

NOTICE: The geotechnical report is included herein for informational purposes only. This report was not prepared for purposes of bid development. It was produced to assist the design engineer regarding overall project feasibility and to make recommendations regarding some design parameters. Contractors are encouraged to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer.



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October 6, 2014

Riverside County Flood Control
and Water Conservation District
1995 Market Street
Riverside, California 92501
Attention: Mr. Mekbib Degaga

Job No. 14311-3

Dear Mr. Degaga:

This letter transmits six copies of our updated Geotechnical Investigation report prepared for the proposed Romoland MDP Line A, Stage 4 project located in Riverside County, California.

We appreciate this opportunity to provide geotechnical services for this project. If you have questions or comments concerning this report, please contact this firm at your convenience.

Respectfully submitted,

CHJ CONSULTANTS

Maihan Noorzay, P.E.

Project Engineer

MN:lb

Distribution: Riverside County Flood Control and Water Conservation District (6)



**UPDATED GEOTECHNICAL INVESTIGATION
ROMOLAND MDP LINE A, STAGE 4
RIVERSIDE COUNTY, CALIFORNIA
PREPARED FOR
RIVERSIDE COUNTY FLOOD CONTROL
AND WATER CONSERVATION DISTRICT
PROJECT NO. 4-0-00310-04
JOB NO. 14311-3**



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and Water Conservation District
1995 Market Street
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Attention: Mr. Mekbib Degaga

Job No. 14311-3

Dear Mr. Degaga:

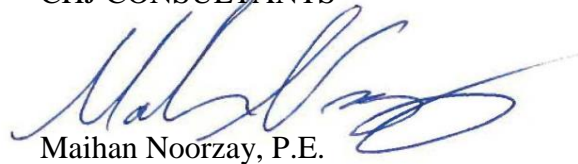
Attached herewith is an updated geotechnical investigation report prepared for the proposed Romoland MDP Line A, Stage 4 project located in Riverside County, California. Per your request, this report incorporates recommendations provided in the report titled "Geotechnical Investigation Homeland/Romoland ADP Phase 1, Romoland Area", prepared by C.H.J., Incorporated, dated April 27, 2004.

This report was based upon a scope of services generally outlined in our proposal letter dated April 9, 2014, and other written and verbal communications.

We appreciate this opportunity to provide geotechnical services for this project. If you have questions or comments concerning this report, please contact this firm at your convenience.

Respectfully submitted,

CHJ CONSULTANTS



Maihan Noorzay, P.E.
Project Engineer

MN:lb



TABLE OF CONTENTS

	<u>PAGE</u>
INTRODUCTION	1
SCOPE OF SERVICES	2
PROJECT CONSIDERATIONS	3
SITE DESCRIPTION	3
FIELD INVESTIGATION	4
Current Exploration	4
Prior Exploration	5
Seismic Refraction Survey	6
LABORATORY INVESTIGATION	6
GEOLOGY AND SUBSURFACE SOIL CONDITIONS	7
Reach 2	7
Reach 3	8
FAULTING AND SEISMIC SHAKING	9
SEISMIC DESIGN CONSIDERATIONS	9
GROUNDWATER	10
PERCOLATION TESTING	13
EXCAVATION POTENTIAL OF BEDROCK	14
FLOODING AND EROSION	16
CONCLUSIONS.....	17
RECOMMENDATIONS	19
General	19
Initial Site Preparation	19
Preparation of Fill Areas	20
Preparation of Structural Areas	20
Compacted Fills and Backfills	20
Foundation Design	22
Lateral Loading	24
Preliminary Shoring Recommendations.....	27
Trench Excavation.....	31
Pipe Zone and Bedding	31
Expansive Soils	32
Corrosivity Testing.....	33
Existing Pavement Thickness.....	34
Soil Erosion	34
Construction Observation.....	34
LIMITATIONS.....	35
CLOSURE	36
REFERENCES	37
AERIAL PHOTOGRAPHS EXAMINED	39



TABLE OF APPENDICES

ENCLOSURE

APPENDIX "A" - GEOTECHNICAL MAPS

Index Map.....	"A-1"
Plat.....	"A-2"

APPENDIX "B" - EXPLORATORY LOGS—CURRENT INVESTIGATION

Key to Logs	"B" (1 of 2)
Soil Classification Chart.....	"B" (2 of 2)
Exploratory Borings	"B-1"-"B-11"

APPENDIX "B-1" - EXPLORATORY LOGS—PREVIOUS INVESTIGATION

Exploratory Borings	"B-12"-"B-50"
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APPENDIX "C" - LABORATORY TESTING—CURRENT INVESTIGATION

Particle Size Distribution.....	"C-1"
Compaction Curves	"C-2"
Direct Shear Tests	"C-3"
R-Value Test.....	"C-4"-"C-7"
Chemical/Corrosivity Test Results.....	"C-8"

APPENDIX "C-1" - LABORATORY TESTING—PREVIOUS INVESTIGATION

Test Data Summary Sheets.....	"C-1"-"C-2"
Gradations Curves	"C-4"-"C-6"
Direct Shear Test	"C-9"-"C-11"
Consolidation Test.....	"C-12"
Chemical/Corrosivity Test Results.....	"C-13"-"C-14"

APPENDIX "D" - PERCOLATION TEST DATA

APPENDIX "E" - GEOPHYSICAL SEISMIC SURVEY



UPDATED GEOTECHNICAL INVESTIGATION
ROMOLAND MDP LINE A, STAGE 4
RIVERSIDE COUNTY, CALIFORNIA
PREPARED FOR
RIVERSIDE COUNTY FLOOD CONTROL
AND WATER CONSERVATION DISTRICT
PROJECT NO. 4-0-00310-04
CHJ CONSULTANTS JOB NO. 14311-3

INTRODUCTION

During March and April of 2004, C.H.J., Incorporated performed a geotechnical investigation for the proposed Homeland/Romoland ADP, Phase 1 project, located within the Romoland area of Riverside County, California. The purposes of the previous investigation were to explore and evaluate the subsurface soil conditions at the subject site and to provide appropriate geotechnical recommendations for design and construction of the proposed structures and storm drain improvements.

During June through August of 2014, representatives of CHJ Consultants performed an additional geotechnical investigation for the proposed Romoland MDP Line A, Stage 4, within Riverside County, California. The area of the current study pertains to Reach 2 (Romoland MDP Line A, Line A-2 and Line A-3) and Reach 3 (Homeland MDP Line 1). The purpose of this investigation was to update the April 2004 report with the following:

1. Determination of soil properties and design parameters at the intersection of State Highway 74 and Briggs Road, and two alignment crossings of BNSF railroad tracks (Line A-3 and Line A, Stage 4) at Matthews/Case Road and near McLaughlin Road. Per the client's request, we did not perform planned soil borings at the intersection of State Highway 74 and Palomar Road.
2. Measurement of infiltration capacity at the Briggs Road basin. Per the client's request we did not perform percolation testing at the Juniper Flats basin.
3. Extent, depth and rippability of bedrock along Watson Road from approximately Charina Lane and Pierson Road to the Juniper Flats basin.

The approximate location of the alignments is shown on the attached Index Map (Enclosure "A-1"). For the purpose of this report, the alignments have been divided into three main parts as follows:



Reach 1 includes the proposed storm drain alignment from the San Jacinto River to Interstate 215 and is not a part of this study. Reach 2 (Lines A, A-2 and A-3) and the Briggs Road detention basin include the proposed storm drain alignment from Interstate 215 to the Briggs Road detention basin. Reach 3 and the Juniper Flats Road detention basin include the proposed storm drain alignment from the Briggs Road detention basin to the Juniper Flats Road detention basin.

The results of our investigation, together with our conclusions and recommendations, are presented in this report.

SCOPE OF SERVICES

The scope of services provided during this geotechnical investigation included the following:

- Description of the project site and overall feasibility
- Boring logs including soil types and excavation characteristics
- Existing pavement thickness and existing subgrade R-values for boring locations
- Suitability of on-site materials for backfill, including soil density and sand equivalent values
- Description of groundwater, site and subsurface conditions
- Corrosivity testing of the soil
- Rippability and recommendations for trenching, temporary excavations and shoring
- Allowable bearing and lateral earth pressures
- Soil unit weight in the compacted backfill prism and dimensionless product of the Rankine ratio and sidewall friction coefficient for use in the Marston-Spangler method of pipe design
- Percentages of sand, very fine sand, silt and clay for use in determining the soil erodibility factor
- Infiltration rates based on the Porchet method of converting the percolation rate at a depth of 5 feet below the proposed final grade of the detention basin (Briggs Road basin only)



- Clarification of the separation between the bottom of the detention basin and the historic high groundwater level
- Measurement of the extent/depth and rippability characteristics of bedrock along the Watson Road portion of Reach 3, with recommendations for excavation equipment

PROJECT CONSIDERATIONS

The project consists of approximately 41,000 lineal feet of underground storm drain located within the Caltrans right of way, the city of Perris, the city of Menifee and Riverside County. Information provided for the 2004 investigation indicated that the subject storm drain improvements will include construction of both unlined and concrete-lined trapezoidal channels, reinforced concrete pipe, reinforced concrete boxes, overcrossings and slab bridges.

Based on review of the plans provided, it appears that the Briggs Road basin will be constructed primarily by excavation, and only minor embankment is required. The anticipated depth of excavation for the basin is expected to be on the order of 20 to 25 feet below existing ground surface (bgs).

The excavation depths necessary for construction of the storm drain improvements are anticipated to vary between 10 and 20 feet bgs.

SITE DESCRIPTION

The proposed storm drain alignment is located in the Homeland and Romoland areas of Riverside County, the city of Menifee and the city of Perris.

Portions of the alignment cross the Caltrans right of way (State Highway 74) at Palomar Road and Briggs Road.



The majority of the alignment transverses open farmland. Within Reach 2 (Line A-3) and Reach 3, a portion of the alignment will be coincident with either dirt or paved roads. The Briggs Road basin is in an area of vacant field with Briggs Road along the west boundary. The west portion of Reach 2 parallels a Southern California Edison power transmission line to the south.

Previous work performed for this site included examination of aerial imagery for past land usage and potential geologic hazards. Evidence of shallow ponded water was visible in the aerial imagery along the eastern portion of the alignment. Several southwest-trending stream channels with evidence of recent flow were seen in the eastern portion of the proposed alignment and the vicinity of the proposed Juniper Flats Road detention basin. Evidence of land clearing and borrow activity is visible in the 1974 to 2013 aerial photographs north of the proposed Juniper Flats Road Detention basin. No other significant features were visible in the aerial imagery examined as part of this investigation.

FIELD INVESTIGATION

CURRENT EXPLORATION:

During July and August of 2014, the soils conditions at two locations within Reach 2 and two locations within Reach 3 were explored by means of four geotechnical borings (Boring Nos. 1 through 4). In addition, four borings were drilled in the area of Briggs Road basin (Boring Nos. 5 through 8) and three borings were drilled in the area of Juniper Flats basin (Boring Nos. 9 through 11) for the purpose of infiltration testing. The borings were drilled with a CME 75, truck mounted drill rig equipped for soil sampling to a maximum depth of 66-1/2 feet below the existing ground surface. The approximate locations of the borings performed for this update report are shown on the attached Plat (Enclosure "A-2").

Continuous logs of the subsurface conditions, as encountered within the exploratory borings, were recorded at the time of drilling by a staff geologist from this firm. Both a standard penetration test (SPT) sampler (2-inch outer diameter and 1-3/8-inch inner diameter) and a modified California sampler (3-1/4-inch outer diameter and 2-3/8-inch inner diameter) were utilized in our current



investigation. Relatively undisturbed samples were obtained by driving the sampler ahead of the borings at selected levels. The penetration resistance was recorded on the boring logs as the number of hammer blows used to advance the sampler a total of 18 inches, in 6-inch increments (or less if noted). The samplers are driven with an automatic hammer that drops a 140-pound weight 30 inches for each blow. Both relatively undisturbed and bulk samples of typical soil types obtained were returned to the laboratory in sealed containers for testing and evaluation.

PRIOR EXPLORATION:

Previous work in the project area (including Reach 1) included 50 exploratory borings drilled to a maximum depth of 26-1/2 feet below the existing ground surface with a truck-mounted CME 55 drill rig equipped for soil sampling. The approximate locations of the previous exploratory borings are indicated on the attached Plat (Enclosure "A-2"). Reach 1 is not included within the scope of this investigation; therefore, the logs for Boring Nos. 1 through 12 are not included with this report.

The locations of the previous exploratory borings are described as follows. Exploratory Boring Nos. 13 through 34 and 47 through 52 were drilled along Reach 2 and within the proposed Briggs Road detention basin. Exploratory Boring No. 46 was not drilled due to conflicts with existing utilities. Reach 3 and the Juniper Flats Road detention basin were explored by Exploratory Boring Nos. 35 through 45.

Our current boring logs and the previous exploratory boring logs are presented in Appendix "B" and Appendix "B-1", respectively. The current blowcount data are raw numbers that do not include correction for hammer type (automatic vs. manual cathead) or sampler size (ring sampler vs. SPT sampler). The previous boring logs provide equivalent SPT-N₆₀ blowcounts that include correction for sampler size and an effective overburden pressure of 1 ton per square foot. The stratification lines presented on the boring logs represent approximate boundaries between soil types, which may include gradual transitions.



SEISMIC REFRACTION SURVEY:

A seismic survey was conducted by Terra Geosciences from approximately Station 83 to Station 115 along Watson Road. Terra Geosciences' report is included as Appendix "E". A discussion of the excavation potential of bedrock in this area is presented in a following section.

LABORATORY INVESTIGATION

Included in the previous laboratory testing program were field moisture content determinations on all samples returned to the laboratory and field dry densities on all undisturbed ring samples. The results are included on the boring logs. Optimum moisture content - maximum dry density relationships were established for typical soil types to evaluate the relative compaction and recompaction characteristics of the subsoils. Direct shear tests were performed on selected undisturbed and remolded soil samples in order to provide shear strength parameters for frictional resistance, bearing capacity and lateral earth pressure evaluations. Sieve analysis, sand equivalent and Atterberg limit tests were performed for classification purposes. Expansion index testing was also performed to evaluate the expansive characteristics of the soils. A selected sample of material was delivered to M. J. Schiff and Associates, Inc. for chemical/corrosivity testing as part of the prior investigation.

Laboratory testing performed for the current report update include field moisture content and field dry densities, optimum moisture content – maximum density, consolidation, direct shear testing, R-value, sand equivalent and sieve analysis, including hydrometer analysis. Selected samples of material were delivered to HDR for preliminary corrosivity analysis.

The current and previous laboratory test results are presented in Appendix "C" and Appendix "C-1", respectively. Soil classifications are in accordance with the Unified Soil Classification System (USCS).



GEOLOGY AND SUBSURFACE SOIL CONDITIONS

The alignment is located on the Perris Block, a mass of relatively high land composed of crystalline bedrock of the Southern California Batholith that is thinly and discontinuously mantled by sedimentary material (Woodford and others, 1971). Geologic mapping by Morton (2003a, 2003b, 2003c) and Morton and Matti (2001) indicates that the alignment area is primarily underlain by older alluvial deposits. The area of Watson Road and the Juniper Flats basin includes alluvium overlying zones of variably weathered shallow bedrock. A discussion of subsurface conditions for specific areas of the alignment based on the current and prior explorations is presented in the following section.

REACH 2:

Geologic mapping shows Reach 2 and the Briggs Road detention basin underlain by older alluvium. Young axial valley deposits are mapped near the southeastern-most portion of the proposed Briggs Road detention basin.

As encountered within the exploratory borings, the soils along Reach 2 and the Briggs Road detention basin are composed primarily of silty sand with interbedded with lenses of sandy clay, silt and sand. The cohesive soils were encountered in very stiff states, and the cohesionless soils were in dense to very dense states. Exploratory Boring No. 32 of the previous investigation was drilled within an area of younger alluvium as indicated on regional geologic mapping (Morton, 2003c). The soils encountered at Boring No. 32 of the previous investigation were composed of silty sand in a loose state underlain by silty sand in a dense state at approximately 10 feet bgs.

Exploratory Boring Nos. 24, 25 and 47 of the previous investigation encountered fill to depths of 3, 2 and 4 feet bgs, respectively. Disturbed native soils were encountered at the surface in all other borings.



Granitic bedrock was encountered in the area of the Briggs Road basin in Boring No. 7 of the current investigation at a depth of 38 feet bgs. Refusal to the drilling augers did not occur within the depth of drilling.

Previous expansion index testing conducted on a selected sample of clay bearing soil along Reach 2 indicated that the soils tested exhibit a "medium" potential for expansion when tested in accordance with Uniform Building Code Standard Test Method 18-2.

REACH 3:

The southern and western portions of Reach 3 are shown as being underlain by older alluvium on regional geologic mapping. Various geologic units are mapped in the eastern portion of Reach 3, including young axial fan deposits, very old fan deposits and granitic bedrock (Morton and Matti, 2001). The Juniper Flats Road detention basin is underlain by young alluvial fan deposits and very old fan deposits.

Blowcount data from the exploratory borings conducted for Reach 3 and the proposed Juniper Flats detention basin indicate that alluvium, composed of loose silty sand and sand, extends to approximate depths ranging from 5 to 10 feet along the proposed alignment. Medium dense silty sand and sand generally underlies the alluvium.

The previous investigation indicated that granitic bedrock was encountered at an approximate depth of 15, 6 and 23 feet bgs in Exploratory Boring Nos. 39, 40 and 43, respectively. Granitic bedrock was encountered in the area of the Juniper Flat basin at depths between 10 and 15 feet bgs based on our current investigation. Refusal to further advancement of the augers due to bedrock did not occur within the depth of drilling.

In Exploratory Boring Nos. 36, 37 and 40 of the previous investigation fill to depths of 3, 4 and 5 feet bgs, respectively, was encountered. Disturbed native soils were encountered at the surface in all other borings.



The soils encountered in the exploratory borings conducted for Reach 3 and the Juniper Flats Road detention basin are generally granular and considered to be non-critically expansive.

A more detailed description of the subsurface soil conditions encountered in the current and previous exploratory borings is presented on the attached boring logs in Appendix "B" and Appendix "B-1", respectively.

FAULTING AND SEISMIC SHAKING

The alignment does not lie within or adjacent to an Alquist-Priolo Earthquake Fault Zone designated by the State of California to include traces of suspected active faulting. No evidence for active faulting on the site was observed during the geologic field reconnaissance or on the aerial photographs reviewed.

The San Jacinto fault zone is approximately 7-1/2 miles northeast of the site. The Elsinore fault zone is present approximately 10-1/2 miles southwest of the site. The San Andreas fault zone is located along the southwest margin of the San Bernardino Mountains, approximately 22 miles northeast of the site.

As for all areas of southern California, there is a potential for seismic shaking from the San Jacinto fault or other regional faults to occur during the lifetime of the alignment. Therefore, engineered structures such as retaining walls or embankments should be designed according to the applicable seismic design standards. The seismic design parameters for the alignment based on the 2013 California Building Code (CBC) are provided in the following section.

SEISMIC DESIGN CONSIDERATIONS

Based on the geologic setting of and subsurface data from the site, the geologic materials underlying the site can be classified as Site Class "C, dense soil or soft rock" and "D, stiff soil", according to the



2013 CBC. The Class "C" parameters are applicable to the portion of the alignment east of Station 99+00 at Watson Road.

Summary of Seismic Design Parameters		
Site Class	C	D
Mapped Spectral Acceleration Parameters	$S_s = 1.50$ and $S_1 = 0.60$	$S_s = 1.50$ and $S_1 = 0.60$
Site Coefficients	$F_a = 1.0$ and $F_v = 1.3$	$F_a = 1.0$ and $F_v = 1.5$
Adjusted Maximum Considered Earthquake Spectral Response Parameters	$S_{MS} = 1.50$ and $S_{M1} = 0.78$	$S_{MS} = 1.50$ and $S_{M1} = 0.90$
Design Spectral Acceleration Parameters	$S_{DS} = 1.00$ and $S_{D1} = 0.52$	$S_{DS} = 1.00$ and $S_{D1} = 0.60$

The geometric mean peak ground acceleration (PGA_M) for evaluation of settlement or liquefaction effects is 0.50g.

GROUNDWATER

Groundwater data from the California Department of Water Resources (DWR, 2014) and Western Municipal Water District (WMWD, 2014) were reviewed in order to estimate groundwater levels for the alignment area. The following table summarizes groundwater data for the alignment area. Well locations are shown on Enclosure "A-1".



Well No.	Measuring Point Elevation (feet amsl)	Depth to Groundwater (feet)	Date Measured	Location	Data Source
EMWD12759	1,493	50.6	10/13/2011	1/4 mile east of Menifee Road at State Highway 74	DWR 2014
		48.5	3/10/2014		
EMWD12761 05S03W13H001	1,522	80.5	3/13/1995	1/4 mile south of State Highway 74 at Briggs Road	DWR 2014 WMWD 2014
		70.8	10/12/2011		
		62.8	2/23/2012		
		67.1	10/28/2013		
		67.7	3/10/2014		
EMWD12757	1,527	69.7	10/12/2011	State Highway 74 at Briggs Road	DWR 2014
		65.9	3/10/2014		
05S03W11D001	1,467	134	5/5/1994	Mapes/Ball Road	WMWD 2014
05S03W9H002	1,418	52.5	10/29/2013	Near Watson Road and Interstate 215	WMWD 2014
		46.6	10/12/2005		
		98.1	9/1994		
05S03W11M002	1,451	98.2	10/9/2003	Southeast Watson Road/Antelope Road	
		128	12/23/1996		
05S03W11M003	1,453	96.5	10/30/2013	Southeast Watson Road/Antelope Road	
		97.5	4/30/2013		
05S03W11R	1,480	51.7	11/1/2000	Northwest of State Highway 74 and Menifee Road	
		55.6	3/16/1995		
05S03W13A001	1,524	64.3	10/28/2013	Southwest of State Highway 74 and Briggs Road	
		59.2	10/18/2012		
		61.3	2/14/2012		
		84.5	3/14/1995		
05S03W13C001	1,491	47.3	10/28/2013	Southwest of State Highway 74 and Menifee Road	
		46.9	3/19/2013		
		55.1	10/11/2004		



Well No.	Measuring Point Elevation (feet amsl)	Depth to Groundwater (feet)	Date Measured	Location	Data Source
05S03W14L001	--	72	6/5/1995	Southwest of Palomar Road and McLaughlin Road	DWR 2004
05S03W15A001	1,427	70	10/24/2013	Southwest of State Highway 74 and Antelope Road	WMWD 2014
		74	11/14/2012		
05S03W15C001	1,428	72.4	10/24/2013	Southwest of State Highway 74 and Sherman Road	
		73.4	11/14/2012		
05S03W15P002	--	32	10/2/1994	Near Helene Way and Sherman Road	DWR 2004
05S03W15Q001	--	32	5/22/1995	Near Helene Way and Dawson Road	
05S03W16K001	1,420	63	10/24/2013	West Interstate 215 and McLaughlin Road	WMWD 2014
		66.8	11/4/2012		
05S03W23C001	1,447	48.7	10/28/2013	Southeast of Antelope Road and Rouse Road	
		46.1	3/20/2013		
		47.3	10/26/2010		
		54.5	10/8/2004		

Groundwater was not encountered within the depths of borings drilled for the current or prior investigations of the alignment. Based on the groundwater data examined, it appears that groundwater occurs at depths greater than approximately 45 feet bgs in the majority of the alignment. The prior investigation stated the potential for shallower groundwater to occur along Reach 2 near Interstate 215 where water was measured at 32 feet bgs. Groundwater levels can be expected to vary based on precipitation conditions or groundwater pumping activities.

The depth to groundwater may be shallower in areas of shallow bedrock—generally along Watson Road east of Station 90+00. Perched groundwater may occur in this area; however, groundwater was not encountered in borings drilled to bedrock in the area of the Juniper Flats basin.



Liquefaction and other shallow groundwater hazards for a specific portion of the site can be evaluated upon request.

PERCOLATION TESTING

Percolation testing, in accordance with County of Riverside Department of Environmental Health procedure, was performed within Briggs Road Basin. Per the client's request, the percolation testing for the Juniper Flats basin was not performed.

For the Briggs Road basin, the percolation testing was performed for Exploratory Boring Nos. 5, 6 and 7 of the current investigation. At the time of our investigation, Exploratory Boring No. 8 was not tested due to the presence of standing water at the location of the boring. The field test data along with plots of infiltration rate versus total elapsed time are presented in Appendix "D". Infiltration rates, based on the Porchet method of converting the percolation rate, are included in the following table and do not include safety factors.

Test Location	Infiltration Rate	
	cm. / hr.	in. / hr.
5	1.1	0.4
6	5.7	2.2
7	1.9	0.8

It should be noted that infiltration rates determined by testing are ultimate rates based on short-duration field test results. The percolation test utilized clear water, and percolation rates can be affected by buildup of silt, debris, the degree of soil saturation and other factors. An appropriate safety factor should be applied to measured percolation rates prior to use in design to accommodate potential subsoil inconsistencies, possible compaction related to site grading and potential silting of the percolating soils. A safety factor should be determined with consideration to other factors in the storm water



retention system design, particularly storm water volume estimates, and the safety factors associated with those design components.

Based on review of the exploratory boring logs, it is anticipated that soils encountered up to 10 feet below the approximate bottom of basin elevation at the Briggs Road basin will consist of dense to very dense, fine to coarse silty sands (SM) and sands with silt (SP-SM). Within Exploratory Boring No. 7, granitic bedrock was encountered at a depth of approximately 38 feet below existing ground surface.

Groundwater was not encountered in the exploratory borings drilled within the Briggs Road basin. Based on groundwater data provided by California Department of Water Resources (DWR, 2014), it is anticipated that the historic high groundwater may be on the order of 60 feet below the existing ground surface within the location of the Briggs Road basin. It is our understanding that the bottom of basin would be on the order of 25 feet bgs. Therefore, it is the opinion of this firm that a minimum of 10 feet vertical separation from the bottom of the basin to the historic high groundwater table will be maintained.

EXCAVATION POTENTIAL OF BEDROCK

During our previous investigation, conducted in 2004, shallow bedrock was encountered along most of the Watson Road portion of Line 1. Shallow bedrock along the alignment can significantly increase the cost of construction if it cannot be excavated by conventional excavation equipment. The portion of Line 1 from Station 83 (Charina Lane) to Station 116 (Juniper Flats Road) was identified as the area to be investigated with respect to the excavation potential of the bedrock. This area includes shallow subsurface bedrock and bedrock outcrops. Rock outcrops are located west of Leon Road and northwest of Juniper Flat Road/Watson Road.

A seismic survey was conducted by Terra Geosciences (June 5, 2014). Terra Geosciences' report is included as Appendix "E". The seismic survey included a total of seventeen 24-channel seismic refraction lines utilizing 10-foot geophone spacing. Geophones were overlapped to allow



measurement of relatively continuous seismic refraction lines. Due to vehicle traffic on Leon Road, geophones and cables could not be placed there, and the survey was broken into two separate lines. The lines are designated Line S-1 (west of Leon Road) and S-2 (east of Leon Road).

Seismic refraction surveys measure the compressional (p-wave) velocities and depths of the subsurface materials. The seismic velocity can be utilized to estimate the rippability and trenchability of subsurface materials. A chart included in the Caterpillar Performance Handbook correlates seismic velocity of different rock types to rippability by various bulldozer models. Published data are not available for the trenchability of bedrock. Based upon our experience with bedrock in the Inland Empire, a Cat 235/Cat 349 excavator or equivalent can trench bedrock with a seismic velocity of up to approximately 4,300 feet per second (fps). Smaller, rubber-tire-mounted equipment encounters refusal at slower seismic velocities (approximately 3,300 fps). It should be noted that these estimated refusal velocities depend on numerous factors, including the bucket size and shape, the condition of the equipment, the skill and experience of the operator and the structure in the rock material.

A summary of the p-wave velocity profile determined by the survey, along with the stationing and approximate proposed pipeline invert, is included in Appendix "E". The models show the 4,000 fps contour as a dotted line. Four thousand fps is the approximate velocity at which excavation is expected to be difficult with a Cat 235/Cat 349 excavator. The pipeline invert models (2 sheets) are discussed below from west to east.

At Stations 91 and 93, the 4,000 fps contour is slightly deeper than the proposed invert. This area is expected to be generally excavatable by conventional equipment. In order to ensure efficient excavation, it may be prudent to utilize alternate excavation procedures, such as pre-splitting or blasting, since these methods are expected to be required farther east along the alignment.

Hard bedrock with a velocity up to approximately 9,000 fps is expected along the pipeline invert from approximately Station 99 to Station 105+50. This area is located both west and east of Leon Road. West of Leon Road, hard outcrops were observed. Alternate excavation methods,



particularly pre-splitting or blasting, are expected to be required for excavation in this area. The proposed invert is 10 to 15 feet deep and may be too deep for efficient chain trenching.

Near Stations 107 and 108, the 4,000 fps contour is slightly deeper than the proposed invert. This area is expected to be generally excavatable by conventional equipment. In order to ensure efficient excavation, it may be prudent to utilize alternate excavation procedures, such as pre-splitting or blasting, since these methods are expected to be required along other portions of the alignment.

Near Station 110, the proposed invert is expected to encounter bedrock with a velocity between 4,000 and 5,000 fps. Alternate excavation methods are expected to be required in this area.

A detailed discussion of the seismic refraction theory, methods and results are included in Appendix "E". It should be noted that depths and velocities computed by the seismic refraction method are subject to an error rate of up to 10 percent.

FLOODING AND EROSION

The majority of the alignment is included within a flood zone designated as "Zone A" by FEMA (2008). Zone A designates areas susceptible to a 100-year flood event. No evidence of recent significant flooding of the site was observed during the geologic field reconnaissance or on the aerial photographs reviewed. Evidence of ponded water and shallow stream channel deposits along the proposed alignment and the proposed basins was visible on the aerial photographs reviewed.

The upper soils encountered within the site are moderately susceptible to erosion by wind and water. Water should not be allowed to flow over any graded or natural areas in such a way as to cause erosion.

Sieve analysis including hydrometer testing was performed on select samples for determination of percentages of sand, very fine sand, silt and clay for use in determining the soil erodibility factor. The results of the sieve analysis testing performed for the current investigation are included in



Appendix "C". Additional information regarding the soil erodibility factor is provided in a later section of this report.

CONCLUSIONS

On the basis of our field and laboratory investigations, including a review of the previous report, it is the opinion of this firm that the proposed storm drain improvements are feasible from a geotechnical standpoint, provided the recommendations contained in this report are implemented during design and construction.

Based on review of the exploratory boring logs, the majority of the soils encountered within the upper 15 feet of the alignment within Reach 2 are classified as silty sand with interbedded lenses of sandy clay, silt and sand. Within Reach 3, the majority of the soils encountered within the upper 15 feet of the alignment were classified as silty sand and sand. These soils should provide suitable backfill material for both reinforced concrete pipe (RCP) and the reinforced concrete box (RCB), provided that they are free of organic or other deleterious material and that appropriate measures are taken to account for soil corrosivity as described in a later section of this report. The soils should be moisture treated to near optimum moisture content outside of the excavation to prevent potentially porous clods and air voids from being incorporated into the fill. In addition, mixture and moisture treatment of backfill material outside of the excavation prior to lift placement in the trench or excavation may help to prevent wet "pumping" conditions during backfill operations.

Should wet conditions develop in the excavations, additional removal and recompaction or stabilization of the subgrade soils may be required to provide firm and unyielding structural support.

The materials encountered during our current investigation were generally fine silty sands, sandy silts, and clays with relatively low sand equivalent test results and generally would not be suitable for use as pipe bedding. Jetting to compact imported pipe bedding is also not recommended with the fine-grained, silty, clayey native soils because of the relatively impermeable excavation wall material.



Because mechanical compaction may not be effective within the pipe zone, consideration could be given to utilizing lean sand/cement slurry as an alternative.

Though some of the soils encountered in our exploratory borings may be classified as Type "A" or Type "B", they are typically interbedded with Type "C" soils. Therefore, the soils along the alignment generally should be considered as a Type "C" soil in accordance with the CAL/OSHA excavation standards.

The conditions experienced during the drilling operations and our exploratory boring data both indicate that, in general, for most of the project alignment, construction difficulties associated with trench excavation are not expected. However, based on the results of the seismic refraction survey conducted along a portion of Line 1 (Watson Road from Charina Lane to Juniper Flats Road), significant quantities of non-trenchable bedrock will be encountered at and above the proposed pipe invert. In particular, bedrock at invert elevation from Stations 99 to 105+50 is expected to be non-trenchable with conventional large excavators (Cat 235/Cat 349). Alternate means of excavation, such as splitting and/or blasting, are expected to be needed in this area. In addition, a few localized areas of slow production may be encountered where the proposed invert is slightly above or below the 4,000 fps rock velocity contour (Stations 91, 93, 107 and 108).

Based upon the previous field investigation and test data, it is our opinion that the materials and conditions of the native soils encountered below approximately 10 feet will provide adequate support for the proposed storm drain improvements. Previous density testing and equivalent SPT-N₆₀ data indicate that both the younger alluvial and older native alluvial soils and weathered granitic bedrock materials are in place in dense to very dense states at the depths indicated for the bottom of the proposed structures.

The previous study indicated that clayey soils with a "medium" expansion potential were present within Reach 2. As such, the proposed improvements in this area should be designed to accommodate the effects of expansive soils.



The field investigation and data examined for the current report generally confirm the conditions encountered previously.

Results of chemical/corrosivity testing are presented in the "Corrosivity Testing" section of this report.

RECOMMENDATIONS

GENERAL:

The project flood control improvements are to be designed and constructed according to Riverside County Flood Control specifications and standard drawings or other standards specified by Riverside County Flood Control.

It is imperative that no excavation, backfilling or other grading operations be performed without the presence of a representative of the geotechnical engineer. An on-site, pre-job meeting with the owner, Riverside County Flood Control and Water Conservation District, the contractor and the geotechnical engineer should occur prior to all grading/excavation-related operations. Operations undertaken at the site without the geotechnical engineer present may result in exclusions of affected areas from the final compaction report for the project.

Construction of the subject improvements should be performed, at a minimum, in accordance with these recommendations, Riverside County Flood Control specifications, and standard drawings, as well as with applicable specifications or requirements of the various utilities involved. The following recommendations are presented for your assistance in establishing proper geotechnical criteria.

INITIAL SITE PREPARATION:

All areas of construction should be stripped of significant vegetation and other deleterious materials. These materials should be removed from the site for disposal. Any conflicting existing utility lines should be traced, removed and rerouted from the project area.



Any existing undocumented fills encountered during construction should be completely removed and cleaned of significant deleterious materials; they may then be reused as compacted fill. The engineering geologist should observe and approve the bottom of all excavations prior to scarification or placement of fill.

Cavities created by removal of subsurface obstructions such as structures, individual effluent disposal systems and utilities should be thoroughly cleaned of loose soil, organic matter and other deleterious materials, shaped to provide access for construction equipment, and backfilled as recommended for compacted fill or filled with slurry.

PREPARATION OF FILL AREAS:

Prior to placing fill, and after the engineering geologist has observed and approved the bottoms, the surfaces of all areas to receive fill should be scarified to a depth of 6 inches or more. The scarified soils should be brought to near optimum moisture content and recompacted to a minimum relative compaction of 90 percent in accordance with ASTM D1557.

PREPARATION OF STRUCTURAL AREAS:

Structural elements, such as RCBs or overcrossing foundation systems, should rest upon at least 12 inches of properly compacted soil or approved original ground soils. Unsuitable foundation soil conditions may be encountered along the alignment or may develop upon wetting.

Based on our investigation, deeper removals, up to 3 feet, and replacement with a lean slurry sand/cement slurry or crushed rock and geotextile may be recommended if necessary for bottom stabilization. These removals will not require additional lateral overexcavation.

COMPACTED FILLS AND BACKFILLS:

The on-site soils should provide adequate quality backfill material provided they are free from organic matter and other deleterious materials. Unless approved by the geotechnical engineer, rock or similar irreducible material with a maximum dimension greater than 3 inches should not be buried or placed in backfills. Silts and clays, if encountered, may be difficult to recompact. The results of



in situ density testing performed on undisturbed samples obtained from the site investigation are presented in our boring logs in Appendix "B" and Appendix "B-1". Sand equivalent test results are included in Appendix "C" and Appendix "C-1". It is anticipated that the unit weight of the compacted soils will be on the order of 130 to 145 pounds per cubic foot. The sand equivalent tests indicated a range of values from 9 to 31.

If utilized, import fill should be inorganic, non-expansive, granular soil free from rocks or lumps greater than 3 inches in maximum dimension. Sources for import fill should be observed and approved by the geotechnical engineer prior to their use. The contractor should verify, by testing, that the import material has no environmental issues. Import fill should be sampled by the geotechnical engineer at the source prior to importation to the site. The proposed import fill should be tested and approved by the geotechnical engineer relative to expansion potential, sulfate content and corrosion potential. The contractor should obtain environmental certification that the proposed import is acceptable in accordance with the State of California Department of Toxic Substance Control standards.

Fill to be compacted by heavy equipment should be spread in near-horizontal layers, approximately 8 inches in thickness. For fill to be compacted by hand-operated equipment, thinner lifts not more than 6 inches in thickness should be utilized. Each lift shall be spread evenly, brought to near optimum moisture content and compacted to a minimum relative compaction of 90 percent in accordance with ASTM D1557.

To help avoid pumping and overly wet conditions of trench backfills, backfill material should be mixed and moisture treated outside of the excavation prior to lift placement in the trench.

Finish grades and soils required to be compacted to at least 95 percent relative compaction such as street subgrade should be moisture treated to near optimum moisture content not exceeding 2 percent above (ASTM D1557).



A lean sand/cement slurry may be utilized to fill cavities, such as void areas created by caving or undermining of soils beneath existing improvements or pavement to remain, or any other areas that would be difficult to properly backfill and test.

FOUNDATION DESIGN:

Although no building structures are proposed, other structures such as RCBs and overcrossing foundation systems may be safely founded on conventional spread foundations, either individual spread footings and/or continuous wall footings, bearing entirely on a minimum of 12 inches of compacted soil or entirely upon approved original ground soils. The engineering geologist should observe and approve the bottom of all excavations, either prior to the foundation being placed on original ground soils or prior to scarification or placement of fill.

Foundations should be a minimum of 12 inches wide and should be established at a minimum depth of 12 inches below lowest adjacent final subgrade level. For the minimum width and depth, the following tables provide allowable bearing capacities for Reach 2 and 3. These allowable bearing values utilized a factor of safety of 3 and may be increased by one-third for wind or seismic loading.

[INTENTIONAL BLANK]



Allowable Bearing Capacity: Reach 2				
Location/Area	Allowable Bearing Capacity (psf)	Increase Allowed (psf) for Additional Foot of:		Maximum Allowable Bearing Capacity (psf)
		Width	Depth	
LINE A				
At Trumble Road*	3,250	250	500	4,000
At Sherman Road*	3,250	500	900	4,250
At Dawson Road*	3,250	500	900	4,250
Matthews Road Near McLaughlin Road	3,300	500	1,000	4,500
At McKinley Road*	3,300	500	1,000	4,500
LINE A-2				
McLaughlin Road to Palomar*	3,500	500	1,000	4,500
LINE A-3				
At Matthews Road and Palomar	3,300	500	1,000	4,500
At Menifee Road*	2,750	500	1,000	4,250
At Malaga Road*	2,750	500	1,000	4,250

*From previous report



Allowable Bearing Capacity: Reach 3				
Location/Area	Allowable Bearing Capacity (psf)	Increase Allowed for Additional Foot of: (psf)		Maximum Allowable Bearing Capacity (psf)
		Width	Depth	
From Mclaughlin Road to State Highway 74*	2,500	500	1,000	3,500
Briggs Road and State Highway 74 ⁺	2,500	500	1,000	4,000
At Emperor Road*	1,600	500	1,000	2,500
At Sultanas Road*	1,600	500	1,000	2,500
At Pierson Road*	1,600	500	1,000	2,500

* From previous report
+ Caltrans Right-of-Way

LATERAL LOADING:

For preliminary design purposes, the ultimate lateral active and at-rest earth pressure, passive earth pressure, and base friction given in the following tables may be utilized for a particular structure or area utilizing native on-site soils.



Lateral Loading Criteria: Reach 2				
Location	Active (psf)	At-Rest (psf)	Passive (psf)	Base Friction
LINE A				
At Trumble Road*	35	80	375	0.30
At Sherman Road*	35	80	425	0.40
At Dawson Road*	35	80	425	0.40
Matthews Road Near McLaughlin Road	35	65	425	0.40
At McKinley Road*	30	65	425	0.40
LINE A-2				
McLaughlin Road to Palomar*	30	65	425	0.40
LINE A-3				
At Matthews Road and Palomar	35	65	425	0.40
At Menifee Road*	30	65	425	0.40
At Malaga Road*	30	65	425	0.40

*From previous report

Lateral Loading Criteria: Reach 3				
Location	Active (psf)	At-Rest (psf)	Passive (psf)	Base Friction
From Mclaughlin Road to State Highway 74*	30	65	400	0.40
Briggs Road and State Highway 74 ⁺	45	65	330	0.34
At Emperor Road*	35	65	400	0.40
At Sultanas Road*	35	65	400	0.40
At Pierson Road*	35	65	400	0.40

* From previous report

+ Caltrans Right-of-Way

If appropriate, base friction and passive earth pressure may be combined without reduction.



Imported Soils

The values presented in this section are for a granular imported soil with a minimum angle of internal friction of at least 34 degrees and no cohesion and an assumed unit weight of 125 pounds per cubic foot (pcf). Soils with differing friction angle/cohesion combinations may be considered at the time that the import source is known.

Lateral Loading Criteria: Import Soil				
Location	Active (psf)	At-Rest (psf)	Passive (psf)	Base Friction
Imported Soil	40	65	425	0.40

These values provided for lateral loading should be verified prior to construction when the backfill materials and conditions have been determined.

A minimum rectangular pressure distribution of 125 psf should be applied over the whole depth of the trench to account for any traffic surcharge. Other surcharges may be treated as additional trench height by assuming one additional foot of height for each 125 psf of areal surcharge.

A frictional resistance coefficient of 0.35 may be assumed for thrust blocks and concrete-coated piping.

The buoyant unit weight of soil to resist uplift would generally vary between approximately 60 and 70 pcf depending upon the actual materials and conditions.

Foundation concrete should be placed in neat excavations with vertical sides, or the concrete should be formed and the excavations properly backfilled as recommended for site fill.



PRELIMINARY SHORING RECOMMENDATIONS:

General

We anticipate that temporary shoring may be required during excavation for the proposed storm drain improvements. The following recommendations are preliminary and may require revision for final design. The contractor should be responsible for final shoring design and for providing adequate excavation support.

Lateral Pressures

For design of cantilevered shoring, a triangular distribution of lateral earth pressure may be used. It may be assumed that the retained soils with a level surface behind the cantilevered shoring will exert a lateral pressure equal to that developed by a fluid with a density of 45 pcf.

For the design of tie-back or braced shoring, we recommend the use of a rectangular distributed apparent earth pressure with the maximum equal to $28H$ in pounds per square foot, where H is the height of the shoring in feet. The design engineer should refer to FHWA-IF-99-015 or the latest Caltrans "Trenching and Shoring Manual" for the recommended apparent earth pressure diagram.

The upper 10 feet of shoring adjacent to streets or other vehicular traffic areas should be designed to resist a uniform construction surcharge load of 75 psf or an alternative traffic surcharge load of 125 psf, in addition to the recommended earth pressures. If traffic is kept back at least 10 feet from the shoring, the traffic surcharge may be disregarded.

Shoring adjacent to existing buildings should be designed to support the lateral surcharge pressure from existing building foundations, or the foundations should be underpinned.

Design of Soldier Piles

For the design of soldier piles spaced a minimum of two diameters on center, the *ultimate* lateral bearing value (passive value) of the soils below the level of excavation may be assumed to be 300 psf per foot of depth below the excavated surface, up to a maximum of 3,000 psf. A factor of safety of 2 could be utilized to obtain the *allowable* value. To develop the full lateral value, provisions



should be taken to assure firm contact between the soldier piles and the undisturbed soils. The concrete placed in the soldier pile excavations may be a lean-mix concrete. However, the concrete used in the portion of the soldier pile that is below the planned excavated level should be of sufficient strength to adequately transfer the imposed loads to the surrounding soils. Provided that the portion of the soldier piles below the excavated level is backfilled with structural concrete, the soldier piles below the excavated level may be used to resist downward loads. The frictional resistance between the concrete soldier piles and the soils below the excavated level can be calculated as the product of 0.2 and the effective overburden pressure, σ_{v0}' for level backfill or the product of 0.25 and the dead load as recommended in the 2013 CBC, not to exceed 500 psf.

If this report or portions thereof are provided to contractors or included in specifications, it should be understood by all parties that they are provided for information only and should be used as such.

Lagging

Continuous lagging will be required between the soldier piles. The soldier piles and anchors should be designed for the full anticipated lateral pressure. However, the pressure on the lagging will be less due to arching in the soils. We recommended that the lagging be designed for the recommended earth pressure.

Anchor Design

Tie-back friction anchors may be used to resist lateral loads. For design purposes, it may be assumed that the active wedge adjacent to the shoring is defined by a plane drawn at 30 degrees from the vertical through the bottom of the excavation. Friction anchors should extend at least 15 feet beyond the potential active wedge and to a greater length if necessary to develop the desired capacities.

The capacities of the anchors should be confirmed by testing of the initial anchors as outlined in the following section. For preliminary design purposes, it may be estimated that drilled friction anchors will develop an average friction value of 450 psf with a minimum overburden of 15 feet over the center of the anchor bond zone. Only the frictional resistance developed beyond the active wedge



would be effective in resisting lateral loads. If the anchors are spaced at least 6 feet on center, no reduction in the capacity of the anchors need be considered due to group action.

Anchor Installation

The anchors may be installed at angles of 15 to 30 degrees below the horizontal. Caving and difficult drilling of the anchor holes should be anticipated and provisions made to minimize the effects of caving.

The anchors should be filled with concrete placed by pumping from the tip out, and the concrete should extend from the tip of the anchor to the active wedge. To reduce the hazard of caving, we suggest that the portion of the anchor shaft within the active wedge be backfilled with sand before testing the anchor. This portion of the shaft should be filled tightly and flush with the face of the excavation. The sand backfill may contain a small amount of cement to allow the sand to be placed by pumping.

Anchor Testing

The geotechnical engineer should select at least 2 percent of the initial anchors for a 24-hour 200 percent test and at least an additional 5 percent of the anchors for quick 200 percent tests. The purpose of the 200 percent tests is to verify the friction value assumed in design. The anchors should be tested to develop twice the assumed friction value. Anchor rods of sufficient strength should be installed in these anchors to support the 200 percent test loading. Where satisfactory tests are not achieved on the initial anchors, the anchor diameter and/or length should be increased until satisfactory test results are obtained.

The total anchor rod, including anchor rod stretch, during the 24-hour 200 percent test should not exceed 12 inches. During the 24-hour test, the anchor deflection should not exceed 3/4 inch, measured after the 200 percent test load is applied. If the anchor movement after the 200 percent load has been applied for 12 hours is less than 1/2 inch and the movement over the previous 4 hours has been less than 0.1 inch, the 24-hour test may be terminated.



For the quick 200 percent tests, the 200 percent test load should be maintained for 30 minutes. The total anchor rod, including anchor rod stretch, during the 200 percent quick tests should not exceed 12 inches; the deflection after the 200 percent test load has been applied should not exceed 1/4 inch during the 30-minute period.

Where satisfactory tests are not achieved on the initial anchors, the anchor diameter and/or length should be increased until satisfactory test results are obtained.

All production anchors should be pretested to at least 150 percent of the design load; the total deflection during the test should not exceed 12 inches. The rate of creep under the 150 percent test should not exceed 0.1 inch over a 15-minute period in order for the anchor to be approved for the design loading.

After a satisfactory test, each anchor should be locked off at the design load. The locked-off load should be verified by rechecking the load in the anchor. If the locked-off load varies by more than 10 percent from the design loads, the load should be reset until the anchor is locked off within 10 percent of the design load.

The installation of the anchors and the testing of the completed anchors should be observed by our firm.

Deflection

It is difficult to accurately predict the amount of deflection of a shored excavation. It should be realized, however, that some deflection will occur. We estimate that this deflection could be on the order of 1 inch at the top of the shored excavation. If greater deflection occurs during construction, additional bracing may be necessary to reduce movement or settlement of the adjacent structures and utilities. If reducing the deflection of the shoring is desired, a higher active pressure could be used in the shoring design.



Monitoring

Some means of monitoring the performance of the shoring system is recommended. The monitoring should consist of periodic surveying of the lateral and vertical locations of the tops of all soldier piles. In addition, we recommend that monuments be established on the surrounding ground prior to excavation and that they be monitored for horizontal and vertical movement during and following excavation and shoring installation. Also, a survey of existing cracks and offsets in nearby buildings and infrastructure should be performed and recorded and photographic records should be made.

TRENCH EXCAVATION:

The soils encountered within our exploratory borings are generally classified as a Type "C" soil in accordance with the CAL/OSHA (State of California, 2001) excavation standards. Unless specifically evaluated by our engineering geologist, all the trench excavations should be performed following the recommendation of CAL/OSHA (State of California, 2001) for Type "C" soil in accordance with the CAL/OSHA (State of California, 2001) excavation standards. Based upon a soil classification of Type "C", the temporary excavation should not be inclined steeper than 1.5 horizontal (h) to 1 vertical (v) for maximum trench depth of less than 20 feet. For trench excavation deeper than 20 feet or for conditions that differ from those described for Type "C" in the CAL/OSHA excavation standards, this firm should be contacted.

PIPE ZONE AND BEDDING:

Based on the results of our maximum density and optimum moisture testing, and a minimum relative compaction requirement of 90 percent, we anticipate that the wet soil unit weight in the compacted backfill prism should be 130 to 145 pounds per cubic foot. The dimensionless product of the Rankine ratio and the sidewall friction coefficient should not exceed 0.150 for use in the Marston-Spangler method of pipe design.

Pipe bedding material should meet and be placed according to the "Greenbook" or other project specifications. Pipe bedding should be uniform, free-draining, granular material with a sand equivalent of at least 30. Our sand equivalent results performed on various samples obtained along



the alignment were relatively low, ranging from 9 to 31. Based upon these results, the on-site soils are not anticipated to be suitable for use as pipe bedding.

Further, based upon our findings, the majority of the subgrade soils to be excavated during construction of Reach 2 continuing to Reach 3 north to Highway 74 are anticipated to be moisture sensitive with the potential of being or becoming overly wet and spongy. Because of potential construction difficulties related to overly wet, pumping soil conditions, we do not recommend densification of the pipe bedding material by jetting. The "Greenbook" specifies a minimum sand equivalent of 15 for trench wall materials in order for pipe bedding to be densified by jetting.

Densification of imported bedding material by mechanical means may prove to be impractical to achieve the minimum 85 percent relative compaction specified by the "Greenbook" for the pipe zone. Without jetting to help ensure the in-filling of any voids beneath and around the pipe, and because it would be difficult or impossible to adequately perform compaction tests or to verify the conditions within the lower portion of the pipe zone, consideration should be given to utilizing a lean sand/cement slurry densified by vibrators for the pipe zone. The use of slurry would lend itself to this project because any additional removals or stabilization of unsuitable subgrade soils would be minimized. Other advantages of utilizing slurry typically include time savings, no need for compaction testing, and better overall performance with greatly reduced settlement potential to better support the street and related improvements.

EXPANSIVE SOILS:

Expansion index testing was performed in the previous investigation. Because expansive soils were not a design consideration for the proposed storm drain improvements, limited testing for expansion potential on selected clayey soils within Reach 2 was conducted. Soils with an expansion potential of "medium" was encountered. Previous Atterberg limit testing conducted on clay samples from Reach 2 indicated a plasticity index of 22. Additional evaluation of soils for expansion potential should be conducted if the materials are to be exported for structural fill or if improvements sensitive to expansive soil movements are constructed. Materials encountered within Reach 3 during this investigation were generally granular and considered to be non-critically expansive.



It should be noted that, due to the expansion potential of the clayey soils on the site, the ground may be subject to shrinkage cracking. Shrinkage cracking tends to be more of an aesthetic condition than a structural problem, since moisture tends to be retained and kept relatively constant below the building foundations. However, sidewalks and other associated flatwork areas may be subjected to heave/shrinkage cycles if underlying soils and adjacent ground are not kept at a constant moisture.

Additional expansion index testing was not performed for the report update.

CORROSIVITY TESTING:

For the previous study, samples of soil material obtained from selected depths along the alignment were delivered to M. J. Schiff & Associates, Inc. for preliminary soil corrosivity testing. Selected samples were also delivered to HDR for the current study. Laboratory testing consisted of pH, resistivity and major soluble salts commonly found in soils. Results for Reaches 2 and 3 are discussed below.

Soluble chloride content levels were generally not at high enough levels to be of concern with respect to corrosion of reinforcing steel.

Results of the resistivity testing indicated that the on-site soils are mildly to moderately corrosive at as-received moisture state to ferrous metals. Soils tested for Reaches 2 and 3 indicated a moderately corrosive to corrosive condition in a saturated state to ferrous metals.

Results of the soluble sulfate testing performed indicated a "not applicable" (Class S0) anticipated exposure to sulfate attack within Reach 2. The soluble sulfate testing within Reach 3 indicated a "not applicable" to "moderate" (Class S0 to S1) anticipated exposure to sulfate attack. Based upon the criteria from Table 4.3.1 of the Structural Concrete Building Code (ACI 318-11) and Commentary, no special measures are needed for Reach 2. Reach 3 will have additional requirements for concrete such as specific cement types, water-cement ratios, and minimum compressive strength as indicated on Table 4.3.1 of the Structural Concrete Building Code (ACI 318-11) and Commentary.



Tests performed for the current report generally confirm the test results of the previous study.

These tests have been performed in order to provide preliminary screening of the site for potentially corrosive soils. CHJ Consultants does not practice corrosion engineering. If further information concerning the corrosion characteristics, or interpretation of the results submitted herein, is required, then a competent corrosion engineer could be consulted. The results of the laboratory tests performed appear in Appendix "C" and Appendix "C-1".

EXISTING PAVEMENT THICKNESS:

Existing pavement thickness was recorded for the current study, and R-value testing was performed on the subgrade materials encountered during our current site investigation. The pavement sections at State Highway 74 near Briggs Road included 7 inches of asphalt concrete over 7 inches of aggregate base. R-value testing performed within the Reach 2 area ranged from 17 to 42. R-value testing performed within the Reach 3 area of the project, specifically at State Highway 74 near Briggs Road, ranged from 70 to 64. The testing performed is indicated on the boring logs in Appendix "B". Results of the R-value tests are presented in Appendix "C".

CHJ Consultants does not practice traffic engineering. Traffic indices should be provided by a professional traffic engineer.

SOIL EROSION:

The upper soils encountered within the site generally consist of silty sands that are moderately susceptible to erosion by wind and water. Based on the classification of near-surface soils, a preliminary soil erosion factor (K-factor) of 0.42 could be utilized in the design. For more precise determination of the soil erodibility factor, the results of the sieve analysis tests provided in Appendix "C" should be utilized.

CONSTRUCTION OBSERVATION:

All grading operations, including site clearing and stripping, should be observed by a representative of the geotechnical engineer. The geotechnical engineer's field representative will be present to



provide observation and field testing and will not supervise or direct any of the actual work of the contractor, his employees or agents. Neither the presence of the geotechnical engineer's field representative nor the observations and testing by the geotechnical engineer shall excuse the contractor in any way for defects discovered in his work. It is understood that the geotechnical engineer will not be responsible for job or site safety on this project, which will be the sole responsibility of the contractor.

LIMITATIONS

CHJ Consultants has striven to perform our services within the limits prescribed by our client, and in a manner consistent with the usual thoroughness and competence of reputable geotechnical engineers and engineering geologists practicing under similar circumstances. No other representation, express or implied, and no warranty or guarantee is included or intended by virtue of the services performed or reports, opinion, documents, or otherwise supplied.

This report reflects the testing conducted on the site as the site existed during the investigation, which is the subject of this report. However, changes in the conditions of a property can occur with the passage of time, due to natural processes or the works of man on this or adjacent properties. Changes in applicable or appropriate standards may also occur whether as a result of legislation, application, or the broadening of knowledge. Therefore, this report is indicative of only those conditions tested at the time of the subject investigation, and the findings of this report may be invalidated fully or partially by changes outside of the control of CHJ Consultants. This report is therefore subject to review and should not be relied upon after a period of one year.

The conclusions and recommendations in this report are based upon observations performed and data collected at separate locations, and interpolation between these locations, carried out for the project and the scope of services described. It is assumed and expected that the conditions between locations observed and/or sampled are similar to those encountered at the individual locations where observation and sampling was performed. However, conditions between these locations may vary significantly. Should conditions be encountered in the field by the client or any firm performing



services for the client or the client's assign, that appear different than those described herein, this firm should be contacted immediately in order that we might evaluate their effect.

If this report or portions thereof are provided to contractors or included in specifications, it should be understood by all parties that they are provided for information only and should be used as such.

The report and its contents resulting from this investigation are not intended or represented to be suitable for reuse on extensions or modifications of the project, or for use on any other project.

CLOSURE

We appreciate this opportunity to be of service and trust this report provides the information desired at this time. Should questions arise, please do not hesitate to contact this office.

Respectfully submitted,
CHJ CONSULTANTS

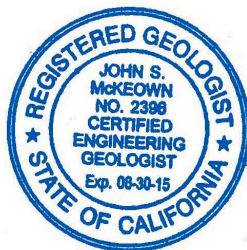


Maihan Noorzay, R.C.E. 77901
Project Engineer

James F. Cooke, G.E. 3012
Managing Engineer



John S. McKeown, C.E.G. 2396
Engineering Geologist



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President



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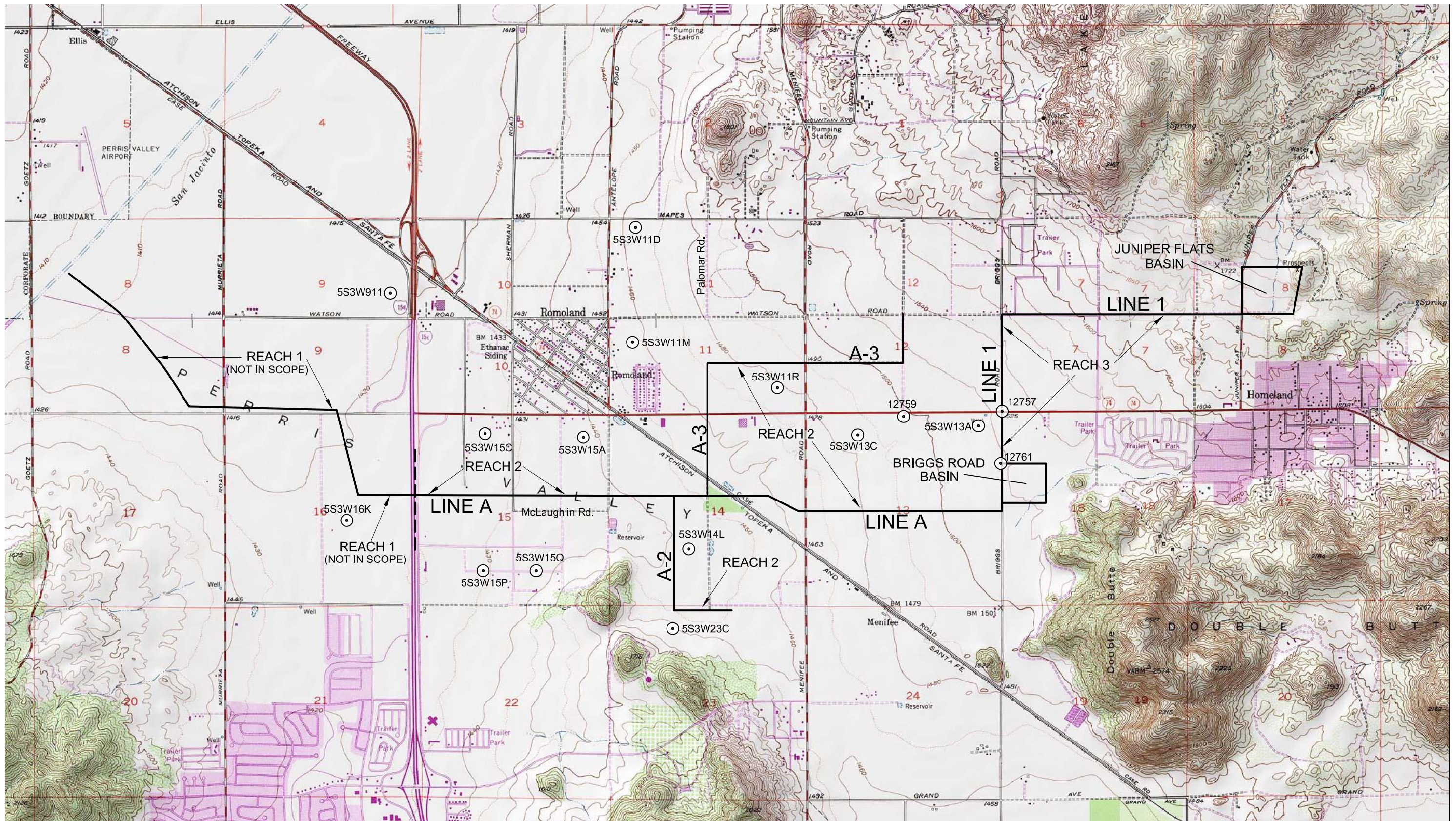
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APPENDIX "A"
GEOTECHNICAL MAPS



SCALE: 1" = 2500'

LEGEND:

5S3W16C
 APPROXIMATE LOCATION OF WELL

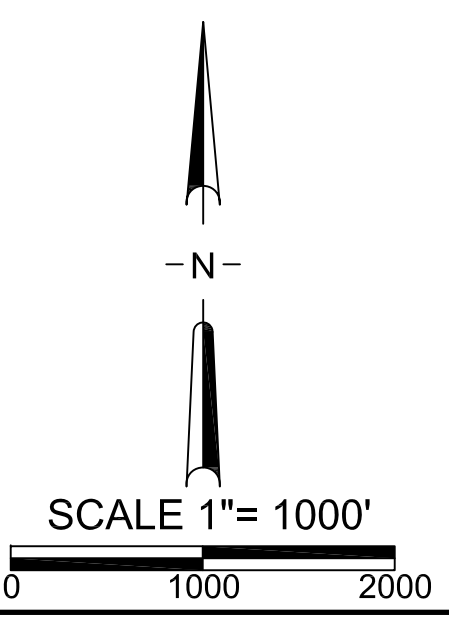
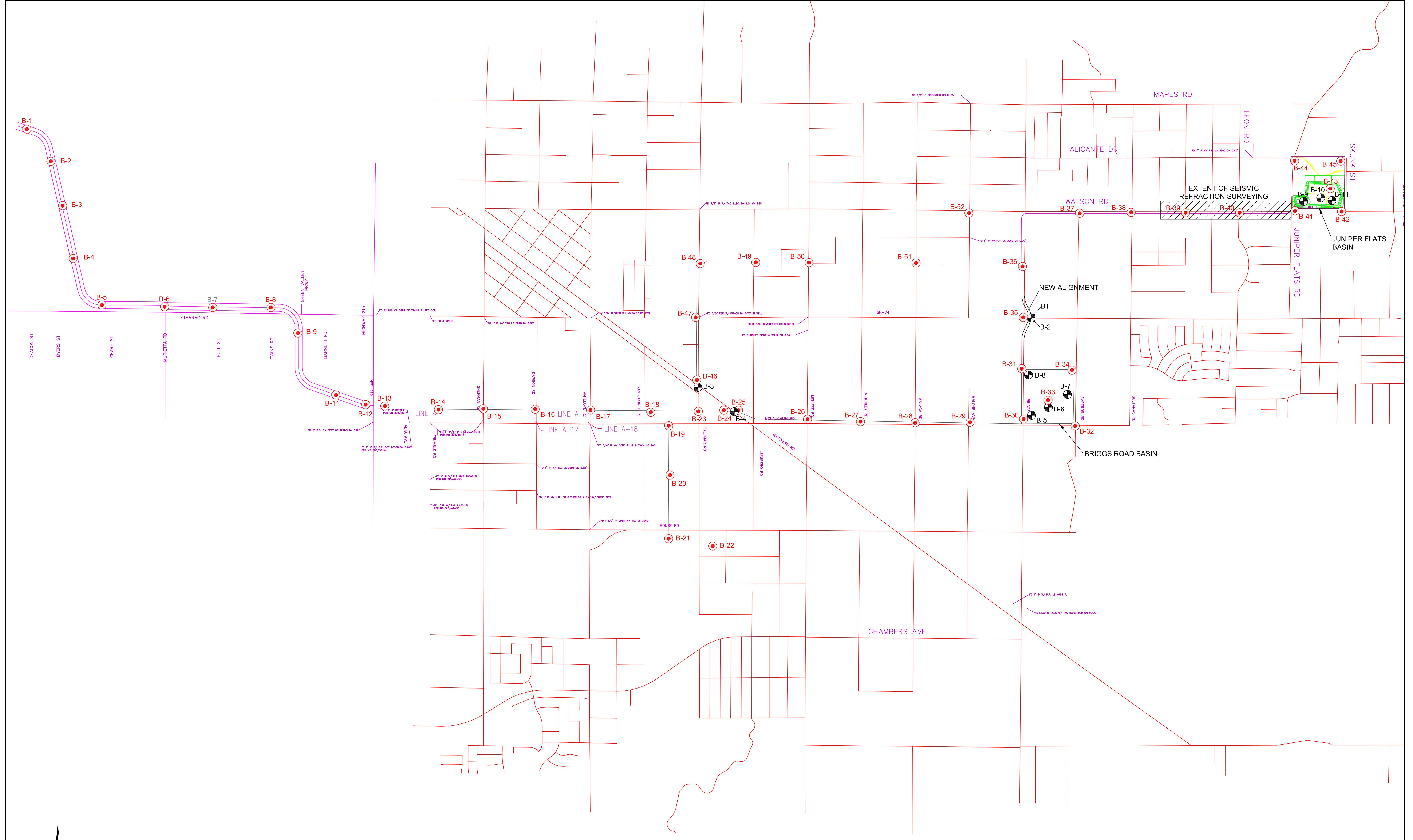
INDEX MAP

FOR: COUNTY OF RIVERSIDE FLOOD CONTROL AND WATER CONSERVATION DISTRICT
 DATE: OCTOBER 2014

GEOTECHNICAL INVESTIGATION ROMOLAND MDP LINE A, STAGE 4
 PROJECT NO. 4-0-00310-04
 RIVERSIDE COUNTY, CALIFORNIA

ENCLOSURE "A-1"
 JOB NUMBER 14311-3





LEGEND:

- EXPLORATORY BORING
- EXPLORATORY BORING (PREVIOUS INVESTIGATION, 2004)

PLAT		ENCLOSURE "A-2"
FOR: COUNTY OF RIVERSIDE FLOOD CONTROL AND WATER CONSERVATION DISTRICT		GEOTECHNICAL INVESTIGATION ROMOLAND MDP LINE A, STAGE 4
DATE: OCTOBER 2014		PROJECT NO. 4-0-00310-04 RIVERSIDE COUNTY, CALIFORNIA
		JOB NUMBER 14311-3
CHJ Consultants		

APPENDIX "B"

EXPLORATORY LOGS—CURRENT INVESTIGATION



KEY TO LOGS

LEGEND OF LAB/FIELD TESTS:

Blows	A measure of the penetration resistance of soil expressed as the number of hammer blows required to advance the indicated sampler 6 inches (or less if noted). Samplers are driven with an automatic hammer that drops a 140-pound weight 30 inches for each blow. After the required seating, samplers are advanced up to 18 inches ahead of the boring, providing up to three sets of blows per drive.
Bulk	Indicates Disturbed or Bulk Sample
Consol.	Consolidated Test (ASTM D2435)
Cor.	Chemical/Corrosivity Tests (ASTM G187)
Dist.	Indicates Disturbed Sample
DS	Direct Shear Test (ASTM D3080)
Hydro.	Hydrometer Analysis (ASTM D422)
Exp.	Expansion Test (California Building Code Standard Test Method 18-2)
MDC	Optimum Moisture - Maximum Density Determination (ASTM D1557)
N.R.	Indicates No Recovery of Sample
PI	Plasticity Index
Ring	Indicates Relatively Undisturbed Ring Sample. Relatively Undisturbed Ring Samples are obtained with a "Modified California Sampler" (3.25" O.D. and 2.42" I.D.) lined with rings driven with a 140-pound weight falling 30 inches.
RV	R-Value (CT 301)
SA	Sieve Analysis (ASTM D422)
SE	Sand Equivalent (ASTM D2419)
SPT	Indicates a Sample Obtained with an Unlined Standard Penetration Test Sampler (2" O.D. and 1-3/8" I.D.).

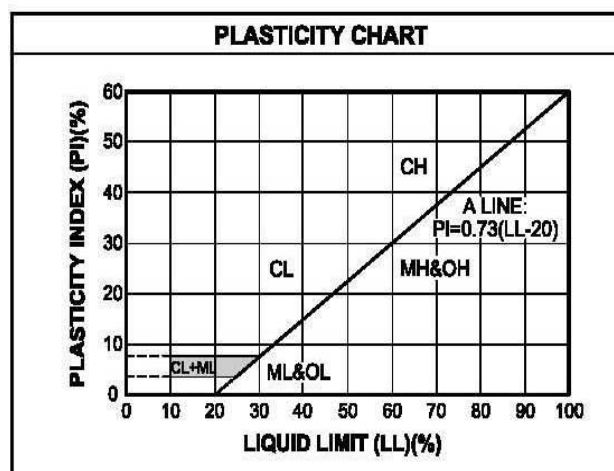


UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART							
COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size)							
Clean Gravels (Less than 5% fines)							
GRAVELS More than 50% of coarse fraction larger than No.4 sieve size	<table border="0" style="display: inline-table; vertical-align: middle;"> <tr> <td style="padding-right: 5px;">GW</td> <td>Well-graded gravels, gravel-sand mixtures, little or no fines</td> </tr> <tr> <td>GP</td> <td>Poorly-graded gravels, gravel-sand mixtures, little or no fines</td> </tr> </table>	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines		
	GW	Well-graded gravels, gravel-sand mixtures, little or no fines					
GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines						
Gravels with fines (More than 12% fines)							
	<table border="0" style="display: inline-table; vertical-align: middle;"> <tr> <td style="padding-right: 5px;">GM</td> <td>Silty gravels, gravel-sand-silt mixtures</td> </tr> <tr> <td>GC</td> <td>Clayey gravels, gravel-sand-clay mixtures</td> </tr> </table>	GM	Silty gravels, gravel-sand-silt mixtures	GC	Clayey gravels, gravel-sand-clay mixtures		
	GM	Silty gravels, gravel-sand-silt mixtures					
GC	Clayey gravels, gravel-sand-clay mixtures						
Clean Sands (Less than 5% fines)							
SANDS 50% or more of coarse fraction smaller than No.4 sieve size	<table border="0" style="display: inline-table; vertical-align: middle;"> <tr> <td style="padding-right: 5px;">SW</td> <td>Well-graded sands, gravelly sands, little or no fines</td> </tr> <tr> <td>SP</td> <td>Poorly graded sands, gravelly sands, little or no fines</td> </tr> </table>	SW	Well-graded sands, gravelly sands, little or no fines	SP	Poorly graded sands, gravelly sands, little or no fines		
	SW	Well-graded sands, gravelly sands, little or no fines					
SP	Poorly graded sands, gravelly sands, little or no fines						
Sands with fines (More than 12% fines)							
	<table border="0" style="display: inline-table; vertical-align: middle;"> <tr> <td style="padding-right: 5px;">SM</td> <td>Silty sands, sand-silt mixtures</td> </tr> <tr> <td>SC</td> <td>Clayey sands, sand-clay mixtures</td> </tr> </table>	SM	Silty sands, sand-silt mixtures	SC	Clayey sands, sand-clay mixtures		
	SM	Silty sands, sand-silt mixtures					
SC	Clayey sands, sand-clay mixtures						
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size)							
SILTS AND CLAYS Liquid limit less than 50%	<table border="0" style="display: inline-table; vertical-align: middle;"> <tr> <td style="padding-right: 5px;">ML</td> <td>Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity</td> </tr> <tr> <td>CL</td> <td>Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays</td> </tr> <tr> <td>OL</td> <td>Organic silts and organic silty clays of low plasticity</td> </tr> </table>	ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	OL	Organic silts and organic silty clays of low plasticity
	ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity					
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays					
OL	Organic silts and organic silty clays of low plasticity						
SILTS AND CLAYS Liquid limit 50% or greater	<table border="0" style="display: inline-table; vertical-align: middle;"> <tr> <td style="padding-right: 5px;">MH</td> <td>Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts</td> </tr> <tr> <td>CH</td> <td>Inorganic clays of high plasticity, fat clays</td> </tr> <tr> <td>OH</td> <td>Organic clays of medium to high plasticity, organic silts</td> </tr> </table>	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	CH	Inorganic clays of high plasticity, fat clays	OH	Organic clays of medium to high plasticity, organic silts
	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts					
	CH	Inorganic clays of high plasticity, fat clays					
OH	Organic clays of medium to high plasticity, organic silts						
<table border="0" style="display: inline-table; vertical-align: middle;"> <tr> <td style="padding-right: 5px;">PT</td> <td>Peat and other highly organic soils</td> </tr> </table>	PT	Peat and other highly organic soils					
PT	Peat and other highly organic soils						
HIGHLY ORGANIC SOILS							

LABORATORY CLASSIFICATION CRITERIA	
$C_u = \frac{D_{60}}{D_{10}} \text{ greater than } 4; C_c = \frac{D_{30}^2}{D_{10} \times D_{60}} \text{ between } 1 \text{ and } 3$	
GP Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4
GC	Atterberg limits above "A" line with P.I. greater than 7
Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.	
$C_u = \frac{D_{60}}{D_{10}} \text{ greater than } 6; C_c = \frac{D_{30}^2}{D_{10} \times D_{60}} \text{ between } 1 \text{ and } 3$	
SP Not meeting all gradation requirements for SW	
SM	Atterberg limits below "A" line or P.I. less than 4
SC	Atterberg limits above "A" line with P.I. greater than 7
Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size).
Coarse-grained soils are classified as follows:
Less than 5 percent.....GW, GP, SW, SP
More than 12 percent.....GM, GC, SM, SC
5 to 12 percent.....Borderline cases requiring dual symbols



EXPLORATORY BORING NO. 1

Date Drilled: 8/6/14

Client: Riverside County Flood Control District

Equipment: CME 75 Truck Rig

Driving Weight / Drop: 140 lbs./ 30 in.

Surface Elevation(ft): 1528

Logged by: VJR

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
	●●●●	Asphalt Concrete, 7"	Fill						
	●●●●	Aggregate Base, 7"							
	●●●●	(SP-SM) Sand, fine to medium with coarse, with silt, brown		X	X	14	8.1	109	Ring
	●●●●			X	X	14			
	●●●●			X	X	11	4.2		MDC, RV
5	●●●●	(SM-SC) Silty Clayey Sand, fine to medium, dark brown	Native	X	X	7	11.1	127	Hydro., Ring
	●●●●			X	X	10			
	●●●●			X	X	12	12.4		SE
	●●●●			X	X	10			
	●●●●			X	X	26	10.0	132	Ring
	●●●●			X	X	26			
15	●●●●	(SM) Silty Sand, fine to medium, yellow brown		X	X	13	6.8	130	Ring
	●●●●			X	X	26			Cor.
	●●●●			X	X	36			
20	●●●●			X	X	30	11.4	125	Ring
	●●●●			X	X	50/5"			
25	●●●●	(SM) Silty Sand, fine to coarse, dark brown	Added Water	X	X	21	8.4	112	DS, Ring
	●●●●			X	X	50/2"			
30	●●●●		Added Water	X	X	35	7.1	126	Ring
	●●●●			X	X	50/4"			

10391-3 14311-3.GPJ CHJ/GDT 8/19/14



ROMOLAND MDP, LINE A, STAGE 4
ROMOLAND, RIVERSIDE COUNTY, CA

Job No. Enclosure
14311-3 B-1a

EXPLORATORY BORING NO. 1

Date Drilled: 8/6/14

Client: Riverside County Flood Control District

Equipment: CME 75 Truck Rig

Driving Weight / Drop: 140 lbs./ 30 in.

Surface Elevation(ft): 1528

Logged by: VJR

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
40	[Stippled Pattern]	(SM) Silty Sand, fine to coarse, dark brown	Added Water	X		34 50/4"	7.4	124	Ring
45	[Stippled Pattern]			X		25 50/5"	9.8	122	DS, Ring
50		END OF BORING		X		50/5"	5.2	110	Ring
55		NO REFUSAL, NO BEDROCK NO GROUNDWATER NO CAVING, FILL TO 5'							
60									
65									

10331-3 14311-3.GPJ CHJ.GDT 8/19/14



ROMOLAND MDP, LINE A, STAGE 4
ROMOLAND, RIVERSIDE COUNTY, CA

Job No. Enclosure
14311-3 B-1b

EXPLORATORY BORING NO. 2

Date Drilled: 8/6/14

Client: Riverside County Flood Control District

Equipment: CME 75 Truck Rig

Driving Weight / Drop: 140 lbs./ 30 in.

Surface Elevation(ft): 1528

Logged by: VJR

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		Asphalt Concrete, 7"	Fill						
		Aggregate Base, 7"							
		(SM) Silty Sand, fine to medium with coarse, dark brown		X		7 4 4	6.7		SPT
5	[Diagonal Hatching]	(SC) Clayey Sand, fine to medium, yellow brown	Native	X	[Cross-hatching]	4 4 7			MDC, RV Hydro., SPT
10	[Diagonal Hatching]		Smoky Auger to 20'	X		7 8 13	12.4		SPT
15	[Diagonal Hatching]	(SM) Silty Sand, fine to medium with coarse, yellow brown		X		4 8 15			Cor., SE SPT
20	[Dotted]	(SM) Silty Sand, fine to coarse, strong brown	Added Water	X		17 27 37		SPT	
25	[Dotted]		Added Water	X		16 25 43		SPT	
30	[Dotted]		Added Water	X		17 30 34		SPT	

10831-3 14311-3.GPJ CHJ.GDT 8/19/14



ROMOLAND MDP, LINE A, STAGE 4
ROMOLAND, RIVERSIDE COUNTY, CA

Job No. Enclosure
14311-3 B-2a

EXPLORATORY BORING NO. 2

Date Drilled: 8/6/14

Client: Riverside County Flood Control District

Equipment: CME 75 Truck Rig

Driving Weight / Drop: 140 lbs./ 30 in.

Surface Elevation(ft): 1528

Logged by: VJR

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine to coarse, strong brown		X		11 25 30			SPT
40		(SM) Silty Sand, fine to medium, yellow brown	Added Water	X		7 16 21			SPT
45				X		25 28 34			SPT
50			Added Water	X		14 23 27			SPT
55			Added Water	X		18 27 40			SPT
60	[Hatched Pattern]	Granitic Bedrock recovered as (SM) Silty Sand, fine to coarse, brown		X		40 50			SPT
65	[Hatched Pattern]			X		20 24 28			SPT
		END OF BORING NO REFUSAL, NO CAVING NO GROUNDWATER, FILL TO 5' GRANITIC BEDROCK AT 60'							

10331-3 14311-3.GPJ CHJ.GDT 8/19/14



ROMOLAND MDP, LINE A, STAGE 4
ROMOLAND, RIVERSIDE COUNTY, CA

Job No. Enclosure
14311-3 B-2b

EXPLORATORY BORING NO. 3

Date Drilled: 8/6/14

Client: Riverside County Flood Control District

Equipment: CME 75 Truck Rig

Driving Weight / Drop / Sampler Size: 140 lbs./ 30 in.

Surface Elevation(ft): 1452

Logged by: VJR

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
5	(CL) Sandy Clay, fine, with silt, dark yellow brown		Native				8.5		Cor., RV
				X		16 17 36	9.8	129	Ring
				X		7 14 42	12.9	126	Hydro., Ring
10	(ML) Sandy Silt, fine with medium, few clay, dark yellow brown		Smoky Auger	X		20 50/5	7.5	132	Ring
							10.2		MDC
15			Added Water	X		18 50/5"	15.1	116	DS, Ring
20		(SM) Silty Sand, fine with medium, yellow brown	Added Water	X		40 50/5"	11.5	120	Ring
25			Added Water	X		33 50/4"	14.4	119	Ring
30			Added Water	X		26 50	16.8	116	Ring

10331-3 14311-3.GPJ CHJ.GDT 8/28/14



ROMOLAND MDP, LINE A, STAGE 4
ROMOLAND, RIVERSIDE COUNTY, CA

Job No. Enclosure
14311-3 B-3a

EXPLORATORY BORING NO. 3

Date Drilled: 8/6/14

Client: Riverside County Flood Control District


Equipment: CME 75 Truck Rig

Driving Weight / Drop: 140 lbs./ 30 in.

Surface Elevation(ft): 1452

Logged by: VJR

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
40		(SM) Silty Sand, fine with medium, yellow brown		<input checked="" type="checkbox"/>		23 40 50/3"	16.2	117	Ring
45		END OF BORING NO REFUSAL, NO BEDROCK NO GROUNDWATER NO CAVING, NO FILL		<input checked="" type="checkbox"/>		17 50	18.2	113	Ring
50									
55									
60									
65									

10331-3 14311-3.GPJ CHJ.GDT 8/19/14



ROMOLAND MDP, LINE A, STAGE 4
ROMOLAND, RIVERSIDE COUNTY, CA

Job No. Enclosure
14311-3 B-3b

EXPLORATORY BORING NO. 4

Date Drilled: 8/6/14

Client: Riverside County Flood Control District

Equipment: CME 75 Truck Rig

Driving Weight / Drop: 140 lbs./ 30 in.

Surface Elevation(ft): 1454

Logged by: VJR

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(ML) Sandy Silt, fine, light brown	Native	X	X	3 6 13	3.5		Cor., RV SPT
5		(SM-SC) Silty, Clayey Sand, fine to medium, strong brown		X		37 37 50			Hydro., SPT
10		(ML) Sandy Silt, fine with medium, few clay, strong brown	Smoky Auger	X	X	14 25 40	6.8		SPT MDC
15			Added Water	X		10 17 36			SPT
20		(SM) Silty Sand, fine to medium, brown	Added Water	X		13 21 27			SPT
25			Added Water	X		10 22 36			SPT
30				X		10 17 38			SPT

10331-3 14311-3.GPJ CHJ.GDT 8/19/14



ROMOLAND MDP, LINE A, STAGE 4
ROMOLAND, RIVERSIDE COUNTY, CA

Job No. Enclosure
14311-3 B-4a

EXPLORATORY BORING NO. 4

Date Drilled: 8/6/14

Client: Riverside County Flood Control District

Equipment: CME 75 Truck Rig

Driving Weight / Drop: 140 lbs./ 30 in.

Surface Elevation(ft): 1454

Logged by: VJR

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
40	[Dotted Pattern]	(SM) Silty Sand, fine to medium, brown	Added Water	X		15			SPT
				X		18		21	
45	[Dotted Pattern]	(SM) Silty Sand, fine to medium, few clay, brown	Added Water	X		13			SPT
				X		35		50	
50	[Dotted Pattern]	END OF BORING		X		9			SPT
				X		14		20	
55	[Dotted Pattern]	NO REFUSAL, NO BEDROCK NO GROUNDWATER NO CAVING, NO FILL		X		12			SPT
				X		12		13	
60									
65									

10331-3 14311-3.GPJ CHJ.GDT 8/19/14



ROMOLAND MDP, LINE A, STAGE 4
ROMOLAND, RIVERSIDE COUNTY, CA

Job No. Enclosure
14311-3 B-4b

EXPLORATORY BORING NO. 5

Date Drilled: 5/29/14

Client: Riverside County Flood Control District

Equipment: CME 75 Track Rig

Driving Weight / Drop: 140 lbs./ 30 in.

Surface Elevation(ft): 1521

Logged by: VJR

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
5	[Dotted pattern]	(SM) Silty Sand, fine, light brown	Native		[Cross-hatch pattern]		3.8		
10	[Dotted pattern]			[X]		50	6.7	Dist.	Ring
20	[Dotted pattern]	(SM) Silty Sand, fine to coarse, dark brown		[X]		20 27 45	10.1	128	Ring
25	[Dotted pattern]		Approximate Bottom of Basin						
30	[Dotted pattern]	(SP-SM) Sand, fine to medium, with silt, brown		[X]		17 32 46	3.6	122	Ring
		END OF BORING							
		NO REFUSAL, NO FILL NO GROUNDWATER NO CAVING, NO BEDROCK							

10331-3 14311-3.GPJ CHJ.GDT 8/19/14



ROMOLAND MDP, LINE A, STAGE 4
ROMOLAND, RIVERSIDE COUNTY, CA

Job No. Enclosure
14311-3 B-5

EXPLORATORY BORING NO. 6

Date Drilled: 5/29/14

Client: Riverside County Flood Control District

Equipment: CME 75 Track Rig

Driving Weight / Drop: 140 lbs./ 30 in.

Surface Elevation(ft): 1523

Logged by: VJR

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with medium, brown	Native						
5	[Stippled pattern]						4.6		
10	[Stippled pattern]	(SP-SM) Sand, fine to medium, with silt, brown		X		12 21 21	1.8	124	Ring
15	[Stippled pattern]								
20	[Stippled pattern]	(SP) Sand, fine to medium, few silt, dark brown		X		20 24 32	3.6	119	Ring
25	[Stippled pattern]		Approx. Bottom of Basin						
30	[Stippled pattern]	END OF BORING		X		9 27 38	8.0	112	Ring
		NO REFUSAL, NO FILL NO GROUNDWATER NO CAVING, NO BEDROCK							

10331-3 14311-3.GPJ CHJ.GDT 8/19/14



ROMOLAND MDP, LINE A, STAGE 4
ROMOLAND, RIVERSIDE COUNTY, CA

Job No. Enclosure
14311-3 B-6

EXPLORATORY BORING NO. 7

Date Drilled: 5/29/14

Client: Riverside County Flood Control District

Equipment: CME 75 Track Rig

Driving Weight / Drop: 140 lbs./ 30 in.

Surface Elevation(ft): 1529

Logged by: VJR

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
5	[Dotted pattern]	(SM) Silty Sand, fine, brown	Native		[Cross-hatched pattern]		4.8		
10	[Dotted pattern]	(SP-SM) Sand, fine to medium, with silt, brown		[X]		7 11 12	1.6	113	Ring
20	[Dotted pattern]			[X]		18 39 49	5.5	134	Ring
30	[Diagonal hatching]	(SC) Clayey Sand, fine to medium, with coarse, with silt, dark brown	Approx. Bottom of Basin Hard Drilling	[X]		15 32 50/5"	8.8	134	Ring

10331-3 14311-3.GPJ CHJ.GDT 8/19/14



ROMOLAND MDP, LINE A, STAGE 4
ROMOLAND, RIVERSIDE COUNTY, CA

Job No. Enclosure
14311-3 B-7a

EXPLORATORY BORING NO. 7

Date Drilled: 5/29/14

Client: Riverside County Flood Control District

Equipment: CME 75 Track Rig

Driving Weight / Drop: 140 lbs./ 30 in.

Surface Elevation(ft): 1529

Logged by: VJR

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
	[Diagonal Hatching]	(SC) Clayey Sand, fine to medium, with coarse, with silt, dark brown							
40	[Cross-hatching]	Granitic Bedrock recovered as (SP-SM) Sand, fine to medium, with coarse, with silt, gray brown							
		END OF BORING		X		50/4"	3.9	106	Ring
45		NO REFUSAL, NO FILL NO GROUNDWATER NO CAVING, BEDROCK AT 38'							
50									
55									
60									
65									

10331-3 14311-3.GPJ CHJ.GDT 8/19/14



ROMOLAND MDP, LINE A, STAGE 4
ROMOLAND, RIVERSIDE COUNTY, CA

Job No. Enclosure
14311-3 B-7b

EXPLORATORY BORING NO. 8

Date Drilled: 5/29/14

Client: Riverside County Flood Control District

Equipment: CME 75 Track Rig

Driving Weight / Drop: 140 lbs./ 30 in.

Surface Elevation(ft): 1518

Logged by: VJR

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine to medium, red brown	Native						
5	[Dotted pattern]				[Cross-hatched]		7.6		
10	[Dotted pattern]			[X]		12 20 24	4.9	128	Ring
15	[Dotted pattern]								
20	[Dotted pattern]		Approx. Bottom of Basin						
25	[Dotted pattern]	END OF BORING		[X]		50	7.2	108	Ring
25		NO REFUSAL, NO FILL NO GROUNDWATER NO CAVING, NO BEDROCK							
30									

10831-3 14311-3.GPJ CHJ.GDT 8/19/14



ROMOLAND MDP, LINE A, STAGE 4
ROMOLAND, RIVERSIDE COUNTY, CA

Job No. Enclosure
14311-3 B-8

EXPLORATORY BORING NO. 9

Date Drilled: 5/29/14

Client: Riverside County Flood Control District

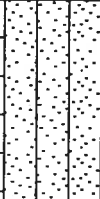

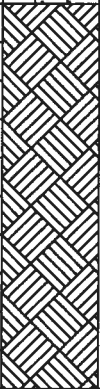

Equipment: CME 75 Track Rig

Driving Weight / Drop: 140 lbs./ 30 in.

Surface Elevation(ft): 1703

Logged by: VJR

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
5		(SM) Silty Sand, fine to medium, brown	Native				2.9		
10		Granitic Bedrock recovered as (SP-SM) Sand, fine to medium, with silt, gray brown				50/5"	3.8	125	Ring
20		END OF BORING				50/1"	N.R.	N.R.	Ring
25		NO REFUSAL, NO FILL NO GROUNDWATER NO CAVING, BEDROCK AT 10'							
30									

10391-3 14311-3.GPJ CHJ.GDT 8/19/14



ROMOLAND MDP, LINE A, STAGE 4
ROMOLAND, RIVERSIDE COUNTY, CA

Job No. Enclosure
14311-3 B-9

EXPLORATORY BORING NO. 10

Date Drilled: 5/29/14

Client: Riverside County Flood Control District

Equipment: CME 75 Track Rig

Driving Weight / Drop: 140 lbs./ 30 in.

Surface Elevation(ft): 1705

Logged by: VJR

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
5	[Dotted Pattern]	(SM) Silty Sand, fine to medium, dark brown	Native	X	[Cross-hatched]	4 6 9	6.5 11.1	115	Ring
15	[Diagonal Hatching]	Granitic Bedrock recovered as (SP-SM) Sand, fine to medium, with silt, gray brown		X		50/5"	4.4	113	Ring
25	[Diagonal Hatching]	END OF BORING		X		50/4"	N.R.	N.R.	Ring
30		NO REFUSAL, NO FILL NO GROUNDWATER NO CAVING, BEDROCK AT 15'							

10331-3 14311-3.GPJ CHJ.GDT 8/19/14



ROMOLAND MDP, LINE A, STAGE 4
ROMOLAND, RIVERSIDE COUNTY, CA

Job No. Enclosure
14311-3 B-10

EXPLORATORY BORING NO. 11

Date Drilled: 5/29/14

Client: Riverside County Flood Control District

Equipment: CME 75 Track Rig

Driving Weight / Drop: 140 lbs./ 30 in.

Surface Elevation(ft): 1705

Logged by: VJR

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
5	[Dotted pattern]	(SM) Silty Sand, fine with medium, dark brown	Native		[Dotted pattern]		3.2		
10	[Dotted pattern]			X		6 11 17	3.4	125	Ring
20	[Dotted pattern]	(SP-SM) Sand, fine to medium with coarse, with silt, brown		X		12 19 20	2.7	123	Ring
25		END OF BORING NO REFUSAL, NO FILL NO GROUNDWATER NO CAVING, NO BEDROCK							
30									

10331-3 14311-3.GPJ CHJ.GDT 8/19/14



ROMOLAND MDP, LINE A, STAGE 4
ROMOLAND, RIVERSIDE COUNTY, CA

Job No. Enclosure
14311-3 B-11

APPENDIX "B-1"

EXPLORATORY LOGS—PREVIOUS INVESTIGATION

EXPLORATORY BORING NO. 13

Client: Albert A. Webb Associates

Date Drilled: 3/14/04

Location: Station 124+00

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1426.0/1414.0

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with clay, light brown	Native				8.4		
5						30/4.5"	14.2	117	Ring
		(SM) Silty Sand, fine to medium with coarse, light brown					9.4		MDC, SA
10						53/11"	11.1 11.0	124	Ring
		(SC) Clayey Sand, fine to medium with coarse and silt, yellow brown							
15						30/5"	11.1	124	Ring, DS
20						43	11.9	119	Ring
25						46/11"	12.0	120	Ring
		END OF BORING							
30		NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CH.J.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No. Enclosure
04175-3 B-12

EXPLORATORY BORING NO. 14

Client: Albert A. Webb Associates

Date Drilled: 3/15/04

Location: Station 137+80

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1427.0/1418.1

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
5		(SM) Silty Sand, fine with medium and coarse, light brown	Native				6.1	125	Ring
					30/6"	3.6 7.3			
10		(SM) Silty Sand, fine to medium, orange brown				30/4"	11.3 9.5	Dist.	DS, MDC, SA Ring
15		(ML) Sandy Silt, fine with clay, brown					12.4	128	Ring
						52	12.0		
20		(SC) Clayey Sand, fine to medium with coarse, light brown					11.7	130	Ring
						30/6"	10.4		
25		(SP-SC) Sand, fine to medium with coarse, clay and silt, yellow brown					7.0	123	Ring
						30/4"	8.4		
30		END OF BORING							
		NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/22/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No. Enclosure
04175-3 B-13

EXPLORATORY BORING NO. 16

Client: Albert A. Webb Associates

Date Drilled: 3/15/04

Location: Station 166+50

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1435.0/1425.9

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with medium and coarse, light brown	Native				7.1		
5						30/3"	8.8	113	Ring
							9.4		
10		(SM) Silty Sand, fine, light brown				30/6"	9.0	123	Ring, DS
							14.9		
15		(SM) Silty Sand, fine, light brown				30/4"	12.5	120	Ring
							6.9		
20		(SP) Sand, fine with medium, light brown				46	4.4	115	Ring
							5.3		
25		END OF BORING				30/5"	3.2	109	Ring
30		NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/22/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No. Enclosure
04175-3 B-15

EXPLORATORY BORING NO. 17

Client: Albert A. Webb Associates

Date Drilled: 3/15/04

Location: Station 176+00

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1438.6/1428.5

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
5		(SM) Silty Sand, fine with medium, coarse and clay, light brown	Native			30/4"	9.7	126	Ring
10		(SM) Silty Sand, fine with medium and coarse, light brown				30/5.5"	10.5	114	Ring
15		(SP-SM) Sand, fine to medium with clay, light brown				56/11"	11.5	127	Ring
20		(SM) Silty Sand, fine to medium with coarse and clay, orange brown				30/6"	6.4	120	Ring
25		(ML) Sandy Silt, fine, light brown					11.1		
30		END OF BORING				47	12.6	114	Ring
		NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/22/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No.
04175-3

Enclosure
B-16

EXPLORATORY BORING NO. 18

Client: Albert A. Webb Associates

Date Drilled: 3/15/04

Location: Station 193+50

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1444.0/1433.0

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with medium and coarse, light brown	Native				13.2		
5		(SM) Silty Sand, fine to medium with coarse and clay, light brown					9.1		
10						30/2"	9.0	Dist.	Ring
15		(SP-SM) Sand, fine with medium, coarse and silt, light brown				49	5.0 7.3	117	Ring
20						30/6"	8.7	113	Ring
25		(SP) Sand, fine to medium with coarse, yellow brown				30/6"	2.0		
30		END OF BORING NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No.
04175-3

Enclosure
B-17

EXPLORATORY BORING NO. 19

Client: Albert A. Webb Associates

Date Drilled: 3/9/04

Location: Station 3+50

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1444.5/1434.5

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with medium, coarse and clay, light brown	Native	X	X		9.1		
		(SM) Silty Sand, fine with medium, light brown		X	X	19	7.1	112	Ring
5		(SM) Silty Sand, fine with medium, light brown		X	X	30/4"	7.6	116	Ring
		(ML) Clayey Silt, fine, light brown		X	X		17.6		Exp., PI
10		(SM) Silty Sand, fine with clay, light brown		X	X	39	7.3	122	Ring
		(SM) Silty Sand, fine with clay, light brown		X	X		7.0		
15		(SM) Silty Sand, fine with clay, light brown		X	X	37	7.2	122	Ring
		(SM) Silty Sand, fine to medium with clay, light brown		X	X		8.1		
20		(SM) Silty Sand, fine to medium with clay, light brown		X	X	30/6"	7.3	Dist.	Ring
		(SM) Silty Sand, fine to medium with clay, light brown		X	X		8.1		
25		(SM) Silty Sand, fine to medium with clay, light brown		X	X	30/4"	11.0	122	Ring
		END OF BORING							
30		NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/22/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No.
04175-3

Enclosure
B-18

EXPLORATORY BORING NO. 20

Client: Albert A. Webb Associates

Date Drilled: 3/9/04

Location: Station 16+25

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1444.0/1436.6

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with medium and clay, light brown	Fill				9.3		
		(SM) Silty Sand, fine with medium, coarse and clay, light brown	Native	X	X	53/10"	7.8 8.8	128	Ring
5		(SM) Silty Sand, fine with medium, coarse and clay, light brown					10.7		
		(SM) Silty Sand, fine with medium, coarse and clay, light brown		X		30/4.5"	9.1	120	Ring
10		(ML) Sandy Silt, fine, light red brown					11.7		
		(ML) Sandy Silt, fine, light red brown		X		52/11.5"	12.0	124	Ring
15		(SP-SM) Sand, fine to medium with coarse and silt, red brown					10.7		
		(SP-SM) Sand, fine to medium with coarse and silt, red brown		X		36	3.1	111	Ring
20									
				X		46/10"	17.7	115	Ring
25		END OF BORING							
30		NO BEDROCK NO REFUSAL FILL TO 2.0' SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/22/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No.
04175-3

Enclosure
B-19

EXPLORATORY BORING NO. 21

Client: Albert A. Webb Associates

Date Drilled: 3/9/04

Location: Station 29+50

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1447.0/1438.7

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with clay, brown	Native	X	X		1.8		
		(SM) Silty Sand, fine, light brown		X	X	11	11.4	125	Ring
5		(SM) Silty Sand, fine, light brown		X	X	30/4"	12.7	116	Ring
		(SM) Silty Sand, fine with coarse and gravel to 1", light brown		X	X		8.3		
10		(SM) Silty Sand, fine with coarse and gravel to 1", light brown		X	X	50	10.0	117	Ring
		(SM) Silty Sand, fine, light brown		X	X		24.2		
15		(SM) Silty Sand, fine, light brown		X	X	46/11"	19.9	Dist.	Ring
		(SM) Silty Sand, fine, light brown		X	X		4.7		
20		(SM) Silty Sand, fine, light brown		X	X	30/5"	7.0	Dist.	Ring
		(ML) Silt, fine, light brown		X	X		16.3		
25		(ML) Silt, fine, light brown		X	X	53/9"	17.4	127	Ring
		END OF BORING							
30		NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/22/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No. Enclosure
04175-3 B-20

EXPLORATORY BORING NO. 22

Client: Albert A. Webb Associates

Date Drilled: 3/10/04

Location: Station 39+50

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1448.0/1441.2

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with medium and clay, light brown	Native				10.7		
5		(SM) Silty Sand, fine with medium, light brown		X	X	5	10.7	111	Ring
		(SM) Silty Sand, fine with medium, light brown			X		6.8		
10		(SP-SM) Sand, fine to medium with coarse and silt, light brown		X	X	30/6"	8.1	118	Ring
		(SP-SM) Sand, fine to medium with coarse and silt, light brown			X		7.8		
15		(ML) Sandy Silt, fine, light brown		X	X	54/10"	4.9	119	Ring
		(ML) Sandy Silt, fine, light brown			X		12.4		
20		(ML) Silt, fine, light brown		X	X	51/10.5"	14.4	111	Ring
		(ML) Silt, fine, light brown			X		25.8		
25		END OF BORING		X	X	40	20.3	105	Ring
30		NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CH.L.GDT 4/22/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No.
04175-3

Enclosure
B-21

EXPLORATORY BORING NO. 23

Client: Albert A. Webb Associates

Date Drilled: 3/5/04

Location: Station 202+50

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1449.0/1437.8

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with medium, coarse and clay, light brown	Native				8.1		
		(SM) Silty Sand, fine to medium, light brown				30/5.5"	9.5	125	Ring
5							6.8		MDC, SA
		(SM) Silty Sand, fine with medium and coarse, light brown				30/6"	8.0	Dist.	Ring, DS
10							7.3		
		(ML) Silt, fine, light brown				30/6"	7.4	127	Ring
15							16.6		
						49	16.1	115	Ring
20							18.5	Dist.	Ring
							16.7	113	Ring
25						42			
		END OF BORING							
30		NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No.
04175-3

Enclosure
B-22

EXPLORATORY BORING NO. 24

Client: Albert A. Webb Associates

Date Drilled: 3/15/04

Location: Station 209+50

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1452.0/1442.0

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine, brown	Fill				12.9		
5	[Diagonal Hatching]	(SC) Clayey Sand, fine to medium with coarse, brown	Native	[X]	[Diagonal Hatching]	16	6.1 12.4	130	Ring
		(SM) Silty Sand, fine to medium with coarse and clay, brown			[Diagonal Hatching]		7.1		
10				[X]		22	8.9	122	Ring
	[Diagonal Hatching]	(SC) Clayey Sand, fine to medium with coarse, light brown		[X]	[Diagonal Hatching]	55/11"	7.5 8.2	131	Ring
15		(SM) Silty Sand, fine with medium, coarse and clay, light brown			[Diagonal Hatching]		13.6		
				[X]		30/5"	13.5	Dist.	Ring
20									
				[X]		30/5.5"	14.7	Dist.	Ring
25		END OF BORING							
30		NO BEDROCK NO REFUSAL FILL TO 3.0' SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/22/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No.
04175-3

Enclosure
B-23

EXPLORATORY BORING NO. 25

Client: Albert A. Webb Associates

Date Drilled: 3/15/04

Location: Station 211+65

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1452.0/1443.2

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with medium, light brown	Fill				16.4		
		(SC) Clayey Sand, fine with medium, brown	Native				14.6		
5		(SM) Silty Sand, fine with medium, light brown		X	X	59/11"	12.9 11.5	118	Ring
		(SM) Silty Sand, fine to medium with coarse and clay, light brown		X	X	30/5"	10.2		
10		(SM) Silty Sand, fine with medium and coarse, light brown		X	X	30/4"	7.4	128	Ring
15		(ML) Sandy Silt, fine with medium, light brown		X	X	30/5"	10.5		
				X	X	30/4"	9.9	Dist.	Ring
20				X	X	30/5"	10.5		
				X	X	30/5"	11.5	118	Ring
25				X	X	30/6"	9.4	115	Ring
		END OF BORING							
30		NO BEDROCK NO REFUSAL FILL TO 2.0' SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/22/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No.
04175-3

Enclosure
B-24

EXPLORATORY BORING NO. 26

Client: Albert A. Webb Associates

Date Drilled: 3/5/04

Location: Station 230+00

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1465.0/1453.9

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Clayey Sand, fine, brown	Native		X		13.5		
5		(SM) Silty Sand, fine to medium with coarse, light brown		X		19	16.2	103	Ring
		(SM) Silty Sand, fine to medium with coarse, light brown			X		9.1		MDC
10		(SM) Silty Sand, fine, light brown		X		42	4.2	123	Ring
		(SM) Silty Sand, fine, light brown			X		10.4	130	Ring
15		(SM) Silty Sand, fine with medium and coarse, light brown			X	56	10.4	130	Ring
		(SM) Silty Sand, fine with medium and coarse, light brown			X		15.9		
20		(SM) Silty Sand, fine to medium with coarse, light brown		X		40	10.3	128	Ring
		(SM) Silty Sand, fine to medium with coarse, light brown			X		4.8		
25		END OF BORING		X		40	5.0	123	Ring
30		NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/22/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No.
04175-3

Enclosure
B-25

EXPLORATORY BORING NO. 27

Client: Albert A. Webb Associates

Date Drilled: 3/5/04

Location: Station 245+50

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1478.0±/1470.9

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine to medium with coarse and clay, light brown	Native				12.7		
		(SM) Silty Sand, fine with medium, light brown		X	X	14	11.8	122	Ring
5		(SM) Silty Sand, fine, light brown		X	X	30	13.0	123	Ring
10		(SM) Silty Sand, fine with medium and coarse, light brown		X	X	30/3"	10.2	130	Ring
15		(SM) Silty Sand, fine with medium and coarse, light brown		X	X	50	9.3	118	Ring
20		(SM) Silty Sand, fine with medium and coarse, light brown		X	X	30/9"	8.2	130	Ring
25		(SM) Silty Sand, fine with medium and coarse, light brown		X	X	34	7.5	110	Ring
		END OF BORING							
30		NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No. 04175-3
Enclosure B-26

EXPLORATORY BORING NO. 28

Client: Albert A. Webb Associates

Date Drilled: 3/5/04

Location: Station 256+90

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1490.0±/1480.9 Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with medium and coarse, light brown	Native				4.8		MDC, SA
5				X		56	4.9	106	Ring
10				X		25	8.8	115	Ring
		(SC) Clayey Sand, fine with medium and silt, light brown					15.2		
15				X		37	12.0	127	Ring
		(SM) Silty Sand, fine with medium and clay, light brown					11.8		
20				X		30/5"	11.6	124	Ring
		(SM) Silty Sand, fine to medium with coarse and gravel to 1", red brown					4.2		
25				X		30/6"	5.0	Dist.	Ring
30		END OF BORING NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No. Enclosure
04175-3 B-27

EXPLORATORY BORING NO. 29

Client: Albert A. Webb Associates

Date Drilled: 3/5/04

Location: Station 270+00

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1501.6±/1488.2 Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SC) Clayey Sand, fine with medium, coarse and silt, brown	Native				12.4		
5		(SM) Silty Sand, fine to medium with coarse and clay, light brown				13	13.2	123	Ring
10		(SM) Silty Sand, fine with medium and clay, light brown				5	8.6	110	Ring
15		(SM) Silty Sand, fine with medium and clay, light brown				35	14.2	123	Ring
20		(ML) Sandy Silt, fine with calcium carbonate nodules, light brown				41	10.9	131	Ring
25		(SM) Silty Sand, fine to medium with coarse and clay, light red brown				29	15.7	117	Ring
30		END OF BORING				35	7.4	119	Ring
		NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No. Enclosure
04175-3 B-28

EXPLORATORY BORING NO. 30

Client: Albert A. Webb Associates

Date Drilled: 3/5/04

Location: Station 282+00

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1515.0±/1494.0

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with medium, coarse and clay, brown	Native				9.4		
5		(SM) Silty Sand, fine to medium with coarse, brown		X		9	8.2 6.1	125	Ring
		(SW-SM) Sand, fine to coarse with silt and gravel to 3/8", light brown					3.9		MDC, SA
10		(ML) Sandy Silt, fine with medium, light brown		X		11	2.8	109	Ring
15				X		29	11.1	115	Ring
20		(SP-SM) Sand, fine to medium with coarse, silt and gravel to 1/2", light brown		X		23	18.9	111	Ring
							3.7		
25		END OF BORING		X		34	6.1	120	Ring
30		NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN_04175-3.GPJ CHJLGD 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No.
04175-3

Enclosure
B-29

EXPLORATORY BORING NO. 31

Client: Albert A. Webb Associates

Date Drilled: 3/9/04

Location: Station 11+50

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1521.0±/1501.3

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with medium and coarse, brown	Native				6.8		
				X		18	5.9	118	Ring
5		(SM) Silty Sand, fine with medium, coarse and clay, light brown					7.6		
				X		52	11.3	128	Ring
10		(SM) Silty Sand, fine to medium and coarse and clay, light brown					11.3		DS, PI, SA
				X		44	8.3	132	Ring
15				X		20	9.5	118	Ring
20				X		26	6.9	117	Ring
25		(SM) Silty Sand, fine to medium with coarse and clay, red brown					8.7		
				X		30/3"	8.8	Dist.	Ring
30		END OF BORING NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No.
04175-3

Enclosure
B-30

EXPLORATORY BORING NO. 32

Client: Albert A. Webb Associates

Date Drilled: 3/9/04

Location: Briggs Basin

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): unknown

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with medium and coarse, brown	Native				7.8		
5		(SM) Silty Sand, fine with medium and coarse, brown		X		13	6.5	105	Ring
		(SM) Silty Sand, fine with medium and coarse, brown					6.6		
10		(SM) Silty Sand, fine to medium with coarse and clay, light brown		X		8	8.3	108	Ring
		(SM) Silty Sand, fine to medium with coarse and clay, light brown					5.8		
15		(SM) Silty Sand, fine with medium and coarse, light brown		X		49	6.3	132	Ring
		(SM) Silty Sand, fine with medium and coarse, light brown					7.6		
20				X		55/10"	8.3	126	Ring
							7.6		
25				X		28	9.3	111	Ring
							7.6		
30		END OF BORING							
		NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No. Enclosure
04175-3 B-31

EXPLORATORY BORING NO. 33

Client: Albert A. Webb Associates

Date Drilled: 3/5/04

Location: Briggs Basin

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): unknown

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine to medium with coarse, light brown	Native				7.1		
5				X	X	21	5.8	127	Ring
		(SP-SM) Sand, fine to medium with coarse, silt and gravel to 1/2", light brown		X	X	37	5.4 3.9	130	Ring
10		(ML) Sandy Silt, fine, brown		X	X	7	8.7 12.3	108	Ring
		(SM) Silty Sand, fine, light brown		X	X	26	3.9 12.2	106	Ring
15				X	X	32	6.3 6.2	125	Ring
20		(SM) Silty Sand, fine to medium with coarse and clay, red brown		X	X	50	6.4 5.6	134	Ring
25		(SM) Silty Sand, fine to medium with coarse and clay, light brown		X	X				
		END OF BORING							
30		NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CH.J.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No. Enclosure
04175-3 B-32

EXPLORATORY BORING NO. 34

Client: Albert A. Webb Associates

Date Drilled: 3/5/04

Location: Briggs Basin

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): unknown

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with medium and coarse, light brown	Native				4.8		
5		(SM) Silty Sand, fine to medium with coarse and gravel to 3/8", light brown				22	6.5	113	Ring
		(SP) Sand, fine to medium with coarse and gravel to 1/2", light brown				8	2.3	107	Ring
10		(SM) Silty Sand, fine to medium with coarse, clay and gravel to 3/4", light brown				27	2.9	126	Ring
15		(SP) Sand, fine to medium with coarse, light red brown				25	1.5	111	Ring
20						55/10.5"	6.6	132	Ring
25		END OF BORING							
30		NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No. 04175-3 Enclosure B-33

EXPLORATORY BORING NO. 35

Client: Albert A. Webb Associates

Date Drilled: 3/9/04

Location: Station 27+50

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1523.5±/1514.0

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with medium and coarse, light brown	Native		XXXX		4.4		
5						30/3"	5.6	124	Ring
					XXXX		5.8		
10				XXXX		26	7.6	119	Ring
		(SM) Silty Sand, fine to medium with coarse, light brown			XXXX		7.6		
15						30/3"	9.6	125	Ring
20				XXXX		46	5.3	120	Ring
25				XXXX		49	6.9	132	Ring
		END OF BORING							
30		NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No. Enclosure
04175-3 B-34

EXPLORATORY BORING NO. 36

Client: Albert A. Webb Associates

Date Drilled: 3/9/04

Location: Station 38+00

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1540.0±/1531.0

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with medium, coarse and gravel to 3/8", brown	Fill				8.4		
5		(SM) Silty Sand, fine with medium, coarse and clay, light brown	Native				11.3		
10		(SM) Silty Sand, fine with medium, coarse and clay, light brown		X		23	8.2	123	Ring
15		(SM) Silty and, fine with medium and coarse, orange brown		X		24	11.0	127	Ring
20				X		30/4"	9.5	127	Ring
25				X		43	8.0	123	Ring
30		END OF BORING NO BEDROCK NO REFUSAL FILL TO 3.0' SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/28/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No.
04175-3

Enclosure
B-35

EXPLORATORY BORING NO. 37

Client: Albert A. Webb Associates

Date Drilled: 3/4/04

Location: Station 64+50

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1584.0±/1575.0 Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine to medium with coarse, clay and gravel to 1/2", brown	Fill	X	X		9.9		
		(SM) Silty Sand, fine to coarse, brown	Native	X	X	21	4.7	124	Ring
5		(SM) Silty Sand, fine to medium with coarse, clay and gravel to 1/2", brown		X	X	7	5.5	116	Ring
		(SM) Silty Sand, fine to medium with coarse, clay and gravel to 1/2", brown		X	X		9.7		
10		(SM) Silty Sand, fine with medium, coarse and clay, light brown		X	X	31	9.1	124	Ring
				X	X		9.1		
15				X	X	22	8.4	128	Ring
				X	X		9.7		
20				X	X	50	9.7	132	Ring
				X	X		8.2		
25				X	X	44	8.2	130	Ring
		END OF BORING							
30		NO BEDROCK NO REFUSAL FILL TO 4.0' SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No. Enclosure
04175-3 B-36

EXPLORATORY BORING NO 38

Client: Albert A. Webb Associates

Date Drilled: 3/4/04

Location: Station 77+80

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1617.0±/1606.0

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with medium, coarse and gravel to 3/8", light brown	Native		XXXX		4.8		
5				X		13	3.9	116	Ring
		(SM) Silty Sand, fine to medium with coarse, clay and gravel to 3/8", light brown			XXXX		8.1		
10				X		38	10.0	130	Ring
15				X		42	5.5	128	Ring
20		(SM) Silty Sand, fine to medium with coarse, light brown			XXXX		4.8		
25				X		47	2.1	123	Ring
30		END OF BORING NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No. 04175-3 Enclosure B-37

EXPLORATORY BORING NO. 39

Client: Albert A. Webb Associates

Date Drilled: 3/4/04

Location: Station 90+00

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1631.0±1626.5

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with medium, coarse and gravel to 3/8", light brown	Native				4.8		
5				X		13	3.3	116	Ring
10		(SM) Silty Sand, fine with medium and clay, light brown			X	30/5"	7.3 6.3	123	Ring
15		(SM) Weathered Granitic Bedrock recovered as Silty Sand, fine to medium with coarse, clay and gravel to 3/8", light brown	Bedrock	X	X	30/6"	5.9 6.4	127	Ring
20				X		30/5"	5.7	118	Ring
25		END OF BORING							
30		BEDROCK AT 15.5' NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CH1.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No. Enclosure
04175-3 B-38

EXPLORATORY BORING NO. 40

Client: Albert A. Webb Associates

Date Drilled: 3/4/04

Location: Station 104+00

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1668.0±/1653.0

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine to medium with coarse and gravel to 1/2", light brown	Fill				3.4		
5		(SM) Silty Sand, fine with medium and coarse, light brown	Native				4.6		
		(SM) Weathered Granitic Bedrock recovered as Silty Sand, fine to medium with coarse and gravel to 3/8", light gray brown	Bedrock				1.8		
						30/2"	6.9	Dist.	Ring
10									
						30/1"	N.R.	N.R.	Ring
15									
20									
25		END OF BORING							
30		BEDROCK AT 6.0' NO REFUSAL FILL O 5.0' SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No.
04175-3

Enclosure
B-39

EXPLORATORY BORING NO. 41

Client: Albert A. Webb Associates

Date Drilled: 3/3/04

Location: Station 116+00

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1695.0±/1684.0

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine to medium with coarse, light brown	Native				3.9		SA
5				X		53/11"	3.8	130	Ring
10		(SP-SM) Sand, fine to medium with coarse, silt and gravel to 1/2", light brown			X	28	2.4	122	Ring
15		(SW-SM) Weathered Granitic Bedrock Recovered as Sand, fine to medium with silt and gravel to 1", light brown	Bedrock		X	30/5.15"	2.7	124	Ring
20					X	30/4"	5.7	Dist.	Ring
25		END OF BORING							
30		BEDROCK AT 14.0' NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CH.L.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No.
04175-3

Enclosure
B-40

EXPLORATORY BORING NO. 42

Client: Albert A. Webb Associates

Date Drilled: 3/3/04

Location: Juniper Flats Basin

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): unknown

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine to medium with coarse and gravel to 1/2", brown	Native				5.3		
5		(SM) Silty Sand, fine to medium with coarse and clay, red brown		X	X	7	2.1	108	Ring
		(SM) Silty Sand, fine to medium with coarse and clay, red brown					5.8		
		(SM) Silty Sand, fine to medium with coarse and clay, red brown		X	X	32	7.0	135	Ring
10		(SM) Weathered Granitic Bedrock Recovered as Silty Sand, fine to coarse with clay, gray brown	Bedrock		X		4.1		
		(SM) Weathered Granitic Bedrock Recovered as Silty Sand, fine to coarse with clay, gray brown		X	X	30/3"	1.0	Dist.	Ring
15									
				X	X	30/2.5"	1.3	Dist.	Ring
20									
25		END OF BORING							
		BEDROCK AT 10.0' NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							
30									

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No. Enclosure
04175-3 B-41

EXPLORATORY BORING NO. 43

Client: Albert A. Webb Associates

Date Drilled: 3/3/04

Location: Juniper Flats Basin

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): unknown

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine to medium with coarse and gravel to 3/8", brown	Native				6.8		
5				X		7	3.0	111	Ring
				X		6	3.8	112	Ring
10		(SW-SM) Sand, fine to coarse with silt, brown					3.2		
				X		8	2.6	108	Ring
15		(ML) Sandy Silt, fine, light brown					17.9		
				X		12	9.4	120	Ring
		(SM) Silty Sand, fine to medium with coarse, clay and gravel to 2 1/2", gray brown					14.4		
20				X		53/11"	12.5	120	Ring
25		(SW-SM) Weathered Granitic Bedrock recovered as Sand, fine to coarse with gravel to 3/8", light gray brown	Bedrock				2.4		
				X		30/4"	4.9	Dist.	Ring
		END OF BORING							
30		BEDROCK AT 23.0' NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No. Enclosure
04175-3 B-42

EXPLORATORY BORING NO. 44

Client: Albert A. Webb Associates

Date Drilled: 3/3/04

Location: Juniper Flats Basin

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): unknown

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
5		(SM) Silty Sand, fine with medium, coarse and gravel to 3/8", light brown	Native				3.4		
						10	2.0	110	Ring
10		(SM) Silty Sand, fine with medium, coarse and gravel to 3/8", red brown					4.1		
						30/4"	4.3	Dist.	Ring
15		(SM) Silty Sand, fine to medium with coarse and gravel to 1/2", light brown					3.2		
						26	3.0	116	Ring
20		(SM) Silty Sand, fine to medium with coarse and gravel to 1/2", light brown					3.2		
						31	2.7	118	Ring
25		(SM) Silty Sand, fine with medium, coarse and clay, light brown					6.0		
						23	6.0	116	Ring
30		END OF BORING							
		NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No. Enclosure
04175-3 B-43

EXPLORATORY BORING NO. 45

Client: Albert A. Webb Associates

Date Drilled: 3/3/04

Location: Juniper Flats Basin

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): unknown

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with medium, coarse and gravel to 3/8", light brown	Native	X	X		6.3		
		(SP) Sand, fine to medium with coarse and gravel to 1/2", light brown		X	X	10	2.2	112	Ring
5		(SM) Silty Sand, fine with medium and coarse, red brown		X	X	7	1.9	113	Ring
10		(SP-SM) Weathered Granitic Bedrock recovered as Sand, fine to medium with coarse, silt and gravel to 1/2", light gray brown	Bedrock	X	X	8	6.0	112	Ring
15				X	X	30/6"	2.8	115	Ring
20				X	X	30/6"	2.2	119	Ring
25		END OF BORING							
30		BEDROCK AT 13.0' NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No. Enclosure
04175-3 B-44

EXPLORATORY BORING NO. 47

Client: Albert A. Webb Associates

Date Drilled: 3/5/04

Location: Station 20+25

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1459.4±/1449.6

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with medium, coarse and clay, brown	Fill				9.4		
5		(SM) Silty Sand, fine to medium with coarse, clay and gravel to 3/8", light brown	Native			26	5.0	136	Ring
10		(ML) Sandy Clayey Silt, fine with medium and coarse, light brown				34	15.6	114	Ring
15		(ML) Sandy Silt, fine with clay, light brown				37	15.9	118	Ring
20		(SM) Silty Sand, fine with medium and coarse, light brown				30/5"	5.9	Dist.	Ring
25		(ML) Sandy Silt, fine, light brown				30/6"	10.3	127	Ring
		END OF BORING							
30		NO BEDROCK NO REFUSAL FILL TO 4.0' SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No.
04175-3

Enclosure
B-45

EXPLORATORY BORING NO. 48

Client: Albert A. Webb Associates

Date Drilled: 3/4/04

Location: Station 38+00

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1472.4±/14466.0 Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
5		(SM) Silty Sand, fine to medium with coarse, light brown	Native		X		4.6		DS, MDC, SA
10		(SM) Silty Sand, fine to medium with coarse and gravel to 3/8", light brown		X	X	11	7.2	117	Ring, Consol.
15		(SM) Silty Sand, fine to medium with coarse, clay and gravel to 3/4", light brown		X	X	47	10.9	129	Ring
20		(SM) Silty Sand, fine, light brown		X	X	35	9.3	129	Ring
25		(SM) Silty Sand, fine, light brown		X	X	26	8.3	119	Ring
30		END OF BORING							
		NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No. Enclosure
04175-3 B-46

EXPLORATORY BORING NO. 49

Client: Albert A. Webb Associates

Date Drilled: 3/4/04

Location: Station 49+25

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1480.8±/1473.5 Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with medium, coarse and clay, brown	Native	X	X		7.6		
		(SM) Silty Sand, fine with medium and coarse, light brown		X	X	30	5.2	126	Ring
5		(SM) Silty Sand, fine with medium and coarse, light brown		X	X	36	7.6	129	Ring
		(SM) Silty Sand, fine with medium and clay, light brown		X	X		10.7		
10		(SM) Silty Sand, fine with medium and clay, light brown		X	X	39	15.1	121	Ring
		(SM) Silty Sand, fine to medium with coarse and clay, light brown		X	X		7.8		
15		(SM) Silty Sand, fine to medium with coarse and clay, light brown		X	X	30/5.5"	12.1	116	Ring
		(SM) Silty Sand, fine to medium with coarse, light brown		X	X		7.1		
20		(SM) Silty Sand, fine to medium with coarse, light brown		X	X	48	5.7	119	Ring
		(SP) Sand, fine to medium with coarse, light brown		X	X		2.5		
25		(SP) Sand, fine to medium with coarse, light brown		X	X	52/11"	3.7	115	Ring
		END OF BORING							
30		NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJLGD.T 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No.
04175-3

Enclosure
B-47

EXPLORATORY BORING NO. 50

Client: Albert A. Webb Associates

Date Drilled: 3/4/04

Location: Station 64+35

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1491.0±/1483.8

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
5		(SM) Silty Sand, fine to medium with coarse and clay, brown	Native		X		8.1		
10		(SM) Silty Sand, fine to medium with coarse and gravel to 3/8", light brown		X		23	3.3	119	Ring
15		(SM) Silty Sand, fine with medium, light brown		X		30/4"	8.3	Dist.	Ring
20				X		49	8.4	124	Ring
25		END OF BORING		X		46/11.5"	8.0	Dist.	Ring
30		NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER							

BORING LOG - WEBB ASSOC. ADP STORM DRAIN_04175-3.GPJ CHJ.GDT 4/26/04



HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No. Enclosure
04175-3 B-48

EXPLORATORY BORING NO. 51

Client: Albert A. Webb Associates

Date Drilled: 3/4/04

Location: Station 90+30

Equipment / Driving Wt./Drop: CME 55 Drill Rig/140 lbs/30 in

Surface/Flow Line Elevation(ft): 1516.0±/1509.5

Logged by: S.H.

Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES		BLOWS/FOOT (Equiv. SPT)	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
				DRIVE	BULK				
		(SM) Silty Sand, fine with medium and coarse, light brown	Native				7.1		
5		(SM) Silty Sand, fine to medium with coarse and clay, light brown		X	X	34	8.3	125	Ring
10				X	X	22	8.5	122	Ring
15		(SM) Silty Sand, fine with medium and coarse, light brown		X	X	30/5"	6.4 7.3	Dist.	Ring
20				X	X	30/3"	6.7	130	Ring
25		END OF BORING		X	X		8.1		
30		NO BEDROCK NO REFUSAL NO FILL SLIGHT CAVING NO FREE GROUNDWATER		X	X	31	10.3	120	Ring

BORING LOG - WEBB ASSOC. ADP STORM DRAIN 04175-3.GPJ CHJ.GDT 4/26/04

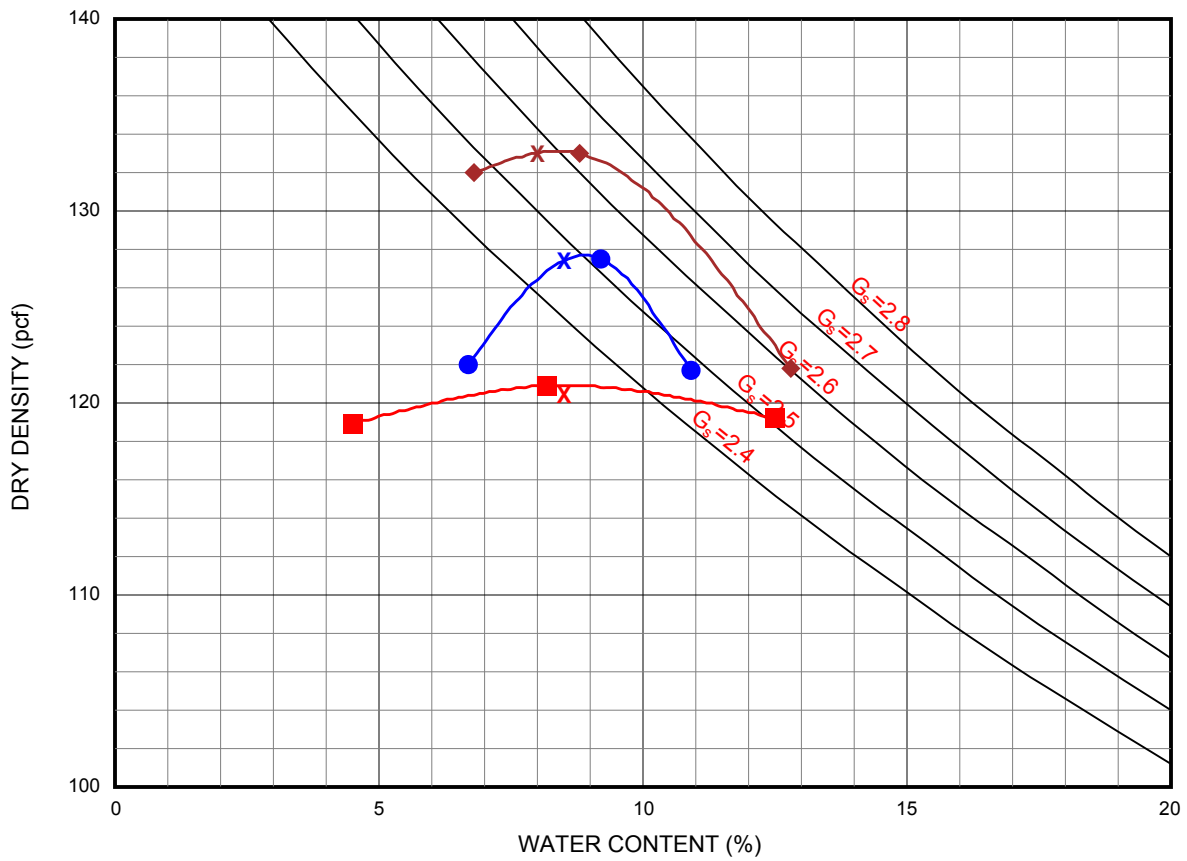


HOMELAND/ROMOLAND ADP PHASE I
RIVERSIDE COUNTY, CALIFORNIA

Job No. 04175-3 Enclosure B-49

APPENDIX "C"

LABORATORY TESTING—CURRENT INVESTIGATION



	Boring No.	Depth (ft)	USCS Classification	γ_{dmax} (pcf)	w_o (%)
●	1*	4	(SP-SM) Sand, fine to medium with coarse, with silt, brown	127.5	8.5
■	2*	4	(SM) Silty sand, fine to medium with coarse, dark brown	120.5	8.5
◆	3	12	(ML) Sandy Silt, fine with medium, few clay, dark yellow brown	133.0	8.0

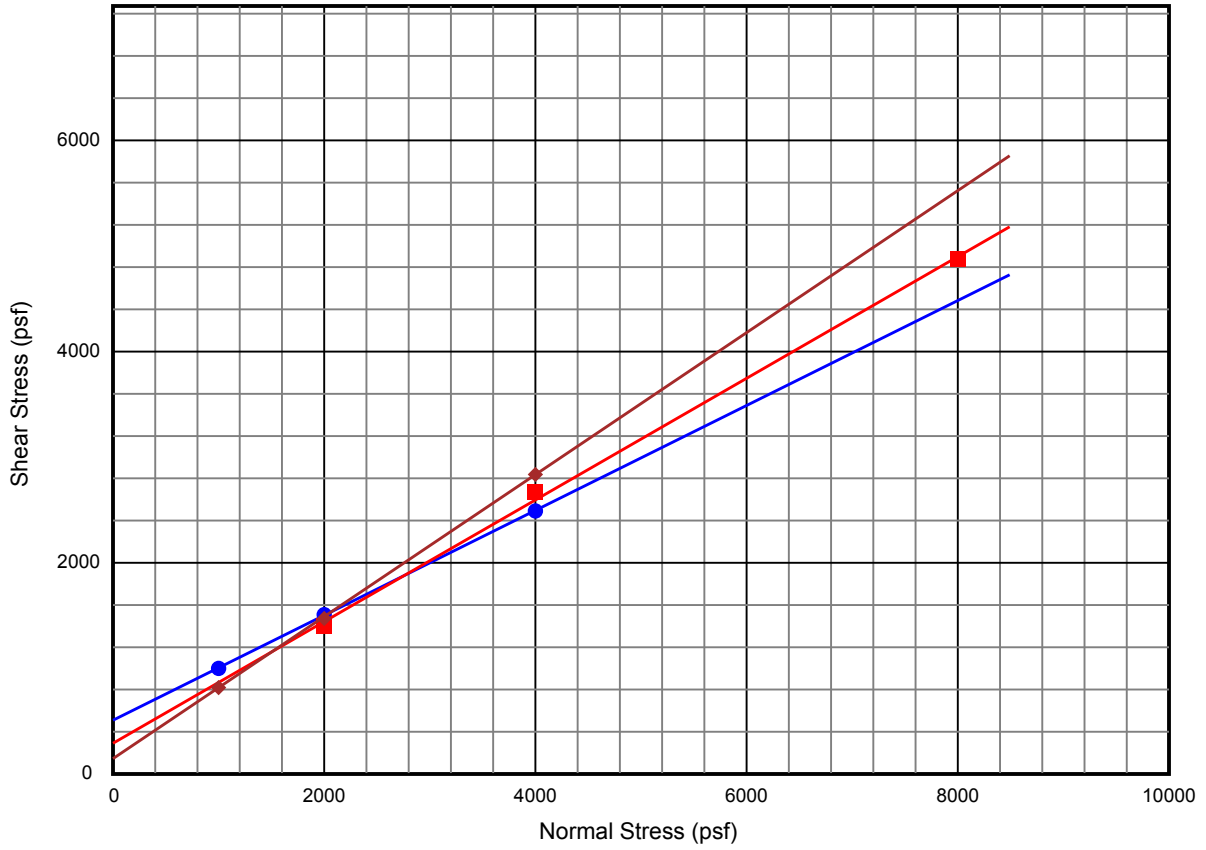
* Caltrans Right-of-Way

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COMPACTION CURVES (ASTM D1557)

Project:	Romoland MDP Line A, Stage 4				
Location:	Riverside County, California				
Job Number:	14311-3	Engineer:	MNoorzay	Enclosure:	C-2



	Boring No.	Depth (ft)	γ_d (pcf)	w (%)	C_{pk} (psf)	ϕ_{pk} (°)	C_{rs} (psf)	ϕ_{rs} (°)
●	1*	25	112.0	8.4	468.2	29.9	515.0	26.4
(SM) Silty Sand, fine to coarse, dark brown / Undisturbed								
■	1*	40	122.0	9.8	693.6	27.5	286.0	30.0
(SM) Silty Sand, fine to coarse, dark brown / Undisturbed								
◆	3	15	116.0	15.1	0.0	43.9	137.6	34.0
(ML) Sandy Silt, fine with medium, few clay, dark yellow brown / Undisturbed								

* Caltrans Right-of-Way

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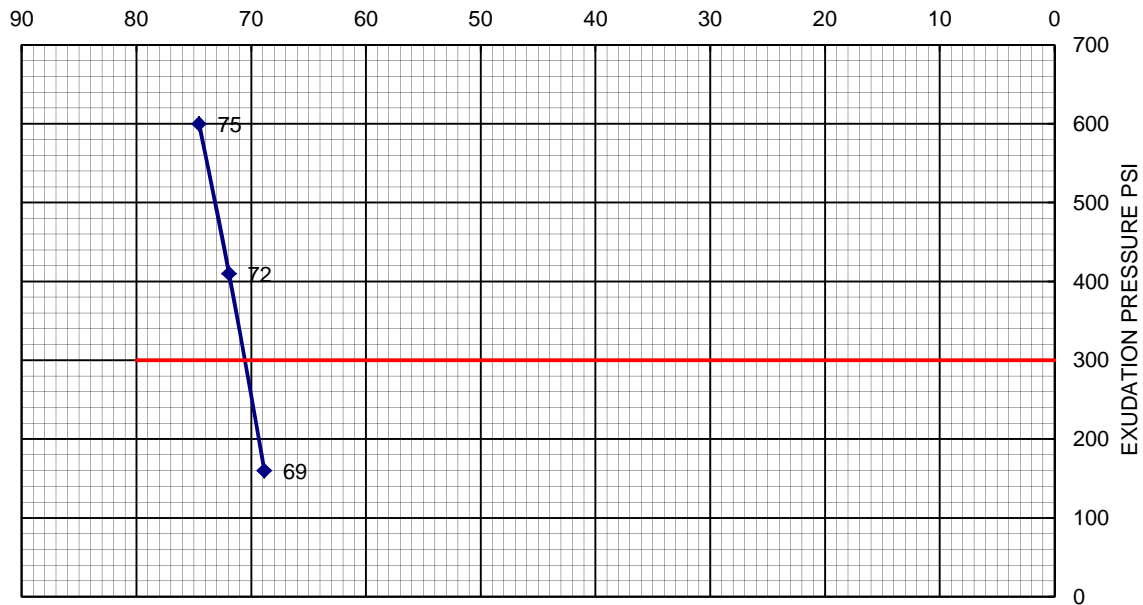


DIRECT SHEAR TESTS (ASTM D3080)

Project:	Romoland MDP Line A, Stage 4		
Location:	Riverside County, California		
Job Number:	14311-3	Engineer:	MNoorzay
Enclosure:	C-3		

Traffic Index (T.I.)	5.0	A	B	C	D
COMPACTOR AIR PRESSURE P.S.I.		350	350	350	
INITIAL MOISTURE %		6.8	6.8	6.8	
WATER ADDED, ML		30	25	15	
WATER ADDED %		2.9	2.4	1.4	
MOISTURE AT COMPACTION %		9.7	9.2	8.2	
HEIGHT OF BRIQUETTE		2.49	2.48	2.53	
WET WEIGHT OF BRIQUETTE		1100	1092	1112	
DENSITY LB. PER CU.FT.		122.0	122.1	123.0	
STABILOMETER PH AT 1000 LBS.		19	18	16	
2000 LBS.		30	28	26	
DISPLACEMENT		4.90	4.60	4.40	
R-VALUE		69	72	75	
EXUDATION PRESSURE		160	410	600	
THICK. INDICATED BY STAB.		0.50	0.45	0.41	
EXPANSION PRESSURE		0	0	0	
THICK. INDICATED BY E.P.		0.00	0.00	0.00	

EXUDATION CHART
R-VALUE



R-Value: 70

Sample No.	Depth (ft)	Soil/Sample Type	SE	w _o (%)
1A*	4	(SP-SM) Sand, fine to medium with coarse, with silt, brown	-	6.8

* Caltrans Right-of-Way



CHJ Consultants

R-VALUE TEST

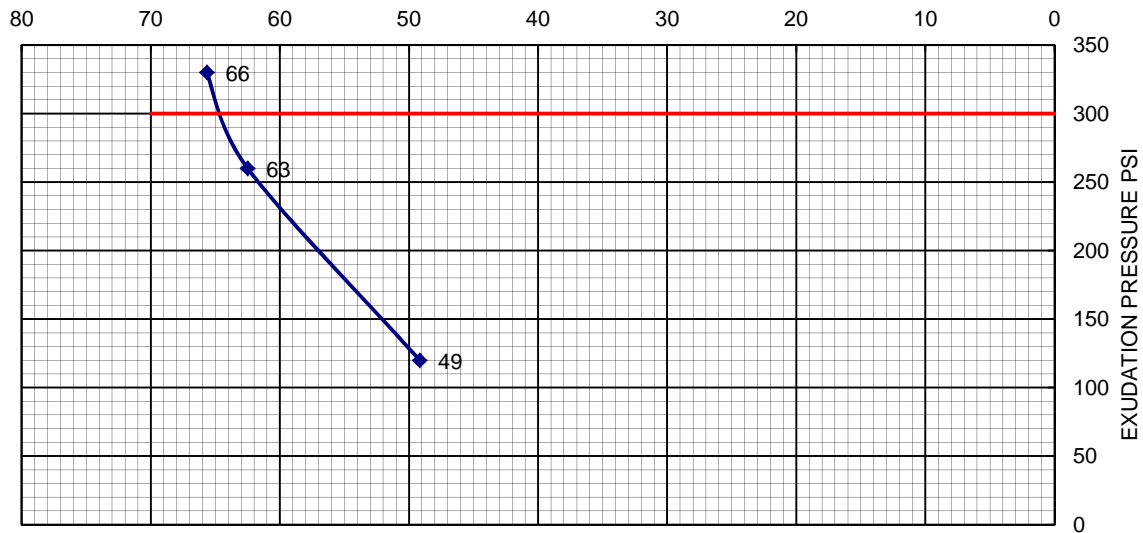
Project: Romoland MDP Line A, Stage 4

Location: Riverside County, California

Job No.: 14311-3 Enclosure: C-4

Traffic Index (T.I.)	5.0	A	B	C	D
COMPACTOR AIR PRESSURE P.S.I.	100	200	300		
INITIAL MOISTURE %	8.1	8.1	8.1		
WATER ADDED, ML	25	15	5		
WATER ADDED %	2.4	1.4	0.5		
MOISTURE AT COMPACTION %	10.5	9.5	8.6		
HEIGHT OF BRIQUETTE	2.45	2.47	2.48		
WET WEIGHT OF BRIQUETTE	1114	1134	1135		
DENSITY LB. PER CU.FT.	124.7	127.0	127.7		
STABILOMETER PH AT 1000 LBS.	30	25	22		
2000 LBS.	56	40	38		
DISPLACEMENT	4.80	4.50	4.20		
R-VALUE	49	63	66		
EXUDATION PRESSURE	120	260	330		
THICK. INDICATED BY STAB.	0.81	0.60	0.55		
EXPANSION PRESSURE	0	0	0		
THICK. INDICATED BY E.P.	0.00	0.00	0.00		

EXUDATION CHART
R-VALUE



R-Value: 64

Sample No.	Depth (ft)	Soil/Sample Type	SE	w _o (%)
2A*	4	(SM) Silty sand, fine to medium with coarse, dark brown	-	8.1

* Caltrans Right-of-Way

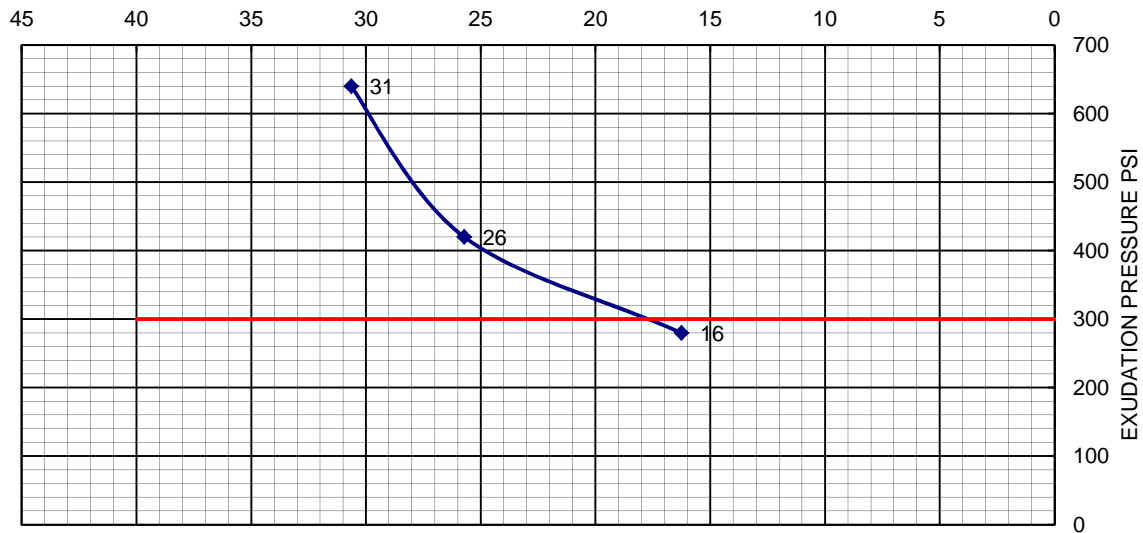


R-VALUE TEST

Project:	Romoland MDP Line A, Stage 4		
Location:	Riverside County, California		
Job No.:	14311-3	Enclosure:	C-5

Traffic Index (T.I.)	5.0	A	B	C	D
COMPACTOR AIR PRESSURE P.S.I.		100	100	300	
INITIAL MOISTURE %		7.6	7.6	7.6	
WATER ADDED, ML		35	25	20	
WATER ADDED %		3.3	2.4	1.9	
MOISTURE AT COMPACTION %		10.9	10.0	9.5	
HEIGHT OF BRIQUETTE		2.48	2.47	2.46	
WET WEIGHT OF BRIQUETTE		1136	1133	1134	
DENSITY LB. PER CU.FT.		125.1	126.4	127.6	
STABILOMETER PH AT 1000 LBS.		48	43	40	
2000 LBS.		108	93	90	
DISPLACEMENT		6.20	5.20	4.40	
R-VALUE		16	26	31	
EXUDATION PRESSURE		280	420	640	
THICK. INDICATED BY STAB.		1.34	1.19	1.11	
EXPANSION PRESSURE		10	21	29	
THICK. INDICATED BY E.P.		0.33	0.70	0.97	

EXUDATION CHART
R-VALUE



R-Value: 17

Sample No.	Depth (ft)	Soil/Sample Type	SE	w _o (%)
3A	0	(CL) Sandy Clay, fine, with silt, dark yellow brown	-	7.6



R-VALUE TEST

Project: Romoland MDP Line A, Stage 4

Location: Riverside County, California

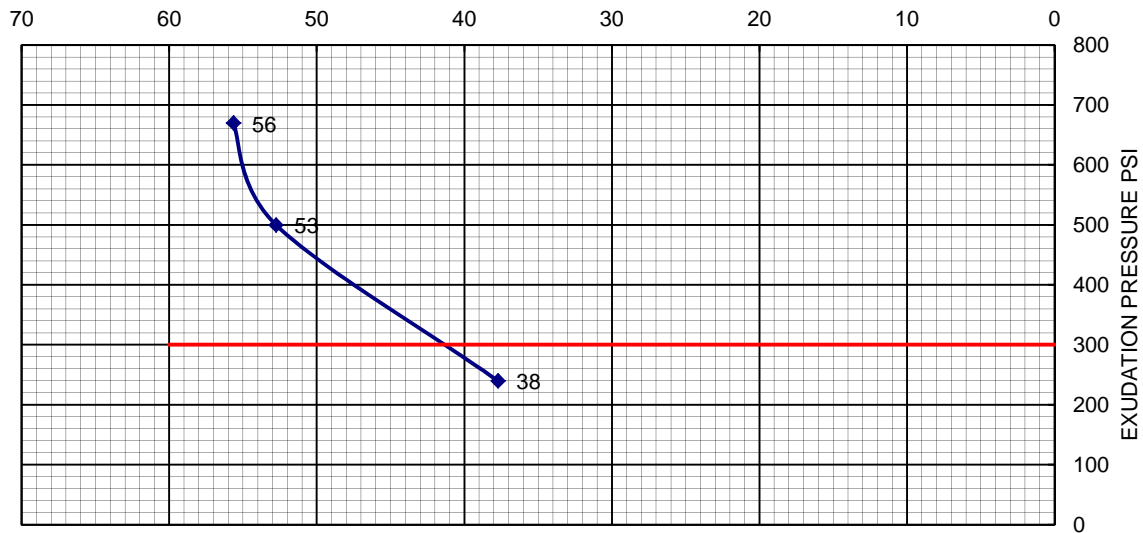
Job No.: 14311-3

Enclosure:

C-6

Traffic Index (T.I.)	5.0	A	B	C	D
COMPACTOR AIR PRESSURE P.S.I.	350	350	350	350	
INITIAL MOISTURE %	3.4	3.4	3.4	3.4	
WATER ADDED, ML	90	80	70		
WATER ADDED %	8.4	7.5	6.4		
MOISTURE AT COMPACTION %	11.8	10.9	9.8		
HEIGHT OF BRIQUETTE	2.50	2.50	2.55		
WET WEIGHT OF BRIQUETTE	1102	1104	1126		
DENSITY LB. PER CU.FT.	119.4	120.7	121.8		
STABILOMETER PH AT 1000 LBS.	30	23	22		
2000 LBS.	61	44	42		
DISPLACEMENT	6.70	5.90	5.60		
R-VALUE	38	53	56		
EXUDATION PRESSURE	240	500	670		
THICK. INDICATED BY STAB.	1.00	0.76	0.71		
EXPANSION PRESSURE	5	16	22		
THICK. INDICATED BY E.P.	0.17	0.53	0.73		

EXUDATION CHART
R-VALUE



R-Value: 42

Sample No.	Depth (ft)	Soil/Sample Type	SE	w _o (%)
4A	0	(ML) Sandy Silt, fine, light brown	-	3.4



R-VALUE TEST

Project: Romoland MDP Line A, Stage 4

Location: Riverside County, California

Job No.: 14311-3

Enclosure:

C-7

**Table 1 - Laboratory Tests on Soil Samples**

C.H.J. Consultants
Romoland
Your #14311-3, HDR Lab #14-0600LAB
13-Aug-14

Sample ID			1C*	2B*	3A	4A
Resistivity						
	Units					
as-received	ohm-cm		11,600	8,400	10,800	60,000
saturated	ohm-cm		3,800	2,800	2,500	1,560
pH			7.6	7.6	6.7	6.8
Electrical						
Conductivity	mS/cm		0.04	0.04	0.06	0.15
Chemical Analyses						
Cations						
calcium	Ca ²⁺	mg/kg	19	17	32	71
magnesium	Mg ²⁺	mg/kg	2.6	3.0	6.2	16
sodium	Na ¹⁺	mg/kg	42	51	35	57
potassium	K ¹⁺	mg/kg	1.8	1.9	10	12
Anions						
carbonate	CO ₃ ²⁻	mg/kg	ND	ND	ND	ND
bicarbonate	HCO ₃ ¹⁻	mg/kg	70	64	55	49
fluoride	F ¹⁻	mg/kg	1.7	5.8	2.1	1.8
chloride	Cl ¹⁻	mg/kg	1.5	0.8	6.6	12
sulfate	SO ₄ ²⁻	mg/kg	11	13	22	53
phosphate	PO ₄ ³⁻	mg/kg	0.9	2.6	8.8	4.6
Other Tests						
ammonium	NH ₄ ¹⁺	mg/kg	ND	ND	0.3	0.3
nitrate	NO ₃ ¹⁻	mg/kg	5.7	14	43	216
sulfide	S ²⁻	qual	na	na	na	na
Redox	mV		na	na	na	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.

mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

* Caltrans Right-of-Way

APPENDIX "C-1"

LABORATORY TESTING—PREVIOUS INVESTIGATION

TEST DATA SUMMARY

OPTIMUM MOISTURE - MAXIMUM DENSITY RELATION(S):

ASTM D 1557-00

<u>Boring No.</u>	<u>Depth of Sample (ft.)</u>	<u>Classification</u>	<u>Optimum Moisture (Percent)</u>	<u>Maximum Dry Density (pcf)</u>
2	5.0	Sandy Clay, fine with medium, light brown (CL)	17.5	115.0
5	0.0	Clayey Sand, fine, red brown (SC)	14.5	119.0
11	4.0	Silty Sand, fine with medium and coarse, light brown (SM)	9.5	133.0
13	7.0	Silty Sand, fine to medium with coarse, light brown (SM)	7.5	132.5
14	7.0	Silty Sand, fine to medium, orange brown (SM)	13.5	126.0
23	3.0	Silty Sand, fine to medium, light brown (SM)	10.5	129.5
26	5.0	Silty Sand, fine to medium with coarse, light brown (SM)	10.5	130.0
28	0.0	Silty Sand, fine to medium, light brown (SM)	8.0	136.0
30	6.0	Sand, fine to coarse with silt and gravel to 3/8", light brown (SW-SM)	10.5	129.0
37	4.0	Silty Sand, fine to coarse, brown (SM)	7.5	137.0
41	0.0	Silty Sand, fine to medium with coarse, brown (SM)	8.5	135.5
48	0.0	Silty Sand, fine to medium with coarse, light brown (SM)	9.0	126.0
52	4.0	Silty Sand, fine to coarse with gravel to 3/8", light brown (SM)	6.5	130.0

TEST DATA SUMMARY

EXPANSION INDICES:

California Building Code Standard Test Method 18-2

<u>Boring No.</u>	<u>Depth of Sample (ft.)</u>	<u>Initial Moisture (%)</u>	<u>Final Moisture (%)</u>	<u>Degree of Saturation (%)</u>	<u>Expansion Index</u>	<u>Expansion Potential</u>
2	5.0	11.1	31.7	50	67	"medium"
19	8.0	15.9	32.5	53	84	"medium"

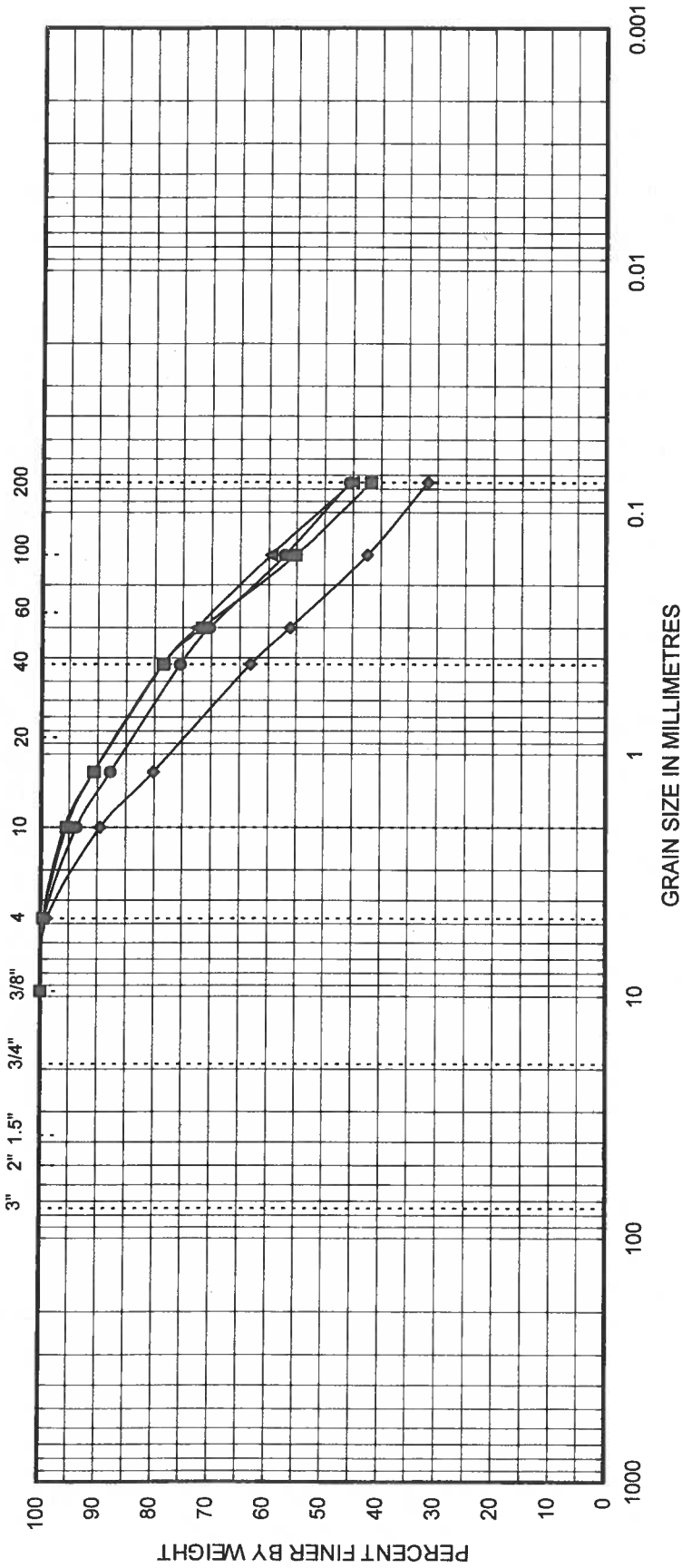
ATTERBERG LIMITS:

ASTM D 4318

<u>Boring No.</u>	<u>Depth of Sample (ft.)</u>	<u>Liquid Limit</u>	<u>Plastic Limit</u>	<u>Plasticity Index</u>
2	5.0	47	23	24
2	10.0	--	--	GNP
19	8.0	48	26	22
31	9.0	22	19	4

GNP = granular non-plastic

Sieve Sizes - U.S.A. Standard Series (ASTM C136)



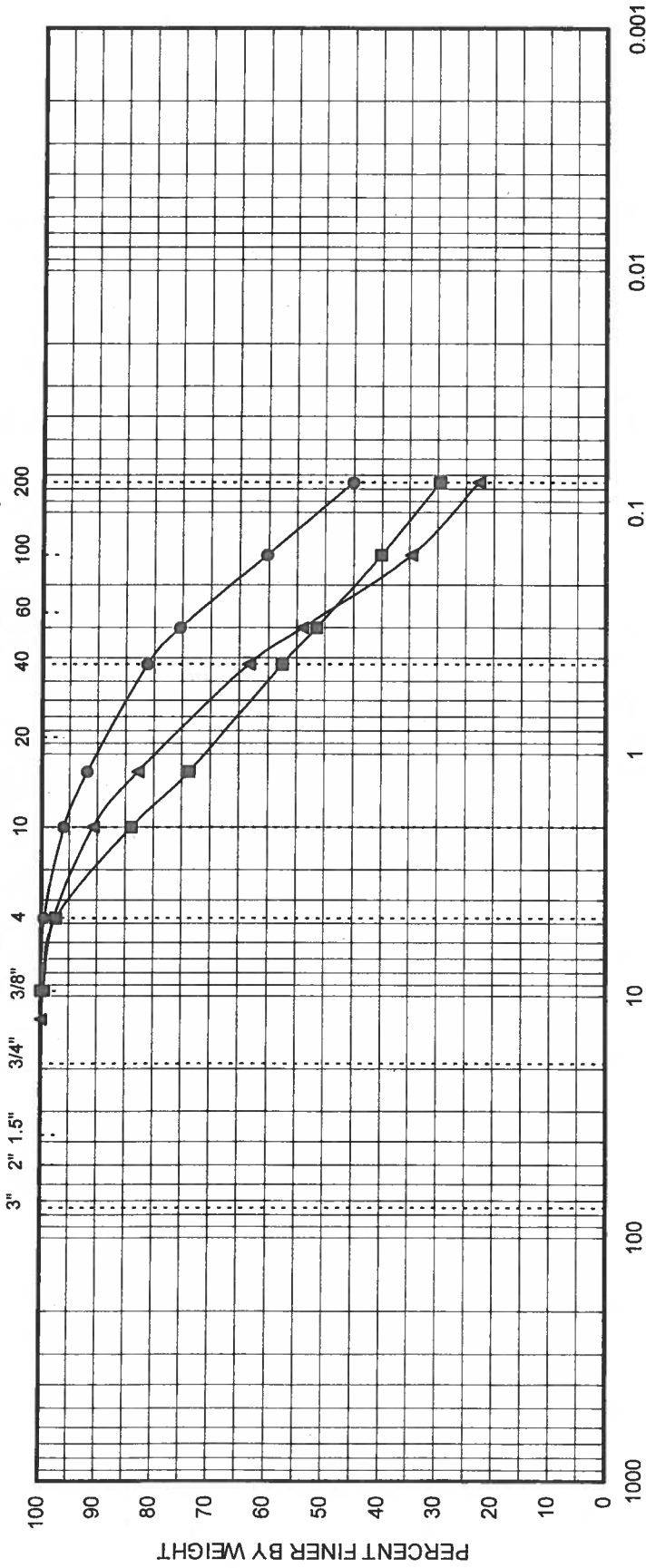
Symbol	Boring	Depth (ft)	Gravel		Sand			Silt or Clay							
			Coarse	Fine	Coarse	Medium	Fine	D ₁₀ (mm)	D ₃₀ (mm)	D ₅₀ (mm)	D ₆₀ (mm)	C _u	C _c	SE	
●	13	7.0	Silty Sand, fine to medium with coarse (SM)			0.098	0.175	0.221	0.365	0.098	0.175	0.221	0.365	10	
■	14	7.0	Silty Sand, fine to medium (SM)			0.115	0.184			0.115	0.184			12	
▲	23	3.0	Silty Sand, fine to medium (SM)			0.095	0.154			0.095	0.154				
◆	26	5.0	Silty Sand, fine to medium with coarse (SM)			0.095	0.154			0.095	0.154				

GRADATION CURVES

Project:	Homeland/Romoland ADP Phase 1		
Location:	Romoland Area, Riverside County, California		
Job Number:	04175-3	Enclosure:	"C-4"



Sieve Sizes - U.S.A. Standard Series (ASTM C136)



GRAIN SIZE IN MILLIMETRES

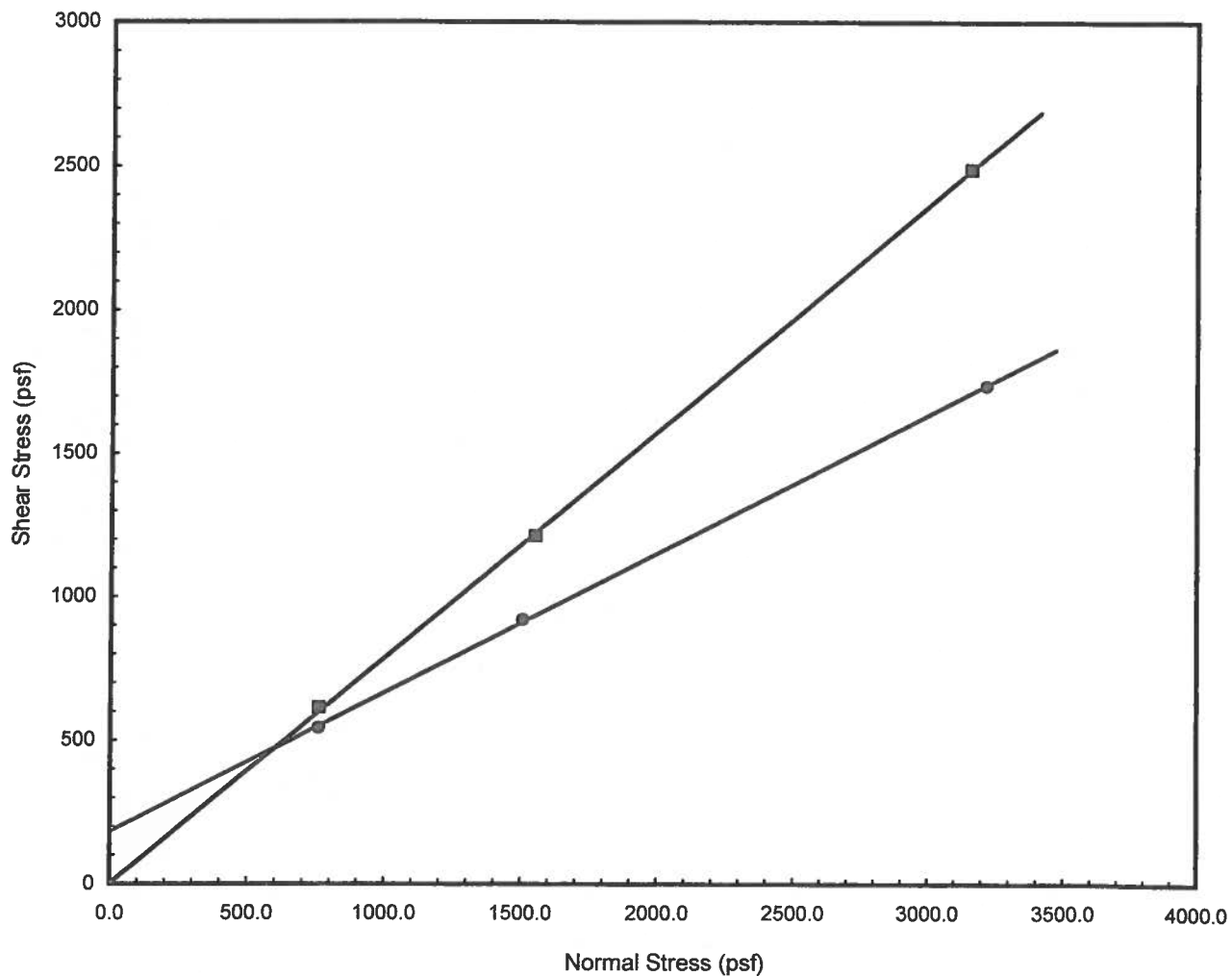
Symbol	Boring	Depth (ft)	Gravel		Sand			Silt or Clay					
			Coarse	Fine	Coarse	Medium	Fine	D ₁₀ (mm)	D ₃₀ (mm)	D ₅₀ (mm)	D ₆₀ (mm)	C _u	C _c
●	31	9.0	Silty Sand, fine to medium with coarse and clay (SM)			0.077	0.114	0.260	0.497	0.149			10
■	37	4.0	Silty Sand, fine to coarse (SM)			0.077	0.114	0.260	0.497	0.149			17
▲	41	0.0	Silty Sand, fine to medium with coarse (SM)			0.077	0.114	0.260	0.497	0.149			22

GRADATION CURVES

Project:	Homeland/Romoland ADP Phase 1		
Location:	Romoland Area, Riverside County, California		
Job Number:	04175-3	Enclosure:	"C-6"



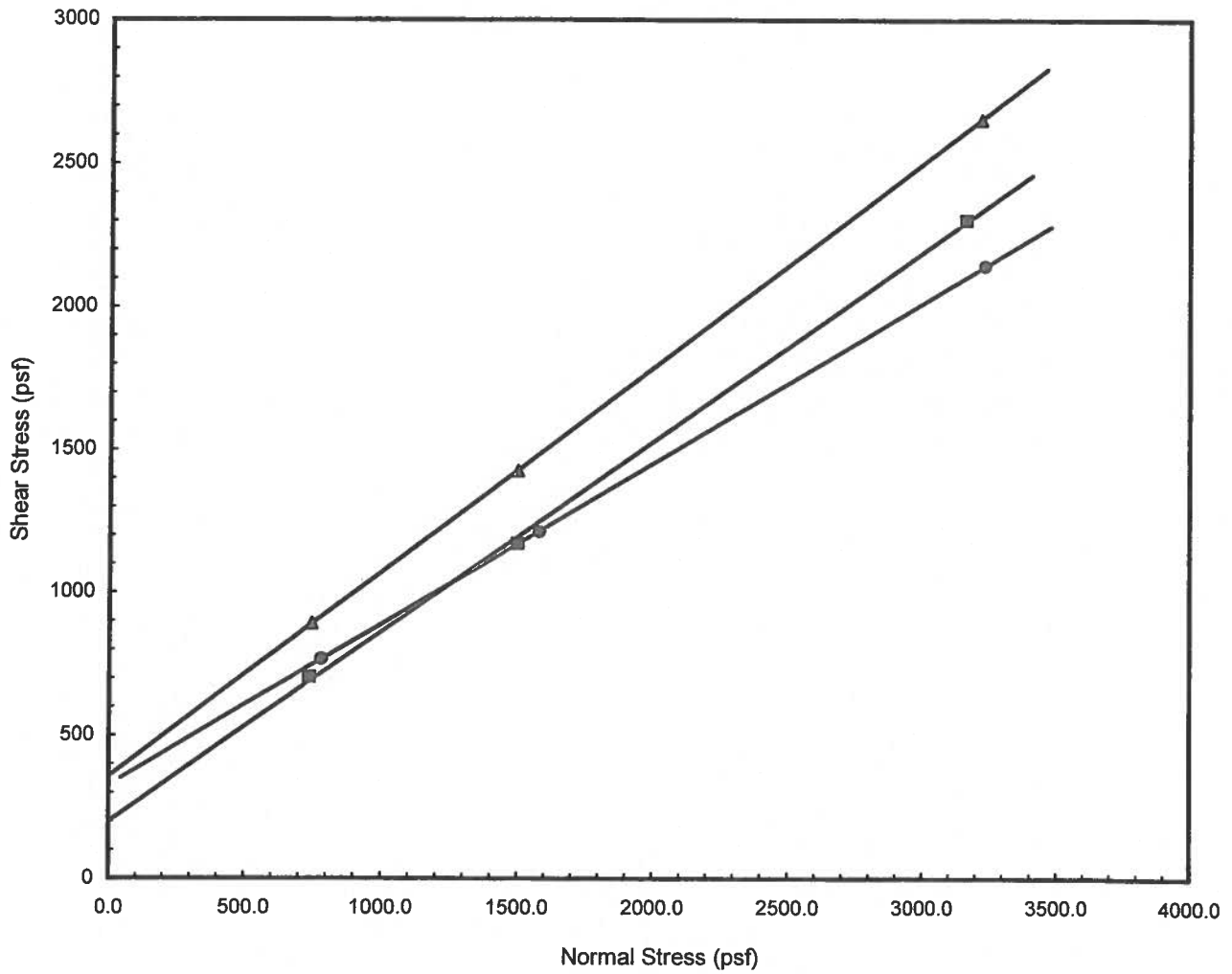
Direct Shear Test (ASTM D 3080)



Boring #	Depth(ft)	Soil/Sample Type	γ_d (pcf)	MC(%)	C (psf)	ϕ (°)
● 14	7	Silty Sand, fine to medium (SM) / remolded	113	13.5	182	26
■ 48	0	Silty Sand, fine to medium with coarse (SM) / remolded	113	9.0	0	38

DIRECT SHEAR TEST			
Project:	Homeland/Romoland ADP Phase 1		
Location:	Romoland Area, Riverside County, California		
Job No.:	04175-3	Enclosure:	"C-9"

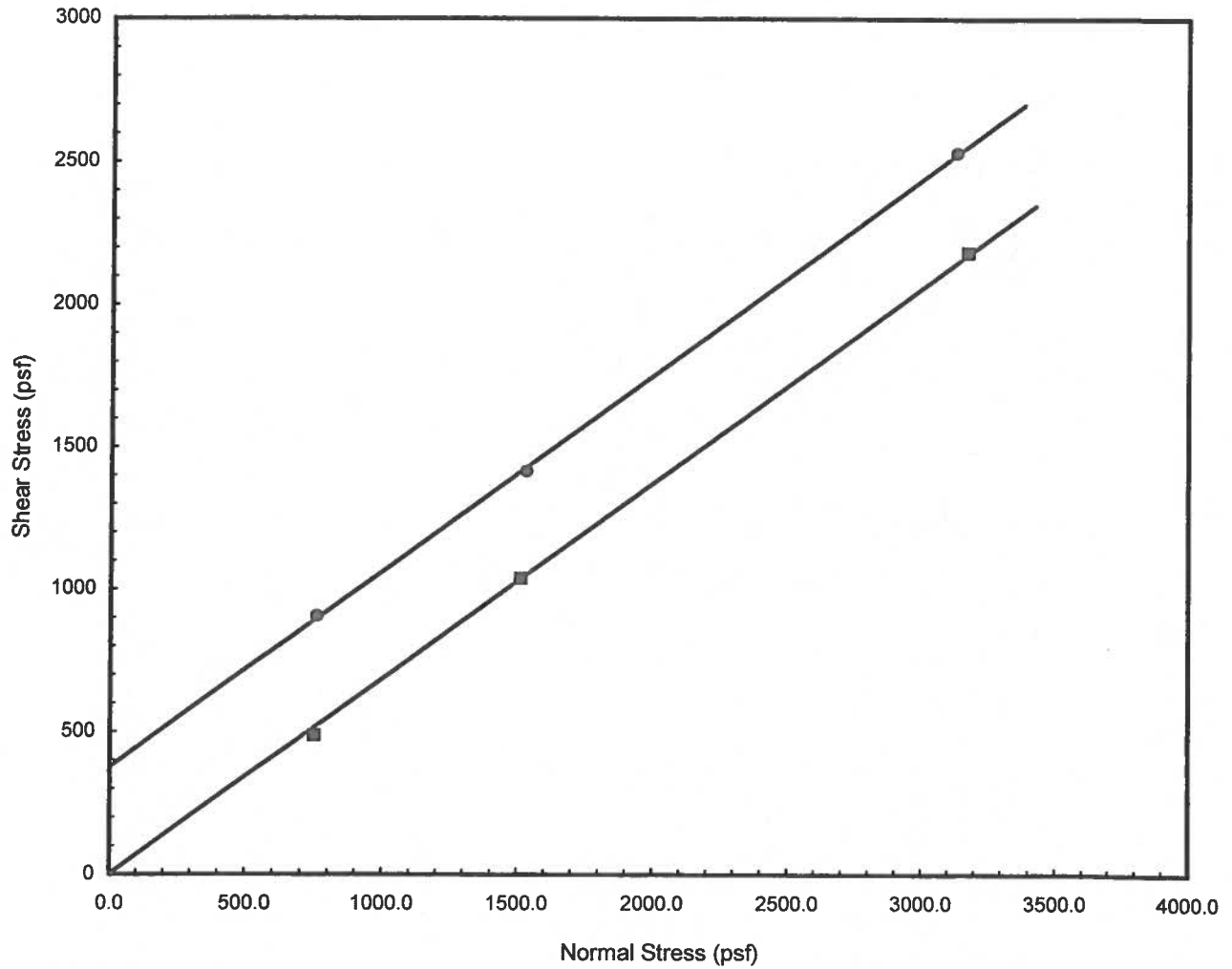
Direct Shear Test (ASTM D 3080)



Boring #	Depth(ft)	Soil/Sample Type	γ_d (pcf)	MC(%)	C (psf)	ϕ (°)
● 13	15	Clayey Sand, fine to medium with coarse and silt (SC) / undisturbed	124	11.1	325	29
■ 16	7	Silty Sand, fine with medium and coarse (SM) / undisturbed	123	9.0	198	34
▲ 23	5	Silty Sand, fine to medium (SM) / undisturbed	108	8.0	355	36

DIRECT SHEAR TEST			
Project:	Homeland/Romoland ADP Phase 1		
Location:	Romoland Area, Riverside County, California		
Job No.:	04175-3	Enclosure:	"C-10"

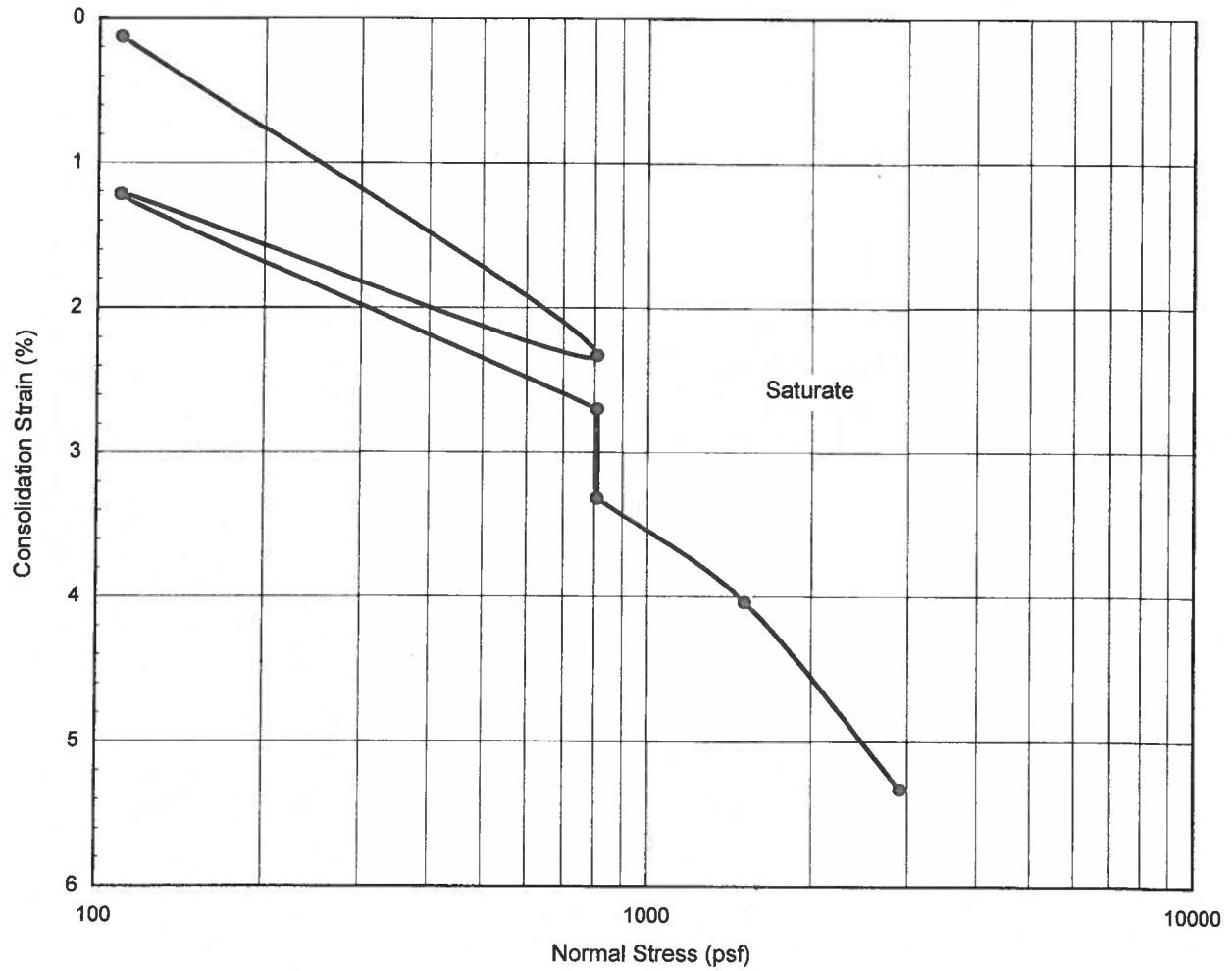
Direct Shear Test (ASTM D 3080)



Boring #	Depth(ft)	Soil/Sample Type	γ_d (pcf)	MC(%)	C (psf)	ϕ (°)
● 31	10	Silty Sand, fine to medium with coarse and clay (SM) / undisturbed	132	8.3	375	34
■ 37	5	Silty Sand, fine to coarse (SM) / undisturbed	116	5.5	0	34

DIRECT SHEAR TEST			
Project:	Homeland/Romoland ADP Phase 1		
Location:	Romoland Area, Riverside County, California		
Job No.:	04175-3	Enclosure:	"C-11"

Consolidation Test (ASTM D 2435)



Boring #	Depth(ft)	Soil/Sample Type	γ_d (pcf)	MC(%)	HCS(%)
48	7	Silty Sand, fine to medium with coarse / undisturbed	117	7.2	0.62

* HCS - Hydroconsolidation strain in percent.

CONSOLIDATION TEST			
Project:	Homeland/Romoland ADP Phase 1		
Location:	Romoland Area, Riverside County, California		
Job No.:	04175-3	Enclosure:	"C-12"

Table 1 - Laboratory Tests on Soil Samples

Storm Drain-Romoland
 Your #04175-3, MJS&A #04-0586LAB
 27-Apr-04

Sample ID			13C @ 11'	26A @ 0'
Resistivity	Units			
as-received	ohm-cm		3,300	3,900
saturated	ohm-cm		2,600	3,300
pH			7.7	7.2
Electrical				
Conductivity	mS/cm		0.06	0.11
Chemical Analyses				
Cations				
calcium	Ca ²⁺	mg/kg	16	32
magnesium	Mg ²⁺	mg/kg	ND	10
sodium	Na ¹⁺	mg/kg	3	ND
Anions				
carbonate	CO ₃ ²⁻	mg/kg	ND	ND
bicarbonate	HCO ₃ ¹⁻	mg/kg	58	49
chloride	Cl ¹⁻	mg/kg	ND	ND
sulfate	SO ₄ ²⁻	mg/kg	ND	59
Other Tests				
ammonium	NH ₄ ¹⁺	mg/kg	na	na
nitrate	NO ₃ ¹⁻	mg/kg	na	na
sulfide	S ²⁻	qual	na	na
Redox		mV	na	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
 mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

M. J. Schiff & Associates, Inc.

Consulting Corrosion Engineers - Since 1959
431 W. Baseline Road
Claremont, CA 91711

Phone: (909) 626-0967 Fax: (909) 626-3316
E-mail lab@mjschiff.com
website: mjschiff.com

Table 1 - Laboratory Tests on Soil Samples

Romoland - Storm Drain
Your #04175-3, MJS&A #04-0457LAB
31-Mar-04

Sample ID

36B

Resistivity		Units	
as-received		ohm-cm	4,600
saturated		ohm-cm	1,600
pH			7.6
Electrical			
Conductivity		mS/cm	0.23
Chemical Analyses			
Cations			
calcium	Ca ²⁺	mg/kg	48
magnesium	Mg ²⁺	mg/kg	17
sodium	Na ¹⁺	mg/kg	74
Anions			
carbonate	CO ₃ ²⁻	mg/kg	ND
bicarbonate	HCO ₃ ¹⁻	mg/kg	104
chloride	Cl ¹⁻	mg/kg	45
sulfate	SO ₄ ²⁻	mg/kg	195
Other Tests			
ammonium	NH ₄ ¹⁺	mg/kg	na
nitrate	NO ₃ ¹⁻	mg/kg	na
sulfide	S ²⁻	qual	na
Redox		mV	na

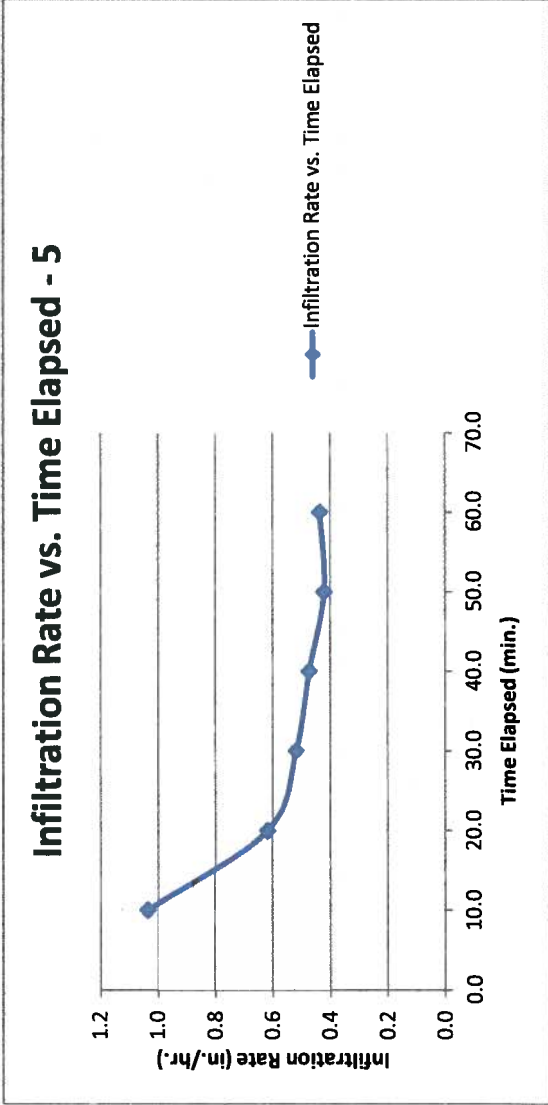
Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.
Redox = oxidation-reduction potential in millivolts
ND = not detected
na = not analyzed

APPENDIX "D"

PERCOLATION TEST DATA

Excavation Percolation Testing Procedures

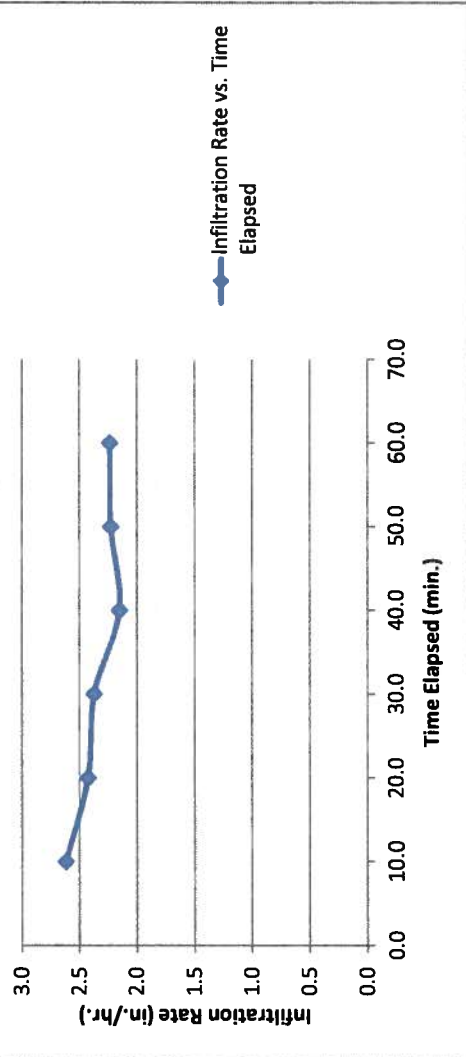
Job Number: 14311-3		Boring Number: 29		Hole Radius (in.): 5		Tested By: VJR		
Depth of Test Hole (ft.): B		C		D		E		
A	Reading Interval (min)	Beginning Depth (ft.)	Ending Depth (ft.)	Change in Depth (in.) (C-D)	Field Percolation Rate (in./hr.) (E/B)	Average Head Height (in.)	Infiltration Rate (in./hr.)	Time Elapsed (min.)
1	25	12.50	16.50	48.0	115.2	174	1.3	-
2	25	16.50	18.60	25.2	60.5	137.4	0.9	-
3	10	7.40	9.20	21.6	129.6	248.4	1.0	10.0
4	10	9.20	10.20	12.0	72.0	231.6	0.6	20.0
5	10	10.20	11.00	9.6	57.6	220.8	0.5	30.0
6	10	11.00	11.70	8.4	50.4	211.8	0.5	40.0
7	10	11.70	12.30	7.2	43.2	204	0.4	50.0
8	10	12.30	12.90	7.2	43.2	196.8	0.4	60.0



Excavation Percolation Testing Procedures

Job Number: 14311-3		Boring Number: 29		Hole Radius (in.): 6		Tested By: VJR		
Depth of Test Hole (ft.): 29		Beginning Depth (ft.): C		Ending Depth (ft.): D		Change in Depth (in.): E		
Reading Interval (min): B		Field Percolation Rate (in./hr.): F		Average Head Height (in.): G		Infiltration Rate (in./hr.): H		
Test	Reading Interval (min)	Beginning Depth (ft.)	Ending Depth (ft.)	Change in Depth (in.) (C-D)	Field Percolation Rate (in./hr.) (E/B)	Average Head Height (in.)	Infiltration Rate (in./hr.)	Time Elapsed (min.)
1	25	20.00	25.10	61.2	146.9	77.4	3.7	-
2	25	25.10	27.10	24.0	57.6	34.8	3.1	-
3	10	19.00	21.00	24.0	144.0	108	2.6	10.0
4	10	21.00	22.50	18.0	108.0	87	2.4	20.0
5	10	22.50	23.70	14.4	86.4	70.8	2.4	30.0
6	10	23.70	24.60	10.8	64.8	58.2	2.2	40.0
7	10	22.10	23.30	14.4	86.4	75.6	2.2	50.0
8	10	23.30	24.30	12.0	72.0	62.4	2.2	60.0

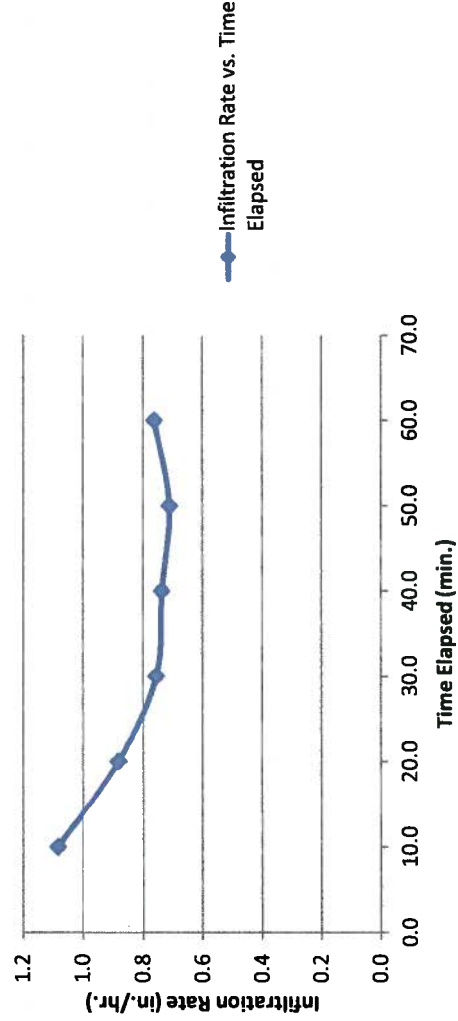
Infiltration Rate vs. Time Elapsed - 6



Excavation Percolation Testing Procedures

Job Number:	14311-3	Boring Number:	7	Tested By:	VJR					
Depth of Test Hole (ft.)	39	Hole Radius (in.)	4							
A	B	C	D	E	F	G	H	I		
Test	Reading Interval (min)	Beginning Depth (ft.)	Ending Depth (ft.)	Change in Depth (in.) (C-D)	Field Percolation Rate (in./hr.) (E/B)	Average Head Height (in.)	Infiltration Rate (in./hr.)	Time Elapsed (min.)		
1	25	16.20	21.50	63.6	152.6	241.8	1.3	-		
2	25	21.50	24.90	40.8	97.9	189.6	1.0	-		
3	10	16.00	18.00	24.0	144.0	264	1.1	10.0		
4	10	18.00	19.50	18.0	108.0	243	0.9	20.0		
5	10	19.50	20.70	14.4	86.4	226.8	0.8	30.0		
6	10	20.70	21.80	13.2	79.2	213	0.7	40.0		
7	10	21.80	22.80	12.0	72.0	200.4	0.7	50.0		
8	10	21.30	22.40	13.2	79.2	205.8	0.8	60.0		

Infiltration Rate vs. Time Elapsed - 7



APPENDIX "E"
GEOPHYSICAL SEISMIC SURVEY



**GEOPHYSICAL SEISMIC SURVEY
PROPOSED HOMELAND MDP PROJECT
LINE 1, STAGE 1; STATIONS 83+10 – 115+30
HOMELAND AREA, RIVERSIDE COUNTY, CALIFORNIA**

Project No. 142718-1

June 5, 2014

Prepared for:

CHJ Consultants
1355 E. Cooley Drive
Colton, CA 92324

Consulting Engineering Geology & Geophysics

P.O. Box 1090, Loma Linda, CA 92354 • 909 796-4667

CHJ Consultants
1355 E. Cooley Drive
Colton, CA 92324

June 5, 2014
Project No. 142718-1

Attention: Mr. Jay Martin

Regarding: Geophysical Seismic Survey
Proposed Homeland MDP Project
Line 1, Stage 1; Stations 83+10 – 115+30
Homeland Area, Riverside County, California
CHJ Project No. 14311-3

EXECUTIVE SUMMARY

In accordance with your request, we have completed a Geophysical Seismic Survey utilizing the seismic refraction method, along the proposed Homeland MDC Pipeline project, between Stations 83+10 to 115+30, located in the Homeland area of Riverside County, California. As requested, this survey involved performing two long seismic traverses for purposes of profiling the subsurface along the proposed pipeline alignment between the distance stationing as outlined above.

In summary, the field data appeared to be of very good quality and processing proceeded with little difficulty. The methodology, field procedures, data processing, and findings of the survey is detailed within this report along with the representative subsurface seismic survey models being presented within Appendices A and B for visual and reference purposes.

This opportunity to be of service is sincerely appreciated. If you should have any questions regarding this report or do not understand the limitations of this survey or the data that is presented, please do not hesitate to contact our office at your earliest convenience.

Respectfully submitted,
TERRA GEOSCIENCES



Donn C. Schwartzkopf
Principal Geophysicist
PGP 1002



TABLE OF CONTENTS

	<u>Page No.</u>
INTRODUCTION	1
SCOPE OF SERVICES	1
SEISMIC REFRACTION SURVEY	2
Methodology	2
Field Procedures	2
Data Processing	3
GEOLOGIC AND EARTHWORK CONSIDERATIONS	4
GENERALIZED RIPPABILITY CHARACTERISTICS OF BEDROCK	4
Rippable Condition (0 - 3,000 ft/sec)	5
Marginally Rippable Condition (3,000 - 4,000 ft/sec)	5
Non-Rippable Condition (4,000 ft/sec or greater)	5
CLOSURE	6
ILLUSTRATIONS	
Seismic Line Location Map	Plate 1
APPENDICES	
Refraction Tomographic Models	Appendix A
Pipeline Invert Models	Appendix B
References	Appendix C

INTRODUCTION

As requested, this firm has performed a geophysical survey using the seismic refraction method along the proposed Homeland MDC Pipeline project, between Stations 83+10 to 115+30, in the Homeland Area of Riverside County, California, as delineated by you. The purpose of this survey was to assess the general seismic velocity characteristics of the underlying earth materials and to evaluate whether high velocity earth materials (potentially non-rippable) are present along local areas which could possibly indicate areas of potential excavation difficulties, and also to aid in evaluating the subsurface structure and seismic velocity distribution.

The bedrock earth materials exposed within the study area have been mapped by Morton and Matti (2001) and Morton (2003) as being Cretaceous age heterogeneous granitic rocks generally described as being a mixture of medium-grained granitic rocks containing abundant schist and gneiss ranging in composition from hornblende-rich tonalite to leucocratic tonalite and from potassium feldspar-free rocks to granodiorite. Surficially mantling the bedrock across the predominance of the subject study area are mapped alluvial fan deposits comprised of younger cobble- and gravel-sand deposits (Holocene and latest Pleistocene age) and older indurated sandy deposits (late to middle Pleistocene age).

Location of the seismic survey lines in the field was accomplished by the use of the provided site plans (Homeland MDP, Line 1 Stage 1; Sheets 11-15 of 34), along with Google™ Earth (2014) imagery and associated GPS coordinates. Using both of these sources, it is believed that the placement of the survey locations was fairly accurate. The location of the seismic traverses have been approximated on a captured Google™ Earth image (Google™ Earth, 2014) which is presented as the Seismic Line Location Map, Plate 1 for reference.

SCOPE OF SERVICES

As authorized by you, the following services were performed during this study:

- **Review of available published and unpublished geologic/geophysical data in our files pertinent to the site.**
- **Performing a seismic survey by a State of California licensed Professional Geophysicist, to include seventeen traverses using the seismic refraction method along selected portions of the subject site.**
- **Data processing and compilation of the seismic survey images for presentation purposes.**
- **Preparation of this report, presenting the results of our findings with respect to the seismic velocity characteristics and the subsurface geologic structure of the underlying earth materials where locally surveyed.**

SEISMIC REFRACTION SURVEY

Methodology

The seismic refraction method consists of measuring (at known points along the surface of the ground) the travel times of compressional waves (P-waves) generated by an impulsive energy source, which is a function of the distance between the energy source and fixed receivers, the depth to the refractor, and the seismic velocities of the materials through which the wave passes. This information can then be used to estimate the layering, structure, and seismic acoustic velocities of subsurface horizons. Seismic waves travel down and through the soils and rocks, and when the wave encounters a contact between two earth materials having different velocities, some of the wave's energy travels along the contact at the velocity of the lower layer. The fundamental assumption is that each successively deeper layer has a velocity greater than the layer immediately above it. As the wave travels along the contact, some of the wave's energy is refracted toward the surface where it is detected by a series of motion-sensitive transducers (geophones). The arrival time of the seismic wave at the geophone locations can be related to the relative seismic velocities of the subsurface in feet per second (fps), which can then be used to aid in interpreting both the depth and type of materials encountered.

Field Procedures

A total of seventeen seismic refraction survey lines were performed located just south of Watson Road as close as possible along the proposed pipeline alignment. This alignment was located in the field using both GPS coordinates and measurements of existing cultural features obtained from the provided site plans. Due to the presence of Leon Road around Station 103+70±, one long continuous and unbroken survey traverse was not possible and the line was divided into two segments, one being west of Leon Road (Seismic Line S-1; Station 83+10 to 103+60) and the other to the east of Leon Road (Seismic Line S-2; Station 103+80 to 115+30). Seismic Line S-1 consisted of eleven individual traverses that were overlapped and combined to produce one continuous 2,050-foot long survey line. Seismic Line S-2 consisted of six traverses that were overlapped and combined to produce one continuous 1,150-foot long survey line.

All of the individual spreads consisted of a series of twenty-four geophones that were spaced at equidistant 10-foot centers, with six common geophones overlapped between each spread, which allowed for merging of the individual spreads during processing. A 16-pound sledge-hammer was used as an energy source to produce the seismic waves and each spread used twenty-four, 14-Hz geophones to detect both the direct and refracted waves. The seismic wave arrivals were recorded on a 24-channel Geometrics SmartSeis[®] model signal enhancement refraction seismograph. Seven shot points were utilized along each seismic line spread using offset, forward, reverse, and intermediate locations, in order to obtain sufficient data for velocity analysis and depth modeling purposes. The data was acquired using a sampling rate of 0.0625 milliseconds having a record length of 0.12 seconds with no acquisition filters.

During acquisition, the data acquired were digitally recorded on the in-board seismograph computer of which the data on the display screen were used to analyze the arrival time of the primary seismic “P”-waves at each geophone station, in the form of a wiggle trace, for quality control purposes in the field. Each geophone and seismic shot location was surveyed using a hand level and ruler for relative topographic correction, with “0” representing the lowest point along the survey line. All of the recorded seismic data was subsequently transferred to our office computer for further processing, analyzing, and printing purposes.

Data Processing

The processing of the raw data was initially performed using the computer program **SIPwin** (Rimrock Geophysics, Inc., 2004). This primary analysis involved manually selecting the first “P-wave” break for each shot/receiver record collected during our survey. A total of 2,856 picks were then manually selected, generated from the 119 shot point locations (seven shot points for each of the 17 seismic lines), multiplied by the 24 geophone receiver locations for each spread. The manual picks were then used to generate time-distance plots for line to line comparisons and quality control purposes. This data was then input into the computer program **Rayfract™** (Intelligent Resources, Inc., 1996-2014) along with the horizontal and vertical surface line geometry.

Rayfract™ is seismic refraction tomography software that models subsurface refraction, transmission, and diffraction of acoustic waves which generally indicates the relative structure and velocity distribution of the subsurface using first break energy propagation modeling. An initial 1D gradient model is created using the Delta-t-V method which gives a good initial fit between modeled and picked first breaks. This initial model is then refined automatically with a true 2D WET (Wavepath Eikonal Traveltime) tomographic inversion (Schuster and Quintus-Bosz, 1993). WET tomography models multiple signal propagation paths contributing to one first break, whereas conventional ray tracing tomography is limited to the modeling of just one ray per first break.

The representative Refraction Tomographic Models for Seismic Line S-1 and S-2 are included within Appendix A which present the entire sampling depth imaged based on the subsurface wave-path ray coverage. The relatively large spacing of the geophone receivers (i.e. 10 feet) combined with the overlapping spreads and far-off end shots, resulted in obtaining very deep imaging. Due to the length of the models, the vertical axis was highly exaggerated (conversely the horizontal axis was compressed) by a factor of 4 to 5 for purposes of displaying the profiles on one sheet. Included within Appendix B are the accompanying Pipeline Invert Models for both seismic lines which show the approximate proposed pipeline invert for visual purposes. These models are enlarged and exaggerated in the vertical direction by a factor of 8 to 12 and generally only show a portion of the upper 30 to 60± feet to better display the proposed pipeline invert. Since the geophone receiver and shot locations are not tied to any known survey data and respective ground elevations, the pipeline invert as shown on the survey profiles is considered to be approximate.

Rayfract™ produces a “smoothed” tomographic image that displays the velocity gradient within the limits of the sampled subsurface seismic wave ray coverage. The data appeared to be of very good quality which was verified by the Root Mean Square Error (RMS) that is displayed on the tomographic models, which range from values of 1.3 and 1.8%. The RMS error (misfit between picked and modeled first break times) is automatically calculated during the processing routine, with a value of less than 2.0% being preferred.

GEOLOGIC AND EARTHWORK CONSIDERATIONS

It should be noted that seismic velocities obtained within bedrock materials are influenced by the nature and character of the localized major structural discontinuities (foliation, fracturing, etc.), creating anisotropic conditions. Anisotropy (direction-dependent properties of materials) can be caused by “micro-cracks,” jointing, foliation, layered or inter-bedded rocks with unequal layer stiffness, small-scale lithologic changes, etc. (Barton, 2007). Velocity anisotropy complicates interpretation and it should be noted that the seismic velocities obtained during this survey may have been influenced by the nature and character of any localized structural discontinuities within the bedrock underlying the subject site. Generally, it is expected that higher (truer) velocities will be obtained when the seismic waves propagate along direction (strike) of the dominant geologic structure, with a damping effect when the seismic waves travel in a perpendicular direction. Such variable directions can result in velocity differentials of between 2% to 40% depending upon the degree of the structural fabric (i.e., weakly-moderately-strongly foliated, respectively).

To evaluate whether a particular bedrock material can be ripped or excavated, this geophysical survey should be used in conjunction with the geologic and/or geotechnical report and/or information gathered for the subject project which may describe the physical properties of the bedrock. The physical characteristics of bedrock materials that favor ripping generally include the presence of fractures, faults, and other structural discontinuities, weathering effects, brittleness or crystalline structure, stratification or lamination, large grain size, moisture permeated clay, and low compressive strength. If the bedrock is foliated and/or fractured at depth, this structure could aid in excavation production. Unfavorable bedrock conditions can include such characteristics as massive and homogeneous formations, non-crystalline structure, absence of planes of weakness, and formations of clay origin where moisture makes the material plastic.

GENERALIZED RIPPABILITY CHARACTERISTICS OF BEDROCK

Generally, the rippability of granitic bedrock is evaluated using the Ripper Performance Charts which are prepared and described by Caterpillar, Inc. (2000 and 2012), for various sized dozers vs. seismic velocity. However, there are no such performance charts available which relate typical excavation characteristics using large excavators

such as most likely will be used during construction of the pipeline. We have found however, that there are “rules-of-thumb” for large trench excavating equipment and are based on personal communication with local grading contractors and geotechnical consultants over the years, of which the following discussion below should only be considered as a general guideline.

A generalized summary of the excavation characteristics of granitic bedrock has been estimated to aid in evaluating potential excavation difficulties with respect to the seismic velocities obtained during our geophysical survey. The velocity ranges described below are considered to be approximate and assume typical, good-working, heavy excavation equipment, such as a Caterpillar 235 excavator or equivalent.

Rippable Condition (0 - 3,000 ft/sec):

This seismic velocity range indicates predominantly rippable materials which may consist of alluvial-type deposits, artificial fill, and/or very highly weathered and decomposed granitic bedrock with random hardrock floaters. These materials will typically break down into slightly silty, well-graded sand, whereas floaters will require special considerations for excavation and disposal.

Marginally Rippable Condition (3,000 - 4,000 ft/sec):

This range of velocities indicates materials which may consist of highly weathered granitic bedrock or large areas of moderately-weathered granitics separated by highly weathered fractured zones. This velocity range is estimated to be within the expected limits for reasonable trench excavation using large excavators, of which we have been told that 4,000± fps is the approximate velocity boundary where production is greatly impeded. Based on the local degree of bedrock weathering, fracture spacing, equipment type, and excavation techniques, etc., the production time may vary and is expected to increase as the upper velocity limit is encountered. Possible construction delays could be incurred within this velocity range. Excavations may produce material that will partially break down into a coarse, slightly silty to clean sand, with a high percentage of very coarse sand to pebble-sized material. Less fractured or weathered materials will probably require blasting and/or breaking to facilitate removal.

Non-Rippable Condition (4,000 ft/sec or greater):

This velocity range may include non-rippable material consisting primarily of moderately weathered and fractured granitics at lower velocities and only slightly to unfractured rock and fresher granitics at higher velocities. Materials within the lower end of this velocity range may be slightly rippable, depending upon the degree of fracturing and the skill and experience of the operator. Tooth penetration is often the key to ripping success, regardless of seismic velocity. If the fractures and joints do not allow tooth penetration, the material may not be ripped effectively; however, pre-blasting or "popping" may induce sufficient fracturing to permit tooth entry. Breaking and/or blasting within these bedrock materials should be expected for utility trench excavations.

As presented on the enlarged Pipeline Invert Models within Appendix B, the 4,000 ft/sec velocity contour line has been depicted as a thicker, dashed line for purposes of visually approximating the depth where excavation difficulty or non-production will most likely be encountered, as discussed above. It can be seen that the predominance of the expected excavation difficulties will most likely be encountered somewhere between Station 99+40 to 105+40, with other local areas along the proposed pipeline approaching potentially low-production and/or non-excavatable materials.

CLOSURE

The field survey was performed by the undersigned on May 24 and 25, 2014 using "state of the art" geophysical equipment and techniques along the selected portion of the subject study area as directed by you. An attempt was made to locate the survey lines directly above the proposed pipeline location as previously discussed, but since survey stakes or any other means of positively identifying the pipeline centerline was not present, the location of our lines should be considered approximate.

It is important to understand that the fundamental limitation for seismic refraction surveys is known as nonuniqueness, wherein a specific seismic refraction data set does not provide sufficient information to determine a single "true" earth model. Therefore, the interpretation of any seismic data set uses "best-fit" approximations along with the geologic models that appear to be most reasonable for the local area being surveyed. Client should also understand that when using the theoretical geophysical principles and techniques discussed in this report, sources of error are possible in both the data obtained and in the interpretation and that the results of this survey may not represent actual subsurface conditions. These are all factors beyond **Terra Geosciences** control and no guarantees as to the results of this survey can be made. We make no warranty, either expressed or implied. If the client does not understand the limitations of this geophysical survey, additional input should be sought from the consultant.

This opportunity to be of service is sincerely appreciated. If you should have any questions regarding this report or do not understand the limitations of this study or the data that is presented, please do not hesitate to contact our office at your earliest convenience.

SEISMIC LINE LOCATION MAP



APPENDIX A

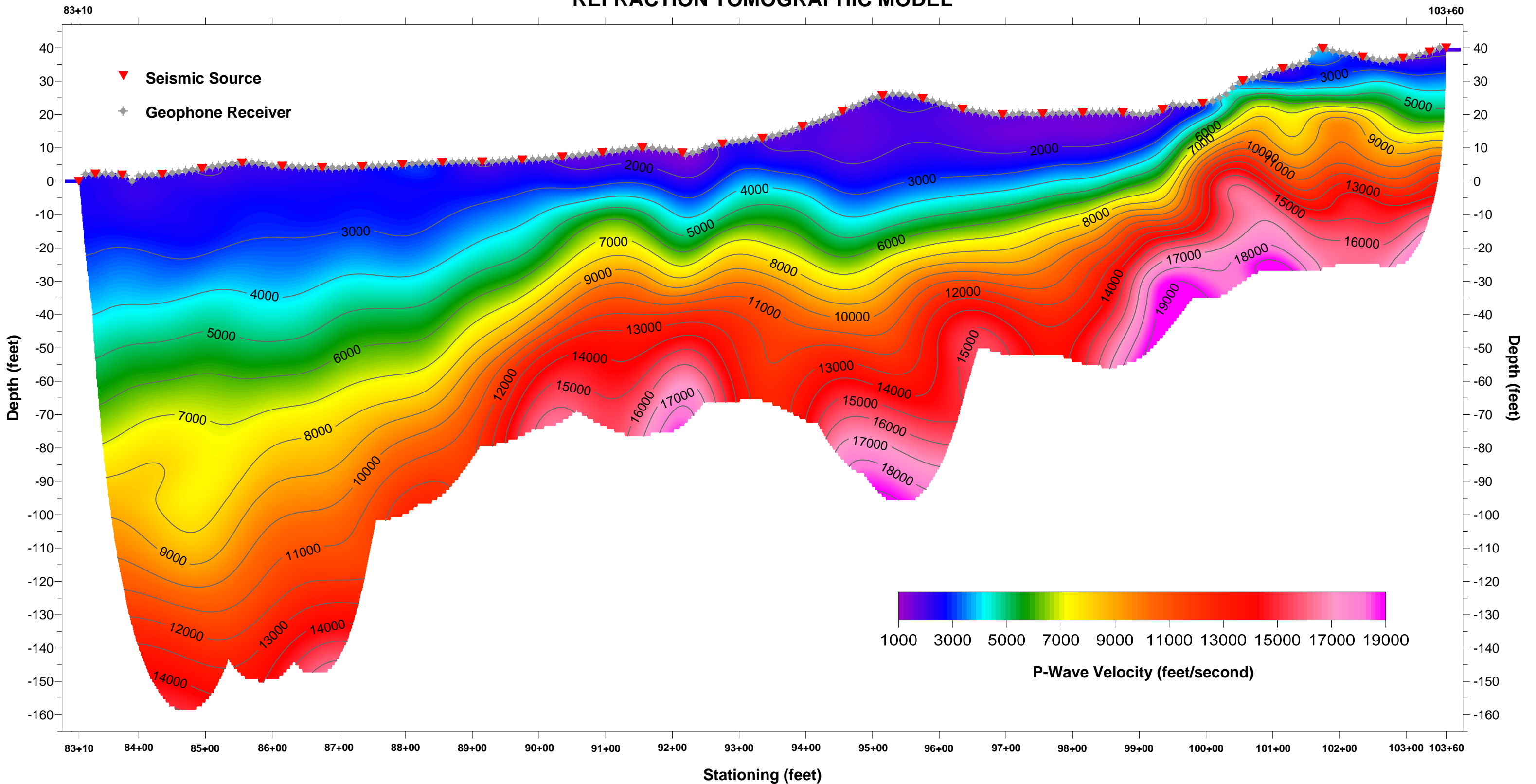
REFRACTION TOMOGRAPHIC MODELS



SEISMIC LINE S-1

← West - East →

REFRACTION TOMOGRAPHIC MODEL



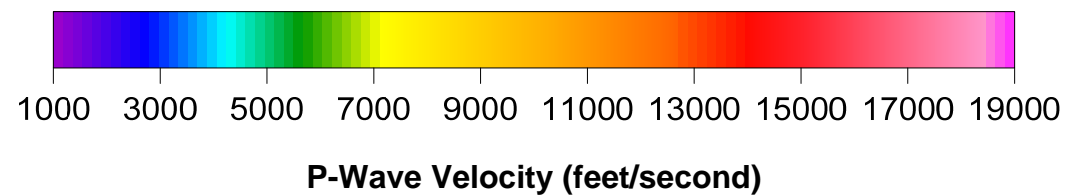
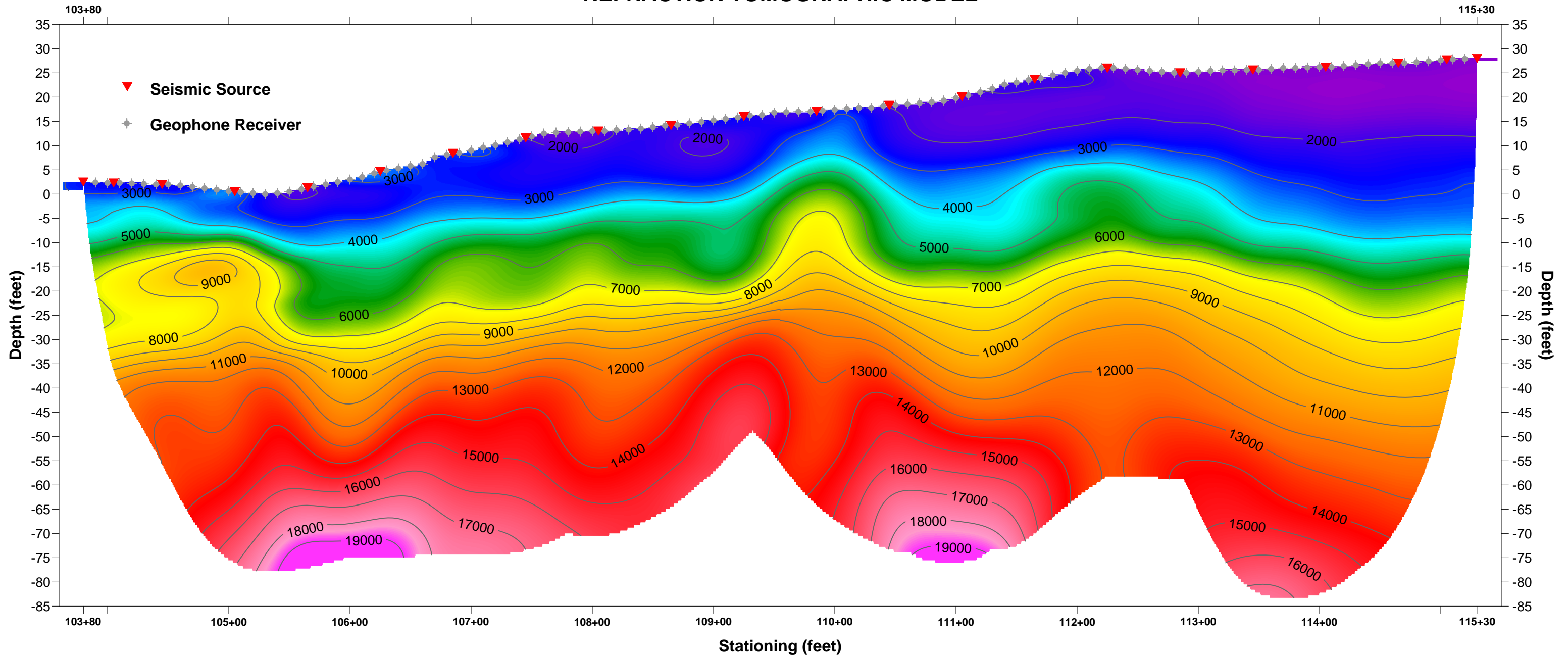
NOTE: Vertical Exaggeration 5X

SEISMIC LINES 1-11, RMS error 1.8 %, Rayfract Version 3.31

SEISMIC LINE S-2

← West - East →

REFRACTION TOMOGRAPHIC MODEL



NOTE: Vertical Exaggeration 4X

SEISMIC LINES 12-17, RMS error 1.4 %, Rayfract Version 3.31

APPENDIX B

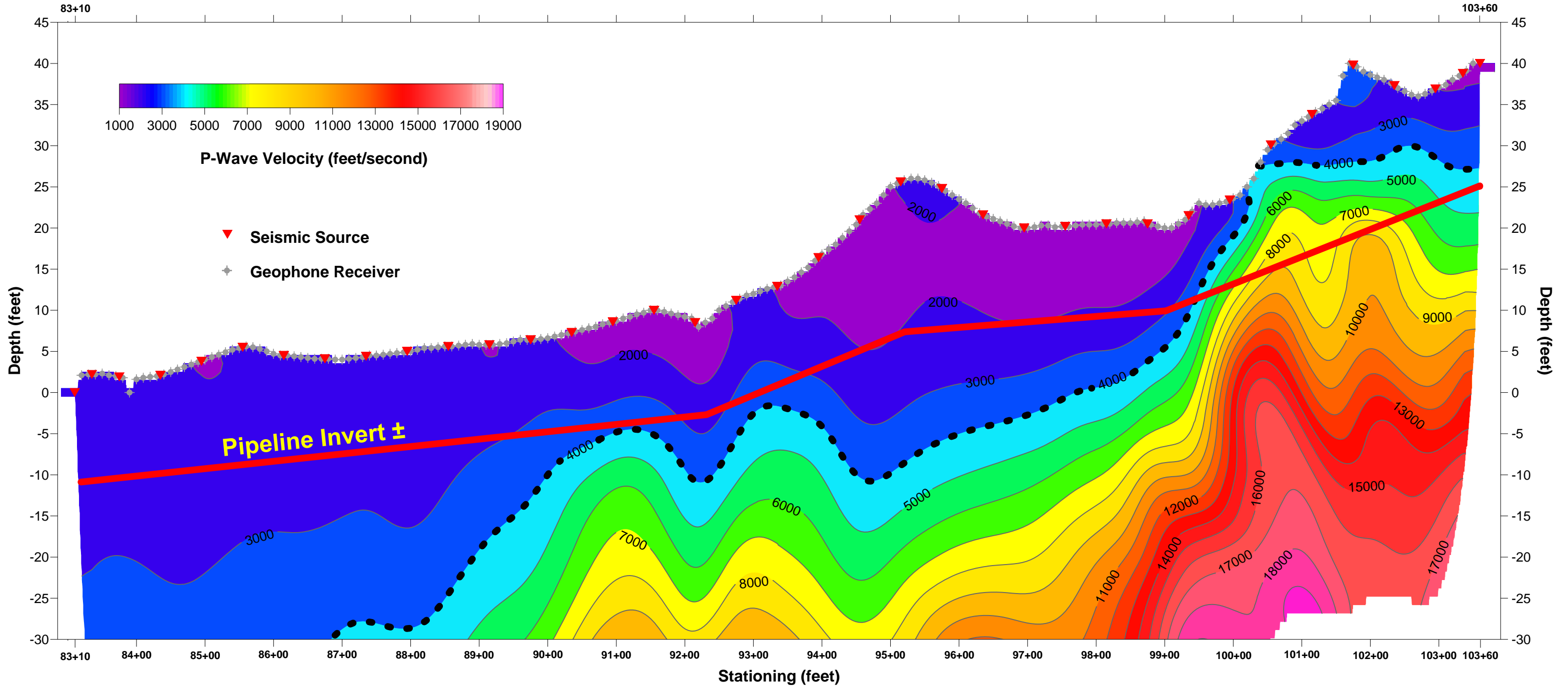
PIPELINE INVERT MODELS



SEISMIC LINE S-1

← West - East →

PIPELINE INVERT MODEL: STATION 83+10 - 103+60



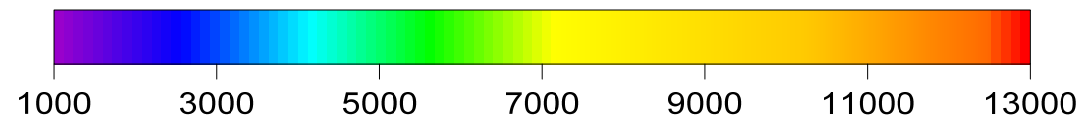
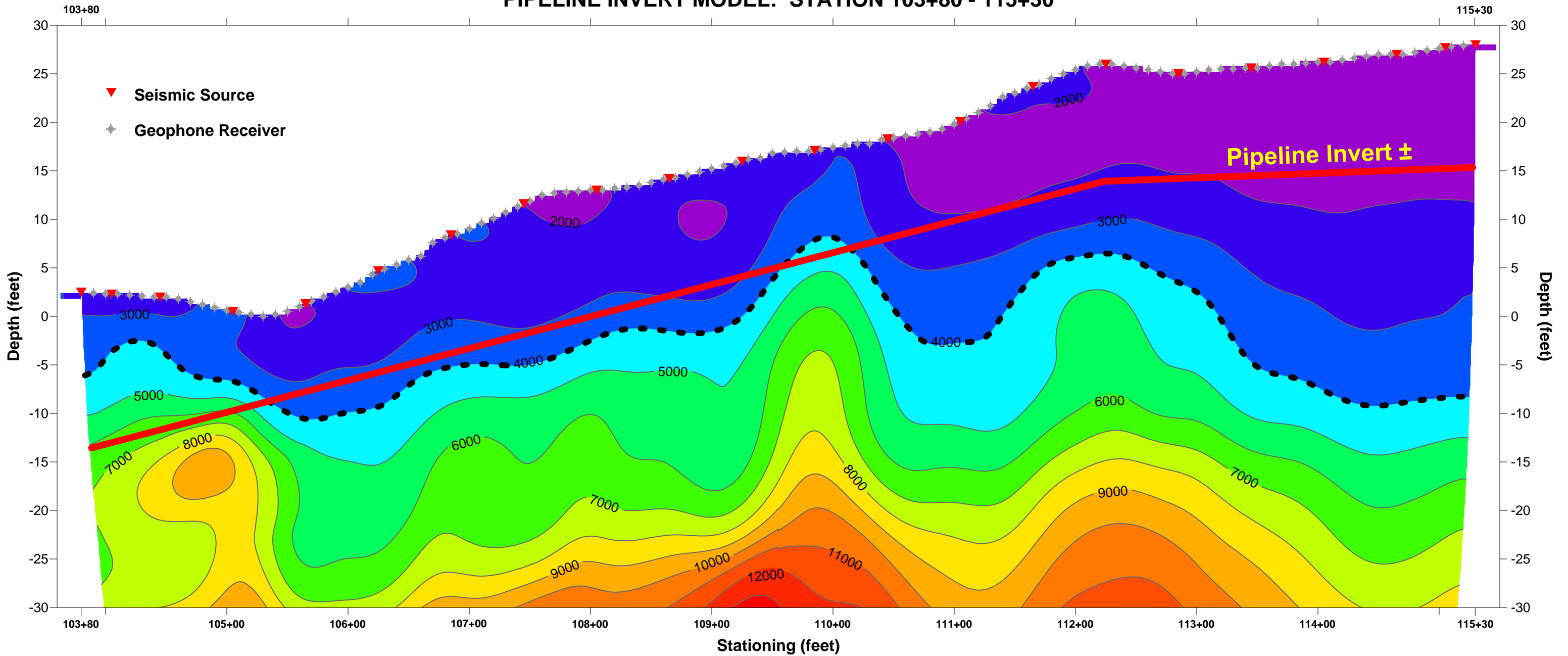
NOTE: Vertical Exaggeration 12X

SEISMIC LINES 1-11, RMS error 1.8 %, Rayfract Version 3.31

SEISMIC LINE S-2

← West - East →

PIPELINE INVERT MODEL: STATION 103+80 - 115+30



P-Wave Velocity (feet/second)

NOTE: Vertical Exaggeration 8X

SEISMIC LINES 12-17, RMS error 1.4 %, Rayfract Version 3.31

APPENDIX C

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