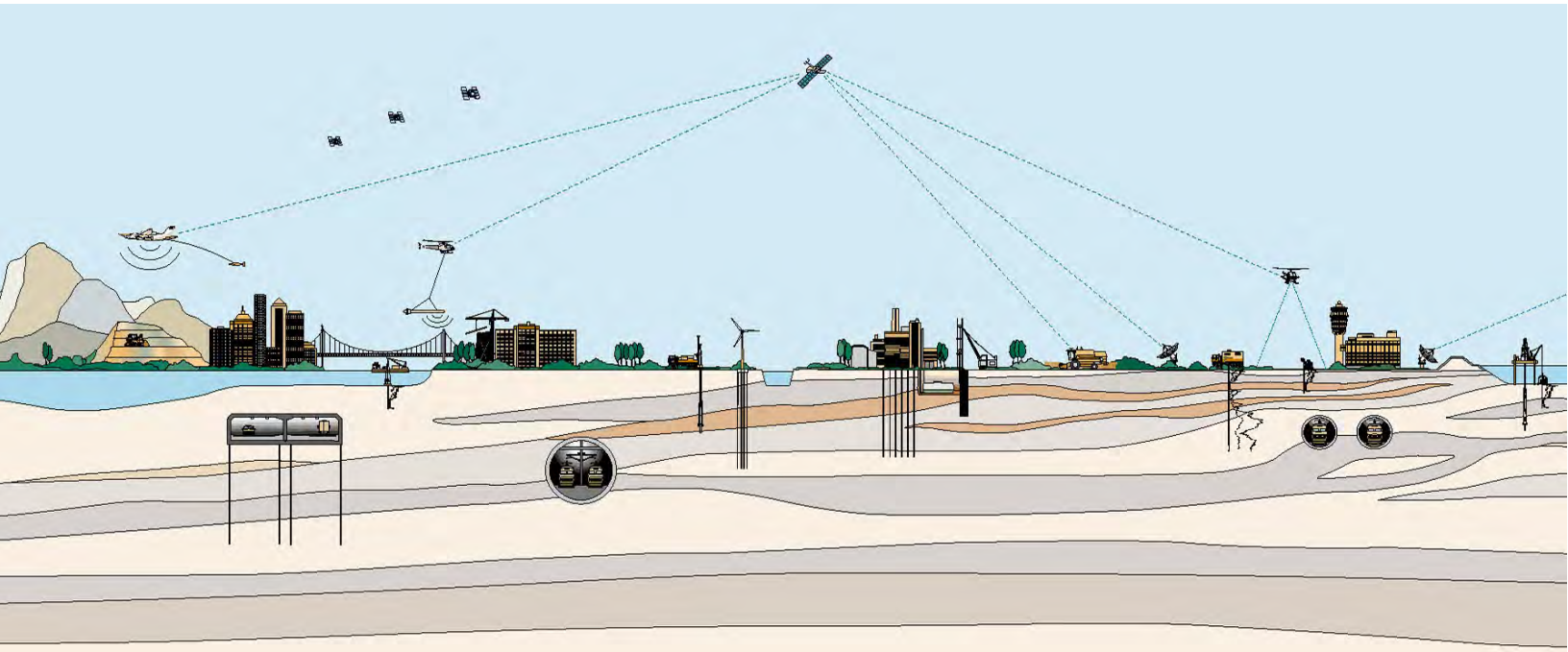
FUGRO CONSULTANTS, INC.

ADDENDUM and UPDATE
TO GEOTECHNICAL REPORT
Los Osos Wastewater Project
San Luis Obispo County, California

Prepared for:
Camp, Dresser & McKee, Inc. (CDM)

October 24, 2011
Fugro Project No. 04.6111.0030



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October 24, 2011
Project No. 04.6111.0030

CDM
2295 Gateway Oaks Drive, Suite 240
Sacramento, California 95833

Attention: Mr. Michael Middleton

Subject: Addendum and Update to Geotechnical Report, Los Osos Wastewater Project, San Luis Obispo County, California

Dear Mr. Middleton:

Fugro is pleased to submit this addendum and update to our Geotechnical Report prepared for the design of the County of San Luis Obispo's Los Osos Wastewater Project. The purpose of this report is to provide geotechnical recommendations for the design of the collection system, effluent disposal system, pump stations, and conveyance to and from the wastewater treatment plant. This report was prepared in accordance with our subconsulting agreement for professional services with CDM dated May 17, 2011.

Fugro prepared a Geotechnical Report dated March 9, 2004 report for the design of this project under subcontract to MWH. The report included Volume 2 dated March 4, 2004 that presents supporting field and laboratory test data from various previous geotechnical studies performed by Fugro, CFS, and Metcalf & Eddy. The recommendations of the March 9, 2004 report and supporting data presented in Volume 2 are considered applicable and can be used in the design of the pipeline collection system, pump stations, and effluent disposal system for the current project being designed by CDM.

The recommendations presented in the March 9, 2004 for the design of the mid-town (Tri-W site) wastewater treatment plant site are no longer considered applicable to the current project. A new site has been selected for the wastewater treatment plant that is located behind the cemetery on Los Osos Valley Road (the Giacomazzi site). The design of the new treatment plant site is not a part of our current scope of work or project, and a geotechnical evaluation has not yet been performed for the design of that facility.

This report includes supplemental field and laboratory data collected along Los Osos Valley Road, updated seismic data for use with the 2010 California building code, recommendations for the design of the conveyance pipelines between the treatment plant and the mid-town pump station, and recommendations for the design of the mid-town pump station.

This report is an addendum to the previous report, and should be used in association with the recommendations and data presented in the March 9, 2004 report.

We appreciate the opportunity to provide our services on this project. Please contact the undersigned if you have questions regarding this report, or require additional information

Sincerely,

FUGRO CONSULTANTS, INC.

Jonathan D. Blanchard, GE2312
Principal Geotechnical Engineer

Reviewed by:

Craig D. Prentice, CEG 1602
Principal Engineering Geologist

Copies Submitted: 2 – addressee (1 pdf)
1 – Mr. Bruce Corwin, CDM

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1.0 PROJECT DESCRIPTION

The project generally consists of the design of the collection system for the Los Osos wastewater project. The project components for the effluent disposal system (currently limited to the Broderson site), the pump stations, and collection system are described in the Geotechnical Report. Some modifications are being made to the design to address lower flows being used in the current design of the collection system, and will result in some modifications to the depth and grade of the pipeline network. This addendum provides supplemental information for the design of the pipeline that will reach along Los Osos Valley Road and for the mid-town pump station to the wastewater treatment plant. The location of the project relative to nearby roadways and landmarks is shown on Plate 1, Cumulative Field Exploration Plan.

The improvements addressed by this addendum include the following:

- The collection system will be by gravity flow with pump stations that will divert flow to the new Mid-Town Pump Station that will be located near the intersection of Ravena Avenue and Los Osos Valley Road. The pump station will be located approximately 50 feet north of Los Osos Valley Road. The depth of the pump station has not been determined at this time. The standby power building for this facility will be located on Palisades Avenue, about 30 to 40 feet west of the library parking lot.
- A force main will be designed along approximately 2 miles of Los Osos Valley Road to convey raw sewage from the Mid-Town Pump Station to the new treatment plant site on the Giacomazzi Property, north of the cemetery and the Clark Valley Road intersection (CDM 2011a, 2011b). The force main will be designed with approximately 4 feet of cover, except where the pipeline may be deepened to approximately 8 feet to avoid conflicts with utility pipes.
- The pipeline alignment within town will generally run between the centerline of Los Osos Valley Road and the westbound shoulder between Ravena and Palisades, along the eastbound shoulder between Palisades to about 700 feet east of South Bay Boulevard, and generally between the westbound shoulder and centerline to Clark Valley Road.
- A second recycled water pipeline will be installed along Los Osos Valley Road to convey treated effluent from the plant back into town and to the Broderson site for recycling and disposal. The recycled water pipeline will be buried at approximately the same depth and general alignment as for the force main.
- The force mains will cross Los Osos Creek at the bridge on Los Osos Valley Road. One pipe will likely be located on the south side of the bridge and one on the north side. The pipes will be structurally suspended from the existing bridge.

2.0 WORK PERFORMED

2.1 PURPOSE

The purpose of this report is to provide additional geotechnical recommendations for the design of the force mains along Los Osos Valley Road, to update the seismic data for use with the current building code, and to supplement the previous Geotechnical Report (Fugro 2004). The main geotechnical considerations that we evaluated for the project are characterization of the soil and groundwater conditions encountered, foundation support for the bridge at Los Osos Creek, and the trench subgrade and support conditions along Los Osos Valley Road.

2.2 SCOPE OF WORK

To evaluate the geotechnical considerations for the project, we have performed the following scope of work:

- Consulted with CDM and the County regarding our approach to the geotechnical evaluation, the project objectives, site access, and to obtain project information;
- Visited the site to observe the general site conditions, marked boring locations, contacted Underground Services Alert to clear the drilling locations in advance of our field exploration program, obtained an encroachment permit for drilling from the County, and prepared a Health and Safety Plan for the field work;
- Performed a field exploration program consisting of drilling six (6) borings along Los Osos Valley Road (the numbers of borings were reduced based on modifications to the project limits provided by CDM and helped allow time to comply with permit conditions while backfilling explorations);
- Performed laboratory testing on selected samples obtained from the field exploration program; and
- Prepared this report summarizing the field and laboratory data obtained for the site, providing updated seismic data for the design of the project, and a description of the subsurface conditions and recommendations for the design of the new force mains along Los Osos Valley Road.

2.3 FIELD EXPLORATION

The field exploration program consisted of drilling and sampling six (6) borings at the site on June 20 and 21, 2011. The logs for the field data collected are presented in Appendix A. The approximate locations of the borings are shown on Plate 1, Cumulative Field Exploration Plan and Plate 2, Field Exploration Plan. The drilling contractor for the project was S/G Drilling Company of Lompoc, California. S/G used a CME85, truck-mounted drill rig equipped with 8-inch hollow stem augers to advance the borings to depths of approximately 40 feet below the existing ground surface.

The borings were sampled using 2-inch outside diameter standard penetration test (SPT) split spoon and 3-inch outside diameter modified California split-spoon samplers. The SPT sampler was used without liners. The modified California sampler was used with 1-inch high brass liners. The samplers were driven into the materials at the bottom of the borehole using a 140-pound automatic trip hammer with a 30-inch drop. The blow count (N-value) is the number of blows from the hammer that were needed to drive the sampler 1 foot, after the sampler had been seated 6 inches into the material at the bottom of the hole. Bulk samples were collected from the drill cuttings retrieved from the auger flights. A field engineer from Fugro logged the subsurface conditions encountered, recorded field test data, packaged samples recovered from the borings, and transported the samples to the laboratory for subsequent testing. The borings in Los Osos Valley Road were backfilled with 2 sacks of sand-cement slurry or grout and topped with rapid set concrete that was colored black.

The sample intervals, uncorrected field N-values recorded during sampling, a description of the subsurface conditions encountered, and other field and laboratory data are presented on the logs of the borings in Appendix A.

2.4 LABORATORY TESTING

Laboratory tests were performed on selected soil samples retrieved from the boring. The laboratory program included tests for moisture content and unit weight, grain size analyses, compaction, plasticity (Atterberg Limits), compaction (Proctor), direct shear strength, triaxial shear strength, R-value and corrosion. Corrosion tests were performed by Cooper Testing Labs of Palo Alto, California. The tests were performed in general accordance with the applicable standards of ASTM. The results of the tests are presented in Appendix B.

2.5 GENERAL CONDITIONS

Fugro prepared the conclusions, recommendations, and professional opinions of this report in accordance with the generally accepted geotechnical principles and practices at this time and location. This warranty is in lieu of all other warranties, either expressed or implied. This report was prepared for the exclusive use of Camp Dresser and McKee, Incorporated (CDM) and their authorized agents only. It may not contain sufficient information for the purposes of other parties or other uses. If any changes are made in the project as described in this report, the conclusions and recommendations contained in this report should not be considered valid unless Fugro reviews the changes and modifies and approves, in writing, the conclusions and recommendations of this report. This report and the drawings contained in this report are intended for design-input purposes; they are not intended to act as construction drawings or specifications.

The scope of services did not include any environmental assessments for the presence or absence of hazardous/toxic materials in the soil, surface water, groundwater, or atmosphere. Any statements, or absence of statements, in this report or data presented herein regarding odors, unusual or suspicious items, or conditions observed are strictly for descriptive purposes and are not intended to convey engineering judgment regarding potential hazardous/toxic assessment.

Soil and rock deposits can vary in type, strength, and other geotechnical properties between points of observations and exploration. Additionally, groundwater and soil moisture conditions can vary seasonally or for other reasons. Therefore, we do not and cannot have a complete knowledge of the subsurface conditions underlying the site. The conclusions and recommendations presented in this report are based upon the findings at the points of exploration, and interpolation and extrapolation of information between and beyond the points of observation. These findings are subject to confirmation based on the conditions revealed by construction.

3.0 SITE CONDITIONS

3.1 GEOLOGIC SETTING

The project area lies within the Los Osos Valley that is part of the Coast Ranges geologic and geomorphic province. The regional geology is described in the Geotechnical Report. The surficial geology of the project vicinity, as mapped by Hall (1973) is shown on Plate 3, Regional Geologic Map. As shown on Plate 3, the collection system area and Los Osos community are underlain predominantly by Sand Dune Deposits. East of Los Osos Creek, the pipeline alignment is within the Sand Dune Deposits, crosses a low area mapped as alluvium along Los Osos Creek and to the east, and then rises up near the cemetery to an area that is also mapped by Hall as Sand Dune Deposits. However, the sand dune deposits encountered in this vicinity appear to be composed of moderately indurated and weathered clayey sand, suggesting these deposits are older (pre-Holocene) deposits that the dune sand encountered west of Los Osos Creek.

3.2 SUBSURFACE CONDITIONS

A description of the predominant geologic units and soil conditions encountered in our explorations is presented below. Logs of the explorations are presented in Appendix A. Previous boring information collected by Moore & Taber (1991) for the Los Osos Creek Bridge is presented in Appendix C. The subsurface conditions encountered at the site generally consisted of units of pavement and artificial fill (Af), alluvium (Qa), sand dune deposits (Qs), and older sand dune deposits (Qos). The approximate locations of the borings and cumulative field exploration plan for the project is shown on Plate 1. The locations of the explorations drilled along Los Osos Valley Road are shown on Plate 2. The subsurface conditions and logs of the previous explorations are presented in the Geotechnical Report (Fugro 2004).

Pavement Conditions. Drill holes DH-501 through DH-505 were drilled within the pavements along Los Osos Valley Road. A summary of the approximate pavement thicknesses encountered is presented below:

Approximate Pavement Thicknesses Encountered

Drill Hole No.	Location along Los Osos Valley Road	Pavement Section Encountered
501	West bound shoulder	8 inches asphalt concrete over 15 inches of base
502	Westbound lane	6.5 inches of asphalt concrete over 5 inches of base
503	Westbound shoulder	9 inches asphalt concrete on subgrade
504	West bound shoulder (near bridge)	5 inches asphalt concrete over 11 inches of base
505	Westbound fast lane	6 to 7 inches of asphalt concrete over 8 inches of base

Artificial fill materials (Af). In addition to the pavement materials described above, artificial fill materials were encountered in DH-504 drilled near the Los Osos Creek Bridge to approximately 4.5 feet below the ground surface. The fill materials appear to be associated with backfill that was previously placed behind the bridge abutments. Embankment fill associated with roadway construction is also present along Los Osos Valley Road, with thicknesses that appear to be up to approximately 15 feet. The fill material encountered in DH-504 consisted of stiff sandy lean clay (CL) with varying amounts of angular gravel and intermixed soil. The artificial fill materials were underlain by alluvium (Qal).

Alluvium (Qal). Alluvium was encountered below the pavement materials in DH-503 and DH-504 that were drilled along the valley floor of Los Osos Creek, and within the areas mapped as alluvium by Hall (1973) on Plate 3. An older alluvial deposit was also encountered below the dune sand deposits in DH-502. The alluvium generally consisted of an upper and lower unit. The upper unit consisted of interbedded loose to medium dense clayey sand (SC) and soft to stiff lean clay with sand (CL). DH-502 and DH-503 were terminated within the upper unit at approximately 15.5 feet below the existing ground surface.

The alluvium encountered below the dune sand in DH-502 is likely older terrace deposits that have not been differentiated by Hall. The alluvium was notably softer at DH-504 drilled on the east side of the bridge on Los Osos Valley Road. The lower unit of alluvium was encountered in DH-504 at a depth of approximately 23 feet. The lower unit consisted of interbedded layers of loose to medium dense sand and gravel with varying amounts of silt. Sand flowed into the augers during the sampling at 25 feet, and likely resulted in the lower field blowcount at that depth as noted on the boring log. DH-504 was terminated with the lower unit at approximately 40.5 feet below the ground surface.

The subsurface conditions encountered near the bridge differed from those reported by Moore & Taber (1991) for the Los Osos Creek Bridge in that soils encountered within DH-504 were generally softer, and less interbedded. Moore & Taber reportedly encountered relatively dense sand and gravel and hard clay soil below depths of approximately 50 to 60 feet.

Samples of the alluvium that were tested had dry unit weights that ranged from approximately 97 to 131 pounds per cubic foot (pcf) and corresponding moisture contents of approximately 7 to 23 percent.

Sand Dune Deposits (Qs): Sand dune deposits were encountered in the drill holes west of Los Osos Creek, and near the cemetery east of the lowland area along Los Osos Creek. Dune sand deposits comprise the predominant geologic unit exposed at the ground surface over the collection system area. The areal extent of the dune sand deposits, as mapped by Hall (1973), is indicated on Plate 3, and is generally consistent with units encountered in the explorations. The dune sands encountered east of Los Osos Creek appear to be an older dune sand deposit that is composed of moderately indurated sand, referred to as Qos on the boring logs.

The older dune sand encountered within DH-501 and DH-502 generally consisted of medium to very dense clayey sand (SC). The older dune sand was relatively heavily oxidized with orange and gray mottling throughout, and contained pockets of clay. The older dune sand was underlain by older alluvium in DH-502 at approximately 7 feet below the ground surface and was encountered to the maximum depth explored in DH-501, approximately 15.5 feet below the ground surface.

Dune sand, typical of that encountered elsewhere within the collection area, was encountered in DH-505 and DH-506 drilled approximately 1,000 feet west of Los Osos Creek and at the mid-town pump station site (near Ravena Avenue), respectively. The dune sand generally consisted of medium dense poorly graded sand and sand with silt (SP-SM). The relative density of the dune sand generally increased with depth, and the dune sand was dense to very dense below depths of approximately 15 to 20 feet. The dune sand was encountered to the maximum depths explored, approximately 40 feet below the ground surface.

Laboratory tests performed on selected samples typically had dry densities that ranged from approximately 114 to 117 pcf within the older dune sand, and from approximately 100 to 114 pcf within the dune sand encountered west of Los Osos Creek. Moisture contents ranged from approximately 3 to 15 percent. Sieve analysis tests indicate that material finer than the U.S. Standard 200 sieve ranged from approximately 19 to 34 percent for samples of the older sand dune deposits (from DH-501 and DH-502), and from approximately 1 to 9 percent for samples of the younger dune sand deposits (from DH-505 and DH-506). Sand equivalent test results for samples of older dune sand ranged from approximately 14 to 17. Sand equivalent test results for samples the younger dune sand ranged from approximately 24 to 76.

3.3 GROUNDWATER CONDITIONS

Groundwater was encountered in DH-503 and DH-504 drilled within the lowland areas of Los Osos Valley Road at approximately 13 and 24 feet below the ground surface, respectively (approximately el. 72 feet). The soils were relatively wet at a depth of approximately 15 feet in DH-505 (el. 148 feet). Moore & Taber (1991) reportedly encountered groundwater near el. 69 feet near the Los Osos Creek Bridge in March of 1989. The groundwater levels in the vicinity of the bridge are likely near or higher than the water level in Los Osos Creek which was flowing at

the time of our June 2011 field exploration program. Groundwater was encountered at approximately 39 feet below the ground surface in DH-506 drilled near the proposed mid-town pump station site and Ravena Avenue. Groundwater and soil moisture conditions will vary seasonally due to storm runoff, groundwater pumping, and irrigation, as well as other factors.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations of this report are intended to supplement the previous recommendations presented in the Geotechnical Report. The following recommendations presented for the design of the proposed raw sewage and recycled water force mains along Los Osos Valley Road are intended to be complete for that reach of pipeline. Other recommendations for the design of the collection system, effluent disposal, and pump stations are presented in the Geotechnical Report (Fugro 2004). Seismic data has been updated for the current building code.

4.1 SEISMIC DATA

4.1.1 Liquefaction

Liquefaction and seismic hazards were evaluated as part of the 2004 report, and can be considered applicable to the design of the current collection and pump stations. Generally, potentially liquefiable soils were encountered within low-lying areas within the collection system area and along the shoreline of Morro Bay where various pump stations are also planned that extend to depths of roughly 10 feet below the ground surface and could result in approximately 1 to 2 inches of seismic settlement in response to the design earthquake. The structures are generally to be designed to tolerate the additional settlement. Seismic data for the updated building code based design considered the potential for liquefaction.

4.1.2 Code Based Design

Structures should be designed to resist the lateral forces generated by earthquake shaking in accordance with the building code and local design practice. This section presents seismic design parameters for use with the 2010 California Building Code (CBC). The site coordinate and USGS interactive web page “Seismic Design Values for Buildings” (USGS 2008) was used to obtain seismic design criteria. Based on these criteria, the seismic data for use with code-based designs are provided:

Seismic Data

California Building Code	Seismic Parameter	Value for Site Class D	Value for Site Class F (liquefaction)
Site Coordinates	Latitude, degrees	35.3127	35.3127
	Longitude, degrees	-120.8383	-120.8383
Section 1613.5.1 Figure 1613.5	Ss , Seismic Factor, Site Class B at 0.2 sec	1.472	1.472
	S_1, Seismic Factor, Site Class B at 1 sec	0.555	0.555
	Site Class	S_D, Stiff soil*	S_F, Liquefiable**
Section 1613.5.3 Table 1613.5.3(1)	Fa, Site Coefficient for Site Class	1.0	0.9
Section 1613.5.3 Table 1613.5.3(2)	Fv, Site Coefficient for Site Class	1.5	2.4
Section 1614A	S_{MS}, Site Specific Response Parameter for Site Class at 0.2 sec.	1.472	1.325
	S_{M1}, Site Specific Response Parameter for Site Class at 1 sec.	0.833	1.333
	S_{DS} = 2/3 S_{MS},	0.981	0.883
	S_{D1} = 2/3 S_{M1}	0.555	0.889

* Assumes site mitigation performed to address liquefaction.
**Assume no site mitigation is performed to address liquefaction and is equivalent Site Class E.

Based on potential liquefaction hazards, lower portions of the collection system area and some pump station locations are classified as a Site Class F per the building code. The values and subsequent response spectra were estimated for a Site Class E, "S_E", soft soil site, based on the estimated residual shear strength of potentially liquefiable soils. Other areas of the site, and prior to there being liquefaction, are classified as Site Class D, "S_D",, The design for pump stations should consider the higher of either the Site Class F or Site Class D values presented in the table above for design and the structural period being considered.

4.2 LOS OSOS VALLEY ROAD FORCE MAINS

The following recommendations apply to the design of the force mains along Los Osos Valley Road between the mid-town pump station and Clark Valley Road. The pipe within this reach is designed with 4 feet of cover, except where the pipe will be deepened to a depth of approximately 8 to 10 to avoid existing utilities. Material recommendations for bedding and trench backfill materials are presented in the Geotechnical Report.

4.2.1 Foundation Support and Trench Bottom Stabilization

Pipe bedding should generally be placed on a relatively undisturbed subgrade, free of loose or disturbed materials. Where the subgrade is relatively firm and unyielding the pipe bedding material can be placed directly on the undisturbed trench bottom.

Where soft, wet, or yielding subgrade material is encountered, the trench subgrade should be stabilized to a firm and unyielding condition prior to placement of bedding material. Stabilization of the subgrade can consist of removing 12 inches of trench subgrade and replacing the soil with a thicker layer of gravel bedding material. Open-graded materials used for bedding (such as pea gravel) should be encased in a geotextile to reduce the potential for the adjacent sandy soil to migrate into the trench. Where the base of the trench has been disturbed or is not properly dewatered, the contractor should be responsible for removing the disturbed material and replacing it with compacted fill. The contractor may elect to scarify and compact the exposed subgrade of the trench to assist in achieving compaction in the bedding if desired. The following table summarizes the anticipated subgrade conditions along the trench subgrade for the force main construction on Los Osos Valley Road.

Anticipated Subgrade Conditions
along Los Osos Valley Road Force Mains

Reach	Trench Depth (feet)	Subgrade	Foundation Preparation
Midtown PS to 300 feet east of Palomino Drive	5 feet typical 10 feet maximum	Loose to medium dense sand	Undisturbed trench bottom
300 feet east of Palomino Drive to 300 feet east of Sombrero Drive	5 feet typical	Clay and loose clayey sand that is wet of optimum	Stabilize with 12 inches gravel in fabric
300 feet east of Sombrero Drive to Clark Valley Road	5 feet typical	Older dune sand and roadway embankment (to west)	Undisturbed trench bottom

We recommend that the project specifications provide for review of the pipe subgrade conditions at the time of construction, and allowances for increasing the quantity of trench excavation and bedding thickness below the pipe at the contract unit rates, if needed, to help stabilize the foundation support soils below the trench. The actual thickness of gravel needed to stabilize the subgrade should be evaluated based on the subgrade conditions encountered and bedding material used during the construction. The gravel used in stabilization of the subgrade can be included in the recommended bedding thickness below the pipe. A cushion of sand bedding can be provided over the gravel and geotextile, if needed, to help set the pipe.

4.2.2 Pipe Zone Bedding Material

Bedding is select material placed between the trench subgrade and the bottom of the pipe. Bedding material can consist of imported sand, gravel, crushed aggregate, or excavated on-site material having a sand equivalent of at least 30 and conforming to the suggested materials specification of the Geotechnical Report. Where open graded gravel materials are used as bedding, a geotextile for separation should be provided around the bedding material to reduce the potential for the native soil to pipe into the bedding material. Where gravel is placed to stabilize the subgrade below the pipe, the gravel should be continued up to the springline of the pipe.

The bedding thickness below the pipe should be at least 6 inches or one third of the pipe diameter, whichever is greater. Where the in-situ materials below the bottom of pipe meet the recommended material requirements for pipe zone bedding, the bedding material can be omitted provided the trench subgrade is prepared and compacted as recommended below. Bedding materials should be compacted to at least 90 percent relative compaction, prior to placing the pipe or the pipe zone materials. Bedding should be placed such that the middle third of the pipe is supported in the bedding material prior to placement and compaction of the subsequent pipe zone material.

Where the in-situ material within 9 inches of the bottom of the pipe meets the recommended material requirements for bedding, bedding can consist of scarifying the existing soil, and compacting the in-situ material in-place to at least 90 percent relative compaction. The depth of compaction should extend to at least 9 inches below the bottom of the pipe. The purpose of scarifying the subgrade is to evaluate if there are rocks or deleterious objects within the bedding thickness and to allow for removal of the oversized material. Care should be taken that scarification or disturbance of the soil does not occur below 9 inches or the depth of compaction. Excavation of the prepared bedding should be provided below the bell of the pipe such that the entire pipe is supported and in firm contact with the bedding. Additional material meeting the requirements for pipe bedding can be used to fill depressions left from trench excavation or compaction, if needed.

4.2.3 Pipe Zone Material

Pipe zone material placed above the bedding to at least 12 inches above the top of the pipe should be compacted to at least 90 percent relative compaction prior to placing trench backfill. Compaction within the pipe zone should be performed such that the pipe is fully supported, and such that excessive deformation or damage to the pipe does not occur. Material should be hand shoveled and sliced below the haunches of the pipe during placement to provide support for the pipe and assist with compaction.

4.2.4 Trench Backfill

Trench backfill is material placed above the pipe zone material and below the ground surface, finished grade, or pavement structural section. Trench backfill should consist of excavated on-site soil that conforms to the suggested material specification of this report, or imported material that is free of organics, debris and other deleterious materials. Trench backfill should be compacted to at least 90 percent relative compaction, except in roadway areas where trench backfill placed within 3 feet of finished grade of the pavement surface should be compacted to at least 95 percent relative compaction.

4.2.5 Backfill and Compaction

Fill placement and grading operations should be performed according to the grading recommendations of this report. We recommend that fill materials be compacted to at least 90 percent relative compaction, as determined by the latest approved edition of ASTM D 1557,

unless a higher degree of compaction is otherwise recommended. We recommend the following minimum relative compaction be provided for the locations indicated:

Location	Recommended Minimum Relative Compaction
General	90 % U.O.N.
Pipe Zone and Bedding	90 % U.O.N.
Trench backfill in non-pavement areas or placed greater than 3 feet below finished grade in pavement areas	90 % U.O.N.
Trench backfill placed within 3 feet of finished grade in pavement areas	95 %
Aggregate Base or Subbase	95 %
Asphalt Concrete	95 %
Building Areas	95 %

U.O.N. = unless otherwise noted

4.2.6 Thrust Resistance

Where pressurized portions of the pipeline change direction abruptly, resistance to thrust forces can be provided by mobilizing frictional resistance between the pipe and surrounding soil, and by the use of a thrust block, or by a combination of the two.

We understand that pressurized pipelines could be designed to resist thrust using restrained joints in conjunction with mobilized pipeline/soil resistance. A coefficient of lateral earth pressure, K_o, value of 0.7 can be used in conjunction with a coefficient of friction of 0.35 or 0.20 between the pipe and granular backfill material in contact with DIP or PVC pipes, respectively. The recommended values assume that granular pipe zone materials will be placed adjacent to the pipe, as recommended in this report.

Thrust blocks can be designed to resist lateral forces based on the passive resistance acting on the bearing side of the block, and the estimated frictional resistance acting along the base of the block. Thrust blocks should be designed with a minimum cover of 3 feet below finished grade and a net passive resistance of 350 pounds per cubic foot, equivalent fluid weight. One half of the recommended passive resistance should be used if the block will be submerged or founded below the groundwater table. A coefficient of friction of 0.45 can be used to estimate sliding resistance on the base of thrust blocks.

We recommend that thrust blocks be designed assuming submerged overburden soils. A buoyant soil unit weight of 48 pounds per cubic foot for the overburden soils should be used when computing the frictional and passive resistance on thrust blocks or pipes with restrained joints.

4.2.7 Modulus of Soil Reaction (E′)

Flexible and semi-rigid pipes are typically designed to withstand a certain amount of deflection from applied earth loads. Those deflections can be estimated with the aid of

equations developed by Spangler and Handy (1982) or Howard (2002). We have recommended E′ values for general conditions that were estimated for pipeline trenches backfilled with granular materials complying with the recommendations of this report, and for in-situ materials consisting of normally consolidated sand. On the basis of our evaluation, we recommend that an E′ value of 1,000 psi be used for pipe design.

The E′ value was estimated as the weaker of the pipe zone material or in-situ material beyond the springline of the pipe. The recommended E′ value was selected based on the soil conditions encountered at the site. The geotechnical engineer should review the trench during construction. If unsuitable materials are encountered along the spring line of the pipe, the trench detail and design of the pipe should be reviewed to evaluate if modifications to the design are needed to provide for the lower springline support. Placing slurry or a concrete cradle below the haunches of the pipe can help to provide additional springline support for pipes embedded in relatively weak soils.

4.3 MID TOWN PUMP STATION

The mid-town pump station and standby power building will be located on the north side of Los Osos Valley Road near Ravena Drive. The pump stations and vaults for the pump stations should be designed according to the recommendations of the Geotechnical Report. The soil conditions encountered at the site (DH-506) generally consist of dune sand with groundwater encountered at approximately 38 feet below the ground surface.

4.4 STANDBY POWER BUILDINGS

Recommendations for site preparation, grading and foundation design for the standby power buildings are provided in the Geotechnical Report. The following table supplements the table presented in Section 6.5.2.1 of the Geotechnical Report to include recommendations for the standby power buildings at Palisades Drive and Solano Street:

Location	Existing Ground Surface	Groundwater Depth Encountered	Estimated Depth of Removal Below the Existing Ground Surface
Palisade (Midtown) Standby Power Building west of library parking lot	el. 86 ft.	13 feet in B-1	5 feet or 1 foot below the bottom of footings, whichever is deeper.
Solano Standby Power Building and Pump Station at Donna Avenue	el. 16 ft.	3 feet in DH--116	5 feet or 1 foot below the bottom of footings, whichever is deeper[1]
[1] Provide subgrade stabilization to address groundwater or wet soil conditions as recommended in Geotechnical Report (Section			

5.0 NATURALLY OCCURRING ASBESTOS

Naturally occurring asbestos (NOA) is common in serpentine rock throughout San Luis Obispo County. The California Air Resources Board has identified serpentine rock as having the potential to contain asbestos that locally is common to or within the Franciscan Formation. Franciscan or serpentine rocks are not mapped or know to be present within the project area,

and were not encountered within the depth of the anticipated site grading and excavation at the locations explored. Therefore, it is our opinion that there is a low potential to encounter serpentine rocks during construction, and no special mitigation will need to be considered for the design or construction of the project to address NOA.

6.0 CONTINUATION OF SERVICES

The geotechnical evaluation consists of an ongoing process involving the planning, design, and construction phases of the project. To provide this continued service, we recommend that the geotechnical engineer be provided the opportunity to review the project plans and specifications, and observe portions of the construction.

6.1 REVIEW OF PLANS AND SPECIFICATIONS

The geotechnical engineer should review the foundation and grading plans for the project. The purpose of the review is to evaluate if the plans and specifications were prepared in general accordance with the recommendations of this report.

6.2 GEOTECHNICAL OBSERVATION AND TESTING

Field exploration and site reconnaissance provides only a limited view of the geotechnical conditions of the site. Substantially more information will be revealed during the excavation, grading and ground improvement phases of the construction. Subsurface conditions, excavations and fill placement should be observed by the geotechnical professional during construction to evaluate if the materials encountered during construction are consistent with those assumed for this report.

7.0 REFERENCES

Camp, Dresser & McKee, Inc. (CDM 2011b), Los Osos Wastewater Project, draft plans for the Solano, Mid-Town, and Palisades pump stations and standby power buildings, and the pump stations plans for Areas A and D, received via email on October 21.

Camp, Dresser & McKee, Inc. (CDM 2011a), Los Osos Wastewater Project, Preliminary Plan and Profile, Force Main between Ravena and Clark Valley Road, draft sketch and mark-up, received via email on July 27.

Fugro West, Inc. (2004), *Geotechnical Report, Los Osos Wastewater Project, Los Osos Community Services District, San Luis Obispo County, California,* consultant report prepared for Montgomery Watson Harza, Project No. 3055.001, dated March 9 and *Volume 2 – Attachments* dated March 4, 2004.

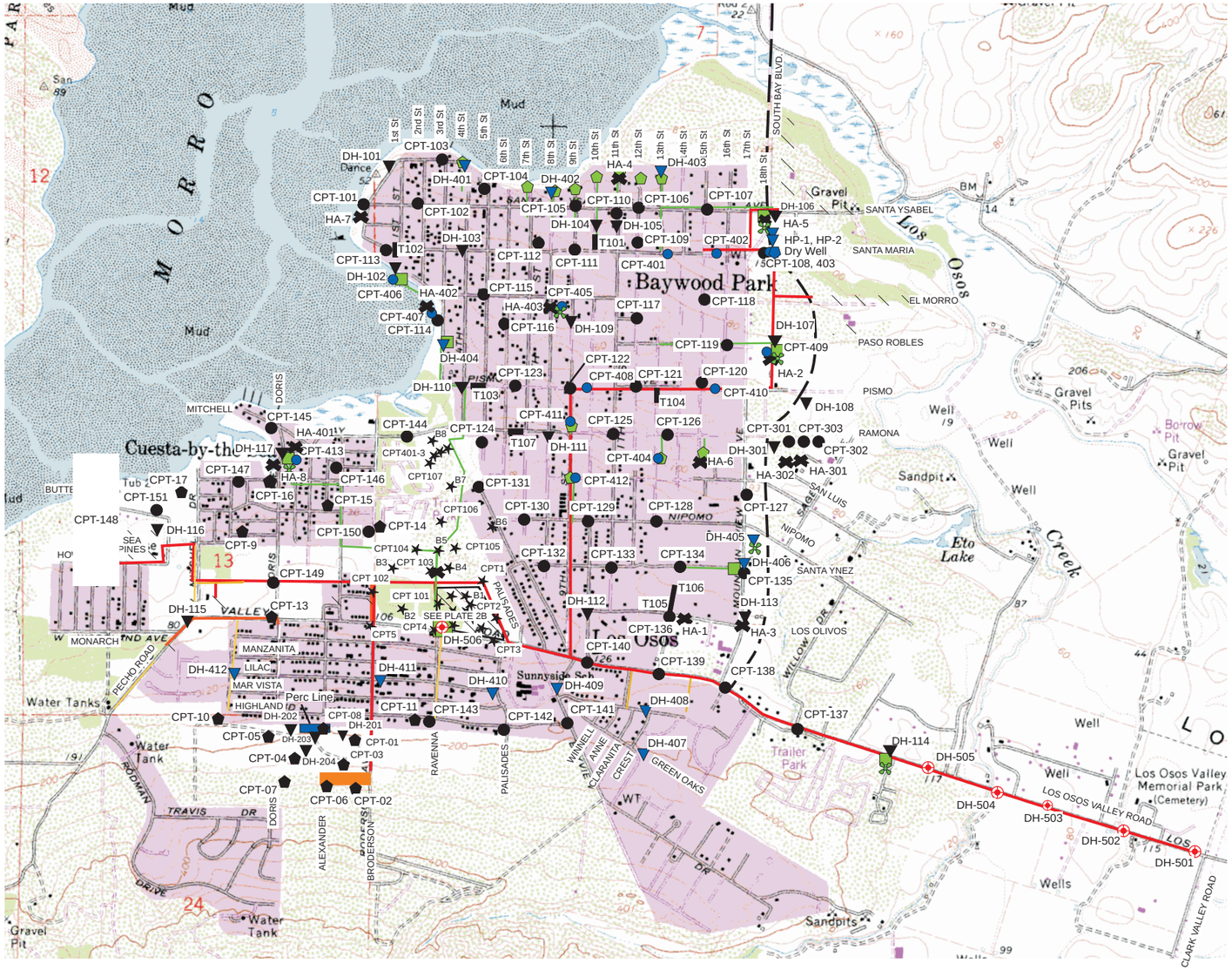
Howard, A. (1996), *Pipeline Installation*, A Manual for Construction of Buried Pipe, Relatively Publishing, Lakewood, CO.

Moore & Taber (1991), As-Built Plans Entitled: *Los Osos Valley Road at Los Osos Creek, San Luis Obispo, California, Log of Test Borings",* Drilling Date March 20, 1989, Sheet 20 of 20, Job No. P12A140, plans dated February 1991.

Rick Engineering, Inc. (2011), Plans Entitled: Aerial Topographic Survey, Los Osos Valley Road, Los Osos, California, Scale 1" = 40 feet, 6 sheets, original dated June 17.

Spangler, M.G. and Handy, R.L. (1982), "Loads on Underground Conduit", *Soil Engineering*, Harper and Rowe, 4th edition, pp. 727-761.

PLATES



Previous Data

- CPT site (Fugro 1996)
- CPT site (Fugro 1997)
- Hand auger site (Fugro 1997)
- Trench (Fugro 1997)
- Hollow stem auger boring site (Fugro 1997)
- Boring/CPT site (CFS 2000)
- Hollow stem auger boring site (Fugro 2011 - current study)

Supplemental Data

- Hollow stem auger boring site; HP = boring with hydro probe casing (Fugro 2002)
- CPT site (Fugro 2003)
- Prototype dry well
- Prototype percolation line

Proposed Improvements (based on MWH 2004 design)

- Distribution pipelines
- Force mains
- Pump station
- Pocket pump station
- Effluent disposal site
- Standby power building
- Previous Tri-W wastewater treatment facility site

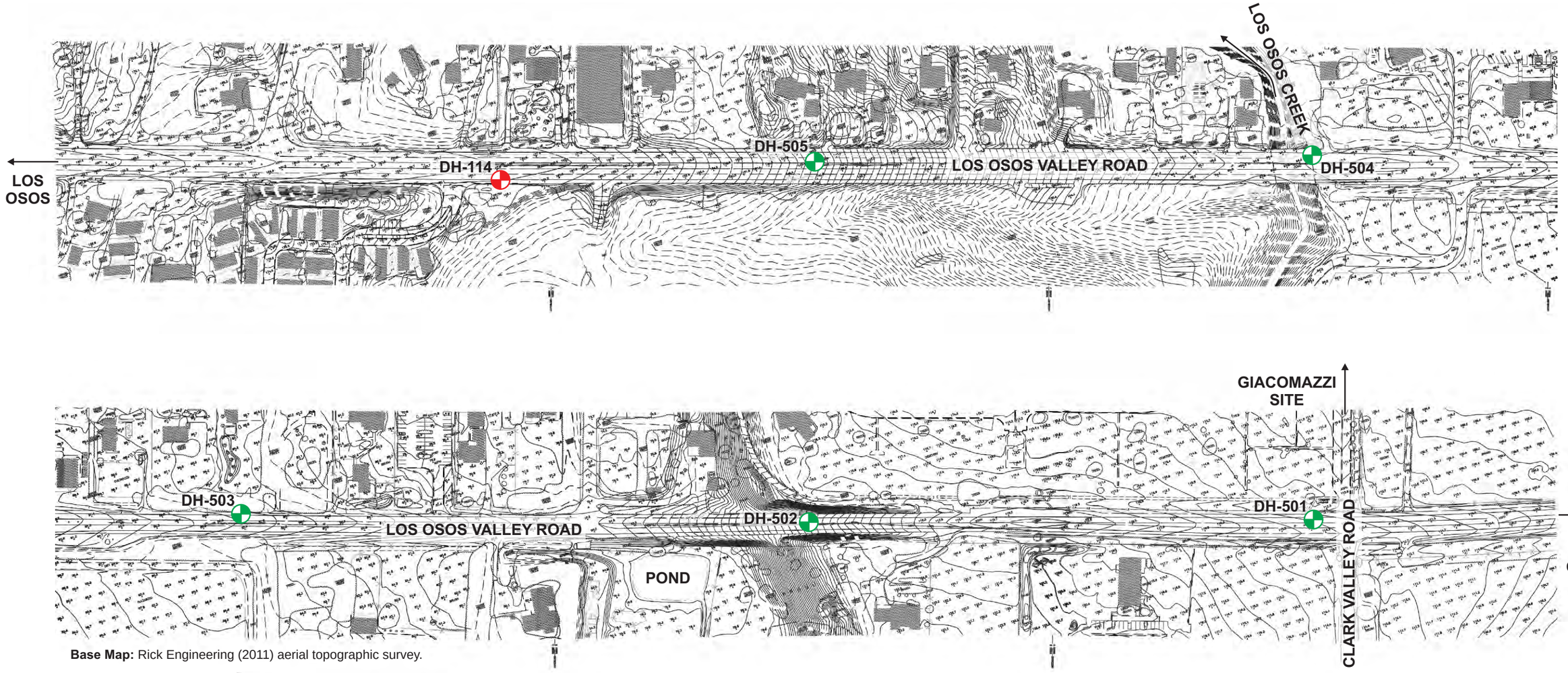
NORTH

0 2000

FEET

CUMULATIVE FIELD EXPLORATION PLAN
Los Osos Wastewater Collection System
Los Osos, California

PLATE 1



Base Map: Rick Engineering (2011) aerial topographic survey.

NORTH

0 100 200

FEET

All locations and dimensions are approximate

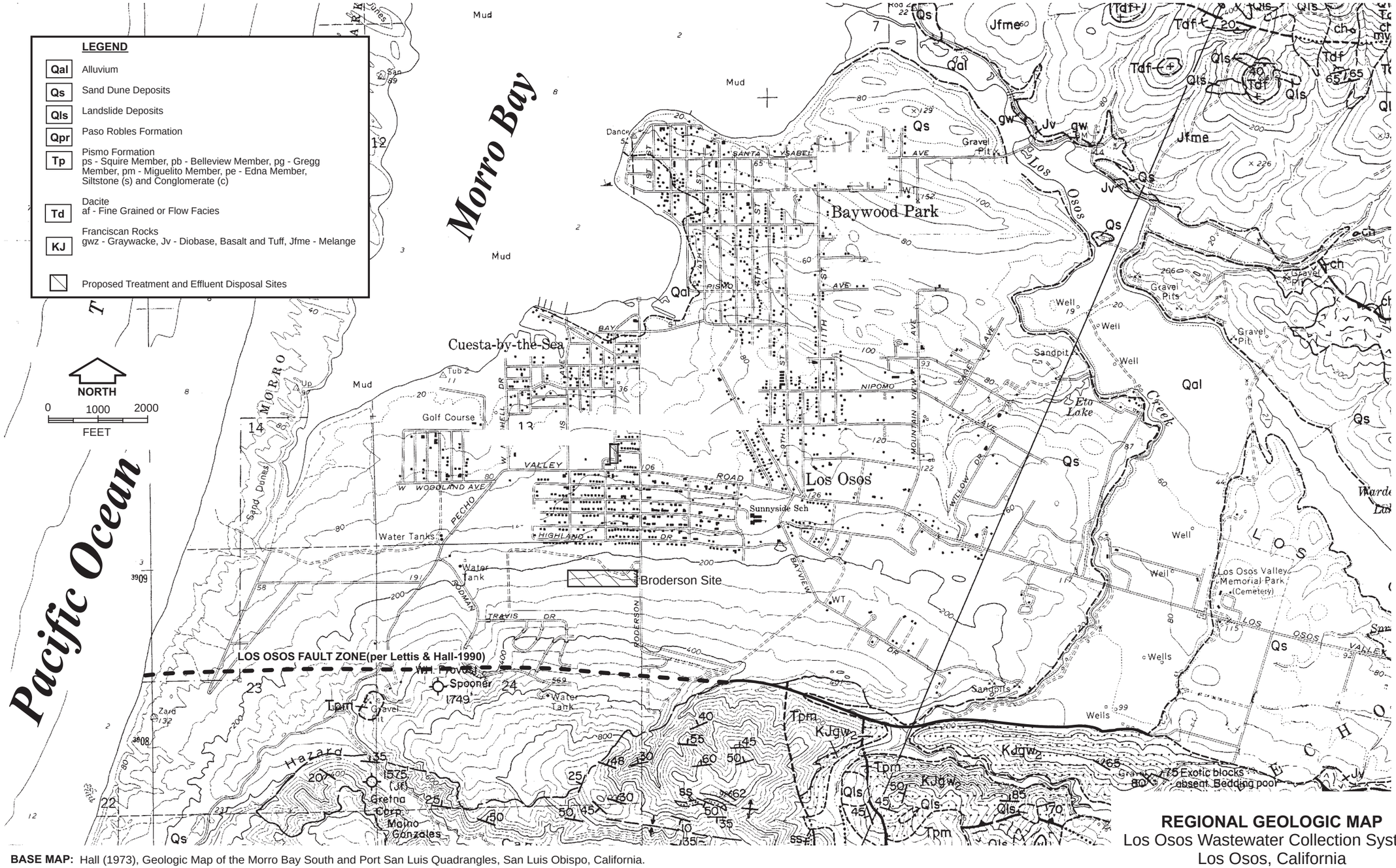
LEGEND

DH-501 June 2011 drill hole location

DH-114 January (1997) drill hole (see Fugro 2004 report)

FIELD EXPLORATION PLAN
Los Osos Wastewater Collection System
Los Osos, California

PLATE 2

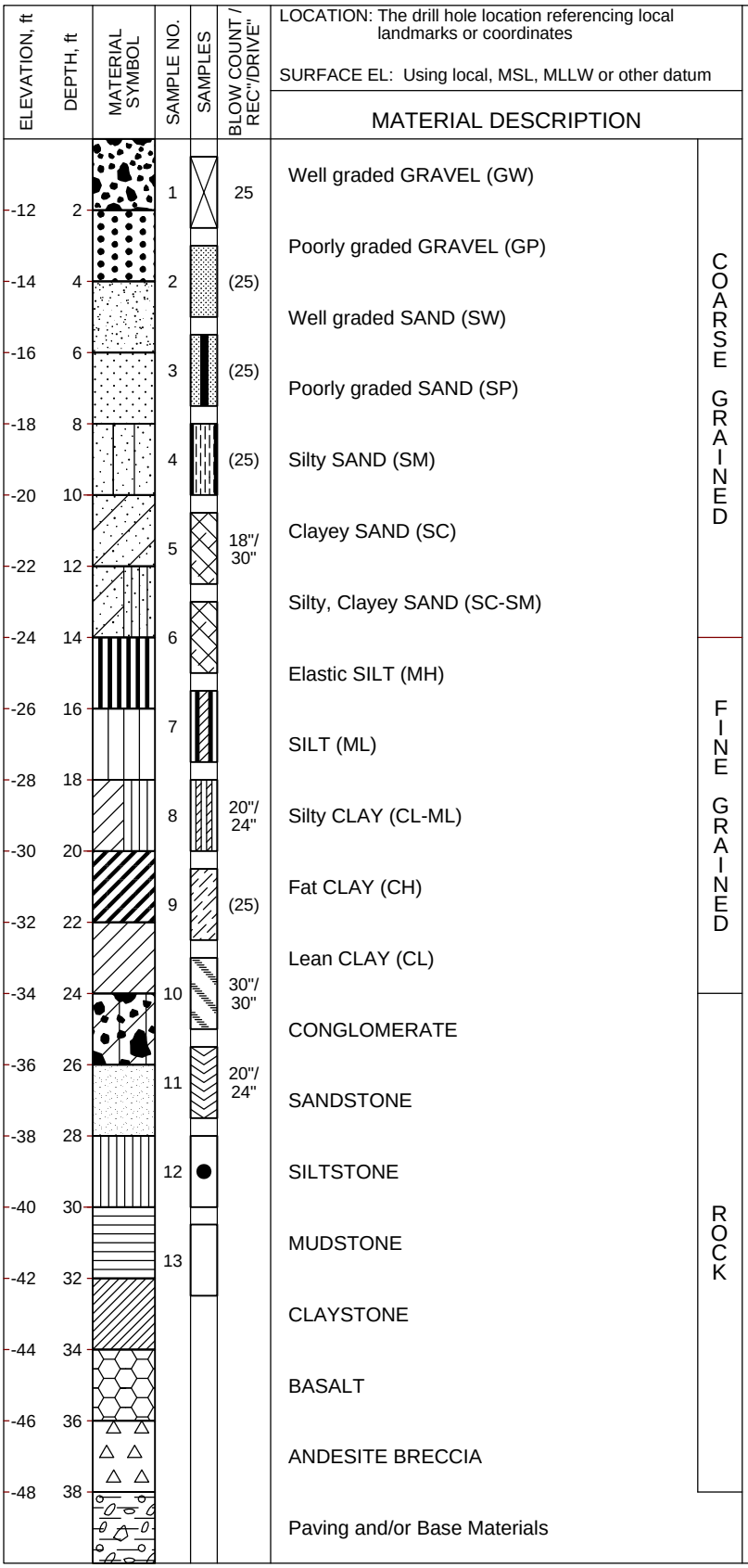


BASE MAP: Hall (1973), Geologic Map of the Morro Bay South and Port San Luis Quadrangles, San Luis Obispo, California.

REGIONAL GEOLOGIC MAP
Los Osos Wastewater Collection System
Los Osos, California

PLATE 3

APPENDIX A



General Notes

Soil Texture Symbol

Sloped line in symbol column indicates transitional boundary

Samplers and sampler dimensions (unless otherwise noted in report text) are as follows:

Symbol for:

1	SPT Sampler, driven 1-3/8" ID, 2" OD
2	CA Liner Sampler, driven 2-3/8" ID, 3" OD
3	CA Liner Sampler, disturbed 2-3/8" ID, 3" OD
4	Thin-walled Tube, pushed 2-7/8" ID, 3" OD
5	Bulk Bag Sample (from cuttings)
6	CA Liner Sampler, Bagged
7	Hand Auger Sample
8	CME Core Sample
9	Pitcher Sample
10	Lexan Sample
11	Vibracore Sample
12	No Sample Recovered
13	Sonic Soil Core Sample

Sampler Driving Resistance

Number of blows with 140 lb. hammer, falling 30" to drive sampler 1 ft. after seating sampler 6"; for example,

Blows/ft	Description
25	25 blows drove sampler 12" after initial 6" of seating
86/11"	After driving sampler the initial 6" of seating, 36 blows drove sampler through the second 6" interval, and 50 blows drove the sampler 5" into the third interval
50/6"	50 blows drove sampler 6" after initial 6" of seating
Ref/3"	50 blows drove sampler 3" during initial 6" seating interval

Blow counts for California Liner Sampler shown in ( )

Length of sample symbol approximates recovery length

Classification of Soils per ASTM D2487 or D2488

Geologic Formation noted in bold font at the top of interpreted interval

Strength Legend

Q = Unconfined Compression
u = Unconsolidated Undrained Triaxial
t = Torvane
p = Pocket Penetrometer
m = Miniature Vane

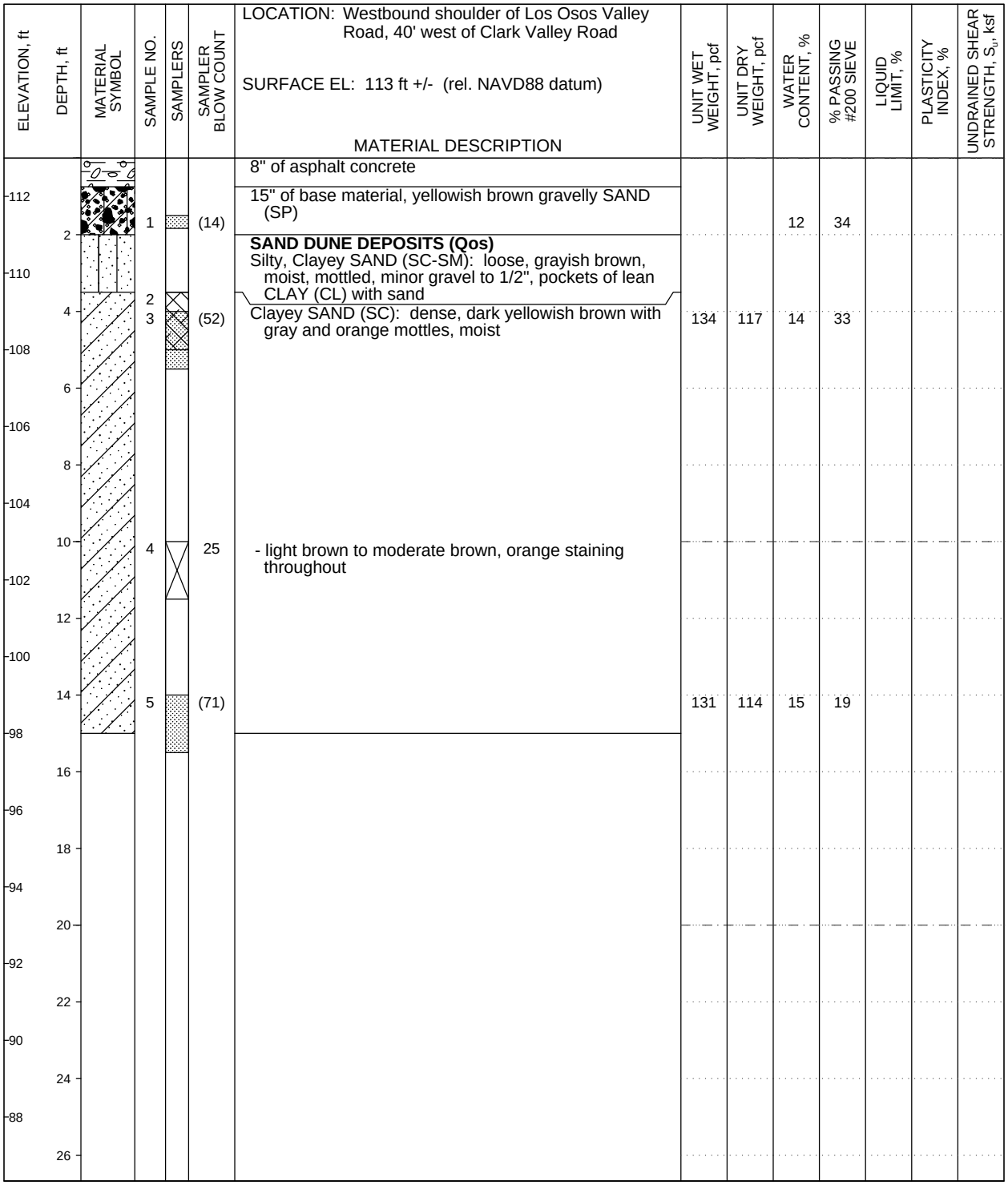
Water Level Symbols

- Initial or perched water level
- Final ground water level
- Seepages encountered

Rock Quality Designation (RQD) is the sum of recovered core pieces greater than 4 inches divided by the length of the cored interval.

KEY TO TERMS & SYMBOLS USED ON LOGS

PLATE A-1



The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

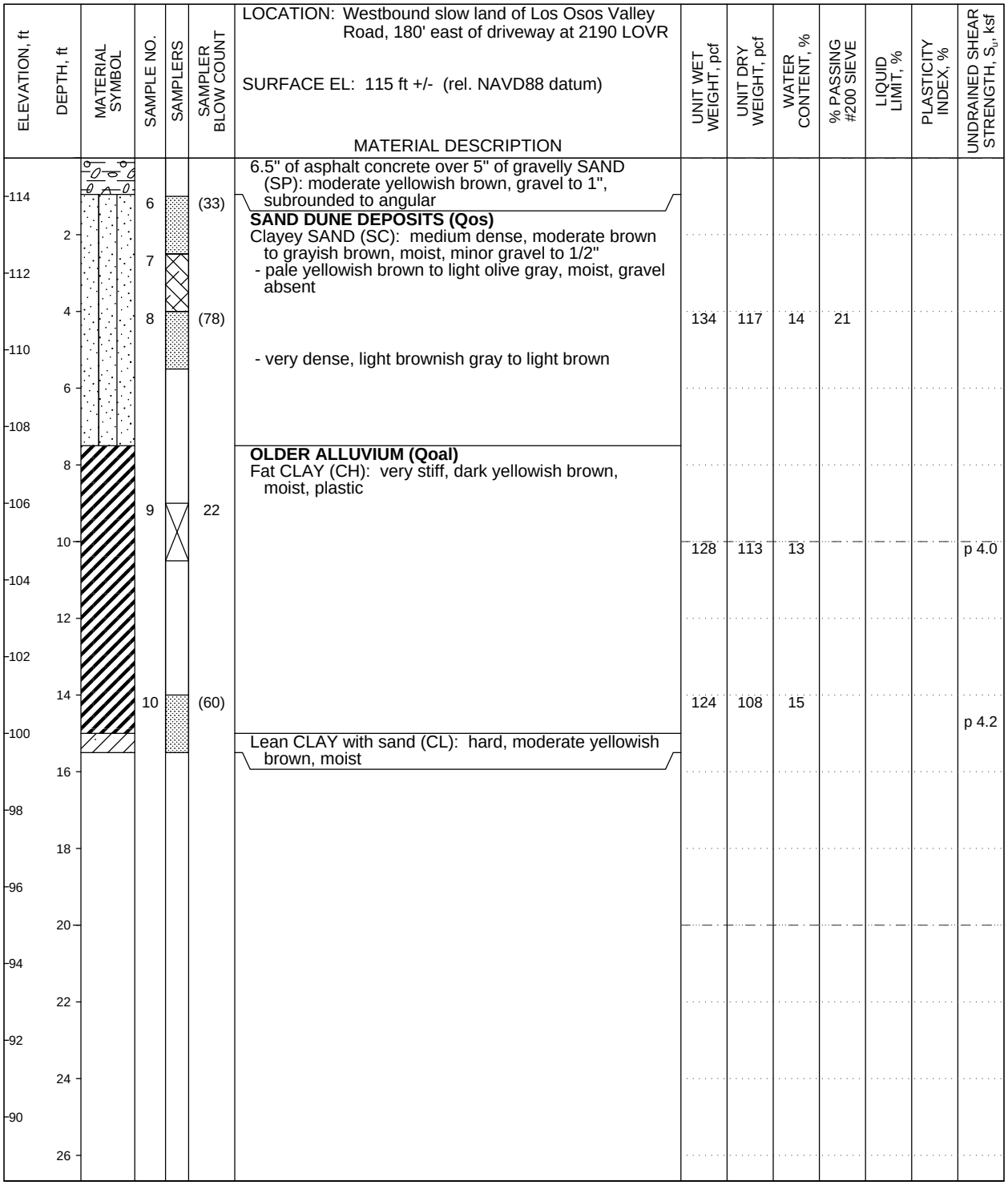
COMPLETION DEPTH: 15.5 ft
DEPTH TO WATER: Not Encountered
BACKFILLED WITH: Sand cement slurry
DRILLING DATE: June 20, 2011

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Company
LOGGED BY: T Nicely
CHECKED BY: J Blanchard

LOG OF BORING NO. DH-501

Los Osos Wastewater Collection System
Los Osos, California

PLATE A-2



The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

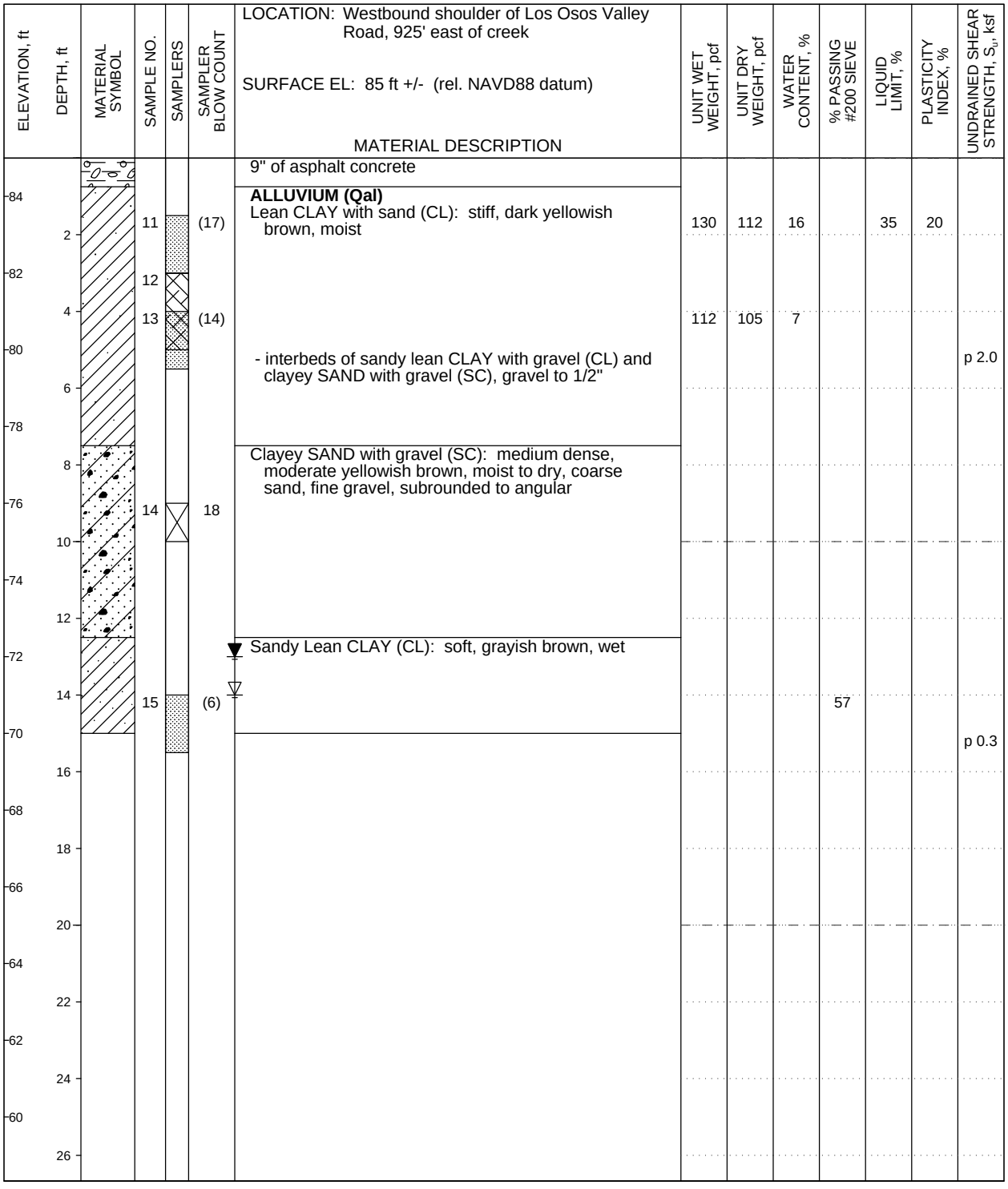
COMPLETION DEPTH: 15.5 ft
DEPTH TO WATER: Not Encountered
BACKFILLED WITH: Sand cement slurry
DRILLING DATE: June 20, 2011

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Company
LOGGED BY: T Nicely
CHECKED BY: J Blanchard

LOG OF BORING NO. DH-502

Los Osos Wastewater Collection System
Los Osos, California

PLATE A-3



The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

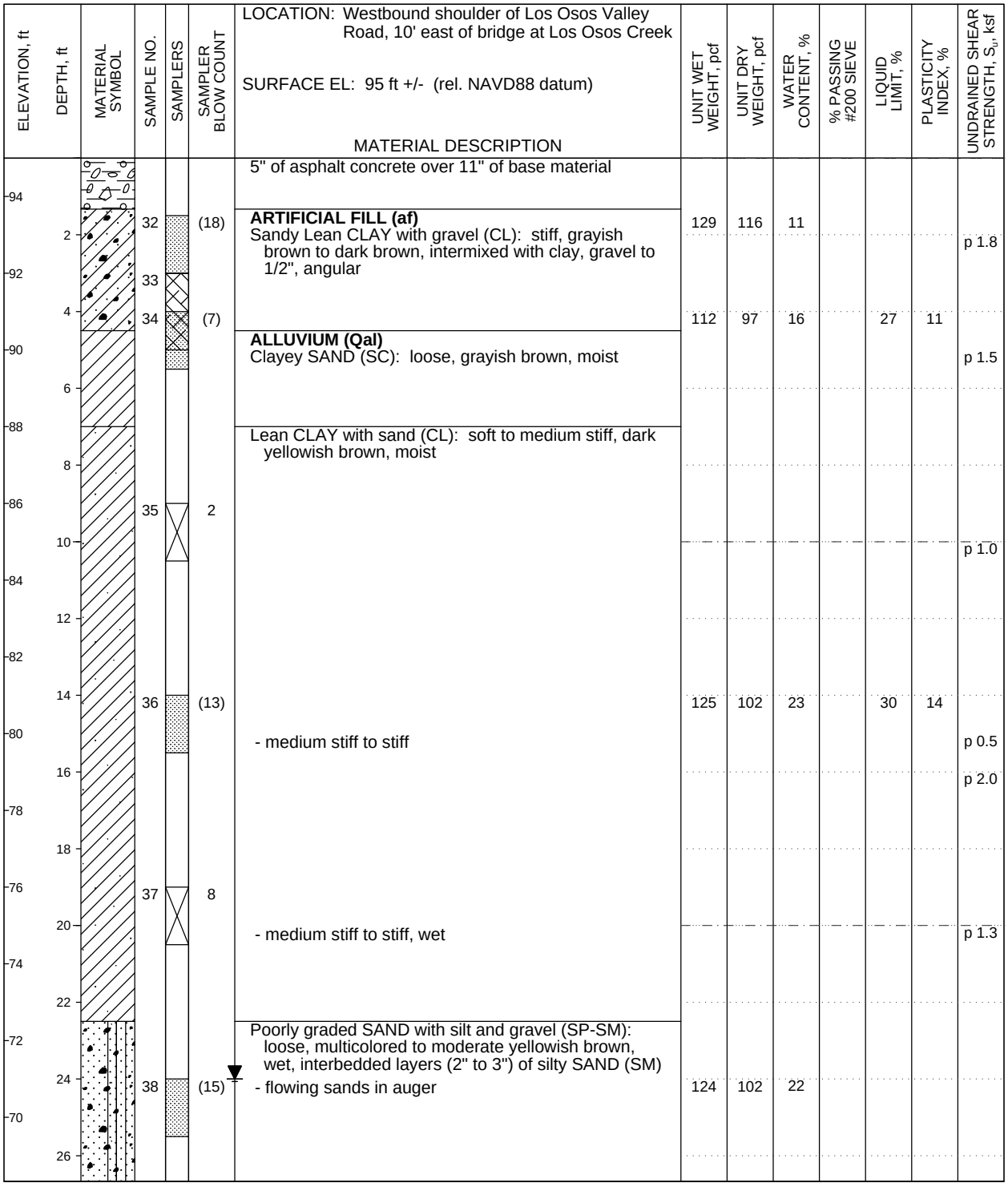
COMPLETION DEPTH: 15.5 ft
DEPTH TO WATER: 13.0 ft
BACKFILLED WITH: Sand cement slurry
DRILLING DATE: June 20, 2011

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Company
LOGGED BY: T Nicely
CHECKED BY: J Blanchard

LOG OF BORING NO. DH-503

Los Osos Wastewater Collection System
Los Osos, California

PLATE A-4



The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

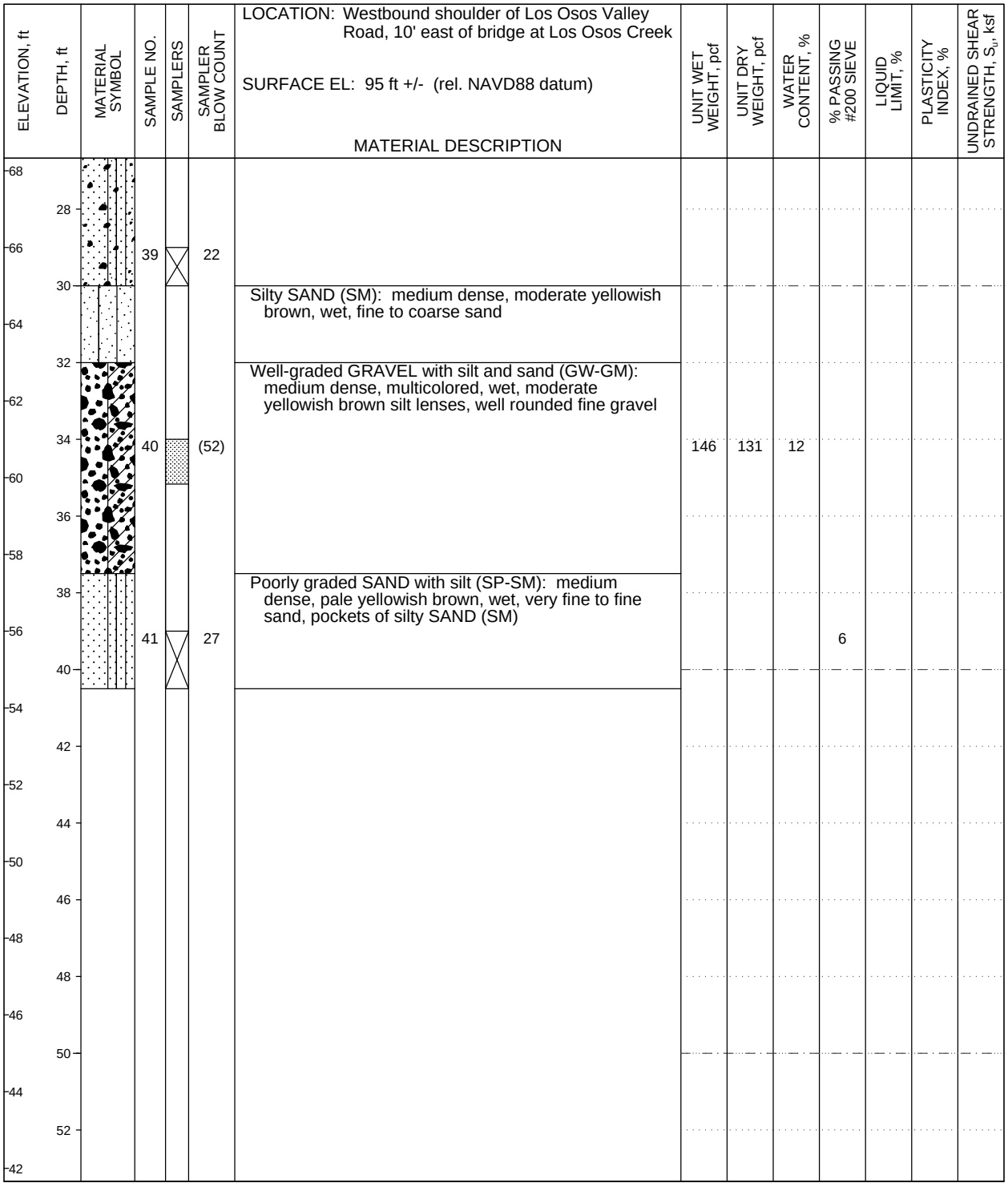
COMPLETION DEPTH: 40.5 ft
DEPTH TO WATER: 24.0 ft
BACKFILLED WITH: Grout
DRILLING DATE: June 21, 2011

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Company
LOGGED BY: T Nicely
CHECKED BY: J Blanchard

LOG OF BORING NO. DH-504

Los Osos Wastewater Collection System
Los Osos, California

PLATE A-5a



The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

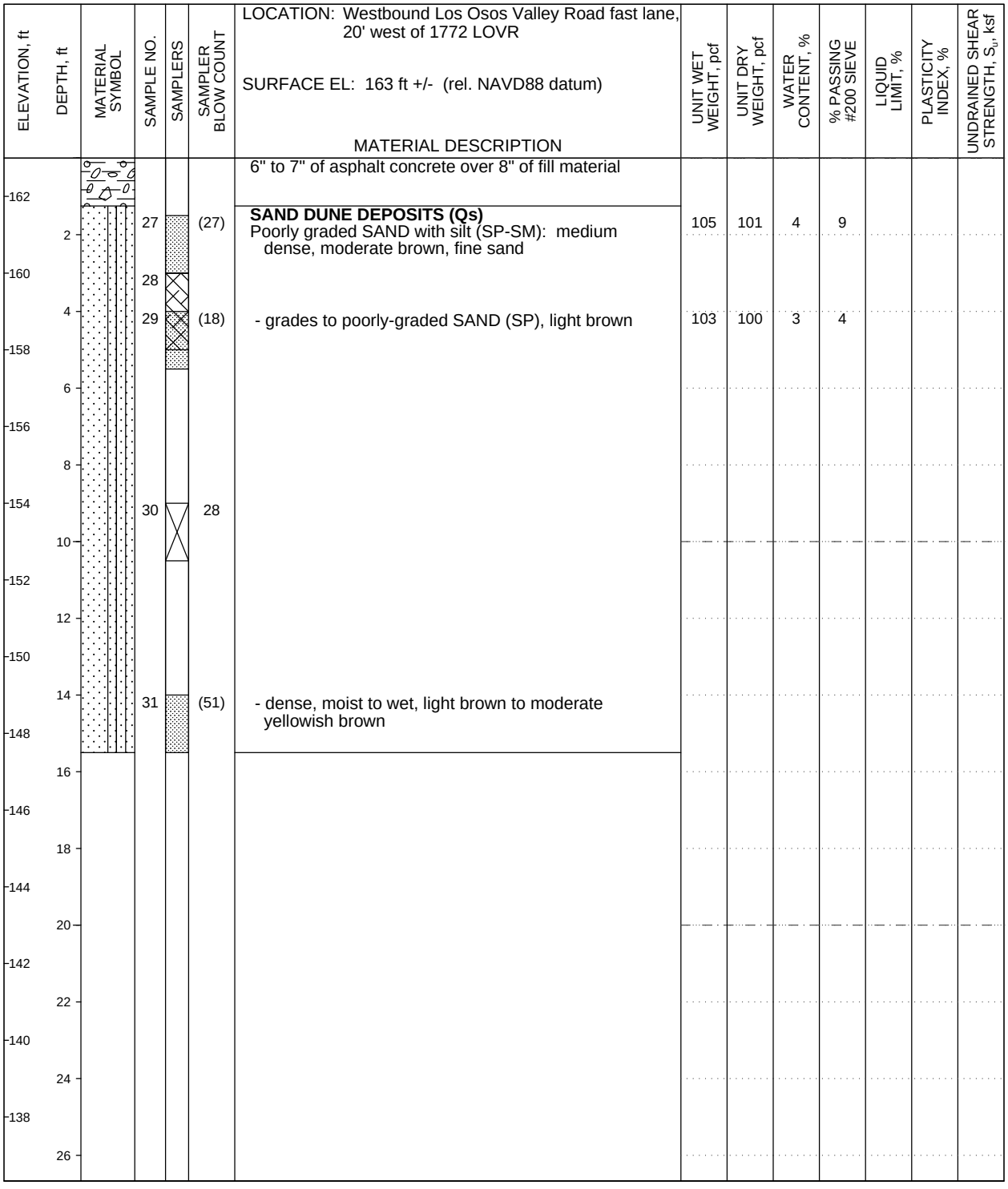
COMPLETION DEPTH: 40.5 ft
DEPTH TO WATER: 24.0 ft
BACKFILLED WITH: Grout
DRILLING DATE: June 21, 2011

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Company
LOGGED BY: T Nicely
CHECKED BY: J Blanchard

LOG OF BORING NO. DH-504

Los Osos Wastewater Collection System
Los Osos, California

PLATE A-5b



The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 15.5 ft
DEPTH TO WATER: Not Encountered
BACKFILLED WITH: Sand cement slurry
DRILLING DATE: June 21, 2011

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Company
LOGGED BY: T Nicely
CHECKED BY: J Blanchard

LOG OF BORING NO. DH-505

Los Osos Wastewater Collection System
Los Osos, California

PLATE A-6

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
						LOCATION: Mid-town Pump Station, 40' north of Los Osos Valley Road at Ravenna Avenue SURFACE EL: 100 ft +/- (rel. NAVD88 datum)							
98	2		16 17		(18)	**SAND DUNE DEPOSITS (Qs)** Poorly graded SAND with silt (SP-SM): medium dense, moderate brown, moist, fine sand	105	101	4				
96	4		18		(20)	- grades to poorly graded SAND (SP)				1			
94	6												
92	8												
			19		(29)								
90	10		20		23								
88	12												
86	14		21		(29)		120	114	6	2			
84	16												
82	18												
			22		33								
80	20					- dense							
78	22												
76	24		23		(59/9")					1			
74	26					- very dense							

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

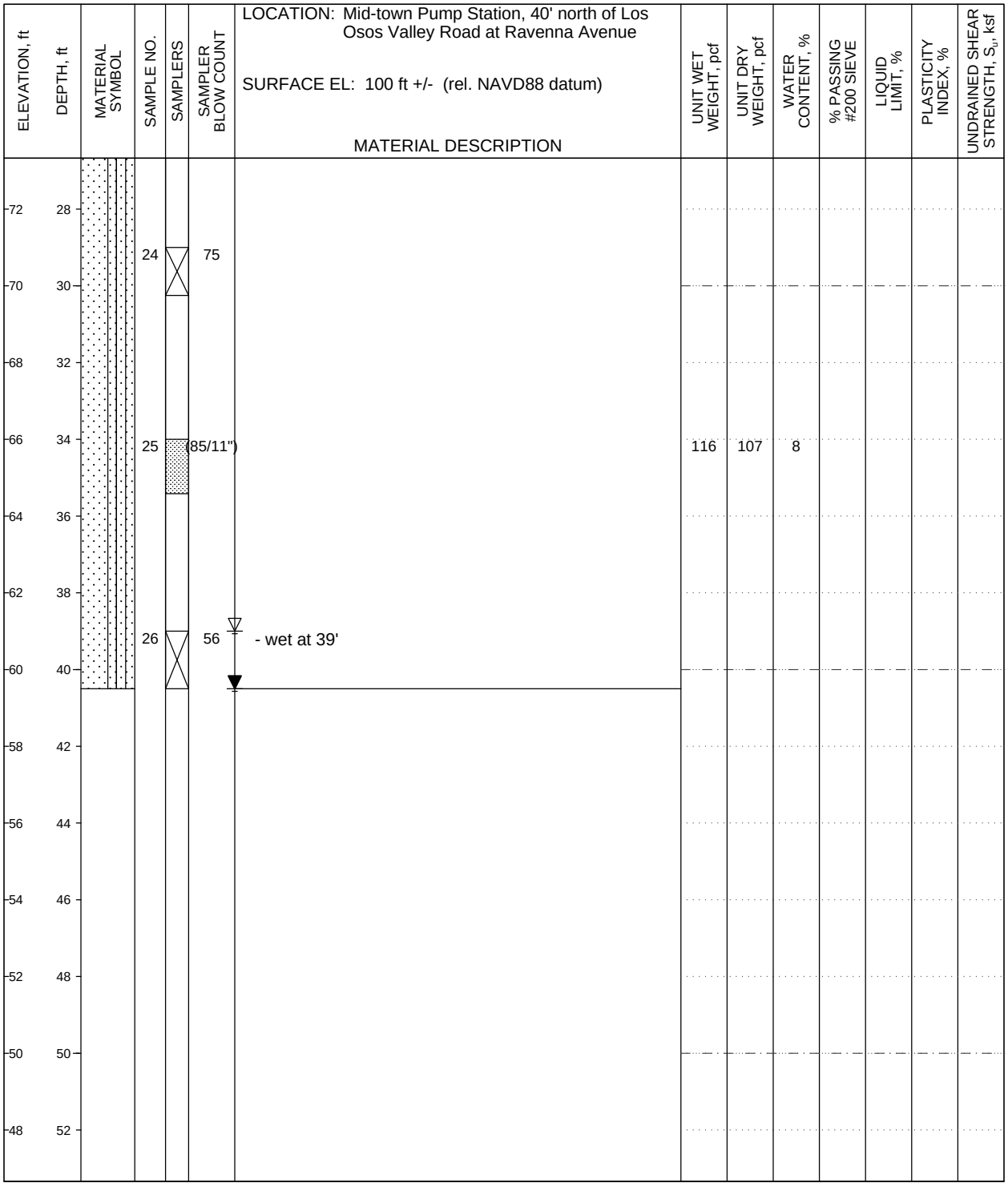
COMPLETION DEPTH: 40.5 ft
DEPTH TO WATER: 40.5 ft
BACKFILLED WITH: Native Materials
DRILLING DATE: June 20, 2011

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Company
LOGGED BY: T Nicely
CHECKED BY: J Blanchard

LOG OF BORING NO. DH-506

Los Osos Wastewater Collection System
Los Osos, California

PLATE A-7a



The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 40.5 ft
DEPTH TO WATER: 40.5 ft
BACKFILLED WITH: Native Materials
DRILLING DATE: June 20, 2011

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Company
LOGGED BY: T Nicely
CHECKED BY: J Blanchard

LOG OF BORING NO. DH-506

Los Osos Wastewater Collection System
Los Osos, California

PLATE A-7b

APPENDIX B

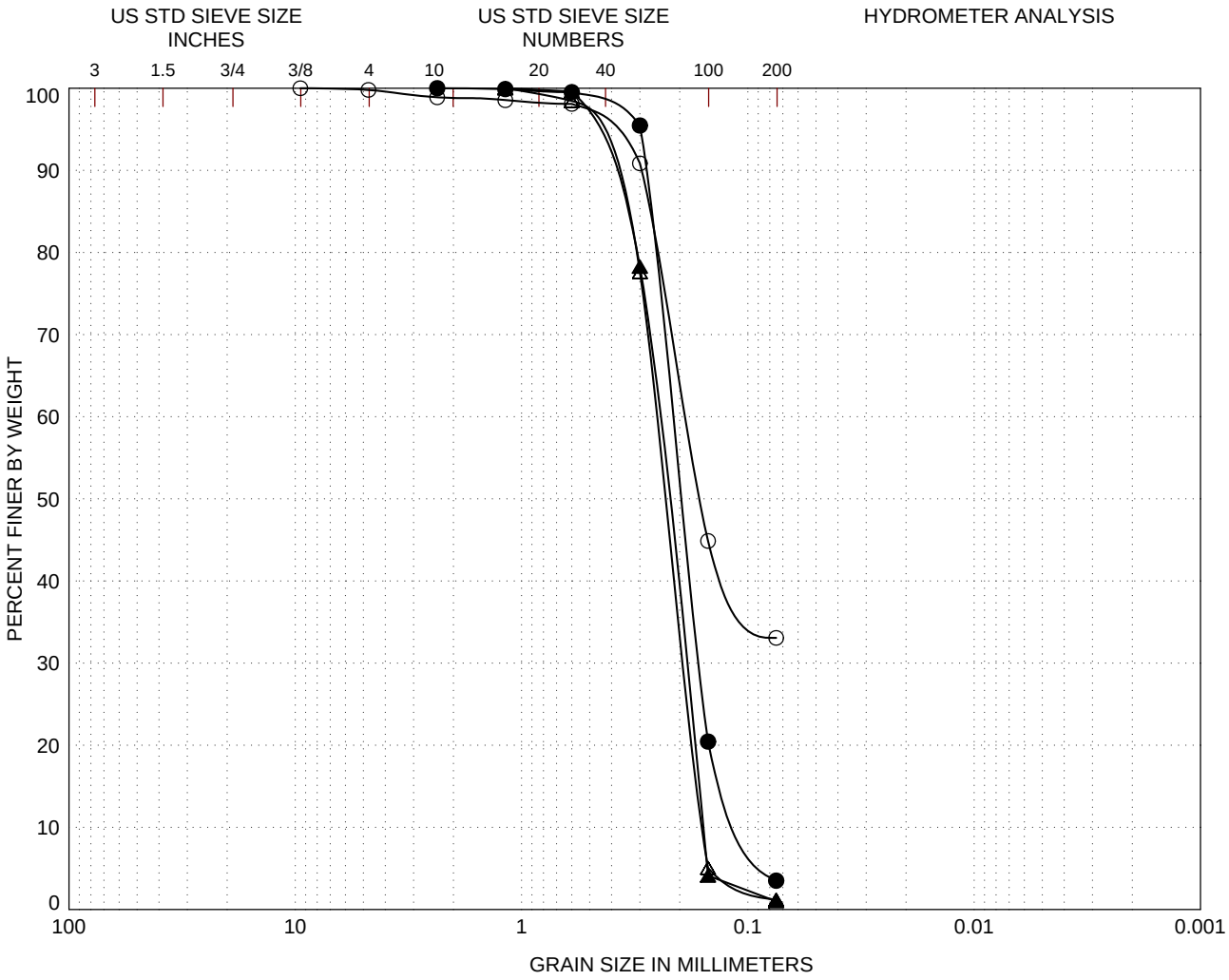
DRILL HOLE	DEPTH, ft	SAMPLE NUMBER	MATERIAL DESCRIPTION	UWW pcf	UDW pcf	MC %	FINES %	ATTERBERG LIMITS		COMPACTION TEST		DIRECT SHEAR		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				R-VALUE	EXPANSION INDEX	SAND EQUIVALENT (SE)	SPECIFIC GRAVITY
								LL	PI	MAX DD pcf	OPT MC %	C ksf	PHI deg	Qu, ksf	S_U (Cell Prs.) ksf	R	pH	Cl	So_4 (ppm)				
DH-501	1.5	1	Clayey SAND (SC)			12	34																
DH-501	3.5	2	Clayey SAND (SC)																	18			
DH-501	4.0	3	Clayey SAND (SC)	134	117	14	33															14	
DH-501	14.0	5	Clayey SAND (SC)	131	114	15	19																
DH-502	1.0	6	Clayey SAND (SC)	127	115	17						0.5	35										
DH-502	2.5	7	Clayey SAND (SC)													2082	8.10	30	15.5				
DH-502	4.0	8	Clayey SAND (SC)	134	117	14	21															17	
DH-502	10.0	9	Fat CLAY (CH)	128	113	13																	
DH-502	14.0	10	Clayey SAND (SC)	124	108	15																	
DH-503	1.5	11	Lean CLAY with sand (CL)	130	112	16		35	20														
DH-503	3.0	12	Lean CLAY (CL)											1.9	1.0 (0.4)	1658	7.80	13	26	10			
DH-503	4.0	13	Clayey SAND with gravel (SC)	112	105	7								3.2	1.6 (0.9)								
DH-503	14.0	15	Sandy Lean CLAY (CL)	125	102	23	57																
DH-504	1.5	32	Sandy Lean CLAY (CL)	129	116	11																	
DH-504	3.0	33	Sandy Lean CLAY (CL)							126.7	9.9			1.3	0.7 (0.4)								
DH-504	4.0	34	Clayey SAND (SC)	112	97	16		27	11														
DH-504	9.0	35	Lean CLAY with sand (CL)																				
DH-504	14.0	36	Lean CLAY with sand (CL)	125	102	23		30	14							1971	7.70	22	47				
DH-504	24.0	38	Poorly graded SAND with silt (SP-SM)	124	102	22																	
DH-504	34.0	40	Poorly graded GRAVEL with clay (GP-GC)	146	131	12																	
DH-504	39.0	41	Poorly graded SAND with silt (SP-SM)				6																
DH-505	1.5	27	Poorly graded SAND with silt (SP-SM)	105	101	4	9															24	
DH-505	4.0	29	Poorly graded SAND (SP)	103	100	3	4															49	
DH-506	2.0	17	Poorly graded SAND (SP)	105	101	4																	
DH-506	4.0	18	Poorly graded SAND (SP)				1															76	
DH-506	14.0	21	Poorly graded SAND (SP)	120	114	6	2																
DH-506	24.0	23	Poorly graded SAND (SP)				1																
DH-506	34.0	25	Poorly graded SAND (SP)	116	107	8																	

SUMMARY OF LABORATORY TEST RESULTS

Los Osos Wastewater Collection System
Los Osos, California

PLATE B-1

CDM
Project No. 04.6111.0030

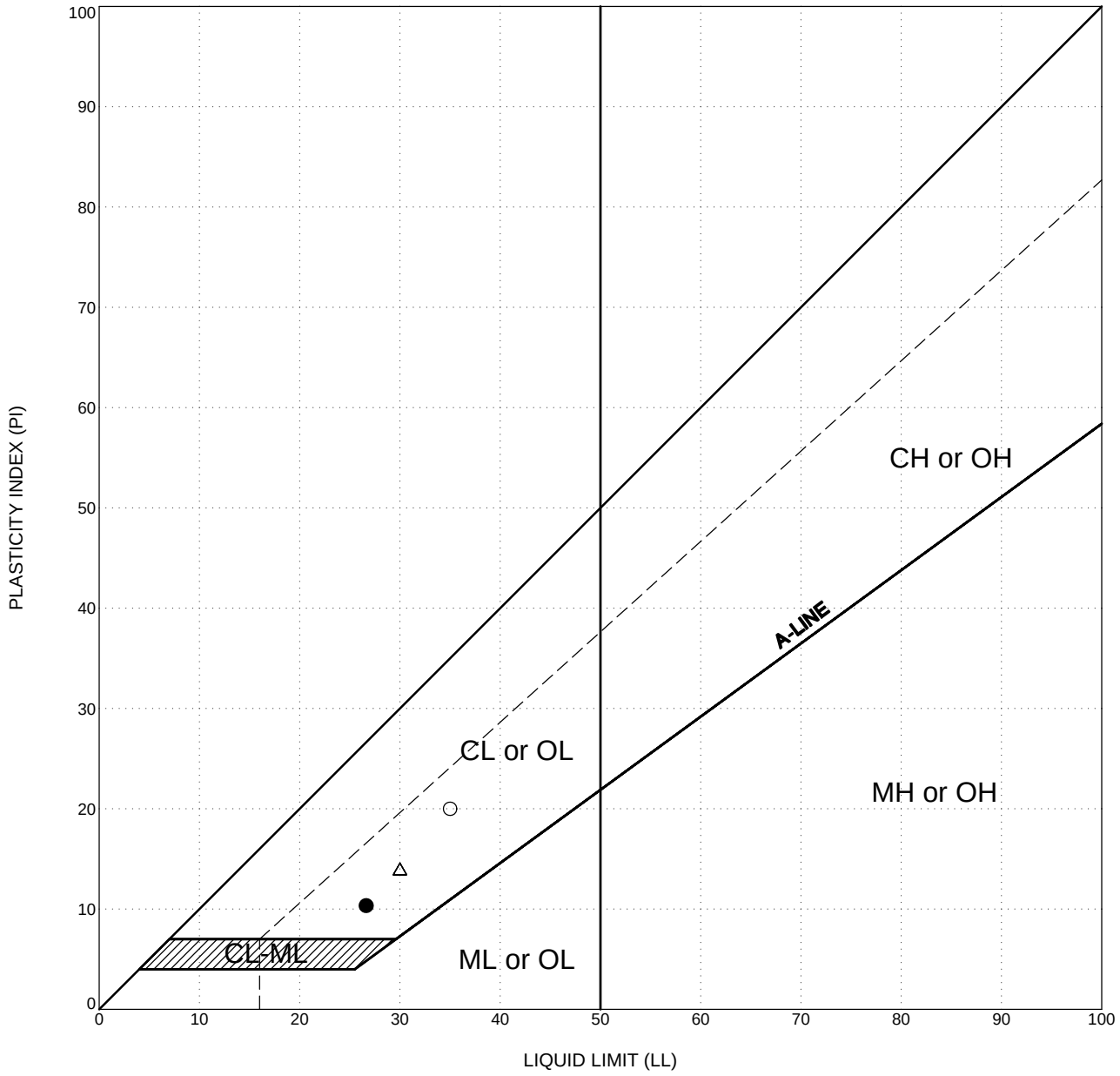


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND	(location)	(depth,ft)	CLASSIFICATION	Cc	Cu
○	DH-501	4.0	Clayey SAND (SC)		
●	DH-505	4.0	Poorly graded SAND (SP)	1.3	2.2
△	DH-506	4.0	Poorly graded SAND (SP)	0.9	1.6
▲	DH-506	24.0	Poorly graded SAND (SP)	0.9	1.6

GRAIN SIZE CURVES
Los Osos Wastewater Collection System
Los Osos, California

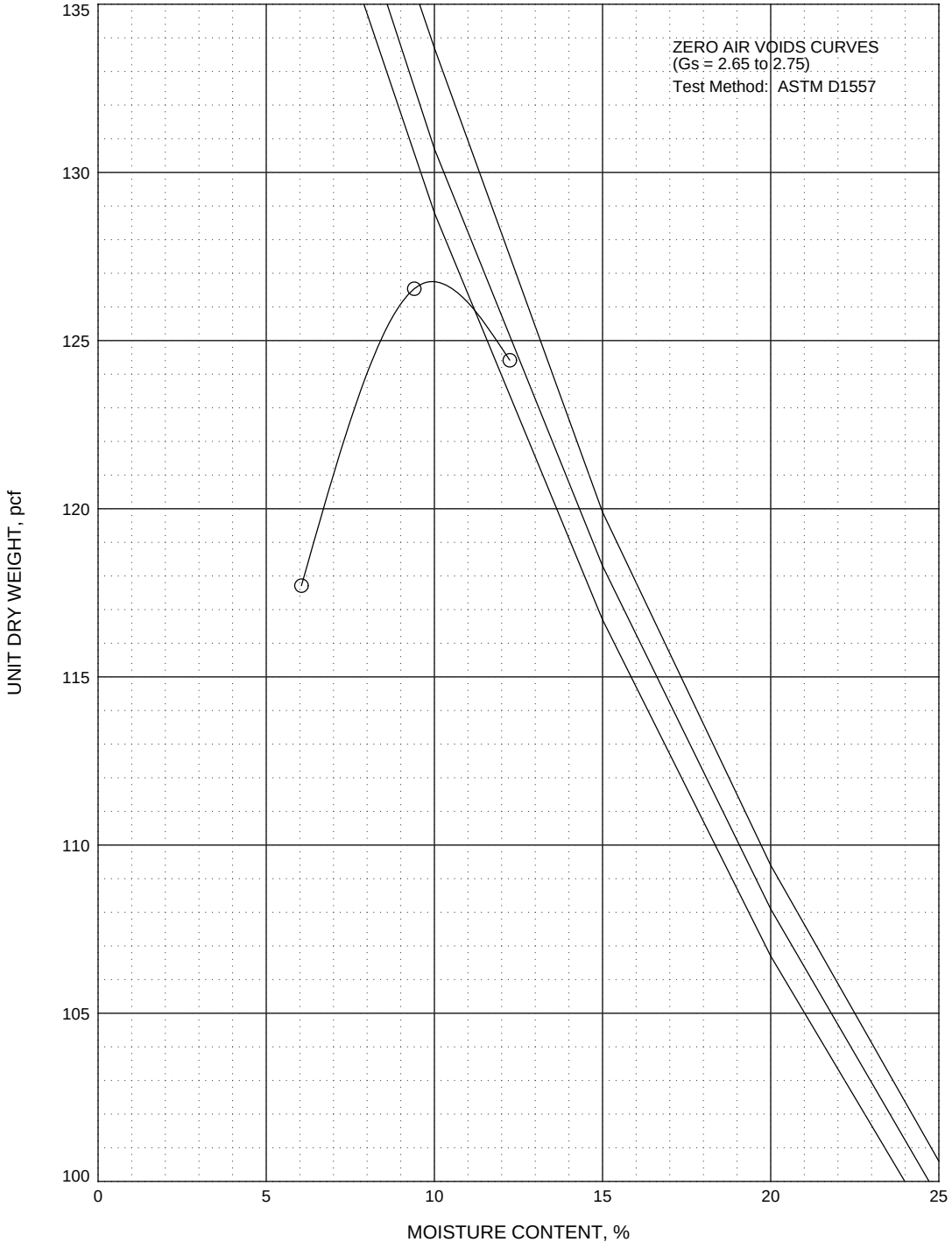
PLATE B-2



LEGEND	location	depth, ft	CLASSIFICATION	ATTERBERG LIMITS TEST RESULTS LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
○	DH-503	1.5	Lean CLAY with sand (CL)	35	15	20
●	DH-504	4.0	Clayey SAND (SC)	27	16	11
△	DH-504	14.0	Lean CLAY with sand (CL)	30	16	14

PLASTICITY CHART
Los Osos Wastewater Collection System
Los Osos, California

PLATE B-3

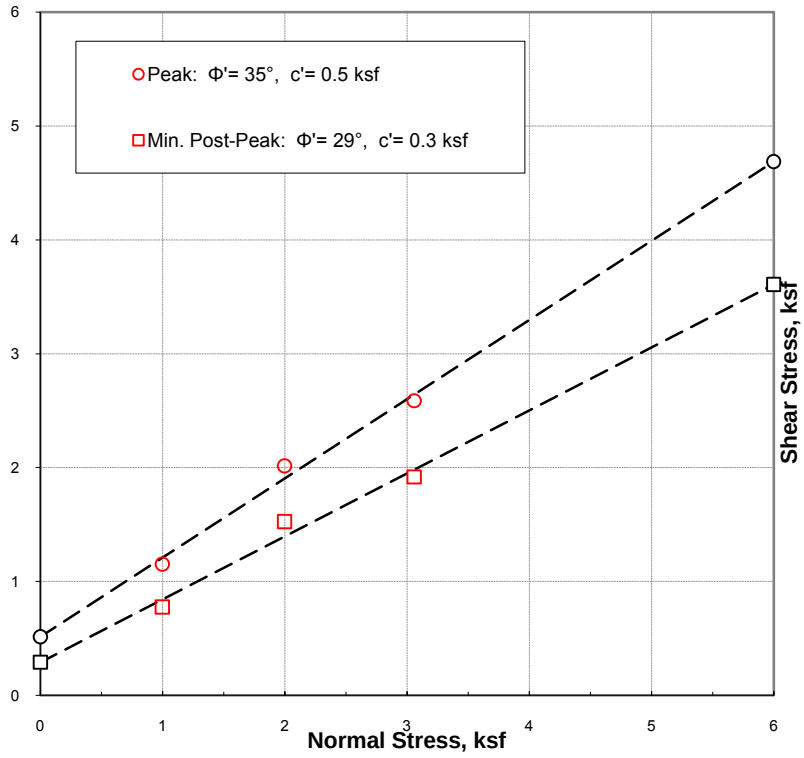


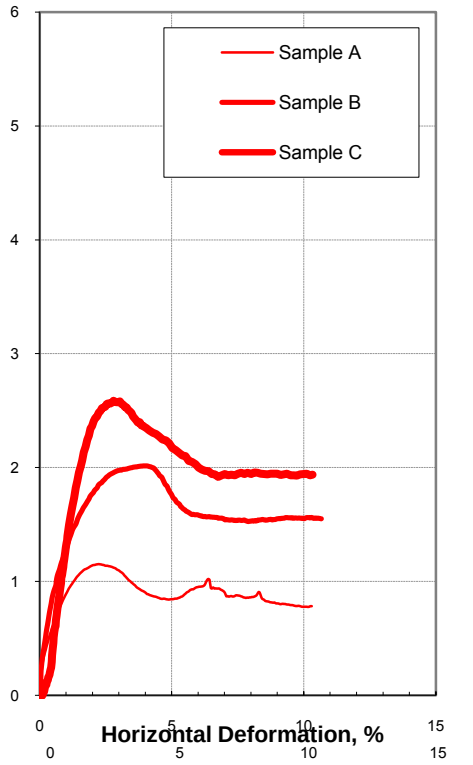
LEGEND			CLASSIFICATION	MAXIMUM UNIT DRY WEIGHT, pcf	OPTIMUM WATER CONTENT, %
	(location)	depth, ft			
○	DH-504	3.0	Sandy Lean CLAY (CL)	126.7	9.9

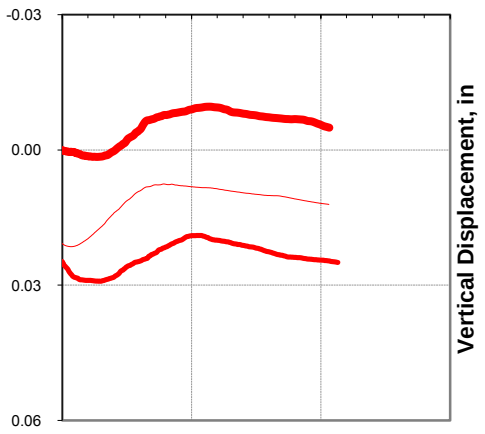
COMPACTION TEST RESULTS

Los Osos Wastewater Collection System
Los Osos, California

PLATE B-4







SAMPLE ID	Boring Number:	DH-502			
	Sample Number:	6			
	Sample Depth:	1.0 ft			
	USCS Classification:	Clayey SAND (SC): gray w/ FeO2 staining, moist			
INITIAL	Sample No.	A	B	C	D
	Water Content, %	12.9%	12.9%	12.9%	
	Dry Unit Weight, pcf	114.8	112.8	112.2	
	Saturation, %	78%	73%	72%	
	Void Ratio	0.44	0.47	0.47	
	Diameter, in	2.42	2.42	2.42	
	Height, in	1.00	1.00	1.00	
FINAL	Water Content, %	16.8%	17.9%	16.8%	
	Dry Unit Weight, pcf	112.2	109.2	112.1	
	Void Ratio	0.47	0.51	0.48	
TEST SUMMARY	Deformation at Peak, %	2.23	3.92	2.79	
	Displacement Rate, in/min	0.001	0.001	0.001	
	Normal Stress, ksf	1.0	2.0	3.1	
	Peak Shear Stress, ksf	1.15	2.02	2.59	
	Min. Post-Peak Stress, ksf	0.78	1.53	1.92	
REMARKS	Test Method: ASTM D3080				

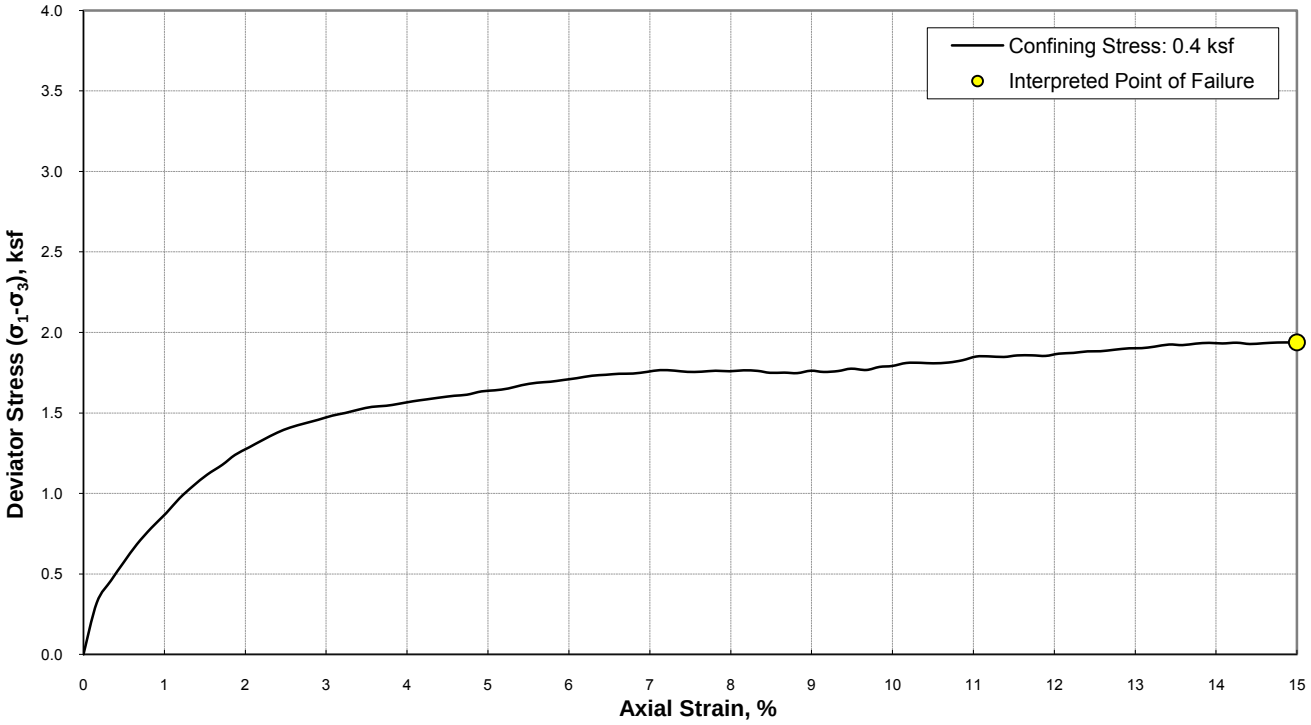
CLASSIFICATION

Sieve Size	% Passing
3/8-in. (9.5mm)	---
#4 (4.75mm)	---
#16 (1.18mm)	---
#30 (0.6mm)	---
#100 (0.150mm)	---
#200 (0.075mm)	---

Atterberg Limits	
Liquid Limit, %	---
Plastic Limit, %	---
Plasticity Index, %	---
Estimated Gs	2.65
k_{avg} 20°C, cm/sec	---

DIRECT SHEAR TEST RESULTS
Los Osos Wastewater Collection System
Los Osos, California

PLATE B-5



SAMPLE ID

Boring Number.:	DH-503
Sample Number.:	13
Sample Depth:	4.0 ft
USCS Classification:	Sandy lean CLAY (CL): olive brown, moist

SAMPLE PROPERTIES

Water Content, %	7.3%
Dry Unit Weight, pcf	104.7
Saturation, %	47%
Void Ratio	0.61
Diameter, in	2.42
Height, in	5.00

SAMPLE IMAGES

Sample Not Recoverable for Post-Test Photograph

CLASSIFICATION

Sieve Size	% Passing
3/8-in. (9.5mm)	---
#4 (4.75mm)	---
#16 (1.18mm)	---
#30 (0.6mm)	---
#100 (0.150mm)	---
#200 (0.075mm)	---

Other Parameters	
Liquid Limit	---
Plastic Limit	---
Plasticity Index	---
Estimated Gs	2.70
S_u from T_v, ksf	---
S_u from PP, ksf	---

TEST SUMMARY

Maximum Deviator Stress, ksf	1.9
Undrained Shear Strength, ksf	1.0
Axial Strain at Failure, %	15.0
Strain Rate, %/min	1.0
Cell Pressure, ksf	0.4
Tested By:	JC
Date Tested:	6/29/11

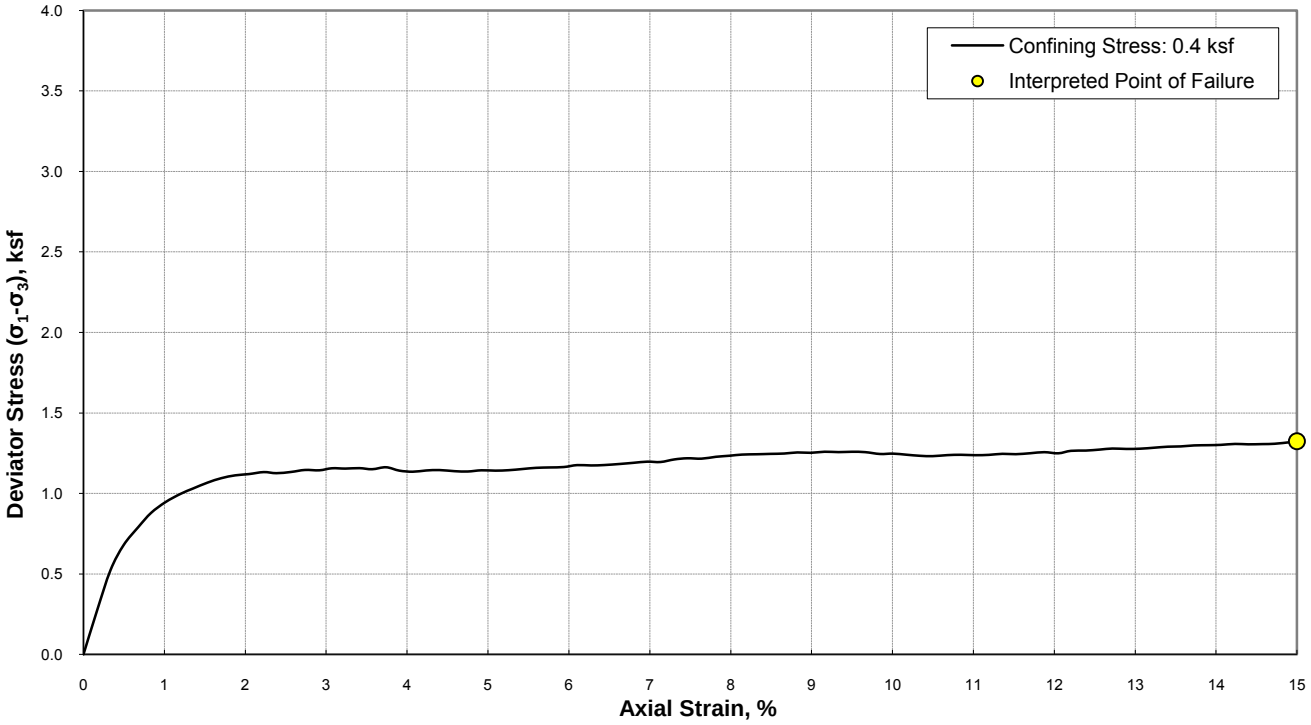
REMARKS

Test Method: ASTM 2850

UNCONSOLIDATED, UNDRAINED TRIAXIAL TEST

Los Osos Wastewater Collection System
Los Osos, CA

PLATE B-5a



SAMPLE ID

Boring Number.:	DH-504
Sample Number.:	34
Sample Depth:	4.0 ft
USCS Classification:	Clayey SAND (SC): dark olive brown, moist

SAMPLE PROPERTIES

Water Content, %	15.9%
Dry Unit Weight, pcf	96.7
Saturation, %	52%
Void Ratio	0.74
Diameter, in	2.42
Height, in	5.00

SAMPLE IMAGES

CLASSIFICATION

Sieve Size	% Passing	Other Parameters	
3/8-in. (9.5mm)	---	Liquid Limit	---
#4 (4.75mm)	---	Plastic Limit	---
#16 (1.18mm)	---	Plasticity Index	---
#30 (0.6mm)	---	Estimated Gs	2.70
#100 (0.150mm)	---	S_u from T_v, ksf	---
#200 (0.075mm)	---	S_u from PP, ksf	---

TEST SUMMARY

Maximum Deviator Stress, ksf	1.3
Undrained Shear Strength, ksf	0.7
Axial Strain at Failure, %	15.0
Strain Rate, %/min	1.0
Cell Pressure, ksf	0.4
Tested By:	JC
Date Tested:	6/29/11

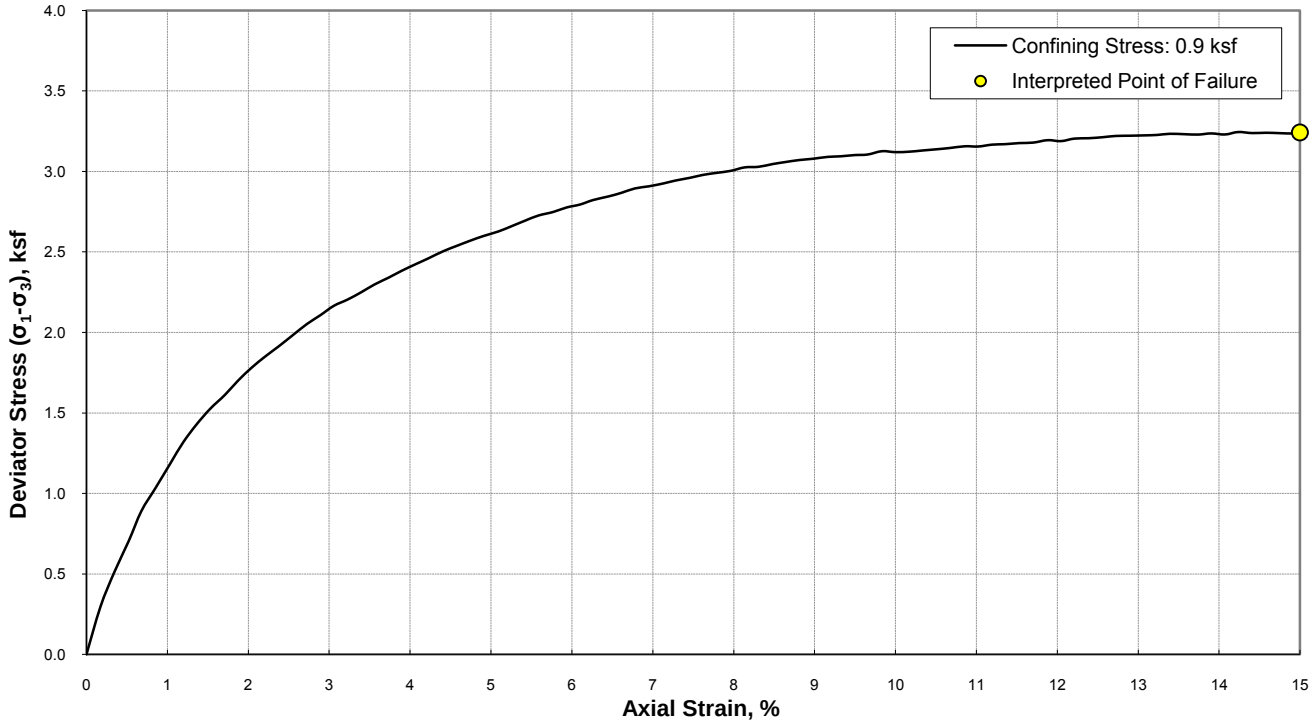
REMARKS

Test Method: ASTM 2850

UNCONSOLIDATED, UNDRAINED TRIAXIAL TEST

Los Osos Wastewater Collection System
Los Osos, CA

PLATE B-5b



SAMPLE ID

Boring Number.:	DH-504
Sample Number.:	36
Sample Depth:	14.0 ft
USCS Classification:	Lean CLAY with sand (CL): dark olive brown, moist

SAMPLE PROPERTIES

Water Content, %	22.5%
Dry Unit Weight, pcf	102.2
Saturation, %	75%
Void Ratio	0.65
Diameter, in	2.42
Height, in	5.00

SAMPLE IMAGES

CLASSIFICATION

Sieve Size	% Passing	Other Parameters	
3/8-in. (9.5mm)	---	Liquid Limit	---
#4 (4.75mm)	---	Plastic Limit	---
#16 (1.18mm)	---	Plasticity Index	---
#30 (0.6mm)	---	Estimated Gs	2.70
#100 (0.150mm)	---	S_u from T_v, ksf	---
#200 (0.075mm)	---	S_u from PP, ksf	---

TEST SUMMARY

Maximum Deviator Stress, ksf	3.2
Undrained Shear Strength, ksf	1.6
Axial Strain at Failure, %	15.0
Strain Rate, %/min	1.0
Cell Pressure, ksf	0.9
Tested By:	JC
Date Tested:	6/29/11

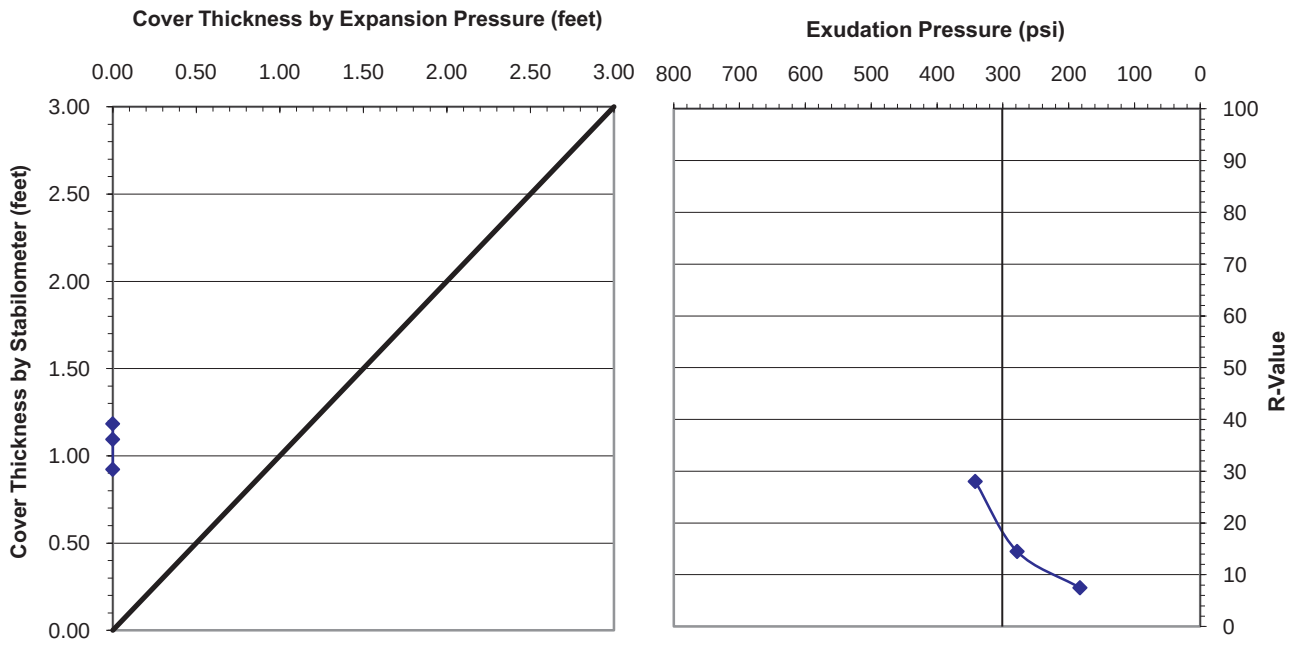
REMARKS

Test Method: ASTM 2850

UNCONSOLIDATED, UNDRAINED TRIAXIAL TEST

Los Osos Wastewater Collection System
Los Osos, CA

PLATE B-5c



Sample No. DH-501 #2 **Depth:** 3'-5'
Description: Brown clayey SAND (SC)
Date Tested: 6/30/2011
Test Method: ASTM D2844, CT301
Initial Moisture Content: 11.2%

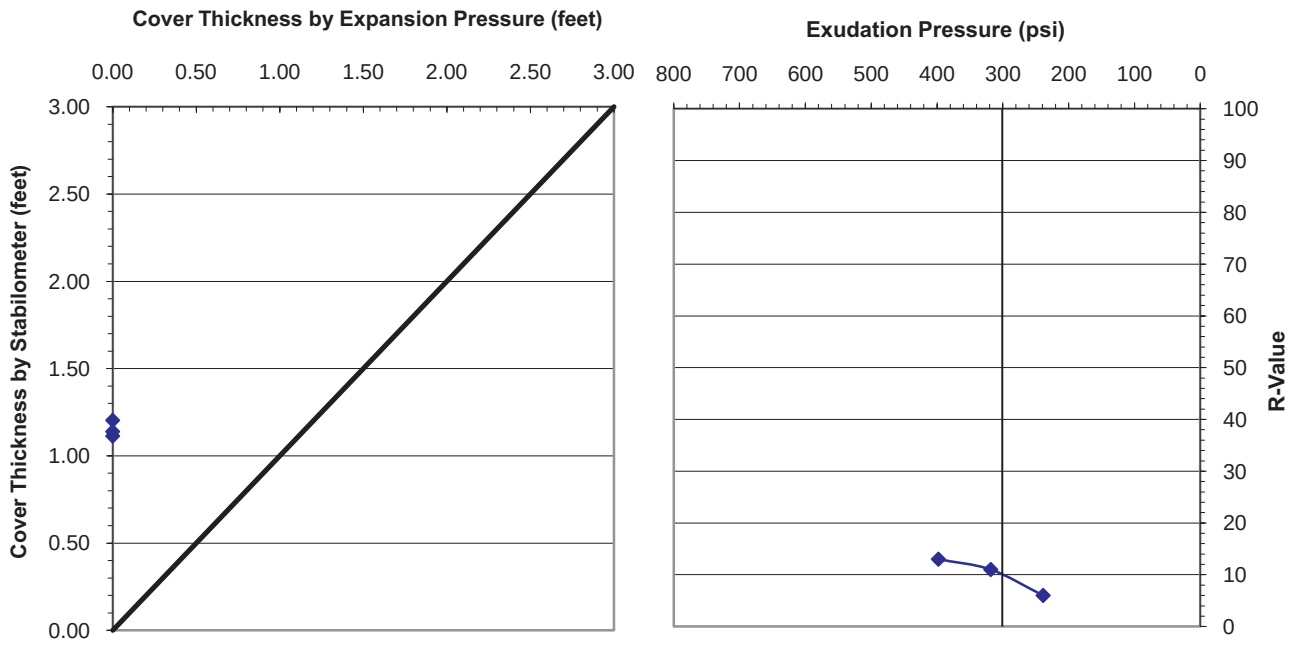
Dry Unit Weight (pcf)	Water Content (%)	Exudation Pressure (psi)	Expansion Pressure (psf)	R-Value
118.7	13.4	183	0	8
123.3	12.2	278	0	15
124.6	11.2	342	0	28

R-value at Exudation Pressure of 300 psi: **18**
R-value by Expansion Pressure: TI = 4 **N/A**

Remarks: R-value by stabilometer controls.

R-VALUE TEST RESULTS
Los Osos Wastewater Collection System
Los Osos, California

PLATE B-6a



Sample No. DH-503 #12 **Depth:** 3'-5'
Description: Dark brown sandy lean CLAY (CL)
Date Tested: 6/30/2011
Test Method: ASTM D2844, CT301
Initial Moisture Content: 16.5%

Dry Unit Weight (pcf)	Water Content (%)	Exudation Pressure (psi)	Expansion Pressure (psf)	R-Value
105.6	20.6	239	0	6
107.7	19.4	318	0	11
110.5	18.3	398	0	13

R-value at Exudation Pressure of 300 psi: **10**
R-value by Expansion Pressure: TI = 4 **N/A**

Remarks: R-value by stabilometer controls.

R-VALUE TEST RESULTS
Los Osos Wastewater Collection System
Los Osos, California

PLATE B-6b

Corrosivity Test Summary

COOPER TESTING LABORATORY

CTL #	446-111	**Date:**	7/11/2011	**Tested By:**	PJ	**Checked:**	PJ
Client:	Fugro West	**Project:**	Los Osos WWP Collection System			**Proj. No:**	04.6111.0030
Remarks:							

Sample Location or ID			Resistivity @ 15.5 °C (Ohm-cm)			Chloride	Sulfate		pH	ORP	Moisture	Soil Visual Description
Boring	Sample, No.	Depth, ft.	As Rec.	Minimum	Saturated	mg/kg	mg/kg	%		(Redox)	At Test	
						Dry Wt.	Dry Wt.	Dry Wt.		mv	%	
			ASTM G57	Cal 643	ASTM G57	Cal 422-mod.	Cal 417-mod.	Cal 417-mod.	Cal 643	SM 2580B	ASTM D2216	
DH-502	7	2.5-4	-	2082	-	30	155	0.0155	8.1	-	13.6	Olive Clayey SAND
DH-503	12	3-5	-	1658	-	13	26	0.0026	7.8	-	15.3	Brown Sandy CLAY
DH-504	35	9.0	-	1971	-	22	47	0.0047	7.7	-	18.5	Greenish Gray Sandy CLAY/ Clayey SAND

CORROSION TEST RESULTS
Los Osos Wastewater Collection System
Los Osos, California

APPENDIX C

DIST | COUNTY | ROUTE | POST MILES | TOTAL PROJECT | SHEET NO. | TOTAL SHEETS
20 | 20

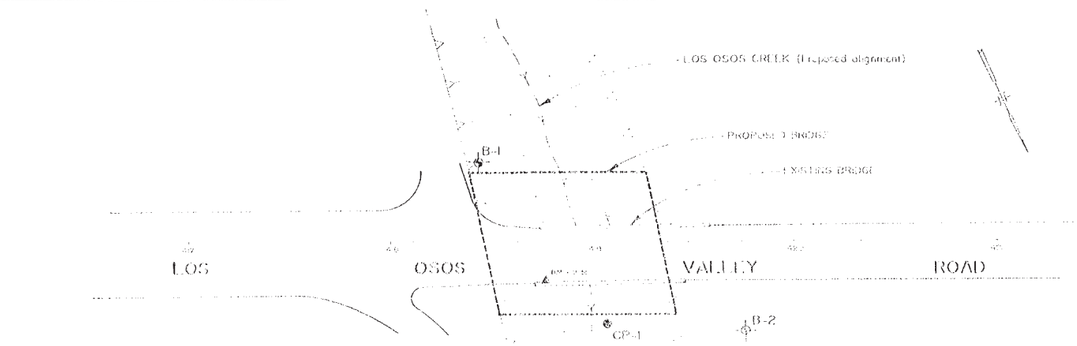
33798

MOORE & TABER
5620 DISTRICT BLVD., SUITE 103
BAKERSFIELD CA. 93313
12/8/89

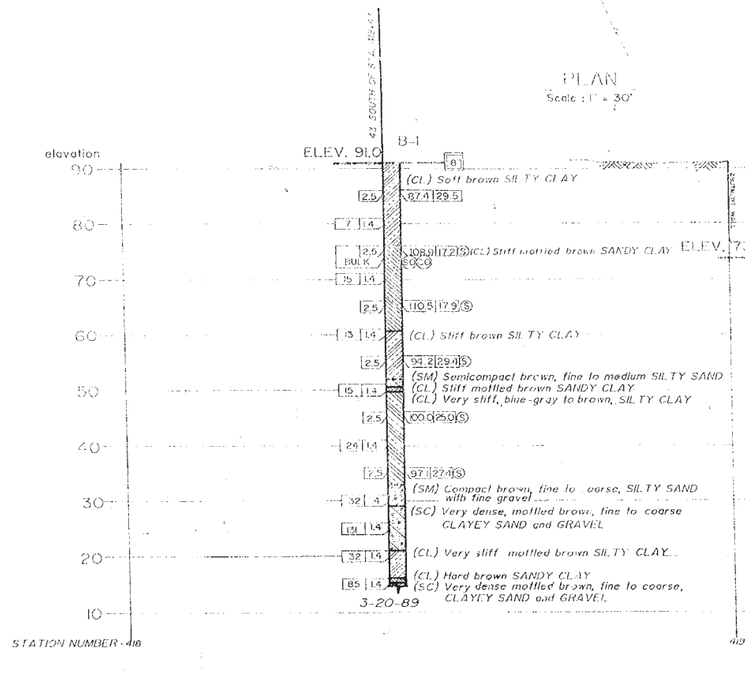
NOTES:

1) BENCHMARK "BM" on northeasterly wingwall of 1 on Osos Creek Bridge. (Elev. 91.58)

2) Borings logged by David L. Fearnbo Registered Geotechnical Engineer



PLAN
Scale : 1" = 30'



PROFILE
Scale : 1" = 10'

AS BUILT
JOB #: P12A140 RE: Addendum #4 DATE: 12-6-89

MOORE & TABER
CONSULTING ENGINEERS AND GEOLOGISTS

STRUCTURES - DESIGN

BRIDGE NO. 49C - 238
POST MILL

LOS OSOS VALLEY ROAD BRIDGE AT LOS OSOS CREEK
SAN LUIS OBISBO COUNTY, CALIFORNIA

LOG OF TEST BORINGS

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

PROJECT ENGINEER: CU
DESIGNED BY: WO

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET | OF