AGENDA
GROUNDWATER BANKING JOINT POWERS AUTHORITY
BOARD OF DIRECTORS

February 6, 2023

Due to COVID-19, this meeting will be conducted as a teleconference pursuant to the provisions of the Ralph M. Brown Act. All parties/public may attend the meeting via teleconferencing and offer public comments by phone, using the call-in information below or digital internet access.

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

- Consider adoption of Resolution No. 2023-01– Authorizing AB 361 Teleconference Meeting

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 p.m. on February 5, 2023.

ALL VOTES SHALL BE TAKEN BY A ROLL CALL VOTE

1. COMMUNICATIONS TO THE BOARD

a) Written:
b) Oral:

2. ITEMS RECEIVED TOO LATE TO BE AGENDIZED

.

3. CONSENT ITEMS

a) Meeting Minutes November 7, 2022

4. JPA ADMINISTRATIVE AND FINANCIAL REPORT

a) Budget to Actual Report for 2nd Quarter Fiscal Year Ending June 30, 2023 (Cheryl)
b) Fiscal Year Ending June 30, 2023 Forecast (Fiona/Cheryl)
c) Approval for Replacement of Assistant Treasurer (Cheryl)

5. KERN FAN GROUNDWATER STORAGE PROJECT

a) Engineering (Dan)
   i. Design Update
   ii. Conveyance Alternatives
b) Grant Funding Update (Dan/Fiona)
c) State Agreements Update (Fiona)
d) Special Counsel for Public Benefits Agreement
e) Interim Operating Agreements (Trent/Paul)

6. GENERAL MANAGER'S REPORT

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 and possible others 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

9. OPEN SESSION

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

10. ADJOURN

****

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 February 2, 2023. I, Leslie Bonkowski, 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 February 2, 2023.

RESOLUTION NO. 2023-01

A RESOLUTION OF THE GROUNDWATER BANKING JOINT POWERS AUTHORITY ("AUTHORITY") TO IMPLEMENT TELECONFERENCING REQUIREMENTS DURING A PROCLAIMED STATE OF EMERGENCY BY EXECUTIVE ORDER, AND AUTHORIZING REMOTE TELECONFERENCE MEETINGS FOR A THIRTY (30) DAY PERIOD PURSUANT TO BROWN ACT PROVISIONS.

WHEREAS, THE GROUNDWATER BANKING JOINT POWERS AUTHORITY is committed to preserving and ensuring public access and participation in meetings of the Authority; and

WHEREAS, all meetings of the Authority legislative bodies are open and public, as required by the Ralph M. Brown Act (Cal. Gov. Code 54950 – 54963), so that any member of the public may attend, participate, and watch the Authority's legislative bodies conduct their business; and

WHEREAS, the Brown Act, Government Code section 54953(e), makes provisions for remote teleconferencing participation in meetings by members of a legislative body, without compliance with the requirements of Government Code section 54953(b)(3), subject to the existence of certain conditions; and

WHEREAS, a required condition is that a state of emergency is declared by the Governor pursuant to Government Code section 8625, proclaiming the existence of conditions of disaster or of extreme peril to the safety of persons and property within the state caused by conditions as described in Government Code section 8558; and

WHEREAS, the State Legislature amended the Brown Act through Assembly Bill No. 361 (AB 361); and

WHEREAS, AB 361 amended the Brown Act so that a local agency may use teleconferencing without complying with the regular teleconferencing requirements of the Act, where the legislative body holds a meeting during a proclaimed state of emergency and makes certain findings; and

WHEREAS, Government Code section 54953 requires that the legislative body make additional findings every 30 days in order to continue such teleconferencing.

NOW THEREFORE, the Authority hereby finds, determines, declares, orders, and resolves as follows:

1. That the foregoing recitals are true and correct and incorporates them by this reference.

2. The Board of Directors of the Authority finds, by a majority vote, the following:

    a. That there exists a proclaimed state of emergency; and

    b. State or local officials have imposed or recommended measures to promote social distancing.

3. The Authority is authorized to take all steps and perform all actions necessary to execute and implement this Resolution in compliance with Government Code section 54953.

4. That this Resolution shall take effect February 6, 2023 and shall remain in effect for thirty (30) days thereafter (until March 8, 2023), provided the conditions set forth in Section 2 remain.

PASSED AND ADOPTED by the Authority February 6, 2023, by the following vote:

AYES:

NOES:

ABSTAIN:

ABSENT:

_____
Chair

ATTEST:

_____
Secretary

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

November 7, 2022
2:00 PM

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
Peer Swan
Doug Reinhart
Jason Selvidge

DIRECTORS ABSENT

OTHERS PRESENT

Doug Gosling- JPA Legal Counsel
Dan Bartel- RRBWSD
Megan Misuraca- RRBWSD
Dan Raytis- RRBWSD
Cheryl Clary- IRWD
Eileen Lin- IRWD
Robert Jacobson- IRWD
Paul Weghorst- IRWD
Trent Taylor- RRBWSD
Paul Cook- IRWD
Herbert Ng- IRWD
Robert Huang- IRWD
Vladimir Li- IRWD
Kellie Welch-IRWD
Curtis Skaggs- Dee Jaspar & Associates
Wayne Dahl- Dahl Consultants
Joseph Long- Stantec Engineering
Dave Rogers- Dahl Consultants

CALL TO ORDER

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

Mr. Gosling reviewed Resolution No. 2022-06- Authorizing AB 361 Teleconference Meeting with the Board. A motion was made by Director Selvidge with a second by Director Swan adopting Resolution 2022-06. A roll call vote was taken and the motion unanimously passed.

PUBLIC COMMENT NOTICE

There were no public comments.

1. **COMMUNICATIONS TO THE BOARD**
   a). Written: None.

b). Oral: None.

2. ITEMS RECEIVEDTOO LATE TO BE AGENDIZED

None.

3. CONSENT ITEMS

a) Regular Meeting Minutes September 19, 2022

A motion was made by Director Selvidge with a second by Director Reinhart to adopt the consent items. A roll call vote was taken and the motion unanimously passed.

4. JPA ADMINISTRATIVE AND FINANCIAL REPORT

a) Consideration on Possible Action on Approval of Fiscal Year End June 30, 2022 Audit- Ms. Clary reviewed the audit report with the Board. A motion was made by Director Swan with a second by Director Selvidge to approve the Fiscal Year End June 30, 2022 audit report completed by Davis-Farr and Associates. A roll call vote was taken and the motion unanimously passed.

b) Budget to Actual Report for 1st Quarter Fiscal Year Ending June 30, 2023- Ms. Clary reviewed the budget to actual report for 1st Quarter FYE June 30, 2023.

c) Consideration and Possible Action of Voter Designation for ACWA- A motion was made by Director Reinhart with a second by Director Swan to designate Trent Taylor as the authorized voter on behalf of the GBJPA for ACWA. A roll call vote was taken and the motion unanimously passed.

5. KERN FAN GROUNDWATER STORAGE PROJECT

a) Engineering
   i. Design Update-Mr. Bartel reported on design efforts for Ph.1 of the project.
   ii. Conveyance Alternative-Mr. Bartel briefed the Board on the Conveyance Alternative 5. Stantec Engineering and Dahl Consultants gave a detailed presentation of the alternative to the Board.

b) Grant Funding Update- Mr. Bartel reviewed the feasibility study for the Small Surface Storage and Groundwater Storage Project Grant with the Board.

c) State Agreements Update- Ms. Sanchez briefed the Board on the latest efforts in obtaining the agreements with the Department of Water Resources.

6. GENERAL MANAGER'S REPORT

None.

7. **OTHER BUSINESS**
   None.

8. **CLOSED SESSION**
   None.

9. **OPEN SESSION**

10. **ADJOURN**
    Director Pierucci adjourned the meeting at 3:36 p.m.

February 6, 2023
Prepared by: Herbert Ng HN
Reviewed by: Cheryl Clary CC
Agenda Item: 4a

FY 2022-23 Quarterly Actual to Budget Results

DISCUSSION:

The quarterly unaudited actual to budget and forecast results for the six-month period ended December 31, 2022 is attached as Exhibit "A". The report separates capital and operating expenditures.

The six-month year to date total expenditures were $274.3 thousand compared to a budget of $1.1 million. Actual expenditures were $778.5 thousand or 74% under budget. This is primarily due to lower expenditures than budgeted related to the timing for engineering design. Exhibit "A" provides additional comments.

The full year budget was $5.6 million compared to the full year forecast of $835.8 thousand. This is primarily due to the delay in design and construction.

No cash call is required at this time.

RECCOMMENDATION:

Receive and File.

LIST OF EXHIBITS:

Exhibit "A" – FY 2022-23 Actual to Budget Results (Unaudited)

Exhibit A

Groundwater Banking Joint Powers Authority

Unaudited Actual to Budget Report

Fiscal Year 2022-23

Task / Account	Task / Account Name	Unaudited Actual 12/31/22	Budget 12/31/22	Budget (Over) /Under	Approved FY2022-23 Budget	Forecast Full Year FY2022-23	Forecast (Over)/ Under	FY2022-23 Budget/Forecast Variance Comment
Kern Fan Groundwater Capital Project								
1.00	Engineering - Planning and Design Staff	$ 23,823	$ 14,350	$ (9,473)	$ 28,700	$ 50,000	$ (21,300)	JWP and staff time for USBR grant preparation
1.10	Grant Administration and Reporting	1,377	12,600	11,223	25,200	25,200	-	Primarily staff time. Timing of billing.
1.15	CWC and USBR Feasibility Studies	19,582	18,500	(1,082)	37,000	25,000	12,000	USBR study accepted. May need additional work, pending USBR further review.
1.16	JPA Administration	26,051	37,200	11,149	74,400	60,000	14,400	Expenditures lower than anticipated
1.40	Supplemental Environmental Impact Report	659	8,750	8,091	17,500	5,000	12,500	DWR delayed SEIR by several months (additional analysis of high flows)
1.50	Agreements with State Agencies	11,811	6,000	(5,811)	12,000	20,000	(8,000)	CDFW/CWC pushing forward Public Benefits Agmt Template development
1.80	Property Pre-Acquisition Work and Geophysical Study (1)	-	-	-	-		-	
3.00	Engineering Design - Outside	190,474	761,000	570,526	1,522,000	500,000	1,022,000	Timing of expenditures. More expenditures anticipated for Q3/Q4 and next FY.
4.00	Engineering CA&I - Outside	-	84,375	84,375	337,500	-	337,500	Pending notification of federal grant award
5.00	Construction	-	-	-	3,262,500	-	3,262,500	Pending notification of federal grant award
5.10	Land	-	-	-	-		-	
6.00	Legal JPA	7,648	62,850	55,202	125,700	60,000	65,700	Lawsuits dismissed. Timing of expenditures. Special counsel support for state agmts.
900.00	Preliminary Design Report and Feasibility Report	-	9,500	9,500	9,500	3,500	6,000	Timing of invoices from outside consultants/Less outside technical support needed.
906.00	Development of Agreement with FWS	-	-	-	-		-	
908.00	Development of Agreement with DWR	1,661	11,250	9,589	22,500	5,000	17,500	Timing of invoices from outside consultants/Less outside technical support needed.
916.00	Habitat Credit Purchase	-	-	-	-		-	
918.00	Environmental	-	25,000	25,000	50,000	25,000	25,000	Pending potential NEPA/additional CEQA for Phase 1. Timing of expenditures.
922.00	Permitting	-	-	-	-		-	
928.00	PG&E Service	-	-	-	-		-	
930.00	Bid Phase	-	-	-	-		-	
	Capital Project Total	283,086	1,051,375	768,289	5,524,500	778,700	4,745,800	
Operating Income								
460022	Lease Revenue	(32,175)	(32,200)	(25)	(32,200)		(32,200)	Bolthouse lease
	Operating Income Total	(32,175)	(32,200)	(25)	(32,200)	-	(32,200)	
Operating Expense								
699115	Website Maintenance	900	500	(400)	1,000	900	100	Annual invoice paid in full 2nd Quarter.
699134	Administration/Management	18,701	25,300	6,599	50,600	45,000	5,600	Additional staff time Q4 for year end close.
699135	Audit	-	5,000	5,000	5,000	5,000	-	
699136	Bank Charges	125	850	725	1,700	1,700	-	
699137	Insurance	2,688	1,950	(738)	3,900	3,900	-	
699139	Membership	971	-	(971)	600	600	-	
	Operating Expense Total	23,385	33,600	10,215	62,800	57,100	5,700	
Total		**$ 274,296**	**$ 1,052,775**	**$ 778,479**	**$ 5,555,100**	**$ 835,800**	**$ 4,719,300**	

Note:

(1) Actual amounts included labor and consultants charges.

February 6, 2023
Prepared by: Robert Jacobson
Reviewed by: Cheryl Clary
Agenda item: 4c

Resignation and Appointment of Assistant Treasurer

DISCUSSION:

Due to the upcoming retirement of Assistant Treasurer Robert Jacobson, staff recommends that the Board appoint Ms. Jennifer Davis, Treasury Manager, as the Assistant Treasurer of the Groundwater Banking Joint Powers Authority effective immediately upon Mr. Jacobson's retirement.

The current Resolution and Certificate of Incumbency names the Board of Directors, General Manager, Treasurer and Assistant Treasurer as Authorized Signers to establish new accounts, close accounts and to enter into agreements for treasury/cash management services.

RECOMMENDATION:

That the Board appoint Jennifer Davis as the Groundwater Banking Joint Powers Authority Assistant Treasurer effective immediately upon Mr. Jacobson's retirement.

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

GBJPA
Groundwater Banking
Joint Powers Authority

KERN FAN GROUNDWATER STORAGE PROJECT

PREPARED FOR: Groundwater Banking Joint Powers Authority (GBJPA) File

PREPARED BY: Curtis Skaggs, P.E.

DATE: January 24, 2023

SUBJECT: ***Kern Fan Groundwater Storage Project – Task No. 1***
Engineering Professional Services

I. DP#1 "Recharge Basins & Infrastructure" – MCE/AECOM

MCE and AECOM are continuing to work on the 60% level drawings for the West Enos property. The design has been revised to make one of the existing wells a monitoring well, to realign the recovery pipeline alignments, and to add an emergency spillway basin in the northwest corner of the property. The topographic surveying for the recovery pipeline from the West Enos property to the Central Intake Pipeline is complete and they are currently working on the design of the recovery pipeline.

The geotechnical investigation work has been completed for the Stockdale North property by Soils Engineering, Inc. (SEI). A draft report is attached. MCE plans to survey the site in early February with preliminary design beginning shortly thereafter.

Deliverables:

- 30% Level Plans for Stockdale North
- Geotechnical Report for Stockdale North
- 60% Level Plans for West Enos

II. DP#2 "Recovery Wells" – Zeiders

Once the 60% level drawings are received for the West Enos property they will be provided to Zeiders Consulting to begin preparation of plans and specifications for the recovery well facilities on the property.

Deliverables:

- 60% Level Plans and Specifications

III. DP#3 (Aqueduct Turnout) and DP#4 (Conveyance Facilities) – Stantec/Dahl/P&P

Stantec completed the preparation of Technical Memorandum No. 1, dated October 5, 2022, for consideration of the potential joint works project utilizing Pool 1 of the Cross Valley Canal.

Stantec also prepared a slide presentation highlighting the work completed in Technical Memorandum No. 1 and presented this to the following:

- Kern County Water Agency (KCWA) and CVC Advisory Committee Presentation – October 21st, 2022
- Kern Water Bank Authority (KWBA) and CVC Participants – October 26th, 2022
- GBJPA Board – November 7th, 2022

Stantec also prepared a preliminary "Opinion of Probable Construction Cost" (OPCC) for the Joint Works Project (Alternative 5). The estimate is for the portion from the California Aqueduct to the project pump station proposed near the I-5 Freeway and ranged between $18,073,600 to $27,111,000, see attached. In addition, a meeting was held with the Kern Water Bank Authority to discuss other potential alignments across the KWBA property and obtain their input. The KWBA was amenable to the proposed alignments and provided some information that will be helpful as Stantec evaluates the alignments.

Deliverables:

- Technical Memorandum for Joint-Use Alignment (Completed Oct. 5th)
- Presentation and report for meeting with KCWA (Completed)
- Preliminary Opinion of Probable Construction Cost for Alt. 5 (Completed)

IV. Project Management – Dee Jaspar & Associates, Inc.

Dee Jaspar & Associates, Inc. (DJA) is working with each of the engineering teams associated with the Design Packages referenced above and managing the project design.

DJA is also working to establish project survey control. Maps are currently being reviewed and put together to determine nearby monumentation. DJA has completed surveying of CVC benchmarks and County monuments and is currently coordinating access to the California Aqueduct. DJA will then begin preparing a map illustrating the horizontal and vertical survey control for the project.

DJA completed the preparation of project cost estimates for the Task No. 1 scope of work as part of the WaterSMART Grant application process.

SOILS ENGINEERING, INC.

GEOTECHNICAL ENGINEERING SERVICES

FOR THE

PH. 2 GBJPA KERN FAN RECHARGE FACILITIES

35.358081, -119.265315

BAKERSFIELD, KERN COUNTY, CA

Prepared for:

Meyer Civil Engineering, Inc.
11200 River Run Blvd., Ste. 102
Bakersfield, CA 93312

By:

SOILS ENGINEERING, INC.
SEI File No. 22-18413
January 18, 2023

_____
On Man Lau, M.Sc., P.E., G.E.
Engineering Manager

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GEOTECHNICAL ENGINEERING SERVICES

FOR THE

PH. 2 GBJPA KERN FAN RECHARGE FACILITIES

35.358081, -119.265315

BAKERSFIELD, KERN COUNTY, CA

SOILS ENGINEERING, INC.
SEI File No. 22-18413
January 18, 2023

INTRODUCTION

At your request, Soils Engineering, Inc. has prepared this Geotechnical Investigation for the subject site. This report includes recommendations for the site preparation and grading and for foundation design.

Appendix A, "Guide Specifications for Earthwork," is provide as supplement to Section I, "Earthwork," in the recommendations of the report.

Appendix B, "Field Investigation," contains a sample location map, Figure 1, and Logs of Test Borings and Test Pits, Figures 16 through 29.

Appendix C, "Soils Test Data," contains tabulations of laboratory test data.

Appendix D, "Seismic Investigation," contains information provided by EQFAULT, and the ASCE.

Appendix E, "Slope Stability Analysis," contains Static Analysis information.

We hope this provides the information you require. If you have any questions regarding the contents of our report, or if we can be of further assistance, please contact us.

Respectfully submitted,
SOILS ENGINEERING, INC.

SITE INFORMATION

A. PROJECT DESCRIPTION

The GBJPA Kern Fan Recharge Facility Phase 2 is located within an existing active agricultural property in Section 35, Township 29, Range 25 with the following coordinates: 35.358081, -119.265315. The proposed improvement is to construct a groundwater recharge basin approximately 160-Acres in size. Currently the site is agricultural land (almond orchard) with an irrigation reservoir along with a chemical mixing area on the northeast corner of the site. There is a dirt road that transects the site east west from the center of the site. Rosedale Intake Canal is the western border, agricultural lands are the northern & eastern border, and Stockdale Hwy is the southern border. Overall, the site appears to be relatively flat with mostly consisting of a ground dirt surface between the almond trees.

B. GEOLOGIC SETTING

According to the 2010 Geologic Map of California the zone of influence for the proposed construction is located wholly within Pleistocene-Holocene marine and nonmarine sedimentary rock deposits (Q) within the eastern portion of the southern San Joaquin Valley. Although the site is not located in an Alquist-Priolo (earthquake fault) Special Study Zone, there are various earthquake faults in the vicinity. Nearby faults, with distances from the site, are tabulated below.

Kern Front	9.8	miles/	15.8	kilometers
White Wolf	21.1	miles/	34	Kilometers
Pleito Thrust	27	miles/	43.5	Kilometers
San Andreas – 1857 Rupture M-2a, Whole M-1a and other segments	27	miles/	43.4	Kilometers
Big Pine	39.8	miles/	64.1	kilometers
Garlock (West)	41.8	miles/	67.3	Kilometers
San Juan	41.8	miles/	67.3	Kilometers
San Gabriel	49.6	miles/	79.9	Kilometers

The largest estimated maximum site acceleration, based on deterministic methods, is 0.220g from a 6.3 magnitude earthquake on the Kern Front Fault approximately 15.8 kilometers away. The information above is from the program EQFault (vers.3.0) and a complete listing of faults within 100-miles is presented in Appendix D.

C. SUBSURFACE CONDITIONS

Surface soils encountered in our field investigation of 4 soil borings (B-5 to B-8) consisted predominately of a yellowish brown, dry to damp, fine grained Silty Sand or a brown, dry, low plasticity Sandy Silt in the top 16'. A reddish brown, hard, medium plasticity Clay was encountered at a depth of 11' to 15' in boring B-7. These soils are classified as SM, ML, and CL in the Unified Soil Classification System (USCS).

Testing performed in our laboratory showed an Expansion Index of 3 and 26, which is indicative of a low expansive soil. Expansive soils are defined in the 2022 California Building Code (CBC), Section 1803A.5.3. Soils are expansive when the EI result is greater than 20, per ASTM D4829, Expansion Index of Soils. Design of foundations for structures shall be designed in accordance with the 2022 CBC, Sections 1808A.6.1, & 1808A.6.2.

The majority of the near surface soils should provide adequate support for the proposed structures provided that a portion of the surface soils are excavated and compacted as outlined in the earthwork recommendations of this report. Detailed descriptions of the various soils encountered during our field investigation are shown on Figures 16 through 29 in Appendix B, "Field Investigation." A "Key to Symbols" legend describing the symbols in the test logs is also attached.

D. GROUNDWATER

Groundwater was not encountered in any of the test borings during the field investigation to a depth of 16.5 feet bgs. According to maps prepared by the State of California, and presented on the SGMA Data Viewer, the depth to water was 195' in the Spring of 2021 near the site. Accordingly, groundwater should have no effect on site preparation, grading, or foundation design.

E. SEISMIC DESIGN VALUES

Per the 2022 California Building Code (CBC) and American Society of Civil Engineers (ASCE) 7-16 Section 20.3, and local knowledge the site is classified as Site Class D. Utilizing the USGS and ASCE 7-16 seismic design methodologies the following seismic design values were determined.

SEISMIC DESIGN CRITERIA		VALUE	SOURCE
Risk Category		**II**	2022 CBC Table 1604.5 or 1604A.5
Site Class		**D**	2022 CBC §1613.2.2 or 1613A.2.2; ASCE 7-16 Table. 20.3-1; Site Specific Soils Report, and local knowledge.
Mapped MCER Spectral Response Acceleration, short period	**S_S**	**0.947g**	SEAOC-OSHPD software; 2022 CBC Figure 1613.2.1(1)
Mapped MCER Spectral Response Acceleration, at 1-sec. Period	**S_1**	**0.356g**	SEAOC-OSHPD software; 2022 CBC Figure 1613.2.1(2)
Site Coefficient	**F_a**	**1.121**	SEAOC- OSHPD software; 2022 CBC Table 1613.2.3(1) or 1613A.2.3(1)
Site Coefficient	**F_V***	**1.944***	2022 CBC Table 1613.2.3(2) or 1613A.2.3(2)
Adjusted MCER Spectral Response Acceleration, short period, F_a * S_s	**S_{MS}**	**1.062g**	SEAOC- OSHPD software; 2022 CBC §1613.2.3 or 1613A.2.3
Adjusted MCER Spectral Response Acceleration, 1-sec. period, F_V * S_1	**S_{M1}***	**0.692g***	2022 CBC §1613.2.3 or 1613A.2.3
Design Spectral Response Acceleration, short period, 2/3 * S_{MS}	**S_{DS}**	**0.708g**	SEAOC- OSHPD software; 2022 CBC §1613.2.4 or 1613A.2.4
Design Spectral Response Acceleration, 1-sec. period, 2/3 * S_{MI}	**S_{D1}***	**0.461g***	2022 CBC §1613.2.4 or 1613A.2.4
Peak Ground Acceleration for Max. Considered Earthquake (MCEG)	**PGA**	**0.416g**	SEAOC- OSHPD software; ASCE 7-16 Fig 22-9
Site Coefficient, F_{PGA} = 1.184 F_{PGA}* PGA	**PGA_M**	**0.492g**	SEAOC- OSHPD software; ASCE 7-16 §11.8.3.2
Mapped Risk Coefficient at 0.2 second Spectral Response Period	**C_{RS}**	**0.916**	SEAOC- OSHPD software; ASCE 7-16 Figure 22-18A
Mapped Risk Coefficient at 1 second Spectral Response Period	**C_{R1}**	**0.908**	SEAOC- OSHPD software; ASCE 7-16 Figure 22-19A
Seismic Design Category, short period		**D**	2022 CBC §1613.2.5
Seismic Design Category, 1second period *		**D***	2022 CBC §1613.2.5
MCER = Maximum Considered Earthquake (risk targeted) MCEG = Maximum Considered Earthquake (geometric mean)			

SEISMIC DESIGN CRITERIA		VALUE	SOURCE
** The project designer shall confirm that a ground motion hazard analysis is not required in accordance with ASCE 7-16 §11.4.8-Exception 2. The values tabulated above for S_{M1}, S_{D1}, and the Seismic Design Category/1-second period are based on the site coefficient, F_v, interpolated from 2022 CBC Table 1613.2.3(2) or 1613A.2.3(2). The use of that table is predicated on the above referenced Exception 2 being applicable for the site and the structure(s). Where the above referenced Exception 2 does not apply, the values for F_v, S_{M1}, S_{D1}, and for the Seismic Design Category/1-second period may not be applicable for the site and structure(s).*			

F. SLOPE STABILITY ANALYSIS

Slope stability analyses were performed on the proposed inter-basin and perimeter levees. The proposed inter-basin levee is approximately 6 feet high with 4:1 exterior and interior slopes. The proposed perimeter levee is approximately 6 feet high with 2:1 exterior slope and 4:1 interior slope.

For the inter-basin levee, the analysis indicated a safety factor greater than 1.5 for static and 1.1 for pseudo-static which are considered to be stable.

For the perimeter levee, the analysis indicated a safety factor greater than 1.5 for static and 1.1 for pseudo-static which are considered to be stable.

G. DISPERSIVE SOILS

The upper 5 to 7 feet of the on-site soil consists of silty sand and sandy silts. Based on laboratory test results presented in Appendix C, the upper 5 feet of the on-site soil is considered to have dispersive potential. In areas with pipelines extending through levees, cut-off walls must be used.

H. INFILTRATION RATE OF SOILS

The upper 11 feet of the on-site soil consists of sand, silty sand, and sandy silts. Based on laboratory test results presented in Appendix C, Table 1, the permeability tests indicate the permeability rates range from 1.46 x 10-5 cm/sec to 4.02 x 10-6 cm/sec. The estimated infiltration rate is approximately 6 inches per day. The design engineer should apply the appropriate safety factor to account for siltation at the bottom of the recharge basin.

I. LEVEE SEEPAGE

Based on the site conditions, to reduce the seepage going underneath the Levees, a key should be constructed. The key should be constructed per Earthwork Recommendations, Section C, Ground Surface Preparation of this report.

EARTHWORK RECOMMENDATIONS

"Earthwork Specifications," in Appendix A are provided for general guidance in preparing site grading plans. In addition, the following specific recommendations are provided and supersede the latter wherever discrepancies may exist:

A. COMPACTION AND OPTIMUM MOISTURE

Unless otherwise specified herein, the terms "compaction" or "compacted", wherever used or implied in this report, should be interpreted as compaction to ninety percent (90%), or greater, of the laboratory maximum density (as determined in accordance with ASTM Test Method D1557). The term, “Optimum Moisture,” wherever use or implied within this report, should be interpreted as that obtained by the above-described test method.

B. STRIPPING

Prior to soil compaction, existing ground surfaces should be stripped of surface vegetation. In no instance should material which has been stripped be used as engineered fill or blended with and compacted in original ground.

C. GROUND SURFACE PREPARATION

Ground surfaces in the proposed levee and structures shall be compacted in accordance with the following procedures:

1. Following the required stripping, and/or removal of underground structures, the exposed soil surface in the proposed **Inter-basin and Perimeter Levees**, areas to receive fill must be over-excavated uniformly to a depth of two (2) feet below existing grade. An 8-foot-wide keyway must be placed below the proposed levees. The keyway should extend 4 feet below bottom of the levee. The over-excavation must extend at least 5 feet laterally beyond the outside edge of the proposed levee to receive fill.

2. The bottom of the excavation shall be reviewed by the geotechnical engineer or his or her representative prior to any backfill operations. The top 8 inches of material exposed at the bottom of the excavation shall be scarified and compacted to a minimum of 90 percent of ASTM D1557.

3. Moisten excavated and imported soils to near the optimum moisture or to a moisture consistent with effective compaction and soil stability. Compact moistened soils to a minimum of 90 percent of the maximum density obtained by ASTM Test Method D1557.

D. EARTHWORK IN PIPE TRENCHES

Earthwork in pipe trenches shall consist of excavating the trench to the minimum depth and width, sufficient space between trench walls and the pipe to permit access to compaction equipment and compaction of backfill to stabilize internal unbalanced forces and to adequately buffer surface loads.

Trench Excavation - Trench bottom widths shall provide a minimum clearance of 18” between the pipe and the trench wall. Special excavation shall be made for pipe bell clearance.

Pipe Foundation - Pipe foundation materials consist of in-situ material beneath the pipe. The pipe foundation area should be cleaned of all loose excavated materials and reviewed by the geotechnical engineer prior to placement of pipe-bedding and/or pipe. If unstable materials are found at the trench bottom they should be excavated and removed or excavated and compacted to 90%.

Pipe Bedding - is used to support soil loads on the pipe. For rigid pipe, such as reinforced concrete to steel, pipe bedding is used to distribute loads on the pipe to the foundation; for flexible pipe such as PVC, bedding is used to resist localized deflection. Pipe bedding shall consist of soils classified as Sand (SW or SP) in the Unified Soils Classification System.

Pipe Bedding Compaction - Pipe bedding shall be compacted to 90% of the maximum density obtainable by ASTM Test Method D1557.

Pipe Bedding Thickness – Pipe bedding thickness should consist of 4” to 6”. Ponding and jetting is not an acceptable method for compacting bedding material.

Pipe Bedding Gradation - Pipe bedding materials shall have a maximum particle size of 3/4 inch and meet the following graduation requirements.

Pipe Bedding Gradation	
Size	Percent by Weight
Passing #200	Less than 5 %
Passing #50	Less than 20%
Passing #4	Greater Than 25% but Less than 50%

Pipe Trench Backfill - Backfill for pipelines traversing areas proposed for structures, pavements, concrete slabs-on-grade, or areas to receive engineered fill for future construction should be compacted in accordance with the same requirements for adjacent and/or overlying fill materials.

Materials placed and compacted within the pipe zone shall be compacted to 90% of the maximum density obtainable by ASTM Test Method D1557. The pipe zone extends from the top of the pipe-bedding to 12 inches above the top of the pipe. Where the pipe trench is excavated into clay, silt, silty clay, or clayey silt, or clayey-sand, pipe zone materials shall consist of select fill meeting the same requirements for pipe bedding. Sand, or silty-sand exposed in the pipe trench may be used for pipe zone materials provided that care is taken to assure that no voids are present between the pipe-walls and backfill, i.e., contact between backfill and pipe is firm and continuous.

The haunch area up to one foot above the top of the pipe should be backfilled with "cohesionless" material. Cohesionless native materials may be used for trench and pipe or conduit backfill. The term "cohesionless," as used herein, is defined as material which when dry, will flow readily in the haunch areas of the pipe trench.

Pipe backfill materials should not contain rocks larger than one (1.0) inch in maximum dimension. Where adjacent native materials exposed on the trench bottoms contain protruding rock fragments larger than two inches in maximum dimension, conduits and pipelines should be laid on a bedding consisting of clean, cohesionless sand (SP), in the Unified Soils Classification System.

Compaction Requirements - shall be 90% in the pipe zone (12” above the top of pipe) and above that line, except in any city street, State Right-of-Way or county road where it shall be 95% to the surface. Where not otherwise specified in our plans or in these recommendations, the following compaction requirements are applicable to all electrical, gas or water conduits:

TABLE A Compaction Depth			
Area	**Haunch to 1 ft. Above Top of Pipe**	**1 ft. Above Top of Pipe To 2'6" Below Finish Grade**	**2'6" Below Finished Grade to Finished Subgrade**
Structural	90%	90%	90%
Pavements	90%	90%	90%
Non-Structural	90%	90%	90%

Trench Slope Construction - Temporary slopes for trench construction shall be graded no steeper than two horizontal to one vertical (2H:1V) in materials described as silty sand (SM) and two horizontal to one vertical (2H:1V) in sand (SP or SW).

E. ENGINEERED FILL

The on-site soils are acceptable for use as engineered fill provided that all vegetation and deleterious debris are removed. Engineered fill materials should be placed in thin layers (less than eight inches uncompacted thickness) of relatively uniform thickness, moisture conditioned to near the optimum moisture content, or to a moisture content commensurate with effective compaction and soil stability and compacted to no less than ninety percent (90%) of the laboratory maximum density as determined in accordance with ASTM Test Method D1557. Refer to "Placing, Spreading and Compacting Fill Materials," in Appendix A.

If clean sand is encountered, the sand should be mixed with on-site silty soil to have a uniformly mixed material with at least 40% fines to be used as engineered fill for the inter-basin and perimeter levees.

F. IMPORTED FILL

Prior to importation of fill material, it shall be tested for conformance with the pesticide, metals, and hydrocarbon limits promulgated by DTSC (Department of Toxic Substances Control) Tabulated below are recommended limits for physical characteristics for import fill materials. Materials of equal or better quality than on-site material can be reviewed by the GEOR on a case-by-case basis. No soil materials shall be imported onto the project site without prior approval by the GEOR. Deviation from the specifications given below shall be approved by the GEOR prior to import operations.

Maximum Percent Passing #200 Sieve 40
Maximum Percent Retained 3" Sieve..... 0
Maximum Percent Retained 1½" Sieve for *Structure Areas* 5
Maximum Liquid Limit 40
Maximum Plasticity Index..... 14
Maximum Expansion Index 20

Furthermore, the soils proposed for import shall be generally homogenous and shall not contain cemented or clayey lumps larger than one inch. When such lumps are present, they shall not represent more than ten percent (10%) of the material by dry weight. Where a proposed import source contains obviously variable soils, such as clay and/or silt layers, the soils which do not meet the above requirements shall be segregated and not used for this project or the various layers shall be thoroughly mixed prior to acceptance testing by the Geotechnical Engineer. The contractor shall provide sufficient notice, prior to import operations, to allow testing and evaluation of the proposed import materials.

Because of the time needed to perform the above tests, the contractor shall provide a means by which the Geotechnical Engineer or others can verify that the soil(s) which was sampled and tested is the same soil(s) which is being imported to the project.

G. DRAINAGE

Finished ground grades adjacent to the proposed structure should be sloped to provide positive free drainage away from the foundations. No areas should be constructed that would allow drainage generated on the site, or water impinging upon the site from outside sources to pond near footings and slabs or behind curbs. Subsurface walls should be waterproofed and should include a subsurface drainage system.

FOUNDATION RECOMMENDATIONS

TABLE B
FOUNDATION DESIGN CRITERIA

Footing Type	Minimum Width (ft.)	Minimum Depth Below Lowest Adjacent Subgrade (ft.)	Maximum Allowable Soil Bearing Pressure (lbs. / sq. ft.)
Continuous	2	1.5	3000
Isolated	2	1.5	3000

Bearing pressures given are for the minimum widths and depths shown above.

Bearing pressures given above are for dead and sustained (loads acting most of the time) live loads; they may be increase by one-third for wind and/or seismic loading conditions. The proposed foundations shall be reinforced in accordance with the structural engineer's recommendations.

Settlement

Provided maximum allowable soil bearing pressures given above are not exceeded, total settlement should not exceed one inch. A major portion, two-thirds to one-half, of total settlement should occur before the end of construction. Differential settlements should occur before the end of construction. Differential settlements should, accordingly, be less than one-half of an inch.

MODULUS OF SUBGRADE REACTION

Modulus of subgrade reaction for use in design of foundations is based on ranges of values for soil types provided by Foundation Analysis and Design by Joseph E Bowles[1]. Equation 1 should be used for footings on sandy soils. Foundations on clay soils should employ Equation 2. Equation 3 is for rectangular footings having dimensions b and mb. Ks1 is the modulus of subgrade reaction from the source referenced above based on a 1-foot x 1-foot square plate. For general guidance Ks1 of 150 kcf may be used for the subsurface cohesionless soils.

[1] Bowles, Joseph E; FOUNDATION ANALYSIS AND DESIGN McGraw-Hill Book Company (1977); Table 9-1 pg. 26

Equation (1) $k_{sf} = K_{s1} \times \left(\frac{B+1}{2B}\right)^2$

Equation (2) $k_{sf} = K_{s1} \times B$

Equation (3) $k_{sf} = K_{s1} \times \frac{m+.5}{1.5 \times m}$

Values given above should be used for guidance. Local values may be higher or lower and should be based on results of in-situ plate bearing tests performed in accordance with ASTM Test Method D1195.

LATERAL EARTH PRESSURES

Lateral earth pressures and friction coefficients for determining the passive lateral resistance of foundations against lateral movement and the active lateral forces against retaining walls and subsurface walls, expressed as equivalent fluid pressures, are given below in Table C. Lateral earth pressures were computed assuming that backfill materials are essentially free draining and level; and that no surcharge loads, or sloping backfills are present within a distance from the wall equal to or less than the height (H)* of the wall.

(H)* = the height of backfill above the lowest adjacent ground surface.

TABLE C
EQUIVALENT FLUID LATERAL EARTH PRESSURES

Case	Lateral Earth Pressures lbs./ft3	Lateral Earth Pressures lbs./ft3 (Saturated Condition)
Active	40 P.C.F	80 P.C.F
Passive	360 P.C.F.	230 P.C.F.
At-Rest	50 P.C.F.	90 P.C.F.

Active Case: Active lateral earth pressures should be used when computing forces against free standing retaining walls, unrestrained at the tops. Active pressures should not be used where tilting outward of the walls is greater than .002H would not be desirable.

Passive Case: Passive lateral earth pressures should be used when computing the lateral resistance provided by undisturbed or compacted native soils against the movement of footing. When computing passive resistance, the upper one foot of embedment depth should be discounted.

At-Rest Case: At-rest pressures should be used for subsurface walls restrained at their tops by floor diaphragms or tie-backs and for retaining walls where tilting outward greater than .002 H would not be desirable.

Saturated (Submerged) Soil Conditions: If retaining walls are furnished with drainage devices, submerged soil conditions should not occur. In the event that drainage devices fail or become plugged, submerged conditions behind walls may occur. Walls would be subjected to lateral earth pressures given for submerged conditions.

Frictional Resistance: A friction coefficient of **0.40** may be used when computing the frictional resistance to sliding of footings, grade beams, and slabs-on-grade. Frictional resistance and passive lateral soil resistance may be combined without reduction.

SOIL CORROSIVITY

Soluble Sulfates (SO4)
The Sulfate (SO4) concentration measured ranged from 98 ppm to 374 ppm.

Based on Table 19.3.1.1 "Exposure categories and classes" of ACI 318-19 "Building Code Requirements for Structural Concrete" the soil exposure is classified as S1. Per Table 19.3.2.1 "Requirement for Concrete by Exposure Class" of the same reference, Type II cement should be used.

Chlorides (Cl)
The Chloride (Cl) concentration measured ranged from 177 ppm to 296 ppm. Generally, chloride concentrations greater than 500 ppm are considered to be corrosive to foundation elements. (Ref: Caltrans Corrosion Guidelines / Version 1.0)

pH
The soil pH result ranged from 7.8 to 8.1. Generally, a pH level less than 5.5 are considered to be corrosive to foundation elements. (Ref: Caltrans Corrosion Guidelines / Version 1.0)

Minimum Resistivity
The minimum resistivity ranged from **921 ohm-cm to 946 ohm-cm**. Based on this result, the on-site soil is considered to be **corrosive** to buried metals. Other factors, including soil pH, soluble salts (type and concentration), soil types, and aerobic versus anaerobic conditions are expected to affect buried metals. Soils Engineering, Inc. does not practice in the specific field of corrosion engineering or electrical engineering. For specific recommendations regarding corrosion and/or earth grounding, it is recommended that an engineer practicing in the field for which there is concern be consulted.

The corrosion test results are presented in Appendix C.

LIMITATIONS, OBSERVATION, AND TESTING

Conclusions and recommendations in this report are given for the GBJPA Kern Fan Recharge Facilities, within the Phase 2 location at coordinates 35.358081, -119.265315 in Bakersfield, Kern County, California, and are based on the following:

a. The information retrieved from four (4) exploratory borings and ten (10) test pits performed at the subject site to a maximum depth of 16.5 feet below the existing ground surface;
b. Our laboratory testing program results;
c. Our engineering analysis based on the information defined in this report;
d. Our experience in the Kern County area.

Variations in soil type, strength and consistency may exist between specific boring locations. These variations may not become evident until after the start of construction. If such variations appear, a re-evaluation of the soils test data and recommendations may be necessary.

Unless a Geotechnical Engineer of this firm is afforded the opportunity to review plans and specifications, we accept no responsibility for compliance with design concepts or interpretations made by others about foundation support, fill selection, fill placement or other recommendations presented in this report. Changes in conditions of the subject property can occur with time because of natural processes or the works of man on the subject site or on adjacent properties.

Changes in conditions of the subject property can occur with time because of natural processes or the works of man on the subject site or on adjacent properties. Changes in applicable engineering and construction standards can also occur as the result of legislation or from the broadening of knowledge. Accordingly, the finding of this report may be invalidated, wholly or in part, by changes beyond our control. Therefore, this report is subject to review and should not be relied upon without review after a period of two years or after any modifications to the site.

REVIEW OF EARTHWORK OPERATIONS

Review of earthwork operations relating to site clearing, ground stabilization, placement and compaction of fill materials, and finished grading is critical to the structural integrity of building foundation and floor systems. While the preliminary Geotechnical investigation and report provide guidelines, which are used by the design team, i.e., architects, grading engineers, structural engineers, landscape engineers, etc., in completing their respective tasks, review of plans and site review and testing during earthwork operations are vital adjuncts to the completion of the Geotechnical engineer's tasks.

The most prevalent cause of failure of a structure foundation system is lack of adequate review and testing during the earthwork phase of the project. Projects rarely reach completion without some alteration being required such as may result from a change in subsurface conditions, an amendment in the size and scope of the project, a revision of the grading plans or a variation in structural details. Occasionally, even minor changes can significantly affect the performance of foundations.

It is imperative, therefore, that any revisions to the project scope, any change in structural detail, or change in consultant, be brought to the attention of Soils Engineering, Inc. to allow for timely review and revision of recommendations and for an orderly transfer of responsibility and approval.

It is the responsibility of the owner or his representative to ensure that a representative of our firm is present always during earthwork operations relating to site preparation and grading, so that relative compaction tests can be performed, earthwork operations can be observed and compliance with the recommendations provided herein can be established.

This engineering report has been prepared within the limits prescribed to us by the client or his representative, in accordance with the generally accepted principles and practices of Geotechnical engineering. No other warranty, expressed or implied, is included or intended in this report.

Respectfully submitted,
SOILS ENGINEERING, INC.

APPENDIX A

GENERAL GUIDE SPECIFICATIONS FOR EARTHWORK

1. GENERAL

1.1 Scope

These specifications and plans include all earthwork pertaining to site rough grading including, but not limited to, furnishing all labor and equipment necessary for clearing and grubbing; stripping; preparation of ground surfaces to receive fill; excavation; placement and compaction of structural and non-structural fill; disposal of excess materials and products of clearing, grubbing, and stripping; and any other work necessary to bring ground elevations to the lines and grades shown on the project plans. Wherever discrepancies between these guide-specifications and the earthwork recommendations in Section I of the above geotechnical report, the most stringent recommendations shall supersede.

1.2 Performance:

It shall be the responsibility of the contractor to complete all earthwork in accordance with project plans and specifications. No variance from plans and specifications shall be permitted without written approval of the Engineer-of-Record, hereinafter referred to as the "Engineer" or his designated representative, hereinafter referred to as the "Soils Engineer." Earthwork shall not be considered complete until the "engineer" has issued a written statement confirming substantial compliance of earthwork operations to these specifications and to the project plans. The contractor shall assume sole responsibility for job site conditions during earthwork operations on the project, including safety of all persons and preservation of all property. This requirement shall apply continuously and not be limited to normal working hours. The contractor shall defend, indemnify, and hold harmless the owners, engineer, and soils engineer from all liability and claims, real or alleged, arising out of performance of earthwork on this project, except from liability incurred through sole negligence of the owner, engineers, or soils engineers.

2. DEFINITIONS

2.1 Excavations:

Excavation shall be defined within the content of these specifications as earth material excavated for constructing fill embankment; grading the site to elevations shown on project plans; or placing underground pipelines, conduits, or other subsurface utilities or minor structures. Excavations shall be made true to the lines shown on project plans and to within plus or minus one-tenth (0.1) of a foot, of grades shown on the accepted site grading plans.

2.2 Engineered Fill:

Engineered fill shall be construed within the body of these specifications as earth materials conforming to specifications provided in the soils or geotechnical report placed to raise the grade of the site, to backfill excavations, or to construct asphaltic concrete or Portland cement concrete pavement; and upon which the soils engineer has performed sufficient tests and has made sufficient observation during placement and compaction to enable him to issue a written statement confirming substantial conformance of the work to project earthwork specifications.

2.3 On-Site Material:

On-site material is earth material obtained in excavation made on the project site.

2.4 Imported Material:

Imported materials are earth materials obtained off the site, hauled in, and placed as fill.

2.5 "Compaction" or "Compacted:"

Wherever expressed or implied within the context of these specifications shall be interpreted as compaction to ninety (90) percent of the maximum density obtainable by ASTM Test Method D1557.

2.6 Grading Plane:

The grading Plane is the surface of the basement material upon which the lowest layer of subbase, base, asphaltic or Portland cement concrete, surfacing, or another specified layer is placed.

3. SITE CONDITIONS

The contractor shall visit the site, prior to bid submittal, to explore existing subsurface conditions; to survey site topographic, and to define the nature of materials that may be encountered while performing its work under this contract. Moreover, the contractor shall make his own interpretation of the contents of the Geotechnical Report, as they pertain to said conditions. The contractor shall assume all liability under the contract for any loss sustained because of variations which may exist between specific soil boring locations or changed conditions resulting from natural or man-made circumstances occurring after the date of the Preliminary Field Investigations.

4. CLEARING AND GRUBBING

4.1 Clearing and Grubbing

Clearing and grubbing shall consist of removing all debris such as metal, broken concrete, trash, vegetation growth and other biodegradable substances, from all areas to be graded. Existing obstructions below shall be removed in accordance with the following procedures:

4.1.1 Slabs and Pavements - Shall be completely removed. Asphaltic or Portland Cement, concrete fragments may be used in engineered fills provided they are broken down to a maximum dimension of six (6.0) inches and thoroughly dispersed within a friable soil matrix. Engineered fill containing said fragments should not be placed above the elevation of the bottom of the lowest structure footing.

4.1.2 Foundations - Existing at the time of grading shall be removed to a depth not less than two (2.0) feet below the bottom of the lowest structure footing.

4.1.3 Basements, Septic Tanks – Buried concrete containers of similar construction located within areas destined to receive pavements, structures, or engineered fills should be completely removed and disposed of off the site. Basements, septic tanks, etc., situated outside structures, or structural fill areas shall be disposed of by breaking an

opening in bottoms to permit drainage, and by breaking walls down to not less than two (2.0) feet below finished subgrade.

4.1.4 Buried Utilities – Such as sewer, water and gas lines or electrical conduits to remain in service shall be re-routed to pass no closer than four (4.0) feet to the outside edge of proposed exterior footings of structures. Lines to be abandoned shall be completely removed to a minimum depth of two (2.0) feet below finished building pad grade. Concrete lines deeper than two (2.0) feet below finished building pad grade and having diameters less than six (6.0) inches can be crushed in place.

4.1.5 Root Systems – Shall be completely removed to a minimum depth of two (2.0) feet below the bottom of the lowest proposed structure footing or to two (2.0) feet below finished subgrade, whichever depth is lower. Root systems deeper than the elevation indicated above shall be excavated to allow no roots larger than two (2.0) inches in diameter.

4.1.6 Cavities – Resulting from clearing and grubbing or cavities existing on the site because of man-made or natural activity shall be backfilled with earth materials placed and compacted in accordance with Sections 5.3 and 5.4 of these specifications.

4.1.7 Preservation or Monuments, Construction Stakes, Property Corner Stakes, or other temporary or permanent horizontal or vertical control reference points shall be the responsibility of the contractor. Where these markers are disturbed, they shall be replaced at the contractor's expense.

5. SITE GRADING

Site grading shall consist of excavation and placement of fills to lines and grades shown on the project plans and in accordance with project specifications and recommendations of the Preliminary Soils Report, whichever is more stringent. The following are recommendations issued in this report:

5.1 Areas to Receive Fill:

5.1.1 Surfaces to receive fill shall be scarified to a depth of at least six (6.0) inches, or as recommended in this report, whichever is greater, until the surface is free from ruts, hummocks or other uneven features which would tend to prevent uniform compaction by the equipment to be used.

5.1.2 After the area to receive fill has been cleared and scarified, it shall be moistened and compacted to a depth of at least six (6.0) inches in accordance with specifications for compacting fill material in paragraph 5.4, below.

5.2 Excavation:

5.2.1 Excavations shall be cut to elevations plus or minus 0.1 foot of the grades shown on the accepted plans.

5.2.2 When excavated materials are to be used in engineered fill, the excavation shall be made in a manner to produce as much mixing of the excavated materials as practicable.

5.2.3 When excavations are to be backfilled, and where surfaces exposed by excavation are to support structures or concrete floor slabs, the exposed surfaces shall be scarified,

moistened and compacted, as stated above, for areas to receive fill. Over excavation below specified depths will not eliminate the requirement for exposed surface compaction.

5.3 Fill Materials:

5.3.1 Materials obtained from on-site excavations will be considered satisfactory for construction of on-site engineered fills, unless otherwise stated in the Soils Report or Foundation Investigation. If unexpected pockets of poor or weak materials are encountered in excavations, and they cannot be upgraded by mixing with other materials or by other means, they may be rejected by the soils engineer for use in engineered fill. Rocks larger than 12 inches in size in any dimension shall not be allowed in the proposed building area. If a large amount of rocks greater than 12 inches in size in any dimension is encountered, a rock disposal area shall be located on the grading plan. Rocks shall be mixed with well-graded soils to assure that the voids in these areas will fill properly.

5.3.2 When imported fill materials are necessary to bring the site up to planned grades, no material shall be imported prior to its approval and acceptance by the soils engineer.

5.3.3 The soils engineer shall be given notice of the proposed source of imported materials with adequate time allowance for his testing of the proposed materials. The time required for testing will vary with different types of materials, job conditions, and ultimate function of filled areas. Under best conditions the time requirement will not be less than 48 hours.

5.4 Placing, Spreading, and Compacting Fill Material:

5.4.1 The fill materials shall be placed in layers which, when compacted, shall not exceed six (6.0) inches in thickness. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to insure uniformity of material in each layer. Increased thickness of layers may be approved by the soils engineer when conditions warrant.

5.4.2 All fills shall be placed in level layers; layers shall be continuous over the area of any structural unit, and all portions of the fill shall be brought up simultaneously within the area of any structural unit. When imported material is used, it must be placed so that its thickness is as uniform as possible within the area of any structural unit.

5.4.3 When materials are to be excavated and replaced in a compacted condition, segmented, or leap-frogging of cut-fill operations within the area of any structural unit will not be permitted unless the method is specifically described by the soils engineer.

5.4.4 When the moisture content of fill material is below the lower limit specified by the Soils Engineer, water shall be added until the moisture content is as specified; and when it is above the upper limit specified, the material shall be aerated by blading or other satisfactory methods until the moisture content is as specified.

5.4.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted to not less than ninety (90) percent of maximum density in accordance with ASTM Density Test Method D1557. Compaction shall be by equipment of such design that it will be able to compact the fill to specified density. When the soils engineer specifies a specific type of compaction equipment to be used, such equipment shall be used as specified.

5.4.6 Compaction of each layer shall be continuous over its entire area and the equipment shall make sufficient trips to ensure that the desired density has been obtained.

5.4.7 Field density tests shall be made by the soils engineer. The compaction of each layer of fill shall be subject to testing. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density tests shall be taken in the compacted material below the disturbed surface. When tests indicate the density of any layer of fill or portion thereof is below the required ninety (90) percent density, the layer or portion shall be re-worked until the required density has been obtained.

5.4.8 When the soils engineer specifies compaction to other standards or to percentages other than ninety (90) percent, such specification, with respect to the items, shall supersede these specifications.

5.4.9 The fill operation shall be continued in six (6) inch compacted layers, as specified above, until the fill has been brought to within 0.1 foot, plus or minus, of the finished slopes and grades, as shown on the accepted plans. The finished surface of fill areas shall be graded or bladed to a smooth and uniform surface and no loose material shall be left on the surface.

5.4.10 No fill materials shall be placed, spread, or compacted while it is frozen or thawing or during unfavorable weather conditions. When work is interrupted by weather conditions, fill operations shall not be resumed until the soils engineer indicates that moisture content and density of previously placed fill are satisfactory.

5.5 Observations and Testing:

The soils engineer shall be provided with a 48-hour notice, in order that he may be present at the site during all earthwork activities related to excavation, tree root removal, stripping, backfill, and compaction and filling of the site and to perform periodic compaction tests so that substantial conformance to these recommendations can be established.

APPENDIX B

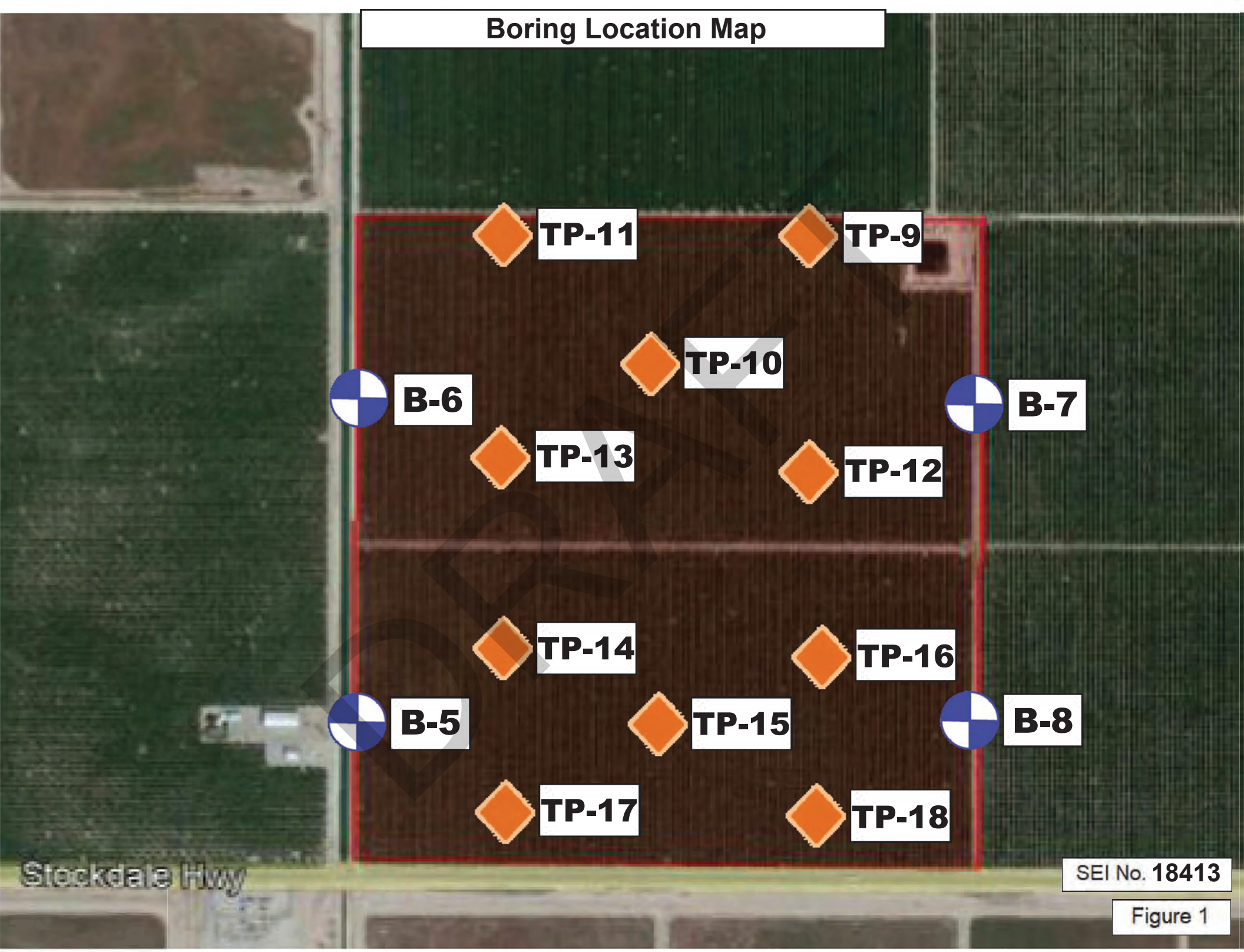
FIELD INVESTIGATION

Four (4) test borings were drilled at the subject site and terminated at a maximum depth of 16 feet below the existing ground surface. Ten (10) test pits were excavated as well and terminated at a maximum depth of 7 feet. The borings were advanced using an eight (8.0) inch hollow-stem auger and the test pits utilized a backhoe. Test data and descriptions from these holes form the basis of the conclusions and recommendations contained in this report.

Undisturbed samples and disturbed bulk samples were obtained. Undisturbed samples were taken using either a 2-3/8" (inside diameter) split-barrel sampler or a 1-3/8" (inside diameter), 2" (outside diameter) Standard Penetration Sampler (SPT). Penetration resistance of undisturbed soils was obtained by driving the above-described sampler using a one-hundred-forty-pound hammer falling thirty inches (30"). Blow counts for each six inch (6") driven increment was recorded and are reported on the Test Borings Logs. In addition, bulk soil samples, selected as most representative of near surface soils encountered, were taken for laboratory testing.

As drilling and excavation progressed, earth materials encountered were logged and classified in accordance with the Unified Soils Classification System and presented graphically on Logs of Test Borings, Figure 16 through 29, along with the Legend. Approximate locations of test locations are shown on the Sample Location Map, Figure 1.

Boring Location Map

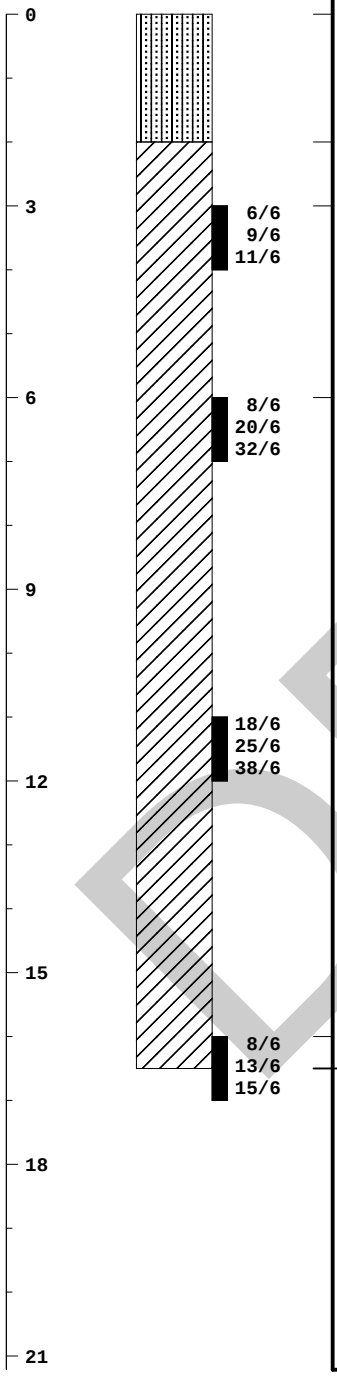


SEI No. 18413

Figure 1

LOG OF TEST BORING
BORING B-5 Ph. 2

PROJECT: *GBJPA Recharge Facilities*
FILE NO: *18413*
BORING DATE: *11/9/22*
ELEV.: *Approx. 326'*
BORING LOCATION: *See Sample Location Map, Figure 1*
START: *11/9/22*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *11/9/22*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ⬢ **:** *N/A*
LOGGER: *M. WATTS*



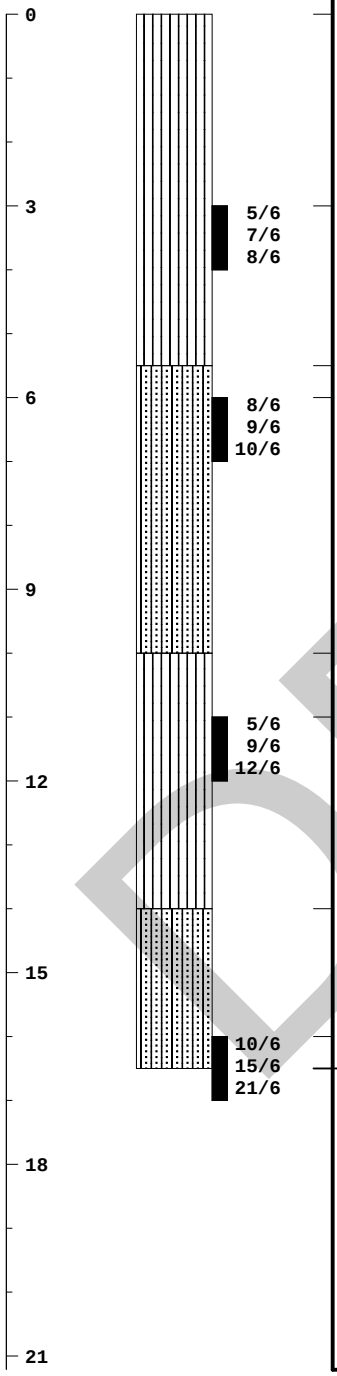
ELEVATION/ DEPTH (feet)	USCS	Description	Remarks	Density pcf	Moisture %
	SM	SILTY SAND; light yellowish brown, dry, fine.			
	CL	SANDY CLAY; light yellowish brown, dry, low plasticity.			
		dark brown, trace of clay, low to medium plasticity, Very stiff.		121.3	7.2
		Hard.		107.1	15.3
				101.7	9.6
		Yellowish brown, damp, very stiff.		116.2	14.9
		BOTTOM.			

Figure Number 16

LOG OF TEST BORING
BORING B-6 Ph. 2

PROJECT: *GBJPA Recharge Facilities*
BORING DATE: *11/9/22*
BORING LOCATION: *See Sample Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▰ **:** *N/A*

FILE NO: *18413*
ELEV.: *Approx. 326'*
START: *11/9/22*
FINISH: *11/9/22*
LOGGER: *M. WATTS*

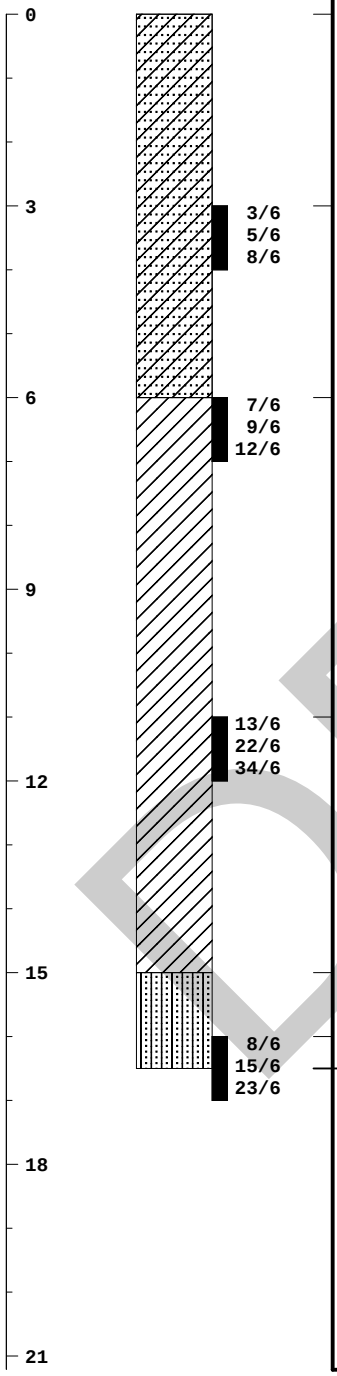


ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		ML	SANDY SILT; brown, dry, low plasticity.			
			Stiff.		109.8	9.8
		SM	SILTY SAND; light brown, dry, fine.			
			Medium dense.		116.1	8.6
		ML	SANDY SILT; brown, dry to damp, low plasticity.			
			Very stiff.		114.9	11.1
		SM	SILTY SAND; brown, damp, fine.			
			Dense.		117.7	8.7
			BOTTOM.			

Figure Number 17

LOG OF TEST BORING
BORING B-7 Ph. 2

PROJECT: *GBJPA Recharge Facilities*
FILE NO: *18413*
BORING DATE: *11/9/22*
ELEV.: *Approx. 326'*
BORING LOCATION: *See Sample Location Map, Figure 1*
START: *11/9/22*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *11/9/22*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▰ **:** *N/A* **LOGGER:** *M. WATTS*

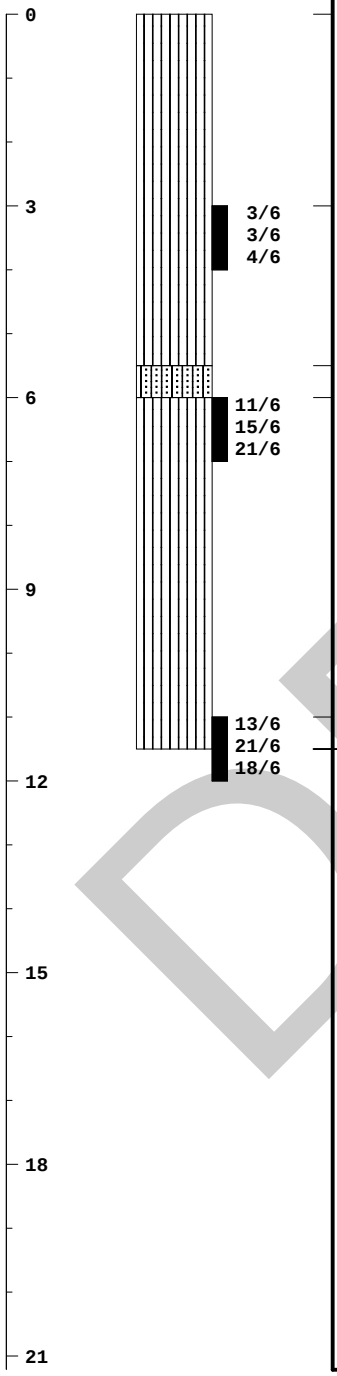


ELEVATION/ DEPTH (feet)	USCS	Description	Remarks	Density pcf	Moisture %
0	SC	CLAYEY SAND; brown, dry, cohesive.			
3		Medium dense.		113.7	10.8
6	CL	SANDY CLAY; light brown, dry to damp, low plasticity.		120.6	14.5
9					
12		reddish brown, damp, hard, medium plasticity.		111.8	19.9
15	SM	SILTY SAND; light yellowish brown, dry, fine.			
		Dense.		115.6	5.5
		BOTTOM.			
18					
21					

Figure Number 18

LOG OF TEST BORING
BORING B-8 Ph. 2

PROJECT: *GBJPA Recharge Facilities*
FILE NO: *18413*
BORING DATE: *11/9/22*
ELEV.: *Approx. 326'*
BORING LOCATION: *See Sample Location Map, Figure 1*
START: *11/9/22*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
FINISH: *11/9/22*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▶ **:** *N/A*
LOGGER: *M. WATTS*



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		ML	SANDY SILT; brown, dry, low plasticity.			
			Medium stiff.		91.7	12.2
		SM	SILTY SAND; brown, dry, fine.			
		ML	SANDY SILT; light brown, dry, with clay, low plasticity, Medium dense.		124.2	8.2
			Hard.		118.8	13.7
			BOTTOM.	Refusal due to tight drilling.		

Figure Number 19

LOG OF TEST BORING
BORING TP-9

PROJECT: *GBJPA Recharge Facilities*
BORING DATE: *11/8/22*
BORING LOCATION: *See Sample Location Map, Figure 1*
DRILL METHOD: *Backhoe*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▶ **:** *N/A*

FILE NO: *18413*
ELEV.: *Approx. 326'*
START: *11/8/22*
FINISH: *11/8/22*
LOGGER: *M. WATTS*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
0		SM	**SILTY SAND; light yellowish brown, dry to damp, fine.**			
3						
6			**BOTTOM.**			
9						
12						
15						
18						
21						

Figure Number 20

LOG OF TEST BORING
BORING TP-10

PROJECT: *GBJPA Recharge Facilities*
BORING DATE: *11/8/22*
BORING LOCATION: *See Sample Location Map, Figure 1*
DRILL METHOD: *Backhoe*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▶ **:** *N/A*

FILE NO: *18413*
ELEV.: *Approx. 326'*
START: *11/8/22*
FINISH: *11/8/22*
LOGGER: *M. WATTS*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
0		SM	**SILTY SAND; yellowish brown, dry to damp, fine.**			
3						
6			**BOTTOM.**			
9						
12						
15						
18						
21						

Figure Number 21

LOG OF TEST BORING
BORING TP-11

PROJECT: *GBJPA Recharge Facilities*
BORING DATE: *11/8/22*
BORING LOCATION: *See Sample Location Map, Figure 1*
DRILL METHOD: *Backhoe*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▶ **:** *N/A*

FILE NO: *18413*
ELEV.: *Approx. 326'*
START: *11/8/22*
FINISH: *11/8/22*
LOGGER: *M. WATTS*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
0		ML	**SANDY SILT; light yellowish brown, dry to damp, fine.**			
3						
6			**BOTTOM.**			
9						
12						
15						
18						
21						

Figure Number 22

LOG OF TEST BORING
BORING TP-12

PROJECT: *GBJPA Recharge Facilities*
BORING DATE: *11/8/22*
BORING LOCATION: *See Sample Location Map, Figure 1*
DRILL METHOD: *Backhoe*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▶ **:** *N/A*

FILE NO: *18413*
ELEV.: *Approx. 326'*
START: *11/8/22*
FINISH: *11/8/22*
LOGGER: *M. WATTS*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
0		ML	**SANDY SILT; yellowish brown, dry to damp, fine.**			
3						
6			**BOTTOM.**			
9						
12						
15						
18						
21						

Figure Number 23

LOG OF TEST BORING
BORING TP-13

PROJECT: *GBJPA Recharge Facilities*
BORING DATE: *11/8/22*
BORING LOCATION: *See Sample Location Map, Figure 1*
DRILL METHOD: *Backhoe*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▶ **:** *N/A*

FILE NO: *18413*
ELEV.: *Approx. 326'*
START: *11/8/22*
FINISH: *11/8/22*
LOGGER: *M. WATTS*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
0		ML	**SANDY SILT; light yellowish brown, dry to damp, fine.**			
3						
6			**BOTTOM.**			
9						
12						
15						
18						
21						

Figure Number 24

LOG OF TEST BORING
BORING TP-14

PROJECT: *GBJPA Recharge Facilities*
BORING DATE: *11/8/22*
BORING LOCATION: *See Sample Location Map, Figure 1*
DRILL METHOD: *Backhoe*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▶ **:** *N/A*

FILE NO: *18413*
ELEV.: *Approx. 326'*
START: *11/8/22*
FINISH: *11/8/22*
LOGGER: *M. WATTS*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
0		ML	**SANDY SILT; light yellowish brown, dry to damp, fine.**			
3						
6			**BOTTOM.**			
9						
12						
15						
18						
21						

Figure Number 25

LOG OF TEST BORING
BORING TP-15

PROJECT: *GBJPA Recharge Facilities*
BORING DATE: *11/8/22*
BORING LOCATION: *See Sample Location Map, Figure 1*
DRILL METHOD: *Backhoe*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▰ **:** *N/A*

FILE NO: *18413*
ELEV.: *Approx. 326'*
START: *11/8/22*
FINISH: *11/8/22*
LOGGER: *M. WATTS*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
0		SM	**SILTY SAND; light yellowish brown, dry, fine.**			
3						
6			**BOTTOM.**			
9						
12						
15						
18						
21						

Figure Number 26

LOG OF TEST BORING
BORING TP-16

PROJECT: *GBJPA Recharge Facilities*
BORING DATE: *11/8/22*
BORING LOCATION: *See Sample Location Map, Figure 1*
DRILL METHOD: *Backhoe*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A*
CAVING - ▶ **:** *N/A*

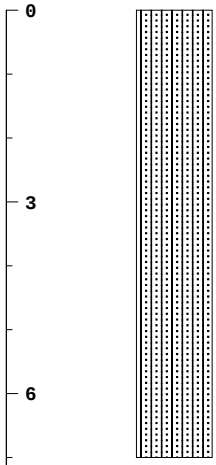
FILE NO: *18413*
ELEV.: *Approx. 326'*
START: *11/8/22*
FINISH: *11/8/22*
LOGGER: *M. WATTS*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
0		SM	**SILTY SAND; yellowish brown, dry to damp, fine.**			
3						
6			**BOTTOM.**			
9						
12						
15						
18						
21						

Figure Number 27

LOG OF TEST BORING
BORING TP-17

PROJECT: *GBJPA Recharge Facilities*
FILE NO: *18413*
BORING DATE: *11/8/22*
ELEV.: *Approx. 326'*
BORING LOCATION: *See Sample Location Map, Figure 1*
START: *11/8/22*
DRILL METHOD: *Backhoe*
FINISH: *11/8/22*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▰ **:** *N/A* **LOGGER:** *M. WATTS*



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		SM	**SILTY SAND; yellowish brown, dry to damp, fine.**			
			BOTTOM.			

Figure Number 28

LOG OF TEST BORING
BORING TP-18

PROJECT: *GBJPA Recharge Facilities*
BORING DATE: *11/8/22*
BORING LOCATION: *See Sample Location Map, Figure 1*
DRILL METHOD: *Backhoe*
DESCRIPTION: *Geotechnical Engineering Services*
DEPTH TO WATER - ▼ **:** *N/A* **CAVING -** ▰ **:** *N/A*

FILE NO: *18413*
ELEV.: *Approx. 326'*
START: *11/8/22*
FINISH: *11/8/22*
LOGGER: *M. WATTS*

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
0		ML	**SANDY SILT; yellowish brown, dry to damp, fine.**			
3						
6			**BOTTOM.**			
9						
12						
15						
18						
21						

Figure Number 29

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Silty sand
	Low plasticity clay
	Silt
	Clayey sand
Soil Samplers	
	California sampler

Notes:

1. Four (4) exploratory borings and ten (10) test pits were drilled and excavated between 11/08/2022 and 11/09/2022 using an 8-inch outside diameter hollow-stem auger and a back hoe.

2. No free groundwater was encountered to the maximum depth explored of 16.5'.

3. Boring locations are shown on the Sample Location Map, Figure 1.

4. These logs are subject to the limitations, conclusions, and recommendations in this report.

5. Results of tests conducted on samples recovered are reported on the logs.

APPENDIX C

SOIL TEST DATA

SIEVE ANALYSES AND HYDROMETER TESTS (ASTM D422)

Grain size distributions for samples selected as most representative of sub-soils and moisture levels encountered in our test locations were determined by sieve analysis and hydrometer (ASTM Test Method D422). Test result is shown in Figures A-26 through A-49.

IN-SITU MOISTURE RELATIONSHIPS (ASTM D2216)

Moisture density data for disturbed native soils was obtained by use of a 2-3/8-inch (inside diameter) split-barrel sampler. Test results are given on the Test Boring Logs, Figures 16 through 29.

CONSOLIDATION TESTS (ASTM D2435)

Compressibility of soils was determined on saturated, undisturbed samples of native materials. Consolidation Test Reports, Figures B-4 through B-6, graphically express the relationship of vertical strain vs. applied vertical (normal) load for earth materials selected as most representative of the soil strata within the anticipated zone of influence of foundation loads.

DIRECT SHEAR TESTS (ASTM D3080)

One quick-consolidated direct shear test was performed on an undisturbed, saturated sample of native earth materials. This test provides information on soil shear strength vs. normal load and is used to determine the angle of internal friction and cohesion of earth materials under essentially drained conditions. Test results are presented in Figures C-2 and C-3.

ATTERBERG LIMITS (ASTM D4318)

Atterberg Limits are laboratory tests for arbitrary moisture contents to determine when a soil is on the verge of being a viscous liquid. The moisture content of the soil when this state occurs is known as the Liquid Limit (LL), or a non-plastic. The moisture content of which the soil mass becomes brittle and non-yielding is known as the Plastic Limit (PL). The range of moisture contents for which the soil mass is neither a liquid or a brittle solid, when the soil is in a plastic state, is known as the Plasticity Index (PI) and is computed as the difference between the Liquid Limit (LL) and the Plastic Limit (PL). Test results are presented on Figures D-3 and D-4.

MAXIMUM DENSITY - OPTIMUM MOISTURE RELATIONSHIPS (ASTM D1557)

Maximum density - optimum moisture test results provide a relationship between soil moisture content at compaction vs. dry density for a fixed compactive effort. Test results are presented on Figures E-1 and E-2.

Meyer Civil Engineering, Inc.

Geotechnical Engineering Services
GBJPA Kern Fan Recharge Facilities
Bakersfield, CA

SEI File No. 22-18413
December 29, 2022

TABLE 1

TEST LOCATION	USCS	% < # 200	HYDRO RESULTS		CONSOLIDATION				DIRECT SHEAR		UNCONFINED COMPRESSION		ATTERBERG LIMITS			E.I.	PERM.	R-VALUE @ 300 psi		MAXIMUM DENSITY	
			% SILT	% CLAY	C_C	C_S	S.P. (pcf)	HV %	C, (ksf)	F.A.	Q_U, (ksf)	C, (ksf)	LL	PL	PI		K	R.V.	E.P. (psi)	MDD (pcf)	O.M.
B-5 @ 0-5' (W/O Solution)	CL	51	42	9									27	18	9	26					
B-5 @ 0-5' (W/Solution)	CL	51	28	23																	
B-5 @ 3'	CL	63			0.07	0.02	2222	0.9									NO FLOW				
B-5 @ 6'	CL	80															NO FLOW				
B-6 @ 3'	ML	63			0.11	0.02	81	0.1									4.02×10^{-6}				
B-6 @ 6'	SM	41															9.62×10^{-6}				
B-7 @ 0-5' (W/O Solution)	CL	59	53	6									29	18	11	3					
B-7 @ 0-5' (W/Solution)	CL	57	27	30																	
B-7 @ 3'	SC	49							0.28	31.9							4.35×10^{-6}				
B-7 @ 6'	CL	67			0.04	0.02	862	0.2													
B-8 @ 3'	ML	62							0.12	30.6							1.46×10^{-5}				
B-8 @ 6'	ML	52															NO FLOW				

CONSOLIDATION
Cc - Compression Index
Cs - Swell Index
S.P. (pcf) - Swell Pressure
HV % - Heave Precentage / Collapase

DIRECT SHEAR
C (ksf) - Cohesion
F.A. - Friction Angle
S.G. - Specfic Gravity

E.I. - EXPANSION INDEX

UNCONFINED COMPRESSION
QU (ksf) - Unconfined Compression Strength
C, (ksf) - Cohesion
MAXIMUM DENSITY
MDD (pcf) - Max Dry Density / O.M. - Optimum Moisture

(R)ESISTANCE VALUE
RV - R-Value @ 300 psi
EV - Expansion Press @ 300 psi

CONSTANT HEAD PERMEABILITY
K - Coefficient of Permeability (cm/sec)

Meyer Civil Engineering, Inc.

Geotechnical Engineering Services
GBJPA Kern Fan Recharge Facilities
Bakersfield, CA

SEI File No. 22-18413
December 29, 2022

TABLE 1

TEST LOCATION	USCS	% < # 200	HYDRO RESULTS		CONSOLIDATION				DIRECT SHEAR		UNCONFINED COMPRESSION		ATTERBERG LIMITS			E.I.	PERM.	R-VALUE @ 300 psi		MAXIMUM DENSITY	
			% SILT	% CLAY	C_C	C_S	S.P. (pcf)	HV %	C, (ksf)	F.A.	Q_U, (ksf)	C, (ksf)	LL	PL	PI		K	R.V.	E.P. (psi)	MDD (pcf)	O.M.
TP-9 @ 0-7' (W/O Solution)	SM	46	38	8																122.2	12.0%
TP-9 @ 0-7' (W/Solution)	SM	46	27	19																	
TP-10 @ 0-7'	SM	40																			
TP-11 @ 0-7'	ML	62																			
TP-12 @ 0-7'	ML	64																			
TP-13 @ 0-7'	ML	55																			
TP-14 @ 0-7'	ML	58																		112.9	16.3%
TP-15 @ 1-4'	SM	36																			
TP-15 @ 4-7'	SM	49																			
TP-16 @ 0-7'	SM	41																			
TP-17 @ 0-7'	SM	48																			
TP-18 @ 0-7'	ML	73																			

CONSOLIDATION
Cc - Compression Index
Cs - Swell Index
S.P. (pcf) - Swell Pressure
HV % - Heave Precentage / Collapase

DIRECT SHEAR
C (ksf) - Cohesion
F.A. - Friction Angle
S.G. - Specfic Gravity

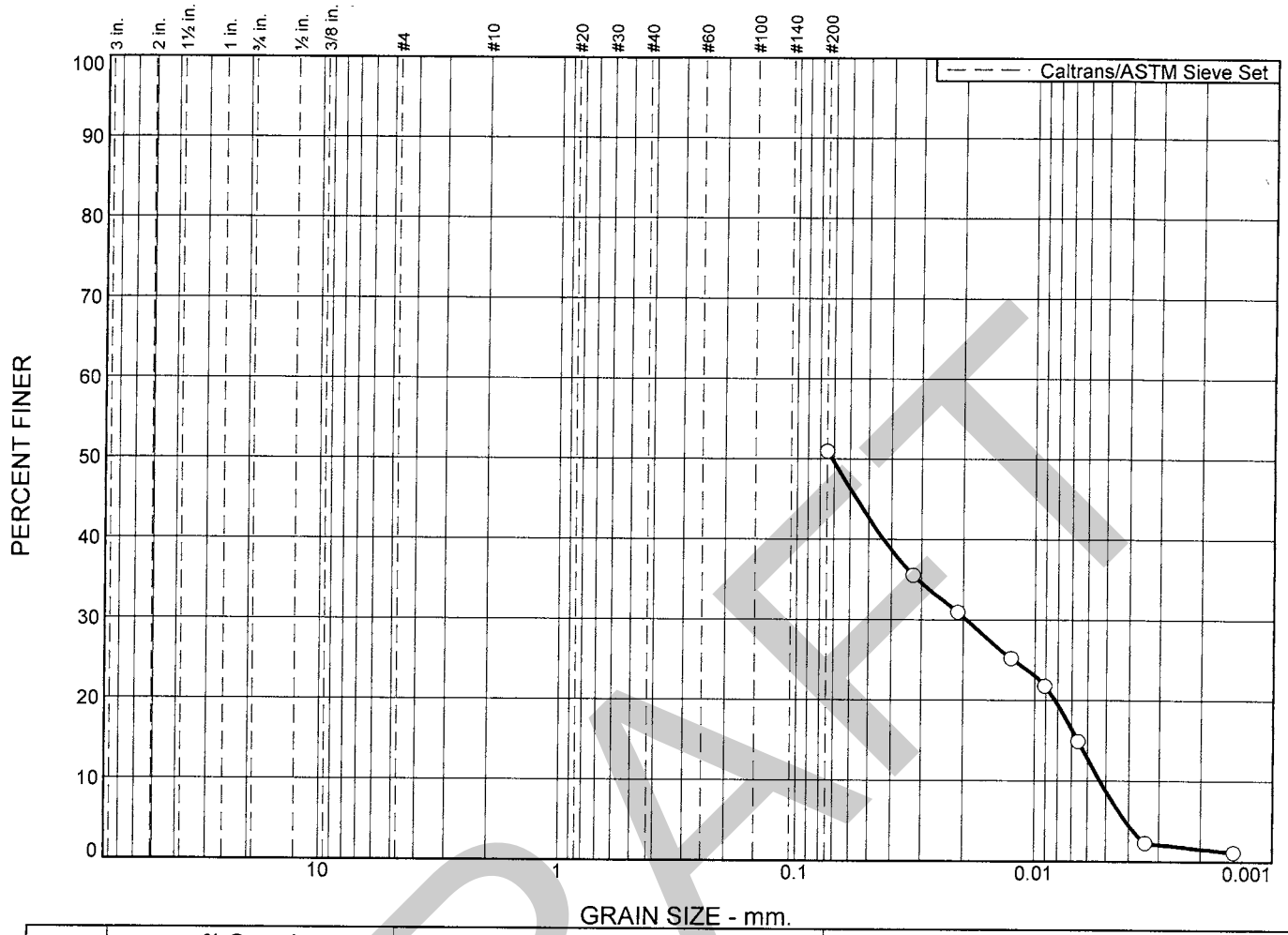
E.I. - EXPANSION INDEX

UNCONFINED COMPRESSION
QU (ksf) - Unconfined Compression Strength
C, (ksf) - Cohesion
MAXIMUM DENSITY
MDD (pcf) - Max Dry Density / O.M. - Optimum Moisture

(R)ESISTANCE VALUE
RV - R-Value @ 300 psi
EV - Expansion Press @ 300 psi

CONSTANT HEAD PERMEABILITY
K - Coefficient of Permeability (cm/sec)

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							42	9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○		84951	0-5'	SANDY CLAY (B-5)	CL
				(W/O Solution)	

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project No.: 18413

Figure A-26

GRAIN SIZE DISTRIBUTION TEST DATA

12/29/2022

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project Number: 18413
Location: B-5 @ 0-5'
Depth: 0-5' **Sample Number:** 84951
Material Description: SANDY CLAY (B-5)
(W/O Solution)
USCS: CL
Material specification: Caltrans/ASTM Sieve Set

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Lower Spec. Limit, %	Upper Spec. Limit, %	Deviation From Spec., %
86.90	0.00	0.00	3"					
			2"					
			1.5"					
			1"					
			.75"					
			.50"					
			.375"					
			#4					
			#8					
			#16					
			#30					
			#50					
			#100					
			#200	42.60	51	0.0	0.0	*+51*

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100
Weight of hydrometer sample =91.5
Hygroscopic moisture correction:
Moist weight and tare = 242.80
Dry weight and tare = 237.10
Tare weight = 122.80
Hygroscopic moisture = 5.0%
Table of composite correction values:

Temp., deg. C:	19.0	20.0
Comp. corr.:	-1.0	-1.0

Meniscus correction only = 0.0
Specific gravity of solids = 2.65
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.164 **x** Rm

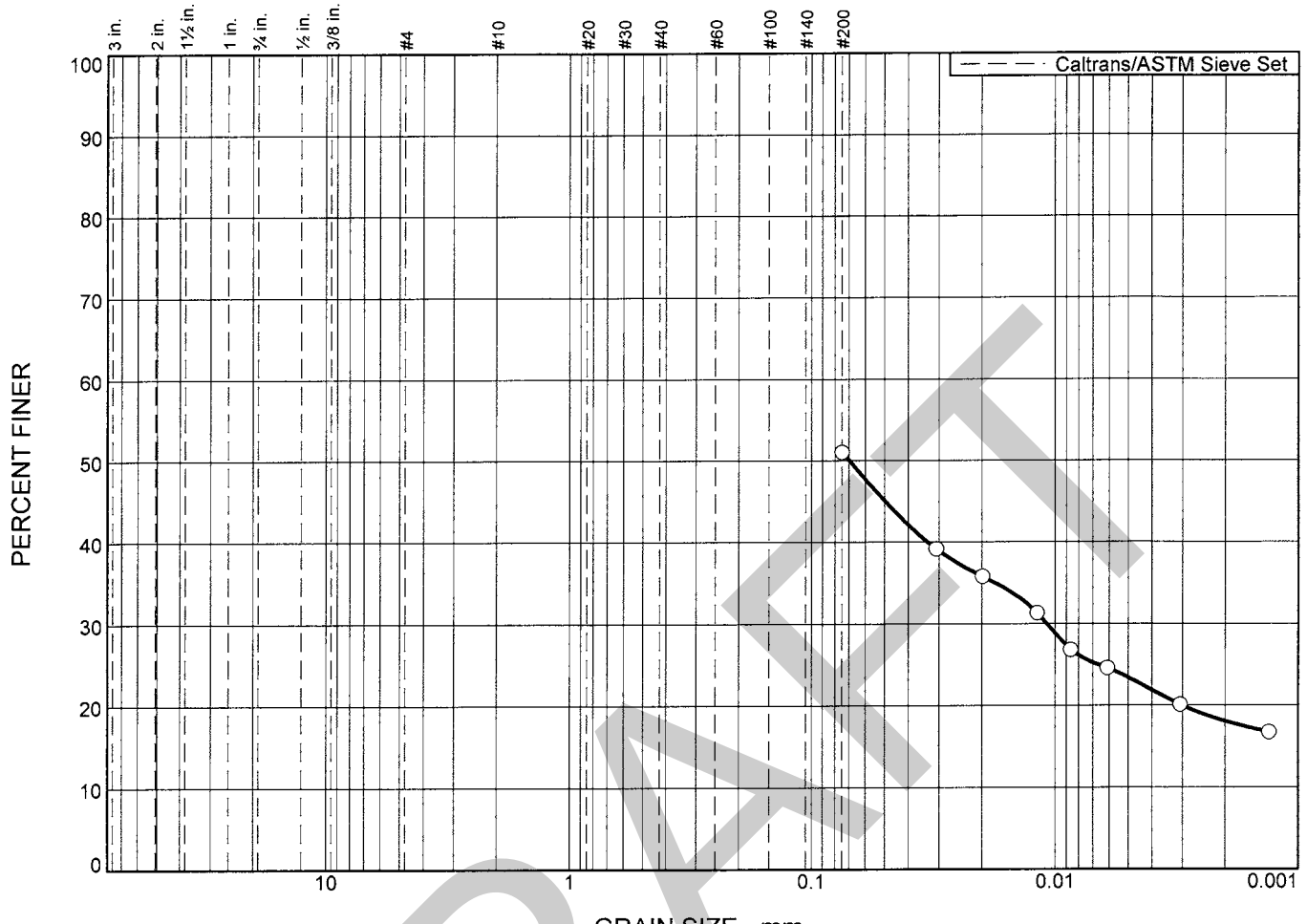
Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer
2.00	19.0	32.0	31.0	0.0138	32.0	11.0	0.0325	35.6
5.00	19.0	28.0	27.0	0.0138	28.0	11.7	0.0211	31.0
15.00	19.0	23.0	22.0	0.0138	23.0	12.5	0.0126	25.2
30.00	19.0	20.0	19.0	0.0138	20.0	13.0	0.0091	21.8
60.00	20.0	14.0	13.0	0.0136	14.0	14.0	0.0066	14.9
250.00	20.0	3.0	2.0	0.0136	3.0	15.8	0.0034	2.3
1440.00	19.0	2.0	1.0	0.0138	2.0	16.0	0.0015	1.1

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
								42	9	51

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0053	0.0066	0.0082	0.0194	0.0716					

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							28	23

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○		84951	0-5'	SANDY CLAY (B-5)	CL
				(W/Solution)	

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities

Project No.: 18413 **Figure** A-27

GRAIN SIZE DISTRIBUTION TEST DATA

12/29/2022

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project Number: 18413
Location: B-5 @ 0-5'
Depth: 0-5' **Sample Number:** 84951
Material Description: SANDY CLAY (B-5)
(W/Solution)
USCS: CL
Material specification: Caltrans/ASTM Sieve Set

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Lower Spec. Limit, %	Upper Spec. Limit, %	Deviation From Spec., %
89.10	0.00	0.00	3"					
			2"					
			1.5"					
			1"					
			.75"					
			.50"					
			.375"					
			#4					
			#8					
			#16					
			#30					
			#50					
			#100					
			#200	43.60	51	0.0	0.0	*+51*

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100
Weight of hydrometer sample =93.8
Hygroscopic moisture correction:
Moist weight and tare = 242.80
Dry weight and tare = 237.10
Tare weight = 122.80
Hygroscopic moisture = 5.0%
Table of composite correction values:

Temp., deg. C:	19.0	20.0
Comp. corr.:	-4.0	-4.0

Meniscus correction only = 0.0
Specific gravity of solids = 2.65
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.164 **x Rm**

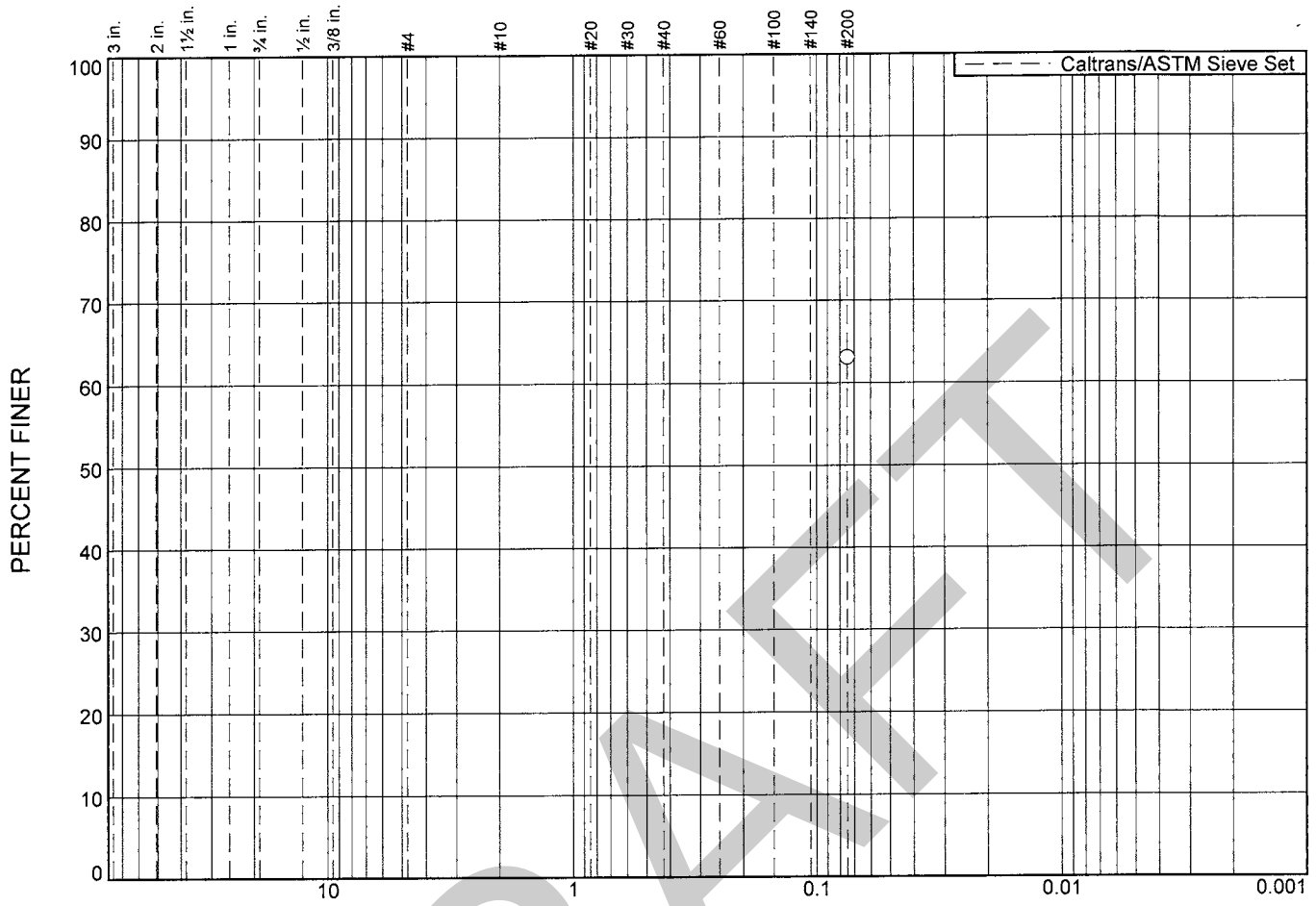
Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer
2.00	19.0	39.0	35.0	0.0138	39.0	9.9	0.0307	39.2
5.00	19.0	36.0	32.0	0.0138	36.0	10.4	0.0199	35.8
15.00	19.0	32.0	28.0	0.0138	32.0	11.0	0.0119	31.3
30.00	19.0	28.0	24.0	0.0138	28.0	11.7	0.0086	26.9
60.00	20.0	26.0	22.0	0.0136	26.0	12.0	0.0061	24.6
250.00	20.0	22.0	18.0	0.0136	22.0	12.7	0.0031	20.1
1440.00	19.0	19.0	15.0	0.0138	19.0	13.2	0.0013	16.8

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
								28	23	51

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
		0.0030	0.0108	0.0699					

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							63	

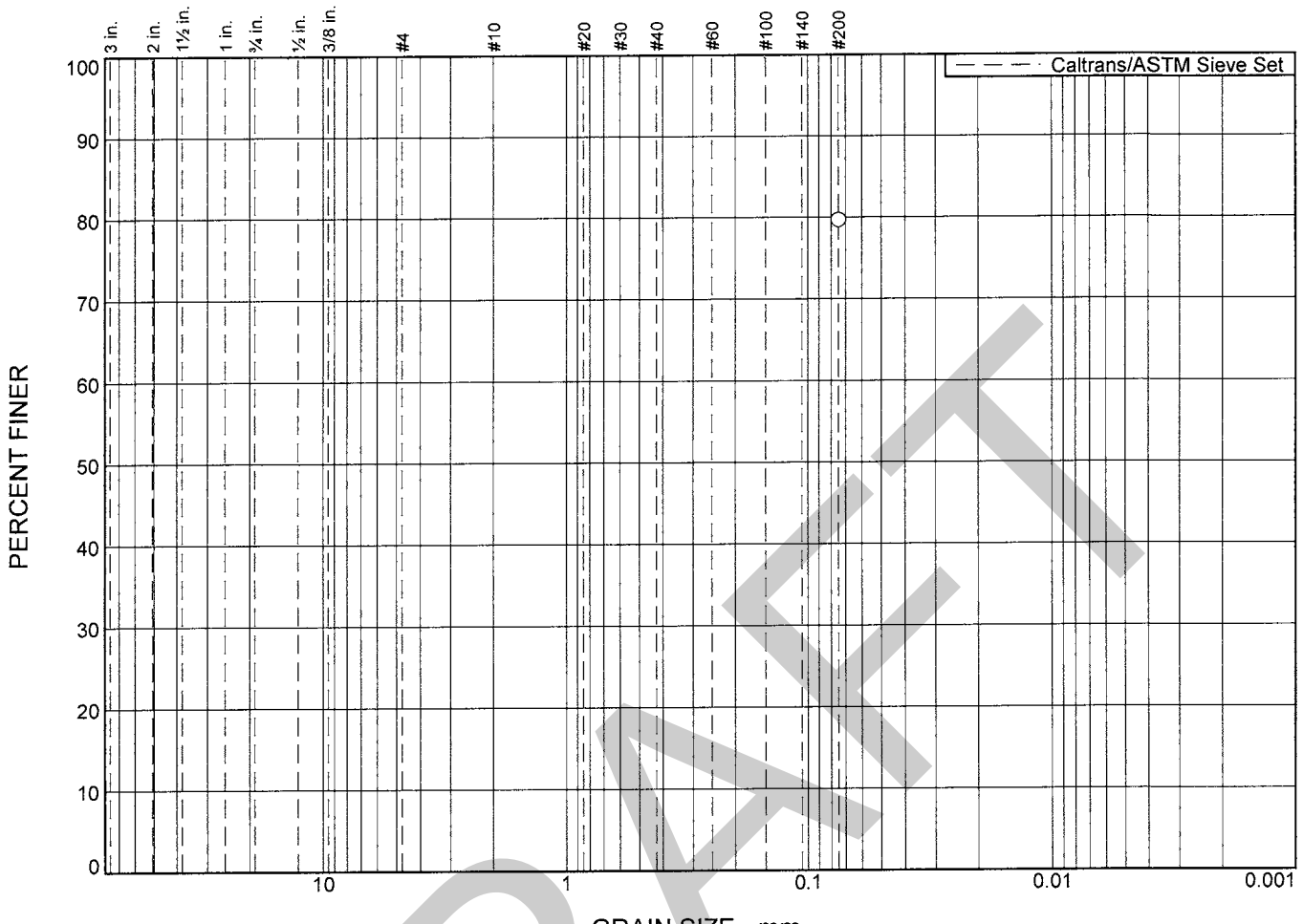
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-5 Ph. 2		3'	SANDY CLAY	CL

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project No.: 18413 **Figure** A-28

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							80	

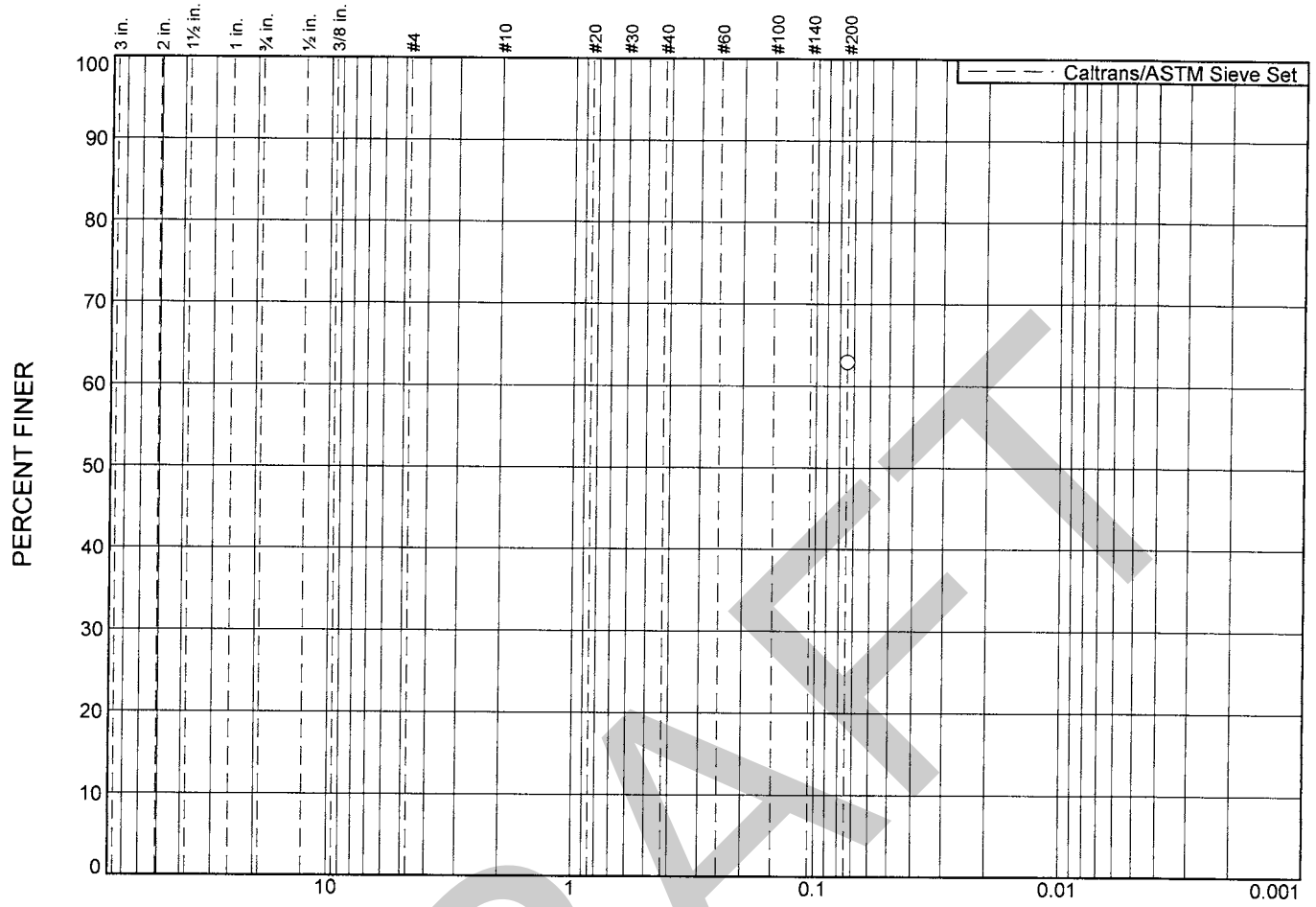
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-5 Ph. 2		6'	SANDY CLAY	CL

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project No.: 18413 **Figure** A-29

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							63	

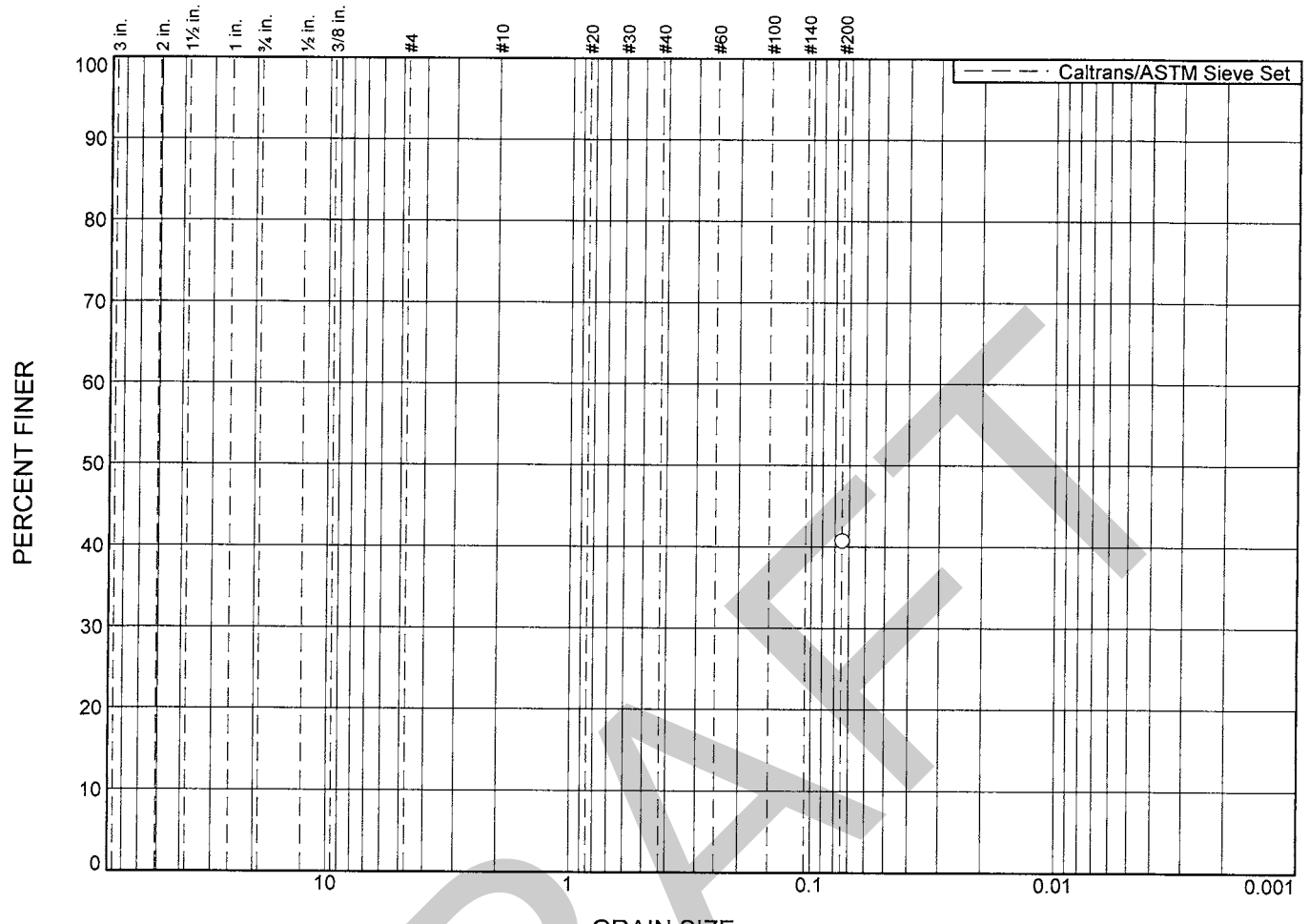
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-6 Ph. 2		3'	SANDY SILT	ML

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project No.: 18413
Figure A-30

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							41	

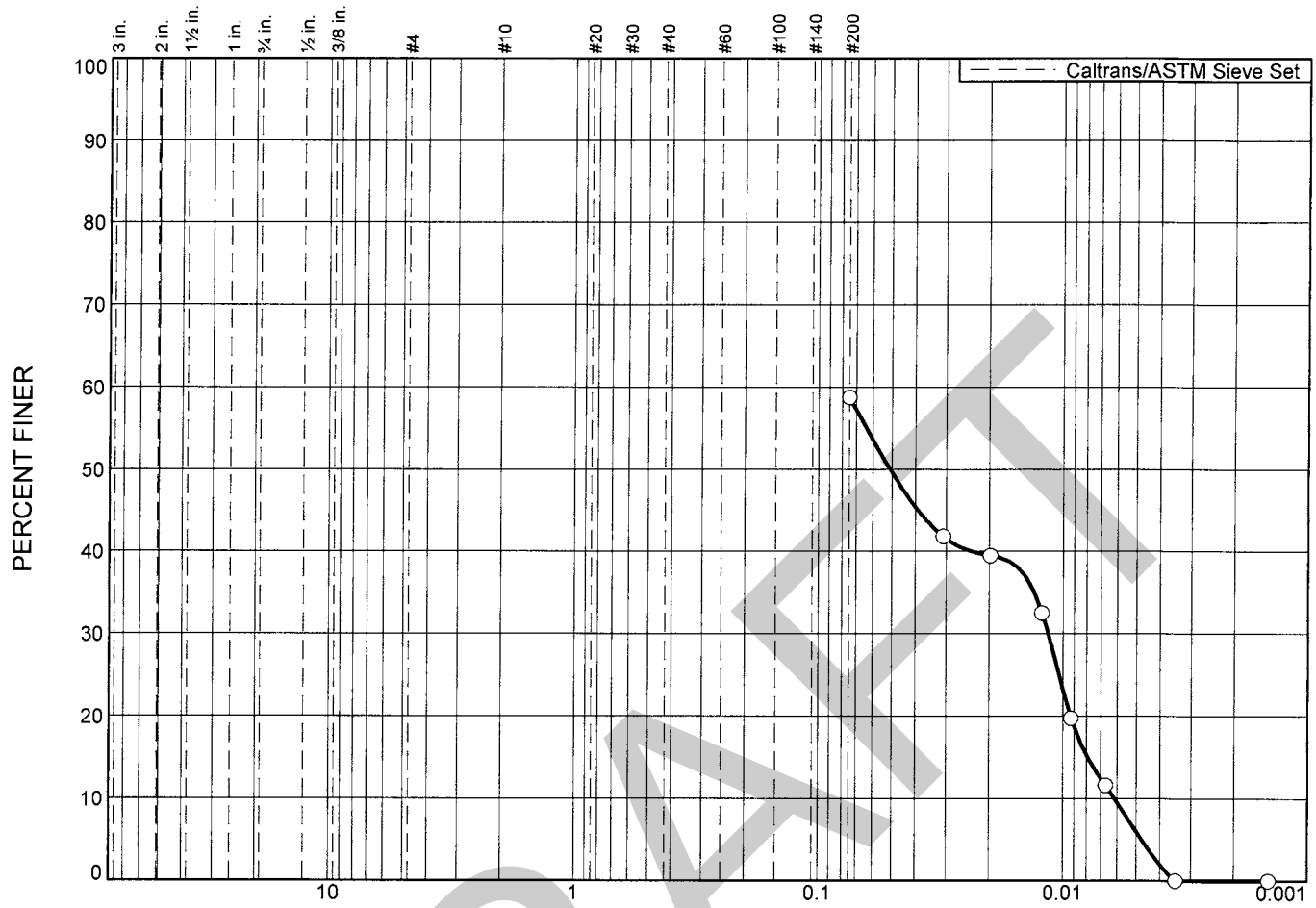
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-6 Ph. 2		6'	SILTY SAND	SM

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project No.: 18413
Figure A-31

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							53	6

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○		84960	0-5'	SANDY CLAY (B-7)	CL
				(W/O Solution)	

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities

Project No.: 18413 **Figure** A-32

GRAIN SIZE DISTRIBUTION TEST DATA

12/29/2022

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project Number: 18413
Location: B-7 @ 0-5'
Depth: 0-5' **Sample Number:** 84960
Material Description: SANDY CLAY (B-7)
(W/O Solution)
USCS: CL
Material specification: Caltrans/ASTM Sieve Set

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Lower Spec. Limit, %	Upper Spec. Limit, %	Deviation From Spec., %
85.60	0.00	0.00	3"					
			2"					
			1.5"					
			1"					
			.75"					
			.50"					
			.375"					
			#4					
			#8					
			#16					
			#30					
			#50					
			#100					
			#200	35.30	59	0.0	0.0	*+59*

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100
Weight of hydrometer sample =92.9
Hygroscopic moisture correction:
Moist weight and tare = 213.90
Dry weight and tare = 208.80
Tare weight = 144.50
Hygroscopic moisture = 7.9%
Table of composite correction values:

Temp., deg. C:	20.0	19.0
Comp. corr.:	-1.0	0.0

Meniscus correction only = 0.0
Specific gravity of solids = 2.65
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.164 **x Rm**

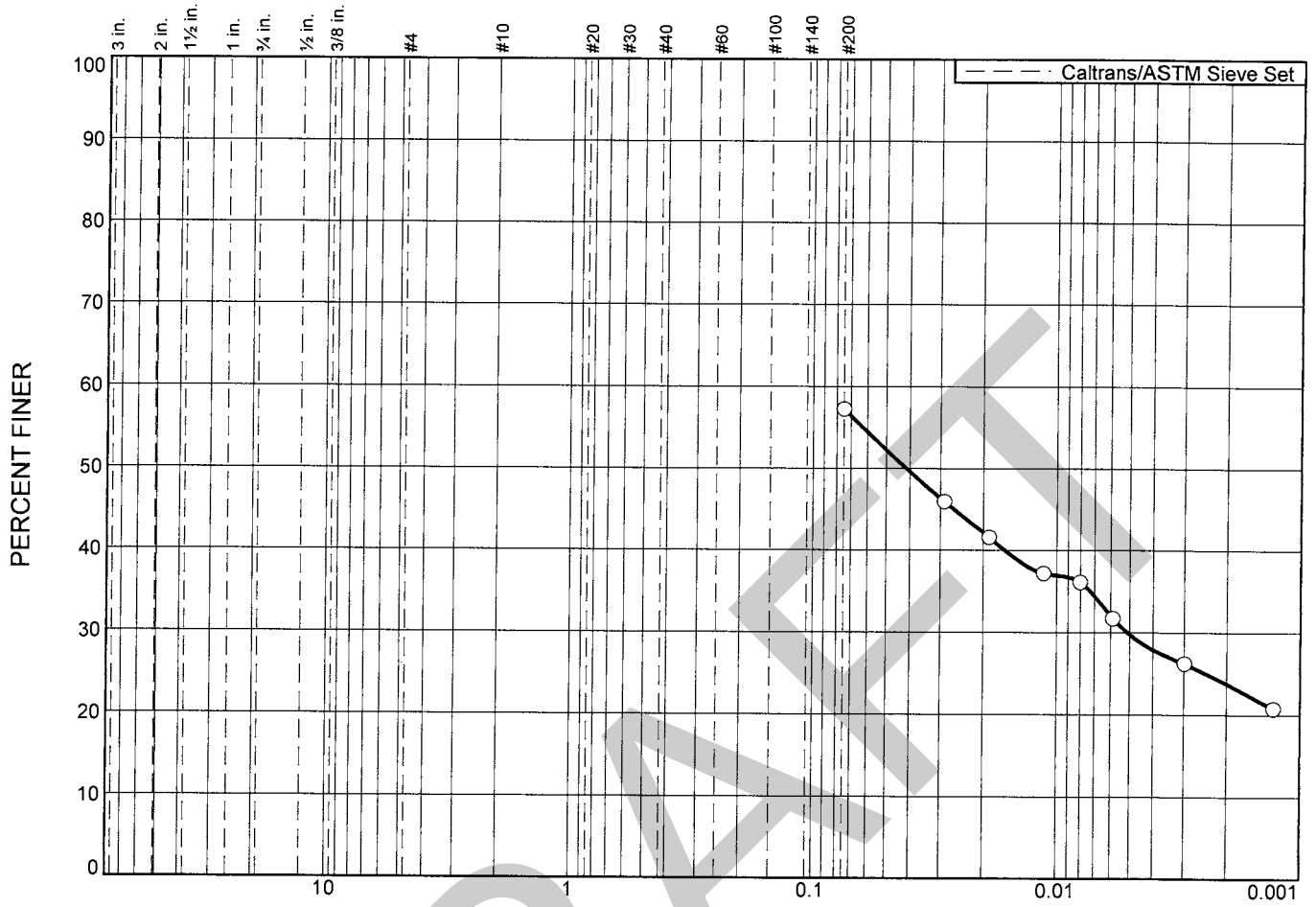
Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer
2.00	20.0	37.0	36.0	0.0136	37.0	10.2	0.0309	41.8
5.00	20.0	35.0	34.0	0.0136	35.0	10.6	0.0198	39.5
15.00	19.0	28.0	28.0	0.0138	28.0	11.7	0.0122	32.5
30.00	19.0	17.0	17.0	0.0138	17.0	13.5	0.0093	19.8
60.00	20.0	11.0	10.0	0.0136	11.0	14.5	0.0067	11.6
250.00	20.0	1.0	0.0	0.0136	1.0	16.1	0.0035	0.0
1440.00	20.0	1.0	0.0	0.0136	1.0	16.1	0.0014	0.0

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
								53	6	59

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0062	0.0079	0.0093	0.0115	0.0510					

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							27	30

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○		84960	0-5'	SANDY CLAY (B-7)	CL
				(W/Solution)	

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project No.: 18413
Figure A-33

GRAIN SIZE DISTRIBUTION TEST DATA

12/29/2022

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project Number: 18413
Location: B-7 @ 0-5'
Depth: 0-5'
Sample Number: 84960
Material Description: SANDY CLAY (B-7)
(W/Solution)
USCS: CL
Material specification: Caltrans/ASTM Sieve Set

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Lower Spec. Limit, %	Upper Spec. Limit, %	Deviation From Spec., %
90.80	0.00	0.00	3"					
			2"					
			1.5"					
			1"					
			.75"					
			.50"					
			.375"					
			#4					
			#8					
			#16					
			#30					
			#50					
			#100					
			#200	38.80	57	0.0	0.0	+57

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100
Weight of hydrometer sample =98.6
Hygroscopic moisture correction:
Moist weight and tare = 213.90
Dry weight and tare = 208.80
Tare weight = 144.50
Hygroscopic moisture = 7.9%
Table of composite correction values:

Temp., deg. C:	19.0	20.0
Comp. corr.:	-4.0	-3.0

Meniscus correction only = 0.0
Specific gravity of solids = 2.65
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.164 x Rm

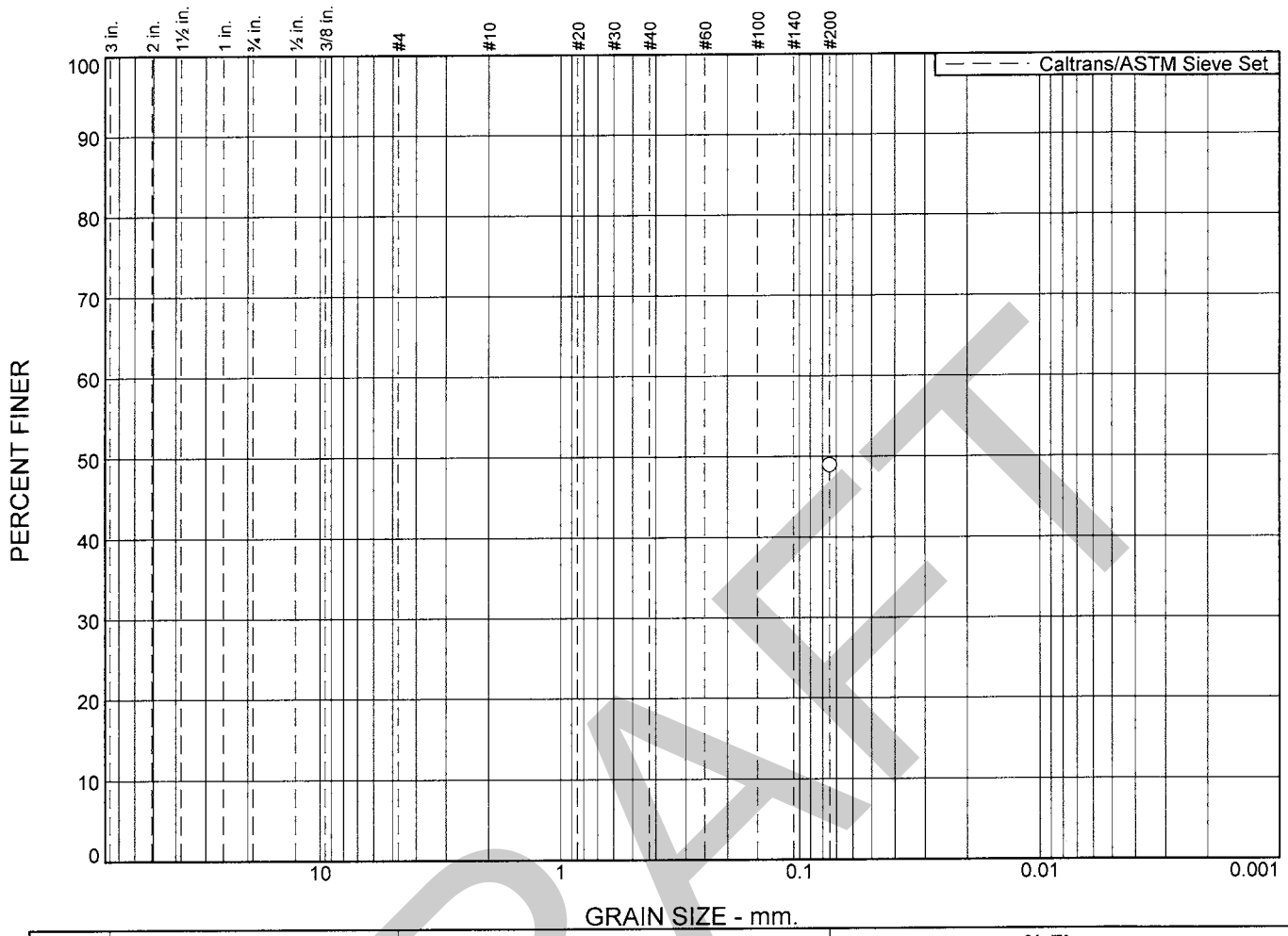
Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer
2.00	19.0	46.0	42.0	0.0138	46.0	8.8	0.0289	46.0
5.00	19.0	42.0	38.0	0.0138	42.0	9.4	0.0190	41.6
15.00	19.0	38.0	34.0	0.0138	38.0	10.1	0.0113	37.2
30.00	20.0	36.0	33.0	0.0136	36.0	10.4	0.0080	36.1
60.00	19.0	33.0	29.0	0.0138	33.0	10.9	0.0059	31.7
250.00	19.0	28.0	24.0	0.0138	28.0	11.7	0.0030	26.3
1440.00	19.0	23.0	19.0	0.0138	23.0	12.5	0.0013	20.8

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
								27	30	57

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
			0.0051	0.0414					

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							49	

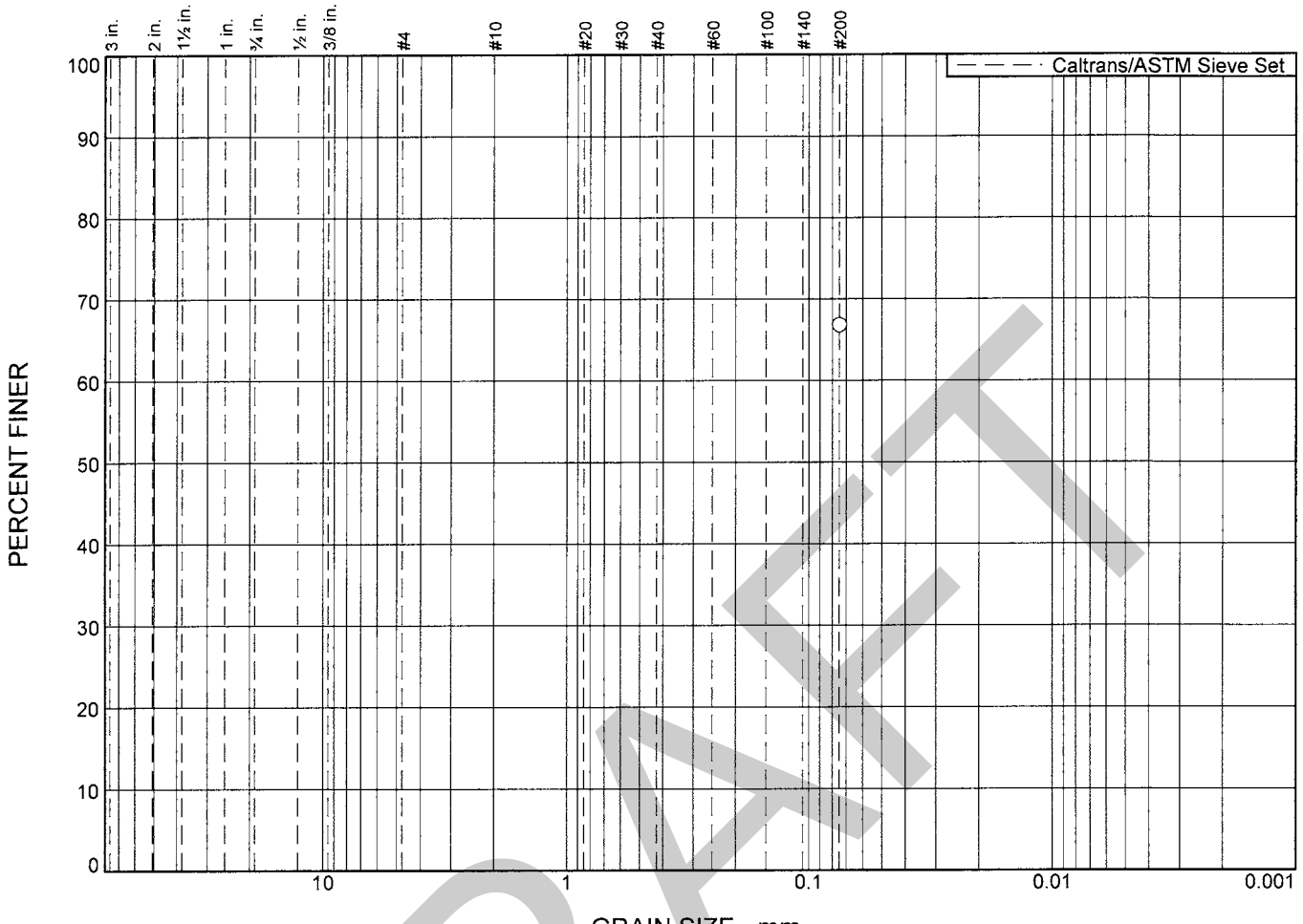
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-7 Ph. 2		3'	CLAYEY SAND	SC

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project No.: 18413 **Figure** A-34

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							67	

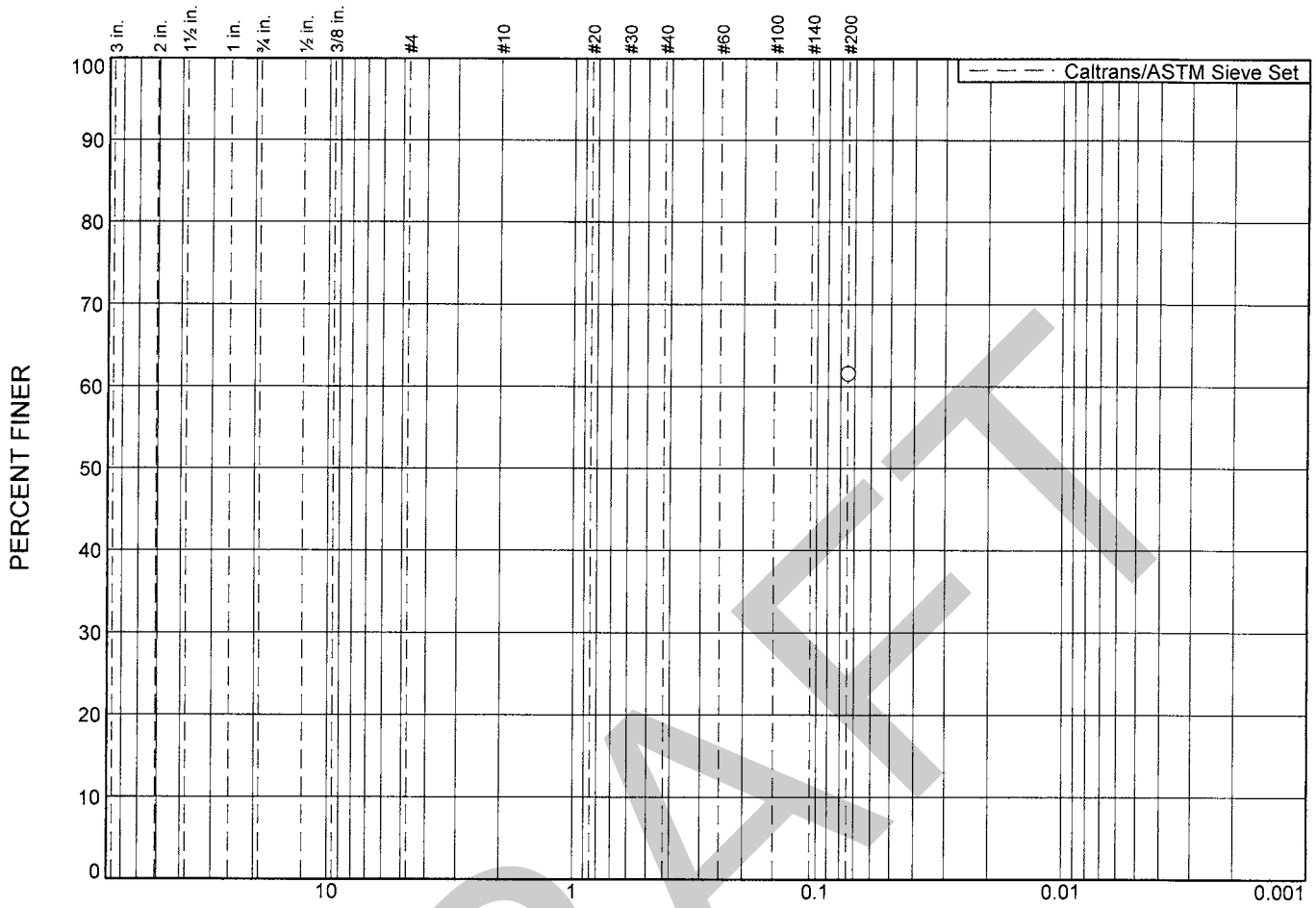
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-7 Ph. 2		6'	SANDY CLAY	CL

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project No.: 18413 **Figure** A-35

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							62	

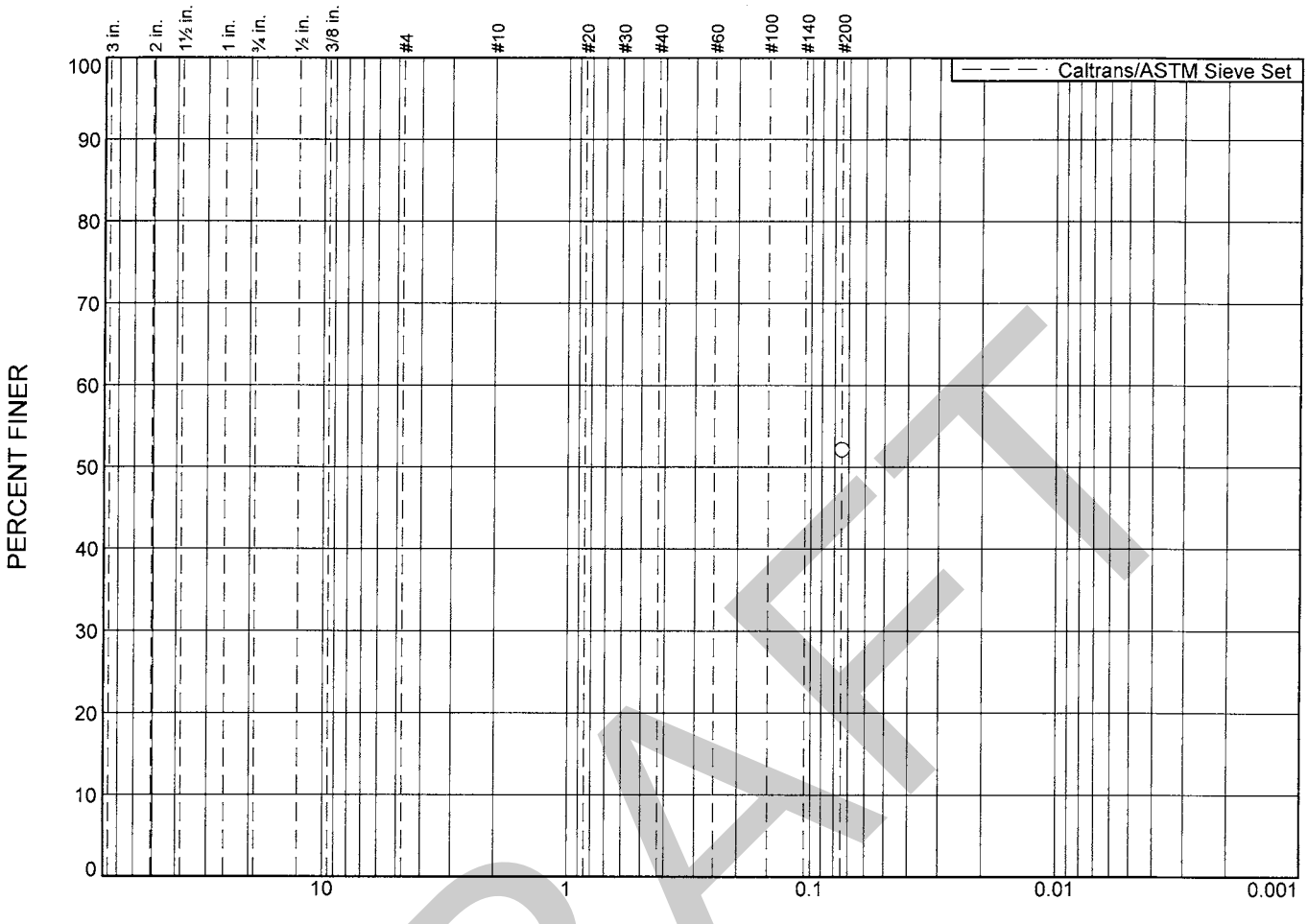
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-8 Ph. 2		3'	SANDY SILT	ML

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project No.: 18413 **Figure** A-36

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							52	

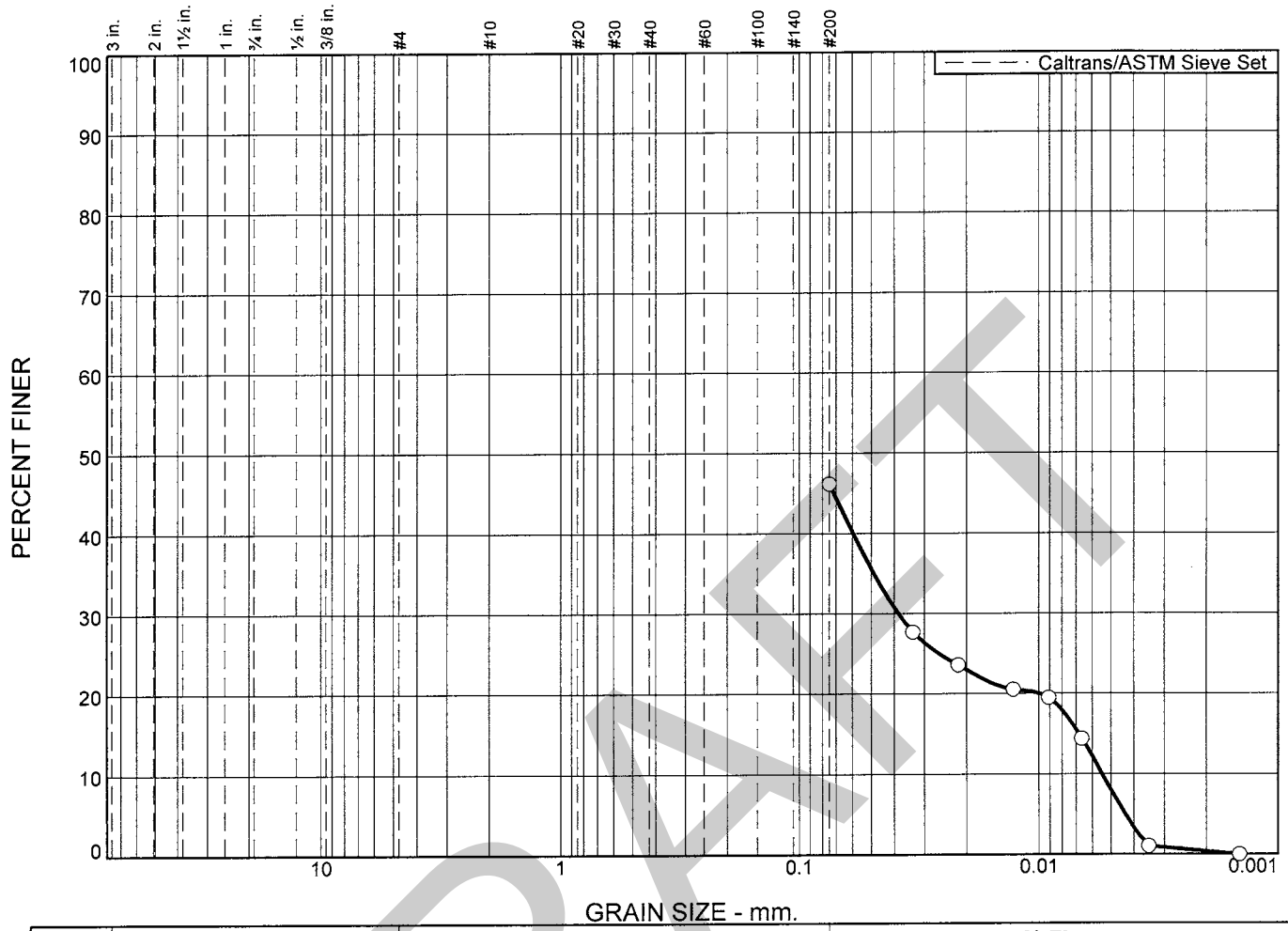
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-8 Ph. 2		6'	SANDY SILT	ML

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project No.: 18413 **Figure** A-37

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							38	8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○		85006	0-7'	SILTY SAND (TP-9)	SM
				(W/O Solution)	

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities

Project No.: 18413 **Figure** A-38

GRAIN SIZE DISTRIBUTION TEST DATA

12/29/2022

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project Number: 18413
Location: TP-9 @ 0-7'
Depth: 0-7' **Sample Number:** 85006
Material Description: SILTY SAND (TP-9)
(W/O Solution)
USCS: SM
Material specification: Caltrans/ASTM Sieve Set

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Lower Spec. Limit, %	Upper Spec. Limit, %	Deviation From Spec., %
97.20	0.00	0.00	3"					
			2"					
			1.5"					
			1"					
			.75"					
			.50"					
			.375"					
			#4					
			#8					
			#16					
			#30					
			#50					
			#100					
			#200	52.30	46	0.0	0.0	*+46*

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100
Weight of hydrometer sample =102.7
Hygroscopic moisture correction:
Moist weight and tare = 187.40
Dry weight and tare = 184.10
Tare weight = 123.00
Hygroscopic moisture = 5.4%
Table of composite correction values:

Temp., deg. C:	19.0	20.0
Comp. corr.:	-1.0	0.0

Meniscus correction only = 0.0
Specific gravity of solids = 2.65
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.164 **x Rm**

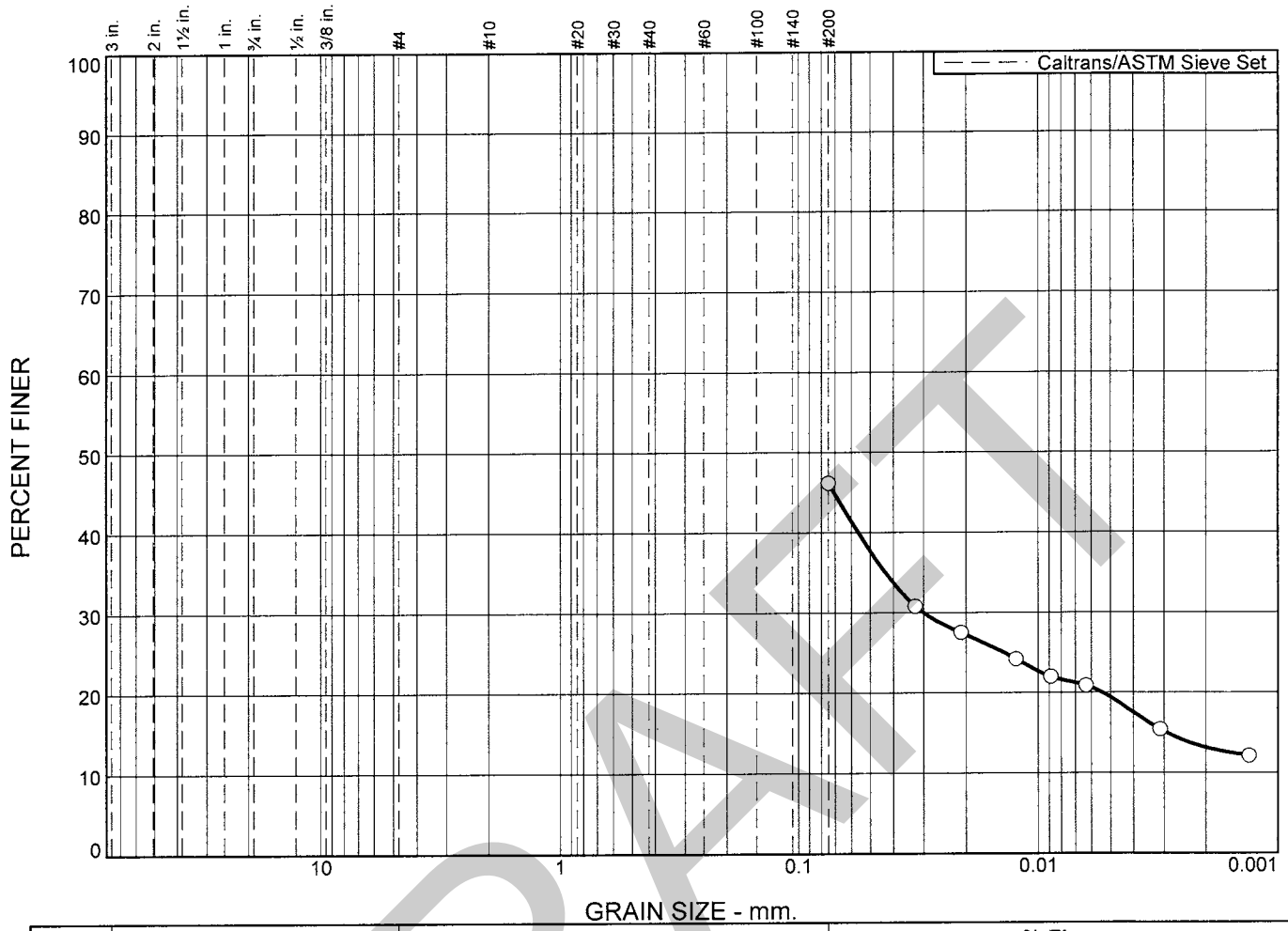
Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer
2.00	19.0	28.0	27.0	0.0138	28.0	11.7	0.0334	27.7
5.00	19.0	24.0	23.0	0.0138	24.0	12.4	0.0217	23.6
15.00	19.0	21.0	20.0	0.0138	21.0	12.9	0.0128	20.5
30.00	19.0	20.0	19.0	0.0138	20.0	13.0	0.0091	19.5
60.00	19.0	15.0	14.0	0.0138	15.0	13.8	0.0066	14.4
250.00	19.0	2.0	1.0	0.0138	2.0	16.0	0.0035	1.0
1440.00	20.0	0.0	0.0	0.0136	0.0	16.3	0.0015	0.0

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
								38	8	46

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0055	0.0068	0.0098	0.0385						

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							27	19

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○		85006	0-7'	SILTY SAND (TP-9)	SM
				(W/Solution)	

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities

Project No.: 18413 **Figure** A-39

GRAIN SIZE DISTRIBUTION TEST DATA

12/29/2022

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project Number: 18413
Location: TP-9 @ 0-7'
Depth: 0-7' **Sample Number:** 85006
Material Description: SILTY SAND (TP-9)
(W/Solution)
USCS: SM
Material specification: Caltrans/ASTM Sieve Set

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Lower Spec. Limit, %	Upper Spec. Limit, %	Deviation From Spec., %
97.20	0.00	0.00	3"					
			2"					
			1.5"					
			1"					
			.75"					
			.50"					
			.375"					
			#4					
			#8					
			#16					
			#30					
			#50					
			#100					
			#200	52.30	46	0.0	0.0	*+46*

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100
Weight of hydrometer sample =95.7
Hygroscopic moisture correction:
Moist weight and tare = 187.40
Dry weight and tare = 184.10
Tare weight = 123.00
Hygroscopic moisture = 5.4%
Table of composite correction values:

Temp., deg. C:	19.0	21.0
Comp. corr.:	-4.0	-4.0

Meniscus correction only = 0.0
Specific gravity of solids = 2.65
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.164 x Rm

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer
2.00	19.0	32.0	28.0	0.0138	32.0	11.0	0.0325	30.8
5.00	19.0	29.0	25.0	0.0138	29.0	11.5	0.0210	27.5
15.00	19.0	26.0	22.0	0.0138	26.0	12.0	0.0124	24.2
30.00	19.0	24.0	20.0	0.0138	24.0	12.4	0.0089	22.0
60.00	19.0	23.0	19.0	0.0138	23.0	12.5	0.0063	20.9
250.00	21.0	18.0	14.0	0.0135	18.0	13.3	0.0031	15.4
1440.00	21.0	15.0	11.0	0.0135	15.0	13.8	0.0013	12.1

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
								27	19	46

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
	0.0029	0.0054	0.0299						

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							40	

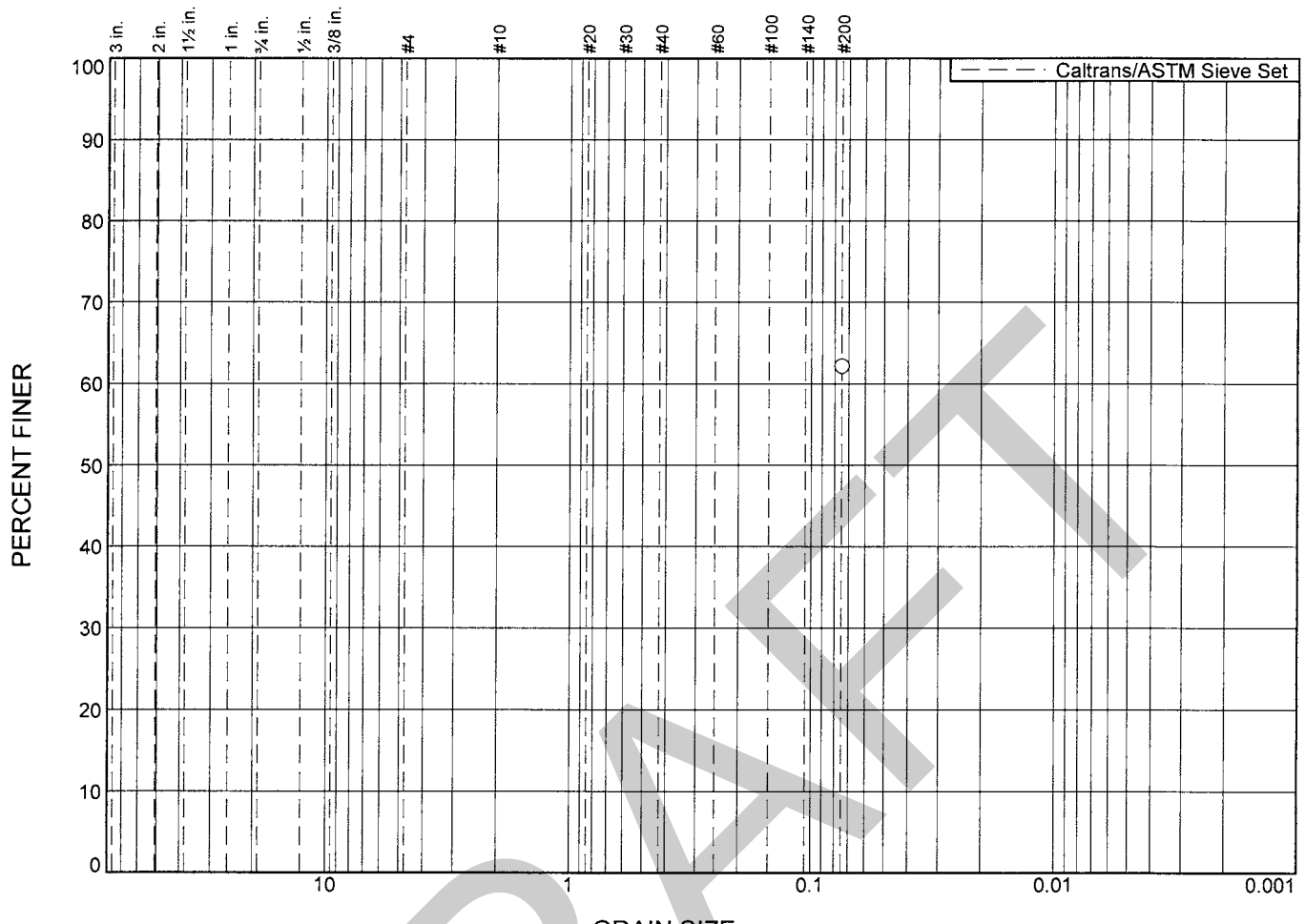
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○		85007	0-7'	SILTY SAND (TP-10)	SM

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project No.: 18413 **Figure** A-40

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							62	

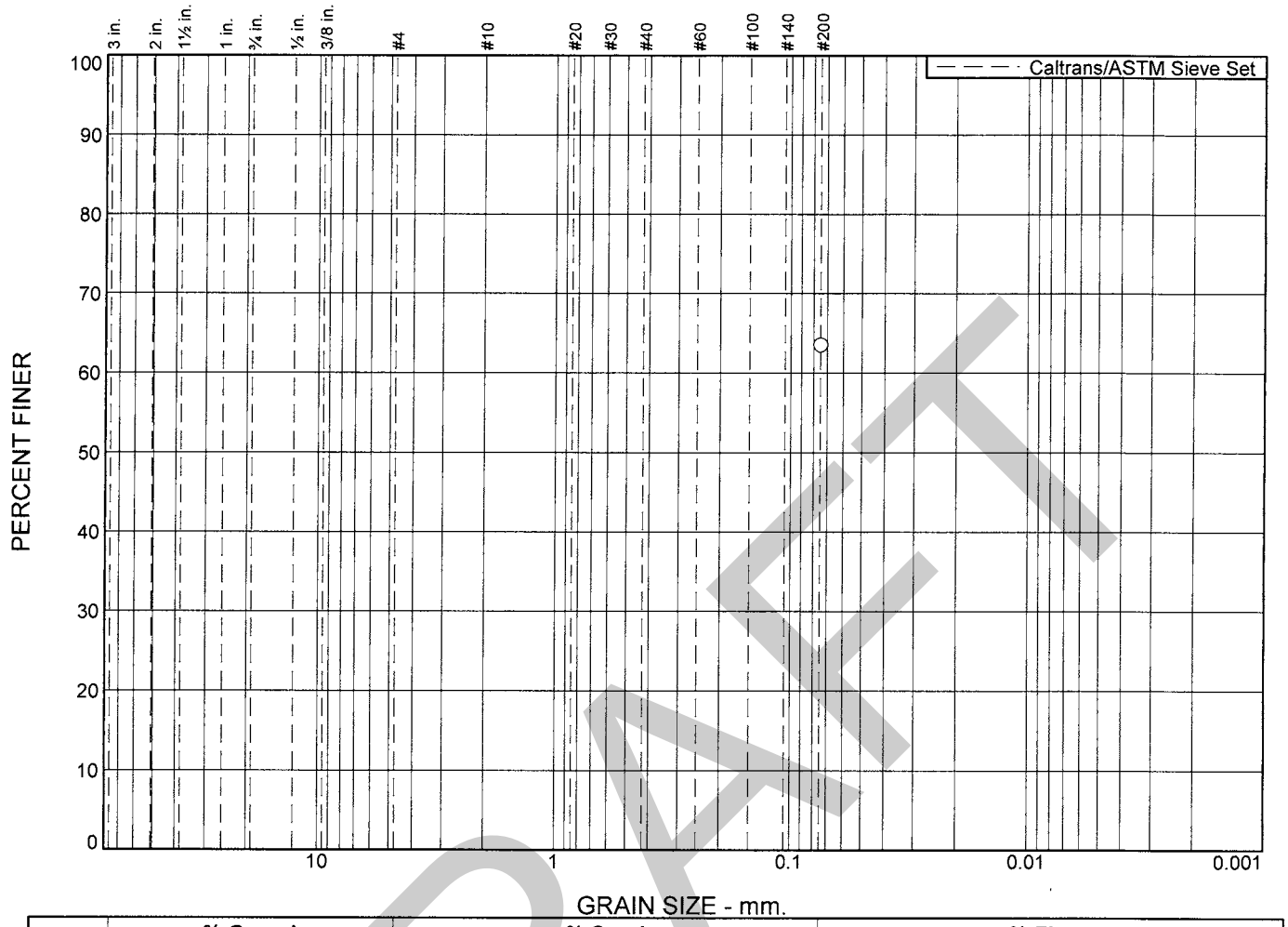
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○		85008	0-7'	SANDY SILT (TP-11)	ML

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project No.: 18413 **Figure** A-41

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							64	

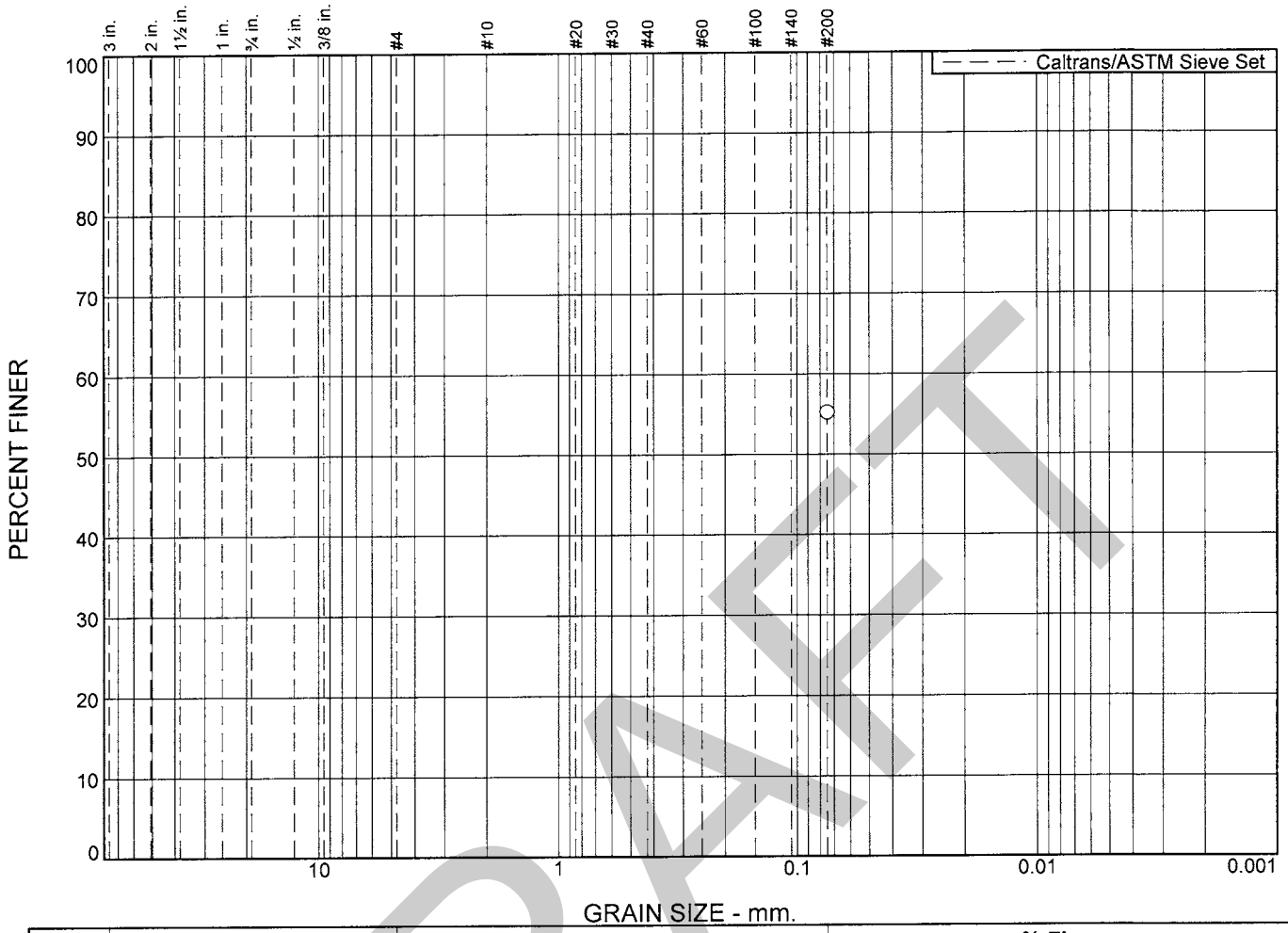
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○		85009	0-7'	SANDY SILT (TP-12)	ML

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project No.: 18413 **Figure** A-42

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							55	

SOIL DATA

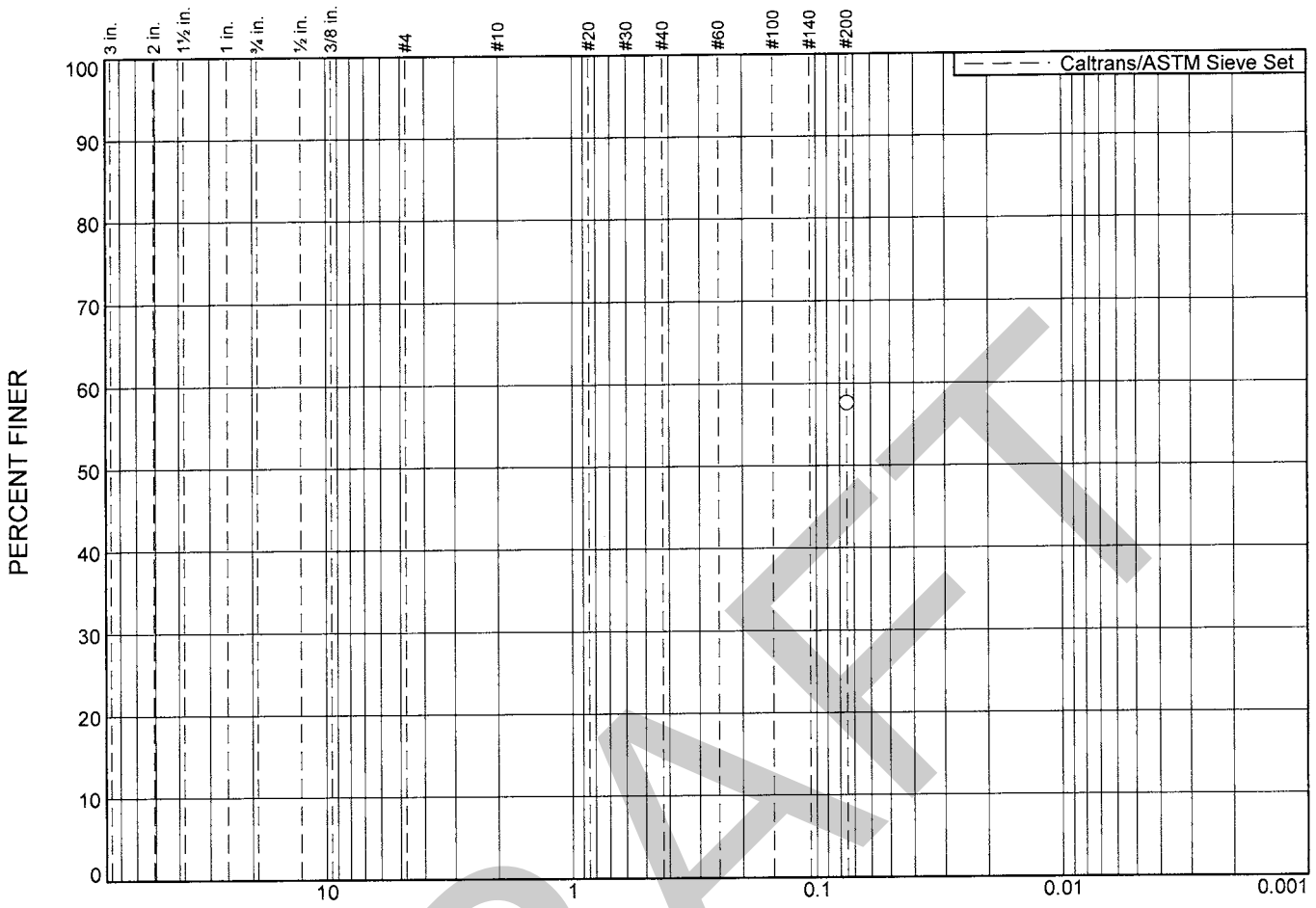
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○		85010	0-7'	SANDY SILT (TP-13)	ML

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities

Project No.: 18413 **Figure** A-43

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							58	

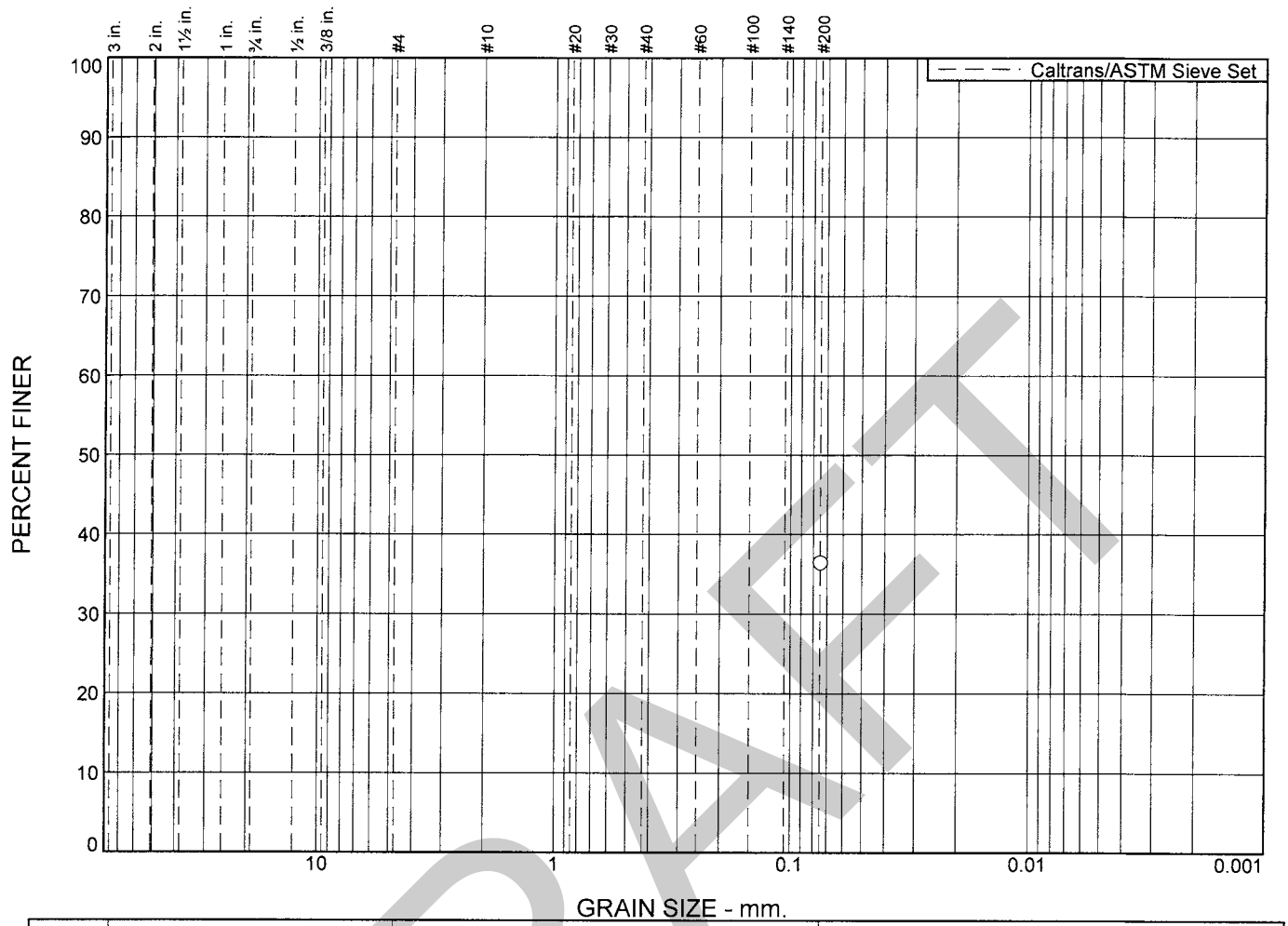
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○		85011	0-7'	SANDY SILT (TP-14)	ML

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project No.: 18413 **Figure** A-44

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							36	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○		85012	1-4'	SILTY SAND (TP-15)	SM

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project No.: 18413 **Figure** A-45

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							49	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○		85013	4-7'	SILTY SAND (TP-15)	SM

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities

Project No.: 18413 **Figure** A-46

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							41	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○		85014	0-7'	SILTY SAND (TP-16)	SM

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities

Project No.: 18413 **Figure** A-47

Particle Size Distribution Report

	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							48	

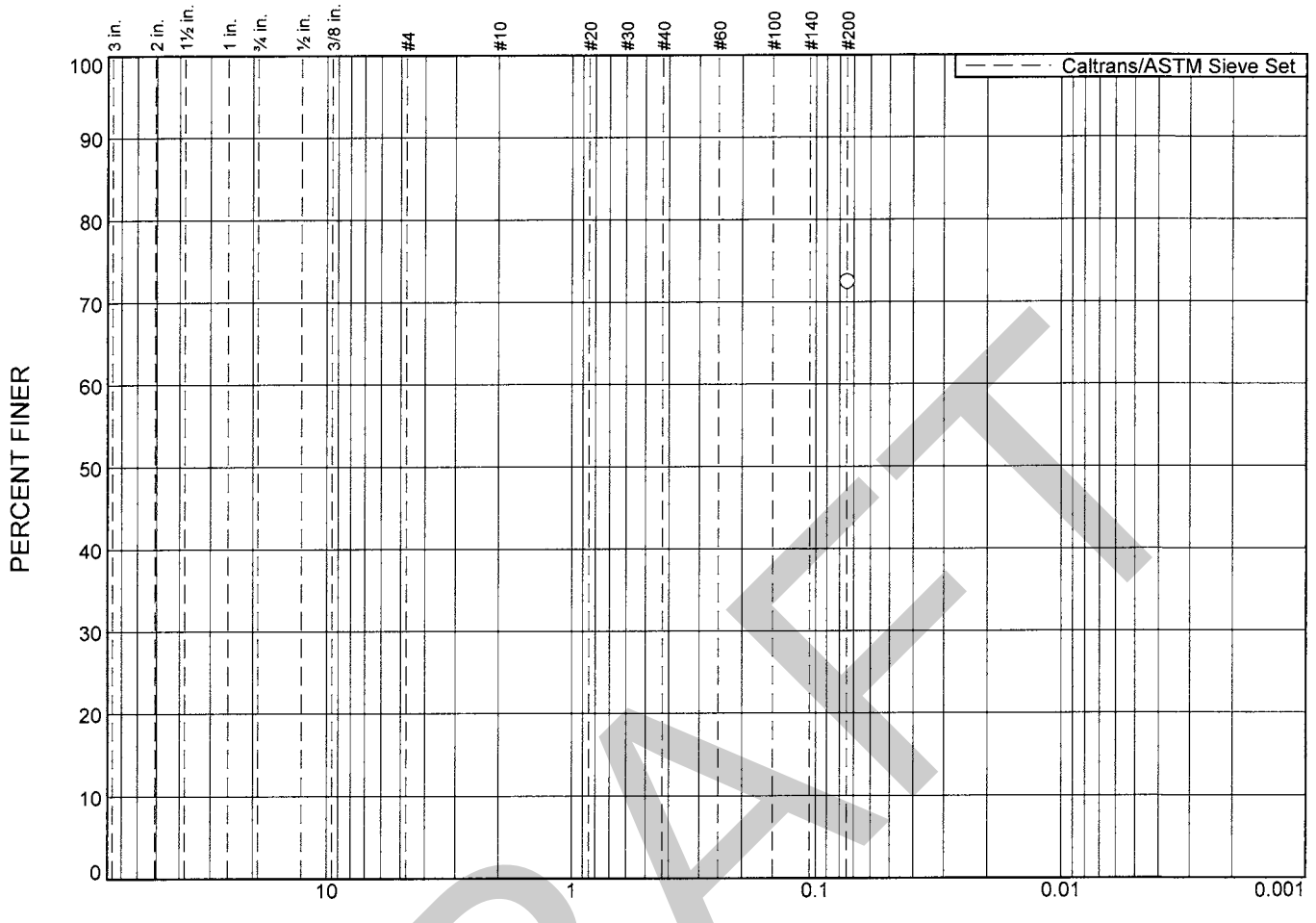
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○		85015	0-7'	SILTY SAND (TP-17)	SM

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities
Project No.: 18413 **Figure** A-48

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							73	

SOIL DATA

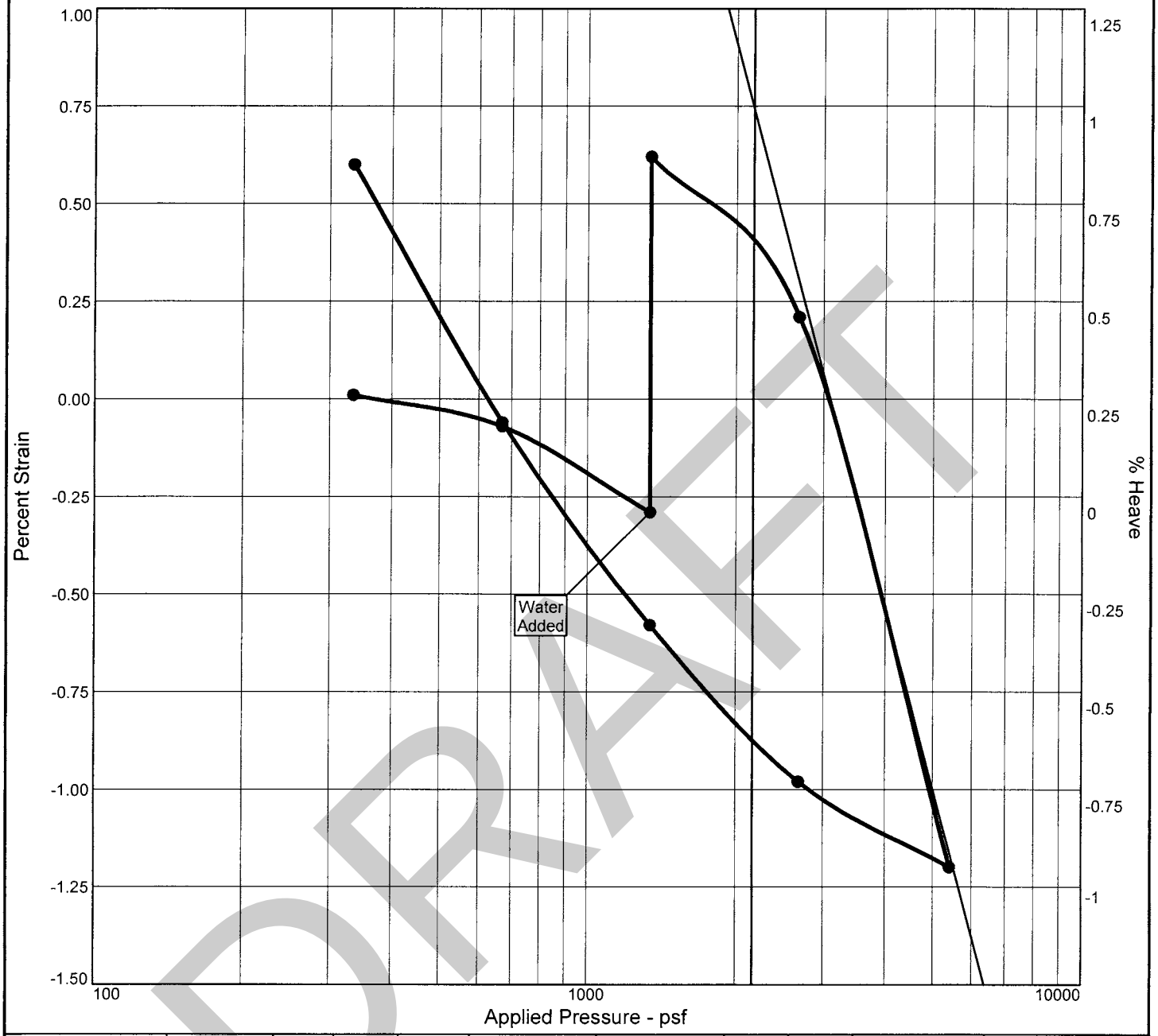
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○		85016	0-7'	SANDY SILT (TP-18)	ML

SOILS ENGINEERING, INC.

Client: Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities

Project No.: 18413 **Figure** A-49

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
50.3 %	9.3 %	110.9	N/A	N/A	2.65	336	2608	0.07	0.02	2222	0.9	0.491

MATERIAL DESCRIPTION	USCS	AASHTO
SANDY CLAY	CL	N/A

Project No. 18413 **Client:** Meyer Civil Engineering, Inc.

Project: GBJPA Recharge Facilities

Source of Sample: B-5 Ph. 2 **Depth:** 3'

Remarks:

Test Date: 11/21/22

SOILS ENGINEERING, INC.

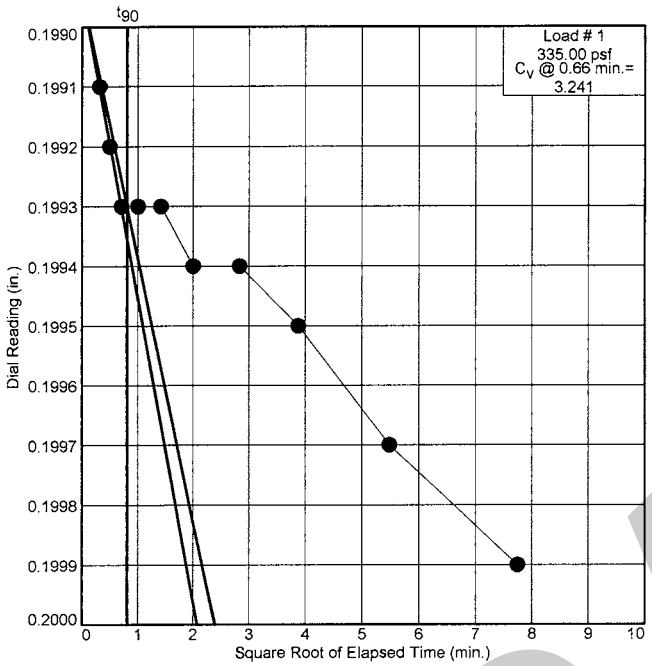
Figure B-4

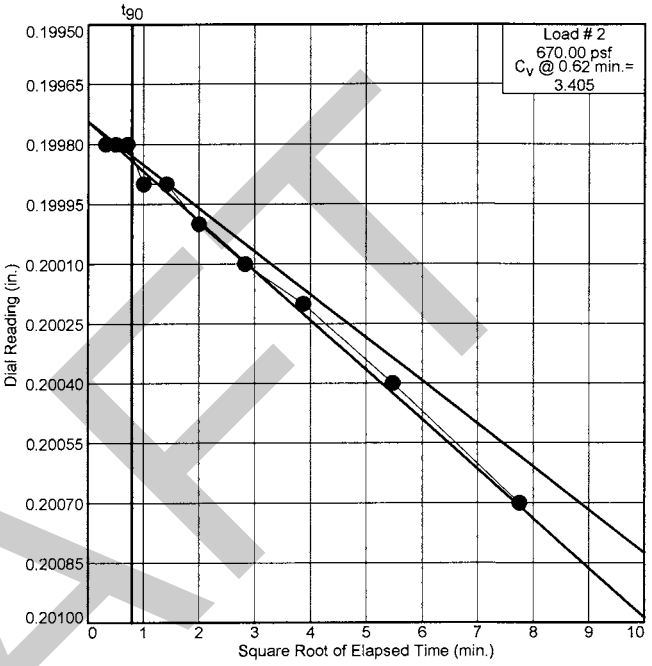
Checked By: AL

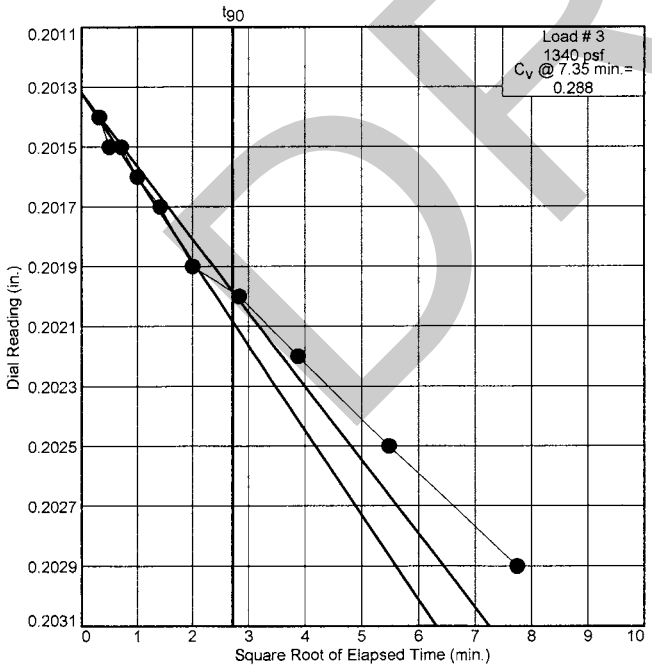
Dial Reading vs. Time

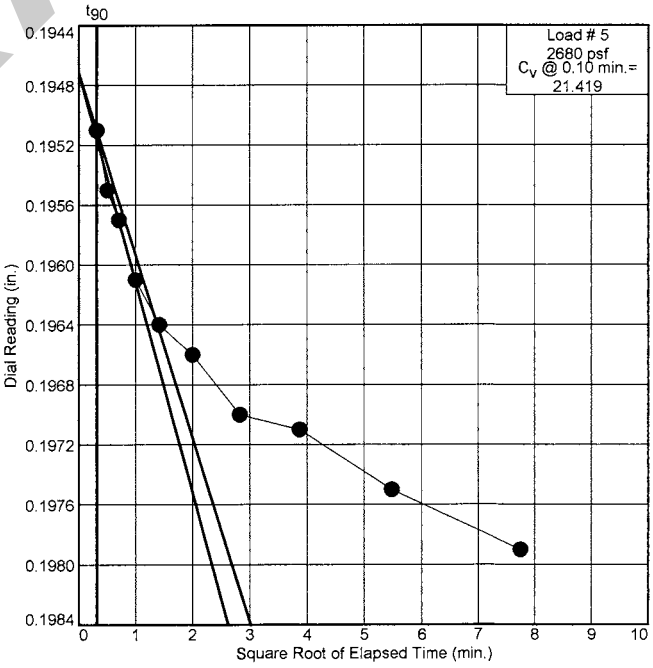
Project No.: 18413
Project: GBJPA Recharge Facilities

Source of Sample: B-5 Ph. 2 Depth: 3'









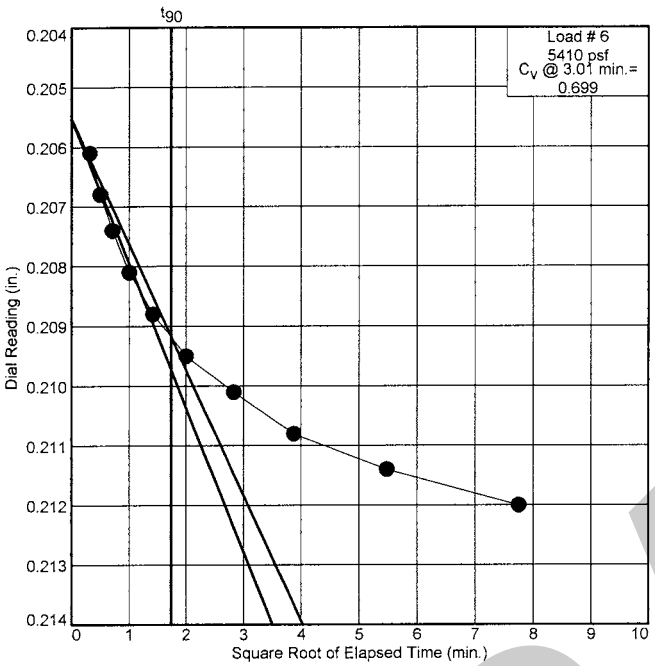
SOILS ENGINEERING, INC.

Figure B-4

Dial Reading vs. Time

Project No.: 18413
Project: GBJPA Recharge Facilities

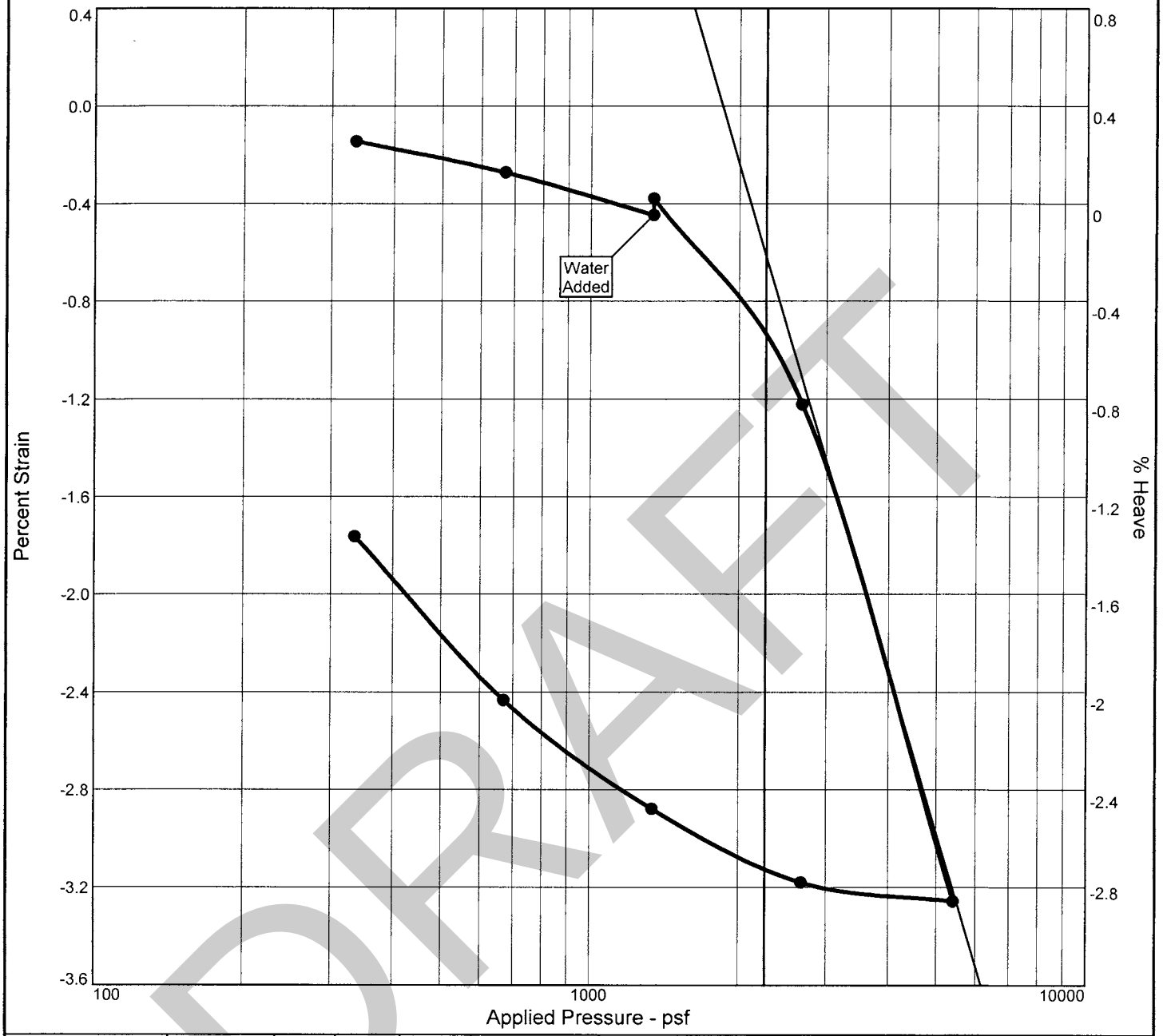
Source of Sample: B-5 Ph. 2 Depth: 3'



SOILS ENGINEERING, INC.

Figure B-4

CONSOLIDATION TEST REPORT



Natural Sat.	Natural Moist.	Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
26.7 %	6.0 %	103.8	N/A	N/A	2.65	336	2602	0.11	0.02	81.35	0.1	0.594

MATERIAL DESCRIPTION	USCS	AASHTO
SANDY SILT	ML	N/A

Project No. 18413 **Client:** Meyer Civil Engineering, Inc.

Project: GBJPA Recharge Facilities

Source of Sample: B-6 Ph. 2 **Depth:** 3'

Remarks:
Test Date: 11/21/22

SOILS ENGINEERING, INC.

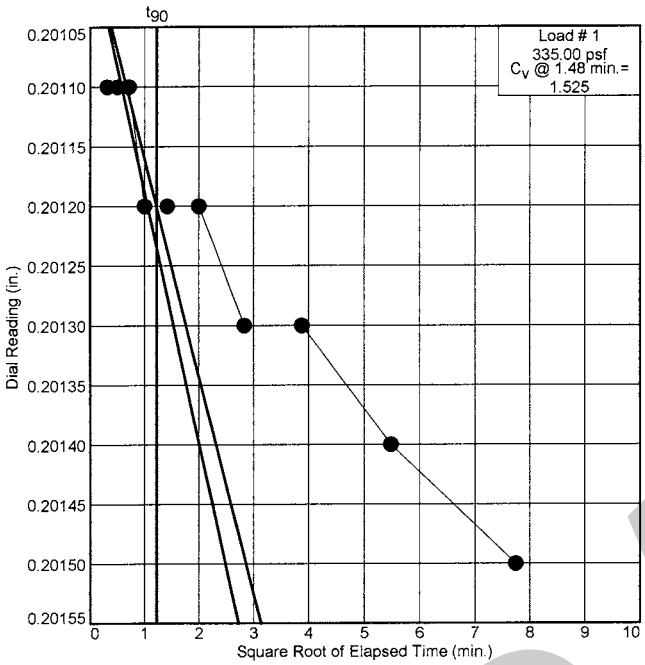
Figure B-5

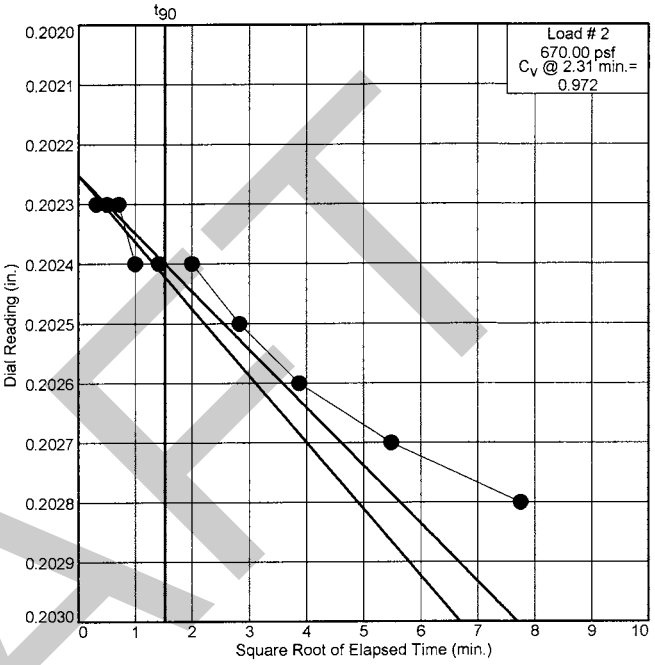
Checked By: AL

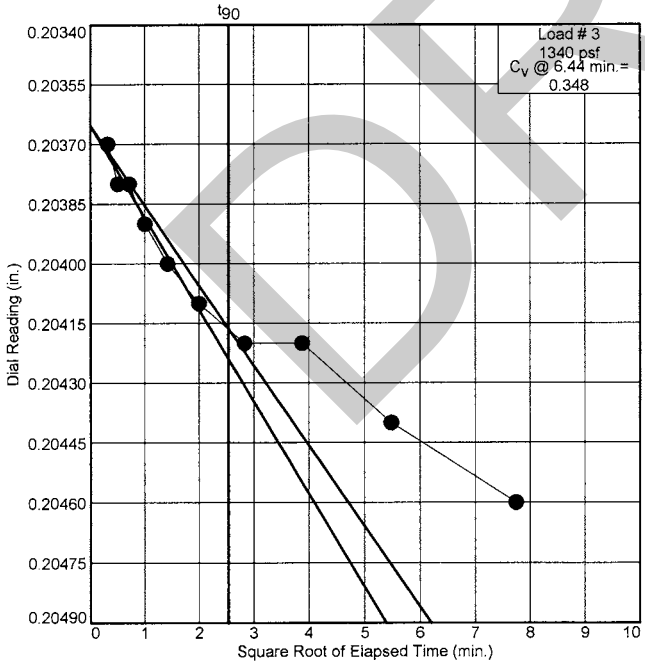
Dial Reading vs. Time

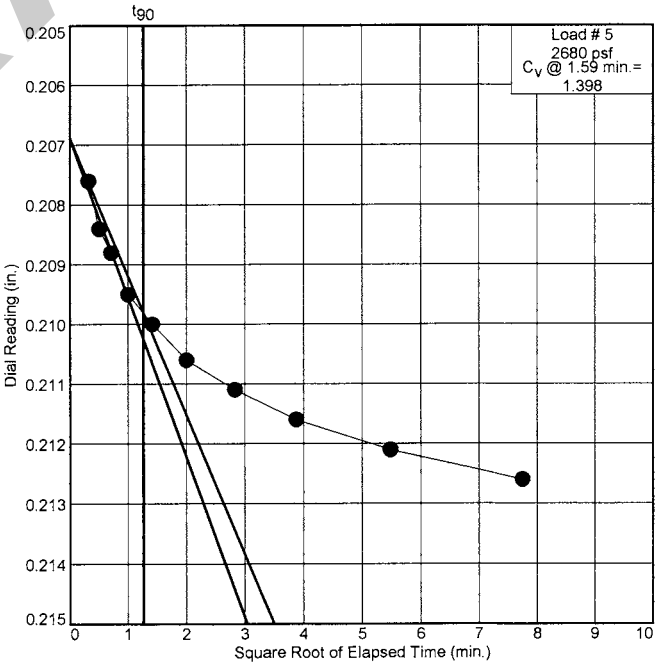
Project No.: 18413
Project: GBJPA Recharge Facilities

Source of Sample: B-6 Ph. 2 Depth: 3'









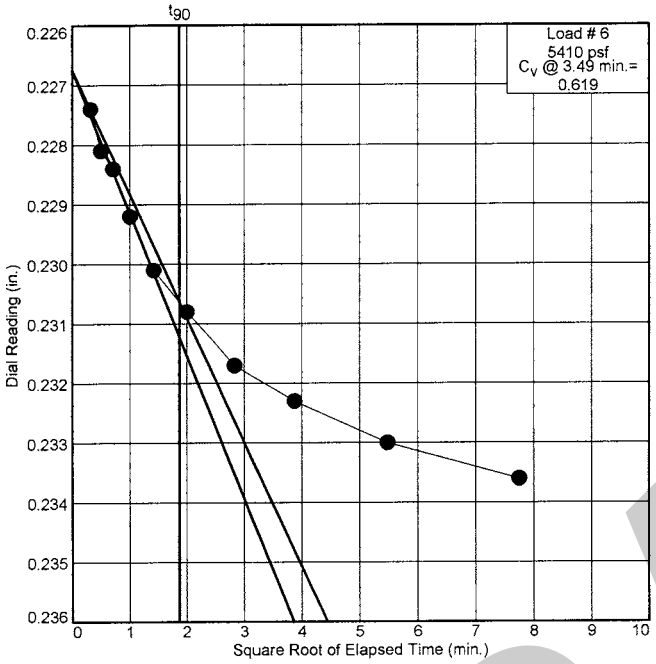
SOILS ENGINEERING, INC.

Figure B-5

Dial Reading vs. Time

Project No.: 18413
Project: GBJPA Recharge Facilities

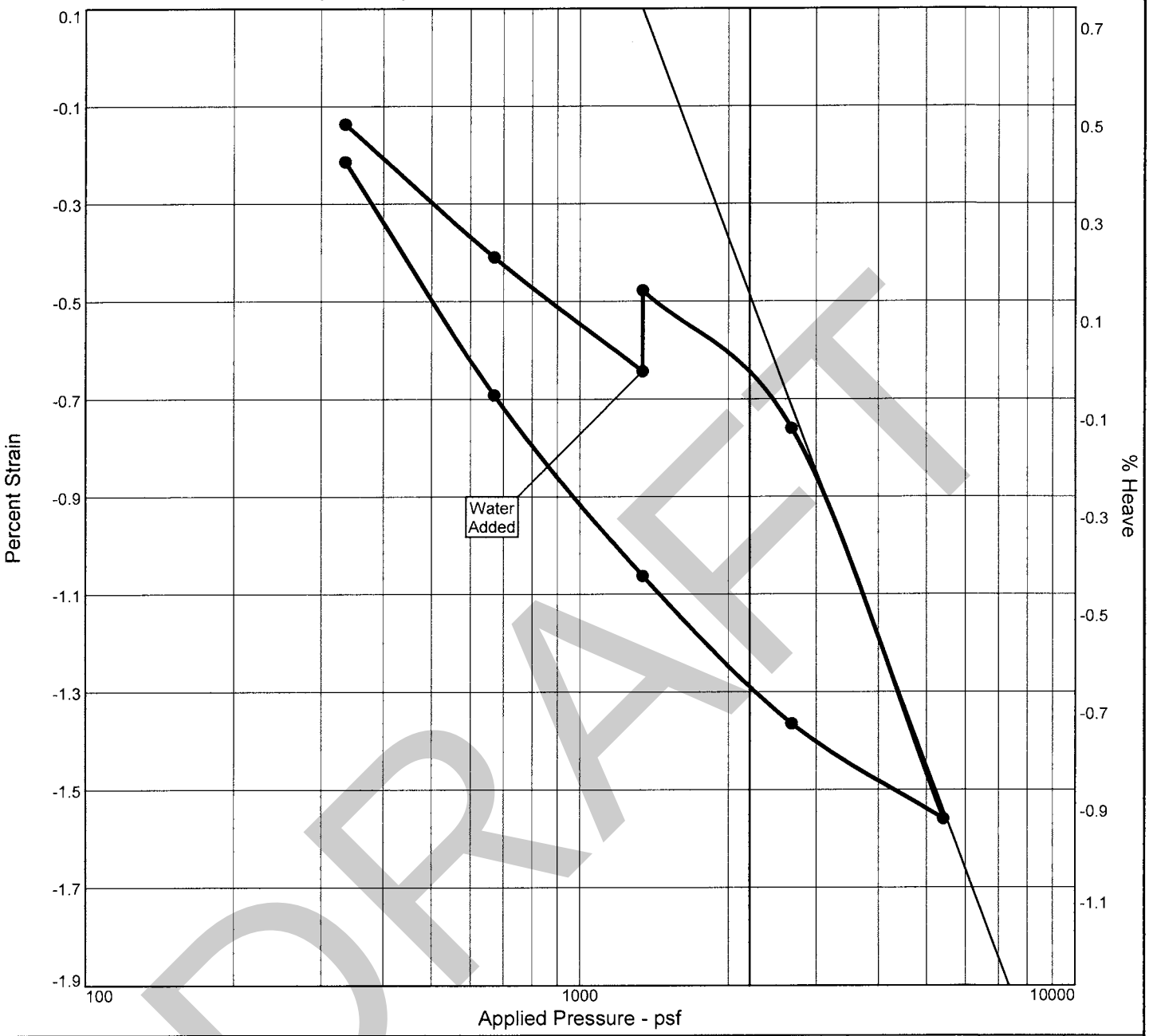
Source of Sample: B-6 Ph. 2 Depth: 3'



SOILS ENGINEERING, INC.

Figure B-5

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
66.1 %	13.5 %	107.4	N/A	N/A	2.65	336	2598	0.04	0.02	861.85	0.2	0.540

MATERIAL DESCRIPTION	USCS	AASHTO
SANDY CLAY	CL	N/A

Project No. 18413 **Client:** Meyer Civil Engineering, Inc.

Project: GBJPA Recharge Facilities

Source of Sample: B-7 Ph. 2 **Depth:** 6'

Remarks:

Test Date: 11/21/22

SOILS ENGINEERING, INC.

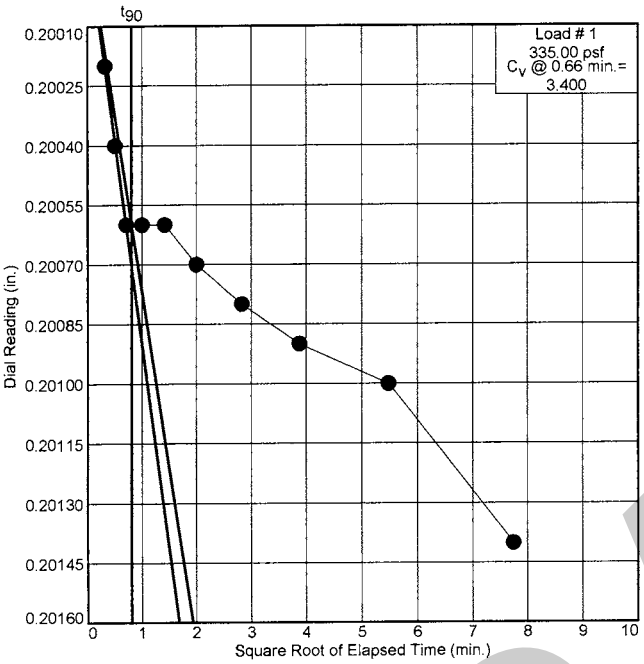
Figure B-6

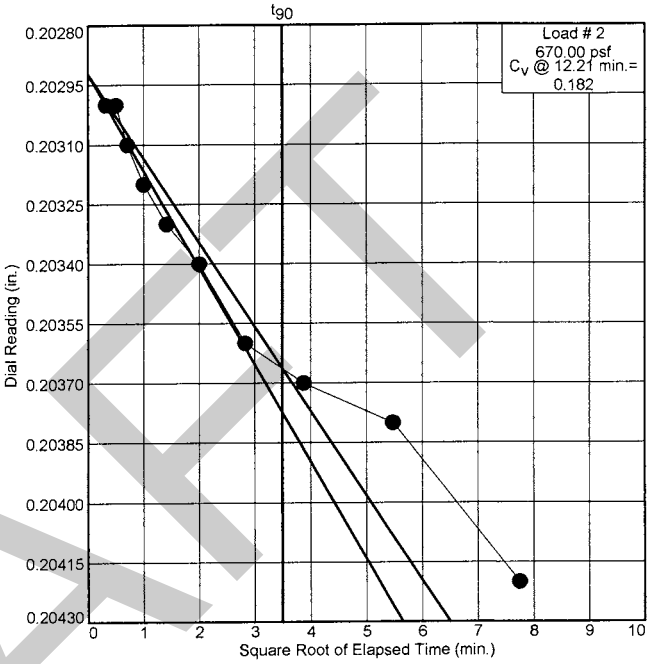
Checked By: AL

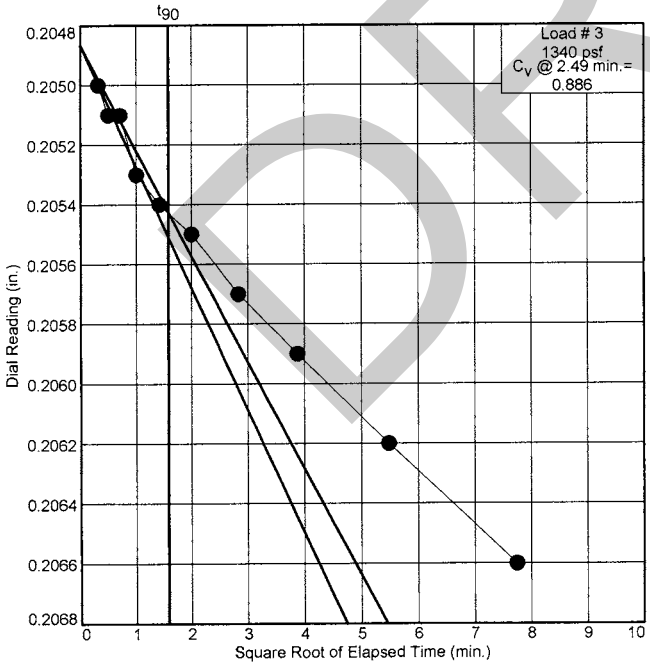
Dial Reading vs. Time

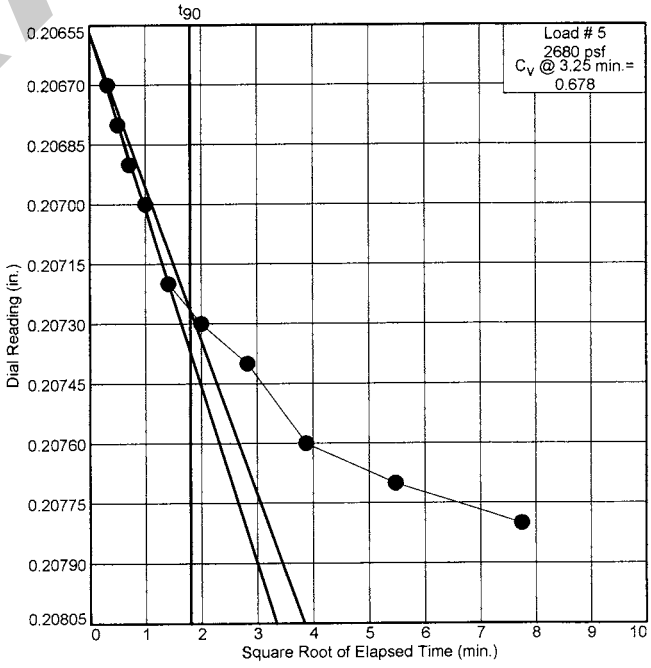
Project No.: 18413
Project: GBJPA Recharge Facilities

Source of Sample: B-7 Ph. 2 Depth: 6'









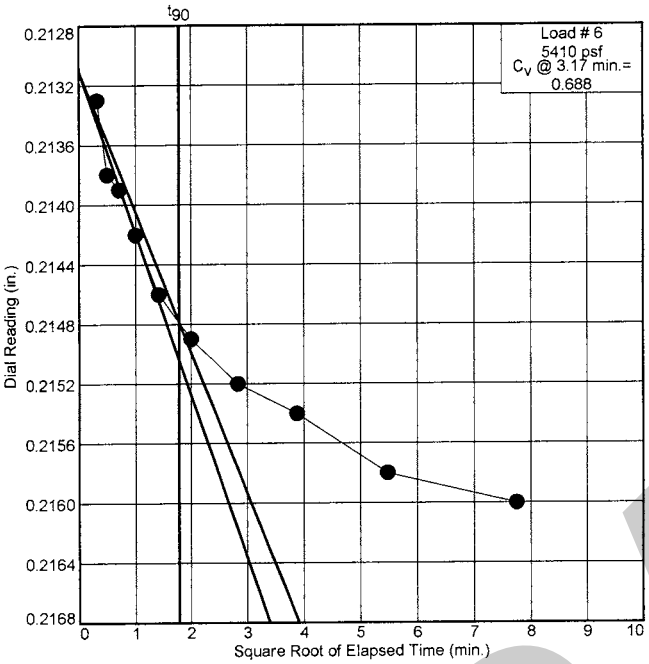
SOILS ENGINEERING, INC.

Figure B-6

Dial Reading vs. Time

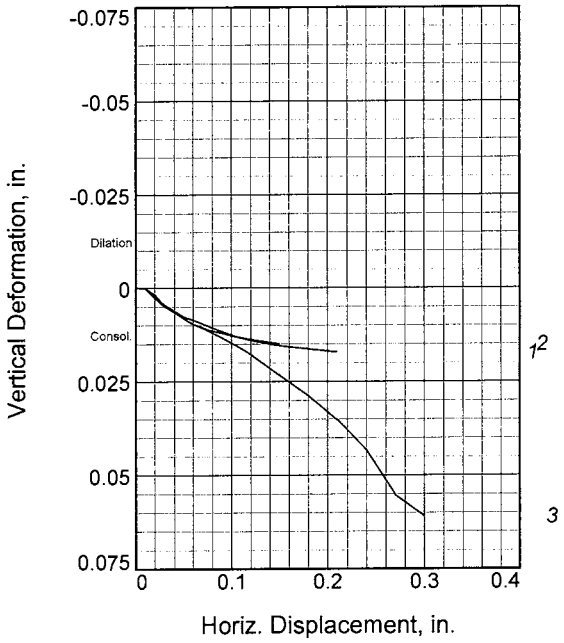
Project No.: 18413
Project: GBJPA Recharge Facilities

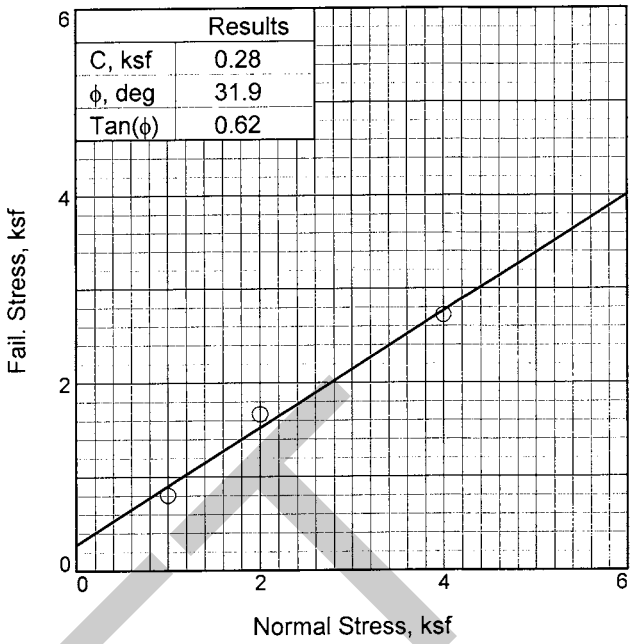
Source of Sample: B-7 Ph. 2 Depth: 6'

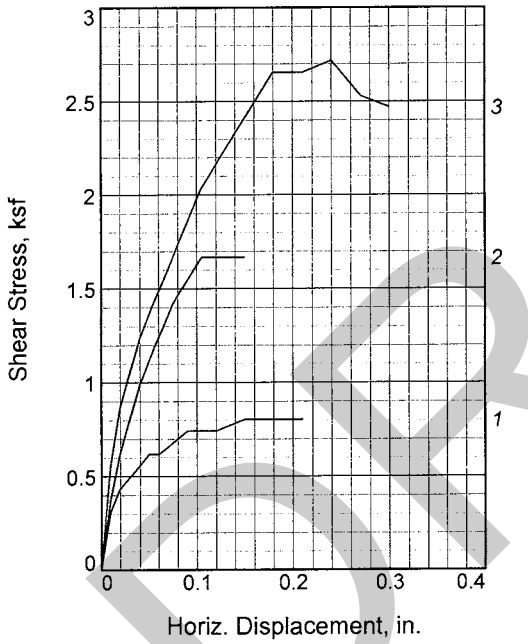


SOILS ENGINEERING, INC.

Figure B-6







Sample No.		1	2	3
Initial	Water Content, %	9.0	7.9	9.5
	Dry Density, pcf	98.8	101.6	101.4
	Saturation, %	35.2	33.2	39.8
	Void Ratio	0.6743	0.6290	0.6317
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	19.9	16.4	17.6
	Dry Density, pcf	98.8	101.6	101.4
	Saturation, %	78.3	69.2	74.0
	Void Ratio	0.6743	0.6290	0.6317
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	4.00
Fail. Stress, ksf		0.80	1.67	2.72
Displacement, in.		0.15	0.11	0.24
Ult. Stress, ksf				
Displacement, in.				
Strain rate, in./min.		N/A	N/A	N/A

Sample Type: 2.5" X 6" TUBE
Description: CLAYEY SAND; brown, poorly graded, low plasticity, medium dense.
LL= N/A **PI=** N/A
Assumed Specific Gravity= 2.65
Remarks: Test Date: 12/06/22

Figure C-2

Client: Meyer Civil Engineering, Inc.

Project: GBJPA Recharge Facilities

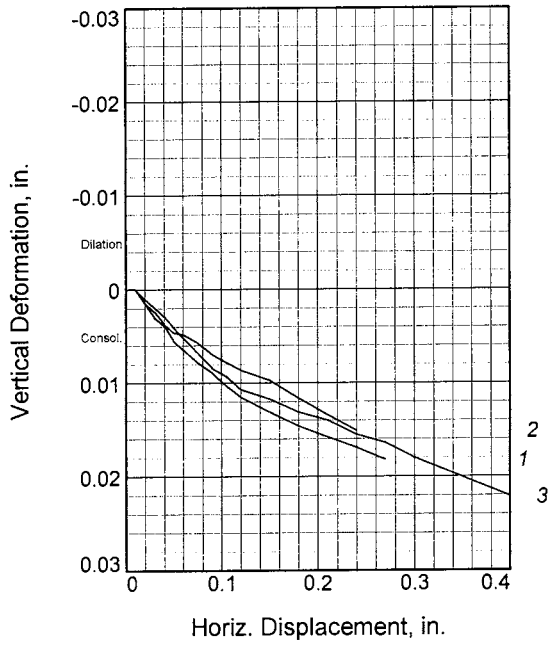
Source of Sample: B-7 Ph. 2 **Depth:** 3'

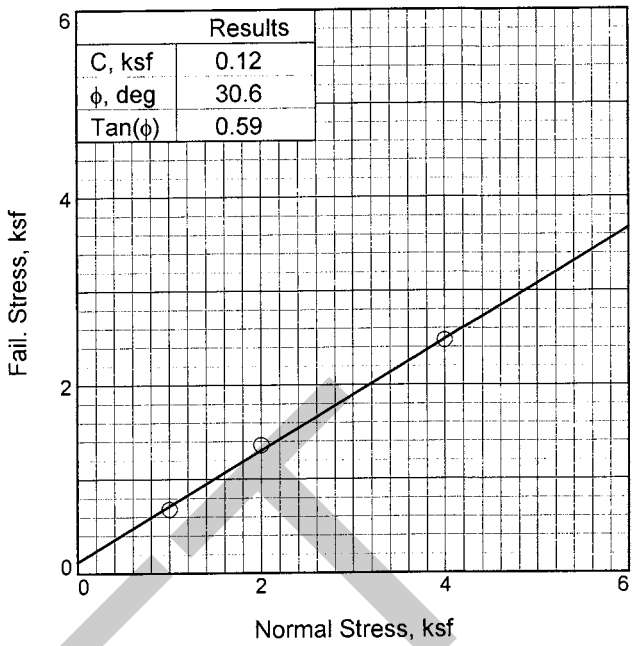
Proj. No.: 18413 **Date Sampled:** 11/09/22

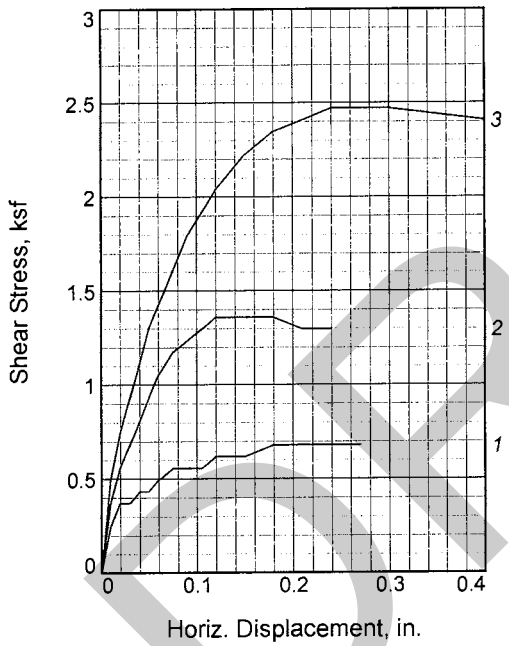
DIRECT SHEAR TEST REPORT

SOILS ENGINEERING, INC.

Tested By: DH **Checked By:** AL







Sample No.		1	2	3
Initial	Water Content, %	25.4	20.5	20.3
	Dry Density, pcf	92.1	96.5	96.7
	Saturation, %	84.5	76.0	75.6
	Void Ratio	0.7963	0.7146	0.7101
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	21.2	19.8	19.5
	Dry Density, pcf	92.1	96.5	96.7
	Saturation, %	70.5	73.4	72.7
	Void Ratio	0.7963	0.7146	0.7101
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	4.00
Fail. Stress, ksf		0.68	1.36	2.47
Displacement, in.		0.18	0.12	0.24
Ult. Stress, ksf				
Displacement, in.				
Strain rate, in./min.		N/A	N/A	N/A

Sample Type: 2.5" X 6" TUBE
Description: SANDY SILT; brown, poorly graded, with clay, low to medium plasticity.
LL= N/A **PI=** N/A
Assumed Specific Gravity= 2.65
Remarks: Test Date: 12/21/22

Figure C-3

Client: Meyer Civil Engineering, Inc.

Project: GBJPA Recharge Facilities

Source of Sample: B-8 Ph. 2 **Depth:** 3'

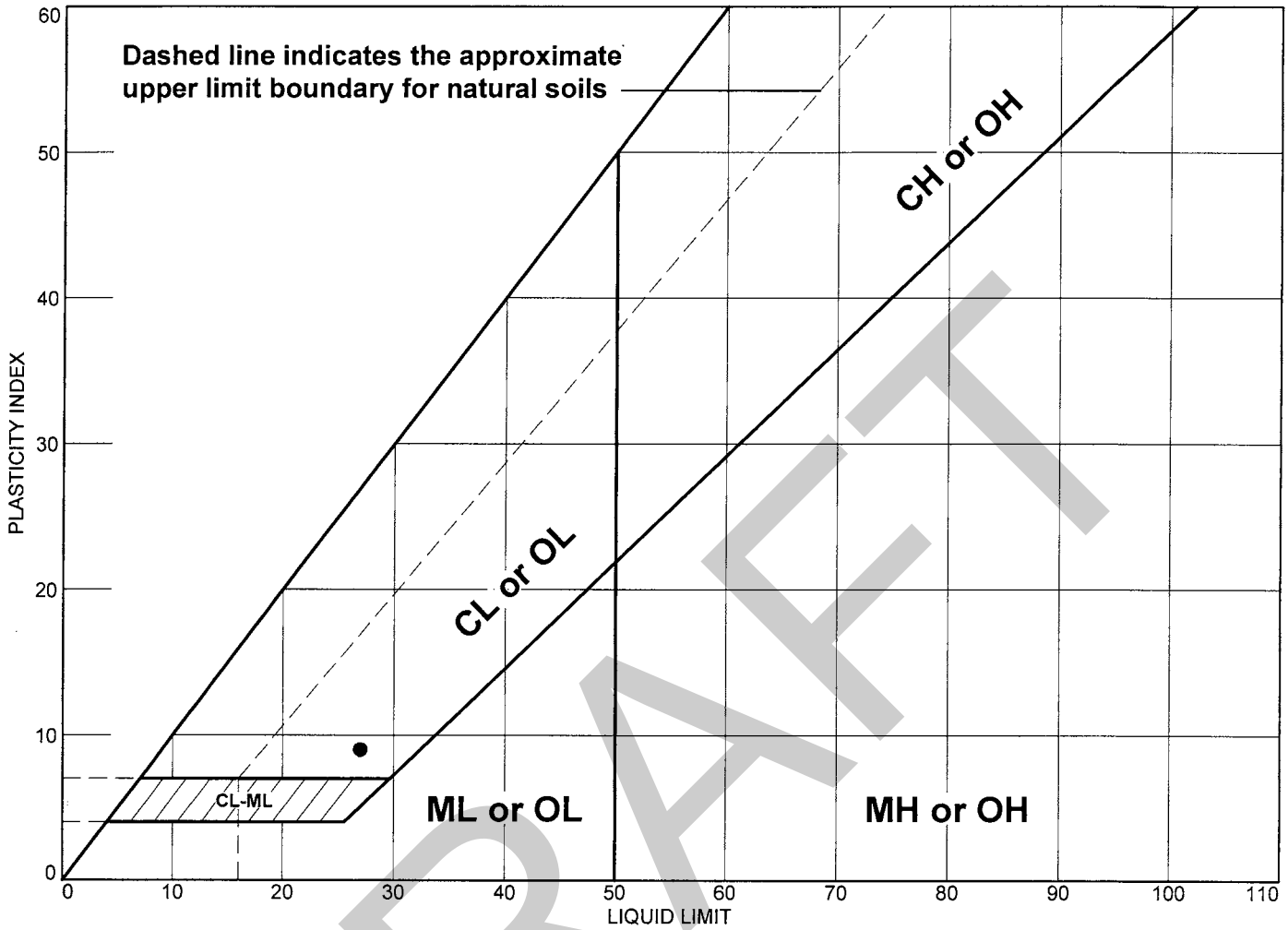
Proj. No.: 18413 **Date Sampled:** 11/09/22

DIRECT SHEAR TEST REPORT

SOILS ENGINEERING, INC.

Tested By: DH **Checked By:** AL

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	SANDY CLAY (B-5) (W/O Solution)	27	18	9	100	51	CL

Project No. 18413 **Client:** Meyer Civil Engineering, Inc.

Project: GBJPA Recharge Facilities

● **Location:** B-5 @ 0-5' **Depth:** 0-5' **Sample Number:** 84951

Remarks:

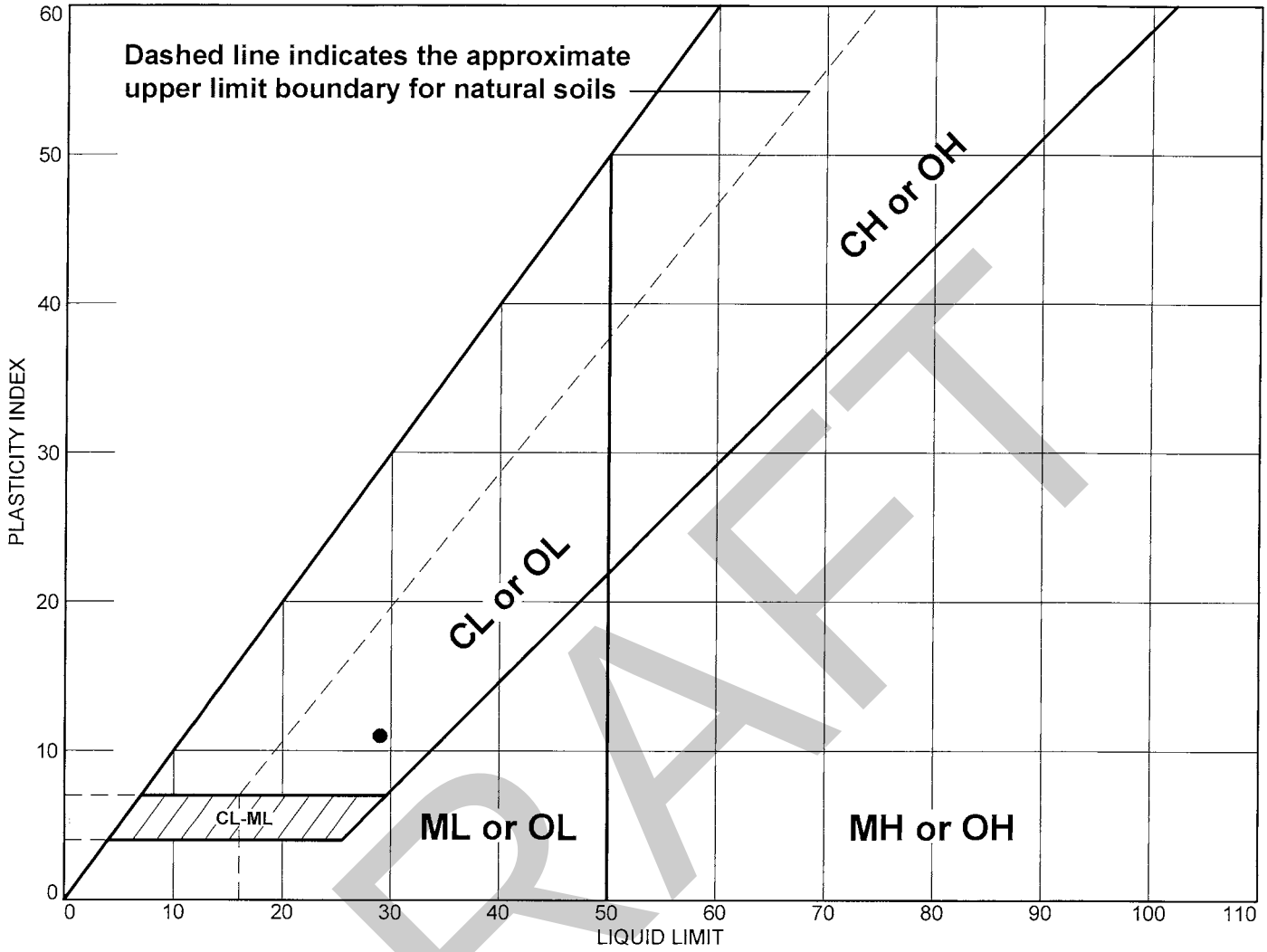
● Test Date: 12/27/22

SOILS ENGINEERING, INC.

Figure D-3

Tested By: LW **Checked By:** AL

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	SANDY CLAY (B-7) (W/O Solution)	29	18	11		59	CL

Project No. 18413 **Client:** Meyer Civil Engineering, Inc.

Project: GBJPA Recharge Facilities

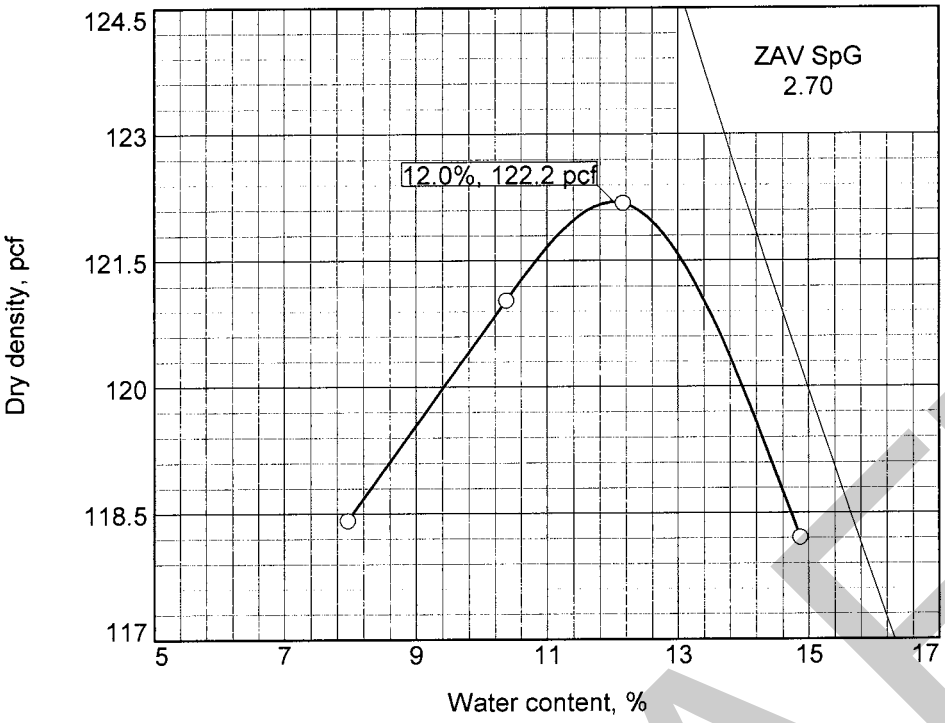
● **Location:** B-7 @ 0-5' **Depth:** 0-5' **Sample Number:** 84960

Remarks:

SOILS ENGINEERING, INC.

Figure D-4

COMPACTION TEST REPORT



Curve No.
1

Test Specification:
ASTM D 1557 Method A Modified

Hammer Wt.: 10 lb.
Hammer Drop: 18 in.
Number of Layers: five
Blows per Layer: 25
Mold Size: 0.03333 cu. ft.
Test Performed on Material Passing #4 **Sieve**

Soil Data

NM	N/A	**Sp.G.**	EST. 2.65
LL	N/A	**PI**	N/A
%>#4	N/A	**%<#200**	N/A
USCS	SM	**AASHTO**	N/A

TESTING DATA

	1	2	3	4	5	6
WM + WS	4107.0	4193.8	4246.0	4227.0		
WM	2174.2	2174.2	2174.2	2174.2		
WW + T #1	209.1	195.7	194.2	191.5		
WD + T #1	200.1	185.5	182.6	178.0		
TARE #1	87.1	87.2	87.2	87.2		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	8.0	10.4	12.2	14.9		
DRY DENSITY	118.4	121.0	122.2	118.2		

TEST RESULTS

Maximum dry density = 122.2 pcf

Optimum moisture = 12.0 %

Material Description

SILTY SAND; brown, fine, with clay, cohesive

Project No. 18413 **Client:** Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities

○ **Location:** TP-9 @ 0-7' **Depth:** 0-7' **Sample Number:** 85006

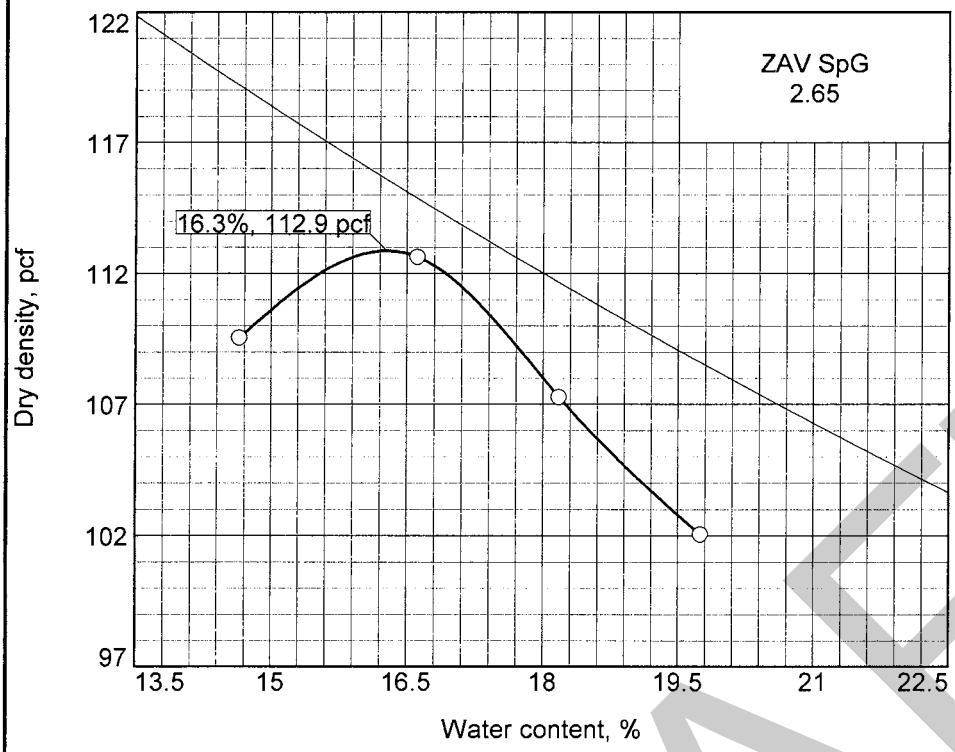
Remarks:
SAmpled No: 85006
Sampled by: MW
Date Tested: 11/28/22

SOILS ENGINEERING, INC.

Figure E-1

Tested By: RC **Checked By:** AL

COMPACTION TEST REPORT



Curve No.
2

Test Specification:
ASTM D 1557 Method B Modified

Hammer Wt.: 10 lb.
Hammer Drop: 18 in.
Number of Layers: five
Blows per Layer: 25
Mold Size: 0.03333 cu. ft.
Test Performed on Material Passing 3/8 in. **Sieve**

Soil Data

NM N/A **Sp.G.** 2.65
LL N/A **PI** N/A
%>3/8 in. N/A **%<#200** N/A
USCS ML **AASHTO** N/A

TESTING DATA

	1	2	3	4	5	6
WM + WS	4073.0	4160.1	4091.0	4021.7		
WM	2174.2	2174.2	2174.2	2174.2		
WW + T #1	205.2	200.2	208.6	219.4		
WD + T #1	190.1	184.1	189.9	197.6		
TARE #1	87.0	87.2	87.0	87.2		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	14.6	16.6	18.2	19.7		
DRY DENSITY	109.6	112.6	107.3	102.1		

TEST RESULTS

Maximum dry density = 112.9 pcf

Optimum moisture = 16.3 %

Material Description

SANDY SILT; brown, fine, with clay, low plasticity.

Project No. 18413 **Client:** Meyer Civil Engineering, Inc.
Project: GBJPA Recharge Facilities

○ **Location:** TP-14 @ 0-7' **Depth:** 0-7' **Sample Number:** 85011

Remarks:
Sample NO: 85011
Sampled by:MW
Date Tested:11/28/22

SOILS ENGINEERING, INC.

Figure E-2

Tested By: RC **Checked By:** AL

EXPANSION INDEX (ASTM D4829)

The Expansion Index test is designed to measure a basic index property of soil and in this respect is comparable to other index tests such as the Atterberg Limits. In formulating the test procedures, no attempt has been made to duplicate any particular moisture or loading conditions which may occur in the field. Rather, an attempt has been made to control all variables which influence the expansive characteristics of a particular soil and still retain a practical test for general engineering usage. Near surface soils were obtained and tested for expansiveness. Test results are presented on the Laboratory Testing Recap Table 1.

PERMEABILITY TESTS (ASTM D2434)

Permeability of in-situ soil specimens were determined by the Constant Head Method. Test results are shown on the Laboratory Testing Recap Table 1.

SOIL CORROSIVITY (SO_4 / pH / Chlorides)

Tests for Soluble Sulfates (SO_4), Soluble Chlorides (Cl), and pH values were performed on two (2) composite sample taken from the upper 5 feet of B-5 and B-7, to determine the corrosion potential of the soils. Corrosion prevention measures and the extent to which measures should be taken (if any) should be addressed with the corrosion engineer. Soluble Sulfates and Soluble Chlorides values were determined according to EPA 300.0M. The pH values were determined according to EPA 9045C. Result of the constituent is discussed in the report, under the **Soil Corrosivity** section and presented in this section.

APPENDIX D

SEISMIC INVESTIGATION

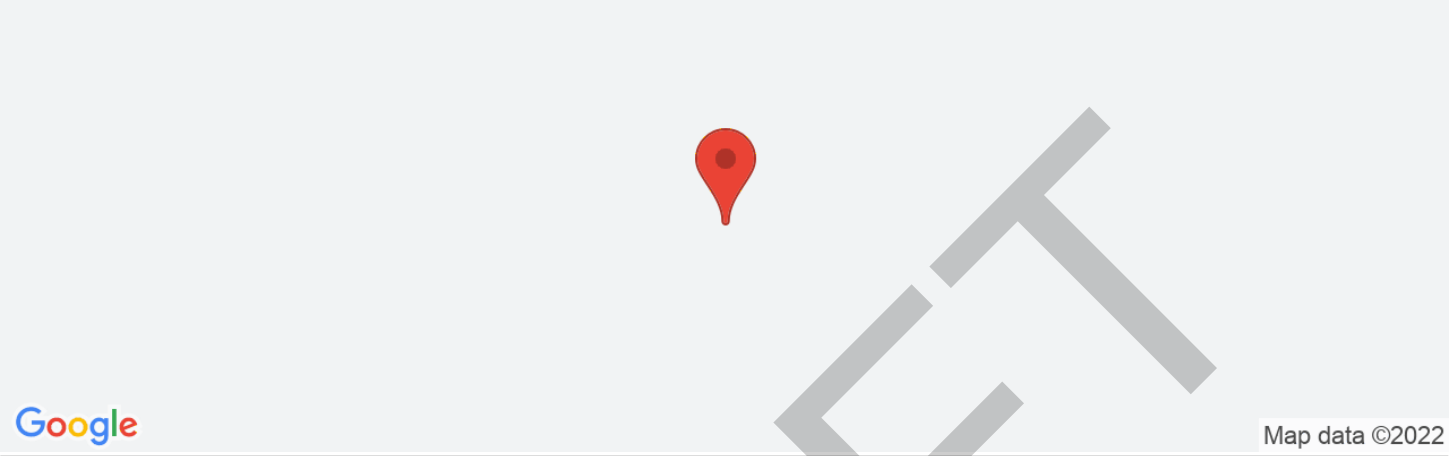
SEISMIC DESIGN INFORMATION ASCE 7 Hazards Report

EQFAULT
Version 3.00

California Fault Map

18413 GBJPA Kern Fan Recharge Facilities Phase 2

Latitude, Longitude: 35.358081, -119.265315



Date	8/23/2022, 11:27:07 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	0.947	MCE_R ground motion. (for 0.2 second period)
S_1	0.356	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.062	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	0.708	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1.121	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.416	MCE_G peak ground acceleration
F_{PGA}	1.184	Site amplification factor at PGA
PGA_M	0.492	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	0.947	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.034	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.356	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.392	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.416	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.916	Mapped value of the risk coefficient at short periods

Type	Value	Description
C_{R1}	0.908	Mapped value of the risk coefficient at a period of 1 s
C_V	1.273	Vertical coefficient

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*                    *
*    E Q F A U L T   *
*                    *
*    Version 3.00    *
*                    *
**********************

     DETERMINISTIC ESTIMATION OF
PEAK ACCELERATION FROM DIGITIZED FAULTS


JOB NUMBER: 18413-S
                                                DATE: 08-23-2022

JOB NAME: 18413 - South

CALCULATION NAME: Test Run Analysis

FAULT-DATA-FILE NAME: CGSFLTE.DAT


SITE COORDINATES:
   SITE LATITUDE:  35.3581
   SITE LONGITUDE:  119.2653

SEARCH RADIUS:   100  mi

ATTENUATION RELATION:   3) Boore et al. (1997) Horiz. - NEHRP D (250)
   UNCERTAINTY (M=Median, S=Sigma): M       Number of Sigmas:  0.0
   DISTANCE MEASURE:  cd_2drp
   SCOND:   0
   Basement Depth:  5.00 km     Campbell SSR:        Campbell SHR:
   COMPUTE PEAK HORIZONTAL ACCELERATION

FAULT-DATA FILE USED:  CGSFLTE.DAT


MINIMUM DEPTH VALUE (km):  0.0
```

EQFAULT SUMMARY

DETERMINISTIC SITE PARAMETERS

Page 1

ABBREVIATED FAULT NAME	APPROXIMATE DISTANCE mi (km)	ESTIMATED MAX. EARTHQUAKE EVENT MAXIMUM EARTHQUAKE MAG.(Mw)	PEAK SITE ACCEL. g	EST. SITE INTENSITY MOD.MERC.
Kern Front	9.8(15.8)	6.3	0.220	IX
WHITE WOLF	21.1(34.0)	7.3	0.213	VIII
SAN ANDREAS - Cho-Moj M-1b-1	27.0(43.4)	7.8	0.189	VIII
SAN ANDREAS - 1857 Rupture M-2a	27.0(43.4)	7.8	0.189	VIII
SAN ANDREAS - Whole M-1a	27.0(43.4)	8.0	0.210	VIII
SAN ANDREAS - Carrizo M-1c-2	27.0(43.4)	7.4	0.153	VIII
PLEITO THRUST	27.0(43.5)	7.0	0.151	VIII
SAN ANDREAS - Cholame M-1c-1	34.0(54.7)	7.3	0.122	VII
BIG PINE	39.8(64.1)	6.9	0.087	VII
GARLOCK (West)	41.8(67.3)	7.3	0.104	VII
SAN JUAN	41.8(67.3)	7.1	0.093	VII
SAN GABRIEL	49.6(79.9)	7.2	0.086	VII
SANTA YNEZ (East)	56.9(91.5)	7.1	0.074	VII
NORTH CHANNEL SLOPE	57.5(92.6)	7.4	0.104	VII
M.RIDGE-ARROYO PARIDA-SANTA ANA	57.6(92.7)	7.2	0.093	VII
GREAT VALLEY 14	58.2(93.6)	6.4	0.061	VI
SAN CAYETANO	58.9(94.8)	7.0	0.083	VII
SAN LUIS RANGE (S. Margin)	59.7(96.0)	7.2	0.091	VII
SANTA YNEZ (West)	61.6(99.1)	7.1	0.069	VI
SAN ANDREAS - Mojave M-1c-3	62.4(100.4)	7.4	0.080	VII

RED MOUNTAIN	63.5(102.2)	7.0	0.078	VII
SAN ANDREAS - Parkfield	64.4(103.6)	6.5	0.049	VI
LOS ALAMOS-W. BASELINE	67.4(108.5)	6.9	0.071	VI
VENTURA - PITAS POINT	68.5(110.3)	6.9	0.070	VI
LOS OSOS	69.1(111.2)	7.0	0.073	VII
HOLSER	69.8(112.3)	6.5	0.056	VI
SANTA SUSANA	69.8(112.3)	6.7	0.062	VI
LIONS HEAD	69.9(112.5)	6.6	0.059	VI
GARLOCK (East)	70.2(112.9)	7.5	0.077	VII
RINCONADA	70.2(113.0)	7.5	0.077	VII
OAK RIDGE (Onshore)	70.6(113.7)	7.0	0.072	VI
OAK RIDGE MID-CHANNEL STRUCTURE	70.8(114.0)	6.6	0.058	VI
CASMALIA (Orcutt Frontal Fault)	72.5(116.6)	6.5	0.054	VI
NORTHRIDGE (E. Oak Ridge)	73.1(117.6)	7.0	0.070	VI
So. SIERRA NEVADA	73.1(117.6)	7.3	0.082	VII
GREAT VALLEY 13	73.4(118.2)	6.5	0.053	VI
SIMI-SANTA ROSA	73.4(118.2)	7.0	0.070	VI
CHANNEL IS. THRUST (Eastern)	75.2(121.0)	7.5	0.089	VII
SIERRA MADRE (San Fernando)	78.4(126.2)	6.7	0.056	VI
OAK RIDGE(Blind Thrust Offshore)	81.8(131.7)	7.1	0.067	VI

DETERMINISTIC SITE PARAMETERS

ABBREVIATED FAULT NAME	APPROXIMATE DISTANCE mi (km)	ESTIMATED MAX. EARTHQUAKE EVENT: MAXIMUM EARTHQUAKE MAG.(Mw)	ESTIMATED MAX. EARTHQUAKE EVENT: PEAK SITE ACCEL. g	ESTIMATED MAX. EARTHQUAKE EVENT: EST. SITE INTENSITY MOD.MERC.
ANACAPA-DUME	82.7(133.1)	7.5	0.083	VII
LENWOOD-LOCKHART-OLD WOMAN SPRGS	85.3(137.2)	7.5	0.066	VI
SAN ANDREAS (Creeping)	85.5(137.6)	6.2	0.033	V
VERDUGO	86.7(139.6)	6.9	0.058	VI
LITTLE LAKE	86.9(139.8)	6.9	0.048	VI
MALIBU COAST	90.1(145.0)	6.7	0.051	VI
HOSGRI	90.3(145.3)	7.5	0.063	VI
SIERRA MADRE	90.9(146.3)	7.2	0.065	VI
GREAT VALLEY 12	91.3(146.9)	6.3	0.041	V
OWENS VALLEY	92.3(148.6)	7.6	0.066	VI
SANTA CRUZ ISLAND	95.6(153.8)	7.0	0.057	VI
SANTA MONICA	96.2(154.8)	6.6	0.046	VI
HOLLYWOOD	97.6(157.0)	6.4	0.041	V
SANTA ROSA ISLAND	99.0(159.4)	7.1	0.058	VI

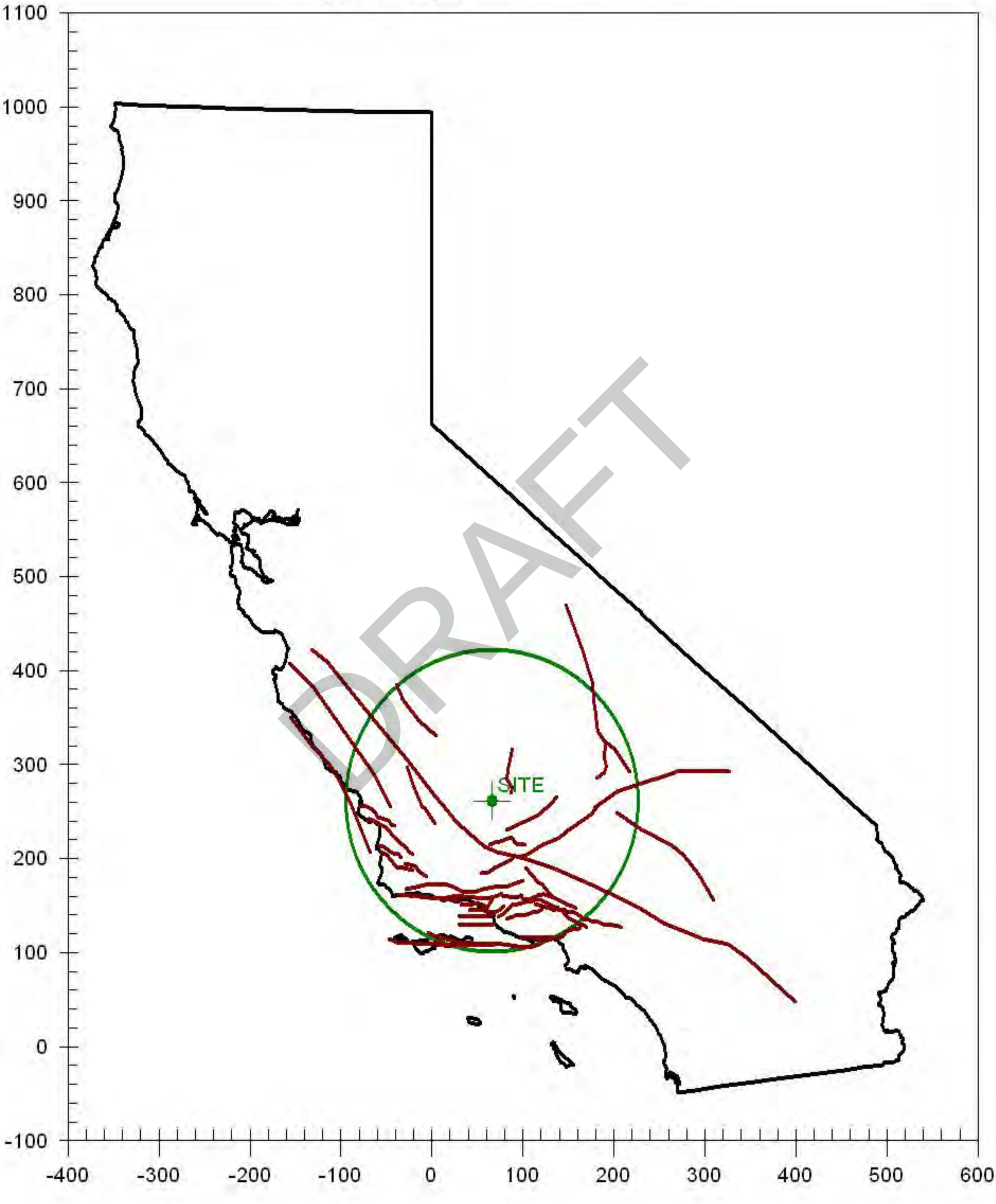
-END OF SEARCH- 54 FAULTS FOUND WITHIN THE SPECIFIED SEARCH RADIUS.

THE Kern Front FAULT IS CLOSEST TO THE SITE.
IT IS ABOUT 9.8 MILES (15.8 km) AWAY.

LARGEST MAXIMUM-EARTHQUAKE SITE ACCELERATION: 0.2201 g

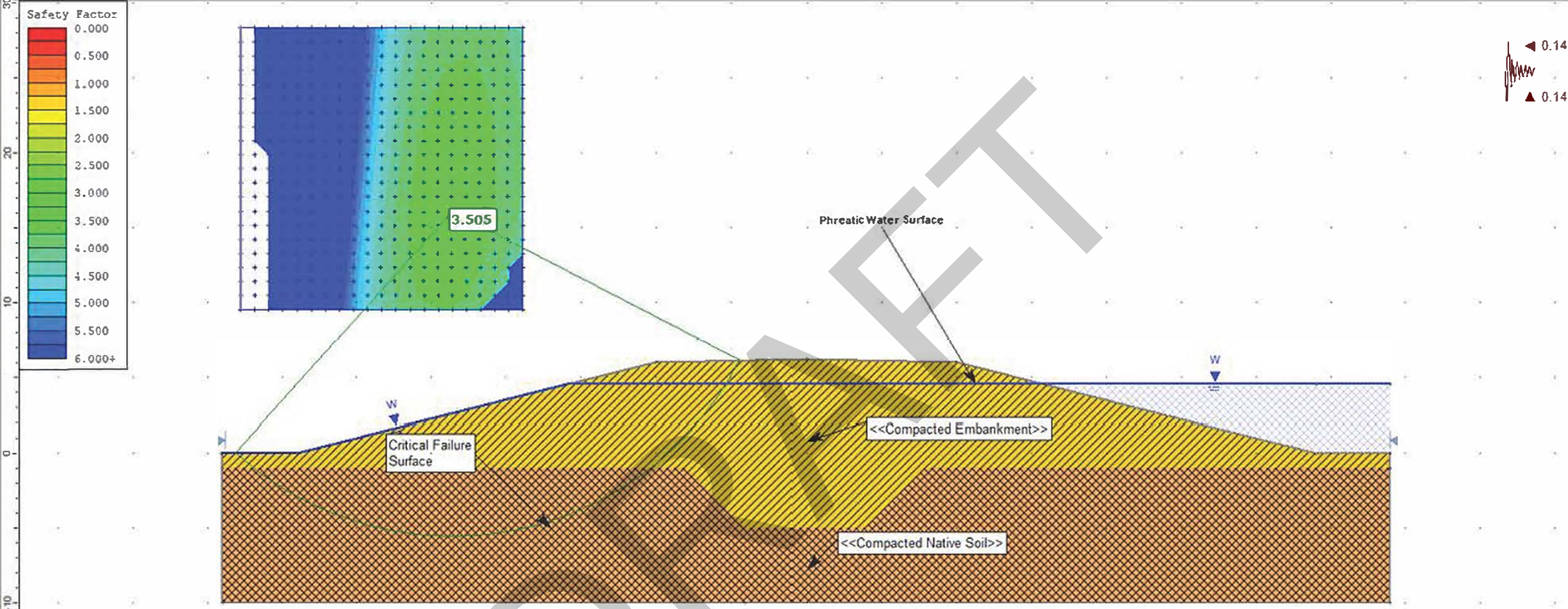
CALIFORNIA FAULT MAP

18413 - South



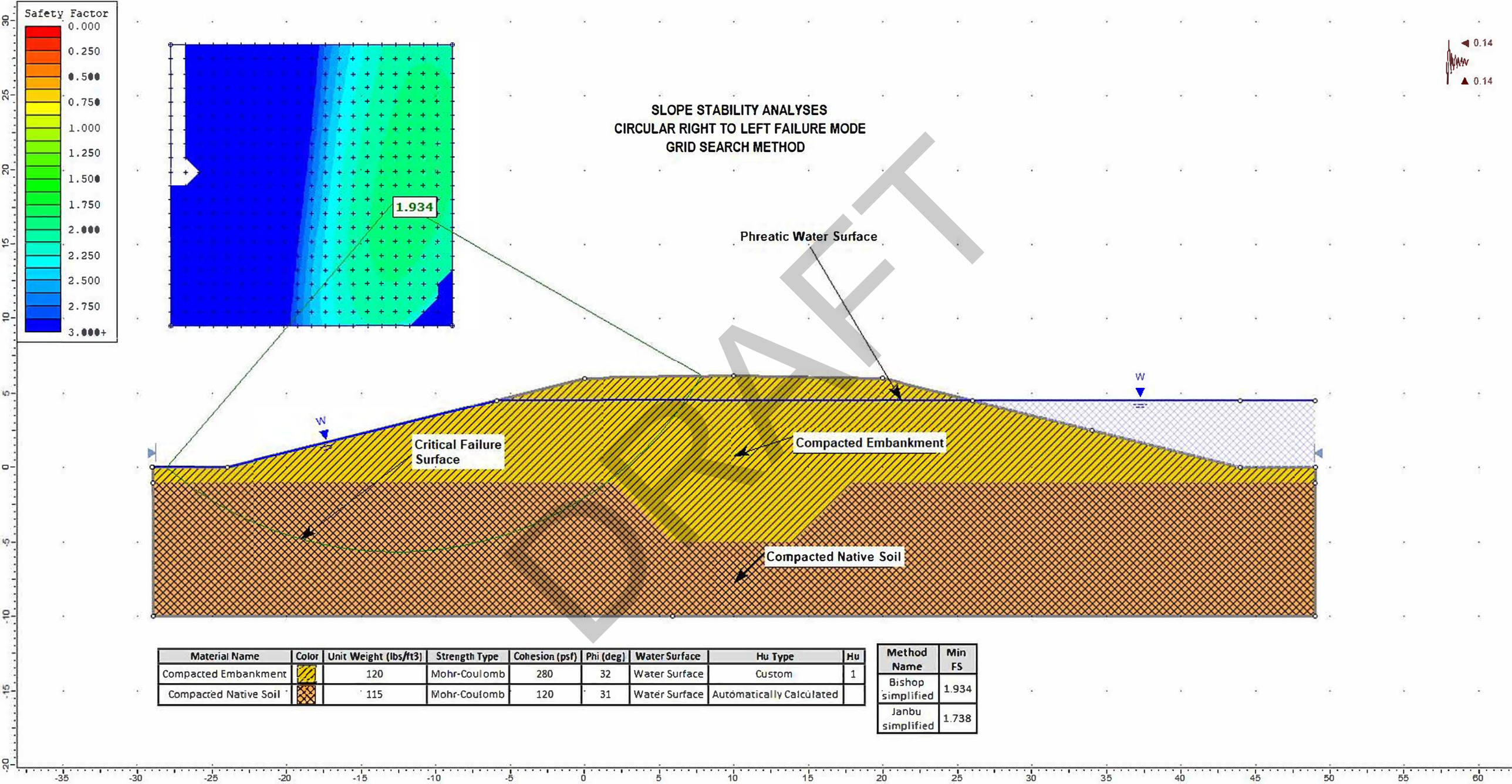
APPENDIX E

SLOPE STABILITY ANALYSIS



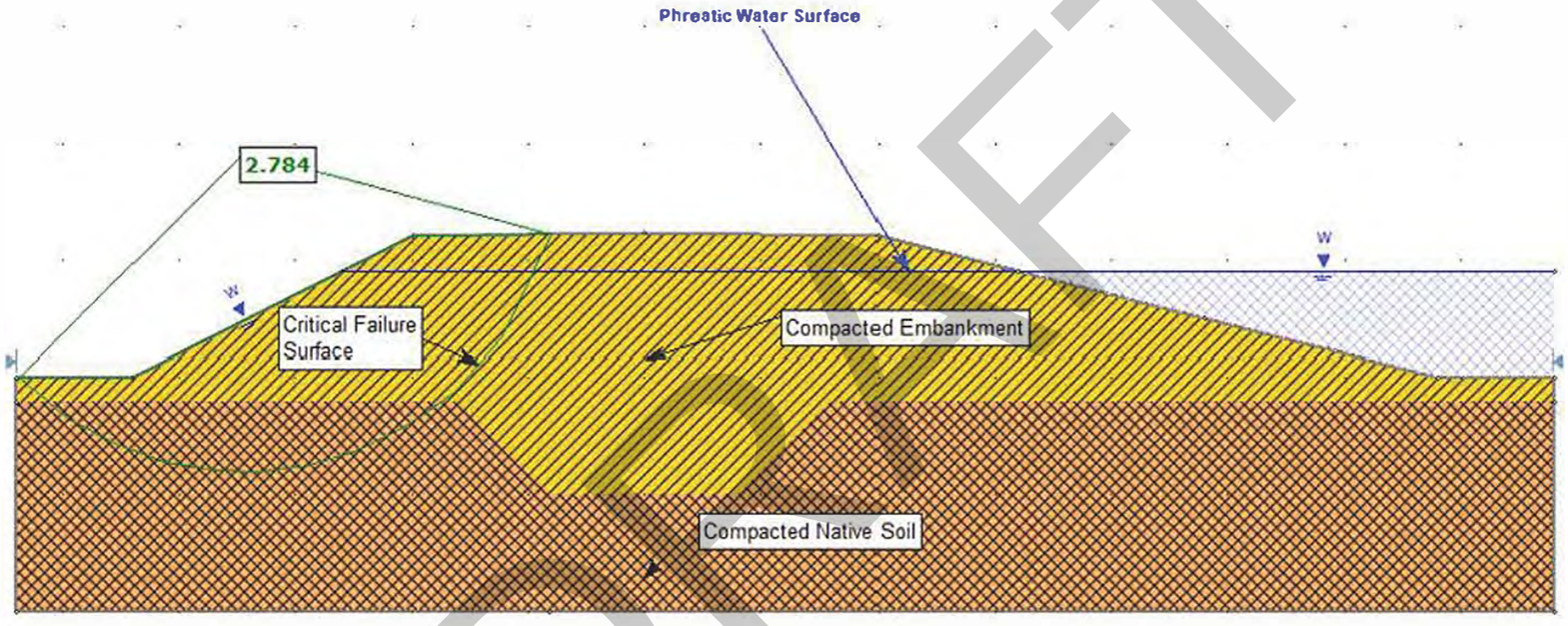
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Compacted Embankment		120	Mohr-Coulomb	280	32	Water Surface	Custom	1
Compacted Native Soil		115	Mohr-Coulomb	120	31	Water Surface	Automatically Calculated	

Method Name	Min FS
Bishop simplified	3.505
Janbu simplified	3.188



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Compacted Embankment		120	Mohr-Coulomb	280	32	Water Surface	Custom	1
Compacted Native Soil		115	Mohr-Coulomb	120	31	Water Surface	Automatically Calculated	

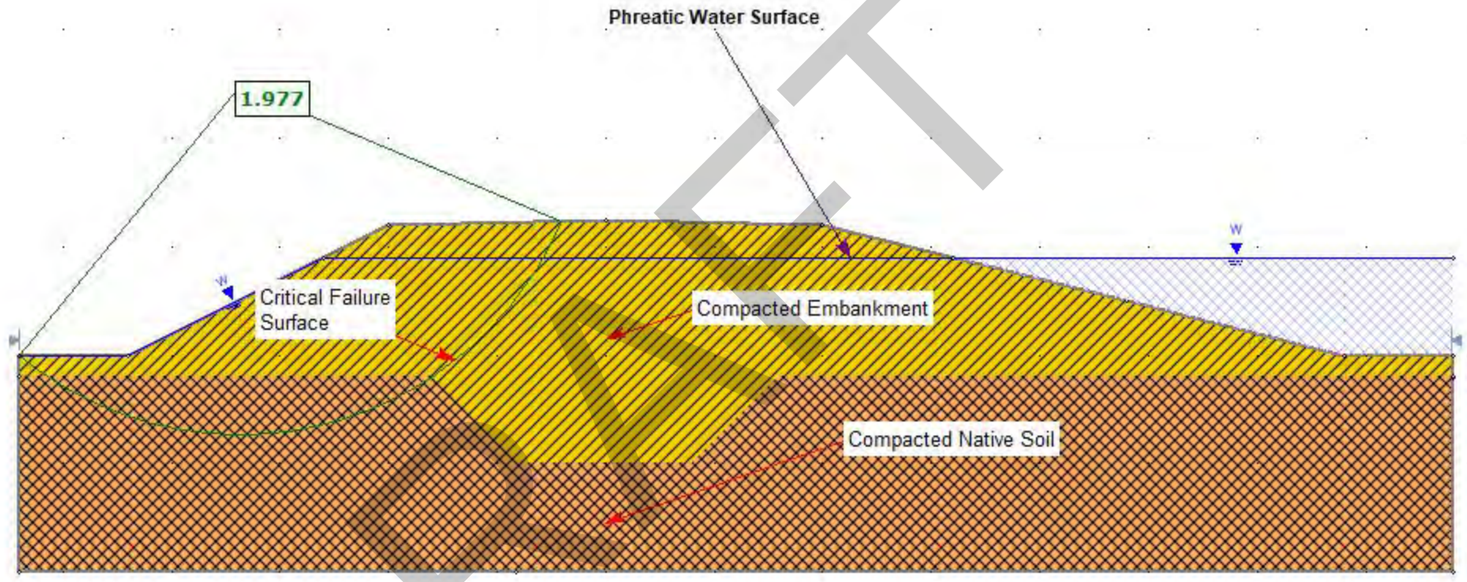
Method Name	Min FS
Bishop simplified	1.934
Janbu simplified	1.738



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru Type	Ru
Compacted Embankment		120	Mohr-Coulomb	280	32	Water Surface	Custom	1
Compacted Native Soil		115	Mohr-Coulomb	120	31	Water Surface	Automatically Calculated	

Method Name	Min FS
Ordinary/ Fellenius	2.784
Bishop simplified	2.915

SLOPE STABILITY ANALYSES
NON-CIRCULAR RIGHT TO LEFT FAILURE MODE
REFINED-ANALYSES SEARCH METHOD



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Compacted Embankment		120	Mohr-Coulomb	280	32	Water Surface	Custom	1
Compacted Native Soil		115	Mohr-Coulomb	120	31	Water Surface	Automatically Calculated	

Method Name	Min FS
Ordinary/ Fellenius	1.893
Bishop simplified	1.977

Preliminary Opinion of Construction Cost
for Joint Works Project (Alt. 5)

GBJPA -
Kern Fan Joint Works Project
Conceptual Opinion of Probable Construction Costs

Report Date

Prepared under the supervision of Joseph Long, Professional Civil Engineer in the State of California.

Prepared by:

David T. Phelps, PE
Cole Warrick, PE

Revision	Description	Author		Quality Check		Independent Review	
00	Concept	Phelps Warrick Dahl		Warrick		Long	

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1.0 INTRODUCTION

1.1 OPINION OF PROBABLE CONSTRUCTION COSTS INTENT AND PURPOSE

Stantec has prepared the following Conceptual Design Level Opinion of Probable Construction to provide GBJPA with a budgetary evaluation of construction values for the Kern Fan Joint Works Project.

Stantec has no control over the costs of labor, materials, competitive bidding environments, unidentified field conditions, financial and/or commodity market conditions, or any other factors likely to affect the OPCC of this project, all of which are and will unavoidably remain in a state of change, especially in light of high market volatility attributable to Acts of God and other market forces or events beyond the control of the parties. As such, Client recognizes that this OPCC is based on normal market conditions, defined by stable resource supply/demand relationships, and does not account for extreme inflationary or deflationary market cycles. Client further acknowledges that this OPCC is a "snapshot in time" and that the reliability of this OPCC will degrade over time. Client agrees that Stantec cannot and does not make any warranty, promise, guarantee or representation, either express or implied that proposals, bids, project construction costs, or cost of O&M functions will not vary significantly from Stantec's good faith effort in the preparation of the following information.

1.2 BASIS OF QUANTITIES

The Basis of Quantities was developed through material quantity calculations obtain as part of the conceptual design efforts for the portion of the project that requires potential cooperation with the Kern County Water Agency. It is noted that material quantities were prepared based on available information and without the benefit of a design level topographic survey. It is anticipated as the project progresses from the conceptual stage into design phases, material will be adjusted to reflect the actual design. This estimate is based on conceptual project figures (as shown in TM 1) and is to be used only for budgetary purposes and comparison

The following elements have been included in the development of the attached. Estimates.

2.0 BASIS OF COST OPINION

Stantec has prepared the following Opinion of Probable Construction based on the following operational assumptions of the Kern Fan Conveyance System:

Aqueduct Turn-out /Turn-in Assumptions –

- The existing Greater Bakersfield 1 and 2 turn out structures will be repurposed for both the Kern Fan Conveyance and the Cross-Valley Canal intake structure.
- The existing downstream siphons will be replaced as part of the repurposing of the turn out structures.
- A new transition structure downstream of the existing turnout structures will be constructed for a combined use conveyance structure.
- A new box culvert siphon will replace the existing pipeline siphons
- The existing drainage canal siphon will be removed and reconstructed as a overhead aqueduct structure.

Conveyance Systems Assumptions –

- Canal lining joints not sealed
- Canal lining thickness is 3.5” un-reinforced
- Earthwork quantities estimated without a topo survey, subject to refinement
- Transitions on grade are 7” thick reinforced concrete
- Structural wall concrete thicknesses assumed to be 30” at base, 18” at the top for conceptual estimating only. To be refined later
- Structural concrete inverts thicknesses assumed to be 30” for conceptual estimating only. To be refined later

3.0 COST DEVELOPMENT ASSUMPTIONS

Stantec developed the following Opinion of Probable Construction Costs used current pricing for materials directly from vendors as appropriate, and recent bid costs for similar projects. Cost factor have been applied as follows:

- All costs are present value
- Material and labor escalation assumed to be 5% for 1 year
- Staging contingency is assumed to be 20% to prevent flow delivery interruption
- Estimating contingency is assumed to be 15%, Mobilization is assumed to be 5% total project cost, Ancillary items assumed to be 5% of total project cost
- ROW costs are excluded for the purposes of this OPCC

Stantec

ENGINEERS OPINION OF CONSTRUCTION COST - AACE LEVEL 5
Kern Fan Groundwater Storage Project
November 2022 OPCC

Project: GBJPA Kern Fan Groundwater Storage Project
Location : Kern Count, CA

Date: 11/30/2022 by: S. Urbon
Checked: 12/13/2022 by: C. Warrick, S. Fox

ITEM NO.	DESCRIPTION	UNIT	APPROX. QUANTITY	UNIT PRICE	AMOUNT	ESTIMATION METHOD	NOTES
1	REMOVE & SALVAGE EXISTING RCP TURNOUT PIPELINES	LF	750	$1,000	$750,000		$1,000 per LF of pipe includes excavation, salvage of existing pipe, and haul away.
2	RELOCATION OF SWP TURNOUT CONTROL BUILDING AND ELECTRICAL	LS	1	$850,000	$850,000	Based on Recent Bids	Based on AVEK High Desert Water Bank plus demolition allocation.
3	PREWETTING / CONSOLIDATION	LS	1	$500,000	$500,000		
4	INLET TRANSITION STRUCTURE CONCRETE	CY	3,096	$1,600	$4,954,000	Caltrans cost data.	30-Inch base and 24-Inch walls assumed
	Bifurcation Inlet?	CY	392	$600	$236,000	Caltrans cost data.	Thickness assumed to be 7-in.
5	CANAL EARTHWORK	CY	343,500	$7	$2,405,000	Based on Recent Bids	Based on AVEK High Desert Water Bank
6	CANAL TRIMING	SY	164,000	$5	$820,000	Based on Recent Bids	Based on Friant-Kern Canal
7	CANAL LINING	SY	164,000	$35	$5,740,000	Based on Recent Bids	Based on Friant-Kern Canal, 3.5-inches thick and unreinforced
8	PUMPING PLANT 1 FOREBAY CONCRETE	CY	1,046	$600	$627,600	Caltrans cost data.	Thickness assumed to be 7-in.
9	SIPHON EXTENSION	LS	1	$1,191,000	$1,191,000		See "Item 9 Brk" tab

GBPJA SUBTOTAL: $18,073,600

Contingency, Mobilization, & Ancillary Items	*25%*	*$4,518,400.00*
GBPJA Staging Contingency	*20%*	*$3,614,720.00*
Material and Labor Escalation:	*5%*	*$903,680.00*

PRELIMINARY JOINT WORK ESTIMATE: $27,111,000

NOTES	
1	All costs reported above are present value.

Phone No. (661) 634-1400

Mailing Address
3200 Rio Mirada Drive
Bakersfield, CA 93308

January 26, 2023

Mr. Dan Bartel
Rosedale-Rio Bravo Water Storage District
849 Allen Road
Bakersfield, CA 93314

Re: Alternative No. 5 for the Kern Fan Groundwater Storage Project

Dear Mr. Bartel:

The Kern County Water Agency (Agency) has reviewed the Groundwater Banking Joint Powers Authority (GBJPA) Kern Fan Project Conveyance Alternative 5 (Alternative) presentation and Technical Memorandum No. 1 provided by Rosedale-Rio Bravo Water Storage District (Rosedale) at the October 17, 2022 Cross Valley Canal (CVC) Advisory Committee meeting and would like to provide the following comments.

The Draft Environmental Impact Report (DEIR) for the Kern Fan Groundwater Storage Project did not analyze the potential impacts of the proposed Alternative. Absent a full analysis, it is not possible to determine whether the proposed Alternative will have significant impacts on the environment. The proposed Alternative must be analyzed pursuant to the California Environmental Quality Act (CEQA) prior to any consideration of the Alternative.

The Alternative attempts to solve a capacity problem in Pool No. 1 of the CVC that does not exist. The presentation provided indicated the proposed Alternative would resolve "capacity" issues in Pool No. 1 of the CVC; however, there are no existing capacity issues in Pool No. 1. Pool No. 1 has adequate freeboard to accommodate the design flows of 1,422 cubic feet per second (cfs) from the California Aqueduct (Aqueduct) when the Aqueduct elevations in Pool 28 are sufficient.

The flow analysis used in the presentation used a time period that does not represent typical forward flow conditions. Flow data from 2015 through 2018 were used to analyze capacity in forward flow operations; however, the CVC operated in reverse flow for the majority of the time in years 2015, 2016 and 2018 due to groundwater recovery operations. It is inappropriate to use flow data from reverse flow operations to justify the lack of sufficient elevation for forward flow operations. Further, during forward flow operations, there were only limited periods in which it was necessary to maximize CVC operations. the CVC operated to the maximum design flows in forward flow for a limited

time in 2017 when Article 21 water was available. Therefore, statements made in the presentation, such as "maintaining a flow of 1,422 cfs for consecutive days is not possible" and the "flow rate of 1,100 to 1,200 cfs is possible, but difficult" are unsubstantiated.

While no capacity issue exists in Pool No. 1, there are operational issues with Aqueduct water surface elevations that the Agency is working with the California Department of Water Resources (DWR) to address. The proposed Alternative does not resolve the DWR operating water surface elevation or operational issues in Pool 28 or adjacent pools and may further exacerbate Pool 28 and downstream Aqueduct operations. The designs provided indicate that there will be no change to the turnouts off of the Aqueduct and absent changes to the Aqueduct it is unclear how the proposed Alternative will improve deliveries off the Aqueduct. Operational issues in Pool 28 of the Aqueduct must be resolved prior to consideration of the proposed Alternative as the CVC will continue to be reliant upon sufficient Aqueduct water surface elevations.

The proposed Alternative anticipates increasing the forward flow capacity by realigning, increasing the size and potentially lowering the elevation of the conveyance facility between the Aqueduct turnouts and the new and existing canal inverts to improve forward flow operations; however, it is unclear from the data and information provided how the Alternative would operate during reverse flow conditions. There is insufficient data and no modeling provided to demonstrate that there will be no impact to reverse flow operations. For example, eliminating the bifurcation and widening and deepening the canal prism may eliminate the head necessary to deliver water to the Aqueduct. No information was provided on operations of the canals where they are bifurcated after the outlet transition structure or once joined back together in the pool near the pumping plants. The proposed Alternative must demonstrate that there will be no disparate flows or vortexing. In addition, the analysis should discuss the potential impacts to the A-plant and B-plants from the Alternative. Further, it is unclear how the proposed Alternative will impact operations, existing agreements, CVC capacities and delivery priorities. Therefore, more technical data is required to determine how the new facility would operate with the CVC pumping plants, new GBJPA turnout structure, CVC and Aqueduct under all operating scenarios.

The Agency is aware of the existing capacity issues within CVC Pool Nos. 2, 3 and 4 and is actively working with the CVC Participants to resolve the issues with the Hydraulic Improvement Project (HIP). The HIP are currently underway, and this project is not necessary to resolve existing issues within the CVC. The HIP must be completed prior to any consideration of the proposed Alternative, including operational modeling.

Historically, the CVC has had unused capacity that is made available to the CVC Participants based on their integrated canal percentages and/or through capacity sharing agreements between CVC Participants. Should Rosedale desire additional capacity within the CVC, there are opportunities to enter into agreements with other CVC Participants to utilize existing, unused capacity.

In conclusion, consideration of the proposed Alternative is premature as it has not been analyzed pursuant to CEQA. The presentation lacks important operational information and reverse flow analyses. The analysis provided is flawed as it uses reverse and low-flow forward flow data to justify the lack of sufficient pool elevation for maximum forward flow operations. In addition, the Alternative will not

resolve existing CVC capacity issues in Pool Nos. 2, 3 or 4 and attempts to solve issues in Pool No. 1 that do not exist. The Alternative should only be considered after the proper analyses are performed and the HIP are complete. Evaluation of the proposed Alternative is inappropriate at this time.

Agency staff are available to meet with Rosedale staff to ensure the Agency's concerns are adequately addressed. If you have any questions, please contact Monica Tennant of my staff at (661) 634-1419.

Sincerely,

Lauren Bauer
Water Resources Manager

Small Surface Water and Groundwater Storage Projects

NOFO No. R23AS00019

December 2022

Groundwater Banking Joint Powers Authority (GBJPA)

Phase 1 - Kern Fan Groundwater Storage Project

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1. Technical Proposal and Evaluation Criteria

1.1 Executive Summary

The executive summary should include:

- ***the date, applicant name, city, county, and State,***
- ***a one-paragraph summary of the work for which funding is being requested, including how funds will be used to accomplish specific project activities.***

The Phase 1 - Kern Fan Groundwater Storage Project ("Project", "Phase 1") is a joint effort between Irvine Ranch Water District ("IRWD", "Irvine") and the Rosedale-Rio Bravo Water Storage District ("RRBWSD", "Rosedale") operating collectively as the Groundwater Banking Joint Powers Authority ("GBJPA"). See **Figure 1** below to view Rosedale and Irvine service areas. The GBJPA is in the process of developing the Kern Fan Project, a regional groundwater bank in Kern County, California, immediately west of the City of Bakersfield that has the potential to store up to 100,000 acre-feet of surplus water made available during wet years. Due to the large scale of the Kern Fan Project, implementation has been broken up into multiple independent operational phases, with Phase 1 being a standalone project. Phase 1 includes the acquisition of 350 acres in Kern County for the construction and operation of recharge basins, recovery wells, and conveyance infrastructure and interconnections. The GBJPA proposes to utilize resources in a cost-share agreement with the United States Bureau of Reclamation ("Reclamation", "USBR") to implement the proposed Project. Once implemented, the Project has the potential to provide approximately 28,000 acre-feet of new groundwater storage and 14,480 acre-feet of drought year supply in the Central Valley to provide long-term water supply for agriculture, municipal users, and disadvantaged communities alike. USBR funds would be used to accomplish the following Project activities:

- West Enos and North Stockdale Recharge Basins - Construction of approximately 300 net wetted acres (85% of total acres) of direct recharge basins on the West Enos property (approximately 201 acres) and the Stockdale North property (approximately 147 acres).
- West Enos and North Stockdale Recovery Wells - Well drilling and equipping of four (4) conjunctive use recovery wells. Two wells will be located on the West Enos property and two wells will be located on the Stockdale North property.

The above-described Project facilities support the program requirements set forth by USBR. Phase 1 will be operated to meet the following planning objectives:

- Capture, recharge, and store water from the SWP and Central Valley Project ("CVP") and other available water supplies for later use during dry periods
- Provide Rosedale and IRWD customers and banking partners with increased water supply reliability
- Provide ecosystem benefits through intermittent wetland habitat for migratory birds and other waterfowl along the Pacific Flyway

- Provide ecosystem benefits by increasing operational flexibility for managing stored water pools throughout the state
- Provide water supply benefits for agricultural, municipal, and industrial users
- Assist in achieving groundwater sustainability within the Kern Sub-basin
- Increase water management and operational flexibility

A third consecutive dry year in California has limited water supplies and threatened the groundwater sustainability of the Central Valley. The proposed Project is critical for enhancing water storage, creating a reliable water supply for future generations, and meeting landmark California Sustainable Groundwater Management Act ("SGMA") goals. See **Table 1** below for Project and applicant information.

Table 1: Project and Applicant Information

Project Information	
Date	Friday, December 9, 2022
Project Name	Phase 1 - Kern Fan Groundwater Storage Project
Applicant Name	Groundwater Banking Joint Powers Authority (GBJPA)
City, County, State	Bakersfield, Kern County, California

Figure 1. RRBWSD and IRWD Boundaries and Location

1.2 Technical Project Description

The technical project description should describe the project in its entirety. This description shall have sufficient detail to permit a comprehensive evaluation of the proposal.

The proposed Project is located in Kern County, California, approximately 5 miles west of the City of Bakersfield, and within the boundaries of the Rosedale-Rio Bravo Water Storage District. The Project includes the acquisition of 350 acres in Kern County for the construction and operation of recharge basins, recovery wells, conveyance infrastructure, and interconnections with existing conveyance facilities. The properties have been acquired by the GBJPA and include the West Enos property (sometimes referred to as “Bolthouse” in technical studies) and the Stockdale North property (sometimes referred to as “Diamond” in technical studies) to be converted from farmland to groundwater recharge basins. The West Enos property latitude is {35°22’35.33’’N} and longitude is {119°15’24.90’’W} (approximately 201 acres) and the Stockdale North property latitude is {35°21’29.24’’N} and longitude is {119°15’57.02’’W} (approximately 149 acres). The GBJPA intends to construct approximately 300 wetted acres of recharge basins on both properties and two (2) recovery wells on each property, for a total of

four (4) recovery wells. Both the West Enos and Stockdale North properties are adjacent to existing Rosedale and IRWD's groundwater recharge basins and conveyance facilities, which provide advantageous locations for the development of water banking and recovery. These facilities are shown in Figure 2 below and referred to as 'Existing Conjunctive Use Facilities'.

Figure 2. Project Location – West Enos (pink) and Stockdale North (green)

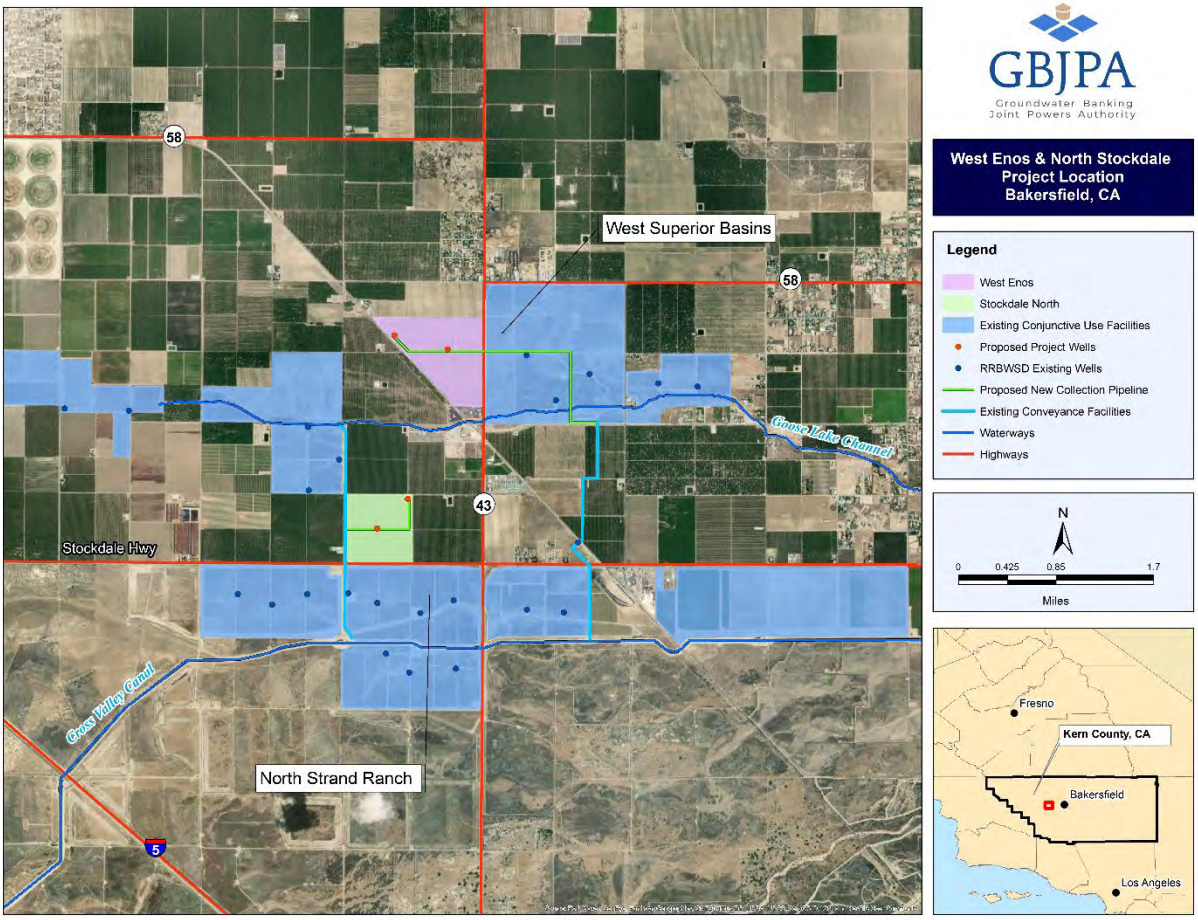


Figure 2 shows the location of the proposed West Enos and Stockdale North recharge basins as well as a preliminary estimate of the locations of the wells and conveyance facilities that will deliver water to and from the Stockdale North and West Enos Phase 1 project site.

Phase 1 is designed to improve the GBJPA's water storage opportunities for future generations by increasing groundwater storage in wet years and recovering groundwater during periods of drought and limited water supply. This will be accomplished in four major steps. The GBJPA will construct recharge basins on the recently acquired West Enos property (201 acres) and Stockdale North property (149 acres). Current agricultural practices will be ceased, existing almond trees and other crops will be removed from the properties, and levees will be constructed to build approximately 3 to 5 separate recharge basins on each property. Precast concrete structures and gates will be used to control flows between individual recharge basins but also to deliver high flows to the Stockdale North and West Enos recharge basins. The second step will be the drilling and equipping of four (4) production wells, two on each of the sites for recharge.

Earthen well pads will be constructed as part of the recharge basin construction, serving as drill islands. Wells will be drilled approximately based on the hydrogeology and local experience. Equipping will be done after the drilling is finished, see **Appendix A** for a layout of the well equipping facilities. The final major step will be the installation of the recovery conveyance pipelines which will deliver recovered groundwater to existing conveyance facilities. It will require jack and boring under state highways, as well as a significant amount of piping to provide connections to existing conveyance facilities. Fortunately, major pipelines and channels have already been constructed by Rosedale with additional capacity to cater to recovery flows off both the Stockdale North and West Enos properties. These existing facilities, run north and south and convey water to and from the Cross Valley Canal which can run to or from California Aqueduct (state water) and the Friant Kern Canal (federal water). Additional details of the four project components are described below.

1. **Recharge Basins –** GBJPA seeks to construct approximately 300 net acres (85% of total acres) of direct recharge basins via the placement of 320,000 cubic yards (CY) of compacted levees that are approximately 2-5 feet in height. Upwards of 14,000 acre-feet per year (AFY) (on average wet year 120 days/year) of recharge water will be conveyed from recharge basin to recharge basin via inter-basin check structures. During flood years, when water supplies are abundant throughout the year, the Project could provide approximately 28,000 acre-feet of storage into the Kern Subbasin. Water would be conveyed to the recharge facilities using the existing Cross Valley Canal and Gooselake Channel conveyance facilities and subsequently diverted through two separate inverted siphons with sluice gates. Approximately 60 cfs (cubic feet per second) of intake capacity would be required to serve the Stockdale North property from the existing North Strand Recharge Project, and 80 cfs of intake capacity to be built off the existing West Superior property. See **Figure 2** for project component locations.

2. **Well Drilling –** GBJPA seeks to drill four (4) conjunctive use recovery wells. Two wells will be located on the West Enos Property and the Stockdale North property will accommodate the other two wells. At an estimated 5 cfs per well, these wells can recover a total of 20 cfs, which correlates to a maximum of 14,425 acre-feet per year (AFY). The GBJPA has hired a hydrogeologist to perform a groundwater impact analysis to study any negative effects on current facilities as well as local landowner wells. The GBJPA will use previous logs from nearby wells, historical water levels in the area, zone water quality sampling data, and local knowledge to assist with well design and water quality implications. Wells will be drilled to an approximate depth of 650-850 feet, with perforations from approximately 400-700 feet. The final design is subject to change based on field data collected during the pilot hole drilling, sampling, and the well development process. See **Appendix B** for an example of a similar well design in the area.

3. **Well Equipping -** The GBJPA uses a standardized design when equipping its wells. Apart from the pump, which is designed specifically for each well, each facility will have variable frequency drives (VFDs), vacuum relief valve, sleeve coupling with joint harness, high-pressure switch, pressure transmitter, sample port, check valve, pressure gauge, flowmeter, butterfly valve, pipe supports, and a combination air vent. Well discharge piping will be 12-inch fusion bonded epoxy lined and coated steel piping. See **Appendix A** for a typical well-equipping design.

4. **Water Conveyance Connections -** The GBJPA currently has 3 main ways to convey recovered groundwater, all of which run north-south and connect current recovery facilities to the Cross Valley Canal. The water then can be conveyed west to the California Aqueduct to satisfy State Water demands, or east to the Friant Kern Canal to satisfy Federal Water demands. A critical piece of the project is connecting the new wells with current delivery facilities so that the water can be accessible for both the State and Federal Water Contractors in dry years. The return pipeline from the West Enos recovery facility will run under Enos Lane (Hwy 43) through the same crossing as the delivery box and will run parallel to existing conveyance until it connects to the existing Central Intake Pipeline, running south to the Cross Valley Canal, through approximately 10,000 feet (ft) of 24" PVC pipe. The Stockdale North property will have two recovery wells, both tying back into Rosedale Turnout No. 2 where the water is conveyed south to the Cross Valley Canal, approximately 2,500 ft of 18" PVC pipe, and 1,200 ft. of 24" PVC pipe.

As with most major projects, many aspects, or details from each of the listed steps require parallel progression and overlap is necessary to produce an efficient project schedule. It is estimated that the Project, including the environmental review, will be completed in approximately 39 months. Please see **Appendix C** for a preliminary Project Schedule.

With extreme restrictions in California regarding the development and construction of more above-ground water storage, the Phase 1 Project provides an achievable way to increase water storage opportunities in the State via groundwater banking. Some of the major benefits of this project are listed below:

- Support the GBJPA's water users (agricultural, municipal, and industrial).
- Provide enhanced protection against prolonged drought and climatic changes.
- Reduce groundwater pumping lifts and resulting energy savings.
- Support third-party banking and transfer partners.
- Provide intermittent wetland habitat for wildlife environmental benefits.
- Provide intermittent upland habitat for wildlife environmental benefits
- Support the GBJPA's obligations and exchanges (agricultural, municipal, and industrial)

1.3 Evaluation Criteria

E.1.1. Evaluation Criterion 1—Water Supply Reliability (35 points)

E.1.1.1. Subcriterion No. 1a—Enhanced Water Supplies (20 points)

How many additional acre-feet of water are expected to be made available on average each year upon completion of the project? What percentage of the service area's overall water supply will the project's water provide upon project completion? Use the total average project water production over the anticipated life of the project.

Upon completion of the project, an additional 28,000 AF will be accessible for storage within the aquifer. In a single year, 14,940 AF can be recharged, and approximately 14,480 AF can be recovered. The calculation basis for each of these volumes is provided below.

Recharge Calculation:
The infiltration rate is the depth of the water that is banked in the aquifer per day. The infiltration rates used in this calculation are from a technical memorandum prepared by a professional hydrogeologist in the Kern Fan Project Final Environmental Impact Report (EIR) (see **Appendix P**), estimated at 0.5 ft/day (West Enos recharge basins) and 0.3 ft/day (Stockdale North recharge basins). In California, high-flow state and federal waters are typically available for four months (March-June) during wet years, so this analysis is being done for an average wet year. The wetted area, which is approximately 85% of the total acreage of each property, is also used for the calculation.

West Enos:
0.5 ft/day (infiltration rate) x 174 wetted acres (85% wetted area) x 120 days/year (4 months) = 10,440 AF per year (AFY)

Stockdale North:
0.3 ft/day (infiltration rate) x 125 wetted acres (85% wetted area) x 120 days/year (4 months) = 4,500 AF per year (AFY)

Recovery Calculation:
Based on local knowledge and historical records, a conservative estimate of 5 cubic feet per second (cfs) was used for the flow rate at each recovery well. A conversion factor worth noting for the calculation is that 1 cfs = 1.983 acre-feet/day. Four wells, as stated in the project description will be drilled and equipped. In critical and some dry years these wells run continuously for the entire year.

West Enos:
5 cfs (flow rate) x 1 cfs/1.983 AFD (acre-feet/day) x 365 days/year x 2 wells = 7,240 AF / year

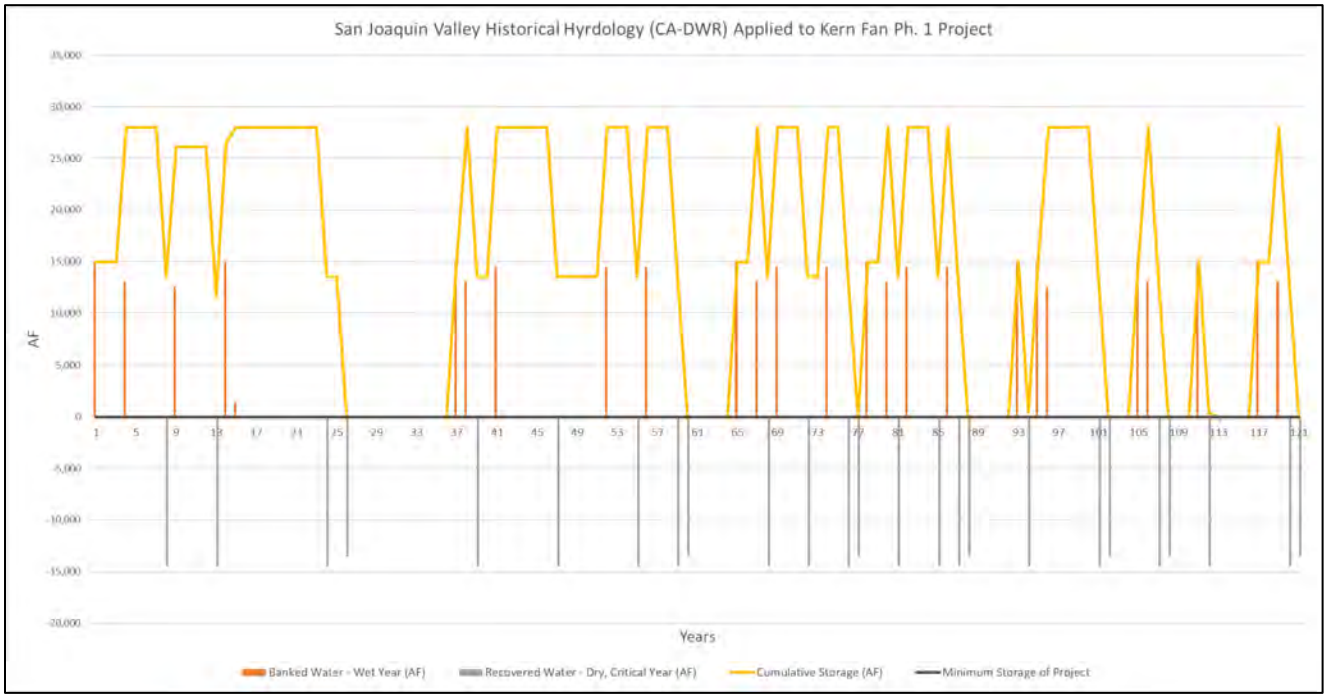
Stockdale North:
5 cfs (flow rate) x 1 cfs/1.983 AFD (acre-feet/day) x 365 days/year x 2 wells = 7,240 AF / year

Total Phase 1 recovery = 14,480 AFY

The expected recharge and recovery capacities for Phase 1 will allow the Project sponsor to recharge and recover water into and from the aquifer. This water will be stored in the 28,000 AF storage account assigned to Phase 1. Water recharged on Phase 1 will fill the 28,000 AF storage account assigned to Phase 1. Similarly, water recovered from Phase 1, will be withdrawn from the 28,000 AF storage account assigned to Phase 1.

The available recharge and recovery capacities given the 28,000 AF storage limitation were modeled for the 1901-2021 hydrology from DWR's Bulletin 120, for the San Joaquin Valley Watershed water year indices as shown in the graphic below (**Figure 3**). It shows that approximately **2,940 AFY (acre-ft/year)** of average annual water supply benefit (banked/recovered) is realized over the period. Using this model, water was stored for 26 of the 121 years (22% of the time) and likewise water was recovered in critically dry years, 26 of the 121 years (22% of the time). This 2,940 AFY was calculated by analyzing historical hydrology, utilizing recharge capacity in "wet" year and recovery capacity in "critical" and "dry" year.

Figure 3. San Joaquin Valley Historical Hydrology



The GBJPA used two different methods to calculate the annual water supply benefit. In the feasibility study modeling results provided by consultants at MBK Engineers performed a hydrologic analysis using the CalSim II baseline Benchmark model with 20135 Central Tendency Climate data, published by Reclamation in March 2022. For purposes of this calculation, the results from MBK's analysis attributed solely to the 100,000 AF storage of the full Kern Fan Project were scaled down proportionally to the 28,000 AF of groundwater storage provided in Phase 1. The expected average annual water supply for the Phase 1 Project is approximately 2,482 AF per year, which is comparable to the other benefit calculation 2,940 AFY computed in the previous section.

The typical lifespan of wells is approximately 50 years. Motors, pumps, and electrical systems are about 10-20 years, while typical conveyance facilities are estimated to be about 50-100 years. For purposes of the application criteria, the proposed anticipated 'life' of the Project could provide water supply benefits for 50-plus years until facilities would need to be replaced and/or repaired. This timeframe for life cycle analysis has been used in the Small Storage Program Feasibility Study.

RRBWSD's average annual water supply (1993-2013) for agricultural use is about 85,000 AFY from various sources (i.e. Kern River, SWP, CVP, banked groundwater, and exchanges). Since RRBWSD is an equal participant in the Project, RRBWSD's annual benefit during a dry year is half of the 14,480 AFY, which is **7,240 AFY**. This number divided by RRBWSD's supply is the percent of the total water supply calculation, during a dry year.

IRWD's average annual potable water supply from the last twenty years (2002 – 2021) is approximately 59,000 AFY. Unlike RRBWSD, most of IRWD's demand is mainly domestic/residential users, so only potable supply will be considered for this calculation. Since IRWD is an equal participant in the Project, IRWD's annual benefit during a dry year is half of the 14,480 AFY, which is **7,240 AFY**. This number divided by IRWD's potable water supply is the percent of the total water supply calculation, during a dry year.

RRBWSD Water Supply (dry year) -

Estimated Amount of Project Additional Water Supply	7,240 AFY
Average Annual Water Supply	85,000 AFY
Project Percentage of Total Water Supply	8.5%

IRWD Water Supply (dry year)-

Estimated Amount of Project Additional Water Supply	7,240 AFY
Average Annual Water Supply	58,810 AFY
Project Percentage of Total Water Supply	12.3 %

During an average year, the supplies of the project aren't physically collected, because water is either being banked or the facilities are in a standby operation (not banking, not recovering). For the average annual calculation, MBK's modeling results were used. It is estimated that 1,375 AF/year average annual yield is available for Rosedale and 1,108 AF/year average annual yield is available for IRWD. The difference of average annual yield is due to an additional amount of loss percentage of recharge water that is required for IRWD as this water is ultimately used outside of Kern County requiring additional losses.

RRBWSD Water Supply (average) -

Estimated Amount of Project Additional Water Supply	1,375 AFY
Average Annual Water Supply	85,000 AFY
Project Percentage of Total Water Supply	1.6%

IRWD Water Supply (average)-

Estimated Amount of Project Additional Water Supply	1,108 AFY
Average Annual Water Supply	58,810 AFY
Project Percentage of Total Water Supply	1.9 %

Will the project reduce or eliminate the reliance on imported water or other sources of surface water supplies that are less reliable? Explain.

Yes. The proposed Project will reduce the reliance on imported water supplies. The Project will capture, recharge, and store excess water from the SWP, CVP, and other available water supplies during wet years. During dry periods with limited water availability, the Project will be able to recover these previously stored wet-year water supplies for the water users; therefore, reducing the reliance on surface water supplies.

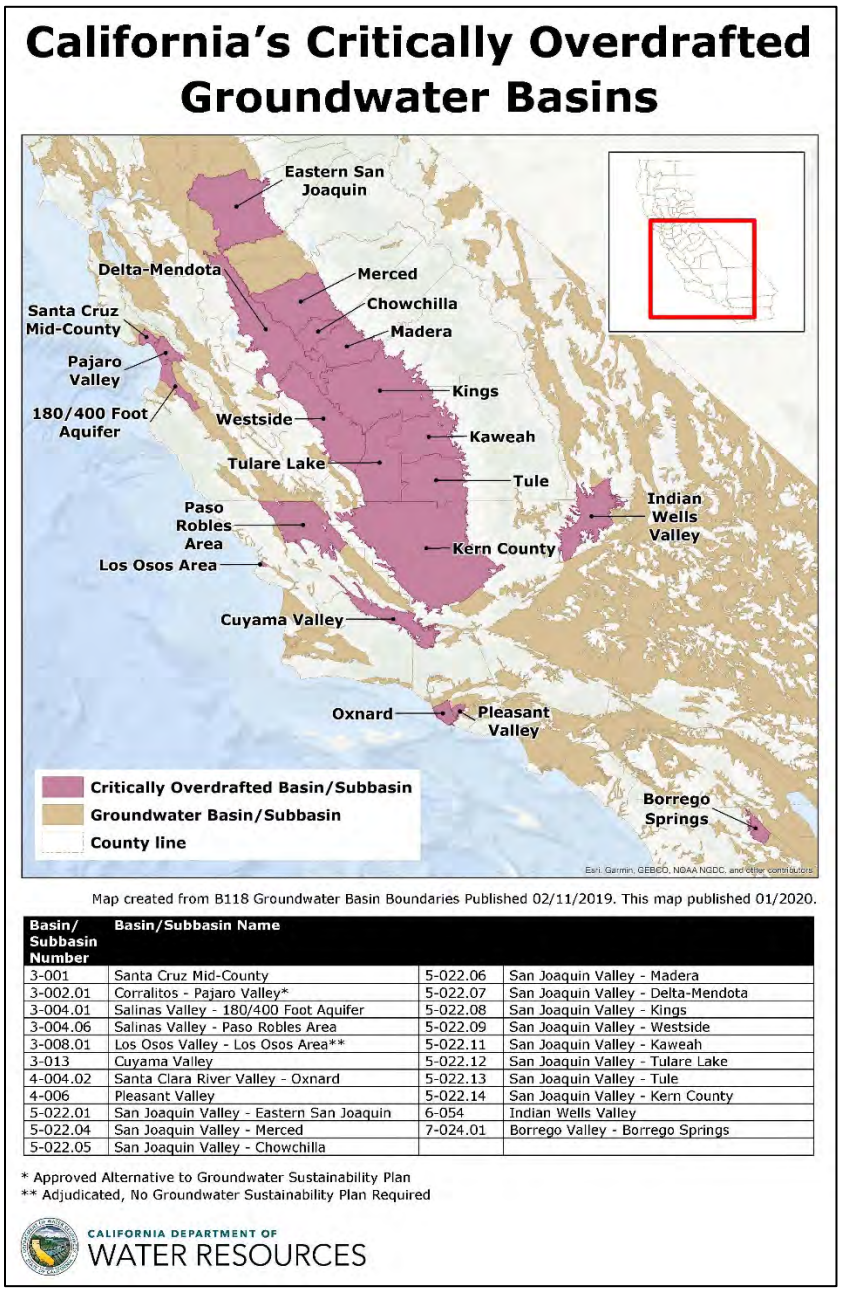
Will the project reduce groundwater overdraft and positively contribute to the sustainable yield of a groundwater basin or local aquifer? Explain.

The Project will reduce groundwater overdraft and positively contribute to the sustainable yield of the Kern Sub-basin. SGMA requires governments and water agencies of high and medium-priority basins to halt overdrafting and bring groundwater basins into balanced levels of pumping and recharge. The California Department of Water Resources ("DWR") has determined that the Kern Sub-basin, where the proposed Project is located, is a critically over-drafted sub-basin of high and medium priority (DWR, 2022). There is a critical need to develop additional groundwater recharge in the Kern Sub-basin area to improve sustainable water management. See **Figure 4** below.

Phase 1 would contribute to sustainable groundwater storage through the development of the West Enos and Stockdale North recharge basins, approximately 350 acres of recharge basins that would provide approximately 28,000 AF of new groundwater storage. The project will be a net reduction of overlying water use in Rosedale's service area by converting irrigated land to recharge basins (a compatible agricultural use) to capture excess water supplies. The full Kern Fan Project will consist of approximately 1,280 acres and has been allocated a maximum storage

capacity of 100,000 AF in Rosedale's Conjunctive Use Program. Phase 1 of the Kern Fan Project is the first phase to implement the full Kern Fan Project. To estimate the storage capacity associated with Phase 1, the Project sponsor estimated the maximum storage capacity per acre based on the maximum storage capacity of the full Kern Fan Project and the total acres of land that will be acquired (100,000 AF / 1,280 acres = 78.125 AF/acre). The maximum storage capacity per acre rate was then multiplied by the number of acres of land in Phase 1 to estimate an approximate storage capacity for Phase 1 (78.125 AF/acre x 350 acres = 27,344 AF). Using this approximation as a general basis, the Project sponsor has assigned 28,000 AF of the full Kern Fan Project's 100,000 AF maximum storage capacity to Phase 1. To confirm that there is at least 28,000 AF of storage capacity associated with Phase 1 lands, hydrogeologists at Thomas Harder & Co. prepared a technical memorandum, provided as **Appendix E**, that summarizes an analysis of aquifer storage potential beneath the Phase 1 properties. The aquifer storage capacity of Phase 1 properties was estimated as the volume of groundwater that can be stored in the aquifer directly beneath the sites. The aquifer storage capacity was estimated by multiplying the total aquifer volume beneath the sites by the specific yield of the aquifer sediments. Using this methodology, the estimated storage capacity for the Phase 1 properties is approximately 29,700 AF (Thomas Harder & Co., 2022).

Figure 4. SGMA Critically Overdrafted Basins



Map created from B118 Groundwater Basin Boundaries Published 02/11/2019. This map published 01/2020.

Basin/ Subbasin Number	Basin/Subbasin Name		
3-001	Santa Cruz Mid-County	5-022.06	San Joaquin Valley - Madera
3-002.01	Corralitos - Pajaro Valley*	5-022.07	San Joaquin Valley - Delta-Mendota
3-004.01	Salinas Valley - 180/400 Foot Aquifer	5-022.08	San Joaquin Valley - Kings
3-004.06	Salinas Valley - Paso Robles Area	5-022.09	San Joaquin Valley - Westside
3-008.01	Los Osos Valley - Los Osos Area**	5-022.11	San Joaquin Valley - Kaweah
3-013	Cuyama Valley	5-022.12	San Joaquin Valley - Tulare Lake
4-004.02	Santa Clara River Valley - Oxnard	5-022.13	San Joaquin Valley - Tule
4-006	Pleasant Valley	5-022.14	San Joaquin Valley - Kern County
5-022.01	San Joaquin Valley - Eastern San Joaquin	6-054	Indian Wells Valley
5-022.04	San Joaquin Valley - Merced	7-024.01	Borrego Valley - Borrego Springs
5-022.05	San Joaquin Valley - Chowchilla		

* Approved Alternative to Groundwater Sustainability Plan
** Adjudicated, No Groundwater Sustainability Plan Required

CALIFORNIA DEPARTMENT OF WATER RESOURCES

The Project is not expected to adversely impact the aquifer, overdraft, or cause land subsidence, as the GBJPA intends to replenish groundwater supplies via multiple existing and future aquifer recharge facilities and projects (see **Figure 2** for District well locations and nearby surface water supplies). The West Enos and Stockdale North properties will be converted from intensive agricultural activities to groundwater recharge facilities and will be utilized in conjunction with Rosedale and Irvine's existing 2,200 acres of recharge facilities. As part of SGMA compliance, monitoring wells are measured monthly to ensure that water levels do not exceed established water level minimum thresholds and do not trigger undesirable results.

Will the project alleviate pressure on existing water supplies and/or facilities? If so, please identify the supplies and/or facilities and explain how they will be impacted by the project, including quantifications where applicable.

By storing excess wet year water supplies, the Project will alleviate drought-year water supply demands from the SWP and CVP. A description of each source of water supply and how each water supply will be impacted by the Project is included below:

State Water Project (SWP):
DWR delivers water to 29 SWP Contractors, including 21 contractors south of the Delta. The California Aqueduct is a primary part of the SWP and carries water from the Delta to the San Joaquin Valley and Southern California. SWP Contractors can request delivery of water up to their Table A amounts under a given allocation set by DWR based on hydrologic conditions. Rosedale currently receives SWP water for its Conjunctive Use Program through a water supply contract with the Kern County Water Agency ("KCWA"), one of the SWP Contractors. IRWD is a landowner in the Dudley Ridge Water District ("DRWD"), a SWP contractor located in Kings County. Through IRWD's land ownership in DRWD, IRWD is entitled to a portion of DRWD's Table A SWP allocation. Particularly during wet hydrologic years, DWR may declare Article 21 water available, which is uncontrolled water that exceeds SWP Contractors Table A requests and cannot be stored in State reservoirs. Article 21 supplies are usually available for a short duration and can be diverted and stored in non-SWP facilities for future use. Article 21 water stored by the Project can be used in dry years when the SWP supplies are short which will help to reduce pressure on the SWP system.

Central Valley Project (CVP):
The United States Bureau of Reclamation (Reclamation) delivers Central Valley Project (CVP) supplies to federal contractors in California. The additional water that could be captured and stored by the Phase 1 Project is defined under Section 215 of the Reclamation Reform Act of 1982, as excess irrigation water to be released due to flood control criteria or un-managed, un-storable flood flows from the Delta. As a result of these flood flows occurring in short duration, Section 215 authorizes Reclamation to declare the availability of Section 215 water for CVP south-of-Delta contractors and enter into temporary water service contracts for this surplus water for south-of-Delta contractor use. Other federal water supplies could also be available for the Project.

Rosedale's service area is within the CVP place of use for banking and direct use of CVP water, and Rosedale has historically entered into contracts with Reclamation for Section 215 water. The availability period for Section 215 water delivery depends on hydrologic conditions and water demands. The excess Section 215 water made available to Rosedale is through the Friant-Kern Canal and Rosedale primarily takes delivery through its existing capacity rights and connections to the Cross Valley Canal (CVC) and Kern River conveyances. See **Figure 5** below for the Project's proximity to conveyance facilities. Rosedale currently has a turnout off the Kern River Channel with a capacity of 600 cfs. Rosedale can take delivery of both Friant-Kern and Kern River flows through this turnout. Currently, Rosedale has an obligation of 367 cfs, of its 600 cfs turnout capacity, for various banking partners and programs. The remaining 233 cfs of turnout capacity is available for other programs. Rosedale shares the Kern County Sub-Basin with many

federal contract districts. The Project could be used to help fulfill obligations to both state and federal contractors. The Section 215 water and/or other available federal water supplies that could be captured would be stored by the project for the benefit of Rosedale and IRWD through exchanges that ensure the water is used in the CVP Place of Use.

Additionally, excess federal water supplies, such as Recovered Water Account ("RWA") water could be recharged and stored in the Phase 1 Project and then returned to federal contract districts via banking and exchange agreements. RWA water is available to Friant Division long-term water contractors during wet hydrologic conditions when water is not required to meet other Federal obligations. The RWA water is available to long-term Friant Division contractors who experience a reduction in water deliveries due to requirements outlined in the San Joaquin River Settlement. See **Appendix F** for a list of historical banking and recovery exchanges/contracts within RRBWSD.

CVP and SWP Supplies Impacted by Project:

Due to the nature of California's hydrology, there are often wet-year surplus flows in the SWP and CVP systems that may be diverted to storage. Currently, there is insufficient storage capacity and conveyance infrastructure to capture and store this water, which is then lost to the ocean. The Phase 1 Project can help to improve water supply reliability and operational flexibility of the SWP and CVP systems. By integrating the operation of SWP and CVP surface reservoirs with groundwater storage in the Kern River Fan Project, water supplies that would have been lost to the ocean can be made available for use in dry years.

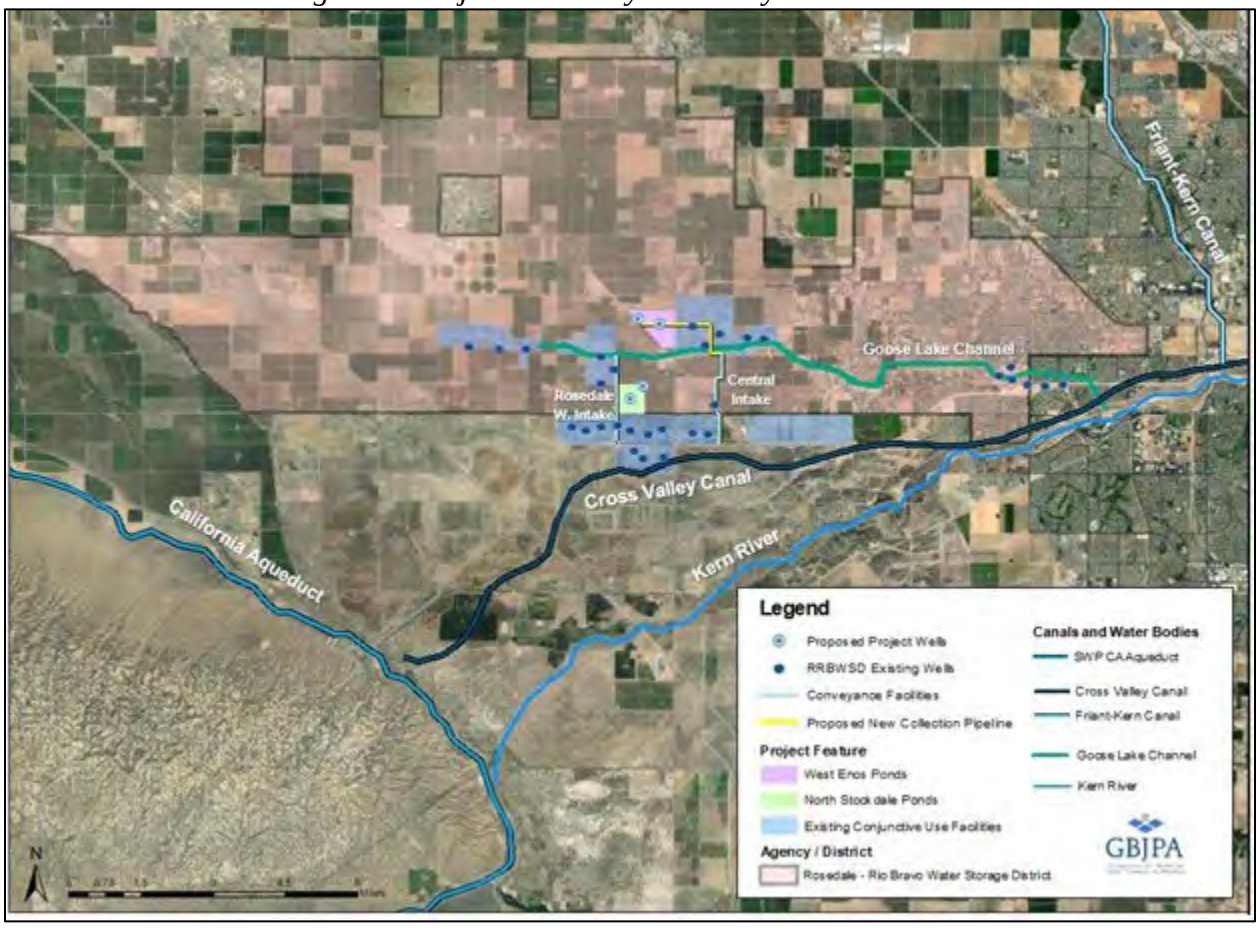
The GBJPA utilized modeling results provided by consultants at MBK Engineers to estimate the anticipated water supply that could be available for the Project. MBK Engineers performed a hydrologic analysis using the CalSim II baseline Benchmark model with 2035 Central Tendency Climate data, published by Reclamation in March 2022. The analysis looked at the availability of Article 21 and Section 215 water supplies that could be delivered to the full Kern Fan Project. The Phase 1 Project can operate as a stand-alone project. Therefore, the water supply yield results from MBK's analysis were scaled down proportionally from the full Kern Fan Project storage of 100,000 AF to the Phase 1 storage of 28,000 AF of groundwater storage (MBK, 2022). Projected water supplies on an average annual basis for the Phase 1 Project are presented in **Table 2** below.

While only Article 21 and Section 215 water supplies were used in the analysis, other SWP and Federal surplus water supplies could be delivered to the Project. MBK's analysis is included in **Appendix G**.

Table 2: Projected Water Supply for Phase 1

Water Supply Type	*Amount (AF per year)*
Article 21 (SWP)	1,737
Section 215 (CVP)	745
Total	**2,482**

Figure 5. Project Proximity to Conveyance Facilities



What performance measures will be used to quantify actual benefits upon completion of the project?

Performance measurements will be a key instrument for quantifying the water benefits of this Project. After Project completion, pertinent data will be included in the annual operations report with a monthly summary of recovery flow rates, the total volume of recharged water, and a summary of return obligations to state and federal contractors. The data will also include the calculated estimate of recharge water that would stay within the basin and comprises the

increased groundwater levels benefit from the Project. The data will be compared with the projected annual water recovered and recharged as calculated in this grant application.

For the intermittent wetland benefit, it is expected that performance measures would be included in an agreement for public benefits that is currently in development with the California Department of Fish and Wildlife. This agreement is expected to be required as a condition of state funding for the overall Kern Fan Project, although Phase 1 of the project is a standalone project that does not require state funding.

E.1.1.2. Subcriterion No.1b—Contributions to Water Supply Sustainability (15 points)

Will the project make water available to address a specific concern? Consider the number of acre-feet of water to be made available and the severity of the concern. Explain the role of the project in addressing that concern and the extent to which the project will address it. Specific concerns may include, but are not limited to:

a) Water Supply Shortages

Water supplies in California continue to be stressed due to the over-pumping of groundwater basins, implementation of SGMA, increased competition for water supplies, shortages from the Colorado River, population growth, supply limitations from environmental constraints in the Delta, climate change, and recurrent droughts among other factors. Under such conditions, the GBJPA, along with countless other water agencies, are pursuing projects and/or programs that will address these concerns and allow for the acquisition and storage of water supplies. By capturing water during wet years when excess supplies are available, Rosedale and IRWD will be able to utilize the stored water during dry years when water supplies are extremely limited. Water supplies from the Project can also be utilized during other water supply shortages such as a Delta levee failure event. The Project is anticipated to provide approximately **28,000 AF** of additional groundwater storage (see section E.1.1.1. and **Appendix E** for further Project storage analysis).

b) Water Supply Reliability

Additional groundwater storage and banked water supplies provided by the proposed Project are crucial for Rosedale and IRWD to meet future dry year demands and maintain long-term water supply reliability. As previously described under Section E.1.1.1, the Project is anticipated to make an additional 14,480 AFY of water supplies available for the GBJPA and its beneficiaries that can be utilized during dry years. This dry year supply would provide Rosedale and IRWD customers with increased water supply reliability.

c) Groundwater Depletion

See **Appendix H** for groundwater level reports in Rosedale. After years of over-pumping groundwater supplies and the implementation of the landmark Sustainable Groundwater Management Act (SGMA), groundwater is no longer a reliable source of water supply without

sufficient replenishment. SGMA requires governments and water agencies of high and medium-priority basins to halt overdrafts and bring groundwater basins into balanced levels of pumping and recharge. DWR has determined the Kern County Subbasin, where the proposed Project is located, is a critically over-drafted subbasin of high priority (see **Figure 4**). The Project will provide an improved groundwater level benefit in Kern County as a result of the Project's leave behind water which will help the Kern County Sub-basin comply with SGMA goals. Monitoring wells are measured monthly to ensure that water levels do not exceed established water level minimum thresholds to avoid undesirable results under SGMA.

d) Water Quality Issues

Water quality impacted by the Project has been analyzed in the Kern Fan Project Final Environmental Impact Report (EIR). The water quality of all the existing Rosedale recovery wells meets the DWR's Water Quality Policy for Acceptance of Non-Project Water into the SWP, except for a few naturally occurring constituents in a few wells. Impacts on water quality due to the Project were determined as less than significant with mitigation. It is the GBJPA's responsibility to ensure that all water quality is sufficient to meet applicable water quality requirements. Based on preliminary sampling results, the underlying groundwater is mostly within drinking water standards, and the only constituents that were found to be above the drinking water Maximum Contaminant Levels ("MCLs") were gross alpha, 1,2,3-TCP, and arsenic, which are known regional issues. Gross alpha concentrations detected were not substantially above the MCL and the underlying groundwater quality would likely benefit from the high-quality surface water used for recharging. The Project recharge water would not have elevated concentrations of arsenic and its addition would be expected to reduce the concentrations of arsenic in the deeper portions of the aquifer. Therefore, the addition of recharge water would have a beneficial impact on groundwater quality. Less is known about the extent of 1,2,3-TCP in the regional aquifer. With the recent adoption in 2017 of an MCL for 1,2,3- TCP, banking projects and water purveyors continue to learn the extent and mitigation techniques to best manage the contaminant. As stated above, water extracted for the proposed Project purposes will meet applicable requirements for water quality. The proposed recharge water would not have elevated concentrations of 1,2,3-TCP (Kern Fan Project DEIR, 2020). For more information regarding water quality and mitigation, please see **Appendix P** to access the Kern Fan Project DEIR.

Additionally, before acquiring both the West Enos and Stockdale North properties, the GBJPA consulted with hydrogeologists at Thomas Harder & Co. to conduct a Recharge and Recovery Suitability Report for both properties (See **Appendix I**). The analysis consisted of reviewing background documents, data, and reports associated with the parcels and the surrounding areas to evaluate whether managed recharge at the West Enos and Stockdale North properties were feasible and whether the Project would pose a risk to groundwater quality resulting from the proposed recharge activities (Thomas Harder & Co., 2021). A summary of findings from the reports is as follows:

- The proposed Project sites have historically been used for irrigated agriculture.
- Constituents of expected concern in the groundwater beneath the proposed Project sites include TDS, chloride, nitrate, arsenic, and pesticides (1,2,3-TCP and EDB/DBCP).

- Naturally occurring arsenic has been detected in groundwater samples from nearby wells at concentrations that exceed the MCL. This constituent can be avoided in future project wells through site-specific testing and designing the wells to avoid the aquifer zones that contain high arsenic concentrations.
- 1,2,3-TCP is a pesticide that has been detected in groundwater from wells throughout the Kern Fan area. Concentrations in the discharge of project recovery wells may be addressed through blending and may be reduced over time with the recharge of water that does not contain detectable 1,2,3-TCP.

e) Natural disasters that may impact water supply infrastructure

The natural disasters that most commonly affect the area of this project would be drought, flooding, and earthquakes. This project positively impacts the water supply in years of drought and flooding, by capturing extra flood water and adding supply in dry years. The operational flexibility that the project provides by delivering water to either State (California Aqueduct) or Federal (Friant-Kern Canal) facilities can be used advantageously if an emergency happens to either facility via natural disaster. A 2016 IRWD Water Supply Reliability Evaluation, using a comprehensive distribution system simulation model, cited IRWD's water banking capabilities as essential to eliminating potable water shortages during simulated earthquake induced California Delta Levee failures.

f) Heightened Competition for Water Supplies

The Phase 1 Project will provide sustainable water management and offer noteworthy, measurable benefits. By storing excess water supplies when available, the Project will provide increased water supply reliability which will alleviate the stress of increased competition for water supplies from the Delta and climate change impacts.

g) Availability of Alternative Supplies

Due to the nature of California's hydrology, during wet seasons there are often surplus flows in the SWP and CVP systems that may be diverted to storage. Currently, there is insufficient storage capacity and conveyance infrastructure to capture and store this water, which is then lost to the ocean. The Phase 1 Project can help to improve water supply availability and operational flexibility of the SWP and CVP systems during these high flow periods. On the converse side, dry years supplies can be extremely inadequate, but recovered water from the Project can provide an alternative dry year supply to users across the basin and state.

h) Increasing Cost of Water Supplies

Increases in the cost of water supplies will be addressed by the proposed Project. Rosedale and IRWD customers are supportive of the Phase 1 Project as it will provide a cost-effective and reliable supplemental source of water. Since the Project will bank water during wet years when there is excess supply, these water supplies will be low-cost compared to purchasing water supplies in dry years when supplies are limited and are extremely high cost. During periods of

drought, many farmers are forced to fallow their lands due to the inability to purchase costly water supplies (up to $2,000/AF). The Phase 1 Project will provide agricultural customers with an affordable water supply during periods of drought. See attached **Appendix J** for Stakeholder Support Letters.

EO 14008, focuses on increasing resilience to climate change and supporting climate resilient development. EO 14008 also emphasizes the need to prioritize and take robust actions to reduce climate pollution; increase resilience to the impacts of climate change; protect public health; and conserve our lands, waters, oceans, and biodiversity.

a) Will the project address climate change in the service area? Explain.

California's climate has been trending toward one that cycles between periods of large amounts of precipitation and times of drought. The California Department of Water Resources estimates a 10% reduction in water supply by 2040 in a planning scenario that considers increased temperatures and decreased runoff. *California's Water Supply Strategy – Adapting to a Hotter, Drier Future (Aug 2022)* identifies the need to expand average annual groundwater recharge by at least 500,000 AF, and specifically includes the overall Kern Fan Groundwater Storage Project, which the Project is a phase of, as a key component in meeting California's expanded water storage objective and helping address climate change, and at the same time address local GBJPA climate change adaptation. While there are still uncertainties associated with the future impacts of climate change on California's weather cycles, it is reasonable to expect that changes to weather cycles will result in more rainfall and less snow in the mountains, earlier snowmelt, more intense rain events, and increasingly frequent droughts. These climate conditions will cause more intense periods of available excess supplies and longer periods of supply shortages. The Project will provide increased water supply reliability benefits for multiple local stakeholders that are crucial in mitigating the effects of climate change. Groundwater storage provided by the Project will allow for these excess supplies to be captured and utilized when needed, increasing resilience to climate change and satisfying the demands within the Project's service area. Additional Project benefits include intermittent wetland habitat that will be created for waterfowl and migratory birds along the Pacific Flyway, improved groundwater levels in the Kern County Sub-Basin, and preservation of permanent agriculture crops.

b) Will water made available by this project be resilient to the impacts of climate change? Particularly in consideration of alternative water supply options that exist in the service area, to what extent does the project represent a resilient alternative? Explain.

The Phase 1 Project will provide sustainable water management and offer noteworthy, measurable benefits. By storing excess water supplies when available, the Project will provide increased water supply reliability which will alleviate the stress of increased competition for water supplies from the Delta and climate change impacts. Environmental uncertainties relevant to the benefits provided by the Project include climate change, variation in snowpack, and periods of multi-year drought because the project benefits depend upon water supplies available for recharge and storage in the Project. The operations of the Project as a whole were modeled by MBK Engineers to demonstrate the ability to maintain benefits under a range of hydrologic conditions and climate change conditions (**Appendix G**). Climate change in California is

expected to result in warmer winters with increased rainfall and less snowpack. Currently, much of California's water supply is stored within the snowpack and is slowly released into existing surface storage reservoirs over the springtime. As this shifts to increased rainfall, the wet periods with excess supplies will be more frequent and intense, and new groundwater storage will be needed to manage this change. The Kern Fan Project Phase 1 will help address this change, and store water that would otherwise be lost to ocean, for the expected more frequent and extended dry periods. As a result of storing water that would otherwise be lost, the Project will create a new, climate resilient water supply.

As described in the Project Feasibility Study, the GBJPA developed alternatives that address defined resource challenges and achieve Reclamation requirements. The GBJPA analyzed an Existing Water Bank Alternative that would involve participation in the Willow Springs Water Bank ("WSWB"). WSWB is an existing facility located in the Antelope Valley in Southern California capable of storing 500,000 acre-feet of water underground. As part of this alternative plan, Rosedale and IRWD would pay WSWB to buy into the developed capacities (if available) of the WSWB to store up to 28,000 AF of water. The water stored by Rosedale and IRWD could consist of a mix of unallocated Article 21 and other SWP water. No Kern River water or federal water supplies would be able to be captured by the WSWB alternative since there is no federal conveyance to WSWB. Since the water would be stored in an existing water banking facility, only a portion of the benefits identified as part of the Project would be realized. Unlike the proposed Project, participation in the WSWB would not generate any new intermittent wetland benefits, agricultural benefits resulting from crop substitution, or improved groundwater level benefits in the Kern Fan area of Kern County. Therefore, the proposed Project represents a more resilient alternative to Climate Change than the WSWB alternative. Additionally, the alternative does not fully meet all of the Small Storage Program priorities such as projects with multiple stakeholders and projects that provide multiple benefits including ecosystem benefits and groundwater enhancements

c) Does the project include other natural hazard risk reductions for hazards such as wildfires or floods? Explain.

Uncertainties related to the effects of climate change increase the need for water supply reliability that comes from new storage capacity. Climate change is expected to result in California becoming hotter and drier, with more periods of extended drought, wildfires, and a shift from less snowfall to more rainfall with significant potential for flooding. Due to these climatic uncertainties, there is a need for more storage to capture water supplies during wet periods and facilities to recover water supplies during dry periods. Storage capacity south of the Delta will be especially valuable as the effects of climate change continue, making dry year surface supplies increasingly less reliable to users south of the Delta. Therefore, the proposed Project has the potential to reduce these natural hazard risks by storing available flood water during wet years reducing potential flooding to agricultural areas and increasing water supplies throughout the state during dry years, which could also provide beneficial uses for fighting fires.

d) Does the project contribute to climate change resiliency in other ways not described above? Explain.

The Project will include sustainable infrastructure to improve community climate resilience. The Project will utilize high-efficiency electric motors and variable frequency drives (VFDs) to best match supply and demand and not waste energy via manually back-pressuring the system. Additionally, the Project would contribute to climate change resiliency benefits through the creation of intermittent wetland habitats for migratory birds along the Pacific Flyway, improved groundwater levels in the Kern County Sub-Basin, and preservation of permanent agriculture crops. The construction of recharge basins will promote healthy lands and soils, as well as protect water supplies and their associated users. Included in **Appendix K** is a visual representation of the multiple ecosystem benefits provided by groundwater recharge basins.

Severity of actual or potential drought impacts to be addressed by the project. Describe recent, existing, or potential drought conditions in the project area.

The State of California suffers from recurrent water supply shortages due to drought and the associated impacts of climate change, further exacerbated by increased competition for limited surface and groundwater supplies. This year, California is once again faced with dry conditions, with most of the state facing severe or extreme drought conditions. The Sierra snowpack, where much of the state's water is stored as snowmelt, occurred well below normal conditions. This year, April measurements of the Sierra snowpack, when the snowpack is typically near its deepest, were only 38% of the average (Sierra Nevada Updates, 2022). As a result, deliveries from the State Water Project have been reduced to five percent allocations with the expectation that next year will be dry as well. In addition, water supplies in major reservoirs throughout the state are at low levels and legal and environmental restrictions have impaired the SWP's ability to move water through the Delta, making dry year surface supplies increasingly less reliable to users South of the Delta (RRBWSD and IRWD). Additionally, January-October of 2022 has been the driest on record in California, see **Figure 6** below from the National Oceanic and Atmospheric Administration ("NOAA"), and Kern County continues to remain in exceptional drought conditions, see **Figure 7** from the U.S. Drought Monitor.

Figure 6. January-October 2022 Statewide Precipitation Ranks

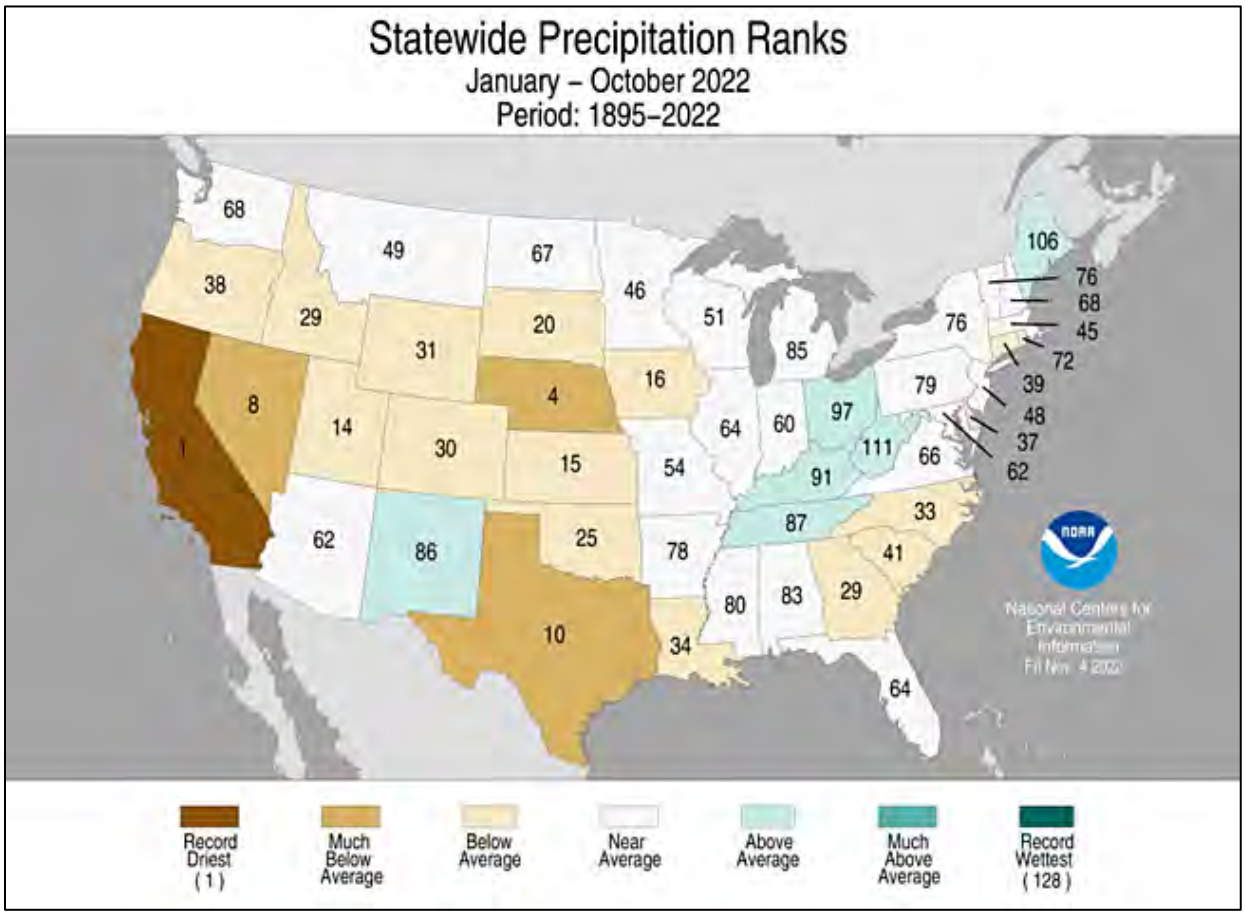
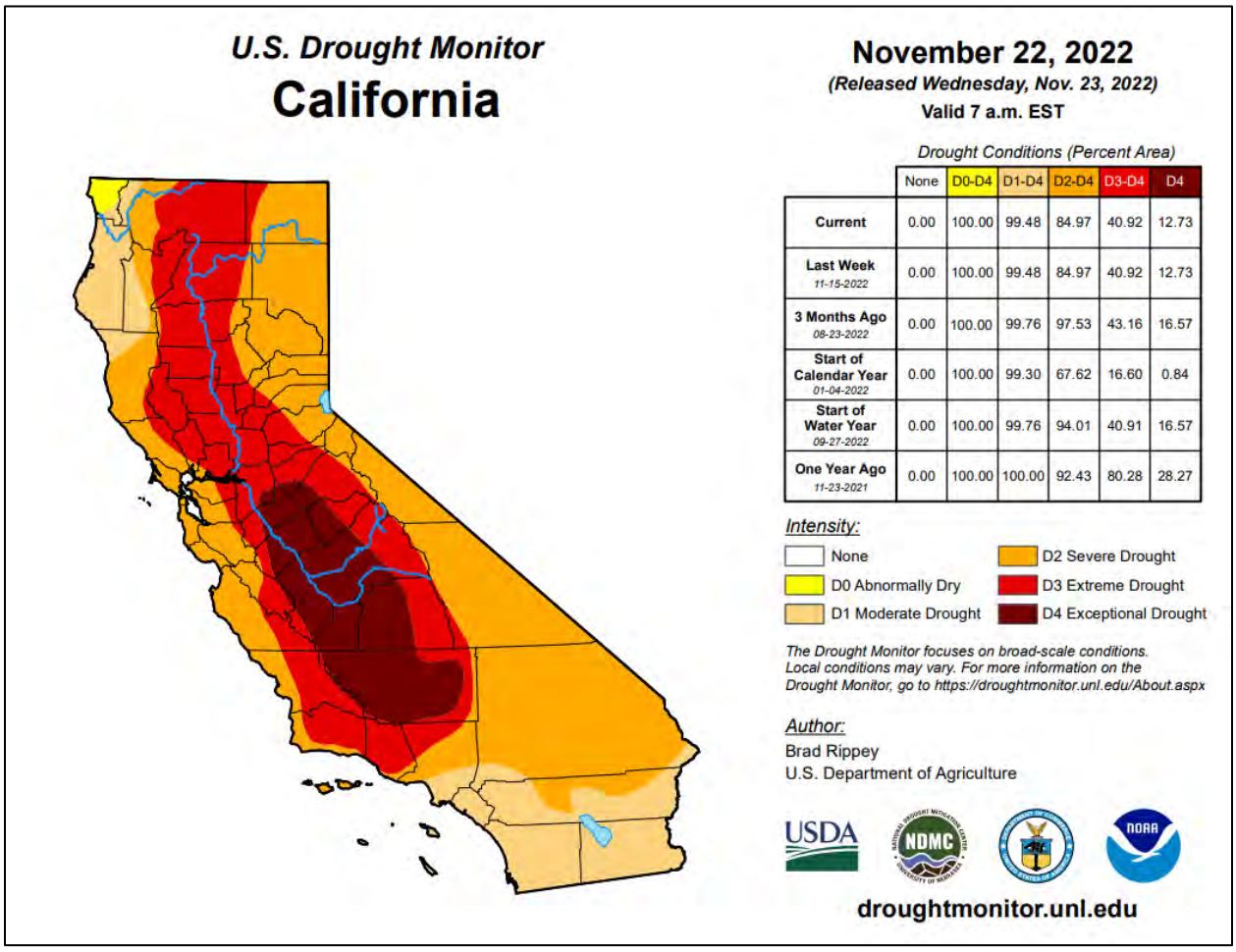


Figure 7. California Drought Monitor as of November 2022



a) Will the project help create additional flexibility to address drought? Will water made available by this project continue to be available during periods of drought? To what extent is the water made available by this project more drought resistant than alternative water supply options? Explain.

Phase I will help create additional flexibility to address drought. In response to the decreased reliability of water supplies due to drought, the GBJPA is pursuing the proposed Project to capture and recharge water into groundwater storage when water supplies are available during wet year cycles. This stored water may then be extracted during dry years when needed to provide environmental, agricultural, and water supply benefits. Additional groundwater storage is needed because groundwater storage projects allow the coordinated management of surface water and groundwater resources to maximize the availability and reliability of water supplies.

As previously described in this application and further detailed in the Project Feasibility Study, the GBJPA analyzed a No Project Alternative and an Existing Water Bank Alternative that would involve participation in the Willow Springs Water Bank. Since the water would be stored in an existing water banking facility, only a portion of the benefits identified as part of the Project would be realized. Unlike the proposed Project, participation in the WSWB would not

generate any new intermittent wetland benefits, agricultural benefits resulting from crop substitution, or improved groundwater level benefits in the Kern Fan area of Kern County. Therefore, the proposed Project would represent a more resilient alternative to Climate Change.

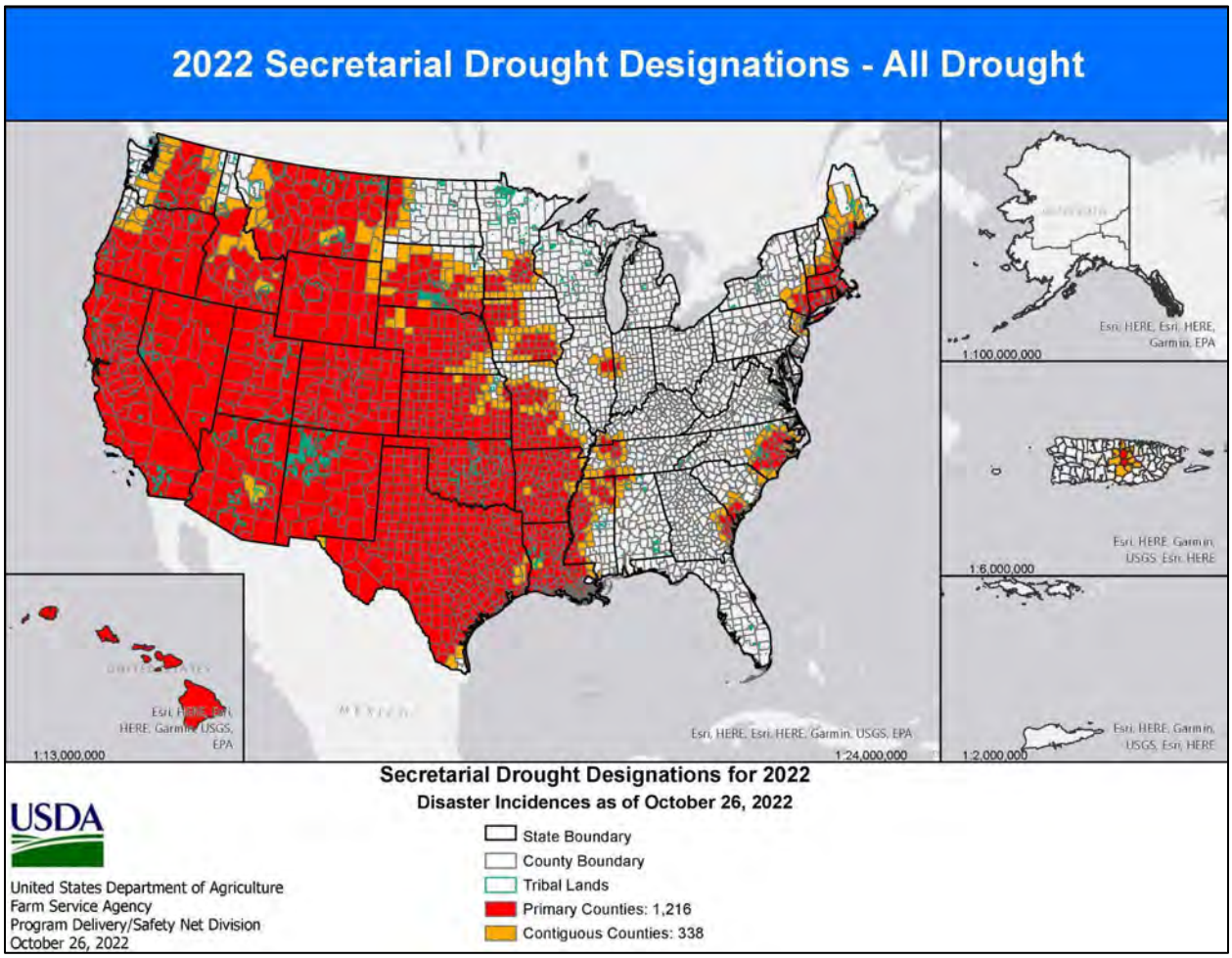
b) Has the area served by the project been identified by the United States Drought Monitor as experiencing extreme or exceptional drought for at least one consecutive year in the last four years? Explain.

Yes. The area served by the Project has experienced both extreme and exceptional drought conditions for at least one consecutive year in the last four years (from December 2020-December 2021). Please see **Appendix L** for the last four years of Kern County drought data (calculated via cumulative percent area) taken from the U.S. Drought Monitor website, as well as a fact sheet describing the calculation of the Drought Severity and Coverage Index. According to the data provided in **Appendix L**, from December 15, 2020, to December 28, 2021, Kern County experienced levels of both severe (D3) and exceptional (D4) drought conditions. See also **Figure 7** above for the most current drought conditions in the area. You may also use the following link for more information regarding drought conditions in Kern County via the United States Drought Monitor website: https://droughtmonitor.unl.edu/DmData/DataTables.aspx?county,06029.

c) Has the area served by the project been designated as a drought disaster area by the State in the last four years? Explain.

Yes. The area served by the Project, Kern County, has been designated by the United States Department of Agriculture ("USDA") as a Secretarial Drought Designated area for multiple years. The Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency (EM) loans available to producers suffering losses in those counties and in counties that are contiguous to a designated county. The Secretarial Disaster Designation Process includes Fast Track Secretarial disaster designations for severe drought, which provide for a nearly automatic designation when, during the growing season, any portion of a county meets the D2 (Severe Drought) drought intensity value for eight consecutive weeks or a higher drought intensity value for any length of time as reported in the U.S. Drought Monitor. **Figure 8** below shows Secretarial Drought Designations for 2022, where Kern County is listed as a primary county. See **Appendix M** for the last four years of Secretarial Drought Designation maps, where Kern County has been listed as either a primary or contiguous county. **Appendix M** also includes the USDA's Disaster Assistance fact sheet for more information regarding the disaster designation and declaration processes.

Figure 8. 2022 Secretarial Drought Designations



E.1.2. Evaluation Criterion 2—Water Management Flexibility (16 points)

E.1.2.1. Subcriterion No. 2a—Operational Flexibility (10 points)

Will the project help create additional operational flexibility to improve the management of water supplies? If so, how?

Yes, the project will create additional operational flexibility to improve the management of water supplies on a fundamental level, by storing excess water in flood years and calling upon those supplies during droughts. This project will also increase operational flexibility by allowing the GBJPA to meet return obligations and potentially form more exchanges and partnerships throughout the state, with both SWP and Federal supplies and obligations. See **Appendix F** for a historic log of exchanges/contracts that Rosedale has participated in. The project will also create

operational flexibility throughout local and State entities by providing a dry year water supply, a beneficial tool for better water management during prolonged drought.

The Project is intended to be integrated with Rosedale's Conjunctive Use Program. The proposed Project will provide flexibility for the GBJPA to integrate the operation of the project recovery facilities within the project area with other recovery facilities in Rosedale's Conjunctive Use Program, including other existing Rosedale facilities, the Strand Ranch and Stockdale Projects' onsite and offsite facilities. As part of this project, to optimize the operational flexibility of groundwater and facility management, Rosedale could recover groundwater on behalf of itself and/or IRWD, at any facility available to Rosedale within its Conjunctive Use Program (Final EIR, 2021). Overall, the Project offers exceptional flexibility to better manage available supplies, utilizing the groundwater basin as storage and existing infrastructure for the conveyance of water, all of which supports improved operations of the state and federal water systems.

Does the project implement a regional or state water plan or an integrated resource management plan? Explain.

The proposed Project is a milestone in Rosedale's Groundwater Sustainability Plan to obtain a sustainable water supply by 2040. The path and the milestones to meet by 2030 can be seen in **Appendix N**. The project is critical to meeting RRBMA's goals and successfully implementing the water plan through the Kern County Sub-Basin. This project will also contribute to the Joint Operating Committee and the Kern Fan Monitoring Committee, protecting groundwater for both agricultural and domestic users alike. To view Rosedale's Groundwater Sustainability Plan, use the following for more information: https://www.rrbwsd.com/wp-content/uploads/2022/07/2022-07-15-jpa.-RRBMA-Revised-GSP-Chapter-clean-FINAL.pdf.

The Project will also help implement *California's Water Supply Strategy – Adapting to a Hotter, Drier Future* released in August 2022. This focused plan is designed to ensure California's water can meet future needs and adapt to climate change and prioritizes the key strategies, including the need to expand average annual groundwater recharge by at least 500,000 AF. It specifically identifies the overall Kern Fan Groundwater Storage Project, which this Project is an initial phase of, as a key component in meeting California's expanded water storage objectives. https://resources.ca.gov/-/media/CNRA-Website/Files/Initiatives/Water-Resilience/CA-Water-Supply-Strategy.pdf

Will the project protect or improve the quality of surface water or groundwater? If so, explain how the project will accomplish this and the extent to which the project will do this.

In general, when groundwater levels stay high, fewer arsenic levels are present in the groundwater. Testing will be done at the pilot well hole sites for certain constituents of concern and at the direction of a hydrogeologist to minimize water quality impacts. An extremely strenuous water quality testing procedure is also completed while recovering water back to the Cross Valley Canal and will be required of the four additional wells in this project. The recharge of high-quality water into the aquifer is also expected to improve groundwater quality in the vicinity of the recharge basins. See section E.1.1.2 (d) for more information regarding water quality in the Project area.

Will steps be taken to minimize the environmental impacts of source water acquisition (intakes or groundwater pumping) as part of the project? If so, explain.

Yes. Phase 1 of the Kern Fan Project is uniquely geographically located to take advantage of innovative water management actions that minimize the environmental impacts of source water acquisitions/diversions. Operational exchanges of source water types (i.e. surface water exchanges) limit the quantity of water needed to be diverted through canals or open stream systems, taking advantage of the infrastructure already in place. Operational exchanges of source water types for groundwater (i.e. surface water supplies for previous banked groundwater supplies) allow for groundwater that has been previously recharged within the aquifer to remain within the aquifer. These surface water supplies can subsequently be diverted and/or utilized to lessen the environmental impacts at the source water point of diversion. In addition, all diversions to the Project for groundwater recharge will create temporary wetland habitats for migratory birds within the Project vicinity.

Will the project provide water or habitat for non-listed species? If so, how?

Yes, as previously stated recharge basins act as a great source of habitat for a large variety of species due to the variable management of said recharge basins. During recharge years with water supply availability, ducks, herons, shorebirds, and various other non-listed species can nest and roost at the Project site. During dry years, the recharge basins with native grasses and weeds act as a great source of upland habitat for quail, dove, and various other birds, mammals, and reptiles. On the back end, providing additional surface water supplies will in part be directed to providing water and habitat for non-listed species during threatening droughts.

E.1.2.2. Subcriterion No. 2b—Legal and Contractual Water Supply Obligations (6 Points)

Does the project help fulfill any of Reclamation's legal or contractual obligations such as providing water for Tribes, water right settlements, river restoration, minimum flows, legal court orders, or other obligations? Explain.

Yes. The Project will provide Rosedale and IRWD, both public water districts, with a more reliable water supply that can be utilized during drought or other periods of supply interruption. The project could provide opportunities to fulfill Reclamation's obligations by storing excess federal water supplies for increased Federal water supply reliability in dry years.

Will the project provide water or habitat for Federally listed threatened or endangered species? If so, how?

Yes. The Project will provide intermittent wetland benefits for migratory birds along the Pacific Flyway and other waterfowl in Kern County. The Project area will also support suitable foraging and hunting habitat for several raptor species, reptiles, and mammals that are typical to the western Mojave Desert region. Several Federally listed threatened or endangered species that could be supported by such habitat include the San Joaquin kit fox, Tipton kangaroo rat,

Nelson's antelope squirrel and the American badger. These three species have a medium or high potential to occur on Project site based on past detections and observed suitable habitat.

Will the additional storage in the local area provided by the project reduce reliance on imported water supplies that have an impact on Federally listed threatened or endangered species? If so, how?

Yes. The Project is a regional project that will provide increased water supplies for its stakeholders (Rosedale and IRWD) by storing excess water supplies when available, reducing reliance on the Delta and Friant water systems during periods of drought. The Delta is an important ecosystem for several threatened and endangered species such as the delta smelt and other listed salmonid species which are impacted during dry, critical years. Project operations during dry years will provide benefit to the Delta, as the GBJPA would be recovering water stored by the Project, subsequently reducing exports from the Delta.

Does the local area depend in whole or in part on imported water from the Colorado River Basin or other basins experiencing comparable levels of long-term drought? If so, will the project reduce reliance on imports specifically from the Colorado River? Explain.

Yes. IRWD receives imported water through the Municipal Water District of Orange County (MWDOC), which is a member agency of the Metropolitan Water District (MWD). MWD provides imported water to Orange County which consists of a blend of water from the Colorado River and the State Water Project. IRWD will utilize water stored within the Project to meet its imported needs when MWD is allocating water to its member agencies, potentially reducing the necessary supplies diverted from the Colorado River.

E.1.3. Evaluation Criterion 3— Rural and Economically Disadvantaged Communities (10 points)

Does the project provide benefits to at least one rural community? If so, explain and discuss to what extent the project serves rural communities. For the purposes of this funding opportunity, a rural community is defined as an incorporated or unincorporated census designated place with fewer than 50,000 people.

Yes, the project provides benefits to multiple rural communities. Many landowners living in the Rosedale-Rio Bravo WSD boundary are not connected to public water lines and are reliant on groundwater and a private or community well to deliver drinking water to their households. During severe droughts, residential users of the groundwater have had wells go dry and lose access to clean drinking water. These communities are outside of the greater Bakersfield area and would be considered rural communities by these standards.

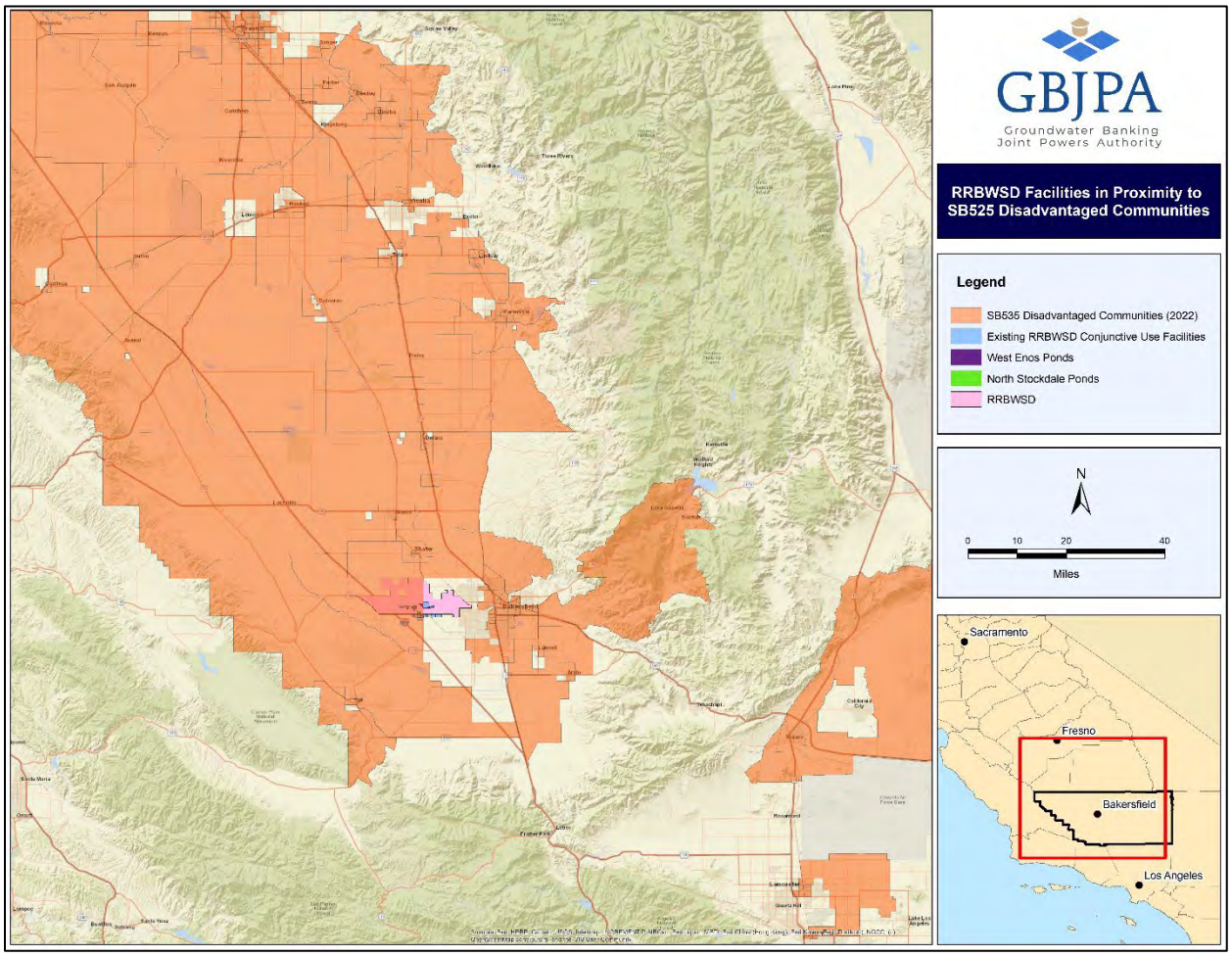
EO 14008 and EO 13985 affirm the advancement of environmental justice and equity for all through the development and funding of programs to invest in disadvantaged or underserved communities.

Does the project provide benefits to at least one economically disadvantaged community? If so, explain and discuss to what extent the project serves economically disadvantaged communities. This may include neighborhoods, census tracts, census designated places, or incorporated areas within a larger service area that are economically disadvantaged. A community may be considered disadvantaged based on a combination of variables that may include:

- ***a. low income, high and/or persistent poverty,***
- ***b. high unemployment and/or underemployment,***
- ***c. racial and/or ethnic segregation, particularly where the segregation stems from discrimination by Federal or non-Federal government entities,***
- ***d. linguistic isolation,***
- ***e. high housing cost burden relative to available income and substandard housing,***
- ***f. high transportation cost burden and/or limited access to public transportation,***
- ***g. high energy cost burden,***
- ***h. disproportionate environmental stressor burden and high cumulative impacts,***
- ***i. limited water and sanitation access and affordability,***
- ***j. disproportionate impacts from climate change,***
- ***k. jobs lost due to energy transition (e.g., fossil fuels to renewables),***
- ***l. jobs lost due to environmental regulations on resource intensive industries, and/or***
- ***m. lack of access to affordable healthcare.***

The GBJPA has groundwater banking projects with agencies that serve areas that include disadvantaged communities such as Rosedale, Lamont, Arvin, Delano, Firebaugh, Dos Palos, Los Banos, Gustine, and Newman. These facilities would provide drought water supplies to these areas. All of the previously mentioned communities lie within the orange areas of the map, see **Figure 9**, which represents SB 535 Disadvantaged Communities designation. These areas are below 80% of the statewide median income.

Figure 9. SB 535 Disadvantaged Communities Designation (in orange)



E.1.4. Evaluation Criterion 4—Stakeholder Support (9 points)

Does the project promote collaborative partnerships to address water and related issues? Explain.

Yes, the Project will promote collaborative partnerships throughout the State. For one, IRWD and Rosedale-Rio Bravo will be working together to maximize supplies banked in wet years and recover those supplies in years of drought. The Project will also promote regional partnerships that will provide a reduced reliance on the Delta and Friant water systems during periods of drought. Lastly, the Project will build drought resiliency for local stakeholders by maintaining groundwater levels and creating opportunities for other water exchanges throughout the State. Please see attached **Appendix J** for Stakeholder support letters and support letters from other entities regarding the full Kern Fan Project.

Does the project include outreach and opportunities for the public to learn about the project either during planning, design, construction, and/or completion? Explain.

The project has included outreach and opportunities for the public/stakeholders to voice concerns and support for the project for the past two years. The construction of both of these project sites are adjacent to state highways and will be in the public eye for stakeholders and the general public for the duration of the Project. The Project also has a website available to the public for more information on the project. (https://www.kernfanproject.com/)

Rosedale routinely encourages its Stakeholders to attend monthly Board meetings and Stakeholder Advisory Committee meetings that occur every other month. In addition, the proposed overall Kern Fan Groundwater Storage Project is a planned supplemental water supply project included in the Rosedale Management Area ("RRBMA") Groundwater Sustainability Plan. To maintain groundwater sustainability within the Rosedale management area, the RRBMA plans to implement a combination of water banking projects and water management actions. Rosedale works closely with its landowners to discuss the implementation of the Groundwater Sustainability Plan. The Stakeholder Group is made up of representatives from four key interests within the RRBMA: Agricultural, Urban, areas outside of the Rosedale service area boundary, and Groundwater Banking entities. These meetings provide stakeholders within the RRBMA an opportunity to participate in the development and implementation of the Groundwater Sustainability Plan. IRWD also encourages public participation and invites customers to attend Board meetings and comment on agenda items or other issues in front of their Board. The GBJPA recently had a presentation regarding Kern Fan Project conveyance alternatives on October 26, 2022, where the public was invited to attend in person or via Zoom, provide comments, ask questions, and access and download presentation materials.

Does the project provide a more reliable water supply for States, Indian Tribes, and/or local governments (including subdivisions of those entities)? If so, identify the specific beneficiaries and explain how reliability is improved for each by partnership in the project.

The Project does not specifically benefit one State or local government entity, but by increasing dry year water supplies many state and local government entities stand to benefit. As shown in **Appendix J**, which includes support letters for the Project, there are numerous entities and governmental districts that would benefit from water supply reliability improvements provided by the proposed Project.

E.1.5. Evaluation Criterion 5—Economic Benefits (30 points)

E.1.5.1. Subcriterion No. 5a—Cost Effectiveness (10 points)

1. ***Reclamation will calculate the cost per acre-foot of water produced by the project using information provided by project sponsors.***

   Please provide the following information for this calculation:
   (a) the total estimated construction costs, by year, for the project (include all previous and planned work) as shown in Table 3.

The estimated construction costs by year can be found in **Table 3** below and are backed up in **Appendix O with additional backup in Appendix S** .

Table 3. Estimated Construction Costs by Year

Calendar Year	***Construction Cost***
1. 2022	***$8,995,398.00*****
2. 2023	***$6,532,958.74***
3. 2024	***$12,853,448.84***
4. 2025	***$7,590,727.79***

*** Please note the costs associated with 2022 are property acquisition costs*
Costs are shown in 2022 dollars

(b) total estimated or actual costs to plan and design the project.

$1,245,000 for the design of the facilities for the project and an additional $250,000 for the design of the SCADA components. As part of the environmental planning of the project an additional $130,000 was estimated and $35,000 for NEPA review. Total planning/design = $1,660,000. Please note construction management and inspection services were not included in this. See **Appendix O** and the Budget Proposal (**Table 11**) for more detail and backup.

(c) the average annual operation and maintenance costs for the life of the project. Please do not include periodic replacement costs in the operation and maintenance costs. Periodic replacement costs should be provided separately in response to Question (f) below. Note: This is an annual cost, not total cost.

The average annual estimated operation and maintenance (O&M) costs for the Phase 1 Project is $335,242 in 2022 dollars. The Project sponsor estimated the O&M annual costs of the Phase 1 Project based on the 2021 Preliminary Design Report prepared by Dee Jaspar & Associates for the full Kern Fan Project, which includes Phase 1 facilities (**Appendix T**). The Preliminary Design Report includes the estimated operation and maintenance costs for the Kern Fan Project for three types of operating years: Recharge, Recovery, and Idle. The estimated costs were based on Rosedale's actual costs and extensive experience operating and maintaining recharge basins, recovery wells, and other appurtenant facilities. The number of Recharge, Recovery and Idle years expected over the life of the Project were based on the modeling results of MBK Engineers (**Appendix G**). The proportions of Recharge, Recovery and Idle years were used to calculate a weighted annual O&M cost. This annual value was

applied to the 50 years of expected operation to determine an appropriate present value of O&M costs.

(d) the year the project will begin to deliver from stored water upon completion.

The GBJPA estimates that water deliveries to the Phase 1 Project for storage will be available by 2026.

(e) the projected life (in years) that the project is expected to last. Note: this should be measured from the time the project starts delivering water.

The typical lifespan of wells is approximately 50 years. Motors, pumps, and electrical systems are about 10-20 years, and typical conveyance facilities are estimated to be about 50-100 years. For purposes of the application criteria, the proposed anticipated 'life' of the Project could provide water supply benefits for 50-plus years until facilities would need to be replaced and/or repaired. The project sponsor estimated the replacement costs of the Phase 1 Project based on the 2021 Preliminary

(f) all estimated replacement costs by year as shown in Table 4. If there are multiple replacement costs in 1 year, or at the same interval, please total them and put them on one line with the year or interval.

Table 4. Replacement Costs by Year

Description of Replacement Requirement	Year	Cost
Interbasin Recharge Basin Structures (West Enos)	**2073**	**$436,037**
Interbasin Recharge Basin Structures (Stockdale North)	**2074**	**$290,692**
Conveyance Pipeline and Crossings (West Enos)	**2099**	**$16,267,275**
Conveyance Pipeline and Crossings (Stockdale North)	**2100**	**$19,010,172**
(2) Well Replacement (West Enos)	**2073**	**$7,002,479**
(2) Well Replacement (Stockdale North)	**2074**	**$6,785,964**
(2) Pump, Motor, Well Appurtenances (West Enos)	**2034**	**$3,755,305**
(2) Pump, Motor, Well Appurtenances (Stockdale North)	**2035**	**$3,755,305**

The assumptions made in the table above closely follow a standard engineering lifespan calculation. The interbasin structures in the recharge basins typically last 50

years, the pipeline which will be PIP PVC pipe, an estimated 75 years, the well replacement approximately 50 years, and the pump and motor, and other well appurtenances every 10 years. Using an engineer's recommendation, a flat 2% for inflation was applied to all replacement costs. See **Appendix S** for backup.

(g) The maximum volume of new water (in acre-feet) that will be available for delivery annually upon completion of the project. This volume of water must correspond to the costs provided above. If costs are only provided for a portion of the project, then only the water produced by that same portion or phase of the project will be considered.

The Project will be able to deliver water based on the availability of water supply which is dependent upon the hydrology of that year. The GBJPA utilized modeling results provided by consultants at MBK Engineers to estimate the anticipated water supply that could be available for the Project. MBK Engineers performed a hydrologic analysis using the CalSim II baseline Benchmark model with 20135 Central Tendency Climate data, published by Reclamation in March 2022. For purposes of this feasibility study, the results from MBK's analysis attributed solely to the 100,000 AF storage of the full Kern Fan Project were scaled down proportionally to the 28,000 AF of groundwater storage provided in Phase 1. The expected average annual water supply for the Phase 1 Project is approximately 2,482 AF per year (**Appendix G**). The other method of calculating the annual water supply, as shown in evaluation criteria E.1.1, produced a very comparable 2,940 AF per year.

In extremely wet years the Project sponsor could potentially use the recharge basins year-round to store water in the aquifer. The GBJPA estimates that in a typical wet year, the recharge basins will be used for 4 months out of the year and can recharge approximately 14,940 AF of water into the aquifer. In extremely wet years, the Project sponsor could potentially use the recharge basins year-round to store water in the aquifer.

The total costs and estimated water supplies estimated for the Project are summarized in Table 8 below.

2. Reclamation will calculate the cost per acre-foot for the project using the information requested in Section E.1.5.1, Question 1, and compare it to any other water supply options identified by the applicant as a potential alternative to evaluate the cost effectiveness of the project. Please provide the following information for this comparison:

(a) a description of the conditions that exist in the area and projections of the future with, and without, the project.

The GBJPA has evaluated the conditions and future projections with, and without the Phase 1 Project. As mentioned, water supplies in California are stressed due to increased competition, reoccurring drought, environmental restrictions, and the effects of climate change. The Phase 1

Project will provide an essential supplemental supply for IRWD during periods of extended drought and major water supply interruptions and in meeting Rosedale's supplemental water supply needs to help avoid a potential long-term water supply deficiency. In addition, IRWD and Rosedale need to plan for supply shortages due to long-term climate change impacts that affect the timing and frequency of water supplies. By capturing water during wet years when excess supplies are available, Rosedale and IRWD will be able to utilize the stored water during dry years when water supplies are extremely limited. This dry year supply would provide Rosedale and IRWD customers with increased water supply reliability. Water supplies from the Project can also be utilized during other water supply shortages such as a Delta levee failure event. In addition, during wet years Rosedale and IRWD can procure water at a low cost in comparison to purchasing water during dry years when water supplies are extremely high cost. During periods of drought, many farmers are forced to fallow their lands due to the inability to purchase costly water supplies. The Phase 1 Project will provide Rosedale and DRWD agricultural customers with an affordable water supply during periods of drought.

During recharge events, the Project will provide intermittent wetland habitat along the Pacific Flyway that supports migratory birds and other waterfowl. Project operations during dry years will also provide an indirect benefit to the Delta, as the GBJPA would reduce its imports from the Delta by recovering water from the Project in Kern County instead.

The Project is intended to be integrated with Rosedale's Conjunctive Use Program. The proposed Project will provide flexibility for the GBJPA to integrate the operation of the project recovery facilities within the project area with other recovery facilities in Rosedale's Conjunctive Use Program, including other existing Rosedale facilities, the Strand Ranch and Stockdale Projects' onsite and offsite facilities. As part of this project, to optimize the operational flexibility of groundwater and facility management, Rosedale could recover groundwater on behalf of itself and/or IRWD, at any facility available to Rosedale within its Conjunctive Use Program (Final EIR, 2021). Overall, the Project offers exceptional flexibility to better manage available supplies, utilizing the groundwater basin as storage and existing infrastructure for the conveyance of water, all of which supports improved operations of the state and federal water systems.

Without Project Future Projections

Without the Project, Rosedale and IRWD would not be able to fully meet demands during droughts and other water supply interruptions. Additional stored water supplies would not be available to Rosedale and IRWD during periods of drought or supply interruption, decreasing water supply reliability for their customers. Rosedale and IRWD would be forced to procure costly dry year supplies, and likely would need to pass these costs on to their customers. This would create negative impacts on Rosedale and DRWD and even potentially other federal contractors that could benefit from dry year supplies provided by Phase 1. To procure dry year supplies, Rosedale and IRWD would likely rely on what little water supplies are available from the Delta. During wet-years, intermittent wetland habitat along the Project recharge basins would not exist along the Pacific Flyway for waterfowl and other shorebirds, raptors, and migrating birds. Rosedale would also be in danger of triggering minimum thresholds and exceedances, and by doing so would fail to comply with their GSP under SGMA. Finally, without the Project's additional groundwater storage, during wet years excess water supplies would be lost to the

ocean or otherwise left uncaptured for future use due to a lack of storage options available. A No Project Alternative does not meet any of the Planning Objectives or Small Storage Program priorities described above.

(b) the cost per acre-foot of other water supply alternatives that could be implemented by the non-Federal project sponsor in lieu of the project.

The cost-effectiveness of the Project has been compared to IRWD and Rosedale purchasing alternative water supplies during dry years. Without the project, IRWD's only alternative is to continue to purchase imported water from the Metropolitan Water District of Southern California (MWD) to supplement its water supply during dry periods to meet demands. Without the Project, Rosedale, and DRWD would have to purchase water through a water market, likely north of the Delta.

The Project sponsor completed an analysis comparing the proposed Project supply costs to purchasing imported water from MWD and a water market north of the Delta. The "Other Water Supply Alternative" includes the cost to purchase MWD untreated water and the cost to purchase water north of the Delta through a water market over the same 50-year operating period. Under the "Other Supply Alternative, the Project sponsor would need to purchase at least 124,100 AF of imported water. For the Phase 1 Project supply, the GBJPA considered all costs associated with the Project supply including capital, interest during construction, O&M, and replacement costs. The GBJPA's calculated cost per AF of these water supply alternatives is shown in **Table 5**.

Table 5: Cost/AF Comparison of Water Supply Alternatives

Description (Based on 50-year operating period)	Phase 1 Project Supply Alternative	Other Water Supply Alternative
Total imported water purchases from MWD (AF)	-	55,350
Total imported water purchases from north of the Delta (AF)	-	68,750
Net present value of imported water purchases from MWD	-	$53.4 million
Net present value of imported water purchases from north of the Delta	-	$34.5 million
Total avoided imported water purchases (AF)	124,100	-
Net present value of all project costs	$50.15 million	-
Cost per AF (50 years, net present value basis)	**$404.15**	**$708.56**

The net present value of the cost of the "Other Water Supply Alternative" (imported water purchases) over the 50-year period is $708.56 per AF. The net present value unit cost of the "Phase 1 Project Supply Alternative" is $404.15 per AF, a savings of $304 per AF. The analysis demonstrates that the Phase 1 Project is cost-effective as compared to the "Other Water Supply Alternative" (dollars per AF). The details and assumptions used to determine the cost of purchasing water from MWD and through a water market north of the Delta are described in the "Project Benefits" section below.

(c) if available, the cost per acre foot of one water supply project with similar characteristics to the project. This information does not have to be provided if it is not available. It is intended to provide another possible comparison to demonstrate the cost effectiveness of the project.

The GBJPA has evaluated the approximate cost per acre-foot of participating in an existing water bank, the Willow Springs Water Bank (WSWB). WSWB is an existing facility located in the Antelope Valley in Southern California capable of storing 500,000 AF of water underground. The WSWB is situated on highly permeable soils near three major water conveyance facilities (East Branch of the California Aqueduct, the Antelope Valley-East Kern West Feeder, and the Los Angeles Aqueduct) and offers water storage opportunities to both upstream and downstream water agencies.

If available, Rosedale and IRWD would pay WSWB to buy into the developed capacities (if available) of the WSWB to store up to 28,000 AF of water. The water stored by Rosedale and IRWD could consist of a mix of unallocated Article 21 and other SWP water. No Kern River water or federal water supplies such as Section 215 or RWA supplies would be able to be captured by the WSWB alternative since there is no federal conveyance to WSWB.

The cost to buy into a developed water bank was determined based on acquiring shares that would provide at least 28,000 AF of storage, approximately 14,940 AF of recharge capacity per year, and 14,480 AF of recovery capacity per year. The GBJPA would need to purchase shares where one share is equal to 5 AF of storage, 1/3 AF per year of recharge capacity, and 1 AF per year of recovery capacity. To acquire the minimum capacities stated, approximately 45,455 shares at a total cost of $79.5 million would need to be purchased. The annual operations and maintenance (O&M) cost associated with the WSWB includes the additional cost of power to pump the available Article 21 and other SWP supplies to the project diversions off the California Aqueduct.

Participation in the WSWB would potentially allow the GBJPA to store approximately 1,730 AF of water on an average annual basis based on projected average annual Article 21 supplies. It should be noted that only Article 21 and other SWP supplies can be stored in the WSWB as the WSWB would not be able to store other available supplies such as Federal CVP or Section 215 water. The cost of project water on a dollar per AF basis was calculated based on the total cost to participate in WSWB divided by the projected water supply over the life of the Project (1,730 AF x 50 years).

Table 6 shows feasibility-level cost estimates for the Existing Water Bank Alternative Plan in 2022 dollars.

Table 6: Existing Water Bank Alternative Plan Cost Estimates

	Existing Water Bank Participation
Buy-in Cost for 45,455 Shares	$79.5 million
Annual Operation and Maintenance Costs[1]	$2.0 million
Total Annual Costs	$4.63 million
Dollar per AF Cost	$1,590

Notes:

[1] O&M cost reflect an average annual put/take of 1,730 AFY associated with Article 21 and other water supplies

(d) discussion of the degree to which the project is cost-effective, including, where applicable, a discussion of why the project may be cost effective even if the overall project cost appears to be high.

The net present value of the cost of imported water purchases from MWD and through a water market north of the Delta over the 50-year period is $708.56 per AF. As shown in Table 8 below, the net present value unit cost for the Project is $404.15 per AF, a savings of $304 per AF (See **Table 5**).

Without the Project, the GBJPA's estimated costs would be $87.9 million ($53.4 million + $34.5 million) as shown in Table 5 over the 50-year operating period. With the implementation of the Project, GBJPA's estimated costs would be approximately $50.15 million (see **Table 8**). The Phase 1 Project represents a net present value savings in excess of $37.7 million over the 50-year period. This demonstrates that the Project is highly cost-effective.

E.1.5.2. Subcriterion No. 5b—Economic Analysis and Project Benefits (20 points)

1. Summarize the economic analysis performed for the project, including information on the project's estimated benefits and costs. Describe the methodologies used for the analysis that has been conducted. Points will be awarded based on a comparison of the benefits and costs of the project. The information provided should include:

(a) quantified and monetized project costs, including capital costs and operations and maintenance costs.

(b) quantified and monetized project benefits. This includes benefits that can be quantified and expressed as a monetized benefit per acre-foot. This may include, but is not limited to: benefits related to water supply quantity and water supply reliability, recreational benefits, ecosystem benefits, water quality, flood risk mitigation, and energy efficiency. Benefits may also include the avoided costs of no action (i.e., the costs that would be incurred if the project were not implemented), and the willingness of users or customers to pay for a benefit or to avoid a negative outcome (i.e., the willingness of households to pay for a water supply system that would reduce the chance of a drought emergency within a locality or State).

(c) if quantified and/or monetized information for these benefits is not available, they may be addressed in response to Question 2 below.

(d) (A comparison of the project's quantified and monetized benefits and costs.

****Please note that information must be included in the proposal to be considered. Scores will not be based on information provided in the project's feasibility study if the information is not included in the proposal.***

2. ***Some project benefits may be difficult to quantify and/or monetize. Describe any economic benefits of the project that are difficult to quantify and/or monetize. Provide a qualitative discussion of the economic impact of these benefits. Points will be awarded based on the potential economic impact of the project-related benefits. Some examples of benefits may include, but are not limited to, benefits to habitat or species, local impacts on residents and/or businesses, job creation, and regional impacts. This may also include benefits listed in Section E.5.1.2, Question 1, if they have not been monetized (e.g., water reliability, water quality, recreation, flood risk mitigation, etc.).***

3. ***Does the project provide multiple benefits, or is it a single purpose facility? If the project provides multiple benefits, please describe. The purpose of this question is to identify projects with multiple benefit categories (i.e., projects will be evaluated based on how the proposed project will provide multiple benefits, including water supply reliability, ecosystem benefits, groundwater management and enhancement, and water quality improvements.***

The GBJPA performed a comprehensive quantification and monetization evaluation of the costs and benefits of the Phase 1 Project. The following costs and benefits have been identified and quantified.

Project Costs

The GBJPA has quantified and monetized the Project costs, including operations, maintenance, and replacement costs. The capital cost estimate for the Phase 1 Project is considered a Class 3 Level Cost Estimate per the AACE International guidelines. The Class 3 estimate includes the contract costs which are the estimated construction costs; the field costs which include a twenty percent (20%) contingency and design contingencies for unlisted items; and the construction costs which include the land acquisition costs, easement procurement costs, mitigation costs fees, and the non-contract costs which include project management, engineering design, bid administration, and construction management and inspection. The 20% contingency utilized is consistent with the Class 3 estimate criteria per AACE International Practice No. 18R-97 and the Reclamation Manual Directives and Standards document FAC 09-01. The capital cost estimate for the Phase 1 Project Alternative Plan is $36.6 million.

Interest during construction is calculated separately from the project's capital costs. Costs are in 2022 dollars, expressed in present value terms at the expected start of project operations using the Federal water resources planning discount rate of 2.25 percent interest during construction, which is the interest on capital expenditures between the time of expenditure and the start of operations. The Phase 1 Project is expected to incur Interest During Construction costs from the

period May 2023 through September 2025. The estimated interest during construction for the Phase 1 Project is $2.47 million.

As mentioned, a Preliminary Design Report was prepared for the full Kern Fan Project, which includes the Phase 1 Project facilities. The Preliminary Design Report includes the estimated operation, maintenance, and replacement costs for the Kern Fan Project for three types of operating years: Recharge, Recovery, and Idle. The estimated costs were based on Rosedale's actual costs and extensive experience operating and maintaining recharge basins, recovery wells, and other appurtenant facilities. The operation, maintenance, and replacement costs for the Phase 1 Project were estimated using costs documented in the Kern Fan Project Preliminary Design Report. The estimated operations, maintenance, and replacement cost for the 50-year operations period starting in 2026 is $11.06 million.

The net present value of the capital, operations, maintenance, and replacement costs for the Phase 1 Project is $50.16 million (see Table 8).

Project Benefits

The Phase 1 Project is a regional project that will provide increased water supplies for multiple stakeholders including IRWD, Rosedale, DRWD, and potentially other federal water districts which will help to provide a more reliable supply for local agencies and communities, especially during dry years when surface water supplies are short. The Phase 1 Project is intended to be integrated with Rosedale's Conjunctive Use Program. The Project would provide flexibility for the GBJPA to integrate operations of the Project with existing IRWD and Rosedale recharge and recovery facilities, thereby maximizing operational efficiency and effectively managing water supplies. The Project could provide opportunities to fulfill Reclamation's obligations by storing excess federal water supplies for increased water supply reliability for many Friant federal water districts during dry years. In addition, during dry years, Project operations will reduce impacts on threatened environmental resources in the Delta by recovering banked water from the Project and reducing water exports thus alleviating stress in the Delta during critical periods. The Project offers exceptional flexibility to better manage available supplies, which supports improved operations of the state and federal water systems.

Additionally, the Phase 1 Project will provide increased water supply reliability benefits that are crucial in mitigating the effects of climate change in California. Climate change is expected to result in California becoming hotter and drier, with more periods of extended drought, a shift from snowfall to rainfall with significant potential for flooding, and the need for more storage to capture supplies during wet periods. Additional Project benefits include intermittent wetland habitat that will be created for waterfowl and migratory birds along the Pacific Flyway, improved groundwater levels in the Kern County Sub-Basin, and preservation of permanent agriculture crops.

The basis for the quantification of benefits provided by the Project is the modeled water supplies anticipated for the Project. MBK Engineers performed a hydrologic analysis, presented in **Appendix G**, using the CalSim II baseline Benchmark model with 2035 Central Tendency Climate data, published by Reclamation in March 2022. The Baseline scenario for this analysis is

the Reclamation Benchmark Model dated March 3, 2022. Regulatory requirements in the model included all existing regulatory requirements, actions detailed in the 2019 United States Fish and Wildlife Service (USFWS) and the 2019 National Oceanic and Atmospheric Administration (NOAA) Fisheries Biological Opinions for delta smelt and listed salmonid species, as well as the March 31, 2020, Incidental Take Permit, issued by the California Department of Fish and Wildlife (CDFW) for the SWP. The benchmark model also included the changes to operating criteria and requirements put in place under the 2018 Coordinated Operations Agreement Addendum. The hydrologic analysis was performed for the full Kern Fan Project consisting of 100,000 AF of groundwater storage. The availability of Article 21 and Section 215 water supplies were modeled in this analysis, however additional water supplies may be available for recharge at the Project. For purposes of this Feasibility Study, the results from MBK's analysis were scaled proportionally to the 28,000 AF of groundwater storage provided by the Phase 1 Project. Based on previous investigations by MBK Engineers, project yield is more dependent on available water supply than groundwater storage capacity. Therefore, the project sponsors feel that this approach is acceptable, as it still depicts the availability of water supplies.

A spreadsheet model was prepared by consultants at M.Cubed to evaluate the economic benefits of the full Kern Fan Project. Further detail on the methods and assumptions used for calculating the economic benefits is provided in the Feasibility Study. The benefits can be further broken down in **Appendix D** and in the following sections.

M&I Water Supply Benefits

The Phase 1 Project would result in a net increase of M&I water supply due to increased capacity to capture and store surplus Article 21 and other sources of water supplies. It should be noted that Section 215 supplies are not considered M&I water supplies because they can only be used in the CVP Place of Use.

To quantify the benefits to M&I water users, consultant M.Cubed (**Appendix D**) performed an analysis utilizing an alternative cost approach to estimate the water supply benefits of the project. The Article 21 water supply from the project is divided between agricultural (75%) and M&I uses (25%), which have different alternative costs of water. The Phase 1 Project is expected to provide approximately 21,400 AF of SWP Article 21 water for M&I purposes over the life of the project.
For M&I uses by IRWD, the alternative supply cost is the Tier 1 untreated rate from the MWD, DWR variable OMPR component, and Pacific Gas and Electric (PG&E) pumping costs, which was approximately $676 per AF in 2015. This rate was escalated over time using MWD's forecast of Tier 1 prices as found in their Ten-Year Financial Forecast provided at a February 9, 2016, MWD Board Meeting. According to the forecast of Full-Service Untreated Tier 1 water, prices are projected to increase by an average of 5.6% from 2016 to 2026. Over the same period, average CPI inflation is projected to be 2.3%, resulting in an average real price increase of 3.3%. This rate of increase was applied to the MWD Tier 1 rates over the life of the project.
Conveyance costs in the SWP were applied using data provided by DRWD, which includes monthly conveyance costs from 2001 to 2017. Conveyance costs average $17.10 per AF in 2015 dollars.

The net present value in 2022 dollars of the M&I water supply benefit over the life of the project is estimated to be $21.14 million. The GBJPA estimates the M&I water supply benefit to be $987.89 per AF ($21.14 million divided by 21,400 AF of SWP Article 21 water). It should be noted that this benefit is attributed only to 25% of the Article 21 water from the Project for M&I uses.

Agricultural Water Supply Benefits

The incremental change in annual agricultural water supply provided by the Phase 1 Project is the basis for agricultural water supply benefits. As mentioned, the Article 21 water supply from the project is divided between agricultural (75%) and M&I uses (25%), and all Section 215 water is attributed to agriculture since it can only be used in a CVP Place of Use. The Phase 1 Project is expected to provide approximately 124,100 AF of SWP Article 21 water and Section 215 water for agricultural purposes over the life of the project.

The alternative cost approach described for the M&I water supply benefits is applied to estimate the benefits of improved agricultural water supply (**Appendix D**). Delta export unit values[1] are provided for the 2030 and 2045 years, which are re-weighted according to the water year types during which Rosedale and IRWD are expected to recover stored groundwater based on hydrologic modeling by MBK Engineers. Since Rosedale and IRWD are projected to accrue water supplies in different water year types (with Rosedale drawing on their supplies mainly in dry and critically dry years) two different water values are required – one weighted for IRWD's supply and one weighted for Rosedale's supply. Water cost anchor points were used for 2030, 2045, and 2070 – 2030 unit values weighted at 2030 recovery levels, 2045 unit values weighted at 2030 recovery levels, and 2045 unit values weighted at 2070 recovery levels. Unit values for 2026 to 2075 were determined by interpolating between these unit values. The full range of unit values ranges from $293/AF for IRWD and $305/AF for Rosedale in 2030 to $744/AF for IRWD and $797/AF for Rosedale in 2045, in 2015 dollars. Conveyance costs in SWP were also applied using data provided by DRWD, which includes monthly conveyance costs from 2001 to 2017. Conveyance costs average $17.10/AF in 2015 dollars. The agricultural benefits were calculated in 2015 dollars and then escalated to 2022 dollars.

The net present value in 2022 dollars of the agricultural water supply benefit over the life of the project is estimated to be $51.2 million. The GBJPA estimates the agricultural water supply benefit to be $498.48 per AF ($51.2 million divided by 102,700 of SWP Article 21 and Section 215 water).

Groundwater Level Improvement Benefit

The additional water stored in Kern County as a result of the proposed Phase 1 Project will improve water levels in the Kern Sub-basin and support groundwater sustainability. The Phase 1

[1] The Delta export unit values were developed by the California Water Commission in their Water Storage Investment Program Technical Reference (November 2016). The unit values were developed from a statistical analysis based on water transfer prices from 1992 to 2015, the Statewide Agricultural Production Model (SWAP), and assumptions regarding groundwater sustainability requirements in California by 2045. The Technical Reference can be found here: https://cwc.ca.gov/Water-Storage

Project would provide local groundwater benefits based on a 2003 Memorandum of Understanding (MOU) between Rosedale and other adjacent water banking entities in Kern County. Per the MOU, a portion of banked groundwater, referred to as leave-behind water, is not recovered by the banking entity and remains in the ground to bolster local groundwater levels. The Phase 1 Project is a planned supplemental water supply project to provide the GBJPA with additional water supplies and is not related to mitigation for basin overdraft.

For the Phase 1 Project, groundwater basin leave-behind percentages vary depending on the water supply account – 9% of water in the M&I account and 4% of water in the agricultural account will be left behind to help recharge local basins, according to groundwater modeling assumptions used by MBK Engineers. These percentages are consistent with the MOU. Based on these values, a weighted average leave-behind rate of 6.5% was utilized to calculate the total groundwater level benefit.

For evaluating groundwater benefits from the project alternative plans, the alternative cost of recharging groundwater was considered to be the cost of purchasing water through a water market, likely north of the Delta. Average costs for purchasing Delta export water on the water market were based on unit values developed by the CWC in the WSIP Technical Reference. These unit values were developed from a statistical analysis based on water transfer prices from 1992 to 2015, the Statewide Agricultural Production Model (SWAP), and assumptions regarding groundwater sustainability requirements in the state by 2045. These unit values were developed for various water year types (wet, above normal, below normal, dry, and critical) for 2030 and 2045, the year it is assumed that groundwater basins will reach sustainable levels. Delta export costs used for the analysis were weighted according to historic water year type frequency according to the San Joaquin River Water Year Index to arrive at benchmark values for 2030 and 2045. SWP conveyance costs were also added to Delta Export costs.

The net present value in 2022 dollars of the groundwater level improvement benefit over the life of the project is estimated to be $4.0 million. The GBJPA estimates the groundwater level improvement benefit to be $32.31 per AF ($4.0 million divided by 124,100 AF of the Project water supply).

Agricultural Impact Benefit

The Phase 1 Project would provide a greater degree of reliability for agricultural water supply, which creates benefits to local agriculture that go beyond the value of the water supply itself. Not only would the project capture and store water for the benefit of agricultural uses, but an additional agricultural benefit is the preservation of permanent crops that would need to be replaced with low-value crops that could be fallowed if water was not available. The Phase 1 Project firms up the dry year supplies available for agricultural use by storing water that can be withdrawn for irrigation use in dry years and thus providing a greater degree of reliability for permanent crops. Permanent crops such as nuts and fruit require irrigation in all years and cannot be fallowed during dry years. So, without a reliable dry year water supply, the probable alternative is to switch to row crops, which may be fallowed when water supplies are short. With increased reliability, it is estimated that this acreage could instead be converted to higher-value permanent crops, such as fruit or nut trees. While the value of agricultural water to the existing

mix of crops is already included under the calculation of agricultural water supply benefit, the positive effects of preserving permanent agriculture are a separate benefit.

Without water provided through the Phase 1 Project, it is estimated that the alternative plans would prevent impacts to approximately 570 acres of crops from being fallowed in critically dry years when supplies are low. Per the Kern Groundwater Authority, the Groundwater Sustainability Agency in the Kern County Sub-Basin, an average annual native yield of 0.15 AF is allocated per acre to developed irrigated lands. The average annual precipitation for Rosedale's service area is estimated at 0.44 AF per acre, as described in the Rosedale-Rio Bravo Management Area Groundwater Sustainability Plan Chapter. Permanent crops, such as almonds, require approximately 3 AF of water per year per farmed acre. The total of Project water, plus the native yield of the Kern County Sub-Basin, plus precipitation provides 3 AF of water which is enough to irrigate approximately 570 acres, as shown below in **Table 7.**

Table 7: Agricultural Benefit Calculation Assumptions (Annual Water Demands per Crop)

Water Supplied by the Project per acre:	2.41 AF per acre (1,375 AF / 570 acres)
Native (safe) yield of basin:	0.15 AF per acre
Average annual precipitation:	0.44 AF per acre
Total AF per acre available for permanent crops:	3.00 AF per acre

Only Rosedale's water supply from the Phase 1 Project was considered when calculating the agricultural impact benefit. With 1,375 AF of Rosedale's annual water supply provided by the project, it is estimated that 570 acres of permanent crops could stay in production in Kern County. Impact Analysis for Planning (IMPLAN) data for Kern County was used to estimate the effects of crop conversion. IMPLAN is an input-output modeling software that allows users to estimate how economic changes in particular sectors impact the local economy. The value of cotton and permanent tree crops was used as an input into the IMPLAN model. The IMPLAN results estimate the direct impacts of crop conversion. It should be noted that only the direct benefits measured from IMPLAN were used in the benefit calculation and the indirect and induced benefits were excluded.

The net present value in 2022 dollars of the agricultural impact benefit over the life of the project is estimated to be $32.2 million. Backup can be found in the M.Cubed technical memorandum in **Appendix D**. The GBJPA estimates the agricultural impact benefit to be $467.75 per AF ($32.2 million divided by Rosedale's water supply over the life of the Project, 68,750 AF).

Intermittent Wetland Habitat Benefit

The Phase 1 Project would provide important intermittent wetland habitat for migratory birds during the years that the Project takes and recharges water into storage. During those years, the approximately 300 acres of wetted area that comprise the project's recharge basins will be inundated with water to percolate into the groundwater basin. The Pacific Flyway is a major migration route for waterfowl that extends from Alaska to South America, passing through Canada, California, and Mexico. In California, 95% of historic wetlands have been lost. The Central Valley in California is the most important waterfowl wintering area along the Pacific

Flyway. The open water and vegetation that will be provided as intermittent wetland habitat by the Phase 1 Project will provide substantial benefits to wintering waterfowl, shorebirds, raptors, and other native and migrating birds. Water will typically be recharged at the Phase 1 Project during the winter and spring months and will provide temporary habitat during wet and normal years when recharge activity occurs. The intermittent wetland habitat that will be provided by the Phase 1 Project will be approximately 300 acres.

Per the USFWS classification of wetlands in the United States, the Project will provide a wetland habitat that will most closely resemble a classification of Intermittent Flooded Riverine Wetlands with Unconsolidated Sandy Bottoms. Accordingly, the recharge basins constructed for the Project will be designed to meet intermittent wetland requirements during recharge operations. The recharge basins will provide intermittent wetland habitat to support waterfowl, shorebirds, raptors, and other migratory bird species along the Pacific Flyway.

Rosedale has been working with the Environmental Defense Fund (EDF) to construct and operate recharge facilities that have multi-benefits, including intermittent wetlands and bird habitats. EDF partnered with Point Blue Conservation Science, Audubon California, and Sustainable Conservation to develop a guide on how to build this kind of preferred recharge basin that provides operational benefits to basin management while also creating valuable water bird habitats. **Appendix K** is the guide prepared by EDF that describes the wildlife benefits associated with the multi-uses of recharge basins as intermittent wetlands.

To estimate the benefits associated with the creation of intermittent wetland habitat, an alternative cost approach was utilized. Under this approach, it is assumed that the GBJPA would purchase the land to create an equivalent acreage of wetlands over a similar period as those created by the Phase 1 Project and deliver the same volume of water through water purchases. To estimate the value of land required, the cost of a permanent easement for the wetlands and a long-term easement for constructing water conveyance facilities to the wetland was determined. Costs were estimated for a canal connection to the California Aqueduct, a conveyance canal to the site, canal siphons, and lift stations in addition to significant earthwork and interbasin structures to keep water in the recharge basins. Also included were the costs of restoring the land to its pre-wetland condition at the end of the project, based on a subset of costs from the project budget. For this approach, since the alternative project would only take excess water in wet years, the Delta Export unit value for wet years provided in the WSIP Technical Reference was utilized, which ranges from $204 in 2030 to $414 in 2045. Conveyance costs were added in from the period from 2001 to 2017 – $17.10 per AF. The annual benefit was estimated by interpolating between these values and leaving prices beyond 2045 at $414/AF to be conservative.

The net present value in 2022 dollars of the intermittent wetland benefit over the life of the project is estimated to be $62.2 million. See benefit summary in Table 8. The GBJPA estimates the intermittent wetland benefit to be $500.98 per AF ($62.2 million divided by 124,100 AF of the Project water supply).

The total cost per acre foot for the project, including replacement, is approximately $404.15 per AF. The total sum of benefits is approximately $1,375.28 per AF demonstrating that the project is highly cost-effective.

Table 8: Monetized Project Costs and Benefits Per AF

COSTS		
Project Capital Costs:	$	36,625,324
Interest During Construction:	$	2,472,209
NPV of O&M Costs:	$	10,001,746
NPV of Replacement Costs:	$	1,056,138
Total Costs:	$	50,155,417
Total AF Water Supplied:		124,100
Cost/AF:	**$**	**404.15**
BENEFITS		
M&I Water Supply Benefit:	$	21,140,855
Agricultural Water Supply Benefit:	$	51,193,439
Groundwater Level Improvement Benefit:	$	4,009,057
Agricultural Impact Benefit:	$	32,157,933
Intermittent Wetland Benefit:	$	62,171,008
Total Benefits:	$	170,672,292
Total AF Water Supplied:		124,100
Benefits/AF:	**$**	**1,375.28**
Benefit-Cost Ratio		**3.4**

1. ***Some Project benefits may be difficult to quantify and/or monetize. Describe any economic benefits of the project that are difficult to quantify and/or monetize. Provide a qualitative discussion of the economic impact of these benefits. Points will be awarded based on the potential economic impact of the project-related benefits. Some examples of benefits may include, but are not limited to, benefits to habitat or species, local impacts on residents and/or businesses, job creation, and regional impacts. This may also include benefits listed in Section E.5.1.2, Question 1, if they have not been monetized (e.g., water reliability, water quality, recreation, flood risk mitigation etc.).***

Project benefits that are difficult to quantify or monetize include:

- Climate change resiliency;
- Flood control;
- Secondary economic impacts from the preservation of permanent agricultural crops; and
- Increased operational flexibility.

Climate Change Resiliency

California's climate has been trending toward one that cycles between periods of large amounts of precipitation and times of drought. The California Department of Water Resources estimates a 10% reduction in water supply by 2040 in a planning scenario that considers increased

temperatures and decreased runoff[2]. While there are still uncertainties associated with the future impacts of climate change on California's weather cycles, it is reasonable to expect that changes to weather cycles will result in more rainfall and less snow in the mountains, earlier snowmelt, more intense rain events, and increasingly frequent droughts. These climate conditions will cause shorter periods of available excess supplies and longer periods of supply shortages. Groundwater storage provided by the Project will allow for these excess supplies to be captured and utilized when needed, increasing IRWD, Rosedale, and DRWD's resiliency to climate change. The additional benefits of climate change resiliency provided by the Project have not been quantified, but the Project sponsor recognizes the importance of mitigating the effects of climate change. Potable water system simulation models, used in a 2016 IRWD Water Supply Reliability Evaluation, demonstrated that IRWD's water banking capabilities were essential to maintaining a potable water supply during severe simulated climate change conditions.

Flood Control

In the event of a large flood event on the Kern River, the Phase 1 Project could potentially divert sufficient flood flows to avoid damage to federally insured crops downstream on the Kern River. The Phase 1 Project does offer some flood control protections in the form of reducing peak cfs flow on the Kern River during large flooding events downstream of the Project. Expected benefits include reduced flood damage on crops bordering the Kern River (e.g. potatoes, carrots, lettuce, and alfalfa) and the potential for fewer affected crops overall in the broader floodplain as well as the Buena Vista and Tulare Lake beds downstream – depending on the event and peak flow distribution. Although exceedingly rare, in the case of a 100 to 500-year flood event with upwards of 10,000 cfs in peak flow (before the Project site), the additional diversion capacity offered by the Project has the potential to reduce damage to federally insured crops in contribution with other diversions and efforts in the area. These benefits were not quantified as part of the Feasibility Study and are described here as a qualitative benefit of the Project.

Secondary Economic Impacts from the Preservation of Permanent Agricultural Crops

The expected benefit from preserving permanent agriculture will also result in secondary economic impacts. Although not monetized in the Feasibility Study, the additional permanent agriculture output is expected to contribute positively to the agricultural industry's increased purchase of goods and services from other local industries, as well as the impact on the local economy from an increase in household spending due to an increase in jobs.

Increased Operational Flexibility

In 2017, the Association of California Water Agencies (ACWA) completed a Storage Integration Study (June 2017). The purpose of this study was to define and quantify the benefits of integrating the operations of new storage projects with the existing SWP and the CVP. The study also analyzed how improved Delta conveyance capability could increase the benefits of integrated operations of proposed and existing storage facilities to help fulfill statewide water supply needs and priorities.

[2] California's Water Supply Strategy – Adapting to a Hotter, Drier Future, Aug 2022

The ACWA study shows that significant surplus water was available almost every year, which could be stored for later use during water-short years. Due to the nature of California's hydrology, there are often surplus flows in the SWP and CVP systems that may be diverted to storage. Surplus water in the ACWA report is defined as flow above what is necessary to satisfy all current water demands, including existing environmental mitigation measures and compliance obligations. This water cannot all be captured and stored with existing storage and conveyance infrastructure. Per the study, the Delta has the greatest availability of surplus flows, with an average annual of over 10 million AF. In wet years, there is an average of over 22 million AF of Delta surplus water. If there are no uses or demands for the surplus water and it cannot be diverted into storage, flooding can occur, and then ultimately this water is lost to the ocean.

ACWA identified the Kern Fan Groundwater Storage Project, as proposed by the GBJPA, as a means improve water supply reliability and operational flexibility of the SWP and CVP systems during periods of drought. By integrating the operation of SWP and CVP surface reservoirs with groundwater banking in the Kern River Fan Project, water supply reliability could be improved at a minimum cost. The Phase 1 Project will provide greater operational flexibility by utilizing up to 28,000 AF of contingency groundwater storage to augment supplies during periods when other water sources may be limited or unavailable.

2. Project Budget

2.1 Funding Plan

Describe how the non-Federal share of project costs will be provided. Reclamation will use this information in making a determination of financial capability

The GBJPA, which is made up of Irvine Ranch Water District and Rosedale-Rio Bravo Water Storage District, have different ways of funding the GBJPA's contribution to the cost share requirement of this funding opportunity. Rosedale's cost-match will be covered by the District's capital facility improvement portion of the regular budget. Rosedale-Rio Bravo maintains a capital improvement account and receives revenue through water sales and banking operations as well as land assessments. Irvine Ranch Water District will be contributing through a reserve account.

Please identify the sources of the non-Federal cost share contribution for the project, including: any monetary contributions by the applicant towards the cost-share requirement and source of funds (e.g., reserve account, tax revenue, and/or assessments)

The sources of the non-Federal cost share contribution are broken down in the paragraph above. Rosedale-Rio Bravo's contribution will come from a capital improvement account, revenue through existing water sales and banking operations, and land assessments. Irvine Ranch Water District will be contributing through a reserve account.

Please identify any costs that will be contributed by the applicant

The GBJPA will be contributing just over 75% of the costs towards the project or $29,358,150. See **Table 9** below for the breakdown of the funding amount.

Table 9. Funding Sources

Funding Source	**Funding Amount**
Non-Federal Entities	
Groundwater Banking Joint Powers Authority	$29,358,150.00
Groundwater Banking Joint Powers Authority (in-kind)	$ 0
Non-Federal Subtotal	**$29,323,150.00**
Requested Reclamation Funding	**$ 9,774,383.00**
Total Project Funding	***$39,132,533.00***

Please identify any third-party contribution costs (i.e., goods and services provided by a third party)

There will be no third-party contribution costs associated with the project funding.

Please identify any cash requested or received from other non-Federal entities and any pending funding requests (i.e., grants or loans) that have not yet been approved and explain how the project will be affected if such funding is denied.

There will be no third-party contribution costs to this project. The scope of the project was too large to be applicable for the WaterSMART drought resiliency grant, and at this time there are no other pending funding requests.

Please identify whether the budget proposal includes any project costs that have been or may be incurred prior to award. For each cost, describe:
• the project expenditure and amount,
• the date of cost incurrence, and
• how the expenditure benefits the project.

Included in the budget proposal are the property costs, which between both properties totaled $8,995,398.00. The West Enos property was acquired in January 2022 and the Stockdale North property was acquired in December 2021. These expenditures were necessary for the project because the acquisition of the land is critical for the construction of the facilities. These properties were beneficial in location to existing conveyance as well as to other existing recovery wells. Along with property acquisition costs the GBJPA has incurred feasibility, environmental

permitting, and conceptual design/consultant costs from Dee Jaspar and Associates, Meyers Civil Engineering and Harder Company, and Environmental Science Associates for approximately $350,000. These costs were incurred in 2021-2022 and were critical costs for analyzing the location of the recovery wells, environmental obstacles, and the effectiveness of the recharge ground.

Please refer to **Table 10** (below) for a summary of all funding sources.

Table 10. Summary of Funding Sources

Funding Sources	Percent of Total Project Cost	Total Cost by Source
Recipient Funding	75%	$ 29,358,150
Reclamation Funding	25%	$ 9,774,383
Other Federal Funding	0%	$ 0
Total	**100%**	**$ 39,132,533**

2.2 Budget Proposal

Submission of a budget proposal is mandatory. Applications that fail to fully disclose this information will be considered ineligible and will not pass initial screening. The total project cost is the sum of all allowable items of costs, including all required cost sharing and voluntary committed cost sharing (including third-party contributions) that are necessary to complete the project. The budget proposal should include detailed information on the categories listed below and must clearly identify all project costs, including those that will be contributed as non-Federal cost share by the applicant (required and voluntary), third-party in-kind contributions, and those that will be covered using the funding requested from Reclamation, and any requested pre-award costs. Unit costs must be provided for all budget items, including the cost of services or other work to be provided by consultants and contractors. Applicants are strongly encouraged to review the procurement standards for Federal awards found at 2 CFR §200.317 through §200.326 before developing their budget proposal.

It is also strongly advised that applicants use the budget proposal format shown in Table 2 or a similar format that provides this information. If selected for award, successful applicants must submit detailed supporting documentation for all budgeted costs.

The estimated cost of the project including feasibility study, environmental assessments, all associated construction costs, CEQA documents, and permits is **$39,132,533**. Please refer to **Table 11**. A detailed and itemized breakdown of each facility and component of the project in **Table 11** can be found on pages 7-8 of **Appendix O**. The GBJPA is requesting approximately

$9,774,383 (or just less than 25% of total project costs) in federal funding from USBR for this Project. The GBJPA is estimated to provide 75% of project funding if the requested award amount is granted. At this time, the GBJPA is solely responsible for the funding of the Project.

Table 11. Budget Proposal

Groundwater Banking Joint Power Authority R23AS00019 Phase 1 - Kern Fan Groundwater Storage Project			GBJPA Project Costs			Budget			
Item		Budget Item Description	$/Unit	Unit	QTY	GBJPA Funding	Reclamation Funding	Total	Explanation of Estimate
1		*Contractual / Construction*						33,500,324	
	a	Land Acquisition	8,995,398	LS	1	8,995,398		8,995,398	engineers est.
	b	Well Drilling	1,280,698	LS	4	3,073,675	2,049,116	5,122,791	engineers est.
	c	Well Equipping	1,540,329	LS	4	3,696,790	2,464,526	6,161,316	engineers est.
	d	Conveyance	7,988,850	LS	1	4,793,310	3,195,540	7,988,850	engineers est.
	e	Recharge Ponds	13,861	Ac.	360	3,093,781	1,896,188	4,989,969	engineers est.
	f	SCADA and PLC Programming	242,000	LS	1	107,988	134,012	242,000	engineers est.
2		*Environmental and Regulatory Compliance*						165,000	
	a	Reclamation NEPA Review	30,000	LS	1	0	35,000	35,000	USBR estimate
	b	Environmental studies, surveys, groundwater impact analysis, and biological education	130,000	LS	1	130,000		130,000	prior project
		E&R percent of total cost						0%	
3		*Engineering and Administration*						2,995,000	
	a	Engineering Design	1,245,000	LS	1	1,245,000		1,245,000	past project
	b	Construction Management & Inspection	1,500,000	LS	1	1,500,000		1,500,000	past project
	c	Communication Design	250,000	LS	1	250,000		250,000	past project
4		*Variable Costs*						2,472,209	
	a	Interest During Construction (over 3 years of construction	824,069.79	LS	3	2,472,209		2,472,209	
5		*Total*						$ 39,132,533	0
	a	GBJPA Contribution				29,358,150			
	b	Reclamation Contribution					9,774,383		
	c	Percent Funded by GBJPA						75%	

2.3 Budget Narrative

Submission of a budget narrative is mandatory. Applications that fail to fully disclose this information will be considered ineligible and will not pass initial screening. The budget narrative provides a discussion of, or explanation for, items included in the budget proposal. The types of information to describe in the narrative include, but are not limited to, those listed in the following subsections. The information in the narrative should include, but is not limited to, that identified in the Budget Narrative Guidance attached to this NOFO. Applicants may elect to use the Budget Detail and Narrative spreadsheet for their budget narrative. Costs, including the valuation of third-party in-kind contributions, must comply with the applicable cost principles contained in 2 CFR Part §200, available at the eCFR (www.ecfr.gov).

Table 12. Budget Narrative Form

Summary			
6. Budget Object Category	Total Cost	Federal Estimated Amount	Non-Federal Estimated Amount
a. Personnel	$0		
b. Fringe Benefits	$0		
c. Travel	$0		
d. Equipment	$0		
e. Supplies	$0		
f. Contractual	$8,995,398		
g. Construction	$30,137,135		
h. Other Direct Costs	$0		
i. Total Direct Costs	$39,132,533		
i. Indirect Charges	$0		
Total Costs	$39,132,533	$9,774,383	$29,358,150
	Cost Share Percentage	24.98%	75.02%

The following is a description of the line items in **Table 11** in the budget proposal and the required Budget Narrative Form in **Table 12.**

Contractual / Construction – Work in this section will be done by contractors and consultants. All required materials as shown in detailed project budgets from the Project and Capital Budget are shown in **Appendix O**.

Environmental and Regulatory Compliance - The GBJPA intends to work with Reclamation to determine the potential environmental effects the proposed Project may have with the National Environmental Policy Act (NEPA), National Historic Preservation Act (NHPA), Endangered Species Act (ESA), and the Clean Water Act to ensure compliance with all applicable environmental laws. Based on the inspection of the NOFO, it is understood that Reclamation will determine who will perform the work under this category (i.e. Reclamation, the Applicant, or a consultant). For purposes of this grant proposal, based on previous projects performed by the GBJPA, and feedback from Reclamation, it was assumed that the work would be performed at an estimated cost of $35,000. The GBJPA will provide all funding related to environmental and regulatory compliance for the Project regarding CEQA requirements.

a) This is the estimated cost to conduct project biological and cultural surveys by qualified consultants as required for CEQA and NEPA compliance.

b) This is the estimated cost to prepare all necessary studies, reports, and other documents for the project. This includes the cost for environmental consultants.

Engineering and Administration - This is the estimated cost for engineering design and specifications for facility design, surveying, and construction management (including inspection) as well as contractor construction activities for each component. Design is estimated at 5% of

total project costs, surveying and testing 1%, and inspection 2% for a combined 8% of project costs. This is consistent with prior RRB and IRWD projects.

Total Costs – These are the totals for GBJPA contribution, Reclamation contribution, and the total estimated cost of the project. See **Tables 10, 11, and 12** for the total Federal and Non-Federal cost-share amounts.

2.4 Letters of Commitment

No project funding will be provided by a source other than the GBJPA, thus, no letters of commitment were necessary.

3. Environmental and Cultural Resources Compliance

Submission of the environmental and regulatory compliance within the application is recommended, but not required. Submission of environmental and cultural resources compliance is mandatory prior to issue of an award. Please answer the questions from Section H.1., Environmental and Cultural Resource Considerations, in this section.

To allow Reclamation to assess the probable environmental and cultural resources impacts and costs associated with each application, all applicants must respond to the following list of questions focusing on NEPA, ESA, and NHPA requirements. Applicants are to answer the following questions to the best of their knowledge. If any question is not applicable to the project, please explain why. The application should include the answers to the following questions.

Will the proposed project impact the surrounding environment (e.g., soil [dust], air, water [quality and quantity], animal habitat)? Please briefly describe all earth-disturbing work and any work that will affect the air, water, or animal habitat in the project area. Please also explain the impacts of such work on the surrounding environment and any steps that could be taken to minimize the impacts.

The proposed Project components are both near and within developed agriculture and recharge basin land cover. The proposed project will require significant earth-disturbing activities. When considering the potential surface area to be disturbed the most surface area. This would require clearing and grubbing of approximately 360 acres of area that is currently heavily disturbed with ongoing intensive farming activities. The installation of the conveyance would also be a ground-disturbing activity but would mainly happen on or next to the existing recharge ground. The drilling and equipping of the wells, as well as the installation of interbasin structures, would require minimal excavation to construct.

RRBWSD, as well as local contractors, have extensive experience with excavating activities and utilize best management practices concerning dust and erosion control. RRBWSD or the

contractor would utilize a water truck or portable pumps for necessary dust suppression. Dust impacts on the environment will be minimal but will be evaluated according to CEQA and NEPA requirements.

All earth-disturbing activities will be done absent of local irrigation or drain water in the canals or drains. Disturbed earth will have no contact with flowing water and therefore will have no impact on irrigation supply water or drain water. Project activities would not occur on natural streams or river channels. There will be no impacts on water but the potential impacts have been evaluated according to CEQA and NEPA requirements.

All project activities will occur on routinely disturbed ground and therefore will have minimal or no impact on animal habitats. The presence of working facilities along with routine RRBWSD and farmer activities make it unlikely for animals to use project sites as habitats. Potential impacts on habitat will be evaluated according to CEQA and NEPA requirements. Any necessary preconstruction biological or cultural surveys will be conducted by qualified personnel as required for CEQA and NEPA compliance.

Is the applicant aware of any species listed or proposed to be listed as a Federal threatened or endangered species, or designated critical habitat in the project area? If so, would they be affected by any activities associated with the proposed project?

Although all Project activities are going to be conducted on land that is routinely disturbed by farming operations and existing recharge basin land cover, Kern County is known to have a habitat that can support endangered and threatened species. The project areas contain suitable habitats for three special-status mammal species, including an additional special-status species that were observed on-site during the reconnaissance survey. San Joaquin kit fox, Tipton kangaroo rat, and Nelson's antelope squirrel are three species that have a medium or high potential to occur on-site based on past CNDDB detections and observed suitable habitat. The additional special-status species observed on-site is the American badger. The proposed project could result in adverse impacts on migratory birds protected under the MBTA and special-status bird species, including the Burrowing owl, Swainson's hawk, California horned-lark, and Tricolored blackbird. The CEQA-Plus document employs several mitigation measures to reduce the impact to less than significant with adopted mitigated. Please see **Appendix Q** for access to the Kern Fan Project DEIR and FEIR.

Are there wetlands or other surface waters inside the project boundaries that potentially fall under CWA jurisdiction as "Waters of the United States?" If so, please describe and estimate any impacts the proposed project may have.

According to the U.S. Fish and Wildlife Service National Wetlands Inventory, there are no wetlands within Project boundaries. There are, however, wetlands indicated in the nearby vicinity of the Project site, but they are not expected to be negatively impacted by the Project due to the limited nature of the ground disturbance.

When was the water delivery system constructed?

RRBWSD operates a surface water delivery system with more than 25 miles of earthen canals. The water delivery system was developed in the 1970s. Many of the canal alignments have been realigned or modified over that time. Additionally, almost all of the check and gate structures have been replaced or updated over the same period to maintain a working water delivery system. Due to increases in water demand over time, additional water delivery features and enlargements have been constructed for better water management and increased operational flexibility.

Will the proposed project result in any modification of or effects to, individual features of an irrigation system (e.g., headgates, canals, or flumes)? If so, state when those features were constructed and describe the nature and timing of any extensive alterations or modifications to those features completed previously.

There will be no modifications to an existing irrigation distribution system.

Are any buildings, structures, or features in the irrigation district listed or eligible for listing on the National Register of Historic Places? A cultural resources specialist at the applicant's local Reclamation office or the State Historic Preservation Office can assist in answering this question.

There are no registered historical landmarks within the project boundaries. If Reclamation deems it necessary, the GBJPA will retain a private cultural resources management consultant or arrange for Reclamation staff to carry out a consultation to evaluate if any buildings or structures are eligible under the National Register of Historic Places. The expectation is that no historical landmarks will be identified, as the Project will be constructed near actively disturbed agricultural lands.

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

The GBJPA does not have any knowledge of known archeological sites within or in the vicinity of the proposed Project sites. A Class III Inventory/Phase I Survey will be conducted. There has been over a century of ongoing farming operations on the Project sites and it is very unlikely that archaeological sites would be currently located or discovered. Nevertheless, the GBJPA is prepared to implement any necessary mitigation measures should cultural resources be identified for any component of the Project.

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

The proposed Project will not have a disproportionately high and adverse effect on low income or minority populations. Construction of the Project will support the agricultural-based economy in the Southern San Joaquin Valley and should only have positive impacts on low income or minority persons living in the region.

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

The proposed Project will not limit access to the ceremonial use of Indian sacred sites or result in other impacts on tribal lands.

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

The proposed Project will not contribute to the introduction, continued existence, or spread of noxious weeds or non-native species in the region.

4. Required Permits or Approvals

There are multiple required permits for a Project with this many components. It is the GBJPA's full intention to satisfy all CEQA and NEPA compliance requirements by October 2023. Another requirement of all projects in California with ground-disturbing activities is routine submissions of the Stormwater Pollution Prevention Plan (SWPPP), which is filed through the Stormwater Multiple Application and Report Tracking System (SMARTS) at the CA State Water Resources Control Board. For the crossing underneath Stockdale Highway and State Highway 43, a Caltrans permit will be required. Well drilling permits are also mandatory as requested by the County of Kern Environmental Health Department required for any drilling or construction of new wells in the county. In compliance with Executive Order N-7-22, coordination between the applicable Groundwater Sustainability Agency will also be required. Due to the nature and location of selected project sites, we expect that no third-party approval or permits will be required from the state to break ground for the Project.

5. Overlap or Duplication of Effort Statement

Applicants must also state if the proposal submitted for consideration under this program does or does not in any way duplicate any proposal or project that has been or will be submitted for funding consideration to any other potential funding source—whether it be Federal or non-Federal. If such a circumstance exists, applicants must detail:

- ***when the other duplicative proposal(s) were submitted,***
- ***to whom (agency name and Financial assistance program), and***
- ***when funding decisions are expected to be announced. If at any time a proposal is awarded funds that would be duplicative of the funding requested from Reclamation, applicants must notify the NOFO point of contact or the program coordinator immediately.***

This grant application submitted for consideration under the USBR's Small Storage Projects does duplicate a similar proposal that was submitted by the GBJPA on June 15, 2022, to the Bureau of Reclamation. The previous application was submitted for consideration under the WaterSMART Drought Response Program: Drought Resiliency Projects for the Fiscal Year 2023 (R23AS00005). Grant funds were anticipated to be used towards the construction of the West Enos and Stockdale North Recharge and Recovery Project. The GBJPA was notified a few

months after submission that the proposal was not awarded any federal funds, due to the size of the project. Because no funds were awarded, the GBJPA were encouraged to submit a similar proposal under the USBR's Small Surface Water and Groundwater Storage Project funding opportunity.

Additionally, the GBJPA has requested funding under the Water Storage Investment Program administered by the California Water Commission. Since a final funding agreement has not been executed with the California Water Commission yet, funding from the State will not be used to construct the proposed Phase 1. It is expected that once a final funding agreement is executed, the State funding will be used for later phases of the Kern Fan Project.

6. Letters of Support

Please see **Appendix J** for Letters of Support for the Kern Fan Project and Phase 1 of the Kern Fan Project.

7. Official Resolutions

Please see **Appendix Q** for the GBJPA's official resolution.

8. Conflict of Interest Disclosure

Per the Financial Assistance Interior Regulation (FAIR), 2 CFR §1402.112, no actual or potential conflict of interest exists.

9. Uniform Audit Reporting Statement

Please see **Appendix R** for the GBJPA's Auditor's Report.

10. References

California Department of Water Resources (DWR), 2022. *Critically Overdrafted Basins Map*. Retrieved from DWR: https://water.ca.gov/programs/groundwater-management/bulletin-118/critically-overdrafted

California Office of Environmental Health Hazard Assessment (OEHHA), 2022. S*B 535 Disadvantaged Communities (2022 Update) Map*. Retrieved from OEHHA: https://oehha.ca.gov/calenviroscreen/sb535

California's Water Supply Strategy – Adapting to a Hotter, Drier Future, August 2022.

Curtis M. Skaggs, PE, 2022. Preliminary Design Report. *Kern Fan Groundwater Storage Project – Proposed Projects and Capital Budget for 2022-23 through 2024-25*

Groundwater Banking JPA (GBJPA), 2020. Kern Fan Groundwater Storage Project Draft Environmental Impact Report SCH No. 2020049019. Prepared by Environmental Science Associates (ESA), 2020.

M. Cubed, 2022. Technical Memorandum. Estimate of Benefits from the Kern Fan Groundwater Storage Project – Phase 1 for the Small Surface Water and Groundwater Storage Projects Program

MBK Engineers, 2022. Technical Memorandum. *Updated Analysis of Kern Fan Groundwater Storage Project*

National Oceanic and Atmospheric Administration (NOAA), 2022. National Temperature and Precipitation Maps – Statewide Precipitation Ranks. Retrieved from NOAA: https://www.ncei.noaa.gov/access/monitoring/us-maps/ytd/202204

Sierra Nevada Updates, 2022. *California's 2021-22 snowpack- prelude to a drought*. Retrieved from Sierra Nevada Conservancy: https://sierranevada.ca.gov/californias-2021-22-snowpack-prelude-to-adrought/

Thomas Harder & Co., 2021. Technical Memorandum. *Recharge and Recovery Suitability Report for the Bolthouse Property.*

Thomas Harder & Co., 2021. Technical Memorandum. *Recharge and Recovery Suitability Report for the Diamond Property.*

Thomas Harder & Co., 2022. Technical Memorandum. *Aquifer Storage Potential for the West Enos and North Stockdale Portions of the Kern Fan Storage Project*