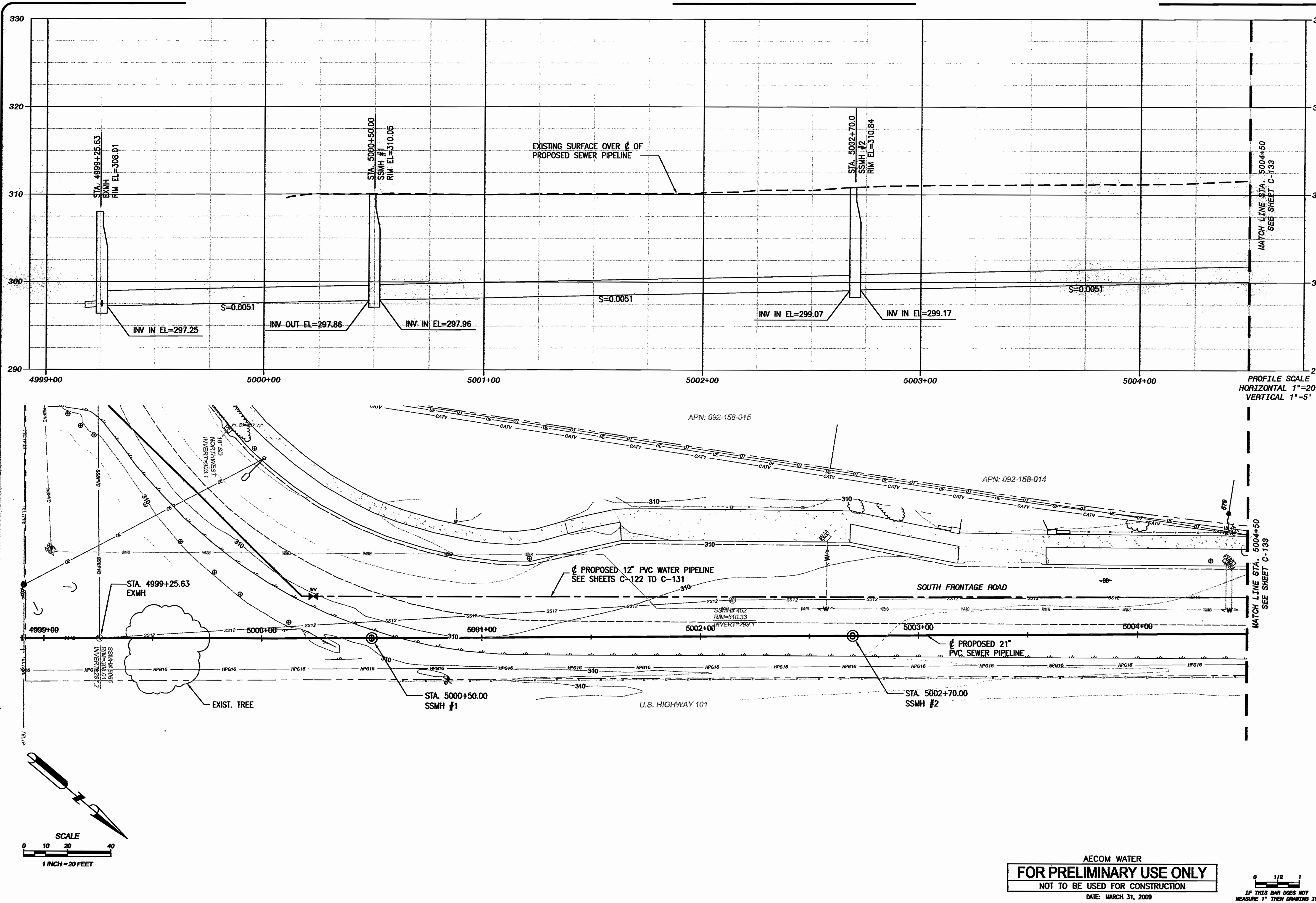
DESIGNED:	JHR
DETAILED:	JPF
CHECKED:	
APPROVED:	
DATE:	MARCH 2009
AECOM PROJECT NO.	60081295.0001
NCSD PROJECT NO.	
CADD STDS.	BOYLE

REV.	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

C-131

SHEET 33 OF 64

DWG: W:\Nipomo CSD (19998)\19998.70 Waterline Intertie Project Design\Design Plans\CAD\Planset\BP-2_NIPOMO PIPELINE\30% Planset\C-122 to C-131.dwg Layout Name: C-131 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 2:03 PM



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REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

SOUTH FRONTAGE SEWER REPLACEMENT PLAN AND PROFILE STA 4999+00 to 5004+50

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009

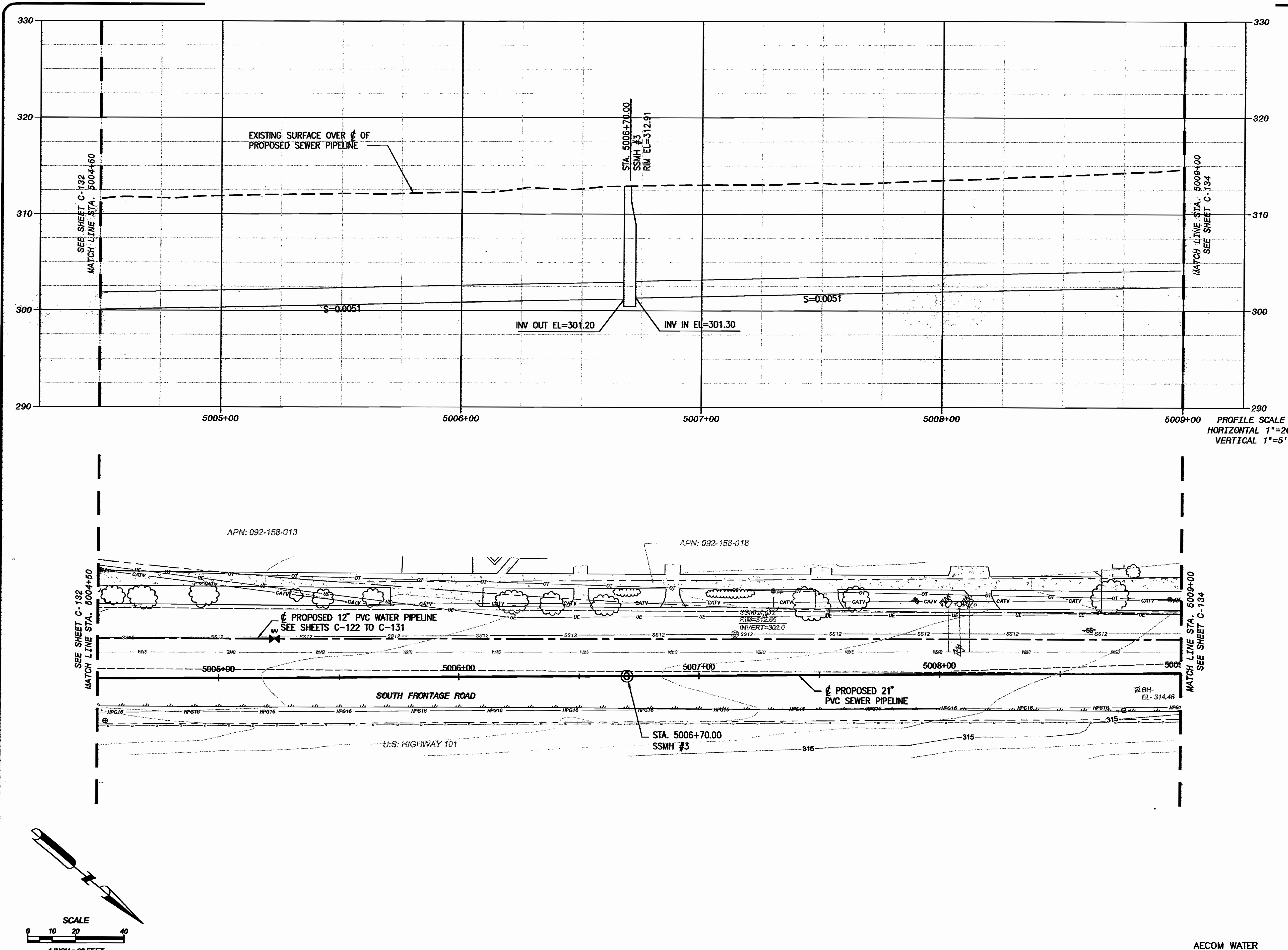
AECOM PROJECT NO. 60061295.0001

NCSD PROJECT NO.

CADD STDS. BOYLE

C-132

SHEET 34 OF 64



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DATE: MARCH 31, 2009

0 1/2 1

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REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

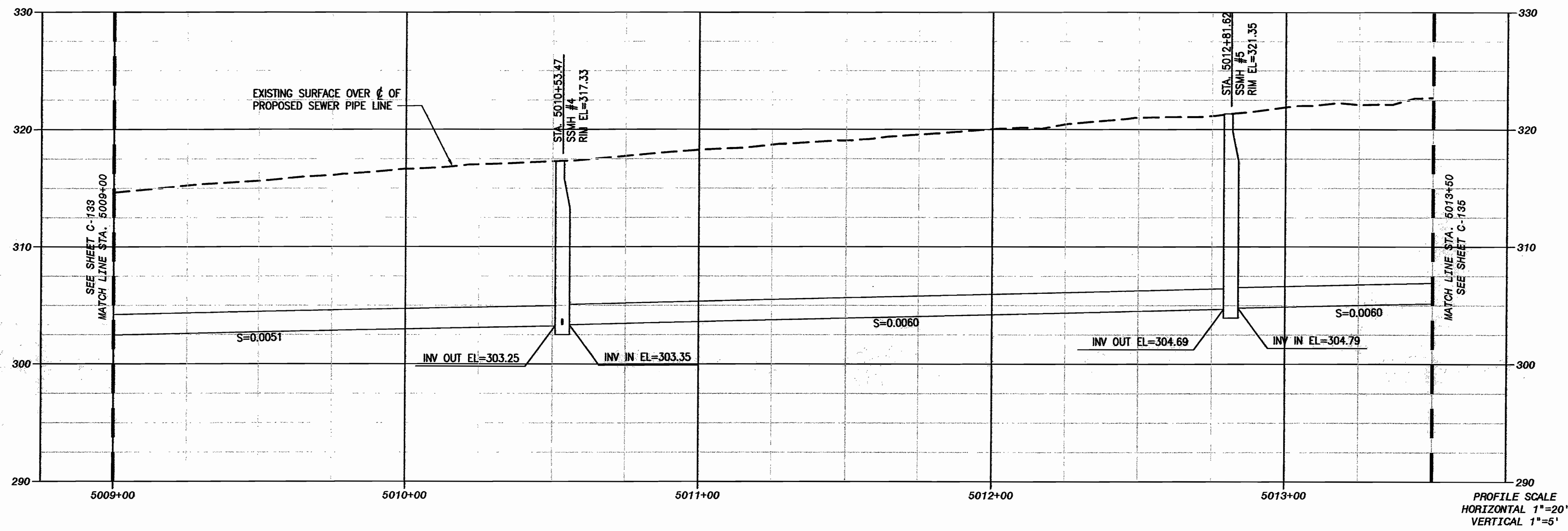
SOUTH FRONTAGE SEWER REPLACEMENT
PLAN AND PROFILE
STA 5004+50 to 5009+00

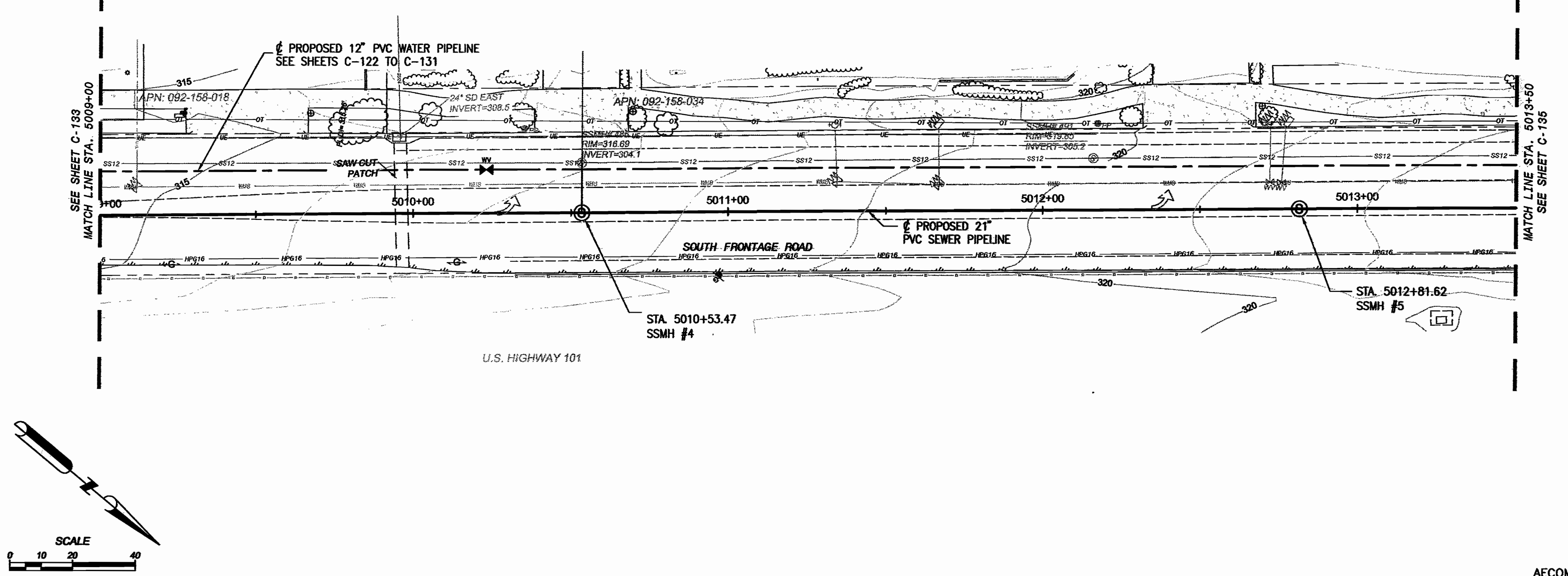
DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-133

SHEET 35 OF 64

DWG: W:\Nipomo CSD (19996)\19996.70 Waterline Intertie Project Design\Design Plans\CAD\Plansets\BP-2_NIPOMO PIPELINE\30% Plansets\C-132 to C-138.dwg Layout Name: C-133 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 2:20 PM
XREFS: fugro points - NCSD-SD_BP2 - Ex-Utilities - WaterlineBase - Surface-Sections-3-4-5 IMAGES: Nipomo logo.jpg - Santa Maria Waterline-1.sid - Santa Maria Waterline-2.sid -





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DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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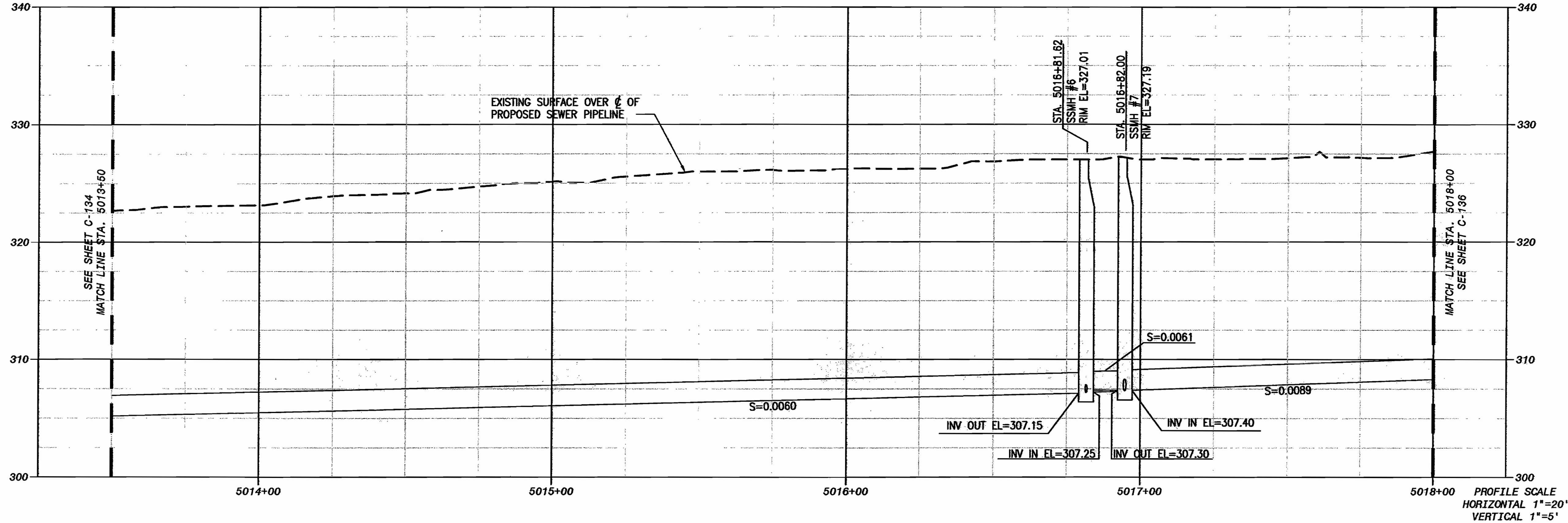
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

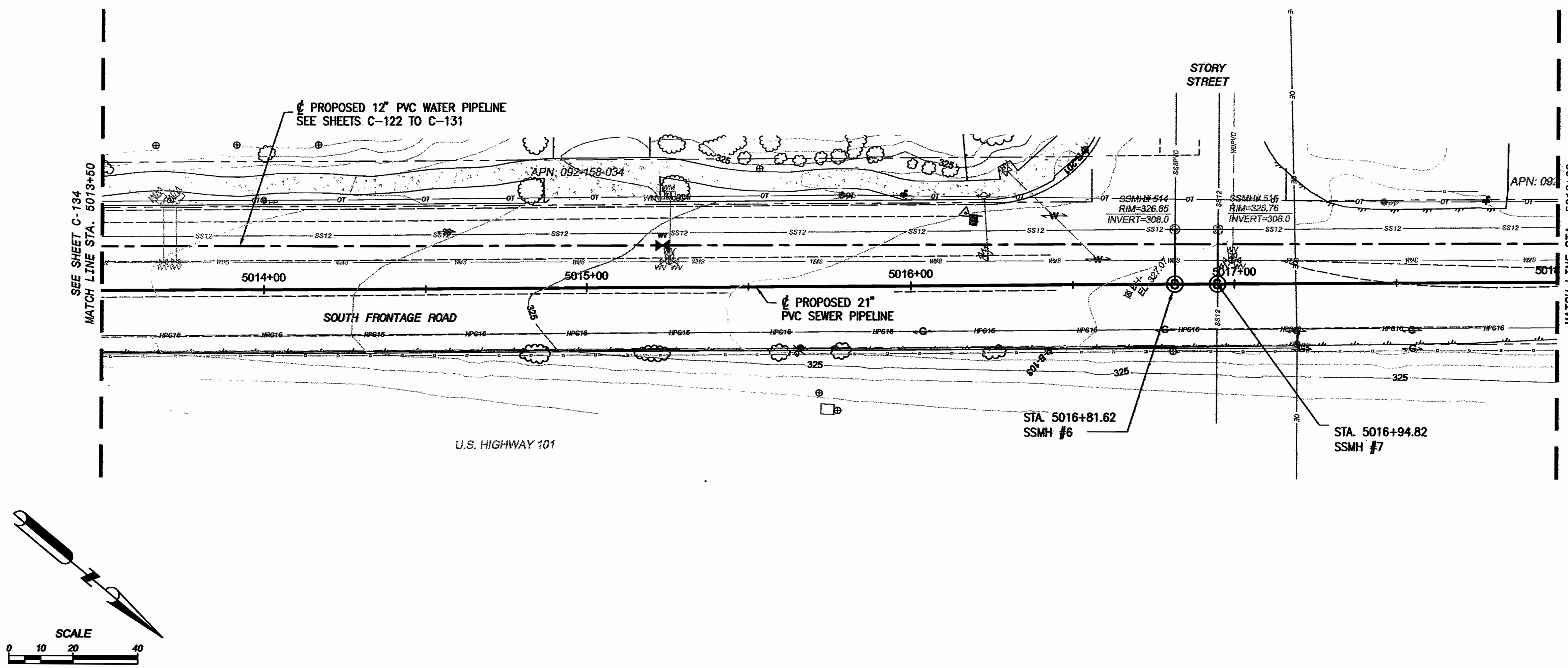
SOUTH FRONTAGE SEWER REPLACEMENT
PLAN AND PROFILE
STA 5009+00 to 5013+50

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-134
SHEET 36 OF 64

DWG: W:\Nipomo CSD (19990)\19990.70 Waterline Intertie Project Design\Design Plans\CAD\Planset\BP-2_NIPOMO PIPELINE\30% Planset\C-132 to C-138.dwg Layout Name: C-134 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 2:21 PM
XREFS: fugro points - NCSD-BD_BP2 - Ex-Utilities - Surface-Sections3-4-5 - Watsonbase - Santa Maria Waterline-1.sid - Santa Maria Waterline-2.sid - IMAGES: Nipomo logo.jpg





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DATE: MARCH 31, 2009

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PROJECT ENGINEER: JOSHUA H REYNOLDS — REG NUMBER C65400 — EXP DATE 09/30/2009

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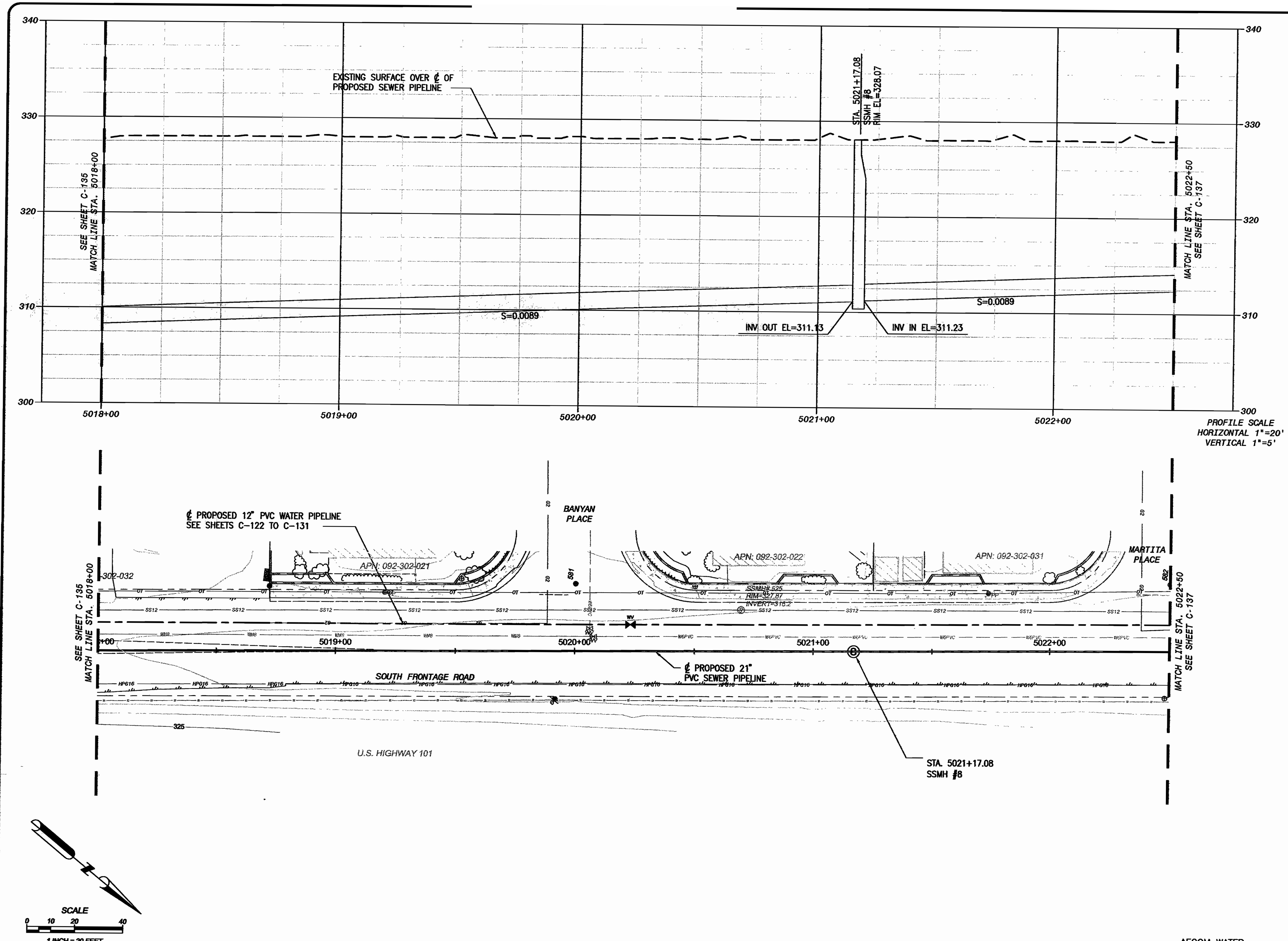
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

SOUTH FRONTAGE SEWER REPLACEMENT PLAN AND PROFILE STA 5013+50 to 5018+00

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081296.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-135

SHEET 37 OF 64



DWG: W:\Nipomo CSD (19996)\19996.70 Waterline Intertie Project Design\Design Plans\CAD\Planset\BP-2_NIPOMO PIPELINE\30% Planset\C-132 to C-138.dwg Layout Name: C-136 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 2:22 PM

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DATE: MARCH 31, 2009

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PROJECT ENGINEER: JOSHUA H REYNOLDS | REG NUMBER: C65400 | EXP DATE: 09/30/2009

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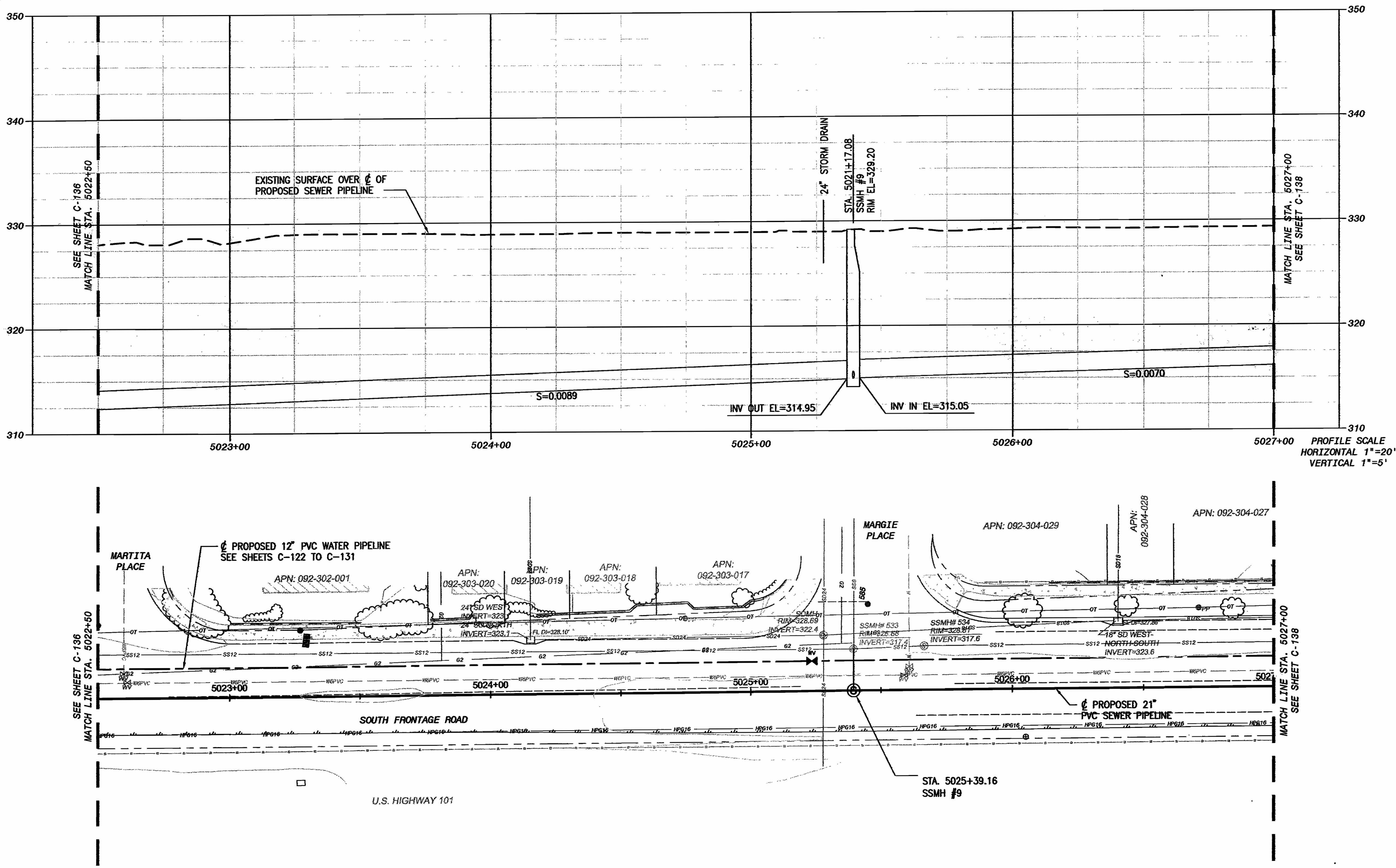
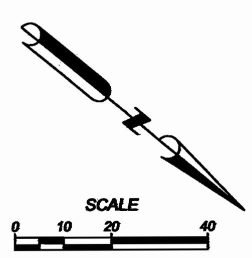
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

SOUTH FRONTAGE SEWER REPLACEMENT
PLAN AND PROFILE
STA 5018+00 to 5022+50

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061296.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-136
SHEET 38 OF 64





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DATE: MARCH 31, 2009

0 1/2 1

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REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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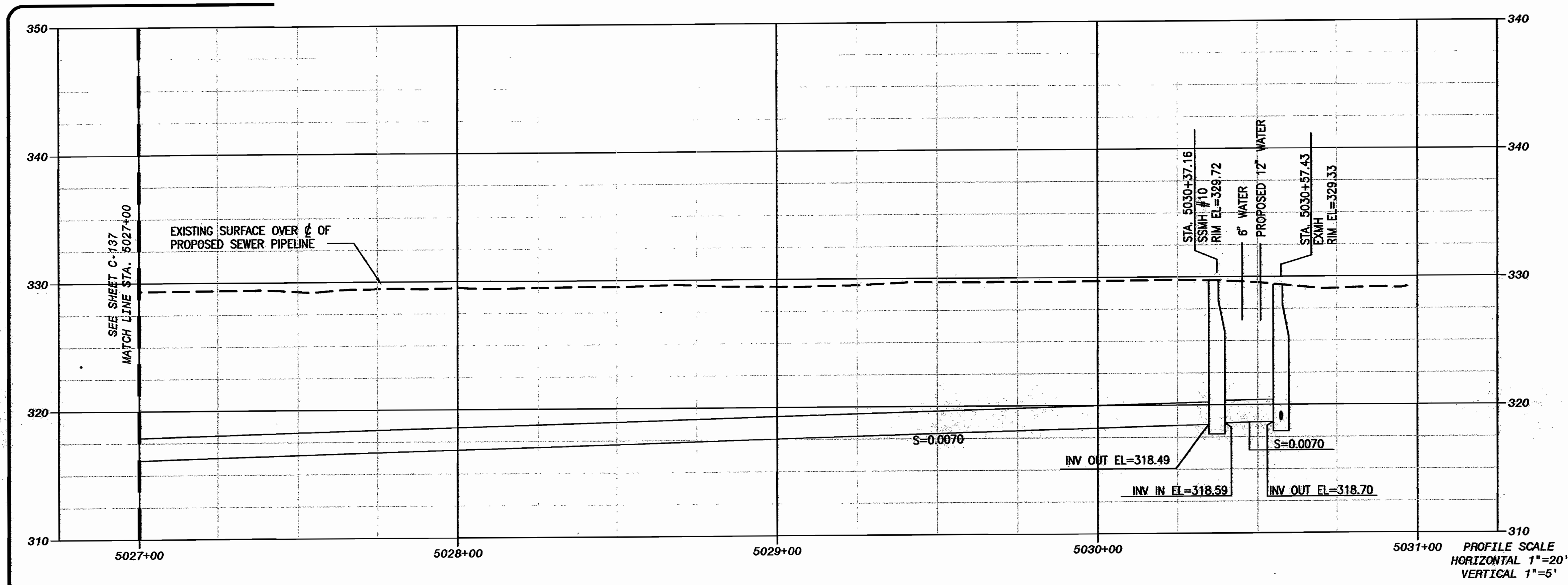
NIPOMO COMMUNITY SERVICES DISTRICT WATERLINE INTERTIE PROJECT - BP2

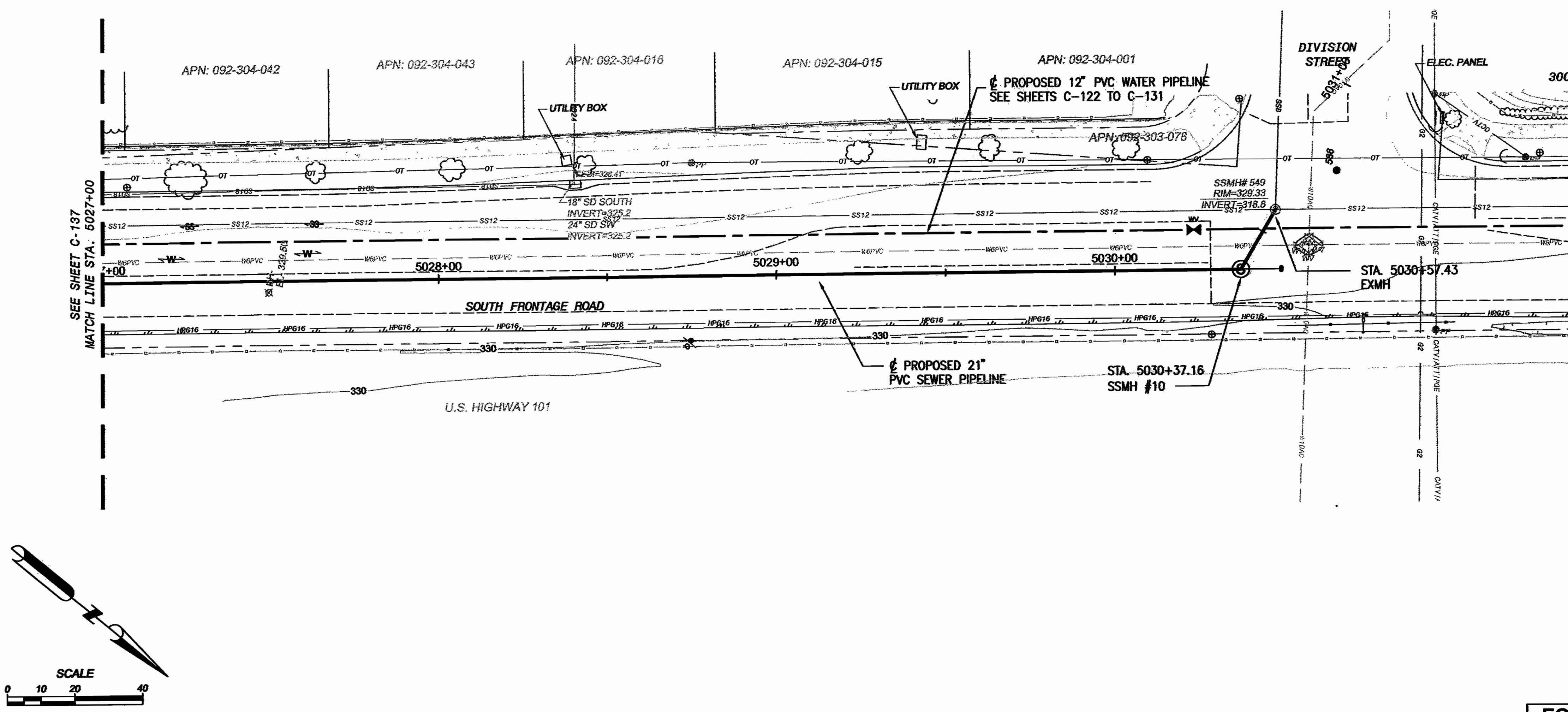
SOUTH FRONTAGE SEWER REPLACEMENT PLAN AND PROFILE STA 5022+50 to 5027+00

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-137

SHEET 39 OF 64





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AECOM WATER

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DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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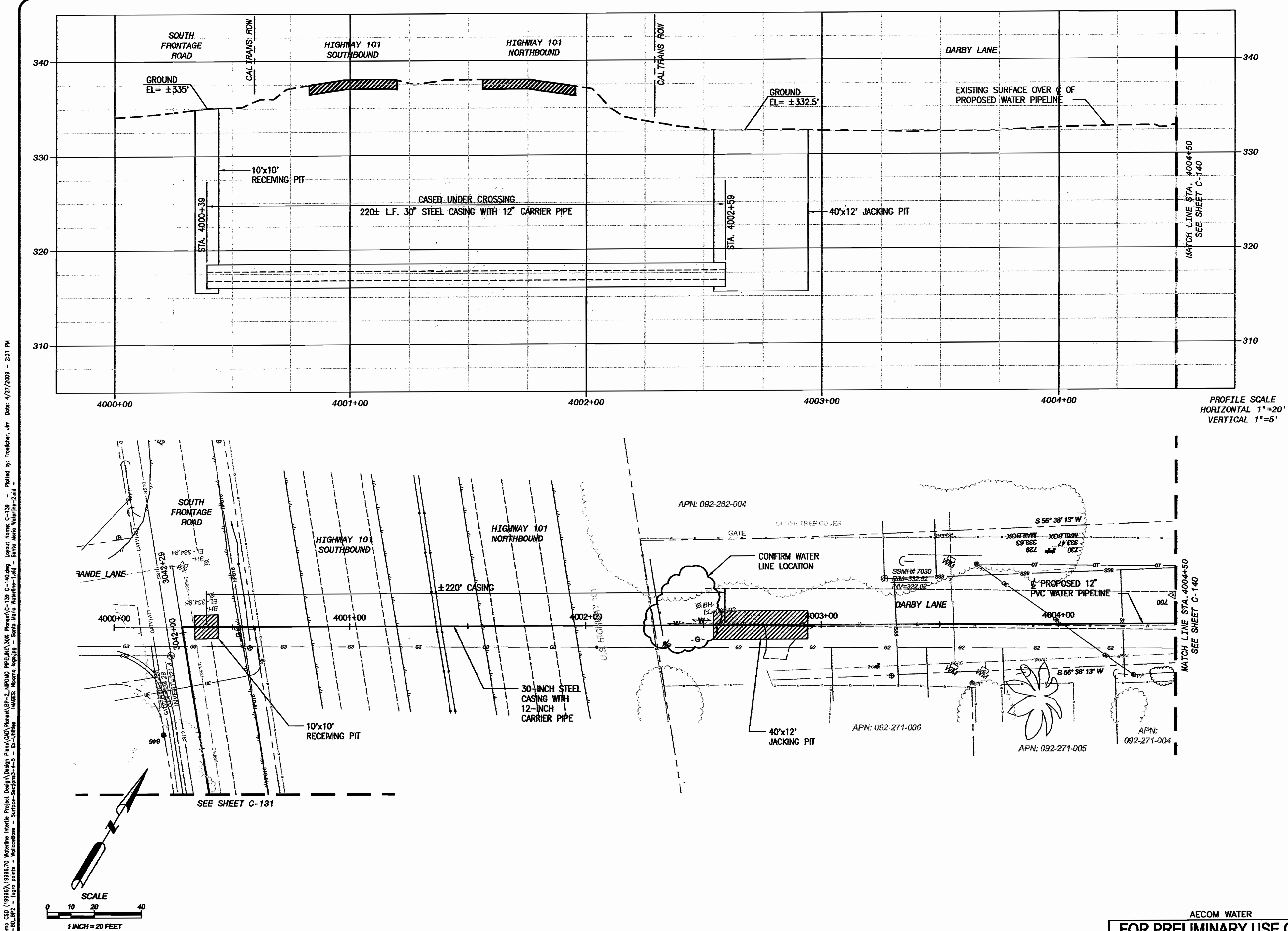
NIPOMO COMMUNITY SERVICES DISTRICT WATERLINE INTERTIE PROJECT - BP2

SOUTH FRONTAGE SEWER REPLACEMENT PLAN AND PROFILE STA 5027+00 to 5031+00

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-138

SHEET 40 OF 64



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DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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NIPOMO

NIPOMO COMMUNITY SERVICES DISTRICT WATERLINE INTERTIE PROJECT - BP2

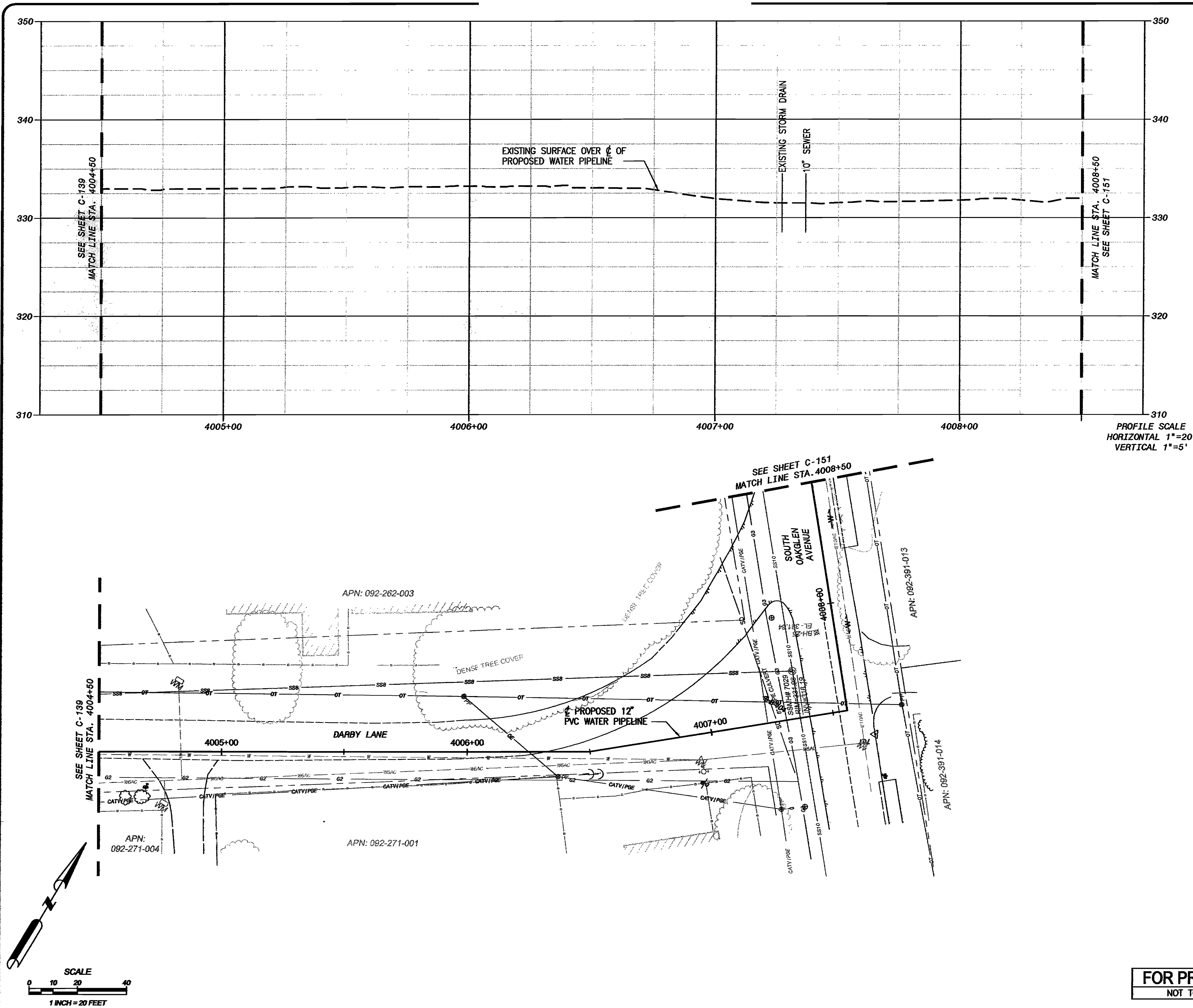
HIGHWAY 101 CROSSING PLAN AND PROFILE STA 4000+00 to 4004+50

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-139

SHEET 41 OF 64

DWG: W:\Nipomo CSD (19996)\19996.70 Waterline Intertie Project Design\Design Plans\CAD\Planset\BP-2_NIPOMO PIPELINE\30% Planset\C-139 C-140.dwg Layout Name: C-139 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 2:31 PM
XREFS: NCSD-BD_BP2 - fugro points - WallaceBase - Surface-Sections3-4-5 - Ex-Utilities IMAGES: Nipomo logo.jpg - Santo Maria Waterline-1.sid - Santo Maria Waterline-2.sid -



AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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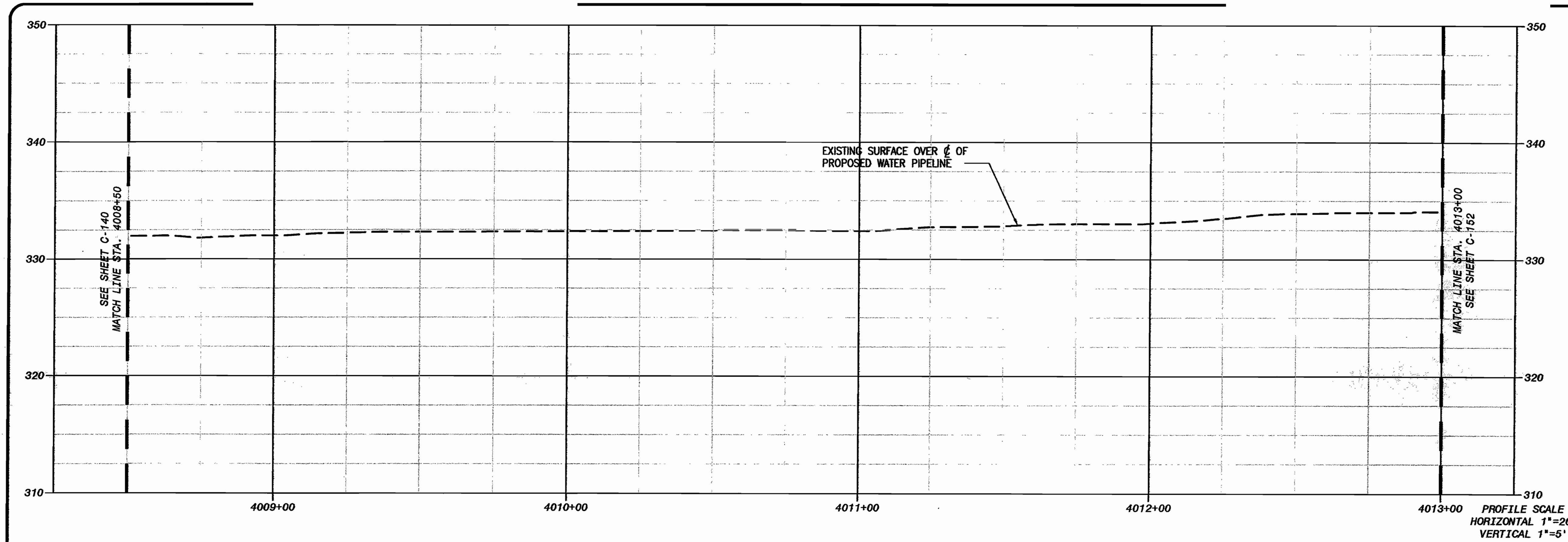
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

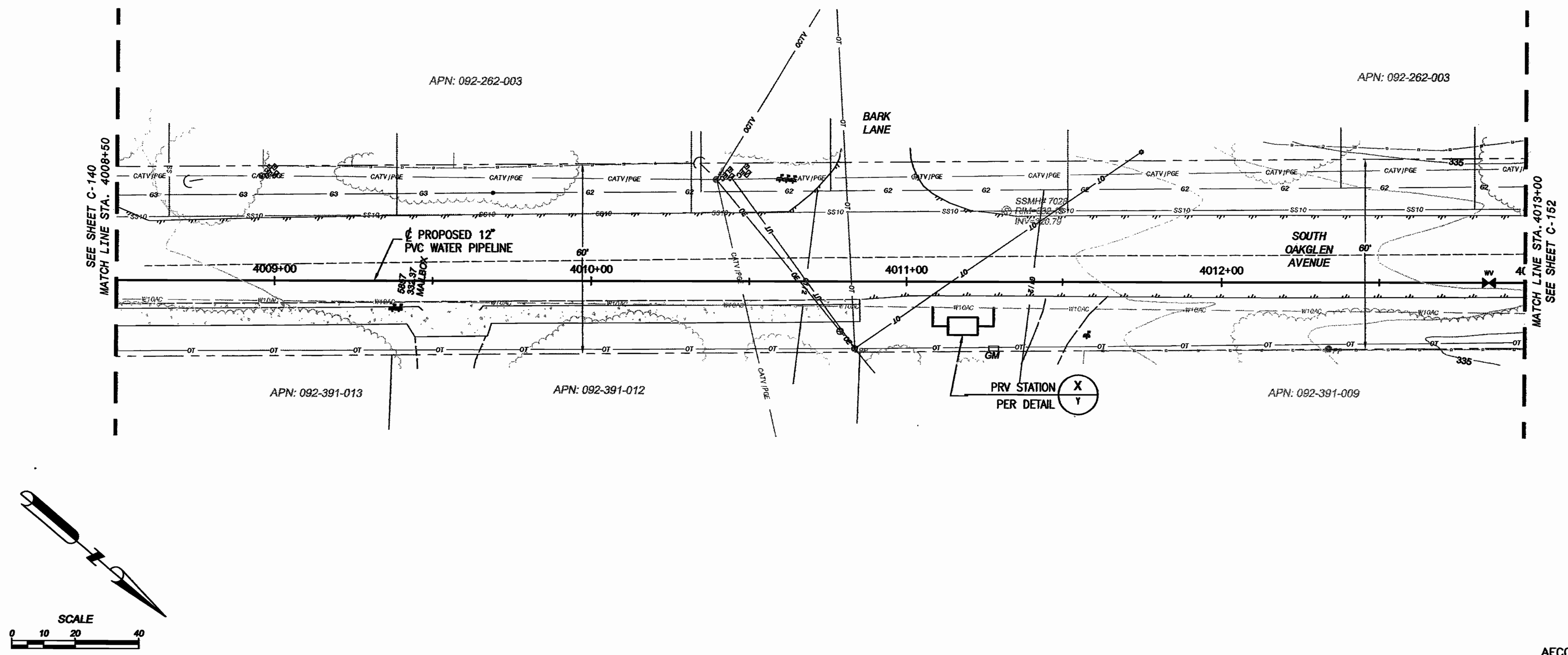
DARBY LANE
PLAN AND PROFILE
STA 4004+50 to 4008+50

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-140
SHEET 42 OF 64

DWG: W:\Nipomo CSD (19996)\19996.70 Waterline Intertie Project Design\Design Plans\CAD\Planset\BP-2_NIPOMO PIPELINE\30% Planset\C-139 C-140.dwg Layout Name: C-140 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 2:31 PM





AECOM WATER
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DATE: MARCH 31, 2009

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR

PROJECT ENGINEER: JOSHUA H REYNOLDS — REG NUMBER: C65400 — EXP DATE: 09/30/2009

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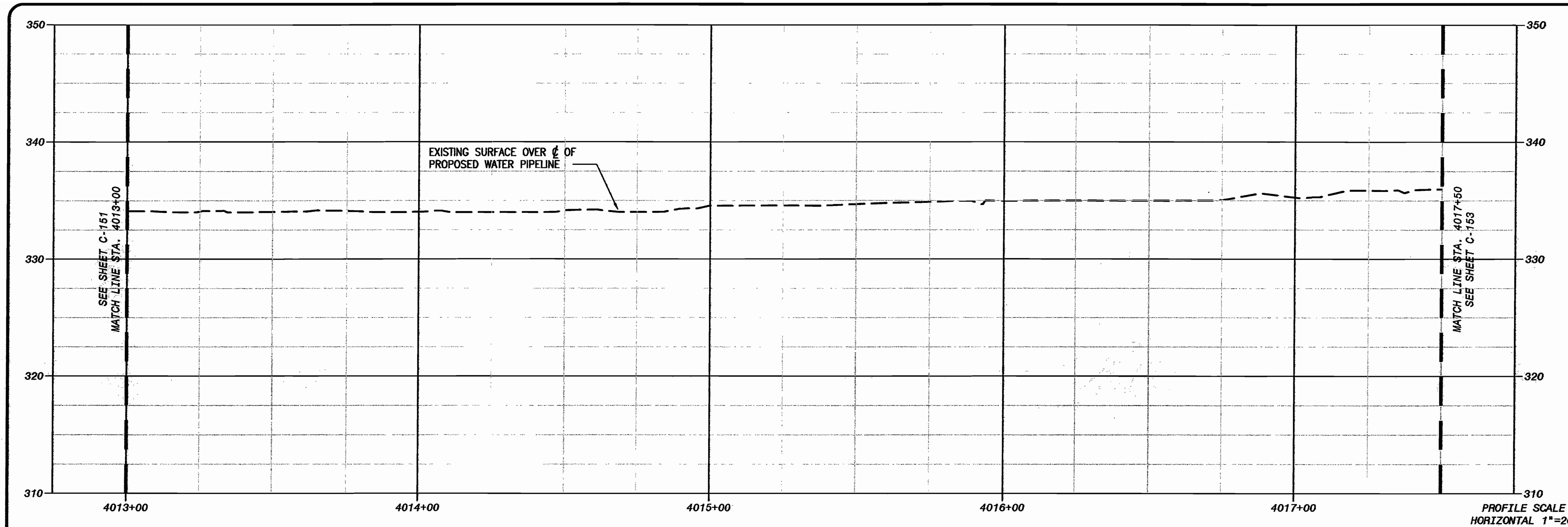
NIPOMO COMMUNITY SERVICES DISTRICT WATERLINE INTERTIE PROJECT - BP2

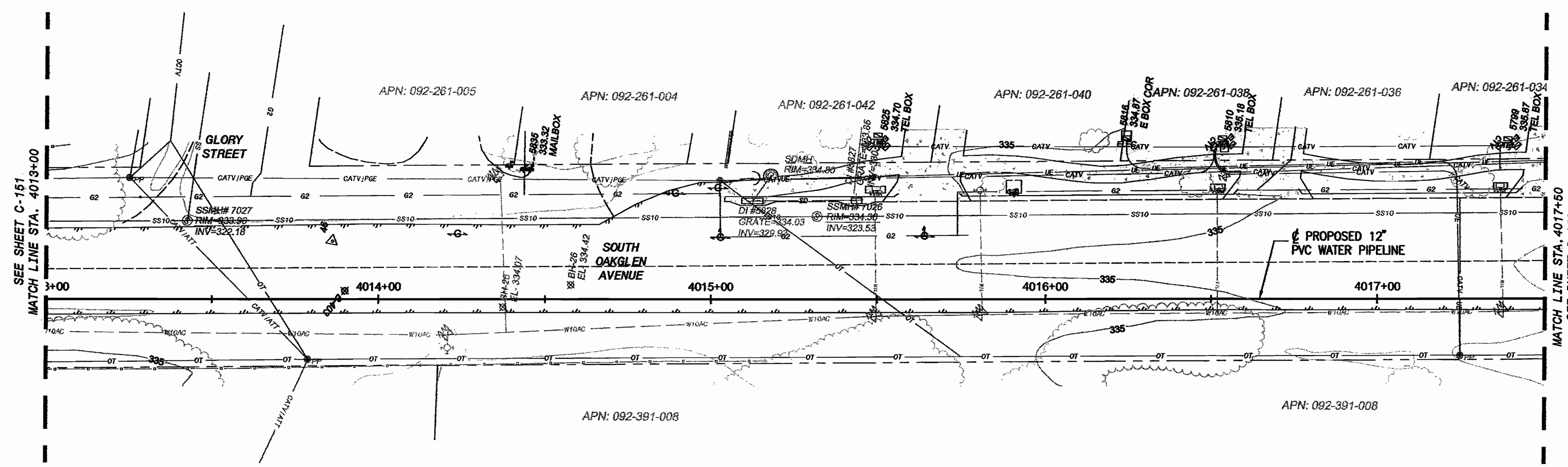
SOUTH OAKGLEN AVENUE PLAN AND PROFILE STA 4008+50 to 4013+00

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-151
SHEET 43 OF 64



PROFILE SCALE
HORIZONTAL 1"=20'
VERTICAL 1"=5'



SCALE

0 10 20 40

1 INCH = 20 FEET

AECOM WATER

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DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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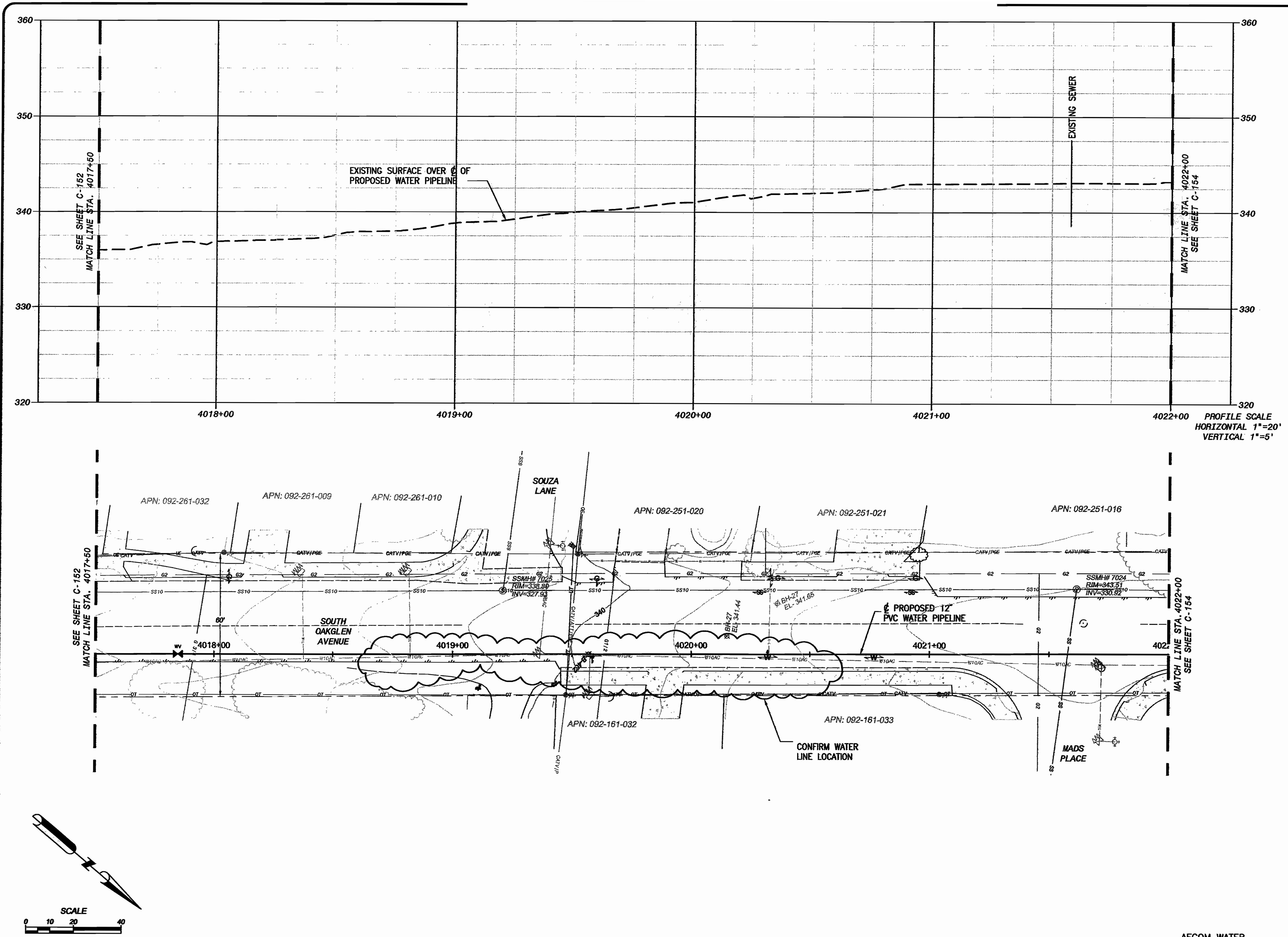
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

SOUTH OAKGLEN AVENUE PLAN AND PROFILE STA 4013+00 to 4017+50

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-152

SHEET 44 OF 64



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NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP2

SOUTH OAKGLEN AVENUE
PLAN AND PROFILE
STA 4017+50 to 4022+00

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009

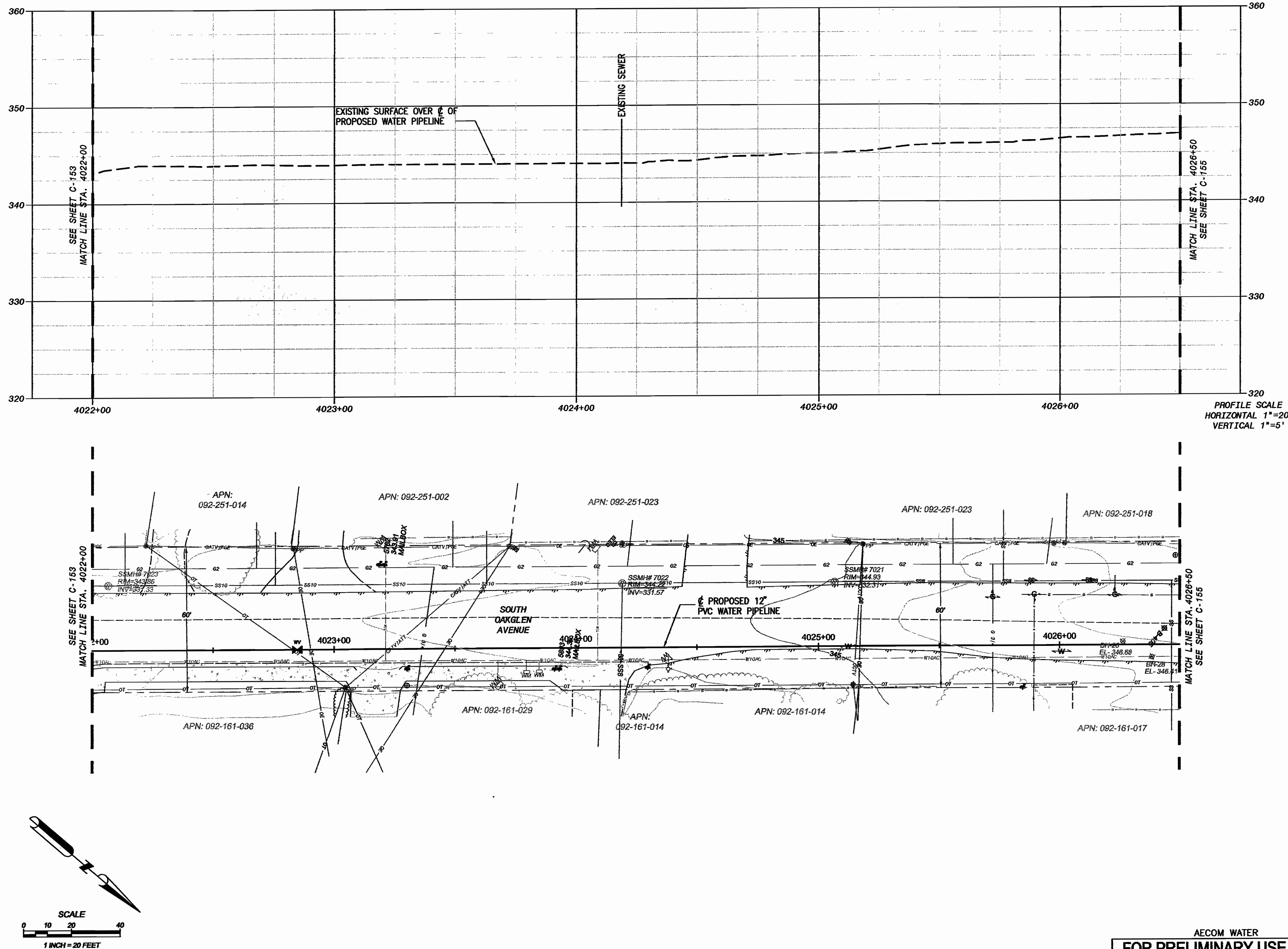
AECOM PROJECT NO.
60081295.0001

NCSD PROJECT NO.

CADD STDS.
BOYLE

C-153

SHEET
45 OF 64



DWG: W:\Nipomo CSD (19996)\19996.70 Waterline Intertie Project Design\Design Plans\CAD\Planset\BP-2_NIPOMO PIPELINE\30% Planset\C-151 to C-155.dwg Layout Name: C-154 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 2:39 PM

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DATE: MARCH 31, 2009

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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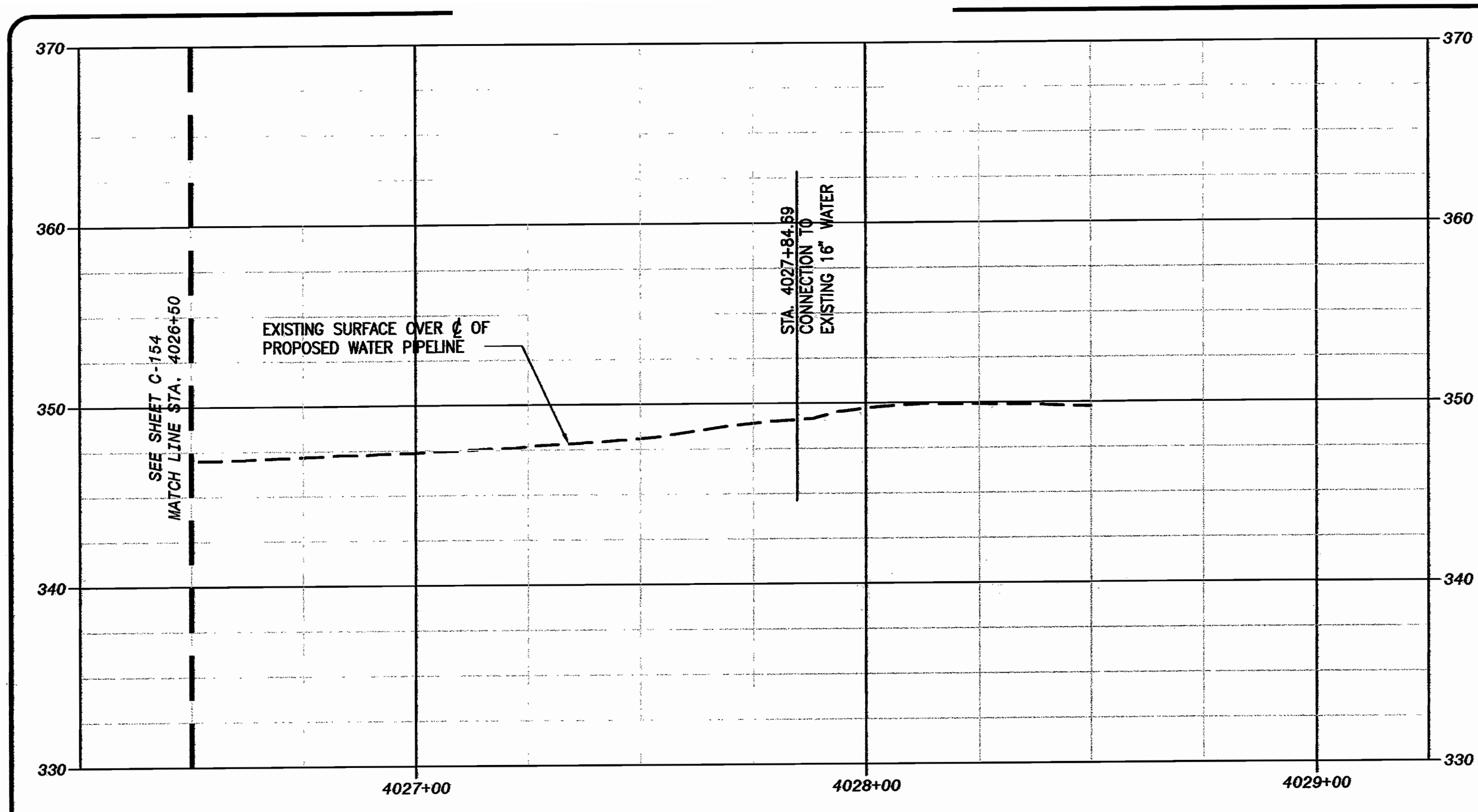
NIPOMO COMMUNITY SERVICES DISTRICT WATERLINE INTERTIE PROJECT - BP2

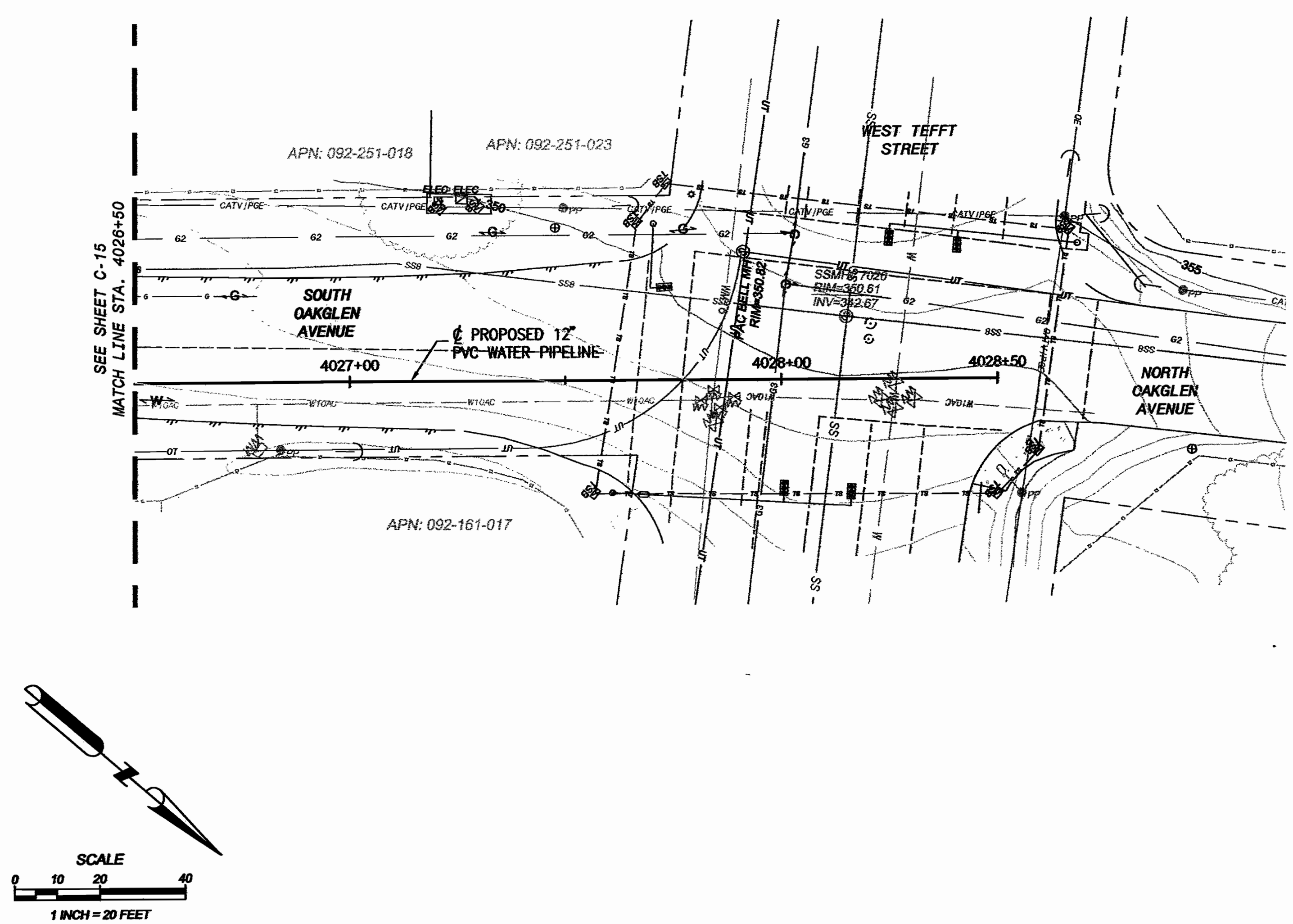
SOUTH OAKGLEN AVENUE PLAN AND PROFILE STA 4022+00 to 4026+50

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-154



PROFILE SCALE
HORIZONTAL 1"=20'
VERTICAL 1"=5'



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FOR PRELIMINARY USE ONLY

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DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
4			
3			
2			
1			

PROJECT ENGINEER	REG NUMBER	EXP DATE
JOSHUA H REYNOLDS	C65400	09/30/2009

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NIPOMO COMMUNITY SERVICES DISTRICT WATERLINE INTERTIE PROJECT - BP2

SOUTH OAKGLEN AVENUE PLAN AND PROFILE STA 4026+50 to 4029+00

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009

AECOM PROJECT NO. 60061295.0001

NCSD PROJECT NO.

CADD STDS. BOYLE

C-155

NIPOMO COMMUNITY SERVICES DISTRICT

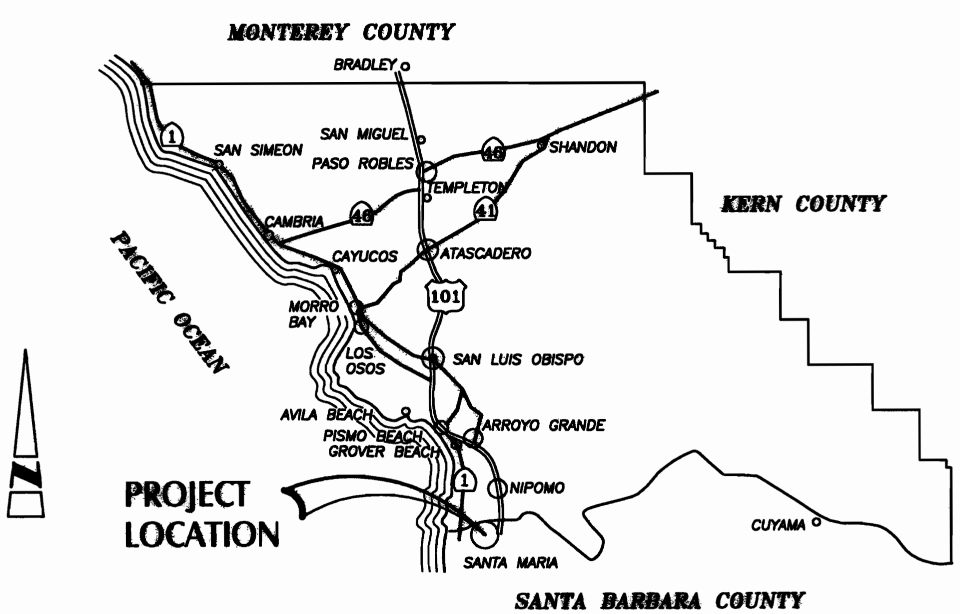
Construction Plans for

WATERLINE INTERTIE PROJECT

Bid Package 3

Blosser Road Water Main and Flow Meter

March 2009



VICINITY MAP

LOCATION MAP

Sheet Index

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2	G-002	SHEET INDEX, LEGEND, ABBREVIATION & GENERAL NOTES
3	C-101	PLAN & PROFILE - STA. 1+00 to 5+00
4	C-102	PLAN & PROFILE - STA. 5+00 to 9+50
5	C-103	PLAN & PROFILE - STA. 9+50 to 14+00
6	C-104	PLAN & PROFILE - STA. 14+00 to 18+50
7	C-105	PLAN & PROFILE - STA. 18+50 to 23+00
8	C-106	PLAN & PROFILE - STA. 23+00 to 27+50
9	C-107	PLAN & PROFILE - STA. 27+50 to 32+00
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11	C-109	PLAN & PROFILE - STA. 36+50 to 41+00
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15	C-113	LEVEE CROSSING PLAN AND PROFILE-STA. 54+50 to 57+00
16	C-114	LEVEE CROSSING PLAN AND PROFILE-STA. 57+00 to 62+00
17	C-401	METERING STATION PLAN & SECTIONS
18	C-501	BLOSSER ROAD PIPELINE DETAILS - 1
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20	C-503	LEVEE CROSSING BORE & JACK DETAILS
21	E-101	ELECTRICAL SINGLE LINE DIAGRAM & NOTES
22	E-102	ELECTRICAL PLAN AND DETAILS
23	E-501	ELECTRICAL DETAILS

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**PRELIMINARY PLANS FOR ALIGNMENT REVIEW - NOT FOR CONSTRUCTION

AECOM

PROJECT: WATERLINE INTERTIE PROJECT

CLIENT: NIPOMO COMMUNITY SERVICES DISTRICT

APPROVED BY:

GENERAL MANAGER — DATE

DISTRICT ENGINEER — DATE

PROJECT MANAGER: MICHAEL NUNLEY, PE — DATE: 2/2009

ENGINEER OF RECORD: JOSHUA REYNOLDS, PE — DATE: 2/2009

ACCOUNT NUMBER: 60061295 — FILE NUMBER

SHEET NUMBER 1 OF 23 SHEETS

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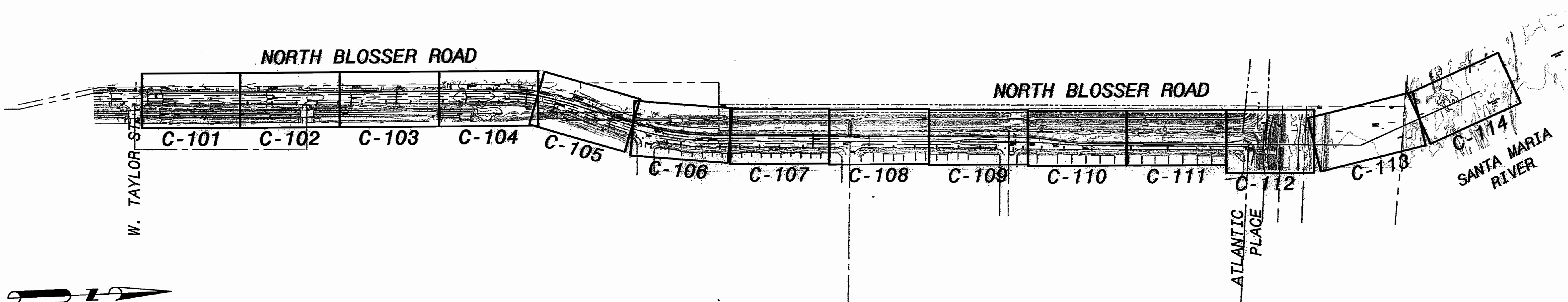

SCALE
0 250 500
1 INCH = 250 FEET

SHEET INDEX

SCALE: 1" = 250'

1
-

AECOM WATER

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DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR

PROJECT ENGINEER	REG NUMBER	EXP DATE
JOSHUA H. REYNOLDS	C65400	09-30-2009

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NIPOMO

NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP3

GENERAL NOTES

DESIGNED: ES
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009

AECOM PROJECT NO.
60061295.0001

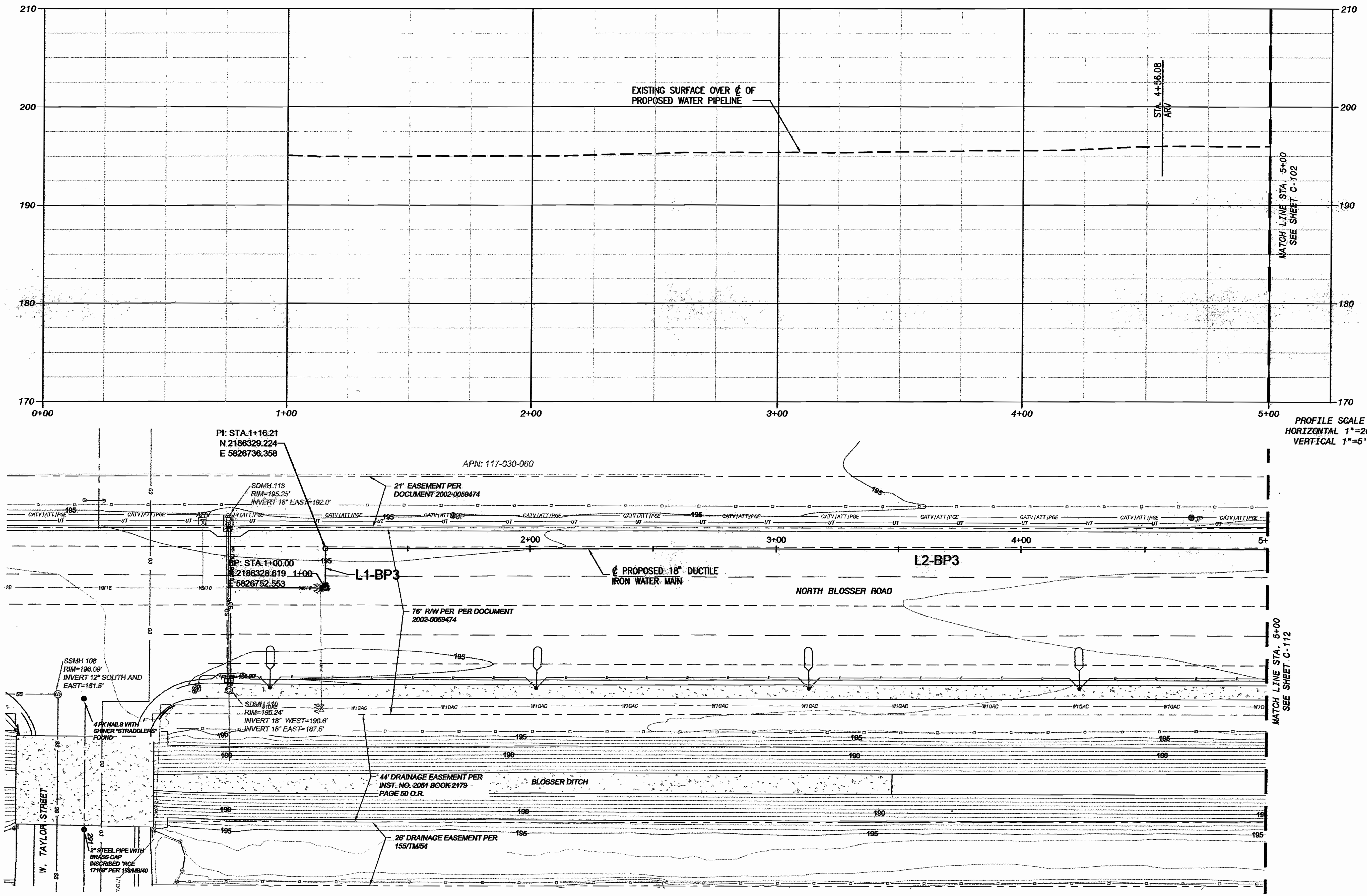
NCSD PROJECT NO.

CADD STDS.
BOYLE

G-002

SHEET
2 OF 22

DWG: W:\Nipomo CSD (19996)\19996.70 Waterline Intertie Project Design\Design Plans\CAD\Plans\BP-3_BLOSSER ROAD\30% Plans\G-002.dwg Layout Name: G-002 -- Plotted by: Froelicher, Jim Date: 4/21/2009 - 2:01 PM



Line Table: Blosser Road		
Line #	Length	Direction
L1-BP3	16.21'	N87° 51' 33.20"W
L2-BP3	1506.93'	N2° 07' 21.93"E

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP3

PLAN AND PROFILE
STA. 1+00 to STA. 5+00

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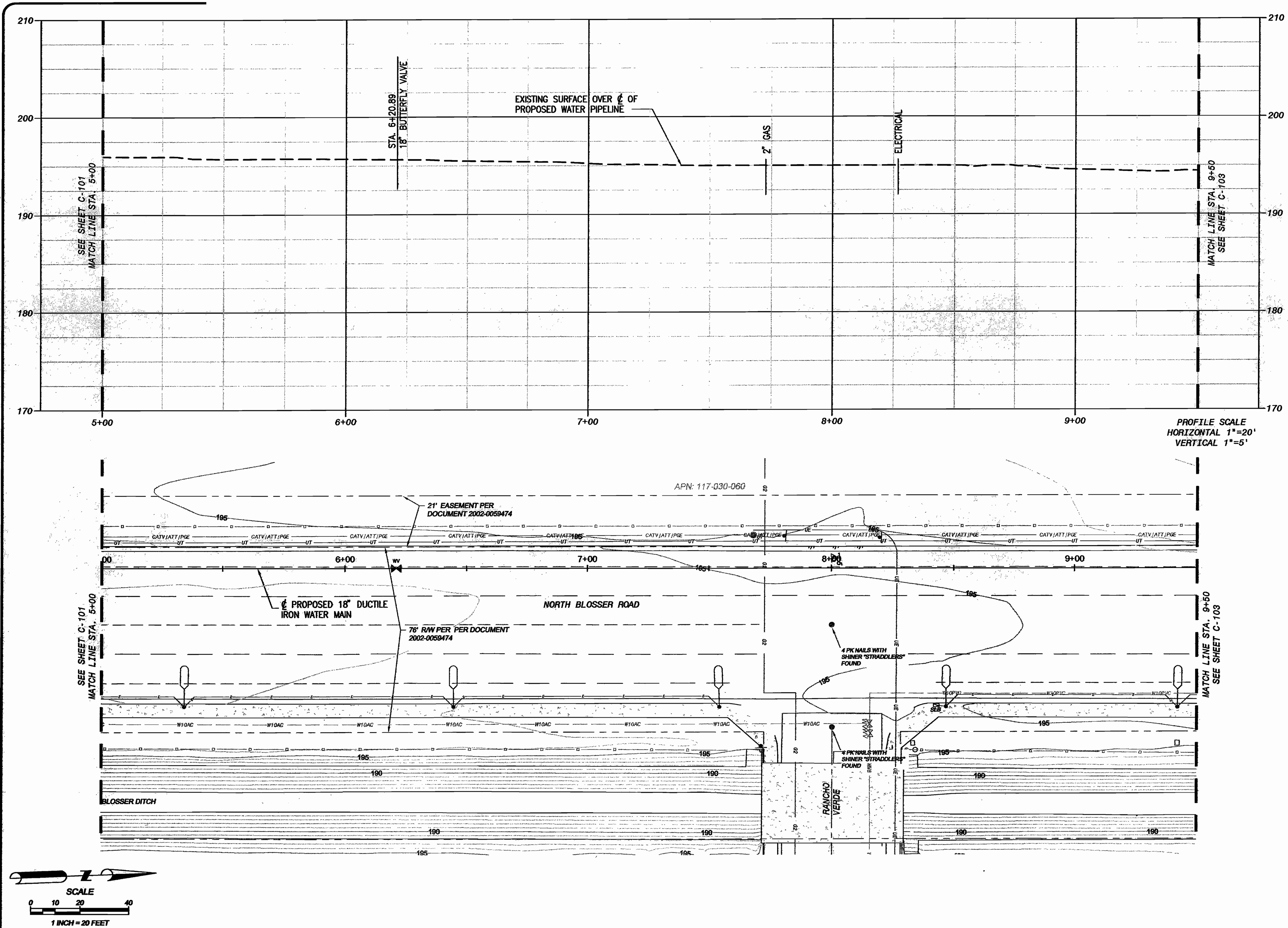
REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H. REYNOLDS		C65400	09/30/2009

DESIGNED: ES
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-101
SHEET 3 OF 22

DWG: W:\Nipomo CSD (19998)\19998.70 Waterline Intertie Project Design\Design Plans\CAD\Planset\BP-3_BLOSSER ROAD\30% Planset\C-101 to C-111.dwg Layout Name: C-101 - Plotted by: Froelicher, Jim Date: 4/21/2009 - 2:02 PM



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REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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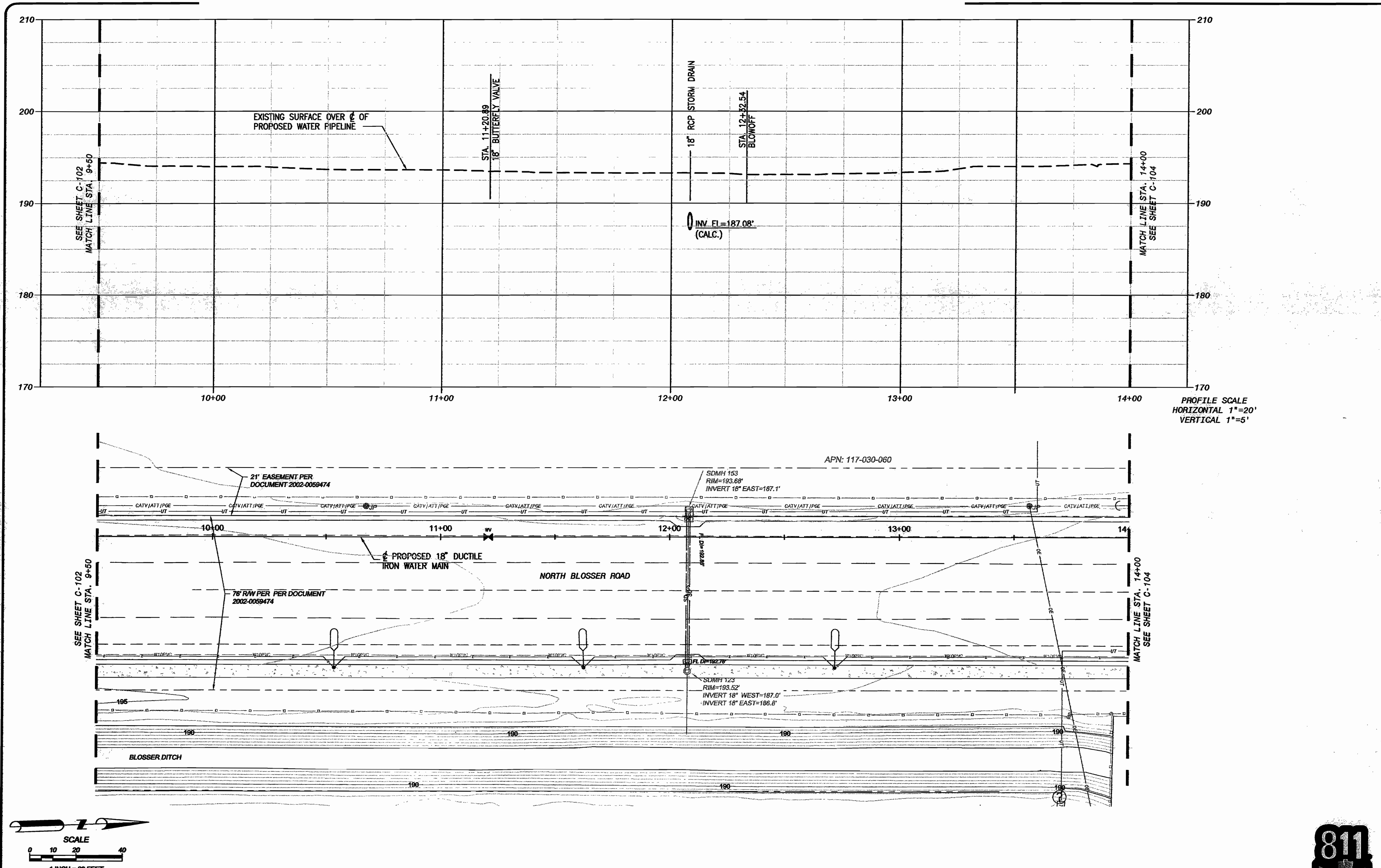
NIPOMO COMMUNITY SERVICES DISTRICT WATERLINE INTERTIE PROJECT - BP3

PLAN AND PROFILE STA. 5+00 to STA. 9+50

DESIGNED: ES
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-102
SHEET 4 OF 22



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REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP3

PLAN AND PROFILE
STA. 9+50 to STA. 14+00

DESIGNED: ES
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
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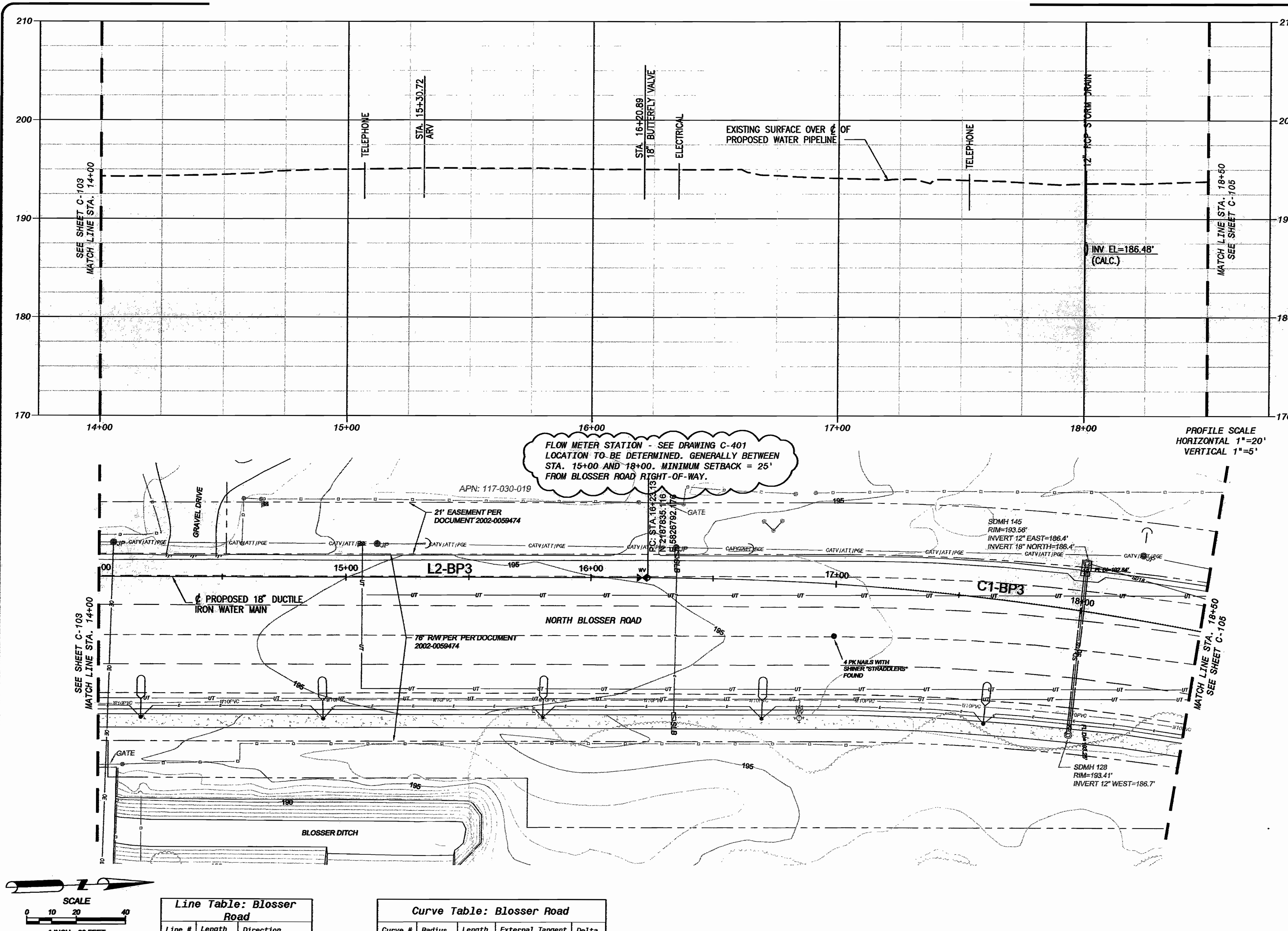
C-103
SHEET 5 OF 22



Line Table: Blosser Road		
Line #	Length	Direction
L2-BP3	1506.93'	N2° 07' 21.93"E

Curve Table: Blosser Road				
Curve #	Radius	Length	External Tangent	Delta
C1-BP3	1193.50'	361.95'	182.38	17.376

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REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H. REYNOLDS		C65400	09/30/2009

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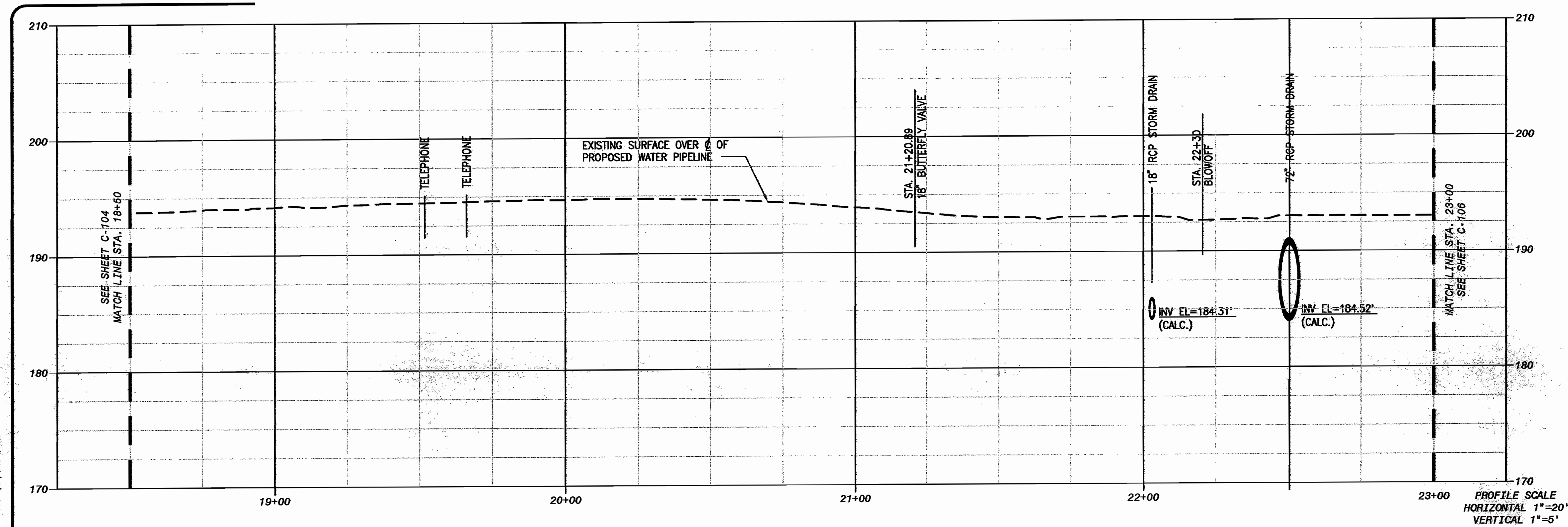
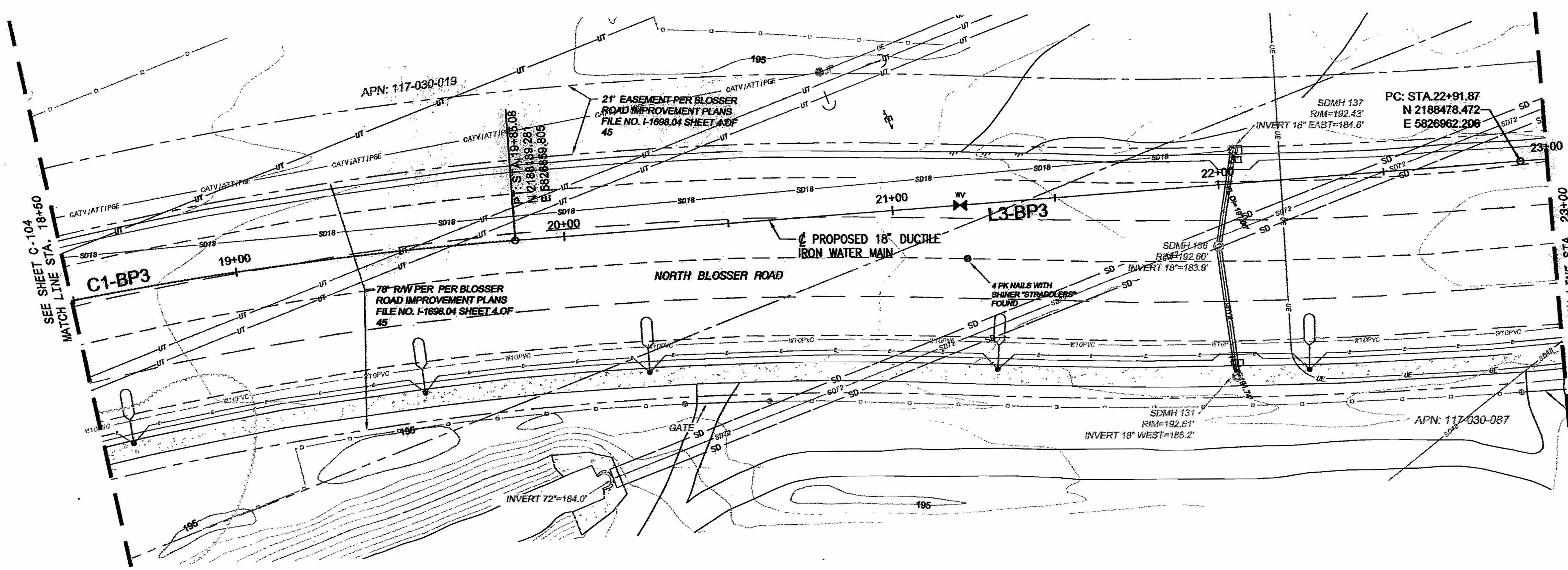
WATERLINE INTERTIE PROJECT - BP3

PLAN AND PROFILE
STA. 14+00 to STA. 18+50

DESIGNED: ES
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-104
SHEET 6 OF 22





SCALE
0 10 20 40
1 INCH = 20 FEET

Curve Table: Blosser Road				
Curve #	Radius	Length	External Tangent	Delta
C1-BP3	1193.50'	361.95'	182.38	17.376

Line Table: Blosser Road		
Line #	Length	Direction
L3-BP3	306.78'	N19° 29' 55.29"E

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REV | DATE | DESCRIPTION | APPR
PROJECT ENGINEER: JOSHUA H REYNOLDS | REG NUMBER: C65400 | EXP DATE: 09/30/2009

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NIPOMO COMMUNITY SERVICES DISTRICT WATERLINE INTERTIE PROJECT - BP3

PLAN AND PROFILE STA. 18+50 to STA. 23+00

DESIGNED: ES
DETAILED: JPF
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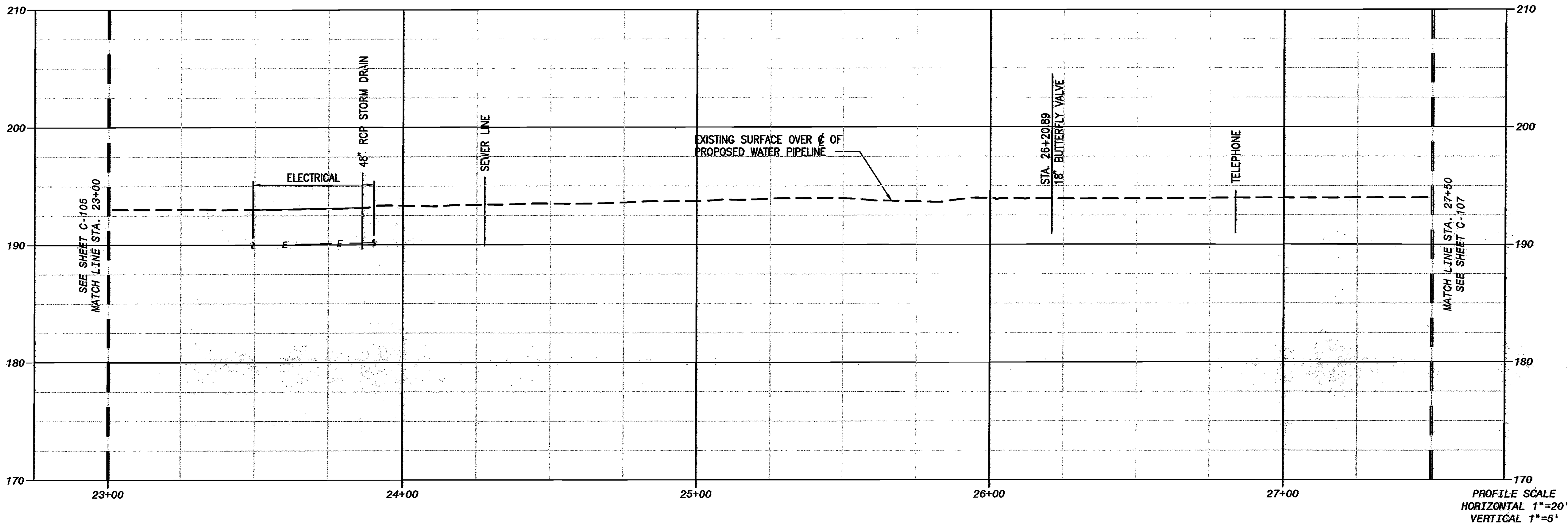
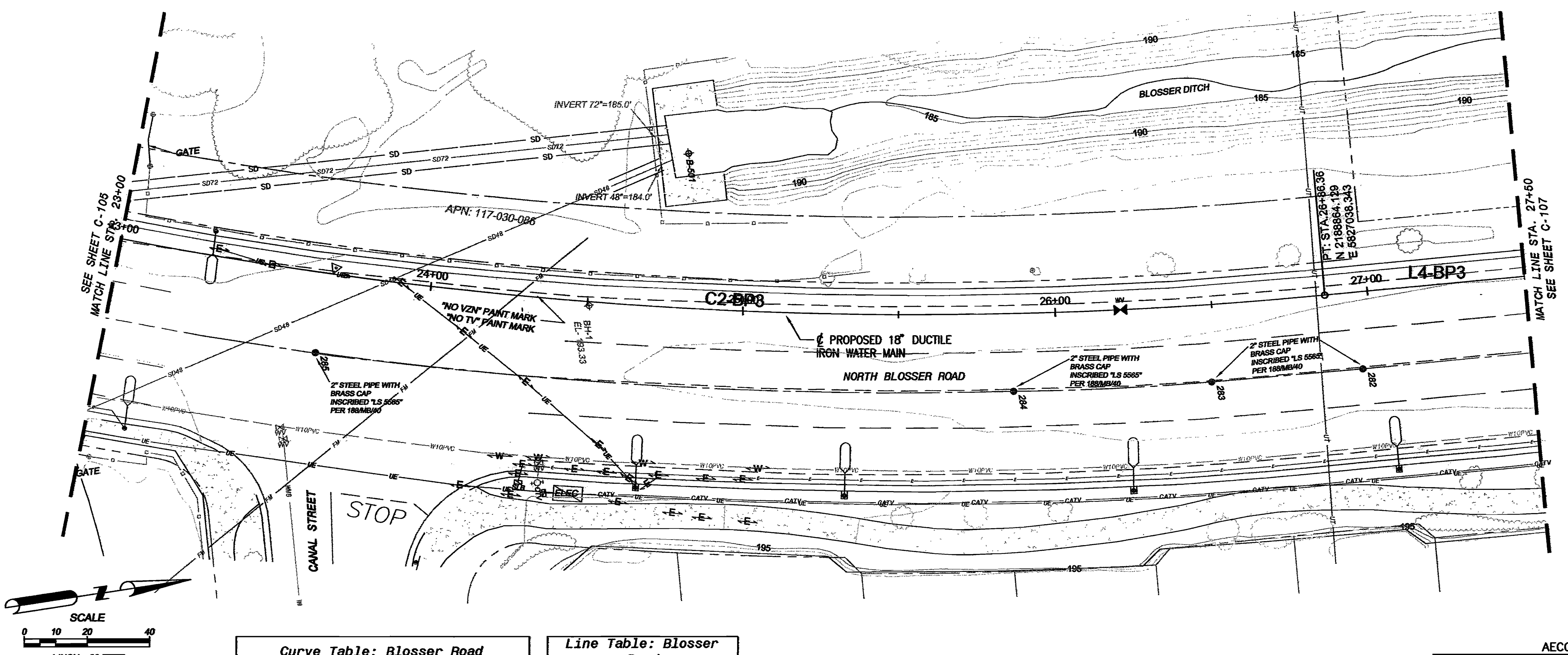
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-105
SHEET 7 OF 22





Curve Table: Blosser Road				
Curve #	Radius	Length	External Tangent	Delta
C2-BP3	1356.58'	394.49'	198.65	16.662

Line Table: Blosser Road		
Line #	Length	Direction
L4-BP3	1364.82'	N2° 50' 13.86"E

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REV	DATE	DESCRIPTION	APPR
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JOSHUA H REYNOLDS		C85400	09/30/2009

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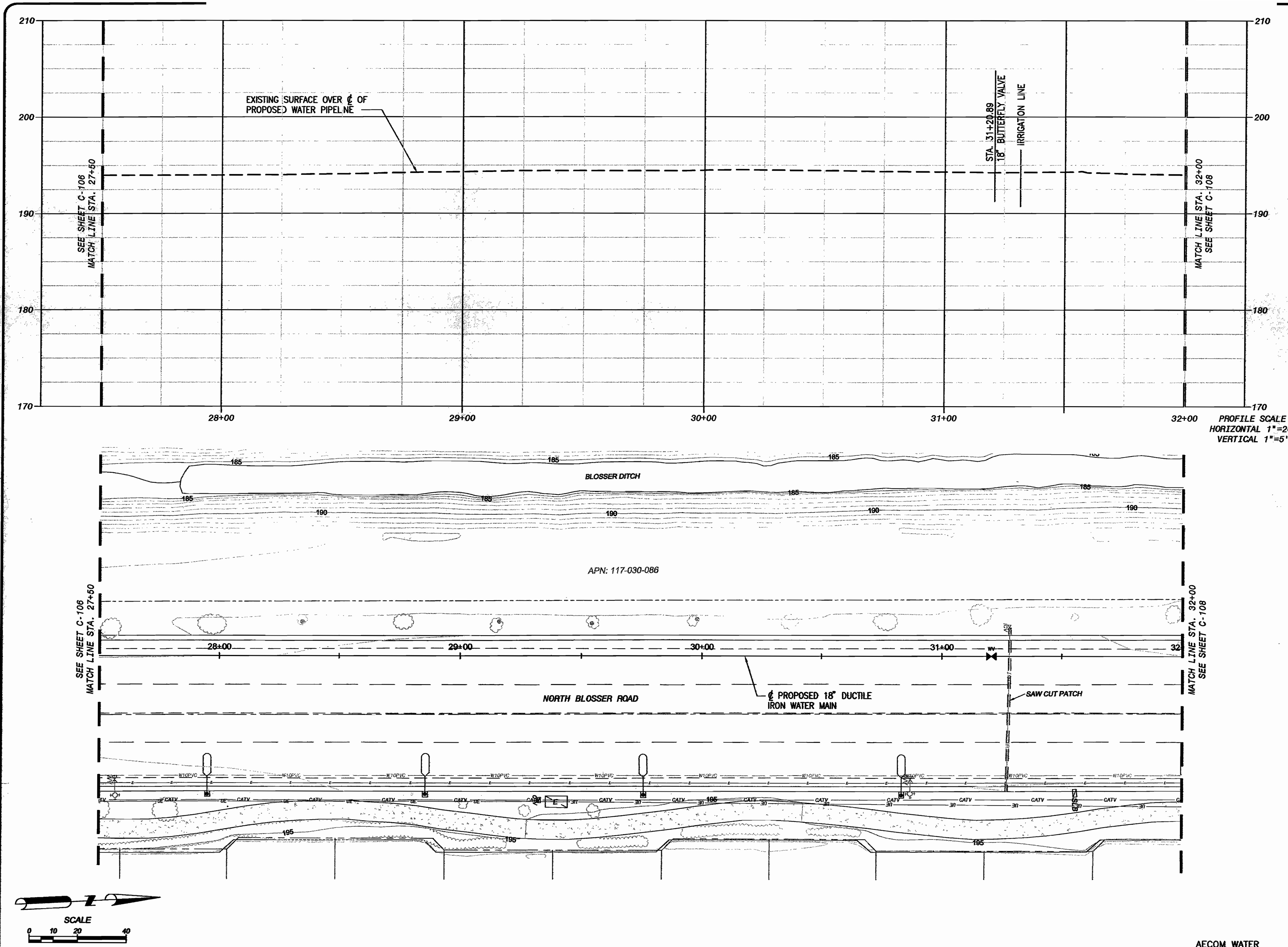
WATERLINE INTERTIE PROJECT - BP3

PLAN AND PROFILE
STA. 23+00 to STA. 27+50

DESIGNED: ES
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-106
SHEET 8 OF 22



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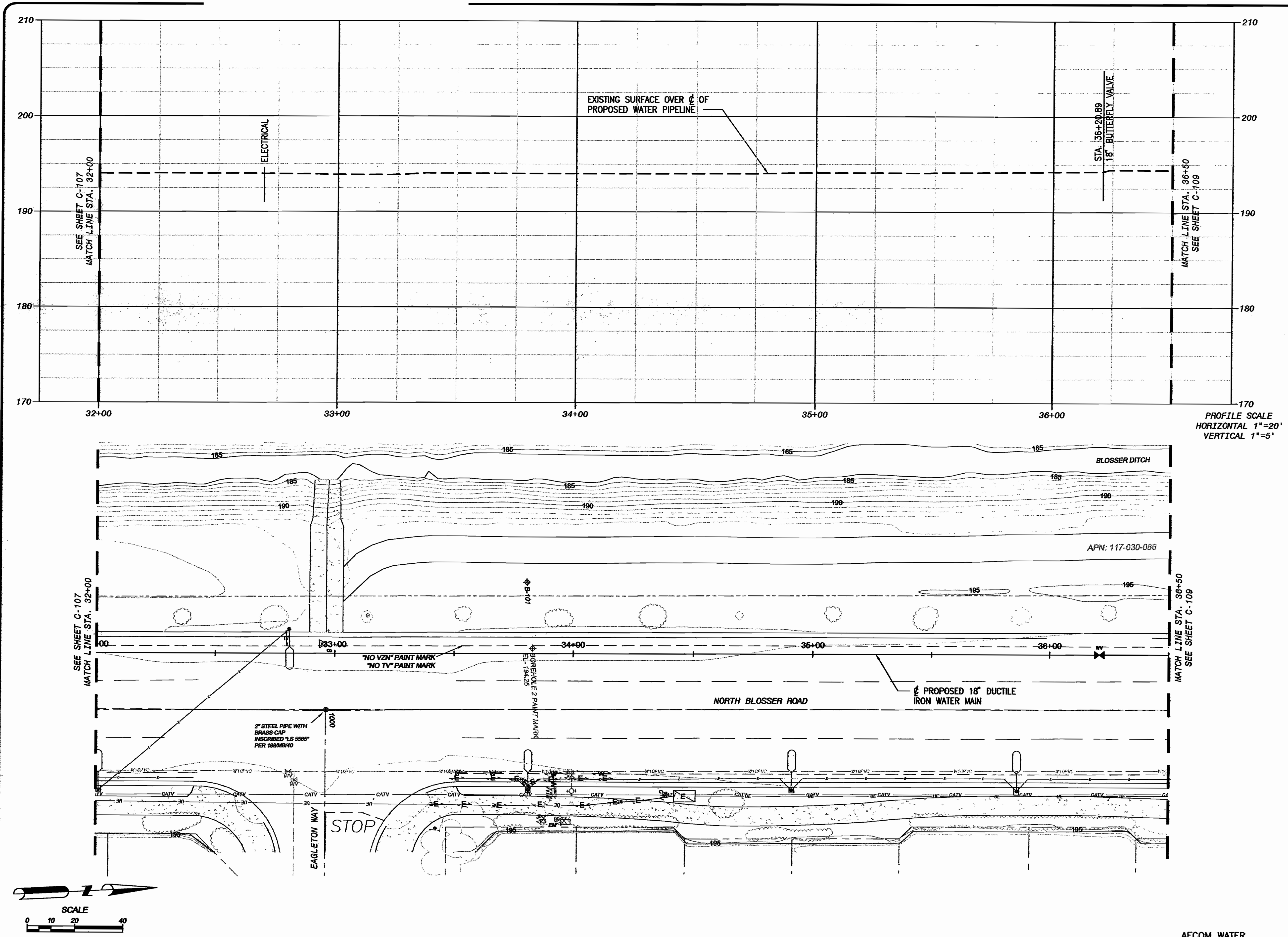
PROJECT ENGINEER: JOSHUA H REYNOLDS — REG NUMBER: C65400 — EXP DATE: 09/30/2009

NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP3

PLAN AND PROFILE
STA. 27+50 to STA. 32+00

DESIGNED: ES
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-107
SHEET 9 OF 22



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DATE: MARCH 31, 2009

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PROJECT ENGINEER: JOSHUA H. REYNOLDS — REG NUMBER: C65400 — EXP DATE: 09/30/2009

NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP3

PLAN AND PROFILE
STA. 32+00 to STA. 36+50

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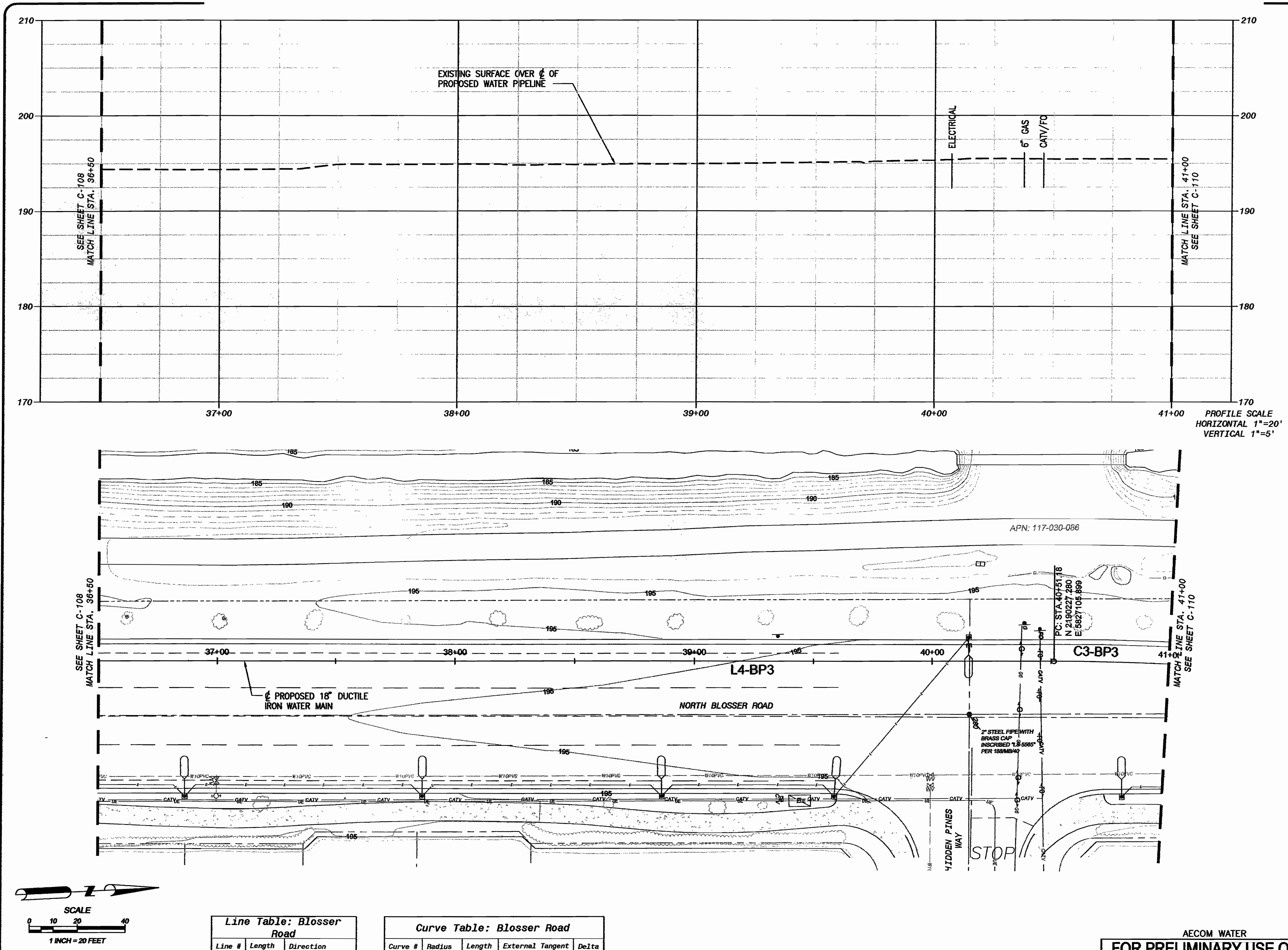
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-108
SHEET 10 OF 22



Line Table: Blosser Road		
Line #	Length	Direction
L4-BP3	1364.82'	N2° 50' 13.86"E

Curve Table: Blosser Road				
Curve #	Radius	Length	External Tangent	Delta
C3-BP3	1057.07'	166.54'	83.44	9.027

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP3

PLAN AND PROFILE
STA. 36+50 to STA. 41+00

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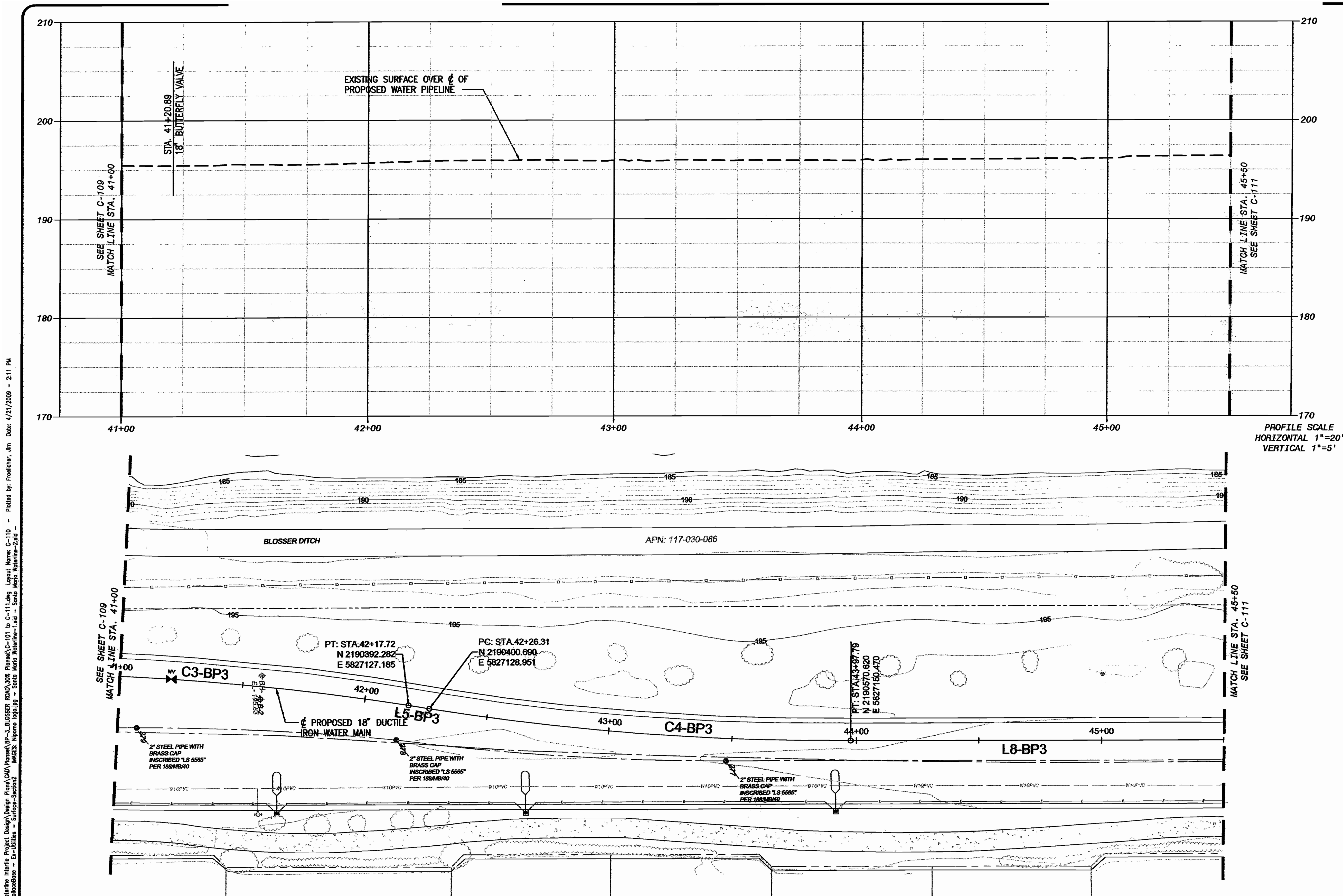
DESIGNED: ES
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-109
SHEET 11 OF 22



Curve Table: Blosser Road				
Curve #	Radius	Length	External Tangent	Delta
C3-BP3	1057.07'	166.54'	83.44	9.027
C4-BP3	1057.07'	171.47'	85.93	9.294

Line Table: Blosser Road		
Line #	Length	Direction
L5-BP3	8.59'	N11° 51' 51.06"E
L8-BP3	690.14'	N2° 44' 34.25"E

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP3

PLAN AND PROFILE
STA. 41+00 to STA. 45+50

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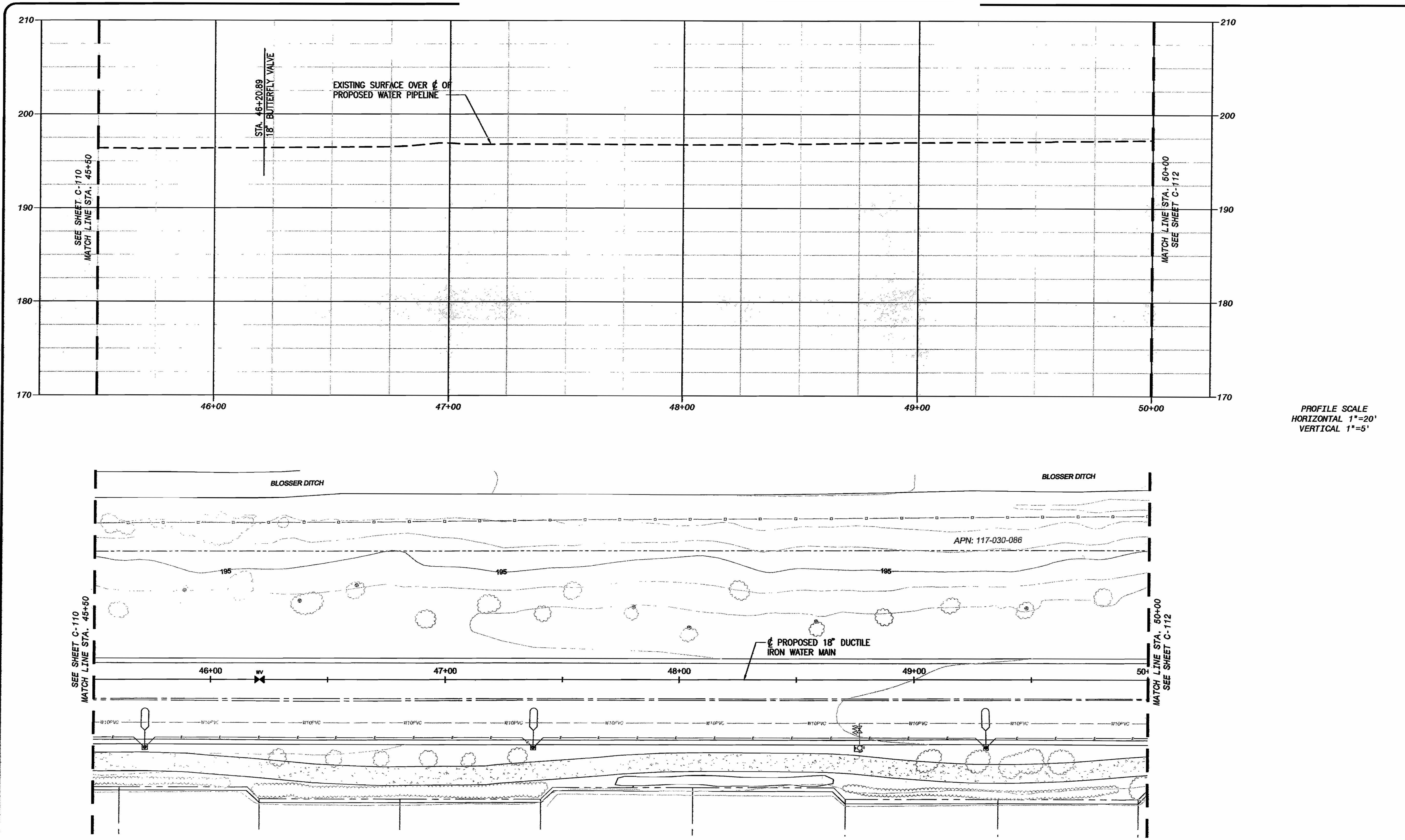
PROJECT ENGINEER: JOSHUA H. REYNOLDS — REG NUMBER: C65400 — EXP DATE: 09/30/2009

DESIGNED: ES
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-110
SHEET 12 OF 22



PROFILE SCALE
HORIZONTAL 1"=20'
VERTICAL 1"=5'

SCALE
0 10 20 40
1 INCH = 20 FEET

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DATE: MARCH 31, 2009

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0 1/2 1
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REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP3

PLAN AND PROFILE
STA. 45+50 to STA. 50+00

DESIGNED: ES
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-111
SHEET 13 OF 22

DWG: W:\Nipomo CSD (19990)\19998.70 Waterline Intertie Project Design\Design Plans\CAD\Plansets\BP-3_BLOSSER ROAD\30% Planset\C-101 to C-111.dwg Layout Name: C-111 - Plotted by: Froelicher, Jim Date: 4/21/2009 - 2:12 PM
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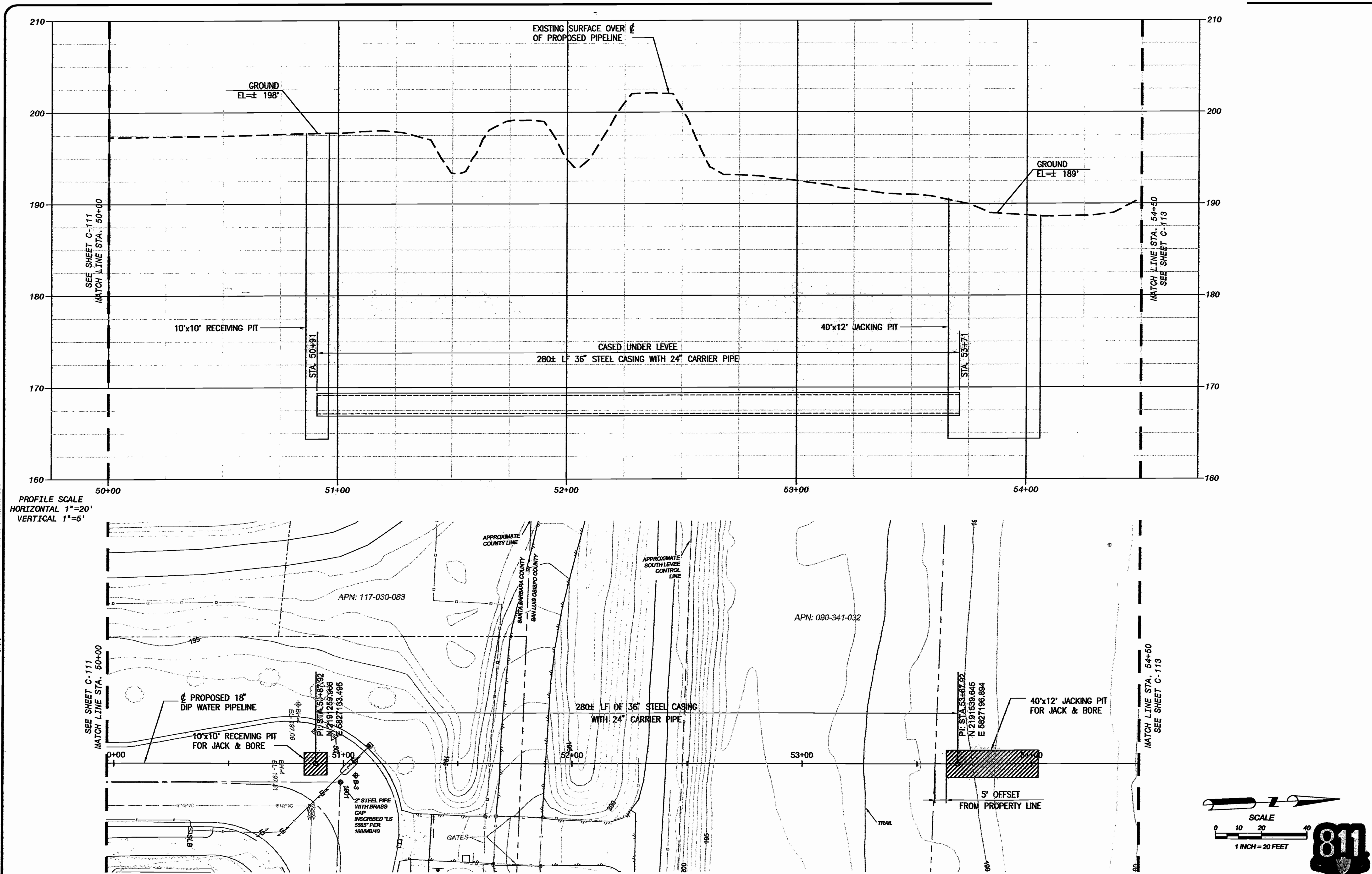

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NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP3

LEVEE BORE AND JACK
PLAN AND PROFILE
STA. 50+00 to 54+50

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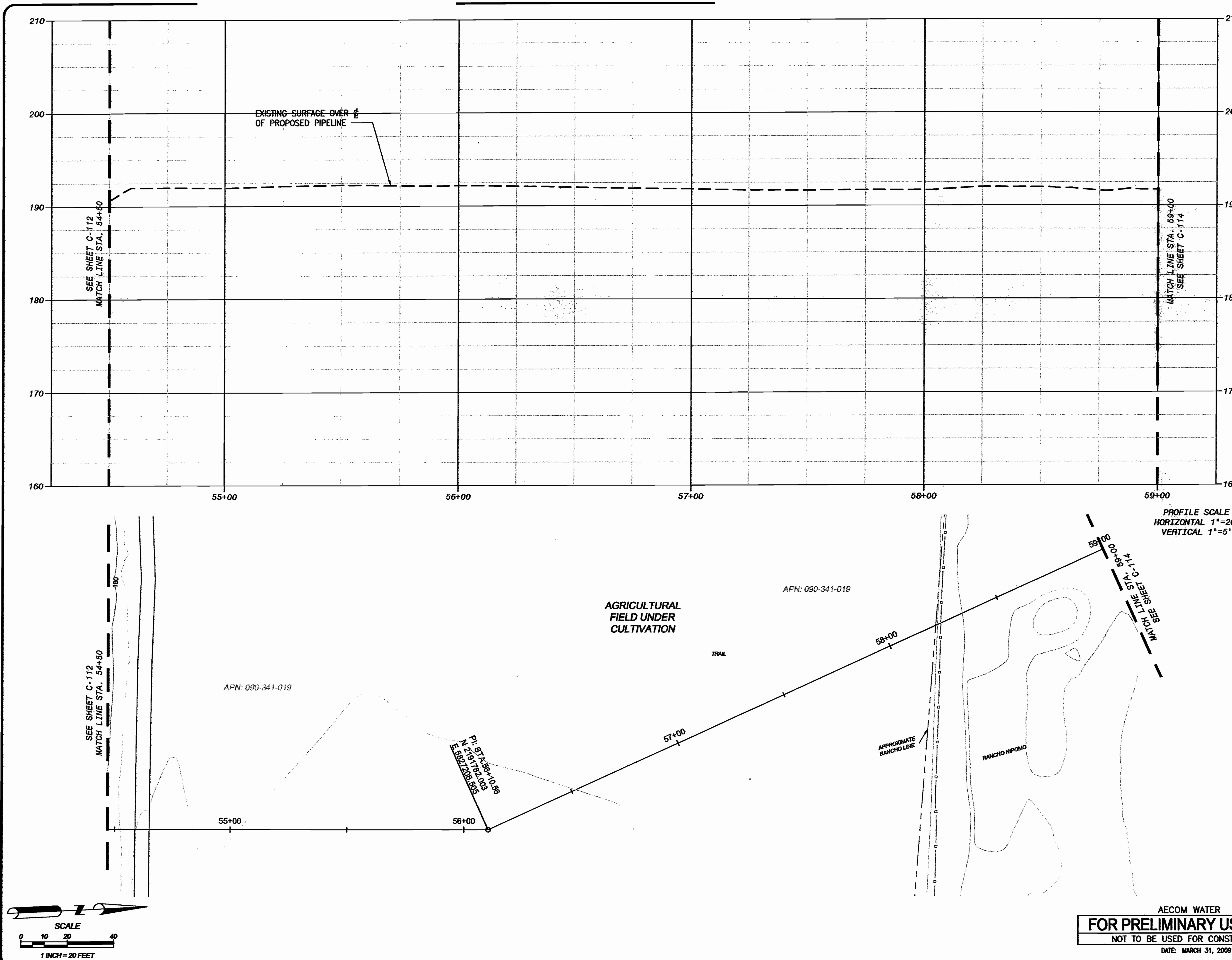
DESIGNED:	CR
DETAILED:	JPF
CHECKED:	
APPROVED:	
DATE:	MARCH 2009
AECOM PROJECT NO.	60061295.0001
NCSD PROJECT NO.	
CADD STDS.	BOYLE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE

C-112

SHEET 14 OF 22



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0 1/2 1

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AECOM WATER

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DATE: MARCH 31, 2009

REV	DATE	DESCRIPTION	EXP DATE	APPR
PROJECT ENGINEER		REG NUMBER		

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NIPOMO COMMUNITY SERVICES DISTRICT WATERLINE INTERTIE PROJECT - BP3

LEVEE BORE AND JACK PLAN AND PROFILE STA. 54+50 to 57+00

DESIGNED: CR
DETAILED: JPF
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APPROVED:
DATE: MARCH 2009

AECOM PROJECT NO. 60061295.0001

NCSD PROJECT NO.

CADD STDS. BOYLE

C-113

SHEET 15 OF 22

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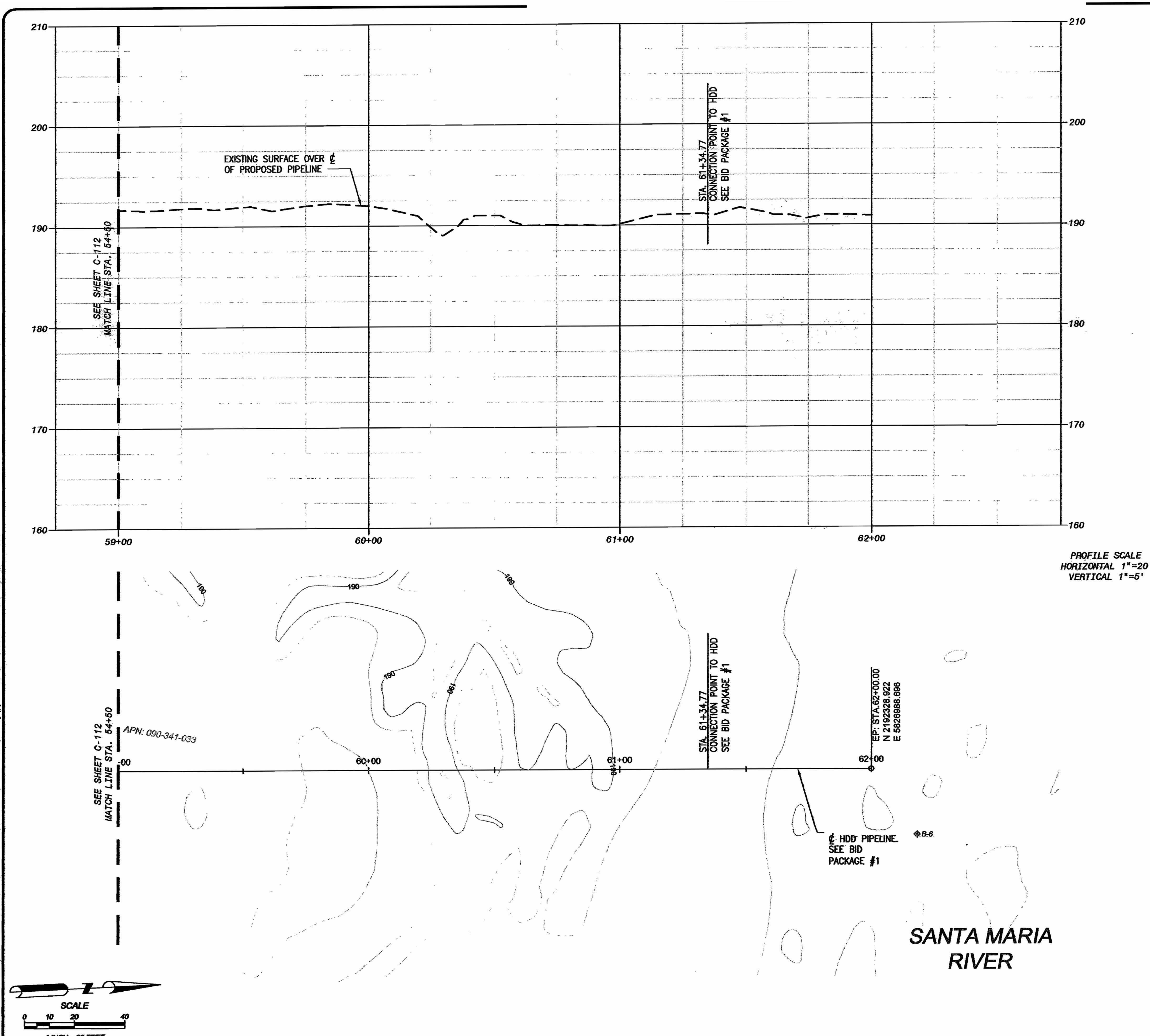

AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

Know what's **below.** **Call** before you dig.

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR

PROJECT ENGINEER — REG NUMBER — EXP DATE

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP3

LEVEE BORE AND JACK PLAN AND PROFILE STA. 59+00 to 62+00

DESIGNED: CR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009

AECOM PROJECT NO. 60061295.0001

NCSD PROJECT NO.

CADD STDS. BOYLE

C-114

SHEET 16 OF 22

NIPOMO COMMUNITY SERVICES DISTRICT

Construction Plans for

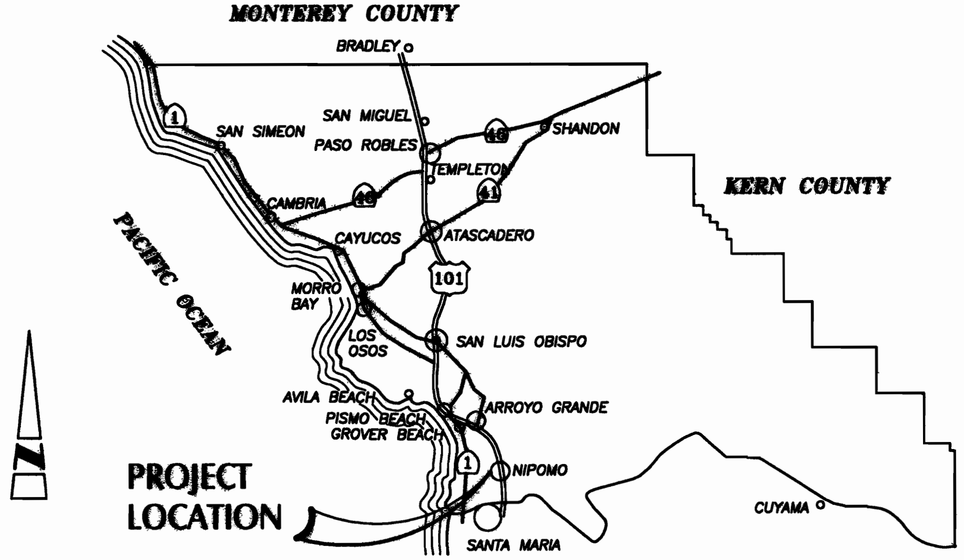
WATERLINE INTERTIE PROJECT

Bid Package 4

Joshua Road Pump Station and Reservoir

Wellhead Chloramination Improvements

MARCH 2009



VICINITY MAP

LOCATION MAP

**PRELIMINARY PLANS FOR ALIGNMENT REVIEW - NOT FOR CONSTRUCTION

811 Know what's below. Call before you dig.

AECOM

PROJECT	WATERLINE INTERTIE PROJECT
CLIENT	NIPOMO COMMUNITY SERVICES DISTRICT
APPROVED BY:	
PROJECT MANAGER	MICHAEL NUNLEY, PE 3/2009
DESIGNER OF RECORD	JOSHUA REYNOLDS, PE 3/2009
	60081295
SHEET NUMBER	1 of 71

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DWG: W:\Nipomo CSD (19996)\19996.70 Waterline Intertie Project Design\Design Plans\CAD\Planset\BP-4_JOSHUA\30% Planset\G-001.dwg Layout Name: G-001 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 2:48 PM
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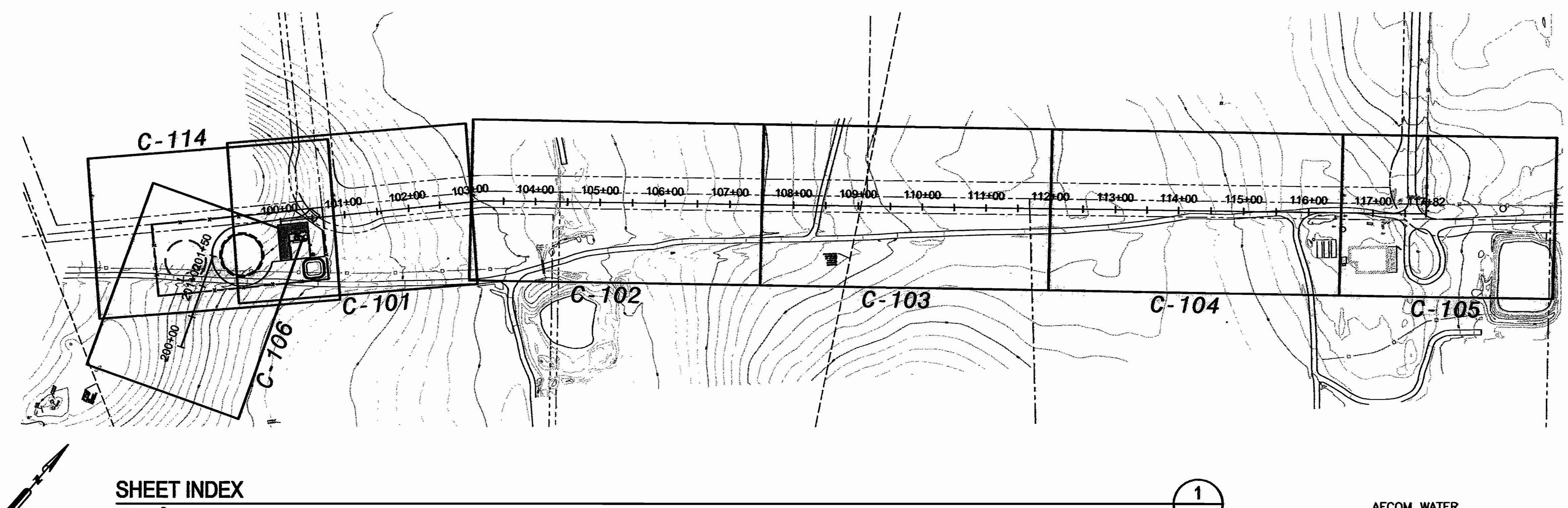
IMAGES: Nipomo logo.jpg -

Sheet Index



SHEET INDEX
SCALE: 1" = 100'

1
-

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REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H. REYNOLDS		C65400	09-30-2009

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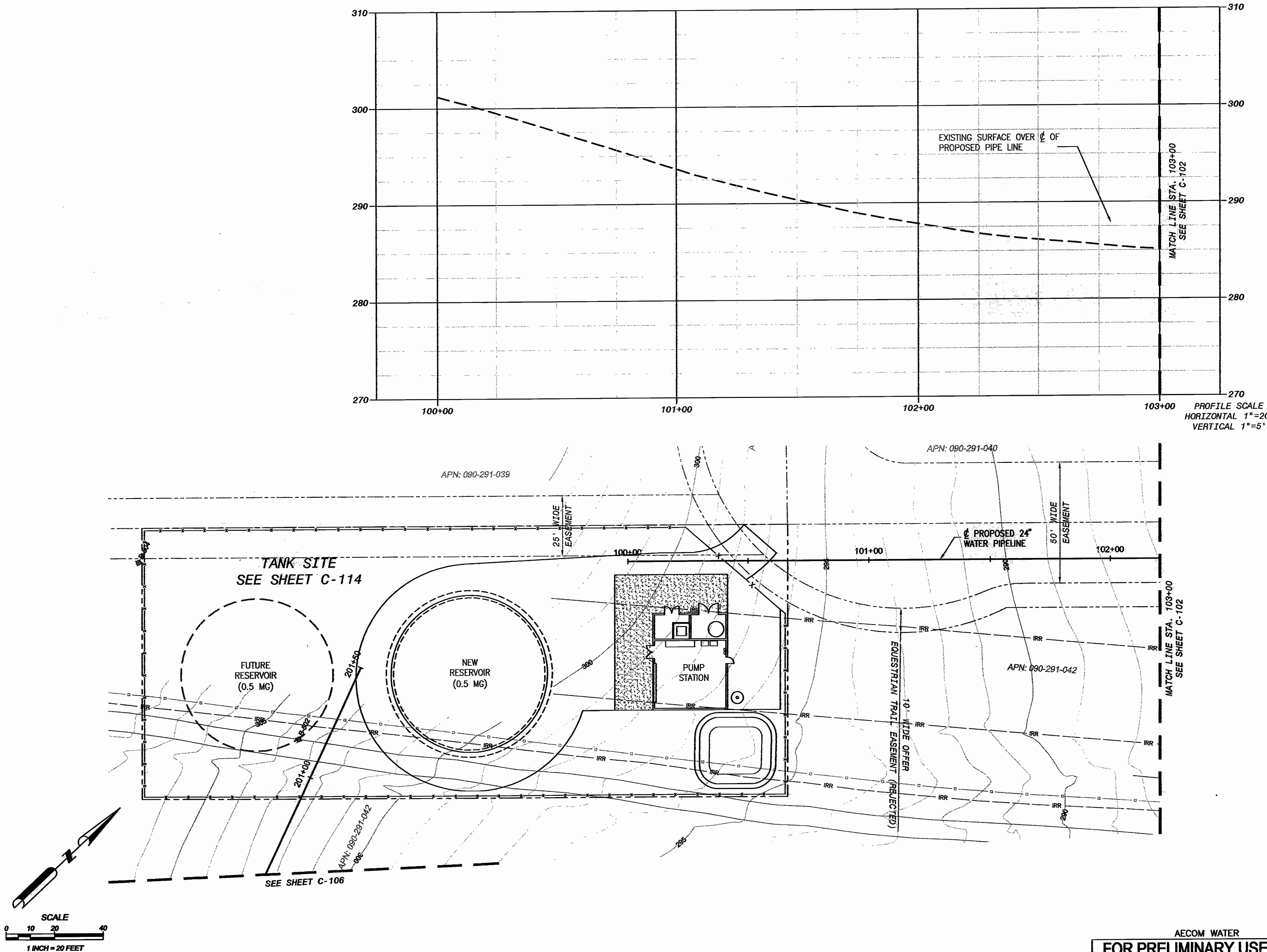
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP4

SHEET INDEX, GENERAL NOTES LEGENDS AND ABBREVIATIONS

DESIGNED: CR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

G-002
SHEET 2 OF 71



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DATE: MARCH 31, 2009

0 1/2 1

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REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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NIPOMO COMMUNITY SERVICES DISTRICT WATERLINE INTERTIE PROJECT - BP4

MESA AREA PIPELINE PLAN AND PROFILE STA 100+00 to 103+00

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009

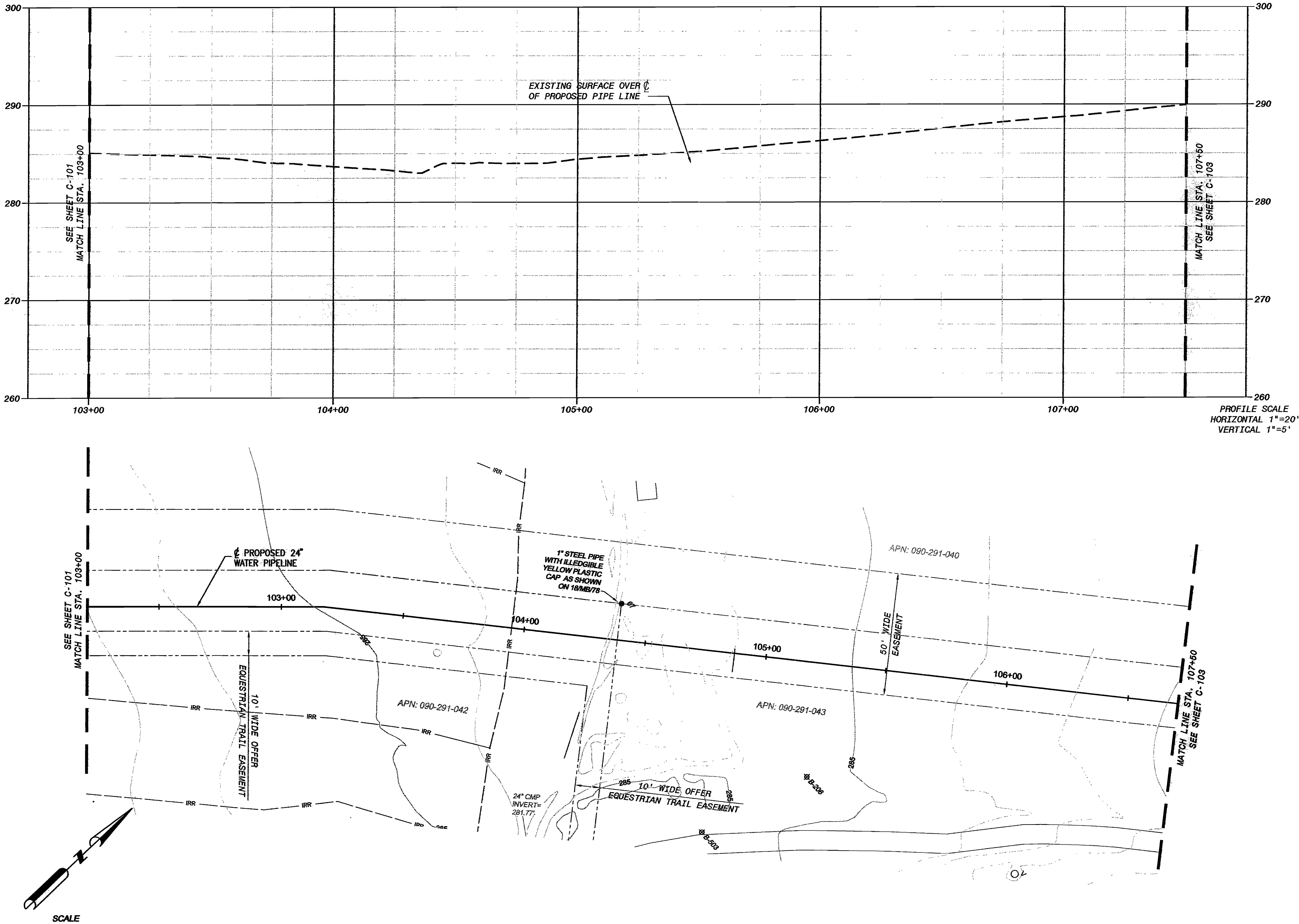
AECOM PROJECT NO. 60081295.0001

NCSD PROJECT NO.

CADD STDS. BOYLE

C-101

SHEET 3 OF 71



SCALE

0 10 20 40

1 INCH = 20 FEET

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DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR

PROJECT ENGINEER: JOSHUA H REYNOLDS — REG NUMBER: C65400 — EXP DATE: 09/30/2009

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP4

MESA AREA PIPELINE PLAN AND PROFILE STA 103+00 to 107+500

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009

AECOM PROJECT NO. 60061295.0001

NCSD PROJECT NO.

CADD STDS. BOYLE

C-102

SHEET 4 OF 71

DWG: W:\Nipomo CSD (19996)\19996.7D Waterline Intertie Project Design\Design Plans\CAD\Planset\BP-4_JOSHUA\30% Planset\C-101 to C-105.dwg Layout Name: C-102 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 3:03 PM
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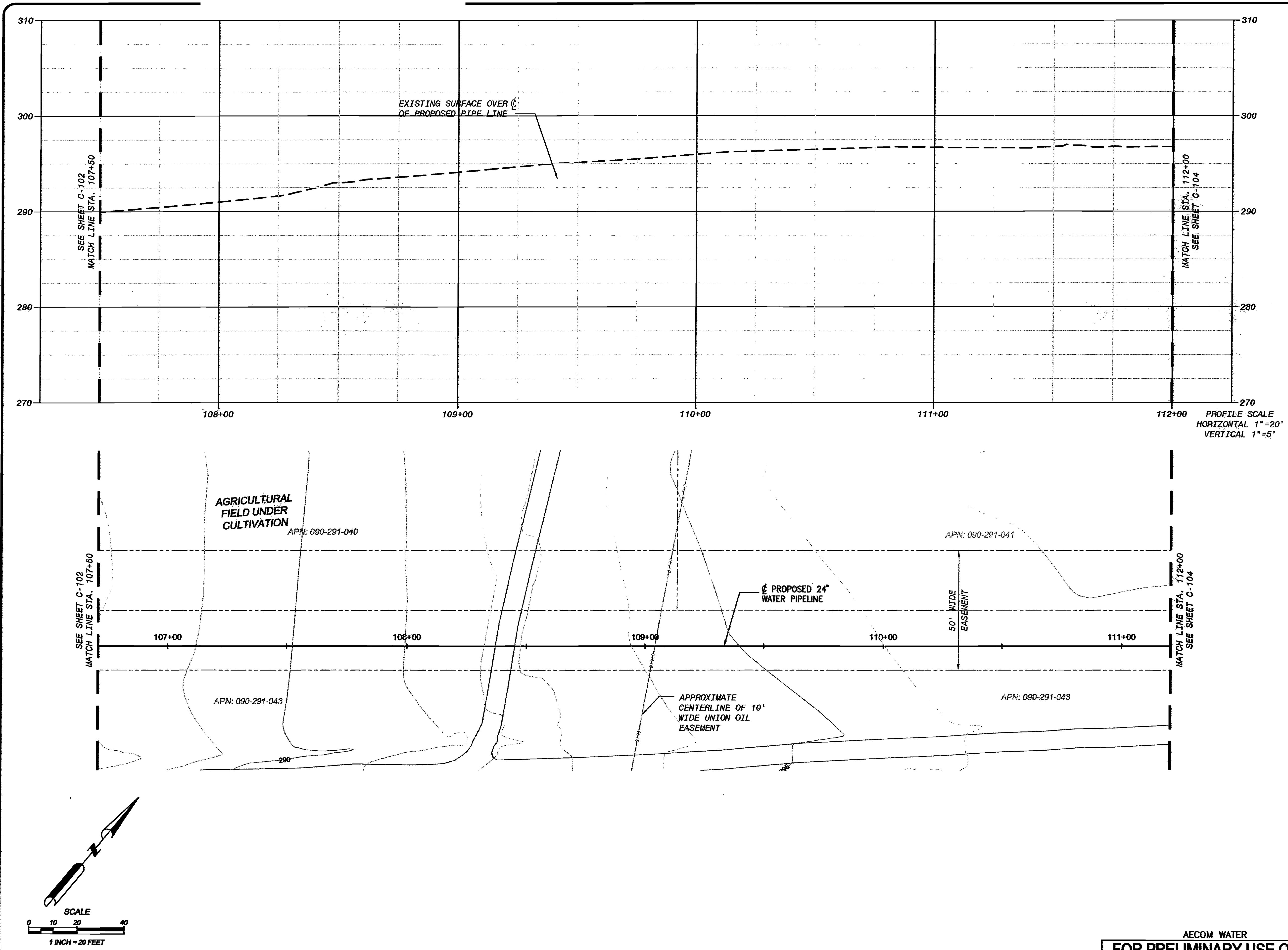

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DATE: MARCH 31, 2009

0 1/2 1

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP4

MESA AREA PIPELINE
PLAN AND PROFILE
STA 107+50 to 112+00

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PROJECT ENGINEER: JOSHUA H. REYNOLDS | REG NUMBER: C65400 | EXP DATE: 09/30/2009

DESIGNED: JHR
DETAILED: JPF
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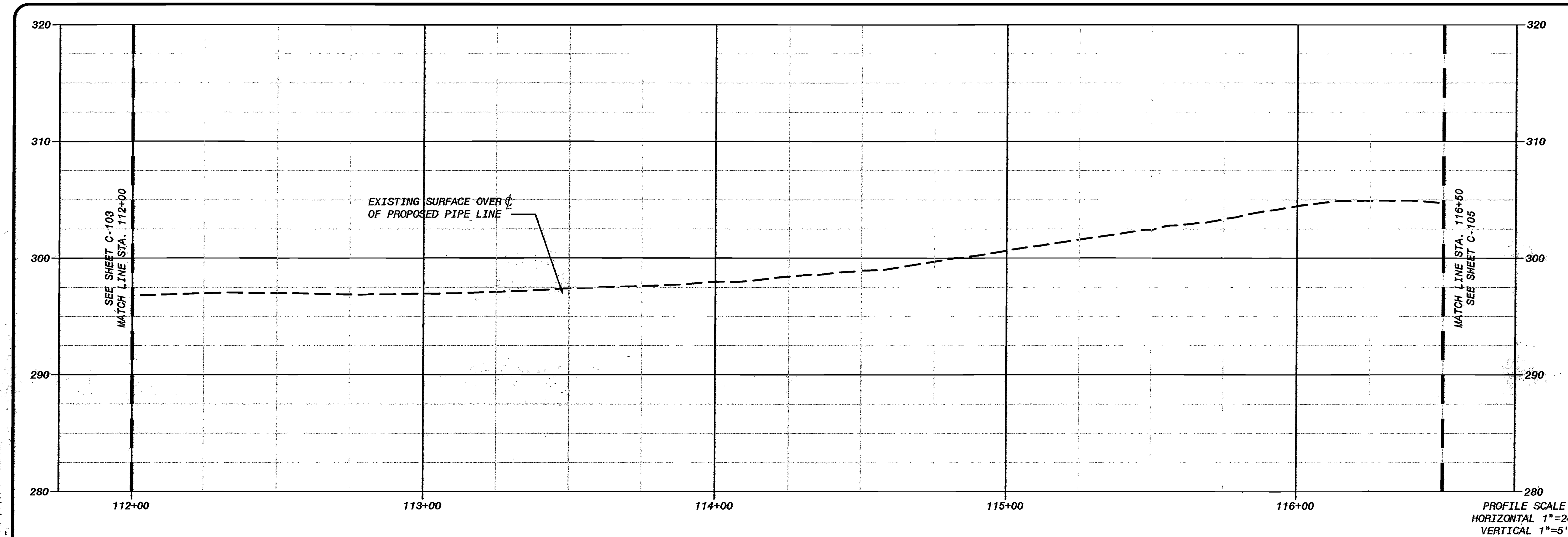
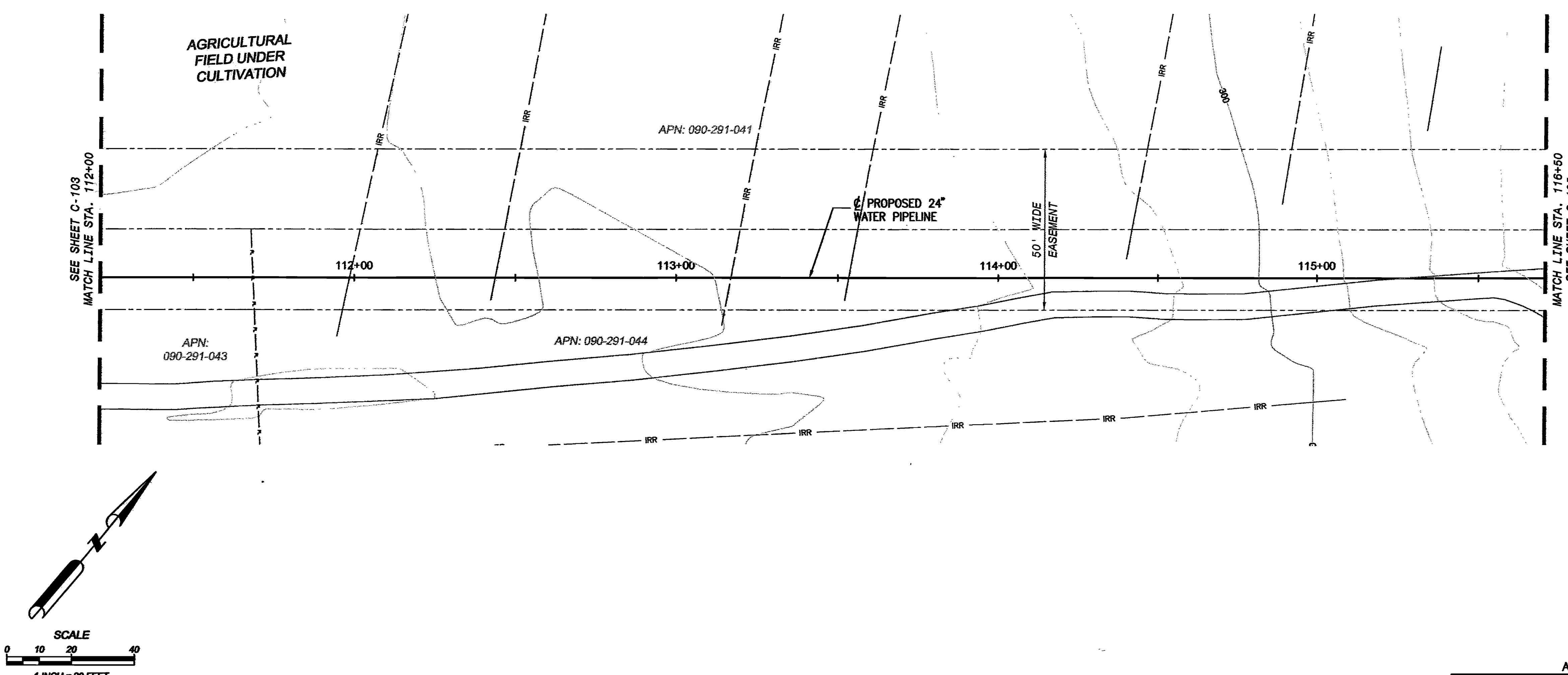
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-103
SHEET 5 OF 71





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REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H REYNOLDS		C65400	09/30/2009

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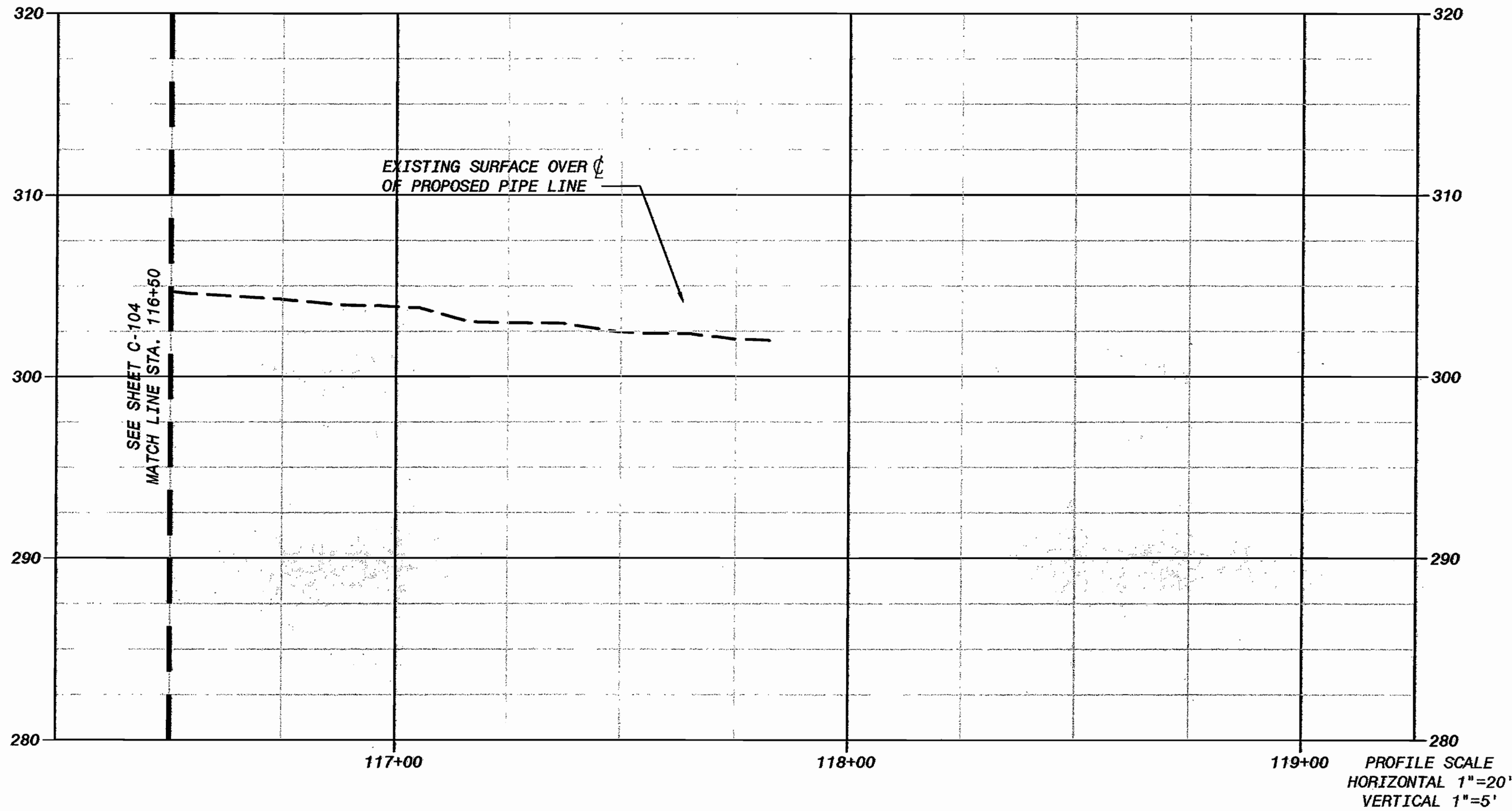
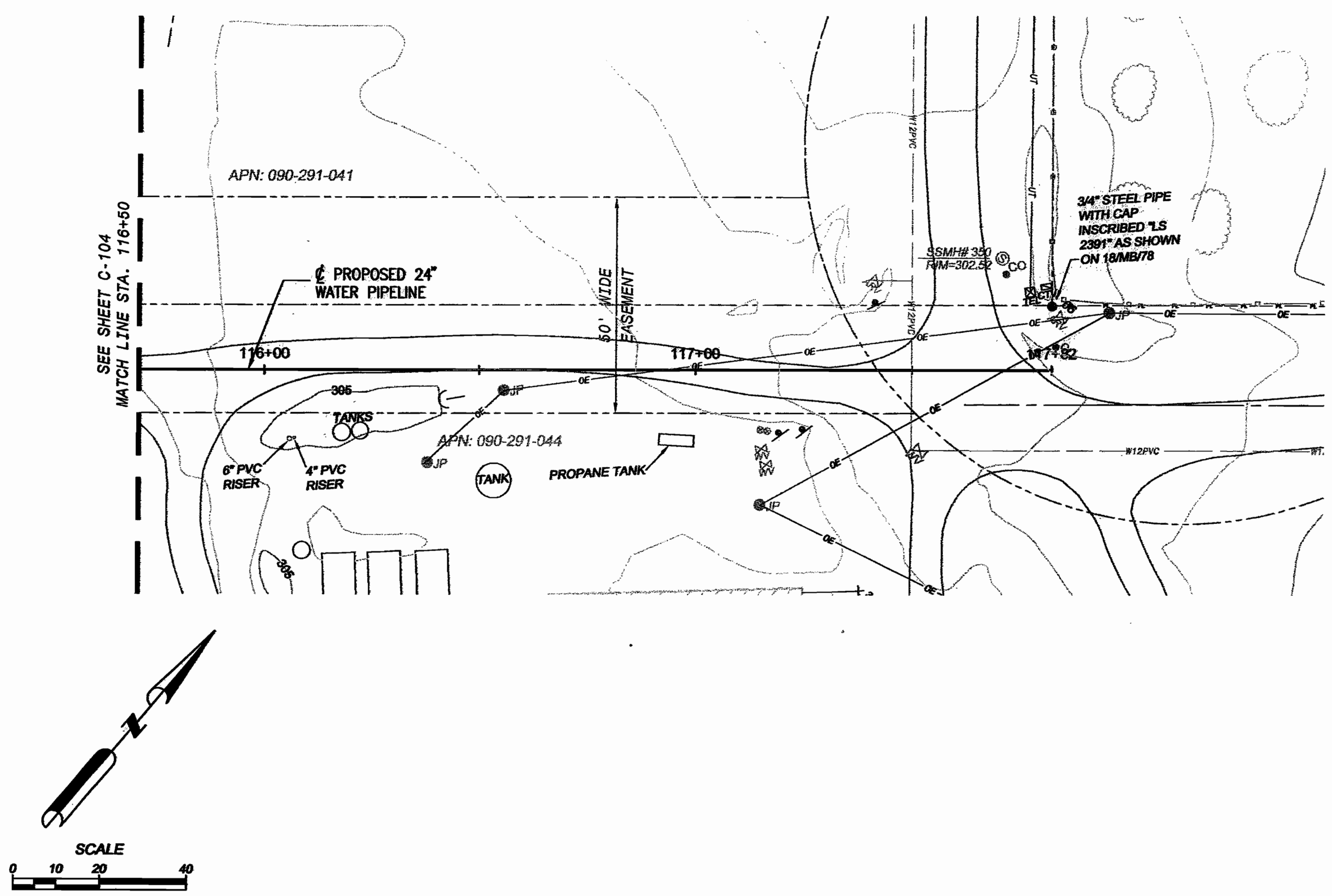
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP4

MESA AREA PIPELINE PLAN AND PROFILE STA 112+00 to 116+50

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-104
SHEET 6 OF 71





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0 1/2 1

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REV	DATE	DESCRIPTION	APPR

PROJECT ENGINEER: JOSHUA H. REYNOLDS — REG NUMBER: C65400 — EXP DATE: 09/30/2009

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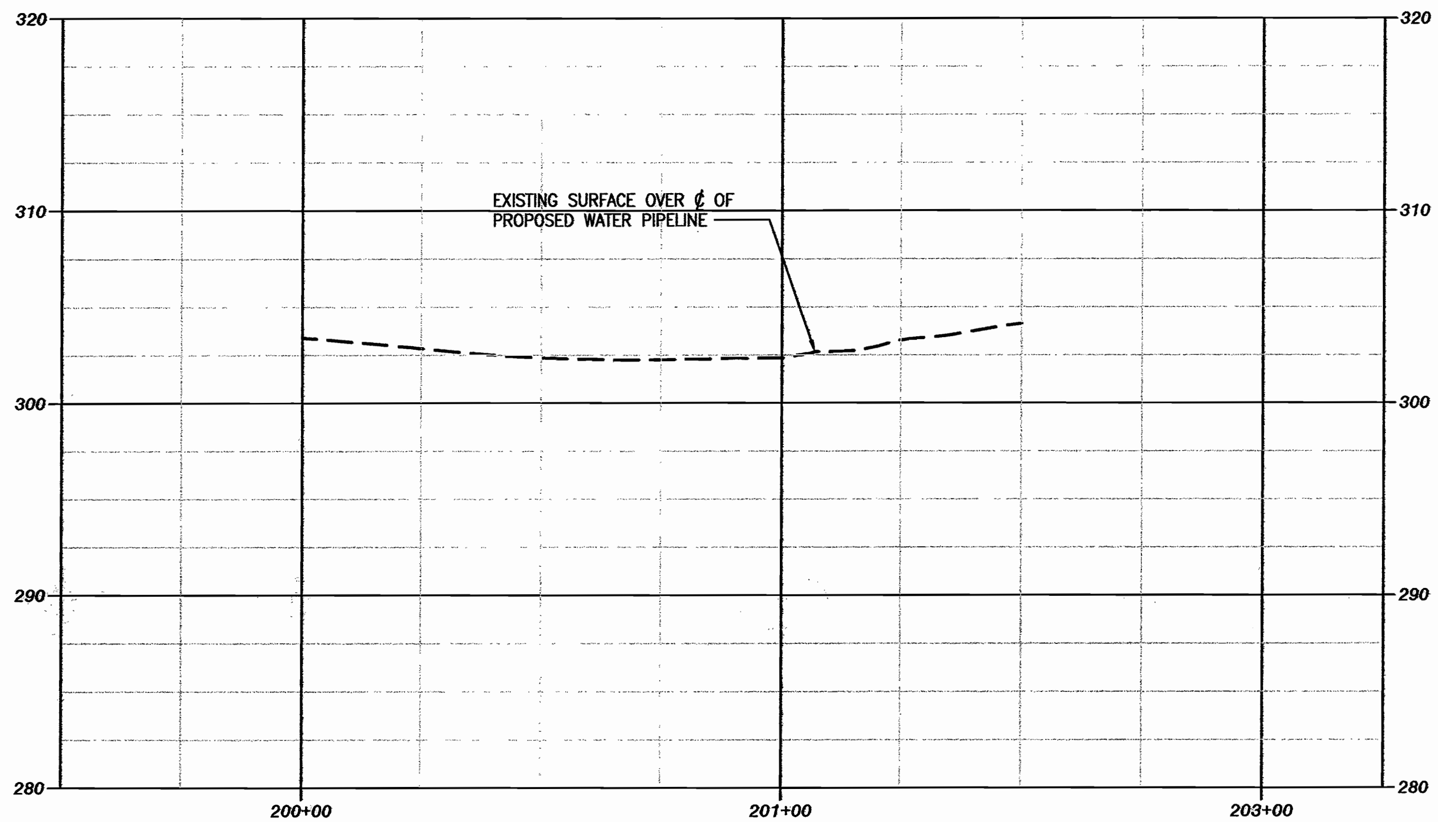
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP4

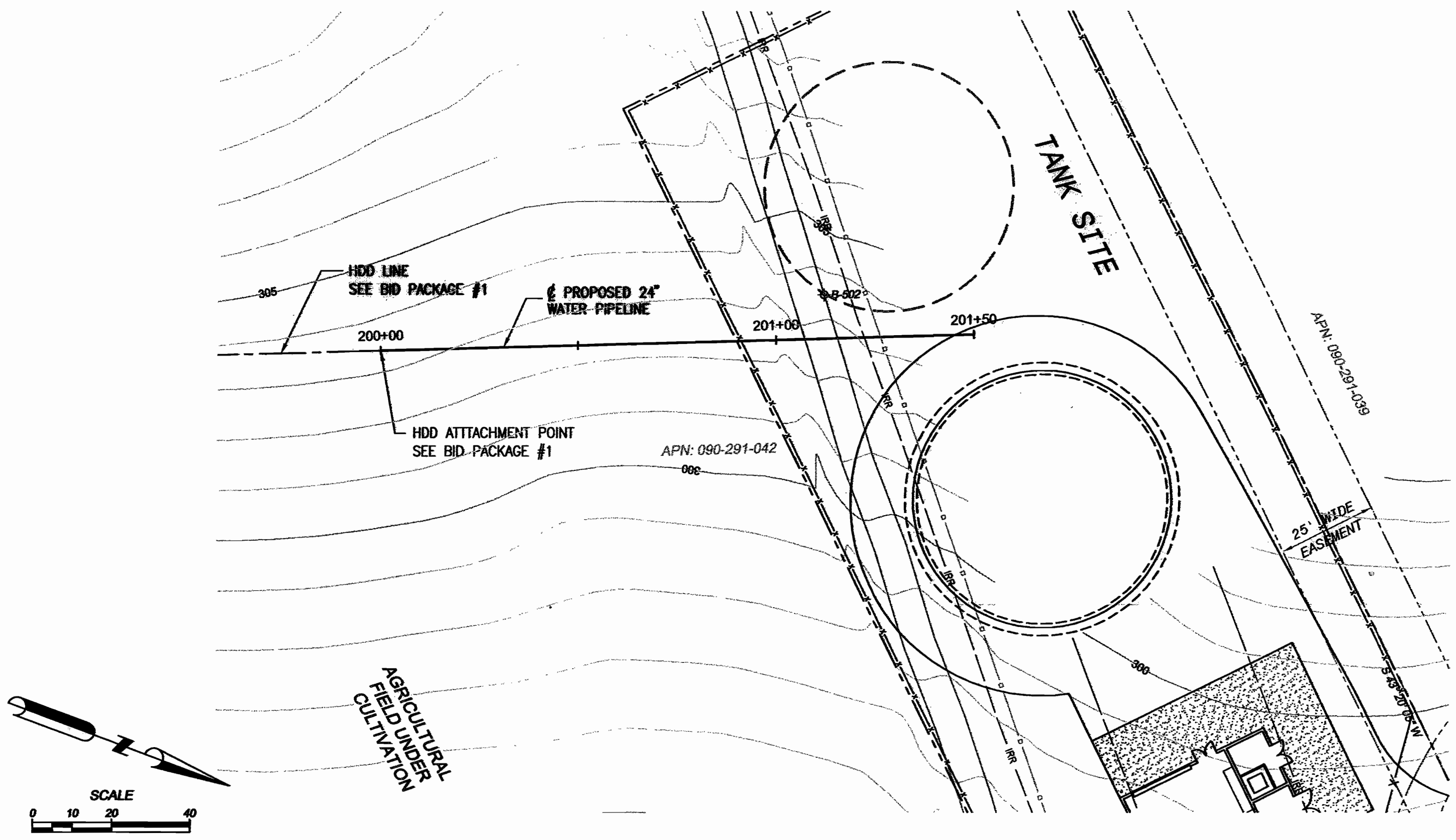
MESA AREA PIPELINE PLAN AND PROFILE STA 116+50 to 119+00

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-105
SHEET 7 OF 71



PROFILE SCALE
HORIZONTAL 1"=20'
VERTICAL 1"=5'



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DATE: MARCH 31, 2009

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JOSHUA H REYNOLDS C65400 09/30/2009

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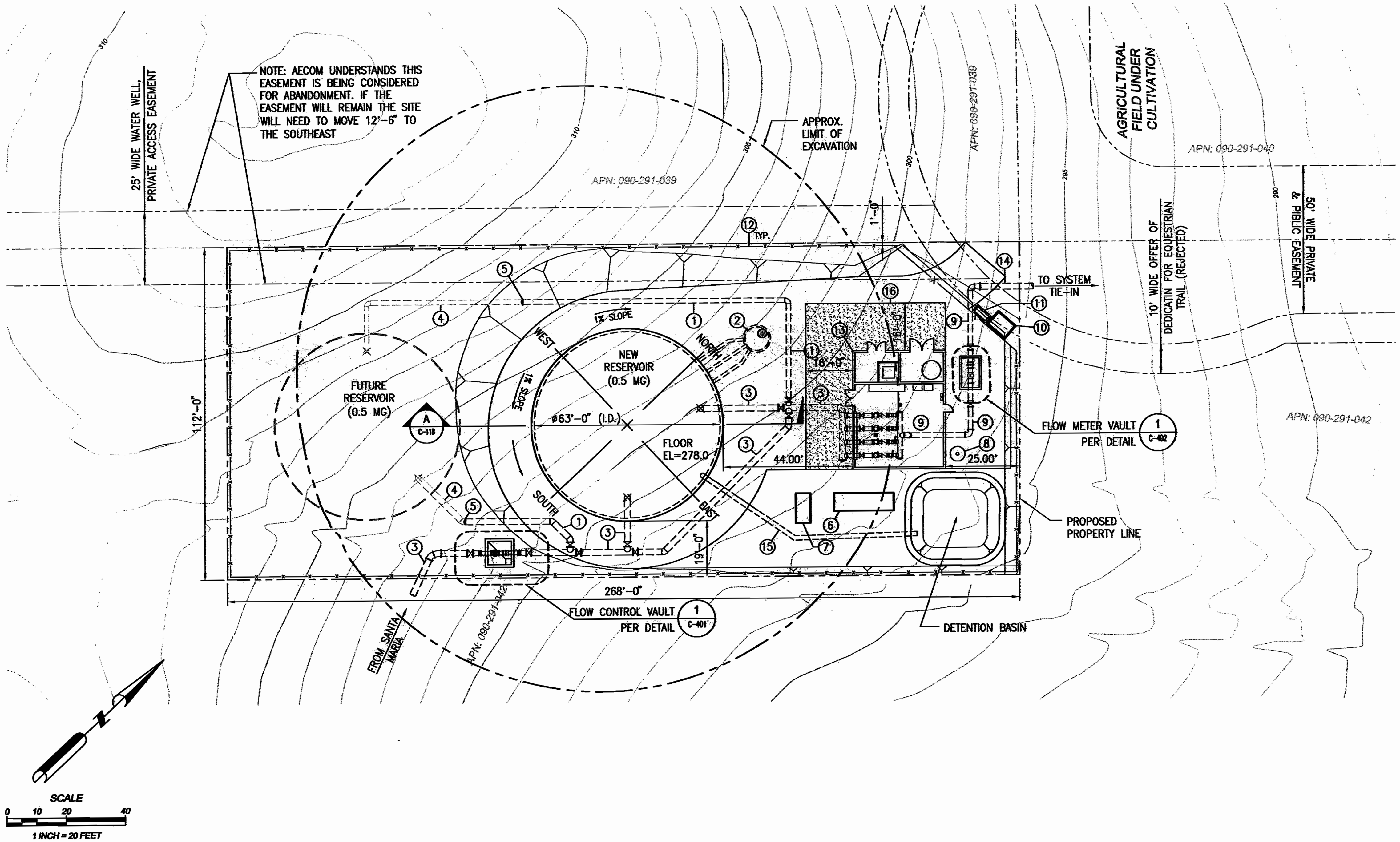
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP4

PIPELINE FROM HDD TO TANK SITE
PLAN AND PROFILE
STA 200+00 to 201+50

DESIGNED: JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-106
SHEET 8 OF 71



CONSTRUCTION NOTES:

1. 18"ø WSP
2. DRAINAGE MANHOLE, SEE DETAIL X/Y
3. 24"ø WSP
4. FUTURE 18"ø WSP
5. 18" BLIND FLANGE
6. EMERGENCY GENERATOR
7. GENERATOR FUEL TANK
8. SURGE TANK
9. 18"ø DIP
10. PG&E PAD MOUNTED TRANSFORMER
11. METERING SWITCHBOARD
12. 6'-0" HIGH CHAIN LINK FENCE WITH THREE STRANDS OF BARBED WIRE, SEE DETAIL U/V
13. PUMP STATION AND CHLORAMINE BOOSTER BUILDING, SEE DETAIL 1/C-121
14. 24"ø DIP
15. 18"ø DIP TANK OVERFLOW
16. ASPHALT APRON

NOTES:

1. GRADING IS PRELIMINARY, TO BE REVISED IN 60% SUBMITTAL

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DATE: MARCH 31, 2009

0 1/2 1

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PROJECT ENGINEER: JOSHUA H. REYNOLDS | REG NUMBER: C58400 | EXP DATE: 09/30/2009

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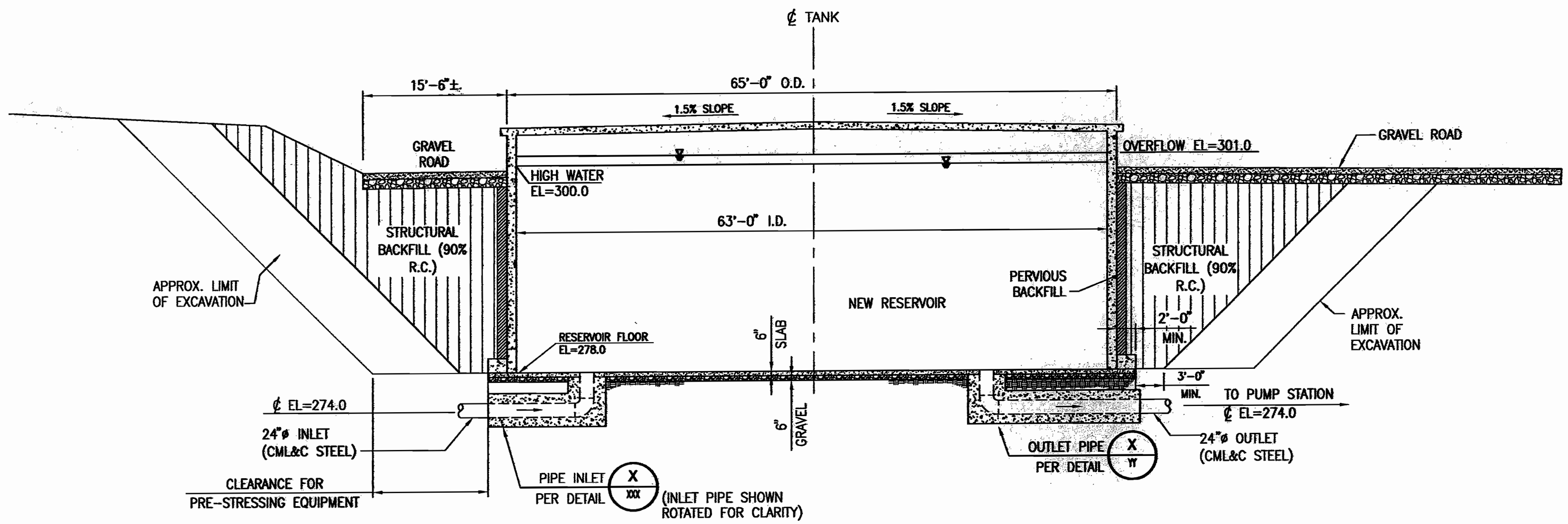
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP4

RESERVOIR SITE PLAN

DESIGNED: JHR/ES
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-114

SHEET 16 OF 71



SECTION A

SCALE: 1/8"=1'-0"

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DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV.	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H. REYNOLDS		C65400	09/30/2009

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP4

RESERVOIR SECTION VIEW

DESIGNED: ES/JHR
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-118
SHEET 20 OF 71

DWG: W:\Nipomo CSD (19996)\19996.70 Waterline Intertie Project Design\Design Plans\CAD\Planset\BP-4_JOSHUA\30% Planset\C-118.dwg Layout Name: C-118 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 3:08 PM
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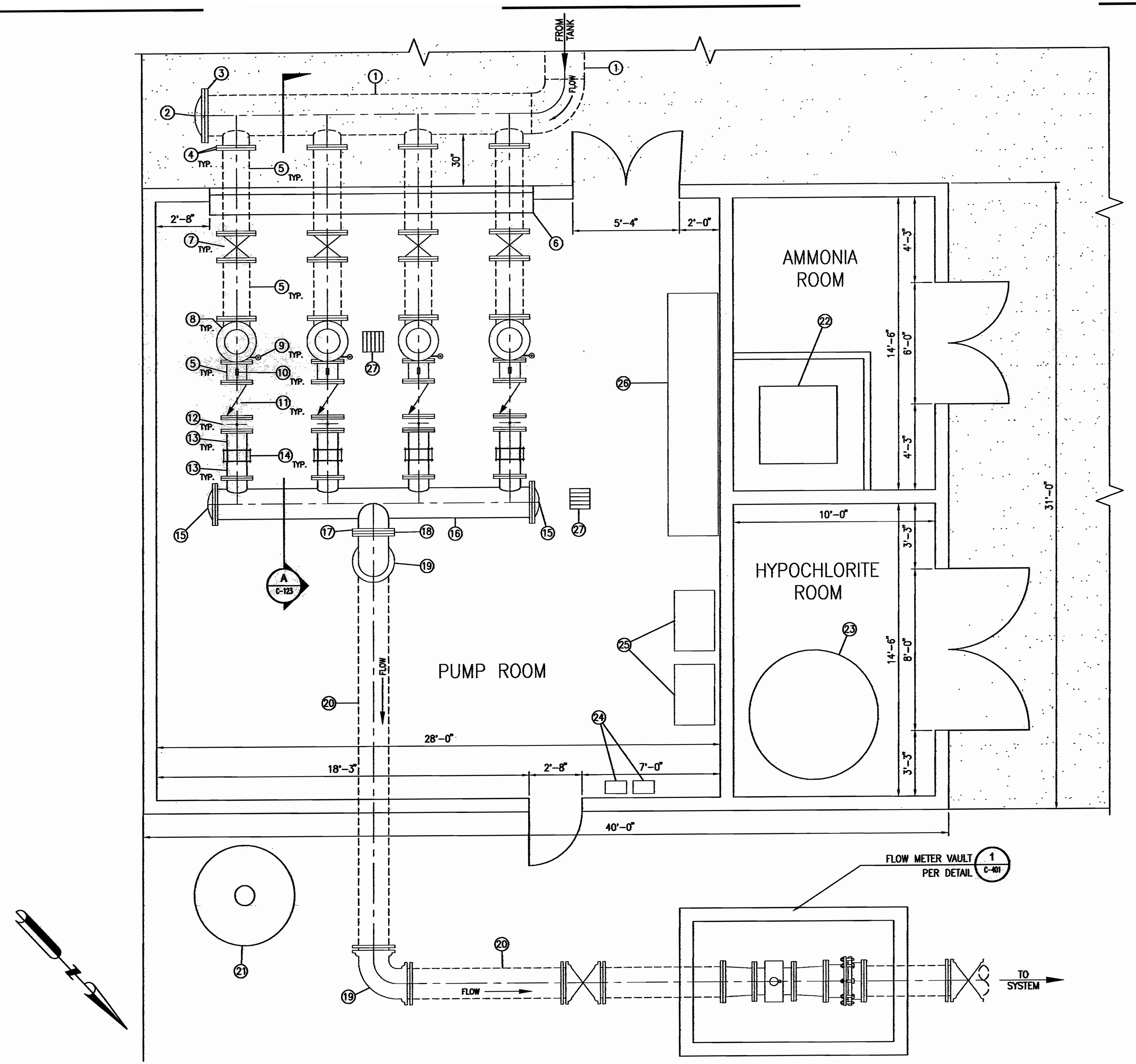

PUMP STATION FLOOR PLAN

SCALE: 3/8"=1'-0"

1
-

CONSTRUCTION NOTES:

1. 24"ø CMLC WELDED STEEL PIPE
2. 24" BLIND FLANGE
3. 24" WELDABLE FLANGE
4. 16" WELDABLE FLANGE
5. 16"ø WELDED STEEL PIPE SPOOL, FLG'D
6. 16-FOOT WIDE ROLL-UP DOOR
7. 16" RESILIENT WEDGE GATE VALVE, FLG'D
8. 5 STAGE, 100hp VERTICAL TURBINE PUMP RATED AT 800gpm AT 350-ft TDH
9. AIR RELEASE VALVE
10. PRESSURE GAUGE
11. 12" CHECK VALVE, FLG'D
12. 12" BUTTERFLY VALVE, FLG'D
13. 12"ø WELDED STEEL PIPE SPOOL, PExFLG
14. 12" COUPLER
15. 18" BLIND FLANGE
16. 18"ø WELDED STEEL PIPE
17. 18" WELDABLE FLANGE
18. WESTFALL STATIC MIXER
19. 18" 90° ELBOW, FLG'D
20. 18"ø DUCTILE IRON PIPE
21. 5'ø x 8'-0" HIGH BLADDER SURGE TANK
22. 220gal AMMONIUM SULFATE SOLUTION TANK
23. 1000gal SODIUM HYPOCHLORITE TANK
24. RESIDUAL METERS
25. SKID MOUNTED CHEMICAL METERING PUMPS
26. MOTOR CONTROL CENTER
27. 12"x12" FLOOR DRAIN

AECOM WATER

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NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

0 1/2 1

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REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
JOSHUA H. REYNOLDS		C58400	09/30/2009

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP4

PUMP STATION FLOOR PLAN

DESIGNED: JHR/ES
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-121
SHEET 21 OF 71

DWG: W:\Nipomo CSD (19996)\19996.70 Waterline Intertie Project Design\Design Plans\CAD\Planset\BP-4_JOSHUA\30% Planset\C-121.dwg Layout Name: C-121 - Plotted by: Froelicher, Jim Date: 4/27/2009 - 3:09 PM
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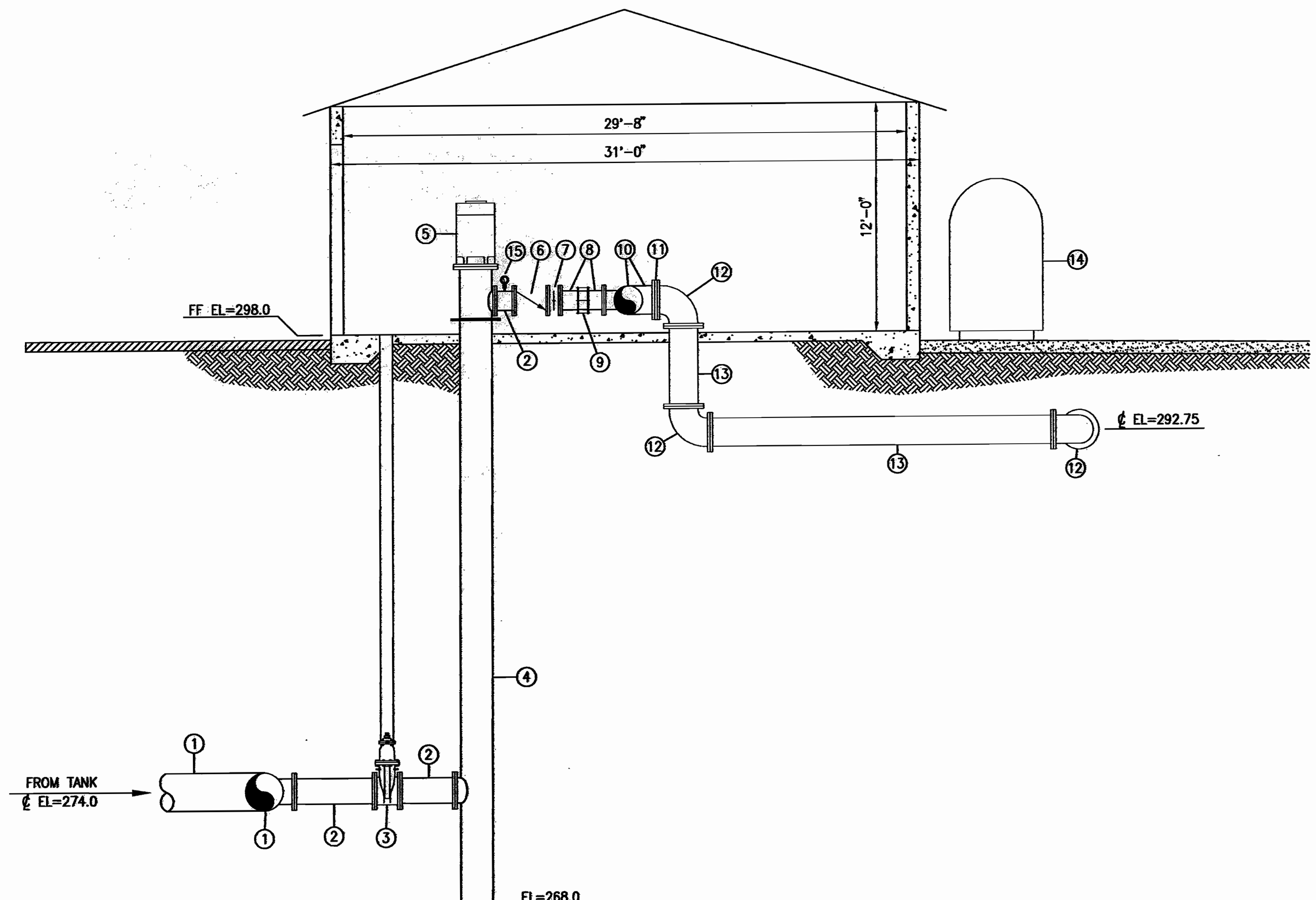

PUMP STATION SECTION

SCALE: 1/4"=1'-0"

A
–

CONSTRUCTION NOTES:

1. 24"ø CMLC WELDED STEEL PIPE
2. 16"ø WELDED STEEL PIPE SPOOL, FLG'D
3. 16" RESILIENT WEDGE GATE VALVE, FLG'D
4. 20"ø SUCTION CAN
5. 5 STAGE, 100hp VERTICAL TURBINE PUMP RATED AT 800gpm AT 350-ft TDH
6. 12" CHECK VALVE, FLG'D
7. 12" BUTTERFLY VALVE, FLG'D
8. 12"ø WELDED STEEL PIPE SPOOL, PExFLG
9. 12" COUPLER
10. 18"ø WELDED STEEL PIPE
11. WESTFALL STATIC MIXER
12. 18" 90° ELBOW, FLG'D
13. 18"ø DUCTILE IRON PIPE
14. 5'ø x 8'-0" HIGH BLADDER SURGE TANK
15. PRESSURE GAUGE

AECOM WATER

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DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

PROJECT ENGINEER: JOSHUA H. REYNOLDS
REG NUMBER: C58400
EXP DATE: 09/30/2009

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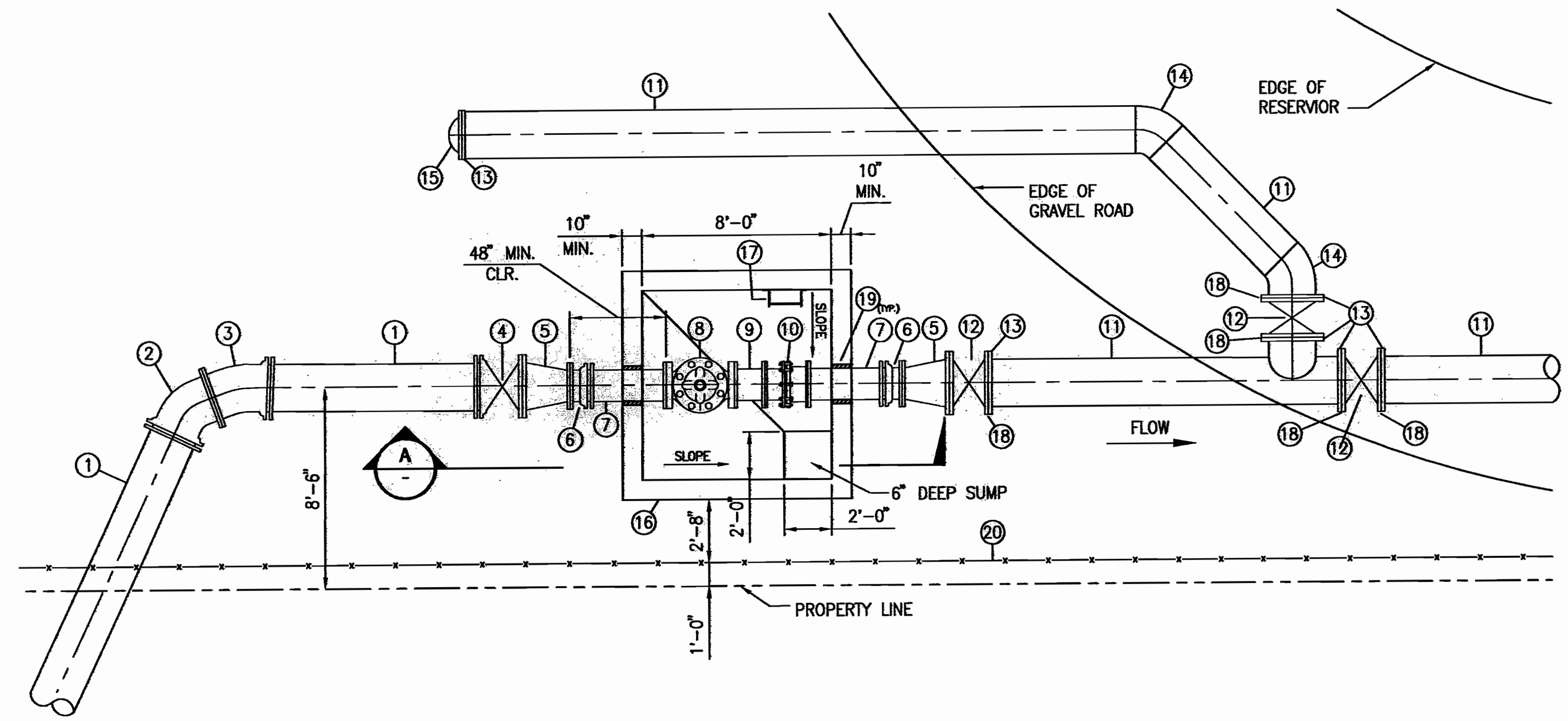
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP4

PUMP STATION
PIPING SECTION

DESIGNED: JHR/ES
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061296.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

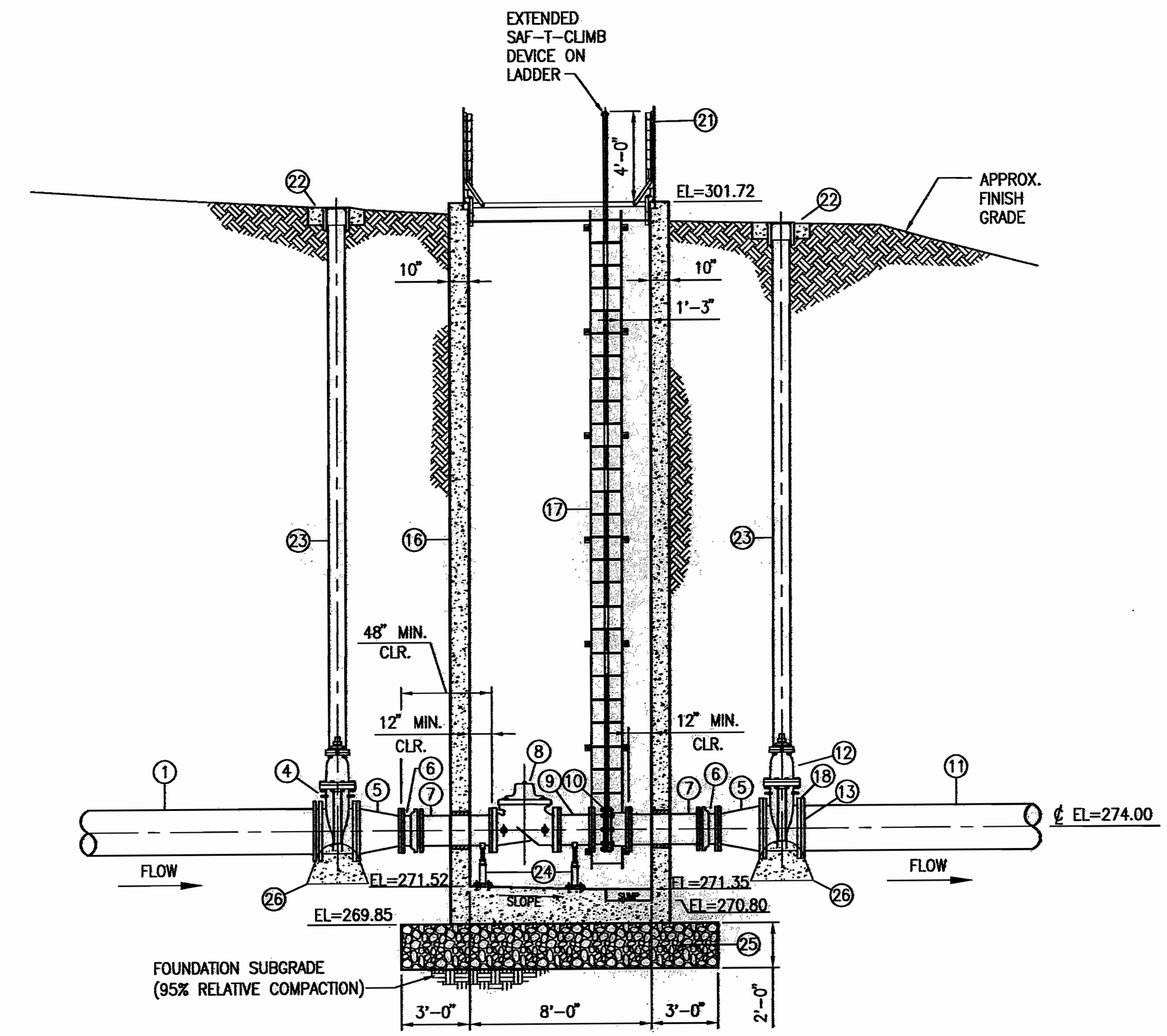
C-123

SHEET 22 OF 71



FLOW CONTROL VALVE VAULT

SCALE: 1/4"=1'-0"



SECTION

SCALE: 1/4"=1'-0"

CONSTRUCTION NOTES:

1. 24"ø DUCTILE IRON PIPE
2. 24" D.I. 45° ELBOW, MJxFLG, RESTRAINED
3. 24" D.I. 22.5° ELBOW, MJxFLG, RETRAINGED
4. 24" RESILIENT WEDGE GATE VALVE, MJxFLG
5. 24"x16" D.I. REDUCER, FLG'D
6. 16" MJ x FLANGE ADAPTER
7. 16"ø DIP SPOOL, FLGxPE
8. 16" REDUCED PORT ELECTRONIC FLOW CONTROL AND HIGH WATER SHUT-OFF VALVE
9. 16"ø DIP SPOOL, FLG'D
10. 16" DISMANTLING JOINT
11. 24"ø I.D. WELDED STEEL PIPE, CML&C
12. 24" RESILIENT WEDGE GATE VALVE, FLG'D
13. 24" WELDED NECK FLANGE OR DOUBLE WELDED SLIP-ON FLANGE
14. 24"ø WSP 45° ELBOW, MJxFLG
15. 24" DI BLIND FLANGE
16. 8'-0" x 8'-0" CONCRETE VAULT PER DETAIL X/Y
17. LADDER, 316 STAINLESS STEEL WITH 304 SST SAF-T-CLIMB DEVICES PER DETAIL X/Y
18. INSULATING FLANGE PER DETAIL X/Y
19. PIPE PENETRATION PER DETAIL X/Y
20. 6-FOOT HIGH CHAIN LINK SECURITY FENCE PER DETAIL X/Y
21. 8'-0"x8'-0" DOUBLE LEAF ALUMINUM ACCESS HATCH PER SPEC. SECTION ______.
22. VALVE BOX AND CONCRETE RING PER DETAIL X/Y
23. 8"ø SDR-35 PVC EXTENSION
24. PIPE SUPPORT PER DETAIL X/Y
25. CLEAN COMPACTED CRUSHED ROCK, 90% REL. COMP., SURROUNDED ALL SIDES WITH GEOFABRIC, PER SPEC. ______.
26. CONCRETE ANCHOR BLOCK PER DETAIL X/Y

AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER	JOSHUA H. REYNOLDS	REG NUMBER C58400	EXP DATE 09/30/2009

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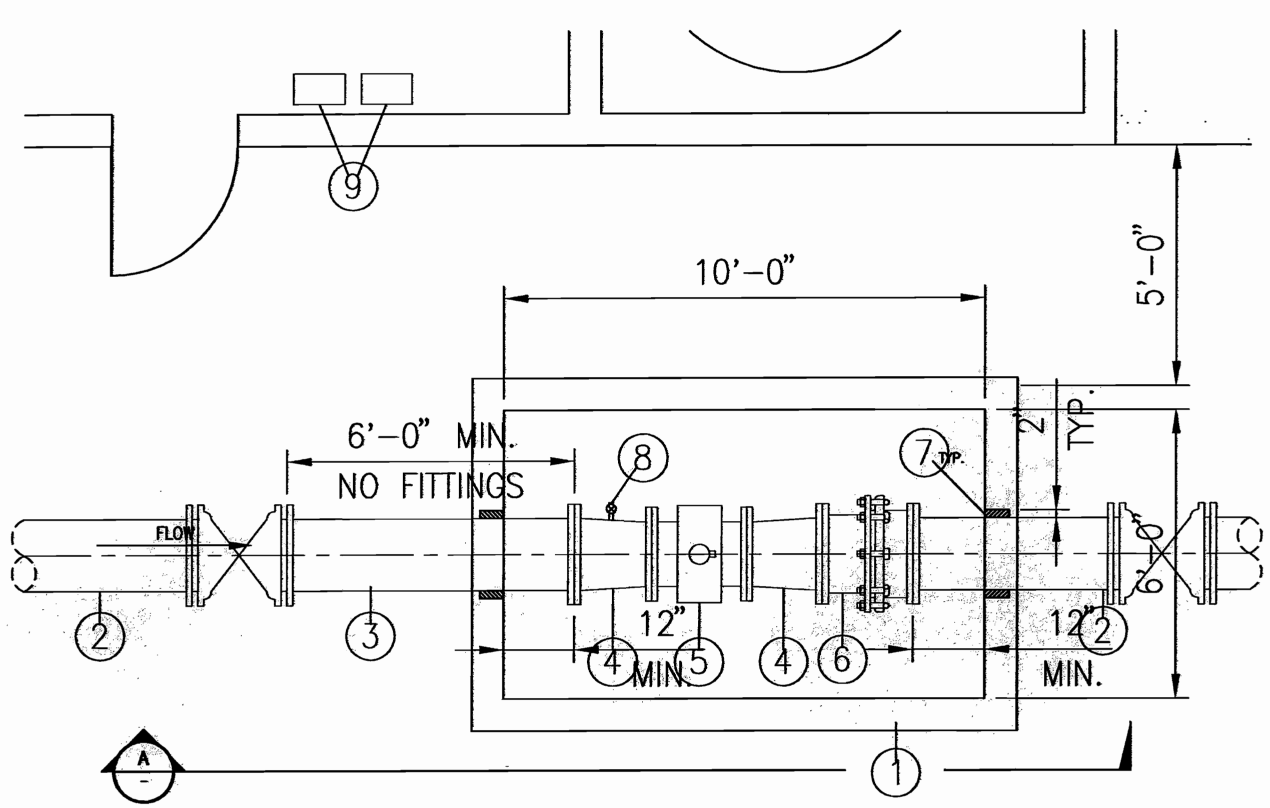
NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP4

FLOW CONTROL VALVE VAULT

DESIGNED: JHR/ES
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60061295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-401

SHEET 32 OF 71



CONSTRUCTION NOTES:

1. 6'x10' CONCRETE VAULT
2. 18"ø DIP
3. 18"ø X 6'-0" DIP SPOOL, FLG,D
4. 18"x16" REDUCER, FLG'S
5. 16" PROMAG W REMOTE MAG METER
6. 18" DISMANTLING COUPLING
7. LINK SEAL & GROUT
8. TAP FOR RESIDUAL SAMPLE
9. RESIDUAL METERS

FLOW METER VAULT

SCALE: 1/2"=1'-0"

1
-

AECOM WATER

FOR PRELIMINARY USE ONLY

NOT TO BE USED FOR CONSTRUCTION

DATE: MARCH 31, 2009

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

REV	DATE	DESCRIPTION	APPR

PROJECT ENGINEER: JOSHUA H. REYNOLDS | REG NUMBER: C56400 | EXP DATE: 09/30/2009

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NIPOMO COMMUNITY SERVICES DISTRICT
WATERLINE INTERTIE PROJECT - BP4

FLOW METER VAULT

DESIGNED: JHR/ES
DETAILED: JPF
CHECKED:
APPROVED:
DATE: MARCH 2009
AECOM PROJECT NO. 60081295.0001
NCSD PROJECT NO.
CADD STDS. BOYLE

C-402

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