



**CITY OF MORRO BAY
WATER RECLAMATION FACILITY
CITIZEN ADVISORY COMMITTEE (WRFCAC)
AGENDA**

The City of Morro Bay is dedicated to the preservation and enhancement of the quality of life. The City shall be committed to this purpose and will provide a level of municipal service and safety consistent with and responsive to the needs of the public.

**February 2, 2016
Veterans Memorial Building – 3:00 P.M. to 5:00 P.M.
209 Surf Street, Morro Bay, CA**

John Diodati, Chairperson

Bill Woodson,
Vice Chairperson

Dale Guerra

Barbara Spagnola

Mary (Ginny) Garelick

Paul Donnelly

Valerie Levulett

Planning Commission
Member: Richard Sadowski

Public Works Advisory Board
Member: Stephen Shively

ESTABLISH QUORUM AND CALL TO ORDER
MOMENT OF SILENCE/PLEDGE OF ALLEGIANCE
ANNOUNCEMENTS/PRESENTATIONS

PUBLIC COMMENT PERIOD

Members of the audience wishing to address the Board on City business matters other than scheduled items may do so at this time. To increase the effectiveness of the Public Comment Period, the following rules shall be followed:

- When recognized by the Chair, please come forward to the podium and state your name and address for the record. Board meetings are audio and video recorded and this information is voluntary and desired for the preparation of minutes.
- Comments are to be limited to three minutes.
- All remarks shall be addressed to the Board, as a whole, and not to any individual member thereof.
- The Board respectfully requests that you refrain from making slanderous, profane or personal remarks against any elected official, commission and/or staff.
- Please refrain from public displays or outbursts such as unsolicited applause, comments or cheering.
- Any disruptive activities that substantially interfere with the ability of the Board to carry out its meeting will not be permitted and offenders will be requested to leave the meeting.
- Your participation in Board meetings is welcome and your courtesy will be appreciated.

In compliance with the Americans with Disabilities Act, if you need special assistance to participate in this meeting, please contact the Public Works Department at (805) 772-6262. Notification 24 hours prior to the meeting will enable the City to make reasonable arrangements to ensure accessibility to this meeting.

A. CONSENT CALENDAR

A-1 Approval of minutes from the Water Reclamation Facility Citizen Advisory Committee meeting of November 17, 2015

Staff Recommendation: Approve minutes as submitted.

A-2 Approval of minutes from the Water Reclamation Facility Citizen Advisory Committee meeting of January 5, 2016

Staff Recommendation: Approve minutes as submitted.

B. BUSINESS ITEMS

B-1 WRF Program Update

Staff Recommendation: Receive update.

B-2 WRFCAC Sub-Committee Updates and Recommendations

Finance, Environmental and Engineering Sub-Committees to present their analyses and findings to the entire committee.

Recommendation: Receive and consider updates.

B-3 Update of Site Evaluation and Fatal Flaw Analysis

Recommendation: Receive update and provide comments.

B-4 Morro Valley Groundwater Reconnaissance Study

Recommendation: Receive study and provide comments.

C. COMMITTEE MEMBER CLOSING COMMENTS

D. ADJOURNMENT

Adjourn to the Water Reclamation Facility Citizen Advisory Committee meeting at the Morro Bay Veteran's Memorial Building, 209 Surf Street, on March 1, 2016, at 3:00 p.m.

This agenda is subject to amendment up to 72 hours prior to the date and time set for the meeting. Please refer to the agenda posted at the Public Works Department, 955 Shasta Avenue, for any revisions or call the department at 772-6262 for further information.

Materials related to an item on this agenda are available for public inspection during normal business hours in the Public Works Department, at Mill's/ASAP, 495 Morro Bay Boulevard, or the Morro Bay Library, 695 Harbor, Morro Bay, CA 93442.

This agenda may be found on the Internet at: www.morro-bay.ca.us/wrfcac or you can subscribe to Notify Me for email notification when the Agenda is posted on the City's website. To subscribe, go to www.morro-bay.ca.us/notifyme and follow the instructions.

Materials related to an item on this agenda submitted to the Committee after publication of the agenda packet are available for inspection at the Public Works Department during normal business hours or at the scheduled meeting.

The public comment period was closed.

A. CONSENT AGENDA
<https://youtu.be/mAW15PGHjuc?t=13m43s>

A-1 APPROVAL OF MINUTES FROM THE WRFCAC REGULAR MEETING OF
NOVEMBER 3, 2015

The public comment period was opened, seeing none, the public comment period was closed.

MOTION:

Steve Shively moved to approve Item A-1 with the following correction: Richard Sadowski stated his comment needs to be corrected to read as follows “the plant needs to be a reclamation plant”, not reclamation ready plant. The motion was seconded by Barbara Spagnola and carried unanimously, 7-0.

B. OLD BUSINESS - None

C. NEW BUSINESS

C-1 FACILITY MASTER PLAN UPDATE
<https://youtu.be/mAW15PGHjuc?t=14m53s>

Discussion took place amongst committee members, staff and Brad Hemken (Black & Veatch) regarding Memorandum 6.

Richard Sadowski left the meeting at 3:17p.m.

Brad Hemken introduced Jake Holde and Sandeep Sathyamoorthy with Black & Veatch and presented an overview of Technical Memorandum 7, Liquid Treatment Alternatives.

Dale Guerra arrived to the meeting at 3:46p.m.

The public comment period was opened, seeing none, the public comment period was closed.

C. COMMITTEE MEMBER CLOSING COMMENTS - None

ADJOURNMENT

The meeting adjourned at 4:00p.m.

B. BUSINESS ITEMS

B-1 WRF PROGRAM UPDATE

<https://youtu.be/WsFvA2JG6WM?t=3m10s>

Mike Nunley presented the Staff Report.

The public comment period was opened, seeing none, the public comment period was closed.

B-2 WRFCAC SUB-COMMITTEE UPDATES AND RECOMMENDATIONS - None

B-3 SALINITY SOURCE

<https://youtu.be/WsFvA2JG6WM?t=17m25s>

Mike Nunley presented a PowerPoint slide presentation.

The public comment period was opened.

Steve MacElvaine stated since the committee is considering eliminating the self-regenerating systems and if some people use brine containments, is there really any significant change.

The public comment period was closed.

C. COMMITTEE MEMBER CLOSING COMMENTS

<https://youtu.be/WsFvA2JG6WM?t=1h16s>

Steve Shively stated the City should consider adopting an ordinance to limit the amount of salts currently going into the system.

Richard Sadowski asked if the City is considering to treat industrial waste at the facility and is there consideration for a concentrated collection system in regards to the Facility Master Plan. He stated the City should not be subsidizing the California State Parks dump stations.

Rob Livick clarified it is too early to tell what impact the El Nino flows through the sewer system will have.

Ginny Garelick asked when the WRF Managers review the industrial users, can they specify what the percentage of usage is.

John Diodati clarified if there is significant additional cost to treatment than a rate structure can be set up to compensate the City for those costs.

Barbara Spagnola stated for planning purposes, when will the budget formatting reports be available?

Mike Nunley responded the committee will have a draft by the end of next week.

ADJOURNMENT

The meeting adjourned at 4:11p.m.



AGENDA NO: B-1

MEETING DATE: February 2, 2016

Staff Report

DATE: January 28, 2016

TO: Water Reclamation Facility Citizens Advisory Committee

FROM: Mike Nunley, PE – Water Reclamation Facility (WRF) Program Manager

SUBJECT: WRF Program Update

RECOMMENDATION

Staff recommends WRFCAC review the current status and the proposed next steps regarding the development of a WRF program.

ALTERNATIVES

No alternatives are recommended.

FISCAL IMPACT

Attachment 1 is a summary of the existing contracts with consultants used to assist in the WRF project.

DISCUSSION

Staff provides this report as a monthly update to the progress made to date on the new WRF project. With the denial of the permit for the WWTP project in its current location, the City has embarked on a process for a WRF. This staff report provides the following:

1. Review of what has occurred to date. See the list of major milestones or accomplishments since the last update to City Council below. See Attachment 1 for a summary of project expenses to date. Customer rates and fees are the current revenue source for the program budget.
2. Schedule for near-term activities

Accomplishments and Milestones

The City's Program Management team and technical consultants performed the following tasks since the December 1 program update:

- Continued coordination with California Department of Water Resources and State Water Resources Control Board for review and approval of Recycled Water Facilities Planning

Prepared By: ___MN___

Dept Review: ____

City Manager Review: _____

City Attorney Review: _____

- Grant application. Formal response is expected by end of January or first week in February.
- Continued fatal flaw analysis and negotiation with owners of Morro Valley properties
 - Reviewed draft report from Morro Valley groundwater evaluation
 - Completed WRF Program website (morrobaywrf.com)
 - Began internal draft of Notice of Preparation for California Environmental Quality Act (CEQA) compliance

Budget and Expenses

The Financial Subcommittee reviewed the draft contract summary report developed by the Program Management team and provided comments and recommendations. MKN will work with the subcommittee to develop a revised summary report. The attached summary provides an overview of existing consultant budgets, contract change orders, draw requests (including invoiced amounts that have not yet been approved), and total invoices paid.

Near-Term Schedule

An updated schedule for upcoming meetings and workshops will be provided to City Council at the February 23 meeting.

Additional Information on State Water Project

Chairman Diodati provided a schematic of the Coastal Branch of the State Water Project. This is in response to the discussion about the State Water Project at the January 5 meeting.

ATTACHMENTS

1. Summary of Project Expenses and Estimated Costs
2. Schematic of Coastal Branch of State Water Project



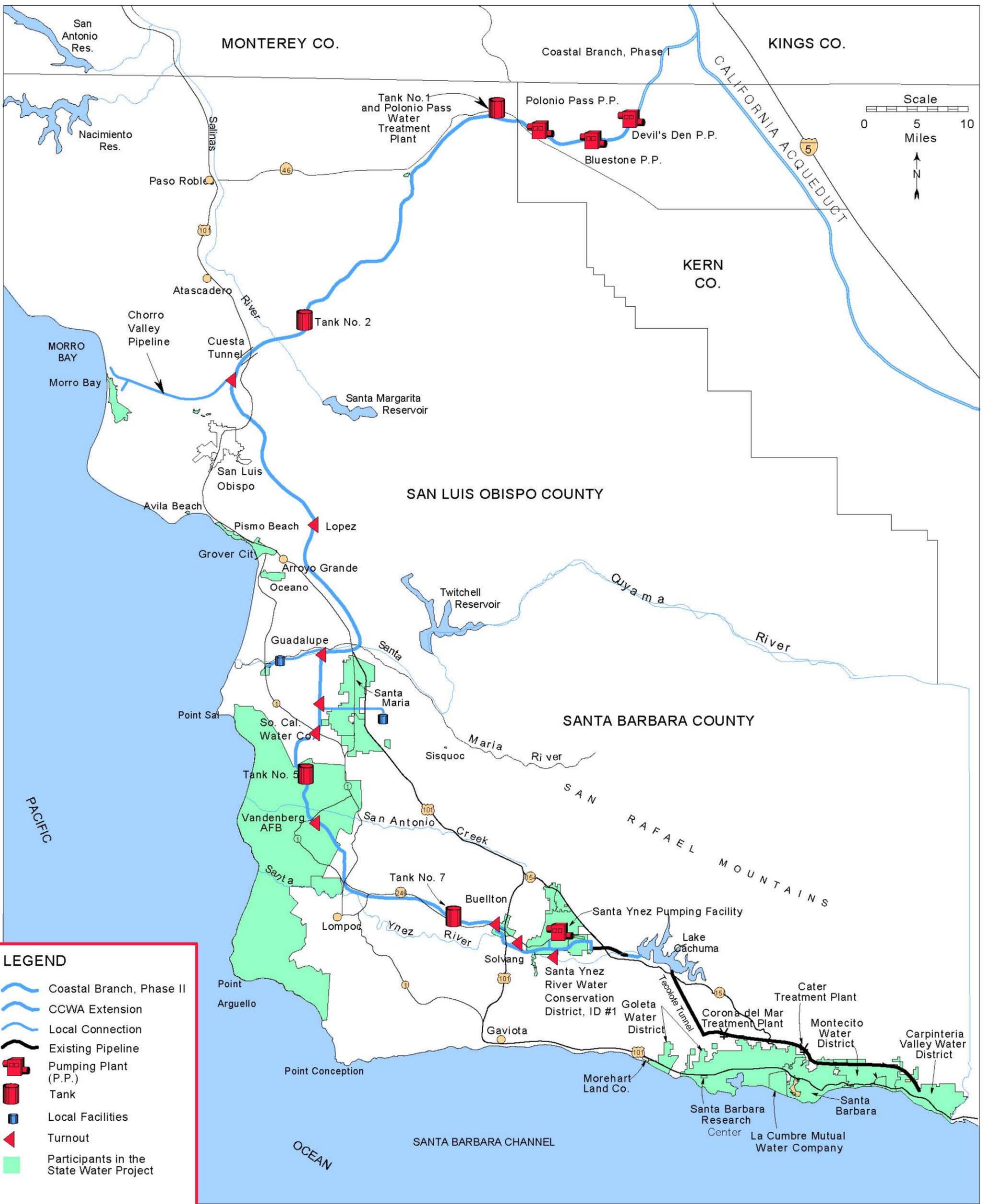
City of Morro Bay
955 Shasta Avenue
Morro Bay, California 93422

Printed on Thu Jan 28, 2016 at 01:07 pm PST

WRF Program Admin, Planning, & Permitting - Phases 1&2
Site - Morro Valley
Morro Bay California. 93442

Commitments Log

#	Title	Contract Company	Status	Original Contract Value	Approved Change Orders	Total Contract Amount	Draw Requests	Total Payments	Total Remaining	% Paid	Pending Change Orders
SC-001	Facility Master Plan	Black & Veatch	Approved	\$710,123.00	\$0.00	\$710,123.00	\$334,974.52	\$334,974.65	\$375,148.35	47.17%	\$0.00
SC-002	CEQA/NEPA Documentation and Consulting	ESA	Approved	\$346,538.00	\$0.00	\$346,538.00	\$0.00	\$0.00	\$346,538.00	0.00%	\$0.00
SC-003	MacElvaine Property - Fatal Flaw - Cultural Resources	Far Western	Approved	\$12,000.00	\$0.00	\$12,000.00	\$9,979.00	\$9,979.00	\$2,021.00	83.16%	\$0.00
SC-004	Righetti Property - Fatal Flaw - Cultural Resources	Far Western	Approved	\$6,485.59	\$0.00	\$6,485.59	\$0.00	\$0.00	\$6,485.59	0.00%	\$0.00
SC-005	MacElvaine Property - Fatal Flaw - Biological Resources	Kevin Merk Associates	Approved	\$12,835.00	\$0.00	\$12,835.00	\$11,240.00	\$11,240.00	\$1,595.00	87.57%	\$0.00
SC-006	Survey - Righetti Property	JoAnn Head Land Surveying	Approved	\$15,644.00	\$0.00	\$15,644.00	\$6,477.50	\$6,477.50	\$9,166.50	41.41%	\$0.00
SC-007	Survey - Highway 41 and MacElvaine Property	JoAnn Head Land Surveying	Approved	\$45,050.00	\$0.00	\$45,050.00	\$41,343.00	\$41,343.00	\$3,707.00	91.77%	\$0.00
SC-008	Salinity Identification Study	Larry Walker Associates	Approved	\$23,640.00	\$0.00	\$23,640.00	\$22,920.00	\$22,920.00	\$720.00	96.95%	\$22,800.00
SC-009	MacElvaine Property (SE) - Fatal Flaw - Geotech and Initial Hydrologic Field Testing	Fugro	Approved	\$38,600.00	\$47,800.00	\$86,400.00	\$48,955.20	\$44,322.70	\$42,077.30	51.30%	\$0.00
SC-010	Grant and Loan Funding - Tracking and SRF Support	Kestrel	Approved	\$65,752.00	\$0.00	\$65,752.00	\$19,989.79	\$19,989.79	\$45,762.21	30.40%	\$0.00
SC-011	2015 Program Management	MKN & Associates, Inc.	Approved	\$920,808.00	\$0.00	\$920,808.00	\$180,566.85	\$149,392.15	\$771,415.85	16.22%	\$0.00
			Totals:	\$2,197,475.59	\$47,800.00	\$2,245,275.59	\$676,445.86	\$640,638.79	\$1,604,636.80	28.53%	\$22,800.00



LEGEND

- Coastal Branch, Phase II
- CCWA Extension
- Local Connection
- Existing Pipeline
- Pumping Plant (P.P.)
- Tank
- Local Facilities
- Turnout
- Participants in the State Water Project



AGENDA NO: B-3

MEETING DATE: February 2, 2016

Staff Report

DATE: January 28, 2016

TO: Water Reclamation Facility Citizens Advisory Committee

FROM: Mike Nunley, PE – Water Reclamation Facility (WRF) Program Manager

SUBJECT: Update of Site Evaluation and Fatal Flaw Analysis

RECOMMENDATION

Staff recommends WRFCAC review the presentation and provide comments

ALTERNATIVES

No alternatives are recommended.

FISCAL IMPACT

All current fatal flaw analyses and studies are being performed under existing contracts and authorizations. No additional expenditures are proposed as part of this progress report.

DISCUSSION

John Rickenbach, Deputy Program Manager, will provide a presentation and update of the current fatal flaw analyses, negotiations, and site studies underway at the MacElvaine and Righetti Properties.

A draft site options report is anticipated for release by February 5. A Joint WRFCAC/City Council study session has been proposed for February 9 to review the options report in detail. It is assumed that no decision will be made at that meeting, but WRFCAC and Council will have an opportunity to review the draft report and provide comments in anticipation of a future Council meeting to select a property for further negotiation.

Prepared By: ___MN___

Dept Review: ____

City Manager Review: _____

City Attorney Review: _____



AGENDA NO: B-4

MEETING DATE: February 2, 2016

Staff Report

DATE: January 28, 2016

TO: Water Reclamation Facility Citizens Advisory Committee

FROM: Mike Nunley, PE – Water Reclamation Facility (WRF) Program Manager

SUBJECT: Review of Morro Valley Groundwater Reconnaissance Study

RECOMMENDATION

Staff recommends WRFCAC review the presentation and provide comments

ALTERNATIVES

No alternatives are recommended.

FISCAL IMPACT

The current study was performed under existing contracts and authorizations. Additional investigation may be authorized within the City's purchasing policy.

DISCUSSION

Paul Sorensen, a Principal Hydrogeologist with Fugro Consultants, Inc., will provide an overview of the work completed thus far in the Morro Valley groundwater basin. This work is the initial phase of investigation for potential groundwater recharge or prevention of seawater intrusion as part of the City's ultimate water reuse program.

ATTACHMENTS

1. Morro Valley Groundwater Reconnaissance Study (Fugro, 2016)

Prepared By: ___MN___

Dept Review: ____

City Manager Review: _____

City Attorney Review: _____

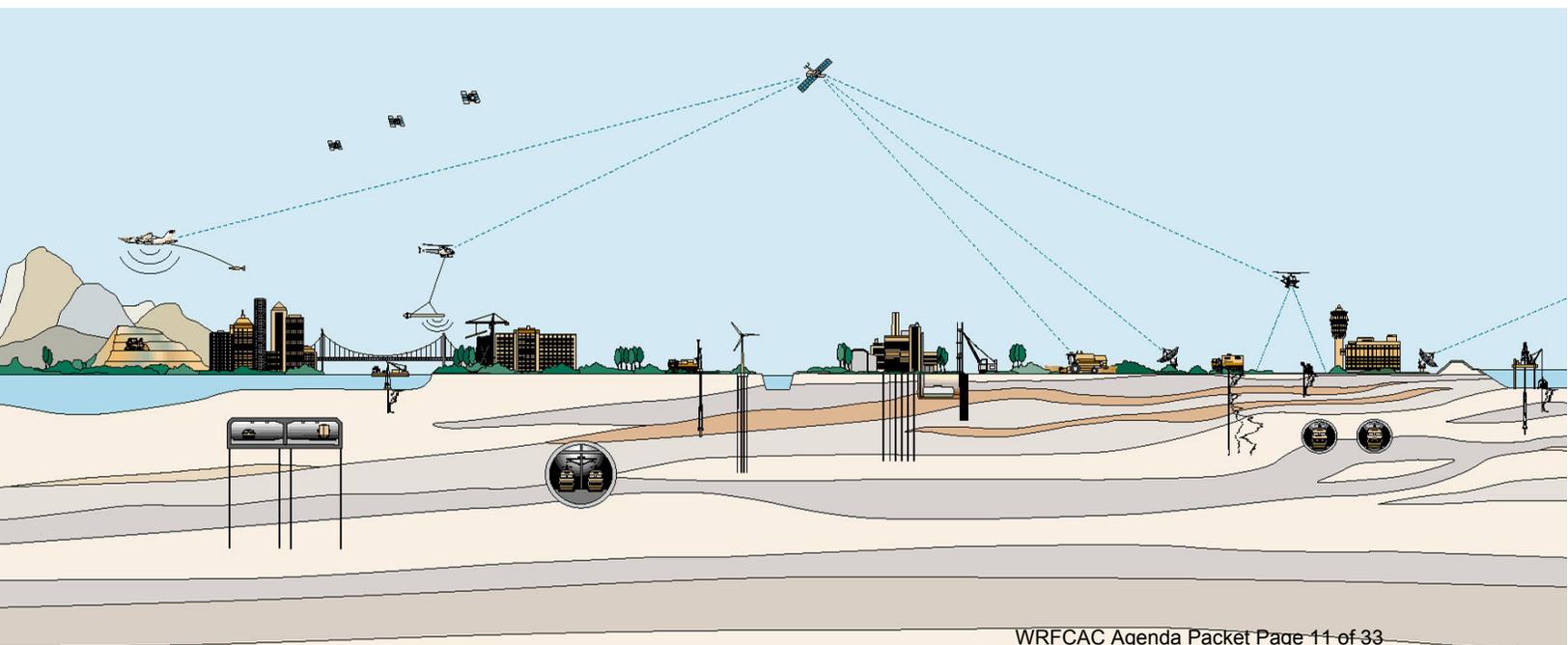
FUGRO CONSULTANTS, INC.



MORRO VALLEY GROUNDWATER RECONNAISSANCE STUDY

Prepared for:
City of Morro Bay

January 2016




FUGRO CONSULTANTS, INC.

5855 Capistrano Ave, Suite C
 Atascadero, California 93422
 T (805) 468-6060

January 16, 2016
 Project No. 04.62150033

City of Morro Bay
 Public Services
 955 Shasta Street
 Morro Bay, CA 93442

Attention: Mr. Rob Livick

Subject: Morro Valley Groundwater Reconnaissance Study

Dear Mr. Livick:

This report presents the results of our Morro Valley Groundwater Reconnaissance Study and feasibility screening investigation. The purpose of the study was to evaluate the feasibility of developing a local, onsite disposal / groundwater recharge percolation facility in the valley. Our services were performed in general accordance with our proposal dated September 3, 2015. Authorization for our work was provided by our consultant agreement with the City of Morro Bay dated April 10, 2015, as modified on September 9, 2015.

We appreciate the opportunity to provide our services on this project. Please contact the undersigned if you have questions regarding this report, or require additional information.

Sincerely,

FUGRO CONSULTANTS, INC.

Jennifer Wilson, PG, CEG
 Senior Project Geologist

Paul A. Sorensen, PG, CHG
 Principal Hydrogeologist



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1.0 INTRODUCTION

The purpose of the Morro Valley Groundwater Reconnaissance Study is to perform a feasibility-level screening investigation of the potential to develop an effluent disposal or groundwater recharge facility in Morro Valley. The project is associated with the relocation of the City of Morro Bay's existing Water Reclamation Facility (WRF). To date, it is our understanding that two locations are under consideration for location of the new WRF, including the MacElvaine and Righetti properties, located approximately one mile and 0.2 miles east of the Morro Bay city limits, respectively. The locations of the MacElvaine and Righetti properties are shown on **Figure 1**.

1.1 PROJECT UNDERSTANDING

This desktop screening investigation of lower Morro Valley will be used by the City of Morro Bay to evaluate the feasibility for development of an onsite disposal/groundwater recharge facility in the valley. Some of the potential benefits to locating the facility in this area are the possible use of processed effluent to actively recharge the Morro Valley alluvial groundwater basin, provide agricultural landowners in the valley with an in-lieu source of irrigation supply, and increase the City's water supply capability in its Morro well field.

1.2 SCOPE OF WORK

The scope of the desktop screening investigation is to review, compare, and interpret existing well log and other geologic data and maps to assess geologic and hydrogeologic conditions and make general conclusions regarding the feasibility of developing a disposal / recharge facility in lower Morro Valley.

2.0 METHODOLOGY

2.1 DATA COMPILATION AND REVIEW

A Well Completion Report (well log) request was made from the California Department of Water Resources (DWR) to obtain copies of all available well logs for the lower Morro Valley and the City of Morro Bay. A total of 526 documents were obtained from the DWR request. In addition to the well completion reports, the DWR-provided data also included site plans, well construction details, boring logs, well driller's reports and logs, and other supporting documentation for several of the wells. A brief summary of the data received is presented in **Table 1**.

It is important to note that the information included on the well logs is quite variable in detail, amount of information, and consistency of descriptions, so application of the information on the logs must be tempered with that in mind. The material description, color, consistency, and density terms, when included on the logs and reports, are not always consistently applied, and very few boring logs contain blow count or other engineering information. Most of the



lithologic descriptions are imprecise, at best, and do not follow the Unified Soil Classification System, the ASTM Standard for visually describing soils (D-2488), or use the Munsell color system. Many of the well completion reports do not include geographic coordinates and were approximately located using site plans (when provided) and historic aerial photographs. The limitations of the logs, as described here, are not meant to discount any value gained from their inspection and review, but to caution that the results of this review is based on these existing logs and do not reflect inspection and review of new data by qualified geologists and engineers. Despite these limitations, the results presented in this report represent a large advancement of the overall body of knowledge of the geologic and hydrogeologic conditions of the Morro Valley groundwater basin.

Table 1. DWR Well Completion Report Request Data Summary

Well Completion Report Status	Number of Wells
Wells located west of Highway 1 in the vicinity of Morro Creek	94
Wells located east of Highway 1 within lower Morro Valley	25
Wells located outside of lower Morro Valley and central Morro Bay	7
Well completion reports with no lithologic information	28
Wells that could not be located using the information provided	18

Additional data used during this screening level study included Fugro's in-house data, readily available data from public domain (e.g. published geologic maps and reports), and background reports provided by the City of Morro Bay and reviewed during the Phase 1 study. No field work or additional test hole drilling were performed during this phase of work. A map showing the distribution of well log data reviewed as part of this study is included as **Figure 2**.

2.2 PREPARATION OF GEOLOGIC CROSS-SECTIONS

Utilizing the well completion report data obtained from the DWR and the additional data gathered and reviewed as part of this screening study (see Section 2.1), five geologic cross-sections were prepared to assess the subsurface stratigraphy and hydrogeologic conditions of lower Morro Valley (see **Figures 5 through 10**). Two of the cross-sections, A-A' and B'B', follow the channels of Morro Creek and Little Morro Creek (**Figures 6 and 7**, respectively) and three of the cross-sections traverse lower Morro Valley; one east of Nagano Road (cross-section C-C', **Figure 8**), one west of Nagano Road (cross-section E-E', **Figure 10**), and one east of the Narrows (cross-section D-D', **Figure 9**).



3.0 GEOLOGIC SITE CONDITIONS

3.1 GEOLOGIC SETTING

Lower Morro Valley is located within the southern portion of the Coast Range geomorphic province. The Coast Ranges are structurally controlled north- to northwest-trending mountain ranges that rise 2,000 to 4,000 feet above sea level (with peaks up to 6,000 feet), and have intervening valleys that trend subparallel to the San Andreas fault system. Lower Morro Valley is a roughly east-trending coastal stream valley located in the Santa Lucia Mountains (part of the Coast Ranges) and is defined to the north and south by Morro Creek and Little Morro Creek, respectively. The valley floor is blanketed by Quaternary-age alluvial sediments underlain by Jurassic-Cretaceous Franciscan Formation mélange and metavolcanics (Hall and Prior, 1975; Hall et al., 1979; Dibblee and Minch, 2006) (**Figure 3**). The slopes that bound the valley are composed of Franciscan Formation mélange and metavolcanics that are overlain at the higher elevations by serpentinite, unnamed Cretaceous sedimentary rocks, and Tertiary-age Pismo Formation units. As noted by Hall and Prior (1975), no stratigraphic order can be determined for the Franciscan Formation units, and contacts between metavolcanic rock and other units of the Franciscan Formation and serpentinite are inferred to be fault-related rather than depositional. The Franciscan Formation is considered a non-water bearing formation, and there are few water wells that penetrate and extract groundwater from the formation.

The Cambria fault is the only mapped fault that crosses lower Morro Valley (**Figure 3**). The Cambria fault is a northwest-trending, steeply northeast-dipping fault that is concealed in lower Morro Valley by Holocene alluvium (Fugro, 2015). The fault has been characterized as a reverse or thrust fault according to the County of San Luis Obispo (1999) and as a normal fault according to Caltrans (2012). According to Lettis et al. (2004), the Cambria fault defines the southern margin of the Cambria structural block in the Los Osos domain. The Cambria fault has been characterized by the County of San Luis Obispo (1999), Lettis et al. (2004) and Jennings and Bryant (2010) as potentially active with the most recent activity estimated to be Pleistocene-age. However, PG&E (2015) notes that recent mapping of marine terraces on opposite sides of the onshore portion of the Cambria fault indicate that the fault does not vertically displace late Pleistocene marine terraces. As noted on Figure 3, the exact location of the Cambria Fault where it crosses Morro Valley is not fully known or understood.

3.2 SURFACE CONDITIONS

Several of the well logs and other data reviewed documented between two and eight feet of topsoil within lower Morro Valley. Soils of the lower Morro Valley are primarily from the Marimel series (Marimel silty clay loam, drained), which consists of deep, somewhat poorly drained soils that formed in alluvium weathered from sedimentary rock; and the Salinas series (Salinas silty clay loam), which consists of deep, well drained soils that formed in alluvium weathered from sandstone and shale (Ernstrom, 1984) (**Figure 4**). Other soil series that occur within the valley are the Cropley Clay, located along a limited section of Little Morro Creek west of Nagano Road, which consists of very deep, moderately well and well drained soils that



formed in alluvium from mixed rock sources; and Psamments and Fluvents, located along the active channel of Morro Creek, which are very recently formed soils (Entisols) that are very sandy (Fluvents) or alluvial (Psamments) in nature (Ernstrom, 1984).

3.3 SUBSURFACE CONDITIONS

The subsurface conditions documented in the well logs and other data reviewed for lower Morro Valley generally consisted of varying thicknesses of interbedded coarse- and fine-grained alluvium (Qal) overlying Franciscan Formation bedrock. The locations of the data compiled and reviewed for this study are shown on **Figure 2** and discussed in more detail below.

Cross-Section A (Figure 6). The surface material documented along the northern half of the valley consists primarily of clay and fine-grained deposits, except along the active channel of Morro Creek, which consists primarily of silty sand and well-graded gravel (e.g. boring DH-102 and Well No. 4). These materials are underlain by interbedded coarse and fine-grained alluvium of varying lateral and vertical extent. The uncertainty in continuity of these deposits is also a result of subsurface data gaps in the center of the valley (**Figure 2**). Franciscan bedrock, described as claystone, shale, and serpentine, underlies the alluvium and was documented at elevations ranging between 60 and 80 feet above mean sea level (amsl) at the eastern edge of the valley to about -40 feet amsl west of Highway 1.

Cross-Section B (Figure 7). Similar to Cross-Section A (**Figure 6**), the surface material documented along the southern half of the valley consists primarily of clay and fine grained- deposits, except along the active channel of Little Morro Creek, which consists primarily of clay and gravel mix (e.g. Well No. 2). These materials are underlain by interbedded coarse and fine-grained alluvium of varying lateral and vertical extent. The deposits appear to be more interbedded and variable in the southern-central portion of the valley than is observed in the northern-central portion of the valley, as seen in Well E0228020. The uncertainty in continuity of these deposits is also a result of subsurface data gaps in the center of the valley (**Figure 2**). Franciscan bedrock, described as sandstone, shale, and serpentine, underlies the alluvium and was documented at elevations ranging between 80 feet amsl at the eastern edge of the valley to about -50 feet amsl west of Highway 1.

Cross-Section C (Figure 8). The surface material documented along the eastern edge of the valley consists of a relatively thin (between 10 and 20 feet thick) zone of primarily silt and silty sand between Morro Creek and Little Morro Creek underlain by interbedded coarse- and fine-grained alluvium of varying lateral and vertical extent. The uncertainty in continuity of these deposits is also a result of subsurface data gaps in the center of the valley (**Figure 2**). Franciscan bedrock, described as claystone, shale, and serpentine, underlies the alluvium and was documented at elevations ranging between 70 and 80 feet amsl on the north side of the valley to between 50 and 60 feet amsl on the south side of the valley.



Cross-Section D (Figure 9). The surface material documented along the western edge of the valley near the Narrows consisted primarily of clay along the southern side of the valley and gravel along the northern side of the valley. Due to the absence of subsurface data in the center of the valley, it is unclear where the transition of the surface materials from fine-grained to coarse-grained occurs. These surficial deposits are underlain by interbedded coarse- and fine-grained alluvium of varying lateral and vertical extent. Franciscan bedrock, described as sandstone, underlies the alluvium and was documented at an elevations ranging between 0 and -20 feet amsl.

Cross-Section E (Figure 10). Cross-Section E, placed through the central-western portion of the valley, contains the most complete set of subsurface data in the lower Morro Valley. The majority of the subsurface data is test hole data collected as part of Brown and Caldwell's groundwater evaluation of the Cabrillo property (1981) (e.g. BC-1 through 5, and BC-7 through 8). The surface material documented in this portion of the valley consists of a surficial clay zone underlain by a coarse-grained zone, which is subsequently underlain by a second clay zone underlain by a second coarse-grained zone. Franciscan bedrock, described as sandstone, shale, and serpentine, underlies the alluvium and was documented at an elevations ranging between 0 and -20 feet amsl.

4.0 SUMMARY OF FINDINGS

The following is a general summary of the findings of this investigation. We based our opinion of the hydrogeologic conditions of lower Morro Valley, presented below, on these findings.

- Alluvium encountered in lower Morro Valley generally consists of interbedded coarse-and fine grained material. Franciscan mélangé bedrock was encountered below the alluvium at depths ranging from about 80 feet to -50 feet amsl.
- The thickness of the alluvium is variable across the valley, with a minimum thickness between 30 and 40 feet along the northern side of the valley at the base of the mountain slopes, and a maximum thickness between 80 and 85 feet documented near the active channels of Morro Creek and Little Morro Creek. The thickness of alluvium in the center of the valley is variable and ranges between 60 and 80 feet.
- Surficial deposits in the valley are primarily fine-grained and described as clay with minor amounts of silt, sand, and gravel documented in some locations. The surficial fine-grained deposits have variable thickness across the valley, ranging between 6 feet (e.g. Well E0194872) and 60 feet (e.g. Well E0248314). Coarse-grained surficial deposits, described as silty sand and well-graded gravel with varying amounts of clay, are limited in lateral and vertical extent (between 10 and 30 feet thick) and mostly located along the active channel of Morro Creek. The mapped soils in lower Morro Valley (**Figure 4**) show a similar distribution of coarse- and fine-grained deposits across the valley.



- The subsurface data reviewed for the western half of Morro Valley support Brown and Caldwell's (1981) observations of the generalized presence of two aquifers (or aquifer zones) in the valley. The upper aquifer lies beneath the first zone of clay deposits, which is subsequently underlain by a second clay zone capping the lower aquifer, which was described by Brown and Caldwell (1981) as the main groundwater producing aquifer. Based on the subsurface data reviewed, the aquifers appear to extend approximately 2,400 feet east of Cross-Section E based on the subsurface lithology of Wells E0194872 and E0228020. Beyond this distance, the continuity of these aquifers further east is uncertain due the absence of subsurface data in portions of the center of the valley. West of Cross-Section E, the subsurface data suggests the continuity of the aquifers past the Narrows to Well No. 13 and Well 3, which is consistent with Brown and Caldwell's (1981) observations; however beyond that, the continuity of the aquifers further west is unclear.

4.1 OPINION OF HYDROGEOLOGIC CONDITIONS

The City is considering percolation ponds and injection wells as options to dispose of treated effluent and provide recharge to the alluvial groundwater basin. Percolation ponds are typically effective where the subsurface profile is relatively uniform and permeable in the vertical and horizontal direction. The subsurface conditions shown on **Figures 6 through 10** indicate that the vertical profile is interbedded (i.e., not uniform) with a high percentage content of fine-grained materials. Relatively impermeable, fine-grained soils that are likely to impede percolation were encountered throughout lower Morro Valley and extend between 6 feet and 60 feet below the ground surface. The thickness of the documented surficial fine-grained deposits would likely make it economically impractical for removal during construction of percolation ponds.

The only portion of the Morro Valley that appears to us to have any feasibility for the development of surface infiltration and recharge ponds may be in the western-most (most downstream) portion of the valley, just above the Narrows. Additional site-specific field work would be required to further investigate this area.

The potential for recharge by injection wells may be less impacted by the valley's interbedded vertical profile, if the recharge waters could be injected directly into the lower aquifer zone beneath the thick clay-rich surface materials. However, the relatively permeable alluvial units documented in lower Morro Valley appear to be laterally constrained by relatively impermeable bedrock or fine-grained soils. The recharge potential would be limited to the anticipated thickness and laterally constrained materials of the relatively permeable alluvial units, which vary widely across the valley (between roughly 5 feet and 30 feet). Furthermore, the receiving coarse-grained aquifer constitutes the base of the alluvial sediments throughout most of the valley and are therefore the first materials to be saturated during normal to heavy rainfall years when the aquifer is recharged. In other words, there must be present an unsaturated aquifer with sufficient available storage in order to make any recharge facility feasible, particularly an injection program into the deeper portions of the zone.



The only part of the valley that may be feasible for the development of recharge facilities capable of the anticipated volume is the westernmost (most downstream) part of the valley, just above the Narrows. Additional field work must be conducted to further investigate this part of the valley, including borings, laboratory permeability tests, and field testing of percolation/infiltration capacity. The limited vertical and horizontal limits of relatively permeable alluvial units throughout most of the remaining portions of the valley likely provide insufficient infiltration capacity and/or storage capacity to accommodate the recharge volumes anticipated from the new WRF.

4.2 POSSIBLE FOLLOW-ON STUDIES

Based on our findings, we have identified the potential need for and value of possible follow-on studies to help the City of Morro Bay assess their next steps. These studies could include:

- Additional subsurface data collection in the lower part of the valley, just upstream of the Narrows, particularly along the active channel of Morro Creek, to evaluate the lateral and vertical extent of coarse-grained surficial deposits and assess the feasibility of surface or near-surface recharge facilities. These additional studies might take the form of hollow-stem borings and subsurface sampling, cone penetration testing, laboratory testing of selected aquifer materials, pumping tests of existing water well(s) (if available), and field testing of percolation/infiltration capacity of the soils;
- Groundwater flow modeling and, possibly, water quality modeling to assess the impact(s) on the City of Morro Bay's well field water supply from the operation of a recharge facility upstream of the Narrows;
- Groundwater flow modeling and evaluation of feasibility of injecting the treated effluent to create a seawater injection barrier downstream of the City's well field in order to increase production capacity of the municipal water supply well field, and;
- Further evaluation of alternative recharge and/or disposal concepts to meet seasonal demands (e.g. in-lieu, direct discharge, offshore disposal).

5.0 LIMITATIONS OF THIS STUDY

Fugro prepared the conclusions and professional opinions presented in this report in accordance with generally accepted geotechnical engineering principles and practices at the time and location this report was prepared. This statement is in lieu of all warranties, expressed or implied.

This report has been prepared for the City of Morro Bay and their authorized agents only. It may not contain sufficient information for the purposes of other parties or other uses. If any changes are made in the project or site conditions as described in this report, the



conclusions and recommendations contained in this report should not be considered valid unless Fugro reviews the changes and modifies and approves, in writing, the conclusions and recommendations of this report. The report and drawings contained in this report are not intended to act as construction drawings or specifications.

Soil and rock deposits will vary in type, strength, and other geotechnical properties between points of observation and exploration. We do not and cannot have complete knowledge of the subsurface conditions underlying the site. The conclusions and recommendations presented in this report are based upon the findings at the points of exploration, and interpolation and extrapolation of information between and beyond the points of observation, and are subject to confirmation based on the conditions revealed during construction.

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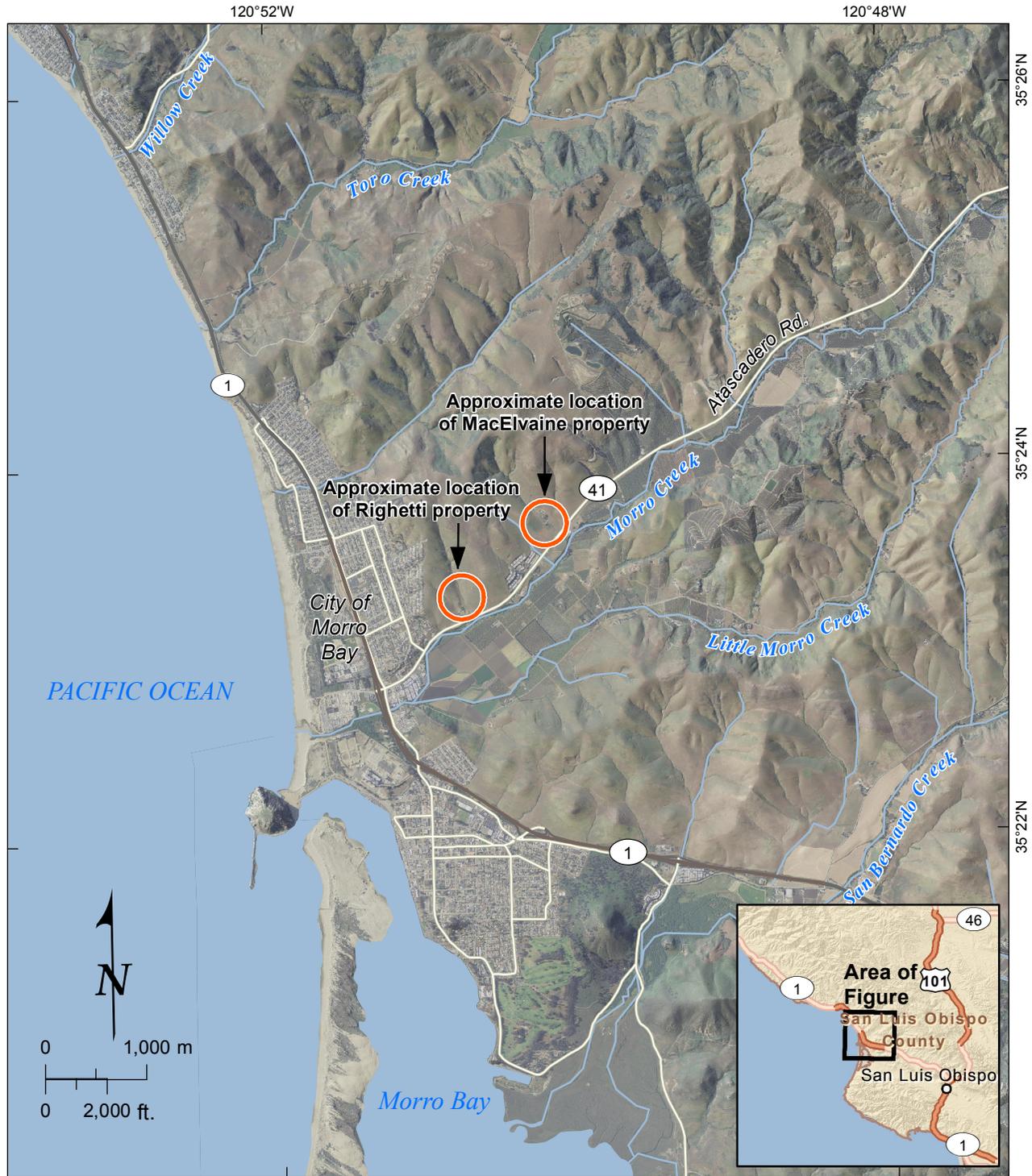
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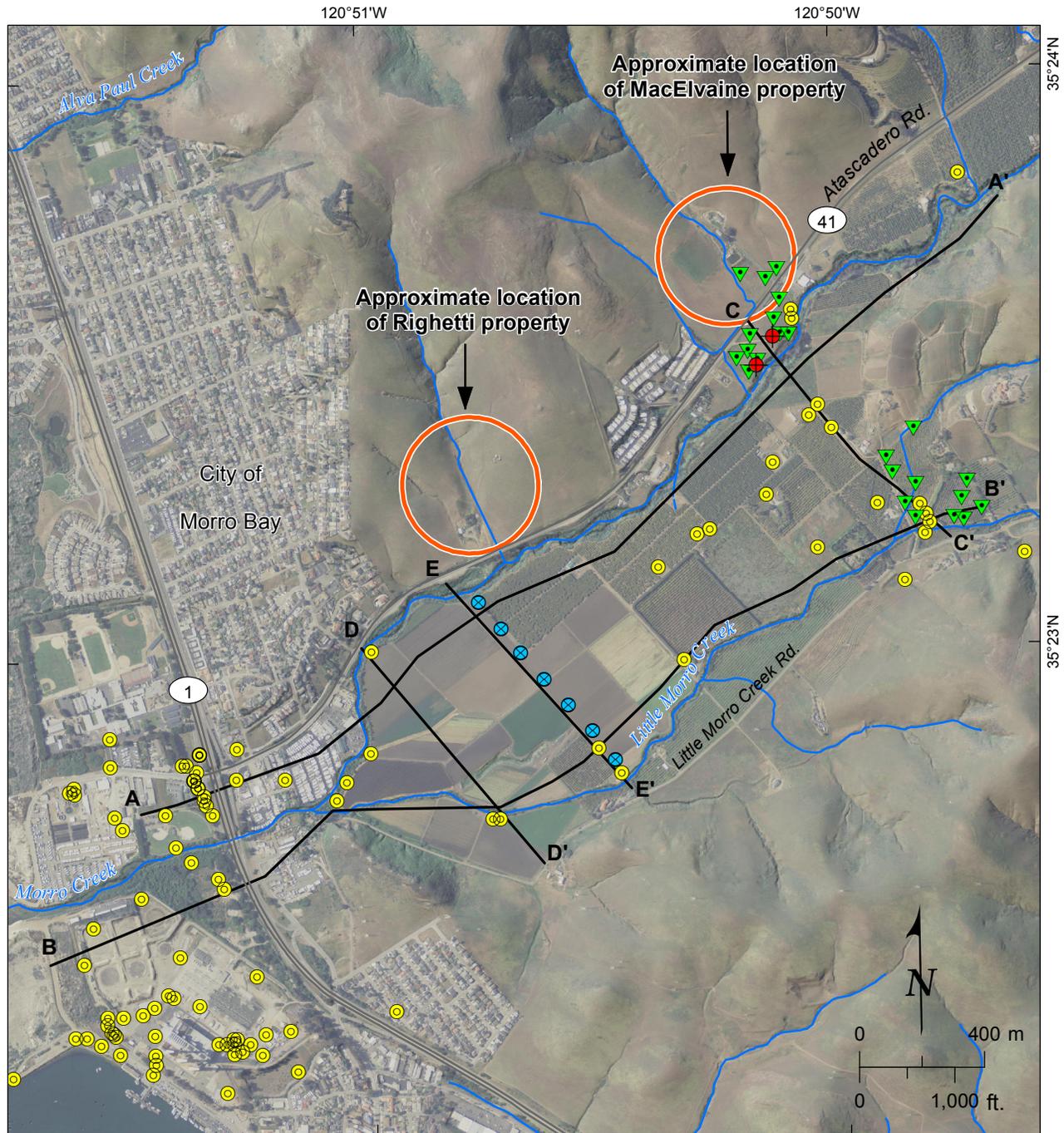






Imagery from NAIP, 2012.

VICINITY MAP
Morro Valley Groundwater
Recharge Reconnaissance Study
San Luis Obispo County, CA

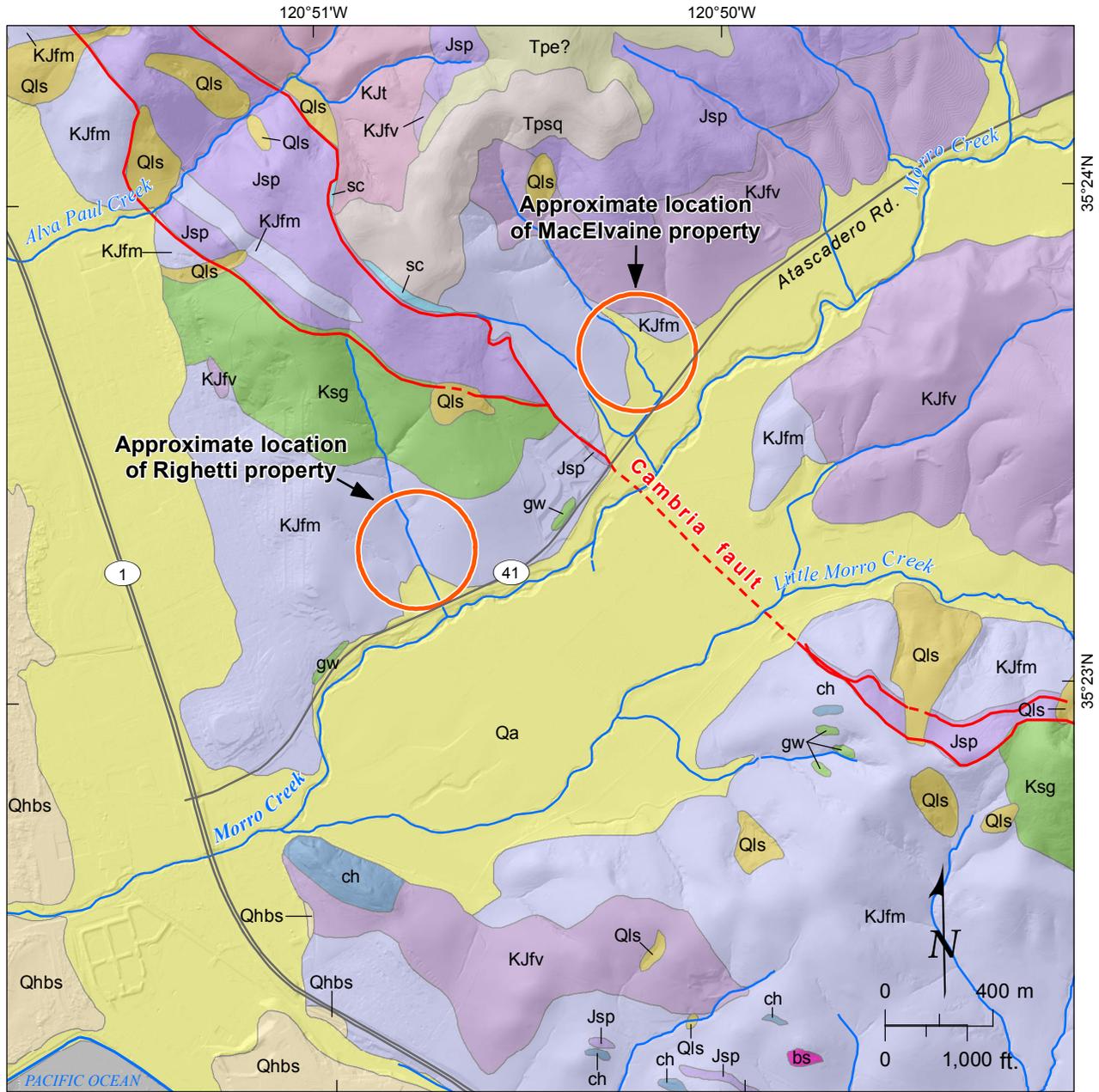


Imagery from NAIP, 2012.

Explanation

-  Boring from Fugro in-house data
-  CPT from Fugro in-house data
-  Test hole from Brown and Caldwell (1981)
-  Well from DWR and Fugro in-house data. Multiple wells present in some locations.
-  Cross section line

MORRO VALLEY DATA COMPILATION MAP
 Morro Valley Groundwater
 Recharge Reconnaissance Study
 San Luis Obispo County, CA

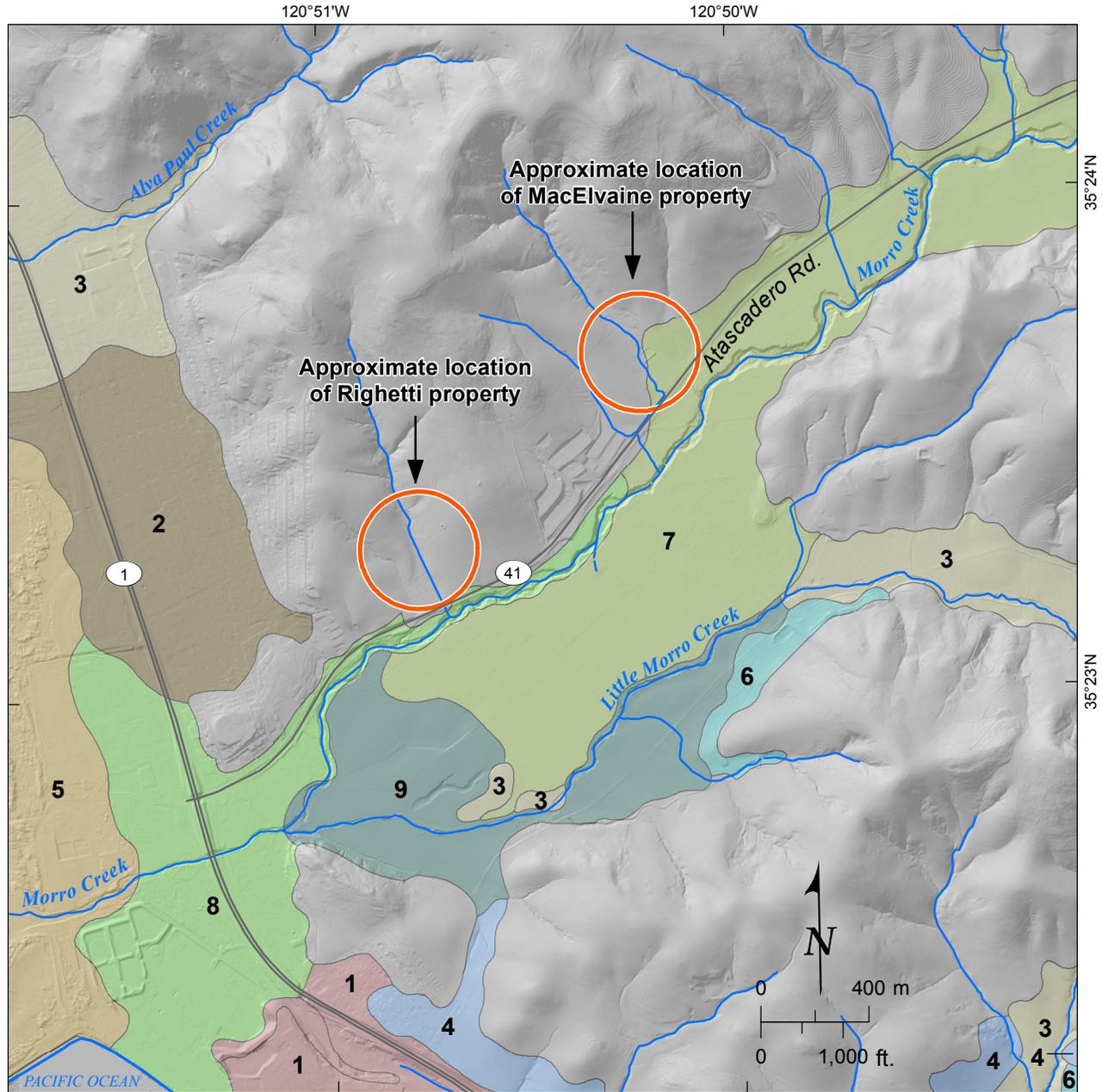


Hall, C.A. and Prior, S.W., 1975.

Explanation

Qa Alluvium deposits	KJfm Franciscan melange
Qhbs Beach sand deposits	KJfv Franciscan, metavolcanic rocks
Qls Landslide deposits	KJt Toro Formation, undifferentiated
Tpsq Squire Member of Pismo Formation	bs Blueschist
Tpe Edna Member of Pismo Formation	ch Chert
Ksg Graywacke and interbedded shale	gw Graywacke
 Fault, dashed where inferred	sc Silica-carbonate rocks
	Jsp Serpentine

GEOLOGIC MAP
Morro Valley Groundwater
Recharge Reconnaissance Study
San Luis Obispo County, CA

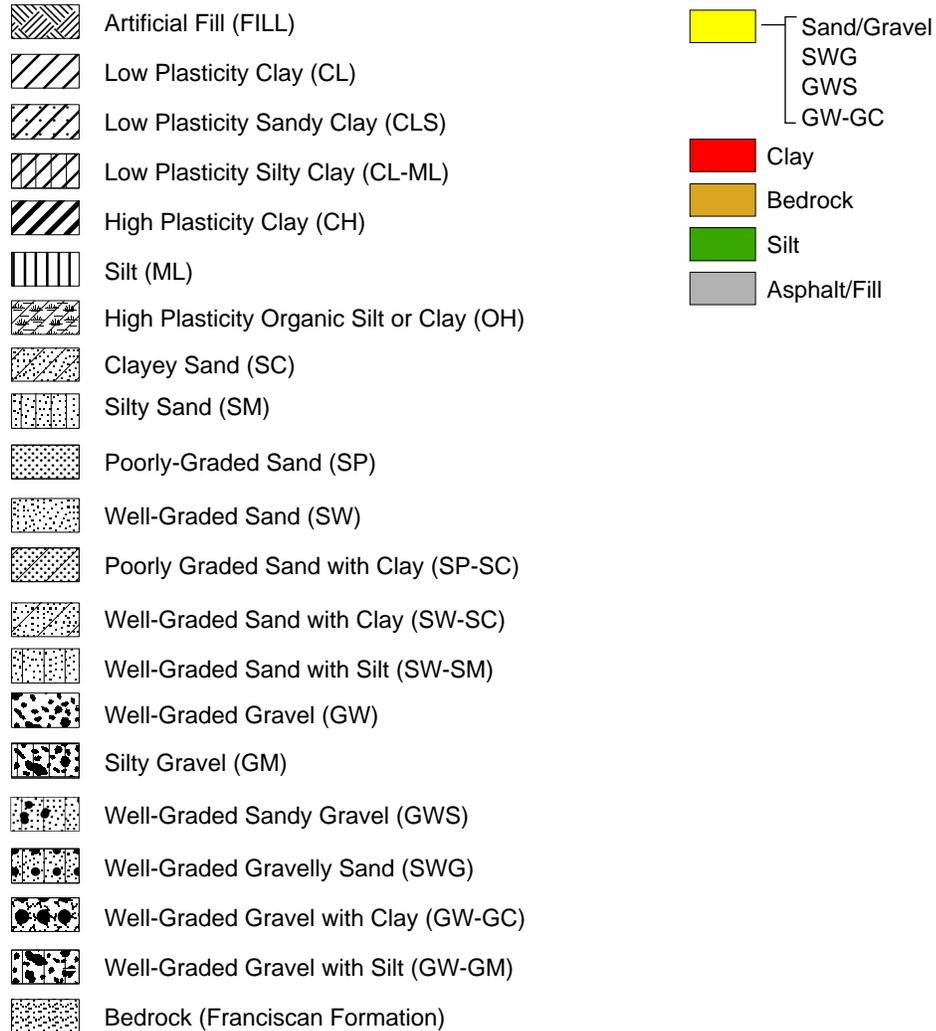


Soil data modified from USDA, NRCS (SSURGO 2.2)

Explanation

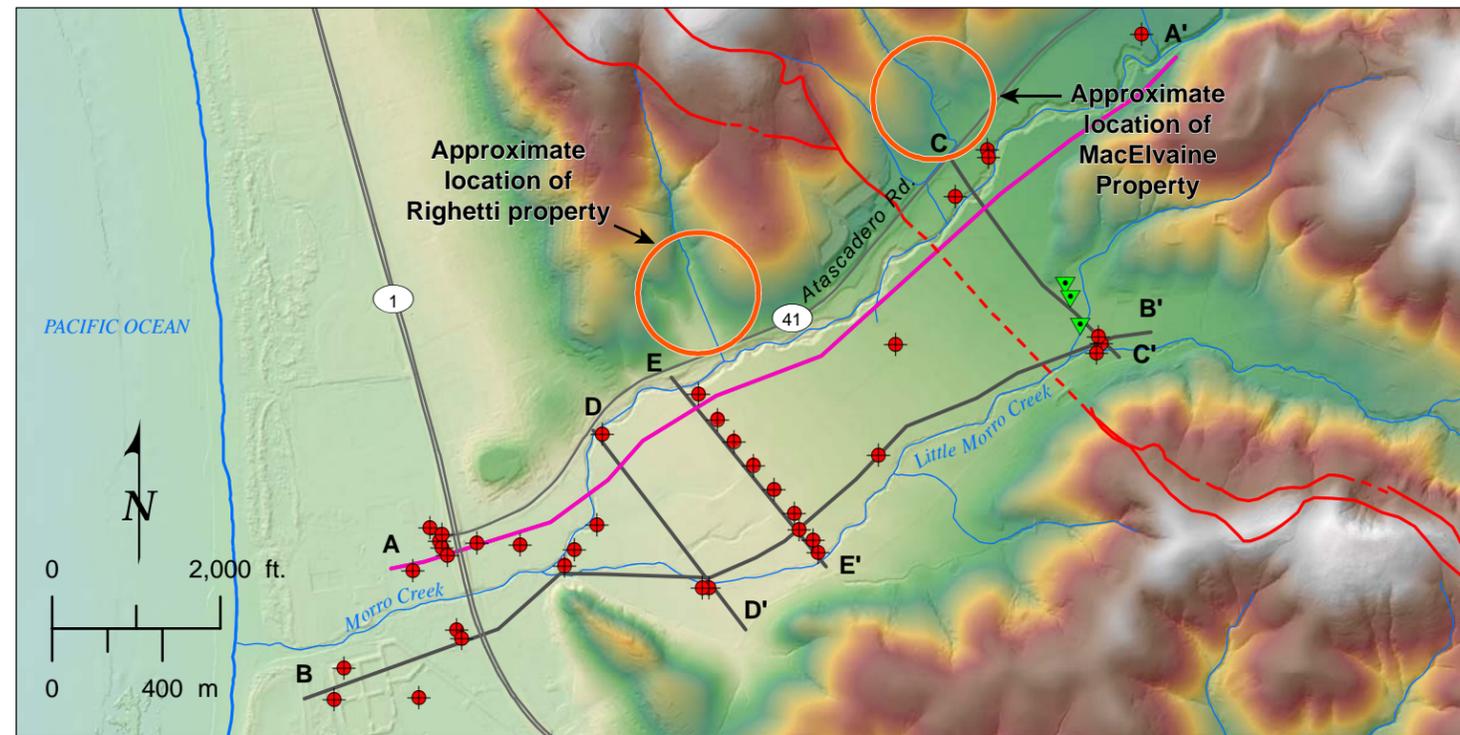
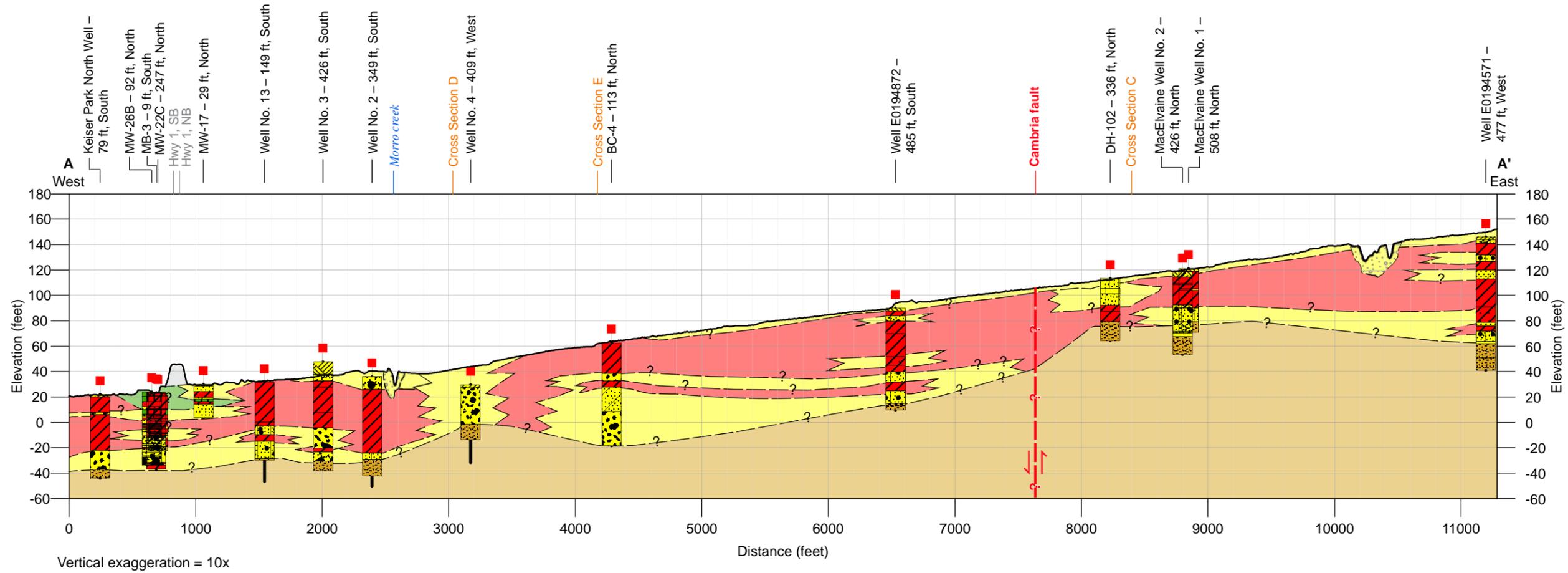
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	9 Salinas silty clay loam																		

MORRO VALLEY SOILS MAP
 Morro Valley Groundwater
 Recharge Reconnaissance Study
 San Luis Obispo County, CA

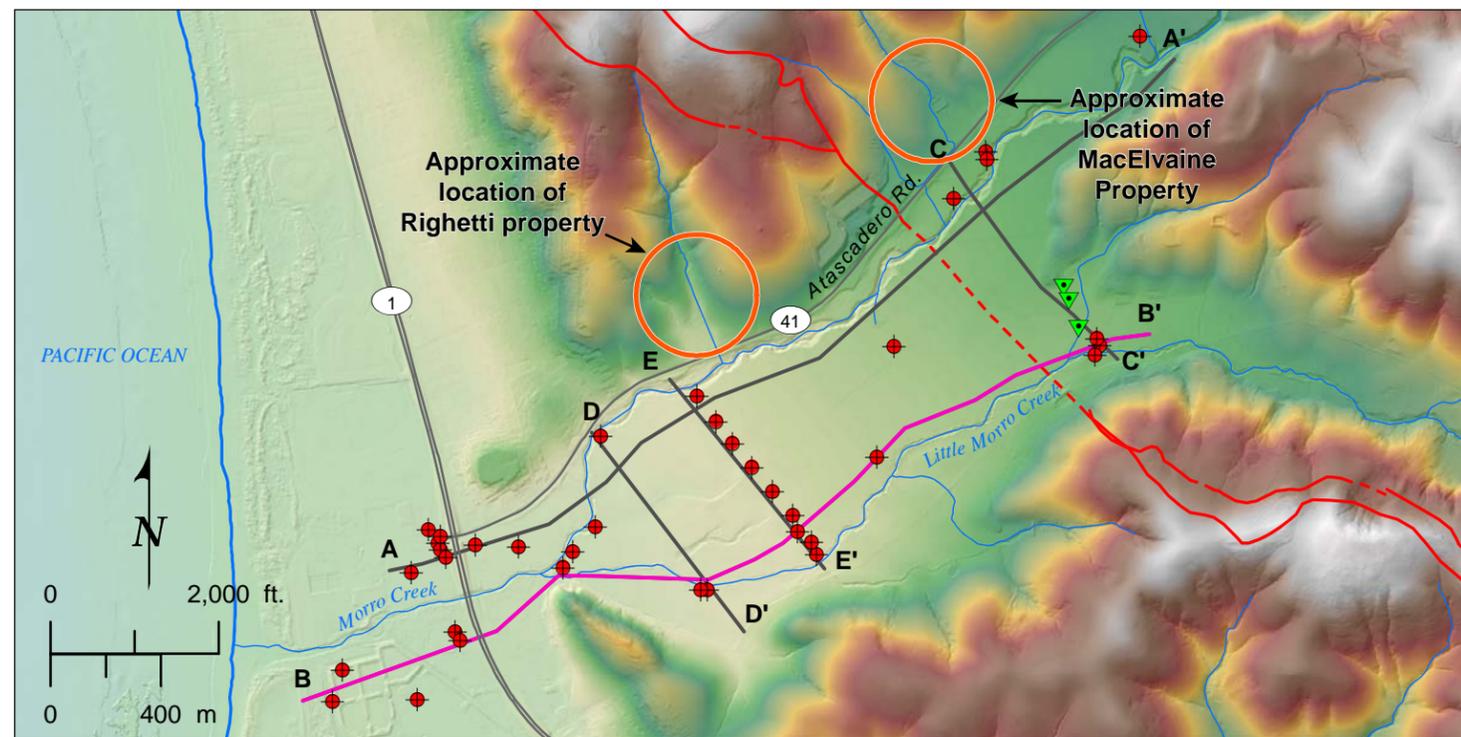
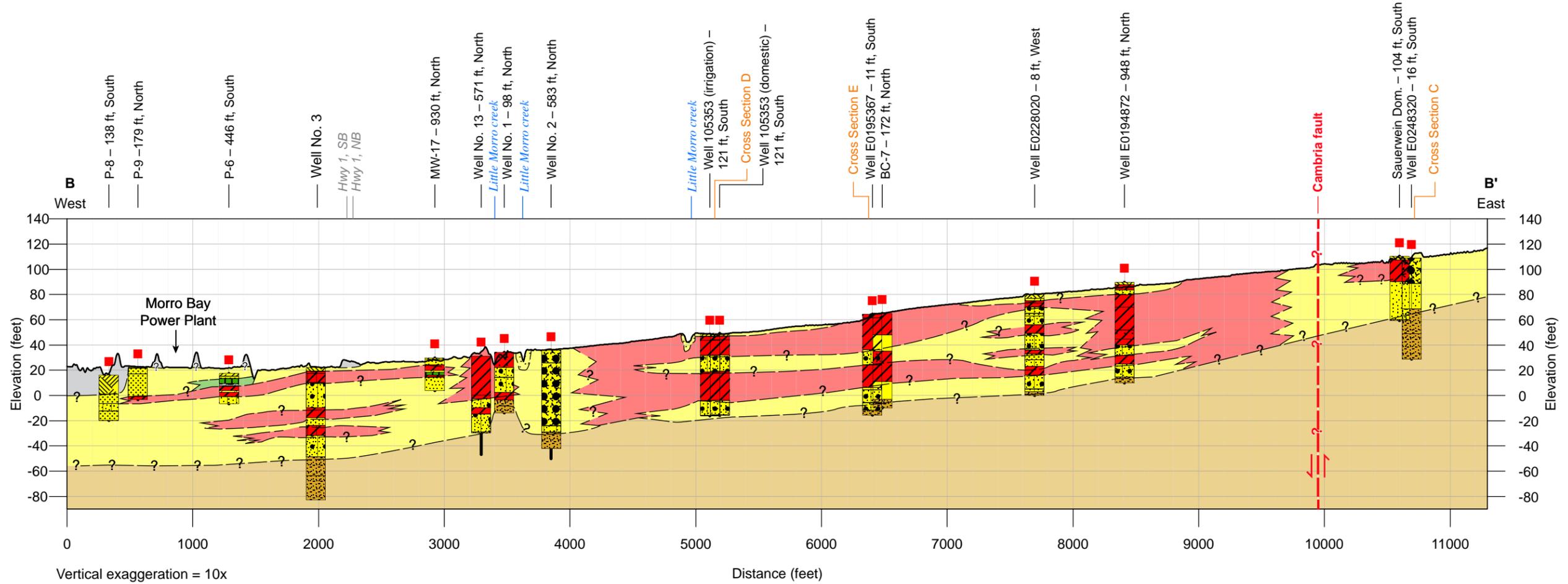


**KEY TO TERMS AND SYMBOLS
 USED ON GEOLOGIC CROSS-SECTIONS**
 Morro Valley Groundwater
 Recharge Reconnaissance Study
 San Luis Obispo County, CA

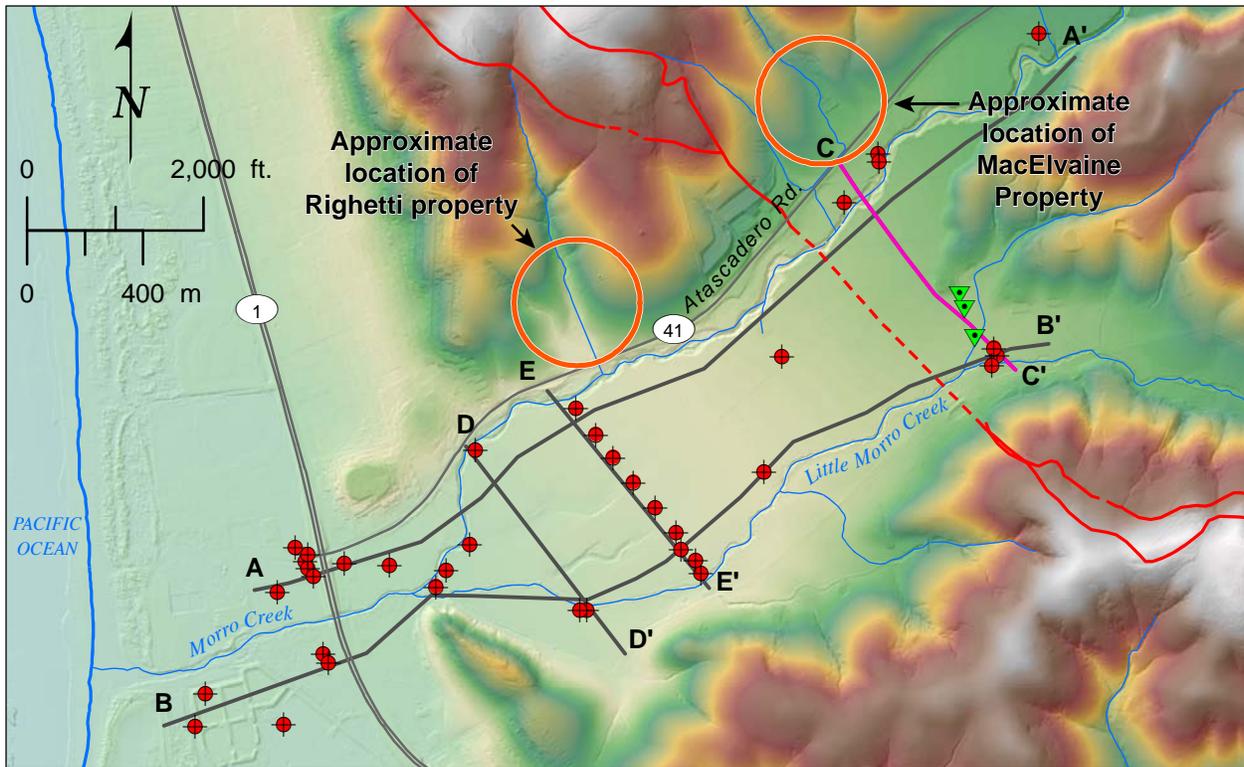
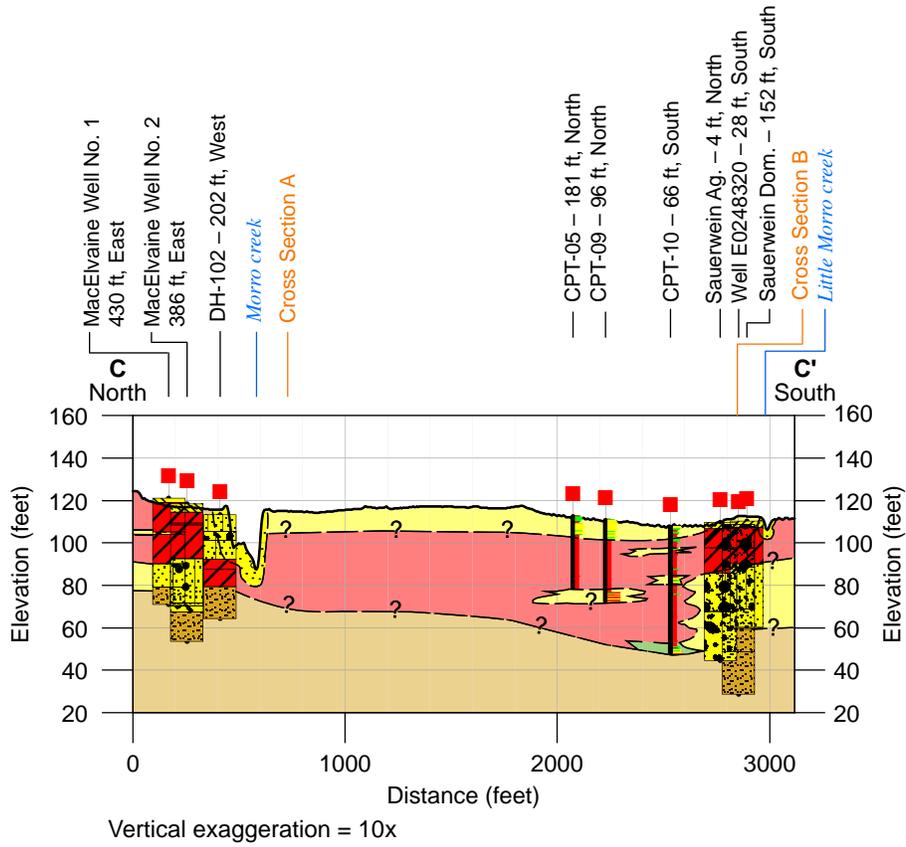
FIGURE 5



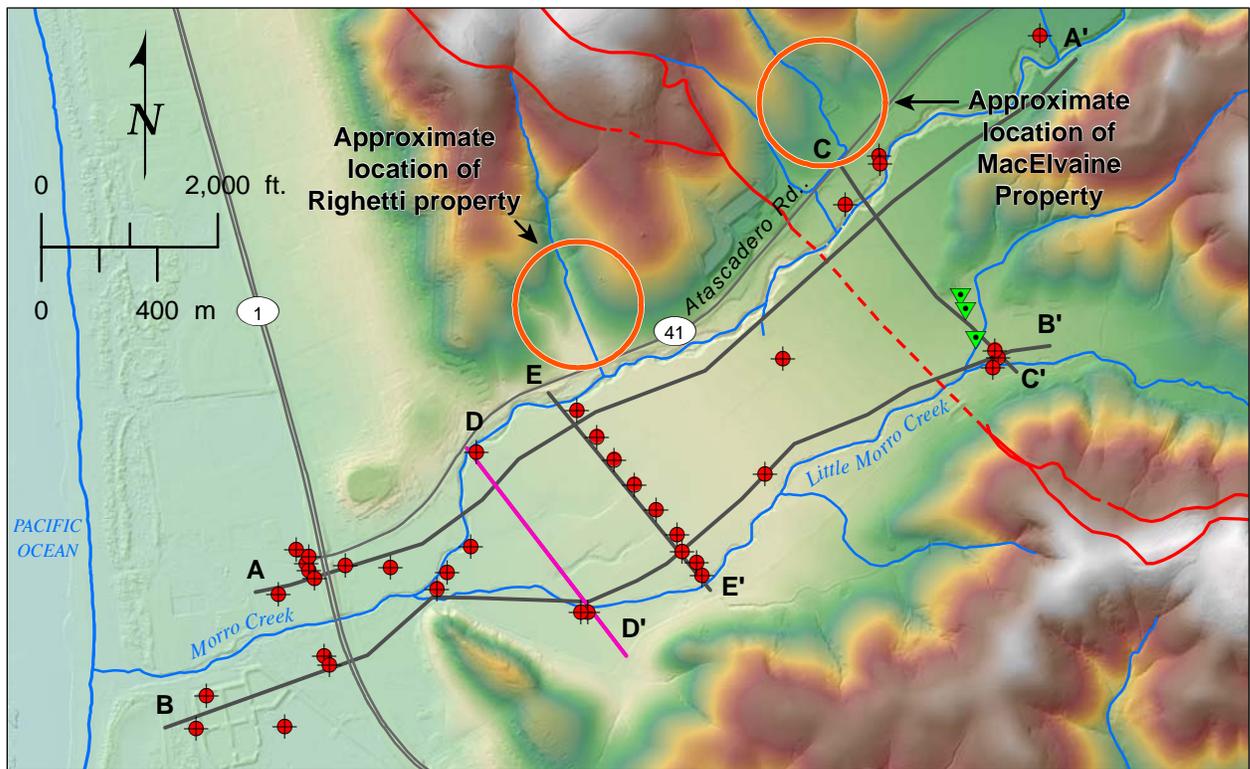
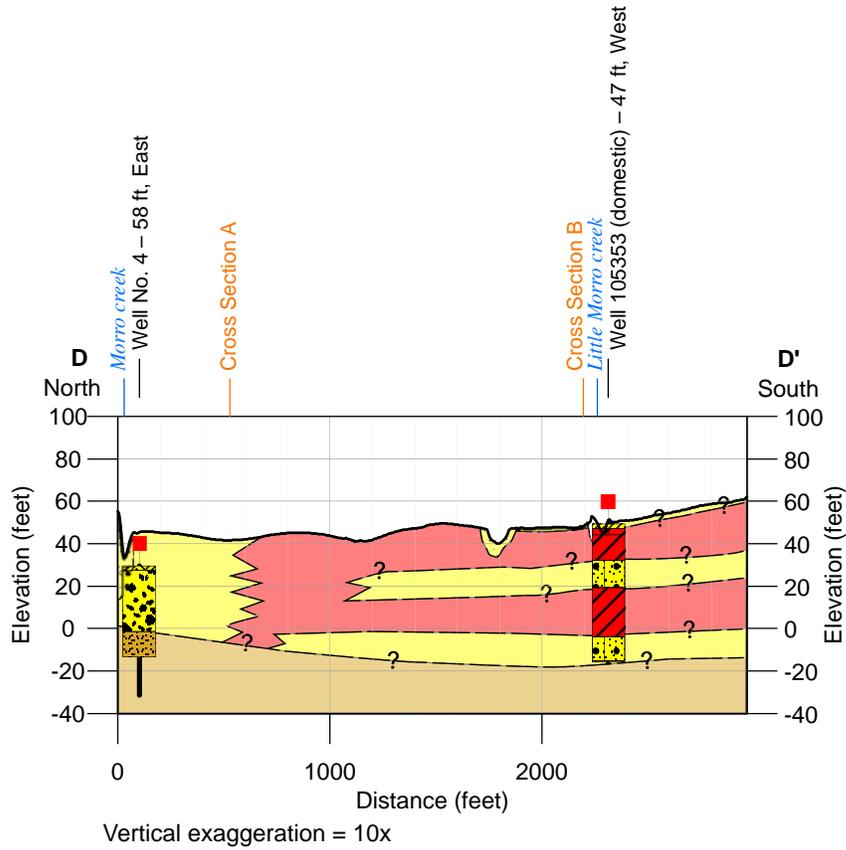
CROSS SECTION A-A'
Morro Valley Groundwater
Recharge Reconnaissance Study
San Luis Obispo County, CA



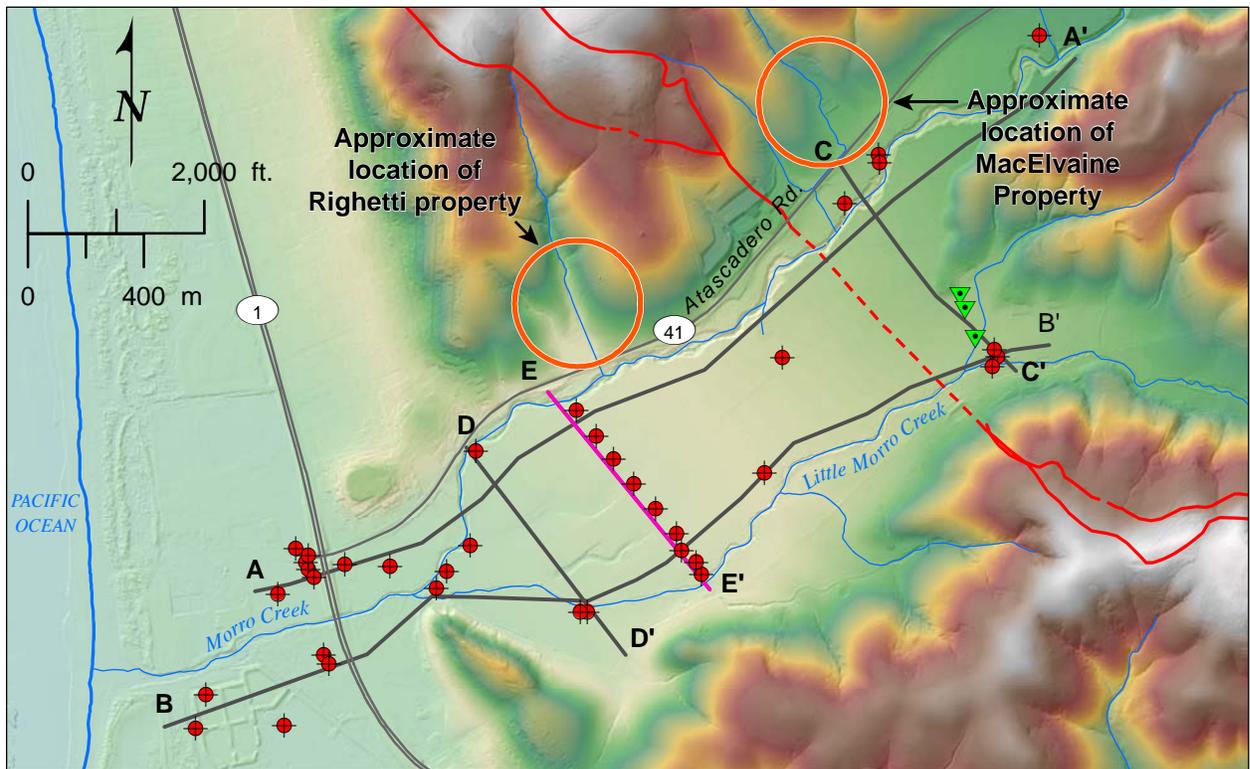
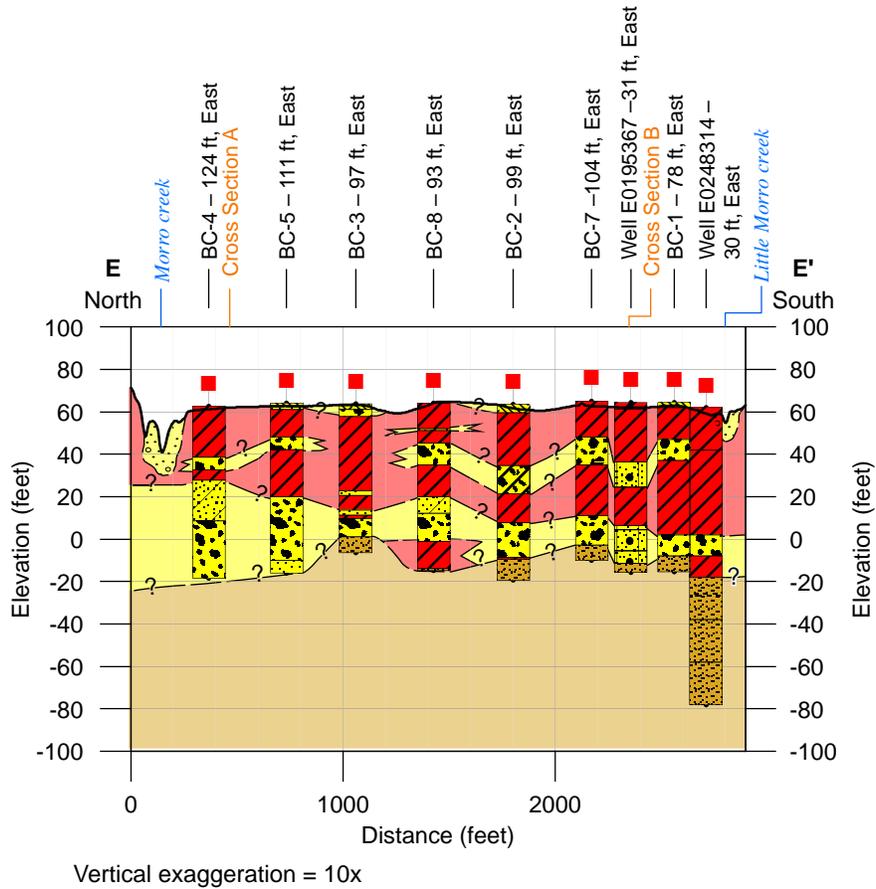
CROSS SECTION B-B'
Morro Valley Groundwater
Recharge Reconnaissance Study
San Luis Obispo County, CA



CROSS SECTION C-C'
Morro Valley Groundwater
Recharge Reconnaissance Study
San Luis Obispo County, CA



CROSS SECTION D-D'
 Morro Valley Groundwater
 Recharge Reconnaissance Study
 San Luis Obispo County, CA



CROSS SECTION E-E'
 Morro Valley Groundwater
 Recharge Reconnaissance Study
 San Luis Obispo County, CA

FIGURE 10