

KERN COUNTY WATER AGENCY

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The Kern County Water Agency (Agency) was created in 1961 by a special act of the California State Legislature and serves as the local contracting entity for the State Water Project. The Agency participates in a wide scope of water management activities, including water quality, flood control and groundwater operations to preserve and enhance Kern County's water supply—the main ingredient for the well-being of an economy.

Over the years, the Agency has experienced extreme variations in water supply on both local and statewide fronts due to drought conditions, increasing environmental regulations in the Sacramento-San Joaquin Delta and ever-expanding demands on the state's water system. Making the best possible use of existing water supplies and protecting these supplies from external threats have become increasingly important. The Agency will continue to face these challenges by developing unique solutions and striving for excellence in technical, administrative, policy-making and financial arenas.

"The Agency is committed to the health and well-being of Kern County citizens . . ."

Kern County Water Agency | 18500 1st St., Hanford, CA 93230 | Phone: 805.434.1400

***KERN COUNTY WATER AGENCY
IMPROVEMENT DISTRICT NO. 4***

***CROSS VALLEY CANAL EXTENSION
LINING PROJECT – POOL NO. 8***

KERN COUNTY, CA

**APPLICATION SUBMITTED TO
UNITED STATES BUREAU OF RECLAMATION
FOR A
WaterSMART: WATER AND ENERGY EFFICIENCY GRANT
(FUNDING OPPORTUNITY ANNOUNCEMENT NO. R16-FOA-DO-004)**

JANUARY 2016



**KERN COUNTY WATER AGENCY – IMPROVEMENT DISTRICT No. 4
Project Manager: David Beard, ID4 Manager
PO Box 58, Bakersfield, CA 93302-0058**



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List of Abbreviation

AF	Acre-feet
BOD	basis of design
CASGEM	California State Groundwater Elevation Monitoring
CEQA	California Environmental Quality Act
CO2e	carbon dioxide equivalent
CVC	Cross Valley Canal
CVP	Central Valley Project
CWD	Cawelo Water District
DAC	disadvantaged community
DCP	Dust Control Plan
DWR	California Department of Water Resources
ID	Irrigation District
ID4	Improvement District No. 4
IRWMP	Integrated Regional Water Management Plan
IS	Initial Study
ISR	Indirect Source Review
KCWA	Kern County Water Agency
MND	mitigated negative declaration
NEPA	National Environmental Policy Act
P&P	Provost & Pritchard Consulting Group
PG&E	Pacific Gas & Electric
PS&E	plans, specifications and estimates
SJRRP	San Joaquin River Restoration Program
SJVAPCD	San Joaquin Valley Air Pollution Control District
SWP	State Water Project
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
USBR	United States Bureau of Reclamation



TECHNICAL PROPOSAL

1 . Executive Summary

(a) General Project Information

Proposal Name: Kern County Water Agency – Cross Valley Canal Extension Lining Project – Pool No. 8

Date: January 19, 2016

Applicant Name: Kern County Water Agency Improvement District No. 4

City, County, State: Bakersfield, Kern County, California

(b) Project Summary

The Cross Valley Canal Extension Lining Project – Pool No. 8 includes installation of 5,280 lineal feet of fiber-reinforced concrete lining on an existing earthen canal to reduce seepage and improve water reliability. The estimated reduction in seepage is 2,300 AF/year. In dry years the conserved water will be conveyed to the Henry C. Garnett Water Purification Plant for delivery to local water purveyors. In normal and wet years a volume of water equivalent to the conserved seepage will be diverted to the Kern River or groundwater banks for recharge and habitat enhancement. Conserved water may also be available for water management programs with other agencies in the Kern County region. Energy savings will be realized, and greenhouse gas emissions reduced, by eliminating the need to replace the lost water. No project components will be located on Federal facilities or lands. Work on the project has already begun including a California Environmental Quality Act Initial Study that was adopted in December 2015, lining alternatives study, hydraulic analysis, and conceptual design. The project will be completed in December 2018.



2 . Background Data

The Kern County Water Agency (KCWA or Agency) is a public California body politic and corporate formed pursuant to the provisions of Chapter 99 of the California Water Code at Appendix Section 99-1, et seq. The primary purpose for creating the Agency was to establish a single entity in Kern County to negotiate and administer a water supply contract with the State of California for its State Water Project (SWP).

Improvement District No. 4 (ID4) was formed by a resolution adopted by the KCWA Board of Directors on December 21, 1971 to provide a supplemental water supply for portions of the metropolitan Bakersfield area through the importation of SWP water. In order to have a means for transporting this supplemental water to ID4 from the California Aqueduct, ID4 participated in the Cross Valley Canal. Upon reaching ID4, the imported supply was to be delivered directly to recharge areas or to the Henry C. Garnett Water Purification Plant for treatment and delivery to four retail water purveyors in the Bakersfield area. KCWA is the appropriate entity to submit the Fiscal Year 2016 USBR WEEG grant application on behalf of its Improvement District No. 4.

(a) Location

KCWA is located in Kern County, California, primarily in the southern end of the San Joaquin Valley. **Figure 1** is a vicinity map showing the location of KCWA Member Units, ID4, and the proposed project.

(b) Water Supply Source and Water Supply System

ID4 provides a wholesale treated water supply to four retail customers: California Water Service Company, City of Bakersfield, East Niles Community Services District and North of the River Municipal Water District. ID4's customer connections are fully metered.

The annual surface water supply for ID4 includes a SWP Table A allocation of 77,000 AF of municipal and industrial (M&I) water and 5,946 AF of firm agricultural water supplies for a total of 82,946 AF. This allocation is subject to reduction from droughts and regulatory requirements for environmental protection. Unless additional facilities are constructed to stabilize/restore the SWP yield, Table A allocation reductions will occur more frequently in future years.

ID4 delivers surface water from its SWP allocation (either directly or by exchange with Kern River interests or Friant-Kern Canal interests) to the Henry C. Garnett Water Purification Plant for distribution to metropolitan Bakersfield water purveyors. Water is delivered through the Cross Valley Canal and Cross Valley Canal Extension (both owned by KCWA). ID4 also participates in groundwater banking projects along the Kern River Alluvial Fan (Kern Fan) that provide water to the Henry C. Garnett Water Purification Plant through direct delivery or by exchange in dry years. ID4 maintains records of water availability, water usage, water deliveries and water losses. A summary of operations is prepared annually and included in the Improvement District No. 4 Report on Water Conditions (see <http://www.kcwa.com/Documents/ROWC2014.pdf>).

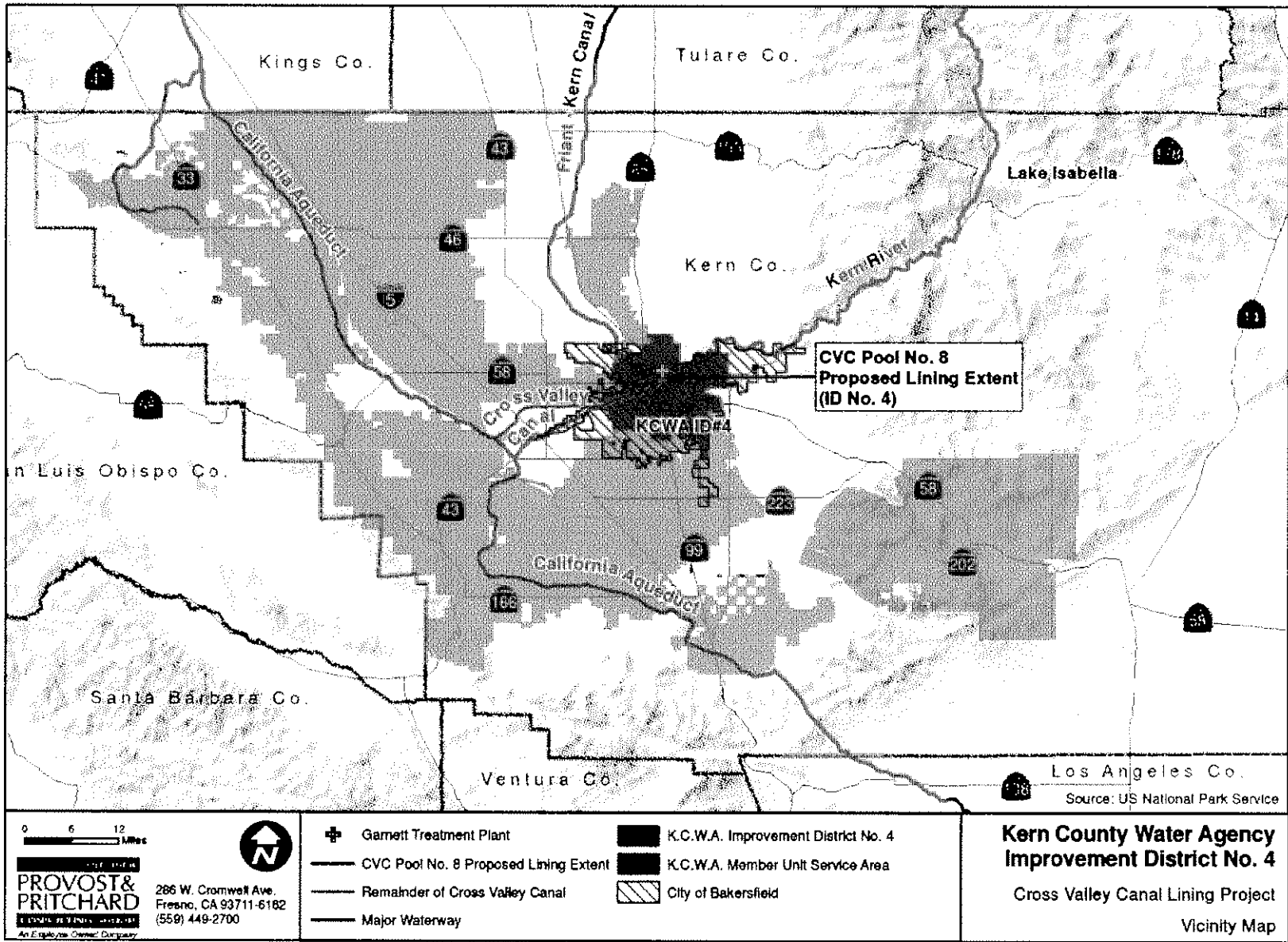


Figure 1 – Cross Valley Canal Lining Project – Vicinity Map

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**Kern County Water Agency
 Improvement District No. 4**
 Cross Valley Canal Lining Project
 Vicinity Map





ID4 deliveries water to retail agencies that have approximately 394,000 connections.

(c) Land Use

ID4 is primarily comprised of urban lands. In 2015, land use in ID4 included: Municipal and Industrial: 59,019 acres, Agriculture: 5,199 acres, Undeveloped: 5,182 acres, and Total Area: 65,400 acres

(d) Energy Efficiency

ID4 currently uses power from the Pacific Gas & Electric Company. Energy is needed to recover canal seepage through operation of well pumps and four of the CVC pumping plants. **Attachment 5** documents energy intensity for well pumps utilized by ID4. Energy intensity is 'the energy consumption per unit volume of water through one or several consecutive segments of the water use cycle'. ID4 also documents the energy intensity at their pumping plants. This energy intensity data is useful for planning energy conservation projects.

(e) Past Working Relationships with the United States Bureau of Reclamation

In the past, KCWA has had the following working relationships with Reclamation:

1. KCWA frequently obtains contracts for San Joaquin River Floodwater (called Section 215 water) from the USBR. These are temporary annual contracts. This water is an important supplementary supply for ID4.
2. KCWA frequently performs water exchanges and transfers with Reclamation water contractors that receive either Cross Valley Canal Central Valley Project (CVP) water or Friant Division CVP water. These agencies include Kern-Tulare Water District, Pixley Irrigation District, Arvin-Edison Water Storage District, Delano-Earlimart Irrigation District and others.
3. KCWA frequently uses the interconnection between the Friant-Kern Canal and the Cross Valley Canal (CVC) to take delivery of CVP water (Section 215 water or water transfers). This facility allows a transfer point between State and Federal facilities. ID4 directly delivers the water to the Henry C. Garnett Water Purification Plant, recharges the water in the Kern River channel, or delivers it to one of several groundwater banking projects in Kern County.

3. Technical Project Description

Overview:

The proposed project includes lining approximately 5,280 lineal feet of earthen canal in Pool No. 8 of the CVC Extension with fiber-reinforced concrete. The lining will reduce seepage, increase water reliability, reduce maintenance efforts and reduce the potential for canal breaches. **Figure 1** shows the project location, ID4 boundaries and the KCWA Member Unit service areas. **Figure 2** provides a more detailed map of the project location, including the specific alignment of CVC Pool No. 8 that will be lined (5,280 feet of 6,477 total feet of Pool No. 8 are proposed to be lined.)



The CVC Extension was designed and built as an earth canal in 1975 to convey water to the Henry C. Garnett Water Purification Plant. The CVC Extension is composed of two pools, Pool 7 and Pool No. 8, that are served by lift pumps. Both pools were constructed in fill areas and cut sections. This application proposes to make improvements to Pool No. 8; Pool 7 is being lined using other funding.

The CVC Extension is located in an area with sandy soils, with high percolation rates, resulting in high seepage losses (see **Attachment 1**). Lining the canal will reduce water losses due to seepage. These losses are especially detrimental in dry years when water supplies are limited. The earthen canal is also experiencing erosion, canal bank sloughing and aquatic weed growth (see Photographs 1 and 2). These problems can be remedied with concrete canal lining.

Project Benefits

Major project benefits will include:

- Conservation of water through reduction in canal seepage
- Elimination of the need to recover seeped water through wells resulting in energy and cost savings
- Reduction in greenhouse gas emissions through energy savings
- Improved water reliability due to lower potential for canal breaches and higher surface water deliveries in dry years
- Conserved water and improved conveyance facility to facilitate water management programs
- Increased diversions into the Kern River channel and groundwater banks in normal and wet years for groundwater recharge and habitat enhancement

Project beneficiaries will be ID4 and ID4 water purveyors. The project will conserve water and reduce the cost of water deliveries. The region covering the Kern Groundwater sub-basin will also benefit from reduced groundwater demands in an overdrafted groundwater basin. Property owners adjacent to the canal will also benefit from a lower risk of canal breaching and flooding. Lastly, ID4 will have additional flexibility to pursue beneficial water management programs with other agencies.

Urgency of Project:

The project is urgently needed for the following reasons:

- Reduce canal seepage and preserve water supplies, especially during droughts
- Prevent the need to pump groundwater at ID4 wells to compensate for seepage losses, and help reduce groundwater overdraft consistent with the provisions of the California Sustainable Groundwater Management Act (SGMA)
- Improve the reliability of water supplies by guaranteeing higher deliveries through a reduction in seepage losses

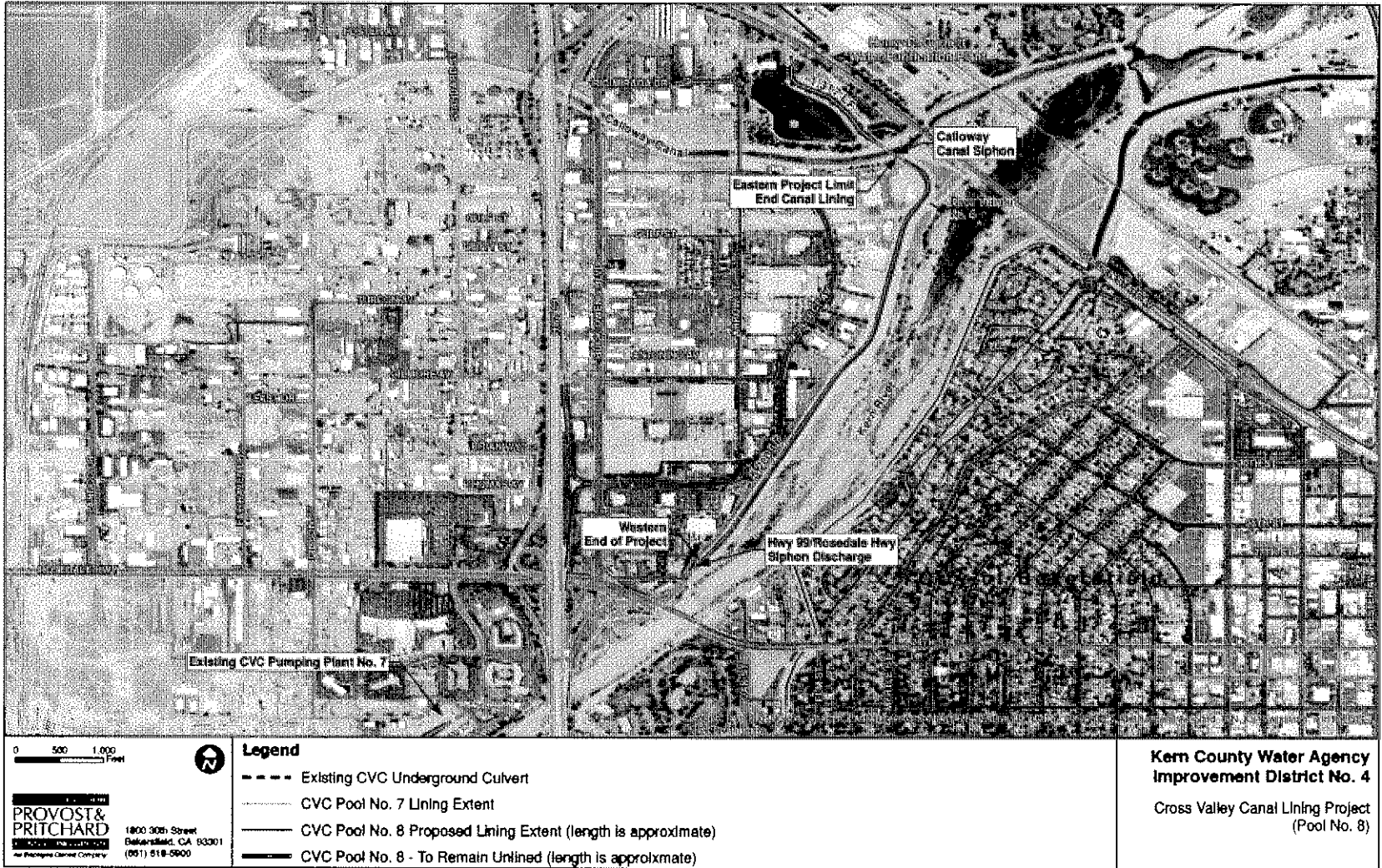


Figure 2 – Cross Valley Canal Lining Project – Pool No. 8



Site Photographs:



Photograph 1 - Cross Valley Canal Extension



Photograph 2 – Canal Bank Erosion and Aquatic Weed Growth in Existing Earth Canal



Proposed Facilities:

The proposed facilities include 4-inch thick fiber reinforced concrete lining on 5,280 lineal feet of existing earthen canal. Ancillary project features include safety ladders, safety booms, fencing and improvements to access roads. Preliminary design drawings are included as **Attachment 2**. The USBR prepared a report in November 2002 entitled “*Canal-Lining Demonstration Project Year 10 Final Report*.” The report states that “concrete and earth canal linings have a typical service life of about 50 years” (see **Attachment 4**).

No Action

The “Without-project” conditions are assumed to be similar to historical conditions for the last 12 years of operations (2004 to 2015). Seepage would continue every year with total losses averaging 2,300 AF/year. In addition, additional energy would be used, and greenhouse gas emissions would occur to acquire the lost water from other sources.

Scope of Work

Work Completed to Date

Work completed to date includes a feasibility level analysis consisting of an evaluation of canal lining alternatives, preliminary design drawings, a channel analysis memorandum, a preliminary cost estimate, and an adopted CEQA Initial Study.

Alternative lining materials for the CVC Extension were investigated and several water districts were contacted to obtain information on their experience with different lining options. Lining options considered included different types of geomembrane liner, concrete cloth, concrete liner and a fiber-reinforced concrete. A fiber-reinforced concrete liner was selected for the many benefits it offers including:

- Concrete liners have a 50-year life expectancy (as opposed to 25 years for geomembranes).
- Geomembrane liners pose safety hazards due to their slippery surface.
- Concrete channels can be cleaned with little risk of damaging the lining materials.
- The KCWA has practical experience with concrete liners.
- Fiber reinforced concrete contains fibers (typically polypropylene) that help to control cracking due to plastic shrinkage and drying shrinkage, and also help reduce the permeability of concrete.
- In a report from November 2002 entitled *Canal-Lining Demonstration Project Year 10 Final Report*, the USBR stated that concrete lining has ‘*excellent durability*’, that ‘*Maintenance requirements are relatively low for concrete (lining)*’, and that exposed geomembranes require about twice the maintenance as concrete lining. They also looked at several concrete lining projects and found they had attractive benefit-cost ratios ranging from 3 to 3.5.



Preliminary construction plans (approximate design level of 15%) have been prepared for the project that shows the limits of construction, a proposed cross section, and construction details (see **Attachment 2**).

A channel analysis memorandum (see **Attachment 3**) documents a hydraulic analysis to optimize the canal configuration, and provides design details for the project.

A CEQA Initial Study was completed and adopted with a Mitigated Negative Declaration by KCWA on December 16, 2015.

Project Tasks

Task 1 - Administration: Tasks include meetings with USBR, implementing the contracts and agreements, administration of the overall grant, administration of project, coordination and correspondence with sub-consultants, and preparation of quarterly invoices.

Deliverables: Meeting minutes, Quarterly Invoices

Task Status: 0% - Work has not begun on this task.

Task 2 - Reporting: This task includes preparation of semi-annual reports during the project, which will document progress to date, and discuss any issues related to budget or schedule. This task also includes a final performance/progress report and a Draft and Final Project Report.

Deliverables: Semi-Annual Progress Reports, Draft Report and Final Report.

Task Status: 0% - Work has not begun on the above tasks.

Task 3 – Land Purchase/Easement: KCWA is currently in the process of identifying and obtaining temporary construction easements adjacent to the CVC Pool No. 8 right-of-way for the installation of the canal lining. These easements are expected to cover approximately 2 acres.

Deliverables: Easement documents

Task Status: 10% - District is obtaining easement information and coordinating with landowners.

Task 4 - Assessment and Evaluation: Review the operational characteristics of the CVC, including pipelines used for siphons, canal turnouts/points of delivery and associated facilities in CVC Pool No. 8. Perform a hydraulic analysis to optimize the new channel cross-section to convey design flow, and to quantify the dynamic hydraulic impacts at CVC Pumping Plant No. 8 and other facilities within CVC Pool No. 8 with the new canal cross-section in place. Prepare preliminary construction plans, initial project cost estimates and schedule.

Deliverables: 15% Construction Plans, channel analysis memorandum and preliminary cost estimate.

Task Status: 100% - Engineering consultant has completed the feasibility evaluation



Task 5 - Final Design:

Subtask 5.1 – Survey and Utility Investigation: KCWA consultant will conduct topographic and boundary surveys along the CVC Pool No. 8 canal. Existing utilities will be identified and incorporated into plan and profile drawings. Review right-of-ways and perform required title searches.

Subtask 5.2 – Geotechnical Investigation: A licensed geotechnical firm will perform a comprehensive geotechnical review of the canal alignment including reaches adjacent to existing siphon structures and turnouts for the design of the project. Work will include field investigations (drilling), laboratory soils testing and a geotechnical report.

Subtask 5.3 – Project Design: A basis of design (BOD) memorandum will be prepared for the project that documents the assumptions, design criteria, and proposed design layouts. After approval of the BOD, the Plans, Specifications and Cost Estimates (PS&E) will be prepared for the canal lining. The PS&E will be prepared at 50%, 90%, and 100% design levels for review by KCWA staff. QA/QC reviews will be conducted at each interval by a Principal level engineer. At completion of this subtask, the PS&E will be incorporated into contract documents for bid by Contractors.

Deliverables: BOD memorandum, 50%, 90%, and 100% PS&E, contract documents

Task Status: 0% - Work has not begun on the above tasks

Task 6 - Environmental Documentation: This task includes complying with both the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA). Preparation of CEQA/NEPA compliance documents including a CEQA Initial Study and NEPA Environmental Assessment, biological review, and cultural resources review. Tribal notification will be included in the process.

Deliverables: Adopted CEQA and NEPA document and all notices

Task Status: 75% - Biological and cultural resources studies have been completed for CEQA compliance, but may need additional work for NEPA compliance. The CEQA Initial Study is completed and was adopted with a Mitigated Negative Declaration in December 2015.

Task 7 - Permitting: This task involves applying for and securing the appropriate local and state permits for the project. The KCWA owns and operates the canal and does not need special permits to modify the canal. No major regulatory hurdles are expected to delay completion of the project.

Subtask 7.1 – SWPPP: A Storm Water Pollution Prevention Plan (SWPPP) will be prepared in accordance with the State Water Resources Control Board (SWRCB) requirements and uploaded to their website.

Subtask 7.2 – DCP: A Dust Control Plan (DCP) will be prepared in accordance with the San Joaquin Valley Air Pollution Control District (SJVAPCD) requirements.

Deliverables: SWPPP, DCP

Task Status: 0% - Work has not begun.



Task 8 - Construction Contracting: Issue contract documents for a minimum 30-day public noticed bid. Assist during bidding process including job walks, bid opening and bid review. Prepare addendums, if necessary, prior to contract bid date. Select lowest responsible qualified bidder. Award contract.

Deliverables: Advertisement for bids; pre-bid contractors meeting notes; evaluation of bids; contract award.

Task Status: 0% - Work has not begun.

Task 9 - Construction:

Subtask 9.1: Mobilization and Site Preparation: CVC Pool No. 8 canal alignment will be staked by surveyors for construction. Contractors will locate existing utilities (USA) and mobilize equipment.

Subtask 9.2: Construction: Canal lining will be installed in accordance with the Plans and Specifications.

Subtask 9.3: Performance Testing & Demobilization: Canal lining shall be operated in accordance with the technical documents. Training will be conducted for the operators to ensure canal operation meets KCWA operational requirements.

Deliverables: Meeting notes for canal operations training

Task Status: 0% - Work has not begun.

Task 10 - Environmental Compliance/Mitigation/Enhancement: Prepare field reviews and compliance documentation in accordance with the SWPPP, DCP, and CEQA/NEPA mitigation measures.

Deliverables: Field review reports and compliance documentation for the SWPPP, DCP, CEQA and NEPA.

Task Status: 0% - Work has not begun.

Task 11 - Construction Administration: Work consists of processing contractor requests for payment, material submittal reviews, holding a pre-construction meeting, construction monitoring, soil compaction and materials testing, responding to requests for information (RFIs), issuing change orders as needed, preparation of project record drawings, and project closeout.

Deliverables: preconstruction and progress meeting minutes, construction photographs, change orders, pay requests, record drawings, certificate of project completion

Task Status: 0% - Work has not begun.

Task 12 – Public Outreach: Public outreach will be performed to educate the public on the grant award, the construction schedule and the project benefits. Public outreach will be accomplished through the following: 1) A press release will be posted on the KCWA website and submitted to local newspapers; 2) Adjacent landowners will be notified of the project; 3) Signs will be posted on the construction site explaining the project; 4) The grant award and project



will be announced at a KCWA Board of Directors meeting and at a Kern Regional Water Management Group meeting. A CVC Extension Lining ad hoc committee was also formed at KCWA to obtain input from multiple parties on the project.

Deliverables: Press release, notification letter to adjacent landowners, Board of Directors meeting minutes.

Task Status: 0% - Work has not begun.

Task 13 – Performance Measures Validation. This task includes validating the project performance through monitoring efforts. This will be performed for several months after project completion and the results will be reported to USBR. Monitoring will likely continue after the contract with USBR is over. Performance measures validation will be performed through monitoring:

- Reduction in seepage
- Reduction in energy costs from reduced seepage
- Increase in water marketing
- Increased Kern River Flows

Deliverables: Project monitoring data

Task Status: 0% - Work has not begun.

4 . Performance Measures

See Subcriterion 3 of Part (f) Implementation and Results for specific information on performance measures.

5 . Evaluation Criteria

(a) *Water Conservation (28 points)*

Subcriterion No. A.1 – Quantifiable Water Savings: Describe the amount of water saved . (24 points)

Water Supply Benefits

The project consists of the lining 5,280 lineal feet of earthen canal in the CVC Extension Pool No. 8, substantially reducing seepage in a major conveyance canal. Pool No. 8 is 6,477 feet long, but only the first 5,280 feet, from the upstream end to the Calloway Canal Siphon, will be lined. The water savings are documented in the seepage calculations table (see **Attachment 1**), which is discussed below.

Summary of CVC Pool No. 8 Flows and Seepage

Existing baseline water associated with the project includes:



Average water deliveries in CVC Pool No. 8 = 52,550 AF/year
Average seepage losses in CVC Pool No. 8 area to be lined = 2,920 AF/year
Net seepage losses after considering evaporation and precipitation = 2,880 AF/year
Estimated water savings from lining (assumed 80% reduction) = 2,300 AF/year (or 2,300 AF/mile)

Methodology for Estimating Water Savings

Seepage is directly measured as the difference in pumping at Pumping Plant No. 7 (at the upstream end of Pool No. 8) and deliveries to the Henry C. Garnett Water Purification Plant, while also taking into account five different diversions along Pool No. 8. Seepage in the area to be lined was estimated by prorating the total Pool No. 8 seepage based on the percentage of Pool No. 8 to be lined (about 82% of Pool No. 8 will be lined). Evaporation from the canal and direct precipitation onto the canal were also considered in the analysis. It should be noted that ID4 incurs all of the seepage losses in the CVC Extension.

These seepage losses are based on long-term data from 2004 to 2015. With a new concrete liner, the seepage is estimated to be reduced by 80%. This factor is based on a 10-year USBR study on canal linings which included seepage reduction estimates. An excerpt of this study is included as **Attachment 4**. The data collected by USBR showed an effectiveness ranging from 60 to 90% with a long-term effectiveness of about 70%. With a new concrete liner and the utilization of fiber reinforcement, cracking would be reduced, improving water tightness. A factor of 80% was used in this analysis and has been applied in the summary table.

Canal seepage reduces the volume of water that reaches the Henry C. Garnett Water Purification Plant and distribution system. The water also percolates in an area approximately five miles away from ID4 wells. The seepage could also be lost to confining layers, flow out of the area, or be pumped by others. All of the water lost to seepage is from the SWP, either delivered directly or by exchange through the CVC, or delivered to groundwater banks, stored, and later delivered to ID4. Reducing seepage will make more efficient and effective use of SWP water. In normal and wet years, beneficial recharge will occur in targeted areas using the conserved water, while in dry/drought years, less groundwater extractions occur, benefiting the Kern Groundwater Sub-Basin. In summary, the project will conserve water, increase water reliability and improve drought preparedness.

Life of Project

The USBR prepared a report in November 2002 entitled “Canal-Lining Demonstration Project Year 10 Final Report.” The report states that “concrete and earth canal linings have a typical service life of about 50 years” (see **Attachment 4** for more details).

Subcriterion No. A.2 – Percentage of Total Supply (4 points)

The water savings from this program is estimated to be 2,300 AF/year, which will amount to about 4.0% of the district’s total average water deliveries of 68,200 AF/year.



(b) Energy-Water Nexus (16 points)

Subcriterion B.1 - Implementing Renewable Energy Projects Related to Water Management and Delivery (16 points)

The project does not include new energy systems. However, the energy savings described below will reduce emissions of pollutants and greenhouse gases from natural gas fired power plants that provide electricity to the area.

Subcriterion B.2 - Increasing Energy Efficiency in Water Management (4 points)

Potential energy benefits can be divided into two categories:

1. Energy embedded in the water saved for the project
2. Energy embedded in the imported water for its supply and conveyance to the system

Energy embedded in water saved for the project includes a reduction in groundwater well pumping. The project conserves energy by eliminating seepage and subsequent groundwater pumping to recover the seeped water. ID4 wells must be operated to augment the seepage losses. Energy embedded in water saved also includes energy use on CVC Extension pump stations before the water is lost to seepage.

Energy is embedded in the imported water supply, both from the SWP and groundwater banks. Energy is utilized to pump and convey this water to ID4. However, the project will not eliminate the need for this energy usage, so this is not claimed as a benefit.

Energy intensity is 'the energy consumption per unit volume of water through one or several consecutive segments of the water use cycle'. Energy is needed to recover seeped water through operation of well pumps and four of the CVC pumping plants. **Attachment 5** documents energy use for well pumps utilized by ID4. The average energy use is approximately 260 kWh/AF for a pump operating with 200 feet of total dynamic head (which is the long-term approximate average in the Kern Fan). Energy use at the CVC pumping plants is approximately 21 kWh/AF per plant, based on District records. Each pumping plant has a similar hydraulic operating condition.

The resultant **annual average energy reduction** is estimated as:

$$(260 \text{ kWh} + 4 \times 21 \text{ kWh})/\text{AF} \times 2,300 \text{ AF} = (344 \text{ kWh}/\text{AF}) \times 2,300 \text{ AF} = 791,200 \text{ kWh}$$

The resultant **total lifetime energy reduction** is estimated as:

$$791,200 \text{ kWh}/\text{year} \times 50 \text{ years} = 39,560,000 \text{ kWh}$$



Greenhouse Gas Emission Reductions

The effects of climate change will likely make imported water supplies less reliable in the future. It will reduce the natural storage and re-regulation of local surface water supplies by lessening the snowpack, increasing the amount of precipitation that comes in the form of rainfall, and likely reduce the overall volume of precipitation falling on the region. The project will help to mitigate this impact by reducing greenhouse gas (GHG) emissions.

The reduction in energy required to pump water that has seeped from the canal will reduce GHG emissions. The local electrical utility, Pacific, Gas & Electric, could not provide a 'local total-output emission rate' and only provided general information on GHG emissions when local data was requested.

A January 2013 memorandum from the San Joaquin Valley Unified Air Pollution Control District (which covers the project location and project benefit area) discussed GHG emissions from electrical use. The memo states:

"each electricity supplier may purchase and provide electricity from a variety of power plants that can vary from day to day and year to year. Because of this variability, it would be impossible to establish a GHG emission factor for each electricity supplier".

However, the memo does provide an emission factor of 313 kg CO₂e/MWh (or 0.313 kg CO₂e/kWh) for use in estimating GHG emissions in the geographic area covered by the Air Pollution Control District, and states that this value is 'accepted as a reasonable estimate'. This value was therefore used in the GHG reduction calculations. This results in the following GHG emission reductions:

Annual GHG emission reductions = 791,200 kWh/year x 0.313 kg CO₂e/kWh = **247,600 kg CO₂e/year**

Project Lifetime GHG emission reductions = 39,560,000 kWh x 0.313 kg CO₂e/kWh = **12,382,000 kg CO₂e**

(c) Benefits to Endangered Species (12 points)

1. What is the relationship of the species to water supply?

ID4's primary water supply comes from a SWP contract with water originating in the Sacramento-San Joaquin Delta (Delta). The Delta has numerous endangered species issues that have resulted in curtailment of water supplies to contractors. The proposed project will conserve SWP water.

In normal to wet years, water that would have seeped in the CVC Extension will be used for recharge in more suitable areas, including the Kern River Corridor and multiple groundwater banking facilities. This will provide incidental habitat enhancement, including intermittent wetland habitat.



2. What is the extent to which the proposed project would reduce the likelihood of listing or would otherwise improve the status of the species?

By increasing the volume of water in the Kern River channel or local groundwater spreading grounds, wetland habitat will be improved. This habitat is especially beneficial as it provides wetlands for migratory birds along the Pacific Flyway in addition to benefiting other wildlife. Typically, in most years, there is no water in the Kern River channel at the River Turnout No. 4 (and further downstream). The project is expected to increase the frequency and length of time that the river channel is saturated. Normal and wet years occur approximately 50% of the time in the area, so the water delivered, on average, to these areas would be 50% x 2,300 AF/year = 1,150 AF/year.

3. How is the species adversely affected by a Reclamation project?

ID4 relies heavily on their SWP water supply. SWP pumps in the Delta are considered by some to adversely alter Bay-Delta water conditions for fish and their habitat and/or cause predation or entrainment near or in the pumps' fish screens under certain water conditions. This has been the subject of many studies. The species are subject to recovery and/or conservation plans under the Endangered Species Act. The proposed project will contribute to improving the status of the listed fish species by conserving Delta water. The US Fish & Wildlife Service has listed 54 different endangered or threatened species that '*Occur in or may be affected by Projects in the Sacramento/San Joaquin Delta*' (the list is not attached due to space limitations).

4. Is the species subject to a recovery plan or conservation plan under the Endangered Species Act? Yes

5. What is the extent to which the proposed project would reduce the likelihood of listing or would otherwise improve the status of the species?

Conservation of SWP water will occur every year, and increased water delivery to the Kern River or groundwater banks will occur about every other year. Cumulatively, these efforts should have a positive impact on endangered species. The CEQA Initial Study analysis also concluded that the project would have no adverse impacts on endangered species.

(d) Water Marketing (12 points)

1. Estimated amount of water to be marketed.

The volume of water to be marketed through water management programs would vary, but could include the total amount conserved, which is estimated to be 2,300 AF/year. The seepage reduction will represent a potential water supply and therefore could be available for marketing.



2. A detailed description of the mechanism through which water will be marketed (e.g., individual sale, contribution to an existing market, the creation of a new water market, or construction of a recharge facility).

The proposed project will reduce canal seepage and create a potential water supply. This will provide several opportunities for water management programs (exchanges and transfers), including:

- a) ID4 participates in five different groundwater banking projects including: Kern Water Bank, the Pioneer Project, the City of Bakersfield’s 2800 Acre Recharge Facility, Rosedale-Rio Bravo Water Storage District, and ID4 Joint Use Groundwater Recovery Project area. The project would reduce its need to access banked water supplies. This excess capacity could be marketed to other local districts through water management programs.
- b) ID4 is a wholesale provider and they incur all of the losses from seepage. Reducing seepage losses will allow them to deliver additional water directly to their retail customers, especially in dry years when the retail customers face shortages. ID4 treated water deliveries are dependent on groundwater banking capacity and surface water entitlements. Shortages due to reduced surface water supplies (during droughts or limited Delta pumping to protect fish) or reduced banking project capacity are prorated among ID4 customers. This project would help reduce the risk of future shortages to ID4 customers, and allow ID4 to deliver more water to them.

3. Number of users, types of water use, etc. in the water market

ID4 has unique access to numerous conveyance facilities and water supplies that provide significant flexibility in delivering, transferring and exchanging water supplies. These include the Friant-Kern Canal (Friant CVP water), CVC (SWP water), California Aqueduct, numerous groundwater banks in Kern County, and various local interconnections. In 2015, ID4 obtained SWP by exchange with Kern Delta Water District, Nickel Rio Bravo Wells and North Kern Water Storage District. Transfers and exchanges with many other agencies are feasible using the Friant-Kern Canal, CVC, California Aqueduct and Calloway Canal. These partners include agricultural and urban water agencies. **Figure 3** is a schematic diagram showing the numerous conveyance facilities in the area, with the Henry C. Garnett Water Purification Plant on the eastern edge of the figure.

Exchanges of SWP water for Kern River and Friant-Kern Canal water will typically improve the quality of raw water delivered to the Henry C. Garnett Water Purification Plant and water spread for replenishment of the groundwater aquifer. Also, there are savings to ID4 in reduced CVC pumping costs when the exchange entity can accept return of ID4 water in the California Aqueduct, or at locations west of the Henry C. Garnett Water Purification Plant.

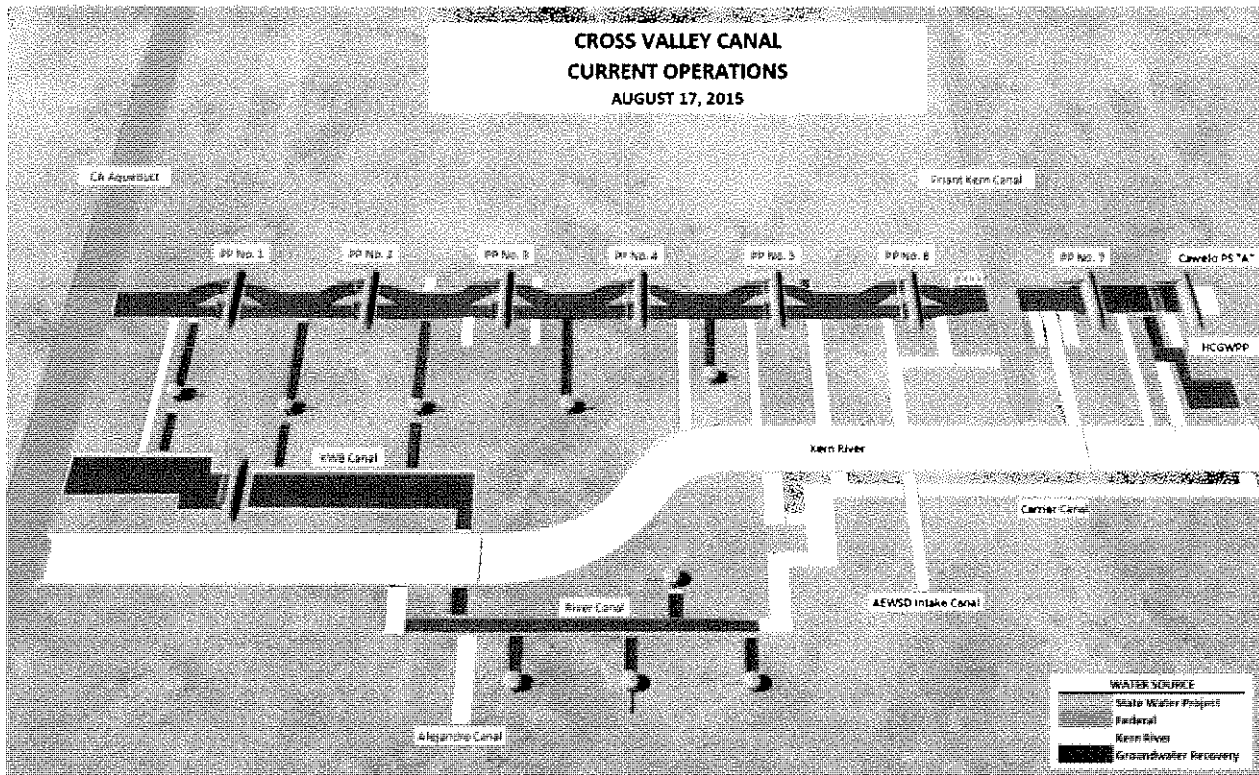


Figure 3 – Cross Valley Canal Schematic

4. A description of any applicable legal issues pertaining to water marketing or banking (e.g., restrictions to marketing under reclamation law or contracts, individual project authorities, or State water laws).

ID4 has extensive experience with water marketing, transfers and exchanges and the relevant legal issues. Water would likely be marketed to other water agencies in Kern County, to help benefit the local and regional water supplies. Exchanges and transfers within the broader area covered by the KCWA have limited legal issues, and have been performed many times in the past. ID4 will consult legal staff on pertinent legal issues before any water marketing efforts.

5. Estimated duration of water transfers or market

Project water marketing would persist as long as the reduction in canal seepage is realized. The project is expected to have a life expectancy of 50-years.

(e) Other Contributions to Water Supply Sustainability (14 points)

Subcriterion E.1 – Addressing Adaptation Strategies in a WaterSMART Basin Study (14 points)

The proposed project area falls under the Sacramento-San Joaquin Rivers WaterSMART Basin



Study. According to the USBR website this study is still in progress.

Subcriterion E.2 – Expediting Future On-Farm Irrigation Improvements (14 points)

ID4 does not provide an agricultural water supply. However, the proposed project will also benefit Cawelo Water District (CWD), an agricultural water district, which conveys water in CVC Pool No. 8. This will provide a more reliable water supply for CWD. Lack of reliable water supplies often discourages growers from installing drip and micro-spray irrigation systems. As a result, the project could help to expedite on-farm irrigation improvements.

Subcriterion E.3 – Other Water Sustainability Benefits (14 points)

1. Will the project make water available to alleviate water supply shortages resulting from drought?

The project will conserve water by reducing seepage losses. The project will ensure that a larger volume of surface water is delivered in all hydrologic year types. This will be especially valuable in drought years when surface water supplies are limited.

2. Explain in detail the existing or recent drought conditions in the project area. Describe the impacts that are occurring now or are expected to occur as a result of drought conditions.

On January 14, 2014 Kern County issued a notice “Proclaiming a State of Local Emergency in Kern County Caused by a Severe Water Shortage and Requesting Immediate State and Federal Assistance”. This area is still experiencing drought conditions as of January 2016.

In 2014, the final SWP Table A water allocation was only 5 percent and the Kern River runoff was 24 percent of normal. In 2014, combined Kern area surface-water supplies from the Kern River, SWP, and CVP yielded approximately 200,000 AF (versus an average of 2,000,000 AF). As a result, the Kern Region saw record groundwater extractions from the Kern Groundwater Subbasin.

With dropping groundwater levels, energy costs for pumping have increased substantially compared to prior years, some wells have failed, replacement wells drilled, wells and/or pumps had to be deepened, and there is potential for the return of inelastic land surface subsidence (which had been largely arrested by water supply, recharge, and banking projects). **Figure 4** is a long-term hydrograph of groundwater levels at a well in ID4.

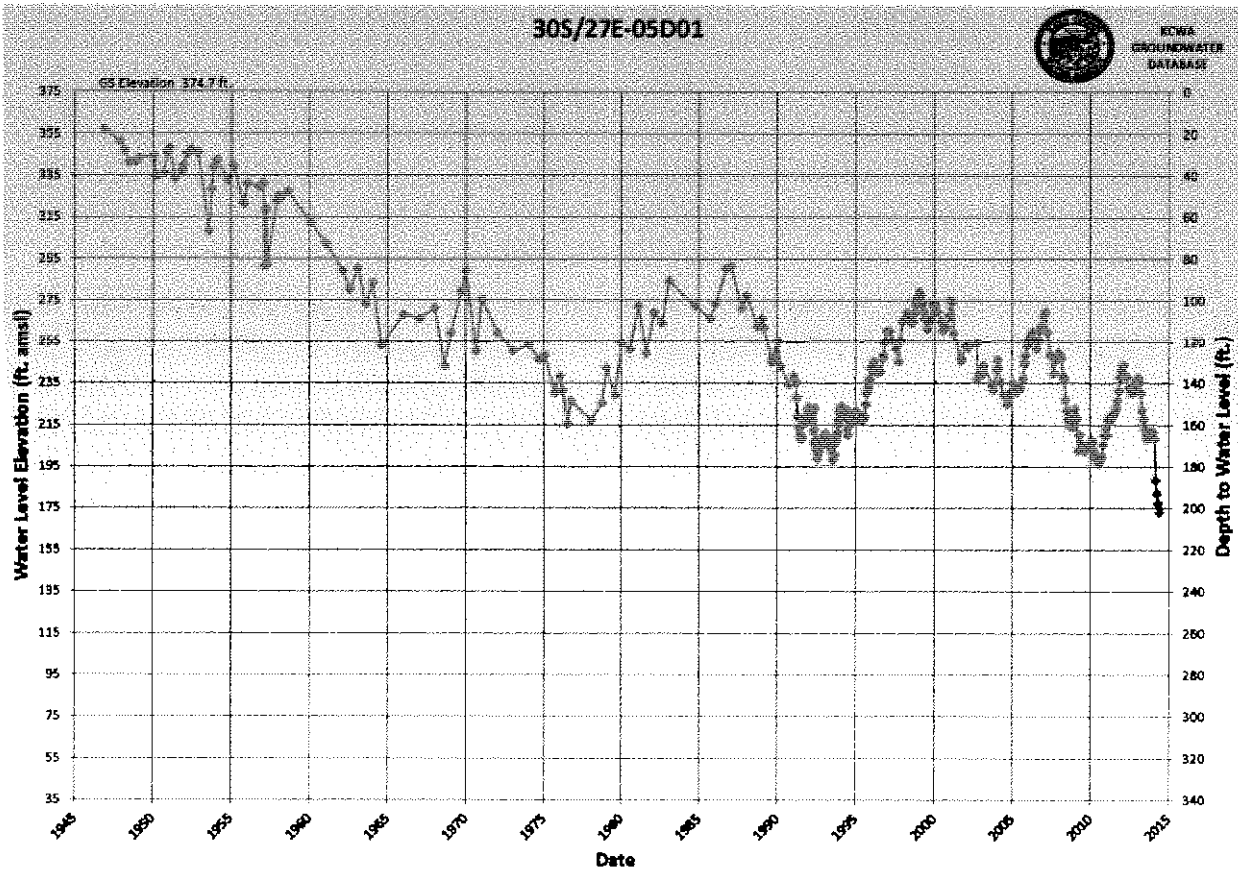


Figure 4 - Long-Term Hydrograph - Well near California State University Bakersfield

Groundwater levels in ID4 fluctuate with wet and dry periods. During wet periods intentional groundwater recharge is maximized to help balance out groundwater overdraft in dry periods. However, the recent drought has caused groundwater to reach the lowest historical level at the well in Figure 4, as well as in other areas of ID4.

3. Will the project make water available to address a specific concern?

Water contracts are insufficient to meet the full delivery demand at the Henry C. Garnett Water Purification Plant. SWP supplies are reduced in droughts, and are curtailed on a regular basis for environmental reasons. Therefore, ID4 must also rely on groundwater banks and other transfers and exchanges. Seepage reduction adds another potential water source and will directly help ID4 meet the water demands of their retail water agencies.

4. Will the project directly address a heightened competition for finite water supplies and over-allocation (e.g., population growth)?

ID4 currently has finite water supplies and must ration water during extended dry years. The Bay-Delta Issues, previously described, have been reducing overall water supplies to KCWA. The project will bring new water supplies into the area, thus helping to directly address the issue.

In September 2014, the State of California passed Senate Bill 1168, Assembly Bill 1739, and



Senate Bill 1319, which are collectively known as the Sustainable Groundwater Management Act. These bills impose mandates for sustainable groundwater management on local agencies in high- and medium-priority groundwater basins, and require essentially no long-term depletion of aquifers. The project will help to meet that goal by increasing surface water deliveries to the area, thus reducing reliance on groundwater supplies.

5. Describe how the water source that is the focus of this project (river, aquifer, or other source of supply) is impacted by climate variation.

Climate change is perceived to have a profound impact on California water resources, as evidenced by changes in snowpack, sea level, and river flows. These changes are expected to continue in the future and more of our precipitation will likely fall as rain instead of snow. Furthermore, DWR states “By 2050, scientists project a loss of at least 25 percent of the Sierra snowpack. This loss of snowpack means less water will be available for Californians to use.” <http://www.water.ca.gov/climatechange/>. The District’s surface water supplies come largely from mountainous areas in the Kern River watershed, San Joaquin River watershed, and high elevation areas north of the Delta, and are directly susceptible to these predicted changes.

6. Will the project help to address an issue that could potentially result in an interruption to the water supply if unresolved?

The condition of the canal has raised concerns of potential breaches. Although a breach has been avoided so far, there have been instances where the canal came close to breaching the canal bank due to rodent burrowing. A canal breach would flood the surrounding areas, cause property damage, and disrupt water service to the Henry C. Garnett Water Purification Plant (on which much of the metropolitan Bakersfield area relies for drinking water). Lining the canal banks would reduce the risk of a canal breach.

7. Will the project make water available for rural or economically disadvantaged communities?

The project benefit area includes the entire region of ID4 that receives treated surface water. This area is called the Treated Water Service Area and covers 30,274 acres. Using the CalEnviroScreen 2.0 Tool, it was determined that 66% of the project benefit area, and 69% of the population, has a CalEnviroScreen score of 76 or higher (required to be designated a disadvantaged community in California). **Attachment 7** is a map showing the boundaries of ID4, the Treated Water Service Area (also the area of benefit), the project location, and the disadvantaged community census tracts.

8. Does the project promote and encourage collaboration among parties? Is there widespread support for the project? What is the significance of the collaboration/support?

The project has a public outreach component that will make other agencies and the general public aware of the project and its benefits (see Task 12 in the Scope of Work). The public outreach includes a press release, website posting, notification of adjacent landowners, project site signs, and announcement at KCWA and Kern Regional Water Management Group meetings. A CVC Extension Lining ad hoc committee was also formed at KCWA to obtain input from



multiple parties on the project. The project has received support from the four retail water agencies that purchase water from ID4. The project has also gone through the public review process for the California Environmental Quality Act and the project Initial Study was adopted at a public hearing on December 16, 2015.

9. Will the project help to prevent a water-related crisis or conflict? Is there frequently tension or litigation over water in the basin?

Groundwater overdraft is a regional problem in Kern County that creates tension and conflict. The project will provide regional benefits by implementing a project listed in the Kern Integrated Regional Water Management Plan (IRWMP) that is also consistent with many of the regional goals provided in the Kern IRWMP. The project will also provide regional benefits by conserving groundwater in the Kern Groundwater Subbasin, which is in a state of overdraft. If a project benefits groundwater conditions in one area it almost certainly provides regional benefits in terms drought protection, reductions in conflicts, and groundwater quality improvement.

10. Will the project increase awareness of water and/or energy conservation and efficiency efforts? Will the project serve as an example of water and/or energy conservation and efficiency within a community?

The project has a public outreach component that will make other agencies and the general public aware of the project and its benefits (see Task 12 in the Scope of Work). The public outreach includes a press release, website posting, notification of adjacent landowners, project site signs, and announcement at KCWA and Kern Regional Water Management Group meetings.

11. Does the project integrate water and energy components?

The project conserves water by reducing seepage, while simultaneously eliminating the need to pump the seepage losses from groundwater wells, which requires additional energy. Hence, both water and energy are conserved.

Other Ancillary Project Benefits

Reduction in Damage from Canal Seepage. Currently canal seepage is causing high groundwater levels and damage to adjacent parking lot pavement. With installation of the concrete lining it is anticipated that groundwater levels will decline and these problems will cease.

Reduced Maintenance Efforts. Earthen canals require on-going maintenance to repair gullies, rills, sloughing and animal burrows. Maintenance efforts are expected to be considerably less after the canal is lined.

Cost Savings. The project will conserve water and thereby reduce water purchase costs, canal pumping costs and groundwater recovery costs. These cost savings will benefit ID4 and their water purveyors.



(f) Implementation and Results (10 points)

Subcriterion F.1 - Project Planning. Does the project have a Water Conservation Plan, System Optimization Review, and/or district or geographic area drought contingency plans in place? Does the project relate/have a nexus to an adaptation strategy developed as part of a WaterSMART Basin Study?

The area is being studied under the Sacramento-San Joaquin WaterSMART Basin study, but that study is not yet complete. Other studies/plans that support the project are described below.

- 1. Identify any district-wide, or system-wide, planning that provides support for the proposed project. This could include a Water Conservation Plan, SOR, Basin Study or other planning efforts done to determine the priority of this project in relation to other potential projects.**

Urban Water Management Plan

ID4 prepared an Urban Water Management Plan (UWMP) in 2010 (<http://www.water.ca.gov/urbanwatermanagement/2010uwmps/>) and is currently updating their plan to meet 2015 standards. The proposed project is consistent with several sections of the UWMP, including:

- Section 6 of the UWMP discusses Reliability Planning, and compares supplies and demands in normal, dry and multiple dry years. The proposed project will help to increase available water in all year types.
- Section 8.4 discusses ‘Actions to Prepare for Catastrophic Interruption’. The canal lining will help prevent the risk of a canal breach, which would cause a catastrophic interruption in service.
- 2015 UWMP guidelines require a new Best Management Practice on ‘Programs to assess and manage distribution system real loss’. The project will provide a real method to eliminate a significant portion of ID4’s operational losses.

California State Groundwater Elevation Monitoring Program (CASGEM)

The proposed project is located in the Kern County Groundwater Subbasin (Groundwater Basin Number 5-22.14 per DWR Bulletin 118) of the San Joaquin Valley Groundwater Basin (see **Figure 5**). Under the State of California’s CASGEM Groundwater Basin Prioritization, the Kern County Subbasin has been categorized as a high priority basin due to the reliance of the local population and agricultural economy on groundwater. As a result, increasing water supplies and reducing groundwater overdraft is of paramount importance in the area.

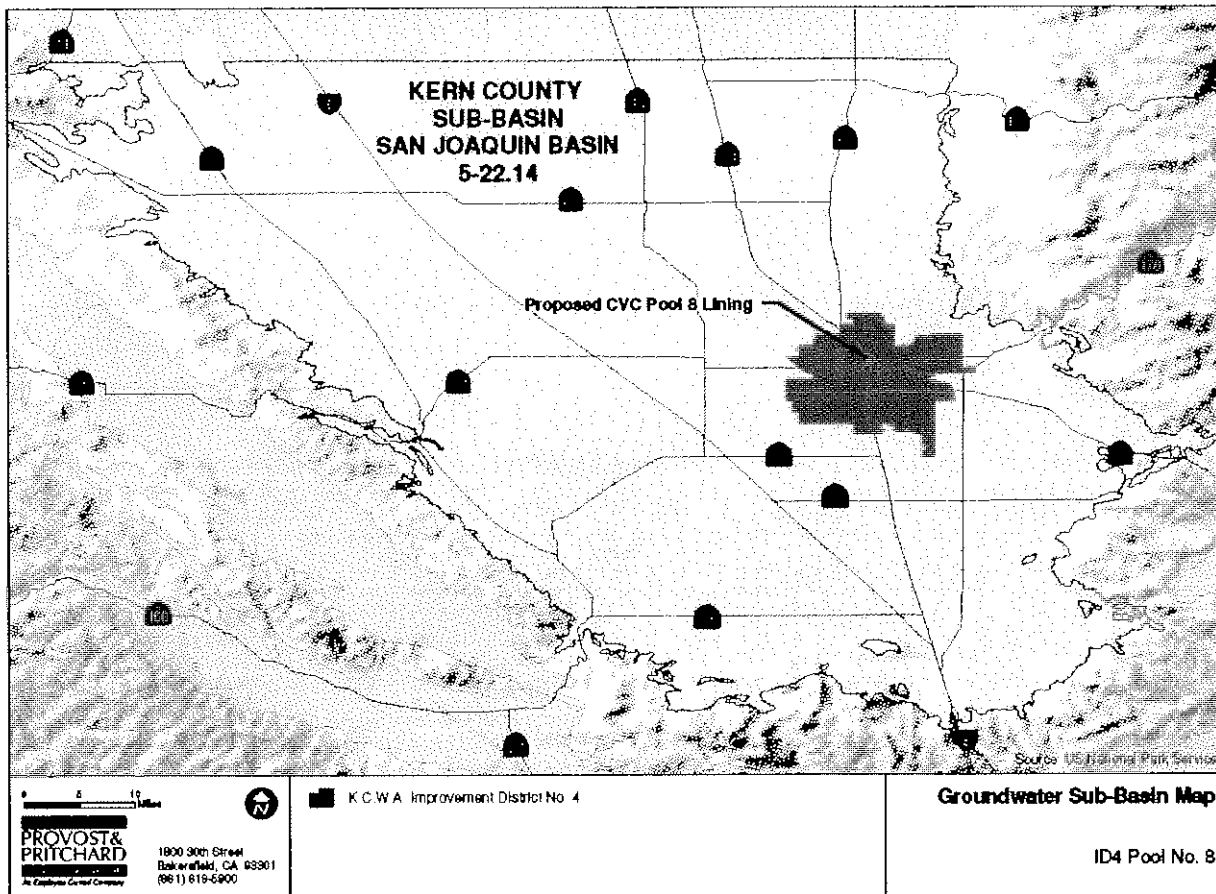


Figure 5 – Groundwater Subbasin Map

- Describe how the project conforms to and meets the goals of any applicable State or regional water plans, and identify any aspect of the project that implements a feature of an existing water plan(s).

Integrated Regional Water Management Plan

KCWA is a member of the Kern Integrated Regional Water Management Group, which adopted the Kern Integrated Regional Water Management Plan (IRWMP) in 2011. The proposed project, CVC Extension Lining Project – Pool No. 8, is formally included on the Kern Regional Water Management Group’s list of projects (see **Attachment 6**), and is listed as a ‘High Priority’ project. The proposed project is also consistent with several goals and objectives of the Kern IRWMP, as shown in **Table 1**.



Table 1: Kern IRWM Plan Objectives Addressed by Project

Kern IRWMP Objectives	CVC Extension Lining Project
Increase Water Supply	
Through cooperation and collaboration with other regions restore water supplies to levels that will mitigate for water lost from the Region and eliminate overdraft	X
Pursue and implement cost effective water use efficiency programs	X
Increase water storage capacity in the region by increasing recharge acreage and expanding groundwater banking programs before all prime recharge land has been developed 8,000 recharge acres as soon as practicable	
Increase/augment water supplies to meet region demands (e.g., M&I, agricultural, environmental) by 2050.	X
Improve Operational Efficiency	
Optimize local management of water resources to improve water supply reliability over the planning horizon	X
Improve Water Quality	
Identify and preserve prime recharge areas in the Kern fan area and other areas	
Improve water quality for DACs and the watershed over the planning horizon	
Continue to provide drinking water that meets or exceeds water quality standards; and support efforts to attain appropriate standards throughout the planning horizon	X
Maximize the use of lesser quality water for appropriate uses (landscaping, certain ag crops, “aesthetic” projects) throughout the planning horizon	
Promote Land Use Planning and Resource Stewardship	
Increase educational opportunities to improve public awareness of water supply, conservation, and water quality issues throughout the planning horizon	X
Improve and coordinate integrated land use planning to support stewardship of environmental resources, such as local rivers and streams and the Kern Fan, and integrate with habitat conservation plans and other ongoing planning efforts from this point forward	
Preserve and improve ecosystem/watershed health throughout the planning horizon	
Improve Regional Flood Management	
Improve regional flood management by addressing preparedness, response, and post flood actions throughout the planning horizon	
Identify and promote innovative flood management projects to protect vulnerable areas	X
Plan new developments to minimize flood impacts from this point forward	

California Water Plan

The 2013 California Water Plan was most recently adopted in October 2014. The proposed project is consistent with the strategy to increase water supply through conjunctive management, found in both the 2009 and 2013 Plans. The project would also aid in achieving the objective of the California Water Plan related to managing the Delta to Achieve the Coequal Goals for California through its contribution to CALFED’s Water Use Efficiency Objective.



Subcriterion F.2 - Readiness to Proceed

Environmental/Plans/Design

Significant preliminary work is already completed, and ID4 is ready to proceed with final design, followed by construction within one year of grant award. Work completed to date includes:

1. Canal lining alternatives study
2. Preliminary design drawings (15%)
3. Hydraulic channel analysis
4. CEQA Initial Study (identified no significant impacts and adopted on December 16, 2015)

Furthermore, the design for Pool No. 7 of the CVC Extension Canal is complete and the project will be bid in March 2016. This project will provide useful design standards and lessons learned that can be used to expedite the Pool No. 8 design and construction.

Project Implementation Plan

A detailed project schedule (Gantt Chart) can be found as **Attachment 8**. The schedule shows the major tasks needed to complete the project. The schedule also shows milestones, major deliverables and linkages between tasks. The tasks shown match tasks listed in the Work Plan and the Budget; however, to better illustrate the timeline and inter-relationships for some tasks, some additional subtasks are shown in the Schedule that are not described in the Work Plan or Budget. The following should be noted regarding the schedule:

- Days shown on the Gantt chart are working days.
- Long-term project monitoring and annual Project Performance Reports are not shown to allow for better clarity of the immediate timeline. Annual monitoring will continue after project completion for the period specified in the grant agreement.
- The Agency is accounting for financing to provide for their cost shares in their annual budgets for fiscal years 2016, 2017 and 2018.
- The project is not expected to involve a lengthy process for easement acquisition. The Agency has already begun investigations and several alternative properties could provide construction laydown areas.
- Based on a review of permitting requirements and potential environmental issues, no major delays due to environmental documentation or permitting are anticipated. The CEQA Initial Study is already completed and adopted, and will be converted into a NEPA Environmental Assessment for review, circulation and adoption.
- The project will be constructed between the months of April through October. These generally represent periods with little to no rainfall in the area and will reduce the risk for weather delays.
- Construction will coincide with the delivery of Kern River water to the Henry C. Garnett Water Purification Plant, during which time flows in Pool No. 8 are the lowest.
- The Agency considers the schedule reasonable based on their experience constructing similar projects.



- Work has already begun on the project including conceptual designs, canal hydraulic analyses and environmental documentation.

Project Milestones

Major project milestones are shown in **Table 2**. Refer to the schedule (**Attachment 8**) for more details.

Table 2 – Major Project Milestones

Task	Date
Grant Award (assumed)	October 2016
Complete Design /Env. Documentation	July 2017
Begin Construction	March 2018
Complete Construction	September 2018
Submit Final Project Report	December 2018

The project completion date of December 2018 is 9 months before the assumed contractual deadline of September 30, 2019. This provides a buffer in case of unforeseen circumstances and will help ensure that the project is completed within the grant agreement period.

Permitting Requirements

Permitting requirements will be minimal and require compliance with stormwater and dust control regulations. No biological or cultural resources are expected to be in the area, but if they are found, or if they are potentially in the area, then KCWA will incorporate the necessary project feature(s) to reduce or avoid impacts. Furthermore, information gathered and lessons learned from the adjacent lining of Pool No. 7 will help to ensure a smoother permitting process.

Subcriterion F.3 - Performance Measures

Provide a brief summary describing the performance measure that will be used to quantify actual benefits upon completion of the project (i.e., water saved, marketed, or better managed, or energy saved).

Project monitoring will be performed for a period at least five years to verify that the project is meeting its stated water and energy goals. KCWA already measures flows and seepage losses in the CVC Extension, and continuing that effort will be consistent with existing operations. The results will be made available to USBR, if requested. Following is a general discussion on the monitoring methodology.



Table 3 - Project Performance Monitoring Table

Project Benefits	Numeric Targets (Performance Measures)	Measurement Tools
Water Conservation	2,300 AF/year or 4.1% of flows in Pool No. 8	Difference in flow rates in canal between beginning of Pool No. 8 and the Henry C. Garnett Water Purification Plant
Energy Savings	792,200 kWh/yr	<p>Energy savings will be directly linked to the water savings from no longer having to use energy to replace the lost water.</p> <p>Energy Saved = 344 kWh/AF x AF conserved</p>
Greenhouse Gas Emission Reductions	247,600 kg CO ₂ e/yr	<p>Greenhouse gas emission reduction is linked directly to energy savings.</p> <p>Greenhouse gas emission reductions = 0.313 kg CO₂e/kWh x kWh conserved</p>
Water Spreading for Recharge and Habitat Enhancement	1,150 AF/year	Volume of conserved water delivered to Kern River or groundwater banks
Water Marketed	Varies depending on availability. Long-term goal of 500 AF/year	Volume of conserved water transferred or exchanged with other water agencies
Prevention of Interrupted Service	Non-quantifiable.	



Subcriterion F.4 – Reasonableness of Costs

Include information related to the total project cost, annual acre-feet conserved, energy capacity, or other project benefits and the expected life of the improvement(s).

$$\frac{\$3,768,167 \text{ (project cost)}}{2,300 \text{ AF/yr Conserved} \times 50 \text{ years Improvement Life}} = \$33 / \text{AF Conserved}$$

(g) **Additional Non-Federal Funding (4 points)**

The total local funding provided =

$$\frac{\text{Non-Federal Funding}}{\text{Total Project Cost}} = \frac{\$2,768,167}{\$3,768,167} = 73\%$$

(h) **Connection to Reclamation Project Activities (4 points)**

1. How is the proposed project connected to Reclamation project activities?

- a. KCWA obtains annual contracts for Friant Division Central Valley Project (CVP) floodwater (Section 215 water) from Reclamation. This water is delivered to ID4 through the CVC Extension Canal. The project will therefore help to reduce Section 215 seepage losses.
- b. ID4 frequently performs transfers and exchanges with other water agencies for Friant CVP water
- c. Friant CVP water is delivered to the area through a series of facilities including the Friant-Kern Canal of the Friant CVP Division.

2. Does the applicant receive Reclamation project water?

KCWA frequently obtains contracts for San Joaquin River Floodwater (called Section 215 water) from the USBR. These are temporary annual contracts. This water is an important supplementary supply for ID4. KCWA also frequently performs water exchanges and transfers with USBR water contractors that receive either Cross Valley Canal CVP water or Friant Division CVP water. These agencies include Kern-Tulare Water District, Pixley Irrigation District, Arvin-Edison Water Storage District, Delano-Earlimart Irrigation District and others.

3. Is the project on Reclamation project lands or involving Reclamation facilities?

The project is not on Reclamation land and will not involve modifications to Reclamation facilities. Friant CVP water is delivered to the project through a series of facilities including the Friant-Kern Canal of the Friant CVP Division. The Friant CVP water is also captured in the Reclamation owned Friant Dam on the San Joaquin River.

4. Is the project in the same basin as a Reclamation project or activity?



The project is in the Sacramento-San Joaquin Rivers WaterSmart Basin. Within this basin are several Reclamation projects and activities, most notably, the Friant Division of the CVP. The Friant Division includes Friant Dam on the San Joaquin River, and the Friant-Kern Canal.

5. Will the proposed work contribute water to a basin where a Reclamation project is located?

The proposed project will conserve water and thus make a new water supply available in the Sacramento-San Joaquin Basin, where the Friant Division of the CVP, and other Reclamation facilities, are found. Some of the seepage losses saved will be Friant CVP water delivered to the ID4 water treatment plant.

6. Will the project help Reclamation meet trust responsibilities to Tribes?

The project does not involve any Native American Tribes. Tribes were consulted during the CEQA Initial Study but did not provide any comments on the project.

ENVIRONMENTAL & CULTURAL RESOURCES COMPLIANCE

1. Will the project impact the surrounding environment

The potential impacts from the project were investigated in a CEQA Initial Study (not included but available on request). **Table 4** summarizes the results of the Initial Study under seventeen CEQA topics. No significant impacts were identified. The CEQA Initial Study was adopted as a Mitigated Negative Declaration on December 16, 2015. The CEQA IS covers a three mile length of the CVC Extension covering Pools 7 and 8. This application seeks funding for one mile of the canal in Pool No. 8.

The CEQA Initial Study made the following Mandatory Findings of Significance:

“The proposed project does not have the potential to degrade the quality of the environment, reduce the habitat or population size for fish or wildlife species or adversely affect human beings either directly or indirectly. There are no known projects in the area that would result in cumulatively considerable impacts. Therefore, the potential impacts of the project are not individually or cumulatively significant.”

Under no circumstances will any ground-disturbing activity take place before environmental and cultural resources compliance is complete and Reclamation explicitly authorizes work to proceed.

2. Are you aware of any species listed or proposed to be listed as a Federal endangered or threatened species, or designated Critical Habitat in the project area? If so, would they be affected by any activities associated with the proposed project?

The CEQA Initial Study did not identify any endangered species on the project site, but did identify potential habitat and several mitigation measures are proposed. The project was deemed to have a less than significant impact on biological resources. Furthermore, the project



area is previously disturbed and surrounded on all sides with fencing. Therefore, the proposed project will not interfere with wildlife movement. Lastly, the City of Bakersfield prepared a Metropolitan Bakersfield Habitat Conservation Plan, which can be found at: (<http://www.bakersfieldcity.us/weblink7/ElectronicFile.aspx?docid=625001&dbid=0>). According to the CEQA Initial Study, the proposed project will not conflict with the goals of this document.

Table 4 – Summary of CEQA Initial Study

Topic	Potential Impact	Notes
Aesthetics	No impact	The project would concrete line an earthen canal in a fenced industrial area, and would not impact aesthetics.
Agricultural Resources	No impact	The project will not be constructed on agricultural lands, or directly impact agricultural lands.
Air Quality	Less than significant impact	Project would not create long-term air pollution, or increase populations or traffic. Temporary construction emissions would be below State and Federal criteria pollutant standards
Biological Resources	Less than significant impact	Biological survey of site, staging areas and 250-foot buffer found no special status species. Site could provide potential habitat so eight mitigation measures will be implemented.
Cultural Resources	No impact	No cultural resources were found during the initial canal construction in 1976. A cultural records search and tribal notification had no results.
Geology and Soils	No impact	Land is relatively flat. No or less than significant risk of landslides, liquefaction, soil erosion, lateral spreading, subsidence, high soil expansion, or septic system problems.
Greenhouse Gas Emissions	No impact	The project will not directly or indirectly generate greenhouse gases (GHG). By preventing seepage groundwater pumping will be reduced, thereby reducing GHGs.
Hazards and Hazardous Matls	No impact	The project will not involve the use, transport or exposure of hazardous materials.
Hydrology and Water Quality Resources	No Impact	The project site does not include any lakes, streams, floodplains, or other bodies of water. The project will not have a significant impact on groundwater levels or groundwater quality.
Land Use Planning	No impact	The project would not divide a community, or conflict with any applicable land use plans, policies or regulations.
Mineral Resources	No impact	There are no known mineral resources on the site.
Noise	No impact	No long-term noise would be generated by the project. The project will only produce temporary construction noise that will comply with applicable standards.
Pop./ Housing	No impact	The project would have no impact on population growth or housing availability.
Public Services	No impact	The project would not require the addition or alteration of any public services.
Recreation	No impact	The project does not include the construction of new recreational facilities or impacts to existing recreational facilities.
Transportation and Traffic	No impact	Construction traffic would be temporary and no roads would be modified.
Utilities and Service Systems	No impact	The project will not generate additional solid waste, wastewater, or stormwater. The project will not adversely alter wastewater treatment requirements.

3. Are there wetlands or other surface waters inside the project boundaries that potentially fall under Federal Clean Water Act jurisdiction as “waters of the United States”? If so, please describe and estimate any impacts the project may have.



According to the CEQA Initial Study “No riparian habitat or other sensitive natural communities are present on the project site” and “The project area does not include any wetlands”. The project will also not expand the existing footprint of the CVC Extension.

4. When was the water delivery system constructed?

The water delivery system was constructed in the 1970’s.

5. Will the project result in any modification of or effects to, individual features of an irrigation system (e.g., headgates, canals, or flumes)?

The Project will not involve modification of or effects to irrigation systems.

6. Are any buildings, structures, or features in the irrigation district listed or eligible for listing on the National Register of Historic Places?

A cultural resources records search was conducted using the California Historical Resources Information System, at California State University, Bakersfield. According to the records search, there are no known cultural resources within the project area or a ½ mile radius that are listed in the National Register of Historic Places, the California Register, the California Points of Historical Interest, California Inventory of Historic Resources, or the California State Historic Landmarks.

7. Are there any known archeological sites in the proposed project area?

No archeological sites are known to exist in the proposed project area, none were identified during construction in the 1970’s, nor were any identified in the cultural resources records search described above.

8. Will the project have a disproportionately high and adverse effect on low income or minority populations?

No. The project is not anticipated to have negative impacts on any communities, but rather will improve water reliability that will benefit the local community.

9. Will the project limit access to and ceremonial use of Indian sacred sites or result in other impacts on tribal lands?

No. No tribal lands are in the area. In addition, no Indian sacred sites are known to be in the area nor were any identified in the cultural resources records search described above. Native American Tribes were consulted during the CEQA Initial Study, but provided no comments.

10. Will the project contribute to the introduction, continued existence, or spread of noxious weeds or non-native invasive species known to occur in the area?

No. The project will not introduce or promote noxious weeds or non-native invasive species.

**Kern County Water Agency
Improvement District No. 4
Cross Valley Canal Extension Lining - Pool 8
Canal Seepage Calculations**

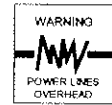
Year	Total Conveyance in CVC Pool No. 8	Total Losses in CVC Pool No. 8	Canal Evaporation		Direct Precipitation onto Canal		Current Seepage Loss Estimate	Losses of Water from Groundwater Banks	Losses of Water from State Water Project	Estimated Seepage Loss Reduction w/ Concrete Liner (80%)
	(AF)	(AF)	(in)	(AF)	(in)	(AF)	(AF)			(AF)
2004	56,044	2,582	70.26	34	7.01	3.4	2,551	2,551	0	2,041
2005	82,315	1,520	64.83	31	10.23	4.9	1,493	0	1,493	1,195
2006	116,687	2,091	63.87	31	5.68	2.7	2,063	0	2,063	1,650
2007	41,725	1,953	44.79	22	0.87	0.4	1,931	1,931	0	1,545
2008	11,666	246	45.49	22	0.63	0.3	224	0	224	179
2009	23,163	267	10.43	5	0	0.0	0	0	0	0
2010	37,814	1,382	34.02	16	6.93	3.3	1,368	0	1,368	1,095
2011	70,581	1,796	58.12	28	6.34	3.1	1,771	0	1,771	1,417
2012	94,606	4,335	69.76	34	5.79	2.8	4,304	0	4,304	3,443
2013	57,850	5,511	69.47	33	3.75	1.8	5,479	5,479	0	4,383
2014	32,001	6,667	12.32	6	0	0.0	6,661	6,661	0	5,329
2015	42,190	6,719	25.64	12	0	0.0	6,707	6,707	0	5,365
Total:	666,643	35,066	-	-	-	-	34,553	23,329	11,223	27,642
Average:	55,554	2,922	47.42	26	3.94	1.90	2,879	1,944	935	2,304
Percent:	100%	5.3%	-	-	-	-	5.2%			4.1%

Notes:

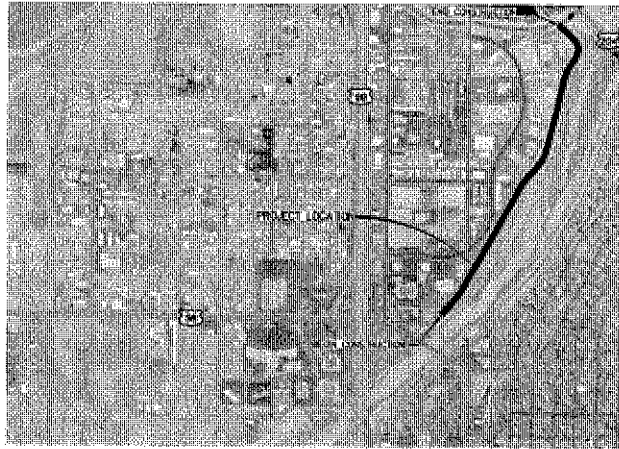
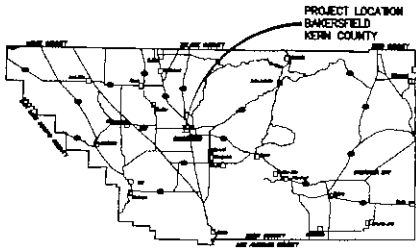
1) Average Water Surface Area: 251,856 SF

2) Total losses based on flow measurements at Pumping Plant 7 (u/s end of reach) and water treatment plant (d/s end of reach) and considering various diversions from Pool 8.

KCWA IMPROVEMENT DISTRICT NO. 4 KERN COUNTY, CA



CROSS VALLEY CANAL EXTENSION LINING PROJECT PHASE 2-POOL NO. 8



SITE MAP



GENERAL NOTES

1. KCWA (805-834-1400) SHALL BE CONTACTED AT LEAST 48 HOURS PRIOR TO COMMENCEMENT OF WORK ON OR NEAR EXISTING OVERHEAD FACILITIES.
2. USED MATERIAL, DEBRIS, WROTS, OR SCRAP, ETC. ARE NOT ACCEPTABLE FOR USE ON KCWA FACILITIES.
3. ALL CONSTRUCTION SHALL BE IN CONFORMANCE WITH THESE PLANS, PROJECT SPECIFICATIONS AND KCWA SPECIFICATIONS.
4. CONTRACTOR SHALL FIELD VERIFY THE HORIZONTAL AND VERTICAL LOCATIONS OF ALL EXISTING FACILITIES PRIOR TO COMMENCING WORK. CALL UNDERGROUND SERVICE ALERT (USA) AT 8-1-1. CONTRACTOR SHALL MAKE EMPLOYER AWARE OF ANY DISCREPANCIES.
5. ALL CAST-IN-PLACE CONCRETE STRUCTURES SHALL BE FORMED INSIDE AND OUT AND CONCRETE VIBRATED SUFFICIENTLY TO PROVIDE FOR SMOOTH SURFACED WALLS/FLOORS WITHOUT VOIDS AND HONEYCOMBS.
6. KCWA SHALL INSPECT ALL WORK PHASES ON FACILITIES FOR CONFORMANCE TO KCWA SPECIFICATIONS. REINFORCING SHALL NOT BE ENCASED IN CONCRETE WITHOUT PRIOR KCWA INSPECTIONS. LIKEWISE, CONCRETE SHALL NOT BE COVERED WITH EXPOSED PRIOR TO KCWA INSPECTION.
7. CONCRETE DESIGN MIX SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL. ALL CONCRETE SHALL HAVE A 28-DAY MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI UNLESS OTHERWISE SPECIFIED.
8. ALL CONSTRUCTION SHALL BE PERFORMED IN ACCORDANCE WITH APPLICABLE HEALTH AND SAFETY LAWS OF THE STATE OF CALIFORNIA AND CALIFORNIA STANDARDS.
9. CANAL EMBANKMENTS SHALL BE COMPACTED IN ACCORDANCE WITH THE SPECIFICATIONS AND THE GEOTECHNICAL REPORT CONTAINED IN THE SPECIFICATIONS.
10. ALL EXCESS MATERIAL AND/OR DEBRIS SHALL BE REMOVED UPON COMPLETION OF INSTALLATION.
11. CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ADEQUATE DUST CONTROL AT ALL TIMES.

SPECIAL NOTE
WHERE UNDERGROUND AND SURFACE STRUCTURES ARE SHOWN ON THE PLANS, THE LOCATIONS, DEPTH AND DIMENSIONS OF STRUCTURES ARE BELIEVED TO BE REASONABLY CORRECT, BUT ARE NOT GUARANTEED. SUCH STRUCTURES ARE SHOWN FOR THE INFORMATION OF THE CONTRACTOR, BUT INFORMATION SO GIVEN IS NOT TO BE CONSIDERED AS A REPRESENTATION THAT SUCH STRUCTURES WILL, IN ALL CASES, BE FOUND WHERE SHOWN, OR THAT THEY REPRESENT ALL OF THE STRUCTURES WHICH MAY BE ENCOUNTERED.

ON-SITE SAFETY AND PROTECTION NOTES
THE OWNER OR ITS AGENTS TO CONDUCT CONSTRUCTION REVIEW OF THE CONTRACTOR'S PERFORMANCE AND THE ADEQUACY OF THE CONTRACTOR'S SAFETY MEASURES IN OR NEAR THE CONSTRUCTION SITE AND SHALL NOT BE CONSIDERED AS SUPERVISION OF THE ACTUAL CONSTRUCTION WORK. THE ENGINEER, OWNER OR ITS AGENTS RESPONSIBLE FOR PROVIDING A SAFE PLACE FOR THE PERFORMANCE OF WORK BY THE CONTRACTOR, SUBCONTRACTORS, OR SUPPLIERS, OR FOR ACCESS, VISIT, USE, WORK, TRAVEL OR OCCUPANCY BY ANY PERSON.

THE CONTRACTOR SHALL HAVE AT THE WORK SITE, COPIES OR SUITABLE EXTRACTS OF CONSTRUCTION SAFETY ORDERS ISSUED BY CALIFORNIA CONTRACTOR SHALL COMPLY WITH PROVISIONS OF THESE AND ALL OTHER APPLICABLE LAWS, ORDINANCES AND REGULATIONS. THE CONTRACTOR MUST COMPLY WITH PROVISIONS OF THE SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION, PROMULGATED BY THE SECRETARY OF LABOR UNDER SECTION 107 OF THE CONTRACT WORK HOURS AND SAFETY STANDARDS ACT, AS SET FORTH IN TITLE 29 C.F.R.

TO PROTECT THE LIVES AND HEALTH OF CONTRACTOR'S EMPLOYEES UNDER THE CONTRACT, THE CONTRACTOR SHALL COMPLY WITH ALL PERTINENT PROVISIONS OF THE "MANUAL OF AIDEMENT PREVENTION IN CONSTRUCTION" ISSUED BY THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA, INC. AND SHALL MAINTAIN AN ACCURATE RECORD OF ALL CASES OF DEATH, OCCUPATIONAL DISEASE, AND INJURY REQUIRING MEDICAL ATTENTION OR CAUSING LOSS OF TIME FROM WORK, ARISING OUT OF AND IN THE COURSE OF EMPLOYMENT OR WORK UNDER THE CONTRACT.

THE CONTRACTOR ALONE SHALL BE RESPONSIBLE FOR THE SAFETY, EFFICIENCY, AND ADEQUACY OF CONTRACTOR'S FACILITIES, APPLIANCES, AND METHODS AND FOR ANY DAMAGE, WHICH MAY RESULT FROM THEIR FAILURE OR THEIR IMPROPER CONSTRUCTION, MAINTENANCE OR OPERATION.

THE CONTRACTOR AGREES THAT IT SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY, THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS AND THAT THE CONTRACTOR SHALL DEFEND, INDEMNIFY AND HOLD THE OWNER, PROJECT & FUTURE CONSULTING GROUP, AND THEIR RESPECTIVE AGENTS HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPT FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF OWNER, ENGINEER, OR THEIR RESPECTIVE AGENTS.

THE OWNER AND ITS AGENTS SITE RESPONSIBILITIES ARE LIMITED SOLELY TO THE ACTIVITIES OF THEIR EMPLOYEES ON SITE. THESE RESPONSIBILITIES SHALL NOT BE INTERPRETED BY ANY PARTY TO MEAN THAT THE OWNER OR ITS AGENTS HAVE RESPONSIBILITY FOR SITE SAFETY, SAFETY IN, OR OF ADJACENT SITES IS THE SOLE AND EXCLUSIVE RESPONSIBILITY OF THE CONTRACTOR ALONE. THE CONTRACTOR'S METHODS OF WORK PERFORMANCE, SUPERVISORSHIP AND THE CONTRACTOR'S EMPLOYEES, AND SCHEDULING OF CONSTRUCTION ARE ALSO THE SOLE AND EXCLUSIVE RESPONSIBILITIES OF THE CONTRACTOR ALONE.

APPROVALS

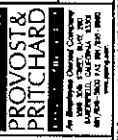
_____ DAVID BRAND CM MANAGER	_____ DATE
_____ MARTIN YARCA ENGINEERING AND GROUNDWATER SERVICES MANAGER	_____ DATE

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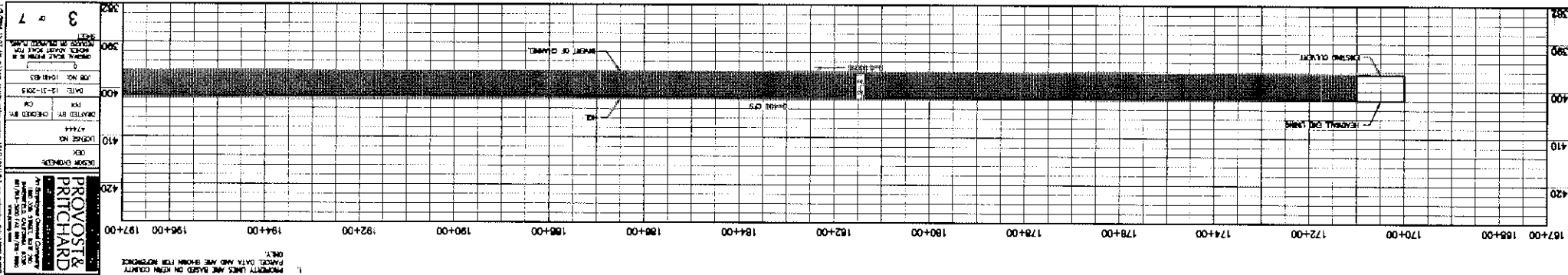
PRELIMINARY 15% PLANS
 NOT FOR CONSTRUCTION
 12-31-2015



CROSS VALLEY CANAL EXTENSION LINING PROJECT
 PHASE 2-POOL NO. 8
 KCWA IMPROVEMENT DISTRICT NO. 4
 KERN COUNTY, CA



DESIGN ENGINEER	
REV	
LICENSE NO.	47444
DRAWN BY:	CHEKED BY:
PS	CM
DATE:	12-31-2015
JOB NO.	1048193
ORIGINAL SCALE SHOWN IS IN PLACE UNLESS INDICATED OTHERWISE ON THIS SHEET.	



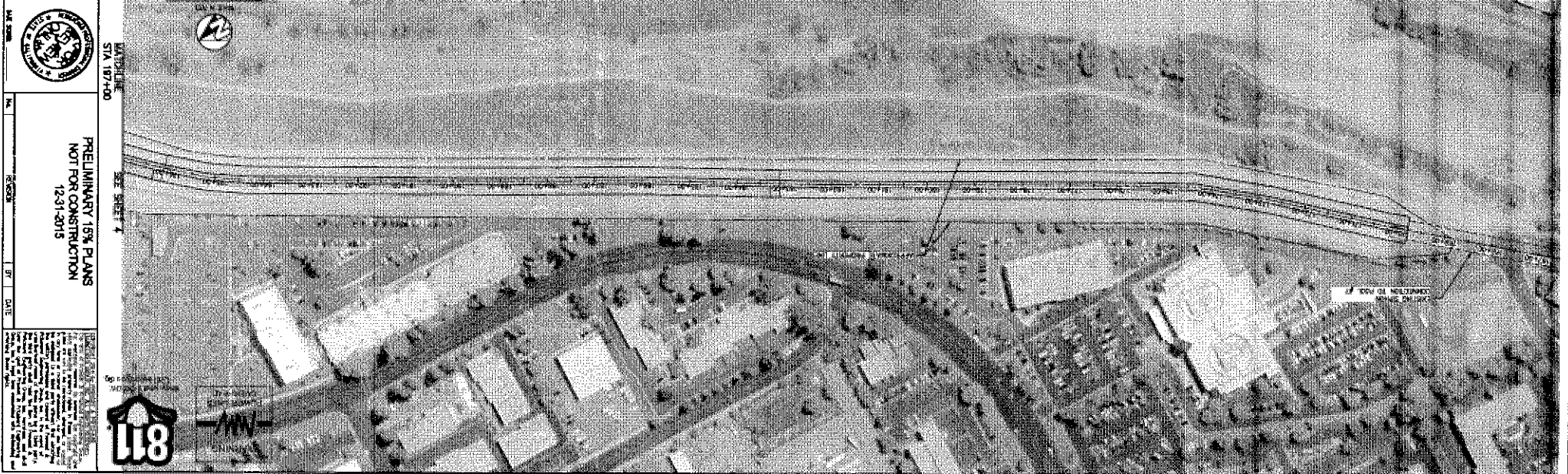
- ① CANAL LIMB DIRECTION
- ② CANAL LIMB DIRECTION TO ASSEMBLY
- ③ FAN OWN SAFETY LADDER
- ④ FAN SAFETY CABLE & ROPE
- ⑤ ASSEMBLY

NOTES
 1. PROPERTY LINES ARE BASED ON KERN COUNTY RECORD DATA AND ARE SHOWN FOR REFERENCE ONLY.

PROVOST & PRITCHARD
 Agricultural Consulting Engineers
 1000 N. G Street, Suite 100
 Hanford, CA 93230
 Phone: (559) 831-1111
 Fax: (559) 831-1112
 Email: info@provostpritchard.com

GROSS VALLEY CANAL EXTENSION LIMB PROJECT
 PHASE 2 - P.O.L. NO. 8
 KOWA IMPROVEMENT DISTRICT NO. 4
 KERN COUNTY, CA

STA. 167+00 TO 197+00



811

PRELIMINARY 15% PLANS
 NOT FOR CONSTRUCTION
 12-31-2015

DATE: _____
 BY: _____
 CHECKED BY: _____

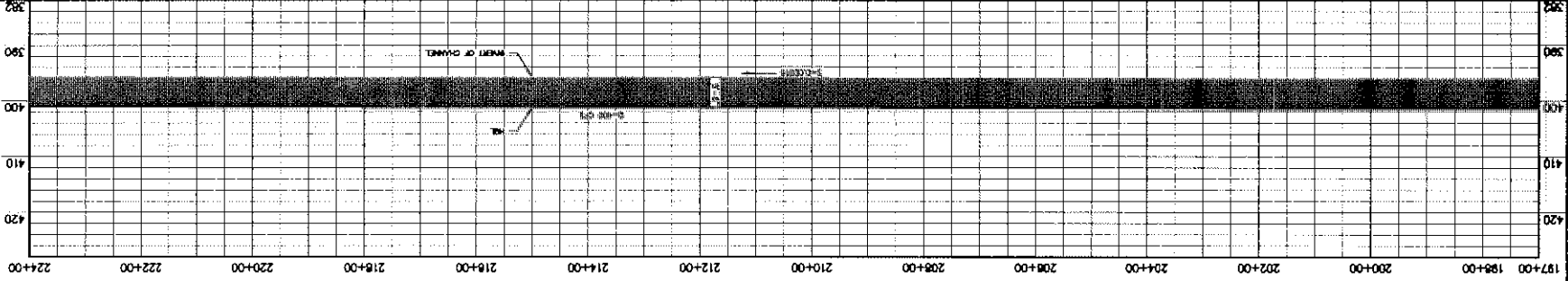
SCALE: _____

PROJECT NO. _____

SHEET NO. _____

TOTAL SHEETS _____

DATE: _____



- ① CONSTRUCT STRUCTURE TO CANAL LINES CONNECTION
- ② CANAL LINES CONNECTION
- ③ CANAL SAFETY FLOOD
- ④ CANAL SAFETY GATE & FLOOD ASSEMBLY

NOTES
 1. PROPERTY LINES ARE BASED ON KERN COUNTY PLATTED DATA AND ARE SHOWN FOR REFERENCE ONLY.

DATE: 12-31-2015
 DRAWN BY: C. CHEN
 CHECKED BY: C. CHEN
 SCALE: AS SHOWN
 SHEET NO.: 48 OF 75

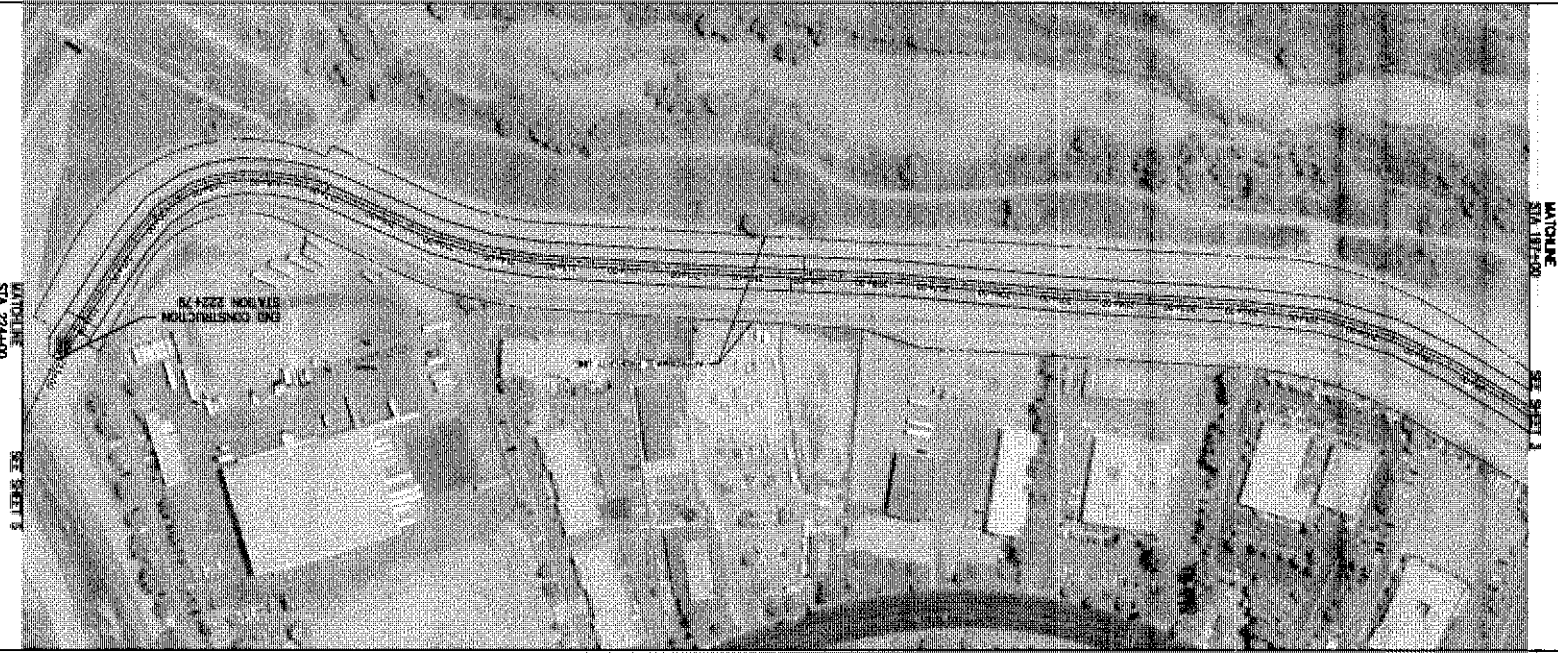
PROVOST & PITCHARD
 4100 Granddame Canyon
 Lancaster, California 93533
 805.799.1111 FAX 805.799.1100

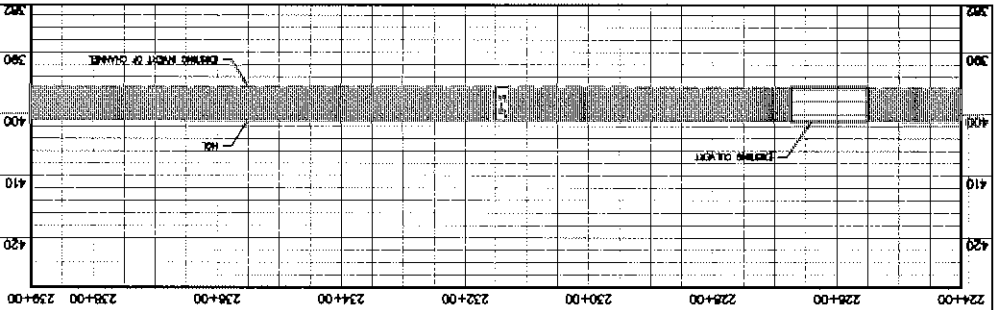
GROSS VALLEY CANAL EXTENSION LINING PROJECT
 PHASE 2-FLOOD NO. 8
 KOWA IMPROVEMENT DISTRICT NO. 4
 KERN COUNTY, CA
 STA 197+00 TO 224+00



PRELIMINARY 15% PLANS
 NOT FOR CONSTRUCTION
 12-31-2015

811
 Know what's below
 Call before you dig

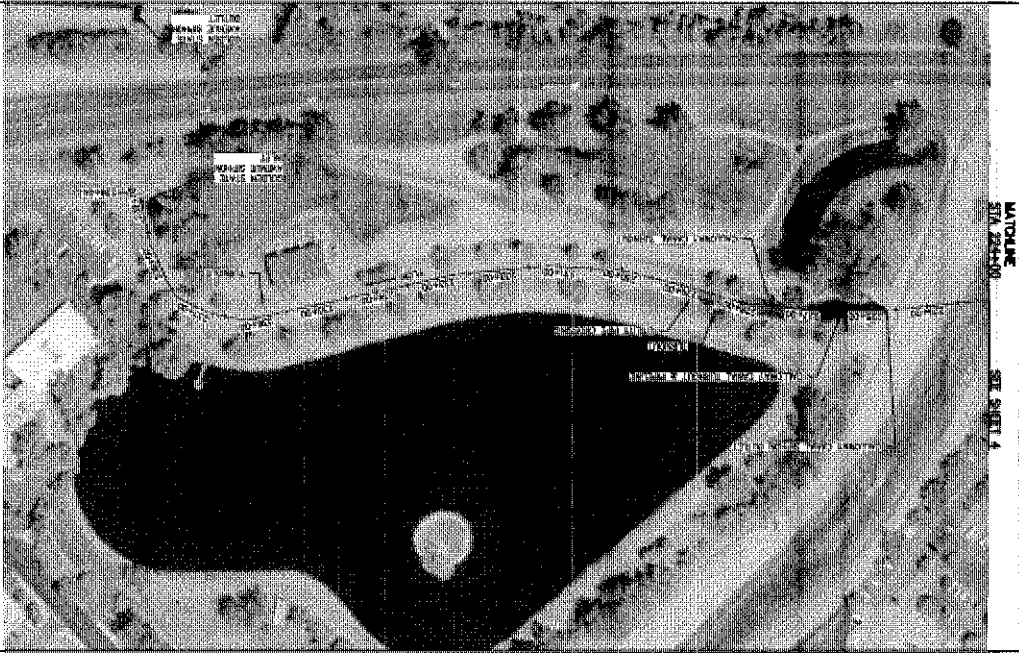




1. NO WORK DONE ON THIS SHEET.

NOTE

- ① CANAL LINING CONNECTION
- ② CANAL SAFETY FLOOR
- ③ FAN SAFETY CABLE & FLOAT ASSEMBLY

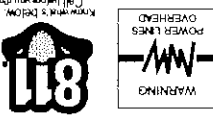


DATE: 12-31-2015	DATE: 12-31-2015
PROJECT NO: 13-01-0015	PROJECT NO: 13-01-0015
DATE: 12-31-2015	DATE: 12-31-2015
PROJECT NO: 13-01-0015	PROJECT NO: 13-01-0015

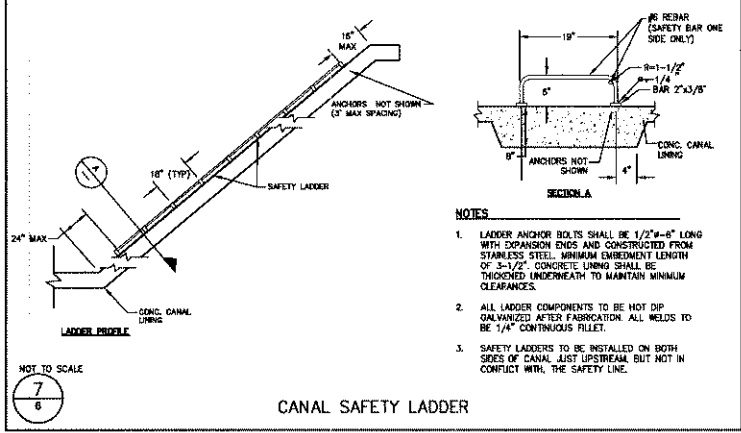
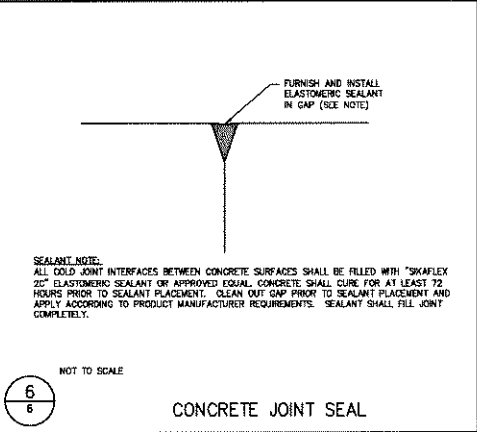
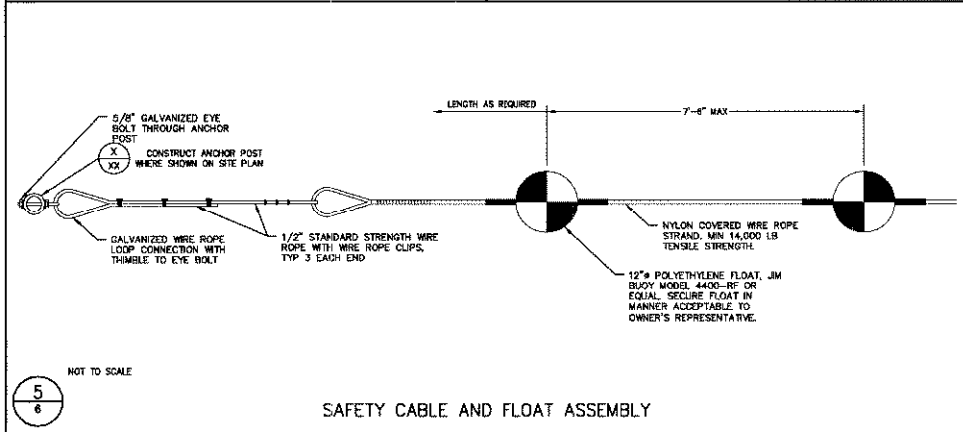
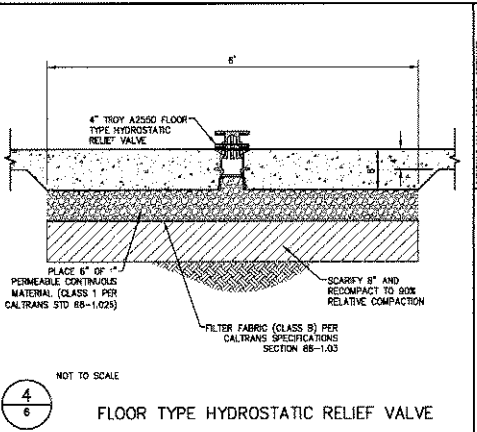
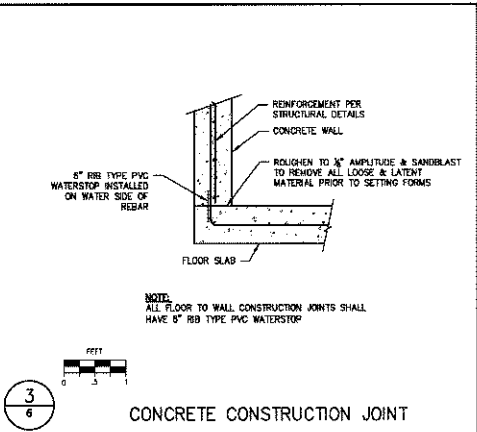
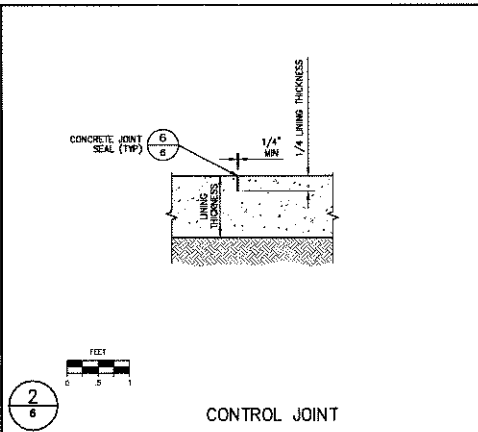
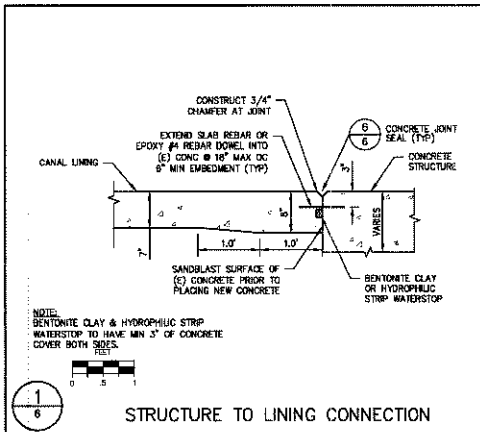
PROVOST & PRITCHARD
 10000 N. GARDEN AVENUE
 SUITE 100
 DENVER, CO 80231
 PHONE: 303.755.1100
 FAX: 303.755.1101
 WWW.PPENGINEERS.COM

CROSS VALLEY CANAL EXTENSION LINING PROJECT
 PHASE 2-POOL NO. 8
 KONA IMPROVEMENT DISTRICT NO. 4
 KERN COUNTY, CA

STA 224+00 TO END



PRELIMINARY 15% PLANS
 NOT FOR CONSTRUCTION
 12-31-2015



**PRELIMINARY 15% PLANS
NOT FOR CONSTRUCTION
12-31-2015**

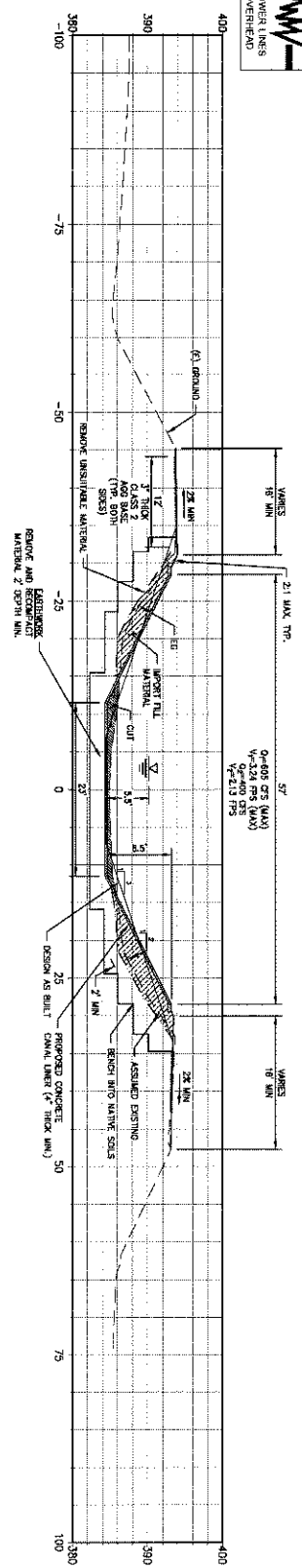
**CROSS VALLEY CANAL EXTENSION LINING PROJECT
PHASE 2-POOL NO. 8
KOWA IMPROVEMENT DISTRICT NO. 4
KERN COUNTY, CA**

PROVOST & PRITCHARD
GENERAL ENGINEERS
1601 WEST 5000 AVENUE, SUITE 2000
HAYWARD, CALIFORNIA 94545
(925) 781-5000 FAX (925) 781-5000

DESIGN ENGINEER: OEK
LICENSE NO: 47444
DRAFTED BY: PPS
CHECKED BY: CM
DATE: 12-31-2015
JOB NO: 10481453
D: 1
ORIGINAL SCALE SHOWN IS IN INCHES. ADJUST SCALE FOR REDUCED OR ENLARGED PLANS.
SHEET: **6** OF **7**



WARNING
POWER LINES
OVERHEAD



TYPICAL CROSS SECTION
 L=5,280 L.F.

EST. CONCRETE CANAL LINING FOR THIS CROSS SECTION =
 63.0 SQ FT PER FT



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CROSS VALLEY CANAL EXTENSION LINING PROJECT
 PHASE 2-POL NO. 8
 KCWA IMPROVEMENT DISTRICT NO. 4
 KERN COUNTY, CA

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MEMORANDUM

To: David Beard, KCWA ID4
 From: Benjamin Fenters, Calvin Monreal
 Subject: ID4 CVC Pool No. 8 Channel Analysis
 Date: December 29, 2015

The following is support information regarding the hydraulic analysis of the Cross Valley Canal Extension Lining Project – Phase 2 (Pool No. 8) located near the intersection of the Westside Parkway and Mohawk Street in Bakersfield, California for the categories as listed below.

The existing extension of the Cross Valley Canal (CVC) was designed and built as an earth canal in 1975 to convey water to the Improvement District No. 4 Henry C. Garnett Water Purification Plant. The CVC Extension is composed of two pools, Pool No. 7 and Pool No. 8, both of which were constructed with fill areas and cut sections. The length of Pool 8, earthen canal section is approximately 6,477 feet, where the total pool (including siphons) is 6,855 feet long, the length of the project is 5,280 feet. This analysis is only for Phase 2 of the CVC Extension Lining Project, which is composed of Pool No. 8.

Existing Conditions of Channel and Surrounding Area

The trapezoidal channel existing dimensions of the Pool 8 canal are as follows:

Side slope	3:1± horizontal: vertical
Bottom width	14± feet
Design water level	5.5± feet
Total depth	8.5± feet
Freeboard	3.0± feet
Top width	65± feet
Channel slope	0.0016±
Design flow	306 cfs

The existing channel's side slopes have eroded such that the cross sectional profile is more characteristic of a parabolic bowl shape than the original trapezoidal shape; the top width and the water surface width have remained approximately the same.

The existing right of way varies along the alignment. The existing channel has some plant growth on the banks and saturated material that is considered unsuitable for use as embankment/compacted fill to support the proposed canal lining and will have to be removed and replaced with suitable material. Downstream of the Calloway Canal Siphon several large trees are growing along the canal bank.

One existing turnout is present along the project alignment; the Kern River Turnout #4 and Overpour Spill Structure is located approximately 550 feet upstream of the Calloway Canal Siphon. A utility pipeline crossing is located approximately 315 feet downstream of the Calloway Canal Siphon.

Proposed Design

The design criteria that were considered included initial capital cost, constructability, maintenance and life of the project.

A hydraulic analysis of different cross-sections was performed to determine the optimal canal configuration. After evaluating various configuration options, it was determined that the optimal configuration was to not down-size the canal significantly, but only import enough fill material to replace the unsuitable material to be removed, slightly widen the existing operating roads, and essentially line the existing canal section. The original design inverts, channel slope and canal depth will not be changed. The side slopes will be changed from 3:1 (horizontal: vertical) to 2:1 (horizontal: vertical), the bottom width will increase by 9 feet giving an oversized canal. The oversized (bigger) canal cross-section will benefit the project in cost reduction (less import material) and water storage capacity of the pool, reducing fluctuations in water levels, which will prevent over topping. Concrete lining and geomembrane lining were both evaluated.

The extra concrete lining required in the bottom of the canal was determined to be less expensive than importing and compacting the large volume of fill material required to down-size the canal; additionally, the oversized canal provides more flexibility in operations by providing additional storage. The proposed design channel dimensions are as follows:

Side slope	2:1 horizontal: vertical
Bottom width	23± feet
Design water level	5.5 feet
Total depth	8.5 feet
Freeboard	3.0 feet
Top width	57± feet
Channel slope	0.00016 ft/ft
Design flow	400 cfs

The proposed canal configuration will allow for a smooth transition connection to the existing siphon and culvert inlet and outlet concrete transition sections. There will be no liner added to this section of canal in the area adjacent to the ponds. It was determined that the proposed concrete lining for the canal would possess a 50-year life span. This alternative was chosen because of the low maintenance activities once installed. Also, the Agency is more familiar with concrete lined channels and it matches current operations.

Figure 1, below shows the hydraulic analysis performed on the channel and its design characteristics. Pool No. 8 will operate at a velocity of approximately 2.1 feet per second within the typical proposed open channel portions and 7.96 feet per second for the siphons at a water depth of 5.5 feet, with a free board of 3 feet. The reduced velocity will act as a safety factor in the event that pumps at the Henry C. Garnett Water Purification Plant or Cawelo Water District Pump Station A shut down suddenly, reducing the wave speed and the probability of over topping the canal.

HYDRAULIC CHARECTERISTICS OF THE CHANNEL FLOW FOR POOL 8													
Beg Station	End Station	Length (ft)	Beg HGL EL (ft)	End HGL EL (ft)	D (ft)	b (ft)	n	HGL Slope s	z	Q (cfs)	V (ft/s)	Vel Head (ft)	Note
1054+35	1105+95	5160	5.6	5.5	5.5	23	0.015	0.000075	2	400	2.14	0.07	
1105+95	1109+73	378	7.8	5.6									Calloway Canal Siphon
1109+73	1122+90	1317	5.6	5.5	5.5	23	0.015	0.000075	2	400	2.14	0.07	

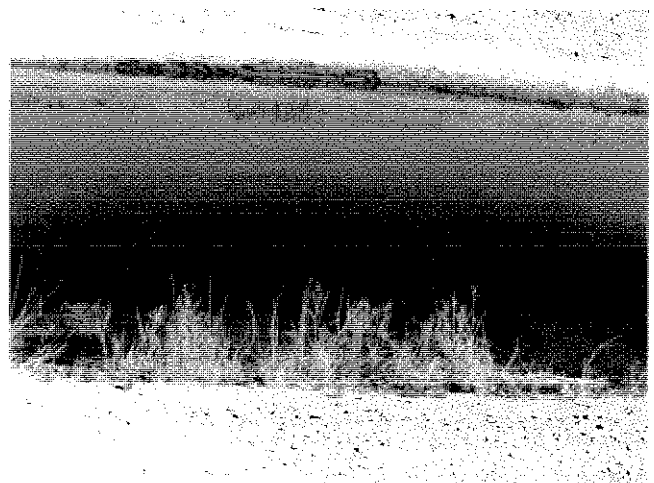
Calculations are based on the Manning Equation as applied to Trapezoidal Channels

per Page 7-16 of "HANDBOOK OF HYDRAULICS" Sixth Edition by Brater & King.

Calloway Siphon Headloss estimated to be 2.2 ft @ 400 CFS

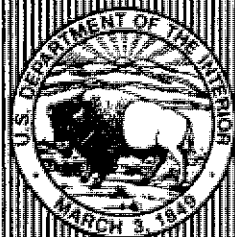
Figure 1-Hydraulic Characteristics of the Channel Flow

The following pictures show the Cross Valley Canal



R-02-03

CANAL-LINING DEMONSTRATION PROJECT YEAR 10 FINAL REPORT



November 2002

U.S. DEPARTMENT OF THE INTERIOR
Bureau of Reclamation

Pacific Northwest Region
Water Conservation Center

Technical Service Center
Civil Engineering Services
Materials Engineering Research Laboratory

EXECUTIVE SUMMARY

Reclamation has constructed 34 canal-lining test sections in 11 irrigation districts in four States to assess durability and effectiveness (seepage reduction) over severe rocky subgrades. The lining materials include combinations of geosynthetics, shotcrete, roller compacted concrete, grout mattresses, soil, elastomeric coatings, and sprayed-in-place foam. Twenty-eight test sections are located in central Oregon, three are in Montana, two are in Idaho, and one is in Oklahoma. Each test section typically covers 15,000 to 30,000 square feet. The test sections now range in age from 1 to 10 years. Preliminary benefit/cost (B/C) ratios have been calculated based on initial construction costs, maintenance costs, durability (service life), and effectiveness (determined by preconstruction and postconstruction ponding tests). The 34 test sections are divided into 4 generic categories as shown in the table below.

Table ES-1.—Test results for the 34 test sections

Type of Lining	Construction Cost (\$/ft ²)	Durability (years)	Maintenance Cost (\$/ft ² -yr)	Effectiveness at Seepage Reduction (percent)	B/C Ratio
Fluid-applied Membrane	\$1.40 - \$4.33	10 - 15 yrs	\$0.010	90 %	0.2 - 1.5
Concrete alone	\$1.92 - \$2.33	40 - 60 yrs	\$0.005	70 %	3.0 - 3.5
Exposed Geomembrane	\$0.78 - \$1.53	10 - 25 yrs	\$0.010	90 %	1.9 - 3.2
Geomembrane with Concrete Cover	\$2.43 - \$2.54	40 - 60 yrs	\$0.005	95 %	3.5 - 3.7

Each of the lining alternatives offers advantages and disadvantages. The geomembrane with concrete cover seems to offer the best long-term performance.

Fluid-applied membrane – Many of these test sections have failed and have been removed from the study. Most of the problems were related to poor quality control because of adverse weather common to field construction in late fall and early spring. These types of linings may have potential for special niche applications such as lining existing steel flumes or existing concrete channels.

Concrete – Excellent durability, but long-term effectiveness was only 70 percent because of random cracking. Irrigation districts are familiar with concrete, and they can easily perform required maintenance.

Exposed Geomembrane – The effectiveness is excellent (90 percent), but exposed geomembranes are susceptible to mechanical damage from animal traffic, construction equipment, and vandalism. Although exposed geomembranes have the lowest initial construction costs, they have a limited service life (typically 15 to 20 years). Also, exposed geomembranes are often poorly maintained because irrigation districts are unfamiliar with the geomembrane material, and sometimes need special equipment and training to perform even minor repairs.

Concrete with Geomembrane Underliner – The geomembrane underliner provides the water barrier, and the concrete cover protects the geomembrane from mechanical damage and weathering. System effectiveness is estimated at 95 percent. Districts can readily maintain the concrete cover, but they do not have to maintain the geomembrane underliner.

Effectiveness – Ponding tests showed a typical preconstruction seepage rate of about 1.0 foot per day. Postconstruction ponding tests showed effectiveness of 70 to 95 percent for the various lining alternatives.

Maintenance – Over the course of 10 years, maintenance costs have been relatively low for all the lining alternatives. Generally, exposed geomembranes require about twice the maintenance of concrete linings. For all lining alternatives, benefit/cost analysis shows that every \$1 spent on maintenance returns \$10 in conserved water by increasing effectiveness and design life. Therefore, more emphasis should be placed on maintenance, especially for exposed geomembrane linings.

New Test Sections

The newest test sections have been in service for only 1 to 2 years. While some of these test sections look promising, more time is needed to evaluate them before estimating service lives and benefit-cost ratios. These test sections include:

- Wet-applied polyurethane geocomposite
- Exposed reinforced metallized polyethylene
- Exposed bituminous geomembrane
- Exposed white textured HDPE
- Exposed EVA geocomposite

Coupon Testing

Six of the exposed geomembrane test sections were sampled for laboratory evaluation. Although many of the exposed geomembranes visually appear to be in excellent condition, the changes in physical properties suggest that many are beginning to degrade. Service life predictions are included in table ES-2.

Table ES-2—Coupon Testing of Exposed Geomembrane test sections

Test Section	Material	Age	Visual Assessment	Physical Property Testing	Service Life Prediction
A-3	80-mil Textured HDPE	10 years	Excellent	Elongation down 90% OIT down 30%	20-25 years
A-4	30-mil PVC with Bonded Geotextile	10 years	Very Good	Tensile up 30% Modulus up 140% Elongation down 70%	10-15 years
A-5	45-mil Hypalon	10 years	Fair to Poor	Tear strength down 60%	10-15 years
A-6	36-mil Hypalon	10 years	Fair	Tear strength down 60%	10-15 years
O-3	45-mil EPDM	2 years	Excellent	Elongation down 30% Tear strength down 50%	15-20 years
O-4	30-mil LLDPE	2 years	Excellent	Tensile down 10% Tear Strength down 10%	10-15 years

construction bids may be somewhat higher, depending on additional items such as mobilization, design costs, additional subgrade preparation, attachment to structures, contingencies, and unlisted items.

In addition to initial construction costs, the 34 test sections are evaluated for durability, maintenance requirements, and effectiveness at reducing seepage. These factors are combined to calculate life cycle costs.

Environmental Assessment of Canal Lining

Seepage from canals may contribute to groundwater and wetlands. The impact on groundwater and wetlands should be assessed prior to canal lining. This assessment may be mandated for projects using federal funding.

Sometimes canal seepage does not return to the river or increase local groundwater. In this case, the canal seepage is lost to beneficial use, and the canal-lining can proceed without further environmental assessment.

More often, canal seepage returns to the river or contributes to local groundwater. Other users may be using this water by diverting from the river or pumping from aquifers. These users may have a legal right to the water leaking from the canal.

Short sections of canal are often lined to mitigate problems associated with canal seepage. These problems often include stability of the canal bank, flooding of nearby houses and basements, and flooding of adjacent farmland removing it from production. In these cases, short sections (typically a few thousand linear feet) of canal are often lined without further environment assessment.

Restoration to Original Condition – Canals that were originally lined with concrete or compacted earth deteriorate over time and experience increased seepage rates. Concrete and compacted earth canal linings have a typical service life of about 50 years. Over time, the concrete cracks, subsides and heaves. Earth linings are gradually removed as the canal is cleaned out each year. A district that over-excavates their canal 1 inch each year, will completely remove a 3-ft compacted clay lining in only 36 years. The water lost to seepage belongs to the canal owner, and it is the owners right to re-line the canal to restore its original condition.

Value of Conserved Water

The B/C analysis uses \$50 per acre-ft for the value of the conserved water. This value was selected as a reasonable price for water purchased on the open market. At the low end, farmers typically pay an assessment of \$8 to \$20 per acre-ft for the water delivered by their irrigation district. Additional water (when available) can usually be purchased for about twice this cost (\$15 to \$40 per acre-ft). These costs only reflect the costs for building and maintaining the infrastructure and for delivering the water. These costs do reflect the value of the water on the open market. When cities and developers need to purchase water on the open market, they typically pay \$100 to \$300 per acre-ft, with the higher prices paid in drought years and in areas where water is especially scarce. Based on this range of prices, a value of \$50 per acre-ft seemed quite reasonable.

Effectiveness

Canal lining effectiveness is sometimes expressed as an absolute post-construction seepage rate (ft³/ft²-day). This study found that effectiveness is better expressed as a percent reduction in seepage, because the final seepage rate is a function of not only the lining material, but also the permeability of the native soils. For instance, let's look at a geomembrane lining with a small defect (hole). If the subgrade is moderately impermeable (fine-grained soils), then little water will seep through this defect. Conversely, if the subgrade is relatively permeable (sands and gravels), then a substantial amount of water will seep through this same defect. However, in both cases, the percent seepage reduction provided by canal lining (in this case, a geomembrane with a small defect) will be similar.

Using this approach, the various test sections have been divided into four broad categories. Linings within each of these categories use similar materials and have similar design lives, similar maintenance requirements, and similar effectiveness at reducing seepage. The effectiveness values were estimated from the ponding tests on the Arnold and North Unit Canals. Estimates of the durability and maintenance requirements were based on 10-year performance and our knowledge of the materials. Durability estimates have been modified slightly from the 7-year report, based on additional performance data. (See table 18.)

Table 18.—Test section results

Type of Lining	Number of Test Sections	Effectiveness (Seepage Reduction)	Durability	Maintenance (\$/ft ² -yr)
Concrete	6	70 percent	40-60 years	\$0.005
Exposed Geomembrane	14	90 percent	10-25 years	\$0.010
Fluid-applied Geomembrane	8	90 percent	10-15 years	\$0.010
Concrete with Geomembrane Underliner	3	95 percent	40-60 years	\$0.005

Concrete—Concrete includes RCC, Shotcrete, and grout-filled mattresses. When new, concrete is initially quite watertight, although concrete does have a measurable permeability. However, within the first couple of years, concrete starts to develop cracks because of shrinkage during curing, and thermal movement (temperature differences between day and night and summer and winter). Furthermore, concrete often continues to crack over time because of subgrade movement. Also, Shotcrete thickness is difficult to control in the field, and holes routinely develop where original Shotcrete thickness was less than 1 inch. The grout-filled mattress has also cracked, especially in areas where it is less than 1 inch thick because of the rocky subgrade. Cracks tend to grow in length and numbers over the years, but so far, have not widened significantly. Also the concrete degrades because of freezing and thawing. All these degradation modes lead to a predicted service life of 40 to 60 years. Ponding tests show an effectiveness (seepage reduction) of 60 to 90 percent and an estimated long-term effectiveness of about 70 percent. Maintenance requirements are relatively low for concrete, and irrigation district personnel are familiar with concrete and comfortable making the repairs.

CHAPTER 5 BENEFIT/COST ANALYSIS

All the canal-lining alternatives were compared using Benefit/Cost (B/C) analysis. Alternatives with a B/C ratio greater than 1 are economically viable, but alternatives with a B/C ratio less than 1 cannot be justified based on economics. Obviously, the higher the B/C ratio, the better the alternative economically. For instance:

- B/C = 10 every dollar invested (cost) returns \$10 in benefit
- B/C = 1 every dollar invested (cost) returns \$1 in benefit
- B/C = 0.5 every dollar invested (cost) returns \$0.50 in benefit

Benefit—The primary purpose of all the canal-lining alternatives is to conserve irrigation water. Therefore, the primary benefit is the value of the conserved water. For this study, the value of that water is estimated at \$50 per acre-foot. District water assessments typically range from \$10 to \$25 per acre-foot, while water purchased on the open market costs as much as \$300 per acre-foot. Secondary benefits are also achieved by canal lining. That is use of adjacent cropland normally flooded by leaking canals and remediation of damage to structures near canals (such as flooded basements) are examples of secondary benefits. However, the value of these secondary benefits is not included in this analysis.

The amount of water conserved by each canal-lining alternative depends on its effectiveness (percent seepage reduction) and the preconstruction seepage rate. For this study, we used a 180-day irrigation season, and a conservative preconstruction seepage rate of 1.0 foot/day (ft³/ft²/day). The effectiveness, durability, and maintenance requirements for four generic types of canal linings are listed in table 19.

Cost—The cost of each alternative is calculated as its life-cycle cost (\$/ft²-yr). Life-cycle costs are calculated using initial costs, design life (durability), and maintenance costs. Initial costs were taken from tables 2, 3, and 4 in chapter 1 of this report. Durability and Maintenance costs were taken from table 19.

Table 19.—Effectiveness, durability, and maintenance requirements of generic types of canal linings

Type of Lining	Number of Test Sections	Effectiveness (Seepage Reduction)	Durability	Maintenance (\$/ft 2-yr)
Concrete	6	70 percent	40-60 years	\$0.005
Exposed Geomembrane	14	90 percent	10-25 years	\$0.010
Fluid-applied Geomembrane	8	90 percent	10-15 years	\$0.010
Concrete with Geomembrane Underliner	3	95 percent	40-60 years	\$0.005

Benefit/Cost Ratios—B/C ratios were calculated for each test section and are tabulated in table 20. Sample calculation is shown in appendix E. Many test sections have favorable B/C ratios, and the lining alternatives with the highest B/C ratio include exposed geomembranes, geomembranes with concrete

Exhibit C-1 Well Power Calculation Sheet

$$\text{Power Charge} = \text{Power Rate (\$/KWH)} \times \text{Energy Use (Avg. KWH/AF)} \times \text{Annual Pumping (AF)}$$

Notes:

1) \$/KWH is calculated by using the PG&E, AG 5b rate or future equivalent determined prior to May 1 of each year. Currently AG 5b includes demand charges, electric energy charges for on peak, off peak and partial peak and associated energy tariffs.

2) The following table will be used to determine the KWH/AF. Pump TDH is a value calculated from the measurements from wells in the well field at one hour of pumping. If multiple wells are used, the average calculated TDH for the operational wells will be used for determination of energy use.

3) If the calculated total dynamic head (TDH) is greater than 400 feet, the KWH/AF will be recalculated.

Pump TDH After 1 Hour of Pumping	Average KWH/AF	KWH Per 21,000 AF	Cost Per 21,000 AF (\$)
50.0	156.3	3,282,288.8	385,341
60.0	163.3	3,429,473.1	402,620
70.0	169.7	3,563,995.4	418,413
80.0	175.8	3,692,054.4	433,447
90.0	181.8	3,817,488.0	448,173
100.0	187.8	3,942,888.5	462,895
110.0	193.8	4,070,153.5	477,836
120.0	200.0	4,200,781.9	493,172
130.0	206.5	4,336,044.5	509,052
140.0	213.2	4,477,090.4	525,610
150.0	220.2	4,625,017.4	542,977
160.0	227.7	4,780,923.3	561,280
170.0	235.5	4,945,946.7	580,654
180.0	243.9	5,121,301.9	601,241
190.0	252.8	5,308,313.2	623,196
200.0	262.3	5,508,450.2	646,692
210.0	272.5	5,723,366.0	671,923
220.0	283.6	5,954,942.5	699,110
230.0	295.5	6,205,343.5	728,507
240.0	308.4	6,477,079.9	760,409
250.0	322.5	6,773,091.7	795,161
260.0	337.9	7,096,850.3	833,170
270.0	354.9	7,452,491.5	874,922
280.0	373.6	7,844,987.8	921,002
290.0	394.3	8,280,376.5	972,116
300.0	417.4	8,766,064.9	1,029,136
310.0	443.4	9,311,247.0	1,093,140
320.0	472.7	9,927,479.9	1,165,486
330.0	506.2	10,629,499.4	1,247,903
340.0	544.6	11,436,396.1	1,342,633
350.0	589.2	12,373,356.8	1,452,632
360.0	641.6	13,474,311.8	1,581,884
370.0	704.1	14,786,094.0	1,735,887
380.0	779.8	16,375,221.1	1,922,451
390.0	873.3	18,339,459.7	2,153,053
400.0	991.8	20,828,630.5	2,445,281

Example:

$$\$646,692 = 0.1174/\text{KWH} \times 262.3\text{KWH/AF} \times 21,000 \text{ AF}$$

**Exhibit C-2
250 HP Power Cost Calculation Sheet**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16.0	17	18	19	20
Pumping Level	Pump Column Losses	Discharge Head	Total Dynamic Head (TDH)	Pump Flow	Pump Bowl Efficiency	Pump Bowl Power	Pump Shaft Losses	Pump Thrust Losses	Motor Efficiency	Overall Efficiency	Input Power	Electric Power	Energy Use	Water Production	Energy Use	Unit Cost-PG&E 5b	Cost Per Acre-Foot	Cost Per Hour of Operation	Cost Per Day of Operation
(ft)	(ft)	(ft)	(ft)	(GPM)	(%)	(HP)	(HP)	(HP)	(%)	(%)	(HP)	(KW)	KWH/Day	(AF/Day)	KWH/AF	(\$/KWH)	(\$/AF)	(\$/HR)	(\$/Day)
-20.3	22.7	27.6	30	4,422	24.2%	138.6	2.0	0.826	94.0%	22.7%	150.4	112.2	2,693.5	19.5	137.8	0.1174	16.2	13.176	316.2
-6.8	21.2	25.6	40	4,329	29.9%	146.4	2.0	0.826	94.3%	28.2%	158.3	118.1	2,834.7	19.1	148.2	0.1174	17.4	13.866	332.8
6.5	19.7	23.8	50	4,236	35.3%	151.6	2.0	0.826	94.5%	33.3%	163.4	121.9	2,926.2	18.7	156.3	0.1174	18.3	14.314	343.5
19.5	18.4	22.1	60	4,143	40.4%	155.4	2.0	0.826	94.7%	38.3%	167.0	124.6	2,980.4	18.3	163.3	0.1174	19.2	14.628	351.1
32.3	17.2	20.5	70	4,050	45.2%	158.3	2.0	0.826	95.0%	42.9%	169.7	126.6	3,037.9	17.9	169.7	0.1174	19.9	14.861	356.7
45.0	16.0	19.0	80	3,957	49.8%	160.6	2.0	0.826	95.2%	47.4%	171.7	128.1	3,074.8	17.5	175.8	0.1174	20.6	15.041	361.0
57.4	14.9	17.6	90	3,864	54.0%	162.5	2.0	0.826	95.3%	51.5%	173.4	129.4	3,104.4	17.1	181.8	0.1174	21.3	15.186	364.5
69.7	13.9	16.4	100	3,771	58.0%	164.1	2.0	0.826	95.5%	55.4%	174.8	130.4	3,129.1	16.7	187.8	0.1174	22.0	15.307	367.4
81.8	13.0	15.2	110	3,678	61.7%	165.6	2.0	0.826	95.7%	59.1%	176.0	131.3	3,150.2	16.3	193.8	0.1174	22.8	15.410	369.8
93.8	12.1	14.1	120	3,584	65.1%	166.8	2.0	0.826	95.9%	62.4%	177.0	132.0	3,168.9	15.8	200.0	0.1174	23.5	15.501	372.0
105.6	11.3	13.1	130	3,491	68.2%	168.0	2.0	0.826	96.0%	65.5%	177.9	132.7	3,185.7	15.4	206.5	0.1174	24.2	15.583	374.0
117.3	10.5	12.2	140	3,398	71.0%	169.1	2.0	0.826	96.1%	68.3%	178.8	133.4	3,201.3	15.0	213.2	0.1174	25.0	15.680	375.8
128.9	9.8	11.3	150	3,304	73.6%	170.1	2.0	0.826	96.3%	70.8%	179.6	134.0	3,216.1	14.6	220.2	0.1174	25.9	15.732	377.6
140.4	9.1	10.5	160	3,211	75.8%	171.0	2.0	0.826	96.4%	73.1%	180.4	134.6	3,230.4	14.2	227.7	0.1174	26.7	15.802	379.3
151.8	8.5	9.7	170	3,117	77.8%	172.0	2.0	0.826	96.5%	75.1%	181.2	135.2	3,244.5	13.8	235.5	0.1174	27.7	15.871	380.9
163.0	7.9	9.0	180	3,023	79.5%	172.9	2.0	0.826	96.5%	76.7%	182.0	135.8	3,258.6	13.4	243.9	0.1174	28.6	15.940	382.6
174.2	7.4	8.4	190	2,930	80.9%	173.8	2.0	0.826	96.6%	78.1%	182.8	136.4	3,272.9	12.9	252.8	0.1174	29.7	16.010	384.2
185.3	6.9	7.8	200	2,836	82.0%	174.7	2.0	0.826	96.7%	79.3%	183.6	137.0	3,287.6	12.5	262.3	0.1174	30.8	16.082	386.0
196.4	6.4	7.2	210	2,742	82.8%	175.6	2.0	0.826	96.7%	80.1%	184.5	137.6	3,302.8	12.1	272.5	0.1174	32.0	16.156	387.8
207.3	6.0	6.7	220	2,648	83.3%	176.5	2.0	0.826	96.8%	80.6%	185.4	138.3	3,318.8	11.7	283.6	0.1174	33.3	16.235	389.6
218.2	5.6	6.2	230	2,554	83.6%	177.5	2.0	0.826	96.8%	80.9%	186.3	139.0	3,335.7	11.3	295.5	0.1174	34.7	16.317	391.6
229.0	5.2	5.7	240	2,460	83.5%	178.5	2.0	0.826	96.8%	80.9%	187.3	139.7	3,353.6	10.9	308.4	0.1174	36.2	16.405	393.7
239.8	4.9	5.3	250	2,366	83.2%	179.5	2.0	0.826	96.8%	80.5%	188.4	140.5	3,372.8	10.5	322.5	0.1174	37.9	16.498	396.0
250.5	4.5	4.9	260	2,272	82.6%	180.6	2.0	0.826	96.8%	79.9%	189.5	141.4	3,393.4	10.0	337.9	0.1174	39.7	16.599	398.4
261.2	4.2	4.6	270	2,178	81.7%	181.7	2.0	0.826	96.7%	79.0%	190.8	142.3	3,415.7	9.6	354.9	0.1174	41.7	16.708	401.0
271.8	3.9	4.2	280	2,084	80.5%	183.0	2.0	0.826	96.7%	77.9%	192.1	143.3	3,440.0	9.2	373.6	0.1174	43.9	16.827	403.9
282.4	3.7	3.9	290	1,989	79.0%	184.3	2.0	0.826	96.7%	76.4%	193.6	144.4	3,466.5	8.8	394.3	0.1174	46.3	16.957	407.0
292.9	3.4	3.7	300	1,895	77.3%	185.8	2.0	0.826	96.6%	74.6%	195.3	145.7	3,495.8	8.4	417.4	0.1174	49.0	17.100	410.4
303.4	3.2	3.4	310	1,800	75.2%	187.4	2.0	0.826	96.5%	72.6%	197.1	147.0	3,528.1	8.0	443.4	0.1174	52.1	17.258	414.2
313.9	3.0	3.1	320	1,706	72.9%	189.1	2.0	0.826	96.4%	70.3%	199.1	148.5	3,564.2	7.5	472.7	0.1174	55.5	17.435	418.4
324.3	2.8	2.9	330	1,611	70.3%	191.1	2.0	0.826	96.3%	67.7%	201.3	150.2	3,604.7	7.1	506.2	0.1174	59.4	17.633	423.2
334.7	2.6	2.7	340	1,517	67.4%	193.3	2.0	0.826	96.2%	64.8%	203.9	152.1	3,650.7	6.7	544.6	0.1174	63.9	17.858	428.6
345.1	2.4	2.5	350	1,422	64.2%	195.9	2.0	0.826	96.1%	61.6%	206.8	154.3	3,703.2	6.3	589.2	0.1174	69.2	18.115	434.8
355.5	2.2	2.3	360	1,327	60.7%	198.9	2.0	0.826	95.9%	58.2%	210.2	156.8	3,764.1	5.9	641.6	0.1174	75.3	18.413	441.9
365.8	2.1	2.1	370	1,233	56.9%	202.4	2.0	0.826	95.8%	54.5%	214.2	159.8	3,835.6	5.4	704.1	0.1174	82.7	18.762	450.3
376.1	1.9	2.0	380	1,138	52.8%	206.6	2.0	0.826	95.6%	50.5%	219.0	163.4	3,920.9	5.0	779.8	0.1174	91.5	19.180	460.3
386.4	1.8	1.8	390	1,043	48.5%	211.7	2.0	0.826	95.4%	46.3%	224.8	167.7	4,024.9	4.6	873.3	0.1174	102.5	19.688	472.5
396.6	1.7	1.7	400	948	43.9%	218.2	2.0	0.826	95.3%	41.8%	232.1	173.1	4,154.9	4.2	991.8	0.1174	116.4	20.324	487.8
406.9	1.6	1.6	410	853	39.0%	226.7	2.0	0.826	95.1%	37.0%	241.4	180.1	4,322.7	3.8	1,146.9	0.1174	134.6	21.145	507.5
417.1	1.5	1.5	420	758	33.7%	238.1	2.0	0.826	94.8%	32.0%	254.1	189.5	4,548.8	3.3	1,358.3	0.1174	159.5	22.251	534.0
427.3	1.4	1.4	430	663	28.3%	254.6	2.0	0.826	94.6%	26.7%	272.1	203.0	4,871.7	2.9	1,663.7	0.1174	195.3	23.831	571.9

Footnotes:

- 1) Pump characteristics derived from a four stage Flowserve 14ENL Pump with a 10.6-inch trim and a design point of 2500 GPM @ 226 Ft.
- 2) Power usage derived from a 250 HP US premium efficient hollowshaft electric motor.
- 3) Power costs based on a PG&E AG 5b melded unit rate of \$0.1174/KWH

RRBWS D JURP05-1228

**Kern IRWM Group
Project Prioritization List**

Form #

Subregion	Project Applicant	Title	Tier 1 Score (1)	Subregion Top 5	Priority	Supplemental Drought Form Submitted	
CK-1	County of Kern	County of Kern	South Shafter Sewer	31	Y	High	
CK-2	County of Kern	County of Kern	Caliente Creek Habitat Restoration	44	Y	High	
CK-3	County of Kern	County of Kern	Lakeshore Pines Leachfield Restoration	29	Y	High	
CK-4	County of Kern	County of Kern	Lake Isabella Detailed Sewer Study	33	Y	High	
CK-5	County of Kern	County of Kern	Krista Mutual Water Company Water Project	30	Y	High	
CK-6	County of Kern	County of Kern	Reeder Tract WWT Facility	22		Low	
CK-7	County of Kern	County of Kern	Sandy Creek Bank and Erosion Protection	24		Low	
CK-8	County of Kern	County of Kern	South Taft Sewer Improvements	26		Low	
CK-9	County of Kern	County of Kern	Cuddy Creek Restoration Project	28		Low	
CK-10	County of Kern	County of Kern	Reconstruction of Adams/Jefferson St - Ford City	13		Low	
CK-11	County of Kern	County of Kern	Disadvantaged Community Leak Detection Program	27		Low	
CK-12	County of Kern	County of Kern	Athal Water Project			A	
GB-1	Greater Bakersfield	Improvement District No. 4	Recharge Improvement Project	19	Y	High	
GB-2	Greater Bakersfield	Improvement District No. 4	Beardsley Pipeline	22	Y	High	Y
GB-3	Greater Bakersfield	Improvement District No. 4	CVC Extension Lining	17	Y	High	Y
GB-4	Greater Bakersfield	Improvement District No. 4	Groundwater Monitoring Wells	16	Y	High	
GB-6	Greater Bakersfield	Improvement District No. 4	Surface Water Quality Monitoring Stations	10	Y	High	
GB-5	Greater Bakersfield	City of Bakersfield	Water Conservation Project for Metropolitan Bakersfield	20		Rd2 Imp. Grant	
WA-1	KCWA	Kern County Water Agency	Biodenitrification of Groundwater Pilot Program	24	Y	High	
WA-2	KCWA	Kern County Water Agency	Photovoltaic Arrays	21	Y	High	
WA-3	KCWA	Kern County Water Agency	Well-head Arsenic Treatment	23	Y	High	
KF-2	Kern Fan	Kern Water Bank Authority	Kern Water Bank Short-Term Storage Program	21	Y	High	Y
KF-3	Kern Fan	Buena Vista Water Storage District	Brackish Groundwater Remediation Project	27	Y	High	Y
KF-4	Kern Fan	Buena Vista Water Storage District	Conservation Easement Water Acquisition and Management Project	20	Y	High	Y
KF-5	Kern Fan	Buena Vista Water Storage District	Groundwater Recharge and Recovery Project	36	Y	High	Y
KF-1	Kern Fan	Kern Water Bank Authority	Kern Water Bank Recharge and Recovery Enhancement Project	36		Rd2 Imp. Grant	
KF-6	Kern Fan	Tulare Basin Wildlife Partners	Goose Lake Wetlands Reserve Program Residual Value Purchase			Low	
KF-7	Kern Fan	Tulare Basin Wildlife Partners	Goose Lake Conservation Plan and DFG CAPP			Low	
KF-8	Kern Fan	Tulare Basin Wildlife Partners	Riparian and Wildlife Corridor Planning Area - Kern River			Low	
KF-9	Kern Fan	Buena Vista Water Storage District	Water Exchange Project			Low	
KF-10	Kern Fan	Buena Vista Water Storage District	On-Farm Water Use Efficiency	18		Low	
KF-11	Kern Fan	Buena Vista Water Storage District	Northern Improvement Project	19		Low	
KF-12	Kern Fan	Buena Vista Water Storage District	Kern Fan Direct Recharge and Recovery Project			Low	
KF-13	Kern Fan	Buttonwillow County Water District	Waterline Replacement Project	18		Low	



Kern IRWM Group
Project Prioritization List

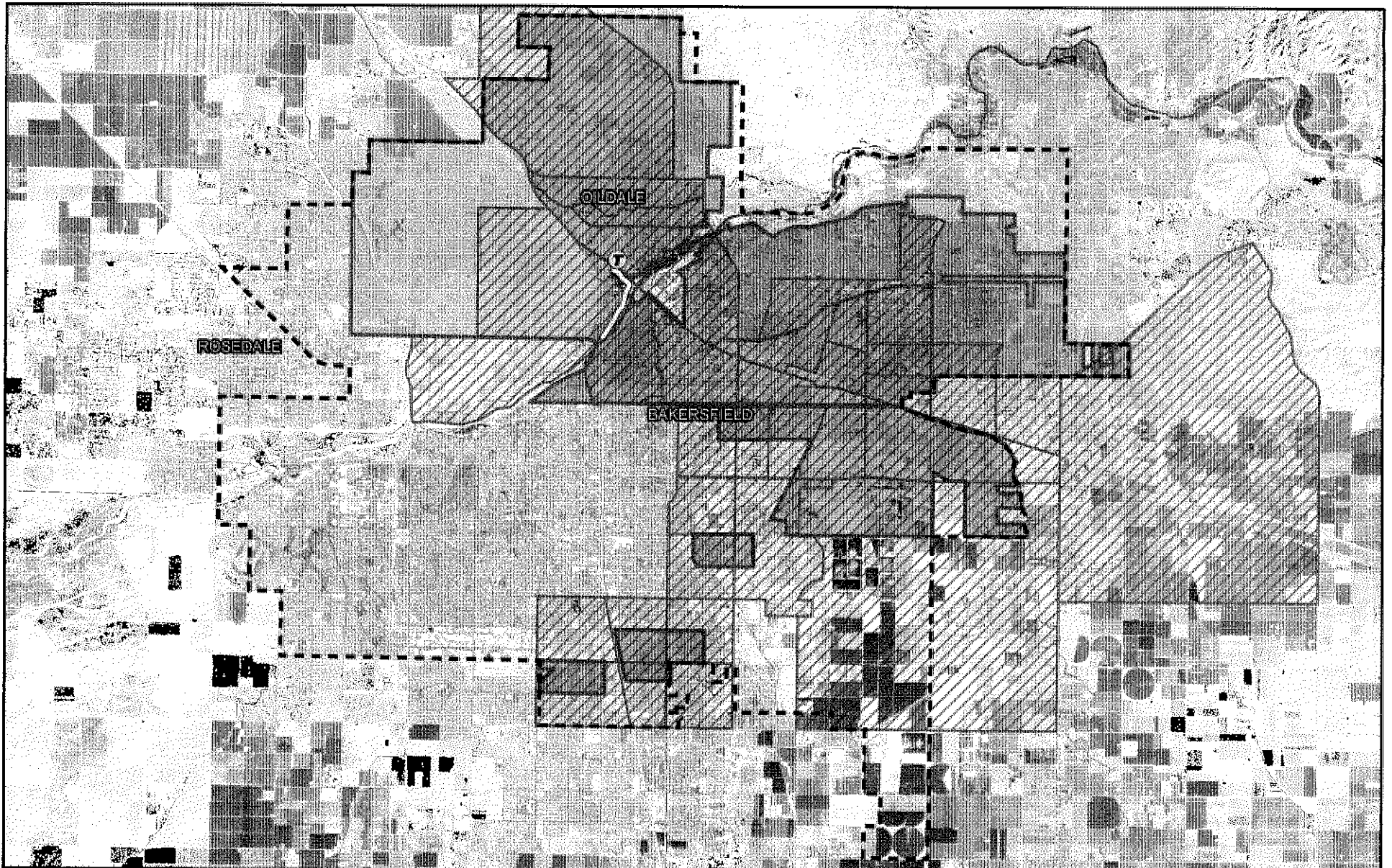
4/10/2014

Form #	Subregion	Project Applicant	Title	Tier 1 Score (1)	Subregion Top 5	Priority	Supplemental Drought Form Submitted
KR-1	Kern River Valley	County of Kern	Weldon Regional Water Project	39	Y	High	
KR-2	Kern River Valley	Tubatulabal Tribal Water Board	Phase II Safe Drinking Water and Tribal Allotments Community Water System	48	Y	High	Y
KR-3	Kern River Valley	Tubatulabal Tribal Water Board	Phase II Safe Drinking Water and Community Use Area - White Blanket Allotment	38	Y	High	
KR-4	Kern River Valley	Desert Mountain Resources Conservation and Development Council	Eradication of Invasive Weeds in the Kern River Valley and Walker Basin	47	Y	High	Y
KR-5	Kern River Valley	County of Kern	Tradewinds Auxiliary Well or Uranium Treatment	30	Y	High	Y
MF-1	Mountains/Foothills	County of Kern	GHSC Force Main Project	27	Y	High	
MF-4	Mountains/Foothills	Bear Valley Community Services District	Radio Nuclides Treatment Project	23	Y	High	Y
MF-2	Mountains/Foothills	Tehachapi-Cummings County Water District	Tehachapi Regional Water Conservation Program	36		Rd2 Imp. Grant	
MF-3	Mountains/Foothills	Tehachapi-Cummings County Water District	Public Facility Distribution Line and Nitrate Removal Program	41		Rd2 Imp. Grant	
	Mountains/Foothills	Frazier Park Public Utility District	Well Replacement		N	Removed	
NC-1	North County	City of Shafter	Well No. 15	27	Y	High	
NC-2	North County	City of McFarland	Browning Road Storage Tank and Booster Facility	37	Y	High	Y
SC-8	South County	Arvin-Edison Water Storage District	In-Lieu Banking Program	78	Y	High	Y
SC-11	South County	Arvin-Edison Water Storage District	Improved Stormwater Management and Flood Control	75	Y	High	
SC-10	South County	Arvin-Edison Water Storage District	South Canal Balancing Reservoir	67	Y	High	
SC-7	South County	Arvin-Edison Water Storage District	Forrest Frick Rehabilitation Project	56	Y	High	Y
SC-1	South County	Arvin-Edison Water Storage District/Kern Delta Water District	AEWSD Intake Canal and Kern Delta Buena Vista River Canal Intertie Project	54	Y	High	
SC-2	South County	City of Arvin	Sycamore Drainage Facilities	32		Rd2 Imp. Grant	
SC-3	South County	Wheeler Ridge-Maricopa Water Storage District	Groundwater Storage and Recover in White Wolf Basin	43		Low	
SC-9	South County	Arvin-Edison Water Storage District	Lateral Capacity Improvement Project	43		Low	
SC-5	South County	Mettler County Water District	Mettler Groundwater Protection Project	38		Low	
SC-4	South County	Arvin-Edison Water Storage District	Wasteway Basin Improvement Project	32		Low	
SC-14	South County	Lamont Public Utilities District	Renovation of Belowground Storage Reservoir	20		Low	
SC-15	South County	Arvin Community Services District	Arsenic Mitigation Project	16		Low	
SC-13	South County	Lamont Public Utilities District	Water Quality Improvement Project for Well No. 16	14		Low	
SC-12	South County	Lamont Public Utilities District	Well No. 19 Arsenic Reduction Blending Project	12		Low	
SC-6	South County	Wheeler Ridge-Maricopa Water Storage District	Solar Power Generation	3		Low	
SC-16	South County	Mettler County Water District	Mettler Well No. 4 Project			Low	

Form #	Subregion	Project Applicant	Title	Tier 1 Score (1)	Subregion Top 5	Priority	Supplemental Drought Form Submitted
WS-1	Westside	Lost Hills Water District	Regional Brackish Water Treatment Project	13	Y	High	Y
WS-2	Westside	Berrenda Mesa Water District	Westside Districts' Groundwater Banking Project	25	Y	High	
WS-3	Westside	Berrenda Mesa Water District	Lost Hills Surface Water Treatment Plant	19	Y	High	
WS-4	Westside	Lost Hills Utility District	Construction of a New Well to Provide a Firm Water Supply to the LHUD Users	17	Y	High	Y
WS-5	Westside	Lost Hills Utility District	Storage Tank Rehabilitation to the LHUD 2.0 MG Storage Tank	11	Y	High	Y
WS-6	Westside	City of Taft	Storm Drain and Floodplain Basin Project	8		Low	
WS-7	Westside	City of Maricopa	Maricopa Wastewater Project	6		Low	
WS-8	Westside	Tulare Basin Wildlife Partners	Buena Vista Lake-Kern Lake Conservation Plan and DFG CAPP	8		Low	

Notes:

(1) Highlight indicates project re-submitted & rescored










0 0.5 1 1.5 2 Miles



PROVOST & PRITCHARD
CONSULTING GROUP
An Employee Owned Company

286 W. Cromwell Ave.
Fresno, CA 93711-6182
(559) 449-2700

Legend

-  Improvement District No. 4
-  Treated Water Service Area (30,264 Ac.)
-  Northwest Feeder Area (23,970 Ac.)
-  Original Service Area (8,294 Ac.)
-  Treatment Plant
-  CVC Lining, Pool 8 (Project Location)
- Census Tracts (CalEnviroScreen 2.0)**
-  CES Score Percentile >=76

Kern County Water Agency
Cross Valley Canal Extension Lining (CVC Pool 8)
Disadvantaged Community Map

Kern County Water Agency
Cross Valley Canal Extension Lining - Pool No. 8

ID	Task Name	Duration	Start	Finish	2016				2017				2018				2019	
					Qtr 4, 2015	Qtr 1, 2016	Qtr 2, 2016	Qtr 3, 2016	Qtr 4, 2016	Qtr 1, 2017	Qtr 2, 2017	Qtr 3, 2017	Qtr 4, 2017	Qtr 1, 2018	Qtr 2, 2018	Qtr 3, 2018	Qtr 4, 2018	Qtr 1, 2019
1	Task 1 Direct Project Administration	588 days	Thu 9/29/16	Mon 12/31/18														
2	Contract Start Date (Assumed)	0 days	Mon 10/3/16	Mon 10/3/16														
3	Grant Administration	587 days	Thu 9/29/16	Fri 12/28/18														
4	Task 2 - Reporting	497 days	Wed 2/1/17	Thu 12/27/18														
5	Quarterly Reporting (every 3 months)	478 days	Wed 2/1/17	Fri 11/30/18														
6	Project Completion Report	1 mon	Sat 12/1/18	Thu 12/27/18														
7	Task 3 - Land Purchase/Easement	86 days	Fri 4/1/16	Fri 7/29/16														
8	3.1 Temporary Easement Procurement	86 days	Fri 4/1/16	Fri 7/29/16														
9	Task 4 - Assessment and Evaluation	45 days	Thu 10/1/15	Wed 12/2/15														
10	4.1 Feasibility Study	45 days	Thu 10/1/15	Wed 12/2/15														
11	Task 5 - Final Design	134 days	Wed 2/1/17	Mon 8/7/17														
12	5.1 Survey and Utility Investigation	10 days	Wed 2/1/17	Tue 2/14/17														
13	5.2 Geotechnical Investigation	6 mons	Tue 2/21/17	Mon 8/7/17														
14	5.3 Project Design	120 days	Tue 2/21/17	Mon 8/7/17														
15	Task 6 - Environmental Documentation	140 days	Thu 9/1/16	Wed 3/15/17														
16	6.1 NEPA Documentation	7 mons	Thu 9/1/16	Wed 3/15/17														
17	6.2 Biological Studies	7 mons	Thu 9/1/16	Wed 3/15/17														
18	6.3 Cultural Resources Studies	7 mons	Thu 9/1/16	Wed 3/15/17														
19	Task 7 - Permitting	20 days	Mon 3/6/17	Fri 3/31/17														
20	7.1 SWPPP	20 days	Mon 3/6/17	Fri 3/31/17														
21	7.2 DCP/ISR	20 days	Mon 3/6/17	Fri 3/31/17														
22	Task 8 - Construction Contracting	61 days	Fri 11/10/17	Fri 2/2/18														
23	8.1 Construction Bid Process	45 days	Fri 11/10/17	Thu 1/11/18														
24	8.2 Bid Award & Execute Contract Documents	15 days	Mon 1/15/18	Fri 2/2/18														
25	Task 9 - Construction	149 days	Wed 2/21/18	Mon 9/17/18														
26	9.1 Mobilization & Site Preparation	20 days	Wed 2/21/18	Tue 3/20/18														
27	9.2 Prject Construction	114 days	Wed 3/21/18	Mon 8/27/18														
28	9.2.1 Earthwork	70 days	Wed 3/21/18	Tue 6/26/18														
29	9.2.2 Install Liner	85 days	Tue 5/1/18	Mon 8/27/18														
30	9.3 Performance Testing & Demobilization	15 days	Tue 8/28/18	Mon 9/17/18														
31	Task 10 - Env. Compliance/Mitigation/Enhancement	120 days	Wed 3/21/18	Tue 9/4/18														
32	10.1 SWPPP & ISR Compliance/Mitigation Measures	6 mons	Wed 3/21/18	Tue 9/4/18														
33	Task 11 - Construction Administration	129 days	Wed 3/21/18	Mon 9/17/18														
34	11.1 Construction Administration	120 days	Wed 3/21/18	Tue 9/4/18														
35	11.2 Material Submittal Review	10 days	Wed 3/21/18	Tue 4/3/18														
36	11.3 Construction Review	120 days	Wed 3/21/18	Tue 9/4/18														
37	11.4 Soils/Materials/Testing	120 days	Wed 3/21/18	Tue 9/4/18														
38	11.5 Project Closeout	10 days	Tue 9/4/18	Mon 9/17/18														
39	Task 12 - Public Outreach	262 days	Mon 10/3/16	Tue 10/3/17														

Project: Project1.8 updated

Task:		Summary		Inactive Milestone	Duration-only		Start-only		External Milestone		Manual Progress
Split:		Project Summary		Inactive Summary	Manual Summary Rollup		Finish-only		Deadline		Progress
Milestone:		Inactive Task		Manual Task	Manual Summary		External Tasks		Progress		

BEFORE THE BOARD OF DIRECTORS
OF THE
KERN COUNTY WATER AGENCY

In the matter of:

AUTHORIZATION FOR IMPROVEMENT *
DISTRICT NO. 4 TO APPLY FOR A FEDERAL *
WATER AND ENERGY EFFICIENCY GRANT *

I, Lucinda J. Infante, Secretary of the Board of Directors of the Kern County Water Agency, of the County of Kern, State of California, do hereby certify that the following resolution proposed by Director Wulff, and seconded by Director Lundquist, was duly passed and adopted by said Board of Directors at an official meeting hereof this 16th day of December, 2015, by the following vote, to wit:

Ayes: Lundquist, Fast, Wulff, Milobar, Hafenfeld and Page

Noes: None

Absent: None


Secretary of the Board of Directors
of the Kern County Water Agency

Resolution No. 43-15

WHEREAS, the Board of Directors of the Kern County Water Agency (Agency) is also empowered as the Board of Directors of the Agency Improvement District No. 4 (ID4); and

WHEREAS, the U.S. Department of Interior Bureau of Reclamation (USBR) released a Funding Opportunity Announcement for WaterSMART: Water and Energy Efficiency Grants for Fiscal Year 2016 (WaterSMART Program); and

WHEREAS, the WaterSMART Program will provide funding to projects that conserve and use water more efficiently; increase use of renewable energy and improve energy efficiency; benefit

endangered and threatened species; facilitate water markets and carry out other activities to address climate-related impacts on water; or prevent any water-related crisis or conflict; and

WHEREAS, Agency staff is recommending ID4 submit a WaterSMART Program application for the Cross Valley Canal Extension Lining Project – Phase II; and

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of the Kern County Water Agency that:

1. The foregoing recitals are true and correct.
2. The General Manager is hereby authorized and directed to submit an application to USBR to obtain a WaterSMART: Water and Energy Efficiency Grant for Fiscal Year 2016.
3. The General Manager is hereby authorized and directed to prepare the necessary data, conduct investigations, file such application, and execute a grant agreement and any amendments thereto, with USBR. Said application will include a commitment to the financial and legal obligations associated with receipt of financial assistance under the grant program. Said application will also include a commitment to work with Reclamation to meet established deadlines for entering into a cooperative agreement should its application be approved for funding.



SOILS ENGINEERING, INC.

August 18, 2014

Proposal No. 14-288b

Kern County Water Agency
3200 Rio Mirada Dr.
P.O. Box 58
Bakersfield, CA 93302-0058

Attention: Martin Varga, Engineering & Groundwater Services Manager

Subject: Proposal for Geotechnical Investigation
For the proposed lining of Pool 8 of the
Cross Valley Canal East of Friant-Kern Canal
In Bakersfield, Kern County, California

Dear Mr. Varga:

In accordance with your email communication, and the scope of work provided by Provost & Pritchard, we are issuing the following proposal to provide a Geotechnical Investigation for the proposed concrete lining of portions of the Cross Valley Canal between the Highway 99-24th Street Siphon and the Golden State Avenue siphon. Pool 8 has two reaches and is comprised of approximately 6,400 linear feet of unlined canal that would be concrete lined.

The proposal is to remove unsuitable material from the existing cross-section, bench and side slopes, and bring in import fill material (a foot or two on the bottom and three feet or so on the sides). Compaction testing of the fill material will be necessary to guarantee a good foundation for the concrete lining.

1. Field Investigation

Our scope of work will consist of drilling at total of twelve (12) borings to a maximum depth of fifteen (15) feet below existing levee grade.

Boring will be advanced using a 4-¼ inch I.D. hollow-stem auger attached to a CME-75 drill rig. Earth materials encountered will be logged, classified in accordance with the Unified Soils Classification System, and graphically presented on Test Boring Logs.

Undisturbed and bulk soil samples of representative subsurface soils will be obtained at five (5) foot intervals. Undisturbed samples will be retrieved using ASTM D1586 for granular soils and ASTM D1587 for cohesive soils. Standard Penetration Test results will be recorded for each sampling process.

2. Laboratory Testing

The following laboratory tests are anticipated:

- 14 Sieve Analyses (ASTM D-422)
- 4 Direct Shear test (ASTM D-3080)
- 6 PH/Sulfate & Chloride Test
- 36 In-Place Tube Density Determinations (ASTM D-2937)
- 36 In-Place Moisture Content (ASTM D-2216)