Appendix B

Geotechnical Study

EN Engineering, LLC.
3000 Executive Parkway, Suite 505
San Ramon, CA 94583

July 25, 2017
Project No.: T200

Attention: Mr. Colin Lakin, Project Engineer

Project: Pacific Gas & Electric Co.
R-893 Replacement Project (I-580 Crossing)
L-131 MP 32.29
Livermore, California

Subject: DESKTOP GEOLOGICAL/GEOTECHNICAL STUDY

References:
1. *"Special Study Zones, Livermore 7.5-Minute Quadrangle, Alameda County, California, Official Map,"* prepared by California Department of Conservation, Division of Mines and Geology, dated January 1, 1982.
2. *"USGS Open File Report 88-516, Plate-1 Geologic Map of the Livermore Gravels, Alameda County, California,"* prepared by Vincent Barlock, dated 1988."
3. "*Geotechnical Log of Test Boring Sheet, Arroyo Las Positas Bridge*", prepared by Caltrans, dated October 27, 2005.
4. *"Seismic Hazard Zones, Livermore 7.5-Minute Quadrangle, Alameda County, California, Official Map,"* prepared by California Geologic Survey, dated August 27, 2008.
5. "*Supplemental Geotechnical Investigation, Sage Residential Project – Tract 8121, Portola Avenue, Livermore, California*", prepared by Berlogar Stevens & Associates, dated April 1, 2013.
6. "*Pipeline – Design Basis Plan, R-893 Replacement Project*", prepared by Pacific Gas & Electric Company, dated June 29, 2017.

Dear Mr. Lakin,

As requested, we have prepared this desktop geological / geotechnical study for the design and construction of Pacific Gas and Electric Company's (PG&E) proposed replacement of the R-893 24-inch gas transmission pipeline in Livermore, California. The site location in relation to surrounding streets and landmarks is shown in *Figure No. 1, Vicinity Map*. The purpose of this report is to provide a preliminary geological hazard assessment and geotechnical recommendations prior to a completing our proposed geotechnical study. To develop this report, TGE has reviewed project alignment plans and documents, previous geotechnical information by Caltrans and Berlogar Stevens & Associates (see References No. 3 and 5 above) performed in the vicinity of the site, available geologic and seismic hazard maps for the area, and performed a site reconnaissance.

The proposed project consists of installing a 24-inch gas transmission pipeline beneath the I-580 Freeway by means of either Jack-and-Bore or Horizontal Directional Drilling (HDD). Five separate options and alignments are currently being considered for the installation as shown on *Figure No. 2, Plot Plan*. Option No. 3 is most desirable with option No. 5 a second choice. For each option, the trenchless installations will begin on the northside of the I-580 freeway within a new Shea Homes residential development and end within the gravel parking lot of G&M Farms on the south side of I-580. The beginning elevation of the project ranges from approximately 430 to 440 feet above mean sea level (MSL) depending on the option chosen, and ends at approximately 420 feet MSL. In addition to the I-580 freeway, the gas transmission line will cross Arroyo Las Positas, a small creek.

The study area is generally underlain by Surficial Deposits (Qu) as shown on *Figure No. 3*, Regional Geology Map. Based on review of boring logs in the vicinity of the project by Caltrans and Berlogar Stevens & Associates, these materials consist primarily of clay in a stiff to very stiff condition, with relatively thin interlayered zones of silty sand, clayey sand, poorly-graded sand and gravel.

During the site reconnaissance, standing water was observed within Arroyo Las Positas. Therefore, groundwater is anticipated within the project alignment. Caltrans encountered groundwater during their exploratory borings performed for the I-580 Arroyo Las Positas bridge overcrossing at elevations ranging from approximately 387 feet to 403 feet MSL. The exploratory borings performed for the Shea Homes development on the north side of the alignment did not encounter groundwater to the maximum depth explored of approximately 407 feet MSL.

Based on our review of the USGS fault map shown in *Figure No. 4, Regional Fault Map*, no known active faults with the potential for surface fault rupture are known to exist beneath the project alignment. Accordingly, the potential for surface rupture at the site due to faulting is considered very low during the design life of the proposed structures. A detailed fault investigation is not recommended. However, regional seismic activity is capable of producing high ground accelerations and strong ground shaking. The Seismic Hazard Zones Map (see *Figure No. 5*) indicates that the project alignment is within an area of liquefaction potential (i.e., area consisting of alluvial deposits with presence of shallow groundwater) and earthquake-induced landslide potential. The potential for liquefaction and landslides should be addressed by the design level geotechnical report.

The geotechnical borings in the area suggest that the project alignment is underlain primarily by clayey soils. Fine grained soils such as clay and silt are not suitable for use as fills in utility trenches. In addition, clay soils typically have a low electrical resistivity which can present a high potential for corrosion to buried ferrous materials. The design level geotechnical report should evaluate corrosion potential and provide mitigation considerations, if necessary.

A potential for scour exists within Arroyo Las Positas. Based on our preliminary review the potential for scour ranges from about 10 to 12 feet below existing ground surface. The design level geotechnical report should evaluate the potential scour depth to ensure the gas line is installed sufficiently below the maximum scour depth.

Construction considerations include groundwater and variable ground conditions along the project alignment. The design level geotechnical report should specifically address detailed construction recommendations related to installation of the pipeline by means of Jack-and-Bore and HDD methods.

TGE appreciates the opportunity to provide this geotechnical engineering service for this project and we look forward to continuing our role as your geotechnical engineering consultant. Please do not hesitate to contact the undersigned with any questions, comments, or concerns regarding this project.

Respectfully submitted,
TRINITY Geotechnical Engineering, Inc.

Jeffrey Magalong, PE
President

Dennis Poland, PG, CEG
Principal Engineering Geologist

Reviewed by,
VO Engineering, Inc.

Van Olin, PE, GE
Principal Geotechnical Engineer

7/25/17

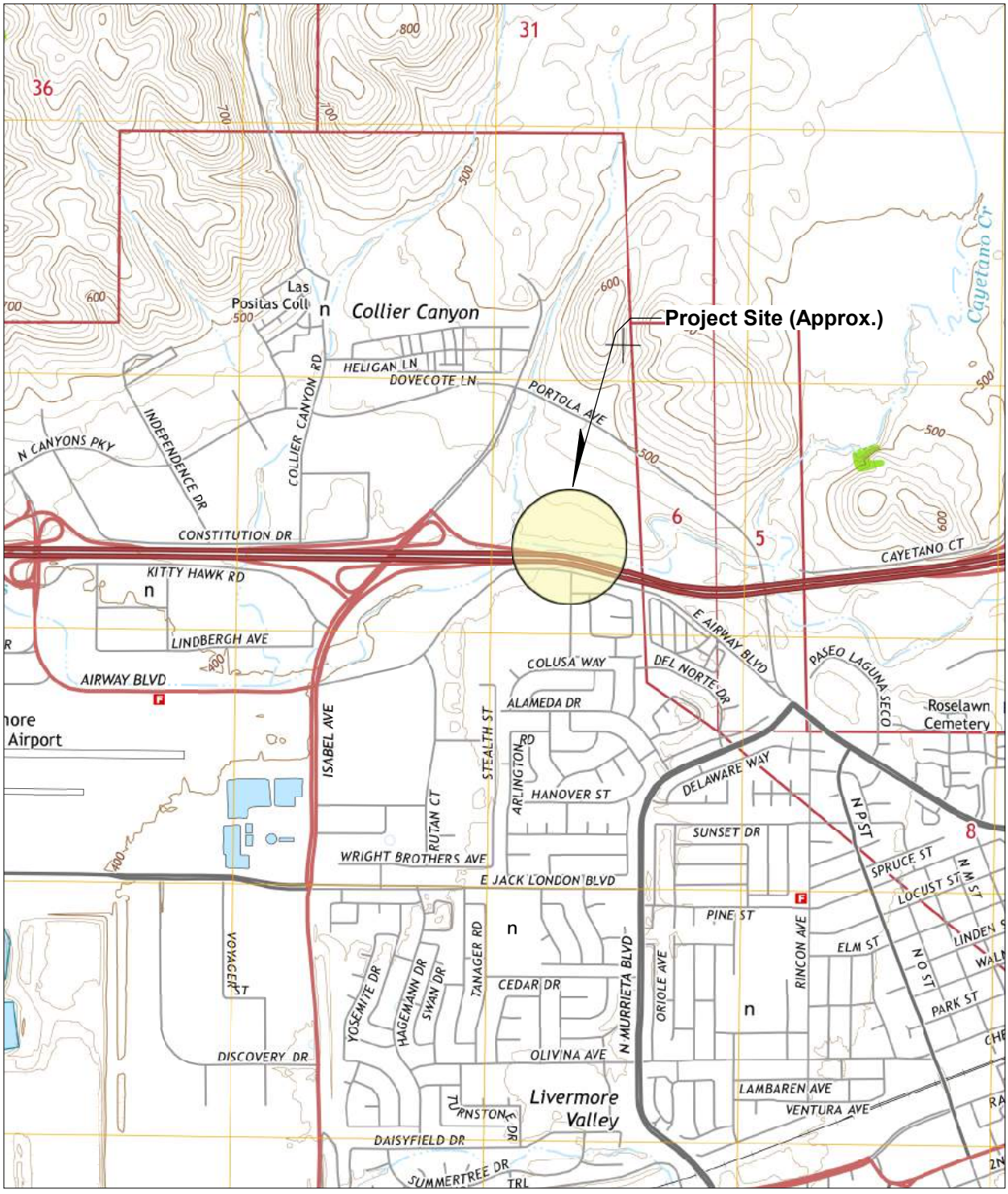
Attachments:
Figure No. 1 – Vicinity Map
Figure No. 2 – Plot Plan
Figure No. 3 – Regional Geology Map
Figure No. 4 – Regional Fault Map
Figure No. 5 – Seismic Hazard Zones Map

Appendix A – Caltrans Log of Test Boring Sheets
Appendix B – Shea Homes Geotechnical Report

Distribution: (1) Addressee, via email

TRINITY
GEOTECHNICAL ENGINEERING, INC.

FIGURES



Reference: USGS 2015 Topographic Map (Livermore, CA - 7.5 Minute Quadrangle)

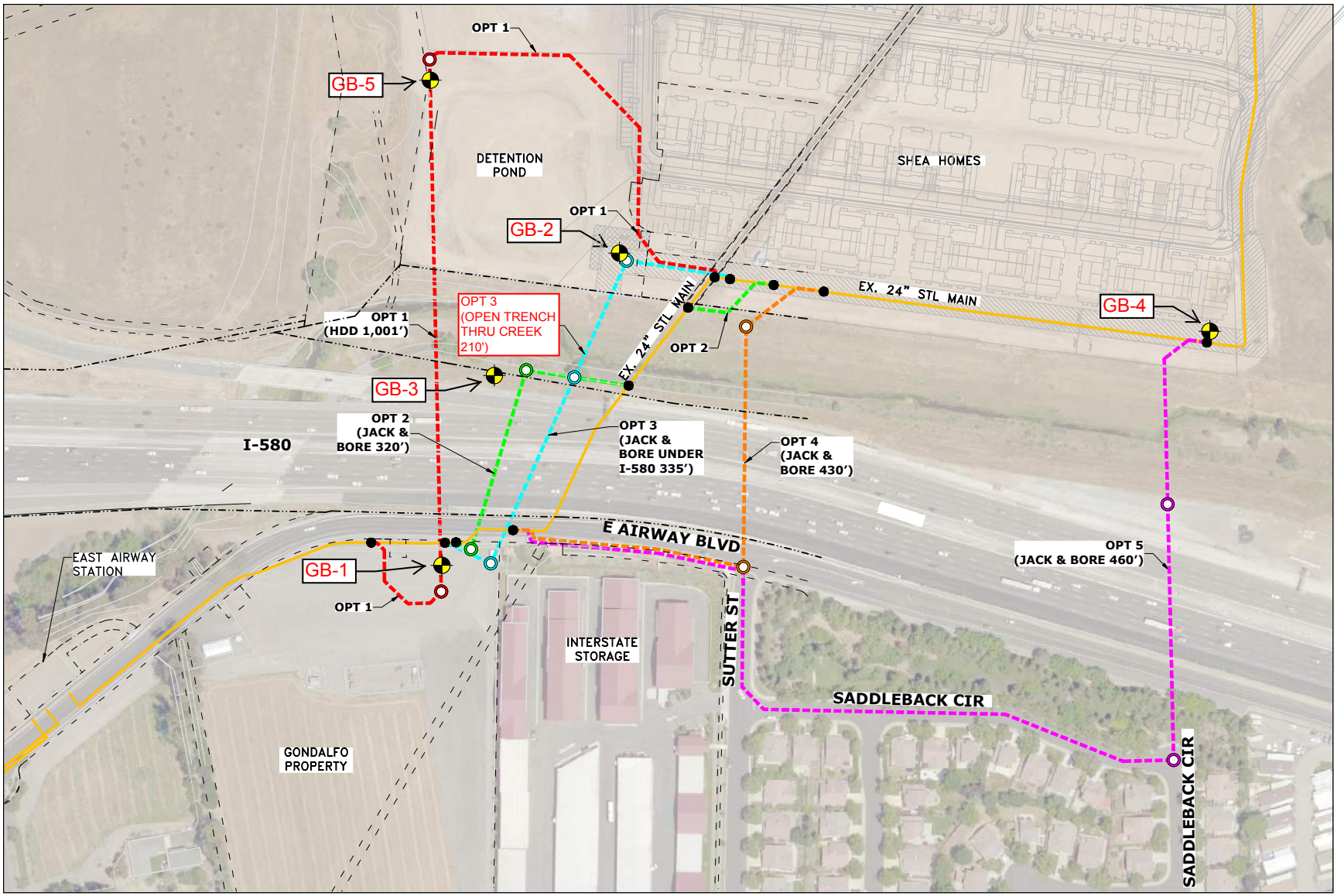
TRINITY GEOTECHNICAL ENGINEERING, INC.

Gas Transmission & Distribution
Pacific Gas and Electric Co.
San Francisco, California

Vicinity Map

R-893 Replacement Project
Livermore, CA

TGE Project No.: T200	Figure No.: 1



Reference: Pipeline - Design Basis Plan, R-893 Replacement Project, L-131 MP 32.29, Replace 24" Gas Pipeline - Livermore, CA, Dwg. No. 74008389, prepared by EN Engineering, dated 4/29/17.

TRINITY GEOTECHNICAL ENGINEERING, INC.

Legend

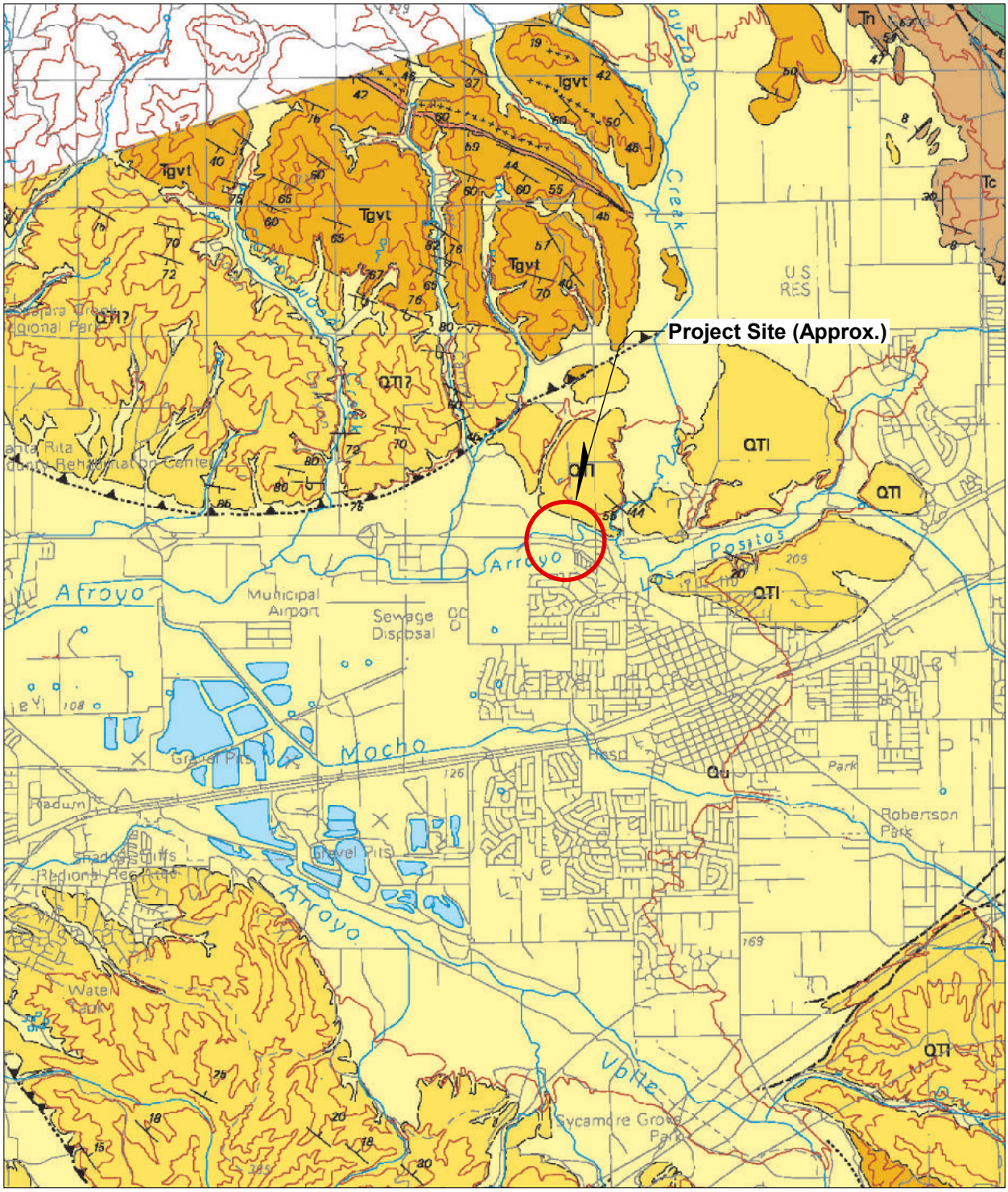
- Prop. Boring Locations (Approx.)
- Prop. Bore/HDD Entry / Exit
- Prop. Tie-in
- Option 1
- Option 2 (Ruled out)
- Option 3
- Option 4
- Option 5

Gas Transmission & Distribution
Pacific Gas and Electric Co.
San Francisco, California

Plot Plan

R-893 Replacement Project
Livermore, CA

TGE Project No.: T200 | **Figure No.: 2**

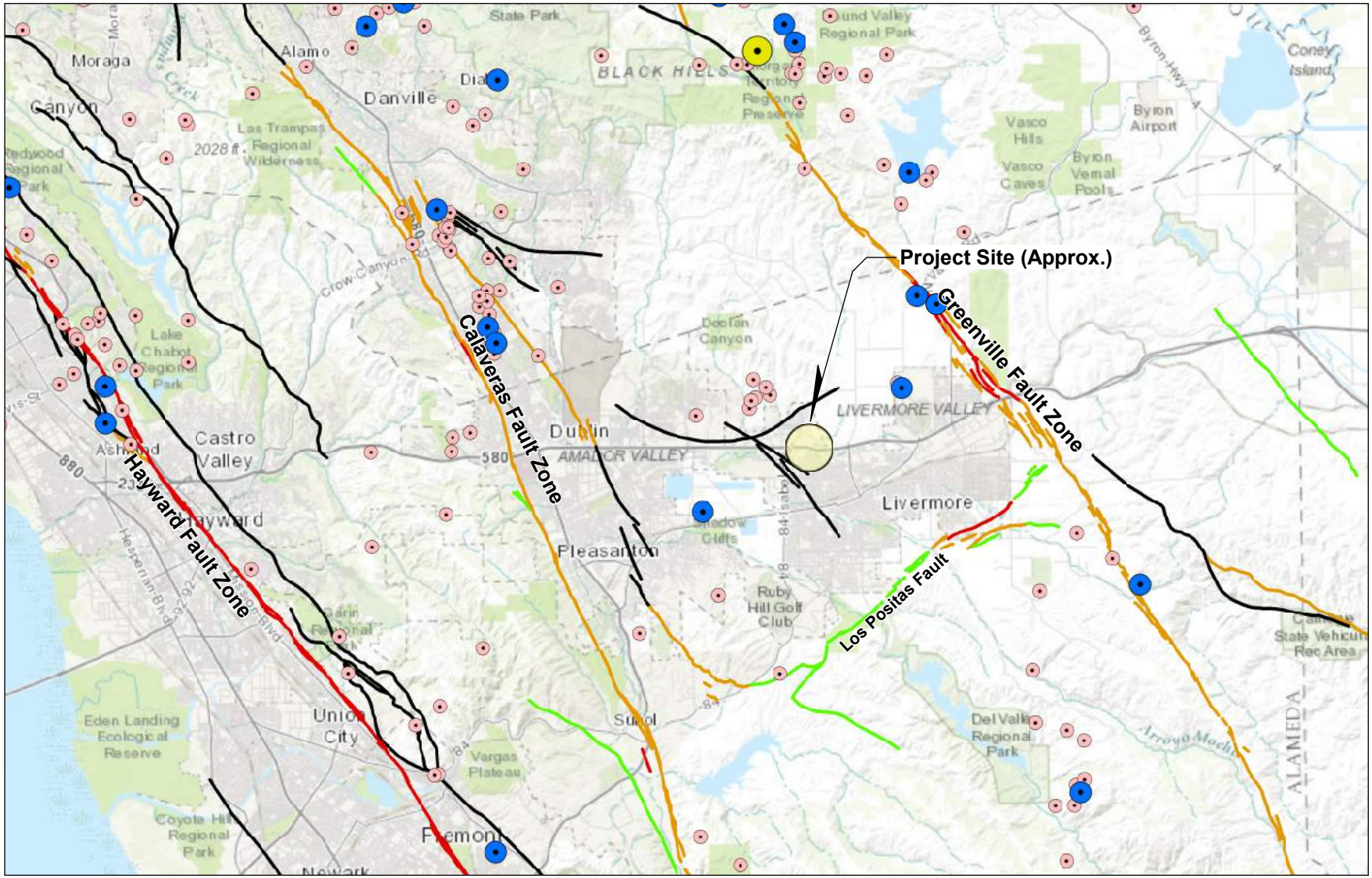


Reference: Preliminary Geologic Map Emphasizing Bedrock Formations in Alameda County, California:Derived from the Digital Database Open-File 96-252, dated 1996.

MAP UNITS

Qu - Surficial Deposits (undivided)

TRINITY GEOTECHNICAL ENGINEERING, INC.	Gas Transmission & Distribution **Pacific Gas and Electric Co.** San Francisco, California	**Regional Geology Map** **R-893 Replacement Project** **Livermore, CA** **TGE Project No.: T200** | **Figure No.: 3**



Reference: Esri; U.S. Geological Survey and California Geological Survey, 2006, Quaternary fold and fault database for the United States; USGS Earthquake Archives

Quaternary Faults - Faults are classified by age of last known movement.

Historic — <150 years ago

Holocene to Latest Pleistocene — <15,000 years ago

Late Quaternary — <130,000 years ago

Quaternary — >1.6 Ma

TRINITY GEOTECHNICAL ENGINEERING, INC.

Earthquake Epicenter by Magnitude

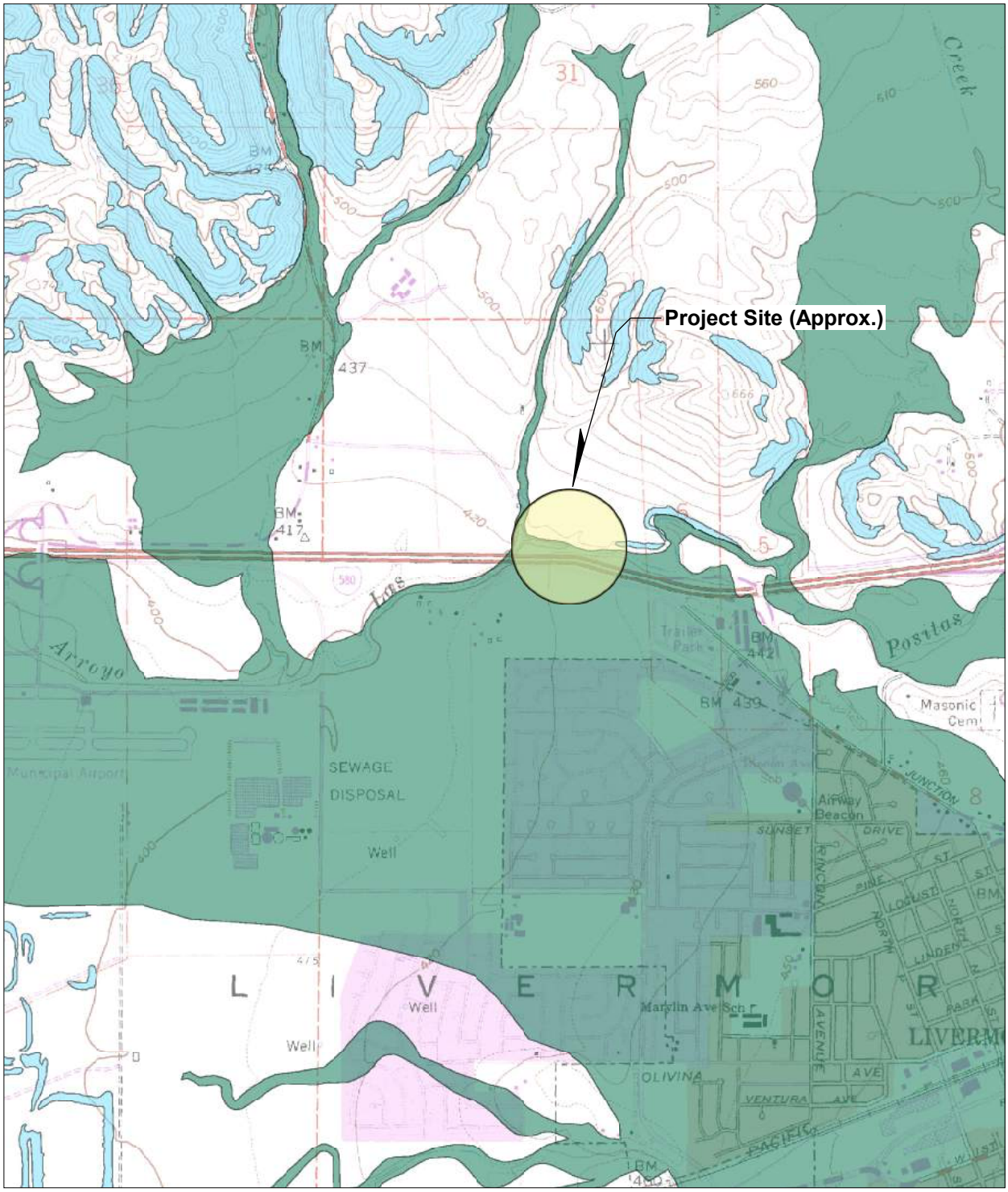
- 3.0 - 3.9
- 4.0 - 4.9
- 5.0 - 5.9

Gas Transmission & Distribution
Pacific Gas and Electric Co.
San Francisco, California

Regional Fault Map

R-893 Replacement Project
Livermore, CA

TGE Project No.: T200 | **Figure No.: 4**



Reference: CGS Earthquake Zones of Required Investigation, Livermore, Quadrangle, dated 2008

MAP UNITS

- Liquefaction Zones
- Earthquake-Induced Landslide Zones

TRINITY GEOTECHNICAL ENGINEERING, INC.

Gas Transmission & Distribution
Pacific Gas and Electric Co.
San Francisco, California

Seismic Hazard Zones Map

R-893 Replacement Project
Livermore, CA

TGE Project No.: T200	Figure No.: 5

TRINITY
GEOTECHNICAL ENGINEERING, INC.

APPENDIX A

Caltrans Log of Test Boring Sheets

Dist	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala	84,580	46.4/47.2, 21.0/24.0	1	477

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

HPLUL-6204(078)

PROJECT PLANS FOR CONSTRUCTION ON

4

STATE HIGHWAY

HP2IL-6204(079)

IN ALAMEDA COUNTY
IN LIVERMORE

ON ROUTE 580 FROM 0.2 KM EAST OF PORTOLA AVENUE OVERCROSSING TO 0.1 KM EAST OF AIRWAY BOULEVARD OVERCROSSING AND ON ROUTE 84 FROM 0.3 KM NORTH OF AIRWAY BOULEVARD TO 0.5 KM SOUTH OF PORTOLA AVENUE

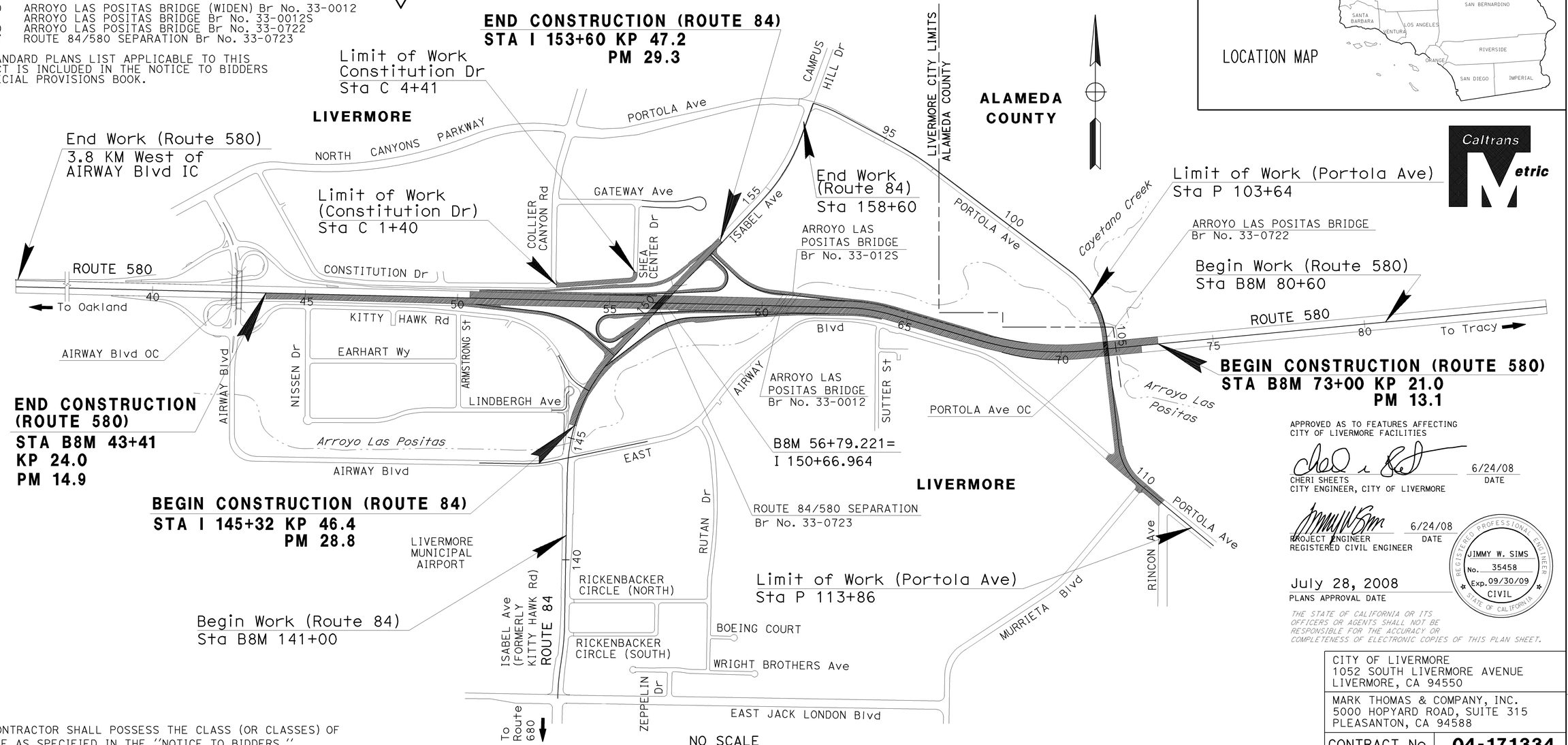
TO BE SUPPLEMENTED BY STANDARD PLANS DATED JULY 2004

4 REVISED PER ADDENDUM No. 4 DATED APRIL 29, 2009

INDEX OF SHEETS

THE STANDARD PLANS LIST APPLICABLE TO THIS CONTRACT IS INCLUDED IN THE NOTICE TO BIDDERS AND SPECIAL PROVISIONS BOOK.

LOCATION MAP



NO SCALE

THE CONTRACTOR SHALL POSSESS THE CLASS (OR CLASSES) OF LICENSE AS SPECIFIED IN THE "NOTICE TO BIDDERS."

APPROVED AS TO FEATURES AFFECTING CITY OF LIVERMORE FACILITIES

CHERI SHEETS
CITY ENGINEER, CITY OF LIVERMORE — 6/24/08 DATE

PROJECT ENGINEER
REGISTERED CIVIL ENGINEER — 6/24/08 DATE

REGISTERED PROFESSIONAL ENGINEER
JIMMY W. SIMS
No. 35458
Exp. 09/30/09
CIVIL
STATE OF CALIFORNIA

July 28, 2008
PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF ELECTRONIC COPIES OF THIS PLAN SHEET.

CITY OF LIVERMORE
1052 SOUTH LIVERMORE AVENUE
LIVERMORE, CA 94550

MARK THOMAS & COMPANY, INC.
5000 HOPYARD ROAD, SUITE 315
PLEASANTON, CA 94588

CONTRACT No. **04-171334**

CONSULTANT DESIGN ENGINEER: JIMMY W. SIMS | REGISTRATION No. C39838 | LICENSE Exp DATE 12/31/09 | DATE SIGNED 4/04/08

CALTRANS DESIGN OVERSIGHT APPROVAL: NESTOR P. PEREZ

APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

Approved as to impact on State facilities and conformance with applicable State standards and practices and that technical oversight was performed as described in the California Department of Transportation A&E Consultant Service Manual.

LAST REVISION DATE PLOTTED => 27-APR-2009
00-00-00 TIME PLOTTED => 1421

BORDER LAST REVISED 3/1/2007 | CALTRANS WEB SITE IS: HTTP://WWW.DOT.CA.GOV/ | RELATIVE BORDER SCALE IS IN MILLIMETERS 0 20 40 60 80 | USERNAME => trannda | DGN FILE => 417133ab001.add | CU 04257 | EA 171331

Dist	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala	84,580	46.4/47.2, 21.0/24.0	18	477

REGISTERED CIVIL ENGINEER — 3/31/08 DATE

JIMMY W. SIMS No. 35458 Exp. 09/30/09 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

7-28-08
PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF ELECTRONIC COPIES OF THIS PLAN SHEET.

CITY OF LIVERMORE
1052 SOUTH LIVERMORE AVENUE
LIVERMORE, CA 94550

MARK THOMAS & COMPANY, INC.
5000 HOPYARD RD, SUITE 315
PLEASANTON, CA 94588

Caltrans Metric

CURVE DATA

No.	RADIUS	DELTA	TANGENT	LENGTH	NORTHING	EASTING
1	599.395	14°48'26"	77.886	154.904	633453.6850	1885777.6987
2	210.000	37°10'54"	70.635	136.278	634309.0532	1885576.2420
3	1000.000	2°51'53"	25.005	50.000	633032.2448	1885591.5118
4	1213.167	1°59'48"	21.141	42.278	633444.4479	1885728.8504
5	1002.400	2°51'59"	25.078	50.146	633026.1240	1885628.2119

LIVERMORE

GROUND COVER

+95.007, 20.310 Lt
END FENCE (TYPE CL-1.8)
CONNECT TO Exist FENCE
END REMOVE FENCE

Exist FENCE TO REMAIN

HMA DIKE (TYPE E)

BRIDGE No. 33-0012 (SEE STRUCTURE PLANS)

+80.5, 9.600Lt
Beg MBGR
CONNECT TO BRIDGE RAILING
Beg HMA DIKE (TYPE F)

SEE NOTE 10

MBGR (TYPE 12B LAYOUT)

R/W

IR3 +95.7
END MBGR
END HMA DIKE (TYPE F)
Beg HMA DIKE (TYPE C)

IR3 62+71.365 POT=
B8M 62+71.365, 21.031 Lt

Arroyo Las Positas

+71.365 BC
9.600 Lt

B8M 63+00, 28.717 Lt
Beg Conc BARRIER (TYPE 60C)
END HMA DIKE (TYPE E)

R/W IR3 60+33.729 EC

SEE NOTE 10

ALTERNATIVE FLARED TERMINAL SYSTEM

APPROACH SLAB

+14.7
END HMA DIKE (TYPE C)
Beg HMA DIKE (TYPE E)

HMA DIKE (TYPE E)

+12.582 EC/BC
27.438 Lt

Exist FENCE TO REMAIN

Conc BARRIER (TYPE 60C)

SEE SHEET L-6

APPROACH SLAB

2.4 Shld C

7.2

N 634 100

IR3 LINE

E 1 885 600

WB OFF-RAMP

+60.215 EB

S83°38'25"E 237.636

IR3 +08.715 BB

B8M +59.141

IR3 +02.966
END HMA DIKE (TYPE E)

MBGR TO REMAIN

B8M +89.363
21.031 Lt
CONFORM

SAWCUT & CONFORM

WB ROUTE 580

21.031

B8M 62+75.941 BC

3.0 Shld

3.6

Var

REMOVE FENCE

MATCH LINE

B8M LINE

IR3 61+89.065 POT=
B8M 61+89.363, 28.032 Lt

S88°31'10"E 941.104

SEE SHEET L-9

IR1 +66.680 BB

IR1 +21.1
0.571Rt
Beg REMOVE FENCE

IR3 +70.2
Beg CRASH CUSHION (TYPE ADIEM)
CONNECT TO BRIDGE RAILING

CRASH CUSHION (TYPE ADIEM)

SAWCUT & CONFORM

REMOVE MBGR

IR1 +20.551 EB

30.305

EB ROUTE 580

258.272
N87°28'12"E IR1 LINE

EB ON-RAMP

S89°39'55"E
100.020

2.4

3.6

R/W

TCE

IR1 61+80.708 POT=
B8M 61+80.708, 23.705 Rt

EAST AIRWAY Blvd

E 1 885 800

Exist FENCE TO REMAIN

N 634 000

IR1 60+30.688 BC
RW No.2
(SEE RETAINING WALL PLANS)

IR1 60+80.688 EC

IR1 +54.9
10.753 Rt
END FENCE (TYPE CL-1.8)
END REMOVE FENCE

IR1 +61.522
CONFORM TO Exist

IR1 +61.401
6.000 Rt
END HMA DIKE (TYPE E)
CONFORM TO Exist

IR1 +29.103 BC
4.671 Rt

IR1 +58.662
END RW No.2
CONNECT TO WW

IR1 +16.9
6.660 Rt
Beg FENCE (TYPE CL-1.8)

IR1 +18.846
Beg HMA DIKE (TYPE E)

BRIDGE No. 33-012
(SEE STRUCTURE PLANS)

MATCH LINE SEE SHEET L-7

SEE SHEET L-6

ALL DIMENSIONS ARE IN METERS
UNLESS OTHERWISE SHOWN

LAYOUT
SCALE 1:500

FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET L-1

L-8

LAST REVISION DATE PLOTTED => 18-AUG-2008
00-00-00 TIME PLOTTED => 11:08

REVISED BY | DATE REVISED
MARCUS NG | BRAD LEVEEN
CALCULATED-DESIGNED BY | CHECKED BY
CONSULTANT FUNCTIONAL SUPERVISOR: NESTOR P. PEREZ
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION — Caltrans

BORDER LAST REVISED 3/1/2007

RELATIVE BORDER SCALE IS IN MILLIMETERS 0 20 40 60 80

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DGN FILE => 417133ea008.dgn

CU 04257

EA 171331

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Ala	84,580	46.4/47.2, 21.0/24.0	418	477

GEOTECHNICAL PROFESSIONAL — 3-4-08 DATE

7-28-08
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/09 — STATE OF CALIFORNIA

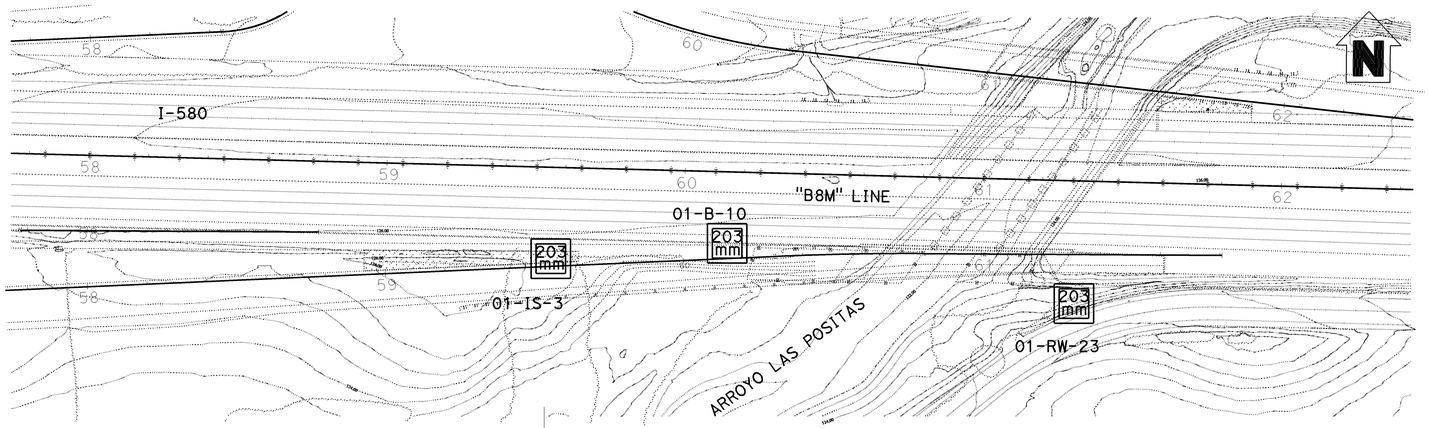
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

ALAMEDA COUNTY CONGESTION MANAGEMENT AGENCY
1333 BROADWAY, SUITE 220
OAKLAND, CA 94612

PARIKH CONSULTANTS, INC.
356 SOUTH MILPITAS BLVD
MILPITAS CA 95035

Caltrans Metric

PLAN
1 : 1000



BENCH MARKS

BENCHMARK NO. Y-1257

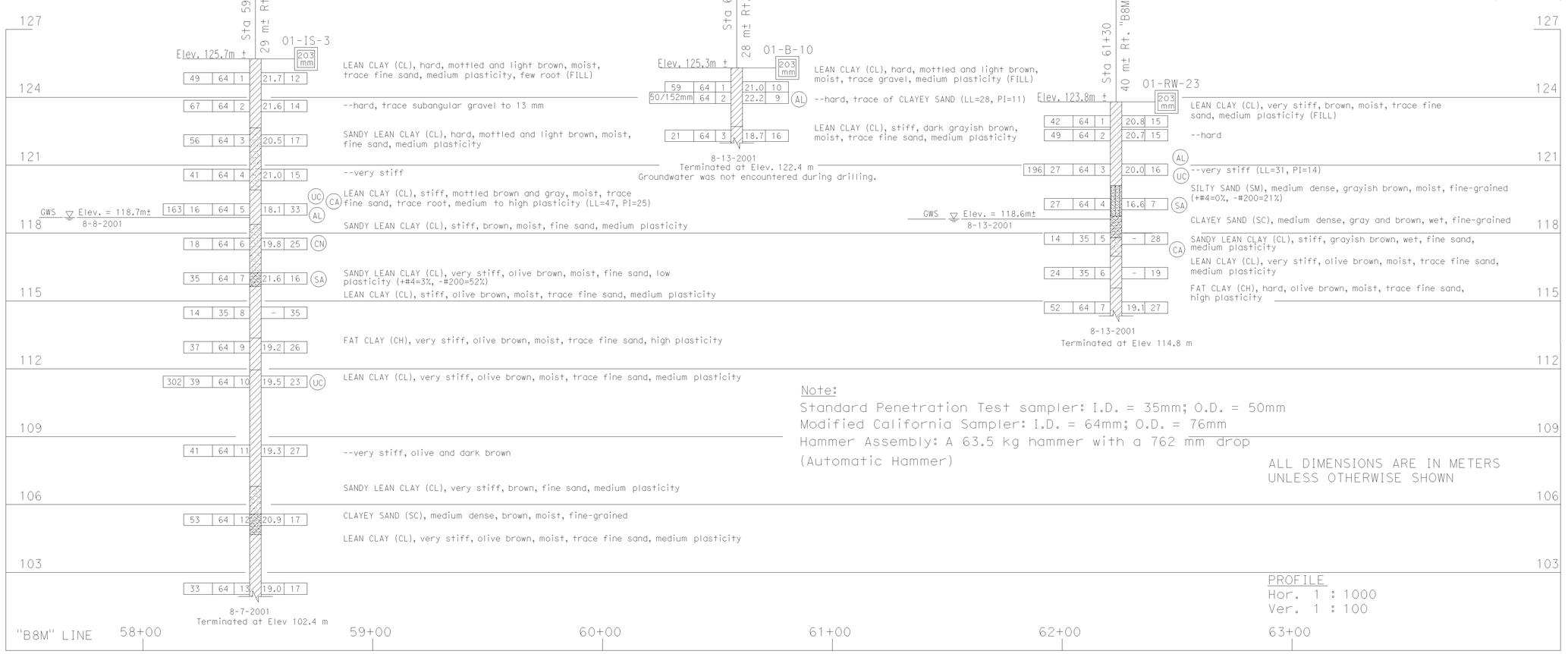
A brass disk set in the top of the south concrete wall of a 0.9 m by 1.2 m structure of a catch basin, located south of the east bound lanes of I-580. Elev: 127.129 m

BENCHMARK NO. A 446 B1

A brass disk on the North Livermore Ave bridge over Arroyo Las Positas, in the top of the west concrete walkway of the bridge. Elev: 140.511 m

DATUM

North American Vertical Datum of 1988 (NAVD 29)

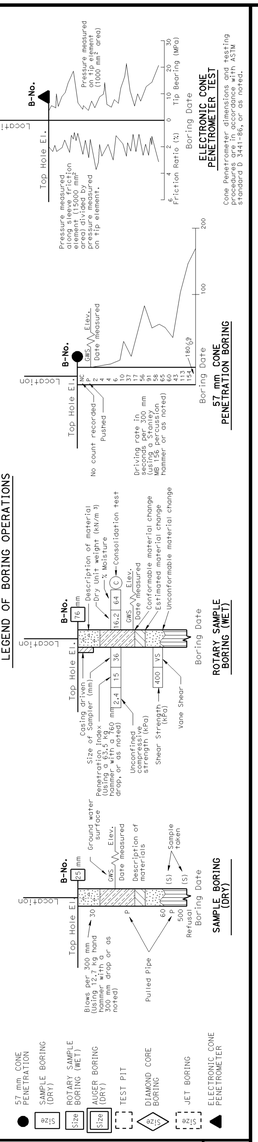


Note:
Standard Penetration Test sampler: I.D. = 35mm; O.D. = 50mm
Modified California Sampler: I.D. = 64mm; O.D. = 76mm
Hammer Assembly: A 63.5 kg hammer with a 762 mm drop
(Automatic Hammer)

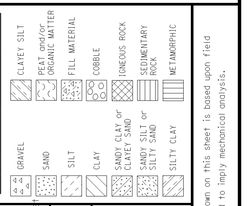
ALL DIMENSIONS ARE IN METERS
UNLESS OTHERWISE SHOWN

PROFILE
Hor. 1 : 1000
Ver. 1 : 100

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS



CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

	SPT N-Value (Blows/ 0.3m)	
Cohesive	<2	Very Soft
	2-4	Soft
	5-8	Firm
	9-15	Stiff
	16-30	Very stiff
	>31	Hard
Granular	0-4	Very Loose
	5-10	Loose
	11-30	Medium Dense
	31-50	Dense
	>50	Very Dense

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

DESIGN OVERSIGHT — Emil A. Vergara Jr. — 3-14-08 SIGN OFF DATE

DRAWN BY: R. AU
CHECKED BY: A. LAM

D. ALEXANDER/ F. LI
FIELD INVESTIGATION BY:
DATE:

PREPARED FOR THE STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

A. LAM
PROJECT ENGINEER

BRIDGE NO. 33-0012
KILOMETER POST 22.2

ARROYO LAS POSITAS BRIDGE (WIDEN)

LOG OF TEST BORINGS 1 OF 3

GEOTECHNICAL LOG OF TEST BORINGS SHEET (METRIC) (REV. 10/27/05)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04257
EA 171331

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 12 OF 14

FILE => 33-0012-z-ltb01.dgn

USERNAME = jtrricht DATE PLOTTED => 18-AUG-2008 TIME PLOTTED => 11:24

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Ala	84,580	46.4/47.2, 21.0/24.0	419	477

Caltrans Metric

GEOTECHNICAL PROFESSIONAL — 3-4-08 DATE

7-28-08
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/09 — STATE OF CALIFORNIA

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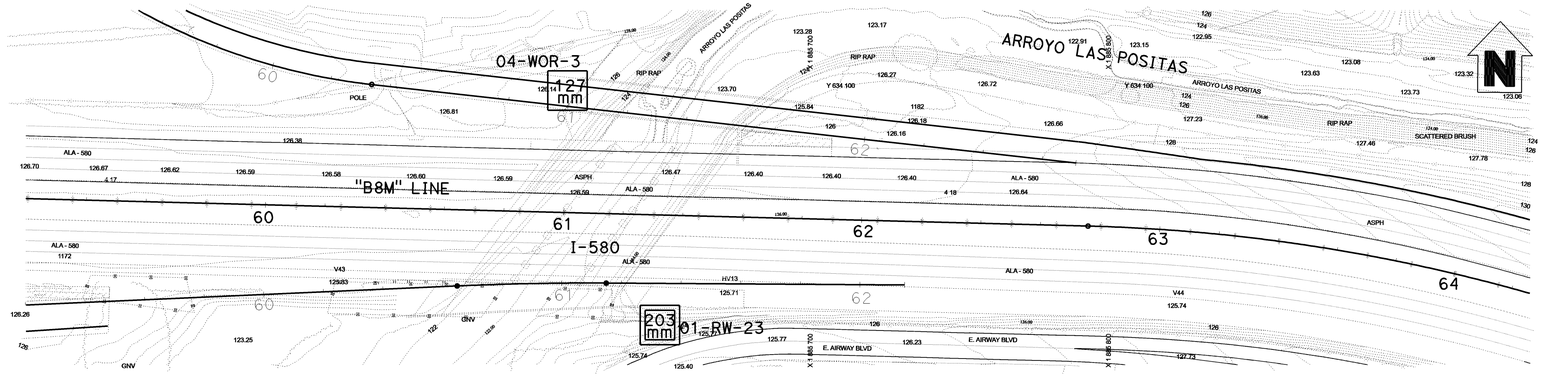
ALAMEDA COUNTY CONGESTION MANAGEMENT AGENCY
1333 BROADWAY, SUITE 220
OAKLAND, CA 94612

PARIKH CONSULTANTS, INC.
356 SOUTH MILPITAS BLVD
MILPITAS CA 95035

PLAN
1 : 1000



BENCH MARKS

BENCHMARK NO. Y-1257

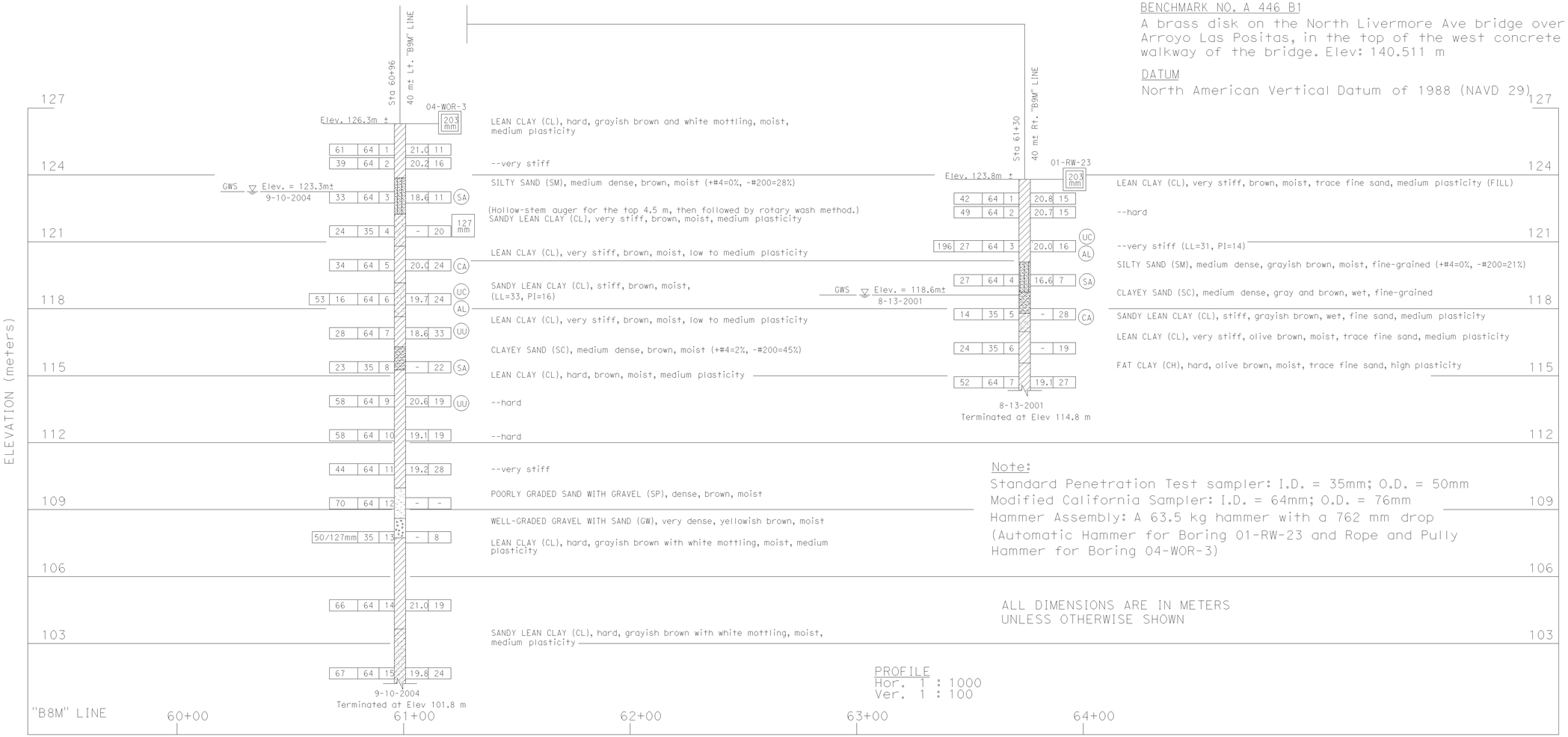
A brass disk set in the top of the south concrete wall of a 0.9 m by 1.2 m structure of a catch basin, located south of the east bound lanes of i-580. Elev: 127.129 m

BENCHMARK NO. A 446 B1

A brass disk on the North Livermore Ave bridge over Arroyo Las Positas, in the top of the west concrete walkway of the bridge. Elev: 140.511 m

DATUM

North American Vertical Datum of 1988 (NAVD 29)

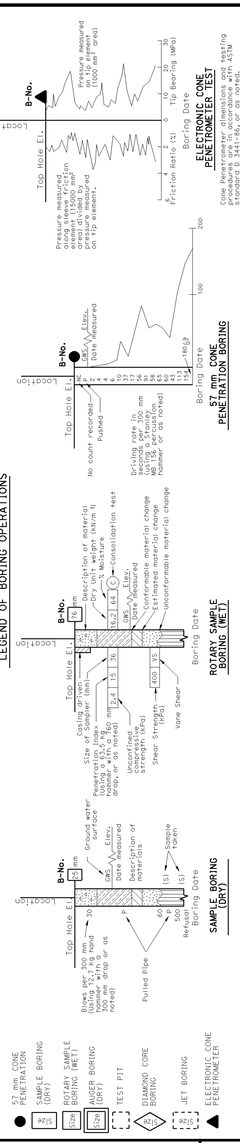


Note:
Standard Penetration Test sampler: I.D. = 35mm; O.D. = 50mm
Modified California Sampler: I.D. = 64mm; O.D. = 76mm
Hammer Assembly: A 63.5 kg hammer with a 762 mm drop
(Automatic Hammer for Boring 01-RW-23 and Rope and Pully Hammer for Boring 04-WOR-3)

ALL DIMENSIONS ARE IN METERS
UNLESS OTHERWISE SHOWN

PROFILE
Hor. 1 : 1000
Ver. 1 : 100

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

GRAVEL · SAND · SILT · CLAY · SANDY CLAY or CLAYEY SAND · SANDY SILT or SILTY SAND · SILTY CLAY · CLAYEY SILT · PEAT and/or ORGANIC MATTER · TILL MATERIAL · COBBLE · IGNEOUS ROCK · SEDIMENTARY ROCK · METAMORPHIC

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

Cohesive	SPT N-Value (Blows/0.3m)	<2	Very Soft
		2-4	Soft
		5-8	Firm
		9-15	Stiff
		16-30	Very stiff
		>31	Hard
Granular	SPT N-Value (Blows/0.3m)	0-4	Very Loose
		5-10	Loose
		11-30	Medium Dense
		31-50	Dense
		>50	Very Dense

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

DESIGN OVERSIGHT Emil A. Vergara Jr.
3-14-08
SIGN OFF DATE

DRAWN BY: R. AU
CHECKED BY: A. LAM

D. ALEXANDER/ F. LI
FIELD INVESTIGATION BY:
DATE:

PREPARED FOR THE STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

A. LAM
PROJECT ENGINEER

BRIDGE NO. 33-0012
KILOMETER POST 22.2

ARROYO LAS POSITAS BRIDGE (WIDEN)

LOG OF TEST BORINGS 2 OF 3

GEOTECHNICAL LOG OF TEST BORINGS SHEET (METRIC) (REV. 10/27/05)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04257
EA 171331

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 13 OF 14

FILE => 33-0012-z-1tb02.dgn

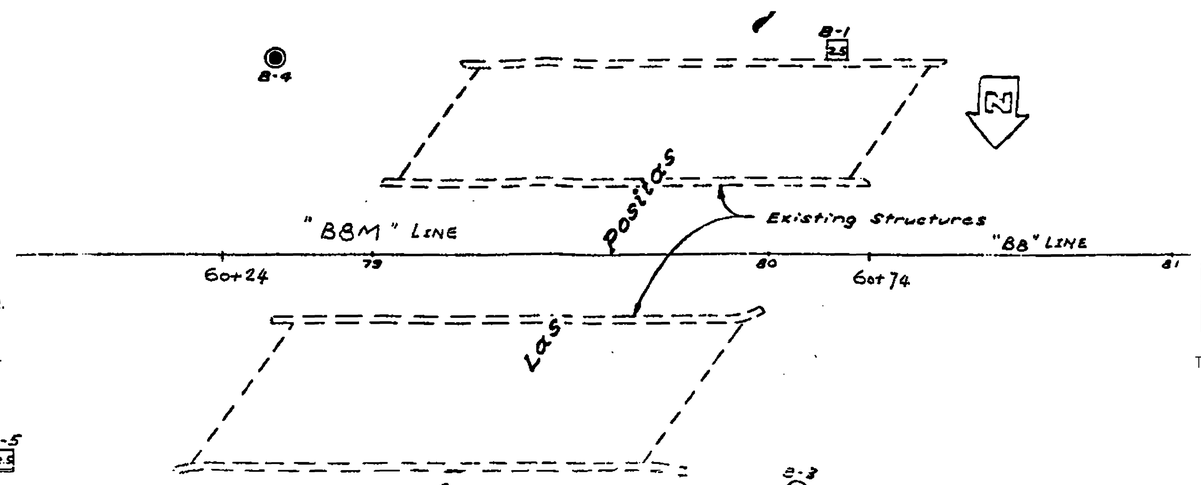
USERNAME = tfright DATE PLOTTED => 18-AUG-2008 TIME PLOTTED => 11:25

Revisions made to this Log of Test Borings from the original 1970 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from "B8M" Line
B-1	60+71	15.9m± Lt.
B-3	60+69	18.3m± Rt.
B-4	59+28	15.2m± Lt.
B-5	60+08	15.9m± Rt.

Notes:

1. See the General Plan and/or Foundation Plan for Metric Stationing.
2. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.



Date approved April 27 1970

DIVISION OF ENGINEERING SERVICES – GEOTECHNICAL SERVICES

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	KILOMETER POST–TOTAL PROJECT	Sheet No.	Total Sheets
04	Ala	84,580	46.4/47.2,21.0/24.0	420	477

CERTIFIED ENGINEER — 2/22/08 DATE

ARROYO LAS POSITAS BRIDGE (WIDEN)

LOG OF TEST BORINGS 3 OF 3

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

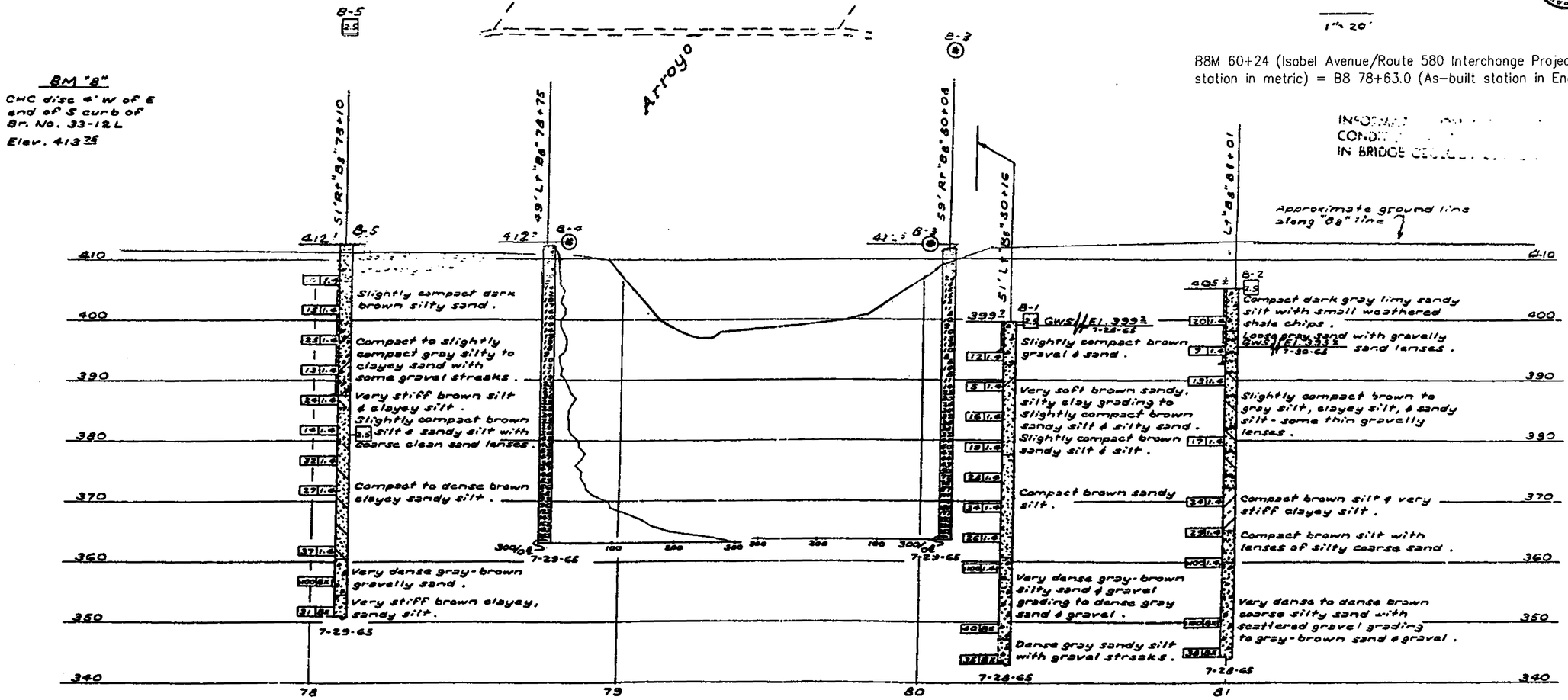
CU: 04257
EA: 171331

BRIDGE No.	
33-0012	
Sheet	of
14	14

To accompany plans dated 7-28-08

1" = 20'

B8M 60+24 (Isabel Avenue/Route 580 Interchange Project control line station in metric) = B8 78+63.0 (As-built station in English)



PROFILE
Vert. 1"=10'
Horiz. 1"=20'

AS BUILT PLANS
Contract No. 04-136444
Date Completed 9-25-72
Document No. 6229

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

ARROYO LAS POSITAS BRIDGE

LOG OF TEST BORINGS

SCALE As Noted	Bridge 33-12	File	3312-8 Drawing	Sheet 10	of 10

04204
136441

Disregard prefix heading and/or numbers → PREL. DRAWING No. PR-3312-

FILENAME= 33-0012-z-ltb03.tif

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Ala	84,580	46.4/47.2, 21.0/24.0	423	477

P.K. Chen 3-4-08
REGISTERED STRUCTURAL ENGINEER

7-28-08
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — PO-KANG CHEN — No. S3112 — Exp. 9/30/09 — STRUCTURAL — STATE OF CALIFORNIA

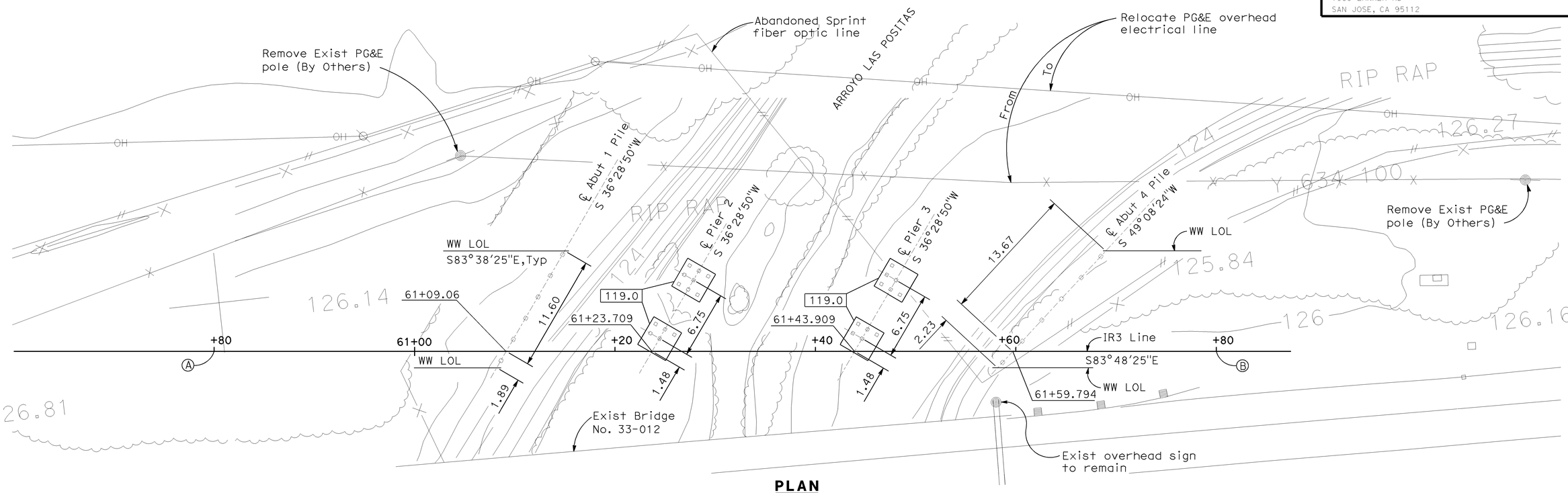
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

CITY OF LIVERMORE
3589 PACIFIC AVENUE
LIVERMORE, CA 94550

MARK THOMAS & COMPANY, INC.
1960 ZANKER RD
SAN JOSE, CA 95112

BACKFILL AT PIERS
No scale

EXCAVATION AT PIERS
No scale



PLAN
1:200

BENCH MARKS

BENCHMARK NO. 1

Set nail and shiner on the Northerly side of West Bound Highway 580.
Northing: 634081.3472
Easting: 1885617.9549
Elevation: 126.34 meters

BENCHMARK NO. 2

Aerial Panel HV-13, nail and shiner on the Southerly side of East Bound Highway 580
Northing: 634032.7565
Easting: 1885673.4027
Elevation: 125.71 meters

LEGEND

Indicates bottom of footing elevation

□ or ▽ Indicates pile (not all piles shown)

126.61 Indicates spot elevation

Utilities shown are for reference only. For all above ground and underground utilities, see "Utility Plans".

"IR3" LINE ALIGNMENT DATA

	North	East
Ⓐ 60+80.00	1885598.967	634095.220
Ⓑ 61+80.00	1885698.351	634084.143

DATUM

North American Vertical Datum 1929 (NAD 83)

HYDROLOGIC SUMMARY

Drainage area: 180 square kilometers

	DESIGN FLOOD	BASE FLOOD
Frequency (Years)	50	100
Discharge (Cubic Meters per Second)	212.40	254.58
Water Surface (Elevation at Bridge), m	124.23	124.43

Flood Plain Data are based upon information available when the plans were prepared and are shown to meet Federal requirements. The accuracy of said information is not warranted by the State and interested or affected parties should make their own investigation.

ALL DIMENSIONS AND ELEVATIONS ARE SHOWN IN METERS, EXCEPT AS NOTED

GEOTECHNICAL PROFESSIONAL — APPROVAL DATE 4/25/06

DESIGN OVERSIGHT Emil A. Vergara Jr. — 3-14-08 SIGN OFF DATE

FOUNDATION PLAN SHEET (METRIC) (REV. 10/27/05)

SCALE:	VERT.DATUM	HORZ.DATUM	
PHOTOGRAMMETRY AS OF:		ALIGNMENT TIES	
SURVEYED	BY MTCo	DRAFTED	BY
FIELD CHECKED	BY MTCo	CHECKED	BY

DESIGN	BY T. WALKER	CHECKED	P. CHEN
DETAILS	BY R. DAVIS	CHECKED	T. WALKER
QUANTITIES	BY T. WALKER	CHECKED	R. DAVIS

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

PO-KANG CHEN
PROJECT ENGINEER

CU 04257
EA 171331

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

FILE => 33-0012s-e-fdp.dgn

BRIDGE NO. 33-0012S
KILOMETER POST 22.2

ARROYO LAS POSITAS BRIDGE
FOUNDATION PLAN

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY)					SHEET	OF
4/25/06	5/31/07	10/17/07	1/28/08	3/4/08	3	11

USERNAME => ttrichf DATE PLOTTED => 18-AUG-2008 TIME PLOTTED => 11:25

APPENDIX B

Shea Homes Geotechnical Report

SUPPLEMENTAL GEOTECHNICAL INVESTIGATION
SAGE RESIDENTIAL PROJECT – TRACT 8121
PORTOLA AVENUE
LIVERMORE, CALIFORNIA

FOR
SHEA HOMES
April 1, 2013

Job No. 3498.100

BERLOGAR STEVENS & ASSOCIATES

Via E-mail and Mail

April 1, 2013
Job No. 3498.100

BERLOGAR STEVENS & ASSOCIATES

Mr. David Best
Shea Homes
2580 Shea Center Drive
Livermore, California 94551

Subject: Supplemental Geotechnical Investigation
Sage Residential Project– Tract 8121
Portola Avenue
Livermore, California

Dear Mr. Best:

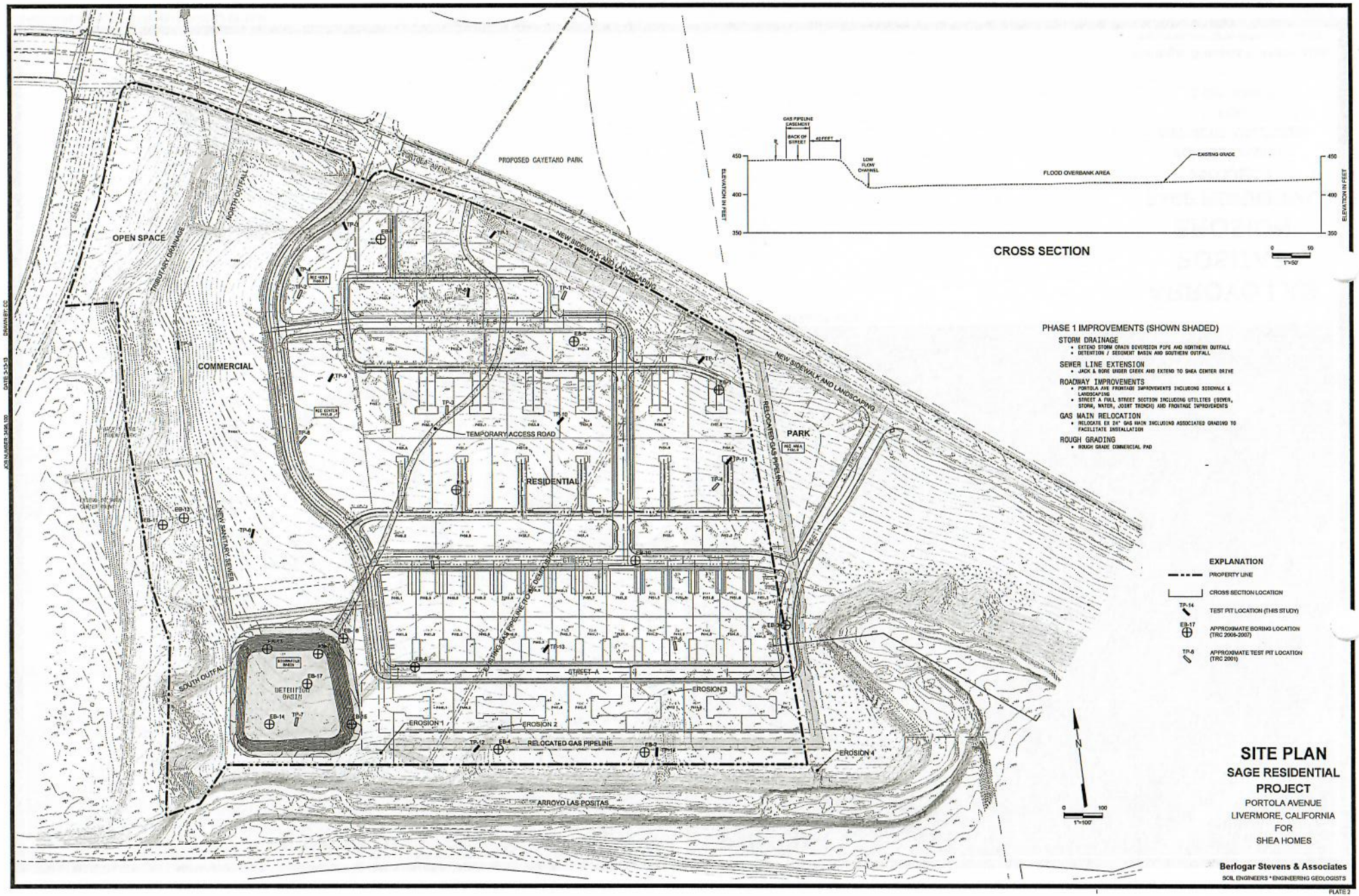
INTRODUCTION

Berlogar Stevens & Associates (BSA) has completed a supplemental geotechnical investigation for the Sage residential project in Livermore, California. The site is located between Portola Avenue and Highway 580, east of Isabel Drive as shown on Plate 1, Vicinity Map. A Geotechnical Investigation report has been prepared by TRC dated December 14, 2007. Our report presents the results of our investigation and provides updated recommendations for the design and construction of the subject project. Recommendations in this report are based on the following preliminary drawings provided by MacKay & Somps:

- Preliminary grading plan emailed to us on 3/4/13.
- Phase 1 Improvement Exhibit dated 2/14/13.
- Grading and Improvement Plans, Storm Drain Outfall dated February 2013.
- Gas Line Relocation, 2/21/13.
- Preliminary Earthwork (cut and fill map), 3/22/13.

The subject property is an approximately 59 acre site, of which approximately 37-acres on the east side will contain the Sage residential project. Approximately 3.5 acres on the southwest corner will be rezoned for a detention pond, as shown on Plate 2, Site Plan. The remainder is currently zoned commercial and has no specific uses that are yet defined. The residential component will be 2- and 3-story, multi-family residential structures. Grading for this project will involve cuts up to about 25 feet deep and fills up to 20 feet thick. The project will be graded in two or more phases, with Phase 1 (outlined on Plate 2) planned for the near future consisting of the following:

1. Sheet grading the commercial portion located along the western side of the site.
2. Constructing an approximately 10-foot deep, 300-foot square detention basin with a 15-foot wide gravel maintenance road around the perimeter. A south outfall into a tributary drainage channel will be constructed with approximately 200 feet of 24-inch diameter storm drain pipe



SITE PLAN

SAGE RESIDENTIAL PROJECT

PORTOLA AVENUE
LIVERMORE, CALIFORNIA
FOR
SHEA HOMES

Berlogar Stevens & Associates
SOIL ENGINEERS • ENGINEERING GEOLOGISTS

PLATE 2

DRAWN BY: CC
DATE: 3-13-13
JOB NUMBER: 3498.100

EXPLORATORY BORING: EB-2

Sheet 1 of 1

DRILL RIG: MOBILE B-53	PROJECT NO: 1080-10G
BORING TYPE: 8-INCH HOLLOW STEM AUGER	PROJECT: SHEA CENTER II GARDEN DISTRICT
LOGGED BY: PL	LOCATION: LIVERMORE, CA
START DATE: 8-18-06 FINISH DATE: 8-18-06	COMPLETION DEPTH: 25.0 FT.

This log is a part of a report by TRC, and should not be used as a stand-alone document. This description applies only to the location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with time. The description presented is a simplification of actual conditions encountered. Transitions between soil types may be gradual.

ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
432.0	0	SURFACE ELEVATION: 432.0 FT. (+/-)						
		LEAN CLAY WITH SAND (CL) very stiff to hard, moist, brown, moderate plasticity, fine sand, some caliche Liquid Limit = 35, Plasticity Index = 20	CL	27		15	99	81
				54		19	106	
	5			85/10"		18	110	
				39		19	108	
	10							
420.0		**SILTY SAND (SM)** medium dense, moist, brown, fine sand	SM					
418.0		**SANDY LEAN CLAY (CL)** very stiff, moist, brown, fine to medium sand, some caliche	CL	31		18	105	
	15							
414.5		**SILTY SAND (SM)** dense, moist, brown, fine sand	SM	78				
412.3	20	**POORLY GRADED SAND WITH GRAVEL (SP)** very dense, moist, brown, coarse sand, fine gravel	SP					
410.5		**SANDY LEAN CLAY (CL)** hard, moist, brown	CL	57		20	109	
407.0	25	Bottom of Boring at 25 feet						
	30							

Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression
1.0 2.0 3.0 4.0

GROUND WATER OBSERVATIONS:
NO FREE GROUNDWATER ENCOUNTERED

LA_CORP.GDT 10/29/07 SR*

TRC

EXPLORATORY BORING: EB-4

Sheet 1 of 1

DRILL RIG: MOBILE B-53	PROJECT NO: 1080-10G
BORING TYPE: 8-INCH HOLLOW STEM AUGER	PROJECT: SHEA CENTER II GARDEN DISTRICT
LOGGED BY: PL	LOCATION: LIVERMORE, CA
START DATE: 8-18-06 FINISH DATE: 8-18-06	COMPLETION DEPTH: 20.0 FT.

This log is a part of a report by TRC, and should not be used as a stand-alone document. This description applies only to the location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with time. The description presented is a simplification of actual conditions encountered. Transitions between soil types may be gradual.

ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
436.0	0	SURFACE ELEVATION: 436.0 FT. (+/-)						
		SANDY LEAN CLAY (CL) very stiff, moist, brown, fine sand	CL	33		10	103	
432.8		**SILTY SAND (SM)** medium dense, moist, brown, fine to medium sand	SM	24		18	106	
431.0	5	**POORLY GRADED SAND WITH SILT (SP-SM)** medium dense, moist, brown, fine to medium sand, some gravel		26		7	105	10
	10		SP-SM	53		5	105	7
422.3		**SANDY LEAN CLAY (CL)** very stiff, moist, brown, fine sand		29		14	115	
	15		CL					
417.3		**SILTY SAND WITH GRAVEL (SM)**	SM	79		12	114	15
416.0	20	hard, moist, brown, fine to medium sand, fine gravel Bottom of Boring at 20 feet						
	25							
	30							

Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression
1.0 2.0 3.0 4.0

GROUND WATER OBSERVATIONS:
NO FREE GROUNDWATER ENCOUNTERED

LA CORP.GDT 10/29/07 SR*

TRC

EXPLORATORY BORING: EB-13

Sheet 1 of 1

DRILL RIG: TRACK RIG	PROJECT NO: 1080-10G
BORING TYPE: 4-INCH SOLID STEM AUGER	PROJECT: SHEA CENTER II GARDEN DISTRICT
LOGGED BY: PL	LOCATION: LIVERMORE, CA
START DATE: 4-16-07 FINISH DATE: 4-16-07	COMPLETION DEPTH: 25.5 FT.

This log is a part of a report by TRC, and should not be used as a stand-alone document. This description applies only to the location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with time. The description presented is a simplification of actual conditions encountered. Transitions between soil types may be gradual.

Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression
1.0 2.0 3.0 4.0

ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
		SURFACE ELEVATION: 432.5 FT. (+/-)						
432.5	0	**LEAN CLAY (CL)** stiff, moist, dark brown	CL	37		16	105	
427.5	5	**LEAN CLAY (CL)** very stiff to hard, moist, gray brown with white streaks, some fine sand, some caliche		76/11"		12	105	
	10	increase sand		53/6"		10	97	
	15		CL	53/6"		17	105	
	20			54/6"		17	110	
				54/6"				
408.8		**SILTY SAND (SM)** dense, moist, light brown, fine sand	SM	85		14	100	
407.3	25	**LEAN CLAY (CL)** very stiff, moist, gray brown with white streaks	CL	51/6"		15	112	
407.0		Bottom of Boring at 25.5 feet						
	30							

GROUND WATER OBSERVATIONS:
NO FREE GROUNDWATER ENCOUNTERED

LA_CORP.GDT 10/29/07 SR

TRC

EXPLORATORY BORING: EB-14

Sheet 1 of 1

DRILL RIG: TRACK RIG	PROJECT NO: 1080-10G
BORING TYPE: 4-INCH SOLID STEM AUGER	PROJECT: SHEA CENTER II GARDEN DISTRICT
LOGGED BY: PL	LOCATION: LIVERMORE, CA
START DATE: 4-16-07 FINISH DATE: 4-16-07	COMPLETION DEPTH: 19.0 FT.

This log is a part of a report by TRC, and should not be used as a stand-alone document. This description applies only to the location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with time. The description presented is a simplification of actual conditions encountered. Transitions between soil types may be gradual.

ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
		SURFACE ELEVATION: 425.0 FT. (+/-)						
425.0	0	**LEAN CLAY WITH SAND (CL)** stiff to very stiff, moist, dark brown, medium to coarse sand	CL	44		12	105	
420.0	5	**SILTY CLAY (CL)** very stiff to hard, moist, gray brown with white streaks, some caliche		89/9.5"		15	105	
	10	some fine sand	CL	53/6"		13	100	
		Liquid Limit = 45, Plasticity Index = 28		54/6"		18	97	
	15	trace coarse sand		76		14	108	
406.0				89		17	104	
	20	Bottom of Boring at 19.0 feet						
	25							
	30							

Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression
1.0 2.0 3.0 4.0

GROUND WATER OBSERVATIONS:
NO FREE GROUNDWATER ENCOUNTERED

LA CORP.GDT 10/29/07 SR*

TRC