

Atlantic Richfield Company

Chuck Carmel

Remediation Management Project Manager

RECEIVED

By Alameda County Environmental Health 9:25 am, May 01, 2015

PO Box 1257
San Ramon, CA 94583
Phone: (925) 275-3804
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April 30, 2015

Re: First Quarter 2015 Groundwater Monitoring Report, Updated Conceptual Site Model,
and Case Closure Request
Atlantic Richfield Company Station #498
286 South Livermore Ave, Livermore, California
ACEH Case #RO0002873

"I declare, that to the best of my knowledge at the present time, that the information and/or recommendations contained in the attached document are true and correct."

Submitted by,



Chuck Carmel
Remediation Management Project Manager

Attachment



**FIRST QUARTER 2015 GROUNDWATER MONITORING REPORT, UPDATED CONCEPTUAL SITE
MODEL, AND CASE CLOSURE REQUEST
Atlantic Richfield Company Station #498
286 South Livermore Avenue
Livermore, Alameda County, California**

Prepared for:

Mr. Chuck Carmel
Atlantic Richfield Company
P.O. Box 1257
San Ramon, CA 94583

Prepared by:

Broadbent & Associates, Inc.
4820 Business Center Drive, Suite 110
Fairfield, CA 94534

April 30, 2015

No. 08-82-603

April 30, 2015

Project No. 08-82-603

Atlantic Richfield Company
P.O. Box 1257
San Ramon, CA 94583
Submitted via ENFOS

Attn.: Mr. Chuck Carmel

RE: First Quarter 2015 Groundwater Monitoring Report, Updated Conceptual Site Model, and Case Closure Request
Atlantic Richfield Company Station #498
286 South Livermore Ave, Livermore, Alameda County, California
ACEH Case #RO0002873; GeoTracker Global ID #T0600124081

Dear Mr. Carmel:

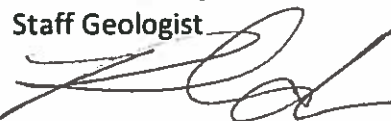
Broadbent & Associates, Inc. (Broadbent) is pleased to submit this *First Quarter 2015 Groundwater Monitoring Report, Updated Conceptual Site Model, and Case Closure Request* for Atlantic Richfield Company Station #498 located at 286 South Livermore Avenue, Livermore, Alameda County, California (Site). This report has been prepared on behalf of Atlantic Richfield Company (a BP affiliated company) for submittal to Alameda County Environmental Health (ACEH) for use in evaluation of the Site for closure under the State Water Resources Control Board's Low-Threat Underground Storage Tank Case Closure Policy.

Please do not hesitate to contact us at (707) 455-7290 if you should have any questions or require additional information.

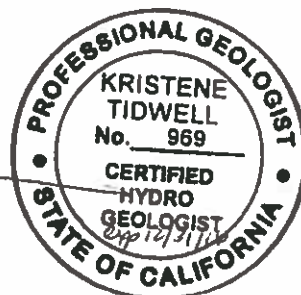
Sincerely,

BROADBENT & ASSOCIATES, INC.

Nicholas Vrdoljak
Staff Geologist



Kristene Tidwell, P.G., C.Hg.
Associate Hydrogeologist



cc: Mr. Jerry Wickham, Alameda County Environmental Health (submitted via ACEH ftp site)
Electronic copy uploaded to GeoTracker

FIRST QUARTER 2015 GROUNDWATER MONITORING REPORT, UPDATED CONCEPTUAL SITE MODEL, AND CASE CLOSURE REQUEST
Atlantic Richfield Company Station No. 498
286 South Livermore Avenue, Livermore, California
Fuel Leak Case No. R00002873

TABLE OF CONTENTS

<u>No.</u>	<u>Section</u>	<u>Page</u>
1.0	INTRODUCTION	1
1.1	Site Setting	1
1.2	Site Background	1
1.3	Document Purpose and Organization.....	2
2.0	FIRST QUARTER 2015 MONITORING REPORT.....	2
2.1	Summary	2
2.2	Activities Conducted and Results.....	3
2.3	Discussion.....	4
2.4	Recommendations	4
2.5	Limitations.....	4
3.0	JUSTIFICATION FOR SITE CLOSURE	4
3.1	General Criteria.....	4
3.2	Media-Specific Criteria – Groundwater	6
3.3	Media-Specific Criteria – Petroleum Vapor Intrusion to Indoor Air	6
3.4	Media-Specific Criteria – Direct Contact and Outdoor Air Exposure	6
3.5	Recommendation for Case Closure	7
4.0	LIMITATIONS	7
5.0	REFERENCES	7

LIST OF DRAWINGS

Drawing 1	Site Location Map
Drawing 2	Site Map with Well and Boring Locations
Drawing 3	Groundwater Elevation Contours and Analytical Summary Map, February 2015
Drawing 4	GRO Isoconcentration Contour Map, February 2015
Drawing 5	Benzene Isoconcentration Contour Map, February 2015
Drawing 6	MTBE Isoconcentration Contour Map, February 2015

LIST OF TABLES

Table 1	Conceptual Site Model
Table 2	Summary of Groundwater Monitoring Data: Relative Water Elevations and Laboratory Analyses
Table 3	Summary of Fuel Additives Analytical Data
Table 4	Historical Groundwater Gradient – Direction and Magnitude

LIST OF FIGURES

Figure 1	MW-1 Concentrations and Groundwater Elevations vs Time
Figure 2	MW-2 Concentrations and Groundwater Elevations vs Time
Figure 3	MW-3 Concentrations and Groundwater Elevations vs Time
Figure 4	MW-4 Concentrations and Groundwater Elevations vs Time

APPENDICES

Appendix A	Detailed Site Background
Appendix B	Historical Soil and Groundwater Data
Appendix C	Historical Soil Boring / Monitoring Well Logs and Geologic Cross-Sections
Appendix D	Field Methods
Appendix E	Field Data Sheets
Appendix F	Laboratory Report and Chain-of-Custody Documentation
Appendix G	GeoTracker Upload Confirmation Receipts

FIRST QUARTER 2015 GROUNDWATER MONITORING REPORT, UPDATED CONCEPTUAL SITE MODEL, AND CASE CLOSURE REQUEST

Atlantic Richfield Company Station No. 498
286 Livermore Avenue, Livermore, California
Fuel Leak Case No. RO0002873

1.0 INTRODUCTION

On behalf of the Atlantic Richfield Company– (ARC, a BP affiliated company) Broadbent & Associates, Inc. (Broadbent) has prepared this *First Quarter 2015 Groundwater Monitoring Report, Updated Conceptual Site Model (CSM), and Case Closure Request (CCR)* for the Atlantic Richfield Company (ARC) Station No. 498 (herein referred to as Station No. 498), located at 286 South Livermore Avenue in Livermore, California (Site). This CSM and CCR was prepared in order to evaluate the Site’s eligibility to be closed under the California State Water Resources Control Board’s (CSWRCB) *Low Threat Underground Storage Tank Case Closure Policy (LTCP; CSWRCB, 2012)*. This CSM and CCR includes discussions on the Site background and previous environmental activities, regional and Site geology and hydrogeology, and justification for case closure. Additionally included in this report is the First Quarter 2015 groundwater monitoring results.

1.1 Site Setting

The Site is an active ARC-branded service station located at the northern corner of the intersection of South Livermore Avenue and Third Street in Livermore, California. The land use in the immediate vicinity of the Site is mixed commercial and residential. Current structures at the Site include three underground storage tanks (USTs), two fuel dispenser islands with a total of four dispensers, and a station building. The majority of the Site is paved with asphalt and concrete. The location of the Site is presented in Drawing 1. A Site Plan that shows current and former well locations is provided as Drawing 2. A Groundwater Elevation Contour Map presenting the most current groundwater data (February 2015) is provided as Drawing 3.

The Site is bounded by the two-lane Third Street to the southeast, the two-lane South Livermore Avenue to the southwest, an optometry office to the northwest, and a residential property to the northeast. A Shell Station formerly resided on the property immediately southeast of the Site across Third Street. This station is identified as a closed leaking UST case, ACEH Fuel Leak Case No. RO0002525 / GeoTracker Global ID No. T0600156427, on the State Water Resources Control Board’s Geotracker website. The environmental case was closed in 2007.

1.2 Site Background

The Site has operated as a gasoline fueling station since the environmental case was open in 1991. The Site is likely to remain a service station for the foreseeable future. A detailed history of previous Site activities is presented in Appendix A. Historic soil and groundwater data are presented in Appendix B. Copies of available soil boring and monitoring well construction logs and geologic cross-sections are provided in Appendix C.

FIRST QUARTER 2015 GROUNDWATER MONITORING REPORT, UPDATED CONCEPTUAL SITE MODEL, AND CASE CLOSURE REQUEST

Atlantic Richfield Company Station No. 498
286 Livermore Avenue, Livermore, California
Fuel Leak Case No. R00002873

1.3 Document Purpose and Organization

The purpose of this document is to evaluate the current Site conditions as presented in Broadbent's April 2014 *Additional Soil & Groundwater Investigation and Conceptual Site Model* report and present the case for Site closure under the LTCP. The following section presents justification for closure based on the CSM. The CSM is presented as Table 1. Tables 2 and 3 present historical and current groundwater analytical data. Table 4 summarizes historical and current groundwater gradients. Additionally, the groundwater monitoring results from First Quarter 2015 are presented herein.

In order to evaluate Site conditions against the LTCP, each category in the policy has been individually evaluated using the data presented in the CSM (Table 1). These evaluations are presented in the following sections.

2.0 FIRST QUARTER 2015 MONITORING REPORT

WORK PERFORMED THIS QUARTER (First Quarter 2015):

1. Submitted *Fourth Quarter 2014 Quarterly Monitoring Report* on January 15, 2015.
2. Conducted groundwater monitoring/sampling for First Quarter 2015 on February 10, 2015.

WORK SCHEDULED FOR NEXT QUARTER (Second Quarter 2015):

1. Submit *First Quarter 2015 Groundwater Monitoring Report, Updated Conceptual Site Model, and Case Closure Request* (contained herein).
2. No other activities are scheduled for Second Quarter 2015.

2.1 Summary

QUARTERLY MONITORING PLAN SUMMARY:

Groundwater level gauging:	<u>MW-1, MW-2, MW-3, MW-4, MW-5A/B and MW-6A/B</u>	Quarterly
Groundwater sample collection:	<u>MW-1, MW-2, MW-3, MW-4, MW-5A/B and MW-6A/B</u>	Quarterly
Biodegradation indicator parameter monitoring:	<u>None</u>	(Quarterly)

QUARTERLY RESULTS SUMMARY:

LNAPL

LNAPL observed this quarter:	<u>No</u>	(yes\no)
LNAPL recovered this quarter:	<u>None</u>	(gal)
Cumulative LNAPL recovered:	<u>None</u>	(gal)

Groundwater Elevation and Gradient:

Depth to groundwater:	29.88 ft (MW-1) to 44.04 ft (MW-6A)	(ft below TOC)
Gradient direction:	<i>Northwest</i>	(compass direction)
Gradient magnitude:	<u>0.02</u>	(ft/ft)
Average change in elevation:	<u>+10.76</u>	(ft since last measurement)

Laboratory Analytical Data

Summary:

Analytical Results are as follows:

- GRO was detected in four wells with a maximum concentration of 2,000 µg/L in well MW-3.
- Benzene was detected in three wells with a maximum concentration of 350 µg/L in well MW-3.
- Ethylbenzene was detected in three wells with a maximum concentration of 30 µg/L in well MW-3.
- Total Xylenes were detected in two wells with a maximum concentration of 11 µg/L in well MW-1.
- MTBE was detected in four wells with a maximum concentration of 1,700 µg/L in well MW-6a.
- Toluene was detected in two wells with a maximum concentration of 2.7 µg/L in well MW-3.

2.2 Activities Conducted and Results

First Quarter 2015 groundwater monitoring and sampling activities were conducted on February 13, 2015 by Broadbent personnel in accordance with the First Quarter monitoring plan. No irregularities were noted during gauging. Light Non-Aqueous Phase Liquid (LNAPL) was not present in the wells monitored during this event. Depth to groundwater ranged from 29.88 ft in MW-1 to 44.04 ft in MW-6A. As shown on Drawing 3, groundwater gradient on February 13, 2015 was 0.02 ft/ft in a northwest direction. Current and historic groundwater elevations and groundwater sample analytical data are provided in Tables 2 and 3. Historical groundwater gradient information is provided in Table 4. Drawing 3 presents a groundwater elevation contours and analytical summary map for February 13, 2015. Field procedures used during groundwater monitoring are provided in Appendix D. Field data sheets are included in Appendix E.

Groundwater samples were collected on February 13, 2015. No irregularities were reported during sampling with the exception of MW-4 containing insufficient water for sampling. Samples were submitted to Test America Laboratories, Inc. (Test America) of Irvine, California

for analyses of Gasoline Range Organics, by EPA Method 8015B, and for benzene; toluene; ethylbenzene; total xylenes; methyl-t-butyl ether (MTBE); ethyl-t-butyl ether (ETBE); tert-amyl-methyl ether (TAME); isopropyl ether (DIPE); tert-butyl alcohol (TBA); 1,2-dibromoethane (EDB); 1,2-dichloroethane; and ethanol by EPA Method 8260B. No irregularities were encountered during analysis of the samples. Laboratory analytical report and chain of custody record are provided in Appendix C. Groundwater monitoring data (GEO_WELL) and laboratory analytical results (EDF) were uploaded to the GeoTracker AB2886 database. Upload confirmation receipts are provided in Appendix F.

Results of the sampling event are included in the laboratory analytical data summary above. These results indicate that the highest concentrations of petroleum hydrocarbons are present in well MW-3. Further discussion of these results is presented below.

2.3 Discussion

Review of historical groundwater gradient data indicates that levels were within historical limits for all wells. Groundwater elevations yielded a potentiometric groundwater gradient to the northwest at 0.02 ft/ft, consistent with the historic gradient data presented in Table 4.

Review of historical data indicates that concentration levels for the First Quarter 2015 were generally within historical limits with the exception of the recently installed MW-5A and MW-6A wells. MW-5A increased in concentration for benzene, ethylbenzene, and GRO relative to the Second Quarter 2014 sampling event, which was the last time MW-5A was sampled. MW-6A increased in concentration for GRO and MTBE relative to the Second Quarter 2014 sampling event, which was also the last time well MW-6A was sampled. Tables 2 and 3 show the change in concentrations from the previous sampling event. The data also indicates that well MW-3 has consistently maintained the highest residual concentrations of petroleum hydrocarbons at the site relative to the other wells.

Only seven of the eight wells were sampled during the First Quarter sampling event due to insufficient water in one of the wells (MW-4). The nearly dry wells are likely a result from the ongoing drought conditions seen throughout the surrounding region.

3.0 JUSTIFICATION FOR SITE CLOSURE

As indicated in Section 1.3 above, the Site was evaluated for Closure based on comparing data presented in the CSM (Table 1) against the LTCP (CSWRCB, 2012). Closure criteria in the LTCP are organized into the following categories:

- General Criteria
- Media Specific Criteria-Groundwater
- Media Specific Criteria – Petroleum Vapor Intrusion to Indoor Air
- Media Specific Criteria – Direct Contact and Outdoor Air Exposure

The following sections present the details of the evaluation.

3.1 General Criteria

The general criteria relates to the Site use, presence of free product, petroleum sources, and completeness of the Site understanding. As evidenced in the data presented in the CSM, a sufficiently good understanding of Site conditions, on- and offsite receptors, and Site history has been established. These general criteria and a discussion on how the Site is consistent with these criteria are presented below.

The unauthorized release is located within the service area of a public water system

The Site is located within the Zone 7 Water Agency service area.

The unauthorized release consists only of petroleum

The original release source at the Site is uncertain, however only petroleum components have historically been detected. Additionally, concentrations have been located in and around the UST basin and product lines. All analytical data collected to date has shown no indication of any other contaminant releases other than petroleum (Table 2, Table 3, and Appendix A). The Site has been a retail service station since at least 1993 based on a review of historical aerial photographs and there is no evidence that any other activities have occurred at the Site which may have caused non-petroleum releases.

The unauthorized release has been stopped

The USTs, product piping, and product dispensers where the releases are thought to have occurred have been removed and replaced; thereby, removing the possible leak sources (Table 1; Appendix A).

Free product has been removed to the maximum extent practicable

Free product has never been measured in Site wells since monitoring operations began. As free product has not been observed for over 15 years, removal of the free product has been completed to the maximum extent practicable.

A conceptual site model (CSM) that assesses the nature, extent, and mobility of the release has been developed

A CSM has been prepared and updated for this Site and is presented as Table 1.

Secondary source has been removed to the extent practical

The dispensers and product piping were upgraded in 2001. It is not clear whether over-excavation activities occurred during these activities, although the sample data from this area indicate the fuel delivery system did not have a release, leaving the USTs as the most likely potential source. However, the highest concentrations of hydrocarbon constituents have historically been observed in well MW-3, which is located upgradient from the UST system. If the USTs were the source of the release, MW-1 would typically contain the highest concentrations due to its downgradient position from the USTs. Residual petroleum concentrations in groundwater indicate no significant secondary sources are present. Therefore, a secondary source has been removed to the extent practical.

Soil and groundwater have been tested for MTBE and results reported in accordance with Health and Safety Code 25296.15

Soil and groundwater samples collected have been analyzed for methyl tert-butyl ether (MTBE). Historical MTBE analytical data are included in Tables 2 and 3 and Appendix B.

Nuisance as defined by the Water Code section 13050 does not exist at this site

A nuisance as defined by the water code does not exist at this Site.

3.2 Media-Specific Criteria - Groundwater

The LTCP lists four scenarios for groundwater plumes. According to the petroleum plume sizes indicated in Drawings 4, 5, and 6, the plume is less than 100 feet in length when presuming the UST system and piping is the source. Under worst-case scenarios, if an offsite source is presumed and plume length is measured from MW-3, then the length closely approaches 100 feet. Current hydrocarbon concentrations do not exceed the maximum levels listed within the LTCP and free product has never been observed at the Site. A previous sensitive receptor survey indicated that one domestic or water supply wells was located within a ½ mile radius of the Site. This well is located 400 feet east of the Site (upgradient), as presented in the CSM (Table 1). The closest surface water is the Arroyo Mocho Stream, located approximately 0.62 miles south of the Site (Table 1). Site impacts have been defined downgradient to the highest degree possible. Further definition is impossible due to the denial of offsite access by the neighboring properties. Based on these criteria, the Site is eligible for closure under the LTCP groundwater category 1.

3.3 Media Specific Criteria – Petroleum Vapor Intrusion to Indoor Air

The Site is an active service station, and therefore the LTCP considers that petroleum vapors from onsite fueling activities are a far greater risk than those associated with exposure to vapors from historic petroleum releases. Concentrations above cleanup levels do not extend beyond the property boundaries with the possible exception of MTBE. Currently, MTBE does not seem to extend into any offsite area; however, previously it could have been present under the adjacent parking lot. Due to the relatively small MTBE plume size, it is unlikely that MTBE impacts will extend a significant distance in the direction of the parking lot. Regardless, Broadbent unsuccessfully attempted to negotiate access to assess the offsite impacts in this parking lot in 2013. Offsite MTBE vapor intrusion is considered of negligible risk due to the inherently low vapor risk of MTBE. Any additional assessment is impossible due to the inaccessibility of the area. Because of the lack of risk to offsite areas, lack of access, small aerial extent of MTBE, and the current Site use as a gas station, this Site data meets the criteria for closure according to the LTCP.

3.4 Media Specific Criteria – Direct Contact and Outdoor Air Exposure

Soil borings were advanced at the Site several times and soil samples were collected from each boring. Soil samples have historically been non-detectable at shallow depths by laboratory reporting limits, with the exception of the samples collected in 2001 during the fuel delivery

system upgrade. Samples at approximately 3 to 5 feet bgs were collected during this investigation. Petroleum impacts that appeared in the 2001 investigation are shown on the next page in Table A. Several soil borings have been advanced since 2001 and results indicate that impacts are concentrated at 25 ft bgs and deeper. These concentrations are well below the values listed in Table 1 of the LTCP. Locations of the soil samples collected, as well as further historical data, are presented in Appendix B.

Table A: Representative Maximum Concentrations of Petroleum Components in Soil Samples - 0 to 5 feet bgs

Sample Identification and Depth	Sample Date	Benzene (mg/kg)	Ethylbenzene (mg/kg)
DP-1 @ 3.0'	6/1/2001	<0.0010	0.0010
DP-3 @ 3.5'	6/1/2001	0.11	1.2
PL-2 @ 4.5'	6/1/2001	<0.0050	<0.0050
LTCP Maximum* - 0-5/5-10 feet bgs		8.2/12	89/134

*Under a commercial/industrial exposure setting
mg/kg = milligrams per kilogram

Soil samples collected from 2001 (mentioned above) were not analyzed for naphthalene or poly-aromatic hydrocarbons (PAHs). Naphthalene has not been included in the analysis of past soil samples collected at the Site. This apparent data gap can be addressed using the published relative concentrations of naphthalene and benzene in gasoline. This approach has been used by State Water Board staff in recent Closure Orders pursuant to the Policy (e.g., SWB WQ Order 2013-0003): Gasoline mixtures contain an average of approximately 2 percent benzene and 0.25 percent naphthalene (Potter and Simmons 1998); therefore, benzene concentrations can be directly substituted for naphthalene concentrations with a safety factor of approximately 10. The maximum benzene concentrations from the Site are less than the naphthalene criteria in Table 1 of the Policy. Therefore, the estimated naphthalene concentrations at the Site meet the Policy criteria for direct contact by a factor of approximately 10. Based on the data presented herein and in Appendix B, remaining petroleum concentrations in soil appear to be within acceptable levels for closure under the LTCP.

3.5 Recommendation for Case Closure

As presented above and in the attached CSM table (Table 1), this Site appears to meet all applicable criteria for case closure under the LTCP. Over 10 years of soil and 5 years of groundwater monitoring data and effective remedial efforts have shown that petroleum hydrocarbons exhibit a stable-to-decreasing trend at the Site. Adequate Site characterization both on- and off-Site to the best extent possible, evaluation of receptors, historical descriptions, and technical analysis have been performed at the Site and in this document to support a recommendation for case closure. We hereby recommend that a determination of No Further Action be made for this Site. Upon concurrence of this recommendation from the ACEH, closure activities including well decommissioning should be carried out.

4.0 LIMITATIONS

This document has been prepared for the exclusive use of Atlantic Richfield Company. The findings presented in this report are based upon the observations of previous consultants' field personnel, points of investigation and results of laboratory tests. Services were performed in accordance with the generally accepted standard of practice at the time this report was written. No warranty, expressed or implied, is intended. It is possible that variations in the soil or ground-water conditions could exist beyond the points explored in this investigation. Also, changes in site conditions could occur at some time in the future due to variations in rainfall, temperature, regional water usage or other factors.

5.0 REFERENCES

Alameda County Environmental Health, September 9, 2013. Case File Review for Fuel Leak Case No. RO0002873 and GeoTracker Global ID T0600124081, ARCO #0498, 286 South Livermore Avenue, Livermore, CA. Letter from Mr. Jerry Wickham (ACEH) to Mr. Chuck Carmel (Atlantic Richfield Company).

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Broadbent & Associates, Inc., May 3, 2013. *Soil and Groundwater Investigation Report*, Atlantic Richfield Company Station #498, 286 South Livermore Avenue, Livermore, CA.

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California Department of Water Resources, 2003. *San Francisco Hydrologic Region Livermore Valley Groundwater Basin*. Bulletin No. 118.

California Regional Water Quality Control Board, San Francisco Bay Region, Groundwater Committee, June 1999. *East Bay Plain Groundwater Basin Beneficial Use Evaluation Report*, Alameda County and Contra Costa Counties, CA.

California Regional Water Quality Control Board, San Francisco Bay Region, November 2007 (Revised May 2008; ESL Workbook updated February 2013). Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater.

Delta, September 19, 2001. *Product Line and Dispenser Island Sampling Results*, ARCO Station No. 498, 286 South Livermore Avenue, Livermore, CA.

Potter, T.L. and K.E. Simmons, 1998. Composition of Petroleum Mixtures. TPHCWG Series, Vol. 2 Amherst Scientific Publishers, MA.

San Francisco Bay Regional Water Quality Control Board, February 2013. *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater*.

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DRAWINGS

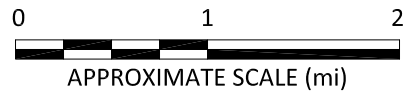
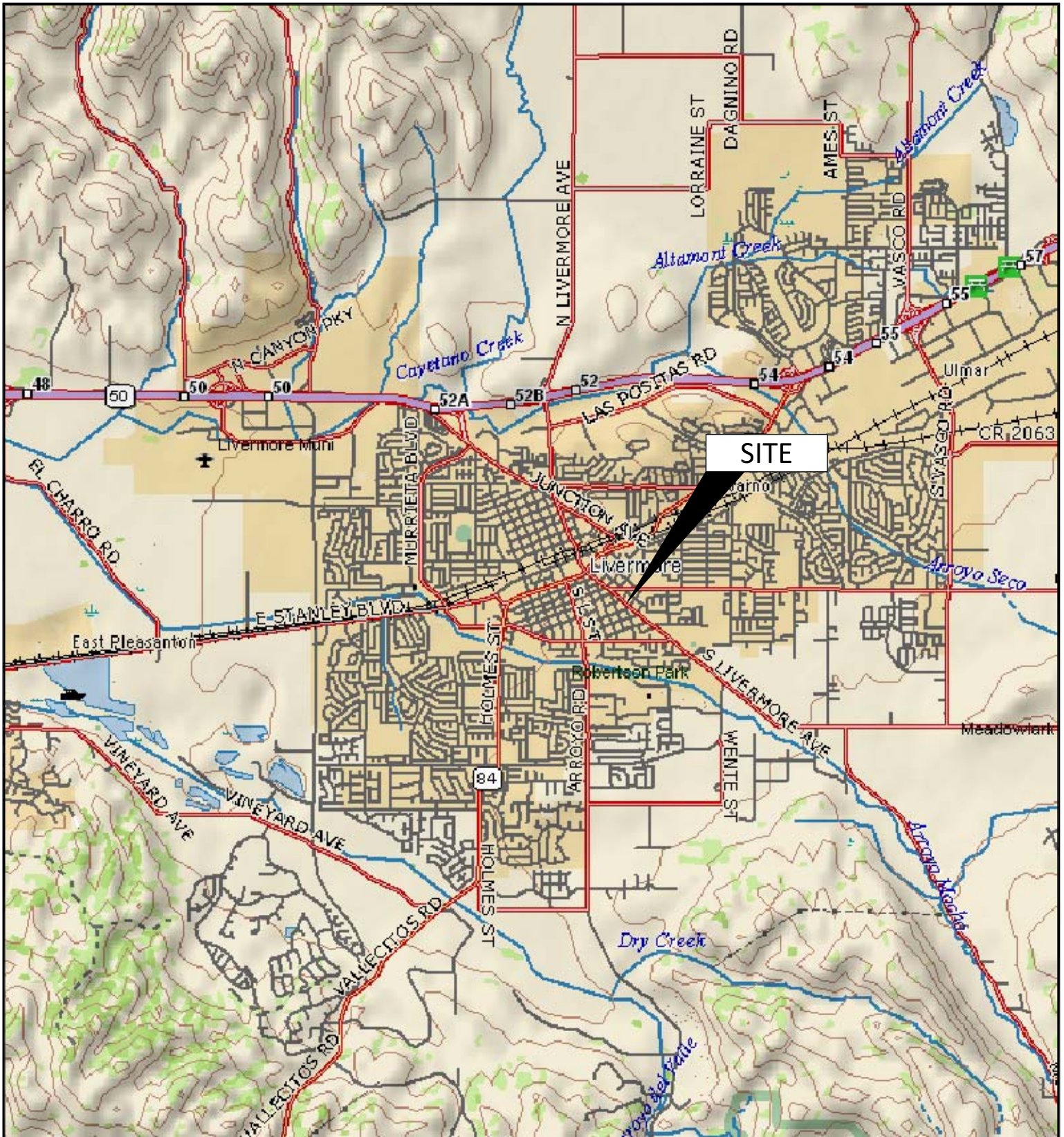


IMAGE SOURCE: DELORME



1370 Ridgewood Dr., Suite 5
Chico, California 95973

Project No.: 08-82-603 Date: 12/3/2012

Station #498
286 South Livermore Avenue
Livermore, California

Site Location Map

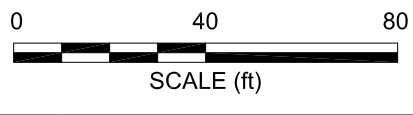
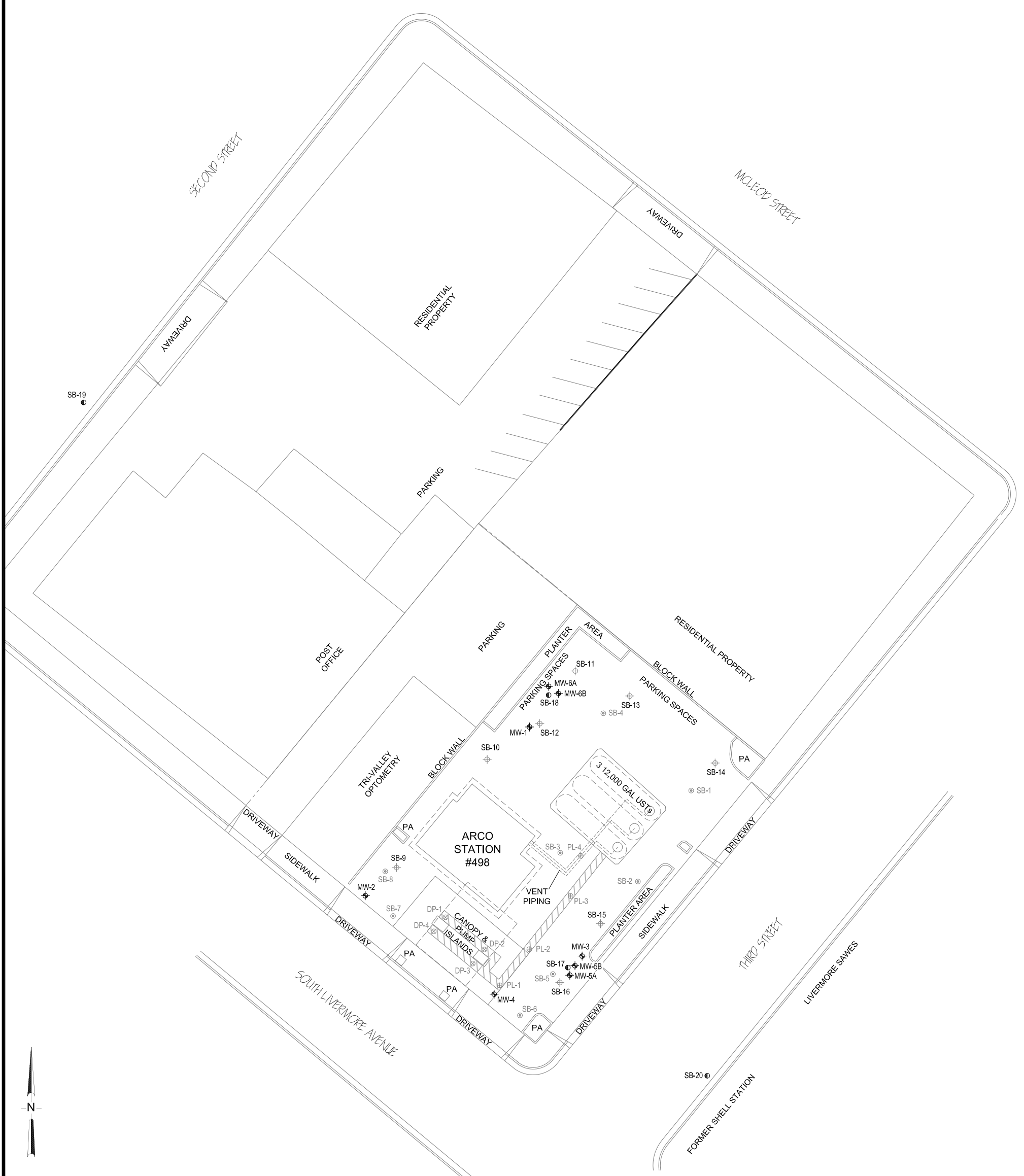
Drawing

1

LEGEND

◆	Monitor Well	●	CPT Borings (Broadbent 2014)
⊕	CPT Borings (Broadbent 2013)	<	Not detected at or above laboratory reporting limits
⊙	Soil Boring (URS 2005)	NS	Not sampled
⊕	Product Line Soil Sample (Delta 2001)	.	Not used in contour interval
⊗	Dispenser Pump Soil Sample (Delta 2001)	▭	Product Line Excavation Trench

NOTES: SITE MAP ADAPTED FROM WATSON WEST, DELTA ENVIRONMENTAL AND WOOD RODGERS FIGURES. WOOD RODGERS SURVEY COMPLETED DECEMBER 2, 2008. SITE DIMENSIONS AND FACILITY LOCATIONS NOT VERIFIED.

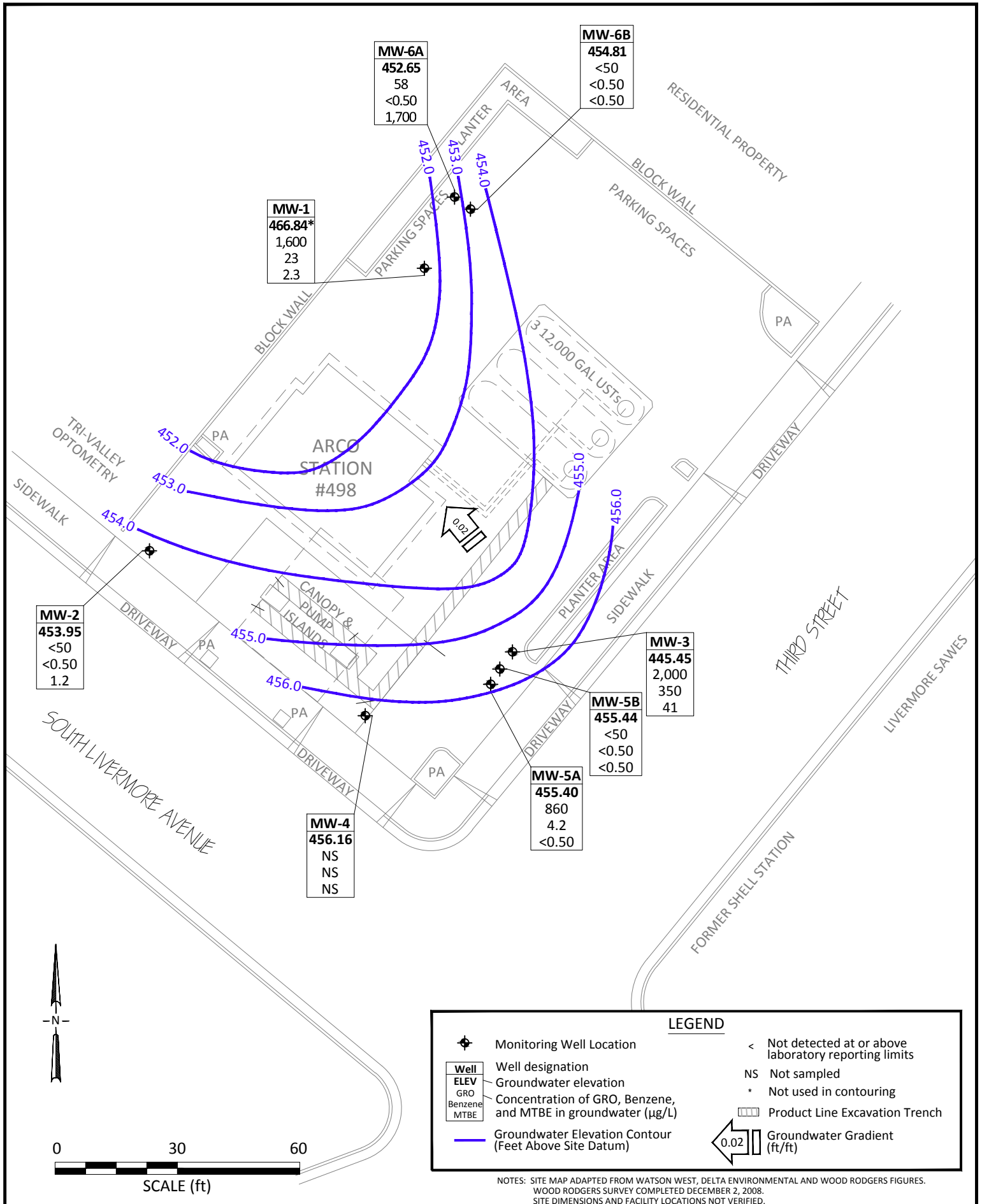


BROADBENT
1370 Ridgewood Dr., Suite 5
Chico, California 95973
Project No.: 08-82-103 Date: 7/24/2013

Station #498
286 South Livermore Avenue
Livermore, California

Site Map with Boring
and Well Locations

Drawing
2



MW-2
453.95
<50
<0.50
1.2

MW-1
466.84*
1,600
23
2.3

MW-6A
452.65
58
<0.50
1,700

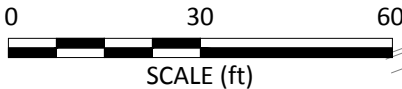
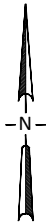
MW-6B
454.81
<50
<0.50
<0.50

MW-3
445.45
2,000
350
41

MW-5B
455.44
<50
<0.50
<0.50

MW-5A
455.40
860
4.2
<0.50

MW-4
456.16
NS
NS
NS

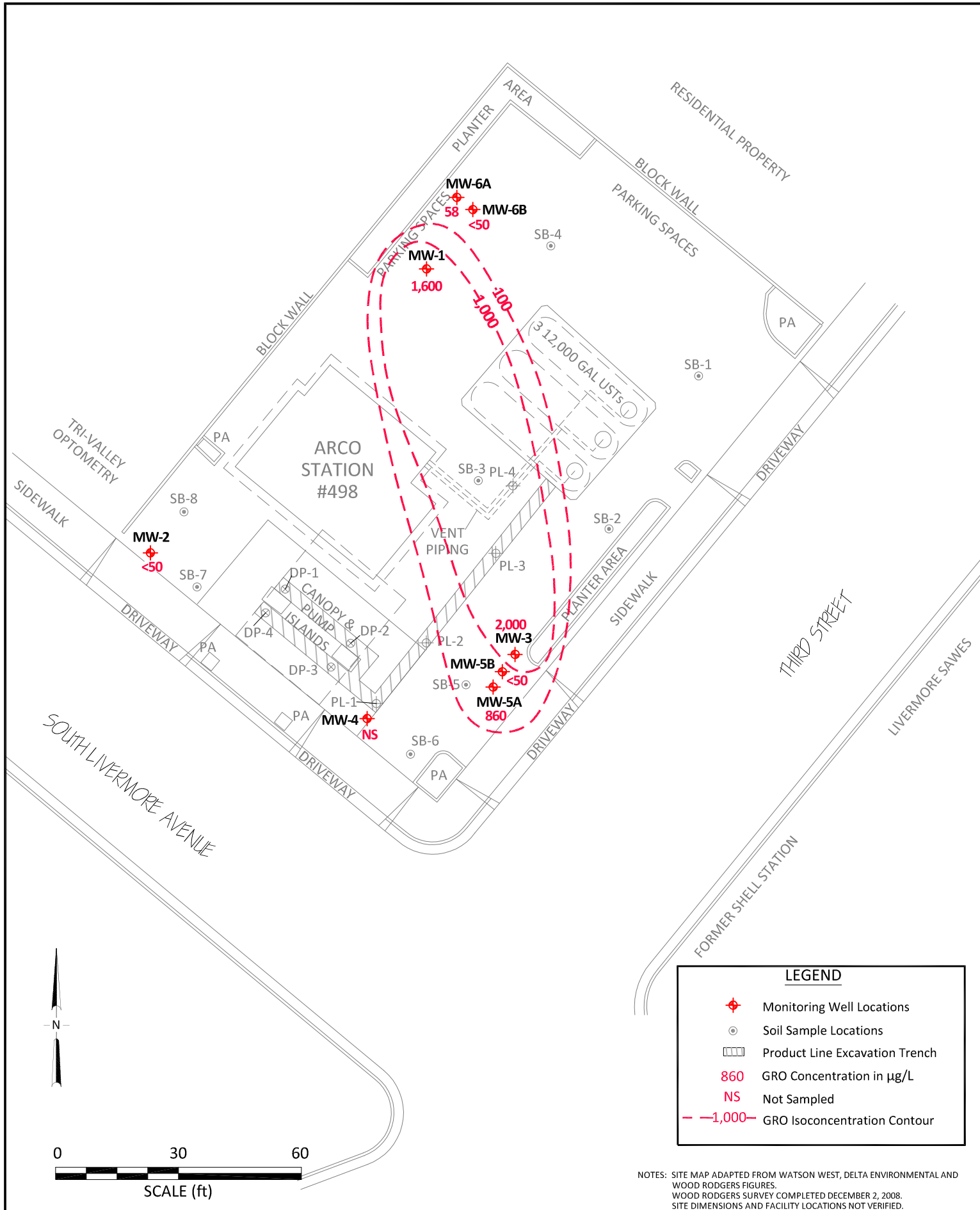


LEGEND

- Monitoring Well Location
- | |
|-------------|
| Well |
| ELEV |
| GRO |
| Benzene |
| MTBE |

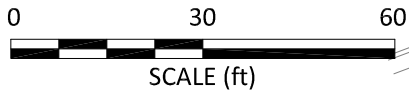
 Well designation
- Groundwater elevation
- Concentration of GRO, Benzene, and MTBE in groundwater (µg/L)
- Product Line Excavation Trench
- Groundwater Elevation Contour (Feet Above Site Datum)
- Groundwater Gradient (ft/ft)
- < Not detected at or above laboratory reporting limits
- NS Not sampled
- * Not used in contouring

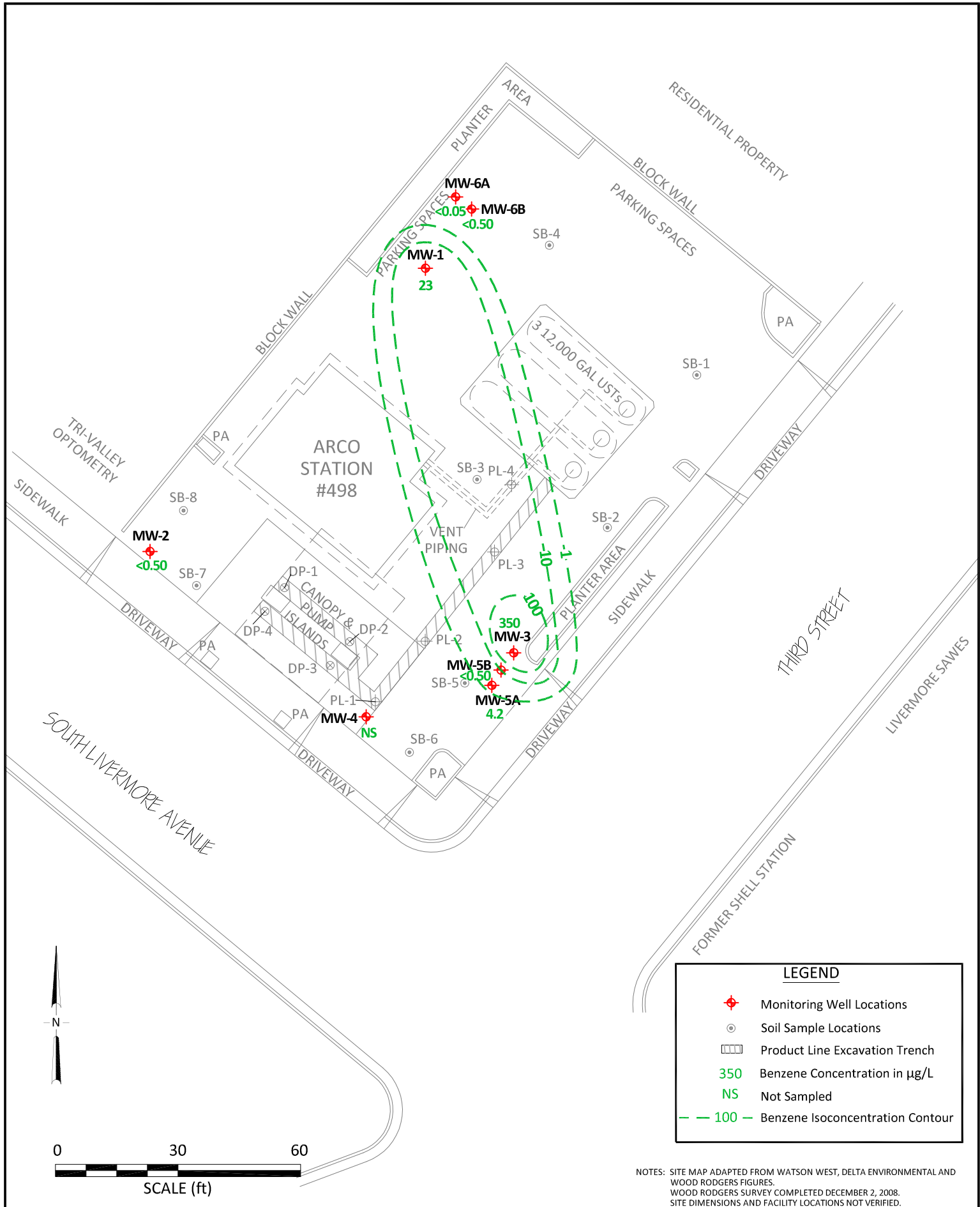
NOTES: SITE MAP ADAPTED FROM WATSON WEST, DELTA ENVIRONMENTAL AND WOOD RODGERS FIGURES. WOOD RODGERS SURVEY COMPLETED DECEMBER 2, 2008. SITE DIMENSIONS AND FACILITY LOCATIONS NOT VERIFIED.



LEGEND	
	Monitoring Well Locations
	Soil Sample Locations
	Product Line Excavation Trench
860	GRO Concentration in µg/L
NS	Not Sampled
- -1,000 - -	GRO Isoconcentration Contour

NOTES: SITE MAP ADAPTED FROM WATSON WEST, DELTA ENVIRONMENTAL AND WOOD RODGERS FIGURES. WOOD RODGERS SURVEY COMPLETED DECEMBER 2, 2008. SITE DIMENSIONS AND FACILITY LOCATIONS NOT VERIFIED.

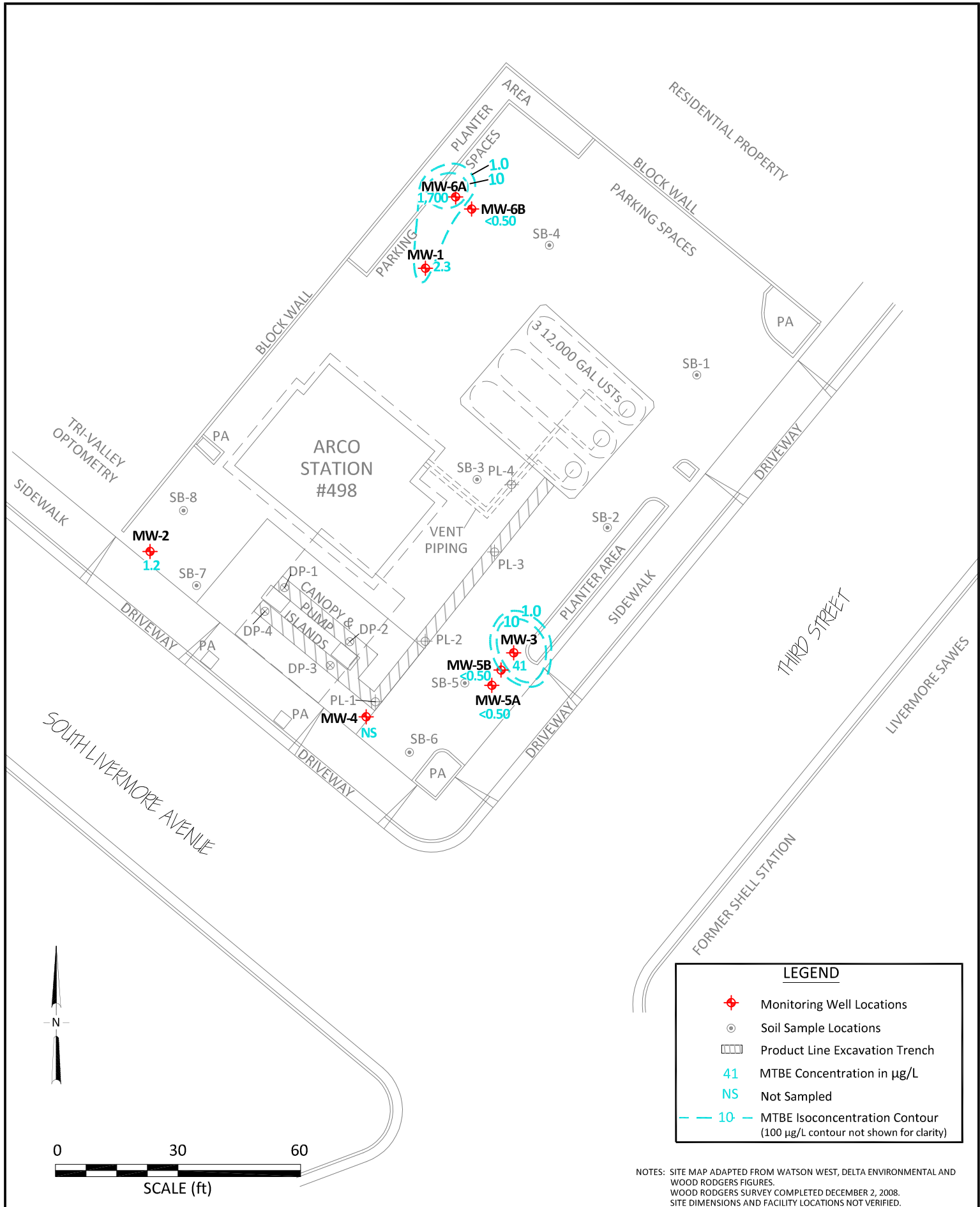




LEGEND	
	Monitoring Well Locations
	Soil Sample Locations
	Product Line Excavation Trench
350	Benzene Concentration in µg/L
NS	Not Sampled
— 100 —	Benzene Isoconcentration Contour

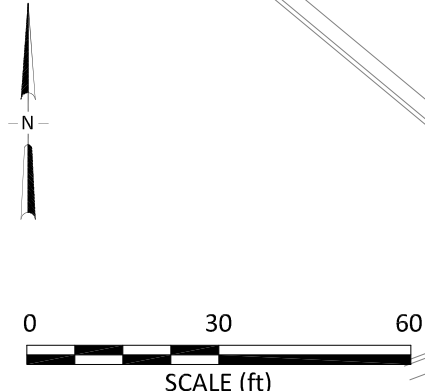
NOTES: SITE MAP ADAPTED FROM WATSON WEST, DELTA ENVIRONMENTAL AND WOOD RODGERS FIGURES. WOOD RODGERS SURVEY COMPLETED DECEMBER 2, 2008. SITE DIMENSIONS AND FACILITY LOCATIONS NOT VERIFIED.





LEGEND	
	Monitoring Well Locations
	Soil Sample Locations
	Product Line Excavation Trench
41	MTBE Concentration in µg/L
NS	Not Sampled
10	MTBE Isoconcentration Contour (100 µg/L contour not shown for clarity)

NOTES: SITE MAP ADAPTED FROM WATSON WEST, DELTA ENVIRONMENTAL AND WOOD RODGERS FIGURES.
WOOD RODGERS SURVEY COMPLETED DECEMBER 2, 2008.
SITE DIMENSIONS AND FACILITY LOCATIONS NOT VERIFIED.



TABLES

TABLE 1

CONCEPTUAL SITE MODEL

Atlantic Richfield Company Station No. 498
286 South Livermore Avenue
Livermore, California

CSM Element	CSM Sub-Element	Description	Data Gap	How to Address
Geology and Hydrogeology	Regional	<p>The Site is located within the Livermore Valley Groundwater Basin. According to the <i>California Groundwater, Bulletin 118</i>, the Livermore Valley basin, “extends from the Pleasanton Ridge east to the Altamont Hills (about 14 miles) and from the Livermore Upland north to the Orinda Upland (about 3 miles).” The valley’s principal streams include Arroyo Valle, Arroyo Mocho, and Arroyo las Positas; all converging to form Arroyo de la Laguna. These natural drainages are located approximately 1.3 miles north (Arroyo las Positas), 0.6 miles south (Arroyo Mocho), and 2.5 miles southwest (Arroyo Valle) of the Site.</p> <p>The groundwater basin is bounded by several faults; these faults act as barriers to the lateral movement of groundwater and divide the groundwater basin into several subbasins. The water-bearing materials in the Livermore basin include the Livermore Formation, the Tassahara Formation, and valley-fill.</p> <p>Natural recharge occurs primarily along the uplands and edges of the Livermore Valley groundwater basin, through the arroyos during periods of precipitation and winter flow, by underground flow, and by applied irrigation water seeping into the ground. The basin is also recharged by controlled releases from the South Bay Aqueduct along with local surface water stored at Del Valle reservoir into Arroyo Valle and Arroyo Mocho. Mine quarrying pits on the west side of the Livermore Valley are currently being used for storm water collection to assist in recharge of groundwater in the basin (Zone 7 Water Agency, 2005).</p> <p>The basins’ groundwater is a multi-layered system with an unconfined upper aquifer overlying deeper semi-confined to confined aquifers separated by clay aquitards. These clay aquitards impede the vertical movement of groundwater between the upper and deeper aquifers. Most of the water for municipal and agricultural use is pumped from the deeper aquifers. The general groundwater gradient within the basin is to the west, then south towards Arroyo de la Laguna. Groundwater near the center of Livermore Valley flows toward a cone of depression located west of the city of Livermore near gravel mining areas. The groundwater depression is thought to have been created by extraction of groundwater for municipal and agricultural use and dewatering for gravel quarrying (Zone 7 Water Agency, 2005). The extraction of groundwater has lessened over the years due to usage of water from the State Water Project.</p>	None	NA

TABLE 1**CONCEPTUAL SITE MODEL**

Atlantic Richfield Company Station No. 498
 286 South Livermore Avenue
 Livermore, California

CSM Element	CSM Sub-Element	Description	Data Gap	How to Address
Geology and Hydrogeology (Cont.)	Site	<p>The Site elevation is approximately 500 feet above mean sea level; regional topography slopes from east to west (USGS Topographic Map, Livermore Quadrangle – 7.5 Minute Series). As stated above, the regional surface and groundwater flow is generally to the west. The historical groundwater flow direction at the Site has been generally to the west-northwest (Table 3). Since 2008, the hydraulic gradient has remained consistent at 0.020 ft/ft (Table 3), only deviating to 0.010 ft/ft once during Second Quarter 2010. Historical depth to groundwater measurements have ranged from approximately 26.69 to 50.25 ft bgs (Table 1).</p> <p>In general, the soil underlying the site primarily consists of a layer of sand and silty sand that extends to approximately 34 ft bgs with two to four foot thick interbedded lenses of clay and silty clay. At approximately 34 feet bgs the geology transitions to clay and silty clay with interspersed lenses of sand and silt. A small layer of sand and/or silty sand appears to be present beneath the silt and/or clay layer between approximately 57 and 66 ft bgs. Beneath this sand/silty sand layer is another clay and/or silty clay layer extending from a depth of approximately 66 to at least 75 ft bgs, the maximum depth explored. Geologic cross-sections are provided as Drawings 4 through 6 and boring logs are presented in Appendix D.</p>	None	NA
Surface Water Bodies		The principal surface water bodies in the site vicinity are Arroyo Mocho to the southwest and Arroyo Las Positas to the north, located approximately 4,100 feet and 7,100 feet from the Site, respectively.	None	NA
Nearby Wells		In 2013, a Sensitive Receptor Survey was carried out to identify the presence of water wells within a 2,000 foot radius of the Site. The survey indicated the presence of four domestic wells, three municipal wells, and three wells of unknown use. The nearest well to the Site is a domestic well located approximately 400 feet in the upgradient direction; wells in the downgradient direction from the Site were not identified in the Sensitive Receptor Survey. Additional sensitive receptor data is provided in Appendix L.	None	NA

TABLE 1**CONCEPTUAL SITE MODEL**

Atlantic Richfield Company Station No. 498
 286 South Livermore Avenue
 Livermore, California

CSM Element	CSM Sub-Element	Description	Data Gap	How to Address
Constituents of Concern	Light-Non Aqueous Phase Liquid (LNAPL)	Measureable LNAPL has never been detected on-Site. Therefore LNAPL is not considered a constituent of concern.	None	NA
	Gasoline Range Organics	<p>Historically, concentrations of GRO have been detected in monitoring wells MW-1, MW-2, MW-3, MW-4, and MW-5A. GRO has not been detected in MW-2 and MW-4 since November 11, 2009 and October 25, 2011, respectively. The historical maximum detected concentration of GRO was recorded on December 29, 2008 in well MW-3 at 28,000 µg/L. The maximum detected concentration within the last four monitoring events was reported in well MW-3 at 3,500 µg/L, indicating a decreasing GRO trend over time. GRO has never been detected in the more recently installed MW-5B, MW-6A, nor MW-6B.</p> <p>Based on recent and historical data, the GRO plume has been defined and appears to be restricted to the central portion of the Site. The GRO plume length is less than 100 feet when measured from the UST/product piping, which is the presumed source of contamination. As a worst case scenario, if an offsite source of GRO exists and the plume length is measured from MW-3, the length appears to be approaching the 100 foot limit for closure under criteria 1.</p> <p>A GRO isoconcentration contour map for the First Quarter 2015 groundwater monitoring and sampling event is presented as Drawing 4. GRO concentration trend graphs for wells MW-1 through 4 are included as Figures 1 through 4. Decreasing trends indicate that the concentrations will continue to degrade over time.</p>	None	NA
	Benzene	Historically, concentrations of benzene have been detected in monitoring wells MW-1, MW-2, and MW-3; benzene was detected during a single monitoring event in MW-4 on March 20, 2009. Benzene was detected during a single monitoring event in MW-5A on February 2014. The historical maximum concentration of benzene was reported in well MW-3 at 960 µg/L on April 24, 2013. The maximum detected concentration within the last four monitoring events was reported in well MW-3, which is also the historical maximum detection referenced above.	None	NA

TABLE 1

CONCEPTUAL SITE MODEL

Atlantic Richfield Company Station No. 498
 286 South Livermore Avenue
 Livermore, California

CSM Element	CSM Sub-Element	Description	Data Gap	How to Address
Constituents of Concern (Cont.)	Benzene (Cont.)	<p>Benzene has never been detected in the recently installed wells MW-5B, MW-6A, and MW-6B.</p> <p>Based on recent and historical data, the benzene plume has been delineated and appears to be isolated within the central portion of the Site. A benzene isoconcentration contour map for the First Quarter 2015 groundwater monitoring and sampling event is presented as Drawing 5. Benzene concentration trend graphs for wells MW-1 through 4 are included in Figures 1 through 4; the graphs indicate a stable to decreasing trend in benzene concentrations over time.</p>		
	Methyl tert-butyl ether (MTBE)	<p>Historically, concentrations of MTBE have been detected in monitoring wells MW-1, MW-2, MW-3, and MW-4. MTBE has also been detected in the recently installed MW-5A, 5B, and 6A. The historical maximum MTBE concentration was reported in well MW-6A at a concentration of 1700 µg/L on February 10, 2015.</p> <p>Based on recent and historical data, the MTBE plume has been delineated and appears to be generally isolated onsite in two separate plumes, with the potential exception along the northwestern property boundary. Access to the offsite areas for further study has not been secured by the property owners. Also, the most recent groundwater monitoring data indicates no offsite presence of MTBE. During Broadbent's 2013 <i>Additional Soil and Groundwater Investigation</i>, SB-19 was drilled on Second Street, northwest of the Site and as close as access issues would allow. The soil and groundwater samples obtained from SB-19 were non-detect for MTBE.</p> <p>An MTBE isoconcentration contour map for the First Quarter 2015 groundwater monitoring and sampling event is presented as Drawing 6. MTBE concentration trend graphs for wells MW-1 through 4 are presented in Figures 1 through 4. The graphs indicate that MTBE concentrations have generally decreased over time and will continue to degrade in the future.</p>	None	NA

TABLE 1

CONCEPTUAL SITE MODEL

Atlantic Richfield Company Station No. 498
 286 South Livermore Avenue
 Livermore, California

CSM Element	CSM Sub-Element	Description	Data Gap	How to Address
Potential Sources	Onsite	<p>The exact release source and volume released at the Site is unknown. The minimal concentrations observed in soil sample data collected from beneath the product lines and dispensers during upgrade activities conducted in 2001 are not indicative of a release from the fuel delivery system. It is noted that since the USTs were not removed during upgrade activities, it is difficult to assess potential contamination associated with a release from the USTs. Historically, the highest concentrations observed in groundwater have been from well MW-3, which is positioned in a general upgradient location onsite and cross-gradient of the USTs. This appears to suggest the possibility of an offsite source contributing to elevated hydrocarbon concentrations onsite in the southern portion of the property.</p> <p>Regardless of the release source, current concentration trends, as depicted in the graphs presented in Figures 1 through 4, indicate decreasing contaminant concentrations over time. These trends are anticipated to continue in the future.</p>	None	NA
	Offsite	<p>A former Shell service station was located southeast of the Site, directly across Third Street. Three USTs, one waste oil tank, and associated dispensers and product piping were removed from the site in 2003. Subsequent investigations included numerous soil and groundwater sampling events.</p> <p>The case associated with this site was closed in June 2007. The Closure letter from the ACEH noted that concentrations of 540 µg/L TPHg and 3.5 µg/L MTBE remained in shallow groundwater.</p> <p>Due the relatively minimal petroleum compounds noted in soil and groundwater samples at this adjacent Shell site and the fact that the case is closed, it appears unlikely that this adjacent Shell station is an offsite source. However, based on the data collected from recently installed CPT boring SB-20 located immediately downgradient of the former Shell location, it appears that residual contamination within groundwater in the more shallow clay layer, presumably from the former Shell Station, is present in the form of GRO at a concentration of 1,400 µg/L. It is possible that his residual contamination has migrated within the shallow groundwater to Station 498.</p>	Potential, unknown offsite sources	It is unlikely that this is able to be addressed due to: limited available records and inability to access the offsite properties.

TABLE 1**CONCEPTUAL SITE MODEL**

Atlantic Richfield Company Station No. 498
 286 South Livermore Avenue
 Livermore, California

CSM Element	CSM Sub-Element	Description	Data Gap	How to Address
Potential Sources (Cont.)	Offsite (Cont.)	Additionally, the highest concentration of MTBE was observed at MW-6A, which is upgradient from the UST system. Due to the absence of any other petroleum infrastructure in the immediate area, it is possible that the MTBE impacts have migrated from an unknown area upgradient to the east. Adjacent landowners have not permitted access for additional study in the area.		
Nature and Extent of Environmental Impacts	Extent in Soil	<p>Soil contamination appears defined and limited to the Site boundaries. Based on historical data, the highest recently observed concentrations of GRO and benzene were noted in CPT boring SB-15 at concentrations of 1,500 mg/kg and 4.8 mg/kg, respectively, in 2013 at a depth of approximately 38 feet bgs. Boring SB-15 was located in the southeastern portion of the Site. However, this soil sample was collected within the saturated zone and was likely impacted by the presence of contaminated groundwater. Prior to the 2013 investigation, the highest concentration of GRO or TPHg was recorded at approximately 25 feet bgs in the boring advancing for installation of well MW-3, also located within the southeastern portion of the Site, at a concentration of 530 mg/kg in 2008. Shallow soil samples collected during product line and dispenser upgrades in 2001 indicated minimal hydrocarbon impact to shallow soils within the vicinity of the product delivery components. The highest concentrations of TPHg and benzene detected during the 2001 upgrades were observed at approximately 3.5 feet bgs in the soil sample collected from DP-3, located within the southwestern portion of the Site at concentrations of 87 mg/kg and 0.11 mg/kg, respectively. It is unclear whether over-excavation activities were conducted during product line and dispenser upgrades as the report documenting this work could not be located.</p> <p>Since the concentrations observed in soil samples collected in 2001 and 2008 were representative of overall concentrations at the time of sampling, it is likely that these concentrations have further attenuated over the last 6 to 13 years. Furthermore, aside from the deep soil sample collected from SB-15 during the 2013 onsite CPT investigation, as previously discussed, soil concentrations from the other 13 soil samples collected during this investigation were not detected above laboratory reporting limits for each constituent analyzed for. Based on current and historic data and observations, soil at the Site appears to be adequately defined.</p>	None	NA

TABLE 1**CONCEPTUAL SITE MODEL**

Atlantic Richfield Company Station No. 498
 286 South Livermore Avenue
 Livermore, California

CSM Element	CSM Sub-Element	Description	Data Gap	How to Address
Nature and Extent of Environmental Impacts (Cont.)	Extent in Shallow Groundwater	<p>Data from the more recently installed wells MW-5A, 5B, 6A, and 6B have shown a groundwater gradient that flows radially inward to the area around the UST system. The current groundwater monitoring network at the Site includes well MW-1 located downgradient from the USTs; upgradient well MW-3; crossgradient well MW-4; downgradient well MW-2, upgradient wells MW-5A and B, and downgradient wells MW-6A and B. Isoconcentration maps for the most recent event conducted in First Quarter 2015 are included as Drawings 4, 5, and 6, respectively. Based on these drawings, the extent of impact is predominantly isolated onsite. Stable to decreasing concentration trends at each well are also evident in the concentration and groundwater elevation trend graphs for GRO, benzene, and MTBE provided in Figures 1 through 4.</p> <p>Petroleum compounds appear defined in each direction. Accessibility issues were encountered at the properties immediately north of the Site. In this northern area, current relatively low concentrations exist, together with a lack of sensitive receptors to the north, and the general cross-gradient direction, additional assessment further north of the Site does not appear warranted nor feasible at this time. Additionally, it is not anticipated that the influence of petroleum compounds potentially extending beyond the Site boundaries will affect human health and trends indicate that the concentrations of the compounds will continue to degrade over time.</p>	None	NA
	Extent in Deeper Groundwater	<p>The extent of environmental impact in deeper groundwater was recently investigated at the Site during CPT activities and deeper well installations (MW-5B and MW-6B). Results from the CPT assessment indicated moderate GRO impact (880 µg/L) at SB-17 between approximately 60 and 65 feet bgs in the southern portion of the Site. Concentrations for the remaining groundwater samples collected from the deeper water-bearing zone during CPT activities were below laboratory reporting limits with the exception of a minor detection of GRO (54 µg/L) just above the laboratory reporting limit in upgradient, offsite boring SB-20. The recent groundwater samples collected from newly installed wells MW-5B and MW-6B, screened within the deeper water-bearing sand zone, resulted in detections below laboratory reporting limits for each constituent analyzed for.</p>	Potential	Additional sampling of deeper wells to establish concentration and gradient trends

TABLE 1**CONCEPTUAL SITE MODEL**

Atlantic Richfield Company Station No. 498
 286 South Livermore Avenue
 Livermore, California

CSM Element	CSM Sub-Element	Description	Data Gap	How to Address
Nature and Extent of Environmental Impacts (Cont.)	Extent in Deeper Groundwater (Cont.)	A downward vertical gradient was previously thought to exist at the Site based on results from PPDTs conducted during CPT investigation activities in 2013. However, based on the relative absences of contaminants in groundwater samples collected from deeper wells MW-5B and MW-6B compared to the shallow wells within the same vicinity and higher groundwater elevations observed in deep wells compared to their shallow well pairings (MW-5A and MW- A), this does not appear to be the case. In contrast, due to the higher elevations observed in the deeper wells, an upward vertical gradient may actually exist.		
	Extent in Soil Vapor	The extent of environmental impact in soil vapor has not been investigated at the Site. Based on current concentrations of petroleum compounds in groundwater monitoring wells at the Site and their location (an active service station), soil vapor assessment is not warranted at the Site. Additionally, the LTCP states that the exposure from current fueling operations represents a greater risk than any associated with potential groundwater or soil vapor exposure (CSWRCB, 2012).	None	NA
Migration Pathways	Potential Conduits	A potential transmissive conduit study has not been performed on Site. However, underground utilities tend to be shallow, above 10 feet bgs. Historical depth-to-groundwater measurements at the Site have averaged approximately 36 feet bgs, which is well below the anticipated depth of utilities within the area. Therefore, potential migration of contaminants along underground conduits does not pose a concern at the Site.	None	NA
Potential Receptors	Onsite	No onsite water supply wells or surface water bodies exist. The only potential onsite receptor would be onsite workers exposed to gasoline vapors. However, the exposure from current fueling operations represents a greater risk than any associated with potential groundwater or soil vapor exposure (CSWRCB, 2012).	None	NA

TABLE 1

CONCEPTUAL SITE MODEL

Atlantic Richfield Company Station No. 498
286 South Livermore Avenue
Livermore, California

CSM Element	CSM Sub-Element	Description	Data Gap	How to Address
Potential Receptors (Cont.)	Offsite	<p>The nearest potential surface water bodies appear to be two creeks, Arroyo Mocho and Arroyo Las Positas. However, both are located outside of the 2,000 foot search radius utilized during the Sensitive Receptor Survey. Arroyo Mocho is located approximately 4,100 feet to the southwest of the Site, in a general cross-gradient direction and Arroyo Las Positas is located approximately 7,100 feet to the north of the Site, in a general down-gradient direction. A Sensitive Receptor Survey was completed in 2013. Results from this survey identified four domestic wells, three municipal wells, and three wells of unknown use within a 2,000-foot search radius of the Site. The potential impact to municipal and domestic wells within the search radius is possible; however, the closest domestic well, located approximately 400 feet to the East of the Site, is cross-gradient from the predominantly West-Northwest flow direction. A well log with owner information could not be located for this well. All three of the Cal Water municipal water supply wells are located either cross-gradient or up-gradient at a minimum distance of approximately 1,390 feet from the Site. The remaining domestic wells and wells of unknown use were all located at a distance at or greater than 740 feet in either a cross-gradient or up-gradient direction of groundwater flow from the Site. Sensitive receptor data including a map depicting locations is provided in Appendix L.</p> <p>Since the plume is almost entirely limited to onsite and hydrocarbon concentrations in downgradient boring SB-19 were below laboratory reporting limits, these offsite receptors are not anticipated to be affected. Additionally, overall concentration trends for Site wells are decreasing, indicating that the plume size is shrinking. Concentration trend graphs are included in Figures 1 through 4.</p>	None	NA

TABLE 1

CONCEPTUAL SITE MODEL

Atlantic Richfield Company Station No. 498
286 South Livermore Avenue
Livermore, California

CSM Element	CSM Sub-Element	Description	Data Gap	How to Address
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Notes:

ACEH = Alameda County Environmental Health
bgs = below ground surface
BTEX = benzene, toluene, ethylbenzene, xylenes
Cambria = Cambria Environmental Technology, Inc.
CPT = Cone Penetration Test
CRA = Conestoga-Rovers & Associates
CSM = Conceptual Site Model
CSWRCB = California State Water Resources Control Board
ft = foot
ft/ft = foot per foot

LTCP = Low Threat Closure Policy
mg/kg = milligrams per kilogram
mg/m³ = milligrams per cubic meter
MTBE = Methyl tert-butyl Ether
GRO = Gasoline Range Organics
NA = Not Applicable
No. = Number
PPDT = Pore Pressure Dissipation Test
UST = Underground Storage Tank
µg/L = micrograms per liter

All report references are included in Section 9 of the preceding report

Table 2. Summary of Groundwater Monitoring Data: Relative Water Elevations and Laboratory Analyses

ARCO Service Station #498, 286 South Livermore Avenue, Livermore, CA

Well ID and Date Monitored	P/NP	TOC (feet)	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)	DTW (feet)	Product Thickness (feet)	Water Level Elevation (feet)	Concentrations in µg/L						DO (mg/L)	pH	Footnote
								GRO/TPHg	Benzene	Toluene	Ethyl-Benzene	Total Xylenes	MTBE			
MW-1																
12/29/2008	P	496.72	20.00	40.00	28.81	0.00	467.91	1,100	38	1.2	4.0	3.3	17	2.72	6.83	
3/20/2009	P		20.00	40.00	28.95	0.00	467.77	640	9.1	<0.50	4.1	<0.50	21	0.35	7.28	
6/2/2009	P		20.00	40.00	30.90	0.00	465.82	600	1.6	<0.50	<0.50	<0.50	32	0.59	7.17	
9/2/2009	P		20.00	40.00	32.00	0.00	464.72	570	<0.50	<0.50	<0.50	<0.50	5.3	1.02	7.38	
11/9/2009	P		20.00	40.00	31.82	0.00	464.90	1,000	130	12	35	39	140	1.39	7.02	
5/20/2010	P		20.00	40.00	28.94	0.00	467.78	1,000	4.4	<0.50	0.76	0.73	22	0.59	6.6	
11/2/2010	P		20.00	40.00	32.03	0.00	464.69	1,300	83	20	40	61	39	0.72	6.0	b (GRO), c
5/25/2011	P		20.00	40.00	26.69	0.00	470.03	2,900	32	3.1	20	2.9	<0.50	0.68	7.0	lw (GRO)
10/25/2011	P		20.00	40.00	30.11	0.00	466.61	1,100	20	3.7	<0.50	5.4	21	0.78	7.4	lw (GRO)
4/10/2012	P		20.00	40.00	30.35	0.00	466.37	1,300	13	2.0	7.0	7.1	5.0	0.20	6.71	lw (GRO)
10/9/2012	NP		20.00	40.00	37.61	0.00	459.11	700	<0.50	<0.50	<0.50	<1.0	3.2	2.79	7.93	
4/24/2013	P		20.00	40.00	29.48	0.00	467.24	1,600	87	12	87	15	12	1.49	7.22	
10/9/2013	P		20.00	40.00	31.26	0.00	465.46	810	12	0.90	4.3	2.6	30	4.24	7.17	
2/21/2014	P		20.00	40.00	30.67	0.00	466.05	1,300	19	3.0	30	4.2	2.5	1.23	7.22	
5/21/2014	P		20.00	40.00	32.88	0.00	463.84	710	<0.50	<0.50	<0.50	<1.0	1.0	0.61	7.63	
8/19/2014	--		20.00	40.00	39.67	0.00	457.05	--	--	--	--	--	--	--	--	d
11/20/2014	--		20.00	40.00	39.69	0.00	457.03	--	--	--	--	--	--	--	--	
2/10/2015	P		20.00	40.00	29.88	0.00	466.84	1,600	23	2.7	12	5.1	2.3	0.83	6.04	
MW-2																
12/29/2008	P	495.35	37.00	57.00	48.76	0.00	446.59	110	7.1	<0.50	<0.50	0.76	16	1.04	7.67	
3/20/2009	P		37.00	57.00	38.78	0.00	456.57	200	3.9	<1.0	<1.0	<1.0	56	0.41	7.51	
6/2/2009	P		37.00	57.00	43.98	0.00	451.37	110	5.1	<1.0	<1.0	<1.0	44	1.87	7.42	
9/2/2009	P		37.00	57.00	50.25	0.00	445.10	88	0.79	<0.50	<0.50	<0.50	12	1.55	6.91	
11/9/2009	P		37.00	57.00	43.79	0.00	451.56	58	2.0	<0.50	<0.50	<0.50	13	0.86	7.14	
5/20/2010	P		37.00	57.00	32.07	0.00	463.28	<50	<0.50	<0.50	<0.50	<0.50	27	0.61	6.8	
11/2/2010	P		37.00	57.00	39.23	0.00	456.12	<50	<0.50	<0.50	<0.50	<0.50	57	1.34	6.8	
5/25/2011	P		37.00	57.00	28.19	0.00	467.16	<50	<0.50	<0.50	<0.50	<0.50	15	3.74	7.1	
10/25/2011	P		37.00	57.00	33.33	0.00	462.02	<50	<0.50	<0.50	<0.50	<0.50	5.7	1.28	7.8	
4/10/2012	P		37.00	57.00	39.25	0.00	456.10	<50	<0.50	<0.50	<0.50	<0.50	1.1	1.04	7.13	
10/9/2012	P		37.00	57.00	41.84	0.00	453.51	<50	<0.50	<0.50	<0.50	<1.0	0.60	2.76	7.71	

Table 2. Summary of Groundwater Monitoring Data: Relative Water Elevations and Laboratory Analyses

ARCO Service Station #498, 286 South Livermore Avenue, Livermore, CA

Well ID and Date Monitored	P/NP	TOC (feet)	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)	DTW (feet)	Product Thickness (feet)	Water Level Elevation (feet)	Concentrations in µg/L						DO (mg/L)	pH	Footnote
								GRO/TPHg	Benzene	Toluene	Ethyl-Benzene	Total Xylenes	MTBE			
MW-2 Cont.																
4/24/2013	P	495.35	37.00	57.00	33.17	0.00	462.18	<50	<0.50	<0.50	<0.50	<1.0	1.1	2.51	7.53	
10/9/2013	P		37.00	57.00	35.23	0.00	460.12	<50	<0.50	<0.50	<0.50	<1.0	5.9	4.30	7.46	
2/21/2014	P		37.00	57.00	36.49	0.00	458.86	<50	<0.50	<0.50	<0.50	<1.0	3.6	8.05	7.17	
5/21/2014	P		37.00	57.00	40.87	0.00	454.48	<50	<0.50	<0.50	<0.50	<1.0	4.1	674	7.67	
8/19/2014	P		37.00	57.00	51.54	0.00	443.81	<50	<0.50	<0.50	<0.50	<1.0	0.60	7.33	8.37	
11/20/2014	--		37.00	57.00	56.79	0.00	438.56	--	--	--	--	--	--	--	--	
2/10/2015	P		37.00	57.00	41.40	0.00	453.95	<50	<0.50	<0.50	<0.50	<1.0	1.2	2.54	6.46	
MW-3																
12/29/2008	P	496.32	37.00	57.00	48.21	0.00	448.11	28,000	310	200	840	6,200	71	1.95	7.39	
3/20/2009	P		37.00	57.00	38.48	0.00	457.84	11,000	360	84	600	1,500	71	0.56	7.25	
6/2/2009	P		37.00	57.00	43.33	0.00	452.99	5,100	310	14	180	310	66	2.06	7.18	a
9/2/2009	P		37.00	57.00	49.60	0.00	446.72	25,000	380	150	930	2,900	75	1.35	6.93	
11/9/2009	P		37.00	57.00	43.25	0.00	453.07	6,900	390	27	480	680	69	0.54	6.9	
5/20/2010	P		37.00	57.00	31.56	0.00	464.76	9,400	690	<10	300	83	77	0.36	6.8	
11/2/2010	P		37.00	57.00	38.68	0.00	457.64	4,400	420	<10	110	33	70	0.59	6.8	b (GRO)
5/25/2011	P		37.00	57.00	27.56	0.00	468.76	4,500	560	<10	210	22	74	0.70	9.8	lw (GRO)
10/25/2011	P		37.00	57.00	32.77	0.00	463.55	2,700	190	<4.0	82	51	33	0.69	7.6	
4/10/2012	P		37.00	57.00	38.69	0.00	457.63	3,000	440	<4.0	69	10	46	0.28	6.57	lw (GRO)
10/9/2012	P		37.00	57.00	41.19	0.00	455.13	1,600	210	<2.0	28	7.4	33	1.23	7.39	
4/24/2013	P		37.00	57.00	32.52	0.00	463.80	3,500	960	3.6	110	6.0	89	1.15	7.21	
10/9/2013	P		37.00	57.00	34.59	0.00	461.73	<50	390	<2.5	33	<5.0	94	4.12	7.27	
2/21/2014	P		37.00	57.00	36.03	0.00	460.29	2,000	210	<2.0	27	<4.0	44	2.03	7.41	
5/21/2014	P		37.00	57.00	40.41	0.00	455.91	1,500	170	1.0	15	<2.0	29	0.50	7.52	
8/19/2014	P		37.00	57.00	51.01	0.00	445.31	2,300	160	8.9	220	70	25	0.19	6.57	
11/20/2014	--		37.00	57.00	55.24	0.00	441.08	--	--	--	--	--	--	--	--	
2/10/2015	P		37.00	57.00	40.58	0.00	455.74	2,000	350	2.1	30	11	41	0.63	6.63	
MW-4																
12/29/2008	--	496.01	20.00	40.00	--	--	--	--	--	--	--	--	--	--	--	Dry
3/20/2009	P		20.00	40.00	37.82	0.00	458.19	410	0.78	<0.50	<0.50	0.64	16	0.52	7.16	

Table 2. Summary of Groundwater Monitoring Data: Relative Water Elevations and Laboratory Analyses

ARCO Service Station #498, 286 South Livermore Avenue, Livermore, CA

Well ID and Date Monitored	P/NP	TOC (feet)	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)	DTW (feet)	Product Thickness (feet)	Water Level Elevation (feet)	Concentrations in µg/L						DO (mg/L)	pH	Footnote
								GRO/TPHg	Benzene	Toluene	Ethyl-Benzene	Total Xylenes	MTBE			
MW-4 Cont.																
6/2/2009	--	496.01	20.00	40.00	--	--	--	--	--	--	--	--	--	--	--	Dry
9/2/2009	--		20.00	40.00	--	--	--	--	--	--	--	--	--	--	--	Dry
11/9/2009	--		20.00	40.00	--	--	--	--	--	--	--	--	--	--	--	Dry
5/20/2010	P		20.00	40.00	31.29	0.00	464.72	290	<2.0	<2.0	<2.0	<2.0	10	0.82	6.6	
11/2/2010	NP		20.00	40.00	38.42	0.00	457.59	51	<2.0	<2.0	<2.0	<2.0	5.1	1.12	6.4	b (GRO), c
5/25/2011	P		20.00	40.00	27.58	0.00	468.43	94	<1.0	<1.0	<1.0	<1.0	6.2	0.86	6.9	lw (GRO)
10/25/2011	P		20.00	40.00	32.51	0.00	463.50	73	<0.50	<0.50	<0.50	<0.50	4.3	0.49	7.4	lw (GRO)
4/10/2012	--		20.00	40.00	38.47	0.00	457.54	<50	<0.50	<0.50	<0.50	<0.50	0.85	--	7.06	
10/9/2012	--		20.00	40.00	39.86	0.00	456.15	--	--	--	--	--	--	--	--	d
4/24/2013	P		20.00	40.00	32.50	0.00	463.51	<50	<0.50	<0.50	<0.50	<1.0	1.2	1.32	7.01	
10/9/2013	P		20.00	40.00	34.77	0.00	461.24	<50	<0.50	<0.50	<0.50	<1.0	<0.50	4.14	6.98	
2/21/2014	P		20.00	40.00	35.88	0.00	460.13	<50	<0.50	<0.50	<0.50	<1.0	<0.50	2.33	6.76	
5/21/2014	--		20.00	40.00	39.08	0.00	456.93	--	--	--	--	--	--	--	--	
8/19/2014	--		20.00	40.00	39.82	0.00	456.19	--	--	--	--	--	--	--	--	d
11/20/2014	--		20.00	40.00	39.84	0.00	456.17	--	--	--	--	--	--	--	--	
2/10/2015	--		20.00	40.00	39.85	0.00	456.16	--	--	--	--	--	--	--	--	d
MW-5A																
2/21/2014	P	495.98	--	--	36.17	0.00	459.81	840	3.1	<0.50	19	15	3.1	2.39	7.19	
5/21/2014	P		--	--	40.15	0.00	455.83	510	<0.50	<0.50	<0.50	<1.0	<0.50	0.51	7.46	
8/19/2014	--		--	--	49.26	0.00	446.72	--	--	--	--	--	--	--	--	d
11/20/2014	--		--	--	49.29	0.00	446.69	--	--	--	--	--	--	--	--	
2/10/2015	P		--	--	40.58	0.00	455.40	860	4.2	<0.50	0.65	<1.0	<0.50	2.29	6.68	
MW-5B																
2/21/2014	P	496.04	--	--	35.84	0.00	460.20	<50	<0.50	<0.50	<0.50	<1.0	<0.50	8.42	7.65	
5/21/2014	P		--	--	40.22	0.00	455.82	<50	<0.50	<0.50	<0.50	<1.0	0.60	1.74	7.62	
8/19/2014	P		--	--	50.85	0.00	445.19	<50	<0.50	<0.50	<0.50	<1.0	<0.50	10.86	7.03	
11/20/2014	P		--	--	56.89	0.00	439.15	<50	<0.50	<0.50	<0.50	<1.0	<0.50	4.10	7.50	
2/10/2015	P		--	--	40.60	0.00	455.44	<50	<0.50	<0.50	<0.50	<1.0	<0.50	5.40	7.05	
MW-6A																

Table 2. Summary of Groundwater Monitoring Data: Relative Water Elevations and Laboratory Analyses
ARCO Service Station #498, 286 South Livermore Avenue, Livermore, CA

Well ID and Date Monitored	P/NP	TOC (feet)	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)	DTW (feet)	Product Thickness (feet)	Water Level Elevation (feet)	Concentrations in µg/L						DO (mg/L)	pH	Footnote
								GRO/TPHg	Benzene	Toluene	Ethyl-Benzene	Total Xylenes	MTBE			
MW-6A Cont.																
2/21/2014	P	496.69	--	--	37.40	0.00	459.29	<50	<5.0	<5.0	<5.0	<10	780	9.15	7.36	
5/21/2014	P		--	--	40.65	0.00	456.04	<50	<5.0	<5.0	<5.0	<10	880	0.57	7.64	
8/19/2014	--		--	--	49.30	0.00	447.39	--	--	--	--	--	--	--	--	d
11/20/2014	--		--	--	49.41	0.00	447.28	--	--	--	--	--	--	--	--	
2/10/2015	P		--	--	44.04	0.00	452.65	58	<5.0	<5.0	<5.0	<10	1,700	0.77	6.93	
MW-6B																
2/21/2014	P	496.89	--	--	37.26	0.00	459.63	<50	<0.50	<0.50	<0.50	<1.0	<0.50	5.81	7.36	
5/21/2014	P		--	--	41.64	0.00	455.25	<50	<0.50	<0.50	<0.50	<1.0	<0.50	2.43	7.57	
8/19/2014	P		--	--	52.25	0.00	444.64	<50	<0.50	<0.50	<0.50	<1.0	<0.50	8.33	7.41	
11/20/2014	P		--	--	58.23	0.00	438.66	<50	<0.50	<0.50	<0.50	<1.0	<0.50	5.06	7.53	
2/10/2015	P		--	--	42.08	0.00	454.81	<50	<0.50	<0.50	<0.50	<1.0	<0.50	6.76	7.10	

Symbols & Abbreviations:

-- = Not sampled/analyzed/applicable/measured/ available
< = Not detected at or above specified laboratory reporting limit
DO = Dissolved oxygen
DTW = Depth to water in ft bgs
ft bgs= feet below ground surface
ft MSL= feet above mean sea level
GRO = Gasoline range organics
GWE = Groundwater elevation measured in ft MSL
mg/L = Milligrams per liter
MTBE = Methyl tert-butyl ether
NP = Not purged before sampling
P = Purged before sampling
TOC = Top of casing measured in ft MSL
µg/L = Micrograms per liter

Footnotes:

a = Sample preserved improperly
b = Quantitation of unknown hydrocarbon(s) in sample based on gasoline
c = Hydrocarbon odor
d = Insufficient water within well casing to collect sample
lw = Quantitated against gasoline

Table 3. Summary of Fuel Additives Analytical Data
ARCO Service Station #498, 286 South Livermore Avenue, Livermore, CA

Well ID and Date Monitored	Concentrations in µg/L								Footnote
	Ethanol	TBA	MTBE	DIPE	ETBE	TAME	1,2-DCA	EDB	
MW-1									
12/29/2008	<300	<10	17	<0.50	<0.50	<0.50	<0.50	<0.50	
3/20/2009	<300	25	21	<0.50	<0.50	<0.50	<0.50	<0.50	
6/2/2009	<300	28	32	<0.50	<0.50	<0.50	<0.50	<0.50	
9/2/2009	<300	17	5.3	<0.50	<0.50	<0.50	<0.50	<0.50	
11/9/2009	<300	47	140	<0.50	<0.50	3.1	<0.50	<0.50	
5/20/2010	<300	75	22	<0.50	<0.50	<0.50	<0.50	<0.50	
11/2/2010	<300	50	39	<0.50	<0.50	<0.50	<0.50	<0.50	
5/25/2011	<300	32	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
10/25/2011	<300	78	21	<0.50	<0.50	0.72	<0.50	<0.50	
4/10/2012	<300	49	5.0	<0.50	<0.50	<0.50	<0.50	<0.50	
10/9/2012	<150	47	3.2	<0.50	<0.50	<0.50	<0.50	<0.50	
4/24/2013	<150	43	12	<0.50	<0.50	<0.50	<0.50	<0.50	
10/9/2013	<150	79	30	<0.50	<0.50	0.52	<0.50	<0.50	
2/21/2014	<150	12	2.5	<0.50	<0.50	<0.50	<0.50	<0.50	
5/21/2014	<150	12	1.0	<0.50	<0.50	<0.50	<0.50	<0.50	
2/10/2015	<150	<10	2.3	<0.50	<0.50	<0.50	<0.50	<0.50	
MW-2									
12/29/2008	<300	22	16	<0.50	<0.50	<0.50	<0.50	<0.50	
3/20/2009	<600	62	56	<1.0	<1.0	<1.0	<1.0	<1.0	
6/2/2009	<600	83	44	<1.0	<1.0	<1.0	<1.0	<1.0	
9/2/2009	<300	37	12	<0.50	<0.50	<0.50	<0.50	<0.50	
11/9/2009	<300	41	13	<0.50	<0.50	<0.50	<0.50	<0.50	
5/20/2010	<300	22	27	<0.50	<0.50	<0.50	<0.50	<0.50	
11/2/2010	<300	26	57	<0.50	<0.50	<0.50	<0.50	<0.50	
5/25/2011	<300	<10	15	<0.50	<0.50	<0.50	<0.50	<0.50	
10/25/2011	<300	<10	5.7	<0.50	<0.50	<0.50	<0.50	<0.50	
4/10/2012	<300	<10	1.1	<0.50	<0.50	<0.50	<0.50	<0.50	
10/9/2012	<150	<10	0.60	<0.50	<0.50	<0.50	<0.50	<0.50	
4/24/2013	<150	<10	1.1	<0.50	<0.50	<0.50	<0.50	<0.50	
10/9/2013	<150	<10	5.9	<0.50	<0.50	<0.50	<0.50	<0.50	
2/21/2014	<150	<10	3.6	<0.50	<0.50	<0.50	<0.50	<0.50	

Table 3. Summary of Fuel Additives Analytical Data
ARCO Service Station #498, 286 South Livermore Avenue, Livermore, CA

Well ID and Date Monitored	Concentrations in µg/L								Footnote
	Ethanol	TBA	MTBE	DIPE	ETBE	TAME	1,2-DCA	EDB	
MW-2 Cont.									
5/21/2014	<150	<10	4.1	<0.50	<0.50	<0.50	<0.50	<0.50	
8/19/2014	<150	<10	0.60	<0.50	<0.50	<0.50	<0.50	<0.50	
2/10/2015	<150	<10	1.2	<0.50	<0.50	<0.50	<0.50	<0.50	
MW-3									
12/29/2008	<30,000	<1,000	71	<50	<50	<50	<50	<50	
3/20/2009	<7,500	<250	71	<12	<12	<12	<12	<12	
6/2/2009	<3,000	100	66	<5.0	<5.0	<5.0	<5.0	<5.0	
9/2/2009	<7,500	<250	75	<12	<12	<12	<12	<12	
11/9/2009	<3,000	<100	69	<5.0	<5.0	<5.0	<5.0	<5.0	
5/20/2010	<6,000	<200	77	<10	<10	<10	<10	<10	
11/2/2010	<6,000	<200	70	<10	<10	<10	<10	<10	
5/25/2011	<6000	<200	74	<10	<10	<10	<10	<10	
10/25/2011	<2,400	<80	33	<4.0	<4.0	<4.0	<4.0	<4.0	
4/10/2012	<2,400	<80	46	<4.0	<4.0	<4.0	<4.0	<4.0	
10/9/2012	<600	56	33	<2.0	<2.0	<2.0	<2.0	<2.0	
4/24/2013	<380	71	89	<1.3	<1.3	<1.3	<1.3	<1.3	
10/9/2013	<750	100	94	<2.5	<2.5	<2.5	<2.5	<2.5	
2/21/2014	<600	58	44	<2.0	<2.0	<2.0	<2.0	<2.0	
5/21/2014	<300	46	29	<1.0	<1.0	<1.0	<1.0	<1.0	
8/19/2014	<600	<40	25	<2.0	<2.0	<2.0	<2.0	<2.0	
2/10/2015	<600	66	41	<2.0	<2.0	<2.0	<2.0	<2.0	
MW-4									
3/20/2009	<300	2,000	16	<0.50	<0.50	<0.50	<0.50	<0.50	
5/20/2010	<1,200	1,000	10	<2.0	<2.0	<2.0	<2.0	<2.0	
11/2/2010	<1,200	500	5.1	<2.0	<2.0	<2.0	<2.0	<2.0	
5/25/2011	<600	230	6.2	<1.0	<1.0	<1.0	<1.0	<1.0	
10/25/2011	<300	150	4.3	<0.50	<0.50	<0.50	<0.50	<0.50	
4/10/2012	<300	<10	0.85	<0.50	<0.50	<0.50	<0.50	<0.50	
4/24/2013	<150	24	1.2	<0.50	<0.50	<0.50	<0.50	<0.50	
10/9/2013	<150	13	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	

Table 3. Summary of Fuel Additives Analytical Data
ARCO Service Station #498, 286 South Livermore Avenue, Livermore, CA

Well ID and Date Monitored	Concentrations in µg/L								Footnote
	Ethanol	TBA	MTBE	DIPE	ETBE	TAME	1,2-DCA	EDB	
MW-4 Cont.									
2/21/2014	<150	37	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
MW-5A									
2/21/2014	<150	19	3.1	<0.50	<0.50	<0.50	<0.50	<0.50	
5/21/2014	<150	<10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
2/10/2015	<150	16	<0.50	--	<0.50	<0.50	<0.50	<0.50	
MW-5B									
2/21/2014	<150	<10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
5/21/2014	<150	<10	0.60	<0.50	<0.50	<0.50	<0.50	<0.50	
8/19/2014	<150	<10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
11/20/2014	<150	<10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
2/10/2015	<150	<10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
MW-6A									
2/21/2014	<1,500	<100	780	<5.0	<5.0	<5.0	<5.0	<5.0	
5/21/2014	<1,500	130	880	<5.0	<5.0	<5.0	<5.0	<5.0	
2/10/2015	<1,500	<100	1,700	<5.0	<5.0	<5.0	<5.0	<5.0	
MW-6B									
2/21/2014	<150	<10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
5/21/2014	<150	<10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
8/19/2014	<150	<10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
11/20/2014	<150	<10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
2/10/2015	<150	21	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	

Symbols & Abbreviations:

--/-- = Not sampled/analyzed/applicable/measured/available

< = Not detected at or above specified laboratory reporting limit

1,2-DCA = 1,2-Dichloroethane

DIPE = Diisopropyl ether

EDB = 1,2-Dibromoethane

ETBE = Ethyl tert-butyl ether

MTBE = Methyl tert-butyl ether

TAME = tert-Amyl methyl ether

TBA = tert-Butyl alcohol

µg/L = Micrograms per liter

Table 4. Summary of Groundwater Gradient - Direction and Magnitude
ARCO Service Station #498, 286 South Livermore Avenue, Livermore, CA

Date Measured	Approximate Gradient Direction	Approximate Gradient Magnitude (ft/ft)
12/29/2008	NA	NA
3/20/2009	North-Northwest	0.02
6/2/2009	NA	NA
9/2/2009	NA	NA
11/9/2009	NA	NA
5/20/2010	West-Northwest	0.02
11/2/2010	West-Northwest	0.02
5/25/2011	West-Northwest	0.02
10/25/2011	West-Northwest	0.02
4/10/2012	West-Northwest	0.01
10/9/2012	West-Northwest	0.02
4/24/2013	West-Northwest	0.02
10/9/2013	West-Northwest	0.02
2/21/2014	West-Northwest	0.02
8/19/2014	West-Northwest	0.02
11/20/2014	Radially Inward	0.02
2/10/2015	Northwest	0.02

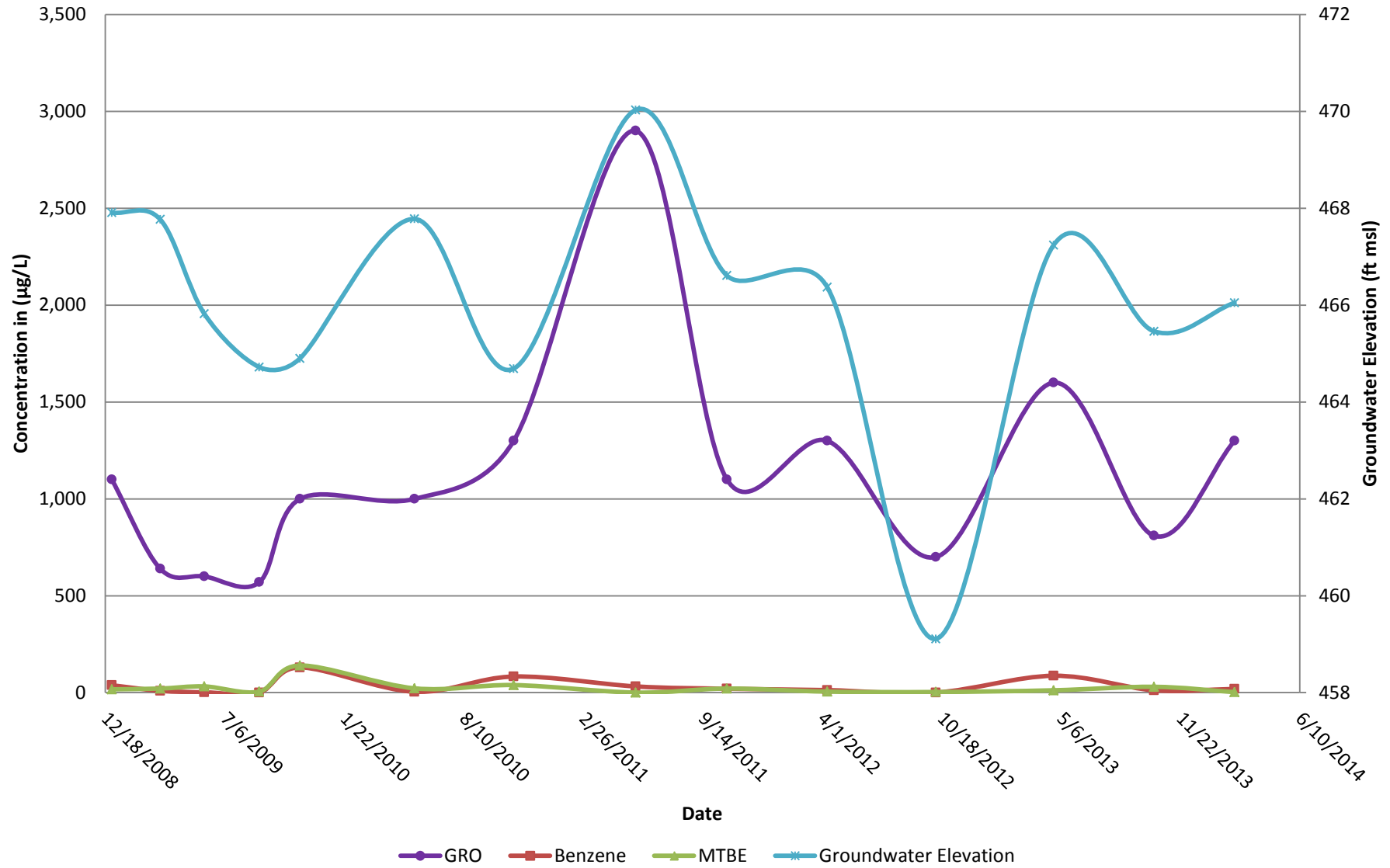
Symbols & Abbreviations:
 NA = Not Available

FIGURES

MW-1 Concentrations and Groundwater Elevations vs Time

ARCO Station #498

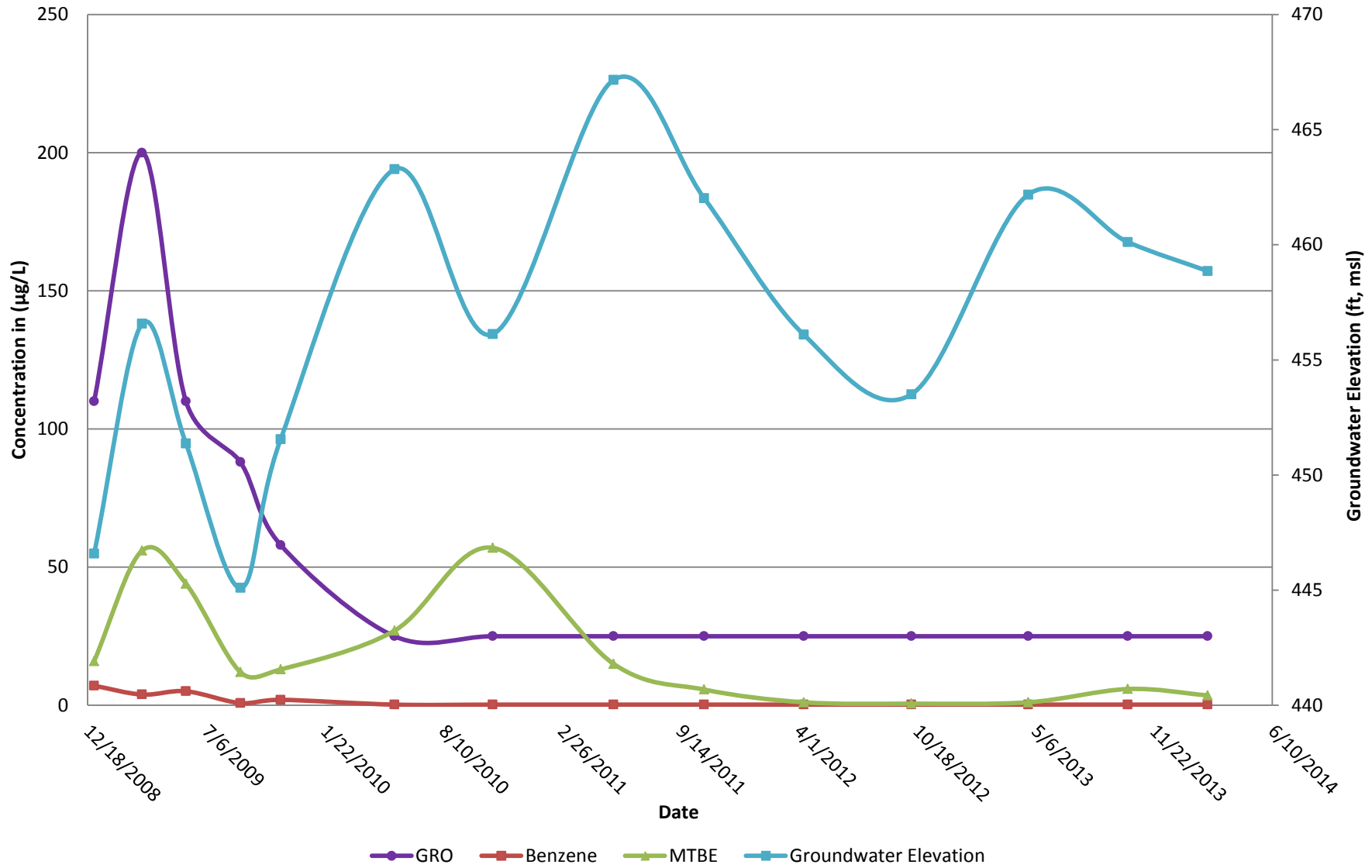
286 South Livermore Avenue, Livermore, California



MW-2 Concentrations and Groundwater Elevations vs Time

ARCO Station #498

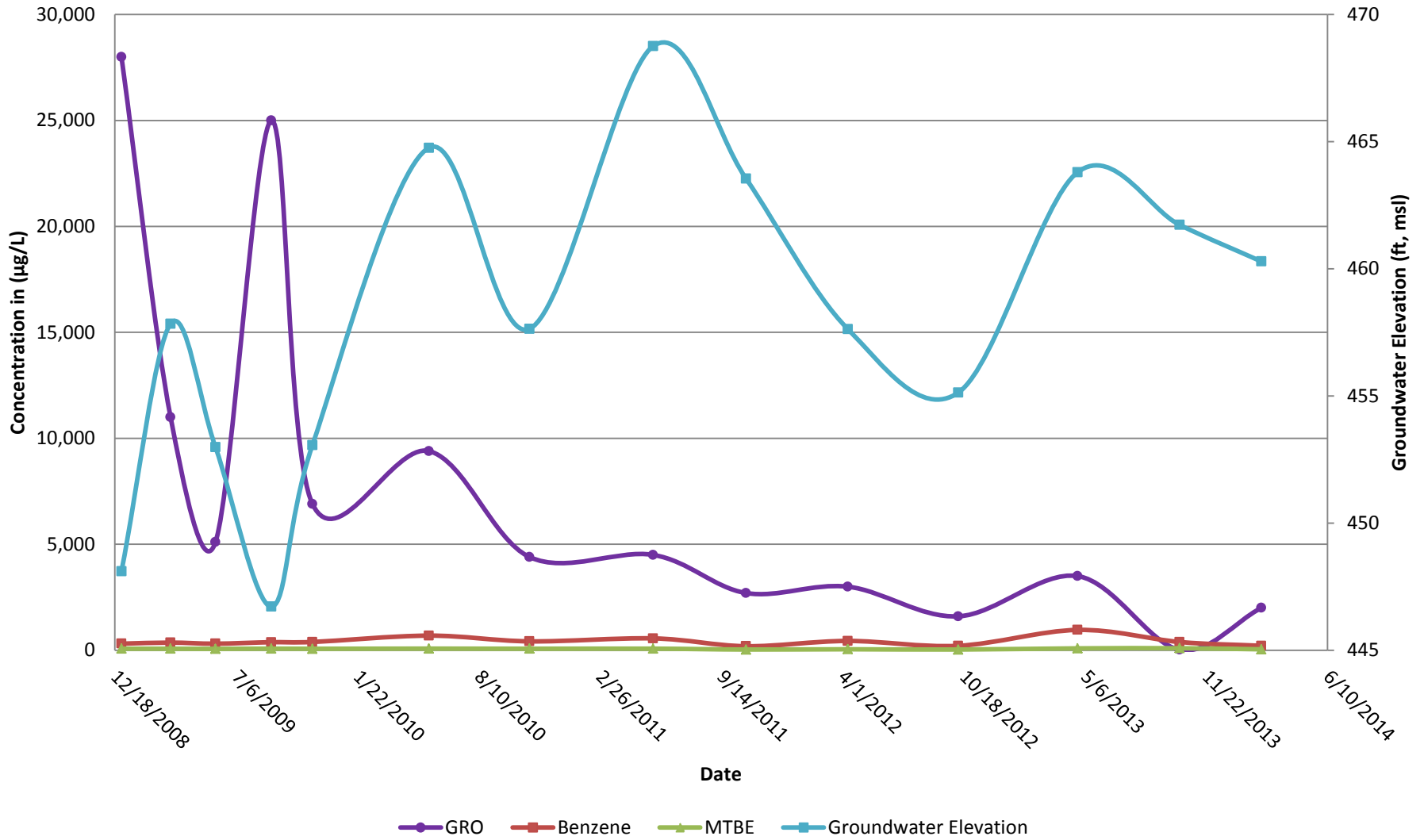
286 South Livermore Avenue, Livermore, California



MW-3 Concentrations and Groundwater Elevations vs Time

ARCO Station #498

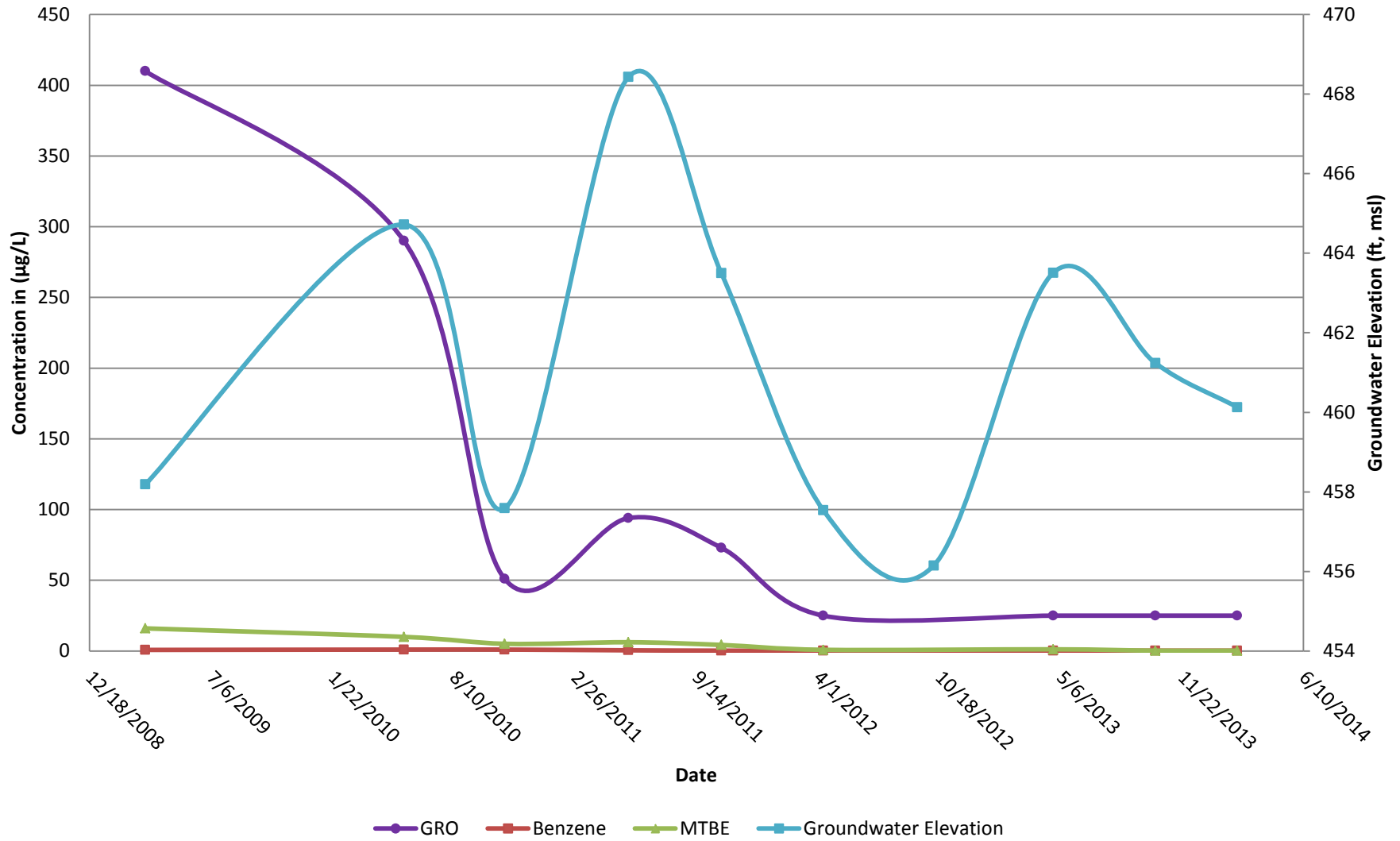
286 South Livermore Avenue, Livermore, California



MW-4 Concentrations and Groundwater Elevations vs Time

ARCO Station #498

286 South Livermore Avenue, Livermore, California



APPENDIX A

Detailed Site Background

During product line and dispenser upgrade activities completed in June 2001, Delta Environmental Consultants, Inc. (Delta) collected soil samples beneath the product lines and dispenser islands. Total purgeable hydrocarbons as gasoline (TPHg) were detected in two of the four dispenser island samples at 1.8 milligrams per kilogram (mg/kg) in sample DP-1 and 87 mg/kg in sample DP-3. Benzene, toluene, ethylbenzene, and total xylenes (BTEX), and methyl tertiary butyl ether (MTBE) were also detected in dispenser island sample DP-3. Toluene and total xylenes were detected in product line sample PL-2 at relatively low concentrations. Historic soil analytical data are provided in Appendix C. Historic soil sample locations are depicted in Drawing 2. Product line and dispenser island sampling activities are summarized in the Delta September 19, 2001 *Product Line and Dispenser Island Sampling Results* report.

In January 2005, URS completed a site assessment to fulfill a due diligence audit as part of the sale of the Property. Field activities were conducted to assess whether subsurface soils in the vicinity of the USTs and fuel dispensers had been impacted by petroleum hydrocarbons. The work was not required as part of a regulatory agency directive. Eight soil borings were advanced using a direct push Geoprobe® 6600 drill rig. URS stated in the February 15, 2005 Site Assessment Report that the proposed total depth of all borings was 30 feet below ground surface (bgs); however, due to difficult drilling conditions encountered, the borings were only advanced to depths ranging from 15 to 25 feet bgs. Groundwater was not encountered in the borings advanced. MTBE and tert-butyl alcohol (TBA) were detected in four of the collected soil samples (SB-1-22', SB-1-24', SB-3-25', and SB-8-25') at maximum concentrations of 0.022 mg/kg (SB-8-25') and 0.031 mg/kg (SB-1-22'), respectively. Historic soil analytical data are provided in Appendix B and sample locations are depicted on Drawing 2.

In November 2008, a soil and groundwater investigation was completed, which included the installation of monitor wells MW-1 through MW-4. Field activities were conducted to further define the vertical and lateral extent of impacted soil and complete an initial groundwater investigation. Soil sample analytical results showed the presence of petroleum hydrocarbon impacted soil at all four sample locations (MW-1 through MW-4) at depths ranging from 15 to 35 feet bgs. Historic soil analytical data are provided in Appendix B. Elevated groundwater concentrations were detected in well MW-3 and moderately elevated concentrations were detected in wells MW-1 and MW-2. Well MW-4 was found to be dry. The February 6, 2009 Soil and Ground-Water Investigation and Fourth Quarter, 2008 Quarterly Monitoring Report recommended that two additional quarters (First and Second Quarter, 2009) of groundwater monitoring/sampling be completed to better understand the hydrogeology before additional investigative work activities were proposed.

Broadbent prepared the *Soil and Groundwater Investigation Work Plan* on August 28, 2009, which proposed installation of three additional groundwater monitoring wells (MW-5, MW-6, and MW-7). The purpose of locating proposed well MW-5 adjacent to MW-1 was to determine if anomalous water levels observed in MW-1 were potentially due to a localized perched water-bearing zone. Proposed wells MW-6 and MW-7 were located off-Site and to the northwest of the station in order to further delineate the down-gradient extent of groundwater contamination. In a letter dated February 10, 2010, ACEH requested a Work Plan Addendum to address concerns regarding the proposed locations of wells MW-6 and MW-7, which may not have adequately characterized the extent of impacted groundwater due to the calculated groundwater flow direction on November 9, 2009, which was south-southwest instead of northwest as was calculated on March 20, 2009. On April 12, 2010, Broadbent submitted the *Soil and Groundwater Investigation Work Plan Addendum*,

which stated that the locations of MW-6 and MW-7 were based on the flow directions calculated at the Shell Station located across 3rd Street and data collected from the Site during the First Quarter 2009 groundwater monitoring event. In a letter dated August 12, 2010, ACEH approved the proposed scope of work.

Numerous attempts to obtain off-Site property access in order to complete the installation of off-Site wells have been made. However, off-Site property owners have been unresponsive and/or uncooperative in allowing access, which delayed commencement of the proposed scope of work. On August 29, 2012, ACEH, Atlantic Richfield Company, and Broadbent met to discuss the possibility of advancing borings along the northwestern property boundary in lieu of the off-Site borings. In a letter dated September 18, 2012, ACEH accepted advancing borings along the northwestern property boundary to define the site stratigraphy and vertical and lateral distribution of contamination and requested submittal of a Work Plan by November 30, 2012. ACEH also recommended use of Cone Penetration Testing (CPT) drilling procedures to adequately characterize subsurface hydro-geologic features. The *Soil and Groundwater Investigation Work Plan* dated December 7, 2012 detailed proposed CPT drilling activities and was approved by ACEH in their letter dated December 24, 2012. Details and results from the boring installations performed between March 18 and 22, 2013 were provided to ACEH in the *Soil and Groundwater Investigation Report* dated May 3, 2013. Boring locations are depicted on Drawing 2. Soil and groundwater analytical data from this investigation are provided in Appendix C.

Quarterly groundwater monitoring and sampling has been conducted on wells MW-1, MW-2, MW-3, and MW-4 at the Site since November 2008. The monitoring and sampling schedule was modified to be conducted semi-annually during the second and fourth quarters of each calendar year in June 2009. Groundwater flow direction on-Site has consistently been to the West-Northwest historically, with an average gradient of approximately 0.02. Historic groundwater monitoring and analytical data are provided in Tables 3 through 5.

APPENDIX B

Historical Soil and Groundwater Data

TABLE 1

SOIL SAMPLE LABORATORY ANALYTICAL RESULTS

ARCO Service Station No. 498
286 South Livermore Avenue
Livermore, California

Sample ID	Date	Depth (ft)	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl- benzene (mg/kg)	Total Xylenes (mg/kg)	TPH as gasoline (mg/kg)	MTBE (mg/kg)	Total Lead (mg/kg)
<u>Dispenser Island Samples</u>									
DP-1	06/01/01	3.0	<0.0050	<0.0050	<0.0050	0.019	1.8	<0.050	23
DP-2	06/01/01	3.5	<0.0050	<0.0050	<0.0050	<0.0050	<1.0	<0.050	3.7
DP-3	06/01/01	3.5	0.11	2.8	1.2	8.9	87	3.7	17
DP-4	06/01/01	3.5	<0.0050	<0.0050	<0.0050	<0.0050	<1.0	<0.050	4.2
<u>Product Line Samples</u>									
PL-1	06/01/01	3.8	<0.0050	<0.0050	<0.0050	<0.0050	<1.0	<0.050	2.3
PL-2	06/01/01	4.5	<0.0050	0.011	<0.0050	0.010	<1.0	<0.050	13
PL-3	06/01/01	5.0	<0.0050	<0.0050	<0.0050	<0.0050	<1.0	<0.050	5.4
PL-4	06/01/01	2.5	<0.0050	<0.0050	<0.0050	<0.0050	<1.0	<0.050	190
<u>Soil Stockpile Results</u>									
SP-1,2,3,4	06/01/01	Composite	<0.0050	<0.0050	<0.0050	0.13	5.6	<0.050	32

TPH = Total purgeable hydrocarbons.

MTBE = Methyl tertiary butyl ether (analyzed by DHS LUFT Methods)

NA = Not Analyzed

Table 1 - Soil Analytical Data
ARCO Service Station #0498
286 South Livermore Avenue, Livermore California

Sample Name	Sample Depth (ft)	Date Sampled	TPH-GRO (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)
SB-1-7'	7.0	01/20/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-1-12'	12.0	01/20/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-1-17'	17.0	01/20/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-1-22'	22.0	01/20/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-1-24'	24.0	01/20/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-2-10'	10.0	01/19/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-2-15'	15.0	01/19/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-2-18.5'	18.5	01/19/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-3-10'	10.0	01/19/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-3-15'	15.0	01/19/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-3-20'	20.0	01/19/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-3-25'	25.0	01/19/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-4-7'	7.0	01/19/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-4-12'	12.0	01/19/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-4-17'	17.0	01/19/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-4-22'	22.0	01/19/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-5-10'	10.0	01/20/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-5-15'	15.0	01/20/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-6-10'	10.0	01/20/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-6-15'	15.0	01/20/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-6-22'	22.0	01/20/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-7-10'	10.0	01/20/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-7-14.5'	14.5	01/20/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-7-20'	20.0	01/20/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-8-10'	10.0	01/20/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-8-15'	15.0	01/20/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-8-20'	20.0	01/20/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-8-25'	25	01/20/05	ND <1.0	ND <0.005	ND <0.005	ND <0.005	ND <0.005

Notes:

- ND = Not Detected at or above the laboratory reporting limit
- mg/kg = milligrams per kilogram
- TPH-GRO = Total Petroleum Hydrocarbons gasoline range organics
- BTEX = Benzene, toluene, ethylbenzene, and xylenes

Table 2 Soil Analytical Data-Oxygenates
ARCO Service Station #0498
286 South Livermore Avenue, Livermore California

Sample Name	Sample Depth (ft)	Date Sampled	Ethanol (mg/kg)	TBA (mg/kg)	MTBE (mg/kg)	DIPE (mg/kg)	ETBE (mg/kg)	TAME (mg/kg)	1,2-DCA (mg/kg)	EDB (mg/kg)
SB-1-7'	7.0	01/20/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-1-12'	12.0	01/20/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-1-17'	17.0	01/20/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-1-22'	22.0	01/20/05	ND <0.1	0.031	0.015	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-1-24'	24.0	01/20/05	ND <0.1	0.025	0.006	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-2-10'	10.0	01/19/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-2-15'	15.0	01/19/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-2-18.5'	18.5	01/19/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-3-10'	10.0	01/19/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-3-15'	15.0	01/19/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-3-20'	20.0	01/19/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-3-25'	25.0	01/19/05	ND <0.1	0.021	0.011	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-4-7'	7.0	01/19/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-4-12'	12.0	01/19/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-4-17'	17.0	01/19/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-4-22'	22.0	01/19/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-5-10'	10.0	01/20/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-5-15'	15.0	01/20/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-6-10'	10.0	01/20/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-6-15'	15.0	01/20/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-6-22'	22.0	01/20/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-7-10'	10.0	01/20/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-7-14.5'	14.5	01/20/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-7-20'	20.0	01/20/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-8-10'	10.0	01/20/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-8-15'	15.0	01/20/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-8-20'	20.0	01/20/05	ND <0.1	ND <0.01	ND <0.005	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005
SB-8-25'	25	01/20/05	ND <0.1	0.012	0.022	ND <0.01	ND <0.005	ND <0.005	ND <0.005	ND <0.005

Notes:

- ND = Not Detected at or above the laboratory reporting limit
- mg/kg = milligrams per kilogram
- TBA = Tert-butyl alcohol
- MTBE = Methyl tertiary butyl ether
- DIPE = Di-isopropyl ether
- ETBE = Ethyl tertiary butyl ether
- TAME = Tert-amyl methyl ether
- 1,2-DCA = 1,2-Dichloroethane
- EDB = 1,2-Dibromoethane

Table 1. Summary of Soil Sample Analytical Data
Station #498, 286 South Livermore Avenue, Livermore, CA

Boring and Sample Date	Sample ID	Concentrations in (mg/kg)								Comments
		GRO/TPHg	Benzene	Toluene	Ethyl-Benzene	Total Xylenes	MTBE	Ethanol	TBA	
MW-1										
11/24/2008	MW-1 25'	45	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.10	<0.010	
11/24/2008	MW-1 30'	0.86	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.10	<0.010	
11/24/2008	MW-1 40'	<0.50	<0.0010	<0.0010	<0.0010	<0.0010	0.16	0.23	0.036	
MW-2										
11/24/2008	MW-2 40'	<0.50	<0.0010	<0.0010	<0.0010	<0.0010	0.010	<0.10	0.022	
11/24/2008	MW-2 45'	18	<0.0010	<0.0010	<0.0010	<0.0010	0.0019	0.44	0.022	
11/24/2008	MW-2 50'	<0.50	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.10	<0.010	
MW-3										
11/26/2008	MW-3 15'	6.7	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.10	0.14	
11/26/2008	MW-3 20'	210	<0.0010	<0.0010	0.88	<0.0010	<0.0010	<0.10	<0.010	
11/26/2008	MW-3 25'	530	<0.10	<0.10	1.5	0.17	<0.10	<10	<1.0	
11/26/2008	MW-3 30'	0.84	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.10	<0.010	
11/26/2008	MW-3 35'	<0.50	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.10	0.028	
11/26/2008	MW-3 40'	<0.50	<0.0010	<0.0010	<0.0010	<0.0010	0.013	<0.10	0.014	
MW-4										
11/25/2008	MW-4 30'	2.0	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.35	0.054	
11/25/2008	MW-4 35'	75	<0.0010	<0.0010	<0.0010	<0.0010	0.0030	<0.10	0.65	
11/25/2008	MW-4 40'	<0.50	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.10	0.14	

SYMBOLS AND ABBREVIATIONS:

< = Not detected at or above specified laboratory reporting limit

GRO = Gasoline range organics

MTBE = Methyl tert-butyl ether

TBA = Tert-Butyl Alcohol

mg/kg = Milligrams per Kilogram

NOTES:

1,2-dibromoethane (EDB), 1,2-dichloroethane (1,2 DCA), Di-isopropyl ether (DIPE), ethyl tert-butyl ether (ETBE) and ter-amyl methyl ether (TAME) were not detected at or above their respective laboratory reporting limits.

GRO (C6-C12) analyzed using EPA method 8015B.

Benzene, toluene, ethylbenzene, total xylenes, MTBE, ethanol and TBA analyzed using EPA method 8260B.

The number after space in Sample ID denotes the depth at which the sample was collected in feet bls.

**Table 1. Summary of Soil Sample Analytical Data
Station #498, 286 South Livermore Avenue, Livermore, California**

Soil Boring Identification*	Sample ID	Date Collected	GRO mg/kg	Benzene mg/kg	Toluene mg/kg	Ethylbenzene mg/kg	Xylenes mg/kg	MTBE mg/kg	Comments
SB-9	SB-9-20'	3/22/2013	<0.380	<0.0020	<0.0020	<0.0020	<0.0040	<0.0049	
	SB-9-37'	3/22/2013	<0.390	<0.0020	<0.0020	<0.0020	<0.0040	<0.0049	
SB-10	SB-10-15'	3/18/2013	<0.400	<0.0020	<0.0020	<0.0020	<0.0040	<0.0049	
SB-11	SB-11-15'	3/20/2013	<0.390	<0.0020	<0.0020	<0.0020	<0.0040	<0.0049	
SB-12	SB-12-15'	3/20/2013	<0.400	<0.0020	<0.0020	<0.0020	<0.0040	<0.0050	
	SB-12-30'	3/20/2013	<0.350	<0.0020	<0.0020	<0.0020	<0.0040	<0.0050	
SB-13	SB-13-14'	3/21/2013	<0.390	<0.0020	<0.0020	<0.0020	<0.0040	<0.0050	
	SB-13-27'	3/21/2013	<0.370	<0.0020	<0.0020	<0.0020	<0.0040	<0.0050	
SB-14	SB-14-18'	3/22/2013	<0.38	<0.0020	<0.0020	<0.0020	<0.0040	<0.0050	
	SB-14-37'	3/22/2013	<0.38	<0.0020	<0.0020	<0.0020	<0.0039	<0.0049	
SB-15	SB-15-24'	3/21/2013	<0.38	<0.0020	<0.0020	<0.0020	<0.0040	<0.0050	
	SB-15-38'	3/21/2013	1,500	4.8	53	35	230	<2.5	
SB-16	SB-16-13'	3/21/2013	<0.40	<0.0020	<0.0020	<0.0020	<0.0040	<0.0049	
	SB-16-26'	3/21/2013	<0.36	<0.0020	<0.0020	<0.0020	<0.0040	<0.0050	
ESLs	--	--	83	0.044	2.9	2.9	2.3	0.023	

Abbreviations & Symbols:

Bolded concentrations exceed their respective ESL.

* = See Drawing 2 for soil boring locations.

GRO: Gasoline range organics.

TestAmerica: GRO (C6-C12)

GRO analyzed using EPA method 8015B

Benzene, Toluene, Ethylbenzene, Total Xylenes, and MTBE analyzed using EPA method 8260B.

mg/kg = Milligrams per kilogram.

ESLs = Environmental Screening Levels for deep soil (>3 meters bgs) where groundwater is a current or potential source of drinking water (San Francisco Bay Regional Water Quality Control Board, 2013).

bgs = Below ground surface

Notes:

1,2-dibromoethane (EDB), 1,2-dichloroethane (1,2 DCA), tert-butyl alcohol (TBA), Di-isopropyl ether (DIPE), ethyl tert-butyl ether (ETBE), ter-amyl methyl ether (TAME), and ethanol were not detected at or above their respective laboratory reporting limit.

The last number in each Sample ID denotes the depth at which the sample was collected in feet bgs (i.e., SB-9-20' was collected at a depth of 20 feet bgs)

**Table 2. Summary of Groundwater Sample Analytical Data
Station #498, 286 South Livermore Avenue, Livermore, California**

Sample ID*	Sample Depth (ft. bgs)	Date Collected	GRO µg/L	Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Xylenes µg/L	MTBE µg/L	TBA µg/L	TAME µg/L	Comments
SB-9	55-60	3/22/2013	<50	<0.50	<0.50	<0.50	<1.0	1.9	<10	<0.50	
SB-10	45-50	3/18/2013	<50	<2.0	<2.0	<2.0	<4.0	520	67	<2.0	
SB-11	45-50	3/20/2013	73	<5.0	<5.0	<5.0	<10	1,700	570	7.5	
SB-12	45-50	3/20/2013	<50	<1.0	<1.0	<1.0	<2.0	570	21	4	
SB-13	51-56	3/21/2013	<50	<0.50	<0.50	<0.50	<1.0	100	<10	<0.50	
SB-14	55-60	3/22/2013	<50	<0.50	<0.50	<0.50	<1.0	<0.50	<10	<0.50	
SB-15	50-55	3/21/2013	6,300	4.7	8.2	110	52	<1.0	<20	<1.0	
SB-16	55-60	3/21/2013	26,000	180	360	1,500	9,300	<25	<500	<25	
ESLs	--	--	100	1.0	40	30	20	5.0	12	--	

Abbreviations & Symbols:

Bolded concentrations exceed their respective ESL.

* = See Drawing 2 for soil boring locations.

-- = Not applicable or available

GRO: Gasoline range organics.

TestAmerica.: GRO (C6-C12)

GRO analyzed using EPA method 8015B

TBA = Tert-butyl alcohol

TAME = Tert-amyl methyl ether

Benzene, Toluene, Ethylbenzene, Total Xylenes, MTBE, TBA and TAME analyzed using EPA method 8260B.

µg/L = Micrograms per liter.

ESLs = Environmental Screening Levels where groundwater is a current or potential source of drinking water (San Francisco Bay Regional Water Quality Control Board, 2013).

bgs = Below ground surface

Notes:

1,2-dibromoethane (EDB), 1,2-dichloroethane (1,2 DCA), Di-isopropyl ether (DIPE), ethyl tert-butyl ether (ETBE), and ethanol were not detected at or above their respective laboratory reporting limit.

Table 3. Summary of Pore Pressure Dissipation Tests and Corresponding Piezometric Surface Station #498, 286 South Livermore Avenue, Livermore, California

CPT Boring ID	Test Depth (ft bgs)	u_0 (psi)	u_0 (ft H ₂ O)	Piezometric Surface (ft bgs)
SB-9	32.80	Not Applicable - Readings did not reach equilibrium		
SB-9	45.11	Negative readings indicative of dry soil conditions		
SB-9	52.00	Negative readings indicative of dry soil conditions		
SB-9	57.07	Negative readings indicative of dry soil conditions		
SB-10	29.50	Negative readings indicative of dry soil conditions		
SB-10	39.50	Not Applicable - Test terminated early		
SB-10	42.98	3.46	7.99	34.99
SB-10	49.21	Not Applicable - Readings did not reach equilibrium		
SB-10	57.74	6.62	15.29	42.45
SB-11	25.09	Negative readings indicative of dry soil conditions		
SB-11	36.42	Negative readings indicative of dry soil conditions		
SB-11	45.11	13.19	30.47	14.64
SB-11	55.28	18.02	41.63	13.65
SB-12	15.09	Negative readings indicative of dry soil conditions		
SB-12	20.01	Negative readings indicative of dry soil conditions		
SB-12	25.26	Negative readings indicative of dry soil conditions		
SB-12	30.02	Negative readings indicative of dry soil conditions		
SB-12	35.10	Negative readings indicative of dry soil conditions		
SB-12	40.19	9.04	20.88	19.31
SB-12	45.60	7.31	16.89	28.71
SB-12	57.07	11.11	25.66	31.41
SB-13	40.03	15.60	36.04	3.99
SB-13	55.12	14.22	32.85	22.27
SB-14	40.02	6.97	16.10	23.92
SB-14	56.27	10.77	24.88	31.39
SB-15	40.35	8.00	18.48	21.87
SB-15	58.07	11.11	25.66	32.41
SB-16	35.10	2.82	6.51	28.59
SB-16	55.12	6.62	15.29	39.83
SB-16	57.91	6.62	15.29	42.62

Abbreviations and Notes:

ft = feet

bgs = below ground surface

psi = pounds per square inch

H₂O = Water

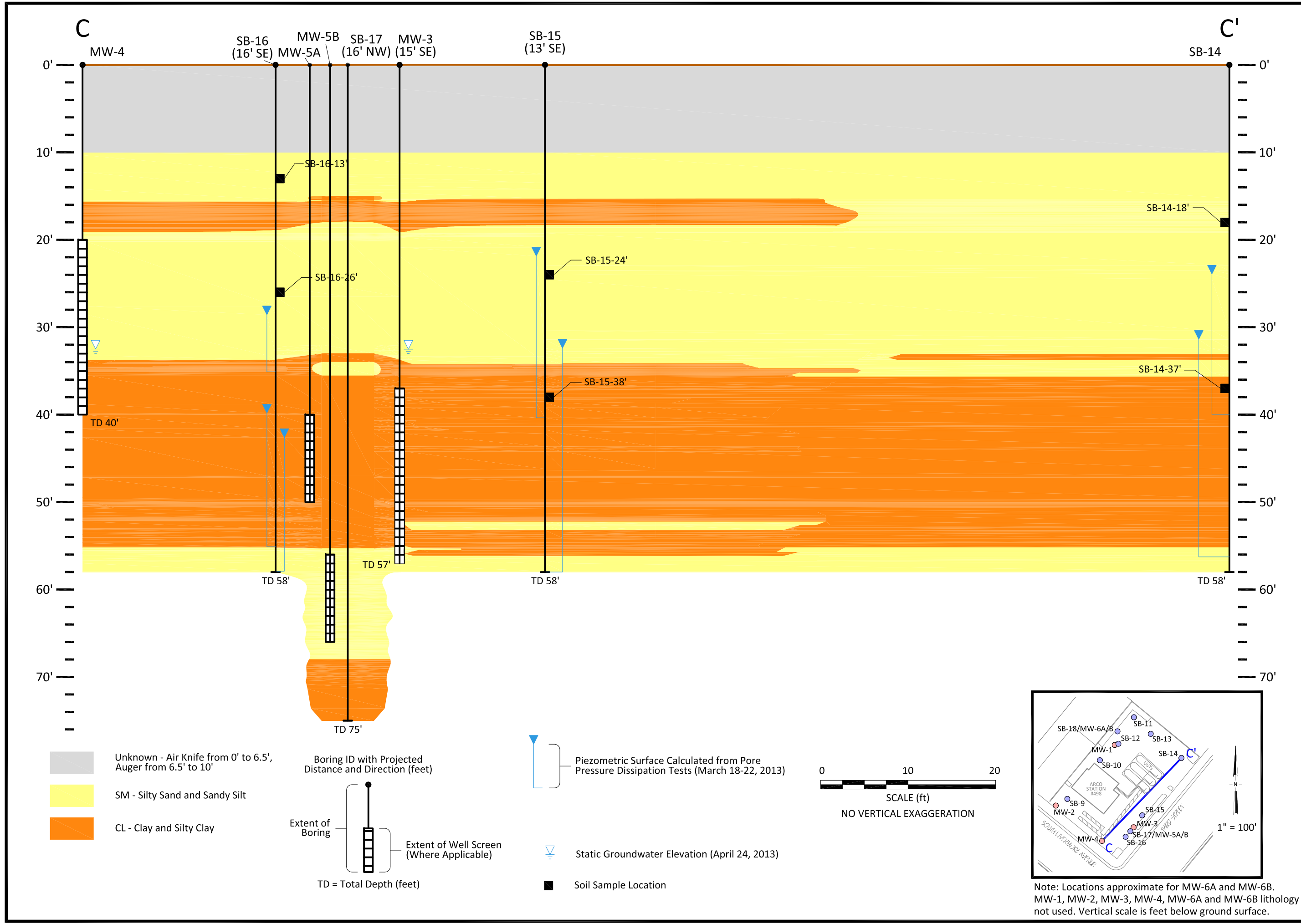
u_0 = Equilibrium pore pressure at end of dissipation test

Conversion: 1 psi = 2.31 ft H₂O

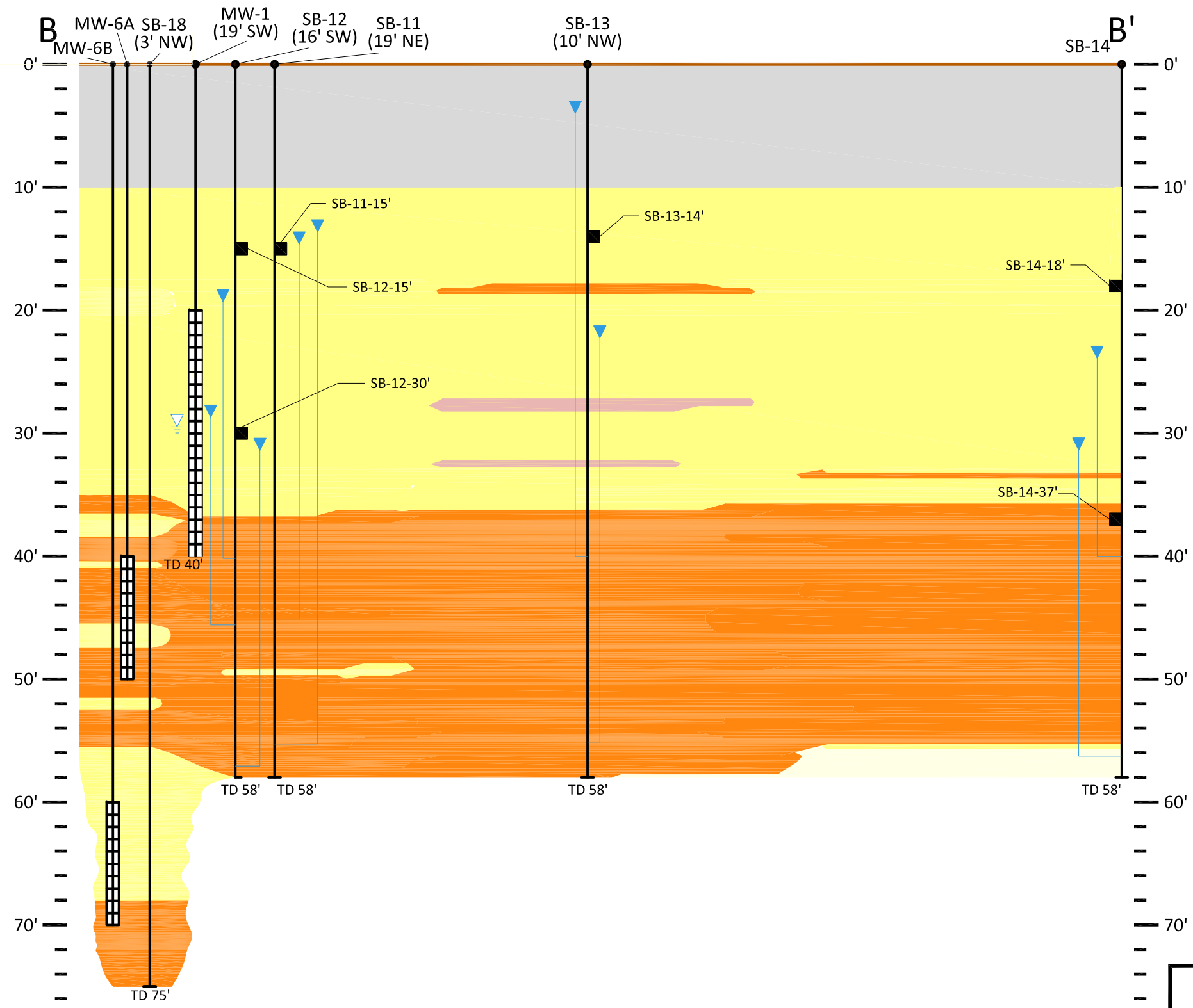
Piezometric Surface (ft bgs) = Test Depth (ft bgs) – u_0 (feet H₂O)

APPENDIX C

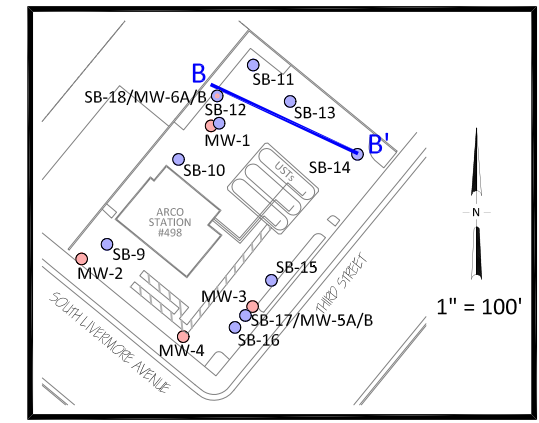
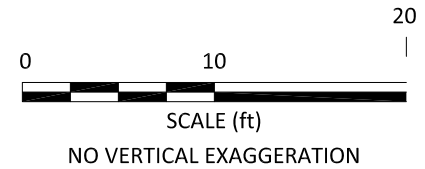
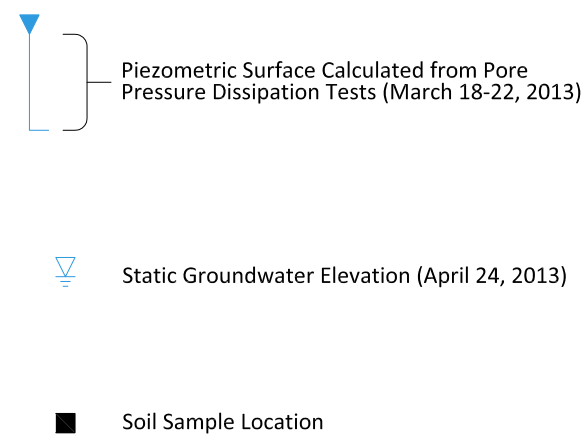
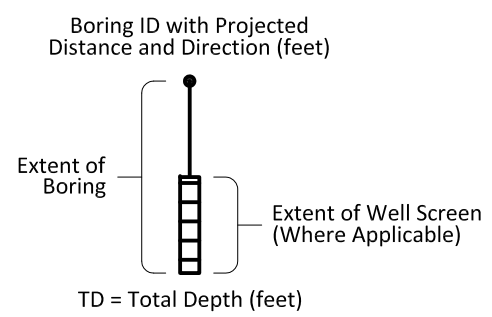
Historical Soil Boring / Monitoring Well Logs and Geologic Cross-Sections



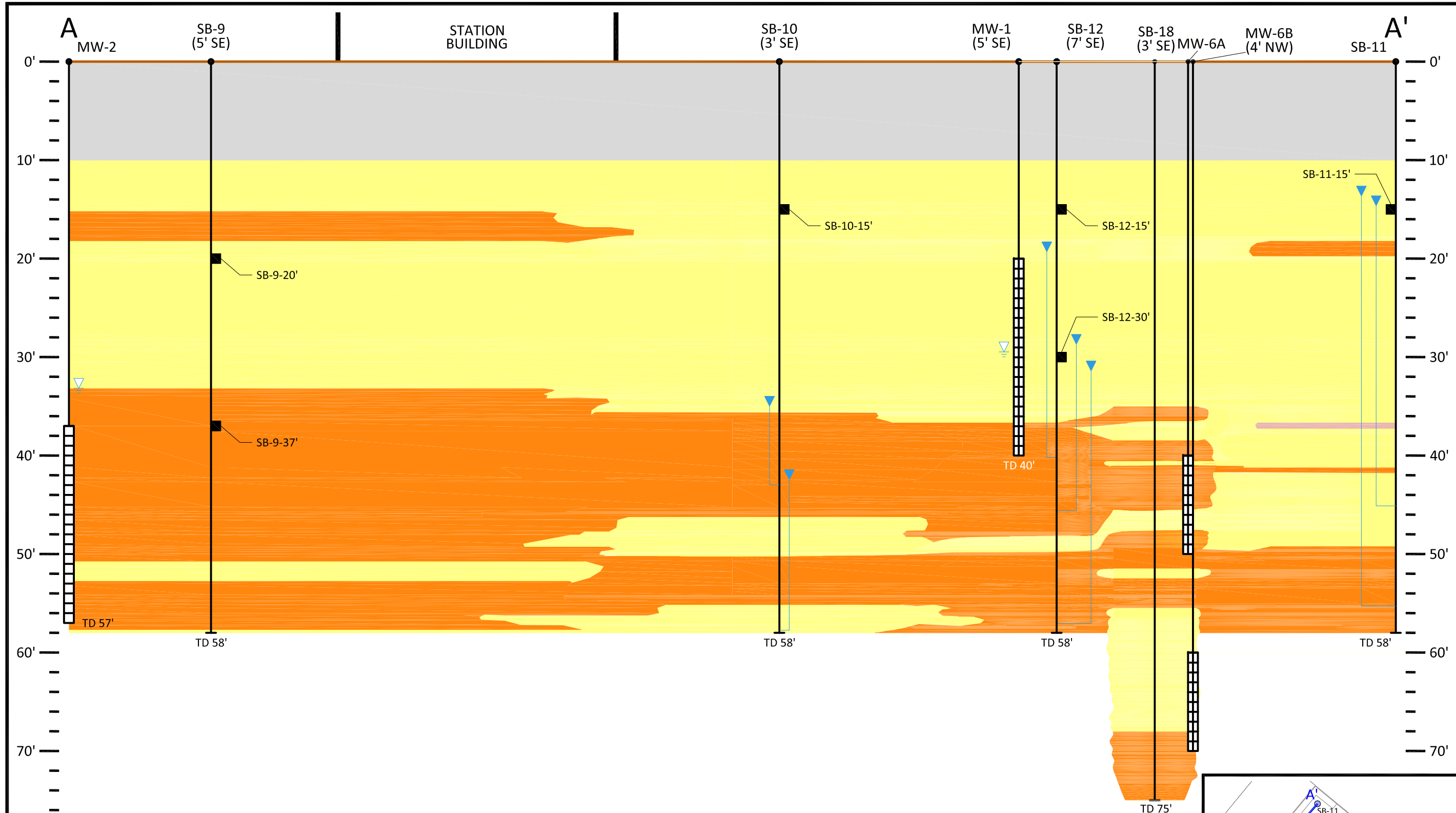
Note: Locations approximate for MW-6A and MW-6B. MW-1, MW-2, MW-3, MW-4, MW-6A and MW-6B lithology not used. Vertical scale is feet below ground surface.



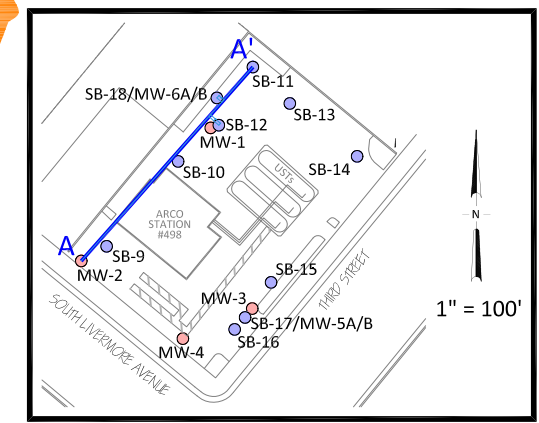
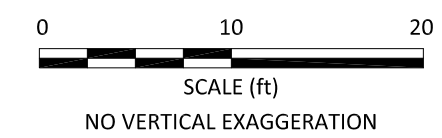
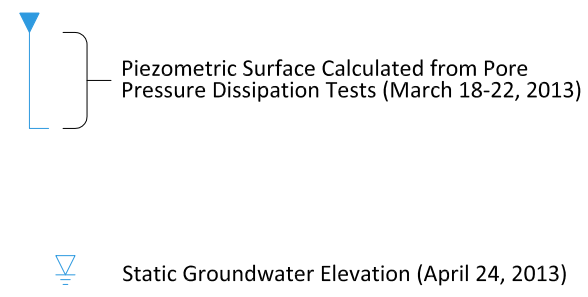
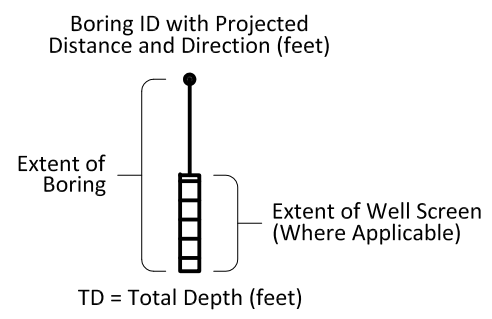
- Unknown - Air Knife from 0' to 6.5', Auger from 6.5' to 10'
- SW - Sand
- SM - Silty Sand and Sandy Silt
- CL - Clay and Silty Clay



Note: Locations approximate for MW-6A and MW-6B. MW-1, MW-2, MW-3, MW-4, MW-6A and MW-6B lithology not used. Vertical scale is feet below ground surface.



- Unknown - Air Knife from 0' to 6.5', Auger from 6.5' to 10'
- SW - Sand
- SM - Silty Sand and Sandy Silt
- CL - Clay and Silty Clay



Note: MW-1, MW-2, MW-3, MW-4, MW-6A and MW-6B lithology not used. Vertical scale is feet below ground surface.

■ Soil Sample Location

MONITOR WELL DIAGRAM



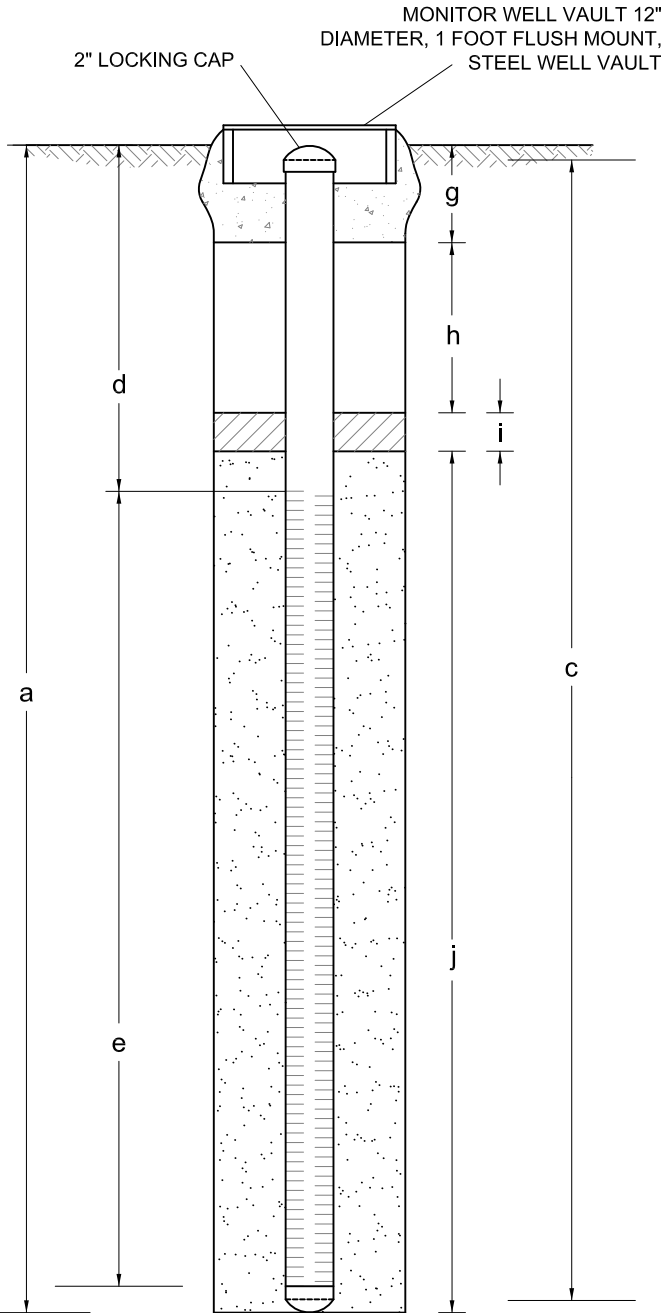
Project Number: 08-82-103

Project Name: BP 498

Location: 286 S Livermore Ave, Livermore, CA

Date(s): 01/13/2014 - 01/14/2014

Boring / Well No.: MW-6B



EXPLORATORY BORING

a. Total Depth: 70 ft.

b. Diameter: 8 in.

Drilling Method: Hollow Stem Auger

WELL CONSTRUCTION

Drilling Contractor: Gregg Drilling

c. Total Casing Length: 70 ft.

Material: Schedule 40 PVC

Diameter: 2 inches

d. Depth to Top Perforations: 60 ft.

e. Perforated Length: 10 ft.

Perforated Interval From: 60 ft. to 70 ft.

Perforation Type: Factory Slotted

Perforation Size: 0.010"

g. Surface Seal: 0 to 0.5 ft.

Surface Seal Material: Concrete

h. Backfill Length: 54.5 ft

Backfill Material: Neat Cement

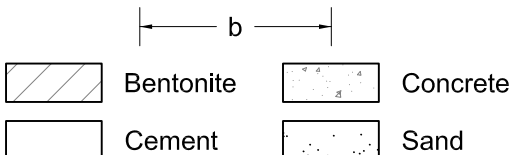
i. Seal Length: 4 ft.

Seal Material: Bentonite

j. Filter Pack Length: 11 ft.

Filter Pack Material: #2/12 Sand

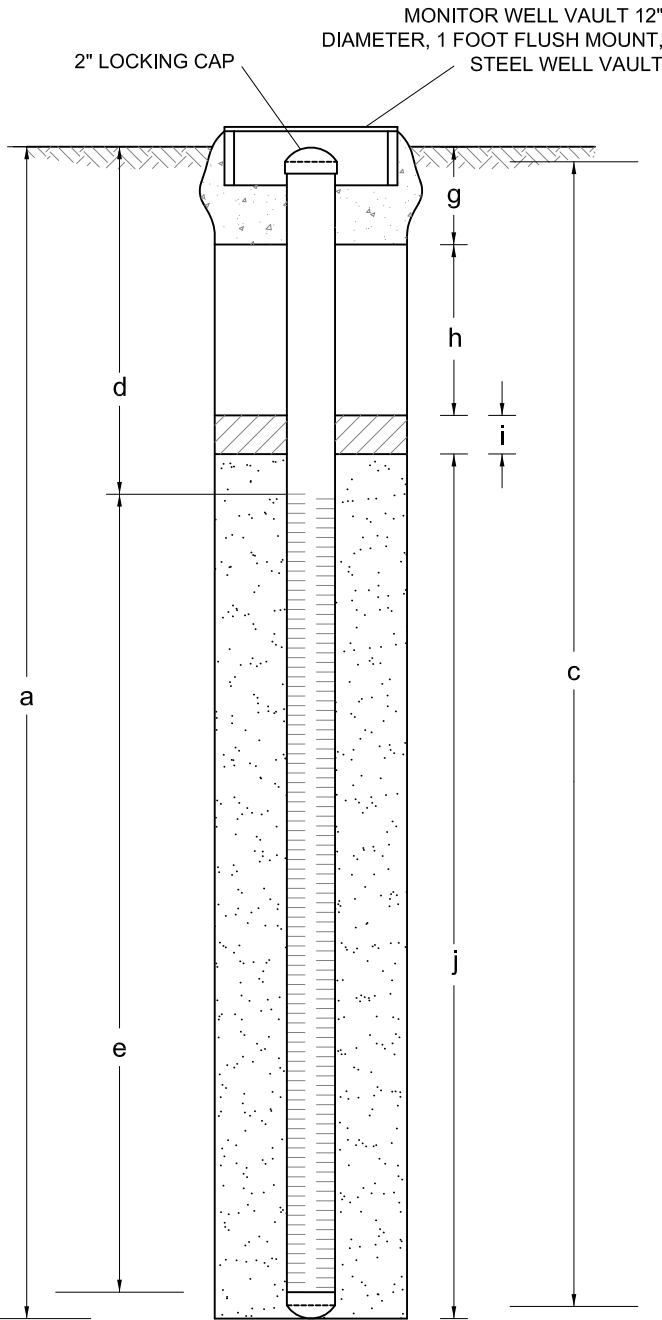
NOTES



MONITOR WELL DIAGRAM



Project Number: 08-82-103
 Project Name: BP 498
 Location: 286 S Livermore Ave, Livermore, CA
 Date: 01/15/2014
 Boring / Well No.: MW-6A



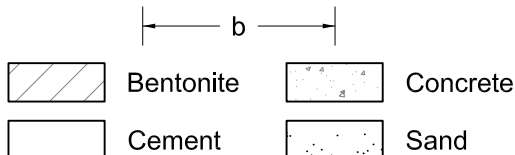
EXPLORATORY BORING

a. Total Depth: 50 ft.
 b. Diameter: 8 in.
 Drilling Method: Hollow Stem Auger

WELL CONSTRUCTION

Drilling Contractor: Gregg Drilling
 c. Total Casing Length: 50 ft.
 Material: Schedule 40 PVC
 Diameter: 2 inches
 d. Depth to Top Perforations: 40 ft.
 e. Perforated Length: 10 ft.
 Perforated Interval From: 40 ft. to 50 ft.
 Perforation Type: Factory Slotted
 Perforation Size: 0.010"
 g. Surface Seal: 0 to 0.5 ft.
 Surface Seal Material: Concrete
 h. Backfill Length: 34.5 ft
 Backfill Material: Neat Cement
 i. Seal Length: 4 ft.
 Seal Material: Bentonite
 j. Filter Pack Length: 11 ft.
 Filter Pack Material: #2/12 Sand

NOTES



MONITOR WELL DIAGRAM



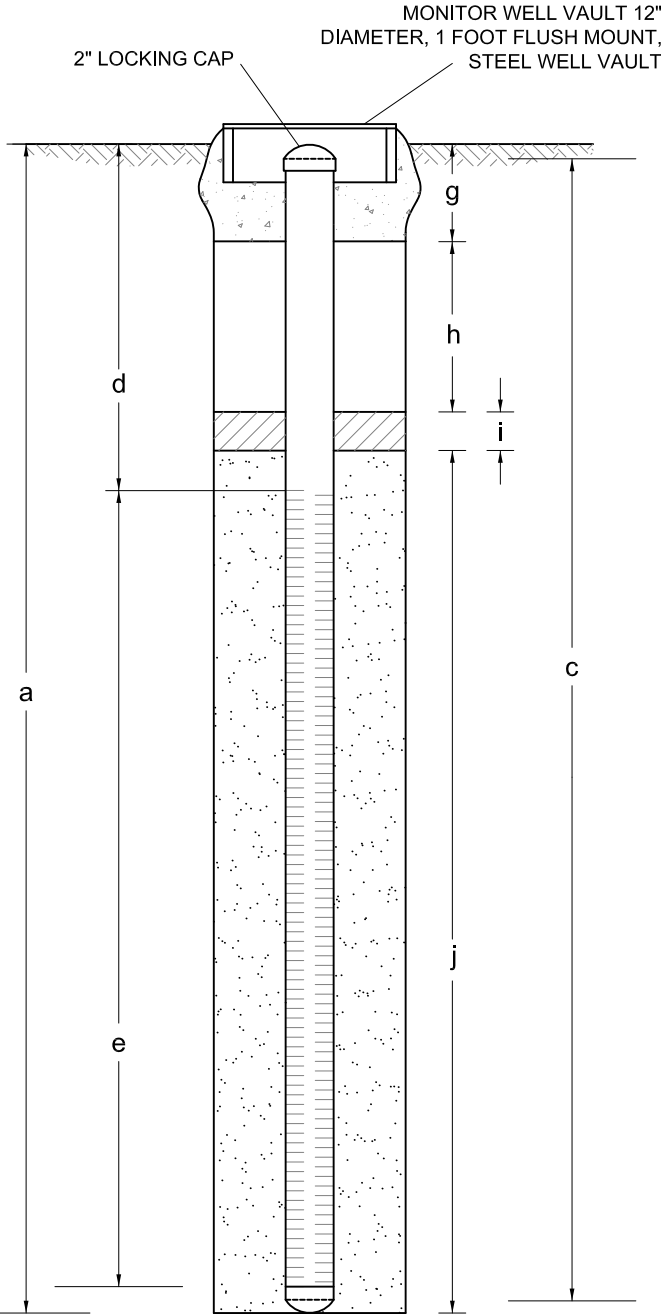
Project Number: 08-82-103

Project Name: BP 498

Location: 286 S Livermore Ave, Livermore, CA

Date: 01/14/2014

Boring / Well No.: MW-5B



EXPLORATORY BORING

a. Total Depth: 66 ft.

b. Diameter: 8 in.

Drilling Method: Hollow Stem Auger

WELL CONSTRUCTION

Drilling Contractor: Gregg Drilling

c. Total Casing Length: 66 ft.

Material: Schedule 40 PVC

Diameter: 2 inches

d. Depth to Top Perforations: 56 ft.

e. Perforated Length: 10 ft.

Perforated Interval From: 56 ft. to 66 ft.

Perforation Type: Factory Slotted

Perforation Size: 0.010"

g. Surface Seal: 0 to 0.5 ft.

Surface Seal Material: Concrete

h. Backfill Length: 50.5 ft

Backfill Material: Neat Cement

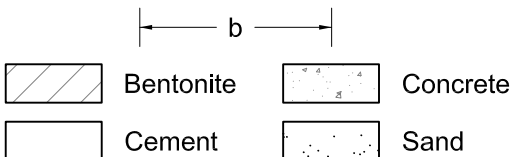
i. Seal Length: 4 ft.

Seal Material: Bentonite

j. Filter Pack Length: 11 ft.

Filter Pack Material: #2/12 Sand

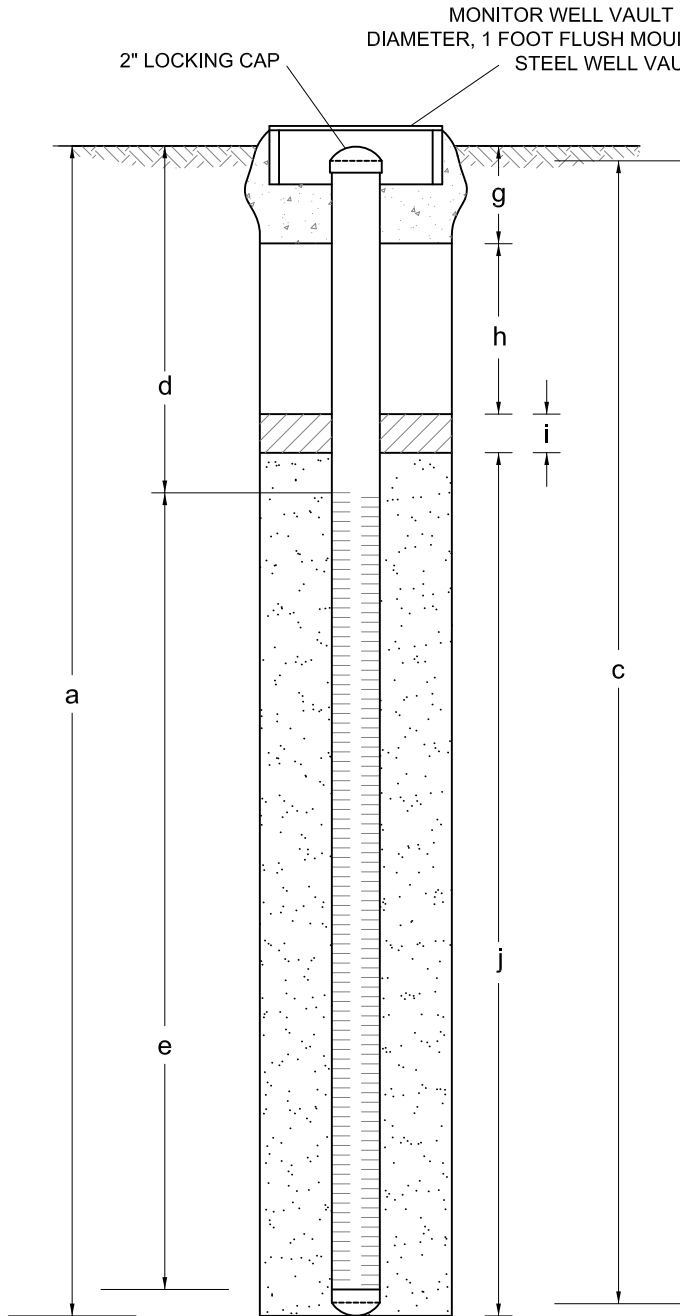
NOTES



MONITOR WELL DIAGRAM



Project Number: 08-82-103
 Project Name: BP 498
 Location: 286 S Livermore Ave, Livermore, CA
 Date: 01/15/2014
 Boring / Well No.: MW-5A



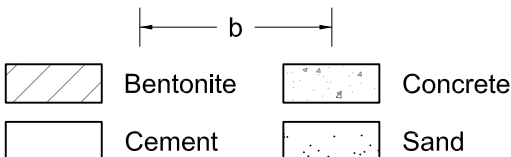
EXPLORATORY BORING

a. Total Depth: 50 ft.
 b. Diameter: 8 in.
 Drilling Method: Hollow Stem Auger

WELL CONSTRUCTION

Drilling Contractor: Gregg Drilling
 c. Total Casing Length: 50 ft.
 Material: Schedule 40 PVC
 Diameter: 2 inches
 d. Depth to Top Perforations: 40 ft.
 e. Perforated Length: 10 ft.
 Perforated Interval From: 40 ft. to 50 ft.
 Perforation Type: Factory Slotted
 Perforation Size: 0.010"
 g. Surface Seal: 0 to 0.5 ft.
 Surface Seal Material: Concrete
 h. Backfill Length: 34.5 ft
 Backfill Material: Neat Cement
 i. Seal Length: 4 ft.
 Seal Material: Bentonite
 j. Filter Pack Length: 11 ft.
 Filter Pack Material: #2/12 Sand

NOTES





1333 Broadway, Suite 800
Oakland, California 94612

LOG OF BORING

Borehole ID: SB-1

Total Depth: 24 ft bgs

PROJECT INFORMATION	DRILLING INFORMATION
Project: ARCO Site 0498-Livermore	Drilling Company: Cascade Drilling
Site Location: 286 S. Livermore Ave., Livermore, CA	Driller: Tom Evans
Project Manager: Scott Robinson	Type of Drilling Rig: Geoprobe 6600
RG: Bob Horwath	Drilling Method: Direct Push
Geologist: Jacob Henry	Sampling Method: Continuous
Job Number: 38487288	Date(s) Drilled: 1/20/05

BORING INFORMATION	
Groundwater Depth: NA	Boring Location: 286 S. Livermore Ave., Livermore, CA
Air Knife or Hand Auger Depth: 5 ft bgs	Boring Diameter: 2 in
Coordinates: X Y	Boring Type: Exploratory

Depth (ft bgs)	Symbol	Lithologic Description	USCS	PID (ppm)	Sample ID	Recovery	Comments
0							Surface conditions- Asphalt
2							Air Knifed to a Depth of 5 ft.
4							
6		SANDY GRAVEL: 2.5Y3/2, very dark grayish brown, loose, very fine to coarse sand, fine gravels, minor coarse gravels (subangular to angular), minimal fines, dry.	SP	0.0	SB1-7'		
8							
10		Same as above, no coarse gravels					
12				0.5	SB1-12'		
14							
16		Increase in fines (silt/clay) content, color change to 10Y4/1, dark greenish gray, odor.					
18				0.5	SB1-17'		
20							
22		CLAYEY SAND: 10Y4/1, dark greenish gray, moderately dense, fine to medium sand with minor coarse sand, fine gravels, low plasticity, dry to damp, odor.	SC	9.7	SB1-22'		
24				11.3	SB1-24'		Borings terminated at 24 ft bgs
26							



1333 Broadway, Suite 800
Oakland, California 94612

LOG OF BORING

Borehole ID: SB-2

Total Depth: 22 ft bgs

PROJECT INFORMATION	DRILLING INFORMATION
Project: ARCO Site 0498-Livermore	Drilling Company: Cascade Drilling
Site Location: 286 S. Livermore Ave., Livermore, CA	Driller: Tom Evans
Project Manager: Scott Robinson	Type of Drilling Rig: Geoprobe 6600
RG: Bob Horwath	Drilling Method: Direct Push
Geologist: Jacob Henry	Sampling Method: Continuous
Job Number: 38487288	Date(s) Drilled: 1/20/05

BORING INFORMATION	
Groundwater Depth: NA	Boring Location: 286 S. Livermore Ave., Livermore, CA
Air Knife or Hand Auger Depth: 5 ft bgs	Boring Diameter: 2 in
Coordinates: X Y	Boring Type: Exploratory

Depth (ft bgs)	Symbol	Lithologic Description	USCS	PID (ppm)	Sample ID	Recovery	Comments
0							Surface conditions- Asphalt
2							Air Knifed to a Depth of 5 ft.
4							
6	^	GRAVELLY SAND: 2.5Y3/3, dark olive brown, loose, medium to coarse sand, coarse gravels (angular to subangular), no fines, damp.	SP				
8	^						
10	^	Same as above, minor fines, solid rock (quartz).		0.5	SB2-10'		
12	^						
14	^						
16	o	SANDY GRAVEL: 2.5Y5/3, light olive brown, dense, coarse gravel (1.5" +), coarse sand. Gravel greater than 2" diameter, possible cobbles (subrounded to aubangular), minor fines, damp.	GW	10.7	SB2-15'		
18	o			17.8	SB2-18.5'		
20	o	Same as above, increased fines, some gravel clast greater than 2" diameter.		22.2			
22	o	Increased fines.		7901			Borings terminated at 22 ft bgs
24							
26							



1333 Broadway, Suite 800
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LOG OF BORING

Borehole ID: SB-3

Total Depth: 25 ft bgs

PROJECT INFORMATION	DRILLING INFORMATION
Project: ARCO Site 0498-Livermore	Drilling Company: Cascade Drilling
Site Location: 286 S. Livermore Ave., Livermore, CA	Driller: Tom Evans
Project Manager: Scott Robinson	Type of Drilling Rig: Geoprobe 6600
RG: Bob Horwath	Drilling Method: Direct Push
Geologist: Jacob Henry	Sampling Method: Continuous
Job Number: 38487288	Date(s) Drilled: 1/20/05

BORING INFORMATION

Groundwater Depth: NA	Boring Location: 286 S. Livermore Ave., Livermore, CA
Air Knife or Hand Auger Depth: 5 ft bgs	Boring Diameter: 2 in
Coordinates: X Y	Boring Type: Exploratory

Depth (ft bgs)	Symbol	Lithologic Description	USCS	PID (ppm)	Sample ID	Recovery	Comments
0							Surface conditions- Asphalt
2							Air Knifed to a Depth of 5 ft.
4							
6	^	GRAVELLY SAND: 2.5Y4/4, olive brown, dense, coarse sand, minor medium sand, fine gravels with rare coarse gravels (subangular to subrounded), minor non-plastic fines, damp.	SP				
8	^						
10	^	Increased fines (clay) content, medium to coarse sand, fine gravels, dry to damp.		2.5	SB3-10'		
12	^						
14	^						
16	^	Color change to 2.5Y5/2, light olive brown, medium sand, fine gravels, damp, odor.					
18	^						
20	^						
22	^						
24	^	Increased fines.					
26							Borings terminated at 25 ft bgs



1333 Broadway, Suite 800
Oakland, California 94612

LOG OF BORING

Borehole ID: SB-4

Total Depth: 26 ft bgs

PROJECT INFORMATION	DRILLING INFORMATION
Project: ARCO Site 0498-Livermore	Drilling Company: Cascade Drilling
Site Location: 286 S. Livermore Ave., Livermore, CA	Driller: Tom Evans
Project Manager: Scott Robinson	Type of Drilling Rig: Geoprobe 6600
RG: Bob Horwath	Drilling Method: Direct Push
Geologist: Jacob Henry	Sampling Method: Continuous
Job Number: 38487288	Date(s) Drilled: 1/20/05

BORING INFORMATION

Groundwater Depth: NA	Boring Location: 286 S. Livermore Ave., Livermore, CA
Air Knife or Hand Auger Depth: 5 ft bgs	Boring Diameter: 2 in
Coordinates: X Y	Boring Type: Exploratory

Depth (ft bgs)	Symbol	Lithologic Description	USCS	PID (ppm)	Sample ID	Recovery	Comments
0							Surface conditions- Asphalt
2							Air Knifed to a Depth of 5 ft.
4							
6	^	GRAVELLY SAND: 2.5Y5/4, light olive brown, loose, fine to coarse sand, coarse gravel (0.75 to 1'), angular to subangular, no fines, dry.	GW	0.0	SB4-7'		
8	^						
10	^	2.5Y4/4, light brown, moderately dense, fine to coarse sand, fine gravels, angular to subangular, low plasticity, dry to damp.	GC	28.8	SB4-12'		
12	^						
14	^						
16	^	SANDY SILT: 2.5Y4/4, olive brown, firm, low plasticity, very fine to fine sand, dry to damp.	ML	35.5	SB4-17'		
18	^						
20	^	GRAVELLY SAND: 2.5Y4/4, olive brown, moderately dense, fine to coarse sand, coarse gravel (0.75' +), angular to subangular, no to low plasticity, dry to damp.	GC	22.2	SB4-22'		
22	^						
24	^						
26	^						Borings terminated at 26 ft bgs Lost rods and sampler down hole.



1333 Broadway, Suite 800
Oakland, California 94612

LOG OF BORING

Borehole ID: SB-5

Total Depth: 15 ft bgs

PROJECT INFORMATION		DRILLING INFORMATION	
Project: ARCO Site 0498-Livermore		Drilling Company: Cascade Drilling	
Site Location: 286 S. Livermore Ave., Livermore, CA		Driller: Tom Evans	
Project Manager: Scott Robinson		Type of Drilling Rig: Geoprobe 6600	
RG: Bob Horwath		Drilling Method: Direct Push	
Geologist: Jacob Henry		Sampling Method: Continuous	
Job Number: 38487288		Date(s) Drilled: 1/20/05	

BORING INFORMATION

Groundwater Depth: NA	Boring Location: 286 S. Livermore Ave., Livermore, CA
Air Knife or Hand Auger Depth: 5 ft bgs	Boring Diameter: 2 in
Coordinates: X Y	Boring Type: Exploratory

Depth (ft bgs)	Symbol	Lithologic Description	USCS	PID (ppm)	Sample ID	Recovery	Comments
0							Surface conditions- Asphalt
2							Air Knifed to a Depth of 5 ft.
4							
6		CLAYEY SAND: 2.5Y3/3, dark olive brown, moderately dense, fine to medium sand, rare coarse sand, fine to coarse gravel (subangular to subrounded), low plasticity fines, dry.	SC				
8							
10				0.5	SB5-10'		
12		Increase in fine to coarse gravel content, rare cobbles.					
14		SANDY CLAY: 10YR4/4, dark yellowish brown, very hard, low plasticity, very fine to fine sand, dry.	CL				Lost sampler down hole.
16				19.5	SB5-15'		Borings terminated at 15 ft bgs
18							
20							
22							
24							
26							



1333 Broadway, Suite 800
Oakland, California 94612

LOG OF BORING

Borehole ID: SB-6

Total Depth: 24 ft bgs

PROJECT INFORMATION	DRILLING INFORMATION
Project: ARCO Site 0498-Livermore	Drilling Company: Cascade Drilling
Site Location: 286 S. Livermore Ave., Livermore, CA	Driller: Tom Evans
Project Manager: Scott Robinson	Type of Drilling Rig: Geoprobe 6600
RG: Bob Horwath	Drilling Method: Direct Push
Geologist: Jacob Henry	Sampling Method: Continuous
Job Number: 38487288	Date(s) Drilled: 1/20/05

BORING INFORMATION

Groundwater Depth: NA	Boring Location: 286 S. Livermore Ave., Livermore, CA
Air Knife or Hand Auger Depth: 5 ft bgs	Boring Diameter: 2 in
Coordinates: X Y	Boring Type: Exploratory

Depth (ft bgs)	Symbol	Lithologic Description	USCS	PID (ppm)	Sample ID	Recovery	Comments
0							Surface conditions- Asphalt
2							Air Knifed to a Depth of 5 ft.
4							
6	∧	GRAVELLY SAND: 2.5Y5/3, light olive brown, loose, fine to coarse sand, fine gravels (subrounded to subangular), non-plastic fines (minor fines), dry.	SP				
8	∧						
10	∧			0.0	SB6-10'		
12	∧						
14	∧						
14	∧	CLAYEY SAND: 2.5Y4/3, olive brown, dense, low plasticity fines, very fine to fine sand, dry.	SC	1.0	SB6-15'		
16		No Recovery from 15 to 20 feet bgs. Shoe of sampling rod contained: Sandy Clay: 2.5Y5/4, light olive brown, very hard, very fine to fine sand, low plasticity, dry.					
18							
20				14			
20		CLAYEY SAND: Same as above.					
22				18.9	SB6-22'		
22							
24		SILTY CLAY: 5GY4/1, dark greenish gray, very hard, low plasticity, very fine to fine sands, dry, odor.	ML	11.8	SB6-24'		
24							Borings terminated at 24 ft bgs
26							



1333 Broadway, Suite 800
Oakland, California 94612

LOG OF BORING

Borehole ID: SB-7

Total Depth: 20 ft bgs

PROJECT INFORMATION		DRILLING INFORMATION	
Project: ARCO Site 0498-Livermore		Drilling Company: Cascade Drilling	
Site Location: 286 S. Livermore Ave., Livermore, CA		Driller: Tom Evans	
Project Manager: Scott Robinson		Type of Drilling Rig: Geoprobe 6600	
RG: Bob Horwath		Drilling Method: Direct Push	
Geologist: Jacob Henry		Sampling Method: Continuous	
Job Number: 38487288		Date(s) Drilled: 1/20/05	

BORING INFORMATION			
Groundwater Depth: NA		Boring Location: 286 S. Livermore Ave., Livermore, CA	
Air Knife or Hand Auger Depth: 5 ft bgs		Boring Diameter: 2 in	
Coordinates: X	Y	Boring Type: Exploratory	

Depth (ft bgs)	Symbol	Lithologic Description	USCS	PID (ppm)	Sample ID	Recovery	Comments
----------------	--------	------------------------	------	-----------	-----------	----------	----------

0							Surface conditions- Asphalt
2							Air Knifed to a Depth of 5 ft.
4							
6	∧	GRAVELLY SAND: 2.5Y6/2, light yellowish brown, loose, fine to coarse sand, fine gravels (subangular to subrounded), minimal fines, dry.	SP				
8	∧						
10	∧			11.3	SB7-10'		
12	∧	Increase in fines (clay), minor coarse gravels (subangular).					
14	∧						
16	∕	SANDY SILTY CLAY: 10YR4/4, dark yellowish brown, very hard, low plasticity, very fine to fine sand, minor coarse sand, minor coarse gravels, dry.	CL	16.7	SB7-14.5'		
18	∕	Color change to 10YR4/4, dark yellowish brown, very hard, increased silt content, decreased fine gravel (rounded), fine sand, rare coarse sand (rounded), dry.					
20		Refusal at 20 ft. bgs.		27.1	SB7-20'		Borings terminated at 20 ft bgs
22							
24							
26							



1333 Broadway, Suite 800
Oakland, California 94612

LOG OF BORING

Borehole ID: SB-8

Total Depth: 25 ft bgs

PROJECT INFORMATION	DRILLING INFORMATION
Project: ARCO Site 0498-Livermore	Drilling Company: Cascade Drilling
Site Location: 286 S. Livermore Ave., Livermore, CA	Driller: Tom Evans
Project Manager: Scott Robinson	Type of Drilling Rig: Geoprobe 6600
RG: Bob Horwath	Drilling Method: Direct Push
Geologist: Jacob Henry	Sampling Method: Continuous
Job Number: 38487288	Date(s) Drilled: 1/20/05

BORING INFORMATION	
Groundwater Depth: NA	Boring Location: 286 S. Livermore Ave., Livermore, CA
Air Knife or Hand Auger Depth: 5 ft bgs	Boring Diameter: 2 in
Coordinates: X Y	Boring Type: Exploratory

Depth (ft bgs)	Symbol	Lithologic Description	USCS	PID (ppm)	Sample ID	Recovery	Comments
0							Surface conditions- Asphalt
2							Air Knifed to a Depth of 5 ft.
4							
6	∧	GRAVELLY SAND: 2.5Y5/3, light olive brown, loose, fine to medium sand, minor coarse sand, fine to coarse gravels (subangular to subrounded), minor fines, dry.	SP				
8	∧						
10	∧			14	SB8-10'		
12	∧						
14	■	SANDY CLAY: 10YR4/2, brown, very hard, low plasticity, very fine to fine sand (subrounded), dry to damp.	CL	16.7	SB8-15'		
16	●	CLAYEY SAND: 2.5Y4/3, olive brown, moderately dense, fine to medium sand, rare coarse sand, rare fine gravels (rounded to subrounded), low plasticity fines, dry to damp.	SC				
18		Color change to 10Y5/1, greenish gray, odor.					
20	■	SANDY CLAYEY GRAVEL: 10Y4/1, dark greenish gray, loose, medium to coarse sand, fine to coarse gravels (subangular to angular), non-plastic fines, damp to moist, odor.	GC	14	SB8-20'		
22							
24							
26				21.1	SB8-25'		Borings terminated at 25 ft bgs

SOIL BORING LOG

Boring No. MW-1

Sheet: 1 of 3

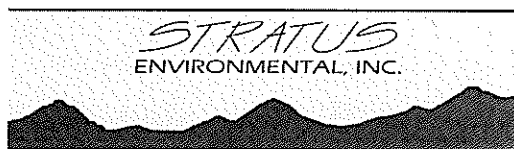
Client	Arco 498	Date	11/24/2008 - 11/25/2008	
Address	286 South Livermore Avenue	Drilling Co.	Woodward Drilling	rig type: BK-81
	Livermore, CA	Driller	Dave	
Project No.	E-498	Method	Hollow Stem Auger	Hole Diameter: 8 inches
Logged By:	Collin Fischer	Sampler:	18" x 2" Split Spoon	
Well Pack	sand: 40 ft. to 17 ft	Well Construction	Casing Material: Schedule 40 PVC	Screen Interval: 20 ft. to 40 ft.
	bent.: 17 ft. to 14 ft		Casing Diameter: 2 in.	Screen Slot Size: 0.020-in.
	grout: 14 ft. to 0 ft.	Depth to GW:	▽ first encountered 32'	static ▼

Sample Type	Sample No.	Blow Count	Sample		Well Details	Depth Scale	Lithologic Column	Descriptions of Materials and Conditions	PID (PPM)
			Time	Recov.					
								Cleared to 5' bgs with air knife	
						1			
						2			
						3			
						4			
						5			
						6			
						7			
						8			
						9			
						10			
	MW-1 10'	50/3"	1550	0		11		No recovery	
						12			
						13			
						14			
						15	GC	Gravel with silty clay matrix	
S	MW-1 15'	14	1555	100		16			0
		14				17		Silty sand with clay, SM, dark yellowish brown, dense, moist 60% coarse sand, 40% clayey silt	
		16				18	SM		
						19			
						20			

Recovery _____

Sample _____

Comments:



SOIL BORING LOG

Boring No. MW-1

Sheet: 2 of 3

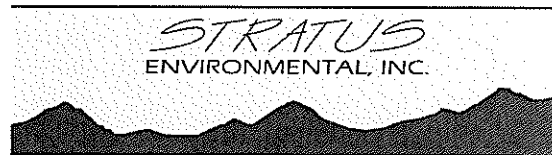
Client	Arco 498	Date	11/24/2008 - 11/25/2008
Address	286 South Livermore Avenue Livermore, CA	Drilling Co.	Woodward Drilling rig type: BK-81
Project No.	E-498	Driller	Dave
Logged By:	Collin Fischer	Method	Hollow Stem Auger Hole Diameter: 8 inches
		Sampler:	18" x 2" Split Spoon
Well Pack	sand: 40 ft. to 17 ft bent.: 17 ft. to 14 ft grout: 14 ft. to 0 ft.	Well Construction	Casing Material: Schedule 40 PVC Screen Interval: 20 ft. to 40 ft. Casing Diameter: 2 in. Screen Slot Size: 0.020-in.
		Depth to GW:	▽ first encountered 32' static ▼

Sample		Blow Count	Sample		Well Details	Depth Scale	Lithologic Column	Descriptions of Materials and Conditions	PID (PPM)
Type	No.		Time	Recov.					
S	MW-1 20'	50/5.5"	1600	0		21 22 23 24	SM Silty sand with clay, SM, dark yellowish brown, dense, moist 60% coarse sand, 40% clayey silt	0	
S	MW-1 25'	41 50/5"	1605	100		25 26 27 28	GM Gravel with clayey silt, GM, dark grayish brown, very dense, moist 70% gravel, 30% clayey silt	0	
S	MW-1 30'	12 15 18	1610	67		29 30 31 32 33 34	GM Gravel with clayey silt, GM, dark grayish brown, very dense, moist 70% gravel, 30% clayey silt	0	
S	MW-1 35'	6 7 9	1615	67		35 36 37 38 39 40	ML Clayey silt, ML, dark yellowish brown, very stiff, medium plasticity, moist 60% silt, 40% clay	0	

Recovery _____

Sample _____

Comments:



SOIL BORING LOG

Boring No. MW-1

Sheet: 3 of 3

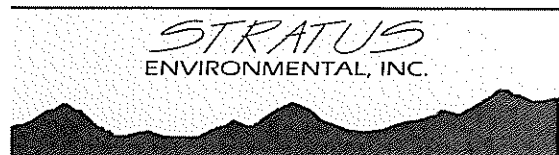
Client	<u>Arco 498</u>	Date	<u>11/24/2008 - 11/25/2008</u>	
Address	<u>286 South Livermore Avenue</u>	Drilling Co.	<u>Woodward Drilling</u>	<u>rig type: BK-81</u>
	<u>Livermore, CA</u>	Driller	<u>Dave</u>	
Project No.	<u>E-498</u>	Method	<u>Hollow Stem Auger</u>	<u>Hole Diameter: 8 inches</u>
Logged By:	<u>Collin Fischer</u>	Sampler:	<u>18" x 2" Split Spoon</u>	
Well Pack	<u>sand: 40 ft. to 17 ft</u>	Well Construction	<u>Casing Material: Schedule 40 PVC</u>	<u>Screen Interval: 20 ft. to 40 ft.</u>
	<u>bent.: 17 ft. to 14 ft</u>		<u>Casing Diameter: 2 in.</u>	<u>Screen Slot Size: 0.020-in.</u>
	<u>grout: 14 ft. to 0 ft.</u>	Depth to GW:	<u>▽ first encountered 32'</u>	<u>static ▼</u>

Sample Type	Sample No.	Blow Count	Sample		Well Details	Depth Scale	Lithologic Column	Descriptions of Materials and Conditions	PID (PPM)	
			Time	Recov.						
	MW-1 40'	9	0755	100		41	ML	Clayey silt, ML, dark yellowish brown, very stiff, medium plasticity moist, 60% silt, 40% clay	2	
		10				42				
		12				43				
						44				
						45				
						46				
						47				
						48				
						49				
						50				
						51				
						52				
						53				
						54				
						55				
						56				
						57				
						58				
						59				
						60				

Recovery _____

Sample _____

Comments:



SOIL BORING LOG

Boring No. MW-2

Sheet: 1 of 3

Client	Arco 498	Date	November 24, 2008
Address	286 South Livermore Avenue Livermore, CA	Drilling Co.	Woodward Drilling rig type: BK-81
Project No.	E-498	Driller	Dave
Logged By:	Collin Fischer	Method	Hollow Stem Auger Hole Diameter: 8 inches
Well Pack	sand: 57 ft. to 34 ft. bent.: 34 ft. to 31 ft. grout: 31 ft. to 0 ft.	Sampler:	18" x 2" Split Spoon
Well Construction	Casing Material: Schedule 40 PVC	Screen Interval:	37 ft. to 57 ft.
	Casing Diameter: 2 in.	Screen Slot Size:	0.020-in.
Depth to GW:	▽ first encountered	static	▼

Sample Type	Sample No.	Blow Count	Sample		Well Details	Depth Scale	Lithologic Column	Descriptions of Materials and Conditions	PID (PPM)
			Time	Recov.					
						1		Cleared to 5' bgs with air knife	
						2			
						3			
						4			
						5			
						6			
						7			
						8			
						9			
S	MW-2 10'	50/5.5"	1000	100		10			
						11	GM	Silty gravel, GM, dark yellowish brown, very dense, dry 75% medium to coarse grained gravel, 25% silt	0
						12			
						13			
						14			
S	MW-2 15'	16 10 11	1005	67		15			
						16			
						17	CL	Silty clay, CL, dark yellowish brown, very stiff, medium plasticity, moist 70% clay, 30% silt	0
						18			
						19			
						20	GC		

Recovery _____
Sample _____

Comments:



SOIL BORING LOG

Boring No. MW-2

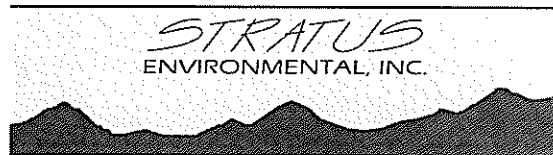
Sheet: 2 of 3

Client	Arco 498	Date	November 24, 2008
Address	286 South Livermore Avenue Livermore, CA	Drilling Co.	Woodward Drilling rig type: BK-81
Project No.	E-498	Driller	Dave
Logged By:	Collin Fischer	Method	Hollow Stem Auger Hole Diameter: 8 inches
		Sampler:	18" x 2" Split Spoon
Well Pack	sand: 57 ft. to 34 ft. bent.: 34 ft. to 31 ft. grout: 31 ft. to 0 ft.	Well Construction	Casing Material: Schedule 40 PVC Casing Diameter: 2 in. Screen Interval: 37 ft. to 57 ft. Screen Slot Size: 0.020-in.
		Depth to GW:	▽ first encountered static ▼

Sample Type	Sample No.	Blow Count	Sample		Well Details	Depth Scale	Lithologic Column	Descriptions of Materials and Conditions	PID (PPM)
			Time	Recov.					
S	MW-2 20'	16 21 30	1010	67		21	GC	Silty clayey gravel, GC, dark yellowish brown, very dense, moist to wet 75% medium gravel, 25% silty clay	0
						22			
						23			
						24			
S	MW-2 25'	19 19 25	1015	67		25	GP	Silty sandy gravel, GP, dark yellowish brown, dense, moist to wet 70% medium gravel, 30% silty coarse grained sand	0
						26			
						27			
						28			
						29			
S	MW-2 30'	12 12 16	1020	67		30	GC	Silty clayey gravel, GC, dark yellowish brown, very dense, moist to wet 75% medium gravel, 25% silty clay	0
						31			
						32			
						33			
						34			
						35			
						36			
S	MW-2 37'	10 12 12	1028	100		37	ML	Clayey silt, ML, dark yellowish brown, very stiff, medium plasticity, moist 60% silt, 40% clay	1.4
						38			
						39			
						40			

Recovery _____
Sample _____

Comments:



SOIL BORING LOG

Boring No. MW-2

Sheet: 3 of 3

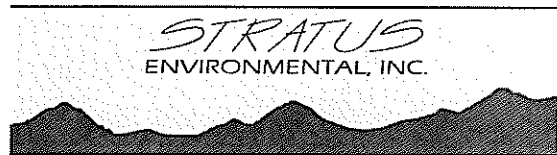
Client	Arco 498	Date	November 24, 2008
Address	286 South Livermore Avenue Livermore, CA	Drilling Co.	Woodward Drilling rig type: BK-81
Project No.	E-498	Driller	Dave
Logged By:	Collin Fischer	Method	Hollow Stem Auger Hole Diameter: 8 inches
Well Pack	sand: 57 ft. to 34 ft. bent.: 34 ft. to 31 ft. grout: 31 ft. to 0 ft.	Sampler:	18" x 2" Split Spoon
Well Construction	Casing Material: Schedule 40 PVC	Screen Interval:	37 ft. to 57 ft.
	Casing Diameter: 2 in.	Screen Slot Size:	0.020-in.
Depth to GW:	▽ first encountered	static	▼

Sample		Blow Count	Sample		Well Details	Depth Scale	Lithologic Column	Descriptions of Materials and Conditions	PID (PPM)
Type	No.		Time	Recov.					
S	MW-2 40'	9	1035	100	[Well Diagram]	41	ML Clayey silt, ML, dark yellowish brown, very stiff, medium plasticity, moist 60% silt, 40% clay	2.3	
		10				42			
		10				43			
						44			
						45			
S	MW-2 45'	10	1040	100	[Well Diagram]	46	CL Silty clay, CL, dark yellowish brown, very stiff, medium plasticity, moist 80% clay, 20% silt	38	
		12				47			
		13				48			
						49			
						50			
S	MW-2 50'	9	1050	100	[Well Diagram]	51	SW-SC Clayey sand with gravel, dark grayish brown, dense, moist 40% clay, 35% medium grained sand, 25% medium gravel	46	
		21				52			
		22				53			
						54			
						55			
S	MW-2 55'	32	1100	100	[Well Diagram]	56	GW-GC Gravel with clayey sand, GC, dark grayish brown, very dense, wet 60% medium to coarse gravel, 40% clayey medium to coarse grained sand	0	
		50/5"				57			
						58			
						59			
						60			

Recovery _____

Sample _____

Comments:



SOIL BORING LOG

Boring No. MW-3

Sheet: 1 of 3

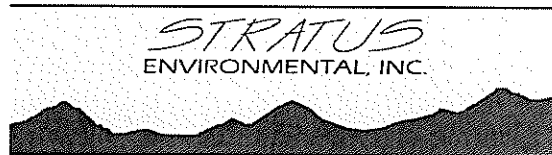
Client	ARCO 498	Date	11/25/2008 - 11/26/2008	
Address	2186 S. Livermore Aveune	Drilling Co.	Woodward Drilling	rig type: BK-81
	Livermore, CA	Driller	Dave	
Project No.	E498	Method	Hollow Stem Auger	Hole Diameter: 8 inches
Logged By:	Collin Fischer	Sampler:		
Well Pack	sand: 34 ft. to 57 ft	Well Construction	Casing Material: Schedule 40 PVC	Screen Interval: 37 ft. to 57 ft.
	bent.: 31 ft. to 34 ft.		Casing Diameter: 2 in.	Screen Slot Size: 0.020-in.
	grout: 0 ft. to 31 ft.	Depth to GW:	▽ first encountered 52	static ▼

Sample Type	Sample No.	Blow Count	Sample		Well Details	Depth Scale	Lithologic Column	Descriptions of Materials and Conditions	PID (PPM)
			Time	Recov.					
								Cleared to 5' bgs with air knife.	
						1			
						2			
						3			
						4			
						5			
						6			
						7			
						8			
						9			
						10			
S	MW-3 10'	6	1335	67		10			
		7				11	GC	Gravel with silty clay, GC, dark yellowish brown, medium dense, moist 70% medium gravel, 30% silty clay	0
		7				12			
						13			
						14			
						15			
	MW-3 15'	10	1340	33		15			
		10				16	ML	Clayey silt, ML, dark grayish brown, very stiff, low plasticity, moist 60% silt, 40% clay	82
		11				17			
						18			
						19			
						19	GC		
						20			

Recovery _____

Sample _____

Comments:



SOIL BORING LOG

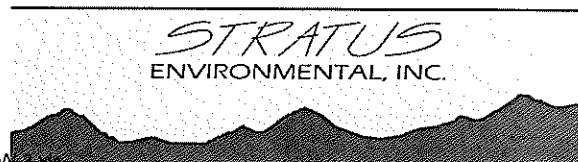
Boring No. MW-3

Sheet: 2 of 3

Client	ARCO 498	Date	11/25/2008 - 11/26/2008
Address	2186 S. Livermore Aveune Livermore, CA	Drilling Co.	Woodward Drilling rig type: BK-81
Project No.	E498	Driller	Dave
Logged By:	Collin Fischer	Method	Hollow Stem Auger Hole Diameter: 8 inches
Well Pack	sand: 34 ft. to 57 ft. bent.: 31 ft. to 34 ft. grout: 0 ft. to 31 ft.	Well Construction	Casing Material: Schedule 40 PVC Casing Diameter: 2 in. Screen Interval: 37 ft. to 57 ft. Screen Slot Size: 0.020-in.
		Depth to GW:	▽ first encountered 52 static ▼

Sample		Blow Count	Sample		Well Details	Depth Scale	Lithologic Column	Descriptions of Materials and Conditions	PID (PPM)
Type	No.		Time	Recov.					
S	MW-3 20'	9 12 15	1345	67		21	GC	Gravel with silty clay, GC, dark yellowish brown, medium dense, moist 70% medium gravel, 30% silty clay	216
						22			
						23			
						24			
S	MW-3 25'	12 15 17	1350	67		25	GC	Gravel with silty clay, GC, dark yellowish brown, dense, moist 70% medium gravel, 30% silty clay	106
					26				
					27				
					28				
S	MW-3 30'	12 12 15	1355	67		30	GC	Gravel with silty clay, GC, dark yellowish brown, medium dense, moist 70% medium gravel, 30% silty clay	76
					31				
					32				
					33				
S	MW-3 35'	12 12 15	1400	100		35	ML	Clayey silt, ML, dark grayish brown, very stiff, low plasticity, moist 60% silt, 40% silt	14.8
					36				
					37				
					38				
					39				
					40				

Comments:



SOIL BORING LOG

Boring No. MW-3

Sheet: 3 of 3

Client	ARCO 498	Date	11/25/2008 - 11/26/2008	
Address	2186 S. Livermore Aveune	Drilling Co.	Woodward Drilling	rig type: BK-81
	Livermore, CA	Driller	Dave	
Project No.	E498	Method	Hollow Stem Auger	Hole Diameter: 8 inches
Logged By:	Collin Fischer	Sampler:		
Well Pack	sand: 34 ft. to 57 ft.	Well Construction	Casing Material: Schedule 40 PVC	Screen Interval: 37 ft. to 57 ft.
	bent.: 31 ft. to 34 ft.		Casing Diameter: 2 in.	Screen Slot Size: 0.020-in.
	grout: 0 ft. to 31 ft.	Depth to GW:	▽ first encountered 52	static ▼

Sample		Blow Count	Sample		Well Details	Depth Scale	Lithologic Column	Descriptions of Materials and Conditions	PID (PPM)	
Type	No.		Time	Recov.						
S	MW-3 40'	6 10 12	1405	100		41	ML	Clayey silt, ML, dark grayish brown, very stiff, low plasticity, moist 70% silt, 30% silt	20	
						42				
						43				
						44				
						45	CL	Clayey silt, ML, dark grayish brown, very stiff, low plasticity, moist 70% silt, 30% silt		
S	MW-3 45'	13 13 15	0805	100		46			Silty clay, CL, dark yellowish brown, very stiff, medium plasticity, moist 80% clay, 20% silt	4.8
						47				
						48				
						49				
						50	ML	Clayey silt with coarse sand trace gravel, ML, dark yellowish brown, hard low plasticity, wet, 50% silt, 30% clay, 20% coarse grained sand 10% fine gravel	7	
S	MW-3 50'	15 15 17	0830	100	51					
					52					
					53					
					54					
					55					
S	MW-3 55'	30 32 50/3"	0850	100		56	ML	Clayey silt with coarse sand trace gravel, ML, dark yellowish brown, hard low plasticity, wet, 50% silt, 30% clay, 20% coarse grained sand 10% fine gravel		
					57					
					58					
					59					
					60					

Comments:

STRATUS
ENVIRONMENTAL, INC.

SOIL BORING LOG

Boring No. MW-4

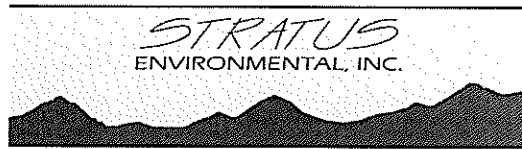
Sheet: 1 of 3

Client	Arco 498	Date	November 25, 2008
Address	286 South Livermore Avenue Livermore, CA	Drilling Co.	Woodward Drilling rig type: BK-81
Project No.	E-498	Driller	Dave
Logged By:	Collin Fischer	Method	Hollow Stem Auger Hole Diameter: 8 inches
		Sampler:	18" x 2" Split Spoon
Well Pack	sand: 40 ft. to 17 ft. bent.: 17 ft. to 14 ft. grout: 14 ft. to 0 ft.	Well Construction	Casing Material: Schedule 40 PVC Screen Interval: 20 ft. to 40 ft. Casing Diameter: 2 in. Screen Slot Size: 0.020-in. Depth to GW: ▽ first encountered 32' static ▼

Sample Type	Sample No.	Blow Count	Sample		Well Details	Depth Scale	Lithologic Column	Descriptions of Materials and Conditions	PID (PPM)
			Time	Recov.					
						1		Cleared to 5' bgs with air knife	
						2			
						3			
						4			
						5			
						6			
						7			
						8			
						9			
S	MW-4 10'	9	0925	67		10			
		16				11	GC	Gravel with silty clay, GC, dark yellowish brown, hard 70% medium to coarse gravel, 30% silty clay	0
		17				12			
						13			
						14			
S	MW-4 15'	9	0930	67		15			
		10				16	CL	Silty clay, CL, dark yellowish brown, very stiff, medium plasticity, moist 60% clay, 40% silt	0
		10				17			
						18			
						19			
						20	GM		

Recovery _____
Sample _____

Comments:



SOIL BORING LOG

Boring No. MW-4

Sheet: 2 of 3

Client	Arco 498	Date	November 25, 2008
Address	286 South Livermore Avenue Livermore, CA	Drilling Co.	Woodward Drilling rig type: BK-81
Project No.	E-498	Driller	Dave
Logged By:	Collin Fischer	Method	Hollow Stem Auger Hole Diameter: 8 inches
		Sampler:	18" x 2" Split Spoon
Well Pack	sand: 40 ft. to 17 ft. bent.: 17 ft. to 14 ft. grout: 14 ft. to 0 ft.	Well Construction	Casing Material: Schedule 40 PVC Casing Diameter: 2 in. Screen Interval: 20 ft. to 40 ft. Screen Slot Size: 0.020-in.
		Depth to GW:	▽ first encountered 32' static ▼

Sample Type	Sample No.	Blow Count	Sample		Well Details	Depth Scale	Lithologic Column	Descriptions of Materials and Conditions	PID (PPM)
			Time	Recov.					
S	MW-4 20'	12 14 14	0935	67		21	GM	Gravel with clayey silt, dark grayish brown, medium dense, moist 70% medium gravel, 30% clayey silt	0
						22			
						23			
						24			
						25			
S	MW-4 25'	16 18 20	0940	67		26	GP	Gravel with silty sand, GP, dark grayish brown, dense, moist to wet 70% medium gravel, 30% fine to medium grained silty sand	0
						27			
						28			
						29			
						30			
S	MW-4 30'	16 17 19	0945	67		31	GM	Gravel with clayey silt, dark grayish brown, medium dense, moist 70% medium gravel, 30% clayey silt	0
						32	▽		
						33			
						34			
						35			
S	MW-4 35'	6 10 16	0950	67		36	ML	Clayey silt, ML, dark yellowish brown, very stiff, medium plasticity, moist 60% silt, 40% clay	212
						37			
						38			
						39			
						40			

Recovery _____
Sample _____

Comments:



SOIL BORING LOG

Boring No. MW-4

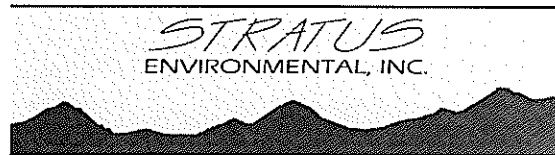
Sheet: 3 of 3

Client	Arco 498	Date	November 25, 2008	
Address	286 South Livermore Avenue	Drilling Co.	Woodward Drilling	rig type: BK-81
	Livermore, CA	Driller	Dave	
Project No.	E-498	Method	Hollow Stem Auger	Hole Diameter: 8 inches
Logged By:	Collin Fischer	Sampler:	18" x 2" Split Spoon	
Well Pack	sand: 40 ft. to 17 ft.	Well Construction	Casing Material: Schedule 40 PVC	Screen Interval: 20 ft. to 40 ft.
	bent.: 17 ft. to 14 ft.		Casing Diameter: 2 in.	Screen Slot Size: 0.020-in.
	grout: 14 ft. to 0 ft.	Depth to GW:	▽ first encountered 32'	static ▼

Sample Type	Sample No.	Blow Count	Sample		Well Details	Depth Scale	Lithologic Column	Descriptions of Materials and Conditions	PID (PPM)
			Time	Recov.					
	MW-4 40'	10	0955	100		40	ML	Clayey silt, ML, dark yellowish brown, very stiff, medium plasticity, moist 60% silt, 40% clay	13.4
		10				41			
		12				42			
						43			
						44			
						45			
						46			
						47			
						48			
						49			
						50			
						51			
						52			
						53			
						54			
						55			
						56			
						57			
						58			
						59			
						60			

Recovery _____
Sample _____

Comments:





LITHOLOGIC LOG

PROJECT NAME: BP 498

PROJECT NUMBER: 08-82-498

DATE: 3/22/2013

SITE ADDRESS: 286 South Livermore Ave., Livermore, CA

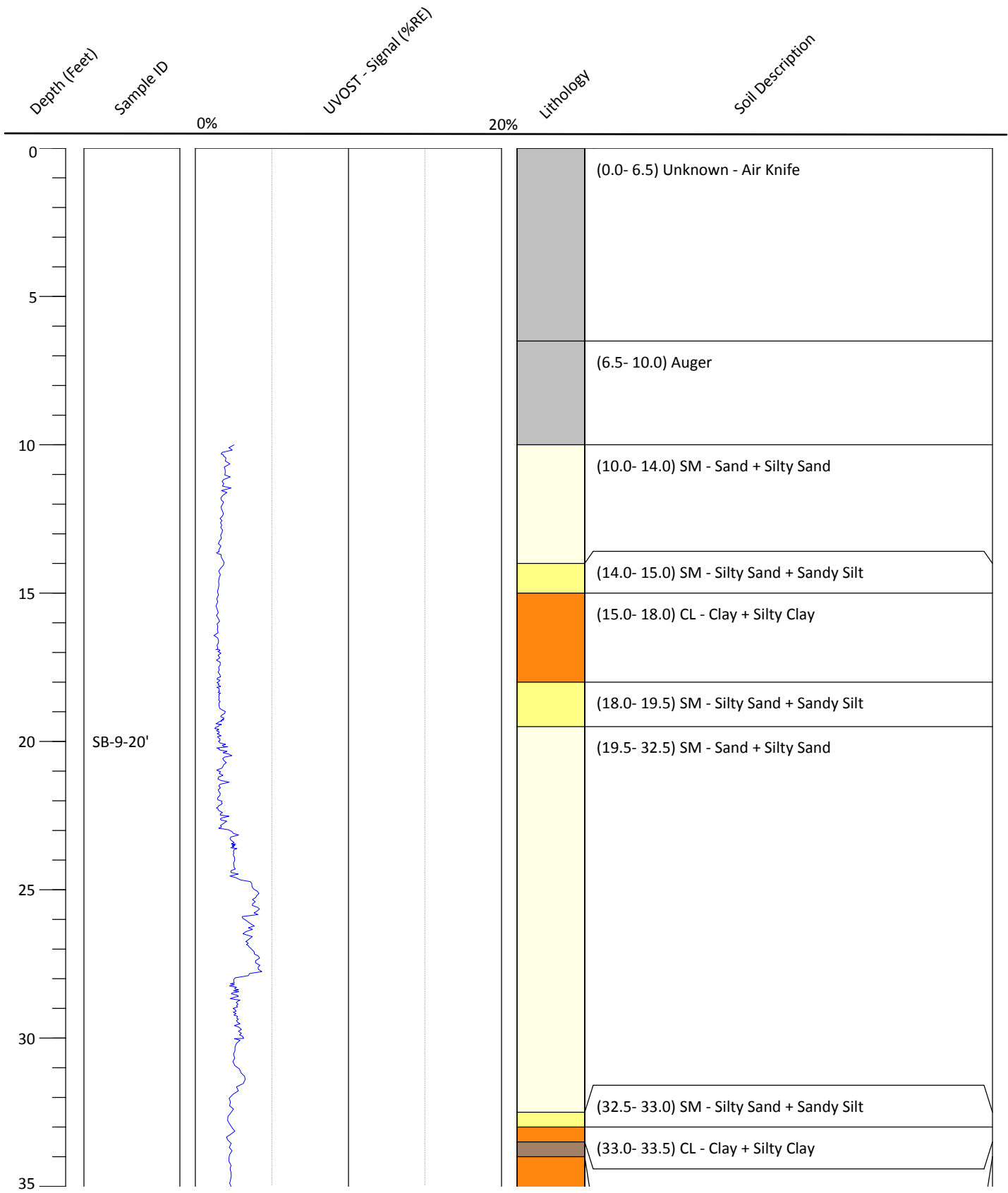
BORING ID: SB-9

DRILLING COMPANY: Gregg Drilling

SAMPLE METHOD: Direct Push

BORE HOLE DIAMETER: 1.78"

DRILLING METHOD: CPT





LITHOLOGIC LOG

PROJECT NAME: BP 498

PROJECT NUMBER: 08-82-498

DATE: 3/22/2013

SITE ADDRESS: 286 South Livermore Ave., Livermore, CA

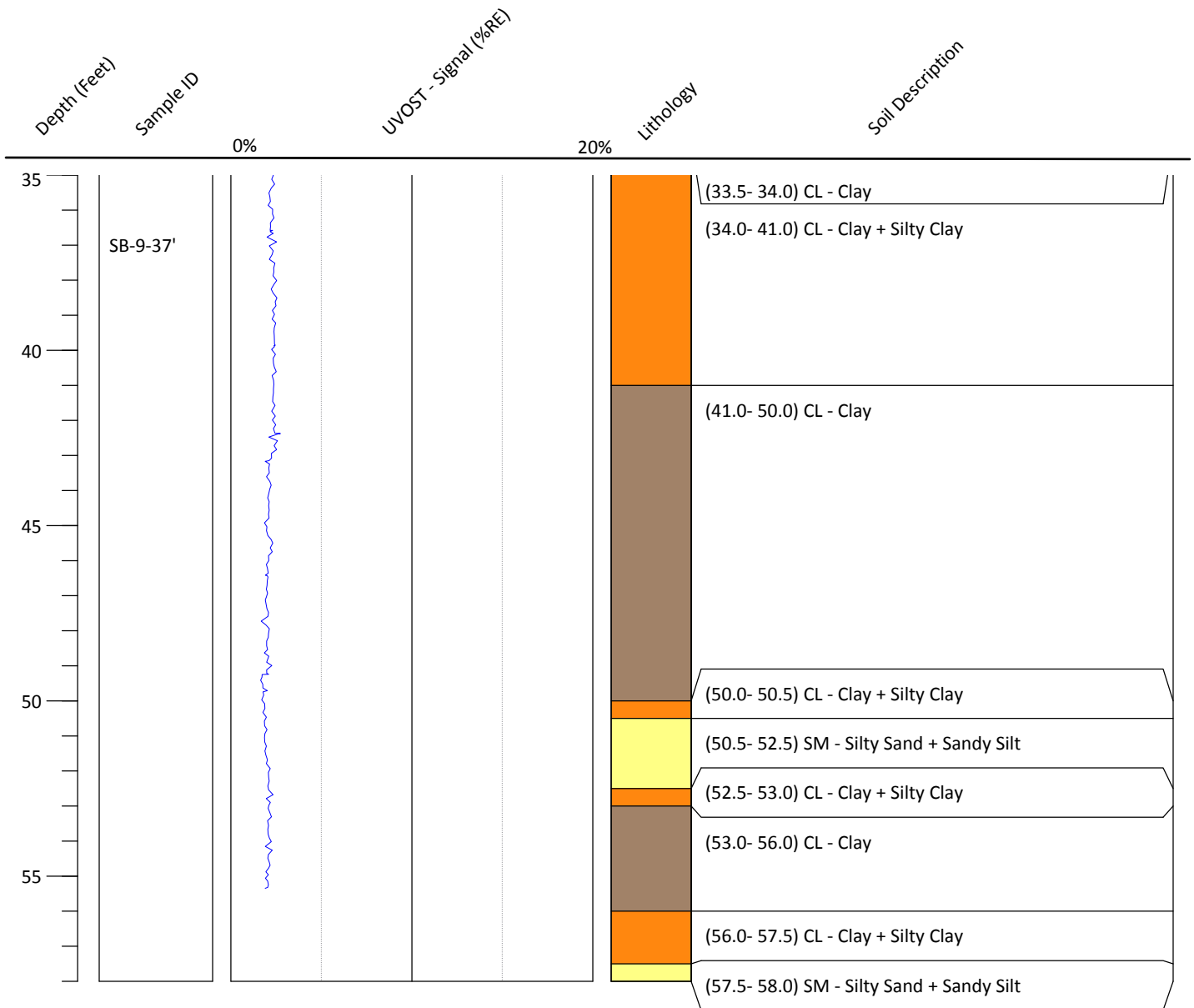
BORING ID: SB-9

DRILLING COMPANY: Gregg Drilling

SAMPLE METHOD: Direct Push

BORE HOLE DIAMETER: 1.78"

DRILLING METHOD: CPT





LITHOLOGIC LOG

PROJECT NAME: BP 498

PROJECT NUMBER: 08-82-603

DATE: 3/18/2013

SITE ADDRESS: 286 South Livermore Ave., Livermore, CA

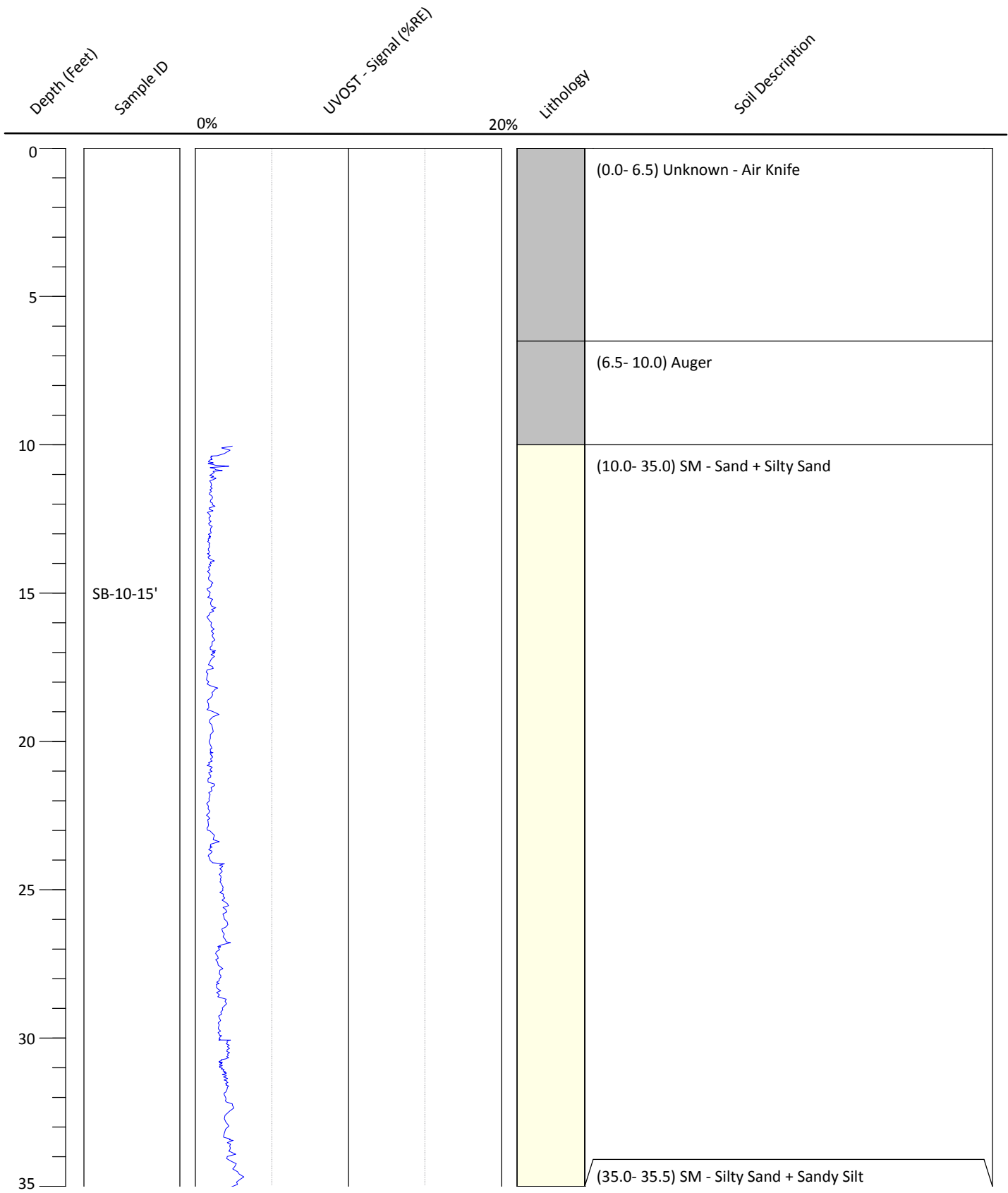
BORING ID: SB-10

DRILLING COMPANY: Gregg Drilling

SAMPLE METHOD: Direct Push

BORE HOLE DIAMETER: 1.78"

DRILLING METHOD: CPT



LITHOLOGIC LOG

PROJECT NAME: BP 498

PROJECT NUMBER: 08-82-603

DATE: 3/18/2013

SITE ADDRESS: 286 South Livermore Ave., Livermore, CA

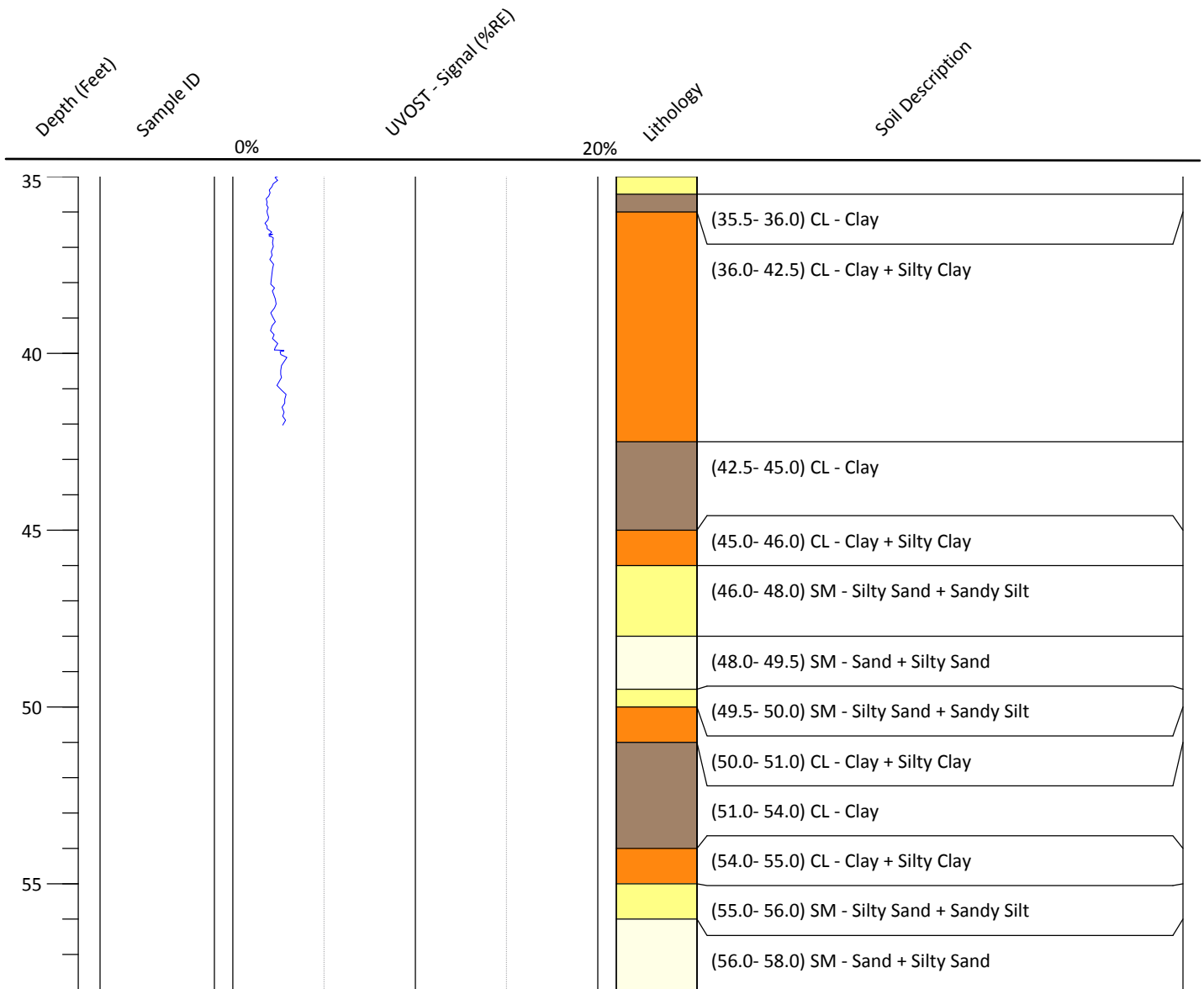
BORING ID: SB-10

DRILLING COMPANY: Gregg Drilling

SAMPLE METHOD: Direct Push

BORE HOLE DIAMETER: 1.78"

DRILLING METHOD: CPT





LITHOLOGIC LOG

PROJECT NAME: BP 498

PROJECT NUMBER: 08-82-603

DATE: 3/20/2013

SITE ADDRESS: 286 South Livermore Ave., Livermore, CA

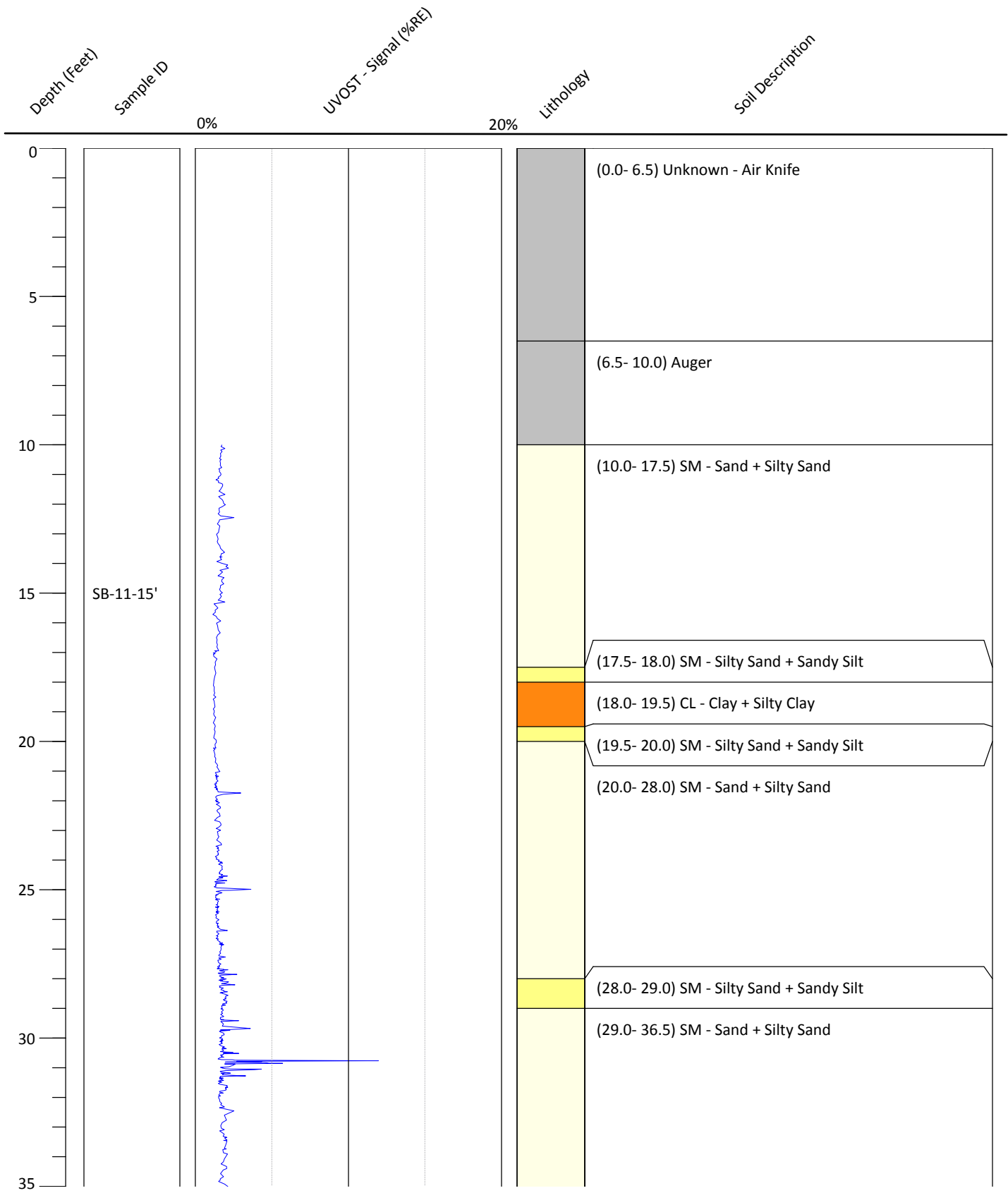
BORING ID: SB-11

DRILLING COMPANY: Gregg Drilling

SAMPLE METHOD: Direct Push

BORE HOLE DIAMETER: 1.78"

DRILLING METHOD: CPT



LITHOLOGIC LOG

PROJECT NAME: BP 498

PROJECT NUMBER: 08-82-603

DATE: 3/20/2013

SITE ADDRESS: 286 South Livermore Ave., Livermore, CA

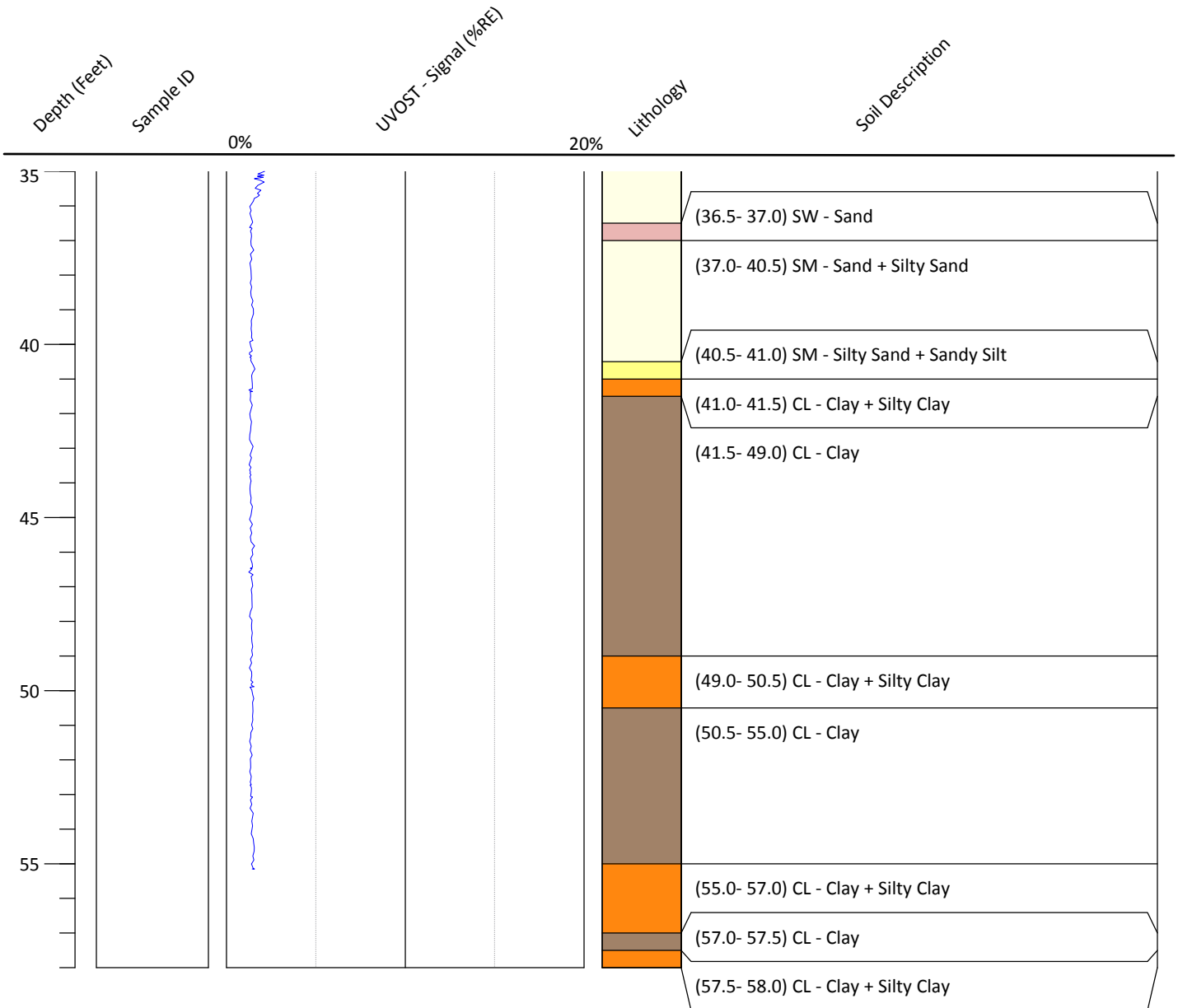
BORING ID: SB-11

DRILLING COMPANY: Gregg Drilling

SAMPLE METHOD: Direct Push

BORE HOLE DIAMETER: 1.78"

DRILLING METHOD: CPT





LITHOLOGIC LOG

PROJECT NAME: BP 498

PROJECT NUMBER: 08-82-603

DATE: 3/20/2013

SITE ADDRESS: 286 South Livermore Ave., Livermore, CA

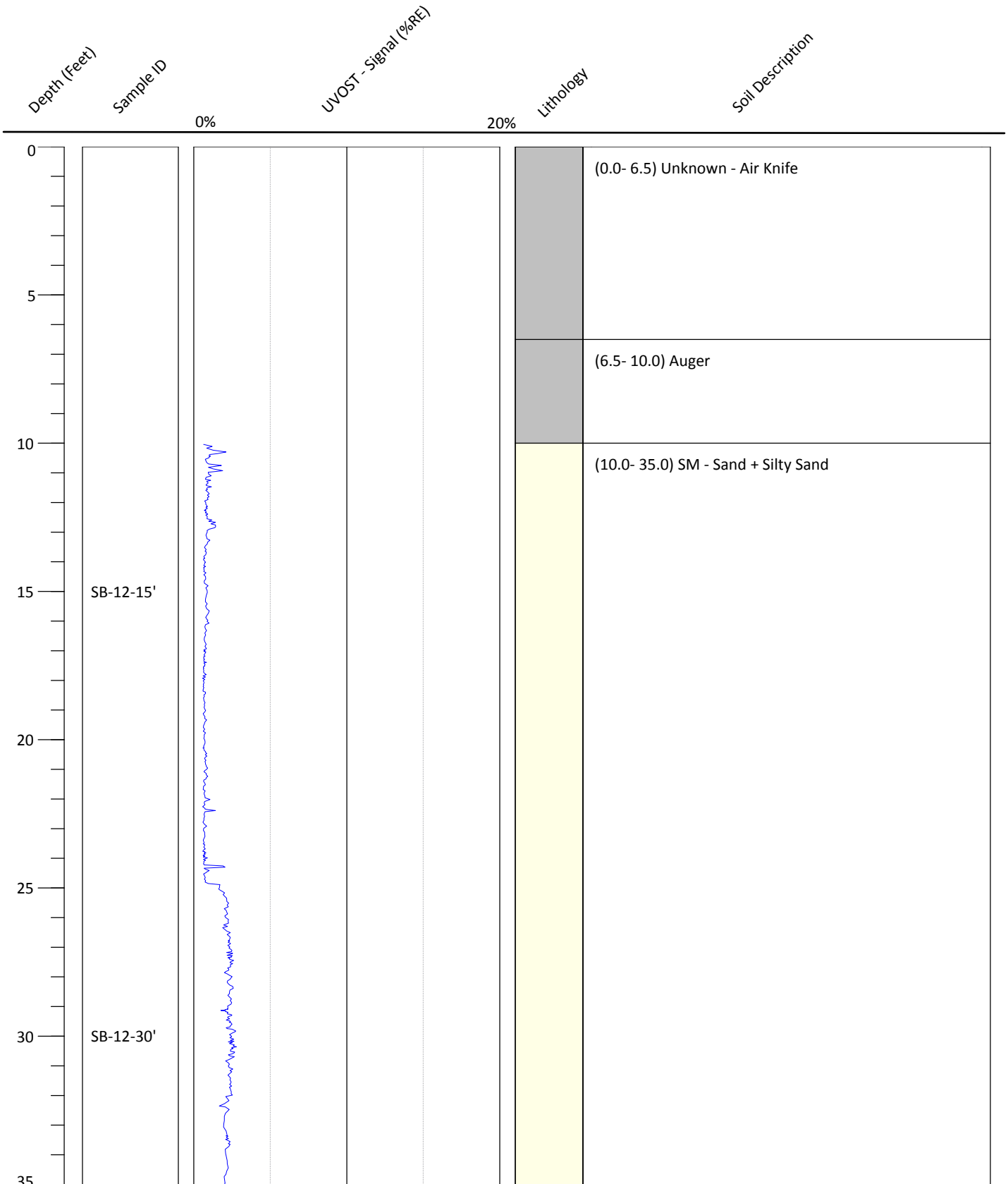
BORING ID: SB-12

DRILLING COMPANY: Gregg Drilling

SAMPLE METHOD: Direct Push

BORE HOLE DIAMETER: 1.78"

DRILLING METHOD: CPT



LITHOLOGIC LOG

PROJECT NAME: BP 498

PROJECT NUMBER: 08-82-603

DATE: 3/20/2013

SITE ADDRESS: 286 South Livermore Ave., Livermore, CA

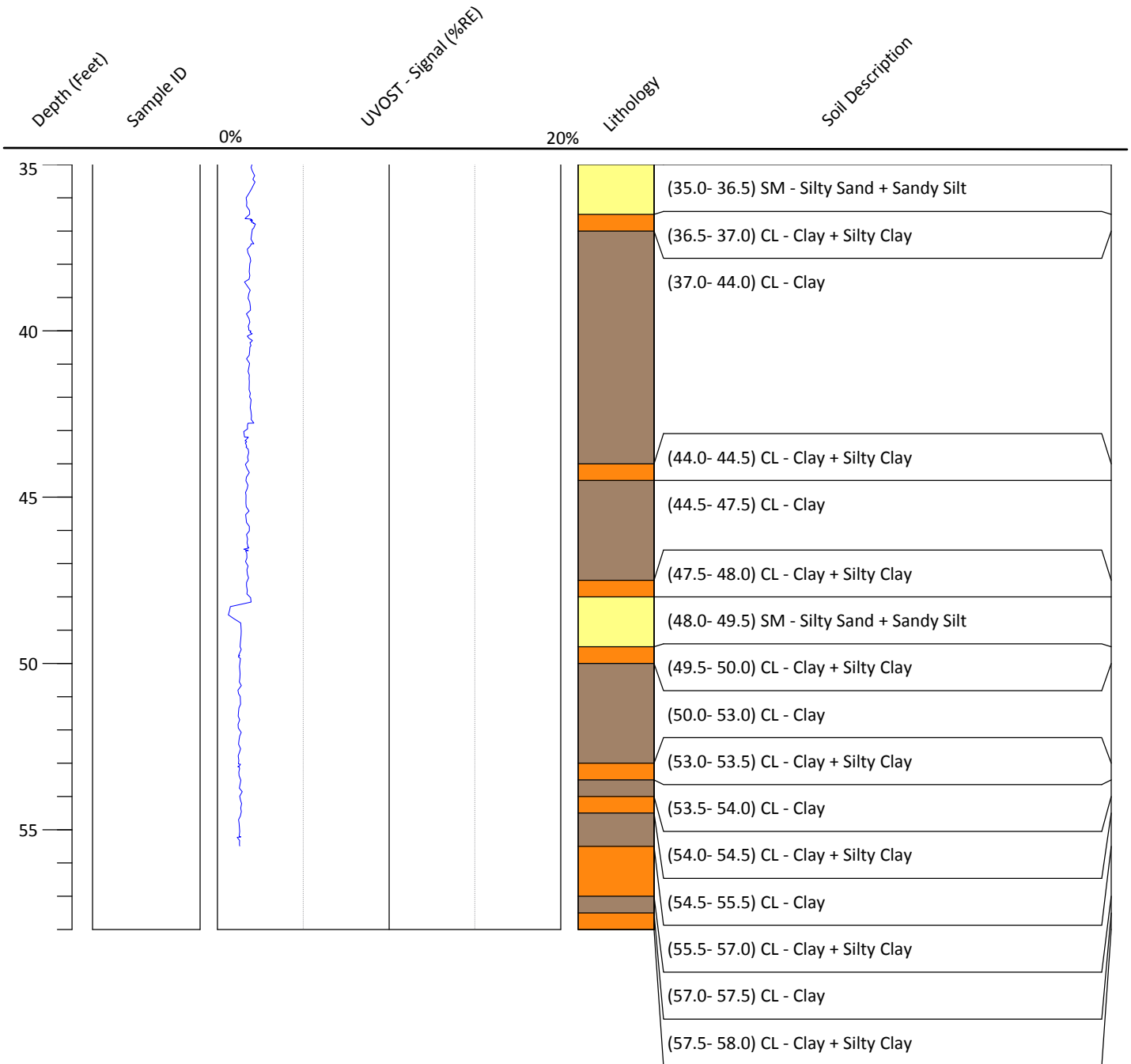
BORING ID: SB-12

DRILLING COMPANY: Gregg Drilling

SAMPLE METHOD: Direct Push

BORE HOLE DIAMETER: 1.78"

DRILLING METHOD: CPT





LITHOLOGIC LOG

PROJECT NAME: BP-498

PROJECT NUMBER: 08-82-603

DATE: 3/21/2013

SITE ADDRESS: 286 South Livermore Ave, Livermore, CA

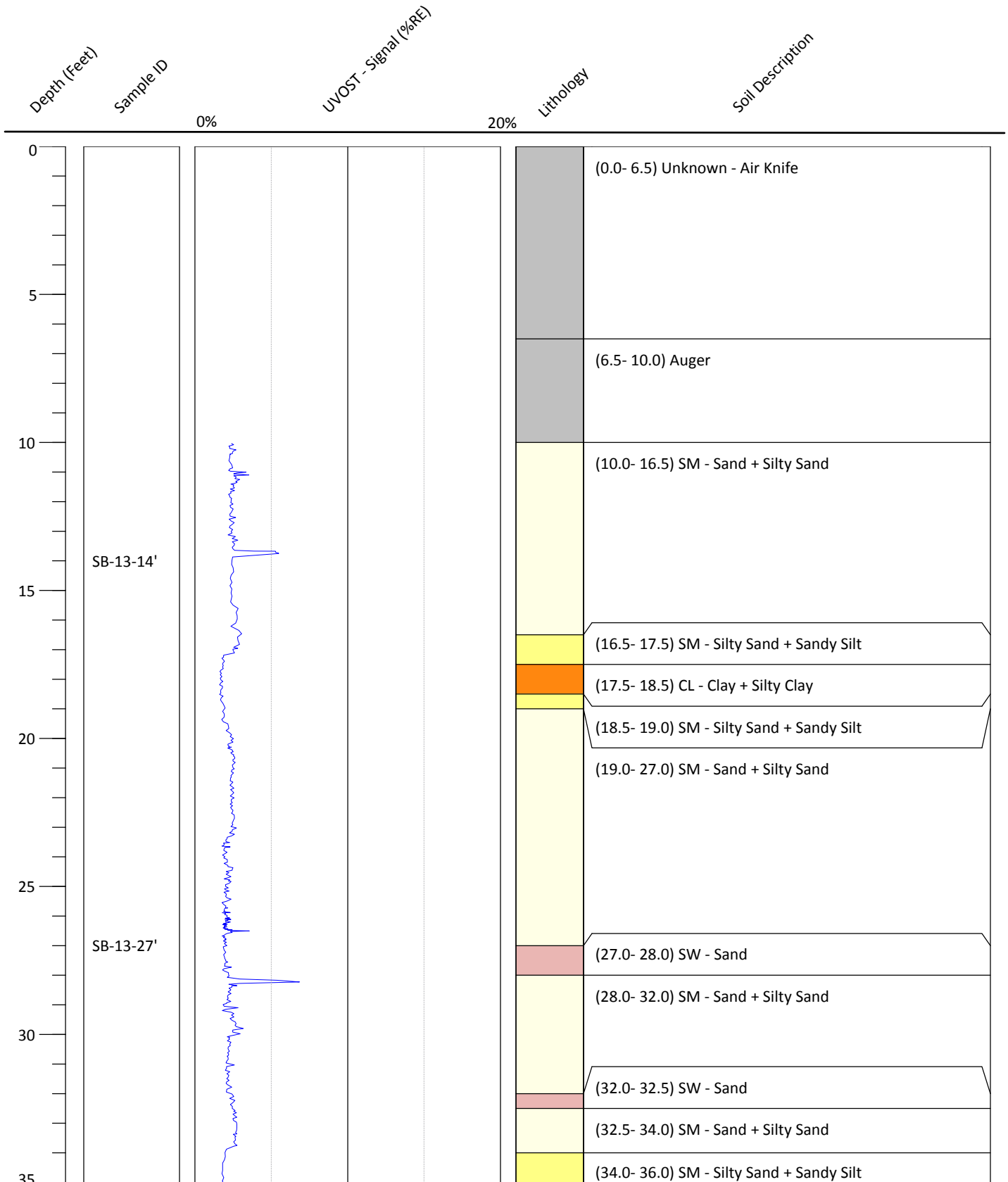
BORING ID: SB-13

DRILLING COMPANY: Gregg Drilling

SAMPLE METHOD: Direct Push

BORE HOLE DIAMETER: 1.78"

DRILLING METHOD: CPT





LITHOLOGIC LOG

PROJECT NAME: BP-498

PROJECT NUMBER: 08-82-603

DATE: 3/21/2013

SITE ADDRESS: 286 South Livermore Ave, Livermore, CA

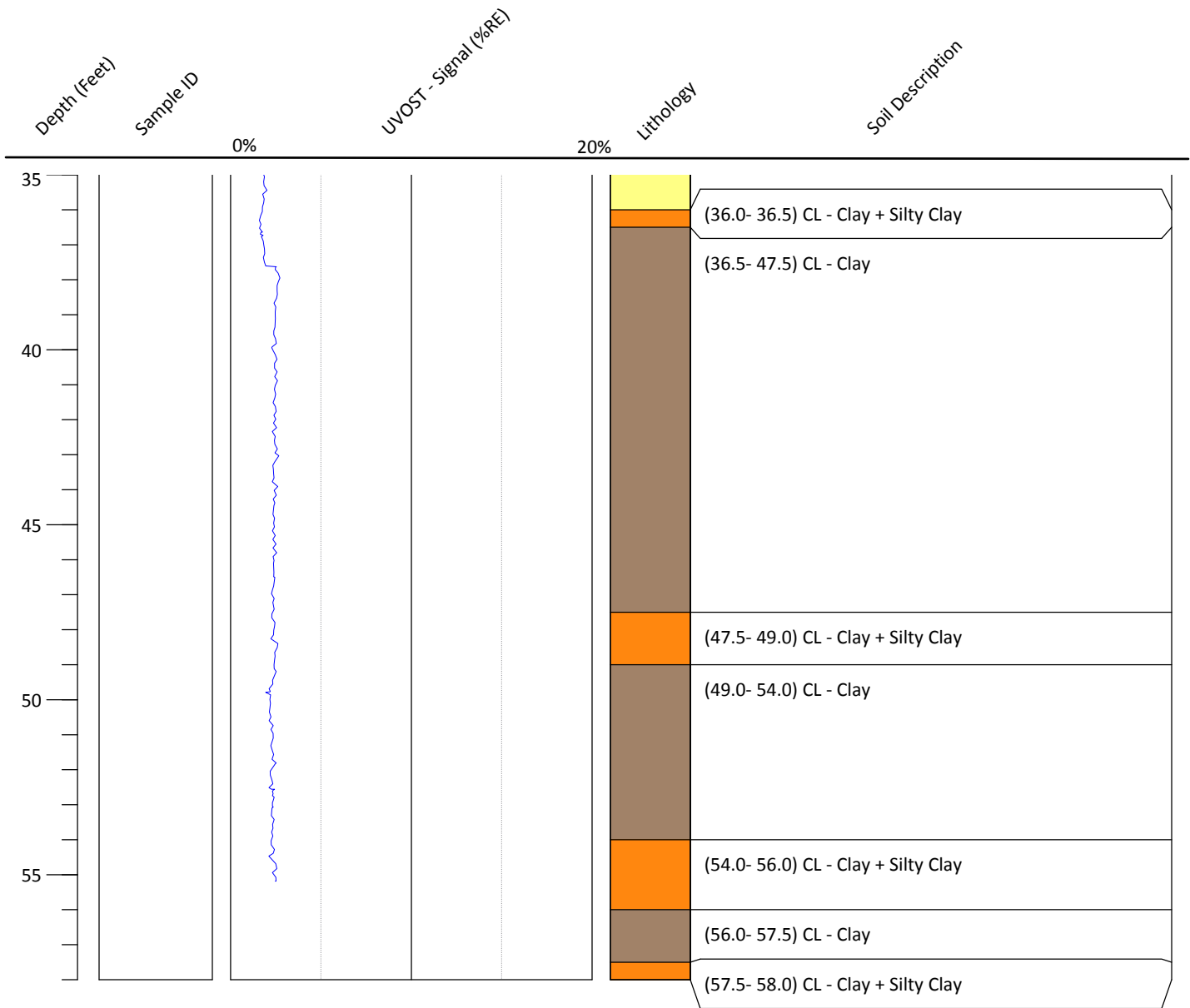
BORING ID: SB-13

DRILLING COMPANY: Gregg Drilling

SAMPLE METHOD: Direct Push

BORE HOLE DIAMETER: 1.78"

DRILLING METHOD: CPT





LITHOLOGIC LOG

PROJECT NAME: BP 498

PROJECT NUMBER: 08-82-603

DATE: 3/22/2013

SITE ADDRESS: 286 Livermore Ave., Livermore, CA

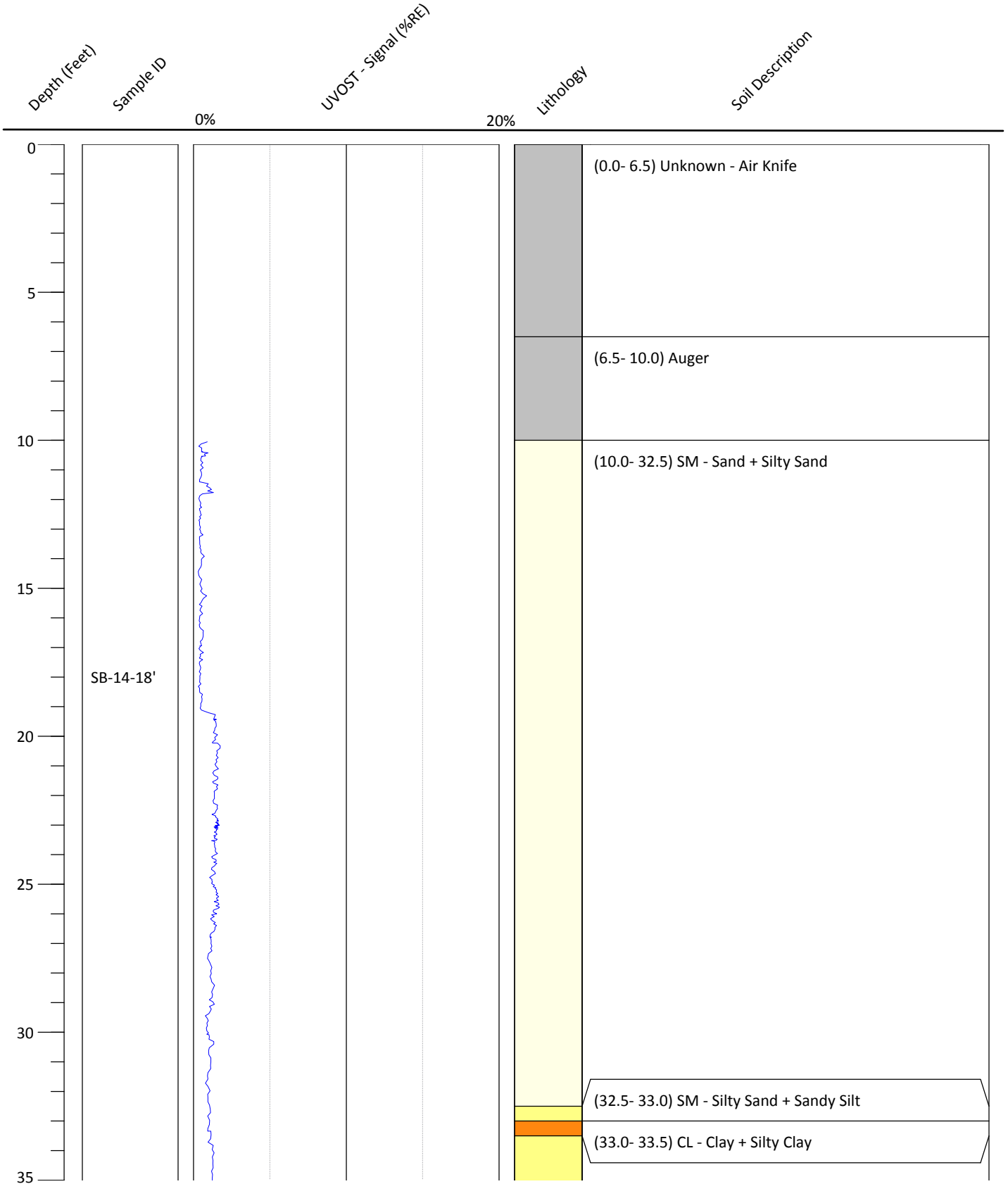
BORING ID: SB-14

DRILLING COMPANY: Gregg Drilling

SAMPLE METHOD: Direct Push

BORE HOLE DIAMETER: 1.78"

DRILLING METHOD: CPT



LITHOLOGIC LOG

PROJECT NAME: BP 498

PROJECT NUMBER: 08-82-603

DATE: 3/22/2013

SITE ADDRESS: 286 Livermore Ave., Livermore, CA

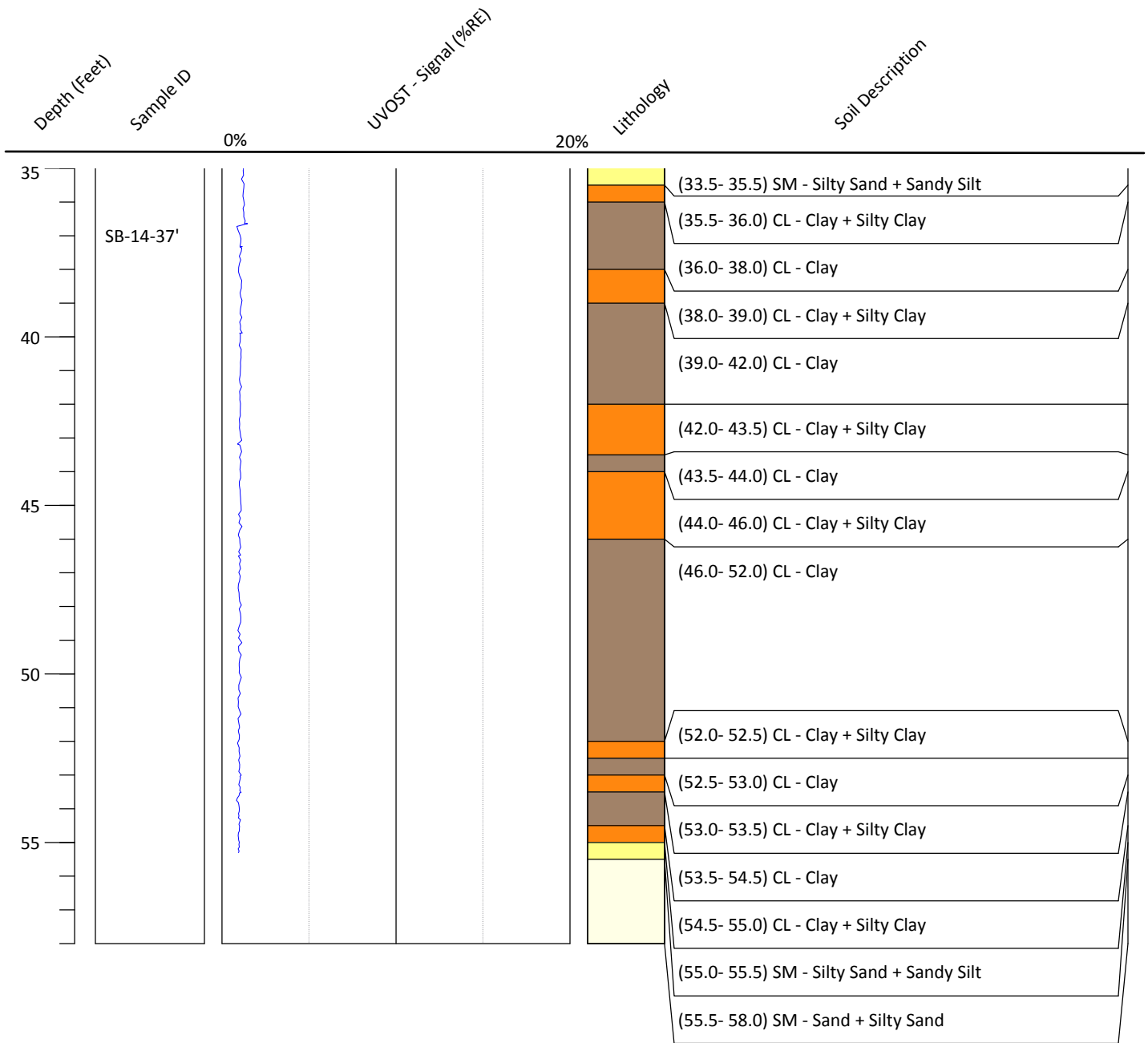
BORING ID: SB-14

DRILLING COMPANY: Gregg Drilling

SAMPLE METHOD: Direct Push

BORE HOLE DIAMETER: 1.78"

DRILLING METHOD: CPT





LITHOLOGIC LOG

PROJECT NAME: BP 498

PROJECT NUMBER: 08-82-603

DATE: 3/21/2013

SITE ADDRESS: 286 South Livermore Ave., Livermore, CA

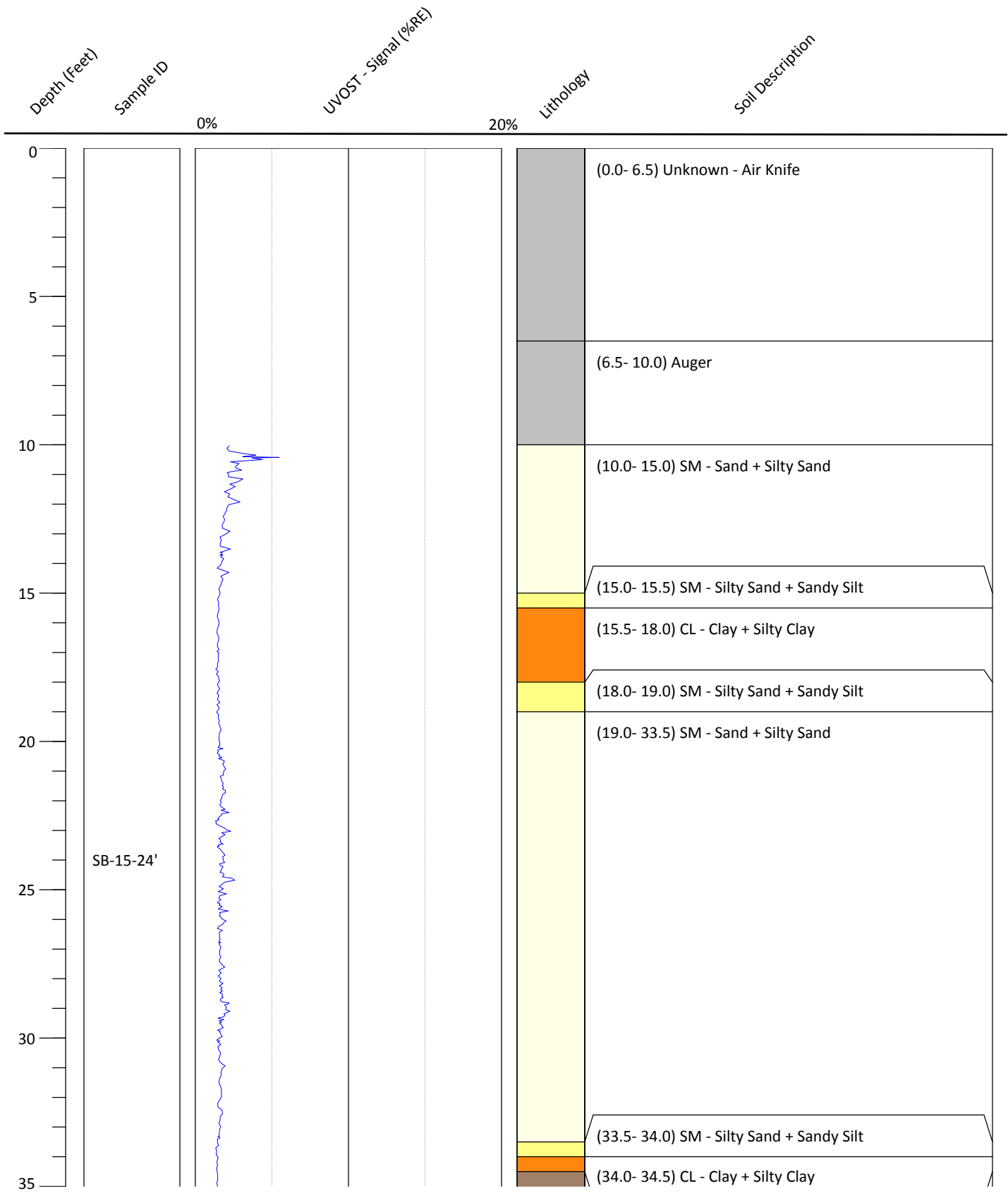
BORING ID: SB-15

DRILLING COMPANY: Gregg Drilling

SAMPLE METHOD: Direct Push

BORE HOLE DIAMETER: 1.78"

DRILLING METHOD: CPT



SB-15-24'

LITHOLOGIC LOG

PROJECT NAME: BP 498

PROJECT NUMBER: 08-82-603

DATE: 3/21/2013

SITE ADDRESS: 286 South Livermore Ave., Livermore, CA

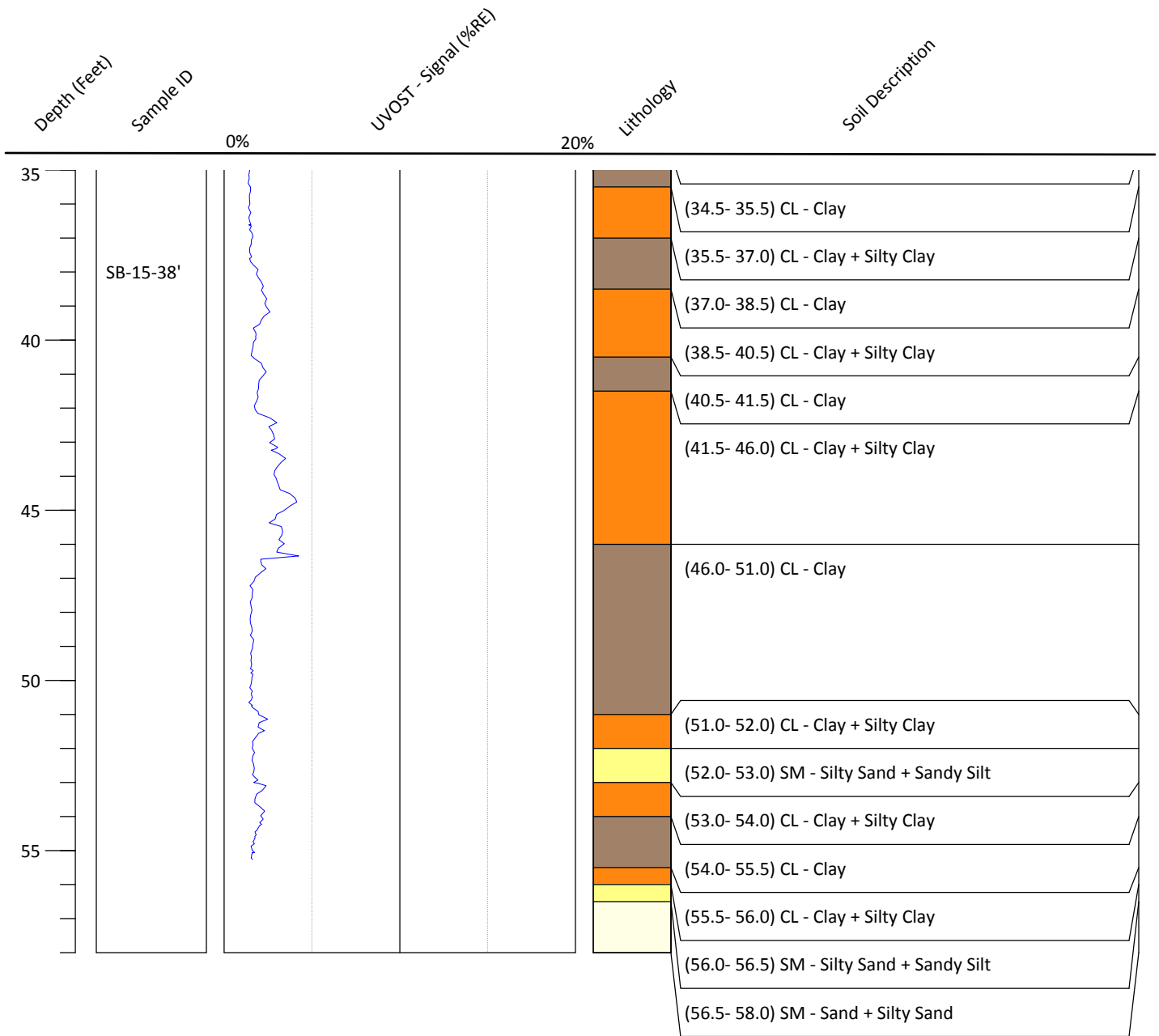
BORING ID: SB-15

DRILLING COMPANY: Gregg Drilling

SAMPLE METHOD: Direct Push

BORE HOLE DIAMETER: 1.78"

DRILLING METHOD: CPT





LITHOLOGIC LOG

PROJECT NAME: BP 498

PROJECT NUMBER: 08-82-603

DATE: 3/21/2013

SITE ADDRESS: 286 South Livermore Ave., Livermore, CA

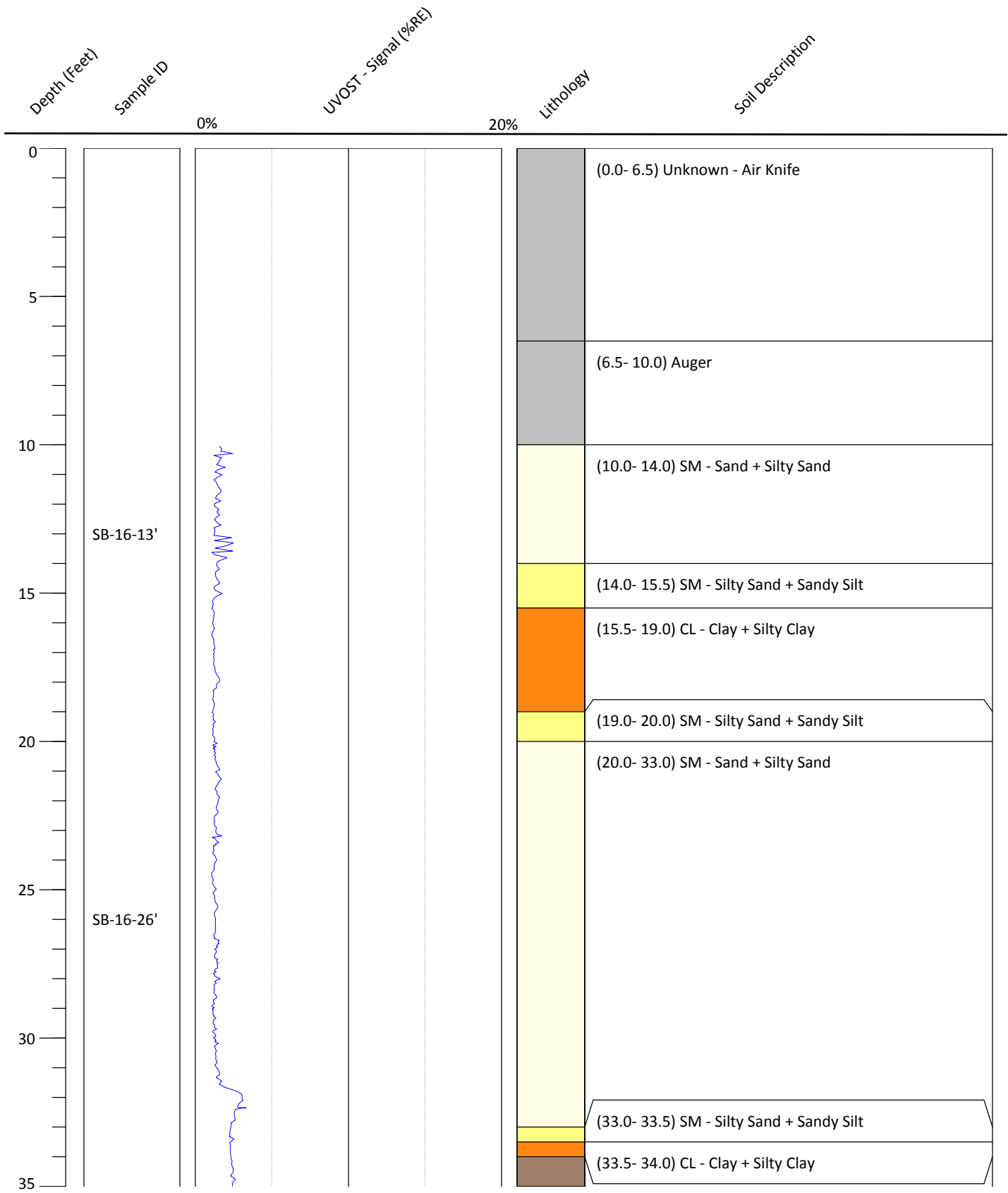
BORING ID: SB-16

DRILLING COMPANY: Gregg Drilling

SAMPLE METHOD: Direct Push

BORE HOLE DIAMETER: 1.78"

DRILLING METHOD: CPT



LITHOLOGIC LOG

PROJECT NAME: BP 498

PROJECT NUMBER: 08-82-603

DATE: 3/21/2013

SITE ADDRESS: 286 South Livermore Ave., Livermore, CA

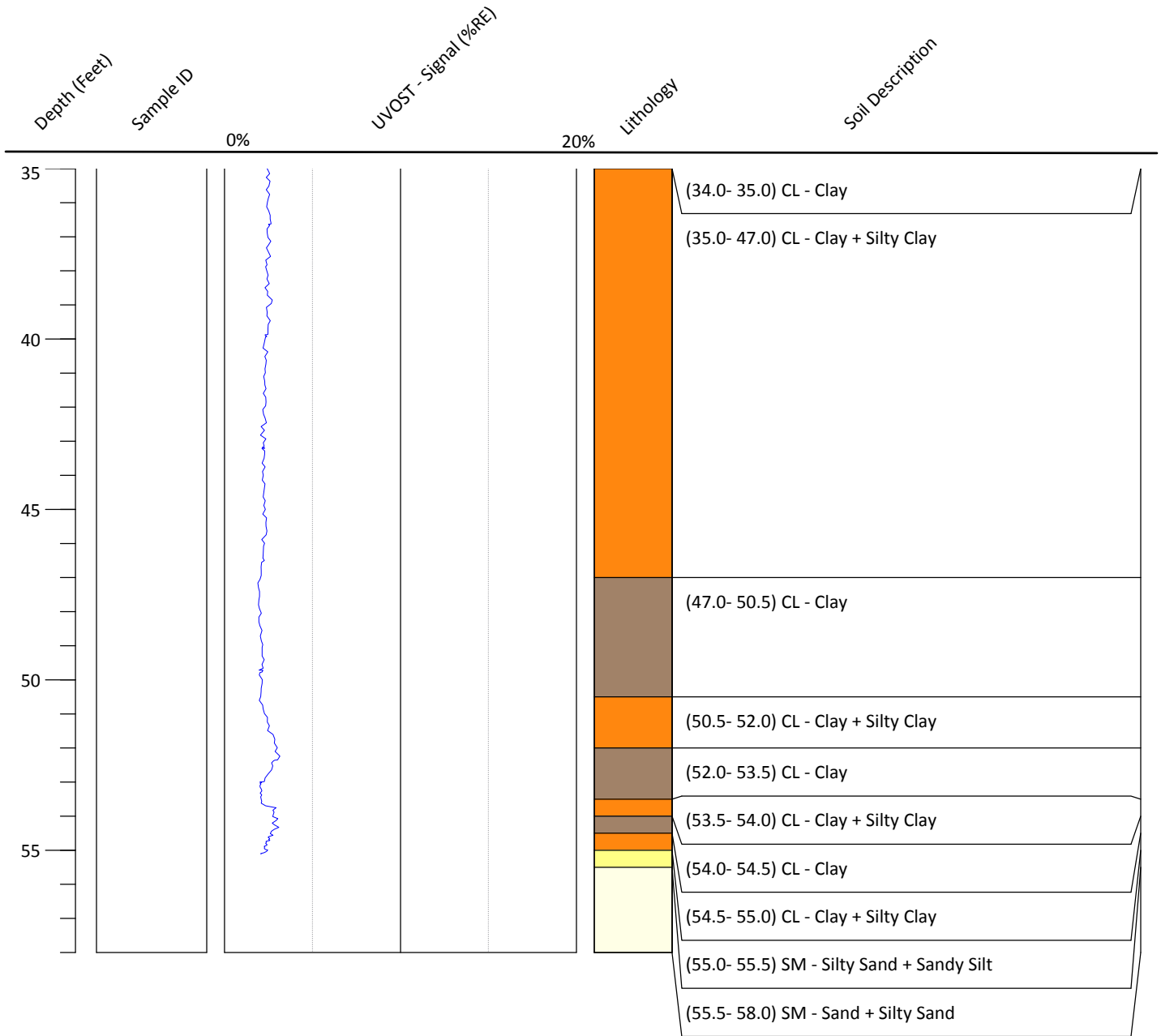
BORING ID: SB-16

DRILLING COMPANY: Gregg Drilling

SAMPLE METHOD: Direct Push

BORE HOLE DIAMETER: 1.78"

DRILLING METHOD: CPT



APPENDIX D

Field Methods

QUALITY ASSURANCE/QUALITY CONTROL FIELD METHODS

Field methods discussed herein were implemented to provide for accuracy and reliability of field activities, data collection, sample collection, and handling. Discussion of these methods is provided below.

1.0 Equipment Calibration

Equipment calibration was performed per equipment manufacturer specifications before use.

2.0 Depth to Groundwater and Light Non-Aqueous Phase Liquid Measurement

Depth to groundwater was measured in wells identified for gauging in the scope of work using a decontaminated water level indicator. The depth to water measurement was taken from a cut notch or permanent mark at the top of the well casing to which the well head elevation was originally surveyed.

Once depth to water was measured, an oil/water interface meter or a new disposable bailer was utilized to evaluate the presence and, if present, to measure the “apparent” thickness of light non-aqueous phase liquid (LNAPL) in the well. If LNAPL was present in the well, groundwater purging and sampling were not performed, unless sampling procedures in the scope of work specified collection of samples in the presence of LNAPL. Otherwise, time allowing, LNAPL was bailed from the well using either a new disposable bailer, or the disposal bailer previously used for initial LNAPL assessment. Bailing of LNAPL continued until the thickness of LNAPL (or volume) stabilized in each bailer pulled from the well, or LNAPL was no longer present. After LNAPL thickness either stabilized or was eliminated, periodic depth to water and depth to LNAPL measurements were collected as product came back into the well to evaluate product recovery rate and to aid in further assessment of LNAPL in the subsurface. LNAPL thickness measurements were recorded as “apparent.” If a bailer was used for LNAPL thickness measurement, the field sampler noted the bailer entry diameter and chamber diameter to enable correction of thickness measurements. Recovered LNAPL was stored on-site in a labeled steel drum(s) or other appropriate container(s) prior to disposal.

3.0 Well Purging and Groundwater Sample Collection

Well purging and groundwater sampling were performed in wells specified in the scope of work after measuring depth to groundwater and evaluating the presence of LNAPL. Purging and sampling were performed using one of the methods detailed below. The method used was noted in the field records. Purge water was stored on-site in labeled steel drum(s) or other appropriate container(s) prior to disposal or on-site treatment (in cases where treatment using an on-site system is authorized).

3.1 Purging a Predetermined Well Volume

Purging a predetermined well volume is performed per ASTM International (ASTM) D4448-01. This purging method has the objective of removing a predetermined volume of stagnant water from the well prior to sampling. The volume of stagnant water

is defined as either the volume of water contained within the well casing, or the volume within the well casing and sand/gravel in the annulus if natural flow through these is deemed insufficient to keep them flushed out.

This purging method involves removal of a minimum of three stagnant water volumes from the well using a decontaminated pump with new disposable plastic discharge or suction tubing, dedicated well tubing, or using a new disposable or decontaminated reusable bailer. If a new disposable bailer was used for assessment of LNAPL, that bailer may be used for purging. The withdrawal rate used is one that minimizes drawdown while satisfying time constraints.

To evaluate when purging is complete, one or more groundwater stabilization parameters are monitored and recorded during purging activities until stabilization is achieved. Most commonly, stabilization parameters include temperature, conductivity, and pH, but field procedures detailed in the scope of work may also include monitoring of dissolved oxygen concentrations, oxidation reduction potential, and/or turbidity¹. Parameters are considered stable when two (2) consecutive readings recorded three (3) minutes apart fall within ranges provided below in Table 1. In the event that the parameters have not stabilized and five (5) well casing volumes have been removed, purging activities will cease and be considered complete. Once the well is purged, a groundwater sample(s) is collected from the well using a new disposable bailer. If a new disposable bailer was used for purging, that bailer may be used to collect the sample(s). A sample is not collected if the well is inadvertently purged dry.

Table 1. Criteria for Defining Stabilization of Water-Quality Indicator Parameters

Parameter	Stabilization Criterion
Temperature	± 0.2°C (± 0.36°F)
pH	± 0.1 standard units
Conductivity	± 3%
Dissolved oxygen	± 10%
Oxidation reduction potential	± 10 mV
Turbidity ¹	± 10% or 1.0 NTU (whichever is greater)

3.2 Low-Flow Purging and Sampling

“Low-Flow”, “Minimal Drawdown”, or “Low-Stress” purging is performed per ASTM D6771-02. It is a method of groundwater removal from within a well’s screened interval that is intended to minimize drawdown and mixing of the water column in the well casing. This is accomplished by pumping the well using a decontaminated pump with new disposable plastic discharge or suction tubing or dedicated well tubing at a low flow rate while evaluating the groundwater elevation during pumping.

¹ As stated in ASTM D6771-02, turbidity is not a chemical parameter and not indicative of when formation-quality water is being purged; however, turbidity may be helpful in evaluating stress on the formation during purging. Turbidity measurements are taken at the same time that stabilization parameter measurements are made, or, at a minimum, once when purging is initiated and again just prior to sample collection, after stabilization parameters have stabilized. To avoid artifacts in sample analysis, turbidity should be as low as possible when samples are collected. If turbidity values are persistently high, the withdrawal rate is lowered until turbidity decreases. If high turbidity persists even after lowering the withdrawal rate, the purging is stopped for a period of time until turbidity settles, and the purging process is then restarted. If this fails to solve the problem, the purging/sampling process for the well is ceased, and well maintenance or redevelopment is considered.

The low flow pumping rate is well specific and is generally established at a volume that is less than or equal to the natural recovery rate of the well. A pump with adjustable flow rate control is positioned with the intake at or near the mid-point of the submerged well screen. The pumping rate used during low-flow purging is low enough to minimize mobilization of particulate matter and drawdown (stress) of the water column. Low-flow purging rates will vary based on the individual well characteristics; however, the purge rate should not exceed 1.0 Liter per minute (L/min) or 0.25 gallon per minute (gal/min). Low-flow purging should begin at a rate of approximately 0.1 L/min (0.03 gal/min)², or the lowest rate possible, and be adjusted based on an evaluation of drawdown. Water level measurements should be recorded at approximate one (1) to two (2) minute intervals until the low-flow rate has been established, and drawdown is minimized. As a general rule, drawdown should not exceed 25% of the distance between the top of the water column and the pump in-take.

To evaluate when purging is complete, one or more groundwater stabilization parameters are monitored and recorded during purging activities until stabilization is achieved. Most commonly, stabilization parameters include temperature, conductivity, and pH, but field procedures detailed in the scope of work may also include monitoring of dissolved oxygen concentrations, oxidation reduction potential, and/or turbidity¹. The frequency between measurements will be at an interval of one (1) to three (3) minutes; however, if a flow cell is used, the frequency will be determined based on the time required to evacuate one cell volume. Stabilization is defined as three (3) consecutive readings recorded several minutes apart falling within ranges provided in Table 1. Samples will be collected by filling appropriate containers from the pump discharge tubing at a rate not to exceed the established pumping rate.

3.3 Minimal Purge, Discrete Depth, and Passive Sampling

Per ASTM D4448-01, sampling techniques that do not rely on purging, or require only minimal purging, may be used if a particular zone within a screened interval is to be sampled or if a well is not capable of yielding sufficient groundwater for purging. To properly use these sampling techniques, a water sample is collected within the screened interval with little or no mixing of the water column within the casing. These techniques include minimal purge sampling which uses a dedicated sampling pump capable of pumping rates of less than 0.1 L/min (0.03 gal/min)², discrete depth sampling using a bailer that allows groundwater entry at a controlled depth (e.g. differential pressure bailer), or passive (diffusion) sampling. These techniques are based on certain studies referenced in ASTM D4448-01 that indicate that under certain conditions, natural groundwater flow is laminar and horizontal with little or no mixing within the well screen.

² According to ASTM D4448-01, studies have indicated that at flow rates of 0.1 L/min, low-density polyethylene (LDPE) and plasticized polypropylene tubing materials are prone to sorption. Therefore, TFE-fluorocarbon or other appropriate tubing material is used, particularly when tubing lengths of 50 feet or longer are used.

4.0 Decontamination

Reusable groundwater sampling equipment were cleaned using a solution of Alconox or other acceptable detergent, rinsed with tap water, and finally rinsed with distilled water prior to use in each well. Decontamination water was stored on-site in labeled steel drum(s) or other appropriate container(s) prior to disposal.

5.0 Sample Containers, Labeling, and Storage

Samples were collected in laboratory prepared containers with appropriate preservative (if preservative was required). Samples were properly labeled (site name, sample I.D., sampler initials, date, and time of collection) and stored chilled (refrigerator or ice chest with ice) until delivery to a certified laboratory, under chain of custody procedures.

6.0 Chain of Custody Record and Procedure

The field sampler was personally responsible for care and custody of the samples collected until they were properly transferred to another party. To document custody and transfer of samples, a Chain of Custody Record was prepared. The Chain of Custody Record provided identification of the samples corresponding to sample labels and specified analyses to be performed by the laboratory. The original Chain of Custody Record accompanied the shipment, and a copy of the record was stored in the project file. When the samples were transferred, the individuals relinquishing and receiving them signed, dated, and noted the time of transfer on the record.

7.0 Field Records

Daily Report and data forms were completed by staff personnel to provide daily record of significant events, observations, and measurements. Field records were signed, dated, and stored in the project file.

APPENDIX E

Field Data Sheets



Project: BP 498 Project No.: 08-82-603
Field Representative(s): AM/NV Day: Tuesday Date: 2/10/15
Time Onsite: From: 0815 To: 1230; From: _____ To: _____; From: _____ To: _____

- Signed HASP
- Safety Glasses
- Hard Hat
- Steel Toe Boots
- Safety Vest
- UST Emergency System Shut-off Switches Located
- Proper Gloves
- Proper Level of Barricading
- Other PPE (describe) _____

Weather: Sunny

Equipment In Use: H₂O Level meter, V52 meter, bladder pump

Visitors: None

TIME:

WORK DESCRIPTION:

<u>0815</u>	<u>Arrived onsite. Conducted tailgate.</u>
<u>0830</u>	<u>Set up to gauge wells.</u>
<u>0900</u>	<u>Set up @ Mw-2 for sampling</u>
<u>0930</u>	<u>Set up @ Mw-1 & Mw-5A/B</u>
<u>1050</u>	<u>Set up @ Mw-3 & Mw-5A/B</u>
<u>1230</u>	<u>Completed fieldwork & offsite.</u>

Signature:



GROUNDWATER MONITORING SITE SHEET

Project: BP 498 Project No.: 08-82-603 Date: 2/10/15
 Field Representative: AM/NV Elevation: —
 Formation recharge rate is historically: High Low (circle one)
 W. L. Indicator ID #: — Oil/Water Interface ID #: — (List #s of all equip used)

WELL ID RECORD					WELL GAUGING RECORD					LAB ANALYSES		
Well ID	Well Sampling Order	As-Built Well Diameter (inches)	As-Built Well Screen Interval (ft)	Previous Depth to Water (ft)	Time (24 00)	Depth to LNAPL (ft)	Apparent LNAPL Thickness (ft)*	Depth to Water (ft)	Well Total Depth (ft)			
Mw-1					0833			29.89	40.30			
Mw-2					0850			41.40	57.18			
Mw-3					0843			40.87	55.43			
Mw-4					0848			39.85	40.13			
Mw-5A					0846			40.58	49.66			
Mw-5B					0845			40.60	65.79			
Mw-6A					0839			44.04	49.69			
Mw-6B					0835			42.03	69.59			

* Device used to measure LNAPL thickness: Bailer Oil/Water Interface Meter (circle one)
 If bailer used, note bailer dimensions (inches): Entry Diameter _____ Chamber Diameter _____

Signature: Ally [Signature]



GROUNDWATER SAMPLING DATA SHEET

Project: BP 498 Project No.: 08-92-603 Date: 2/10/15
 Field Representative: AM/NV
 Well ID: MW-1 Start Time: 0930 End Time: 0950 Total Time (minutes): 20

PURGE EQUIPMENT Disp. Bailer 120V Pump Flow Cell
 Disp. Tubing 12V Pump Peristaltic Pump Other/ID#: Bladder Pump

WELL HEAD INTEGRITY (cap, lock, vault, etc.) Comments: _____
 Good Improvement Needed (circle one)

PURGING/SAMPLING METHOD Predetermined Well Volume Low-Flow Other: _____ (circle one)

PREDETERMINED WELL VOLUME						LOW-FLOW		
Casing Diameter	Unit Volume (gal/ft) (circle one)					Previous Low-Flow Purge Rate:	(lpm)	
1" (0.04)	1.25" (0.08)	2" (0.17)	3" (0.38)	Other: _____	Total Well Depth (a):	<u>40.50</u> (ft)		
4" (0.66)	6" (1.50)	8" (2.60)	12" (5.81)	_____ ()	Initial Depth to Water (b):	<u>29.88</u> (ft)		
Total Well Depth (a): _____ (ft)					Pump In-take Depth = b + (a-b)/2:	<u>35.09</u> (ft)		
Initial Depth to Water (b): _____ (ft)					Maximum Allowable Drawdown = (a-b)/8:	<u>1.30</u> (ft)		
Water Column Height (WCH) = (a - b): _____ (ft)					Low-Flow Purge Rate:	<u>0.25</u> (lpm)*		
Water Column Volume (WCV) = WCH x Unit Volume: _____ (gal)					Comments:	_____		
Three Casing Volumes = WCV x 3: _____ (gal)					*Low-flow purge rate should be within range of instruments used but should not exceed 0.25 gpm. Drawdown should not exceed Maximum Allowable Drawdown.			
Five Casing Volumes = WCV x 5: _____ (gal)								
Pump Depth (if pump used): _____ (ft)								

GROUNDWATER STABILIZATION PARAMETER RECORD

Time (24:00)	Cumulative Vol. gal or l	Temperature °C	pH	Conductivity μS or mS	DO mg/L	ORP mV	Turbidity NTU	NOTES Odor, color, sheen or other
<u>0938</u>	<u>0.0</u>	<u>19.13</u>	<u>6.44</u>	<u>0.811</u>	<u>3.99</u>	<u>-152</u>	<u>>800</u>	
<u>0940</u>	<u>0.5</u>	<u>19.96</u>	<u>6.21</u>	<u>0.797</u>	<u>1.65</u>	<u>-165</u>	<u>576</u>	
<u>0942</u>	<u>1.0</u>	<u>20.21</u>	<u>6.07</u>	<u>0.791</u>	<u>1.11</u>	<u>-163</u>	<u>419</u>	
<u>0944</u>	<u>1.5</u>	<u>20.36</u>	<u>6.02</u>	<u>0.815</u>	<u>0.93</u>	<u>-162</u>	<u>66.3</u>	
<u>0946</u>	<u>2.0</u>	<u>20.46</u>	<u>6.04</u>	<u>0.838</u>	<u>0.83</u>	<u>-168</u>	<u>35.7</u>	

Previous Stabilized Parameters _____

PURGE COMPLETION RECORD Low Flow & Parameters Stable 3 Casing Volumes & Parameters Stable 5 Casing Volumes
 Other: _____

SAMPLE COLLECTION RECORD		GEOCHEMICAL PARAMETERS	
Parameter	Time	Measurement	
Depth to Water at Sampling: <u>32.25</u> (ft)			
Sample Collected Via: <input type="checkbox"/> Disp. Bailer <input type="checkbox"/> Dedicated Pump Tubing			
<input checked="" type="checkbox"/> Disp. Pump Tubing Other: _____			
Sample ID: <u>MW-1</u> Sample Collection Time: <u>0950</u> (24:00)			
Containers (#): <u>6</u> VOA (<input checked="" type="checkbox"/> preserved or <input type="checkbox"/> unpreserved) <input type="checkbox"/> Liter Amber			
Other: _____ Other: _____			
Other: _____ Other: _____			

Signature: [Signature]



GROUNDWATER SAMPLING DATA SHEET

Page 3 of 9

Project: BP 498 Project No.: 08-82-603 Date: 2/10/15
Field Representative: AM / NV
Well ID: MW-2 Start Time: 0900 End Time: 0920 Total Time (minutes): 20

PURGE EQUIPMENT Disp. Bailer 120V Pump Flow Cell
 Disp. Tubing 12V Pump Peristaltic Pump Other/ID#: Bladder Pump

WELL HEAD INTEGRITY (cap, lock, vault, etc.) Comments: _____
 Good Improvement Needed (circle one)

PURGING/SAMPLING METHOD Predetermined Well Volume Low-Flow Other: _____ (circle one)
PREDETERMINED WELL VOLUME
Casing Diameter | Unit Volume (gal/ft) (circle one)
1" | (0.04) 1.25" | (0.08) 2" | (0.17) 3" | (0.38) Other: _____
4" | (0.66) 6" | (1.50) 8" | (2.60) 12" | (5.81) _____ | (____)
Total Well Depth (a): _____ (ft)
Initial Depth to Water (b): _____ (ft)
Water Column Height (WCH) = (a - b): _____ (ft)
Water Column Volume (WCV) = WCH x Unit Volume: _____ (gal)
Three Casing Volumes = WCV x 3: _____ (gal)
Five Casing Volumes = WCV x 5: _____ (gal)
Pump Depth (if pump used): _____ (ft)
LOW-FLOW
Previous Low-Flow Purge Rate: _____ (lpm)
Total Well Depth (a): 57.18 (ft)
Initial Depth to Water (b): 41.40 (ft)
Pump In-take Depth = b + (a-b)/2: 49.29 (ft)
Maximum Allowable Drawdown = (a-b)/8: 1.97 (ft)
Low-Flow Purge Rate: 0.25 (Lpm)*
Comments: _____
**Low-flow purge rate should be within range of instruments used but should not exceed 0.25 gpm. Drawdown should not exceed Maximum Allowable Drawdown.*

GROUNDWATER STABILIZATION PARAMETER RECORD

Time (24:00)	Cumulative Vol. gal or (l)	Temperature °C	pH	Conductivity μ S or (mS)	DO mg/L	ORP mV	Turbidity NTU	NOTES Odor, color, sheen or other
<u>0910</u>	<u>0.0</u>	<u>16.96</u>	<u>6.04</u>	<u>1.4</u>	<u>4.64</u>	<u>82</u>	<u>7.0</u>	
<u>0912</u>	<u>0.5</u>	<u>18.20</u>	<u>6.25</u>	<u>1.13</u>	<u>3.09</u>	<u>92</u>	<u>6.0</u>	
<u>0914</u>	<u>1.0</u>	<u>18.63</u>	<u>6.43</u>	<u>1.12</u>	<u>2.55</u>	<u>91</u>	<u>14.9</u>	
<u>0916</u>	<u>1.5</u>	<u>18.93</u>	<u>6.47</u>	<u>1.12</u>	<u>2.44</u>	<u>94</u>	<u>55.8</u>	
<u>0919</u>	<u>2.0</u>	<u>18.90</u>	<u>6.46</u>	<u>1.12</u>	<u>2.54</u>	<u>98</u>	<u>13.2</u>	

Previous Stabilized Parameters _____

PURGE COMPLETION RECORD Low Flow & Parameters Stable 3 Casing Volumes & Parameters Stable 5 Casing Volumes
 Other: _____

SAMPLE COLLECTION RECORD
Depth to Water at Sampling: 41.41 (ft)
Sample Collected Via: Disp. Bailer Dedicated Pump Tubing
 Disp. Pump Tubing Other: _____
Sample ID: MW-2 Sample Collection Time: 0920 (24:00)
Containers (#): 6 VOA (2 preserved or unpreserved) Liter Amber
Other: _____ Other: _____
Other: _____ Other: _____
GEOCHEMICAL PARAMETERS
Parameter | Time | Measurement
DO (mg/L)
Ferrous Iron (mg/L)
Redox Potential (mV)
Alkalinity (mg/L)
Other: _____
Other: _____

Signature: Ala Madris



GROUNDWATER SAMPLING DATA SHEET

Page 4 of 9

Project: BP 498 Project No.: 08-82-603 Date: 2/10/15
 Field Representative: 3 AM/NV
 Well ID: MW-3A Start Time: 1140 End Time: 1155 Total Time (minutes): 15

PURGE EQUIPMENT Disp. Bailer 120V Pump Flow Cell
 Disp. Tubing 12V Pump Peristaltic Pump Other/ID#: Bladder Pump

WELL HEAD INTEGRITY (cap, lock, vault, etc.) Comments: _____
 Good Improvement Needed (circle one)

PURGING/SAMPLING METHOD Predetermined Well Volume Low-Flow Other: _____ (circle one)

PREDETERMINED WELL VOLUME						LOW-FLOW	
Casing Diameter	Unit Volume (gal/ft)	(circle one)				Previous Low-Flow Purge Rate:	(lpm)
1" (0.04)	1.25" (0.08)	2" (0.17)	3" (0.38)	Other: _____	Total Well Depth (a):	<u>55.43</u> (ft)	
4" (0.66)	6" (1.50)	8" (2.60)	12" (5.81)	_____ ()	Initial Depth to Water (b):	<u>40.58</u> (ft)	
Total Well Depth (a): _____ (ft)					Pump In-take Depth = b + (a-b)/2:	<u>48.00</u> (ft)	
Initial Depth to Water (b): _____ (ft)					Maximum Allowable Drawdown = (a-b)/8:	<u>1.95</u> (ft)	
Water Column Height (WCH) = (a - b): _____ (ft)					Low-Flow Purge Rate:	<u>0.25</u> (Lpm)*	
Water Column Volume (WCV) = WCH x Unit Volume: _____ (gal)					Comments: _____		
Three Casing Volumes = WCV x 3: _____ (gal)					*Low flow purge rate should be within range of instruments used but should not exceed 0.25 gpm. Drawdown should not exceed Maximum Allowable Drawdown.		
Five Casing Volumes = WCV x 5: _____ (gal)							
Pump Depth (if pump used): _____ (ft)							

GROUNDWATER STABILIZATION PARAMETER RECORD

Time (24:00)	Cumulative Vol. gal or (l)	Temperature °C	pH	Conductivity μS or (mS)	DO mg/L	ORP mV	Turbidity NTU	NOTES Odor, color, sheen or other
<u>1146</u>	<u>0.0</u>	<u>20.25</u>	<u>7.05</u>	<u>1.05</u>	<u>3.93</u>	<u>-158</u>	<u>104</u>	
<u>1148</u>	<u>0.5</u>	<u>19.97</u>	<u>6.66</u>	<u>1.08</u>	<u>1.09</u>	<u>-156</u>	<u>95.4</u>	
<u>1150</u>	<u>1.0</u>	<u>19.91</u>	<u>6.66</u>	<u>1.08</u>	<u>0.92</u>	<u>-158</u>	<u>91.7</u>	
<u>1152</u>	<u>1.5</u>	<u>19.90</u>	<u>6.64</u>	<u>1.08</u>	<u>0.66</u>	<u>-166</u>	<u>62.8</u>	
<u>1154</u>	<u>2.0</u>	<u>19.97</u>	<u>6.63</u>	<u>1.08</u>	<u>0.63</u>	<u>-170</u>	<u>54.5</u>	

Previous Stabilized Parameters _____

PURGE COMPLETION RECORD Low Flow & Parameters Stable 3 Casing Volumes & Parameters Stable 5 Casing Volumes
 Other: _____

SAMPLE COLLECTION RECORD

Depth to Water at Sampling: <u>41.22</u> (ft) Sample Collected Via: <input type="checkbox"/> Disp. Bailer <input type="checkbox"/> Dedicated Pump Tubing <input checked="" type="checkbox"/> Disp. Pump Tubing Other: _____ Sample ID: <u>MW-3A</u> Sample Collection Time: <u>1155</u> (24:00) Containers (#): <u>6</u> VOA (<input checked="" type="checkbox"/> preserved or <input type="checkbox"/> unpreserved) <input type="checkbox"/> Liter Amber Other: _____ Other: _____ Other: _____ Other: _____	GEOCHEMICAL PARAMETERS <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Parameter</th> <th>Time</th> <th>Measurement</th> </tr> </thead> <tbody> <tr> <td>DO (mg/L)</td> <td></td> <td></td> </tr> <tr> <td>Ferrous Iron (mg/L)</td> <td></td> <td></td> </tr> <tr> <td>Redox Potential (mV)</td> <td></td> <td></td> </tr> <tr> <td>Alkalinity (mg/L)</td> <td></td> <td></td> </tr> <tr> <td>Other:</td> <td></td> <td></td> </tr> <tr> <td>Other:</td> <td></td> <td></td> </tr> </tbody> </table>	Parameter	Time	Measurement	DO (mg/L)			Ferrous Iron (mg/L)			Redox Potential (mV)			Alkalinity (mg/L)			Other:			Other:		
Parameter	Time	Measurement																				
DO (mg/L)																						
Ferrous Iron (mg/L)																						
Redox Potential (mV)																						
Alkalinity (mg/L)																						
Other:																						
Other:																						

Signature: Alex Mack Revision: 3/15/2013



GROUNDWATER SAMPLING DATA SHEET

Project: BP 498 Project No.: 08-82-603 Date: 2/10/15
 Field Representative: AM/NV
 Well ID: MW-4 Start Time: _____ End Time: _____ Total Time (minutes): _____

PURGE EQUIPMENT Disp. Bailer 120V Pump Flow Cell
 Disp. Tubing 12V Pump Peristaltic Pump Other/ID#:

WELL HEAD INTEGRITY (cap, lock, vault, etc.) Comments: _____
 Good Improvement Needed (circle one)

PURGING/SAMPLING METHOD Predetermined Well Volume Low-Flow Other: _____ (circle one)

PREDETERMINED WELL VOLUME						LOW-FLOW	
Casing Diameter	Unit Volume (gal/ft) (circle one)					Previous Low-Flow Purge Rate:	(lpm)
1" (0.04)	1.25" (0.08)	2" (0.17)	3" (0.38)	Other: _____	Total Well Depth (a):	(ft)	
4" (0.66)	6" (1.50)	8" (2.60)	12" (5.81)	_____ ()	Initial Depth to Water (b):	(ft)	
Total Well Depth (a): _____ (ft)					Pump In-take Depth = $b + (a-b)/2$:	(ft)	
Initial Depth to Water (b): _____ (ft)					Maximum Allowable Drawdown = $(a-b)/8$:	(ft)	
Water Column Height (WCH) = $(a - b)$:					Low-Flow Purge Rate:	(Lpm)*	
Water Column Volume (WCV) = $WCH \times \text{Unit Volume}$:					Comments:		
Three Casing Volumes = $WCV \times 3$:							
Five Casing Volumes = $WCV \times 5$:							
Pump Depth (if pump used): _____ (ft)					*Low flow purge rate should be within range of instruments used but should not exceed 0.25 gpm. Drawdown should not exceed Maximum Allowable Drawdown.		

GROUNDWATER STABILIZATION PARAMETER RECORD

Time (24:00)	Cumulative Vol. gal or L	Temperature °C	pH	Conductivity μS or mS	DO mg/L	ORP mV	Turbidity NTU	NOTES Odor, color, sheen or other
								In sufficient water.
								No Sample Collection

Previous Stabilized Parameters _____

PURGE COMPLETION RECORD Low Flow & Parameters Stable 3 Casing Volumes & Parameters Stable 5 Casing Volumes
 Other: _____

SAMPLE COLLECTION RECORD		GEOCHEMICAL PARAMETERS		
		Parameter	Time	Measurement
Depth to Water at Sampling: _____ (ft)		DO (mg/L)		
Sample Collected Via: <input type="checkbox"/> Disp. Bailer <input type="checkbox"/> Dedicated Pump Tubing		Ferrous Iron (mg/L)		
<input type="checkbox"/> Disp. Pump Tubing <input type="checkbox"/> Other: _____		Redox Potential (mV)		
Sample ID: _____ Sample Collection Time: _____ (24:00)		Alkalinity (mg/L)		
Containers (#): <input type="checkbox"/> VOA (<input checked="" type="checkbox"/> preserved or <input type="checkbox"/> unpreserved) <input type="checkbox"/> Liter Amber		Other:		
<input type="checkbox"/> Other: _____ <input type="checkbox"/> Other: _____		Other:		
<input type="checkbox"/> Other: _____ <input type="checkbox"/> Other: _____		Other:		

Signature: Aly [Signature]



GROUNDWATER SAMPLING DATA SHEET

Page 6 of 9

Project: BP 498 Project No.: 08-82-603 Date: 2/10/15
 Field Representative: AM/NV
 Well ID: MW-5A Start Time: 1050 End Time: 1105 Total Time (minutes): 15

PURGE EQUIPMENT Disp. Bailer 120V Pump Flow Cell
 Disp. Tubing 12V Pump Peristaltic Pump Other/ID#: Bladder Pump

WELL HEAD INTEGRITY (cap, lock, vault, etc.) Comments: _____
 Good Improvement Needed (circle one)

PURGING/SAMPLING METHOD Predetermined Well Volume Low-Flow Other: _____ (circle one)

PREDETERMINED WELL VOLUME					LOW-FLOW				
Casing Diameter Unit Volume (gal/ft) (circle one)						Previous Low-Flow Purge Rate: _____ (lpm)			
1" (0.04)	1.25" (0.08)	2" (0.17)	3" (0.38)	Other: _____		Total Well Depth (a): <u>49.66</u> (ft)			
4" (0.66)	6" (1.50)	8" (2.60)	12" (5.81)	_____" (_____) _____		Initial Depth to Water (b): <u>40.58</u> (ft)			
Total Well Depth (a): _____ (ft)						Pump In-take Depth = b + (a-b)/2: <u>45.12</u> (ft)			
Initial Depth to Water (b): _____ (ft)						Maximum Allowable Drawdown = (a-b)/8: <u>1.13</u> (ft)			
Water Column Height (WCH) = (a - b): _____ (ft)						Low-Flow Purge Rate: <u>0.25</u> (Lpm)*			
Water Column Volume (WCV) = WCH x Unit Volume: _____ (gal)					Comments: _____				
Three Casing Volumes = WCV x 3: _____ (gal)					*Low flow purge rate should be within range of instruments used but should not exceed 0.25 gpm. Drawdown should not exceed Maximum Allowable Drawdown.				
Five Casing Volumes = WCV x 5: _____ (gal)									
Pump Depth (if pump used): _____ (ft)									

GROUNDWATER STABILIZATION PARAMETER RECORD

Time (24:00)	Cumulative Vol. gal or l	Temperature °C	pH	Conductivity μS or μS	DO mg/L	ORP mV	Turbidity NTU	NOTES Odor, color, sheen or other
1056	0.0	19.74	6.86	1.07	3.20	-180	316	
1058	0.5	20.57	6.66	1.07	1.40	-783	147	
1100	1.0	20.11	6.64	1.07	2.56	-197	114	
1102	1.5	20.17	6.65	1.06	2.42	-191	52.4	
1104	2.0	20.22	6.68	1.05	2.29	-195	17.2	

Previous Stabilized Parameters _____

PURGE COMPLETION RECORD Low Flow & Parameters Stable 3 Casing Volumes & Parameters Stable 5 Casing Volumes
 Other: _____

SAMPLE COLLECTION RECORD

SAMPLE COLLECTION RECORD		GEOCHEMICAL PARAMETERS	
Parameter	Time	Measurement	
Depth to Water at Sampling: <u>41.93</u> (ft)			
Sample Collected Via: <input type="checkbox"/> Disp. Bailer <input type="checkbox"/> Dedicated Pump Tubing			
<input checked="" type="checkbox"/> Disp. Pump Tubing Other: _____			
Sample ID: <u>MW-5A</u> Sample Collection Time: <u>1105</u> (24:00)			
Containers (#): <u>6</u> VOA (<input checked="" type="checkbox"/> preserved or <input type="checkbox"/> unpreserved) <input type="checkbox"/> Liter Amber			
Other: _____			
Other: _____			
Other: _____			
Other: _____			

Signature: [Signature]



GROUNDWATER SAMPLING DATA SHEET

Project: BP 498 Project No.: 08-92-603 Date: 2/10/15
 Field Representative: _____
 Well ID: MW-5B Start Time: 1115 End Time: 1130 Total Time (minutes): 15

PURGE EQUIPMENT Disp. Bailer 120V Pump Flow Cell
 Disp. Tubing 12V Pump Peristaltic Pump Other/ID#: Bladder Pump

WELL HEAD INTEGRITY (cap, lock, vault, etc.) Comments: _____
 Improvement Needed (circle one)

PURGING/SAMPLING METHOD Predetermined Well Volume Low-Flow Other: _____ (circle one)

PREDETERMINED WELL VOLUME						LOW-FLOW	
Casing Diameter Unit Volume (gal/ft) (circle one)						Previous Low-Flow Purge Rate: _____ (lpm)	
1" (0.04)	1.25" (0.08)	2" (0.17)	3" (0.38)	Other: _____	Total Well Depth (a): <u>65.79</u> (ft)		
4" (0.66)	6" (1.50)	8" (2.60)	12" (5.81)	_____ (____)	Initial Depth to Water (b): <u>40.60</u> (ft)		
Total Well Depth (a): _____ (ft)					Pump In-take Depth = b + (a-b)/2: <u>53.19</u> (ft)		
Initial Depth to Water (b): _____ (ft)					Maximum Allowable Drawdown = (a-b)/8: <u>3.14</u> (ft)		
Water Column Height (WCH) = (a - b): _____ (ft)					Low-Flow Purge Rate: <u>0.25</u> (Lpm)*		
Water Column Volume (WCV) = WCH x Unit Volume: _____ (gal)					Comments: _____		
Three Casing Volumes = WCV x 3: _____ (gal)					*Low-flow purge rate should be within range of instruments used but should not exceed 0.25 gpm. Drawdown should not exceed Maximum Allowable Drawdown.		
Five Casing Volumes = WCV x 5: _____ (gal)							
Pump Depth (if pump used): _____ (ft)							

GROUNDWATER STABILIZATION PARAMETER RECORD

Time (24:00)	Cumulative Vol. gal or \bar{d}	Temperature °C	pH	Conductivity μ S or \bar{m} S	DO mg/L	ORP mV	Turbidity NTU	NOTES Odor, color, sheen or other
1120	0.0	19.97	7.09	1.10	6.17	-27	472	
1122	0.5	19.72	7.05	1.11	5.50	-11	197	
1124	1.0	19.63	7.05	1.11	5.37	-3	86.4	
1126	1.5	19.54	7.07	1.11	5.29	5	47.9	
1128	2.0	19.53	7.05	1.11	5.40	7	29.8	

Previous Stabilized Parameters _____

PURGE COMPLETION RECORD Low Flow & Parameters Stable 3 Casing Volumes & Parameters Stable 5 Casing Volumes
 Other: _____

SAMPLE COLLECTION RECORD

SAMPLE COLLECTION RECORD		GEOCHEMICAL PARAMETERS	
Parameter	Time	Measurement	
Depth to Water at Sampling: <u>40.54</u> (ft)			
Sample Collected Via: <input checked="" type="checkbox"/> Disp. Pump Tubing <input type="checkbox"/> Disp. Bailer <input type="checkbox"/> Dedicated Pump Tubing		DO (mg/L)	
Sample ID: <u>MW-5B</u> Sample Collection Time: <u>1130</u> (24:00)		Ferrous Iron (mg/L)	
Containers (#): <u>6</u> VOA (<input type="checkbox"/> preserved or <input type="checkbox"/> unpreserved) <input type="checkbox"/> Liter Amber		Redox Potential (mV)	
Other: _____		Alkalinity (mg/L)	
Other: _____		Other: _____	
Other: _____		Other: _____	

Signature: [Signature]



GROUNDWATER SAMPLING DATA SHEET

Page 8 of 9

Project: BP 498 Project No.: 07-82-603 Date: 2/10/15
 Field Representative: AM/NV
 Well ID: MW-6A Start Time: 1000 End Time: 1015 Total Time (minutes): 15

PURGE EQUIPMENT Disp. Bailer 120V Pump Flow Cell
 Disp. Tubing 12V Pump Peristaltic Pump Other/ID#: Bladder Pump

WELL HEAD INTEGRITY (cap, lock, vault, etc.) Comments: _____
 Good Improvement Needed (circle one)

PURGING/SAMPLING METHOD Predetermined Well Volume Low-Flow Other: _____ (circle one)

PREDETERMINED WELL VOLUME						LOW-FLOW		
Casing Diameter	Unit Volume (gal/ft)	(circle one)				Previous Low-Flow Purge Rate:	(lpm)	
1" (0.04)	1.25" (0.08)	2" (0.17)	3" (0.38)	Other: _____	Total Well Depth (a):	<u>49.67</u>	(ft)	
4" (0.66)	6" (1.50)	8" (2.60)	12" (5.81)	_____" (_____) _____	Initial Depth to Water (b):	<u>44.07</u>	(ft)	
Total Well Depth (a): _____ (ft)					Pump In-take Depth = b + (a-b)/2:	<u>46.86</u>	(ft)	
Initial Depth to Water (b): _____ (ft)					Maximum Allowable Drawdown = (a-b)/8:	<u>0.70</u>	(ft)	
Water Column Height (WCH) = (a - b): _____ (ft)					Low-Flow Purge Rate:	<u>0.25</u>	(Lpm)*	
Water Column Volume (WCV) = WCH x Unit Volume: _____ (gal)					Comments: _____			
Three Casing Volumes = WCV x 3: _____ (gal)					*Low flow purge rate should be within range of instruments used but should not exceed 0.25 gpm. Drawdown should not exceed Maximum Allowable Drawdown.			
Five Casing Volumes = WCV x 5: _____ (gal)								
Pump Depth (if pump used): _____ (ft)								

GROUNDWATER STABILIZATION PARAMETER RECORD

Time (24:00)	Cumulative Vol. gal or (l)	Temperature °C	pH	Conductivity μS or μS	DO mg/L	ORP mV	Turbidity NTU	NOTES Odor, color, sheen or other
<u>1004</u>	<u>0.0</u>	<u>17.23</u>	<u>6.89</u>	<u>1.56</u>	<u>3.18</u>	<u>-67</u>	<u>0.0</u>	
<u>1006</u>	<u>0.5</u>	<u>19.43</u>	<u>6.47</u>	<u>1.57</u>	<u>1.58</u>	<u>-105</u>	<u>0.0</u>	
<u>1008</u>	<u>1.0</u>	<u>19.50</u>	<u>6.44</u>	<u>1.57</u>	<u>1.09</u>	<u>-121</u>	<u>>800</u>	
<u>1010</u>	<u>1.5</u>	<u>19.53</u>	<u>6.44</u>	<u>1.56</u>	<u>0.86</u>	<u>-135</u>	<u>565</u>	
<u>1012</u>	<u>2.0</u>	<u>19.56</u>	<u>6.43</u>	<u>1.56</u>	<u>0.77</u>	<u>-139</u>	<u>225</u>	

Previous Stabilized Parameters _____

PURGE COMPLETION RECORD Low Flow & Parameters Stable 3 Casing Volumes & Parameters Stable 5 Casing Volumes
 Other: _____

SAMPLE COLLECTION RECORD

Depth to Water at Sampling: 44.78 (ft)
 Sample Collected Via: Disp. Bailer Dedicated Pump Tubing
 Disp. Pump Tubing Other: _____
 Sample ID: MW-6A Sample Collection Time: 1015 (24:00)
 Containers (#): 6 VOA (preserved or unpreserved) Liter Amber
 Other: _____ Other: _____
 Other: _____ Other: _____

GEOCHEMICAL PARAMETERS

Parameter	Time	Measurement
DO (mg/L)		
Ferrous Iron (mg/L)		
Redox Potential (mV)		
Alkalinity (mg/L)		
Other:		
Other:		

Signature: Alex [Signature]



GROUNDWATER SAMPLING DATA SHEET

Project: BP 498 Project No.: 08-82-603 Date: 2/10/15
 Field Representative: AM/NV
 Well ID: MW-6B Start Time: 1020 End Time: 1035 Total Time (minutes): 15

PURGE EQUIPMENT Disp. Bailer 120V Pump Flow Cell
 Disp. Tubing 12V Pump Peristaltic Pump Other/ID#:

WELL HEAD INTEGRITY (cap, lock, vault, etc.) Comments:
 Good Improvement Needed (circle one)

PURGING/SAMPLING METHOD Predetermined Well Volume Low-Flow Other: (circle one)

PREDETERMINED WELL VOLUME						LOW-FLOW	
Casing Diameter	Unit Volume (gal/ft) (circle one)					Previous Low-Flow Purge Rate:	(lpm)
1" (0.04)	1.25" (0.08)	2" (0.17)	3" (0.38)	Other:	Total Well Depth (a):	<u>69.59</u> (ft)	
4" (0.66)	6" (1.50)	8" (2.60)	12" (5.81)	" ()	Initial Depth to Water (b):	<u>42.08</u> (ft)	
Total Well Depth (a):					Pump In-take Depth = b + (a-b)/2:	<u>55.83</u> (ft)	
Initial Depth to Water (b):					Maximum Allowable Drawdown = (a-b)/8:	<u>3.43</u> (ft)	
Water Column Height (WCH) = (a - b):					Low-Flow Purge Rate:	<u>0.25</u> (lpm)*	
Water Column Volume (WCV) = WCH x Unit Volume:					Comments:		
Three Casing Volumes = WCV x 3:					*Low-flow purge rate should be within range of instruments used but should not exceed 0.25 gpm. Drawdown should not exceed Maximum Allowable Drawdown.		
Five Casing Volumes = WCV x 5:							
Pump Depth (if pump used):							

GROUNDWATER STABILIZATION PARAMETER RECORD

Time (24:00)	Cumulative Vol. gal or (l)	Temperature °C	pH	Conductivity μS or (μS)	DO mg/L	ORP mV	Turbidity NTU	NOTES Odor, color, sheen or other
1027	0.0	19.64	7.24	1.11	8.27	-6	> 500	
1029	0.5	19.42	7.12	1.11	6.98	13	> 500	
1031	1.0	19.43	7.11	1.11	6.87	17	> 500	
1033	1.5	19.42	7.10	1.11	6.76	23	> 500	
1035	2.0	19.42	7.10	1.11	6.76	23	> 500	

Previous Stabilized Parameters

PURGE COMPLETION RECORD Low Flow & Parameters Stable 3 Casing Volumes & Parameters Stable 5 Casing Volumes
 Other:

SAMPLE COLLECTION RECORD

SAMPLE COLLECTION RECORD		GEOCHEMICAL PARAMETERS	
Parameter	Time	Measurement	
Depth to Water at Sampling: <u>42.08</u> (ft)			
Sample Collected Via: <input checked="" type="checkbox"/> Disp. Pump Tubing <input type="checkbox"/> Disp. Bailer <input type="checkbox"/> Dedicated Pump Tubing		DO (mg/L)	
Sample ID: <u>MW-6B</u> Sample Collection Time: <u>1035</u> (24:00)		Ferrous Iron (mg/L)	
Containers (#): <u>6</u> VOA (<input checked="" type="checkbox"/> preserved or <input type="checkbox"/> unpreserved) <input type="checkbox"/> Liter Amber		Redox Potential (mV)	
Other: _____ Other: _____		Alkalinity (mg/L)	
Other: _____ Other: _____		Other: _____	
Other: _____ Other: _____		Other: _____	

Signature: Ally N...



Laboratory Management Program LaMP Chain of Custody Record

BP Site Node Path: BP 498
 BP Facility No: 498

Req Due Date (mm/dd/yy): _____ Rush TAT: Yes ___ No
 Lab Work Order Number: _____

Lab Name: Test America	Facility Address: 286 South Livermore Avenue	Consultant/Contractor: Broadbent & Associates Inc.
Lab Address: 17461 Derian Avenue, Suite 100, Irvine, CA	City, State, ZIP Code: Livermore, California	Consultant/Contractor Project No: 08-82-603
Lab PM: Kathleen Robb	Lead Regulatory Agency: ACEH	Address: 4820 Business Center Drive, Suite 110, Fairfield, CA
Lab Phone: 949-261-1022	California Global ID No.: T0600124081	Consultant/Contractor PM: Kristene Tidwell
Lab Shipping Acct: Fed ex#: 1103-6633-7	Enfos Proposal No/ WR#: 0056X - 0005 / WR273478	Phone: 707-455-7290 Email: ktidwell@broadbentinc.com
Lab Bottle Order No:	Accounting Mode: Provision <input checked="" type="checkbox"/> OOC-BU ___ OOC-RM ___	Email EDD To: ktidwell@broadbentinc.com and to lab.enfosdoc@bp.com
Other Info:	Stage: Execute (4) Activity: GWM (401)	Invoice To: BP <input checked="" type="checkbox"/> Contractor: _____

BP Project Manager (PM): Chuck Carmel	Matrix	No. Containers / Preservative	Requested Analyses	Report Type & QC Level
BP PM Phone: 925-275-3803				Standard <input checked="" type="checkbox"/>
BP PM Email: charles.carmel@bp.com				Full Data Package ___

Lab No.	Sample Description	Date	Time	Soil / Solid	Water / Liquid	Air / Vapor	Is this location a well?	Total Number of Container	Unpreserved	H2SO4	HNO3	HCl	Methanol	GRO by 8015M	BTEX/S FO/EDB by 8260	1,2-DCA and Ethanol by 8260	Comments
	MW-1	2/10/15	0950	x	y			6				x		x	x	x	
	MW-2	↓	0920	x	y			6				x		x	x	x	
	MW-3	↓	1155	x	y			6				x		x	x	x	
	MW-4	—	—	x	y			6				x		x	x	x	
	MW-5A	2/10/15	1105	x	y			6				x		x	x	x	
	MW-5B	↓	1130	x	y			6				x		x	x	x	
	MW-6A	↓	1015	x	y			6				x		x	x	x	
	MW-6B	↓	1035	x	y			6				x		x	x	x	
	TB-498-02092015	—	—	x	n			2				x					ON HOLD

Sampler's Name: Alex Martinez & Nick Vrdojak	Relinquished By / Affiliation	Date	Time	Accepted By / Affiliation	Date	Time
Sampler's Company: Broadbent & Associates	<i>Alex Martinez</i> BAI	2/10/15	1700			
Shipment Method: FedEx Ship Date: 2/10/2015						
Shipment Tracking No: 8037 8050 3274						

Special Instructions:

THIS LINE - LAB USE ONLY: Custody Seals In Place: Yes / No	Temp Blank: Yes / No	Cooler Temp on Receipt: _____ °F/C	Trip Blank: Yes / No	MS/MSD Sample Submitted: Yes / No
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APPENDIX F

Laboratory Report and Chain-of-Custody Documentation

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Irvine
17461 Derian Ave
Suite 100
Irvine, CA 92614-5817
Tel: (949)261-1022

TestAmerica Job ID: 440-101853-1
Client Project/Site: ARCO 0498, Livermore

For:
Broadbent & Associates, Inc.
4820 Business Center Drive
#110
Fairfield, California 94534

Attn: Kristene Tidwell



*Authorized for release by:
2/28/2015 3:30:26 PM*

Kathleen Robb, Project Manager II
(949)261-1022
kathleen.robbs@testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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12

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Table of Contents

Cover Page	1
Table of Contents	2
Sample Summary	3
Case Narrative	4
Client Sample Results	5
Method Summary	12
Lab Chronicle	13
QC Sample Results	15
QC Association Summary	18
Definitions/Glossary	19
Certification Summary	20
Chain of Custody	21
Receipt Checklists	22

Sample Summary

Client: Broadbent & Associates, Inc.
Project/Site: ARCO 0498, Livermore

TestAmerica Job ID: 440-101853-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
440-101853-1	MW-1	Water	02/10/15 09:50	02/13/15 09:45
440-101853-2	MW-2	Water	02/10/15 09:20	02/13/15 09:45
440-101853-3	MW-3	Water	02/10/15 11:55	02/13/15 09:45
440-101853-4	MW-5A	Water	02/10/15 11:05	02/13/15 09:45
440-101853-5	MW-5B	Water	02/10/15 11:30	02/13/15 09:45
440-101853-6	MW-6A	Water	02/10/15 10:15	02/13/15 09:45
440-101853-7	MW-6B	Water	02/10/15 10:35	02/13/15 09:45



Case Narrative

Client: Broadbent & Associates, Inc.
Project/Site: ARCO 0498, Livermore

TestAmerica Job ID: 440-101853-1

Job ID: 440-101853-1

Laboratory: TestAmerica Irvine

Narrative

Job Narrative 440-101853-1

Comments

No additional comments.

Receipt

The samples were received on 2/13/2015 9:45 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 3.6° C.

GC/MS VOA

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

GC VOA

Method(s) 8015B: Surrogate recovery for the following sample(s) was outside control limits: MW-1 (440-101853-1). Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

Method(s) 8015B: The Gasoline Range Organics (GRO) concentration reported for the following sample(s) is due to the presence of discrete peaks: MW-6A (440-101853-6).

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

VOA Prep

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.



Client Sample Results

Client: Broadbent & Associates, Inc.
 Project/Site: ARCO 0498, Livermore

TestAmerica Job ID: 440-101853-1

Client Sample ID: MW-1

Lab Sample ID: 440-101853-1

Date Collected: 02/10/15 09:50

Matrix: Water

Date Received: 02/13/15 09:45

Method: 8260B/5030B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		0.50	ug/L			02/22/15 17:13	1
1,2-Dichloroethane	ND		0.50	ug/L			02/22/15 17:13	1
Benzene	23		0.50	ug/L			02/22/15 17:13	1
Ethanol	ND		150	ug/L			02/22/15 17:13	1
Ethylbenzene	12		0.50	ug/L			02/22/15 17:13	1
Ethyl-t-butyl ether (ETBE)	ND		0.50	ug/L			02/22/15 17:13	1
Isopropyl Ether (DIPE)	ND		0.50	ug/L			02/22/15 17:13	1
m,p-Xylene	3.9		1.0	ug/L			02/22/15 17:13	1
Methyl-t-Butyl Ether (MTBE)	2.3		0.50	ug/L			02/22/15 17:13	1
o-Xylene	1.2		0.50	ug/L			02/22/15 17:13	1
Tert-amyl-methyl ether (TAME)	ND		0.50	ug/L			02/22/15 17:13	1
tert-Butyl alcohol (TBA)	ND		10	ug/L			02/22/15 17:13	1
Toluene	2.7		0.50	ug/L			02/22/15 17:13	1
Xylenes, Total	5.1		1.0	ug/L			02/22/15 17:13	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	95		80 - 120		02/22/15 17:13	1
Dibromofluoromethane (Surr)	99		76 - 132		02/22/15 17:13	1
Toluene-d8 (Surr)	105		80 - 128		02/22/15 17:13	1

Method: 8015B/5030B - Gasoline Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
GRO (C6-C12)	1600		50	ug/L			02/18/15 07:16	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	144	LH	65 - 140		02/18/15 07:16	1

Client Sample Results

Client: Broadbent & Associates, Inc.
 Project/Site: ARCO 0498, Livermore

TestAmerica Job ID: 440-101853-1

Client Sample ID: MW-2
Date Collected: 02/10/15 09:20
Date Received: 02/13/15 09:45

Lab Sample ID: 440-101853-2
Matrix: Water

Method: 8260B/5030B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		0.50	ug/L			02/22/15 17:40	1
1,2-Dichloroethane	ND		0.50	ug/L			02/22/15 17:40	1
Benzene	ND		0.50	ug/L			02/22/15 17:40	1
Ethanol	ND		150	ug/L			02/22/15 17:40	1
Ethylbenzene	ND		0.50	ug/L			02/22/15 17:40	1
Ethyl-t-butyl ether (ETBE)	ND		0.50	ug/L			02/22/15 17:40	1
Isopropyl Ether (DIPE)	ND		0.50	ug/L			02/22/15 17:40	1
m,p-Xylene	ND		1.0	ug/L			02/22/15 17:40	1
Methyl-t-Butyl Ether (MTBE)	1.2		0.50	ug/L			02/22/15 17:40	1
o-Xylene	ND		0.50	ug/L			02/22/15 17:40	1
Tert-amyl-methyl ether (TAME)	ND		0.50	ug/L			02/22/15 17:40	1
tert-Butyl alcohol (TBA)	ND		10	ug/L			02/22/15 17:40	1
Toluene	ND		0.50	ug/L			02/22/15 17:40	1
Xylenes, Total	ND		1.0	ug/L			02/22/15 17:40	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	90		80 - 120		02/22/15 17:40	1
Dibromofluoromethane (Surr)	100		76 - 132		02/22/15 17:40	1
Toluene-d8 (Surr)	104		80 - 128		02/22/15 17:40	1

Method: 8015B/5030B - Gasoline Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
GRO (C6-C12)	ND		50	ug/L			02/18/15 07:45	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	90		65 - 140		02/18/15 07:45	1

Client Sample Results

Client: Broadbent & Associates, Inc.
Project/Site: ARCO 0498, Livermore

TestAmerica Job ID: 440-101853-1

Client Sample ID: MW-3

Lab Sample ID: 440-101853-3

Date Collected: 02/10/15 11:55

Matrix: Water

Date Received: 02/13/15 09:45

Method: 8260B/5030B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		2.0	ug/L			02/22/15 18:07	4
1,2-Dichloroethane	ND		2.0	ug/L			02/22/15 18:07	4
Benzene	350		2.0	ug/L			02/22/15 18:07	4
Ethanol	ND		600	ug/L			02/22/15 18:07	4
Ethylbenzene	30		2.0	ug/L			02/22/15 18:07	4
Ethyl-t-butyl ether (ETBE)	ND		2.0	ug/L			02/22/15 18:07	4
Isopropyl Ether (DIPE)	ND		2.0	ug/L			02/22/15 18:07	4
m,p-Xylene	8.1		4.0	ug/L			02/22/15 18:07	4
Methyl-t-Butyl Ether (MTBE)	41		2.0	ug/L			02/22/15 18:07	4
o-Xylene	2.4		2.0	ug/L			02/22/15 18:07	4
Tert-amyl-methyl ether (TAME)	ND		2.0	ug/L			02/22/15 18:07	4
tert-Butyl alcohol (TBA)	66	ID	40	ug/L			02/22/15 18:07	4
Toluene	2.1		2.0	ug/L			02/22/15 18:07	4
Xylenes, Total	11		4.0	ug/L			02/22/15 18:07	4
Surrogate	%Recovery	Qualifier	Limits			Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	97		80 - 120				02/22/15 18:07	4
Dibromofluoromethane (Surr)	98		76 - 132				02/22/15 18:07	4
Toluene-d8 (Surr)	105		80 - 128				02/22/15 18:07	4

Method: 8015B/5030B - Gasoline Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
GRO (C6-C12)	2000		500	ug/L			02/18/15 08:14	10
Surrogate	%Recovery	Qualifier	Limits			Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	102		65 - 140				02/18/15 08:14	10

Client Sample Results

Client: Broadbent & Associates, Inc.
Project/Site: ARCO 0498, Livermore

TestAmerica Job ID: 440-101853-1

Client Sample ID: MW-5A

Lab Sample ID: 440-101853-4

Date Collected: 02/10/15 11:05

Matrix: Water

Date Received: 02/13/15 09:45

Method: 8260B/5030B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		0.50	ug/L			02/22/15 18:34	1
1,2-Dichloroethane	ND		0.50	ug/L			02/22/15 18:34	1
Benzene	4.2		0.50	ug/L			02/22/15 18:34	1
Ethanol	ND		150	ug/L			02/22/15 18:34	1
Ethylbenzene	0.65		0.50	ug/L			02/22/15 18:34	1
Ethyl-t-butyl ether (ETBE)	ND		0.50	ug/L			02/22/15 18:34	1
Isopropyl Ether (DIPE)	ND		0.50	ug/L			02/22/15 18:34	1
m,p-Xylene	ND		1.0	ug/L			02/22/15 18:34	1
Methyl-t-Butyl Ether (MTBE)	ND		0.50	ug/L			02/22/15 18:34	1
o-Xylene	ND		0.50	ug/L			02/22/15 18:34	1
Tert-amyl-methyl ether (TAME)	ND		0.50	ug/L			02/22/15 18:34	1
tert-Butyl alcohol (TBA)	16	ID	10	ug/L			02/22/15 18:34	1
Toluene	ND		0.50	ug/L			02/22/15 18:34	1
Xylenes, Total	ND		1.0	ug/L			02/22/15 18:34	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	95		80 - 120		02/22/15 18:34	1
Dibromofluoromethane (Surr)	101		76 - 132		02/22/15 18:34	1
Toluene-d8 (Surr)	104		80 - 128		02/22/15 18:34	1

Method: 8015B/5030B - Gasoline Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
GRO (C6-C12)	860		50	ug/L			02/18/15 08:43	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	99		65 - 140		02/18/15 08:43	1

Client Sample Results

Client: Broadbent & Associates, Inc.
 Project/Site: ARCO 0498, Livermore

TestAmerica Job ID: 440-101853-1

Client Sample ID: MW-5B

Lab Sample ID: 440-101853-5

Date Collected: 02/10/15 11:30

Matrix: Water

Date Received: 02/13/15 09:45

Method: 8260B/5030B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		0.50	ug/L			02/22/15 19:01	1
1,2-Dichloroethane	ND		0.50	ug/L			02/22/15 19:01	1
Benzene	ND		0.50	ug/L			02/22/15 19:01	1
Ethanol	ND		150	ug/L			02/22/15 19:01	1
Ethylbenzene	ND		0.50	ug/L			02/22/15 19:01	1
Ethyl-t-butyl ether (ETBE)	ND		0.50	ug/L			02/22/15 19:01	1
Isopropyl Ether (DIPE)	ND		0.50	ug/L			02/22/15 19:01	1
m,p-Xylene	ND		1.0	ug/L			02/22/15 19:01	1
Methyl-t-Butyl Ether (MTBE)	ND		0.50	ug/L			02/22/15 19:01	1
o-Xylene	ND		0.50	ug/L			02/22/15 19:01	1
Tert-amyl-methyl ether (TAME)	ND		0.50	ug/L			02/22/15 19:01	1
tert-Butyl alcohol (TBA)	ND		10	ug/L			02/22/15 19:01	1
Toluene	ND		0.50	ug/L			02/22/15 19:01	1
Xylenes, Total	ND		1.0	ug/L			02/22/15 19:01	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	95		80 - 120		02/22/15 19:01	1
Dibromofluoromethane (Surr)	102		76 - 132		02/22/15 19:01	1
Toluene-d8 (Surr)	103		80 - 128		02/22/15 19:01	1

Method: 8015B/5030B - Gasoline Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
GRO (C6-C12)	ND		50	ug/L			02/18/15 09:12	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	91		65 - 140		02/18/15 09:12	1

Client Sample Results

Client: Broadbent & Associates, Inc.
 Project/Site: ARCO 0498, Livermore

TestAmerica Job ID: 440-101853-1

Client Sample ID: MW-6A

Lab Sample ID: 440-101853-6

Date Collected: 02/10/15 10:15

Matrix: Water

Date Received: 02/13/15 09:45

Method: 8260B/5030B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		5.0	ug/L			02/22/15 19:28	10
1,2-Dichloroethane	ND		5.0	ug/L			02/22/15 19:28	10
Benzene	ND		5.0	ug/L			02/22/15 19:28	10
Ethanol	ND		1500	ug/L			02/22/15 19:28	10
Ethylbenzene	ND		5.0	ug/L			02/22/15 19:28	10
Ethyl-t-butyl ether (ETBE)	ND		5.0	ug/L			02/22/15 19:28	10
Isopropyl Ether (DIPE)	ND		5.0	ug/L			02/22/15 19:28	10
m,p-Xylene	ND		10	ug/L			02/22/15 19:28	10
Methyl-t-Butyl Ether (MTBE)	1700		5.0	ug/L			02/22/15 19:28	10
o-Xylene	ND		5.0	ug/L			02/22/15 19:28	10
Tert-amyl-methyl ether (TAME)	ND		5.0	ug/L			02/22/15 19:28	10
tert-Butyl alcohol (TBA)	ND		100	ug/L			02/22/15 19:28	10
Toluene	ND		5.0	ug/L			02/22/15 19:28	10
Xylenes, Total	ND		10	ug/L			02/22/15 19:28	10

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	95		80 - 120		02/22/15 19:28	10
Dibromofluoromethane (Surr)	100		76 - 132		02/22/15 19:28	10
Toluene-d8 (Surr)	104		80 - 128		02/22/15 19:28	10

Method: 8015B/5030B - Gasoline Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
GRO (C6-C12)	58		50	ug/L			02/18/15 09:40	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	90		65 - 140		02/18/15 09:40	1

Client Sample Results

Client: Broadbent & Associates, Inc.
Project/Site: ARCO 0498, Livermore

TestAmerica Job ID: 440-101853-1

Client Sample ID: MW-6B

Lab Sample ID: 440-101853-7

Date Collected: 02/10/15 10:35

Matrix: Water

Date Received: 02/13/15 09:45

Method: 8260B/5030B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		0.50	ug/L			02/22/15 19:55	1
1,2-Dichloroethane	ND		0.50	ug/L			02/22/15 19:55	1
Benzene	ND		0.50	ug/L			02/22/15 19:55	1
Ethanol	ND		150	ug/L			02/22/15 19:55	1
Ethylbenzene	ND		0.50	ug/L			02/22/15 19:55	1
Ethyl-t-butyl ether (ETBE)	ND		0.50	ug/L			02/22/15 19:55	1
Isopropyl Ether (DIPE)	ND		0.50	ug/L			02/22/15 19:55	1
m,p-Xylene	ND		1.0	ug/L			02/22/15 19:55	1
Methyl-t-Butyl Ether (MTBE)	ND		0.50	ug/L			02/22/15 19:55	1
o-Xylene	ND		0.50	ug/L			02/22/15 19:55	1
Tert-amyl-methyl ether (TAME)	ND		0.50	ug/L			02/22/15 19:55	1
tert-Butyl alcohol (TBA)	21		10	ug/L			02/22/15 19:55	1
Toluene	ND		0.50	ug/L			02/22/15 19:55	1
Xylenes, Total	ND		1.0	ug/L			02/22/15 19:55	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	93		80 - 120		02/22/15 19:55	1
Dibromofluoromethane (Surr)	102		76 - 132		02/22/15 19:55	1
Toluene-d8 (Surr)	103		80 - 128		02/22/15 19:55	1

Method: 8015B/5030B - Gasoline Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
GRO (C6-C12)	ND		50	ug/L			02/18/15 10:09	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	88		65 - 140		02/18/15 10:09	1

Method Summary

Client: Broadbent & Associates, Inc.
Project/Site: ARCO 0498, Livermore

TestAmerica Job ID: 440-101853-1

Method	Method Description	Protocol	Laboratory
8260B/5030B	Volatile Organic Compounds (GC/MS)	SW846	TAL IRV
8015B/5030B	Gasoline Range Organics (GC)	SW846	TAL IRV

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL IRV = TestAmerica Irvine, 17461 Derian Ave, Suite 100, Irvine, CA 92614-5817, TEL (949)261-1022



Lab Chronicle

Client: Broadbent & Associates, Inc.
Project/Site: ARCO 0498, Livermore

TestAmerica Job ID: 440-101853-1

Client Sample ID: MW-1

Lab Sample ID: 440-101853-1

Date Collected: 02/10/15 09:50

Matrix: Water

Date Received: 02/13/15 09:45

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B/5030B		1	10 mL	10 mL	237964	02/22/15 17:13	WC	TAL IRV
Total/NA	Analysis	8015B/5030B		1	10 mL	10 mL	236905	02/18/15 07:16	IM	TAL IRV

Client Sample ID: MW-2

Lab Sample ID: 440-101853-2

Date Collected: 02/10/15 09:20

Matrix: Water

Date Received: 02/13/15 09:45

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B/5030B		1	10 mL	10 mL	237964	02/22/15 17:40	WC	TAL IRV
Total/NA	Analysis	8015B/5030B		1	10 mL	10 mL	236905	02/18/15 07:45	IM	TAL IRV

Client Sample ID: MW-3

Lab Sample ID: 440-101853-3

Date Collected: 02/10/15 11:55

Matrix: Water

Date Received: 02/13/15 09:45

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B/5030B		4	10 mL	10 mL	237964	02/22/15 18:07	WC	TAL IRV
Total/NA	Analysis	8015B/5030B		10	10 mL	10 mL	236905	02/18/15 08:14	IM	TAL IRV

Client Sample ID: MW-5A

Lab Sample ID: 440-101853-4

Date Collected: 02/10/15 11:05

Matrix: Water

Date Received: 02/13/15 09:45

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B/5030B		1	10 mL	10 mL	237964	02/22/15 18:34	WC	TAL IRV
Total/NA	Analysis	8015B/5030B		1	10 mL	10 mL	236905	02/18/15 08:43	IM	TAL IRV

Client Sample ID: MW-5B

Lab Sample ID: 440-101853-5

Date Collected: 02/10/15 11:30

Matrix: Water

Date Received: 02/13/15 09:45

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B/5030B		1	10 mL	10 mL	237964	02/22/15 19:01	WC	TAL IRV
Total/NA	Analysis	8015B/5030B		1	10 mL	10 mL	236905	02/18/15 09:12	IM	TAL IRV

Client Sample ID: MW-6A

Lab Sample ID: 440-101853-6

Date Collected: 02/10/15 10:15

Matrix: Water

Date Received: 02/13/15 09:45

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B/5030B		10	10 mL	10 mL	237964	02/22/15 19:28	WC	TAL IRV

TestAmerica Irvine

Lab Chronicle

Client: Broadbent & Associates, Inc.
Project/Site: ARCO 0498, Livermore

TestAmerica Job ID: 440-101853-1

Client Sample ID: MW-6A

Date Collected: 02/10/15 10:15

Date Received: 02/13/15 09:45

Lab Sample ID: 440-101853-6

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8015B/5030B		1	10 mL	10 mL	236905	02/18/15 09:40	IM	TAL IRV

Client Sample ID: MW-6B

Date Collected: 02/10/15 10:35

Date Received: 02/13/15 09:45

Lab Sample ID: 440-101853-7

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260B/5030B		1	10 mL	10 mL	237964	02/22/15 19:55	WC	TAL IRV
Total/NA	Analysis	8015B/5030B		1	10 mL	10 mL	236905	02/18/15 10:09	IM	TAL IRV

Laboratory References:

TAL IRV = TestAmerica Irvine, 17461 Derian Ave, Suite 100, Irvine, CA 92614-5817, TEL (949)261-1022

QC Sample Results

Client: Broadbent & Associates, Inc.
Project/Site: ARCO 0498, Livermore

TestAmerica Job ID: 440-101853-1

Method: 8260B/5030B - Volatile Organic Compounds (GC/MS)

Lab Sample ID: MB 440-237964/14

Matrix: Water

Analysis Batch: 237964

Client Sample ID: Method Blank

Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		0.50	ug/L			02/22/15 12:45	1
1,2-Dichloroethane	ND		0.50	ug/L			02/22/15 12:45	1
Benzene	ND		0.50	ug/L			02/22/15 12:45	1
Ethanol	ND		150	ug/L			02/22/15 12:45	1
Ethylbenzene	ND		0.50	ug/L			02/22/15 12:45	1
Ethyl-t-butyl ether (ETBE)	ND		0.50	ug/L			02/22/15 12:45	1
Isopropyl Ether (DIPE)	ND		0.50	ug/L			02/22/15 12:45	1
m,p-Xylene	ND		1.0	ug/L			02/22/15 12:45	1
Methyl-t-Butyl Ether (MTBE)	ND		0.50	ug/L			02/22/15 12:45	1
o-Xylene	ND		0.50	ug/L			02/22/15 12:45	1
Tert-amyl-methyl ether (TAME)	ND		0.50	ug/L			02/22/15 12:45	1
tert-Butyl alcohol (TBA)	ND		10	ug/L			02/22/15 12:45	1
Toluene	ND		0.50	ug/L			02/22/15 12:45	1
Xylenes, Total	ND		1.0	ug/L			02/22/15 12:45	1

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	94		80 - 120		02/22/15 12:45	1
Dibromofluoromethane (Surr)	98		76 - 132		02/22/15 12:45	1
Toluene-d8 (Surr)	104		80 - 128		02/22/15 12:45	1

Lab Sample ID: LCS 440-237964/4

Matrix: Water

Analysis Batch: 237964

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,2-Dibromoethane (EDB)	25.0	23.8		ug/L		95	70 - 130
1,2-Dichloroethane	25.0	24.6		ug/L		98	57 - 138
Benzene	25.0	24.2		ug/L		97	68 - 130
Ethanol	1250	1330		ug/L		107	50 - 149
Ethylbenzene	25.0	24.8		ug/L		99	70 - 130
Ethyl-t-butyl ether (ETBE)	25.0	27.2		ug/L		109	60 - 136
Isopropyl Ether (DIPE)	25.0	26.2		ug/L		105	58 - 139
m,p-Xylene	25.0	24.1		ug/L		97	70 - 130
Methyl-t-Butyl Ether (MTBE)	25.0	23.7		ug/L		95	63 - 131
o-Xylene	25.0	24.7		ug/L		99	70 - 130
Tert-amyl-methyl ether (TAME)	25.0	22.7		ug/L		91	57 - 139
tert-Butyl alcohol (TBA)	250	254		ug/L		102	70 - 130
Toluene	25.0	25.1		ug/L		101	70 - 130

Surrogate	LCS %Recovery	LCS Qualifier	Limits
4-Bromofluorobenzene (Surr)	96		80 - 120
Dibromofluoromethane (Surr)	106		76 - 132
Toluene-d8 (Surr)	99		80 - 128

TestAmerica Irvine

QC Sample Results

Client: Broadbent & Associates, Inc.
Project/Site: ARCO 0498, Livermore

TestAmerica Job ID: 440-101853-1

Method: 8260B/5030B - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 440-101849-C-1 MS

Matrix: Water

Analysis Batch: 237964

Client Sample ID: Matrix Spike

Prep Type: Total/NA

Analyte	Sample	Sample	Spike	MS	MS	Unit	D	%Rec	%Rec.
	Result	Qualifier	Added	Result	Qualifier				
1,2-Dibromoethane (EDB)	ND		25.0	25.9		ug/L		103	70 - 131
1,2-Dichloroethane	ND		25.0	26.6		ug/L		106	56 - 146
Benzene	ND		25.0	25.8		ug/L		103	66 - 130
Ethanol	ND		1250	1440		ug/L		115	54 - 150
Ethylbenzene	ND		25.0	27.0		ug/L		108	70 - 130
Ethyl-t-butyl ether (ETBE)	ND		25.0	29.5		ug/L		118	70 - 130
Isopropyl Ether (DIPE)	ND		25.0	28.0		ug/L		112	64 - 138
m,p-Xylene	ND		25.0	25.9		ug/L		104	70 - 133
Methyl-t-Butyl Ether (MTBE)	130		25.0	155	BB	ug/L		113	70 - 130
o-Xylene	ND		25.0	27.1		ug/L		108	70 - 133
Tert-amyl-methyl ether (TAME)	0.57		25.0	25.1		ug/L		98	68 - 133
tert-Butyl alcohol (TBA)	ND		250	275		ug/L		110	70 - 130
Toluene	ND		25.0	27.4		ug/L		110	70 - 130

Surrogate	MS	MS	Limits
	%Recovery	Qualifier	
4-Bromofluorobenzene (Surr)	98		80 - 120
Dibromofluoromethane (Surr)	104		76 - 132
Toluene-d8 (Surr)	100		80 - 128

Lab Sample ID: 440-101849-C-1 MSD

Matrix: Water

Analysis Batch: 237964

Client Sample ID: Matrix Spike Duplicate

Prep Type: Total/NA

Analyte	Sample	Sample	Spike	MSD	MSD	Unit	D	%Rec	%Rec.	RPD	Limit
	Result	Qualifier	Added	Result	Qualifier						
1,2-Dibromoethane (EDB)	ND		25.0	24.5		ug/L		98	70 - 131	5	25
1,2-Dichloroethane	ND		25.0	25.3		ug/L		101	56 - 146	5	20
Benzene	ND		25.0	24.8		ug/L		99	66 - 130	4	20
Ethanol	ND		1250	1370		ug/L		110	54 - 150	5	30
Ethylbenzene	ND		25.0	25.3		ug/L		101	70 - 130	6	20
Ethyl-t-butyl ether (ETBE)	ND		25.0	28.2		ug/L		113	70 - 130	4	25
Isopropyl Ether (DIPE)	ND		25.0	26.8		ug/L		107	64 - 138	4	25
m,p-Xylene	ND		25.0	24.7		ug/L		99	70 - 133	5	25
Methyl-t-Butyl Ether (MTBE)	130		25.0	151	BB	ug/L		99	70 - 130	2	25
o-Xylene	ND		25.0	25.3		ug/L		101	70 - 133	7	20
Tert-amyl-methyl ether (TAME)	0.57		25.0	24.3		ug/L		95	68 - 133	3	30
tert-Butyl alcohol (TBA)	ND		250	264		ug/L		106	70 - 130	4	25
Toluene	ND		25.0	25.8		ug/L		103	70 - 130	6	20

Surrogate	MSD	MSD	Limits
	%Recovery	Qualifier	
4-Bromofluorobenzene (Surr)	96		80 - 120
Dibromofluoromethane (Surr)	104		76 - 132
Toluene-d8 (Surr)	99		80 - 128

TestAmerica Irvine

QC Sample Results

Client: Broadbent & Associates, Inc.
Project/Site: ARCO 0498, Livermore

TestAmerica Job ID: 440-101853-1

Method: 8015B/5030B - Gasoline Range Organics (GC)

Lab Sample ID: MB 440-236905/28

Matrix: Water

Analysis Batch: 236905

Client Sample ID: Method Blank

Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
GRO (C6-C12)	ND		50	ug/L			02/18/15 00:57	1
Surrogate	MB %Recovery	MB Qualifier	Limits			Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	92		65 - 140				02/18/15 00:57	1

Lab Sample ID: LCS 440-236905/27

Matrix: Water

Analysis Batch: 236905

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
GRO (C4-C12)	800	816		ug/L		102	80 - 120
Surrogate	LCS %Recovery	LCS Qualifier	Limits				
4-Bromofluorobenzene (Surr)	103		65 - 140				

Lab Sample ID: 440-101673-A-2 MS

Matrix: Water

Analysis Batch: 236905

Client Sample ID: Matrix Spike

Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
GRO (C4-C12)	ND		800	758		ug/L		95	65 - 140
Surrogate	MS %Recovery	MS Qualifier	Limits						
4-Bromofluorobenzene (Surr)	98		65 - 140						

Lab Sample ID: 440-101673-A-2 MSD

Matrix: Water

Analysis Batch: 236905

Client Sample ID: Matrix Spike Duplicate

Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
GRO (C4-C12)	ND		800	760		ug/L		95	65 - 140	0	20
Surrogate	MSD %Recovery	MSD Qualifier	Limits								
4-Bromofluorobenzene (Surr)	96		65 - 140								

QC Association Summary

Client: Broadbent & Associates, Inc.
Project/Site: ARCO 0498, Livermore

TestAmerica Job ID: 440-101853-1

GC/MS VOA

Analysis Batch: 237964

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
440-101849-C-1 MS	Matrix Spike	Total/NA	Water	8260B/5030B	
440-101849-C-1 MSD	Matrix Spike Duplicate	Total/NA	Water	8260B/5030B	
440-101853-1	MW-1	Total/NA	Water	8260B/5030B	
440-101853-2	MW-2	Total/NA	Water	8260B/5030B	
440-101853-3	MW-3	Total/NA	Water	8260B/5030B	
440-101853-4	MW-5A	Total/NA	Water	8260B/5030B	
440-101853-5	MW-5B	Total/NA	Water	8260B/5030B	
440-101853-6	MW-6A	Total/NA	Water	8260B/5030B	
440-101853-7	MW-6B	Total/NA	Water	8260B/5030B	
LCS 440-237964/4	Lab Control Sample	Total/NA	Water	8260B/5030B	
MB 440-237964/14	Method Blank	Total/NA	Water	8260B/5030B	

GC VOA

Analysis Batch: 236905

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
440-101673-A-2 MS	Matrix Spike	Total/NA	Water	8015B/5030B	
440-101673-A-2 MSD	Matrix Spike Duplicate	Total/NA	Water	8015B/5030B	
440-101853-1	MW-1	Total/NA	Water	8015B/5030B	
440-101853-2	MW-2	Total/NA	Water	8015B/5030B	
440-101853-3	MW-3	Total/NA	Water	8015B/5030B	
440-101853-4	MW-5A	Total/NA	Water	8015B/5030B	
440-101853-5	MW-5B	Total/NA	Water	8015B/5030B	
440-101853-6	MW-6A	Total/NA	Water	8015B/5030B	
440-101853-7	MW-6B	Total/NA	Water	8015B/5030B	
LCS 440-236905/27	Lab Control Sample	Total/NA	Water	8015B/5030B	
MB 440-236905/28	Method Blank	Total/NA	Water	8015B/5030B	

Definitions/Glossary

Client: Broadbent & Associates, Inc.
Project/Site: ARCO 0498, Livermore

TestAmerica Job ID: 440-101853-1

Qualifiers

GC/MS VOA

Qualifier	Qualifier Description
BB	Sample > 4X spike concentration
ID	Analyte identified by RT & presence of single mass ion

GC VOA

Qualifier	Qualifier Description
LH	Surrogate Recoveries were higher than QC limits

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
α	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Certification Summary

Client: Broadbent & Associates, Inc.
Project/Site: ARCO 0498, Livermore

TestAmerica Job ID: 440-101853-1

Laboratory: TestAmerica Irvine

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

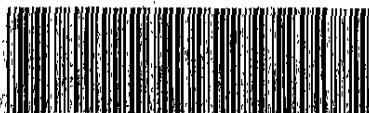
Authority	Program	EPA Region	Certification ID	Expiration Date
Alaska	State Program	10	CA01531	06-30-15
Arizona	State Program	9	AZ0671	10-13-15
California	LA Cty Sanitation Districts	9	10256	01-31-16 *
California	State Program	9	2706	06-30-16
Guam	State Program	9	Cert. No. 12.002r	01-23-15 *
Hawaii	State Program	9	N/A	01-29-16
Nevada	State Program	9	CA015312007A	07-31-15
New Mexico	State Program	6	N/A	01-29-15 *
Northern Mariana Islands	State Program	9	MP0002	01-29-15 *
Oregon	NELAP	10	4005	01-29-16
USDA	Federal		P330-09-00080	06-06-15

* Certification renewal pending - certification considered valid.

TestAmerica Irvine



Laboratory Management Program



440-101853 Chain of Custody

Page 1 of 1

BP Site Node Path: BP 498 (y): _____

Rush TAT: Yes ___ No X

BP Facility No: 498

Lab Work Order Number: _____

Lab Name: Test America	Facility Address: 286 South Livermore Avenue	Consultant/Contractor: Broadbent & Associates Inc.
Lab Address: 17461 Derian Avenue, Suite 100, Irvine, CA	City, State, ZIP Code: Livermore, California	Consultant/Contractor Project No: 08-82-603
Lab PM: Kathleen Robb	Lead Regulatory Agency: ACEH	Address: 4820 Business Center Drive, Suite 110, Fairfield, CA
Lab Phone: 949-261-1022	California Global ID No.: T0600124081	Consultant/Contractor PM: Kristene Tidwell
Lab Shipping Acct: Fed ex#: 1103-6633-7	Enfos Proposal No/ WR#: 0056X - 0005 / WR273478	Phone: 707-455-7290 Email: ktidwell@broadbentinc.com
Lab Bottle Order No:	Accounting Mode: Provision <u>X</u> OOC-BU ___ OOC-RM ___	Email EDD To: ktidwell@broadbentinc.com and to lab_enfosdoc@bp.com
Other Info:	Stage: Execute (4) Activity: GWM (401)	Invoice To: BP <u>X</u> Contractor: _____

BP Project Manager (PM): Chuck Carmel				Matrix											Requested Analyses											Report Type & QC Level							
BP PM Phone: 925-275-3803				Soil / Solid	Water / Liquid	Air / Vapor	Is this location a well?	Total Number of Container	Unpreserved	H2SO4	HNO3	HCl	Methanol	GFC by 8015M	BTEX/5 FO/EDB by 8260	1,2-DCA and Ethanol by 8260												Standard <u>X</u>	Full Data Package ___				
BP PM Email: charles.carmel@bp.com																												Comments					
Lab No.	Sample Description	Date	Time																														
	MW-1	2/10/15	0950	X			6						X	X	X																		
	MW-2	↓	0920	X			6						X	X	X																		
	MW-3	↓	1155	X			6						X	X	X																		
	MW-4	—	—	X			6						X	X	X																		
	MW-5A	2/10/15	1105	X			6						X	X	X																		
	MW-5B	↓	1130	X			6						X	X	X																		
	MW-6A	↓	1015	X			6						X	X	X																		
	MW-6B	↓	1035	X			6						X	X	X																		
	TB-498-02092015	—	—	X		n	2																										

Sampler's Name: Alex Martinez & Nick Vrdojak	Relinquished By / Affiliation				Date	Time	Accepted By / Affiliation				Date	Time
Sampler's Company: Broadbent & Associates	<i>Alex Martinez</i> BAI				2/12/15	1700	<i>Vin Brandi</i> TAI				2/13/15	9:45
Shipment Method: FedEx	Ship Date: 2/10/2015											
Shipment Tracking No: 8037 8050 3033												

Special Instructions: Fed: 7802 0627 0929

THIS LINE - LAB USE ONLY: Custody Seals In Place Yes / No ___ Temp Blank: Yes No / Yes ___ Cooler Temp on Receipt: 43/36 °F / ___ Trip Blank: Yes / No ___ MS/MSD Sample Submitted: Yes No / Yes ___

- 13
- 12
- 11
- 10
- 9
- 8
- 7
- 6
- 5
- 4
- 3
- 2
- 1

Login Sample Receipt Checklist

Client: Broadbent & Associates, Inc.

Job Number: 440-101853-1

Login Number: 101853

List Source: TestAmerica Irvine

List Number: 1

Creator: Blocker, Kristina M

Question	Answer	Comment
Radioactivity wasn't checked or is <=/ background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

APPENDIX G

GeoTracker Upload Confirmation Receipts