FOR CONTRACT NO: 11-290304
PROJECT ID: 1100000359

INFORMATION HANDOUT

MATERIALS INFORMATION

FOUNDATION REPORT FOR E75-N5 CONNECTOR O.C. DATED OCTOBER 18, 2011

FOUNDATION REPORT FOR KEARNY VILLA ROAD O.C. DATED OCTOBER 18, 2011

SEISMIC DESIGN RECOMMENDATIONS DATED OCTOBER 20, 2011

CALTRANS MEMORANDUM REGARDING HAZARDOUS WASTE REVIEW FOR SEISMIC RETROFIT OF E75-N5 CONNECTOR OC ON ROUTE 75 (PALM AVENUE) AT ROUTE 5, SAN DIEGO, CALIFORNIA DATED JANUARY 8, 2013

SITE ASSESSMENT REPORT DATED FEBRUARY 10, 2010

TRANSMITTAL OF THE PROGRESS REPORT OF CAP IMPLEMANTATION AND SITE CLOSURE REQUEST DATED NOVEMBER 4, 2010

ROUTE: 11-SD-75, 805-9.0, 20.2

State of California — Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. MATT HOLM
Structure Design
Office of Bridge Design-South 1
Bridge Design Branch 12

Attention: Doug Menzmer

Date: October 18, 2011

File: 11-SD-075-PM 9.03
11-290301
Proj. ID: 1100000359
E75-N5 Connector OC
(Retrofit)
Br. #57-0708F

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 2 MS #5
Design Branch B

Subject: Foundation Report for E75-N5 Connector OC

In a memorandum dated September 2, 2011, Structures Design, Office of Bridge Design-South I, requested a Foundation Report for the proposed seismic retrofit of E75-N5 Connector Overcrossing (OC) (Br. #57-0708F). The specific request was to provide specified pile tip elevations for retrofit piles at Bents 2 and 6 support locations. This Foundation Report supersedes all previously generated Preliminary Foundation Reports for this structure. These recommendations are based on a review of "As-built" plans, the Log of Test Borings (LOTB's) from 1967 and 1991 subsurface investigations, and 1967 and 1991 Foundation Reports. The structure designer has indicated that all elevations for the design of this retrofit project are being referenced to the NGVD 1929 datum. Therefore, with regards to the foundation recommendations given in this report, all elevations referenced within this report are based on the NAVD 1929 Datum.

Project Description

The E75-N5 Connector OC (Br. #57-0708F) was built in 1973, and connects eastbound Route 75 (Palm Avenue) to northbound Interstate 5, in the city of San Diego, San Diego County. Originally, the bridge was named Palm Connector Overcrossing, however, Bridge Inspection Reports indicate that the structure was renamed to "E75-N5 Connector OC" in 1996. The E75-N5 Connector OC, and is a 6-span, reinforced concrete, box girder structure, with diaphragm abutments and single column bents, all supported on spread footings.

In 1993, the structure was seismically retrofitted. The columns at Bent 4 and 5 received steel column casings. The spread footings at Bent 4 and 5 were enlarged and bar tie-down anchors, with a design force of 150 kips per anchor, were added. A recent seismic analysis showed that the footings at Bents 2 and 6 are susceptible to overturning failure, and the upper portion of the column at Bent 3 lacks shear capacity. The current retrofit strategy proposes to enlarge the footings and add piles at Bents 2 and 6 locations, and to add a steel casing to the upper portion of the column at Bent 3.

Geology

The geologic map "Geology of National City, Imperial Beach, and Otay Mesa Quadrangles, Southern San Diego Metropolitan Area, California" (Kennedy and Tan, 1977) indicates that the site is underlain by Quaternary Bay Point Formation and unnamed, near shore marine sandstone. The Bay Point Formation generally consists of poorly indurated siltstone, sandstone, and cobble conglomerate. The bridge site is also located just south of the Otay River drainage.

"As-built" LOTB information indicates that a subsurface investigation was performed in February 1967, which consisted of two 2.5 inch diameter rotary borings, and five cone penetrometer borings (currently known as dynamic cone penetration borings). During the 1967 investigation, the maximum depth explored in a rotary boring was approximately 46 feet deep (elev. -11.0 ft), and the maximum depth explored in a cone penetrometer boring was approximately 46.6 ft deep (elev. -30.0 ft). In 1991, an additional subsurface investigation was performed for a seismic retrofit of the bridge. That investigation consisted of two 24 inch diameter bucket holes, and one 3 inch diameter auger boring. During the 1991 investigation, the maximum depth explored was approximately 81.5 ft deep (elev. -71.0 ft). The "As-Built" LOTB's from the 1967 and 1991 subsurface investigations revealed the project site is generally underlain by dense to very dense silty sand, clayey sand, and zones of gravels and cobbles.

"As-built" Information

"As-built" information indicates that Abutments 1 and 7, and Bents 2 through 6, are supported on spread footing foundations. Based on "As-built" plans and original ground elevations at the bridge site, approximately 43.0 feet of fill material was placed at Abutment 1 location, and approximately 20.0 feet of fill was placed at Abutment 7 location, prior to construction of the bridge. Based on the 1967 Foundation Report, Abutments 1 and 7 footings appear to be founded on fill material, and Bents 2 through 6 support footings appear to be founded on formational material. Table 1, below, presents the "As-built" bottom of footing elevations, and "As-built" allowable and design footing pressures at those supports.

Table 1 – "As-Built" Spread Footing Information

Location	"As-built" Bottom of Footing Elevations (ft)	"As-built" Allowable Footing Pressures (tsf)	"As-built" Design Footing Pressures (tsf)
Abutment 1	43.0, 45.5	2.0	2.0
Bent 2	17.0	6.0	6.0
Bent 3	11.0	6.0	5.5
Bent 4	5.0	6.0	6.0
Bent 5	0.0	6.0	5.5
Bent 6	5.0	6.0	6.0
Abutment 7	26.0, 28.0, 30.0	2.0	2.0

Ground Water

"As-built" LOTB's from both the 1967 and 1991 subsurface investigations have a note stating that ground water was not encountered during those investigations. However, in Boring B-2, of the 1991 investigation, the soil material is described as "saturated" at a depth of approximately 50 feet. Notes added to the LOTB's of the 1991 subsurface investigation, after the 1993 seismic retrofit was complete, state that a differing site condition was encountered due to the presence of ground water during the retrofit. The note doesn't state the elevation where ground water was encountered, but, it was encountered somewhere between the ground surface and bottom of pile cap elevation. The LOTB's also show that six, 24-inch diameter, temporary dewatering well points were installed near Bents 4 and 5 locations, which extended from 20 to 24 feet deep.

The bridge site is located just southeast of San Diego Bay, and southwest of the Otay River drainage. Aggregate mining pits, full of standing water, lie just northeast of the bridge site, in the Otay River drainage, and salt evaporation ponds are located just to the northwest of the site. Due to the nearness of the site to the Otay River drainage and San Diego Bay, the permeable nature of the underlying soils, and the history of ground water encountered during retrofit construction, it should be anticipated ground water will be encountered during excavation for the retrofit, and dewatering will be required. Ground water elevations, at this location, are subject to seasonal and tidal fluctuations.

Scour Potential

The bridge does not span any watercourse; therefore, scour is not considered an issue at the site.

Corrosion

Corrosion test results from the 1991 subsurface investigation are shown in Table 2, below. The site is considered non-corrosive by current Caltrans standards.

Table 2 – Corrosion Test Summary

Location	pH	Minimum Resistivity (Ohm-Cm)	Sulfate Content (ppm)	Chloride Content (ppm)
Boring B-2 (1991)	7.5	616	204	476

Note: Caltrans currently defines a corrosive environment as an area where the soil has either a pH of 5.5 or less, sulfate concentration of 2000 ppm or greater, or a chloride concentration of 500 ppm or greater. With the exception of MSE walls, soils and water are not tested for sulfates and chlorides if the minimum resistivity is greater than 1,000 Ohm-Cm.

Fault and Seismic Data

The structure site is potentially subject to ground motions from nearby earthquake sources. Based on the 2007 Caltrans fault database, the controlling fault for deterministic seismic procedure is the Newport Inglewood-Rose Canyon Fault Zone (San Diego section) (Fault ID 224, M_{max}=7.5, Right-Lateral Strike-slip, Dip=90 deg), which is located about 2.5 miles west of project site. For deterministic approach, the peak horizontal ground acceleration (PGA) at the site is estimated at 0.46g. The Office of Geotechnical Design-South 2 has provided Final

Seismic Design Recommendations for the site in a separate memorandum, dated October 21, 2011.

Liquefaction Potential

Final Seismic Design Recommendations, dated October 21, 2011, state that due to the dense nature of the underlying sedimentary formational material, the potential for soil liquefaction under strong ground shaking is considered low.

Surface Rupture Potential

The Final Seismic Design Recommendations, dated October 21, 2011 state that the site is not located within the Alquist-Priolo Fault Hazard Zone and is more than three miles from the nearest Caltrans-active faults which are exposed at the surface (Newport Inglewood-Rose Canyon fault zone, San Diego section). Therefore, surface rupture potential at the bridge site is considered low.

Foundation Recommendations

The following recommendations are for the proposed seismic retrofit of E75-N5 Connector OC (Br. #57-0708F). The specific request was to provide specified pile tip elevations for retrofit piles at Bents 2 and 6 support locations. At Bents 2 and 6 support locations, 24-inch diameter Cast-In-Drilled-Hole (CIDH) piles may be used for support for the retrofit. Tables 3 and 4, below, show the foundation design information for Bents 2 and 6, for the Extreme Event Limit State, provided by the structure designer.

Table 3: Bents 2 and 6 General Foundation Information Provided by Structure Designer

Support Location	Design Method	Pile Type	Finished Grade Elevation*	Pile Cut-off Elevation*	Pile Cap Size (ft)		Number of Piles per Support
					B	L	
Bent 2	LRFD	24 inch CIDH	29.0 ft	17.25 ft	24 ft	30 ft	22
Bent 6	LRFD	24 inch CIDH	21.0 ft	5.25 ft	24 ft	30 ft	22

*Elevations are based on NGVD 1929 vertical datum

Table 4: Bents 2 and 6 Foundation Design Loads Provided by Structure Designer

Support Location	Extreme Event Limit State (Controlling Group)	
	Compression	Tension
	Max Per Pile	Max Per Pile
Bent 2	353 kips	101 kips
Bent 6	381 kips	85 kips

The specified pile tip elevations for Bents 2 and 6 CIDH piles are shown in Table 5, below.

Table 5: Foundation Design Recommendations for Bents 2 and 6

Support Location	Pile Type	Cut-Off Elevation	Required Nominal Resistance		Design Tip Elevation	Specified Tip Elevation*
			Extreme Event			
			Comp. (φ=1)	Tension (φ=1)		
Bent 2	24 inch CIDH	17.25 ft	360 kips	110 kips	-15.0 ft (a-II) 0.0 ft (b-II)	-15.0 ft
Bent 6	24 inch CIDH	5.25 ft	390 kips	90 kips	-32.0 ft (a-II) -11.0 ft (b-II)	-32.0 ft

Note: Design tip elevations are controlled by (a-II) Compression (Extreme Event), (b-II) Tension (Extreme Event)
*Specified Pile Tip Elevations are based on NGVD 1929 vertical datum.

The Pile Data Table for Bents 2 and 6 is presented in Table 6, below. The ultimate geotechnical pile capacity for the CIDH piles will meet or exceed the required nominal resistance in compression and tension.

Table 6: Bents 2 and 6 CIDH Pile Data Table

Location	Pile Type	Required Nominal Resistance		Design Tip Elevation	Specified Tip Elevation*
		Compression	Tension		
Bent 2	24 inch CIDH	360 kips	110 kips	-15.0 ft (a-II) 0.0 ft (b-II)	-15.0 ft
Bent 6	24 inch CIDH	390 kips	90 kips	-32.0 ft (a-II) -11.0 ft (b-II)	-32.0 ft

Notes: 1) Design tip elevation is controlled by: (a-II) Compression (Extreme Event), (b-II) Tension (Extreme Event)
*Specified Pile Tip Elevations are based on NGVD 1929 vertical datum.

Construction Considerations:

General Notes:

1) Due to the presence of shallow ground water in the area, structure excavation Type "D" is to be shown on the plans at Bents 2 and 6 support locations.

Construction Considerations:

1) Due to the presence of ground water at shallow depths, as described in the Ground Water section, above, ground water will be encountered during excavation and construction of the pile caps for Bents 2 and 6 supports, as well as the Cast-In-Drilled-Hole (CIDH) piles. Therefore, the contractor should expect, and be prepared to deal with, wet footing excavations as well as the need to control water flowing into the CIDH pile borings, such as installing temporary well points for dewatering, as the contractor did in the previous retrofit

construction. At the time of construction, the ground water surface elevations may be higher or lower than those described in the Ground Water section, above, due to seasonal fluctuations and tidal influences.

2) Due to the non-cohesive nature of the soils, and high ground water table, it is anticipated that concrete placement for the CIDH piles will be done by slurry displacement methods to reduce the potential for caving. At Bents 2 and 6 locations, the calculated geotechnical capacity of the CIDH piles is based on skin friction only and no end-bearing was considered. The skin friction zones used to calculate geotechnical capacity of the CIDH piles are summarized below in Table 7.

Table 7 - CIDH Pile Skin Friction Zone Elevations

Location	Skin Friction Zone Start Elevation*	Skin Friction Zone End Elevation*
Bent 2	12.0 ft	-13.0 ft
Bent 6	0.0 ft	-30.0 ft

* Elevations are based on NGVD 1929 vertical datum.

3) If the CIDH piles are to be constructed using slurry displacement method, the slurry shall consist of mineral or synthetic slurry only. Water shall not be allowed to be used as slurry.

4) If the contractor chooses to use slurry to aid in the construction of CIDH piles, care should be exercised while advancing the drilled hole for the piles. Due to the non-cohesive nature of granular soils, and possible high ground water table, rapid insertion and removal of the drilling tools during the drilling process can cause excessive scouring and caving of the walls of the drilled shaft.

The recommendations contained in this report are based on specific project information regarding structure type, support locations, and design loads that have been provided by Structure Design, Office of Bridge Design – South 1. If any conceptual changes are made during final project design, the Office of Geotechnical Design-South 2, Design Branch B, should review those changes to determine if these foundation recommendations are still applicable. Any questions regarding the above recommendations should be directed to the attention of David (T.M.) Liao, (916) 227-5756, Erich Neupert, (916) 227-4565, or Mark DeSalvatore, (916) 227-5391, at the Office of Geotechnical Design-South 2, Branch B.

Prepared by: Date: 10/15/11

Erich Neupert

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cc: R.E. Pending File
John Stayton - Specs & Estimates
Bruce Lambert – District 11 (Project Manager)
Art Padilla – District 11 (Materials Engineer)
Abbas Abghari – OGDS-2
Mark Willian – GS Corporate

State of California Business, Transportation and Housing Agency

Flex your power!
Be energy efficient!

Memorandum

To: MATT HOLM, BRANCH CHIEF
DEPARTMENT OF TRANSPORTATION
BRIDGE DESIGN BRANCH 12
OFFICE OF BRIDGE DESIGN SOUTH-1

Date: October 20, 2011

File: 11-SD-075-9.03
Project # 1100000359
EA# 11-290301
E75-N5Connector O.C
(Retrofit)
Bridge No. 57-0708F

From: DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES - MS #5
OFFICE OF GEOTECHNICAL DESIGN SOUTH-2

Subject: **Seismic Design Recommendations**

Introduction

This memorandum presents seismic design recommendations for the above bridge. Ground motion recommendations are based on the Caltrans 2009 Seismic Design Procedure (SDP) as described in the Seismic Design Criteria Version 1.5 (SDC) Appendix B.

Seismicity

Based on the 2007 Caltrans fault database and the Caltrans ARS Online Tool v.1.0.4, the site is located about 2.5 miles (4 km) from the Newport Inglewood-Rose Canyon fault zone (San Diego section) (Fault ID 224, M_{Max} = 7.5, RLSS, Dip = 90 degrees), the controlling fault for the deterministic seismic procedure. The peak horizontal ground acceleration at the site is estimated as 0.46g. A copy of a map showing the location of the bridge and the controlling fault is attached.

Soil Profile

The geologic map, "Geology of Southern San Diego Metropolitan Area, California (Kennedy and Tan, 1977) indicates that the site is underlain by Quaternary Bay Point Formation and unnamed, near shore marine sandstone. The Bay Point Formation generally consists of poorly indurated siltstone, sandstone, and cobble conglomerate.

The "As-Built" Logs of Test Borings from the1967 and 1991 subsurface investigations revealed the project site is generally underlain by dense to very dense silty sand, clayey sand, with zones of gravels and cobbles.

The average shear wave velocity for the upper 100 feet of subsurface is estimated as V_{S30} = 400 m/s.

Groundwater was not encountered during the 1967 and 1991 subsurface investigations. During the 1992 seismic retrofit work at the Bent 4 and 5 footing locations, groundwater was encountered and 6 temporary dewatering wells were installed to lower the groundwater table. Based on the 1992 seismic retrofit work history, shallow groundwater tables should be anticipated. The groundwater elevations are subject to seasonal fluctuations and will be encountered at higher or lower elevations depending on conditions at time of construction.

Design Response Spectrum

Based on the 2009 SDP, the design response spectrum is the upper envelope of the deterministic and probabilistic response, but is not less than a deterministic response spectrum resulting from a Mmax = 6.5 earthquake on a vertical strike-slip fault at a distance of 12 km. The deterministic response spectrum is obtained by taking arithmetic average of the median response spectra calculated using the 2008 Campbell-Bozorgnia and 2008 Chiou-Youngs ground motion prediction equations. The Probabilistic response spectrum is obtained for 5 percent probability of exceedance in 50 years (corresponding to approximately a 975 year return period) using the 2008 USGS Seismic Hazard Map. Adjustments to account for site conditions and fault effects are implemented. For this site the deterministic procedure controls and the corresponding spectrum selected for design is the deterministic spectrum. A copy of the acceleration response spectrum recommended for design is attached for your reference.

p-y curves

As requested by the structure engineer, p-y curves were performed at Bent 2 and Bent 6 locations for 24-inch CIDH piles. The digital output and the p-y curve graphs are attached in this report for reference.

Liquefaction Potential Evaluation

Based on available soil information (from As-Built LOTBs), it can be concluded that the potential for soil liquefaction due to strong ground shaking is considered low at the project site due to the dense nature of the underlying sedimentary formational material.

Seismic Settlement

Seismic settlement due to strong ground motion is considered less than an inch.

Surface Fault Rupture Hazard

The site is not located within the Alquist Priolo Fault Hazard Zone and is more than three miles from the nearest Caltrans-active faults which are exposed at the surface (Newport Inglewood-Rose Canyon fault zone, San Diego section). Potential for surface rupture is considered low.

Any questions regarding the above recommendations should be directed to the attention of AnhDan Le (916) 227-7211 or Angel Perez-Cobo (916) 227-7167, Office of Geotechnical Design South-2.

Prepared by: Date: 10/20/11

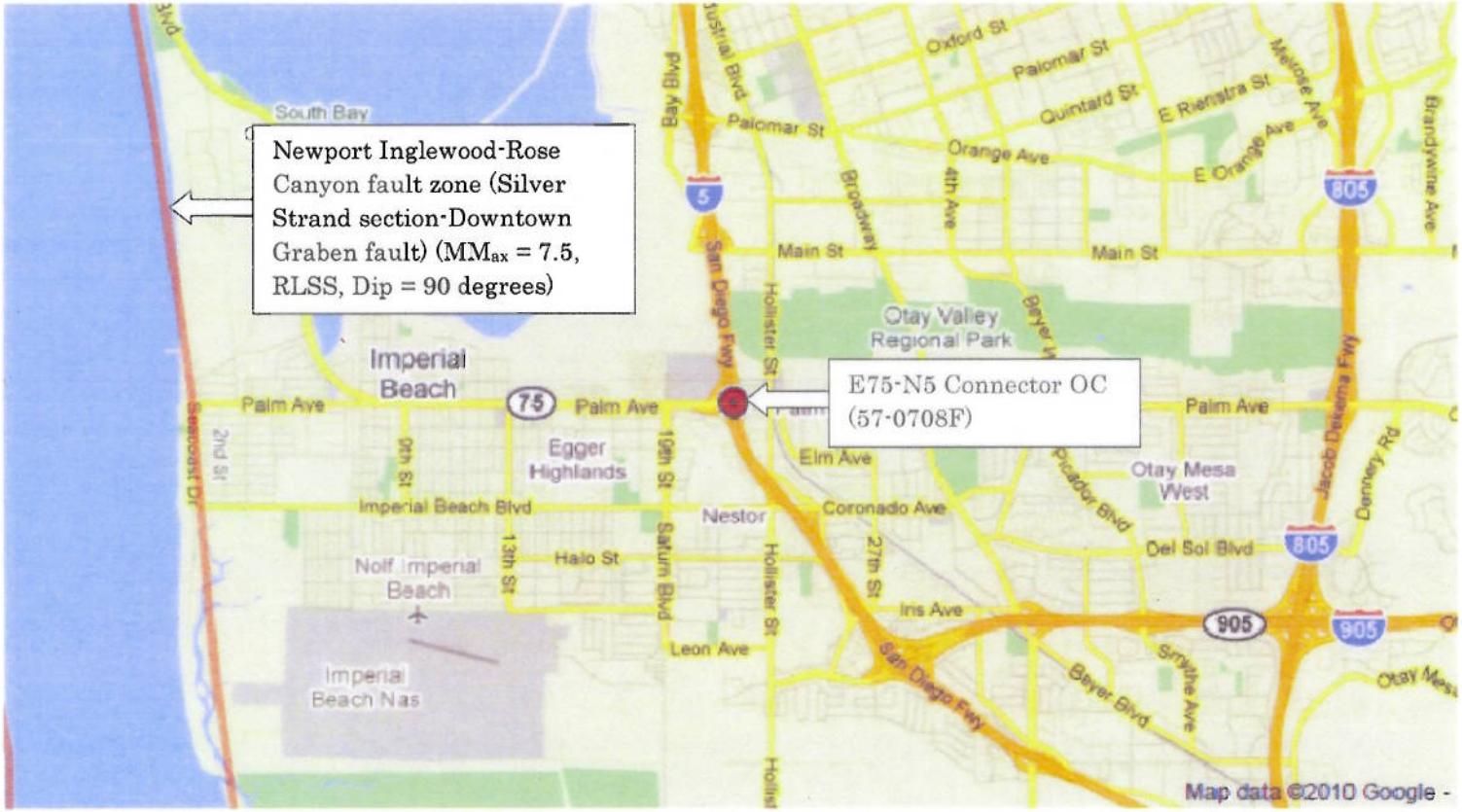
AnhDan Le, Ph.D, G.E.
Transportation Engineer
Office of Geotechnical Design South-2

Supervised by: Date: 10/20/11

Angel Perez-Cobo. P.E.
Senior Transportation Engineer
Office of Geotechnical Design South-2

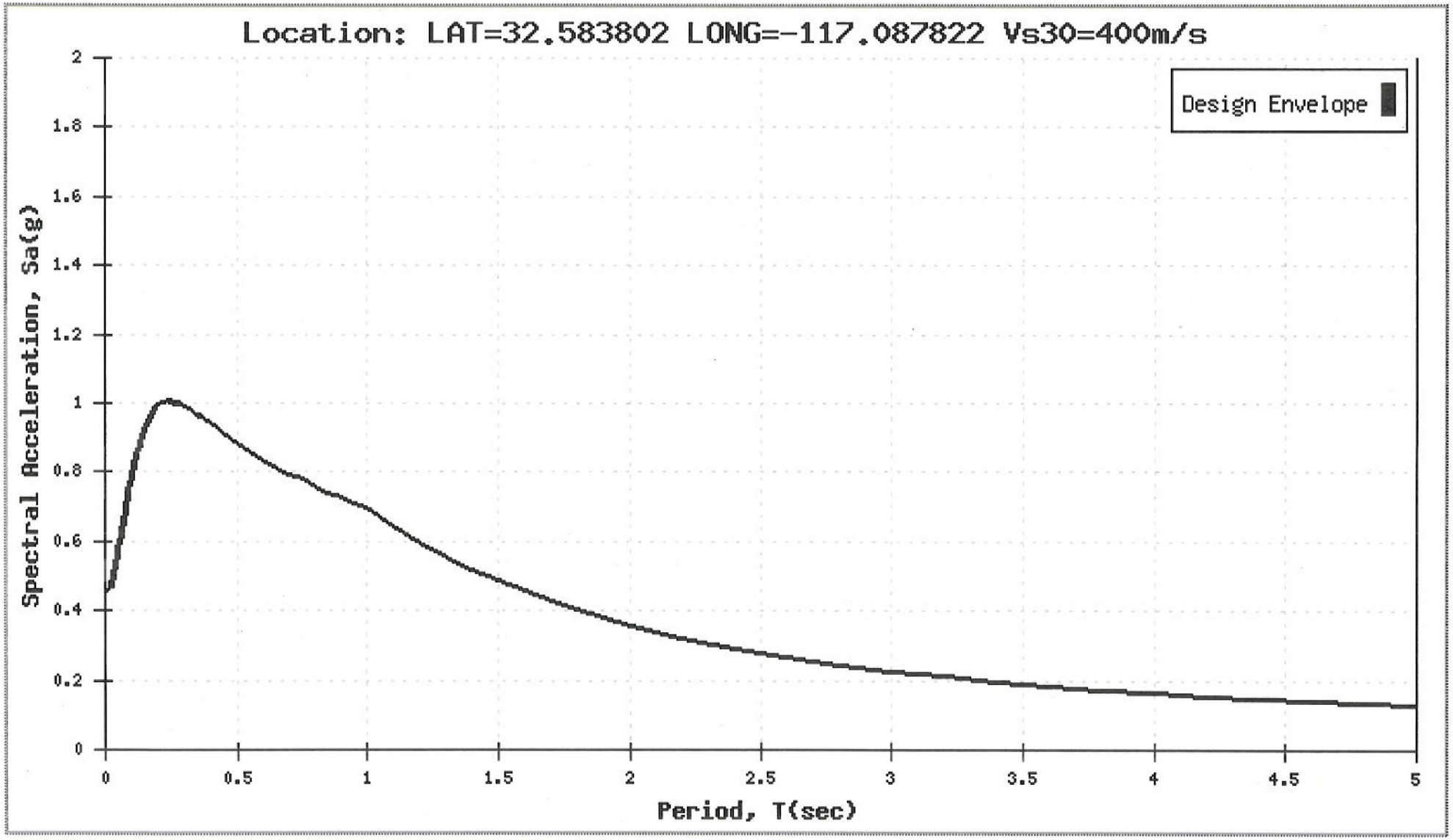
Attachments: Online ARS curve
p-y curves

cc: D Liao - GDS2
M. DeSalvatore - GDS2
File

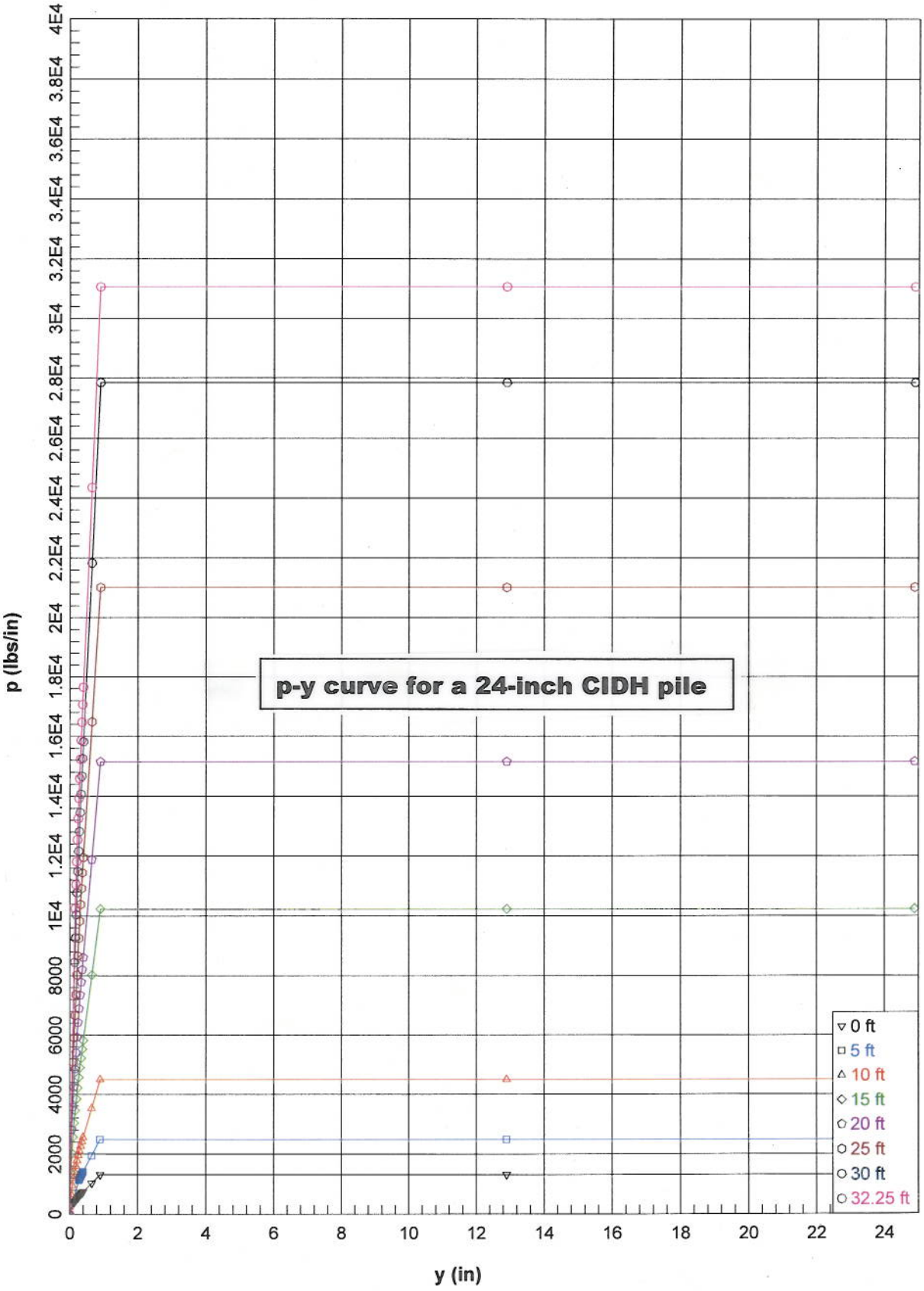


Fault Map
E75-N5 Connector O.C (Retrofit)
Bridge No. 57-0708F

Recommended ARS curve for E75-N5 Connector O.C (Retrofit)
Bridge # 57-0708F



P-Y CURVES BENT 2
BRIDGE # 57-0708F


p-y curve for a 24-inch CIDH pile
p (lbs/in)
y (in)
0
2000
4000
6000
8000
1E4
1.2E4
1.4E4
1.6E4
1.8E4
2E4
2.2E4
2.4E4
2.6E4
2.8E4
3E4
3.2E4
3.4E4
3.6E4
3.8E4
4E4
0
2
4
6
8
10
12
14
16
18
20
22
24
0 ft
5 ft
10 ft
15 ft
20 ft
25 ft
30 ft
32.25 ft

This p-y curve is computed at depth 0 feet below pile head

y, in	p, lbs/in	
0.0000	0.0000	
0.13094	377.11259	*
0.15540	418.49703	
0.17986	457.39325	
0.20432	494.26294	
0.22878	529.43765	
0.25324	563.16542	
0.27770	595.63775	
0.30216	627.00636	
0.32662	657.39393	
0.35108	686.90145	
0.37554	715.61323	
0.40000	743.60063	
0.65000	1026.16886	
0.90000	1308.73709	
12.90000	1308.73709	
24.90000	1308.73709	

This p-y curve is computed at depth 5 feet below pile head.

y, in	p, lbs/in	
0.0000	0.0000	
0.27525	1123.02359	*
0.28659	1150.93315	
0.29793	1178.41300	
0.30927	1205.48573	
0.32061	1232.17198	
0.33196	1258.49067	
0.34330	1284.45917	
0.35464	1310.09347	
0.36598	1335.40837	
0.37732	1360.41757	
0.38866	1385.13378	
0.40000	1409.56885	
0.65000	1945.20500	
0.90000	2480.84116	
12.90000	2480.84116	
24.90000	2480.84116	

This p-y curve is computed at depth 10 feet below pile head.

y, in	p, lbs/in	
0.0000	0.0000	
0.00818	239.37758	*
0.04380	664.00222	
0.07942	953.48331	
0.11504	1194.40819	
0.15066	1407.27804	
0.18628	1601.10023	
0.22190	1780.82522	
0.25752	1949.53427	
0.29314	2109.30592	
0.32876	2261.62410	
0.36438	2407.59390	
0.40000	2548.06564	
0.65000	3516.33057	
0.90000	4484.59551	
12.90000	4484.59551	
24.90000	4484.59551	

This p-y curve is computed at depth 15 feet below pile head.

y, in	p, lbs/in	
0.0000	0.0000	
0.03749	1378.34198	*
0.07044	2022.62801	
0.10340	2554.19490	
0.13636	3022.08595	
0.16931	3447.20092	
0.20227	3840.85487	
0.23522	4210.02623	
0.26818	4559.39335	
0.30113	4892.28115	
0.33409	5211.15725	
0.36704	5517.91525	
0.40000	5814.04750	
0.65000	8023.38552	
0.90000	10233.	
12.90000	10233.	
24.90000	10233.	

This p-y curve is computed at depth 20 feet below pile head.

y, in	p, lbs/in	
0.0000	0.0000	
0.06347	2809.51242	*
0.09406	3568.73050	
0.12466	4235.17808	
0.15525	4839.77714	
0.18584	5399.08940	
0.21644	5923.26306	
0.24703	6419.07177	
0.27762	6891.31440	
0.30822	7343.54393	
0.33881	7778.48173	
0.36941	8198.26927	
0.40000	8604.62913	
0.65000	11874.	
0.90000	15144.	
12.90000	15144.	
24.90000	15144.	

This p-y curve is computed at depth 25 feet below pile head.

y, in	p, lbs/in	
0.0000	0.0000	
0.09820	5083.47344	*
0.12564	5904.99477	
0.15307	6658.48833	
0.18051	7360.53663	
0.20794	8021.79375	
0.23538	8649.60591	
0.26282	9249.30279	
0.29025	9824.90269	
0.31769	10380.	
0.34513	10916.	
0.37256	11435.	
0.40000	11940.	
0.65000	16477.	
0.90000	21015.	
12.90000	21015.	
24.90000	21015.	

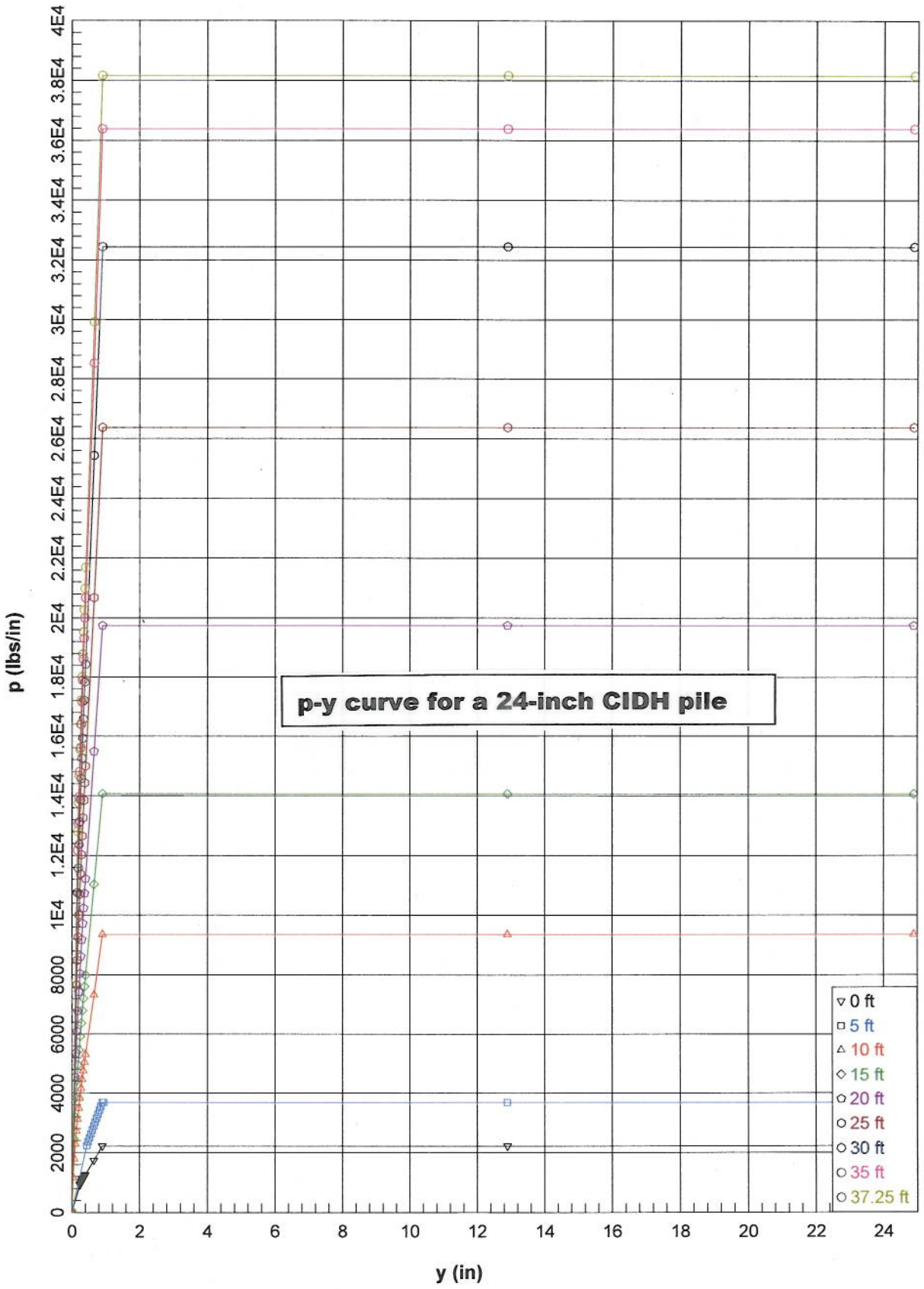
This p-y curve is computed at depth 30 feet below pile head.

y, in	p, lbs/in	
0.0000	0.0000	
0.14256	8448.87474	*
0.16596	9266.96786	
0.18936	10041.	
0.21277	10778.	
0.23617	11484.	
0.25958	12163.	
0.28298	12819.	
0.30638	13453.	
0.32979	14069.	
0.35319	14668.	
0.37660	15251.	
0.40000	15821.	
0.65000	21833.	
0.90000	27845.	
12.90000	27845.	
24.90000	27845.	

This p-y curve is computed at depth 32.25 feet below pile head.

y, in	p, lbs/in	
0.0000	0.0000	
0.16355	10245.	*
0.18504	11044.	
0.20654	11807.	
0.22804	12540.	
0.24953	13245.	
0.27103	13928.	
0.29252	14589.	
0.31402	15232.	
0.33551	15858.	
0.35701	16468.	
0.37850	17064.	
0.40000	17647.	
0.65000	24353.	
0.90000	31059.	
12.90000	31059.	
24.90000	31059.	

P-Y CURVES BENT 6
BRIDGE # 57-0708F


p-y curve for a 24-inch CIDH pile
p (lbs/in)
y (in)
0
2000
4000
6000
8000
1E4
1.2E4
1.4E4
1.6E4
1.8E4
2E4
2.2E4
2.4E4
2.6E4
2.8E4
3E4
3.2E4
3.4E4
3.6E4
3.8E4
4E4
0
2
4
6
8
10
12
14
16
18
20
22
24
0 ft
5 ft
10 ft
15 ft
20 ft
25 ft
30 ft
35 ft
37.25 ft

This p-y curve is computed at depth 0 feet below pile head

y, in	p, lbs/in	
0.0000	0.0000	
0.24115	926.00424	*
0.25559	959.33524	
0.27003	991.93566	
0.28447	1023.85937	
0.29891	1055.15376	
0.31335	1085.86078	
0.32779	1116.01781	
0.34224	1145.65831	
0.35668	1174.81238	
0.37112	1203.50725	
0.38556	1231.76759	
0.40000	1259.61593	
0.65000	1738.26997	
0.90000	2216.92402	
12.90000	2216.92402	
24.90000	2216.92402	

This p-y curve is computed at depth 5 feet below pile head.

y, in	p, lbs/in
0.0000	0.0000
0.44153	2225.30784
0.48321	2357.91543
0.52489	2490.52302
0.56657	2623.13062
0.60825	2755.73821
0.64993	2888.34580
0.69160	3020.95339
0.73328	3153.56098
0.77496	3286.16857
0.81664	3418.77617
0.85832	3551.38376
0.90000	3683.99135
0.94168	3683.99135
0.90000	3683.99135
12.90000	3683.99135
24.90000	3683.99135

This p-y curve is computed at depth 10 feet below pile head.

y, in	p, lbs/in	
0.0000	0.0000	
0.03318	1169.07036	*
0.06653	1784.51541	
0.09988	2284.55298	
0.13322	2721.90298	
0.16657	3117.87788	
0.19992	3483.73199	
0.23326	3826.30344	
0.26661	4150.13073	
0.29996	4458.41616	
0.33331	4753.52336	
0.36665	5037.25836	
0.40000	5311.03959	
0.65000	7329.23461	
0.90000	9347.42964	
12.90000	9347.42964	
24.90000	9347.42964	

This p-y curve is computed at depth 15 feet below pile head.

y, in	p, lbs/in	
0.0000	0.0000	
0.05749	2456.49553	*
0.08862	3196.02912	
0.11976	3838.09905	
0.15090	4417.13317	
0.18204	4950.80089	
0.21317	5449.66071	
0.24431	5920.64342	
0.27545	6368.60078	
0.30659	6797.09267	
0.33772	7208.82660	
0.36886	7605.92109	
0.40000	7990.07235	
0.65000	11026.	
0.90000	14063.	
12.90000	14063.	
24.90000	14063.	

This p-y curve is computed at depth 20 feet below pile head.

y, in	p, lbs/in	
0.0000	0.0000	
0.09036	4538.71673	*
0.11851	5352.34402	
0.14666	6092.83438	
0.17480	6779.26746	
0.20295	7423.49579	
0.23110	8033.50434	
0.25925	8614.98830	
0.28740	9172.18584	
0.31555	9708.35615	
0.34370	10226.	
0.37185	10727.	
0.40000	11214.	
0.65000	15475.	
0.90000	19737.	
12.90000	19737.	
24.90000	19737.	

This p-y curve is computed at depth 25 feet below pile head.

y, in	p, lbs/in	
0.0000	0.0000	
0.13268	7659.64841	*
0.15698	8484.39288	
0.18128	9260.34803	
0.20558	9996.43958	
0.22989	10699.	
0.25419	11373.	
0.27849	12022.	
0.30279	12650.	
0.32709	13258.	
0.35140	13848.	
0.37570	14423.	
0.40000	14983.	
0.65000	20677.	
0.90000	26370.	
12.90000	26370.	
24.90000	26370.	

This p-y curve is computed at depth 30 feet below pile head.

y, in	p, lbs/in	
0.0000	0.0000	
0.16480	10750.	*
0.18618	11578.	
0.20756	12369.	
0.22895	13129.	
0.25033	13861.	
0.27171	14569.	
0.29309	15256.	
0.31447	15923.	
0.33585	16573.	
0.35724	17207.	
0.37862	17826.	
0.40000	18431.	
0.65000	25435.	
0.90000	32439.	
12.90000	32439.	
24.90000	32439.	

This p-y curve is computed at depth 35 feet below pile head.

y, in	p, lbs/in	
0.0000	0.0000	
0.16731	12169.	*
0.18846	13082.	
0.20962	13956.	
0.23077	14796.	
0.25192	15607.	
0.27308	16391.	
0.29423	17152.	
0.31539	17891.	
0.33654	18611.	
0.35769	19314.	
0.37885	20001.	
0.40000	20673.	
0.65000	28528.	
0.90000	36384.	
12.90000	36384.	
24.90000	36384.	

This p-y curve is computed at depth 37.25 feet below pile head.

y, in	p, lbs/in	
0.0000	0.0000	
0.16828	12807.	*
0.18935	13760.	
0.21041	14671.	
0.23148	15547.	
0.25254	16393.	
0.27361	17211.	
0.29467	18005.	
0.31574	18777.	
0.33680	19529.	
0.35787	20263.	
0.37893	20980.	
0.40000	21681.	
0.65000	29920.	
0.90000	38159.	
12.90000	38159.	
24.90000	38159.	

State of California — Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. MATT HOLM
Structure Design
Office of Bridge Design-South 1
Bridge Design Branch 12

Attention: Doug Menzmer

Date: October 18, 2011

File: 11-SD-805-PM 20.23
11-290301
Proj. ID: 1100000359
Kearny Villa Rd. OC
(Retrofit)
Br. #57-0678

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 2 MS #5
Design Branch B

Subject: Foundation Report for Kearny Villa Road OC

In a memorandum dated September 2, 2011, Structures Design, Office of Bridge Design-South I, requested a Foundation Report for the proposed seismic retrofit of Kearny Villa Road Overcrossing (OC) (Br. #57-0678). The specific request was to provide capacities of the existing "H" piles at the Bent 3 support location, provide specified pile tip elevations for retrofit piles at Bent 3 location, and provide soil bearing capacities at Bents 2 and 4 support locations to verify that the existing spread footings will provide adequate support in an extreme event. This Foundation Report supersedes all previously generated Preliminary Foundation Reports for this structure. These recommendations are based on a review of "As-built" plans, the Log of Test Borings (LOTB's) from a 1966 subsurface investigation, and the Foundation Report from 1967. With regards to the foundation recommendations given in this report, all elevations referenced within this report are based on the NAVD 1988 Datum, unless otherwise noted. "As-built" elevations were converted to the current NAVD 88 datum by adding 1.95 ft to the elevations based on the NGVD 29 datum.

Project Description

The project site is located on Route 805 in the city of San Diego, San Diego County. "As-built" information indicates that the Kearny Villa Road OC (Br. #57-0678) was built in 1972. Originally, the bridge was named Artillery Drive Overcrossing. Later, the city street name was changed to Kearny Villa Drive, and a Caltrans' Supplementary Bridge Report, dated October 23, 1980, indicates the need to change the name on the structure, and the records, at that time.

The existing bridge is a 4-span cast-in-place, box-girder structure, with end-diaphragm abutments. The structure is supported on spread footings at Abutments 1 and 5, and Bents 2 and 4 locations. Bent 3 is supported on 10BP57 driven steel "H" piles. A recent seismic analysis showed that the structure is susceptible to shear failure in the upper arms of all three Y-shaped columns, and compression failure in the piles at Bent 3. The current retrofit strategy proposes to encase the columns in concrete, and add piles at the Bent 3 location.

Geology

The bridge site is located in the Peninsular Ranges geomorphic province, in an area of ancient sedimentary marine terraces cut by creeks, which generally flow east to west. The geologic map "Geology of the La Jolla Quadrangle, San Diego County, California (Kennedy, 1975)" indicates that the site is located in what was originally the northern end of Murray Canyon. At the bridge location, the Tertiary Mission Valley Formation is exposed on the sides of the canyon. The Mission Valley Formation is composed of marine, lagoonal, and nonmarine sandstone that lies conformably upon the Stadium Conglomerate. The geologic map shows that the bottom of the canyon consisted of a thin veneer of Quaternary Alluvium and Slopewash, which was underlain by the Stadium Conglomerate. During construction of the I-805 Freeway, at the bridge site, the bottom of the canyon was filled in with about 25 feet of fill material.

"As-built" LOTB information indicates that a subsurface investigation was performed in October 1966, which consisted of one 3 inch diameter rotary boring near the Bent 3 location. The soil boring indicates dense to very dense sand and gravel with cobbles were encountered to about elevation 291.0 ft. Below that, dense sand with clay binder, sandy clay, dense silt, and very dense fine sand with clay binder were encountered to the maximum depth of boring B-1 (elev. 271.0 ft). Based on the geologic map, this material would be considered to be part of the alluvial and slopewash material, as well as the Stadium Conglomerate, originally present at the bottom of the canyon.

"As-built" Foundation Data

Based on the geologic map of the area, and original ground elevations, Abutments 1 and 5, and Bents 2 and 4 support footings appear to be founded on the Mission Valley Formation. Table 1, below, presents the "As-built" bottom of footing elevations, and "As-built" allowable and design footing pressures at those supports.

Table 1 – "As-Built" Spread Footing Information

Location	"As-built" Bottom of Footing Elevations (ft)*	"As-built" Allowable Footing Pressures (tsf)	"As-built" Design Footing Pressures (tsf)
Abutment 1	381.3 to 383.5	2.0	2.0
Bent 2	315.0	4.5	4.5
Bent 4	318.5	4.5	4.5
Abutment 5	371.3 to 375.6	2.0	2.0

*"As-built" elevations are base on NGVD 1929 vertical datum.

Bent 3 is supported on 65 ton design load 10BP57 driven steel "H" piles which were driven through the fill material that was placed in the bottom of the canyon prior to construction. Table 2, below, presents the Bent 3 "As-built" driven pile tip elevations.

Table 2 – Bent 3 "As-Built" Driven "H" Pile Tip Elevations

Location	Pile Type	"As-Built" Pile Tip Elevations (ft)*			Specified Pile Tip Elevation (ft)*
		High	Low	Average	
Bent 3	10BP57 "H" Pile	287.5	284.5	286.0	285.0

*"As-built" elevations are base on NGVD 1929 vertical datum.

Ground Water

Ground water was encountered during the 1966 subsurface investigation at elev. 296.6 ft. Ground water surface elevations are subject to seasonal fluctuations and will be encountered at higher or lower elevations depending on seasonal conditions.

Scour Potential

The bridge does not span any watercourse; therefore, scour is not considered an issue at the site.

Corrosion

Corrosion test results for a soil sample collected from just below the ground surface, near the Bent 4 location, are shown below in Table 3. Based on current Caltrans' standards, the site is considered to be corrosive. Therefore, reinforced concrete (including piles) requires corrosion mitigation in accordance with Bridge Design Specifications, Article 8.22.

Table 3 – Corrosion Test Summary

Location	pH	Minimum Resistivity (Ohm-Cm)	Sulfate Content (ppm)	Chloride Content (ppm)
Sample C702929	7.55	162	2850	2836

Note: Caltrans currently defines a corrosive environment as an area where the soil has either a chloride concentration of 500 ppm or greater, a sulfate concentration of 2000 ppm or greater, or has a pH of 5.5 or less. With the exception of MSE walls, soil and water are not tested for chlorides and sulfates if the minimum resistivity is greater than 1,000 ohm-cm.

Fault and Seismic Data

The structure site is potentially subject to ground motions from nearby earthquake sources. Based on the 2007 Caltrans fault database, the controlling fault for deterministic seismic procedure is the Newport Inglewood-Rose Canyon Fault Zone (San Diego section) (Fault ID 224, M_{max}=7.5, Right-Lateral Strike-slip, Dip=90 deg), which is located about 3.3 miles west of project site. For deterministic approach, the peak horizontal ground acceleration (PGA) at the site is estimated at 0.42g. The Office of Geotechnical Design-South 2 has provided Final Seismic Design Recommendations for the site in a separate memorandum, dated October 21, 2011. Please refer to that memorandum for additional seismic design information.

Liquefaction Potential

Final Seismic Design Recommendations, dated October 21, 2011, state that due to the dense nature of the underlying sedimentary formational material, the potential for soil liquefaction under strong ground shaking is considered low.

Surface Rupture Potential

The Final Seismic Design Recommendations, dated October 21, 2011, state that the site is not located within the Alquist-Priolo Fault Hazard Zone and is more than three miles from the nearest Caltrans-active fault which is exposed at the surface (Newport Inglewood-Rose Canyon fault zone, San Diego section). Therefore, surface rupture potential at the bridge site is considered low.

Foundation Recommendations

The following recommendations are for the proposed seismic retrofit of Kearny Villa Road Overcrossing (OC) (Br. #57-0678). The specific request was to provide capacities of the existing driven piles at Bent 3 location, provide specified pile tip elevations for new retrofit piles at Bent 3, and provide soil bearing capacities at Bents 2 and 4 support locations to verify that the existing spread footings will provide adequate support in an extreme event.

Bent 3 Location

At Bent 3 location, 24-inch diameter Cast-In-Drilled-Hole (CIDH) piles may be used for support for the seismic retrofit. Tables 4 and 5, below, show the foundation design information for Bent 3, for the Extreme Event Limit State, provided by the structure designer.

Table 4: Bent 3 General Foundation Information Provided by Structure Designer

Support Location	Design Method	Pile Type	Finished Grade Elevation	Pile Cut-off Elevation	Pile Cap Size (ft)		Number of Piles per Support
					B	L	
Bent 3	LRFD	24 inch CIDH	334.7 ft	327.7 ft	20 ft	41 ft	8

Table 5: Bent 3 Foundation Design Loads Provided by Structure Designer

Support Location	Extreme Event Limit State (Controlling Group)	
	Compression	Tension
	Max Per Pile	Max Per Pile
Bent 3	365 kips	108 kips

The specified pile tip elevation for Bent 3 CIDH piles is shown in Table 6, below.

Table 6: Bent 3 Foundation Design Recommendations

Support Location	Pile Type	Cut-Off Elevation	Required Nominal Resistance		Design Tip Elevation	Specified Tip Elevation
			Extreme Event			
			Comp. (φ=1)	Tension (φ=1)		
Bent 3	24 inch CIDH	327.7 ft	370 kips	110 kips	294.95 ft (a-II) 308.95 ft (b-II)	294.95 ft

Note: Design tip elevations are controlled by (a-II) Compression (Extreme Event), (b-II) Tension (Extreme Event)

The Pile Data Table for Bent 3 is presented in Table 7, below. The ultimate geotechnical pile capacity for the CIDH piles will meet or exceed the required nominal resistance in compression.

Table 7: Bent 3 CIDH Pile Data Table

Location	Pile Type	Required Nominal Resistance		Design Tip Elevation	Specified Tip Elevation
		Compression	Tension		
Bent 3	24 inch CIDH	370 kips	110 kips	294.95 ft (a-II) 308.95 ft (b-II)	294.95 ft

Notes: 1) Design tip elevation is controlled by: (a-II) Compression (Extreme Event), (b-II) Tension (Extreme Event)

Table 8, below, provides calculated capacities of the existing "H" piles at Bent 3 support location.

Table 8: Bent 3 - Calculated Nominal Resistance of Existing "H" Piles

Support Location	Pile Type	Nominal Resistance*	
		Compression	Tension
Bent 3	10BP57 "H" Piles	260 kips	150 kips

*The Calculated Nominal Resistance in Compression and Tension is based on"As-built" information

Bents 2 and 4 Locations

At Bents 2 and 4 locations, it was requested to calculate the soil bearing capacity, to verify that the existing spread footings will provide adequate support in an extreme event. Tables 9 and 10, below, present Bents 2 and 4 spread footing design information for the Extreme Event Limit State, provided by the structure designer.

Table 9: Bents 2 and 4 Spread Footing Design Information Provided by Structure Designer

Support Location	Design Method	Finished Grade Elevation	Bottom of Footing Elevation	Footing Size		Extreme Event Limit State (Controlling Group)		
						Vertical Load	Effective Dimensions	
				B	L		B'	L'
Bent 2	LRFD	337.56 ft	316.95 ft	15.5 ft	42.5 ft	6,492 kips	7.67 ft	40.79 ft
Bent 4	LRFD	342.55 ft	320.45 ft	15.5 ft	42.5 ft	5,881 kips	7.23 ft	40.67 ft

Table 10:
Bents 2 and 4 LRFD Extreme Event Loads
for Controlling Load Combination Provided by Structure Designer

Support No.	Extreme Event Limit State (Controlling Group) [1]				
	P_{Total} (kips) Gross	M_X (kip-ft)	M_Y (kip-ft)	V_X (kips)	V_Y (kips)
Bent 2	6,492	23,364	0	1,855	688
Bent 4	5,881	22,106	0	1,795	738

1. Controlling load combination is the one resulting in the highest ratio of the Gross Uniform Bearing Stress ($q_{g,u}$) divided by the Factored Gross Nominal Bearing Resistance (q_R) for foundations on soil, or the Gross Maximum Bearing Stress ($q_{g,max}$) divided by the Factored Gross Nominal Bearing Resistance (q_R) for foundations on rock.

Table 11, below, presents the bottom of footing elevations, the Gross Uniform Bearing Stress, and Extreme Event Limit State Factored Gross Nominal Bearing Resistances for Bents 2 and 4 supports.

Table 11:
Bents 2 and 4 LRFD Extreme Event Limit State Spread Footing Recommendations

Support Location	Controlling Case Effective Footing Size (ft)*		Bottom of Footing Elevation (ft)	Footing Embedment Depth (ft)	Gross Uniform Bearing Stress (ksf)	Extreme Event Limit State (φ_b=1.0)
	B'	L'				Factored Gross Nominal Bearing Resistance[1] (ksf)
Bent 2	7.67 ft	40.79 ft	316.95 ft.	20.6 ft.	21.0 ksf	30.0 ksf
Bent 4	7.23 ft	40.67 ft	320.45 ft.	22.1 ft.	20.0 ksf	30.0 ksf

*Controlling case is Extreme Limit State

1. For Extreme Limit State, the controlling load combination is the one resulting in the highest ratio of the Gross Uniform Bearing Stress ($q_{g,u}$) divided by the Factored Gross Nominal Bearing Resistance (q_R) for foundations on soil, or the Gross Maximum Bearing Stress ($q_{g,max}$) divided by the Factored Gross Nominal Bearing Resistance (q_R) for foundations on rock. Factored Gross Nominal Bearing Resistances were calculated for controlling load combinations.

In Table 11, above, the Factored Gross Nominal Bearing Resistances (q_R) used for design, are based on the following design criteria:

1) The final designed spread footing will have an effective width (B') such that the Gross Uniform Bearing Stress ($q_{g,u}$) does not exceed the recommended design values for the Factored Gross Nominal Bearing Resistances (q_R) for the Extreme Limit State.

Based on the information provided, the existing spread footings at Bents 2 and 4 support locations are adequate in an extreme event.

If any of the above loading conditions are changed, minimum footing widths or embedment depths are reduced, or bottom of footing elevations raised, the Office of Geotechnical Design-South 2, Branch B, is to be contacted for reevaluation.

Construction Considerations:

CIDH Piles

1) Due to the non-cohesive nature of the soils, it is anticipated that concrete placement for the CIDH piles will be done by slurry displacement methods to reduce the potential for caving. At Bent 3 location, the calculated geotechnical capacity of the CIDH piles is based on skin friction only and no end-bearing was considered. The skin friction zones used to calculate geotechnical capacity of the CIDH piles are summarized below in Table 12.

Table 12 - CIDH Pile Skin Friction Zone Elevations

Location	Skin Friction Zone Start Elevation	Skin Friction Zone End Elevation
Bent 3	321.95 ft	296.95 ft

2) If the CIDH piles are to be constructed using slurry displacement method, the slurry shall consist of mineral or synthetic slurry only. Water shall not be allowed to be used as slurry.

3) If the contractor chooses to use slurry to aid in the construction of CIDH piles, care should be exercised while advancing the drilled hole for the piles. Due to the non-cohesive nature of granular soils, rapid insertion and removal of the drilling tools during the drilling process can cause excessive scouring and caving of the walls of the drilled shaft.

The recommendations contained in this report are based on specific project information regarding structure type, support locations, and design loads that have been provided by Structure Design, Office of Bridge Design – South 1. If any conceptual changes are made during final project design, the Office of Geotechnical Design-South 2, Design Branch B, should review those changes to determine if these foundation recommendations are still applicable. Any questions regarding the above recommendations should be directed to the attention of David (T.M.) Liao, (916) 227-5756, Erich Neupert, (916) 227-4565, or Mark DeSalvatore, (916) 227-5391, at the Office of Geotechnical Design-South 2, Branch B.

Prepared by: Date: 10/18/11

Erich Neupert

Erich Neupert, P.G., 8137
Engineering Geologist
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cc: R.E. Pending File
John Stayton - Specs & Estimates
Bruce Lambert – District 11 (Project Manager)
Art Padilla – District 11 (Materials Engineer)
Abbas Abghari – OGDS-2
Mark Willian – GS Corporate

State of California Business, Transportation and Housing Agency

Flex your power!
Be energy efficient!

Memorandum

To: MATT HOLM, BRANCH CHIEF
DEPARTMENT OF TRANSPORTATION
BRIDGE DESIGN BRANCH 12
OFFICE OF BRIDGE DESIGN SOUTH-1

Date: October 20, 2011

File: 11-SD-805-20.23
Project # 1100000359
EA# 11-290301
Kearny Villa Rd O.C
(Retrofit)
Bridge No. 57-0678

From: DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES - MS #5
OFFICE OF GEOTECHNICAL DESIGN SOUTH-2

Subject: **Seismic Design Recommendations**

Introduction

This memorandum presents seismic design recommendations for the above bridge. Ground motion recommendations are based on the Caltrans 2009 Seismic Design Procedure (SDP) as described in the Seismic Design Criteria Version 1.5 (SDC) Appendix B.

Seismicity

Based on the 2007 Caltrans fault database and the Caltrans ARS Online Tool v.1.0.4, the site is located about 3.3 miles (5.4 km) from the Newport Inglewood-Rose Canyon fault zone (San Diego section) (Fault ID 224, M_{Max} = 7.5, RLSS, Dip = 90 degrees), the controlling fault for the deterministic seismic procedure. The peak horizontal ground acceleration at the site is estimated as 0.42g. A copy of a map showing the location of the bridge and the controlling fault is attached.

Soil Profile

The proposed bridge site is located in an area of ancient sedimentary terraces cut by creeks, which generally flow north to south. Alluvial and slopewash materials are generally found in the creek bottom, with sedimentary formational material exposed on the canyon sides. The geologic map, "Geology of the La Jolla Quadrangle San Diego County, California (Kennedy 1975)

indicates that the site is underlain by the Mission Valley Formation at the surface, which is described as sandstone and conglomerate. The Mission Valley Formation is underlain by the Stadium Conglomerate.

The "As-Built" Logs of Test Borings from the 1966 subsurface investigation revealed the project site is generally underlain by dense to very dense sand, silt, very hard sandy clay, with zones of gravels and cobbles.

The average shear wave velocity for the upper 100 feet of subsurface is estimated as V_{S30} = 400 m/s.

Groundwater was encountered during the 1966 subsurface investigation at elev. 296.6 ft. The groundwater elevations are subject to seasonal fluctuations and will be encountered at higher or lower elevations depending on conditions at time of construction.

Design Response Spectrum

Based on the 2009 SDP, the design response spectrum is the upper envelope of the deterministic and probabilistic response, but is not less than a deterministic response spectrum resulting from a M_{max} = 6.5 earthquake on a vertical strike-slip fault at a distance of 12 km. The deterministic response spectrum is obtained by taking arithmetic average of the median response spectra calculated using the 2008 Campbell-Bozorgnia and 2008 Chiou-Youngs ground motion prediction equations. The Probabilistic response spectrum is obtained for 5 percent probability of exceedance in 50 years (corresponding to approximately a 975 year return period) using the 2008 USGS Seismic Hazard Map. Adjustments to account for site conditions and fault effects are implemented. For this site the deterministic procedure controls and the corresponding spectrum selected for design is the deterministic spectrum. A copy of the acceleration response spectrum recommended for design is attached for your reference.

p-y curves

As requested by the structure engineer, p-y curves were performed at Bent 3 location for 24-inch CIDH piles. The digital output and the p-y curve graphs are attached in this report for reference.

Liquefaction Potential Evaluation

Based on available soil information (from As-Built LOTBs), it can be concluded that the potential for soil liquefaction due to strong ground shaking is considered low at the project site due to the dense nature of the underlying sedimentary formational material.

Seismic Settlement

Seismic settlement due to strong ground motion is considered less than an inch.

Surface Fault Rupture Hazard

The site is not located within the Alquist Priolo Fault Hazard Zone and is more than three miles from the nearest Caltrans-active faults which are exposed at the surface (Newport Inglewood-Rose Canyon fault zone, San Diego section). Potential for surface rupture is considered low.

Any questions regarding the above recommendations should be directed to the attention of AnhDan Le (916) 227-7211 or Angel Perez-Cobo (916) 227-7167, Office of Geotechnical Design South-2.

Prepared by: Date: 10/20/11

REGISTERED PROFESSIONAL ENGINEER
ANHDAN LE
GE 2931
EXP 9/30/12
GEOTECHNICAL
STATE OF CALIFORNIA

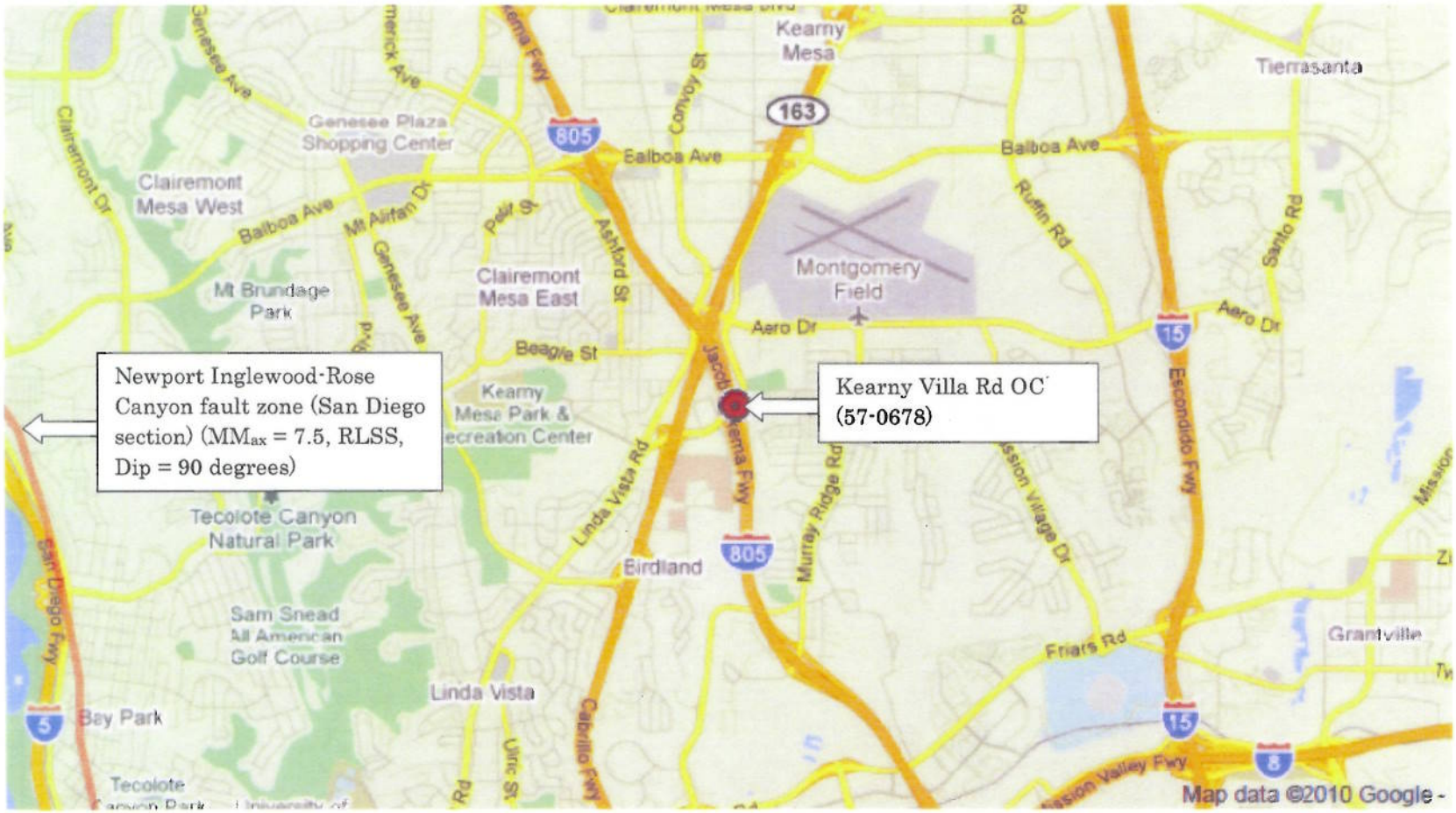
AnhDan Le, Ph.D, G.E.
Transportation Engineer
Office of Geotechnical Design South-2

Supervised by: Date: 10/20/11

Angel Perez-Cobo. P.E.
Senior Transportation Engineer
Office of Geotechnical Design South-2

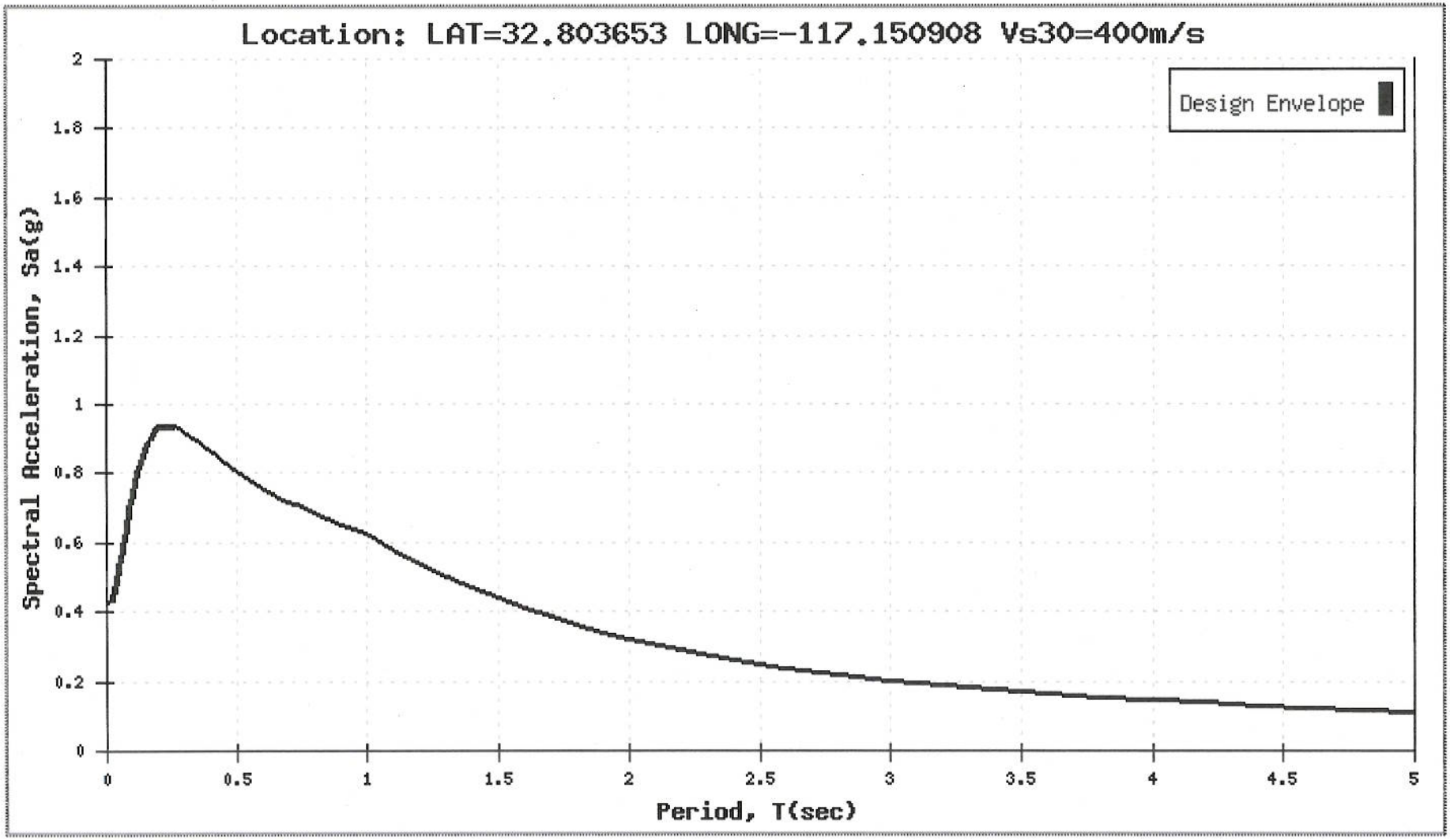
Attachments: Online ARS curve
p-y curves

cc: D Liao - GDS2
M. DeSalvatore - GDS2
File

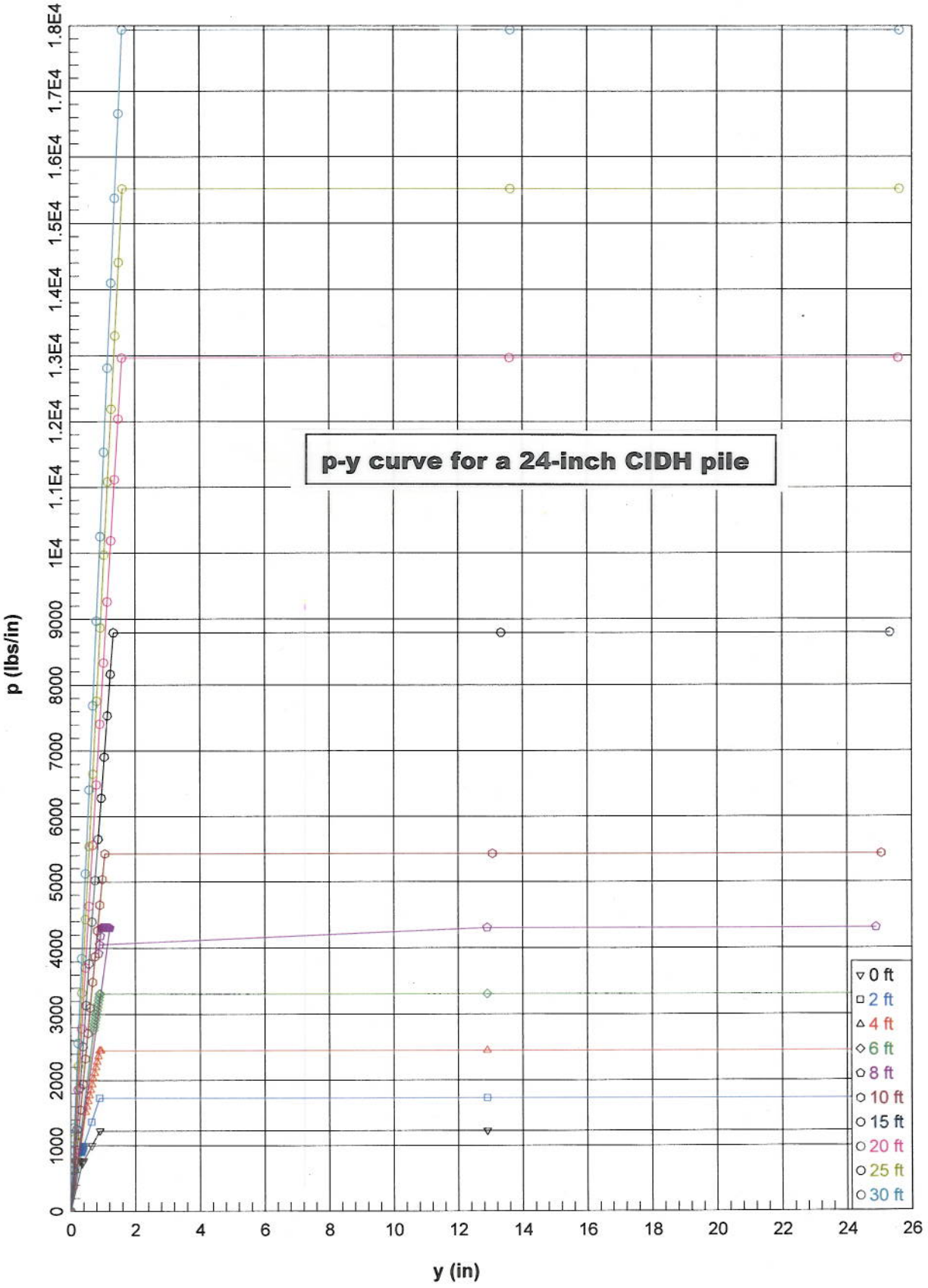


Fault Map
Kearny Villa Road O.C (Retrofit)
Bridge No. 57-0678

Recommended ARS curve for Kearny Villa Road O.C (Retrofit)
Bridge # 57-0678



P-Y CURVES BENT 3
BRIDGE # 57-0678


p-y curve for a 24-inch CIDH pile
p (lbs/in)
y (in)
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
1E4
1.1E4
1.2E4
1.3E4
1.4E4
1.5E4
1.6E4
1.7E4
1.8E4
0
2
4
6
8
10
12
14
16
18
20
22
24
26
0 ft
2 ft
4 ft
6 ft
8 ft
10 ft
15 ft
20 ft
25 ft
30 ft

This p-y curve is computed at depth 0 feet below pile head

y, in	p, lbs/in	
0.0000	0.0000	
0.34697	728.63327	*
0.35179	733.31877	
0.35661	737.97002	
0.36143	742.58771	
0.36625	747.17254	
0.37107	751.72516	
0.37589	756.24621	
0.38072	760.73633	
0.38554	765.19609	
0.39036	769.62610	
0.39518	774.02690	
0.40000	778.39904	
0.65000	1004.38586	
0.90000	1230.37268	
12.90000	1230.37268	
24.90000	1230.37268	

This p-y curve is computed at depth 2 feet below pile head.

y, in	p, lbs/in	
0.0000	0.0000	
0.33357	900.63154	*
0.33961	910.09472	
0.34565	919.48789	
0.35169	928.81280	
0.35772	938.07109	
0.36376	947.26435	
0.36980	956.39410	
0.37584	965.46182	
0.38188	974.46892	
0.38792	983.41673	
0.39396	992.30658	
0.40000	1001.13971	
0.65000	1365.63234	
0.90000	1730.12496	
12.90000	1730.12496	
24.90000	1730.12496	

This p-y curve is computed at depth 4 feet below pile head.

y, in	p, lbs/in
0.0000	0.0000
0.45851	1513.06654
0.49864	1597.83527
0.53878	1682.60400
0.57891	1767.37273
0.61905	1852.14147
0.65918	1936.91020
0.69932	2021.67893
0.73946	2106.44767
0.77959	2191.21640
0.81973	2275.98513
0.85986	2360.75386
0.90000	2445.52260
0.94014	2445.52260
0.90000	2445.52260
12.90000	2445.52260
24.90000	2445.52260

This p-y curve is computed at depth 6 feet below pile head.

y, in	p, lbs/in
0.0000	0.0000
0.70741	2758.90946
0.72492	2808.94825
0.74243	2858.98704
0.75994	2909.02583
0.77744	2959.06462
0.79495	3009.10341
0.81246	3059.14220
0.82997	3109.18099
0.84748	3159.21978
0.86498	3209.25857
0.88249	3259.29736
0.90000	3309.33615
0.91751	3309.33615
0.90000	3309.33615
12.90000	3309.33615
24.90000	3309.33615

This p-y curve is computed at depth 8 feet below pile head.

y, in	p, lbs/in	
0.0000	0.0000	
1.22137	4302.12604	
1.19216	4302.12604	
1.16294	4302.12604	
1.13373	4302.12604	
1.10451	4302.12604	
1.07529	4302.12604	
1.04608	4302.12604	
1.01686	4302.12604	
0.98765	4302.12604	
0.95843	4302.12604	
0.92922	4181.47081	*
0.90000	4050.00000	*
0.87078	3918.52919	*
0.90000	4050.00000	*
12.90000	4302.12604	
24.90000	4302.12604	

This p-y curve is computed at depth 10 feet below pile head.

y, in	p, lbs/in	
0.0000	0.0000	
0.07596	387.42088	*
0.15193	774.84175	*
0.22789	1162.26263	*
0.30386	1549.68350	*
0.37982	1937.10438	*
0.45579	2324.52526	*
0.53175	2711.94613	*
0.60772	3099.36701	*
0.68368	3486.78788	*
0.75965	3874.20876	*
0.83561	4261.62964	*
0.91158	4649.05051	*
0.98754	5036.47139	*
1.06351	5423.89226	
13.06351	5423.89226	
25.06351	5423.89226.	

This p-y curve is computed at depth 15 feet below pile head.

y, in	p, lbs/in	
0.0000	0.0000	
0.09516	628.04138	*
0.19032	1256.08275	*
0.28547	1884.12413	*
0.38063	2512.16551	*
0.47579	3140.20689	*
0.57095	3768.24826	*
0.66610	4396.28964	*
0.76126	5024.33102	*
0.85642	5652.37239	*
0.95158	6280.41377	*
1.04674	6908.45515	*
1.14189	7536.49653	*
1.23705	8164.53790	*
1.33221	8792.57928	
13.33221	8792.57928	
25.33221	8792.57928	

This p-y curve is computed at depth 20 feet below pile head.

y, in	p, lbs/in	
0.0000	0.0000	
0.11435	926.24060	*
0.22870	1852.48120	*
0.34305	2778.72180	*
0.45740	3704.96239	*
0.57175	4631.20299	*
0.68610	5557.44359	*
0.80045	6483.68419	*
0.91481	7409.92479	*
1.02916	8336.16539	*
1.14351	9262.40598	*
1.25786	10189.	*
1.37221	11115.	*
1.48656	12041.	*
1.60091	12967.	
13.60091	12967.	
25.60091	12967.	

This p-y curve is computed at depth 25 feet below pile head.

y, in	p, lbs/in	
0.0000	0.0000	
0.11544	1108.19311	*
0.23087	2216.38621	*
0.34631	3324.57932	*
0.46175	4432.77243	*
0.57718	5540.96553	*
0.69262	6649.15864	*
0.80806	7757.35174	*
0.92349	8865.54485	*
1.03893	9973.73796	*
1.15437	11082.	*
1.26980	12190.	*
1.38524	13298.	*
1.50068	14407.	*
1.61611	15515.	
13.61611	15515.	
25.61611	15515.	

This p-y curve is computed at depth 30 feet below pile head.

y, in	p, lbs/in	
0.0000	0.0000	
0.11544	1281.34828	*
0.23087	2562.69656	*
0.34631	3844.04484	*
0.46175	5125.39312	*
0.57718	6406.74140	*
0.69262	7688.08968	*
0.80806	8969.43795	*
0.92349	10251.	*
1.03893	11532.	*
1.15437	12813.	*
1.26980	14095.	*
1.38524	15376.	*
1.50068	16658.	*
1.61611	17939.	
13.61611	17939.	
25.61611	17939.	

State of California — Business, Transportation and Housing Agency

Memorandum

To: **Bruce Lambert**
Project Manager

Date: January 8, 2013

From: **Joel Kloth**
Engineering Geologist
Environmental Engineering

File: 11-SD-75
PM: 0.00
EA: 290304
PI: 1100000359

Subject: Hazardous Waste Review for Seismic Retrofit of E75-N5 Connector OC on Route 75 (Palm Avenue) at Route 5, San Diego, California

An Initial Site Assessment regarding the potential for encountering hazardous waste issues/materials for the subject project has been completed by Environmental Engineering. There are leaking underground storage tanks (USTs) on service station properties east and west of Route 5 along Route 75 (Palm Avenue).

According to a report entitled "Site Assessment Report, for Atlantic Richfield Company, ARCO Facility No. 5411, 2255 Palm Avenue, San Diego, California", dated February 10, 2010, 0.09 mile east of the subject Connector, groundwater was measured at approximately 31 feet below grade. Proposed excavation and CIDH pile depth will be 40 feet or greater, so groundwater will be encountered. However, in groundwater monitoring wells closest to the subject Connector (MW5 and MW6) benzene and MTBE was below the detection limit in MW5, and benzene was below the detection limit and 0.66 micrograms per liter of MTBE were in MW6 (figure 9 and 10 attached). This indicates that contaminants have not reached the subject Connector location from the east.

According to a report entitled "Transmittal of the Progress Report of CAP Implementation and Site Closure Request" dated November 4, 2010 for the Thrifty Oil Co. Station at 1890 Palm Avenue, 0.25 mile west of the subject Connector location the groundwater is at an approximated depth of 7 feet below grade, However, the groundwater gradient is to the southwest. Thus groundwater contamination will not migrate toward the subject Connector from this location to the west.

Based on review of information found on GeoTracker, encountering hazardous waste issues/materials in the subsurface at the project Connector location are not anticipated.

Selected service station UST report information along Route 75 (Palm Avenue) at Route 5 is attached for review. The entire report information is available on GeoTracker.

Joel Kloth, PG
Engineering Geologist
Environmental Engineering

cc: Jayne Dowda

SITE ASSESSMENT REPORT

PREPARED FOR:

ATLANTIC RICHFIELD COMPANY
ARCO Facility No. 5411
Former Thrifty Oil Company No. 415
2255 Palm Avenue
San Diego, California
SAM Case No. H21097-002
Assessor's Parcel No. 628-060-51-00
Stantec Project No. 211801044

PREPARED BY:

Stantec Consulting
2655 Camino Del Rio North Suite 302
San Diego, California 92108

February 10, 2010

Stantec

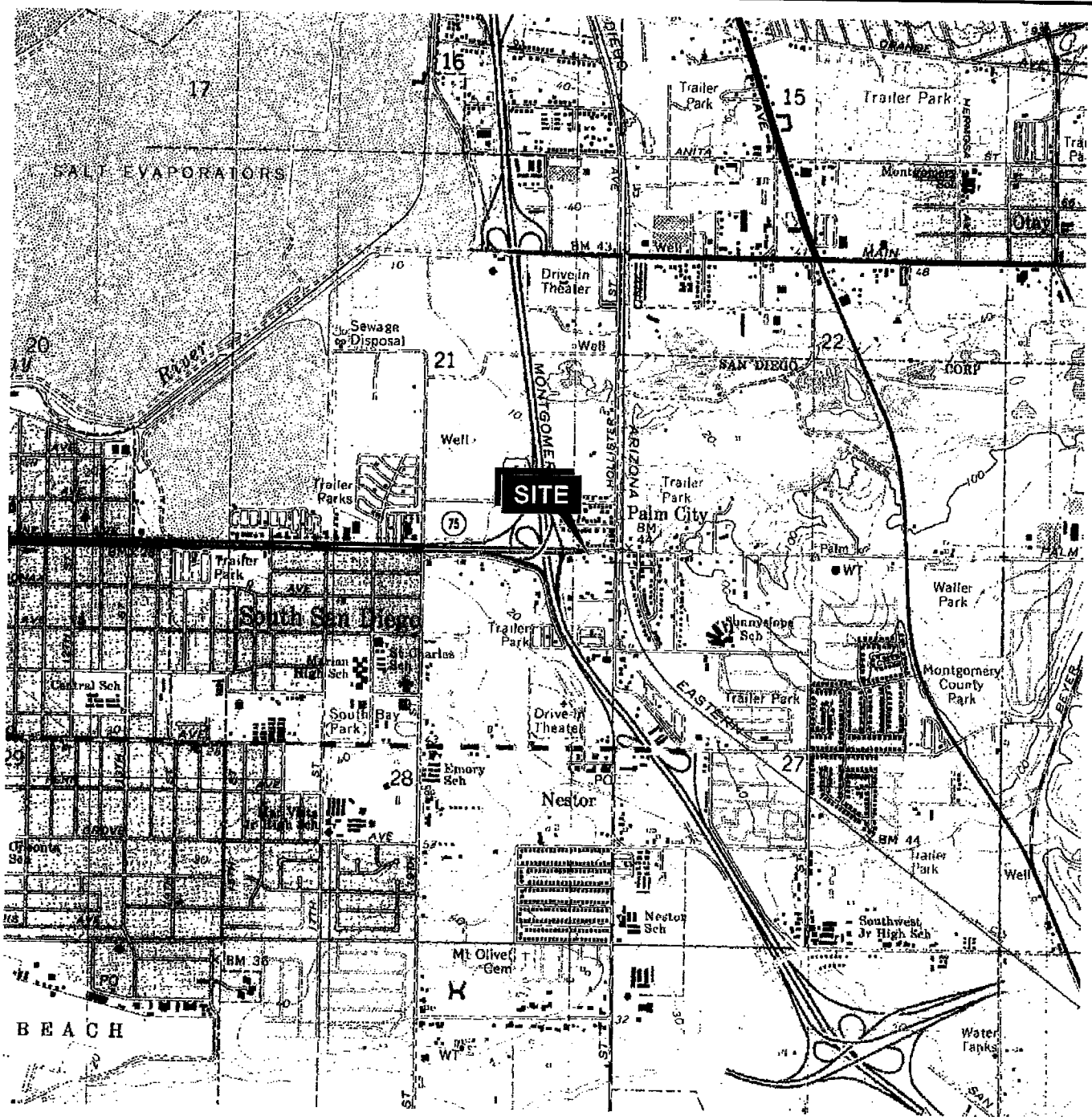
8.0 Findings

The lithology encountered in MW-6 was logged as a soil (due to the difficulty in collecting relatively undisturbed soil samples during air rotary drilling). The soil was characterized as silty sand with gravel, and gravel from the surface to approximately 44.5 feet bgs.

Depth to groundwater in well MW-6 was measured at 31.91 feet from the top of the well casing. For the initial groundwater sampling event (September 28, 2009), dissolved concentrations of GRO and BTEX constituents were detected above LRLs in groundwater samples collected from MW-6. No MTBE or other fuel oxygenates were reported at or above LRLs in groundwater samples collected from MW-6.

For the second groundwater sampling event (December 2, 2009), no dissolved concentrations of GRO, BTEX, MTBE or other fuel oxygenates were reported above LRLs.

Groundwater samples from this assessment and previous groundwater sampling events related to the site are summarized in Table 2. Dissolved GRO, benzene, and MTBE analytical results and a dissolved benzene isoconcentration map from combined sampling event dates, are shown on Figures 9 and 10, respectively.



QUADRANGLE LOCATION

Reference: Terrain Navigator—U.S.G.S., 1975, Imperial Beach, California Quadrangle 7.5—Minute Topographic Map.

N

0 1000 2000

1 INCH = 2000 FEET

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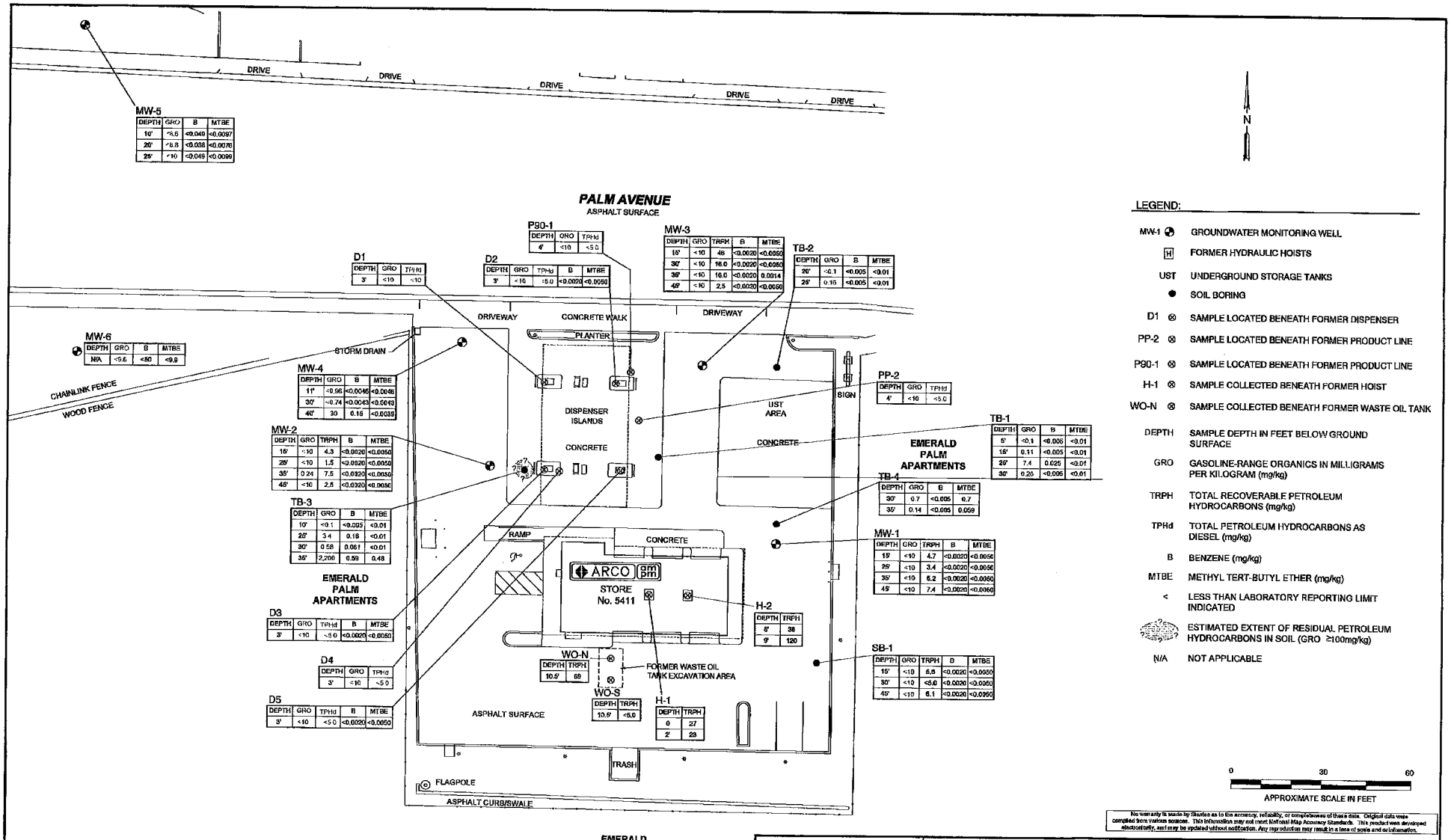
PHONE: (619) 296-6195/296-6199 (FAX)

PREPARED FOR:				
ARCO FACILITY No. 5411 2255 PALM AVENUE SAN DIEGO, CALIFORNIA		SITE LOCATION MAP		FIGURE: 1
JOB NUMBER: 211801044	DRAWN BY: RO	CHECKED BY: mmB	APPROVED BY:	DATE: 7/28/06

FILEPATH:M:\CADD-GIS\Site Location Maps\BP-ARCO\5411-USGS.DWG | rocampo | Jan 27, 2010 at 8:50 | Layout: TOPO MAP

5411-USGS



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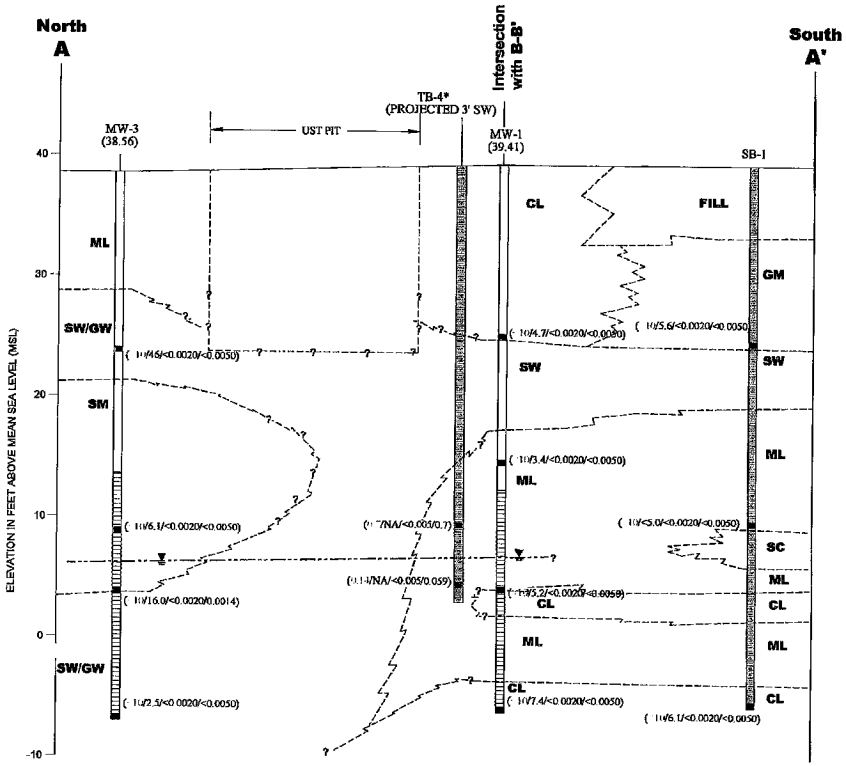
2255 PALM AVENUE
SAN DIEGO, CALIFORNIA

HISTORICAL GRO, TPHd, TRPH, BENZENE AND MTBE CONCENTRATIONS IN SOIL

FIGURE: 3

JOB NUMBER: 211801044 | DRAWN BY: RO | CHECKED BY: mmb. | APPROVED BY: | DATE: 11/28/07



LEGEND:

- MW-1 BORING/WELL IDENTIFICATION
- -INDICATES BACKFILLED BOREHOLE
- -BLANK PVC CASING INTERVAL
- -SCREENED PVC WELL INTERVAL
- (10/<10/<0.0020/<0.0050) SOIL SAMPLE LOCATION WITH GASOLINE-RANGE ORGANICS (GRO),TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (TRPH), BENZENE AND METHYL TERT-BUTYL ETHER (MTBE) CONCENTRATIONS MEASURED IN MILLIGRAMS PER KILOGRAM (mg/kg).
- < CONCENTRATION LESS THAN REPORTING LIMIT
- INFERRED SOIL CONTACT
- GW WELL GRADED GRAVEL
- SW WELL GRADED SAND AND GRAVEL
- SM SILTY SAND
- SC CLAYEY SAND
- ML SILT, CLAYEY SILT
- CL SILTY CLAY
- GM SILTY GRAVEL
- (38.56) WELL CASING ELEVATION IN FEET ABOVE MEAN SEA LEVEL (MSL)
- ▼ DEPTH TO STATIC GROUNDWATER ON SEPTEMBER 16, 2009
- UST PIT
- * SUSPECT LITHOLOGIC DATA, NOT INCLUDED IN CROSS-SECTION

0 20 40
HORIZONTAL SCALE IN FEET

0 10 20
VERTICAL SCALE IN FEET

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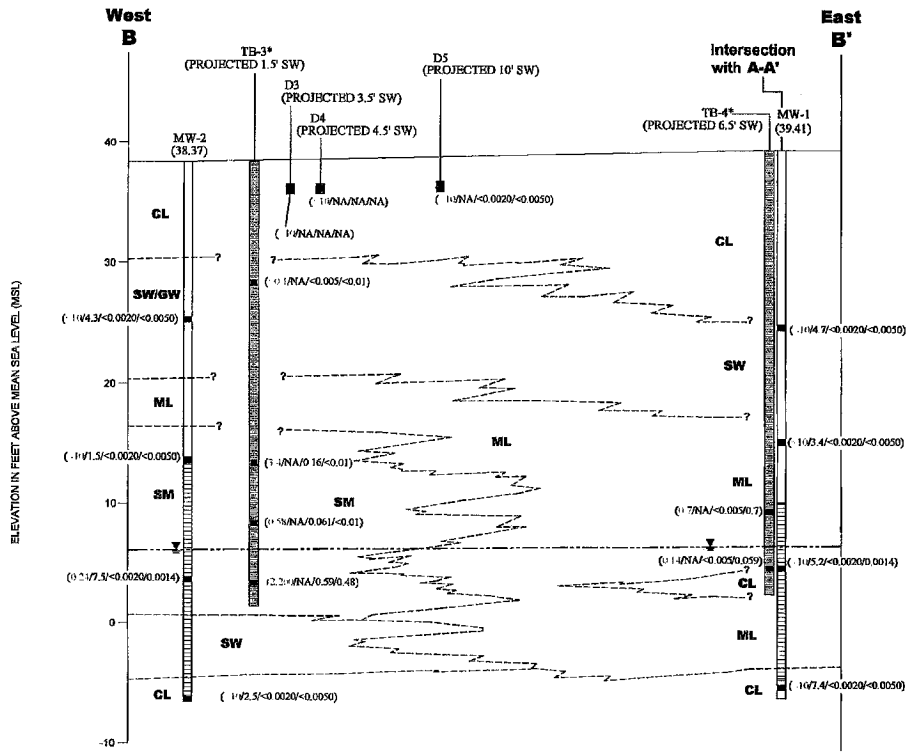
PREPARED FOR:
ARCO FACILITY No. 5411
2255 PALM AVENUE
SAN DIEGO, CALIFORNIA

GEOLOGIC CROSS-SECTION
A-A'

FIGURE: 4

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
211901044	RO	CR		01/25/08

FILEPATH:M:\CADD-08\Projects 2006\BP-Arco\5411-2k6\AR 5411 XA 4-06.dwg | alonzo | Jan 26, 2010 at 9:17 | Layout: Model



LEGEND:

MW-1 BORING/WELL IDENTIFICATION

-INDICATES BACKFILLED BOREHOLE

-BLANK PVC CASING INTERVAL

-SCREENED PVC WELL INTERVAL

(-10/4.3/<0.0020/<0.0050) SOIL SAMPLE LOCATION WITH GASOLINE-RANGE ORGANICS (GRO), TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (TRPH), BENZENE AND METHYL TERT-BUTYL ETHER (MTBE) CONCENTRATIONS MEASURED IN MILLIGRAMS PER KILOGRAM (mg/kg).

NA NOT ANALYZED

< CONCENTRATION LESS THAN INDICATED REPORTING LIMIT

INFERRED SOIL CONTACT

GW WELL GRADED GRAVEL

SW/GW WELL GRADED SAND/GRAVEL

SM SILTY SAND

ML SILT, CLAYEY SILT

CL SILTY CLAY

(39.41) WELL CASING ELEVATION IN FEET ABOVE MEAN SEA LEVEL (MSL)

DEPTH TO STATIC GROUNDWATER ON SEPTEMBER 18, 2009

* LITHOLOGIC DATA NOT INCLUDED IN CROSS-SECTON

0 20 40
HORIZONTAL SCALE IN FEET

0 10 20
VERTICAL SCALE IN FEET

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PHONE: (619) 296-6195/296-6199 (FAX)

PREPARED FOR:
ARCO FACILITY No. 5411
2255 PALM AVENUE
SAN DIEGO, CALIFORNIA

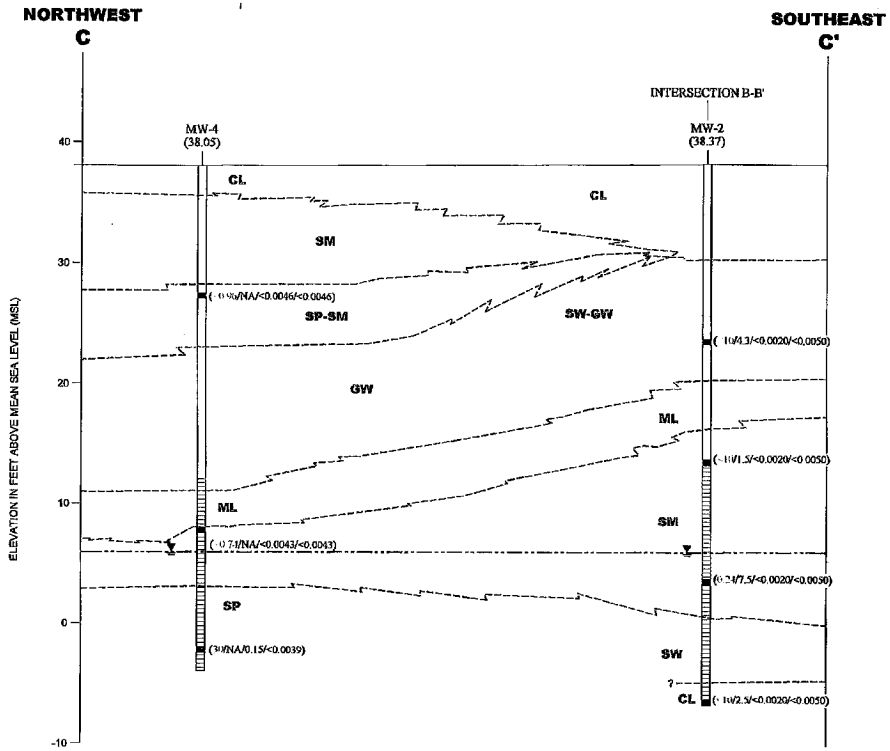
GEOLOGIC CROSS-SECTION
B-B'

FIGURE: 5

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
211801044	RO	CR	MR	01/25/08

FILEPATH:M:\CADD-08\Projects 2008\BP-Arco\5411-2k8\AR 5411 XB 4-06.dwg | jalonzo | Jan 26, 2010 at 9:19 | Layout: Model

AR 5411 XB 4-06



LEGEND:

MW-4	BORING/WELL IDENTIFICATION
	-INDICATES BACKFILLED BOREHOLE
	-BLANK PVC CASING INTERVAL
	-SCREENED PVC WELL INTERVAL
(<10/<10/<0.0020/<0.0050)	SOIL SAMPLE LOCATION WITH GASOLINE-RANGE ORGANICS (GRO), TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (TRPH), BENZENE AND METHYL TERT-BUTYL ETHER (MTBE) CONCENTRATIONS MEASURED IN MILLIGRAMS PER KILOGRAM (mg/kg).
NA	NOT ANALYZED
<	CONCENTRATION LESS THAN INDICATED REPORTING LIMIT
------	INFERRED SOIL CONTACT
GW	WELL GRADED GRAVEL AND COBBLES WITH SAND
SW	WELL GRADED SAND WITH GRAVEL
SM	SILTY SAND
SC	CLAYEY SAND
ML	SILT WITH SAND/SANDY SILT
CL	LEAN CLAY/CLAYEY SILT
SP-SM	POORLY GRADED SAND WITH SILT
SW-GW	WELL GRADED SAND AND GRAVEL
SP	POORLY GRADED SAND WITH GRAVEL
(38.05)	WELL CASING ELEVATION IN FEET ABOVE MEAN SEA LEVEL (MSL)
▼	DEPTH TO STATIC GROUND WATER ON SEPTEMBER 18, 2009

0 10 20
HORIZONTAL SCALE IN FEET

0 10 20
VERTICAL SCALE IN FEET

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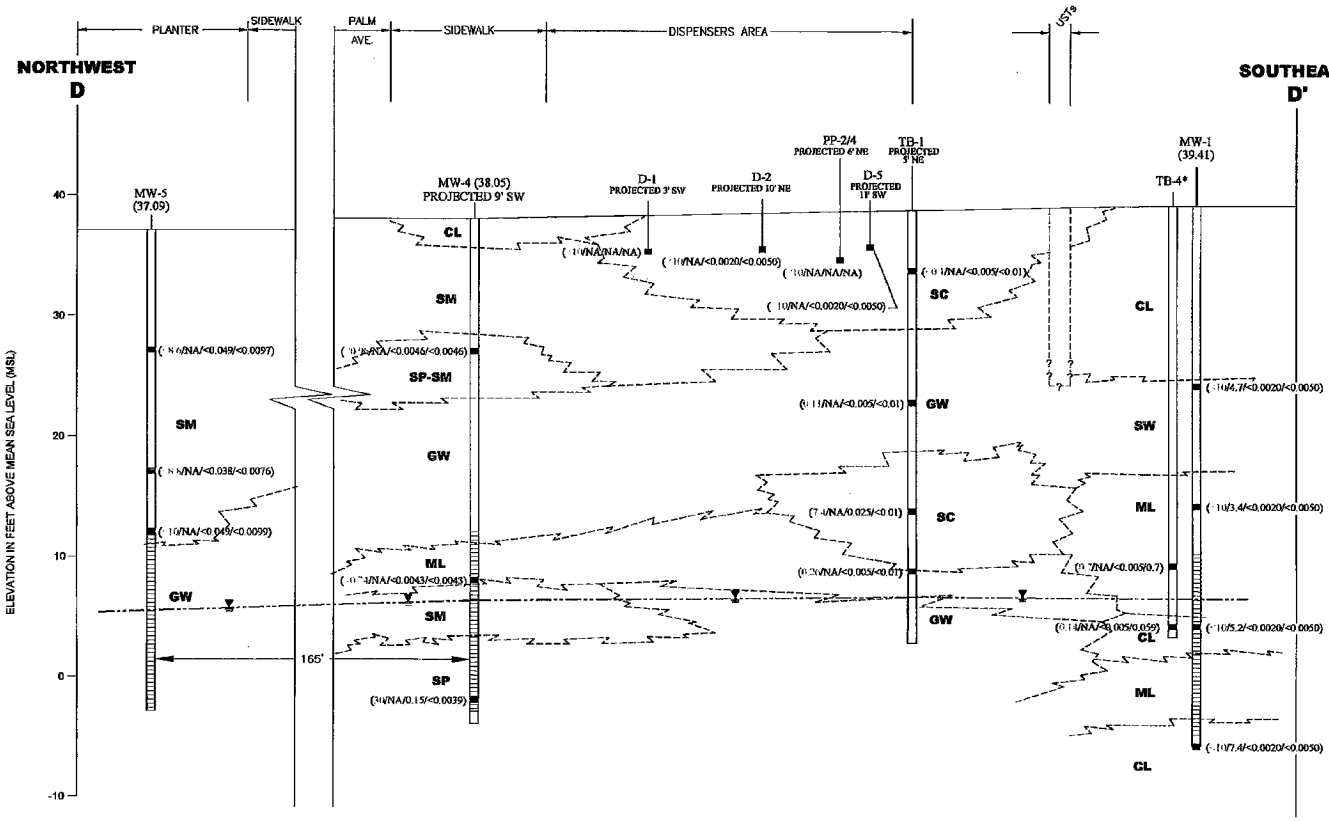
PREPARED FOR:
ARCO FACILITY No. 5411
2255 PALM AVENUE
SAN DIEGO, CALIFORNIA

GEOLOGIC CROSS-SECTION
C-C'

FIGURE: 6

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
211801044	RO	CR		01/25/08

FILEPATH:M:\CADD-08\Projects 2008\BP-Arco\5411-2k8\AR 5411 XC 4-06.dwg | alonzo | Jan 28, 2010 at 9:19 | Layout: Model



LEGEND:

MW-4	BORING/WELL IDENTIFICATION
	-INDICATES BACKFILLED BOREHOLE
	-BLANK PVC CASING INTERVAL
	-SCREENED PVC WELL INTERVAL
(<10/<10/<0.0020/<0.0050)	SOIL SAMPLE LOCATION WITH GASOLINE-RANGE ORGANICS (GRO), TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (TRPH), BENZENE AND METHYL TERT-BUTYL ETHER (MTBE) CONCENTRATIONS MEASURED IN MILLIGRAMS PER KILOGRAM (mg/kg).
NA	NOT ANALYZED
<	CONCENTRATION LESS THAN INDICATED REPORTING LIMIT
------	INFERRED SOIL CONTACT
GW	WELL GRADED GRAVEL AND COBBLES WITH SAND
SW	WELL GRADED SAND WITH GRAVEL
SM	SILTY SAND
SC	CLAYEY SAND
ML	SILT WITH SAND/SANDY SILT
CL	LEAN CLAY/SILTY CLAY
SP-SM	POORLY GRADED SAND WITH SILT
SP	POORLY GRADED SAND WITH GRAVEL
(38.05)	WELL CASING ELEVATION IN FEET ABOVE MEAN SEA LEVEL (MSL)
▼	DEPTH TO STATIC GROUND WATER ON SEPTEMBER 18, 2009
*	LITHOLOGIC DATA NOT INCLUDED IN CROSS-SECTION

0 20 40
HORIZONTAL SCALE IN FEET

0 10 20
VERTICAL SCALE IN FEET

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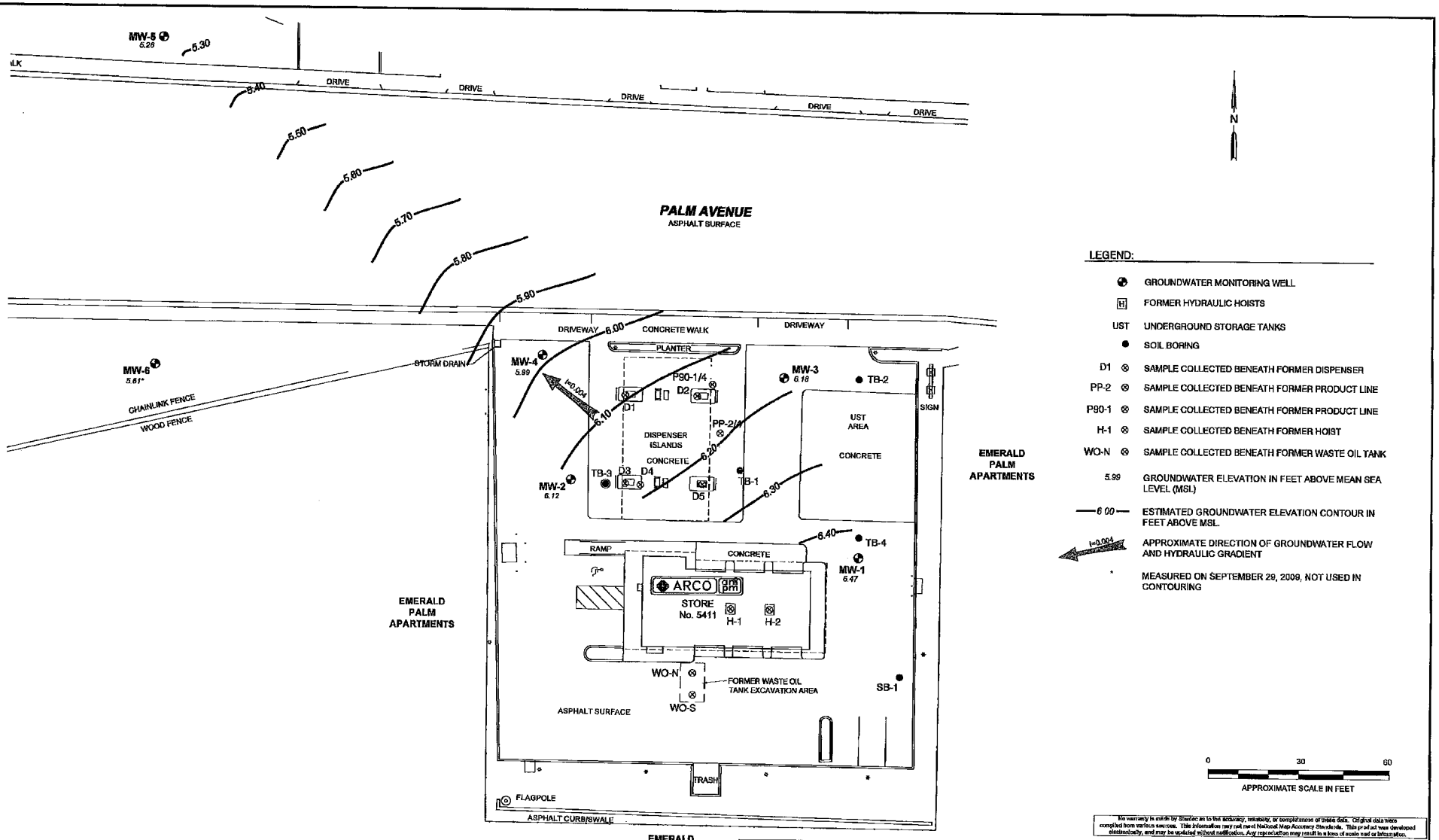
PHONE: (619) 298-6195/298-6199 (FAX)

PREPARED FOR:
ARCO FACILITY No. 5411
2255 PALM AVENUE
SAN DIEGO, CALIFORNIA

GEOLOGIC CROSS-SECTION
D-D'

FIGURE: 7

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
211601044	RO	CR		12/3/07



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2255 PALM AVENUE
SAN DIEGO, CALIFORNIA

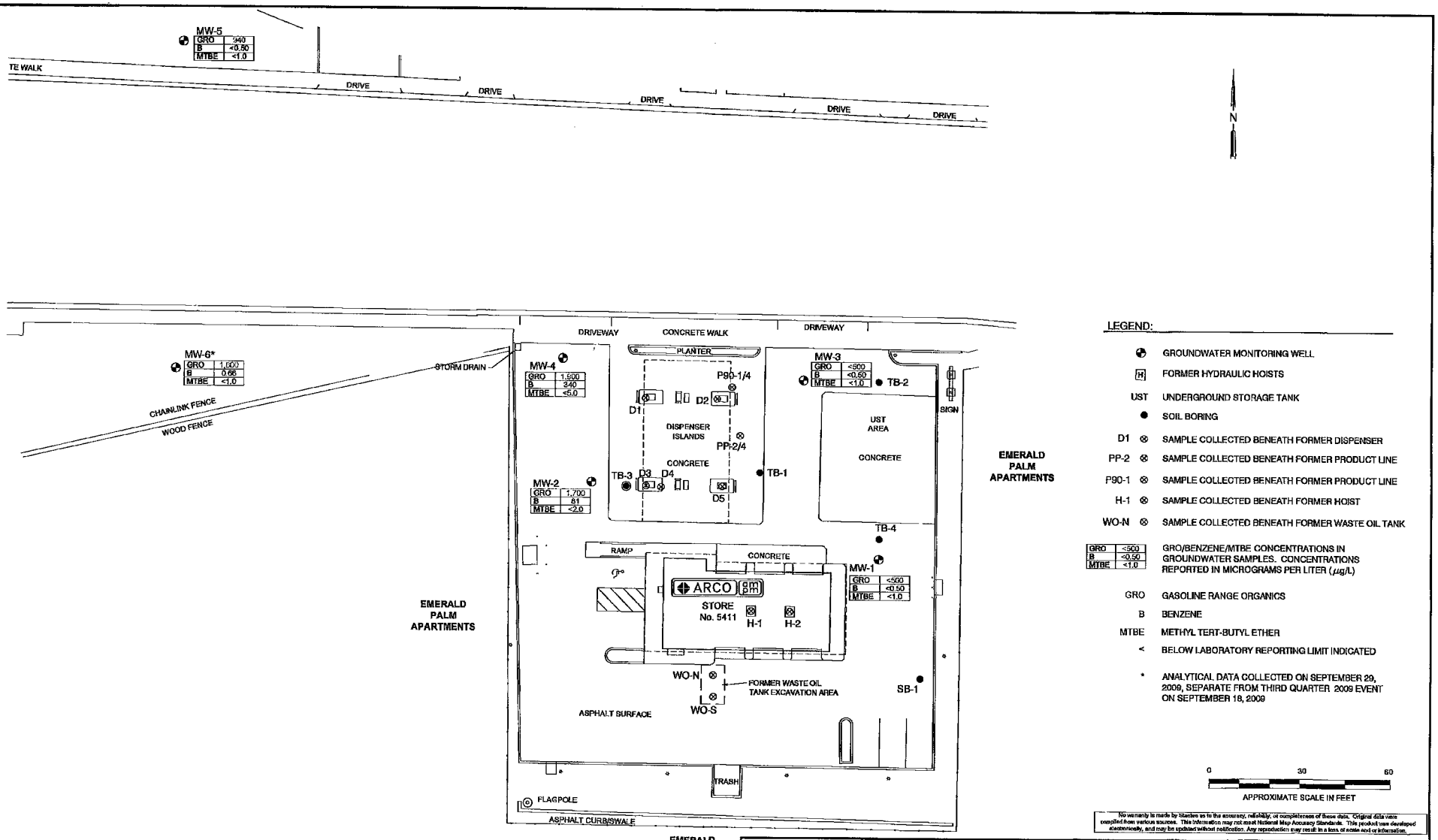
GROUNDWATER ELEVATION CONTOUR MAP
SEPTEMBER 18, 2009

FIGURE: 8

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
211801044	RO	mmb		10/19/09

FILEPATH:M:\CADD-06\Projects 2009\Arco-BP\5411-2K9\5411 GW\dwg\2009-Q3\AR 5411 2009Q3-R1.dwg [alonzo] [Nov 16, 2009 at 9:45] [Layout: GW

AR 5411 2009Q3 GWE



LEGEND:

- ◔ GROUNDWATER MONITORING WELL
- [H] FORMER HYDRAULIC HOISTS
- UST UNDERGROUND STORAGE TANK
- ● SOIL BORING
- D1 ⊗ SAMPLE COLLECTED BENEATH FORMER DISPENSER
- PP-2 ⊗ SAMPLE COLLECTED BENEATH FORMER PRODUCT LINE
- P90-1 ⊗ SAMPLE COLLECTED BENEATH FORMER PRODUCT LINE
- H-1 ⊗ SAMPLE COLLECTED BENEATH FORMER HOIST
- WO-N ⊗ SAMPLE COLLECTED BENEATH FORMER WASTE OIL TANK

GRO	<500
B	<0.50
MTBE	<1.0

GRO/BENZENE/MTBE CONCENTRATIONS IN GROUNDWATER SAMPLES. CONCENTRATIONS REPORTED IN MICROGRAMS PER LITER (µg/L)

- GRO GASOLINE RANGE ORGANICS
- B BENZENE
- MTBE METHYL TERT-BUTYL ETHER
- < BELOW LABORATORY REPORTING LIMIT INDICATED
- * ANALYTICAL DATA COLLECTED ON SEPTEMBER 29, 2009, SEPARATE FROM THIRD QUARTER 2009 EVENT ON SEPTEMBER 18, 2009

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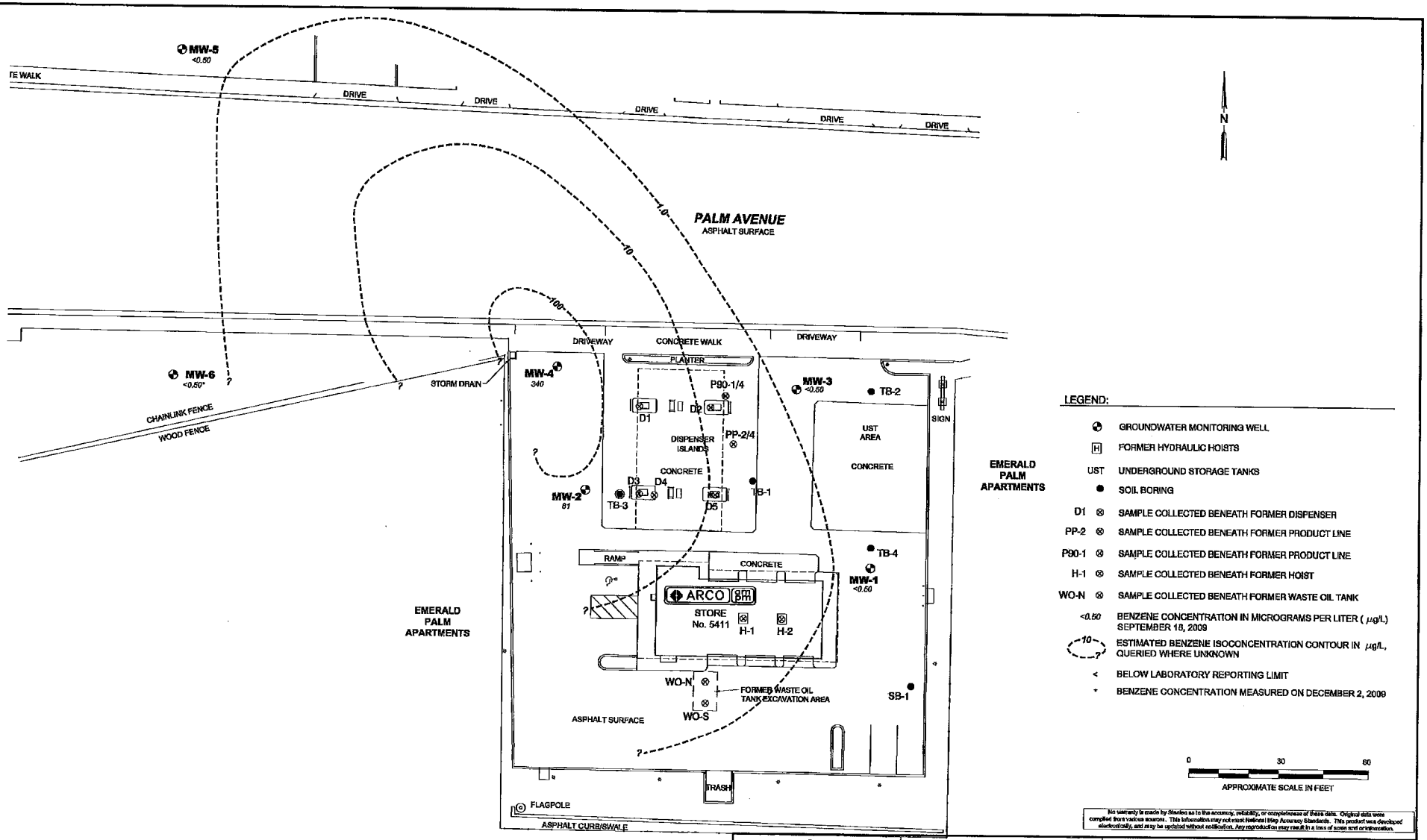
SAN DIEGO, CALIFORNIA

GRO, BENZENE AND MTBE CONCENTRATIONS IN GROUNDWATER SEPTEMBER 2009

FIGURE: 9

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
211801044	RO	mmb.	MC	10/19/09



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BENZENE ISOCONCENTRATION MAP SEPTEMBER 2009

FIGURE: 10

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FILEPATH:M:\CADD-06\Projects 2009\Arco-BP\5411-2K9\AR 5411 2009Q3 ISO-R1.dwg | rocampo | Feb 01, 2010 at 13:24 | Layout: BEN

THRIFTY OIL CO.

November 4, 2010 O-107692

Ms. Teresa Sherman
Department of Environmental Health
San Diego County
P.O. Box 129261
San Diego, CA 92112-9261

Subject: Transmittal of the Progress Report of CAP Implementation and Site Closure Request
Thrifty Oil Co. Station #099
1890 Palm Avenue
San Diego, California
SDDEH Release #H21344-002

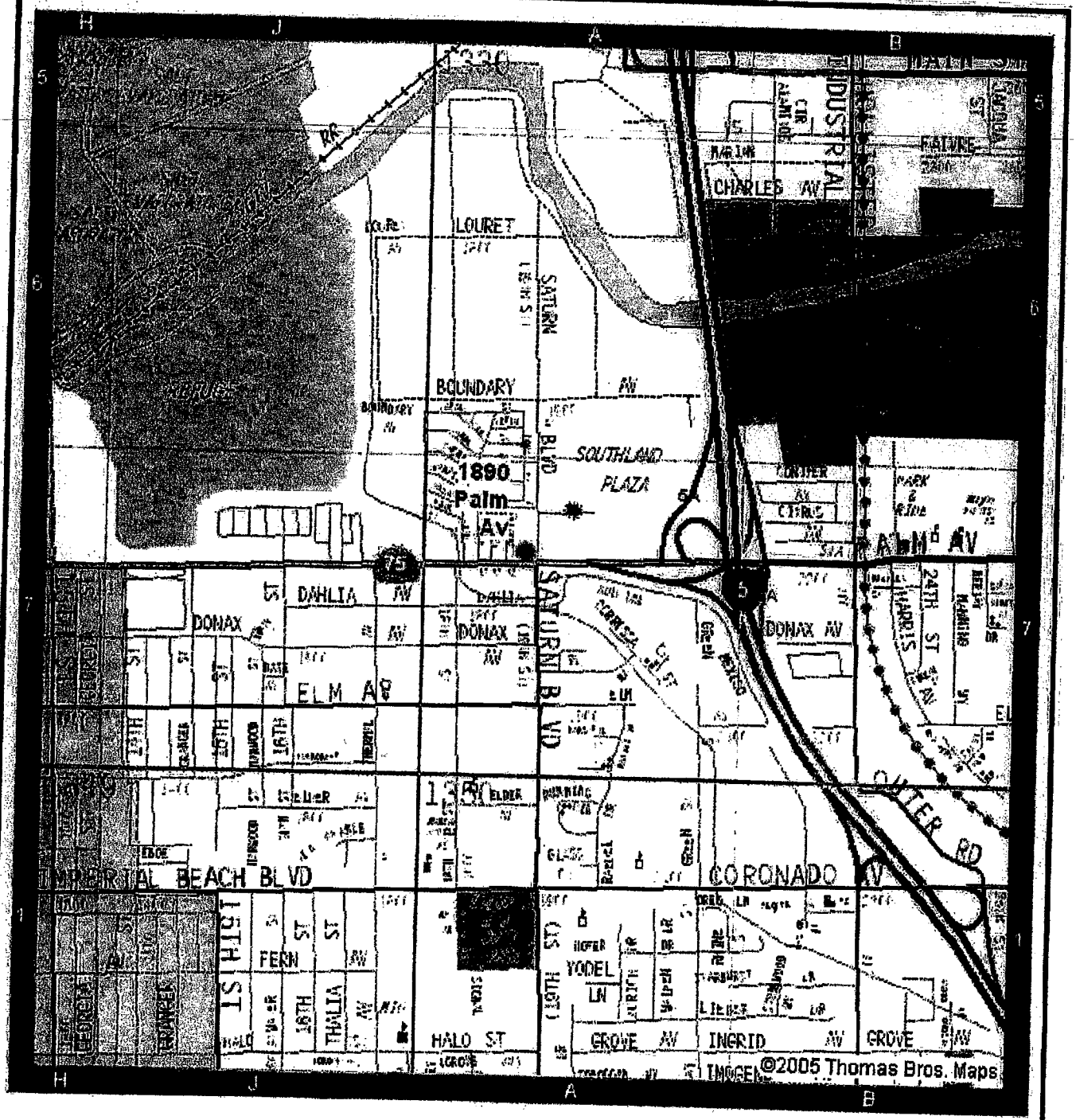
Dear Ms. Sherman

Please find the attached *Transmittal of the Progress Report of CAP Implementation and Site Closure Request* dated November 2, 2010, prepared for your review by Wayne Perry Inc., for the above-referenced Thrifty Oil Co. site. If you have any questions regarding this document, please contact Jim Zenor at (562) 921-3581 at Ext. 427 or Mr. Chris Panaitescu at Ext. 390.

Sincerely,
Thrifty Oil Co.

Chris Panaitescu
General Manager
Environmental Affairs

cc: BP West Coast Products LLP
File



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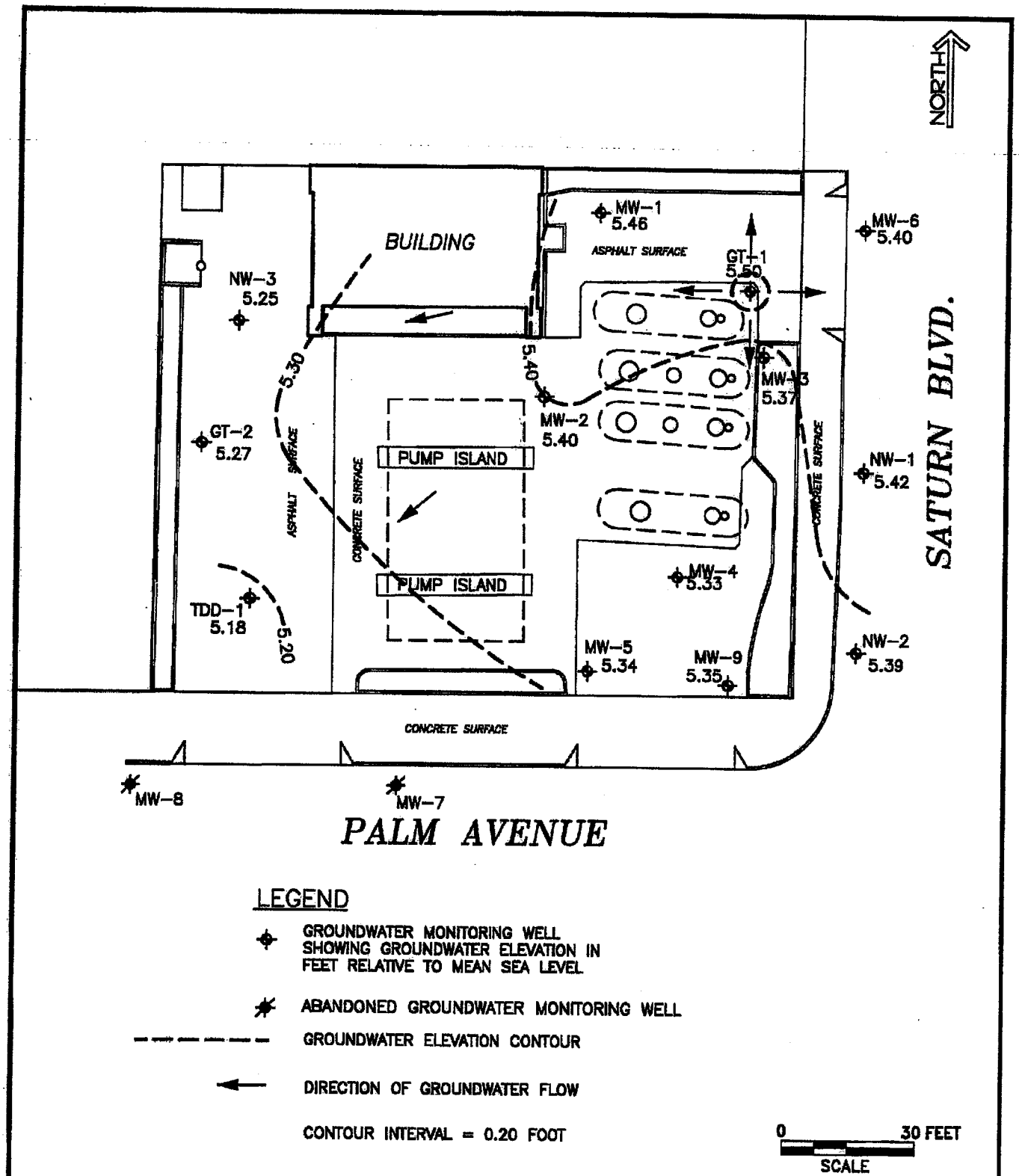
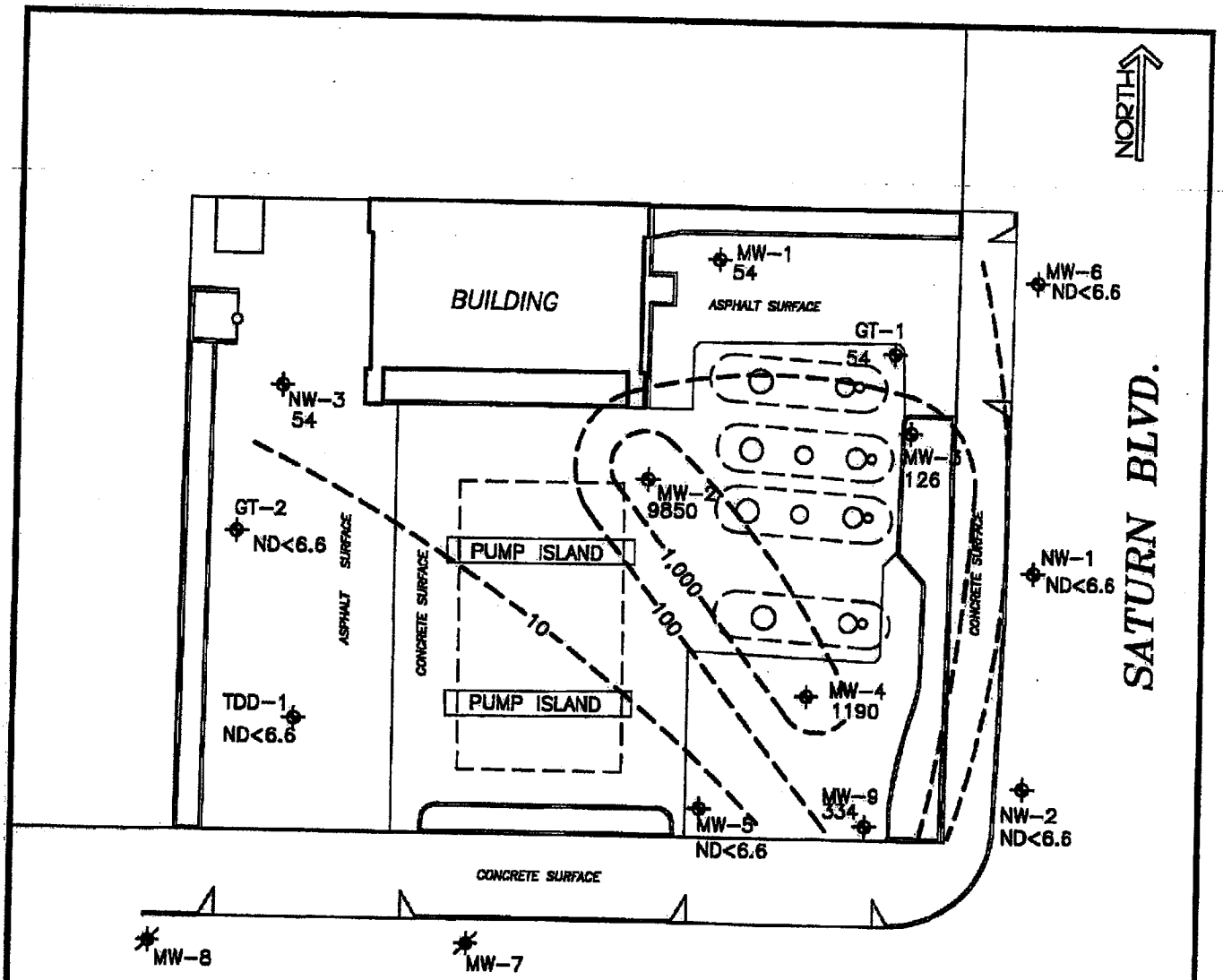
NOT TO SCALE

NORTH

DATE	SITE LOCATION MAP	FIGURE NO. 1
REVISED	THRIFTY OIL SERVICE STATION #099 1890 PALM AVE. SAN DIEGO, CA	
CAD FILE 07242LM		PROJECT NO. 07.242



WaynePerry	DATE DRAWN	GROUNDWATER ELEVATION CONTOUR MAP JUNE 14, 2010	FIGURE NO. 3
	REV. DATE	THRIFTY SERVICE STATION #099 1890 PALM AVE. & SATURN BLVD. SAN DIEGO, CA	
	CAD FILE 07242GW		PROJECT NO. 07.242

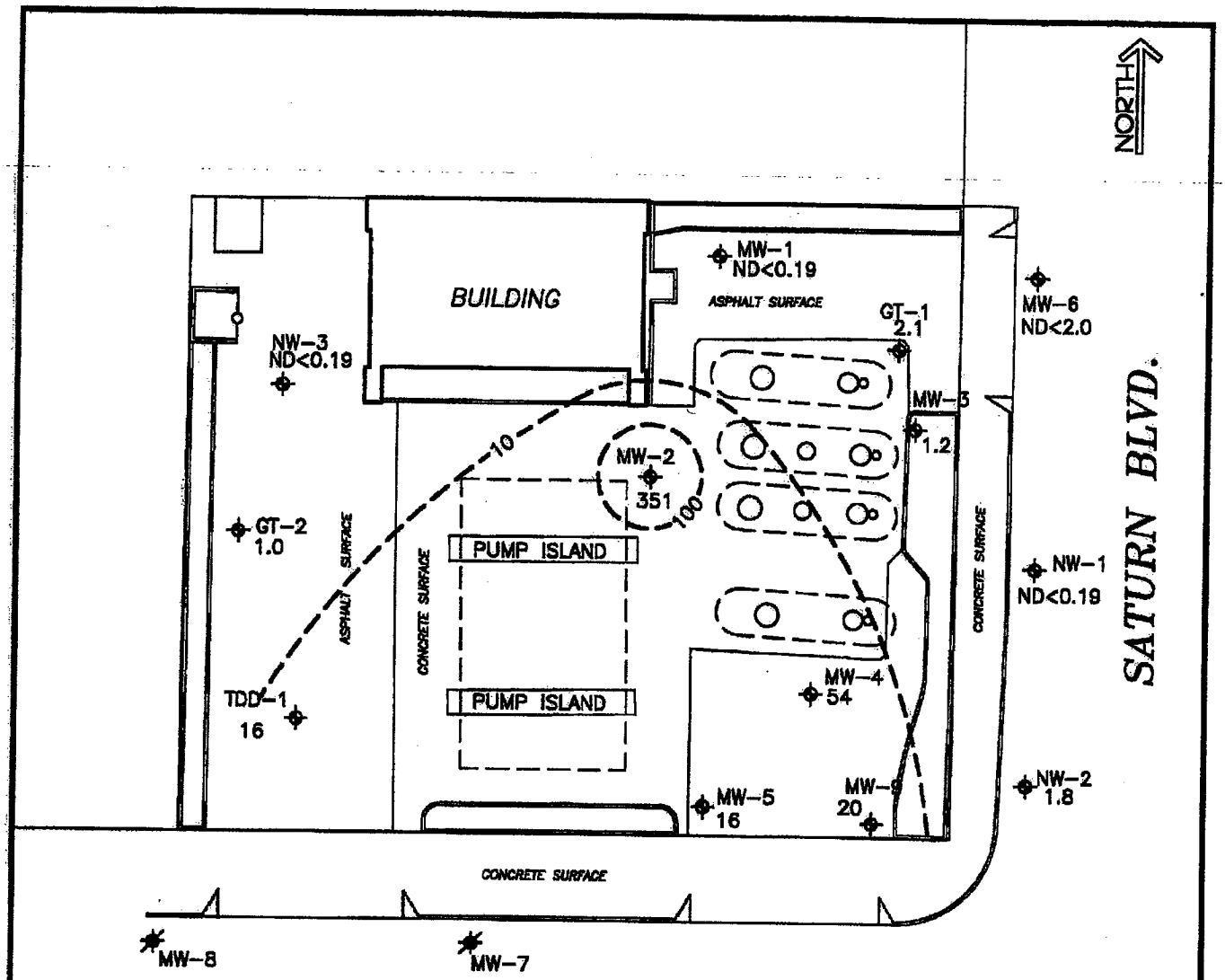


LEGEND

- GROUNDWATER MONITORING WELL SHOWING TPH-G CONCENTRATION IN ug/L
- ABANDONED GROUNDWATER MONITORING WELL
- LINE OF EQUAL TPH-G CONCENTRATION

0 30 FEET
SCALE

Wayne Perry	DATE DRAWN	TPH-G ISOCONCENTRATION MAP JUNE 14 & 15, 2010	FIGURE NO. 4
	REV. DATE	THRIFTY SERVICE STATION #099 1890 PALM AVE. & SATURN BLVD. SAN DIEGO, CA	
	CAD FILE 07242TPH		PROJECT NO. 07.242

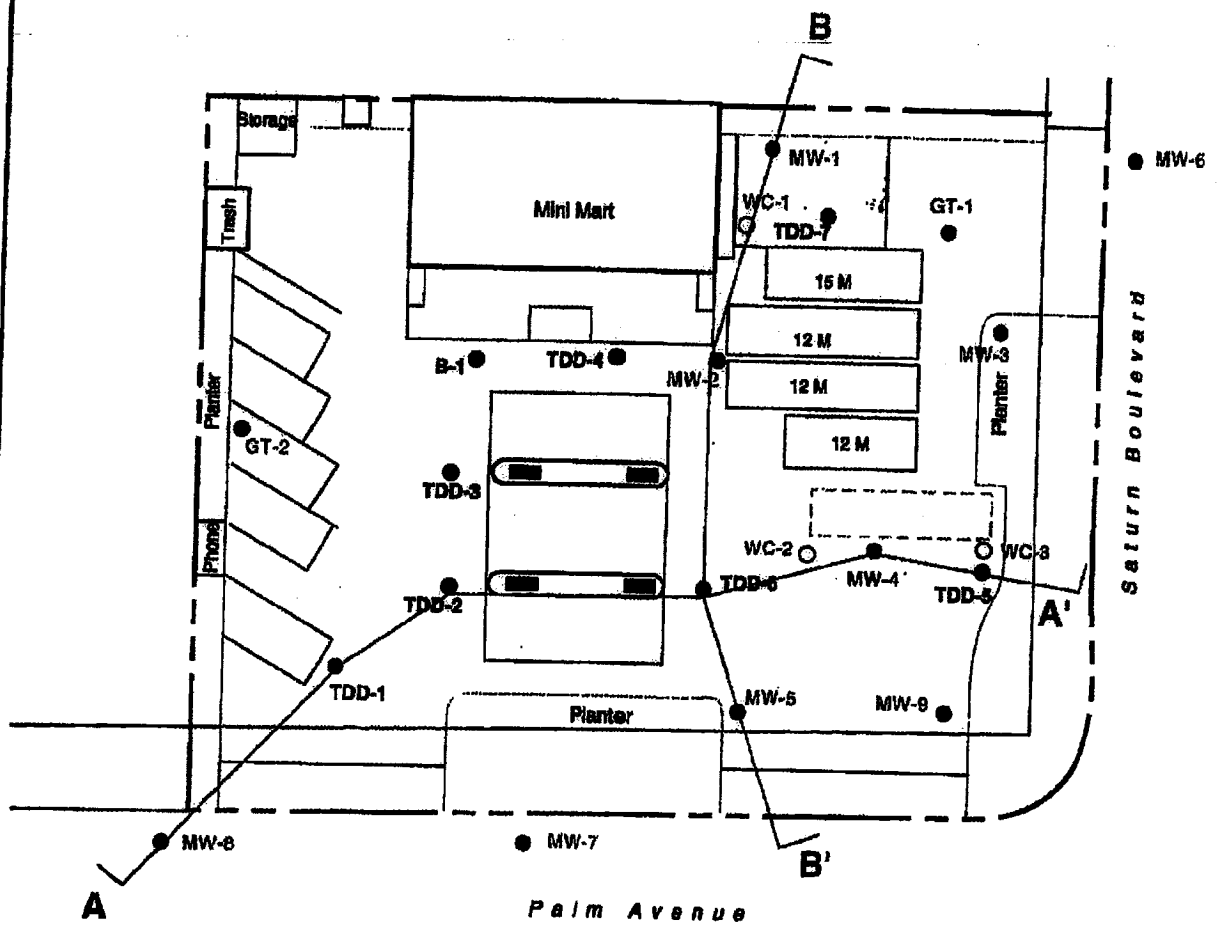


LEGEND

- GROUNDWATER MONITORING WELL SHOWING MTBE CONCENTRATION IN ug/L
- ABANDONED GROUNDWATER MONITORING WELL
- LINE OF EQUAL MTBE CONCENTRATION

0 30 FEET
SCALE

Wayne Perry	DATE DRAWN	MTBE ISOCONCENTRATION MAP JUNE 14 & 15, 2010	FIGURE NO. 6
	REV. DATE	THRIFTY SERVICE STATION #099 1890 PALM AVE. & SATURN BLVD. SAN DIEGO, CA	PROJECT NO. 07.242
	CAD FILE 07242MTB		



EXPLANATION

- MW-5 ● Monitoring Well Location
- TDD-5 ● Former Borehole Location
- Existing UST Location
- Former UST Location
- Dispenser Location
- WC-1 ○ Abandoned Monitoring Wells
- A — A' Geologic Cross-Section Line

N

0 30 Feet

Approximate

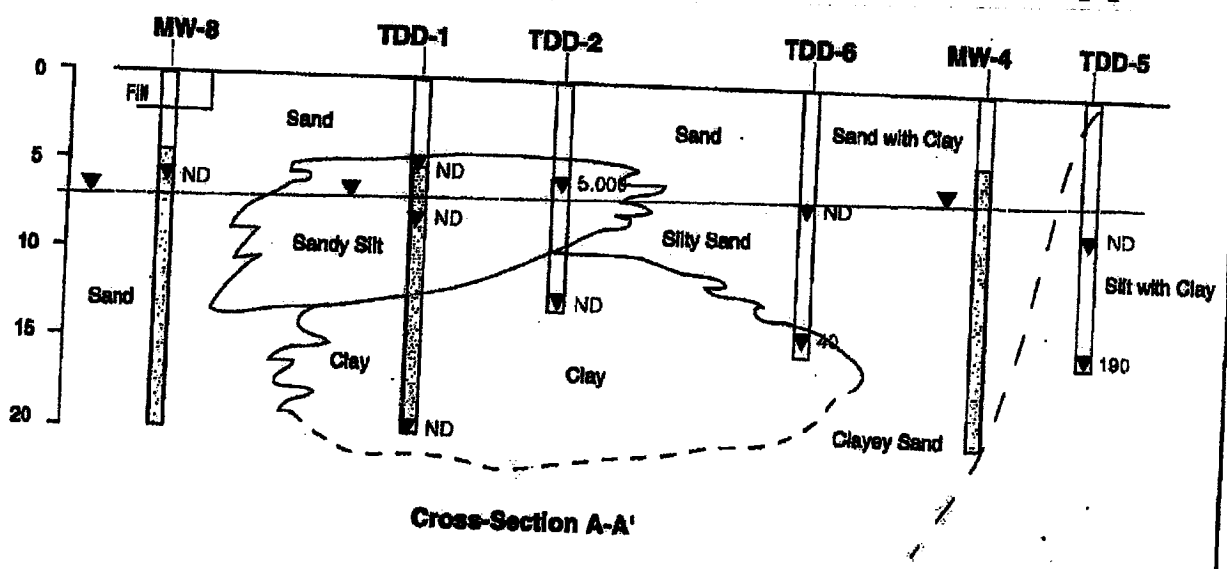
Thrifty - San Diego #099

Site Plan
1890 Palm Avenue

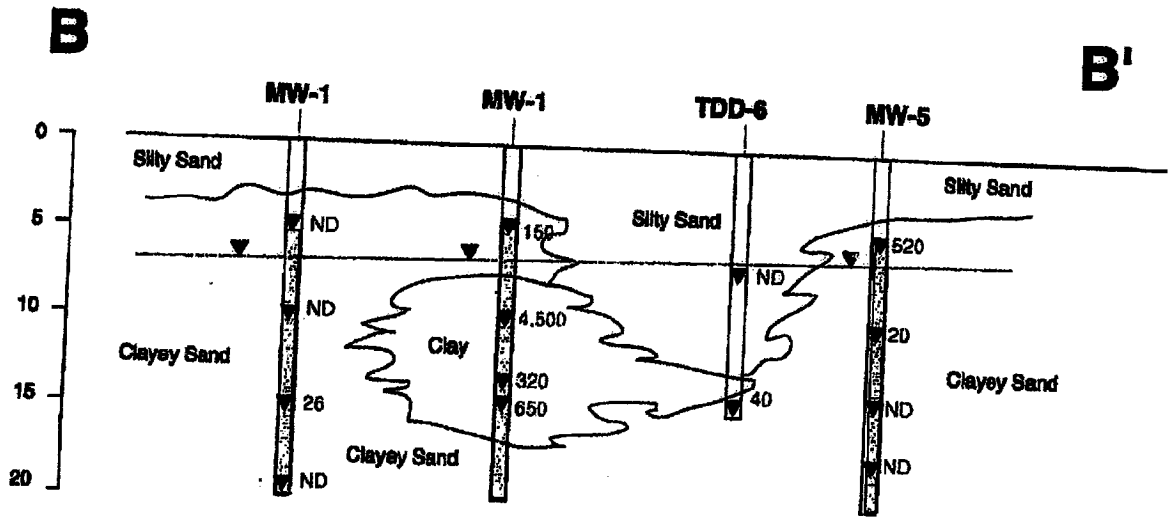
Figure 2
Project No. 7841

7841-04 080200MCS/mcg

LFR LEVINE•FRICKE



Cross-Section A-A'



Cross-Section B-B'

EXPLANATION

TDD-2 Soil Boring

MW-1 Monitoring Well

ND Below Detection Limit

▼ Soil Sampling Location, TPH in mg/kg

▼ Groundwater Level

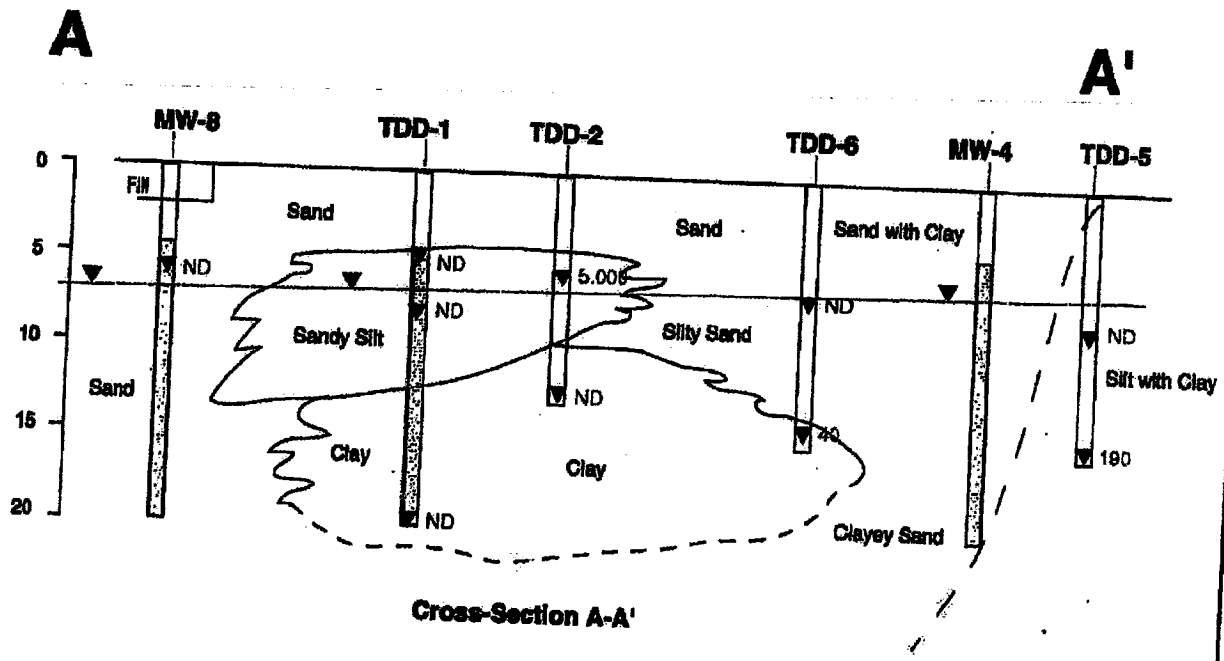
Thrifty - San Diego #099

Geologic Cross-Section
1890 Palm Avenue

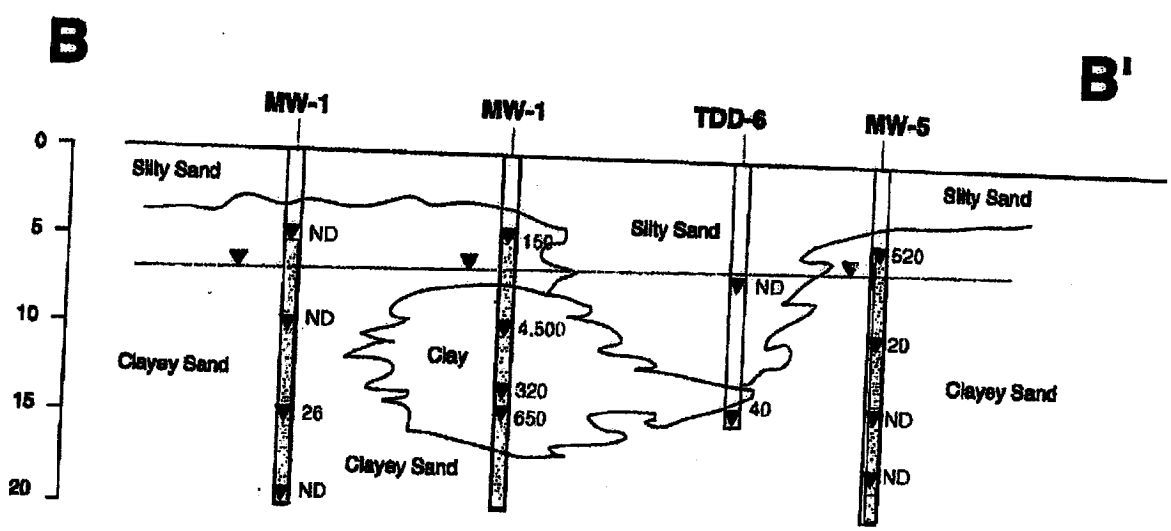
Figure 7
Project No. 7841

7841-05 082200 MCS/meg

LFR LEVINE • FRICKE



Cross-Section A-A'



Cross-Section B-B'

EXPLANATION

TDD-2 Soil Boring

MW-1 Monitoring Well

ND Below Detection Limit

▼ Soil Sampling Location, TPH in mg/kg

▼ Groundwater Level

Thrifty - San Diego #099

Geologic Cross-Section
1890 Palm Avenue

Figure 7
Project No. 7841

7841-08 080200MCS/meg

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