APPENDIX D-1

GEOTECHNICAL INVESTIGATION

REPORT OF

GEOTECHNICAL INVESTIGATION

AND PERCOLATION TESTING FOR SUSMP

PROPOSED COMMERCIAL DEVELOPMENT PROJECT

APN: 0292034170000

913 CALIFORNIA STREET

REDLANDS, CALIFORNIA 92374

FOR

J D FUEL, LLC

PROJECT NO. 23-536-02

NOVEMBER 30, 2023

November 30, 2023 23-536-02

J D Fuel LLC
1031 Rosecrans Avenue, Suite #207
Fullerton, California 92833

Attention: Chandresh Ravaliya

Subject: Geotechnical Investigation
And Percolation Testing For SUSMP
Proposed Commercial Development Project
APN: 0292034170000
913 California Street
Redlands, California 92374

Ladies & Gentlemen:

INTRODUCTION

This report presents the results of a geotechnical investigation for the subject project. During the course of this investigation, the engineering properties of the subsurface materials were evaluated in order to provide recommendations for design and construction of temporary excavation, foundations, grade slabs, and grading. Our investigation included subsurface exploration, soil sampling, laboratory testing, engineering evaluation and analysis, on-site percolation testing for SUSMP, consultation, and preparation of this report.

This office has previously issued a soils report dated April 15, 2005 (AES Report No. 05-533-02) for the subject lot. Based on the conversation with the client, it is our understanding that, since the issuance of the previous report, the owners and design team (including the architect) have changed. The new client has requested a new report for a an entirely different project at the subject site. For reference, we have enclosed a PDF version of the previous report to this new report.

During the course of this investigation, the provided architectural site plan provided by the client was used as reference.

The enclosed Site Plan; Drawing No. 1, shows the approximate location of the drilled borings in relation to the site boundaries and the proposed development. This drawing also shows the location on the plan and profile of Cross Section A-A'.

Figure No. 1 shows the Site Vicinity Map. Figure No. 2 shows the Regional Topographic Map. Figure No. 3 shows the Regional Geologic Map.

The attached Appendix I, describes the method of field exploration. Figure Nos. I-1 through I-6 present summaries of the materials encountered at the location of our borings and test pits. The test pits were excavated for the purpose of percolation testing. Figure No. I-7 presents the Uniform Soil Classification System Chart; a guide to the Log of Exploratory Borings and test pits.

The attached Appendix II describes the laboratory testing procedures. Figure Nos. II-1 and II-2 present the results of direct shear and consolidation tests performed on selected undisturbed soil samples.

It should be noted that the presented recommendations for excavation and foundation are based on our understanding of the depth of cuts setback conditions and assumed structural loading. This office should be consulted to see if the actual structural loading and excavation depths are different from those used during this investigation.

PROJECT CONSIDERATION

It is our understanding that the proposed project will consist of construction of a commercial complex. The proposed project will consist of construction of a one-story carwash tube with vacuum station, one-story coffee shop, a 4-story hotel building, and site improvements including the addition of open paved parking spaces.

The proposed buildings are expected to be established near grade. No basement is proposed.

The flooring system will be in the form of concrete slab established at or close to the existing grade. The approximate location of the proposed buildings with respect to the site boundaries is shown on the enclosed Site Plan; Drawing No.1.

Structural loading data was not available at the time of this investigation. For the purpose of this report, it is assumed that maximum concentrated loads of the interior columns will be on the order of 40 kips for the coffee shop and car wash and 400 kips for

the hotel, combined dead plus frequently applied live loads. Perimeter and interior wall footings of the structure are expected to exert loads of on the order of 2 kips per lineal foot for the coffee shop/car wash structures and 10 kips for the hotel building.

ANTICIPATED SITE GRADING WORK

The site grading is expected to involve removal and recompaction of any surficial fill and loose native soils (a maximum of 2 to 3 feet; to be determined by the Soil Engineer during site grading). The recompacted soils can then be used to receive new fill for support of foundations and grade slabs. The required grading in the areas of surface parking will be limited to removal and recompaction of the top 12 inches of the existing soils. As part of the site grading work, some utility trenches will be backfilled.

The zone of removal should be extended beyond the exterior walls of the proposed buildings a horizontal distance equal to the thickness of fill.

In our previous report, it was noted that due to shrinkage considerations and raising the site grade above the potential flood zone, imported soils will be required to accomplish the site grading work. All imported soils should be non-expansive and granular in nature (similar to the site soils).

SITE CONDITIONS

SURFACE CONDITIONS

The site of the proposed development is an existing vacant located at 913 California Street in Redlands, California. At the time of our filed investigation, the site was vacant and covered with dirt/shrubs. The site was noted to be general level.

An existing service station occurs to the northeast of the subject site and is not part of the scope. A flood control channel occurs to the south of the site. See enclosed Site Plan; Drawing No.1.

SUBSURFACE CONDITIONS

Correlation of the subsoil between the test holes was considered to be good. Generally, the site, to the depth explored, was found to be covered by fill (silty sand) underlain by natural deposits of silty sand, sandy and/or clayey silt, and relatively clean sand soils with variable amounts of gravel. The thickness of the existing fill was found to

be on the order of 1 foot at the location of our test holes. Deeper fill, however, may be present between and beyond our borings and closer to the storm drain channel.

The existing fill and top 2 feet of the site native soils were found to be generally porous and compressible. At their present state, such soils should not be used for support of new fill, structural foundations and grade slabs. The existing fill, however, may be excavated and reused in the areas of compacted fill.

The native soils found below a depth of about 3 feet were found to be medium dense in-place and free of visual porosity. The results of our laboratory testing indicated that the site native soils were of moderate strength and moderately compressible.

The site upper soils (including the existing fill) were found to be granular in nature. Such soils were found to be virtually non-expansive.

During the course of our field exploration, no groundwater was encountered in our test holes extended to maximum depth of 51 feet. No groundwater data could be found in the vicinity of the subject site.

Due to the method of drilling (use of continuous auger) caving was not detected during the course of our field exploration. Foundation construction will not require forming due to the silty nature of the upper site soils.

SEISMIC DESIGN CONSIDERATIONS

In accordance with the ASCE7-16, corresponding to CBC 2022, the project site can be classified as site “D”. The mapped spectral accelerations of S_S= 2.002 (short period) and S_1 =0.792 (1-second period) can be used for this project. These parameters correspond to site Coefficients values of F_a =1.0 and F_V = null (see the Note below), respectively.

The seismic design parameters would be as follows:

$\mathbf{S_{MS}}$= F_a (S_S) = 1.0 (2.002) = 2.002	$\mathbf{S_{M1}}$=F_v (S_1) = 1.7 (0.792) = 1.346
$\mathbf{S_{DS}}$=2/3 (S_{MS}) = 2/3 (2.002) = 1.335	$\mathbf{S_{D1}}$=2/3 (S_{M1}) = 2/3 (1.346) = 0.898

Note: Since the seismic factor S1 is greater than 0.2 site-specific ground motion hazard analysis may be required. The project structural engineer shall determine if an exemption can be applied in accordance with ASCE7-16, Supplement 3, Section 11.4.8.

for structures on Site Class D sites with S1 greater than or equal to 0.2, the parameter SM1 determined by equation (11.4-2) shall be increased by 50%. Alternatively, a supplement report containing a site-specific ground motion hazard analysis in accordance with ASCE7-16 section 21.2 shall be submitted for review and approval. If an exemption applies, a long period coefficient (F_v) of 1.7 may be utilized for calculation of the seismic parameters $\mathbf{S_{M1}}$ and $\mathbf{S_{D1}}$ in the above table.

EVALUATION OF LIQUEFACTION POTENTIAL

As part of our field exploration, one boring was extended to a maximum depth of 51 feet. No water was encountered in our borings. There is no historic groundwater data available for this site and its vicinity. However, for evaluating liquefaction potential at the site, groundwater was assumed at a depth of about 4 feet below ground surface where a BMP will be used for infiltration of stormwater into the subsurface soils.

The results of our liquefaction analysis (using CivilTech program) with lower-level peak ground acceleration (PGA) corresponding to 2/3 of PGA_M (a value of 0.62g) and the predominant earthquake magnitude of 7.22 with 10% probability of exceedance in 50 years (475-year return period) a factor of safety of greater than 1.1 was obtained for all layers. The corresponding seismic related total and differential settlements were found to be negligible. See the enclosed engineering calculation sheets.

When using higher level peak ground acceleration value of 0.93g corresponding to PGA based on PGA_M (Maximum Considered Earthquake-Geometric Mean, MCEg, adjusted to site effects, ASCE 7-16 Eq. 11.8-1) and the predominant earthquake magnitude of 7.55 with 2% probability of exceedance in 50 years (2475-year return period) a factor of safety of greater than 1.0 was also obtained for all layers. The corresponding seismic related total and differential settlements were found to be less than 0.10 of an inch. It is our opinion that soil liquefaction will not occur at this site.

STATEMENT 111

For the purpose of the subject project, it is our opinion that when the proposed grading and construction is made as planned, following the recommendations of this report, the site will be safe against the hazards of landsliding, settlement or slippage. The

proposed construction and grading will not have adverse effect on the geologic stability of the existing properties outside the boundaries of the subject site.

SOIL CHEMICAL IMPURITIES AND CORROSION CONSIDERATIONS

After the proposed finished grades are established, samples of the subgrade materials in contact with foundations and utility lines, should be tested for chemical impurity (soil corrosivity). For the purpose of this report, however, it should be assumed that the site soils are corrosive. Subject to the results of chemical testing during construction, the design may be changed.

EVALUATION AND RECOMMENDATIONS

GENERAL

Based on the geotechnical engineering data derived from this investigation, the site is considered to be suitable for the proposed development. The surficial fill and top zone of porous native soils (a total thickness of on the order of 2 to 3 feet) should be excavated until non-porous soils (to be determined by the Soil Engineer) are exposed. The zone of removal should be extended beyond the exterior walls of the proposed buildings a horizontal distance equal to the thickness of fill.

After proper site grading, conventional spread footing foundation system can be used for support of the proposed buildings. The foundation bearing soils are expected to be properly compacted fill soils.

Grade slabs can be supported on the finished grades which will consist of properly compacted fill soils. Due to granular nature, soil expansion will not be an issue at this site. It is recommended, however, that the grade slabs for this project be taken at least 5 inches and be reinforced with #4 bars placed at every 16 inches on center each way.

The following sections present our specific recommendations for temporary excavation, site grading, site drainage, foundations, lateral design, grade slabs, minor walls, and observations during construction.

TEMPORARY EXCAVATION

Where space limitations permit, unshored temporary excavation slopes can be used. Based upon the engineering characteristics of the site upper soils, it is our opinion that temporary excavation slopes in accordance with the following table should be used:

Maximum Depth of Cut (Ft)	Maximum Slope Ratio (Horizontal: Vertical)
0-3	Vertical
>3	1:1

Water should not be allowed to flow over the top of the excavation in an uncontrolled manner. No surcharge should be allowed within a 45-degree line drawn from the bottom of the excavation. Excavation surfaces should be kept moist but not saturated to retard raveling and sloughing during construction.

It would be advantageous, particularly during wet season construction, to place polyethylene plastic sheeting over the slopes. This will reduce the chances of moisture changes within the soil banks and material wash into the excavation.

GRADING RECOMMENDATIONS

Site grading for the proposed project will involve excavation of the existing fill and native soils until competent native soils are exposed which could be about 2 to 3 feet below the ground surface and properly recompact the excavated soils. The recompacted fill will be used for supporting structural foundations and grade slabs. Debris and rocks larger than 4 inches in diameter should be excluded from the areas of new compacted fill.

For utility trench backfill, place clean sand around and above the utility lines using jetting. The sand should be brought up to 12 inches above utility lines. Above the sand, normal soils from the site can be used. All utility backfills should be placed at a minimum relative compaction of 90% at optimum moisture content.

Prior to placement of any fill on the site, the Soil Engineer should observe the excavation bottoms. The areas to receive compacted fill should be scarified to a depth of about 8 inches, moistened as required to bring to optimum moisture content, and

compacted to at least 90 percent of the maximum dry density as determined by the ASTM Designation D1557 Compaction Method.

General guidelines regarding site grading are presented below which may be included in the earthwork specification. It is recommended that all fill be placed under engineering observation and in accordance with the following guidelines:

1. All vegetation and debris should be collected and hauled off-site. In the areas of new fill, the existing fill should be excavated until native soils are exposed.

2. The excavated areas should be observed and approved by the Soil Engineer prior to placing any fill.

3. The excavated sandy soils from the site are considered to be satisfactory to be reused in the areas of compacted fill and wall backfill provided that rocks larger than 6 inches in diameter are removed.

5. Fill material, approved by the Soil Engineer, should be placed in controlled layers. Each layer should be compacted to at least 90 percent of the maximum unit weight as determined by ASTM designation D 1557-02 for the material used.

6. The fill material shall be placed in layers which, when compacted, shall not exceed 8 inches per layer. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to insure uniformity of material in each layer.

7. When moisture content of the fill material is too low to obtain adequate compaction, water shall be added and thoroughly dispersed until the moisture content is near optimum. When the moisture content of the fill material is too high to obtain adequate compaction, the fill material shall be aerated by blading or other satisfactory methods until near optimum moisture condition is achieved.

8. Inspection and field density tests should be conducted by the Soil Engineer during grading work to assure that adequate compaction is attained. Where compaction of less than 90 percent is indicated, additional compactive effort should be made with adjustment of the moisture content or layer thickness, as necessary, until at least 90 percent compaction is obtained.

SITE DRAINAGE

Site drainage should be provided to divert roof and surface waters from the property through non-erodible drainage devices to the street. In no case should the

surface waters be allowed to pond adjacent to the building or behind the walls. A minimum slope of two and five percent are recommended for paved and unpaved areas, respectively.

The site drainage recommendations should also include the following:

1. Having positive slope away from the buildings, as recommended above;
2. Installation of roof drains, area drains and catch basins with appropriate connecting lines;
3. Managing landscape watering;
4. Regular maintenance of the drainage devices;
5. Installing waterproofing or damp proofing, whichever appropriate, beneath concrete grade slabs and behind the walls;
6. The owners should be familiar with the general maintenance guidelines of the City requirements.

FOUNDATIONS

Conventional spread footing foundation systems could be used to support the proposed buildings. The foundation bearing materials are expected to be firm native and/or properly compacted fill soils.

Exterior and interior footings should be a minimum of 18 inches wide and should be placed at a minimum depth of 24 inches below the lowest adjacent final grades.

Properly designed and constructed spread footings may be based on an allowable maximum bearing pressure of 1,800 pounds per square foot. This value may be increased at a rate of 100 and 200 pounds per square foot for each additional foot of footing width and depth, to a maximum value of 2,400 pounds per square foot. The footings for this project should be connected in both directions using beams.

The above given values are for the total of dead and frequently applied live loads. For short duration transient loading, such as wind or seismic forces, the given values may be increased by one-third.

Under the allowable maximum soil pressure, footings carrying the assumed maximum concentrated loads of up to 400 kips are expected to settle on the order of 3/4 of one inch. Continuous footings, with loads of up to 10 kips per linear foot are expected to settle on the order of ½ of one inch. Maximum differential settlements are expected to

be on the order of 1/4 of an inch. Due to granular nature of the materials, it is anticipated that the major portions of the settlements will occur during construction.

LATERAL DESIGN

Lateral resistance at the base of footings in contact with native soils and/or compacted fill soils may be assumed to be the product of the dead load forces and a coefficient of friction of 0.3. Passive pressure on the face of footings may also be used to resist lateral forces.

A passive pressure of zero at the finished grades and increasing at a rate of 250 pounds per square foot per foot of depth to a maximum value of 1,800 pounds per square foot may be used for footings poured against properly compacted fill soils.

GRADE SLABS

Grade slabs can be supported on finished grade which will consist of properly compacted fill soils. Due to granular nature, soil expansion will not be an issue at this site. It is recommended, however, that the grade slabs for this project be taken at least 5 inches and be reinforced with #4 bars placed at every 16 inches on center each way.

In the areas where moisture sensitive floor covering is used and slab dampness cannot be tolerated, a vapor-barrier should be used beneath the slabs. This normally consists of a 10-mil polyethylene film covered with 2 inches of clean sand.

RETAINING WALLS

Static design of minor retaining walls may be based on an equivalent fluid pressure of 40 pounds per square foot per foot of depth. This assumes that no hydrostatic pressure will occur behind the walls. Hydrostatic pressures should be relieved from the back of the retaining walls through properly designed and constructed subdrain. This normally consisted of 4-inch diameter perforated pipes encased in free draining gravel (at least one cubic foot per lineal foot of the pipes). To reduce the chances of siltation, an approved fabric should be used around the gravel.

Uniform surcharge effects may be computed using a coefficient of 0.47 times the uniform loads. For allowable vertical and lateral pressure refer to the preceding sections.

It is noted that, based on the new Code requirement, if the walls higher than 6 feet should be designed not only for static, but also for seismic lateral earth pressures. For the purpose of this project, the magnitude of seismic lateral earth pressure should be assumed zero at the base of the excavation and increased upward at a rate of 48 pounds per square foot per decreasing depth to a maximum value at the ground surface. The point of application of the lateral thrust of the seismic pressure should be assumed 0.6 time the wall height, measured from the bottom of the wall. The seismic lateral earth pressure should be applied to the active pressure.

ON-SITE INFILTRATION CONSIDERATIONS

As part of the site development, it is required to provide an on-site storm water infiltration system. This normally consists of diversion of the stormwater into an underground system that will allow infiltration into the ground.

PERCOLATION TESTING

The procedure for percolation testing was based on the County of San Bernardino Technical Guidance Document, Appendix VII test procedures. The constant head method described in section 2 of the Design Handbook for Low Impact Development (LID) Best Management Practices (BMP) prepared by Riverside County Flood Control Water Conservation District (9/2011) was used to perform percolation tests. The percolation testing procedure was as follow:

1. Two test pits were excavated to a depth of 2 feet (passing the upper fill);
2. Using hand tools, excavated a 12-inch diameter test hole at the bottom of the test pit to a depth of 32 inches (5 times the radius of the hole);
3. Covered the bottom of the hole with 2 inches of gravel;
4. Due to silty sand native soils (USCS classification of SM), the tests were then run after 2 hours of presoaking instead of 24 hours;
5. As shown in the attached Table 5, our 2 consecutive measurements showed that more than 6 inches of water seeped away in less than 25 minutes. Therefore, the test was run for an additional hour with measurements taken every 10 minutes. The

drop that occurred during the final 10 minutes was used to calculate the percolation rate. File data showing the two 25-minute readings and the six 10-minute readings.

The percolation tests were performed in Test Pit No. 1 and 2 respectively at depth of 3.5 to 4.5 feet below the ground surface in native soils. The enclosed Site Plan; Drawing No. 1, shows the approximate location of excavated test pits and where the percolation test was conducted (Perc-1 and Perc-2).

PERCOLATION RATE CONVERSION

The Percolation Test Data Sheets (Table 5) were prepared as the test was performed in the field. The test was performed using 6 trials. The data collected from Test Pit No.1 at the final interval is as follows:

Time interval, $\Delta t = 10$ minutes

Initial Depth to Water, $D_0 = 12$ inches

Final Depth to Water, $D_f = 13.50$ inches

Total Depth of Test Hole, $D_T = 30$ inches

Test Hole Radius, $r = 6$ inches

The conversion equation used to calculate infiltration rate:

$$I_t = \frac{\Delta H \; 60 \; r}{\Delta t(r + 2H_{avg})}$$

"H_0" is the initial height of water at the selected time interval:

$H_0 = D_T - D_0 = 30 - 12 = 18$ inches

"H_f" is the final height of water at the selected time interval:

$H_f = D_T - D_f = 30 - 13.50 = 16.5$ inches

"ΔH" is the change in height over the time interval:

$H_{avg} = \Delta D = H_0 - H_f = 18 - 16.5 = 1.5$ inches

"H_{avg}" is the average height over the time interval:

$H_{avg} = (H_0 + H_f)/2 = (18 + 16.5)/2 = 17.25$ inches

"I_t" is the tested infiltration rate:

$$I_t = \frac{\Delta H\ 60\ r}{\Delta t(r + 2H_{avg})} = \frac{(1.5\text{ in})(60\text{ min/hr})(6\text{ in})}{(10\text{ min})((6\text{ in}) + 2(1.5))} = 1.3\text{ in/hr}$$

The Percolation Test Data Sheets (Table 5) were prepared as the test was performed in the field. The test was performed using 6 trials. The data collected from Test Pit No.2 at the final interval is as follows:

Time interval, $\Delta t = 10$ minutes

Initial Depth to Water, $D_0 = 12$ inches

Final Depth to Water, $D_f = 13.75$ inches

Total Depth of Test Hole, $D_T = 30$ inches

Test Hole Radius, $r = 6$ inches

The conversion equation used to calculate infiltration rate:

$$I_t = \frac{\Delta H\ 60\ r}{\Delta t(r + 2H_{avg})}$$

"H_0" is the initial height of water at the selected time interval:

$$H_0 = D_T - D_0 = 30 - 12 = 18\text{ inches}$$

"H_f" is the final height of water at the selected time interval:

$$H_f = D_T - D_f = 30 - 13.75 = 16.25\text{ inches}$$

"ΔH" is the change in height over the time interval:

$$H_{avg} = \Delta D = H_0 - H_f = 18 - 16.25 = 1.75\text{ inches}$$

"H_{avg}" is the average height over the time interval:

$$H_{avg} = (H_0 + H_f)/2 = (18 + 16.25)/2 = 17.125\text{ inches}$$

"I_t" is the tested infiltration rate:

$$I_t = \frac{\Delta H\ 60\ r}{\Delta t(r + 2H_{avg})} = \frac{(1.75\text{ in})(60\text{ min/hr})(6\text{ in})}{(10\text{ min})((6\text{ in}) + 2(1.75))} = 1.6\text{ in/hr}$$

The results of our in-situ testing with applied reduction factors indicated that the design infiltration rate was calculated to be about between 1.3 and 1.6 inches per hour. Using a factor of safety of 3, the infiltration rate of 0.43 inches per hour can be used in the design of LID system as the lowest available infiltration rate.

As shown in Drawing No.1, to minimize the potential for ground distress to adjacent buildings or adjacent properties, infiltration chambers set back laterally meet the minimum of 10 feet from the proposed footings and private property lines.

The system should be designed so that any excess water not infiltrated into the subsoil would be diverted into the planter boxes first and then to the street (after going through the required filtration process) or whichever method is acceptable by the City and local jurisdiction.

Assuming that the infiltration system will be maintained at least 10 feet from the building foundations and property lines, it is anticipated that hydroconsolidation, foundation settlement, liquefaction, groundwater, or hydrostatic pressure will not adversely affect the proposed building and off-site structures.

PERCOLATION CONCLUSIONS AND RECOMMENDATIONS

To minimize the potential for ground distress to adjacent buildings or adjacent properties, infiltration systems should be set back laterally a minimum of 10 feet from the proposed footings and private property lines.

Based on the data presented, it is anticipated that foundation settlement, liquefaction, groundwater, or hydrostatic pressure will not adversely affect the site improvements due to the proposed stormwater infiltration system if designed and implemented as recommended herein. It should be noted that the recommended infiltration rates are derived from field testing.

However, the tests are not full size, and the actual permeability or percolation rates obtained from the constructed seepage devices may vary from these test values. The infiltration system design, construction and operation should comply with the manufacturer’s specifications and applicable SUSMP requirements, environmental regulations and other applicable regulations. It should be understood that such infiltration devices are often susceptible to “fouling” or clogging due to silt, organics, or other foreign

matter than enters the water during the life of the facility. Eventual replacement of the devices may be necessary eventually if clogging becomes too extensive over time. Periodic inspection and maintenance is recommended and will extend the life of the product.

Final plans for the development and the stormwater infiltration system should be made available to AES for review prior to final submittal to the City for approval. The infiltration gallery excavation should be observed by a representative of AES prior to placing geotextile fabric, gravel fill, or any other cover to confirm that the intended stratum has been encountered. All backfill should be properly compacted and tested by AES per current City guidelines.

The system should be designed so that any excess water not infiltrated into the subsoil would be diverted into the planter areas first and then to the street (after going through the required filtration process).

OBSERVATION DURING CONSTRUCTION

The presented recommendations in this report assume that all foundations will be established in properly compacted fill soils. All footing excavations should be observed and approved by a representative of this office before reinforcing is placed.

All site grading work should be observed and tested by a representative of this office. Please notify this office at least 24 hours before any observation work is required.

CLOSURE

The findings and recommendations presented in this report were based on the results of our field and laboratory investigations combined with professional engineering experience and judgment. The report was prepared in accordance with generally accepted engineering principles and practice. We make no other warranty, either express or implied.

It is noted that the conclusions and recommendations presented are based on exploration "window" borings and excavations which is in conformance with accepted engineering practice. Some variations of subsurface conditions are common between "windows" and major variations are possible.

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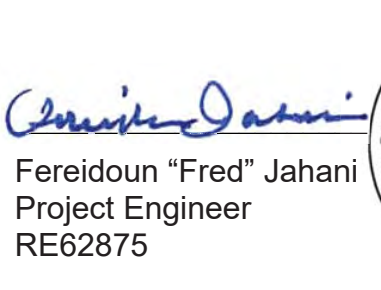
The following Figures and Appendices are attached and complete this report:

Liquefaction Analysis, Wall Pressure Calculations, and Percolation Data Sheets
Drawing No. 1 - Site Plan
Figure No. 1 - Site Vicinity Map
Figure No. 2 - Regional Topographic Map
Figure No. 3 - Regional Geologic Map
Appendix I- Method of Field Exploration
Log of Borings Figure Nos. I-1 through I-6
Unified Soil Classification System Figure No. I-7
Appendix II- Methods of Laboratory Testing
Figure Nos. II-1 and II-2
Appendix III - Soft Copy of AES Soil Report
dated April 15, 2005 (PDF Only)

Respectfully Submitted,

APPLIED EARTH SCIENCES Reviewed by:



Fereidoun "Fred" Jahani
Project Engineer
RE62875

Caro J. Minas, President
Geotechnical Engineer
GE 601

FJ/CJM/la

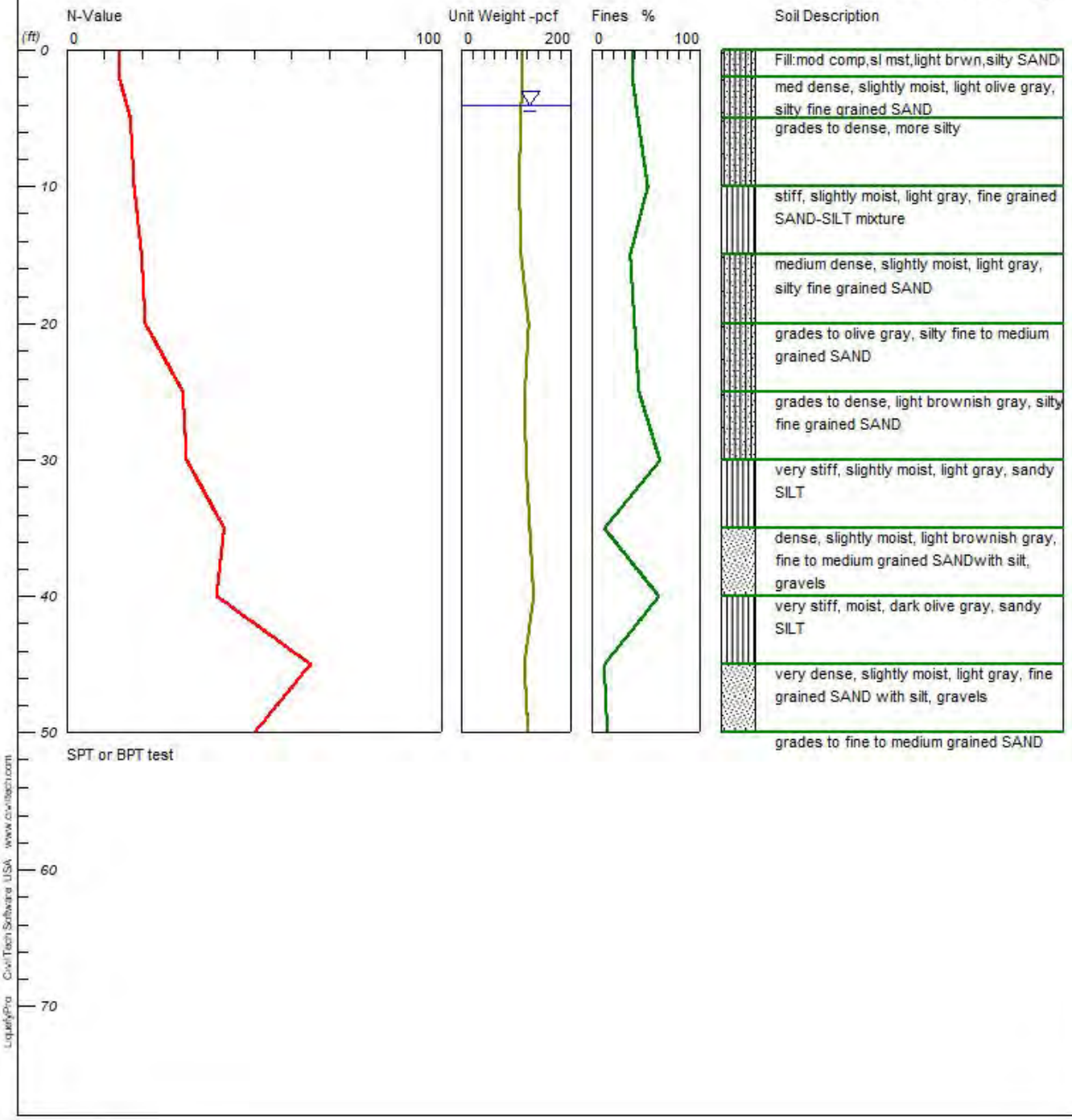
Distribution: (4) Addressee

LIQUEFACTION ANALYSIS

913 California Street

Hole No.=1 Water Depth=4 ft

Magnitude=7.55
Acceleration=0.93g

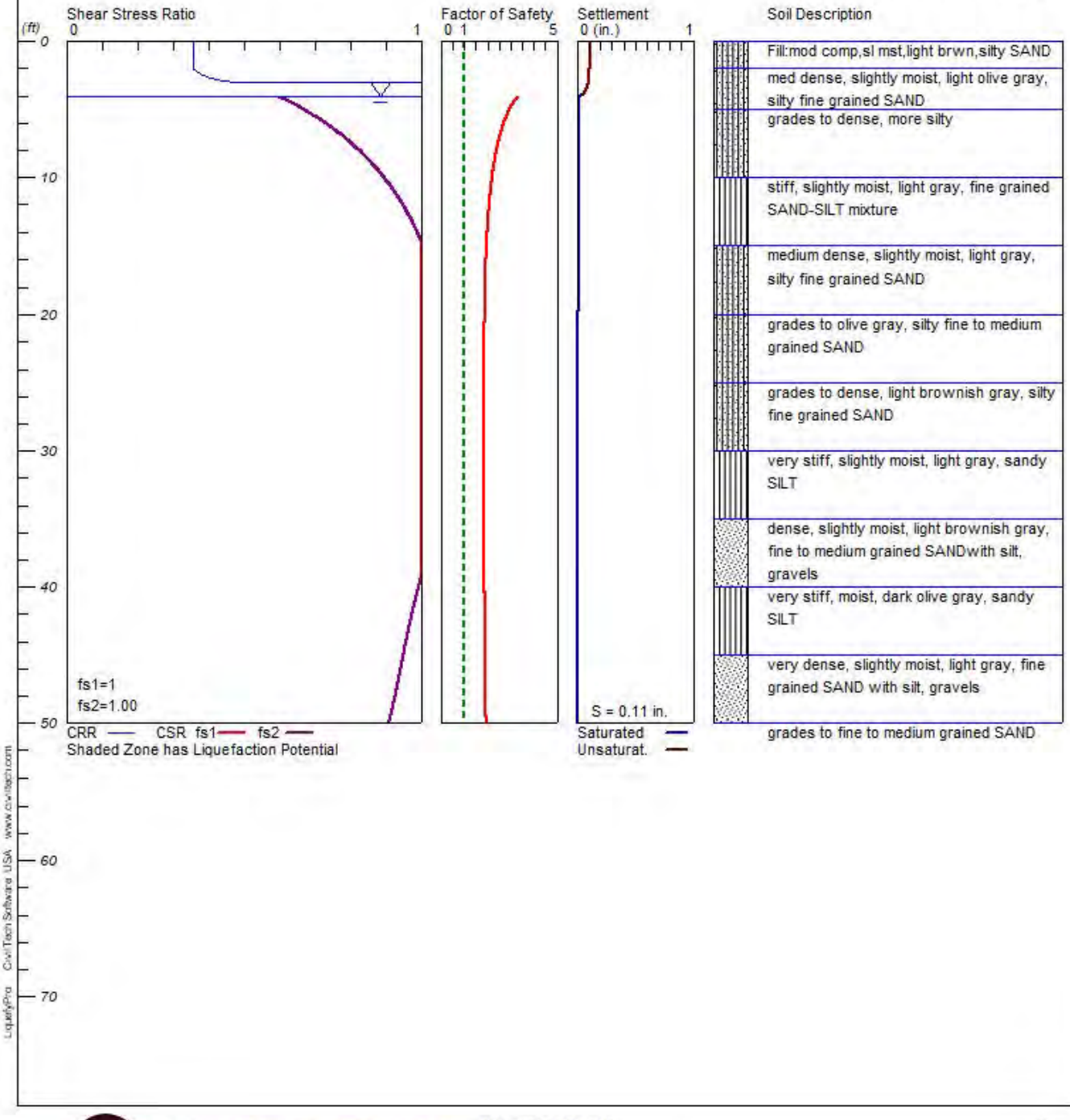


LIQUEFACTION ANALYSIS

913 California Street

Hole No.=1 Water Depth=4 ft

Magnitude=7.55
Acceleration=0.93g



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LIQUEFACTION ANALYSIS SUMMARY

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Title: 913 California Street
Subtitle: 23-536-02_2%

Surface Elev.=
Hole No.=1
Depth of Hole= 50.00 ft
Water Table during Earthquake= 4.00 ft
Water Table during In-Situ Testing= 55.00 ft
Max. Acceleration= 0.93 g
Earthquake Magnitude= 7.55

Input Data:
Surface Elev.=
Hole No.=1
Depth of Hole=50.00 ft
Water Table during Earthquake= 4.00 ft
Water Table during In-Situ Testing= 55.00 ft
Max. Acceleration=0.93 g
Earthquake Magnitude=7.55
No-Liquefiable Soils: Based on Analysis

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Ishihara / Yoshimine
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.2
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1
   Plot two CSR (fs1=1, fs2=User)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	14.00	112.00	38.00
2.00	14.00	112.00	38.00
5.00	17.00	108.00	43.00
10.00	18.00	106.00	52.00
15.00	20.00	109.00	36.00
20.00	21.00	123.00	40.00
25.00	31.00	116.00	44.00
30.00	32.00	118.00	63.00
35.00	42.00	125.00	12.00
40.00	40.00	132.00	62.00
45.00	65.00	115.00	12.00
50.00	50.00	122.00	15.00

Output Results:

Settlement of Saturated Sands=0.02 in.
Settlement of Unsaturated Sands=0.09 in.
Total Settlement of Saturated and Unsaturated Sands=0.11 in.
Differential Settlement=0.056 to 0.073 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.35	0.60	5.00	0.02	0.09	0.11
2.00	0.35	0.60	5.00	0.02	0.09	0.10
4.00	1.97	0.60	5.00	0.02	0.01	0.02
6.00	1.97	0.73	2.69	0.02	0.00	0.02
8.00	1.97	0.83	2.38	0.02	0.00	0.02
10.00	1.97	0.90	2.19	0.02	0.00	0.02
12.00	1.97	0.95	2.07	0.02	0.00	0.02
14.00	1.97	0.99	1.99	0.02	0.00	0.02
16.00	1.97	1.02	1.93	0.01	0.00	0.01
18.00	1.97	1.04	1.89	0.01	0.00	0.01
20.00	1.97	1.05	1.87	0.00	0.00	0.00
22.00	1.97	1.06	1.86	0.00	0.00	0.00
24.00	1.97	1.06	1.85	0.00	0.00	0.00
26.00	1.97	1.07	1.84	0.00	0.00	0.00
28.00	1.97	1.07	1.83	0.00	0.00	0.00
30.00	1.97	1.08	1.83	0.00	0.00	0.00
32.00	1.94	1.06	1.83	0.00	0.00	0.00
34.00	1.92	1.05	1.83	0.00	0.00	0.00
36.00	1.90	1.03	1.84	0.00	0.00	0.00
38.00	1.88	1.01	1.85	0.00	0.00	0.00
40.00	1.85	0.99	1.87	0.00	0.00	0.00
42.00	1.83	0.97	1.88	0.00	0.00	0.00
44.00	1.81	0.96	1.89	0.00	0.00	0.00
46.00	1.80	0.94	1.90	0.00	0.00	0.00

48.00	1.78	0.93	1.92	0.00	0.00	0.00
50.00	1.76	0.91	1.93	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

---

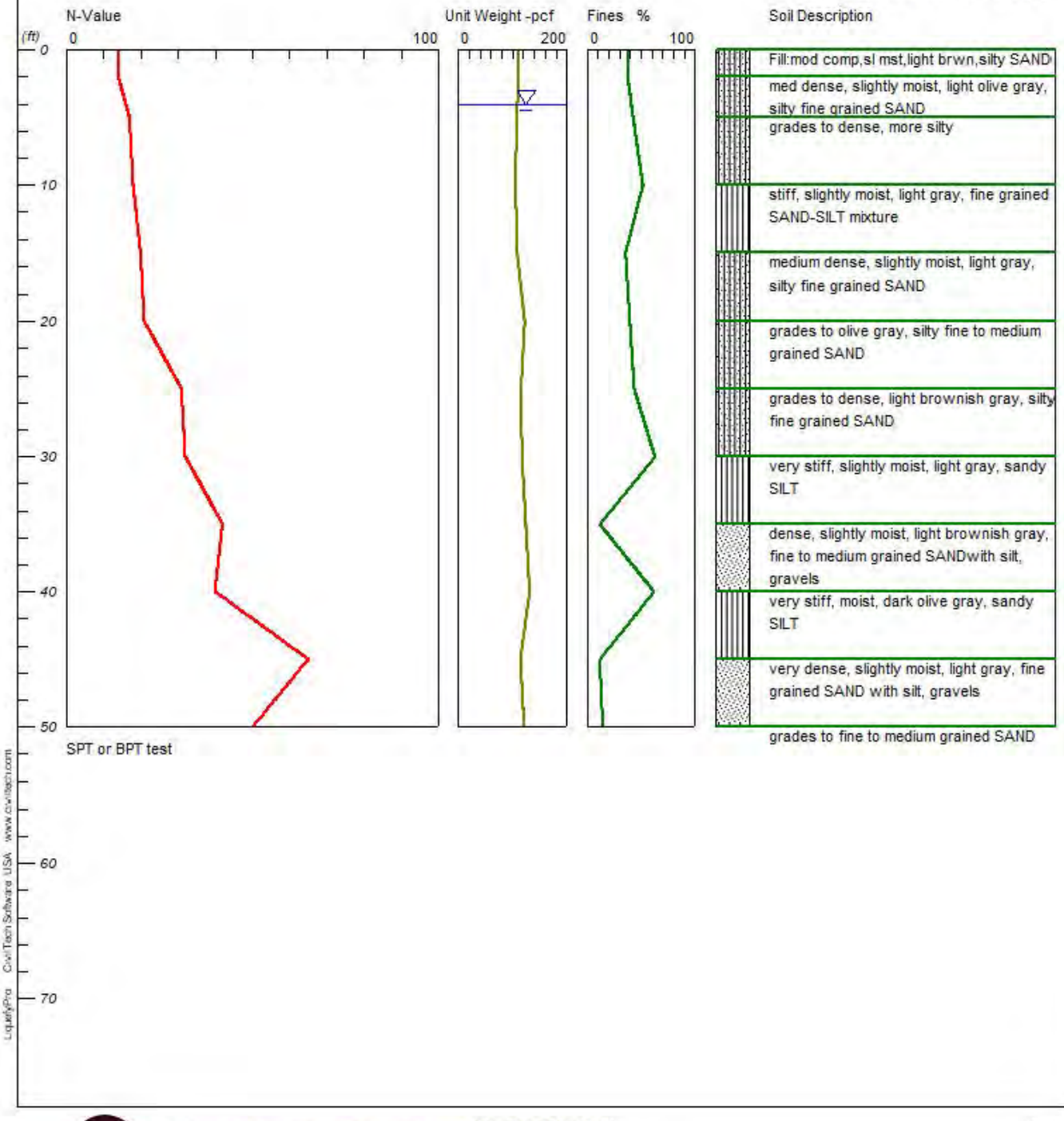
1 atm (atmosphere) = 1 tsf (ton/ft2)
CRRm Cyclic resistance ratio from soils
CSRsf Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat Settlement from saturated sands
S_dry Settlement from Unsaturated Sands
S_all Total Settlement from Saturated and Unsaturated Sands
NoLiq No-Liquefy Soils

LIQUEFACTION ANALYSIS

913 California Street

Hole No.=1 Water Depth=4 ft

Magnitude=7.22
Acceleration=0.62g

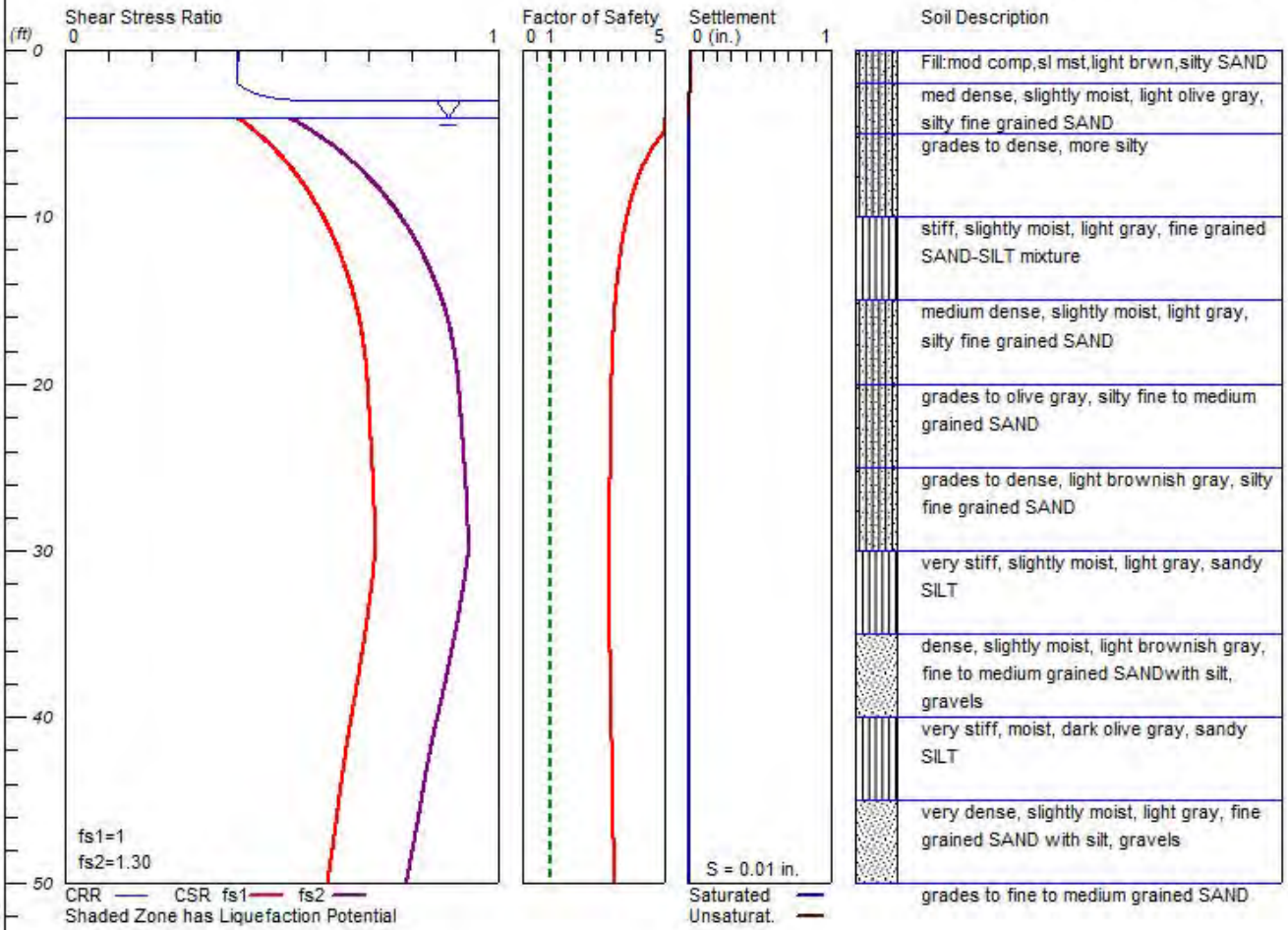


LIQUEFACTION ANALYSIS

913 California Street

Hole No.=1 Water Depth=4 ft

Magnitude=7.22
Acceleration=0.62g



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LIQUEFACTION ANALYSIS SUMMARY

****
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Input File Name: P:\Projects-2023\23-536-02 & 24 xRef 05-333-02\Engineering-Calculation\Liquefaction\23-536-02_10%.liq
Title: 913 California Street
Subtitle: 23-536-02_10%

Surface Elev.=
Hole No.=1
Depth of Hole= 50.00 ft
Water Table during Earthquake= 4.00 ft
Water Table during In-Situ Testing= 55.00 ft
Max. Acceleration= 0.62 g
Earthquake Magnitude= 7.22

Input Data:
Surface Elev.=
Hole No.=1
Depth of Hole=50.00 ft
Water Table during Earthquake= 4.00 ft
Water Table during In-Situ Testing= 55.00 ft
Max. Acceleration=0.62 g
Earthquake Magnitude=7.22
No-Liquefiable Soils: Based on Analysis

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Ishihara / Yoshimine
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.2
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1.3
   Plot two CSR (fs1=1, fs2=User)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	14.00	112.00	38.00
2.00	14.00	112.00	38.00
5.00	17.00	108.00	43.00
10.00	18.00	106.00	52.00
15.00	20.00	109.00	36.00
20.00	21.00	123.00	40.00
25.00	31.00	116.00	44.00
30.00	32.00	118.00	63.00
35.00	42.00	125.00	12.00
40.00	40.00	132.00	62.00
45.00	65.00	115.00	12.00
50.00	50.00	122.00	15.00

Output Results:

Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.01 in.
Total Settlement of Saturated and Unsaturated Sands=0.01 in.
Differential Settlement=0.006 to 0.008 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.40	0.40	5.00	0.00	0.01	0.01
2.00	0.40	0.40	5.00	0.00	0.01	0.01
4.00	2.20	0.40	5.00	0.00	0.00	0.00
6.00	2.20	0.49	4.53	0.00	0.00	0.00
8.00	2.20	0.55	4.01	0.00	0.00	0.00
10.00	2.20	0.60	3.69	0.00	0.00	0.00
12.00	2.20	0.63	3.48	0.00	0.00	0.00
14.00	2.20	0.66	3.34	0.00	0.00	0.00
16.00	2.20	0.68	3.24	0.00	0.00	0.00
18.00	2.20	0.69	3.18	0.00	0.00	0.00
20.00	2.20	0.70	3.15	0.00	0.00	0.00
22.00	2.20	0.70	3.13	0.00	0.00	0.00
24.00	2.20	0.71	3.11	0.00	0.00	0.00
26.00	2.20	0.71	3.09	0.00	0.00	0.00
28.00	2.20	0.72	3.08	0.00	0.00	0.00
30.00	2.20	0.72	3.07	0.00	0.00	0.00
32.00	2.18	0.71	3.07	0.00	0.00	0.00
34.00	2.15	0.70	3.08	0.00	0.00	0.00
36.00	2.13	0.69	3.09	0.00	0.00	0.00
38.00	2.10	0.68	3.11	0.00	0.00	0.00
40.00	2.08	0.66	3.14	0.00	0.00	0.00
42.00	2.05	0.65	3.16	0.00	0.00	0.00
44.00	2.03	0.64	3.18	0.00	0.00	0.00
46.00	2.01	0.63	3.20	0.00	0.00	0.00

48.00	1.99	0.62	3.23	0.00	0.00	0.00
50.00	1.97	0.61	3.25	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

---

1 atm (atmosphere) = 1 tsf (ton/ft2)
CRRm Cyclic resistance ratio from soils
CSRsf Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat Settlement from saturated sands
S_dry Settlement from Unsaturated Sands
S_all Total Settlement from Saturated and Unsaturated Sands
NoLiq No-Liquefy Soils

Assumed Granular Backfill Strength Parameters:			Height of Wall=	6 ft	Seismic
Saturated Unit Weight, γ =	131 pcf		Sds=	1.335	PGA/g
Cohesion, C =	180 psf		Weight of Surcharge Load on Wedge		Sds/2.5
Friction Angle, ϕ =	32 °		W_q=	0.0 K	0.534

					Driving Force	Resisting Force		Factory of Safety	
SECTION	A (sf)	W (K)	L (feet)	α (degrees)	Wsinα (k)	Wcosαtanϕ (k)	CL (k)	∑ RF / ∑ DF	
I	10.0	1.3	6.86	61	1.14	0.40	1.23	1.6	1.1
				∑	1.14	1.63		1.43	

TEMPORARY

FOR TEMPORARY CONDITION: FACTOR OF SAFETY = 1.25 [1.25 (DF) = (RF) + UBF]

1.25 * 1.14 = 1.63 + UBF

UBF = 1.43 - 1.63 = -0.20 k/lft.

Equivalent Fluid Density: $G_h = 2(UBF)/H^2$ G_h = -11.2 PCF

Therefore, for Cantilivered Temporary Condition, use recommended value of: 25 PCF

PERMANENT

FOR PERMANENT CONDITION: FACTOR OF SAFETY = 1.5 [1.5 (DF) = (RF) + UBF]

1.5 * 1.14 = 1.63 + UBF

UBF = 1.71 - 1.63 = 0.08 k/lft.

Equivalent Fluid Density: $G_h = 2(UBF)/H^2$ G_h = 4.7 PCF

Therefore, for Cantilivered Permanent Condition, use recommended value of: 30 PCF

AT-REST

FOR RESTRAINED CONDITION (AT-REST): $K_o = 1-SIN(\phi)$

Ko = 1 - SIN 32

Ko = 1 - 0.53 = 0.47

Equivalent Fluid Density: $G_h = Ko * \gamma$ G_h = N/A PCF

Therefore, for Restrained (At-Rest) Condition, use recommended value of: N/A PCF

SEISMIC

FOR SEISMIC CONDITION: $P_{AE} = {}^1/_2 \gamma H^2 (K_h)$ $K_h = (0.68 * PGA)/g$

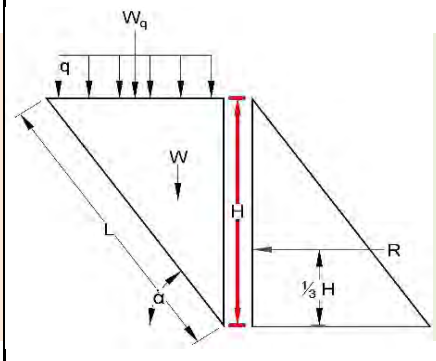
Kh= 0.68 * 0.53 = 0.36

PAE = 1/2 * 131 * 36 * 0.36 = 856.2

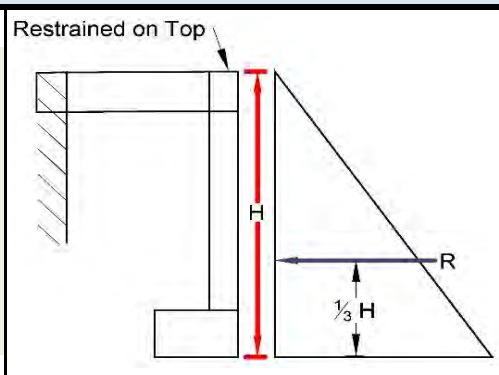
$EFP = (\frac{2xP_{AE}}{H^2})$ 2 * 856.2 / 36 = 47.569

Therefore, for Seismic Condition, use recommended value of: 48 PCF

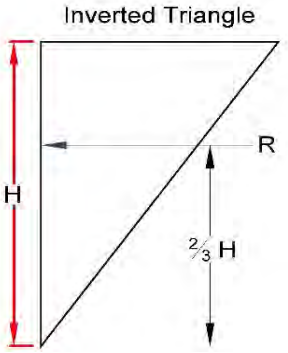
Active (Cantilevered)



Restrained (At-Rest)



Seismic



LATERAL EARTH PRESSURE CALCULATIONS

ACTIVE (Temporary/Permanent), & SEISMIC

Address:	913 California Street, Redlands, CA 91374	Minor Retaining Walls
APPLIED EARTH SCIENCES GEOTECHNICAL • GEOLOGY • ENVIRONMENTAL ENGINEERING CONSULTANTS		PROJECT #: 23-536-02
		CALC SHEET No.: 1

Percolation Test Data Sheet

Project:	Comm. Develop.	Project No:	23-536-02	Date:	9/29/23
Test Hole No:	TP-2	Tested By:	Narek & Daniel		
Depth of Test Hole, D_T:	30"	USCS Soil Classification:	SM, silty fine grained SAND		

Test Hole Dimensions (inches)			Length	Width	
Diameter (if round)=		Sides (if rectangular)=	12"	12"	

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6"? (y/n)
1	1:00	1:25	25	12.0	22.5	10.5	yes ✓
2	1:30	1:55	25	12.0	20	8.0	yes ✓

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Other wise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	Percolation Rate (min./in.)
1	2:00	2:10	10	12.0	15.0"	3"	
2	2:10	2:20	10	12.0	14.5"	2.5"	
3	2:20	2:30	10	12.0	14.25"	2.25"	
4	2:30	2:40	10	12.0	14.0"	2"	
5	2:40	2:50	10	12.0	13.75"	1.75"	
6	2:50	3:00	10	12.0	13.75"	1.75"	
7							
8							
9							
10							
11							
12							
13							
14							
15							

COMMENTS:

Table 5 – Sample Test Data Form for Percolation Test

Percolation Test Data Sheet

Project:	Comm. Deve.	Project No:	23-536-02	Date:	9/29/23
Test Hole No:	TP-1	Tested By:	Narek & Daniel		
Depth of Test Hole, D_T:	30"	USCS Soil Classification:	SM, silty fine grained SAND		
Test Hole Dimensions (inches)			Length	Width	
Diameter (if round)=		Sides (if rectangular)=	12"	12"	

Sandy Soil Criteria Test*

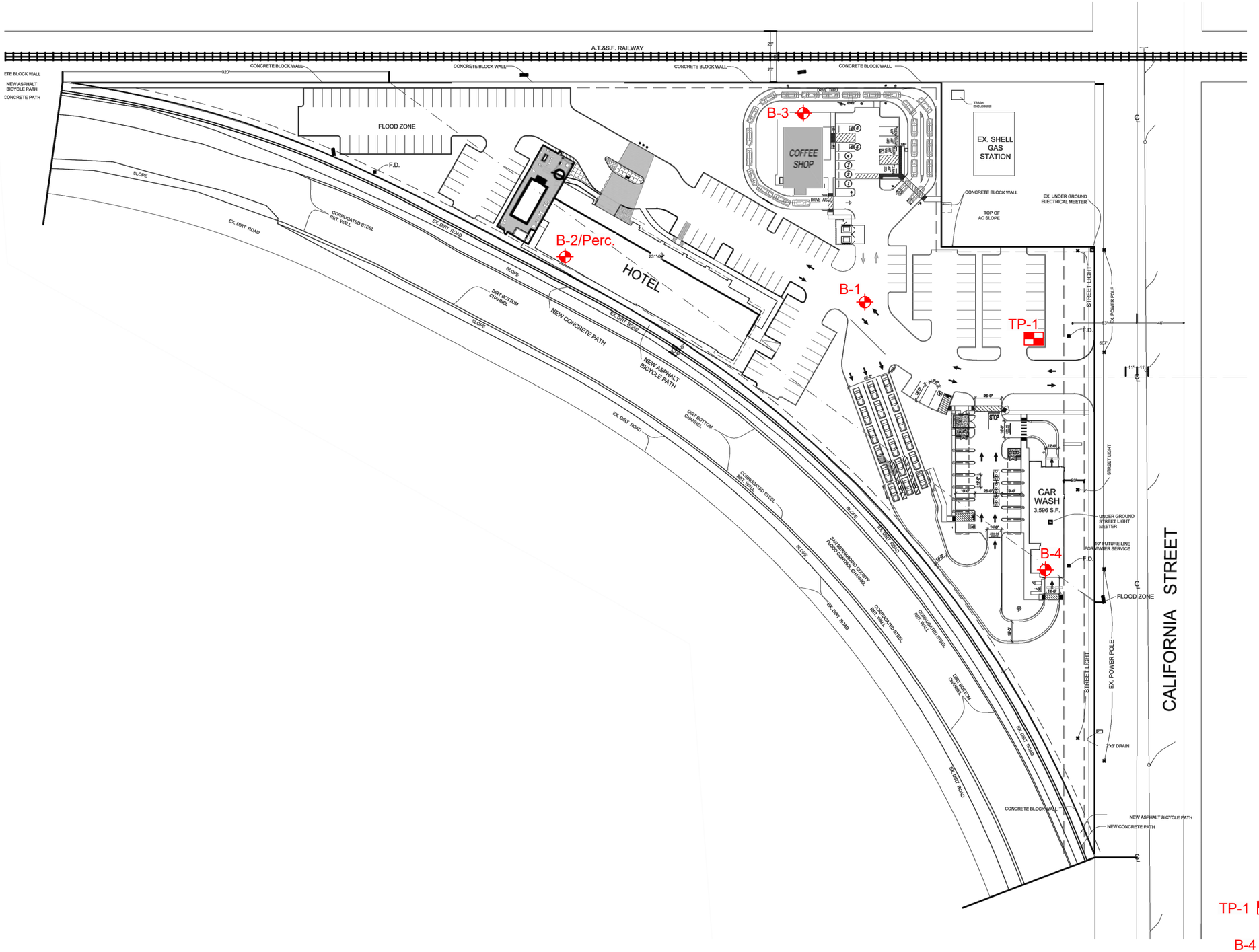
Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6"? (y/n)
1	11:00	11:25	25	12.0	23.0	11.0	yes ✓
2	11:30	11:55	25	12.0	19.5	7.5	yes ✓

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Other wise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	Percolation Rate (min./in.)
1	12:00	12:10	10	12.0	14.5	2.5"	
2	12:10	12:20	10	12.0	14.25	2.25"	
3	12:20	12:30	10	12.0	14.0	2"	
4	12:30	12:40	10	12.0	13.75	1.75"	
5	12:40	12:50	10	12.0	13.5	1.5"	
6	12:50	1:00	10	12.0	13.5	1.5"	
7							
8							
9							
10							
11							
12							
13							
14							
15							

COMMENTS: Cloudy. Dry Ground, sl. soft. First 2 measurements met sandy soils criteria.

Table 5 – Sample Test Data Form for Percolation Test



SITE PLAN

Proposed Large Commercial Development
913 California Street, Redlands, CA 92374

PROJECT No: 23-536-02
DATE: 11 / 30 / 2023
DRAWN BY: VM
DRAWING No: 1

APPLIED EARTH SCIENCES
GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL . ENGINEERING CONSULTANTS
www.aessoil.com
(818) 552-6000

N

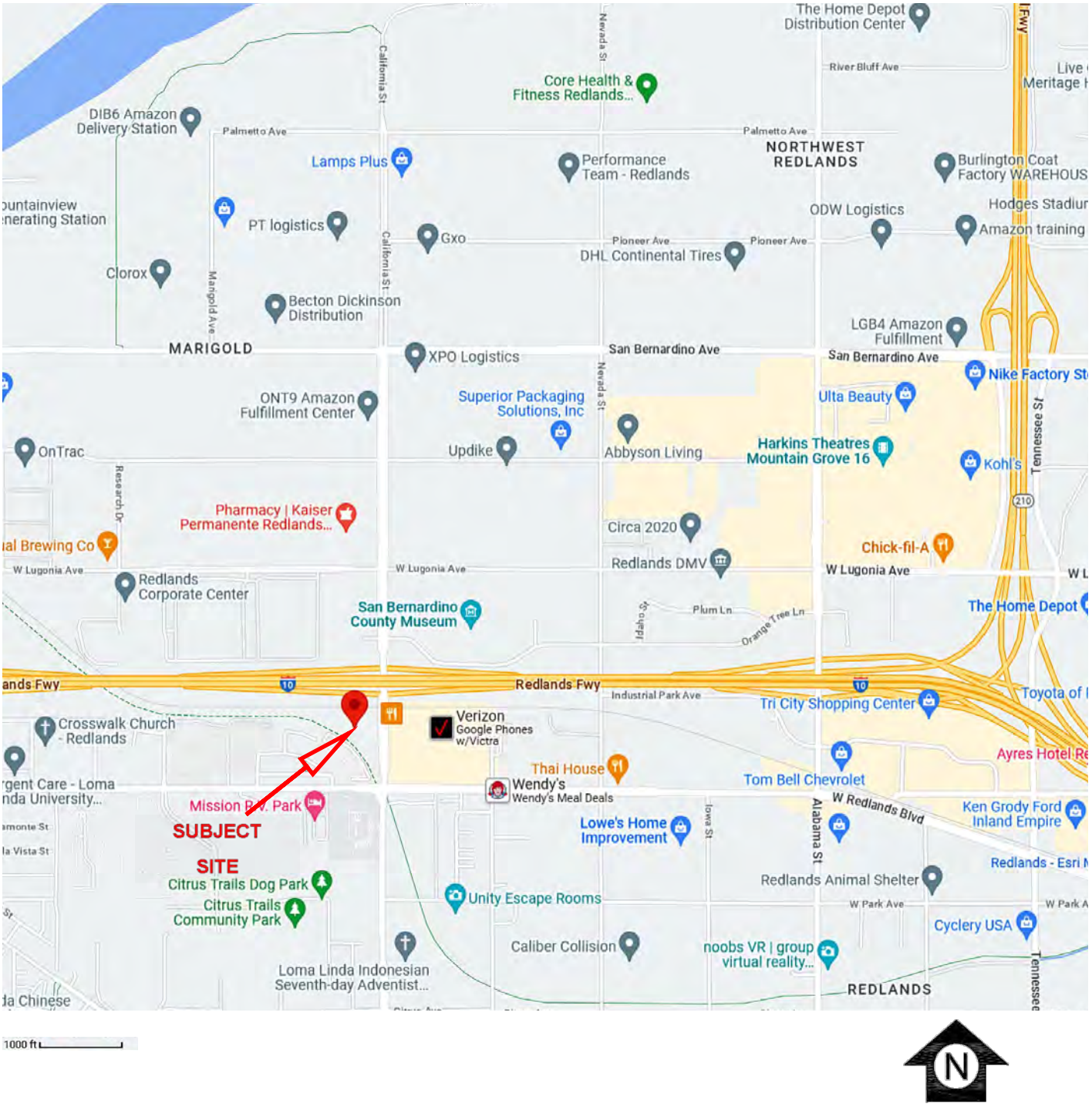
Scale: 1" = 100'

TP-1 = Location & Number of Test Pit

B-4 = Location & Number of Boring

Note:

Site plan prepared by using a base plan provided by the client.



Reference: Portion of Google Map

SITE VICINITY MAP

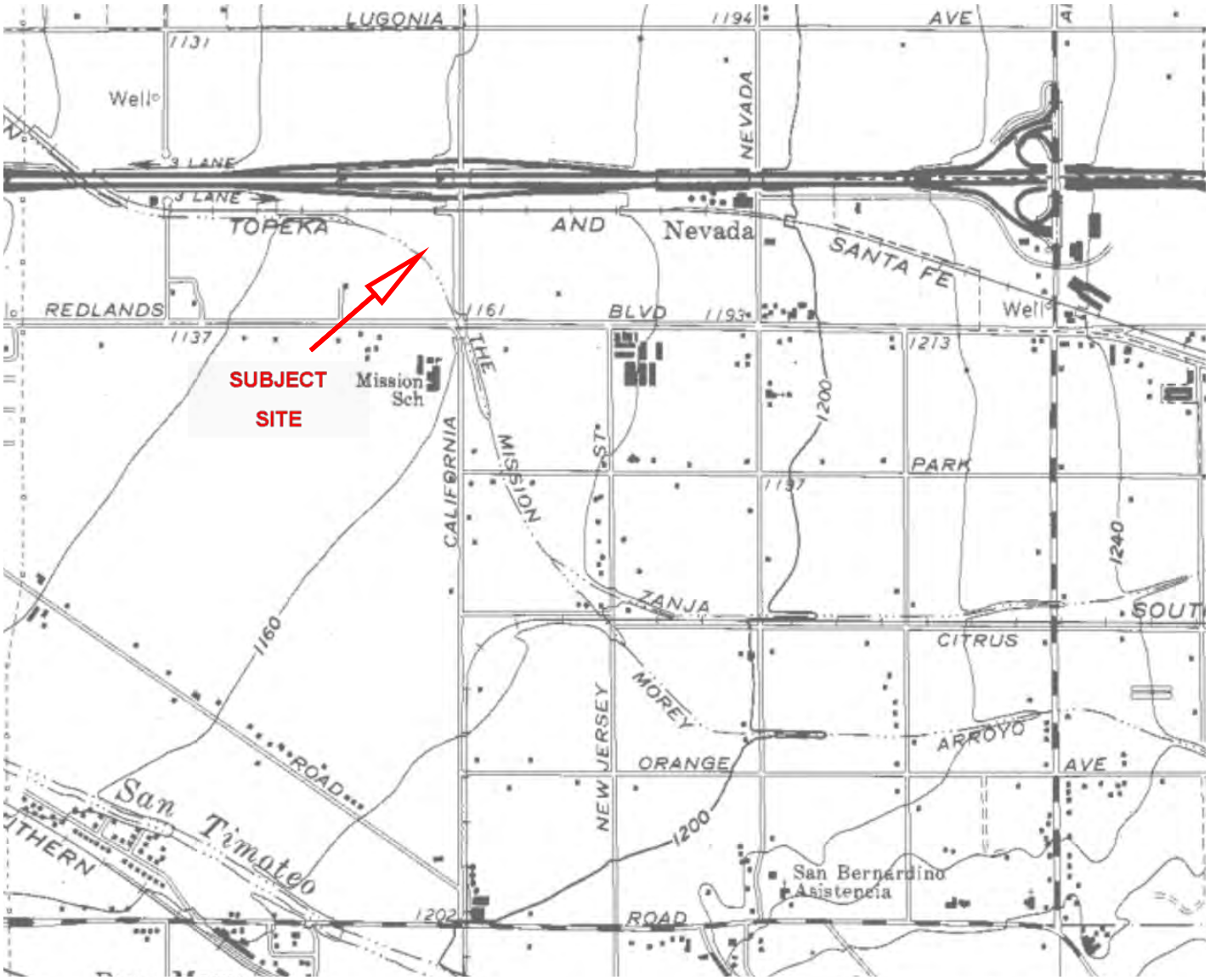
Proposed Large Commercial Development

913 California Street, Redlands, CA 92374

APPLIED EARTH SCIENCES
GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL . ENGINEERING CONSULTANTS

PROJECT No. 23-536-24

FIGURE No. 1



Reference: Redlands Quadrangle 7.5 Minute Series

REGIONAL TOPOGRAPHIC MAP

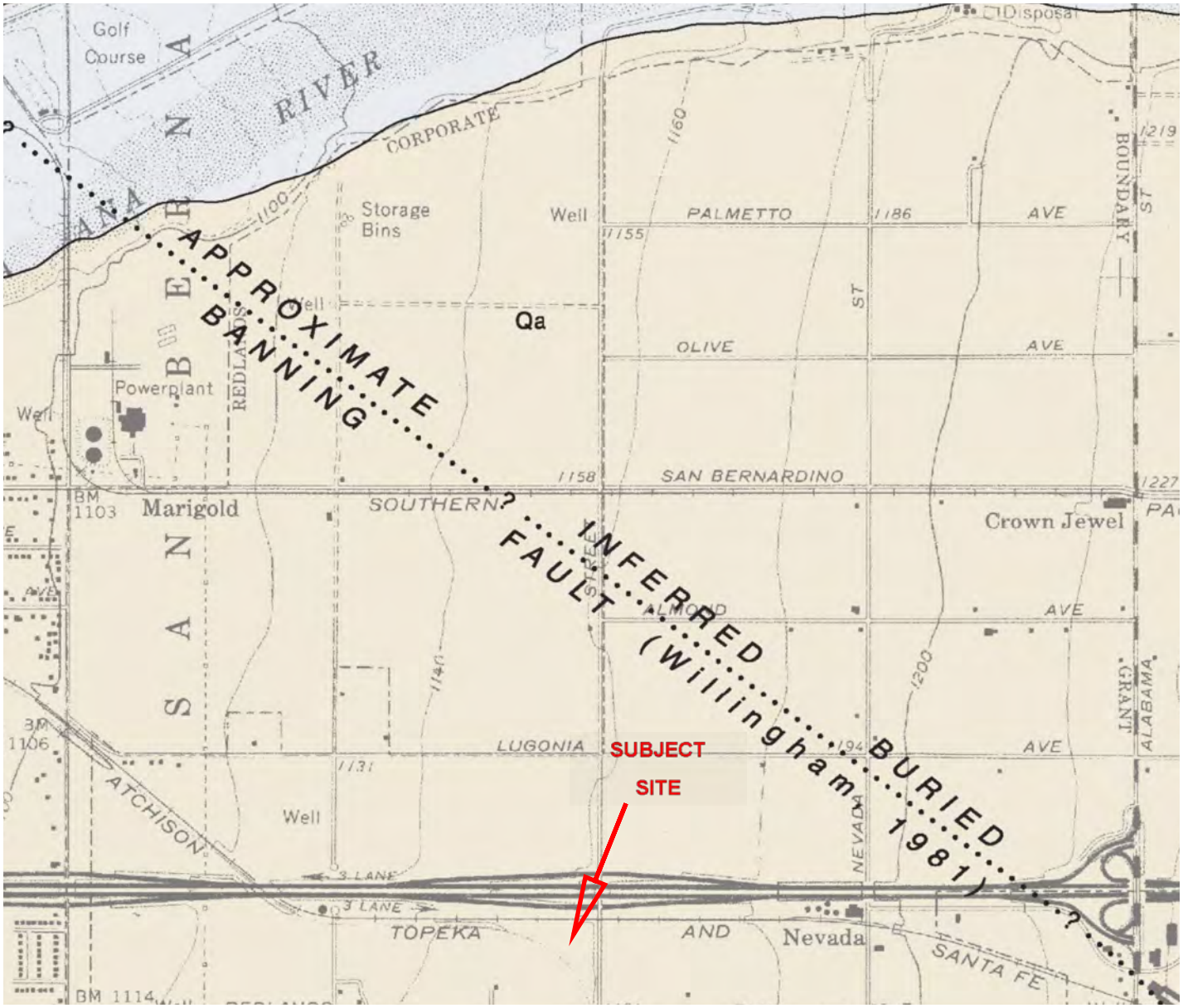
Proposed Large Commercial Development

913 California Street, Redlands, CA 92374

APPLIED EARTH SCIENCES
GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL . ENGINEERING CONSULTANTS

PROJECT No. 23-536-24

FIGURE No. 2



Qa *Alluvial sand and clay of valley areas, covered with gray clay soil; includes alluvial pebbly sand adjacent to mountain terranes*

N

1 0 1/2 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

REGIONAL GEOLOGIC MAP

Proposed Large Commercial Development

913 California Street, Redlands, CA 92374

APPLIED EARTH SCIENCES
GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL . ENGINEERING CONSULTANTS

PROJECT No. 23-536-24

FIGURE No. 3

APPENDIX I

METHOD OF FIELD EXPLORATION

In order to define the subsurface conditions and for the purpose of percolation testing, two test pits and four borings were drilled at the site to a maximum depth of about 51 feet below the existing grades. Borings were drilled with a hollow stem drilling machine. The approximate locations of the drilled borings are shown on the enclosed Site Plan.

Continuous logs of the subsurface conditions, as encountered in the test borings, were recorded during the field work and are presented on Figure Nos. I-1 through I-6 within this Appendix. These figures also show the number and approximate depths of each of the recovered soil samples.

With hollow stem drilling, relatively undisturbed samples of the subsoils were obtained by driving a steel sampler with successive drops of a 140-pound standard sampling hammer free-falling a vertical distance of about 30 inches. The number of blows required for one foot of sampler penetration was recorded at the time of drilling and are shown on the log of exploratory borings. The relatively undisturbed soil samples were retained in brass liner rings 2.5 inches in diameter and 1.0 inch in height.

One boring (B-1) was drilled to a depth of 51 feet for liquefaction studies. The California Modified method samples are normally used for determination of strength and compression characteristics. In our Boring No. 1, California Modified method samples were obtained from depths of 2 to 15 feet. All samples from Boring No. 2 were taken using California Modified method. The remaining samples in Boring No. 1 below 15 feet were SPT samples taken in 1.5-inch diameter cylinders. Such samples are normally used for density, moisture content, and soil classification. See our liquefaction analysis write-up for correction factor of Cs=1 used when cylinders are used in SPT barrels.

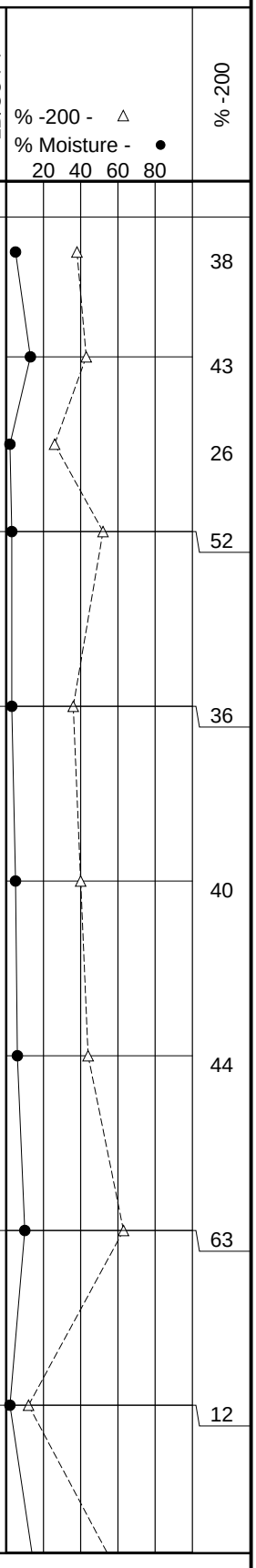
Field investigation for this project and prior work were performed on February 26, 2005, April 27, 2007, and September 29, 2023. The materials excavated from the test borings were placed back and compacted upon completion of the field work. Such materials may settle. The owner should periodically inspect these areas and notify this office if the settlements create a hazard to person or property in order to define subsurface conditions two borings were made at the site.

LOG OF BORING NO.1

23-536-02
913 California Street, Redlands, CA 92374

Type: Hollow Stem Auger, With 140 Lb Hammer Logged by: Daniel
Location: *See Site Plan*

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SPT BLOWS/FT	BLOWS PER FT	% Moisture	UNIT DRY WT LB/CU FT	% -200
0			(SM) FILL: Sand, moderately compact, slightly moist, light brown, silty sand.					
			(SM) SAND: Medium dense, slightly moist, light olive gray, silty fine grained sand.		19	5	107	38
5			(SM) Grades to dense, more silty.		23	13	95	43
			(SM) Grades to light gray, less silty.		22	2	107	26
10			(ML-SM) SILT: Stiff, slightly moist, light gray, fine grained sand-silt mixture.		24	3	103	52
15			(SM) SAND: Medium dense, slightly moist, light gray, silty fine grained sand.	20		3	106	36
20			(SM) Grades to olive gray, silty fine to medium grained sand.	21		5	117	40
25			(SM) Grades to dense, light brownish gray, silty fine grained sand.	31		6	109	44
30			(ML) SILT: Very stiff, slightly moist, light gray, sandy silt.	32		10	107	63
35			(SP) SAND: Dense, slightly moist, light brownish gray, fine to medium grained sand with silt, gravels.	42		2	122	12



COMPLETION DEPTH: 51
DATE: Septmeber 29, 2023

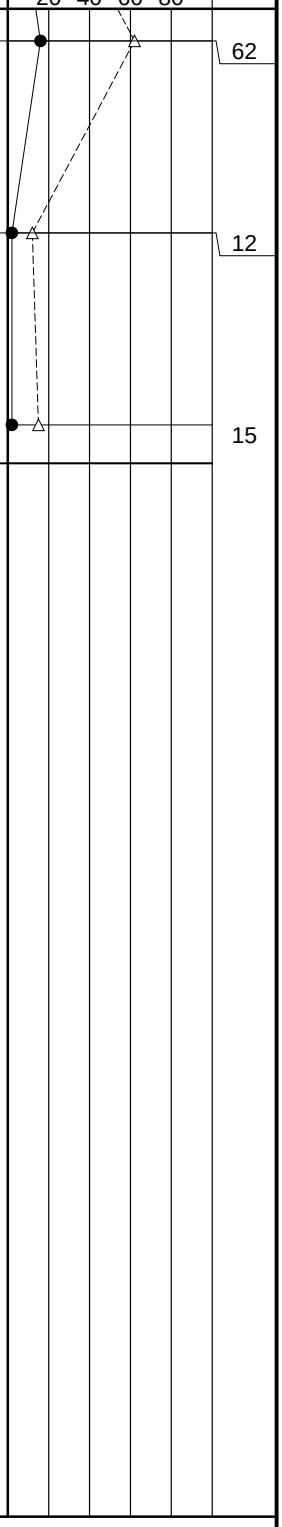
DEPTH TO WATER> INITIAL:
FINAL:

LOG OF BORING NO.1

23-536-02
913 California Street, Redlands, CA 92374

Type: Hollow Stem Auger, With 140 Lb Hammer Logged by: Daniel
Location: *See Site Plan*

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SPT BLOWS/FT	BLOWS PER FT	% Moisture	UNIT DRY WT LB/CU FT	% -200
40			(ML) SILT: Very stiff, moist, dark olive gray, sandy silt.	40		16	113	62
45			(SP) SAND: Very dense, slightly moist, light gray, fine to medium grained sand with silt, gravels.	65		2	113	12
50			(SP) Grades to fine to medium grained sand.	50/6"		2	119	15
			End of Boring @ 51' No Groundwater Encountered Hole Backfilled.					
55								
60								
65								
70								
75								



COMPLETION DEPTH: 51
DATE: Septmeber 29, 2023

DEPTH TO WATER> INITIAL:
FINAL:

LOG OF BORING NO.2

23-536-02
913 California Street, Redlands, CA 92374

Type: Hollow Stem Auger, With 140 Lb Hammer Logged by: Daniel
Location: *See Site Plan*

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SPT BLOWS/FT	BLOWS PER FT	% Moisture	UNIT DRY WT LB/CU FT	% -200 - △ % Moisture - ● 20 40 60 80	% -200
0			(SM) FILL: Sand, moderately compact, slightly moist, light brown, silty fine grained sand.		6	4	105		
			(SM) SAND: Medium dense, slightly moist, yellowish brown, silty fine grained sand.						
5			(SM) Grades to grayish brown, slightly more silty.		10	7	108		
			(SM) Grades to light gray, less silty.		15	2	112		
10			(ML-SM) SILT: Firm, slightly moist, light brownish gray, fine grained sand-silt mixture.		11	11	96		
			(ML) Grades to light gray to olive gray, sandy silt.		17	21	92		
15			(ML) Grades to grayish brown, slightly more sandy.		13	18	98		
20			(SM) SAND: Medium dense to dense, slightly moist, light gray, slightly silty, fine grained sand.		20	3	107		
25			End of Boring @ 21' No Groundwater Encountered Percolation Installed @ 10'-20'.						
30									
35									

COMPLETION DEPTH: 21
DATE: September 29, 2023

DEPTH TO WATER> INITIAL:
FINAL:

LOG OF BORING NO.3

23-536-02
913 California Street, Redlands, CA 92374

Type: Hollow Stem Auger, With 140 Lb Hammer Logged by: Daniel
Location: *See Site Plan*

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SPT BLOWS/FT	BLOWS PER FT	% Moisture	UNIT DRY WT LB/CU FT	% -200 - △ % Moisture - ● 20 40 60 80	% -200
0			(SM) FILL: Sand, moderately compact, slightly moist, light brown, silty fine grained sand.		6	6	107		
			(SM) SAND: Medium dense, slightly moist, yellowish brown, silty fine grained sand.						
5			(SM) Grades to grayish brown, more silty.		9	11	107		
			(SM) Grades to light brownish gray, less silty.		13	7	101		
10			(SM) Grades to light gray, more silty.		14	5	108		
15			(ML) SILT: Firm to stiff, slightly moist, gray, sandy silt.		20	10	99		
			End of Boring @ 16' No Groundwater Encountered Hole Backfilled.						
20									
25									
30									
35									

COMPLETION DEPTH: 16
DATE: September 29, 2023

DEPTH TO WATER> INITIAL:
FINAL:

LOG OF BORING NO.4

23-536-02
913 California Street, Redlands, CA 92374

Type: Hollow Stew Auger, With 140 Lb Hammer Logged by: Daniel
Location: *See Site Plan*

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SPT BLOWS/FT	BLOWS PER FT	% Moisture	UNIT DRY WT LB/CU FT	% -200 - △ % Moisture - ● 20 40 60 80	% -200
0			(SM) FILL: Sand, moderately compact, slightly moist, light brown, silty fine grained sand, cobble trace (4" in size, sub-angular).		10	6	113		
5			(SM) SAND: Medium dense, slightly moist, yellowish brown, silty fine grained sand. (SM) Grades to grayish brown, more silty.		15	10	105		
			(SM) Grades to light gray, less silty.		16	6	102		
10			(SM) Grades to light olive gray, more silty.		12	14	104		
15			(SM) Grades to light brownish gray, less silty.		16	5	109		
			End of Boring @ 16' No Groundwater Encountered Hole Backfilled.						
20									
25									
30									
35									

COMPLETION DEPTH: 16
DATE: September 29, 2023

DEPTH TO WATER> INITIAL:
FINAL:

Date: October 3, 2023
Project No: 23-536-02

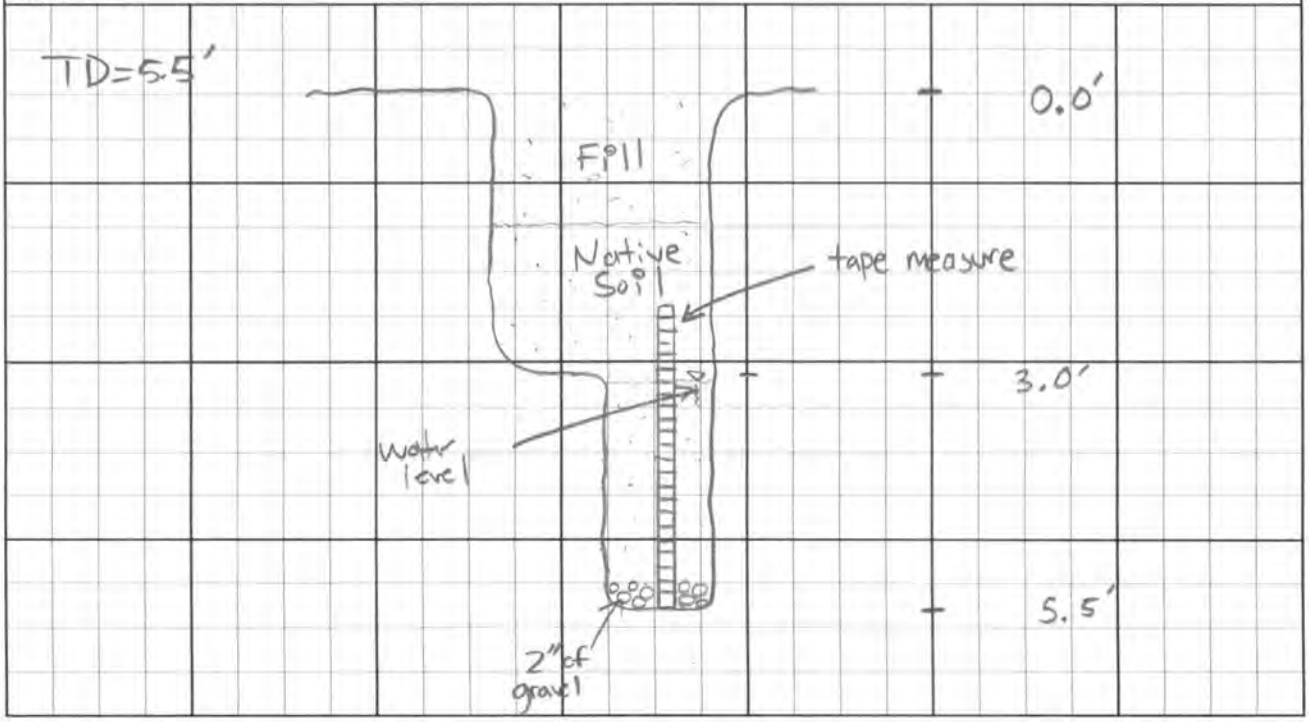
Figure No. I-5

EXPLORATORY TEST PIT NO.1

PROJECT LOCATION: 913 California St., Redlands, CA
PROJECT TYPE: Large Commercial Devel.
DATE LOGGED: September 29, 2023
LOGGED BY: Daniel

DRY DENSITY (PCF)	FIELD MOISTURE (% DRY WEIGHT)	ATTITUDE	BLOWS PER FOOT	GEOLOGIC UNIT	MATERIAL DESCRIPTION (USCS)
				Artificial Fill (Af)	0' - 1.5': Fill: moderately compact, light brown, silty SAND (SM), gravel trace (0.5" in size), rootlets, slightly moist
				Native Soil (Qa)	1.5' - 5.5': Native Soil: medium dense, light brown to light olive gray, silty fine grained SAND (SM), slightly moist
					End of Test Pit at 5.5'. No groundwater encountered, no caving. Test Pit nominally backfilled with excavated materials to surface elevation.

Scale 1"=2'



Date: October 3, 2023
Project No: 23-536-02

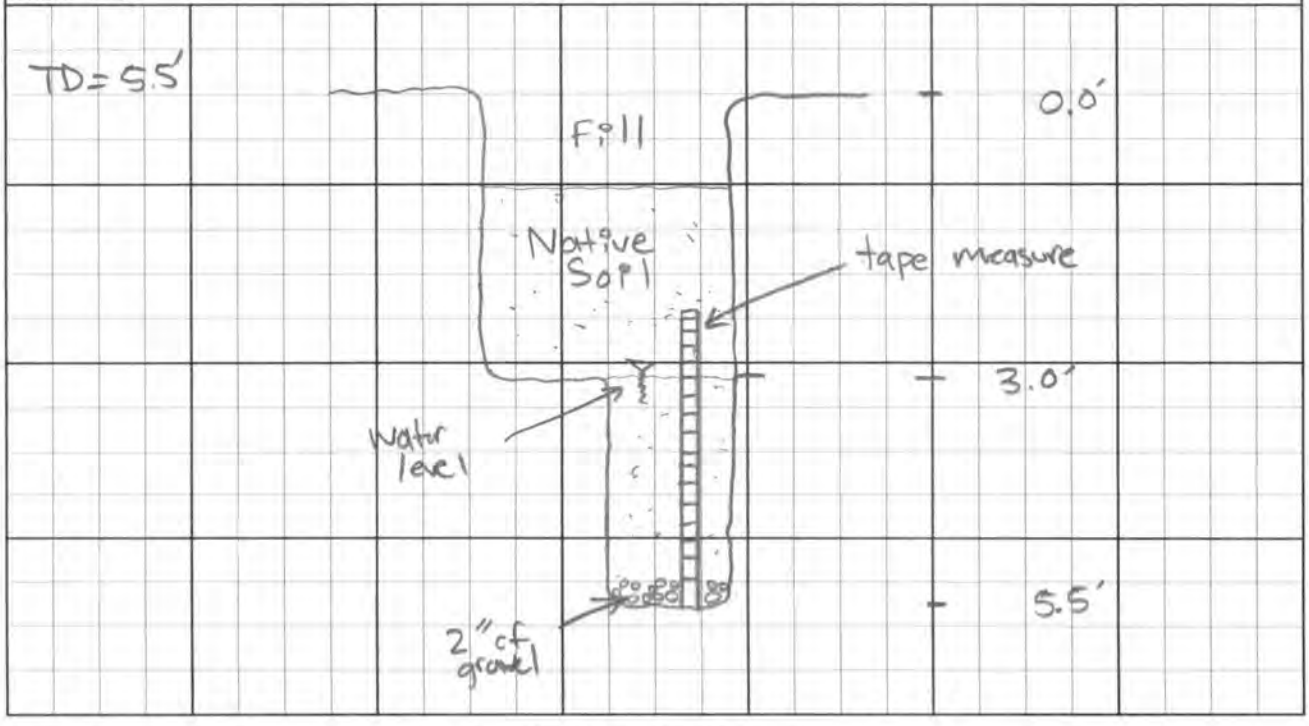
Figure No. I-6

EXPLORATORY TEST PIT NO.2

PROJECT LOCATION: 913 California St., Redlands, CA
PROJECT TYPE: Large Commercial Devel.
DATE LOGGED: September 29, 2023
LOGGED BY: Daniel

DRY DENSITY (PCF)	FIELD MOISTURE (% DRY WEIGHT)	ATTITUDE	BLOWS PER FOOT	GEOLOGIC UNIT	MATERIAL DESCRIPTION (USCS)
				Artificial Fill (Af)	0' - 1.0': Fill: moderately compact, light brown, silty SAND (SM), gravel trace, rootlets, slightly moist
				Native Soil (Qa)	1.0' - 5.5': Native Soil: medium dense, light brown to light olive gray, silty fine grained SAND (SM), slightly moist
					End of Test Pit at 5.5'. No groundwater encountered, no caving. Test Pit nominally backfilled with excavated materials to surface elevation.

Scale 1"=2'



Applied Earth Sciences

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAME
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravels, gravel - sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amt. of fines)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size)	CLEAN SANDS (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amt. 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	Organic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Organic clay 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	Organic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Organic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

SILT OR CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

NO. 200 NO. 40 NO. 10 NO. 4 3/4 in. 3 in. (12 in.)

U. S. STANDARD SIEVE SIZE

UNIFIED SOIL CLASSIFICATION SYSTEM

PROJECT ADDRESS : 913 California Street, CA 92374

JOB No. 23-536-02

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FIGURE No. I-7

APPENDIX II
LABORATORY TESTING PROCEDURES

Moisture Density

The moisture-density information provides a summary of soil consistency for each stratum and can also provide a correlation between soils found on this site and other nearby sites. The tests were performed using ASTM D 2216 Laboratory Determination of water content Test Method. The dry unit weight and field moisture content were determined for each undisturbed sample, and the results are shown on log of exploratory borings.

Shear Tests

Shear tests were made with a direct shear machine at a constant rate of strain. The machine is designed to test the materials without completely removing the samples from the brass rings. The rate of shear was determined through determination of the rate of consolidation of the foundation bearing materials. Considering that such soils are essentially granular in nature with a t90 value of less than 10 seconds, the rate of shearing was selected as 0.01 inches per minute.

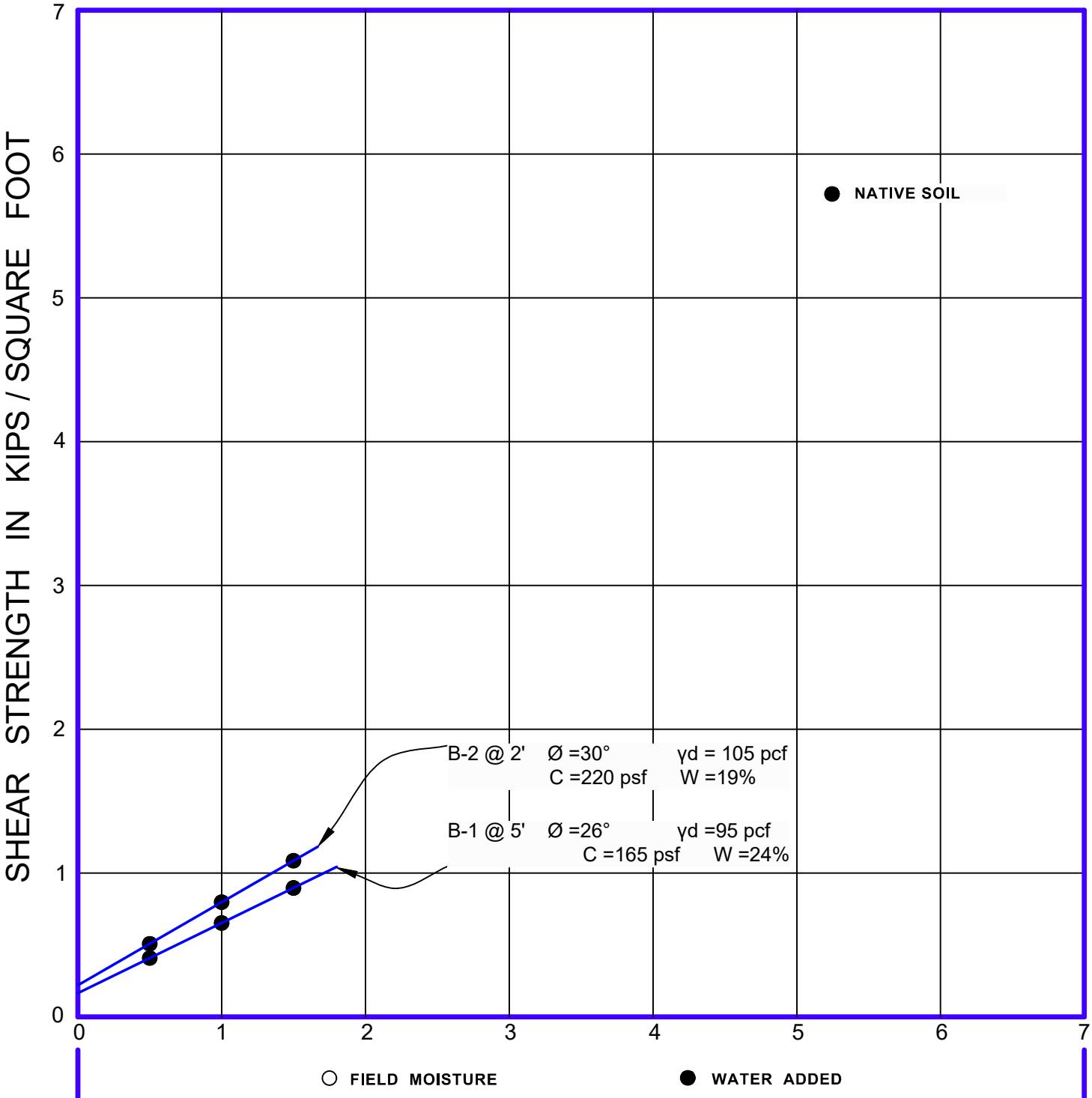
A range of normal stresses was applied vertically, and the shear strength was progressively determined at each load in order to determine the internal angle of friction and the cohesion. The tests were performed using ASTM D 3080 Laboratory Direct Shear Test Method. The Ultimate shear strength results of direct shear tests are presented on Figure No. II-1 within this Appendix.

Consolidation

The apparatus used for the consolidation tests is designed to receive the undisturbed brass ring of soil as it comes from the field. Loads were applied to the test specimen in several increments, and the resulting deformations were recorded at time intervals. Porous stones were placed in contact with the top and bottom of the specimen to permit the ready addition or release of water. ASTM D 2435 Laboratory Consolidation Test Method.

Undisturbed specimens were tested at the field and added water conditions. The test results are shown on Figure No. II-2 within this Appendix.

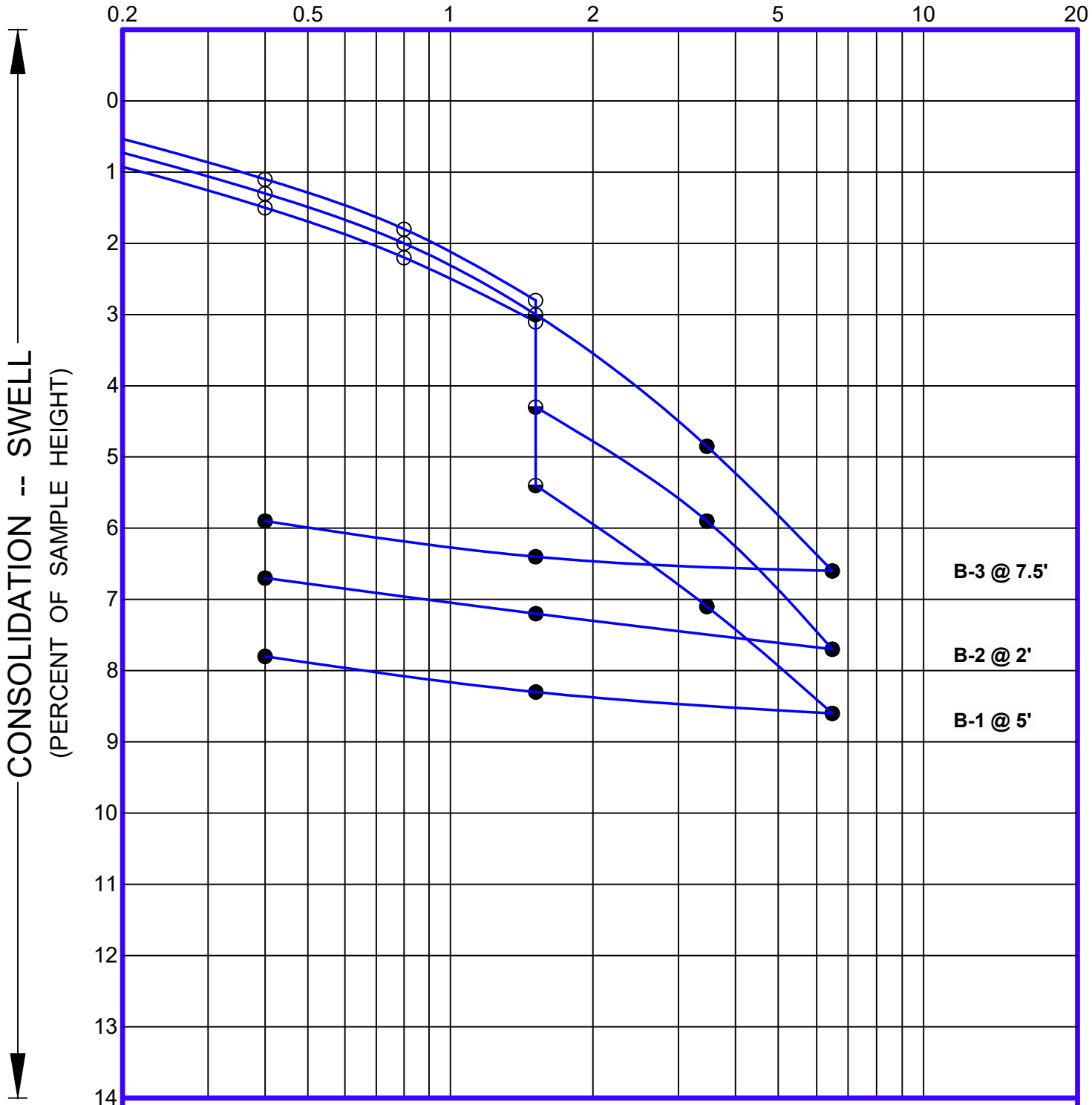
NORMAL STRESS IN KIPS / SQUARE FOOT



DIRECT SHEAR TESTS

PROJECT ADDRESS : 913 California Street, Redlands, CA 92374	JOB No. 23-536-02
APPLIED EARTH SCIENCES GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL . ENGINEERING CONSULTANTS www.aessoil.com (818) 552-6000	FIGURE No. II - 1

PRESSURE IN KIPS PER SQUARE FOOT



SWELL - CONSOLIDATION TESTS

PROJECT ADDRESS : 913 California Street, Redlands, CA 92374	JOB No. 23-536-02
APPLIED EARTH SCIENCES GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL . ENGINEERING CONSULTANTS www.aessoil.com (818) 552-6000	FIGURE No. II - 2

Appendix III

Soft Copy of AES Soil Report dated April 15, 2005 (PDF Only)

Applied Earth Sciences
a division of Applied Soil Technology, Inc.
GEOTECHNICAL & ENVIRONMENTAL ENGINEERING CONSULTANTS

March 26, 2008 05-333-02

Mr. Andre Ohanian
611 Wilshire Boulevard
Suite 802
Los Angeles, California 90017

Subject: Supplement No. 1
Geotechnical Investigation
Proposed Shopping Center
931 California Street
Redland, California

Dear Mr. Ohanian:

INTRODUCTION

We are pleased to submit this Supplement No. 1 report presenting additional geotechnical engineering recommendations for the subject project. The original report of geotechnical investigation for the subject was issued by this office on December 8, 2005.

PROJECT CONSIDERATIONS

Since the issuance of our original report, some changes have been made to the proposed project. Initially, the proposed buildings were planned to be one story and partially two stories high. The current project calls for all buildings to be two stories in height. The shapes of the proposed buildings also have been changed. Our previous Site Plan; Drawing No. 1, has been modified to show the locations of the proposed buildings. The revised plan is enclosed with this Supplement No. 1.

It is further our understanding that, in order to protect the proposed building against channel erosion and possible undermining, it is required that the foundations of the proposed building closest to the channel, be in a form of solid wall extended some 2 feet below the base of the channel. See the sections presented on the enclosed Drawing No. 1.

In our original report, because of the assumption that the proposed buildings will be constructed near grade, recommendations for temporary excavation were not included. Based on the revised project, it is now believed that, in order to extend the footings of the proposed buildings (on the channel side) some 2 feet below the bottom of the channel, some 10 to 15 feet of excavation will be required. The planned line of excavation will be extended to close proximity of the south property line beyond which a road exits. On this basis, during the course of grading and construction of the subject project, temporary excavation will be made.

Where adequate horizontal spacing beyond the planned line of excavation is available, unsupported/open excavation slopes (with inclinations as recommended in this Supplement No. 1) can be used. Where adequate space is not available, temporary shoring should be used. The temporary shoring should be in a form of cantilevered soldier piles. The temporary shoring can then be incorporated into the subsurface walls and be part of the permanent structure. The portion of the piles below the base of the excavation can then provide vertical support for the subsurface wall through skin friction, therefore, eliminating the need to use a relatively large "L" footing. Proper structural connections should be made between the shoring piles and the subsurface walls.

EVALUATION AND RECOMMENDATIONS

GENERAL

Based on the geotechnical engineering data derived during our original investigation, it is believed that the proposed construction (with the current changes) may be made as planned. Except for the changes presented in this Supplement No. 1, all previous recommendations for foundations, grading, slabs, etc., will remain valid.

The following sections present our specific recommendations for temporary excavation, pile foundations, subsurface walls and observation during construction.

TEMPORARY EXCAVATION

Unshored Excavations: Where space limitations permit, unshored temporary excavation slopes could be used. Based upon the engineering characteristics of the site upper soils, it is our opinion that temporary excavation slopes in accordance with the following table should be used:

Maximum Depth of Cut (Ft)	Maximum Slope Ratio (Horizontal:Vertical)
0-5	Vertical
>5	3/4:1

Water should not be allowed to flow over the top of the excavation in an uncontrolled manner. No surcharge should be allowed within a 45-degree line drawn from the bottom of the excavation. Excavation surfaces should be kept moist but not saturated to retard raveling and sloughing during construction.

It would be advantageous, particularly during wet season construction, to place polyethylene plastic sheeting over the slopes. This will reduce the chances of moisture changes within the soil banks and material wash into the excavation.

Cantilevered Soldier Piles: Cantilevered soldier piles should be as a means of temporary shoring where adequate horizontal distance is not available to make unsupported, open excavation slopes. Soldier piles consist of structural steel beams encased in concrete below the excavation bottom and slurry mix above. The lateral resistance for cantilevered soldier piles may be assumed to be offered by available passive pressure below the base of the excavation. An allowable passive pressure of 500 pounds per square foot per foot of depth may be used below the basement level for soldier piles having center-to-center spacing of at least 2-1/2 times the pile diameter. Maximum allowable passive pressure should be limited to 4,000 pounds per square foot. The maximum center-to-center spacing of the vertical shafts should be maintained no greater than 10 feet.

For design of temporary support, active pressure on piles may be computed using an equivalent fluid density of 30 pounds per cubic foot. Uniform surcharge may be computed using an active pressure coefficient of 0.30 times the uniform load.

When using cantilevered soldier piles for temporary shoring, the point of fixity (for the purpose of moment calculations), may be assumed to occur at some 2 feet below the base of the excavation. In order to limit local sloughing, it is recommended that lagging be used between the soldier piles. All wood members left in ground should be pressure treated.

It should be noted that the recommendations presented in this section of the report are for use in design and for cost estimating purposes prior to construction. The contractor is solely responsible for safety during construction.

FRICTION PILES

Friction piles should be used for support of the deep wall footing of the proposed buildings closer to the channel. Piles should be spaced no greater than 12 feet (center-to-center) and have a minimum length of 15 feet below the base of the subsurface wall. For the purpose of estimating vertical capacity of the individual piles, an allowable maximum skin friction value of 550 pounds per square foot may be used for the top 10 feet of the native soils. The allowable maximum skin friction value can be increased to 750 pounds per square foot for the portion of piles extended deeper than 10 feet into native soils. Uplift capacity may be assumed one half of the downward capacity.

The above given allowable maximum bearing and skin friction values are for the total of dead, plus frequently applied live loads. For short duration transient loading; wind or seismic forces, the given value may be increased by one third.

For design, the weight of the shafts can be assumed to be taken by end-bearing, therefore, need not be added to the structural loads. All piles should be concreted as soon as they are excavated and, for safety, should not be left open overnight .

During the course of our field investigation, no caving was experienced in the test holes. On this basis, caving is expected not to occur within the drilled holes.

Total and differential settlements of the proposed buildings and the associated subsurface walls are expected to be within tolerable limits; less than 3/8 and 1/4 of one inch, respectively. The major portion of the settlements are expected to occur during construction.

SUBSURFACE WALLS

The subsurface wall should be designed assuming that the soil on the channel side will be totally erode. Therefore, a "restrained against rotation" assumption should be made.

Static design of the subsurface walls (being restrained against rotation) could be based on an equivalent fluid pressure of 48 pounds per square foot per foot of depth. This assumes that no hydrostatic pressure will occur behind the retaining walls. This will require that proper subdrain be installed behind the subsurface walls on the building side. Subdrain normally consists of 4-inch diameter perforated pipes encased in free-draining gravel (at least one cubic foot per lineal foot of the pipes). In order to reduce the chances of siltation and drain clogging, the free-draining gravel should be wrapped in filter fabric proper for the site soils.

In addition to the lateral earth pressure, the basement garage walls should also be designed for any applicable uniform surcharge loads imposed by the proposed building. Uniform surcharge effects may be computed using a coefficient of 0.30 times the assumed uniform loads.

OBSERVATION DURING CONSTRUCTION

The presented recommendations in this report assume that all shoring piles and foundation excavations (spread footings and piles) will be observed by a representative of this office before reinforcing is placed. It is essential to assure that all excavations are made at proper dimensions, are established in the recommended bearing material and are free of loose and disturbed soils.

-oOo-

Thank you for the opportunity to be of continued service on this project. Should you have any questions regarding this Supplement No. 1, or wish to discuss the project further, please do not hesitate to call us.

Respectfully Submitted,

APPLIED EARTH SCIENCES

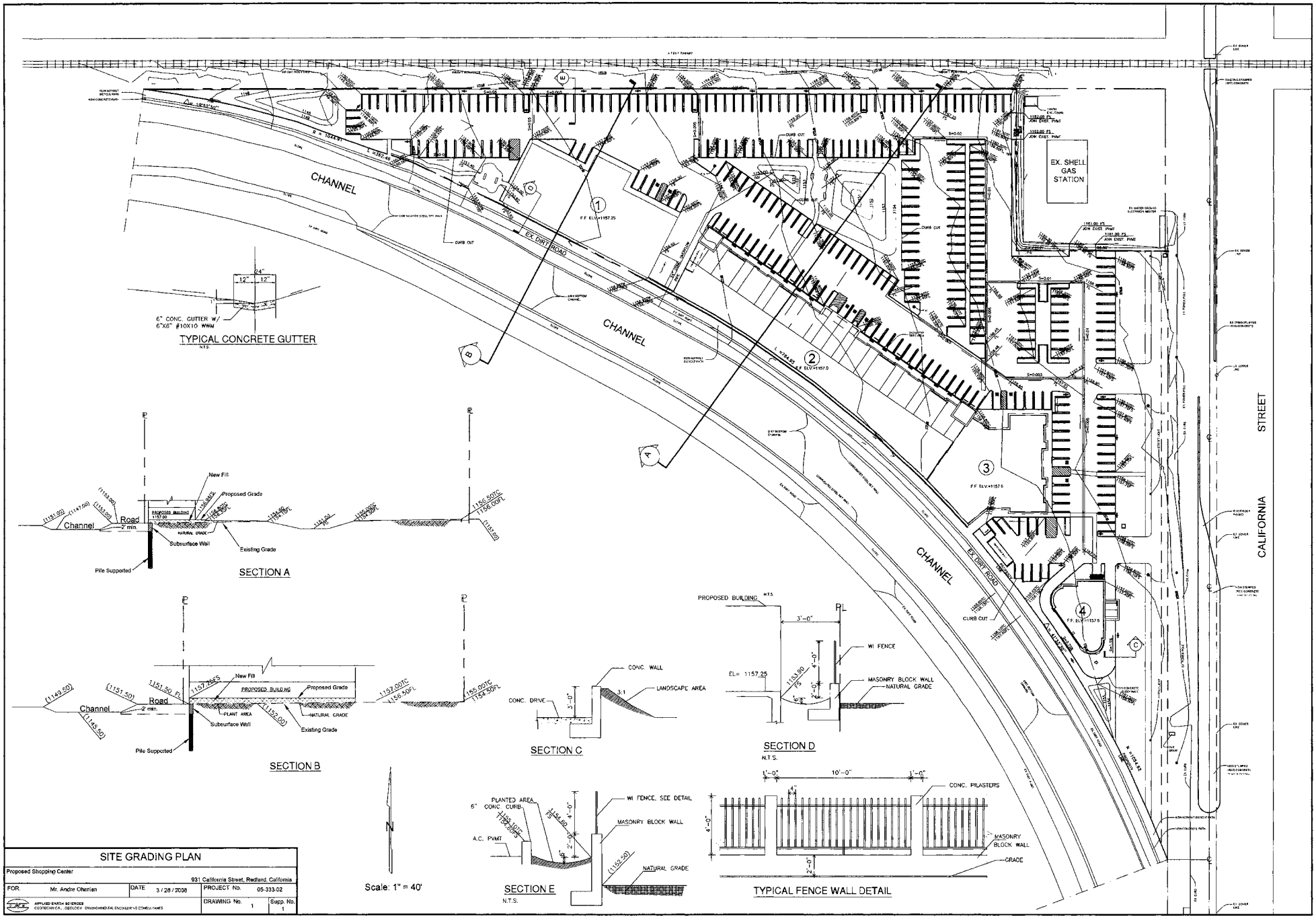
_____

Caro J. Minas, President,
Geotechnical Engineer
GE 601

CJM/ra

Enclosure: Site Plan - Drawing No. 1

Distribution: (4)



SITE GRADING PLAN

Proposed Shopping Center		931 California Street, Redland, California	
FOR: Mr. Andre Ohanian	DATE: 3 / 26 / 2008	PROJECT No. 05-333-02	
APPLIED EARTH SCIENCES ENGINEERING CA., GEOLOGY ENVIRONMENTAL ENGINEERING CONSULTANTS		DRAWING No. 1	Supp. No. 1

SOILS SOUTHWEST, INC.

SOILS, MATERIALS AND ENVIRONMENTAL ENGINEERING CONSULTANTS

897 VIA LATA, SUITE N • COLTON, CA 92324 • (909) 370-0474 • (909) 370-0481 • FAX (909) 370-3156

May 2, 2007 Project No. 07045BSN.

Mr. Andre Ohanian
1042 E. Orange Grove Avenue
Burbank, California 91501

Subject: Soil Percolation Rate for
BMP Detention/Filtration Basin Design
Proposed Shopping Center
910 California Street
Redlands, California

Dear Mr. Ohanian:

For BMP design, six (6) soil percolation testing is performed by using 8-inch diameter test explorations excavated by using a Hollow-Stem Auger (HSA) drillrig advanced to maximum 25 feet below grade. The selected test locations are as suggested by the project civil engineer. Following logging and pre-soaking, field percolation testing is performed in general conformance to the California Stormwater BMP design guidelines and as per the published booklet "Detention Basin Design Criteria for San Bernardino County".

Based on the testing completed for the locations as described, the following information is provided for your use. Approximate test locations and test boring logs are attached.

Test Location	Test Depth (ft)	Soil Type	Percolation Rate (min/inch)
P-1	20	SP-SM/SP	1.75
p-2	25	SP/SP-SM	2.35
P-3	15	SP/SP-SM	2.25
P-4	20	SP/SP-SM	1.95
P-5	20	SP/SP-SM	2.47
P-6	20	SP/SP-SM	2.50

Conclusion:

1. Based on the current explorations and the excavations completed for the site in the past, it is our opinion that the soils existing within the planned disposal areas primarily consist of silty fine sand and fine sand. No shallow depth bedrock or strata considered impermeable to water is encountered. Accordingly, it is our opinion that, in general, the subgrade soils existing as described should be considered homogeneous and fairly uniform.

2. Based on percolation testing completed at this time, it is our opinion that for BMP design, a soil percolation rate of 1.75"/minute may be considered.

3. The BMP detention/infiltration basin installation should conform to the requirements of WQMP and the County Detention Basin Design Criteria.

Should you have any questions regarding the above, please call the undersigned at your convenience.

Respectfully submitted,
Soils Southwest, Inc.

Moloy Gupta, RCE 31708

REGISTERED PROFESSIONAL ENGINEER
MOLOY K. GUPTA
No. 31708
EXP. 12-31-08
STATE OF CALIFORNIA

attached: Test location, Pla
Test Boring Logs

dist/ 5-addressee (by 1 by Fax: 8

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING 1

Project: Soil Percolation Testing for BMP Design		**Job No.:** 07045BSN.
Logged By: J. Flippin	**Boring Diam.:** 8" HSA	**Date:** 4-27-07

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP-SM			Minor weed & grass
								Sand-lt. brn., silty, fine, loose, dry
							4	-dry to damp
							8	
					SP			-color change to lt. grayish brn., fine, dry to damp
							12	
					SP-SM			-silty, fine
							16	
							20	End of test boring @ 20' No bedrock No groundwater Installed perc. pipe
							24	

Groundwater: n/a **Approx. Depth of Bedrock:** n/a **Datum:** N/A **Elevation:** N/A	**Site Location** NWC California St. & Flood Control Channel Redlands., California	**Plate #** P-1

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Colton, CA 92324
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LOG OF BORING 2

Project: Soil Percolation Testing for BMP Design		**Job No.:**	07045BSN.
Logged By: J. Flippin	**Boring Diam.:** 8" HSA	**Date:**	4-27-07

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP			Weed & grass
								Sand-lt. brn., fine, loose, dry
							4	
					SP-SM			-color change to lt. gray, silty, fine, dry
					SP			-scattered rocks to 1", dry to damp
							8	
								-color change to grayish brn, dry to damp
							12	
							16	
					SP-SM			-silty, fine
							20	
							24	
								End of test boring @ 25'
								No bedrock
								No groundwater
								Installed per. pipe

Groundwater: n/a **Approx. Depth of Bedrock:** n/a **Datum:** N/A **Elevation:** N/A	**Site Location** NWC California St. & Flood Control Channel Redlands., California	**Plate #** **P-2**

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING 3

Project: Soil Percolation Testing for BMP Design		**Job No.:** 07045BSN.
Logged By: J. Flippin	**Boring Diam.:** 8" HSA	**Date:** 4-27-07

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP			Weed & grass
								Sand-grayish brn., fine, dry
							4	
					SP-SM			-silty, fine, dry to damp
							8	
							12	
							16	End of test boring @ 15'
								No bedrock
								No groundwater
								Installed perc. pipe
							20	
							24	

Groundwater: n/a **Approx. Depth of Bedrock:** n/a **Datum:** N/A **Elevation:** N/A	**Site Location** NWC California St. & Flood Control Channel Redlands., California	**Plate #** P-3

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING 4

Project: Soil Percolation Testing for BMP Design		**Job No.:**	07045BSN.
Logged By: J. Flippin	**Boring Diam.:** 8" HSA	**Date:**	4-27-07

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP			Weed & grass Sand-lt. brn., fine, dry, w/rootlets
							4	
					SP-SM			-color change to grayish brn., slightly silty, fine
							8	
							12	-some scattered rocks to 1/2"
							16	-some caving
							20	
								End of test boring @ 20' No bedrock No groundwater Installed perc. pipe
							24	

Groundwater: n/a **Approx. Depth of Bedrock:** n/a **Datum:** N/A **Elevation:** N/A	**Site Location** NWC California St. & Flood Control Channel Redlands., California	**Plate #** **P-4**

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING 5

Project: Soil Percolation Testing for BMP Design		**Job No.:**	07045BSN.
Logged By: J. Flippin	**Boring Diam.:** 8" HSA	**Date:**	4-27-07

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP			Weed & grass
								Sand-lt. brn., fine, dry to damp
							4	
					SP-SM			-color change to grayish brn., traces of silt/silty, fine, dry to damp
							8	-color change to lt. gray, dry to damp, some caving
					SP		12	-color change to grayish brn, fine, damp
							16	
							20	
								End of test boring @ 20'
								No bedrock
								No groundwater
								Installed perc. pipe & presoaked
							24	

Groundwater: n/a **Approx. Depth of Bedrock:** n/a **Datum:** N/A **Elevation:** N/A	**Site Location** NWC California St. & Flood Control Channel Redlands., California	**Plate #** **P-5**

Soils Southwest, Inc.
697 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING 6

Project: Soil Percolation Testing for BMP Design		**Job No.:**	07045BSN.
Logged By: J. Flippin	**Boring Diam.:** 8" HSA	**Date:**	4-27-07

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP		0	Weed & grass
								Sand-lt. brn., fine, dry, loose
							4	-color change to lt. ghrayish brn., fine, dry
					SP-SM			-silty, fine, dry to damp
							8	
					SP			-fine, dry
							12	
							16	
							20	
								End of test boring @ 20'
								No bedrock
								No groundwater
								Installed perc. pipe
							24	

Groundwater: n/a **Approx. Depth of Bedrock:** n/a **Datum:** N/A **Elevation:** N/A	**Site Location** NWC California St. & Flood Control Channel Redlands., California	**Plate #** **P-6**

March 17, 2006 05-333-02

Mr. Andre Ohanian
611 Wilshire Boulevard
Suite 802
Los Angeles, California 90017

Subject: Supplement No. 1
Geotechnical Investigation
Soil Permeability Considerations
Proposed Shopping Center
931 California Street
Redland, California

Dear Mr. Ohanian:

INTRODUCTION

We are pleased to submit this Supplement No. 1 report presenting the results of our additional geotechnical engineering evaluation or the subject project. The original report of geotechnical investigation for the subject project was issued by this office on December 8, 2005.

PROJECT CONSIDERATIONS

Based on the newly provided grading data, it is believed that, as part of the proposed project, certain areas of the site should be used as basin for dissipating surface water. The areas will include the surface/open parking and the landscape zones. It is also believed that the accumulated water on the site, resulting from precipitation, should be dissipated into the subgrade within less than 48 hours.

DISCUSSION OF RESULTS AND SUPPLEMENTAL RECOMMENDATIONS

Based on the results of our review of the Site Grading Plan, it is believed that the areas of the propose d buildings will be raised by less than 5 feet. Therefore, imported soils will be required to accomplish the site grading work. All imported soils should granular in nature (sand with little silt) having a coefficient of permeability of no less than 1000 feet per year.

Through our review of the boring logs made at the site, it appears that a silt layer extends to some 15 feet in the area of the north parking lot. Below the silt layer, the subgrade consists of relatively clean sand having very high permeability coefficient.

For the purpose of this project, it is recommended that the silt layer in the area of the parking lot be excavated to expose the relatively clean sand soils. The silt layer can be used to raise the grade in the areas of the proposed building. The sandy imported soils should then be used to fill the resulting cavities.

With the above recommended grading procedure, it is our opinion that surface water from regular precipitation will dissipate into the subgrade within the less than 48 hours. It should be noted, however, that the quality and permeability coefficient of the imported sand soils should be determined by this office during site grading to assure that it meets the recommended criteria.

All the other recommendations presented in or original report will remain applicable.

-oOo-

Thank you for the opportunity to be of continued service on this project. Should you have any questions regarding this Supplement No. 1, or wish to discuss the project further, please do not hesitate to call us.

Respectfully Submitted,
APPLIED EARTH SCIENCES

Caro J. Minas, President
Geotechnical Engineer
GE 601

CJM/RCJ/mg

Distribution: (4)

REPORT OF

GEOTECHNICAL INVESTIGATION

PROPOSED SHOPPING CENTER

931 CALIFORNIA STREET

REDLAND, CALIFORNIA

FOR

MR. ANDRE OHANIAN

PROJECT NO. 05-333-02

DECEMBER 8 , 2005

Applied Earth Sciences
a division of Applied Soil Technology, Inc.
GEOTECHNICAL & ENVIRONMENTAL ENGINEERING CONSULTANTS

December 8, 2005 05-333-02

Mr. Andre Ohanian
611 Wilshire Boulevard
Suite 802
Los Angeles, California 90017

Subject: Geotechnical Investigation
Proposed Shopping Center
931 California Street
Redland, California

Dear Mr. Ohanian:

INTRODUCTION

This report presents the results of a geotechnical investigation performed at the subject site. During the course of this investigation, the engineering properties of the subsurface materials were evaluated in order to provide recommendations for design and construction of foundations, grade slabs, and grading. The investigation included subsurface exploration, soil sampling, laboratory testing, engineering evaluation and analysis, consultation and preparation of this report.

The enclosed Site Plan; Drawing No. 1, shows the approximate location of the drilled borings in relation to the site boundaries. The enclosed Site Plan; Drawing No. 1, shows the approximate location of the drilled borings in relation to the site boundaries and the proposed buildings. The attached Appendix I, describes the method of field exploration. Figure Nos. I-1 through I-5 present summaries of the materials encountered at the locations of our borings. Figure No. I-6 presents the Uniform Soil Classification System Chart; a guide to the Log of Exploratory Boring.

The attached Appendix II describes the laboratory testing procedures. Figure Nos. II-1 And II-2 present the results of direct shear and consolidation tests performed on selected undisturbed samples.

Appendix III present the results of chemical testing as received from the offices of American Environmental Testing Laboratory, Inc.

PROJECT CONSIDERATION

It is our understanding that the proposed project would consist of construction of a shopping center at the subject site. The center will consist of three separate buildings. Two of the proposed buildings (the large ones) will be partially two-story structures with lower floors constructed of concrete block walls and the upper floors being constructed of wood frame. The small (drive-through) building will be constructed of wood frame. The flooring systems of all structures will be in a form of concrete grade slabs established at or near the present grades (no basement is planned).

It is believed that the subject site occurs within a potential flood zone. Therefore, the building pad may need to be raised above the potential flood zone level.

Parking for the proposed facility will be provided in a form of open surface parking. (parking lot).

Structural loading data was not available during the course of our investigation. For the purpose of this study, it is assumed that the magnitude of the collected loads would be on the order of 50 kips, combined dead plus frequently applied live loads. Continuous footings are expected to exert loads of on the order of 2 kips per lineal foot.

SITE GRADING

The grading is expected to involve removal and recompaction of any surficial fill and loose native soils (a maximum thickness of 2 to 3 feet; to be determined by the Soil Engineer). The recompacted soils can then be used to receive new fill for support of foundations and grade slabs. The required grading in the areas of surface parking will be limited to removal and recompaction of the top 12 inches of the existing soils.

The zone of removal should be extended beyond the exterior walls of the proposed buildings a horizontal distance equal to the thickness of fill. The property line footings should be extended through any surficial fill and be established at least 12 inches into native soils.

Note that some 15 percent shrinkage should be considered when reusing the excavated materials in the areas of new fill (to higher densities). Considering this and the planned raise of the site grade above the potential flood zone, imported soils will be required to accomplish the site grading work. All imported soils should be non-expansive and granular in nature (similar to the site upper soils).

SITE CONDITIONS

SURFACE CONDITIONS

The site of the proposed commercial/shopping center is the existing vacant lot located at 941 California Street, Redland, California. The site is triangular in shape and covers a plan area of about 6 acres. See the enclosed Site Plan; Drawing No. 1 for site location.

At the time of our field investigation, the site was vacant and covered with dirt. The site was noted to be generally level.

An existing service station occurs to the northeast of the subject site. An unimproved flood control channel also occurs to the south of the site. See the enclosed Site Plan; Drawing No. 1.

SUBSURFACE CONDITIONS

Correlation of the subsoil between the test borings was considered to be good. Generally, the site, to the depths explored, was found to be covered by surficial fill underlain by natural deposits of silty sand, sandy and/or clayey silt, and relatively clean sand soils. Thickness of the existing fill was found to be less than 12 inches at the location of our borings. Deeper fill, however, may be present between and beyond our borings and closer to the storm drain channel.

The surficial fill and top 2 feet of the site native soils were found to be generally porous and compressible. At their present state, such soils should not be use for support of new fill, structural foundations and grade slabs. The existing fill, however, may be excavated and reused in the areas of compacted fill.

The native soils found below the surficial fill were found to be generally firm in-place. The results of our laboratory testing indicated that the site native soils were of moderate strengths and moderately compressible.

The site upper soils (including the existing fill) were found to be granular in nature. Such soils were found to be virtually non-expansive.

During the course of our field investigation, no groundwater was encountered in our borings drilled to a maximum depth of 51.5 feet. Due to method of drilling, no caving was detected. Due to silty nature of the upper soils, however, forming will not be required during foundation construction.

EVALUATION OF LIQUEFACTION POTENTIAL

As part of our field exploration, one boring was drilled at the subject site to a maximum depth of 51 feet. No groundwater was encountered in our deep borings. For the purpose of evaluating liquefaction potential, SPT (Standard Penetration Test) were conducted from a depth of 15 feet. The results of our in-situ testing indicated that the sand layers below the site were generally dense to very dense in-place (having minimum SPT value of 30). See the Log Of Exploratory Borings in Appendix I. The fine grained (silts and clays) layers with SPT blow counts of less than 30 were found to contain more than 15 percent clay by weight. See the Grain Size Distribution Chart; Figure No. II-3 in the enclosed Appendix II. On this basis, it is our opinion that soil liquefaction will not occur at the subject site.

SEISMIC DESIGN CONSIDERATIONS

The subject site is located within UBC Seismic Zone 4. Based on the results of our field exploration, the subject site can be assumed to have a soil profile type of Sd in accordance with Table 16-J of 1997 Uniform Building Code.

The closest active fault to the subject site is the San Jacinto (San Bernardino) which is designated as Type B seismic source in accordance with CDMG (California Division of Mines and Geology). The subject site occurs some 5 kilometers from this near source zone in accordance with Map M-32 of ICBO (International Conference of Building Officials February 1998). At this distance, for a seismic source B, the near source factors Na and Nv would be 1.0 and 1.3, respectively, in accordance with Tables 16-S and 16-T of the 1997 UBC.

EVALUATION AND RECOMMENDATIONS

GENERAL

Based on the geotechnical engineering data derived from this investigation, the site is considered to be suitable for the proposed development. The surficial fill and top zone of porous native soils (a total thickness of on the order of 2 to 3 feet) should be excavated until non-porous native soils (to be determined by the Soil Engineer) are exposed. The zone of removal should be extended beyond the exterior walls of the proposed building a horizontal distance equal to the thickness of fill.

After proper surface preparation (scarification and compaction in-place to a relative compaction of at least 90 percent at optimum moisture content) the excavated materials should be placed back and compacted, under engineering observation and testing until the proposed finished grades are established.

After proper site grading, conventional spread footing foundation system can be used for support of the proposed structures. The foundation bearing soils are expected to be properly compacted fill soils.

Grade slabs can be supported on the finished grades which will consist of properly compacted fill soils. Due to granular nature, soil expansion will not be an issue at this site. It is recommended, however, that the grade slabs for this project be taken at least 5 inches and be reinforced with # 4 bars placed at every 18 inches on center.

The following sections present our specific recommendations for site grading, foundations, lateral design, grade slabs, minor walls, and observation during construction.

SITE GRADING

All surficial fill the disturbed soils generated from demolition of the existing building/paving should be excavated until native soils are exposed. Prior to placement of any fill on the site, the Soil Engineer should observe the excavation bottoms. The areas to receive compacted fill should be scarified to a depth of about 8 inches, moistened as required to bring to optimum moisture content, and compacted to at least 90 percent of the maximum dry density as determined by the ASTM Designation D 1557-02 Compaction Method.

All import soils should be free of organic matter and rocks larger than 6 inches in diameter. Before import soils are brought to the site, a 40-pound sample of the proposed import soils should be submitted to the Soil Engineer (at least 48 hours in advance) so that the maximum density and expansion character of the import materials can be determined. All fill soils should be placed in layers not exceeding 8 inches in loose thickness and compacted to at least 90 percent of the maximum dry unit weight as determined by ASTM Designation D 1557-02 Compaction Method.

General guidelines regarding site grading are presented below in an itemized form which may be included in the earthwork specification. It is recommended that all fill be placed under engineering observation and in accordance with the following guidelines:

1. All vegetation and debris should be collected and hauled off-site. In the areas of new fill, the existing fill should be excavated until native soils are exposed.

2. The excavated areas should be observed and approved by the Soil Engineer prior to placing any fill.

3. The excavated materials from the site are considered to be satisfactory for reuse in the compacted fill areas. Due to potentially expansive character, it would be desirable to use the site soils in deeper fill areas.

4. Fill material, approved by the Soil Engineer, should be placed in controlled layers. Each layer should be compacted to at least 90 percent of the maximum unit weight as determined by ASTM designation D 1557- 02 for the material used.

5. The fill material shall be placed in layers which, when compacted, shall not exceed 8 inches per layer. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to insure uniformity of material in each layer.

6. When moisture content of the fill material is too low to obtain adequate compaction, water shall be added and thoroughly dispersed until the moisture content is near optimum.

7. When the moisture content of the fill material is too high to obtain adequate compaction, the fill material shall be aerated by blading or other satisfactory methods until near optimum moisture condition is achieved.

8. Inspection and field density tests should be conducted by the Soil Engineer during grading work to assure that adequate compaction is attained. Where compaction of less than 90 percent is indicated, additional compactive effort should be made with adjustment of the moisture content or layer thickness, as necessary, until at least 90 percent compaction is obtained.

SITE DRAINAGE

Site drainage should be provided to divert roof and surface waters from the property through nonerodible drainage devices to the street. In no case should the surface waters be allowed to pond adjacent to building or behind the retaining walls. A minimum slope of one and two percent is recommended for paved and unpaved areas, respectively.

FOUNDATIONS

Conventional spread footing foundation systems on firm native and/or properly compacted fill soils are expected to provide adequate support for the proposed building. Exterior and interior footings should be a minimum of 12 inches wide and should be placed at a minimum depth of 24 inches below the lowest adjacent final grades.

Properly designed and constructed spread footings may be based on an allowable maximum bearing pressure of 1,800 pounds per square foot. This value can be increased at a rate of 100 and 200 pounds per square foot for each additional foot of footing width and depth, to a maximum value of 2,400 pounds per square foot. The footings for this project should be connected in both directions using tie beams.

The above given values are for the total of dead and frequently applied live loads. For short duration transient loading, such as wind or seismic forces, these values may be increased by one-third.

Under the allowable maximum soil pressure, footings carrying the assumed maximum concentrated loads of 50 kips is expected to settle on the order of 3/4 of an inch. Continuous footings, with loads of about 2 kips per lineal foot are expected to settle on the order of 1/2 of an inch. Maximum differential settlements are expected to be on the order of 1/4 of an inch. Major portion of the settlements are expected to occur during construction.

LATERAL DESIGN

Lateral resistance at the base of footings in contact with native soils may be assumed to be the product of the dead load forces and a coefficient of friction of 0.3. Passive pressure on the face of footings may also be used to resist lateral forces. A passive pressure of zero at the ground surface and increasing at a rate of 200 pounds per square foot per foot of depth to a maximum value of 1,750 pounds per square foot may be used for footings poured against native and/or properly compacted fill soils.

GRADE SLABS

Assuming that site grading will be made in accordance with the recommendations in the preceding sections, grade slabs can be supported on the finished grades which will consist of properly compacted fill soils. Due to granular nature, soil expansion will not be an issue at this site. It is recommended, however, that the grade slabs for this project be taken at least 5 inches and be reinforced with # 4 bars placed at every 18 inches on center.

In the areas where moisture sensitive floor covering is used and slab dampness cannot be tolerated, a vapor-barrier should be used beneath the slabs. This normally consists of a 6-mil polyethylene film covered with 2 inches of clean sand.

RETAINING WALLS

Static design of minor retaining walls may be based on an equivalent fluid pressure of 40 pounds per square foot per foot of depth. This assumes that no hydrostatic pressure will occur behind the walls. Hydrostatic pressures should be relieved from the back of the retaining walls through properly designed and constructed subdrain. This normally consists of 4-inch in diameter perforated pipes encased in free draining gravel (at least one cubic foot per lineal foot of the pipe). To reduce the chances of siltation, an approved filter fabric should be used around the gravel.

Uniform surcharge effects may be computed using a coefficient of 0.30 times the uniform loads. For allowable vertical and lateral pressures refer to the preceding sections.

OBSERVATION DURING CONSTRUCTION

The presented recommendations in this report assume that all structural foundations will be established in native and/or properly compacted fill soils. All footing excavations should be observed by a representative of this office before reinforcing is placed.

All site grading work should be observed and tested by a representative of this office. Please notify this office at least 24 hours before any observation work is required.

CLOSURE

The findings and recommendations presented in this report were based on the results of our field and laboratory investigations combined with professional engineering experience and judgment. The report was prepared in accordance with generally accepted engineering principles and practice. We make no other warranty, either express or implied.

It is noted that the conclusions and recommendations presented are based on exploration "window" borings and excavations which is in conformance with accepted engineering practice. Some variations of subsurface conditions are common between "windows" and major variations are possible.

-o0o-

The following Figures and Appendices are attached and complete this report:

Site Plan - Drawing No. 1

Appendix I-Method of Field Exploration
Figure Nos. I-1 through I-6
Appendix II-Methods of Laboratory Testing
Figure Nos. II-1 and II-2
Grain Size Distribution Chart - Figure No. III
Appendix III - Results Of Chemical Testing

Respectfully submitted,

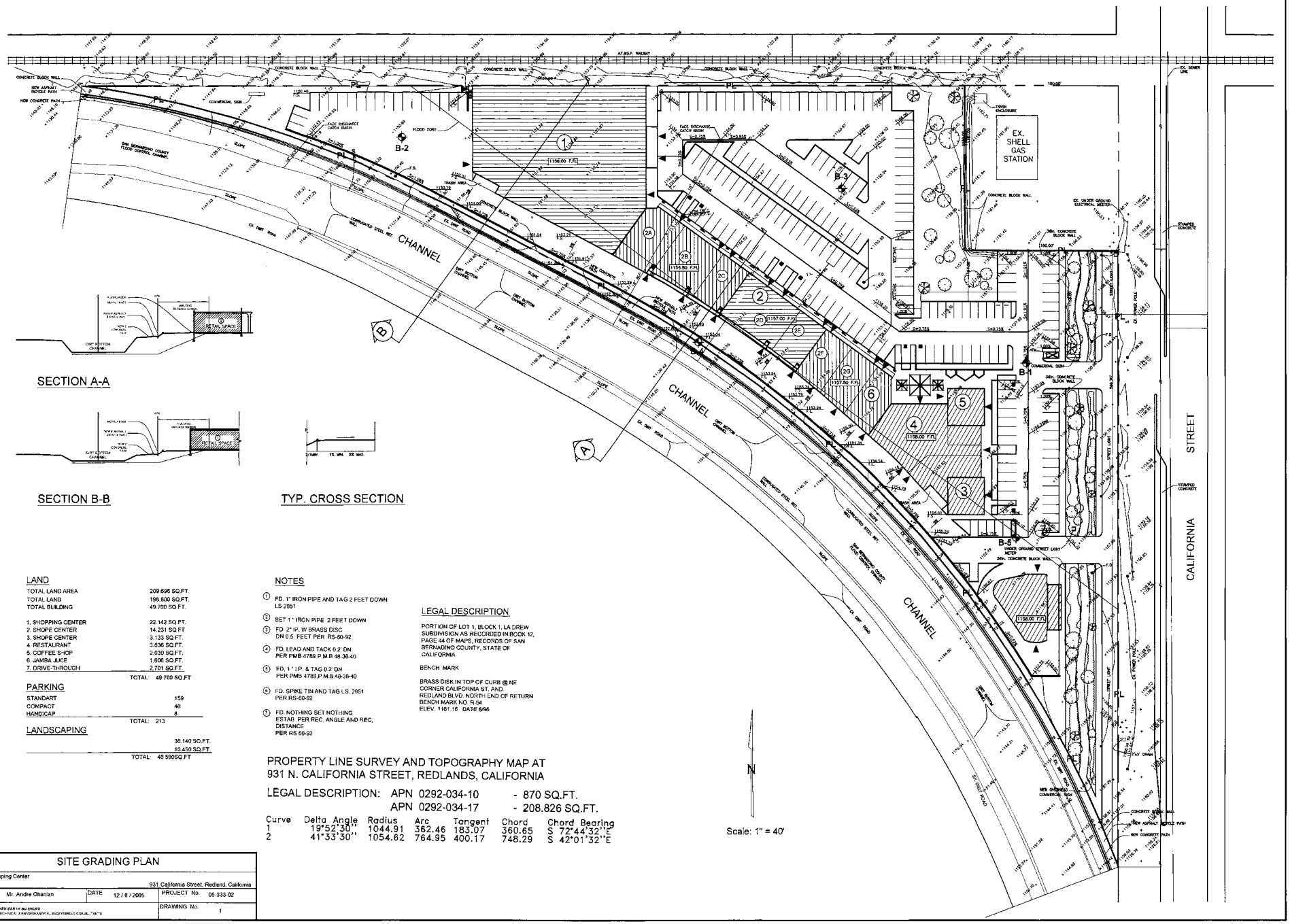
Applied Earth Sciences

Caro J. Minas

Geotechnical Engineer

GE 601

CJM/mg



LAND	
TOTAL LAND AREA	209,696 SQ.FT.
TOTAL LAND	196,500 SQ.FT.
TOTAL BUILDING	49,700 SQ.FT.
1. SHOPPING CENTER	22,142 SQ.FT.
2. SHOPE CENTER	14,231 SQ.FT.
3. SHOPE CENTER	3,133 SQ.FT.
4. RESTAURANT	3,836 SQ.FT.
5. COFFEE SHOP	2,030 SQ.FT.
6. JAMBA JUICE	1,606 SQ.FT.
7. DRIVE-THROUGH	2,701 SQ.FT.
TOTAL:	49,700 SQ.FT

PARKING	
STANDART	159
COMPACT	46
HANDICAP	8
TOTAL:	213

LANDSCAPING	
	36,140 SQ.FT.
	10,450 SQ.FT.
TOTAL	46,590SQ.FT

NOTES

1. FD. 1" IRON PIPE AND TAG 2 FEET DOWN LS 2851
2. SET 1 " IRON PIPE 2 FEET DOWN
3. FD. 2" IP. W BRASS DISC DN 0.5. FEET PER RS-60-92
4. FD. LEAD AND TACK 0.2' DN PER PMB 4789,P.M.B 48-38-40
5. FD, 1 " IP. & TAG 0.2' DN PER PMB 4789,P.M.B 48-38-40
6. FD. SPIKE TIN AND TAG L.S. 2851 PER RS-60-92
7. FD. NOTHING SET NOTHING ESTAB. PER REC. ANGLE AND REC. DISTANCE PER RS 60-92

LEGAL DESCRIPTION

PORTION OF LOT 1, BLOCK 1, LA DREW SUBDIVISION AS RECORDED IN BOOK 12, PAGE 44 OF MAPS, RECORDS OF SAN BERNADINO COUNTY, STATE OF CALIFORNIA

BENCH MARK

BRASS DISK IN TOP OF CURB @ NE CORNER CALIFORNIA ST. AND REDLAND BLVD. NORTH END OF RETURN BENCH MARK NO. R-54 ELEV. 1161.18 DATE 6/96

PROPERTY LINE SURVEY AND TOPOGRAPHY MAP AT
931 N. CALIFORNIA STREET, REDLANDS, CALIFORNIA

LEGAL DESCRIPTION: APN 0292-034-10 - 870 SQ.FT.
APN 0292-034-17 - 208,826 SQ.FT.

Curve	Delta Angle	Radius	Arc	Tangent	Chord	Chord Bearing
1	19°52'30"	1044.91	362.46	183.07	360.65	S 72°44'32"E
2	41°33'30"	1054.62	764.95	400.17	748.29	S 42°01'32"E

N

Scale: 1" = 40'

SITE GRADING PLAN

Proposed Shopping Center — 931 California Street, Redland, California

FOR: Mr. Andre Ohanian | DATE: 12 / 8 / 2005 | PROJECT No. 05-333-02

APPLIED EARTH SCIENCES GEOTECHNICAL & ENVIRONMENTAL ENGINEERING CONSULTANTS | DRAWING No. 1

APPENDIX I

METHOD OF FIELD EXPLORATION

In order to define subsurface conditions, five borings were drilled on the site. The approximate locations of the drilled borings are shown on the enclosed Site Plan. The borings were extended to a maximum depth of 51.5 feet below the existing grade. The borings were drilled using a hollow stem drilling machine.

Logs of the subsurface materials, as encountered in the borings, were recorded in the field and are presented Figure Nos. I-1 and I-2 within Appendix I. These figures also show the number and approximate depths of each of the recovered soil and rock samples.

Relatively undisturbed samples of the subsoil were obtained by driving a steel sampler with successive drops of a 140-pound sampling hammer free-falling a vertical distance of about 30 inches. The number of blows required for one foot of sampler penetration was recorded at the time of drilling and are shown on the log of exploratory borings. The relatively undisturbed soil samples were retained in brass liner rings 2.5 inches in diameter and 1.0 inch in height.

Field investigation for this project was performed on February 26, 2005. The material excavated from the borings was placed back and compacted upon completion of the field work. Such material may settle. The owner should periodically inspect these areas and notify this office if the settlement creates a hazard to persons or property.

BORING No. 1

DATE EXCAVATED: 02/26/05 **GROUND ELEVATION:**

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASS THRU #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
					SAND (SP-SM)		Medium dense, moist, brown, poorly graded sand with silt
5	98	13		5	SILT (ML)		Firm, moist, olive brown, silt with sand
10	99	13		7	(ML)		
15	94	21	71.1	10 (SPT)	(ML)		Grades to clayey
20	117	6	25.3	30 (SPT)	SAND (SM)		Dense, very moist, olive brown, silty sand
25	101	4	19.5	17 (SPT)	(SM)		Grades to clayey
30	104	15	65.7	22 (SPT)	SILT (ML)		Stiff, moist, grayish brown, sandy silt, slightly clayey

LOG OF BORING

JOB NAME: Andre Ohanian JOB No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO : I-1.1

BORING No. 1 (CONTINUED)

DATE EXCAVATED: 02/26/05 **GROUND ELEVATION:**

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASSING #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
							Continue (See Previous Page)
35	115	2	11	33 (SPT)	SAND (SP)		Very dense, wet, gray, poorly graded sand
40	113	3	7.9	43 (SPT)	(SW)		Grades to very dense, wet, gray, well graded sand
45	111	10	37.6	55 (SPT)	(SW-SM)		Grades to well graded sand wilth silt
50	113	3	10.6	54 (SPT)	(SP)		Grades to poorly graded sand
							End of Boring @ 51½ feet No Water

LOG OF BORING

JOB NAME: Andre Ohanian JOB No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO : I-1.2

BORING No. 2

DATE EXCAVATED: 02/26/05 **GROUND ELEVATION:**

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASS THRU #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
					SAND (SP-SM)		Medium dense, moist, brown, poorly graded sand with silt
	98	12		6			
5							
	99	18		9	SILT (ML)		Firm, very moist, olive brown, silt with sand
10							
	96	17		10	(ML)		
15							
	95	21		11	(ML)		
20							
	96	8		25	SAND (SP)		Medium dense, moist, brown, poorly graded sand
25							
	94	24		17	SILT (ML)		Firm, moist, brown, silt with sand
30							
	100	20	57.5	30 (SPT)	(ML)		Grades to stiff, grayish brown, sandy silt

LOG OF BORING

JOB NAME: Andre Ohanian JOB No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO : I-2.1

BORING No. 2 (CONTINUED)

DATE EXCAVATED: 02/26/05 **GROUND ELEVATION:**

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASSING #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
							Continue (See Previous Page)
35	104	20	48	32 (SPT)	(ML)		
40	126	9	18.5	34 (SPT)	SAND (SP-SM)		Dense, moist, olive brown, poorly graded sand with silt
45	110	4	11.4	38 (SPT)	(SP)		Grades to poorly graded sand
50	111	5	9.1	41 (SPT)	(SP)		End of Boring @ 51½ feet No Water

LOG OF BORING

JOB NAME: Andre Ohanian JOB No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO : I-2.2

BORING No. 3

DATE EXCAVATED: 02/26/05 **GROUND ELEVATION:**

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASS THRU #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
	99	12		6	SAND (SP-SM)		Medium dense, moist, dark brown, poorly graded sand with silt
5	100	12		11	SILT (ML)		Firm, moist, light brown, sandy silt
10	101	11		14	(ML)		
15	103	3		15	SAND (SP)		Medium dense, moist, grayish brown, poorly graded sand
20	102	10		18	(SP-SM)		Grades to poorly graded sand with silt
25							End of Boring @ 21 feet No water
30							

LOG OF BORING

JOB NAME: Andre Ohanian JOB No. 05-333-02

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FIGURE NO : I-3

BORING No. 4

DATE EXCAVATED: 02/26/05 **GROUND ELEVATION:**

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASS THRU #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
					SAND (SP-SM)		Medium dense, moist, dark brown, poorly graded sand with silt
	99	12		6			
5							
	98	11		11	SILT (ML)		Firm, moist, brown, sandy silt
10							
	97	13		14	(ML)		
15							
	100	3		15	SAND (SP)		Medium dense, moist, grayish brown, poorly graded sand
20							
	101	4		18	(SP)		
							End of Boring @ 21 feet No water
25							
30							

LOG OF BORING

JOB NAME: Andre Ohanian JOB No. 05-333-02

APPLIED EARTH SCIENCES
GEOTECHNICAL ENGINEERING CONSULTANTS

FIGURE NO : I-4

BORING No. 5

DATE EXCAVATED: 02/26/05 **GROUND ELEVATION:**

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASS THRU #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
					SAND (SP-SM)		Medium dense, moist, dark brown, poorly graded sand with silt
	102	9		6			
5	100	8		8	(SP-SM)		
10	102	7		11	(SP-SM)		
15	98	14		13	SILT (ML)		Firm, moist, brown, sandy silt
20	101	10		14	(ML)		
							End of Boring @ 21 feet No water
25							
30							

LOG OF BORING

JOB NAME: Andre Ohanian JOB No. 05-333-02

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FIGURE NO : I-5

MAJOR DIVISIONS			GROUP SYMBOLS		TYPICAL NAME
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)		GW	Well graded gravels, gravel - Sand mixtures, little or no fines.
				GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amt. of fines)		GM	Silty gravels, gravel-sand-silt mixtures.
				GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size)	CLEAN SANDS (Little or no fines)		SW	Well graded sands, gravelly sands, little or no fines.
				SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amt. 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	Organic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
				CL	Organic clay 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	Organic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
				CH	Organic clays of high plasticity, fat clays.
				OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS				Pt	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

SILT OR CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

NO. 200 NO. 40 NO. 10 NO. 4 3/4 in. 3 in. (12 in.)

U. S. STANDARD SIEVE SIZE

UNIFIED SOIL CLASSIFICATION SYSTEM

JOB NAME: Mr. Andre Ohanian

JOB No. 05-333-02

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FIGURE No. I-6

APPENDIX II

LABORATORY TESTING PROCEDURES

MOISTURE DENSITY

The moisture-density information provides a summary of soil consistency for each stratum and can also provide a correlation between soils found on this site and other nearby sites. The dry unit weight and field moisture content were determined for each undisturbed sample, and the results are shown on the log of exploratory borings.

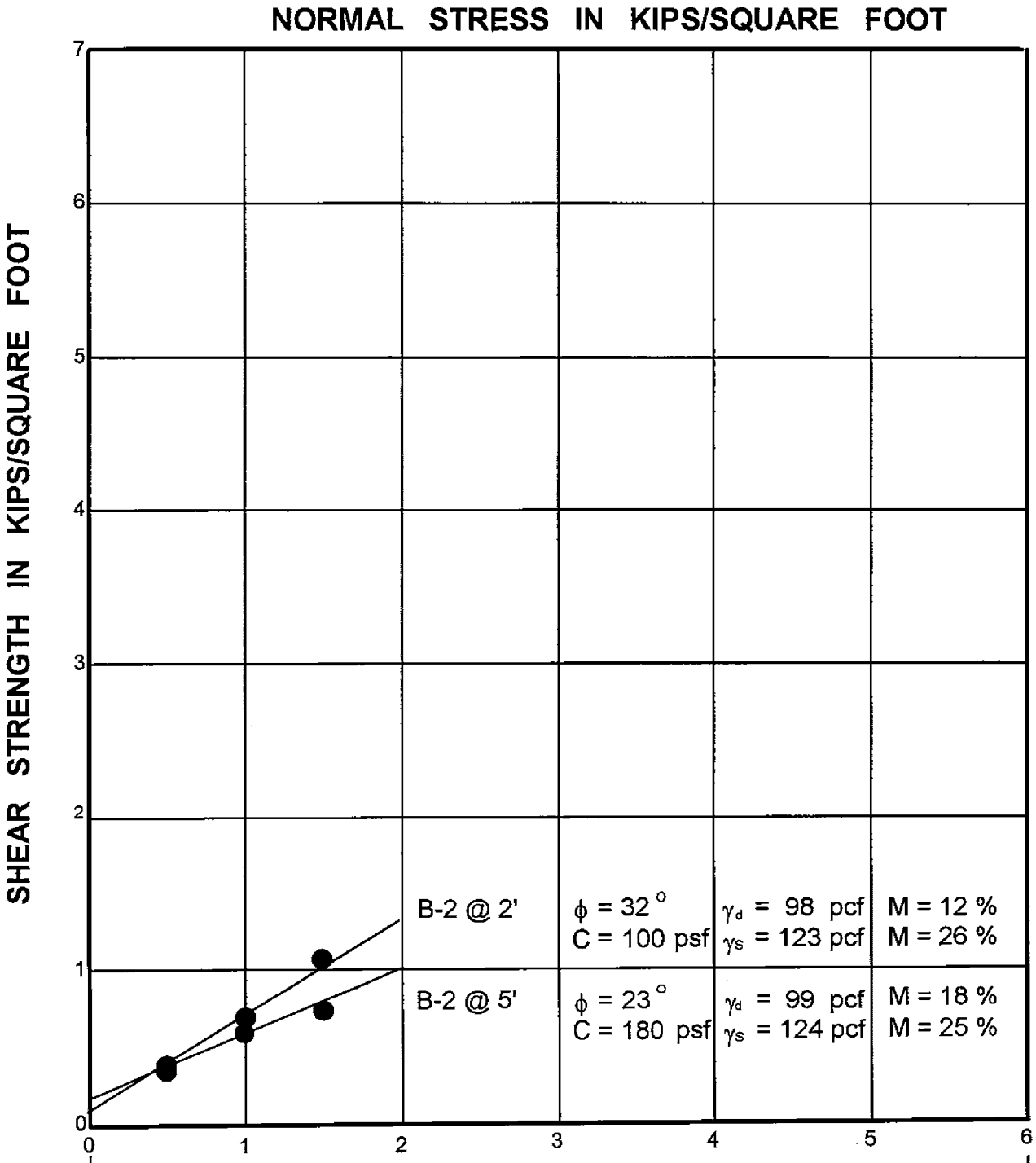
SHEAR TESTS

Shear tests were made with a direct shear machine at a constant rate of strain. The machine is designed to test the soil without completely removing the samples from the brass rings. A range of normal stresses were applied vertically, and the shear strength was progressively determined at each load in order to determine the internal angle of friction and the cohesion. The results of direct shear tests are presented on Figure No. II-1 within this Appendix.

CONSOLIDATION

The apparatus used for the consolidation tests is designed to receive the undisturbed brass ring of soil as it comes from the field. Loads were applied to the test specimen in several increments, and the resulting deformations were recorded at selected time intervals. Porous stones were placed in contact with the top and bottom of the specimen to permit the ready addition or release of water.

Undisturbed specimens were tested at the field and added water conditions. The test results are shown on Figure No. II-2 within this Appendix.



DIRECT SHEAR TESTS

JOB NAME: Mr. Andre Ohanian

JOB NO. 05-333-02

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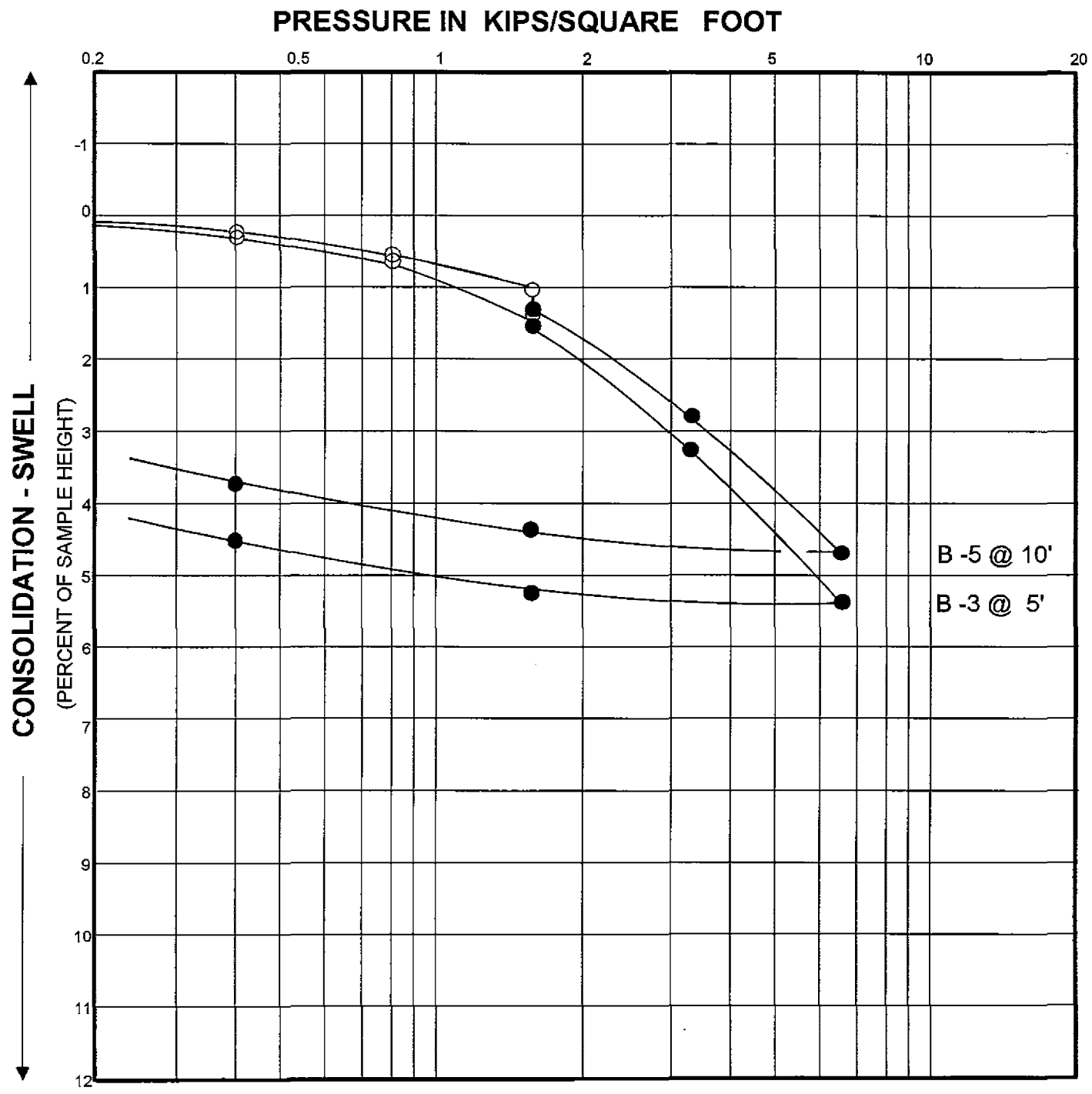
FIGURE NO. II-1



○ FIELD MOISTURE ● WATER ADDED

SWELL-CONSOLIDATION TESTS

JOB NAME: Mr. Andre Ohanian JOB NO. 05-333-02

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FIGURE NO. II-2

APPENDIX III

RESULTS OF CHEMICAL TESTING

BY

AMERICAN ENVIRONMENTAL TESTING LABORATORY, INC.

American Environmental Testing Laboratory Inc.

2834 North Naomi Street Burbank, CA 91504 • DOHS NO: 1541, LACSD NO: 10181
Tel: (888) 288-AETL • (818) 845-8200 • Fax: (818) 845-8840 • www.aetlab.com

ANALYTICAL RESULTS

Ordered By

Applied Earth Science
4742 San Fernando Road
Glendale, CA 91204-

Site

941 California Street
Redlands, CA

Telephone: (818)552-6000
Attn: Caro J. Minas

Page: 2

Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (8021B), Aromatic Volatiles by GC

QC Batch No: 030205

Our Lab I.D.			Method Blank	32568.01	32568.03	32568.06	32568.08
Client Sample I.D.				B1@25'	B1@35'	B2@30'	B2@40'
Date Sampled				02/28/2005	02/28/2005	02/28/2005	02/28/2005
Date Prepared			03/02/2005	03/02/2005	03/02/2005	03/02/2005	03/02/2005
Preparation Method			5030B	5030B	5030B	5030B	5030B
Date Analyzed			03/02/2005	03/02/2005	03/02/2005	03/02/2005	03/02/2005
Matrix			Soil	Soil	Soil	Soil	Soil
Units			ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Dilution Factor			1	1	1	1	1
Analytes	**MDL**	**PQL**	**Results**	**Results**	**Results**	**Results**	**Results**
Benzene	2.5	5.0	ND	ND	ND	ND	ND
Ethylbenzene	2.5	5.0	ND	ND	ND	ND	ND
Toluene (Methyl benzene)	2.5	5.0	ND	ND	ND	ND	ND
Xylenes (Total)	5.0	10.0	ND	ND	ND	ND	ND
Our Lab I.D.				32568.01	32568.03	32568.06	32568.08
Surrogates	**%Rec.Limit**		**% Rec.**	**% Rec.**	**% Rec.**	**% Rec.**	**% Rec.**
Bromofluorobenzene	75-125		95	112	114	95	114
Trifluorotoluene	75-125		95	111	115	95	113

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Page: 3

Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (M8015D), TPH as Diesel and Heavy Hydrocarbons Using GC/FID

QC Batch No: 030205

Our Lab I.D.			Method Blank	32568.02	32568.04	32568.05	32568.07
Client Sample I.D.				B1@30'	B1@40'	B2@25'	B2@35'
Date Sampled				02/28/2005	02/28/2005	02/28/2005	02/28/2005
Date Prepared			03/02/2005	03/02/2005	03/02/2005	03/02/2005	03/02/2005
Preparation Method			3550B	3550B	3550B	3550B	3550B
Date Analyzed			03/03/2005	03/03/2005	03/03/2005	03/03/2005	03/03/2005
Matrix			Soil	Soil	Soil	Soil	Soil
Units			mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dilution Factor			1	1	1	1	1
Analytes	**MDL**	**PQL**	**Results**	**Results**	**Results**	**Results**	**Results**
TPH as Diesel (C13-C22)	5.0	10.0	ND	ND	ND	ND	ND
TPH as Heavy Hydrocarbons (C23-C40)	5.0	10.0	ND	ND	ND	ND	ND
TPH Total as Diesel and Heavy HC.C13-C40	5.0	10.0	ND	ND	ND	ND	ND
Our Lab I.D.				32568.02	32568.04	32568.05	32568.07
Surrogates	**%Rec.Limit**		**% Rec.**	**% Rec.**	**% Rec.**	**% Rec.**	**% Rec.**
Chlorobenzene	75-125		92	96	94	99	89

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Page: **4**

Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (M8015G), TPH as Gasoline and Light Hydrocarbons Using GC/FID

QC Batch No: 030205

Our Lab I.D.			Method Blank	32568.02	32568.04	32568.05	32568.07
Client Sample I.D.				B1@30'	B1@40'	B2@25'	B2@35'
Date Sampled				02/28/2005	02/28/2005	02/28/2005	02/28/2005
Date Prepared			03/02/2005	03/02/2005	03/02/2005	03/02/2005	03/02/2005
Preparation Method			5030B	5030B	5030B	5030B	5030B
Date Analyzed			03/02/2005	03/02/2005	03/02/2005	03/02/2005	03/02/2005
Matrix			Soil	Soil	Soil	Soil	Soil
Units			mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dilution Factor			1	1	1	1	1
Analytes	**MDL**	**PQL**	**Results**	**Results**	**Results**	**Results**	**Results**
TPH as Gasoline and Light HC. (C4-C12)	0.500	1.000	ND	ND	ND	ND	ND
Our Lab I.D.				32568.02	32568.04	32568.05	32568.07
Surrogates	**%Rec.Limit**		**% Rec.**	**% Rec.**	**% Rec.**	**% Rec.**	**% Rec.**
Bromofluorobenzene	75-125		88	89	89	88	90

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Page: 5
Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (8021B), Aromatic Volatiles by GC

QUALITY CONTROL REPORT

QC Batch No: 030205 Sample Spiked: 030205 QC Prepared: 03/02/2005 QC Analyzed: 03/02/2005 Units: ug/Kg

Analytes	Sample Result	MS Concen	MS Recov	MS % REC	MS DUP Concen	MS DUP Recov	MS DUP % REC	RPD %	MS/MSD % Limit	MS RPD % Limit
Benzene	0.0	50.00	41.50 X	83	50.00	41.50 X	83	<1	75-125	<20
Ethylbenzene	0.0	50.00	43.00 X	86	50.00	42.00 X	84	2.4	75-125	<20
Toluene (Methyl benzene)	0.0	50.00	40.50 X	81	50.00	40.00 X	80	1.2	75-125	<20
o-Xylene	0.0	50.00	43.50 X	87	50.00	42.50 X	85	2.3	75-125	<20
m,p-Xylenes	0.0	100.00	77.00 X	77	100.00	75.00 X	75	2.6	75-125	<20

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ANALYTICAL RESULTS

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Page: 6
Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (M8015D), TPH as Diesel and Heavy Hydrocarbons Using GC/FID

QUALITY CONTROL REPORT

QC Batch No: 030205 Sample Spiked: 32568.04 QC Prepared: 03/02/2005 QC Analyzed: 03/02/2005 Units: mg/Kg

Analytes	Sample Result	MS Concen	MS Recov	MS % REC	MS DUP Concen	MS DUP Recov	MS DUP % REC	RPD %	MS/MSD % Limit	MS RPD % Limit
TPH as Diesel (C13-C22)	0.0	500.00	500.00	100	500.00	505.00	101	<1	75-125	<20

QC Batch No: 030205 Sample Spiked: 32568.04 QC Prepared: 03/02/2005 QC Analyzed: 03/02/2005 Units: mg/Kg

Analytes	LCS Concen	LCS Recov	LCS % REC	LCS/LCSD % Limit						
TPH as Diesel (C13-C22)	500.00	510.00	102	75-125						

American Environmental Testing Laboratory Inc.

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ANALYTICAL RESULTS

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Telephone: (818)552-6000
Attn: Caro J. Minas

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Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (M8015G), TPH as Gasoline and Light Hydrocarbons Using GC/FID

QUALITY CONTROL REPORT

QC Batch No: 030205 Sample Spiked: 32576.02 QC Prepared: 03/02/2005 QC Analyzed: 03/02/2005 Units: mg/Kg

Analytes	Sample Result	MS Concen	MS Recov	MS % REC	MS DUP Concen	MS DUP Recov	MS DUP % REC	RPD %	MS/MSD % Limit	MS RPD % Limit
TPH as Gasoline and Light HC. (C4-C12)	0.0	2.50	2.00	80	2.50	2.10	84	4.9	75-125	<20

QC Batch No: 030205 Sample Spiked: 32576.02 QC Prepared: 03/02/2005 QC Analyzed: 03/02/2005 Units: mg/Kg

Analytes	LCS Concen	LCS Recov	LCS % REC	LCS/LCSD % Limit						
TPH as Gasoline and Light HC. (C4-C12)	2.50	2.08	83	75-125						

REPORT OF

GEOTECHNICAL INVESTIGATION

PROPOSED SHOPPING CENTER

941 CALIFORNIA STREET

REDLAND, CALIFORNIA

FOR

MR. ANDRE OHANIAN

PROJECT NO. 05-333-02

APRIL 15, 2005

Applied Earth Sciences GEOTECHNICAL & ENVIRONMENTAL ENGINEERING CONSULTANTS

April 15, 2005 05-333-02

Mr. Andre Ohanian
611 Wilshire Boulevard
Suite 802
Los Angeles, California 90017

Subject: Geotechnical Investigation
Proposed Shopping Center
941 California Street
Redland, California

Dear Mr. Ohanian:

INTRODUCTION

This report presents the results of a geotechnical investigation performed at the subject site. During the course of this investigation, the engineering properties of the subsurface materials were evaluated in order to provide recommendations for design and construction of foundations, grade slabs, and grading. The investigation included subsurface exploration, soil sampling, laboratory testing, engineering evaluation and analysis, consultation and preparation of this report.

The enclosed Site Plan; Drawing No. 1, shows the approximate location of the drilled borings in relation to the site boundaries. The enclosed Site Plan; Drawing No. 1, shows the approximate location of the drilled borings in relation to the site boundaries and the proposed buildings. The attached Appendix I, describes the method of field exploration. Figure Nos. I-1 through I-5 present summaries of the materials encountered at the locations of our borings. Figure No. I-6 presents the Uniform Soil Classification System Chart; a guide to the Log of Exploratory Boring.

The attached Appendix II describes the laboratory testing procedures. Figure Nos. II-1 And II-2 present the results of direct shear and consolidation tests performed on selected undisturbed samples.

Appendix III present the results of chemical testing as received from the offices of American Environmental Testing Laboratory, Inc.

PROJECT CONSIDERATION

It is our understanding that the proposed project would consist of construction of a shopping center at the subject site. The center will consist of two separate structures. Each building will be one or two-story wood frame structure. The flooring system will be in a form of concrete grade slabs established at or near the present grade (no basement is planned).

It is believed that the subject site occurs within a potential flood zone. Therefore, the building pad may need to be raised above the potential flood zone level.

Parking for the proposed facility will be provided in a form of open surface parking. (parking lot).

Structural loading data was not available during the course of our investigation. For the purpose of this study, it is assumed that the magnitude of the collected loads would be on the order of 50 kips, combined dead plus frequently applied live loads. Continuous footings are expected to exert loads of on the order of 2 kips per lineal foot.

SITE GRADING

The grading is expected to involve removal and recompaction of any surficial fill and loose native soils (a maximum thickness of 2 to 3 feet; to be determined by the Soil Engineer). The recompacted soils can then be used to receive new fill for support of foundations and grade slabs. The required grading in the areas of surface parking will be limited to removal and recompaction of the top 12 inches of the existing soils.

The zone of removal should be extended beyond the exterior walls of the proposed buildings a horizontal distance equal to the thickness of fill. The property line footings should be extended through any surficial fill and be established at least 12 inches into native soils.

Note that some 15 percent shrinkage should be considered when reusing the excavated materials in the areas of new fill (to higher densities). Considering this and the planned raise of the site grade above the potential flood zone, imported soils will be required to accomplish the site grading work. All imported soils should be non-expansive and granular in nature (similar to the site upper soils).

SITE CONDITIONS

SURFACE CONDITIONS

The site of the proposed commercial/shopping center is the existing vacant lot located at 941 California Street, Redland, California. The site is triangular in shape and covers a plan area of about 6 acres. See the enclosed Site Plan; Drawing No. 1 for site location.

At the time of our field investigation, the site was vacant and covered with dirt. The site was noted to be generally level.

An existing service station occurs to the northeast of the subject site. An unimproved floor control channel also occurs to the south of the site. See the enclosed Site Plan; Drawing No. 1.

SUBSURFACE CONDITIONS

Correlation of the subsoil between the test borings was considered to be good. Generally, the site, to the depths explored, was found to be covered by surficial fill underlain by natural deposits of silty sand, sandy and/or clayey silt, and relatively clean sand soils. Thickness of the existing fill was found to be less than 12 inches at the location of our borings. Deeper fill, however, may be present between and beyond our borings and closer to the storm drain channel.

The surficial fill and top 2 feet of the site native soils were found to be generally porous and compressible. At their present state, such soils should not be use for support of new fill, structural foundations and grade slabs. The existing fill, however, may be excavated and reused in the areas of compacted fill.

The native soils found below the surficial fill were found to be generally firm in-place. The results of our laboratory testing indicated that the site native soils were of moderate strengths and moderately compressible.

The site upper soils (including the existing fill) were found to be granular in nature. Such soils were found to be virtually non-expansive.

During the course of our field investigation, no groundwater was encountered in our borings drilled to a maximum depth of 51.5 feet. Due to method of drilling, no caving was detected. Due to silty nature of the upper soils, however, forming will not be required during foundation construction.

EVALUATION OF LIQUEFACTION POTENTIAL

As part of our field exploration, one boring was drilled at the subject site to a maximum depth of 51 feet. No groundwater was encountered in our deep borings. For the purpose of evaluating liquefaction potential, SPT (Standard Penetration Test) were conducted from a depth of 15 feet. The results of our in-situ testing indicated that the sand layers below the site were generally dense to very dense in-place (having minimum SPT value of 30). See the Log Of Exploratory Borings in Appendix I. The fine grained (silts and clays) layers with SPT blow counts of less than 30 were found to contain more than 15 percent clay by weight. See the Grain Size Distribution Chart; Figure No. II-3 in the enclosed Appendix II. On this basis, it is our opinion that soil liquefaction will not occur at the subject site.

SEISMIC DESIGN CONSIDERATIONS

The subject site is located within UBC Seismic Zone 4. Based on the results of our field exploration, the subject site can be assumed to have a soil profile type of Sd in accordance with Table 16-J of 1997 Uniform Building Code.

The closest active fault to the subject site is the San Jacinto (San Bernardino) which is designated as Type B seismic source in accordance with CDMG (California Division of Mines and Geology). The subject site occurs some 5 kilometers from this near source zone in accordance with Map M-32 of ICBO (International Conference of Building Officials February 1998). At this distance, for a seismic source B, the near source factors Na and Nv would be 1.0 and 1.3, respectively, in accordance with Tables 16-S and 16-T of the 1997 UBC.

EVALUATION AND RECOMMENDATIONS

GENERAL

Based on the geotechnical engineering data derived from this investigation, the site is considered to be suitable for the proposed development. The surficial fill and top zone of porous native soils (a total thickness of on the order of 2 to 3 feet) should be excavated until non-porous native soils (to be determined by the Soil Engineer) are exposed. The zone of removal should be extended beyond the exterior walls of the proposed building a horizontal distance equal to the thickness of fill.

After proper surface preparation (scarification and compaction in-place to a relative compaction of at least 90 percent at optimum moisture content) the excavated materials should be placed back and compacted, under engineering observation and testing until the proposed finished grades are established.

After proper site grading, conventional spread footing foundation system can be used for support of the proposed structures. The foundation bearing soils are expected to be properly compacted fill soils.

Grade slabs can be supported on the finished grades which will consist of properly compacted fill soils. Due to granular nature, soil expansion will not be an issue at this site. It is recommended, however, that the grade slabs for this project be taken at least 5 inches and be reinforced with # 4 bars placed at every 18 inches on center.

The following sections present our specific recommendations for site grading, foundations, lateral design, grade slabs, minor walls, and observation during construction.

SITE GRADING

All surficial fill the disturbed soils generated from demolition of the existing building/paving should be excavated until native soils are exposed. Prior to placement of any fill on the site, the Soil Engineer should observe the excavation bottoms. The areas to receive compacted fill should be scarified to a depth of about 8 inches, moistened as required to bring to optimum moisture content, and compacted to at least 90 percent of the maximum dry density as determined by the ASTM Designation D 1557-02 Compaction Method.

All import soils should be free of organic matter and rocks larger than 6 inches in diameter. Before import soils are brought to the site, a 40-pound sample of the proposed import soils should be submitted to the Soil Engineer (at least 48 hours in advance) so that the maximum density and expansion character of the import materials can be determined. All fill soils should be placed in layers not exceeding 8 inches in loose thickness and compacted to at least 90 percent of the maximum dry unit weight as determined by ASTM Designation D 1557-02 Compaction Method.

General guidelines regarding site grading are presented below in an itemized form which may be included in the earthwork specification. It is recommended that all fill be placed under engineering observation and in accordance with the following guidelines:

1. All vegetation and debris should be collected and hauled off-site. In the areas of new fill, the existing fill should be excavated until native soils are exposed.

2. The excavated areas should be observed and approved by the Soil Engineer prior to placing any fill.

3. The excavated materials from the site are considered to be satisfactory for reuse in the compacted fill areas. Due to potentially expansive character, it would be desirable to use the site soils in deeper fill areas.

4. Fill material, approved by the Soil Engineer, should be placed in controlled layers. Each layer should be compacted to at least 90 percent of the maximum unit weight as determined by ASTM designation D 1557- 02 for the material used.

5. The fill material shall be placed in layers which, when compacted, shall not exceed 8 inches per layer. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to insure uniformity of material in each layer.

6. When moisture content of the fill material is too low to obtain adequate compaction, water shall be added and thoroughly dispersed until the moisture content is near optimum.

7. When the moisture content of the fill material is too high to obtain adequate compaction, the fill material shall be aerated by blading or other satisfactory methods until near optimum moisture condition is achieved.

8. Inspection and field density tests should be conducted by the Soil Engineer during grading work to assure that adequate compaction is attained. Where compaction of less than 90 percent is indicated, additional compactive effort should be made with adjustment of the moisture content or layer thickness, as necessary, until at least 90 percent compaction is obtained.

SITE DRAINAGE

Site drainage should be provided to divert roof and surface waters from the property through nonerodible drainage devices to the street. In no case should the surface waters be allowed to pond adjacent to building or behind the retaining walls. A minimum slope of one and two percent is recommended for paved and unpaved areas, respectively.

FOUNDATIONS

Conventional spread footing foundation systems on firm native and/or properly compacted fill soils are expected to provide adequate support for the proposed building. Exterior and interior footings should be a minimum of 12 inches wide and should be placed at a minimum depth of 24 inches below the lowest adjacent final grades.

Properly designed and constructed spread footings may be based on an allowable maximum bearing pressure of 1,800 pounds per square foot. This value can be increased at a rate of 100 and 200 pounds per square foot for each additional foot of footing width and depth, to a maximum value of 2,400 pounds per square foot. The footings for this project should be connected in both directions using tie beams.

The above given values are for the total of dead and frequently applied live loads. For short duration transient loading, such as wind or seismic forces, these values may be increased by one-third.

Under the allowable maximum soil pressure, footings carrying the assumed maximum concentrated loads of 50 kips is expected to settle on the order of 3/4 of an inch. Continuous footings, with loads of about 2 kips per lineal foot are expected to settle on the order of 1/2 of an inch. Maximum differential settlements are expected to be on the order of 1/4 of an inch. Major portion of the settlements are expected to occur during construction.

LATERAL DESIGN

Lateral resistance at the base of footings in contact with native soils may be assumed to be the product of the dead load forces and a coefficient of friction of 0.3. Passive pressure on the face of footings may also be used to resist lateral forces. A passive pressure of zero at the ground surface and increasing at a rate of 200 pounds per square foot per foot of depth to a maximum value of 1,750 pounds per square foot may be used for footings poured against native and/or properly compacted fill soils.

GRADE SLABS

Assuming that site grading will be made in accordance with the recommendations in the preceding sections, grade slabs can be supported on the finished grades which will consist of properly compacted fill soils. Due to granular nature, soil expansion will not be an issue at this site. It is recommended, however, that the grade slabs for this project be taken at least 5 inches and be reinforced with # 4 bars placed at every 18 inches on center.

In the areas where moisture sensitive floor covering is used and slab dampness cannot be tolerated, a vapor-barrier should be used beneath the slabs. This normally consists of a 6-mil polyethylene film covered with 2 inches of clean sand.

RETAINING WALLS

Static design of minor retaining walls may be based on an equivalent fluid pressure of 40 pounds per square foot per foot of depth. This assumes that no hydrostatic pressure will occur behind the walls. Hydrostatic pressures should be relieved from the back of the retaining walls through properly designed and constructed subdrain. This normally consists of 4-inch in diameter perforated pipes encased in free draining gravel (at least one cubic foot per lineal foot of the pipe). To reduce the chances of siltation, an approved filter fabric should be used around the gravel.

Uniform surcharge effects may be computed using a coefficient of 0.30 times the uniform loads. For allowable vertical and lateral pressures refer to the preceding sections.

OBSERVATION DURING CONSTRUCTION

The presented recommendations in this report assume that all structural foundations will be established in native and/or properly compacted fill soils. All footing excavations should be observed by a representative of this office before reinforcing is placed.

All site grading work should be observed and tested by a representative of this office. Please notify this office at least 24 hours before any observation work is required.

CLOSURE

The findings and recommendations presented in this report were based on the results of our field and laboratory investigations combined with professional engineering experience and judgment. The report was prepared in accordance with generally accepted engineering principles and practice. We make no other warranty, either express or implied.

It is noted that the conclusions and recommendations presented are based on exploration "window" borings and excavations which is in conformance with accepted engineering practice. Some variations of subsurface conditions are common between "windows" and major variations are possible.

-o0o-

The following Figures and Appendices are attached and complete this report:

Site Plan - Drawing No. 1

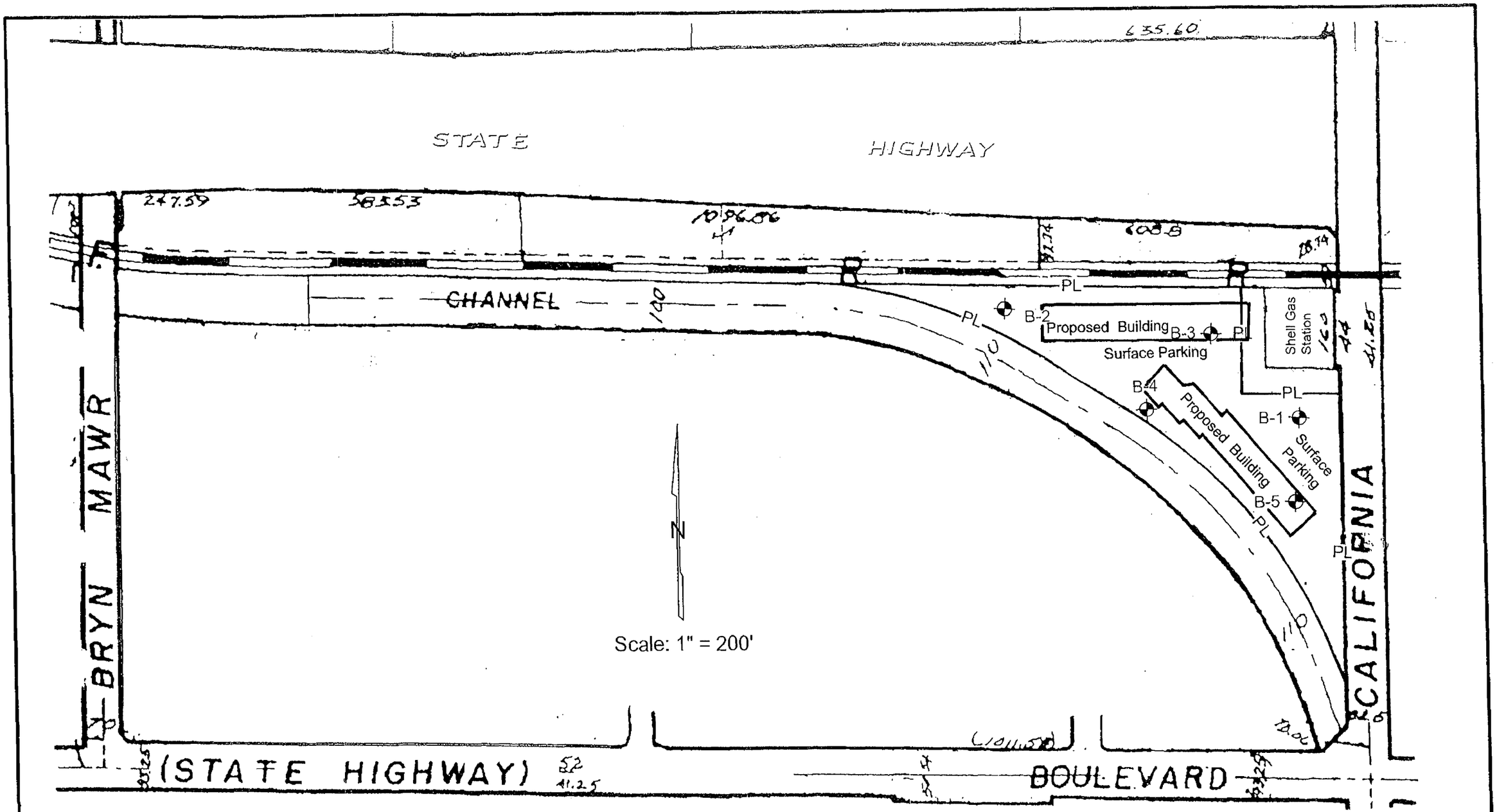
Appendix I-Method of Field Exploration
Figure Nos. I-1 through I-6
Appendix II-Methods of Laboratory Testing
Figure Nos. II-1 and II-2
Grain Size Distribution Chart - Figure No. III
Appendix III - Results Of Chemical Testing

Respectfully submitted,

Applied Earth Sciences

Caro J. Minas
Geotechnical Engineer
GE 601

CJM/mg



Scale: 1" = 200'

SITE PLAN

Proposed Shopping Center

941 California Street, Redland, California

FOR. Mr. Andre Ohanian	DATE 4/15/2005	PROJECT No.	05-333-02
APPLIED EARTH SCIENCES GEOTECHAL ENGINEERING CONSULTANTS		DRAWING No.	1

APPENDIX I

METHOD OF FIELD EXPLORATION

In order to define subsurface conditions, five borings were drilled on the site. The approximate locations of the drilled borings are shown on the enclosed Site Plan. The borings were extended to a maximum depth of 51.5 feet below the existing grade. The borings were drilled using a hollow stem drilling machine.

Logs of the subsurface materials, as encountered in the borings, were recorded in the field and are presented Figure Nos. I-1 and I-2 within Appendix I. These figures also show the number and approximate depths of each of the recovered soil and rock samples.

Relatively undisturbed samples of the subsoil were obtained by driving a steel sampler with successive drops of a 140-pound sampling hammer free-falling a vertical distance of about 30 inches. The number of blows required for one foot of sampler penetration was recorded at the time of drilling and are shown on the log of exploratory borings. The relatively undisturbed soil samples were retained in brass liner rings 2.5 inches in diameter and 1.0 inch in height.

Field investigation for this project was performed on February 26, 2005. The material excavated from the borings was placed back and compacted upon completion of the field work. Such material may settle. The owner should periodically inspect these areas and notify this office if the settlement creates a hazard to persons or property.

BORING No. 1

DATE EXCAVATED: 02/26/05

GROUND ELEVATION:

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASS THRU #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
					SAND (SP-SM)		Medium dense, moist, brown, poorly graded sand with silt
5	98	13		5	SILT (ML)		Firm, moist, olive brown, silt with sand
10	99	13		7	(ML)		
15	94	21	71.1	10 (SPT)	(ML)		Grades to clayey
20	117	6	25.3	30 (SPT)	SAND (SM)		Dense, very moist, olive brown, silty sand
25	101	4	19.5	17 (SPT)	(SM)		Grades to clayey
30	104	15	65.7	22 (SPT)	SILT (ML)		Stiff, moist, grayish brown, sandy silt, slightly clayey

LOG OF BORING

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JOB No. 05-333-02

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FIGURE NO : I-1.1

BORING No. 1 (CONTINUED)

DATE EXCAVATED: 02/26/05

GROUND ELEVATION:

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASSING #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
							Continue (See Previous Page)
35	115	2	11	33 (SPT)	SAND (SP)		Very dense, wet, gray, poorly graded sand
40	113	3	7.9	43 (SPT)	(SW)		Grades to very dense, wet, gray, well graded sand
45	111	10	37.6	55 (SPT)	(SW-SM)		Grades to well graded sand with silt
50	113	3	10.6	54 (SPT)	(SP)		Grades to poorly graded sand
							End of Boring @ 51½ feet No Water

LOG OF BORING

JOB NAME: Andre Ohanian

JOB No. 05-333-02

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FIGURE NO : I-1.2

BORING No. 2

DATE EXCAVATED: 02/26/05

GROUND ELEVATION:

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASS THRU #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
					SAND (SP-SM)		Medium dense, moist, brown, poorly graded sand with silt
	98	12		6			
5							
	99	18		9	SILT (ML)		Firm, very moist, olive brown, silt with sand
10							
	96	17		10	(ML)		
15							
	95	21		11	(ML)		
20							
	96	8		25	SAND (SP)		Medium dense, moist, brown, poorly graded sand
25							
	94	24		17	SILT (ML)		Firm, moist, brown, silt with sand
30							
	100	20	57.5	30 (SPT)	(ML)		Grades to stiff, grayish brown, sandy silt

LOG OF BORING

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JOB No. 05-333-02

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FIGURE NO : I-2.1

BORING No. 2 (CONTINUED)

DATE EXCAVATED: 02/26/05

GROUND ELEVATION:

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASSING #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
							Continue (See Previous Page)
35	104	20	48	32 (SPT)	(ML)		
40	126	9	18.5	34 (SPT)	SAND (SP-SM)		Dense, moist, olive brown, poorly graded sand with silt
45	110	4	11.4	38 (SPT)	(SP)		Grades to poorly graded sand
50	111	5	9.1	41 (SPT)	(SP)		End of Boring @ 51½ feet No Water

LOG OF BORING

JOB NAME: Andre Ohanian

JOB No. 05-333-02

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FIGURE NO : I-2.2

BORING No. 3

DATE EXCAVATED: 02/26/05 **GROUND ELEVATION:**

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASS THRU #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
					SAND (SP-SM)		Medium dense, moist, dark brown, poorly graded sand with silt
	99	12		6			
5							
	100	12		11	SILT (ML)		Firm, moist, light brown, sandy silt
10							
	101	11		14	(ML)		
15							
	103	3		15	SAND (SP)		Medium dense, moist, grayish brown, poorly graded sand
20							
	102	10		18	(SP-SM)		Grades to poorly graded sand with silt
							End of Boring @ 21 feet No water
25							
30							

LOG OF BORING

JOB NAME: Andre Ohanian JOB No. 05-333-02

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FIGURE NO : I-3

BORING No. 4

DATE EXCAVATED: 02/26/05

GROUND ELEVATION:

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASS THRU #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
0					SAND (SP-SM)		Medium dense, moist, dark brown, poorly graded sand with silt
	99	12		6			
5	98	11		11	SILT (ML)		Firm, moist, brown, sandy silt
10	97	13		14	(ML)		
15	100	3		15	SAND (SP)		Medium dense, moist, grayish brown, poorly graded sand
20	101	4		18	(SP)		
							End of Boring @ 21 feet No water
25							
30							

LOG OF BORING

JOB NAME: Andre Ohanian

JOB No. 05-333-02

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FIGURE NO : I-4

BORING No. 5

DATE EXCAVATED: 02/26/05 **GROUND ELEVATION:**

DEPTH IN FEET	DRY DENSITY (PCF)	FIELD MOISTURE (%DRY WEIGHT)	% PASS THRU #200	BLOWS PER FOOT	MATERIAL TYPE	MATERIAL SYMBOL	MATERIAL DESCRIPTION
					SAND (SP-SM)		Medium dense, moist, dark brown, poorly graded sand with silt
	102	9		6			
5	100	8		8	(SP-SM)		
10	102	7		11	(SP-SM)		
15	98	14		13	SILT (ML)		Firm, moist, brown, sandy silt
20	101	10		14	(ML)		
							End of Boring @ 21 feet No water
25							
30							

LOG OF BORING

JOB NAME: Andre Ohanian JOB No. 05-333-02

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FIGURE NO : I-5

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAME
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravels, gravel - Sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amt. of fines)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size)	CLEAN SANDS (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amt. 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	Organic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Organic clay 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	Organic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Organic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

SILT OR CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

NO. 200 NO. 40 NO. 10 NO. 4 3/4 in. 3 in. (12 in.)

U. S. STANDARD SIEVE SIZE

UNIFIED SOIL CLASSIFICATION SYSTEM

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JOB No. 05-333-02

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FIGURE No. I-6

APPENDIX II

LABORATORY TESTING PROCEDURES

MOISTURE DENSITY

The moisture-density information provides a summary of soil consistency for each stratum and can also provide a correlation between soils found on this site and other nearby sites. The dry unit weight and field moisture content were determined for each undisturbed sample, and the results are shown on the log of exploratory borings.

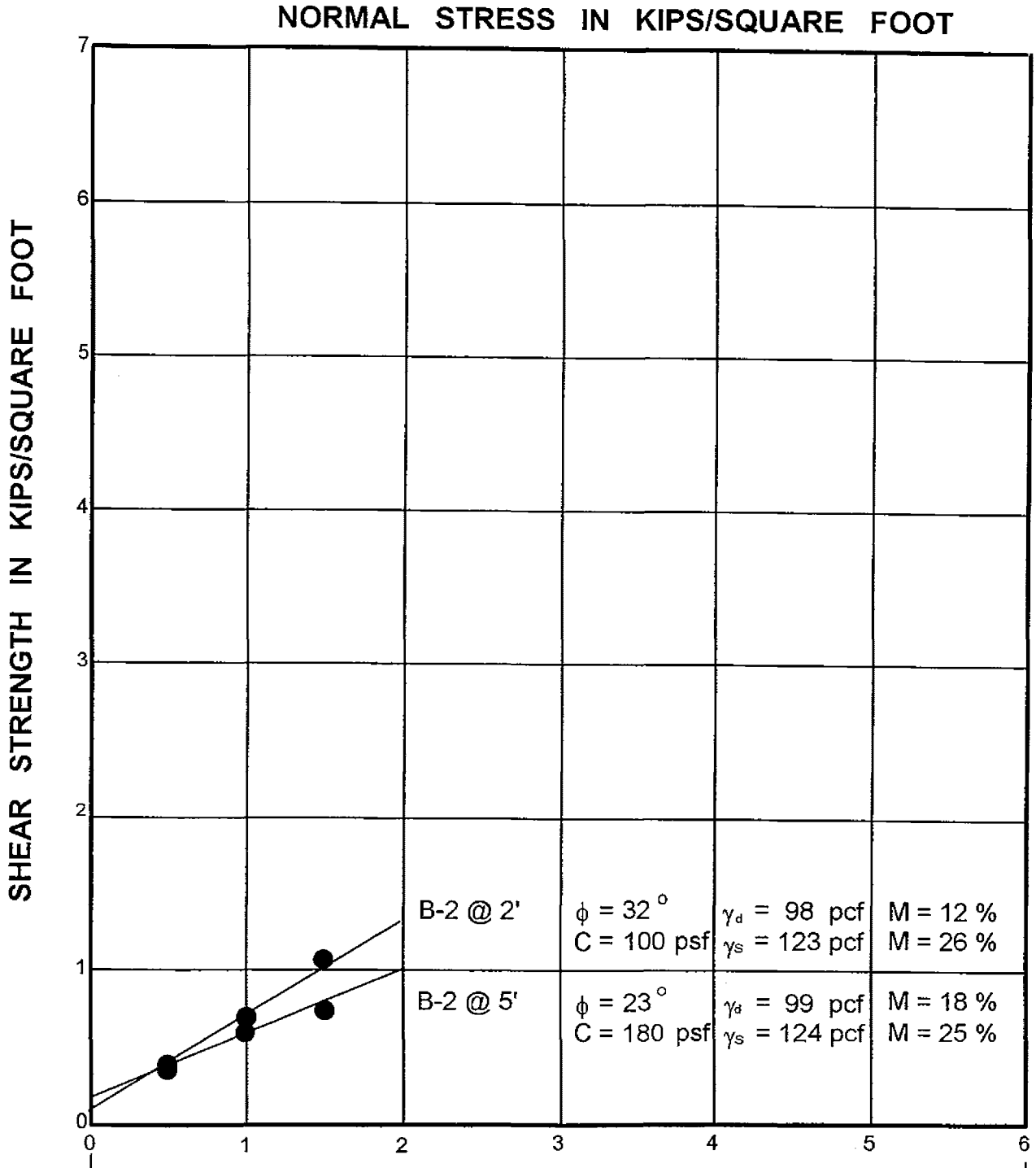
SHEAR TESTS

Shear tests were made with a direct shear machine at a constant rate of strain. The machine is designed to test the soil without completely removing the samples from the brass rings. A range of normal stresses were applied vertically, and the shear strength was progressively determined at each load in order to determine the internal angle of friction and the cohesion. The results of direct shear tests are presented on Figure No. II-1 within this Appendix.

CONSOLIDATION

The apparatus used for the consolidation tests is designed to receive the undisturbed brass ring of soil as it comes from the field. Loads were applied to the test specimen in several increments, and the resulting deformations were recorded at selected time intervals. Porous stones were placed in contact with the top and bottom of the specimen to permit the ready addition or release of water.

Undisturbed specimens were tested at the field and added water conditions. The test results are shown on Figure No. II-2 within this Appendix.



DIRECT SHEAR TESTS

JOB NAME: Mr. Andre Ohanian

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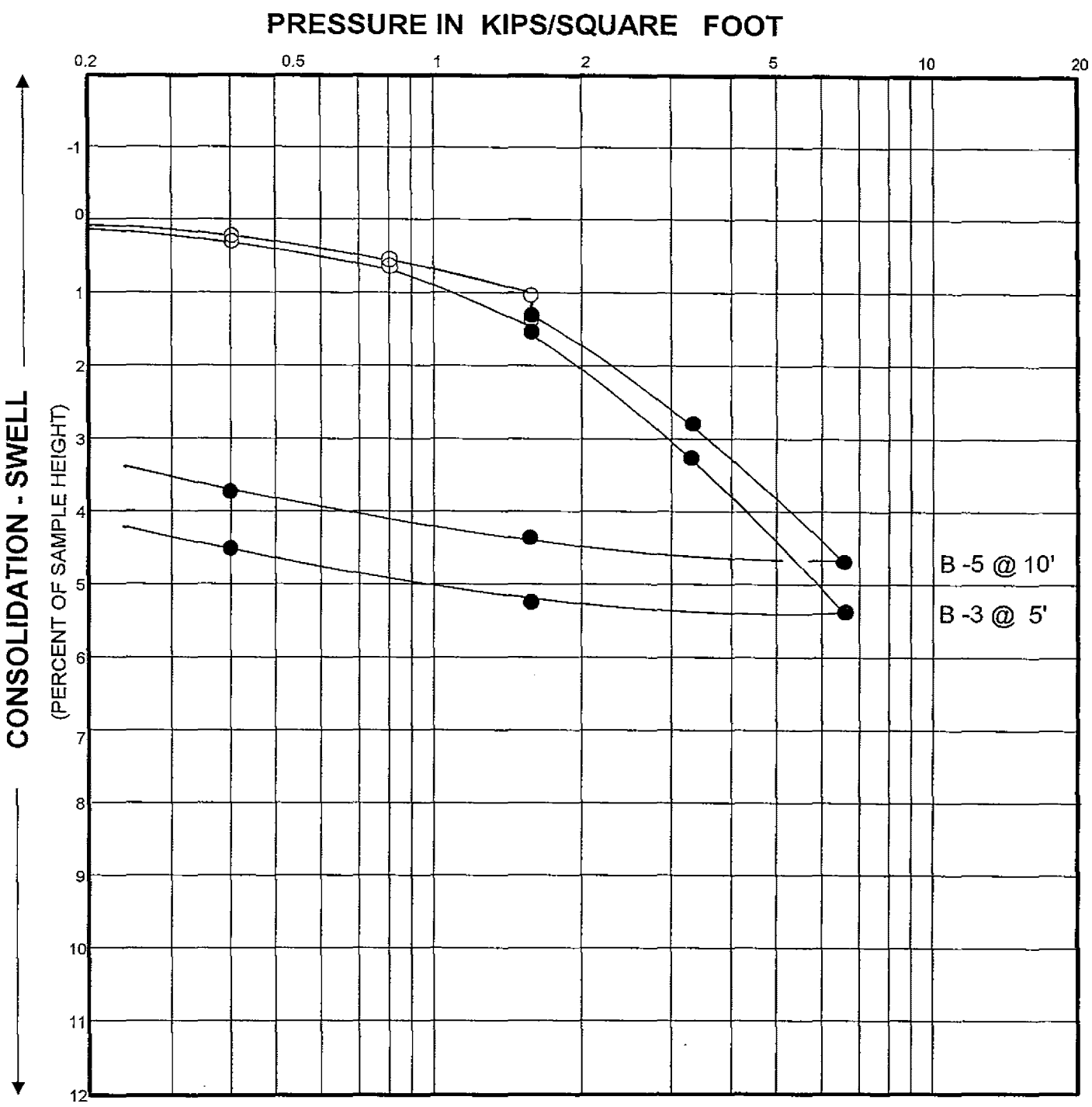
FIGURE NO. II-1



○ FIELD MOISTURE ● WATER ADDED

SWELL-CONSOLIDATION TESTS

JOB NAME: Mr. Andre Ohanian JOB NO. 05-333-02

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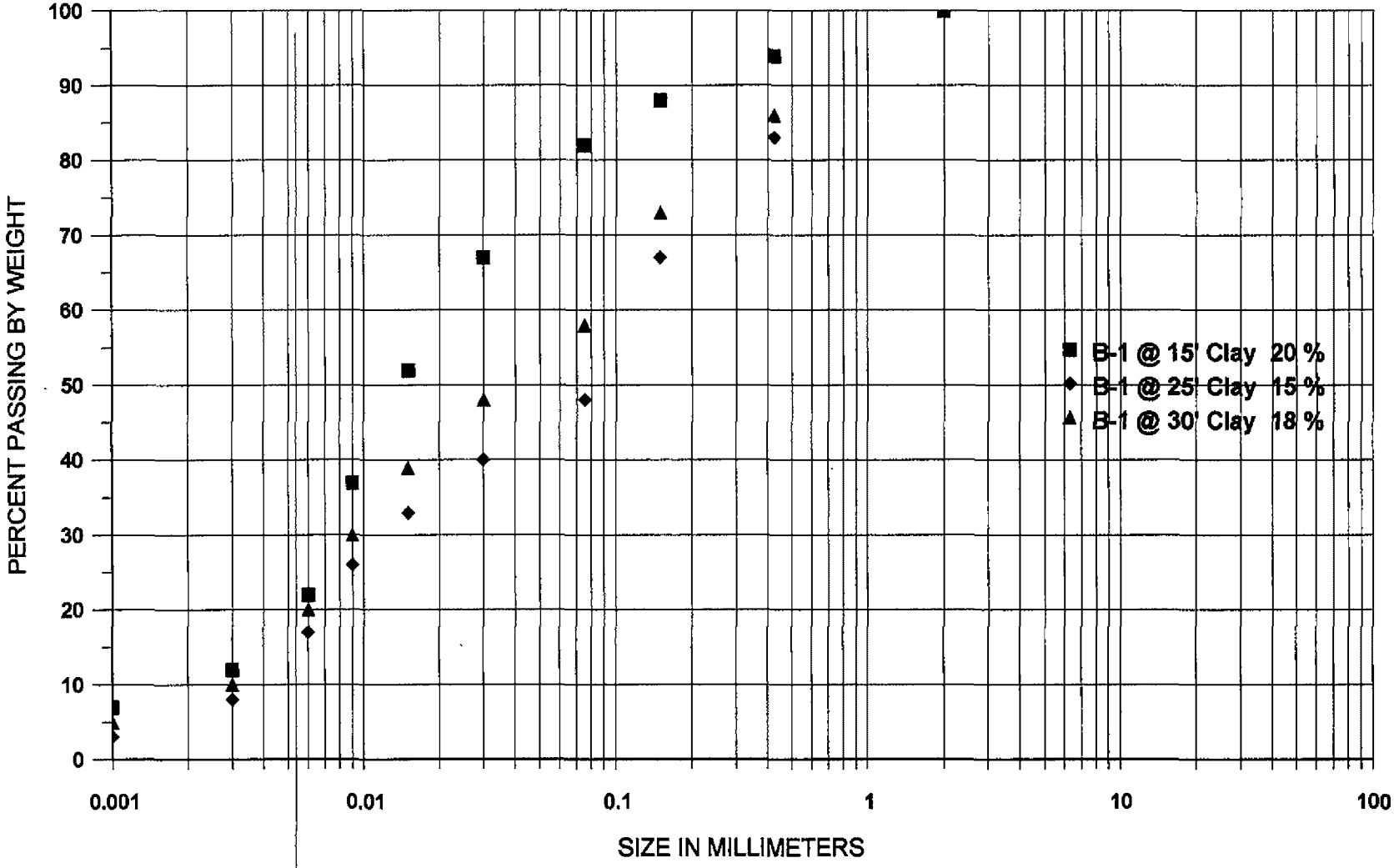
FIGURE NO. II-2

Grain Size Distribution Chart



CLAY	SILT	SAND			GRAVEL			
		FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLE

Project Name: **Mr. Andre Ohanian** Date: **04/12/05** Project No. **05-333-02**

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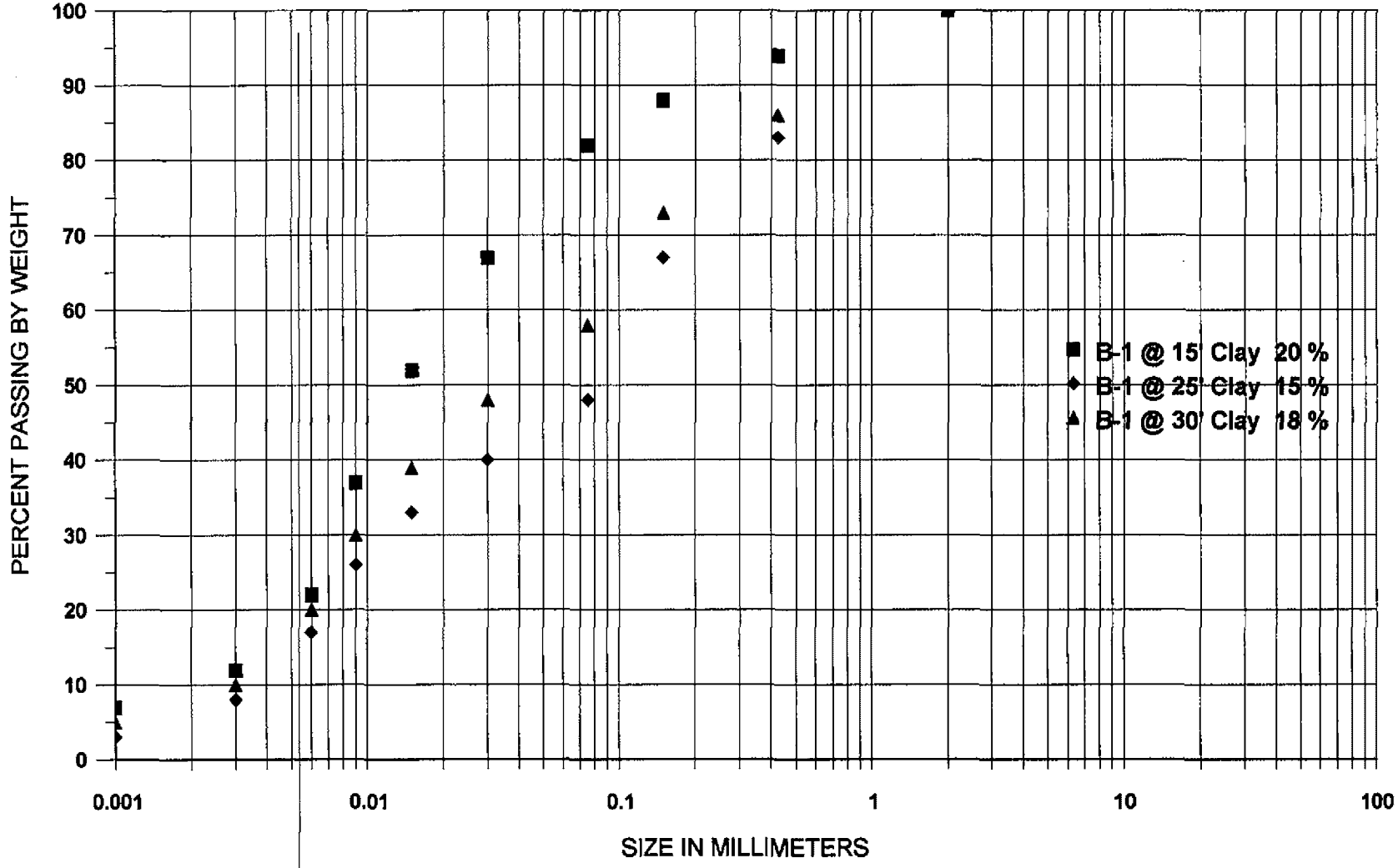
FIGURE No. II-3

Grain Size Distribution Chart



CLAY	SILT	SAND			GRAVEL			COBBLE
		FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	

Project Name: **Mr. Andre Ohanian** Date: **04/12/05** Project No. 05-333-02

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FIGURE No. II-3

APPENDIX III

RESULTS OF CHEMICAL TESTING

BY

AMERICAN ENVIRONMENTAL TESTING LABORATORY, INC.

American Environmental Testing Laboratory Inc.
2834 North Naomi Street Burbank, CA 91504 • DOHS NO: 1541, LACSD NO: 10181
Tel: (888) 288-AETL • (818) 845-8200 • Fax: (818) 845-8840 • www.aetlab.com

ANALYTICAL RESULTS

Ordered By

Applied Earth Science
4742 San Fernando Road
Glendale, CA 91204-

Site

941 California Street
Redlands, CA

Telephone: (818)552-6000
Attn: Caro J. Minas

Page: 2

Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (8021B), Aromatic Volatiles by GC

QC Batch No: 030205

Our Lab I.D.			Method Blank	32568.01	32568.03	32568.06	32568.08
Client Sample I.D.				B1@25'	B1@35'	B2@30'	B2@40'
Date Sampled				02/28/2005	02/28/2005	02/28/2005	02/28/2005
Date Prepared			03/02/2005	03/02/2005	03/02/2005	03/02/2005	03/02/2005
Preparation Method			5030B	5030B	5030B	5030B	5030B
Date Analyzed			03/02/2005	03/02/2005	03/02/2005	03/02/2005	03/02/2005
Matrix			Soil	Soil	Soil	Soil	Soil
Units			ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Dilution Factor			1	1	1	1	1
Analytes	**MDL**	**PQL**	**Results**	**Results**	**Results**	**Results**	**Results**
Benzene	2.5	5.0	ND	ND	ND	ND	ND
Ethylbenzene	2.5	5.0	ND	ND	ND	ND	ND
Toluene (Methyl benzene)	2.5	5.0	ND	ND	ND	ND	ND
Xylenes (Total)	5.0	10.0	ND	ND	ND	ND	ND
Our Lab I.D.				32568.01	32568.03	32568.06	32568.08
Surrogates	**%Rec. Limit**		**% Rec.**	**% Rec.**	**% Rec.**	**% Rec.**	**% Rec.**
Bromofluorobenzene	75-125		95	112	114	95	114
Trifluorotoluene	75-125		95	111	115	95	113

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ANALYTICAL RESULTS

Ordered By

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Glendale, CA 91204-

Site

941 California Street
Redlands, CA

Telephone: (818)552-6000
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Page: 3

Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (M8015D), TPH as Diesel and Heavy Hydrocarbons Using GC/FID

QC Batch No: 030205

Our Lab I.D.			Method Blank	**32568.02**	**32568.04**	**32568.05**	**32568.07**
Client Sample I.D.				B1@30'	B1@40'	B2@25'	B2@35'
Date Sampled				02/28/2005	02/28/2005	02/28/2005	02/28/2005
Date Prepared			03/02/2005	03/02/2005	03/02/2005	03/02/2005	03/02/2005
Preparation Method			3550B	3550B	3550B	3550B	3550B
Date Analyzed			03/03/2005	03/03/2005	03/03/2005	03/03/2005	03/03/2005
Matrix			Soil	Soil	Soil	Soil	Soil
Units			mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dilution Factor			1	1	1	1	1
Analytes	**MDL**	**PQL**	**Results**	**Results**	**Results**	**Results**	**Results**
TPH as Diesel (C13-C22)	5.0	10.0	ND	ND	ND	ND	ND
TPH as Heavy Hydrocarbons (C23-C40)	5.0	10.0	ND	ND	ND	ND	ND
TPH Total as Diesel and Heavy HC.C13-C40	5.0	10.0	ND	ND	ND	ND	ND
Our Lab I.D.				**32568.02**	**32568.04**	**32568.05**	**32568.07**
Surrogates	**%Rec.Limit**		**% Rec.**	**% Rec.**	**% Rec.**	**% Rec.**	**% Rec.**
Chlorobenzene	75-125		92	96	94	99	89

Ameri Environmental Testing Laboratory Inc.

2834 North Naomi Street Burbank, CA 91504 • DOHS NO: 1541, LACSD NO: 10181
Tel: (888) 288-AETL • (818) 845-8200 • Fax: (818) 845-8840 • www.aetlab.com

ANALYTICAL RESULTS

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941 California Street
Redlands, CA

Telephone: (818)552-6000
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Page: 4

Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (M8015G), TPH as Gasoline and Light Hydrocarbons Using GC/FID

QC Batch No: 030205

Our Lab I.D.			Method Blank	32568.02	32568.04	32568.05	32568.07
Client Sample I.D.				B1@30'	B1@40'	B2@25'	B2@35'
Date Sampled				02/28/2005	02/28/2005	02/28/2005	02/28/2005
Date Prepared			03/02/2005	03/02/2005	03/02/2005	03/02/2005	03/02/2005
Preparation Method			5030B	5030B	5030B	5030B	5030B
Date Analyzed			03/02/2005	03/02/2005	03/02/2005	03/02/2005	03/02/2005
Matrix			Soil	Soil	Soil	Soil	Soil
Units			mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Dilution Factor			1	1	1	1	1
Analytes	**MDL**	**PQL**	**Results**	**Results**	**Results**	**Results**	**Results**
TPH as Gasoline and Light HC. (C4-C12)	0.500	1.000	ND	ND	ND	ND	ND
Our Lab I.D.				**32568.02**	**32568.04**	**32568.05**	**32568.07**
Surrogates	**%Rec.Limit**		**% Rec.**	**% Rec.**	**% Rec.**	**% Rec.**	**% Rec.**
Bromofluorobenzene	75-125		88	89	89	88	90

Ameri_ Environmental Testing Lab[illegible]lory Inc.

2834 North Naomi Street Burbank, CA 91504 • DOHS NO: 1541, LACSD NO: 10181
Tel: (888) 288-AETL • (818) 845-8200 • Fax: (818) 845-8840 • www.aetlab.com

ANALYTICAL RESULTS

Ordered By

Applied Earth Science
4742 San Fernando Road
Glendale, CA 91204-

Site

941 California Street
Redlands, CA

Telephone: (818)552-6000
Attn: Caro J. Minas

Page: 5
Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (8021B), Aromatic Volatiles by GC

QUALITY CONTROL REPORT

QC Batch No: 030205 Sample Spiked: 030205 QC Prepared: 03/02/2005 QC Analyzed: 03/02/2005 Units: ug/Kg

Analytes	Sample Result	MS Concen	MS Recov	MS % REC	MS DUP Concen	MS DUP Recov	MS DUP % REC	RPD %	MS/MSD % Limit	MS RPD % Limit
Benzene	0.0	50.00	41.50 X	83	50.00	41.50 X	83	<1	75-125	<20
Ethylbenzene	0.0	50.00	43.00 X	86	50.00	42.00 X	84	2.4	75-125	<20
Toluene (Methyl benzene)	0.0	50.00	40.50 X	81	50.00	40.00 X	80	1.2	75-125	<20
o-Xylene	0.0	50.00	43.50 X	87	50.00	42.50 X	85	2.3	75-125	<20
m,p-Xylenes	0.0	100.00	77.00 X	77	100.00	75.00 X	75	2.6	75-125	<20

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ANALYTICAL RESULTS

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Telephone: (818)552-6000
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Page: 6
Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (M8015D), TPH as Diesel and Heavy Hydrocarbons Using GC/FID

QUALITY CONTROL REPORT

QC Batch No: 030205 Sample Spiked: 32568.04 QC Prepared: 03/02/2005 QC Analyzed: 03/02/2005 Units: mg/Kg

Analytes	Sample Result	MS Concen	MS Recov	MS % REC	MS DUP Concen	MS DUP Recov	MS DUP % REC	RPD %	MS/MSD % Limit	MS RPD % Limit
TPH as Diesel (C13-C22)	0.0	500.00	500.00	100	500.00	505.00	101	<1	75-125	<20

QC Batch No: 030205 Sample Spiked: 32568.04 QC Prepared: 03/02/2005 QC Analyzed: 03/02/2005 Units: mg/Kg

Analytes	LCS Concen	LCS Recov	LCS % REC	LCS/LCSD % Limit						
TPH as Diesel (C13-C22)	500.00	510.00	102	75-125						

American Environmental Testing Laboratory Inc.
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ANALYTICAL RESULTS

Ordered By

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Glendale, CA 91204-

Site

941 California Street
Redlands, CA

Telephone: (818)552-6000
Attn: Caro J. Minas

Page: 7
Project ID: 05-333-02
Project Name: 941 California Street

AETL Job Number	Submitted	Client
32568	03/01/2005	APPES

Method: (M8015G), TPH as Gasoline and Light Hydrocarbons Using GC/FID

QUALITY CONTROL REPORT

QC Batch No: 030205 Sample Spiked: 32576.02 QC Prepared: 03/02/2005 QC Analyzed: 03/02/2005 Units: mg/Kg

Analytes	Sample Result	MS Concen	MS Recov	MS % REC	MS DUP Concen	MS DUP Recov	MS DUP % REC	RPD %	MS/MSD % Limit	MS RPD % Limit
TPH as Gasoline and Light HC. (C4-C12)	0.0	2.50	2.00	80	2.50	2.10	84	4.9	75-125	<20

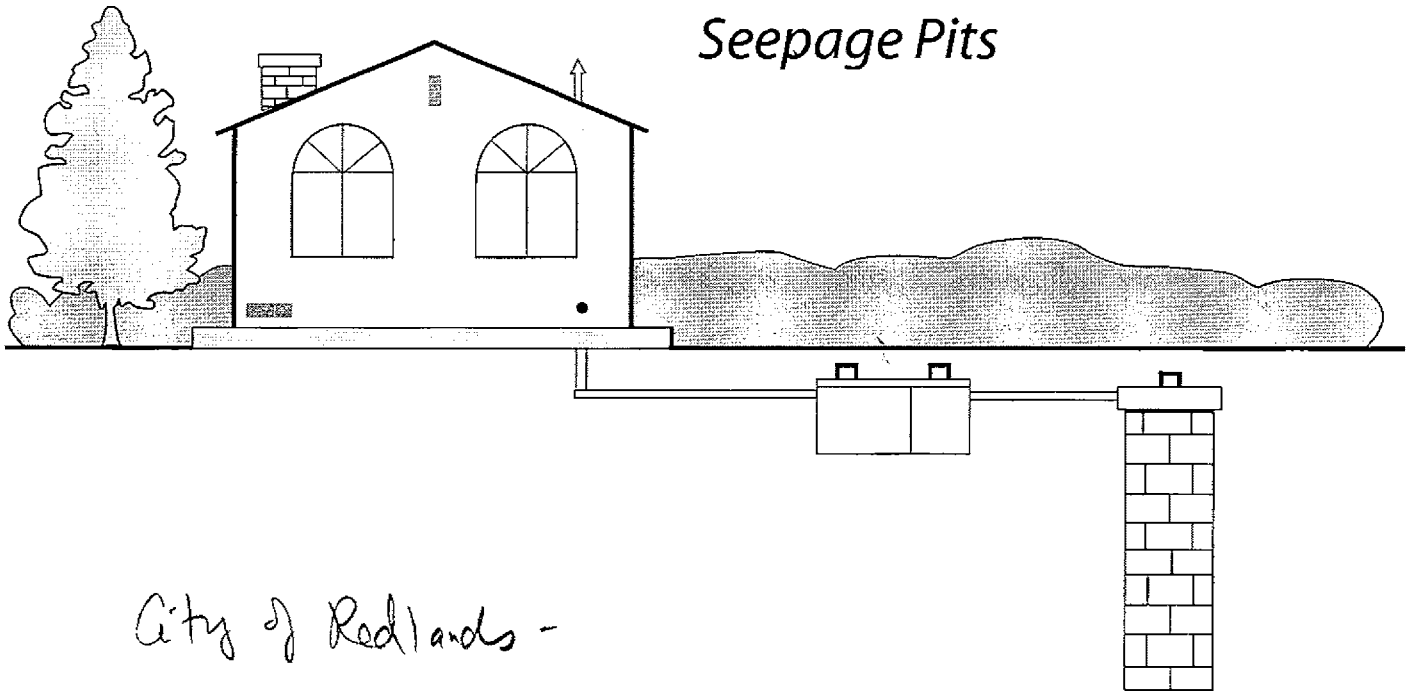
QC Batch No: 030205 Sample Spiked: 32576.02 QC Prepared: 03/02/2005 QC Analyzed: 03/02/2005 Units: mg/Kg

Analytes	LCS Concen	LCS Recov	LCS % REC	LCS/LCSD % Limit						
TPH as Gasoline and Light HC. (C4-C12)	2.50	2.08	83	75-125						

Corwin Porter

On-Site Waste Water Disposal System

Soil Percolation (PERC) Test Report Standards: *Suitability of Lots and Soils for Use of Leachlines or Seepage Pits*



City of Redlands -

DEHS

County of San Bernardino Department of Public Health
DIVISION OF ENVIRONMENTAL HEALTH SERVICES

http://www.sbcounty.gov/dehs

August 1992

FOREWORD

A soil percolation report is a technical document which establishes whether on-site sewage disposal systems can be used for a specific parcel of land to serve a given type of development (such as single/multiple family dwellings, restaurant, campground, etc.).

The soil's percolation condition is determined by testing at the specific site and topographical, geologic, and hydrologic conditions are determined and described in the report. The on-site system is then designed in accordance with this information and County Standards. A properly installed, operated and maintained system should not be subject to premature failure causing nuisances, odors or public health hazards.

Complete reports must be submitted, and all appropriate fees paid to the Division of Environmental Health Services (DEHS), prior to the approval of the use of any on-site percolation system and the application of the design rate.

CONTENTS

APPENDIX

PAGE

For Corwin

What region for RWQCB see A-17

SAN BERNARDINO COUNTY
DIVISION OF ENVIRONMENTAL HEALTH SERVICES
385 North Arrowhead Avenue
San Bernardino, CA 92415-0160
Telephone: (909) 387-4666
FAX Number: (909) 387-4323
http://www.sbcounty.gov/dehs

S.B. County Flood Control Channel (see A-8)

SOIL PERCOLATION (PERC) TEST REPORT STANDARDS
SUITABILITY OF LOTS AND SOILS FOR USE OF LEACHLINES OR SEEPAGE PITS

NOTICE:
At least two working days before conducting routinely scheduled percolation tests, you must contact the Division of Environmental Health Services. Please provide the following: assessor's parcel number, firm's name and person to contact, date(s) of testing, and telephone number. At the option of the specialist, a field inspection during testing or shortly thereafter may be conducted. The date that the specialist (or DEHS Water/ Wastewater Section) was contacted must be stated in the report.

I. A perc report is required by DEHS:

a) For all subdivisions of land, except those for which a waiver has been granted. (see pg A-10, item 4 for criteria.)

b) For any parcel or land division where existing data will not allow the county liquid waste specialist to set a sewage disposal rate.

c) For any single lot where space or soil conditions for on-site sewage disposal are critical (i.e., very small or steep lots, very slow perc times, shallow groundwater with fast perc times, etc.)

d) For all new on-site septic systems within the San Bernardino or Angeles National Forest boundaries and in other mountain areas.

e) For all on-site septic systems requiring an exemption from California Regional Water Quality Control Board (CRWQCB) wastewater discharge prohibitions. (Check with Specialist/ RWQCB for designated areas.)

f) For any commercial or sanitary wastes from industrial developments utilizing on-site percolation systems.

g) For a replacement system where existing data will not allow the county liquid waste specialist to set a design rate.

II. Those who prepare perc reports must have professional experience and be knowledgeable in assessing the site's on-site sewage disposal feasibility. They assume responsibility for the report's contents in accordance with the obligations of their professional registration and may be held liable if false or misleading information is presented. Preparers must possess one of the following professional registrations:

a) A State of California Registered Civil Engineer,

b) A State of California Certified Engineering Geologist,

c) A State of California Registered Environmental Health Specialist,

d) A State of California Registered Geologist,

e) A State of California Geotechnical Engineer

Reports must be properly documented with the original signature, stamp, professional registration number and license expiration date of the preparer. Photo copied signatures are not acceptable. Preparers shall be identified by name, field technicians by initial.

III. Format and other requirements:

1. DESCRIPTION OF SITE AND OF PROPOSAL

1.0 Date/individual that was notified of testing.

1.1 Prepared for: Name of client, address and phone number.

1.2 Location of land:

a) Provide a sufficiently detailed vicinity map, township, range, section, assessor's parcel map or subdivision map, and/or legal description of property. Make sure you have the right parcel; state how the property is identified. (Owner's word alone is not acceptable.) Indicate landmarks and street addresses when possible. Specify those survey monuments found and if the property lines were surveyed, by whom.

1.3 Proposed Development/Project/Land use:

a) State the type of project: i.e., condominium, subdivision tract, lot sale, parcel map, shopping center, etc.
b) State the total acreage, the number of lots, and the average and range of the lot sizes.
c) State the type of sewage disposal system: i.e., septic tank or package plant, leachline(s),or seepage pit(s), separate or common system, other.
d) State if grading is proposed for the development, and how much.

1.4 Description of site and surroundings: (A photograph is often useful.)

a) Topography: Include a topographic map prepared by a Registered Civil Engineer or Licensed Land Surveyor, unless the site and the surroundings are flat or have a uniform, constant slope (+ or - 1% variation) of less than 20%. For instance, "slope of 10% downward from north property line to south property line".

% Slope	Maximum Interval of Contours in Feet For Topo Map
0-2	2
>2-10	4
>10	10

Describe the topography in the area of the proposed disposal site(s) and its location relative to the proposed development.

b) Water courses: Indicate and show on the plot plan any floodway, floodplain, spring(s),

stream(s), and drainage course(s) which encroach within a distance of 1 ½ times the required minimum setback from the disposal area(s).

c) Vegetation type and density (especially groundwater indicators such as willows, reed grasses, cattails, and smoke trees) as well as trees in general, area(s) of proposed system(s).

d) Existing structures: (1) General description of proximity, density, probable kind and number of neighboring septic systems. (2) Indicate whether the proposed system could adversely impact any existing structure's disposal system(s) or replacement area on or in the vicinity of the parcel being tested where known. (3) Indicate location of nearest sewer, and any sewer manholes observed.

e) Indicate the location of any active or inactive well(s) (and their construction details where known) located within 300 feet of the proposed disposal area. Indicate proposed source of domestic water. Identify future well sites, when appropriate.

f) Rock outcroppings: Specify the type of rock (shale, slate, schist, granite).

g) Indicate the depth to historic groundwater and how it was determined. Provide the date and source of information used (Flood Control Agency, local water companies, California Department of Water Resources Bulletin, USGS, DEHS Water/ Wastewater Section, etc.)

h) Any other feature that may affect sewage disposal: fill material, spots of vegetation, obvious signs of slope instability, fractured bedrock, root channels, cracks in the soil profile, suspected infiltration galleries or old mine tunnels, proposed grading over the system, etc.

2. EQUIPMENT

Describe in detail equipment used to perform perc test - backhoe with 12" bucket, rig with 8" diameter, screw-type auger (identify type), 6" posthole digger, shovel, fork and spoon, measuring tape with 1/8" divisions, wire-onfloat sliding on 1/10" gradation scale, etc.

3. METHODOLOGY AND PROCEDURES

3.1 Location of borings and trenchings. Under most circumstances, the random grid method should be utilized. In the event that other methods are used, explain the method and state the specific reason(s) it was used in lieu of the grid method. It is the report preparer's responsibility to ensure that tests were conducted where described in the report. Indicate locations on the plot plan. For easy identification leave three-foot laths marked with your initials, hole/trench number, and the date the test was conducted at each backfilled hole. Estimate theoretical cuts and fills and perform the tests and borings at the depths at which percolation will occur when the system is installed. When final grading is unknown, indicate that leachlines will be located in natural soil ± two (2) feet of cut or fill (± five (5) feet if pits) or at tested depths. If the final system design is not located within the stated range, additional testing will be required prior to final recordation or issuance of a building permit.

3.2 Soil characteristics to determine number of borings or trenchings and tests. Unless deviations are permitted in advance by the county liquid waste specialist, the minimum number of explorations and tests in Tables 3.3, 3.4, and 3.5 is determined based on the following soil characteristics:

A. **Favorable** is defined by the following:
   1. Ideal soil conditions are anticipated.
   2. There is no visual evidence of shallow groundwater, bedrock, impervious materials, etc. Tests and borings performed agree with the visual evidence. Natural or finished slope of the disposal area is 20% or less.

B. **Moderate** is defined by the following:
   1. Only isolated areas of the property are suspected to encounter problems due to groundwater, bedrock, impervious materials, etc.
   2. No more than 10% of the tests and deep borings fail to meet standards.
   3. The minimum number of tests and borings should be spaced in a random grid, the additional tests describe the limits of the problem area(s).
   4. Natural or finished slope of the disposal area is less than 30%.

C. **Severe** is defined by the following:
   1. Obvious surface features indicating site conditions that will hinder subsurface disposal are present.
   2. Through random testing, more than 10% of the tests and borings do not meet standards.
   3. Acceptable testing rates approach the upper limit of approval, or a nonuniform pattern of test rates develop.
   4. Natural or finished slopes of the disposal area equal or exceed 30%.

3.3 Minimum number of exploratory borings

	Gross Lot Size	Soil Conditions	
		Favorable to Moderate	Severe
Subdivisions and individual lot sales	<1 acre	3 borings first 10 lots 1 boring every 10 thereafter	8 borings first 10 lots 5 borings every 10 thereafter
	1-5 acres	5 borings first 10 lots 3 borings every 10 thereafter	2 per lot*
	>5 acres	1 boring per lot*	2 per lot*
Residential lot		1 boring*	2 per lot*
Commercial lot, confluent systems under one ownership		1 boring per 4,000 gallons septic tank capacity*	1 boring per 2,000 gallons septic tank capacity*
Parcel Map	5 acres or less	1 boring in the center of the undivided parcel	2 borings evenly spaced in the undivided parcel

*** In the area of the disposal system, if known.**

3.3.1 Boring/Trenching Results - Number each hole or excavation. Graphically describe soil strata at each hole or excavation.

a) Soil profile descriptions shall be written under the supervision of the registrant for all of the excavations. The thickness (in inches or tenths of a foot) of the different soil horizons observed shall be indicated. Soil horizons shall be described on the basis of color, field texture analyses, soil mottles, bedrock, structure, roots, and pores. Depths shall be measured from the existing ground surface.

b) Where the soil lithology is stratified and low-permeability layers such as sandy silts and clays, or caliche could affect the on-site disposal system performance (leachlines and seepage pits bottomed less than 20 feet below grade), the soil profile shall be described by direct visual observation: i.e., in a backhoed trench, road cut, suitable large (> two (2) feet diameter) boring, or splitspoon sampling.

c) Textures - Use any of the classifications in Appendix pages Al-4. State the approximate percentage of cobbles, gravel, sand, silt, and clay.

d) Colors (dry/moist), reduction-oxidation mottling. (See Appendix.) The Munsell soil color chart shall be the descriptive tool utilized to determine the background soil color.

e) Presence and extent of small/large roots.

f) Ease of excavating/drilling, depth to bedrock and rock competency (soft, firm, hard, refusal).

g) Moisture - If soil at or near the point of saturation is encountered in the exploratory boring, observe the borehole after 24 hours to determine the presence of free water.

h) Free water - The depth to groundwater, if present, shall be reported. Observed groundwater shall be reported at the level groundwater reaches in the excavation, or at the highest level of sidewall seepage into the excavation after 24 hours. Measurements shall be made from the ground level. Soil above the water level in the excavation shall be checked for conditions associated with saturation (mottles).

i) Structural characteristics, stratigraphy, and geologic origin shall be described when determined necessary by the consultant for severe sites only.

j) Indicate method of boring abandonment.

3.4 Minimum Number of Tests for Leachlines:

	Gross Lot Size	Soil Conditions		
		Favorable	Moderate	Severe
Subdivisions (Note-Individual lot sales requires 100% lot testing)	<2.5 acres	6 tests first 10 lots, 1 test every 10 thereafter	9 first 10, 6 next 10	1/lot
	2.5 acres to 5 acres	8 tests first 10 lots, 3 tests every 10 thereafter	10 first 10, 7 next 10	1/lot
	>5 acres	1/lot	1/lot	1/lot
Residential lot		Minimum 4 tests*	4*	6*
Commercial lot, confluent systems under one ownership		4 tests/3,000 gallons septic tank capacity*, 1 test for each additional 2, 000 gallons septic tank capacity	5/3, 000* 2/2,000	6/3,000* 3/2,000
Parcel Map		Minimum one test for each lot in the area of the disposal system or County assigned rate per waiver criteria (minimum 4 tests)	2 tests per lot* (minimum 6 tests)	3/lot* (minimum 8 tests)

Note: *In the general area of the disposal systems (primary and expansion); if known or where proposed.

3.4.1 Standard Percolation Test Procedure for Leachlines

25" – 36" deep

Excavation: Test holes shall be augered or excavated to within 13 inches of the actual test depth which corresponds to the anticipated depth of the leachline or the bed trench bottom. Vary depths to include testing of side wall if the disposal system will be more than three feet below the ground surface. In addition, perform one test in the least permeable soil stratum found during the deep excavation if the soil type changes within 5 feet of the proposed trench bottom.

Test Hole: 1. A hole of diameter 5.5" - 8" (D) or square 5" - 7" (S) should normally be used.

2. Larger holes than stipulated in coarse soils with a rate of less than 8 minutes/inch (mpi) will require a correction factor using the formula:

$$\frac{\text{mpi (test)} \times 6}{\text{actual "D" or "S" dimension}} = \text{mpi corrected}$$

Rates greater than 8 mpi do not need to be corrected.

3. Depth - The minimum test hole depth is 13". All sides to be vertical. (Below the test excavation bottom or at least 5 feet horizontal distance to daylight in a trench bench.)

how?

4. All loose material must be removed from the test hole and the bottom of the hole should be in natural, undisturbed soil.

5. Place two (2) inches of 1/4" to 3/4" gravel over the bottom of the test hole. A perforated can may be placed over the gravel. (Note: if the can has a bottom, gravel may not be necessary.)

Pre-Soak: Fill the hole with 12" of clear water (10" above the gravel or the bottom of the perforated can.)

1. If ten (10) inches of clear water seeps away in two consecutive readings in less than ten (10) minutes each and the soil is of coarse texture, testing can be conducted immediately. Otherwise:

2. Pre-soak by:

   a. Maintain the water level in the test hole at ten (10) inches above the gravel, for at least four (4) hours, or;

   b. For augered test holes with a total depth over four (4) feet from the surface to the gravel, fill the entire hole to the surface. This pre-soak method may require recleaning of the hole and new gravel placement prior to testing, or;

   c. For augered test holes of less than four (4) feet total depth, fill the test hole to the surface and invert a five (5) gallon bottle of water in the hole. This pre-soak method may require recleaning of the hole and new gravel placement prior to testing.

      NOTE: All of the above procedures are designed to allow a minimum of five (5) gallons of water to percolate and saturate the lower 12 inches of the test hole. Other pre-soak methods that also accomplish this may be used, but should be fully described in the final report.

Testing: 1. Begin testing 15-26 hours after the beginning of soaking (except for sandy soils as

noted), to allow time for swelling of clays but prevent soil from drying out.

2. Fill or refill the hole with clear water to eight (8) inches from the bottom of the hole, (6) six inches over the gravel.

Readings:

1. If more than five (5) inches of water is gone in 30 minutes, take readings every 10 minutes for one hour minimum. Refill after each reading. All final time intervals shall provide a minimum of a one (1) inch drop and not more than a three (3) inch drop.

2. If less than one (1) inch is gone in 30 minutes, take 60 minute readings for three (3) hours minimum. Do not refill until at least a one (1) inch drop has occurred.

3. For all other cases, take 30 minute readings for three (3) hours minimum. Refill after each reading. All readings shall provide a minimum 1 inch drop, and a maximum 3 inch drop.

Accuracy: All measurements will be read to the closest 1/8". If the difference between the last two readings is greater than 10%, additional measurements shall be made.

Results: The reported results shall be the most conservative reading in minutes/inch drop.

3.4.2 Continuous Pre-Soak Percolation Test Procedure-Leachlines

DESCRIPTION

This method requires the use of a water reservoir to provide a continuous volume of water in the hole during the pre-soak period. After a predetermined volume of water has seeped through the test hole, the measurement of the percolation rates may commence.

The method described in the following procedure utilizes a 5-gallon water bottle inverted in the test hole. This procedure can be modified to use a reservoir and a float device to control the water level as described:

PROCEDURE:

Excavation: The test excavation shall be constructed so as to facilitate the placement of the 5-gallon reservoir of water over the test hole. The excavation shall reach to within 13 inches of the actual test depth which corresponds to the approximate depth of the leachline or the bed trench bottom. Vary the depths in order to include testing of the sidewall if the disposal system is to be more than three feet below the ground surface. In addition, perform one test if the soil type changes within 5 feet of the proposed trench bottom.

Test Hole:

1. Auger or hand excavation.
2. A hole of diameter 5.5" - 8" (D) or square 5" - 7" (S) shall normally be used.
3. Larger holes than stipulated in coarse soils with a rate of less than 8 minutes/inch (mpi) will require a correction factor using the formula:

$$\text{mpi corrected} = \frac{\text{mpi (test)} \times 6}{\text{actual "D" or "S" dimension}}$$

Rates greater than 8 mpi do not need to be corrected.

4. The minimum test hole depth is 13 inches.

5. All loose material must be removed from the test hole and the bottom of the hole should be in natural, undisturbed soil.

6. Place 2 inches of 1/4" to 3/4" gravel over the bottom of the test hole. A perforated pipe is then placed in the hole to prevent caving and to support the water bottle. The pipe length shall be approximately the same as the test hole depth.

Pre-Soaking: To start, fill the test hole with water to 8 inches above the gravel. Invert a full 5-gallon bottle of clear water over the hole (in a bottle support) so that the hole is filled continuously to approximately 8 inches over the gravel.

When the 5 gallons of water has percolated through the test hole, or after 15 hours but before 26 hours from initiating pre-soak, testing may commence.

Testing:

A. Same day testing - When the 5 gallons has percolated while the tester is present, the test may proceed the same day as the pre-soak.

1. Remove the bottle and adjust the water level to 6 inches above the gravel:

2. Take a minimum of four (4) consecutive measurements at timed intervals that provide not less than a one (1) inch nor more than a 3 inch drop. Refill the water level to 6 inches above the gravel after each measurement.

B. Next day testing - (15-26 hours after starting pre-soak)

1. If water is still present in the test hole, the test shall not start less than 15 hours from initiating the pre-soak.
   a. Remove the bottle and adjust the water level to 6 inches above the gravel.
   b. Take a minimum of two (2) consecutive measurements at time intervals that provide not less than a 1 inch nor more than a 3 inch drop in the water level. Refill the water level to 6 inches above the gravel after each measurement.
2. If no water is left in the test hole, the test shall begin within 26 hours from starting the pre-soak. (Repeat the pre-soak procedure if more than 26 hours have passed.)
   a. Remove the bottle and adjust the water level to 6 inches above the gravel.

   b. Take a series of readings for a minimum of two hours, or four consecutive readings at time intervals that provide not less than a 1 inch nor more than a 3 inch drop in the water level. Refill the water level to 6 inches above the gravel after each measurement.

5.3 Convert Q to seepage pit design rates

5.3.1 Seepage Pit Design - Falling Head Method

Square feet/ gallons septic tank capacity (sf/gstc)

1/Q X 100 = sf/100 gstc

Design depth below inlet = septic tank capacity
Q x D ä

D = Diameter of pit in feet ä = 3.14

Depth below inlet shall be limited to tested depth or by groundwater.

5.3.2 Seepage Pit Design - Weighted Average Method.
Use EPA Design Graph for square feet of pit sidewall.

5.4 Special Criteria

5.4.1 If leachlines or pits serve a common system for two or more units, add 30% more square footage.

Accuracy: All measurements shall be read to 1/8". If the difference between the last two readings is greater than 10%, additional measurements shall be made.

Results: The reported results shall be the most conservative reading in minutes/inch drop.

3.4.3 Leachline Test Results

3.4.3.1 Tabulate all the results, including all tests that "failed" to meet the minimum acceptable standards.

3.4.3.2 Provide copies of all the field data and calculations using the following format:

Leachline Test:

1. Hole No:
2. Diameter in inches:
3. Hours presaturation; gallons used, time presoak initiated:
4. Depth (of bottom) below grade:
5. Types of strata tested:
6. Condition of hole: caving or siltation?
7. Any method used to prevent sidewall caving?
8. Name of tester:
9. Date tested:

Provide numerical values for each of these parameters

t_1 | $depth_1$ | t_2 | $depth_2$ | Δt | Δd | $\frac{\Delta t}{\Delta d}$ mpi (or mpc)

Where:

t_1 = initial time when filling or refilling is completed - minutes

d_1 = initial depth of water in hole

t_2 = final time in minutes

d_2 = final depth of water in hole

Δt = change in time - minutes

Δd = change in depth - inches

3.5 Minimum Number of Tests for Seepage Pits:

	Gross Lot Size	Soil Conditions		
		Favorable	Moderate	Severe
Subdivisions (Note: Individual lot sales require 100% testing)	<1 acre	3 tests first 10 lots; 2 tests for every 10 1 ots thereafter	6 first 10 3 next 10	1/lot*
	1 acre to 2.5 acres	4 tests first 10 lots; 2 tests for every 10 lots thereafter	7 first 10 4 next 10	1/lot*
	>2.5 acres to 5 acres	5 tests first 10 lots; 3 tests for every 10 lots thereafter	8 first 10 5 next 10	1/lot*
	>5 acres	6 tests for first 10 lots; 4 tests for every 10 lots thereafter	1/lot*	2/lot*
Residential lot		2 tests* 2 tests*	3 tests*	
Commercial lot, confluent systems under one ownership		2 tests/4,000* gallons septic tank capacity in sewage disposal area 1 additional test per 2,000 gallons of septic tank capacity or fractional part thereof	2/3,000* 1/2,000	2/3,000* 2/2,000 17,500 gal + 24,000 gal
Parcel Map		2 tests evenly spaced on the undivided parcel	3 tests evenly spaced on the undivided parcel	4 tests evenly spaced

Note: *In the general area of the disposal systems (primary and expansion); if known or where proposed.

3.5.1 Seepage Pit, Weighted Average Percolation Test Procedure

Test each stratum as for leachlines, in Section 3.4.1. Multiply the thickness of each stratum by its perc time; add the results. Divide the total by the sum of all the thicknesses. The result is the average mpi for the given total depth. Exclude all strata with pi > 30. This is not an easy procedure to perform without very accurate instruments.

3.5.2 Sewage Pit, Falling Head Percolation Test Procedure

☆ not suitable for markedly diffs. strata unless each strata tested separately

Test Holes:

a) Holes are 6" to 8" in diameter. Exploratory borings (6"-8") may be backfilled at least 10 feet and used for testing. When backfilling, if soils are too coarse (less than 20% fines) mix top of backfill with driller's mud or other material approved by the Division of Environmental Health Services; cover with one (1) foot of gravel.

b) Depth - Same as the depth estimated for the pit based on the soil log. If distinctly lower permeable stratum (strata) are found with higher permeable stratum within the test boring, the lower permeable stratum should be tested separately. Vary depths when unsure.

c) Because caving may invalidate the results in anticipated adverse areas of percolation, precautions, such as gravel packing, should be used.

Measurements

a) Carefully fill the hole with clear water until the water level is even with the surface of the ground. Refill to the surface for all but the last two (2) readings. The final refills shall be to the proposed depth of the inlet or a minimum of 4 feet below the ground surface.

b) In very sandy soils, where the water on two consecutive readings seeps faster than half the initial wetted depth in 30 minutes, the time intervals shall be 10 minutes or shorter and measurements shall be taken for at least one additional hour until three consecutive readings do not vary by more than 10%. Gravel packed holes must have four (4) consecutive readings where the water seeps faster than half the initial wetted depth in 30 minute intervals to compensate for the reduced water volume of each pre-soak.

c) In soils with fines, soak the hole and let it set overnight. The perc rate measurements shall be made on the day following the soaking, not more than 26 hours after the pre-soak. From the reference point, measure the drop in water level over thirty minute.periods for at least six hours. For the final two readings, read every 30 minutes without refilling and check for possible nonuniform absorption; measure how fast the water level keeps on falling until it gets down to the bottom or slows down. The consultant must determine if the minimum six hour testing should be extended for another 30-60 minutes.

d) Remeasure the depth of the hole with each reading to see if caving has occurred. Caving in excess of 15% of total depth may invalidate the results of shallow test holes.

3.5.3 Seepage Pit Test Results

3.5.3.1 Tabulate all the final results, including all tests that "failed" to meet the standards.

3.5.3.2 Provide copies of all the field data and calculations using the following format:

a) Seepage Pit Test (Falling Head):

1. Boring number
2. Diameter of hole in feet:
3. Hours presaturation, time presoak initiated:
4. Depth (of bottom) below grade
5. Strata peculiarities:
6. Name of tester:
7. Date tested:
8. Method to prevent sidewall caving: Gravel Packed. See Appendix, page A-13.

Provide numerical values for each of these parameters

t_i | t_f | $\hat{}t$ | d_b | d_i | d_f | $F = d_f - d_i = \hat{}d$ | Lave = | $Q = \frac{F\ D\ 9}{Lave\hat{}t}$ | pit mpi = $\frac{180}{Q}$

Where:

t_i = initial time when filling or refilling is completed, hour: minute

t_f = final, end-time of fall, hour: minute

$\hat{}t$ = usually .5 or .166 hour (10 min)

d_b = depth to water bottom, feet

d_i = depth to water surface at t_i, feet

d_f = depth to water surface at t_f, feet

Lave = average length of water column, feet $d_b - (d_i + d_f)/2$

D = diameter of hole in feet

Q = gallons of sewage (or septic tank capacity, whichever is greater) per square foot per day (g/sf/d).

Show your work!!

of sewage pit ?

b) Seepage pit - weighted average method - use format per 3.4.3.2

4. Discussion of Results

4.1 Discuss the uniformity of the soils in regards to the soil classification (favorable, moderate or severe) and percolation times obtained. (Uniform is defined as 4 test results falling within + 1/4 of their mean percolation time.) Based on boring/trenching data, discuss how the most restrictive layer below the disposal area was tested, or can be avoided by proper separation or design. For a given system, at least 3/4 of tests must show acceptable results. For example, if there is a failing test on a lot in a proposed tract/minor subdivision, three additional acceptable tests must be shown on that lot.

4.2 Discuss possible sources of error or variability of results such as: measurement accuracy, cavings, one atypical location, etc. Siltation or caving of test holes may require special construction measures to prevent the soil absorption system from suffering the same fate. Discuss in #7 under Recommendations.

4.3 Especially if seepage pit testing was done by procedure 3.5.2, interpret the results in light of

the soils profile and the final readings. Do not rely only on the formula results. The falling head test is not a suitable test procedure for markedly different strata, unless the strata are tested separately, or mounding analyses performed. (Check references) Discuss under 7.3.

5. Design

5.1 General Criteria

5.1.1 For uniform soil units, use a mpi between mean and most conservative mpi(s), i.e., average mpi = 7, most conservative mpi = 9, design mpi = 8. If there are no uniform soil units, use the most conservative mpi for the entire area. (See 4.1 - Note: Use pit mpi, not Q, for averaging.)

5.1.2 Unless an area has been determined to have degraded groundwater by a CRWQCB, there shall be a minimum of 5 feet (leachlines) or 10 feet (seepage pits) of original soil between the bottom of the soil absorption system and groundwater. If a soil has a perc time less than 5 mpi, then the soil for a total thickness of five (5) feet below the bottom of a leachline to groundwater shall contain at least 15% of material passing the #200 U.S. standard sieve (and less than one fourth (1/4) of the representative soil cross-section shall be occupied by stones larger than 6"). Where this requirement is not met, a 40-foot separation shall be maintained below the bottom of the leachline and the highest historic groundwater level based on recorded data or on observed mottling. Fairly uniform coarse-textured soils (SM or more coarse) shall not be used for seepage pits when a "pit mpi" is less than 10 and where a sieve analysis shows less than 15% fines passing the #200 U.S. standard sieve for a thickness of 10 feet and the separation to groundwater is less than 40 feet. Lahontan Region criteria are more stringent; Board clearance is required.

Basis for 100% passing - 3/8" sieve.

5.1.3 The design Q for seepage pits must be > 1.1 g/sf/day of sewage, but < 4 g/sf/day. Q's greater than 4 g/sf/d will not be credited. Caving seepage pit test holes in coarse textured soils shall not be credited with rates greater than 3 g/sf/day.

5.1.4 Gallons per day are calculated per the most current addition of the UPC Table 1-4/UBC Table 33A and either UPC Table I-2 or Table I-3. 5.2

5.2 Convert percolation times to leachline design rates

See p. 16

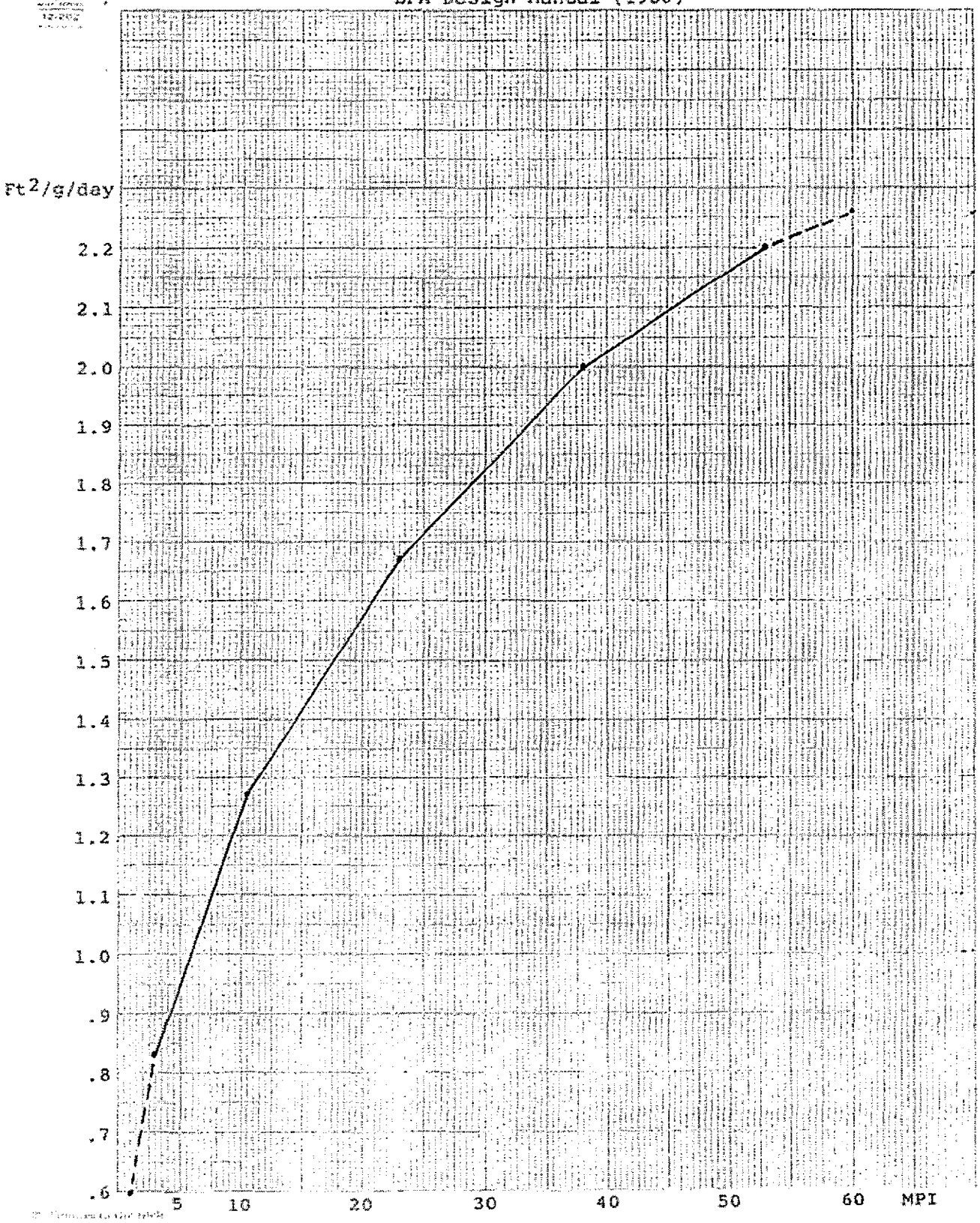
5.2.1 Leachline application rates for domestic sewage (Source: EPA's Design Manual, 1980) minimum square feet of absorption area per gallon of effluent per day

UTILIZE GRAPH FOR APPLICATION RATE

For single homes you may use:

Bedrooms	Gallons of Effluent Per Day	Gallons of Septic Tank Capacity
1-2	500	750
3	670	1,000
4	800	1,200
5-6	1,000	1,500

Midpoints of ranges for leachfield design, from the EPA Design Manual (1980)



5.4.2 For laundromats, restaurants, and confluent systems serving mobilehome parks or shopping centers (three or more retail shops), or if septic tank volume is calculated for flows > 2000 gpd with Vol = .75 flow +1125, multiply square footage by 2.5.

5.4.3 Credit for Alternating Fields:
A credit of 10% reduction in square footage may be given for installation of alternating leach fields or seepage pits (unless the consultant specifies otherwise).

Single houses on lots less than 10,000 square feet in area or with leach fields on ground naturally sloping >30% (with CRWQCB approval) may require alternating leach fields. The 100% expansion area can be used for one of the alternating leach fields. The report preparer must recommend that adequate future access to install the replacement system be maintained. Alternating systems, as well as standard systems, are not recommended in areas where mechanical obstruction of the system(s) may occur due to root intrusion.

Alternating systems may be considered when future access, or critical soils are limiting factors.

5.4.4 Special considerations: See Appendix page A-7, Section B.1.a.

6. Plot System Per Currently Adopted Uniform Plumbing Code

Draw tested property to scale:

Single Family Home, Small Commercial Minimum 1" = 30'
Parcel Map, Subdivision, Large Commercial Minimum 1" = 40'

6.1 Plot system and 100% expansion area, show existing and potential structures, wells, streams, etc. (Check Appendix for allowable separations.) Include contours, significant vegetation (including trees), rock outcropping, location of all borings and tests, and the proposed house pad.

6.2 For lot sales zoned for single family homes (lot sale subdivisions) show a hypothetical system for a five (5) bedroom home on each and every lot; if zoned for multi-unit development, show a hypothetical system sufficient for the effluent discharged by an average of three bedrooms per unit.

6.3 Where grading is expected, include original and finished elevations. If the grading plan was prepared by others, comment as it regards the recommendations set forth in the report. If grading is unknown, include qualifying statements in area(s) for the primary and expansion systems (see 3.1), or title the report "Preliminary". (Preliminary reports must still be adequate for purposes of recordation with recommendations to be followed for building permit purposes.)

6.4 The proposed dwelling/development shall be located so that the initial subsurface sewage disposal system and the required 100% expansion area shall function by gravity flow unless otherwise approved.

6.5 A pump system will be considered only under the following hardship conditions:

a. To salvage an existing structure when an adequate disposal area cannot be reached by gravity flow.

b. To allow new house construction on an existing lot when there is absolutely no other alternative to pumping. This hardship consideration will be based on reasonable site development.

c. See Appendix, Page A-9.

6.6 All designed systems construction details are subject to review by the DEHS and approval by the Department of Building & Safety. Minimum conventional construction details are to be found in the currently adopted Uniform Plumbing Code.

7. General Discussion and Conclusions or Recommendations

7.1 Specify any pertinent CRWQCB requirements and state whether they are being met. All systems must meet the CRWQCB requirements. See Appendix pages A-17-A-22.

7.2 State whether each lot has sufficient area to support an individual sewage disposal system that will meet DEHS standards for the use intended. Include a qualifying statement if swimming pools, building expansions, etc. are or may be allowed; also if grading must be restricted, or if grading plans must be reviewed prior to grading, and installation inspected after grading by soils consultant, or if special construction techniques are required.

7.3 Discuss sewage mounding if lots are to be developed commercially or industrially with flows of 1500 g/d or greater and/or as determined necessary under 4.3. In addition, for commercial and industrial discharges, discuss the on-site system's ability to adequately treat harmful waste constituents prior to entering the groundwater if other than sanitary wastes may be discharged. Indicate if a special treatment process study should be done after the exact nature of the discharge(s) has been determined.

7.4 Recommend that a copy of the DEHS septic system handout *Taking Care of Your Septic System* be obtained by the owner/developer, or provide a copy in report Appendix.

** APPENDIX **

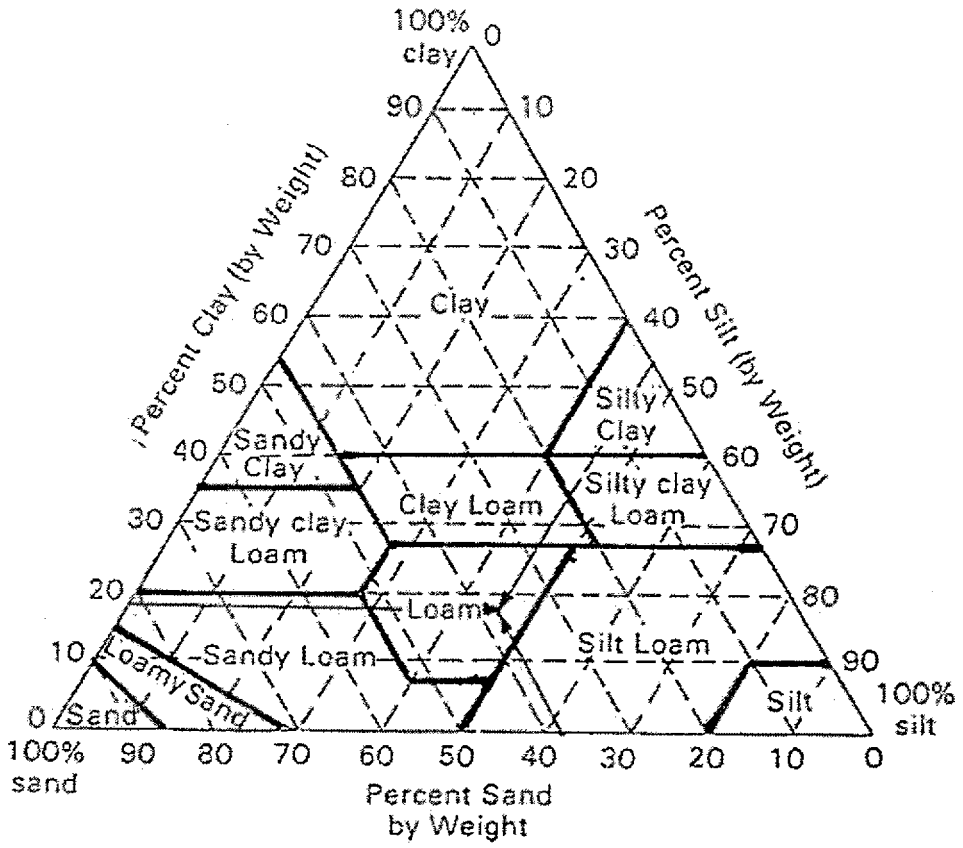
August 1992

Note: The Regional Water Quality Control Board criteria are current at time of publication, but may change. It is the consultant's responsibility to be aware of the minimum criteria. Changes will be made as necessary to the Appendix by the Department.

SOURCE: EPA DESIGN MANUAL FOR ON-SITE SYSTEMS
TEXTURAL PROPERTIES OF MINERAL SOILS

Soil Class	Characteristics & Appearance Dry Soil	Moist Soil
MINIMUM REQUIREMENTS FOR LOCATION OF		
Sand	Loose, single grains which feel gritty. Squeezed in the hand, the soil mass falls apart when the pressure is released.	Squeezed in the hand, it forms a cast which crumbles when touched. Does not form a ribbon between thumb and forefinger.
Sandy Loam	Aggregates easily crushed; very faint velvety feeling initially but with continued rubbing the gritty feeling of sand soon dominates.	Forms a cast which bears careful handling without breaking. Does not form a ribbon between thumb and forefinger.
Loam	Aggregates are crushed under moderate pressure; clods can be quite firm. When pulverized, loam has velvety feel that becomes gritty with continued rubbing. Casts bear careful handling.	Cast can be handled quite freely without breaking. Very slight tendency to ribbon between thumb and forefinger. Rubbed surface is rough.
Silt Loam	Aggregates are firm but may be crushed under moderate pressure. Clods are firm to hard. Smooth, flour-like feel dominates when soil is pulverized.	Cast can be freely handled without breaking. Slight tendency to ribbon between thumb and forefinger. Rubbed surface has a broken or rippled appearance.
Clay Loam	Very firm aggregates and hard clods that strongly resist crushing by hand. When pulverized, the soil takes on a somewhat gritty feeling due to the harshness of the very small aggregates which persist.	Cast can bear much handling without breaking. Pinched between the thumb and forefinger, it forms a ribbon whose surface tends to feel slightly gritty when dampened and rubbed. Soil is plastic, sticky and puddles easily. (Thumbprints visible)
Clay	Aggregates are hard; clods are extremely hard and strongly resist crushing by hand. When pulverized, it has a grit-like texture due to the harshness of numerous very small aggregates which persist.	Casts can bear considerable handling with breaking. Forms a flexible ribbon between thumb and forefinger and retains its plasticity when elongated. Rubbed surface has a very smooth, satin feeling. Sticky when wet and easily puddled.

TEXTURAL TRIANGLE DEFIINING TWELVE TEXTURAL CLASSES OF THE USDA
(ILLUSTRATED FOR A SAMPLE CONTAINING 37% SAND, 45% SILT, AND 18% CLAY)



Second
M = Silt
C = clay

METHOD OF SOIL CLASSIFICATION
(ASTM D 2487)

COARSE-GRAINED SOILS

LESS THAN 50% FINES*

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
GW	WELL-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% FINES	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size
GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% FINES	
GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, MORE THAN 12% FINES	
GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, MORE THAN 12% FINES	
SW	WELL-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% FINES	SANDS More than half of coarse fraction is smaller than No. 4 sieve size
SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% FINES	
SM	SILTY SANDS, SAND-SILT MIXTURES, MORE THAN 12% FINES	
SC	CLAYEY SANDS, SAND-CLAY MIXTURES, MORE THAN 12% FINES	

NOTE:
Coarse-grained soils receive dual symbols if they contain 5 to 12% fines (e.g. SW-SM, GP-GC, etc.)

FINE-GRAINED SOILS

MORE THAN 50% FINES*

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS	SILTS AND CLAYS Liquid limit less than 50
CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
OL	ORGANIC SILTS OR ORGANIC SILTY-CLAYS OF LOW PLASTICITY	
MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDS OR SILTS, ELASTIC SILTS	SILTS AND CLAYS Liquid limit more than 50
CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY	
PT	PEAT, MUCK, AND OTHER HIGHLY ORGANIC SOILS	HIGHLY ORGANIC SOILS

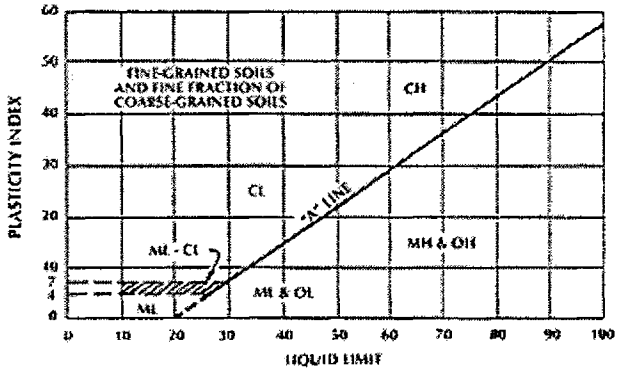
NOTE:
Fine-grained soils receive dual symbols if their limits plot in the hatched zone on the Plasticity Chart (ML-CL)

SOIL SIZES

COMPONENT	SIZE RANGE
BOULDERS	ABOVE 12 in.
COBBLES	3 in. to 12 in.
GRAVEL	No. 4 to 3 in.
Coarse	¾ in. to 3 in.
Fine	No. 4 to ¾ in.
SAND	No. 200 to No. 4
Coarse	No. 10 to No. 4
Medium	No. 40 to No. 10
Fine	No. 200 to No. 40
*Fines (Silt or Clay)	BELOW No. 200

NOTE:
Only sizes smaller than three inches are used to classify soils.

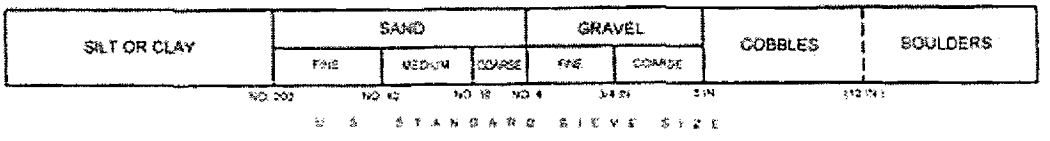
PLASTICITY CHART



MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravels, gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amt. of fines)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size)	CLEAN SANDS (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amt. 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 sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS



UNIFIED SOIL CLASSIFICATION SYSTEM

Reference
The United Soil Classification System, Corps of Engineers, U. S. Army Technical Memorandum No. 3-357 Vol. 1, March, 1953 (Revised April, 1960)

LIQUID WASTE DISPOSAL SYSTEMS

The minimum requirements for the installation of new sewage disposal systems for either new or existing structures shall generally be as follows:

A. Minimum Separations

1. Septic tank to:

a.	Water supply well	100 feet
b.	Buildings or structures[1]	5 feet
c.	Property line adjoining private property	5 feet
d.	Perennial streams[2]	50 feet
e.	Ephemeral streams[3]	50 feet
f.	Large trees[4]	10 feet
g.	Seepage pits or disposal fields	5 feet
h.	Private domestic water lines (building service line)	5 feet
i.	Public domestic water lines (water purveyor's line)	10 feet
j.	Groundwater	5 feet

2. Soil absorption system to:

a.	Water supply well - 100, 150, or 200 ft. depending on whether system has a:	
	Leaching field	100 feet
	Seepage pit	150 feet
	Any system discharging 5,000 gallons/day or more	200 feet
b.	Building or structures[1]	8 feet
c.	Property line adjoining private property (leachlines)	5 feet
d.	Property line adjoining private property (seepage pits)	8 feet
e.	Large trees[4] (seepage pits)	10 feet
f.	Perennial streams[2]	100 feet
g.	Colorado River/Mojave River	200 feet
h.	Ephemeral streams/ Drainage Courses[3]	50 feet
i.	Septic tank	5 feet
j.	Distribution box	5 feet

k.	Private domestic water line (building service line)	5 feet
l.	Public domestic water line (water purveyor's line)	10 feet
m.	High groundwater table level[5]	
	Leachline	5 feet
	Seepage pit	10 feet
n.	Ground surface on sloping ground (When disposal fields and/or seepage pits are installed in sloping ground, the minimum horizontal distance between any part of the leaching system and ground surface shall be 15 feet.) Also see page A-16.	15 feet
o.	Lakes, water reservoirs	200 feet

3. The minimum separations listed herein are largely derived from the Uniform Plumbing Code. In some cases, additions or changes have been made in order to adequately protect the public health. Where differences exist, the greater separation prevails unless specifically waived for cause by the Department of Environmental Health Services.

Footnotes:

[1] Includes porches and steps whether covered or uncovered, breezeways, roofed porte cocheres, roofed patios, carports, covered walls, covered driveway, and similar structures or appurtenances.

[2] A listing of perennial streams will be maintained by the Division of Environmental Health Services. See pages A-14.

[3] An ephemeral stream/drainage course is any stream not listed as a perennial stream by the Division of Environmental Health Services (see Footnote 2). To determine where the setback restrictions should be applied, the U. S. Geological Survey Maps are used as a guide. If a stream is designated on the USGS Map by a blue dash/dotted line, the setback requirements must be met. If not shown, but there is obvious visual evidence of water flow, the setback is determined by the topography and the geology of the proposed site, but is not less than 25'. Distances are measured from the edge of the channel or assumed 0- 100 year flow.

[4] Any tree with a trunk diameter of one foot or more within 5' of the system that are not to be removed during construction.

[5] The highest known level to which groundwater is known to have occurred rather than the level at the time when testing occurred.

B. Other Factors

1. Special Soil Conditions

a. Special soil conditions may require special consideration by the Division of Environmental Health Services and must be considered on a case-by-case basis, particularly in areas of high rainfall or in proximity to water sources.

b. In the Carbon Canyon area for an individual system, the area of the disposal system tests must be located and tested such that borings are spaced 25 feet or less from proposed disposal area(s).

c. San Bernardino County is known to be criss-crossed with flood control channels, water infiltration basins, perc ponds, tunnels and pipelines which supply water to water districts. Special care must be taken in siting the disposal systems. Check with county liquid waste specialist during notification.

d. Mottled soil - A mottled soil is a soil that is marked with spots or blotches of contrasting color which is usually caused by saturation for some period during a normal year.

If this process has prevailed for significant periods over the recent geologic past, the resulting mottled soil colors can be readily observed.

Zones of seasonal or periodic soil saturation shall be estimated at the highest level of soil mottles. However, soil mottles can occur that are not due to zones of seasonal or period soil saturation; therefore, consult with County Specialist. Monitoring wells may be required to verify lack of groundwater. The abundance, size, contrast and color of the soil mottles shall be described in the following manner: (except frozen soils and soils with rapid permeability).

Abundance shall be described as "few" if the mottled color occupies less than 2% of the exposed surface; "common" if the mottled color occupies from 2% to 20% of the exposed surface; or "many" if the mottled color occupies more than 20% of the exposed surface.

Size refers to the length of the mottle measured along the longest dimension and shall be described as fine if the mottle is less than 5 millimeters (mm); medium if the mottle is from 5-15 mm; or coarse if the mottle is greater than 15 mm.

Contrast refers to the difference in color between the soil mottle and the background color of the soil and is described as faint if the mottle is evident, but recognizable with close examination; distinct if the mottle is readily seen but not striking; or prominent if the mottle is obvious and one of the outstanding features of the horizon. The color(s) of the mottle(s) shall be indicated.

e. A leachline test hole 12 inches (30.5 cm) in diameter is used only when the soil is so stoney or coarse-textured that it is not feasible to dig or bore a standard diameter test hole. The results obtained with this larger diameter hole in minutes per inch or minutes per centimeter are multiplied by the correction factor contained in the leachline formula.

See A-13

f. Technical Modifications
Where sidewall soil materials may slough into the test hole during soaking, two techniques are applied: gravel packing and manual removal.

For gravel packing, a perforated open-top cylinder is placed over the 2 inch (5.1 cm) layer of gravel at the bottom of the test hole. The cylinder is centered in the test hole. The 1 to 2 inch (2.5 to 5.1 cm) space between the hole sidewall and the cylinder is filled with loose, uncompacted, pea-sized gravel. The cylinder may be made out of a perforated piece of pipe, tin can, or hardware cloth. The measured water level drops must be corrected after calculating the effect of the gravel volume.

2. Special discharge conditions:

a. Local hydrogeological conditions may necessitate more separation of the sewage disposal system for protection of special resources (drinking water supply, recreation areas, water storage reservoirs, lakes, etc).

b. Fractured bedrock (decomposed granite is not included) and impervious strata are not suitable for sewage disposal. Impervious is defined for design purposes as a stratum with perc times of >120 mpi.

c. The discharge of surface, rain or other clear water into a sewage disposal system is prohibited.

d. Water softener and iron filter discharge to a sewage disposal system or on the ground surface is prohibited unless specifically approved by RWQCB. Discharge shall be by physical or manual removal to an approved disposal site.

e. Discharge of toxic or hazardous chemicals to a domestic system is prohibited. Industrial developments shall have individual monitoring ports for each unit connected to a confluent sewage disposal system if there is a single owner of the development. Multi-owner industrial units (condo type) shall have a separate system for each unit.

f. Other (Sand and grease interceptors and traps will be considered on a case-by-case basis).

3. Alternative On-Site Sewage Disposal Options

a. Pump systems - All proposals for pumping shall be detailed in the perc report and shall be subject to DEHS and Building & Safety approval. A pump system may be approved when it is determined that the proposal is a hardship as defined. The following information is required for review:

1. Percolation data
2. Pump data
3. Design of the pump chamber, to include a storage volume equal to 24 hours design flow, in the event of a power outage or a pump failure, or make provision for overflow to an adequately sized back-up gravity disposal area.
4. Alarm system design
5. Force main and backflow prevention design certified by AWWA Grade II cross-

connection specialist

6. Design of a receiving chamber at the disposal site which allows the simulation of gravity flow to the disposal system. In all cases, gravity flow to the septic tank is required, such that only settled effluent is pumped from the pump chamber. All components shall comply with the latest edition of the UPC and UBC standards.

b. Where site conditions are such that individual septic systems are not feasible for the proposed development, the use of a multiple ownership septic system may be used, complying with the San Bernardino County Code, Title 3, Chapter 8, Article 7, and Water Quality Control Board Waste Discharge Requirements.

c. The use of designed (demonstration) sewage disposal systems may be allowed with the concurrent approval of the appropriate Regional Water Quality Control Board, DEHS and the Department of Building & Safety. Designed sewage disposal systems include, but are not limited to: mound systems, evapotranspiration systems, denitrifying systems, and sand filtration systems. These systems shall not be approved for the creation of new lots unless specifically approved first by the Board of Supervisors and California Water Quality Control Board, but as a remediation for otherwise unsuitable existing lots on a case by case basis.

   The conditions of approval and any required monitoring shall be part of the property's recorded deed.

d. The use of holding tanks shall not be approved for subdivision purposes except if there is documented evidence that a sewer connection will be available within 24 months and the use of the holding tanks complies with San Bernardino County Code, Title 3, Chapter 8, Article 4.

e. Utilization of advanced wastewater package treatment plants may be utilized on or off site for those developments which do not meet the Regional Board's guidelines for septic systems. A percolation report will be required for all developments. Siting of the system and the design of the disposal system shall meet DEHS and the Department of Building & Safety standards. The plant shall have a Waste Discharge Requirement (WDR) or National Pollutant Discharge Elimination System (NPDES) permit from the Regional Water Quality Control Board. The plant shall be under the control of: 1) a public entity or 2) serviced on a regular basis by qualified, certified wastewater treatment plant personnel.

4. Percolation Report Waiver Criteria

The percolation report requirement for non-critical area development (minor subdivision parcel maps) may be waived by the Division of Environmental Health Services upon presentation of the following:

a. The person or consultant requesting the waiver shall refer to actual approved percolation tests performed on the land in question, or a contiguous parcel, and submit copies of the percolation reports (with the property owner's and consultant's written permission), or,

b. The consultant shall provide a soil horizon identification study per the following criteria.

   (1) The study shall be performed by a qualified professional: a Registered Civil

Engineer, Certified Engineering Geologist, Registered Environmental Health Specialist, Registered Geologist, or Geotechnical Engineer.

(2) The site evaluation shall include soil descriptions, properties and expected permeabilities per 3.3.1, depth to zones of soil saturation, depth to impermeable material (s), slope, potential for flooding and type(s) of vegetation.

(3) The depth of the soil profile shall be a minimum 8 feet below the proposed depth of the leachline and 10 feet below the proposed depth of a seepage pit, and shall be of sufficient dimension to be accessible for soil evaluation: in addition, a minimum of two excavations for each lot will be required. Use a backhoe for leachlines, use a bucket rig for seepage pits (or sample in place the soils).

c. The consultant shall provide a statement that there are no factors (list mitigation measures) which would adversely affect the installation of a subsurface sewage disposal system. These would include: water table levels (historic, source of information), drainage channels, cuts and fills, rock ledges and outcrops, steep slopes, and the location of any wells.

d. The document shall include the assessor parcel number, size of the parcels in acres or square feet, location of the property, proposed development on the property, and a plot plan showing building pad, sewage disposal area and 100% expansion.

e. The consultant shall state that the proposed sewage disposal system meets RWQCB standards, DEHS standards, shall not cause a public health nuisance nor degrade surface and/or groundwater. The consultant shall sign the document and include his/her stamp with registration number.

f. A fee shall be paid to the Division of Environmental Health Services as determined by the current fee schedule for review.

DAYLIGHT REQUIREMENTS

Any portion of the disposal field located to the top of a cut or on sloping ground shall maintain a 15 foot horizontal distance from daylight to any portion of the leachline or leach bed. The table gives the minimum cover required versus the percent of slope in the area of the disposal field to meet the 15 foot requirement. This table also gives a factor "f" by which to increase the length of the trench due to the assumed loss in evapotranspiration caused by the added cover.

Slope of the Ground in the Area of the Disposal System	Minimum Cover Over the Drain Lines	f
5%	1.00 ft	1.0
10%	1.50 ft	1.0
15%	2.25 ft	1.0
20%	3.00 ft	1.0
25%	3.75 ft	1.1
30%	4.50 ft	1.2
35%	5.25 ft	1.3
40%	6.00 ft	1.4
45%	7.00 ft	1.5

(Slopes greater than 30% require CRWQCB approval)

Note: If for design purposes additional cover is required over drain lines (e.g.; below fill), the cover factor is still applicable.

SPECIAL CONSIDERATIONS FOR ABSORPTION FIELD PLACEMENT IN SLOPING GROUND

1. If ground slope is > 30%, any portion of an absorption field (except solid pipe) shall be a minimum of 10 feet (horizontally) from the downslope property line(s). It is the report preparer's responsibility to certify that this minimum is applied or expanded if the slope is less than or equal to 30%, but the soil conditions are such that a basement or curtain drain already built 5 feet downslope from the lower property line(s) may be affected by sewage effluent. Show setback on plot.
2. The minimum horizontal distance between any portion of an absorption field (except solid pipe) and an exposed downward sloping impermeable stratum or bedrock in "cut" slope shall be 50 feet. It is the report preparers responsibility to make recommendations so that systems do not daylight. It is the owner/contractor(s) responsibility to install systems per the recommendations. The consultant may wish to inspect installations to be assured that recommendations are followed. If so desired by consultant, make it a requirement of approval. Upon presentation of pertinent engineering data, the County Specialist may stipulate this requirement.

GRAVEL PACKING CORRECTIONS

If gravel packing was used, correct rates for the effect of the gravel volume. Show in detail measurements of the gravel volume and the calculations. The easiest way to calculate per cent gravel voids in the field is as follows:

Fill a 23½ oz. cylindrical tin can "A" with gravel. The gravel should be loose, uncompacted, just like in the test hole. Don't shake the can.* If the gravel is fine (pea size), fill with water and then drain thoroughly. Fill another identical can "B" with water; pour this water into can "A" until water barely drips out of its rim. (No spillages.) Per cent gravel void is equal to height of water missing in B divided by total height of can, times 100. Add formula correction factor to seepage pit or leachline design.

Correction Factor

$$\text{Formula} = [1 + P (C^2 - 1)] / C^2$$

$$C = r_2 / r_1$$

r_2 = radius of hole

r_1 = radius of pipe

P = % of voids

Another method for gravel packing corrections is by weighing the can with gravel, with gravel+water and with water using the formula below. By using this method, you do not have to assume to have two identical cans.

1. Weigh the can = A
2. Fill can with water to top; weigh = B
3. Empty can and fill with gravel (wet or dry as in other method); weigh = C
4. Fill gravel-packed can with water to top; weigh = D
5. Calculate the gravel correction factor using the following equation:

$$\frac{D - C}{B - A} = \text{Gravel Correction Factor (i.e. - \% voids)}$$

* If during field testing the gravel in the test hole is observed to compact, shake the can.

PERENNIAL STREAMS OF SAN BERNARDINO COUNTY

The following list of streams has been provided to the Department by the Regional Water Quality Control Boards. These are the streams which they consider to be wholly or in part perennial. The list may be amended from time to time in order to reflect better or more complete information as it becomes known to the Department.

A. California Regional Water Quality Control Board, Lahontan Region (Regional Board No. 6)

1. East Fork of the West Fork of the Mojave River
2. Seeley Canyon Creek
3. Houston Creek
4. Deep Creek
5. Holcomb Creek
6. Hooks Creek
7. Shale Creek
8. Crab Creek
9. Little Bear Creek (Lake Arrowhead Dam to confluence with Deer Creek)
10. Salt Creek (North of Baker, California)
11. Heath Canyon Creek
12. Swarthout Creek
13. Sheep Creek (North of Highway 2)

B. California Regional Water Quality Control Board Colorado River Basin Region (Regional Board No. 7)

1. Colorado River
2. Whitewater River
3. San Gorgonio River
4. Pinto Creek
5. Copper Basin Creek
6. Arrastre Creek

C. California Regional Water Quality Control Board, Santa Ana Region (Regional Board No. 8)

1. Santa Ana River - Reach 6 (Above confluence with Bear Creek)
    a. Deer Creek
    b. Hamilton Creek
    c. Wildhorse Creek
    d. Cienaga Seca Creek
    e. Coon Creek
    f. Fish Creek
    g. Lost Creek
    h. South Fork - Santa Ana River
    i. Frog Creek
    j. Barton Creek (east and west forks)
    k. Forsee Creek
    l. Schneider Creek
    m. Gold Creek

PERENNIAL STREAMS OF SAN BERNARDINO COUNTY (Cont'd)

2. Mill Creek (above upper powerhouse)
   a. Mountain Home Creek
   b. Monkey Face Creek
   c. Alger Creek
   d. Falls Creek
   e. Vivian Creek

3. Oak Glen Creek (above Oak Glen)
   a. Birch Creek

4. Bear Creek
   a. North Fork - Bear Creek
   b. Grout Creek
   c. Caribou Creek
   d. Rathbone Creek
   e. Metcalf Creek
   f. Kidd Creek
   g. Siberia Creek

5. Lytle Creek (above upper powerhouse)
   a. Middle Fork - Lytle Creek

6. Devil Canyon Creek (east and west forks above power plant)

7. Cajon Creek (above Keenbrook)

8. Waterman Canyon Creek

9. City Creek (above gaging stations)
   a. West Fork - City Creek
   b. East Fork - City Creek
   c. Middle Fork - City Creek

10. Plunge Creek (above gaging stations)
    a. Little Mill Creek
    b. Fredalba Creek

11. Alder Creek (tributary to Santa Ana Reach 5)
    a. Middle Fork - Alder Creek
    b. Hemlock Creek
    c. Keller Creek

PERENNIAL STREAMS OF SAN BERNARDINO COUNTY (Cont'd)

12. East Twin Creek (above gaging stations)
    a. Strawberry Creek
13. East Etiwanda Creek (within National Forest)
14. Day Canyon Creek (above gaging station)
15. Cucamonga Creek (above gaging station)
16. San Antonio Creek (1 mile above community of Mt. Baldy)
    a. Ice House Canyon Creek
17. Chino Creek (from confluence with Santa Ana River to Pine Avenue)
18. Carbon Canyon

Redlands

951-320-6396 Mohamed

REGIONAL WATER QUALITY CONTROL BOARD (RWQCB)
MINIMUM ON-SITE SEWAGE DISPOSAL CRITERIA

951-782-4130 ~~Erin (Stormwater/ Coastal Unit)~~ Nam (inland)

SANTA ANA REGION

A. Unless the developer demonstrates by substantial evidence or the local health authority finds that a pollution, nuisance, or contamination will not occur as a result of the discharge of domestic wastes, the following criteria are considered necessary for the protection of water quality objectives, to prevent impairment of beneficial uses, to prevent pollution, nuisance, or contamination, and to prevent unreasonable degradation of water quality: ~~Keith~~

1. Depth of soil between ground surface and anticipated high groundwater in the disposal area shall not be less than 10 feet.
2. Depth of soil containing at least 10 percent of the particles smaller than 0.08 millimeters between the bottom of the disposal facilities and anticipated high groundwater shall not be less than 5 feet.
3. Depth of soil between the bottom of any leaching system and impermeable strata shall not be less than 8 feet.
4. Natural or finished ground slope in the disposal area shall not be greater than 30 percent.
5. The percolation rate in the disposal area shall not be greater than 60 minutes per inch if the discharge is to be leachfield, and not less than 1.1 gallons of effluent per square foot per day if the discharge is through a seepage pit. If the percolation rates are faster than 5 minutes per inch, additional testing will be required to determine compliance with 2., or if percolation rates are faster than 5 minutes per inch, minimum depth to groundwater between the bottom of ,the disposal facilities and the anticipated high groundwater shall be 40 feet. (The percolation rates shall be determined in accordance with procedures prescribed by the appropriate public agency.)
6. Compliance is required with all applicable local requirements, including but not limited to requirements on lot size, distance from wells, streams, drainage courses, reservoirs, adjoining properties, or other points.

B. Minimum lot size requirements and exemption criteria for new developments using on-site septic tank-subsurface leaching/percolation systems:

1. A minimum lot size of one-half acre (average gross) per dwelling unit is required for new developments in the Region using on-site septic tank-subsurface leaching/percolation systems.
   a. The term "one-half acre" specified as the minimum lot size requirement means an average gross area of land of one-half acre per dwelling unit. In the calculation of the average lot size, areas set aside for streets, curbs, commons, greenbelts, and other easements may be included.

b. A "new" development is defined as a proposed tract, parcel, industrial or commercial development that has not been granted one or more of the following on or prior to September 7, 1989:

   1. Conditional approval or approval of a tentative parcel or tract map by the local agency such as the county/city Planning Commission, City Council, or the Board of Supervisors.

   2. A conditional use permit.

   3. Conditional approval or approval by the San Bernardino County Division of Environmental Health Services, Riverside County Department of Health, Orange County Health Care Agency, or other local agency.

c. The minimum lot size requirement does not apply to existing developments where septic tank-subsurface disposal systems have been installed on or prior to September 7, 1989.

d. Those tracts, parcels, industrial or commercial developments which have received one or more of the approvals listed in "b", above, on or prior to September 7, 1989 are exempt from minimum lot size requirements for use of septic tank-subsurface disposal systems.

e. A residential tract or parcel of five acres or less which is completely surrounded by tract(s) and/or parcel(s) with high density (i.e., less than one-half acre gross average per dwelling unit) residential developments and which has received zoning identical to that of the surrounding developments may be granted an exemption from the minimum lot size requirement, provided that all of the surrounding tract(s) and/or parcel(s) have been granted one or more of the approvals identified in "b", above, on or prior to September 7, 1989. Non-residential property such as schools, churches, public utilities, shopping centers, etc. which border the tracts/parcels in questions are to be disregarded when conformance with this criterion is determined; conformance is to be based solely on the nature of the remaining developments surrounding the property.

This exemption criterion expires after December 31, 1991.

f. For new industrial/commercial developments utilizing septic tank-subsurface disposal systems, the wastewater flow for each one-half acre of land may not exceed that from a three-bedroom, two-bath house as specified in the Uniform Plumbing Code (20 fixture units).

g. This minimum lot size requirement does not affect the lot size criterion for continuing exemptions in prohibition areas (1 acre minimum).

h. This minimum lot size requirement does not preclude the prescription of more stringent lot size requirements in specific areas if it is determined necessary to protect water quality.

i. No exemptions may be granted for new developments on tracts/parcels which are 660 feet or less from a sewer which could serve that tract/parcel, barring legal impediments to such use.

j. New lots of less than one-half acre may be formed by combining two or more lots which have received one of the approvals specified in Section l.bl, above, on or prior to September 7, 1989. Individually, these existing lots would be eligible for an exemption from the minimum lot size requirement. Developments on the combined lots may also be granted an exemption provided that the total number of units proposed for the new parcel is equal to or less than the total number of units proposed for the existing parcel. For the purposes of this subsection, a combined lot of less than one-half acre formed from two or more existing lots shall not be considered a new development.

COLORADO RIVER BASIN REGION

1. In areas overlying groundwaters which are usable or potentially usable for domestic purposes:

   a. Depth of soil between ground surface and high groundwater level or impervious strata in the disposal area shall not be less than 10 feet.

   b. Depth of soil between the bottom of the disposal facility and fractured rock or high groundwater level shall be at least five feet for leachlines and 10 feet for seepage pits where the soil strata consists of at least 10 percent of the material passing a No. 200 sieve. Additional soil depth will be required as the effective grain size of the soil increases.

   c. Natural or finished ground slope in the disposal area shall not exceed 30 percent.

   d. The percolation rate in the disposal area shall not be greater than 60 minutes per inch if the discharge is to a leachfield, and not less than 1.1 gallons of effluent per square foot per day if the discharge is through a seepage pit. If the percolation rates are faster than 5 minutes per inch, additional testing will be required to determine compliance with 1-b, or if percolation rates are faster than 5 minutes per inch, minimum depth to groundwater between the bottom of the disposal facilities and the anticipated high groundwater shall be 40 feet. (The percolation rates shall be determined in accordance with procedures prescribed by the appropriate public agency.)

2. Other structural limitations, such as horizontal distance between a sewage leaching facility and a water well used for domestic purposes, a surface water used for domestic purposes or for water-contact sports, or other surface impoundment accessible to the public shall be as specified by the local regulatory agency.

3. In areas overlying groundwaters which are unusable for domestic or agricultural purposes:

   a. Depth of permeable soil between ground surface and groundwater level shall not be less than four feet.

   b. Depth of permeable soil between the bottom of the disposal facility and impervious strata shall not be less than four feet.

   c. The acceptable percolation rate shall be determined by the county regulatory agency in

consideration of the required disposal area and other technical factors, in consultation with the Regional Board's Executive Officer or his designee.

d. Compliance with the above-listed Criteria 1 through 3, as well as compliance with local codes and/or policies regulating sewage disposal, will be as determined technically by the appropriate county regulatory agency, subject to review by the Regional Board as to the provisions of said Criteria 1 through 3.

LAHONTAN REGION

1. Maximum Density

Individual waste disposal systems associated with new developments which have a gross density greater than two (2) single family equivalent dwelling units per acre will be required to have secondary-level treatment of wastewater. Equivalent dwelling units (EDUs) are defined as a unit of measure used for sizing a development based on the amount of waste generated from that development; the value used in implementation of these criteria is 250 gallons per day per EDU. For the purposes of these criteria, the discharge from a single family dwelling is equal to one EDU. For the purposes of these amendments, senior citizen dwelling units and second units as defined in Government Code Sections 65852.1 and 65852.2 will not be considered as additional dwelling units. In addition to residential developments, this secondary level treatment policy also applies to wastewater discharges from commercial, industrial, recreational and all other developments with wastewater discharge volumes exceeding two EDU per acre density (500/gal/day/acre based on 250 gal/day/EDU). Use of new septic systems is permitted in existing developments as of June 16, 1988 with lot sizes having a net area greater than or equal to 15,000 square feet. The net area is that contained within the boundaries as set forth in the legal lot description.

2. Minimum Distances

The Board has established the minimum distances (see Table entitled, "Minimum Distances for Siting Individual Waste Disposal Systems") necessary to provide protection to water quality and/or public health.

RWQCB MINIMUM ON-SITE SEWAGE DISPOSAL CRITERIA CONT'D

3. Additional Minimum Criteria

   a. The percolation rate in the disposal area shall not be slower than 60 minutes per inch if the discharge is to a leachfield or 30 minutes per inch if discharge is to a seepage pit. If percolation rates are faster than 5 minutes per inch, minimum distance to groundwater between the bottom of the disposal facilities and the anticipated high groundwater shall be 40 feet. (The percolation rates shall be determined in accordance with procedures prescribed by the appropriate local public health agency.)

   b. Clay, bedrock, or other material impermeable to the passage of water shall not be less than 5 feet below the bottom of the leaching trench or less than 10 feet below the bottom of the seepage pit.

   c. Depth to anticipated high groundwater below the bottom of the leaching trench shall not be less than 5 feet. Depth to anticipated high groundwater below the bottom of the seepage pit shall not be less than 10 feet. Greater depths are required if native material does not provide adequate filtration.

   d. Natural ground slope in the disposal area shall not be greater than 30 percent.

Exemptions to the Criteria for Individual Waste Disposal Systems

In certain locations and under special circumstances, the Board or its Executive Office may waive individual criteria.

1. Waiver of one or more individual criteria may occur if:

   a. The area beneath the proposed septic system discharge has no significant amount of groundwater having present or future beneficial uses; or

   b. It can be proven that no pollution, nuisance or unreasonable degradation of either surface or groundwaters will occur as a result of the proposed septic system density when considered individually or cumulatively with other discharges in the area; or

   c. Construction of a community collection, treatment, and disposal system is imminent. Short term, interim use of individual waste disposal systems may be allowed.

MINIMUM DISTANCES FOR SITING INDIVIDUAL WASTE DISPOSAL SYSTEMS (in feet)

Facility	Domestic Well	Public Well	Flowing Stream[1]	Drainage Course or Ephermeral Stream[2]
Septic tank or sewer line	100	100	50	25
Leaching field	100	100	100	50
Seepage pit	150	150	100	50

Facility	Cut or Fill Bank[3]	Property Line[4]	Lake or Reservoir[5]
Septic tank or sewer line	10	25	50
Leaching field	4h	50	200
Seepage pit	4h[6]	75	200

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[1] As measured from the line which defines the limit of a 100-year frequency flood.

[2] As measured from the edge of the channel.

[3] Distance in feet equals four times the vertical height of the cut or fill bank. Distance is measured from the top edge of the bank.

[4] When individual wells are used on the same lot. (Distances are to those property lines contiguous with neighboring lots and not street easements.)

[5] As measured from the high water line.

[6] As measured from the high seepage level.

ADDITIONAL REQUIREMENTS FOR SAN BERNARDINO MOUNTAIN AREAS

PER BOARD ORDERS 6-84-93, 6-81-3

1. Depth of soil* between ground surface and bedrock or any other material of low permeability shall not be less than 10 feet (3.0 m).

2. Depth of soil* between the bottom of the disposal facilities and groundwater shall not be less than 10 feet (3.0 m).

3. All facilities used for collection, transport, treatment or disposal of waste shall be adequately protected against either structural damage or a significant reduction in efficiency resulting from a storm or flood having a recurrence interval of once in 100 years.

* Soil is defined as a granular or weathered material having an effective porosity of greater than 15 percent.

Suggested References

EHS	Our Current "Standards" Booklet
UPC	Current Edition
US EPA	(1980) Design Manual, Onsite Wastewater Treatment and Disposal Systems. EPA 625/1-80-012. Available from NTIS, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22151.
Canter & Knox	(1985) Septic Tank Systems Effects on Ground Water Quality - Lewis Publishers
Kaplan	(1987) Septic Systems Handbook - Lewis Publishers
Winneberger, J.T.	(1984 Septic Tank Systems, Ann Arbor Science (Butterworth Publ.) Boston

American Society of Agricultural Engineers, On-Site Wastewater Treatment Proceedings of the Third, Fourth, Fifth and Sixth National Symposia on Individual and Small Community Sewage Systems, ASAE Publications 1-82, 07-85, 10-87, 10-91, ASAE, 2950 Niles Road, St. Joseph, Michigan 49085-9659

Perkins	(1989) On-site Wastewater Disposal, Lewis Publishers

All of the cited references are of interest, none is the last word on the subject.

Attachment A - Santa Ana

MINIMUM LOT SIZE REQUIREMENTS AND EXEMPTION CRITERIA FOR NEW DEVELOPMENTS USING ON-SITE SEPTIC TANK-SUBSURFACE LEACHING PERCOLATION SYSTEMS

On October 13, 1989, the Regional Board adopted Resolution No. 89-157, amending the Water Quality Control Plan to add a one-half acre minimum lot size requirement for new developments using on-site septic tank-subsurface leaching/percolation systems regionwide. Certain exemptions from the minimum lot size requirement were specified in Resolution No. 89-157. On December 7, 1990, the Regional Board adopted Resolution No. 90-158, which revised the exemption criteria. However, on June 7, 1991, the Regional Board adopted Resolution No. 91-51, rescinding Resolution No. 90-158 and revising the exemption criteria in Resolution No. 89-157. On July 16, 1993, the Regional Board adopted Resolution No. 93-40, revising the requirements and exemption criteria in Resolution No. 89-157, as amended by Resolution No. 91-51. Resolution No. 89-157, as amended by Resolution No. 93-40, stipulates the following:

I. A minimum lot size of one-half acre (average gross) per dwelling unit is required for new developments in the Region using on-site septic tank-subsurface leaching/percolation systems.

A. The term "one-half acre" specified as the minimum lot size requirement means an average gross area of land of one-half acre per dwelling unit. Easements (including streets, curbs, commons, and greenbelts), or those portions thereof which are part of the property proposed for development shall be included in the calculation of the average gross area of land.

B. A "new" development is defined as a proposed tract, parcel, industrial or commercial development for which:

1. One or more of the following has not been granted on or prior to September 7, 1989:

a. Conditional approval or approval of a tentative parcel or tract map by the local agency such as the county/city Planning Commission, City Council or the Board of Supervisors.

b. A conditional use permit.

c. Conditional approval or approval by the San Bernardino County Department of Environmental Health Services, Riverside County Department of Health, Orange County Health Care Agency or other local agency; or

2. One or more of the conditional approvals or approvals listed under B.1., above, were granted on or prior to September 7, 1989 but had expired prior to September 7, 1989.

C. The minimum lot size requirement does not apply to existing developments where septic tank-subsurface disposal systems have been installed on or prior to September 7, 1989. Replacement of the existing septic tank-subsurface disposal systems shall be exempt from the minimum lot size requirements under the following conditions.

1. For Residential. Commercial and Industrial Developments

   Replacement of the existing septic tank-subsurface disposal systems is necessary to bring the system up to code as required by the local health care agencies and/or the building and safety departments.

2. For Single Family Residential Only

   Replacement of the existing septic tank-subsurface disposal systems is proposed to allow additional flows resulting from additions to the existing dwelling unit. (This does not include any free-standing additional structures.)

   (Note: Board staff does not consider the number of bedrooms and/or bathrooms for existing or proposed single-family dwelling units in determining compliance with the exemption criteria.)

   a. An existing development on land zoned single-family residential will be considered as a new development if the addition of any free-standing structures which will result in additional wastewater flows to the septic system is proposed. Commercial and/or industrial developments will be considered as new development if any additions to the existing structures are proposed which will result in additional wastewater flows to the septic system.

   b. For single-family residential developments, if the existing septic system could accommodate additional wastewater flows, then additional installations (rooms/ bathroom) to these developments shall be exempt from the minimum lot size requirements.

D. Those tracts, parcels, industrial or commercial developments which have received one or more of the approvals listed in B.1 ., above, on or prior to September 7, 1989 are exempt from minimum lot size requirements for use of septic tank-subsurface disposal systems. However, those tracts, parcels, industrial or commercial developments which had received one or more of the approvals listed in B.1., above, but for which the approval had expired prior to September 7, 1989 are considered as new development and are subject to the minimum lot size requirements.

E. Industrial/commercial developments are developments other than single-family residential developments. For new industrial/commercial developments utilizing septic tank-subsurface disposal systems, the wastewater flow for each one-half acre gross area of land may not exceed that from a three-bedroom, two-bathroom single-family dwelling unit. For determining compliance with this criterion, a flow rate of 300 gallons per day shall be considered as the flow equivalent to that from a 3-bedroom, 2-bathroom single family dwelling. For industrial/commercial developments with lots smaller than one-half acre, this flow rate requirement shall be prorated. (For example, an industrial/commercial development on a one-quarter (1/4) acre parcel will be in compliance with this requirement if the wastewater flow does not exceed 150 gallons per day.)

F. This minimum lot size requirement does not affect the lot size criterion for continuing exemptions in prohibition areas (1-acre minimum).

G. This minimum lot size requirement does not preclude the prescription of more stringent lot size requirements in specific areas if it is determined necessary to protect water quality.

H. No exemptions shall be granted for new developments on lots less than one-half acre which are 200 feet or less from a sewer which could serve that tract/parcel, barring legal impediments to such use.

All other developments shall be considered on a sliding scale, e.g., for each additional unit (any development which is more than a single family dwelling), this requirement should be increased by 100-feet per dwelling unit. For example, a 10-lot subdivision shall be required to connect to a sewer if the sewer is within 1,100 feet (200 + 9 x 100 feet = 1,100 feet) of the proposed development barring legal impediments to connection to the sewer. For this subsection, a commercial/industrial development which produces a wastewater flow of up to 300 gallons per day would be considered equivalent to a single family dwelling unit.

I. New lots of less than one-half acre may be formed by combining two or more lots which have received one of the approvals specified in Section B.1., above, on or prior to September 7, 1989. Individually, these existing lots would be eligible for an exemption from the minimum lot size requirement. Developments on the combined lots may also be granted an exemption provided that the total number of units proposed for the new parcel is equal to or less than the total number of units proposed for the existing parcel. For the purposes of this subsection, a combined lot of less than one-half acre formed from two or more existing lots shall not be considered a new development.

J. Exemptions from the minimum lot size requirements for the use of septic tank-subsurface disposal systems on lots smaller than one-half acre may be granted if the following conditions are met:

1. The project proponent implements an acceptable offset program. Under an offset program, the project proponent can proceed with development using septic systems on lots smaller than one-half acre if the proponent connects an equivalent number of septic systems to the sewer. The unsewered developments must be those which would not otherwise be required to connect to the sewer.

2. If the septic systems (developments) proposed are not identical to the ones connected to the sewer (the offset), an engineering report shall be submitted certifying that the nitrogen loading rate from the proposed development(s) is(are) equivalent to or less than the nitrogen loading rate from the septic systems in the offset program.

3. The proposed use of septic tank-subsurface disposal systems complies with the Regional Board's "Guidelines for Sewage Disposal from Land Developments."

K. The project proponent may propose an alternative treatment system for sewage disposal as the basis for an exemption from the minimum lot size requirement. Each request for use of an alternative treatment system shall be reviewed on a case-by-case basis and submitted to the Regional Board for consideration.

Individual Wastewater Treatment Systems (Septic Systems)

The following principles and policies will be applied by the Regional Board in review of water quality factors relating to land developments and waste disposal from individual waste disposal systems:

1. The following criteria will be applied as the minimum to ensure continued adequate protection of water quality, protection of present and future beneficial uses, and prevention of pollution, contamination and nuisance conditions. The Regional Board will prohibit the discharge from individual disposal systems which do not conform to these criteria.

2. These criteria prescribe minimum conditions for waste disposal from individual on-site systems and do not preclude the establishment of more stringent criteria by local agencies or the Regional Board. The Regional Board does not intend to preempt the authority of local agencies and wilt support local agencies to the fullest extent possible, particularly in the implementation of more stringent regulations.

3. Detailed procedures to implement these criteria and to process exemptions to these criteria are included in "Regional Board Guidelines for Implementation of Criteria for Individual Waste Disposal Systems" (see Appendix C).

4. The criteria contained herein are applicable to the entire Lahontan Region and pertain to any and all proposed building that involves wastewater discharges to other than a community sewer system. The criteria apply to: (1) proposed building on lots within new subdivisions or parcels, and (2) proposed building on existing subdivided lots or parcels, and (3) proposed subdivisions. The criteria do not apply to: (1) existing individual waste disposal systems, or (2) projects which have final building permits prior to June 16, 1988, unless evidence exists which necessitates retrofit of septic systems to conform with current criteria. The "Regional Board Guidelines for Implementation of Criteria for Individual Waste Disposal Systems" specifies separate exemption procedures for existing developments and for new developments. Existing development includes projects for which final development plans, such as a final tract map, were approved by local agencies prior to June 16, 1988. New development includes subdivisions or individual parcels which do not have final development plans approved by local agencies prior to June 16, 1988.

5. These criteria do not apply to projects within septic system prohibition areas where the criteria are more stringent (for prohibitions, see Section 4.1 of this Chapter); and these criteria will preempt less stringent criteria in septic system prohibition areas.

6. Where community sewer systems are available, the Board will encourage connection to the sewer system in lieu of use of individual disposal systems.

Criteria for Individual Waste Disposal Systems

1. *Maximum Density*

Individual waste disposal systems associated with new developments which have a gross density greater than two (2) single family equivalent dwelling units per acre will be required to have secondary level treatment of wastewater. Equivalent dwelling units (EDUs) are defined as a unit of measure used for sizing a development based on the amount of waste generated from that development; the value used in implementation of these criteria is 250 gallons per day per EDU. For the purposes of these criteria, the discharge from a single family dwelling is equal to one EDU. Senior citizen dwelling units and second units as defined in Government Code Sections 65852.1 and 65852.2 will not be considered as additional dwelling units. In addition to residential developments, this secondary level treatment policy also applies to wastewater discharges from commercial, industrial, recreational and all other developments with wastewater discharge volumes exceeding two EDU per acre density (500/gal/day/acre based on 250 gal/day/EDU). Use of new septic systems is permitted in existing developments with lot sizes having a net area greater than or equal to 15,000 square feet. The net area is that contained within the boundaries as set forth in the legal lot description.

2. *Minimum Distances*

The Regional Board has established the minimum distances (see Table 4.4-1 entitled, "Minimum Distances For Siting Individual Waste Disposal Systems") necessary to provide protection to water quality and/or public health. Local hydrogeological conditions may necessitate greater separation of the sewage disposal system from a well or watercourse for protection of beneficial uses (e.g., drinking supply and water contact recreation).

3. *Additional Minimum Criteria*

a. The percolation rate in the disposal area shall not be slower than 60 minutes per inch if the discharge is to a leachfield or 30 minutes per inch if discharge is to a seepage pit. If percolation rates are faster than 5 minutes per inch, then the soil for a total thickness of five feet below the bottom of the leaching trench shall contain at least 15% of material passing the No. 200 U.S. Standard Sieve and less than one-fourth of the representative soil cross-section shall be occupied by stones larger than 6 inches in diameter. Where the percolation rates are faster than 5 minutes per inch and the above requirement is not met, the minimum distance to ground water between the bottom of the disposal facilities and the anticipated high ground water shall be 40 feet. (The percolation rates shall be determined in accordance with procedures prescribed by the appropriate local public health agency.)

b. Clay, bedrock, other material impervious to the passage of water, or fractured bedrock, shall not be less than 5 feet below the bottom of the leaching trench or less than 10 feet below the bottom of the seepage pit. Impervious is defined for design purposes as a stratum with percolation times of greater than 120 minutes per inch.

c. Depth to anticipated high ground water below the bottom of the leaching trench shall not be less than 5 feet. Depth to anticipated high ground water below the bottom of the seepage pit shall not be less than 10 feet. Greater depths are required if native material does not provide adequate filtration.

d. Ground slope in the disposal area shall not be greater than 30 percent.

e. Minimum criteria specified above must be met within the area of the proposed system and within the 100% expansion area for the proposed system.

Exemptions to the Criteria for Individual Waste Disposal Systems

In certain locations and under special circumstances, the Board or its Executive Officer may waive individual criteria.

1. Waiver of one or more individual criteria may occur if:
   a. The area beneath the proposed septic system discharge has no significant amount of ground water having present or future beneficial uses; or
   b. It can be proven that no pollution, nuisance or unreasonable degradation of either surface or ground waters will occur as a result of the proposed septic system density when considered individually or cumulatively with other discharges in the area; or
   c. Construction of a community collection, treatment, and disposal system is imminent. Short-term, interim use of individual waste disposal systems may be allowed.

Implementation of Criteria for Individual Waste Disposal Systems

1. The Regional Board and the local agencies have adopted, through Memoranda of Understanding, criteria which are compatible with or more stringent than these criteria.
2. The Memoranda of Understanding include the procedures of the review and processing of applications for proposed discharge of wastewater from land developments which only discharge domestic waste, including single-family-unit residential, multi-unit residential, commercial, industrial and recreational developments. The Memoranda of Understanding include provisions for Regional Board review and processing of specific application (e.g., for industrial waste discharges).
3. For those local agencies which have adopted these or more stringent criteria, land developments which only discharge domestic waste, including single-family-unit residential, multi-unit residential, commercial, industrial and recreational developments, will be permitted entirely by the local agency. (However, the Regional Board reserves the authority to take action, if necessary, as described in item 6 below.)
4. Whenever the proposed development will not meet the minimum criteria and no Memorandum of Understanding or other equivalent document exists between the Regional Board and the local agency, applications for all projects shall be transmitted to the Regional Board along with a complete report of waste discharge and a filing fee.
5. The Regional Board will review, on a project-by-project basis, proposals for commercial, industrial, recreational and all other types of developments which discharge industrial waste. If required, the report of waste discharge will contain information on estimated wastewater flows, types of wastes, and occupancy rates which will enable the Regional Board to evaluate the discharge in terms of EDUs.
6. In any case, the Regional Board will prohibit the discharge of wastes from land developments which will result in violation of water quality objectives, will impair present or future beneficial uses of water, or will cause pollution, nuisance, or contamination, or will unreasonably degrade quality of any waters of the State.

Implementation for Other Types of Waste Disposal from Land Developments

1. Severe impact on water quality can result from failure to implement adequate measures to control storm drainage and erosion. Land developers must provide plans for the control of such runoff from initial construction up to the complete build-out of the development. (See "Land Development" section.)
2. The disposal of solid waste can have adverse impacts on water quality and public health. Land developers must submit a plan which conforms to the regional or county master plan and contains adequate provisions for solid waste disposal for complete build-out of the development.

3. The disposal of septic tank sludge is an important part of any area-wide master plan for waste disposal. Land developers must submit a plan which conforms to the regional or county master plan and contains adequate provisions for septic tank sludge disposal for complete build-out of the development.
4. The responsibility for the timely submittal of information necessary for the Board to determine compliance with these guidelines rests with persons submitting proposals for development or discharge. The Porter-Cologne Water Quality Control Act provides that no person shall initiate discharges of waste prior to filing a report of waste discharge and prior to (1) issuance of waste discharge requirements, (2) the expiration of 120 days after submittal of an adequate report of waste discharge, or (3) the issuance of a waiver by the Regional Board.

Alternative Individual Waste Disposal Systems

In areas where conditions do not support the use of conventional individual subsurface waste disposal systems (e.g., septic systems), the use of engineered alternative systems can be considered. Alternative waste disposal systems include, but are not limited to, mound systems, evapotranspiration beds, sand filters (intermittent and/ or recirculating), and lined evaporation ponds. The Regional Board supports the use of engineered alternative systems for waste disposal as a remedy for otherwise unsuitable existing lots. However, the Regional Board discourages the use of engineered alternative systems for new construction, lots, or subdivisions.

Several factors the Local Health Officer and/or the Regional Board staff will consider when evaluating a proposal for the use of an alternative system include, but are not limited to:

1. **size of parcel**
2. **density of surrounding development**
3. **depth to ground water and bedrock**
4. **depth of soils** suitable for waste disposal as classified under the USDA classification system
5. **climate**
6. **access**
   (a) for maintenance and pumping year-round
   (b) control to prevent public contact
7. **emergency contingency plans** (including plans for expansion, replacement or repair)
8. **operation and maintenance requirements**
9. **distance to sewer**

Criteria for Alternative Systems

1. The conditions (soils, ground water, slope) which limit the use of conventional septic tank systems may also apply to alternative systems which rely on soil absorption for treatment and/or disposal of all or most of the wastewater generated (see Criteria for Individual Waste Disposal Systems).
2. **Mound Systems**. Mound systems shall be installed in accordance with criteria established in the State Board's Guidelines for Mound Systems (1980) or other criteria acceptable to the Executive Officer in conformance with standard engineering practices.
3. **Evapotranspiration Systems**. Evapotranspiration systems shall be installed in accordance with criteria contained in the State Board's Guidelines for Evapotranspiration Systems (1980) or other criteria acceptable to the Executive Officer in conformance with standard engineering practices.
4. **Sand Filters**. Sand filters shall be installed in accordance with the specifications for sand fitters in the State of Oregon, Department of Environmental Quality's On-site Sewage Disposal Rules (July 1, 1991) or other criteria acceptable to the Executive Officer in conformance with standard engineering practices.

5. **Grey Water Systems.** Under certain circumstances, grey water systems may be an acceptable method of disposal in conjunction with a composting toilet or holding tank to handle black water. Examples of appropriate applications include recreational areas such as campgrounds, day use facilities, and trailheads. Grey water systems shall be installed in accordance with the California Plumbing Code (24 Cal. Code of Regs., Part 5) and the local administrative authority. If properly constructed and operated, grey water systems are not expected to create a nuisance or pollution.
6. Other proposals for alternative systems shall be evaluated jointly by the local regulatory agency and Regional Board staff on a case-by-case basis. Some engineered systems may be considered experimental by the Regional Board. Experimental systems will be handled with caution. A trial period of at least one year should be established whereby proper system operation must be demonstrated. Under such an approach, experimental systems are granted a one-year conditional approval.
7. All proposals for alternative systems shall be designed by a Civil Engineer, Engineering Geologist or Sanitarian licensed to practice in California.

Maintenance Requirements

System designers should be responsible for developing specifications and procedures for proper system operation. Designers should provide to system owners an informational operation and maintenance document that includes: (1) clear and concise procedures for operation and maintenance, and (2) instructions for repair and/or replacement of critical items within forty-eight hours following failure. Engineered systems should be inspected by a licensed Civil Engineer, Engineering Geologist or Sanitarian during installation to insure conformance with approved plans.

Permitting Authority

The County Health Officer may approve alternative systems when **all** of the following conditions are met:

1. The Health Officer has found the system to be in compliance with criteria approved by the Regional Board Executive Officer (see Criteria for Individual Waste Disposal Systems and Criteria for Alternative Systems above); and
2. The Health Officer has either: (1) informed the Regional Board Executive Officer of the proposal to use the alternative system and the Executive Officer agrees that it complies with the finding in (a) above; or (2) a written agreement that the Executive Officer has delegated approval authority to the County Health Officer; ***and***
3. A public or private entity has agreed in writing to assume responsibility for the inspection, monitoring, maintenance, and eventual decommissioning/reclamation of the system.

If all of the above conditions cannot be met, the Regional Board will consider issuing waste discharge requirements for alternative systems.