AGENDA
GROUNDWATER BANKING JOINT POWERS AUTHORITY
BOARD OF DIRECTORS

May 3, 2021

Due to COVID-19, this meeting will be conducted as a teleconference pursuant to the provisions of the Governor's Executive Orders N-25-20 and N-29-20, which suspend certain requirements of the Ralph M. Brown Act. Members of the public may not attend this meeting in person.

Participation by members of the Board of Directors will be from remote locations. Public access and participation will only be available telephonically/electronically.

To virtually attend the meeting and to be able to view any presentations or additional materials provided at the meeting, please join online using the link and information below:

Via Web: https://zoom.us/j/83815086560
Meeting Number (Access Code): 838 1508 6560
Meeting Password: 982590
Telephone Dial In: (669) 900-6833

As courtesy to the other participants, please mute your phone when you are not speaking.

PLEASE NOTE: Participants joining the meeting will be placed into the lobby when the Board enters closed session. Participants who remain in the "lobby" will automatically be returned to the open session of the Board once the closed session has concluded. Participants who join the meeting while the Board is in closed session will be placed in the waiting room. When the Board has returned to open session, the participants will be automatically added to the meeting.

CALL TO ORDER 2:00 p.m.

ROLL CALL Directors Pierucci, Selvidge, Reinhart, Swan

PUBLIC COMMENT NOTICE

If you wish to address the Board of Directors on any item, please submit a request to speak via the "chat" feature available when joining the meeting virtually. Remarks are limited to three minutes per speaker on each subject. You may also submit a public comment in advance of the meeting by emailing mmisuraca@rrbwsd.com before 5:00 pm. on April 30, 2021.

ALL VOTES SHALL BE TAKEN BY A ROLL CALL VOTE

1. COMMUNICATIONS TO THE BOARD

a) Written:
b) Oral:

2. ITEMS RECEIVEDTOO LATE TO BE AGENDIZED

.

3. CONSENT ITEMS

a) Regular Board Meeting Minutes - February 1, 2021
b) Special Board Meeting Minutes – April 8,2021
c) Consideration and Possible Action of Shared Services Agreement
d) Consideration and Possible Action of Professional Services Agreement
e) Consideration and Possible Action of Approval of Auditors
f) Consideration and Possible Action of Reconciliation through 12/31/2020
g) Consideration and Possible Action of Investment Policy
h) Consideration and Possible Action of Technical Memos 4, 5 & 7
i) Consideration and Possible Action of Technical Services Proposal

4. FINANCE AND ADMINISTRATIVE REPORT

a) Consideration and Possible Action of Conflict-of-Interest Policy (Doug)
b) Consideration and Possible Action of 2021/22 Budget (Cheryl)
c) Consideration and Possible Action of Amendment No. 2 to Bylaws (Doug/Dan)
d) Consideration and Possible Action of Insurance Coverage (Rob)

5. ENGINEERING REPORT

a) Engineering Report (Dan)
   i. Consideration and Possible Action of Technical Memo 6 (Curtis)

6. GENERAL MANAGER'S REPORT

a) Key Agreements with DWR and CDFW Update (Fiona)
b) Grant Funding Update (Fiona)
c) Property Acquisition Update (Dan)

7. OTHER BUSINESS

Pursuant to Government Code Section 54954.2, members of the Board of Directors or staff may ask questions for clarification, make brief announcements,

and make brief reports on his/her own activities. The Board or a Board member may provide a reference to staff or other resources for factual information, request staff to report back at a subsequent meeting concerning any matter, or direct staff to place a matter of business on a future agenda. Such matters may be brought up under the General Manager's Report or Directors' Comments.

8. CLOSED SESSION

a) CLOSED SESSION CONFERENCE WITH REAL PROPERTY NEGOTIATORS – Pursuant to Government Code Section 54956.8:

Property: Parcels 103-110-02; 103-110-04; 103-110-09; 103-120-14; 103-120-15; 103-120-16; 103-120-17; 103-130-01; 103-130-03; 103-130-05; 103-130-07; 103-140-02; 103-140-05; 103-140-06; 103-140-12; 103-140-15; 103-140-16; 103-140-17; 103-140-18; 103-140-19; 103-180-01; 103-180-05; 103-180-07; 103-190-13; 103-190-14; 103-200-23; 103-200-25; 103-200-26; 103-200-27; 103-200-28; 103-200-29; 103-270-07; 104-270-01,06; 104-260-09,15; 104-280-08,29,30,31,32,33, 34,35; 104-260-08;104-270-28;104-291-07;104-240-31,22,30; 104-250-20,21; 104-280-01,02,07,19,24,25,27; 104-240-18;104-292-09; 103-170-09,12,14,15 25-32; 160-010-66, 71; 104-280-18 all in County of Kern

Agency negotiators: Dan Bartel

Negotiating parties: Various parties and Groundwater Banking Joint Powers Authority

Under negotiation: Price and Terms of Payment

b) CLOSED SESSION – Potential Litigation Exposure Pursuant to Government Code Sections 54956.9 (d)(2) and/or 54956.9(d)(4)
Two Matters

9. OPEN SESSION

General Counsel may announce any reportable actions taken during Closed Session.

10. ADJOURN

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Availability of agenda materials: Agenda exhibits and other writings that are disclosable public records distributed to all or a majority of the members of the above-named Board in connection with a matter subject to discussion or consideration at an open meeting of the Board are available for public inspection by contacting Megan Misuraca at mmisuraca@rrbwsd.com. If such writings are distributed to members of the Board less than 72 hours prior to the meeting, they will be available to the public at the

same time as they are distributed to Board Members, except that if such writings are distributed one hour prior to, or during, the meeting, they will be available electronically during the meeting.

Accommodations: Upon request, the Authority will provide for written agenda materials in appropriate alternative formats, and reasonable disability-related modification or accommodation to enable individuals with disabilities to participate in and provide comments at the meeting. Please submit a request, including your name, phone number and/or email address, and a description of the modification, accommodation, or alternative format requested at least two days before the meeting. Requests should be emailed to mmisuraca@rrbwsd.com. Requests made by mail must be received at least two days before the meeting. Requests will be granted whenever possible and resolved in favor of accessibility.

DECLARATION OF POSTING: I, Megan Misuraca, declare under penalty of perjury, that I am employed by the Rosedale-Rio Bravo Water Storage District and I posted the foregoing Agenda at the District Office on or before April 29, 2021. I, Kristine Swan, declare under penalty of perjury, that I am employed by the Irvine Ranch Water District and I posted the foregoing Agenda at the District Office on or before April 29, 2021.

BOARD OF DIRECTORS
GROUNDWATER BANKING JOINT POWERS AUTHORITY
MINUTES OF THE REGULAR BOARD MEETING

February 01, 2021
2:00 P.M.

Note: This meeting was conducted by teleconference pursuant to and in conformance with Executive Order N-29-20 relating to public meetings during the State of Emergency that was declared as a result of COVID-19

DIRECTORS AND ALTERNATES PRESENT

Roy Pierucci
Jason Selvidge
Peer Swan
Doug Reinhart

DIRECTORS ABSENT

None

OTHERS PRESENT

Doug Gosling- JPA Legal Counsel
Eric Averett-RRBWSD
Dan Bartel- RRBWSD
Megan Misuraca- RRBWSD
Cheryl Clary- IRWD
Eileen Lin- IRWD
Fiona Sanchez- IRWD
Robert Jacobson- IRWD
Natalie Palacio- IRWD
Paul Cook- IRWD
Paul Weghorst- IRWD
Kellie Welch- IRWD
Marina Lindsay- IRWD
Eric Robinson-IRWD
Dan Raytis- RRBWSD
Matt Klassen- Landowner

CALL TO ORDER

President Pierucci called the meeting to order at approximately 2:00 PM.

Mr. Gosling announced the JPA received communication regarding item 8b of the agenda and noted the JPA would not undertake any discussion on that item at this meeting.

PUBLIC COMMENT NOTICE

There were no public comments.

1. COMMUNICATIONS TO THE BOARD

a). Written: Two written items were received in respect to the FEIR from Kern County Water Agency and Kern Water Bank Authority. The items were deferred to closed session.

b). Oral: None.

2. ITEMS RECEIVEDTOO LATE TO BE AGENDIZED

None

3. Consent Items

a) Regular Board Meeting Minutes- November 2, 2020
b) Special Board Meeting Minutes- December 28, 2020
A motion was made by Director Reinhart with a second by Director Selvidge to adopt and accept the November 2, 2020 and December 28, 2020 meeting minutes subject to the correction of item 4a on the November 2, 2020 minutes adjusting the cash call to reflect $129,478 rather than $144,949 and a participant name correction on the December 28, 2020 minutes to reflect Jo Ann Corey rather than Jo Ann White. A roll call vote was taken and the motion was unanimously passed.

4. JPA Administrative Actions
None

5. KERN FAN GROUNDWATER STORAGE PROJECT

a) Environmental Update – Mr. Averett gave a brief report noting the 2 items received from Kern Water Bank and Kern County Water Agency to be discussed in closed session.

b) Property Acquisition Update- Mr. Averett reported this item would be discussed under agenda item 8a in closed session.

c) Engineering Report- Mr. Bartel gave a brief update on the status of technical memos.

6. GENERAL MANAGERS REPORT

a) General Manager Transition – Mr. Averett reported that his position with Rosedale will be ending and a transition of the General Manger of Rosedale will be seamless in taking over the General Manager roll in the JPA. Director Reinhart expressed the need to have an alternate for Mr. Averett's position for purposes of conducting business.
b) Grant Funding Update- Ms. Sanchez briefed the Board on the status of funding from the California Water Commission noting that due to increased WSIP funding, the Kern Fan Groundwater Storage Project will be allocated 20.2 million dollars of additional funding that brings the conditional funding total to 87.7 million dollars. Ms. Sanchez reported the JPA still continues to

pursue federal funding opportunities although the project did not make the WIIN Act Funding list.

c) Update on Reconciliation- Mr. Averett reported that Irvine staff completed a detailed spreadsheet outlining consultant and staff costs to date. Rosedale is using the same format and overhead multiplier to compile data to complete the reconciliation. Mr. Averett noted this reconciliation will be completed by the next Board meeting.

d) Update on Key Agreements with DWR and CDFW- Ms. Sanchez gave detailed reports on the status of the agreements with the Department of Water Resources and California Department of Fish and Wildlife. Ms. Sanchez reported on the latest meeting with DWR and noted that CDFW requested the remodeling of pulse flows to include additional data.

e) Groundwater JPA Tasks- Ms. Sanchez gave a brief report on the status of the JPA tasks.

7. OTHER BUSINESS

None

8. CLOSED SESSION

At 2:38 p.m. Director Pierucci announced the Board would enter closed session. The Board reconvened to open session at 3:43 p.m.

9. OPEN SESSION

Mr. Gosling announced staff was directed on item 8a and there was no other reportable actions taken during closed.

10. ADJOURN

Director Pierucci adjourned the meeting at 3:43 p.m.

BOARD OF DIRECTORS
GROUNDWATER BANKING JOINT POWERS AUTHORITY
MINUTES OF THE REGULAR BOARD MEETING

April 08, 2021
9:00 A.M.

Note: This meeting was conducted by teleconference pursuant to and in conformance with Executive Order N-29-20 relating to public meetings during the State of Emergency that was declared as a result of COVID-19

DIRECTORS AND ALTERNATES PRESENT

Roy Pierucci
Gary Unruh
Peer Swan
Doug Reinhart

DIRECTORS ABSENT

Jason Selvidge

OTHERS PRESENT

Doug Gosling- JPA Legal Counsel
Dan Bartel- RRBWSD
Megan Misuraca- RRBWSD
Cheryl Clary- IRWD
Eileen Lin- IRWD
Fiona Sanchez- IRWD
Robert Jacobson- IRWD
Paul Cook- IRWD
Paul Weghorst- IRWD
Dan Raytis- RRBWSD
Ray Bennett- IRWD
George Ming- Alliance Ag Services, LLC
Mike Ming- Alliance Ag Services, LLC
Bob M. – Kern River Valley

CALL TO ORDER

President Pierucci called the meeting to order at approximately 9:00 AM.

PUBLIC COMMENT NOTICE

There were no public comments.

1. COMMUNICATIONS TO THE BOARD

a). Written: None
b). Oral: None.

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2. ITEMS RECEIVEDTOO LATE TO BE AGENDIZED

1. Mr. Gosling requested a motion per Gov.C. § 54954.2(b)(2) to add item 6b to the agenda- [Consideration and Possible Action of Approval to Join ACWA for purposes of Obtaining Insurance Through ACWA JPIA] - as an item that required immediate action and the need for action came to the attention of the local agency subsequent to the agenda being posted. A motion was made by Director Swan with a second by Director Unruh to add item 6b to the agenda as requested. A roll call vote was taken and the motion was unanimously passed.

3. Consent Items

There were no consent items.

4. JPA Administrative Actions

a) Consideration and Possible Action of Amendment to Bylaws- Mr. Gosling reviewed the current Bylaws of the Groundwater Banking Joint Powers Authority with the Board highlighting the requested addition of section 7.f. A motion was made by Director Reinhart with a second by Director Unruh to approve Amendment No. 1 to the Bylaws of the Groundwater Banking Joint Powers Authority. A roll call vote was taken and the motion unanimously passed.

b) Consideration and Possible Action of Land Acquisition Process- Mr. Bartel and Mr. Jacobson reviewed the Property Acquisition Process Guidelines with the Board. A motion was made by Director Swan with a second by Director Unruh to receive and file the Property Acquisition Process Guidelines. The motion was unanimously passed.

5. KERN FAN GROUNDWATER STORAGE PROJECT

a) Property Acquisition Update- Mr. Bartel reported this item would be discussed under agenda item 8a in closed session.

6. GENERAL MANAGERS REPORT

a) Consideration and Possible Action of General Manager Position – Mr. Gosling reported that due to the resignation of Mr. Averett from Rosedale-Rio Bravo Water Storage District it leaves a void in the position of General Manager for the Groundwater Banking Joint Powers Authority. He reported that per section 6 of the Groundwater Banking Joint Powers Authority Agreement, the authority Board of Directors shall appoint a representative of Rosedale-Rio Bravo Water Storage District to serve as the General Manager of the authority unless the Board elects to appoint another individual as long as that individual is not an employee of independent contractor of the same Party as the Treasurer. A motion was made by Director Unruh with a second by Director Swan to appoint Dan Bartel of Rosedale-Rio Bravo Water Storage District as the General Manager of the Groundwater Banking JPA. The motion was unanimously passed.

b) Consideration and Possible Action of Approval to Join ACWA for purposes of Obtaining Insurance Through ACWA JPIA- Mr. Jacobson reported that staff had received various quotes to obtain insurance for the Groundwater Banking JPA and ACWA JPIA was most competitive and the JPA would need to request membership into ACWA to obtain the insurance. A motion was made by Director Swan with a second by Director Unruh to authorize staff to apply for membership into ACWA for the Groundwater Banking JPA. The motion was unanimously passed.

7. OTHER BUSINESS
None

8. CLOSED SESSION

At 9:21 a.m. Director Pierucci announced the Board would enter closed session. The Board reconvened to open session at 10:49 a.m.

9. OPEN SESSION

Mr. Gosling announced staff was directed on item 8a and there were no other reportable actions taken during closed.

10. ADJOURN

Director Pierucci adjourned the meeting at 10:50 a.m.

ATTEST:

_____
Authority Secretary

March 12, 2021
Prepared by: Fiona Sanchez
Agenda Item: 5

SHARED SERVICES AGREEMENT

DISCUSSION:

Pursuant to Article 10 of Groundwater Banking Joint Powers Authority (GBJPA) Agreement, Section 8 of the Bylaws stipulate that the Board negotiate shared staff services agreements with Rosedale-Rio Bravo WSD (RRB) and Irvine Ranch Water District (IRWD) upon formation of the GBJPA. RWD and Rosedale have worked with legal counsel to develop a draft Shared Services Agreement for review by the Committee, which is attached as Exhibit "A".

Key terms of the draft Shared Services Agreement are as follows:

- Hourly rates will be based on the respective RRB or IRWD base salaries;
- A standard agreed upon overhead rate for the GBJPA will be applied. The current agreed upon overhead rate for the GBJPA is 63.9%. The GBJPA overhead rate will be periodically reviewed;
- Mileage will be reimbursed at the standard IRS rate; and
- Expenses will be reimbursed at actual cost.

It is expected that RRB and IRWD each will separately execute the Shared Services Agreement with the GBJPA, following review and approval of the agreement by their respective agencies.

RECOMMENDATION:

That the Committee review and provide input on the draft Shared Services Agreement, and direct staff and legal counsel to make any recommended changes prior to finalization and consideration of approval by the Board.

LIST OF EXHIBITS:

Exhibit "A" – Shared Services Agreement

AGREEMENT FOR SHARED SERVICES RELATED TO THE
GROUNDWATER BANKING JOINT POWERS AUTHORITY

This AGREEMENT (this "Agreement") is made and entered into _____ 2021 ("Effective Date"), by and between the entities executing this Agreement below related to shared services for the GROUNDWATER BANKING JOINT POWERS AUTHORITY ("Authority" or "GBJPA"), a California joint powers authority organized under Article 1, Chapter 5, Division 7, Title 1 of the California Government Code. The executing parties are sometimes referred herein collectively as "Parties" or individually as a "Party."

RECITALS

A. WHEREAS, Rosedale-Rio Brave Water Storage District ("RRB") is a public agency organized in accordance with the California Water Storage District Law (Division 14, commencing with §39000 of the California Water Code) for the purpose of acquiring, storing, distributing, and replenishing water supplies within its boundaries in Kern County, California.

B. WHEREAS, Irvine Ranch Water District ("IRWD") is a public agency organized in accordance with the California Water District Law (Division 13, commencing with §34000 of the California Water Code) to provide water services and certain other services. IRWD's powers and purposes include the acquisition within or outside the district in the State of all necessary property, water, and water rights for the production, storage, transmission, and distribution of water for irrigation, domestic, industrial, and municipal purposes and to provide and sell such water at wholesale and retail to customers within its boundaries in Orange County, California.

C. WHEREAS, both RRB and IRWD entered into an agreement on July 1, 2020 to establish a joint powers authority to pursue and develop the Kern Fan Groundwater Storage Project ("Project").

D. WHEREAS, through the Project, the Parties seek to develop a regional water bank in the Kern County Groundwater Sub-basin of the San Joaquin Valley Groundwater Basin in Kern County. The Project would recharge and store up to 100,000 acre-feet of water during periods when surface water is abundant.

E. WHEREAS, the Parties formed the Authority to achieve the above-described objectives of the Project, and this Agreement will define the rates and timing of reimbursements related to staff time spent on the project and other related costs NOW, THEREFORE, it is agreed by and between the Parties as follows:

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AGREEMENT

1. Staff Time; Rates of Reimbursement

The Parties intend to utilize existing staff at RRB and IRWD to staff and support the planning, design, construction, operation and administration of the Project. The primary responsibility for delegating reimbursable tasks to respective support staff shall lie with authorized persons: the General Manager, Project Manager(s) and Treasurer. Neither RRB nor IRWD will receive reimbursement for any staff time spent in furtherance of the Project that was not delegated to the staff member by an authorized person. RRB and IRWD shall each retain the right to dispute an invoice of the other on the grounds that specific work items were not appropriately authorized, were unnecessary to further the Project objectives, and/or that the time spent or the number of staff members working on a particular matter was excessive. The General Manager and Treasurer shall jointly have the right to resolve these issues. If such disputes can't be resolved, the matter will be resolved by the Board of Directors.

For hours worked on JPA related matters, hourly rates will be charged to the JPA based on the actual respective IRWD or RRB base compensation excluding benefits. A standard agreed upon overhead rate of 63.9% will be applied, unless otherwise agreed upon to all billable labor costs. The GBJPA overhead rate may be periodically reviewed and adjusted by the GBJPA Board of Directors.

All other JPA related expenses will be billed to the JPA based on actual costs. Supporting documentation must be provided. Mileage will be reimbursed at the standard IRS rate.

Each respective member agency will submit a bill for staff hours worked or any other JPA related costs to the JPA on a quarterly basis no later than 30 days after the end of a calendar quarter. The JPA will then reimburse the respective member agency no later than 30 days after receipt of the invoice.

2. Termination

This Agreement shall terminate at the completion of the Project or termination of the Groundwater Banking Joint Powers Authority Agreement and in accordance with the obligations set forth therein.

3. Amendments

This Agreement may be amended, or renewed, in writing at any time and from time to time by unanimous consent of all the member agencies. .

4. Complete Agreement

The foregoing constitutes the full and complete Agreement of the Parties. There are no oral understandings or agreements concerning the subject matter of this Agreement not set forth in writing herein.

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IN WITNESS WHEREOF, the Parties hereto have caused this Agreement to be executed on date set forth below.

IRVINE RANCH WATER DISTRICT	**GROUNDWATER BANKING JOINT POWERS AUTHORITY**
By: _____	By: _____
Print Name: _____	Print Name: _____
Title: _____	Title: _____
Date: _____	Date: _____
Approved as to Form:	Approved as to Form:
_____	_____

DRAFT

March 12, 2021
Prepared by: Fiona Sanchez
Agenda Item: 4

PROFESSIONAL SERVICES AGREEMENT

DISCUSSION:

The Groundwater Banking Joint Powers Authority (GBJPA) anticipates the need for the use of consultants to assist in the development and implementation of the Kern Fan Groundwater Storage Project. As such, the GBJPA will need a Professional Services Agreement for consulting services. The staffs of Rosedale and IRWD jointly worked with legal counsel to develop a draft standard Professional Services Agreement for use by the GBJPA, which is attached as Exhibit "A". A separate Construction Services Contract will be developed at a later date for use by the GBJPA.

RECOMMENDATION:

That the Committee review and provide input on the draft Professional Services Agreement, and direct staff and legal counsel to make any recommended changes prior to finalization and consideration of approval by the Board.

LIST OF EXHIBITS:

Exhibit "A" – Professional Services Agreement

AGREEMENT FOR PROFESSIONAL SERVICES BETWEEN
GROUNDWATER BANKING JOINT POWERS AUTHORITY
AND
CONSULTANT NAME, CAPITALIZED, BOLD

This AGREEMENT FOR PROFESSIONAL SERVICES (this "Agreement") is made and entered into this ____th day of _____ __, by and between GROUNDWATER BANKING JOINT POWERS AUTHORITY, a California joint powers authority organized under Article 1, Chapter 5, Division 7, Title 1 of the California Government Code, hereinafter referred to as "GBJPA," and **CONSULTANT NAME, CAPITALIZED** hereinafter referred to as "CONSULTANT."

W I T N E S S E T H

WHEREAS, GBJPA requires the following technical or professional services of a consultant: <**NAME OF SERVICES, i.e. engineering, architectural, consulting, technical>,** to be rendered on the

PROJECT NAME

as further described below; and,

WHEREAS, CONSULTANT represents that by virtue of its experience and training, it is qualified to perform the services required by GBJPA, and that it has available and will provide personnel and facilities necessary to accomplish the required services within the required time.

NOW, therefore, GBJPA and CONSULTANT agree as follows:

I. Definitions

A. "Scope of Work" means those services described in the scope of work which is attached hereto as Exhibit A and incorporated herein by this reference, as modified by any Variances, and, except to the extent modified by Exhibit A and any Variances, in the Request For Proposal.

B. "Project" means the Project identified in the first recital of this Agreement.

C. "Compensation Schedule" means the fee and cost schedule which is attached hereto as Exhibit B and incorporated herein by this reference, as modified by any Variance.

D. "Work" means all services to be provided by CONSULTANT pursuant to this Agreement.

E. "Notice to Proceed" is defined in Section II.

F. "Variance" means a Professional Services Variance executed and approved in the form of Exhibit C, which is attached hereto and incorporated herein by this reference, pursuant to Section VIII.

G. "Work Product" is defined in Section VI.

H. "Schedule" means the activity schedule set forth in the Request For Proposal, as modified by Exhibit A and any Variances.

I. "Request For Proposal" means the document, including any addenda and attachments thereto, used to solicit the proposal for the Work.

J. "Design Professional Services" means services related to the preparation of engineering or architectural drawings, construction documents and other design-related services required to be performed by or under the supervision of licensed professionals, as well as other services provided by or under the supervision of licensed professionals.

K. "Professional Services" means (1) services involving the provision of a report, study, plan, design, specification, document, program, advice, recommendation, analysis, review, opinion, inspection, investigation, audit, brokering or representation of GBJPA before or in dealings with another party, or (2) any other services which require a special skill or expertise of a professional, scientific or technical nature. Professional Services includes Design Professional Services.

II. CONSULTANT's Services; Authorization

CONSULTANT agrees to perform the services identified in the Scope of Work. CONSULTANT shall furnish all services, materials, equipment, subsistence, transportation and all other items necessary to perform the Work. GBJPA will pay applicable state or local fees necessary to obtain permits for the Project, unless otherwise provided in the Scope of Work.

Specific authorization to proceed with the Work shall be granted in writing by GBJPA. CONSULTANT shall not proceed with the Work unless it is authorized. If it is specified in the Scope of Work that the Work or a portion of the Work is to be performed in phases or tasks as authorized, CONSULTANT shall not proceed with any phase or task unless it is separately authorized. The authorization shall set forth the date of commencement of the Work, or phase or task of the Work ("Notice to Proceed"). CONSULTANT shall commence the Work, or phase or task of the Work, immediately upon receipt of the applicable written Notice to Proceed.

III. Compensation

In return for performing the services described in the Scope of Work, GBJPA agrees to pay, and CONSULTANT agrees to accept, compensation in accordance with the Compensation Schedule. Unless otherwise specified in the Compensation Schedule, compensation shall be made on a time and materials basis. Compensation shall not exceed the amount authorized in the Notice to Proceed, except as approved under Section VIII: Change in Scope of Work.

CONSULTANT shall submit an invoice to GBJPA, on a monthly basis or less frequently, for the Work performed pursuant to this Agreement. Each invoice shall itemize the services rendered by task as set forth in the Scope of Work and the amount due in

accordance with the Compensation Schedule. Within fifteen (15) calendar days of receipt of each invoice, GBJPA shall notify CONSULTANT in writing of any disputed amounts included on the invoice. Within thirty (30) calendar days of receipt of each invoice, GBJPA shall pay all undisputed amounts included on the invoice.

IV. Performance Standards

The standard of care for all Professional Services, including Design Professional Services, performed to execute the Work shall be the care and skill ordinarily used by members of the profession practicing under similar circumstances at the same time and locality of the Project. CONSULTANT makes no other warranty, either expressed or implied.

V. Integration; Amendment

This Agreement represents the entire understanding by and between GBJPA and CONSULTANT as to those matters contained herein. No prior oral or written understanding shall be of any force or effect with respect to those matters covered hereunder. This Agreement may not be modified or altered except in writing signed by both parties hereto.

VI. Documents

All original drawings, specifications, calculations, estimates, studies, reports, memoranda, records, reference material, data, charts, renderings, computations, compilations, submittals and any other documents developed or compiled for the Project, whether in the form of writing, figures, computer disks or other electronic format ("Work Product"), shall be and remain the property of GBJPA, without restriction upon their use or dissemination by GBJPA, with the exception of any intellectual property rights contained therein, owned or created by CONSULTANT prior to the effective date of this Agreement and/or created outside the scope of this Agreement. CONSULTANT may make and retain copies thereof for its records as desired, but no such items shall be the subject of a copyright application by CONSULTANT.

Reuse by GBJPA of Work Product for any project or purpose other than the Project shall be at GBJPA's sole risk. Nothing in this paragraph shall constitute or be construed to be any representation by the CONSULTANT that the Work Product is suitable in any way for any project other than the Project.

All data, documents, discussion and other information developed or received by CONSULTANT or provided for performance of this Agreement are deemed confidential and shall not be disclosed by CONSULTANT without GBJPA's prior written consent. GBJPA shall grant such consent if disclosure is legally required. Upon request, all GBJPA information shall be returned to GBJPA upon the termination or expiration of this Agreement. For this purpose, GBJPA confidential information shall not include (i) information that, at the time of disclosure by CONSULTANT, is publicly available or generally known or available to third parties, or information that later becomes publicly available or generally known or available to third parties through no act or omission by CONSULTANT; (ii) information that CONSULTANT can demonstrate was in its possession prior to receipt from GBJPA; (iii) information received by CONSULTANT from a third party who, to CONSULTANT's knowledge and reasonable belief, did not acquire

such information on a confidential basis either directly or indirectly from GBJPA; or (iv) information CONSULTANT can demonstrate was independently developed by it or a third party or for it or a third party and that was not obtained, in whole or in part, from GBJPA.

CONSULTANT acknowledges that GBJPA is a public agency subject to the Public Records Act. Information that CONSULTANT desires to retain as confidential should not be disclosed to GBJPA unless expressly requested by GBJPA. If GBJPA receives a request to disclose information that was provided to GBJPA by CONSULTANT in the course of performing this Agreement and was designated by CONSULTANT as "confidential information," GBJPA will notify CONSULTANT of such request. If CONSULTANT objects to the disclosure, CONSULTANT shall expeditiously, at its sole expense, seek a court protective order to prevent such disclosure, and absent the granting of such an order, GBJPA shall release the information as required by applicable law.

VII. Performance and Schedule

Time is of the essence in the performance of this Agreement. CONSULTANT agrees to coordinate the Work to ensure its timely completion and shall promptly notify GBJPA of any anticipated delays or causes or casualties beyond the CONSULTANT's control which may affect the Schedule. In the event the time for completing the Scope of Work is projected to be exceeded due to circumstances beyond the control of CONSULTANT, CONSULTANT shall have an additional amount of time to be agreed upon in writing between the parties pursuant to Section VIII, in which to complete the Work. CONSULTANT agrees to complete the Work in accordance with the Schedule.

The time provided to CONSULTANT to complete the Work required by this Agreement shall not affect GBJPA's right to terminate this Agreement.

VIII. Change in Scope of Work

GBJPA may request or CONSULTANT may recommend, that CONSULTANT perform services in addition to or different from that delineated in the original Scope of Work, and may delete services from the Scope of Work, and/or change the Schedule. Upon GBJPA's request or CONSULTANT's recommendation for additional or changed work, CONSULTANT shall provide a cost estimate and written description of the additional or changed work. Prior to any such addition, change, or deletion to the Work or any Schedule change, including a Schedule change pursuant to Section VII, GBJPA and CONSULTANT shall negotiate an adjustment of compensation and time for completion and shall execute a Variance. Upon execution of each Variance, (i) the Scope of Work and Compensation Schedule shall thereafter be as described in Exhibits A and B, respectively, as modified by the Variance and any previously executed Variance, and (ii) the time for completing the Work shall be as set forth in the Variance. Following execution of any Variance, all terms and provisions of the Agreement, except as expressly modified by such Variance, shall remain in full force and effect, including, but not limited to, "Performance Standards" and "Insurance and Indemnification." GBJPA will not be required to pay for any additional or changed work rendered in advance of the execution of a Variance covering the additional or changed work.

IX. Termination or Abandonment

GBJPA has a right to terminate or abandon any portion or all of the Work for any reason by giving ten (10) calendar days written notice. In the event of termination, GBJPA shall have the right to take possession immediately of all Work Product developed for that portion of the Work completed and/or being abandoned, and CONSULTANT shall deliver such Work Product to GBJPA. GBJPA shall pay CONSULTANT for services for any portion of the Work being terminated which were rendered prior to termination. If said termination occurs prior to completion of any task of the Work for which a payment request has not been received, the fee for services performed during such task shall be based on an amount mutually agreed to by GBJPA and CONSULTANT for the portion of such task completed but not paid prior to said termination. GBJPA shall not be liable for any costs other than the fees or portions thereof which are specified herein.

X. Insurance

During the term of the Agreement, CONSULTANT shall carry, maintain and keep in full force insurance against claims for injuries or death or damages to property that may arise from or in connection with CONSULTANT's performance of this Agreement. Such insurance shall be of the types and in the amounts set forth as follows:

Comprehensive general liability insurance with coverage limits of not less than One Million Dollars ($1,000,000) per occurrence and aggregate, including products and operations hazard, contractual insurance, broad form property damage, independent consultants, personal injury, underground hazard, and explosion and collapse hazard where applicable.

Business automobile liability insurance for vehicles used in connection with the performance of this Agreement with minimum limits of One Million Dollars ($1,000,000) per claimant and One Million Dollars ($1,000,000) per incident and aggregate.

Workers' compensation insurance as required by the laws of the State of California. This requirement may be waived by GBJPA upon certification by CONSULTANT that it has no employees or individuals who are defined as "employees" under the Labor Code.

If the Work includes design professional services, then in addition to the above-listed coverages, CONSULTANT shall carry, maintain and keep in full force professional liability insurance, with limits of not less than One Million Dollars ($1,000,000) per claim or occurrence and Two Million Dollars ($2,000,000) aggregate limits, throughout the term of this Agreement to cover claims caused by CONSULTANT's negligent acts, errors, or omissions of a professional nature.

Insurance coverages described above shall be afforded by insurance carriers that meet or exceed requirements for financial performance and security by having a Best's Key Guide rating of "A" or better; additionally, carriers shall have an assigned Financial Size Category of "VIII" or higher.

CONSULTANT shall provide evidence of insurance coverages on forms satisfactory to GBJPA, including endorsements providing that policies cannot be canceled or reduced except on thirty (30) calendar days written notice by the insurance carrier of cancellation or non-renewal (ten (10) calendar days notice for non-payment of premium). Industry standard forms for "certificate of insurance" from ACORD are accepted, provided that appropriate language regarding notice of non-renewal or cancellation is provided on the form. CONSULTANT shall provide proof that policies of insurance required herein expiring or terminated during the term of this Agreement have been renewed or replaced with other policies providing coverage meeting the requirements hereof. Such proof will be furnished at least fourteen (14) calendar days prior to the expiration or termination of the coverages. Any deductibles or self-insured retentions must be declared to and are subject to approval by GBJPA.

The general liability and automobile policies required by this Agreement shall contain an endorsement naming GBJPA and its directors, officers, agents, employees, volunteers, and other entities for which GBJPA directors are the governing body as additional insureds.

The general liability and automobile insurance provided by CONSULTANT shall be primary, and any insurance or self-insurance maintained by GBJPA shall be in excess of CONSULTANT's insurance and shall not contribute with it.

Insurance coverage required herein shall not prohibit CONSULTANT from waiving the right of subrogation prior to a loss. CONSULTANT hereby waives all rights of subrogation against GBJPA.

XI. Indemnification

Procurement of insurance by CONSULTANT shall not be construed as a limitation of CONSULTANT's liability or as full performance of CONSULTANT's duties to indemnify, hold harmless and defend under the following paragraph of this Agreement.

CONSULTANT shall indemnify, defend and hold GBJPA and its directors, officers, agents, employees, and other entities for which GBJPA's directors are the governing body harmless from all damages, costs, liability claims, losses, judgments, penalties and expenses, including reasonable attorney's fees as a result of third party claims, to the proportionate extent arising out of or pertaining or relating to the negligent acts, errors or omissions, or recklessness or willful misconduct of CONSULTANT, its officers, agents or employees, or out of CONSULTANT's breach of its obligations in performing this Agreement.

XII. Attorney's Fees and Costs

In the event an action is commenced by a party to this Agreement against any other party or parties hereto to enforce its rights or obligations arising from this Agreement, the prevailing party in such action, in addition to any other relief and recovery awarded by the court, shall be entitled to recover all statutory costs plus expert witness fees, and a reasonable amount of attorney's fees. If GBJPA is required to initiate or defend litigation with a third party because of the violation of any term or provision of this Agreement by CONSULTANT, then GBJPA shall be entitled to its expert fees, reasonable attorney's fees, and costs from CONSULTANT in that action.

XIII. Successors and Assigns

This agreement and all of the terms, conditions, and provisions hereof shall inure to the benefit of and be binding upon the parties hereto, and their respective successors and assigns; provided, however, that no assignment of this Agreement shall be made without written consent of the parties to this Agreement.

Any attempt by CONSULTANT to assign or otherwise transfer any interest in this Agreement without the prior written consent of GBJPA shall be void. Any notice or instrument required to be given or delivered by this Agreement may be given or delivered by depositing the same in any United States Post Office, registered or certified, postage prepaid, addressed to:

GBJPA:
c/o Rosedale Rio Bravo Water Storage District
849 Allen Road
Bakersfield, CA 93314
Attn: _____

CONSULTANT:
_____
_____
_____
Attn: _____

and shall be effective upon receipt thereof.

XIV. Project Organization

CONSULTANT proposes to assign _____as the Project Manager. The Project Manager shall not be removed from the Project or reassigned without prior approval of GBJPA.

Except as specifically identified in the Scope of Work, no subcontracting or subconsulting of any portion of the Scope of Work shall be made without prior approval of GBJPA, and any attempt to do so shall be void and have no effect.

In the performance of the Work, CONSULTANT shall assign only personnel, including its employees and its authorized subcontractors and subconsultants, who are qualified to perform the Work. If the quality of the Work of personnel assigned by CONSULTANT is unacceptable to GBJPA, CONSULTANT agrees to assign replacement personnel upon GBJPA's request.

CONSULTANT shall comply with all applicable federal, state and local laws and regulations, including the conflict of interest provisions of Sections 1090 et seq. and 81000 et seq. of the California Government Code.

CONSULTANT is an independent contractor and not an agent or employee of GBJPA, and CONSULTANT shall have no authority to act as an agent of GBJPA or to enter into

any agreement for or on behalf of GBJPA. In performing this Agreement, the parties are not the agents, employees, partners, joint venturers or associates of one another. CONSULTANT shall determine the method, details and means of performing the services described in the Scope of Work.

XV. Miscellaneous

GBJPA shall have no obligation under this Agreement to any party other than CONSULTANT.

This Agreement shall be governed by the laws of the State of California. Any action regarding the interpretation or enforcement of this Agreement shall be filed in the County of Kern, California.

If the Work includes public work subject to the requirements of the California Labor Code, CONSULTANT shall comply with the requirements set forth in the attached addendum, which are incorporated herein by this reference, to the extent applicable to any of the Work.

XVI. Compliance with all Laws. CONSULTANT shall, at CONSULTANT's sole cost, comply with all of the requirements of Municipal, County, State, and Federal authorities now in force, or which may hereafter be in force, pertaining to this Agreement, and shall faithfully observe in all activities relating to or growing out of this Agreement all ordinances of the county and State and Federal statutes, rules or regulations, and permitting requirements now in force or which may hereafter be in force including, without limitation.

XVII. Authority. The person(s) executing this Agreement on behalf of the parties hereto warrant that (a) such party is duly organized and existing, (b) they are duly authorized to execute and deliver this Agreement on behalf of said party, (c) by so executing this Agreement, such party is formally bound to the provisions of this Agreement, and (d) the entering into this Agreement does not violate any provision of any other Agreement to which said party is bound.

XVIII. Unauthorized Use of GBJPA's Name. Except as required by law or with the prior written consent of GBJPA and its members (which consent may be withheld in its sole and absolute discretion), CONSULTANT shall not use GBJPA's name, seal or logo on marketing materials, nor shall CONSULTANT state, imply or in any way represent to any third party that GBJPA has endorsed or approved CONSULTANT or any of its work, services or products.

XIX. Execution.

Electronic Signatures. CONSULTANT and GBJPA may execute this Agreement using an "electronic signature," as that term is defined in California Civil Code Section 1633.2, or a "digital signature," as defined by California Government Code Section 16.5. An electronic or a digital signature will have full legal effect and enforceability unless otherwise prohibited by GBJPA or by ordinance, rule, or statute. Nothing in this Section

requires GBJPA to use or accept the submission of any subsequent or related document containing an electronic or digital signature.

CONSULTANT NAME

By:_____
CONSULTANT SIGNATORY NAME, TITLE

GROUNDWATER BANKING JOINT POWERS AUTHORITY

By:_____
GBJPA SIGNATORY NAME, TITLE

March 12, 2021
Prepared by: Cheryl Clary
Agenda Item: 2

Recommendation of Independent Audit Firm

DISCUSSION:

Section 9b of the Bylaws of the GBJPA states that the Board of Directors shall select an Auditor in the manner provided by law. California government code Section 6505 requires Joint Power Authorities to have an annual independent audit and have the audited financial statements available on their Commission website.

Staff solicited a proposal, attached as "Exhibit A", from the existing auditor of the Irvine Ranch Water District (IRWD), Davis Farr, LLP. The proposal is for the fiscal year ended June 30,2021 and an estimated fixed price fee of $5,000. Staff is familiar with Davis Farr, LLP and recommends them due to their professionalism and partner and staff competency. In addition, they are familiar and work well with IRWD staff and are proposing the same audit partner on the GBJPA as the IRWD engagement. Davis Farr is also the current auditor of one of the other Joint Power Authorities, Santiago Aqueduct Commission, of which IRWD is a member.

RECOMMENDATION:

That the Committee recommend Board approval of the firm Davis Farr, LLP to perform the audit for the fiscal year ended June 30,2021.

LIST OF EXHIBITS:

Exhibit "A" – Davis Farr proposal

DavisFarr
CERTIFIED PUBLIC ACCOUNTANTS

Davis Farr LLP
18201 Von Karman Avenue | Suite 1100 | Irvine, CA 92612
Main: 949.474.2020 | Fax: 949.263.5520

February 5, 2021

Groundwater Banking Joint Powers Authority
15600 Sand Canyon Avenue
Irvine, CA 92618

We are pleased to confirm the arrangements of our engagement and the nature of the services we will provide the Groundwater Banking Joint Powers Authority (the "Entity").

ENGAGEMENT OBJECTIVES

We will audit the financial statements as of June 30, 2021 and for the year then ended, and the related notes to the financial statements.

Accounting Standards generally accepted in the United States of America ("US GAAP") provide for certain required supplementary information ("RSI"), such as management's discussion and analysis ("MD&A"), to supplement the Entity's basic financial statements. Such information, although not a part of the basic financial statements, is required by the Government Accounting Standards Board who considers it to be an essential part of financial reporting for placing the basic financial statements in an appropriate operational, economic, or historical context. As part of our engagement, we will apply certain limited procedures to the Entity's RSI in accordance with auditing standards generally accepted in the United States of America ("US GAAS"). These limited procedures will consist of inquiries of management regarding the methods of preparing the information and comparing the information for consistency with management's responses to our inquiries, the basic financial statements, and other knowledge we obtained during our audit of the basic financial statements. We will not express an opinion or provide any assurance on the information because the limited procedures do not provide us with sufficient evidence to express an opinion or provide any assurance. The following RSI is required by US GAAP and will be subjected to certain limited procedures but will not be audited.

1. Management's Discussion and Analysis

OUR RESPONSIBILITIES

The objective of our audit is the expression of an opinion as to whether the financial statements are fairly presented, in all material respects, in conformity with US GAAP and to report on the fairness of the additional information referred to above when considered in relation to the financial statements taken as a whole.

We will also provide a report, which does not include an opinion on, Internal controls related to the financial statements and compliance with the provisions of laws, regulations, contracts, and grant agreements, noncompliance which could have a material effect on the financial statements as required by *Government Auditing Standards*. The report on internal control and compliance will each include a paragraph that states the report is solely to describe the scope and testing of internal control over financial reporting and compliance, and the results of that testing and not to provide an opinion on the effectiveness of internal control over

financial reporting or on compliance and the results of that testing and not to provide an opinion on the effectiveness of internal control over financial reporting or on compliance and that the report is an integral part of an audit performed in accordance with *Government Auditing Standards* in considering internal control over financial reporting and compliance and that the report is not suitable for any other purpose.

Audit

Our audit will be conducted in accordance with US GAAS, the standards for financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States. Our audit will include tests of the accounting records and other procedures we consider necessary to enable us to express such an opinion and render the required reports. We cannot provide assurance that an unmodified opinion will be expressed. Circumstances may arise in which it is necessary for us to modify our opinion or add an emphasis-of-matter or other-matter paragraph. If, for any reason, we are unable to complete the audit, or are unable to form or have not formed an opinion, we may decline to express an opinion or withdraw from this engagement.

Our procedures will include tests of documentary evidence supporting the transactions recorded in the accounts (e.g., tests of the physical existence of inventories, direct confirmation of certain assets and liabilities by correspondence with selected customers, creditors, and financial institutions, etc.). We may also request written representations from the Entity's attorneys as part of the engagement, and they may bill the Entity for responding to this inquiry.

An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements; therefore, our audit will involve judgment about the number of transactions to be examined and the areas to be tested. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluating the overall presentation of the financial statements. We will plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether from errors, fraudulent financial reporting, misappropriation of assets, or violations of laws or governmental regulations that are attributable to the Entity or to acts by management or employees acting on behalf of the Entity.

Because of the inherent limitations of an audit, combined with the inherent limitations of internal controls, and because we will not perform a detailed examination of all transactions, there is a risk that material misstatements may exist and not be detected by us, even though the audit is properly planned and performed in accordance with US GAAS. In addition, an audit is not designed to detect immaterial misstatements or violations of laws or governmental regulations that do not have a direct and material effect on the financial statements. We will inform the appropriate level of management and those charged with governance of any material errors, fraudulent financial reporting, or misappropriation of assets that comes to our attention. We will also inform the appropriate level of management and those charged with governance of any violations of laws or governmental regulations that come to our attention, unless clearly inconsequential, and any material abuse that comes to our attention. Our responsibility, as auditors, is limited to the period covered by our audit and does not extend to any later periods for which we are not engaged as auditors.

Internal Control
Our audit will include obtaining an understanding of the government and its environment, including internal control, sufficient to assess the risks of material misstatement of the financial statements and to design the nature, timing, and extent of further audit procedures. Tests of controls may be performed to test the effectiveness of certain controls that we consider relevant to preventing and detecting errors and fraud that are material to the financial statements and to preventing and detecting misstatements resulting from illegal acts and other noncompliance matters that have a direct and material effect on the financial statements. Our tests, if performed, will be less in scope than would be necessary to render an opinion on internal control and, accordingly, no opinion will be expressed in our report on internal control issued pursuant to *Government Auditing Standards*.

An audit is not designed to provide assurance on internal control or to identify significant deficiencies or material weaknesses. Accordingly, we will express no such opinion. However, during the audit, we will communicate to management and those charged with governance internal control related matters that are required to be communicated under AICPA professional standards and Government Auditing Standards.

Compliance
As part of obtaining reasonable assurance about whether the financial statements are free of material misstatement, we will perform tests of the Entity's compliance with the provisions of applicable laws, regulations, contracts, agreements, and grants. However, the objective of our audit will not be to provide an opinion on overall compliance and we will not express such an opinion in our report on compliance issued pursuant to *Government Auditing Standards*.

The services described above do not relieve management or those charged with governance of their responsibilities.

THOSE CHARGED WITH GOVERNANCE
The preparation and presentation of the financial statements of the Entity are the responsibility of management with oversight from those charged with governance. Those charged with governance are also responsible for overseeing the strategic direction of the Entity and any obligations related to its accountability, resolving disagreements between management and us regarding financial reporting, appointing us to perform the services described above, and informing us about all known or suspected fraud involving the Entity. In turn, we will provide those charged with governance with any communications required by the professional standards described above.

MANAGEMENT'S RESPONSIBILITIES
Management is responsible for all management decisions and performing all management functions, and for designating an individual, preferably from senior management, with suitable skill, knowledge, or experience to oversee these services, any bookkeeping services, tax services, or other services we provide. Management is responsible for evaluating the adequacy and results of the services performed and accepting responsibility for them.

Management is responsible for making all financial records and related information available to us and for the accuracy and completeness of that information. Management is also responsible for providing us with (a) access to all information they are aware of that is relevant to the preparation and fair presentation of the financial statements, (b) additional information that we may request for the purpose of this engagement, and (c) unrestricted access to persons within the Entity from whom we determine it necessary to obtain information.

Management is responsible for establishing and maintaining internal controls, including monitoring ongoing activities, for the selection and application of accounting principles, for the safeguarding of assets, and for the preparation and fair presentation of the financial statements in conformity with US GAAP even though we may assist management with their preparation. Accordingly, management may be required to acknowledge in the written representation letter our assistance with preparation of the financial statements and that management has reviewed and approved the financial statements and related notes prior to their issuance and has accepted responsibility for them.

Management is responsible for adjusting the financial statements to correct material misstatements and for confirming to us in the management representation letter that the effects of any uncorrected misstatements aggregated by us during the current engagement and pertaining to the latest period presented are immaterial, both individually and in the aggregate, to the financial statements taken as a whole.

Management is responsible for the design and implementation of programs and controls to prevent and detect fraud, and for informing us about all known or suspected fraud affecting the Entity involving (a) management, (b) employees who have significant roles in internal controls, and (c) others where the fraud could have a material effect on the financial statements. Management is also responsible for informing us of any known allegations of fraud or suspected fraud affecting the Entity received in communications from employees, former employees, regulators, or others. In addition, management is also responsible for identifying and ensuring that the Entity complies with applicable laws, regulations, contracts, agreements, and grants and for taking timely and appropriate steps to remedy any fraud, illegal acts, violations of contracts or grant agreements, or abuse that we may report.

During the course of our engagement, we will request information and explanations from management regarding the Entity. At the conclusion of our engagement, we will require, as a precondition to the issuance of our report, that management provide certain representations in a written representation letter. The procedures we will perform in our engagement and the conclusions we reach as a basis for our report will be heavily influenced by the written and oral representations that we receive from management. In view of the foregoing, the Entity agrees to release our firm, its shareholders, and other personnel from any liability and costs relating to our services under this letter resulting from false or misleading representations made to us by any member of the Entity's management.

Management is responsible for establishing and maintaining a process for tracking the status of audit findings and recommendations. Management is also responsible for identifying for us previous financial audits, attestation engagements, performance audits or other related studies. This responsibility includes relaying to us corrective actions taken to address significant findings and recommendations resulting from those audits, attestation engagements, performance audits, or other studies. Management is responsible for providing its views on our current findings, conclusions, and recommendations, as well as management’s planned corrective actions, for the report, and for the timing and format for providing that information.

ENGAGEMENT FEES

We estimate that our fixed fees for the services previously outlined will be $ 5,000.

Additionally, our fees are dependent on the availability, quality, and completeness of the Entity's records and, where applicable, upon the Entity's personnel providing the level of assistance identified in the "prepared by client" request list distributed at the end of our planning work (e.g., Entity employees preparing confirmations and schedules we request, locating documents selected by us for testing, etc.).

Should our assumptions with respect to these matters be incorrect, or should the condition of the records, degree of cooperation, or other matters beyond our reasonable control require additional commitments by us beyond those upon which our estimated fees are based, we may adjust our fees and planned completion dates. If significant additional time is necessary, we will discuss it with management and arrive at a new fee estimate as soon as reasonably practicable.

OTHER ENGAGEMENT MATTERS

This letter set forth the rights and responsibilities of the parties with respect to the services to be provided. This engagement is being undertaken solely for the benefit of the parties to this agreement and no other person shall be entitled to enforce the terms of this agreement.

Enclosed, as required by *Government Auditing Standards*, is a copy of the report on the most recent peer review of our firm.

The workpapers for this engagement will be retained in accordance with our firm policy, or for any additional period requested by a cognizant agency. If we are aware that a federal awarding agency, pass-through entity, or auditee is contesting an audit finding, we will contact the party(ies) contesting the audit finding for guidance prior to destroying the workpapers.

Jonathan Foster, CPA, is the engagement partner responsible for supervising the engagement and signing the report.

We appreciate the opportunity to provide these services and believe this letter accurately summarizes the significant terms of our engagement. Please sign the enclosed copy of this letter and return it to us.

Very truly yours,

Jonathan Foster
Davis Farr LLP

The services and arrangements described in this letter are in accordance with our understanding and are acceptable to us.

Groundwater Banking Joint Powers Authority

By_____
Treasurer

Date_____

Report on the Firm's System of Quality Control

Davis Farr LLP
Irvine, California;
and the Peer Review Committee of the California Society of CPAs

We have reviewed the system of quality control for the accounting and auditing practice of Davis Farr LLP (the firm) in effect for the year ended May 31, 2019. Our peer review was conducted in accordance with the Standards for Performing and Reporting on Peer Reviews established by the Peer Review Board of the American Institute of Certified Public Accountants (Standards).

A summary of the nature, objectives, scope, limitations of, and the procedures performed in a System Review as described in the Standards may be found at www.aicpa.org/prsummary. The summary also includes an explanation of how engagements identified as not performed or reported in conformity with applicable professional standards, if any, are evaluated by a peer reviewer to determine a peer review rating.

Firm's Responsibility

The firm is responsible for designing a system of quality control and complying with it to provide the firm with reasonable assurance of performing and reporting in conformity with applicable professional standards in all material respects. The firm is also responsible for evaluating actions to promptly remediate engagements deemed as not performed or reported in conformity with professional standards, when appropriate, and for remediating weaknesses in its system of quality control, if any.

Peer Reviewer's Responsibility

Our responsibility is to express an opinion on the design of the system of quality control and the firm's compliance therewith based on our review.

Required Selections and Considerations

Engagements selected for review included engagements performed under *Government Auditing Standards*, including a compliance audit under the Single Audit Act, and examination of a service organization (SOC 1, Type 2 Report).

As part of our peer review, we considered reviews by regulatory entities as communicated by the firm, if applicable, in determining the nature and extent of our procedures.

Opinion

In our opinion, the system of quality control for the accounting and auditing practice of Davis Farr LLP in effect for the year ended May 31, 2019, has been suitably designed and complied with to provide the firm with reasonable assurance of performing and reporting in conformity with applicable professional standards in all material respects. Firms can receive a rating of *pass, pass with deficiency(ies)* or *fail*. Davis Farr LLP has received a peer review rating of *pass*.

GYL LLP

Ontario, California
September 23, 2019

March 12, 2021
Prepared by: Cheryl Clary
Agenda Item: 1

GBJPA Initial Reconciliation

DISCUSSION:

Certain costs were incurred by the Rosedale-Rio Bravo Water Storage District (RRB) and the Irvine Ranch Water District (IRWD) prior to the formation of the Groundwater Banking Joint Powers Authority (GBJPA) and subsequent to the formation but prior to establishment of the GBJPA bank account with the ability to pay GBJPA related expenditures. Pursuant to Section 10b (1) of the Bylaws of the GBJPA and the Cost Sharing Early Planning Activities Agreement between the two agencies, the agencies agreed to an initial reconciliation to true up expenditures in which each agency would be responsible for an equal share.

Staff has completed the reconciliation which is attached as "Exhibit A". The reconciliation represents a true up of expenses paid by each agency from the early planning activities beginning in 2018 through December 31,2021. The reconciliation includes the following expenses:

- Labor charges related to GBJPA activities based on actual hourly rates
- Overhead applied to labor at the agreed upon rate of 63.9%
- Consultant expenses
- Joint legal costs
- Conference expenses

The reconciliation reflects a final true up of $230,629.24 due from RRB to IRWD.
It is expected that all subsequent GBJPA expenses will be paid from the GBJPA bank account.

RECOMMENDATION:

That the Committee review and recommend Board approval of the GBJPA initial reconciliation.

LIST OF EXHIBITS:

Exhibit "A" – GBJPA Initial Reconciliation

Groundwater Banking Joint Powers Authority
Reconciliation Update
For The Period April 2018 thru December 31, 2020

Capital Costs

	GBJPA Total	IRWD 50%	RRB 50%
1st Billing from IRWD (4/1/18 - 6/30/20)			
Consulting Costs	$344,006.68	$172,003.34	$172,003.34
Total - 1st billing from IRWD (4/1/18 - 6/30/20)	**344,006.68**	**172,003.34**	**172,003.34**
Cost from IRWD (3/1/18 - 12/31/20):			
Consulting Costs (incldg two invoices -Jan~Feb 2021)	423,302.69	211,651.35	211,651.34
Legal Costs	60,205.00	30,102.50	30,102.50
Conference Costs	5,842.63	2,921.31	2,921.32
Labor Costs	187,438.52	93,719.26	93,719.26
G & A Costs @ 63.9%	119,773.21	59,886.61	59,886.60
Total Cost paid by IRWD (3/1/18 - 12/31/20)	**796,562.05**	**398,281.03**	**398,281.02**
Cost from RRB (10/1/18 - 12/31/20):			
Consulting Costs	146,092.28	73,046.14	73,046.14
Labor Costs	115,443.13	57,721.56	57,721.57
G & A Costs @ 63.9%	73,768.16	36,884.08	36,884.08
Total Cost paid by RRB(10/1/18 - 12/31/20)	**335,303.57**	**167,651.78**	**167,651.79**
Total - Capital Costs	**$1,475,872.30**	**$737,936.15**	**$737,936.15**
Payments:			
1st Billing from IRWD	**(344,006.68)**	**(172,003.34)**	**(172,003.34)**
Cost from IRWD (3/1/18-12/31/20)	**(796,562.05)**	**(796,562.05)**	
Cost from RRB(10/1/18-12/31/20)	**(335,303.57)**		**(335,303.57)**
(Receivable)/Due	**$0.00**	**($230,629.24)**	**$230,629.24**

March 12, 2021
Prepared by: R. Jacobson / C. Clary
Agenda Item: 3

Proposed Groundwater Banking Joint Powers Authority
2021 Investment Policy

DISCUSSION:

Section 6a(ii) of the Groundwater Banking Joint Powers Authority (GBJPA) Bylaws states that the Treasurer will work with the Finance Committee to recommend policies to the Board to address certain financial issues. Included is a requirement to establish an Investment Policy to prudently manage excess funds of the GBJPA. The recommended Groundwater Banking Joint Powers Authority 2021 Investment Policy is provided for the Committee's review and comment.

Proposed 2021 Investment Policy:

The proposed GBJPA 2021 Investment Policy adheres to investment-related Government Code Section 53600 *et seq.* and includes policy objectives, a delegation of authority and a detailed schedule of authorized investments. The proposed Policy is provided as Exhibit "A", and authorized investments include:

- US Treasury and Agency Securities
- Local Agency Investment Fund (LAIF)
- California State and Local Agency Securities (subject to Finance Committee approval)
- Negotiable CDs, Commercial Paper, Corporate and Municipal Notes/Bonds as permitted in the Government Code (subject to Finance Committee approval)

As specified in the Government Code, the Policy includes a Board delegation of authority to the Treasurer and Assistant Treasurer to manage the GBJPA's investment program. The delegation of authority is limited to a one-year period, renewable annually.

RECOMMENDATION:

That the Committee review and recommend Board approval of the proposed Groundwater Banking Joint Powers Authority 2021 Investment Policy.

LIST OF EXHIBITS:

Exhibit "A" – Proposed GBJPA 2021 Investment Policy

DRAFT - GROUNDWATER BANKING JOINT POWERS AUTHORITY

2021 INVESTMENT POLICY

Introduction:

This investment policy is intended to establish a clear understanding of the GBJPA's authorized investment activities for members of the public, the Board of Directors of the Groundwater Banking Joint Powers Authority (the "GBJPA"), GBJPA management, and outside investment professionals.

Policy:

It is the policy of the GBJPA to invest its funds in a prudent and professional manner which will provide maximum security of principal while meeting required cash flow demands and conforming to all State statutes governing the investment of public funds, the GBJPA's investment policies, and prudent cash management principles.

Scope:

This investment policy applies to all GBJPA funds that are under the direct oversight of the Board of Directors. The investment of any bond proceeds or related funds will also be made in accordance with this investment policy.

Standard of Care:

The Board of Directors and those persons authorized to make investment decisions on behalf of the GBJPA are trustees of public funds. The standard of care to be used in all investment transactions shall be the "prudent investor" standard set forth in California Government Code Section 53600.3, which states:

> "When investing, reinvesting, purchasing, acquiring, exchanging, selling, or managing public funds, a trustee shall act with care, skill, prudence, and diligence under the circumstances then prevailing, including, but not limited to, the general economic conditions and the anticipated needs of the agency, that a prudent person acting in a like capacity and familiarity with those matters would use in the conduct of funds of a like character and with like aims, to safeguard the principal and maintain the liquidity needs of the agency."

Officers and representatives of the GBJPA involved in the investment process shall refrain from personal business activities that could conflict with proper execution of the investment program or could impair their ability to make impartial investment decisions. "Designated Representatives"

of the GBJPA involved in the investment of GBJPA funds, which includes the Treasurer and Assistant Treasurer, shall disclose all information at the times and in the manner required by the GBJPA's Conflict of Interest Code.

Objectives:

The primary objectives of the GBJPA's investment activities, in priority order, are as follows:

1. Safety: Safety of principal is the foremost objective of the investment program. Investments of the GBJPA shall be undertaken in a manner that seeks to ensure the preservation of capital in the overall portfolio. Accordingly, diversification by issuer, type, and maturity of securities will be made to avoid or minimize potential losses on individual securities.

2. Liquidity: The GBJPA's investments will remain sufficiently liquid to enable the GBJPA to meet all operating and capital cash requirements. To the extent required, this liquidity will be maintained through the purchase of securities with active secondary or resale markets and with short-term maturities so as to minimize market risk on the market price of the securities.

3. Yield: The GBJPA's investments shall be made with the objective of attaining the highest rate of return commensurate with the above requirements for the preservation of capital and the maintenance of adequate liquidity.

Delegation of Authority:

In accordance with Government Code Sections 53607 and 53608, the Board of Directors hereby delegates to the GBJPA's Treasurer and Assistant Treasurer the authority to manage the GBJPA's investment program and to provide for the safekeeping of securities.

Authorized Investments:

The GBJPA is authorized to invest its funds pursuant to the following laws:

California Government Code:

- Section 53600 *et seq.* - General investments
- Section 16429.1 - Local Agency Investment Fund (LAIF)

The language of the Investment Policy will conform to the statutory requirements in effect.

The Treasurer and Assistant Treasurer are authorized to invest GBJPA funds in accordance with these laws, subject to certain restrictions that may be imposed by the GBJPA's Finance Committee and/or Board of Directors. These authorized investments and restrictions are shown in Exhibit "A".

Whenever practical, a competitive process shall be used for the purchase and sale of securities.

The Treasurer and Assistant Treasurer are authorized to invest in securities with terms or remaining maturities in excess of five years as part of the GBJPA's investment program, but no such investments are to be made without the concurrence of the Board of Directors.

Authorized Financial Institutions:

Only financial institutions designated as "primary dealers" by the Federal Reserve Bank of New York, or other dealers that qualify under Securities and Exchange Commission Rule 15C3-1 (uniform net capital rule), are authorized to provide investment services to the GBJPA. The Treasurer may limit the number of dealers authorized to provide such services.

A copy of the GBJPA's annual investment policy shall be provided to each institution authorized by the Treasurer to provide services to the GBJPA. Prior to providing investment services, such financial institution shall acknowledge in writing that it has received the GBJPA's investment policy and that all persons handling the GBJPA's account have reviewed the policy.

All authorized financial institutions are required to send the GBJPA unaudited quarterly and audited annual financial statements or provide electronic access to the financial statements.

Safekeeping and Custody:

All security transactions entered into by the GBJPA shall be conducted on a delivery-versus-payment (DVP) basis. All securities owned by the GBJPA shall be delivered to the GBJPA by book entry, physical delivery, or a third-party custodial agreement. Any third-party custodian shall be designated by the Treasurer, and all securities held by such custodian, including book entry and physical securities, shall be held in a manner that clearly establishes the GBJPA's right of ownership. The GBJPA's custodial agent shall meet the requirements of Government Code Section 53608. The GBJPA's deposits with LAIF or any other authorized investment pool shall be evidenced by the standard reporting requirements of LAIF or the investment pool.

Reporting:

The Treasurer shall file a quarterly report with the Finance Committee at a public meeting that shows the status of the GBJPA's cash and securities, and all related investment transactions that occurred during the period. The status report shall also be filed with the GBJPA's General Manager and will include at least the following information:

- Type of investment
- Original cost
- Issuing institution
- Market value, including source
- Par amount
- Maturity date
- Coupon and/or yield

In addition, the status report shall include the portfolio's rate of return for the period, the average weighted life of the portfolio, a statement regarding the portfolio's compliance with the GBJPA's investment policy, and a statement regarding the GBJPA's ability to meet expenditure requirements over the following six months. (California Government Code Sections 53607 and 53646.)

Investment Policy Adoption and Amendments:

The Treasurer shall submit an investment policy at least annually to the Board of Directors at a public meeting. (California Government Code Section 53646.) The policy shall be effective for the calendar year specified. If the Board of Directors does not approve an investment policy for any calendar year, then the investment policy for the previous calendar year shall remain in effect until a new policy is approved.

The GBJPA's Finance Committee is authorized to make changes in the investment policy from time to time as may be necessary, provided that such changes may only be more restrictive in nature. Any changes that would liberalize the investment policy shall be approved by the Board of Directors before becoming effective. Any changes in the investment policy by the Finance Committee shall be reported to the Board of Directors at its next regular meeting

Exhibit A
Authorized Investments and Restrictions

INVESTMENT TYPE	DESCRIPTION	RESTRICTIONS
U.S. Treasury and Agency Obligations	U.S. Treasury notes, bonds, bills or certificates of indebtedness, or those for which the full faith and credit of the United States are pledged for the payment of principal and interest. Also federal agency or U.S. government sponsored enterprise obligations, participations, or other instruments.	No additional restrictions.
California State and Local Agency Bonds, Notes and Warrants	Registered state warrants, treasury notes or bonds. Any bonds, notes, warrants or other evidences of indebtedness of any local agency in California.	Limited to securities approved by the Finance Committee.
Registered treasury notes or bonds of California or other 49 United States	Registered treasury notes or bonds of any of the other 49 United States in addition to California, including bonds payable solely out of the revenues from a revenue-producing property owned, controlled, or operated by a state or by a department, board, agency, or authority of any of the other 49 United States, in addition to California.	Limited to states and/or agencies approved by the Finance Committee.
U.S. Dollar Denominated Senior Unsecured Unsubordinated Obligations	Permits United States dollar-denominated senior unsecured unsubordinated obligations issued or unconditionally guaranteed by the International Bank for Reconstruction and Development, International Finance Corporation, or Inter-American Development Bank, with a maximum remaining maturity of five years or less, and eligible for purchase and sale within the United States. Must be rated "AA" or its equivalent or better by a nationally recognized statistical rating organization ("NRSRO"). Limited to 30% of local agency funds.	Limited to securities approved by the Finance Committee.
Negotiable Certificates of Deposit	Issued by national or state-chartered banks, savings associations, federal associations, state or federal credit unions, or by a federally-licensed or state-licensed branch of a foreign bank. Specified restrictions on credit unions for conflicts of interest. Limited to 30% of local agency funds.	Limited to domestic and foreign banks and thrift institutions approved by the Finance Committee.

Commercial Paper	Must be of "prime" quality of the highest ranking or of the highest letter and number rating as provided for by an NRSRO. Issuers must be organized and operating in the United States as a general corporation, have assets exceeding $500 million, and have debt other than commercial paper, if any, that is rated "A" or its equivalent or better by an NRSRO. May not exceed 270 days maturity. Local agencies, that have less than $100 million of investment assets under management may invest no more than 25% of their moneys in eligible commercial paper. Local agencies that have $100 million or more of investment assets under management may invest up to 40% percent of their moneys in eligible commercial paper. A local agency may invest no more than 10% of its total investment assets in the commercial paper and the medium-term notes of any single issuer.	Limited to corporations approved by the Finance Committee.
Medium Term Notes	All debt securities issued by U.S. organized and operating corporations or depository institutions licensed by the U.S. or any state and operating within the U.S. Notes must be rated "A" or its equivalent or better by an NRSRO. May not exceed five years maturity, 30% of local agency funds, and no more than 10% of its total investment assets in the commercial paper and the medium-term notes of any single issuer.	For depository institutions, same as shown under Negotiable Certificates of Deposit. For corporations, limited to those approved by the Finance Committee.
Local Agency Investment Fund	Permits a local agency to deposit funds with the State Treasurer for the purpose of investment in securities prescribed in Cal. Gov. Code §§16429.1 *et seq*.	No additional restrictions.
Prohibited Investments	A local agency shall not invest any funds in inverse floaters, range notes, mortgage derived interest-only strips, or any security that could result in zero interest accrual if held to maturity. However, a local agency may hold prohibited instruments until their maturity dates. Notwithstanding the prohibition above, a local agency may invest in securities	No additional restrictions.

	issued by, or backed by, the United States government that could result in zero- or negative-interest accrual if held to maturity, in the event of, and for the duration of, a period of negative market interest rates. A local agency may hold these instruments until their maturity dates. This section shall remain in effect only until January 1, 2026, and as of that date is repealed. (Cal. Gov. Code §53601.6.)	

DEE JASPAR & ASSOCIATES, INC.
CONSULTING CIVIL ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CA 93308
PHONE (661) 393-4796
FAX (661) 393-4799

KERN FAN GROUNDWATER STORAGE PROJECT

TECHNICAL MEMORANDUM NO. 4
(Pump Station Requirements)

PREPARED FOR: Groundwater Banking Joint Powers Authority (JPA)
PREPARED BY: Curtis Skaggs, P.E.
DATE: January 28, 2021

SUBJECT: ***Pump Station Requirements***

I. Executive Summary

There are currently five pump stations illustrated for the project:

1. Pump Station No. 1 at Stockdale Highway for the Conveyance Canal (Capacity = 443 cfs)

2. Pump Station No. 2 at the I-5 Freeway for the Conveyance Canal (Capacity = 435 cfs)

3. Pump Station No. 3 at the west end of the West Basins for the Conveyance Canal (Capacity = 240 cfs)

4. Return Water Pump Station to convey recovered water to the California Aqueduct (Capacity = 70 cfs)

5. Goose Lake Channel Pump Station to convey water from Cross Valley Canal or Kern River Water to the Phase I Property (Capacity = 240 cfs)

See Figure 1 below for the approximate location of each of the above referenced pump stations. The exact number of pump stations, locations of the pump stations, and pump station capacities are subject to change based upon the actual conveyance alignment, Phase I and Phase II property locations, and the design of the conveyance channel.

A Pump Station No. 4 may be necessary at the easterly end of the conveyance channel to lift 129 cfs to the Phase I Property, however this pump station has not been considered herein. This pump station is considered small enough that it may not require physical modeling provided it is designed as outlined herein.

The goal for sizing the pump station pumps and motors is to achieve the following:

- Design for a minimum flowrate of 30 cfs.
- Design for the full range of flow from 30 cfs to the maximum specified design rate in 5 cfs increments.
- Size pumps and pump bays to standardize on two stoplog slot dimensions.
- Size pumps to provide interchangeability between pump stations.

This memorandum serves to outline in general the minimum pump station design standards, evaluate alternatives for pump station configurations and the associated costs, discuss special considerations and other pertinent items such as physical modeling, electrical service, control building design, and the pump station control philosophy. The following outlines the memorandum sections:

Section II.	Pump Station Design Standard	Pg 5
Section III.	Pump Configuration	Pg 5
Section IV.	Discharge Pipe Sizing	Pg 20
Section V.	Special Considerations	Pg 20
Section VI.	Physical Hydraulic Modeling	Pg 25
Section VII.	Low Voltage vs Medium Voltage Service	Pg 28
Section VIII.	Utility Interface	Pg 28
Section IX.	Control Building Design	Pg 29
Section X.	Pump Station Control Philosophy	Pg 29
Section XI.	Summary	Pg 30

Below is a summary of the recommended pump configurations for each pump station facility.

Pump Station Summary

Pump Station Facility	Capacity	Pump Configuration	36-42 cfs Pumps	80-90 cfs Pumps
Pump Station No. 1	443 cfs	Six (6) Pumps	Two	Four
Pump Station No. 2	435 cfs	Six (6) Pumps	Two	Four
Pump Station No. 3	240 cfs	Four (4) Pumps	Two	Two
Pump Station No. 4	129 cfs		If Necessary	
Goose Lake Channel Pump Station	240 cfs	Four (4) Pumps	Two	Two
Return Water Pump Station	72 cfs	Three (3) Pumps	Three	

The pump station design shall be governed by the Hydraulic Institute Standards ANSI/HI 9.8-Most Recent Edition for Pump Intake Design and then the final design requirements determined by physical modeling as described herein. The physical modeling shall be performed prior to finalizing the design of the pump stations, however preliminary design will need to be completed prior to conducting any modeling.

Redundancy has been accounted for in the three conveyance canal pump stations and the Goose Lake Slough pump station. Redundant capacity is built-in by nature of the 1.5 filling factor from Technical Memorandum No. 2 “Conveyance

Capacity Requirements" that is being utilized for the short-term filling of recharge areas. This filling rate allows for the recharge basins to be filled in approximately three (3) to seven (7) days. It is believed that if a pump is out-of-service during the initial recharge filling period, that the pump stations will still be at 67% to 100% of their pumping capacity and that the filling rate can temporarily be reduced until the appropriate repairs are made. However, during the long-term recharge operations the pump stations will still be able to meet approximately 100% of the average maintenance rates for recharge with the largest pump out-of-service.

The Return Water Pump Station is recommended to be designed with a three pump configuration that will have one of the pumps solely for redundancy. Each pump would be sized for 36 cfs. The anticipated capacity of the pump station for returning water is approximately 72 cfs which leaves the third pump for redundancy or extreme conditions when the District may be returning more water than 72 cfs.

The pump and motor sizes utilized herein and the associated costs are preliminary and only for purposes of the preliminary engineering work. It is understood that the actual pump and motor sizes will be determined during the engineering design phase based on the actual hydraulic conditions of the conveyance facilities and that updated pricing will be evaluated.

The designer shall evaluate pumps from several reputable pump manufacturer's to determine the typical pump suction bell diameters for the design pump conditions. The pump suction bell diameters will be critical in the proper design of the pump station and pump bays.

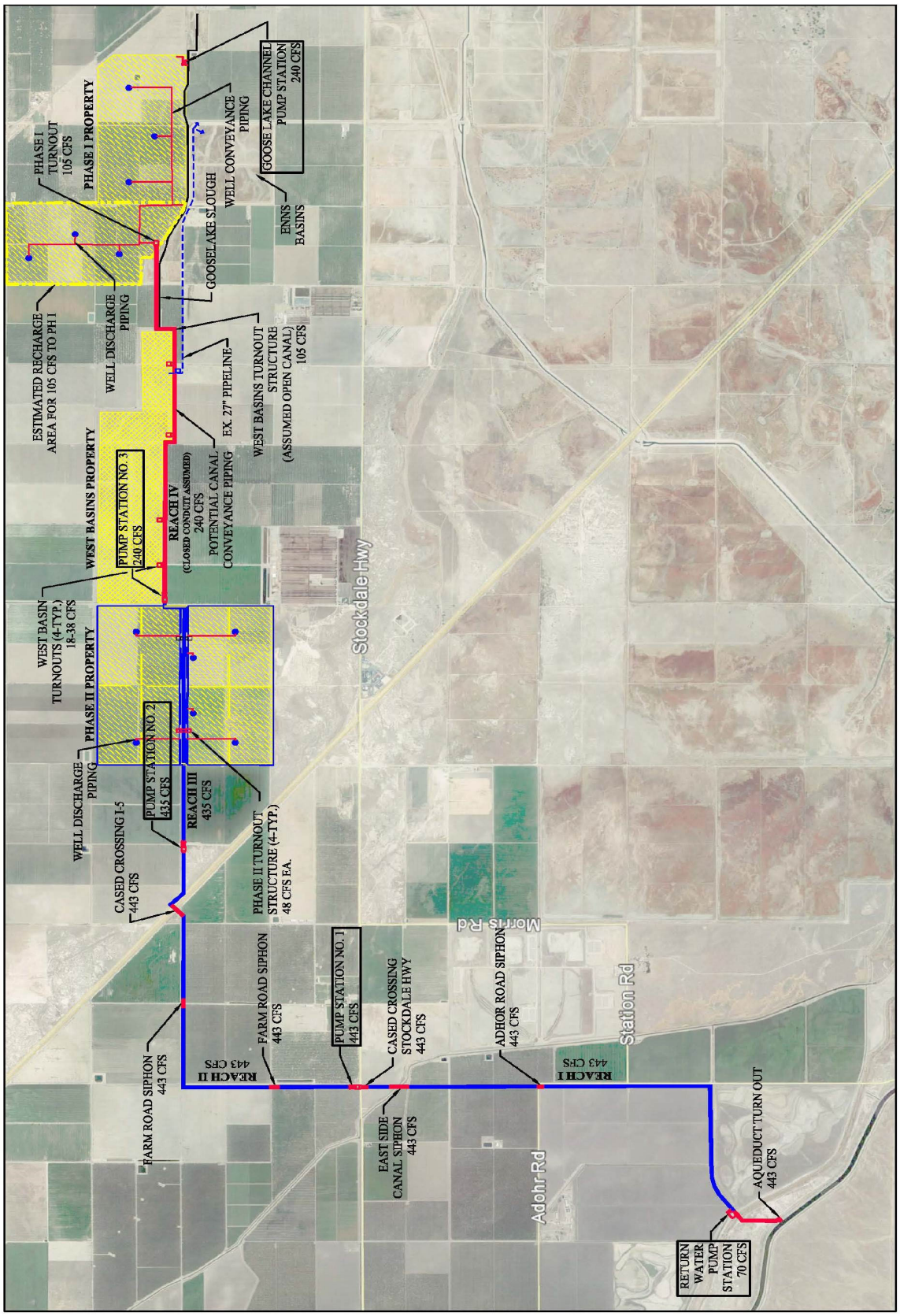


Figure 1: Pump Station Overview Map

II. Pump Station Design Standard

The pump station design shall be governed by the Hydraulic Institute Standards ANSI/HI 9.8-Most Recent Edition for Pump Intake Design.

The intake structure shall be designed to allow the pumps to achieve their optimum hydraulic performance for all operating conditions. The characteristics of the flow approaching an intake structure is one of the most critical considerations. The pump intake structure shall be designed in-line with the canal to provide a uniform approach to the pumps and the geometry of the intake structure should endeavor to limit the cross-flows that create asymmetrical flow patterns approaching any of the pumps.

The pump station shall be a rectangular intake design that is based on the design pump inlet bell diameter. The pump station shall be designed to mitigate or minimize adverse hydraulic performance resulting from the following:

- Submerged Vortices
- Free-Surface Vortices
- Excessive Pre-Swirl of Flow Entering the Pump
- Non-Uniform Spatial Distribution of Velocity at the Impeller Eye
- Excessive Variations in Velocity and Swirl with Time
- Entrained Air or Gas Bubbles

The conveyance canal pump station capacities will range from 240 cfs (107,712 gpm) to 443 cfs (198,818 gpm). These large flow capacities warrant hydraulic model testing. This is discussed further in Item VI below.

In addition, each conveyance canal pump station shall have a gravity return line for returning water to the California Aqueduct and have an approximate capacity of 70 cfs. This shall include a means of isolation via a slide gate or butterfly valve.

III. Pump Configuration

Pump stations shall be an open structure with reinforced concrete dividing walls between each of the pumps. The approach velocities to each pump shall be limited to a maximum of 1.5 ft per second within each pump bay per the Hydraulic Institute Standards. The pump bay width and depth shall be designed to limit the maximum pump approach velocities as well as providing a narrow and long channel flow toward each pump for uniformity and laminar flow.

Careful attention shall be paid to the minimum submergence of the pump bell or intake to reduce the possibility that unacceptable free-surface air core vortices occur. The minimum required submergence shall be determined using the ANSI Pump Intake Design manual, however if a submergence greater than that calculated is required by the pump manufacturer to provide the required NPSH, then the greater submergence shall govern.

A combination of reinforced concrete and heavy bar steel grating shall be designed and constructed for the pump deck that is suitable for a H20 loading. This will allow equipment to utilize the deck for the removal and installation of pumps and motors as well as for cleaning of trashracks while allowing for visibility down into each pump bay and convenient access to the pumps.

The pump stations shall include stop log slots for isolation of a pump bay while the remainder of the pump station is in operation, trashracks, ladder access, and safety grating and guardrailing. The District would prefer to have two sizes of steel stop logs that fit all the pump station bays. The location of stop logs within each pump bay shall take into consideration the need for future diffusing structures or other mitigation measures that could be implemented at the stop log slots.

Several combinations of pumps are evaluated below that consist of a six (6) pump and four (4) pump configuration. An eight (8) pump configuration was also considered during the preliminary engineering work, however the use of VFD's will allow the pumps to cover a wider range of flows and help in reducing the number of pumps needed. The conveyance canal pump stations shall be designed such that they can reach a minimum flow rate of 30 cfs, can cover the full range of flows from 30 cfs to the maximum specified design rate in 5 cfs increments, and minimize the number of pumps. The District would prefer to have consistency of pumps with respect to the size and capacity across all pump stations for ease of operations, maintenance, and pump interchangeability.

An example of this is outlined below with:

A. Pump Stations #1 and #2 with a Six (6) Pump Configuration and a Four (4) Pump Configuration

B. Pump Stations #3 with a Six (6) Pump, Four (4) Pump, and a Three (3) Pump Configuration

A. Pump Station No. 1 and No. 2 Pump Configurations

The Pump Stations No. 1 and No. 2 are essentially the same size at 435 cfs and 443 cfs. A four pump or six pump configuration could be utilized at these stations which would consist of high capacity, low lift pumps and motors. Below is a six pump configuration.

a) Six (6) Pump Configuration

The pump capacities are sized to endeavor to cover the majority of flow possibilities between 30 cfs to 443 cfs in 5 cfs increments.

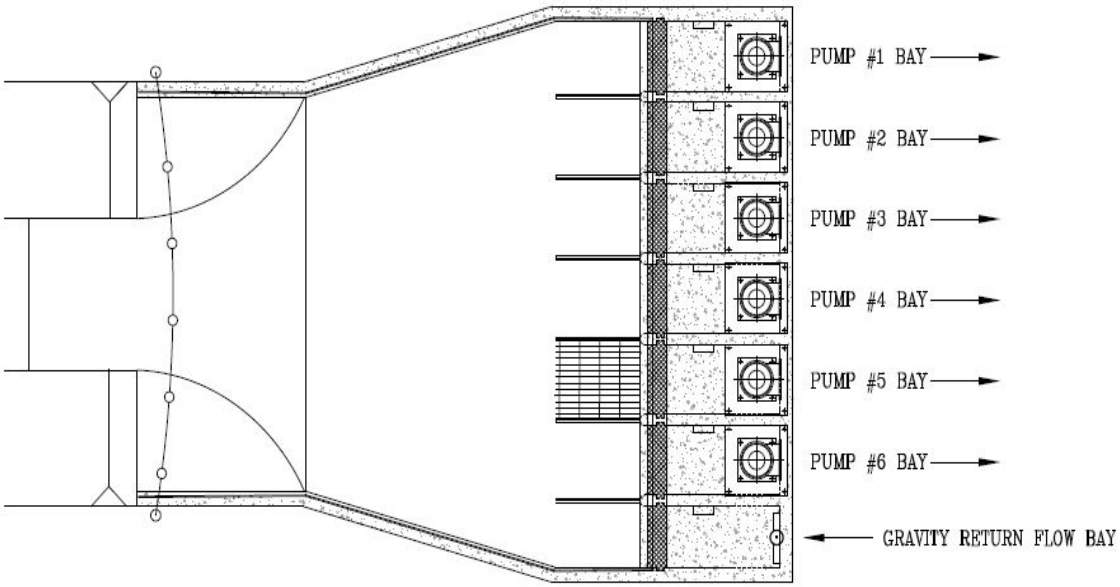


Figure 2: Pump Stations No. 1 and No. 2 Configuration with 6 Pumps

The pump station layout illustrated in Figure 2 above and in subsequent figures is conceptual to represent the number of pump bays and not intended to define the actual pump station design.

Pump Station No. 1 and No. 2 could have the following size pumps in a six pump configuration. Table 1 below illustrates the range of the pump station and its ability to meet the 5 cfs incremental criteria.

Pump Station No. 1

443 CFS Capacity
(2) 42 cfs Pumps
(4) 90 cfs Pumps

Pump Station No. 2

435 CFS Capacity
(2) 40 cfs Pumps
(4) 89 cfs Pumps

The two smaller pumps have an approximate 40 to 42 cfs capacity and the four larger pumps have an approximate 89-90 cfs capacity. It is estimated that the slower speed pumps will be able to reduce their capacity to approximately two-thirds with the use of a variable speed drive (VFD).

Table 1

Pump Station No. 1 and No. 2 with 6 Pump Configuration						
Pump Station Demand	40-42 cfs Pump[1]	40-42 cfs Pump[1]	89-90 cfs Pump[2]	89-90 cfs Pump[2]	89-90 cfs Pump[2]	89-90 cfs Pump[2]
30-45 cfs	x					
50-80 cfs	x	x				
85-90 cfs			x			
95-130 cfs	x		x			
135-170 cfs	x	x	x			
175-215 cfs	x		x	x		
220-260 cfs	x	x	x	x		
265-310 cfs	x		x	x	x	
315-350 cfs	x	x	x	x	x	
355-400 cfs	x		x	x	x	x
405-443 cfs	x	x	x	x	x	x
[1]Pump range with VFD estimated as 27 cfs to 42 cfs.						
[2]Pump range with VFD estimated as 59 cfs to 90 cfs.						

Table 2 below provides a cost estimate for the six (6) pump configuration.

Table 2

Kern Fan Project Pump Stations No. 1 and No. 2 - 6 Pump Configuration					
Item Description	Unit	Quantity		Unit Cost	Extended Cost
Earthwork & Site Ground Cover	1	LS	$	215,000.00	$ 215,000.00
Reinforced Concrete Structure	1	LS	$	920,000.00	$ 920,000.00
Miscellaneous Steel & Trashracks	1	LS	$	215,000.00	$ 215,000.00
Pumps and Motors	1	LS	$	2,222,000.00	$ 2,222,000.00
30" Discharge Piping & Appurtenances	2	EA	$	394,000.00	$ 788,000.00
42" Discharge Piping & Appurtenances	4	EA	$	485,000.00	$ 1,940,000.00
Variable Frequency Drives	1	LS	$	700,000.00	$ 700,000.00
Electrical and Controls	1	LS	$	995,000.00	$ 995,000.00
Electrical Control Building & Foundation	1	LS	$	380,000.00	$ 380,000.00
Cathodic Protection	1	LS	$	25,000.00	$ 25,000.00
Gravity Bypass Pipeline & Slide Gate	1	LS	$	205,000.00	$ 205,000.00
	Total 6 Pump Configuration Estimate:				**$ 8,605,000.00**

Footnote: Costs are for purposes of comparison between pump configurations and not intended to be inclusive of all pump station costs.

b) Four (4) Pump Configuration

The four pump configuration is illustrated below. The pump capacities are sized to endeavor to cover the majority of flow possibilities between 50 cfs to 443 cfs in 5 cfs increments. The limitation of this configuration is that the pump station minimum flow is not as low as the six pump configuration.

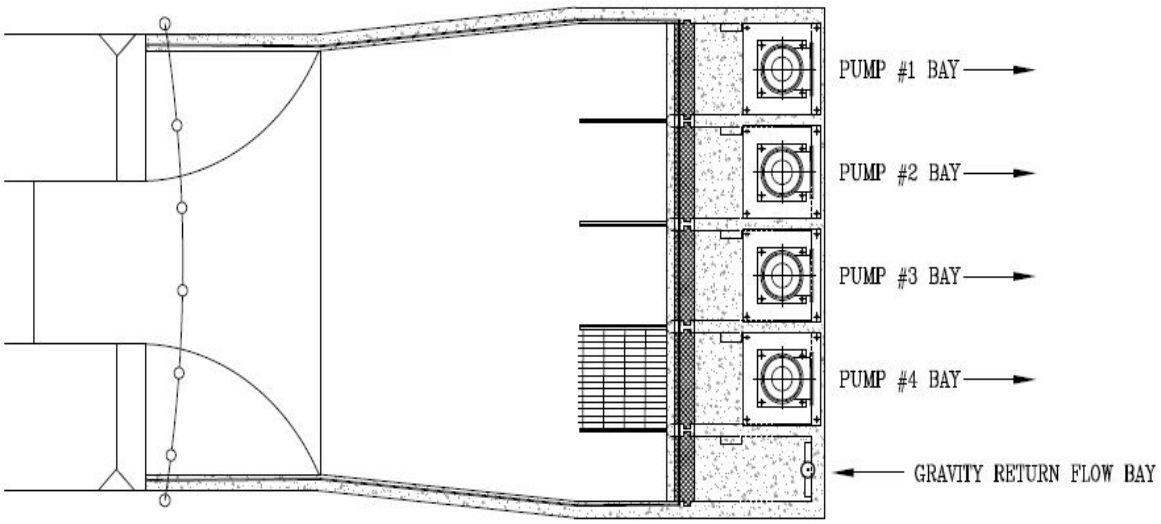


Figure 3: Pump Stations No. 1 and No. 2 Configuration with 4 Pumps

Pump Station No. 1 and No. 2 could have the following size pumps in a four pump configuration. Table 3 below illustrates the range of the pump station and its ability to meet the 5 cfs incremental criteria.

Pump Station No. 1

443 CFS Capacity
(2) 75 cfs Pumps
(2) 147 cfs Pumps

Pump Station No. 2

435 CFS Capacity
(2) 73 cfs Pumps
(2) 145 cfs Pumps

The two smaller pumps have an approximate 73 to 75 cfs capacity and the two larger pumps have an approximate 145-147 cfs capacity. It is estimated that the slower speed pumps will be able to reduce their capacity to approximately two-thirds with the use of a variable speed drive (VFD).

Table 3

Pump Station No. 1 and No. 2 with 4 Pump Configuration				
Pump Station Demand	73-75 cfs Pump[1]	73-75 cfs Pump[1]	145-147 cfs Pump[2]	145-147 cfs Pump[2]
30 cfs				
35 cfs				
40 cfs				
45 cfs				
50-80 cfs	x			
85 cfs				
90 cfs				
95-145 cfs			x	
150-220 cfs	x		x	
225-295 cfs	x	x	x	
300-365 cfs	x		x	x
370-443 cfs	x	x	x	x
[1]Pump range with VFD estimated as 48 cfs to 75 cfs.				
[2]Pump range with VFD estimated as 96 cfs to 145 cfs.				
Pumps may not be able to match these flow rates.				

Table 4 below provides a cost estimate for the four (4) pump configuration.

Table 4

Kern Fan Project Pump Stations No. 1 and No. 2 - 4 Pump Configuration				
Item Description	Unit	Quantity	Unit Cost	Extended Cost
Earthwork & Site Ground Cover	1	LS	$ 200,000.00	$ 200,000.00
Reinforced Concrete Structure	1	LS	$ 816,000.00	$ 816,000.00
Miscellaneous Steel & Trashracks	1	LS	$ 175,000.00	$ 175,000.00
Pumps and Motors	1	LS	$ 1,881,000.00	$ 1,881,000.00
42" Discharge Piping & Appurtenances	2	EA	$ 485,000.00	$ 970,000.00
54" Discharge Piping & Appurtenances	2	EA	$ 600,000.00	$ 1,200,000.00
Variable Frequency Drives	1	LS	$ 600,000.00	$ 600,000.00
Electrical and Controls	1	LS	$ 995,000.00	$ 995,000.00
Electrical Control Building & Foundation	1	LS	$ 380,000.00	$ 380,000.00
Cathodic Protection	1	LS	$ 25,000.00	$ 25,000.00
Gravity Bypass Pipeline & Slide Gate	1	LS	$ 205,000.00	$ 205,000.00
	Total 4 Pump Configuration Estimate:			**$ 7,447,000.00**

Footnote: Costs are for purposes of comparison between pump configurations and not intended to be inclusive of all pump station costs.

c) Pump Station No. 1 and 2 Recommendations

The six (6) pump configuration is better from the standpoint of being able to meet a minimum pump station capacity of 30 cfs and being able to match flows in 5 cfs increments from 30 cfs to 443 cfs. The four (4) pump configuration may have a difficult time matching flows below 50 cfs and even some flows between 80 to 95 cfs. However, the six pump configuration is estimated to be approximately $1,158,000 more in capital cost due to a little bigger structure and more pumps, motors, and electrical.

It is recommended that Pump Stations No. 1 and No. 2 have six pumps and motors each with two (2) 40 to 42 cfs pumps and four (4) 89 to 90 cfs pumps. This will allow pump bay widths to be similar for utilizing two standard stop log slot dimensions and also for providing interchangeability between pumps across all three conveyance canal pump stations.

Redundancy for theses two conveyance canal pump stations is built-in by nature of the 1.5 filling factor that is being utilized for the recharge areas. It is believed that if a pump is out-of-service during the initial recharge filling period at Pump Stations No. 1 and 2, that the pump stations will still be at 67% to 90% capacity and that recharge can temporarily be reduced until the appropriate repairs are made. However, during the long term maintenance rates or average recharge rates, Pump Stations No. 1 and No. 2 would be at 100% capacity with the largest pump out-of-service, i.e. 440 cfs – 90 cfs Pump = 350 cfs > 282 cfs average rate from Technical Memorandum No. 2 “Conveyance Capacity”.

The pump and motor sizes utilized herein and the associated costs are preliminary and only for purposes of the preliminary engineering work. It is understood that the actual pump and motor sizes will be determined during the engineering design phase based on the actual hydraulic conditions of the conveyance facilities and that updated pricing will be evaluated.

B. Pump Station No. 3 Pump Configurations

The Pump Station No. 3 capacity is 240 cfs. A three pump, four pump, or six pump configuration would consist of high capacity, low lift pumps and motors. Below is a six pump configuration. The pump capacities are sized to endeavor to cover the majority of flow possibilities between 30 cfs to 443 cfs in 5 cfs increments.

Pump Station No. 3 supplies Reach 4 of the conveyance facilities. Reach 4 may be an open channel design or closed conduit design. Technical Memorandum No. 3 “Pipeline Requirements” considered Reach 4 as a closed conduit design. The pump configurations described herein would still be appropriate for this condition, however the pumps may pump at a higher head and not really be as interchangeable with the pumps from Pump Stations No. 1 and No. 2. As a closed conduit design, Reach 4

would convey approximately 105 cfs to the West Basins, approximately 129 cfs to the Phase I Property (105 cfs to Phase I & 24 cfs to Enns), and approximately 6 cfs to in-lieu lands.

In an open channel design it is anticipated that Reach 4 will convey water to the east end of the West Basins thus delivering 105 cfs to the West Basins and 6 cfs to in-lieu lands. However, a Pump Station No. 4 would then likely be required to convey 129 cfs to the Phase I Property. This could be achieved by conveying 105 cfs to the Phase I Property and 24 cfs to the Enns Basins through the existing WB Pipeline. This pump station has not been considered at this time, but is considered a small enough pump station that it will likely not require physical modeling, provided it is designed as outlined herein.

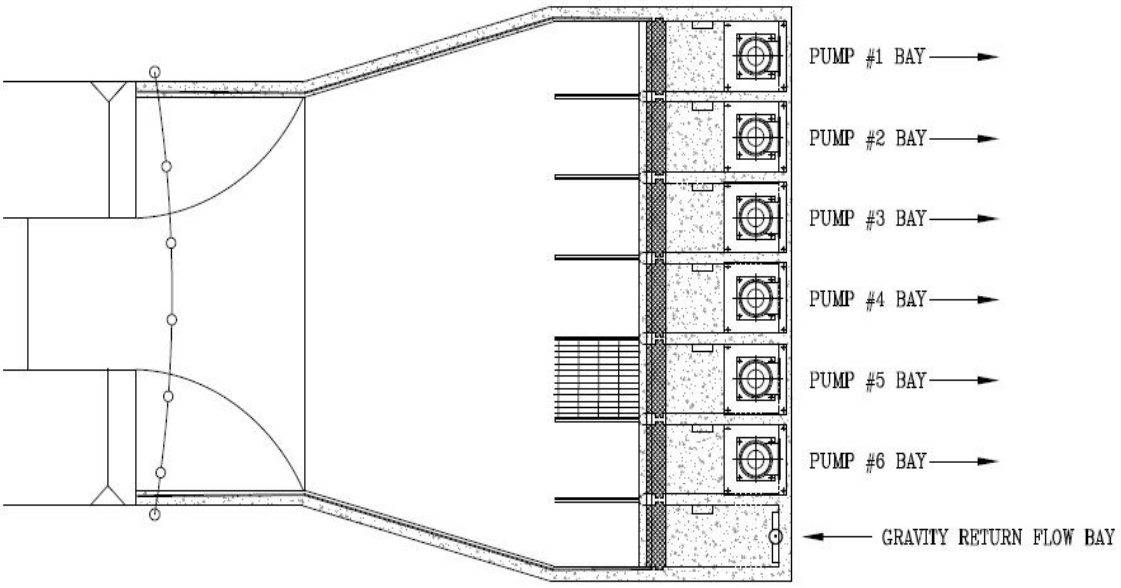


Figure 4: Pump Station No. 3 Configuration with 6 Pumps

a) Six (6) Pump Configuration

Pump Station No. 3 could have the following size pumps in a six pump configuration. Table 5 below illustrates the range of the pump station and its ability to meet the 5 cfs incremental criteria.

Pump Station No. 3

240 CFS Capacity
(6) 40 cfs Pumps

The pump configuration could also be two 25 cfs pumps and four 48 cfs pumps, for example, however the six 40 cfs pumps still allows the pump station to achieve the minimum flowrate of 30 cfs while utilizing pumps of

a similar size and capacity as those of the options for Pump Stations No. 1 and No. 2.

It is estimated that the range of a 40 cfs pump will be approximately 26 cfs to 40 cfs based on an estimate of the VFD being able to ramp down to approximately two-thirds of the pump design capacity.

Table 5

Pump Station No. 3 with 6 Pump Configuration						
Pump Station Demand	40 cfs Pump[1]	40 cfs Pump[1]	40 cfs Pump[1]	40 cfs Pump[1]	40 cfs Pump[1]	40 cfs Pump[1]
30-45 cfs	x					
50-80 cfs	x	x				
85-120 cfs	x	x	x			
125-160 cfs	x	x	x	x		
165-200 cfs	x	x	x	x	x	
205-240 cfs	x	x	x	x	x	x

[1]Pump range with VFD estimated as 26 cfs to 40 cfs.

Table 6 below provides a cost estimate for the six (6) pump configuration.

Table 6

Kern Fan Project Pump Station No. 3 - 6 Pump Configuration				
Item Description	Unit	Quantity	Unit Cost	Extended Cost
Earthwork & Site Ground Cover	1	LS	$ 200,000.00	$ 215,000.00
Reinforced Concrete Structure	1	LS	$ 900,000.00	$ 920,000.00
Miscellaneous Steel & Trashracks	1	LS	$ 200,000.00	$ 215,000.00
Pumps and Motors	1	LS	$ 1,584,000.00	$ 1,584,000.00
30" Discharge Piping & Appurtenances	6	EA	$ 394,000.00	$ 2,364,000.00
Variable Frequency Drives	1	LS	$ 540,000.00	$ 540,000.00
Electrical and Controls	1	LS	$ 880,000.00	$ 880,000.00
Electrical Control Building & Foundation	1	LS	$ 380,000.00	$ 380,000.00
Cathodic Protection	1	LS	$ 25,000.00	$ 25,000.00
Gravity Bypass Pipeline & Slide Gate	1	LS	$ 205,000.00	$ 205,000.00
	Total 6 Pump Configuration Estimate:			$ 7,328,000.00

Footnote: Costs are for purposes of comparison between pump configurations and not intended to be inclusive of all pump station costs.

b) Four (4) Pump Configuration

The four pump configuration would consist of four high capacity, low lift pumps and motors. The pump capacities are sized to endeavor to cover the majority of flow possibilities between 30 cfs to 240 cfs in 5 cfs increments. Table 7 below illustrates the range of the pump station and its ability to meet the 5 cfs incremental criteria.

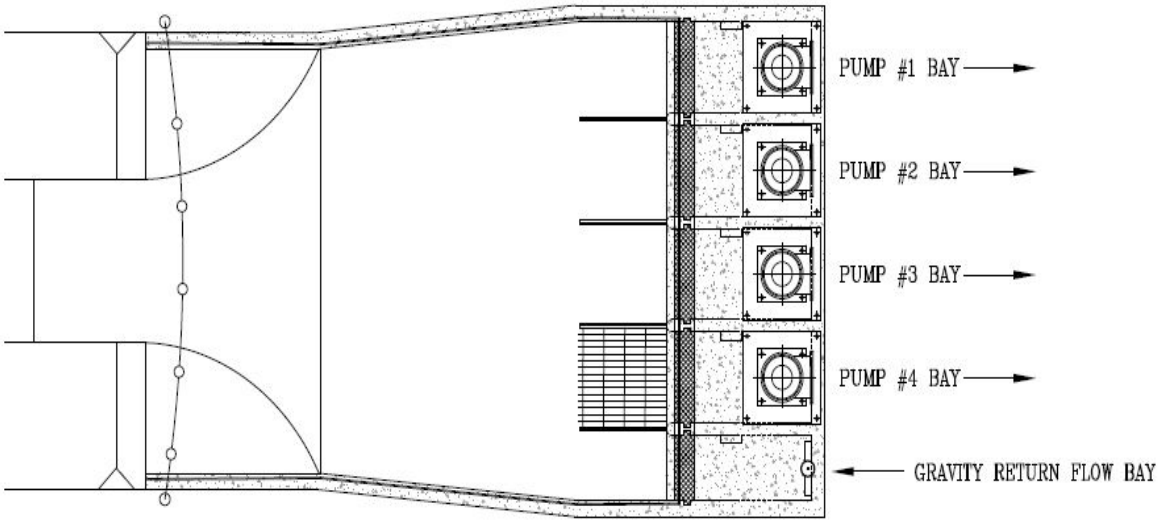


Figure 5: Pump Station No. 3 Configuration with 4 Pumps

Pump Station No. 3

240 CFS Capacity
(2) 40 cfs Pumps
(2) 80 cfs Pumps

The two smaller pumps have an approximate 40 cfs capacity and the two larger pumps have an approximate 80 cfs capacity. It is estimated that the slower speed pumps will be able to reduce their capacity to approximately two-thirds with the use of a variable speed drive (VFD).

Table 7

Pump Station No. 3 with 4 Pump Configuration				
Pump Station Demand	40 cfs Pump[1]	40 cfs Pump[1]	80 cfs Pump[2]	80 cfs Pump[2]
30-45 cfs	x			
50-80 cfs	x	x		
85-120 cfs	x		x	
125-160 cfs	x	x	x	
165-200 cfs	x		x	x
205-240 cfs	x	x	x	x
[1]Pump range with VFD estimated as 26 cfs to 40 cfs.				
[2]Pump range with VFD estimated as 53 cfs to 80 cfs.				

Table 8 below provides a cost estimate for the four (4) pump configuration.

Table 8

Kern Fan Project Pump Stations No. 3 - 4 Pump Configuration						
Item Description	Unit	Quantity		Unit Cost		Extended Cost
Earthwork & Site Ground Cover	1	LS	$	200,000.00	$	200,000.00
Reinforced Concrete Structure	1	LS	$	800,000.00	$	800,000.00
Miscellaneous Steel & Trashracks	1	LS	$	175,000.00	$	175,000.00
Pumps and Motors	1	LS	$	1,287,000.00	$	1,287,000.00
30" Discharge Piping & Appurtenances	2	EA	$	394,000.00	$	788,000.00
42" Discharge Piping & Appurtenances	2	EA	$	485,000.00	$	970,000.00
Variable Frequency Drives	1	LS	$	420,000.00	$	420,000.00
Electrical and Controls	1	LS	$	900,000.00	$	900,000.00
Electrical Control Building & Foundation	1	LS	$	380,000.00	$	380,000.00
Cathodic Protection	1	LS	$	25,000.00	$	25,000.00
Gravity Bypass Pipeline & Slide Gate	1	LS	$	205,000.00	$	205,000.00
		Total 4 Pump Configuration Estimate:				**$ 6,150,000.00**

Footnote: Costs are for purposes of comparison between pump configurations and not intended to be inclusive of all pump station costs.

c) Three (3) Pump Configuration

The three pump configuration would consist of three high capacity, low lift pumps and motors. The pump capacities are sized to endeavor to cover the majority of flow possibilities between 50 cfs to 240 cfs in 5 cfs increments. Table 9 below illustrates the range of the pump station and its ability to meet the 5 cfs incremental criteria.

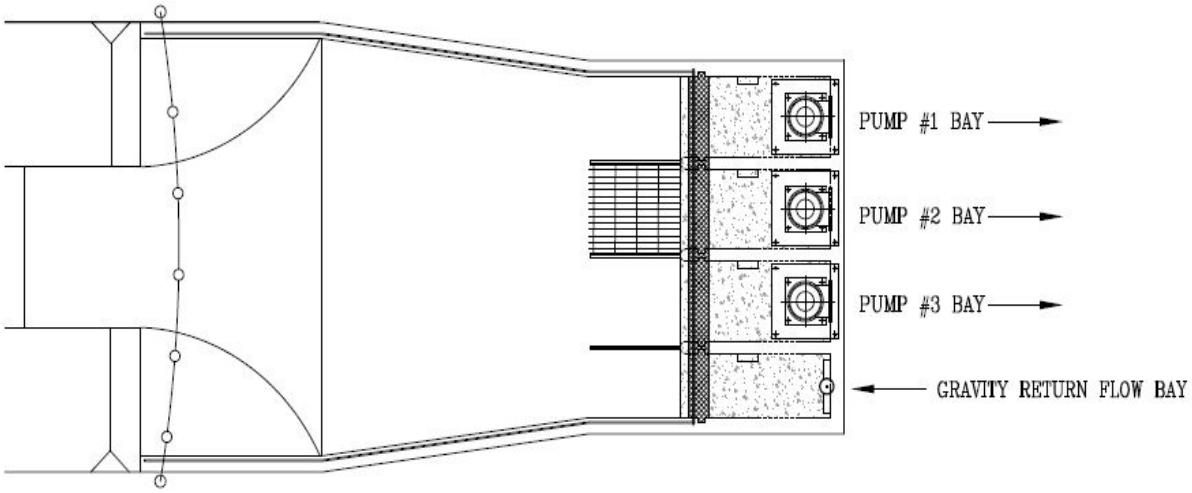


Figure 6: Pump Station No. 3 Configuration with 3 Pumps

Pump Station No. 3

240 CFS Capacity
(3) 80 cfs Pumps

It is estimated that the range of a 80 cfs pump will be approximately 53 cfs to 80 cfs based on an estimate of the VFD being able to ramp down to approximately two-thirds of the pump design capacity.

Table 9

Pump Station No. 3 with 3 Pump Configuration			
Pump Station Demand	80 cfs Pump[1]	80 cfs Pump[1]	80 cfs Pump[1]
30 cfs			
35 cfs			
40 cfs			
45 cfs			
50 cfs			
55-85 cfs	x		
90 cfs			
95 cfs			
100 cfs			
105-160 cfs	x	x	
165-240 cfs	x	x	x

[1]Pump range with VFD estimated as 53 cfs to 80 cfs.
Pumps may not be able to match these flow rates.

Table 10 below provides a cost estimate for the three (3) pump configuration.

Table 10

Kern Fan Project Pump Stations No. 3 - 3 Pump Configuration				
Item Description	Unit	Quantity	Unit Cost	Extended Cost
Earthwork & Site Ground Cover	1	LS	$ 185,000.00	$ 185,000.00
Reinforced Concrete Structure	1	LS	$ 700,000.00	$ 700,000.00
Miscellaneous Steel & Trashracks	1	LS	$ 150,000.00	$ 150,000.00
Pumps and Motors	1	LS	$ 1,138,500.00	$ 1,138,500.00
42" Discharge Piping & Appurtenances	3	EA	$ 485,000.00	$ 1,455,000.00
Variable Frequency Drives	1	LS	$ 360,000.00	$ 360,000.00
Electrical and Controls	1	LS	$ 700,000.00	$ 700,000.00
Electrical Control Building & Foundation	1	LS	$ 380,000.00	$ 380,000.00
Cathodic Protection	1	LS	$ 25,000.00	$ 25,000.00
Gravity Bypass Pipeline & Slide Gate	1	LS	$ 205,000.00	$ 205,000.00
			Total 3 Pump Configuration Estimate:	**$ 5,298,500.00**

Footnote: Costs are for purposes of comparison between pump configurations and not intended to be inclusive of all pump station costs.

d) Pump Station No. 3 Recommendations

The six (6) pump configuration is sufficient from the standpoint of being able to meet a minimum pump station capacity of 30 cfs and being able to match flows in 5 cfs increments from 30 cfs to 240 cfs. However, it is approximately $1,178,000.00 more in capital cost than a four (4) pump configuration. The four (4) pump configuration is also able to meet a minimum pump capacity of 30 cfs while matching flows in 5 cfs increments from 30 cfs to 240 cfs. The three (3) pump configuration is the least capital cost, however it will have difficulty meeting the minimum flow requirements and matching flow rates in 5 cfs increments particularly in the ranges of 30 cfs to 50 cfs and 90 cfs to 100 cfs.

Pump Station No. 3 is recommended to have four pumps and motors with two (2) 40 cfs pumps and two (2) 80 cfs pumps. This will allow pump bay widths to be similar for utilizing two standard stop log slot dimensions and also for providing interchangeability between pumps across all three conveyance canal pump stations.

Redundancy for this conveyance canal pump station is built-in by nature of the 1.5 filling factor that is being utilized for the recharge areas. It is believed that if a pump is out-of-service during the initial recharge filling period at Pump Station No. 3, that the pump station will still be at 67% to 90% capacity and that recharge can temporarily be reduced until the appropriate repairs are made. However, during the long term maintenance rates or average recharge rates, Pump Station No. 3 would be at 90-100% capacity with the largest pump out-of-service, i.e. 240 cfs – 80 cfs Pump = 160 cfs $\leq$ 170 cfs average rate from Technical Memorandum No. 2 "Conveyance Capacity".

The pump and motor sizes utilized herein and the associated costs are preliminary and only for purposes of the preliminary engineering work. It is understood that the actual pump and motor sizes will be determined during the engineering design phase based on the actual hydraulic conditions of the conveyance facilities and that updated pricing will be evaluated.

C. Goose Lake Channel Pump Station

The Goose Lake Channel Pump Station will be utilized to convey water to the proposed Phase I property via the Goose Lake Channel from the Cross Valley Canal (CVC) or the Kern River.

The initial fill rate of the Phase I property has been estimated as 240 cfs. In Technical Memorandum No. 2 (Conveyance Capacity), approximately 129 cfs of this demand will be exchanged with capacity from the east that has historically been delivered to the West Basins and the Enns Basins.

The remaining 111 cfs demand will consist of in-lieu water and water from the California Aqueduct (105 cfs) delivered to the Phase I property.

Given the above criteria, the Goose Lake Channel pump station would be designed for approximately 129 cfs, however it is recommended to design for the initial fill rate of 240 cfs in the event that quantity of water is available from the Goose Lake Channel.

Goose Lake Channel Pump Station Recommendation

A 240 cfs pump station was evaluated under Section B "Pump Station No. 3 Pump Configurations" for a three pump, four pump, and six pump configuration. It is recommended to utilize a four pump configuration with two 40 cfs pumps and two 80 cfs pumps in an effort to standardize the pump sizes.

Redundancy for the Goose Lake Channel Pump Station is built-in by nature of the 1.5 filling factor that is being utilized for the recharge areas. It is believed that if a pump is out-of-service during the initial recharge filling period at the Goose Lake Channel Pump Station, that the pump station will still be at 67% to 90% capacity and that recharge can temporarily be reduced until the appropriate repairs are made. However, during the long term maintenance rates or average recharge rates, the Goose Lake Channel Pump Station would still be at 100% capacity with the largest pump out-of-service, i.e. 240 cfs – 80 cfs Pump = 160 cfs = 160 cfs average rate from Technical Memorandum No. 2 "Conveyance Capacity".

D. Return Water Pump Station

The Return Water Pump Station will be utilized to convey recovered water from the Phase II Property, the West Basins, and the Phase I property as necessary up to the California Aqueduct. The project is anticipated to include up to twelve (12) recovery wells each with a capacity of 5 to 6 cfs for a total return flow capacity of 60 cfs to 72 cfs.

The criteria for the Return Water Pump Station includes:

- Minimum Flow Rate = 24 cfs (Approx. 4 wells)
- Capacity of 24 cfs to 72 cfs in 5 cfs increments
- Full Pump Redundancy if Largest Pump fails

A two pump and three pump configuration has been evaluated with and without pump redundancy:

a) Two Pump Configuration without redundancy

A two pump configuration without redundancy will consist of two pumps each with a capacity of approximately 36 cfs.

72 CFS Capacity
(2) 36 cfs Pumps

b) Two Pump Configuration with redundancy

A two pump configuration with redundancy will consist of two pumps each designed to convey the design flowrate of 72 cfs.

72 CFS Capacity
(2) 72 cfs Pumps

c) Three Pump Configuration without redundancy

A three pump configuration without redundancy will consist of three pumps each with a capacity of approximately 24 cfs.

72 CFS Capacity
(3) 24 cfs Pumps

d) Three Pump Configuration with redundancy

A three pump configuration with redundancy will consist of three pumps each designed to convey the design flowrate of 72 cfs between two pumps.

72 CFS Capacity
(3) 36 cfs Pumps

Return Water Pump Station Recommendation

A three pump configuration with redundancy, i.e. three (3) 36 cfs pumps is recommended. This design will:

- Allow for returning the maximum design flow to the California Aqueduct with one pump or motor out of service.
- Allow for the possibility of the three pumps to be an equivalent size to the 40 cfs pumps utilized at the Conveyance Canal Pump Stations and the Goose Lake Channel Pump Station.
- Achieve an approximate minimum flowrate of 24 cfs.
- Achieve 5 cfs increments from approximately 24 cfs to 72 cfs with the exception of the 40 cfs and 45 cfs increments. However, the canal will act as storage for minor variations in matching of flow rates.

The District will typically utilize the majority of the recovery wells when operating in a recovery mode. It appears unlikely that the District would operate less than four (4) wells when returning water to the California Aqueduct.

The mismatch in flows around the 40 cfs and 45 cfs increments is minor and can be accommodated by utilizing the available storage that is in the canal prism during recovery operations.

In the occasional event whereby there is shallow water at the commencement of recovery operations and the wells are over-performing, the third pump provided for redundancy could be utilized, i.e. 12 wells operating at 7.5 cfs instead of 6 cfs equals 90 cfs < 3 pumps at 36 cfs equating to 108 cfs.

IV. Discharge Pipe Sizing

The pump discharge piping sizes were evaluated in Technical Memorandum No. 3 (Pipeline Requirements). A summary of the sizes is listed below.

Capacity (cfs)	Discharge Pipe Size (in.)
125	48
100	48
90	42
80	42
75	42
65	36
60	36
50	36
40	30
30	24
20	20

The above ground pump discharge piping is anticipated to be fusion bonded epoxy lined and coated steel pipe. The principal advantages of steel pipe include high strength, the ability to deflect without breaking, ease of installation, shock resistance, availability of special configurations and modifications by welding.

It is anticipated that each pump discharge pipe will be independent and discharge directly to the downstream reach of the conveyance canal (pump station afterbay).

V. Special Considerations

A. Trashrack Style

Trashracks shall be utilized to prevent the passage of objectionably large floating and submerged objects or debris that could cause damage or operational problems for the pumps or downstream equipment.

The trashracks shall consist of rows of parallel vertical flat bars with a clear opening between flat bars that is as large as possible yet consistent with the features and equipment to be protected as well as the equipment that the District will use to clean the trashracks.

It is anticipated that the District will manually clean and rake the trashracks.

The trashracks shall be fabricated from structural steel and be hot-dip galvanized for corrosion protection. They shall be end bearing trashracks installed in the inclined position with the bars running from top to bottom and carrying the loads to the reinforced concrete structure. The trashracks shall be designed to provide a maximum approach velocity of 1 to 2 feet per second for the design flows. This slow approach velocity reduces the tendency to collect debris against the racks, minimizes the possibility of trashrack vibration, and makes them easier to clean.

Trashracks shall be installed a minimum of five pump bell diameters ahead of the pump intake.

B. Pump Station Deck

A combination of reinforced concrete and heavy bar steel grating shall be designed and constructed for the pump deck that is suitable for a H20 loading. This will allow equipment to utilize the deck for the removal and installation of pumps and motors as well as for cleaning of trashracks while allowing for visibility down into each pump bay and convenient access to the pumps. The minimum deck width for access shall be a clear width of 16'-0" from the largest pump discharge head and sole plate to the edge of the deck or handrailing.

Handrailing shall be installed around the pump station deck where adjacent to open pump bays or forebays for safety. Railings shall be installed in a manner that they are removable, if necessary, for access to stop log slots, trashracks, and for clean-out of the pump bays and forebay.

The pump station structure and pumps and motors shall be designed for State of California seismic requirements per the 2019 California Building Code (CBC) and ASCE 7-16.

Each pump shall be equipped with a pump mounting pad. The pumps will include a permanently anchored and grouted in place soleplate onto which the pump discharge head will be mounted. It is proposed that the reinforced concrete pump station structures will be constructed as part of the conveyance facility construction and that a separate contract will be issued to equip the pump stations with pumps, motors, discharge piping and appurtenances, and electrical and controls. The reinforced concrete pump station, miscellaneous steel embeds such as ladder rungs, stop log slots, grating, and handrailing, and steel trashracks will be installed as part of the Conveyance Facilities scope of work along with the conveyance canal earthwork and lining work. The "Pump Station Equipping" scope of work will include the pump sole plates, the pump assembly, pump discharge head, pump anchorage, motor, discharge piping, electrical, control building, site lighting, and site development.

C. Cathodic Protection

Cathodic protection shall be provided for buried steel structures and piping at the pump station as well as the submerged steel structures and pumps in order to prevent corrosion. The following items shall have cathodic protection, at a minimum:

- Underground steel pump discharge piping
- Submerged pump column piping
- Submerged steel trashracks

The cathodic protection system shall be designed by a company specializing in impressed current systems.

Anode assemblies shall be mounted in each pump bay within one pipe diameter of the pump column piping and within five-feet of the trashrack. The assembly shall be supported by anode supports for mounting on a concrete deck. The bottom of the anodes shall be one-foot (1') above the structure floor. The copper cables shall be routed to a pole mounted anode junction/resistance box. The anode junction box shall be connected to a wall mounted air-cooled rectifier (40V, 30 Amp) in the electrical/control building. As an alternative, a passive cathodic protection system can be installed utilizing zinc anode ribbons strapped to the pump column piping and trashrack structures or approved equal.

The underground steel pipelines shall be protected by an impressed current system. The soil anodes shall be constructed near the pipeline as directed by the Cathodic Protection specialist. A cathodic protection test station shall be installed as directed by the Cathodic Protection specialist.

D. Flow Meters

It is recommended to install individual flow meters at each pump discharge line so that the performance of the individual pumps and motors can be evaluated. The discharge pipe sizes vary but are expected to range between 30-inch and 54-inch diameter.

There are different types of meters available in these size ranges which are noted below. It is recommended that these meter options be evaluated further during the design phase of the pump stations to select the best meter for the application. The brands and models noted below are for reference, however other meters that are comparable may be considered.

1. Mag Meters (Full Body)

   Mag Meters are available up to 48-inch diameter and flows up to 420 cfs. These are flanged meters that do not have any moving parts and are easy to maintain. These are supplied by McCrometer out of Hemet, California.

2. Mag Meter (Insertion Probe)

   An insertion electromagnetic flow sensor is available from Seametrics. The Model EX210 meter adjusts for pipe sizes from 10-inch to 48-inch diameter and flows up to 250 cfs.

3. Ultrasonic Meter

   An ultrasonic flow transducer is available from Rittmeyer and has several different types that can be utilized, all of which are for pipes flowing full whether above ground or below ground. They provide clamp-on meters or transducers that can be installed through the pipe wall. They are suitable for a full range of pipe diameters, can be replaced with the pipelines in operation, and have a high accuracy. In addition, they make a flow controller / display that can monitor multiple pipes/meters at the same time which is ideal for a pump station facility.

4. Doppler Velocity Meter

   Flow meters utilizing a doppler velocity sensor and depth sensor can provide flow measurement in large diameter pipes for full-pipe flow or partial pipe flow. These are supplied by SonTek, a xylem brand.

E. Valve and Appurtenances

1. Air Release Valve

   An air release and vacuum relief valve is necessary to release air upon start-up or the slow build up of air and to prevent vacuum conditions in the pipeline from developing in the event of a power failure or pump shutdown. The valve shall be designed to allow large quantities of air to escape out of the orifice when filling the pipeline and to close watertight when the liquid enters the valve. The valve shall also permit large quantities of air to enter through the orifice when the pipeline is being drained to break the vacuum.

2. Check Valve

   A check valve is utilized to prevent reverse flow and prevent runaway reverse pump speeds when the pump is shut off. It is common to use a slanting disc check valve in these applications. A slanting disc check valve contains a disc balanced on a pivot. Instead of being perpendicular to the longitudinal axis in conventional swing check valves, the seat is at an angle of 50 to 60 degrees from the valve longitudinal axis. The advantages of this type of valve include low headloss, top-mounted oil dashpots that can be used to control the opening and closing speeds, and the ability to adjust the valve controls in the field. The top-mounted oil dashpot system allows both the opening and closing speeds of the disc to be adjusted over the full range it travels.

3. Dresser Coupling

   A sleeve coupling with AWWA M11 joint restraint harness shall be installed on the discharge piping near the pump discharge head. The coupling provides a flexible connection to the pump discharge head and pump station structure in the event of a seismic event and it is also serves as a convenience for breaking the pipe apart to remove the pump from the pump station, if necessary.

4. Butterfly Valve

   A butterfly valve is recommended as the isolation valve to be installed on each pump discharge line. The isolation valve is either fully opened or fully closed. The valve can be used to isolate the pump discharge piping from the system in the event repairs or maintenance need to be performed.

F. Variable Frequency Drives

The pump station motors will each be equipped with variable speed drives (VFD's). The VFD drives shall be equipped with harmonic protection and include proper shielding and protections from PG&E power variations. These drives shall be the Yaskawa U1000 Industrial Matrix Drive, or approved equal, for ultra-low harmonics, full continuous regeneration, and high efficiency.

G. Site Development

Each of the pump station sites shall have all-weather surfacing installed around the pump station, control building, site lighting, electrical transformer, and site ingress and egress routes.

Site lighting (exterior) with electrical outlets shall be installed around the pump station facilities and control building in a manner that will ensure the entire pump station facility and appurtenances are adequately covered with light and auxiliary power. Type IV light distribution fixtures shall be utilized that cast light 2.75 times wider than their height but produce a more rounded distribution pattern that pushes the light outward. The site lighting shall be LED lighting, include an electrical outlet at the base of the pole, have a photocell for automatic operation, and a switch for manual off, manual on, and operation based on the photocell.

Site security shall consist of fencing around the pump station facilities as well as intrusion alarms at each of the control buildings at access doors. It is anticipated that barbed wire and field fencing will be installed around the conveyance canal. This fencing shall encompass the pump station facilities along the conveyance canal, i.e. Return Water Pump Station, Pump Stations No. 1 – No. 3, and a potential Pump Station No. 4. This fencing shall include multiple access points to the pump station facilities utilizing large drive gates for access with cranes and other large equipment and personnel gates that are 4-feet wide. Double-wide access gates shall be utilized with a minimum 24-ft wide overall opening. It is anticipated that 6-ft tall chainlink fencing with three strands of barbed wire will be installed around the Goose Lake Pump Station Facility and include large drive gates and personnel gates.

VI. Physical Hydraulic Modeling

Physical modeling of the conveyance canal pump station facilities shall be performed by reputable firms or laboratories such as the Utah Water Research Laboratory at Utah State University, the US Bureau of Reclamation Hydraulics Laboratory in Denver, the Clemson Engineering Hydraulics (CEH) in South Carolina, or Northwest Hydraulic Consultants (NHC) Laboratory in Canada or Seattle. Selection of the modeling laboratory should be based on qualifications, experience, costs, and availability and be subject to the approval of the JPA.

In addition to the physical modeling, numerical modeling using Computational Fluid Dynamics (CFD) shall be provided by the laboratory. The design firm shall be responsible for modeling of the entire canal network and structures utilizing HEC-RAS or equivalent to determine operating water levels and velocities for all flow conditions.

It is recommended that hydraulic modeling be performed for the three in-line pump stations along the conveyance canal. Hydraulic modeling may not be required for the Goose Lake Channel Pump Station, the Return Water Pump Station, or a fourth in-line Pump Station at the end of the conveyance channel (if necessary), however this will be at the discretion of the design firm and JPA. The fourth in-line Pump Station (if necessary) and the Return Water Pump Station are believed to be small enough that they do not warrant hydraulic modeling provided they are designed in accordance with the Hydraulic Institute Standards. The Goose Lake Channel Pump Station is equal in capacity to the Conveyance Canal Pump Station No. 3, but can be designed to utilize information from the Pump Station No. 3 modeling and will have a large pool to pump from given the Goose Lake Channel and a new weir structure. However, the necessity for modeling the Goose Lake Channel Pump Station will be at the discretion of the project design firm and the JPA.

The Pump Station facility shall be evaluated at an appropriate scale and be studied to ensure the pump stations:

- Meet the established design criteria
- Prevent accumulation of sediment and debris
- Avoid pump cavitation and vortices
- Optimize hydraulic performance and efficiency
- Reduce maintenance requirements

The hydraulic modeling shall provide recommendations for the overall pump station configuration, curtain walls, fillets, center splitters, and other mitigation measures,

Utah Water Research Laboratory (UWRL)

The UWRL has been building and testing physical scale models since its commissioning in 1965. They build geometrically scaled models and utilize

essential scaling parameters to accurately prototype flow conditions. They have the space to accommodate large model scales and thus reduce the potential for size scaling effects.

UWRL offers a composite model approach that couples physical modeling with numerical modeling that is highly effective in solving a wide array of difficult hydraulic problems. The numerical modeling is performed using Computational Fluid Dynamics (CFD).

US Bureau of Reclamation Hydraulics Laboratory

The US Bureau of Reclamation is capable of conducting large scale physical hydraulic models for conveyance channels and pump stations.

Clemson Engineering Hydraulics (CEH)

Clemson Engineering Hydraulics was first established as a research program at Clemson University in 2000 and then was launched as CEH in 2005 as a private commercial venture to fill the modeling needs of clients regionally, nationally, and worldwide.

The CEH physical modeling facility is a state of the art laboratory with 60,000 square feet of modeling space located near Anderson, South Carolina. The CEH team has extensive modeling experience with over 1,000 model studies of a wide range of hydraulic structures including pump intakes, siphon discharge systems, outfalls, and control structures.

Northwest Hydraulic Consultants (NHC)

NHC performs physical hydraulic modeling as well as numerical modeling using Computational Fluid Dynamics (CFD). These models are complex and sophisticated numerical tools used to investigate flow patterns and velocities in three dimensions and provide a detailed visual representation of the modelled system to address hydraulic issues or concerns. They have facilities in Vancouver, Edmonton, and Seattle.

A. Model Construction

A scale model of the proposed pump station shall be constructed in the selected laboratory. It is assumed at this time that the design of all three pump stations will be similar with the exception of the pump and motor sizes. If any special circumstances exist with one or more of the pump stations, then these special circumstances shall be captured in the model testing.

The layout of the physical modeling shall be based on the preliminary design drawings for the pump stations and the canal conveyance channel. All portions of the pump station that may affect the flow uniformity or the performance of the pumps shall be included in the physical model. The model

shall accurately reflect the orientation and configuration of the forebays and the afterbays at the pump station.

B. Model Testing

Model testing will begin with the proposed engineering design for the pump station, the canal approach, the forebay, and the afterbay and then the channel and forebay geometry will be modified in the physical model until the velocity profiles entering each pump bay are as uniform as possible. The proposed pumps and pump bell data should be known and provided so that the actual flow distribution, velocity profiles, vortices, velocity fluctuations, and general pump bay flow conditions can be measured at each respective pump and pump bay. The testing will need to include all possible scenarios of pump operation and at a minimum, shall include:

- Evaluation of discharge flow conditions to the afterbay specifically with regard to erosion and the need for energy dissipation.

- All pumping configurations shall be tested (i.e., three different flow rates (443 cfs, 435 cfs, and 240 cfs) at the possible pump combinations when pumps are on/off).

- A proposed test iteration is noted below:

Table 11

Test No.	Total Pump Flow Rate (cfs)[1]	Pumps Operating	WS Elev. at Pump (ft)[1]	Test Configuration
1	normal	All	normal	Pump Config. 1
2	low	All	high	Pump Config. 1
3	normal	All	low	Pump Config. 1
4	high	All	low	Pump Config. 1
5	high	All	normal	Pump Config. 1
6	high	All	high	Pump Config. 1
7	normal	One Pump Off	normal	Pump Config. 2
8	low	One Pump Off	high	Pump Config. 2
9	normal	One Pump Off	low	Pump Config. 2
10	high	One Pump Off	low	Pump Config. 2
11	high	One Pump Off	normal	Pump Config. 2
12	high	One Pump Off	high	Pump Config. 2

[1]Specific flow and water surface elevations corresponding to low, normal, and high will be provided during the model construction.

VII. Low Voltage versus Medium Voltage Service

The pump station electrical service may be low voltage or medium voltage depending on the total horsepower of the pump station.

Low voltage service is considered 480 volt service. Medium voltage service is considered 4,160 volt service. PG&E will typically not allow medium voltage service if the load is less than 600 hp.

Low voltage service is recommended under the following two circumstances:

1. Using solid-state reduced voltage starters (SSRV) and load is less than 600 hp.
2. Using variable speed drives (VFD) and the load is less than 2000 hp.

The benefits to low voltage service include the following:

1. Lower equipment cost
2. More familiar to maintenance personnel
3. Easier to obtain parts

The benefits to medium voltage service include the following:

1. Lower amperage
2. Lower energy losses

However, medium voltage service has a greater safety hazard.

At the larger horsepowers, an economic analysis shall be prepared that compares the starter costs, VFD costs, cable costs, etc. between the low voltage and the medium voltage services.

VIII. Utility Interface

PG&E will be the power service provider for the Pump Stations. It will be critical to involve them in the design process early. These will be large horsepower pump stations in the range of 800 hp to 1,600 hp and PG&E may need to make infrastructure upgrades to adequately support and serve these facilities.

It will be prudent to furnish PG&E with information and estimates of all the project loads and to provide an overall map that illustrates the locations of such loads.

Furthermore, the starting of these large motors at the Pump Stations may cause voltage drops or “flicker” and PG&E may require the installation of variable speed drives (VFD’s) for each pump and motor. The use of VFD’s at the Pump

Stations will also afford the JPA greater flexibility in matching flows and reducing the starting and stopping of pumps.

IX. Control Building Design

An electrical control building will be constructed at each Pump Station to house the electrical, control, and SCADA equipment. It is anticipated that the control building will be either a masonry building or a pre-cast concrete building.

The designer shall ensure the building is adequately sized to hold all the electrical and control equipment and provide adequate clearances for access and maintenance. The minimum ceiling height shall be 10-feet. Door openings shall be large enough for the removal of the largest piece of equipment or the roof shall be removable.

The building shall be climate controlled, the VFD units shall be vented to the building exterior and a means incorporated to minimize the AC loading in the building by utilizing outside (unconditioned) air for cooling the VFD units, and the roof shall be sloped appropriately with runoff away from the building ingress and egress. In addition, the building shall have intrusion alarms installed at all doors and access points for building security.

X. Pump Station Control Philosophy

The pump station control philosophy for each pump station facility will be developed during the detailed design of the conveyance canal and pump stations.

The pump stations will need to be capable of being controlled, monitored, and operated both locally and remote through SCADA. The operators shall have the flexibility to turn on pumps and turn off pumps as necessary. In addition, the SCADA system shall provide for water level monitoring in each pump forebay and afterbay as well as indicating the pump flow readings from the flow meters. The SCADA system shall communicate alarms at a minimum for power failure, motor failure, water level alarms, and high pressure alarms.

The Conveyance Canal Pump Station motors will be equipped with variable speed drives and will be able to modulate to maintain flow or level. The canal may be desired to be controlled based on flow or level. It may be advantageous to set the flow rate at each pump station and have the pumps modulate to maintain the flow set point while utilizing the water level as a secondary means of control in the event of high water levels or low water levels that could compromise the performance of the pump based on low submergence. Protective measures such as water level sensors shall be duplicated for redundancy.

The Goose Lake Channel Pump Station and Return Water Pump Station motors will be equipped with variable speed drives and will be able to modulate to maintain flow or level. It is anticipated that the Goose Lake Channel Pump Station and Return Water Pump Station will be operated for long periods of time or turned off for long periods of time. Override protective measures will be

designed such as a low water level cutoff in the event the pump submergence is compromised or a high pressure switch at the pump discharge in the event of a closed valve or blockage. Protective measures such as water level sensors shall be duplicated for redundancy.

XI. Summary

Each pump station shall be designed, at a minimum, in accordance with the Hydraulic Institute Standards ANSI/HI 9.8-Most Recent Edition for Pump Intake Design. Additionally, the conveyance canal pump stations shall have physical modeling and numerical modeling using CFD performed due to the large capacities of these pump stations.

It is recommended that Pump Stations No. 1 and No. 2 have six pumps and motors each with two (2) 40 to 42 cfs pumps and four (4) 89 to 90 cfs pumps. Pump Station No. 3 is recommended to have four pumps and motors with two (2) 40 cfs pumps and two (2) 80 cfs pumps.

In addition, the Goose Lake Channel Pump Station is recommended to have four pumps and motors with two (2) 40 cfs pumps and two (2) 80 cfs pumps and the Return Water Pump Station is recommended to have three (3) 36 cfs pumps. This will allow pump bay widths to be similar for utilizing two standard stop log slot dimensions and also for providing interchangeability between pumps across all pump stations.

A Pump Station No. 4 may be necessary at the easterly end of the conveyance channel to lift 129 cfs to the Phase I Property, however this pump station has not been considered herein. This pump station is considered small enough that it may not require physical modeling provided it is designed as outlined herein.

Table 12

Pump Station Summary				
Pump Station Facility	Capacity	Pump Configuration	36-42 cfs Pumps	80-90 cfs Pumps
Pump Station No. 1	443 cfs	Six (6) Pumps	Two	Four
Pump Station No. 2	435 cfs	Six (6) Pumps	Two	Four
Pump Station No. 3	240 cfs	Four (4) Pumps	Two	Two
Pump Station No. 4	129 cfs	If Necessary		
Goose Lake Channel Pump Station	240 cfs	Four (4) Pumps	Two	Two
Return Water Pump Station	72 cfs	Three (3) Pumps	Three	

The pump stations shall be equipped with galvanized steel trashracks, decks designed for H2O loadings to allow for cleaning of trashracks and removal of pumps/motors, cathodic protection, stilling wells for water level monitoring, and access to the pump forebay behind the trashracks and stoplog slots.

The pump motors will be equipped with variable speed drives. The pump discharge piping shall be equipped with air release valves, check valves, butterfly valves, dresser couplings, and flow meters as appropriate for the application.

The electrical service shall be coordinated early in the design process with PG&E and is anticipated to be a low voltage service (480V). The electrical equipment shall be designed in an electrical control building that is climate controlled to protect the equipment from the elements and vandalism.

XII. Related Work Specified Elsewhere

A. TM 2 – Conveyance Capacity Requirements
B. TM 3 – Pipeline Requirements
C. TM 5 – Geotechnical Investigation
D. TM 6 – Canal Liner and Turnout Requirements
E. TM 10 – Facility Operation and SCADA Requirements
F. TM 11- Engineer's Estimates

DEE JASPAR & ASSOCIATES, INC.
CONSULTING CIVIL ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CA 93308
PHONE (661) 393-4796
FAX (661) 393-4799

KERN FAN GROUNDWATER STORAGE PROJECT

TECHNICAL MEMORANDUM NO. 5
(Geotechnical Investigation)

PREPARED FOR: Groundwater Banking Joint Powers Authority (JPA)
PREPARED BY: Curtis Skaggs, P.E.
DATE: February 10, 2021

SUBJECT: ***Geotechnical Investigation***

I. Executive Summary

This memorandum serves to outline the general requirements for geotechnical investigation work and preparation of project soils reports. The requirements outlined herein should be considered recommendations and an estimate of the work that needs to be included, however the design firm shall ultimately be responsible for ensuring that adequate soils investigation is performed so that all facets of the project can be properly designed to minimize potential failures or problems.

Based on the Technical Memorandum No. 1 "Project Phasing and Design/Contractor Selection", it is envisioned that a Geotechnical Investigation and Soils Report will be necessary for each of the following phases:

- Phase I Recharge Basins & Goose Lake Channel Pump Station, Check Structure, Interbasin Structures, and Well Pipelines Intertie; Phase II Recharge Basins & Phase II Well Pipelines and Interbasin Structures
- Aqueduct Turnout Facility
- Conveyance Facilities including Turnouts & Pump Stations

A map overview of the project and the associated geotechnical portions is illustrated in Figure 1 below.

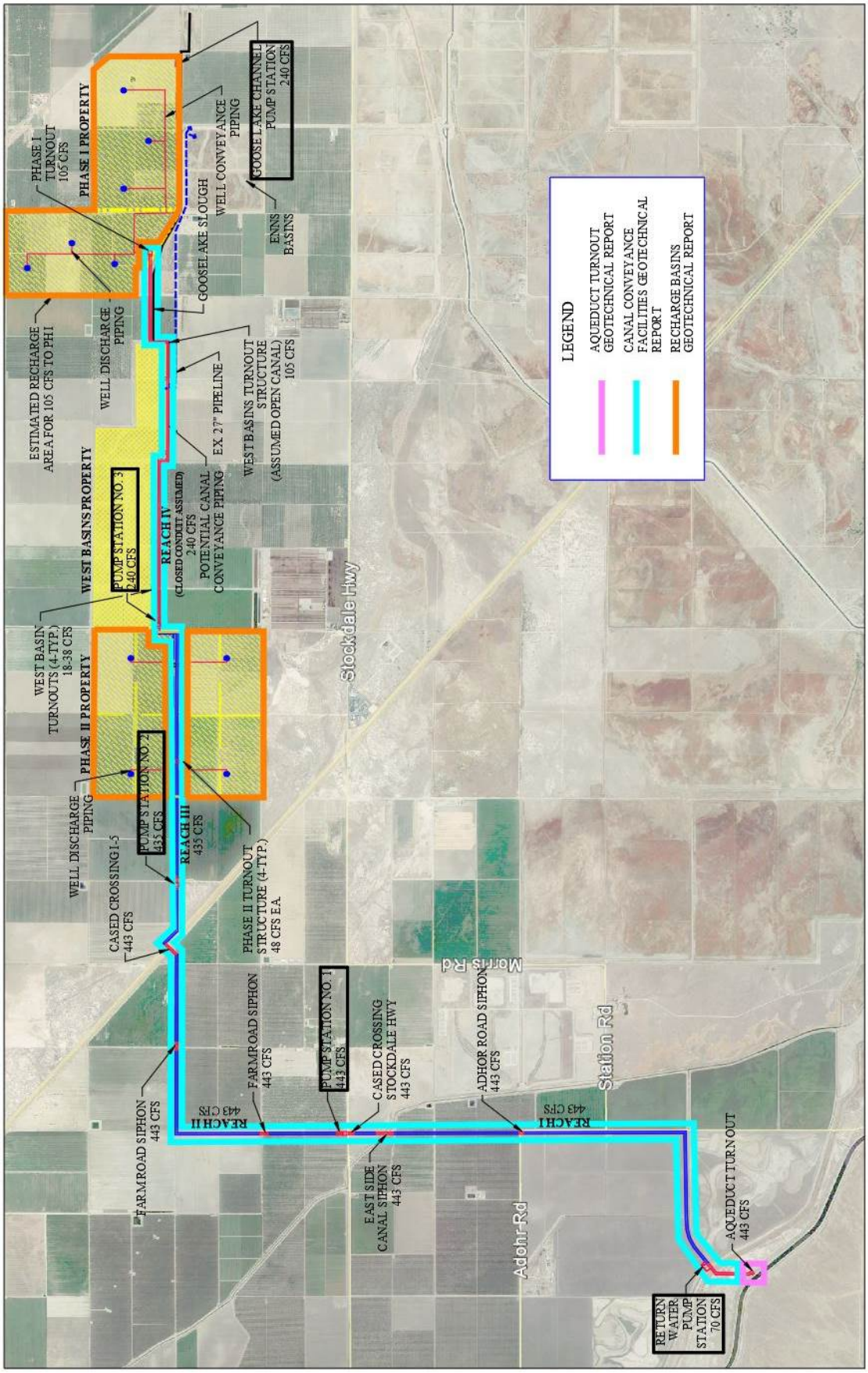


Figure 1: Project Geotechnical Overview

An outline of the memorandum is shown below:

II. Recharge Facility Soils Work Page 8

A. Review of Available Data
   a. Existing Borings
   b. Well Completion Reports
   c. Groundwater Data
   d. Aerial Photography
   e. Geologic Mapping
   f. Transient Electromagnetic (tTEM) Resistivity Correlations, etc.)

B. Field Exploration
   a. Test Pits
   b. Laboratory Testing

C. Site Conditions

D. Engineering Seismology
   a. Seismic Parameters for Engineering Design
      i. American Society of Civil Engineers (ASCE) 7-16
      ii. 2019 California Building Code (CBC)
   b. Liquefaction

E. Design Recommendations
   a. Structure Design
      i. Lateral Earth Pressures
      ii. Resistance to Lateral Loading,
      iii. Bearing Capacity
      iv. Settlement
   b. Levee Construction Earthwork
      i. Slope Stability
      ii. Areas of Concerns requiring Levee Keyways
      iii. Through seepage
      iv. Under seepage
   c. Permanent Slopes
      i. Static Stability
      ii. Seismic Stability
      iii. Maximum Inboard and Outboard Gradients
   d. Temporary Slopes
      i. Slope Stability and Maximum Slope Gradients
   e. Transfer Structures and Pipes
      i. Pipe Backfill Criteria
      ii. Cutoff Walls Backfill Criteria

f. Soil Permeability
    i. In-situ
    ii. Levee Materials
g. Braced Cuts
    i. Bracing
    ii. Shoring

F. Earthwork
a. Preparation of Subgrade/Keyways
b. Borrow Areas
    i. Suitability of Borrow Materials as Levee Fill
        1. Expansive Potential
        2. Dispersiveness
        3. Gradations
        4. Remolded Permeability
    ii. Compaction Criteria
        1. Relative Compaction and Compaction Moisture
        2. Compaction Methods
    iii. Need for Blending of Levee Fill Materials

III. Aqueduct Turnout Soils Work Page 10

A. Review of Available Data
a. Existing Borings
b. Well Completion Reports
c. Groundwater Data
d. Aerial Photography
e. Geologic Mapping

B. Field Exploration
a. Soil Borings at Structure and Along Turnout Alignment
b. Laboratory Testing
c. In-situ Testing
d. Temporary Piezometer

C. Site Conditions
a. Turnout
b. Along Turnout Alignment

D. Engineering Seismology
a. Seismic Parameters for Engineering Design
    i. American Society of Civil Engineers (ASCE) 7-16
    ii. 2019 California Building Code (CBC)
b. Liquefaction

E. Design Recommendations
   a. Structure Design
      i. Lateral Earth Pressures
      ii. Resistance to Lateral Loading
      iii. Bearing Capacity
      iv. Settlement
   b. Pipe Design
      i. Soil Properties
      ii. Vertical Loading
      iii. Soil Friction, E'
         1. Native
         2. Backfill
      iv. Compaction Criteria
         3. Pipe Zone
         4. Trench Zone
   c. Braced Cuts
      i. Bracing
      ii. Shoring
   d. Concrete Corrosion Potential
      i. Sulfate Reaction
      ii. Other Design Considerations
   e. Dewatering
      i. Temporary Piezometers

F. Earthwork
   a. Preparation of Subgrade
   b. Borrow Areas
      i. Suitability of Material
      ii. Gradations
   c. Compaction Criteria
      i. Relative Compaction and Compaction Moisture
      ii. Compaction Methods

IV. Conveyance Soils Work Page 11

A. Review of Available Data
   a. Existing Borings
   b. Well Completion Reports
   c. Groundwater Data
   d. Aerial Photography
   e. Geologic Mapping
   f. Transient Electromagnetic (TEM) Resistivity Correlations, etc.)

B. Field Exploration
   a. Soil Borings at Structures and Along Alignment
   b. Laboratory Testing
   c. In-situ Testing
   d. Temporary Piezometers

C. Site Conditions
   a. Turnouts
   b. Siphons
   c. Along Alignment

D. Engineering Seismology
   a. Seismic Parameters for Engineering Design
      i. American Society of Civil Engineers (ASCE) 7-16
      ii. 2019 California Building Code (CBC)
   b. Liquefaction

E. Design Recommendations
   a. Structure Design
      i. Lateral Earth Pressures
      ii. Resistance to Lateral Loading,
      iii. Bearing Capacity
      iv. Settlement
   b. Bridge Structures
      i. Vertical Capacity
      ii. Lateral Capacity
      iii. Seismic Design
      iv. Construction Considerations
   c. Pipe Design
      i. Soil Properties
      ii. Vertical Loading
      iii. Soil Friction, E'
         1. Native
         2. Backfill
      iv. Compaction Criteria
         3. Pipe Zone
         4. Trench Zone
   d. Jacking & Tunneling Design
      i. Anticipated Soil Stratigraphy
      ii. Tunnel Construction
      iii. Need for Soil Stabilization
   e. Canal Levee Construction
      i. Relative Compaction and Compaction Moisture
      ii. Compaction Methods
      iii. Slope stability
      iv. Permanent Piezometers
   f. Slope Stability
   g. Permanent Slopes
      i. Static Stability
      ii. Seismic Stability
      iii. Maximum Inboard and Outboard Gradients
   h. Temporary Slopes

i. Slope Stability and Maximum Slope Gradients
i. Braced Cuts
i. Bracing
ii. Shoring
j. Concrete Corrosion Potential
i. Sulfate Reaction
ii. Other Design Considerations
k. Dewatering
i. Temporary Piezometers

F. Earthwork
a. Preparation of Subgrade/Keyway
b. Borrow Areas
i. Suitability of Borrow Materials as Fill
1. Expansion Potential
2. Dispersiveness
ii. Gradations
c. Compaction Criteria
i. Relative Compaction and Compaction Moisture
ii. Compaction Methods
iii. Need for Blending of Levee Fill Materials

V. Summary Page 14

These soils reports will become the property of the JPA. As such, the JPA will be permitted to provide copies of the soils reports as necessary to other design firms, general contractors, and subcontractors as required for other phases of the project.

II. Recharge Facility Soils Work

A geotechnical investigation and report is necessary for the recharge facility projects listed in the design phase "Phase I Recharge Basins & Goose Lake Channel Pump Station, Check Structure, Interbasin Structures, and Well Pipelines Intertie; Phase II Recharge Basins & Phase II Well Pipelines and Interbasin Structures. The investigation work is considered the field work, sampling, and testing while the report is considered the final report summarizing the findings, conclusions, and recommendations.

This work will include a review of available data, field exploration, a description of site conditions, an outline of seismic parameters, and design and earthwork recommendations as outlined below.

This information will be necessary for the recharge facility earthwork, the design of earthen levees, the design of interbasin structures, the design of conveyance pipelines, and the design of other associated structures.

A. Review of Available Data

A review of available data in the area of the proposed recharge basins shall be performed. This shall include, but not be limited to, a review of existing borings, well completion reports, groundwater data, historic aerial photographs, geologic mapping, and transient electromagnetic (tTEM) surveys.

It is anticipated that the District will perform tTEM surveys on the Phase I and Phase II properties as part of the due diligence in purchasing the properties. The tTEM survey method measures the electrical resistivity of the earth and these resistivities are translated to soil lithology for a better understanding of the formations below the ground surface.

B. Field Exploration

The field exploration within the proposed recharge basin properties shall consist of test pits, borings, and laboratory testing.

It is anticipated that test pits shall be excavated across the properties of the Phase I and Phase II recharge areas to depths of approximately 5-feet to 10-feet. It is anticipated that up to 30 test pits, or approximately 1 test pit per 20 acres, could be excavated and that these would be performed in areas of geologic interest such as historic channels and seepage paths based upon the review of available data.

The actual depth and quantity of test pits, however, will be dependent on the property, the data review, and the discretion of the soils firm and design firm.

It may also be desirable to perform a few deep borings for correlation with the tTEM survey data.

Soil samples shall be collected from the test pits or borings and the following testing considered:

- Moisture Content (ASTM D2216)
- Unit Weight (ASTM D2937)
- Sieve Analysis (ASTM C136, D422, D1140)
- Dispersive Characteristics of Clay Soil by Double Hydrometer (ASTM D4221)
- Atterberg Limits (ASTM D4318)
- Standard Proctor (ASTM D698) or Modified Proctor (ASTM D1557) as appropriate
- Expansion Index (ASTM D4829)
- Soluble Sulfate & Soluble Chloride Contents (California Test Method No.'s 417 & 422)
- pH and Minimum Resistivity (California Test Method No. 643)
- Strength Testing – Direct Shear (ASTM D3080) or Unconfined Compressive Strength (ASTM D2166)
- Flexible Wall Permeability (ASTM D5084)
- Collapse Potential (ASTM D5333)

C. Site Conditions

The report shall outline the existing site conditions. This shall include background data on the properties and a description of subsurface conditions including obstructions and earth materials.

D. Seismic Design Parameters

The report shall outline the seismic design parameters for engineering design of structures and facilities within the project areas. The seismic parameters shall be in accordance with ASCE 7-16 and the 2019 California Building Code (CBC).

E. Design Recommendations

The report shall outline design recommendations for site earthwork, levee subgrade preparation, embankment construction, structure backfill, and structure design.

This shall include a recommendation of materials, compaction efforts, slope stability, permeability, bearing capacity, settlement, lateral earth pressures, lateral resistance, and pipe design parameters

such as E_b', backfill internal friction, active coefficient, and frictional coefficient.

III. Aqueduct Turnout Facility

A geotechnical investigation and report is necessary for the Aqueduct Turnout Facility.

This work will include a review of available data, field exploration, a description of site conditions, an outline of seismic parameters, and design and earthwork recommendations as outlined below.

This information will be necessary for the turnout facility excavation, subgrade preparation, structure design, turnout piping design, and the structure and pipe backfill and compaction.

A. Review of Available Data

A review of available data in the area of the proposed Aqueduct Turnout shall be performed. This shall include, but not be limited to, a review of existing borings, well completion reports, groundwater data, historic aerial photographs, and geologic mapping.

B. Field Exploration

The field exploration at the Aqueduct Turnout shall consist of a minimum of one boring at the site and laboratory testing.

It is anticipated that the boring will extend to a minimum 10-feet below the planned invert of the turnout structure. It should also be considered to convert this boring into a piezometer for monitoring groundwater levels in the area of the turnout structure pre-construction, during construction, and post-construction of the turnout.

Soil samples shall be collected from the boring and the following testing considered:

- Moisture Content (ASTM D2216)
- Unit Weight (ASTM D2937)
- Sieve Analysis (ASTM C136, D422, D1140)
- Atterberg Limits (ASTM D4318)
- Modified Proctor (ASTM D1557)
- Soluble Sulfate & Soluble Chloride Contents (California Test Method No.'s 417 & 422)
- pH and Minimum Resistivity (California Test Method No. 643)
- Strength Testing – Direct Shear (ASTM D3080) or Unconfined Compressive Strength (ASTM D2166)
- Flexible Wall Permeability (ASTM D5084)

C. Site Conditions

The report shall outline the existing site conditions. This shall include background data on the turnout property and a description of subsurface conditions including obstructions and earth materials.

D. Seismic Design Parameters

The report shall outline the seismic design parameters for engineering design of the structure and appurtenances. The seismic parameters shall be in accordance with ASCE 7-16 and the 2019 California Building Code (CBC).

E. Design Recommendations

The report shall outline design recommendations for earthwork excavation, dewatering if necessary, turnout subgrade preparation, structure design, turnout piping design, and structure and pipe backfill and compaction.

This shall include a recommendation of materials, compaction efforts, dewatering, bearing capacity, seismic design, settlement, lateral earth pressures, lateral resistance, concrete corrosion potential, and pipe design parameters such as E_b', backfill internal friction, active coefficient, and frictional coefficient.

IV. Conveyance Facilities Soils Work

A geotechnical investigation and report is necessary for the Conveyance Facilities listed under the design phase "Conveyance Facilities including Turnouts & Pump Stations".

This work will include a review of available data, field exploration, a description of site conditions, an outline of seismic parameters, and design and earthwork recommendations as outlined below.

This information will be necessary for project earthwork, excavation, dewatering, subgrade preparation, levee embankment construction, structure design, bridge structures or culvert crossings, jacking and tunneling design, turnout design, pipeline design, and the associated backfill and compaction requirements.

A. Review of Available Data

A review of available data in the area of the proposed Conveyance Facility alignment and facilities shall be performed. This shall include, but not be limited to, a review of existing borings, well completion reports, groundwater data, historic aerial photographs, geologic mapping, and correlation with tTEM survey data.

B. Field Exploration

The field exploration for the Conveyance Facilities shall consist of approximately 48 to 50 borings along the conveyance alignment and at critical facilities as well as laboratory testing. It is estimated that borings would be performed at approximate quarter-mile increments along the conveyance canal unless coincident with a project structure. The actual depth and quantity of borings, however, will be dependent on the actual alignment, the data review, and the discretion of the soils firm and design firm.

It is anticipated that the borings will extend to a minimum 10-feet below the planned invert of structures such as the pump stations and the culvert or pipe crossings. It is anticipated that the borings will extend to a minimum of 5-feet below the invert for the conveyance canal as well as for borings at canal turnout structures. It should also be considered to convert some of the borings into piezometers for monitoring groundwater levels in the area of the canal or some structures that are adjacent to recharge facilities or locations with high ground water. Piezometers are estimated at the Return Water Pump Station and Reach 1 of the canal that are adjacent to the Buena Vista Water Storage District recharge area; Pump Station No. 1; the I-5 Cased Crossing; Pump Station No. 2; the portion of Reach 3 of the canal adjacent to the Phase II Recharge Property; Pump Station No. 3; and the portion of Reach 4 of the canal (if open channel) adjacent to the West Basins Property.

Soil samples shall be collected from the borings and the following testing considered:

- Moisture Content (ASTM D2216)
- Unit Weight (ASTM D2937)
- Sieve Analysis (ASTM C136, D422, D1140)
- Dispersive Characteristics of Clay Soil by Double Hydrometer (ASTM D4221)
- Atterberg Limits (ASTM D4318)
- Modified Proctor (ASTM D1557)
- Expansion Index (ASTM D4829)
- Soluble Sulfate & Soluble Chloride Contents (California Test Method No.'s 417 & 422)
- pH and Minimum Resistivity (California Test Method No. 643)
- Strength Testing – Direct Shear (ASTM D3080) or Unconfined Compressive Strength (ASTM D2166)
- Flexible Wall Permeability (ASTM D5084)
- Consolidation – Clayey Soil (ASTM D2435)
- Collapse Potential (ASTM D5333)

C. Site Conditions

The report shall outline the existing site conditions for the conveyance canal alignment, pump stations, turnouts, cased crossings and culvert or siphon crossings. This shall include background data on the project properties and a description of subsurface conditions including obstructions and earth materials.

D. Seismic Design Parameters

The report shall outline the seismic design parameters for engineering design of the structures and appurtenances. The seismic parameters shall be in accordance with ASCE 7-16 and the 2019 California Building Code (CBC).

E. Design Recommendations

The report shall outline design recommendations for earthwork excavation, dewatering if necessary, subgrade preparation, levee embankments, borrow areas, structure design, bridge structures, box culverts, jacking and tunneling design, pump stations, turnouts, pipeline design, and structure backfill and compaction.

Report considerations shall include:

a. Structure Design

The geotechnical report shall provide information for reinforced concrete structure design that includes recommendations for excavation work, dewatering (if necessary), liquefaction, subgrade preparation, backfill and compaction, slope stability for temporary and permanent slopes, braced cuts and shoring, seismic design, concrete corrosion potential, lateral earth pressures, resistance to lateral loading, bearing capacity, and estimated settlement.

b. Bridge Structures

The geotechnical report shall provide information for bridge structure design that includes recommendations for excavation work, dewatering (if necessary), liquefaction, subgrade preparation, backfill and compaction, slope stability for temporary and permanent slopes, braced cuts and shoring, concrete corrosion potential, vertical capacity, lateral capacity, seismic design, and construction considerations.

c. Cased Crossings

The geotechnical report shall provide information for cased crossing design for jack and bore installation as well as the

tunnel boring method. This shall include anticipated soil stratigraphy and recommendations for excavation work, dewatering (if necessary), backfill and compaction, slope stability for temporary and permanent slopes, braced cuts and shoring, concrete corrosion potential, tunnel construction, and the need for soil stabilization.

d. Culvert and Pipe Crossings

The geotechnical report shall provide information for culvert design, siphon design, and buried pipe design. This shall include soil properties and recommendations for excavation work, dewatering (if necessary), slope stability for temporary and permanent slopes, braced cuts and shoring, backfill and compaction, concrete corrosion potential, vertical loading, soil friction for native and backfill material, and pipe zone compaction efforts.

e. Conveyance Canal Design

The geotechnical report shall provide information for the conveyance canal earthwork. This shall include soil properties and recommendations for excavation work, dewatering (if necessary), subgrade preparation, suitability of borrow areas, levee embankment fill, compaction methods, relative compaction and compaction moisture, slope stability for temporary and permanent slopes, braced cuts and shoring, backfill and compaction, concrete corrosion potential, and piezometers for shallow groundwater areas.

Areas of potential borrow material for construction of the conveyance canal will need to be evaluated for their suitability with respect to soil characteristics, gradations, expansive potential, and dispersiveness.

V. Summary

This information herein serves to outline the general requirements for geotechnical investigation work and preparation of project soils reports. The requirements outlined herein should be considered recommendations and an estimate of the work that needs to be included, however the design firm shall ultimately be responsible for ensuring that adequate soils investigation is performed so that all facets of the project can be properly designed to minimize potential failures or problems.

Based on the Technical Memorandum No. 1 “Project Phasing and Design/Contractor Selection”, it is envisioned that a Geotechnical Investigation and Soils Report will be necessary for each of the following phases:

- Phase I Recharge Basins & Goose Lake Channel Pump Station, Check Structure, Interbasin Structures, and Well Pipelines Intertie; Phase II Recharge Basins & Phase II Well Pipelines and Interbasin Structures

- Aqueduct Turnout Facility

- Conveyance Facilities including Turnouts & Pump Stations

These soils reports will become the property of the JPA. As such, the JPA will be permitted to provide copies of the soils reports as necessary to other design firms, general contractors, and subcontractors as required for other phases of the project.

A map of the proposed boring and test pit locations is illustrated in Figure 2 below. This is considered preliminary and subject to change based upon the actual Phase I and Phase II property locations, the actual conveyance canal alignment, and the needs and discretion of the design firm.

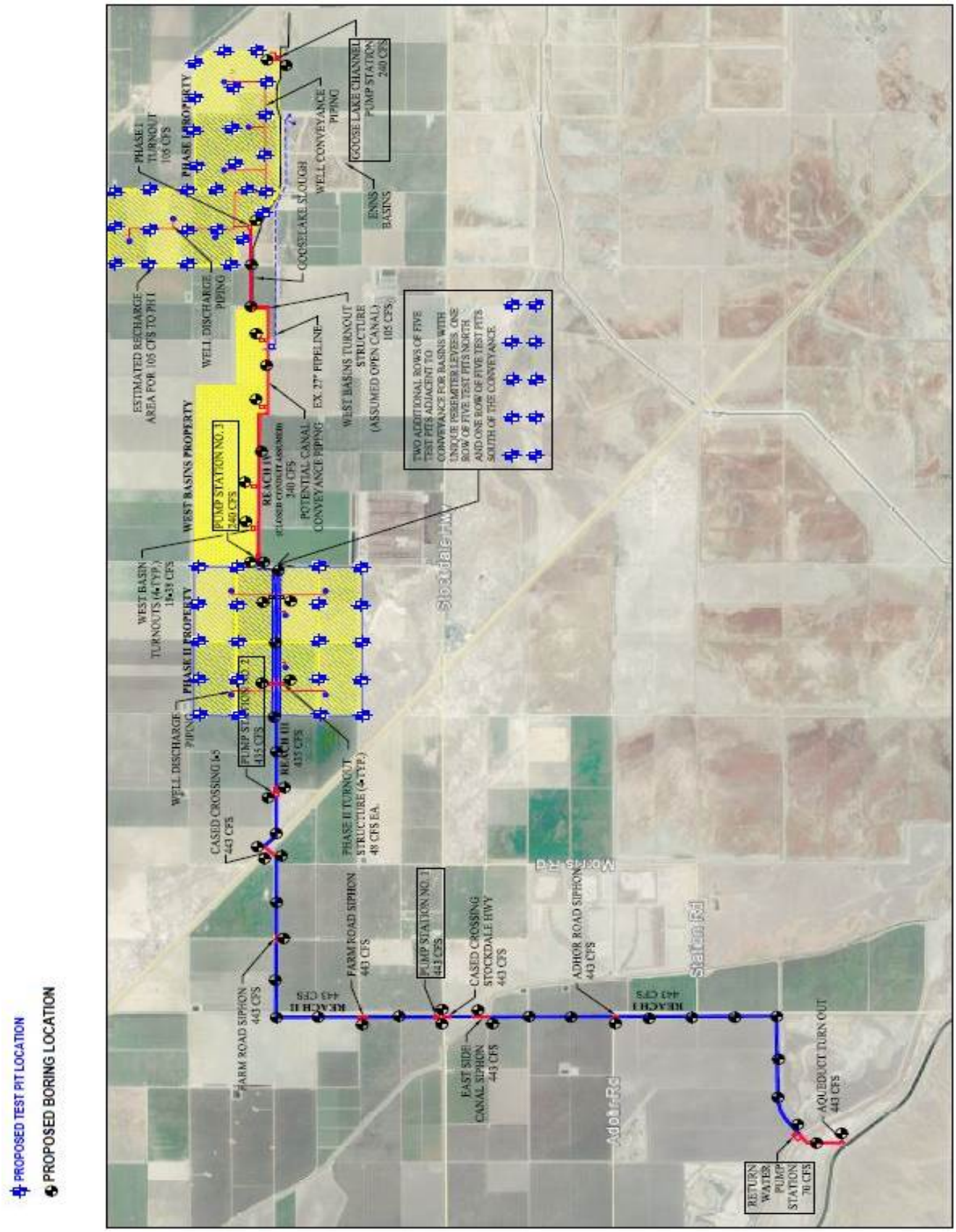


Figure 2: Preliminary Boring and Test Pit Location Map

In addition, below in Table 1 is a matrix table summarizing the proposed project components and the recommended laboratory testing. The actual type of laboratory tests and frequency shall be determined by the site conditions, the project needs, and the design firm.

Table 1

KERN FAN GROUNDWATER STORAGE PROJECT - GEOTECHNICAL INVESTIGATION OF PROJECT COMPONENTS AND LABORATORY TESTING

Reach	Structure Type	Structure Name	Approximate No. of Borings/Test Pits[A]	Comments on Minimum Depth of Exploration (ft)	Approximate No. of Temporary Piezometers[D]	Laboratory Testing[E]: Moisture Content (ASTM D2216)	Unit weight (ASTM D2937)	Sieve Analysis (ASTM C136), (ASTM D422), (ASTM D1140)	Dispersive Characteristics of Clay Soil by Double Hydrometer (ASTM D4221)	Atterberg Limits (ASTM D4318)	Modified Proctor (ASTM D1557)	Expansion Index (ASTM D4829)	Soluble Sulfate & Soluble Chloride Contents (California Test Method No's 417 & 422)	pH and Minimum Resistivity (California Test Method No. 643)	Strength Testing - Direct Shear (ASTM D3080) or Unconfined Compressive Strength (ASTM D2166)	Flexible Wall Permeability (ASTM D5084)	Consolidation (ASTM D2435) - Clayey Soil	Collapse Potential (ASTM D5333)
Reaches 1 - 3	Conveyance	Conveyance (Canal)	19[B]	5 feet below invert		X	X	X	X	X	X	X			X		X	X
Reach 1	Conveyance	Aqueduct Turnout	1	10 feet below invert of structure	1	X	X	X		X	X				X	X		
Reach 1	Pump Station	Return Water Pump Station	1	10 feet below invert of pumping bay	1	X	X	X		X	X				X			
Reach 1	Conveyance	Adhor Road Siphon	1	10 feet below invert of structure		X	X	X		X	X				X			
Reach 1	Conveyance	East Side Canal Siphon	2	10 feet below invert of structure		X	X	X		X	X				X			
Reaches 1/2	Conveyance	Stockdale Cased Crossing	2	10 feet below invert		X	X	X		X	X		X	X	X			
Reach 2	Conveyance	Pump Station No. 1	2	10 feet below invert of pumping bay	1	X	X	X		X	X				X		X	X
Reach 2	Conveyance	Farm Road Siphon	1	10 feet below invert of structure		X	X	X		X	X				X			
Reaches 2/3	Conveyance	Interstate 5 Cased Crossing	3	10 feet below invert	2	X	X	X		X	X		X	X	X	X		
Reach 3	Pump Station	Pump Station No. 2	2	10 feet below invert of pumping bay	1	X	X	X		X	X				X		X	X
Reach 3	Conveyance	Phase 2 Property - Turnout 1	1	5 feet below invert of structure		X	X	X		X	X				X			
Reach 3	Conveyance	Phase 2 Property - Turnout 2	1	5 feet below invert of structure		X	X	X		X	X				X			
Reach 3	Conveyance	Phase 2 Property - Turnout 3	1	5 feet below invert of structure		X	X	X		X	X				X			
Reach 3	Conveyance	Phase 2 Property - Turnout 4	1	5 feet below invert of structure		X	X	X		X	X				X			
Reach 3	Recharge Facility	Phase 2 Property	30[C]	5 to 10 feet		X	X	X	X	X	X	X	X	X	X	X		X
Reach 4	Conveyance	Conveyance (Pipeline)	4[B]	5 feet below invert		X	X	X	X	X	X				X			
Reach 4	Pump Station	Pump Station No. 3	2	10 feet below invert of pumping bay	1	X	X	X		X	X				X		X	X
Reach 4	Conveyance	West Basins Property - Turnout 1	1	5 feet below invert of structure		X	X	X		X	X				X			
Reach 4	Conveyance	West Basins Property - Turnout 2	1	5 feet below invert of structure		X	X	X		X	X				X			
Reach 4	Conveyance	West Basins Property - Turnout 3	1	5 feet below invert of structure		X	X	X		X	X				X			
Reach 4	Conveyance	West Basins Property - Turnout 4	1	5 feet below invert of structure		X	X	X		X	X				X			
Reach 4	Conveyance	Phase 1 Property - Turnout 1	1	5 feet below invert of structure		X	X	X		X	X		X	X	X	X		X
Reach 4	Recharge Facility	Phase 1 Property	28[C]	5 to 10 feet		X	X	X	X	X	X	X	X	X	X	X		X
Reach 4	Pump Station	Goose Lake Channel Pump Station	2	10 feet below invert of pumping bay		X	X	X		X	X				X			

[A]All explorations shall be measured horizontally and vertically by a licensed surveyor.

[B]Explorations advanced along the conveyance and earthen embankments shall be spaced approximately every ¼ mile, unless coincident with a project structure.

[C]Test pit explorations shall be advanced in areas of geologic interest, i.e. historic channels and seepage paths, based on a review of aerial photography, geologic mapping, Transient Electromagnetic (TEM) resistivity correlations, and readily available data.

[D]Piezometers to be installed where groundwater is encountered.

[E]Actual type of laboratory tests and frequency to be determine by site conditions and project needs.

VI. Related Work Specified Elsewhere

A. TM 1 – Project Phasing & Design/Contractor Selection
B. TM 2 – Conveyance Capacity Requirements
C. TM 3 – Pipeline Requirements
D. TM 4 – Pump Station Requirements
E. TM 6 – Canal Liner and Turnout Requirements
F. TM 9 – Recharge Basin Requirements
G. TM 11- Engineer's Estimates

DEE JASPAR & ASSOCIATES, INC.
CONSULTING CIVIL ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CA 93308
PHONE (661) 393-4796
FAX (661) 393-4799

KERN FAN GROUNDWATER STORAGE PROJECT

TECHNICAL MEMORANDUM NO. 7
(Well Drilling and Equipping Requirements)

PREPARED FOR: Kern Fan Joint Powers Authority (JPA)
PREPARED BY: Curtis Skaggs, P.E.
DATE: April 16, 2021

SUBJECT: ***Well Drilling and Equipping Requirements***

I. Executive Summary

It is anticipated that there will be up to a total of twelve (12) recovery water wells constructed as part of this project with up to six (6) wells on the Phase I Property and up to six (6) wells on the Phase II Property. Each of these wells are anticipated to have an approximate capacity of 5 to 6 cfs.

The wells will be drilled using the fluid reverse-rotary drilling method. A surface conductor will be installed to a depth of 50-ft. For purposes of planning-level cost estimates, a pilot hole will be drilled to an approximate depth of 970-ft with formation samples every 10-ft and geophysical logging performed in the completed pilot hole. Water quality depth sampling will be performed in select wells. The wells will then be reamed to their final diameter and 20" I.D. HSLA steel casing installed along with a 3" gravel feed tube, a 3" sounding tube, gravel pack and a cement annular seal from ground surface to an approximate depth of 305-ft. Special testing requirements during the well drilling and development process are outlined in Section III.G.

The depths and diameters of the conductor casing, pilot holes and reamed holes; the lengths of casing, tubing, gravel pack, and cement seals; and the duration of well development methods are merely estimates based upon past experience and have been approximated for cost estimating purposes as part of Technical Memorandum No. 11 "Engineer's Estimate". The well design parameters and specifications will be prepared by the design engineer and project hydrogeologist. The plans and specifications will detail the well design based on the actual project location.

The actual field conditions encountered during the well drilling and development process will dictate the completed well design.

The wells are planned to be equipped with 12-inch column piping, 3 1/2-inch enclosing tubing, 2 3/16-inch lineshaft and a 500 hp motor with variable speed drive. The well will include 12-inch diameter fusion bonded epoxy lined and coated steel discharge piping with valves, fittings, supports, and instrumentation. The well will be protected with a pre-fabricated steel motor enclosure. The well site electrical gear will be free-standing and mounted to a concrete foundation with a galvanized steel shade structure and security locking gate beam across the front of the electrical equipment. Two flood lights will be mounted on the shade structure and one directed to face the electrical equipment and one directed to face the well pump and motor. Well site security and a SCADA system for remote monitoring will be included.

The project is not anticipated to negatively impact neighboring wells or recharge and recovery projects. Potential changes in groundwater levels predicted for project recovery scenarios were analyzed using a calibrated numerical groundwater flow model. The groundwater model used for the analysis was previously developed to evaluate groundwater level changes in the vicinity of banking projects along the Kern River west of Bakersfield, California. The results of this modeling are discussed in the Kern Fan Groundwater Storage Project EIR dated December 2020 and demonstrate that the regional pumping of wells for the project will not negatively impact neighboring wells or neighboring recharge and recovery projects. Anticipated static and pumping water levels for the region are discussed herein based on historical records and may be used for the design of the project pumps and motors.

If the actual well field configurations end up being moderately different from the configurations previously modeled, then the well impact analysis will be re-evaluated and updated as necessary.

In the event that groundwater levels are drawn near established minimum thresholds under SGMA, it is anticipated that groundwater recovery can be shifted to areas where groundwater levels are not near minimum thresholds. The District production wells cover an area of almost 18 square miles providing potential flexibility to shift pumping as needed.

This memorandum addresses the following:

Section II	Well Layout Requirements	Page 3
Section III	Well Design Requirements	Page 8
Section IV	Well Equipping Requirements	Page 15
Section V	Well Site Requirements	Page 21

II. Well Layout Requirements

The Phase I and Phase II Property locations have not been finalized yet, but property locations have been assumed as part of this preliminary engineering work. These property locations are shown in Figure 1 below.

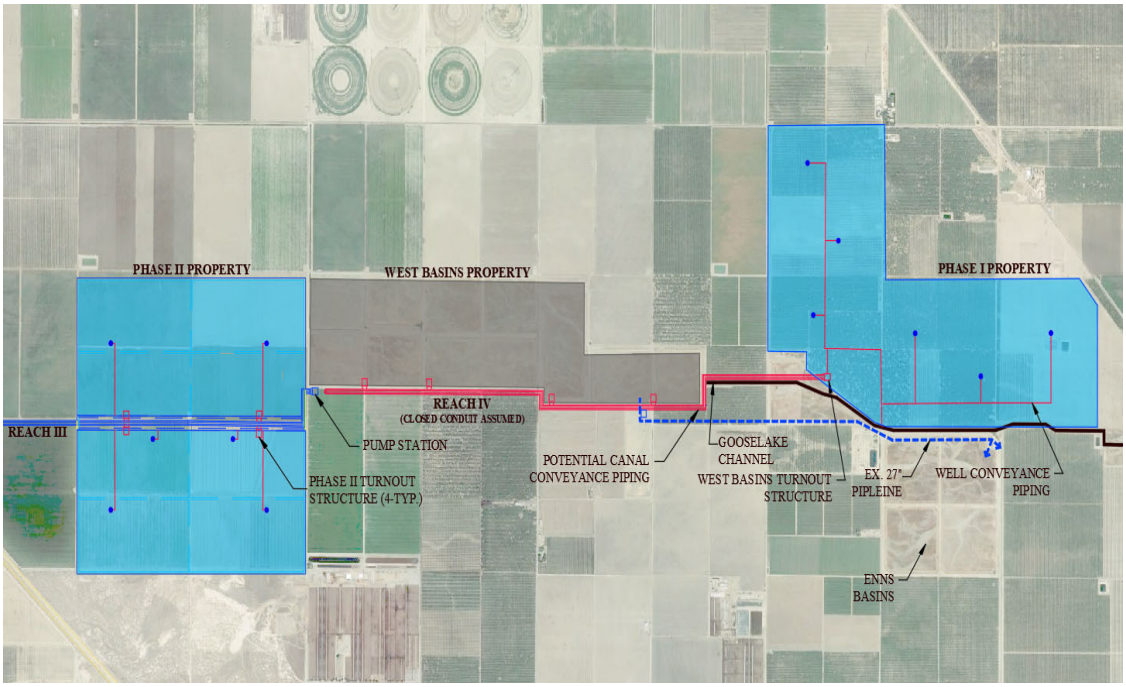


Figure 1: Phase I and Phase II Properties

A. Well Spacing and Setback Requirements

A preliminary layout has been estimated for approximately six (6) recovery water wells on each of the Phase I and Phase II Recharge Properties. The layout estimates a minimum 1,320-ft spacing in between recovery wells and from neighboring wells to minimize drawdown and interference. See Figure 2a and 2b below for a typical preliminary well layout.

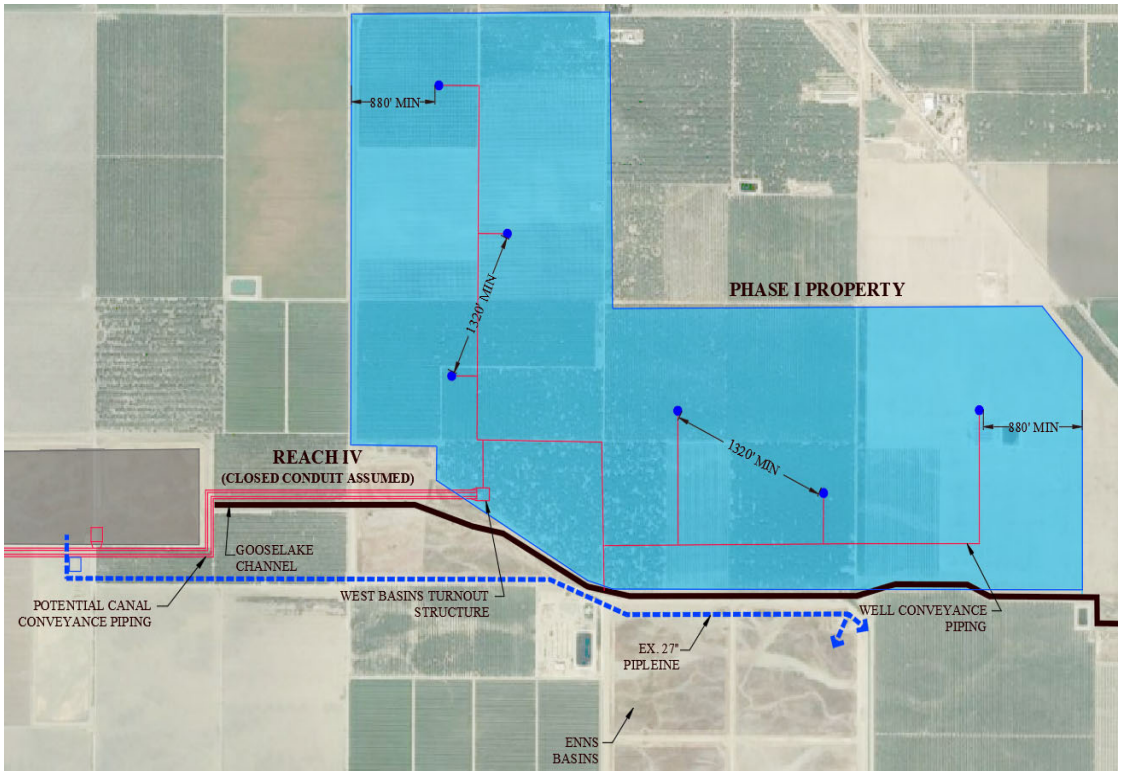


Figure 2a: Preliminary Well Layout for Phase I Property

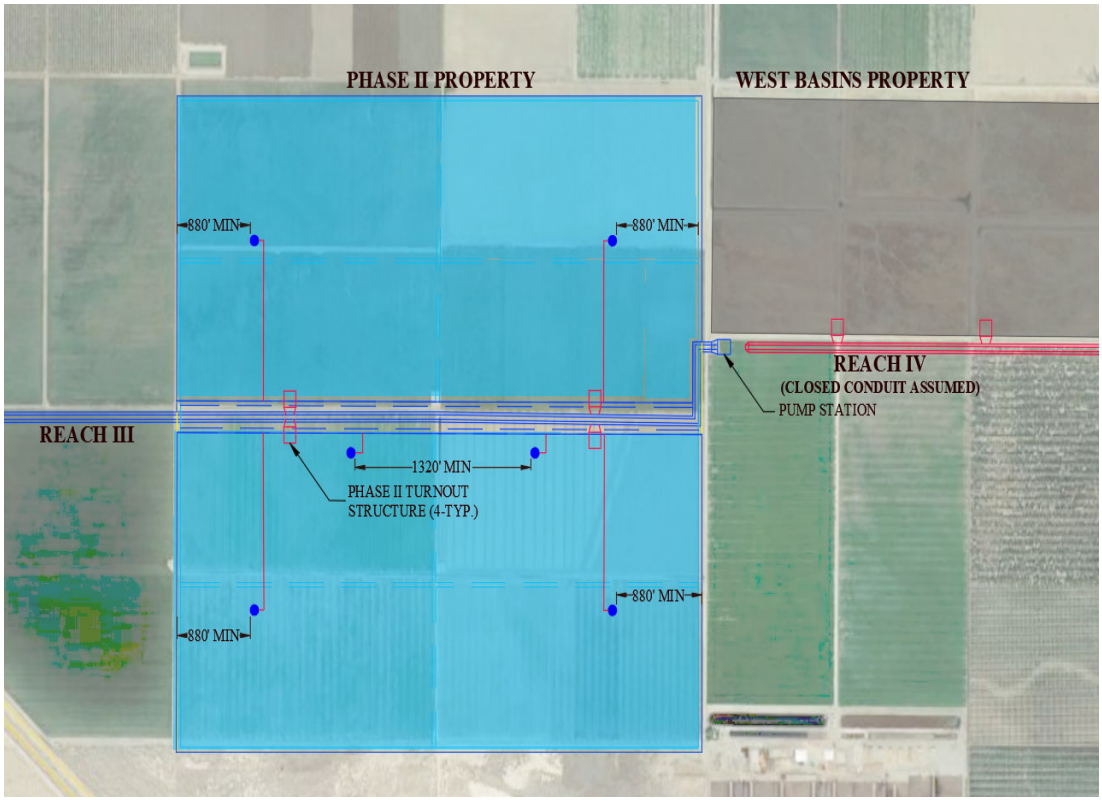


Figure 2b: Preliminary Well Layout for Phase II Property

B. Site Layout

A typical well site layout (an example from the RRBWSD Stockdale East Well Facilities) is illustrated in Figure 3 below. It is anticipated that earth well pads will be graded and prepared as part of the recharge facility earthwork project. The well pads will be approximately 100-ft by 100-ft. These well pads will be utilized for the drilling, construction, and development operations associated with the well construction.

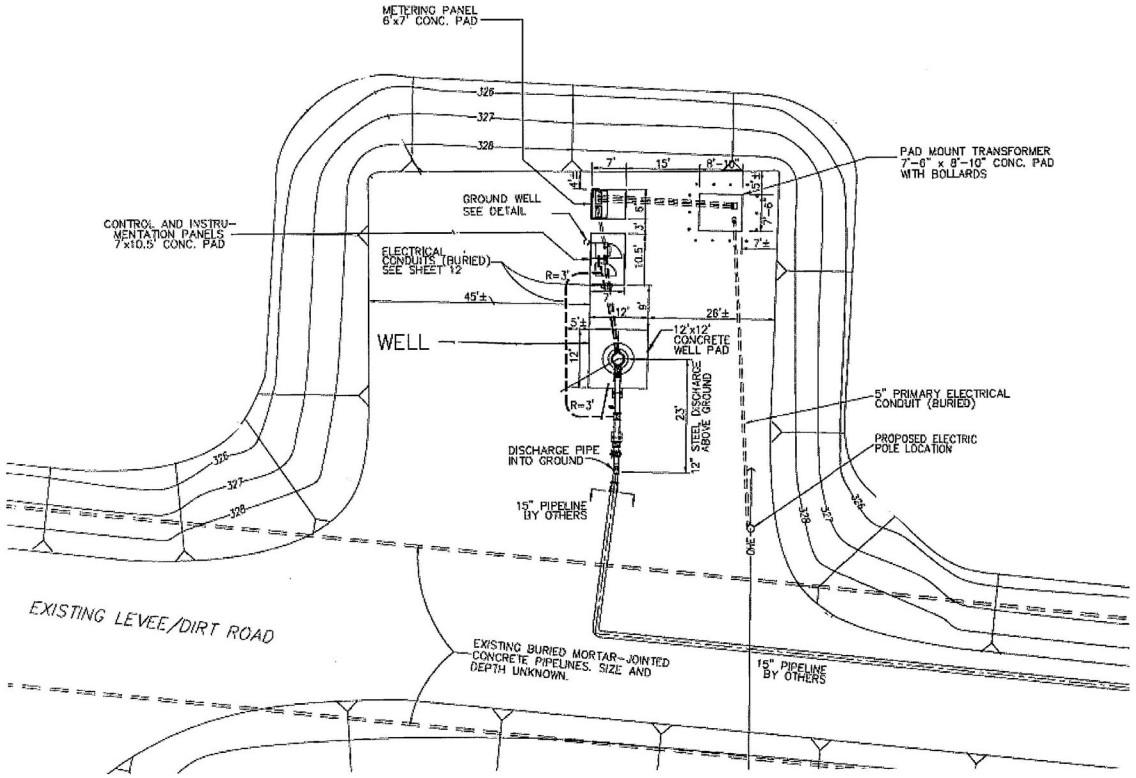


Figure 3: Well Site Layout

The well pad will accommodate the well drilling rig, pipe trailer, field office, mud pits, and settling tanks as well as all ancillary equipment and materials. A preliminary well construction layout is illustrated in Figure 4 below. Equipment may also be stored down in the recharge basin bottoms, however any use or disturbance to the basin bottoms shall be cleaned and ripped at the completion of the project.

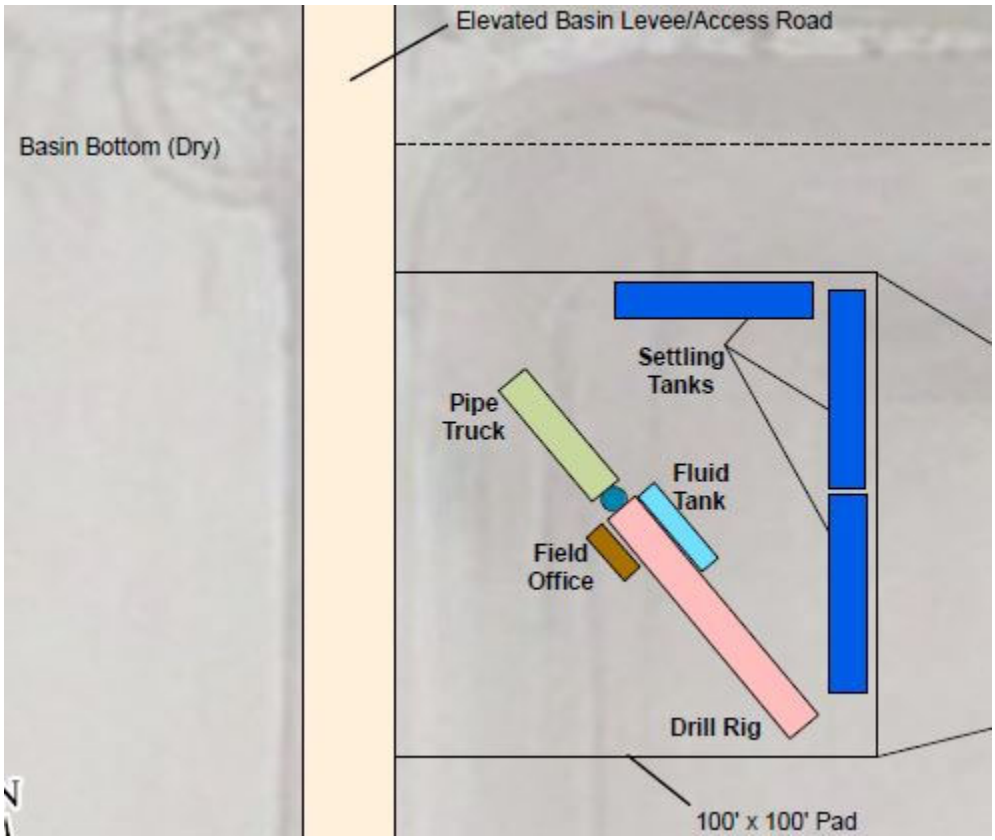


Figure 4: Well Construction Layout

C. Impact Analysis

a. Impact of Well Layout (Localized)

- Sound mitigation is not anticipated to be necessary given the remote location of the well sites relative to homes.

- Turbid groundwater generated during well development and testing will be clarified in a series of 20,000 gallon tanks prior to discharging to a nearby surface basin where it will be allowed to infiltrate into the subsurface. All discharge water will be carefully controlled to prevent runoff to adjacent properties, roads, etc.

- Water for use during the drilling operation will be supplied by the District within one-half (1/2) mile of the drilling location. Only groundwater of suitable quality, approved by the District, will be allowed for use during drilling operations.

- Drilling fluids and cuttings generated during drilling shall be contained on-site during construction. They shall be dried out and then they will be allowed to be

uniformly and evenly spread out on-site or on recharge pond levee slopes as directed by the District.

- All access roads and site areas will be sprayed with water regularly to prevent dust generation as a result of the drilling operation and for dust control.

- Upon completion of well construction, the site will be graded level and the top of well casing will be welded shut to prevent access until the permanent pump is installed.

b. Impact of Well Pumping (Regional)

Potential changes in groundwater levels predicted for project recovery scenarios were analyzed using a calibrated numerical groundwater flow model. The groundwater model used for the analysis was previously developed to evaluate groundwater level changes in the vicinity of banking projects along the Kern River west of Bakersfield, California. The model was developed using MODFLOW, a block centered, finite difference groundwater flow modeling code developed by the United States Geological Survey (USGS) for simulating groundwater flow (McDonald and Harbaugh, 1988).[1] MODFLOW is one of the most widely used and critically accepted model codes available (Anderson and Woessner, 2002).[2] The results of this modeling are discussed in the Kern Fan Groundwater Storage Project EIR dated December 2020 and demonstrate that the regional pumping of wells for the project will not negatively impact neighboring wells or neighboring recharge and recovery projects. Anticipated static and pumping water levels for the region are discussed herein based on historical records and may be used for the design of the project pumps and motors.

If the actual well field configurations end up being moderately different from the configurations previously modeled, then the well impact analysis will be re-evaluated and updated as necessary.

In the event that groundwater levels are drawn near established minimum thresholds under SGMA, it is anticipated that groundwater recovery can be shifted to areas where groundwater levels are not near minimum thresholds. The District production wells cover an area that includes several square miles providing potential flexibility to shift pumping as needed.

[1] McDonald, M.G., and Harbaugh, A.W., 1988. A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model: in Techniques of Water-Resources Investigations of the United States Geological Survey; Book 6 Modeling Techniques.

III. Well Design Requirements

The depths and diameters of the conductor casing, the pilot holes and reamed holes; the lengths of casing, tubing, gravel pack, and cement seals; and the duration of well development methods are merely estimates based upon past experience and have been approximated for cost estimating purposes as part of Technical Memorandum No. 11 "Engineer's Estimate". The well design parameters and specifications will be prepared by the design engineer and project hydrogeologist. The plans and specifications will detail the well design based on the actual project location. The actual field conditions encountered during the well drilling and development process will dictate the well design.

A. Borehole Drilling and Testing Procedures

Each well construction will include a minimum 50-ft deep steel conductor casing to serve as a near-surface sanitary seal and to provide borehole stability during drilling operations. The conductor casing will be set within a nominal 54-inch diameter borehole drilled using a bucket auger to a depth of 50-ft. For planning purposes, it is anticipated that the steel conductor will consist of a mild steel, 42-inch outside diameter casing with a 3/8-inch wall. The annular space between the steel conductor casing and the borehole wall will be filled with a 10.5-sack cement sand slurry to ground surface.

A pilot hole, approximately 17.5-inch diameter, will be drilled to the specified depths using the fluid reverse-rotary drilling method. For purposes of the planning-level cost estimates, each borehole will be drilled to a depth of 970-ft. Composite soil samples shall be collected throughout each 10-ft depth interval of drilling for visual description in the field. Drilling fluids and cuttings will be managed using an above-ground tank. Deviation surveys shall be performed at every 100-ft depth during drilling to verify a plumb pilot hole using an approved mechanical drift indicator. The maximum tolerance for the deviation surveys shall be ½-degree from vertical per 100-feet. At the completion of the pilot hole, geophysical logging shall be performed that includes:

- Gamma Ray
- Sonic Velocity Variable Density
- Spontaneous Potential
- Short Normal Resistivity
- Long Normal Resistivity
- Laterolog Resistivity
- Deviation Survey

The maximum allowable horizontal deviation (drift) from the vertical shall be 6-inches per 100-feet for the well deviation survey.

It is anticipated that isolated aquifer zone testing will be performed in boreholes at selected locations. It is not envisioned to conduct this testing at every well location given their relatively close proximity (approximately six wells per 640 acres). The design firm and hydrogeologist will select the drilling locations at which isolated aquifer zone testing will be conducted to provide the best representation of water quality in the recharge and recovery area. At each borehole selected for testing, the design firm and hydrogeologist will select the number and depth of isolated aquifer zones based on a review of the geophysical logs and log of soil cuttings.

Upon completion of the pilot hole and any aquifer zone testing, the design firm and hydrogeologist will prepare a final well design. The well design will specify the final casing diameter and material, perforation interval, slot size, filter pack gradation, filter pack interval, annular seal interval, sounding tube diameter and entry depth, and gravel feed tube diameter and depth. For planning purposes, the casing is anticipated to be 20-inches in diameter with a 5/16-inch wall thickness. The pilot hole will be enlarged to 36-inches in diameter to accommodate the casing, camera access/sounding tube, and gravel feed tube. The borehole diameter may be reduced to 32-inch diameter from the bottom of the gravel feed tube to the bottom of the borehole. At the completion of the reamed hole, a caliper log and deviation survey shall be performed.

B. Water Quality Testing Strategy

Groundwater quality testing will be conducted at selected well locations. For those locations where isolated aquifer zone testing is specified, the analytical testing suite will be focused on water quality constituents of concern.

Water quality concerns in the area include:

- 1,2,3-TCP (SRL 524M Low Level Test)
- Arsenic
- Nitrate

Nitrate is commonly detected in the shallow aquifer while the Arsenic concentration typically increases with depth. The perforated intervals for each well will be designed, based on the data collected, to avoid these constituents, if possible. It is estimated that three to five zone tests would be performed in select wells and that at least one of the initial wells would have zones in the deeper aquifer from 700-ft to 900-ft to verify the Arsenic concentrations.

Other water quality constituents to be included in the isolated aquifer zone testing suite will include:

- Total dissolved solids,
- pH

- General physical properties (color, odor, turbidity)
- General minerals (cations and anions)
- Ethylene dibromide (EDB)
- Dibromochloropropane (DBCP)
- Gross alpha

The design firm and/or hydrogeologist may select other constituents for analysis as needed.

Upon completion of development and testing of each well, groundwater samples will be collected for analysis of a full Title 22 water quality suite.

C. Casing Material and Size

The recovery well casing and screen is to be manufactured by Roscoe Moss Company of Los Angeles, California. For planning purposes, the casing is anticipated to be constructed of 20-inch I.D. high-strength, low-alloy (HSLA) steel with a 5/16-inch wall thickness. For cost estimating purposes, the blank casing length has been estimated as 420-ft.

The perforated interval lengths and depths as well as the slot size will be determined based upon the formation samples, geophysical logs, depth to water, and water quality data for each well. For cost estimating purposes, a perforated length of 510-ft has been estimated. The perforations are anticipated to be horizontal louvers in the "Ful-Flo" pattern.

D. Filter Pack and Annular Seals

The filter pack shall be designed based on sieve analysis for selected soil samples that are collected during the drilling of the pilot hole. The gravel material shall be composed of sound, durable, well rounded natural particles and be free of organic matter, clay balls, and other deleterious substances. The filter pack shall be placed by pumping into the annular space through a tremie pipe and shall not be allowed to free fall from more than 30-ft below the bottom of tremie pipe. For cost estimating purposes a filter pack length of 665-ft has been used.

The annular seal shall consist of a 10.5 sack cement sand slurry and shall be placed in the annular space from the top of the gravel pack and fine sand to the ground surface. The annular seal shall be placed by pumping into the annular space through a tremie pipe. For cost estimating purposes, a cement annular seal depth of 405-ft has been used.

E. Tubing Material and Sizes

The well installation shall include a gravel feed tube and a sounding tube or camera tube.

The gravel feed tube shall be a 3-inch Schedule 40, ASTM A53 Grade B steel tube. The depth of the feed tube shall be determined at the time of

the final casing design, however for cost estimating purposes a depth of 315-ft has been used.

The sounding tube or camera tube shall be a 3-inch Schedule 40, ASTM A53 Grade B steel tube. The sounding tube shall be installed outside of the casing in the annular space and terminate in a fabricated steel box welded to an opening in the well casing at the depth determined at the time of the final casing design. For cost estimating purposes a depth of 405-ft has been used.

A typical well cross-section is illustrated below in Figure 5 and illustrates the conductor casing, blank casing, perforated casing, tubing, gravel pack, and cement annular seal.

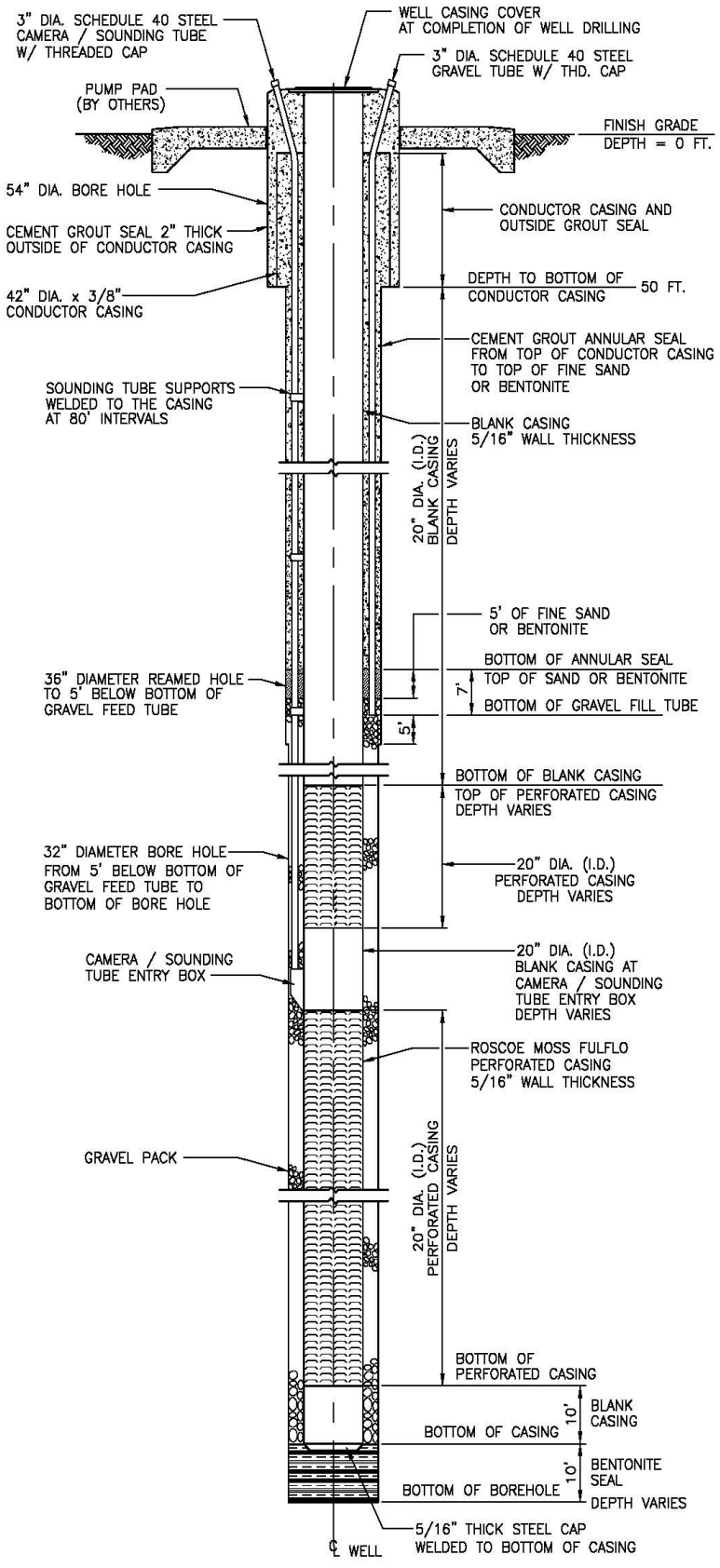


Figure 5: Typical Well Cross-Section

F. Well Development Procedures

Well development shall be performed in a two-stage process that includes initial development by airlifting and swabbing, followed by development by pumping and surging.

The initial development shall be performed using a dual swab tool that has swab flanges no more than 10-feet apart. The outside diameter of the swab rubber wipers shall be no more than one-half inch less than the inside diameter of the well screen. Initially, the well casing shall be airlifted with an open-ended single swab attached to the end of the drill pipe to remove sediment and materials from the bottom of the well. The screened interval of the well shall be swabbed in short screen intervals of no more than 20-feet. The swabbing and airlifting shall be performed to remove mud, sediment, and sand from the gravel pack and continue until the airlifted water is relatively clear.

If the Contractor uses a drilling mud additive at any time during the well construction, then chemical development shall be required in addition to the mechanical development. The chemicals to be utilized shall be a clay-dispersing agent approved by the hydrogeologist.

Pumping and surging development shall be conducted using a vertical turbine test pump. The pump capacity is anticipated to be approximately 4,000 gpm at a 600-ft TDH. The test pump shall be installed to the depth specified by the design firm and hydrogeologist. The quantity of water being pumped during development shall begin at a low volume and gradually increase as development continues. The well shall be thoroughly developed so that it will produce a maximum specific capacity based on the consideration of depth and nature of the water bearing formations and so that it will not produce an amount of fine sand in excess of the sand production limitations.

Chemical development shall be performed during development by pumping and surging using a clay-dispersing agent such as Mud-Nox.

In addition, final well development shall be performed as directed by the design firm and hydrogeologist and include a minimum of three flowrates (steps) for the step-drawdown test and a minimum 24-hr constant rate discharge test.

G. Special Testing Requirements

The minimum well testing requirements are outlined below:

- Deviation surveys (Mechanical Drift Indicator) every 100-ft depth of pilot hole
- Geophysical logs upon completion of pilot hole
  -Sonic Log
  -E-Log/Gamma Ray
  -Deviation Survey (Gyroscopic Survey)
- Isolated Aquifer Zone Test Water Quality Sampling (selected locations)
- Caliper log and Deviation survey (Gyroscopic Survey) upon completion of reamed hole
- Formation sieve analysis
- Gravel sieve analysis
- Well Development Specific Capacity, Turbidity and Sand Content
- Step-Drawdown Pumping Test (Minimum of three steps)
- Constant Rate Pumping Test (Minimum 24hr test)
- Dynamic Flowmeter (Spinner) Survey
- Gyroscopic Well Alignment Survey
- Well Video
- Title 22 Water Quality Analysis

IV. Well Equipping Requirements

A. Vertical Turbine Pump Design Range

a. Historic Water Levels

Water levels were reviewed from August 2013 through March 2021 in the area of the Kern Fan Groundwater Storage Project. Two wells were selected from the Strand Ranch Project, SREX-1 (north side of CVC) and SREX-7 (south side of CVC); two wells from the Stockdale West Project, SWEX-2 and SWEX-3; and three wells from the Drought Relief Project, SUP-1, SUP-5, and the Matuk Well.

The static water levels were low in 2013 through 2016 as a result of the drought. The lowest static water level observed in these wells was approximately 320-ft at SREX-7 around May of 2016. The static water levels then began to trend upwards as a result of groundwater recharge to their peak around January 2020. The shallowest static water level observed was approximately 87-ft at SWEX-3. See the graph of static water levels in Figure 6 below.

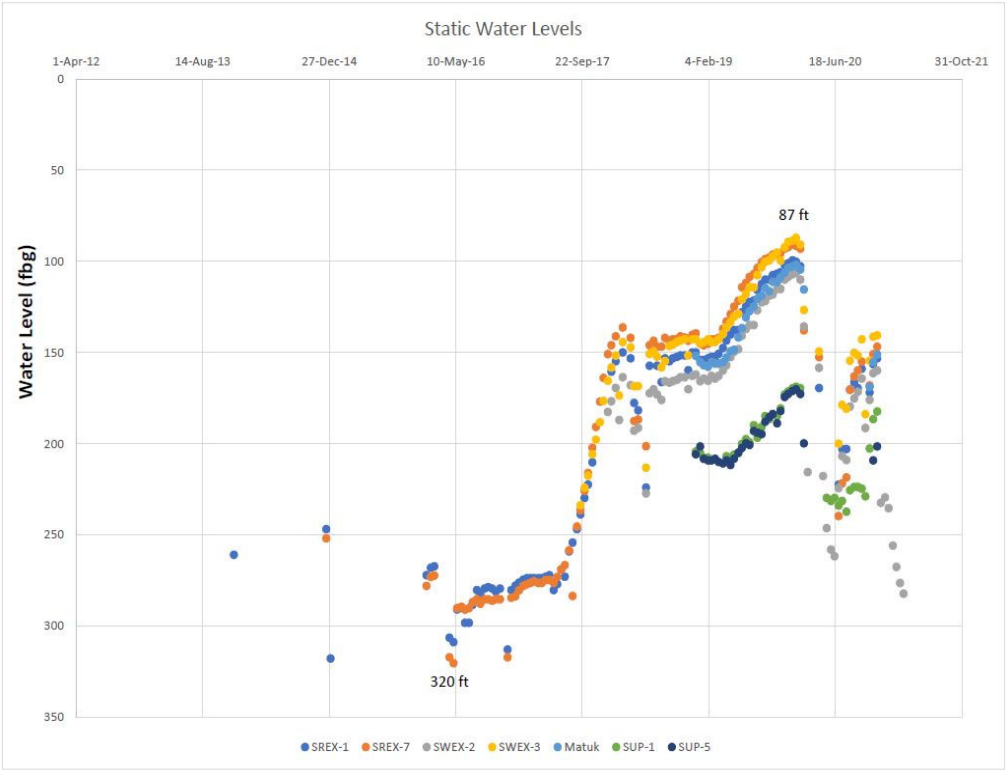


Figure 6: Historic Static Water Levels

The pumping water levels were also low in 2013 through 2016 as a result of the drought. The deepest pumping water level observed in these wells during the drought was approximately 440-ft at SREX-7 around April of 2016. The pumping water levels then began to trend upwards as a result

of groundwater recharge to their peak around February 2018. The shallowest pumping water level observed was approximately 277-ft at SREX-1. See the graph of pumping water levels in Figure 7 below.

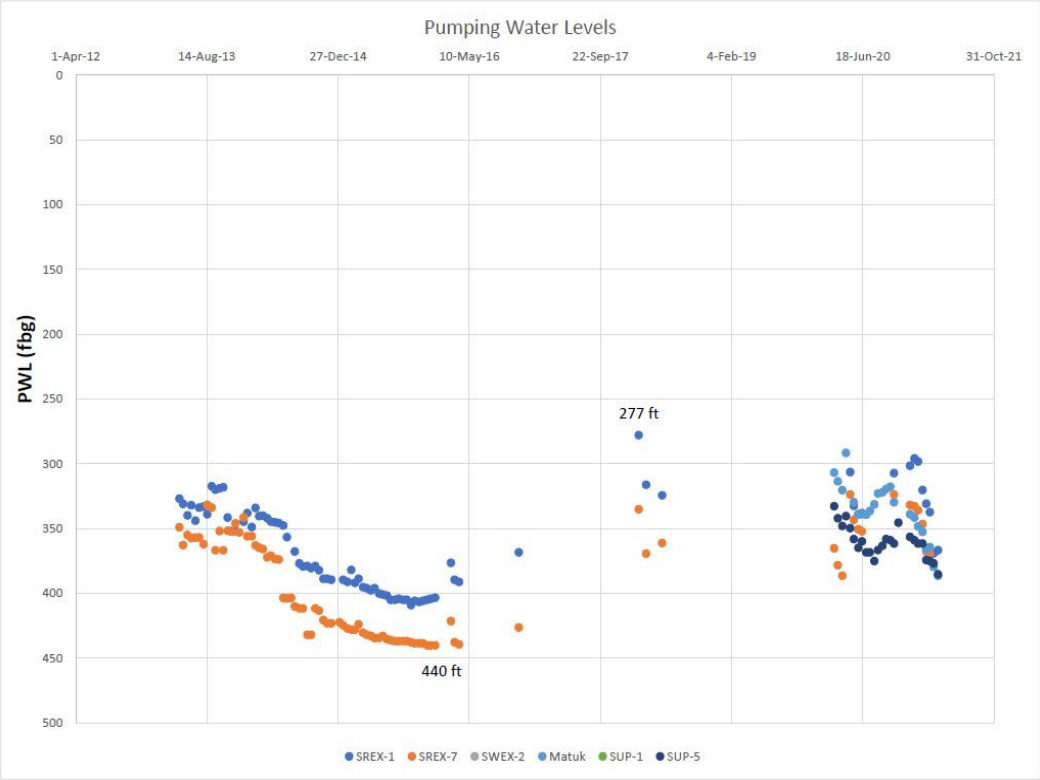


Figure 7: Historic Pumping Water Levels

b. Pump Design Criteria

The actual pump design point will be based upon the results of the well drilling and development, however the historical water level data in the area shall be used to provide a range of water levels for purposes of the pump design. It is recommended that the pump and motor be designed to provide the design flow rate at the deeper pumping water levels and then the VFD can be utilized to operate the pump at slower speeds, if necessary, when water levels are shallow.

The range observed for pumping water levels in the area is approximately 275-ft to 450-ft.

The design operating point for shallow pumping water levels (after recharge periods) would be approximately 4,000 gpm (9.0 cfs) at a pumping water level of 275-ft with a minimum bowl efficiency of 75%. In selecting the actual pump, the engineer will need to take into consideration column friction losses, discharge pipeline losses, and minor losses.

The design operating point for deeper pumping water levels (during sustained dry years) would be approximately 2,250 gpm (5 cfs) at a pumping water level of 450-ft with a minimum bowl efficiency of 68.0%.

In selecting the actual pump, the engineer will need to take into consideration column friction losses, discharge pipeline losses, and minor losses.

The preliminary design operating point for the pump is approximately 3,000 gpm (6.7 cfs) at an approximate pumping water level of 400-ft with a minimum bowl efficiency of 80.0%.

c. Pump Assembly

A vertical turbine pump shall be installed for each well. The size, capacity, and depth of pump setting will be determined based on the results of the final well development. The pump assembly will be oil-lubricated and include a 10 gallon oil reservoir with solenoid valve and manual bypass.

For cost estimating purposes, the pump has been estimated to include 12-inch column pipe, 3 1/2-inch enclosing tubing, and 2 3/16-inch lineshaft. The line shaft shall be Type 416 stainless steel with Type 316 stainless steel shaft couplings and bronze lineshaft bearings. The column piping shall also include a 5-ft section installed just above the pump and a 5-ft section installed just below the pump head. The pump assembly shall include a 5-ft long suction pipe with a stainless steel cone strainer. The depth of the pump setting will be dependent on the design of the well casing (install where adjacent to blank sections of casing), however it is anticipated to be set below a depth of 550-ft.

The pump discharge head shall sit on a reinforced concrete foundation. The camera tube, gravel feed tube, and casing shall be extended or trimmed as necessary to conform to the concrete foundation. In addition, a 3-inch casing vent shall be installed that is screened and extends 3-feet above the foundation.

B. Well Motor Type

The well motor shall be a vertical hollow shaft electric motor. The motor horsepower has been estimated as 400 to 500 hp.

C. Variable Speed Drives

A variable speed drive shall be installed at each well pump and motor. The variable speed drive is more energy efficient, reduces the motor starting voltages and flicker issues with the power supply grid, and provides more pumping flexibility with varying groundwater levels.

The variable speed drive is to be a Yaskawa U1000 Industrial Matrix Drive. This drive has ultra-low harmonics, full continuous regeneration, and high-efficiency.

D. Discharge Pipe Size and Appurtenances

The discharge piping is to be 12-inch fusion bonded epoxy lined and coated steel discharge piping as outlined in Technical Memorandum No. 3 "Pipeline Requirements".

The well discharge shall include the following at a minimum:

- a deep well air release and vacuum relief valve (Waterman AV-150 Air Vent with Vacuum Relief or approved equal)
- a sleeve coupling with joint harness (Dresser or approved equal)
- a high pressure switch (Mercoid or approved equal)
- pressure transmitter (Smar Technology or approved equal)
- sample port
- wafer check valve (Fresno Valve or approved equal)
- pressure gauge (Ashcroft or approved equal)
- magnetic flow meter (Seametrics or approved equal)
- combination air vent and vacuum relief valve assembly (Waterman CR101 or approved equal)
- butterfly valve (Grayline Valve or approved equal) and
- pipe supports

E. Electrical Service & Switchgear

The electrical service is anticipated to be provided by PG&E. A pad mounted transformer, as approved by PG&E, will be installed at each well site with bollards.

Each well site will have a main switchboard section with pull section, meter section, and main breaker. The motor control center will include security power, RTU panel, the well motor starter, 5 kVA transformer, a load panel (circuit breakers), a well level indicator screen, low well level alarm light and reset alarm button. The electrical equipment shall also be equipped with interior lighting and receptacles. The orientation of the electrical gear shall face north or east, as reasonable when designing the site layout, to minimize the direct sunlight on the face of the equipment.

The RTU unit is discussed in Technical Memorandum No. 10 (SCADA) and will be work performed by others. The motor control center (MCC) shall include a spare bucket or cabinet for installation of the RTU and I/O devices.

The electrical gear shall be enclosed in NEMA 3R equipment and shall be fully rated for continuous operation at 50° C ambient conditions within the electrical equipment for outdoor installation. Digital displays shall be installed between a height of 48-inches to 60-inches and be protected from direct sunlight.

F. Instrumentation & Controls

The instrumentation and controls will be utilized for well operation, safety features, and monitoring. The instrumentation and controls shall include the following devices:

- Well Level Transducer (4-20 ma) for monitoring groundwater levels (Endress + Hauser or approved equal). The estimated cost for the transducer is $1,500.00.
- Solenoid for oil drip to deep well pump.
- High Pressure Switch to protect piping from over-pressurizing (Mercoid or approved equal). The estimated cost for the high pressure switch is $1,200.00.
- Pressure Transmitter (4-20 ma) for monitoring discharge pressure (Smar Technology or approved equal). The estimated cost for the pressure transmitter is $1,000.00.
- Flow Meter signal (4 – 20 ma) for monitoring well flow (Seametrics Mag Meter with power supply – not battery)

G. Well Enclosures

The well motor enclosure consists of a 14-ft diameter welded steel hut. The enclosure shall have a cone roof and be tall enough to provide a minimum 24-inch clearance above the top of the well motor. The enclosure shall be made out of 2x2 square tubing, galvanized sheet metal, and 2x2 square welded wire fabric. The enclosure shall include a 31-inch wide by 84-inch tall access door and the enclosure shall be removable for times when the well, pump, and motor need to be serviced.

H. Equipment Security

Site security is important at these well sites to prevent theft and vandalism. Site security includes, site lighting, well motor enclosure, and electrical equipment locking gate beams.

I. Shade Structure

A pre-engineered electrical equipment canopy or shade structure shall be installed at each well site. The shade structure shall consist of steel square tubing for the frame and weather panel material for the roofing and siding. All material shall be hot-dip galvanized steel. The structure shall be anchored to the concrete foundation and designed for seismic and wind loading in accordance with ASCE 7-16 and the 2019 California Building Code (CBC).

The size and height of the shade structure shall be coordinated with the electrical gear dimensions and provide for a minimum 4-ft covered clear

space in front of the electrical gear and a minimum 2-ft clearance around the sides and back of the gear.

J. Control Philosophy and Monitoring

The wells are operated during recovery operations and are manually operated. They are turned on manually and turned off manually unless shutdown on a power failure, equipment failure, or high pressure switch. The operation, control, and monitoring of the well facilities is discussed further in Technical Memorandum No. 10 Facility Operation and SCADA Requirements.

The monitoring devices send information via 4-20 ma signals to the RTU panel or a Mission Unit. The RTU or Mission Unit is a remote monitoring device that displays the following:

- Well Status
- Groundwater Level
- Well Discharge Pressure
- Well Discharge Flow
- Any Alarms

V. Well Site Requirements

A. Site Fencing & Security

Site security is an important feature of these well sites as they are located in remote areas and are often not visible to the public and routine traffic.

Security will need to be provided for the electrical equipment and the well as the most vulnerable well site feature is the copper wiring to the motor.

The security for the electrical equipment shall include a locking cross bar that runs across the front of the electrical gear to prevent it from being opened. It includes steel posts, hinges, gate beams, support beams, and a lock box.

The well motor security consists of a 14-ft diameter welded steel enclosure hut. The enclosure shall have a cone roof and be tall enough to provide a minimum 24-inch clearance above the top of the well motor. The enclosure shall be made out of 2x2 square tubing, galvanized sheet metal, and 2x2 square welded wire fabric. The enclosure shall include a 31-inch wide by 84-inch tall access door and the enclosure shall be removable for times when the well, pump, and motor need to be serviced.

B. Site Lighting

Site lighting is another security feature due to the remote location of these well sites. It is helpful to have them well lit at night to deter trespassing and to aid in visibility for working at night, if necessary. It is estimated that a minimum of two flood lights will be installed at each well site on the shade structure with motion sensors and photo cells. The lighting will be directed to the motor control center and the well pump and motor.

C. Site Ground Surfacing

All-weather surfacing is a requirement for these sites to minimize maintenance for weeds and to provide good access to equipment. It is estimated that the all-weather surfacing will be 4-inch thick, ¾-inch Class II aggregate base.

VI. Related Work Specified Elsewhere

A. TM 1 – Project Phasing and Design/Contractor Selection
B. TM 3 – Pipeline Requirements
C. TM 5 – Geotechnical Investigation
D. TM 9 – Recharge Basin Requirements
E. TM 10 – Facility Operation and SCADA Requirements
F. TM 11- Engineer's Estimates

DEE JASPAR & ASSOCIATES, INC.
CONSULTING CIVIL ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CA 93308
PHONE (661) 393-4796
FAX (661) 393-4799

April 7, 2021

Dan Bartel
Groundwater Banking JPA
c/o Rosedale-Rio Bravo Water Storage District
849 Allen Road
Bakersfield, CA 93314

RE: Kern Fan Groundwater Storage Project
Proposal for Engineering Design RFP

Mr. Bartel,

Attached is a cost proposal for providing engineering services to prepare the Request for Proposals (RFP) for the design phases of the above referenced project. It is anticipated that one RFP will be prepared which will include a proposal form with five different design packages that each proposer can propose on. The RFP will include language stating the JPA can select and award any of the design packages or combination thereof at their discretion.

Task #1 is for the preparation of the RFP and includes:

- General correspondence and discussions
- Prepare a draft RFP for review and comment
- Incorporate comments and issue a second draft RFP for review and comment
- Incorporate comments and issue a final draft RFP

Task #2 is for assistance during the RFP review and selection process and includes:

- Facilitating a pre-proposal project meeting
- Responding to proposal RFI's
- Preparation of proposal addenda as necessary (Estimate of three addenda)
- Participation in firm interviews and correspondence
- Review of proposals and preparation of recommendations
- Assistance with firm selection and agreements

The work will be billed on a time and material basis in accordance with our 2021 Rate Schedule. The cost proposal is a not-to-exceed amount of $55,529.00 as presented in the attached budget.

Please let me know if you have any questions, concerns, or need anything else. Thank you for the opportunity to serve the District on this project.

Thanks,

Curtis Skaggs

Curtis M. Skaggs, PE

Groundwater Banking Joint Powers Authority (JPA)
Kern Fan Groundwater Storage Project

Request for Proposals (RFP) Preparation

	Principal Engineer	Registered Engineer	Staff Engineer	Draftsperson	Secretary	
	Estimated Time (hrs)	Estimated Time (hrs)	Estimated Time (hrs)	Estimated Time (hrs)	Estimated Time (hrs)	Total
Task 1. Preparation of RFP						
General RFP Correspondence and Discussions	4	8	8			$2,996
Preparation of Draft RFP for Review and Comment	2	40	12			$8,014
Incorporate Comments and Issue Second Draft RFP for Review and Comment	2	24	8			$5,064
Incorporate Comments and Issue Final Draft RFP	2	8	4			$2,114
Subtotal:						*$18,188*
Task 2. RFP Review, Interviews, and Recommendations						
Facilitate Pre-Proposal Project Meeting	2	6	4			$1,806
Review RFI's and Discuss	2	20	20			$5,906
Prepare Proposal Addenda as necessary. Estimate (3) Addenda.	3	24	12			$5,748
Participate in Firm Interviews and Correspondence	20	30	15			$10,403
Prepare Firm Recommendations	4	20	12			$5,330
Assistance with Firm Selection and Agreements	8	30	16			$8,148
Subtotal:						*$37,341*
Total Hours Estimated:	49	210	111	0	0	
Total Engineering Estimate:	$9,702	$32,340	$13,487	$0	$0	***$55,529***

April 29, 2021
Prepared by: D. Gosling
Agenda Item: 4. a.

Conflict of Interest Memo

DISCUSSION:

Pursuant to Government Code Sections 87300 et seq. a public agency shall have a Conflict of Interest Code. Pursuant to Government Code Section 87302, the Code should designate individuals who must disclose certain investments, income, interests in real property and business positions, and who must disqualify themselves from making or participating in the making of governmental decisions affecting those interests.

RECOMMENDATION:

That the Board of Directors approve the proposed Resolution to give notice to adopt the Code and provide notice to the county and appropriate posting for the comment period.

LIST OF EXHIBITS:

Exhibit "A" – Resolution 2021-01
Notice to Adopt

RESOLUTION NO. 2021-01

RESOLUTION OF THE BOARD OF DIRECTORS OF THE GROUNDWATER BANKING JOINT POWERS AUTHORITY ANNOUNCING THE INTENT TO ADOPT A NEW CONFLICT OF INTEREST CODE AND ESTABLISHING A COMMENT PERIOD

WHEREAS, the Groundwater Banking Joint Powers Authority ("Authority") was established to primarily implement the Kern Fan Groundwater Storage Project located within the boundaries of the Rosedale Rio-Bravo Water Storage District. It is a joint powers authority comprised of Irvine Ranch Water District and Rosedale Rio-Bravo Water Storage District; and

WHEREAS, Government Code section 87300 et seq. provides for the Board to adopt a Conflict of Interest and the Board has determined that an initial code should be adopted; and

WHEREAS, in accordance with state law, the Authority has prepared the attached Conflict of Interest Code and Notice of Intent; and

WHEREAS, state law requires the Authority to provide a 45-day comment period before adopting the Conflict of Interest Code;

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of the Authority that the Conflict of Interest Code attached hereto as Exhibit A and incorporated herein by this reference is hereby preliminarily adopted.

BE IT FURTHER RESOLVED, that the mandatory 45-day comment period begins on May 3, 2021, and ends June 17, 2021.

ADOPTED, SIGNED AND APPROVED by the Authority, _____, 2021, by the following vote:

AYES:

NOES:

ABSENT:

ABSTAIN:

I HEREBY CERTIFY that the foregoing is the resolution of the Board of Directors of the Groundwater Banking Joint Powers Authority.

ATTEST:

_____ _____

Board President Authority Secretary

GROUNDWATER BANKING JOINT POWERS AUTHORITY

CONFLICT OF INTEREST CODE

The Political Reform Act (Government Code Section 81000, et seq.) requires state and local government agencies to adopt and promulgate conflict of interest codes. The Fair Political Practices Commission has adopted a regulation (2 Cal. Code of Regs. Sec. 18730) that contains the terms of a standard conflict of interest code, which can be incorporated by reference in an agency's code. After public notice and hearing, the standard code may be amended by the Fair Political Practices Commission to conform to amendments in the Political Reform Act. Therefore, the terms of 2 California Code of Regulations Section 18730 and any amendments to it duly adopted by the Fair Political Practices Commission are hereby incorporated by reference, and, along with the attached Attachments A and B, in which individuals or consultants are designated and disclosure categories are set forth, constitute the conflict of interest code of the GROUNDWATER BANKING JOINT POWERS AUTHORITY ("Authority").

Designated individuals shall file their statements with the Authority, which will make the statements available for public inspection and reproduction (Gov. Code Sec. 81008). Statements for all designated individuals will be retained by the Authority.

Attachment A

DESIGNATED POSITIONS AND DISCLOSURE CATEGORIES

Designated Position	Assigned Disclosure Category
Directors	1 & 2
General Manager	1 & 2
Treasurer	1 & 2
Assistant Treasurer	1 & 2
Project Manager(s)	1
Controller	1
Staff Engineer(s)	1
General Counsel	1 & 2
Consultants	1 & 2

Note: The position of General Counsel is filled by an outside consultant who serves in an officer capacity.

*Staff Engineers(s)/Controller: individuals will be provided from the JPA Members via a Shared Services Agreement

*Consultants shall be included in the list of designated positions and shall disclose pursuant to the broadest disclosure category in the code, subject to the following limitation:

The General Manager may determine that a particular consultant or new position, although a "designated position," is hired to perform a range of duties that is limited in scope and thus is not required to fully comply with the disclosure requirements in this section. Such determination shall include a description of the consultant's or new position's duties and, based upon that description, a statement of the extent of disclosure requirements. The General Manager's determination is a public record and shall be retained for public inspection in the same manner and location as this conflict of interest code (Gov. Code Section 81008).

Officials Who Manage Public Investments

The persons holding the following positions are “public officials who manage public investments” within the meaning of that term as used in Government Code Section 87200 and are required to make full disclosure of all economic interests as required in Form 700: members of the Board of Directors, General Manager, Treasurer, and Assistant Treasurer.

An individual holding one of the above-listed positions may contact the Fair Political Practices Commission for assistance or written advice regarding their filing obligations if they believe that their position has been categorized incorrectly. The Fair Political Practices Commission makes the final determination whether a position is covered by Gov. Code Sec. 87200.

Attachment B

DISCLOSURE CATEGORIES

Category 1: Designated positions in this category shall disclose income from any source, interests in real property, investments and all business positions in which the designated employee is a director, officer, partner, trustee, employee, or holds any position of management.

Category 2: Designated positions in this category shall disclose investments; business positions in business entities; and income (including gifts, loans, and travel payments), from sources engaged in providing services (e.g. accounting, auditing, engineering and environmental consulting), supplies, materials, machinery, or equipment of the type utilized by the agency.

DECLARATION OF GENERAL MANAGER FOR THE GROUNDWATER BANKING JOINT POWERS AUTHORITY

The proposed Conflict of Interest Code specifically enumerates each of the positions within the Authority that involve the making or participation in the making of decisions that may foreseeably have a material financial effect on any financial interest. The Authority has satisfied all of the requirements for preliminary approval of the proposed Code.

The reason for this Conflict of Interest Code is to state the organizational positions of the newly formed Authority.

Dated:_____

_____
Dan Bartel
General Manager

GROUNDWATER BANKING JOINT POWERS AUTHORITY

GROUNDWATER BANKING JOINT POWERS AUTHORITY

NOTICE OF INTENTION TO ADOPT

CONFLICT OF INTEREST CODE

NOTICE IS HEREBY GIVEN that the GROUNDWATER BANKING JOINT POWERS AUTHORITY (the "Authority") intends to adopt a Conflict of Interest Code (the "Code") pursuant to Government Code Sections 87300 et seq. Pursuant to Government Code Section 87302, the Code designates individuals who must disclose certain investments, income, interests in real property and business positions, and who must disqualify themselves from making or participating in the making of governmental decisions affecting those interests.

A written comment period has been established commencing on May 3, 2021 and terminating on June 17, 2021. Any interested person may present written comments concerning the proposed Code no later than June 2, 2021 to the Authority, Attention: Secretary, 849 Allen Road, Bakersfield, CA 93314. No public hearing on this matter will be held unless an interested person, or his or her representative, requests such a hearing no later than 15 days prior to the close of the written comment period.

The Authority has prepared a written explanation of the reasons for the designations and the disclosure responsibilities and has available all of the information upon which its proposal is based. The adoption of the Code will not impose a cost savings to the Authority that is required to be reimbursed under Part 7 (commencing with section 17500) of Division 4 of the Government Code; will not result in any nondiscretionary cost or savings to local agencies; will not result in any cost or savings in federal funding to the state; will not impose a mandate on local agencies or school districts; and will not have any potential cost impact on private persons or businesses, including small businesses. No alternative considered by the Authority would be more effective in carrying out the purpose for which the action is proposed or would be as effective and less burdensome to affected private persons than the proposed action.

The reason for the adoption of this Code is to reflect the action of the new agency.

Copies of the proposed Code and all of the information upon which it is based may be obtained from the Authority, 849 Allen Road, Bakersfield, CA 93314. Any inquiries or written comments concerning the proposed Code should be directed to Dan Bartel, 849 Allen Road, Bakersfield, CA 93314, or by phone at (661) 589-6045.

DRAFT

May 03, 2021
Prepared by: Sophia Phuong
Reviewed by: Cheryl Clary
Agenda Item: 4b

GBJPA Proposed FY2021-22 Budget

DISCUSSION:

Exhibit "A" is the proposed budget for the Fiscal Year (FY) 2021-22. The proposed total $39.7million budget includes $39.5 million for Capital and $0.1 million for operating expense. Staff is proposing a one year budget versus a multi-year budget as there are too many unknowns to reasonably estimate expenditures beyond this fiscal year.

As shown in Exhibit "A", the proposed $39.7 million budget for the FY2021-22 reflects an increase of $38.4 million compared to the prior year's $1.2 million approved budget. The increase is primarily due to assumed land acquisitions and the starting of some construction during FY2021-22.

A cash call is requested in July 2021 for a total of $534 thousand which includes approximately $65 thousand for FY2020-21 remaining expenditures and $469 thousand based on the proposed FY2021-22 first quarter budget. The cash calls exclude any funding for land acquisitions which will be requested with separate calls as needed. Each partner will be requested to fund $267 thousand into the GBJPA bank account in July 2021.

RECOMMENDATION:

That the Board of Directors approve of the adoption of the FY2021-22 budget and the cash call in July 2021.

LIST OF EXHIBITS:

Exhibit "A" – GBJPA Proposed FY2021-22 Budget

Exhibit A
Groundwater Banking Joint Powers Authority
Proposed Budget
Proposed Budget FY2021-22

	FY2020-21 Actual (As of 03/31/21)	FY2020-21 Full Year Forecast (As of 3/31/21)	Approved FY2020-21 Budget	Proposed FY2021-22 Budget	$ Increase /(Decrease)	% Increase /(Decrease)
Kern Fan Groundwater Capital Project						
Engineering - Planning and Design Staff	$135,326	$169,158	$389,753	$109,054	($280,699)	-72%
Grant Administration and Reporting	3,174	3,968	1,639	4,712	3,073	187%
CWC and USBR Feasibility Studies	45,947	57,434	12,940	34,370	21,430	166%
JPA Administration	34,033	42,541	101,169	109,354	8,185	8%
Supplemental Environmental Impact Report	17,296	21,620	7,785	89,948	82,163	1055%
Agreements with State Agencies	1,433	1,791	0	52,219	52,219	100%
Property Pre-Acquisition Work and Geophysical Study	49,410	61,763	0	87,572	87,572	100%
Accounting and Financial Reporting	22,371	27,964	22,127	0	(22,127)	100%
Engineering Design - Consultants	2,817	3,521	0	3,793,310	3,793,310	100%
Engineering CA&I- Outside	0	0	0	269,500	269,500	100%
Engineering CA&I - Staff	0	0	0	0	0	0%
Construction	0	0	0	8,704,949	8,704,949	100%
Land	0	0	0	23,065,000	23,065,000	100%
Legal JPA	48,304	60,380	61,500	196,772	135,272	220%
Preliminary Design Report and Feasibility Report	71,527	89,409	181,590	0	(181,590)	-100%
Development of Agreement with FWS	0	0	10,000	10,000	0	0%
Development of Agreement with DWR	44,175	55,219	20,000	20,000	0	0%
Permanent Easements	0	0	15,000	0	(15,000)	-100%
Habitat Credit Purchase	0	0	0	2,400,000	2,400,000	100%
Environmental	341,739	341,739	382,197	0	(382,197)	-100%
Permitting	0	0	15,000	195,000	180,000	1200%
PG&E Service	0	0	15,000	306,250	291,250	1942%
Bid Phase	0	0	0	75,000	75,000	100%
Capital Project Total	817,552	936,505	1,235,700	39,523,010	38,287,310	3098%
Operating Expense						
Administration/Management	24,116	30,145	0	122,000	122,000	100%
General Liability Insurance	0	0	0	1,350	1,350	100%
Legal	0	0	0	0	0	0%
Bank Charges	141	176	0	7,000	7,000	100%
Audit	0	5,000	0	5,000	5,000	100%
Supplies	409	409	0	0	0	0%
Operating Expense Total	24,666	35,730	0	135,350	135,350	100%
Total	**$842,218**	**$972,236**	**$1,235,700**	**$39,658,360**	**$38,422,660**	3109%

May 3, 2021
Prepared by: Dan Bartel
Agenda Item: 4c

Amendment No. 2 to Bylaws of the Groundwater Banking Joint Powers Authority

DISCUSSION:

During the past ten months the Authority has undertaken various actions on Groundwater Banking related items and it has become apparent that the Authority would better served by dissolving the Standing Committees of the Board as expressed within the Bylaws. Given the small number of board members and relatively few issues to address, it is administratively cumbersome to hold two monthly committee meetings and quarterly board meetings(18-28 per year). Staff believes it would be more efficient and effective to instead have the Board meetings every 1-2 months (6-10 per year). This would also help address time-sensitive actions that need to be made by the Board. The Authority has held two special board meetings over the past year so that decisions could be made on a timely basis.

Standing Committees are covered by the Brown Act, with associated meeting requirements. Thus, staff and legal counsel has prepared Amendment No. 2 to the Bylaws, provided as Exhibit "A". Amendment No. 2 would remove the Standing Committees from Section 6 and remove the reference to the Finance Committee in Section 12 of the Bylaws. The Board may still convene ad hoc committees, at its discretion, to address specific financial or project related items.

Per Section 15. of the Bylaws, the Board of Directors may adopt, amend, or repeal any section of the Bylaws.

RECOMMENDATION:

That the Board of Directors approve Amendment No. 2 to the Bylaws of the Groundwater Banking Joint Powers Authority.

LIST OF EXHIBITS:

Exhibit "A" – Draft Amendment No. 2 to the Bylaws of the Groundwater Banking Joint Powers Authority, redline and clean versions

~~FIRST~~ SECOND AMENDED BYLAWS OF THE GROUNDWATER BANKING JOINT POWERS AUTHORITY

~~April 8~~May 3, 2021

PREAMBLE

These Bylaws are provided pursuant to Article 5(E) of the Joint Powers Agreement Between Rosedale-Rio Bravo Water Storage District and Irvine Ranch Water District creating the Groundwater Banking Joint Powers Authority to Develop and Administer a Kern Fan Groundwater Storage Project, effective as of July 1, 2020, as such agreement may be amended or modified from time to time.

1. NAME

The name of this joint powers authority formed pursuant to the Joint Exercise of Powers Act (Government Code section 6500 et seq.) is the Groundwater Banking Joint Powers Authority ("Authority" or "JPA").

2. PURPOSE

The purpose of these bylaws is to describe the processes and procedures of the Authority's governance and administration.

3. MEMBER ENTITIES

The contracting parties to the Groundwater Banking Joint Powers Authority Agreement ("Groundwater Banking JPA Agreement") dated [date] are the member entities of the Groundwater Banking JPA. The contracting parties to the Groundwater Banking JPA Agreement are the Irvine Ranch Water District ("IRWD") and the Rosedale-Rio Bravo Water Storage District ("RRB").

4. BOARD OF DIRECTORS

a. **Directors**

Directors shall be appointed to the Board of Directors in the manner described in Article 5.A. of the Groundwater Banking JPA Agreement.

b. **Alternates**

Alternates shall be appointed to serve on the Board of Directors in the manner described in Article 5.A. of the Groundwater Banking JPA Agreement.

5. BOARD MEETINGS

a. **Regular Meetings**

The Board of Directors shall hold at least one Regular Meeting each year. The date and time of such Regular Meetings shall be set by resolution or ordinance of the Board of Directors at the first meeting of the Board of Directors.

b. **Special Meetings**

The Board of Directors may hold Special Meetings upon providing at least 24 hours' notice.

c. **Adjourned Meetings**

The Board of Directors may adjourn any regular meeting, adjourned regular meeting, special meeting, or adjourned special meeting at any time and to any time and place permissible by law. Adjournment shall not require a quorum of the Board of Directors. If no Director is present at a noticed meeting of the Board of Directors, the [Secretary/General Manager] shall have the authority to adjourn the meeting.

The date, time, and location of the adjourned meeting shall be included on the Notice of Adjournment of any regular meeting, adjourned regular meeting, special meeting, or adjourned special meeting.

d. **Meeting Locations**

Meetings of the Board of Directors shall take place at the main office of RRB, 849 Allen Road, Bakersfield, CA 93390 or IRWD, 15600 Sand Canyon Avenue, Irvine CA 92618, unless otherwise stated on the public notice of the meeting.

Members of the Board of Directors may participate in meetings by teleconference pursuant to the Ralph M. Brown Act ("Brown Act") (Government Code section 54950 et seq.).

e. **Notice and Agenda Procedures**

The Board of Directors shall comply with the Brown Act for meeting agenda and notice requirements.

f. **Quorum**

A quorum of the Board of Directors shall be determined in the manner described in Article 5(C) of the Groundwater Banking JPA Agreement.

g. **Rules of Order**

Action by the Board of Directors requires a unanimous vote consistent with Article 5(D) of the Groundwater Banking JPA Agreement.

h. **Minutes**

Minutes of each meeting of the Board of Directors shall be prepared by the Secretary.

i. **Delegation of Powers**

The Board of Directors may delegate any of its powers except as prohibited in the Groundwater Banking JPA Agreement, these Bylaws, or by law.

j. **Transparency**

All meetings of the Board of Directors shall be conducted in accordance with the Brown Act. While meetings of the Board of Directors are generally open to any member of the public, the Board of Directors may meet in closed session for those reasons expressly allowed under the Brown Act.

The Groundwater Banking JPA shall be subject to the California Public Records Act (Government Code section 6250 et seq.).

6. COMMITTEES

~~a. **Standing Committees**~~

~~The Groundwater Banking JPA Board of Directors shall appoint members of standing committees as follows:~~

~~i. **Project Committee.** There shall be a standing Project Committee to assist the Board of Directors in overseeing the planning, design, construction, construction management, and operation of the Kern Fan Project. The Project Committee shall comprise one Groundwater Banking JPA Board member and one other member appointed by RRB and one Groundwater Banking JPA Board member and one other member appointed by IRWD, plus the Groundwater Banking JPA's General Manager and its Treasurer. The Project Committee shall recommend to the Groundwater Banking JPA Board of Directors principles and guidelines for the planning, design, construction, construction management, and operation of the Kern Fan Project. The Groundwater Banking JPA Board of Directors may adopt such principles and guidelines after considering the Project Committee's recommendation and retains its full discretion to modify or reject such recommended policies.~~

~~ii. **Finance Committee.** There shall be a Finance Committee to assist the Groundwater Banking JPA Board of Directors in overseeing the financing of the Kern Fan Project. The Finance Committee shall comprise one Groundwater Banking JPA Board member appointed by RRB and one Groundwater Banking JPA Board member appointed by IRWD, plus the Groundwater Banking JPA's General Manager and its Treasurer. The Finance Committee shall work with the Treasurer to recommend to the Groundwater Banking JPA Board of Directors policies addressing financial issues, including but not limited to: (a) purchase orders/invoices; (b) construction contracts; (c) professional services agreements; (d) change orders/variances; (e) liability/property settlements; (f) acquisition of land and easements; (g) disposition of property; (h) check-signing authority; (i) claims settlements; (j) investment policy; and (k) capitalization. The Groundwater Banking JPA Board of Directors may adopt such policies after considering the Finance Committee's recommendation and retains its full discretion to modify or reject such recommended policies.~~

~~b.~~a. **Ad Hoc Committees**

The Groundwater Banking JPA Board of Directors may appoint one or more ad hoc committees.

~~C~~b. ~~.~~ To the extent that the Brown Act applies to Authority committees, committee members may participate in committee meetings by teleconference pursuant to the Brown Act.

7. OFFICERS

a. **General Manager**

The General Manager shall be appointed by the Board of Directors in the manner described in Article 6 of the Groundwater Banking JPA Agreement. The General Manager and any designees shall administer planning, construction and operation of the Kern Fan Project.

The Kern Fan JPA Board of Directors shall adopt one or more policies delegating certain authority to the General Manager.

b. **Treasurer**

The Treasurer shall be appointed by the Board of Directors in the manner described in Article 7 of the Groundwater Banking JPA Agreement. The Treasurer and any designees shall administer the Groundwater Banking JPA's financial management function.

The Groundwater Banking JPA Board of Directors shall adopt one or more policies delegating certain authority to the Treasurer.

c. **Legal Counsel**

The Legal Counsel shall be appointed by the Board of Directors in the manner described in Article 9 of the Groundwater Banking JPA Agreement.

d. **Secretary**

The Legal Counsel shall serve as Secretary pursuant to Article 9 of the Groundwater Banking JPA Agreement. The Secretary or any designees shall maintain the official records of the Groundwater Banking JPA, including Board meeting minutes.

e. **Resignation of Officers**

Officers may resign from their position at any time by providing the Board of Directors with written notice of their intention to resign. Such written notice should include an effective date of the resignation. The effectiveness of resignation shall not require written notice.

f. **Designation of Responsibilities**

Both the General Manager and the Treasurer, may from time to time, designate and assign a portion or all of their responsibilities to an individual to act on their behalf to carry out their respective duties and obligations related to the Kern Fan Project. The designee shall act with full authority on matters undertaken on the General Manager or Treasurer's behalf. The designee shall be accountable to the Groundwater Banking JPA Board of Directors, the General Manager and Treasurer and other Officers. The designee shall continue to act on behalf of the General Manager or Treasurer until revoked, which shall be effective upon notice given verbally or in writing by the General Manager or Treasurer as to their respective designees. A writing may include, but is not limited to electronic mail (e-mail).

8. STAFF

Pursuant to Article 10 of the Groundwater Banking JPA Agreement, upon formation of the Groundwater Banking JPA, the Board of Directors shall negotiate shared staff services agreements with RRB and IRWD specifying the hourly rates at which RRB or IRWD staff will provide services to the Groundwater Banking JPA. The Board of Directors shall approve and enter into one or more shared staff services agreement(s) with RRB and IRWD for planning, design, construction and operation of the Kern Fan Project.

9. PROFESSIONAL SERVICES

a. **Legal Services**

The Board of Directors shall have the sole authority to enter into contracts for legal services on behalf of the Groundwater Banking JPA. This power may not be delegated, regardless of the amount of the contract and any spending authority vested in any Officer [or Staff] of the Groundwater Banking JPA.

b. **Audit Services**

The Board of Directors shall select an Auditor in the manner provided by law.

10. FINANCE

a. **Grant Compliance**

The Board of Directors shall delegate responsibility for monitoring compliance with all applicable grant funding obligations to a compliance officer. The compliance officer may be a member of RRB or IRWD staff.

b. **Member Funding**

(1) **Equal Funding Principle**

The general principle governing member funding of the Groundwater Banking JPA is that RRB and IRWD shall fund equally (50-50) the costs to form the Groundwater Banking JPA, the costs to apply for and to obtain

grant funding for the Kern Fan Project, and the costs to administer, design, construct and operate the Kern Fan Project and the Authority to meet all of its objectives, including all obligations arising from acceptance of grant funding for the Kern Fan Project.

RRB and IRWD have incurred various expenses in connection with the Kern Fan Project. Specifically, prior to formation of the Groundwater Banking JPA, RRB and IRWD each incurred costs to apply for and to obtain grant funding for the Kern Fan Project, to initiate California Environmental Quality Act ("CEQA") review, to conduct studies on the feasibility of constructing and operating Kern Fan Project components, like a new turnout on the Cross Valley Canal, and to complete other tasks facilitating the Kern Fan Project. Additional costs were incurred in the form of staff and legal costs.

Some of these early implementation expenses were governed by the Agreement Between Rosedale-Rio Bravo Water Storage District and Irvine Ranch Water District for Cost Sharing Early Planning Activities for the Kern Fan Groundwater Storage Project ("Early Cost-Share Agreement") while other early implementation expenses were agreed to between RRB and IRWD outside of the Early Cost-Share Agreement.

To the extent that net costs incurred by RRB or IRWD related to these early activities are not equal (50-50), an initial reconciliation of such differences will be made between RRB and IRWD within the first fiscal quarter following the Groundwater Banking JPA's formation. To the extent that any additional costs are incurred by RRB or IRWD from obligations related to the early implementation expenses after the initial reconciliation, RRB and IRWD will make additional reconciliations until all such obligations are satisfied.

(2) **Exceptions By Special Activities Agreements**

The only exception to the general principle of 50-50 cost-share may arise from the Groundwater Banking JPA Board of Directors' approving one or more Special Activities Agreements that provide for RRB or IRWD to participate in or to add a component of the Kern Fan Project pursuant to article 3(d) of the Groundwater Banking JPA Agreement. Any Special Activities Agreement deviating from the 50-50 cost-share principle shall specify how costs associated with the special activities deviate from the 50-50 cost-share principle, including but not limited to any one-time costs and any ongoing costs.

(3) **Initial Member Funding Contributions to Open Bank Accounts**

Upon formation of the Groundwater Banking JPA, RRB and IRWD each shall contribute $2,500 to the Groundwater Banking JPA, for a total of $5,000, to provide a basis for opening one or more bank accounts for the Groundwater Banking JPA.

(4) ***Ongoing funding for Groundwater Banking JPA operations:***

The Board of Directors shall annually adopt a budget encompassing the reasonably anticipated costs for implementing the Kern Fan Project, plus prudent reserves. The Board of Directors shall require ongoing financial contributions from RRB and IRWD to maintain adequate bank account balances to meet the reasonably anticipated costs for implementing the Kern Fan Project and prudent reserves, after accounting for grant funding. The Board of Directors shall determine the amount and timing of such contributions by resolution.

c. **Audit Interval**

Audits of the Groundwater Banking JPA's finances shall be prepared in the manner described in Article 13 of the Groundwater Banking JPA Agreement. The cost to complete the annual audit of the Groundwater Banking JPA's finances shall be allocated half (50 percent) to RRB and half (50 percent) to IRWD.

11. SPECIAL ACTIVITIES AGREEMENTS

a. Pursuant to article 3(D) of the Groundwater Banking JPA Agreement, either of the Parties may enter into Special Activities Agreements with the Groundwater Banking JPA providing for their independent choices whether to participate in or to add a component of the Kern Fan Project or to allow use of a Party's capacity in the Kern Fan Project to implement an independent operating program or project with a third party.

b. No Special Activities Agreement may become legally effective without prior unanimous approval of the Groundwater Banking JPA Board of Directors.

c. A Special Activities Agreement may result in a Party having a larger capital investment in Kern Fan Project recharge, storage, recovery or conveyance capacity than the other Party and/or result in a Party achieving greater than 50 percent of the Kern Fan Project recharge, storage or recovery capacity upon implementation of the special activity. A Special Activities Agreement may provide for the creation of a committee under which a Party may exercise proportionally greater voting power over recommendations from the committee to the Groundwater Banking JPA Board of Directors regarding the approval and administration of the Special Activities Agreement. The committee created by a Special Activities Agreement shall make recommendations to the Groundwater Banking JPA Board of Directors regarding the administration, planning, design, construction, construction management, and operation of the special activity. The Groundwater Banking JPA Board of Directors shall retain its full discretion to modify or reject any recommendation of a committee created by a Special Activities Agreement. No Special Activities Agreement may affect the requirement that all decisions of the Groundwater Banking JPA Board of Directors must be unanimous under Section 6(g) of these Bylaws and Article 5(D) of the Groundwater Banking JPA Agreement. No Special Activities Agreement may affect the provisions for resolving deadlock decisions of the JPA Board of Directors contained in Article 5(D) of Groundwater Banking JPA Agreement and such

deadlock provisions would apply to decisions of the Groundwater Banking JPA Board of Directors related to special activities. RRB or IRWD each may carry out their own projects to help integrate the Kern Fan Project with their other projects, including interties with the Stockdale East Project, the Stockdale West Project, and the Strand Ranch Project. Such integration projects do not require a Special Activities Agreement with the Groundwater Banking JPA.

12. INSURANCE

The Groundwater Banking JPA Board of Directors ~~Finance Committee~~ shall determine ~~recommend to the Groundwater Banking JPA Board of Directors one or more policies on~~ required insurance coverage that shall be maintained for the Groundwater Banking JPA. The Groundwater Banking JPA Board of Directors ~~shall adopt one or more such policies after considering the Finance Committee's recommendation and~~ retains its full discretion to adopt ~~modify~~ or reject ~~such recommended~~ policies.

13. PROJECT FACILITY OPERATION COSTS

RRB and IRWD shall pay operations, maintenance, energy and replacement ("OME&R") costs consistent with their respective proportional use of the Kern Fan Project facilities and any facilities constructed under Special Activities Agreements governing the Parties' independent choices whether to participate in or to add a component of the Kern Fan Project as follows:

a. Variable OME&R costs include, but are not limited to, energy costs and other costs that are attributable to the use of Kern Fan Project facilities (including wear and tear) and shall be paid pro rata based on actual use of Kern Fan Project facilities by RRB or IRWD.

b. Fixed OME&R costs include, but are not limited to, any costs on Kern Fan Project land or facilities that are incurred irrespective of use of such land or facilities, and shall be shared equally between the Parties , or as otherwise agreed in a Special Activities Agreement.

c. RRB and IRWD shall equally split the OME&R costs associated with the public benefits or ecosystem account associated with participating in the WSIP that are not grant-funded, such as the recharge and recovery operations that are necessary to meet the project's ecosystem public benefits requirements.

RRB and IRWD shall each pay half of the Groundwater Banking JPA's costs for its insurance coverage, its annual financial audit, and its use of legal counsel. JPA insurance, audit and/or legal counsel costs attributable to a Special Activity shall be paid by the Special Activity participant(s) proportional to their respective percentage interest in the Special Activity, as defined in the relevant Special Activities Agreement.

14. TERMINATION

a. **Distribution of Assets**

To implement article 1(A) of the Groundwater Banking JPA Agreement, the Parties shall meet and confer prior to eighteen (18) months before expiration of the Agreement's initial term to determine whether the Agreement will be extended. The Parties may continue to meet and confer during the last eighteen (18) months of the Agreement's initial term. If within six (6) months before expiration of the Agreement's initial term the Parties have failed to reach agreement on extending the Agreement's initial term or integrating the Kern Fan Project facilities into one or more other existing water storage and recovery programs or projects, then the Parties shall implement the Groundwater Banking JPA Agreement's provisions for Disposition of Kern Fan Project Property, Facilities and Other Assets Upon Termination.

b. To implement articles 1(A) and 1(B) of the Groundwater Banking JPA Agreement, the Parties shall comply with the following rules:

   i. At least six (6) months before expiration of the Groundwater Banking JPA Agreement's term, and within one year after providing any advance written notice of intent to terminate the Groundwater Banking JPA Agreement early, RRB shall deliver to IRWD either a notice exercising RRB's first right to acquire IRWD's interest in all Kern Fan Project facilities, capacities and real or personal property held by the Groundwater Banking JPA or written confirmation that RRB elects not to exercise its first right to acquire IRWD's interest in all Kern Fan Project facilities, capacities and real or personal property held by the Groundwater Banking JPA. Any RRB notice exercising its first right to acquire shall comply with the valuation rules specified in article 1(B) of the Groundwater Banking JPA Agreement.

   ii. If RRB confirms in writing its election not to exercise its first right to acquire IRWD's interest in all Kern Fan Project facilities, capacities and real or personal property held by the Authority, or fails to provide such written confirmation within the time constraints above, then article 1(B) of the Groundwater Banking JPA Agreement provides that IRWD may hold its interest or sell its interest to a mutually acceptable third party. Upon IRWD notifying RRB of a proposed third-party buyer for IRWD's interest in the Kern Fan Project, RRB shall have 180 days to deliver its approval or rejection of IRWD's proposal, unless the Parties mutually agree in writing to extend the 180-day period. If RRB fails to affirmatively approve or reject IRWD's proposal within 180 days or any mutually agreed time extension, IRWD's proposal shall be deemed approved by RRB.

15. AMENDMENTS

The Board of Directors may adopt, amend, or repeal any section of these Bylaws, except insofar as such a change would conflict with the Groundwater Banking JPA Agreement.

16. RECORDS AND REPORTS

a. **Maintenance of Records**

Records of the Groundwater Banking JPA shall be maintained at the principal places of business of the member agencies, Kern Fan Project facilities, and any other facility designated by the Board of Directors, Officers, or Staff. In addition to maintaining financial accounting and other records, the Groundwater Banking JPA shall maintain at least the following water accounting records for the Kern Fan Project:

i. Amount of water delivered for recharge by each Party and the source of all water delivered for recharge;

ii. Amount of stored water to provide ecosystem public benefits;

iii. Amount of IRWD stored water; and

iv. Amount of RRB stored water.

b. **Public Records**

Requests for the inspection of any public record maintained by the Groundwater Banking JPA shall be handled in accordance with the California Public Records Act (Government Code section 6250 et seq.).

c. **Inspection Rights of Directors and Members**

Directors and designated representatives of the member agencies shall have an absolute right to inspect the records of the Groundwater Banking JPA with reasonable notice to the Groundwater Banking JPA. Any records determined to be confidential by the Groundwater Banking JPA, in consultation with its Legal Counsel, may be designated as such and may be reviewed subject to the execution of a non-disclosure agreement; the review of confidential documents by directors and designated representatives shall not act as a waiver of any applicable privileges.

d. **Fiscal Year**

The Fiscal Year of the Groundwater Banking JPA shall begin on July 1st of each calendar year and close on June 30th of each calendar year.

17. CONSTRUCTION

Any section of these Bylaws that is determined to be inconsistent with any term of the Groundwater Banking JPA Agreement or any applicable law shall be deemed to be ineffective for so long as the conflicting term of the Groundwater Banking JPA Agreement or applicable law remain in effect. Such construction shall not affect the applicability of any other section of these Bylaws.

SECOND AMENDED BYLAWS OF THE GROUNDWATER BANKING JOINT POWERS AUTHORITY

May 3, 2021

PREAMBLE

These Bylaws are provided pursuant to Article 5(E) of the Joint Powers Agreement Between Rosedale-Rio Bravo Water Storage District and Irvine Ranch Water District creating the Groundwater Banking Joint Powers Authority to Develop and Administer a Kern Fan Groundwater Storage Project, effective as of July 1, 2020, as such agreement may be amended or modified from time to time.

1. NAME

The name of this joint powers authority formed pursuant to the Joint Exercise of Powers Act (Government Code section 6500 et seq.) is the Groundwater Banking Joint Powers Authority ("Authority" or "JPA").

2. PURPOSE

The purpose of these bylaws is to describe the processes and procedures of the Authority's governance and administration.

3. MEMBER ENTITIES

The contracting parties to the Groundwater Banking Joint Powers Authority Agreement ("Groundwater Banking JPA Agreement") dated [date] are the member entities of the Groundwater Banking JPA. The contracting parties to the Groundwater Banking JPA Agreement are the Irvine Ranch Water District ("IRWD") and the Rosedale-Rio Bravo Water Storage District ("RRB").

4. BOARD OF DIRECTORS

a. Directors

Directors shall be appointed to the Board of Directors in the manner described in Article 5.A. of the Groundwater Banking JPA Agreement.

b. Alternates

Alternates shall be appointed to serve on the Board of Directors in the manner described in Article 5.A. of the Groundwater Banking JPA Agreement.

5. BOARD MEETINGS

a. Regular Meetings

The Board of Directors shall hold at least one Regular Meeting each year. The date and time of such Regular Meetings shall be set by resolution or ordinance of the Board of Directors at the first meeting of the Board of Directors.

b. **Special Meetings**

The Board of Directors may hold Special Meetings upon providing at least 24 hours' notice.

c. **Adjourned Meetings**

The Board of Directors may adjourn any regular meeting, adjourned regular meeting, special meeting, or adjourned special meeting at any time and to any time and place permissible by law. Adjournment shall not require a quorum of the Board of Directors. If no Director is present at a noticed meeting of the Board of Directors, the [Secretary/General Manager] shall have the authority to adjourn the meeting.

The date, time, and location of the adjourned meeting shall be included on the Notice of Adjournment of any regular meeting, adjourned regular meeting, special meeting, or adjourned special meeting.

d. **Meeting Locations**

Meetings of the Board of Directors shall take place at the main office of RRB, 849 Allen Road, Bakersfield, CA 93390 or IRWD, 15600 Sand Canyon Avenue, Irvine CA 92618, unless otherwise stated on the public notice of the meeting.

Members of the Board of Directors may participate in meetings by teleconference pursuant to the Ralph M. Brown Act ("Brown Act") (Government Code section 54950 et seq.).

e. **Notice and Agenda Procedures**

The Board of Directors shall comply with the Brown Act for meeting agenda and notice requirements.

f. **Quorum**

A quorum of the Board of Directors shall be determined in the manner described in Article 5(C) of the Groundwater Banking JPA Agreement.

g. **Rules of Order**

Action by the Board of Directors requires a unanimous vote consistent with Article 5(D) of the Groundwater Banking JPA Agreement.

h. **Minutes**

Minutes of each meeting of the Board of Directors shall be prepared by the Secretary.

i. **Delegation of Powers**

The Board of Directors may delegate any of its powers except as prohibited in the Groundwater Banking JPA Agreement, these Bylaws, or by law.

j. **Transparency**

All meetings of the Board of Directors shall be conducted in accordance with the Brown Act. While meetings of the Board of Directors are generally open to any member of the public, the Board of Directors may meet in closed session for those reasons expressly allowed under the Brown Act.

The Groundwater Banking JPA shall be subject to the California Public Records Act (Government Code section 6250 et seq.).

6. COMMITTEES

a. **Ad Hoc Committees**

The Groundwater Banking JPA Board of Directors may appoint one or more ad hoc committees.

b. To the extent that the Brown Act applies to Authority committees, committee members may participate in committee meetings by teleconference pursuant to the Brown Act.

7. OFFICERS

a. **General Manager**

The General Manager shall be appointed by the Board of Directors in the manner described in Article 6 of the Groundwater Banking JPA Agreement. The General Manager and any designees shall administer planning, construction and operation of the Kern Fan Project.

The Kern Fan JPA Board of Directors shall adopt one or more policies delegating certain authority to the General Manager.

b. **Treasurer**

The Treasurer shall be appointed by the Board of Directors in the manner described in Article 7 of the Groundwater Banking JPA Agreement. The Treasurer and any designees shall administer the Groundwater Banking JPA's financial management function.

The Groundwater Banking JPA Board of Directors shall adopt one or more policies delegating certain authority to the Treasurer.

c. **Legal Counsel**

The Legal Counsel shall be appointed by the Board of Directors in the manner described in Article 9 of the Groundwater Banking JPA Agreement.

d. **Secretary**

The Legal Counsel shall serve as Secretary pursuant to Article 9 of the Groundwater Banking JPA Agreement. The Secretary or any designees shall maintain the official records of the Groundwater Banking JPA, including Board meeting minutes.

e. **Resignation of Officers**

Officers may resign from their position at any time by providing the Board of Directors with written notice of their intention to resign. Such written notice should include an effective date of the resignation. The effectiveness of resignation shall not require written notice.

f. **Designation of Responsibilities**

Both the General Manager and the Treasurer, may from time to time, designate and assign a portion or all of their responsibilities to an individual to act on their behalf to carry out their respective duties and obligations related to the Kern Fan Project. The designee shall act with full authority on matters undertaken on the General Manager or Treasurer's behalf. The designee shall be accountable to the Groundwater Banking JPA Board of Directors, the General Manager and Treasurer and other Officers. The designee shall continue to act on behalf of the General Manager or Treasurer until revoked, which shall be effective upon notice given verbally or in writing by the General Manager or Treasurer as to their respective designees. A writing may include, but is not limited to electronic mail (e-mail).

8. STAFF

Pursuant to Article 10 of the Groundwater Banking JPA Agreement, upon formation of the Groundwater Banking JPA, the Board of Directors shall negotiate shared staff services agreements with RRB and IRWD specifying the hourly rates at which RRB or IRWD staff will provide services to the Groundwater Banking JPA. The Board of Directors shall approve and enter into one or more shared staff services agreement(s) with RRB and IRWD for planning, design, construction and operation of the Kern Fan Project.

9. PROFESSIONAL SERVICES

a. **Legal Services**

The Board of Directors shall have the sole authority to enter into contracts for legal services on behalf of the Groundwater Banking JPA. This power may not be delegated, regardless of the amount of the contract and any spending authority vested in any Officer [or Staff] of the Groundwater Banking JPA.

b. **Audit Services**

The Board of Directors shall select an Auditor in the manner provided by law.

10. FINANCE

a. **Grant Compliance**

The Board of Directors shall delegate responsibility for monitoring compliance with all applicable grant funding obligations to a compliance officer. The compliance officer may be a member of RRB or IRWD staff.

b. **Member Funding**

(1) **Equal Funding Principle**

The general principle governing member funding of the Groundwater Banking JPA is that RRB and IRWD shall fund equally (50-50) the costs to form the Groundwater Banking JPA, the costs to apply for and to obtain grant funding for the Kern Fan Project, and the costs to administer, design, construct and operate the Kern Fan Project and the Authority to meet all of its objectives, including all obligations arising from acceptance of grant funding for the Kern Fan Project.

RRB and IRWD have incurred various expenses in connection with the Kern Fan Project. Specifically, prior to formation of the Groundwater Banking JPA, RRB and IRWD each incurred costs to apply for and to obtain grant funding for the Kern Fan Project, to initiate California Environmental Quality Act ("CEQA") review, to conduct studies on the feasibility of constructing and operating Kern Fan Project components, like a new turnout on the Cross Valley Canal, and to complete other tasks facilitating the Kern Fan Project. Additional costs were incurred in the form of staff and legal costs.

Some of these early implementation expenses were governed by the Agreement Between Rosedale-Rio Bravo Water Storage District and Irvine Ranch Water District for Cost Sharing Early Planning Activities for the Kern Fan Groundwater Storage Project ("Early Cost-Share Agreement") while other early implementation expenses were agreed to between RRB and IRWD outside of the Early Cost-Share Agreement.

To the extent that net costs incurred by RRB or IRWD related to these early activities are not equal (50-50), an initial reconciliation of such differences will be made between RRB and IRWD within the first fiscal quarter following the Groundwater Banking JPA's formation. To the extent that any additional costs are incurred by RRB or IRWD from obligations related to the early implementation expenses after the initial reconciliation, RRB and IRWD will make additional reconciliations until all such obligations are satisfied.

(2) **Exceptions By Special Activities Agreements**

The only exception to the general principle of 50-50 cost-share may arise from the Groundwater Banking JPA Board of Directors' approving one or more Special Activities Agreements that provide for RRB or IRWD to participate in or to add a component of the Kern Fan Project pursuant to article 3(d) of the Groundwater Banking JPA Agreement. Any Special Activities Agreement deviating from the 50-50 cost-share principle shall specify how costs associated with the special activities deviate from the 50-

50 cost-share principle, including but not limited to any one-time costs and any ongoing costs.

(3) **Initial Member Funding Contributions to Open Bank Accounts**

Upon formation of the Groundwater Banking JPA, RRB and IRWD each shall contribute $2,500 to the Groundwater Banking JPA, for a total of $5,000, to provide a basis for opening one or more bank accounts for the Groundwater Banking JPA.

(4) ***Ongoing funding for Groundwater Banking JPA operations:***

The Board of Directors shall annually adopt a budget encompassing the reasonably anticipated costs for implementing the Kern Fan Project, plus prudent reserves. The Board of Directors shall require ongoing financial contributions from RRB and IRWD to maintain adequate bank account balances to meet the reasonably anticipated costs for implementing the Kern Fan Project and prudent reserves, after accounting for grant funding. The Board of Directors shall determine the amount and timing of such contributions by resolution.

c. **Audit Interval**

Audits of the Groundwater Banking JPA's finances shall be prepared in the manner described in Article 13 of the Groundwater Banking JPA Agreement. The cost to complete the annual audit of the Groundwater Banking JPA's finances shall be allocated half (50 percent) to RRB and half (50 percent) to IRWD.

11. SPECIAL ACTIVITIES AGREEMENTS

a. Pursuant to article 3(D) of the Groundwater Banking JPA Agreement, either of the Parties may enter into Special Activities Agreements with the Groundwater Banking JPA providing for their independent choices whether to participate in or to add a component of the Kern Fan Project or to allow use of a Party's capacity in the Kern Fan Project to implement an independent operating program or project with a third party.

b. No Special Activities Agreement may become legally effective without prior unanimous approval of the Groundwater Banking JPA Board of Directors.

c. A Special Activities Agreement may result in a Party having a larger capital investment in Kern Fan Project recharge, storage, recovery or conveyance capacity than the other Party and/or result in a Party achieving greater than 50 percent of the Kern Fan Project recharge, storage or recovery capacity upon implementation of the special activity. A Special Activities Agreement may provide for the creation of a committee under which a Party may exercise proportionally greater voting power over recommendations from the committee to the Groundwater Banking JPA Board of Directors regarding the approval and

administration of the Special Activities Agreement. The committee created by a Special Activities Agreement shall make recommendations to the Groundwater Banking JPA Board of Directors regarding the administration, planning, design, construction, construction management, and operation of the special activity. The Groundwater Banking JPA Board of Directors shall retain its full discretion to modify or reject any recommendation of a committee created by a Special Activities Agreement. No Special Activities Agreement may affect the requirement that all decisions of the Groundwater Banking JPA Board of Directors must be unanimous under Section 6(g) of these Bylaws and Article 5(D) of the Groundwater Banking JPA Agreement. No Special Activities Agreement may affect the provisions for resolving deadlock decisions of the JPA Board of Directors contained in Article 5(D) of Groundwater Banking JPA Agreement and such deadlock provisions would apply to decisions of the Groundwater Banking JPA Board of Directors related to special activities. RRB or IRWD each may carry out their own projects to help integrate the Kern Fan Project with their other projects, including interties with the Stockdale East Project, the Stockdale West Project, and the Strand Ranch Project. Such integration projects do not require a Special Activities Agreement with the Groundwater Banking JPA.

12. INSURANCE

The Groundwater Banking JPA Board of Directors shall determine required insurance coverage that shall be maintained for the Groundwater Banking JPA. The Groundwater Banking JPA Board of Directors retains its full discretion to adopt or reject policies.

13. PROJECT FACILITY OPERATION COSTS

RRB and IRWD shall pay operations, maintenance, energy and replacement ("OME&R") costs consistent with their respective proportional use of the Kern Fan Project facilities and any facilities constructed under Special Activities Agreements governing the Parties' independent choices whether to participate in or to add a component of the Kern Fan Project as follows:

a. Variable OME&R costs include, but are not limited to, energy costs and other costs that are attributable to the use of Kern Fan Project facilities (including wear and tear) and shall be paid pro rata based on actual use of Kern Fan Project facilities by RRB or IRWD.

b. Fixed OME&R costs include, but are not limited to, any costs on Kern Fan Project land or facilities that are incurred irrespective of use of such land or facilities, and shall be shared equally between the Parties , or as otherwise agreed in a Special Activities Agreement.

c. RRB and IRWD shall equally split the OME&R costs associated with the public benefits or ecosystem account associated with participating in the WSIP that are not grant-funded, such as the recharge and recovery operations that are necessary to meet the project's ecosystem public benefits requirements.

RRB and IRWD shall each pay half of the Groundwater Banking JPA's costs for its insurance coverage, its annual financial audit, and its use of legal counsel. JPA insurance,

audit and/or legal counsel costs attributable to a Special Activity shall be paid by the Special Activity participant(s) proportional to their respective percentage interest in the Special Activity, as defined in the relevant Special Activities Agreement.

14. TERMINATION

a. **Distribution of Assets**

To implement article 1(A) of the Groundwater Banking JPA Agreement, the Parties shall meet and confer prior to eighteen (18) months before expiration of the Agreement's initial term to determine whether the Agreement will be extended. The Parties may continue to meet and confer during the last eighteen (18) months of the Agreement's initial term. If within six (6) months before expiration of the Agreement's initial term the Parties have failed to reach agreement on extending the Agreement's initial term or integrating the Kern Fan Project facilities into one or more other existing water storage and recovery programs or projects, then the Parties shall implement the Groundwater Banking JPA Agreement's provisions for Disposition of Kern Fan Project Property, Facilities and Other Assets Upon Termination.

b. To implement articles 1(A) and 1(B) of the Groundwater Banking JPA Agreement, the Parties shall comply with the following rules:

i. At least six (6) months before expiration of the Groundwater Banking JPA Agreement's term, and within one year after providing any advance written notice of intent to terminate the Groundwater Banking JPA Agreement early, RRB shall deliver to IRWD either a notice exercising RRB's first right to acquire IRWD's interest in all Kern Fan Project facilities, capacities and real or personal property held by the Groundwater Banking JPA or written confirmation that RRB elects not to exercise its first right to acquire IRWD's interest in all Kern Fan Project facilities, capacities and real or personal property held by the Groundwater Banking JPA. Any RRB notice exercising its first right to acquire shall comply with the valuation rules specified in article 1(B) of the Groundwater Banking JPA Agreement.

ii. If RRB confirms in writing its election not to exercise its first right to acquire IRWD's interest in all Kern Fan Project facilities, capacities and real or personal property held by the Authority, or fails to provide such written confirmation within the time constraints above, then article 1(B) of the Groundwater Banking JPA Agreement provides that IRWD may hold its interest or sell its interest to a mutually acceptable third party. Upon IRWD notifying RRB of a proposed third-party buyer for IRWD's interest in the Kern Fan Project, RRB shall have 180 days to deliver its approval or rejection of IRWD's proposal, unless the Parties mutually agree in writing to extend the 180-day period. If RRB fails to affirmatively approve or reject IRWD's proposal within 180 days or any mutually agreed time extension, IRWD's proposal shall be deemed approved by RRB.

15. AMENDMENTS

The Board of Directors may adopt, amend, or repeal any section of these Bylaws, except insofar as such a change would conflict with the Groundwater Banking JPA Agreement.

16. RECORDS AND REPORTS

a. **Maintenance of Records**

Records of the Groundwater Banking JPA shall be maintained at the principal places of business of the member agencies, Kern Fan Project facilities, and any other facility designated by the Board of Directors, Officers, or Staff. In addition to maintaining financial accounting and other records, the Groundwater Banking JPA shall maintain at least the following water accounting records for the Kern Fan Project:

i. Amount of water delivered for recharge by each Party and the source of all water delivered for recharge;

ii. Amount of stored water to provide ecosystem public benefits;

iii. Amount of IRWD stored water; and

iv. Amount of RRB stored water.

b. **Public Records**

Requests for the inspection of any public record maintained by the Groundwater Banking JPA shall be handled in accordance with the California Public Records Act (Government Code section 6250 et seq.).

c. **Inspection Rights of Directors and Members**

Directors and designated representatives of the member agencies shall have an absolute right to inspect the records of the Groundwater Banking JPA with reasonable notice to the Groundwater Banking JPA. Any records determined to be confidential by the Groundwater Banking JPA, in consultation with its Legal Counsel, may be designated as such and may be reviewed subject to the execution of a non-disclosure agreement; the review of confidential documents by directors and designated representatives shall not act as a waiver of any applicable privileges.

d. **Fiscal Year**

The Fiscal Year of the Groundwater Banking JPA shall begin on July 1st of each calendar year and close on June 30th of each calendar year.

17. CONSTRUCTION

Any section of these Bylaws that is determined to be inconsistent with any term of the Groundwater Banking JPA Agreement or any applicable law shall be deemed to be ineffective for so long as the conflicting term of the Groundwater Banking JPA Agreement

or applicable law remain in effect. Such construction shall not affect the applicability of any other section of these Bylaws.

May 3, 2021
Prepared by: Rob Jacobson
Agenda Item: 4d

Recommendation for Insurance Coverage

DISCUSSION:

Section 12 of the Bylaws of the GBJPA states that the Finance Committee will recommend to the Board required insurance coverages for the JPA. The GBJPA Joint Powers Agreement includes a requirement for a general liability insurance policy with minimum coverage of $5 million, as well as fidelity bonds for the General Manager, Treasurer and Assistant Treasurer.

Alliant Insurance Services contacted multiple providers for required general liability and bonding policies. Based on Alliant's search, the Association of California Water Agencies – Joint Powers Insurance Authority (ACWA-JPIA) provided the most competitive general liability coverage with an annual premium of $750, with a commitment for three years of coverage. The proposed policy includes liability coverage for public officials. Coverage is pending the GBJPA's acceptance as an ACWA member which is expected to occur at the June 4, 2021 ACWA Board meeting.

Hartford is the recommended provider for bonding with $250,000 coverage each for the General Manager, Treasurer and Assistant Treasurer. The total cost for bonding is estimated at $3,000 per year.

Appointment of ACWA-JPIA Director:

The Joint Powers Agreement creating the ACWA-JPIA provides for each Member Agency to appoint a Director and Alternate Director. The appointed Director must be a member of the Member Agency's governing board and the Alternate Director may be on the governing board or an officer of the Member Agency. Staff recommends that the Board appoint a Director and Alternate Director to a represent the Groundwater Banking Joint Powers Authority when the policy is issued.

RECOMMENDATION:

That the Board approve the proposed general liability insurance policy with ACWA-JPIA and bonding coverage with Hartford and appoint a Director and Alternate Director to a represent the Groundwater Banking Joint Powers Authority on the Board of Directors of the ACWA-JPIA.

LIST OF EXHIBITS:

None.

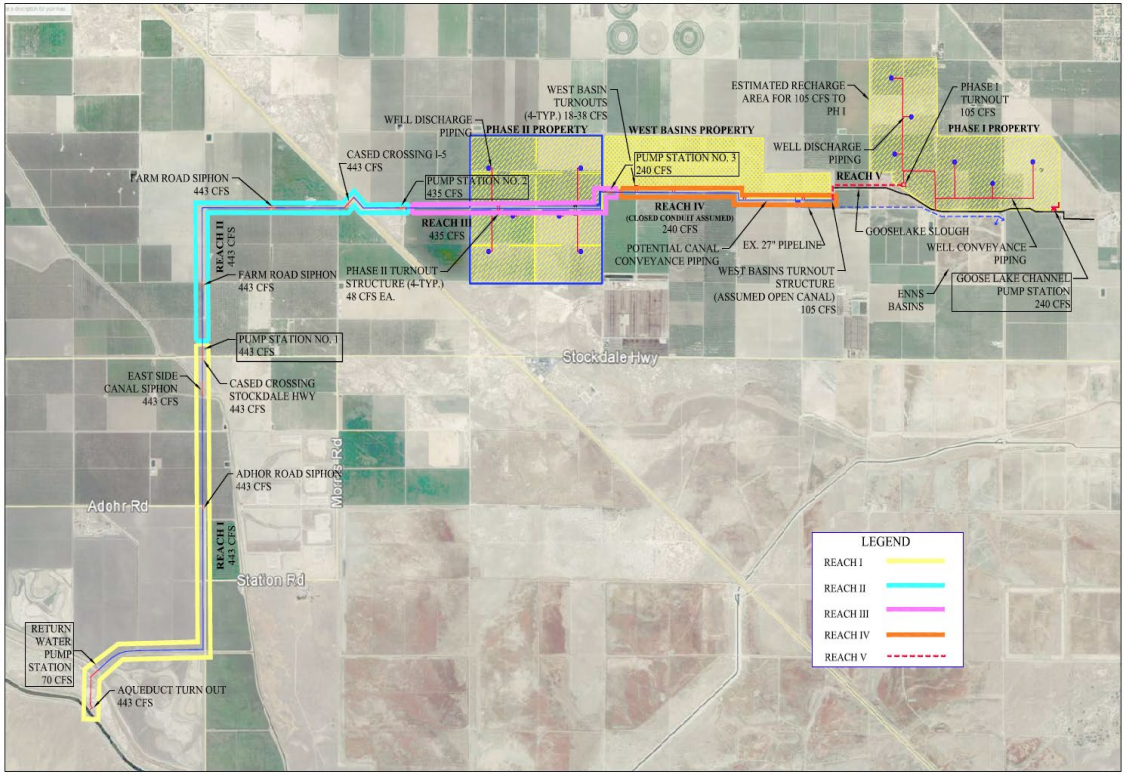
GBJPA
Groundwater Banking
Joint Powers Authority

Kern fan groundwater storage project

Design, Engineering, ROW Acquisition, and Construction Team
Dan Bartel (Staff)
Ray Bennet (Staff)
Markus Nygren (Staff)
Curtis Skaggs (Consultant)
Bill Zeiders (Consultant)

On Behalf of Groundwater Banking Joint Powers Authority
849 Allen Road
Bakersfield, CA 93314

Technical memoranda



Purpose of Technical Memoranda

- Document the previously developed preliminary design work provided by Dee Jaspar & Associates, Inc. as part of the Grant Application processes.
- Incorporate RRBWSD and IRWD design, construction, and operational experience into the Design Process.
- Provide a forum for agreement by the District's on design decisions prior to the hard engineering design process.
- Perform Value Engineering as previously discussed by both District's.
- Provide thorough project documentation of JPA expectations to be used for the RFP and final design purposes.

Technical memoranda

Priority 1	Status
1. Project Phasing and Design / Contractor Selection	JPA Approved
2. Conveyance Capacity Requirements	JPA Approved
3. Pipeline Requirements	JPA Approved
4. Pump Station Requirements	Committee Approved
Priority 2	
5. Geotechnical Report	Committee Approved
6. Conveyance and Turnout Requirements	Committee Approved
7. Well Drilling and Equipping Requirements	Committee Approved
8. ROW Acquisitions	50%
Priority 3	
9. Recharge Basin Requirements	10%
10. Facility Operation and SCADA Requirements	10%
11. Engineer's Estimate	10%

Tm#6 – conveyance and turnout requirements

GBJPA

Purpose

To evaluate conveyance facility alternatives for open canal or pipeline including canal lining alternatives, capital costs, and operations & maintenance costs over a fifty-year period.

Alternatives Considered:

1. Earth Lined Canal
   - 1a. Earth Lined Canal with Return Water Pipeline
   - 1b. Earth Lined Canal with Bentonite Lining

2/3. Poly Lined Canal
   - 2. High Density Polyethylene (HDPE)
   - 3. Reinforced Polyethylene (RPE)

4. Shotcrete Lined Canal

5. Concrete Lined Canal

6. Conveyance Pipeline

Summary of Conveyance Alternatives

Ranking by Present Worth	Alternative No.	Alternative	Earthwork & Conveyance Facility Costs[2]	Pump Station Costs[3]	Right-of-Way Costs[4]	Lining Cost or Earth Canal Option Costs[5]	Total Conveyance Cost w/ Pump Stations[6]	Present Worth on 50 Yr Basis[7]
1	6	Pipeline	$62,242,300	$13,383,200	$3,750,000	NA	$79,375,500	$182,191,000
2	1a	Earth Lined w/Return Pipeline	$22,193,716	$28,945,000	$5,625,000	$10,519,000	$67,282,716	$188,594,201
3	2/3	HDPE/RPE Lined	$20,750,355	$28,945,000	$5,000,000	$5,596,190	$60,291,545	$190,764,330
4	4	Shotcrete Lined	$20,750,355	$28,945,000	$5,000,000	$14,818,490	$69,513,845	$191,170,614
5	5	Concrete Lined	$20,750,355	$28,945,000	$5,000,000	$16,001,690	$70,697,045	$191,481,030
6	1	Earth Lined[1]	$22,193,716	$28,945,000	$5,625,000	NA	$56,763,716	$197,012,451
7	1b	Earth Lined w/Bentonite Liner	$22,193,716	$28,945,000	$5,625,000	$15,135,216	$71,898,932	$202,678,919

[1]Earth Lined canal does not include a lining. There is additional earthwork and associated costs which are included under "Earthwork & Conveyance Facility Costs".

[2]Earthwork and conveyance costs based upon Tables 1 - 4 and include earthwork, facility relocations, fencing, spillways, and road crossings.

[3]Pump Station costs based on those developed in TM #4 plus a 15% contingency to account for unknowns and PG&E electrical service costs.

[4]Right-of-way costs estimated at $25,000 per acre.

[5]Costs from the liner alternatives evaluation in Sections III thru VI

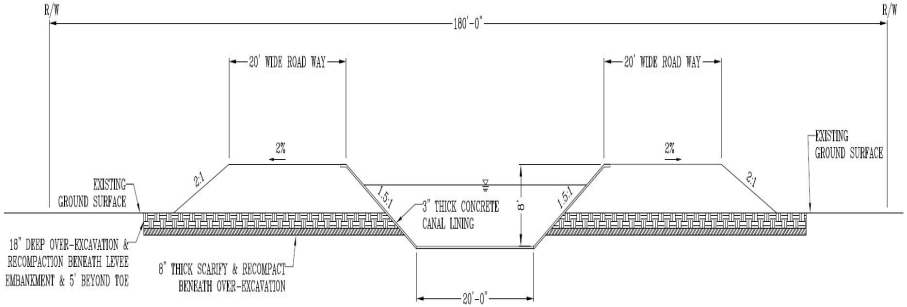
[6]Total conveyance cost includes earthwork & conveyance facilities, pump stations, R/W, and linings.

[7]Present worth analysis based on 50 year period - see Exhibit C for spreadsheets.

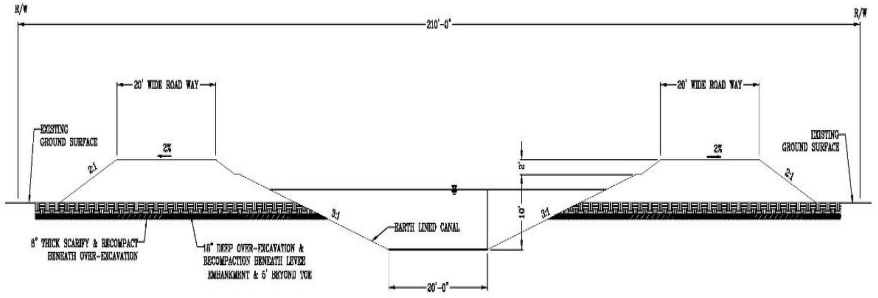
OPEN CANAL ALTERNATIVES

Description

- Conveyance alignment estimated as 46,400-ft or 8.80 miles in length. Extends from end of Aqueduct Turnout Piping to the east end of the RRBWSD West Basins.
- Lined canal options have an estimated cross section with 20 -ft wide bottom, 1.5:1 side slopes, and 8ft depth.
- Lined canal right-of-way estimated as 180-ft width and approximately 200 acres. Land costs estimated at $25,000 per acre for a total cost of $5,000,000.
- Unlined canal option has an estimated cross section with 20 -ft wide bottom, 3:1 side slopes, and 10-ft depth.
- Unlined canal right-of-way estimated as 210-ft width and approximately 225 acres. Land costs estimated at $25,000 per acre for a total cost of $5,625,000.



Typical Lined Canal Cross-Section



Typical Unlined Canal Cross-Section

OPEN CANAL ALTERNATIVES

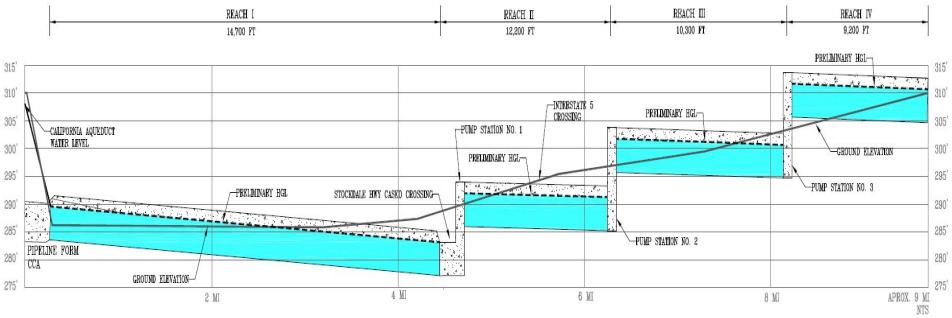
Description

- Canal earthwork volumes for 1.5:1 side slope cross section estimated at 244,227 cy cut and 716,381 cy fill. Total earthwork cost estimate for clearing and grubbing, subgrade preparation, cut/fill, and levee embankment construction is $5,705,205.

- Canal cost estimate for 1.5:1 side slopes, excluding canal linings, pump stations, and R/W is approximately $20,750,355. This cost includes earthwork, facility relocations, safety features, road surfacing, fencing, road crossings, emergency spillways, and transition structures.

- Canal earthwork volumes for 3:1 side slope cross-section estimated at 472,615 cy cut and 783,801 cy fill. Total earthwork cost estimate for clearing and grubbing, subgrade preparation, cut/fill, and levee embankment construction is $7,148,566.

- Canal cost estimate for 3:1 side slopes, excluding canal linings, pump stations, and R/W is approximately $22,193,716. This cost includes earthwork, facility relocations, safety features, road surfacing, fencing, road crossings, emergency spillways, and transition structures.



Preliminary Canal Profile

Earth lined canal capital

GBJPA

Earth Lined Canal

- Capital Cost

  Estimated = $56,763,716
  R/W = $5,625,000
  Canal Conveyance = $22,193,716
  Pump Stations (4) = $28,945,000

- Seepage Losses (Recovery)

  - Return 50,000 ac-ft in a dry year
  - Estimate 30% seepage losses
  - Requires 16 wells at 6cfs each
  - Estimated O&M of $4,902,912.00

- Advantages
  - Capital cost

- Disadvantages
  - Seepage losses particularly when recovering water for return to Aqueduct
  - Increased canal maintenance
    Levee monitoring for rodent holes & erosion
    Weed control
    Removal of sediment and debris

Earth Lined Canal w/Return Water Pipeline

- Capital Cost

  Estimated = $67,282,716
  R/W = $5,625,000
  Canal Conveyance = $22,193,716
  Pump Stations (4) = $28,945,000
  Pipeline (45,000-ft – 54") = $10,519,000

- Seepage Losses (Recovery)

  - Return 50,000 ac-ft in a dry year
  - Estimate 0% seepage losses
  - Requires 12 wells at 6cfs each
  - Estimated O&M of $3,677,184.00

- Advantages
  - Eliminates seepage losses

- Disadvantages
  - Increased canal maintenance
    Levee monitoring for rodent holes & erosion
    Weed control
    Removal of sediment and debris

Earth Lined Canal w/Bentonite Lining

- Capital Cost

  Estimated = $71,898,932
  R/W = $5,625,000
  Canal Conveyance = $22,193,716
  Pump Stations (4) = $28,945,000
  Clay Lining = $15,135,216

- Seepage Losses (Recovery)

  - Return 50,000 ac-ft in a dry year
  - Estimate 15% seepage losses
  - Requires 14 wells at 6cfs each
  - Estimated O&M of $4,290,048.00

- Advantages
  - Reduces seepage losses

- Disadvantages
  - Increased canal maintenance
    Levee monitoring for rodent holes & erosion
    Weed control
    Removal of sediment and debris

Earth lined canal - o&m

Earth Lined Canal

- O&M Costs – 50 year basis

  PW Operations Costs estimated = $140,248,735
  Recovery Well Pumping Costs (Dry Years)
  Canal Operations Costs (Idle, Wet, Dry)
  Pump Station Replacement Costs (Every 25yrs)

- Idle Year (5 out of 10 years)
  - Approximately $138k per year inflated at 3% per year.
  - Cost includes field staff time, equipment cost, weed control, rodent control, maintenance, and PG&E standby costs.

- Dry Year (3 out of 10 years)
  - Recovery well pumping costs for 16 wells at $4,902,912 and inflated at 3% per year.
  - Canal operation costs and PG&E costs for 12 months.

- Wet Year (2 out of 10 years)
  - Canal operation costs, PG&E costs, and DWR Conveyance costs for 4 months plus 8 months idle costs.

Earth Lined Canal w/Return Water Pipeline

- O&M Costs – 50 year basis

  PW Operations Costs estimated = $121,311,485
  Recovery Well Pumping Costs (Dry Years)
  Canal Operations Costs (Idle, Wet, Dry)
  Pump Station Replacement Costs (Every 25yrs)

- Idle Year (5 out of 10 years)
  - Approximately $138k per year inflated at 3% per year.
  - Cost includes field staff time, equipment cost, weed control, rodent control, maintenance, and PG&E standby costs.

- Dry Year (3 out of 10 years)
  - Recovery well pumping costs for 12 wells at $3,677,184 and inflated at 3% per year.
  - Canal operation costs and PG&E costs for 12 months.

- Wet Year (2 out of 10 years)
  - Canal operation costs, PG&E costs, and DWR Conveyance costs for 4 months plus 8 months idle costs.

Earth Lined Canal w/Bentonite Lining

- O&M Costs – 50 year basis

  PW Operations Costs estimated = $130,779,987
  Recovery Well Pumping Costs (Dry Years)
  Canal Operations Costs (Idle, Wet, Dry)
  Pump Station Replacement Costs (Every 25yrs)

- Idle Year (5 out of 10 years)
  - Approximately $138k per year inflated at 3% per year.
  - Cost includes field staff time, equipment cost, weed control, rodent control, maintenance, and PG&E standby costs.

- Dry Year (3 out of 10 years)
  - Recovery well pumping costs for 14 wells at $4,290,048 and inflated at 3% per year.
  - Canal operation costs and PG&E costs for 12 months.

- Wet Year (2 out of 10 years)
  - Canal operation costs, PG&E costs, and DWR Conveyance costs for 4 months plus 8 months idle costs.

lined canal Options– capital

GBJPA

Poly Lined Canal

- Capital Cost

  Estimated = $60,291,545
  R/W = $5,000,000
  Canal Conveyance = $20,750,355
  Pump Stations (4) = $28,945,000
  Poly Lining = $5,596,190

- Advantages
  - Eliminates seepage losses
  - Improved hydraulic properties
  - Ease of installation

- Disadvantages
  - Subject to UV and wind damage
  - Subject to damage by animals
  - Subject to rodent damage
  - Difficult to clean without damaging
  - Subject to cost volatility based on petroleum products and materials

Shotcrete Lined Canal

- Capital Cost

  Estimated = $69,513,845
  R/W = $5,000,000
  Canal Conveyance = $20,750,355
  Pump Stations (4) = $28,945,000
  Shotcrete Lining = $14,818,490

- Advantages
  - Eliminates seepage losses
  - Good durability
  - Long useful life

- Disadvantages
  - Requires skilled construction personnel including certified nozzleman.
  - Requires significant quality control measures for rebound, thickness, and uniformity.
  - Less durable than conventional concrete.
  - Subject to damage from settlement, shrinkage, and hydrostatic pressure.

Concrete Lined Canal

- Capital Cost

  Estimated = $70,697,045
  R/W = $5,000,000
  Canal Conveyance = $20,750,355
  Pump Stations (4) = $28,945,000
  Concrete Lining = $16,001,690

- Advantages
  - Eliminates seepage losses
  - Good durability
  - Long useful life

- Disadvantages
  - High capital cost
  - Subject to damage from settlement, shrinkage, and hydrostatic pressure

lined canalOptions- o&m

Poly Lined Canal

- O&M Costs

  PW Operations Costs estimated = $130,472,785
  Recovery Well Pumping Costs (Dry Years)
  Canal Operations Costs (Idle, Wet, Dry)
  Pump Station Replacement Costs (Every 25yrs)
  Liner Replacement (Patches every 5yrs and complete liner replacement every 20 yrs)

- Idle Year (5 out of 10 years)
  - Approximately $70k per year inflated at 3% per year.
  - Cost includes field staff time, equipment cost, weed control, rodent control, maintenance, and PG&E standby costs.

- Dry Year (3 out of 10 years)
  - Recovery well pumping costs for 12 wells at $3,677,184 and inflated at 3% per year.
  - Canal operation costs and PG&E costs for 12 months.

- Wet Year (2 out of 10 years)
  - Canal operation costs, PG&E costs, and DWR Conveyance costs for 4 months plus 8 months idle costs.

Shotcrete Lined Canal

- O&M Costs

  PW Operations Costs estimated = $121,656,769
  Recovery Well Pumping Costs (Dry Years)
  Canal Operations Costs (Idle, Wet, Dry)
  Pump Station Replacement Costs (Every 25yrs)
  Liner Replacement (Repairs every 3 yrs)

- Idle Year (5 out of 10 years)
  - Approximately $70k per year inflated at 3% per year.
  - Cost includes field staff time, equipment cost, weed control, rodent control, maintenance, and PG&E standby costs.

- Dry Year (3 out of 10 years)
  - Recovery well pumping costs for 12 wells at $3,677,184 and inflated at 3% per year.
  - Canal operation costs and PG&E costs for 12 months.

- Wet Year (2 out of 10 years)
  - Canal operation costs, PG&E costs, and DWR Conveyance costs for 4 months plus 8 months idle costs.

Concrete Lined Canal

- O&M Costs

  PW Operations Costs estimated = $120,783,985
  Recovery Well Pumping Costs (Dry Years)
  Canal Operations Costs (Idle, Wet, Dry)
  Pump Station Replacement Costs (Every 25yrs)
  Liner Replacement (Repairs every 5 yrs after 15 years)

- Idle Year (5 out of 10 years)
  - Approximately $70k per year inflated at 3% per year.
  - Cost includes field staff time, equipment cost, weed control, rodent control, maintenance, and PG&E standby costs.

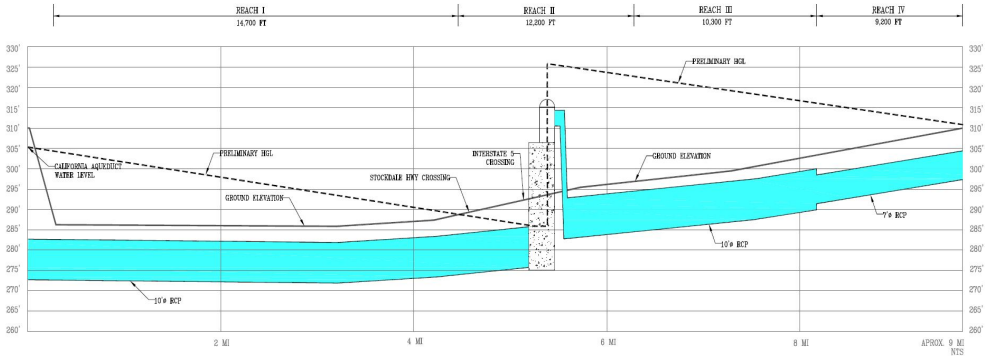
- Dry Year (3 out of 10 years)
  - Recovery well pumping costs for 12 wells at $3,677,184 and inflated at 3% per year.
  - Canal operation costs and PG&E costs for 12 months.

- Wet Year (2 out of 10 years)
  - Canal operation costs, PG&E costs, and DWR Conveyance costs for 4 months plus 8 months idle costs.

pipeline ALTERNATIVE

Description

- Conveyance alignment estimated as 46,400-ft or 8.80 miles in length. Extends from end of Aqueduct Turnout Piping to the east end of the RRBWSD West Basins.
- Estimated 10-ft Diameter RCP Pipeline for canal equivalents of Reach 1, 2, and 3, and a 7-ft diameter RCP Pipeline for Reach 4.
- Pipeline right-of-way estimated as 140-ft width and approximately 150 acres. Land costs estimated at $25,000 per acre for a total cost of $3,750,000.
- Single pump station and bypass with an estimated cost of $13,383,200.
- Pipeline alternative allows for smaller R/W, less obtrusive to property owners, less maintenance, 1 pump station versus 3, and ability to float off static water level in Aqueduct at Pump Station.



Typical Pipeline Profile

Pipeline alternative

Pipeline – Capital Costs

- Estimated = $79,375,500

  R/W = $3,750,000
  Pipeline Conveyance = $58,964,900
  Road Crossings = $3,277,400
  Pump Station & Bypass = $13,383,200

- Advantages
  - Smaller R/W than canal
  - Less obtrusive to property owners
  - Less maintenance than canal
  - One pump station instead of three for canal
  - Ability to float off static water level or operating water surface of California Aqueduct up to the Pump Station which eliminates risk of flooding if slide gate fails or a levee embankment breaches.

- Disadvantages
  - Higher capital cost than a canal
  - Higher energy costs due to friction head

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Pipeline – O&M Costs

- PW Operations Costs estimated = $102,815,500

  Recovery Well Pumping Costs (Dry Years)
  Pipeline Operations Costs (Idle, Wet, Dry)
  Pump Station Replacement Costs (Every 25yrs)

- Idle Year (5 out of 10 years)
  - Approximately $35k per year inflated at 3% per year.
  - Cost includes field staff time, equipment cost, general maintenance, and PG&E standby costs.

- Dry Year (3 out of 10 years)
  - Recovery well pumping costs for 12 wells at $3,677,184 and inflated at 3% per year.
  - Pipeline operation costs and PG&E costs for 12 months.

- Wet Year (2 out of 10 years)
  - Pipeline operation costs, PG&E costs, and DWR Conveyance costs for 4 months plus 8 months idle costs.

summary

Summary of Conveyance Alternatives

Ranking by Present Worth	Alternative No.	Alternative	Earthwork & Conveyance Facility Costs[2]	Pump Station Costs[3]	Right-of-Way Costs[4]	Lining Cost or Earth Canal Option Costs[5]	Total Conveyance Cost w/ Pump Stations[6]	Present Worth on 50 Yr Basis[7]
1	6	Pipeline	$62,242,300	$13,383,200	$3,750,000	NA	$79,375,500	$182,191,000
2	1a	Earth Lined w/Return Pipeline	$22,193,716	$28,945,000	$5,625,000	$10,519,000	$67,282,716	$188,594,201
3	2/3	HDPE/RPE Lined	$20,750,355	$28,945,000	$5,000,000	$5,596,190	$60,291,545	$190,764,330
4	4	Shotcrete Lined	$20,750,355	$28,945,000	$5,000,000	$14,818,490	$69,513,845	$191,170,614
5	5	Concrete Lined	$20,750,355	$28,945,000	$5,000,000	$16,001,690	$70,697,045	$191,481,030
6	1	Earth Lined[1]	$22,193,716	$28,945,000	$5,625,000	NA	$56,763,716	$197,012,451
7	1b	Earth Lined w/Bentonite Liner	$22,193,716	$28,945,000	$5,625,000	$15,135,216	$71,898,932	$202,678,919

[1]Earth Lined canal does not include a lining. There is additional earthwork and associated costs which are included under "Earthwork & Conveyance Facility Costs".

[2]Earthwork and conveyance costs based upon Tables 1 - 4 and include earthwork, facility relocations, fencing, spillways, and road crossings.

[3]Pump Station costs based on those developed in TM #4 plus a 15% contingency to account for unknowns and PG&E electrical service costs.

[4]Right-of-way costs estimated at $25,000 per acre.

[5]Costs from the liner alternatives evaluation in Sections III thru VI

[6]Total conveyance cost includes earthwork & conveyance facilities, pump stations, R/W, and linings.

[7]Present worth analysis based on 50 year period - see Exhibit C for spreadsheets.

Recommendations

- Earth lined canal not recommended due to cost, maintenance, and concerns with embankment breaches or rodent holes.
- Poly lined and concrete lined canal alternatives recommended for an open channel. Recommend bid alternates.
- Pipeline option most expensive capital cost, but most economical over 50 year present worth cost basis. This alternative als o eliminates risk associated with slide gate failure at Aqueduct or embankment failure.
- Recommended that in the design phase (once Phase I and II properties are acquired, alignments fixed, and topographical survey ing completed) the design firm perform updated value engineering work for final decision by JPA.

Summary

- Any questions or comments on the items covered or discussed in the two TM's?
- Next Steps…..
- Preparation of RFP/RFQ's
- Currently working on Technical Memorandum #8 – Right of Way Acquisitions
- Will soon begin working to complete the final three memoranda:

  - TM#9 – Recharge Basin Requirements
  - TM#10 – Facility Operation and SCADA Requirements
  - TM#11– Engineer's Estimate

GBJPA

Groundwater Banking
Joint Powers Authority

THANK YOU

DBARTEL@RRBWSD.COM

http://www.kernfanproject.com/

DEE JASPAR & ASSOCIATES, INC.
CONSULTING CIVIL ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CA 93308
PHONE (661) 393-4796
FAX (661) 393-4799

KERN FAN GROUNDWATER STORAGE PROJECT

TECHNICAL MEMORANDUM NO. 6
(Conveyance and Turnout Requirements)

PREPARED FOR: Kern Fan Joint Powers Authority (JPA)
PREPARED BY: Curtis Skaggs, P.E.
DATE: March 25, 2021

SUBJECT: ***Conveyance and Turnout Requirements***

I. Executive Summary

This memorandum serves to consider the conveyance facility alternatives including potential canal lining alternatives, capital costs, and operations and maintenance costs over a fifty-year period. The canal lining alternatives considered herein include:

1. Earth Lined Canal (with mitigation options – see below)
2. High-Density Polyethylene (HDPE) Lined Canal
3. Reinforced Polyethylene (RPE) Lined Canal
4. Shotcrete Lined Canal
5. Concrete Lined Canal

In addition, a pipeline alternative (Alternative No. 6) has also been considered herein.

The outline of the memorandum includes the following:

Section II	Open Channel Canal	Page 8
Section III	Earth Lined Canal (with options)	Page 18
Section IV	Poly Lined Canal (HDPE or RPE)	Page 25
Section V	Shotcrete Lined Canal	Page 29
Section VI	Concrete Lined Canal	Page 31
Section VII	Canal Lining Summary/Present Worth Analysis	Page 33
Section VIII	Pipeline Option	Page 37
Section IX	Turnout Requirements	Page 42
Section X	Summary	Page 44

The conveyance facility will cross recharge facilities, agricultural lands, private property, County roads, Stockdale Highway, and the I-5 Freeway. The conveyance facility is also planned to be utilized in the reverse

direction during recovery operations for returning water to the California Aqueduct.

In order to prepare an Engineer's Estimate for the proposed project, preliminary quantities needed to be estimated. Elevations along the canal alignment were estimated using Google Earth and a preliminary conveyance canal line and grade established. Canal cross-sections and earthwork quantity estimates were prepared for the canal conveyance alignment and are attached in Appendix A and B. The canal alignment, elevations, grades, slopes, and quantities are all estimates and are outlined herein for purposes of showing what the cost estimates are based upon. However, the quantities are merely for purposes of the cost estimate in Technical Memorandum No. 11 and no representations are made beyond that. The actual alignment, elevations, grades, slopes, and quantities may be very different once design information is obtained and layout completed.

Section II of this memorandum provides detail for the conveyance canal facility including the proposed preliminary alignment and canal profile. The conveyance canal is estimated as approximately 8.80 miles long or 46,400-ft. The canal cross-section for the lined canal options is estimated to be 8-ft deep with a 20-ft wide bottom and 1.5:1 side slopes. This section of the memorandum outlines the anticipated earthwork associated with the conveyance canal construction, the estimated earthwork volumes, the estimated right-of-way required, and the conveyance canal features. Tables 1 through 4 therein provide the capital cost estimate for the conveyance facilities while excluding any lining costs, pump station costs, or right-of-way acquisition. The earthwork cost estimate for the above described canal prism is $5,705,205 and the conveyance canal costs as outlined in Table 1 through 4 are estimated at $20,750,355.

Section III of this memorandum considers the earth lined canal and the sub-alternates that include mitigation efforts such as a return water pipeline or bentonite lining. The earth lined canal alternative is estimated to be a 20-ft wide bottom with 3:1 side slopes and an approximate 10-ft depth. This requires additional earthwork and increases the earthwork costs from $5,705,205 to approximately $7,148,566. This in turn increases the conveyance canal costs outlined in Tables 1 through 4 from $20,750,355 to approximately $22,193,716.

Sections IV through VI serve to evaluate the canal lining options such as poly linings, shotcrete lining, and conventional concrete canal lining. The construction methods are discussed therein, the hydraulic impacts are addressed, capital costs for each lining are developed, and the advantages and disadvantages are discussed. The lining capital costs are summarized below:

1. Earth Lined Canal	$NA
1a. Earth Lined Canal with Return Water Pipeline	$10,519,000
1b. Earth Lined Canal with Bentonite Lining	$15,135,216
2/3. Poly Lined Canal - High-Density Polyethylene (HDPE) Lined Canal or Reinforced Polyethylene (RPE) Lined Canal	$5,596,190

4. Shotcrete Lined Canal $14,818,490
5. Concrete Lined Canal $16,001,690

Section VII summarizes the canal lining alternatives and discusses the present worth analysis. Four canal lining alternatives and one pipeline alternative were evaluated:

1. Earth Lined Canal (see mitigation options below)
2/3. Poly Lined Canal - High-Density Polyethylene (HDPE) Lined Canal or Reinforced Polyethylene (RPE) Lined Canal
4. Shotcrete Lined Canal
5. Concrete Lined Canal
6. Conveyance Pipeline

In addition, two additional alternatives were considered as part of mitigation efforts with an earth lined canal:

1a. Earth Lined Canal with Parallel Return Water Pipeline
1b. Earth Lined Canal with Bentonite Lining

The capital costs were considered for each of the above alternatives including earthwork and conveyance facility costs, pump station costs, right-of-way costs, and canal lining costs.

The right-of-way costs are estimated as follows:

> Canal with 1.5:1 Side Slopes – 180 ft Permanent R/W or approximately 200 acres at $25,000 per acre……..…..$5,000,000
>
> Canal with 3:1 Side Slopes – 210 ft Permanent R/W or approximately 225 acres at $25,000 per acre……..$5,625,000
>
> Closed Conduit – 140 ft Permanent R/W or approximately 150 acres at $25,000 per acre……...$3,750,000

The pump station costs for the conveyance canal alternatives include three pump stations along the alignment and a return water pump station. The costs from Technical Memorandum No. 4 "Pump Station Requirements" have been utilized for the pump stations. Pump Station No. 1 and No. 2 are estimated as $8,605,000 each, Pump Station No. 3 is estimated as $6,150,000 and the Return Water Pump Station is estimated as $2,081,000. The total pump station costs are approximately $28,945,000 which includes an approximate 15% contingency to account for unknowns and PG&E service costs.

The capital costs, including earthwork costs, conveyance facilities, pump stations, and right-of-way acquisition (not including lining or mitigation costs), are summarized below:

Earth Lined Alternatives (1, 1a, and 1b)	$56,763,716
Lined Alternatives (2, 3, 4, and 5)	$54,695,355

Section VIII evaluates a pipeline alternative for the conveyance facility. Alternative No. 6 is a conveyance pipeline, however due to the capacity and size of the pipeline, it is a much more significant capital cost. The capital cost for the pipeline, including the pump station, pipeline right-of-way, and road crossing work at Adohr Road, Stockdale Hwy, and the I-5 Fwy, is approximately $79,375,500.00.

In addition, a present worth analysis was performed that considered the well pumping costs during recovery periods, conveyance canal operational costs in an idle year, dry year, and wet year, and also the canal lining replacement costs and pump station replacement costs over a fifty-year (50) period. Below is a summary of the conveyance alternative costs and a ranking based upon a fifty (50) year present worth analysis.

Summary of Conveyance Alternatives

Ranking by Present Worth	Alternative No.	Alternative	Earthwork & Conveyance Facility Costs[2]	Pump Station Costs[3]	Right-of-Way Costs[4]	Lining Cost or Earth Canal Option Costs[5]	Total Conveyance Cost w/ Pump Stations[6]	Present Worth on 50 Yr Basis[7]
1	6	Pipeline	$62,242,300	$13,383,200	$3,750,000	NA	$79,375,500	$182,191,000
2	1a	Earth Lined w/Return Pipeline	$22,193,716	$28,945,000	$5,625,000	$10,519,000	$67,282,716	$188,594,201
3	2/3	HDPE/RPE Lined	$20,750,355	$28,945,000	$5,000,000	$5,596,190	$60,291,545	$190,764,330
4	4	Shotcrete Lined	$20,750,355	$28,945,000	$5,000,000	$14,818,490	$69,513,845	$191,170,614
5	5	Concrete Lined	$20,750,355	$28,945,000	$5,000,000	$16,001,690	$70,697,045	$191,481,030
6	1	Earth Lined[1]	$22,193,716	$28,945,000	$5,625,000	NA	$56,763,716	$197,012,451
7	1b	Earth Lined w/Bentonite Liner	$22,193,716	$28,945,000	$5,625,000	$15,135,216	$71,898,932	$202,678,919

[1]Earth Lined canal does not include a lining. There is additional earthwork and associated costs which are included under "Earthwork & Conveyance Facility Costs".

[2]Earthwork and conveyance costs based upon Tables 1 - 4 and include earthwork, facility relocations, fencing, spillways, and road crossings.

[3]Pump Station costs based on those developed in TM #4 plus a 15% contingency to account for unknowns and PG&E electrical service costs.

[4]Right-of-way costs estimated at $25,000 per acre.

[5]Costs from the liner alternatives evaluation in Sections III thru VI

[6]Total conveyance cost includes earthwork & conveyance facilities, pump stations, R/W, and linings.

[7]Present worth analysis based on 50 year period - see Exhibit C for spreadsheets.

Of the alternatives evaluated herein, the earth lined canal is not considered a good alternative due to concerns with rodent holes and piping failures, liability due to adjacent landowners, and overall increased canal maintenance with weed control, sedimentation, and rodent hole control. In addition, seepage losses are a concern when returning water to the California Aqueduct. In order to mitigate canal seepage when returning water to the Aqueduct, a return water pipeline or bentonite clay liner has been included in the cost. The earth lined canal alternative with a return water pipeline has the lowest present worth among the canal options, however it is not the recommended alternative for the reasons outlined above.

The poly lined and concrete lined alternatives are very similar in present worth over a fifty-year period and either alternative would be a good option for the conveyance canal. The HDPE or RPE canal lining has the best hydraulic properties and is easier to maintain than an earth lined canal. The drawback to the HDPE or RPE canal lining is the estimated useful life of 10 to 20 years for the San Joaquin Valley, however the present worth analysis demonstrates that this is a viable alternative over a fifty-year period. The concrete linings are also economical when evaluating the present worth over a fifty-year period and are more durable when performing canal cleaning and maintenance. Both of these lining systems are quality canal linings and result in a long useful life, however the shotcrete lining requires greater skill and quality control during application.

The pipeline alternative has the most expensive capital cost, however, it does allow for the elimination of a couple of pump stations and lower operations and maintenance expenses, therefore, over a fifty-year life cycle the closed conduit alternative actually becomes economical.

In addition, the pipeline alternative provides the added safety benefit of minimizing risks of levee breaches or flooding in Reach 1 or 2 as a result of the elevated head of the California Aqueduct above those reaches of an open channel. The pipeline alternative could place a single pump station on the east side of the I-5 Freeway which is at an elevation that would allow for it to float off the Aqueduct at the static or operating level of the California Aqueduct.

If the conveyance canal alternative is selected for design then the conventional concrete, shotcrete, and poly liners are all reasonable options as they are very similar in present worth based upon a fifty-year (50) period. In that event it is recommended that the “Conveyance Facilities including Turnouts & Pump Stations” bid package include bid alternates for the three types of canal linings. This will provide competitive pricing for each alternative, account for market fluctuations in material pricing, and allow the JPA to evaluate the lining costs in light of the total overall project costs.

However, the pipeline alternative is the most economical alternative when factoring in the operational, maintenance, and replacement costs over a fifty-year (50) period. In view of the operational and safety benefits, it is recommended that a pipeline alternative be considered in the design phase.

It is recommended that once the Phase I and Phase II properties are acquired, alignments fixed, and topographical survey completed, that the design firm perform updated value engineering work for the conveyance canal verses pipeline alternatives as well as considering hybrid approaches that utilize both reaches of conveyance canal and reaches of pipeline. At that time the JPA can evaluate the capital costs, the present worth, and the benefits of each alternative in making their final decision.

II. Open Channel Canal

A. Constructability/Methods

The primary purpose of this memorandum is to evaluate lining alternatives for the conveyance canal, however there are many other aspects of the project that will contribute to the overall costs of the canal. These include the earthwork, drainage systems (if necessary), transition structures, facility relocations, canal safety features, road surfacing, and fencing.

The conceptual conveyance alignment is shown in Figure 1. This alignment is subject to change as the JPA begins to acquire property and right-of-way.

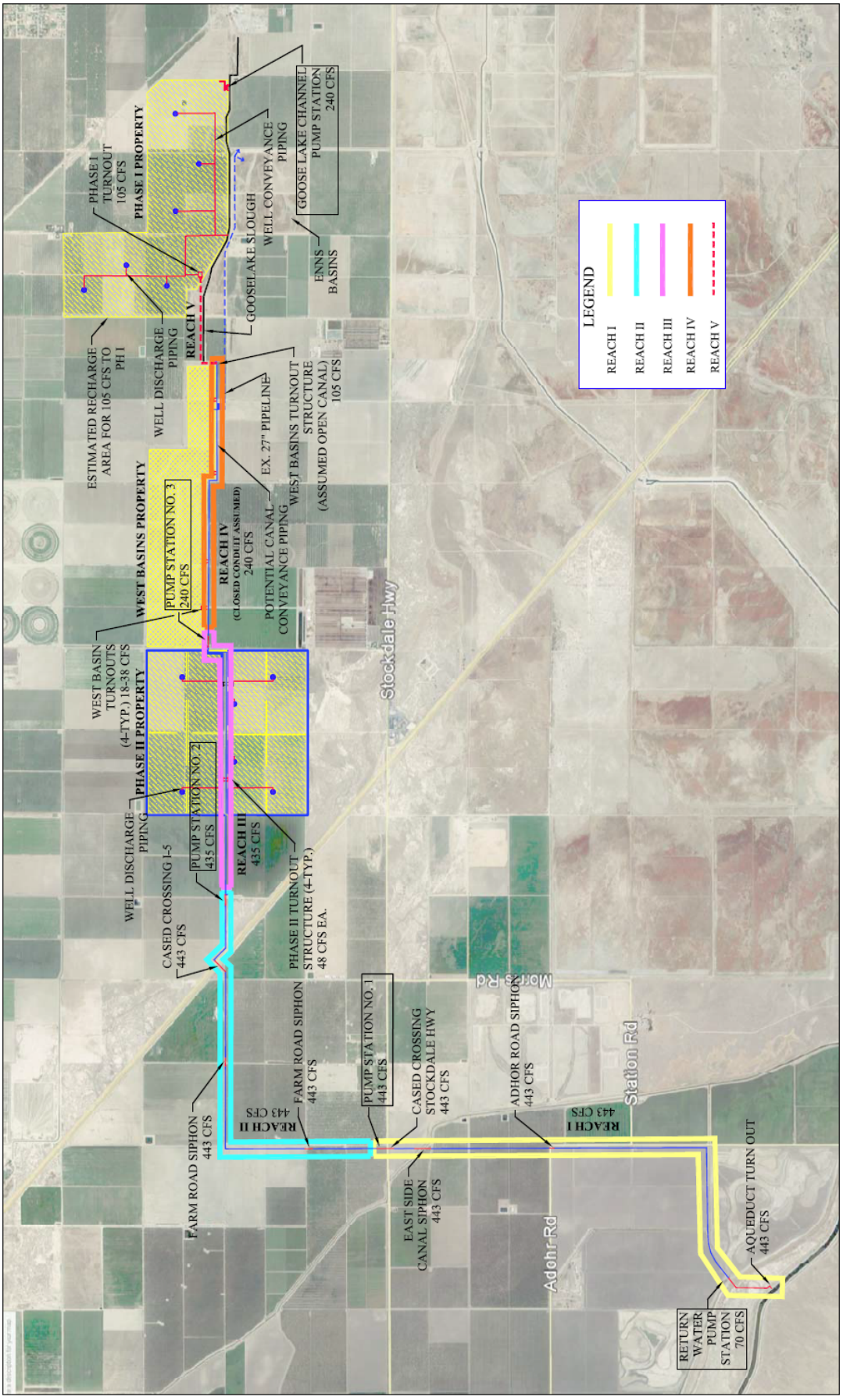


Figure 1: Preliminary Conveyance Alignment

The conceptual canal profile is shown in Figure 2. The elevations, slopes, and cross-sections of the canal are subject to change as well. The design firm will be responsible for value engineering the conveyance design.

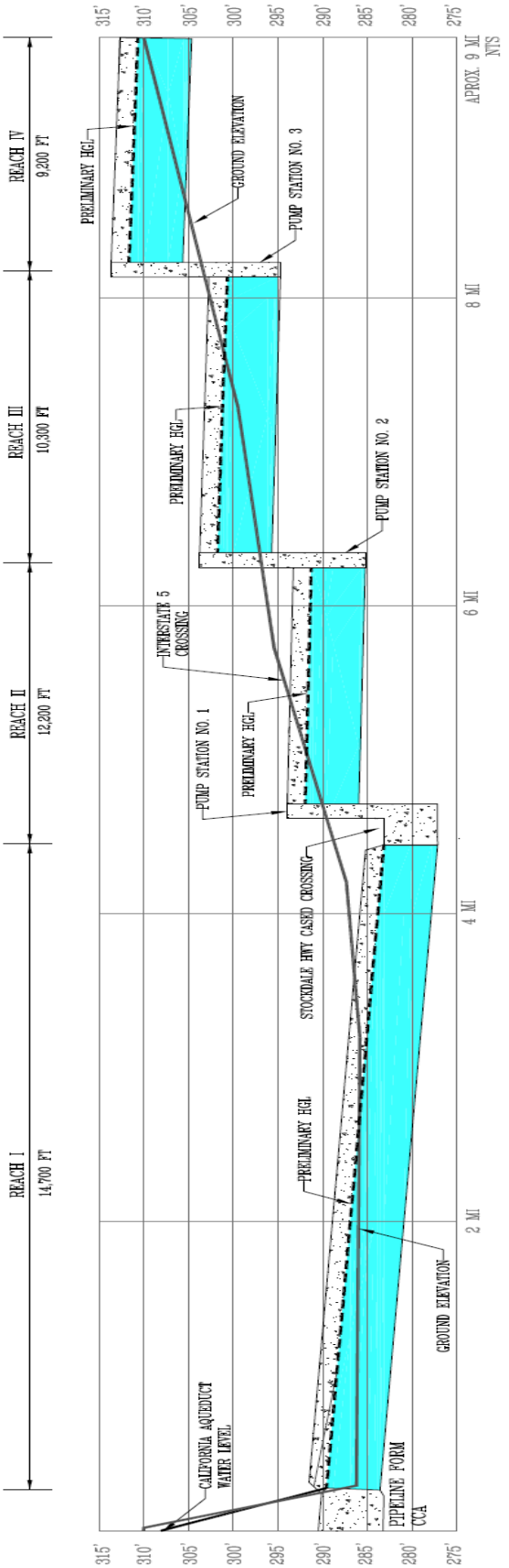


Figure 2: Preliminary Canal Profile

The elevations, slopes, and cross-sections identified herein are preliminary and for purposes of developing the preliminary Engineer's Estimates. These will be finalized during the design phase once the alignment is determined, detailed project surveying is performed, and detailed hydraulic analyses are completed.

Preliminary hydraulic modeling was performed utilizing Hec-Ras 5.0.7. The side slopes of a lined canal are anticipated to be 1.5:1 as originally outlined above. The canal cross-section is estimated as 8-ft deep with a 20-ft wide bottom. The pump stations along the conveyance canal have been estimated to have an approximate 15-ft to 20-ft total dynamic head at each station for the design capacities discussed in Technical Memorandum No. 4 "Pump Station Requirements". An earth-lined canal will have a different cross-section that has been estimated as 10-ft deep with a 20-ft wide bottom and 3:1 side slopes.

The earthwork of the canal will likely require borrow material of a suitable nature as determined by the soils firm and design firm. Potential borrow areas will be identified along the canal alignment and may include existing recharge areas of the Buena Vista Water Storage District, the West Kern Water Storage District, the Kern Water Bank Authority, as well as the Phase II property and the West Basins. The earthwork will involve clearing and grubbing of the right-of-way and the borrow areas. The subgrade will require excavation and re-compaction beneath the canal and the embankment levees. If a canal lining is constructed, the canal final grade must be flat and smooth, dry and free of rocks, rubble, roots, vegetation, debris, voids, protrusions, and any other objects. The earth material for the canal shall not be expansive or dispersive. The soils should have less than 15% finer than a 5 micron sieve so that there is not too much clay but also greater than 20% material finer than a 75 micron sieve so that there are fine sands and silts that provide good cohesion. The canal and levee material are estimated to be compacted to a minimum 90% relative compaction and graded to provide a smooth and uniform surface.

An approximate 180-ft wide permanent right-of-way has been estimated for the conveyance canal alignment and an approximate 260-ft wide temporary right-of-way. The conceptual canal cross-section includes an approximate 20-ft wide access road on each side of the canal for maintenance and operations. In addition, the right-of-way includes space for vehicular access along the outside toe of the exterior levee slopes for maintenance and weed abatement. See the canal cross-section below in Figure 3. This equates to an approximate land acquisition of 200 acres for canal right-of-way (with 1.5:1 side slopes), i.e. 180-ft by 46,400-ft = 8,352,000 sf or 192 acres. The land costs have been estimated at $25,000 per acre.

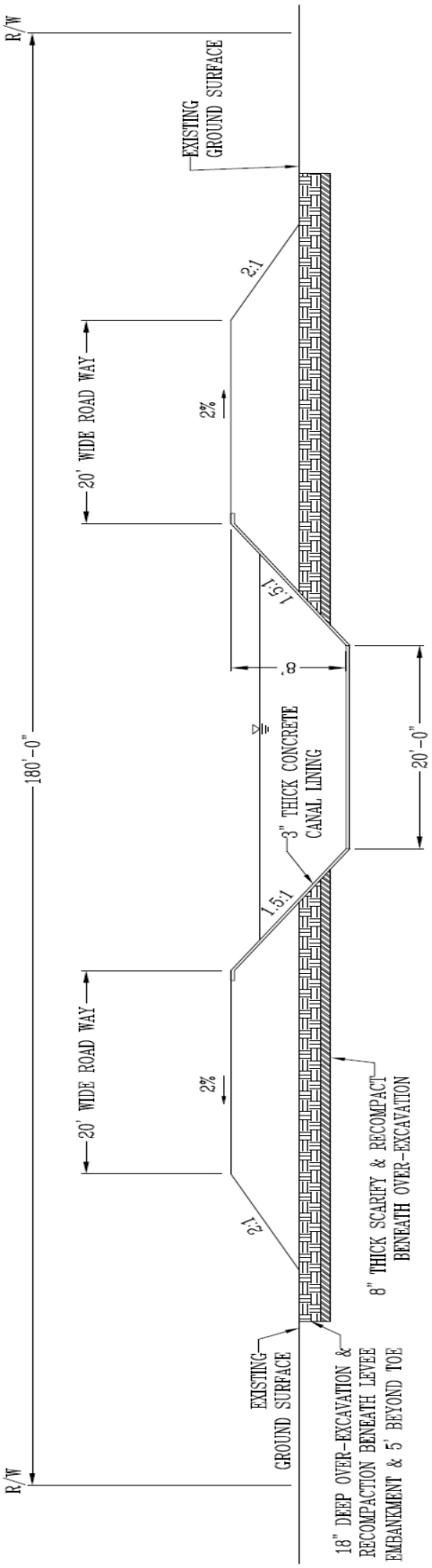


Figure 3: Preliminary Canal Cross-Section with 1.5:1 Side Slopes

Earthwork calculations were performed for the preliminary canal alignment for cost estimating purposes. Cross-sections were prepared for each reach of the lined canal options at approximate 1,000-ft intervals and illustrate the estimated "neat-line" cut and fill area for the conveyance canal and levee embankments/roads. The earthwork volume calculations utilizing the average end area method are attached in Appendix B. The calculations demonstrate the estimated cut and fill volumes for each reach of the canal resulting in a total of 244,227 cubic yards of cut and 716,381 cubic yards of fill for the entire conveyance canal. In addition, calculations for the subgrade preparation (over-excavation and re-compaction beneath the canal and embankments) have been prepared and estimate a "neat-line" volume of 226,189 cubic yards for the entire conveyance canal.

Where areas of the conveyance canal are in cut and adjacent to recharge operations, it may be necessary to install piezometers and a drainage system, add recharge basin setbacks or acquire additional conveyance right-of-way, put limits on recharge when groundwater levels are too shallow, or some combination thereof. The piezometers can be utilized to monitor the groundwater levels to ensure that water levels are maintained below the invert of the canal particularly if the canal is concrete lined. This is due to concerns with damaging concrete panels from a difference in hydrostatic pressure from the back side of the panel to the canal side. The drainage system can also provide mitigation in these situations as it collects water along the backside of the canal liner and allows for it to flow into the canal through a flapper valve if there is a difference in hydrostatic pressure.

It is also anticipated at this time that there will be canal safety features, all-weather road surfacing on the top of embankment levees, and canal fencing. The canal safety features include ladder rungs and safety buoys at the upstream and downstream side of siphon or culvert crossings and pump stations and ladder rungs at approximate quarter-mile distances in long stretches of the canal.

In addition, emergency spillways are recommended in reaches of the canal adjacent to recharge properties where water could be spilled over in the event of pump station problems or other issues. Reach 1 of the canal is well below the California Aqueduct elevation and if the turnout slide gate were to fail or not close it would be problematic. Therefore, it is recommended to provide an emergency spillway in Reach 1 of the canal that could discharge to the Buena Vista Water Storage District recharge basins, the West Kern Water District recharge basins, and/or the East Side Canal. Agreements with those agencies would be required. Emergency spillways could also be provided in Reach 3 that would discharge to the Phase II property and in Reach 4 that would discharge to the West Basins property.

The top of levee embankments are anticipated to provide for access along the canal and for canal maintenance. The levee embankment roads are estimated at 20-ft wide with a 16-ft wide all-weather road surfacing. The canal fencing is estimated to run parallel to the canal on each side and consist of barbed wire fencing with t-posts and chainlink access drive gates and personnel gates where appropriate.

The estimated capital costs for each reach of the canal are estimated in Tables 1 through 4 below. These costs are for the items discussed above and do not yet include costs for canal lining or right-of-way acquisition.

Table 1

Conveyance Canal				
Reach 1 - Approx. 14,700 LF				
Description	Quantity	Unit	Unit Cost	Extended Cost
Canal Clearing and Grubbing	90	AC	$1,200.00	$108,000.00
Subgrade Preparation	73,763	CY	$4.60	$339,309.80
Canal Earthwork-Cut	71,517	CY	$4.50	$321,826.50
Canal Earthwork-Fill	264,090	CY	$4.50	$1,188,405.00
Ladder Rungs	22	EA	$2,500.00	$55,000.00
Safety Buoys	8	EA	$10,000.00	$80,000.00
Facility Relocations	3	EA	$50,000.00	$150,000.00
Road Surfacing	4,400	CY	$50.00	$220,000.00
Barbed Wire Fencing	29,400	LF	$7.50	$220,500.00
Aqueduct Turnout Afterbay	1	LS	$283,000.00	$283,000.00
Emergency Spillway	1	LS	$168,750.00	$168,750.00
Adohr Road Crossing	1	LS	$954,400.00	$954,400.00
East Side Canal Crossing	1	LS	$1,429,000.00	$1,429,000.00
Stockdale Hwy Cased Crossing	1	LS	$1,529,000.00	$1,529,000.00
			Subtotal:	$7,047,191.30
			Cost per LF:	$479.40

*Earthwork quantities above are for the lined canal options with 1.5:1 side slopes.
**The costs do not include any lining options.

Table 2

Conveyance Canal				
Reach 2 - Approx. 12,200 LF				
Description	Quantity	Unit	Unit Cost	Extended Cost
Canal Clearing and Grubbing	75	AC	$1,200.00	$90,000.00
Subgrade Preparation	54,931	CY	$4.60	$252,682.60
Canal Earthwork-Cut	68,876	CY	$4.50	$309,942.00
Canal Earthwork-Fill	188,724	CY	$4.50	$849,258.00
Ladder Rungs	18	EA	$2,500.00	$45,000.00
Safety Buoys	8	EA	$10,000.00	$80,000.00
Facility Relocations	7	EA	$50,000.00	$350,000.00
Road Surfacing	3,650	CY	$50.00	$182,500.00
Barbed Wire Fencing	24,400	LF	$7.50	$183,000.00
Pump Station No. 1 Afterbay	1	LS	$427,000.00	$427,000.00
Farm Road Crossing No. 1	1	LS	$764,000.00	$764,000.00
Farm Road Crossing No. 2	1	LS	$764,000.00	$764,000.00
I-5 Fwy Cased Crossing	1	LS	$2,374,000.00	$2,374,000.00
			Subtotal:	$6,671,382.60
			Cost per LF:	$546.83

*Earthwork quantities above are for the lined canal options with 1.5:1 side slopes.
**The costs do not include any lining options.

Table 3

Conveyance Canal				
Reach 3 - Approx. 10,300 LF				
Description	Quantity	Unit	Unit Cost	Extended Cost
Canal Clearing and Grubbing	65	AC	$1,200.00	$78,000.00
Subgrade Preparation	60,331	CY	$4.60	$277,522.60
Canal Earthwork-Cut	68,073	CY	$4.50	$306,328.50
Canal Earthwork-Fill	149,708	CY	$4.50	$673,686.00
Ladder Rungs	16	EA	$2,500.00	$40,000.00
Safety Buoys	8	EA	$10,000.00	$80,000.00
Facility Relocations	5	EA	$50,000.00	$250,000.00
Road Surfacing	3100	CY	$50.00	$155,000.00
Barbed Wire Fencing	20600	LF	$7.50	$154,500.00
Emergency Spillway	1	LS	$168,750.00	$168,750.00
Pump Station No. 2 Afterbay	1	LS	$427,000.00	$427,000.00
Farm Road Crossing No. 3	1	LS	$764,000.00	$764,000.00
Farm Road Crossing No. 4	1	LS	$764,000.00	$764,000.00
			Subtotal:	$4,138,787.10
			Cost per LF:	$401.82

*Earthwork quantities above are for the lined canal options with 1.5:1 side slopes.
**The costs do not include any lining options.

Table 4

Conveyance Canal				
Reach 4 - Approx. 9,200 LF				
Description	Quantity	Unit	Unit Cost	Extended Cost
Canal Clearing and Grubbing	55	AC	$1,200.00	$66,000.00
Subgrade Preparation	37,164	CY	$4.60	$170,954.40
Canal Earthwork-Cut	35,761	CY	$4.50	$160,924.50
Canal Earthwork-Fill	113,859	CY	$4.50	$512,365.50
Ladder Rungs	14	EA	$2,500.00	$35,000.00
Safety Buoys	6	EA	$10,000.00	$60,000.00
Facility Relocations	5	EA	$50,000.00	$250,000.00
Road Surfacing	2,800	CY	$50.00	$140,000.00
Barbed Wire Fencing	18,400	LF	$7.50	$138,000.00
Pump Station No. 3 Afterbay	1	LS	$427,000.00	$427,000.00
Farm Road Crossing No. 5	1	LS	$764,000.00	$764,000.00
Emergency Spillway	1	LS	$168,750.00	$168,750.00
			Subtotal:	$2,892,994.40
			Cost per LF:	$314.46

*Earthwork quantities above are for the lined canal options with 1.5:1 side slopes.
**The costs do not include any lining options.

Table 5 summarizes the canal costs absent of any canal linings which will be discussed in detail below.

Table 5

Conveyance Canal		
Cost Summary (w/o Canal Linings)		
Reach No.	Earthwork Cost Estimate	Total Cost Estimate
Reach 1	$1,957,541	$7,047,191
Reach 2	$1,501,883	$6,671,383
Reach 3	$1,335,537	$4,138,787
Reach 4	$910,244	$2,892,994
Total (w/o Canal Linings):	$5,705,205	$20,750,355

*Earthwork quantities above are for the lined canal options with 1.5:1 side slopes.
**The costs do not include any lining options.

III. Earth Lined Canal

A. Constructability/Methods

i) Earth Lined Canal

The earth lined canal is estimated to be constructed to the lines and grades established during the design phase. The side slopes of an earth lined canal shall be revised to be 3:1 in order to alleviate erosion and provide for canal maintenance. The material for the canal shall not be expansive or dispersive. Expansive soils could result in swelling, drying, and shrinkage that results in cracking and problems with seepage or a levee breach. Dispersive soils can pose a threat as they move away from water and could result in piping or a levee breach. The soils should have less than 15% finer than a 5 micron sieve so that there is not too much clay but also greater than 20% material finer than a 75 micron sieve so that there are fine sands and silts that provide good cohesion. The canal and levee material are anticipated to be compacted to a minimum 90% relative compaction.

The quantities for an earth lined canal with 3:1 side slopes is approximately 472,615 cubic yards of cut and 783,801 cubic yards of fill for the entire conveyance canal. In addition, the quantity for the subgrade preparation of an earth lined canal is approximately 254,216 cubic yards for over-excavation and re-compaction, see Appendix B. The quantities noted herein are subject to change based on the final alignment, recharge locations, and final design. Borrow material is anticipated to be obtained from areas in close proximity to the canal including, but not limited to, the Buena Vista Water Storage District recharge basins, the West Kern Water District recharge basins, the Phase II recharge basins, and the West Basins. Costs associated with the borrow material have been included in the unit prices utilized for the earthwork cut, fill, and subgrade preparation.

An approximate 210-ft wide permanent right-of-way has been estimated for the conveyance canal alignment and an approximate 290-ft wide temporary right-of-way. The conceptual canal cross-section includes an approximate 20-ft wide access road on each side of the canal for maintenance and operations. In addition, the right-of-way includes space for vehicular access along the outside toe of the exterior levee slopes for maintenance and weed abatement. See the canal cross-section below in Figure 4. This equates to an approximate land acquisition of 225 acres for canal right-of-way (with 3:1 side slopes), i.e. 210-ft by 46,400-ft = 9,744,000 sf or 224 acres. The land costs have been estimated at $25,000 per acre.

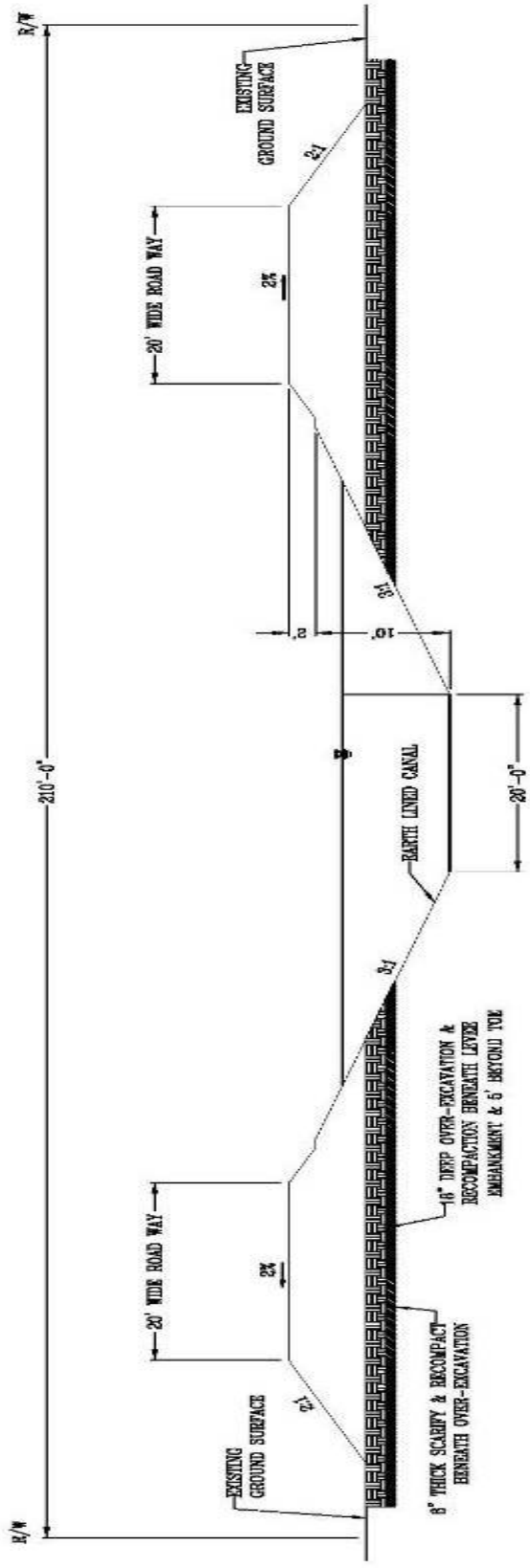


Figure 4: Preliminary Canal Cross-Section with 3:1 Side Slopes

For an earth lined canal there are concerns with rodent holes, piping, and levee breaches particularly in areas of levee embankment fill. In order to mitigate these concerns, a synthetic sheet piling could be utilized, or high risk areas of the canal could be lined, or increased maintenance could be implemented.

ii) Earth Lined Canal with Return Water Pipeline

Seepage losses are a concern with an earth lined canal. The seepage during recharge operations is not so much a concern as it can be counted as groundwater recharge, however it is a concern when operating the canal in the reverse direction for recovery of water and the return of water to the California Aqueduct. This could be mitigated with either a parallel return water pipeline or a special clay or bentonite liner.

In reverse flow operations, the Return Water Pump Station has been estimated to have an approximate 25-ft to 30-ft total dynamic head to return approximately 72 cfs to the California Aqueduct. If a parallel return water pipeline were utilized then this pump station could be eliminated and the water discharged directly to the California Aqueduct. The parallel return pipeline is estimated to be a 48" PVC or 54" HDPE pipeline for conveying 72 cfs based on Technical Memorandum No. 3 "Pipeline Requirements".

iii) Earth Lined Canal with Bentonite Liner

If a bentonite liner were utilized it is estimated that it would be a 1-ft thick liner in the earthen canal prism with a minimum clay content of 12% to 15%. Fill material that has a clay content less than this will require some form of soil amendment or importation of a soil with adequate clay content. Powdered bentonite could be used as a soil amendment. The percentage of bentonite added would be the difference between the natural site clay content and the required minimum clay content. The minimum pounds of bentonite per square foot of amended area will be the percentage bentonite times the compacted dry density of the site soil times the liner thickness. Bentonite shall be evenly spread by a computerized spreading truck which is directly fed by the bulk delivery truck. Spread rate shall be confirmed by a pan test. The amended area shall be uniformly mixed and moisture conditioned by a cross-shafted mixer directly connected to the water truck. This equipment is standard for a specialty soil stabilization contractor. Stabilization contractors typically only spread the amendment, moisture condition, and compact the amended soil. They do not move material to achieve rough grade or fine grade, therefore they generally subcontract to a general earthwork contractor. However, in some instances soil amendment can be performed in-place for a liner thickness up to 1.5 feet with the typical cross-shafted mixer and open-hub compactors and this may be an option.

B. Capital Cost Estimate

i) Earth Lined Canal

The earthwork for the conveyance canal has been considered separately and will be roughly the same for any of the above lining alternatives. The earth lined canal is planned to have 3:1 side slopes to reduce velocities and minimize erosion and sediment transport. Typically, seepage in the earth lined canal for this project would not be a concern since the seepage can be accounted for as groundwater recharge under the project. However, seepage is a concern when operating the canal in the reverse direction for recovery of water and the return of water to the Aqueduct. Therefore, a return pipeline would need to be constructed parallel to the canal or a special earth liner such as a clay liner or bentonite liner constructed. The capital cost estimates compare the costs of different lining materials. However, the earth lined canal will require a different canal cross-section in order to mitigate soil erosion and prevent seepage. Therefore, capital costs for the additional canal earthwork are also included.

The capital cost estimate for the canal earthwork with 3:1 side slopes is $7,148,566. This adds approximately $1,443,361 ($7,148,566 - $5,705,205) to the cost of the earthwork over and above the cost for the canal earthwork on the other lining alternatives because of the wider canal cross-section.

Additional Earthwork	$1,443,361

This alternative, as noted previously, would result in seepage losses. This is not a primary concern when recharging water as the JPA would account for the losses and include it with the overall recharge operations. However, during recovery operations the JPA would need to pump additional well water to overcome those losses. If the goal were to return 50,000 ac-ft in a dry year, and assuming 30% seepage losses, then it is estimated that 71,500 ac-ft would need to be pumped.

Monthly RRBWSD Operation & Maintenance Cost per well:	$1,333.00
Monthly PG&E Pumping Cost per well:	$24,150.00
Monthly Mission Unit O&M Cost per well:	$53.00
Subtotal Monthly Cost per well:	$25,536.00
Subtotal Annual Cost per well:	$306,432.00

It is estimated that it would require sixteen (16) recovery wells at 6 cfs each to return 71,500 ac-ft in one year. This is estimated to result in an annual O&M cost for sixteen wells of approximately $4,902,912.00. This is approximately $98.00 per ac-ft for returning 50,000 ac-ft.

ii) Earth Lined Canal with Return Water Pipeline

One of the recommended mitigation measures for the earth lined canal option is a parallel return water pipeline. The option to install a return water pipeline and not line the earthen canal involves installing approximately 45,000 feet of 48” to 54” pipe which at $280/lf equates to approximately $12,600,000. However, this does

eliminate the need for the Return Water Pump Station in turn saving approximately $2,081,000. This results in an additional cost of $10,519,000 or $12,600,000 - $2,081,000.

Return Water Pipeline	$10,519,000
Additional Earthwork	$1,443,361
Total Earth Lined Canal with Pipeline:	$11,962,361

This alternative would avoid seepage losses during recovery operations. The estimated O&M costs are listed below for returning 50,000 ac-ft in a dry year.

Monthly RRBWSD Operation & Maintenance Cost per well:	$1,333.00
Monthly PG&E Pumping Cost per well:	$24,150.00
Monthly Mission Unit O&M Cost per well:	$53.00
Subtotal Monthly Cost per well:	$25,536.00
Subtotal Annual Cost per well:	$306,432.00

It is estimated that it would require twelve (12) recovery wells at 6 cfs each to return 50,000 ac-ft in one year. This is estimated to result in an annual O&M cost for twelve wells of approximately $3,677,184.00. This is approximately $73.54 per ac-ft for returning 50,000 ac-ft.

iii) Earth Lined Canal with Bentonite Liner

Another potential mitigation measure is to line the earth canal with a bentonite liner approximately 1-ft thick. The soil amendment cost to treat/amend, mix, and compact the soil for a 1-ft thick liner is estimated at $3.93 per square foot. There are approximately 83 sf/lf x 46,400 lf or 3,851,200 square feet.

1-ft Thick Clay Liner at $3.93/sf	$15,135,216
Additional Earthwork	$1,443,361
Total Earth Lined Canal with Bentonite:	$16,578,577

This alternative would reduce the seepage losses, however it is estimated that there would still be some seepage. For purposes of this memorandum, an estimated seepage loss of 15% has been used. During recovery operations the JPA would need to pump additional well water to overcome those losses. If the goal were to return 50,000 ac-ft in a dry year, and assuming 15% seepage losses, then it is estimated that 58,850 ac-ft would need to be pumped.

Monthly RRBWSD Operation & Maintenance Cost per well:	$1,333.00
Monthly PG&E Pumping Cost per well:	$24,150.00
Monthly Mission Unit O&M Cost per well:	$53.00
Subtotal Monthly Cost per well:	$25,536.00
Subtotal Annual Cost per well:	$306,432.00

It is estimated that it would require fourteen (14) recovery wells at 6 cfs each to return 58,850 ac-ft in one year. This is estimated to result in an annual O&M cost for fourteen wells of approximately $4,290,048.00. This is approximately $85.80 per ac-ft for returning 50,000 ac-ft.

iv) Earth Lined Canal Summary

A summary of the costs for the earth lined canal options is provided in Table 6. A capital cost estimate is provided for the earth lined canal earthwork and then the additional capital costs are shown for adding a parallel pipeline or adding a bentonite liner. In addition, the operations and maintenance (O&M) costs are shown for each option and are based on the number of recovery wells necessary to return 50,000 ac-ft per year in a dry year while accounting for seepage losses. A present worth value is shown for the O&M costs as well as for the capital and O&M costs.

A present worth analysis was evaluated based on a capital recovery of 20 years and O&M costs for recovery operations anticipated to be approximately three years out of every ten years. The O&M costs were increased over a 20 year period at an inflation rate of 3% per year. The present worth values shown below are over a 20 year period.

Table 6

Conveyance Canal				
Cost Summary (w/o Canal Linings)				
Earth Lined Canal Options	Capital Cost Estimate	O&M Cost Estimate ($/yr)	Present Worth O&M Cost	Present Worth Capital & O&M Cost
Earth Lined Canal	$7,148,566	$4,902,912	$30.3 M	$37.5 M
Including Return Water Pipeline	$17,667,566	$3,677,184	$22.7 M	$40.4 M
Including Bentonite Liner	$22,283,782	$4,290,048	$26.5 M	$48.8 M

C. Hydraulic Impacts of Friction Losses

The earth lined canal has a 20-ft wide bottom with 3:1 side slopes. A Manning's coefficient of 0.022 to 0.040 was utilized which is a range for an earth lined canal that is maintained with short grass and few weeds to an unmaintained canal with a clean bottom and brush on the side slopes. The velocities of an earth lined canal are less than that of a lined canal and have been maintained in the range of 1.0 to 2.5 fps to minimize erosion and sediment transport. The water depth varies from approximately 6-ft to 8.22-ft. This increases the canal depth from 8-ft to approximately 10-ft as a result of the higher Manning's coefficient.

D. Advantages and Disadvantages

An earth lined canal is, generally speaking, the most economical conveyance canal since it does not require the additional cost associated with a canal lining. However, there are characteristics of the earth lined canal that are a concern. These include the following:

- There are portions of the canal that may be elevated above the natural ground surface. In addition, there may be long periods of time where this canal is not being utilized and is in a dry condition thus providing suitable habitat for rodents. The major concern is with rodent holes over time that could lead to piping and a levee breach and the potential for property damage to adjacent agricultural crops, homes, equipment, etc.
- Seepage losses particularly when recovering water for return to the California Aqueduct.
- Increased canal maintenance

In order to mitigate the above concerns with rodent holes, synthetic sheet piling could be considered, or concrete lining in high risk areas, or implementation of increased canal and levee maintenance to minimize rodent holes and seepage paths.

Seepage losses could be mitigated by constructing a 1-ft or 2-ft thick clay liner in the conveyance canal for the canal bottom and side slopes or a return water pipeline could be installed parallel to the canal for use during recovery operations.

In addition, an earth lined canal will require greater maintenance in general. The maintenance includes:

- Levee monitoring for rodent holes and areas of significant erosion that require earthwork maintenance
- Weed control on levee slopes and the canal bottom
- Removal of sediment and debris potentially at siphon crossings, turnouts, and pump station forebays

IV. Poly Lined Canal

A. Constructability/Methods

The poly lined canal will be constructed to the lines and grades established during the design phase. The side slopes of a poly lined canal are anticipated to be 1.5:1 as discussed above in Section II. The subgrade for the lining must be flat and smooth, dry and free of rocks, rubble, roots, vegetation, debris, voids, protrusions, and any other objects that can potentially puncture the liner over time. In some cases, a compacted bedding may be necessary. The subgrade material for the canal shall not be expansive or dispersive. The soils should have less than 15% finer than a 5 micron sieve so that there is not too much clay but also greater than 20% material finer than a 75 micron sieve so that there are fine sands and silts that provide good cohesion. The canal and levee material are estimated to be compacted to a minimum 90% relative compaction and graded to provide a smooth and uniform surface for the installation of the poly lining.

An anchor trench will need to be excavated parallel to the canal on each side of the conveyance canal, the poly liner installed in the trench, and the trench backfilled and compacted. In addition, the poly liner will need to be connected to the concrete at all structures, turnouts, and lift stations. See figures 5 and 6 for examples of typical installations.

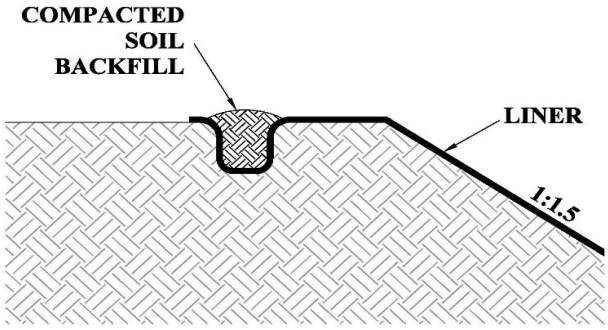


Figure 5: Typical Anchor Trench Detail

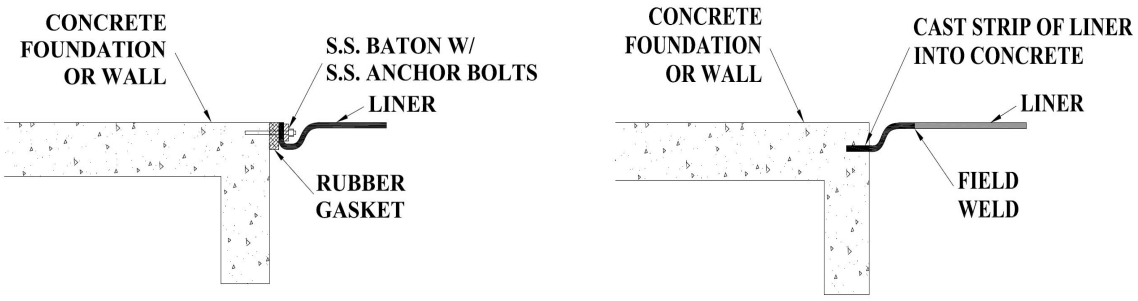


Figure 6: Typical HDPE Fastening to Concrete Structures Detail

B. Poly Liner Options

The two primary poly liners are a High Density Polyethylene (HDPE) lining and a Reinforced Polyethylene lining (RPE).

The high density polyethylene lining is a thick and durable liner that can be installed in exposed applications. HDPE liners should be installed by trained installers. The HDPE liner thickness of 40 mil and 60 mil can be utilized, however a 60 mil thickness is recommended for this application. The common HDPE properties are listed below:

- Nominal Thickness (ASTM D5199) 60 mil
- Density (ASTM D792) > 0.94 mg/l
- Tensile Strength (ASTM D6693) 126 lb/in
- Tear Resistance (ASTM D1004) 42 lbs
- Puncture Resistance (ASTM D4833) 108 lbs

The reinforced polyethylene is a combination of polyethylene reinforcement and co-extrusion in a special weave pattern which enhances thickness, flatness, tear properties, and UV resistance. The RPE lining comes in 30 mil thickness and 40 mil thickness. The 40 mil lining is the recommended thickness for canal lining installations. The common RPE properties are listed below:

- Nominal Thickness (ASTM D1777) 40 mil
- Weight 20.8 oz/yd^2
- Mullen Burst (ASTM D751) 800 psi
- Hydrostatic Resistance (ASTM D751) 769 psi
- Permeability (ASTM D4491) 2.06×10^{-12} cm/s
- Puncture Resistance (ASTM D4833) 243 lbs

C. Capital Cost Estimate

A 60 mil thick membrane HDPE lining or a 40 mil thick RPE lining is recommended for canal conveyance. The poly lining material will be approximately 2,830,400 sf based upon a canal length of 46,400 ft and a cross

sectional area of 61 sf/ft which includes an anchor trench on each side of the canal.

The capital cost estimates compare the costs of different lining materials. The poly lined canal is estimated to utilize approximately 2,830,400 sf of material. In addition, there will be locations where the lining must be connected to the concrete structures in the canal such as the transition structures, turnouts, and pump stations. This is estimated to be approximately 1,500 lineal feet. There will also be the need for underdrains where the canal is in cut adjacent to recharge basins.

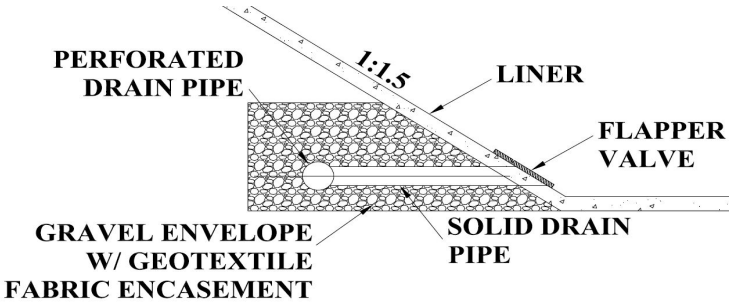


Figure 7: Typical Underdrain System

The capital cost estimate for the canal earthwork is approximately $5,705,205 and for the total canal without lining is $20,750,355. The cost of adding a Poly Lining adds $5,596,190 as presented below and summarized in Table 7 - Canal Lining Alternatives.

Poly Lining at $1/sf	$2,830,400
Poly Anchor Trench Installation	$928,000
Connection to Structures at $23/lf	$34,500
Underdrain System	$1,803,290
Total Poly Lining:	$5,596,190

D. Hydraulic Impacts of Friction Losses

The Manning's coefficient utilized for a poly lined canal is 0.010 and represents a well maintained canal. The velocities of the poly lined canal range from approximately 2.0 fps to 3.5 fps. The water depth varies from approximately 6-ft to 6.76-ft. This maintains a minimum of 1-ft of freeboard from the top of canal lining for an 8-ft deep canal cross-section.

E. Advantages and Disadvantages

A poly lined canal is an economical alternative and worth considering. It is less expensive than concrete lining and has other advantages as well as outlined below:

- Eliminates seepage losses
- Improved hydraulic properties with coefficient of friction of 0.10

- Ease of installation
- Less installation time

However, the poly lining can be prone to surface deterioration and tearing from UV damage and wind. The disadvantages are listed below:

- Subject to UV and wind damage
- Subject to damage by animals such as cattle or sheep
- More difficult to clean the canal of sediment and tumble weeds while not damaging lining
- Subject to rodent damage
- Petroleum product material cost volatility is greater than the concrete lining options

If the side slopes of the canal are 1.5:1 it is recommended that the lining be installed perpendicular to the canal conveyance direction. . Furthermore, the addition of future pipelines to the canal or well discharges would likely require concrete splash pads if discharging over the liner or a poly boot if penetrating the liner. The canal will have long periods of time when it is not in operation and is empty thus subject to sun exposure, wind, and damage. The anticipated useful life of a typical poly liner that is exposed to the elements in the San Joaquin Valley is 10 to 20 years. The Canal Lining Demonstration Project – Year 25 Durability Report by the Bureau of Reclamation estimated the useful life of an exposed geomembrane liner to be approximately 15 to 30 years.

V. Shotcrete Lined Canal

A. Constructability/Methods

The shotcrete lined canal is estimated to be constructed to the lines and grades established during the design phase. The side slopes of a shotcrete lined canal shall be 1.5:1 as discussed above in Section II. The subgrade material for the canal shall not be expansive or dispersive. The soils should have less than 15% finer than a 5 micron sieve so that there is not too much clay but also greater than 20% material finer than a 75 micron sieve so that there are fine sands and silts that provide good cohesion. The canal and levee material are estimated to be compacted to a minimum 90% relative compaction and graded to provide a smooth and uniform surface for the installation of the shotcrete lining.

The application of shotcrete is highly specialized and requires a certified nozzleman in order to ensure against rebound which results from a portion of the mortar bouncing away from the surface to which it is applied. It is recommended that the shotcrete lining have a smooth trowel surface in order to improve the hydraulic characteristics.

B. Capital Cost Estimate

Shotcrete is a pneumatically applied Portland cement mortar lining. The shotcrete lining is recommended to have a minimum 3" thickness. The shotcrete lining material would be approximately 2,366,400 sf based upon a canal length of 46,400 ft and a cross sectional area of 51 sf/ft. (Approximately 21,911 cubic yards).

The capital cost estimates compare the costs of different lining materials only. The shotcrete lined canal is estimated to utilize approximately 2,366,400 sf of material. There will also be the need for underdrains where the canal is in cut adjacent to recharge basins.

The capital cost estimate for the canal earthwork is $5,705,205 and for the total canal without lining is $20,750,355. The cost of adding a shotcrete lining adds $14,818,490 as presented below and summarized in Table 7 - Canal Lining Alternatives.

Shotcrete Lining at $5.50/sf	$13,015,200
Underdrain System	$1,803,290
Total Shotcrete Lining:	$14,818,490

C. Hydraulic Impacts of Friction Losses

The Manning's coefficient utilized for a shotcrete lined canal is between 0.025 to 0.030 per the Hydraulic Design Handbook. The Manning's coefficient assumes that the shotcrete surface will not be as smooth as conventional concrete placement and finishing. The velocities of the shotcrete lined canal range from approximately 2.0 fps to 3.0 fps. The water depth varies from approximately 6-ft to 7.33-ft. This would require the canal depth to be increased by approximately 0.5-ft to 1.0-ft in some locations to an 8.5-ft to 9.0-ft depth in order to maintain the minimum of 1-ft of freeboard to the top of canal lining.

D. Advantages and Disadvantages

A shotcrete lined canal is an economical alternative and worth considering. The shotcrete lining has the following advantages:

- High tensile strength
- Good durability
- Low permeability
- Long useful life

However, in general this type of lining is only slightly more economical than formed in place concrete when considering long, un-impacted stretches of canal. The disadvantages of shotcrete lining include:

- The shotcrete lining requires skilled operating personnel including a certified nozzleman
- Additional quality control measures to ensure against excessive rebound and to ensure application at the proper thickness and uniformity
- Less durable than conventional concrete lining
- Subject to damage from settlement, shrinkage, and hydrostatic pressure

If a concrete lined canal is the selected alternative, it is recommended that the concrete lining be allowed to be constructed by shotcrete application, slip-form placed, or formed in place.

VI. Conventional Concrete Lined Canal

A. Constructability/Methods

The concrete lined canal is estimated to be constructed to the lines and grades established during the design phase. The side slopes of a concrete lined canal are estimated to be 1.5:1 as discussed above in Section II. The subgrade material for the canal shall not be expansive or dispersive. The soils should have less than 15% finer than a 5 micron sieve so that there is not too much clay but also greater than 20% material finer than a 75 micron sieve so that there are fine sands and silts that provide good cohesion. The canal and levee material are estimated to be compacted to a minimum 90% relative compaction and graded to provide a smooth and uniform surface for the installation of the concrete lining.

B. Capital Cost Estimate

Concrete lining can be placed by slip-lining, using a rolling screed, or by cast in place methods. The concrete lining is recommended to have a minimum 3" thickness and crack control spacing at approximate 10'-0" spacing. The concrete lining material would be approximately 2,366,400 sf based upon a canal length of 46,400 ft and a cross sectional area of 51 sf/ft. (Approximately 21,911 cubic yards).

The capital cost estimates compare the costs of different lining materials only. The concrete lined canal is estimated to utilize approximately 2,366,400 sf of material. There will also be the need for underdrains where the canal is in cut adjacent to recharge basins.

The capital cost estimate for the canal earthwork is $5,705,205 and for the total canal without lining is $20,750,355. The cost of adding a concrete lining adds $16,001,690 as presented below and summarized in Table 7.

Concrete Lining at $6/sf	$14,198,400
Underdrain System	$1,803,290
Total Concrete Lining:	$16,001,690

C. Hydraulic Impacts of Friction Losses

Canal Hydraulics:

The Manning's coefficient utilized for the concrete lined canal is 0.012 to 0.016 per the Hydraulic Design Handbook. The velocities of the concrete lined canal range from approximately 2.0 fps to 3.2 fps. The water depth varies from approximately 6-ft to 7-ft. This maintains a minimum of 1-ft of freeboard from the top of canal lining and has better hydraulic characteristics than the shotcrete lining.

D. Advantages and Disadvantages

A concrete lined canal is an expensive alternative, but also is the most durable and has the longest useful life. The advantages include:

- High tensile strength
- Good durability for cleaning and maintenance
- Low permeability
- Long useful life

The disadvantages of concrete lining include:

- High capital cost
- Subject to damage from settlement, shrinkage, and hydrostatic pressure

Concrete lining has a typical useful life of beyond 60 years if well maintained and protected. The concrete lined canal will also require the smallest amount of maintenance for the canal lining alternatives and has better hydraulic characteristics than the shotcrete lining. Typical maintenance is the cleaning and removal of sediment and mud, if applicable, and then the replacement of cracked panels if it occurs.

VII. Canal Lining Summary/Present Worth Analysis

Six lining options (four canal lining options and two mitigation options for the earth lined canal) for the conveyance canal were evaluated. Below is a summary of the options:

Table 7
Canal Lining Alternatives

Conveyance Canal			
Lining Alternative	Estimated Liner Unit Cost per SF	Estimated Liner Unit Cost per LF	Estimated Liner or Earth Canal Total Cost
Earth Lined[1]	NA	NA	$1,443,361
HDPE/RPE Lined	$1.98	$121	$5,596,190
Earth Lined with Return Pipeline	NA	NA	$11,962,361
Shotcrete Lined	$6.26	$319	$14,818,490
Concrete Lined	$6.76	$345	$16,001,690
Earth Lined with Bentonite Liner	$4.30	$357	$16,578,577

[1]The earth lined alternative does not have a lining, however the cost shown is the estimate of additional earthwork necessary for 3:1 side slopes.

Table 8
Canal Lining Alternatives

Conveyance Canal			
Lining Alternative	Estimated Liner or Earth Canal Cost	Estimated Canal Unit Cost per LF	Estimated Canal Total Cost w/o Pump Stations
Earth Lined	$1,443,361	$478	$22,193,716
HDPE/RPE Lined	$5,596,190	$568	$26,346,545
Earth Lined with Return Pipeline	$11,962,361	$705	$32,712,716
Shotcrete Lined	$14,818,490	$767	$35,568,845
Concrete Lined	$16,001,690	$792	$36,752,045
Earth Lined with Bentonite Liner	$16,578,577	$805	$37,328,932

The estimated total canal cost above in Table 8 is the conveyance canal cost from Tables 1 through 4 in the amount of $20,750,355 plus the estimated liner cost or earth canal plus mitigation costs.

In addition, a present worth analysis was performed for each of the alternatives. The present worth analysis considered the project capital cost for each lining option. The capital cost included the conveyance canal costs from Tables 1 through 4, the estimated liner costs or mitigation costs, the right-of-way acquisition, and the estimated pump station costs for three pump stations and a return water pump station. The capital recovery for these costs was estimated at a 3% interest rate over a twenty (20) year period.

The cost of the conveyance canal including the three pump stations and the return water pump station as well as right-of-way procurement is as follows:

Conveyance Canal Cost Estimate (w/ 1.5:1 Slopes)	$20,750,355
Three Pumps Stations & Return Water Pump Station	$28,945,000
Right-of-Way Cost Estimate	$5,000,000
Conveyance Canal Estimate (w/ 1.5:1 Slopes)	$54,695,355

The estimated cost of the earthen conveyance canal with 3:1 side slopes including the three pump stations and the return water pump station as well as right-of-way procurement is as follows:

Conveyance Canal Cost Estimate (w/ 3:1 Slopes)	$22,193,716
Three Pumps Stations & Return Water Pump Station	$28,945,000
Right-of-Way Cost Estimate	$5,625,000
Conveyance Canal Estimate (w/ 3:1 Slopes)	$56,763,716

The pump station costs are based upon the cost estimates from Technical Memorandum No. 4 "Pump Station Requirements" which estimated $8,605,000 for Pump Station No. 1, $8,605,000 for Pump Station No. 2, and $6,150,000 for Pump Station No. 3. A cost estimate of $2,081,000 has been used for the Return Water Pump Station. Each of these pump station cost estimates have been increased by 15% to account for unknowns and PG&E service costs.

The operations and maintenance (O&M) costs were also included for each option and include the recovery well pumping costs, the canal operation costs for idle years, wet years, and dry years, and the liner replacement or repair costs. It has been estimated that there will be two wet years and three dry years out of every ten years and the remaining years will be idle years. The recovery well pumping costs in dry years are the same for the lined canal options whereby 72 cfs is being recovered from approximately twelve (12) wells. However, the earth lined canal alternative with bentonite liner estimates utilizing fourteen (14) wells to recover 84 cfs as a result of seepage losses while returning water to the California Aqueduct. Also the earth lined canal alternative estimates utilizing sixteen (16) wells to recover 96 cfs as a result of seepage losses while returning water to the California Aqueduct. The canal operations costs consist of RRBWSD operations and maintenance costs, electricity costs, mission unit costs, and DWR conveyance costs. These costs are similar for most of the options with the exception that the idle year costs for the earth lined canal options (1, 1a, and 1b) are more for the RRBWSD maintenance costs as they have to perform weed and rodent control along the conveyance canal. Pump station replacement costs have been included for items such as the pumps, the motors, the VFD's, electrical gear, and cathodic protection. It has been estimated that these items will be replaced every twenty-five (25) years and include an inflate rate of 3% per year. The liner replacement and repair costs are included for the poly lined canal, shotcrete lined canal, and the concrete lined canal. The poly lined canal estimates minor patches or repairs about every five years at a cost of $25,000 per year and

inflation at 3% per year. The shotcrete lined canal estimates panel replacements about every three years for approximately 1,200 lineal feet of side slope panels at a cost of $129,549 per year and inflation at 3% per year. The concrete lined canal estimates that it will be more durable than a shotcrete lined canal and panel replacements will not be necessary for the first 10 to 15 years. The concrete lined canal estimates panel replacement about every five years, beginning in year fifteen, for approximately 1,200 lineal feet of side slope panels at a cost of $150,000 per year and inflation at 3% per year. The present worth values are summarized in the table below.

Table 9

Summary of Conveyance Canal Alternatives

Ranking by Present Worth	Alternative No.	Alternative	Lining Cost or Earth Canal Option Costs[2]	Total Conveyance Cost w/ Pump Stations[3]	Present Worth
1	1a	Earth Lined w/Return Pipeline	$11,962,361.00	$67,282,716	$188,594,201
2	2/3	HDPE/RPE Lined	$5,596,190.00	$60,291,545	$190,764,330
3	4	Shotcrete Lined	$14,818,490.00	$69,513,845	$191,170,614
4	5	Concrete Lined	$16,001,690.00	$70,697,045	$191,481,030
5	1	Earth Lined[1]	$1,443,361.00	$56,763,716	$197,012,451
6	1b	Earth Lined w/Bentonite Liner	$16,578,577.00	$71,898,932	$202,678,919

[1]Earth Lined lining cost is the increased cost related to earthwork for a larger canal cross section (3:1 side slopes).

[2]Costs from the liner alternatives evaluation in Sections III thru VI

[3]Total conveyance cost includes pump stations, road crossings, and return water pipelines.

The earth lined canal is not considered a good alternative due to concerns with rodent holes and piping failures, liability due to adjacent landowners, and overall increased canal maintenance with weed control, sedimentation, and rodent hole control. In addition, seepage losses are a concern when returning water to the California Aqueduct. In order to mitigate canal seepage when returning water to the Aqueduct, a return water pipeline or bentonite clay liner has been included in the cost. The earth lined canal alternative with a return water pipeline has the lowest present worth over a fifty-year (50) period, however it is not the recommended alternative for the reasons outlined above.

The HDPE or RPE canal lining is an economical alternative, has the best hydraulic properties, and is easier to maintain than an earth lined canal. The drawback to the HDPE or RPE canal lining is the estimated useful life of 10 to 20 years for the San Joaquin Valley. However, the present worth analysis still demonstrates it is a viable and economical alternative.

The cost difference between the shotcrete lining and the concrete lining is also not very significant. Both of these lining systems are quality canal linings and result in a long useful life, however the shotcrete lining requires greater skill and quality control during application. It is recommended that the conventional concrete lining be selected between these two options, however the contract documents could allow for

both application methods and the most economical alternative could be selected at bid time.

The conventional concrete, shotcrete, and poly liners are all very similar in present worth value over a fifty-year (50) period. If the conveyance canal alternative is selected, it is recommended that the "Conveyance Facilities including Turnouts & Pump Stations" bid package include bid alternates for the three types of canal linings. This will provide competitive pricing for each alternative, account for market fluctuations in material pricing, and allow the JPA to evaluate the lining costs in light of the total overall project costs.

VIII. Pipeline Option

A. Constructability/Methods

Technical Memorandum No. 3 "Pipeline Requirements" serves to evaluate the various pipe options and provides estimates of pipeline sizes and cost estimates.

The conveyance facility for the project could be a pipeline and if so, it is anticipated that it would be reinforced concrete pipe (RCP). For cost estimating purposes, the cost for dry cast RCP was utilized. The conveyance reach capacities are shown below in Table 10 along with the pipe size and type from Technical Memorandum No. 3.

Table 10

Conveyance Pipe Options				
Conveyance Reach	Reach Capacity	Pipe Size	Pipe Type	Material & Installation Cost
No. 1	443 cfs	120-in	RCP	$1,365/LF
No. 2	443 cfs	120-in	RCP	$1,365/LF
No. 3	435 cfs	120-in	RCP	$1,365/LF
No. 4	240 cfs	90-in	RCP	$727/LF
No. 5, if necessary	105 cfs	60-in	HDPE or PVC	$333/LF

Figure 8 is a conceptual illustration of the conveyance pipeline and includes a single pump station near the I-5 Freeway to pump the water to the Phase I, Phase II, and West Basin recharge properties. A pipeline bypass around the pump station could be constructed with valving such that the pressure from the well pumping could be maintained when returning water during recovery operations to the California Aqueduct.

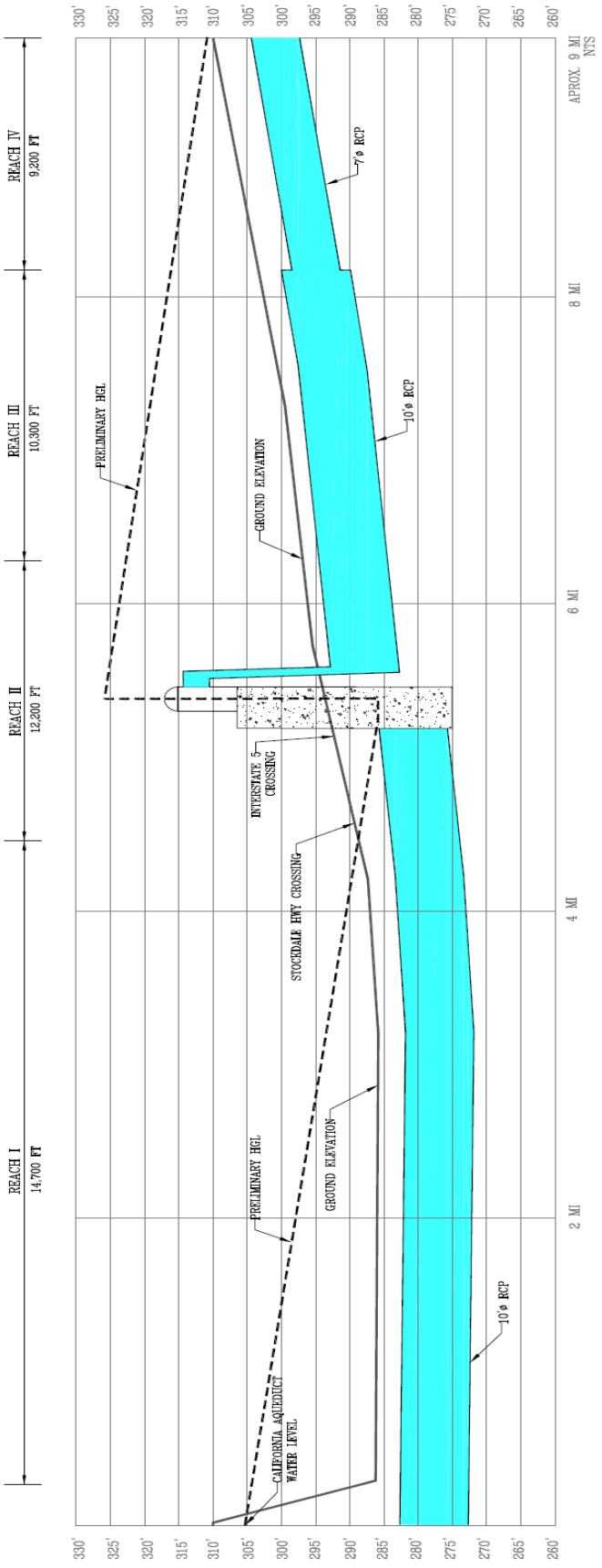


Figure 8: Preliminary Pipeline Profile

B. Capital Cost Estimate

The capital cost estimate for an underground pipeline is shown below in Table 11. The cost estimate is itemized for each reach of the conveyance and includes material and installation costs, however it does not take into account any special crossings, road crossings, or structures.

Table 11

Conveyance Pipe Options			
Conveyance Reach	Reach Length	Pipe Unit Cost	Pipeline Total Cost
No. 1	14,700-ft	$1,365/LF	$20,065,500
No. 2	12,200-ft	$1,365/LF	$16,653,000
No. 3	10,300-ft	$1,365/LF	$14,059,500
No. 4	9,200-ft	$727/LF	$6,688,400
No. 5, if necessary	4,500-ft	$333/LF	$1,498,500
		Total not including Reach 5:	$57,466,400
		Total including Reach 5:	$58,964,900

Table 12 compares the pipeline cost with the canal alternative costs for each reach of canal and the total cost as well. The pipeline alternative is much more expensive in the first three reaches of the canal. The pipe size and capacity reduces significantly in Reach No. 4 which brings the cost more in line with an open channel design, however it is still the most expensive alternative. In Reach 5, the pipe size and type are such that a pipeline is the most economical.

Table 12

Summary of Conveyance Alternative Capital Costs w/o Pump Stations						
Alternative	Reach No. 1	Reach No. 2	Reach No. 3	Reach No. 4	Reach No. 5, if necessary	Total Cost
Earth Lined	$7,504,463.00	$7,050,887	$4,459,188	$3,179,178	$1,498,500	$23,692,216
HDPE/RPE Lined	$8,820,122.00	$8,142,795	$5,381,045	$4,002,584	$1,498,500	$27,845,046
Earth Lined w/Return Pipeline	$10,836,991.00	$9,816,659	$6,794,225	$5,264,842	$1,498,500	$34,211,217
Shotcrete Lined	$11,741,842.00	$10,567,624	$1,428,236	$5,831,143	$1,498,500	$31,067,345
Earth Lined w/Bentonite Liner	$12,299,456.00	$11,030,405	$7,818,945	$6,180,126	$1,498,500	$38,827,432
Concrete Lined	$12,116,692.00	$10,878,724	$7,690,886	$6,065,743	$1,498,500	$38,250,545
Pipeline	$20,065,500.00	$16,653,000	$14,059,500	$6,688,400	$1,498,500	$58,964,900

There may be opportunities to design the conveyance facilities as a hybrid approach. For instance, Reach No. 1 and Reach No. 2 of the conveyance could be a pipeline due to the energy, O&M, and safety benefits, while Reach No. 3 could be open canal. Reach No. 4 and Reach No. 5, if necessary, could then be a pipeline. However, there are off-setting benefits. The savings by utilizing Reach No. 3 as a canal is approximately $7 to $9M, however it requires a second pump station installed instead of just one pump station for the pipeline alternative which minimizes the true capital cost savings. The design

firm should evaluate and consider a hybrid approach as part of the value engineering work.

The estimated overall capital cost for a pipeline, including the pump station, right-of-way, and road crossings, is as follows:

Conveyance Pipeline	$58,964,900
Adhor Road Earthwork	$216,000
Adhor Pavement Repair	$50,400
East Side Canal Earthwork	$216,000
Stockdale Cased Crossing	$975,000
I-5 Fwy Cased Crossing	$1,820,000
Pump Station & Bypass	$13,383,200
Right-of-Way Acquisition	$3,750,000
Total Pipeline Cost:	$79,375,500

C. O&M Impacts – Energy Costs related to Friction Losses

For purposes of this memorandum it has been estimated that a 120-inch diameter RCP pipeline would be installed from the California Aqueduct to the east side of the I-5 Freeway. A pump station would be constructed on the east side of the I-5 Freeway and pump approximately 435 cfs at a total dynamic head of approximately 50-ft. This is an approximate 3,800 hp pump station. It is estimated that the energy costs would be approximately $1,240,615 to convey approximately 112,500 ac-ft during a recharge year.

A present worth analysis was performed for the pipeline alternative. The present worth analysis considered the project capital cost of $79,375,500. The capital recovery for this cost was estimated at a 3% interest rate over a twenty (20) year period.

The operations and maintenance (O&M) costs were also included for this alternative and include the recovery well pumping costs and the pipeline operation costs in idle years, wet years, and dry years. It has been estimated that there will be two wet years and three dry years out of every ten years and the remaining years will be idle years. The recovery well pumping costs in dry years are the same for the lined canal options whereby 72 cfs is being recovered from approximately twelve (12) wells. The pipeline operations costs consist of RRBWSD operations and maintenance costs, electricity costs, mission unit costs, and DWR conveyance costs. A pipeline design is anticipated to include a single pump station with an approximate 50-ft TDH and also a smaller return water pump station. Pump station replacement costs have been included that account for replacing pumps, motors, VFD's, electrical gear, and cathodic protection every twenty-five (25) years. These costs have been inflated at 3% per year.

D. Advantages and Disadvantages

A pipeline alternative has been considered herein. The pipeline sizes and types have been based on the recommendations outlined in Technical Memorandum No. 3. The advantages to a pipeline for the conveyance facilities include:

- Smaller temporary and permanent right-of-way than an open channel design
- Less obtrusive to nearby properties and farming operations
- Less maintenance
- System operation simplified by one pumping station instead of three for conveyance canal
- Ability to float off static water level or operating water level of California Aqueduct from Aqueduct to Pump Station which eliminates risk of open canal design and flooding if slide gate fails or a levee embankment breaches.

The disadvantages of a pipeline include the following:

- Higher capital cost
- Higher energy cost due to friction head

IX. Turnout Requirements

A. Turnout Locations and Capacities

Technical Memorandum No. 3 "Pipeline Requirements" serves to evaluate the various turnout pipe options and provides estimates of the turnout pipeline sizes and cost estimates. These are summarized briefly below in Table 13.

Table 13

Turnout Locations and Capacities		
Turnout Location	Turnout Capacity	Turnout Size
Phase II Property	48 cfs	48"
West Basins Property	18 to 38 cfs	36"
Phase I Property	105 cfs	54"
In-Lieu Farmer Properties	5 to 20 cfs	24"

The turnout structures will be prefabricated structures that are the same size for uniformity and ease when replacing. The turnout structures will have 24" diameter pipes for the in-lieu farmer turnouts and 36" and 48" diameter pipes for the recharge basins. It is anticipated that the conveyance pipeline over to the Phase I property will be a 54" pipeline where it discharges to the Phase I property.

B. Turnout Pipe Materials

The proposed turnout pipeline materials are discussed in Technical Memorandum No. 3 "Pipeline Requirements". These are summarized briefly below in Table 14.

Table 14

Turnout Pipe Type		
Turnout Location	Turnout Capacity	Turnout Pipe Material
Phase II Property	48 cfs	ADS N12 WT HDPE
West Basins Property	18 to 38 cfs	DR41 HDPE
Phase I Property	105 cfs	DR41 HDPE
In-Lieu Farmer Properties	5 to 20 cfs	ADS N12 WT HDPE

C. Turnout Metering

It is recommended to install individual flow meters at each turnout facility so that the flow rates and recharge performance can be monitored. The turnout pipe sizes vary but are expected to range between 24-inch and 54-inch diameter.

There are different types of meters available in these size ranges which are noted below. It is recommended that these meter options be evaluated further during the design phase to select the best meter for the application. The brands and models noted below are for reference, however other meters that are comparable may be considered.

1. Ultrasonic Meter

   An ultrasonic flow transducer is available from Rittmeyer for measurement in a circular pipe under partially filled conditions. They are suitable for a full range of pipe diameters, can be replaced with the pipelines in operation, and have a high accuracy. The flow in closed pipes is able to be measured either with sensors mounted to the inside or outside of the pipe as well as non-invasive sensors installed on a mounting frame on the outside of the pipe. In addition, they make a flow controller / display that can monitor multiple pipes/meters at the same time which is ideal for a multiple barrel turnout facility.

2. Doppler Velocity Meter

   Flow meters utilizing a doppler velocity sensor and depth sensor can provide flow measurement in large diameter pipes for full-pipe flow or partial pipe flow. These are supplied by SonTek, a xylem brand.

X. Summary

The conveyance facility is estimated to be approximately 8.80 miles long or approximately 46,400-ft. This conveyance facility will cross recharge facilities, agricultural lands, private property, County roads, Stockdale Highway, and the I-5 Freeway. This facility is also planned to be utilized in the reverse direction during recovery operations for returning water to the California Aqueduct.

The cost of a conveyance canal is estimated to be approximately $20,750,355 for canal options with 1.5:1 side slopes to $22,193,716 for unlined earth canal options with 3:1 side slopes. This does not include any canal linings, however the cost does include earthwork, facility relocations, safety features, road surfacing, barbed wire perimeter fencing, and canal structures such as road crossings, see Tables 1 through 4. However, the cost estimate does not include the purchase of easements or rights-of-way.

The cost of the conveyance canal increases when including the three pump stations and the return water pump station as well as right-of-way procurement.

Conveyance Canal Cost Estimate (w/ 1.5:1 Slopes)	$20,750,355
Three Pumps Stations & Return Water Pump Station	$28,945,000
Right-of-Way Cost Estimate	$5,000,000
Conveyance Canal Estimate (w/ 1.5:1 Slopes)	$54,695,355

The estimated cost of the earthen conveyance canal with 3:1 side slopes increases when including the three pump stations and the return water pump station as well as right-of-way procurement.

Conveyance Canal Cost Estimate (w/ 3:1 Slopes)	$22,193,716
Three Pumps Stations & Return Water Pump Station	$28,945,000
Right-of-Way Cost Estimate	$5,625,000
Conveyance Canal Estimate (w/ 3:1 Slopes)	$56,763,716

Four canal lining alternatives were evaluated:

1. Earth Lined Canal
2/3. Poly Liners (HDPE or RPE)
4. Shotcrete Lined Canal
5. Concrete Lined Canal

In addition, two additional alternatives were considered as part of mitigation efforts with an earth lined canal:

1a. Earth Lined Canal with Parallel Return Water Pipeline
1b. Earth Lined Canal with Bentonite Lining

The capital costs, O&M costs, present worth values, and advantages/disadvantages were considered for each alternative and are shown in Table 15 below.

A sixth alternative was also considered which is a pipeline, however due to the capacity and size of the pipeline, it is a much more significant capital cost. The capital cost for the pipeline, including the pump station, pipeline right-of-way, and road crossing work at Adohr Road, Stockdale Hwy, and the I-5 Fwy is approximately $79,375,500. However, as a result of eliminating some pump stations and having a reduced O&M cost, the pipeline becomes more economical over a fifty (50) year life cycle.

The conveyance costs are estimated for each alternative in Table 15 below. This includes the lining cost as well as the total cost and includes the conveyance canal costs from Tables 1 through 4 in the amount of $20,750,355 plus the right-of-way costs, the pump station costs, and the estimated liner cost.

A present worth analysis was performed for each of the alternatives including the pipeline alternative. The present worth analysis considered the project capital cost for each alternative. The capital cost for the conveyance canal options includes the conveyance canal costs from Tables 1 through 4, the estimated liner costs, right-of-way acquisition, and the estimated pump station costs for three pump stations and a return water pump station.

The capital cost for the pipeline option includes the pipeline costs, road crossings, pump station costs for one pump station, right-of-way acquisition, and a return water pump station. The capital recovery for these costs was estimated at a 3% interest rate over a twenty (20) year period.

The operations and maintenance (O&M) costs were also included for each alternative and include the recovery well pumping costs, the canal operation costs for idle years, wet years, and dry years, and the liner replacement or repair costs. It has been estimated that there will be two wet years and three dry years out of every ten years and the remaining years will be idle years. The recovery well pumping costs in dry years are the same for the lined canal options and the closed conduit option whereby 72 cfs is being recovered from approximately twelve (12) wells. However, the earth lined canal alternative with bentonite liner estimates utilizing fourteen (14) wells to recover 84 cfs as a result of seepage losses while returning water to the California Aqueduct. Also the earth lined canal alternative estimates utilizing sixteen (16) wells to recover 96 cfs as a result of seepage losses while returning water to the California Aqueduct. The canal operations costs consist of RRBWSD operations and maintenance costs, electricity costs, mission unit costs, and DWR conveyance costs. These costs are similar for most of the options with the exception that the idle year costs for the earth lined canal options (1, 1a, and 1b) are more for the RRBWSD maintenance costs as they have to perform weed and rodent control along the entire conveyance canal. Also the idle year maintenance costs for the closed conduit option have been reduced as a result of the RRBWSD maintenance being minimized with a pipeline. Pump Station replacement costs have been included and account for pump,

motor, VFD, electrical gear, and cathodic protection replacement every twenty-five (25) years. The liner replacement and repair costs are included for the poly lined canal, shotcrete lined canal, and the concrete lined canal. The poly lined canal estimates minor patches or repairs about every five years at a cost of $25,000 per year and inflation at 3% per year. The shotcrete lined canal estimates panel replacements about every three years for approximately 1,200 lineal feet of side slope panels at a cost of $129,549 per year and inflation at 3% per year. The concrete lined canal estimates that it will be more durable than a shotcrete lined canal and panel replacements will not be necessary for the first 10 to 15 years. The concrete lined canal estimates panel replacement about every five years, beginning in year fifteen, for approximately 1,200 lineal feet of side slope panels at a cost of $150,000 per year and inflation at 3% per year. The present worth values are summarized in the table below.

Table 15

Summary of Conveyance Alternatives

Ranking by Present Worth	Alternative No.	Alternative	Earthwork & Conveyance Facility Costs[2]	Pump Station Costs[3]	Right-of-Way Costs[4]	Lining Cost or Earth Canal Option Costs[5]	Total Conveyance Cost w/ Pump Stations[6]	Present Worth on 50 Yr Basis[7]
1	6	Pipeline	$62,242,300	$13,383,200	$3,750,000	NA	$79,375,500	$182,191,000
2	1a	Earth Lined w/Return Pipeline	$22,193,716	$28,945,000	$5,625,000	$10,519,000	$67,282,716	$188,594,201
3	2/3	HDPE/RPE Lined	$20,750,355	$28,945,000	$5,000,000	$5,596,190	$60,291,545	$190,764,330
4	4	Shotcrete Lined	$20,750,355	$28,945,000	$5,000,000	$14,818,490	$69,513,845	$191,170,614
5	5	Concrete Lined	$20,750,355	$28,945,000	$5,000,000	$16,001,690	$70,697,045	$191,481,030
6	1	Earth Lined[1]	$22,193,716	$28,945,000	$5,625,000	NA	$56,763,716	$197,012,451
7	1b	Earth Lined w/Bentonite Liner	$22,193,716	$28,945,000	$5,625,000	$15,135,216	$71,898,932	$202,678,919

[1]Earth Lined canal does not include a lining. There is additional earthwork and associated costs which are included under "Earthwork & Conveyance Facility Costs".

[2]Earthwork and conveyance costs based upon Tables 1 - 4 and include earthwork, facility relocations, fencing, spillways, and road crossings.

[3]Pump Station costs based on those developed in TM #4 plus a 15% contingency to account for unknowns and PG&E electrical service costs.

[4]Right-of-way costs estimated at $25,000 per acre.

[5]Costs from the liner alternatives evaluation in Sections III thru VI

[6]Total conveyance cost includes earthwork & conveyance facilities, pump stations, R/W, and linings.

[7]Present worth analysis based on 50 year period - see Exhibit C for spreadsheets.

The earth lined canal is not considered a good alternative due to concerns with rodent holes and piping failures, liability due to adjacent landowners, and overall increased canal maintenance with weed control, sedimentation, and rodent hole control. In addition, seepage losses are a concern when returning water to the California Aqueduct. In order to mitigate canal seepage when returning water to the Aqueduct, a return water pipeline or bentonite clay liner has been included in the cost. The earth lined canal alternative with a return water pipeline has the lowest present worth among canal alternatives, however it is not the recommended alternative for the reasons outlined above.

The poly lined and concrete lined alternatives are very similar in present worth over a fifty-year period. The HDPE or RPE canal lining is an economical alternative, has the best hydraulic properties, and is easier to maintain than an earth lined canal. The drawback to the HDPE or RPE canal lining is the estimated useful life of 10 to 20 years for the San Joaquin Valley. However, the present worth analysis demonstrates that this is still a viable alternative.

The cost difference between the shotcrete lining and the concrete lining is also not very significant. Both of these lining systems are quality canal linings and result in a long useful life, however the shotcrete lining requires greater skill and quality control during application. The concrete lined canal alternative, however, is the most expensive lining alternative.

If the conveyance canal alternative is selected for design then the conventional concrete, shotcrete, and poly liners are all reasonable options as they are very similar in present worth based upon a fifty-year (50) period. In that event it is recommended that the "Conveyance Facilities including Turnouts & Pump Stations" bid package include bid alternates for the three types of canal linings. This will provide competitive pricing for each alternative, account for market fluctuations in material pricing, and allow the JPA to evaluate the lining costs in light of the total overall project costs.

However, the pipeline alternative appears to be the most economical over a 50 year period based upon the present worth analysis and therefore should be considered. There are significant benefits to the pipeline alternative that pertain to energy savings, operational and maintenance savings, reduced infrastructure, reduced right-of-way, and safety. The primary safety benefit is the pipeline alternative could place a single pump station on the east side of the I-5 Freeway which is at an elevation that would allow for it to float off the Aqueduct at the static or operating level of the California Aqueduct. This eliminates risks associated with canal levee breaches or overflows.

It is recommended that once the Phase I and Phase II properties are acquired, alignments fixed, and topographical survey completed, that the design firm perform updated value engineering work for the conveyance canal verses pipeline alternatives as well as considering hybrid approaches that utilize both reaches of conveyance canal and reaches of pipeline. At that time the JPA can evaluate the capital costs, the present worth, and the benefits of each alternative in making their final decision.

XI. Related Work Specified Elsewhere

A. TM 2- Conveyance Capacity Requirements
B. TM 3 – Pipeline Requirements
C. TM 4 – Pump Station Requirements
D. TM 5 – Geotechnical Investigation
E. TM 8 - ROW Acquisition
F. TM 10 – Facility Operation and SCADA Requirements
G. TM 11- Engineer's Estimates

Appendices

Appendix A – Canal Cross Sections
Appendix B – Quantity Calculations
Appendix C – Present Worth Analysis

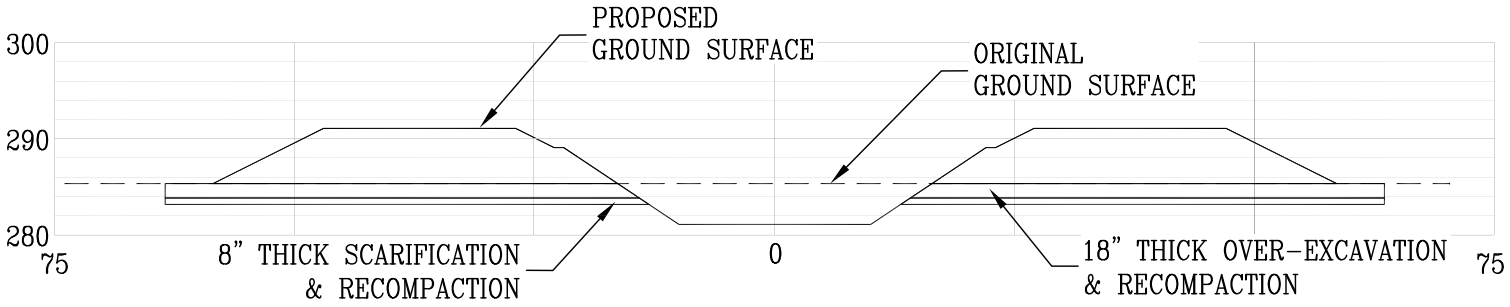
Appendix A
Canal Cross Sections

REACH 1

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

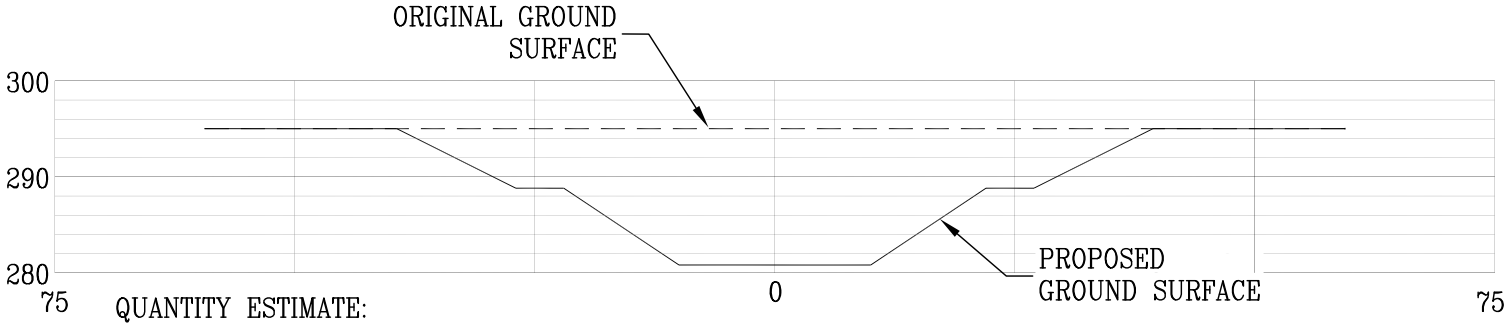
SCALE: 1"= 20'

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
FAX 661 393-4799
639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
PHONE 559 791-9286
FAX 559 783-9275



QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 112.1 CF/LF
"NEAT LINE" FILL AREA 362.7 CF/LF
OVER-EXCAVATION 144.8 CF/LF

STA 0+00



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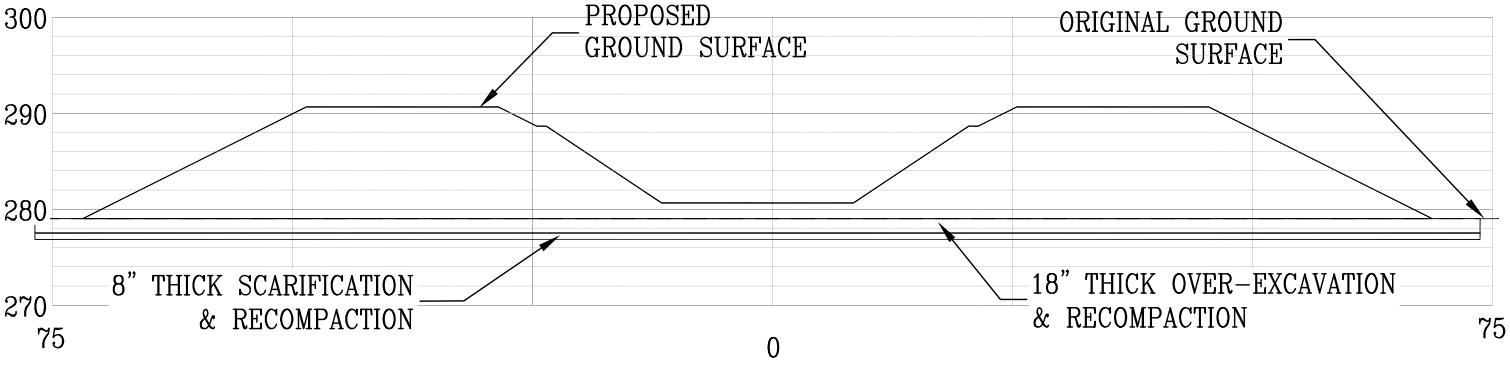
OVER-EXCAVATION 0 CF/LF

STA 6+04



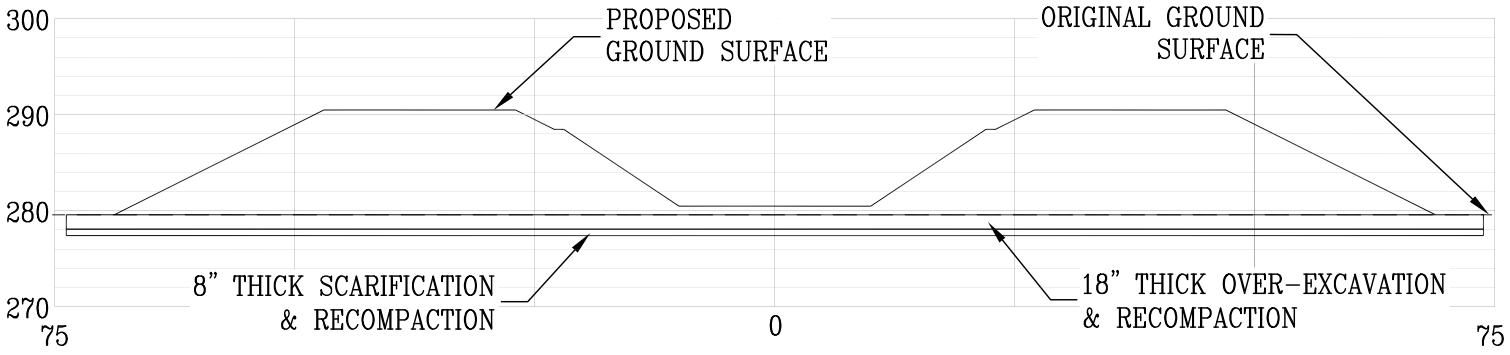
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 0 CF/LF
"NEAT LINE" FILL AREA 1007.7 CF/LF
OVER-EXCAVATION 225.8 CF/LF

STA 12+04

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

SCALE: 1"= 20'

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
FAX 661 393-4799
639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
PHONE 559 791-9286
FAX 559 783-9275



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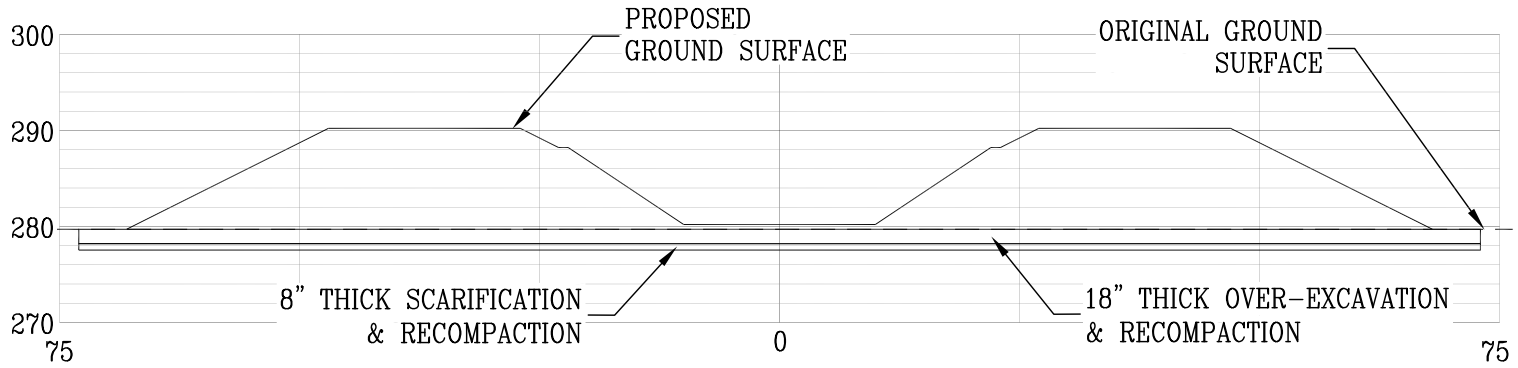
OVER-EXCAVATION 221.4 CF/LF

STA 18+04



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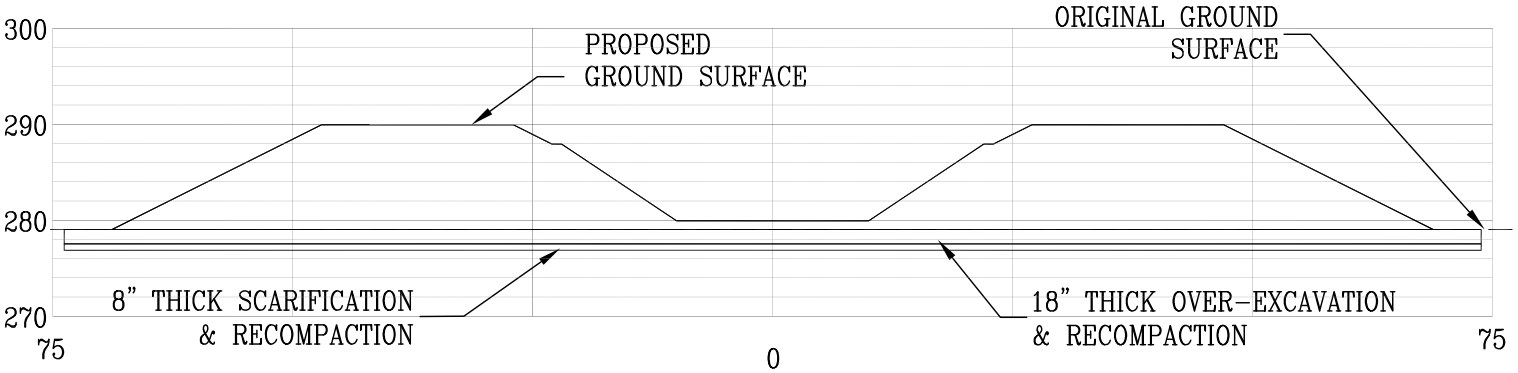
"NEAT LINE" FILL AREA 851.5 CF/LF
OVER-EXCAVATION 219.0 CF/LF

STA 28+04



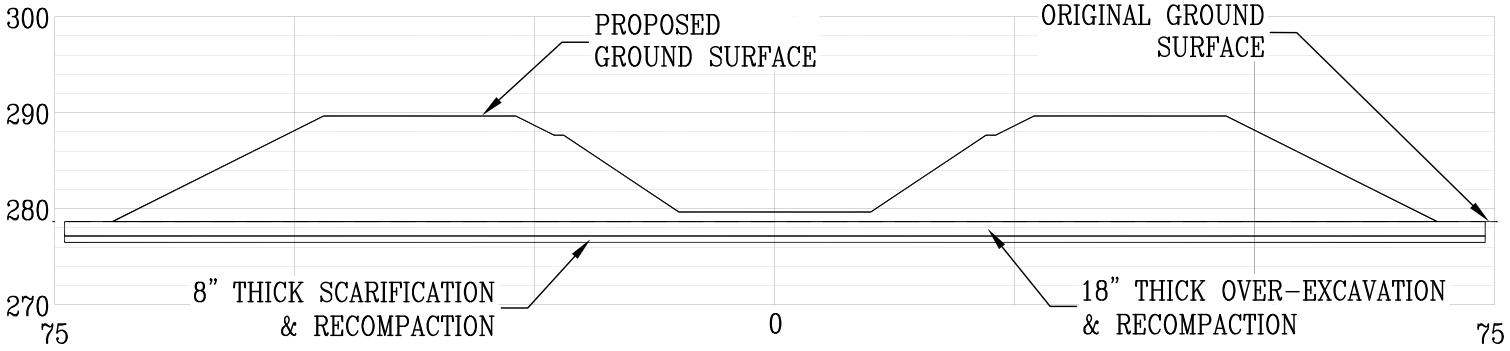
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 0 CF/LF
"NEAT LINE" FILL AREA 906.2 CF/LF
OVER-EXCAVATION 221.4 CF/LF

STA 38+04

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

SCALE: 1"= 20'

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
FAX 661 393-4799
639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
PHONE 559 791-9286
FAX 559 783-9275



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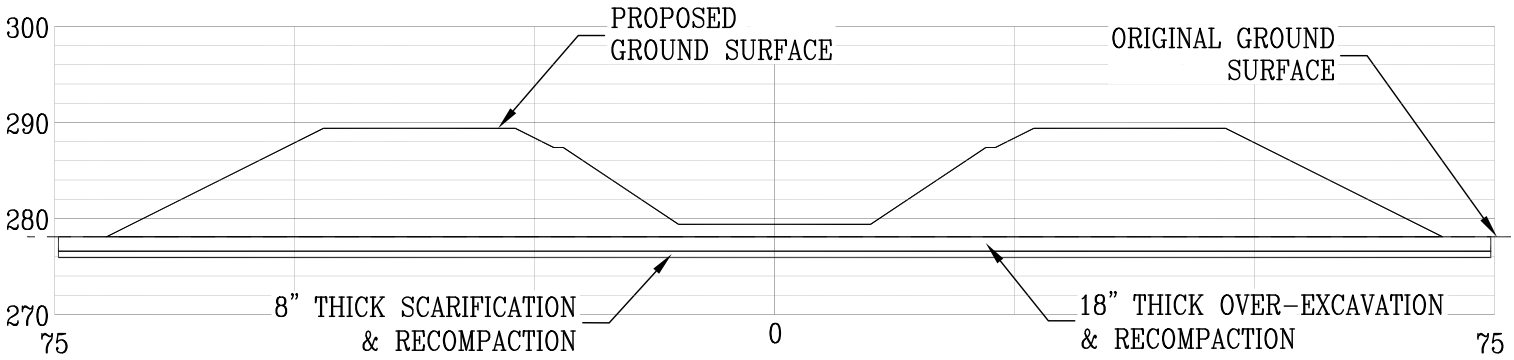
OVER-EXCAVATION 222.0 CF/LF

STA 48+04



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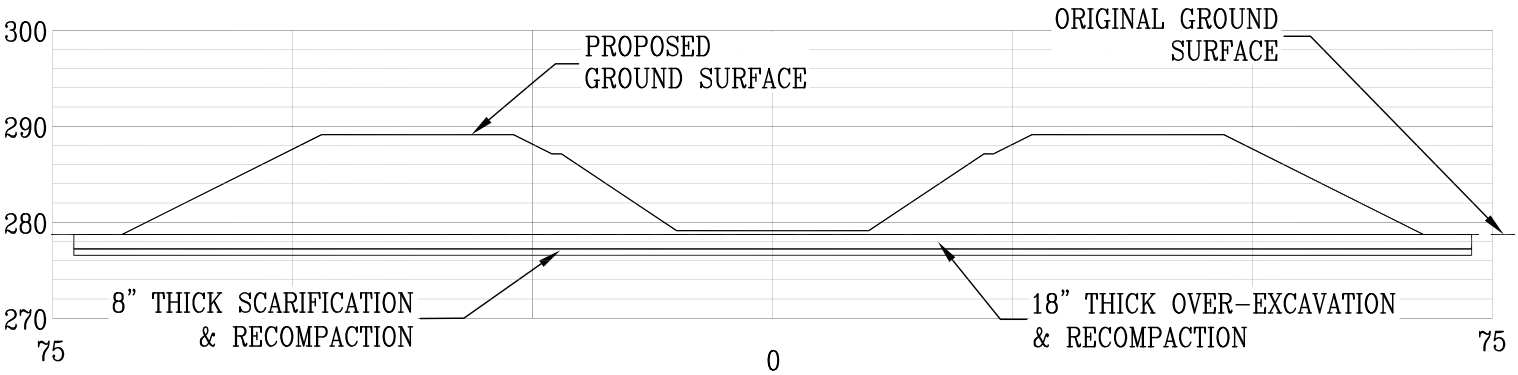
"NEAT LINE" FILL AREA 961.6 CF/LF
OVER-EXCAVATION 223.8 CF/LF

STA 58+04



QUANTITY ESTIMATE:
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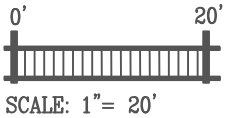
"NEAT LINE" FILL AREA 837.9 CF/LF
OVER-EXCAVATION 218.4 CF/LF

STA 68+04

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS



SCALE: 1"= 20'

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
FAX 661 393-4799
639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
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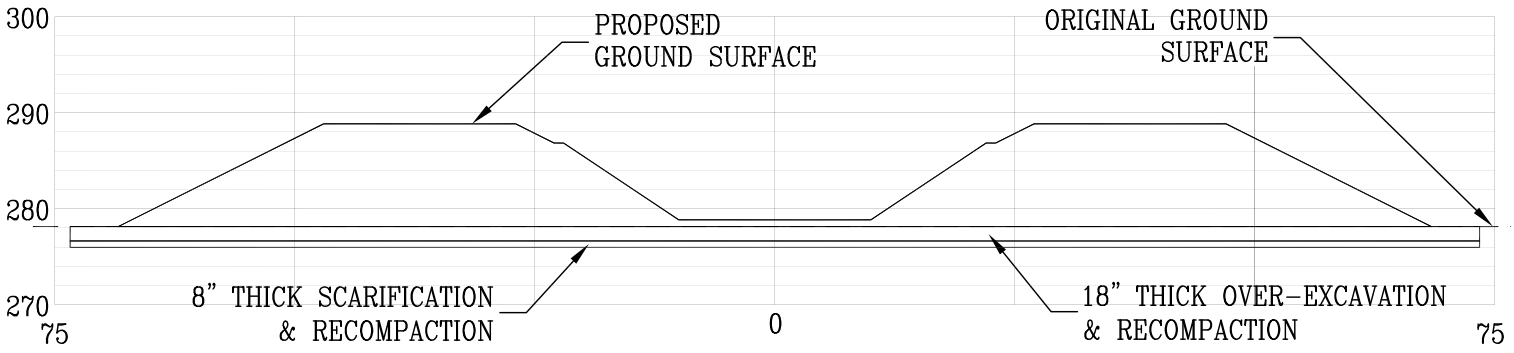

QUANTITY ESTIMATE:
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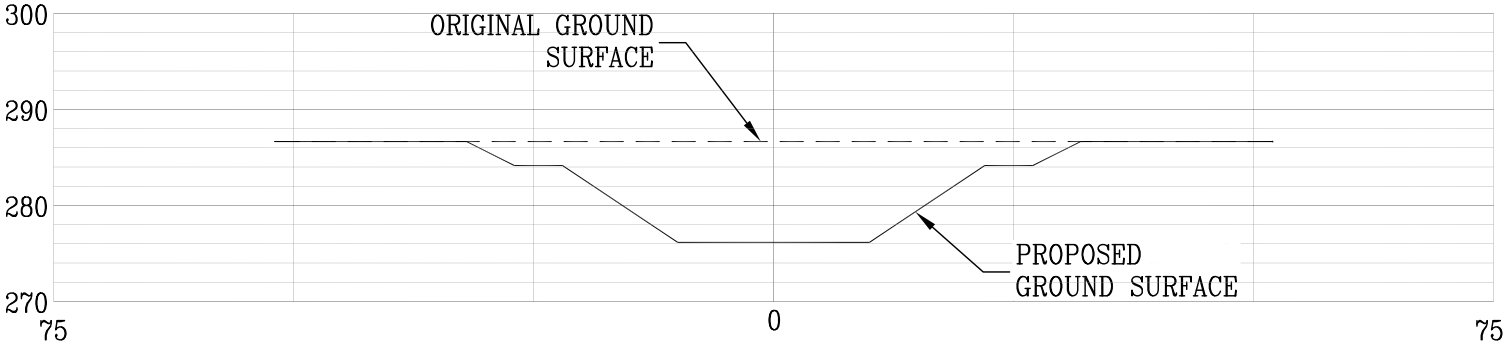
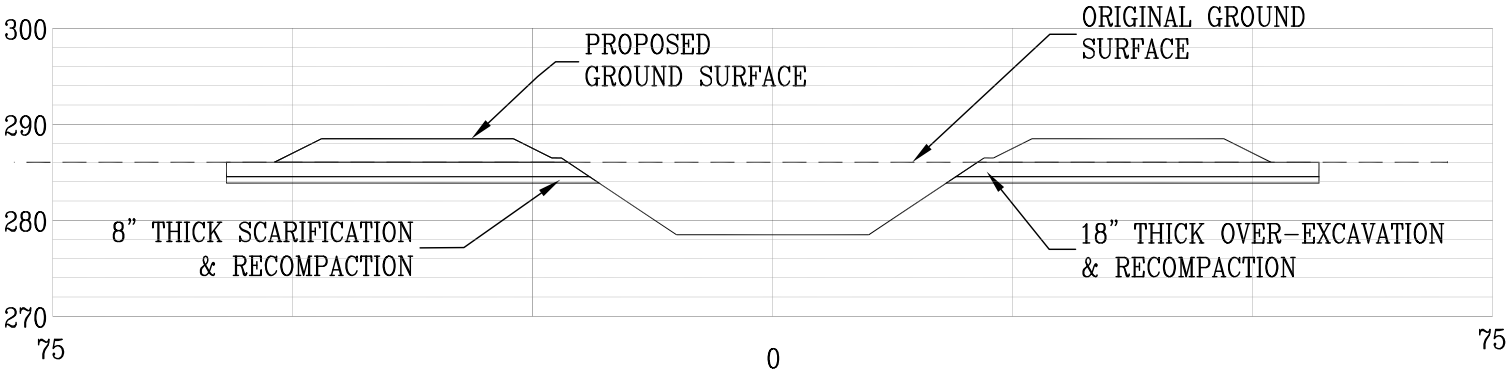
"NEAT LINE" FILL AREA 878.8 CF/LF
OVER-EXCAVATION 220.2 CF/LF

STA 78+04



QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 403.5 CF/LF
"NEAT LINE" FILL AREA 0 CF/LF
OVER-EXCAVATION 0 CF/LF

STA 85+80



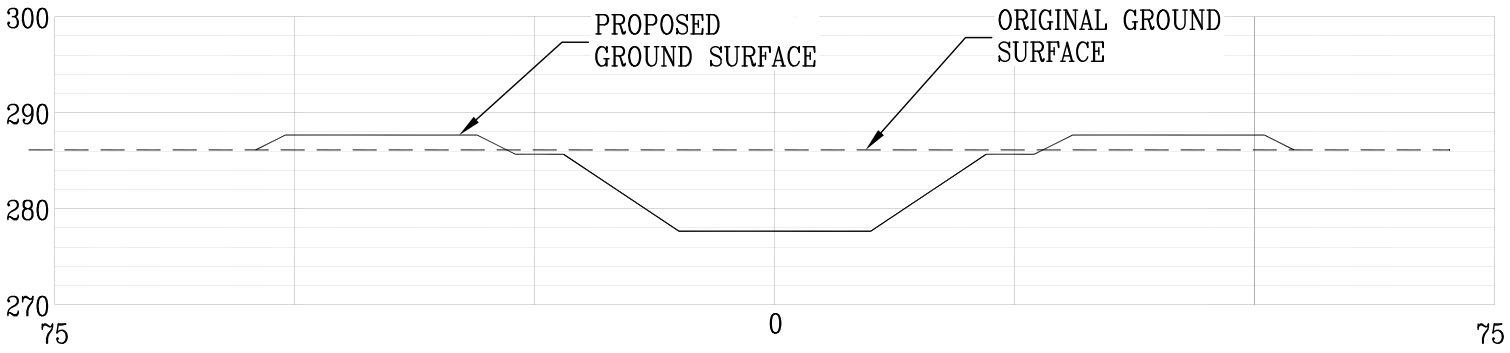
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 236.5 CF/LF
"NEAT LINE" FILL AREA 122.8 CF/LF
OVER-EXCAVATION 110.1 CF/LF

STA 89+00

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

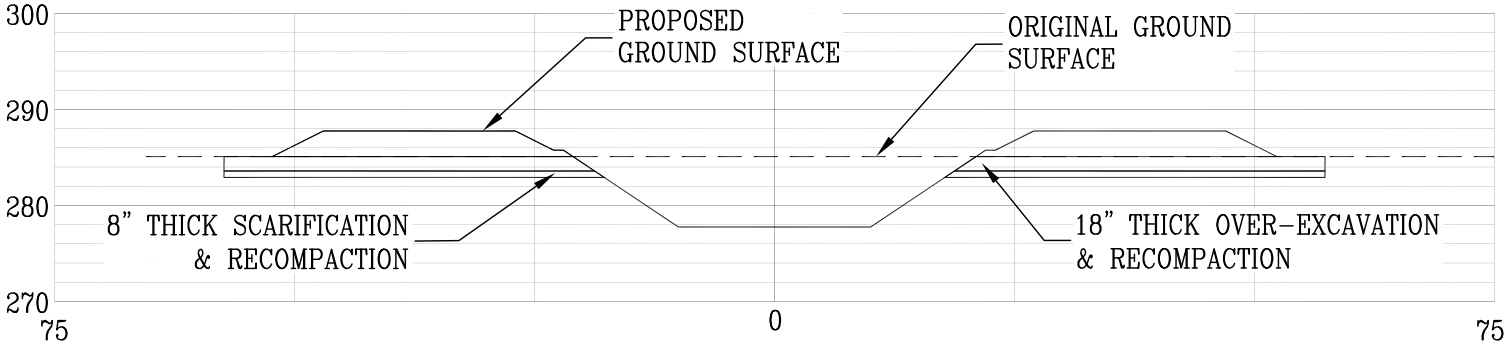
SCALE: 1"= 20'

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
FAX 661 393-4799
639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
PHONE 559 791-9286
FAX 559 783-9275



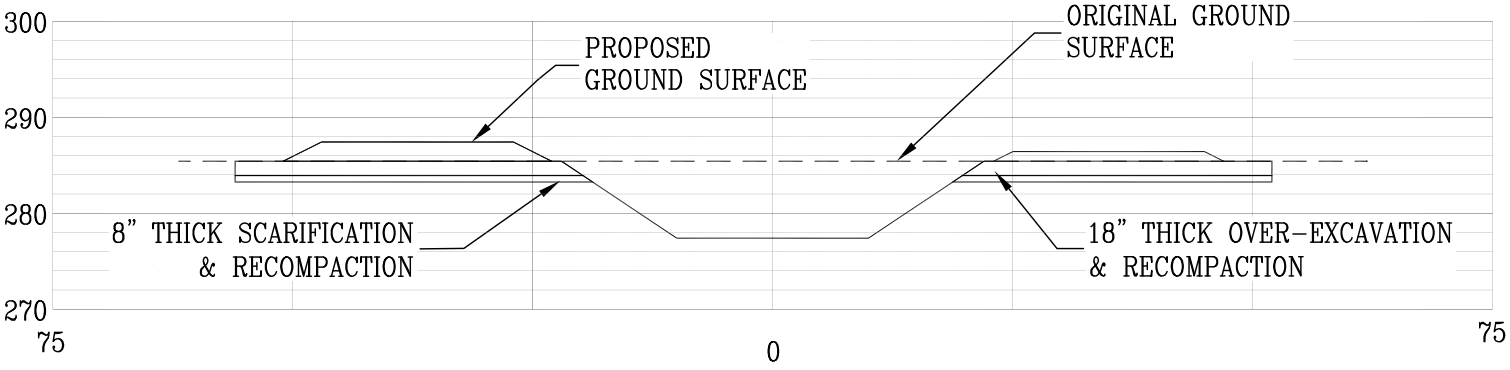
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 281.3 CF/LF
"NEAT LINE" FILL AREA 71.0 CF/LF
OVER-EXCAVATION 0 CF/LF

STA 99+55



QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 227.2 CF/LF
"NEAT LINE" FILL AREA 136.4 CF/LF
OVER-EXCAVATION 112.4 CF/LF

STA 109+75



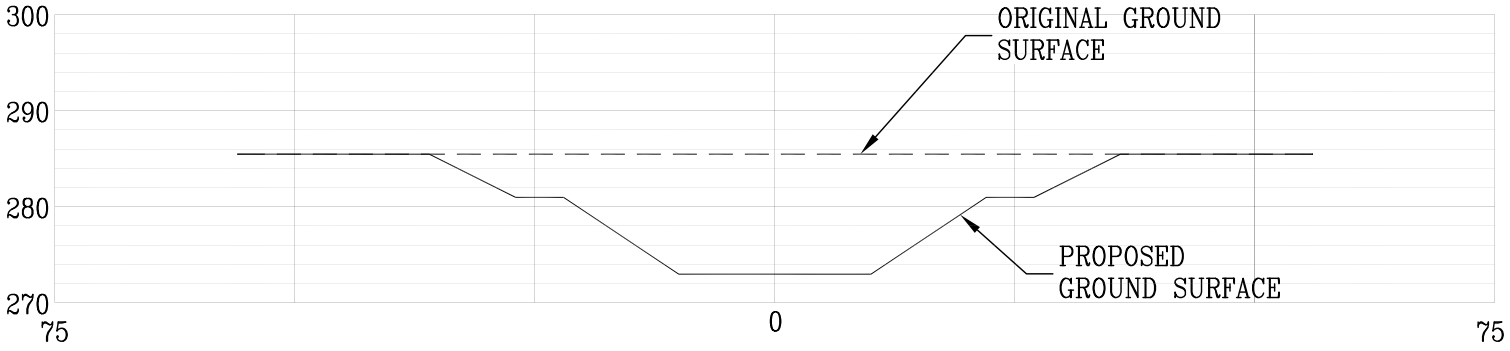
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 256.0 CF/LF
"NEAT LINE" FILL AREA 96.0 CF/LF
OVER-EXCAVATION 105.4 CF/LF

STA 119+75

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

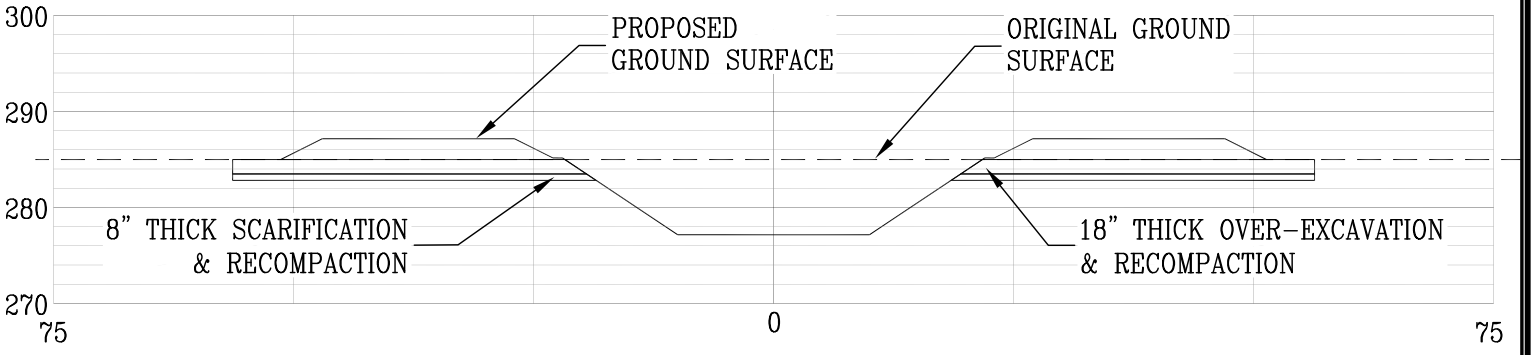
SCALE: 1"= 20'

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
FAX 661 393-4799
639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
PHONE 559 791-9286
FAX 559 783-9275



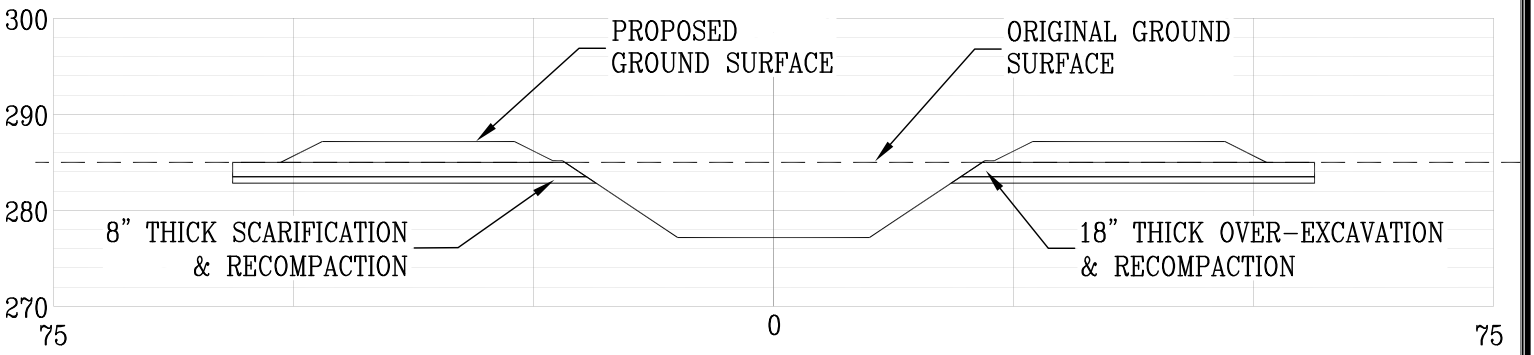
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 539.5 CF/LF
"NEAT LINE" FILL AREA 0 CF/LF
OVER-EXCAVATION 0 CF/LF

STA 130+10



QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 248.6 CF/LF
"NEAT LINE" FILL AREA 106.0 CF/LF
OVER-EXCAVATION 107.2 CF/LF

STA 133+35



QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 248.6 CF/LF
"NEAT LINE" FILL AREA 106.0 CF/LF
OVER-EXCAVATION 107.2 CF/LF

STA 138+60

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

SCALE: 1"= 20'

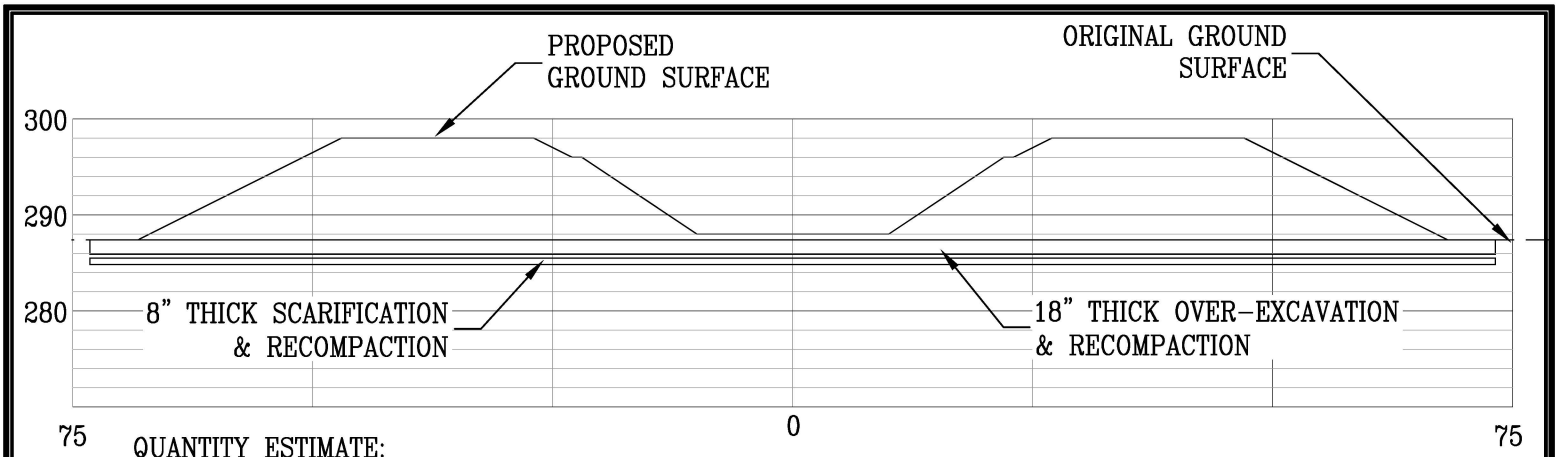
DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
FAX 661 393-4799
639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
PHONE 559 791-9286
FAX 559 783-9275

REACH 2

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

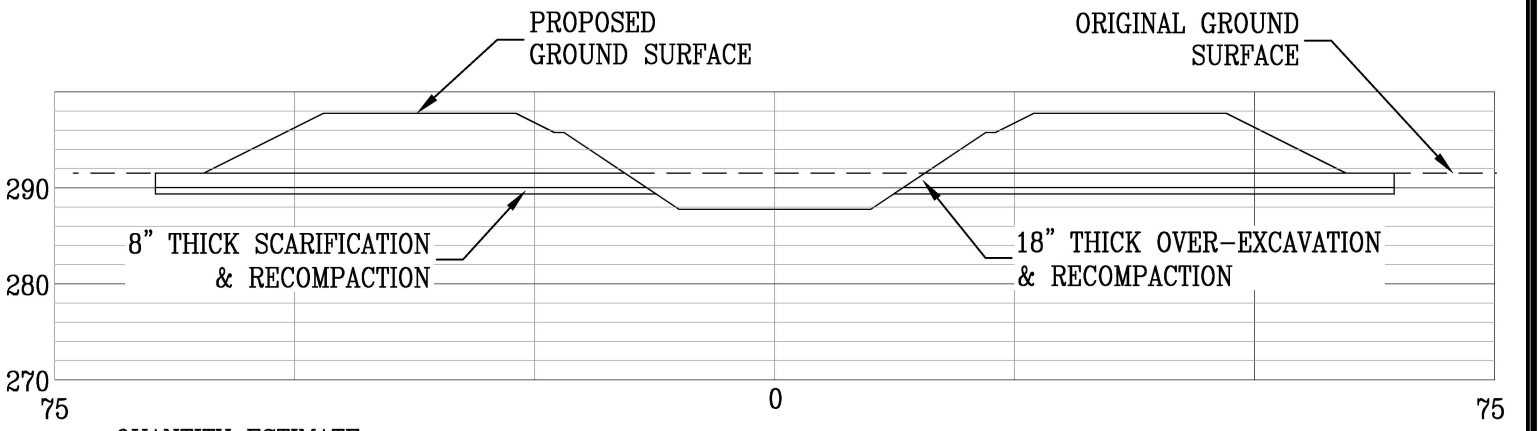
SCALE: 1"= 20'

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
FAX 661 393-4799
639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
PHONE 559 791-9286
FAX 559 783-9275



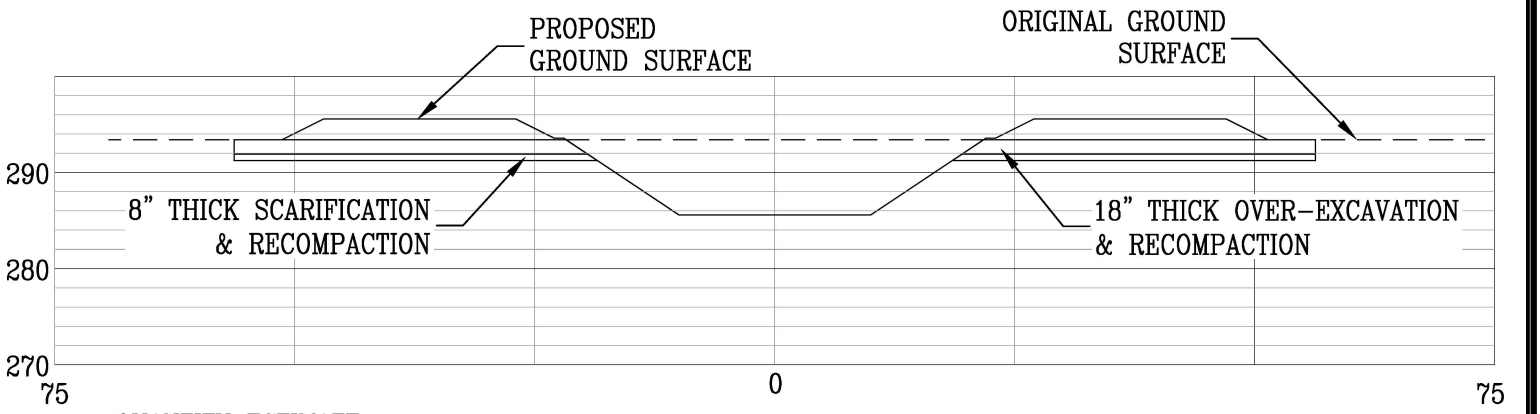
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 0 CF/LF
"NEAT LINE" FILL AREA 865.4 CF/LF
OVER-EXCAVATION 219.6 CF/LF

STA 143+40



QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 96.1 CF/LF
"NEAT LINE" FILL AREA 405.7 CF/LF
OVER-EXCAVATION 150.0 CF/LF

STA 153+40



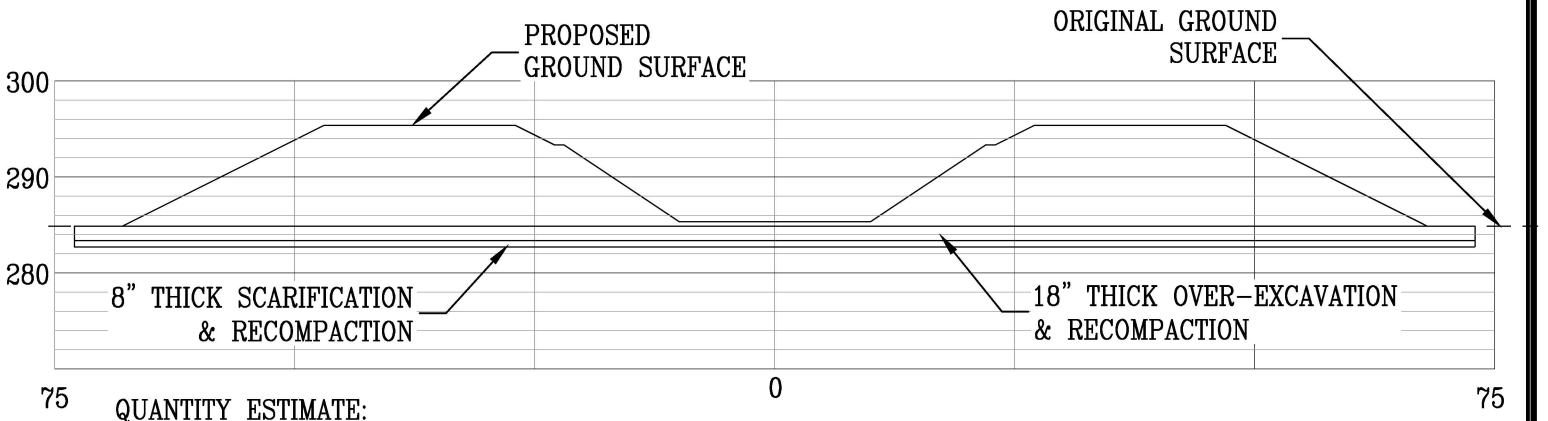
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 249.4 CF/LF
"NEAT LINE" FILL AREA 104.8 CF/LF
OVER-EXCAVATION 107.0 CF/LF

STA 163+40

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

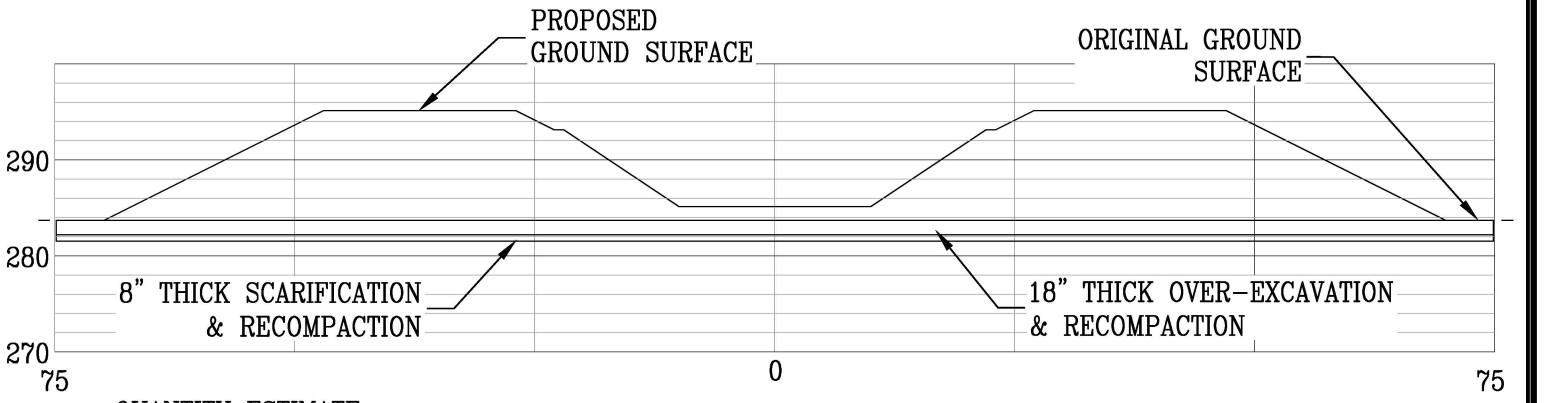
SCALE: 1"= 20'

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
FAX 661 393-4799
639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
PHONE 559 791-9286
FAX 559 783-9275



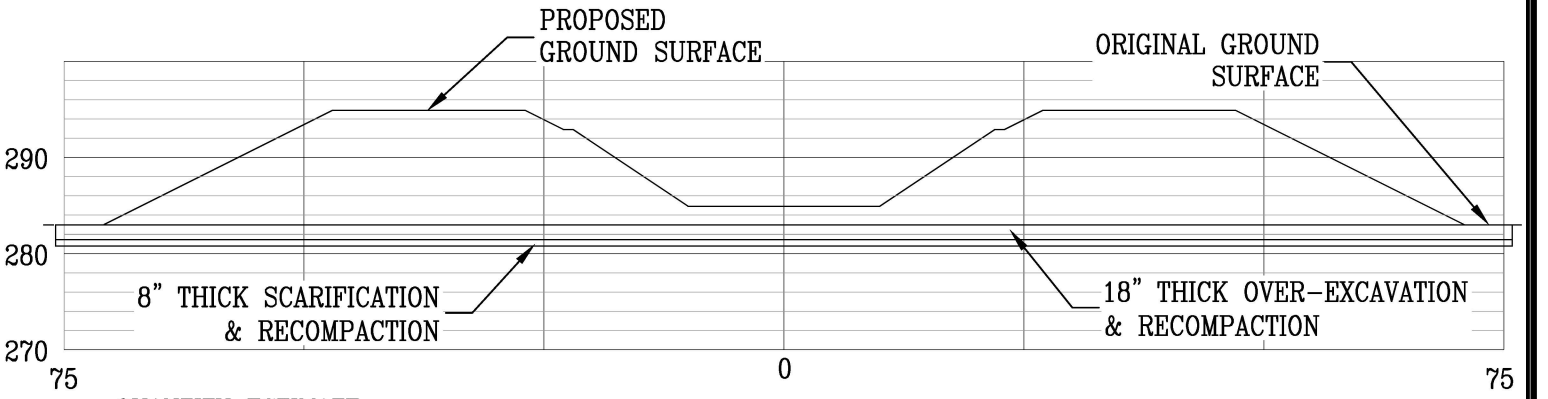
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 0 CF/LF
"NEAT LINE" FILL AREA 847.0 CF/LF
OVER-EXCAVATION 218.9 CF/LF

STA 173+40



QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 0 CF/LF
"NEAT LINE" FILL AREA 979.9 CF/LF
OVER-EXCAVATION 224.6 CF/LF

STA 183+40



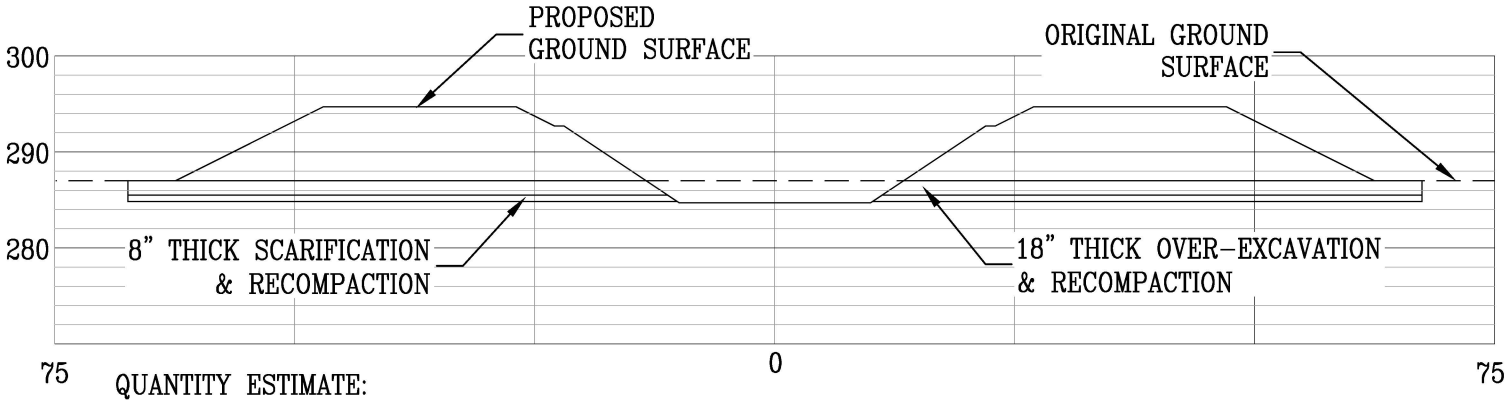
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 0 CF/LF
"NEAT LINE" FILL AREA 1,051.5 CF/LF
OVER-EXCAVATION 287.4 CF/LF

STA 193+40

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

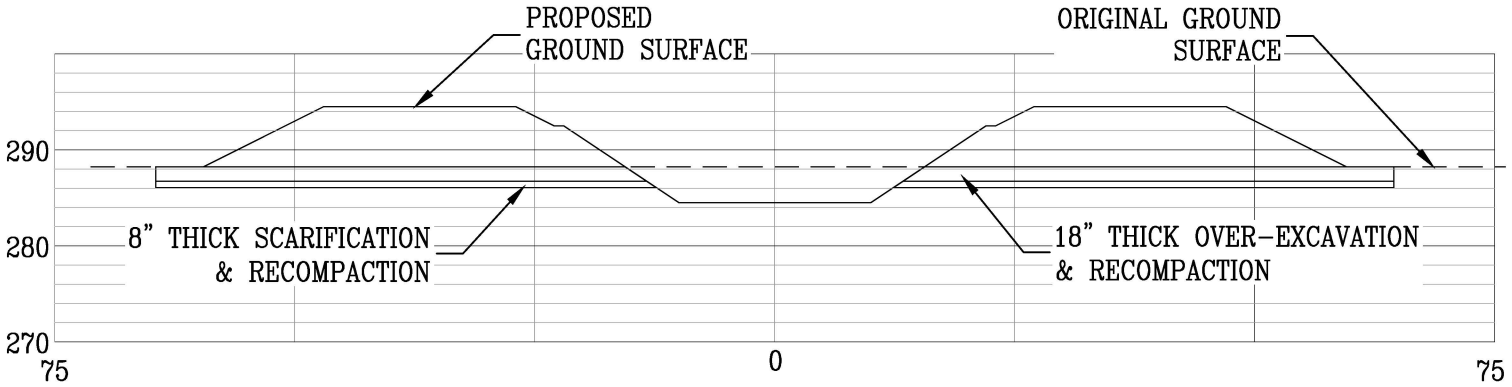
SCALE: 1"= 20'

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
FAX 661 393-4799
639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
PHONE 559 791-9286
FAX 559 783-9275



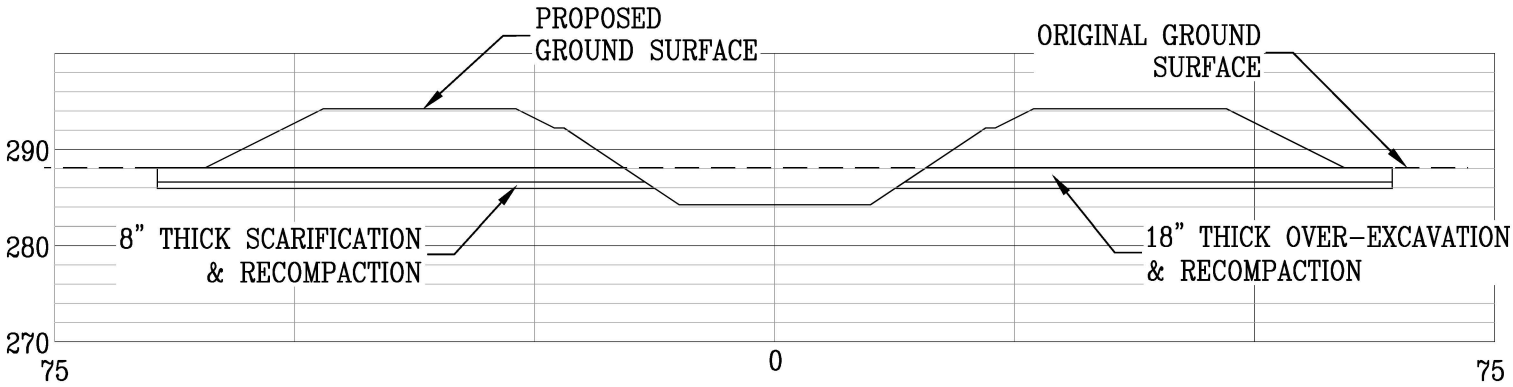
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 53.9 CF/LF
"NEAT LINE" FILL AREA 540.0 CF/LF
OVER-EXCAVATION 165.2 CF/LF

STA 203+40



QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 96.1 CF/LF
"NEAT LINE" FILL AREA 405.7 CF/LF
OVER-EXCAVATION 150.0 CF/LF

STA 217+70



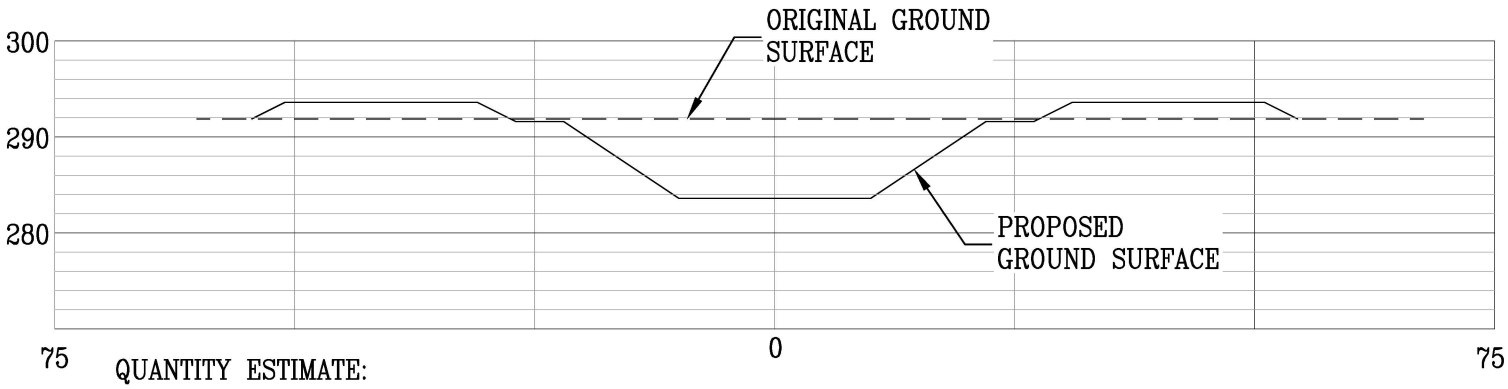
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 99.2 CF/LF
"NEAT LINE" FILL AREA 397.0 CF/LF
OVER-EXCAVATION 149.0 CF/LF

STA 221+90

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

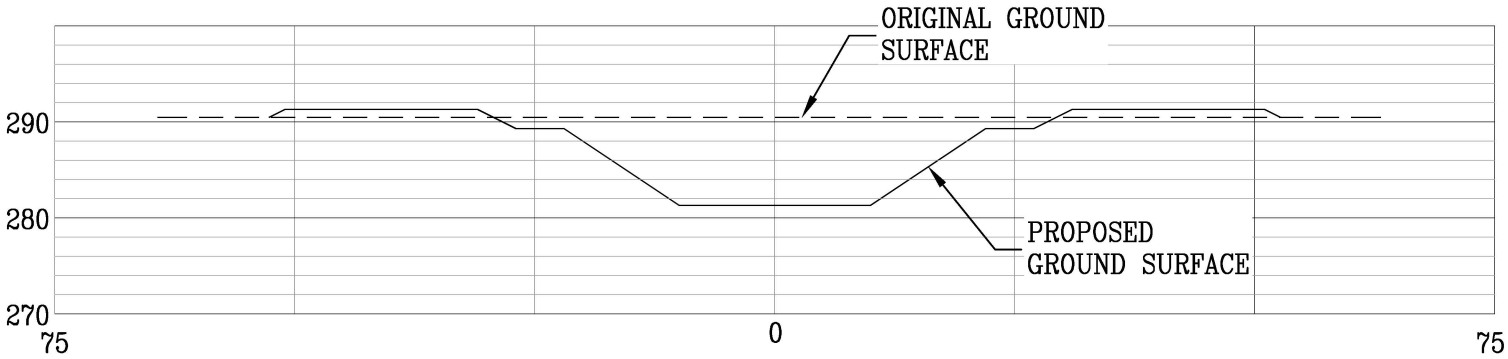
SCALE: 1"= 20'

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
FAX 661 393-4799
639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
PHONE 559 791-9286
FAX 559 783-9275



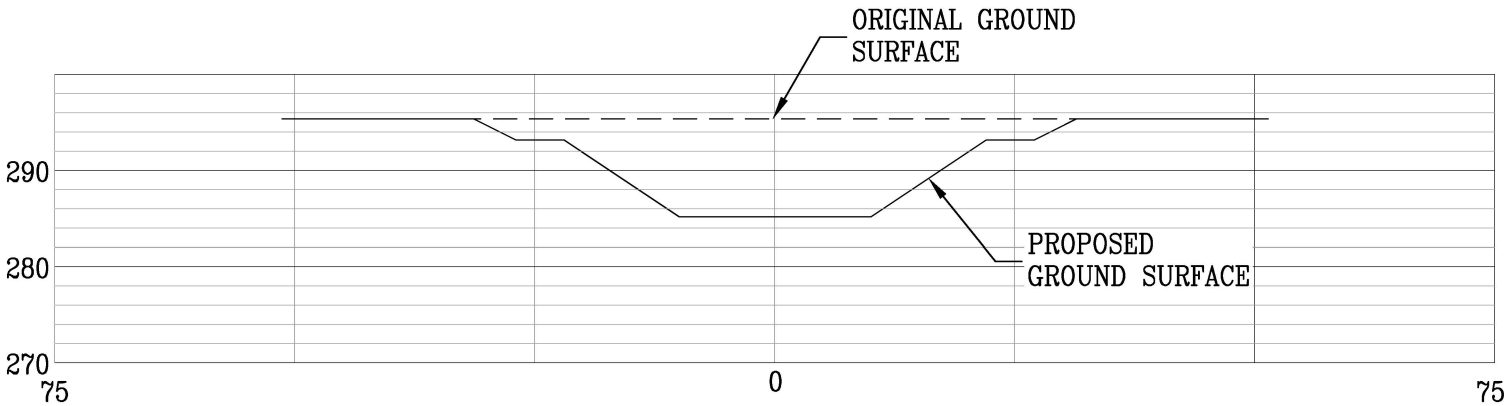
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 269.6 CF/LF
"NEAT LINE" FILL AREA 82.2 CF/LF
OVER-EXCAVATION 0 CF/LF

STA 232+30



QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 320.7 CF/LF
"NEAT LINE" FILL AREA 36.9 CF/LF
OVER-EXCAVATION 0 CF/LF

STA 242+30



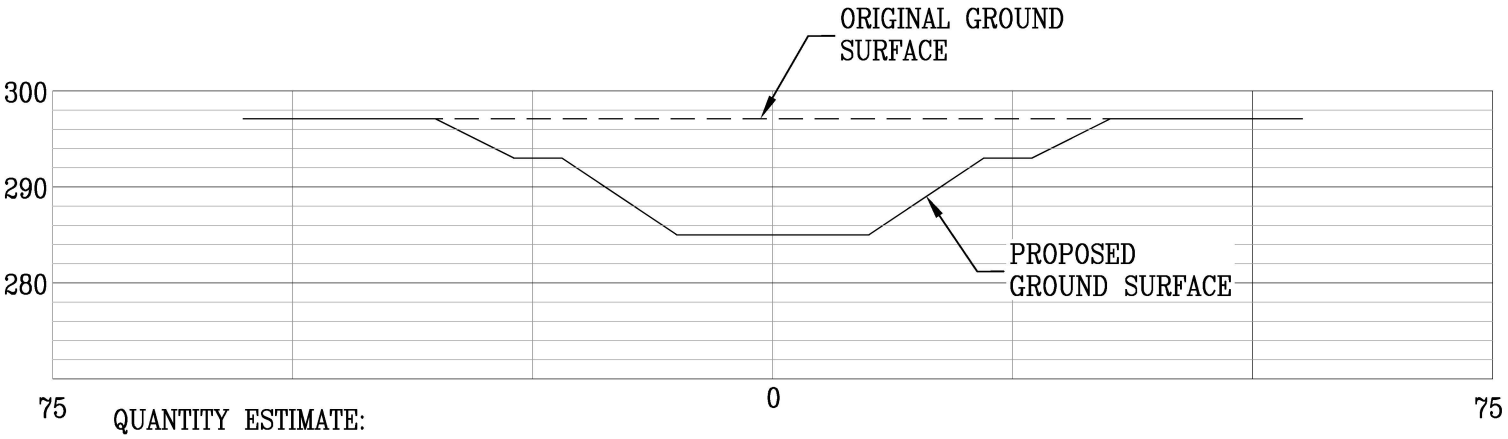
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 384.5 CF/LF
"NEAT LINE" FILL AREA 0 CF/LF
OVER-EXCAVATION 0 CF/LF

STA 252+70

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

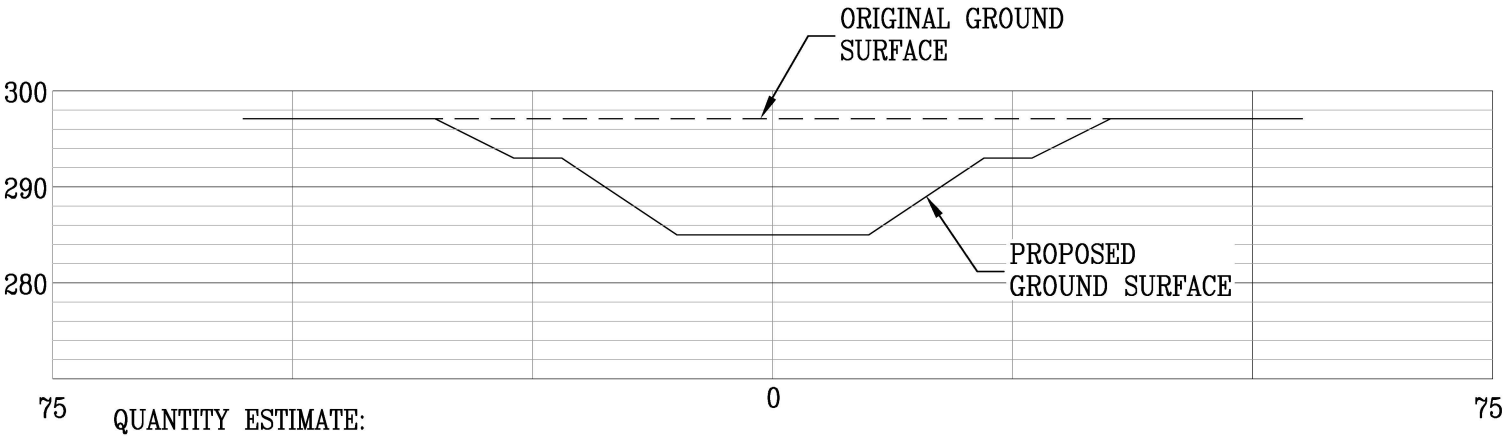
SCALE: 1"= 20'

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
FAX 661 393-4799
639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
PHONE 559 791-9286
FAX 559 783-9275



QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 511.0CF/LF
"NEAT LINE" FILL AREA 0 CF/LF
OVER-EXCAVATION 0 CF/LF

STA 256+90



QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 511.0CF/LF
"NEAT LINE" FILL AREA 0 CF/LF
OVER-EXCAVATION 0 CF/LF

STA 267+20

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

SCALE: 1"= 20'

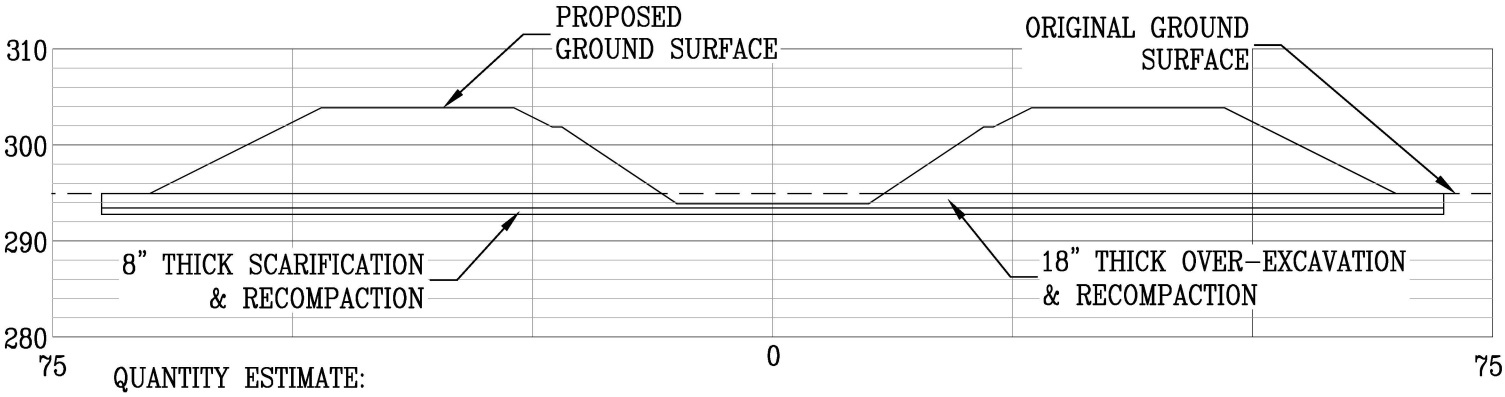
DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
FAX 661 393-4799
639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
PHONE 559 791-9286
FAX 559 783-9275

REACH 3

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

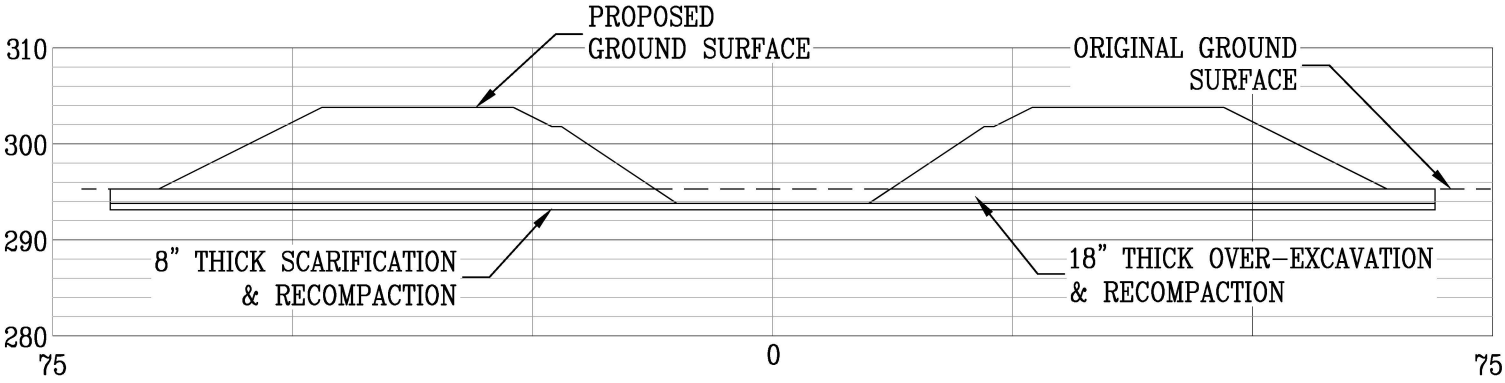
SCALE: 1"= 20'

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
FAX 661 393-4799
639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
PHONE 559 791-9286
FAX 559 783-9275



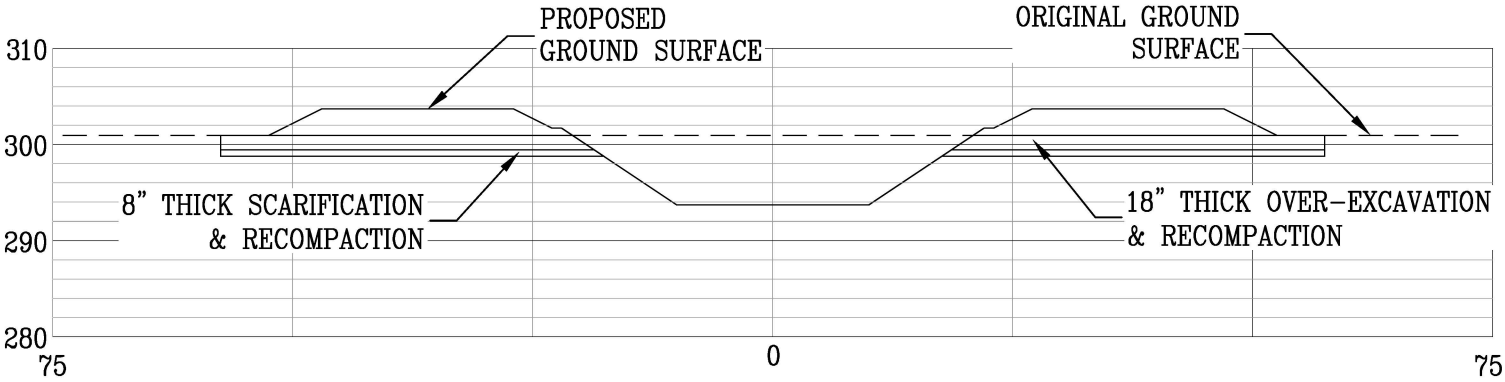
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 22.7 CF/LF
"NEAT LINE" FILL AREA 668.2 CF/LF
OVER-EXCAVATION 187.0 CF/LF

STA 267+20



QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 33.4 CF/LF
"NEAT LINE" FILL AREA 620.8 CF/LF
OVER-EXCAVATION 173.8 CF/LF

STA 278+00



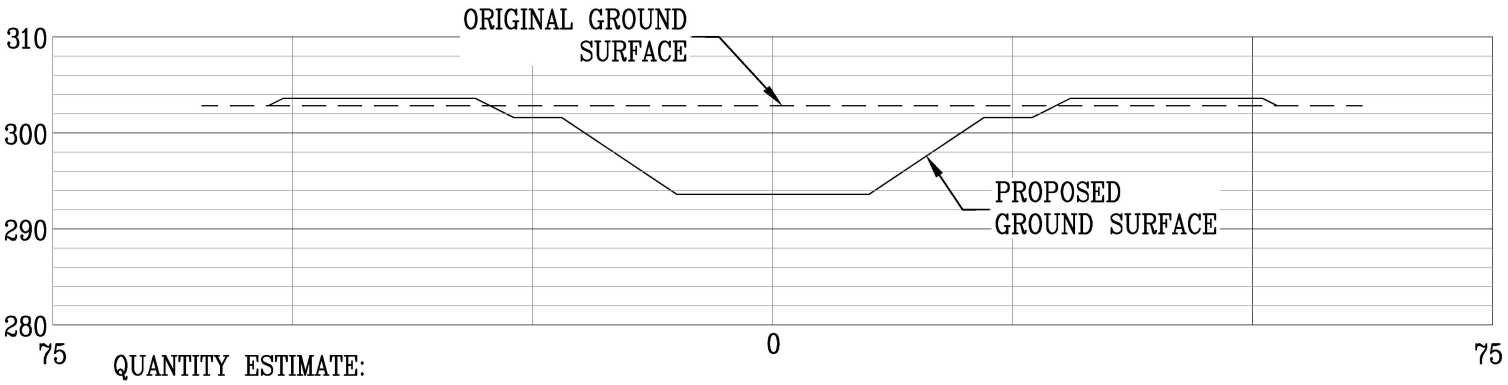
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 223.8 CF/LF
"NEAT LINE" FILL AREA 141.4 CF/LF
OVER-EXCAVATION 113.2 CF/LF

STA 288+00

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

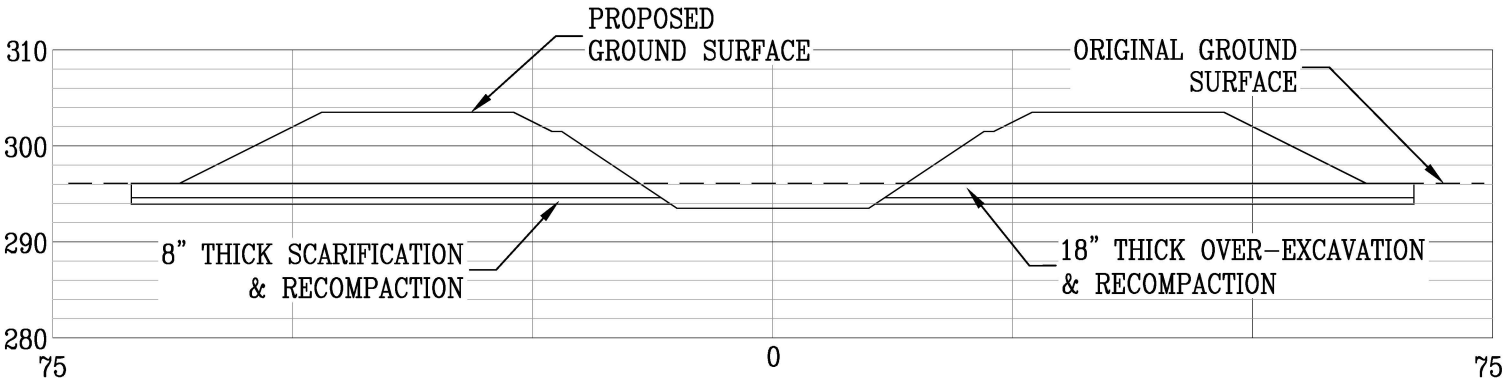
SCALE: 1"= 20'

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
FAX 661 393-4799
639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
PHONE 559 791-9286
FAX 559 783-9275



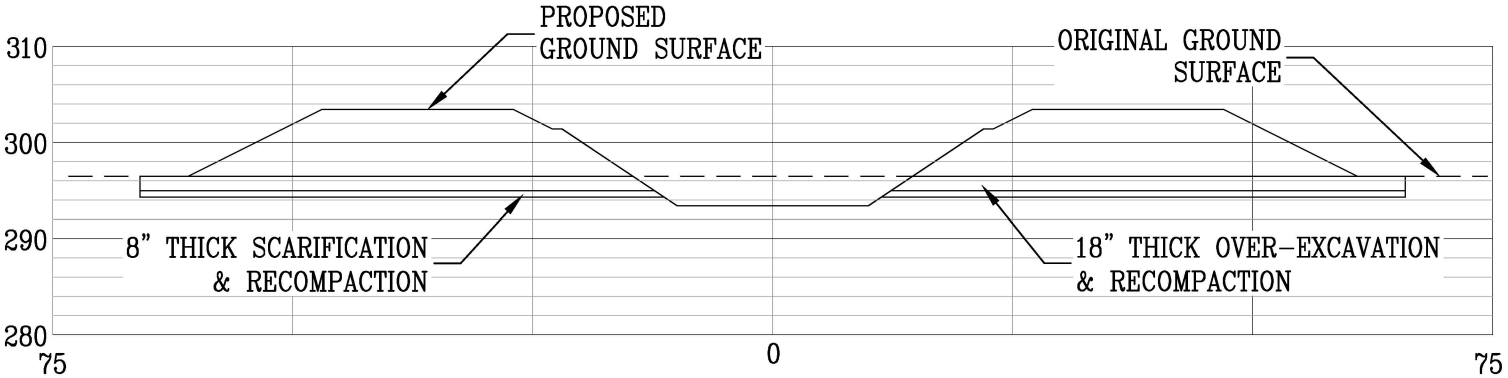
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 326.6 CF/LF
"NEAT LINE" FILL AREA 32.2 CF/LF
OVER-EXCAVATION 0 CF/LF

STA 298+00



QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 62.1 CF/LF
"NEAT LINE" FILL AREA 511.2 CF/LF
OVER-EXCAVATION 162.0 CF/LF

STA 308+00



QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 75.0 CF/LF
"NEAT LINE" FILL AREA 448.8 CF/LF
OVER-EXCAVATION 161.4 CF/LF

STA 318+00

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

SCALE: 1"= 20'

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
FAX 661 393-4799
639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
PHONE 559 791-9286
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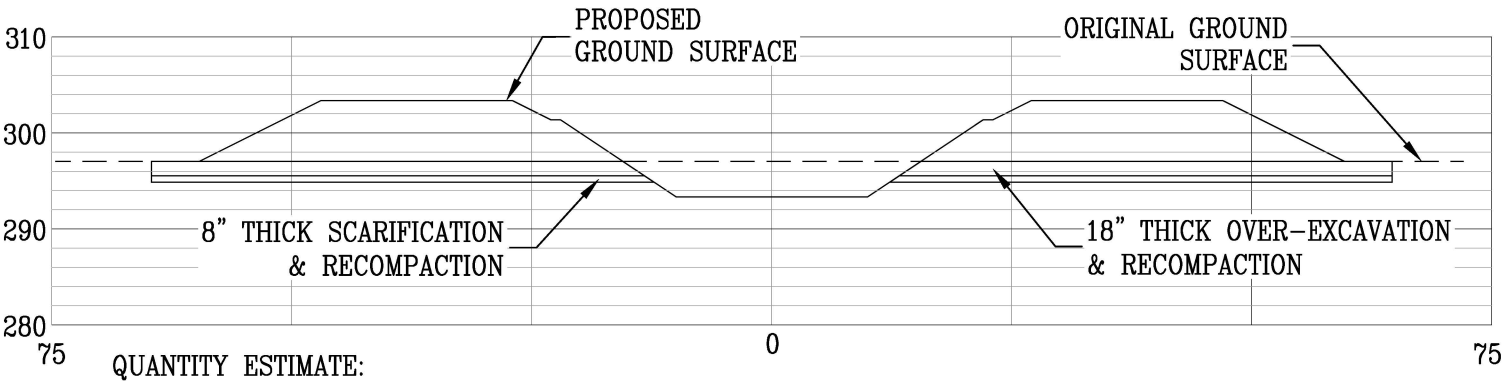
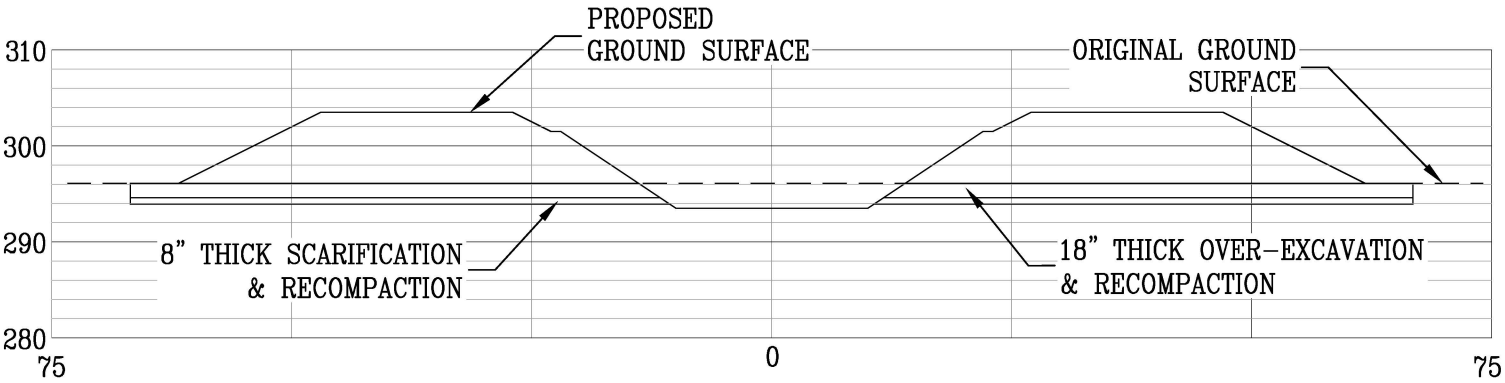


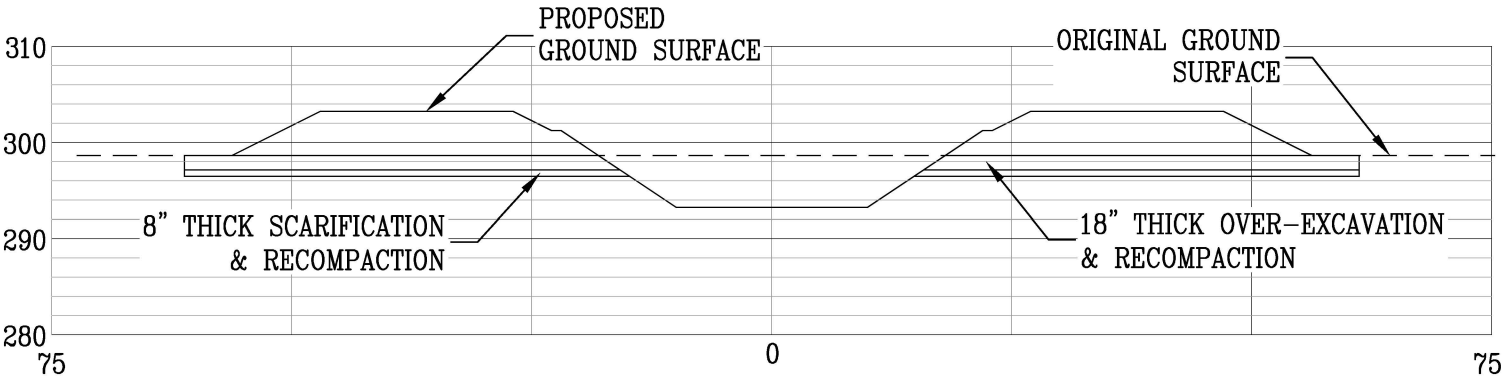
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 94.5 CF/LF
"NEAT LINE" FILL AREA 410.1 CF/LF
OVER-EXCAVATION 150.5 CF/LF

STA 328+00



QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 91.4 CF/LF
"NEAT LINE" FILL AREA 419.0 CF/LF
OVER-EXCAVATION 151.6 CF/LF

STA 338+00



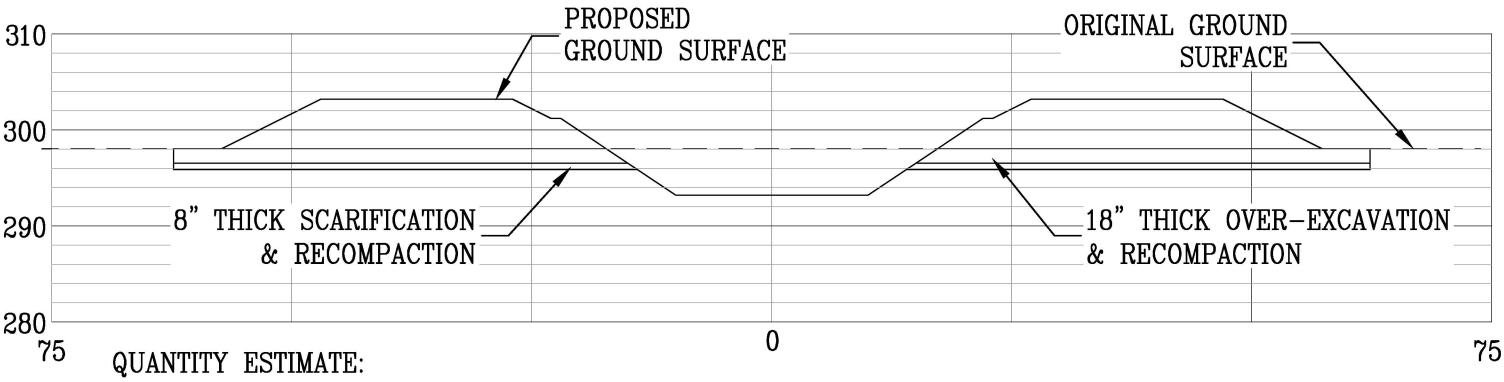
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 151.7 CF/LF
"NEAT LINE" FILL AREA 270.6 CF/LF
OVER-EXCAVATION 132.6 CF/LF

STA 348+00

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

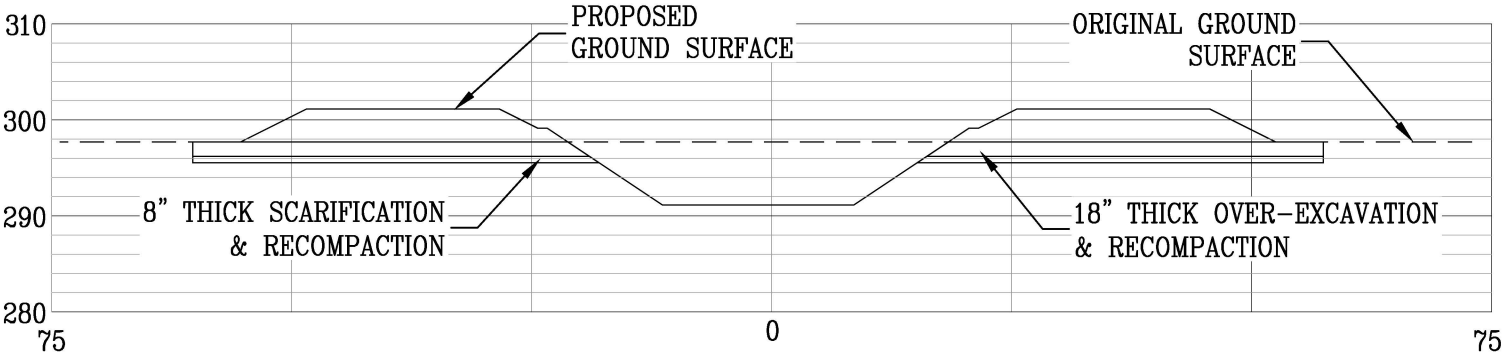
SCALE: 1"= 20'

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
FAX 661 393-4799
639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
PHONE 559 791-9286
FAX 559 783-9275



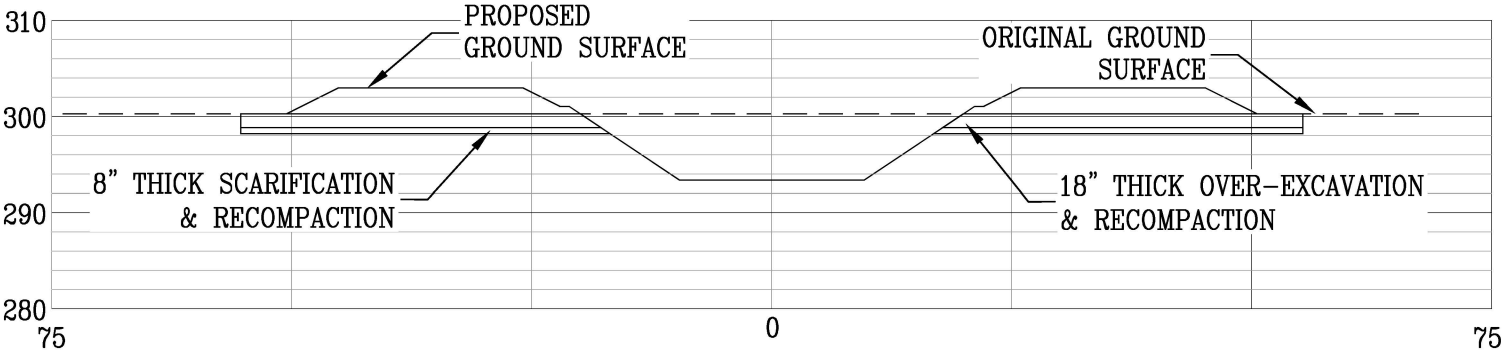
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 132.3 CF/LF
"NEAT LINE" FILL AREA 313.4 CF/LF
OVER-EXCAVATION 138.4 CF/LF

STA 358+00



QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 195.4 CF/LF
"NEAT LINE" FILL AREA 187.4 CF/LF
OVER-EXCAVATION 120.6 CF/LF

STA 368+00



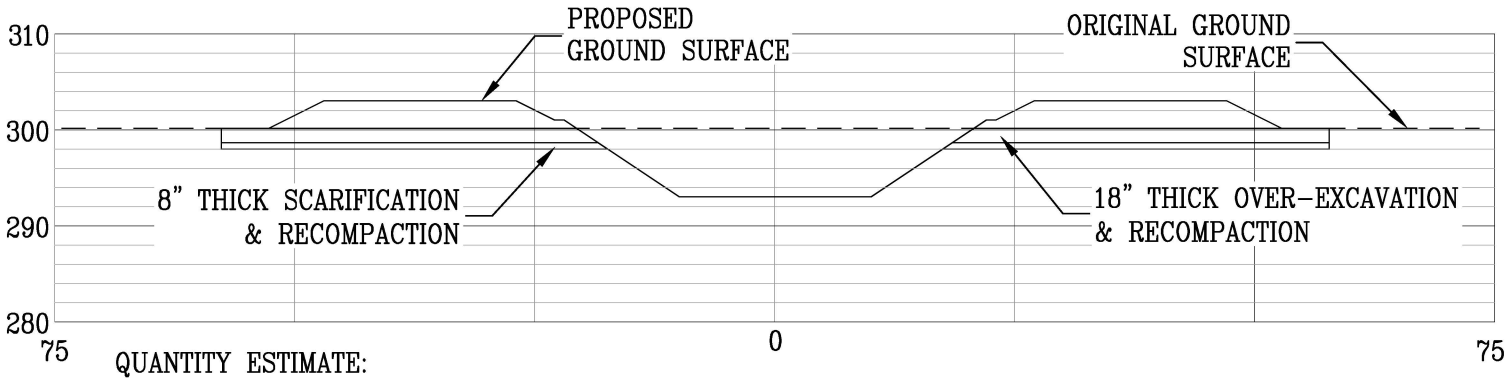
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 221.8 CF/LF
"NEAT LINE" FILL AREA 144.6 CF/LF
OVER-EXCAVATION 103.8 CF/LF

STA 378+00

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

SCALE: 1"= 20'

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
FAX 661 393-4799
639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
PHONE 559 791-9286
FAX 559 783-9275



QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 219.7 CF/LF
"NEAT LINE" FILL AREA 147.8 CF/LF
OVER-EXCAVATION 114.3 CF/LF

STA 392+80

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

0' 20'
SCALE: 1"= 20'

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
FAX 661 393-4799
639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
PHONE 559 791-9286
FAX 559 783-9275

REACH 4

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

SCALE: 1"= 20'

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
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639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
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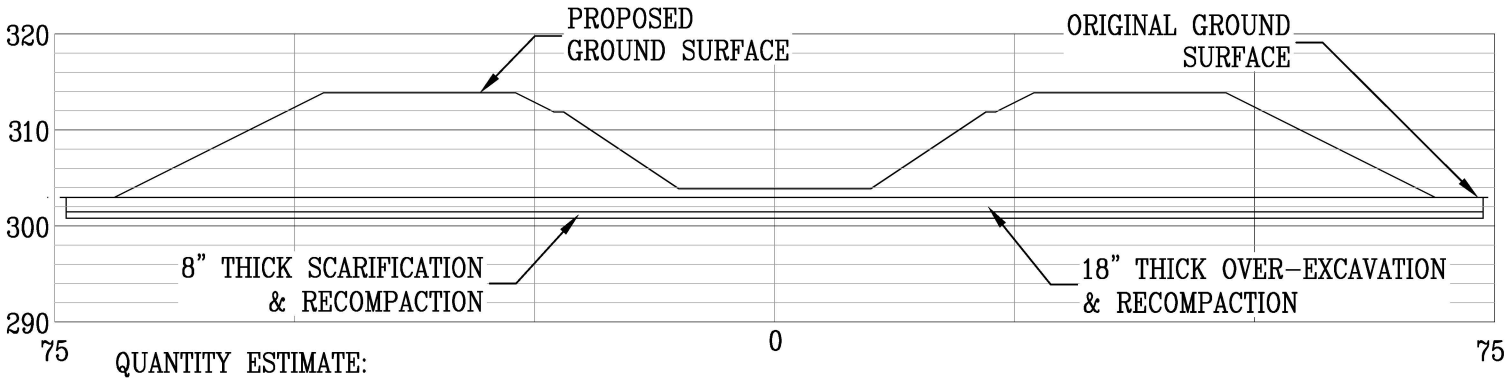
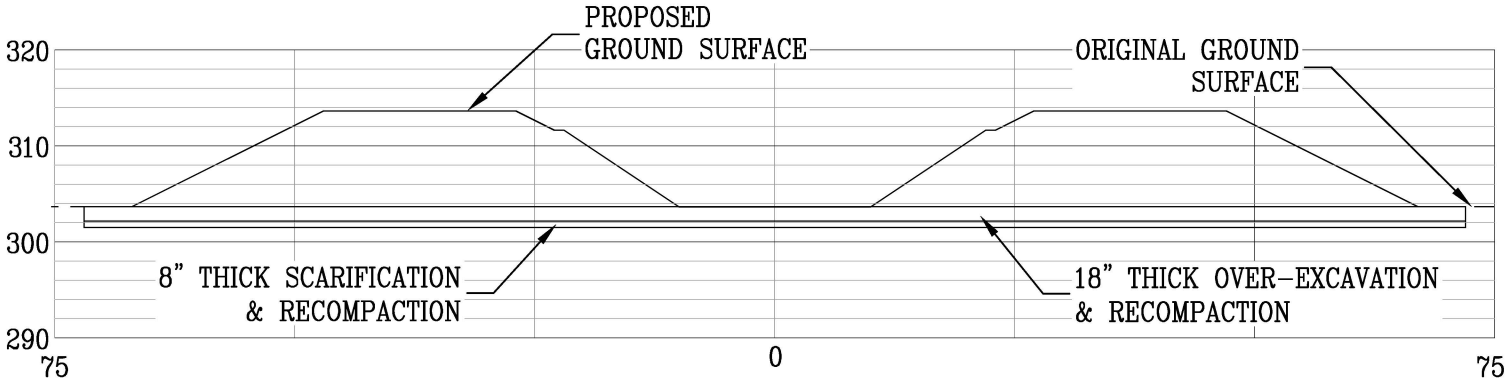


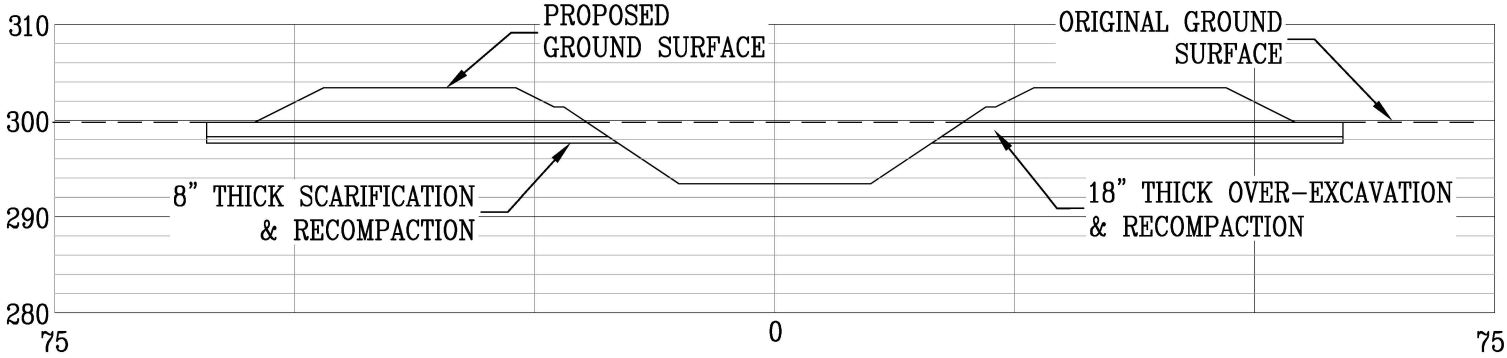
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 0 CF/LF
"NEAT LINE" FILL AREA 906.2 CF/LF
OVER-EXCAVATION 221.4 CF/LF

STA 393+60



QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 0 CF/LF
"NEAT LINE" FILL AREA 781.7 CF/LF
OVER-EXCAVATION 215.9 CF/LF

STA 406+00



QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 189.4 CF/LF
"NEAT LINE" FILL AREA 197.8 CF/LF
OVER-EXCAVATION 122.2 CF/LF

STA 416+00

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

SCALE: 1"= 20'

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2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
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639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
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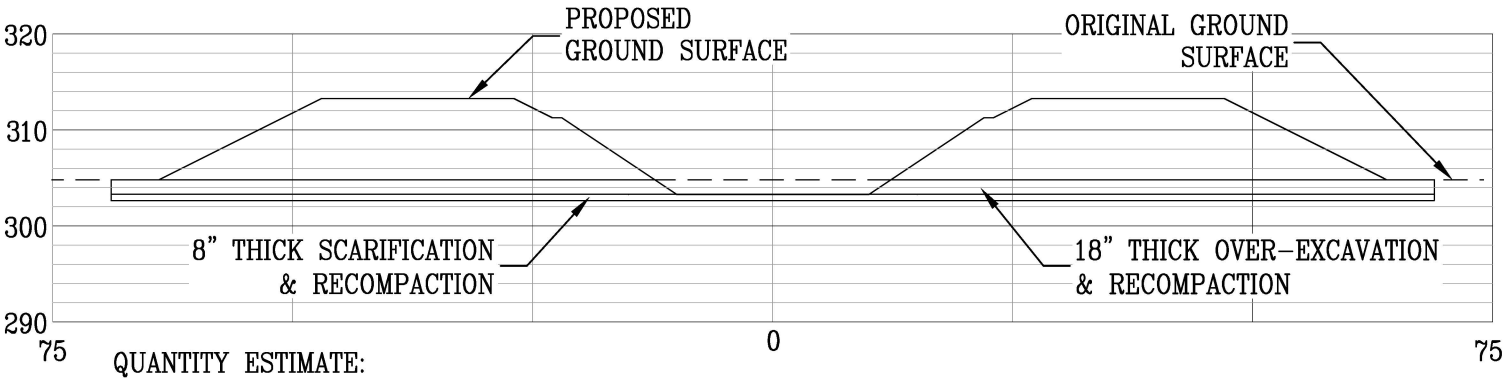
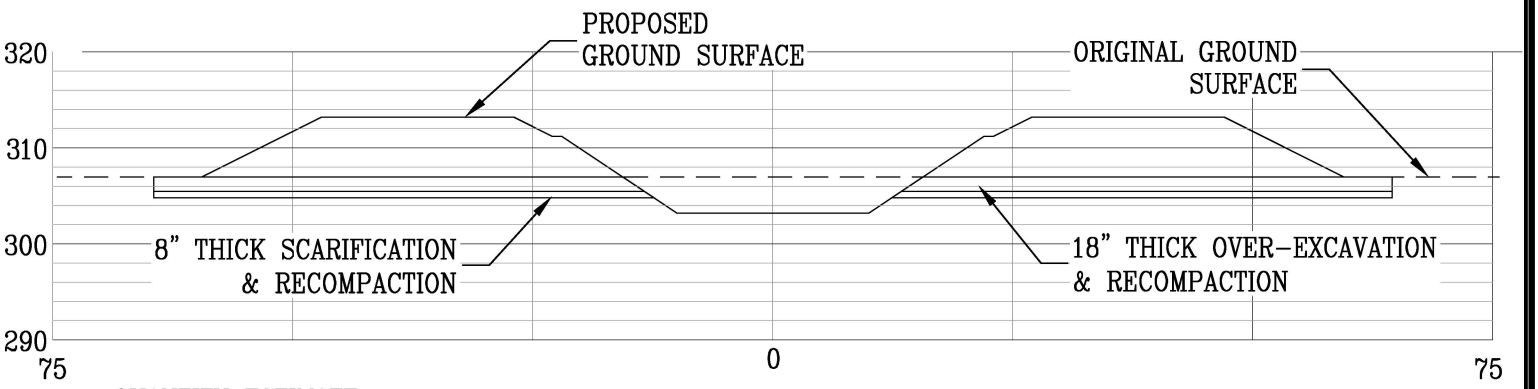


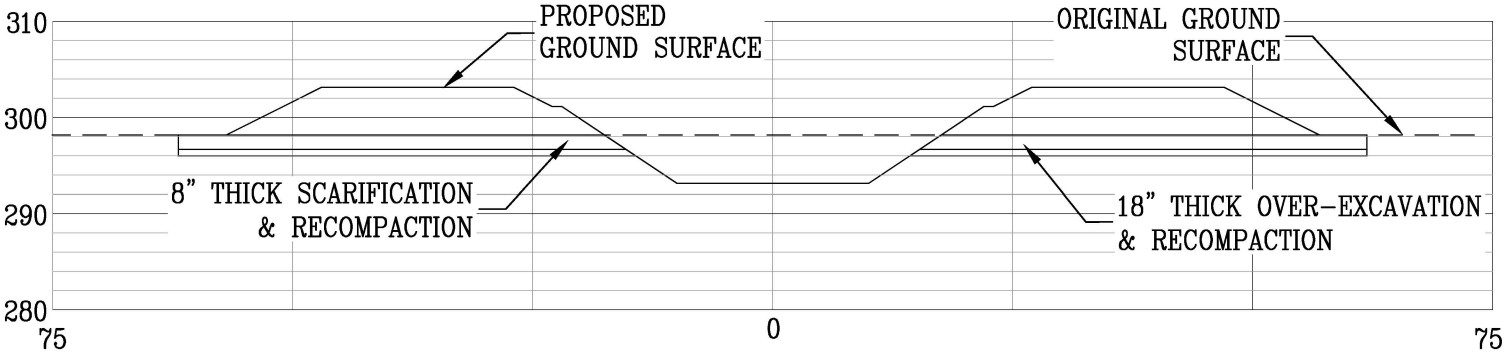
QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 34.4 CF/LF
"NEAT LINE" FILL AREA 616.7 CF/LF
OVER-EXCAVATION 161.2 CF/LF

STA 426+00



QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 96.1 CF/LF
"NEAT LINE" FILL AREA 405.7 CF/LF
OVER-EXCAVATION 150.0 CF/LF

STA 436+00



QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 139.3 CF/LF
"NEAT LINE" FILL AREA 297.6 CF/LF
OVER-EXCAVATION 136.4 CF/LF

STA 446+00

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

SCALE: 1"= 20'

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
FAX 661 393-4799
639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
PHONE 559 791-9286
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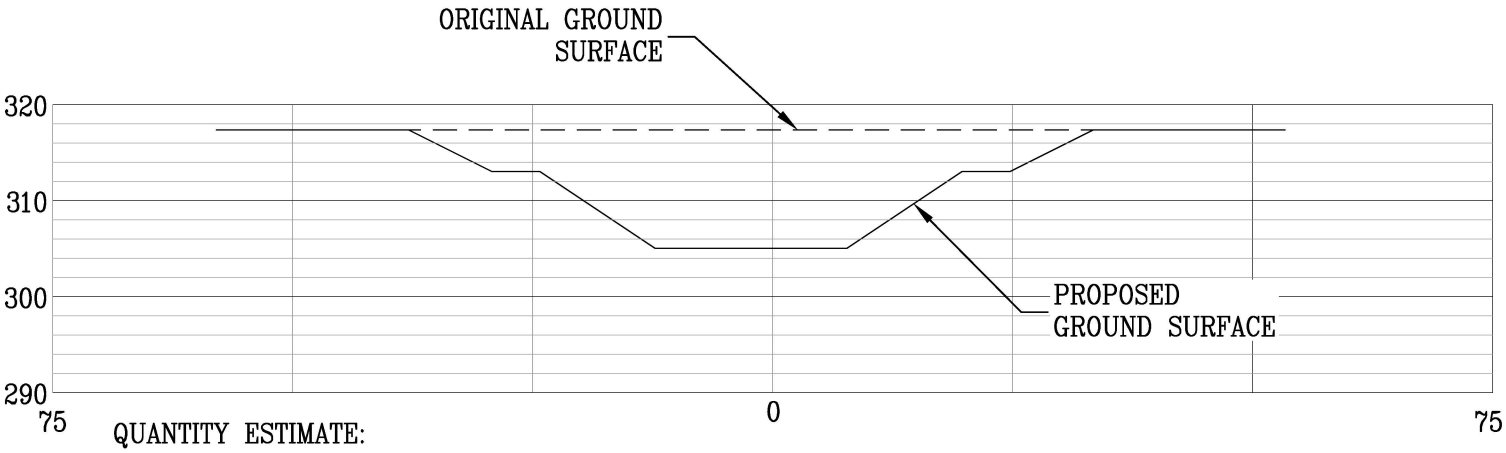

QUANTITY ESTIMATE:
"NEAT LINE" CUT AREA 528.7 CF/LF
"NEAT LINE" FILL AREA 0 CF/LF
OVER-EXCAVATION 0 CF/LF

STA 464+00

Kern Fan Groundwater Storage Project
CANAL CROSS-SECTIONS

SCALE: 1"= 20'

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
2730 UNICORN ROAD, BLDG A
BAKERSFIELD, CALIFORNIA 93308
PHONE 661 393-4796
FAX 661 393-4799
639 N. MAIN STREET, #B
PORTERVILLE, CALIFORNIA 93257
PHONE 559 791-9286
FAX 559 783-9275

Appendix B
Quantity Calculations

IRVINE RANCH / ROSEDALE RIO BRAVO WATER STORAGE DISTRICT

KERN FAN GROUNDWATER STORAGE PROJECT - CONVEYANCE CHANNEL (1.5:1 SLOPES)

EARTHWORK VOLUME CALCULATIONS

			END AREA		AVG END AREA		VOLUME	
STATION	**DESC**	**DIST**	**CUT (ft2)**	**FILL (ft2)**	**CUT (ft2)**	**FILL (ft2)**	**CUT (yd3)**	**FILL (yd3)**
-	BEGIN CANAL		112.1	362.7				
		604			389.9	181.4	8,722	4,057
604			667.7	-				
		600			333.9	503.9	7,419	11,197
1,204			-	1,007.7				
		600			-	957.0	-	21,266
1,804			-	906.2				
		1,000			-	878.9	-	32,550
2,804			-	851.5				
		1,000			-	878.9	-	32,550
3,804			-	906.2				
		1,000			-	913.1	-	33,819
4,804			-	920.0				
		1,000			-	940.8	-	34,844
5,804			-	961.6				
		1,000			-	899.8	-	33,324
6,804			-	837.9				
		1,000			-	858.4	-	31,791
7,804			-	878.8				
		776			201.8	439.4	5,798	12,629
8,580	BEGIN SIPHON		403.5	-				
8,900	END SIPHON		236.5	122.8				
		1,055			258.9	96.9	10,116	3,786
9,955			281.3	71.0				
		1,020			254.3	103.7	9,605	3,918
10,975			227.2	136.4				
		1,000			241.6	116.2	8,948	4,304
11,975			256.0	96.0				
		1,035			397.8	48.0	15,247	1,840
13,010	BEGIN SIPHON		539.5	-				
13,335	END SIPHON		248.6	106.0				
		525			248.6	106.0	4,834	2,061
13,860	BEGIN SIPHON		248.6	106.0				
14,185	END SIPHON		297.6	56.2				
		75			297.6	56.2	827	156
14,260	PP#1 FOREBAY		297.6	56.2				
					REACH 1 SUBTOTAL		71,517	264,090
14,340	PP#1 AFTERBAY		-	865.1				
		1,000			48.1	635.4	1,780	23,533
15,340			96.1	405.7				
		1,000			172.8	255.3	6,398	9,454
16,340			249.4	104.8				
		1,000			124.7	475.9	4,619	17,626
17,340			-	847.0				
		1,000			-	913.5	-	33,831
18,340			-	979.9				
		1,000			-	1,015.7	-	37,619
19,340			-	1,051.5				
		1,000			27.0	795.8	998	29,472
20,340			53.9	540.0				
		1,430			75.0	472.9	3,972	25,044
21,770	BEGIN SIPHON		96.1	405.7				

			END AREA		AVG END AREA		VOLUME	
STATION	**DESC**	**DIST**	**CUT (ft2)**	**FILL (ft2)**	**CUT (ft2)**	**FILL (ft2)**	**CUT (yd3)**	**FILL (yd3)**
22,190	END SIPHON		99.2	397.0				
		1,040			184.4	239.6	7,103	9,229
23,230			269.6	82.2				
		1,000			295.2	59.6	10,931	2,206
24,230			320.7	36.9				
		1,040			352.6	18.5	13,582	711
25,270	BEGIN SIPHON		384.5	-				
25,690	END SIPHON		511.0	-				
		1,030			511.0	-	19,494	-
26,720	PP#2 FOREBAY		511.0	-				
					REACH 2 SUBTOTAL		68,876	188,724
26,700	PP#2 AFTERBAY		22.7	668.2				
		1,100			28.1	644.5	1,143	26,257
27,800			33.4	620.8				
		1,000			128.6	381.1	4,763	14,115
28,800			223.8	141.4				
		1,000			275.2	86.8	10,193	3,215
29,800			326.6	32.2				
		1,000			194.4	271.7	7,198	10,063
30,800			62.1	511.2				
		1,000			68.6	480.0	2,539	17,778
31,800			75.0	448.8				
		1,000			84.8	429.5	3,139	15,906
32,800			94.5	410.1				
		1,000			93.0	414.6	3,443	15,354
33,800			91.4	419.0				
		1,000			121.6	344.8	4,502	12,770
34,800			151.7	270.6				
		1,000			142.0	292.0	5,259	10,815
35,800			132.3	313.4				
		1,000			163.9	250.4	6,069	9,274
36,800			195.4	187.4				
		1,000			208.6	166.0	7,726	6,148
37,800			221.8	144.6				
		1,480			220.8	146.2	12,100	8,014
39,280	PP#3 FOREBAY		219.7	147.8				
					REACH 3 SUBTOTAL		68,073	149,708
39,360	PP#3 AFTER BAY		-	906.2				
		1,240			-	844.0	-	38,759
40,600			-	781.7				
		1,000			94.7	489.8	3,507	18,139
41,600			189.4	197.8				
		1,000			111.9	407.3	4,144	15,083
42,600			34.4	616.7				
		1,000			65.3	511.2	2,417	18,933
43,600			96.1	405.7				
		1,000			117.7	351.7	4,359	13,024
44,600			139.3	297.6				
		1,800			320.0	148.8	21,333	9,920
46,400			528.7	-				
					REACH 4 SUBTOTAL		35,761	113,859
						TOTALS	244,227	716,381

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
3701 PEGASUS DRIVE, SUITE 121
BAKERSFIELD, CALIFORNIA 93308
PHONE 805 393-4795
FAX 805 393-4799

IRVINE RANCH / ROSEDALE RIO BRAVO WATER STORAGE DISTRICT

KERN FAN GROUNDWATER STORAGE PROJECT - SUBGRADE PREPARATION (1.5:1 SLOPE)

EARTHWORK VOLUME CALCULATIONS

			END AREA		AVG END AREA		VOLUME	
STATION	**DESC**	**DIST**	**CUT (ft2)**	**FILL (ft2)**	**CUT (ft2)**	**FILL (ft2)**	**CUT (yd3)**	**FILL (yd3)**
-	BEGIN CANAL		144.8	144.8				
		604			72.4	72.4	1,620	1,620
604			-	-				
		600			112.9	112.9	2,509	2,509
1,204			225.8	225.8				
		600			223.6	223.6	4,969	4,969
1,804			221.4	221.4				
		1,000			220.2	220.2	8,156	8,156
2,804			219.0	219.0				
		1,000			220.2	220.2	8,156	8,156
3,804			221.4	221.4				
		1,000			221.7	221.7	8,211	8,211
4,804			222.0	222.0				
		1,000			222.9	222.9	8,256	8,256
5,804			223.8	223.8				
		1,000			221.1	221.1	8,189	8,189
6,804			218.4	218.4				
		1,000			219.3	219.3	8,122	8,122
7,804			220.2	220.2				
		776			110.1	110.1	3,164	3,164
8,580	BEGIN SIPHON		-	-				
8,900	END SIPHON		110.1	110.1				
		1,055			55.1	55.1	2,151	2,151
9,955			-	-				
		1,020			56.2	56.2	2,123	2,123
10,975			112.4	112.4				
		1,000			108.9	108.9	4,033	4,033
11,975			105.4	105.4				
		1,035			52.7	52.7	2,020	2,020
13,010	BEGIN SIPHON		-	-				
13,335	END SIPHON		107.2	107.2				
		525			107.2	107.2	2,084	2,084
13,860	BEGIN SIPHON		107.2	107.2				
14,185	END SIPHON		-	-				
		75			-	-	-	-
14,260	PP#1 FOREBAY		-	-				
					REACH 1 SUBTOTAL		73,763	73,763
14,340	PP#1 AFTERBAY		219.6	219.6				
		1,000			184.8	184.8	6,844	6,844
15,340			150.0	150.0				
		1,000			128.5	128.5	4,759	4,759
16,340			107.0	107.0				
		1,000			163.0	163.0	6,035	6,035
17,340			218.9	218.9				
		1,000			221.8	221.8	8,213	8,213
18,340			224.6	224.6				
		1,000			226.0	226.0	8,370	8,370
19,340			227.4	227.4				
		1,000			196.3	196.3	7,270	7,270
20,340			165.2	165.2				
		1,430			157.6	157.6	8,347	8,347
21,770	BEGIN SIPHON		150.0	150.0				

			END AREA		AVG END AREA		VOLUME	
STATION	**DESC**	**DIST**	**CUT (ft2)**	**FILL (ft2)**	**CUT (ft2)**	**FILL (ft2)**	**CUT (yd3)**	**FILL (yd3)**
22,190	END SIPHON		149.0	149.0				
		1,040			74.5	74.5	2,870	2,870
23,230			-	-				
		1,000			-	-	-	-
24,230			-	-				
		1,040			-	-	-	-
25,270	BEGIN SIPHON		-	-				
25,690	END SIPHON		-	-				
		1,030			-	-	-	-
26,720	PP#2 FOREBAY		-	-				
					REACH 2 SUBTOTAL		52,709	52,709
26,700	PP#2 AFTERBAY		187.0	187.0				
		1,100			180.4	180.4	7,350	7,350
27,800			173.8	173.8				
		1,000			143.5	143.5	5,315	5,315
28,800			113.2	113.2				
		1,000			56.6	56.6	2,096	2,096
29,800			-	-				
		1,000			81.0	81.0	3,000	3,000
30,800			162.0	162.0				
		1,000			161.7	161.7	5,989	5,989
31,800			161.4	161.4				
		1,000			156.0	156.0	5,776	5,776
32,800			150.5	150.5				
		1,000			151.1	151.1	5,594	5,594
33,800			151.6	151.6				
		1,000			142.1	142.1	5,263	5,263
34,800			132.6	132.6				
		1,000			135.5	135.5	5,019	5,019
35,800			138.4	138.4				
		1,000			129.5	129.5	4,796	4,796
36,800			120.6	120.6				
		1,000			112.2	112.2	4,156	4,156
37,800			103.8	103.8				
		1,480			109.1	109.1	5,978	5,978
39,280	PP#3 FOREBAY		114.3	114.3				
					REACH 3 SUBTOTAL		60,331	60,331
39,360	PP#3 AFTER BAY		221.4	221.4				
		1,240			218.7	218.7	10,042	10,042
40,600			215.9	215.9				
		1,000			169.1	169.1	6,261	6,261
41,600			122.2	122.2				
		1,000			141.7	141.7	5,248	5,248
42,600			161.2	161.2				
		1,000			155.6	155.6	5,763	5,763
43,600			150.0	150.0				
		1,000			143.2	143.2	5,304	5,304
44,600			136.4	136.4				
		1,800			68.2	68.2	4,547	4,547
46,400			-	-				
					REACH 4 SUBTOTAL		37,164	37,164
						TOTALS	223,967	223,967

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
3701 PEGASUS DRIVE, SUITE 121 BAKERSFIELD, CALIFORNIA 93308
PHONE 805 393-4796 FAX 805 393-4799

IRVINE RANCH / ROSEDALE RIO BRAVO WATER STORAGE DISTRICT

KERN FAN GROUNDWATER STORAGE PROJECT - CONVEYANCE CANAL (EARTHLINED 3:1 SLOPES)

EARTHWORK VOLUME CALCULATIONS

			END AREA		AVG END AREA		VOLUME	
STATION	**DESC**	**DIST**	**CUT (ft2)**	**FILL (ft2)**	**CUT (ft2)**	**FILL (ft2)**	**CUT (yd3)**	**FILL (yd3)**
-	BEGIN CANAL		242.2	383.8				
		604			688.6	191.9	15,403	4,293
604			1,134.9	-				
		600			571.4	559.1	12,697	12,424
1,204			7.8	1,118.2				
		600			16.7	1,063.3	371	23,628
1,804			25.6	1,008.3				
		1,000			31.2	979.3	1,156	36,270
2,804			36.8	950.3				
		1,000			31.2	979.3	1,156	36,270
3,804			25.6	1,008.3				
		1,000			24.3	1,015.7	900	37,617
4,804			23.0	1,023.0				
		1,000			19.3	1,045.5	713	38,720
5,804			15.5	1,067.9				
		1,000			27.6	1,002.0	1,022	37,109
6,804			39.7	936.0				
		1,000			35.4	957.5	1,311	35,463
7,804			31.1	979.0				
		776			384.3	489.5	11,045	14,069
8,580	BEGIN SIPHON		737.5	-				
8,900	END SIPHON		464.6	123.1				
		1,055			503.2	97.1	19,662	3,792
9,955			541.8	71.0				
		1,020			494.8	104.1	18,691	3,931
10,975			447.7	137.1				
		1,000			473.9	116.6	17,550	4,317
11,975			500.0	96.0				
		1,035			722.8	48.0	27,705	1,840
13,010	BEGIN SIPHON		945.5	-				
13,335	END SIPHON		486.5	106.0				
		525			486.5	106.0	9,460	2,061
13,860	BEGIN SIPHON		486.5	106.0				
14,185	END SIPHON		568.6	56.2				
		75			568.7	56.2	1,580	156
14,260	PP#1 FOREBAY		568.8	56.2				
					REACH 1 SUBTOTAL		140,421	291,960
14,340	PP#1 AFTERBAY		33.9	964.6				
		1,000			124.1	698.7	4,594	25,878
15,340			214.2	432.8				
		1,000			351.2	268.8	13,006	9,956
16,340			488.1	104.8				
		1,000			262.8	525.7	9,733	19,470
17,340			37.5	946.6				
		1,000			25.0	1,017.1	924	37,670
18,340			12.4	1,087.6				
		1,000			6.2	1,127.1	230	41,743
19,340			-	1,166.5				
		1,000			70.8	877.8	2,620	32,511
20,340			141.5	589.1				
		1,430			177.9	511.0	9,419	27,061
21,770	BEGIN SIPHON		214.2	432.8				

			END AREA		AVG END AREA		VOLUME	
STATION	**DESC**	**DIST**	**CUT (ft2)**	**FILL (ft2)**	**CUT (ft2)**	**FILL (ft2)**	**CUT (yd3)**	**FILL (yd3)**
22,190	END SIPHON		219.8	422.8				
		1,040			371.2	252.5	14,298	9,726
23,230			522.6	82.2				
		1,000			564.4	59.3	20,902	2,196
24,230			606.1	36.4				
		1,040			656.9	18.2	25,303	701
25,270	BEGIN SIPHON		707.7	-				
25,690	END SIPHON		902.6	-				
		1,030			902.6	-	34,433	-
26,720	PP#2 FOREBAY		902.6	-				
					REACH 2 SUBTOTAL		135,462	206,912
26,700	PP#2 AFTERBAY		88.9	740.6				
		1,100			97.9	712.4	3,986	29,024
27,800			106.8	684.2				
		1,000			274.3	413.3	10,157	15,306
28,800			441.7	142.3				
		1,000			528.7	87.3	19,580	3,231
29,800			615.6	32.2				
		1,000			385.6	293.6	14,280	10,874
30,800			155.5	555.0				
		1,000			166.5	530.3	6,167	19,641
31,800			177.5	505.6				
		1,000			194.5	471.7	7,204	17,470
32,800			211.5	437.8				
		1,000			208.8	442.9	7,733	16,404
33,800			206.1	448.0				
		1,000			259.2	364.3	9,600	13,493
34,800			312.3	280.6				
		1,000			295.1	304.5	10,928	11,276
35,800			277.8	328.3				
		1,000			334.1	259.5	12,372	9,609
36,800			390.3	190.6				
		1,000			414.1	168.1	15,337	6,226
37,800			437.9	145.6				
		1,480			436.1	147.3	23,902	8,071
39,280	PP#3 FOREBAY		434.2	148.9				
					REACH 3 SUBTOTAL		141,246	160,625
39,360	PP#3 AFTER BAY		25.6	1,008.2				
		1,240			39.1	942.7	1,796	43,294
40,600			52.6	877.2				
		1,000			216.2	539.4	8,006	19,978
41,600			379.7	201.6				
		1,000			244.1	440.5	9,039	16,315
42,600			108.4	679.4				
		1,000			161.3	556.1	5,974	20,596
43,600			214.2	432.8				
		1,000			252.2	371.7	9,339	13,767
44,600			290.1	310.6				
		1,800			320.0	155.3	21,333	10,353
46,400			929.3	-				
					REACH 4 SUBTOTAL		55,486	124,303
						TOTALS	472,615	783,801

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
3701 PEGASUS DRIVE, SUITE 121
BAKERSFIELD, CALIFORNIA 93308
PHONE 805 393-4796
FAX 805 393-4799

IRVINE RANCH / ROSEDALE RIO BRAVO WATER STORAGE DISTRICT

KERN FAN GROUNDWATER STORAGE PROJECT - SUBGRADE PREPARATION (3:1 SLOPE)

EARTHWORK VOLUME CALCULATIONS

			END AREA		AVG END AREA		VOLUME	
STATION	**DESC**	**DIST**	**CUT (ft2)**	**FILL (ft2)**	**CUT (ft2)**	**FILL (ft2)**	**CUT (yd3)**	**FILL (yd3)**
-	BEGIN CANAL		265.0	165.0				
		604			132.5	82.5	2,964	1,846
604			-	-				
		600			136.0	136.0	3,022	3,022
1,204			272.0	272.0				
		600			260.9	260.9	5,798	5,798
1,804			249.8	249.8				
		1,000			243.1	243.1	9,002	9,002
2,804			236.3	236.3				
		1,000			243.1	243.1	9,002	9,002
3,804			249.8	249.8				
		1,000			251.4	251.4	9,311	9,311
4,804			253.0	253.0				
		1,000			257.7	257.7	9,543	9,543
5,804			262.3	262.3				
		1,000			248.6	248.6	9,206	9,206
6,804			234.8	234.8				
		1,000			239.0	239.0	8,850	8,850
7,804			243.1	243.1				
		776			121.6	121.6	3,493	3,493
8,580	BEGIN SIPHON		-	-				
8,900	END SIPHON		115.5	115.5				
		1,055			57.8	57.8	2,257	2,257
9,955			-	-				
		1,020			59.4	59.4	2,244	2,244
10,975			118.8	118.8				
		1,000			113.8	113.8	4,215	4,215
11,975			108.8	108.8				
		1,035			54.4	54.4	2,085	2,085
13,010	BEGIN SIPHON		-	-				
13,335	END SIPHON		111.3	111.3				
		525			111.3	111.3	2,164	2,164
13,860	BEGIN SIPHON		111.3	111.3				
14,185	END SIPHON		-	-				
		75			-	-	-	-
14,260	PP#1 FOREBAY		-	-				
						REACH 1 SUBTOTAL	83,155	82,037
14,340	PP#1 AFTERBAY		239.7	239.7				
		1,000			206.1	206.1	7,633	7,633
15,340			172.5	172.5				
		1,000			141.8	141.8	5,250	5,250
16,340			111.0	111.0				
		1,000			173.4	173.4	6,422	6,422
17,340			235.8	235.8				
		1,000			251.0	251.0	9,294	9,294
18,340			266.1	266.1				
		1,000			273.3	273.3	10,120	10,120
19,340			280.4	280.4				
		1,000			237.4	237.4	8,791	8,791
20,340			194.3	194.3				
		1,430			183.4	183.4	9,713	9,713
21,770	BEGIN SIPHON		172.5	172.5				

			END AREA		AVG END AREA		VOLUME	
STATION	**DESC**	**DIST**	**CUT (ft2)**	**FILL (ft2)**	**CUT (ft2)**	**FILL (ft2)**	**CUT (yd3)**	**FILL (yd3)**
22,190	END SIPHON		171.0	171.0				
		1,040			85.5	85.5	3,293	3,293
23,230			-	-				
		1,000			-	-	-	-
24,230			-	-				
		1,040			-	-	-	-
25,270	BEGIN SIPHON		-	-				
25,690	END SIPHON		-	-				
		1,030			-	-	-	-
26,720	PP#2 FOREBAY		-	-				
					REACH 2 SUBTOTAL		60,518	60,518
26,700	PP#2 AFTERBAY		213.0	213.0				
		1,100			209.7	209.7	8,541	8,541
27,800			206.3	206.3				
		1,000			163.2	163.2	6,043	6,043
28,800			120.0	120.0				
		1,000			60.0	60.0	2,222	2,222
29,800			-	-				
		1,000			94.9	94.9	3,515	3,515
30,800			189.8	189.8				
		1,000			186.4	186.4	6,904	6,904
31,800			183.0	183.0				
		1,000			178.2	178.2	6,598	6,598
32,800			173.3	173.3				
		1,000			174.1	174.1	6,446	6,446
33,800			174.8	174.8				
		1,000			161.3	161.3	5,974	5,974
34,800			147.8	147.8				
		1,000			151.9	151.9	5,626	5,626
35,800			156.0	156.0				
		1,000			143.3	143.3	5,306	5,306
36,800			130.5	130.5				
		1,000			125.7	125.7	4,654	4,654
37,800			120.8	120.8				
		1,480			121.2	121.2	6,641	6,641
39,280	PP#3 FOREBAY		121.5	121.5				
					REACH 3 SUBTOTAL		68,469	68,469
39,360	PP#3 AFTER BAY		249.8	249.8				
		1,240			239.2	239.2	10,983	10,983
40,600			228.5	228.5				
		1,000			180.7	180.7	6,691	6,691
41,600			132.8	132.8				
		1,000			169.3	169.3	6,269	6,269
42,600			205.7	205.7				
		1,000			189.1	189.1	7,004	7,004
43,600			172.5	172.5				
		1,000			162.8	162.8	6,028	6,028
44,600			153.0	153.0				
		1,800			76.5	76.5	5,100	5,100
46,400			-	-				
					REACH 4 SUBTOTAL		42,074	42,074
						TOTALS	254,216	253,098

DEE JASPAR & ASSOCIATES, INC.
CIVIL • ENGINEERS
3701 PEGASUS DRIVE, SUITE 121 BAKERSFIELD, CALIFORNIA 93308
PHONE 805 393-4796 FAX 805 393-4799

Appendix C
Present Worth Analysis

Kern Fan Proje
Earth Lined Can

Alternative No. 1 - Earth Lined Canal (3:1 Side Slopes)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
CAPITAL COST	**$ 56,763,716**																					
O&M COSTS	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year
Recovery Well Pumping Costs [1]	$ -	$ -	$ -	$ -	$ 5,683,819	$ 5,854,333	$ 6,029,963	$ -	$ -	$ -	.	$ -	$ -	$ -	$ 7,638,577	$ 7,867,734	$ 8,103,766	$ -	$ -	$ -	$ -	$ -
Canal Operation Costs [2]	$ 138,200	$ 142,346	$ 3,382,929	$ 151,015	$ 419,019	$ 431,590	$ 444,537	$ 169,969	$ 4,039,394	$ 180,320	$ 185,729	$ 191,301	$ 4,546,374	$ 202,951	$ 563,127	$ 580,020	$ 597,421	$ 228,424	$ 5,428,608	$ 242,335	$ 249,605	$ 257,093
Pump Station No. 1 Replacement Costs [3]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pump Station No. 2 Replacement Costs [3]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pump Station No. 3 Replacement Costs [4]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Return Water Pump Station Replacement Costs [5]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Liner Replacement or Repairs [6]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Annual Operating Cost	$ 138,200	$ 142,346	$ 3,382,929	$ 151,015	$ 6,102,838	$ 6,285,923	$ 6,474,501	$ 169,969	$ 4,039,394	$ 180,320	$ 185,729	$ 191,301	$ 4,546,374	$ 202,951	$ 8,201,704	$ 8,447,755	$ 8,701,187	$ 228,424	$ 5,428,608	$ 242,335	$ 249,605	$ 257,093
Capital Recovery @ 3.0% / 20yrs.	$ 3,815,413	$ 3,815,413	$ 3,815,413	$ 3,815,413	$ 3,815,413	$ 3,815,413	$ 3,815,413	$ 3,815,413	$ 3,815,413	$ 3,815,413	$ 3,815,413	$ 3,815,413	$ 3,815,413	$ 3,815,413	$ 3,815,413	$ 3,815,413	$ 3,815,413	$ 3,815,413	$ 3,815,413	$ 3,815,413	$ -	$ -
Total Annual Costs	$ 3,953,613	$ 3,957,759	$ 7,198,342	$ 3,966,428	$ 9,918,251	$ 10,101,336	$ 10,289,914	$ 3,985,382	$ 7,854,807	$ 3,995,733	$ 4,001,143	$ 4,006,714	$ 8,361,787	$ 4,018,365	$ 12,017,117	$ 12,263,168	$ 12,516,601	$ 4,043,837	$ 9,244,021	$ 4,057,748	$ 249,605	$ 257,093
Average Monthly Cost	$ 329,468	$ 329,813	$ 599,862	$ 330,536	$ 826,521	$ 841,778	$ 857,493	$ 332,115	$ 654,567	$ 332,978	$ 333,429	$ 333,893	$ 696,816	$ 334,864	$ 1,001,426	$ 1,021,931	$ 1,043,050	$ 336,986	$ 770,335	$ 338,146	$ 20,800	$ 21,424
Equivilant Average Monthly Cost	$ 1,103,528	$ 1,103,528	$ 1,103,528	$ 1,103,528	$ 1,103,528	$ 1,103,528	$ 1,103,528	$ 1,103,528	$ 1,103,528	$ 1,103,528	$ 1,103,528	$ 1,103,528	$ 1,103,528	$ 1,103,528	$ 1,103,528	$ 1,103,528	$ 1,103,528	$ 1,103,528	$ 1,103,528	$ 1,103,528	$ -	$ -
Present Worth of Op. Costs @ 3%	$ 138,200	$ 138,200	$ 3,188,735	$ 138,200	$ 5,422,292	$ 5,422,292	$ 5,422,292	$ 138,200	$ 3,188,735	$ 138,200	$ 138,200	$ 138,200	$ 3,188,735	$ 138,200	$ 5,422,292	$ 5,422,292	$ 5,422,292	$ 138,200	$ 3,188,735	$ 138,200	$ 138,200	$ 138,200
Present Worth of Op. Costs	**$ 140,248,735**																					
Present Worth of Capital + Op. Costs	**$ 197,012,451**																					

[1]Recovery well pumping costs in dry year estimated as $4,902,912 per Section III. for 16 wells and increased for inflation at 3% per year.

[2]Canal operation costs based on 1) Idle Year = O&M Cost Estimate $69,100 per year x 2 due to increased canal maintenance for tumbleweeds and rodent holes; 2) Wet Year = O&M Cost Estimate based on $9,000 per month, $158.33 per month, and $404,296.88 per month for four months plus energy costs for three pump stations each with a 20-ft lift to move 112,500 ac-ft = $1,488,848 plus 8 idle months of $46,067; and 3) Dry Year = O&M Cost Estimate based on $8,000 per mo

[3]Pump Station replacement costs include pump and motor replacement at $2,222,000, VFD's at $700,000, electrical and control equipment at $900,000, and cathodic protection at $25,000. Costs increased for inflation at 3% per year.

[4]Pump Station replacement costs include pump and motor replacement at $1,287,000, VFD's at $420,000, electrical and control equipment at $565,000, and cathodic protection at $25,000. Costs increased for inflation at 3% per year.

[5]Pump Station replacement costs include pump and motor replacement at $540,000, VFD's at $150,000, electrical and control equipment at $565,000, and cathodic protection at $15,000. Costs increased for inflation at 3% per year.

[6]No liner replacement or repairs as part of the earth lined canal alternative.

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23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069
Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year
$ -	$ -	$ 10,265,609	$ 10,573,577	$ 10,890,785	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 13,796,120	$ 14,210,004	$ 14,636,304	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 18,540,832	$ 19,097,057	$ 19,669,968	$ -	$ -	$ -
$ 6,109,946	$ 272,750	$ 756,795	$ 779,499	$ 802,884	$ 306,982	$ 7,295,595	$ 325,677	$ 335,448	$ 345,511	$ 8,211,257	$ 366,553	$ 1,017,069	$ 1,047,581	$ 1,079,009	$ 412,558	$ 9,804,670	$ 437,683	$ 450,814	$ 464,338	$ 11,035,242	$ 492,616	$ 1,366,856	$ 1,407,862	$ 1,450,098	$ 554,444	$ 13,176,656	$ 588,210
$ -	$ -	$ 8,013,274	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,778,017
$ -	$ -	$ 8,013,274	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,778,017
$ -	$ -	$ 5,350,314	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 11,202,370
$ -	$ -	$ 2,581,649	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,405,399
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 6,109,946	$ 272,750	$ 34,980,915	$ 11,353,076	$ 11,693,668	$ 306,982	$ 7,295,595	$ 325,677	$ 335,448	$ 345,511	$ 8,211,257	$ 366,553	$ 14,813,189	$ 15,257,585	$ 15,715,312	$ 412,558	$ 9,804,670	$ 437,683	$ 450,814	$ 464,338	$ 11,035,242	$ 492,616	$ 19,907,688	$ 20,504,918	$ 21,120,066	$ 554,444	$ 13,176,656	$ 50,752,012
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 6,109,946	$ 272,750	$ 34,980,915	$ 11,353,076	$ 11,693,668	$ 306,982	$ 7,295,595	$ 325,677	$ 335,448	$ 345,511	$ 8,211,257	$ 366,553	$ 14,813,189	$ 15,257,585	$ 15,715,312	$ 412,558	$ 9,804,670	$ 437,683	$ 450,814	$ 464,338	$ 11,035,242	$ 492,616	$ 19,907,688	$ 20,504,918	$ 21,120,066	$ 554,444	$ 13,176,656	$ 50,752,012
$ 509,162	$ 22,729	$ 2,915,076	$ 946,090	$ 974,472	$ 25,582	$ 607,966	$ 27,140	$ 27,954	$ 28,793	$ 684,271	$ 30,546	$ 1,234,432	$ 1,271,465	$ 1,309,609	$ 34,380	$ 817,056	$ 36,474	$ 37,568	$ 38,695	$ 919,604	$ 41,051	$ 1,658,974	$ 1,708,743	$ 1,760,005	$ 46,204	$ 1,098,055	$ 4,229,334
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 3,188,735	$ 138,200	$ 17,208,292	$ 5,422,292	$ 5,422,292	$ 138,200	$ 3,188,735	$ 138,200	$ 138,200	$ 138,200	$ 3,188,735	$ 138,200	$ 5,422,292	$ 5,422,292	$ 5,422,292	$ 138,200	$ 3,188,735	$ 138,200	$ 138,200	$ 138,200	$ 3,188,735	$ 138,200	$ 5,422,292	$ 5,422,292	$ 5,422,292	$ 138,200	$ 3,188,735	$ 11,924,200

nth, $52.78 per month, and energy cost for Return Water Pump Station for 25-ft lift to move 50,000 ac-ft = $275,660.00. Costs increased for inflation at 3% per year.

Kern Fan Proje
Earth Lined Canal with Ret

Alternative No. 1a - Earth Lined Canal (3:1 Side Slopes) with Return Pipeline	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
CAPITAL COST	**$ 67,282,716**																					
O&M COSTS	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year
Recovery Well Pumping Costs [1]	$ -	$ -	$ -	$ -	$ 4,262,883	$ 4,390,769	$ 4,522,492	$ -	$ -	$ -	.	$ -	$ -	$ -	$ 5,728,958	$ 5,900,827	$ 6,077,851	$ -	$ -	$ -	$ -	$ -
Canal Operation Costs [2]	$ 138,200	$ 142,346	$ 3,382,929	$ 151,015	$ 419,019	$ 431,590	$ 444,537	$ 169,969	$ 4,039,394	$ 180,320	$ 185,729	$ 191,301	$ 4,546,374	$ 202,951	$ 563,127	$ 580,020	$ 597,421	$ 228,424	$ 5,428,608	$ 242,335	$ 249,605	$ 257,093
Pump Station No. 1 Replacement Costs [3]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pump Station No. 2 Replacement Costs [3]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pump Station No. 3 Replacement Costs [4]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Return Water Pump Station Replacement Costs [5]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Liner Replacement or Repairs [6]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Annual Operating Cost	$ 138,200	$ 142,346	$ 3,382,929	$ 151,015	$ 4,681,902	$ 4,822,359	$ 4,967,029	$ 169,969	$ 4,039,394	$ 180,320	$ 185,729	$ 191,301	$ 4,546,374	$ 202,951	$ 6,292,084	$ 6,480,847	$ 6,675,272	$ 228,424	$ 5,428,608	$ 242,335	$ 249,605	$ 257,093
Capital Recovery @ 3.0% / 20yrs.	$ 4,522,455	$ 4,522,455	$ 4,522,455	$ 4,522,455	$ 4,522,455	$ 4,522,455	$ 4,522,455	$ 4,522,455	$ 4,522,455	$ 4,522,455	$ 4,522,455	$ 4,522,455	$ 4,522,455	$ 4,522,455	$ 4,522,455	$ 4,522,455	$ 4,522,455	$ 4,522,455	$ 4,522,455	$ 4,522,455	$ -	$ -
Total Annual Costs	$ 4,660,655	$ 4,664,801	$ 7,905,384	$ 4,673,470	$ 9,204,357	$ 9,344,814	$ 9,489,485	$ 4,692,424	$ 8,561,849	$ 4,702,775	$ 4,708,185	$ 4,713,756	$ 9,068,829	$ 4,725,407	$ 10,814,540	$ 11,003,302	$ 11,197,728	$ 4,750,879	$ 9,951,063	$ 4,764,790	$ 249,605	$ 257,093
Average Monthly Cost	$ 388,388	$ 388,733	$ 658,782	$ 389,456	$ 767,030	$ 778,735	$ 790,790	$ 391,035	$ 713,487	$ 391,898	$ 392,349	$ 392,813	$ 755,736	$ 393,784	$ 901,212	$ 916,942	$ 933,144	$ 395,907	$ 829,255	$ 397,066	$ 20,800	$ 21,424
Equivilant Average Monthly Cost	$ 1,056,374	$ 1,056,374	$ 1,056,374	$ 1,056,374	$ 1,056,374	$ 1,056,374	$ 1,056,374	$ 1,056,374	$ 1,056,374	$ 1,056,374	$ 1,056,374	$ 1,056,374	$ 1,056,374	$ 1,056,374	$ 1,056,374	$ 1,056,374	$ 1,056,374	$ 1,056,374	$ 1,056,374	$ 1,056,374	$ -	$ -
Present Worth of Op. Costs @ 3%	$ 138,200	$ 138,200	$ 3,188,735	$ 138,200	$ 4,159,809	$ 4,159,809	$ 4,159,809	$ 138,200	$ 3,188,735	$ 138,200	$ 138,200	$ 138,200	$ 3,188,735	$ 138,200	$ 4,159,809	$ 4,159,809	$ 4,159,809	$ 138,200	$ 3,188,735	$ 138,200	$ 138,200	$ 138,200
Present Worth of Op. Costs	**$ 121,311,485**																					
Present Worth of Capital + Op. Costs	**$ 188,594,201**																					

[1]Recovery well pumping costs in dry year estimated as $3,677,184 per Section III. for 12 wells due to pipeline and increased for inflation at 3% per year.

[2]Canal operation costs based on 1) Idle Year = O&M Cost Estimate $69,100 per year x 2 due to increased canal maintenance for tumbleweeds and rodent holes; 2) Wet Year = O&M Cost Estimate based on $9,000 per month, $158.33 per month, and $404,296.88 per month for four months plus energy costs for three pump stations each with a 20-ft lift to move 112,500 ac-ft = $1,488,848 plus 8 idle months of $46,067; and 3) Dry Year = O&M Cost Estimate based on $8,000 per mo

[3]Pump Station replacement costs include pump and motor replacement at $2,222,000, VFD's at $700,000, electrical and control equipment at $900,000, and cathodic protection at $25,000. Costs increased for inflation at 3% per year.

[4]Pump Station replacement costs include pump and motor replacement at $1,287,000, VFD's at $420,000, electrical and control equipment at $565,000, and cathodic protection at $25,000. Costs increased for inflation at 3% per year.

[5]Pump Station replacement costs include pump and motor replacement at $540,000, VFD's at $150,000, electrical and control equipment at $565,000, and cathodic protection at $15,000. Costs increased for inflation at 3% per year.

[6]No liner replacement or repairs as part of the earth lined canal alternative.

ct
turn Pipeline

23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069
Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year
$ -	$ -	$ 7,699,240	$ 7,930,217	$ 8,168,124	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,347,135	$ 10,657,549	$ 10,977,276	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 13,905,684	$ 14,322,855	$ 14,752,540	$ -	$ -	$ -
$ 6,109,946	$ 272,750	$ 756,795	$ 779,499	$ 802,884	$ 306,982	$ 7,295,595	$ 325,677	$ 335,448	$ 345,511	$ 8,211,257	$ 366,553	$ 1,017,069	$ 1,047,581	$ 1,079,009	$ 412,558	$ 9,804,670	$ 437,683	$ 450,814	$ 464,338	$ 11,035,242	$ 492,616	$ 1,366,856	$ 1,407,862	$ 1,450,098	$ 554,444	$ 13,176,656	$ 588,210
$ -	$ -	$ 8,013,274	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,778,017
$ -	$ -	$ 8,013,274	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,778,017
$ -	$ -	$ 5,350,314	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 11,202,370
$ -	$ -	$ 2,581,649	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,405,399
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 6,109,946	$ 272,750	$ 32,414,547	$ 8,709,716	$ 8,971,008	$ 306,982	$ 7,295,595	$ 325,677	$ 335,448	$ 345,511	$ 8,211,257	$ 366,553	$ 11,364,204	$ 11,705,130	$ 12,056,284	$ 412,558	$ 9,804,670	$ 437,683	$ 450,814	$ 464,338	$ 11,035,242	$ 492,616	$ 15,272,540	$ 15,730,716	$ 16,202,638	$ 554,444	$ 13,176,656	$ 50,752,012
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 6,109,946	$ 272,750	$ 32,414,547	$ 8,709,716	$ 8,971,008	$ 306,982	$ 7,295,595	$ 325,677	$ 335,448	$ 345,511	$ 8,211,257	$ 366,553	$ 11,364,204	$ 11,705,130	$ 12,056,284	$ 412,558	$ 9,804,670	$ 437,683	$ 450,814	$ 464,338	$ 11,035,242	$ 492,616	$ 15,272,540	$ 15,730,716	$ 16,202,638	$ 554,444	$ 13,176,656	$ 50,752,012
$ 509,162	$ 22,729	$ 2,701,212	$ 725,810	$ 747,584	$ 25,582	$ 607,966	$ 27,140	$ 27,954	$ 28,793	$ 684,271	$ 30,546	$ 947,017	$ 975,428	$ 1,004,690	$ 34,380	$ 817,056	$ 36,474	$ 37,568	$ 38,695	$ 919,604	$ 41,051	$ 1,272,712	$ 1,310,893	$ 1,350,220	$ 46,204	$ 1,098,055	$ 4,229,334
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 3,188,735	$ 138,200	$ 15,945,809	$ 4,159,809	$ 4,159,809	$ 138,200	$ 3,188,735	$ 138,200	$ 138,200	$ 138,200	$ 3,188,735	$ 138,200	$ 4,159,809	$ 4,159,809	$ 4,159,809	$ 138,200	$ 3,188,735	$ 138,200	$ 138,200	$ 138,200	$ 3,188,735	$ 138,200	$ 4,159,809	$ 4,159,809	$ 4,159,809	$ 138,200	$ 3,188,735	$ 11,924,200

nth, $52.78 per month, and energy cost for Return Water Pump Station for 25-ft lift to move 50,000 ac-ft = $275,660.00. Costs increased for inflation at 3% per year.

Kern Fan Proje
Earth Lined Canal with Ber

Alternative No. 1b - Earth Lined Canal (3:1 Side Slopes) with Bentonite Liner	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
CAPITAL COST	**$ 71,898,932**																					
O&M COSTS	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year
Recovery Well Pumping Costs [1]	$ -	$ -	$ -	$ -	$ 4,973,341	$ 5,122,542	$ 5,276,218	$ -	$ -	$ -	.	$ -	$ -	$ -	$ 6,683,755	$ 6,884,268	$ 7,090,796	$ -	$ -	$ -	$ -	$ -
Canal Operation Costs [2]	$ 138,200	$ 142,346	$ 3,382,929	$ 151,015	$ 419,019	$ 431,590	$ 444,537	$ 169,969	$ 4,039,394	$ 180,320	$ 185,729	$ 191,301	$ 4,546,374	$ 202,951	$ 563,127	$ 580,020	$ 597,421	$ 228,424	$ 5,428,608	$ 242,335	$ 249,605	$ 257,093
Pump Station No. 1 Replacement Costs [3]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pump Station No. 2 Replacement Costs [3]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pump Station No. 3 Replacement Costs [4]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Return Water Pump Station Replacement Costs [5]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Liner Replacement or Repairs [6]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Annual Operating Cost	$ 138,200	$ 142,346	$ 3,382,929	$ 151,015	$ 5,392,360	$ 5,554,131	$ 5,720,755	$ 169,969	$ 4,039,394	$ 180,320	$ 185,729	$ 191,301	$ 4,546,374	$ 202,951	$ 7,246,882	$ 7,464,288	$ 7,688,217	$ 228,424	$ 5,428,608	$ 242,335	$ 249,605	$ 257,093
Capital Recovery @ 3.0% / 20yrs.	$ 4,832,738	$ 4,832,738	$ 4,832,738	$ 4,832,738	$ 4,832,738	$ 4,832,738	$ 4,832,738	$ 4,832,738	$ 4,832,738	$ 4,832,738	$ 4,832,738	$ 4,832,738	$ 4,832,738	$ 4,832,738	$ 4,832,738	$ 4,832,738	$ 4,832,738	$ 4,832,738	$ 4,832,738	$ 4,832,738	$ -	$ -
Total Annual Costs	$ 4,970,938	$ 4,975,084	$ 8,215,667	$ 4,983,752	$ 10,225,098	$ 10,386,869	$ 10,553,493	$ 5,002,706	$ 8,872,132	$ 5,013,057	$ 5,018,467	$ 5,024,039	$ 9,379,111	$ 5,035,689	$ 12,079,619	$ 12,297,026	$ 12,520,954	$ 5,061,161	$ 10,261,345	$ 5,075,072	$ 249,605	$ 257,093
Average Monthly Cost	$ 414,245	$ 414,590	$ 684,639	$ 415,313	$ 852,092	$ 865,572	$ 879,458	$ 416,892	$ 739,344	$ 417,755	$ 418,206	$ 418,670	$ 781,593	$ 419,641	$ 1,006,635	$ 1,024,752	$ 1,043,413	$ 421,763	$ 855,112	$ 422,923	$ 20,800	$ 21,424
Equivilant Average Monthly Cost	$ 1,135,267	$ 1,135,267	$ 1,135,267	$ 1,135,267	$ 1,135,267	$ 1,135,267	$ 1,135,267	$ 1,135,267	$ 1,135,267	$ 1,135,267	$ 1,135,267	$ 1,135,267	$ 1,135,267	$ 1,135,267	$ 1,135,267	$ 1,135,267	$ 1,135,267	$ 1,135,267	$ 1,135,267	$ 1,135,267	$ -	$ -
Present Worth of Op. Costs @ 3%	$ 138,200	$ 138,200	$ 3,188,735	$ 138,200	$ 4,791,042	$ 4,791,042	$ 4,791,042	$ 138,200	$ 3,188,735	$ 138,200	$ 138,200	$ 138,200	$ 3,188,735	$ 138,200	$ 4,791,042	$ 4,791,042	$ 4,791,042	$ 138,200	$ 3,188,735	$ 138,200	$ 138,200	$ 138,200
Present Worth of Op. Costs	**$ 130,779,987**																					
Present Worth of Capital + Op. Costs	**$ 202,678,919**																					

[1]Recovery well pumping costs in dry year estimated as $4,290,048 per Section III. for 14 wells and increased for inflation at 3% per year.

[2]Canal operation costs based on 1) Idle Year = O&M Cost Estimate $69,100 per year x 2 due to increased canal maintenance for tumbleweeds and rodent holes; 2) Wet Year = O&M Cost Estimate based on $9,000 per month, $158.33 per month, and $404,296.88 per month for four months plus energy costs for three pump stations each with a 20-ft lift to move 112,500 ac-ft = $1,488,848 plus 8 idle months of $46,067; and 3) Dry Year = O&M Cost Estimate based on $8,000 per mo

[3]Pump Station replacement costs include pump and motor replacement at $2,222,000, VFD's at $700,000, electrical and control equipment at $900,000, and cathodic protection at $25,000. Costs increased for inflation at 3% per year.

[4]Pump Station replacement costs include pump and motor replacement at $1,287,000, VFD's at $420,000, electrical and control equipment at $565,000, and cathodic protection at $25,000. Costs increased for inflation at 3% per year.

[5]Pump Station replacement costs include pump and motor replacement at $540,000, VFD's at $150,000, electrical and control equipment at $565,000, and cathodic protection at $15,000. Costs increased for inflation at 3% per year.

[6]No liner replacement or repairs as part of the earth lined canal alternative.

ct
ntonite Liner

23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069
Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year
$ -	$ -	$ 8,982,408	$ 9,251,880	$ 9,529,436	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 12,071,605	$ 12,433,753	$ 12,806,766	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,223,228	$ 16,709,925	$ 17,211,222	$ -	$ -	$ -
$ 6,109,946	$ 272,750	$ 756,795	$ 779,499	$ 802,884	$ 306,982	$ 7,295,595	$ 325,677	$ 335,448	$ 345,511	$ 8,211,257	$ 366,553	$ 1,017,069	$ 1,047,581	$ 1,079,009	$ 412,558	$ 9,804,670	$ 437,683	$ 450,814	$ 464,338	$ 11,035,242	$ 492,616	$ 1,366,856	$ 1,407,862	$ 1,450,098	$ 554,444	$ 13,176,656	$ 588,210
$ -	$ -	$ 8,013,274	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,778,017
$ -	$ -	$ 8,013,274	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,778,017
$ -	$ -	$ 5,350,314	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 11,202,370
$ -	$ -	$ 2,581,649	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,405,399
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 6,109,946	$ 272,750	$ 33,697,714	$ 10,031,379	$ 10,332,320	$ 306,982	$ 7,295,595	$ 325,677	$ 335,448	$ 345,511	$ 8,211,257	$ 366,553	$ 13,088,674	$ 13,481,334	$ 13,885,774	$ 412,558	$ 9,804,670	$ 437,683	$ 450,814	$ 464,338	$ 11,035,242	$ 492,616	$ 17,590,084	$ 18,117,786	$ 18,661,320	$ 554,444	$ 13,176,656	$ 50,752,012
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 6,109,946	$ 272,750	$ 33,697,714	$ 10,031,379	$ 10,332,320	$ 306,982	$ 7,295,595	$ 325,677	$ 335,448	$ 345,511	$ 8,211,257	$ 366,553	$ 13,088,674	$ 13,481,334	$ 13,885,774	$ 412,558	$ 9,804,670	$ 437,683	$ 450,814	$ 464,338	$ 11,035,242	$ 492,616	$ 17,590,084	$ 18,117,786	$ 18,661,320	$ 554,444	$ 13,176,656	$ 50,752,012
$ 509,162	$ 22,729	$ 2,808,143	$ 835,948	$ 861,027	$ 25,582	$ 607,966	$ 27,140	$ 27,954	$ 28,793	$ 684,271	$ 30,546	$ 1,090,723	$ 1,123,445	$ 1,157,148	$ 34,380	$ 817,056	$ 36,474	$ 37,568	$ 38,695	$ 919,604	$ 41,051	$ 1,465,840	$ 1,509,816	$ 1,555,110	$ 46,204	$ 1,098,055	$ 4,229,334
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 3,188,735	$ 138,200	$ 16,577,042	$ 4,791,042	$ 4,791,042	$ 138,200	$ 3,188,735	$ 138,200	$ 138,200	$ 138,200	$ 3,188,735	$ 138,200	$ 4,791,042	$ 4,791,042	$ 4,791,042	$ 138,200	$ 3,188,735	$ 138,200	$ 138,200	$ 138,200	$ 3,188,735	$ 138,200	$ 4,791,042	$ 4,791,042	$ 4,791,042	$ 138,200	$ 3,188,735	$ 11,924,200

nth, $52.78 per month, and energy cost for Return Water Pump Station for 25-ft lift to move 50,000 ac-ft = $275,660.00. Costs increased for inflation at 3% per year.

Kern Fan Proje
Poly Lined Cana

Alternative No. 2/3 - HDPE Lined Canal or RPE Lined Canal	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
CAPITAL COST	**$ 60,291,545**																					
O&M COSTS	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year
Recovery Well Pumping Costs [1]	$ -	$ -	$ -	$ -	$ 4,262,883	$ 4,390,769	$ 4,522,492	$ -	$ -	$ -	.	$ -	$ -	$ -	$ 5,728,958	$ 5,900,827	$ 6,077,851	$ -	$ -	$ -	$ -	$ -
Canal Operation Costs [2]	$ 69,100	$ 71,173	$ 3,382,929	$ 75,507	$ 419,019	$ 431,590	$ 444,537	$ 84,984	$ 4,039,394	$ 90,160	$ 92,865	$ 95,651	$ 4,546,374	$ 101,476	$ 563,127	$ 580,020	$ 597,421	$ 114,212	$ 5,428,608	$ 121,167	$ 124,802	$ 128,546
Pump Station No. 1 Replacement Costs [3]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pump Station No. 2 Replacement Costs [3]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pump Station No. 3 Replacement Costs [4]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Return Water Pump Station Replacement Costs [5]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Liner Replacement or Repairs [6]	$ -	$ -	$ -	$ -	$ 28,982	$ -	$ -	$ -	$ -	$ 33,598	.	$ -	$ -	$ -	$ 38,949	$ -	$ -	$ -	$ -	$ -	$ 9,647,163	$ -
Total Annual Operating Cost	$ 69,100	$ 71,173	$ 3,382,929	$ 75,507	$ 4,710,884	$ 4,822,359	$ 4,967,029	$ 84,984	$ 4,039,394	$ 123,758	$ 92,865	$ 95,651	$ 4,546,374	$ 101,476	$ 6,331,034	$ 6,480,847	$ 6,675,272	$ 114,212	$ 5,428,608	$ 121,167	$ 9,771,965	$ 128,546
Capital Recovery @ 3.0% / 20yrs.	$ 4,052,539	$ 4,052,539	$ 4,052,539	$ 4,052,539	$ 4,052,539	$ 4,052,539	$ 4,052,539	$ 4,052,539	$ 4,052,539	$ 4,052,539	$ 4,052,539	$ 4,052,539	$ 4,052,539	$ 4,052,539	$ 4,052,539	$ 4,052,539	$ 4,052,539	$ 4,052,539	$ 4,052,539	$ 4,052,539	$ -	$ -
Total Annual Costs	$ 4,121,639	$ 4,123,712	$ 7,435,468	$ 4,128,046	$ 8,763,422	$ 8,874,898	$ 9,019,568	$ 4,137,523	$ 8,091,933	$ 4,176,297	$ 4,145,403	$ 4,148,189	$ 8,598,913	$ 4,154,015	$ 10,383,572	$ 10,533,386	$ 10,727,811	$ 4,166,751	$ 9,481,147	$ 4,173,706	$ 9,771,965	$ 128,546
Average Monthly Cost	$ 343,470	$ 343,643	$ 619,622	$ 344,004	$ 730,285	$ 739,575	$ 751,631	$ 344,794	$ 674,328	$ 348,025	$ 345,450	$ 345,682	$ 716,576	$ 346,168	$ 865,298	$ 877,782	$ 893,984	$ 347,229	$ 790,096	$ 347,809	$ 814,330	$ 10,712
Equivilant Average Monthly Cost	$ 1,068,530	$ 1,068,530	$ 1,068,530	$ 1,068,530	$ 1,068,530	$ 1,068,530	$ 1,068,530	$ 1,068,530	$ 1,068,530	$ 1,068,530	$ 1,068,530	$ 1,068,530	$ 1,068,530	$ 1,068,530	$ 1,068,530	$ 1,068,530	$ 1,068,530	$ 1,068,530	$ 1,068,530	$ 1,068,530	$ -	$ -
Present Worth of Op. Costs @ 3%	$ 69,100	$ 69,100	$ 3,188,735	$ 69,100	$ 4,185,559	$ 4,159,809	$ 4,159,809	$ 69,100	$ 3,188,735	$ 94,850	$ 69,100	$ 69,100	$ 3,188,735	$ 69,100	$ 4,185,559	$ 4,159,809	$ 4,159,809	$ 69,100	$ 3,188,735	$ 69,100	$ 5,410,500	$ 69,100
Present Worth of Op. Costs	**$ 130,472,785**																					
Present Worth of Capital + Op. Costs	**$ 190,764,330**																					

[1]Recovery well pumping costs in dry year estimated as $3,677,184 per Section III. for 12 wells and increased for inflation at 3% per year.

[2]Canal operation costs based on 1) Idle Year = O&M Cost Estimate $69,100 per year; 2) Wet Year = O&M Cost Estimate based on $9,000 per month, $158.33 per month, and $404,296.88 per month for four months plus energy costs for three pump stations each with a 20-ft lift to move 112,500 ac-ft = $1,488,848 plus 8 idle months of $46,067; and 3) Dry Year = O&M Cost Estimate based on $8,000 per month, $52.78 per month, and energy cost for Return Water Pump Station for 7

[3]Pump Station replacement costs include pump and motor replacement at $2,222,000, VFD's at $700,000, electrical and control equipment at $900,000, and cathodic protection at $25,000. Costs increased for inflation at 3% per year.

[4]Pump Station replacement costs include pump and motor replacement at $1,287,000, VFD's at $420,000, electrical and control equipment at $565,000, and cathodic protection at $25,000. Costs increased for inflation at 3% per year.

[5]Pump Station replacement costs include pump and motor replacement at $540,000, VFD's at $150,000, electrical and control equipment at $565,000, and cathodic protection at $15,000. Costs increased for inflation at 3% per year.

[6]Liner replacement or repairs estimated as minor patches at $25,000 every five years and complete liner replacement after 20 years at 40 years. Costs increased for inflation at 3% per year.

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al

23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069
Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year
$ -	$ -	$ 7,699,240	$ 7,930,217	$ 8,168,124	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,347,135	$ 10,657,549	$ 10,977,276	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 13,905,684	$ 14,322,855	$ 14,752,540	$ -	$ -	$ -
$ 6,109,946	$ 136,375	$ 756,795	$ 779,499	$ 802,884	$ 153,491	$ 7,295,595	$ 162,839	$ 167,724	$ 172,756	$ 8,211,257	$ 183,276	$ 1,017,069	$ 1,047,581	$ 1,079,009	$ 206,279	$ 9,804,670	$ 218,842	$ 225,407	$ 232,169	$ 11,035,242	$ 246,308	$ 1,366,856	$ 1,407,862	$ 1,450,098	$ 277,222	$ 13,176,656	$ 294,105
$ -	$ -	$ 8,013,274	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,778,017
$ -	$ -	$ 8,013,274	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,778,017
$ -	$ -	$ 5,350,314	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 11,202,370
$ -	$ -	$ 2,581,649	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,405,399
$ -	$ -	$ 52,344	$ -	$ -	$ -	$ -	$ 60,682	$ -	$ -	$ -	$ -	$ 70,347	$ -	$ -	$ -	$ -	$ -	$ 17,423,849	$ -	$ -	$ -	$ 94,540	$ -	$ -	$ -	$ -	$ 109,598
$ 6,109,946	$ 136,375	$ 32,466,891	$ 8,709,716	$ 8,971,008	$ 153,491	$ 7,295,595	$ 223,520	$ 167,724	$ 172,756	$ 8,211,257	$ 183,276	$ 11,434,551	$ 11,705,130	$ 12,056,284	$ 206,279	$ 9,804,670	$ 218,842	$ 17,649,255	$ 232,169	$ 11,035,242	$ 246,308	$ 15,367,080	$ 15,730,716	$ 16,202,638	$ 277,222	$ 13,176,656	$ 50,567,505
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 6,109,946	$ 136,375	$ 32,466,891	$ 8,709,716	$ 8,971,008	$ 153,491	$ 7,295,595	$ 223,520	$ 167,724	$ 172,756	$ 8,211,257	$ 183,276	$ 11,434,551	$ 11,705,130	$ 12,056,284	$ 206,279	$ 9,804,670	$ 218,842	$ 17,649,255	$ 232,169	$ 11,035,242	$ 246,308	$ 15,367,080	$ 15,730,716	$ 16,202,638	$ 277,222	$ 13,176,656	$ 50,567,505
$ 509,162	$ 11,365	$ 2,705,574	$ 725,810	$ 747,584	$ 12,791	$ 607,966	$ 18,627	$ 13,977	$ 14,396	$ 684,271	$ 15,273	$ 952,879	$ 975,428	$ 1,004,690	$ 17,190	$ 817,056	$ 18,237	$ 1,470,771	$ 19,347	$ 919,604	$ 20,526	$ 1,280,590	$ 1,310,893	$ 1,350,220	$ 23,102	$ 1,098,055	$ 4,213,959
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 3,188,735	$ 69,100	$ 15,971,559	$ 4,159,809	$ 4,159,809	$ 69,100	$ 3,188,735	$ 94,850	$ 69,100	$ 69,100	$ 3,188,735	$ 69,100	$ 4,185,559	$ 4,159,809	$ 4,159,809	$ 69,100	$ 3,188,735	$ 69,100	$ 5,410,500	$ 69,100	$ 3,188,735	$ 69,100	$ 4,185,559	$ 4,159,809	$ 4,159,809	$ 69,100	$ 3,188,735	$ 11,880,850

25-ft lift to move 50,000 ac-ft = $275,660.00. Costs increased for inflation at 3% per year.

Kern Fan Proje
Shotcrete Lined C

Alternative No. 4- Shotcrete Concrete Liner	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
CAPITAL COST	**$ 69,513,845**																					
O&M COSTS	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year
Recovery Well Pumping Costs [1]	$ -	$ -	$ -	$ -	$ 4,262,883	$ 4,390,769	$ 4,522,492	$ -	$ -	$ -	.	$ -	$ -	$ -	$ 5,728,958	$ 5,900,827	$ 6,077,851	$ -	$ -	$ -	$ -	$ -
Canal Operation Costs [2]	$ 69,100	$ 71,173	$ 3,382,929	$ 75,507	$ 419,019	$ 431,590	$ 444,537	$ 84,984	$ 4,039,394	$ 90,160	$ 92,865	$ 95,651	$ 4,546,374	$ 101,476	$ 563,127	$ 580,020	$ 597,421	$ 114,212	$ 5,428,608	$ 121,167	$ 124,802	$ 128,546
Pump Station No. 1 Replacement Costs [3]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pump Station No. 2 Replacement Costs [3]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pump Station No. 3 Replacement Costs [4]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Return Water Pump Station Replacement Costs [5]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Liner Replacement or Repairs [6]	$ -	$ -	$ 137,439	$ -	$ -	$ 150,183	$ -	$ -	$ 164,109	$ -	$ -	$ 179,326	$ -	$ -	$ 195,954	$ -	$ -	$ 214,125	$ -	$ -	$ 233,980	$ -
Total Annual Operating Cost	$ 69,100	$ 71,173	$ 3,520,367	$ 75,507	$ 4,681,902	$ 4,972,542	$ 4,967,029	$ 84,984	$ 4,203,503	$ 90,160	$ 92,865	$ 274,977	$ 4,546,374	$ 101,476	$ 6,488,039	$ 6,480,847	$ 6,675,272	$ 328,337	$ 5,428,608	$ 121,167	$ 358,782	$ 128,546
Capital Recovery @ 3% / 20yrs.	$ 4,672,422	$ 4,672,422	$ 4,672,422	$ 4,672,422	$ 4,672,422	$ 4,672,422	$ 4,672,422	$ 4,672,422	$ 4,672,422	$ 4,672,422	$ 4,672,422	$ 4,672,422	$ 4,672,422	$ 4,672,422	$ 4,672,422	$ 4,672,422	$ 4,672,422	$ 4,672,422	$ 4,672,422	$ 4,672,422	$ -	$ -
Total Annual Costs	$ 4,741,522	$ 4,743,595	$ 8,192,790	$ 4,747,930	$ 9,354,324	$ 9,644,964	$ 9,639,452	$ 4,757,407	$ 8,875,925	$ 4,762,582	$ 4,765,287	$ 4,947,399	$ 9,218,796	$ 4,773,898	$ 11,160,461	$ 11,153,269	$ 11,347,695	$ 5,000,759	$ 10,101,030	$ 4,793,590	$ 358,782	$ 128,546
Average Monthly Cost	$ 395,127	$ 395,300	$ 682,732	$ 395,661	$ 779,527	$ 803,747	$ 803,288	$ 396,451	$ 739,660	$ 396,882	$ 397,107	$ 412,283	$ 768,233	$ 397,825	$ 930,038	$ 929,439	$ 945,641	$ 416,730	$ 841,753	$ 399,466	$ 29,899	$ -
Equivilant Average Monthly Cost	$ 1,070,806	$ 1,070,806	$ 1,070,806	$ 1,070,806	$ 1,070,806	$ 1,070,806	$ 1,070,806	$ 1,070,806	$ 1,070,806	$ 1,070,806	$ 1,070,806	$ 1,070,806	$ 1,070,806	$ 1,070,806	$ 1,070,806	$ 1,070,806	$ 1,070,806	$ 1,070,806	$ 1,070,806	$ 1,070,806	$ -	$ -
Present Worth of Op. Costs @ 3%	$ 69,100	$ 69,100	$ 3,318,284	$ 69,100	$ 4,159,809	$ 4,289,358	$ 4,159,809	$ 69,100	$ 3,318,284	$ 69,100	$ 69,100	$ 198,649	$ 3,188,735	$ 69,100	$ 4,289,358	$ 4,159,809	$ 4,159,809	$ 198,649	$ 3,188,735	$ 69,100	$ 198,649	$ 69,100
Present Worth of Op. Costs	**$ 121,656,769**																					
Present Worth of Capital + Op. Costs	**$ 191,170,614**																					

[1]Recovery well pumping costs in dry year estimated as $3,677,184 per Section III. for 12 wells and increased for inflation at 3% per year.

[2]Canal operation costs based on 1) Idle Year = O&M Cost Estimate $69,100 per year; 2) Wet Year = O&M Cost Estimate based on $9,000 per month, $158.33 per month, and $404,296.88 per month for four months plus energy costs for three pump stations each with a 20-ft lift to move 112,500 ac-ft = $1,488,848 plus 8 idle months of $46,067; and 3) Dry Year = O&M Cost Estimate based on $8,000 per month, $52.78 per month, and energy cost for Return Water Pump Station for 7

[3]Pump Station replacement costs include pump and motor replacement at $2,222,000, VFD's at $700,000, electrical and control equipment at $900,000, and cathodic protection at $25,000. Costs increased for inflation at 3% per year.

[4]Pump Station replacement costs include pump and motor replacement at $1,287,000, VFD's at $420,000, electrical and control equipment at $565,000, and cathodic protection at $25,000. Costs increased for inflation at 3% per year.

[5]Pump Station replacement costs include pump and motor replacement at $540,000, VFD's at $150,000, electrical and control equipment at $565,000, and cathodic protection at $15,000. Costs increased for inflation at 3% per year.

[6]Liner replacement or repairs estimated as replacing 1,200-ft of lining at $129,549 every three years. Costs increased for inflation at 3% per year.

Kern Fan Proje
Concrete Lined Ca

Alternative No. 5- Conventional Concrete Liner	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
CAPITAL COST	**$ 70,697,045**																					
O&M COSTS	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year
Recovery Well Pumping Costs [1]	$ -	$ -	$ -	$ -	$ 4,262,883	$ 4,390,769	$ 4,522,492	$ -	$ -	$ -	.	$ -	$ -	$ -	$ 5,728,958	$ 5,900,827	$ 6,077,851	$ -	$ -	$ -	$ -	$ -
Canal Operation Costs [2]	$ 69,100	$ 71,173	$ 3,382,929	$ 75,507	$ 419,019	$ 431,590	$ 444,537	$ 84,984	$ 4,039,394	$ 90,160	$ 92,865	$ 95,651	$ 4,546,374	$ 101,476	$ 563,127	$ 580,020	$ 597,421	$ 114,212	$ 5,428,608	$ 121,167	$ 124,802	$ 128,546
Pump Station No. 1 Replacement Costs [3]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pump Station No. 2 Replacement Costs [3]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pump Station No. 3 Replacement Costs [4]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Return Water Pump Station Replacement Costs [5]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Liner Replacement or Repairs [6]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 226,888	$ -	$ -	$ -	$ -	$ 263,026	$ -	$ -
Total Annual Operating Cost	$ 69,100	$ 71,173	$ 3,382,929	$ 75,507	$ 4,681,902	$ 4,822,359	$ 4,967,029	$ 84,984	$ 4,039,394	$ 90,160	$ 92,865	$ 95,651	$ 4,546,374	$ 101,476	$ 6,518,973	$ 6,480,847	$ 6,675,272	$ 114,212	$ 5,428,608	$ 384,193	$ 124,802	$ 128,546
Capital Recovery @ 3% / 20yrs.	$ 4,751,952	$ 4,751,952	$ 4,751,952	$ 4,751,952	$ 4,751,952	$ 4,751,952	$ 4,751,952	$ 4,751,952	$ 4,751,952	$ 4,751,952	$ 4,751,952	$ 4,751,952	$ 4,751,952	$ 4,751,952	$ 4,751,952	$ 4,751,952	$ 4,751,952	$ 4,751,952	$ 4,751,952	$ 4,751,952	$ -	$ -
Total Annual Costs	$ 4,821,052	$ 4,823,125	$ 8,134,881	$ 4,827,459	$ 9,433,854	$ 9,574,311	$ 9,718,981	$ 4,836,936	$ 8,791,346	$ 4,842,112	$ 4,844,817	$ 4,847,602	$ 9,298,326	$ 4,853,428	$ 11,270,925	$ 11,232,799	$ 11,427,224	$ 4,866,164	$ 10,180,560	$ 5,136,145	$ 124,802	$ 128,546
Average Monthly Cost	$ 401,754.33	$ 401,927	$ 677,907	$ 402,288	$ 786,154	$ 797,859	$ 809,915	$ 403,078	$ 732,612	$ 403,509	$ 403,735	$ 403,967	$ 774,860	$ 404,452	$ 939,244	$ 936,067	$ 952,269	$ 405,514	$ 848,380	$ 428,012	$ 10,400	$ -
Equivilant Average Monthly Cost	$ 1,072,544	$ 1,072,544	$ 1,072,544	$ 1,072,544	$ 1,072,544	$ 1,072,544	$ 1,072,544	$ 1,072,544	$ 1,072,544	$ 1,072,544	$ 1,072,544	$ 1,072,544	$ 1,072,544	$ 1,072,544	$ 1,072,544	$ 1,072,544	$ 1,072,544	$ 1,072,544	$ 1,072,544	$ 1,072,544	$ -	$ -
Present Worth of Op. Costs @ 3%	$ 69,100	$ 69,100	$ 3,188,735	$ 69,100	$ 4,159,809	$ 4,159,809	$ 4,159,809	$ 69,100	$ 3,188,735	$ 69,100	$ 69,100	$ 69,100	$ 3,188,735	$ 69,100	$ 4,309,809	$ 4,159,809	$ 4,159,809	$ 69,100	$ 3,188,735	$ 219,100	$ 69,100	$ 69,100
Present Worth of Op. Costs	**$ 120,783,985**																					
Present Worth of Capital + Op. Costs	**$ 191,481,030**																					

[1]Recovery well pumping costs in dry year estimated as $3,677,184 per Section III. for 12 wells and increased for inflation at 3% per year.

[2]Canal operation costs based on 1) Idle Year = O&M Cost Estimate $69,100 per year; 2) Wet Year = O&M Cost Estimate based on $9,000 per month, $158.33 per month, and $404,296.88 per month for four months plus energy costs for three pump stations each with a 20-ft lift to move 112,500 ac-ft = $1,488,848 plus 8 idle months of $46,067; and 3) Dry Year = O&M Cost Estimate based on $8,000 per month, $52.78 per month, and energy cost for Return Water Pump Station for 7

[3]Pump Station replacement costs include pump and motor replacement at $2,222,000, VFD's at $700,000, electrical and control equipment at $900,000, and cathodic protection at $25,000. Costs increased for inflation at 3% per year.

[4]Pump Station replacement costs include pump and motor replacement at $1,287,000, VFD's at $420,000, electrical and control equipment at $565,000, and cathodic protection at $25,000. Costs increased for inflation at 3% per year.

[5]Pump Station replacement costs include pump and motor replacement at $540,000, VFD's at $150,000, electrical and control equipment at $565,000, and cathodic protection at $15,000. Costs increased for inflation at 3% per year.

[6]Liner replacement or repairs estimated as replacing 1,200-ft of lining at $150,000 every five years after the first 15 years. Costs increased for inflation at 3% per year.

ct
ınal

23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069
Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year
$ -	$ -	$ 7,699,240	$ 7,930,217	$ 8,168,124	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,347,135	$ 10,657,549	$ 10,977,276	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 13,905,684	$ 14,322,855	$ 14,752,540	$ -	$ -	$ -
$ 6,109,946	$ 136,375	$ 756,795	$ 779,499	$ 802,884	$ 153,491	$ 7,295,595	$ 162,839	$ 167,724	$ 172,756	$ 8,211,257	$ 183,276	$ 1,017,069	$ 1,047,581	$ 1,079,009	$ 206,279	$ 9,804,670	$ 218,842	$ 225,407	$ 232,169	$ 11,035,242	$ 246,308	$ 1,366,856	$ 1,407,862	$ 1,450,098	$ 277,222	$ 13,176,656	$ 294,105
$ -	$ -	$ 8,013,274	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,778,017
$ -	$ -	$ 8,013,274	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,778,017
$ -	$ -	$ 5,350,314	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 11,202,370
$ -	$ -	$ 2,581,649	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,405,399
$ -	$ -	$ 304,919	$ -	$ -	$ -	$ -	$ 353,485	$ -	$ -	$ -	$ -	$ 409,786	$ -	$ -	$ -	$ -	$ 475,054	$ -	$ -	$ -	$ -	$ 550,718	$ -	$ -	$ -	$ -	$ 638,433
$ 6,109,946	$ 136,375	$ 32,719,466	$ 8,709,716	$ 8,971,008	$ 153,491	$ 7,295,595	$ 516,324	$ 167,724	$ 172,756	$ 8,211,257	$ 183,276	$ 11,773,990	$ 11,705,130	$ 12,056,284	$ 206,279	$ 9,804,670	$ 693,896	$ 225,407	$ 232,169	$ 11,035,242	$ 246,308	$ 15,823,258	$ 15,730,716	$ 16,202,638	$ 277,222	$ 13,176,656	$ 51,096,340
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 6,109,946	$ 136,375	$ 32,719,466	$ 8,709,716	$ 8,971,008	$ 153,491	$ 7,295,595	$ 516,324	$ 167,724	$ 172,756	$ 8,211,257	$ 183,276	$ 11,773,990	$ 11,705,130	$ 12,056,284	$ 206,279	$ 9,804,670	$ 693,896	$ 225,407	$ 232,169	$ 11,035,242	$ 246,308	$ 15,823,258	$ 15,730,716	$ 16,202,638	$ 277,222	$ 13,176,656	$ 51,096,340
$ 509,162	$ 11,365	$ 2,726,622	$ 725,810	$ 747,584	$ 12,791	$ 607,966	$ 43,027	$ 13,977	$ 14,396	$ 684,271	$ 15,273	$ 981,166	$ 975,428	$ 1,004,690	$ 17,190	$ 817,056	$ 57,825	$ 18,784	$ 19,347	$ 919,604	$ 20,526	$ 1,318,605	$ 1,310,893	$ 1,350,220	$ 23,102	$ 1,098,055	$ 4,258,028
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 3,188,735	$ 69,100	$ 16,095,809	$ 4,159,809	$ 4,159,809	$ 69,100	$ 3,188,735	$ 219,100	$ 69,100	$ 69,100	$ 3,188,735	$ 69,100	$ 4,309,809	$ 4,159,809	$ 4,159,809	$ 69,100	$ 3,188,735	$ 219,100	$ 69,100	$ 69,100	$ 3,188,735	$ 69,100	$ 4,309,809	$ 4,159,809	$ 4,159,809	$ 69,100	$ 3,188,735	$ 12,005,100

25-ft lift to move 50,000 ac-ft = $275,660.00. Costs increased for inflation at 3% per year.

ct
anal

23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069
Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year
$ -	$ -	$ 7,699,240	$ 7,930,217	$ 8,168,124	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,347,135	$ 10,657,549	$ 10,977,276	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 13,905,684	$ 14,322,855	$ 14,752,540	$ -	$ -	$ -
$ 6,109,946	$ 136,375	$ 756,795	$ 779,499	$ 802,884	$ 153,491	$ 7,295,595	$ 162,839	$ 167,724	$ 172,756	$ 8,211,257	$ 183,276	$ 1,017,069	$ 1,047,581	$ 1,079,009	$ 206,279	$ 9,804,670	$ 218,842	$ 225,407	$ 232,169	$ 11,035,242	$ 246,308	$ 1,366,856	$ 1,407,862	$ 1,450,098	$ 277,222	$ 13,176,656	$ 294,105
$ -	$ -	$ 8,013,274	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,778,017
$ -	$ -	$ 8,013,274	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,778,017
$ -	$ -	$ 5,350,314	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 11,202,370
$ -	$ -	$ 2,581,649	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,405,399
$ -	$ 255,676	$ -	$ -	$ 279,384	$ -	$ -	$ 305,291	$ -	$ -	$ 333,599	$ -	$ -	$ 364,533	$ -	$ -	$ 398,335	$ -	$ -	$ 435,272	$ -	$ -	$ 475,633	$ -	$ -	$ 519,737	$ -	$ -
$ 6,109,946	$ 392,051	$ 32,414,547	$ 8,709,716	$ 9,250,392	$ 153,491	$ 7,295,595	$ 468,129	$ 167,724	$ 172,756	$ 8,544,856	$ 183,276	$ 11,364,204	$ 12,069,663	$ 12,056,284	$ 206,279	$ 10,203,005	$ 218,842	$ 225,407	$ 667,441	$ 11,035,242	$ 246,308	$ 15,748,173	$ 15,730,716	$ 16,202,638	$ 796,959	$ 13,176,656	$ 50,457,907
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 6,109,946	$ 392,051	$ 32,414,547	$ 8,709,716	$ 9,250,392	$ 153,491	$ 7,295,595	$ 468,129	$ 167,724	$ 172,756	$ 8,544,856	$ 183,276	$ 11,364,204	$ 12,069,663	$ 12,056,284	$ 206,279	$ 10,203,005	$ 218,842	$ 225,407	$ 667,441	$ 11,035,242	$ 246,308	$ 15,748,173	$ 15,730,716	$ 16,202,638	$ 796,959	$ 13,176,656	$ 50,457,907
$ 509,162	$ 32,671	$ 2,701,212	$ 725,810	$ 770,866	$ 12,791	$ 607,966	$ 39,011	$ 13,977	$ 14,396	$ 712,071	$ 15,273	$ 947,017	$ 1,005,805	$ 1,004,690	$ 17,190	$ 850,250	$ 18,237	$ 18,784	$ 55,620	$ 919,604	$ 20,526	$ 1,312,348	$ 1,310,893	$ 1,350,220	$ 66,413	$ 1,098,055	$ 4,204,826
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 3,188,735	$ 198,649	$ 15,945,809	$ 4,159,809	$ 4,289,358	$ 69,100	$ 3,188,735	$ 198,649	$ 69,100	$ 69,100	$ 3,318,284	$ 69,100	$ 4,159,809	$ 4,289,358	$ 4,159,809	$ 69,100	$ 3,318,284	$ 69,100	$ 69,100	$ 198,649	$ 3,188,735	$ 69,100	$ 4,289,358	$ 4,159,809	$ 4,159,809	$ 198,649	$ 3,188,735	$ 11,855,100

25-ft lift to move 50,000 ac-ft = $275,660.00. Costs increased for inflation at 3% per year.

Kern Fan Proje
Closed Conduit Pip

Alternative No. 6- Closed Conduit Pipeline	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
CAPITAL COST	**$ 79,375,500**																					
O&M COSTS	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year
Recovery Well Pumping Costs [1]	$ -	$ -	$ -	$ -	$ 4,262,883	$ 4,390,769	$ 4,522,492	$ -	$ -	$ -	.	$ -	$ -	$ -	$ 5,728,958	$ 5,900,827	$ 6,077,851	$ -	$ -	$ -	$ -	$ -
Pipeline Operation Costs [2]	$ 34,550	$ 35,587	$ 3,119,132	$ 37,754	$ 232,879	$ 239,865	$ 247,061	$ 42,492	$ 3,724,407	$ 45,080	$ 46,432	$ 47,825	$ 4,191,852	$ 50,738	$ 312,970	$ 322,359	$ 332,030	$ 57,106	$ 5,005,291	$ 121,167	$ 62,401	$ 64,273
Pump Station No. 1 Replacement Costs [3]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Return Water Pump Station Replacement Costs [4]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	.	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Liner Replacement or Repairs [5]	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Annual Operating Cost	$ 34,550	$ 35,587	$ 3,119,132	$ 37,754	$ 4,495,762	$ 4,630,635	$ 4,769,554	$ 42,492	$ 3,724,407	$ 45,080	$ 46,432	$ 47,825	$ 4,191,852	$ 50,738	$ 6,041,928	$ 6,223,186	$ 6,409,881	$ 57,106	$ 5,005,291	$ 121,167	$ 62,401	$ 64,273
Capital Recovery @ 3% / 20yrs.	$ 5,335,280	$ 5,335,280	$ 5,335,280	$ 5,335,280	$ 5,335,280	$ 5,335,280	$ 5,335,280	$ 5,335,280	$ 5,335,280	$ 5,335,280	$ 5,335,280	$ 5,335,280	$ 5,335,280	$ 5,335,280	$ 5,335,280	$ 5,335,280	$ 5,335,280	$ 5,335,280	$ 5,335,280	$ 5,335,280	$ -	$ -
Total Annual Costs	$ 5,369,830	$ 5,370,867	$ 8,454,412	$ 5,373,034	$ 9,831,042	$ 9,965,915	$ 10,104,834	$ 5,377,773	$ 9,059,687	$ 5,380,360	$ 5,381,713	$ 5,383,106	$ 9,527,133	$ 5,386,018	$ 11,377,208	$ 11,558,466	$ 11,745,162	$ 5,392,386	$ 10,340,571	$ 5,456,448	$ 62,401	$ 64,273
Average Monthly Cost	$ 447,485.87	$ 447,572	$ 704,534	$ 447,753	$ 819,254	$ 830,493	$ 842,069	$ 448,148	$ 754,974	$ 448,363	$ 448,476	$ 448,592	$ 793,928	$ 448,835	$ 948,101	$ 963,205	$ 978,763	$ 449,366	$ 861,714	$ 454,704	$ 5,200	$ -
Equivilant Average Monthly Cost	$ 1,020,508	$ 1,020,508	$ 1,020,508	$ 1,020,508	$ 1,020,508	$ 1,020,508	$ 1,020,508	$ 1,020,508	$ 1,020,508	$ 1,020,508	$ 1,020,508	$ 1,020,508	$ 1,020,508	$ 1,020,508	$ 1,020,508	$ 1,020,508	$ 1,020,508	$ 1,020,508	$ 1,020,508	$ 1,020,508	$ -	$ -
Present Worth of Op. Costs @ 3%	$ 34,550	$ 34,550	$ 2,940,081	$ 34,550	$ 3,994,426	$ 3,994,426	$ 3,994,426	$ 34,550	$ 2,940,081	$ 34,550	$ 34,550	$ 34,550	$ 2,940,081	$ 34,550	$ 3,994,426	$ 3,994,426	$ 3,994,426	$ 34,550	$ 2,940,081	$ 69,100	$ 34,550	$ 34,550
Present Worth of Op. Costs	**$ 102,815,500**																					
Present Worth of Capital + Op. Costs	**$ 182,191,000**																					

[1]Recovery well pumping costs in dry year estimated as $3,677,184 per Section III. for 12 wells and increased for inflation at 3% per year.

[2]Pipeline operation costs based on 1) Idle Year = O&M Cost Estimate $69,100 per year divided by 2 because there will be less maintenance than a canal; 2) Wet Year = O&M Cost Estimate based on $9,000 per month, $52.78 per month, and $404,296.88 per month for four months plus energy costs for one pump station with a 50-ft lift to move 112,500 ac-ft = $1,240,615 plus 8 idle months of $46,067; and 3) Dry Year = O&M Cost Estimate based on $8,000 per month, $52.78 per n

[3]Pump Station replacement costs include pump and motor replacement at $2,800,000, VFD's at $840,000, electrical and control equipment at $1,500,000, and cathodic protection at $25,000. Costs increased for inflation at 3% per year.

[4]Return Water Pump Station replacement costs include pump and motor replacement at $500,000, VFD's at $120,000, electrical and control equipment at $500,000, and cathodic protection at $15,000. Costs increased for inflation at 3% per year.

ct
eline

23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069
Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year	Idle Year	Idle Year	Wet Year	Idle Year	Dry Year	Dry Year	Dry Year	Idle Year	Wet Year	Idle Year
$ -	$ -	$ 7,699,240	$ 7,930,217	$ 8,168,124	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,347,135	$ 10,657,549	$ 10,977,276	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 13,905,684	$ 14,322,855	$ 14,752,540	$ -	$ -	$ -
$ 5,633,499	$ 68,187	$ 420,605	$ 433,224	$ 446,220	$ 76,746	$ 6,726,693	$ 81,419	$ 83,862	$ 86,378	$ 7,570,952	$ 91,638	$ 565,259	$ 582,216	$ 599,683	$ 103,140	$ 9,040,112	$ 109,421	$ 112,703	$ 116,085	$ 10,174,726	$ 123,154	$ 759,660	$ 782,450	$ 805,923	$ 138,611	$ 12,149,155	$ 147,052
$ -	$ -	$ 10,499,382	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 21,983,373
$ -	$ -	$ 2,307,221	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,830,809
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 5,633,499	$ 68,187	$ 20,926,449	$ 8,363,441	$ 8,614,344	$ 76,746	$ 6,726,693	$ 81,419	$ 83,862	$ 86,378	$ 7,570,952	$ 91,638	$ 10,912,394	$ 11,239,765	$ 11,576,958	$ 103,140	$ 9,040,112	$ 109,421	$ 112,703	$ 116,085	$ 10,174,726	$ 123,154	$ 14,665,344	$ 15,105,305	$ 15,558,464	$ 138,611	$ 12,149,155	$ 26,961,235
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 5,633,499	$ 68,187	$ 20,926,449	$ 8,363,441	$ 8,614,344	$ 76,746	$ 6,726,693	$ 81,419	$ 83,862	$ 86,378	$ 7,570,952	$ 91,638	$ 10,912,394	$ 11,239,765	$ 11,576,958	$ 103,140	$ 9,040,112	$ 109,421	$ 112,703	$ 116,085	$ 10,174,726	$ 123,154	$ 14,665,344	$ 15,105,305	$ 15,558,464	$ 138,611	$ 12,149,155	$ 26,961,235
$ 469,458	$ 5,682	$ 1,743,871	$ 696,953	$ 717,862	$ 6,395	$ 560,558	$ 6,785	$ 6,988	$ 7,198	$ 630,913	$ 7,637	$ 909,366	$ 936,647	$ 964,747	$ 8,595	$ 753,343	$ 9,118	$ 9,392	$ 9,674	$ 847,894	$ 10,263	$ 1,222,112	$ 1,258,775	$ 1,296,539	$ 11,551	$ 1,012,430	$ 2,246,770
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 2,940,081	$ 34,550	$ 10,294,426	$ 3,994,426	$ 3,994,426	$ 34,550	$ 2,940,081	$ 34,550	$ 34,550	$ 34,550	$ 2,940,081	$ 34,550	$ 3,994,426	$ 3,994,426	$ 3,994,426	$ 34,550	$ 2,940,081	$ 34,550	$ 34,550	$ 34,550	$ 2,940,081	$ 34,550	$ 3,994,426	$ 3,994,426	$ 3,994,426	$ 34,550	$ 2,940,081	$ 6,334,550

nonth, and energy cost for Return Water Pump Station for 10-ft lift to move 50,000 ac-ft = $110,277.00. Costs increased for inflation at 3% per year.

Irvine Ranch Water District
Operation & Maintenance Cost Estimate
Phase I Well Field Operation Costs

Type of Year	Monthly RRBWSD Operation Cost[1,2]	Monthly PG&E Cost[3,5]	Monthly Mission Unit Cost[4]	DWR Conveyance Cost	Total Monthly Cost	Total Annual Cost if Utilized for 12 Months[6]	Average Cost per Ac-Ft[7]
Dry Year (Pumping Wells)	$ 8,000.00	$ 144,900.00	$ 316.67	$ -	$ 153,216.67	$ 1,838,600.00	$ 73.54
Wet Year (Recharging Water)	$ 9,000.00	$ 1,500.00	$ 316.67	$ -	$ 10,816.67	$ 90,600.00	$ 1.61
Idle Year	$ 4,100.00	$ 1,500.00	$ 316.67	$ -	$ 5,916.67	$ 71,000.00	

1. Rosedale's operation cost includes pond maintenance, oil for reservoirs, field staff time, equipment cost, weed control cost, rodent control cost, office staff, overhead cost, etc.
2. Cost includes one additional piece of equipment for property maintenance
3. Monthly PG&E cost to operate (6) 400 hp wells
4. Average monthly cost for cellular service to (6) Mission Units
5. Assumed 35 cfs flow rate for a 30 day month for a total of 2,083 ac-ft of water recovered per month or 25,000 ac-ft/y
6. Dry year annual cost based on operating 12 months out of the year. Wet year annual cost based on 4 months of recharging water up to 56,250 ac-ft and 8 months at idle costs.
7. Dry year pumping 25,000 ac-ft and a wet year recharging 56,250 ac-ft.

Canal Operation Costs

Type of Year	Monthly RRBWSD Operation Cost[1,2]	Monthly PG&E Cost[3]	Monthly Mission Unit Cost[4]	DWR Conveyance Cost[5]	Total Monthly Cost	Total Annual Cost[6]	Average Cost per Ac-Ft[7]
Dry Year (Pumping Wells)	$ 8,000.00	$ 14,040.00	$ 158.33	$ -	$ 22,198.33	$ 266,380.00	$ 10.66
Wet Year (Recharging Water)	$ 9,000.00	$ 230,400.00	$ 158.33	$ 404,296.88	$ 643,855.21	$ 2,621,487.50	$ 46.60
Idle Year	$ 4,100.00	$ 1,500.00	$ 158.33	$ -	$ 5,758.33	$ 69,100.00	

1. Rosedale's operation cost includes pond maintenance, oil for reservoirs, field staff time, equipment cost, weed control cost, rodent control cost, office staff, overhead cost, etc.
2. Cost includes one additional piece of equipment for canal maintenance
3. Monthly PG&E cost to operate two lift stations moving 230 cfs at a 20-ft TDH each, Total 56,250 ac-ft / year for wet years. Monthly PG&E cost to operate Return Water Lift Station moving 35 cfs at a 25-ft TDH, total 25,000 ac-ft/yr.
4. Average monthly cost for cellular service to (3) Mission Units
5. Article 21 water cost estimated at $23.00/AF for 112,500 ac-ft, however IRWD's share (37.5%) is paid through agreement with Metropolitan Water District. Therefore the estimated monthly water costs include $23/AF for 70,312.5 ac-ft.
6. Dry year annual cost based on operating 12 months out of the year. Wet year annual cost based on 4 months of recharging water up to 56,250 ac-ft and 8 months at idle costs.
7. Dry year conveying 25,000 ac-ft to aqueduct and a wet year recharging 112,500 ac-ft

Goose Lake Channel Turnout Operation Costs

Type of Year	Monthly RRBWSD Operation Cost[1]	Monthly PG&E Cost[2]	Monthly Mission Unit Cost[3]	DWR Conveyance Cost	Total Monthly Cost	Total Annual Cost[4]	Average Cost per Ac-Ft[5]
Dry Year (Pumping Wells)	$ 1,500.00	$ 300.00	$ 52.78	$ -	$ 1,852.78	$ 22,233.33	$ 0.89
Wet Year (Recharging Water)	$ 4,000.00	$ 52,500.00	$ 52.78	$ -	$ 56,552.78	$ 237,033.33	$ 4.21
Idle Year	$ 1,000.00	$ 300.00	$ 52.78	$ -	$ 1,352.78	$ 16,233.33	

1. Rosedale's operation cost includes pond maintenance, oil for reservoirs, field staff time, equipment cost, weed control cost, rodent control cost, office staff, overhead cost, etc.
2. Monthly PG&E cost to operate (4) 200 hp lift pumps moving 240 cfs, Total 56,250 ac-ft / year
3. Average monthly cost for cellular service to (1) Mission Units
4. Dry year annual cost based on operating 12 months out of the year. Wet year annual cost based on 4 months of recharging water up to 56,250 ac-ft and 8 months at idle costs.
5. Dry year pumping 25,000 ac-ft and a wet year recharging 56,250 ac-ft.

Phase II Well Field Operation Costs

Type of Year	Monthly RRBWSD Operation Cost[1,2]	Monthly PG&E Cost[3]	Monthly Mission Unit Cost[4]	DWR Conveyance Cost	Total Monthly Cost	Total Annual Cost if Utilized for 12 Months[6]	Average Cost per Ac-Ft[7]
Dry Year (Pumping Wells)	$ 8,000.00	$ 144,900.00	$ 316.67	$ -	$ 153,216.67	$ 1,838,600.00	$ 73.54
Wet Year (Recharging Water)	$ 9,000.00	$ 1,500.00	$ 316.67	$ -	$ 10,816.67	$ 90,600.00	$ 1.61
Idle Year	$ 4,100.00	$ 1,500.00	$ 316.67	$ -	$ 5,916.67	$ 71,000.00	

1. Rosedale's operation cost includes pond maintenance, oil for reservoirs, field staff time, equipment cost, weed control cost, rodent control cost, office staff, overhead cost, etc.
2. Cost includes one additional piece of equipment for property maintenance
3. Monthly PG&E cost to operate (6) wells
4. Average monthly cost for cellular service to (6) Mission Units
5. Assumed 35 cfs flow rate for a 30 day month for a total of 2,083 ac-ft of water recovered per month or 25,000 ac-ft/y
6. Dry year annual cost based on operating 12 months out of the year. Wet year annual cost based on 4 months of recharging water up to 56,250 ac-ft and 8 months at idle costs.
7. Dry year pumping 25,000 ac-ft and a wet year recharging 56,250 ac-ft.

Total Project Operation Costs

Type of Year	Monthly RRBWSD Operation Cost[1,2]	Monthly PG&E Cost[3]	Monthly Mission Unit Cost[4]	DWR Conveyance Cost	Total Monthly Cost	Total Annual Cost if Utilized for 12 Months[6]	Average Cost per Ac-Ft[7]
Dry Year (Pumping Wells and Returning Water)	$ 25,500.00	$ 304,140.00	$ 844.44	$ -	$ 330,484.44	$ 3,965,813.33	$ 79.32
Wet Year (Conveying and Recharging Water)	$ 31,000.00	$ 285,900.00	$ 844.44	$ 404,296.88	$ 722,041.32	$ 3,039,720.83	$ 27.02
Idle Year	$ 13,300.00	$ 4,800.00	$ 844.44	$ -	$ 18,944.44	$ 227,333.33	

PROPERTY ACCESS AGREEMENT

This Property Access Agreement ("Agreement") is made and entered into by and between the GROUNDWATER BANKING JOINT POWERS AUTHORITY (hereafter "JPA") and _____ (hereafter "Landowner") and _____ (hereafter "Tenant"), all of of whom shall be referred to individually as a "Party" to this Agreement and collectively as the "Parties" to this Agreement.

RECITALS

This PROPERTY ACCESS AGREEMENT is made with reference to the following facts and circumstances:

Landowner has expressed interest in the sale of said property for the purposes of the Kern Fan Project.

JPA has expressed interest in the potential purchase of property for said project and would like to collect information to determine the suitability of the property for a groundwater recharge, storage and recovery project.

NOW, THEREFORE, in consideration of the mutual covenants and promises contained in the PROPERTY ACCESS AGREEMENT, the parties expressly agree, and contract as follows:

TERMS AND CONDITIONS

1. Right of Entry. Tenant and Landowner grants to the JPA and its employees, agents, consultants, and contractors a non-exclusive license to enter onto Landowner's Land detailed in Exhibit A to obtain water quality data from Landowner's well(s) and to perform a geophysical evaluation using ground penetrating radar, as detailed in Exhibit B ("Evaluation Plan and Timeline"), with any further conditions listed under "Access Instructions" in Exhibit C. Unless otherwise agreed to by the Parties in a written amendment to this Agreement, the Parties agree that the JPA's access to Landowner's Land shall be in compliance with the conditions specified herein.

2. Access and Control. Except as otherwise provided in this Agreement, Tenant and Landowner retain the exclusive right of access to and control over the Landowner's Land. Nothing contained in this Agreement shall be construed as affording the public a right of access to any portion of the Landowner's Land or precluding Tenant or Landowner's right to grant access to third parties across the Landowner's Land, provided that such access is not inconsistent with this Agreement or unreasonably interferes with JPA's access granted hereunder.

3. No Easement. The Parties agree that this Agreement does not grant the JPA a possessory right, easement, or other land interest with respect to Landowner's Land.

4. Costs. The Parties agree that all water and soil quality testing and geophysical evaluation performed by the JPA under this Agreement shall be funded by the JPA.

5. Electronic Data, Reports, and Evaluations. JPA shall provide Tenant and Landlord copies of all water and soil quality testing and geophysical evaluation data including but not limited to electronic data, reports, and other documents provided by its employees, agents, consultants and contractor that relate to the activities authorized on the Landowner's Land in Exhibit B.

6. Maintenance of Landowner's Land. The Parties acknowledge that this Agreement grants the JPA a non-exclusive license to access Landowner's Land for the limited purpose of obtaining water quality data from Landowner's well(s) and geophysical information using ground penetrating radar about Landowner's Land. Accordingly, except as provided in Section 7 of this Agreement below ("Damage/Restoration"), the Parties agree that the JPA (including its employees, agents, consultants, and contractors) is under no obligation to maintain or otherwise repair the Landowner's Land.

7. Damage/Restoration. The JPA (including its employees, agents, consultants, and contractors) shall take all reasonable precautions to avoid damaging Landowner's Land or Tenant's crops, field preparations, or other assets. If any damage is caused by the JPA in the course of performance of this Agreement, the JPA shall notify the Landowner and Tenant immediately. In addition, the JPA will at its sole cost and expense work with the Tenant and Landowner to take all action reasonably necessary to repair the damage and restore them to the condition that existed immediately prior to the damage caused by the JPA.

8. Schedule or Notice of Access. The JPA shall coordinate with the Landowner representative for access to Landowner's Land. JPA shall provide 72 hr notice to Landowner for access. Landowner shall coordinate with Tenant and provide its approval for such access or provide an alternative date/time for JPA access within 72 hrs of receipt of JPA request.

9. Indemnity. The JPA agrees to defend, indemnify, and hold harmless Tenant and Landowner for any costs, claims, damages, losses or other liabilities arising out of the JPA's (including any employees, agents, consultants, and contractors) actions on Landowner's Land under this Agreement, with the exception that the JPA shall not be responsible for defending, indemnifying, or holding harmless Tenant or Landowner with regard to costs, claims, damages, losses, or other liabilities arising out of the sole negligence or intentional misconduct of the Tenant or Landowner.

10. Insurance. Prior to entering onto Landowner's Land and upon request, JPA shall provide to Tenant and Landowner a certificate that names the Tenant and Landowner as additional insured and is a "claim based" general liability insurance policy in the amount of at least $1,000,000 Dollars aggregate, or equivalent coverage through participation in a self-insurance risk pool. Other parties gaining access to the subject property in the course performing the work herein shall evidence "claim based" general liability insurance policies of at least $500,000 Dollars aggregate. JPA and any person or entity accessing Landowner's land pursuant to this agreement shall maintain such minimum level of insurance at all times while accessing Landowner's land.

11. Written Notices. Written notices between the Parties shall be sent via U.S. mail or electronic mail to the addresses listed below the parties' respective signatures.

12. Entire Agreement. This Agreement contains the entire understanding of the Parties and supersedes all prior agreements and understandings among the Parties related to the subject matter of this Agreement.

13. Amendment. Amendments to this Agreement shall become effective upon execution of a written amendment signed by both Parties.

14. Severability. If any provision of this Agreement is held to be unenforceable for any reason, it shall be adjusted, rather than voided, if possible, to achieve the intent of the Parties, and the balance of the Agreement shall remain in full force and effect.

15. Governing Law. This Agreement shall be interpreted and enforced pursuant to the laws of the state of California with venue for any action or proceeding to be in Kern County, California.

16. Effective Date. This Agreement shall become effective as of the latest date of execution below.

JPA REPRESENTATIVE

Signed _____
Dan Bartel, General Manager – GBJPA

Date _____, 2021

Address: 849 Allen Road. Bakersfield, CA 93314

Email: dbartel@rrbwsd.com

LANDOWNER REPRESENTATIVE

Signed: _____

Name: _____

Date: _____, 2021

Address: _____

Email: _____

TENANT REPRESENTATIVE

Signed: _____

Name: _____

Date: _____, 2021

Address: _____

Email: _____

EXHIBIT A

Parcel (Referenced in the attached Agreement as "Landowner's Land")
Landowner Name, Contact Name: APN(s):

EXHIBIT B

Evaluation Plan and Timeline

[To be completed by JPA]

EXHIBIT C

Special Access Instructions

[To be completed by Landowner and Tenant]