2004 Water Use Efficiency Proposal Solicitation Package

APPENDIX A: Project Information Form

Applying for: ❑ Urban X Agricultural

1. **(Section A)** Urban or Agricultural Water Use Efficiency Implementation Project

❑ (a) implementation of Urban Best Management Practice, #__________________________

X (b) implementation of Agricultural Efficient Water Management Practice, #______________

❑ (c) implementation of other projects to meet California Bay-Delta Program objectives, Targeted Benefit # or Quantifiable Objective #, if applicable ______________

❑ **(d) Specify other:** ____________________

2. **(Section B)** Urban or Agricultural Research and Development; Feasibility Studies, Pilot, or Demonstration Projects; Training, Education or Public Information; Technical Assistance

❑ (e) research and development, feasibility studies, pilot, or demonstration projects

❑ (f) training, education or public information programs with statewide application

❑ (g) technical assistance

❑ **(h) other**

3. Principal applicant (Organization or affiliation): **Patterson Irrigation District**

4. Project Title: **Decision support for implementation and evaluation of agricultural water reuse best management practices to improve district-level irrigation efficiency**

5. Person authorized to sign and submit proposal and contract:

Name, title	**John Sweigard**
Mailing address	**Patterson Irrigation District**
	Orange Avenue
	Patterson, CA
Telephone	**209 892 6233**
Fax.	
E-mail	**pidgm@gvni.com**

6. Contact person (if different):

Name, title.	**Same as above**
Mailing address.	
TelephoneFax.	
E-mail	

7. Grant funds requested (dollar amount): **$1,053,000**
(from Table C-1, column VI)

8. Applicant funds pledged (dollar amount): **$647,000**

9.Total project costs (dollar amount): **$1,700,000**
(from Table C-1, column IV, row n)

10. Percent of State share requested (%) 62%
(from Table C-1)

11. Percent of local share as match (%) 38%
(from Table C-1)

12. Is your project locally cost effective?
Locally cost effective means that the benefits to an entity (in dollar terms) of implementing a program exceed the costs of that program within the boundaries of that entity.
(If yes, provide information that the project in addition to Bay-Delta benefit meets one of the following conditions: broad transferable benefits, overcome implementation barriers, or accelerate implementation.)

❑ (a) yes
X (b) no

11. Is your project required by regulation, law or contract?
If no, your project is eligible.
If yes, your project may be eligible only if there will be accelerated implementation to fulfill a future requirement and is not currently required.
Provide a description of the regulation, law or contract and an explanation of why the project is not currently required.

❑ (a) yes
X (b) no

12. Duration of project (month/year to month/year): **2 years**

13. State Assembly District where the project is to be conducted: **26th**

14. State Senate District where the project is to be conducted: **12th**

15. Congressional district(s) where the project is to be conducted: **18th**

16. County where the project is to be conducted: Stanislaus County

17. Location of project (longitude and latitude) 37.5414 ; -121.1172

18. How many service connections in your service area (urban)? NA

19. How many acre-feet of water per year does your agency serve? 45,000

20. Type of applicant (select one):

- ❑ **(a) City**
- ❑ **(b) County**
- ❑ **(c) City and County**
- ❑ **(d) Joint Powers Authority**
- **X (e) Public Water District**
- ❑ **(f) Tribe**
- ❑ **(g) Non Profit Organization**
- ❑ **(h) University, College**
- ❑ **(i) State Agency**
- ❑ **(j) Federal Agency**
- ❑ **(k) Other**
  - ❑ **(i) Investor-Owned Utility**
  - ❑ **(ii) Incorporated Mutual Water Co.**
  - ❑ **(iii) Specify** ___________________

21. Is applicant a disadvantaged community? If 'yes' include annual median household income. (Provide supporting documentation.)

❑ **(a) yes,** ________ **median household income**

X (b) no

2004 Water Use Efficiency Proposal Solicitation Package
APPENDIX B: Signature Page

By signing below, the official declares the following:

The truthfulness of all representations in the proposal;

The individual signing the form has the legal authority to submit the proposal on behalf of the applicant;

There is no pending litigation that may impact the financial condition of the applicant or its ability to complete the proposed project;

The individual signing the form read and understood the conflict of interest and confidentiality section and waives any and all rights to privacy and confidentiality of the proposal on behalf of the applicant;

The applicant will comply with all terms and conditions identified in this PSP if selected for funding; and

The applicant has legal authority to enter into a contract with the State.

	John Sweigard , General Manager	1/10/05
Signature	Name and title	Date

Title : Decision support for implementation and evaluation of agricultural water reuse best management practices to improve district-level irrigation efficiency

B. Scope of Work

Relevance and Importance

1. Abstract (Executive Summary)

The proposal will be subdivided into two major work tasks or phases. A map, Figure 1, indicating the project area is attached.

Phase 1 is to design, develop and implement a return flow detention reservoir and associated real-time flow and water quality monitoring system to improve water reuse and boost in-district water use efficiency for both West Stanislaus and Patterson Irrigation Districts. The reservoir will have secondary benefits of a) reducing the silt loading to the San Joaquin River; b) reducing organophosphorus (OP) pesticide levels in the drainage water discharged to the San Joaquin River and c) reducing algae and other organic constituents in surface drainage adversely affecting the dissolved oxygen level within the San Joaquin River. Design and construction will be completed during year 1 of the project; real-time monitoring and SCADA control will be implemented in year 2. The 15 – 20 acre return flow recovery reservoir will reduce direct discharges to the San Joaquin River (California Bay-Delta Authority (CBDA) Quantifiable Objectives 81, 98, 101, 104) and develop additional water supplies, which could reduce diversion requirements by increasing operational flexibility (CBDA Quantifiable Objective 90).

Phase 2 of the project, will be implemented in parallel with Phase 1 and will continue through both years of the two year project. Phase 2 is concerned with evaluation of the regional improvements to district-scale irrigation water use efficiency through implementation of drainage and tailwater recovery systems. This evaluation will be performed through the application of a state-of-the-art remote-sensing based crop water use analysis system – LAWS. LAWS (land, air, water simulator) has been developed by the US Bureau of Reclamation in partnership with Resource Management Associates and UC Davis to automate the computation of crop water budgets and assess water requirements continuously during the irrigation season. Unlike commercial irrigation scheduling software which is relevant to field-scale applications, LAWS can be applied regionally – allowing the evaluation of water use efficiency at the water district and basin-scales.

2. Statement of Critical Water Issues

Increases in population growth and continuing competition between agricultural and environmental uses of water in California will require ever increasing demands on agricultural water suppliers to prudently manage their existing water supplies. The availability of new agricultural water supply is unlikely to occur in the future, and hence more pressure will be imposed on farmers and water district personnel to efficiently manage existing water supplies. Further constraints on farming operations will be imposed by the Central Valley Regional Water Quality Control Board (CVRWQCB) which has sanctioned total maximum daily load (TMDL) limits for various constituents in the San Joaquin River. Fortuitously (although at significant cost) constraints imposed by water quality regulations have encouraged the formation of coalitions among water districts and other water users and purveyors in the watersheds subjected to regulation for the purpose of real-time flow and water quality monitoring. This action will within a few years herald a new chapter in coordinated watershed management as simulation models and decision support systems are developed to encourage a total watershed approach to water and water quality management.

West-side ephemeral streams run to the east and through the watershed covered by Patterson and West Stanislaus Irrigation Districts – these San Joaquin River tributaries have been included in other water quality improvement programs underway in the River Basin. Eight drainage return flow sites within Patterson and West Stanislaus Irrigation Districts have been included in a dissolved oxygen (DO) total maximum daily load (TMDL) allocation issued by the CRWQCB and a recent CBDA Directed Action. These programs are examining sources of algal biomass loading to the SJR under the prevailing hypothesis that algae are the primary source of oxygen demand in the SJR up-stream of Vernalis. Similarly the CBDA Drinking Water Quality Program Multi-Year Program Plan calls for monitoring and assessment actions to understand existing water quality, develop conceptual models useful for improved water quality management, and to provide a mechanism for monitoring water quality improvements (CBDA 2003). This program builds local community capacity to assess and effectively manage their watersheds to reduce negative impacts and provide positive impacts to the Bay-Delta ecosystem. Projects funded under both the CBDA Drinking Water Program and the CBDA Water Use Efficiency Program have demonstrably assisted local stakeholders in meeting TMDL requirements for pesticides, salt, organic carbon, and oxygen demanding materials produced within the watershed. For example in 2002, the first phase of a master plan to reduce contaminant loading to the San Joaquin River was successfully implemented in the Patterson Irrigation District using CBDA Water Use Efficiency program funds. This project improved the operation of the Marshall Road Drain, situated in the south-west corner of the District and has led to significant, documented water savings. The proposed project builds upon the success of this early WUE project and adds an important evaluation component that was not considered previously. Formal evaluation of innovative water conservation and reuse projects is necessary for technology transfer and to encourage other water districts to invest in these new technologies.

The proposed project will fill a critical Bay-Delta need by reducing surface drainage flows to the San Joaquin River and providing the analytical tools to evaluate the direct benefit in terms of saved water and also perform a more comprehensive economic evaluation of this best-management practice than has been possible previously in this watershed. The proposed project is also consistent with the local water management plans prepared by PID for the U.S. Bureau of Reclamation which call for construction of regulatory reservoirs to capture operational spill and improve distribution system delivery flexibility. The project also complements other resource plans prepared by the Westside Resource Conservation District.

3. Nature, Scope, and Objectives of Project

Location of project

This project is located on the Westside of the San Joaquin River (SJR) in Stanislaus County (Figure 1). This project will make use of recent installations of real-time water quality monitoring data in all of the major tributaries and agricultural drains that return flow to the SJR from the Westside of the river in Stanislaus County. The land use in this area is predominantly agricultural. Agriculture production in Stanislaus County had a gross value of $1.37 billion in 2002, ranking the sixth highest among California counties (California Agricultural Statistics Service, 2002). West Stanislaus County (WSC) alone produced $22.9 million in apricots, $38.9 million in almonds, $18.8 million in dry beans, $13.4 million in alfalfa, $3.6 million in peaches, and $2.5 million in walnuts (Stanislaus County Agriculture Commissioner's Office 2003; California Agricultural Statistics Service 2003). WSC also produces nearly all of the county's cantaloupe and honeydew melons, broccoli and cauliflower, herbs and spices, and squash (Stanislaus County Agriculture Commissioner's Office 2003).

Tributaries to the SJR that lie within the two water districts are mostly ephemeral streams, which convey surface runoff from the Coast Range during winter and contain mostly agricultural surface drainage in the summer months (Quinn and Tulloch 2002). The major tributaries entering the SJR in WSC are Hospital Creek, Ingram Creek, Orestimba Creek, and Del Puerto Creek. In addition there are a number of agricultural drains that discharge directly or indirectly to the SJR.

The specific goals of this project will be to :

a) Improve the management of the existing water supplies through construction of drainage and tailwater recovery reservoir systems to further improve the local efficiency of water management, and reduce the water demand from the San Joaquin River.
b) Implement a state-of-the-art remote-sensing based crop water use analysis system – LAWSto evaluate regional improvements to district-scale irrigation water use efficiency through implementation of drainage and spill water recovery systems.

c) Realize secondary goals consistent with CBDA quantifiable objectives which include (i) reduce silt loading to the San Joaquin River; (ii) reduce OP pesticide levels in the drainage water discharged to the San Joaquin River; (iii) reduce constituents adversely affecting the dissolved oxygen level within the San Joaquin River.

The primary project goals specifically address the following Quantifiable Objectives in the 2000 Record of Decision (ROD) for the Water Use Efficiency Program (WUEP) which have the following objectives:

- Achieve multiple benefits - by reducing losses that currently return to the water system (either as groundwater recharge, river accretion, or direct reuse)
- Preserve local flexibility - Bymaintaining the flexibility of implementing water use management and efficiency improvements at the local level while exploring regional programs to maximize benefits.
- Build on existing water use efficiency programs, CALFED will enhance the positive momentum established by the existing programs.

Project secondary goals specifically address the following Quantifiable Objectives defined as Priority Outcomes in the CALFED ROD which pertain to water quality:

No. 81 Reduce nutrients to enhance and maintain beneficial uses of water.
No. 90 Provide long term diversion flexibility to increase the water supply for beneficial uses.
No. 98 Reduce native constituents to enhance and maintain beneficial uses of water.
No. 101 Reduce pesticides to enhance and maintain beneficial uses of water.
No. 104 Reduce salinity to enhance and maintain beneficial uses of water.

4. Technical/Scientific Merit, Feasibility, Monitoring, and Assessment

Nutrients, pesticides, salinity, and native constituent loading to the San Joaquin River should be reduced with the proposed project. Preliminary estimates for the proposed facility indicate there is potential for the 6,800 acre watershed to reduce agricultural surface drainage by approximately 1,600 to 2,500 acre feet per year. If the total dissolved solids in the drainage water is approximately 900 parts per million, this would equate to a reduction of approximately 2,000 to 3,000 tons of salt per year to the San Joaquin River. A comparable reduction in loading would occur with the proposed drainage and tailwater recovery reservoir in conjunction with irrigation delivery system improvements, which will further increase water delivery flexibility to local water suppliers. Increased water delivery flexibility will improve water operations and overall water management in the local agricultural area.

Methods, procedures, and facilities.

4.1 Plan, design, construct and operate a drainage and tailwater recovery reservoir within Patterson Irrigation District.

Land to be acquired will be negotiated by the Patterson Irrigation District and we foresee early completion of the construction phase of the project. This project will allow a unique cooperation between Patterson ID and West Stanislaus ID and some potential sharing of the conserved water in the project. Project design will follow design criteria previously established for the Marshall Road facility, which will save time and effort. Similar concrete work and plumbing will be used, though it will handle a reduced impoundment volume at the new site. Input and output monitoring of flow, EC, sediment turbidity, carbon, nitrate-nitrogen and phosphate loading will be designed and installed at the new facility which is an innovation, not considered at the Marshall Road site. Flow, EC and sediment turbidity will be monitored continuously and tied into the District SCADA network. Stage sensors will be used to continuously measure the volume of water and its nutrient load within the drainage reservoir. We plan to download performance data to the Patterson Irrigation District office and to maintain a database for system assessment. To the extent possible we will use IEP and SWAMP database protocols for database design.

Deliverables : Quarterly reports of progress on reservoir design, construction and operation. Performance database for use in the BMP evaluation.

4.2 Design and install real-time flow and water quality monitoring and control system for efficient water management

We will design, install and operate a real-time monitoring and control system for the landowner installed drainage and tailwater recovery reservoir facility. This will require the integration of data feeds from the real-time water quality monitoring systems, constructed with CRWQCB funds and installed in the drainages adjacent to the new facility. The operation and maintenance of these sites by the District will comprise some of the cost-share accounting for the proposed project. Where necessary we will make improvements to the existing system, which only measures stage and electrical conductivity, to accommodate real-time monitoring of sediment turbidity and other water quality parameters of concern to other cooperating CBDA programs.

Deliverables: Quarterly reports documenting progress on integration of the monitoring network. Database of real-time flow and water quality data.

4.3: Develop best management practices for real-time operation of drainage and tailwater recovery reservoirs

As part of the project we will monitor, evaluate and contrast the performance of irrigation district-owned and privately owned drainage and tailwater recovery reservoir facilities operated in this project with respect to water savings and efficiency of salt and nutrient removal from the San Joaquin River. This will be accomplished by taking periodic grab samples and the analysis of real-time flow and water quality data collected at the facilities. One new privately owned facility has been constructed by a large grower in the West Stanislaus Irrigation District. He has indicated interest in cooperating in the study in return for assistance with the installation of real-time monitoring sensors and related equipment. We will compare and contrast performance of the private and water district-run facilities to each other and to the Marshall Road facility that has been operational for the past 3 years. On the basis of this data reduction and performance analysis we will make suggestions for best management practice guidelines that can assist the future real-time operation of similar ponds on the west-side of the San Joaquin Basin.

Deliverables : Report documenting analysis of reservoir reuse and impoundment efficiency. Workshops and other technology transfer events to disseminate findings and information gathered in the project.

4.4 Design and develop a GIS database for storage and retrieval of hydrologic and land use data and conduct an evaluation of basin water use efficiency using remote sensing and LANDSAT data resulting from implementation of the project.

The types of input data will include:

- Land use classification, acreage, water use coefficients, and service area identification.
- Atmospheric precipitation, potential evapotranspiration, consumptive use demand, and deficit water demand.
- Soil hydraulic properties, soil water content, soil water salinity, ground surface elevation, surface water runoff quantity and discharge location, and groundwater depth.
- Surface water supply, groundwater supply, irrigation efficiency, irrigation demand priority, crop consumptive use, drainage-interception, and deep-percolation.

A GIS database will be developed that identifies the location and aerial extent of various types of historical land uses. This work will focus on land classification using spectral reflectance data from LANDSAT 5 and LANDSAT 7 satellites. The principal objective will be the development of historical data sets identifying various important classes of land use before and after project implementation. These land use classes will include agricultural, urban, riparian, and native vegetation categories. The agricultural vegetation will be further sub-classified according to groupings of similar consumptive use water demand characteristics based on the California Irrigation Management Information System (CIMIS) categories. The CIMIS database contains historical as well as current reference crop evapotranspiration (ETo) data that may be used with various crop specific coefficients (Kc) to estimate crop consumptive use demand.

Historical LANDSAT data sets for the study area will be used to develop the land classification scheme in cooperation with the DWR Division of Local Assistance and the Office of Water Use Efficiency that has been performing similar analysis for more than a decade. This historical data set for the study area will be used to develop image classification methods by correlating spectral reflectance data with crop maps developed for the same time period by the California Department of Water Resources (DWR). After development of the initial historic land use map, the land use classification system will be used to analyze LANDSAT data for the current time period. The current LAWS software contains procedures derived from publications developed by the Office of Water Use Efficiency to compute crop consumptive use (ETc). The procedures employ the daily crop water demand (Cwd), the current soil water content θ_t, the crop rooting depth and the growth period to compute the actual consumptive use.

We will use interpolation procedures to estimate daily ETo values for the study area based on the closest CIMIS station. We may also derive daily ETo from weather data and the use of the Penman-Monteith equation if available and more representative than the CIMIS data. Daily rainfall data may be obtained from District gauges. Daily crop coefficients (Kc) values are computed based on vegetation type and growth stage. Kc values may be adjusted for crop maturity and the presence of cover crops. Bare soil evaporation will be computed in the non-growing season. Spatial interpolation algorithms have already been developed to estimate appropriate values of daily weather data for use in the ETo and Kc calculations. The crop water demand (Cwd) is computed as the product of ETo and Kc.

The LAWS software has been developed by the US Bureau of Reclamation to assist in forecasts of crop consumptive use and to quantify the reliability of these forecasts for both short and long term future water management operations.

5. Schedule

TASK NUMBER	DESCRIPTION	COMPLETION SCHEDULE
4.1	Plan, design, construct and operate a drainage and tailwater recovery reservoir	18 months
4.2	Design and install real-time flow and water quality monitoring and control system	18 months
4.3	Develop best management practices for real-time operation of drainage and tailwater recovery reservoirs	22 months

4.4	Design and develop a GIS database of hydrologic and land use data and conduct an evaluation of basin water use efficiency using remote sensing and LANDSAT data	24 months

6. Monitoring and Assessment

This proposed project involves some earthmoving to create a surface impoundment of privately owned land. One surface impoundment has already been constructed and the second will commence once the land acquisition has been completed. The remainder of the project involves real-time monitoring and drainage management, which, in accordance with Section 15306 of the California Public Resources Code, has been determined to not result in serious or major disturbance to any environmental resource. A Categorical Exemption will be filed with the California State Clearinghouse to comply with CEQA. The lead agency for this project is not a Federal Agency and NEPA does not apply.

The two irrigation districts are among the most progressive in the Basin in the implementation of agricultural drainage management practices, commonly referred to as best management practices or BMPs. A BMP evaluation program covering the entire domain of West Stanislaus County was approved by the CBDA Drinking Water Program (DWQP) and will begin in early 2005. Work performed under the current project proposal, if funded, will be tightly integrated with these ongoing CBDA funded projects.

Project cooperators will work in cooperation with the West Stanislaus Resource Conservation District in gathering data and monitoring the proposed water reuse reservoir to be constructed in Phase 1. Flow meters will be installed to monitor the drainage flows into the reservoir. A flow meter will also be installed to measure the quantity of drainage water pumped back for reuse in the existing irrigation supply system. Water samples will be obtained to verify the quality of the water being recaptured and no longer being discharged into the San Joaquin River. The project team will oversee all data collection, handling, storage and accessibility to project information.

C. Outreach, Community Involvement and Information Transfer

Outreach to area growers will be provided through BMP publications and programs developed by the Coalition for Urban/Rural Environmental Stewardship (CURES). Outreach efforts initiated by the BMP evaluation project (a joint venture between CURES and the San Joaquin Valley Drainage Authority) will be expanded in the local study area under this project. Outreach will include a combination of approaches such as demonstration field days, direct mail, grower meetings, and personal visits by collaborator firms and organizations. The intent of the grower outreach program is to create project awareness among the growers in the region; to promote information acquired from this and related agricultural water quality projects; to identify contacts for grower financial assistance on future BMP installations. As part of the outreach program, a database of growers that are contacted will be developed to track adoption of practices in the project region.

Deliverables : Report on demonstration field days, direct mail, grower meetings, and personal visits by collaborator firms and organizations in quarterly and annual reports .

D. Qualifications of the Applicants, Cooperators and Establishment of Partnerships

The applicant is the Patterson Irrigation District. The following entities will be cooperators on this project, most of whom have worked cooperatively with Patterson Irrigation District for many years:

John Sweigard – General Manager, Patterson Irrigation District
Address: P.O. Box 685, Patterson, CA 95363
Phone: 209-892-6233

John Sweigard is General Manager of the Patterson Irrigation District in Patterson, California. He holds a B.S. in Agricultural Engineering from California Polytechnic State University in San Luis Obispo, California and has been employed by Patterson Irrigation District as General Manager for the duration of his employment with the district of eight years. Mr. Sweigard has been involved in water resources, primarily working for irrigation districts, water companies and reclamation districts, for 12 years ranging from capacities as a ditchtender working his way through college to his current position as General Manager. Mr. Sweigard was also an undergraduate research assistant at the Irrigation and Training and Research Center for two years while working toward his B.S. Mr. Sweigard has been responsible for the design, planning and implementation of the modernization, rehabilitation and automation of the Patterson Irrigation District. Mr. Sweigard is also in charge of the master planning for all district issues including water and energy resources, drainage and regulatory compliance. Professional activities include the preparation of technical papers for the US Committee on Irrigation and Drainage in the areas of facility modernization, rehabilitation and automation, TMDL issues and Supervisory Control and Data Acquisition (SCADA).

Nigel Quinn - Project Investigator (Geological Scientist, Lawrence Berkeley National Laboratory)

Nigel Quinn received a B.Sc. (Honors) in irrigation engineering and hydrology from the Cranfield Institute of Technology in England an MS from Iowa State University in

Agricultural and Environmental Engineering and a PhD from Cornell University in Water Resource Systems Engineering. He works as a consultant to the US Bureau of Reclamation dividing his time between monitoring efforts in support of the Grasslands Bypass project, various CALFED water quality management projects, development of real-time forecasting tools for the San Joaquin River and selenium fate and transport research projects. He has been affiliated with Lawrence Berkeley National Laboratory for the past 9 years and the University of California, Berkeley for the past two years. Nigel is the author of over 50 publications and reports on various aspects of water resources and drainage engineering.

Roger Reynolds P.E. - Vice President of Summers Engineering, Inc
Roger L. Reynolds is Vice President of Summers Engineering, Inc., in Hanford, California. He holds a B.S.C.E. from the University of California at Davis and has been employed by Summers Engineering, Inc., for the past thirty-two years. He is a registered civil engineer in the State of California. Mr. Reynolds' work has been in water resources engineering with a particular emphasis on irrigation and drainage projects. Summers Engineering, Inc., is a consultant to several water agencies in the State of California and Mr. Reynolds has been responsible for the design, rehabilitation, and master planning for numerous irrigation, drainage, groundwater, and water supply projects. Professional activities have included the preparation of a technical paper entitled *Putah South Canal Remote Acoustic Water Level Monitoring and Flow Measurement* presented at the U. S. Committee on Irrigation and Drainage National Conference in October 1992 and a paper entitled *MOU on Efficient Water Management Practices by California Agricultural Water Suppliers - - Can It Work?* presented at the U.S. Committee on Irrigation and Drainage National Conference in December 1996. In 1991 Mr. Reynolds was appointed by the California Director of the Department of Water Resources to be a member of the California Assembly Bill 3616 Advisory Committee developing efficient water management practices for agriculture. In July 1997, he was elected as Co-Chair of the Agricultural Water Management Council formed under the A.B. 3616 Memorandum of Understanding. Mr. Reynolds is a member of the American Water Works Association, the U. S. Committee on Irrigation and Drainage and the Association of California Water Agencies Groundwater and Water Management Committees.

Michal Koller, PhD GIS and Remote Sensing Analyst , Contractor, US Bureau of Reclamation
Michal Koller's interests are in projects in remote sensing, image analysis, bio-systems modeling, and geographic information system (GIS). He has experience in remote sensing area including analysis of multi-spectral imagery from Land Satellite (LANDSAT), panchromatic data sets from Indian Remote Sensing (IRS) satellite, and low, medium, and high-resolution multi-spectral imagery from low- and high-altitude aircraft. He has done extensive analysis of agricultural remote sensing data, algorithm development, and development of vegetation indices (NDVI, SAVI, LAI) for modeling agricultural crops biomass and yield. He is in charge of the design and

development of Land Atmosphere Water Simulator (LAWS) Prototype, a project sponsored by U.S. Bureau of Reclamation. LAWS is a GIS based model to predict and simulate the consumptive use of irrigation water by agricultural crops. The model assists water managers to assess the risks of not meeting water demands as the irrigation season develops using either historical or forecasted crop, soil, and weather data. Dr Koller processes and analyzes satellite imagery for land cover and crop classification and is developing a geo-database using soil, crop, and agro-meteorological data. He holds a Ph.D. in Biological and Agricultural Engineering from University of California, Davis. In his dissertation research he focused on crop growth modeling to predict crop yield on a spatial basis using aerial imagery.

Ronald Roos, General Manager – West Stanislaus Irrigation District
Mr. Roos has been a special district General Manager for the past twenty-two years. Mr. Roos is familiar with all aspects of managing and operating an Irrigation District. He was involved with San Luis Water Association for many years. When the Association became the San Luis Delta-Mendota Water Authority, Mr. Roos was appointed to the Board of Directors a position he holds today. Mr. Roos also sits on the Finance and Administration Committee of that same Authority, and is also on Board of Directors of the San Joaquin Valley Drainage Authoity. Mr. Roos is also the President of the Board for an organization which owns a Retirement Center in the community in which he lives. Mr. Roos is also a member of the Association of California Water Agency through the Irrigation District he manages.

E. Costs and Benefits

1. Attached as Table C-1 is a Budget Summary breakdown for the project.
2. The SCADA monitoring equipment is listed as an equipment purchase. The labor costs for flow monitoring, drainage water sampling, and ongoing maintenance of the Phase 1 constructed tailwater/desilting reservoir would be covered as a local share cost by the participating water agencies. Existing staff of the participating water agencies would be assigned this responsibility. Estimated labor and vehicle costs of $250 per day were utilized. One of the cooperating water agencies has a solar powered flow meter, which will be utilized to obtain flow information. Water quality analysis for the various water samples was assumed at $100 each. A preliminary estimate to construct a 100 acre foot reservoir was prepared. The estimated cost to construct the reservoir levees, the inlet/outlet structures, and a pump with electrical equipment to lift the recovered water back into the adjacent irrigation canal is included in the construction cost. The land acquisition costs include the estimated cost to purchase the land for the proposed Phase 1 reservoir site. The estimated Engineering costs cover the anticipated cost to meet CEQA requirements, review the field data, and finalize the design and administer construction for the reservoir.

The Budget Summary also includes estimated costs for the field sampling and flow monitoring. It is assumed measuring weirs will be installed at appropriate locations in each watershed to provide the ability to measure the drainage flows for each drainage channel. The consulting costs include providing a detailed review of each drainage watershed, analyzing the field data, meeting with the cooperating agencies, and designing specific water management options to address the goals of the project outlined in the Item B., Scope of Work, Abstract (Executive Summary).

3. Benefit Summary Breakdown.

   a. One of the quantified benefits with the construction of the proposed reservoir in Phase 1 is the reduction of PID's pumping from the San Joaquin River. If the proposed project is constructed, the water stored and reused by the District (estimated to range from 1,600 to 2,500 acre feet), will reduce the annual quantity of water pumped from the river. This is a benefit to PID. The future anticipated benefits following completion of the Phase 2 master plan strategy and construction of recommended facilities should be proportional to the anticipated benefits under Phase 1.

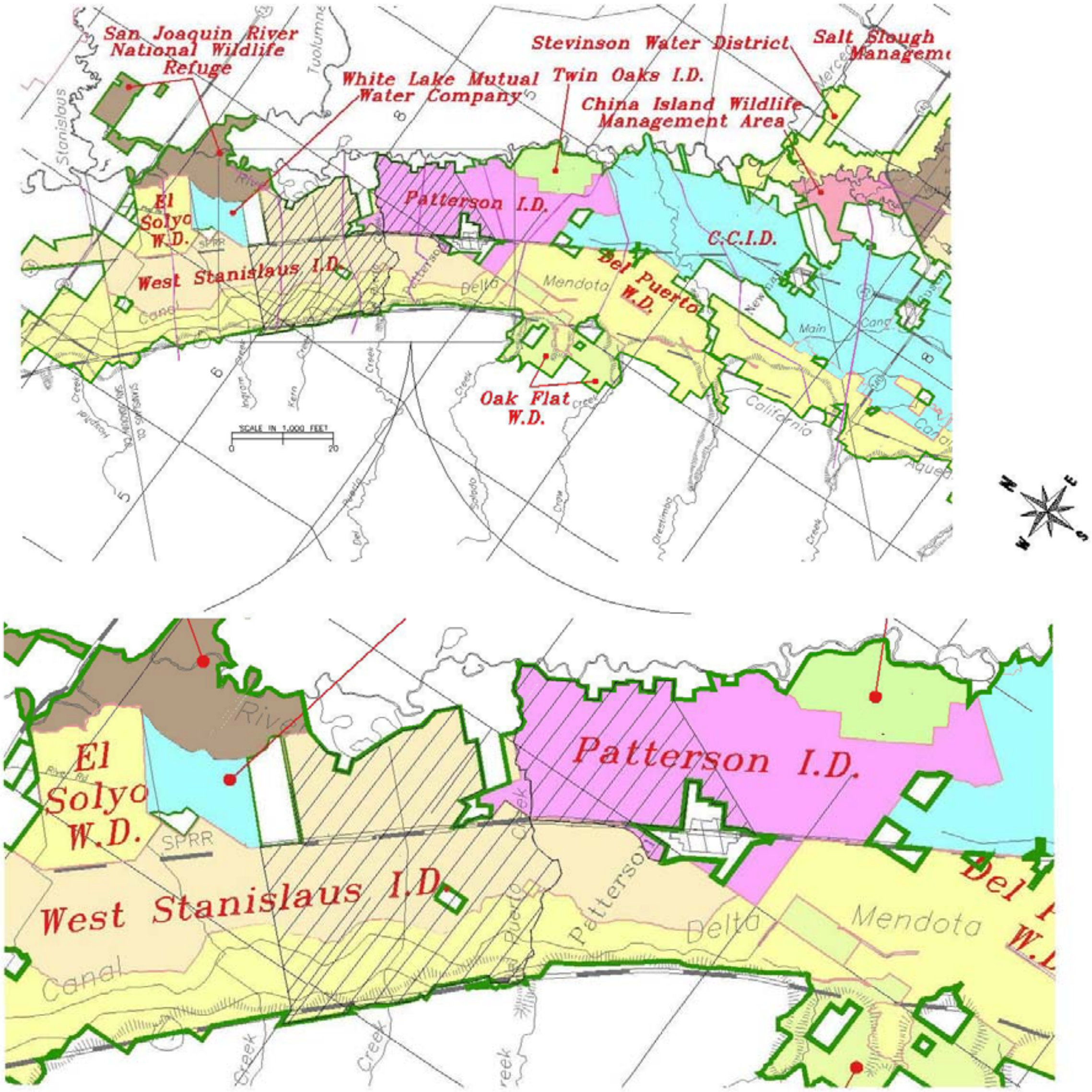
   b. Non–quantified benefits include the increased opportunity to improve water management and operational efficiency. The reuse of drainage and operational spill water will increase PID's operational flexibility by providing additional storage to meet peak irrigation demands near the end of an irrigation lateral and allow the capture and reuse of operational spills. The construction and maintenance of an additional reservoir and pump station will not simplify labor requirements, but it should provide additional operational flexibility. This is a benefit to PID. The future non-quantifiable benefits for implementation of recommended Phase 2 projects should be comparable and provide increased operational flexibility to the participating water suppliers.

      An additional non-quantifiable benefit is the reduction of drainage water flows back into the San Joaquin River. It is estimated the Phase 1 project will reduce the drainage flows into the river by at least 1600 acre feet per year. This is a CALFED Bay-Delta benefit. The anticipated future implementation of recommended Phase 2 projects should provide comparable benefits to the CALFED Bay-Delta program.

4. Assessment of Costs and Benefits. Tables C-3 and C-6 summarize the costs and benefits of the project.

   The analysis assumptions are based on current year construction costs and interest rates of 6% to calculate the present worth of annual maintenance costs over 20 years. The benefit to cost ratio is 0.35, per table C-7.

Figure 1



PATTERSON IRRIGATION DISTRICT
Water Use Efficiency Project

LOCATION MAP

SUMMERS ENGINEERING INC.
Consulting Engineers
HANFORD CALIFORNIA

NOVEMBER 2004

References

California Bay-Delta Authority. 2003. CalFed Bay-Delta Program Drinking Water Quality Program Multi-Year Program Plan (Years 4 – 7). August. California Bay-Delta Authority, Sacramento, CA (http://calwater.ca.gov/Programs/Programs.shtml)

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Applicant: Patterson Irrigation District

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Section A projects must complete Life of investment, column VII and Capital Recovery Factor Column VIII. Do not use 0.

Table C-1: Project Costs (Budget) in Dollars)

	Category (I)	Project Costs $ (II)	Contingency % (ex. 5 or 10) (III)	Project Cost + Contingency $ (IV)	Applicant Share $ (V)	State Share Grant $ (VI)	Life of investment (years) (VII	Capital Recovery Factor (VIII)	Annualized Costs $ (IX)
	Administration[1]								
	Salaries, wages	$100,000	0	$100,000	$100,000	$0	20	0.0872	$8,720
	Fringe benefits	$0	0	$0	$0	$0	20	0.0872	$0
	Supplies	$0	0	$0	$0	$0	20	0.0872	$0
	Equipment	$0	0	$0	$0	$0	20	0.0872	$0
	Consulting services	$155,000	0	$155,000	$0	$155,000	20	0.0872	$13,516
	Travel	$0	0	$0	$0	$0	20	0.0872	$0
	Other	$0	0	$0	$0	$0	20	0.0872	$0
(a)	Total Administration Costs	$255,000		$255,000	$100,000	$155,000			$22,236
(b)	Planning/Design/Engineering	$160,000	0	$160,000	$147,000	$13,000	20	0.0872	$13,952
(c)	Equipment Purchases/Rentals/Rebates/Vouchers	$0	0	$0	$0	$0	20	0.0872	$0
(d)	Materials/Installation/Implementation	$100,000	0	$100,000	$0	$100,000	20	0.0872	$8,720
(e)	Implementation Verification	$0	0	$0	$0	$0	20	0.0872	$0
(f)	Project Legal/License Fees	$0	0	$0	$0	$0	20	0.0872	$0
(g)	Structures	$0	0	$0	$0	$0	20	0.0872	$0
(h)	Land Purchase/Easement	$400,000	0	$400,000	$400,000	$0	20	0.0872	$34,880
(i)	Environmental Compliance/Mitigation/Enhancement	$15,000	0	$15,000	$0	$15,000	20	0.0872	$1,308
(j)	Construction	$770,000	0	$770,000	$0	$770,000	20	0.0872	$67,144
(k)	Other (Specify)	$0	0	$0	$0	$0	20	0.0872	$0
(l)	Monitoring and Assessment	$0	0	$0	$0	$0	20	0.0872	$0
(m)	Report Preparation	$0	0	$0	$0	$0	20	0.0872	$0
(n)	**TOTAL**	$1,700,000		$1,700,000	$647,000	$1,053,000			$148,240
(o)	Cost Share -Percentage				38	62			

1- excludes administration O&M.

Applicant: **Patterson Irrigation District**

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Table C-2: Annual Operations and Maintenance Costs

Operations (1) (I)	Maintenance (II)	Other (III)	Total (IV) (I + II + II)
$10,000	$20,000	$0	$30,000

(1) Include annual O & M administration costs here.

Table C-3: Total Annual Project Costs

Annual Project Costs (1) (I)	Annual O&M Costs (2) (II)	Total Annual Project Costs (III) (I + II)
$148,240	$30,000	$178,240

(1) From Table C-1, row (n) column (IX)
(2) From Table C-2, column (IV)

Table C- 4: Capital Recovery Table (1)

Life of Project (in years)	Capital Recovery Factor
1	1.0600
2	0.5454
3	0.3741
4	0.2886
5	0.2374
6	0.2034
7	0.1791
8	0.1610
9	0.1470
10	0.1359
11	0.1268
12	0.1193
13	0.1130
14	0.1076
15	0.1030
16	0.0990
17	0.0954
18	0.0924
19	0.0896
20	0.0872
21	0.0850
22	0.0830
23	0.0813
24	0.0797
25	0.0782
26	0.0769
27	0.0757
28	0.0746
29	0.0736
30	0.0726
31	0.0718
32	0.0710
33	0.0703
34	0.0696
35	0.0690
36	0.0684
37	0.0679
38	0.0674
39	0.0669
40	0.0665
41	0.0661
42	0.0657
43	0.0653
44	0.0650
45	0.0647
46	0.0644
47	0.0641
48	0.0639
49	0.0637
50	0.0634

(1) Based on 6% discount rate.

Applicant: **Patterson Irrigation District**

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Table C-5 Project Annual Physical Benefits (Quantitative and Qualitative Description of Benefits)

	Qualitative Description - Required of all applicants[1]				**Quantitative Benefits - where data are available**[2]
	Description of physical benefits (in-stream flow and timing, water quantity and water quality) for:	Time pattern and Location of Benefit	Project Life: Duration of Benefits	State Why Project Bay Delta benefit is Direct[3] Indirect[4] or Both	Quantified Benefits (in-stream flow and timing, water quantity and water quality)
Bay Delta	Reduction in irrigation water demand from the San Joaquin River (see project narrative)	Demand reduction will occur during the irrigation season (March through September) at the San Joaquin River near Patterson	20 years plus	Direct reduction of water supply demand from the San Joaquin River (see project narrative)	2,000 acre feet
Bay Delta	Reduction in sediment and salt discharge to the San Joaquin River by diverting ag surface drainage to the recirculation reservoir (see project narrative)	Reduction in sediment and salt discharge will occur during the irrigation season (March through September) at the San Joaquin River near Patterson	20 years plus	Direct benefit to water quality by reducing the sediment load discharged to the San Joaquin River (see project narrative)	Exact reduction in load unknown at this time. Sediment load reduction could be as much as 700 tons per year and salt load reduction could be up to 2,500 tons per year.
Bay Delta	Reduction in pesticide discharge to the San Joaquin River by diverting ag surface drainage to the tail water reservoir (see project narrative)	Reduction in pesticide discharge will occur during the irrigation season (March through September) at the San Joaquin River near Patterson	20 years plus	Direct benefit to water quality by reducing the pesticide load discharged to the San Joaquin River (see project narrative)	Exact reduction in load unknown
Local	Increase in water supply reliablility: Real-time monitoring and tail water reservoir will help match water supply to demand	Irrigation season (March through September) at the San Joaquin River near Patterson	20 years plus	**Not applicable.**	Unknown

[1] The qualitative benefits should be provided in a narrative description. Use additional sheet.

[2] Direct benefits are project outcomes that contribute to a CALFED objective within the Bay-Delta system during the life of the project.

[3] Indirect benefits are project outcomes that help to reduce dependency on the Bay-Delta system. Indirect benefits may be realized over time.

[4] The project benefits that can be quantified (i.e. volume of water saved or mass of constituents reduced) should be provided.

Applicant: **Patterson Irrigation District**

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Table C-6 Project Annual Local Monetary Benefits

ANNUAL LOCAL BENEFITS	ANNUAL QUANTITY	UNIT OF MEASUREMENT	ANNUAL MONETARY BENEFITS
(a) Avoided Water Supply Costs (Current or Future Source)	2,000	acre foot	$60,000
(b) Avoided Energy Costs	41,000	kwh	$2,100
(c) Avoided Waste Water Treatment Costs	0		$0
(d) Avoided Labor Costs	0		$0
(e) Other (describe)	0		$0
(f) Total [(a) + (b) + (c) + (d) + (e)]			$62,100

Table C-7 Project Local Monetary Benefits and Project Costs

(a) Total Annual Monetary Benefits [(Table C-6, row (f)]		$62,100
(b) Total Annual Project Costs (Table C-3, column III)		$178,240

Table C-8 Applicant's Cost Share and Description

Applicant's cost share %: (from Table C-1, row o, column V)	**38**

The applicant's cost share is approximately equal to the fraction of annual monetary benefits to total annual cost. Applicants match share of the project cost will come in the form of "in-kind services" and cash contributions from district reserves. All land purchases will be completed with District monies.