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TULARE LAKE BASIN W.S.D. BACKGROUND INFORMATION

The Tulare Lake Basin Water Storage District (District) is located in the trough of the San Joaquin Valley, with 98 percent of it acreage in southeastern Kings County and 2 percent in southwestern Tulare County. Refer to Attachment 1 for a location map of the District. The boundary of the District is shown in Attachment 2. The land area of the District encompasses about 190,000 acres in the Tulare Lakebed. District lands are uniformly level at elevations of 170 to 200 feet above sea level.

As a result of the vast majority of the District lands being cultivated, the District itself has a population of less than 100 people. Nearby urban areas include the city of Corcoran and the communities of Kettleman City, Stratford and Alpaugh.

The District's surface water supplies are provided from the Kings and Tule Rivers, and a contracted State Water Project (SWP) supply. Floodwaters from the river systems are also utilized for surface supply, and the District has historically purchased, exchanged and transferred water to meet demands. No groundwater of satisfactory quality has been developed under the southwestern two-thirds of the District. Groundwater above the Corcoran Clay (a preeminent and extensive clay layer that lies about 500 feet to 900 feet below the lakebed) tends to be of poor quality and low yield when pumped. The source below the Corcoran Clay yields sufficient qualities of relatively good quality water, but the wells must be drilled to a depth of 1,500 to 2,000 feet. The principal groundwater supply is imported from private well fields east of the District. Groundwater is used, within limitations of available capacity, to help make up deficiencies in the other supplies. However, during periods of severe drought, some lands must be fallowed. The crops grown in the District are almost exclusively of the field type that adapt well to slightly saline clay soils and hot climates. Successful crops have included cotton, barley, wheat, safflower, and alfalfa. A land use map is included as Attachment 3. Truck crops and deciduous orchards (less salt-tolerant) have historically not been grown.

Tulare Lake Basin is unique area and is essentially a closed basin. Water that is imported or produced in the Basin stays in the Basin until it is consumptively used through surface evaporation or evapotranspiration. Because of this and localized perched water table problems, some of the fertile lands within the District are confronted with a serious drainage problem. As a result, the Tulare Lake Drainage District was organized in 1966 to implement a program to alleviate the drainage problems. The central, eastern, and southern areas of the District lie within the Tulare Lake Drainage District. The overlapping area makes up 67 percent of the drainage district and 78 percent of District. The Drainage District has developed drainage collection facilities for the removal of salt-laden agricultural waste-water. Presently, the method of disposal of the drainage waters is by solar evaporation basins.

Soil types in the District are predominantly clay. The predominant soil type is Tulare Clay, a deep and very finely textured soil. The low vertical permeability of the clay strata has led to high-perched water tables, which underlie essentially the entire District.

Attachment 1 – District Location Map

Attachment 2 – District Boundary Map

Attachment 3 – District Land-Use Map

A – RELEVANCE AND IMPORTANCE

A.1 - Goals and Objectives

The proposed project includes the conversion of 1,900 acres in the Tulare Lake Basin Water Storage District (District) from on-farm flood irrigation to more efficient on-farm irrigation methods, such as drip and linear sprinkler irrigation systems.

The primary goals of the project are to:

- Provide financial assistance to local growers to allow the purchase and installation of more efficient irrigation systems
- Demonstrate the efficiency and benefits of these irrigation systems to further promote their use in the District
- Conserve irrigation water supplies
- Increase crop production yields to aid local economy

This project is consistent with the CALFED fundamental goals of the Water Use Efficiency Program, which are to:

- Reduce existing irrecoverable losses
- Achieve multiple benefits - by reducing losses that return to the water system
- Preserve local flexibility
- Provide incentives to local users – to make irrigation system improvements

The District is located within the Mid-Valley Area Sub-Region, in the Southern San Joaquin Valley Region. This project is consistent with Quantifiable Objectives (QO) and Target Benefits (TB) identified for this region, which include:

- #167: Decrease flows to salt sinks to increase the water supply for beneficial uses. Possible actions include “Improve farm irrigation management (such as irrigation scheduling) and more uniform irrigation methods (such as shorter furrows, sprinkler, or drip).” This will be achieved through a reduction in percolation to the underlying perched water table.

- #168: Decrease non-productive ET to increase water supply for beneficial uses. Possible actions are “Reduce ET flows using improved irrigation methods, such as drip irrigation, and planting densities.” This will be achieved with a reduction in evaporation from the soil surface and ponded tailwater.

A.2 - Need for Project

The proposed project to convert on-farm irrigation systems to more efficient systems is needed to:

- Reduce dry year dependency on limited surface water and groundwater supplies
- Encourage improved on-farm irrigation efficiency
- Increase production yield of crops
- Allow for cultivation of higher value crops, such as tomatoes

- Foster economic development by generating employment opportunities for farm workers

In drier years, the surface water supplies are not sufficient to meet the overall District demand. To reduce groundwater pumping, the District has purchased and/or exchanged surplus local river water and State Project Water. With increased demand on State and local supplies, more efficient use of all District water supplies is needed. The District is located within the Tulare Lake Groundwater Subbasin (5-22.12) of the Tulare Lake Hydrologic Region as identified in DWR Bulletin 180. The Tulare Lake Groundwater Basin has been identified as critically overdrafted.

Most of the soil in the District is highly impermeable, preventing groundwater recharge and creating tailwater conditions in most fields. As a result, tailwater recovery systems have been constructed on most farms, and there are considerable evaporative losses from the ponded tailwater. Nevertheless, some seepage does occur, and water lost to seepage is perched above confining clay material in the aquifer.

A.3 – Consistency with Water Management Plans

The District is a member of the Agricultural Water Management Council (AWMC or Council). The AWMC was formed in 1996, following the work of an advisory committee formed by Assembly Bill (AB) 3616, Agricultural Efficient Water Management Act of 1990. The Council consists of members of the agricultural and environmental communities and other interested parties. The Council has expressed the goal for water suppliers to voluntarily develop Water Management Plans and implement Efficient Water Management Practices (EWMPs) to further advance water use efficiency while maintaining and enhancing economic, environmental and social viability and sustainability of soil and crop production. The District has signed the AWMC Memorandum of Understanding that includes the following primary objectives:

1. Create a constructive working relationship between agricultural water suppliers, environmental interest groups, and other interested parties.
2. Establish a dynamic list of Efficient Water Management Practices.
3. Establish criteria to evaluate the appropriateness of EWMPs.
4. Implement appropriate EWMPs, while avoiding unnecessary or unreasonable planning, paperwork, or expenses for water suppliers, thereby voluntarily achieving more efficient water management than currently exists or may be required by existing law.

The District has solicited comments from the AWMC on their Water Management Plan and is in the final steps of completing their plan.

This project is also consistent with the District's historic operations and activities since 1926, its adopted rules and regulations, and its Water Management Plan.

A.4 - Past Water Demand Activities

The District has a long history of supporting and implementing water conservation measures. These ongoing water conservation efforts are considered important given the limited surface water supplies and overdrafted groundwater aquifer. Specifically, the District has demonstrated their interest in water conservation and management through the following activities:

- Installation of automatic gates
- Installation of metering and measurement devices
- Measurement of water deliveries
- Facilitated the use of recycled wastewater within the District
- Facilitated voluntary water transfers
- Lining of approximately 8 miles of canal that conveys SWP water
- Development of a flexible water ordering schedule
- Conjunctive use of surface and groundwater supplies
- Tailwater recovery systems
- Evaluation of pump efficiencies
- Limited conversions to more efficient irrigation systems

The District has also prepared various plans, policies and reports that document and encourage efficient water management practices. These include:

Tulare Lake Bed Coordinated Groundwater Management Plan: The District is a participant in this regional Groundwater Management Plan that was adopted April 5, 1994. The Plan was adopted to document the local groundwater management practices and conjunctive use programs, encourage the importance of surface water supplies, promote efficient water practices and conservation programs, and preserve local management of the groundwater resources in the Tulare Lake Bed area. This plan is indicative of the District's proactive role in promoting inter-agency cooperation. The plan participants include:

- Alpaugh Irrigation District
- Angiola Water District
- Atwell Island Water District
- City of Corcoran
- Corcoran Irrigation District
- Lovelace Reclamation District #739
- Melga Water District
- Tulare Lake Basin WSD
- Private Landowners

The District also assists in the preparation of the plan's annual groundwater report. The annual report includes the following sections:

1. Introduction
2. Additional Plan Participants
3. Weather Patterns
4. Water Supplies
5. Groundwater Monitoring Program
6. Groundwater Management Programs
7. Mitigation

Water Management Plan: As mentioned, the District has solicited comments from the AWMC on their Water Management Plan and is in the final steps of completing their plan. The draft plan has been prepared in accordance with the guidelines identified in the AWMC MOU.

Water Shortage Allocation Policies: The District has adopted a Water Shortage Allocation Policy for its State Project Water supply. Within the District's Rules and Regulations, this policy states, "Pursuant to powers granted by Section 43003 of the California Water Code, in the event of shortage of Project Water, water will be apportioned to each Water User within the District, on a pro rata basis relating to their respective contract quantities of Table A Water.."

Kings River Water Association: The District is a member of the Kings River Water Association (KRWA), a 28-member group of water agencies that was formed in 1927 to administer and manage water uses on the Kings River. The benefits of KRWA membership include conflict resolution mechanisms, and improved coordination among member agencies. The KRWA opens lines of communication so that members can work together effectively to utilize, trade, and transfer waters from the Kings River.

Association of California Water Agencies: The District is an active member of the Association of California Water Agencies (ACWA). ACWA fosters cooperation among all interest groups concerned with stewardship of the state's water resources. The District attends the ACWA annual meeting and benefits from the educational and informational services that ACWA offers.

Agricultural Water Management Council: As mentioned, the District is a member of the AWMC and is signatory to the Council's Memorandum of Understanding.

The District also participates in the Agricultural Water Caucus and the San Joaquin Valley Agricultural Water Committee.

A.5 – Implementation of Water Management Activities

This project will be part of the District's ongoing efforts to implement more efficient water management practices.

As later described in the Innovation section of this application, although on-farm drip systems are not particularly new or innovative statewide, conversion to drip and linear move systems is still relatively uncommon within the District. It is estimated that 90% of the lands in the District are still using flood irrigation methods. The proposed monitoring and reporting efforts will aid in documenting the success of this project. It is anticipated that the success of this project will encourage conversion of additional acreage within the District.

B - Technical Merit and Feasibility

B.1 - Project Work Plan

The proposed project includes the conversion of 1,900 acres from basin flood irrigation to drip irrigation and linear-move sprinkler systems. The District has received letters of commitment from various growers within the District. Copies of these letters are included in Appendix A. Attachment 4 shows the proposed locations for the irrigation system conversions as determined by growers that have expressed interest in the program.

A more detailed description of the tasks is included in the project workplan below. The workplan was developed to implement the project and ensure that the project meets the listed goals and objectives. A detailed project schedule and budget have been prepared to correspond with these tasks. The schedule is included as Attachment 5, and the corresponding budget is included as Appendix B of this application. The specific tasks identified for implementation of the project are as follows:

Task 1 - Administration

Administration of the grant program and project implementation will be on-going throughout the project, but more intensive during the design and implementation periods prior to the irrigation season. Administration costs will include personnel costs for contract administration, project coordination, project tracking and invoicing, and attending meetings of the District Board Irrigation Efficiency Committee, which is being formed to assist with this project.

Task 2 - Planning/Design/Engineering

The growers will provide District staff with a written request of the acreage desired for conversion during the construction season (prior to irrigation season). The grower will then solicit price quotations for the preferred on-farm system from suppliers in the area. Upon selection of a supplier, an on-farm system will be designed by the supplier, and submitted for review by District staff and the District's consulting engineer as necessary. Upon approval of the chosen system, the grower will receive written approval from the District to commence with the implementation and construction.

On-farm site-specific plans will be prepared for each field being converted to drip irrigation systems. Manufacturer's literature on typical drip irrigation systems is included in Appendix C. A sample design drawing is included in Appendix C. (Site specific design drawings are not provided in this application because drip irrigation system designs are fairly standard, despite being site specific. In addition, irrigation companies do not normally design the systems until someone has agreed to make a purchase). The proposed plans will be reviewed by District staff for compliance with the grower's application. These plans will be prepared by the irrigation system supplier, and do not require the approval of a registered Civil Engineer. However a certified Irrigation Designer or Professional Agricultural Engineer will sign the plans. General technical

support will be provided by a consulting engineer. If required by the State, the District will retain a licensed Civil Engineer to review the proposed on-farm system design.

Task 3 - Materials/Installation/Implementation

The irrigation systems will be designed and constructed in accordance with engineering designs and price quotations from local suppliers. All construction costs are included in this task. Irrigation companies typically furnish the equipment as well as perform the design and installation for new irrigation systems. The estimated costs for drip and sprinkler irrigation systems presented herein are based on these melded costs. These local irrigation companies will construct the proposed irrigation systems. A more detailed discussion of the typical costs is included in Section G.2 – Capital Cost.

The drip systems are proposed to be placed on lands that currently grow tomatoes, as well as on some land that currently has cotton. The drip systems installed will have a life expectancy of up to 20 years if properly maintained and if they do not normally convey water with corrosive properties. These drip systems can usually be designed and installed with 10 weeks notice, depending on the current workload at the irrigation company.

The drip system described above would typically have the following major components:

- Pump
- Filter
- Flowmeter
- Mainline
- Lateral lines
- Drip hose
- Pressure regulator
- Fertigation injector
- Miscellaneous fittings, valves and parts

The linear-move sprinkler systems will typically be installed on lands that currently grow wheat, alfalfa and cotton. Water is usually fed to the sprinkler system from a ditch constructed across the entire length of the irrigated area. The life expectancy of the system would be 20 years if it is properly maintained and does not normally convey water with corrosive properties. A linear-move sprinkler system described above would include the following major components:

- Linear system
- Wheel carts
- Drive unit
- Spray heads
- Pressure regulator
- Hose drops
- Pump
- Flowmeter
- Fertigation/chemigation equipment
- Miscellaneous fittings, valves and parts
- Water delivery canal

Manufacturer's literature for typical linear-move irrigation systems is included in Appendix D.

Task 4 - Implementation Verification

Implementation verification will include District staff time to pre-approve farmer purchases and designs, and field visits to verify purchase, installation, and operation of the irrigation systems. During the field visits the irrigation systems will be inspected for compliance with the farmers pre-application, pictures of the irrigation systems will be taken, and a short field visit report will be prepared.

Task 5 - Project Legal/License Fees

A county permit may be required for growers if a new electricity connection is needed, or an air permit may be required if a new diesel pump is installed. The growers will bear the cost of obtaining these licenses. No other licenses or legal fees are anticipated to be needed for the project.

Task 6 - Environmental Compliance/Mitigation/Enhancement

The District believes that the proposed project is exempt from California Environmental Quality Act (CEQA), which allows for exemptions when a project is "replacement or reconstruction of existing systems or facilities involving negligible or no expansion of capacity." (Section 15301, Class 1). As required, a Notice of Exemption will be prepared and filed with the County and State Clearinghouse prior to installation of the on-farm systems.

Task 7 - Monitoring and Assessment

Monitoring and assessment efforts will include District staff and consultant time to develop the detailed monitoring plan described in the Monitoring and Assessment section of this application. The program will be developed to evaluate the project success and irrigation efficiencies, and re-evaluate the project cost/benefit ratio as part

of the final report. The costs for preparing the annual monitoring reports for 5-years after project implementation will be borne by the District.

Task 8 - Report Preparation
Report preparation will include District staff and consultant time to prepare up to ten (10) quarterly progress reports, as required in the program requirements. Each progress report will include a detailed update of the status of each task described in the workplan, a comparison of the project completion and the original schedule, a listing of the expenditures to date for each task, as well as any other DWR progress reporting requirements.

A Draft Project Report will be prepared near the end of the project implementation period, and submitted to DWR staff for review. The report will include a description of the project construction, an update of the monitoring program being conducted by the District, comparison of the actual expenditures and schedule to the original budget and schedule, along with any other DWR requirements for project reporting. After review by DWR staff, a Final Project Report will be prepared that addresses DWR comments.

B.2 - Schedule

A schedule for the proposed project is included as Attachment 5. It has been assumed that the project will begin on December 1, 2005, as stated in the Proposal Solicitation Package. Drip systems can usually be designed and installed with 10 weeks notice, depending on the current workload at an irrigation company. However because of the significant amount of acres included in the project and the need to have the systems installed prior to the irrigation season, it is anticipated that not all of the acreage will be converted in the first year. For that reason, a 3-year schedule was prepared. Each year, as acreage is proposed for conversion, Tasks 1-7 will be completed during the construction season (non-irrigation season). However, it is possible that conversion of all of the acreage may be able to occur in a shorter timeframe, possibly 1-2 years, depending on the schedules of the chosen contractors. The five year monitoring is not shown on the schedule, but is included in the project workplan and monitoring description.

B.3 - Methods and Procedures

The irrigation systems will be constructed according to designs and manufacturer recommendations from local suppliers. The proposed facilities would also include water-metering equipment to measure monthly and annual water applications.

The District recognizes that higher irrigation efficiencies will not be realized with the new irrigation systems if they are not properly operated and managed. Therefore, the growers will operate and manage the drip and linear sprinkler systems according to recognized guidelines. Specifically, in 1994 the DWR prepared the *Policy Statement on Efficient Water Management for Conservation by Agricultural Water Suppliers, Efficient Water Management Practices for Agricultural Water Suppliers, On-Farm Practices*. Excerpts from this publication for drip irrigation and hand move sprinklers (similar

guidelines to linear move sprinklers) are included in Appendix E. The growers will follow these practices when they are applicable to their specific site conditions and the equipment installed.

Attachment 4 – Field map

Attachment 5 – Project Schedule

C – MONITORING AND ASSESSMENT

C.1 - Baseline Conditions

The District and growers will identify three to four flood-irrigated fields that are not planned for conversion to drip or linear moves, and will conduct monitoring of these fields throughout the project life. These fields will be of the same crop type and similar field conditions as fields that are converted, and will be used as a baseline to compare water delivery amounts and crop production.

In addition, prior to installation of on-farm system improvements, the growers will measure flood irrigation deliveries and crop production on the fields proposed for conversion to drip or linear moves. Historical records will be utilized as available, so that a comparison can be made between pre and post project on-farm water use and crop production of the specific fields being converted.

C.2 – Monitoring Methodology and Considered Factors

Water deliveries to the "baseline" fields, and the converted fields will be recorded and compared. Crop production on each of these fields will also be reported and compared to determine a comparison of yield versus water applied. Site-specific factors will be compared including different field conditions, supply water characteristics, delivery systems, weather conditions, and measurement accuracies. Growers will also be asked to report any differences in farming practices, such as new seeds, fertilizers, etc. that may also be impacting yield and water use efficiency.

The comparison of historic flood deliveries will help give an indication of the efficiency of the delivery system and a comparison to historical data can yield an estimate of the annual water savings.

In addition to water use and production, groundwater levels will be monitored and the amount of tailwater pumping monitored to determine reduction in agricultural runoff.

C.3 - Monitoring Review and Reporting

The District will form a special committee titled the Irrigation Efficiency Committee to assist with implementation of the program. The Irrigation Efficiency Committee will be comprised of District staff and representatives of participating growers. The Committee will meet twice annually during the proposed three-year project implementation period (or more if necessary), as well as during the 5-year monitoring following the project's implementation. During project implementation, the District staff will prepare the required quarterly update reports, and review these reports with the Irrigation Efficiency Committee.

Upon completion of the project, the District will monitor the performance of the project for a minimum of five years. The District staff will prepare an annual report for submittal to the State each January summarizing the operations of each cooperator's irrigation system and providing an estimate of annual water conservation savings. This annual

information will also be included in the Districts Annual Report of the Tulare Lake Bed Coordinated Groundwater Management Plan.

C.4 - Data Management

Data collected for monitoring purposes will be delivered to the District office for assimilation and evaluation. The data will be stored in a database or spreadsheet and summarized in a report that will be submitted to the DWR as part of the quarterly progress reports. Copies of the report will be provided to all participating growers and be available to other growers in the District upon request.

C.5 - Cost estimate for Monitoring

The monitoring costs are described in Section G of this application. The costs for preparing the annual monitoring reports for 5-years after project implementation will be borne by the District.

D – QUALIFICATIONS OF APPLICANT

D.1 - Resumes of project managers

The project manager for the grant will be Mark Gilkey, the District Assistant Manager. A resume for Mr. Gilkey is attached to this application in Appendix F. Mark has worked for the District for more than fifteen years, and is familiar with District operations, on-farm irrigation systems, and report preparation for submission to the State.

In addition, the District may solicit the services of Provost & Pritchard Engineering Group, Inc. (P&P) for assistance in implementing the program and performing annual evaluations. P&P is headquartered in Fresno, California and has one of the largest local multidisciplinary engineering and planning firms in the San Joaquin Valley, including over 100 employees and 29 registered engineers. P&P has significant capabilities in water resources planning and design and has a full understanding of agricultural water practices. Provost and Pritchard also has extensive experience working directly for water and irrigation districts in the San Joaquin Valley. P&P has successfully managed and provided consulting services for numerous DWR grant programs including; the Local Groundwater Assistance Fund (AB303), Proposition 204, and Proposition 13 programs.

The P&P project manager would be Laurence Kimura, who has considerable experience with on-farm irrigation systems and water district management. Mr. Kimura's resume is attached to this application in Appendix F.

D.2 – Cooperators

It is not anticipated that the proposed project will require the involvement of any external cooperators. Several other agencies have expressed support for the project in letters of support (see Appendix G), including the City or Corcoran, Kings County, and Angiola Water District. The District may contract for engineering services with Provost and Pritchard Engineering Group, Inc. The selected irrigation system suppliers and installers will perform system design, layout and construction.

Letters of commitment from growers that have expressed desire to participate in the program are included in Appendix A, and a District map showing the field locations, where they wish to install new irrigation systems is included as Attachment 4. The growers that have asked to participate in the program include:

- J. G. Boswell
- Westlake Farms
- Sandridge Farms
- Hansen Ranches
- Newton Farms
- Gilkey Enterprises

D.3 - Previous WUE Projects

The District has not participated in the Water Use Efficiency Program before, however the District has participated in several State organizations and submitted reporting information to the State for various projects as cited in Section A of this application.

In addition, the District may solicit the services of Provost & Pritchard Engineering Group, Inc. (P&P) for assistance in implementing the program and performing annual evaluations. P&P has successfully managed and provided consulting services for numerous DWR grant programs including the Water Use Efficiency Program Grants to Lost Hills Water District for canal lining projects. Other programs that P&P has successfully managed and provided engineering services for include the Local Groundwater Assistance Fund (AB303), Proposition 204, and Proposition 13 Groundwater Recharge, Storage feasibility studies and construction projects.

D.4 - Disadvantaged Communities

The project area is classified as a disadvantaged community according to the criteria provided in the Water Use Efficiency Grant Application. The criteria states that disadvantaged communities are those that have an annual median household income (MHI) that is less than 80 percent of the statewide MHI. Although the project area is within a disadvantaged community, the District is not requesting that the District cost share be waived. A 50% local cost share will be provided, as described in the Benefits and Costs section of this application.

The proposed project will be implemented in agricultural lands scattered throughout the District. An evaluation of household incomes was based on US Government Census tracts encompassing the District and the nearby City of Corcoran. Although the project will not be implemented within the City of Corcoran, some of the local growers and many of the local farm workers reside in Corcoran.

Attachment 6 illustrates the boundaries of the District and the local 2000 Census Tracts. The District is predominantly located within Census Tracts 16.01. A minor portion of the District is located outside of this tract, but this area comprises about 2 percent of the District and is in an unincorporated area with a population of probably less than 10 people. Therefore, this area was not considered in the analysis.

Attachment 7 shows the median household income for Tract 16.01 that encompasses most of the District, as well as Tracts 13, 14 and 15 that include the urban areas in the City of Corcoran. The census data states that the average Statewide MHI in 1999 was $47,493, so 80% of the Statewide MHI is $37,994. All of the tracts surrounding the District and City of Corcoran fall below this value with incomes ranging from 60-65% of the statewide MHI.

The aforementioned data was compiled in 1999 for the US Government 2000 census. There have been no significant changes in the local economy since 1999 that would raise the local income above 80% of the statewide average. The census data

represents the most recent, comprehensive evaluation of regional income. However, projected incomes for 2002 are available from the Bureau of Labor Statistics, Local Area Unemployment Statistics (see Attachment 7). These show that average incomes in Kings County in 2002 were 73% of the statewide average. Assuming the individual census tracts have similar changes in income from 1999 to 2002 as those projected for Kings County, then in 2002 the census tracts would still be classified as disadvantaged communities.

Attachment 6 - District Census Tract Map

Attachment 7 - Median Household Income Data

E – PUBLIC OUTREACH

E.1 - Past Public Outreach Efforts

In consideration of preparing an application, the District conducted conference calls with District Board members and growers to consider if an application for on-farm irrigation systems was desired. A meeting was held at the District office on December 27, 2004 to discuss the proposed project and solicit input from local farmers. All principal land growers in the District, except one, were interested in the project and attended the meeting.

On December 29, 2004, a letter was sent to all District Water Users, notifying them of the District's interest in preparing an application, and inviting all growers to participate in a discussion meeting. A copy of this letter is included in Appendix H. On January 4, 2005, a meeting was held at the District office with grower representatives and board members. A copy of the agenda for the meeting and the sign-in sheet from this meeting are included in Appendix H. The growers were educated on the Water Use Efficiency Grant program, as well as the costs and benefits of different irrigation systems. The topic was also discussed at the District's regular Board meeting on January 4, 2005. A Secretary's Certificate showing authorization to file an application for the project is included in Appendix H.

E.2 - Public Outreach Plan

The District will form an Irrigation Efficiency Committee to review the project performance and assist in the project implementation. This Committee will be comprised of District staff and participating grower representatives. In addition to the forming of this committee, the District will also make the following outreach efforts:

- Conduct a project kick-off meeting with all interested growers, District staff and DWR representatives
- Provide updates on the project status at monthly public board meetings
- Regularly notify all District water users of project status through direct mailing
- Notification to all growers in the District of project performance
- Make project status reports and monitoring assessments available to all growers
- Communicate project status and outcome to other agencies, including those listed as part of the Tulare Lake Bed Coordinated Groundwater Management Plan

E.3 - Letters of Support

The District has broad-based support for the proposed project from local landowners and other local agencies within the District and surrounding area, as evidenced by letters of support (included in Appendix G) from the following:

- Angiola Water District
- Kings County
- City of Corcoran

Growers in the District have also supported the project, as evidenced by the letters of commitment included in Appendix A.

E.4 - Third party impacts

The proposed project is not anticipated to have adverse impacts to any third parties. Positive third part impacts would include fostering economic development by generating employment opportunities for farm workers.

E.5 - Opposition

The surrounding public agencies and all of the growers in the District have been informed of the project. No one has voiced opposition to the project, but rather many have expressed support through letters of support and interest in participating in the project.

F – INNOVATION

Although on-farm drip systems are not particularly new or innovative statewide, conversion to drip and linear move systems is still relatively uncommon within the District. It is estimated that 90% of the lands in the District are still using flood irrigation methods. The monitoring and reporting efforts will help to document the success of this project. It is anticipated that the success of this project will encourage conversion of additional acreage within the District.

The project also facilitates more detailed on-farm measurement with the installation of metering devices at each of the new on-farm delivery systems. This is needed within the District as the growers have indicated a general understanding of water savings through conversion of on-farm drip and linear systems, but there is little documented information of water savings in the region.

The District growers plan to investigate several innovative and state-of-the-art irrigation methods with their new irrigation systems. A paper entitled '*Drip Irrigation of Row Crops: What is the State of the Art'*, that was prepared at Kansas State University, describes several innovative methods for using drip irrigation systems. District staff and the growers will research and review this report, as well as the most recent drip and linear move technology systems. The report and recent technology advances will presented to, and reviewed by, the Irrigation Efficiency Committee formed as part of this program.

One grower has proposed to use drip irrigation systems on cotton. Drip irrigation is typically used on high value crops and its use for growing cotton is relatively new and untested. This grower will therefore be investigating new and innovative methods to make drip irrigation feasible and economical for cotton and other lower value crops.

G – Benefits and Costs

G.1 - Economic Tables

The economic tables are included in Appendix B, along with the supporting calculations. In summary, the project proposes the conversion of approximately 1,300 acres to drip irrigation and approximately 600 acres to linear-move sprinklers at a cost of $2,104,158. The calculated benefit cost ratio for the project is 0.76.

Cost/benefit analyses were also performed independently for drip and linear-move systems. The analyses concluded that they have benefit/cost ratios of about 0.86 and 0.6, respectively. These individual analyses are not included in this application because the project would include a combination of both types of irrigation systems. The analyses were performed to verify that each type of irrigation system by itself is not locally cost effective (i.e. benefit/cost ratio < 1.0). With the grant funding, the local B/C ratio is greater than 1.0 and the benefits of the project can be realized. Without the funding, the project is not locally economically feasible. The cost of the project was compared to the avoided cost of handling the tailwater along with the projected increased crop yield. The handling of the tailwater, including facilities, pumping and maintenance is conservatively estimated at $10/acre foot. The increase in crop yield is detailed for each crop in the economic supporting tables in Appendix B. By comparison, groundwater pumping costs in the District are estimated to be $50/acre-foot, and State Water Project Dry Year water made available recently was more than $150/acre-foot.

Actual demand for irrigation system conversions in the District is 4,410 acres as shown on supporting tables in Appendix B. However, considering the total WUE grant funding available statewide, and the need to distribute funds to other agencies and geographical areas, the District has chosen to only propose the conversion of 1,900 acres.

G.2 - Capital Cost

A local supplier of irrigation systems, Agri-Valley Irrigation, Inc., located in Fresno, California, was contacted to get cost estimates for drip irrigation and linear-move sprinkler systems. Agri-Valley Irrigation is a major supplier of irrigation systems in the Central Valley and is considered a reliable source for reasonable cost estimates of new irrigation systems. If the project is implemented, the growers will also investigate costs from other local irrigation companies before making any purchases.

The sales representative at Agri-Valley Irrigation said that the costs for drip irrigation systems vary based on site conditions, current market prices and the equipment installed. However, a typical system that would serve 80-acres of row crops, such as tomatoes, would cost about $1,000/acre. This estimate would cover the design, furnishing of materials and equipment, and installation. The sales representative said that the system should last 20 years if properly maintained and does not normally convey water with corrosive properties.

CalWest Rain, an irrigation supply company in Kerman, California was also contacted and provided an estimated cost of $990/acre for new drip irrigation systems. Based on

the estimates provided by these two irrigation companies, a cost estimate of $1,000/acre was used.

The Agri-Valley Irrigation sales representative said that a ½-mile long linear-move sprinkler system would cost about $160,000, which would include delivery and assembly. This system could potentially irrigate up to 320 acres. However, to ensure proper management and adequate pressures the sales representative recommended that a ½-mile long system be used to irrigate no more than 160 acres. Thus the irrigation system would have a unit cost of $1,000/acre. Water is usually fed to the sprinkler system from a ditch constructed across the entire length of the irrigated area. The life expectancy of the system would be 20 years if it is properly maintained and does not normally convey water with corrosive properties.

Manufacturer's literature for typical drip and linear-move irrigation system are included in Appendices C and D**,** respectively.

Irrigation companies typically furnish the equipment as well as perform the design and installation for new irrigation systems. The estimated costs for drip and sprinkler irrigation systems presented herein are based on these melded costs. The irrigation companies could not provide an accurate, detailed breakdown of costs by each phase since they typically provide all these services together. Therefore, there are no costs included in the following items: Planning/Design/Engineering, Equipment Purchases/Rentals/ Rebates/Vouchers, Structures or Construction as these cost are included in Item D-Materials/Installation/Implementation.

Unquantified Costs

The applicant will also contribute to the project through some other costs that are not quantified in the cost estimate. These include the following:

1) Office supplies and mileage. The District will incur costs for office supplies and mileage to implement the project. However, due to the significant effort required to track and request reimbursement for these items, the District will not request reimbursement and will contribute the cost of these items.

2) Farmer administration. The farmers participating in the program will contribute significant time to attend informational meetings, coordinate the purchase and installation of the irrigation systems, test the systems, and receive training. The growers will willingly contribute this time to the project.

3) Permits and licenses. As mentioned above, the growers will contribute the time and fees to secure permits for electricity connections and installing new diesel pumps, if needed.

G.3 - O&M Costs

Operation and maintenance (O&M) costs will be borne by the growers installing the new irrigation systems.

Operating costs for drip-irrigation systems are discussed in '*Crop Yield Increases Required to Recover Irrigation Costs*' by J. Smith at the University of Florida. Operating costs, excluding retrieval and replacement of drip tape, were estimated to be $29.53/acre/year in June 2000. This estimate includes power, labor and maintenance costs. Adjusting the estimate to 2004 prices using the Consumer Price Index results in a cost of $29.53 x 189.3/172.2 = $32.46/acre/year.

A significant cost for drip irrigation systems that are used for row crops is the replacement of drip tape. In some cases the drip tape is placed on the surface, and then removed and replaced each year. However, surface drip tape often blows away from wind and is expensive to dispose. Consequently, many growers are now using buried drip tape due to its higher life expectancy. Buried drip tape only needs to be replaced every 5 years at a cost of $300/acre, according to a sales representative at Agri-Valley Irrigation in Fresno, California. In the economic analysis this cost is simplified to $60/acre/year, resulting in a total annual O&M cost of $60 + $32.46 = $92.46/acre/year.

Operating costs for linear-move sprinkler systems is discussed in '*Selecting a Sprinkler Irrigation System'*, prepared by Tom Scherer at the North Dakota State University Extension Service. Annual operating costs in September 1998 for a linear system that could irrigate a square 160-acre field were estimated to be $39.29/acre/year. This estimate covers power, labor and maintenance costs. Adjusting the cost to 2004 prices using the Consumer Price Index results in a cost of $39.29 x 189.3/163.0 = $45.63/acre/year.

G.4 - Bay-Delta Benefits

The project is located within the Bay-Delta System and will help achieve the Quantifiable Objectives stated in Section A of this application. The proposed project will result in the more efficient use of the District's Bay-Delta water supplies. Section G-5 provides details on the quantities of water conserved by implementing the project. In summary, the water conserved from using more efficient irrigation systems is estimated to be 618 acre-feet/year, and water savings during the 20-year life of the project are estimated to be 12,370 acre-feet. In addition, 'in-kind' water conservation from higher crop yields will conserve an additional 570 acre-feet/year. Therefore, the project will result in higher agricultural yields with no negative impact to the Bay-Delta.

In addition, the project will allow the District to stretch the use of their SWP water supply. This will benefit the Bay-Delta because they will have less demand for other water sources, including non-SWP Bay-Delta water supplies.

Some growers have stated that the new irrigation systems will allow them to plant higher value crops, such as tomatoes. Some high value crops have lower water demands than some crops that are now commonly grown in the District, such as alfalfa. If these lands are converted to less thirsty summer crops then the balance of water would be available for planting winter crops. This would result in a shift of more Bay-

Delta demand from the summer months, when Bay-Delta water supplies are critical, to winter months, when Bay-Delta supplies are less critical. Therefore, the project could result in a beneficial change in the timing of Bay-Delta water demands.

G.5 - Local Benefits

The proposed project will provide many benefits to the District, local growers, and local community. Specific local benefits are discussed below.

Water Conservation

The proposed project will result in water conservation as a result of higher irrigation efficiencies. Higher irrigation efficiencies will be achieved through a more uniform distribution of water, reduction in tailwater and soil surface evaporation, and a reduction in percolation to the perched groundwater. Calculations in Appendix B show that annual water savings are estimated to be 618 acre-feet, and water savings during the 20-year life of the project are estimated to be 12,370 acre-feet.

The project will also result in 'in-kind' water conservation through higher crop yields. Crop yields are estimated to increase by 10% if the irrigation systems are properly operated and managed. Assuming an average water application depth of 3 feet over the 1,900 acres to be converted, the 'in-kind' water savings would be 10% x 3 feet x 1,900 acres = 570 acre-feet/year. In other words, the project will increase agricultural production without the need for 570 additional acre-feet/year, which would have been necessary for the higher production if the new irrigation systems were not installed. In the economic analysis, the 'in-kind' water savings is accounted for in the higher profits resulting from the higher crop yields.

Indirect Groundwater Recharge

Due to the heavy clay soils in the Tulare Lake Basin, it is not possible to recharge the groundwater aquifers directly either through intentional over-irrigation or through the use of spreading basins, such as are used in some other areas. However, the substitution of surplus water that would otherwise be provided from water wells, is just as effective in achieving recharge of the groundwater aquifers. This practice is referred to as 'indirect recharge'. The higher irrigation efficiencies may result in less groundwater pumping to meet water demands and result in indirect recharge.

Higher Crop Yields

Literature reviewed for this application consistently cites a 10% increase in yield as being realistic with drip and sprinkler irrigation systems. The increased yield results from more uniform water distribution, more precise application of fertilizers using the irrigation system, and the ability to match crop evapotranspiration demands more accurately. The District and District growers do recognize that the higher yields are dependent on them properly operating and managing the new irrigation systems.

Appendix B includes a table showing estimated increases in profit after installing the new irrigation systems. The data was provided directly by local growers based on their

research and limited experience with drip and linear-move irrigation systems. Specifically, the table shows increases in profit per acre for each crop type.

Local Economy

The nearby City of Corcoran is almost entirely dependent on agriculture for employment. The proposed project will benefit the local economy through economic growth resulting from the higher crop yields. The local labor force from this economically disadvantaged community will thus benefit from greater job security. In addition, construction of the drip irrigation systems and miscellaneous facilities will require local labor and the purchase of supplies from local companies, thus injecting over $1 million into the local economy.

Other Sundry Benefits

Other benefits from the project include:

- Reduction in the need for reclamation crops
- Reduction in deep percolation of fertilizers to the perched water table
- Higher value crops can be planted with drip irrigation systems
- Reduction or elimination of tailwater pumping and silting problems associated with tailwater
- Reduction in groundwater pumping and air pollution associated with diesel well pumps
- Drip irrigation and sprinkler systems have a more uniform demand and thus a lower peak demand than basin flooding. This will reduce peak flows and provide greater flexibility in operating the District's distribution system.

G.6 - Matching Funds

Although the District qualifies under the disadvantaged community classification, the District will contribute a 50% local cost share for the project. The total cost of the project is estimated to be $2,104,158, therefore the local cost share will be $1,052,079. If grant money for the entire amount is not available, the District would appreciate consideration of partial funding. Since benefits and costs are considered on a per acre basis as shown in the economic tables, the total number of acres converted could be reduced, thereby reducing the total project cost, but keeping the same B/C ratio with a 50% local cost share.

The local and Bay-Delta benefits are described in Table C-5 in Appendix B. The project achieves direct local and direct Bay-Delta benefits. In addition, the project achieves Bay-Delta Quantifiable objectives and reduces demand for non-SWP Bay-Delta water. Therefore it was determined that the Bay-Delta benefits are at least equivalent to the local benefits, so a 50% local cost share was determined.

References

Boyle Engineering Corporation, *Demonstration of Emerging Irrigation Technologies, Final Report – Volume I*, October 1994.

CALFED Bay-Delta Program, *CALFED Water Use Efficiency, Draft Details of Quantifiable Objectives, Appendix A – Complete List of Quantifiable Objectives by Sub-Region*, December 2000.

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California Department of Water Resources – State Water Conservation Coalition, *Policy Statement on Efficient Water Management for Conservation by Agricultural Water Suppliers, Efficient Water Management Practices for Agricultural Water Suppliers, On-Farm Practices,* March 1994.

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Smith, J. L. and Zimit, D. J., *Crop Yield Increases Required to Recover Irrigation Costs*, *University of Florida EDIS Document FE 170*, June 2000.

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Tulare Lake Bed Coordinated Groundwater Management Committee, *Annual Report: 1996-1997*, January 1999.

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THE TABLES ARE FORMATTED WITH FORMULAS: FILL IN THE SHADED AREAS ONLY

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)	1st Year Costs	2nd Year Costs	3rd Year Costs	Total 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)
	Administration[1]										
	Salaries, wages	$6,000	$1,500	$1,500	$9,000	5	$9,450	$4,725	$4,725	20	0.0872
	Fringe benefits	$6,000	$1,500	$1,500	$9,000	5	$9,450	$4,725	$4,725	20	0.0872
	Supplies	$0	$0	$0	$0	5	$0	$0	$0	20	0.0872
	Equipment	$0	$0	$0	$0	5	$0	$0	$0	20	0.0872
	Consulting services	$4,400	$4,400	$2,200	$11,000	5	$11,550	$5,775	$5,775	20	0.0872
	Travel	$0	$0	$0	$0	5	$0	$0	$0	20	0.0872
	Other	$0	$0	$0	$0	5	$0	$0	$0	20	0.0872
(a)	Total Administration Costs	$16,400	$7,400	$5,200	$29,000		$30,450	$15,225	$15,225		
(b)	Planning/Design/Engineering	$6,000	$6,000	$5,600	$17,600	5	$18,480	$9,240	$9,240	20	0.0872
(c)	Equipment Purchases/Rentals/Rebates/Vouchers	$0	$0	$0	$0	5	$0	$0	$0	20	0.0872
(d)	Materials/Installation/Implementation	$380,000	$760,000	$760,000	$1,900,000	5	$1,995,000	$997,500	$997,500	20	0.0872
(e)	Implementation Verification	$2,000	$4,000	$4,160	$10,160	5	$10,668	$5,334	$5,334	20	0.0872
(f)	Project Legal/License Fees				$0	5	$0	$0	$0	20	0.0872
(g)	Structures	$0	$0	$0	$0	5	$0	$0	$0	20	0.0872
(h)	Land Purchase/Easement	$0	$0	$0	$0	5	$0	$0	$0	20	0.0872
(i)	Environmental Compliance/Mitigation/Enhancement	$2,000	$2,000	$1,600	$5,600	5	$5,880	$2,940	$2,940	20	0.0872
(j)	Construction	$0	$0	$0	$0	5	$0	$0	$0	20	0.0872
(k)	Other	$0	$0	$0	$0	5	$0	$0	$0	20	0.0872
(l)	Monitoring and Assessment	$5,000	$5,000	$9,200	$19,200	5	$20,160	$10,080	$10,080	20	0.0872
(m)	Report Preparation	$5,000	$5,000	$12,400	$22,400	5	$23,520	$11,760	$11,760	20	0.0872
(n)	**TOTAL**	**$416,400**	**$789,400**	**$798,160**	$2,003,960		$2,104,158	$1,052,079	$1,052,079		
(o)	Cost Share -Percentage							50	50		

1- excludes administration O&M.

Irrigation companies typically furnish the equipment as well as perform the design and installation for new irrigation systems. The estimated costs for drip and sprinkler irrigation systems presented herein are based on these melded costs. The irrigation companies could not provide an accurate, detailed breakdown of costs by each phase since they typically provide all these services together. Therefore, there are no costs included in Items b–Planning/Design/Engineering, c-Equipment Purchases/Rentals/ Rebates/Vouchers, g-Structures or j-Construction as these cost are all included in Item D-Materials/Installation/Implementation.

Annualized Costs $ (IX)
$824
$824
$0
$0
$1,007
$0
$0
$2,655
$1,611
$0
$173,964
$930
$0
$0
$0
$513
$0
$0
$1,758
$2,051
$183,483

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.

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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 (Tailwater Pumping)	618	Acre-feet	$6,184
(b) Avoided Energy Costs	0		$0
(c) Avoided Waste Water Treatment Costs	0		$0
(d) Avoided Labor Costs	0		$0
(e) Other (Value of Increased Yields)	$246,433	Net Profit	$246,433
(f) Total [(a) + (b) + (c) + (d) + (e)]			$252,617

Table C-7 Project Local Monetary Benefits and Project Costs

(a) Total Annual Monetary Benefits [(Table C-6, row (f)]		$252,617
(b) Total Annual Project Costs (Table C-3, column III)		$332,523

Table C-8 Applicant's Cost Share and Description

Applicant's cost share %: (from Table C-1, row o, column V)	**50**
Describe how the cost share (based on relative balance between Bay-Delta and Local Benefits) is derived. (See Section A-7 for description.)	
The local and Bay-Delta benefits are described in Table C-5 in Appendix B. The project achieves direct local and direct Bay-Delta benefits. In addition, the project achieves Bay-Delta Quantifiable objectives and reduces demand for non-SWP Bay-Delta water. Therefore it was determined that the Bay-Delta benefits are at least equivalent to the local benefits, so a 50% local cost share was determined.	

Local Benefit/Cost Ratio with No External Funding	**0.76**