DRAFT GEOTECHNICAL REPORT

Valencia Road
Alvernon Way to Wilmot Road

Pima County Project No. 4VAKDP

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1.0 INTRODUCTION

NCS Consultants, LLC (NCS) was retained by Psomas to perform geotechnical engineering services in support of the realignment and widening of an approximately 3.25 mile stretch of Valencia Road (Valencia) in Tucson, Arizona. The project boundaries extend from 900 feet east of the intersection of Alvernon Way (Alvernon) and Valencia on the west to 750 feet east of the intersection of Wilmot Road (Wilmot) and Valencia on the east. The project includes the widening of Valencia under the existing Interstate 10 (I-10) bridges, widening the existing bridge over the Union Pacific Railroad (UPRR), adding signalization and a new intersection for Littletown Road, and improving turn lanes at major cross streets (Psomas, 2011). The project, located in Pima County, Arizona, is being developed by the Pima County Department of Transportation (PCDOT). The purpose of this report is to present the draft geotechnical recommendations for the various new facilities associated with this project, including retaining walls, pavements, slopes, bridge foundation, and drainage structures. A project vicinity map and project location map can be found in Figures 1.1 and 1.2, respectively. Section 1.4 contains a description of the existing and proposed roadway configurations.

1.1 Scope of Work

Under a subcontract with Psomas, NCS provided the following geotechnical services as described in the scope of work presented in NCS' cost proposal dated April 27, 2010:

- A field investigation program that includes sixty-three (63) borings and six (6) pavement cores, which provide information for the design of pavements, soil slopes, bridge foundations, retaining walls, and drainage structures. The borings range in depth from approximately 4 feet to 130 feet. The field investigation program is described in Section 4.1. Boring logs and a key to symbols and terms are included in Appendix A.
- Laboratory testing of representative soil samples obtained during the geotechnical field investigation to determine soil classifications and geotechnical properties. The results of the laboratory testing program are discussed in Section 4.2. Laboratory test data and a summary of the results of the laboratory tests are included in Appendix B.
- Engineering analyses and recommendations for the embankments and retaining walls along the project alignment.
- Engineering analyses and recommendations for pavement structures.
- Engineering analyses and recommendations for bridge foundations.
- Evaluation of on-site soils with respect to collapse/swell potential and earthwork (shrink/swell) factors and their use as backfills for embankments, drainage structures, etc.
- Preparation of draft and final geotechnical reports.
- Preparation of a Pavement Design Summary (included in Section 10 of this report).
- Internal Quality Assurance/Quality Control (QA/QC) reviews.

1.2 Project Coordination

NCS' work was coordinated with the following individuals:

- Damon Ballesteros, P.E. – Project Manager, PCDOT
- Kevin Thornton, P.E. – Project Manager, Psomas
- Sean Samsel, P.E.– Project Engineer, Psomas
- David Perrotti, P.E. – Bridge Design, URS
- Brian Lasham – Laboratory Testing, ConformaTech, Inc. (ConformaTech)
- Greg Jones and Gilbert Miranda – Drilling, Geomechanics Southwest, Inc. (GSI)

1.3 Design Standards Used for Development of Geotechnical Recommendations

The geotechnical recommendations within this report were developed by using the following standards for different elements of the project:

- Bridge recommendations were developed in accordance with the 17th Edition of AASHTO (2002) which is based on the Allowable Stress Design (ASD) approach.
- For pavement design, the Preliminary Engineering and Design Manual (ADOT, 1989) and the Pima County Roadway Design Manual (PCDOT, 2010) were used.

1.4 Project Overview and Site Description

The project site is located within the jurisdictions of both un-incorporated Pima County and the City of Tucson. Figure 1.2 shows the project location. The topography is relatively flat and generally rises from west to east. The elevation ranges from 2,650 feet to 2,750 feet.

Throughout most of the project corridor, Valencia has two through lanes in each direction with approximately 20 feet of median. As part of the 20-year Regional Transportation Plan of the Regional Transportation Authority (RTA) approved by voters in May 2006, the roadway will be improved to a six lane roadway (three lanes in each direction) with medians, multiuse lanes, curbs, sidewalks, drainage facilities, UPRR bridge widening, I-10 underpass widening, signals, and signing and pavement marking improvements. At the I-10 underpass, to limit the disturbance to the slope in front of the bridge abutments the multi-use lane and sidewalk on each side of the roadway will be combined and raised up behind the bridge piers (Psomas, 2011).

2.0 GEOLOGY

The project site is located in the Tucson Basin. This basin is a broad 1,000 square mile area in the upper Santa Cruz River drainage basin. The following geologic description is taken from Davidson (1973) and Anderson (1987), who provide a comprehensive discussion of the Tucson Basin based on geohydrologic and geophysical studies.

The Tucson Basin is a structural depression filled with sediments. It is bounded by the Sierrita, Santa Rita, and Empire Mountains to the south; the Rincon Mountains to the east; the Santa Catalina Mountains to the northeast; the Tortolita Mountains to the northwest; and the Tucson Mountains to the west. The basin is 15- to 20-miles wide (east-west) in the southern and central parts and narrows to 4 miles at the northwest outlet; it is approximately 50-miles long (north-south). The project is located in the central part of the basin.

The primary formations of interest for this project are the Tinaja beds and the Fort Lowell Formation. The Tinaja beds were deposited during the Miocene and Pliocene age. They are overlain by the Fort Lowell Formation that is of Pleistocene age. The Tinaja beds consist of three subunits, and are mainly composed of gravel and sand. The Fort Lowell Formation is composed of silty gravel at the edge of the basin, and silty or clayey sands toward the center. Throughout most of the basin, the Fort Lowell Formation is overlain by a thin veneer of younger sediments consisting of sand, silt and gravel or gravelly sand of fluvial origin. From a geotechnical engineering perspective, the younger sediments overlying the Fort Lowell Formation are the most important.

The younger sediments were formed by complex depositional and erosional processes that resulted in a variable surficial stratigraphy throughout the Tucson Basin. At the project site, these sediments range from silty and clayey soils to sandy and gravelly soils. The subsurface investigation program described in Section 4 confirmed the site geology described above.

3.0 SEISMIC CONSIDERATIONS

According to Section 3.2, Division 1A of AASHTO (2002) and ADOT report AZ 92-344 (ADOT, 1992), the acceleration coefficient at the project site is approximately 0.03 to 0.04. This value is based on an earthquake event with a probability of non-exceedance of 90% in 50 years, which is approximately equivalent to 15% exceedance in 75 years. Based on Table 3.4 of AASHTO (2002) the seismic performance category (SPC) is A. For SPC A, as per AASHTO Standard Specifications for Highway Bridges, seismic loading is not incorporated in the design of the bridges. Furthermore, there are no special seismic design requirements for the foundations and abutments of bridges in this category. According to Section 3.5, Division 1A of AASHTO (2002), the soil profile at the project site should be considered Type II.

4.0 GEOTECHNICAL INVESTIGATION PROGRAM

4.1 Geotechnical Borings

A comprehensive field investigation program was performed by NCS to collect data and develop geotechnical recommendations for various features within the project limits. A total of 63 borings and 6 pavement cores were drilled. The field investigation was conducted between December 13, 2010 and March 16, 2011. A breakdown of NCS' field investigation program is as follows:

- Ten (10) borings, between 21.5 feet and 131.5 feet deep, were advanced in the vicinity of the proposed widening of the bridge structure over the UPRR tracks. These are part of the "B-series" borings and are referred to as B01 to B08 and B01A and B02A.

- Two (2) borings, 80.8 feet deep, were advanced in the vicinity of the proposed retaining walls for the truncation of the existing end-slopes of the I-10 Bridge over Valencia. These are also part of the "B-series" borings and are referred to as B09 and B10.

- Twenty (20) borings, between 21.5 feet and 76.5 feet deep, were advanced in the vicinity of the proposed embankments needed for the widening of the existing approaches to the UPRR bridge. These are referred to as the "W-series" borings.

- Two (2) borings, 21.5 feet deep, were advanced in the vicinity of the proposed widened drainage structure at Julian Wash. These are referred to as the "D-series" borings.

- Twenty-nine (29) borings, 3.3 feet to 6.5 feet deep, were advanced throughout the project corridor to provide subsurface information in support of the pavement design. These are referred to as the "P–series" borings.

- Six (6) pavement cores, drilled just deep enough to measure the existing asphaltic concrete thickness, were advanced through the Valencia roadway pavement throughout the project corridor to determine the existing pavement thickness. These are referred to as the "PC–series" borings.

A summary of the boring logs presented in Appendix A is provided in Table 4.1. A summary of the pavement cores is provided in Table 10.1 of Section 10.1. The locations of all borings are shown on the twelve sheets of Figure 4.1.

Table 4.1
Summary of Borings

Boring #	Feature	Drill Rig Type	Northing (feet)	Easting (feet)	Ground Elev. (feet)	Depth (feet)	Bottom Elev. (feet)	Figure 4.1 Sheet No.
B01	UPRR Bridge	Truck	16,456	21,416	2,729.0	21.5	2,707.5	8
B01A	UPRR Bridge	Truck	16,515	21,330	2,696.3	87.0	2,609.3	8
B02	UPRR Bridge	Truck	16,416	21,479	2,727.7	21.5	2,706.2	8
B02A	UPRR Bridge	Truck	16,359	21,533	2,696.7	100.3	2596.4	8
B03	UPRR Bridge	Truck	16,512	21,464	2,694.1	131.5	2,562.6	8
B04	UPRR Bridge	Truck	16,453	21,550	2,695.0	131.5	2,563.5	8
B05	UPRR Bridge	Truck	16,579	21,556	2,694.8	131.0	2,563.8	8
B06	UPRR Bridge	Truck	16,523	21,647	2,695.0	131.5	2,563.5	8
B07	UPRR Bridge	Truck	16,611	21,640	2,728.8	131.0	2,597.8	8
B08	UPRR Bridge	Truck	16,573	21,699	2,727.4	131.5	2,595.9	8
B09	I-10 Ret Wall	Truck	14,222	18,491	2,702.1	80.8	2,621.3	5
B10	I-10 Ret Wall	Truck	14,029	18,591	2,702.5	80.8	2,621.7	5
D01	Drainage	Track	15,412	20,753	2,679.4	21.5	2,657.9	7
D02	Drainage	Track	15,348	20,949	2,683.0	21.5	2,661.5	7
P01	Pavement	Truck	13,992	12,000	2,643.2	6.5	2,636.7	1
P02	Pavement	Truck	13,979	12,487	2,645.6	6.0	2,639.6	1
P03	Pavement	Truck	13,999	12,973	2,649.4	6.5	2,642.9	1,2
P04	Pavement	Truck	14,004	13,464	2,652.0	5.9	2,646.1	2
P06	Pavement	Truck	14,019	14,443	2,660.0	6.5	2,653.5	2
P07	Pavement	Truck	14,133	14,933	2,663.2	6.5	2,656.7	3
P08	Pavement	Truck	14,038	15,426	2,661.2	6.5	2,654.7	3
P09	Pavement	Truck	14,152	15,916	2,663.5	6.0	2,657.5	3
P10	Pavement	Truck	14,055	16,414	2,665.8	6.0	2,659.8	4
P11	Pavement	Truck	14,182	16,901	2,669.7	6.5	2,663.2	4
P12	Pavement	Truck	14,085	17,395	2,674.7	6.0	2,668.7	4
P13	Pavement	Truck	14,184	17,876	2,678.5	5.0	2,673.5	5
P14	Pavement	Truck	14,075	18,366	2,681.7	6.5	2,675.2	5
P15	Pavement	Truck	14,175	18,867	2,685.7	6.0	2,679.7	5
P16	Pavement	Truck	14,170	19,361	2,690.1	6.0	2,684.1	6
P17	Pavement	Truck	14,145	19,848	2,694.8	4.0	2,690.8	6
P18	Pavement	Truck	14,480	20,247	2,695.7	6.0	2,689.7	6
P19	Pavement	Truck	14,764	20,639	2,695.9	6.0	2,689.9	7
P24	Pavement	Truck	16,839	22,471	2,712.0	6.5	2,705.5	9
P25	Pavement	Truck	16,756	22,966	2,709.9	6.5	2,703.4	9
P26	Pavement	Truck	16,855	23,456	2,712.4	6.0	2,706.4	9
P27	Pavement	Truck	16,765	23,947	2,714.8	6.5	2,708.3	10
P28	Pavement	Truck	16,857	24,434	2,717.4	6.5	2,710.9	10
P29	Pavement	Truck	16,772	24,926	2,726.2	6.5	2,719.7	10

Boring #	Feature	Drill Rig Type	Northing (feet)	Easting (feet)	Ground Elev. (feet)	Depth (feet)	Bottom Elev. (feet)	Figure 4.1 Sheet No.
P30	Pavement	Truck	16,864	25,416	2,728.9	6.0	2,722.9	11
P31	Pavement	Truck	16,779	25,905	2,729.7	6.5	2,723.2	11
P32	Pavement	Truck	16,873	26,391	2,733.0	6.5	2,726.5	11
P33	Pavement	Truck	16,792	26,884	2,736.9	6.0	2,730.9	12
P34	Pavement	Truck	16,881	27,374	2,740.7	6.5	2,734.2	12
W01	UPRR Emb	Truck	15,779	20,899	2,691.3	50.5	2,640.8	7
W02	UPRR Emb	Truck	15,769	21,079	2,693.4	55.5	2,637.9	7
W03	UPRR Emb	Truck	15,930	20,940	2,692.2	61.5	2,630.7	7
W04	UPRR Emb	Truck	15,904	21,147	2,694.4	66.4	2,628.0	7,8
W05	UPRR Emb	Track	16,063	21,006	2,693.7	71.5	2,622.2	8
W06	UPRR Emb	Truck	16,039	21,238	2,694.4	71.5	2,622.9	8
W07	UPRR Emb	Truck	16,198	21,078	2,694.8	76.0	2,618.8	8
W08	UPRR Emb	Truck	16,164	21,329	2,695.6	76.5	2,619.1	8
W09	UPRR Emb	Truck	16,319	21,164	2,695.2	76.5	2,618.7	8
W10	UPRR Emb	Truck	16,269	21,436	2,696.7	75.4	2,621.3	8
W11	UPRR Emb	Truck	16,427	21,257	2,696.3	76.5	2,619.8	8
W12	UPRR Emb	Truck	16,559	21,844	2,700.6	75.5	2,625.1	8
W13	UPRR Emb	Truck	16,736	21,692	2,697.2	75.4	2,621.8	8
W14	UPRR Emb	Truck	16,617	21,986	2,701.3	55.8	2,645.5	8
W15	UPRR Emb	Truck	16,792	21,834	2,700.2	71.3	2,628.9	8
W16	UPRR Emb	Truck	16,672	22,124	2,704.7	46.0	2,658.7	8
W17	UPRR Emb	Truck	16,836	21,976	2,701.6	55.9	2,645.7	8
W18	UPRR Emb	Truck	16,723	22,277	2,709.5	21.5	2,688.0	8
W19	UPRR Emb	Truck	16,863	22,126	2,704.0	45.9	2,658.1	8
W20	UPRR Emb	Truck	16,869	22,277	2,707.3	21.5	2,685.8	8

4.1.1 Borings in Relation to Project Features

The second column of Table 4.1 identifies the project feature that is associated with each boring. The layout of the borings and their frequency is in general accordance with the requirements of ADOT (1989) and PCDOT (2010) subject to the constraints of environmental clearances, traffic control and the presence of underground and overhead utilities. To facilitate further association of the project features with the borings, Figure 4.1 shows the linework associated with the proposed slope and bridge features in addition to the boring locations.

4.1.2 Permits and Blue Stake Clearances

All borings were drilled in Pima County (PC-AZ) right-of-way (ROW), City of Tucson (COT) ROW, and Arizona Department of Transportation (ADOT) ROW. The ROW permit to perform the geotechnical investigation within PC-AZ ROW was approved on August 26, 2010. The ROW permit to perform the geotechnical investigation within COT ROW was approved on August 18, 2010. The ROW permit to perform the geotechnical investigation within ADOT ROW was approved on January 4, 2011. Blue Stake clearances and UPRR Right of Entry permits were obtained by GSI.

4.1.3 Drilling, Sampling and Testing Methods

The borings were performed by GSI under supervision of geotechnical personnel from NCS. GSI used truck-mounted CME 75 and track-mounted CME 75 drill rigs. Hollow stem augers having an outside diameter (O.D.) of 7.625 inches and an inside diameter (I.D.) of 4.25 inches were used to advance the borings.

For the “B-series” and “D-series” borings Standard Penetration Tests (SPT) were performed at increments of 5 feet except for borings B09 and B10 where SPTs were performed at increments of 2.5 feet to a depth of 25 feet. SPTs were then performed at increments of 5 feet for depths beyond 25 ft. For the “P-series” borings SPTs were performed at depths of 2.5 and 5 feet. For the “W-series” borings SPTs were performed at increments of 2.5 feet to a depth of 10 feet. SPTs were then performed at increments of 5 feet for depths beyond 10 feet. A 2-inch O.D., 18-inch long split spoon sampler was used in general accordance with ASTM D1586 (ASTM, 2010). The split spoon sampler was driven in increments of 6 inches with a 140-pound automatic hammer freely falling from a height of 30 inches. The number of blows required for each 6 inches of penetration was recorded. The number of blows required to advance the sampler the last 12 inches is defined as the penetration resistance, or SPT N-value. The SPT N-value can be used to provide a qualitative description of the relative density of cohesionless soils or the consistency of cohesive soils. Additionally, 3-inch diameter ring samples were taken at specific locations for laboratory testing to obtain values of in-situ moisture content and density.

Refusal SPT N-values were encountered at various locations throughout the project site. A refusal SPT N-value or "sampler refusal" is noted when the sampler cannot be driven

the full 18-inch length of the sampler or when the blows of any 6-inch increment equal or exceed 50. Refusal N-values may also be indicative of the presence of cobbles or boulders whose size cannot be determined by the exploratory techniques used on this project. ***Therefore, cobbles and/or boulders should be anticipated in excavations.***

All samples were placed and sealed in plastic bags, given an identifying name as to boring number, sample number and depth, and transported to ConformaTech for geotechnical laboratory testing.

Geotechnical personnel from NCS were present throughout the field investigation program to observe the drilling operations, to assist in sampling, and to prepare descriptive logs of each boring. Soils were identified and described in the field in general accordance with ASTM D2488, "Standard Recommended Practice for Description of Soils (Visual-Manual Procedure)" (ASTM, 2010).

4.1.4 Groundwater and Bedrock Conditions

Bedrock was not encountered in any of the borings at the time of the field investigations. The depth to bedrock was inferred from digital maps prepared by Richard, et al. (2007). Based on these digital maps, the bedrock is estimated to be in excess of 4,800 feet below existing ground surface within the project area.

Groundwater was not encountered in any of the borings at the time of the field investigations. The depth to the regional groundwater table is estimated to be near 180 feet based on Arizona Department of Water Resources (ADWR) data accessed via the ADWR website (ADWR, 2011). The measured soil moisture contents within the top 10 feet at the time of the field investigation were found to range from 3.2% to 9.1%.

4.2 Laboratory Testing

Representative samples were retrieved from the borings and tested for classification and material properties. The results of these tests were used to evaluate the subsurface conditions and to aid in the engineering design of the proposed structures. ConformaTech performed the laboratory testing. The laboratory testing program included grain-size analyses, Atterberg limits tests, in situ moisture content and dry unit weight (density) determinations, and tests for collapse index. Selected samples were tested for pH, resistivity, sulfate and chloride contents, R-values and Standard Proctor maximum dry densities and optimum moisture contents. Tests on soil samples were performed in accordance with the standard test procedures listed in Table 4.2. The results of all laboratory tests including a comprehensive summary table are included in Appendix B. Laboratory classifications of the tested soil samples were determined according to the Unified Soil Classification System (USCS) and checked against the visual field classifications, which were then revised where appropriate in accordance with ASTM D2487 (ASTM, 2010).

Table 4.2
Geotechnical Test Methods Applied to Representative Soil Samples
(ARIZ, 2008; ASTM, 2010)

Geotechnical Test	Test Procedure
In-situ Moisture Content	ASTM D2216
Sieve (Grain Size) Analysis	ARIZ 201, ASTM C-136
Atterberg Limits (Soil Plasticity)	ASTM D4318
Collapse Potential	ASTM D5333
Swell Potential	ASTM D4546 Part B
R-value	ASTM D2844
pH	ARIZ 236b
Resistivity	ARIZ 236b
Sulfate and Chloride Content	ASTM D4542
Standard Proctor	ASTM D698

5.0 INTERPRETED SUBSURFACE CONDITIONS

5.1 General Description of Soils within the Limits of the Project

The soils within the project corridor are mostly native, coarse-grained soils (85%) with a little fine-grained soils (15%). Coarse-grained soils are defined as soils with greater than 50% of the material by weight having particle sizes larger than 0.075 mm (No. 200 sieve). Fine-grained soils are defined as soils with greater than 50% of the material by weight having particle sizes smaller than 0.075 mm (No. 200 sieve). The native soils within the limits of the project corridor may be characterized according to the unified Soil Classification System (USCS) as clayey sand (SC), silty sand (SM), lean clay (CL), well-graded sand with silt (SW-SM), well-graded sand with clay (SW-SC), silty clayey sand (SC-SM), silty clay (CL-ML), well-graded sand (SW), poorly-graded sand with silt (SP-SM), and poorly-graded sand with clay (SP-SC). Within the sand fraction there is roughly an equal portion of fine and medium sand with generally less coarse sand. The density of the coarse-grained soils varies from very loose to very dense, and the consistency of the fine-grained soils varies from very stiff to hard. The terms used to describe density and consistency are explained on Sheet 2 of 4 of “Key to Soil Symbols and Terms” in Appendix A. The soils generally become denser with depth.

Effect of Cementation: Most of the soils encountered in the borings exhibited varying degrees of calcium carbonate ($CaCO_3$) or lime cementation. In the field, cementation is commonly identified based on the observed reaction (“no”, “weak” or “strong”) between a soil sample and HCl acid of 10% concentration (ASTM D2488). The terms used to express the reaction to HCl are explained on Sheet 2 of 4 of “Key to Soil Symbols and Terms” in Appendix A. Although the reaction to HCl acid indicates the presence of calcium carbonate or lime, it does not necessarily reflect the degree of carbonate cementation. This is particularly true within the limits of this project and is observed quite often in the boring logs in Appendix A. Some samples have relatively low SPT N-values but exhibit a “strong” reaction to HCl, e.g., Boring P11, Sample S1 where SPT N-value = 7 and HCL reaction is "strong". This behavior may indicate that the soil particles

are coated with $CaCO_3$ or lime but the voids are mostly clear, i.e., the particles are not significantly cemented to each other; therefore, the density is loose. In other cases, soil samples may exhibit "no" to "weak" reaction to HCl but have relatively high SPT N-values, e.g., Boring B01A, Sample S3 where SPT N-value = 59 and there is no reaction to HCL. This behavior may be due to the effects of induration. Given the spatial variability of the cementation and/or induration at the project site, it is not possible to quantify the effect of cementation reliably in design. Therefore the effect of cementation was disregarded in assigning the values of the soil properties listed in Section 5.7.

In contrast to design, the degree and variability of cementation/induration can have a significant influence on construction activities such as drilling shafts or digging deep excavations. The degree of cementation/induration may necessitate the use of rock excavation tools. Therefore, to evaluate the effect of cementation/induration on construction activities, contractors are advised to review the boring logs carefully with respect to the qualitative description of a sample's reaction with HCl acid and the qualitative description of degree of cementation (if noted) in conjunction with its SPT N-value.

5.2 Identification of Potentially Hydro-Collapsible Soils

Some soils in the desert southwest are known to undergo rapid volume change (collapse) under moisture ingress and/or stress. Collapse-susceptible (metastable) soils may be encountered in the project corridor during construction.

Collapse tests were performed on ring samples, which were progressively loaded to 4 ksf and then inundated with water to obtain an estimation of the collapse index (I_e). The collapse tests were performed in accordance with ASTM D5333. The collapse index is expressed as a percentage and is defined as the difference in the height of the sample before and after inundation at 4 ksf divided by the original height of the sample. Table 5.1 presents a summary of the results of the collapse tests. The measured collapse indices at an applied stress of 4 ksf ranged from 5.68% to 18.76%. As can be seen in Table 5.2, the degree of severity of potential collapse settlement with respect to constructed facilities for this magnitude of collapse index is considered to be "moderate" to "severe" according to ASTM D5333.

The physical significance of the collapse index can be illustrated with a simple example. Consider a sample that exhibits a collapse index of 5% under a stress of 4 ksf applied during a laboratory collapse test. The sample was retrieved from an 8-feet thick layer of soil in the field. In this case, the layer has the potential to experience a rapid collapse settlement equal to 0.05 times 8 feet or 0.4 feet (4.8 inches) if the entire 8-feet thick layer becomes wetted and the average applied stress in the layer is approximately equal to 4 ksf, the applied stress under which the sample was inundated during the laboratory test. However, that potential would not be fully realized if only the top 4 feet of the layer becomes wetted; then only 0.05 times 4 feet or 0.2 feet (2.4 inches) of collapse settlement would occur under an average applied stress of 4 ksf. Nor would that potential be fully realized if the average applied stress in the layer were less than 4 ksf. In that case the

collapse potential (I_c) would have to be estimated from the collapse test results for the applied stress in the field. For this project, collapse is primarily a concern underneath the drainage structure at Julian Wash and pavements. Recommendations for the mitigation of the effects of collapse potential are discussed in Section 6.3 and Section 10.6.

Table 5.1
Summary of the Results of Collapse Tests (ASTM D5333)

Boring	Sample	Depth (feet)	USCS Symbol (Note 1)	PI	In situ dry density (pcf)	In situ moisture content (%)	Collapse index, I_e (%) (Note 2)	Blows/ft (Note 3)	Figure 4.1 Sheet No.
D02	R2	5.0	SM	NP	96.5	3.3	6.92	14	7
P03	R1	2.5	SC-SM	6	83.6	6.9	5.68	42	2
P13	R1	2.5	SC	13	87.0	5.4	10.35	30	5
P18	R2	5.0	CL	22	85.4	9.5	18.76	80	6
P28	R1	2.5	SC-SM	7	93.7	5.7	10.72	24	10
P34	R1	2.5	SC	8	91.1	9.1	15.70	34	12
W12	R2	5.0	SC	11	86.8	6.7	14.24	22	8
W13	R2	5.0	SM	9	85.6	5.8	8.11	8	8

Notes:
1. The USCS symbol and PI for sample R1 of boring P03 was assumed to be the same as the results for sample CU1 of boring P03, which was a bulk sample from 0.0 to 5.0 feet.
2. Collapse index was measured under a constant applied pressure of 4 ksf as per ASTM D5333.
3. This column reports the blows per foot for the 3-inch O.D. sampler with internal rings. The equivalent SPT N-value is approximately 0.44 times the value noted.

Table 5.2
Classification of Collapse Index (ASTM D5333)

Collapse Index (I_e)	Degree of Specimen Collapse
0	None
0.1 to 2%	Slight
2.1 to 6%	Moderate
6.1 to 10%	Moderately severe
>10%	Severe

5.3 Identification of Potentially Expansive (Swelling) Soils

Certain types of soils are known to expand in the presence of water. These soils generally contain expansive clay minerals such as montmorillonite. Expansive soils are primarily a concern for pavements, which typically do not have significant overburden to resists the swelling of the soils. Although the near surface soils are not predominantly fine-grained soils, many of them have substantial medium plasticity fines as can be seen in the plasticity charts in Appendix B. Therefore, it was decided to conduct a test on such a sample to determine the swell potential of such soils. The swell test was performed in

accordance with ASTM D4546 Part B. The swell test was performed on a sample, remolded to approximately 95% of maximum dry density and near 3% below optimum moisture content. The maximum dry density and optimum moisture content were determined in accordance with ASTM D698. The sample was tested for one-dimensional expansion in accordance with ASTM D4546 Part B by applying a surcharge of 125 psf. Testing the remolded sample provides relevant information for the swell potential of the in situ soil when used for pavement subgrade. Table 5.3 presents the result of the swell test, which suggests that, in general, the swell potential of the site soils is negligible.

Table 5.3
Summary of the Result of the Swell Potential Test on a Remolded Compacted Sample (ASTM D4546, Method B)

Boring (Note 1)	% fines	PI	Max dry density (pcf) (Note 2)	Optimum moisture content (%) (Note 2)	Remolded dry density before test [after test] (pcf)	Remolded moisture content before test [after test] (%)	Swell potential SP (%) (Note 3)
P29	36	17	115.7	13.8	108.5	12.0	1

Notes:
1. The sample was a bulk sample from a depth of 0 to 5 feet.
2. Max dry density and optimum moisture content were determined in accordance with ASTM D698.
3. Swell potential was measured as per ASTM D4546, Method B. A negative value indicates collapse. A seating pressure of 125 psf was used.

5.4 Shrink-Swell Characteristics (Earthwork Factors) of On-site Soils

Within the project corridor there are no areas of significant cut that could be used as a source of potential borrow material for the construction of embankments in fill sections. Therefore, no earthwork factors have been provided in this report. Once potential barrow sources have been identified, earthwork factors must be evaluated and used to determine the quantity of borrow material needed.

5.5 Electro-chemical Properties of On-site Soils

As indicated previously, within the project corridor there are no areas of significant cut that could be used as a source of potential borrow material for backfill purposes. However, the electro-chemical properties of on-site soils should be considered in the design of soil nail walls, drilled shafts, and cross-drainage structures. A limited electro-chemical testing program was performed to evaluate the corrosiveness of the on-site soils at the locations of the design features stated above. The electro-chemical tests consisted of pH, resistivity, chloride and sulfate content. These tests were performed on three samples; one sample in the Julian Wash, one sample near the UPRR bridge and one sample at the I-10 Bridge north abutment. The results of the electro-chemical tests are summarized in Table 5.4. The limiting chemical properties for bedding and shading material for pipe or drainage structures are shown in Table 5.5. From a comparison of

the electro-chemical properties listed in Table 5.4 with the requirements shown in Table 5.5, the following conclusions are made with respect to the suitability of the tested on-site soils as bedding and shading material for pipe or drainage structures:

- Meet the requirements for pH for all applications
- Does not meet the requirements for resistivity for all applications

The soils in the existing I-10 Bridge abutments were tested to determine the corrosiveness of the on-site soils with respect to soil nails. Based on the results of a test performed on Sample CU1 from Boring B09 shown in Table 5.4, it was determined from the low value (926 ohm-cm) of resistivity that the soil has a large corrosion potential (FHWA, 2010). For such a large level of corrosivity, the soil nails will need to be provided with double corrosion protection, i.e., a coating and grout encapsulation.

Table 5.4
Summary of Electro-chemical Properties of On-site Soils

Boring	Sample Depth (feet)	Electro-chemical Properties of the Soil Samples			
		pH	Resistivity (ohm-cm)	Sulfates (ppm)	Chlorides (ppm)
B02	5.0 – 10.0	7.6	2523	79	13
B09	10.0 – 15.0	7.3	926	90	120
D02	0.0 – 5.0	8	8716	ND	ND
Legend: ND – Not-detectable or below Practical Quantitation Limit (PQL)					

Table 5.5
Limiting Criteria for Electro-chemical Properties of Backfill Soils (COTPC, 2003)

Property	Limiting Criteria
	Structure Backfill (203-5.02) Bedding Material (501-2.04) Shading Material (501-2.05)
Resistivity (ohm-cm)	> 2,000
pH	6 < pH < 9 (for metals) 6 < pH < 12 (for concrete)

5.6 Suitability of Soils for Backfill Applications Based on Percent Fines and Plasticity Index

As indicated previously, within the project corridor there are no areas of significant cut that could be used as a source of potential borrow material for backfill purposes. Therefore no recommendations will be provided in this report regarding the suitability of on-site soils for backfill applications. For the purposes of cost estimating, it is recommended that the use of off-site borrow material be considered for all potential applications in order to be conservative with respect to project cost. All borrow materials shall meet the mechanical properties criteria shown in Table 5.6 for their respective potential applications. Resistivity and other electro-chemical requirements, which were

discussed in the previous section and are not included in this table, should be considered independently.

During construction if the contractor wishes to use on-site material for a given application, appropriate laboratory test results demonstrating that the material does in fact meet the relevant specifications must be furnished.

Table 5.6
Limiting Criteria for Selected Mechanical Parameters of Backfill Soils

Potential Application	Mechanical Parameter Requirement [1]		
	% Fines, X [2]	PI	X + PI
Structure backfill	-	-	≤25
Bedding material	≤8%	≤8	-
Shading material	-	-	≤25
Trench backfill outside roadway prism [3]	-	-	-
Trench backfill within roadway prism [4]	-	-	≤25

Notes:
1. Refer to relevant specification in COTPC (2003) for full gradation and other requirements.
2. % fines or X is the percent of material passing the No. 200 sieve, which has a sieve opening size of 0.075 mm.
3. Section 501-2.06 of COTPC (2003) for trench backfill only requires material to be less than 8-in. in size and free of organics, debris, rubbish etc.
4. Section 501-3.04 of COTPC (2003) requires trench backfill to meet shading material requirements (Section 501-2.05 of COTPC (2003)) when located within the roadway prism.

5.7 Engineering Properties of Soils

The soil properties of interest for the geotechnical analyses and design are the total (moist) unit weight, γ, the shear strength parameters defined by the angle of effective (drained) internal friction, ϕ', and the effective (drained) cohesion, c', and elastic parameters defined by the elastic modulus, E, and Poisson's ratio, υ. The values of the soil properties used here for analysis and design were derived from published correlations between those properties and SPT N-values and measured index properties such as grain size data and Atterberg Limits (AASHTO, 2002 and FHWA, 2006). A representative range of values was assigned to each of the design soil properties to represent variations in moisture content, grain size, plasticity and density within the project limits and with depth. Design values used in this report are a function of the soil layer that was being analyzed.

Because of the overall sandy nature of the coarse-grained soils and the generally low to medium plasticity of their intermixed fines, the following range of values for the design soil properties of the in situ soils was used in the geotechnical analyses over the entire site:

- Total (moist) unit weight (γ): 115 to 120 pcf
- Angle of effective (drained) internal friction (ϕ'): 32 to 38 degrees
- Effective (drained) cohesion (c'): 0 to 10 psf
- Elastic modulus of soil, E: 280 to 364 ksf
- Poisson's ratio, υ: 0.25

6.0 RECOMMENDATIONS FOR ROADWAY SLOPES AND EMBANKMENTS

6.1 Introduction

To allow for the widening of the existing UPRR bridge, approximately 12 feet of embankment fill will need to be added to each side of the existing large approach embankments. The existing approach embankments have slopes approximately 2H:1V (H=Horizontal; V=Vertical). The existing slopes appear to be stable except for erosion gullies that have formed along their surfaces. Because of the close proximity of the toes of the existing embankments to the PC-AZ ROW line, the additional embankment fills required for the widening of Valencia also have proposed slopes of 2H:1V. These approach embankments reach heights up to approximately 31 feet. To avoid creating a preferential slip surface at the interface of the existing and proposed embankments, the new embankment fill shall be benched into the existing embankment at a minimum of 6 feet horizontally according to Section 203-9.03 of COTPC (2003).

6.2 Deep-Seated Slope Instability

With respect to global stability, the new UPRR bridge approach embankments have a factor of safety of 1.25 against deep seated slope instability. The desired factor of safety against deep seated slope instability is 1.5. Therefore, the proposed slopes do not meet this criterion. Also, with the additional embankment fill being relatively thin combined with slopes of 2H:1V, this situation has the potential to create slope instability as well as poor pavement subgrade performance leading to longitudinal cracks. A geosynthetic reinforced platform (GRP) is therefore recommended in this area on both sides of the embankment along its entire length to prevent the longitudinal cracks from developing and to obtain a factor of safety against deep seated slope instability of 1.5. This GRP is schematically shown as Figure 6.1 and is discussed further in Section 6.6 of this report.

6.3 Settlement of Fills

Due to the additional embankment fills to widen the existing approach embankments to the UPRR bridge, the existing embankment soils and the foundation soils will experience compression. These settlements could have undesirable effects on existing structures such as the bridge joints and drilled shaft foundations of the bridge abutments, and the gas and fiber-optic lines located at shallow depths below the existing embankment fills. The gas and fiber-optic lines are noted on Sheet 8 of 12 in Figure 5.1. Advanced numerical analyses using the finite element approach were performed to evaluate the vertical movements that may be anticipated due to the construction of the additional side fills in order to assess their impact on these features within and under the existing embankments.

The numerical analyses were performed by using SIGMA/W (2010) software, which can simulate staged (sequential) construction of the embankments such as the placement of additional fills over existing fills.

Based on the numerical analysis it was found that approximately 1½ inches of settlement can be anticipated within the footprint of the additional side fills. A settlement of approximately ½ inch can be anticipated within the footprint of the top of the existing embankment. Given the shallow depth of the Kinder-Morgan gas lines and the fiber optic lines underneath the existing embankments, it is expected that these lines will experience the same settlements. These settlements will also impose downdrag loads on the drilled shafts of the existing bridge abutments. Construction issues related to these settlements are discussed in Section 9.

As noted in Section 5.2, the on-site soils have a large collapse index. To mitigate the detrimental effects of potential settlements due to collapsible soils, it is recommended that the 3 feet of native soils below the proposed additional embankment side fills be overexcavated and recompacted. The 3 foot deep zone of recompaction should extend a minimum of 1 foot beyond the toe of the new side slopes. The native soils should be recompacted to achieve a maximum dry density corresponding to 100% of the Standard Proctor effort according to ASTM D698 with compaction moisture content within ±2% of the optimum moisture content. During the recompaction process, the natural ground should be cleared of all vegetation, such as trees, upturned stumps, cacti, brush, roots, grass, weeds and any man-made debris.

6.4 Ground Compaction Factor

The Ground Compaction Factor (GCF) is related to the amount of settlement anticipated during construction of the new embankments due to the weight of the embankments alone. Based on the subsurface conditions encountered during investigations, a GCF of 0.15 feet is recommended for the new embankment fills of the UPRR bridge approaches. The GCF should be applied from outside toe to outside toe.

6.5 Erosion Protection

Due to the 2H:1V slope of the additional fill on the existing UPRR bridge approach embankments the same surface raveling and erosion gullies can be expected as can be seen on the existing embankment slopes. To prevent erosion gullies from forming, some form of slope protection such as rip-rap should be considered. Vegetation of such steep slopes is expected to be difficult if not impossible.

6.6 Geosynthetic Reinforced Platform

As discussed in Section 6.1, to prevent longitudinal cracks from developing and to obtain a factor of safety of 1.5 against deep-seated slope instability, a geosynthetic reinforced platform is recommended on both sides of the embankment along its entire length.

The GRP design and slope stability analyses were performed by using ReSSA Version 3.0 (ReSSA, 2010). The following assumptions were made:

- Free end of reinforcements at the face of the slope, i.e., no connection strength.
- 3 layers of geogrid with 100% area coverage at each geogrid level.
- Factor of safety against pullout = 1.5 minimum.
- Pullout resistance factor, F* = 0.8.
- Scale correction factor, $\alpha = 0.8$.
- Reduction factor for installation damage, $RF_{ID} = 1.45$.
- Reduction factor for durability, $RF_D = 1.2$.
- Reduction factor for creep, $RF_{CR} = 2.6$.
- Additional reduction factor, $RF_A = 1.5$.
- Minimum ultimate (or yield) tensile strength of geogrid, T_{ult} = 4,800 lb/ft.
- Minimum long-term tensile strength on a load per unit width of reinforcing basis = 707 lb/ft.

The above parameters and those discussed in Section 5.7 were used to perform parametric analyses. As a result of these analyses, the following recommendations for the GRP are identified:

- The GRP should be a minimum of 4-feet thick with three layers of geogrid ranging from 14-feet to 18-feet wide and vertically spaced at 16-inch (maximum) intervals as shown in Figure 6.1.
- The geogrid should have a minimum long-term ultimate tensile strength of 4,800 lb/ft as measured by the wide-width strip tensile test described in ASTM D4595. A Tensar UX1400HS or equivalent uniaxial geogrid will meet this requirement.
- The geogrid coverage at each layer of the geogrid should be 100%.
- The depth of the top layer of geogrid may be adjusted according to the pavement subgrade requirements.
- If the geomaterial in the GRP is composed primarily of rock fragments (material having less than 25 percent passing a 3/4-inch sieve) then a similar layer of separation fabric should also be placed at the interface of the pavement subgrade and the top of the proposed “rocky” geomaterial.

7.0 RECOMMENDATIONS FOR RETAINING WALLS

7.1 Introduction

To accommodate the widened roadway prism underneath the existing I-10 Overpass at Valencia, a retaining wall will be needed to support the existing end-slopes that will need to be truncated. The main requirements on this project are similar to those for most projects of this nature, i.e., to provide safe, aesthetically pleasing retaining walls while minimizing the project cost and at the same time not closing down the overpass. There are several possible wall alternatives that could be used. Because of the space constraints imposed by the existing I-10 Bridge and its foundation elements, the project team determined that a soil nail wall is the best alternative from the viewpoint of economics of construction. Therefore, only the soil nail wall alternative will be discussed in this report.

7.2 Soil Nail Retaining Walls

The proposed soil nail walls at the east and west abutments are each approximately 300-feet long. The existing slopes have a grade ranging from 1.4H:1V to 1.5H:1V. At the location of the wall, the retained wall height varies from approximately 3 feet to 9 feet, which includes an embedment depth of 2 feet. The final wall facing will extend approximately 2 feet to 3 feet above the intersection point of the existing slope paving and the back-face of the soil nail wall.

The soil nail wall face will be comprised of a temporary shotcrete facing having a minimum 4-inch thickness and a final (permanent) facing whose thickness will be based on structural and architectural finish considerations. A minimum nominal nail-head capacity of 15 kips may be assumed for the shotcrete facing as 15 kips to determine soil nail lengths and spacings.

Detailed construction plans were developed for the soil nail walls; they are part of the project plan set

7.2.1 Geotechnical Design Criteria

The following criteria were used in the analyses for the soil nail wall:

Design Soil Properties. The following design properties were selected based on the soils data from borings B09 and B10 that were drilled through the I-10 embankments:

- Unit weight (total): 115 pcf
- Effective friction angle: 34 degrees
- Effective cohesion: 0 psf
- No water table

Geotechnical Design Reference:

- FHWA (2003), ***Geotechnical Engineering Circular No. 7 – Soil Nail Walls***, Report No. FHWA0-IF-03-017, Federal Highway Administration, Washington, DC.
- FHWA (2010). ***Hollow Bar Soil Nails – Review of Corrosion Factors and Mitigation Practice***, Authors: Samtani, N. C. and Nowatzki, E. A., Central Federal Lands Highway Division, Federal Highway Administration, Lakewood, CO.

Factors of Safety (after Table 5.3 of FHWA [2003] for permanent structures):

- Soil shear strength (friction and cohesion): 1.50
- Nail adhesion (pullout resistance): 2.0
- Nail tendon capacity: 1.8 (inverse of 0.55)
- Nail head strength: 1.5
- Global (rotational, wedge) stability: 1.5
- Sliding at the base of the soil nail wall: 1.5

7.2.1

7.2.2 Geotechnical Analyses and Recommendations

Using the above criteria and the minimum nominal nail head capacity of 15 kips, soil nail analyses were performed by using the GOLDNAIL (1996) computer program. The following geotechnical recommendations are based on the soil nail analyses:

- Minimum 2 feet embedment of the soil nail wall below finished grade in front of the wall.
- All nails shall be 14 feet long as measured from the back of the soil nail wall facing.
- The horizontal spacing of the nails shall not exceed 5 feet.
- The number of nail rows shall be as follows based on wall height (H) that includes 2 feet of embedment:
  - 1 row for H < 5 feet.
  - 2 rows for 5 feet ≤ H < 7 feet
  - 3 rows for 7 feet ≤ H < 9 feet
- For locations where 2 or more rows are needed, the nails can be laid out using the following guidelines
  - The top row of nails should be within 1 foot to 3 feet from the top of the retained soil behind the wall.
  - The bottom row of nails should be within 1 foot to 3 feet from the bottom of the wall.
  - For 3 rows of nails, locate the center row approximately equidistant between the top and bottom rows of nails.
- The angle of inclination of all nails shall not be steeper than 15 degrees as measured from the horizontal with a tolerance of ± 3 degrees.
- The minimum soil nail drill-hole diameter shall be 6 inches.
- The nominal (ultimate) pullout resistance is 2 kips/ft assuming use of threaded (or deformed) solid bar soil nails.
- The nails should be installed by using the temporary stabilizing berm or slotted excavation technique as noted in FHWA (2003). This recommendation is made to mitigate possible detrimental movement and instability issues that could affect the existing bridge foundations.
- The nail tendons should be sized for a minimum tensile capacity, R_T, of 25 kips where R_T is as defined in FHWA (2003)[1]. If Grade 60 steel is used for nail tendons, i.e., a yield stress, f_y = 60 ksi, the minimum cross-sectional area of the solid bar nail tendon is approximately 0.42 in^2.
- Because of the low resistivity of the I-10 embankment soils as noted in Section 5.5, the nail tendons should be protected against corrosion by use of encapsulation according to the recommendations for Class 1 corrosion protection in Appendix C of FHWA (2003) and as required by the ADOT Bridge Group.
- Soil nail grout shall have the following properties:
  - Minimum 28-day compressive strength of 3,000 psi,
  - Minimum 3-day compressive strength of 1,500 psi,

[1] This value of 25 kips is referred to as the "nominal nail tendon tensile (yield) strength" in GOLDNAIL (1996) terminology.

  - Neat-cement grout having a water:cement ratio of 0.45
  - Type I/II Portland cement conforming to ASTM C150/AASHTO M85
  - Mixed uniformly and free of lumps
- Two verification tests shall be performed at each abutment. Additional verification tests may need to be performed at locations specified by the Engineer. Verification testing shall be performed in accordance with the requirements of FHWA (2003) and project plans.
- Five percent of the production nails in each row shall be proof tested with a minimum of one proof test per row of nails. Proof testing shall be in accordance with the requirements of FHWA (2003) and project plans.

8.0 RECOMMENDATIONS FOR BRIDGE FOUNDATIONS

8.1 Introduction

The bridge structure over the UPRR tracks is proposed to be widened approximately 20 feet on both sides of the bridge. The existing UPRR bridge is a three-span structure. The center span is approximately 117-feet long while the two end spans are each approximately 52-feet long. The existing UPRR bridge is supported by one row of 2-feet diameter caissons at each abutment and one row of 4-feet diameter caissons at each pier location. The as-built drawings indicate that the abutment foundations extend to El. 2648 feet and the pier foundations extend to El. 2638 feet.

8.2 Feasible Foundation Types Based on General Subsurface Conditions

Based on discussions with the project team, the desire is to match the existing UPRR bridge deep foundations. Therefore, shallow foundations will not be analyzed. For deep foundations, driven piles are not considered feasible for this project because of the difficulties associated with the advancement of such piles through the very dense or hard soils that exist at depth throughout the project site. Drilled shafts, whose construction generates less noise and vibration than driven piles, and can be advanced to target depths in the soils found at the project site. Drilled shafts are considered to be more feasible than driven piles and are therefore recommended for this project.

8.3 Subsurface Conditions

As shown on Sheet 8/12 of Figure 4.1, ten borings, B01A, B02A, and B01 through B08, ranging from 21.5 feet to 131.5 feet deep, were advanced in the vicinity of the proposed abutment and pier locations to obtain geotechnical data for development of bridge foundation recommendations. Based on the results of the geotechnical investigations, the following subsurface layers were found:

- Layer L1: Approximately the top 75-feet of soil below existing grade. The soil is prominently silty sand and clayey sand having relatively high SPT N-blow counts.

- Layer L1a: Same as layer L1 except that the material has relatively moderate SPT N-blow counts and extends to a depth of approximately 35-feet below existing grade.

- Layer L1b: Same as Layer L1a except having slightly higher SPT N-blow counts and is encountered below Layer L1a.

- Layer L2: Encountered below Layer L1. The soil is predominantly silty sand and clayey sand having SPT N-blow counts approaching or at refusal.

8.4 Design Procedures for Drilled Shafts

The design of drilled shafts involves evaluation of the axial and lateral capacities for a given set of loading and soil conditions. Typically, the shaft design proceeds by first evaluating axial resistance followed by lateral resistance. The final length and diameter for a given shaft will be the larger of the length and diameter required from axial and lateral load analysis.

8.4.1 Axial Load Analysis

In this report, **design** axial capacity charts are presented for evaluating the size of drilled shafts based on axial load considerations. The charts contain plots of depth below the approximate existing grade versus design axial capacity for a range of shaft diameters. The drilled shaft design axial capacity charts presented in Figures 8.1, 8.2, and 8.3 are applicable at the abutments, east pier and west pier locations, respectively. The design charts permit the structural engineer to design an optimal foundation size for given axial load conditions by selecting from a range of shaft diameters and lengths. The drilled shaft design capacity charts should be used in accordance with the procedures described in Appendix C. The charts incorporate the following assumptions:

- Tip resistance based on strain compatibility with side-resistance.
- A factor of safety of 2.5 with respect to the "ultimate axial capacity" as given by Eq. 4.6.5.1-1 in AASHTO (2002).
- Group Reduction Factor (GRF) not included. Therefore, the structural designer should include a GRF when appropriate as demonstrated in Appendix C.
- Weight of the shaft below zero depth is included.

8.4.2 Lateral Load Analysis

Once a shaft is sized based on axial capacity considerations, a lateral load analysis should be performed. Use of the computer program LPILE^{PLUS} Version 5.0 (Reese et al., 2004), a later version of that program, or a similar program is recommended for this purpose. The LPILE^{PLUS} program is based on the "p-y" concept and includes the effect of soil-structure interaction along the full embedment depth of the shaft or pile. The geotechnical parameters given in Tables 8.1, 8.2, and 8.3 can be used in the LPILE^{PLUS} Version 5.0 program or a later version. The lateral load analysis of drilled shafts is an iterative process that starts by assuming that the drilled shaft is cantilevered with fixity

occurring at a certain depth below a certain reference depth line. For abutments, the reference depth line should be the bottom of the embankment fills while for piers the reference depth line should be the top of the shaft below existing grade. For preliminary analysis, the depth to fixity below the reference depth line may be assumed to be as follows based on recommendations by McBride and Maroney (1986):

- For 3-feet to 5-feet diameter drilled shafts, depth to fixity = 4D, where D is the diameter of the shaft.

- For 6-feet to 10-feet diameter drilled shafts, depth to fixity = 3.5D where D is the diameter of the shaft.

The cantilever model provides only an initial estimate of the depth to fixity. Once the cantilevered frame analysis is performed, the analysis is iteratively repeated until the deformations (deflections and rotations) at the point of application of the loads from the cantilever model and the LPILE^{PLUS} model are in reasonable conformance, i.e. convergence is achieved. Once convergence is achieved, the distribution of shears and moments from the LPILE^{PLUS} model should be used for the design of the shaft reinforcement. The buckling failure mode should also be checked in the equivalent cantilevered model as appropriate.

Lateral load analysis of shaft groups may be performed by using software GROUP 5.0 (Reese et al, 2000) or a later version of that program. The geotechnical parameters given in Tables 8.1, 8.2, and 8.3 can be used in the GROUP 5.0 program or a later version of it.

Note that the final length for a given shaft will be the larger of the lengths required from axial and lateral load analysis.

Table 8.1
Soil Properties Recommended for the Lateral Load Design of Drilled Shafts for the East and West Abutments of the UPRR Bridge

Layer	Top Elevation - Bottom Elevation	Design N-value	Design Effective Unit Weight	Design Friction Angle	LPILE Parameters	
					LPILE Soil Type	Lateral Soil Modulus
		N	γ'	φ		k
	(feet)	(blows/foot)	(pcf)	(degrees)		(pci)
L1	Bottom of Fill (2,695) - 2,660	45	120	37	Sand (Reese et al.)	225
L2	2,660 - 2,596	50	120	38	Sand (Reese et al.)	225

LEGEND:
k : Lateral soil modulus (From LPILE Manual for static loading; for cyclic loading use 50% of listed value). The k value applies to the indicated "soil" type as per the LPILE^{PLUS} Version 5.0 or later.

Note: **The k value, soil type, and ε_{50} values assume that the structural engineer will use LPILE^{PLUS} Version 5.0 or later and GROUP Version 5.0 or later for lateral load analysis.**

Table 8.2
Soil Properties Recommended for the Lateral Load Design of Drilled Shafts for the East Pier of the UPRR Bridge

Layer	Top Elevation - Bottom Elevation	Design N-value	Design Effective Unit Weight	Design Friction Angle	LPILE Parameters	
					LPILE Soil Type	Lateral Soil Modulus
		N	γ'	φ		k
	(feet)	(blows/foot)	(pcf)	(degrees)		(pci)
L1	Existing Grade (2,696) - 2,660	45	120	37	Sand (Reese et al.)	225
L2	2,660 - 2,562	50	120	38	Sand (Reese et al.)	225

LEGEND:
k : Lateral soil modulus (From LPILE Manual for static loading; for cyclic loading use 50% of listed value). The k value applies to the indicated "soil" type as per the LPILE^{PLUS} Version 5.0 or later.

Note: **The k value, soil type, and ε_{50} values assume that the structural engineer will use LPILE^{PLUS} Version 5.0 or later and GROUP Version 5.0 or later for lateral load analysis.**

Table 8.3
Soil Properties Recommended for the Lateral Load Design of Drilled Shafts for the West Pier of the UPRR Bridge

Layer	Top Elevation - Bottom Elevation	Design N-value	Design Effective Unit Weight	Design Friction Angle	LPILE Parameters	
					LPILE Soil Type	Lateral Soil Modulus
		N	γ'	φ		k
	(feet)	(blows/foot)	(pcf)	(degrees)		(pci)
L1a	Existing Grade (2,695) - 2,660	30	120	34	Sand (Reese et al.)	90
L1b	2,660 - 2,620	40	120	36	Sand (Reese et al.)	225
L2	2,620 - 2,563	50	120	38	Sand (Reese et al.)	225

LEGEND:

k : Lateral soil modulus (From LPILE Manual for static loading; for cyclic loading use 50% of listed value). The k value applies to the indicated "soil" type as per the LPILE^{PLUS} Version 5.0 or later.

Note: **The k value, soil type, and ε_{50} values assume that the structural engineer will use LPILE^{PLUS} Version 5.0 or later and GROUP Version 5.0 or later for lateral load analysis.**

8.4.3 Total and Differential Settlements

Settlements of individual drilled shafts will depend on the magnitude of the design loads during final design, the depth of the drilled shaft, and the quality of the shaft construction. Estimates of the shaft settlements expected for the bridge structures were obtained using procedures described in Section 4.6.5.5 of AASHTO (2002). For the soils encountered during the investigation program conducted as part of this report, the settlements may be anticipated to be approximately 1% of the shaft diameter. Thus, for a 4-ft diameter shaft, the estimated settlement is equal to 0.01 x 4-ft = 0.04-ft $\simeq$ 0.5 inches. Most of the settlements are expected to occur by the end of construction.

After settlements are evaluated for a given substructure element, i.e., pier or abutment, the differential settlement between the substructure elements should be considered in the superstructure design. The following approach is recommended for the evaluation of differential settlements between adjacent support elements:

- The actual settlement at any support element could be as large as the calculated value of settlement for that element.

- At the same time, the actual settlement of an adjacent support element could be zero.

Use of the above approach would result in an estimated maximum possible differential settlement equal to the larger of the two total settlements at either end of any span. The angular distortions generated by differential settlements can be evaluated by using the guidance in Article 4.4.7.2.5 of AASHTO (2002). For evaluating the differential settlements it is recommended that a staged construction analysis be considered.

8.4.4 Downdrag (Negative Skin Friction)

Downdrag or negative skin friction may have to be considered for the new drilled shafts if they are constructed before embankment fills near the abutment locations. Factors that will influence the design include construction sequencing, materials utilized in the fill, embankment geometry, and embankment foundation preparation. Regardless of construction sequence, downdrag will need to be considered for the existing bridge abutment drilled shafts. Figure 8.4 presents the ultimate capacity chart to estimate the drag load based on the negative skin friction that is generated by the soils surrounding the drilled shaft(s) dragging them down as the soils settle under the fill load. The term "negative skin friction" is used to define the direction of the frictional forces, which act in the opposite direction (negative) to the direction of the skin friction forces that ordinarily resist the axial loads applied to the shaft(s). The chart is in reference to the top elevation of the existing west abutment (i.e., El. 2728) and extends to the depth at which downdrag is dissipated (i.e., approximately El. 2697). Coincidently, the depth at which the downdrag is dissipated is approximately equal to the bottom of the existing embankments. The downdrag load is added to the structure load prior to using the axial capacity chart. The integrity of the existing shafts should be evaluated due to downdrag loads.

8.4.5 Construction Considerations for Drilled Shafts

Based on the boring logs, the following construction considerations are provided for drilled shafts to ensure that the design assumptions are satisfied:

1. The minimum concrete cover over reinforcing steel should be 6-inches.

2. Cobbles and boulders may be encountered during the construction of the drilled shafts.

3. Poorly graded sands and gravels should be anticipated at various depths. These soils are prone to caving as well as large fluid losses during slurry-assisted drilled shaft construction. Therefore, localized caving should be anticipated during drilled shaft construction.

4. Temporary surface casing is recommended to aid in alignment of shafts, to prevent surface sloughing or raveling and to ensure personnel safety. A minimum 10-ft long temporary surface casing with at least 2-ft above the ground surface is recommended. The diameter of the surface casing should not be more than 12-inches larger than the nominal diameter of the shaft.

5. End-bearing has been included in the axial resistance charts for drilled shafts. To ensure the development of design end-bearing without significant displacement, it is recommended that the bottoms of all drilled shafts be cleaned with a "spin-bottom" cleanout bucket before concrete is placed in the shaft. A minimum of two passes with the cleanout bucket is recommended. If slurry construction processes are used, then the sand content prior to concreting must be less than 1% by volume.

6. The reinforcing cage should be placed in the drilled shaft within two hours after the shaft bottom has been cleaned. The shaft bottom should be inspected immediately prior to lifting the cage and re-cleaned if deemed necessary by the Engineer.

7. To prevent contamination of the shaft bottom from side-wall raveling after placement of the reinforcing cage, it is recommended that concreting of the shaft should commence within two hours after placement of the reinforcing cage. Concreting of the entire shaft should be completed in one operation once it has commenced.

8. Cross-hole sonic logging (CSL) tubes are recommended for integrity tests in all production shafts. A minimum of four CSL tubes are recommended for pier shafts and abutment shafts. The inspection tubes should be uniformly distributed around the inside circumference of the reinforcing steel cage. All possible logging combinations for any given number of tubes are recommended. The loggings should be performed by the Contractor in accordance with the requirements of project specifications and ADOT special provisions for integrity testing

9. A minimum of four tubes for gamma-gamma logging (GDL) should be attached at 90-degree intervals to the outside of the cage to evaluate the concrete cover thickness. All production shafts should be tested. The loggings should be performed by the Contractor in accordance with the requirements of project specifications and ADOT special provisions for integrity testing.

10. To minimize the reduction in open cage area and allow better flow of concrete to the outside of the cage, both CSL and GDL tests may be required to be performed in the same tube. In this case, we recommend a Schedule 80 PVC tube with an inside diameter that can fit the probes used in CSL and GDL tests.

11. The construction of a confirmation shaft is recommended to assess constructability. A confirmation shaft is the first production shaft drilled at the bridge site and is intended solely to confirm the suitability of the contractor's chosen equipment and construction techniques for the construction of the drilled shafts at that specific site.

12. It is assumed that construction of drilled shafts will be in accordance with the latest version of Section 609 of ADOT (2008).

9.0 CONSTRUCTION SEQUENCING TO MITIGATE THE EFFECT OF GROUND DEFORMATIONS DUE TO ADDITIONAL APPROACH EMBANKMENT FILLS

As noted in Section 6.3, settlements can be expected to occur due to construction of additional side fills on the existing approach embankments to the UPRR bridge. Because of the calculated ground deformations associated with the construction of the new approach embankment fills, consideration shall be given to the following:

1. Construct drilled shafts for the abutments after the new approach embankment fills have been placed. In this way, the downdrag forces acting on the new drilled shafts will be mitigated as noted earlier.

2. The abutment joints of the existing UPRR bridge may need to be adjusted after the new approach embankment fills have been placed because the downdrag forces noted earlier may cause up to ½ inch of settlement of the existing abutment shafts.

3. All utilities that will be buried under the new embankments shall take into consideration the estimated settlements and their construction should be sequenced as appropriate.

4. The Kinder Morgan gasoline lines and the fiber-optic lines shown in Sheet 8 of 12 in Figure 5.1 are expected to deform up to 1½ inches due to the new approach embankment fills. The integrity of these lines should be analyzed by their owners to verify that 1½ inches of deformation is acceptable. If this amount of deformation is not acceptable, then mitigation measures will be needed to prevent or allow such deformation.

From the above discussion it is evident that specific construction sequencing will be needed to help mitigate the effects of ground deformations due to construction of the new approach embankment fills. It is recommended that the specific construction sequence be detailed in project plans and/or special provisions.

10.0 RECOMMENDATIONS FOR PAVEMENT STRUCTURES

10.1 Pavement Investigations

Twenty-nine pavement borings listed in Table 4.1 were performed in support of the pavement analysis for this project. As indicated previously, these are referred to as the "P–series" borings. All the pavement borings were advanced to a depth of at least 5 feet below existing ground surface. The logs for the "P series" borings are contained in Appendix A. Six pavement cores were also performed to identify the existing pavement thickness. As indicated previously, these are referred to as the "PC–series" borings. A summary of the pavement cores is presented in Table 10.1.

Table 10.1
Summary of Pavement Cores

Boring #	Feature	Drill Rig Type	Northing (feet)	Easting (feet)	Ground Elev (feet)	Existing Asphaltic Concrete Thickness (inches)	Figure 4.1 Sheet No.
PC01	Pavement Core	Truck	14,0495	14,287	2,658	7	2
PC02	Pavement Core	Truck	14,151	16,689	2,668	6 ½	4
PC03	Pavement Core	Truck	14,089	19,229	2,691	7 ½	6
PC04	Pavement Core	Truck	16,455	21,416	2,729	6 ¾	8
PC05	Pavement Core	Truck	16,770	22,762	2,709	8 ½	9
PC06	Pavement Core	Truck	16,847	25,219	2,729	7	10

10.2 R-value Evaluation

A total of four laboratory R-values and twenty-eight correlated R-values were used to evaluate the subgrade support within the project area. Mean and construction control R-values were calculated from these data in accordance with the requirements of Section 202.02 of ADOT (1989). Tables 10.2 and 10.3 list the correlated and measured R-value data from the "P-series" borings within the project area. By using the procedure outlined in Section 202.02 of ADOT (1989), a mean R-value of 42.2 was computed for the on-site subgrade soils west of Craycroft Road and a mean R-value of 21.1 was computed for the on-site subgrade soils east of Craycroft Road. In an effort to minimize the amount of soil

replacement, the project team determined that for this phase of the project a design R-value of 30 shall be used for pavement analyses west of Craycroft Road, and a design R-value of 20 shall be used for pavement analyses east of Craycroft Road. Subgrade acceptance charts corresponding to R-values of 30 and 20 are shown in Figures 10.1 and 10.2, respectively.

Table 10.2
Summary of R-values West of Craycroft Road

Boring	% Passing #200	PI	R_{corr}	R_{tested}
P01	22.0	14	42.7	
P02	39.0	12	36.5	
P03	27.0	6	54.5	
P06	18.0	5	64.1	52
P07	29.0	9	47.1	
P08	22.0	7	56.1	
P09	32.0	23	26.1	
P10	39.0	21	25.6	
P11	24.0	14	41.5	
P12	25.0	5	58.2	
P13	28.0	7	51.6	
P14	25.0	11	46.0	
P15	15.0	13	48.9	
P16	39.0	12	36.5	22
P17	35.0	18	30.5	
P18	42.0	21	24.6	
P19	36.0	18	30.1	
		n:	**17.0**	**2.0**
		Mean:	**42.4**	**37.0**
		Min:	**24.6**	**22.0**
		Max:	**64.1**	**52.0**
		Std.Dev.:	**12.4**	**21.2**
		R(mean)	**42.2**	
		R(design)	**30**	

Table 10.3
Summary of R-values East of Craycroft Road

Boring	% Passing #200	PI	R_{corr}	R_{tested}
P24	29.0	13	40.3	
P25	21.0	5	61.5	
P26	15.0	12	50.8	
P27	21.0	18	37.0	
P28	34.0	11	40.6	14
P29	36.0	17	31.3	
P30	36.0	14	35.2	
P31	30.0	17	34.0	
P32	37.0	27	20.8	
P33	28.0	16	36.3	
P34	41.0	18	28.1	9
		n:	**11.0**	**2.0**
		Mean:	**37.8**	**11.5**
		Min:	**20.8**	**9.0**
		Max:	**61.5**	**14.0**
		Std.Dev.:	**10.9**	**3.5**
		R(mean)	**21.1**	
		R(design)	**20**	

10.3 18-kip Equivalent Single Axle Load (ESAL) Data

Table 10.4 summarizes the estimated design one-way 18-kip ESAL values provided by Psomas.

Table 10.4
Design Equivalent Single Axle Loads
(Design Life = 20 years; Design Year: 2035)

Location	Arterial or Collector Classification	Design One-Way 18-kip ESALs
Valencia Road (West of I-10)	Arterial	15,416,191
Valencia Road (East of I-10)	Arterial	6,720,725

10.4 Parameters for Flexible Pavement Analysis

The pavement analysis was performed in general conformance with Section 3.13 of PCDOT (2010). In addition to the assumed design R-values of 30 and 20, the following design parameters were used for the flexible pavement design:

- Level of Reliability (R) = 95% for arterials, which is recommended for roadways with average daily traffic levels (ADT) over 5,000.
- Z_R = -1.645 for a level of reliability of 95%.

- Standard Error: $S_0 = 0.35$.
- Seasonal Variation Factor = 1.7
- Initial Serviceability Index: $P_0 = 4.2$ for arterials.
- Terminal Serviceability Index: $P_t = 2.8$ for arterials.
- $\Delta PSI = P_0 - P_t = 1.4$ for arterials.
- The resilient modulus: M_R = 13,000 psi and 8,800 psi for the assumed R-values of 30 and 20, respectively.
- Quality of base drainage = Fair.
- Quality of subbase drainage = Fair.
- Base drainage coefficient = 0.92
- Subbase drainage coefficient = 0.92
- Structural coefficient for asphaltic concrete (AC) = 0.44
- Structural coefficient for asphalt rubber asphaltic concrete (ARAC) = 0.55 for a structural thickness up to 2 inches.
- Structural coefficient for aggregate base course (AB) = 0.12

10.5 Recommendations for Pavement Sections

The design parameters listed in Section 10.4 were used to calculate the structural number required for the flexible pavement design. Table 10.5 presents the required minimum structural number and the required level of reliability for arterial roadways based on PCDOT (2010). Appendix D contains the pavement design calculation worksheets.

Table 10.5
Required Flexible Pavement Parameters (PCDOT, 2010)

Type of Roadway	ADT Range	Required Minimum Structural Number	Required Level of Reliability
Arterials	>5,000	2.64	95%

Based on the demarcation of R-values as west and east of Craycroft Road and the demarcation of ESALs as west and east of I-10, the alignment was divided into three different locations for evaluation of pavement sections. These are West, Central, and East. West refers to the alignment west of I-10. The design ESAL value west of I-10 and design R-value west of Craycroft apply to the West pavement section. Central refers to the alignment east of I-10 and west of Craycroft Road. The design ESAL value east of I-10 and design R-value west of Craycroft apply to the Central pavement section. East refers to the alignment east of Craycroft Road. The design ESAL value east of I-10 and design R-value east of Craycroft apply to the East pavement section.

Table 10.6 provides a summary of the recommended pavement sections along with the design R-value (Column 2), calculated required structural number (Column 3) and provided structural number (Column 7) for the project roadway listed in Table 10.4. The calculated required structural number shown in Table 10.6 was obtained by solving the flexible pavement design equation iteratively. The calculated structural numbers exceed the minimum required structural number shown in Table 10.5 in all cases. Recommended thicknesses of Rubberized Asphaltic Concrete (ARAC), Asphaltic Concrete (AC) and

Aggregate Base (AB) are provided in Columns 4 through 6 of Table 10.6, respectively. The provided structural number based on the recommended AC and AB thicknesses is presented in Column 7 of Table 10.6. As can be seen, the provided structural number in Column 7 equals or exceeds both the minimum required and calculated structural number. The recommended structural sections shown in Table 10.6 can be seen graphically in Figure 10.3.

Table 10.6
Structural Numbers and Recommended Flexible Pavement Sections

Location	Design R-value	Calculated Required Structural Number	ARAC [1] (inches)	AC [2] (inches)	AB [3] (inches)	Provided Structural Number
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
West	30	4.62	2	5.5	10	4.62
Central	30	4.03	2	4.5	9	4.07
East	20	4.67	2	5.5	11	4.73

1. Per PCDOT (2010), minimum 2 inches for arterials (when used).
2. Per PCDOT (2010), minimum 5 inches for arterials when no ARAC is used, minimum 2.5 inches for arterials when ARAC is used.
3. Per PCDOT (2010) minimum 4 inches for arterials.

Alternative Pavement Sections: There are many possible alternative pavement sections that could satisfy the calculated structural numbers and meet the minimum required structural numbers. Table 10.7 shows alternative pavement sections that could be considered by the project team. In this case, the Alternative 1 section attempts to minimize the AB thickness, and the Alternative 2 section attempts to minimize the thickness of AC by utilizing additional AB material. However, in some cases the Alternative 2 section resulted in a pavement section not meeting the guidance in PCDOT (2010). That guidance states that the ratio of AB to AC, which includes ARAC, should be between 1:1 and 1.75:1. In such cases, the Alternative 2 pavement section was not included in Table 10.7.

Table 10.7
Alternative Pavement Sections

Location	Design R-value	Alternative 1			Alternative 2		
		AR-AC (inches)	AC (inches)	AB (inches)	AR-AC (inches)	AC (inches)	AB (inches)
West	30	2	6	8	2	5	12
Central	30	2	5	7	NA	NA	NA
East	20	2	6	9	NA	NA	NA

Notes:
NA – The AC thickness was not able to be reduced compared to the recommended pavement section shown in Table 10.6 and was therefore not included in this table.

10.6 Mitigation Measures for Unsuitable Subgrade Soils

SPT N-values were measured at 2.5 feet and 5.0 feet in each pavement boring to collect samples for collapse and swell testing based on past input from PCDOT. These blow counts indicated that the top several feet of the native soils ranged from loose to very dense. The loose soils could cause problems with pavement subgrade performance and lifespan. As can be seen in Section 5.2 the degree of severity of potential collapse settlement with respect to constructed facilities, such as pavements, ranges from "moderate" to "severe" throughout the project corridor. Therefore to mitigate the problems that may occur because of loose and collapse-susceptible soils, overexcavation, moisture conditioning and recompaction of the native soils is recommended to a depth of 3 feet from the bottom of the pavement structural section throughout the project corridor.

If the overexcavated soils do not meet the appropriate subgrade acceptance chart (Figure 10.1 or 10.2) then appropriate replacement soils shall be used. Table 10.8 provides station limits where poor subgrade compared to a design R-value of 30 or 20 is anticipated based on location within the project corridor. Within these limits the subgrade can be improved by using one of the following two options:

Option 1: Overexcavate 3 feet of soil below the bottom of the pavement structural section and replace it with borrow material meeting the appropriate subgrade acceptance chart presented in Figures 10.1 and 10.2.

Option 2: After recompaction of the overexcavated native soils, use a geogrid meeting the requirements of Section 1014-3 of COTPC (2003) and placed in accordance with the requirements of Section 306 of the COTPC (2003). If the geogrid option is used then a separation fabric meeting the requirements of Section 1014-4 of COTPC (2003) shall be placed in accordance with Section 208 of COTPC (2003) under the geogrid to prevent migration of fines from the subgrade into the pavement section. Furthermore, the geogrid shall have a minimum 6-inch thick compacted AB layer placed on it before construction of the AC.

Figure 10.4 shows the requirements for the mitigation of poor subgrade conditions by subgrade overexcavation and recompaction or subgrade replacement.

Table 10.8
Anticipated Limits of Poor Subgrade With Respect to Design R-value

Station Limits (Location in Reference to Craycroft Rd)	Design R-value
160+50 to 170+50 (West)	30
195+00 to 210+00 (West)	30
259+00 to 264+00 (East)	20
288+50 to 294+00 (East)	20

Note:
Subgrade shall be replaced with material meeting criteria shown in the appropriate subgrade acceptance chart (Figure 10.1 or 10.2). In cases where the roadway profile is being raised above existing grade, the depth of replacement may be reduced or eliminated as depicted graphically in Figure 10.4.

10.6.1 Proof-Rolling

Proof-rolling is recommended to evaluate the stability and uniformity of the subgrades. Proof-rolling should be performed on the entire area of subgrade prepared as noted above. The proof-rolling should be done immediately after subgrade compaction while the moisture content of the subgrade soil is near optimum or at the moisture content that achieved the required compaction.

If proof-rolling is performed after installation of pipe underdrains, do not use the proof-roller within 1.5 feet of the underdrains.

Proof-rolling should be performed with a pneumatic-tired tandem-axle roller with at least 3 wheels on each axle, a gross weight of 25 tons (50 kips), a minimum tire pressure of 75 psi and a minimum rolling width of 75 inches. A Caterpillar PS-300B (or PF-300B), Ingersoll-Rand PT-240R, BOMAG BW24R, Dynapac CP271 or equipment with equivalent capabilities should be used for proof-rolling.

Proof-rolling equipment should be operated at a speed between 1.5 to 3 miles per hour or slower as required by the Engineer to permit measurements of the deformations, ruts and/or pumping.

Proof-rolling is generally carried out in two directions at right angles to each other with no more than 24 inches between tire tracks of adjacent passes. If it is not practical to proof roll in two perpendicular directions within the spread footing excavations because of space constraints, proof-rolling should be performed parallel to the longer dimension of the excavation with a minimum of 6 inches of overlap between the tracks of adjacent passes. For retaining wall backfills where proof-rolling may not be possible perpendicular to the wall because of space constraints, one-directional proof rolling should be performed parallel to the wall with a minimum of 6 inches of overlap between the tracks of adjacent passes. The contractor should operate the proof-roller in a pattern that readily allows for the recording of deformation data and complete coverage of the subgrade.

The following actions shall be taken based on the results of the proof-rolling activity:

1. Rutting less than ¼ inch – the subgrade is acceptable.
2. Rutting greater than ¼ inch and less than 1½ inches – the subgrade needs to be scarified and re-compacted.
3. Rutting greater than 1½ inches – removal and reconstruction of the compacted area.
4. Pumping (deformation which rebounds or materials are squeezed out of wheel's path) greater than 1 inch – remediate as directed by the Engineer.

The approved proof-rolled soils should be maintained in their "as-approved" condition throughout the duration of the construction of the structure. Construction should not commence until the subgrade on which the structure will be constructed has been approved by the Engineer.

11.0 RECOMMENDATIONS FOR DRAINAGE STRUCTURES

The existing drainage structures will remain for this project,. An extension of the cross-drainage reinforced concrete box culvert (RCBC) at the Julian Wash is proposed to carry water under the widened Valencia alignment. The settlements beneath this box structure are anticipated to be less than ½ inch. Settlements are immediate and should be complete by the time the finished grade is established above the box. Differential settlements of up to ½ inch may occur between the sides of the RCBCs or between the ends of a length of RCBC segment because of differences in loading and soil conditions. Differential settlements should be factored into the structural design of the box structure extension.

The sides of all RCBCs should be designed for an "at-rest" lateral earth pressure condition equivalent to a hydrostatic (horizontal) pressure distribution of 55 psf per foot of wall depth. Lateral loads due to surcharge loads, including construction and traffic loads, should be added directly to these loads for design. These recommendations also apply to any smaller RCBCs and reinforced concrete pipe culverts (RCPC) that are not mentioned specifically in this report but are shown on the project plans.

12.0 TEMPORARY EXCAVATIONS

Temporary cut and fill slopes may be required. In general, temporary slopes should be excavated in accordance with OSHA (1995). According to Subpart P, Appendix A, the near surface soils at the site (within the upper 5 to 15 feet) are predominantly "Type B" soils for the existing embankment fill of the UPRR bridge approaches and "Type C" soils for the native material elsewhere throughout the project limits.

For excavations less than 20 feet in "Type B" soils, Subpart P, Appendix B indicates a maximum allowable unshored slope of 1H:1V.

For excavations less than 20 feet in "Type C" soils, Subpart P, Appendix B indicates a maximum allowable unshored slope of 1.5H:1V.

This recommendation is based on the soil moisture contents being maintained at or near optimum moisture content for fill slopes and at or near in-situ moisture contents for cut slopes. Significant moisture increases in the soils within the slope could weaken the slopes due to a reduction in shear strength. For shoring requirements refer to Subpart P, Appendix B of OSHA (1995).

Should steeper slopes be required because of the proximity of the temporary excavations to existing structures or for purposes of construction economy, the stability of the slopes should be verified through analysis by a registered Professional Engineer in the State of Arizona with demonstrated geotechnical engineering knowledge and experience.

For all excavations, the perimeter should be protected against water infiltration from surface runoff or other reasons. Moderate to severe raveling and erosion of excavation faces may occur because of water infiltration and/or surface runoff. Heavy equipment or traffic should not be allowed within 10 feet from the edge of any excavation.

13.0 LIMITATIONS OF THE REPORT

NCS Consultants, LLC (NCS) represents that our services are performed within the limits prescribed by the Client, Psomas, in a manner consistent with the level of care and skill ordinarily exercised by other professional consultants under similar circumstances. No other representation to the Client, expressed or implied, and no warranty or guarantee are included or intended.

The recommendations contained in this report are based on our understanding of the proposed corridor configuration and on field and laboratory investigations performed by NCS. It is anticipated that there will be variations in the soils between the boring locations. The nature and extent of the variations may not be evident until construction occurs. Thus, if any conditions are encountered that are significantly different from those described in this report, NCS should be notified immediately so that any necessary revisions to the recommendations contained in this report can be made.

14.0 REFERENCES

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FIGURES

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Figure 1.1 – Project Vicinity Map (Source: PAG Urban-Rural Boundary Map)

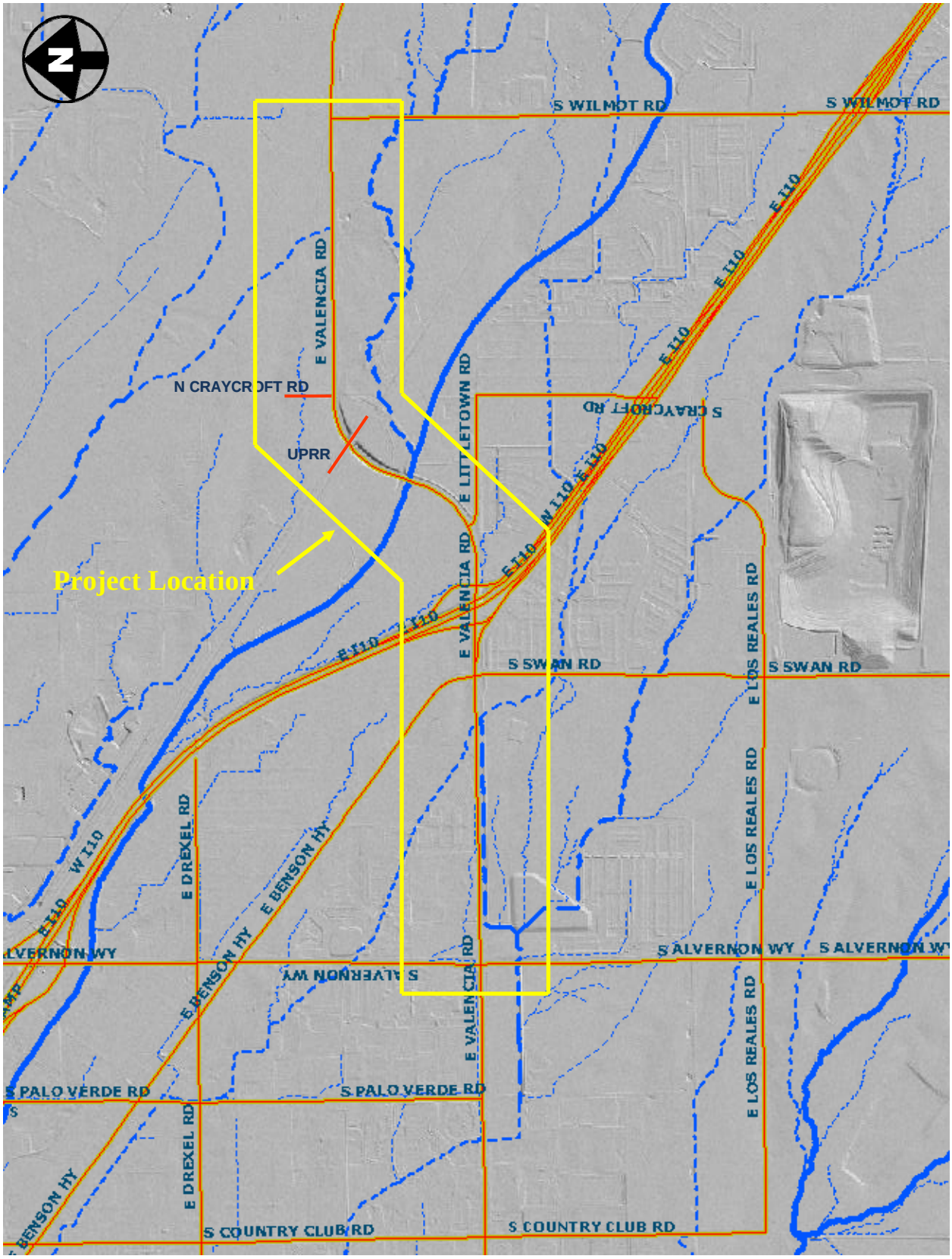


Figure 1.2 – Project Location Map with Shaded Relief (Source: Pima County Map Guide)

LEGEND

D01 (20') Soil boring I.D. (depth) and Location

PC01 Pavement Core I.D. and Location

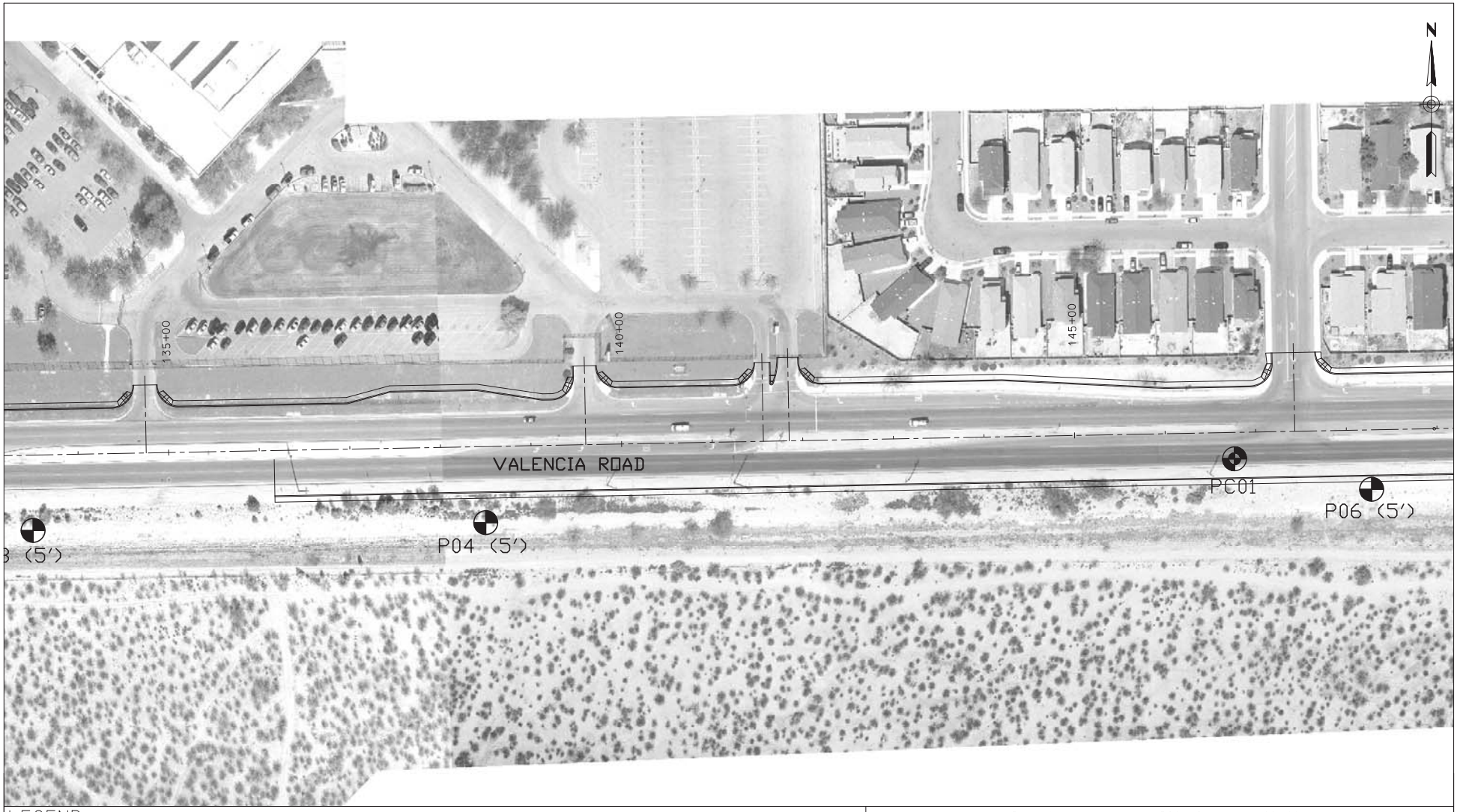
0 50' 100'

Base files provided by PSOMAS on June 09, 2011

VALENCIA ROAD - ALVERNON WAY TO WILMOT ROAD

NCS CONSULTANTS, LLC
640 W PASEO RIO GRANDE
TUCSON, AZ 85737
520-544-2786

FIGURE 4.1: BORING LOCATION PLAN



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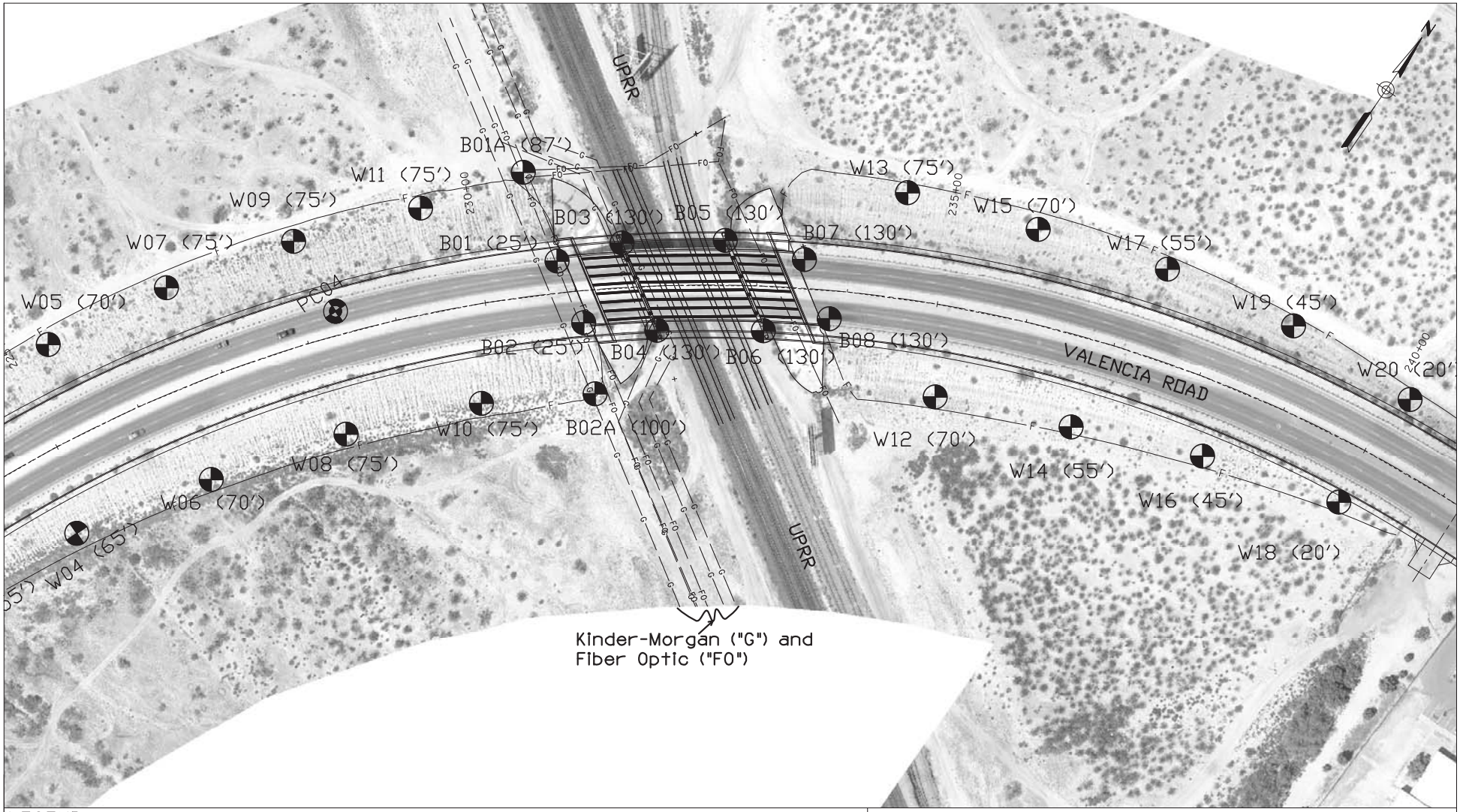

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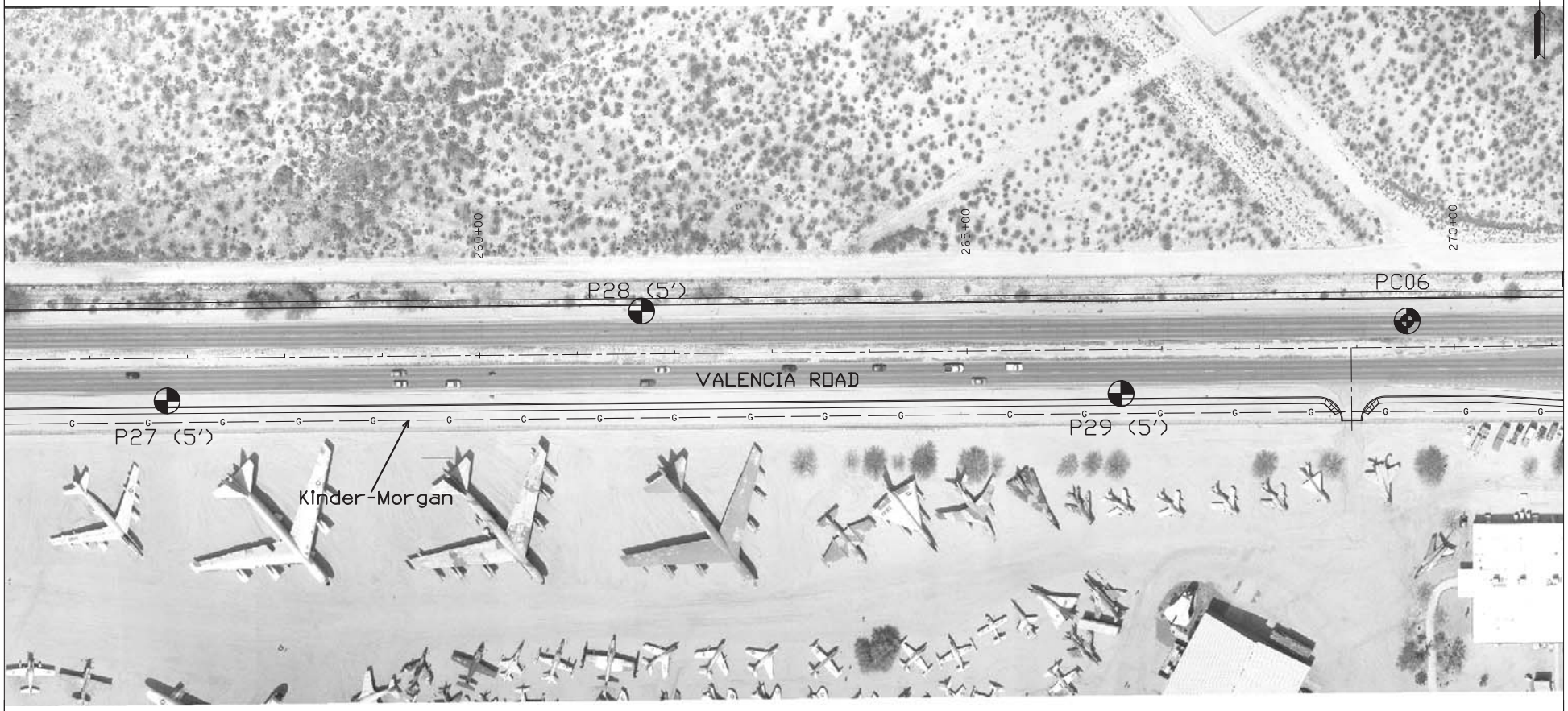

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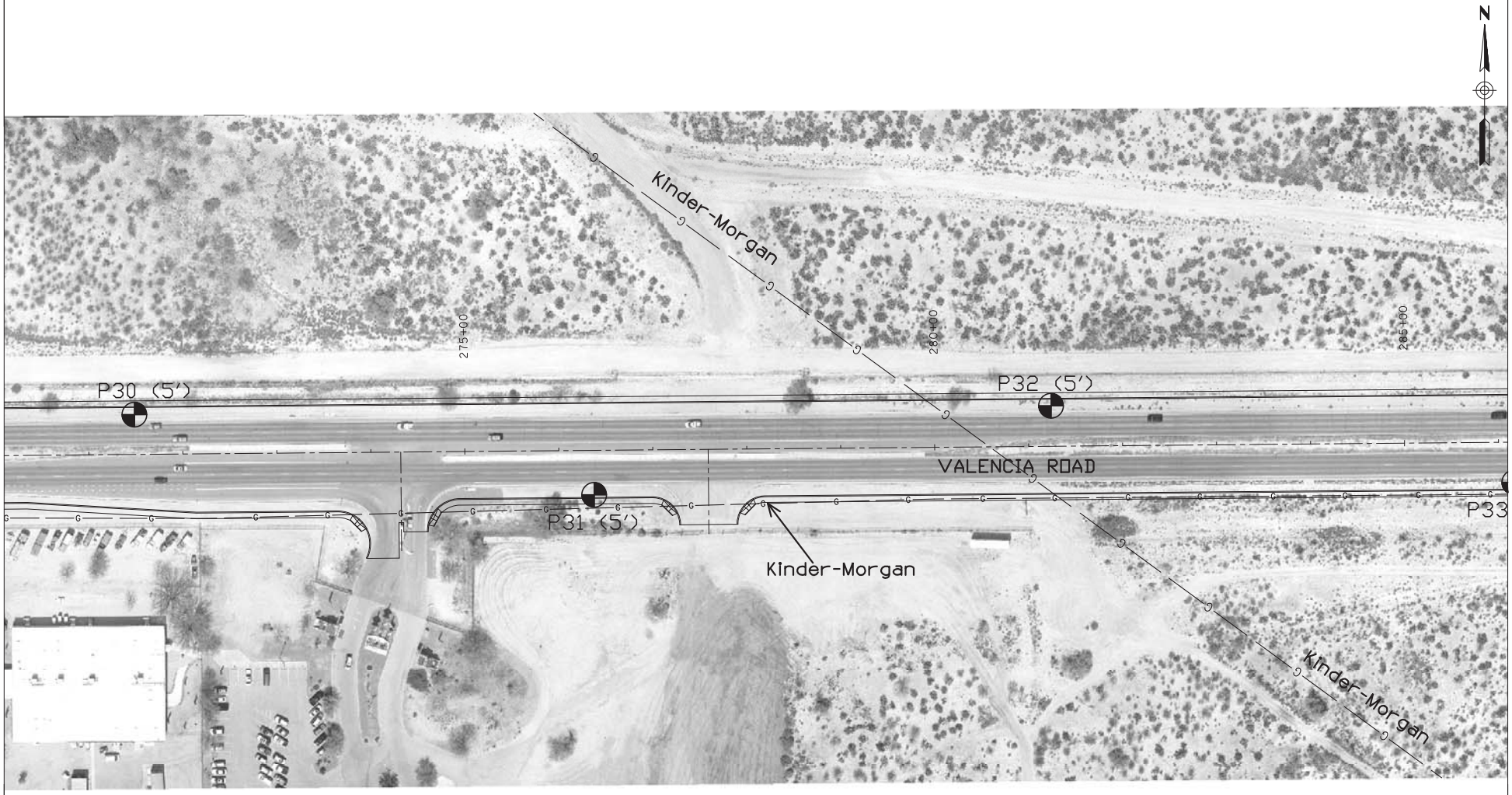

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Base files provided by PSOMAS on June 09, 2011

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Base files provided by PSOMAS on June 09, 2011

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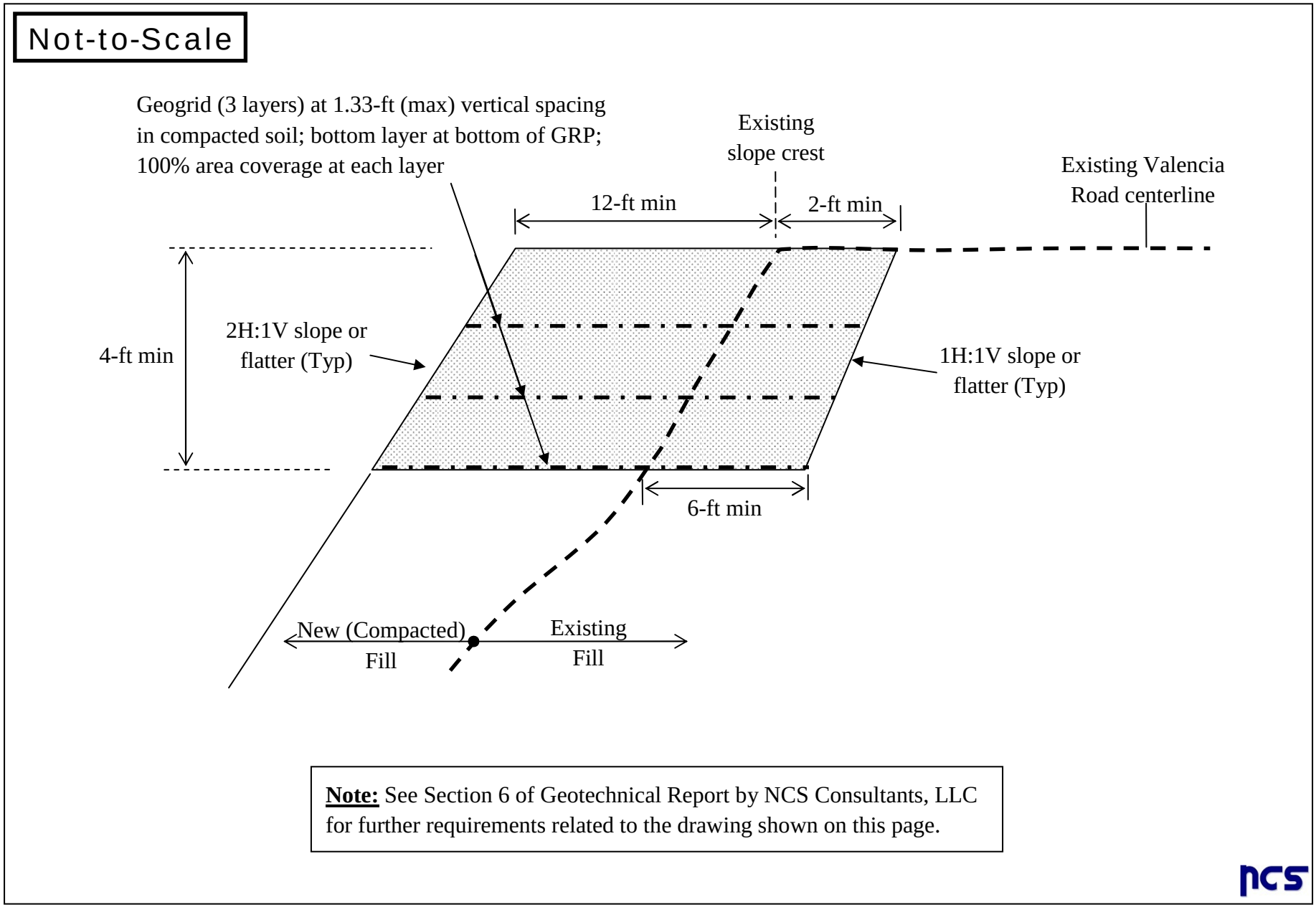

Figure 6.1: Schematic of Geosynthetic Reinforced Platform (GRP).

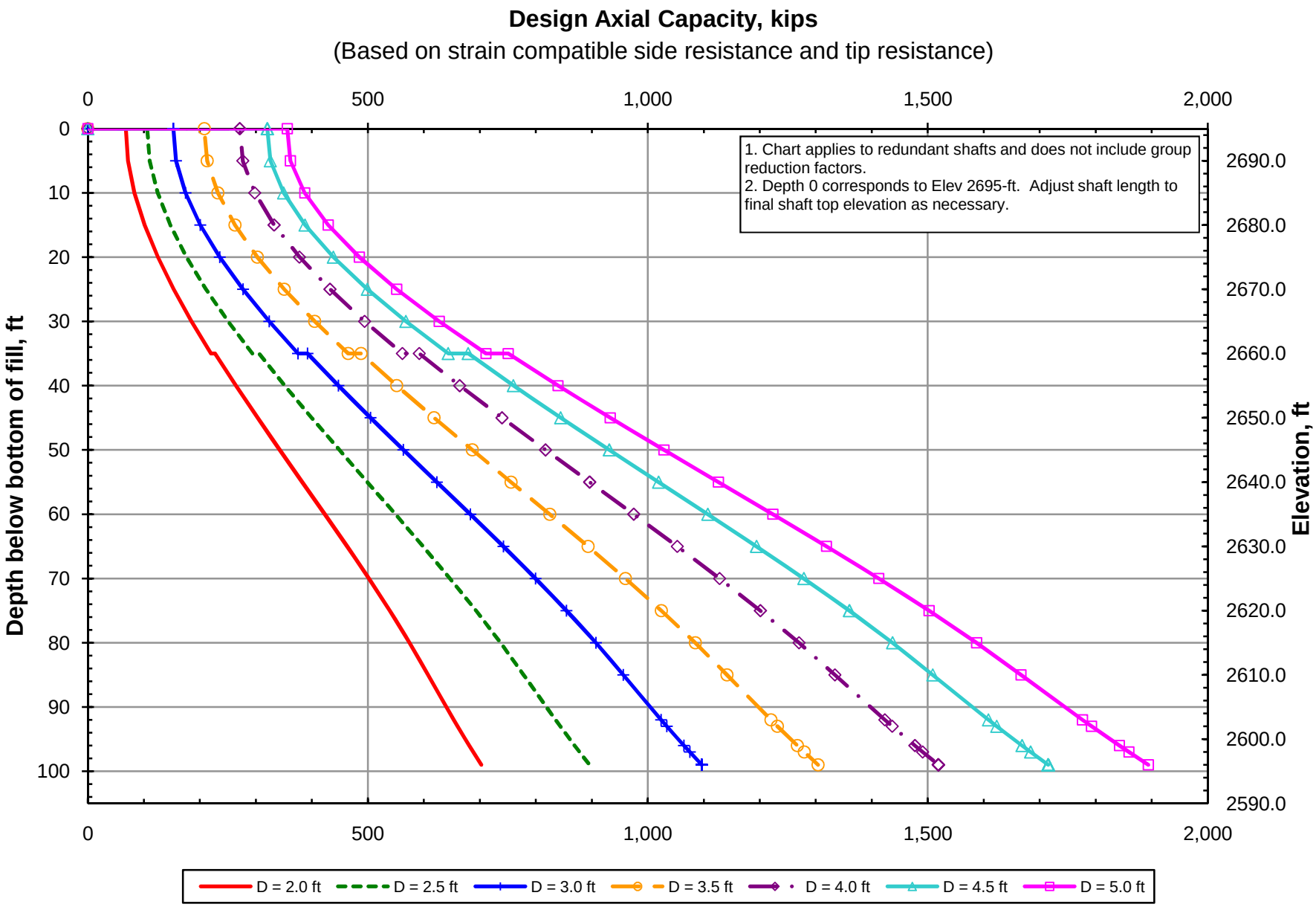

Figure 8.1: Axial Capacity Chart - UPRR Overpass, Abutments (Based on strain compatible side resistance and tip resistance)

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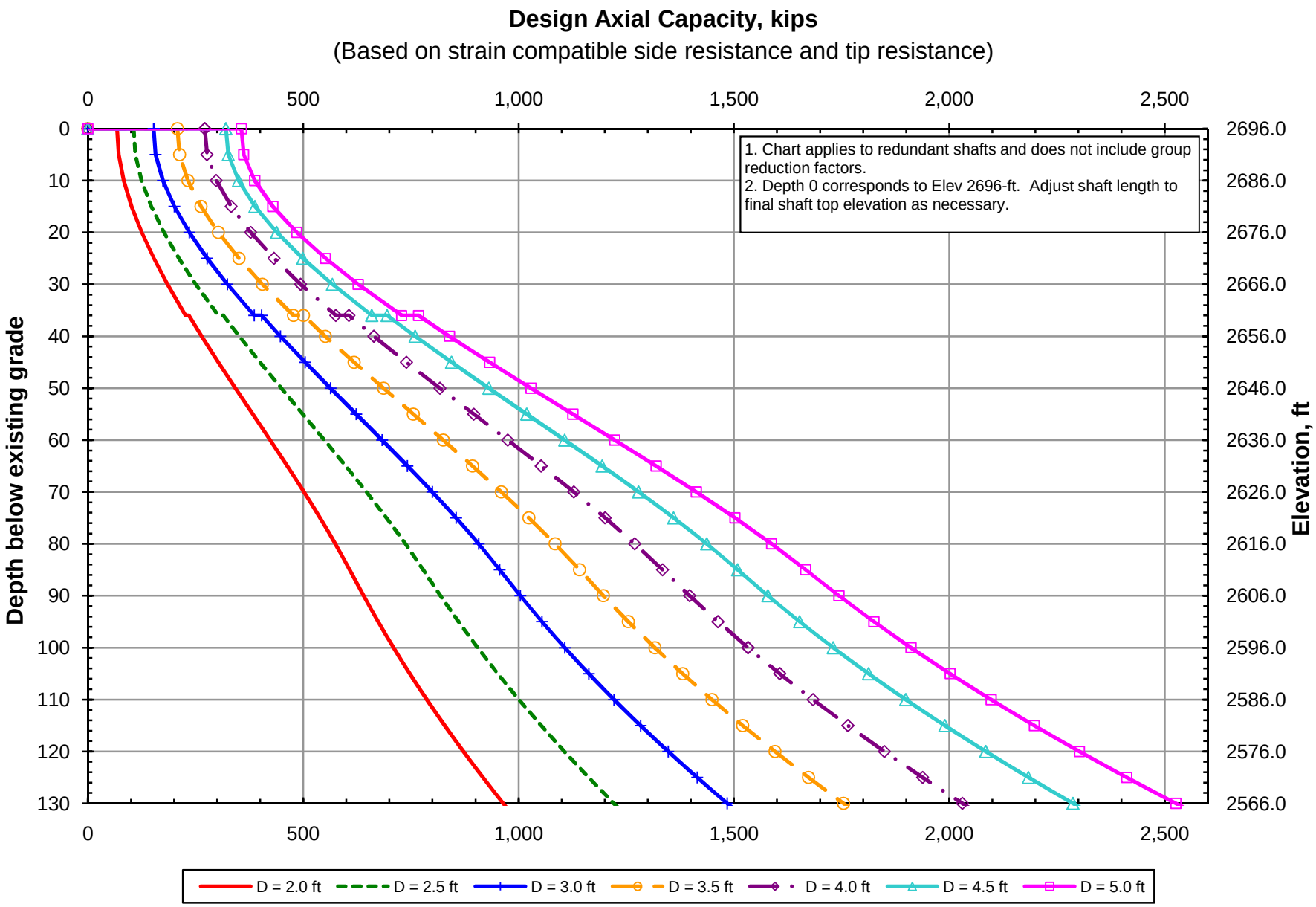

Figure 8.2: Axial Capacity Chart - UPRR Overpass, East Pier (Based on strain compatible side resistance and tip resistance)

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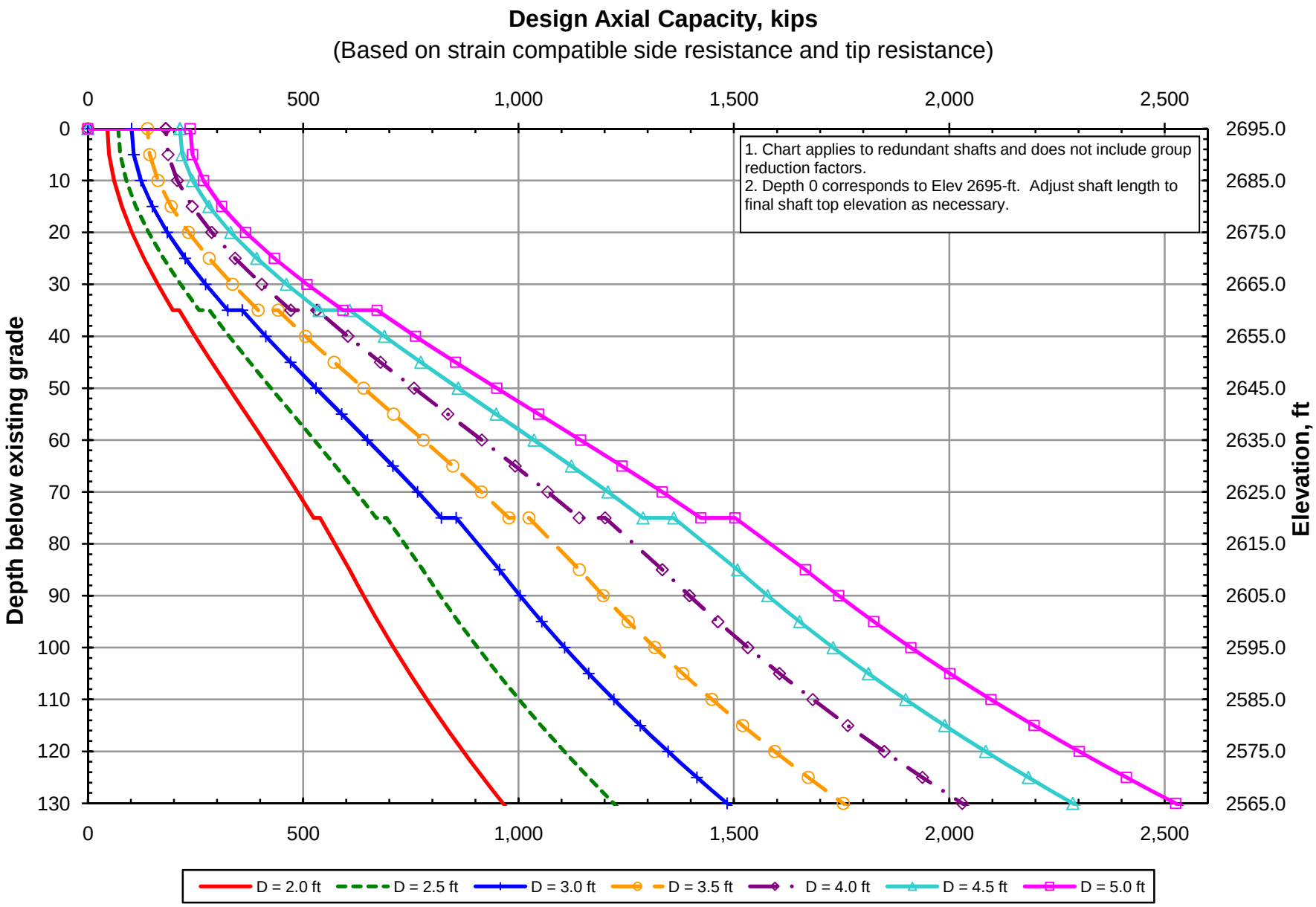

Figure 8.3: Axial Capacity Chart - UPRR Overpass, West Pier (Based on strain compatible side resistance and tip resistance)

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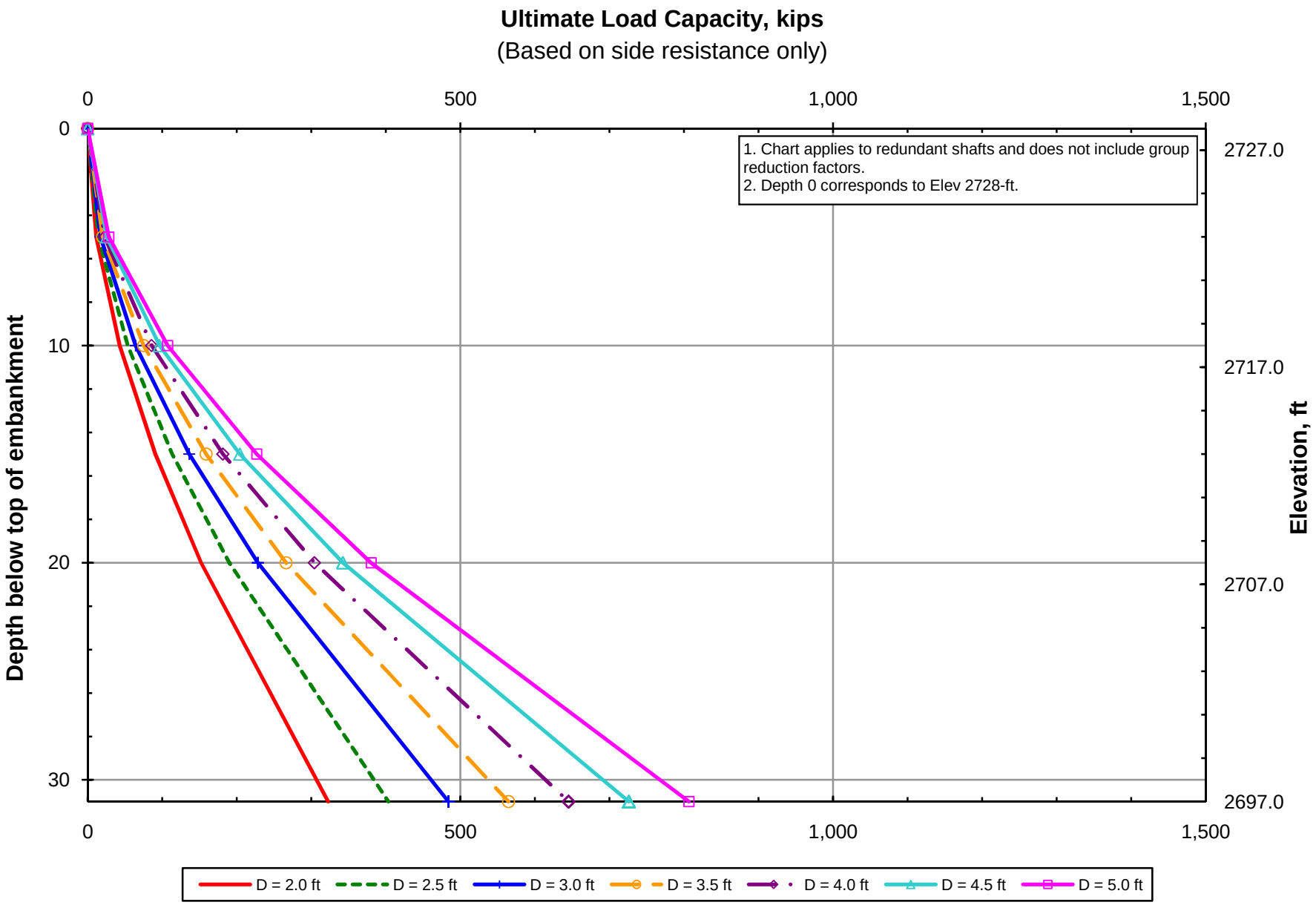

Figure 8.4: Axial Capacity Chart - UPRR Overpass, Single Shaft Drag Load Due to Embankment Fills

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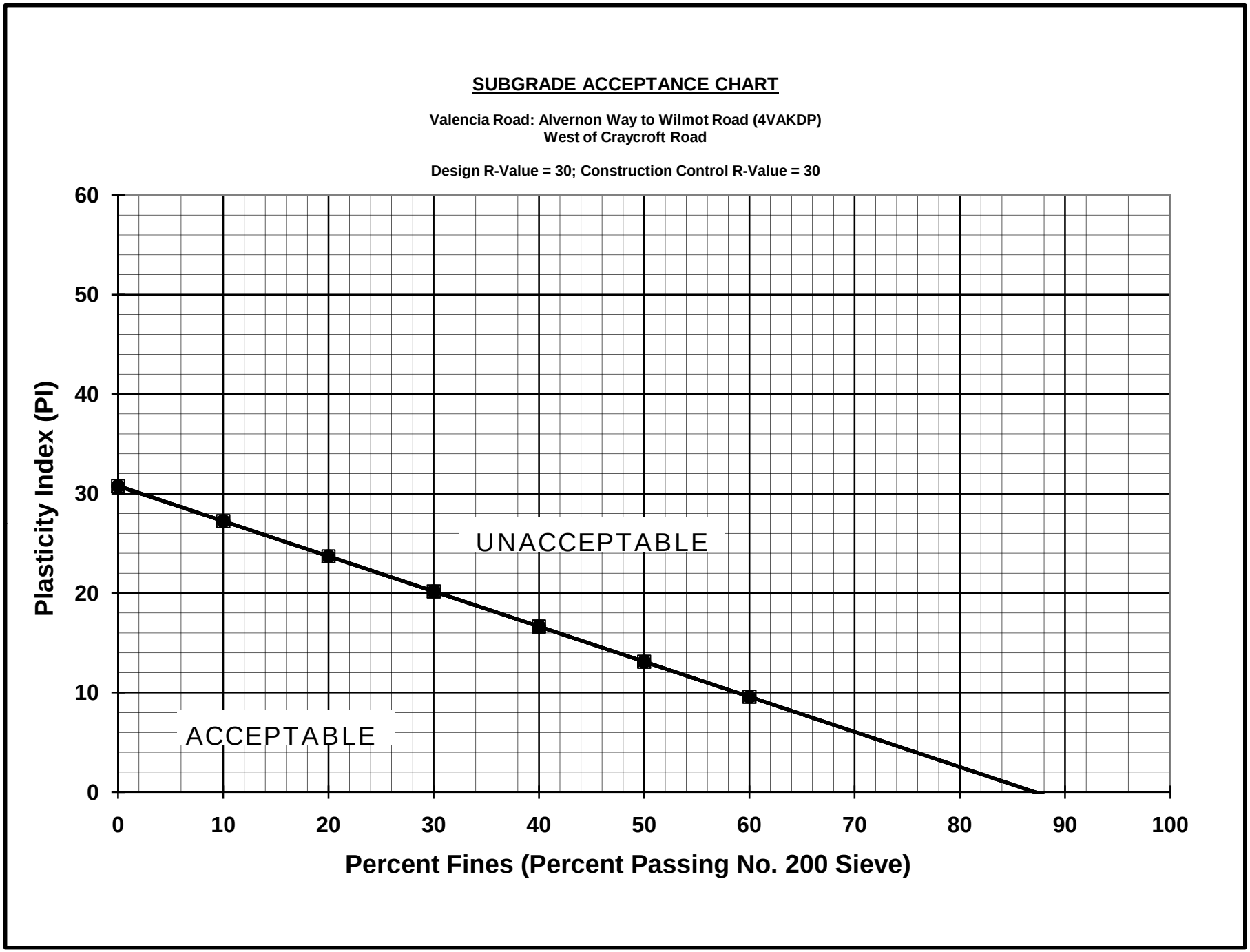


Figure 10.1: Subgrade Acceptance Chart (West of Craycroft Road)

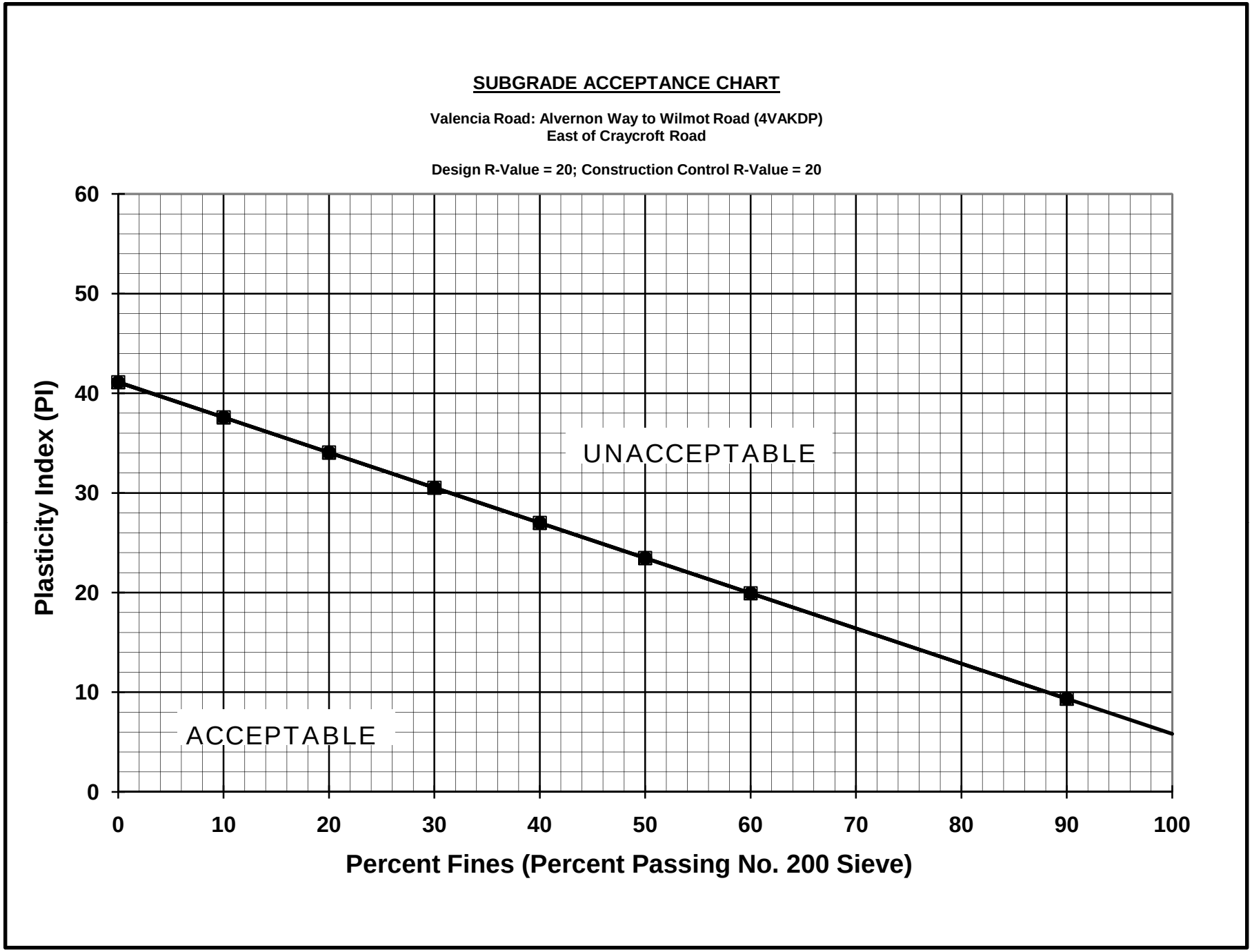
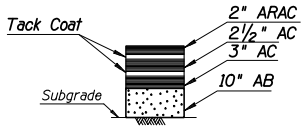
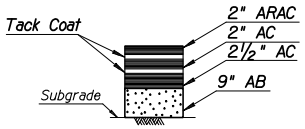


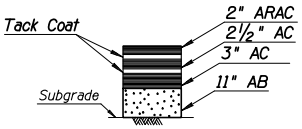
Figure 10.2: Subgrade Acceptance Chart (East of Craycroft Road)



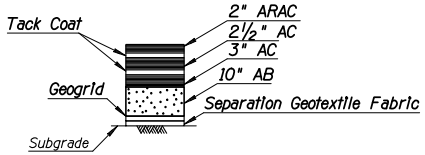
Total Thickness = 17½"
VALENCIA ROAD (WEST)
FLEXIBLE PAVEMENT SECTION



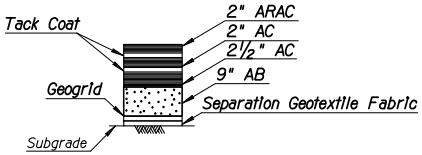
Total Thickness = 15½"
VALENCIA ROAD (CENTRAL)
FLEXIBLE PAVEMENT SECTION



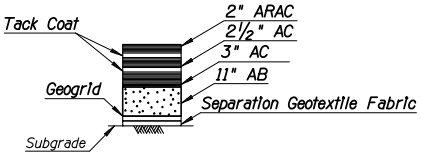
Total Thickness = 18½"
VALENCIA ROAD (EAST)
FLEXIBLE PAVEMENT SECTION



Total Thickness = 17½"
VALENCIA ROAD (WEST)
FLEXIBLE PAVEMENT SECTION
Geogrid Option



Total Thickness = 15½"
VALENCIA ROAD (CENTRAL)
FLEXIBLE PAVEMENT SECTION
Geogrid Option

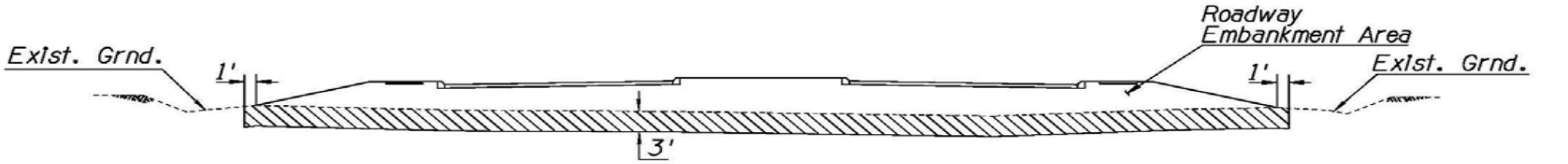


Total Thickness = 18½"
VALENCIA ROAD (EAST)
FLEXIBLE PAVEMENT SECTION
Geogrid Option

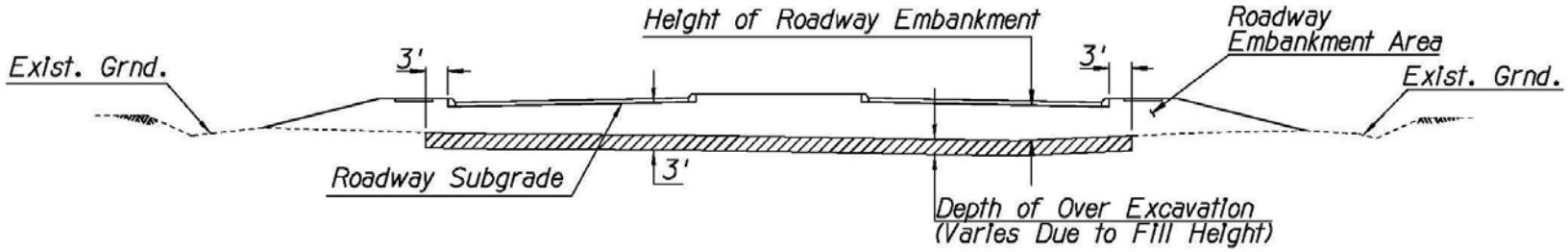
Note: Not to Scale.

FIGURE 10.3: Recommended Pavement Structural Sections

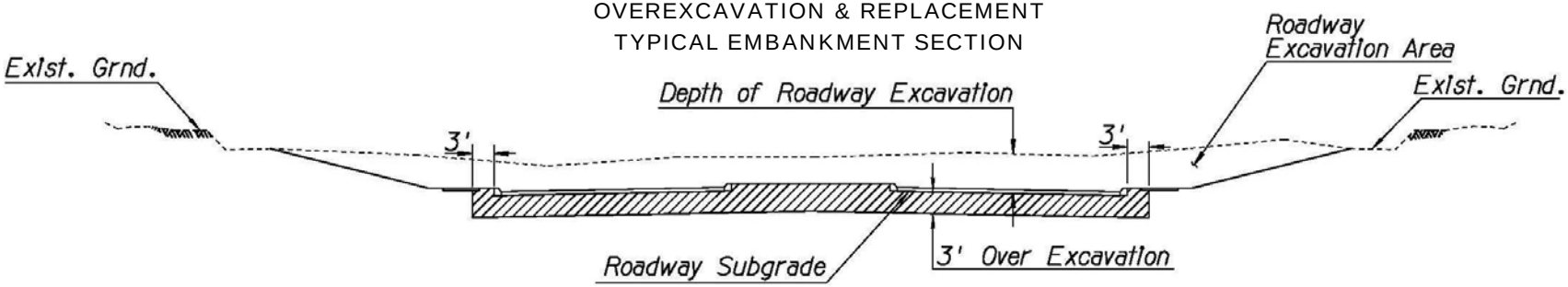
Valencia Road:
Alvernon Way to Wilmot Road



OVEREXCAVATION & RECOMPACTION
TYPICAL EMBANKMENT SECTION



OVEREXCAVATION & REPLACEMENT
TYPICAL EMBANKMENT SECTION



OVER EXCAVATION & RECOMPACTION / REPLACEMENT
TYPICAL EXCAVATION SECTION

Note: For embankments where overexcavation and replacement are required, the overexcavation and recompaction limits shown above still apply for material outside of the replacement zone. Refer to Sections 6.3 and 10.6 of this report for more detail.

Figure 10.4: Subgrade Overexcavation and Recompaction / Replacement Requirements

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APPENDIX A

BORING LOGS

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NCS Consultants, LLC

PROJECT: Valencia: Alvernon to Wilmot
PROJECT #: J2010-09
LOCATION: Tucson, Arizona
CLIENT: PSOMAS

KEY TO SOIL SYMBOLS AND TERMS

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	SOIL SAMPLE						BLOWS			N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
		GRAPHIC	TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	0-6 INCH	6-12 INCH	12-18 INCH						
1	2	3	4	5	6	7	8	9	9	9	10	11	12	13	14	15
15	2600		S	1		16	17.5	10	21	26	47	14	SILTY SAND, dense, dry to moist, dark brown, medium to fine SAND, little non plastic fines, trace gravel, weak reaction to HCl. (SM)			X
20	2595															

1	Depth:	Distance (in feet) below ground surface.
2	Elevation	Elevation (in feet) above Mean Sea Level
3	Graphic:	Symbol associated with USCS classification (see Sheet 2).
4	Type:	Sampler type (See Sampler Codes below).
5	Number:	Identifies the number of the sample collected with indicated sample type.
6	Symbol:	Symbol associated with sampler type.
7	Depth From:	Beginning depth of sample run (ft.).
8	Depth To:	Ending depth of sample run (ft.).
9	Blows/6" (0/6):	The number of blows of a 140-lb hammer falling 30" used to drive the sampler 6".
10	N-Value:	Sum of blows for last 12-inches. Only reported for standard 2" O.D. sampler. "R" value indicates sampler refusal.
11	Rec (in.):	The amount of sample recovered (in inches) from the sampler. "--" indicates data not recorded.
12	Visual Soil Identification/Description and Remarks	Description of the soil and the USCS designation is based on visual identification (ASTM D 2488, Visual-Manual Procedure). Where laboratory tests were performed, the description and USCS designation represents classification of soil according to ASTM D 2487. Refer to laboratory test data to identify samples that were tested to obtain the soil classification.
13	Moisture, %:	Moisture content, (%) of sample collected. A blank field indicates the moisture content was not measured.
14	Dry Density (pcf):	Dry Density of sample collected. A blank field indicated the dry density was not measured.
15	Samples Sent to Lab:	An "X" indicates the sample was sent to a laboratory for testing.

SAMPLER CODES:

HSA = hollow stem auger
S = standard split-spoon
U = shelby tube
P = piston
R = ring
C = core barrel

NCS Consultants, LLC

PROJECT: Valencia: Alvernon to Wilmot
PROJECT #: J2010-09
LOCATION: Tucson, Arizona
CLIENT: PSOMAS

KEY TO SOIL SYMBOLS AND TERMS

CORRELATION OF STANDARD PENETRATION RESISTANCE WITH RELATIVE DENSITY AND CONSISTENCY

Relative Density of Cohesionless Soils:
(FHWA HI-97-021)

Penetration Resistance, N (blows/ft)	Relative Density
0-4	Very loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
>50	Very Dense

Consistency of Cohesive Soils:
(FHWA HI-97-021)

Penetration Resistance, N (blows/ft)	Consistency
<2	Very soft
2-4	Soft
4-8	Medium
8-15	Stiff
15-30	Very stiff
>30	Hard

PARTICLE SIZE DEFINITION FOR GRAVELS AND SANDS

(FHWA HI-97-021)

Soil Component	Grain Size
Boulders*	12 inches +
Cobbles*	12 inches to 3 inches
Gravel	
Coarse	3 inches to 3/4 inches
Fine	3/4 inches to #4 sieve
Sand	
Coarse	#4 to #10 sieve
Medium	#10 to #40 sieve
Fine	#40 to #200 sieve

* Boulders and cobbles are not considered soil or part of the soil's classification or description, except under miscellaneous description; i.e., with cobbles at about 5 percent (volume)

OTHER TERMINOLOGY (Modified from ASTM D 2488)

Quantity:

Trace	<5%
Few	5-10%
Little	15-25%
Some	30-45%
Mostly	50-100%

Reaction to HCl:

No reaction	No visible reaction
Weak reaction	Some reaction, with bubbles forming slowly
Strong reaction	Violent reaction, with bubbles forming immediately

Cementation:

Weak	Crumbles or breaks with handling or little finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

Note: Reaction to dilute HCl (as per ASTM D 2488) does not necessarily correlate to the degree of carbonate cementation. Reaction to HCl, degree of carbonate cementation, SPT-N values and other relevant factors should all be evaluated together to determine the significance of cementation and/or presence of carbonate.

GENERAL NOTES

1. Classifications are based on the United Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.

2. Surface elevations are based on topographic maps and estimated locations.

3. Descriptions on these boring logs apply only at the specified locations and at the time the borings were made. They are not warranted to be representative of subsurface conditions at other locations and times.

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PROJECT: Valencia: Alvernon to Wilmot
PROJECT #: J2010-09
LOCATION: Tucson, Arizona
CLIENT: PSOMAS

KEY TO SOIL SYMBOLS AND TERMS

USCS CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (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 (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR 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 GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

NCS Consultants, LLC

PROJECT: Valencia: Alvernon to Wilmot
PROJECT #: J2010-09
LOCATION: Tucson, Arizona
CLIENT: PSOMAS

KEY TO SOIL SYMBOLS AND TERMS

PLASTICITY OF FINES (MATERIAL PASSING #200 SIEVE)
Based on Field Procedures (FHWA HI-97-021)

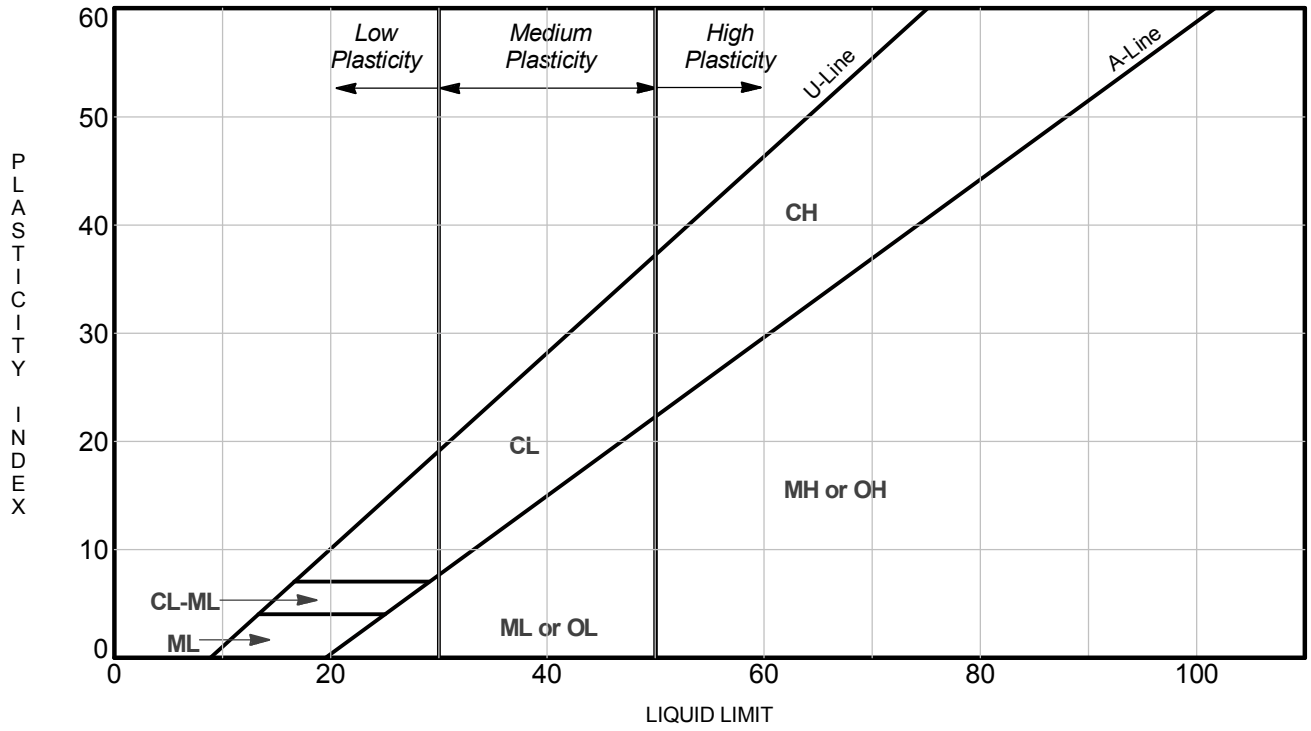
Plasticity Index	Adjective	Thread Smallest Diameter, mm
0	Nonplastic	Ball Cracks
1-10	Low Plasticity	6 - 3
>10-20	Medium Plasticity	1 - 1/2
>20-40	High Plasticity	3/4
>40	Very Plastic	1/2

Refer to A-Chart on this sheet for plasticity based on laboratory test results

DESCRIPTION OF WATER CONTENT OF SOILS
(FHWA HI-97-021)

Description	Conditions
Dry	No sign of water and soil dry to touch
Moist	Signs of water and soil is relatively dry to touch
Wet	Signs of water and soil definitely wet to touch; granular soil exhibits some free water when densified

Plasticity Chart (A-Chart)



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SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,456 **E:** 21,416
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 230+84
OFFSET: 35 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,729
TOTAL DEPTH: 21.5

START DATE: 02/03/2011 **TIME:** 08:30 AM
FINISH DATE: 02/03/2011 **TIME:** 09:30 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
													CLAYEY SAND (fill), medium dense, dry to moist, dark brown, fine to coarse SAND, some medium plasticity fines, weak cementation, weak reaction with HCl. (SC)			
5	2725		S	1		5.0	6.5	4	12	14	26	16				
10	2720		S	2		10.0	11.5	13	14	20	34	8	Becomes dense.			
			CU	1		10.0	15.0									
15	2715		R	3		15.0	16.0	8	19			12	Becomes medium dense.			
20	2710		S	4		20.0	21.5	5	8	12	20	18	Becomes few fine to coarse gravel, max. particle size 0.75".			X
25	2705												End of boring at 20'. Sampler stopped at 21.5'. No groundwater encountered. Backfilled with cuttings.			

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NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,515 **E:** 21,330
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 230+60
OFFSET: -01+37

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,696.3
TOTAL DEPTH: 87

START DATE: 02/07/2011 **TIME:** 07:00 AM
FINISH DATE: 02/07/2011 **TIME:** 09:00 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2695												CLAYEY SAND (native), dense, dry, brown, fine to coarse SAND, some low plasticity fines, weak cementation, strong reaction with HCl. (SC)			
5	2690		S	1	X	5.0	6.5	8	15	18	33	12				
10	2685		S	2	X	10.0	11.5	13	30	32	62	11	Becomes very dense, little low plasticity fines.			
15	2680		S	3	X	15.0	16.5	14	24	35	59	10	Becomes fine SAND, some low plasticity fines, no cementation, no reaction with HCl.			
20	2675		S	4	X	20.0	21.5	10	16	27	43	16	Becomes dense, fine to medium SAND, weak cementation, strong reaction with HCl.			X
25													SANDY LEAN CLAY, hard, dry, brown, low plasticity CLAY, some fine sand, moderate cementation, weak reaction with HCl. (CL)			

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NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2670		S	5	X	25.0	26.5	10	12	17	29	6	CLAYEY SAND, medium dense, dry, brown, fine to coarse SAND, little low plasticity fines, no cementation, no reaction with HCl. (SC)			
30	2665		S	6	X	30.0	31.4	14	44	50/5	R	14	SILTY SAND, very dense, dry, brown, fine to coarse SAND, some low plasticity fines, trace fine to coarse subrounded gravel, moderate cementation, weak reaction with HCl, max. particle size 1". (SM)			
35	2660		S	7	X	35.0	36.5	11	24	30	54	17	Becomes SILTY SAND WITH GRAVEL, little fine subrounded gravel, little low plasticity fines, 2" gravel present in cuttings.	2.0		X
40	2655		S	8	X	40.0	41.5	10	21	31	52	5	CLAYEY SAND WITH GRAVEL, very dense, dry, brown, fine to coarse SAND, little fine to coarse subrounded gravel, little low plasticity fines, weak cementation, weak reaction with HCl, max. particle size 1". (SC)			
45	2650		S	9	X	45.0	46.5	19	41	50/6	R	17	Becomes CLAYEY SAND, fine to medium SAND, some low plasticity fines, strong cementation, strong reaction with HCl.			
50	2645		S	10	X	50.0	50.9	21	50/5		R	11				
55	2640		S	11	X	55.0	56.5	14	35	36	71	16	Becomes some medium plasticity fines, trace fine subrounded gravel, max. particle size 0.35".			X
60	2635		S	12	X	60.0	61.5	16	28	33	61	15				
65													LEAN CLAY WITH SAND, hard, dry, brown, low plasticity CLAY, little fine sand,			

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PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2630		S	13	X	65.0	66.5	17	33	49	82	18	no cementation, no reaction with HCl. (CL)			X
70	2625		S	14	X	70.0	71.5	20	36	40	76	13	CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, some low plasticity fines, trace fine subrounded gravel, strong cementation, weak reaction with HCl, max. particle size 0.25". (SC)			
75	2620		S	15	X	75.0	76.5	28	46	46	92	10	SILTY SAND WITH GRAVEL, very dense, dry, light brown, fine to coarse SAND, little low plasticity fines, little fine subrounded gravel, no cementation, no reaction with HCl, max. particle size 0.5". (SM)			
80	2615		S	16	X	80.0	81.3	30	36	50/4	R	10	Becomes SILTY SAND, some low plasticity fines.			
85	2610		S	17	X	85.0	86.5	25	40	49	89	13	CLAYEY SAND, very dense, dry, brown, fine to medium SAND, some low plasticity fines, no cementation, no reaction with HCl. (SC) [Silt may be present within sample]			
90	2605												Auger refusal at 87'. No groundwater encountered. Backfilled with cuttings.			
95	2600															
100	2595															
105																

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NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,416 **E:** 21,479
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 231+07
OFFSET: 35 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,727.7
TOTAL DEPTH: 21.5

START DATE: 02/03/2011 **TIME:** 09:30 AM
FINISH DATE: 02/03/2011 **TIME:** 10:30 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
													CLAYEY SAND (fill), medium dense, dry to moist, dark brown, fine to coarse SAND, little low plasticity fines, few fine gravel, moderate cementation, strong reaction with HCl. (SC)			
	2725															
5			R	1		5.0	6.0	8	25			12				
	2720		CU	1		5.0	10.0							8.3		X
10			S	2		10.0	11.5	13	13	13	26	18				
	2715															
15			S	3		15.0	16.5	8	9	10	19	18	Becomes some medium plasticity fines.			X
	2710															
20			S	4		20.0	21.5	9	12	14	26	18				
	2705												End of boring at 20'. Sampler stopped at 21.5'. No groundwater encountered. Backfilled with cuttings.			
25																

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NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Eric
INSPECTOR: NAB

COORDINATES **N:** 16,359 **E:** 21,533
LOCATION: Tucson, Arizona

REF. ALIGNMENT: Valencia CL
STATION: 231+15
OFFSET: 01+14

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,696.7
TOTAL DEPTH: 100.3

START DATE: 02/03/2011 **TIME:** 11:30 AM
FINISH DATE: 02/03/2011 **TIME:** 03:30 PM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2695												CLAYEY SAND (native), very dense, dry, brown, fine to coarse SAND, some low plasticity fines, weak cementation, strong reaction with HCl. (SC)			
5	2690		S	1	X	5.0	6.5	15	32	57	89	16				
10	2685		S	2	X	10.0	11.5	6	13	21	34	18	Becomes dense, fine to medium SAND, trace fine gravel, no cementation, no reaction with HCl.			X
15	2680		S	3	X	15.0	16.4	21	26	50/5	R	6	SILTY SAND, very dense, dry, brown, fine to coarse SAND, little nonplastic fines, trace fine subrounded gravel, no cementation, no reaction with HCl, max. particle size 0.25". (SM)			
20	2675		S	4	X	20.0	21.5	6	10	14	24	18	Becomes medium dense, some low plasticity fines.			
25													CLAYEY SAND, very dense, dry, light brown, fine to medium SAND, little low			

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NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Eric
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2670		S	5	X	25.0	26.5	16	23	29	52	14	plasticity fines, weak cementation, weak reaction with HCl. (SC)			
30	2665		S	6	X	30.0	31.5	12	17	24	41	18	WELL-GRADED SAND WITH SILT, dense, dry, tan, fine to coarse SAND, few nonplastic fines, few fine to coarse subrounded gravel, no cementation, no reaction with HCl, max. particle size 1". (SW-SM)	0.6		X
35	2660		S	7	X	35.0	36.5	16	32	36	68	18	Becomes very dense.			
40	2655		S	8	X	40.0	41.5	13	20	20	40	12	Becomes WELL-GRADED SAND WITH SILT AND GRAVEL, dense, little fine to coarse SAND, subrounded gravel.			
45	2650		S	9	X	45.0	46.5	20	28	30	58	0	Becomes very dense. No recovery. Rock in sampler tip.			
50	2645		S	10	X	50.0	51.5	11	21	34	55	16	SILTY SAND, very dense, dry, redish brown, fine to coarse SAND, some nonplastic fines, no cementation, no reaction with HCl. (SM)			
55	2640		S	11	X	55.0	56.0	24	50/6		R	12	CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, some low plasticity fines, no cementation, no reaction with HCl. (SC)			
60	2635		S	12	X	60.0	61.5	21	36	33	69	14				
65													SILTY, CLAYEY SAND, dense, dry, brown, fine to medium SAND, some low			

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BORING LOG: B02A

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Eric
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2630		S	13	X	65.0	66.5	15	21	25	46	18	plasticity fines, moderate cementation, strong reaction with HCl. (SC-SM)			X
70	2625		S	14	X	70.0	71.5	21	31	37	68	12	CLAYEY SAND, very dense, dry, brown, fine SAND, some low plasticity fines, no cementation, no reaction with HCl. (SC)			
75	2620		S	15	X	75.0	76.5	25	36	36	72	14	WELL-GRADED SAND WITH SILT, very dense, dry, light brown, fine to coarse SAND, few nonplastic fines, few fine subrounded gravel, no cementation, no reaction with HCl, max. particle size 0.25". (SW-SM)			
80	2615		S	16	X	80.0	80.4	50/5			R	2	Becomes strong cementation, strong reaction with HCl.			
85	2610		S	17	X	85.0	86.5	31	45	44	89	18	CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, little medium plasticity fines, trace fine gravel, no cementation, no reaction with HCl. (SC)			X
90	2605		S	18	X	90.0	91.4	25	38	50/5	R	4	Becomes fine SAND, some low plasticity fines.			
95	2600		S	19	X	95.0	96.5	21	40	50/6	R	15	Becomes fine to coarse SAND.			
100			S	20	X	99.0	100.3	21	41	50/3	R	13	SANDY LEAN CLAY, hard, dry, buff, medium plasticity CLAY, some fine sand, no cementation, no reaction with HCl. (CL)			
	2595												End of boring at 99'. Sampler stopped at 100.3'. No groundwater encountered. Backfilled with cuttings.			
105																

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NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,512 **E:** 21,464
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 231+55
OFFSET: 50 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,694.1
TOTAL DEPTH: 131.5

START DATE: 01/05/2011 **TIME:** 10:50 AM
FINISH DATE: 01/05/2011 **TIME:** 04:30 PM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
5	2690												WELL-GRADED SAND WITH CLAY (native), medium dense, moist, tan, fine to coarse subrounded SAND, few fine gravel, few medium plasticity fines, no cementation, no reaction with HCl. (SW-SC)			
10	2685		S	2	X	10.0	11.5	8	8	8	16	18				X
15	2680		S	3	X	15.0	16.5	10	15	22	37	18	SANDY LEAN CLAY, hard, moist, brown, low plasticity CLAY, some fine sand, moderate cementation, strong reaction with HCl. (CL)			
20	2675		S	4	X	20.0	21.5	11	12	15	27	18	SILTY, CLAYEY SAND, medium dense, moist, tan, fine to medium SAND, some low plasticity fines, weak cementation, weak reaction with HCl. (SC-SM)			
25	2670												CLAYEY SAND, very dense, dry, brown, fine to medium SAND, some low plasticity			

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BORING LOG: B03

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	5	X	25.0	26.5	12	14	49	63	18	fines, no cementation, no reaction with HCl. (SC)			
30	2665		S	6	X	30.0	31.5	5	7	10	17	18	SILTY SAND, medium dense, dry, light brown, fine to coarse SAND, some nonplastic fines, trace fine to coarse gravel, no cementation, no reaction with HCl, max. particle size 1". (SM)			
35	2660		S	7	X	35.0	36.5	12	21	31	52	18	CLAYEY SAND, very dense, moist, brown, fine to coarse SAND, little low plasticity fines, few fine to coarse subrounded gravel, no cementation, no reaction with HCl, max. particle size 1". (SC) Rock in sampler tip.			
40	2655		S	8	X	40.0	41.5	12	14	15	29	18	Becomes medium dense, trace fine subrounded gravel, weak cementation, weak reaction with HCl, max. particle size 0.5".			
45	2650		S	9	X	45.0	46.5	17	31	31	62	18	Becomes very dense, trace fine gravel, moderate cementation, strong reaction with HCl, max. particle size 0.25".			
50	2645		S	10	X	50.0	51.5	11	12	15	27	18	SILTY, CLAYEY SAND, medium dense, moist, light brown, fine to medium SAND, some low plasticity fines, trace fine gravel, weak cementation, strong reaction with HCl. (SC-SM)			X
55	2640		S	11	X	55.0	56.5	18	22	28	50	18	CLAYEY SAND, dense, dry to moist, light brown, fine to medium SAND, some low plasticity fines, moderate cementation, strong reaction with HCl. (SC) Begin adding 1-2 buckets of water after each sample.			
60	2635		S	12	X	60.0	61.5	6	12	16	28	18	Becomes medium dense, fine to coarse SAND, weak cementation, weak reaction with HCl.			
65	2630												SILTY, CLAYEY SAND, dense, dry to moist, brown, fine to medium SAND, some			

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PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	13	X	65.0	66.5	8	18	24	42	18	low plasticity fines, no cementation, no reaction with HCl. (SC-SM)			
70	2625		S	14	X	70.0	71.5	13	25	37	62	18	CLAYEY SAND, very dense, moist, brown, fine to coarse subrounded SAND, some low plasticity fines, few fine to coarse subrounded gravel, weak cementation, weak reaction with HCl, max. particle size 1". (SC)			
75	2620		S	15	X	75.0	76.5	10	7	12	19	18	SILTY SAND, medium dense, dry to moist, tan, fine to coarse SAND, little nonplastic fines, trace fine subrounded gravel, no cementation, no reaction with HCl, max. particle size 0.25". (SM)			
80	2615		S	16	X	80.0	81.5	13	13	22	35	18	Becomes dense, fine SAND, some low plasticity fines.			
85	2610		S	17	X	85.0	86.5	23	27	35	62	18	CLAYEY SAND, very dense, dry to moist, brown, fine SAND, some low plasticity fines, no cementation, no reaction with HCl. (SC)			
90	2605		S	18	X	90.0	91.5	12	16	25	41	18	Becomes dense, fine to medium SAND.			
95	2600		S	19	X	95.0	96.5	6	9	20	29	18	SANDY LEAN CLAY, very stiff, moist, brown, medium plasticity CLAY, little fine sand, trace fine gravel, weak cementation, weak reaction with HCl. (CL)	22.5		X
100	2595		S	20	X	100.0	101.5	25	25	39	64	18	Becomes hard, moderate cementation, strong reaction with HCl.			
105	2590															

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NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	21		105.0	105.8	30	50/3		R	9				
	2585															
110			S	22		110.0	111.5	12	24	34	58	18				
	2580												SANDY, SILTY CLAY, very dense, moist, brown, low plasticity SILT-CLAY, some fine sand, trace fine gravel, moderate cementation, strong reaction with HCl. (CL-ML)			
115			S	23		115.0	116.4	22	35	50/5	R	15				X
	2575															
120			S	24		120.0	121.5	14	27	32	59	18				
	2570															
125			S	25		125.0	125.1	50/1			R	1				
	2565															
130			S	26		130.0	131.5	33	23	22	45	18	Becomes dense.			
	2560												End of boring at 130'. Sampler stopped at 131.5'. No groundwater encountered. Backfilled with ADWR-compliant grout.			
135																
	2555															
140																
	2550															
145																

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BORING LOG: B04

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Chuck
INSPECTOR: NAB

COORDINATES **N:** 16,453 **E:** 21,550
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 231+86
OFFSET: 50 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,695
TOTAL DEPTH: 131.5

START DATE: 01/04/2011 **TIME:** 08:00 AM
FINISH DATE: 01/04/2011 **TIME:** 10:00 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
5	2690												CLAYEY SAND (native), medium dense, dry, tan, fine to coarse SAND, little low plasticity fines, moderate cementation, strong reaction with HCl. (SC)			
10	2685		S	2	X	10.0	11.5	12	13	13	26	14				
15	2680		S	3	X	15.0	16.5	10	14	20	34	18	SANDY LEAN CLAY, hard, dry, tan, medium plasticity CLAY, some fine to coarse sand, few fine gravel, moderate cementation, strong reaction with HCl. (CL)			X
20	2675		S	4	X	20.0	21.5	7	10	13	23	17	SILTY SAND, medium dense, dry, tan, fine to coarse SAND, little nonplastic fines, no cementation, no reaction with HCl. (SM)			
25	2670												SANDY LEAN CLAY, very stiff, dry, brown, low plasticity CLAY, some fine sand, no cementation, no reaction with HCl. (CL)			

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BORING LOG: B04

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Chuck
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	5	X	25.0	26.5	5	12	17	29	18				
30	2665		S	6	X	30.0	31.5	10	16	16	32	18	SILTY SAND, dense, dry, tan, fine to coarse SAND, little nonplastic fines, few fine subangular gravel, no cementation, no reaction with HCl, max. particle size 0.25". (SM)			
35	2660		S	7	X	35.0	36.5	9	16	17	33	18	CLAYEY SAND, dense, moist, brown, fine to coarse SAND, some low plasticity fines, few fine to coarse gravel, weak cementation, weak reaction with HCl. (SC)	8.6		X
40	2655		S	8	X	40.0	41.5	8	12	12	24	18	Becomes medium dense, moderate cementation.			
45	2650		S	9	X	45.0	46.5	9	18	15	33	18	SILTY, CLAYEY SAND, dense, dry to moist, brown, fine to coarse SAND, little low plasticity fines, no cementation, no reaction with HCl. (SC-SM)			
50	2645		S	10	X	50.0	51.5	17	25	26	51	18	CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, some low plasticity fines, trace fine subangular gravel, moderate cementation, strong reaction with HCl, max. particle size 0.25". (SC) Begin adding 1-2 buckets of water after each sample.			
55	2640		S	11	X	55.0	56.5	10	16	19	35	18	Becomes dense.			
60	2635		S	12	X	60.0	61.5	14	24	20	44	18	WELL-GRADED SAND WITH SILT, dense, dry, tan, fine to coarse SAND, few nonplastic fines, trace fine gravel, no cementation, no reaction with HCl, max. particle size 0.25". (SW-SM)			
65	2630												CLAYEY SAND, dense, dry, brown, fine			

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BORING LOG: B04

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Chuck
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	13	X	65.0	66.5	8	14	16	30	18	SAND, some low plasticity fines, trace fine subangular gravel, no cementation, no reaction with HCl, max. particle size 0.25". (SC)			
70	2625		S	14	X	70.0	71.5	9	14	19	33	18	SANDY LEAN CLAY, very stiff, moist, brown, medium plasticity CLAY, some fine sand, weak cementation, weak reaction with HCl. (CL)			
													CLAYEY SAND, dense, moist, brown, fine to coarse subrounded SAND, little low plasticity fines, no cementation, no reaction with HCl. (SC) Added 2 buckets of water.			
75	2620		S	15	X	75.0	76.5	9	28	31	59	18	SILTY SAND, very dense, moist, tan, fine to coarse subrounded SAND, little nonplastic fines, few fine to coarse subrounded gravel, no cementation, no reaction with HCl, max. particle size 1". (SM)			
80	2615		S	16	X	80.0	81.5	33	25	50/6	R	18	CLAYEY SAND, very dense, moist, brown, fine to coarse SAND, some low plasticity fines, few fine subrounded gravel, no cementation, no reaction with HCl, max. particle size 0.5". (SC)			X
85	2610		S	17	X	85.0	86.5	11	20	23	43	18				
90	2605		S	18	X	90.0	91.5	13	18	23	41	18	Becomes dense, no gravel.			
95	2600		S	19	X	95.0	96.5	9	20	23	43	18	Becomes some medium plasticity fines, moderate cementation, strong reaction with HCl.			
100	2595		S	20	X	100.0	101.5	9	22	46	68	18	SANDY LEAN CLAY, hard, moist, brown, medium plasticity CLAY, some fine sand, trace fine gravel, moderate cementation, strong reaction with HCl. (CL)	13.7		X
105	2590															

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BORING LOG: B04

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Chuck
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	21	X	105.0	106.0	23	50/6		R	12				
110	2585		S	22	X	110.0	111.5	19	28	50/6	R	18	Becomes low plasticity CLAY, weak reaction with HCl.			
115	2580		S	23	X	115.0	116.5	14	29	50/6	R	18	Becomes medium plasticity CLAY, strong reaction with HCl.			
120	2575		S	24	X	120.0	121.5	16	18	20	38	18				
125	2570		S	25	X	125.0	126.3	23	31	50/4	R	16	CLAYEY SAND, very dense, moist, brown, fine to medium SAND, some medium plasticity fines, no cementation, no reaction with HCl. (SC)			
130	2565		S	26	X	130.0	131.5	17	26	45	71	18	Becomes moderate cementation, strong reaction with HCl.			
135	2560												End of boring at 130'. Sampler stopped at 131.5'. No groundwater encountered. Backfilled with ADWR-compliant grout.			
140	2555															
145	2550															

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BORING LOG: B05

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,579 **E:** 21,556
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 232+65
OFFSET: 50 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,694.8
TOTAL DEPTH: 131

START DATE: 01/07/2011 **TIME:** 08:00 AM
FINISH DATE: 01/07/2011 **TIME:** 02:30 PM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
5	2690		S	1	X	5.0	6.5	15	26	36	62	16	SILTY SAND (native), very dense, dry, tan, fine to coarse subrounded SAND, little medium plasticity fines, few fine subrounded gravel, no cementation, strong reaction with HCl, max. particle size 0.5". (SM)			X
10	2685		S	2	X	10.0	11.5	28	38	45	83	13	Becomes little low plasticity fines.			
15	2680		S	3	X	15.0	16.0	38	50/6		R	13	CLAYEY SAND, very dense, dry, light brown, fine to coarse subrounded SAND, some low plasticity fines, weak cementation, strong reaction with HCl. (SC)			
20	2675		S	4	X	20.0	21.5	14	24	38	62	16	LEAN CLAY WITH SAND, hard, dry, brown, medium plasticity CLAY, little fine sand, moderate cementation, strong reaction with HCl, Mottled with dark and light strands. (CL)			
25	2670												SILTY SAND, dense, dry, light brown, fine to coarse SAND, little low plasticity fines,			

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BORING LOG: B05

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	5	X	25.0	26.5	11	17	20	37	18	trace fine subrounded gravel, no cementation, weak reaction with HCl, max. particle size 0.5". (SM)			
30	2665		S	6	X	30.0	31.5	11	21	27	48	18	Becomes little nonplastic fines, few fine subrounded gravel, max. particle size 0.75".			
35	2660		S	7	X	35.0	36.5	20	22	25	47	18	CLAYEY SAND, dense, dry, brown, fine to coarse SAND, little low plasticity fines, few fine subrounded gravel, weak cementation, weak reaction with HCl, max. particle size 0.5". (SC)			
40	2655		S	8	X	40.0	41.5	15	31	40	71	18	Becomes very dense, some low plasticity fines, no cementation, strong reaction with HCl.			
45	2650		S	9	X	45.0	46.5	12	22	30	52	18	Becomes fine to medium SAND.			
50	2645		S	10	X	50.0	51.4	21	39	50/5	R	10	Becomes strong cementation.			
55	2640		S	11	X	55.0	56.5	18	19	24	43	18	SANDY LEAN CLAY, hard, dry, brown, low plasticity CLAY, some fine to medium sand, trace fine gravel, weak cementation, strong reaction with HCl. (CL) Begin adding 1-2 buckets of water after each sample.			X
60	2635		S	12	X	60.0	60.5	50/6			R	6	Becomes no cementation, no reaction with HCl.			
65	2630												CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, some low plasticity			

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BORING LOG: B05

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	13	X	65.0	66.0	34	50/6		R	10	fines, weak cementation, weak reaction with HCl. (SC)			
70	2625		S	14	X	70.0	70.8	30	50/4		R	6	Becomes no cementation, no reaction with HCl.			
75	2620		S	15	X	75.0	75.9	34	50/5		R	12	POORLY GRADED SAND WITH CLAY, very dense, dry, light brown, fine to coarse subrounded SAND, few low plasticity fines, few fine subrounded gravel, no cementation, no reaction with HCl, max. particle size 0.5". (SP-SC)			X
80	2615		S	16	X	80.0	81.4	27	40	50/5	R	14	SANDY LEAN CLAY, hard, dry, brown, medium plasticity CLAY, some fine to coarse sand, no cementation, no reaction with HCl. (CL)			
85	2610		S	17	X	85.0	86.5	25	27	35	62	18	Being adding water.			
90	2605		S	18	X	90.0	91.5	30	40	50/6	R	18	CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, some low plasticity fines, no cementation, no reaction with HCl. (SC)			
95	2600		S	19	X	95.0	96.5	26	33	50/6	R	18	SANDY LEAN CLAY, hard, dry, brown, medium plasticity CLAY, some fine sand, moderate cementation, strong reaction with HCl. (CL)			
100	2595		S	20	X	100.0	101.4	30	40	50/5	R	17				
105	2590												CLAYEY SAND, very dense, dry to moist, brown, fine to coarse SAND, some low			

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BORING LOG: B05

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	21	X	105.0	105.8	41	50/4		R	10	plasticity fines, moderate cementation, strong reaction with HCl. (SC)			
110	2585		S	22	X	110.0	110.5	50/6			R	6	LEAN CLAY WITH SAND, hard, dry to moist, brown, medium plasticity CLAY, little fine sand, no cementation, no reaction with HCl. (CL)			
115	2580		S	23	X	115.0	115.8	29	50/3		R	8	CLAYEY SAND, very dense, moist, brown, fine to coarse SAND, little low plasticity fines, weak cementation, weak reaction with HCl. (SC)			
120	2575		S	24	X	120.0	120.5	50/6			R	4	SILTY SAND, very dense, moist, tan, fine to coarse SAND, little nonplastic fines, no cementation, no reaction with HCl. (SM)			
125	2570		S	25	X	125.0	125.2	50/2			R	0	No recovery. Rock in sampler tip.			
130	2565		S	26	X	130.0	131.0	25	50/6		R	12				
													End of boring at 130'. Sampler stopped at 131'. No groundwater encountered. Backfilled with ADWR-compliant grout.			
135	2560															
140	2555															
145	2550															

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BORING LOG: B06

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,523 **E:** 21,647
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 233+12
OFFSET: 47 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,695
TOTAL DEPTH: 131.5

START DATE: 01/06/2011 **TIME:** 09:30 AM
FINISH DATE: 01/06/2011 **TIME:** 04:20 PM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
													CLAYEY SAND (native), loose, dry, tan, fine to coarse SAND, little low plasticity fines, trace fine subrounded gravel, no cementation, strong reaction with HCl, max. particle size 0.5". (SC)			
5	2690		S	1	X	5.0	6.5	5	5	4	9	10				
10	2685		S	2	X	10.0	11.5	13	19	26	45	17	Becomes dense, moderate cementation.			
15	2680		S	3	X	15.0	16.5	19	20	22	42	12				
													SANDY LEAN CLAY, hard, dry, brown, low plasticity CLAY, some fine sand, moderate cementation, strong reaction with HCl. (CL)			
20	2675		S	4	X	20.0	21.5	14	19	29	48	16				
25	2670															

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BORING LOG: B06

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	5		25.0	26.5	10	30	34	64	18				
30	2665		S	6		30.0	31.5	10	9	19	28	18	SILTY SAND, medium dense, dry, tan, fine to medium SAND, some nonplastic fines, no cementation, no reaction with HCl. (SM)			
35	2660		S	7		35.0	36.5	16	25	24	49	18	CLAYEY SAND, dense, dry, tan, fine to coarse SAND, some low plasticity fines, moderate cementation, strong reaction with HCl. (SC)			
40	2655		R	8		40.0	41.0	14	26			12	Becomes medium dense, weak cementation.			
45	2650		S	9		45.0	46.0	40	50/6		R	8	Becomes very dense, brown, moderate cementation, weak reaction with HCl.			
50	2645		S	10		50.0	51.5	12	16	15	31	18	Becomes dense, fine to medium SAND, weak cementation, strong reaction with HCl.			
55	2640		S	11		55.0	56.4	36	49	50/5	R	12	Begin adding 1-2 buckets of water after each sample. Becomes very dense, fine to coarse SAND, strong cementation.			
60	2635		S	12		60.0	61.5	21	31	35	66	18	Becomes moderate cementation, weak reaction with HCl.			
65	2630												LEAN CLAY WITH SAND, hard, dry, brown, medium plasticity CLAY, little fine			

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BORING LOG: B06

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	13	X	65.0	66.5	12	25	41	66	18	sand, trace fine gravel, moderate cementation, strong reaction with HCl. (CL)			X
70	2625		S	14	X	70.0	71.5	10	20	30	50	18	CLAYEY SAND, dense, dry to moist, brown, fine to medium SAND, some low plasticity fines, weak cementation, weak reaction with HCl. (SC)			
75	2620		S	15	X	75.0	76.5	20	43	44	87	14	WELL-GRADED SAND WITH SILT, very dense, dry, tan, fine to coarse subrounded SAND, few fine subrounded gravel, few nonplastic fines, no cementation, no reaction with HCl, max. particle size 0.25". (SW-SM)			
80	2615		S	16	X	80.0	81.5	14	20	24	44	18	SILTY SAND, dense, dry, tan, fine SAND, some low plasticity fines, no cementation, no reaction with HCl. (SM) Begin adding water.			
85	2610		S	17	X	85.0	86.5	14	21	24	45	12	SANDY, SILTY CLAY, hard, moist, brown, low plasticity SILT-CLAY, some fine to coarse sand, trace fine gravel, moderate cementation, weak reaction with HCl. (CL-ML)	9.9		X
90	2605		S	18	X	90.0	91.4	30	40	50/5	R	16	Becomes strong reaction with HCl.			
95	2600		S	19	X	95.0	96.5	15	22	47	69	18	Becomes fine sand, weak cementation.			
100	2595		S	20	X	100.0	101.5	18	27	40	67	18	Becomes moderate cementation.			
105	2590															

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BORING LOG: B06

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	21	X	105.0	105.8	30	50/4		R	10				
													SANDY LEAN CLAY, hard, moist, brown, low plasticity CLAY, some fine sand, trace fine gravel, weak cementation, weak reaction with HCl. (CL)			
110	2585		S	22	X	110.0	111.5	12	21	37	58	18				X
115	2580		S	23	X	115.0	116.3	20	40	50/3	R	14				
													SILTY SAND, very dense, dry, tan, fine to coarse SAND, some nonplastic fines, strong cementation, strong reaction with HCl. (SM)			
120	2575		S	24	X	120.0	121.5	30	17	26	43	12	CLAYEY SAND, dense, moist, tan, fine SAND, little medium plasticity fines, trace fine subangular gravel, no cementation, no reaction with HCl, max. particle size 0.5". (SC)			
125	2570		S	25	X	125.0	126.0	21	50/6		R	12	Becomes very dense, strong cementation, strong reaction with HCl.			
130	2565		S	26	X	130.0	131.5	20	21	29	50	0	Becomes dense, Sampler contains 6" slough material. No recovery.			
													End of boring at 130'. Sampler stopped at 131.5'. No groundwater encountered. Backfilled with ADWR-compliant grout.			
135	2560															
140	2555															
145	2550															

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BORING LOG: B07

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: RAI

COORDINATES **N:** 16,611 **E:** 21,640
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 233+51
OFFSET: 32 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,728.8
TOTAL DEPTH: 131

START DATE: 12/21/2010 **TIME:** 09:14 AM
FINISH DATE: 12/21/2010 **TIME:** 02:40 PM

Type/Symbol	Casing	Split Spoon S	Ring Sampler R	Shelby Tube U	Cuttings CU	Core Barrel C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
													8" of Asphaltic Concrete.			
5	2725		S	1		5.0	6.5	7	12	12	24	18	SILTY, CLAYEY SAND (fill), medium dense, moist, brown, fine to coarse subrounded to subangular SAND, little low plasticity fines, few fine gravel, no cementation, strong reaction with HCl. (SC-SM)			X
10	2720		S	2		10.0	11.5	8	11	19	30	18	SANDY LEAN CLAY (fill), very stiff, moist, brown, medium plasticity CLAY, little fine to coarse subrounded to subangular sand, trace fine to coarse subrounded to subangular gravel, moderate cementation, weak reaction with HCl, max. particle size 1". (CL)			
15	2715		R	3		15.0	16.0	13	32			12	Becomes strong reaction with HCl, max. particle size 0.75".			
20	2710		S	4		20.0	21.5	12	13	15	28	18	Becomes dry to moist, tan, low plasticity CLAY, some fine to coarse subrounded to subangular sand, few fine to coarse subrounded to subangular gravel, weak cementation, max. particle size 1.25".			
25	2705															

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BORING LOG: B07

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: RAI

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	5	X	25.0	26.5	5	8	12	20	18	Becomes few fine subrounded to subangular gravel, max. particle size 0.25".			
	2700															
30			S	6	X	30.0	31.5	8	14	23	37	18	Becomes hard, few fine to coarse subrounded to subangular gravel, max. particle size 1".			
	2695															
35			S	7	X	35.0	36.5	6	16	20	36	10	Becomes moist, brown, few fine subrounded to subangular gravel, weak reaction with HCl, max. particle size 0.25".			
	2690												Becomes (native), dry, light brown, some medium plasticity CLAY, few fine subangular gravel, strong reaction with HCl, max. particle size 0.75".			
40			S	8	X	40.0	41.5	23	33	27	60	13				X
	2685												CLAYEY SAND WITH GRAVEL, very dense, dry to moist, light brown, fine to coarse subrounded to subangular SAND, little fine subrounded to subangular gravel, little low plasticity fines, no cementation, no reaction with HCl, max. particle size 0.75". (SC)			
45			S	9	X	45.0	46.0	30	50/6		R	6				
	2680												WELL-GRADED SAND WITH CLAY AND GRAVEL, dense, dry, light brown, fine to coarse subrounded to subangular SAND, little fine subrounded to subangular gravel, few nonplastic fines, no cementation, strong reaction with HCl, max. particle size 0.75". (SW-SC)			
50			S	10	X	50.0	51.5	14	20	26	46	4				
	2675												CLAYEY SAND, very dense, dry, light brown, fine to coarse subrounded to subangular SAND, some low plasticity fines, no cementation, strong reaction with HCl. (SC)			
55			S	11	X	55.0	55.8	43	50/4		R	8				
	2670															
60			S	12	X	60.0	61.5	17	18	22	40	18	Becomes dense, fine subrounded to subangular SAND, some nonplastic fines, trace fine gravel, weak reaction with HCl.			X
	2665															
65																

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BORING LOG: B07

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: RAI

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	13	X	65.0	65.5	50/6			R	5	Becomes very dense, weak cementation, strong reaction with HCl.			
	2660															
70			S	14	X	70.0	70.9	42	50/5		R	11	Becomes fine to coarse SAND, few fine subrounded to subangular gravel, no cementation, max. particle size 0.5".			
	2655															
75			S	15	X	75.0	76.0	36	50/6		R	10	Becomes little nonplastic fines, max. particle size 0.25".			
	2650															
80			S	16	X	80.0	81.4	29	37	50/5	R	17	Becomes weak reaction with HCl.			
	2645															
85			S	17	X	85.0	86.0	38	50/6		R	6	Becomes moderate cementation, strong reaction with HCl.			
	2640															
90			S	18	X	90.0	91.5	21	26	36	62	18	Becomes some nonplastic fines, trace fine subrounded to subangular gravel, max. particle size 0.5".			
	2635															
95			S	19	X	95.0	95.8	36	50/4		R	8				
	2630															
100			S	20	X	100.0	101.5	16	17	21	38	18	Becomes dense, fine subrounded to subangular SAND, some low plasticity fines, no cementation, weak reaction with HCl.			
	2625															
105																

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BORING LOG: B07

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: RAI

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	21		105.0	105.3	50/4			R	4	Becomes very dense, some nonplastic fines.			
	2620												SANDY LEAN CLAY, hard, dry, brown, medium plasticity CLAY, little fine to coarse subrounded to subangular sand, few fine to coarse gravel, no cementation, no reaction with HCl. (CL)			
110			S	22		110.0	111.0	32	50/6		R	12				X
	2615															
115			S	23		115.0	115.5	50/6			R	6				
	2610												CLAYEY SAND, very dense, dry, brown, fine to coarse subrounded to subangular SAND, some low plasticity fines, trace fine subrounded to subangular gravel, moderate cementation, strong reaction with HCl, max. particle size 0.5". (SC) Added water to boring at 123'. Slow auger advance from 122' to 125'.			
120			S	24		120.0	121.5	20	35	50/6	R	18				
	2605															
125			S	25		125.0	125.5	50/6			R	6	Becomes fine subrounded to subangular SAND, weak cementation.			
	2600															
130			S	26		130.0	131.0	27	50/6		R	12				
	2595												End of boring at 130'. Sampler stopped at 131'. No groundwater encountered. Backfilled with ADWR-compliant grout.			
135																
	2590															
140																
	2585															
145																

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BORING LOG: B08

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,573 **E:** 21,699
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 233+82
OFFSET: 31 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,727.4
TOTAL DEPTH: 131.5

START DATE: 12/15/2010 **TIME:** 09:40 AM
FINISH DATE: 12/20/2010 **TIME:** 11:50 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2725												SANDY LEAN CLAY (fill), very stiff, moist, dark brown, medium plasticity CLAY, some fine to coarse sand, moderate cementation, strong reaction with HCl. (CL)			
5			S	1	X	5.0	6.5	5	8	14	22	18				
	2720															
10			S	2	X	10.0	11.5	4	7	14	21	18	Becomes trace coarse subangular gravel, max. particle size 0.75".			
	2715															
15			S	3	X	15.0	16.5	9	16	11	27	18	CLAYEY SAND (fill), medium dense, moist, dark brown, fine to coarse SAND, little low plasticity fines, few fine to coarse subangular gravel, moderate cementation, strong reaction with HCl, max. particle size 0.75". (SC)			X
	2710															
20			S	4	X	20.0	21.5	7	10	8	18	18	SANDY LEAN CLAY (fill), very stiff, moist, dark brown, medium plasticity CLAY, some fine sand, moderate cementation, strong reaction with HCl. (CL)			
	2705															
25																

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BORING LOG: B08

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2700		S	5	X	25.0	26.5	5	11	22	33	18	Becomes hard.			
30	2695		S	6	X	30.0	31.5	7	11	19	30	18	Becomes LEAN CLAY WITH SAND, very stiff, little fine to coarse sand.			
35	2690		S	7	X	35.0	36.5	7	18	25	43	7	Becomes SANDY LEAN CLAY, hard, some fine to coarse sand.			
40	2685		S	8	X	40.0	41.5	5	10	14	24	18	Becomes (native) very stiff, light brown, low plasticity CLAY.			
45	2680		S	9	X	45.0	46.5	17	27	50/6	R	7	Becomes hard.			
50	2675		S	10	X	50.0	51.5	21	21	31	52	18	WELL-GRADED SAND WITH SILT, very dense, dry, tan, fine to coarse SAND, few fine to coarse subrounded gravel, few nonplastic fines, no cementation, no reaction with HCl, max. particle size 0.5". (SW-SM)			X
55	2670		S	11	X	55.0	56.0	22	50/6		R	12	SILTY SAND, very dense, dry, tan, fine to coarse SAND, some low plasticity fines, no cementation, no reaction with HCl. (SM)			
60	2665		S	12	X	60.0	61.5	31	34	27	61	18	CLAYEY SAND, very dense, dry, tan, fine to coarse SAND, little low plasticity fines, trace fine subangular gravel, no cementation, no reaction with HCl, max. particle size 0.5". (SC)			
65																

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BORING LOG: B08

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	13	X	65.0	65.5	50/6			R	3				
	2660															
70			S	14	X	70.0	71.5	15	20	21	41	18	Becomes dense, some medium plasticity fines.			
	2655															
75			S	15	X	75.0	76.0	41	50/6		R	5	Becomes very dense.			
	2650															
80			S	16	X	80.0	81.0	20	50/6		R	12	SANDY LEAN CLAY, hard, dry, brown, low plasticity CLAY, some fine to medium sand, trace fine gravel, weak cementation, weak reaction with HCl. (CL)			X
	2645															
85			S	17	X	85.0	85.8	34	50/3		R	6	CLAYEY SAND, very dense, dry, brown, fine SAND, some medium plasticity fines, no cementation, no reaction with HCl. (SC)			
	2640															
90			S	18	X	90.0	91.5	21	28	34	62	18	Becomes trace fine to coarse gravel, max. particle size 1".			
	2635															
95			S	19	X	95.0	96.4	28	45	50/5	R	18				
	2630															
100			S	20	X	100.0	101.4	28	41	50/5	R	15				
	2625															
105																

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BORING LOG: B08

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2620		S	21		105.0	105.2	50/3			R	0	No recovery. Begin adding water.			
110	2615		S	22		110.0	110.3	50/3			R	3	WELL-GRADED SAND WITH SILT, very dense, dry, tan, fine to coarse subangular SAND, few nonplastic fines, trace fine subangular gravel, no cementation, no reaction with HCl, max. particle size 0.25". (SW-SM)			
115	2610		S	23		115.0	116.5	15	29	43	72	10	CLAYEY SAND, very dense, wet, brown, fine to coarse subrounded SAND, little low plasticity fines, trace fine to coarse subangular gravel, no cementation, no reaction with HCl, max. particle size 1". (SC)			
120	2605		S	24		120.0	121.5	14	22	27	49	18	SANDY LEAN CLAY, hard, moist, brown, medium plasticity CLAY, some fine to medium sand, trace fine gravel, weak cementation, strong reaction with HCl. (CL)	14.9		X
125	2600		S	25		125.0	126.5	27	29	29	58	18	Becomes some fine sand.			
130	2595		S	26		130.0	131.5	22	26	47	73	18				
135	2590												End of boring at 130'. Sampler stopped at 131.5'. No groundwater encountered. Backfilled with ADWR-compliant grout.			
140	2585															
145																

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BORING LOG: B09

SHEET 1 of 3
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 14,222 **E:** 18,491
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 188+80
OFFSET: 98 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,702.1
TOTAL DEPTH: 80.75

START DATE: 01/14/2011 **TIME:** 10:30 AM
FINISH DATE: 01/14/2011 **TIME:** 01:00 PM

Type/Symbol	Casing	Split Spoon S	Ring Sampler R	Shelby Tube U	Cuttings CU	Core Barrel C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2700		S	1		2.5	4.0	10	24	40	64	7	CLAYEY SAND (native), very dense, dry, tan, fine to coarse SAND, some low plasticity fines, weak cementation, strong reaction with HCl. (SC)			
5			S	2		5.0	6.5	20	22	18	40	18	SANDY LEAN CLAY, hard, moist, dark brown, medium plasticity CLAY, some fine to coarse sand, no cementation, no reaction with HCl. (CL)			
	2695		S	3		7.5	9.0	13	16	17	33	15	CLAYEY SAND, dense, dry, light brown, fine to coarse SAND, some low plasticity fines, strong cementation, strong reaction with HCl. (SC)			
10			R	4		10.0	11.0	23	30			12	Becomes medium dense.			
	2690		CU	1		10.0	15.0						SANDY LEAN CLAY, very stiff, moist, dark brown, medium plasticity CLAY, some fine to coarse subrounded sand, trace fine gravel, moderate cementation, weak reaction with HCl. (CL)	9.6		X
			S	5		12.5	14.0	7	14	13	27	16				X
15			S	6		15.0	16.5	26	28	34	62	18				
	2685		R	7		17.5	18.5	19	47			12	CLAYEY SAND, very dense, dry to moist, brown, fine to coarse SAND, little low plasticity fines, weak cementation, strong reaction with HCl. (SC)			
20			S	8		20.0	21.5	4	4	3	7	18	SANDY LEAN CLAY, very stiff, moist, dark brown, medium plasticity CLAY, some fine to coarse sand, moderate cementation, strong reaction with HCl. (CL) Becomes medium.			
	2680		S	9		22.5	24.0	5	6	7	13	18	CLAYEY SAND, medium dense, dry, brown, fine to coarse SAND, little low plasticity fines, few fine subrounded gravel,			
25																

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BORING LOG: B09

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	10	X	25.0	26.5	5	12	34	46	18	weak cementation, strong reaction with HCl, max. particle size 0.75". (SC)			
	2675												SILTY SAND, dense, dry to moist, brown, fine to coarse SAND, little low plasticity fines, few fine subrounded gravel, no cementation, strong reaction with HCl, max. particle size 0.5". (SM)			
30			S	11	X	30.0	31.0	32	50/6		R	4	Becomes very dense. Rock in sampler tip.			
	2670															
													CLAYEY SAND, medium dense, dry, brown, fine SAND, some medium plasticity fines, no cementation, no reaction with HCl. (SC)			
35			S	12	X	35.0	36.5	8	12	17	29	16				
	2665															
40			S	13	X	40.0	41.5	13	23	29	52	14	Becomes very dense, moderate cementation, strong reaction with HCl.			
	2660															
													SANDY, SILTY CLAY, stiff, dry, brown, low plasticity SILT-CLAY, some fine sand, trace fine gravel, weak cementation, strong reaction with HCl. (CL-ML)			
45			S	14	X	45.0	46.5	6	6	8	14	18				X
	2655															
													CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, some low plasticity fines, few fine to coarse subrounded gravel, weak cementation, weak reaction with HCl, max. particle size 1". (SC)			
50			S	15	X	50.0	51.0	21	50/6		R	10				
	2650												WELL-GRADED SAND WITH SILT, dense, dry, tan, fine to coarse SAND, few nonplastic fines, few fine to coarse subrounded gravel, no cementation, no reaction with HCl, max. particle size 1". (SW-SM)			
55			S	16	X	55.0	56.5	17	21	24	45	11				
	2645															
													LEAN CLAY WITH SAND, hard, dry, brown, medium plasticity CLAY, little fine to coarse sand, trace fine gravel, moderate cementation, strong reaction with HCl. (CL)			
60			S	17	X	60.0	61.5	8	18	17	35	18				X
	2640															
													CLAYEY SAND, very dense, dry, brown, fine to medium SAND, some low plasticity			
65																

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BORING LOG: B09

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	18	X	65.0	66.0	25	50/6		R	12	fines, trace fine gravel, moderate cementation, strong reaction with HCl. (SC)			X
	2635															
70			S	19	X	70.0	70.5	50/6			R	6				
	2630															
75			S	20	X	75.0	76.0	18	50/6		R	12	Becomes fine to coarse SAND, some medium plasticity fines.			
	2625															
80			S	21	X	80.0	80.8	38	50/3		R	10				
	2620												End of boring 80'. Sampler stopped at 80.8'. No groundwater encountered. Backfilled with 2-sack sand slurry (Type I/II Portland).			
85																
	2615															
90																
	2610															
95																
	2605															
100																
	2600															
105																

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BORING LOG: B10

SHEET 1 of 3
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 14,029 **E:** 18,591
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 189+83
OFFSET: 94 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,702.5
TOTAL DEPTH: 80.8

START DATE: 01/13/2011 **TIME:** 11:00 AM
FINISH DATE: 01/13/2011 **TIME:** 02:20 PM

Type/Symbol	Casing	Split Spoon S	Ring Sampler R	Shelby Tube U	Cuttings CU	Core Barrel C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2700		S	1		2.5	4.0	17	32	26	58	14	CLAYEY SAND WITH GRAVEL (native), very dense, dry, tan, fine to coarse SAND, little medium plasticity fines, little fine to coarse subangular gravel, weak cementation, strong reaction with HCl, max. particle size 1.5". (SC)			X
5			R	2		5.0	5.5	50/6				6	Becomes CLAYEY SAND, some low plasticity fines, few fine to coarse subrounded gravel, max. particle size 1".			
	2695		S	3		7.5	9.0	13	21	22	43	15	Becomes dense.			
10			S	4		10.0	11.5	10	14	13	27	18	Becomes medium dense.			
	2690		R	5		12.5	13.5	18	23			12	SANDY LEAN CLAY, very stiff, moist, brown, medium plasticity CLAY, some fine to coarse sand, weak cementation, weak reaction with HCl. (CL)			
15			S	6		15.0	16.5	10	12	17	29	18				
	2685		S	7		17.5	19.0	14	17	22	39	10	CLAYEY SAND, dense, moist, brown, fine to coarse SAND, some low plasticity fines, trace fine subrounded gravel, weak cementation, strong reaction with HCl, max. particle size 0.25". (SC)			
20			S	8		20.0	21.5	11	17	20	37	13	SILTY SAND, dense, moist, tan, fine to coarse SAND, some medium plasticity fines, few fine subrounded gravel, weak cementation, strong reaction with HCl, max. particle size 0.25". (SM)			X
	2680															
25																

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BORING LOG: B10

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	9		25.0	26.0	28	50/6		R	12	CLAYEY SAND, very dense, dry, tan, fine to coarse SAND, little low plasticity fines, few fine subrounded gravel, weak cementation, strong reaction with HCl, max. particle size 0.75". (SC)			X
30	2675		S	10		30.0	31.5	14	23	31	54	18	Becomes moist, dark brown, some medium plasticity fines, trace fine subrounded gravel, moderate cementation, weak reaction with HCl, max. particle size 0.25".			
	2670															
35			S	11		35.0	36.5	17	31	27	58	15	SILTY SAND, very dense, dry, tan, fine to coarse SAND, little nonplastic fines, few fine to coarse subrounded gravel, no cementation, weak reaction with HCl, max. particle size 1". (SM)			
	2665															
40			S	12		40.0	41.5	7	10	12	22	18	WELL-GRADED SAND WITH SILT, medium dense, moist, brown, fine to coarse SAND, few nonplastic fines, few fine subrounded gravel, no cementation, no reaction with HCl, max. particle size 0.25". (SW-SM)			X
	2660															
45			S	13		45.0	46.5	10	14	22	36	18	CLAYEY SAND, dense, moist, brown, fine to coarse SAND, some medium plasticity fines, no cementation, no reaction with HCl. (SC)			
	2655															
50			S	14		50.0	51.4	37	41	50/5	R	16	SILTY SAND WITH GRAVEL, very dense, dry, gray - brown, fine to coarse subrounded SAND, few nonplastic fines, little fine to coarse subrounded gravel, no cementation, no reaction with HCl, max. particle size 1". (SM)	3.0		X
	2650															
55			S	15		55.0	55.5	50/6			R	4	Rock in sampler tip.			
	2645															
60			S	16		60.0	61.5	23	14	16	30	18	Becomes medium dense, tan, fine SAND, some low plasticity fines, strong reaction with HCl.			
	2640															
65													CLAYEY SAND, very dense, dry, light			

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BORING LOG: B10

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	17	X	65.0	65.9	25	50/5		R	10	brown, fine to coarse SAND, some medium plasticity fines, few fine to coarse subrounded gravel, moderate cementation, strong reaction with HCl, max. particle size 1". (SC)			
	2635															
70			S	18	X	70.0	70.5	50/6			R	6	Becomes little low plasticity fines.			
	2630															
75			S	19	X	75.0	75.4	50/5			R	5	Becomes some low plasticity fines.			
	2625															
80			S	20	X	80.0	80.8	38	50/4		R	10				
	2620												End of boring 80'. Sampler stopped at 80.8'. No groundwater encountered. Backfilled with 2-sack sand slurry (Type I/II Portland).			
85																
	2615															
90																
	2610															
95																
	2605															
100																
	2600															
105																

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BORING LOG: D01

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Tim
INSPECTOR: NAB

COORDINATES **N:** 15,412 **E:** 20,753
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 218+62
OFFSET: 109 Lt.

RIG TYPE: Track mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,679.4
TOTAL DEPTH: 21.5

START DATE: 03/16/2011 **TIME:** 01:45 PM
FINISH DATE: 03/16/2011 **TIME:** 02:15 PM

Type/Symbol	Casing	Split Spoon S	Ring Sampler R	Shelby Tube U	Cuttings CU	Core Barrel C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
													SANDY LEAN CLAY (native), stiff, moist, brown, low plasticity CLAY, some fine to medium sand, trace fine gravel, no cementation, no reaction with HCl. (CL)			
5	2675		S	2		5.0	6.5	2	4	7	11	18				X
			CU	1		5.0	10.0									
10	2670		R	3		10.0	11.0	11	13			12	CLAYEY SAND, medium dense, moist, brown, fine to coarse SAND, little low plasticity fines, trace fine to coarse subrounded gravel, no cementation, no reaction with HCl, max. particle size 1". (SC)			
15	2665		S	4		15.0	16.5	9	12	17	29	15	WELL-GRADED SAND WITH SILT AND GRAVEL, medium dense, moist, light brown, fine to coarse SAND, few nonplastic fines, some fine to coarse subangular gravel, no cementation, no reaction with HCl, max. particle size 1.5". (SW-SM)			X
20	2660		S	5		20.0	21.5	4	8	12	20	18				
25	2655												End of boring at 20'. Sampler stopped at 21.5'. No groundwater encountered. Backfilled with cuttings.			

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BORING LOG: D02

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Tim
INSPECTOR: NAB

COORDINATES **N:** 15,348 **E:** 20,949
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 218+64
OFFSET: 97 Rt.

RIG TYPE: Track mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,683
TOTAL DEPTH: 21.5

START DATE: 03/16/2011 **TIME:** 02:45 PM
FINISH DATE: 03/16/2011 **TIME:** 03:20 PM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2680		CU	1		0.0	5.0						SILTY SAND (native), loose, moist, brown, fine to coarse SAND, little nonplastic fines, few fine subrounded gravel, no cementation, no reaction with HCl, max. particle size 0.5". (SM)			X
5			R	2		5.0	6.0	6	8			12		3.3	96.5	X
	2675															
10			S	3		10.0	11.5	7	14	11	25	18				X
	2670												SILTY, CLAYEY SAND, medium dense, moist, brown, fine to coarse SAND, little low plasticity fines, few fine gravel, no cementation, no reaction with HCl. (SC-SM)			
15			S	4		15.0	16.5	5	7	9	16	18	WELL-GRADED SAND, medium dense, moist, tan, fine to coarse SAND, no cementation, no reaction with HCl. (SW)			
	2665												SANDY LEAN CLAY, very stiff, moist, brown, medium plasticity CLAY, fine to medium SAND, no cementation, no reaction with HCl. (CL)			
20			S	5		20.0	21.5	9	10	16	26	18				X
	2660												End of boring at 20'. Sampler stopped at 21.5'. No groundwater encountered. Backfilled with cuttings.			
25																

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BORING LOG: P01

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 13,992 **E:** 12,000
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 123+89
OFFSET: 42 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,643.2
TOTAL DEPTH: 6.5

START DATE: 02/01/2011 **TIME:** 07:30 AM
FINISH DATE: 02/01/2011 **TIME:** 07:45 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2640		CU	1		0.0	5.0						CLAYEY SAND WITH GRAVEL (native), dense, dry, brown, fine to coarse SAND, little medium plasticity fines, little fine to coarse subrounded gravel, no cementation, strong reaction with HCl, max. particle size 1". (SC)	3.8		X
			S	1		2.5	3.7	12	25	20	45	8				
5			S	2		5.0	6.5	7	25	35	60	13	Becomes dark brown, moderate cementation.			
	2635												End of boring at 5'. Sampler stopped at 6.5'. No groundwater encountered. Backfilled with cuttings.			
10																
	2630															
15																
	2625															
20																
	2620															
25																

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BORING LOG: P02

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 13,979 **E:** 12,487
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 128+76
OFFSET: 64 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,645.6
TOTAL DEPTH: 6

START DATE: 12/13/2010 **TIME:** 09:00 AM
FINISH DATE: 12/13/2010 **TIME:** 09:15 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2645		CU	1		0.0	5.0						CLAYEY SAND, medium dense, dry, brown, fine to coarse SAND, some low plasticity fines, few fine rounded gravel, no cementation, strong reaction with HCl, max. particle size 3/4". (SC)			X
			R	1		2.5	3.5	24	28			12				
5	2640		S	2		5.0	6.0	32	50/6		R	4	Becomes very dense, weak cementation.			
													End of boring at 5'. Sampler stopped at 6'. No groundwater encountered. Backfilled with cuttings.			
10	2635															
15	2630															
20	2625															
25																

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SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 13,999 **E:** 12,973
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 133+61
OFFSET: 53 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,649.4
TOTAL DEPTH: 6.5

START DATE: 02/01/2011 **TIME:** 07:50 AM
FINISH DATE: 02/01/2011 **TIME:** 08:05 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			CU	1		0.0	5.0						SILTY, CLAYEY SAND WITH GRAVEL (native), medium dense, dry, light brown, fine to coarse SAND, little low plasticity fines, little fine to coarse gravel, no cementation, strong reaction with HCl. (SC-SM)			
			R	1		2.5	3.5	12	30			12		6.9	83.6	X X
5	2645		S	2		5.0	6.5	20	28	21	49	8	Becomes dense.			
													End of boring at 5'. Sampler stopped at 6.5'. No groundwater encountered. Backfilled with cuttings.			
10	2640															
15	2635															
20	2630															
25	2625															

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BORING LOG: P04

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NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 14,004 **E:** 13,464
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 138+52
OFFSET: 58 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,652
TOTAL DEPTH: 5.9

START DATE: 12/13/2010 **TIME:** 09:30 AM
FINISH DATE: 12/13/2010 **TIME:** 09:45 AM

Type/Symbol	Casing	Split Spoon S	Ring Sampler R	Shelby Tube U	Cuttings CU	Core Barrel C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2650		CU	1		0.0	5.0						CLAYEY SAND (native), medium dense, dry, brown, fine to coarse SAND, some low plasticity fines, trace fine subrounded gravel, no cementation, strong reaction with HCl, max. particle size 0.5". (SC)			
			S	1		2.5	4.0	6	8	11	19	8				
5			R	2		5.0	5.9	17	50/5			12	Becomes very dense.			
	2645												End of boring at 5'. Sampler stopped at 5.9'. No groundwater encountered. Backfilled with cuttings.			
10	2640															
15	2635															
20	2630															
25																

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BORING LOG: P06

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 14,019 **E:** 14,443
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 148+32
OFFSET: 61 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,660
TOTAL DEPTH: 6.5

START DATE: 12/14/2010 **TIME:** 07:40 AM
FINISH DATE: 12/14/2010 **TIME:** 08:15 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			CU R	1 1		0.0 2.5	5.0 3.3	28	50/3			4	SILTY SAND WITH GRAVEL, very dense, dry, brown, fine to coarse SAND, little low plasticity fines, some fine to coarse subangular gravel, no cementation, strong reaction with HCl, max. particle size 0.5". (SM)			X
5	2655		S	2		5.0	6.5	8	33	37	70	18	Becomes little nonplastic fines, few fine subangular gravel.			
													End of boring at 5'. Sampler stopped at 6.5'. No groundwater encountered. Backfilled with cuttings.			
10	2650															
15	2645															
20	2640															
25	2635															

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BORING LOG: P07

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 14,133 **E:** 14,933
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 153+24
OFFSET: 44 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,663.2
TOTAL DEPTH: 6.5

START DATE: 01/07/2011 **TIME:** 12:10 PM
FINISH DATE: 01/07/2011 **TIME:** 12:30 PM

Type/Symbol	Casing	Split Spoon S	Ring Sampler R	Shelby Tube U	Cuttings CU	Core Barrel C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2660		CU	1		0.0	5.0						SILTY, CLAYEY SAND WITH GRAVEL (native), loose, dry, brown, fine to coarse SAND, little low plasticity fines, little fine to coarse subrounded gravel, weak cementation, weak reaction with HCl, max. particle size 1". (SC-SM)			X
			R	1		2.5	3.5	6	8			12				X
5			S	2		5.0	6.5	7	9	7	16	5	Becomes medium dense.			
	2655												End of boring at 5'. Sampler stopped at 6.5'. No groundwater encountered. Backfilled with cuttings.			
10																
	2650															
15																
	2645															
20																
	2640															
25																

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BORING LOG: P08

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 14,038 **E:** 15,426
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 158+15
OFFSET: 61 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,661.2
TOTAL DEPTH: 6.5

START DATE: 12/14/2010 **TIME:** 08:15 AM
FINISH DATE: 12/14/2010 **TIME:** 08:30 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2660		CU	1		0.0	5.0						SILTY, CLAYEY SAND WITH GRAVEL, medium dense, dry, brown, fine to coarse SAND, little low plasticity fines, little fine to coarse subrounded gravel, no cementation, strong reaction with HCl, max. particle size 0.5". (SC-SM)			
			R	1		2.5	3.5	20	32			12				X
5													Becomes dense.			
	2655		S	2		5.0	6.5	7	20	23	43	10				
													End of boring at 5'. Sampler stopped at 6.5'. No groundwater encountered. Backfilled with cuttings.			
10	2650															
15	2645															
20	2640															
25																

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BORING LOG: P09

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 14,152 **E:** 15,916
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 163+07
OFFSET: 43 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,663.5
TOTAL DEPTH: 6

START DATE: 01/07/2011 **TIME:** 11:30 AM
FINISH DATE: 01/07/2011 **TIME:** 12:00 PM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			CU	1		0.0	5.0						CLAYEY SAND (native), dense, dry, brown, fine to coarse SAND, some medium plasticity fines, few fine to coarse subrounded gravel, no cementation, weak reaction with HCl, max. particle size 1". (SC)			X
	2660		S	1		2.5	4.0	19	19	18	37	5				
5			R	2		5.0	6.0	10	21			12	Becomes medium dense.			
													End of boring at 5'. Sampler stopped at 6'. No groundwater encountered. Backfilled with cuttings.			
	2655															
10																
	2650															
15																
	2645															
20																
	2640															
25																

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BORING LOG: P10

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 14,055 **E:** 16,414
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 168+03
OFFSET: 63 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,665.8
TOTAL DEPTH: 6

START DATE: 12/14/2010 **TIME:** 08:50 AM
FINISH DATE: 12/14/2010 **TIME:** 09:10 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2665												CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, some medium plasticity fines, few fine to coarse subangular gravel, moderate cementation, strong reaction with HCl, max. particle size 0.5". (SC)			
			CU	1		0.0	5.0									X
			S	1		2.5	4.0	28	37	37	74	3				
5													Rock in sampler tip.			
	2660		R	2		5.0	6.0	15	25			12	Becomes medium dense, some low plasticity fines, max. particle size 1".			
													End of boring at 5'. Sampler stopped at 6'. No groundwater encountered. Backfilled with cuttings.			
10	2655															
15	2650															
20	2645															
25																

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BORING LOG: P11

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 14,182 **E:** 16,901
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 172+92
OFFSET: 54 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,669.7
TOTAL DEPTH: 6.5

START DATE: 01/07/2011 **TIME:** 11:00 AM
FINISH DATE: 01/07/2011 **TIME:** 11:20 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			CU	1		0.0	5.0						CLAYEY SAND WITH GRAVEL (native), loose, dry, brown, fine to coarse SAND, little medium plasticity fines, little fine to coarse subrounded gravel, weak cementation, strong reaction with HCl, max. particle size 1". (SC)			X
			S	1		2.5	4.0	3	3	4	7	14				
5	2665		S	2		5.0	6.5	21	24	28	52	8	Becomes very dense.			
													End of boring at 5'. Sampler stopped at 6.5'. No groundwater encountered. Backfilled with cuttings.			
10	2660															
15	2655															
20	2650															
25	2645															

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BORING LOG: P12

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 14,085 **E:** 17,395
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 177+85
OFFSET: 48 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,674.7
TOTAL DEPTH: 6

START DATE: 12/14/2010 **TIME:** 09:30 AM
FINISH DATE: 12/14/2010 **TIME:** 09:45 AM

Type/Symbol	Casing	Split Spoon S	Ring Sampler R	Shelby Tube U	Cuttings CU	Core Barrel C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			CU	1		0.0	5.0						SILTY, CLAYEY SAND WITH GRAVEL, medium dense, dry, brown, fine to coarse SAND, little low plasticity fines, little fine subangular gravel, weak cementation, strong reaction with HCl, max. particle size 0.5". (SC-SM)			X
			S	1		2.5	4.0	8	12	11	23	0				
5	2670		R	2		5.0	6.0	20	40			12	No recovery. Rock in sampler tip.			
													End of boring at 5'. Sampler stopped at 6'. No groundwater encountered. Backfilled with cuttings.			
10	2665															
15	2660															
20	2655															
25	2650															

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BORING LOG: P13

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 14,184 **E:** 17,876
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 182+66
OFFSET: 54 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,678.5
TOTAL DEPTH: 5

START DATE: 02/01/2011 **TIME:** 09:00 AM
FINISH DATE: 02/01/2011 **TIME:** 09:15 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2675		CU R	1 1		0.0 2.5	5.0 3.5	10	20			12	CLAYEY SAND (native), medium dense, dry, brown, fine to coarse SAND, little low plasticity fines, few fine to coarse gravel, no cementation, strong reaction with HCl. (SC)	5.4	87.0	X X
5													End of boring at 5'. No groundwater encountered. Backfilled with cuttings.			
	2670															
10																
	2665															
15																
	2660															
20																
	2655															
25																

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BORING LOG: P14

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 14,075 **E:** 18,366
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 187+57
OFFSET: 50 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,681.7
TOTAL DEPTH: 6.5

START DATE: 02/01/2011 **TIME:** 09:30 AM
FINISH DATE: 02/01/2011 **TIME:** 09:45 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2680		CU	1		0.0	5.0						CLAYEY SAND WITH GRAVEL (native), medium dense, dry, brown, fine to coarse SAND, little low plasticity fines, little fine to coarse gravel, no cementation, strong reaction with HCl. (SC)			X
			S	1		2.5	4.0	4	5	8	13	6				
5			S	2		5.0	6.5	4	8	16	24	10				
	2675												End of boring at 5'. Sampler stopped at 6.5'. No groundwater encountered. Backfilled with cuttings.			
10	2670															
15	2665															
20	2660															
25																

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BORING LOG: P15

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 14,175 **E:** 18,867
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 192+57
OFFSET: 55 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,685.7
TOTAL DEPTH: 6

START DATE: 02/01/2011 **TIME:** 08:40 AM
FINISH DATE: 02/01/2011 **TIME:** 08:50 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2685		CU	1		0.0	5.0						CLAYEY SAND WITH GRAVEL (native), medium dense, dry, brown, fine to coarse SAND, few medium plasticity fines, little fine to coarse subrounded gravel, no cementation, strong reaction with HCl, max. particle size 0.5". (SC)	4.1		X
			S	1		2.5	4.0	7	7	10	17	8				
5	2680		R	2		5.0	6.0	20	30			12				
													End of boring at 5'. Sampler stopped at 6'. No groundwater encountered. Backfilled with cuttings.			
10	2675															
15	2670															
20	2665															
25																

REPORT ncs boring | PROJECT p:\valencia - alvernon to wilmot\gint\valencia(alvernon-wilmot).gpj | LIBRARY ncs gintlib v5.0.glb | LAST MOD 06/13/11 09:11 am | PRINTED 06/22/11 01:36 pm

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BORING LOG: P16

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 14,170 **E:** 19,361
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 197+53
OFFSET: 53 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,690.1
TOTAL DEPTH: 6

START DATE: 01/07/2011 **TIME:** 10:20 AM
FINISH DATE: 01/07/2011 **TIME:** 10:35 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			CU	1		0.0	5.0						CLAYEY SAND (native), very dense, dry, brown, fine to medium SAND, some low plasticity fines, trace fine subrounded gravel, weak cementation, strong reaction with HCl, max. particle size 0.5". (SC)			X
			S	1		2.5	4.0	19	27	30	57	15				
5	2685		S	2		5.0	6.0	21	50/6		R	12				
													End of boring at 5'. Sampler stopped at 6'. No groundwater encountered. Backfilled with cuttings.			
10	2680															
15	2675															
20	2670															
25																

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SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 14,145 **E:** 19,848
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 202+29
OFFSET: 58 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,694.8
TOTAL DEPTH: 4

START DATE: 12/14/2010 **TIME:** 09:50 AM
FINISH DATE: 12/14/2010 **TIME:** 10:15 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			CU R	1 1		0.0 2.5	5.0 3.3	28	50/4			10	CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, some medium plasticity fines, few fine subangular gravel, moderate cementation, strong reaction with HCl, max. particle size 0.5". (SC)			X
5	2690												End of boring at 2.5'. Sampler stopped. at 4'. No groundwater encountered. Backfilled with cuttings.			
10	2685															
15	2680															
20	2675															
25	2670															

REPORT ncs boring | PROJECT p:\valencia - alvernon to wilmot\gint\valencia(alvernon-wilmot).gpj | LIBRARY ncs gintlib v5.0.glb | LAST MOD 06/13/11 09:18 am | PRINTED 06/22/11 01:36 pm

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BORING LOG: P18

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 14,480 **E:** 20,247
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 207+41
OFFSET: 48 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,695.7
TOTAL DEPTH: 6

START DATE: 01/07/2011 **TIME:** 09:55 AM
FINISH DATE: 01/07/2011 **TIME:** 10:15 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2695												SANDY LEAN CLAY (native), very stiff, dry, brown, medium plasticity CLAY, some fine to coarse sand, trace fine subrounded gravel, no cementation, weak reaction with HCl, max. particle size 0.5". (CL)			
			CU	1		0.0	5.0									X
			S	1		2.5	4.0	9	14	14	28	13				
5																
	2690		R	2		5.0	6.0	30	50/6			12	Becomes hard.	9.5	85.4	X
													End of boring at 5'. Sampler stopped at 6'. No groundwater encountered. Backfilled with cuttings.			
10	2685															
15	2680															
20	2675															
25																

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BORING LOG: P19

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES N: 14,764 **E:** 20,639
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 212+17
OFFSET: 47 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,695.9
TOTAL DEPTH: 6

START DATE: 12/14/2010 **TIME:** 10:50 AM
FINISH DATE: 12/14/2010 **TIME:** 11:20 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2695												CLAYEY SAND, dense, dry, light brown, fine to coarse subrounded SAND, some medium plasticity fines, few fine gravel, no cementation, strong reaction with HCl. (SC)			
			CU	1		0.0	5.0									X
			S	1		2.5	4.0	18	24	25	49	4				
5																
	2690		R	2		5.0	6.0	23	46			12	Becomes dry to moist, dark brown, some medium plasticity fines.			
													End of boring at 5'. Sampler stopped at 6'. No groundwater encountered. Backfilled with cuttings.			
10	2685															
15	2680															
20	2675															
25																

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BORING LOG: P24

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,839 **E:** 22,471
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 242+04
OFFSET: 44 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,712
TOTAL DEPTH: 6.5

START DATE: 01/07/2011 **TIME:** 09:30 AM
FINISH DATE: 01/07/2011 **TIME:** 09:50 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2710		CU	1		0.0	5.0						CLAYEY SAND (native), medium dense, dry, brown, fine to coarse SAND, little medium plasticity fines, few fine subrounded gravel, weak cementation, strong reaction with HCl, max. particle size 0.5". (SC)			
			R	1		2.5	3.5	20	45			12				X
5																
			S	2		5.0	6.5	14	19	14	33	14	Becomes dense.			
	2705												End of boring at 5'. Sampler stopped at 6.5'. No groundwater encountered. Backfilled with cuttings.			
10																
	2700															
15																
	2695															
20																
	2690															
25																

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BORING LOG: P25

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,756 **E:** 22,966
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 246+98
OFFSET: 44 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,709.9
TOTAL DEPTH: 6.5

START DATE: 12/15/2010 **TIME:** 08:30 AM
FINISH DATE: 12/15/2010 **TIME:** 08:40 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			CU	1		0.0	5.0						SILTY SAND WITH GRAVEL, very dense, dry, light brown, fine to coarse SAND, little low plasticity fines, little fine to coarse subangular gravel, no cementation, strong reaction with HCl, max. particle size 0.5". (SM)			X
			S	1		2.5	4.0	9	24	50/6	R	10				
5	2705		S	2		5.0	6.5	27	31	26	57	5				
													End of boring at 5'. Sampler stopped at 6.5'. No groundwater encountered. Backfilled with cuttings.			
10	2700															
15	2695															
20	2690															
25	2685															

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BORING LOG: P26

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,855 **E:** 23,456
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 251+89
OFFSET: 51 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,712.4
TOTAL DEPTH: 6

START DATE: 01/07/2011 **TIME:** 09:15 AM
FINISH DATE: 01/07/2011 **TIME:** 09:25 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2710		CU	1		0.0	5.0						CLAYEY SAND WITH GRAVEL (native), medium dense, dry, brown, fine to coarse SAND, little medium plasticity fines, little fine subrounded gravel, weak cementation, strong reaction with HCl, max. particle size 0.5". (SC)			X
			S	1		2.5	4.0	6	5	7	12	14				
5			R	2		5.0	6.0	10	13			12				
	2705												End of boring at 5'. Sampler stopped at 6'. No groundwater encountered. Backfilled with cuttings.			
10																
	2700															
15																
	2695															
20																
	2690															
25																

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SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,765 **E:** 23,947
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 256+79
OFFSET: 44 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,714.8
TOTAL DEPTH: 6.5

START DATE: 12/15/2010 **TIME:** 07:00 AM
FINISH DATE: 12/15/2010 **TIME:** 07:15 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			CU	1		0.0	5.0						CLAYEY SAND WITH GRAVEL, medium dense, moist, brown, fine to coarse SAND, little medium plasticity fines, little fine subrounded gravel, weak cementation, strong reaction with HCl, max. particle size 0.5". (SC)			X
			S	1		2.5	4.0	6	8	11	19	14				
5	2710		S	2		5.0	6.5	5	10	17	27	16				
													End of boring at 5'. Sampler stopped at 6.5'. No groundwater encountered. Backfilled with cuttings.			
10	2705															
15	2700															
20	2695															
25	2690															

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SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,857 **E:** 24,434
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 261+67
OFFSET: 44 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,717.4
TOTAL DEPTH: 6.5

START DATE: 01/07/2011 **TIME:** 09:00 AM
FINISH DATE: 01/07/2011 **TIME:** 09:10 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2715		CU	1		0.0	5.0						SILTY, CLAYEY SAND (native), medium dense, dry, brown, fine to coarse SAND, some low plasticity fines, few fine subrounded gravel, weak cementation, strong reaction with HCl, max. particle size 0.5". (SC-SM)			
			R	1		2.5	3.5	10	14			12		5.7	93.7	X X
5			S	2		5.0	6.5	4	6	6	12	18				
	2710												End of boring at 5'. Sampler stopped at 6.5'. No groundwater encountered. Backfilled with cuttings.			
10																
	2705															
15																
	2700															
20																
	2695															
25																

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BORING LOG: P29

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,772 **E:** 24,926
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 266+58
OFFSET: 45 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,726.2
TOTAL DEPTH: 6.5

START DATE: 12/15/2010 **TIME:** 07:20 AM
FINISH DATE: 12/15/2010 **TIME:** 07:30 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2725		CU	1		0.0	5.0						CLAYEY SAND, medium dense, moist, brown, fine to coarse SAND, some medium plasticity fines, few fine subrounded gravel, weak cementation, strong reaction with HCl, max. particle size 0.5". (SC)			
			R	1		2.5	3.5	13	22			12				X
5																
	2720		S	2		5.0	6.5	10	15	10	25	18	Becomes fine to coarse subrounded SAND, little low plasticity fines, few fine subrounded gravel.			
													End of boring at 5'. Sampler stopped at 6.5'. No groundwater encountered. Backfilled with cuttings.			
10	2715															
15	2710															
20	2705															
25																

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BORING LOG: P30

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,864 **E:** 25,416
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 271+49
OFFSET: 42 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,728.9
TOTAL DEPTH: 6

START DATE: 01/07/2010 **TIME:** 08:10 AM
FINISH DATE: 01/07/2010 **TIME:** 08:15 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			CU	1		0.0	5.0						CLAYEY SAND (native), dense, dry, brown, fine to coarse SAND, some medium plasticity fines, few fine subrounded gravel, weak cementation, strong reaction with HCl, max. particle size 0.5". (SC)			X
	2725		S	1		2.5	4.0	6	11	22	33	18				
5			R	2		5.0	6.0	14	10			12	Becomes medium dense.			
													End of boring at 5'. Sampler stopped at 6'. No groundwater encountered. Backfilled with cuttings.			
	2720															
10																
	2715															
15																
	2710															
20																
	2705															
25																

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BORING LOG: P31

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,779 **E:** 25,905
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 276+37
OFFSET: 47 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,729.7
TOTAL DEPTH: 6.5

START DATE: 12/15/2010 **TIME:** 07:35 AM
FINISH DATE: 12/15/2010 **TIME:** 07:45 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			CU	1		0.0	5.0						CLAYEY SAND, medium dense, moist, brown, fine to coarse SAND, some medium plasticity fines, few fine gravel, weak cementation, strong reaction with HCl. (SC)			
			R	1		2.5	3.5	16	24			12				X
5	2725		S	2		5.0	6.5	7	8	6	14	16				
													End of boring at 5'. Sampler stopped at 6.5'. No groundwater encountered. Backfilled with cuttings.			
10	2720															
15	2715															
20	2710															
25	2705															

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BORING LOG: P32

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,873 **E:** 26,391
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 281+24
OFFSET: 43 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,733
TOTAL DEPTH: 6.5

START DATE: 01/07/2011 **TIME:** 08:00 AM
FINISH DATE: 01/07/2011 **TIME:** 08:05 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2730		CU	1		0.0	5.0						CLAYEY SAND (native), medium dense, dry, brown, fine to coarse SAND, some high plasticity fines, few fine subrounded gravel, weak cementation, strong reaction with HCl, max. particle size 0.5". (SC)			
			R	1		2.5	3.5	21	21			12				X
5																
			S	2		5.0	6.5	3	4	5	9	13	Becomes loose.			
	2725												End of boring at 5'. Sampler stopped at 6.5'. No groundwater encountered. Backfilled with cuttings.			
10																
	2720															
15																
	2715															
20																
	2710															
25																

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BORING LOG: P33

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,792 **E:** 26,884
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 286+16
OFFSET: 43 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,736.9
TOTAL DEPTH: 6

START DATE: 12/15/2010 **TIME:** 08:00 AM
FINISH DATE: 12/15/2010 **TIME:** 08:20 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2735		CU	1		0.0	5.0						CLAYEY SAND, medium dense, dry, brown, fine to coarse SAND, little medium plasticity fines, few fine subrounded gravel, weak cementation, strong reaction with HCl, max. particle size 0.5". (SC)			X
			S	1		2.5	4.0	8	8	10	18	18				
5			R	2		5.0	6.0	37	43			12	Becomes dense, fine to medium SAND, some low plasticity fines.			
	2730												End of boring at 5'. Sampler stopped at 6'. No groundwater encountered. Backfilled with cuttings.			
10																
	2725															
15																
	2720															
20																
	2715															
25																

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BORING LOG: P34

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,881 **E:** 27,374
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 291+07
OFFSET: 42 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,740.7
TOTAL DEPTH: 6.5

START DATE: 01/07/2011 **TIME:** 07:40 AM
FINISH DATE: 01/07/2011 **TIME:** 07:55 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2740		CU	1		0.0	5.0						CLAYEY SAND (native), medium dense, dry, brown, fine to coarse SAND, some medium plasticity fines, few fine subrounded gravel, no cementation, strong reaction with HCl, max. particle size 0.5". (SC)			
			R	1		2.5	3.5	17	17			12		9.1	91.1	X X
5	2735		S	2		5.0	6.5	8	10	11	21	18				
													End of boring at 5'. Sampler stopped at 6.5'. No groundwater encountered. Backfilled with cuttings.			
10	2730															
15	2725															
20	2720															
25																

REPORT ncs boring | PROJECT p:\valencia - alvernon to wilmot\gint\valencia(alvernon-wilmot).gpj | LIBRARY ncs gintlib v5.0.glb | LAST MOD 06/19/11 05:44 pm | PRINTED 06/22/11 01:36 pm

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BORING LOG: W01

SHEET 1 of 2
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 15,779 **E:** 20,899
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 222+56
OFFSET: 87 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,691.3
TOTAL DEPTH: 50.5

START DATE: 02/07/2011 **TIME:** 09:00 AM
FINISH DATE: 02/07/2011 **TIME:** 11:00 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2690												CLAYEY SAND (native), very dense, dry, dark brown, fine to coarse SAND, some low plasticity fines, strong cementation, strong reaction with HCl. (SC)			
			R	1		2.5	3.5	21	50/6			12				
5																
	2685		S	2		5.0	6.5	15	30	24	54	6	Becomes trace fine to coarse subrounded gravel, max. particle size 1.5".			
			S	3		7.5	9.0	8	46	47	93	18	WELL-GRADED SAND WITH CLAY AND GRAVEL, very dense, dry, tan, fine to coarse SAND, little fine to coarse subrounded gravel, few medium plasticity fines, no cementation, no reaction with HCl, max. particle size 1". (SW-SC)	3.2		X
10																
	2680		S	4		10.0	11.0	21	50/6		R	8	CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, some low plasticity fines, moderate cementation, strong reaction with HCl. (SC)			
15																
	2675		R	5		15.0	15.5	50/6				6	Becomes some medium plasticity fines, few fine to coarse subrounded gravel, weak cementation, max. particle size 1.5".			
20																
	2670		S	6		20.0	21.5	10	24	37	61	16	Becomes no cementation, no reaction with HCl.			
25																

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BORING LOG: W01

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2665		S	7	X	25.0	26.5	11	39	49	88	10	Becomes fine to medium SAND, some low plasticity fines, weak cementation, weak reaction with HCl.			
30	2660		S	8	X	30.0	31.5	13	36	45	81	18	SANDY LEAN CLAY, hard, dry, brown, medium plasticity CLAY, fine to medium sand, trace fine gravel, moderate cementation, strong reaction with HCl. (CL)			X
35	2655		S	9	X	35.0	36.5	17	34	50/6	R	8	CLAYEY SAND, very dense, dry, brown, fine to medium SAND, some low plasticity fines, few fine to coarse subrounded gravel, weak cementation, weak reaction HCl. (SC)			
40	2650		S	10	X	40.0	40.4	50/5			R	4	Becomes strong cementation, strong reaction with HCl.			
45	2645		S	11	X	45.0	45.8	42	50/3		R	6	Becomes weak reaction with HCl.			
50	2640		S	12	X	50.0	50.5	50/6			R	5	End of boring at 50'. Sampler stopped at 50.5'. No groundwater encountered. Backfilled with cuttings.			
55	2635															
60	2630															
65																

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BORING LOG: W02

SHEET 1 of 2
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: RAI

COORDINATES **N:** 15,769 **E:** 21,079
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 223+09
OFFSET: 86 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,693.4
TOTAL DEPTH: 55.5

START DATE: 12/27/2010 **TIME:** 01:10 PM
FINISH DATE: 12/27/2010 **TIME:** 02:50 PM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2690		R	1		2.5	3.5	21	50/6			12	CLAYEY SAND (native), very dense, dry, tan, fine to coarse subrounded to subangular SAND, some medium plasticity fines, few fine subrounded to subangular gravel, no cementation, strong reaction with HCl, max. particle size 0.5". (SC)			X
5			S	2		5.0	6.5	11	18	19	37	18	Becomes CLAYEY SAND WITH GRAVEL, dense, little medium plasticity fines, little fine to coarse subrounded to subangular gravel, weak reaction with HCl, max. particle size 1".			
	2685		S	3		7.5	9.0	31	37	30	67	4				
10			S	4		10.0	11.5	12	27	28	55	12	SANDY LEAN CLAY, hard, dry, tan, medium plasticity CLAY, some fine to coarse subrounded to subangular sand, weak cementation, strong reaction with HCl. (CL)			
	2680												CLAYEY SAND, very dense, dry, tan, fine to coarse subrounded to subangular SAND, some medium plasticity fines, moderate cementation, weak reaction with HCl. (SC)			
15			S	5		15.0	15.9	40	50/5		R	6				
	2675												SANDY LEAN CLAY, hard, dry, light brown, medium plasticity CLAY, some fine to coarse subrounded to subangular sand, weak cementation, strong reaction with HCl. (CL)			
20			S	6		20.0	21.5	10	27	25	52	18	SILTY SAND, very dense, dry, tan, fine to coarse subrounded to subangular SAND, little nonplastic fines, few fine to coarse subrounded to subangular gravel, no cementation, strong reaction with HCl, max. particle size 1.25". (SM)			X
	2670															
25																

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BORING LOG: W02

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: RAI

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	7	X	25.0	26.0	27	50/6		R	6	SANDY LEAN CLAY, hard, dry, brown, medium plasticity CLAY, some fine to coarse subrounded to subangular sand, moderate cementation, weak reaction with HCl. (CL)			
	2665															
30			S	8	X	30.0	31.4	13	21	50/5	R	17				
	2660															
35			S	9	X	35.0	36.5	13	30	33	63	12				
	2655															
40			S	10	X	40.0	41.5	20	27	40	67	18				
	2650															
45			S	11	X	45.0	45.8	37	50/4		R	6	Becomes low plasticity CLAY.			
	2645															
50			S	12	X	50.0	51.4	25	29	50/5	R	18	Becomes medium plasticity CLAY.			
	2640															
55			S	13	X	55.0	55.5	50/6			R	6	Becomes weak cementation, strong reaction with HCl.			
	2635												End of boring at 55'. Sampler stopped at 55.5'. No groundwater encountered. Backfilled with cuttings.			
60																
	2630															
65																

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BORING LOG: W03

SHEET 1 of 2
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 15,930 **E:** 20,940
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 356+62
OFFSET: 2728 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,692.2
TOTAL DEPTH: 61.5

START DATE: 02/08/2011 **TIME:** 11:30 AM
FINISH DATE: 02/08/2011 **TIME:** 01:30 PM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2690		S	1		2.5	4.0	15	20	22	42	4	CLAYEY SAND (native), dense, dry, dark brown, fine to coarse SAND, some medium plasticity fines, no cementation, no reaction with HCl. (SC)			
5			S	2		5.0	6.5	12	26	32	58	13	Becomes very dense, brown, fine to medium SAND, trace fine gravel, strong cementation, strong reaction with HCl.			X
	2685		R	3		7.5	8.3	47	50/3			9				
10			S	4		10.0	11.5	5	21	47	68	10				
	2680															
15			S	5		15.0	16.3	16	37	50/3	R	16	Becomes fine to coarse SAND, little low plasticity fines.			
	2675															
20			S	6		20.0	21.5	9	22	33	55	16	SILTY SAND WITH GRAVEL, very dense, dry, light tan, fine to coarse SAND, little nonplastic fines, little fine subrounded gravel, no cementation, no reaction with HCl, max. particle size 0.25". (SM)			
	2670															
25													CLAYEY SAND, very dense, dry, brown, fine to medium SAND, some low plasticity			

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BORING LOG: W03

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	7	X	25.0	26.5	13	27	44	71	18	fines, moderate cementation, weak reaction with HCl. (SC)			
	2665															
30			S	8	X	30.0	31.5	14	27	50/6	R	12	Becomes strong reaction with HCl.			
	2660															
35			S	9	X	35.0	36.4	15	43	50/5	R	17	Becomes strong cementation.			
	2655															
40			S	10	X	40.0	41.0	17	50/6		R	3				
	2650															
45			S	11	X	45.0	46.5	17	29	38	67	18	Becomes fine to coarse SAND, some medium plasticity fines, trace fine gravel, no cementation, no reaction with HCl.			X
	2645															
50			S	12	X	50.0	50.4	50/5			R	4	Becomes strong cementation, strong reaction with HCl.			
	2640															
55			S	13	X	55.0	55.8	20	50/3		R	5	Becomes fine SAND, some low plasticity fines, trace fine subrounded gravel, max. particle size 0.2".			
	2635															
60			S	14	X	60.0	61.5	3	4	25	29	10	SILTY SAND WITH GRAVEL, medium dense, dry, tan, fine to coarse SAND, little nonplastic fines, little fine gravel, no cementation, no reaction with HCl, max. particle size 0.25". (SM)			
	2630												End of boring at 60'. Sampler stopped at 61.5'. No groundwater encountered. Backfilled with cuttings.			
65																

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BORING LOG: W04

SHEET 1 of 3
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 15,904 **E:** 21,147
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 224+66
OFFSET: 94 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,694.4
TOTAL DEPTH: 66.4

START DATE: 01/02/2011 **TIME:** 12:30 PM
FINISH DATE: 01/02/2011 **TIME:** 03:00 PM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	1		2.5	4.0	13	18	20	38	18	SILTY, CLAYEY SAND (native), dense, moist, dark brown, fine to coarse SAND, some low plasticity fines, weak cementation, strong reaction with HCl. (SC-SM)			
5	2690		S	2		5.0	6.5	15	24	37	61	4	CLAYEY SAND, very dense, dry, dark brown, fine to coarse SAND, some low plasticity fines, trace fine subangular gravel, weak cementation, weak reaction with HCl, max. particle size 0.75". (SC)			
			S	3		7.5	9.0	24	22	28	50	18	Becomes dense, light brown, strong reaction with HCl.			
10	2685		R	4		10.0	11.0	19	34			12	Becomes medium dense, brown, little medium plasticity fines, trace fine gravel, no cementation. (SC)			X
15	2680		S	5		15.0	15.9	36	50/5		R	4	Becomes very dense, some low plasticity fines, few fine to coarse subrounded gravel, weak reaction with HCl, max. particle size 1.5". (SC)			
20	2675		S	6		20.0	21.5	8	18	21	39	14	WELL-GRADED SAND WITH SILT, dense, dry, brown, few nonplastic fines, fine to coarse SAND, no cementation, no reaction with HCl. (SW-SM)			
25	2670												SILTY, CLAYEY SAND, very dense, dry, brown, fine to medium subrounded SAND,			

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BORING LOG: W04

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	7	X	25.0	26.5	24	38	33	71	18	some low plasticity fines, trace fine gravel, weak cementation, strong reaction with HCl. (SC-SM)	5.0		X
30	2665		S	8	X	30.0	31.5	13	27	37	64	18	CLAYEY SAND, very dense, dry, brown, fine to medium SAND, some low to medium plasticity fines, weak cementation, strong reaction with HCl. (SC)			
35	2660		S	9	X	35.0	36.0	25	50/6		R	12	Becomes fine to coarse SAND, some low plasticity fines, no cementation, no reaction with HCl.			
40	2655		S	10	X	40.0	41.0	35	50/6		R	12	Becomes some low to medium plasticity fines, moderate cementation, strong reaction with HCl.			
45	2650		S	11	X	45.0	46.5	12	18	18	36	18	Becomes dense, some medium plasticity fines, trace fine gravel, weak cementation.			X
50	2645		S	12	X	50.0	50.8	40	50/4		R	10	Becomes very dense, no cementation, no reaction with HCl.			
55	2640		S	13	X	55.0	55.9	32	50/5		R	11	Becomes some low plasticity fines, strong cementation, strong reaction with HCl.			
60	2635		S	14	X	60.0	61.5	33	34	28	62	6				
65	2630												SANDY LEAN CLAY, hard, dry, tan, medium plasticity CLAY, some fine sand,			

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BORING LOG: W04

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	15	X	65.0	66.4	20	40	50/5	R	16	no cementation, no reaction with HCl. (CL)			
													End of boring at 65'. Sampler stopped at 66.4'. No groundwater encountered. Backfilled with cuttings.			
70	2625															
75	2620															
80	2615															
85	2610															
90	2605															
95	2600															
100	2595															
105	2590															

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BORING LOG: W05

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Tim
INSPECTOR: NAB

COORDINATES **N:** 16,063 **E:** 21,006
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 225+41
OFFSET: 105 Lt.

RIG TYPE: Track mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,693.7
TOTAL DEPTH: 71.5

START DATE: 03/16/2011 **TIME:** 08:40 AM
FINISH DATE: 03/16/2011 **TIME:** 11:00 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	1	X	2.5	4.0	18	17	17	34	9	CLAYEY SAND (native), dense, dry, dark brown, fine to coarse SAND, some low plasticity fines, moderate cementation, weak reaction with HCl. (SC)			
5	2690		S	2	X	5.0	6.5	13	20	23	43	14	Becomes fine to medium SAND, little low plasticity fines, strong cementation, strong reaction with HCl.			
	2685		S	3	X	7.5	9.0	28	43	41	84	18	WELL-GRADED SAND WITH CLAY, very dense, dry, light brown, fine to coarse SAND, few low plasticity fines, trace fine subangular gravel, no cementation, strong reaction with HCl, max. particle size 0.5". (SW-SC)			
10			S	4	X	10.0	11.5	23	30	44	74	18	Last 3" in sampler become moderate cementation.			
	2680															
15			S	5	X	15.0	15.8	44	50/4		R	7	CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, little low plasticity fines, moderate cementation, strong reaction with HCl. (SC)			
	2675															
20			S	6	X	20.0	21.5	15	21	19	40	18	WELL-GRADED SAND WITH SILT, dense, dry, tan, fine to coarse SAND, few nonplastic fines, trace fine subrounded gravel, no cementation, weak reaction with HCl, max. particle size 0.25". (SW-SM)			X
	2670												SILTY SAND, dense, dry, tan, fine to coarse SAND, little nonplastic fines, trace			
25																

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BORING LOG: W05

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Tim
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	7		25.0	26.5	26	28	21	49	18	fine subrounded gravel, weak cementation, weak reaction with HCl, max. particle size 0.5". (SM)			
	2665												SILTY, CLAYEY SAND, medium dense, dry, tan, fine to coarse SAND, little low plasticity fines, few fine to coarse subrounded gravel, no cementation, no reaction with HCl, max. particle size 1". (SC-SM)			
30			S	8		30.0	31.5	9	12	11	23	15				
	2660												CLAYEY SAND, very dense, dry to moist, brown, fine to coarse SAND, little low plasticity fines, no cementation, no reaction with HCl. (SC)			
35			S	9		35.0	36.5	14	21	31	52	12				
	2655															
40			S	10		40.0	41.5	24	32	37	69	15	Becomes fine to medium SAND, moderate cementation, strong reaction with HCl.			
	2650															
45			S	11		45.0	46.5	27	21	31	52	16	Becomes dry, some low plasticity fines, no cementation, no reaction with HCl. [Silt may be present within sample]			
	2645															
50			S	12		50.0	50.4	50/5			R	4	Becomes fine SAND, some medium plasticity fines, moderate cementation, strong reaction with HCl.			
	2640												SILTY SAND, very dense, dry, light brown, fine to medium SAND, little nonplastic fines, trace fine gravel, no cementation, weak reaction with HCl. (SM)			
55			S	13		55.0	56.5	38	34	31	65	18		2.0		X
	2635												CLAYEY SAND, very dense, dry, brown, fine SAND, some low plasticity fines, moderate cementation, strong reaction with HCl. (SC)			
60			S	14		60.0	61.5	29	31	46	77	18				
	2630															
65																

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BORING LOG: W05

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Tim
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	SOIL SAMPLE DEPTH (FT) FROM	SOIL SAMPLE DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	15	X	65.0	65.8	36	50/4		R	7				
	2625															
70			S	16	X	70.0	71.5	24	33	38	71	15	Becomes fine to coarse SAND.			
													End of boring at 70'. Sampler stopped at 71.5'. No groundwater encountered. Backfilled with cuttings.			
	2620															
75																
	2615															
80																
	2610															
85																
	2605															
90																
	2600															
95																
	2595															
100																
	2590															
105																

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BORING LOG: W06

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,039 **E:** 21,238
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 226+41
OFFSET: 106 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,694.4
TOTAL DEPTH: 71.5

START DATE: 01/02/2011 **TIME:** 08:00 AM
FINISH DATE: 01/02/2011 **TIME:** 11:15 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	1		2.5	4.0	17	36	40	76	10	CLAYEY SAND (native), very dense, moist, brown, fine to coarse SAND, some low plasticity fines, no cementation, strong reaction with HCl. (SC)			
5	2690		S	2		5.0	6.4	19	40	50/5	R	15	Becomes dry, little medium plasticity fines, few fine subangular gravel, weak cementation, max. particle size 0.5".			X
			R	3		7.5	8.4	17	50/5			11				
10	2685		S	4		10.0	10.9	41	50/5		R	11	Becomes little low plasticity fines, few fine subrounded gravel, moderate cementation, max. particle size 0.75".			
15	2680		S	5		15.0	16.5	12	42	47	89	5	Becomes weak cementation.			
20	2675		S	6		20.0	21.5	23	34	35	69	18	SILTY SAND, very dense, dry, light brown, fine to coarse subrounded SAND, little nonplastic fines, trace fine subrounded gravel, no cementation, weak reaction with HCl, max. particle size 0.25". (SM)			
25	2670												CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, little low plasticity			

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BORING LOG: W06

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	7	X	25.0	26.5	22	43	48	91	6	fines, moderate cementation, weak reaction with HCl. (SC)			
30	2665															
			S	8	X	30.0	31.5	23	27	30	57	18	POORLY GRADED SAND WITH SILT AND GRAVEL, very dense, dry, light brown, fine to coarse subrounded SAND, few nonplastic fines, little fine to coarse subrounded gravel, no cementation, no reaction with HCl, max. particle size 0.75". (SP-SM)			X
35	2660		S	9	X	35.0	35.9	37	50/5		R	10	WELL-GRADED SAND WITH CLAY AND GRAVEL, very dense, dry, brown, fine to coarse subrounded SAND, little fine subrounded gravel, few low plasticity fines, no cementation, no reaction with HCl, max. particle size 0.5". (SW-SC)			
40	2655		S	10	X	40.0	41.5	26	31	36	67	18	CLAYEY SAND, very dense, dry, brown, fine to medium SAND, some low plasticity fines, weak cementation, weak reaction with HCl. (SC)			
45	2650		S	11	X	45.0	45.9	42	50/5		R	5	Becomes fine to coarse SAND, little low plasticity fines, trace fine subrounded gravel, strong reaction with HCl, max. particle size 0.75".			
50	2645		S	12	X	50.0	51.5	11	14	19	33	18	Becomes dense, fine to medium SAND, some medium plasticity fines.			
55	2640		S	13	X	55.0	56.0	29	50/6		R	12	SILTY, CLAYEY SAND, very dense, dry, light brown, fine to coarse subrounded SAND, little low plasticity fines, few fine subrounded gravel, no cementation, weak reaction with HCl, max. particle size 0.5". (SC-SM)			
60	2635		S	14	X	60.0	61.5	21	23	31	54	18	CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, some low plasticity fines, trace fine subangular gravel, no cementation, weak reaction with HCl, max. particle size 0.5". (SC)			
65	2630															

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BORING LOG: W06

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	15	X	65.0	66.4	24	43	50/5	R	16	Becomes weak cementation.			
70	2625		S	16	X	70.0	71.5	18	27	46	73	18				
													End of boring at 70'. Sampler stopped at 71.5'. No groundwater encountered. Backfilled with cuttings.			
75	2620															
80	2615															
85	2610															
90	2605															
95	2600															
100	2595															
105	2590															

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BORING LOG: W07

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,198 **E:** 21,078
LOCATION: Tucson, Arizona

REF. ALIGNMENT: Valencia CL
STATION: 226+87
OFFSET: 115 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,694.8
TOTAL DEPTH: 76

START DATE: 02/09/2011 **TIME:** 11:53 AM
FINISH DATE: 02/09/2011 **TIME:** 01:30 PM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	1		2.5	4.0	6	12	13	25	7	CLAYEY SAND (native), medium dense, dry, brown, fine to coarse SAND, some low plasticity fines, moderate cementation, strong reaction with HCl. (SC)			
5	2690		S	2		5.0	6.5	16	37	41	78	8	Becomes very dense, light brown, little low plasticity fines.			
			S	3		7.5	9.0	8	11	13	24	13	Becomes medium dense, weak cementation.			
10	2685		S	4		10.0	10.8	31	50/3		R	5	Becomes very dense.			
15	2680		R	5		15.0	15.9	24	50/5			11	Becomes some low plasticity fines.			
20	2675		S	6		20.0	21.5	8	18	17	35	18	SILTY SAND, dense, dry, light tan, fine to coarse SAND, little nonplastic fines, trace fine subrounded gravel, no cementation, no reaction with HCl, max. particle size 0.25". (SM)			
25	2670															

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BORING LOG: W07

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	7	X	25.0	26.5	9	14	19	33	18	Becomes SILTY SAND WITH GRAVEL, little nonplastic fines, little fine to coarse subrounded gravel, max. particle size 1".			
30	2665		S	8	X	30.0	31.5	7	19	27	46	18	Becomes SILTY SAND, little low plasticity fines, few fine subrounded gravel, max. particle size 0.2".			X
35	2660		S	9	X	35.0	36.5	8	17	26	43	17	CLAYEY SAND WITH GRAVEL, dense, dry, brown, fine to coarse SAND, little low plasticity fines, some fine to coarse subrounded gravel, moderate cementation, strong reaction with HCl, max. particle size 1". (SC)			
40	2655		S	10	X	40.0	41.4	17	26	50/5	R	0	Becomes very dense. No recovery. Rock in sampler tip.			
45	2650		S	11	X	45.0	46.5	23	37	44	81	18	SILTY SAND, very dense, dry, brown, fine to coarse SAND, little low plasticity fines, few fine subrounded gravel, weak cementation, weak reaction with HCl, max. particle size 0.25". (SM)			
50	2645		S	12	X	50.0	50.8	21	50/4		R	6	CLAYEY SAND, very dense, dry, brown, fine to medium SAND, some low plasticity fines, moderate cementation, strong reaction with HCl. (SC)			
55	2640		S	13	X	55.0	56.4	28	43	50/5	R	17				
60	2635		S	14	X	60.0	61.5	15	26	43	69	14	SILTY SAND, very dense, dry, light tan, fine to coarse SAND, some low plasticity fines, few fine subrounded gravel, no cementation, no reaction with HCl, max. particle size 0.75". (SM)			
65	2630															

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BORING LOG: W07

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	15	X	65.0	66.5	5	20	31	51	18	Becomes little nonplastic fines, trace fine subrounded gravel, max. particle size 0.02".			
70	2625		S	16	X	70.0	71.4	26	41	50/5	R	9	CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, some low plasticity fines, strong cementation, weak reaction with HCl. (SC)			
75	2620		S	17	X	75.0	76.0	26	50/6		R	12	Becomes light brown.			
													End of boring at 75'. Sampler stopped at 76'. No groundwater encountered. Backfilled with cuttings.			
80	2615															
85	2610															
90	2605															
95	2600															
100	2595															
105	2590															

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BORING LOG: W08

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: RAI

COORDINATES **N:** 16,164 **E:** 21,329
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 228+10
OFFSET: 107 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,695.6
TOTAL DEPTH: 76.5

START DATE: 12/27/2010 **TIME:** 10:20 AM
FINISH DATE: 12/27/2010 **TIME:** 12:50 PM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2695												SILTY SAND WITH GRAVEL (native), very dense, dry, tan, fine to coarse subrounded to subangular SAND, some nonplastic fines, little fine subrounded to subangular gravel, no cementation, no reaction with HCl, max. particle size 0.5". (SM)			
5	2690		S	1		5.0	6.5	15	27	45	72	18				
10	2685		R	2		10.0	10.4	50/5				3	Becomes some low plasticity fines, strong reaction with HCl.			
15	2680		S	3		15.0	16.5	14	30	34	64	18	SILTY, CLAYEY SAND, very dense, dry, tan, fine to coarse SAND, little low plasticity fines, few fine subrounded to subangular gravel, no cementation, weak reaction with HCl. (SC-SM)			X
20	2675		S	4		20.0	21.5	10	26	35	61	12				
25													CLAYEY SAND, very dense, dry, tan, fine to coarse subrounded to subangular			

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BORING LOG: W08

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: RAI

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2670		S	5	X	25.0	26.0	26	50/6		R	18	SAND, some low plasticity fines, few fine subrounded to subangular gravel, weak cementation, weak reaction with HCl, max. particle size 0.5". (SC)			
30	2665		S	6	X	30.0	31.0	6	50/6		R	7	WELL-GRADED SAND WITH SILT AND GRAVEL, very dense, dry, tan, fine to coarse subrounded to subangular SAND, some fine to coarse subrounded to subangular gravel, few nonplastic fines, no cementation, no reaction with HCl, max. particle size 1". (SW-SM)			
35	2660		S	7	X	35.0	36.5	14	37	37	74	12	WELL-GRADED SAND WITH SILTY CLAY AND GRAVEL, very dense, dry, tan, fine to coarse subrounded to subangular SAND, some fine to coarse subrounded to subangular gravel, few low plasticity fines, no cementation, weak reaction with HCl, max. particle size 1.25". (SW-SC)			X
40	2655		S	8	X	40.0	40.5	50/6			R	4	Becomes few nonplastic fines, some fine subrounded to subangular gravel, max. particle size 0.75".			
45	2650		S	9	X	45.0	46.5	17	23	29	52	18	Becomes no reaction with HCl, max. particle size 0.25".			
50	2645		S	10	X	50.0	50.3	50/4			R	4	LEAN CLAY WITH SAND, hard, dry, tan, medium plasticity CLAY, little fine to coarse subrounded to subangular sand, few fine subangular gravel, moderate cementation, strong reaction with HCl, max. particle size 0.5". (CL)			
55	2640		S	11	X	55.0	55.5	50/6			R	6	CLAYEY SAND, very dense, dry, tan, fine to coarse subrounded to subangular SAND, some medium plasticity fines, few fine subrounded to subangular gravel, moderate cementation, strong reaction with HCl, max. particle size 0.25". (SC)			
60	2635		S	12	X	60.0	60.9	31	50/5		R	5	LEAN CLAY WITH SAND, hard, dry, tan, medium plasticity CLAY, little fine subrounded to subangular sand, weak cementation, weak reaction with HCl. (CL)			
65																

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BORING LOG: W08

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: RAI

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2630		S	13	X	65.0	66.5	19	22	24	46	18				
70	2625		S	14	X	70.0	70.9	30	50/5		R	8	Becomes no cementation, no reaction with HCl.			
75	2620		S	15	X	75.0	76.5	19	29	40	69	18	Becomes SANDY LEAN CLAY, nonplastic CLAY, some fine subrounded to subangular sand.			
													End of boring at 75'. Sampler stopped at 76.5'. No groundwater encountered. Backfilled with cuttings.			
80	2615															
85	2610															
90	2605															
95	2600															
100	2595															
105																

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BORING LOG: W09

SHEET 1 of 3
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,319 **E:** 21,164
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 228+21
OFFSET: 119 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,695.2
TOTAL DEPTH: 76.5

START DATE: 02/09/2011 **TIME:** 09:20 AM
FINISH DATE: 02/09/2011 **TIME:** 11:40 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	1	X	2.5	4.0	19	19	20	39	8	CLAYEY SAND (native), dense, dry, dark brown, fine to coarse SAND, some low plasticity fines, moderate cementation, weak reaction with HCl. (SC)			
5	2690		S	2	X	5.0	6.5	12	26	27	53	5	Becomes very dense, light brown, strong reaction with HCl.			
			S	3	X	7.5	9.0	17	23	28	51	18	Becomes weak reaction with HCl.			
10	2685		S	4	X	10.0	11.0	19	50/6		R	4	Becomes trace fine subrounded gravel, strong cementation, strong reaction with HCl, max. particle size 0.2".			
15	2680		S	5	X	15.0	16.5	6	8	11	19	18	SILTY SAND, medium dense, dry, tan, fine to coarse SAND, little nonplastic fines, few fine subrounded gravel, no cementation, weak reaction with HCl, max. particle size 1". (SM)			X
20	2675		S	6	X	20.0	21.5	6	20	22	42	17	WELL-GRADED SAND WITH SILT, dense, dry, tan, fine to coarse SAND, few nonplastic fines, trace fine gravel, no cementation, no reaction with HCl, max. particle size 0.75". (SW-SM)			
25													SILTY SAND, dense, dry, tan, fine to coarse SAND, little nonplastic fines, trace			

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BORING LOG: W09

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	7	X	25.0	26.5	9	15	16	31	18	fine subrounded gravel, no cementation, no reaction with HCl, max. particle size 0.25". (SM)			
30	2665		S	8	X	30.0	31.5	12	30	50/6	R	15	Becomes SILTY SAND WITH GRAVEL, very dense, little low plasticity fines, little fine to coarse subrounded gravel, weak reaction with HCl, max. particle size 1".			
35	2660		S	9	X	35.0	36.3	14	34	50/4	R	16	WELL-GRADED SAND WITH SILT AND GRAVEL, very dense, dry, brown, fine to coarse SAND, some fine to coarse subangular gravel, few nonplastic fines, no cementation, no reaction with HCl, max. particle size 1". (SW-SM)			
40	2655		S	10	X	40.0	41.5	14	27	28	55	10	Becomes weak reaction with HCl.			
45	2650		S	11	X	45.0	46.5	11	14	18	32	16	CLAYEY SAND, dense, dry, brown, fine to coarse SAND, some low plasticity fines, few fine subrounded gravel, weak cementation, strong reaction with HCl, max. particle size 0.2". (SC)			X
50	2645		S	12	X	50.0	50.8	27	50/3		R	6	Becomes very dense, strong cementation, max. particle size 0.5".			
55	2640		S	13	X	55.0	55.4	50/5			R	5	Becomes some low plasticity fines.			
60	2635		S	14	X	60.0	61.5	22	37	44	81	16	SILTY SAND WITH GRAVEL, very dense, dry, tan, fine to coarse SAND, little low plasticity fines, little fine to coarse subrounded gravel, weak cementation, strong reaction with HCl, max. particle size 1". (SM)			
65													SILTY, CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, some low			

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NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	15	X	65.0	66.4	16	40	50/5	R	17	plasticity fines, trace fine subrounded gravel, moderate cementation, strong reaction with HCl, max. particle size 0.2". (SC-SM)			
70	2625		S	16	X	70.0	70.8	17	50/4		R	6	CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, some low plasticity fines, strong cementation, strong reaction with HCl. (SC)			
75	2620		S	17	X	75.0	76.5	17	25	35	60	12	Becomes fine to medium SAND, no cementation, no reaction with HCl.			
													End of boring at 75'. Sampler stopped at 76.5'. No groundwater encountered. Backfilled with cuttings.			
80	2615															
85	2610															
90	2605															
95	2600															
100	2595															
105																

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SHEET 1 of 3
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,269 **E:** 21,436
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 229+67
OFFSET: 115 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,696.7
TOTAL DEPTH: 75.4

START DATE: 12/13/2010 **TIME:** 11:50 AM
FINISH DATE: 12/13/2010 **TIME:** 02:30 PM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2695		R	1		2.5	3.5	28	39			11	SILTY SAND (native), medium dense, dry, brown, fine to coarse SAND, little nonplastic fines, few fine subrounded gravel, moderate cementation, strong reaction with HCl, max. particle size 0.25". (SM)			
5	2690		S	2		5.0	6.5	13	19	26	45	4	SANDY LEAN CLAY, hard, dry, dark brown, medium plasticity CLAY, some fine sand, weak cementation, strong reaction with HCl. (CL)			
			S	3		7.5	9.0	21	23	43	66	17	CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, little medium plasticity fines, weak cementation, strong reaction with HCl. (SC)			
10	2685		S	4		10.0	10.3	50/4			R	4				
15	2680		S	5		15.0	16.5	14	24	21	45	15	WELL-GRADED SAND WITH CLAY, dense, dry, light brown, fine to coarse SAND, few low plasticity fines, trace fine subrounded gravel, no cementation, weak reaction with HCl, max. particle size 0.25". (SW-SC)			
20	2675		S	6		20.0	21.5	7	12	19	31	18	WELL-GRADED SAND WITH SILT, dense, dry, light brown, fine to coarse subrounded SAND, few nonplastic fines, trace fine subrounded gravel, no cementation, weak reaction with HCl, max. particle size 0.25". (SW-SM)			
25													LEAN CLAY WITH SAND, hard, dry, dark brown, medium plasticity CLAY, little fine			

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BORING LOG: W10

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2670		S	7	X	25.0	26.5	18	28	34	62	18	sand, trace fine gravel, weak cementation, weak reaction with HCl. (CL)			X
30	2665		S	8	X	30.0	30.9	32	50/5		R	10	SILTY SAND, very dense, dry, tan, fine to coarse SAND, little nonplastic fines, trace fine subangular gravel, no cementation, no reaction with HCl, max. particle size 0.5". (SM)			
35	2660		S	9	X	35.0	36.5	11	19	39	58	15	WELL-GRADED SAND WITH SILT AND GRAVEL, very dense, dry, tan, fine to coarse SAND, few nonplastic fines, little fine to coarse subrounded gravel, no cementation, no reaction with HCl, max. particle size 1". (SW-SM)			
40	2655		S	10	X	40.0	41.5	5	19	21	40	17	SILTY SAND, dense, dry, tan, fine to coarse SAND, little nonplastic fines, few fine to coarse subrounded gravel, no cementation, no reaction with HCl, max. particle size 1". (SM)			
45	2650		S	11	X	45.0	46.5	16	20	39	59	18	Becomes very dense, little low plasticity fines, few fine gravel.			X
50	2645		S	12	X	50.0	50.5	50/6			R	6	CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, little low plasticity fines, few fine to coarse subangular gravel, no cementation, no reaction with HCl, max. particle size 1". (SC)			
55	2640		S	13	X	55.0	55.9	35	50/5		R	10	Becomes trace fine subangular gravel.			
60	2635		S	14	X	60.0	61.5	18	42	50/6	R	17	Becomes CLAYEY SAND WITH GRAVEL, little low plasticity fines, little fine subangular gravel.	2.7		X
65													SILTY SAND, very dense, dry, brown, fine to coarse SAND, little low plasticity fines,			

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BORING LOG: W10

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2630		S	15	X	65.0	65.9	27	50/5		R	11	few fine subangular gravel, no cementation, no reaction with HCl, max. particle size 0.5". (SM)			
70	2625		S	16	X	70.0	71.5	20	26	31	57	18	SANDY LEAN CLAY, hard, dry, brown, medium plasticity CLAY, some fine to medium sand, no cementation, no reaction with HCl. (CL)			
75			S	17	X	75.0	75.4	50/5			R	5				
	2620												End of boring at 75'. Stopped sampler at 75.4'. No groundwater encountered. Backfilled with cuttings.			
80	2615															
85	2610															
90	2605															
95	2600															
100	2595															
105																

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SHEET 1 of 3
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,427 **E:** 21,257
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 229+54
OFFSET: 123 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,696.3
TOTAL DEPTH: 76.5

START DATE: 02/08/2011 **TIME:** 08:30 AM
FINISH DATE: 02/08/2011 **TIME:** 10:40 AM

Type/Symbol	Casing	Split Spoon S	Ring Sampler R	Shelby Tube U	Cuttings CU	Core Barrel C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2695		S	1		2.5	4.0	27	23	15	38	9	CLAYEY SAND (native), dense, dry, brown, fine to coarse SAND, some low plasticity fines, moderate cementation, strong reaction with HCl. (SC)			
5	2690		R	2		5.0	6.0	10	22			12	Becomes medium dense.			
			S	3		7.5	9.0	20	17	19	36	6	Becomes dense, light brown, little low plasticity fines.			
10	2685		S	4		10.0	11.5	8	10	17	27	15	SILTY SAND WITH GRAVEL, medium dense, dry, light brown, fine to coarse subrounded SAND, little low plasticity fines, little fine subrounded gravel, no cementation, strong reaction with HCl, max. particle size 0.5". (SM)			
15	2680		S	5		15.0	16.5	5	13	20	33	15	WELL-GRADED SAND WITH SILT, dense, dry, tan, fine to coarse SAND, few nonplastic fines, few fine subrounded gravel, no cementation, weak reaction with HCl, max. particle size 0.5". (SW-SM)			
20	2675		S	6		20.0	21.5	10	19	29	48	18	CLAYEY SAND, dense, dry, brown, fine to coarse SAND, some medium plasticity fines, weak cementation, strong reaction with HCl. (SC)			
25													LEAN CLAY WITH SAND, hard, dry, brown, low plasticity CLAY, little fine sand,			

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BORING LOG: W11

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2670		S	7	X	25.0	26.5	13	31	42	73	14	trace fine gravel, moderate cementation, weak reaction with HCl. (CL)			X
30	2665		S	8	X	30.0	31.5	10	19	19	38	18	WELL-GRADED SAND WITH SILT, dense, dry, tan, fine to coarse SAND, few nonplastic fines, trace fine subrounded gravel, no cementation, no reaction with HCl, max. particle size 0.25". (SW-SM)			
35	2660		S	9	X	35.0	36.5	5	35	49	84	14	SILTY SAND WITH GRAVEL, very dense, dry, light brown, fine to coarse SAND, little fine to coarse subrounded gravel, little nonplastic fines, no cementation, no reaction with HCl, max. particle size 1". (SM)			
40	2655		S	10	X	40.0	41.5	6	18	22	40	12	WELL-GRADED SAND WITH SILT AND GRAVEL, dense, dry, brown, fine to coarse SAND, few nonplastic fines, little fine to coarse subrounded gravel, no cementation, no reaction with HCl, max. particle size 1". (SW-SM)			
45	2650		S	11	X	45.0	46.5	9	20	32	52	13	SILTY SAND, very dense, dry, tan, fine to coarse SAND, little nonplastic fines, trace fine subrounded gravel, no cementation, weak reaction with HCl, max. particle size 0.5". (SM)			
50	2645		S	12	X	50.0	51.0	24	50/6		R	12	CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, little low plasticity fines, trace fine subrounded gravel, weak cementation, strong reaction with HCl, max. particle size 0.25". (SC)			
55	2640		S	13	X	55.0	56.3	25	40	50/4	R	13	Becomes little low plasticity fines.			
60	2635		S	14	X	60.0	61.5	16	25	35	60	16	WELL-GRADED SAND WITH SILT AND GRAVEL, very dense, dry, tan, fine to coarse SAND, few nonplastic fines, some fine to coarse subrounded gravel, no cementation, no reaction with HCl, max. particle size 1". (SW-SM)			
65																

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BORING LOG: W11

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2630		S	15	X	65.0	66.3	12	34	50/4	R	15	SILTY, CLAYEY SAND, very dense, dry, brown, fine to medium SAND, some low plasticity fines, trace fine gravel, no cementation, no reaction with HCl. (SC-SM)			
70	2625		S	16	X	70.0	71.5	11	14	18	32	18	Becomes dense.	6.9		X
75	2620		S	17	X	75.0	76.5	23	34	41	75	18	SILTY SAND, very dense, dry, light tan, fine to coarse SAND, little nonplastic fines, no cementation, no reaction with HCl. (SM)			
80	2615												End of boring at 75'. Sampler stopped at 76.5'. No groundwater encountered. Backfilled with cuttings.			
85	2610															
90	2605															
95	2600															
100	2595															
105																

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BORING LOG: W12

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,559 **E:** 21,844
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 235+15
OFFSET: 108 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,700.6
TOTAL DEPTH: 75.5

START DATE: 02/04/2011 **TIME:** 08:00 AM
FINISH DATE: 02/04/2011 **TIME:** 10:15 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2700		S	1		2.5	4.0	17	26	16	42	10	CLAYEY SAND (native), dense, dry, light brown, fine to medium SAND, some low plasticity fines, no cementation, strong reaction with HCl. (SC)			
5	2695		R	2		5.0	6.0	7	15			12	Becomes loose, fine to coarse SAND, trace fine gravel.	6.7	86.8	X
			S	3		7.5	9.0	15	11	13	24	4	Becomes medium dense, tan.			
10	2690		S	4		10.0	11.5	7	15	17	32	15	Becomes dense, weak cementation.			
15	2685		S	5		15.0	16.5	17	26	34	60	13	Becomes very dense, weak reaction with HCl.			
20	2680		S	6		20.0	21.5	6	9	15	24	16	WELL-GRADED SAND WITH SILT AND GRAVEL, medium dense, dry, tan, fine to coarse SAND, few nonplastic fines, little fine to coarse subrounded gravel, no cementation, weak reaction with HCl, max. particle size 1". (SW-SM)			X
25													SILTY SAND, very dense, dry, tan, fine to coarse SAND, some nonplastic fines,			

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BORING LOG: W12

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2675		S	7		25.0	26.5	23	31	49	80	17	moderate cementation, strong reaction with HCl. (SM)			
30	2670		S	8		30.0	31.5	15	15	27	42	18	Becomes dense, no cementation, no reaction with HCl.			
35	2665		S	9		35.0	35.8	27	50/3		R	8	CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, some low plasticity fines, weak cementation, strong reaction with HCl. (SC)			
40	2660		R	10		40.0	41.0	8	16			12	Becomes medium dense, fine SAND, moderate cementation.			
45	2655		S	11		45.0	46.0	18	50/6		R	8	Becomes very dense.			
50	2650		S	12		50.0	51.5	15	16	21	37	18	SILTY SAND, dense, dry, tan, fine to coarse SAND, little nonplastic fines, no cementation, no reaction with HCl. (SM)			
55	2645		S	13		55.0	55.9	33	50/5		R	11	CLAYEY SAND, very dense, dry, dark brown, fine to coarse SAND, some medium plasticity fines, no cementation, no reaction with HCl. (SC)			
60	2640		S	14		60.0	61.0	24	50/6		R	12	Becomes strong cementation, strong reaction with HCl.			
65																

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BORING LOG: W12

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2635		S	15	X	65.0	66.0	19	50/6		R	6				
													SANDY LEAN CLAY, hard, dry, brown, low plasticity CLAY, some fine SAND, trace fine subangular gravel, no cementation, no reaction with HCl. (CL)			
70	2630		S	16	X	70.0	71.5	14	29	31	60	16				X
75	2625		S	17	X	75.0	75.5	50/6			R	3	Becomes gray, max. particle size 0.5".			
													End of boring at 75'. Sampler stopped at 75.5'. No groundwater encountered. Backfilled with cuttings.			
80	2620															
85	2615															
90	2610															
95	2605															
100	2600															
105																

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BORING LOG: W13

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Chuck
INSPECTOR: NAB

COORDINATES **N:** 16,736 **E:** 21,692
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 234+51
OFFSET: 117 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,697.2
TOTAL DEPTH: 75.4

START DATE: 02/02/2011 **TIME:** 07:30 AM
FINISH DATE: 02/02/2011 **TIME:** 10:00 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2695		S	1		2.5	4.0	2	9	9	18	10	CLAYEY SAND (native), medium dense, dry, brown, fine to coarse SAND, some low plasticity fines, weak cementation, strong reaction with HCl. (SC)			
5			R	2		5.0	6.0	3	5			12	SILTY SAND, very loose, dry, brown, fine to coarse SAND, little medium plasticity fines, few fine gravel, weak cementation, strong reaction with HCl. (SM)	5.8	85.6	X
	2690		S	3		7.5	9.0	10	11	12	23	13	CLAYEY SAND, medium dense, dry, brown, fine to coarse SAND, some low plasticity fines, weak cementation, strong reaction with HCl. (SC)			
10			S	4		10.0	11.5	29	30	31	61	4	Becomes very dense.			
	2685															
15			S	5		15.0	16.5	16	30	47	77	14				
	2680															
20			S	6		20.0	21.5	16	31	46	77	15	SILTY SAND, very dense, dry, tan, fine to coarse SAND, little nonplastic fines, no cementation, weak reaction with HCl. (SM)			
	2675															
25																

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BORING LOG: W13

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Chuck
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2670		S	7	X	25.0	26.5	16	21	21	42	18	Becomes dense.			
30	2665		S	8	X	30.0	31.5	33	40	44	84	13	CLAYEY SAND, very dense, dry, light brown, fine to coarse SAND, little low plasticity fines, trace fine subrounded gravel, weak cementation, strong reaction with HCl, max. particle size 0.5". (SC)			
35	2660		S	9	X	35.0	36.5	26	38	46	84	15	Becomes some low plasticity fines, weak reaction with HCl.			
40	2655		S	10	X	40.0	41.5	12	30	38	68	16	Becomes little medium plasticity fines, few fine gravel, moderate cementation, strong reaction with HCl.			X
45	2650		S	11	X	45.0	45.9	34	50/5		R	11	Becomes no cementation, no reaction with HCl.			
50	2645		S	12	X	50.0	50.5	50/6			R	6	SILTY SAND, very dense, dry, light brown, fine to coarse SAND, little nonplastic fines, no cementation, no reaction with HCl. (SM)			
55	2640		S	13	X	55.0	56.4	25	36	50/5	R	17	CLAYEY SAND, very dense, dry, brown, fine to medium SAND, some medium plasticity fines, few fine gravel, no cementation, no reaction with HCl. (SC)	6.4		X
60	2635		S	14	X	60.0	61.5	19	32	45	77	14	Becomes strong cementation, weak reaction with HCl.			
65																

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BORING LOG: W13

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Chuck
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	15	X	65.0	66.5	20	30	44	74	14	Becomes no cementation, no reaction with HCl.			
	2630															
70			S	16	X	70.0	71.5	23	33	48	81	16	Becomes light brown, fine to coarse SAND, little low plasticity fines.			
	2625															
													SILTY SAND, very dense, dry, brown, fine to coarse SAND, little nonplastic fines, no cementation, no reaction with HCl. (SM)			
75			S	17	X	75.0	75.4	50/5			R	4				
	2620												End of boring at 75'. Sampler stopped at 75.4'. No groundwater encountered. Backfilled with cuttings.			
80																
	2615															
85																
	2610															
90																
	2605															
95																
	2600															
100																
	2595															
105																

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BORING LOG: W14

SHEET 1 of 2
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,617 **E:** 21,986
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 236+75
OFFSET: 106 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,701.3
TOTAL DEPTH: 55.8

START DATE: 02/04/2011 **TIME:** 09:15 AM
FINISH DATE: 02/04/2011 **TIME:** 10:30 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2700												CLAYEY SAND (native), medium dense, dry, light brown, fine to coarse SAND, some low plasticity fines, weak cementation, strong reaction with HCl. (SC)			
			S	1		2.5	4.0	8	8	15	23	10				
5																
			S	2		5.0	5.9	27	50/5		R	5	Becomes CLAYEY SAND WITH GRAVEL, very dense, little low plasticity fines, little fine to coarse subrounded gravel, max. particle size 1". Rock in sampler tip.			
	2695															
			S	3		7.5	8.5	20	50/6		R	4	WELL-GRADED SAND WITH CLAY AND GRAVEL, very dense, dry, tan, fine to coarse SAND, few low plasticity fines, little fine to coarse subangular gravel, weak cementation, strong reaction with HCl, max. particle size 1". (SW-SC)			
10																
	2690		S	4		10.0	11.5	19	40	42	82	5				
													SILTY SAND, very dense, dry, tan, fine to coarse SAND, some nonplastic fines, moderate cementation, strong reaction with HCl. (SM)			
15																
	2685		R	5		15.0	16.0	6	19			12				X
													WELL-GRADED SAND WITH SILT AND GRAVEL, medium dense, dry, tan, fine to coarse SAND, few nonplastic fines, little fine to coarse subrounded gravel, weak cementation, weak reaction with HCl, max. particle size 1.5", caliche clasts present. (SW-SM)			
20																
	2680		S	6		20.0	21.5	16	20	25	45	10	Becomes dense.			
													CLAYEY SAND, very dense, dry, buff, fine SAND, some medium plasticity fines, no			
25																

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BORING LOG: W14

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2675		S	7		25.0	26.5	11	23	31	54	12	cementation, no reaction with HCl, silt may be present. (SC)			
30	2670		S	8		30.0	31.5	15	30	45	75	15				
35	2665		R	9		35.0	36.0	33	47			12	Becomes dense, weak cementation, strong reaction with HCl.			
40	2660		S	10		40.0	41.5	22	33	41	74	5	Becomes very dense, strong cementation.			
45	2655		S	11		45.0	46.5	10	13	27	40	18	Becomes dense, fine to medium SAND, little low plasticity fines, trace fine gravel, no cementation, no reaction with HCl.			X
50	2650		S	12		50.0	50.8	30	50/4		R	10	Becomes CLAYEY SAND WITH GRAVEL, very dense, tan, little low plasticity fines, little fine subrounded gravel, max. particle size 0.25".			
55	2645		S	13		55.0	55.8	20	50/4		R	10	Becomes CLAYEY SAND, some low plasticity fines.			
60	2640												End of boring at 55'. Sampler stopped at 55.8'. No groundwater encountered. Backfilled with cuttings.			
65																

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BORING LOG: W15

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Chuck
INSPECTOR: NAB

COORDINATES **N:** 16,792 **E:** 21,834
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 235+96
OFFSET: 110 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,700.2
TOTAL DEPTH: 71.3

START DATE: 02/02/2011 **TIME:** 12:00 PM
FINISH DATE: 02/02/2011 **TIME:** 02:00 PM

Type/Symbol	Casing	Split Spoon S	Ring Sampler R	Shelby Tube U	Cuttings CU	Core Barrel C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	1		2.5	4.0	9	11	28	39	5	CLAYEY SAND (native), dense, dry, brown, fine to coarse SAND, some low plasticity fines, no cementation, strong reaction with HCl. (SC)			
5	2695		S	2		5.0	6.5	4	8	11	19	16	Becomes medium dense, some medium plasticity fines, trace fine gravel.			X
			R	3		7.5	8.5	22	47			12	Becomes dense.			
10	2690		S	4		10.0	11.5	5	10	13	23	6	Becomes medium dense.			
15	2685		S	5		15.0	16.5	6	18	25	43	10	SILTY SAND, dense, dry, tan, fine to coarse SAND, little low plasticity fines, trace fine subrounded gravel, no cementation, weak reaction with HCl, max. particle size 0.5". (SM)			
20	2680		S	6		20.0	21.5	12	15	26	41	13				
25													POORLY GRADED SAND WITH SILT, medium dense, dry, tan, fine to coarse			

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BORING LOG: W15

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Chuck
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	7	X	25.0	26.5	12	13	15	28	18	SAND, few nonplastic fines, few fine gravel, no cementation, no reaction with HCl. (SP-SM)			X
30	2670		S	8	X	30.0	30.9	26	50/5		R	11	CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, some low plasticity fines, strong cementation, strong reaction with HCl. (SC)			
35	2665		S	9	X	35.0	36.5	14	30	36	66	18				
40	2660		S	10	X	40.0	41.5	16	29	30	59	12	Becomes no cementation, no reaction with HCl.			
45	2655		S	11	X	45.0	46.4	18	33	50/5	R	18				
50	2650		S	12	X	50.0	50.9	39	50/5		R	11	Becomes fine to medium SAND.			
55	2645		S	13	X	55.0	56.5	9	11	31	42	18	WELL-GRADED SAND WITH SILT, dense, dry, redish brown, fine to coarse SAND, few nonplastic fines, no cementation, no reaction with HCl. (SW-SM)			
60	2640		S	14	X	60.0	61.0	20	50/6		R	12	CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, some medium plasticity fines, no cementation, no reaction with HCl. (SC)			
65																

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BORING LOG: W15

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Chuck
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	15	X	65.0	66.5	14	20	42	62	18	Becomes strong cementation, strong reaction with HCl.			
70	2630		S	16	X	70.0	71.3	26	39	50/4	R	18				
													End of boring at 70'. Sampler stopped at 71.3'. No groundwater encountered. Backfilled with cuttings.			
75	2625															
80	2620															
85	2615															
90	2610															
95	2605															
100	2600															
105																

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BORING LOG: W16

SHEET 1 of 2
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,672 **E:** 22,124
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 238+36
OFFSET: 89 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,704.7
TOTAL DEPTH: 46

START DATE: 02/04/2011 **TIME:** 10:40 AM
FINISH DATE: 02/04/2011 **TIME:** 12:00 PM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	1	X	2.5	4.0	10	10	6	16	12	SILTY, CLAYEY SAND WITH GRAVEL (native), medium dense, dry, brown, fine to coarse SAND, little low plasticity fines, little fine to coarse subrounded gravel, weak cementation, strong reaction with HCl, max. particle size 1". (SC-SM)			X
5	2700		S	2	X	5.0	6.5	11	17	28	45	6	Becomes dense.			
			S	3	X	7.5	9.0	19	16	12	28	0	Becomes medium dense. No recovery.			
10	2695		S	4	X	10.0	11.4	13	36	50/5	R	15	SILTY SAND WITH GRAVEL, very dense, dry, tan, fine to coarse SAND, little nonplastic fines, little fine subrounded gravel, no cementation, strong reaction with HCl, max. particle size 0.25". (SM)			
15	2690		S	5	X	15.0	16.5	5	13	22	35	18	Becomes SILTY SAND, dense, some nonplastic fines, weak reaction with HCl.			
20	2685		S	6	X	20.0	21.5	15	28	36	64	12	Becomes very dense.			
25	2680												CLAYEY SAND, very dense, dry, tan, fine to coarse SAND, little low plasticity fines, no			

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BORING LOG: W16

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	7		25.0	26.5	14	20	37	57	15	cementation, no reaction with HCl. (SC)			
30	2675		S	8		30.0	31.5	17	35	36	71	18	Becomes few fine to coarse subrounded to subangular gravel, max. particle size 1".			
35	2670		S	9		35.0	36.5	22	32	50/6	R	16	Becomes some low plasticity fines, strong cementation, strong reaction with HCl.			
40	2665		S	10		40.0	41.5	13	40	45	85	12				
45	2660		R	11		45.0	46.0	29	47			12	Becomes dense, few fine subrounded gravel, max. particle size 0.25".			
													End of boring at 45'. Sampler stopped at 46'. No groundwater encountered. Backfilled with cuttings.			
50	2655															
55	2650															
60	2645															
65	2640															

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BORING LOG: W17

SHEET 1 of 2
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,836 **E:** 21,976
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 237+31
OFFSET: 107 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,701.6
TOTAL DEPTH: 55.9

START DATE: 02/01/2011 **TIME:** 10:20 AM
FINISH DATE: 02/01/2011 **TIME:** 11:20 AM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2700		S	1	X	2.5	4.0	4	9	9	18	15	CLAYEY SAND (native), medium dense, dry, brown, fine to coarse SAND, some low plasticity fines, no cementation, strong reaction with HCl. (SC)			
5	2695		S	2	X	5.0	6.5	19	26	36	62	5	Becomes very dense, light brown.			
			S	3	X	7.5	9.0	23	31	43	74	18	Becomes little low plasticity fines, moderate cementation, weak reaction with HCl.			
10	2690		S	4	X	10.0	11.5	18	32	30	62	10	Becomes no cementation.			
15	2685		S	5	X	15.0	16.5	7	9	10	19	18	WELL-GRADED SAND WITH SILT, medium dense, dry, brown, fine to coarse SAND, few nonplastic fines, trace fine subrounded gravel, no cementation, weak reaction with HCl, max. particle size 0.5". (SW-SM)	1.0		X
20	2680		S	6	X	20.0	21.5	8	16	17	33	18	Becomes dense, light brown, trace fine subangular gravel, no reaction with HCl.			
25													WELL-GRADED SAND, medium dense, dry, light brown, fine to coarse SAND, trace			

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BORING LOG: W17

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2675		S	7	X	25.0	26.5	8	14	16	30	0	fine subrounded gravel, trace nonplastic fines, no cementation, no reaction with HCl, max. particle size 0.5". (SW) No recovery.			
30	2670		S	8	X	30.0	31.5	10	15	18	33	2	Becomes dense.			
35	2665		S	9	X	35.0	36.5	17	33	43	76	14	CLAYEY SAND, very dense, dry, light brown, fine to coarse SAND, little low plasticity fines, moderate cementation, strong reaction with HCl. (SC)			
40	2660		S	10	X	40.0	41.5	17	29	33	62	17	Becomes brown, fine to medium SAND, some medium plasticity fines, trace fine gravel.			X
45	2655		S	11	X	45.0	46.0	32	50/6		R	12	Becomes no cementation, no reaction with HCl.			
50	2650		S	12	X	50.0	51.5	19	28	40	68	18	Becomes fine SAND, strong cementation, strong reaction with HCl.			
55	2645		S	13	X	55.0	55.9	31	50/5		R	7	End of boring at 55'. Sampler stopped at 55.9'. No groundwater encountered. Backfilled with cuttings.			
60	2640															
65																

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BORING LOG: W18

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,723 **E:** 22,277
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 240+00
OFFSET: 64 Rt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,709.5
TOTAL DEPTH: 21.5

START DATE: 02/04/2011 **TIME:** 12:15 PM
FINISH DATE: 02/04/2011 **TIME:** 12:50 PM

Type/Symbol	Casing	Split Spoon S	Ring Sampler R	Shelby Tube U	Cuttings CU	Core Barrel C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			R	1		2.5	3.5	15	20			12	CLAYEY SAND (native), medium dense, dry, brown, fine to coarse SAND, some low plasticity fines, few fine to coarse subrounded gravel, weak cementation, weak reaction with HCl, max. particle size 1". (SC)			
5	2705		S	2		5.0	6.5	10	12	30	42	14	Becomes dense, little low plasticity fines, few fine subrounded gravel, strong reaction with HCl, max. particle size 0.5".			
			S	3		7.5	9.0	20	19	12	31	13				
10	2700		S	4		10.0	11.0	27	50/6		R	12	SILTY SAND, very dense, dry, brown, fine to coarse SAND, little nonplastic fines, few fine subrounded gravel, no cementation, strong reaction with HCl, max. particle size 0.5". (SM)			
15	2695		S	5		15.0	16.5	13	15	17	32	18	Becomes dense, weak reaction with HCl.			
20	2690		S	6		20.0	21.5	13	27	30	57	18	Becomes very dense.			
25	2685												End of boring at 20'. Sampler stopped at 21.5'. No groundwater encountered. Backfilled with cuttings.			

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BORING LOG: W19

SHEET 1 of 2
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,863 **E:** 22,126
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 238+76
OFFSET: 98 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,704
TOTAL DEPTH: 45.9

START DATE: 02/01/2011 **TIME:** 12:00 PM
FINISH DATE: 02/01/2011 **TIME:** 01:15 PM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	1		2.5	4.0	8	21	36	57	10	CLAYEY SAND (native), very dense, dry, brown, fine to coarse SAND, some low plasticity fines, trace fine gravel, weak cementation, strong reaction with HCl. (SC)			X
5	2700		S	2		5.0	6.5	20	20	30	50	18	Becomes dense, strong cementation.			
			S	3		7.5	8.4	36	50/5		R	6	Becomes very dense, no cementation.			
10	2695		S	4		10.0	11.5	26	26	22	48	18	Becomes dense, weak cementation.			
15	2690		R	5		15.0	16.0	12	16			12	WELL-GRADED SAND WITH SILT, medium dense, dry, light brown, fine to coarse SAND, few nonplastic fines, trace fine subrounded gravel, no cementation, strong reaction with HCl, max. particle size 0.5". (SW-SM)			
20	2685		S	6		20.0	21.5	8	10	12	22	0	No recovery.			
25	2680												CLAYEY SAND, dense, dry, brown, fine to medium SAND, some low plasticity fines,			

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BORING LOG: W19

NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	SOIL SAMPLE NUMBER	SOIL SAMPLE SYMBOL	DEPTH (FT) FROM	DEPTH (FT) TO	BLOWS 0-6 INCH	BLOWS 6-12-INCH	BLOWS 12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
			S	7	X	25.0	26.5	12	20	22	42	13	moderate cementation, weak reaction with HCl. (SC)			
	2675															
30			S	8	X	30.0	31.5	12	18	19	37	12				
													SILTY SAND, dense, dry, tan, fine to coarse SAND, little nonplastic fines, no cementation, strong reaction with HCl. (SM)			
	2670															
35			S	9	X	35.0	36.5	29	36	32	68	18	CLAYEY SAND, very dense, dry, brown, fine to coarse SAND, some medium plasticity fines, few fine gravel, weak cementation, strong reaction with HCl. (SC)	4.2		X
	2665															
40			S	10	X	40.0	41.4	29	36	50/5	R	10	Becomes weak reaction with HCl.			
	2660															
45			S	11	X	45.0	45.9	36	50/5		R	11	Becomes no cementation, no reaction with HCl.			
													End of boring at 45'. Sampler stopped at 45.9'. No groundwater encountered. Backfilled with cuttings.			
	2655															
50																
	2650															
55																
	2645															
60																
	2640															
65																

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BORING LOG: W20

SHEET 1 of 1
NCS PROJECT #: J2010-09

PROJECT: Valencia: Alvernon to Wilmot
CLIENT: PSOMAS
CLIENT PROJECT #: 4VAKDP

CONTRACTOR: GSI
DRILLER: Steve
INSPECTOR: NAB

COORDINATES **N:** 16,869 **E:** 22,277
LOCATION: Tucson, Arizona
REF. ALIGNMENT: Valencia CL
STATION: 240+16
OFFSET: 82 Lt.

RIG TYPE: Truck mt. CME 75
DRILLING METHOD: 8" OD HSA
HAMMER TYPE: Auto Hammer

COMMENTS:

SURFACE ELEV.: 2,707.3
TOTAL DEPTH: 21.5

START DATE: 02/01/2011 **TIME:** 02:10 PM
FINISH DATE: 02/01/2011 **TIME:** 02:50 PM

	Casing	Split Spoon	Ring Sampler	Shelby Tube	Cuttings	Core Barrel
Type/Symbol		S	R	U	CU	C
I.D.		1.375"	2.5"		--	
O.D.		2"	3"		--	
Length		18"	18"		--	
Hammer WT.	140 lbs.		Drill Rod Size			
Hammer Fall	30 in.		I.D. (O.D.)			

GROUNDWATER DATA

Date	Time	Water Depth (ft)	Casing Depth (ft)	Hole Depth (ft)	Symbol

DEPTH BELOW SURFACE (FT)	ELEVATION (FT)	GRAPHIC	SOIL SAMPLE TYPE	NUMBER	SYMBOL	DEPTH (FT) FROM	TO	BLOWS 0-6 INCH	6-12-INCH	12-18 INCH	N-VALUE	RECOVERY (IN)	VISUAL SOIL IDENTIFICATION / DESCRIPTION AND REMARKS	MOISTURE, %	DRY DENSITY (PCF)	SAMPLES SENT TO LAB
	2705		R	1		2.5	3.5	25	41			12	CLAYEY SAND (native), medium dense, dry, light tan, fine to coarse SAND, some medium plasticity fines, moderate cementation, strong reaction with HCl. (SC)			
5			S	2		5.0	5.5	50/6			R	6	Becomes very dense, brown, no cementation.			
	2700		S	3		7.5	8.5	22	50/6		R	8	Becomes moderate cementation.			
10			S	4		10.0	11.0	29	50/6		R	6	WELL-GRADED SAND WITH CLAY, very dense, dry, brown, fine to coarse SAND, few low plasticity fines, no cementation, weak reaction with HCl. (SW-SC)			
	2695															
15			S	5		15.0	16.5	6	16	17	33	18	POORLY GRADED SAND WITH SILT AND GRAVEL, dense, dry, brown, fine to coarse SAND, few nonplastic fines, little fine to coarse subrounded gravel, no cementation, weak reaction with HCl, max. particle size 0.75". (SP-SM)			X
	2690															
20			S	6		20.0	21.5	5	13	27	40	14	SILTY SAND, dense, dry, light brown, fine to coarse SAND, little nonplastic fines, trace fine subrounded gravel, no cementation, weak reaction with HCl, max. particle size 0.5". (SM)			
	2685												End of boring at 20'. Sampler stopped at 21.5'. No groundwater encountered. Backfilled with cuttings.			
25																

REPORT ncs boring | PROJECT p:\valencia - alvernon to wilmot\gint\valencia(alvernon-wilmot).gpj | LIBRARY ncs gintlib v5.0.glb | LAST MOD 06/20/11 10:10 am | PRINTED 06/22/11 01:37 pm

APPENDIX B

LABORATORY TEST RESULTS

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Boring	Sample	Depth (ft)	Mid-Point Elevation (ft)	Grain Size Dist. (% Passing)[1]						Atterbergs			In-Situ		USCS Class.		AASHTO 1995 Classification	R-Value		Proctor	
				3/4"	1/4"	#4	#8	#40	#200	LL[2]	PI[2]	LI	Moisture (%)	Dry Dens. (pcf)	Fines	Sample	(Group Index)	Calc.	Lab	Max Dry Dens. (pcf)	Optimum Moist. (%)
B01	S4	20.0 - 21.5	2708	97	94	92	84	51	31	33	15	--	--	--	CL	SC	A-2-6 (1)	--	--	--	--
B01A	S4	20.0 - 21.5	2675	100	100	100	95	67	45	29	10	--	--	--	CL	SC	A-4 (1)	--	--	--	--
B01A	S7	35.0 - 36.5	2660	100	84	79	69	34	17	22	3	-5.7	2.0	--	ML	SM	A-1-b (0)	--	--	--	--
B01A	S11	55.0 - 56.5	2640	100	98	97	93	69	41	35	15	--	--	--	CL	SC	A-6 (2)	--	--	--	--
B01A	S13	65.0 - 66.5	2630	100	100	100	100	93	78	29	13	--	--	--	CL	CL	A-6 (8)	--	--	--	--
B02	CU1	5.0 - 10.0	2718	100	93	89	75	42	25	25	8	-1.1	8.3	--	CL	SC	A-2-4 (0)	--	--	--	--
B02	S3	15.0 - 16.5	2711	100	97	95	86	52	30	31	13	--	--	--	CL	SC	A-2-6 (0)	--	--	--	--
B02A	S2	10.0 - 11.5	2685	100	97	97	92	68	31	27	11	--	--	--	CL	SC	A-2-6 (0)	--	--	--	--
B02A	S6	30.0 - 31.5	2665	94	89	86	70	28	7	NP	NP	--	0.6	--	ML	SW-SM	A-1-b (0)	--	--	--	--
B02A	S13	65.0 - 66.5	2630	100	100	100	96	77	43	25	5	--	--	--	CL-ML	SC-SM	A-4 (0)	--	--	--	--
B02A	S17	85.0 - 86.5	2610	100	99	97	89	50	28	35	15	--	--	--	CL	SC	A-2-6 (1)	--	--	--	--
B03	S2	10.0 - 11.5	2683	100	94	91	78	22	8	42	20	--	--	--	CL	SW-SC	A-2-7 (0)	--	--	--	--
B03	S10	50.0 - 51.5	2643	100	97	97	93	70	38	26	7	--	--	--	CL	SC-SM	A-4 (0)	--	--	--	--
B03	S19	95.0 - 96.5	2598	100	99	99	98	90	69	36	13	0.0	22.5	--	CL	CL	A-6 (8)	--	--	--	--
B03	S23	115.0 - 116.5	2578	100	100	99	99	88	58	24	4	--	--	--	CL-ML	CL-ML	A-4 (0)	--	--	--	--
B04	S3	15.0 - 16.5	2679	100	94	92	88	71	56	32	14	--	--	--	CL	CL	A-6 (5)	--	--	--	--
B04	S7	35.0 - 36.5	2659	96	92	90	86	66	43	26	10	-0.7	8.6	--	CL	SC	A-4 (1)	--	--	--	--
B04	S16	80.0 - 81.5	2614	100	95	93	85	64	45	27	8	--	--	--	CL	SC	A-4 (1)	--	--	--	--
B04	S20	100.0 - 101.5	2594	100	99	98	96	85	52	30	11	-0.5	13.7	--	CL	CL	A-6 (3)	--	--	--	--
B05	S1	5.0 - 6.5	2688	100	95	93	81	40	20	40	6	--	--	--	ML	SM	A-1-b (0)	--	--	--	--
B05	S11	55.0 - 56.5	2638	100	100	99	97	79	53	29	10	--	--	--	CL	CL	A-4 (3)	--	--	--	--
B05	S15	75.0 - 76.5	2618	100	96	92	76	26	11	26	9	--	--	--	CL	SP-SC	A-2-4 (0)	--	--	--	--
B06	S13	65.0 - 66.5	2629	100	99	99	98	93	74	35	13	--	--	--	CL	CL	A-6 (9)	--	--	--	--
B06	S17	85.0 - 86.5	2609	100	99	98	95	81	67	26	6	-1.7	9.9	--	CL-ML	CL-ML	A-4 (2)	--	--	--	--
B06	S22	110.0 - 111.5	2584	100	99	99	98	89	67	28	8	--	--	--	CL	CL	A-4 (3)	--	--	--	--

All data shown tested by **ConformaTech**.

-- Not Tested

1. Only selected sieve sizes are included here. For full sieve data refer to Table B.2.

2. A liquid limit (LL) and a plasticity index (PI) of NP indicates the material is non-plastic.

NCS Consultants, LLC

Sheet 1 of 5
06/22/2011

TABLE B.1

SUMMARY OF LAB TESTING

Project: Valencia: Alvernon to Wilmot
Location: Tucson, Arizona
Client: PSOMAS

REPORT ncs_lab_summary_simple_aashto | PROJECT p:\valencia - alvernon to wilmot\grint\valencia(alvernon-wilmot).gpj | LIBRARY ncs gintlib v5.0.glb | LAST MOD 06/13/11 03:59 pm | PRINTED 06/22/11 03:44 pm

Boring	Sample	Depth (ft)	Mid-Point Elevation (ft)	Grain Size Dist. (% Passing)[1]						Atterbergs			In-Situ		USCS Class.		AASHTO 1995 Classification	R-Value		Proctor	
				3/4"	1/4"	#4	#8	#40	#200	LL[2]	PI[2]	LI	Moisture (%)	Dry Dens. (pcf)	Fines	Sample	(Group Index)	Calc.	Lab	Max Dry Dens. (pcf)	Optimum Moist. (%)
B07	S1	5.0 - 6.5	2722	100	97	94	82	45	24	21	4	--	--	--	CL-ML	SC-SM	A-1-b (0)	--	--	--	--
B07	S8	40.0 - 41.5	2687	100	94	92	85	66	51	36	14	--	--	--	CL	CL	A-6 (4)	--	--	--	--
B07	S12	60.0 - 61.5	2667	100	99	98	94	75	31	NP	NP	--	--	--	ML	SM	A-2-4 (0)	--	--	--	--
B07	S22	110.0 - 111.5	2617	91	90	90	86	72	61	33	13	--	--	--	CL	CL	A-6 (6)	--	--	--	--
B08	S3	15.0 - 16.5	2711	93	92	86	78	48	29	28	11	--	--	--	CL	SC	A-2-6 (0)	--	--	--	--
B08	S10	50.0 - 51.5	2676	98	93	88	73	29	11	NP	NP	--	--	--	ML	SW-SM	A-1-b (0)	--	--	--	--
B08	S16	80.0 - 81.5	2646	100	99	98	95	77	52	28	8	--	--	--	CL	CL	A-4 (2)	--	--	--	--
B08	S24	120.0 - 121.5	2606	100	97	96	94	73	55	31	11	-0.5	14.9	--	CL	CL	A-6 (4)	--	--	--	--
B09	CU1	10.0 - 15.0	2687	100	94	92	86	64	45	45	27	-0.3	9.6	--	CL	SC	A-7-6 (7)	--	--	--	--
B09	S5	12.5 - 14.0	2688	100	98	97	93	73	54	32	15	--	--	--	CL	CL	A-6 (5)	--	--	--	--
B09	S14	45.0 - 46.5	2656	100	99	99	97	86	62	25	6	--	--	--	CL-ML	CL-ML	A-4 (1)	--	--	--	--
B09	S17	60.0 - 61.5	2641	100	96	95	93	85	70	NP	NP	--	--	--	ML	ML	A-4 (0)	--	--	--	--
B09	S18	65.0 - 66.5	2636	100	98	97	94	73	42	26	9	--	--	--	CL	SC	A-4 (1)	--	--	--	--
B10	S1	2.5 - 4.0	2699	88	77	74	67	45	26	33	11	--	--	--	CL	SC	A-2-6 (0)	--	--	--	--
B10	S8	20.0 - 21.5	2681	100	89	85	76	49	32	35	9	--	--	--	ML	SM	A-2-4 (0)	--	--	--	--
B10	S9	25.0 - 26.0	2677	100	95	92	81	45	24	27	9	--	--	--	CL	SC	A-2-4 (0)	--	--	--	--
B10	S12	40.0 - 41.5	2661	100	95	92	77	33	11	NP	NP	--	--	--	ML	SW-SM	A-1-b (0)	--	--	--	--
B10	S14	50.0 - 51.5	2651	85	75	71	61	30	14	NP	NP	--	3.0	--	ML	SM	A-1-b (0)	--	--	--	--
D01	S2	5.0 - 6.5	2673	100	100	99	95	79	54	27	8	--	--	--	CL	CL	A-4 (2)	--	--	--	--
D01	S4	15.0 - 16.5	2663	81	69	65	52	24	12	NP	NP	--	--	--	ML	SW-SM	A-1-a (0)	--	--	--	--
D02	CU1	0.0 - 5.0	2678	100	93	89	75	30	12	NP	NP	--	--	--	ML	SW-SM	A-1-b (0)	--	--	--	--
D02	R2	5.0 - 6.0	2677	100	95	92	81	41	15	NP	NP	--	3.3	96.5	ML	SM	A-1-b (0)	--	--	--	--
D02	S3	10.0 - 11.5	2672	100	95	92	83	48	26	25	4	--	--	--	CL-ML	SC-SM	A-2-4 (0)	--	--	--	--
D02	S5	20.0 - 21.5	2662	100	100	100	98	87	64	30	14	--	--	--	CL	CL	A-6 (6)	--	--	--	--
P01	CU1	0.0 - 5.0	2638	88	77	74	64	39	22	34	14	-1.2	3.8	--	CL	SC	A-2-6 (0)	42.7	--	--	--

All data shown tested by **ConformaTech**.

-- Not Tested

1. Only selected sieve sizes are included here. For full sieve data refer to Table B.2.

2. A liquid limit (LL) and a plasticity index (PI) of NP indicates the material is non-plastic.

NCS Consultants, LLC

Sheet 2 of 5
06/22/2011

TABLE B.1

SUMMARY OF LAB TESTING

Project: Valencia: Alvernon to Wilmot
Location: Tucson, Arizona
Client: PSOMAS

REPORT ncs_lab_summary_simple_ashto | PROJECT p:\valencia - alvernon to wilmot\grint\valencia(alvernon-wilmot).gpj | LIBRARY ncs gintlib v5.0.glb | LAST MOD 06/13/11 03:59 pm | PRINTED 06/22/11 03:44 pm

Boring	Sample	Depth (ft)	Mid-Point Elevation (ft)	Grain Size Dist. (% Passing)[1]						Atterbergs			In-Situ		USCS Class.		AASHTO 1995 Classification	R-Value		Proctor	
				3/4"	1/4"	#4	#8	#40	#200	LL[2]	PI[2]	LI	Moisture (%)	Dry Dens. (pcf)	Fines	Sample	(Group Index)	Calc	Lab	Max Dry Dens. (pcf)	Optimum Moist. (%)
P02	CU1	0.0 - 5.0	2641	99	94	92	86	60	39	29	12	--	--	--	CL	SC	A-6 (1)	36.5	--	--	--
P03	CU1	0.0 - 5.0	2644	96	85	81	72	49	27	27	6	--	--	--	CL-ML	SC-SM	A-2-4 (0)	54.5	--	--	--
P03	R1	2.5 - 3.5	2646	--	--	--	--	--	--	--	--	--	6.9	83.6	--	--	--	--	--	--	--
P06	CU1	0.0 - 5.0	2655	88	69	65	56	39	18	27	5	--	--	--	ML	SM	A-1-b (0)	64.1	52.0	--	--
P07	CU1	0.0 - 5.0	2658	97	90	87	78	53	29	29	9	--	--	--	CL	SC	A-2-4 (0)	47.1	--	--	--
P07	R1	2.5 - 3.5	2660	79	75	72	64	41	22	27	7	--	--	--	CL	SC-SM	A-2-4 (0)	--	--	--	--
P08	CU1	0.0 - 5.0	2656	94	87	83	71	42	22	24	7	--	--	--	CL	SC-SM	A-2-4 (0)	56.1	--	--	--
P09	CU1	0.0 - 5.0	2659	97	88	86	77	54	32	41	23	--	--	--	CL	SC	A-2-7 (2)	26.1	--	--	--
P10	CU1	0.0 - 5.0	2661	99	95	93	87	63	39	37	21	--	--	--	CL	SC	A-6 (3)	25.6	--	--	--
P11	CU1	0.0 - 5.0	2665	93	85	82	73	46	24	33	14	--	--	--	CL	SC	A-2-6 (0)	41.5	--	--	--
P12	CU1	0.0 - 5.0	2670	98	85	81	69	47	25	26	5	--	--	--	CL-ML	SC-SM	A-1-b (0)	58.2	--	--	--
P13	CU1	0.0 - 5.0	2674	98	92	91	85	53	28	23	7	--	--	--	CL	SC-SM	A-2-4 (0)	51.6	--	--	--
P13	R1	2.5 - 3.5	2675	100	95	92	82	50	31	32	13	-1.0	5.4	87.0	CL	SC	A-2-6 (0)	--	--	--	--
P14	CU1	0.0 - 5.0	2677	95	87	84	76	47	25	24	11	--	--	--	CL	SC	A-2-6 (0)	46.0	--	--	--
P15	CU1	0.0 - 5.0	2681	95	84	80	65	31	15	33	13	-1.2	4.1	--	CL	SC	A-2-6 (0)	48.9	--	--	--
P16	CU1	0.0 - 5.0	2685	100	99	98	94	69	39	25	12	--	--	--	CL	SC	A-6 (1)	36.5	22.0	--	--
P17	CU1	0.0 - 5.0	2690	99	91	89	81	56	35	35	18	--	--	--	CL	SC	A-2-6 (2)	30.5	--	--	--
P18	CU1	0.0 - 5.0	2691	100	95	93	88	66	42	37	21	--	--	--	CL	SC	A-6 (4)	24.6	--	--	--
P18	R2	5.0 - 6.0	2690	100	97	97	92	72	52	38	22	-0.3	9.5	85.4	CL	CL	A-6 (8)	--	--	--	--
P19	CU1	0.0 - 5.0	2691	99	96	93	87	60	36	35	18	--	--	--	CL	SC	A-6 (2)	30.1	--	--	--
P24	CU1	0.0 - 5.0	2707	99	91	88	79	50	29	31	13	--	--	--	CL	SC	A-2-6 (0)	40.3	--	--	--
P25	CU1	0.0 - 5.0	2705	96	84	80	65	40	21	30	5	--	--	--	ML	SM	A-1-b (0)	61.5	--	--	--
P26	CU1	0.0 - 5.0	2707	99	85	80	65	32	15	35	12	--	--	--	CL	SC	A-2-6 (0)	50.8	--	--	--
P27	CU1	0.0 - 5.0	2710	97	83	77	62	35	21	42	18	--	--	--	CL	SC	A-2-7 (0)	37.0	--	--	--
P28	CU1	0.0 - 5.0	2712	100	95	93	86	56	34	27	11	--	--	--	CL	SC	A-2-6 (0)	40.6	14.0	--	--

All data shown tested by **ConformaTech**.

-- Not Tested

1. Only selected sieve sizes are included here. For full sieve data refer to Table B.2.

2. A liquid limit (LL) and a plasticity index (PI) of NP indicates the material is non-plastic.

NCS Consultants, LLC

Sheet 3 of 5
06/22/2011

TABLE B.1
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Project: Valencia: Alvernon to Wilmot
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Client: PSOMAS

REPORT ncs_lab_summary_simple_aashto | PROJECT p:\valencia - alvernon to wilmot\grint\valencia(alvernon-wilmot).gpj | LIBRARY ncs gintlib v5.0.glb | LAST MOD 06/13/11 03:59 pm | PRINTED 06/22/11 03:44 pm

Boring	Sample	Depth (ft)	Mid-Point Elevation (ft)	Grain Size Dist. (% Passing)[1]						Atterbergs			In-Situ		USCS Class.		AASHTO 1995 Classification	R-Value		Proctor	
				3/4"	1/4"	#4	#8	#40	#200	LL[2]	PI[2]	LI	Moisture (%)	Dry Dens. (pcf)	Fines	Sample	(Group Index)	Calc	Lab	Max Dry Dens. (pcf)	Optimum Moist. (%)
P28	R1	2.5 - 3.5	2714	100	96	95	89	55	31	22	7	-1.3	5.7	93.7	CL	SC-SM	A-2-4 (0)	--	--	--	--
P29	CU1	0.0 - 5.0	2721	100	93	91	81	57	36	36	17	--	--	--	CL	SC	A-6 (2)	31.3	--	115.7	13.8
P30	CU1	0.0 - 5.0	2724	100	95	93	85	59	36	30	14	--	--	--	CL	SC	A-6 (1)	35.2	--	--	--
P31	CU1	0.0 - 5.0	2725	100	94	91	81	49	30	36	17	--	--	--	CL	SC	A-2-6 (1)	34.0	--	--	--
P32	CU1	0.0 - 5.0	2728	100	96	93	82	53	37	51	27	--	--	--	CH	SC	A-7-6 (4)	20.8	--	--	--
P33	CU1	0.0 - 5.0	2732	100	96	94	85	52	28	32	16	--	--	--	CL	SC	A-2-6 (1)	36.3	--	--	--
P34	CU1	0.0 - 5.0	2736	100	94	92	84	63	41	37	18	--	--	--	CL	SC	A-6 (3)	28.1	9.0	--	--
P34	R1	2.5 - 3.5	2737	100	96	94	85	61	39	26	8	-1.1	9.1	91.1	CL	SC	A-4 (0)	--	--	--	--
W01	S3	7.5 - 9.0	2682	96	82	79	68	30	9	37	15	-1.3	3.2	--	CL	SW-SC	A-2-6 (0)	--	--	--	--
W01	S8	30.0 - 31.5	2660	100	99	99	96	81	62	35	17	--	--	--	CL	CL	A-6 (8)	--	--	--	--
W02	R1	2.5 - 3.5	2690	100	95	92	84	52	33	30	12	--	--	--	CL	SC	A-2-6 (0)	--	--	--	--
W02	S6	20.0 - 21.5	2672	96	90	87	74	35	15	NP	NP	--	--	--	ML	SM	A-1-b (0)	--	--	--	--
W03	S2	5.0 - 6.5	2686	100	100	97	93	70	42	44	23	--	--	--	CL	SC	A-7-6 (5)	--	--	--	--
W03	S11	45.0 - 46.5	2646	100	100	97	90	66	39	31	11	--	--	--	CL	SC	A-6 (1)	--	--	--	--
W04	R4	10.0 - 11.0	2683	100	97	96	88	41	20	38	17	--	--	--	CL	SC	A-2-6 (0)	--	--	--	--
W04	S7	25.0 - 26.5	2668	100	96	95	91	69	35	24	4	-3.8	5.0	--	CL-ML	SC-SM	A-2-4 (0)	--	--	--	--
W04	S11	45.0 - 46.5	2648	100	98	96	91	62	37	31	13	--	--	--	CL	SC	A-6 (1)	--	--	--	--
W05	S6	20.0 - 21.5	2672	100	97	95	86	35	11	NP	NP	--	--	--	ML	SW-SM	A-1-b (0)	--	--	--	--
W05	S13	55.0 - 56.5	2637	100	98	98	90	45	19	NP	NP	--	2.0	--	ML	SM	A-1-b (0)	--	--	--	--
W06	S2	5.0 - 6.5	2688	100	94	91	78	47	29	42	18	--	--	--	CL	SC	A-2-7 (1)	--	--	--	--
W06	S8	30.0 - 31.5	2663	98	90	85	67	22	10	NP	NP	--	--	--	ML	SP-SM	A-1-b (0)	--	--	--	--
W07	S8	30.0 - 31.5	2663	100	97	94	85	48	20	20	1	--	--	--	ML	SM	A-1-b (0)	--	--	--	--
W08	S3	15.0 - 16.5	2679	100	97	94	86	52	26	25	6	--	--	--	CL-ML	SC-SM	A-2-4 (0)	--	--	--	--
W08	S7	35.0 - 36.5	2659	86	69	64	54	21	9	24	7	--	--	--	CL	SW-SC	A-2-4 (0)	--	--	--	--
W09	S5	15.0 - 16.5	2679	100	94	91	81	46	16	NP	NP	--	--	--	ML	SM	A-1-b (0)	--	--	--	--

All data shown tested by **ConformaTech**.

-- Not Tested

1. Only selected sieve sizes are included here. For full sieve data refer to Table B.2.

2. A liquid limit (LL) and a plasticity index (PI) of NP indicates the material is non-plastic.

NCS Consultants, LLC

Sheet 4 of 5
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Boring	Sample	Depth (ft)	Mid-Point Elevation (ft)	Grain Size Dist. (% Passing)[1]						Atterbergs			In-Situ		USCS Class.		AASHTO 1995 Classification	R-Value		Proctor	
				3/4"	1/4"	#4	#8	#40	#200	LL[2]	PI[2]	LI	Moisture (%)	Dry Dens. (pcf)	Fines	Sample	(Group Index)	Calc.	Lab	Max Dry Dens. (pcf)	Optimum Moist. (%)
W09	S11	45.0 - 46.5	2649	100	90	88	81	53	34	27	11	--	--	--	CL	SC	A-2-6 (0)	--	--	--	--
W10	S7	25.0 - 26.5	2670	100	100	99	98	89	71	31	13	--	--	--	CL	CL	A-6 (7)	--	--	--	--
W10	S11	45.0 - 46.5	2650	100	93	90	81	42	21	22	3	--	--	--	ML	SM	A-1-b (0)	--	--	--	--
W10	S14	60.0 - 61.5	2635	99	89	84	70	34	16	NP	NP	--	2.7	--	ML	SM	A-1-b (0)	--	--	--	--
W11	S7	25.0 - 26.5	2670	100	100	99	97	91	78	29	12	--	--	--	CL	CL	A-6 (7)	--	--	--	--
W11	S16	70.0 - 71.5	2625	100	99	98	96	78	44	25	4	-3.5	6.9	--	CL-ML	SC-SM	A-4 (0)	--	--	--	--
W12	R2	5.0 - 6.0	2695	100	100	99	93	66	42	27	11	-0.8	6.7	86.8	CL	SC	A-6 (1)	--	--	--	--
W12	S6	20.0 - 21.5	2679	92	86	81	66	23	7	NP	NP	--	--	--	ML	SW-SM	A-1-b (0)	--	--	--	--
W12	S16	70.0 - 71.5	2629	100	99	99	98	87	59	29	11	--	--	--	CL	CL	A-6 (4)	--	--	--	--
W13	R2	5.0 - 6.0	2691	100	93	90	79	52	29	33	9	-2.0	5.8	85.6	ML	SM	A-2-4 (0)	--	--	--	--
W13	S10	40.0 - 41.5	2656	100	95	94	85	50	27	31	15	--	--	--	CL	SC	A-2-6 (1)	--	--	--	--
W13	S13	55.0 - 56.5	2641	100	90	88	84	63	43	31	13	-0.9	6.4	--	CL	SC	A-6 (2)	--	--	--	--
W14	R5	15.0 - 16.0	2685	84	77	71	54	21	7	NP	NP	--	--	--	ML	SW-SM	A-1-b (0)	--	--	--	--
W14	S11	45.0 - 46.5	2655	100	99	99	94	55	24	26	8	--	--	--	CL	SC	A-2-4 (0)	--	--	--	--
W15	S2	5.0 - 6.5	2694	100	98	95	90	61	39	39	18	--	--	--	CL	SC	A-6 (3)	--	--	--	--
W15	S7	25.0 - 26.5	2674	100	93	89	77	34	6	NP	NP	--	--	--	ML	SP-SM	A-1-b (0)	--	--	--	--
W16	S1	2.5 - 4.0	2701	89	84	82	75	48	25	25	6	--	--	--	CL-ML	SC-SM	A-1-b (0)	--	--	--	--
W17	S5	15.0 - 16.5	2685	100	98	97	86	36	9	NP	NP	--	1.0	--	ML	SW-SM	A-1-b (0)	--	--	--	--
W17	S10	40.0 - 41.5	2660	100	96	95	92	73	48	31	13	--	--	--	CL	SC	A-6 (3)	--	--	--	--
W19	S1	2.5 - 4.0	2700	100	99	97	91	65	39	30	9	--	--	--	CL	SC	A-4 (0)	--	--	--	--
W19	S9	35.0 - 36.5	2668	100	94	92	84	51	32	38	18	-0.9	4.2	--	CL	SC	A-2-6 (1)	--	--	--	--
W20	S5	15.0 - 16.5	2691	96	88	84	71	38	6	NP	NP	--	--	--	ML	SP-SM	A-1-b (0)	--	--	--	--

All data shown tested by **ConformaTech**.

-- Not Tested

1. Only selected sieve sizes are included here. For full sieve data refer to Table B.2.
2. A liquid limit (LL) and a plasticity index (PI) of NP indicates the material is non-plastic.

NCS Consultants, LLC

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TABLE B.1
SUMMARY OF LAB TESTING

Project: Valencia: Alvernon to Wilmot
Location: Tucson, Arizona
Client: PSOMAS

REPORT ncs_lab_summary_simple_aashto | PROJECT p:\valencia - alvernon to wilmot\grint\valencia(alvernon-wilmot).gpj | LIBRARY ncs gintlib v5.0.glb | LAST MOD 06/13/11 03:59 pm | PRINTED 06/22/11 03:44 pm

Boring	Sample	Depth (ft)	Mid-Point Elevation (ft)	Grain Size Dist. (% Passing)[1]																			
				6"	3"	2.5"	2"	1.5"	1.25"	1"	3/4"	1/2"	3/8"	1/4"	#4	#8	#10	#16	#30	#40	#50	#100	#200
B01	S4	20.0 - 21.5	2708	--	--	--	--	--	--	100	97	97	96	94	92	84	83	70	58	51	46	38	31
B01A	S4	20.0 - 21.5	2675	--	--	--	--	--	--	--	--	--	--	--	100	95	94	84	72	67	62	54	45
B01A	S7	35.0 - 36.5	2660	--	--	--	--	--	--	--	100	94	89	84	79	69	66	53	41	34	29	21	17
B01A	S11	55.0 - 56.5	2640	--	--	--	--	--	--	--	--	--	100	98	97	93	92	84	74	69	63	52	41
B01A	S13	65.0 - 66.5	2630	--	--	--	--	--	--	--	--	--	--	--	100	100	99	98	95	93	91	86	78
B02	CU1	5.0 - 10.0	2718	--	--	--	--	--	--	--	100	98	97	93	89	75	73	59	48	42	37	30	25
B02	S3	15.0 - 16.5	2711	--	--	--	--	--	--	--	--	100	100	97	95	86	84	72	59	52	46	37	30
B02A	S2	10.0 - 11.5	2685	--	--	--	--	--	--	--	100	99	99	97	97	92	91	84	74	68	60	43	31
B02A	S6	30.0 - 31.5	2665	--	--	--	--	--	--	100	94	94	93	89	86	70	67	52	36	28	20	11	7
B02A	S13	65.0 - 66.5	2630	--	--	--	--	--	--	--	--	--	--	--	100	96	96	90	82	77	71	58	43
B02A	S17	85.0 - 86.5	2610	--	--	--	--	--	--	--	--	100	100	99	97	89	86	71	57	50	44	35	28
B03	S2	10.0 - 11.5	2683	--	--	--	--	--	--	--	100	98	98	94	91	78	73	57	32	22	16	11	8
B03	S10	50.0 - 51.5	2643	--	--	--	--	--	--	--	--	100	99	97	97	93	91	85	75	70	64	51	38
B03	S19	95.0 - 96.5	2598	--	--	--	--	--	--	--	--	100	100	99	99	98	97	95	92	90	87	79	69
B03	S23	115.0 - 116.5	2578	--	--	--	--	--	--	--	--	--	100	100	99	99	98	97	92	88	82	70	58
B04	S3	15.0 - 16.5	2679	--	--	--	--	--	--	--	100	97	97	94	92	88	86	82	74	71	67	60	56
B04	S7	35.0 - 36.5	2659	--	--	--	--	--	100	96	96	94	93	92	90	86	84	80	71	66	60	50	43
B04	S16	80.0 - 81.5	2614	--	--	--	--	--	--	--	100	99	97	95	93	85	82	76	68	64	61	54	45
B04	S20	100.0 - 101.5	2594	--	--	--	--	--	--	--	--	--	100	99	98	96	95	93	88	85	81	68	52
B05	S1	5.0 - 6.5	2688	--	--	--	--	--	--	--	--	100	99	95	93	81	76	62	47	40	33	25	20
B05	S11	55.0 - 56.5	2638	--	--	--	--	--	--	--	--	--	--	100	99	97	96	92	84	79	73	59	53
B05	S15	75.0 - 76.5	2618	--	--	--	--	--	--	--	100	100	98	96	92	76	69	50	31	26	21	15	11
B06	S13	65.0 - 66.5	2629	--	--	--	--	--	--	--	--	100	99	99	99	98	98	97	94	93	90	84	74
B06	S17	85.0 - 86.5	2609	--	--	--	--	--	--	--	--	100	99	99	98	95	94	91	84	81	77	67	67
B06	S22	110.0 - 111.5	2584	--	--	--	--	--	--	--	--	100	100	99	99	98	98	96	92	89	86	77	67

All data shown tested by **ConformaTech** of **Tucson, Az**, **Brian Lasham**, lab manager.

-- Not Tested

1. Only sieve data is included here. For a summary of lab testing data, refer to Table B.1.

NCS Consultants, LLC

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06/22/2011

TABLE B.2

COMPREHENSIVE SIEVE DATA

Project: Valencia: Alvernon to Wilmot
Location: Tucson, Arizona
Client: PSOMAS

REPORT ncs_full_sieves | PROJECT p:\valencia - alvernon to wilmot\grnt\valencia(alvernon-wilmot).gpj | LIBRARY ncs grntlib v5.0.glb | LAST MOD 06/13/11 03:59 pm | PRINTED 06/22/11 03:45 pm

Boring	Sample	Depth (ft)	Mid-Point Elevation (ft)	Grain Size Dist. (% Passing)[1]																			
				6"	3"	2.5"	2"	1.5"	1.25"	1"	3/4"	1/2"	3/8"	1/4"	#4	#8	#10	#16	#30	#40	#50	#100	#200
B07	S1	5.0 - 6.5	2722	--	--	--	--	--	--	--	100	98	98	97	94	82	78	67	52	45	39	30	24
B07	S8	40.0 - 41.5	2687	--	--	--	--	--	--	--	--	100	98	94	92	85	83	78	70	66	62	52	51
B07	S12	60.0 - 61.5	2667	--	--	--	--	--	--	--	--	--	100	99	98	94	93	87	80	75	71	52	31
B07	S22	110.0 - 111.5	2617	--	--	--	--	--	100	91	91	91	91	90	90	86	85	81	75	72	68	62	61
B08	S3	15.0 - 16.5	2711	--	--	--	--	--	100	95	93	93	92	92	86	78	74	65	53	48	43	35	29
B08	S10	50.0 - 51.5	2676	--	--	--	--	--	--	100	98	98	96	93	88	73	68	53	36	29	23	15	11
B08	S16	80.0 - 81.5	2646	--	--	--	--	--	--	--	--	--	100	99	98	95	93	89	81	77	71	59	52
B08	S24	120.0 - 121.5	2606	--	--	--	--	--	--	--	100	99	99	97	96	94	92	88	78	73	68	58	55
B09	CU1	10.0 - 15.0	2687	--	--	--	--	--	--	--	100	98	97	94	92	86	84	77	68	64	59	52	45
B09	S5	12.5 - 14.0	2688	--	--	--	--	--	--	--	--	--	100	98	97	93	92	87	78	73	69	61	54
B09	S14	45.0 - 46.5	2656	--	--	--	--	--	--	--	--	100	100	99	99	97	96	94	89	86	82	74	62
B09	S17	60.0 - 61.5	2641	--	--	--	--	--	--	--	100	99	97	96	95	93	92	90	86	85	83	79	70
B09	S18	65.0 - 66.5	2636	--	--	--	--	--	--	--	100	99	98	98	97	94	93	88	78	73	67	55	42
B10	S1	2.5 - 4.0	2699	--	--	--	--	--	--	100	88	83	79	77	74	67	65	59	50	45	40	33	26
B10	S8	20.0 - 21.5	2681	--	--	--	--	--	--	--	100	97	93	89	85	76	74	64	53	49	45	38	32
B10	S9	25.0 - 26.0	2677	--	--	--	--	--	--	--	100	99	98	95	92	81	77	67	52	45	38	29	24
B10	S12	40.0 - 41.5	2661	--	--	--	--	--	--	--	--	100	98	95	92	77	74	57	40	33	26	17	11
B10	S14	50.0 - 51.5	2651	--	--	--	--	--	100	95	85	81	78	75	71	61	58	48	36	30	25	18	14
D01	S2	5.0 - 6.5	2673	--	--	--	--	--	--	--	--	--	--	100	99	95	94	89	82	79	75	65	54
D01	S4	15.0 - 16.5	2663	--	--	--	--	--	100	92	81	77	74	69	65	52	50	38	28	24	20	15	12
D02	CU1	0.0 - 5.0	2678	--	--	--	--	--	--	--	100	98	97	93	89	75	72	55	38	30	23	16	12
D02	R2	5.0 - 6.0	2677	--	--	--	--	--	--	--	--	100	99	95	92	81	79	66	50	41	32	21	15
D02	S3	10.0 - 11.5	2672	--	--	--	--	--	--	--	100	97	97	95	92	83	81	68	54	48	42	33	26
D02	S5	20.0 - 21.5	2662	--	--	--	--	--	--	--	--	--	--	--	100	98	98	96	90	87	83	75	64
P01	CU1	0.0 - 5.0	2638	--	--	--	--	--	100	92	88	84	81	77	74	64	61	54	44	39	34	27	22

All data shown tested by **ConformaTech** of **Tucson, Az**, **Brian Lasham**, lab manager.

-- Not Tested

1. Only sieve data is included here. For a summary of lab testing data, refer to Table B.1.

NCS Consultants, LLC

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06/22/2011

TABLE B.2

COMPREHENSIVE SIEVE DATA

Project: Valencia: Alvernon to Wilmot
Location: Tucson, Arizona
Client: PSOMAS

REPORT ncs_full_sieves | PROJECT p:\valencia - alvernon to wilmot\grint\valencia(alvernon-wilmot).gpj | LIBRARY ncs gintlib v5.0.glb | LAST MOD 06/13/11 03:59 pm | PRINTED 06/22/11 03:45 pm

Boring	Sample	Depth (ft)	Mid-Point Elevation (ft)	Grain Size Dist. (% Passing)[1]																			
				6"	3"	2.5"	2"	1.5"	1.25"	1"	3/4"	1/2"	3/8"	1/4"	#4	#8	#10	#16	#30	#40	#50	#100	#200
P02	CU1	0.0 - 5.0	2641	--	--	--	--	--	--	100	99	98	97	94	92	86	84	75	65	60	55	47	39
P03	CU1	0.0 - 5.0	2644	--	--	--	--	--	100	96	96	92	90	85	81	72	69	62	54	49	44	35	27
P06	CU1	0.0 - 5.0	2655	--	--	--	--	--	100	95	88	80	76	69	65	56	54	50	43	39	35	26	18
P07	CU1	0.0 - 5.0	2658	--	--	--	--	--	--	100	97	95	93	90	87	78	75	67	57	53	48	38	29
P07	R1	2.5 - 3.5	2660	--	--	--	100	79	79	79	79	78	77	75	72	64	63	54	45	41	36	28	22
P08	CU1	0.0 - 5.0	2656	--	--	--	--	--	100	96	94	93	91	87	83	71	68	56	46	42	37	30	22
P09	CU1	0.0 - 5.0	2659	--	--	--	--	--	100	98	97	95	93	88	86	77	75	68	59	54	50	40	32
P10	CU1	0.0 - 5.0	2661	--	--	--	--	--	--	100	99	98	97	95	93	87	85	79	68	63	59	50	39
P11	CU1	0.0 - 5.0	2665	--	--	--	--	--	100	96	93	92	89	85	82	73	70	62	51	46	41	33	24
P12	CU1	0.0 - 5.0	2670	--	--	--	--	--	100	99	98	92	90	85	81	69	66	59	51	47	42	34	25
P13	CU1	0.0 - 5.0	2674	--	--	--	--	--	--	100	98	97	94	92	91	85	82	73	59	53	46	36	28
P13	R1	2.5 - 3.5	2675	--	--	--	--	--	--	--	100	100	98	95	92	82	80	66	55	50	45	38	31
P14	CU1	0.0 - 5.0	2677	--	--	--	--	--	--	100	95	94	92	87	84	76	72	64	52	47	42	33	25
P15	CU1	0.0 - 5.0	2681	--	--	--	--	--	--	100	95	92	89	84	80	65	63	51	38	31	26	19	15
P16	CU1	0.0 - 5.0	2685	--	--	--	--	--	--	--	--	100	100	99	98	94	93	86	75	69	62	51	39
P17	CU1	0.0 - 5.0	2690	--	--	--	--	--	--	100	99	97	94	91	89	81	79	71	61	56	50	39	35
P18	CU1	0.0 - 5.0	2691	--	--	--	--	--	--	--	100	98	97	95	93	88	86	79	71	66	60	52	42
P18	R2	5.0 - 6.0	2690	--	--	--	--	--	--	--	100	98	98	97	97	92	92	85	77	72	68	60	52
P19	CU1	0.0 - 5.0	2691	--	--	--	--	--	--	100	99	98	98	96	93	87	85	77	65	60	55	46	36
P24	CU1	0.0 - 5.0	2707	--	--	--	--	--	--	100	99	96	94	91	88	79	77	67	56	50	45	37	29
P25	CU1	0.0 - 5.0	2705	--	--	--	--	--	100	97	96	92	90	84	80	65	62	53	44	40	36	28	21
P26	CU1	0.0 - 5.0	2707	--	--	--	--	--	--	100	99	94	90	85	80	65	61	51	39	32	27	20	15
P27	CU1	0.0 - 5.0	2710	--	--	--	--	--	--	100	97	93	90	83	77	62	59	47	38	35	31	26	21
P28	CU1	0.0 - 5.0	2712	--	--	--	--	--	--	--	100	100	97	95	93	86	84	76	63	56	51	41	34
P28	R1	2.5 - 3.5	2714	--	--	--	--	--	--	--	100	99	98	96	95	89	87	76	62	55	48	38	31

All data shown tested by **ConformaTech** of **Tucson, Az**, **Brian Lasham**, lab manager.

-- Not Tested

1. Only sieve data is included here. For a summary of lab testing data, refer to Table B.1.

NCS Consultants, LLC

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06/22/2011

TABLE B.2

COMPREHENSIVE SIEVE DATA

Project: Valencia: Alvernon to Wilmot
Location: Tucson, Arizona
Client: PSOMAS

REPORT ncs_full_sieves | PROJECT p:\valencia - alvernon to wilmot\gint\valencia(alvernon-wilmot).gpj | LIBRARY ncs gintlib v5.0.glb | LAST MOD 06/13/11 03:59 pm | PRINTED 06/22/11 03:45 pm

Boring	Sample	Depth (ft)	Mid-Point Elevation (ft)	Grain Size Dist. (% Passing)[1]																			
				6"	3"	2.5"	2"	1.5"	1.25"	1"	3/4"	1/2"	3/8"	1/4"	#4	#8	#10	#16	#30	#40	#50	#100	#200
P29	CU1	0.0 - 5.0	2721	--	--	--	--	--	--	--	100	98	96	93	91	81	79	71	62	57	53	45	36
P30	CU1	0.0 - 5.0	2724	--	--	--	--	--	--	--	100	99	97	95	93	85	84	75	64	59	54	45	36
P31	CU1	0.0 - 5.0	2725	--	--	--	--	--	--	--	100	99	97	94	91	81	78	66	54	49	43	35	30
P32	CU1	0.0 - 5.0	2728	--	--	--	--	--	--	--	100	100	99	96	93	82	79	68	57	53	49	44	37
P33	CU1	0.0 - 5.0	2732	--	--	--	--	--	--	--	100	99	98	96	94	85	82	72	58	52	47	38	28
P34	CU1	0.0 - 5.0	2736	--	--	--	--	--	--	--	100	98	97	94	92	84	81	75	66	63	59	51	41
P34	R1	2.5 - 3.5	2737	--	--	--	--	--	--	--	--	100	99	96	94	85	84	74	65	61	56	47	39
W01	S3	7.5 - 9.0	2682	--	--	--	--	--	--	100	96	91	86	82	79	68	67	56	40	30	21	12	9
W01	S8	30.0 - 31.5	2660	--	--	--	--	--	--	--	--	100	99	99	99	96	96	90	84	81	78	71	62
W02	R1	2.5 - 3.5	2690	--	--	--	--	--	--	--	100	99	98	95	92	84	80	71	58	52	47	39	33
W02	S6	20.0 - 21.5	2672	--	--	--	--	--	100	96	96	96	94	90	87	74	70	58	42	35	28	20	15
W03	S2	5.0 - 6.5	2686	--	--	--	--	--	--	--	--	--	--	100	97	93	92	85	76	70	63	50	42
W03	S11	45.0 - 46.5	2646	--	--	--	--	--	--	--	--	--	--	100	97	90	89	80	71	66	61	50	39
W04	R4	10.0 - 11.0	2683	--	--	--	--	--	--	--	100	99	98	97	96	88	84	71	50	41	33	24	20
W04	S7	25.0 - 26.5	2668	--	--	--	--	--	--	--	100	98	98	96	95	91	89	84	74	69	63	49	35
W04	S11	45.0 - 46.5	2648	--	--	--	--	--	--	--	--	100	99	98	96	91	89	82	69	62	56	46	37
W05	S6	20.0 - 21.5	2672	--	--	--	--	--	--	--	100	99	99	97	95	86	83	67	44	35	26	17	11
W05	S13	55.0 - 56.5	2637	--	--	--	--	--	--	--	100	99	99	98	98	90	88	73	55	45	37	26	19
W06	S2	5.0 - 6.5	2688	--	--	--	--	--	--	--	100	99	98	94	91	78	74	64	52	47	43	35	29
W06	S8	30.0 - 31.5	2663	--	--	--	--	--	--	100	98	96	94	90	85	67	61	45	28	22	18	13	10
W07	S8	30.0 - 31.5	2663	--	--	--	--	--	--	--	--	100	99	97	94	85	82	69	55	48	41	29	20
W08	S3	15.0 - 16.5	2679	--	--	--	--	--	--	--	--	100	99	97	94	86	82	73	59	52	46	36	26
W08	S7	35.0 - 36.5	2659	--	--	--	--	--	--	100	86	80	75	69	64	54	50	40	26	21	17	12	9
W09	S5	15.0 - 16.5	2679	--	--	--	--	--	--	--	100	97	97	94	91	81	78	66	53	46	38	26	16
W09	S11	45.0 - 46.5	2649	--	--	--	--	--	--	--	100	97	94	90	88	81	80	70	59	53	48	41	34

All data shown tested by **ConformaTech** of **Tucson, Az**, **Brian Lasham**, lab manager.

-- Not Tested

1. Only sieve data is included here. For a summary of lab testing data, refer to Table B.1.

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Sheet 4 of 5
06/22/2011

TABLE B.2

COMPREHENSIVE SIEVE DATA

Project: Valencia: Alvernon to Wilmot
Location: Tucson, Arizona
Client: PSOMAS

REPORT ncs_full_sieves | PROJECT p:\valencia - alvernon to wilmot\gint\valencia(alvernon-wilmot).gpj | LIBRARY ncs gintlib v5.0.glb | LAST MOD 06/13/11 03:59 pm | PRINTED 06/22/11 03:45 pm

Boring	Sample	Depth (ft)	Mid-Point Elevation (ft)	Grain Size Dist. (% Passing)[1]																			
				6"	3"	2.5"	2"	1.5"	1.25"	1"	3/4"	1/2"	3/8"	1/4"	#4	#8	#10	#16	#30	#40	#50	#100	#200
W10	S7	25.0 - 26.5	2670	--	--	--	--	--	--	--	--	--	--	100	99	98	98	96	92	89	86	79	71
W10	S11	45.0 - 46.5	2650	--	--	--	--	--	--	--	100	97	96	93	90	81	78	67	50	42	35	26	21
W10	S14	60.0 - 61.5	2635	--	--	--	--	--	--	100	99	96	94	89	84	70	66	54	40	34	29	22	16
W11	S7	25.0 - 26.5	2670	--	--	--	--	--	--	--	--	--	100	100	99	97	97	95	93	91	89	84	78
W11	S16	70.0 - 71.5	2625	--	--	--	--	--	--	--	100	99	99	99	98	96	95	91	84	78	71	57	44
W12	R2	5.0 - 6.0	2695	--	--	--	--	--	--	--	--	--	100	100	99	93	91	82	71	66	60	51	42
W12	S6	20.0 - 21.5	2679	--	--	--	--	--	100	92	92	91	89	86	81	66	62	46	30	23	18	11	7
W12	S16	70.0 - 71.5	2629	--	--	--	--	--	--	--	--	100	99	99	99	98	97	95	90	87	83	73	59
W13	R2	5.0 - 6.0	2691	--	--	--	--	--	--	--	100	97	97	93	90	79	77	66	57	52	46	37	29
W13	S10	40.0 - 41.5	2656	--	--	--	--	--	--	--	--	100	96	95	94	85	82	69	57	50	44	34	27
W13	S13	55.0 - 56.5	2641	--	--	--	--	--	--	--	100	94	92	90	88	84	83	77	68	63	58	51	43
W14	R5	15.0 - 16.0	2685	--	--	--	100	84	84	84	84	84	82	77	71	54	51	39	27	21	16	10	7
W14	S11	45.0 - 46.5	2655	--	--	--	--	--	--	--	--	100	100	99	99	94	92	82	65	55	45	32	24
W15	S2	5.0 - 6.5	2694	--	--	--	--	--	--	--	--	100	100	98	95	90	88	77	66	61	55	46	39
W15	S7	25.0 - 26.5	2674	--	--	--	--	--	--	--	--	100	98	93	89	77	75	60	44	34	25	12	6
W16	S1	2.5 - 4.0	2701	--	--	--	--	--	100	89	89	87	86	84	82	75	73	63	54	48	43	33	25
W17	S5	15.0 - 16.5	2685	--	--	--	--	--	--	--	--	100	100	98	97	86	83	65	45	36	26	14	9
W17	S10	40.0 - 41.5	2660	--	--	--	--	--	--	--	100	99	98	96	95	92	91	86	78	73	67	57	48
W19	S1	2.5 - 4.0	2700	--	--	--	--	--	--	--	--	100	99	99	97	91	89	79	70	65	60	50	39
W19	S9	35.0 - 36.5	2668	--	--	--	--	--	--	--	100	96	95	94	92	84	82	69	57	51	46	38	32
W20	S5	15.0 - 16.5	2691	--	--	--	--	--	--	100	96	94	92	88	84	71	69	58	46	38	26	12	6

All data shown tested by **ConformaTech** of **Tucson, Az**, **Brian Lasham**, lab manager.

-- Not Tested

1. Only sieve data is included here. For a summary of lab testing data, refer to Table B.1.

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Sheet 5 of 5
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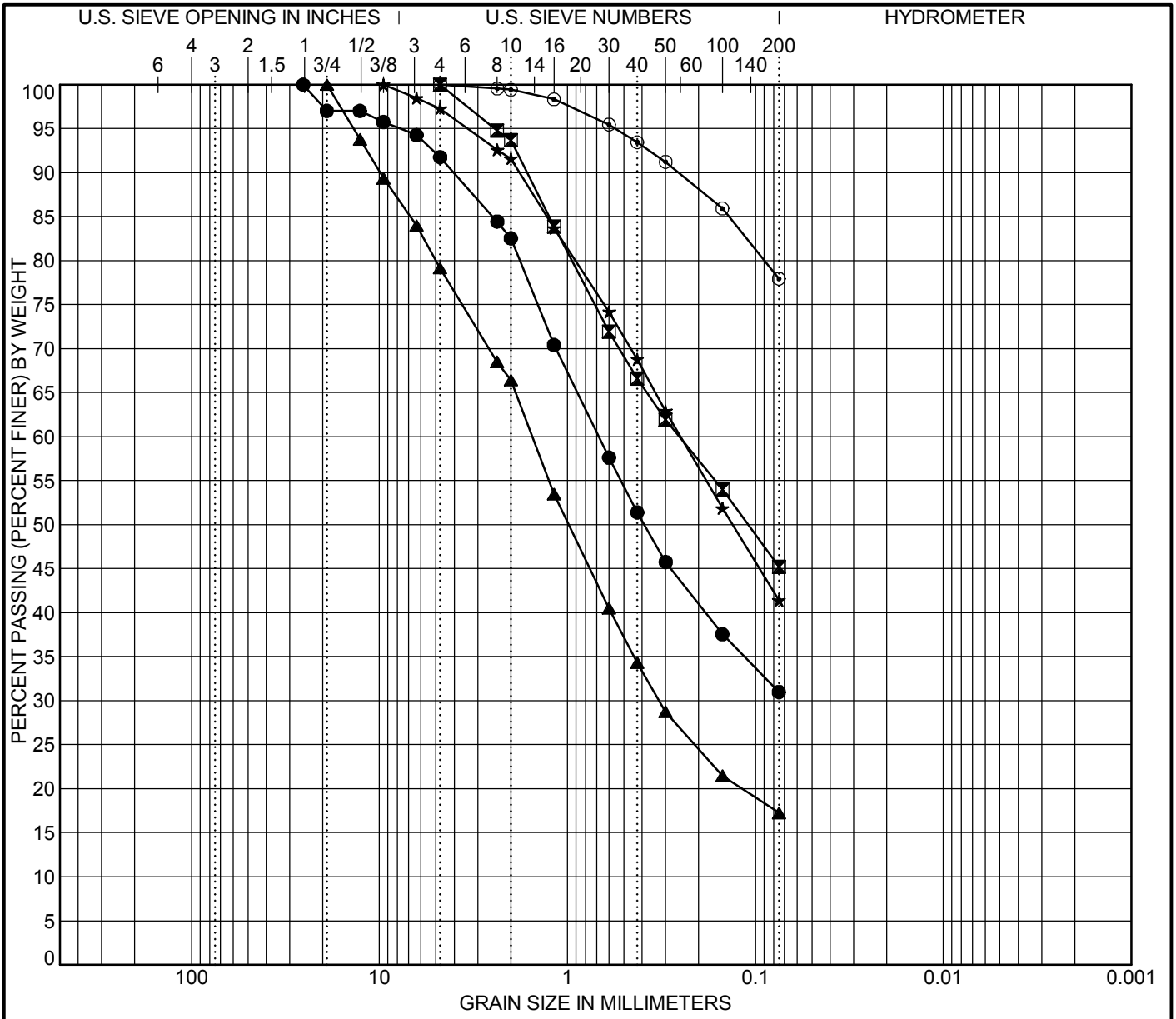
TABLE B.2
COMPREHENSIVE SIEVE DATA

Project: Valencia: Alvernon to Wilmot
Location: Tucson, Arizona
Client: PSOMAS

REPORT ncs_full_sieves | PROJECT p:\valencia - alvernon to wilmot\gint\valencia(alvernon-wilmot).gpj | LIBRARY ncs gintlib v5.0.glb | LAST MOD 06/13/11 03:59 pm | PRINTED 06/22/11 03:45 pm



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	B01	S4	20.0 - 21.5	1.00	2.548	0.717	0.395						33	18	15
⊠	B01A	S4	20.0 - 21.5	0.19	1.277	0.265	0.117						29	19	10
▲	B01A	S7	35.0 - 36.5	0.75	6.955	1.615	1.040	0.330					22	19	3
★	B01A	S11	55.0 - 56.5	0.38	1.321	0.263	0.138						35	20	15
⊙	B01A	S13	65.0 - 66.5	0.19	0.142								29	16	13

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	B01	S4	20.0 - 21.5	0.0	8.2		60.8			31.0		CL	SC	Clayey Sand
					3.0	5.2	9.2	31.1	20.4					
⊠	B01A	S4	20.0 - 21.5	0.0	0.0		54.8			45.2		CL	SC	Clayey Sand
					0.0	0.0	6.3	27.1	21.4					
▲	B01A	S7	35.0 - 36.5	0.0	20.9		61.9			17.2		ML	SM	Silty Sand With Gravel
					0.0	20.9	12.7	32.1	17.1					
★	B01A	S11	55.0 - 56.5	0.0	2.7		55.9			41.4		CL	SC	Clayey Sand
					0.0	2.7	5.7	22.8	27.4					
⊙	B01A	S13	65.0 - 66.5	0.0	0.0		22.0			78.0		CL	CL	Lean Clay With Sand
					0.0	0.0	0.6	6.0	15.5					

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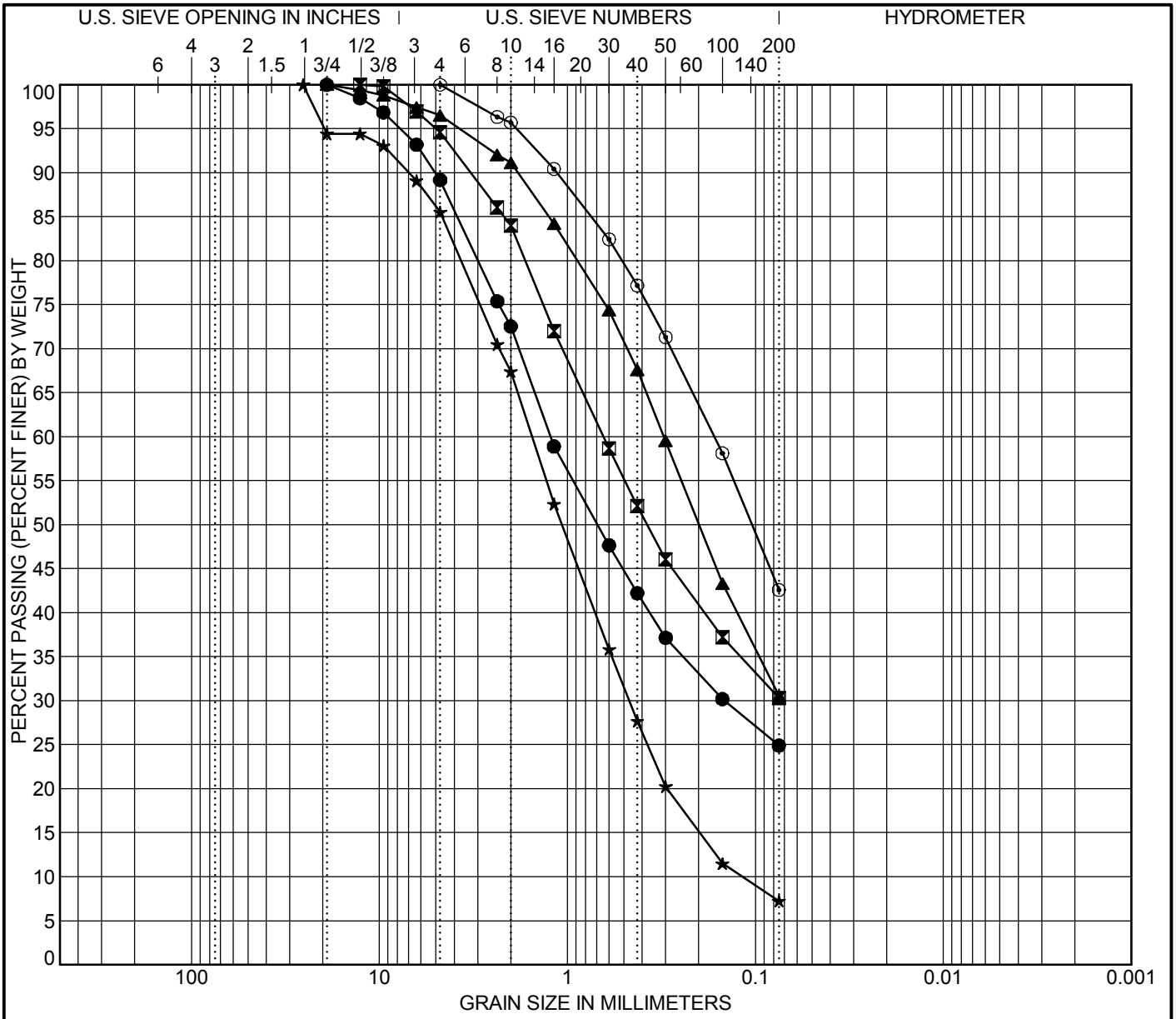
Project: Valencia: Alvernon to Wilmot
Location: Tucson, Arizona
NCS Project Number: J2010-09

Based on Laboratory Data From:
ConformaTech
Brian Lasham, Lab Manager

GRAIN SIZE DISTRIBUTION

1. *Italicized* text indicates no plasticity tests were performed, and field classification of fines was required for USCS classification.

REPORT ncs_grain_size_straight | PROJECT p:\valencia - alvernon to wilmot\grint\valencia(alvernon-wilmot).gpj | LIBRARY ncs gintlib v5.0.glb | LAST MOD 06/19/11 03:07 pm | PRINTED 06/22/11 03:45 pm



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	B02	CU1	5.0 - 10.0	0.75	4.067	1.253	0.732	0.148					25	17	8
⊠	B02	S3	15.0 - 16.5	0.50	2.174	0.664	0.383						31	18	13
▲	B02A	S2	10.0 - 11.5	0.75	1.277	0.308	0.218						27	16	11
★	B02A	S6	30.0 - 31.5	1.00	4.670	1.622	1.109	0.479	0.221	0.118	1.199	13.746	NP	NP	NP
⊙	B02A	S13	65.0 - 66.5	0.19	0.792	0.173	0.114						25	20	5

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	B02	CU1	5.0 - 10.0	0.0	10.8		64.3			24.9		CL	SC	Clayey Sand
					0.0	10.8	16.7	30.3	17.3					
⊠	B02	S3	15.0 - 16.5	0.0	5.4		64.3			30.3		CL	SC	Clayey Sand
					0.0	5.4	10.6	31.9	21.8					
▲	B02A	S2	10.0 - 11.5	0.0	3.5		66.0			30.5		CL	SC	Clayey Sand
					0.0	3.5	5.4	23.5	37.1					
★	B02A	S6	30.0 - 31.5	0.0	14.4		78.3			7.2		ML	SW-SM	Well-Graded Sand With Silt
					5.6	8.9	18.1	39.7	20.5					
⊙	B02A	S13	65.0 - 66.5	0.0	0.0		57.4			42.6		CL-ML	SC-SM	Silty, Clayey Sand
					0.0	0.0	4.3	18.5	34.6					

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Project: Valencia: Alvernon to Wilmot
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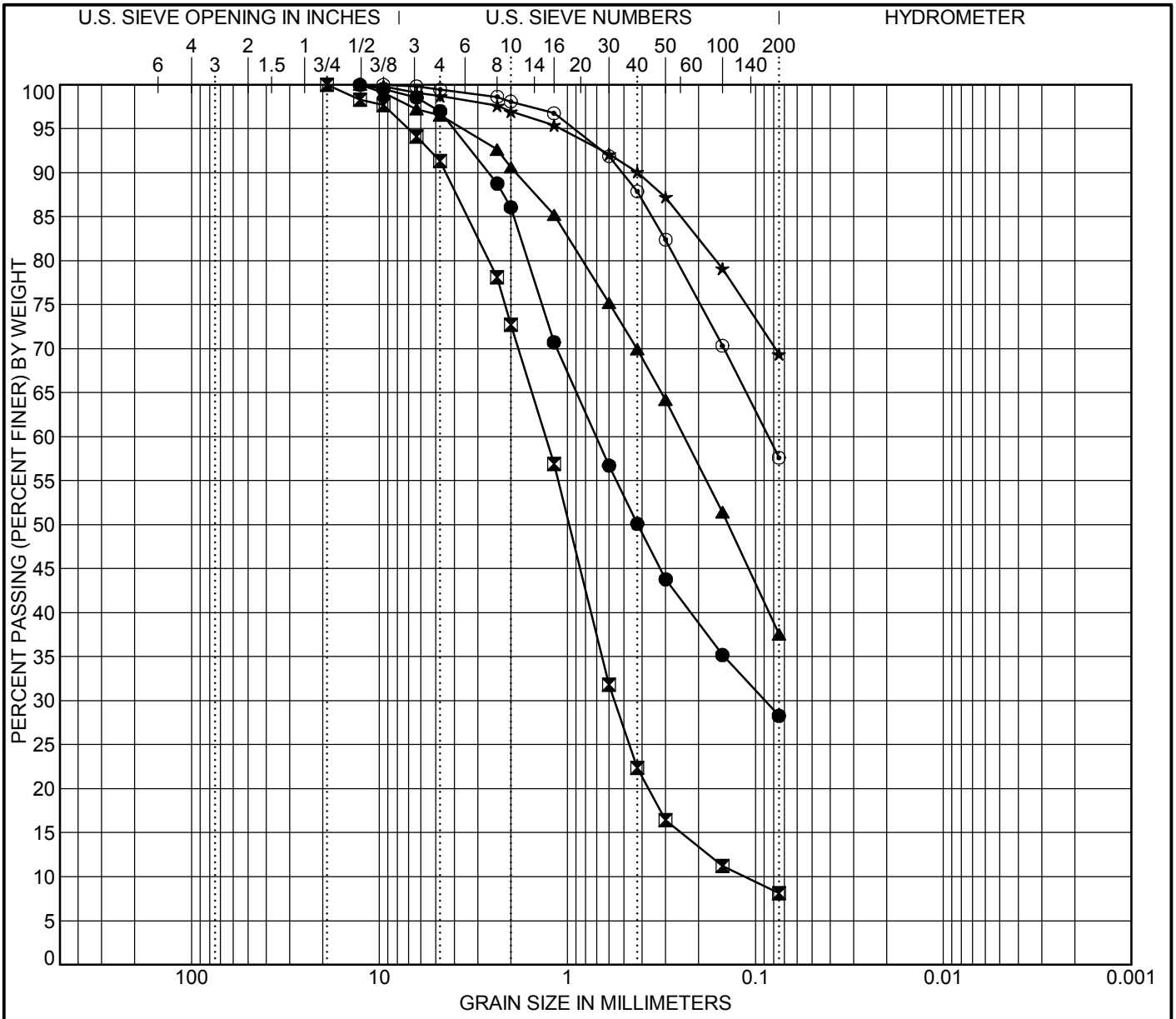
ConformaTech
Brian Lasham, Lab Manager

GRAIN SIZE DISTRIBUTION

1. *Italicized* text indicates no plasticity tests were performed, and field classification of fines was required for USCS classification.

REPORT ncs_grain_size_straight | PROJECT p:\valencia - alvernon to wilmot\grint\valencia(alvernon-wilmot).gpj | LIBRARY ncs gintlib v5.0.glb | LAST MOD 06/21/11 04:50 pm | PRINTED 06/22/11 03:45 pm



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	B02A	S17	85.0 - 86.5	0.50	1.948	0.748	0.423	0.095					35	20	15
⊠	B03	S2	10.0 - 11.5	0.75	3.651	1.358	1.051	0.571	0.265	0.114	2.106	11.912	42	22	20
▲	B03	S10	50.0 - 51.5	0.50	1.168	0.254	0.143						26	19	7
★	B03	S19	95.0 - 96.5	0.50	0.260								36	23	13
⊙	B03	S23	115.0 - 116.5	0.38	0.360	0.090							24	20	4

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	B02A	S17	85.0 - 86.5	0.0	3.0		68.7			28.3		CL	SC	Clayey Sand
					0.0	3.0	10.9	36.0	21.8					
⊠	B03	S2	10.0 - 11.5	0.0	8.6		83.2			8.2		CL	SW-SC	Well-Graded Sand With Clay
					0.0	8.6	18.6	50.4	14.2					
▲	B03	S10	50.0 - 51.5	0.0	3.5		59.0			37.6		CL	SC-SM	Silty, Clayey Sand
					0.0	3.5	5.9	20.7	32.4					
★	B03	S19	95.0 - 96.5	0.0	1.3		29.3			69.4		CL	CL	Sandy Lean Clay
					0.0	1.3	1.7	6.9	20.7					
⊙	B03	S23	115.0 - 116.5	0.0	0.5		41.8			57.6		CL-ML	CL-ML	Sandy Silty Clay
					0.0	0.5	1.4	10.2	30.3					

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Brian Lasham, Lab Manager

GRAIN SIZE DISTRIBUTION

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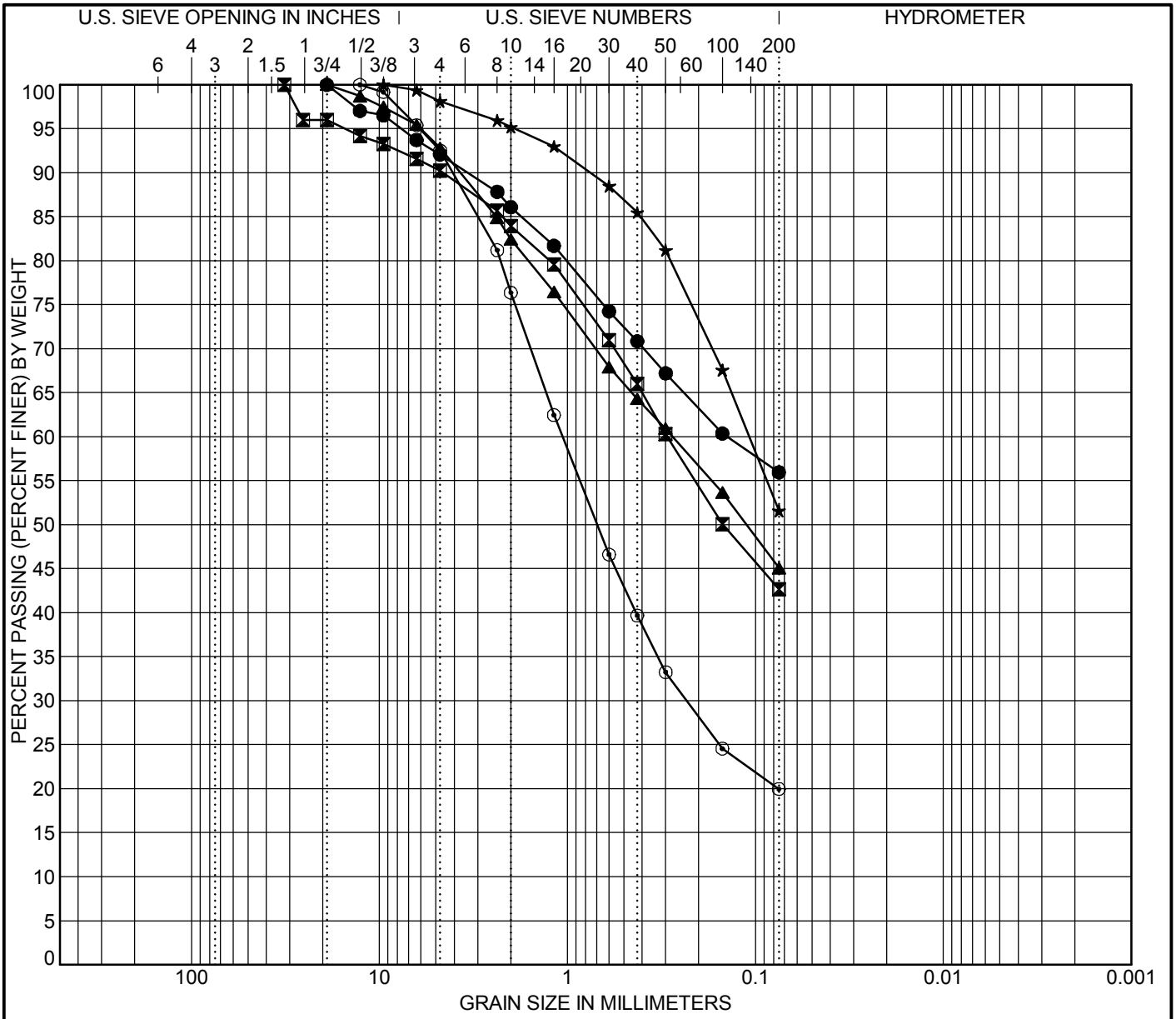
REPORT ncs_grain_size_straight | PROJECT p:\valencia - alvernon to wilmot\grint\valencia(alvernon-wilmot).gpj | LIBRARY ncs gintlib v5.0.glb | LAST MOD 06/19/11 04:47 pm | PRINTED 06/22/11 03:45 pm



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	B04	S3	15.0 - 16.5	0.75	1.801	0.144							32	18	14
⊠	B04	S7	35.0 - 36.5	1.26	2.218	0.296	0.150						26	16	10
▲	B04	S16	80.0 - 81.5	0.75	2.394	0.282	0.120						27	19	8
★	B04	S20	100.0 - 101.5	0.38	0.411	0.117							30	19	11
⊙	B05	S1	5.0 - 6.5	0.50	3.199	1.101	0.739	0.249					40	34	6

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	B04	S3	15.0 - 16.5	0.0	7.9		36.1			55.9		CL	CL	Sandy Lean Clay
					0.0	7.9	6.0	15.2	14.9					
⊠	B04	S7	35.0 - 36.5	0.0	9.7		47.6			42.7		CL	SC	Clayey Sand
					4.0	5.7	6.3	17.9	23.3					
▲	B04	S16	80.0 - 81.5	0.0	7.2		47.7			45.1		CL	SC	Clayey Sand
					0.0	7.2	10.4	18.1	19.2					
★	B04	S20	100.0 - 101.5	0.0	1.9		46.5			51.6		CL	CL	Sandy Lean Clay
					0.0	1.9	2.9	9.7	33.9					
⊙	B05	S1	5.0 - 6.5	0.0	7.5		72.6			20.0		ML	SM	Silty Sand
					0.0	7.5	16.1	36.7	19.7					

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Project: Valencia: Alvernon to Wilmot
Location: Tucson, Arizona
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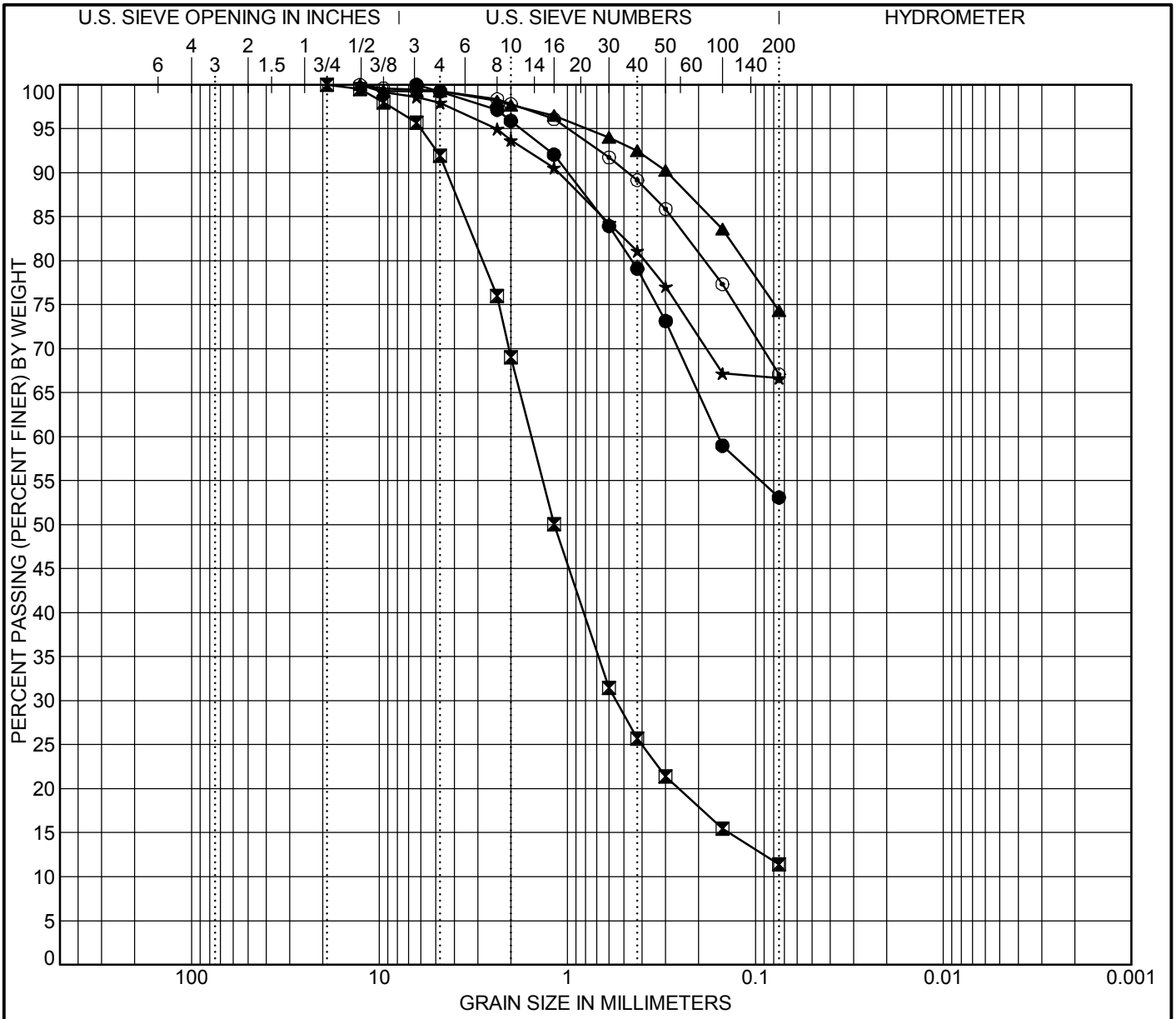
Based on Laboratory Data From:
ConformaTech
Brian Lasham, Lab Manager

GRAIN SIZE DISTRIBUTION

1. *Italicized* text indicates no plasticity tests were performed, and field classification of fines was required for USCS classification.

REPORT ncs_grain_size_straight | PROJECT p:\valencia - alvernon to wilmot\grint\valencia(alvernon-wilmot).gpj | LIBRARY ncs gintlib v5.0.glb | LAST MOD 06/20/11 11:05 am | PRINTED 06/22/11 03:45 pm



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	B05	S11	55.0 - 56.5	0.25	0.679	0.162							29	19	10
⊠	B05	S15	75.0 - 76.5	0.75	3.764	1.641	1.178	0.559	0.143				26	17	9
▲	B06	S13	65.0 - 66.5	0.50	0.183								35	22	13
★	B06	S17	85.0 - 86.5	0.50	0.671								26	20	6
⊙	B06	S22	110.0 - 111.5	0.50	0.285								28	20	8

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	B05	S11	55.0 - 56.5	0.0	0.8		3.3	46.1	26.0	53.1		CL	CL	Sandy Lean Clay
					0.0	0.8		16.8						
⊠	B05	S15	75.0 - 76.5	0.0	8.0		22.9	80.6	14.3	11.4		CL	SP-SC	Poorly Graded Sand With Clay
					0.0	8.0		43.4						
▲	B06	S13	65.0 - 66.5	0.0	0.7		1.6	25.0	18.2	74.3		CL	CL	Lean Clay With Sand
					0.0	0.7		5.2						
★	B06	S17	85.0 - 86.5	0.0	2.1		4.3	31.3	14.4	66.7		CL-ML	CL-ML	Sandy Silty Clay
					0.0	2.1		12.6						
⊙	B06	S22	110.0 - 111.5	0.0	0.8		1.4	32.2	22.1	67.1		CL	CL	Sandy Lean Clay
					0.0	0.8		8.7						

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Project: Valencia: Alvernon to Wilmot
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Brian Lasham, Lab Manager

GRAIN SIZE DISTRIBUTION

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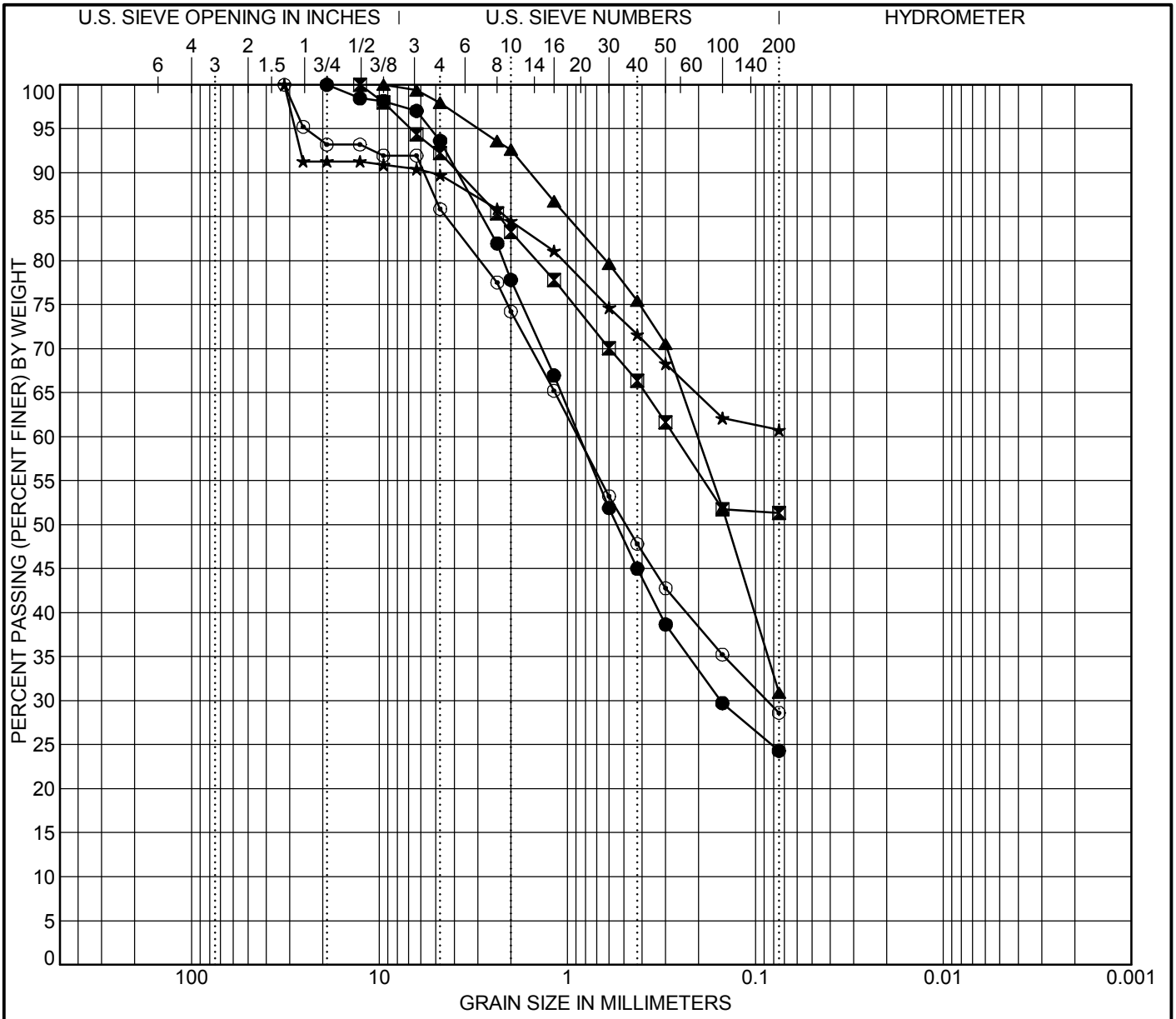
REPORT ncs_grain_size_straight | PROJECT p:\valencia - alvernon to wilmot\grint\valencia(alvernon-wilmot).gpj | LIBRARY ncs gintlib v5.0.glb | LAST MOD 06/20/11 11:06 am | PRINTED 06/22/11 03:46 pm



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	B07	S1	5.0 - 6.5	0.75	3.013	0.930	0.554	0.155					21	17	4
⊠	B07	S8	40.0 - 41.5	0.50	2.292	0.277							36	22	14
▲	B07	S12	60.0 - 61.5	0.38	1.041	0.221	0.145						NP	NP	NP
★	B07	S22	110.0 - 111.5	1.26	2.127								33	20	13
⊙	B08	S3	15.0 - 16.5	1.26	4.509	0.942	0.498	0.092					28	17	11

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	B07	S1	5.0 - 6.5	0.0	6.4		69.3			24.3		CL-ML	SC-SM	Silty, Clayey Sand
					0.0	6.4	15.8	32.8	20.7					
⊠	B07	S8	40.0 - 41.5	0.0	7.8		40.9			51.4		CL	CL	Sandy Lean Clay
					0.0	7.8	9.0	16.9	15.0					
▲	B07	S12	60.0 - 61.5	0.0	2.0		67.1			30.9		ML	SM	Silty Sand
					0.0	2.0	5.3	17.2	44.5					
★	B07	S22	110.0 - 111.5	0.0	10.3		29.0			60.8		CL	CL	Sandy Lean Clay
					8.7	1.6	5.2	12.9	10.8					
⊙	B08	S3	15.0 - 16.5	0.0	14.1		57.3			28.6		CL	SC	Clayey Sand
					6.8	7.3	11.7	26.4	19.2					

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Brian Lasham, Lab Manager

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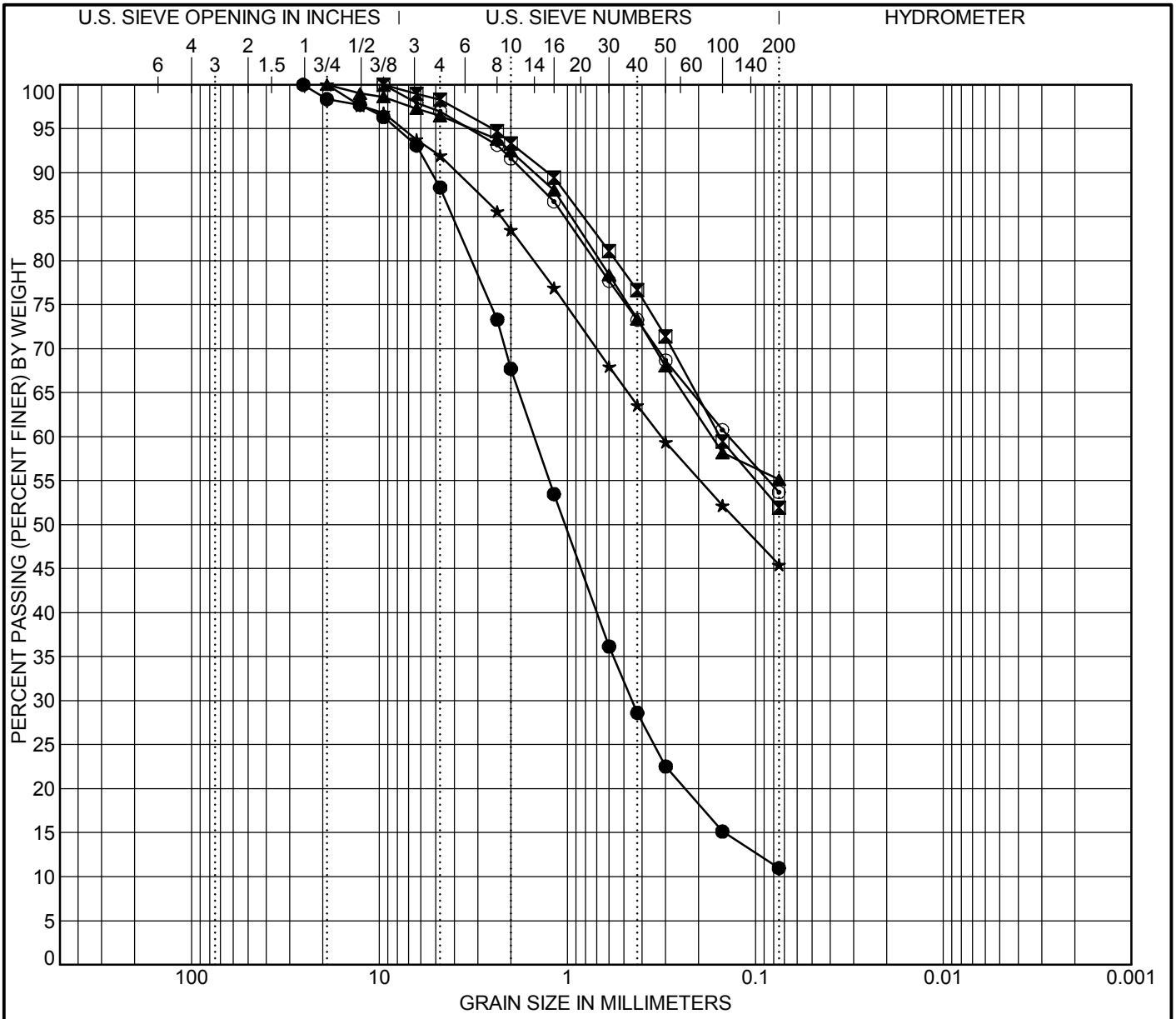

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	B08	S10	50.0 - 51.5	1.00	4.257	1.580	1.080	0.460	0.148				NP	NP	NP
⊠	B08	S16	80.0 - 81.5	0.38	0.878	0.158							28	20	8
▲	B08	S24	120.0 - 121.5	0.75	1.005	0.180							31	20	11
★	B09	CU1	10.0 - 15.0	0.75	2.257	0.319	0.127						45	18	27
⊙	B09	S5	12.5 - 14.0	0.38	1.074	0.142							32	17	15

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	B08	S10	50.0 - 51.5	0.0	11.7		20.6	77.4	17.6	11.0		ML	SW-SM	Well-Graded Sand With Silt
					1.6	10.0		39.1						
⊠	B08	S16	80.0 - 81.5	0.0	1.7		4.9	46.3	24.7	51.9		CL	CL	Sandy Lean Clay
					0.0	1.7		16.7						
▲	B08	S24	120.0 - 121.5	0.0	3.5		4.0	41.3	18.2	55.1		CL	CL	Sandy Lean Clay
					0.0	3.5		19.1						
★	B09	CU1	10.0 - 15.0	0.0	8.1		8.4	46.5	18.1	45.4		CL	SC	Clayey Sand
					0.0	8.1		19.9						
⊙	B09	S5	12.5 - 14.0	0.0	3.0		5.4	43.3	19.6	53.7		CL	CL	Sandy Lean Clay
					0.0	3.0		18.3						

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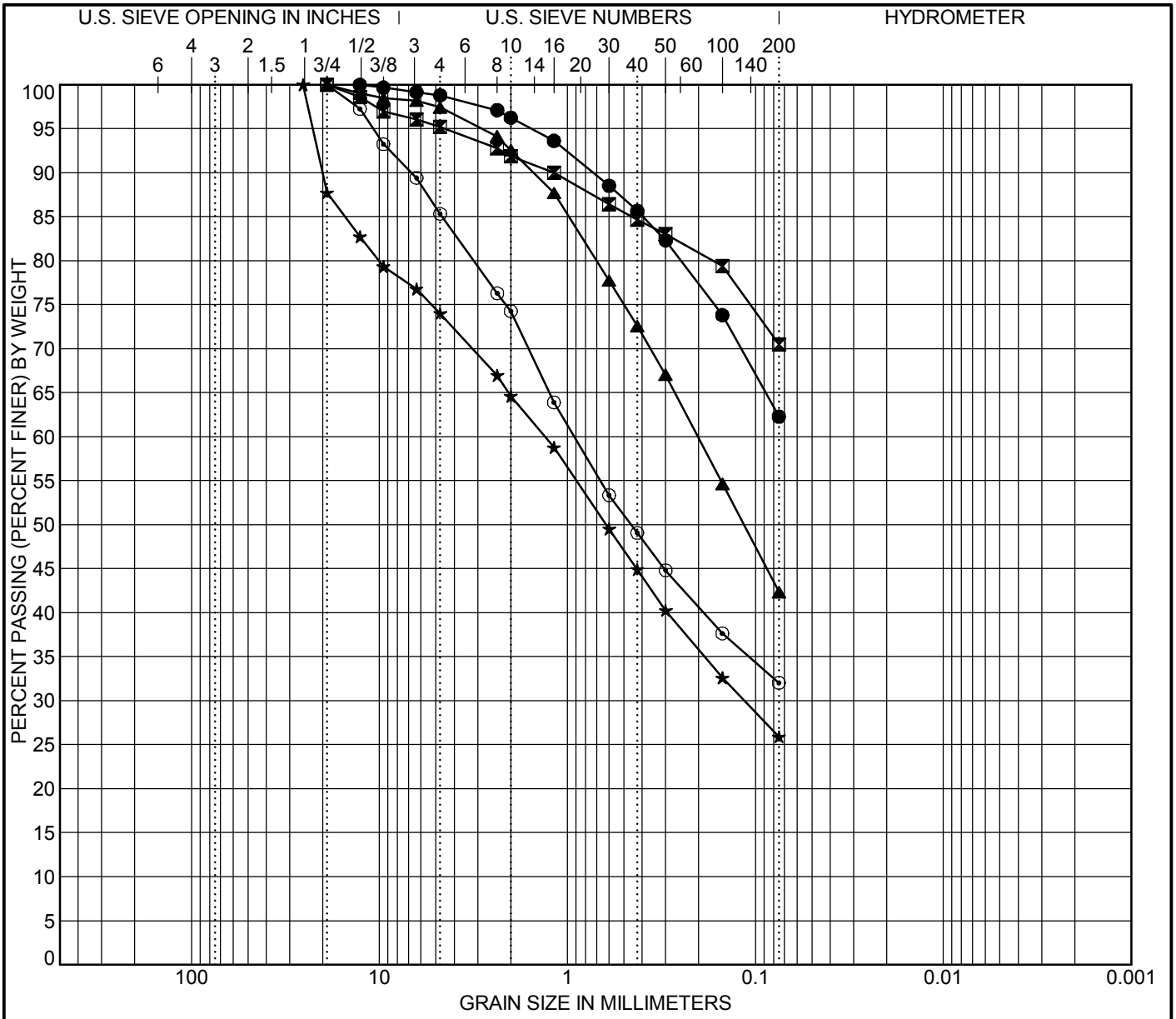

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	B09	S14	45.0 - 46.5	0.50	0.400								25	19	6
⊠	B09	S17	60.0 - 61.5	0.75	0.459								NP	NP	NP
▲	B09	S18	65.0 - 66.5	0.75	1.030	0.218	0.124						26	17	9
★	B10	S1	2.5 - 4.0	1.00	15.623	1.358	0.633	0.123					33	22	11
⊙	B10	S8	20.0 - 21.5	0.75	4.669	0.978	0.464						35	26	9

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	B09	S14	45.0 - 46.5	0.0	1.2		36.5			62.3		CL-ML	CL-ML	Sandy Silty Clay
					0.0	1.2	2.5	10.6	23.4					
⊠	B09	S17	60.0 - 61.5	0.0	4.8		24.7			70.5		ML	ML	Silt With Sand
					0.0	4.8	3.3	7.2	14.2					
▲	B09	S18	65.0 - 66.5	0.0	2.6		55.1			42.4		CL	SC	Clayey Sand
					0.0	2.6	4.9	20.0	30.2					
★	B10	S1	2.5 - 4.0	0.0	26.0		48.1			25.9		CL	SC	Clayey Sand With Gravel
					12.3	13.7	9.4	19.7	19.0					
⊙	B10	S8	20.0 - 21.5	0.0	14.7		53.3			32.0		ML	SM	Silty Sand
					0.0	14.7	11.1	25.2	17.0					

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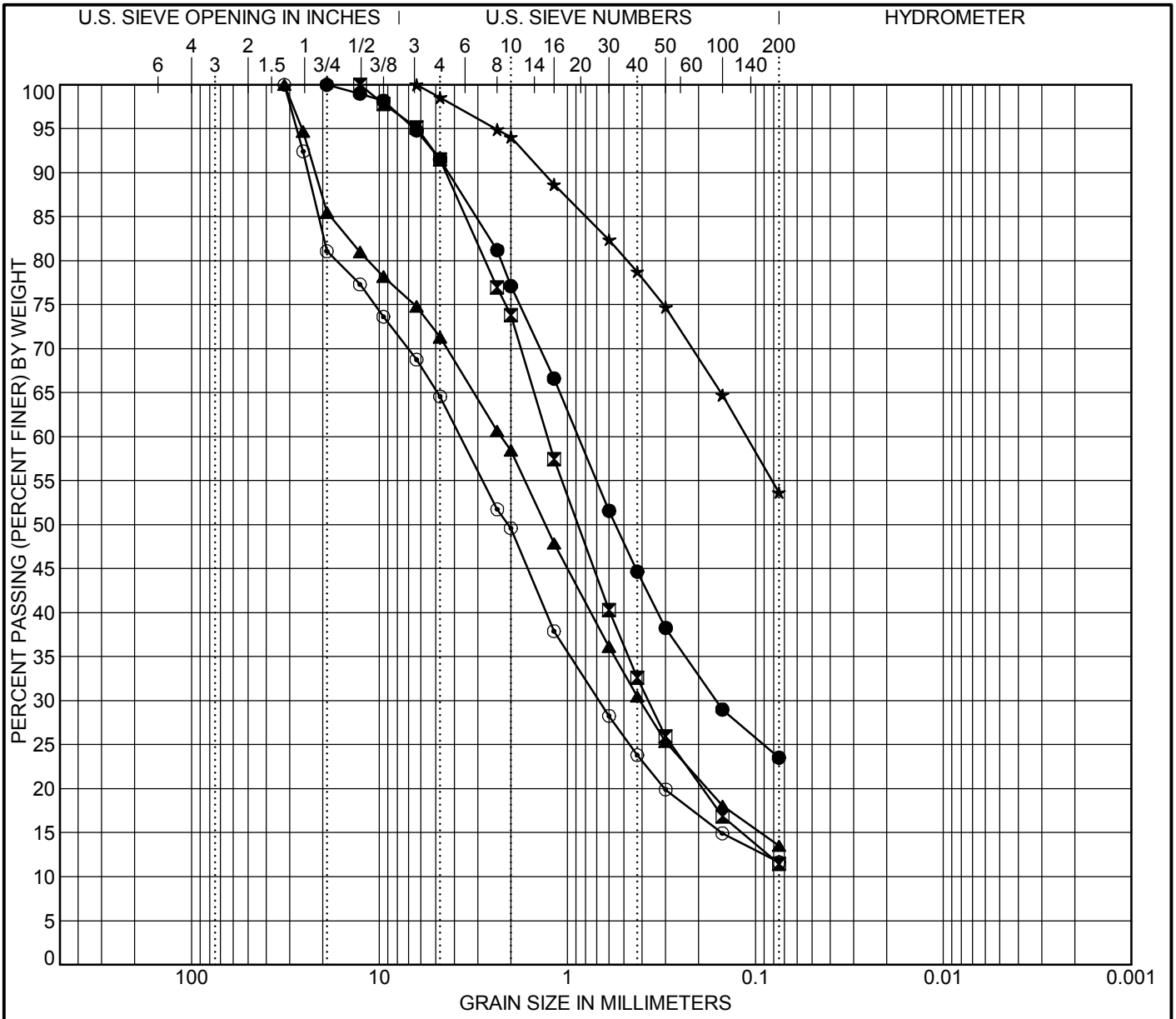

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	B10	S9	25.0 - 26.0	0.75	3.274	0.943	0.562	0.168					27	18	9
⊠	B10	S12	40.0 - 41.5	0.50	3.730	1.323	0.953	0.380	0.127				NP	NP	NP
▲	B10	S14	50.0 - 51.5	1.26	18.375	2.253	1.358	0.414	0.102				NP	NP	NP
★	D01	S2	5.0 - 6.5	0.25	0.847	0.120							27	19	8
⊙	D01	S4	15.0 - 16.5	1.26	21.340	3.957	2.068	0.717	0.153				NP	NP	NP

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	B10	S9	25.0 - 26.0	0.0	8.5		68.0			23.5		CL	SC	Clayey Sand
					0.0	8.5	14.4	32.5	21.1					
⊠	B10	S12	40.0 - 41.5	0.0	8.5		80.1			11.5		ML	SW-SM	Well-Graded Sand With Silt
					0.0	8.5	17.7	41.2	21.1					
▲	B10	S14	50.0 - 51.5	0.0	28.7		57.8			13.5		ML	SM	Silty Sand With Gravel
					14.5	14.2	12.9	28.0	17.0					
★	D01	S2	5.0 - 6.5	0.0	1.4		44.9			53.7		CL	CL	Sandy Lean Clay
					0.0	1.4	4.5	15.3	25.1					
⊙	D01	S4	15.0 - 16.5	0.0	35.4		52.9			11.6		ML	SW-SM	Well-Graded Sand With Silt And Gravel
					18.9	16.5	15.0	25.8	12.2					

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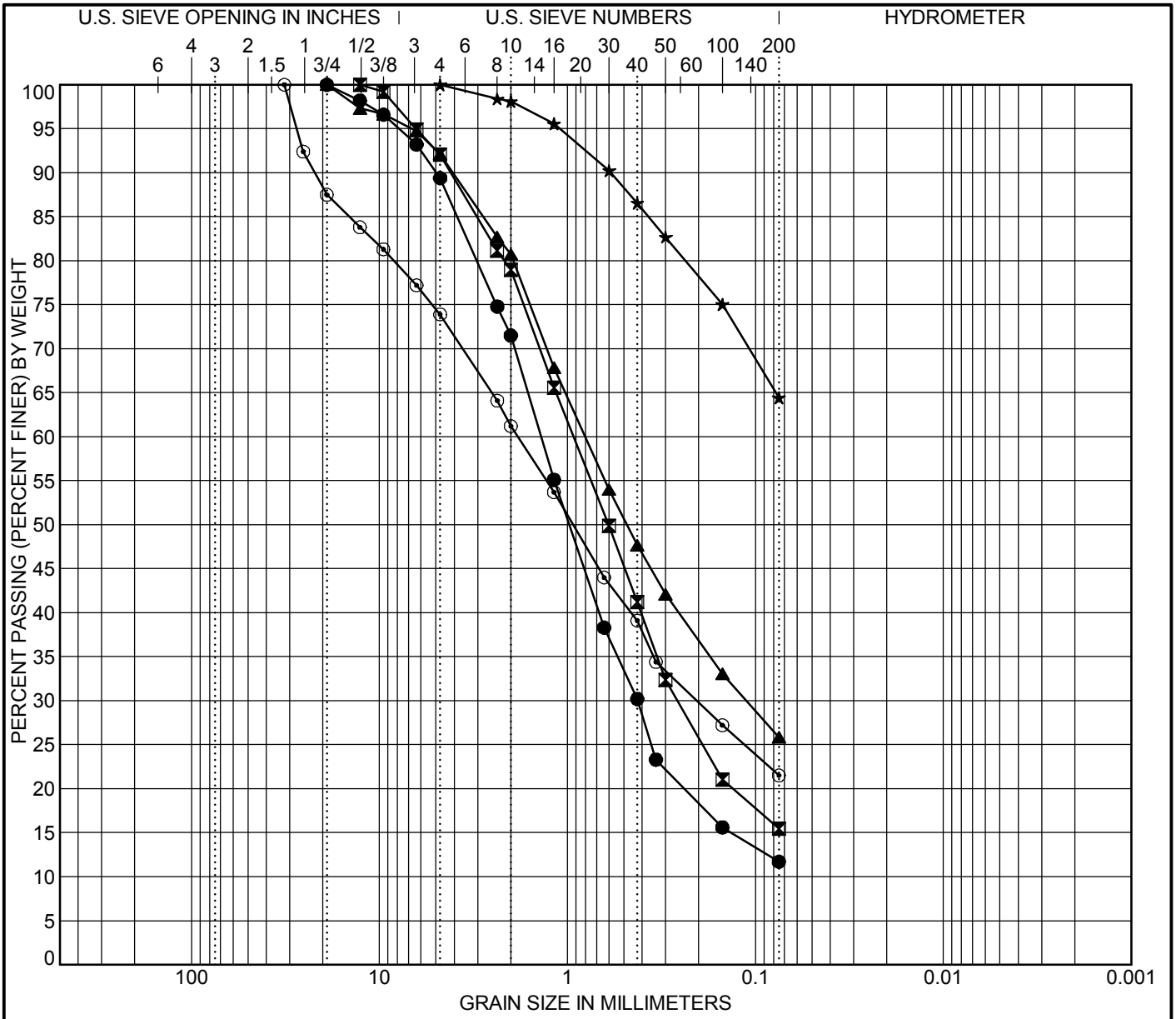

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	D02	CU1	0.0 - 5.0	0.75	4.073	1.448	1.035	0.423	0.140				NP	NP	NP
⊠	D02	R2	5.0 - 6.0	0.50	3.238	0.992	0.605	0.274					NP	NP	NP
▲	D02	S3	10.0 - 11.5	0.75	2.963	0.868	0.492	0.121					25	21	4
★	D02	S5	20.0 - 21.5	0.19	0.375								30	16	14
⊙	P01	CU1	0.0 - 5.0	1.26	14.790	1.876	0.986	0.228					34	20	14

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	D02	CU1	0.0 - 5.0	0.0	10.6		77.7			11.7		ML	SW-SM	Well-Graded Sand With Silt
					0.0	10.6	17.9	41.3	18.5					
⊠	D02	R2	5.0 - 6.0	0.0	7.9		76.6			15.5		ML	SM	Silty Sand
					0.0	7.9	13.1	37.8	25.8					
▲	D02	S3	10.0 - 11.5	0.0	7.9		66.3			25.8		CL-ML	SC-SM	Silty, Clayey Sand
					0.0	7.9	11.4	33.0	21.8					
★	D02	S5	20.0 - 21.5	0.0	0.0		35.6			64.4		CL	CL	Sandy Lean Clay
					0.0	0.0	1.9	11.6	22.1					
⊙	P01	CU1	0.0 - 5.0	0.0	26.1		52.4			21.5		CL	SC	Clayey Sand With Gravel
					12.5	13.6	12.7	22.1	17.6					

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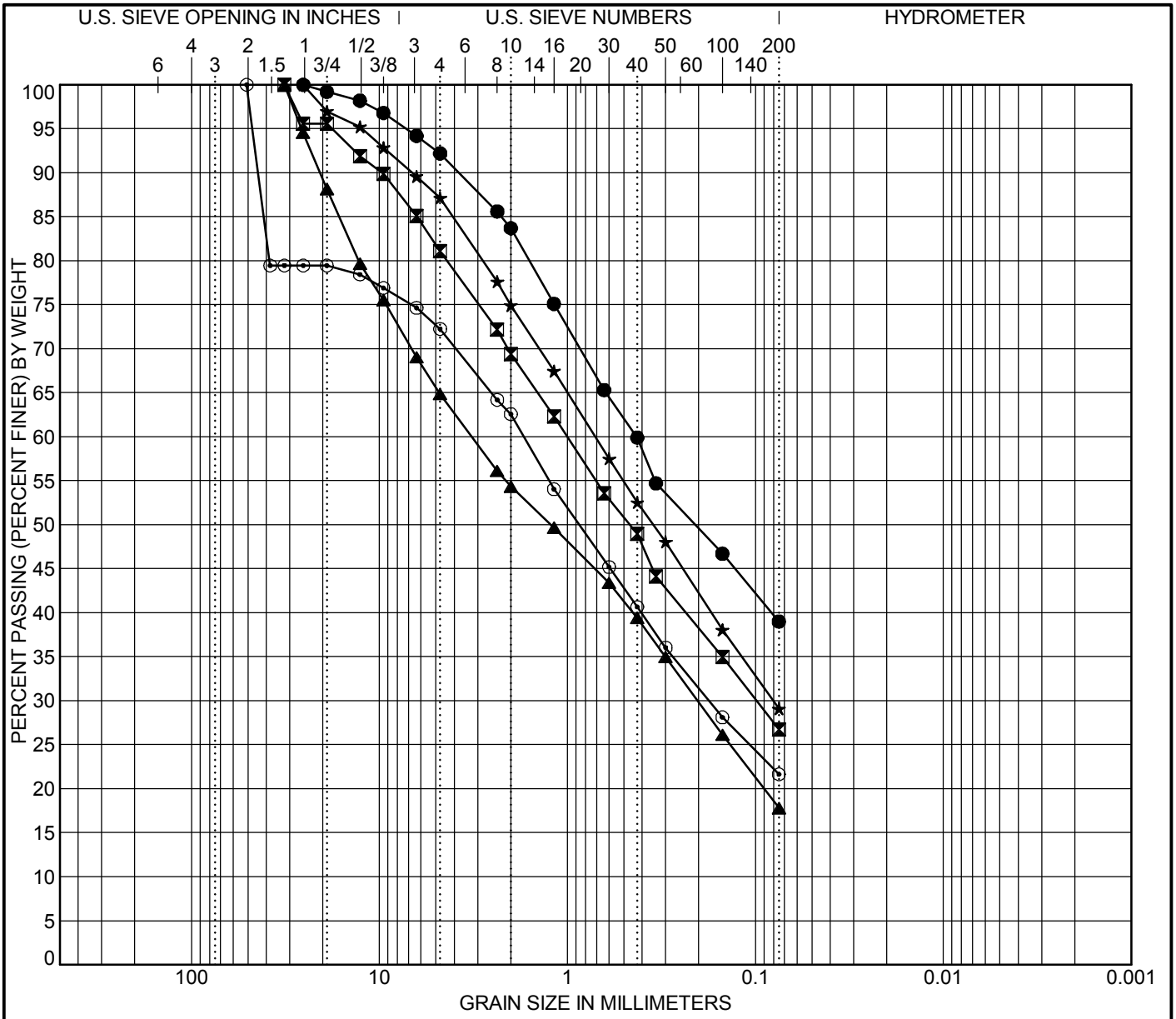

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	P02	CU1	0.0 - 5.0	1.00	2.247	0.429	0.231						29	17	12
⊠	P03	CU1	0.0 - 5.0	1.26	6.311	1.044	0.473	0.107					27	21	6
▲	P06	CU1	0.0 - 5.0	1.26	16.779	3.464	1.245	0.221					27	22	5
★	P07	CU1	0.0 - 5.0	1.00	4.235	0.755	0.356	0.084					29	20	9
⊙	P07	R1	2.5 - 3.5	2.00	41.823	1.765	0.928	0.189					27	20	7

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	P02	CU1	0.0 - 5.0	0.0	7.8		53.2			39.0		CL	SC	Clayey Sand
					0.8	7.0	8.5	23.8	20.9					
⊠	P03	CU1	0.0 - 5.0	0.0	18.9		54.4			26.7		CL-ML	SC-SM	Silty, Clayey Sand With Gravel
					4.4	14.5	11.7	20.4	22.3					
▲	P06	CU1	0.0 - 5.0	0.0	35.1		47.1			17.8		ML	SM	Silty Sand With Gravel
					11.9	23.3	10.5	14.9	21.6					
★	P07	CU1	0.0 - 5.0	0.0	12.9		58.1			29.1		CL	SC	Clayey Sand
					3.0	9.8	12.2	22.4	23.4					
⊙	P07	R1	2.5 - 3.5	0.0	27.8		50.6			21.6		CL	SC-SM	Silty, Clayey Sand With Gravel
					20.5	7.2	9.7	21.9	19.0					

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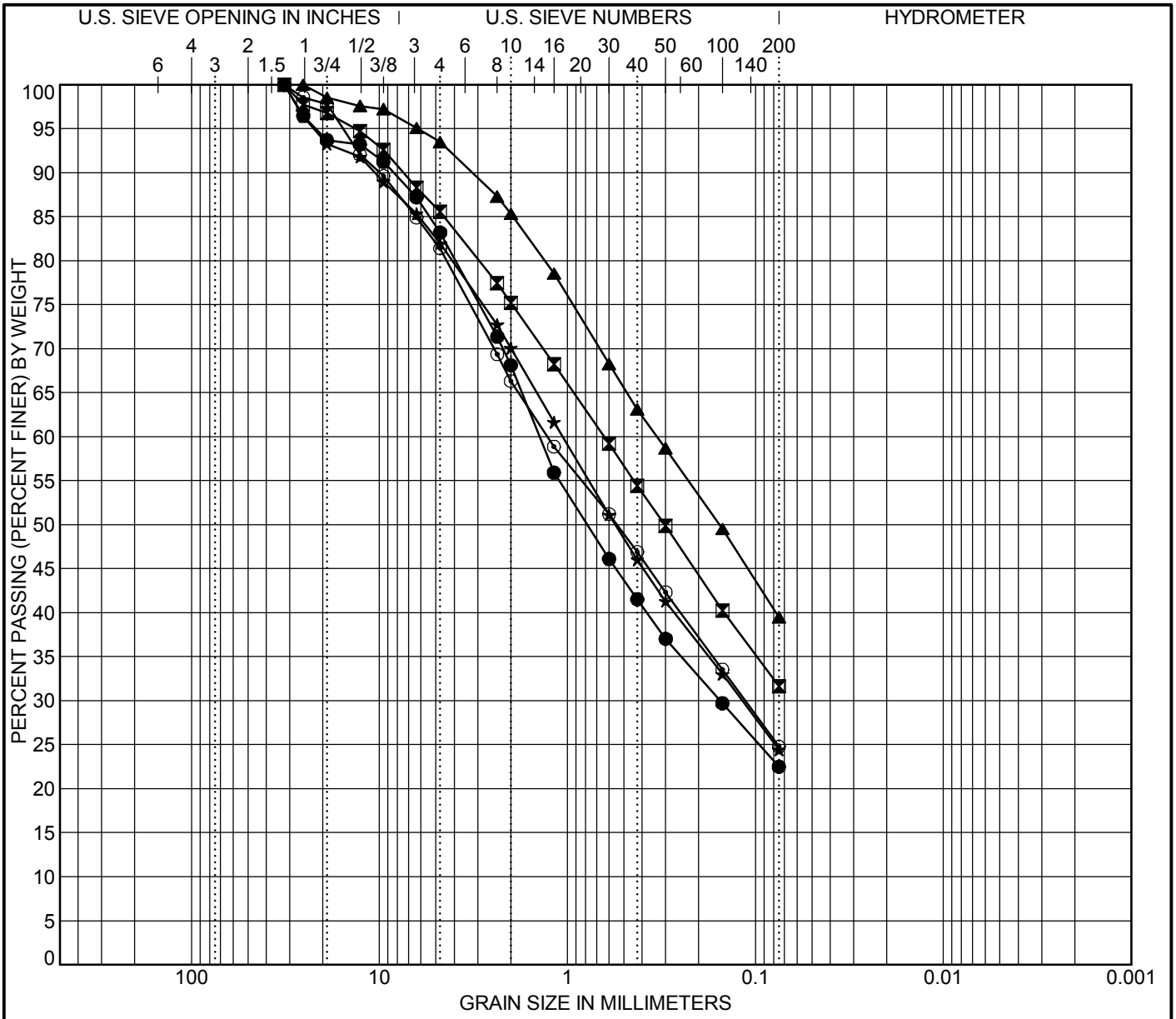

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	P08	CU1	0.0 - 5.0	1.26	5.479	1.473	0.844	0.157					24	17	7
⊠	P09	CU1	0.0 - 5.0	1.26	4.590	0.652	0.304						41	18	23
▲	P10	CU1	0.0 - 5.0	1.00	1.961	0.338	0.159						37	16	21
★	P11	CU1	0.0 - 5.0	1.26	6.193	1.096	0.563	0.126					33	19	14
⊙	P12	CU1	0.0 - 5.0	1.26	6.418	1.310	0.553	0.122					26	21	5

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	P08	CU1	0.0 - 5.0	0.0	16.8		60.7			22.5		CL	SC-SM	Silty, Clayey Sand With Gravel
					6.3	10.5	15.1	26.6	19.0					
⊠	P09	CU1	0.0 - 5.0	0.0	14.4		54.0			31.6		CL	SC	Clayey Sand
					3.2	11.2	10.4	20.8	22.8					
▲	P10	CU1	0.0 - 5.0	0.0	6.5		54.0			39.5		CL	SC	Clayey Sand
					1.5	5.0	8.2	22.2	23.6					
★	P11	CU1	0.0 - 5.0	0.0	18.0		57.5			24.4		CL	SC	Clayey Sand With Gravel
					6.8	11.3	11.9	24.1	21.6					
⊙	P12	CU1	0.0 - 5.0	0.0	18.6		56.6			24.8		CL-ML	SC-SM	Silty, Clayey Sand With Gravel
					2.2	16.4	15.1	19.4	22.1					

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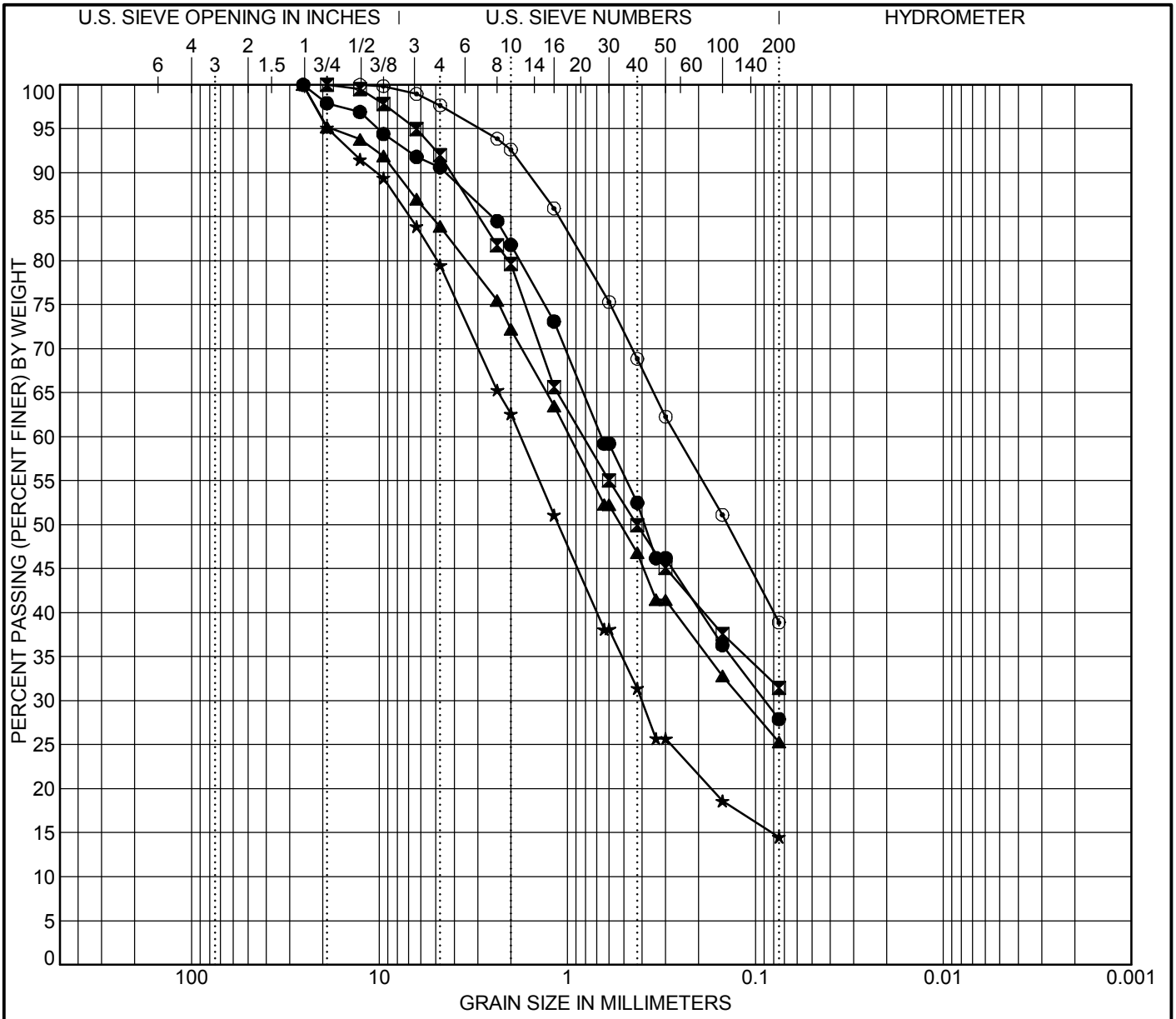

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	P13	CU1	0.0 - 5.0	1.00	2.562	0.636	0.392	0.096					23	16	7
⊠	P13	R1	2.5 - 3.5	0.75	3.147	0.885	0.426						32	19	13
▲	P14	CU1	0.0 - 5.0	1.00	5.324	1.022	0.530	0.124					24	13	11
★	P15	CU1	0.0 - 5.0	1.00	7.001	1.829	1.137	0.405	0.085				33	20	13
⊙	P16	CU1	0.0 - 5.0	0.50	1.131	0.272	0.144						25	13	12

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	P13	CU1	0.0 - 5.0	0.0	9.4		62.7			27.9		CL	SC-SM	Silty, Clayey Sand
					2.1	7.3	8.8	29.3	24.6					
⊠	P13	R1	2.5 - 3.5	0.0	8.0		60.6			31.4		CL	SC	Clayey Sand
					0.0	8.0	12.4	29.7	18.5					
▲	P14	CU1	0.0 - 5.0	0.0	16.1		58.6			25.3		CL	SC	Clayey Sand With Gravel
					4.8	11.3	11.7	25.4	21.5					
★	P15	CU1	0.0 - 5.0	0.0	20.5		65.0			14.5		CL	SC	Clayey Sand With Gravel
					4.9	15.6	16.9	31.2	16.9					
⊙	P16	CU1	0.0 - 5.0	0.0	2.3		58.8			38.9		CL	SC	Clayey Sand
					0.0	2.3	5.0	23.8	30.0					

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Project: Valencia: Alvernon to Wilmot
Location: Tucson, Arizona
NCS Project Number: J2010-09

Based on Laboratory Data From:
ConformaTech
Brian Lasham, Lab Manager

GRAIN SIZE DISTRIBUTION

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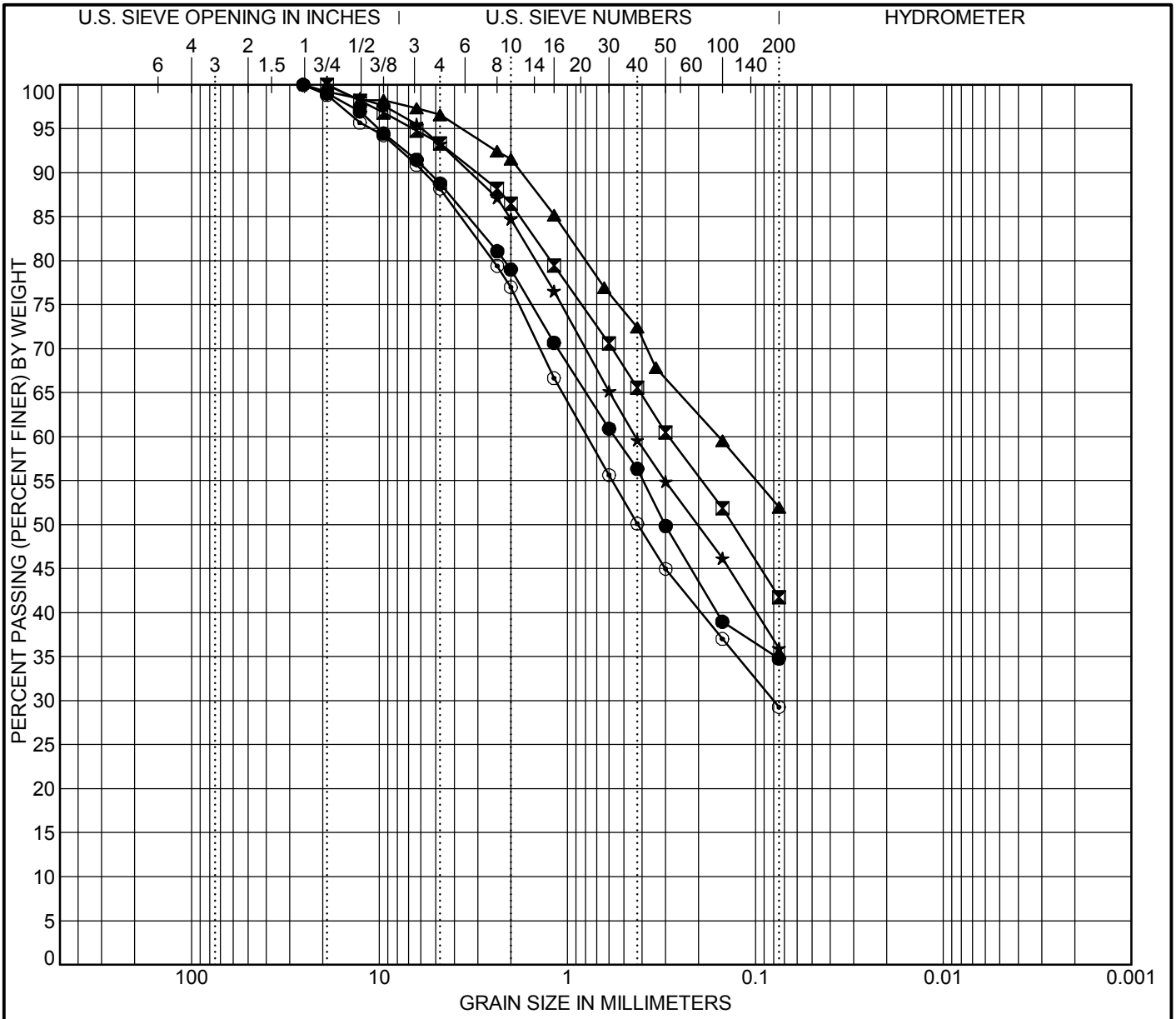

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	P17	CU1	0.0 - 5.0	1.00	3.607	0.566	0.303						35	17	18
⊠	P18	CU1	0.0 - 5.0	0.75	1.832	0.292	0.137						37	16	21
▲	P18	R2	5.0 - 6.0	0.75	1.168	0.161							38	16	22
★	P19	CU1	0.0 - 5.0	1.00	2.039	0.438	0.219						35	17	18
⊙	P24	CU1	0.0 - 5.0	1.00	3.912	0.842	0.422	0.083					31	18	13

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	P17	CU1	0.0 - 5.0	0.0	11.2		54.0			34.8		CL	SC	Clayey Sand
					1.0	10.2	9.8	22.7	21.6					
⊠	P18	CU1	0.0 - 5.0	0.0	6.6		51.6			41.8		CL	SC	Clayey Sand
					0.0	6.6	6.9	20.9	23.8					
▲	P18	R2	5.0 - 6.0	0.0	3.4		44.6			52.0		CL	CL	Sandy Lean Clay
					0.0	3.4	5.0	19.1	20.4					
★	P19	CU1	0.0 - 5.0	0.0	6.7		57.3			35.9		CL	SC	Clayey Sand
					0.8	5.9	8.5	25.1	23.7					
⊙	P24	CU1	0.0 - 5.0	0.0	11.8		58.9			29.3		CL	SC	Clayey Sand
					1.2	10.6	11.2	26.9	20.8					

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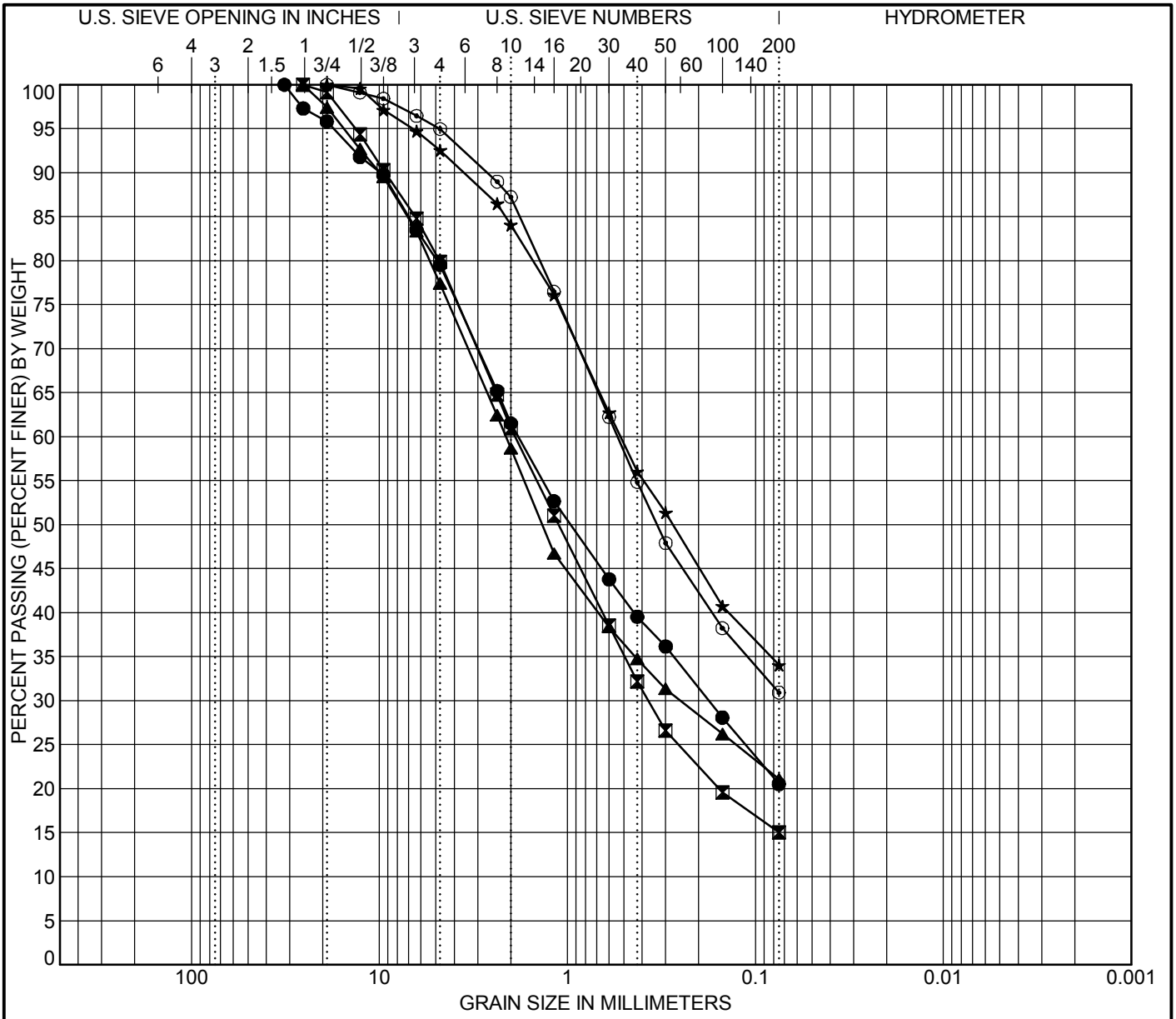

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	P25	CU1	0.0 - 5.0	1.26	7.129	1.868	1.017	0.189					30	25	5
⊠	P26	CU1	0.0 - 5.0	1.00	6.466	1.928	1.139	0.379					35	23	12
▲	P27	CU1	0.0 - 5.0	1.00	7.225	2.130	1.424	0.263					42	24	18
★	P28	CU1	0.0 - 5.0	0.75	2.140	0.531	0.282						27	16	11
⊙	P28	R1	2.5 - 3.5	0.75	1.839	0.549	0.339						22	15	7

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	P25	CU1	0.0 - 5.0	0.0	20.5		59.0			20.5		ML	SM	Silty Sand With Gravel
					4.2	16.3	18.0	22.0	19.0					
⊠	P26	CU1	0.0 - 5.0	0.0	20.1		64.9			15.0		CL	SC	Clayey Sand With Gravel
					0.9	19.2	19.0	28.8	17.1					
▲	P27	CU1	0.0 - 5.0	0.0	22.6		56.3			21.1		CL	SC	Clayey Sand With Gravel
					2.6	20.0	18.8	23.9	13.7					
★	P28	CU1	0.0 - 5.0	0.0	7.4		58.5			34.0		CL	SC	Clayey Sand
					0.0	7.4	8.5	28.0	22.0					
⊙	P28	R1	2.5 - 3.5	0.0	5.0		64.0			30.9		CL	SC-SM	Silty, Clayey Sand
					0.0	5.0	7.7	32.4	23.9					

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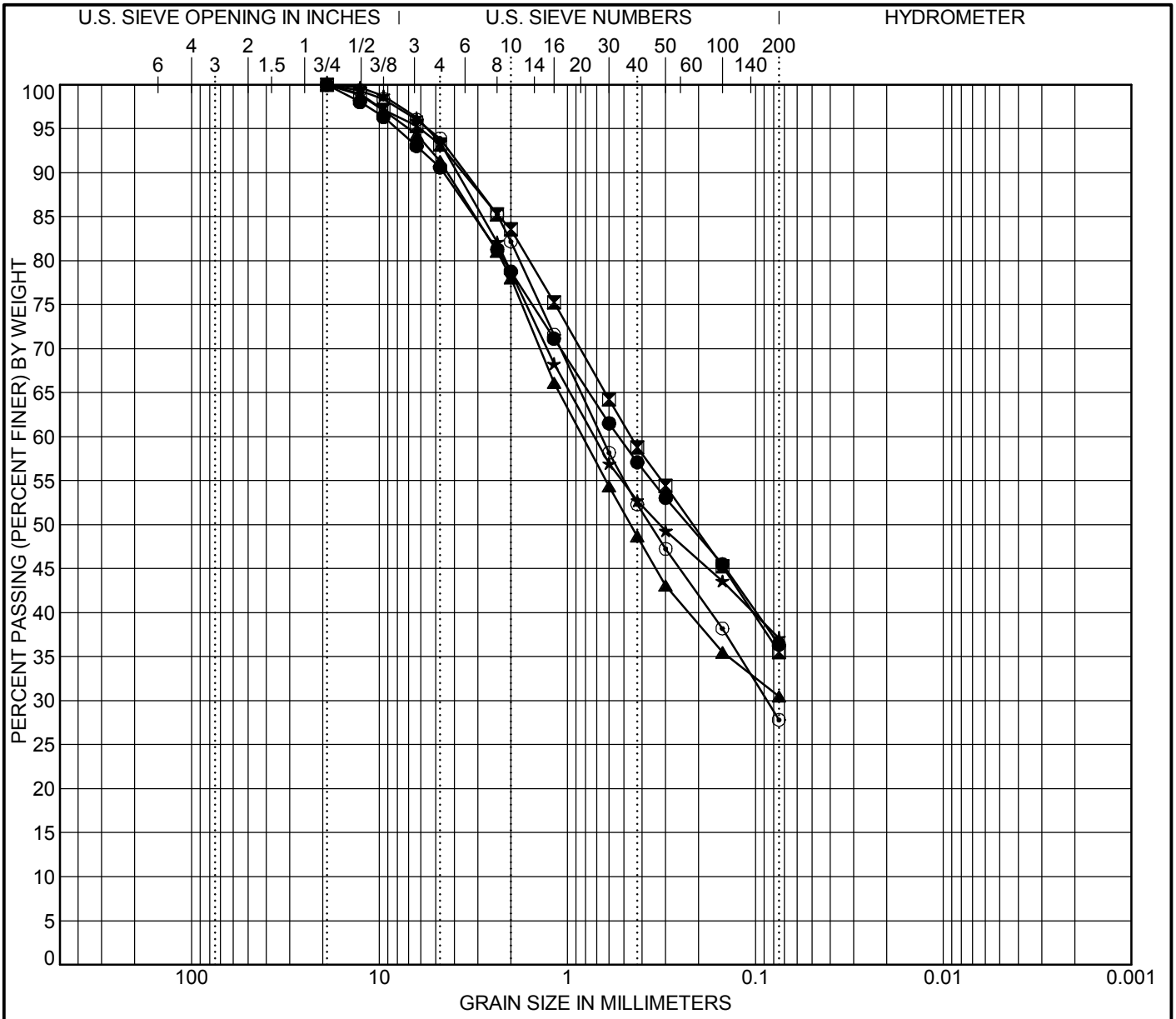

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	P29	CU1	0.0 - 5.0	0.75	3.348	0.541	0.242						36	19	17
⊠	P30	CU1	0.0 - 5.0	0.75	2.299	0.466	0.231						30	16	14
▲	P31	CU1	0.0 - 5.0	0.75	3.311	0.892	0.467						36	19	17
★	P32	CU1	0.0 - 5.0	0.75	2.993	0.767	0.326						51	24	27
⊙	P33	CU1	0.0 - 5.0	0.75	2.330	0.686	0.370	0.093					32	16	16

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	P29	CU1	0.0 - 5.0	0.0	9.4		54.2			36.4		CL	SC	Clayey Sand
					0.0	9.4	11.8	21.7	20.7					
⊠	P30	CU1	0.0 - 5.0	0.0	6.8		57.7			35.5		CL	SC	Clayey Sand
					0.0	6.8	9.6	24.8	23.3					
▲	P31	CU1	0.0 - 5.0	0.0	8.7		60.8			30.5		CL	SC	Clayey Sand
					0.0	8.7	13.3	29.4	18.2					
★	P32	CU1	0.0 - 5.0	0.0	6.5		56.4			37.1		CH	SC	Clayey Sand
					0.0	6.5	14.8	26.0	15.6					
⊙	P33	CU1	0.0 - 5.0	0.0	6.1		66.1			27.8		CL	SC	Clayey Sand
					0.0	6.1	11.7	29.9	24.5					

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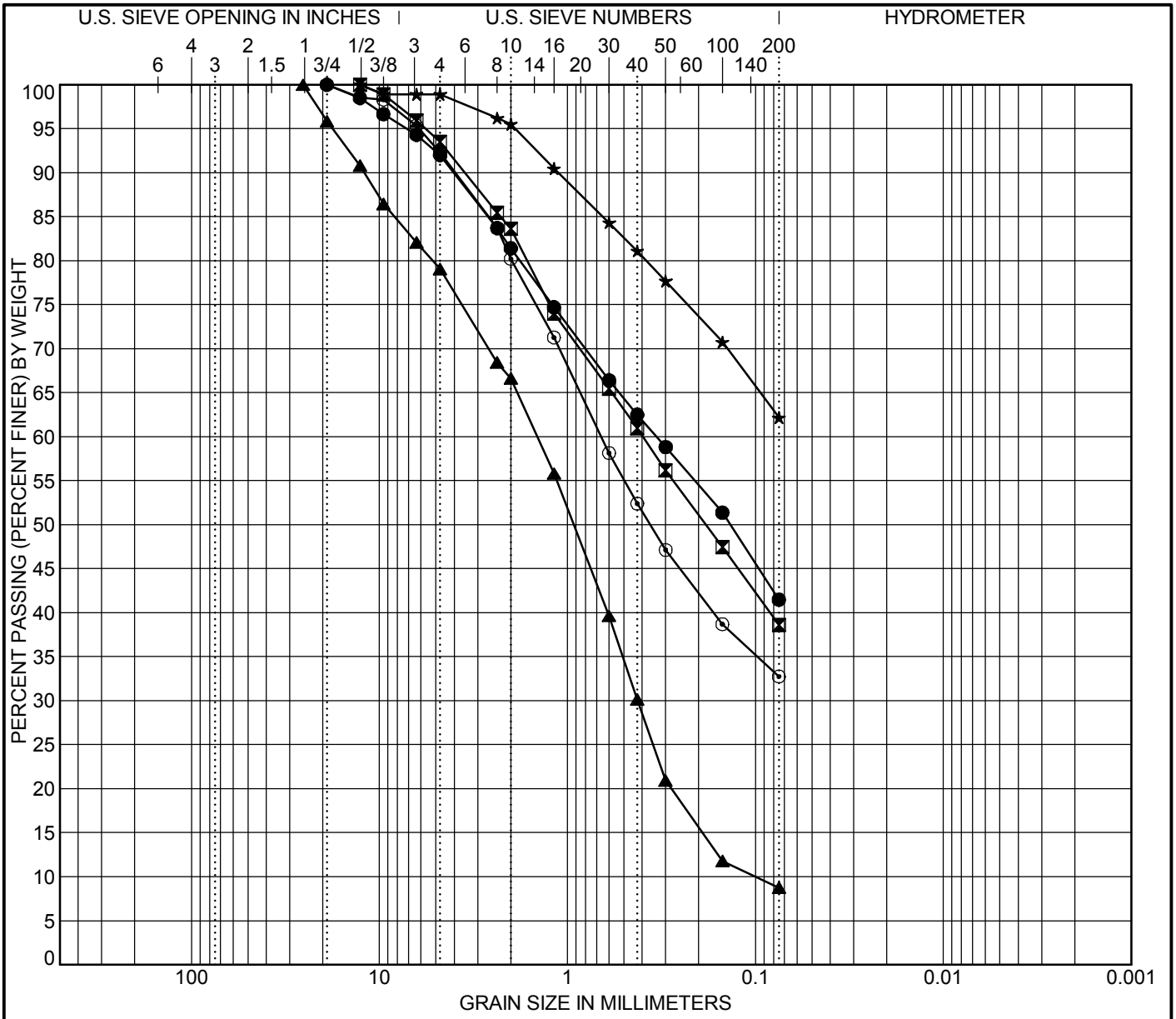

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	P34	CU1	0.0 - 5.0	0.75	2.751	0.341	0.141						37	19	18
⊠	P34	R1	2.5 - 3.5	0.50	2.273	0.401	0.196						26	18	8
▲	W01	S3	7.5 - 9.0	1.00	8.490	1.515	0.993	0.423	0.213	0.100	1.181	15.150	37	22	15
★	W01	S8	30.0 - 31.5	0.50	0.665								35	18	17
⊙	W02	R1	2.5 - 3.5	0.75	2.726	0.689	0.370						30	18	12

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	P34	CU1	0.0 - 5.0	0.0	8.0		50.5			41.5		CL	SC	Clayey Sand
					0.0	8.0	10.6	18.9	21.0					
⊠	P34	R1	2.5 - 3.5	0.0	6.5		54.9			38.6		CL	SC	Clayey Sand
					0.0	6.5	9.8	22.7	22.3					
▲	W01	S3	7.5 - 9.0	0.0	20.9		70.3			8.7		CL	SW-SC	Well-Graded Sand With Clay And Gravel
					4.1	16.8	12.4	36.5	21.4					
★	W01	S8	30.0 - 31.5	0.0	1.1		36.7			62.2		CL	CL	Sandy Lean Clay
					0.0	1.1	3.4	14.4	18.9					
⊙	W02	R1	2.5 - 3.5	0.0	7.7		59.5			32.7		CL	SC	Clayey Sand
					0.0	7.7	12.1	27.8	19.7					

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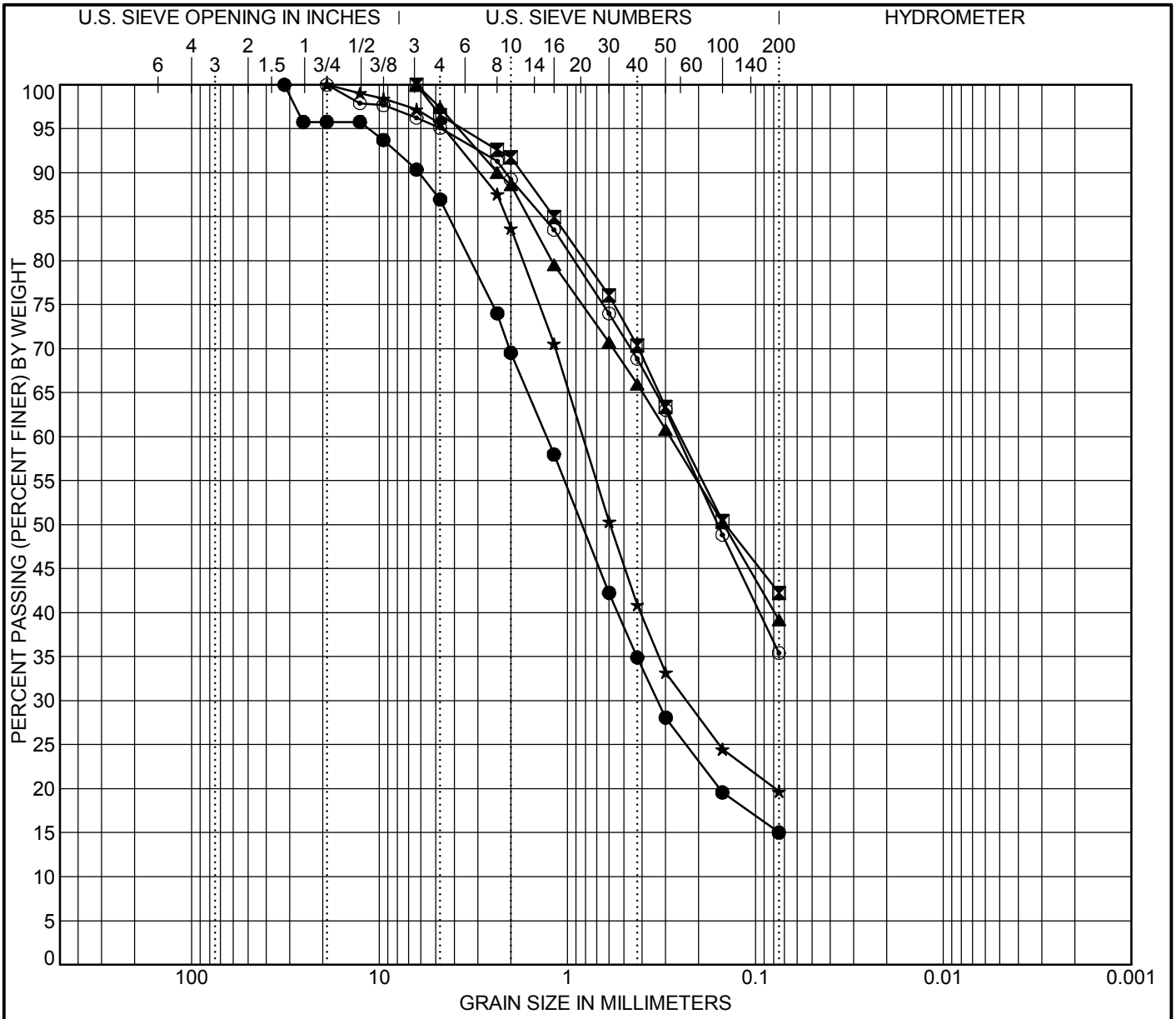

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	W02	S6	20.0 - 21.5	1.26	4.411	1.335	0.909	0.338					NP	NP	NP
⊠	W03	S2	5.0 - 6.5	0.25	1.181	0.264	0.146						44	21	23
▲	W03	S11	45.0 - 46.5	0.25	1.685	0.289	0.149						31	20	11
★	W04	R4	10.0 - 11.0	0.75	2.125	0.901	0.594	0.250					38	21	17
⊙	W04	S7	25.0 - 26.5	0.75	1.398	0.271	0.164						24	20	4

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	W02	S6	20.0 - 21.5	0.0	13.0		71.9			15.0		ML	SM	Silty Sand
					4.2	8.8	17.4	34.6	19.9					
⊠	W03	S2	5.0 - 6.5	0.0	3.5		54.3			42.3		CL	SC	Clayey Sand
					0.0	3.5	4.8	21.3	28.1					
▲	W03	S11	45.0 - 46.5	0.0	2.6		58.3			39.2		CL	SC	Clayey Sand
					0.0	2.6	8.8	22.6	26.8					
★	W04	R4	10.0 - 11.0	0.0	4.4		75.9			19.7		CL	SC	Clayey Sand
					0.0	4.4	11.9	42.8	21.2					
⊙	W04	S7	25.0 - 26.5	0.0	4.9		59.7			35.4		CL-ML	SC-SM	Silty, Clayey Sand
					0.0	4.9	5.8	20.4	33.4					

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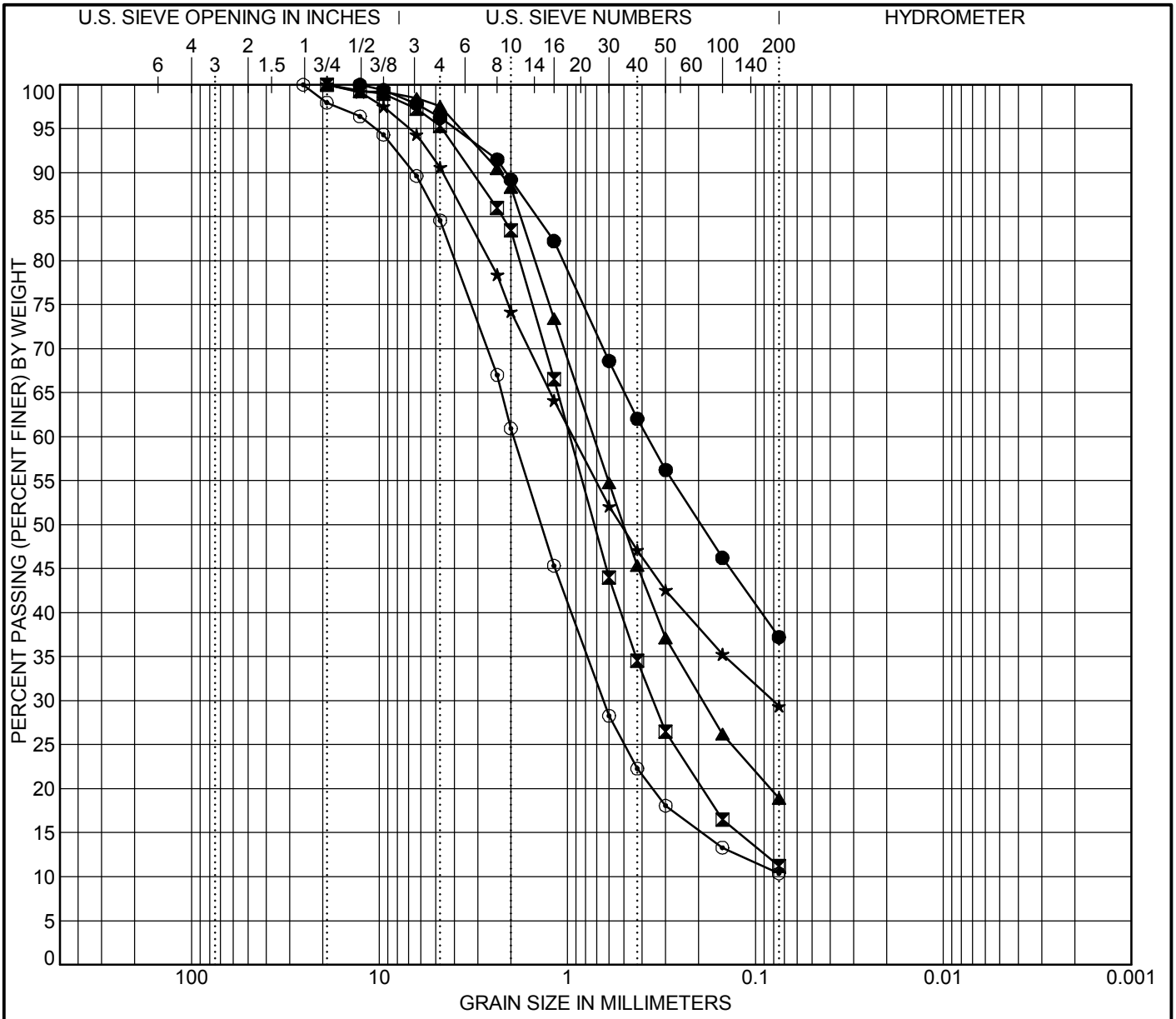

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	W04	S11	45.0 - 46.5	0.50	1.514	0.383	0.210						31	18	13
⊠	W05	S6	20.0 - 21.5	0.75	2.221	1.035	0.780	0.359	0.132				NP	NP	NP
▲	W05	S13	55.0 - 56.5	0.75	1.829	0.781	0.515	0.208					NP	NP	NP
★	W06	S2	5.0 - 6.5	0.75	3.694	0.994	0.529	0.084					42	24	18
⊙	W06	S8	30.0 - 31.5	1.00	4.887	1.957	1.452	0.673	0.209				NP	NP	NP

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	W04	S11	45.0 - 46.5	0.0	3.7		59.1			37.2		CL	SC	Clayey Sand
					0.0	3.7	7.1	27.2	24.8					
⊠	W05	S6	20.0 - 21.5	0.0	4.7		84.1			11.2		ML	SW-SM	Well-Graded Sand With Silt
					0.0	4.7	11.9	48.9	23.3					
▲	W05	S13	55.0 - 56.5	0.0	2.4		78.7			18.9		ML	SM	Silty Sand
					0.0	2.4	9.2	43.0	26.5					
★	W06	S2	5.0 - 6.5	0.0	9.4		61.2			29.4		CL	SC	Clayey Sand
					0.0	9.4	16.4	27.1	17.7					
⊙	W06	S8	30.0 - 31.5	0.0	15.4		74.2			10.4		ML	SP-SM	Poorly Graded Sand With Silt And Gravel
					2.0	13.4	23.6	38.7	11.9					

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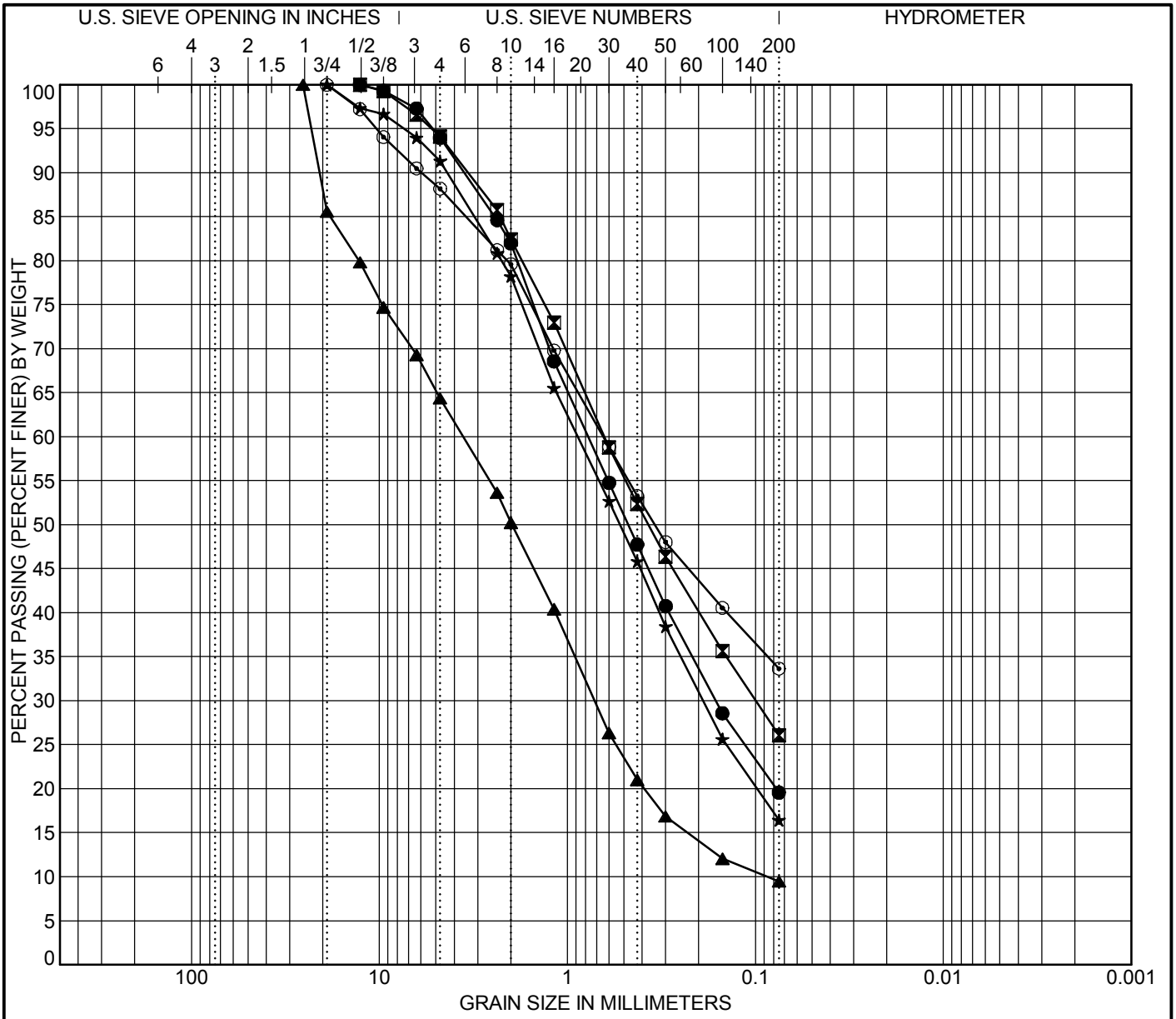

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	W07	S8	30.0 - 31.5	0.50	2.466	0.836	0.484	0.171					20	19	1
⊠	W08	S3	15.0 - 16.5	0.50	2.282	0.654	0.377	0.109					25	19	6
▲	W08	S7	35.0 - 36.5	1.00	18.439	3.829	1.983	0.777	0.248	0.087	1.812	44.011	24	17	7
★	W09	S5	15.0 - 16.5	0.75	3.338	0.945	0.535	0.208					NP	NP	NP
⊙	W09	S11	45.0 - 46.5	0.75	3.683	0.667	0.349						27	16	11

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	W07	S8	30.0 - 31.5	0.0	6.0		12.0	74.4	28.2	19.6		ML	SM	Silty Sand
					0.0	6.0		34.2						
⊠	W08	S3	15.0 - 16.5	0.0	5.9		11.7	68.0	26.3	26.1		CL-ML	SC-SM	Silty, Clayey Sand
					0.0	5.9		30.0						
▲	W08	S7	35.0 - 36.5	0.0	35.6		14.1	54.9	11.6	9.5		CL	SW-SC	Well-Graded Sand With Silty Clay And Gravel
					14.4	21.2		29.2						
★	W09	S5	15.0 - 16.5	0.0	8.7		13.1	74.9	29.4	16.4		ML	SM	Silty Sand
					0.0	8.7		32.4						
⊙	W09	S11	45.0 - 46.5	0.0	11.8		8.6	54.5	19.6	33.6		CL	SC	Clayey Sand
					0.0	11.8		26.3						

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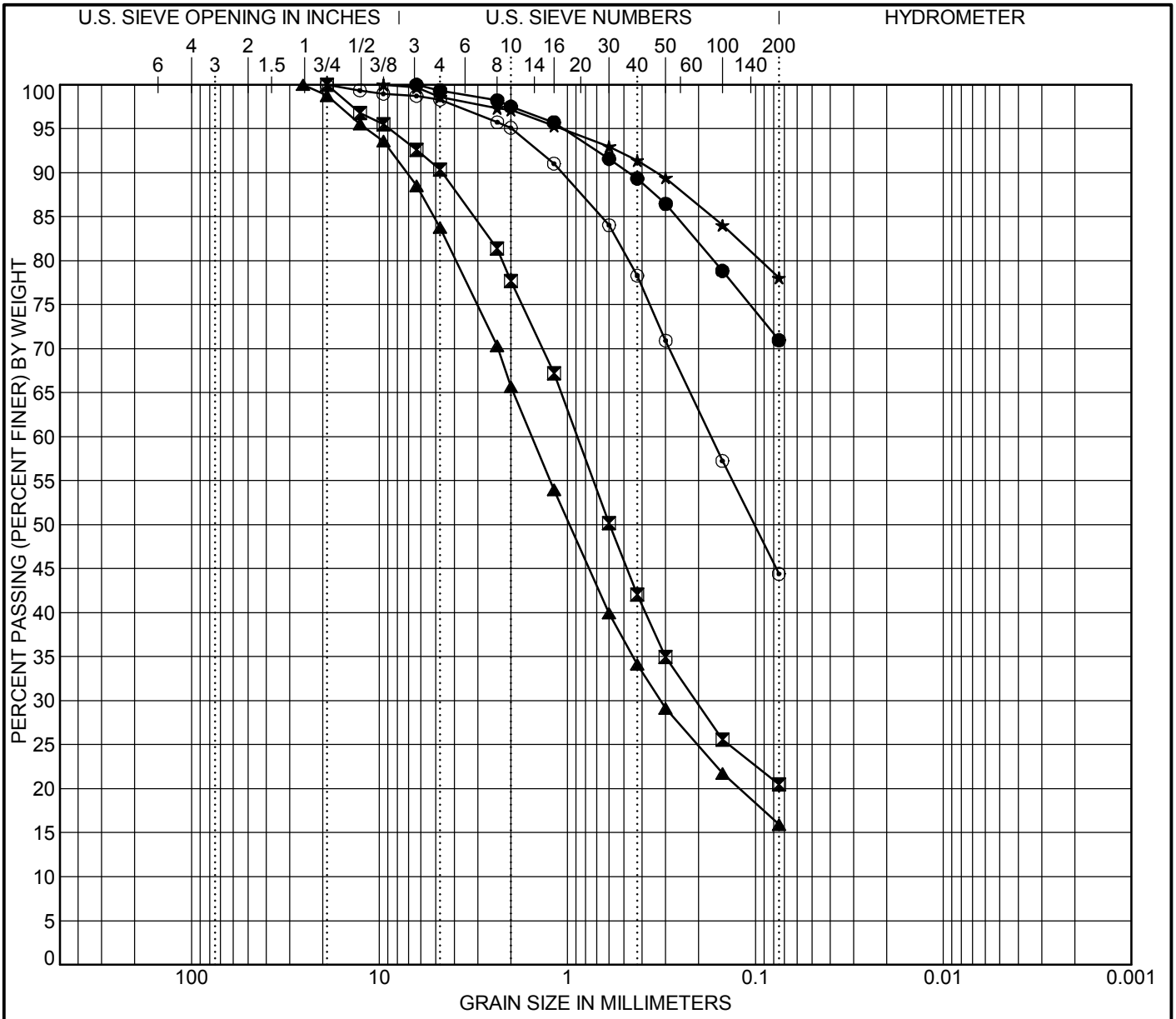

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	W10	S7	25.0 - 26.5	0.25	0.272								31	18	13
⊠	W10	S11	45.0 - 46.5	0.75	3.348	0.954	0.596	0.226					22	19	3
▲	W10	S14	60.0 - 61.5	1.00	5.175	1.623	1.033	0.323					NP	NP	NP
★	W11	S7	25.0 - 26.5	0.38	0.177								29	17	12
⊙	W11	S16	70.0 - 71.5	0.75	0.682	0.183	0.110						25	21	4

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	W10	S7	25.0 - 26.5	0.0	0.6		28.4			71.0		CL	CL	Lean Clay With Sand
					0.0	0.6	1.8	8.2	18.4					
⊠	W10	S11	45.0 - 46.5	0.0	9.7		69.8			20.5		ML	SM	Silty Sand
					0.0	9.7	12.7	35.6	21.6					
▲	W10	S14	60.0 - 61.5	0.0	16.2		67.8			15.9		ML	SM	Silty Sand With Gravel
					1.2	15.0	18.1	31.6	18.2					
★	W11	S7	25.0 - 26.5	0.0	1.4		20.6			78.0		CL	CL	Lean Clay With Sand
					0.0	1.4	1.5	5.7	13.3					
⊙	W11	S16	70.0 - 71.5	0.0	1.7		53.9			44.4		CL-ML	SC-SM	Silty, Clayey Sand
					0.0	1.7	3.2	16.8	33.9					

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Project: Valencia: Alvernon to Wilmot
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Brian Lasham, Lab Manager

GRAIN SIZE DISTRIBUTION

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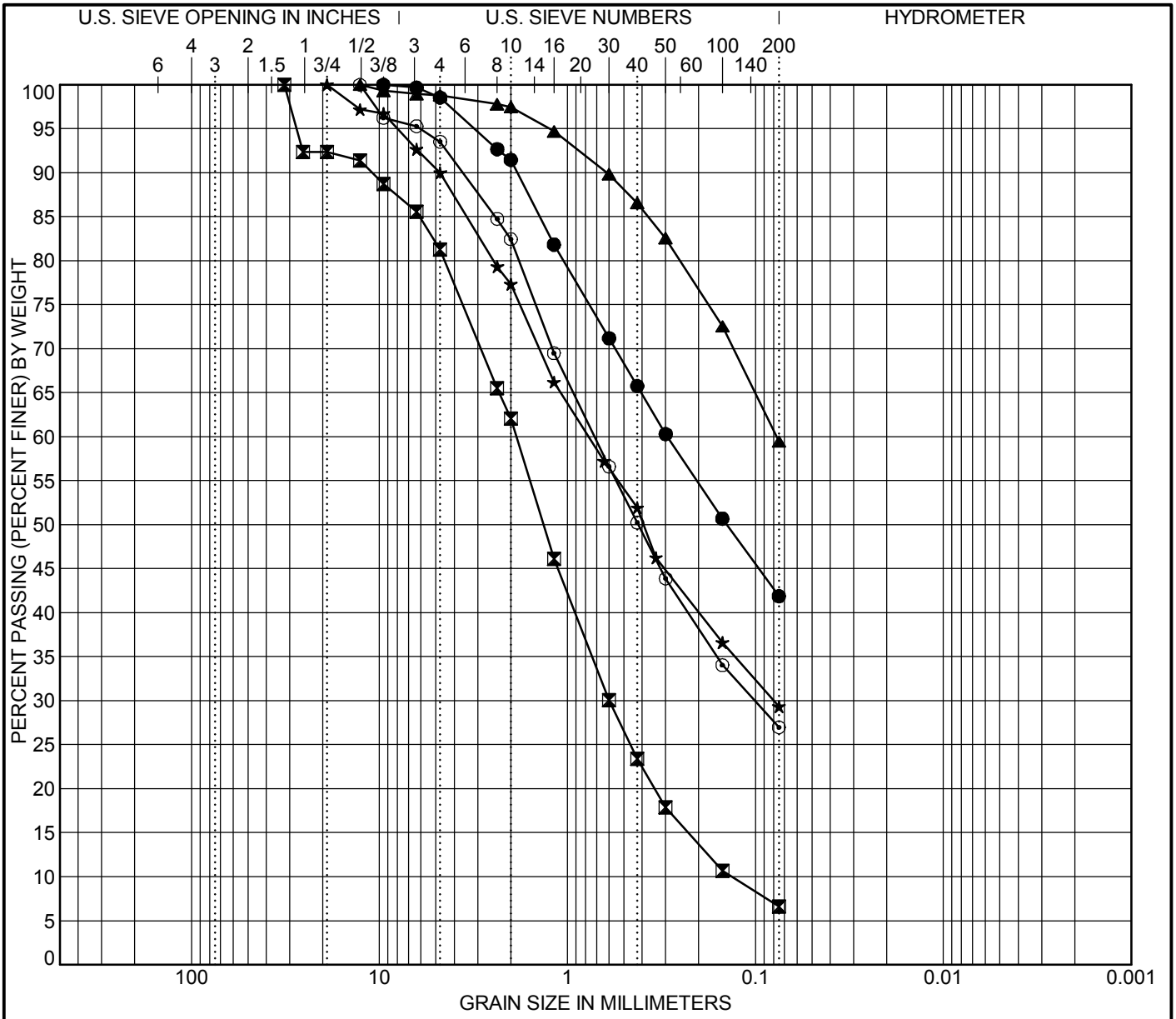

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	W12	R2	5.0 - 6.0	0.38	1.460	0.296	0.145						27	16	11
⊠	W12	S6	20.0 - 21.5	1.26	6.141	1.908	1.404	0.598	0.249	0.134	1.399	14.239	NP	NP	NP
▲	W12	S16	70.0 - 71.5	0.50	0.377	0.078							29	18	11
★	W13	R2	5.0 - 6.0	0.75	3.666	0.814	0.397	0.083					33	24	9
⊙	W13	S10	40.0 - 41.5	0.50	2.432	0.765	0.421	0.109					31	16	15

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	W12	R2	5.0 - 6.0	0.0	1.5		56.7			41.9		CL	SC	Clayey Sand
					0.0	1.5	7.1	25.7	23.9					
⊠	W12	S6	20.0 - 21.5	0.0	18.8		74.6			6.6		ML	SW-SM	Well-Graded Sand With Silt And Gravel
					7.6	11.1	19.2	38.6	16.8					
▲	W12	S16	70.0 - 71.5	0.0	1.2		39.4			59.5		CL	CL	Sandy Lean Clay
					0.0	1.2	1.3	10.9	27.1					
★	W13	R2	5.0 - 6.0	0.0	10.0		60.7			29.3		ML	SM	Silty Sand
					0.0	10.0	12.7	25.4	22.6					
⊙	W13	S10	40.0 - 41.5	0.0	6.5		66.5			27.0		CL	SC	Clayey Sand
					0.0	6.5	11.1	32.2	23.3					

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GRAIN SIZE DISTRIBUTION

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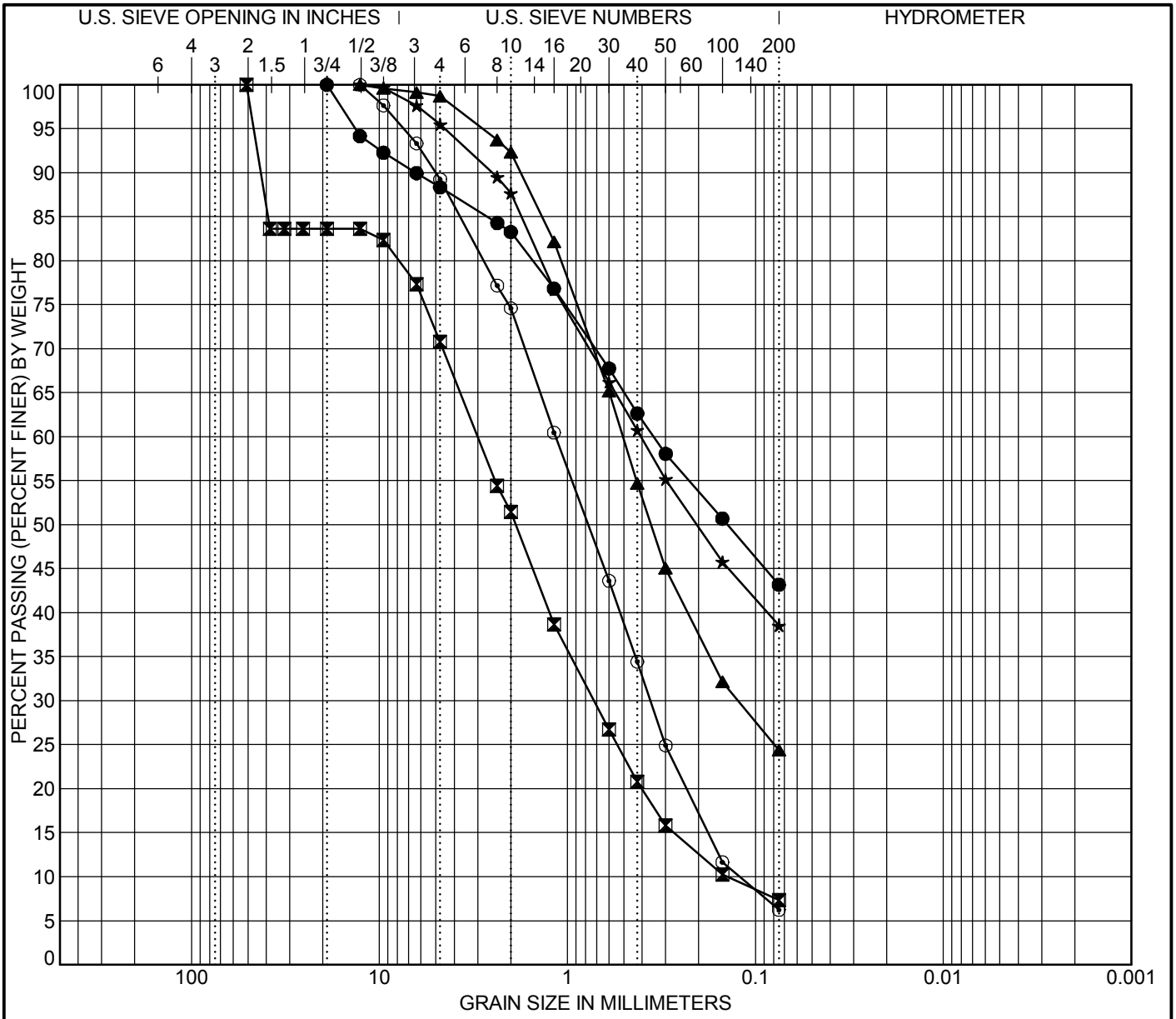

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	W13	S13	55.0 - 56.5	0.75	2.789	0.354	0.144						31	18	13
⊠	W14	R5	15.0 - 16.0	2.00	39.249	3.248	1.918	0.781	0.282	0.142	1.323	22.873	NP	NP	NP
▲	W14	S11	45.0 - 46.5	0.50	1.419	0.517	0.367	0.131					26	18	8
★	W15	S2	5.0 - 6.5	0.50	1.809	0.409	0.221						39	21	18
⊙	W15	S7	25.0 - 26.5	0.50	3.948	1.167	0.843	0.372	0.200	0.122	0.972	9.566	NP	NP	NP

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	W13	S13	55.0 - 56.5	0.0	11.7		45.2			43.2		CL	SC	Clayey Sand
					0.0	11.7	5.1	20.6	19.5					
⊠	W14	R5	15.0 - 16.0	0.0	29.2		63.4			7.3		ML	SW-SM	Well-Graded Sand With Silt And Gravel
					16.4	12.9	19.3	30.6	13.5					
▲	W14	S11	45.0 - 46.5	0.0	1.3		74.3			24.4		CL	SC	Clayey Sand
					0.0	1.3	6.4	37.6	30.3					
★	W15	S2	5.0 - 6.5	0.0	4.5		57.0			38.5		CL	SC	Clayey Sand
					0.0	4.5	7.8	26.9	22.2					
⊙	W15	S7	25.0 - 26.5	0.0	10.8		83.0			6.2		ML	SP-SM	Poorly Graded Sand With Silt
					0.0	10.8	14.6	40.2	28.2					

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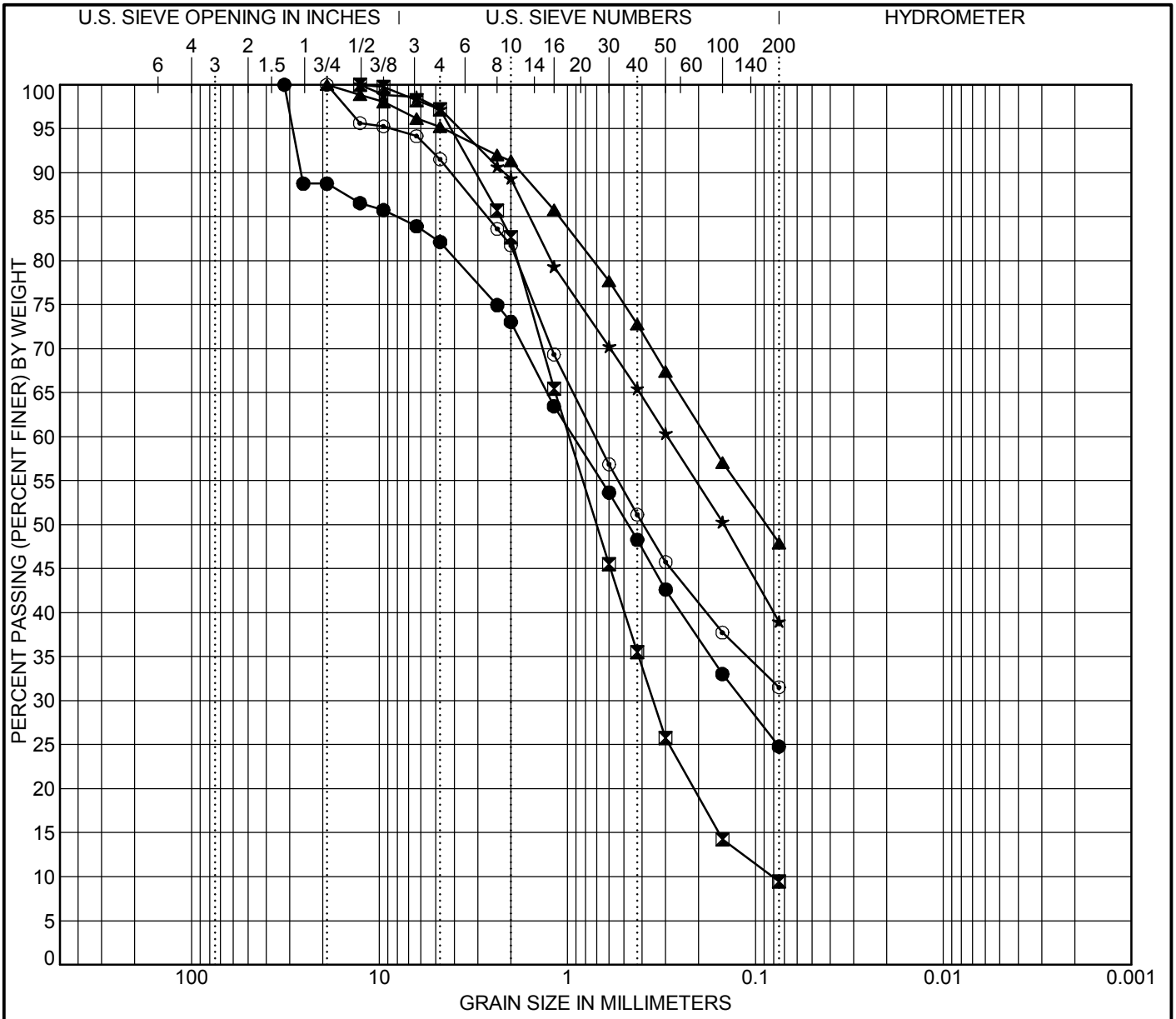

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	W16	S1	2.5 - 4.0	1.26	8.239	0.986	0.483	0.125					25	19	6
⊠	W17	S5	15.0 - 16.5	0.50	2.280	1.042	0.751	0.359	0.163	0.081	1.527	12.864	NP	NP	NP
▲	W17	S10	40.0 - 41.5	0.75	1.126	0.195	0.093						31	18	13
★	W19	S1	2.5 - 4.0	0.50	1.655	0.295	0.148						30	21	9
⊙	W19	S9	35.0 - 36.5	0.75	2.794	0.757	0.400						38	20	18

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	W16	S1	2.5 - 4.0	0.0	17.9		57.3			24.8		CL-ML	SC-SM	Silty, Clayey Sand With Gravel
					11.2	6.6	9.1	24.8	23.5					
⊠	W17	S5	15.0 - 16.5	0.0	2.8		87.7			9.5		ML	SW-SM	Well-Graded Sand With Silt
					0.0	2.8	14.5	47.2	26.0					
▲	W17	S10	40.0 - 41.5	0.0	4.8		47.3			47.9		CL	SC	Clayey Sand
					0.0	4.8	3.9	18.6	24.9					
★	W19	S1	2.5 - 4.0	0.0	2.8		58.3			39.0		CL	SC	Clayey Sand
					0.0	2.8	7.9	23.9	26.5					
⊙	W19	S9	35.0 - 36.5	0.0	8.5		60.0			31.5		CL	SC	Clayey Sand
					0.0	8.5	9.8	30.6	19.6					

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GRAIN SIZE DISTRIBUTION

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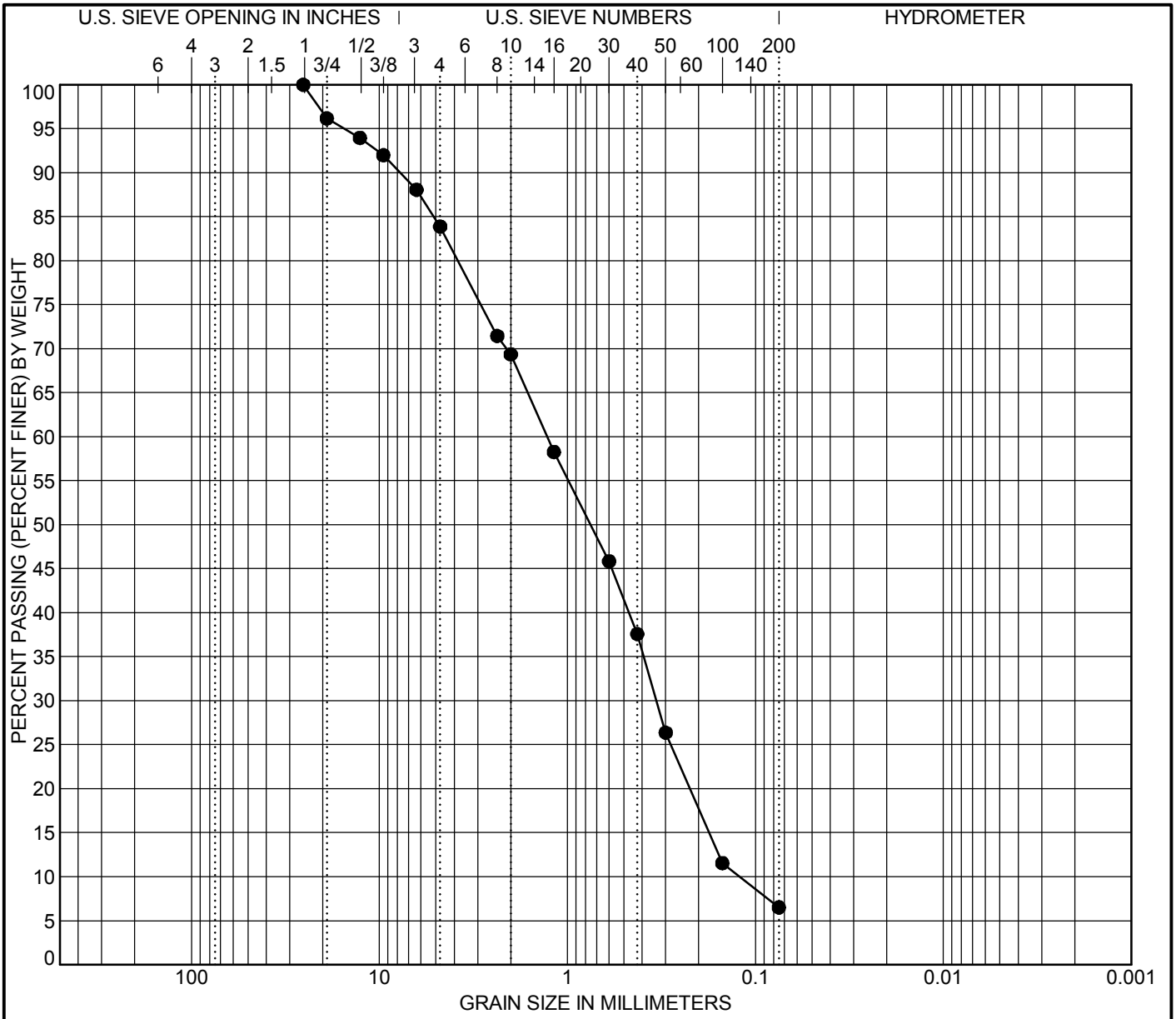

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sym.	Boring	Sample	Depth (ft.)	D100 (in)	D85 (mm)	D60 (mm)	D50 (mm)	D30 (mm)	D15 (mm)	D10 (mm)	Cc	Cu	LL	PL	PI
●	W20	S5	15.0 - 16.5	1.00	5.183	1.318	0.810	0.346	0.198	0.121	0.751	10.893	NP	NP	NP

Sym.	Boring	Sample	Depth (ft.)	% Cobbles & Boulders	% Gravel		% Sand			% Fines		Fines USCS	Sample USCS[1]	USCS Description [1]
					C	F	C	M	F	Silt	Clay			
●	W20	S5	15.0 - 16.5	0.0	16.1		77.4			6.5		ML	SP-SM	Poorly Graded Sand With Silt And Gravel
					3.8	12.3	14.5	31.8	31.1					

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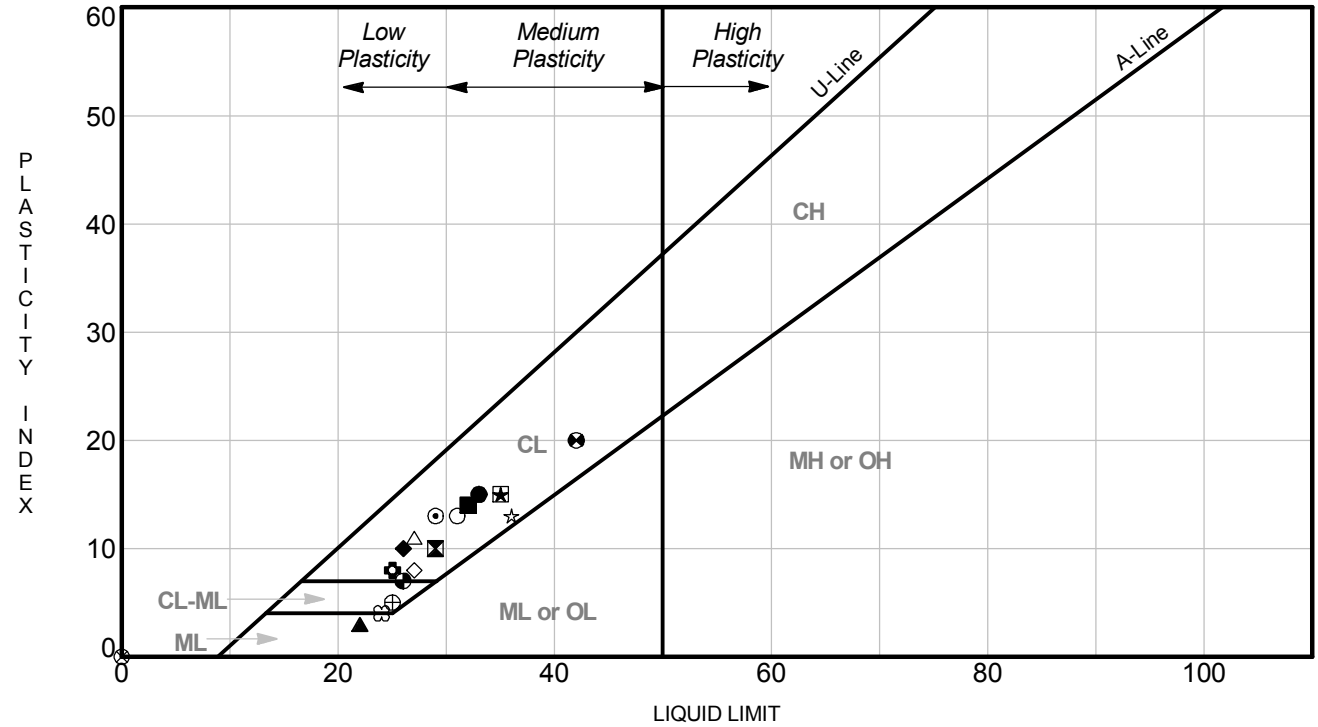

Symbol	Boring	Sample	Depth (ft.)	Natural Water Content (%)	LL[1] (%)	PL[1] (%)	PI[1] (%)	% Pass. #200	Fines USCS	USCS Classification of Entire Sample
●	B01	S4	20.0 - 21.5	--	33	18	15	31	CL	Clayey Sand (SC)
⊠	B01A	S4	20.0 - 21.5	--	29	19	10	45	CL	Clayey Sand (SC)
▲	B01A	S7	35.0 - 36.5	2.0	22	19	3	17	ML	Silty Sand With Gravel (SM)
★	B01A	S11	55.0 - 56.5	--	35	20	15	41	CL	Clayey Sand (SC)
⊙	B01A	S13	65.0 - 66.5	--	29	16	13	78	CL	Lean Clay With Sand (CL)
✿	B02	CU1	5.0 - 10.0	8.3	25	17	8	25	CL	Clayey Sand (SC)
○	B02	S3	15.0 - 16.5	--	31	18	13	30	CL	Clayey Sand (SC)
△	B02A	S2	10.0 - 11.5	--	27	16	11	31	CL	Clayey Sand (SC)
⊗	B02A	S6	30.0 - 31.5	0.6	NP	NP	NP	7	ML	Well-Graded Sand With Silt (SW-SM)
⊕	B02A	S13	65.0 - 66.5	--	25	20	5	43	CL-ML	Silty, Clayey Sand (SC-SM)
□	B02A	S17	85.0 - 86.5	--	35	20	15	28	CL	Clayey Sand (SC)
⊗	B03	S2	10.0 - 11.5	--	42	22	20	8	CL	Well-Graded Sand With Clay (SW-SC)
◕	B03	S10	50.0 - 51.5	--	26	19	7	38	CL	Silty, Clayey Sand (SC-SM)
☆	B03	S19	95.0 - 96.5	22.5	36	23	13	69	CL	Sandy Lean Clay (CL)
✿	B03	S23	115.0 - 116.5	--	24	20	4	58	CL-ML	Sandy Silty Clay (CL-ML)
■	B04	S3	15.0 - 16.5	--	32	18	14	56	CL	Sandy Lean Clay (CL)
◆	B04	S7	35.0 - 36.5	8.6	26	16	10	43	CL	Clayey Sand (SC)
◇	B04	S16	80.0 - 81.5	--	27	19	8	45	CL	Clayey Sand (SC)

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ATTERBERG LIMITS RESULTS

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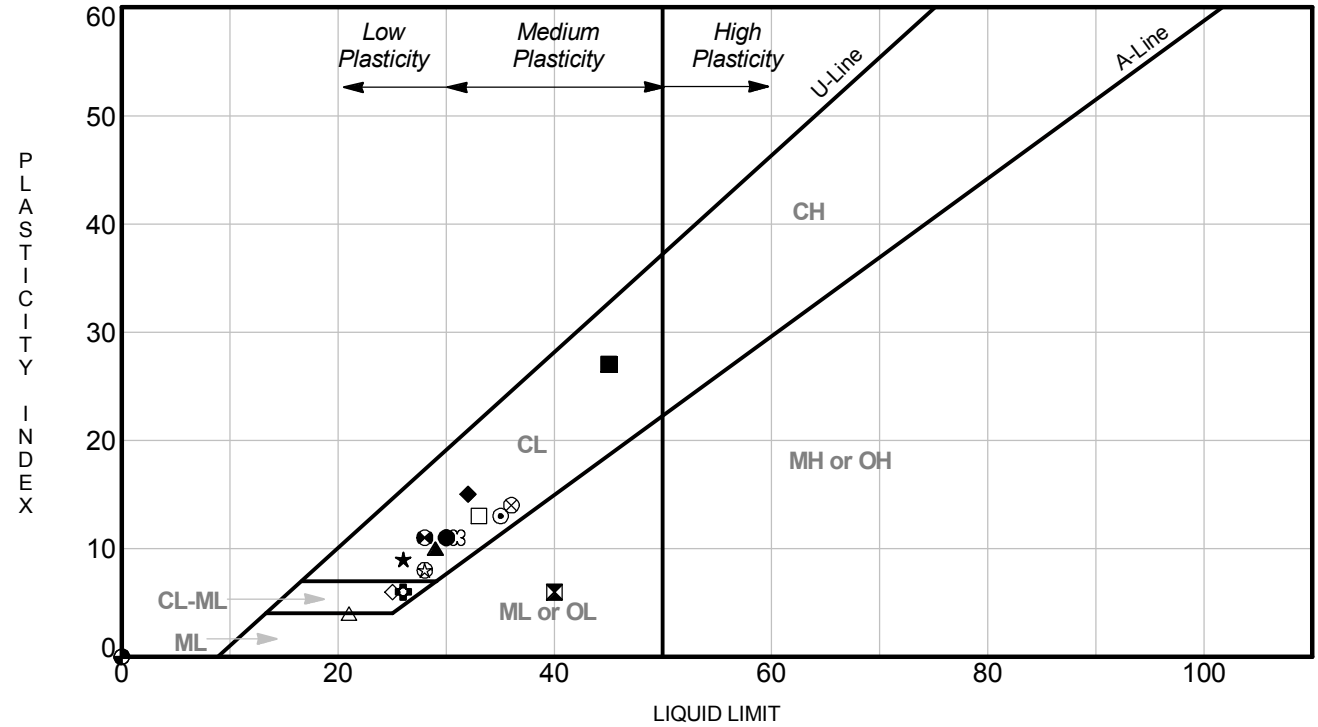

Symbol	Boring	Sample	Depth (ft.)	Natural Water Content (%)	LL[1] (%)	PL[1] (%)	PI[1] (%)	% Pass. #200	Fines USCS	USCS Classification of Entire Sample
●	B04	S20	100.0 - 101.5	13.7	30	19	11	52	CL	Sandy Lean Clay (CL)
⊠	B05	S1	5.0 - 6.5	--	40	34	6	20	ML	Silty Sand (SM)
▲	B05	S11	55.0 - 56.5	--	29	19	10	53	CL	Sandy Lean Clay (CL)
★	B05	S15	75.0 - 76.5	--	26	17	9	11	CL	Poorly Graded Sand With Clay (SP-SC)
⊙	B06	S13	65.0 - 66.5	--	35	22	13	74	CL	Lean Clay With Sand (CL)
✿	B06	S17	85.0 - 86.5	9.9	26	20	6	67	CL-ML	Sandy Silty Clay (CL-ML)
○	B06	S22	110.0 - 111.5	--	28	20	8	67	CL	Sandy Lean Clay (CL)
△	B07	S1	5.0 - 6.5	--	21	17	4	24	CL-ML	Silty, Clayey Sand (SC-SM)
⊗	B07	S8	40.0 - 41.5	--	36	22	14	51	CL	Sandy Lean Clay (CL)
⊕	B07	S12	60.0 - 61.5	--	NP	NP	NP	31	ML	Silty Sand (SM)
□	B07	S22	110.0 - 111.5	--	33	20	13	61	CL	Sandy Lean Clay (CL)
⊗	B08	S3	15.0 - 16.5	--	28	17	11	29	CL	Clayey Sand (SC)
◕	B08	S10	50.0 - 51.5	--	NP	NP	NP	11	ML	Well-Graded Sand With Silt (SW-SM)
☆	B08	S16	80.0 - 81.5	--	28	20	8	52	CL	Sandy Lean Clay (CL)
✿	B08	S24	120.0 - 121.5	14.9	31	20	11	55	CL	Sandy Lean Clay (CL)
■	B09	CU1	10.0 - 15.0	9.6	45	18	27	45	CL	Clayey Sand (SC)
◆	B09	S5	12.5 - 14.0	--	32	17	15	54	CL	Sandy Lean Clay (CL)
◇	B09	S14	45.0 - 46.5	--	25	19	6	62	CL-ML	Sandy Silty Clay (CL-ML)

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ATTERBERG LIMITS RESULTS

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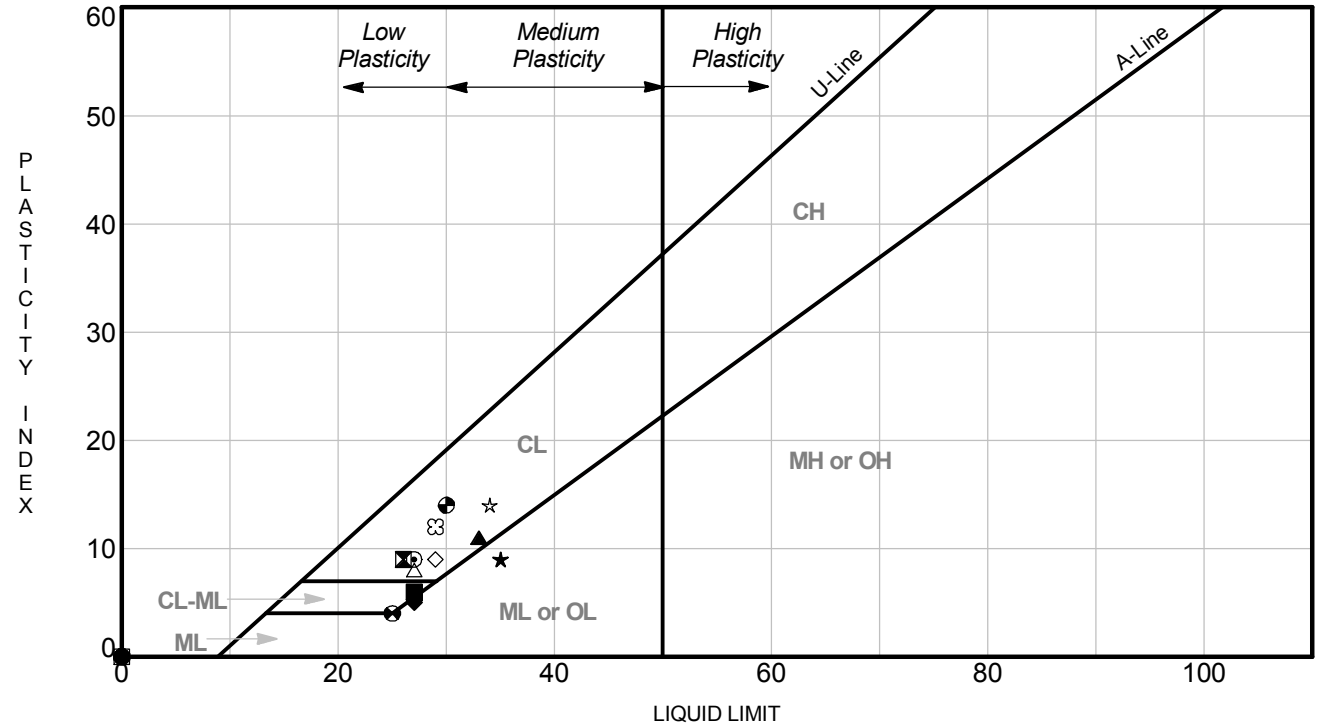

Symbol	Boring	Sample	Depth (ft.)	Natural Water Content (%)	LL[1] (%)	PL[1] (%)	PI[1] (%)	% Pass. #200	Fines USCS	USCS Classification of Entire Sample
●	B09	S17	60.0 - 61.5	--	NP	NP	NP	70	ML	Silt With Sand (ML)
⊠	B09	S18	65.0 - 66.5	--	26	17	9	42	CL	Clayey Sand (SC)
▲	B10	S1	2.5 - 4.0	--	33	22	11	26	CL	Clayey Sand With Gravel (SC)
★	B10	S8	20.0 - 21.5	--	35	26	9	32	ML	Silty Sand (SM)
⊙	B10	S9	25.0 - 26.0	--	27	18	9	24	CL	Clayey Sand (SC)
✿	B10	S12	40.0 - 41.5	--	NP	NP	NP	11	ML	Well-Graded Sand With Silt (SW-SM)
○	B10	S14	50.0 - 51.5	3.0	NP	NP	NP	14	ML	Silty Sand With Gravel (SM)
△	D01	S2	5.0 - 6.5	--	27	19	8	54	CL	Sandy Lean Clay (CL)
⊗	D01	S4	15.0 - 16.5	--	NP	NP	NP	12	ML	Well-Graded Sand With Silt And Gravel (SW-SM)
⊕	D02	CU1	0.0 - 5.0	--	NP	NP	NP	12	ML	Well-Graded Sand With Silt (SW-SM)
□	D02	R2	5.0 - 6.0	--	NP	NP	NP	15	ML	Silty Sand (SM)
⊗	D02	S3	10.0 - 11.5	--	25	21	4	26	CL-ML	Silty, Clayey Sand (SC-SM)
◕	D02	S5	20.0 - 21.5	--	30	16	14	64	CL	Sandy Lean Clay (CL)
☆	P01	CU1	0.0 - 5.0	3.8	34	20	14	22	CL	Clayey Sand With Gravel (SC)
✿	P02	CU1	0.0 - 5.0	--	29	17	12	39	CL	Clayey Sand (SC)
■	P03	CU1	0.0 - 5.0	--	27	21	6	27	CL-ML	Silty, Clayey Sand With Gravel (SC-SM)
◆	P06	CU1	0.0 - 5.0	--	27	22	5	18	ML	Silty Sand With Gravel (SM)
◇	P07	CU1	0.0 - 5.0	--	29	20	9	29	CL	Clayey Sand (SC)

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Project: Valencia: Alvernon to Wilmot
Location: Tucson, Arizona
NCS Project Number: J2010-09

Based on Laboratory Data From:
ConformaTech
Brian Lasham, Lab Manager

ATTERBERG LIMITS RESULTS

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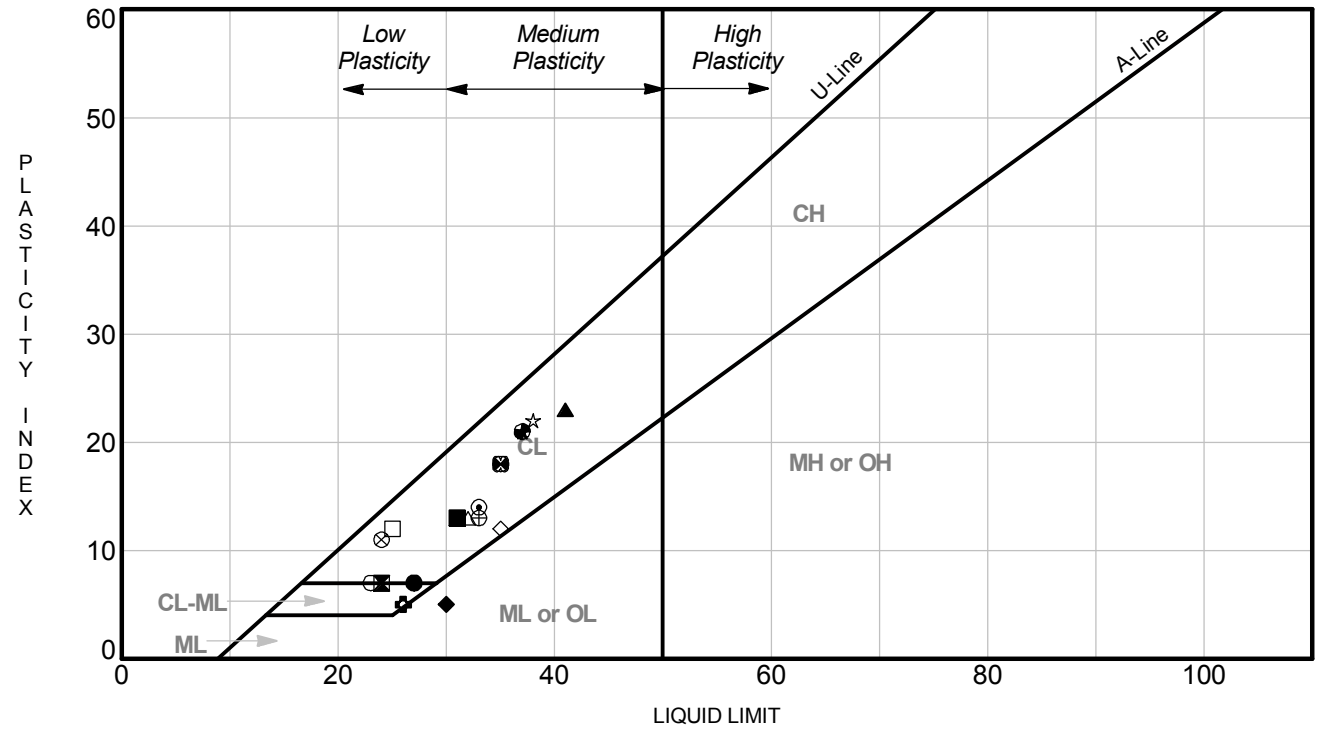

Symbol	Boring	Sample	Depth (ft.)	Natural Water Content (%)	LL[1] (%)	PL[1] (%)	PI[1] (%)	% Pass. #200	Fines USCS	USCS Classification of Entire Sample
●	P07	R1	2.5 - 3.5	--	27	20	7	22	CL	Silty, Clayey Sand With Gravel (SC-SM)
⊠	P08	CU1	0.0 - 5.0	--	24	17	7	22	CL	Silty, Clayey Sand With Gravel (SC-SM)
▲	P09	CU1	0.0 - 5.0	--	41	18	23	32	CL	Clayey Sand (SC)
★	P10	CU1	0.0 - 5.0	--	37	16	21	39	CL	Clayey Sand (SC)
⊙	P11	CU1	0.0 - 5.0	--	33	19	14	24	CL	Clayey Sand With Gravel (SC)
✿	P12	CU1	0.0 - 5.0	--	26	21	5	25	CL-ML	Silty, Clayey Sand With Gravel (SC-SM)
○	P13	CU1	0.0 - 5.0	--	23	16	7	28	CL	Silty, Clayey Sand (SC-SM)
△	P13	R1	2.5 - 3.5	--	32	19	13	31	CL	Clayey Sand (SC)
⊗	P14	CU1	0.0 - 5.0	--	24	13	11	25	CL	Clayey Sand With Gravel (SC)
⊕	P15	CU1	0.0 - 5.0	4.1	33	20	13	15	CL	Clayey Sand With Gravel (SC)
□	P16	CU1	0.0 - 5.0	--	25	13	12	39	CL	Clayey Sand (SC)
⊗	P17	CU1	0.0 - 5.0	--	35	17	18	35	CL	Clayey Sand (SC)
◕	P18	CU1	0.0 - 5.0	--	37	16	21	42	CL	Clayey Sand (SC)
☆	P18	R2	5.0 - 6.0	--	38	16	22	52	CL	Sandy Lean Clay (CL)
✿	P19	CU1	0.0 - 5.0	--	35	17	18	36	CL	Clayey Sand (SC)
■	P24	CU1	0.0 - 5.0	--	31	18	13	29	CL	Clayey Sand (SC)
◆	P25	CU1	0.0 - 5.0	--	30	25	5	21	ML	Silty Sand With Gravel (SM)
◇	P26	CU1	0.0 - 5.0	--	35	23	12	15	CL	Clayey Sand With Gravel (SC)

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ATTERBERG LIMITS RESULTS

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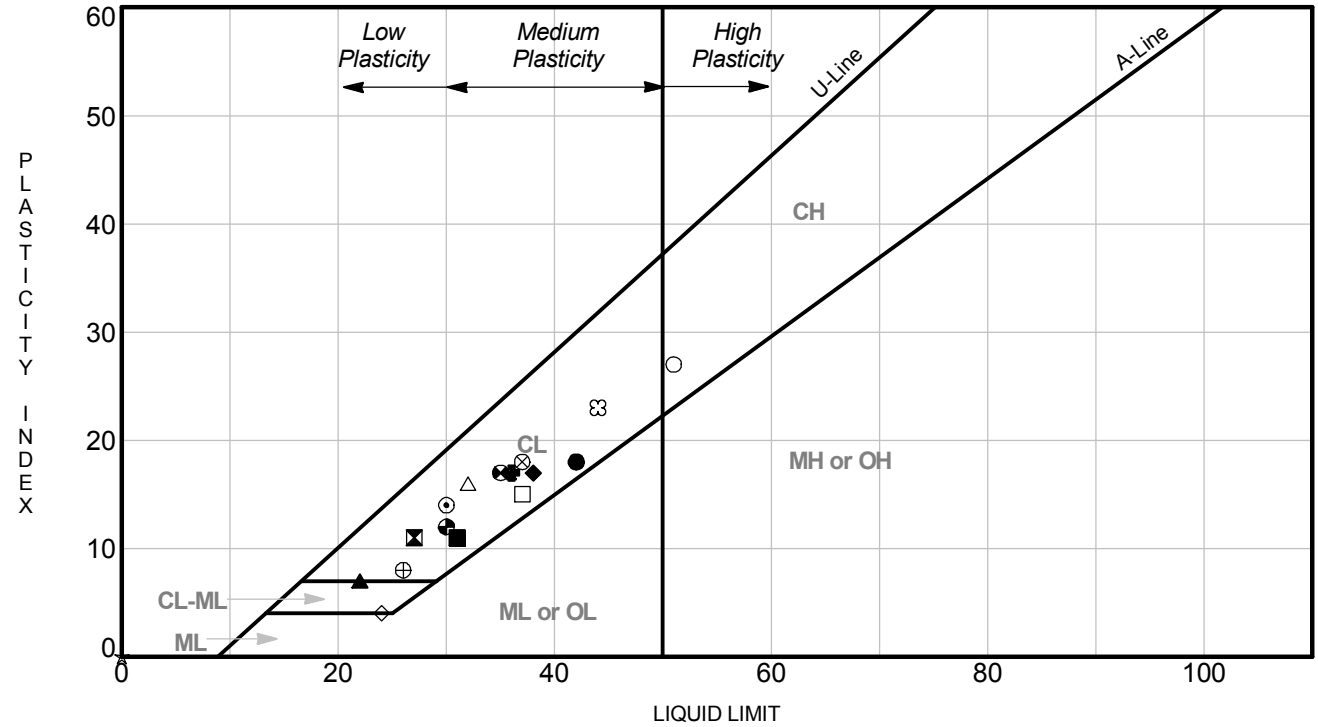

Symbol	Boring	Sample	Depth (ft.)	Natural Water Content (%)	LL[1] (%)	PL[1] (%)	PI[1] (%)	% Pass. #200	Fines USCS	USCS Classification of Entire Sample
●	P27	CU1	0.0 - 5.0	--	42	24	18	21	CL	Clayey Sand With Gravel (SC)
⊠	P28	CU1	0.0 - 5.0	--	27	16	11	34	CL	Clayey Sand (SC)
▲	P28	R1	2.5 - 3.5	--	22	15	7	31	CL	Silty, Clayey Sand (SC-SM)
★	P29	CU1	0.0 - 5.0	--	36	19	17	36	CL	Clayey Sand (SC)
⊙	P30	CU1	0.0 - 5.0	--	30	16	14	36	CL	Clayey Sand (SC)
✿	P31	CU1	0.0 - 5.0	--	36	19	17	30	CL	Clayey Sand (SC)
○	P32	CU1	0.0 - 5.0	--	51	24	27	37	CH	Clayey Sand (SC)
△	P33	CU1	0.0 - 5.0	--	32	16	16	28	CL	Clayey Sand (SC)
⊗	P34	CU1	0.0 - 5.0	--	37	19	18	41	CL	Clayey Sand (SC)
⊕	P34	R1	2.5 - 3.5	--	26	18	8	39	CL	Clayey Sand (SC)
□	W01	S3	7.5 - 9.0	3.2	37	22	15	9	CL	Well-Graded Sand With Clay And Gravel (SW-SC)
⊗	W01	S8	30.0 - 31.5	--	35	18	17	62	CL	Sandy Lean Clay (CL)
◕	W02	R1	2.5 - 3.5	--	30	18	12	33	CL	Clayey Sand (SC)
☆	W02	S6	20.0 - 21.5	--	NP	NP	NP	15	ML	Silty Sand (SM)
✿	W03	S2	5.0 - 6.5	--	44	21	23	42	CL	Clayey Sand (SC)
■	W03	S11	45.0 - 46.5	--	31	20	11	39	CL	Clayey Sand (SC)
◆	W04	R4	10.0 - 11.0	--	38	21	17	20	CL	Clayey Sand (SC)
◇	W04	S7	25.0 - 26.5	5.0	24	20	4	35	CL-ML	Silty, Clayey Sand (SC-SM)

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ATTERBERG LIMITS RESULTS

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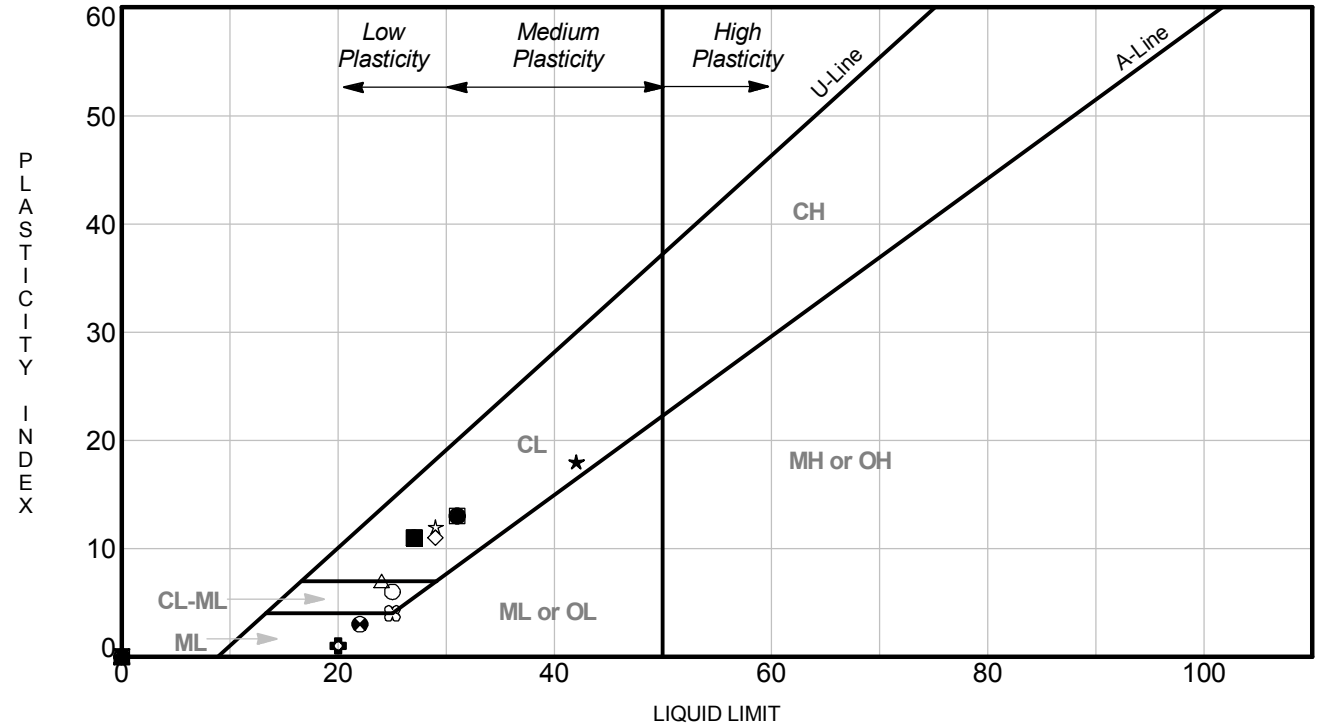

Symbol	Boring	Sample	Depth (ft.)	Natural Water Content (%)	LL[1] (%)	PL[1] (%)	PI[1] (%)	% Pass. #200	Fines USCS	USCS Classification of Entire Sample
●	W04	S11	45.0 - 46.5	--	31	18	13	37	CL	Clayey Sand (SC)
⊠	W05	S6	20.0 - 21.5	--	NP	NP	NP	11	ML	Well-Graded Sand With Silt (SW-SM)
▲	W05	S13	55.0 - 56.5	2.0	NP	NP	NP	19	ML	Silty Sand (SM)
★	W06	S2	5.0 - 6.5	--	42	24	18	29	CL	Clayey Sand (SC)
⊙	W06	S8	30.0 - 31.5	--	NP	NP	NP	10	ML	Poorly Graded Sand With Silt And Gravel (SP-SM)
✿	W07	S8	30.0 - 31.5	--	20	19	1	20	ML	Silty Sand (SM)
○	W08	S3	15.0 - 16.5	--	25	19	6	26	CL-ML	Silty, Clayey Sand (SC-SM)
△	W08	S7	35.0 - 36.5	--	24	17	7	9	CL	Well-Graded Sand With Silty Clay And Gravel (SW-SC)
⊗	W09	S5	15.0 - 16.5	--	NP	NP	NP	16	ML	Silty Sand (SM)
⊕	W09	S11	45.0 - 46.5	--	27	16	11	34	CL	Clayey Sand (SC)
□	W10	S7	25.0 - 26.5	--	31	18	13	71	CL	Lean Clay With Sand (CL)
⊗	W10	S11	45.0 - 46.5	--	22	19	3	21	ML	Silty Sand (SM)
◕	W10	S14	60.0 - 61.5	2.7	NP	NP	NP	16	ML	Silty Sand With Gravel (SM)
☆	W11	S7	25.0 - 26.5	--	29	17	12	78	CL	Lean Clay With Sand (CL)
✿	W11	S16	70.0 - 71.5	6.9	25	21	4	44	CL-ML	Silty, Clayey Sand (SC-SM)
■	W12	R2	5.0 - 6.0	--	27	16	11	42	CL	Clayey Sand (SC)
◆	W12	S6	20.0 - 21.5	--	NP	NP	NP	7	ML	Well-Graded Sand With Silt And Gravel (SW-SM)
◇	W12	S16	70.0 - 71.5	--	29	18	11	59	CL	Sandy Lean Clay (CL)

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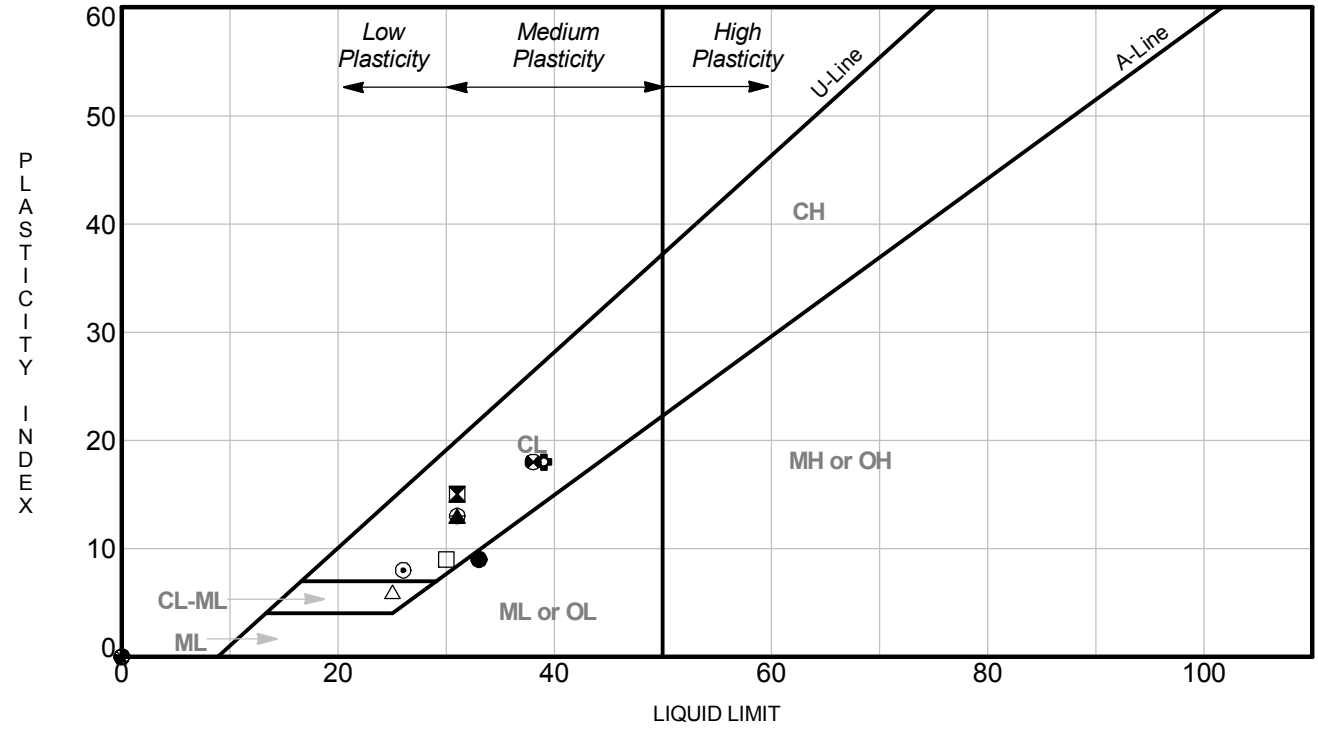

Symbol	Boring	Sample	Depth (ft.)	Natural Water Content (%)	LL[1] (%)	PL[1] (%)	PI[1] (%)	% Pass. #200	Fines USCS	USCS Classification of Entire Sample
●	W13	R2	5.0 - 6.0	5.8	33	24	9	29	ML	Silty Sand (SM)
⊠	W13	S10	40.0 - 41.5	--	31	16	15	27	CL	Clayey Sand (SC)
▲	W13	S13	55.0 - 56.5	6.4	31	18	13	43	CL	Clayey Sand (SC)
★	W14	R5	15.0 - 16.0	--	NP	NP	NP	7	ML	Well-Graded Sand With Silt And Gravel (SW-SM)
⊙	W14	S11	45.0 - 46.5	--	26	18	8	24	CL	Clayey Sand (SC)
✿	W15	S2	5.0 - 6.5	--	39	21	18	39	CL	Clayey Sand (SC)
○	W15	S7	25.0 - 26.5	--	NP	NP	NP	6	ML	Poorly Graded Sand With Silt (SP-SM)
△	W16	S1	2.5 - 4.0	--	25	19	6	25	CL-ML	Silty, Clayey Sand With Gravel (SC-SM)
⊗	W17	S5	15.0 - 16.5	1.0	NP	NP	NP	9	ML	Well-Graded Sand With Silt (SW-SM)
⊕	W17	S10	40.0 - 41.5	--	31	18	13	48	CL	Clayey Sand (SC)
□	W19	S1	2.5 - 4.0	--	30	21	9	39	CL	Clayey Sand (SC)
⊗	W19	S9	35.0 - 36.5	4.2	38	20	18	32	CL	Clayey Sand (SC)
◕	W20	S5	15.0 - 16.5	--	NP	NP	NP	6	ML	Poorly Graded Sand With Silt And Gravel (SP-SM)

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ATTERBERG LIMITS RESULTS

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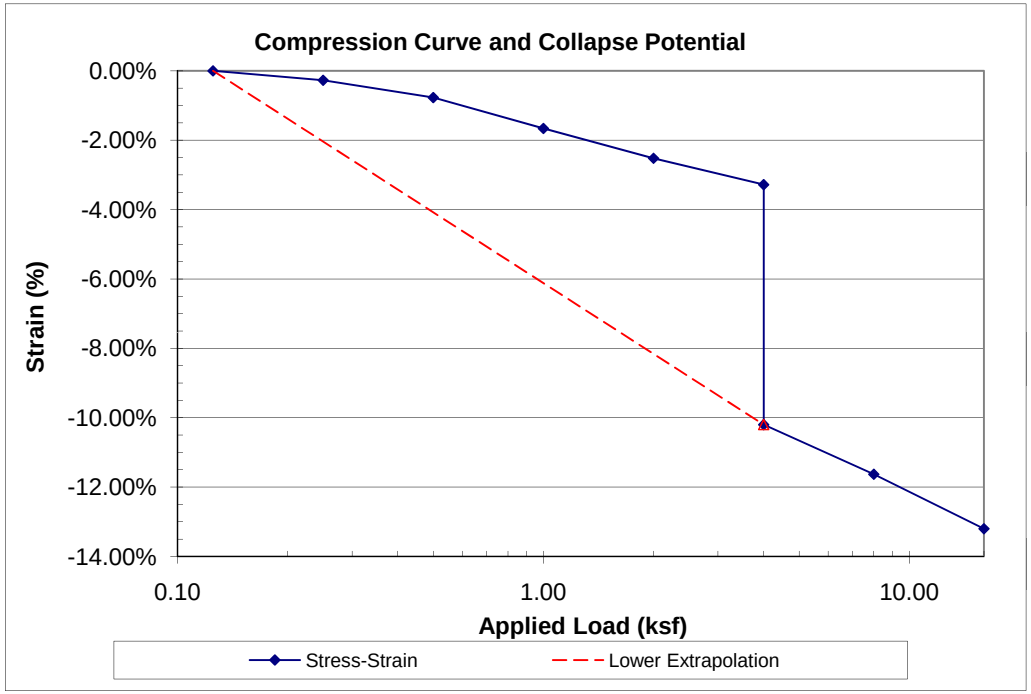
Collapse Potential of Soils
ASTM D 5333-92

Magee Phase 2	
Boring	D02
Sample	R2
Depth (ft)	5.0-6.0
Testing Lab	ConformaTech

Ring Diameter (in)	2.421
Ring Height (in)	1.000
Area (in^2)	4.604

Specific Gravity	2.56

	Before	After
Ring Tare (g)	42.4	42.4
Wet + Tare (g)	162.9	176.8
Dry + Tare (g)	159.0	159.0
m_s (g)	116.6	116.6
m_w (g)	3.9	17.8
Moisture Content (%)	3.3%	15.3%
Total Volume (in^3)	4.604	3.997
Dry Density (pcf)	96.5	111.1
Void Ratio, e	0.656	0.437
Saturation, S	13.1%	89.4%



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Date/Time	Load (ksf)	Dial Reading (in.)	I	Relative Movement (in.)	% Strain
	0.13	0.0847		0.0000	0.00%
	0.25	0.0874		-0.0027	-0.27%
	0.50	0.0924		-0.0077	-0.77%
	1.00	0.1013		-0.0166	-1.66%
	2.00	0.1099		-0.0252	-2.52%
	4.00	0.1175		-0.0328	-3.28%
	4.00	0.1867	x	-0.1020	-10.20%
	8.00	0.201		-0.1163	-11.63%
	16.00	0.2167		-0.1320	-13.20%
				0.0847	8.47%
				0.0847	8.47%
				0.0847	8.47%
				0.0847	8.47%
				0.0847	8.47%
				0.0847	8.47%

Collapse Potential Results

Load At Inundation (ksf)	4.00
Strain Before Wetting	-3.28%
Strain After Wetting	-10.20%
Target Applied Stress (ksf)	4.00
Collapse Potential, Ic at 4.00 ksf:	***6.92%***
Interpolated/Extrapolated Collapse Index, Ie at 4.00 ksf:	***6.92%***
Degree of Collapse (see Table 1)	**Moderately Severe**

Table 1 From ASTM D 5333
Classification of Collapse Index, I_e

Degree of Collapse	Ie Range
None	0% to 0.1%
Slight	0.10% to 2.0%
Moderate	2.10% to 6.0%
Moderately Severe	6.10% to 10.0%
Severe	>10.0%

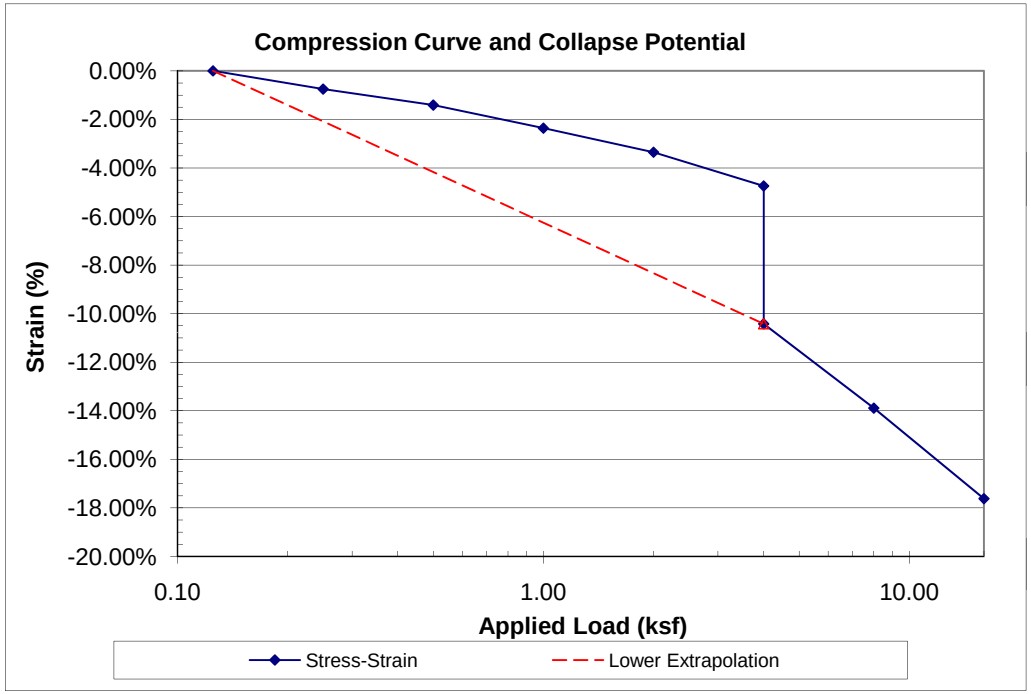
Collapse Potential of Soils
ASTM D 5333-92

Magee Phase 2	
Boring	P03
Sample	R1
Depth (ft)	2.5-3.5
Testing Lab	ConformaTech

Ring Diameter (in)	2.421
Ring Height (in)	1.000
Area (in^2)	4.604

Specific Gravity	2.56

	Before	After
Ring Tare (g)	42.4	42.4
Wet + Tare (g)	150.4	167.8
Dry + Tare (g)	143.4	143.4
m_s (g)	101.0	101.0
m_w (g)	7.0	24.4
Moisture Content (%)	6.9%	24.2%
Total Volume (in^3)	4.604	3.793
Dry Density (pcf)	83.6	101.4
Void Ratio, e	0.912	0.575
Saturation, S	19.5%	107.6%



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Date/Time	Load (ksf)	Dial Reading (in.)	I	Relative Movement (in.)	% Strain
	0.13	0.0511		0.0000	0.00%
	0.25	0.0586		-0.0075	-0.75%
	0.50	0.0652		-0.0141	-1.41%
	1.00	0.0747		-0.0236	-2.36%
	2.00	0.0846		-0.0335	-3.35%
	4.00	0.0985		-0.0474	-4.74%
	4.00	0.1553	x	-0.1042	-10.42%
	8.00	0.19		-0.1389	-13.89%
	16.00	0.2273		-0.1762	-17.62%
				0.0511	5.11%
				0.0511	5.11%
				0.0511	5.11%
				0.0511	5.11%
				0.0511	5.11%
				0.0511	5.11%

Collapse Potential Results

Load At Inundation (ksf)	4.00
Strain Before Wetting	-4.74%
Strain After Wetting	-10.42%
Target Applied Stress (ksf)	4.00
Collapse Potential, Ic at 4.00 ksf:	***5.68%***
Interpolated/Extrapolated Collapse Index, Ie at 4.00 ksf:	***5.68%***
Degree of Collapse (see Table 1)	**Moderate**

Table 1 From ASTM D 5333
Classification of Collapse Index, I_e

Degree of Collapse	Ie Range
None	0% to 0.1%
Slight	0.10% to 2.0%
Moderate	2.10% to 6.0%
Moderately Severe	6.10% to 10.0%
Severe	>10.0%

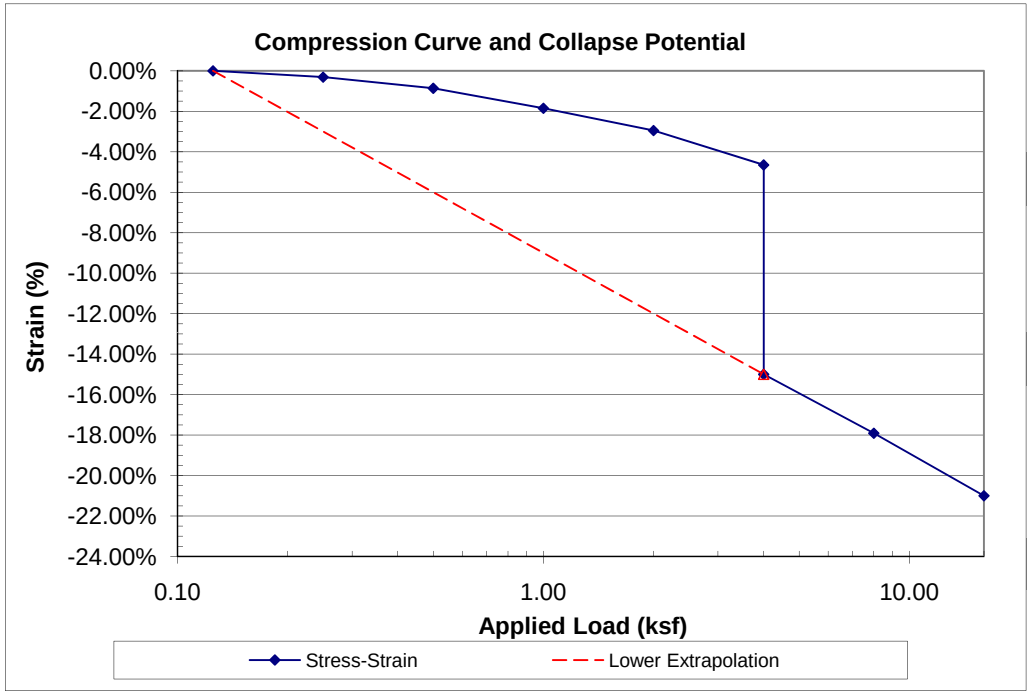
Collapse Potential of Soils
ASTM D 5333-92

Magee Phase 2	
Boring	P13
Sample	R1
Depth (ft)	2.5-3.5
Testing Lab	ConformaTech

Ring Diameter (in)	2.421
Ring Height (in)	1.000
Area (in^2)	4.604

Specific Gravity	2.56

	Before	After
Ring Tare (g)	42.2	42.2
Wet + Tare (g)	153.1	165.9
Dry + Tare (g)	147.4	147.4
m_s (g)	105.2	105.2
m_w (g)	5.7	18.5
Moisture Content (%)	5.4%	17.6%
Total Volume (in^3)	4.604	3.637
Dry Density (pcf)	87.0	110.2
Void Ratio, e	0.835	0.450
Saturation, S	16.6%	100.1%



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Date/Time	Load (ksf)	Dial Reading (in.)	I	Relative Movement (in.)	% Strain
	0.13	0.0254		0.0000	0.00%
	0.25	0.0285		-0.0031	-0.31%
	0.50	0.034		-0.0086	-0.86%
	1.00	0.0439		-0.0185	-1.85%
	2.00	0.0549		-0.0295	-2.95%
	4.00	0.0719		-0.0465	-4.65%
	4.00	0.1754	x	-0.1500	-15.00%
	8.00	0.2045		-0.1791	-17.91%
	16.00	0.2354		-0.2100	-21.00%
				0.0254	2.54%
				0.0254	2.54%
				0.0254	2.54%
				0.0254	2.54%
				0.0254	2.54%
				0.0254	2.54%

Collapse Potential Results

Load At Inundation (ksf)	4.00
Strain Before Wetting	-4.65%
Strain After Wetting	-15.00%
Target Applied Stress (ksf)	4.00
Collapse Potential, Ic at 4.00 ksf:	***10.35%***
Interpolated/Extrapolated Collapse Index, Ie at 4.00 ksf:	***10.35%***
Degree of Collapse (see Table 1)	**Severe**

Table 1 From ASTM D 5333
Classification of Collapse Index, I_e

Degree of Collapse	Ie Range
None	0% to 0.1%
Slight	0.10% to 2.0%
Moderate	2.10% to 6.0%
Moderately Severe	6.10% to 10.0%
Severe	>10.0%

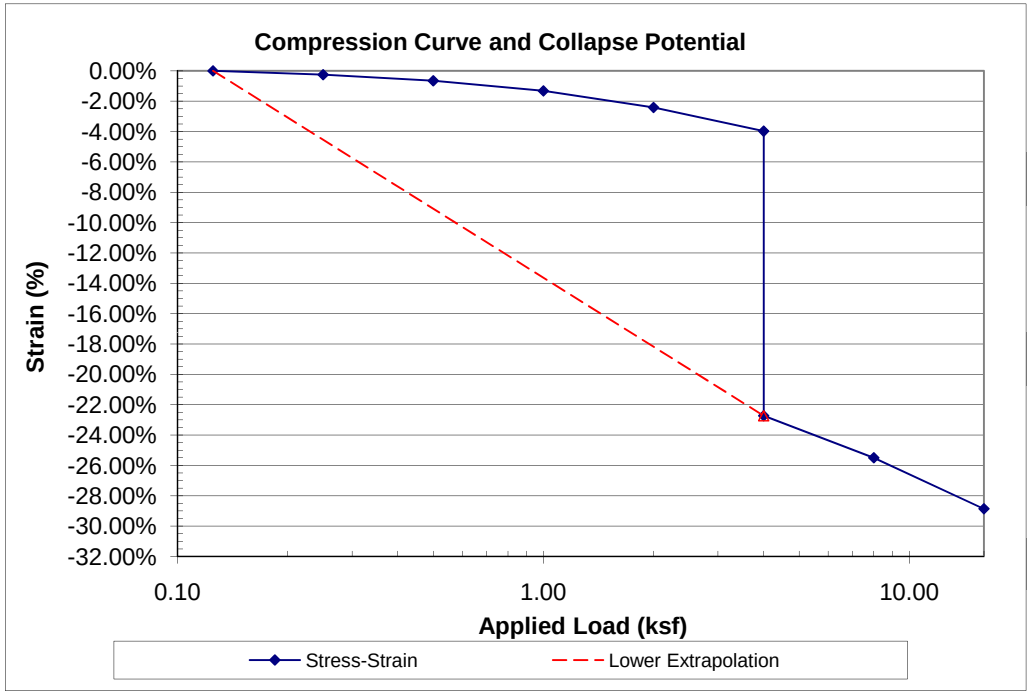
Collapse Potential of Soils
ASTM D 5333-92

Magee Phase 2	
Boring	P18
Sample	R2
Depth (ft)	5.0-6.0
Testing Lab	ConformaTech

Ring Diameter (in)	2.421
Ring Height (in)	1.000
Area (in^2)	4.604

Specific Gravity	2.56

	Before	After
Ring Tare (g)	42.1	42.1
Wet + Tare (g)	155.1	162.1
Dry + Tare (g)	145.3	145.3
m_s (g)	103.2	103.2
m_w (g)	9.8	16.8
Moisture Content (%)	9.5%	16.3%
Total Volume (in^3)	4.604	3.276
Dry Density (pcf)	85.4	120.0
Void Ratio, e	0.871	0.331
Saturation, S	27.9%	125.9%



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Date/Time	Load (ksf)	Dial Reading (in.)	I	Relative Movement (in.)	% Strain
	0.13	0.0893		0.0000	0.00%
	0.25	0.0918		-0.0025	-0.25%
	0.50	0.0958		-0.0065	-0.65%
	1.00	0.1025		-0.0132	-1.32%
	2.00	0.1134		-0.0241	-2.41%
	4.00	0.129		-0.0397	-3.97%
	4.00	0.3166	x	-0.2273	-22.73%
	8.00	0.3443		-0.2550	-25.50%
	16.00	0.3779		-0.2886	-28.86%
				0.0893	8.93%
				0.0893	8.93%
				0.0893	8.93%
				0.0893	8.93%
				0.0893	8.93%
				0.0893	8.93%

Collapse Potential Results

Load At Inundation (ksf)	4.00
Strain Before Wetting	-3.97%
Strain After Wetting	-22.73%
Target Applied Stress (ksf)	4.00
Collapse Potential, Ic at 4.00 ksf:	***18.76%***
Interpolated/Extrapolated Collapse Index, Ie at 4.00 ksf:	***18.76%***
Degree of Collapse (see Table 1)	**Severe**

Table 1 From ASTM D 5333
Classification of Collapse Index, I_e

Degree of Collapse	Ie Range
None	0% to 0.1%
Slight	0.10% to 2.0%
Moderate	2.10% to 6.0%
Moderately Severe	6.10% to 10.0%
Severe	>10.0%

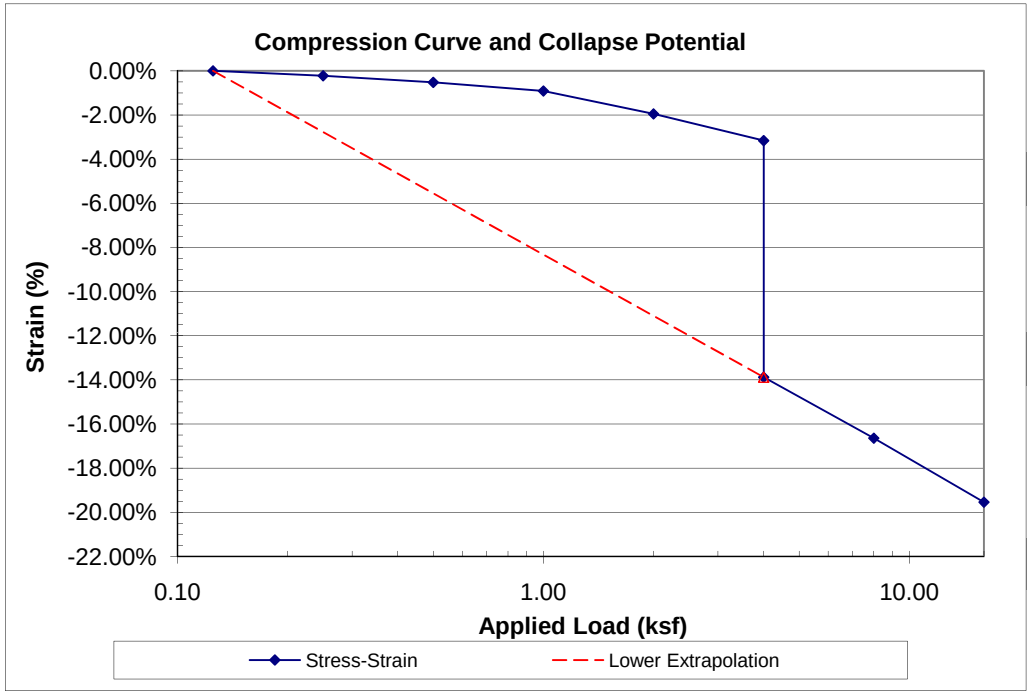
Collapse Potential of Soils
ASTM D 5333-92

Magee Phase 2	
Boring	P28
Sample	R1
Depth (ft)	2.5-3.5
Testing Lab	ConformaTech

Ring Diameter (in)	2.421
Ring Height (in)	1.000
Area (in^2)	4.604

Specific Gravity	2.56

	Before	After
Ring Tare (g)	42.0	42.0
Wet + Tare (g)	161.8	173.0
Dry + Tare (g)	155.3	155.3
m_s (g)	113.3	113.3
m_w (g)	6.5	17.7
Moisture Content (%)	5.7%	15.6%
Total Volume (in^3)	4.604	3.705
Dry Density (pcf)	93.7	116.5
Void Ratio, e	0.704	0.371
Saturation, S	20.9%	107.8%



Loading Data

Date/Time	Load (ksf)	Dial Reading (in.)	I	Relative Movement (in.)	% Strain
	0.13	0.0066		0.0000	0.00%
	0.25	0.0088		-0.0022	-0.22%
	0.50	0.0118		-0.0052	-0.52%
	1.00	0.0157		-0.0091	-0.91%
	2.00	0.0261		-0.0195	-1.95%
	4.00	0.0382		-0.0316	-3.16%
	4.00	0.1454	x	-0.1388	-13.88%
	8.00	0.173		-0.1664	-16.64%
	16.00	0.202		-0.1954	-19.54%
				0.0066	0.66%
				0.0066	0.66%
				0.0066	0.66%
				0.0066	0.66%
				0.0066	0.66%
				0.0066	0.66%

Collapse Potential Results

Load At Inundation (ksf)	4.00
Strain Before Wetting	-3.16%
Strain After Wetting	-13.88%
Target Applied Stress (ksf)	4.00
Collapse Potential, Ic at 4.00 ksf:	***10.72%***
Interpolated/Extrapolated Collapse Index, Ie at 4.00 ksf:	***10.72%***
Degree of Collapse (see Table 1)	**Severe**

Table 1 From ASTM D 5333
Classification of Collapse Index, I_e

Degree of Collapse	Ie Range
None	0% to 0.1%
Slight	0.10% to 2.0%
Moderate	2.10% to 6.0%
Moderately Severe	6.10% to 10.0%
Severe	>10.0%

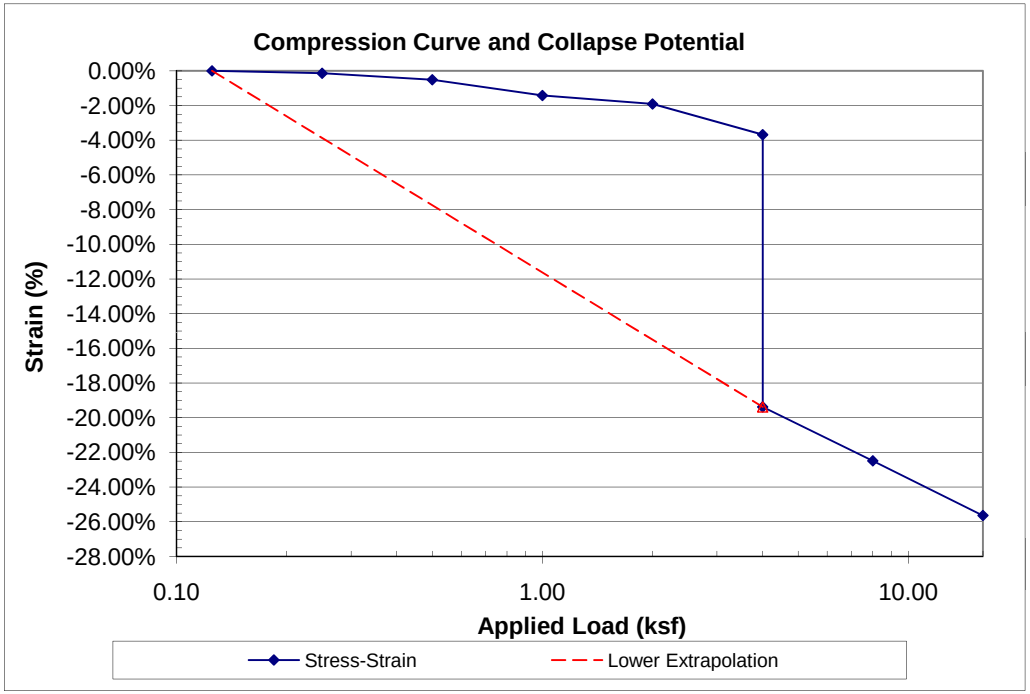
Collapse Potential of Soils
ASTM D 5333-92

Magee Phase 2	
Boring	P34
Sample	R1
Depth (ft)	2.5-3.5
Testing Lab	ConformaTech

Ring Diameter (in)	2.421
Ring Height (in)	1.000
Area (in^2)	4.604

Specific Gravity	2.56

	Before	After
Ring Tare (g)	46.7	46.7
Wet + Tare (g)	166.8	173.8
Dry + Tare (g)	156.8	156.8
m_s (g)	110.1	110.1
m_w (g)	10.0	17.0
Moisture Content (%)	9.1%	15.4%
Total Volume (in^3)	4.604	3.424
Dry Density (pcf)	91.1	122.5
Void Ratio, e	0.754	0.304
Saturation, S	30.9%	130.0%



Loading Data

Date/Time	Load (ksf)	Dial Reading (in.)	I	Relative Movement (in.)	% Strain
	0.13	0.1144		0.0000	0.00%
	0.25	0.1158		-0.0014	-0.14%
	0.50	0.1195		-0.0051	-0.51%
	1.00	0.1286		-0.0142	-1.42%
	2.00	0.1335		-0.0191	-1.91%
	4.00	0.1512		-0.0368	-3.68%
	4.00	0.3082	x	-0.1938	-19.38%
	8.00	0.3393		-0.2249	-22.49%
	16.00	0.3708		-0.2564	-25.64%
				0.1144	11.44%
				0.1144	11.44%
				0.1144	11.44%
				0.1144	11.44%
				0.1144	11.44%
				0.1144	11.44%

Collapse Potential Results

Load At Inundation (ksf)	4.00
Strain Before Wetting	-3.68%
Strain After Wetting	-19.38%
Target Applied Stress (ksf)	4.00
Collapse Potential, Ic at 4.00 ksf:	***15.70%***
Interpolated/Extrapolated Collapse Index, Ie at 4.00 ksf:	***15.70%***
Degree of Collapse (see Table 1)	**Severe**

Table 1 From ASTM D 5333
Classification of Collapse Index, I_e

Degree of Collapse	Ie Range
None	0% to 0.1%
Slight	0.10% to 2.0%
Moderate	2.10% to 6.0%
Moderately Severe	6.10% to 10.0%
Severe	>10.0%

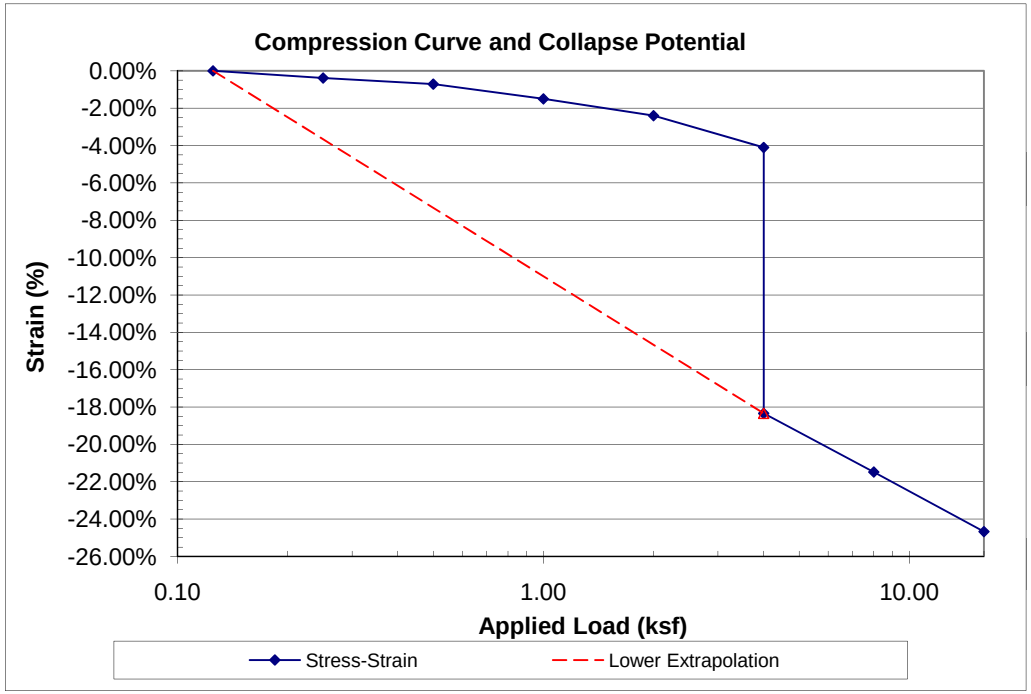
Collapse Potential of Soils
ASTM D 5333-92

Magee Phase 2	
Boring	W12
Sample	R2
Depth (ft)	5.0-6.0
Testing Lab	ConformaTech

Ring Diameter (in)	2.421
Ring Height (in)	1.000
Area (in^2)	4.604

Specific Gravity	2.56

	Before	After
Ring Tare (g)	46.1	46.1
Wet + Tare (g)	158.0	167.1
Dry + Tare (g)	151.0	151.0
m_s (g)	104.9	104.9
m_w (g)	7.0	16.1
Moisture Content (%)	6.7%	15.3%
Total Volume (in^3)	4.604	3.468
Dry Density (pcf)	86.8	115.2
Void Ratio, e	0.841	0.386
Saturation, S	20.3%	101.7%



Loading Data

Date/Time	Load (ksf)	Dial Reading (in.)	I	Relative Movement (in.)	% Strain
	0.13	0.113		0.0000	0.00%
	0.25	0.1168		-0.0038	-0.38%
	0.50	0.1201		-0.0071	-0.71%
	1.00	0.128		-0.0150	-1.50%
	2.00	0.137		-0.0240	-2.40%
	4.00	0.154		-0.0410	-4.10%
	4.00	0.2964	x	-0.1834	-18.34%
	8.00	0.3278		-0.2148	-21.48%
	16.00	0.3597		-0.2467	-24.67%
				0.1130	11.30%
				0.1130	11.30%
				0.1130	11.30%
				0.1130	11.30%
				0.1130	11.30%
				0.1130	11.30%

Collapse Potential Results

Load At Inundation (ksf)	4.00
Strain Before Wetting	-4.10%
Strain After Wetting	-18.34%
Target Applied Stress (ksf)	4.00
Collapse Potential, Ic at 4.00 ksf:	***14.24%***
Interpolated/Extrapolated Collapse Index, Ie at 4.00 ksf:	***14.24%***
Degree of Collapse (see Table 1)	**Severe**

Table 1 From ASTM D 5333
Classification of Collapse Index, I_e

Degree of Collapse	Ie Range
None	0% to 0.1%
Slight	0.10% to 2.0%
Moderate	2.10% to 6.0%
Moderately Severe	6.10% to 10.0%
Severe	>10.0%

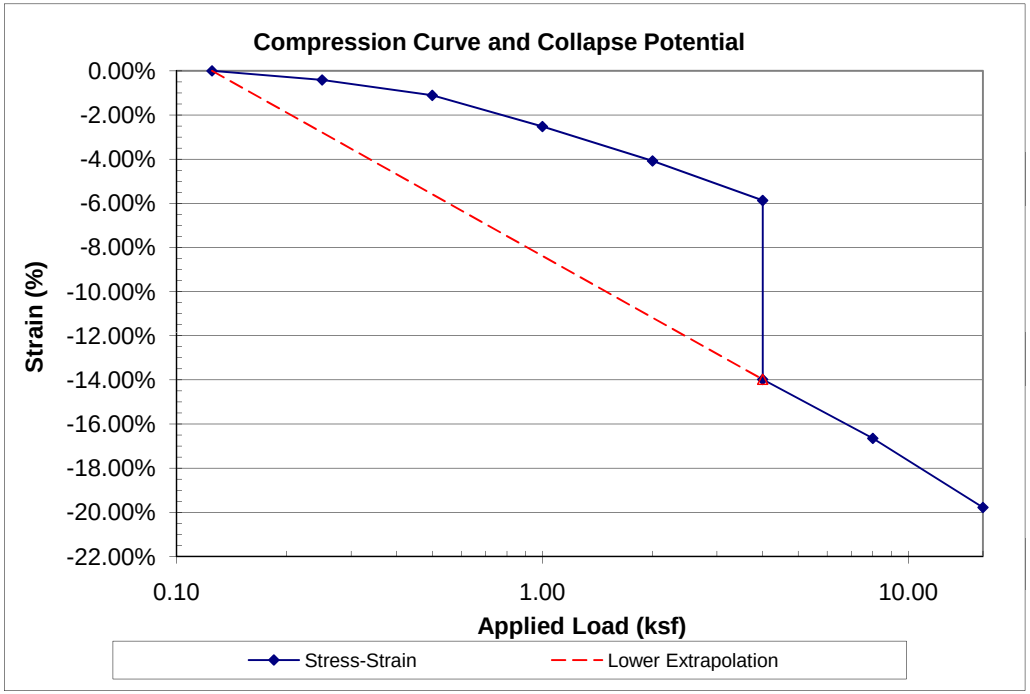
Collapse Potential of Soils
ASTM D 5333-92

Magee Phase 2	
Boring	W13
Sample	R2
Depth (ft)	5.0-6.0
Testing Lab	ConformaTech

Ring Diameter (in)	2.421
Ring Height (in)	1.000
Area (in^2)	4.604

Specific Gravity	2.56

	Before	After
Ring Tare (g)	45.5	45.5
Wet + Tare (g)	155.0	169.1
Dry + Tare (g)	149.0	149.0
m_s (g)	103.5	103.5
m_w (g)	6.0	20.1
Moisture Content (%)	5.8%	19.4%
Total Volume (in^3)	4.604	3.694
Dry Density (pcf)	85.6	106.7
Void Ratio, e	0.865	0.496
Saturation, S	17.1%	100.1%



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Date/Time	Load (ksf)	Dial Reading (in.)	I	Relative Movement (in.)	% Strain
	0.13	0.145		0.0000	0.00%
	0.25	0.1491		-0.0041	-0.41%
	0.50	0.1561		-0.0111	-1.11%
	1.00	0.1702		-0.0252	-2.52%
	2.00	0.1858		-0.0408	-4.08%
	4.00	0.2037		-0.0587	-5.87%
	4.00	0.2848	x	-0.1398	-13.98%
	8.00	0.3115		-0.1665	-16.65%
	16.00	0.3428		-0.1978	-19.78%
				0.1450	14.50%
				0.1450	14.50%
				0.1450	14.50%
				0.1450	14.50%
				0.1450	14.50%
				0.1450	14.50%

Collapse Potential Results

Load At Inundation (ksf)	4.00
Strain Before Wetting	-5.87%
Strain After Wetting	-13.98%
Target Applied Stress (ksf)	4.00
Collapse Potential, Ic at 4.00 ksf:	***8.11%***
Interpolated/Extrapolated Collapse Index, Ie at 4.00 ksf:	***8.11%***
Degree of Collapse (see Table 1)	**Moderately Severe**

Table 1 From ASTM D 5333
Classification of Collapse Index, I_e

Degree of Collapse	Ie Range
None	0% to 0.1%
Slight	0.10% to 2.0%
Moderate	2.10% to 6.0%
Moderately Severe	6.10% to 10.0%
Severe	>10.0%

Swell / Settlement Potential of Soils
ASTM D 4546

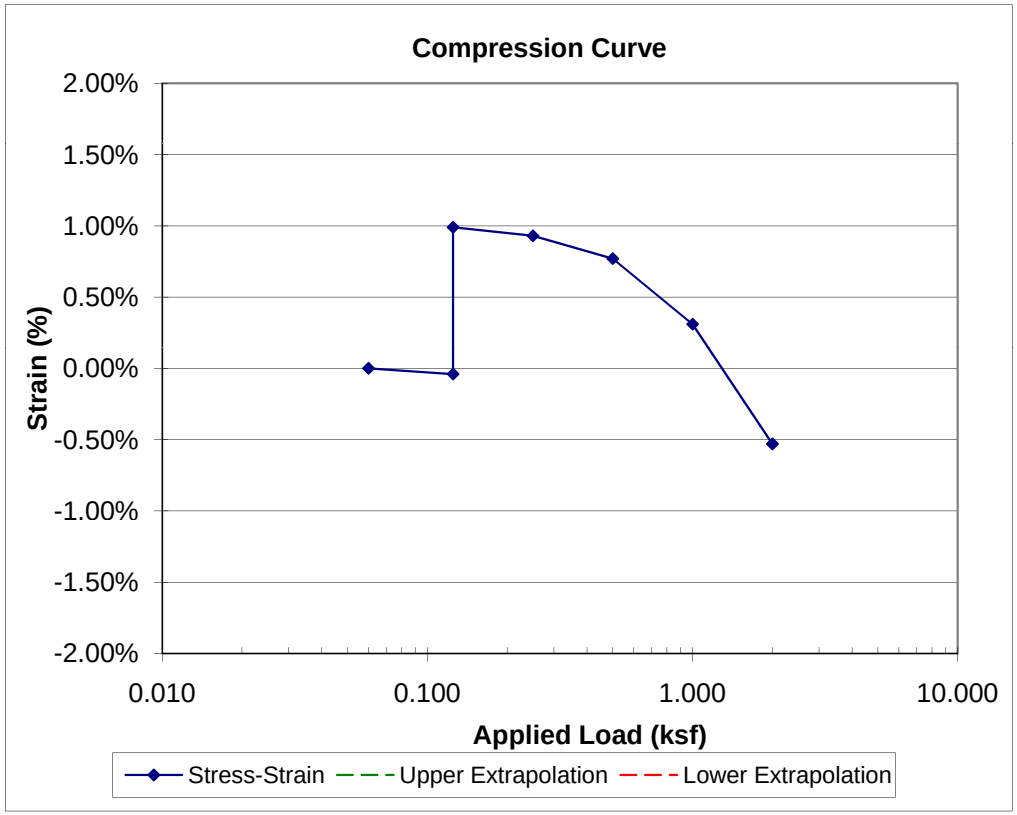
Valencia - Alvernon to Wilmot	
Boring	P29
Sample	CU1
Depth (ft)	0.0-5.0
Testing Lab	ConformaTech

Testing Method	Method B

Ring Diameter (in)	2.421
Ring Height (in)	1.000
Area (in^2)	4.602

Specific Gravity	2.56

	Before	After
Ring Tare (g)	38.8	38.8
Wet + Tare (g)	185.5	192.0
Dry + Tare (g)	169.8	169.8
m_s (g)	131.0	131.0
m_w (g)	15.7	22.2
Moisture Content (%)	12.0%	16.9%
Total Volume (in^3)	4.602	4.577
Dry Density (pcf)	108.5	109.0
Void Ratio, e	0.473	0.465
Saturation, S	64.9%	93.3%



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Date/Time	Load (ksf)	Dial Reading (in.)	I	Relative Movement (in.)	% Strain
	0.060	0.1859		0.0000	0.00%
	0.125	0.1863		-0.0004	-0.04%
	0.125	0.176	x	0.0099	0.99%
	0.250	0.1766		0.0093	0.93%
	0.500	0.1782		0.0077	0.77%
	1.000	0.1828		0.0031	0.31%
	2.000	0.1912		-0.0053	-0.53%
				0.1859	18.59%

Swell / Settlement Potential Results

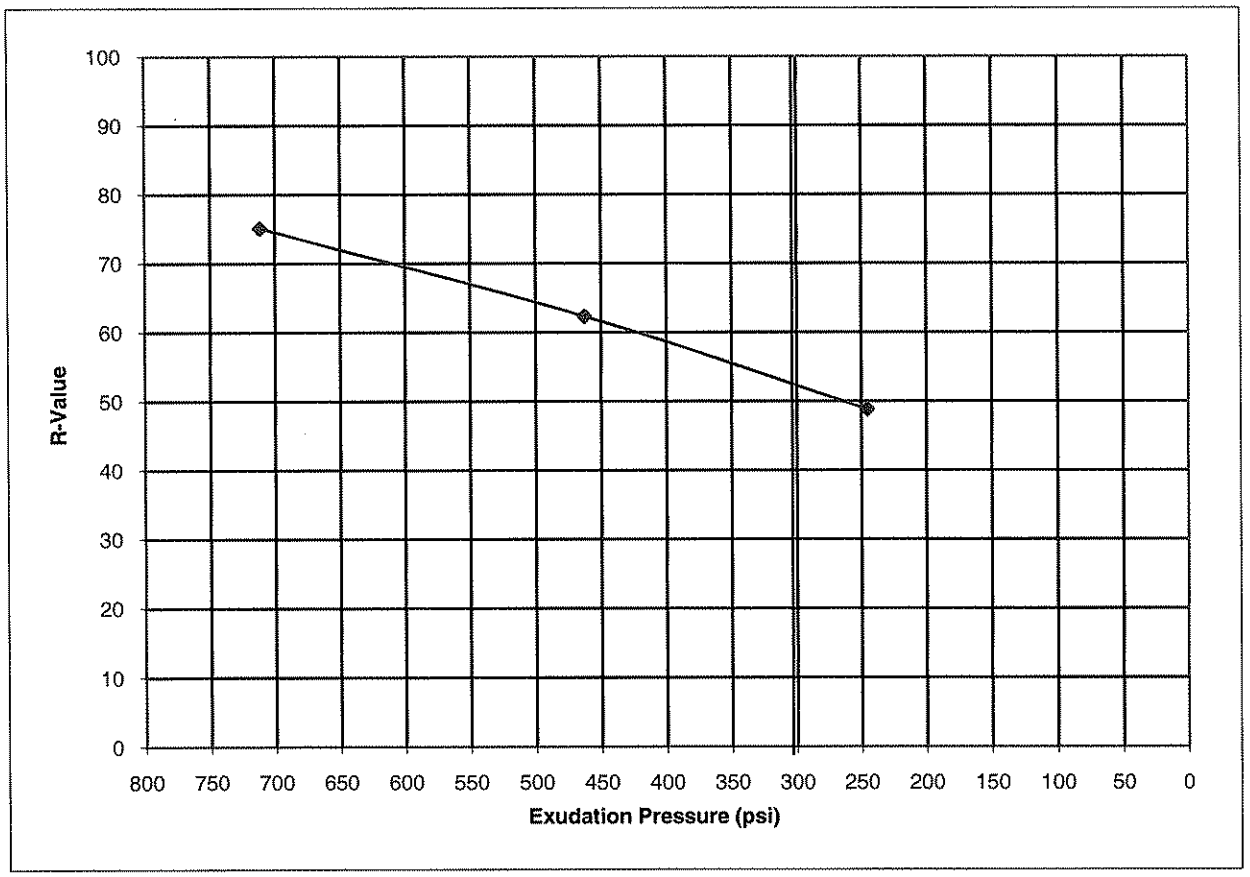
Load At Inundation (ksf)	0.125
% Strain Before Inundation	-0.04%
% Strain After Inundation	0.99%
Percent Heave	**1.03%**

The Sample Heaved 1.03%

PROJECT:	Valencia Road	**JOB NO:**	4-119-000069
LOCATION:	Alvernon to Wilmot; Tucson, AZ	**WORK ORDER NO:**	37
MATERIAL:	Silty Clay w/Gravel	**LAB NO:**	141
SAMPLE SOURCE:	P06 CU1 @ 0.0-5.0'	**DATE SAMPLED:**	03/07/11

RESISTANCE R-VALUE AND EXPANSION PRESSURE OF COMPACTED SOILS (ASTM D2844)

SPECIMEN I. D.	**A**	**B**	**C**
Moisture Content	12.8%	12.3%	11.9%
Compaction Pressure (psi)	350	350	350
Specimen Height (inches)	2.49	2.48	2.51
Dry Density (pcf)	121.5	121.7	122.0
Horiz. Pres. @ 1000lbs (psi)	32.0	23.0	17.0
Horiz. Pres. @ 2000lbs (psi)	67.0	48.0	31.0
Displacement	3.63	3.52	3.44
Expansion Pressure (psi)	0.0	0.3	0.5
Exudation Pressure (psi)	245	462	711
R Value	49	62	75



R Value at 300 PSI = 52

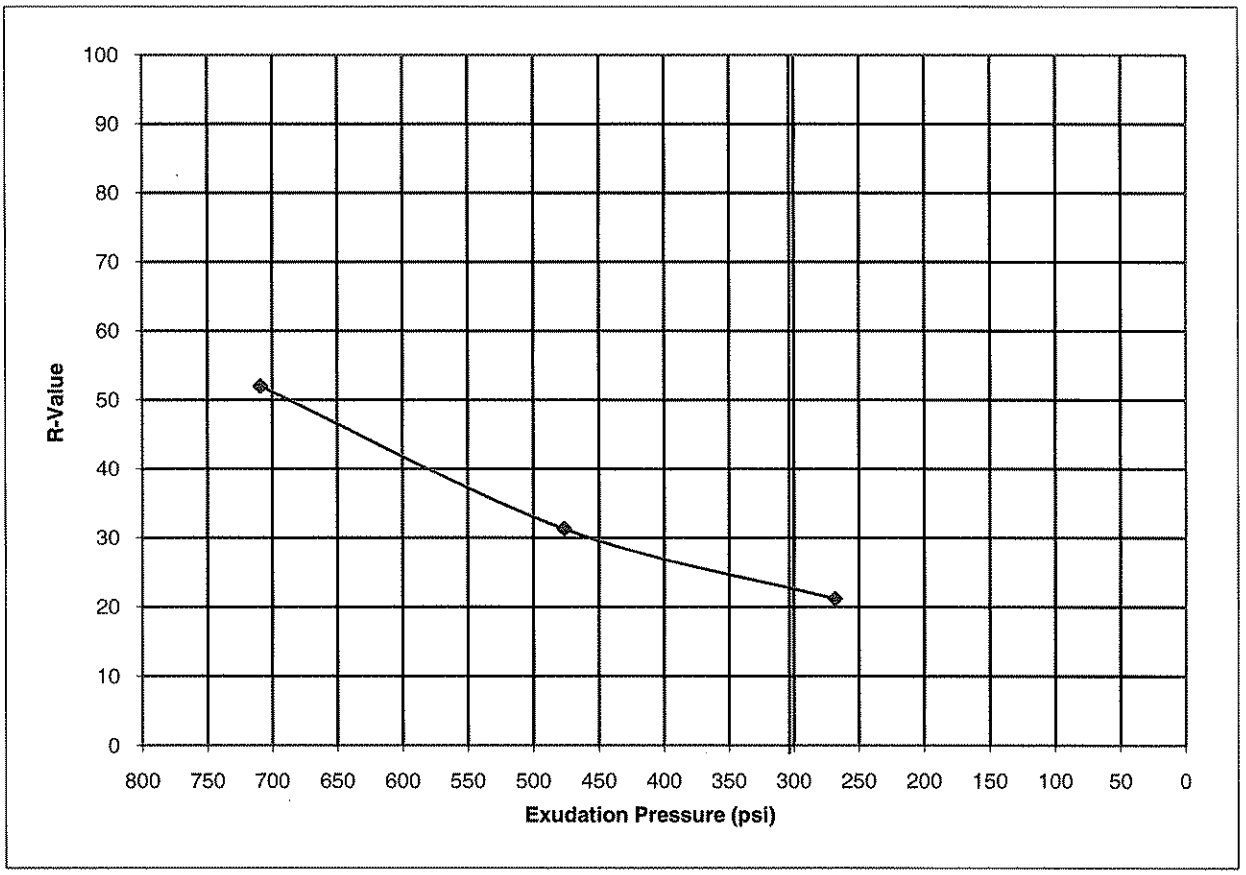
AASHTO R19

REVIEWED BY

PROJECT:	Valencia Road	**JOB NO:**	4-119-000069
LOCATION:	Alvernon to Wilmot; Tucson, AZ	**WORK ORDER NO:**	37
MATERIAL:	Silty Clay w/Gravel	**LAB NO:**	142
SAMPLE SOURCE:	P16 CU1 @ 0.0-5.0'	**DATE SAMPLED:**	03/07/11

RESISTANCE R-VALUE AND EXPANSION PRESSURE OF COMPACTED SOILS (ASTM D2844)

SPECIMEN I. D.	**A**	**B**	**C**
Moisture Content	11.4%	10.8%	10.1%
Compaction Pressure (psi)	100	150	200
Specimen Height (inches)	2.45	2.41	2.40
Dry Density (pcf)	125.4	127.3	129.2
Horiz. Pres. @ 1000lbs (psi)	50.0	40.0	30.0
Horiz. Pres. @ 2000lbs (psi)	118.0	100.0	70.0
Displacement	3.30	3.00	2.68
Expansion Pressure (psi)	0.0	0.5	1.0
Exudation Pressure (psi)	268	476	709
R Value	21	31	52



R Value at 300 PSI = 22

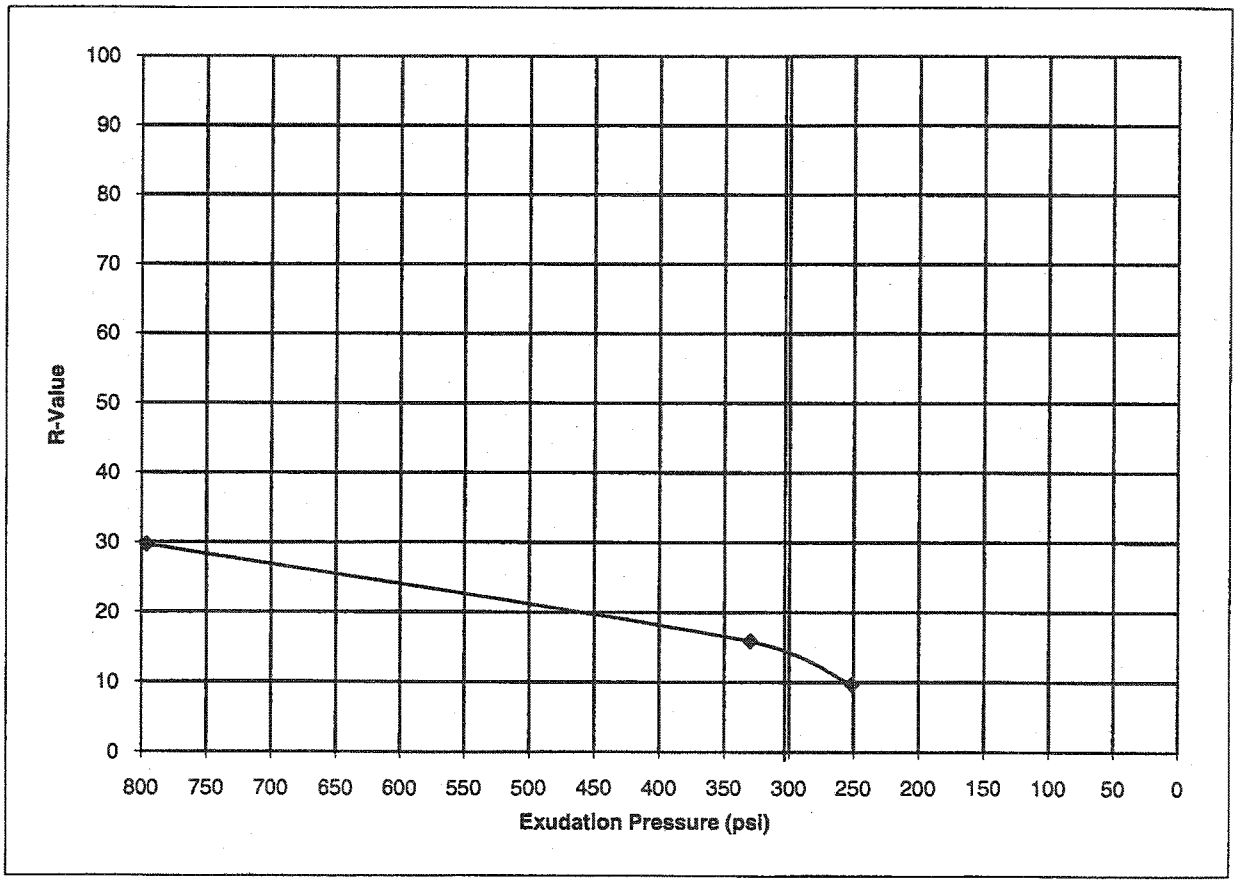
AASHTO R16

REVIEWED BY

PROJECT:	Valencia - Alvenon to Wilmot (11-2810)	**JOB NO:**	4-119-000069
LOCATION:	Tucson, Arizona	**WORK ORDER NO:**	40 (J2009-10)
MATERIAL:	Silty Sandy Clay w/Gravel	**LAB NO:**	150 (1)
SAMPLE SOURCE:	Boring P28 CO1 @ 0.0-5.0' (Batch D)	**DATE RECEIVED:**	03/21/11

RESISTANCE R-VALUE AND EXPANSION PRESSURE OF COMPACTED SOILS (ASTM D2844)

SPECIMEN I. D.	**A**	**B**	**C**
Moisture Content	11.6%	10.8%	9.9%
Compaction Pressure (psi)	50	75	75
Specimen Height (inches)	2.52	2.53	2.52
Dry Density (pcf)	123.7	125.4	129.2
Horiz. Pres. @ 1000lbs (psi)	63.0	55.0	45.0
Horiz. Pres. @ 2000lbs (psi)	139.0	128.0	107.0
Displacement	3.52	3.31	2.93
Expansion Pressure (psi)	0.0	0.0	0.0
Exudation Pressure (psi)	251	330	796
R Value	10	16	30



R Value at 300 PSI = 14

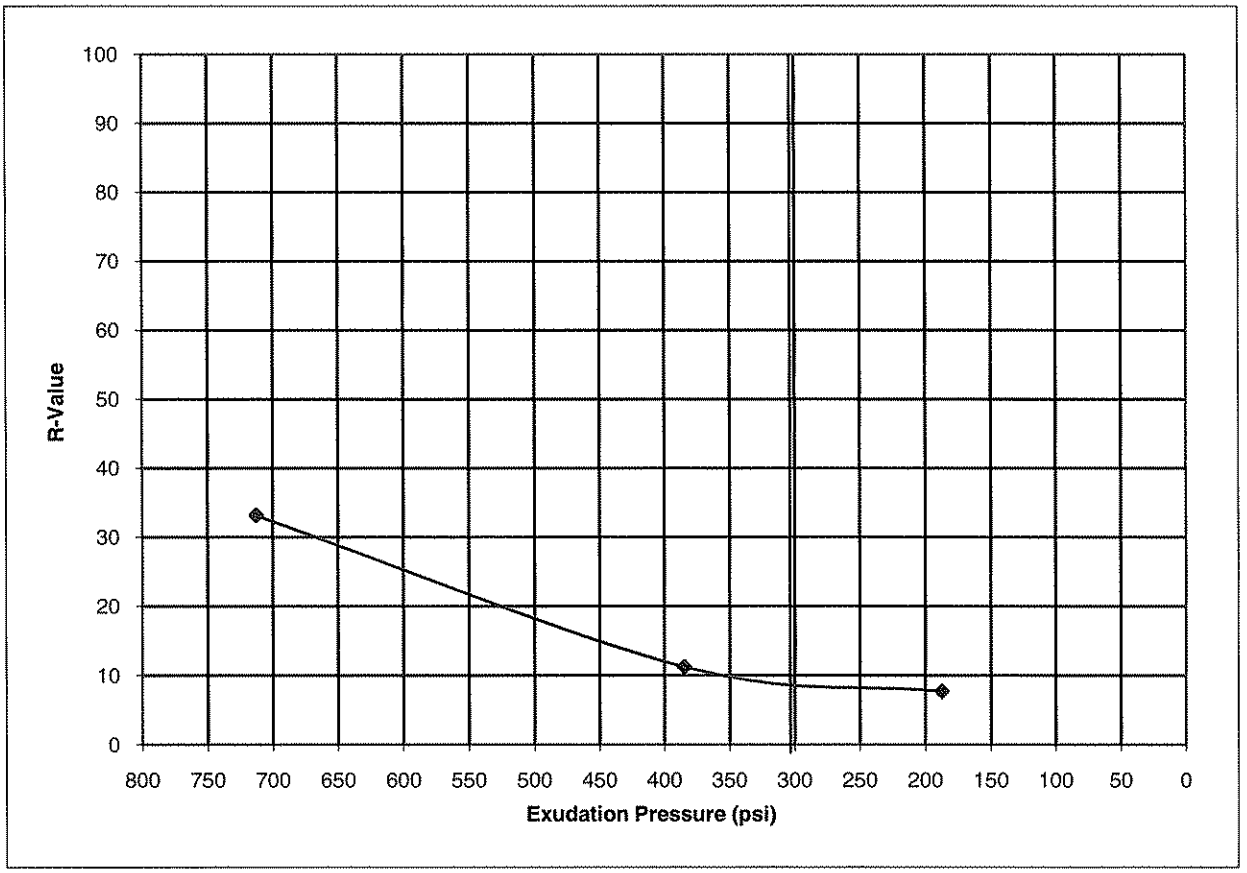
AASHTO R18

REVIEWED BY

PROJECT:	Valencia Road	**JOB NO:**	4-119-000069
LOCATION:	Alvernon to Wilmot; Tucson, AZ	**WORK ORDER NO:**	37
MATERIAL:	Silty Clay w/Gravel	**LAB NO:**	143
SAMPLE SOURCE:	P34 CU1 @ 0.0-5.0'	**DATE SAMPLED:**	03/07/11

RESISTANCE R-VALUE AND EXPANSION PRESSURE OF COMPACTED SOILS (ASTM D2844)

SPECIMEN I. D.	**A**	**B**	**C**
Moisture Content	15.7%	14.3%	12.9%
Compaction Pressure (psi)	50	100	150
Specimen Height (inches)	2.55	2.56	2.41
Dry Density (pcf)	115.0	117.9	121.8
Horiz. Pres. @ 1000lbs (psi)	65.0	61.0	43.0
Horiz. Pres. @ 2000lbs (psi)	139.0	135.0	93.0
Displacement	4.51	3.87	3.31
Expansion Pressure (psi)	0.0	0.3	1.7
Exudation Pressure (psi)	187	385	712
R Value	8	11	33



R Value at 300 PSI = 9

AASHTO R18

REVIEWED BY

Client: Conforma Tech
Project: Soil Samples
Work Order: 11C0388
Date Received: 03/09/2011

Case Narrative

The Arizona Department of Health Services does not license laboratories for the determination of resistivity, chloride, sulfate, or sulfide in a soil matrix.

All soil, sludge, and solid matrix determinations are reported on a wet weight basis unless otherwise noted.

ND Not Detected at or above the PQL

PQL Practical Quantitation Limit

DF Dilution Factor

Turner Laboratories, Inc.

Date: 06/15/2011

Client:	Conforma Tech	**Client Sample ID:**	B02-CU1
Project:	Soil Samples	**Collection Date/Time:**	06/13/2011 1500
Work Order:	11F0427	**Matrix:**	Soil
Lab Sample ID:	11F0427-01	**Order Name:**	Valencia 2819

Analyses	Result	PQL	Qual	Units	DF	Prep Date	Analysis Date	Analyst
Anions by Ion Chromatography-E300								
Chloride	13	10		mg/Kg	1	06/14/2011 1000	06/14/2011 1326	JM
Sulfate	79	50		mg/Kg	1	06/14/2011 1000	06/14/2011 1326	JM

Turner Laboratories, Inc.

Date: 03/17/2011

Client:	Conforma Tech	**Client Sample ID:**	B09- CUI @ 10'15'
Project:	Soil Samples	**Collection Date/Time:**	03/07/2011 1200
Work Order:	11C0388	**Matrix:**	Soil
Lab Sample ID:	11C0388-01	**Order Name:**	Valencia-Alvernon to Wilmot 11-28

Analyses	Result	PQL	Qual	Units	DF	Prep Date	Analysis Date	Analyst
Anions by Ion Chromatography-E300								
Chloride	120	10		mg/Kg	1	03/11/2011 1000	03/11/2011 2301	JM
Sulfate	90	50		mg/Kg	1	03/11/2011 1000	03/11/2011 2301	JM

Turner Laboratories, Inc.

Date: 06/10/2011

Client:	Conforma Tech	**Client Sample ID:**	DO2-CU1 0'-5'
Project:	Soil Samples	**Collection Date/Time:**	06/09/2011 1115
Work Order:	11F0401	**Matrix:**	Soil
Lab Sample ID:	11F0401-01	**Order Name:**	Valencia - Alvernon to Wilmot 281!

Analyses	Result	PQL	Qual	Units	DF	Prep Date	Analysis Date	Analyst
Anions by Ion Chromatography-E300								
Chloride	ND	10		mg/Kg	1	06/10/2011 0730	06/10/2011 1006	JM
Sulfate	ND	50		mg/Kg	1	06/10/2011 0730	06/10/2011 1006	JM

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APPENDIX C

SAMPLE RECOMMENDATIONS FOR DRILLED SHAFTS USING 17TH EDITION OF AASHTO (2002)

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APPENDIX C
Sample Recommendations for Drilled Shafts Using 17th Edition of AASHTO (2002)

In this report, **design** axial capacity charts are presented for evaluating the size of drilled shafts. A sample axial capacity chart is presented in Figure C.1. The design chart permits the structural engineer to select from a range of shaft diameters and lengths to design an optimal foundation size for the given axial load conditions. Tip resistance based on strain compatibility with side-resistance was considered in the development of the charts. The design charts are based on a factor of safety of 2.5 with respect to the "ultimate axial capacity" as given by Eq. 4.6.5.1-1 in AASHTO (2002). No Group Reduction Factor (GRF) was applied. The basis for determination of the axial capacity and the procedure to use the chart is explained below:

The ultimate geotechnical axial capacity (Q_{ult}) of a drilled shaft can be expressed as follows according to Section 4.6.5.1 of AASHTO (2002):

$$Q_{ult} = Q_s + Q_t - W \qquad \text{(AASHTO Eq. 4.6.5.1-1)}$$

where:

Q_{ult}	=	ultimate compressive shaft capacity in kips
Q_s	=	ultimate shaft side-resistance in kips (computed in accordance with Sections 4.6.5.1.1 and 4.6.5.1.2 of AASHTO, 2002)
Q_t	=	ultimate shaft tip resistance in kips (computed in accordance with Sections 4.6.5.1.3 and 4.6.5.1.4 of AASHTO, 2002)
W	=	weight of shaft in kips

As illustrated by Figure C.1, an axial capacity chart shows the relationship between depth of shaft (below finished grade for piers; below bottom of fill for abutments) and design load capacity for a range of shaft diameters and for site–specific subsurface conditions. The axial capacity charts include tip resistance (Q_t) that may be mobilized consistent with the strain required to mobilize skin friction. Site-specific axial capacity charts for the design of drilled shafts for this project based on the above formulation are provided in this report.

The drilled shaft capacity charts provided in this report are in terms of design axial capacities and should be used with design (or allowable) loads. The design axial capacity was computed by dividing the ultimate geotechnical axial capacity (Q_{ult}) by an acceptable factor of safety. A factor of safety of 2.5 was used as per Section 4.6.5.4 of AASHTO (2002).

The design axial capacity determined by using the above procedures is applicable to a single shaft or shafts with a center-to-center (CTC) spacing of 8 diameters or more as per AASHTO (2002). For shafts with a smaller CTC spacing, the design capacity should be reduced to account for the detrimental effects of stress overlap between adjacent shafts. AASHTO (2002) recommends use of a Group Reduction Factor (GRF) based on the CTC spacing. The GRF for axial capacity (GRF_{axial}) can be estimated from the following equations based on AASHTO recommendations (Section 4.6.5.2.4.2 AASHTO, 2002):

$GRF_{axial} = 0.472 + 0.066(X/D)$ for $3D < X < 8D$; $GRF_{axial} = 1.0$ for $X \geq 8D$

where X is the center-to-center spacing of the shafts in a group and D is the shaft diameter. A center-to-center spacing less than 3 times the shaft diameter (X<3D) is not recommended without careful construction sequencing of shafts. The geotechnical engineer should be consulted to verify construction sequencing prior to installation of shafts in this case.

A step-by-step process for the use of a drilled shaft axial capacity chart is described below.

Sample Problem: Consider a single drilled shaft that is part of a 2-shaft pier foundation system for a viaduct (land crossing) having a total pier design (service) load of 600 kips. Assuming the total load is equally distributed between the two shafts, each shaft will carry 300 kips. The problem is to find the depth of embedment below finished grade if the shafts are either 3-ft diameter or 4-ft diameter and are spaced 14-ft apart (center-to-center).

Step-by-step Process to Use the Sample Design Axial Capacity Charts in Figure C.1

Step 1

Use a GRF to adjust the design load for a single shaft to account for group interaction effects. In this example, the GRF for the 3- and 4-ft diameter shafts spaced at 14-ft on centers will be as follows:

Diameter	X/D	GRF
3-ft	4.67	0.78
4-ft	3.50	0.70

Evaluate the prorated design load, P_{adp}, for each shaft as follows:

Diameter	GRF	$P_{adp} = P_{ad}/GRF$
3-ft	0.78	300 kips / 0.78 = 385 kips
4-ft	0.70	300 kips / 0.70 = 429 kips

Step 2

In Figure C.1, draw a vertical line corresponding to the prorated design load from finished grade to the depth below finished grade where this prorated design load line first intersects the capacity curve for an assumed shaft diameter (OP for 3-ft shaft; O'P' for 4-ft shaft). The depth at this intersection represents the required length for shafts with that diameter and group spacing. Using the sample chart provided in Figure C.1, the lengths of the 3-ft and 4-ft diameter shafts will be as follows:

Diameter	P_{adp}	Shaft Length
3-ft	385 kips	44-ft
4-ft	429 kips	36-ft

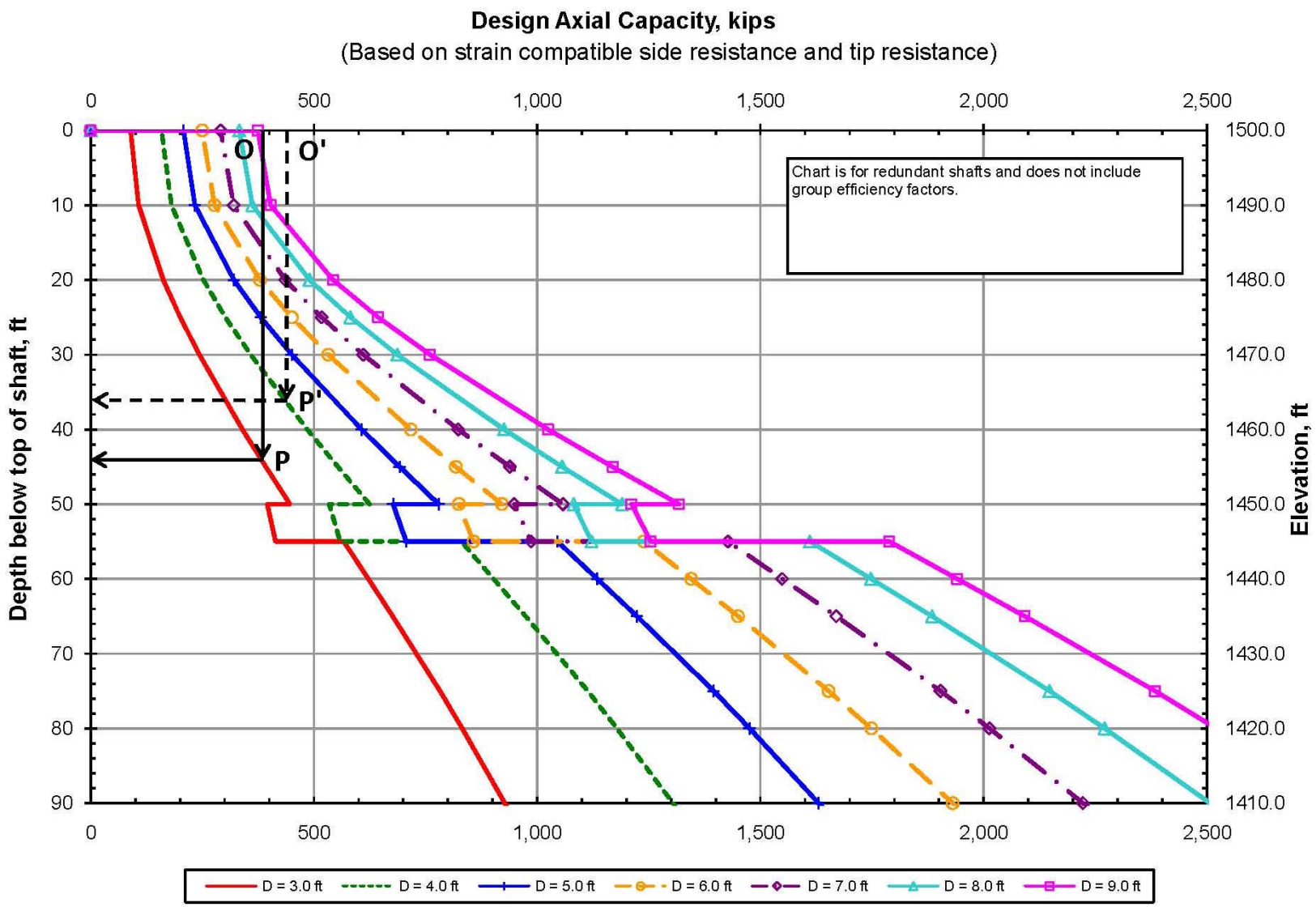

Figure C.1: Sample Drilled Shaft Capacity Chart

Step 3

Check the axial capacity within a depth of 3 diameters below the bottom of the shaft to evaluate the potential for the shaft to punch into a softer deposit below the tip of the shaft. If the capacity is equal to or greater than that of the prorated design load then the length of the shaft determined in Step 2 is adequate. If the capacity is less, as may be the case where there is a weaker soil underlying the shaft tip elevation then the shaft length should be increased until a capacity equal to or greater than the prorated design load is obtained within 3 diameters below the tip of the shaft. In this example, the depth below the tip within which the capacity should be checked is as follows:

Diameter	Shaft Length	Depth below Shaft Tip	Depth below Shaft Top
3-ft	44-ft	3 (3) = 9–ft	44+9 = 53-ft
4-ft	36-ft	3 (4) = 12-ft	36+12 = 48-ft

As shown in Figure C.1, the capacity for all shaft diameters reduces between depths of 50- to 55-ft because of the presence of a weaker layer of soil. For the 4-ft diameter shaft, the top of the softer deposit at 50-ft is below the 48-ft extended length, therefore the 4-ft diameter shaft is adequate. However, for the 3-ft diameter shaft the softer deposit is within 3 diameters below the shaft tip determined from Step 3. Therefore, the shaft should be extended through the softer layer between the depths of 50- to 55-ft. Based on this logic, the recommended length of the shaft would be approximately 56-ft. The procedure should be repeated for the 3-ft diameter shaft founded at a depth of 56-ft to assure that no weaker zone exists within 9 feet of the tip elevation.

By using the above step-by-step procedure, the structural engineer can determine the optimal length for a group of shafts by increasing the diameter of the shafts and/or adjusting the spacing such that the reduction in capacity due to group effects is minimized.

APPENDIX D

PAVEMENT DESIGN CALCULATIONS

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Valencia: Alvernon to Wilmot
West (Flexible) Recommended

	Initials	Date
Made By:	JBH	7/8/2011
Chkd By:	NCS	7/8/2011

AASHTO Flexible Pavement Design Process

Design Method: PCDOT Method

ESAL's (W-18)	**15,416,191**	Flexible 18-kip Equivalent Single Axle Loads
Level of Reliability (R)	**95.00 %**	Section 3.13 (page 3-38)
Zr =	-1.645	Section 3.13 (page 3-38)
Standard Error (So)	**0.35**	Section 3.13 (page 3-38)
Po =	**4.2**	Section 3.13 (page 3-38)
Pt =	**2.8**	Section 3.13 (page 3-38)
Delta-PSI =	1.4	
Resilient Modulus (Mr)	**13,000**	psi with R value of: **30**
Seasonal Variation Factor	**1.7**	Section 3.13 (page 3-37)
Quality of Base Drainage Number	**3**	<=
Quality of Subbase Drainage Number	**3**	<=
Base Drainage Coefficient, m2 =	0.92	Section 3.13 (page 3-38)
Subbase Drainage Coefficient, m3 =	0.92	Section 3.13 (page 3-38)

Excellent:	1
Good:	2
Fair:	3
Poor:	4
Very Poor:	5

Structural Number Required, SN_{reqd} = **4.62**

Layer (Surfacing - Base) Thicknesses:

Asphaltic Concrete =	D1=5.50	inches
Rubberized Asphaltic Concrete =	D2=2.00	inches
Aggregate Base =	D3=10.00	inches
Aggregate Subbase =	D4=0.00	inches
Cement Treated Base =	D5=0.00	inches

Layer Coefficients
Section 3.13 (page 3-38)

a1 =	0.44
a2 =	0.55
a3 =	0.12
a4 =	0.11
a5 =	0.23

Structural Number Provided, SN = **4.62**

PAVEMENT SECTION IS SUFFICIENT
100.10% of that required

Reference:

PCDOT (2010). Pima County Roadway Design Manual, Third Edition. Pima County Department of Transportation, Tucson, AZ

Valencia: Alvernon to Wilmot
West (Flexible) Alternative 1

	Initials	Date
Made By:	JBH	7/8/2011
Chkd By:	NCS	7/8/2011

AASHTO Flexible Pavement Design Process

Design Method: PCDOT Method

ESAL's (W-18)	**15,416,191**	Flexible 18-kip Equivalent Single Axle Loads
Level of Reliability (R)	**95.00 %**	Section 3.13 (page 3-38)
Zr =	-1.645	Section 3.13 (page 3-38)
Standard Error (So)	**0.35**	Section 3.13 (page 3-38)
Po =	**4.2**	Section 3.13 (page 3-38)
Pt =	**2.8**	Section 3.13 (page 3-38)
Delta-PSI =	1.4	
Resilient Modulus (Mr)	**13,000**	psi with R value of: **30**
Seasonal Variation Factor	**1.7**	Section 3.13 (page 3-37)
Quality of Base Drainage Number	**3**	<=
Quality of Subbase Drainage Number	**3**	<=
Base Drainage Coefficient, m2 =	0.92	Section 3.13 (page 3-38)
Subbase Drainage Coefficient, m3 =	0.92	Section 3.13 (page 3-38)

Excellent:	1
Good:	2
Fair:	3
Poor:	4
Very Poor:	5

Structural Number Required, SN_{reqd} = **4.62**

Layer (Surfacing - Base) Thicknesses:

Asphaltic Concrete =	D1=6.00	inches
Rubberized Asphaltic Concrete =	D2=2.00	inches
Aggregate Base =	D3=8.00	inches
Aggregate Subbase =	D4=0.00	inches
Cement Treated Base =	D5=0.00	inches

Layer Coefficients
Section 3.13 (page 3-38)

a1 =	0.44
a2 =	0.55
a3 =	0.12
a4 =	0.11
a5 =	0.23

Structural Number Provided, SN = **4.62**

PAVEMENT SECTION IS SUFFICIENT
100.09% of that required

Reference:

PCDOT (2010). Pima County Roadway Design Manual, Third Edition. Pima County Department of Transportation, Tucson, AZ

Valencia: Alvernon to Wilmot
West (Flexible) Alternative 2

	Initials	Date
Made By:	JBH	7/8/2011
Chkd By:	NCS	7/8/2011

AASHTO Flexible Pavement Design Process

Design Method: **PCDOT Method**

ESAL's (W-18)	**15,416,191**	Flexible 18-kip Equivalent Single Axle Loads	
Level of Reliability (R)	**95.00 %**	Section 3.13 (page 3-38)	
Zr =	-1.645	Section 3.13 (page 3-38)	
Standard Error (So)	**0.35**	Section 3.13 (page 3-38)	
Po =	**4.2**	Section 3.13 (page 3-38)	
Pt =	**2.8**	Section 3.13 (page 3-38)	
Delta-PSI =	1.4		
Resilient Modulus (Mr)	**13,000**	psi with R value of:	**30**
Seasonal Variation Factor	**1.7**	Section 3.13 (page 3-37)	
Quality of Base Drainage Number	**3**	<=	
Quality of Subbase Drainage Number	**3**	<=	
Base Drainage Coefficient, m2 =	0.92	Section 3.13 (page 3-38)	
Subbase Drainage Coefficient, m3 =	0.92	Section 3.13 (page 3-38)	

Excellent:	1
Good:	2
Fair:	3
Poor:	4
Very Poor:	5

Structural Number Required, SN_{reqd} = **4.62**

Layer (Surfacing - Base) Thicknesses:

Asphaltic Concrete =	D1=5.00	inches
Rubberized Asphaltic Concrete =	D2=2.00	inches
Aggregate Base =	D3=12.00	inches
Aggregate Subbase =	D4=0.00	inches
Cement Treated Base =	D5=0.00	inches

Layer Coefficients
Section 3.13 (page 3-38)

a1 =	0.44
a2 =	0.55
a3 =	0.12
a4 =	0.11
a5 =	0.23

Structural Number Provided, SN = **4.62**

PAVEMENT SECTION IS SUFFICIENT
100.12% of that required

Reference:

PCDOT (2010). Pima County Roadway Design Manual, Third Edition. Pima County Department of Transportation, Tucson, AZ

Valencia: Alvernon to Wilmot
Central (Flexible) Recommended

	Initials	Date
Made By:	JBH	7/8/2011
Chkd By:	NCS	7/8/2011

AASHTO Flexible Pavement Design Process

Design Method: PCDOT Method

ESAL's (W-18)	**6,720,725**	Flexible 18-kip Equivalent Single Axle Loads
Level of Reliability (R)	**95.00 %**	Section 3.13 (page 3-38)
Zr =	-1.645	Section 3.13 (page 3-38)
Standard Error (So)	**0.35**	Section 3.13 (page 3-38)
Po =	**4.2**	Section 3.13 (page 3-38)
Pt =	**2.8**	Section 3.13 (page 3-38)
Delta-PSI =	1.4	
Resilient Modulus (Mr)	**13,000**	psi with R value of: **30**
Seasonal Variation Factor	**1.7**	Section 3.13 (page 3-37)
Quality of Base Drainage Number	**3**	<=
Quality of Subbase Drainage Number	**3**	<=
Base Drainage Coefficient, m2 =	0.92	Section 3.13 (page 3-38)
Subbase Drainage Coefficient, m3 =	0.92	Section 3.13 (page 3-38)

Excellent:	1
Good:	2
Fair:	3
Poor:	4
Very Poor:	5

Structural Number Required, SN_{reqd} = **4.03**

Layer (Surfacing - Base) Thicknesses:

Asphaltic Concrete =	D1=4.50	inches
Rubberized Asphaltic Concrete =	D2=2.00	inches
Aggregate Base =	D3=9.00	inches
Aggregate Subbase =	D4=0.00	inches
Cement Treated Base =	D5=0.00	inches

Layer Coefficients
Section 3.13 (page 3-38)

a1 =	0.44
a2 =	0.55
a3 =	0.12
a4 =	0.11
a5 =	0.23

Structural Number Provided, SN = **4.07**

PAVEMENT SECTION IS SUFFICIENT
101.04% of that required

Reference:

PCDOT (2010). Pima County Roadway Design Manual, Third Edition. Pima County Department of Transportation, Tucson, AZ

Valencia: Alvernon to Wilmot
Central (Flexible) Alternative 1

	Initials	Date
Made By:	JBH	7/8/2011
Chkd By:	NCS	7/8/2011

AASHTO Flexible Pavement Design Process

Design Method: PCDOT Method

ESAL's (W-18)	**6,720,725**	Flexible 18-kip Equivalent Single Axle Loads
Level of Reliability (R)	**95.00 %**	Section 3.13 (page 3-38)
Zr =	-1.645	Section 3.13 (page 3-38)
Standard Error (So)	**0.35**	Section 3.13 (page 3-38)
Po =	**4.2**	Section 3.13 (page 3-38)
Pt =	**2.8**	Section 3.13 (page 3-38)
Delta-PSI =	1.4	
Resilient Modulus (Mr)	**13,000**	psi with R value of: **30**
Seasonal Variation Factor	**1.7**	Section 3.13 (page 3-37)
Quality of Base Drainage Number	**3**	<=
Quality of Subbase Drainage Number	**3**	<=
Base Drainage Coefficient, m2 =	0.92	Section 3.13 (page 3-38)
Subbase Drainage Coefficient, m3 =	0.92	Section 3.13 (page 3-38)

Excellent:	1
Good:	2
Fair:	3
Poor:	4
Very Poor:	5

Structural Number Required, SN_{reqd} = **4.03**

Layer (Surfacing - Base) Thicknesses:

Asphaltic Concrete =	D1=5.00	inches
Rubberized Asphaltic Concrete =	D2=2.00	inches
Aggregate Base =	D3=7.00	inches
Aggregate Subbase =	D4=0.00	inches
Cement Treated Base =	D5=0.00	inches

Layer Coefficients
Section 3.13 (page 3-38)

a1 =	0.44
a2 =	0.55
a3 =	0.12
a4 =	0.11
a5 =	0.23

Structural Number Provided, SN = **4.07**

PAVEMENT SECTION IS SUFFICIENT
101.02% of that required

Reference:

PCDOT (2010). Pima County Roadway Design Manual, Third Edition. Pima County Department of Transportation, Tucson, AZ

Valencia: Alvernon to Wilmot
East (Flexible) Recommended

	Initials	Date
Made By:	JBH	7/8/2011
Chkd By:	NCS	7/8/2011

AASHTO Flexible Pavement Design Process

Design Method: PCDOT Method

ESAL's (W-18)	**6,720,725**	Flexible 18-kip Equivalent Single Axle Loads
Level of Reliability (R)	**95.00 %**	Section 3.13 (page 3-38)
Zr =	-1.645	Section 3.13 (page 3-38)
Standard Error (So)	**0.35**	Section 3.13 (page 3-38)
Po =	**4.2**	Section 3.13 (page 3-38)
Pt =	**2.8**	Section 3.13 (page 3-38)
Delta-PSI =	1.4	
Resilient Modulus (Mr)	**8,800**	psi with R value of: **20**
Seasonal Variation Factor	**1.7**	Section 3.13 (page 3-37)
Quality of Base Drainage Number	**3**	<=
Quality of Subbase Drainage Number	**3**	<=
Base Drainage Coefficient, m2 =	0.92	Section 3.13 (page 3-38)
Subbase Drainage Coefficient, m3 =	0.92	Section 3.13 (page 3-38)

Excellent:	1
Good:	2
Fair:	3
Poor:	4
Very Poor:	5

Structural Number Required, SN_{reqd} = **4.67**

Layer (Surfacing - Base) Thicknesses:

Asphaltic Concrete =	D1=5.50	inches
Rubberized Asphaltic Concrete =	D2=2.00	inches
Aggregate Base =	D3=11.00	inches
Aggregate Subbase =	D4=0.00	inches
Cement Treated Base =	D5=0.00	inches

Layer Coefficients
Section 3.13 (page 3-38)

a1 =	0.44
a2 =	0.55
a3 =	0.12
a4 =	0.11
a5 =	0.23

Structural Number Provided, SN = **4.73**

PAVEMENT SECTION IS SUFFICIENT
101.29% of that required

Reference:

PCDOT (2010). Pima County Roadway Design Manual, Third Edition. Pima County Department of Transportation, Tucson, AZ

Valencia: Alvernon to Wilmot
East (Flexible) Alternative 1

	Initials	Date
Made By:	JBH	7/8/2011
Chkd By:	NCS	7/8/2011

AASHTO Flexible Pavement Design Process

Design Method: PCDOT Method

ESAL's (W-18)	**6,720,725**	Flexible 18-kip Equivalent Single Axle Loads
Level of Reliability (R)	**95.00 %**	Section 3.13 (page 3-38)
Zr =	-1.645	Section 3.13 (page 3-38)
Standard Error (So)	**0.35**	Section 3.13 (page 3-38)
Po =	**4.2**	Section 3.13 (page 3-38)
Pt =	**2.8**	Section 3.13 (page 3-38)
Delta-PSI =	1.4	
Resilient Modulus (Mr)	**8,800**	psi with R value of: **20**
Seasonal Variation Factor	**1.7**	Section 3.13 (page 3-37)
Quality of Base Drainage Number	**3**	<=
Quality of Subbase Drainage Number	**3**	<=
Base Drainage Coefficient, m2 =	0.92	Section 3.13 (page 3-38)
Subbase Drainage Coefficient, m3 =	0.92	Section 3.13 (page 3-38)

Excellent:	1
Good:	2
Fair:	3
Poor:	4
Very Poor:	5

Structural Number Required, SN_{reqd} = **4.67**

Layer (Surfacing - Base) Thicknesses:

Asphaltic Concrete =	D1=6.00	inches
Rubberized Asphaltic Concrete =	D2=2.00	inches
Aggregate Base =	D3=9.00	inches
Aggregate Subbase =	D4=0.00	inches
Cement Treated Base =	D5=0.00	inches

Layer Coefficients
Section 3.13 (page 3-38)

a1 =	0.44
a2 =	0.55
a3 =	0.12
a4 =	0.11
a5 =	0.23

Structural Number Provided, SN = **4.73**

PAVEMENT SECTION IS SUFFICIENT
101.28% of that required

Reference:

PCDOT (2010). Pima County Roadway Design Manual, Third Edition. Pima County Department of Transportation, Tucson, AZ