GEOTECHNICAL INVESTIGATION
BLOCKS 29, 30, 31, AND 32
PUBLIC IMPROVEMENTS
MISSION BAY
San Francisco, California

Catellus
San Francisco, California

7 April 2008
Project No. 3347.01

Treadwell&Rollo
Environmental and Geotechnical Consultants

Treadwell&Rollo

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Mr. Scott Shepard
Catellus Urban Development
255 Channel Street
San Francisco, California 94158

Subject: Geotechnical Investigation
Blocks 29, 30, 31 and 32, Public Improvements
Mission Bay
San Francisco, California

Dear Mr. Shepard:

Treadwell & Rollo, Inc. is pleased to present our geotechnical investigation report for the proposed Blocks 29, 30, 31 and 32 Public Improvements in Mission Bay, San Francisco, California. The recommendations presented in this report supplement the recommendations presented in our earlier report titled Revised Geotechnical Recommendations Infrastructure Improvements Mission Bay, dated 4 April 2001. Copies of this report have been distributed as indicated at the end of the report.

The project site comprises of the east side of Third Street adjacent to Blocks 29 and 31, a 15 feet by 55 feet area on the east side of Third Street adjacent to Block 33, the southern sidewalk of South Street adjacent to Blocks 29 and 30, and the east and west side of Terry Francois Boulevard between South Street and 16th Street. The project consists of grading, installation of utilities, streetscape including trees and light poles, and new sidewalks, streets and pavement.

The results of investigations performed in the site vicinity indicate the site is blanketed by heterogeneous fill, which is approximately 9 to 27.5 feet thick. Fill in Mission Bay varies in density and typically contains rubble. The fill is underlain by weak, compressible Bay Mud, which is approximately 3 to 45 feet thick in the project vicinity. Medium dense to very dense sand and stiff to very stiff clay is below the Bay Mud. Bedrock is approximately 41.5 to 106 feet deep.

Our recommendations are based on limited subsurface information from investigations at the site and in the vicinity. Consequently, variations between the expected and actual soil conditions may be found in localized areas during construction. Additionally, unknown obstructions, such as abandoned pile caps and utilities should also be anticipated. We should be retained to observe grading operations, placement and compaction of utility trench backfill, placement and compaction of structural soil and installation of light pole foundations.

We appreciate the opportunity to assist you with this project. If you have any questions, please call.

Sincerely yours,
TREADWELL & ROLLO, INC.

for Joo Chai Wong
Civil Engineer

Serena T. Jang
Geotechnical Engineer

REGISTERED PROFESSIONAL ENGINEER
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TABLE OF CONTENTS

GEOTECHNICAL INVESTIGATION
BLOCKS 29, 30, 31, and 32 PUBLIC IMPROVEMENTS
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1.0 INTRODUCTION

This report presents the results of our geotechnical investigation of Blocks 29, 30, 31, and 32 (Blocks 29-32) Public Improvements project area in Mission Bay. Our services were performed in accordance with our revised proposal dated 2 January 2008. This report supplements the recommendations presented in our report titled *Revised Geotechnical Recommendations Infrastructure Improvements Mission Bay,* dated 4 April 2001, referred to hereafter as the Infrastructure Report.

Our studies are in part based on the plan set, referred to hereafter as the project plans, listed below:

- "Mission Bay Blocks 29-32, Public Improvements, Mission Bay, San Francisco, California, 100% Submittal," by Freyer & Laureta, dated 14 March 2008.

The site location is shown on Figure 1. Based on the project plans, the site is comprised of the east side of Third Street adjacent to Blocks 29 and 31, a 15 feet by 55 feet area on the east side of Third Street adjacent to Block 33, the southern sidewalk of South Street adjacent to Blocks 29 and 30, and the east and west sides of Terry Francois Boulevard between South Street and 16th Street, as shown on Figure 2. We also understand that temporary pavements with less than 5-year design life will be constructed on the east side of Third Street adjacent to Block 33 and at the intersection of 16th Street and Terry Francois Boulevard, as shown on Figure 2. Geotechnical aspects of the project include placement and compaction of fill and structural soil, backfill of utility trenches, installation of light pole foundations, and preparation of sidewalk and roadway subgrade.

2.0 SCOPE OF SERVICES

The purposes of our investigation was to investigate the fill and Bay Mud and to evaluate settlement and seismic hazards at the site as they relate to the infrastructure improvements. To supplement existing subsurface information, we drilled a test boring, advanced three cone penetration tests (CPTs), and performed laboratory tests on selected soil samples recovered from the test borings.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

We began our investigation by reviewing the results of previous studies at and in the vicinity of the site Treadwell & Rollo has performed numerous investigations in the vicinity. In addition, we have developed a database of boring logs from various sources for the Mission Bay area in our files. Locations of test borings and cone penetration tests (CPTs) performed during previous investigations by Treadwell & Rollo and others in the site vicinity are shown on Figure 2. The boring logs for borings that were previously drilled by Treadwell & Rollo have been included in Appendix A. Laboratory test results from these borings are included in Appendix B. Many of the logs of the boring in our database are generally not of sufficient quality to provide quantitative engineering information, but they provide qualitative data for use in our subsurface description. Logs from previous investigations by others are not presented.

To supplement the subsurface data available to us, we drilled one test boring and advanced three CPTs as part of our current investigation. The approximate locations of the boring and CPTs are shown on Figure 2. The logs are presented in Appendix C.

Prior to performing the field investigation, we:

- prepared a health and safety plan
- obtained a soil boring permit from the Monitoring Wells Section of the San Francisco Department of Public Health (SFDPH)
- notified Underground Service Alert
- cleared the boring locations of underground utilities using an independent utility locating contractor.

3.1 Test Boring

On 24 January 2008, one test boring designated as B31-1, was drilled using a truck-mounted, rotary-wash drill rig provided by Pitcher Drilling Company. The test boring was drilled to a total depth of 80 feet below the existing ground surface. Our field engineer logged the boring and obtained samples of the material encountered for visual classification and laboratory testing. The boring was backfilled with grout consisting of cement, bentonite and water under the observation of a SFDPH inspector.

The log of the boring is presented on Figure C-1 in Appendix C. The soil is classified in accordance with the chart shown on Figure C-2.

Soil samples were obtained using three different types of samplers: two split-barrel samplers and a thin-walled sampler. The sampler types are as follows:

- Sprague and Henwood (S&H) split-barrel sampler with a 3.0-inch outside diameter and 2.5-inch-inside diameter, lined with brass tubes with an inside diameter of 2.43 inches
- Standard Penetration Test (SPT) split-barrel sampler sampler with a 2.0-inch-outside and 1.5-inch-inside diameter, without liners
- Shelby tubes with a 3.0-inch outside diameter and 2.875-inch inside diameter.

The sampler types were chosen on the basis of soil type and desired sample quality for laboratory testing. In general, the S&H sampler was used to obtain samples in medium stiff to very stiff cohesive soil and the SPT sampler was used to evaluate the relative density of sandy soil. The Shelby tubes were used to obtain relatively undisturbed samples of soft to stiff cohesive soil.

The S&H and SPT samplers were driven with an automatic trip system and a 140-pound safety hammer falling about 30 inches. Where the S&H sampler was used, the blow counts required to drive the sampler the final 12 inches of an 18-inch drive were corrected to approximate SPT blow counts by multiplying by a factor of 0.7, and the unconverted and converted blow counts are shown on the boring logs. Where the SPT sampler was used, the blow counts required to drive the sampler the final 12 inches of an 18-inch drive were corrected to approximate SPT blow counts by multiplying by a factor of 1.2, and the unconverted and converted blow counts are shown on the boring logs. Hydraulic pressure was used to advance the 36-inch-long Shelby tubes into the soil and the pressure required is shown on the logs, measured in pounds per square inch (psi).

3.2 Laboratory Testing

The samples recovered from the field exploration program were examined for soil classification, and representative samples were selected for laboratory testing. Our laboratory testing program was designed to correlate soil properties and to evaluate engineering properties of the soil at the site. Samples were tested to measure moisture content, dry density, percent fines, Atterberg limits, and consolidation parameters. The test results are presented on the boring logs and in Appendix D.

Additional laboratory testing was performed to evaluate the corrosivity of the various soil types, as corrosive soil can adversely affect underground utilities and foundation elements. The results of the corrosivity analyses are presented in Appendix E.

3.3 Cone Penetration Tests

On 24 January 2008, three CPTs, designated C29-1, C29-2, and C31-1, were advanced by John Sarmiento and Associates. The CPTs were advanced to depths ranging from 35 to 54 feet below the ground surface. The CPT logs showing tip resistance, friction ratio, SPT N-value, shear strength, internal friction angle, and soil classifications are presented on Figures C-3 through C-5. A classification chart for CPTs is included as Figure C-6. The CPT holes were also backfilled with cement grout in accordance with the SFDPH permit.

The CPTs were performed by hydraulically pushing a 1.4-inch diameter (ten square centimeters), cone-tipped probe into the ground. The cone on the end of the probe measures tip resistance, and the friction sleeve behind the cone tip measures frictional resistance. Electrical strain gauges within the cone measure soil parameters continuously for the entire depth advanced. Soil data, including tip resistance, was transferred to a computer while conducting each test. Accumulated data was processed by computer to provide engineering information, such as the types and approximate strength characteristics of the soil encountered.

4.0 SITE CONDITIONS

We evaluated site conditions based on our knowledge of the site history and the results of this and previous investigations in the area. Locations of test borings and cone penetration tests performed during this and previous investigations at the site and in the vicinity are shown on Figure 2.

Mission Bay was originally a shallow bay. It was reclaimed during the late 1800s and early 1900s using excavated soil and rock from other parts of San Francisco. Our studies indicate that the project area was reclaimed in two stages: one beginning around 1884 and one beginning around 1906 and ending around 1920.

The Long Bridge was a pile supported roadway constructed between 1865 and 1868. Historical records indicate this bridge began near the current Fourth Street Bridge, following the line of Fourth and Third Streets, terminating at Third and Kentucky Streets.

During the period between 1900s and 1920s, oil storage tanks, machine shops, and a boiler house were present throughout the site. Between 1935 and 1955, railroad tracks running north-south were constructed in the site vicinity. During 1960s, the vacant areas around the railroad tracks were subject to dumping (ESA, 1990).

The northern portion of the Bode Concrete Plant occupied a portion of the site along the proposed South Street. The plant was demolished in late 2003/early 2004.

4.1 Existing Conditions

Based on existing topographic plans, the site is relatively flat, ranging from approximately Elevations 99 feet to 103 feet[1]. Currently, the proposed Terry Francois Boulevard is a staging area for nearby construction activities. In addition, several soil stockpiles are located along the proposed Terry Francois Boulevard, with the top of stockpile elevations ranging from Elevation 100 to 110.5 feet. The portion of South Street within the project limits is currently part of an unpaved roadway for construction traffic. The portion of Third Street within the project limits is currently the existing Third Street roadway and sidewalk.

4.2 Subsurface Conditions

The results of our study of the area indicate the site, where explored, is blanketed by heterogeneous fill which ranges from approximately 9 to 27-1/2 feet in thickness. The existing fill in Mission Bay varies in density and typically contains rubble. It is predominately a very loose to medium dense sand with varying amounts of clay, silt and gravel and contains organics, bricks, and wood fragments. Large boulders, rubble and old foundations have been encountered within the fill in the site vicinity. Wooden piles installed during the construction of the Long Bridge may be encountered near Third Street. Layers of potentially liquefiable soil were encountered in all the borings and CPTs; these layers range from approximately 2-1/2 to 19 feet thick.

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1 Elevations are based on the San Francisco City Datum plus 100 feet.

A very soft to soft marine clay and silt deposit, known locally as Bay Mud, is present beneath the fill. The Bay Mud thickness ranges approximately between 3 and 45 feet. It generally becomes thinner to the southeast. Laboratory test results from this and nearby investigations indicate the Bay Mud is normally to slightly overconsolidated[2] with consolidation ratios ranging from 1.0 to 1.1. The Bay Mud was measured to have compression ratios of 0.24 to 0.35 and coefficients of consolidation, C_v, of 6 to 26 feet squared per year (ft^2/yr) along the virgin compression curve. The coefficient of consolidation is a measure of the time rate of consolidation settlement; the higher the value, the faster the soil will consolidate.

The Bay Mud is generally underlain by medium dense to very dense sand of the Colma Formation and stiff to very stiff Old Bay Clay. Bedrock was encountered from a depth of 41-1/2 feet in boring B32-3 (Elevation 58 feet) to a depth of 106 feet in boring B30-1 (Elevation -5.4 feet). Bedrock was not encountered on Third Street (within project limit) with the maximum explored depth of 80 feet (Elevation 22 feet).

Groundwater was encountered in several borings. Measured groundwater ranges from depths of 7 to 10.5 feet (corresponding to Elevations 89 to 91.5 feet).

5.0 GEOLOGY AND SEISMICITY

Our evaluation of the geology and seismicity of the area is based on our review of published reports and information in our files from other sites in the vicinity.

5.1 Regional Geology

The site is in the northeast portion of the San Francisco peninsula, which lies within the Coast Ranges geomorphic province. The northwesterly trend of ridges and valleys characteristic of the Coast Ranges is obscured in San Francisco, except for features such as Russian Hill, Telegraph Hill, Hunters Point, and Potrero Hill. San Francisco Bay and the northern portion of the peninsula lie within a down-dropped crustal block bound by the East Bay Hills and the Santa Cruz Mountains. The San Francisco Bay depression resulted from interaction between the major faults of the San Andreas fault zone, particularly the Hayward and San Andreas faults east and west of the bay, respectively (Atwater, 1979).

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[2] A normally consolidated clay has completed consolidation under the existing load and an overconsolidated clay has experienced a pressure greater than its current load.

San Francisco's topography is characterized by relatively rugged hills formed by Jurassic- to Cretaceous-aged bedrock (Schlocker, 1974). The bedrock consists of highly deformed and fractured sedimentary rocks of the Franciscan complex. The present topography resulted mainly from east-west compression of coastal California during the late Pliocene and Pleistocene epochs (Norris and Webb, 1990).

The low-lying areas of the San Francisco peninsula are underlain by Quaternary sediments deposited on eroded Franciscan bedrock. Oscillating late-Quaternary sea levels that resulted from the advance and retreat of glaciers worldwide influenced sediment deposition within the pre-historic bay margin. The resulting sequence of alternating estuarine and terrestrial sediments corresponds to high and low sea-level stands, respectively. In contrast, Quaternary sediments in the plains landward of the bay are predominantly terrestrial.

By late Pleistocene time, the high sea level associated with the Sangamon interglacial (about 125,000 years ago) resulted in deposition of the Yerba Buena Mud (Sloan, 1992). Also known locally as "Old Bay Clay", the Yerba Buena Mud was deposited in an estuarine environment similar in character and extent to the present bay. Sea level lowering associated with the onset of Wisconsin glaciation exposed the bay floor and resulted in terrestrial sedimentation, such as the Colma formation, on the Yerba Buena Mud. Sea level rose again starting roughly 20,000 years ago, fed by the melting of Wisconsin-age glaciers. The sea re-entered the Golden Gate about 10,000 years ago (Atwater, 1979). Inundation of the present bay resulted in deposition of estuarine sediments, called Bay Mud, which continue to accumulate in the bay.

Historical development of the San Francisco Bay area resulted in placement of artificial fill material over substantial portions of modern estuaries, marshlands, tributaries, and creek beds in an effort to reclaim land (Nichols and Wright, 1971).

5.2 Regional Seismicity

The major active faults in the area are the San Andreas, San Gregorio, Hayward, and Calaveras Faults. These and other faults of the region are shown on Figure 3. For the active faults within about 50 kilometers, the distance from the site and estimated maximum Moment magnitude[3] [Working Group on California Earthquake Probabilities (WGCEP) (2003) and Cao et al. (2003)] are summarized in Table 1.

[3] Moment magnitude is an energy-based scale and provides a physically meaningful measure of the size of a faulting event. Moment magnitude is directly related to average slip and fault rupture area.

TABLE 1
Regional Faults and Seismicity

Fault Segment	Approx. Distance from fault (km)	Direction from Site	Mean Characteristic Moment Magnitude
San Andreas – 1906 Rupture	12.5	West	7.90
San Andreas – Peninsula	12.5	West	7.15
San Andreas – North Coast South	16	West	7.45
North Hayward	17	East	6.49
Total Hayward	17	East	6.91
Total Hayward-Rodgers Creek	17	East	7.26
South Hayward	17	East	6.67
Northern San Gregorio	19	West	7.23
Total San Gregorio	19	West	7.44
Mt Diablo – MTD	33	East	6.65
Total Calaveras	34	East	6.93
Rodgers Creek	36	North	6.98
Concord/Green Valley	38	East	6.71
Monte Vista-Shannon	39	Southeast	6.80
Point Reyes	44	West	6.80
West Napa	46	Northeast	6.50
Greenville	51	East	6.94

Figure 3 also shows the earthquake epicenters for events with magnitude greater than 5.0 from January 1800 through January 1996. Since 1800, four major earthquakes have been recorded on the San Andreas Fault. In 1836 an earthquake with an estimated maximum intensity of VII on the Modified Mercalli (MM) scale (Figure 4) occurred east of Monterey Bay on the San Andreas Fault (Toppozada and Borchardt 1998). The estimated Moment magnitude, M_w, for this earthquake is about 6.25. In 1838, an earthquake occurred with an estimated intensity of about VIII-IX (MM), corresponding to a M_w of about 7.5. The San Francisco Earthquake of 1906 caused the most significant damage in the history of the Bay Area in terms of loss of lives and property damage. This earthquake created a surface rupture along the San Andreas Fault from Shelter Cove to San Juan Bautista approximately 470 kilometers in length. It had a maximum intensity of XI (MM), a M_w of about 7.9, and was felt 560 kilometers away in Oregon, Nevada, and Los Angeles. The most recent earthquake to affect the Bay Area was the Loma Prieta Earthquake of 17 October 1989, in the Santa Cruz Mountains with a M_w of 6.9, approximately 93 km from the site.

In 1868 an earthquake with an estimated maximum intensity of X on the MM scale occurred on the southern segment (between San Leandro and Fremont) of the Hayward Fault. The estimated M_w for the earthquake is 7.0. In 1861, an earthquake of unknown magnitude (probably a M_w of about 6.5) was reported on the Calaveras Fault. The most recent significant earthquake on this fault was the 1984 Morgan Hill earthquake (M_w = 6.2).

In 2003 the Working Group on California Earthquake Probabilities (WGCEP 2003) at the U.S. Geologic Survey (USGS) predicted a 62 percent probability of a magnitude 6.7 or greater earthquake occurring in the San Francisco Bay Area by the year 2031. More specific estimates of the probabilities for different faults in the Bay Area are presented in Table 2.

TABLE 2
WGCEP (2003) Estimates of 30-Year Probability (2002 to 2031) of a Magnitude 6.7 or Greater Earthquake

Fault	Probability (percent)
Hayward-Rodgers Creek	27
San Andreas	21
Calaveras	11
San Gregorio	10
Concord-Green Valley	4
Greenville	3

6.0 DISCUSSION

On the basis of our investigation and our recent experience during building and infrastructure development elsewhere in Mission Bay, we conclude the project is feasible from a geotechnical standpoint. Geotechnical issues of concern include:

- static and seismically-induced settlement
- potential for liquefaction
- soil corrosivity
- groundwater
- construction considerations.

6.1 Geologic Hazards

During a major earthquake, strong to violent ground shaking is expected to occur at the project site. Strong ground shaking during an earthquake can result in ground failure such as that associated with soil liquefaction[4], lateral spreading[5], seismic densification[6], landsliding, or can cause a tsunami. Each of these conditions has been evaluated based on our literature review, field investigation, and analysis, and is discussed in this section.

6.1.1 Liquefaction and Associated Hazards

When a saturated soil with little to no cohesion liquefies during a major earthquake, it experiences a temporary loss of shear strength as a result of a transient rise in excess pore water pressure generated by strong ground motion. Flow failure, lateral spreading, differential settlement, loss of bearing, ground fissures, and sand boils are evidence of excess pore pressure generation and liquefaction. The site is within a designated liquefaction hazard zone as designated by the California Geological Survey (CGS) seismic hazard zone map for the area titled *State of California Seismic Hazard Zones, City and County of San Francisco, Official Map,* dated 17 November 2001. However, there was no documented observation of liquefaction at this site during the 1906 Earthquake or the 1989 Loma Prieta Earthquake. [Youd and Hoose (1978) and Benuska (1990)].

The CGS has provided recommendations for the content of site investigation reports within seismic hazard zones in Special Publication 117 (SP 117) titled *Guidelines for Evaluating and Mitigating Seismic Hazard Zones in California,* dated 13 March 1997. Our evaluation of site seismic hazards was performed in general accordance with these guidelines.

All the CPTs and borings drilled during this investigation and in other previous investigations (where fill data was available) encountered a loose to medium dense sand and gravel layer with varying silt and clay content just above or below the water table, with thicknesses ranging from 2-1/2 to 19 feet. This layer

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4 Liquefaction is a transformation of soil from a solid to a liquefied state during which saturated soil temporarily loses strength resulting from the buildup of excess pore water pressure, especially during earthquake-induced cyclic loading. Soil susceptible to liquefaction includes loose to medium dense sand and gravel, low-plasticity silt, and some low-plasticity clay deposits.

5 Lateral spreading is a phenomenon in which surficial soil displaces along a shear zone that has formed within an underlying liquefied layer. Upon reaching mobilization, the surficial blocks are transported downslope or in the direction of a free face by earthquake and gravitational forces.

6 Seismic densification is a phenomenon in which non-saturated, cohesionless soil is densified by earthquake vibrations, causing ground-surface settlement.

could liquefy 2-1/2 to 19 feet. This layer could liquefy in a major earthquake. Using the Tokimatsu and Seed (1984) method for evaluating earthquake-induced liquefaction settlement, we estimate settlements of approximately 1/2 to 7 inches may occur depending upon the layer thickness. The transition between areas that settle and those that do not may be abrupt. Liquefaction-induced settlement may cause damage to pavements, sidewalks, utilities, and other improvements.

Considering the shallow groundwater table and the relatively shallow liquefiable deposits, we conclude ground failure, such as lurch cracking and/or the development of sand boils, could occur. The ground-surface settlement will likely be larger than estimated (1/2 to 7 inches) in areas where sand boils and associated ground failure occur.

6.1.2 Lateral Spreading

Lateral spreading is a phenomenon in which a surficial soil displaces along a shear zone that has formed within an underlying liquefied layer. The surficial blocks are transported downslope or in the direction a free face, such as a channel, by earthquake and gravitational forces. Lateral spreading is generally the most pervasive and damaging type of liquefaction-induced ground failure generated by earthquakes.

The liquefaction layer is not continuous; therefore, we judge the risk of lateral spreading is low.

The project site should not be subject to landslide or erosion. No springs or seepages were observed on site.

6.1.3 Seismic Densification

During strong ground shaking in loose, clean granular deposits above the water table, seismic densification (also referred to as cyclic densification and differential compaction) can also occur. Their development could result in ground surface settlement. Up to 7-1/2 feet of loose to medium dense sand was encountered above the groundwater table in boring and all the CPTs of our current investigation and in several other borings during previous investigations. This layer may densify in a major earthquake. Using the Tokimatsu and Seed (1984) method for evaluating seismically induced settlement in dry sand, we estimate settlement should be less than about 1/2 inch.

6.1.4 Tsunami

According to published data (URS/Blume, 1974) the maximum run up (tsunami wave) at the Presidio occurred after the 1964 Alaskan earthquake. The wave measured 7.5 feet at the Golden Gate; no damage was reported along the San Francisco shoreline. The United States Geologic Survey (USGS) estimates the maximum probable tsunami wave run up at the Golden Gate will be 20 feet (Ritter and Dupre, 1972). If the maximum probable tsunami occurs, the site is within an area of potential tsunami inundation. In the China Basin Channel, the run up would be reduced to less than 10 feet (URS/Blume 1974).

6.1.5 Landslides, Erosion, and Seepages

The site is relatively level; therefore, the project site should not be subject to landslides or erosion. No springs or seepages were observed on site.

6.2 Consolidation Settlement

The results of consolidation testing indicate most of the Bay Mud is normally consolidated with the lower portion slightly overconsolidated. Therefore, primary settlement is complete under the weight of the existing fill and secondary compression is occurring. Placement of new fill bearing in the fill will cause a new cycle of primary consolidation. The magnitude of settlement will depend on the amount the amount of new fill, the present grades, and the variable existing fill and Bay Mud thickness.

Our settlement analysis was based on the original and proposed grades as shown on the project plans. At each settlement point, the thickness of existing fill and Bay Mud was established based on this and previous investigations. We modeled the fill history, proposed fill thickness, and consolidation properties of the Bay Mud using the TCON[7] computer program to predict the amount of settlement that should occur in 50 years. The approximate location of our settlement points is shown on Figure 2 and our estimates of consolidation settlement are presented in Table 3, which is attached. The stationing reference presented in the table is in accordance with the project plans. These predicted settlements should be used to evaluate future changes in grade and settlement of utilities. If any changes are made to the grades as shown on the project plans, we will need to re-evaluate our settlement estimates.

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[7] TCON is a computer program for computing consolidation and time rates of settlements caused by surface loadings.

As discussed previously, we estimate 1/2 to 7 inches of liquefaction-induced settlement may occur during a major earthquake. This settlement is in addition to the predicted consolidation settlement. Therefore, static and seismically-induced settlement will affect various aspects of the planned development, including utilities, building entrances, and sidewalks. Where it is desirable and practical to limit damage to utilities resulting from an earthquake, the utilities should also be designed to tolerate the predicted seismic movements.

6.3 Soil Corrosivity

CERCO Analytical performed tests on one soil sample to evaluate corrosion potential to buried metals and concrete. The results of the tests and a brief evaluation are presented in Appendix E.

The soil sample tested classified the fill as corrosive. Therefore, precautions should be taken to mitigate the effects of corrosion for buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron. Furthermore, all buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion. A corrosion consultant should be consulted, as needed, to provide recommendations and details for corrosion protection.

6.4 Groundwater

Groundwater was encountered in several borings from this and previous investigations. Measured groundwater ranged from Elevation 89 feet (seven feet below ground surface in boring B32-4) to Elevation 91.5 feet (10.5 feet below ground surface in boring B31-1). Considering the drilling method which in most cases involved the addition of fluids, and method and timing of groundwater measurement, we believe some of these reported groundwater elevations do not represent stabilized groundwater levels. However, for engineering analyses, we recommend a design groundwater elevation of 96 feet be used.

6.5 Construction Considerations

The soil at the site consists mainly of sand, gravel and clay that can be excavated with conventional earth-moving equipment such as loaders and backhoes. The fill is easily remolded and loses strength when wet. Therefore, site preparation and grading may be difficult if performed during the rainy season. In addition, heavy vibratory equipment should not be used during site preparation and compaction; vibrators will likely cause a capillary rise, creating a wet subgrade.

Brick, concrete, and other building rubble may be encountered in the fill. Handling and disposal of the fill material should be performed in accordance with a site mitigation plan that includes health and safety criteria.

We anticipate construction dewatering will only be required for excavations extending more than four feet below final site grades, such as excavations for gravity-flow utility lines. From our experience on other projects in Mission Bay, we believe trenches can likely be locally dewatered using sumps. Prior to construction, the groundwater should be tested to determine if it can be discharged directly to the storm drain system or if it must be treated on-site prior to discharge.

7.0 RECOMMENDATIONS

From a geotechnical standpoint, we conclude the site can be developed as planned, provided the improvements can tolerate the predicted settlement and the recommendations presented in this section of the report are incorporated into the design and contract documents. The applicable recommendations presented in our 4 April 2001 report should be incorporated into the project plans and specifications, except as recommended in the following sections.

7.1 New Utilities

Site preparation, fill placement, stabilization of wet and/or soft subgrade and backfilling of utility trenches should be performed in accordance with the recommendations provided in our 4 April 2001 report.

Previously, the northern portion of the Bode Concrete Plant occupied a portion of the site along the proposed South Street and was demolished in late 2003/early 2004. All existing foundations, which will not be reused, should be removed. We understand this work has already been performed; however, if any foundations are encountered, the following recommendations should be followed. Specifically, where encountered, all pile caps and footings should be completely removed beneath new utilities, pavements, sidewalks, and landscaped areas. In general, single piles should be removed to a depth of at least four feet below new improvements and/or utilities and pile groups should be removed at least eight feet below new improvements and/or utilities, or to the Bay Mud, whichever is shallower. The geotechnical engineer may vary the depth of pile removal based upon site specific conditions.

Utilities should be designed to accommodate the predicted settlement throughout the project site, as well as differential settlement where they connect to new and existing structures, where they cross over pile-supported structures, and where they cross over abandoned piles.

7.2 Crushed Rock

Where crushed rock is used as backfill, bedding, cover and/or stabilization material, the material should be placed in eight-inch loose lifts and mechanically densified or tamped into place. All open graded rock should be wrapped with filter fabric.

7.3 Pavements

Currently, the City and County of San Francisco (CCSF) requires city streets to consist of concrete with an asphalt overlay. Concrete pavement is likely to respond to surface settlement in a rigid manner, with displacement strain concentrated at joints or cracks between concrete elements. Asphalt pavement, with a constant more flexible section, can respond to surface settlement with more gradual displacement and less concentrated material strain. The asphalt pavement, better suited to distributing settlement related strain, is less likely to crack in response to long term settlement characteristics of the site. Therefore we recommend all private streets be constructed using a flexible pavement section. In addition, we recommend CCSF considers substituting its standard section with an equivalent street section of aggregate base and asphalt concrete.

Flexible pavements should be designed as recommended in Section 5.8.1 Flexible Pavements of our 4 April 2001 report. Aggregate base should conform to Section 26-1.02A of the current Caltrans Standard Specifications. All aggregate base should be compacted to at least 95 percent relative compaction.

Where rigid pavement is required for loading and service areas, we recommend six inches of concrete for medium traffic and eight inches of concrete for heavy traffic. Loading and service areas should be underlain by six inches of Class 2 aggregate base compacted to 95 percent relative compaction.

7.4 Acceptable Backfill

In accordance with the City and County of San Francisco Standard Specifications, acceptable backfill material can include lumps, ballast, rocks and broken concrete provided they measure three inches or less in greatest dimensions. Pieces that measure six inches or less in greatest dimension may also be

incorporated into the fill provided they are satisfactorily distributed in earth or other fine materials, and are not placed within three feet of finished grade or subgrade. However, rocks, broken concrete or other solid materials, larger than four inches in greatest dimension, should not be placed in backfill or embankment areas where piles are to be installed or driven.

8.0 CONSTRUCTION MONITORING

We should be retained to review final grading and improvement plans. During construction, we should observe site preparation, excavation, compaction of fill and backfill and mat subgrade. These observations will allow us to compare actual with anticipated soil conditions and to check that the contractor's work conforms with the geotechnical aspects of the plans and specifications.

9.0 LIMITATIONS

The conclusions and recommendations presented in this report result from limited engineering studies based on our interpretation of the existing geotechnical conditions and available subsurface data. Actual subsurface conditions may vary. If any variations or unforeseen conditions are encountered during construction, or if the proposed construction will differ from that which is described in this report, Treadwell & Rollo, Inc. should be notified so that supplemental recommendations can be made.

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TABLES

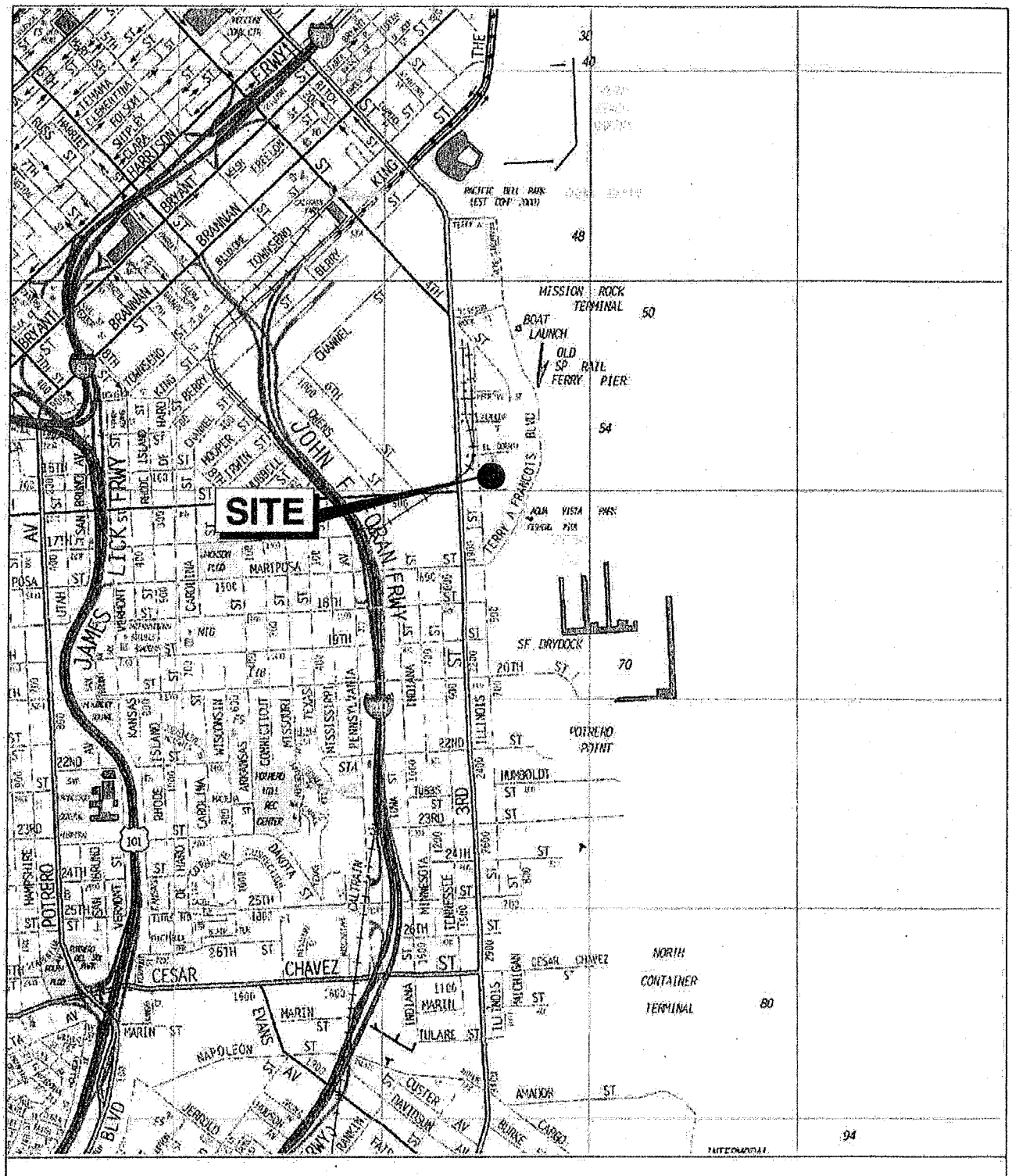
TABLE 3
Estimated 50-Year Elevations
Blocks 29-32 Public Improvements, Mission Bay
San Francisco, California
Project No. 3347.01

T&R Point[1]	Street Name	Station	Approximate Year Fill Placed[2]	Thickness[3]		Elevation[4]							
				Existing Fill (feet)	Existing Bay Mud (feet)	1997 Grade[5] (feet)	2006 Existing Grade[6] (feet)	Proposed Grade[7] (feet)	Final Grade in (feet)[8]				
									1 year	3 years	5 years	10 years	50 years
TH-1	Third Street	1+60	1884	15	11	103.5	103.5	103.5	103.5	103.5	103.5	103.5	103.5
TH-2	Third Street	3+43	1884	14	30	103.0	102.5	102.6	102.6	102.6	102.6	102.6	102.6
TH-3	Third Street	3+97	1884	14	30	103.0	102.0	102.9	102.9	102.9	102.9	102.9	102.9
TH-4	Third Street	7+56	1884	13	44	102.1	101.6	101.6	101.6	101.6	101.6	101.6	101.6
TFB-1	Terry Francois Blvd	0+38	1920	20	35	99.8	99.9	99.9	99.9	99.9	99.9	99.9	99.9
TFB-2	Terry Francois Blvd	0+97	1920	25	29	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
TFB-3	Terry Francois Blvd	1+40	1920	31	22	100.2	99.0	100.0	100.0	100.0	100.0	100.0	100.0
TFB-4	Terry Francois Blvd	3+44	1920	13	22	100.3	100.0	100.3	100.3	100.3	100.3	100.3	100.3
TFB-5	Terry Francois Blvd	5+62	1920	21	7	100.7	100.0	100.5	100.5	100.5	100.5	100.5	100.5
TFB-6	Terry Francois Blvd	6+40	1920	28	3	100.7	100.6	100.6	100.6	100.6	100.6	100.6	100.6
S-1	South Street	0+70	1884	10	44	99.3	101.2	N.A.	101.0	100.9	100.9	100.8	100.6
S-2	South Street	3+50	1884	16	37	99.5	101.7	N.A.	101.5	101.4	101.4	101.3	101.2
S-3	South Street	5+50	1920	9	45	99.5	100.4	N.A.	100.3	100.3	100.3	100.3	100.2
S-4	South Street	6+70	1920	25	32	99.5	99.9	N.A.	99.9	99.9	99.9	99.9	99.9

Notes:

1. Refer to Figure 2 - Site Plan, prepared by Treadwell & Rollo, Inc, for settlement point locations. Settlement points S-1 and S-2 are located within the proposed sidewalk of south street.
2. Mission Bay Infrastructure, Boring Location Plan with Fill Placement History, Project No. 1273-004, Figure 3, Trans Pacific Geotechnical Consultants, Inc., dated 7 July 1993.
3. Based on investigations by Treadwell & Rollo and others within site and site vicinity. Thickness estimated to nearest one foot.
4. All elevations reference San Francisco City Datum plus 100 feet.
5. "1997 Grade" obtained from 1997 Mission Bay Topographic Map by Towill, Inc.
6. The "2006 Existing Grade" are obtained from the existing grades shown on Sheets C3.1 through C3.5 of the project drawings dated 14 March 2008
7. The proposed grade is estimated from the elevations of top of curb, as shown on Sheets C3.1 through C3.5 of the project drawings. Proposed grades of the sidewalks on South Street are not available (N.A.) and assumed to be equal to the 2006 existing grade.
8. Does not include seismically-induced settlement or secondary compression.

FIGURES



Base map: The Thomas Guide
San Francisco County
1999

0 1/4 1/2 Mile

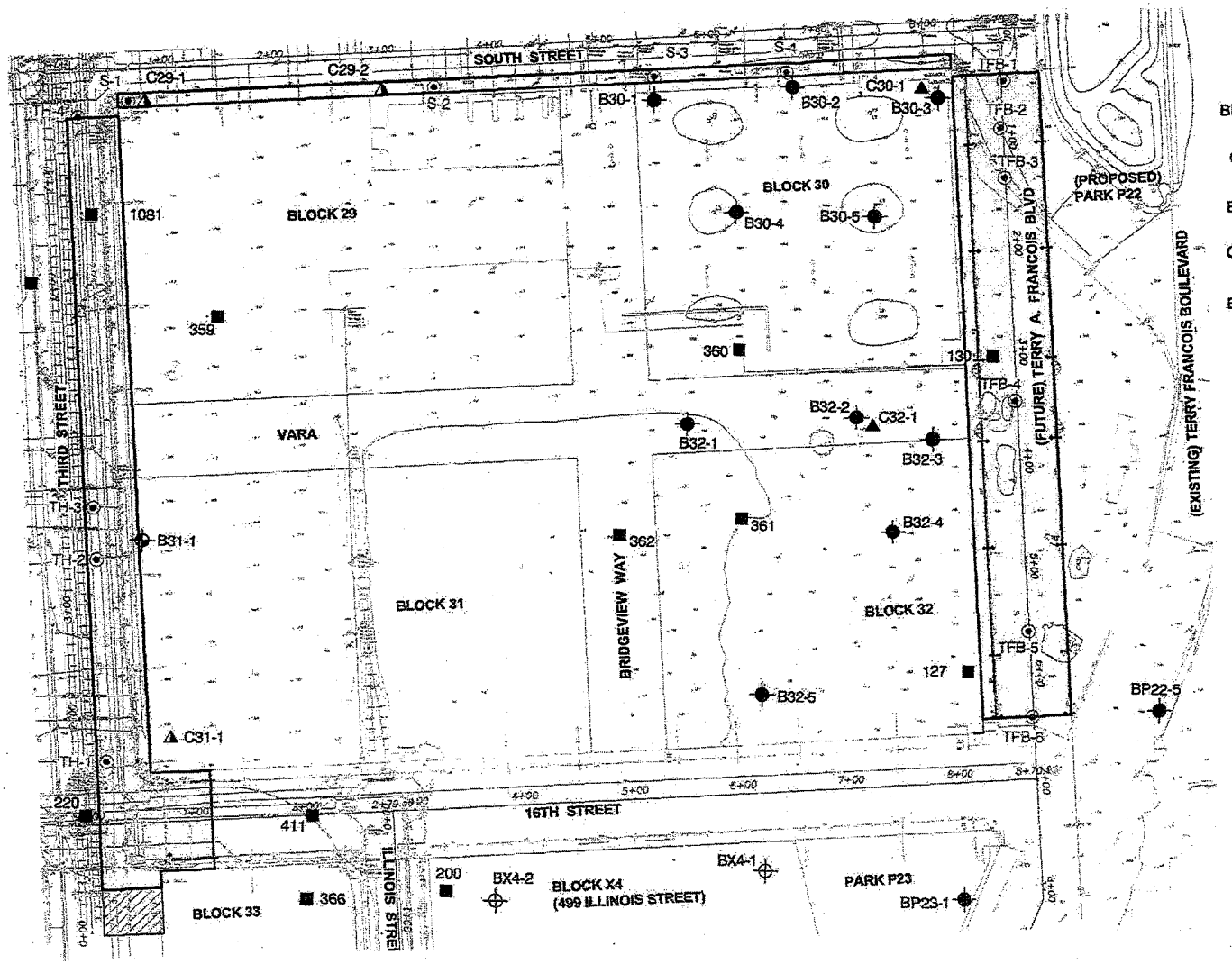
Approximate scale

BLOCKS 29-32 PUBLIC IMPROVEMENTS
MISSION BAY
San Francisco, California

SITE LOCATION MAP

Treadwell&Rollo

Date 04/02/08	Project No. 3347.01	Figure 1



EXPLANATION

- BP22-5 — Approximate location of boring by Treadwell & Rollo, Inc., for previous investigations
- C30-1 — Approximate location of cone penetration test by Treadwell & Rollo, Inc., for previous investigations
- B31-1 — Approximate location of boring by Treadwell & Rollo, Inc., January 2008
- C29-1 — Approximate location of cone penetration test by Treadwell & Rollo, Inc., January 2008
- BX4-1 — Approximate location of boring by Treadwell & Rollo, Inc., for other developer during previous investigations
- 1080 — Borings by others (database designation)
- TH-1 — Settlement Point
- Approximate project limits
- Approximate area of temporary pavement

Reference: Base map from a drawing titled "Survey Control Street", and project limits based on Sheets C3.1 through C3.5, and C3.8 of the project drawings, by Freyer & Laureta, Inc., dated 14 March 2008.

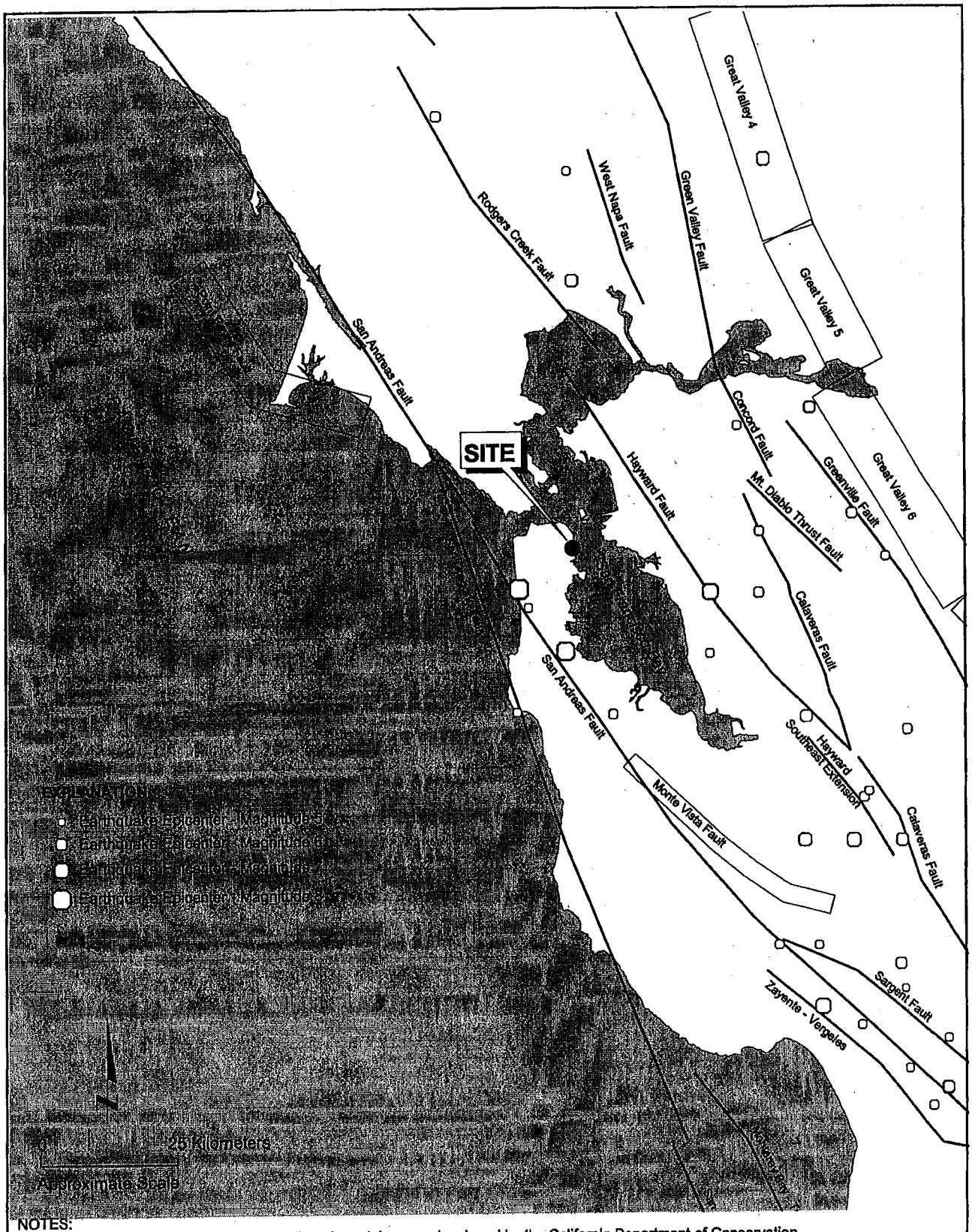
BLOCKS 29-32 PUBLIC IMPROVEMENTS
MISSION BAY
San Francisco, California

SITE PLAN

Date: 04/02/08	Project No. 3347.01	Figure 2

Treadwell&Rollo

R:\Graphics\3300s\3347.01\3347.01 Site Plan.dwg 4/07/08



NOTES:
Digitized data for fault coordinates and earthquake catalog was developed by the California Department of Conservation Division of Mines and Geology. The historic earthquake catalog includes events from January 1800 to December 2000.

BLOCKS 29-32 PUBLIC IMPROMENTS
MISSION BAY
San Francisco, California

MAP OF MAJOR FAULTS AND EARTHQUAKE EPICENTERS IN THE SAN FRANCISCO BAY AREA

Treadwell&Rollo

Date: 03/20/08	Project No. 3347.01	Figure 3

I **Not felt by people, except under especially favorable circumstances. However, dizziness or nausea may be experienced.**
Sometimes birds and animals are uneasy or disturbed. Trees, structures, liquids, bodies of water may sway gently, and doors may swing very slowly.

II **Felt indoors by a few people, especially on upper floors of multi-story buildings, and by sensitive or nervous persons.**
As in Grade I, birds and animals are disturbed, and trees, structures, liquids and bodies of water may sway. Hanging objects swing, especially if they are delicately suspended.

III **Felt indoors by several people, usually as a rapid vibration that may not be recognized as an earthquake at first. Vibration is similar to that of a light, or lightly loaded trucks, or heavy trucks some distance away. Duration may be estimated in some cases.**
Movements may be appreciable on upper levels of tall structures. Standing motor cars may rock slightly.

IV **Felt indoors by many, outdoors by a few. Awakens a few individuals, particularly light sleepers, but frightens no one except those apprehensive from previous experience. Vibration like that due to passing of heavy, or heavily loaded trucks. Sensation like a heavy body striking building, or the falling of heavy objects inside.**
Dishes, windows and doors rattle; glassware and crockery clink and clash. Walls and house frames creak, especially if intensity is in the upper range of this grade. Hanging objects often swing. Liquids in open vessels are disturbed slightly. Stationary automobiles rock noticeably.

V **Felt indoors by practically everyone, outdoors by most people. Direction can often be estimated by those outdoors. Awakens many, or most sleepers. Frightens a few people, with slight excitement; some persons run outdoors.**
Buildings tremble throughout. Dishes and glassware break to some extent. Windows crack in some cases, but not generally. Vases and small or unstable objects overturn in many instances, and a few fall. Hanging objects and doors swing generally or considerably. Pictures knock against walls, or swing out of place. Doors and shutters open or close abruptly. Pendulum clocks stop, or run fast or slow. Small objects move, and furnishings may shift to a slight extent. Small amounts of liquids spill from well-filled open containers. Trees and bushes shake slightly.

VI **Felt by everyone, indoors and outdoors. Awakens all sleepers. Frightens many people; general excitement, and some persons run outdoors.**
Persons move unsteadily. Trees and bushes shake slightly to moderately. Liquids are set in strong motion. Small bells in churches and schools ring. Poorly built buildings may be damaged. Plaster falls in small amounts. Other plaster cracks somewhat. Many dishes and glasses, and a few windows break. Knickknacks, books and pictures fall. Furniture overturns in many instances. Heavy furnishings move.

VII **Frightens everyone. General alarm, and everyone runs outdoors.**
People find it difficult to stand. Persons driving cars notice shaking. Trees and bushes shake moderately to strongly. Waves form on ponds, lakes and streams. Water is muddied. Gravel or sand stream banks cave in. Large church bells ring. Suspended objects quiver. Damage is negligible in buildings of good design and construction; slight to moderate in well-built ordinary buildings; considerable in poorly built or badly designed buildings, adobe houses, old walls (especially where laid up without mortar), spires, etc. Plaster and some stucco fall. Many windows and some furniture break. Loosened brickwork and tiles shake down. Weak chimneys break at the roofline. Cornices fall from towers and high buildings. Bricks and stones are dislodged. Heavy furniture overturns. Concrete irrigation ditches are considerably damaged.

VIII **General fright, and alarm approaches panic.**
Persons driving cars are disturbed. Trees shake strongly, and branches and trunks break off (especially palm trees). Sand and mud erupts in small amounts. Flow of springs and wells is temporarily and sometimes permanently changed. Dry wells renew flow. Temperatures of spring and well waters varies. Damage slight in brick structures built especially to withstand earthquakes; considerable in ordinary substantial buildings, with some partial collapse; heavy in some wooden houses, with some tumbling down. Panel walls break away in frame structures. Decayed pilings break off. Walls fall. Solid stone walls crack and break seriously. Wet grounds and steep slopes crack to some extent. Chimneys, columns, monuments and factory stacks and towers twist and fall. Very heavy furniture moves conspicuously or overturns.

IX **Panic is general.**
Ground cracks conspicuously. Damage is considerable in masonry structures built especially to withstand earthquakes; great in other masonry buildings - some collapse in large part. Some wood frame houses built especially to withstand earthquakes are thrown out of plumb, others are shifted wholly off foundations. Reservoirs are seriously damaged and underground pipes sometimes break.

X **Panic is general.**
Ground, especially when loose and wet, cracks up to widths of several inches; fissures up to a yard in width run parallel to canal and stream banks. Landsliding is considerable from river banks and steep coasts. Sand and mud shifts horizontally on beaches and flat land. Water level changes in wells. Water is thrown on banks of canals, lakes, rivers, etc. Dams, dikes, embankments are seriously damaged. Well-built wooden structures and bridges are severely damaged, and some collapse. Dangerous cracks develop in excellent brick walls. Most masonry and frame structures, and their foundations are destroyed. Railroad rails bend slightly. Pipe lines buried in earth tear apart or are crushed endwise. Open cracks and broad wavy folds open in cement pavements and asphalt road surfaces.

XI **Panic is general.**
Disturbances in ground are many and widespread, varying with the ground material. Broad fissures, earth slumps, and land slips develop in soft, wet ground. Water charged with sand and mud is ejected in large amounts. Sea waves of significant magnitude may develop. Damage is severe to wood frame structures, especially near shock centers, great to dams, dikes and embankments, even at long distances. Few if any masonry structures remain standing. Supporting piers or pillars of large, well-built bridges are wrecked. Wooden bridges that "give" are less affected. Railroad rails bend greatly and some thrust endwise. Pipe lines buried in earth are put completely out of service.

XII **Panic is general.**
Damage is total, and practically all works of construction are damaged greatly or destroyed. Disturbances in the ground are great and varied, and numerous shearing cracks develop. Landslides, rock falls, and slumps in river banks are numerous and extensive. Large rock masses are wrenched loose and torn off. Fault slips develop in firm rock, and horizontal and vertical offset displacements are notable. Water channels, both surface and underground, are disturbed and modified greatly. Lakes are dammed, new waterfalls are produced, rivers are deflected, etc. Surface waves are seen on ground surfaces. Lines of sight and level are distorted. Objects are thrown upward into the air.

BLOCKS 29-32 PUBLIC IMPROVEMENTS
MISSION BAY
San Francisco, California

MODIFIED MERCALLI INTENSITY SCALE

Treadwell&Rollo

Date 03/10/08	Project No. 3347.01	Figure 4

APPENDIX A

Logs of Borings and CPTs from Previous Investigations by Treadwell & Rollo

PROJECT: BLOCK 30
MISSION BAY EAST
San Francisco, California

Log of Boring B30-1

Boring location: See Site Plan, Figure 2 | Logged by: L. Splitter

Date started: 5/6/07 | Date finished: 5/6/07

Drilling method: Rotary Wash

Hammer weight/drop: 140 lbs./30 inches | Hammer type: Rope and Cathead

Sampler: Sprague & Henwood (S&H), Standard Penetration Test (SPT), Shelby Tube (ST)

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION (Ground Surface Elevation: 100.6 feet[2])		LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
1					2 inches concrete over 6 inches aggregate base							
2				SC	CLAYEY SAND (SC) yellow-brown, medium dense, moist, with brick fragments	FILL						
3	S&H		19									
4				CL-ML	SANDY SILTY CLAY with GRAVEL (CL-ML) olive-gray, very stiff, moist, with brick fragments LL = 26, PI = 5							
5												
6	SPT		17									
7				SP	SAND (SP) olive, medium dense, moist, with glass and gravel							
8	SPT		4		gray-brown, very loose, with brick, rock in shoe, blow count low because pushed into clay							
9												
10					CLAY (CH) gray, very soft, wet	BAY MUD						
11	S&H		1									
12												
13					gray, trace sand							
14	ST		0 to 75 psi									
15												
16												
17												
18												
19				CH								
20												
21												
22												
23												
24												
25												
26					shells at 26 feet							
27												
28												
29	ST		0 to 100 psi		blue-gray, soft Consolidation Test, see Figure B-1		TxUU	1,200	360		58.6	63
30												

Treadwell&Rollo

Project No.: 4086.16 | Figure: A-1a

TEST GEOTECH LOG 4086.16.GPJ TR.GDT 9/18/07

PROJECT: BLOCK 30
MISSION BAY EAST
San Francisco, California

Log of Boring B30-1

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
31	ST				CLAY (CH) (continued)						
32											
33											
34											
35											
36											
37											
38											
39											
40											
41											
42				CH							
43					gray, soft						
44	ST		0 to 75 psi								
45											
46											
47											
48											
49											
50											
51											
52											
53					sandy at 54 feet						
54					CLAYEY SAND (SC) mottled olive-gray and olive, dense, wet, fine-grained sand						
55	S&H		35	SC							
56					yellow-brown at 54.75 feet						
57											
58					CLAY (CL) olive, stiff to very stiff, wet,						
59				CL							
60	S&H		8								

BAY MUD

TEST GEOTECH LOG 408616.GPJ TR.GDT 6/19/07

Treadwell&Rollo

Project No.: 4086.16

Figure: A-1b

PROJECT: **BLOCK 30**
MISSION BAY EAST
San Francisco, California

Log of Boring B30-1

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
61	S&H		8	CL	CLAY (CL) (continued) with gray and yellow-brown mottling at 60.5						
62											
63					SANDY CLAY (CL) yellow-brown with gray mottling, hard, wet, trace fine gravel						
64											
65	S&H		35								
66											
67											
68					SAND with CLAY (SP-SC) orange-brown, medium dense, wet						
69											
70	SPT		20	SP-SC							
71											
72											
73											
74											
75	SPT		52		mottled olive and red-brown, very dense						
76											
77					SAND (SP) olive-brown, very dense, wet						
78											
79											
80	SPT		51	SP							
81											
82											
83											
84											
85	SPT		31	CL	SANDY CLAY (CL) olive, hard, wet						
86											
87					SAND with CLAY (SP-SC) olive-brown, very dense, wet						
88				SP-SC							
89											
90	SPT		86/11"						5.6		

COLMA

TEST GEOTECH LOG 406616.GPJ TR.GDT 6/6/07

Treadwell&Rollo

Project No.: 4086.16 | Figure: A-1c

PROJECT: **BLOCK 30**
MISSION BAY EAST
San Francisco, California

Log of Boring B30-1

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value¹	LITHOLOGY	MATERIAL DESCRIPTION		LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
91				SP-SC	SAND with CLAY (SP-SC) (continued)							
92												
93					SAND (SP) olive-brown, very dense, wet	COLMA						
94	SPT		50/5"	SP								
95												
96												
97					CLAY (CH) gray, stiff to very stiff, wet	OLD BAY CLAY						
98												
99												
100	SPT		15	CH								
101												
102												
103												
104												
105					rock fragments in cuttings at 106 feet							
106					SERPENTINITE intensely fractured, low hardness, weak, moderately weathered							
107												
108												
109	SPT		50/5"									
110												
111					CLAYSTONE intensely fractured, low hardness, plastic, deeply weathered	BEDROCK						
112												
113												
114												
115	SPT		71									
116												
117												
118												
119												
120												

Treadwell&Rollo

Project No.: 4086.16

Figure: A-1d

PROJECT: BLOCK 30
MISSION BAY EAST
San Francisco, California

Log of Boring B30-1

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
121					CLAYSTONE (continued)						
122											
123					SERPENTINITE intensely fractured, low hardness, weak, little weathered						
124											
125	SPT		56		BEDROCK						
126											
127					SHALE/SERPENTINITE crushed, soft, plastic						
128											
129	SPT		50/ 2"								
130											
131											
132											
133											
134											
135											
136											
137											
138											
139											
140											
141											
142											
143											
144											
145											
146											
147											
148											
149											
150											

Boring terminated at a depth of 129.2 feet.
Boring backfilled with cement grout.
Groundwater not measured at time of drilling.

[1] S&H blow counts converted to SPT N-values using a factor of 0.6.
[2] Elevation based on San Francisco City Datum plus 100 feet.

Treadwell&Rollo

Project No.: 4086.16 | Figure: A-1e

TEST GEOTECH LOG 4086I6.GPJ TR.GDT 6/12/07

PROJECT:	BLOCK 30 MISSION BAY EAST San Francisco, California	**Log of Boring B30-2**	PAGE 1 OF 4

Boring location: See Site Plan, Figure 2 | Logged by: J. Wong

Date started: 5/3/07 | Date finished: 5/3/07

Drilling method: Rotary Wash

Hammer weight/drop: 140 lbs./30 inches | Hammer type: Rope and Cathead

Sampler: Sprague & Henwood (S&H), Standard Penetration Test (SPT), Shelby Tube (ST)

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION		LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 100.4 feet[2]							
1					2 inches asphalt concret over 12 inches aggregate base							
2					SAND with GRAVEL (SP) olive-brown, medium dense, moist, with angular to subangular gravel, traces of brick and Serpentinite fragments							
3	S&H		17	SP								
4												
5					higher brick content, trace fines							
6	SPT		12									
7					CLAY with SAND and GRAVEL (CH) dark gray, stiff, moist							
8	SPT		9	CH								
9					olive clay was observed from cuttings at 88 feet (5/3/07 at 7:55 am)							
10					CLAYEY SAND with GRAVEL (SC) green-gray, loose, wet, serpentinite fragments LL = 32, PI = 13					17.6	13.0	
11	S&H		7									
12	SPT		48	SC	gray, dense	FILL						
13												
14												
15					SANDY CLAY with GRAVEL (CH) dark gray, stiff, wet, with angular to subangular gravel, and Shale fragments							
16												
17	SPT		13									
18												
19												
20	SPT		14	CH								
21												
22												
23												
24												
25					CLAY (CH) gray, soft, wet, with shell fragments							
26												
27				CH		BAY MUD						
28												
29												
30	ST		100 psi									

Treadwell&Rollo

Project No.: 4086.16 | Figure: A-2a

TEST GEOTECH LOG 408616.GPJ TR.GDT 9/18/07

PROJECT: **BLOCK 30**
MISSION BAY EAST
San Francisco, California

Log of Boring B30-2

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
31	ST		100 psi	CH	CLAY (CH) (continued)					66.9	59
32											
33											
34											
35											
36											
37											
38											
39											
40	ST		100 psi								
41											
42											
43											
44											
45											
46											
47											
48											
49											
50	ST		100 to 250 psi		sand lense at 51.5 feet						
51											
52											
53											
54											
55											
56											
57				CL	CLAY (CL) olive with orange-brown mottling, very stiff, wet						
58											
59	S&H		24			TxUU	2,200	2,030		25.5	100
60											

BAY MUD

Treadwell&Rollo

Project No.: 4086.16 | Figure: A-2b

TEST GEOTECH LOG 408616.GPJ TR.GDT 6/12/07

PROJECT: **BLOCK 30**
MISSION BAY EAST
San Francisco, California

Log of Boring B30-2

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value'	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
60	S&H		24	CL	CLAY (CL) (continued)						
61											
62					SANDY CLAY (CL) yellow-brown with olive mottling, hard, wet						
63											
64											
65	SPT		38	CL							
66											
67					SAND with CLAY (SP-SC) orange-brown, dense, wet						
68											
69											
70	SPT		34	SP-SC							
71											
72											
73											
74											
75	SPT		85/11"		very dense						
76											
77					SAND (SP) olive, very dense, wet						
78											
79											
80	SPT		87/11.5"								
81											
82											
83				SP							
84											
85	SPT		69								
86											
87											
88											
89	SPT		50/3"		SERPENTINITE						
90											

COLMA

BEDROCK

TEST GEOTECH LOG 408616.GPJ TR.GDT 6/12/07

Treadwell&Rollo

Project No.: 4086.16

Figure: A-2c

PROJECT: **BLOCK 30**
MISSION BAY EAST
San Francisco, California

Log of Boring B30-2

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
91					SERPENTINITE intensely fractured, weak, moderately weathered, low hardness BEDROCK						
92											
93											
94	SPT		50/ 1"								
95											
96											
97											
98											
99											
100											
101											
102											
103											
104											
105											
106											
107											
108											
109											
110											
111											
112											
113											
114											
115											
116											
117											
118											
119											
120											

Boring terminated at a depth of 94.1 feet.
Boring backfilled with cement grout.
Groundwater encountered at 9 feet at 7:55 am on 5/3/07.

[1] S&H blow counts converted to SPT N-values using a factor of 0.6.
[2] Elevation based on San Francisco City Datum plus 100 feet.

Treadwell&Rollo

Project No.: 4086.16
Figure: A-2d

TEST GEOTECH LOG 408616.GPJ TR.GDT 6/12/07

PROJECT: **BLOCK 30**
MISSION BAY EAST
San Francisco, California

Log of Boring B30-3

Boring location: See Site Plan, Figure 2 | Logged by: J. Wong

Date started: 5/2/07 | Date finished: 5/2/07

Drilling method: Rotary Wash

Hammer weight/drop: 140 lbs./30 inches | Hammer type: Rope and Cathead

Sampler: Sprague & Henwood (S&H), Standard Penetration Test (SPT), Shelby Tube (ST)

Ground Surface Elevation: +100.3 feet[2]

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION		LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
1					2 inches asphalt concret over 12 inches aggregate base							
2					CLAYEY SAND with GRAVEL (SC) olive-brown, medium dense, moist, with angular to subangular gravel	FILL						
3	S&H		26	SC								
4												
5					olive-gray, with serpentinite fragments							
6	SPT		17									
7					SANDY CLAY with GRAVEL (CL) olive-gray, stiff, moist							
8	SPT		9	CL								
9												
10					▽ SAND with CLAY and GRAVEL (SP-SC) gray, medium dense, wet (5/2/07 at 8:15 am)							
11	S&H		18	SP-SC						6.0	11.0	
12	SPT		14									
13												
14												
15					CLAYEY GRAVEL with SAND (GC) olive-gray, medium dense, wet							
16												
17	SPT		10	GC						13.6	22.3	
18												
19					GRAVEL (GP) dark gray, medium dense, wet							
20	SPT		19	GP								
21					CLAY (CH) gray, soft, wet, with shell fragments	BAY MUD						
22												
23												
24											72.0	57
25	ST		75 psi	CH	Consolidation Test, see Figure B-2							
26												
27												
28												
29												
30												

Treadwell&Rollo

Project No.: 4086.16 | Figure: A-3a

TEST GEOTECH LOG 4086I6.GPJ TR.GDT 9/18/07

PROJECT: **BLOCK 30**
MISSION BAY EAST
San Francisco, California

Log of Boring B30-3

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value¹	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
31					CLAY (CH) (continued)						
32											
33											
34											
35	ST		75 to 100 psi								
36											
37											
38											
39											
40											
41											
42											
43				CH							
44					Consolidation Test, see Figure B-3					63.4	62
45	ST		75 to 100 psi								
46											
47											
48											
49											
50											
51											
52											
53											
54											
55	ST		150 to 250 psi		CLAY (CL) yellow-brown with olive mottling, hard, wet						
56											
57				CL							
58											
59	SPT		37								
60											

BAY MUD

Treadwell&Rollo

Project No.: 4086.16 | Figure: A-3b

TEST GEOTECH LOG 408816.GPJ TR.GDT 9/18/07

PROJECT: BLOCK 30
MISSION BAY EAST
San Francisco, California

Log of Boring B30-3

DEPTH (feet)	Sampler Type	Sample	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
					LABORATORY TEST DATA						
60	SPT		37	CL	CLAY (CL) (continued)						
61											
62					CLAYEY SAND (SC) orange-brown, medium dense, wet						
63											
64											
65	S&H		18	SC							
66											
67											
68											
69					dense, lower fines content						
70	SPT		46								
71											
72					SAND with CLAY (SP-SC) orange-brown, very dense, wet						
73											
74											
75	SPT		69	SP-SC					7.7	25.0	
76											
77											
78					CLAYEY SAND (SC) olive with orange-brown mottling, dense, wet						
79											
80	SPT		34								
81											
82											
83				SC							
84											
85											
86											
87											
88											
89	SPT		33	CL	SANDY CLAY (CL) olive and yellow-brown with dark brown mottling, hard, wet						
90											

COLMA

Treadwell&Rollo

Project No.: 4086.16

Figure: A-3c

TEST GEOTECH LOG 408616.GPJ TR.GDT 6/12/07

PROJECT: BLOCK 30
MISSION BAY EAST
San Francisco, California

Log of Boring B30-3

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
91	SPT		33	CL	SANDY CLAY (CL) (continued)						
92											
93											
94	SPT		50/ 4"		SERPENTINITE intensely fractured, weak, moderately weathered, low hardness						
95					BEDROCK						
96											
97											
98											
99	SPT		50/ 0"								
100											
101											
102											
103											
104											
105											
106											
107											
108											
109											
110											
111											
112											
113											
114											
115											
116											
117											
118											
119											
120											

Boring terminated at a depth of 99 feet.
Boring backfilled with cement grout.
Groundwater encountered at 9.8 feet at 8:15 am on 5/2/07.

[1] S&H blow counts converted to SPT N-values using a factor of 0.6.
[2] Elevation based on San Francisco City Datum plus 100 feet.

Treadwell&Rollo

Project No.: 4086.16
Figure: A-3d

TEST GEOTECH LOG 4086I6.GPJ TR.GDT 6/12/07

PROJECT:	BLOCK 30 MISSION BAY EAST San Francisco, California	**Log of Boring B30-4**
		PAGE 1 OF 4

Boring location: See Site Plan, Figure 2 | Logged by: J. Wong

Date started: 5/5/07 | Date finished: 5/5/07

Drilling method: Rotary Wash

Hammer weight/drop: 140 lbs./30 inches | Hammer type: Rope and Cathead

Sampler: Sprague & Henwood (S&H), Standard Penetration Test (SPT), Shelby Tube (ST)

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION Ground Surface Elevation: 100.4 feet[2]		LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
1					3 inches asphalt concrete over 12 inches aggregate base							
2				SC	CLAYEY SAND (SC) olive-brown, medium dense, moist							
3	S&H		15	SP	SAND (SP) yellow-brown, medium dense, moist, fine-grained sand							
4												
5												
6	SPT		13	CH	CLAY with GRAVEL (CH) gray, stiff, moist							
7												
8	SPT		6		▽ (5/5/07 at 8:40 am)							
9												
10					green with dark green mottling, medium stiff, wet, with angular Serpentinite gravel							
11	S&H		4	GC	CLAYEY GRAVEL (GC) green-gray, loose, wet, with Serpentinite							
12	SPT		12	SC	CLAYEY SAND with GRAVEL (SC) olive, medium dense, wet	FILL						
13												
14												
15												
16					SAND with CLAY and GRAVEL (SP-SC) gray, medium dense, wet							
17	SPT		13									
18												
19												
20	SPT		4	SP-SC	very loose to loose					6.7	19.9	
21												
22												
23												
24												
25												
26				CH	CLAY (CH) gray, medium stiff, wet, with shell fragments	BAY MUD						
27												
28												
29	ST		75 psi				PP		750			
30												

Treadwell&Rollo

Project No.: 4086.16 | Figure: A-4a

TEST GEOTECH LOG 408816.GPJ TR.GDT 9/18/07

PROJECT: BLOCK 30
MISSION BAY EAST
San Francisco, California

Log of Boring B30-4

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value¹	LITHOLOGY	MATERIAL DESCRIPTION		LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
31	ST		75 psi		CLAY (CH) (continued)	BAY MUD						
32												
33												
34												
35												
36												
37												
38												
39												
40	ST		75 to 100 psi	CH	Consolidation Test, see Figure B-4		TxUU	1,500	725		74.4	56
41												
42												
43												
44												
45												
46												
47												
48												
49												
50	ST		100 to 250 psi	SP	SAND (SP) gray, wet							
51												
52					CLAY with SAND (CL) olive with orange-brown mottling, very stiff, wet							
53												
54												
55	S&H		18				TxUU	1,700	3,450		22.3	105
56				CL								
57												
58												
59					olive with red-brown mottling, very stiff, wet							
60	SPT		26									

TEST GEOTECH LOG 408616.GPJ TR.GDT 7/3/07

Treadwell&Rollo

Project No.: 4086.16

Figure: A-4b

PROJECT: BLOCK 30
MISSION BAY EAST
San Francisco, California

Log of Boring B30-4

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value'	LITHOLOGY	MATERIAL DESCRIPTION		LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
61	SPT		26	CL	CLAY with SAND (CL) (continued)							
62					CLAYEY SAND (SC)							
63					orange-brown, medium dense, wet, fine-grained sand							
64												
65	SPT		18									
66												
67												
68												
69				SC	very dense, lower fines content							
70	SPT		58							12.4	23.3	
71												
72												
73												
74					olive, higher fines content							
75	SPT		56									
76												
77					SAND with CLAY (SP-SC)							
78					orange-brown, very dense, wet							
79				SP-SC								
80	SPT		61									
81					SANDY CLAY (CL)							
82					olive, hard, wet							
83				CL								
84												
85	SPT		36		SERPENTINITE	BEDROCK						
86					intensely fractured, moderately hard, weak, moderately weathered							
87					SHALE							
88					intensely fractured, moderately hard, weak, moderately weathered							
89	SPT		50/4.5"									
90												

COLMA

Treadwell&Rollo

Project No.: 4086.16

Figure: A-4c

TEST GEOTECH LOG 408616.GPJ TR.GDT 7/3/07

PROJECT: BLOCK 30
MISSION BAY EAST
San Francisco, California

Log of Boring B30-4

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
91					SHALE (continued)						
92					SERPENTINITE intensely fractured, moderately hard, weak, moderately weathered						
93					BEDROCK						
94	SPT		50/ 5.5"								
95											
96											
97											
98											
99											
100											
101											
102											
103											
104											
105											
106											
107											
108											
109											
110											
111											
112											
113											
114											
115											
116											
117											
118											
119											
120											

Boring terminated at a depth of 95 feet.
Boring backfilled with cement grout.
Groundwater encountered at 8 feet at 8:40 am.

[1] S&H blow counts converted to SPT N-values using a factor of 0.6.
[2] Elevation based on San Francisco City Datum plus 100 feet.

Treadwell&Rollo

Project No.: 4086.16 | Figure: A-4d

TEST GEOTECH LOG 408616.GPJ TR.GDT 7/3/07

PROJECT: **BLOCK 30**
MISSION BAY EAST
San Francisco, California

Log of Boring B30-5

Boring location: See Site Plan, Figure 2 | Logged by: J. Wong

Date started: 5/4/07 | Date finished: 5/4/07

Drilling method: Rotary Wash

Hammer weight/drop: 140 lbs./30 inches | Hammer type: Rope and Cathead

Sampler: Sprague & Henwood (S&H), Standard Penetration Test (SPT), Shelby Tube (ST)

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
					Ground Surface Elevation: 100.3 feet[2]						
1					3 inches asphalt concret over 12 inches aggregate base and 4 inches concrete						
2					CLAYEY SAND with GRAVEL (SC) olive-gray, medium dense, moist						
3	S&H		16	SC							
4											
5					loose to medium dense, with brick fragments						
6	SPT		10								
7											
8	SPT		8		▼ CLAY with SAND (CH) gray, medium stiff to stiff, wet, with brick fragments and Serpentinite (5/4/07 at 8:45 am)						
9				CH							
10					stiff, no brick						
11	S&H		11								
12	SPT		11		SANDY SILTY CLAY (CL-ML) gray, stiff, wet LL = 23, PI = 7						
13				CL-ML							
14											
15					SAND with CLAY and GRAVEL (SP-SC) green-gray, medium dense, wet						
16					FILL						
17	SPT		11						10.8	16.1	
18											
19					loose						
20	SPT		6								
21											
22				SP-SC							
23											
24					green with orange-brown mottling						
25	SPT		6						11.9	24.1	
26											
27											
28											
29											
30	SPT	•	8								

Treadwell&Rollo

Project No.: 4086.16 | Figure: A-5a

TEST GEOTECH LOG 4086.16.GPJ TR.GDT 9/20/07

PROJECT: **BLOCK 30**
MISSION BAY EAST
San Francisco, California

Log of Boring B30-5

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value¹	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
30	SPT	•	8		SAND with CLAY and GRAVEL (SP-SC) (continued)						
31					CLAY (CH) gray, soft, wet						
32											
33											
34											
35	ST		75 to 300 psi		sand lens at 35.5 to 37 feet						
36											
37											
38											
39											
40	S&H		2		with shell fragments						
41				CH							
42											
43											
44											
45	ST		75 to 150 psi								
46											
47											
48											
49											
50											
51											
52					CLAY (CL) yellow-brown with orange-brown mottling, hard, wet, with trace fine-grained sand						
53											
54											
55	SPT		35	CL							
56											
57											
58					CLAYEY SAND (SC) orange-brown, dense, wet						
59				SC							
60	SPT		36						29.2	18.9	

BAY MUD

COLMA

TEST GEOTECH LOG 4086I6.GPJ TR.GDT 7/6/07

Treadwell&Rollo

Project No.: 4086.16 | Figure: A-5b

PROJECT: BLOCK 30
MISSION BAY EAST
San Francisco, California

Log of Boring B30-5

DEPTH (feet)	Sampler Type	Sample	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
					LABORATORY TEST DATA						
61	SPT		36	SC	CLAYEY SAND (SC) (continued)						
62					COLMA						
63					CLAY (CL) olive, very stiff, wet						
64											
65	SPT		22	CL							
66											
67											
68											
69	SPT		50/ 4.5"		SANDSTONE intensely fractured, friable, low hardness						
70											
71											
72											
73					SERPENTINITE intensely fractured, friable, low hardness						
74					BEDROCK						
75	SPT		85/ 10"								
76											
77											
78											
79	SPT		50/ 5.5"								
80											
81											
82											
83											
84											
85											
86											
87											
88											
89											
90											

Boring terminated at a depth of 79.5 feet.
Boring backfilled with cement grout.
Groundwater encountered at 8 feet at 8:55 am on 5/4/07.

[1] S&H blow counts converted to SPT N-values using a factor of 0.6.
[2] Elevation based on San Francisco City Datum plus 100 feet.

Treadwell&Rollo

Project No.: 4086.16
Figure: A-5c

TEST GEOTECH LOG 408616.GPJ TR.GDT 7/6/07

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions		Symbols	Typical Names
Coarse-Grained Soils (more than half of soil > no. 200 sieve size	Gravels (More than half of coarse fraction > no. 4 sieve size)	GW	Well-graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (More than half of coarse fraction < no. 4 sieve size)	SW	Well-graded sands or gravelly sands, little or no fines
		SP	Poorly-graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
Fine -Grained Soils (more than half of soil < no. 200 sieve size)	Silts and Clays LL = < 50	ML	Inorganic silts and clayey silts of low plasticity, sandy silts, gravelly silts
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
		OL	Organic silts and organic silt-clays of low plasticity
	Silts and Clays LL = > 50	MH	Inorganic silts of high plasticity
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic silts and clays of high plasticity
Highly Organic Soils		PT	Peat and other highly organic soils

GRAIN SIZE CHART

Classification	Range of Grain Sizes	
	U.S. Standard Sieve Size	Grain Size in Millimeters
Boulders	Above 12"	Above 305
Cobbles	12" to 3"	305 to 76.2
Gravel	3" to No. 4	76.2 to 4.76
coarse	3" to 3/4"	76.2 to 19.1
fine	3/4" to No. 4	19.1 to 4.76
Sand	No. 4 to No. 200	4.76 to 0.074
coarse	No. 4 to No. 10	4.76 to 2.00
medium	No. 10 to No. 40	2.00 to 0.420
fine	No. 40 to No. 200	0.420 to 0.074
Silt and Clay	Below No. 200	Below 0.074

Unstabilized groundwater level

Stabilized groundwater level

SAMPLE DESIGNATIONS/SYMBOLS

Sample taken with split-barrel sampler other than Standard Penetration Test sampler. Darkened area indicates soil recovered

Classification sample taken with Standard Penetration Test sampler

Undisturbed sample taken with thin-walled tube

Disturbed sample

Sampling attempted with no recovery

Core sample

Analytical laboratory sample

Sample taken with Direct Push sampler

SAMPLER TYPE

C Core barrel

CA California split-barrel sampler with 2.5-inch outside diameter and a 1.93-inch inside diameter

D&M Dames & Moore piston sampler using 2.5-inch outside diameter, thin-walled tube

O Osterberg piston sampler using 3.0-inch outside diameter, thin-walled Shelby tube

PT Pitcher tube sampler using 3.0-inch outside diameter, thin-walled Shelby tube

S&H Sprague & Henwood split-barrel sampler with a 3.0-inch outside diameter and a 2.43-inch inside diameter

SPT Standard Penetration Test (SPT) split-barrel sampler with a 2.0-inch outside diameter and a 1.5-inch inside diameter

ST Shelby Tube (3.0-inch outside diameter, thin-walled tube) advanced with hydraulic pressure

BLOCK 30
MISSION BAY
San Francisco, California

CLASSIFICATION CHART

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Date 05/16/07 | Project No. 4086.16 | Figure A-6

I FRACTURING

Intensity	Size of Pieces in Feet
Very little fractured	Greater than 4.0
Occasionally fractured	1.0 to 4.0
Moderately fractured	0.5 to 1.0
Closely fractured	0.1 to 0.5
Intensely fractured	0.05 to 0.1
Crushed	Less than 0.05

II HARDNESS

1. **Soft** - reserved for plastic material alone.
2. **Low hardness** - can be gouged deeply or carved easily with a knife blade.
3. **Moderately hard** - can be readily scratched by a knife blade; scratch leaves a heavy trace of dust and is readily visible after the powder has been blown away.
4. **Hard** - can be scratched with difficulty; scratch produced a little powder and is often faintly visible.
5. **Very hard** - cannot be scratched with knife blade; leaves a metallic streak.

III STRENGTH

1. **Plastic** or very low strength.
2. **Friable** - crumbles easily by rubbing with fingers.
3. **Weak** - an unfractured specimen of such material will crumble under light hammer blows.
4. **Moderately strong** - specimen will withstand a few heavy hammer blows before breaking.
5. **Strong** - specimen will withstand a few heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments.
6. **Very strong** - specimen will resist heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments.

IV WEATHERING - The physical and chemical disintegration and decomposition of rocks and minerals by natural processes such as oxidation, reduction, hydration, solution, carbonation, and freezing and thawing.

D. Deep - moderate to complete mineral decomposition; extensive disintegration; deep and thorough discoloration; many fractures, all extensively coated or filled with oxides, carbonates and/or clay or silt.

M. Moderate - slight change or partial decomposition of minerals; little disintegration; cementation little to unaffected. Moderate to occasionally intense discoloration. Moderately coated fractures.

L. Little - no megascopic decomposition of minerals; little of no effect on normal cementation. Slight and intermittent, or localized discoloration. Few stains on fracture surfaces.

F. Fresh - unaffected by weathering agents. No disintegration of discoloration. Fractures usually less numerous than joints.

ADDITIONAL COMMENTS:

V CONSOLIDATION OF SEDIMENTARY ROCKS: usually determined from unweathered samples. Largely dependent on cementation.

U = unconsolidated
P = poorly consolidated
M = moderately consolidated
W = well consolidated

VI BEDDING OF SEDIMENTARY ROCKS

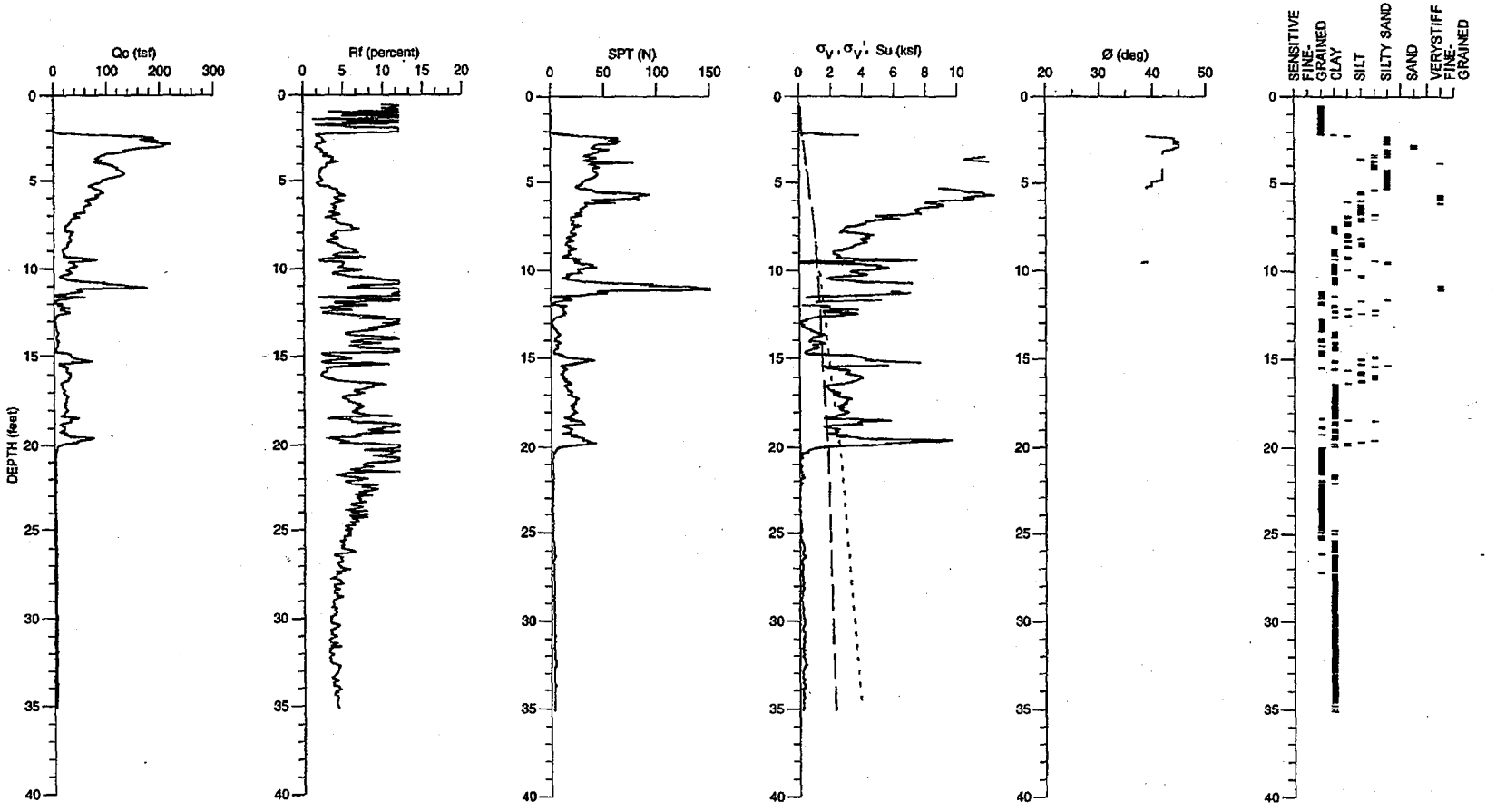
Splitting Property	Thickness	Stratification
Massive	Greater than 4.0 ft.	very thick-bedded
Blocky	2.0 to 4.0 ft.	thick bedded
Slabby	0.2 to 2.0 ft.	thin bedded
Flaggy	0.05 to 0.2 ft.	very thin-bedded
Shaly or platy	0.01 to 0.05 ft.	laminated
Papery	less than 0.01	thinly laminated

BLOCK 30
MISSION BAY
San Francisco, California

PHYSICAL PROPERTIES CRITERIA FOR ROCK DESCRIPTIONS

Treadwell&Rollo

Date 08/03/07 | Project No. 4086.16 | Figure A-7



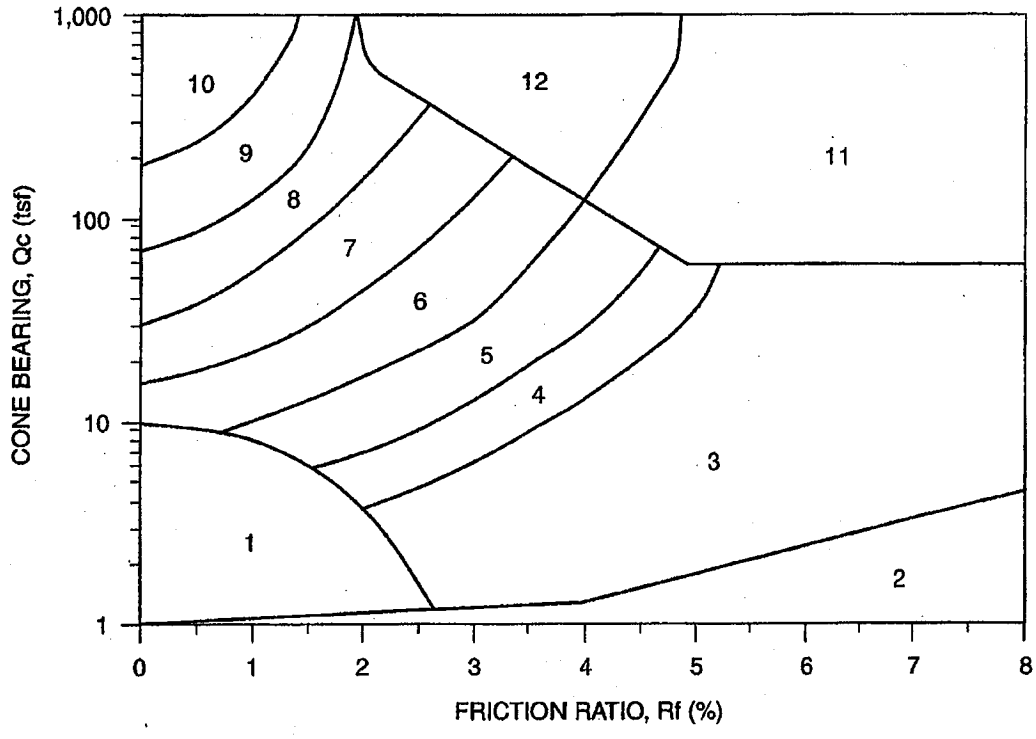
Terminated at 35.0 feet.
Groundwater assumed to be at a depth of 8.0 feet bgs.
Date performed: 05/04/07.
Elevation: 100.3 feet, Datum: San Francisco City Datum plus 100 feet.

BLOCK 30
MISSION BAY
San Francisco, California

CONE PENETRATION TEST RESULTS
C30-1

Date 09/20/07	Project No. 4086.16	Figure A-8

Treadwell&Rollo



ZONE	Qc/N[1]	Su Factor (Nk)[2]	SOIL BEHAVIOR TYPE[1]
1	2	15 (10 for Qc ≤ 9 tsf)	Sensitive Fine-Grained
2	1	15 (10 for Qc ≤ 9 tsf)	Organic Material
3	1	15 (10 for Qc ≤ 9 tsf)	CLAY
4	1.5	15	SILTY CLAY to CLAY
5	2	15	CLAYEY SILT to SILTY CLAY
6	2.5	15	SANDY SILT to CLAYEY SILT
7	3	---	SILTY SAND to SANDY SILT
8	4	---	SAND to SILTY SAND
9	5	---	SAND
10	6	---	GRAVELLY SAND to SAND
11	1	15	Very Stiff Fine-Grained (*)
12	2	---	SAND to CLAYEY SAND (*)

(*) Overconsolidated or Cemented
Qc = Tip Bearing
Fs = Sleeve Friction
Rf = Fs/Qc x 100 = Friction Ratio

Note: Testing performed in accordance with ASTM D3441.

References: 1. Robertson, 1986, Olsen, 1988.
2. Bonaparte & Mitchell, 1979 (young Bay Mud Qc ≤9).
Estimated from local experience (fine-grained soils Qc > 9).

BLOCK 30
MSSION BAY
San Francisco, California

CLASSIFICATION CHART FOR CONE PENETRATION TESTS

Treadwell&Rollo

Date 08/03/07	Project No. 4086.16	Figure A-9

SARIMIENTO

PROJECT: BLOCK 32
MISSION BAY
San Francisco, California

Log of Boring B32-1

Boring location: See Site Plan, Figure 2
Logged by: J. Wong
Date started: 4/30/07 Date finished: 5/1/07
Drilling method: Rotary Wash
Hammer weight/drop: 140 lbs./30 inches Hammer type: Rope and Cathead
Sampler: Sprague & Henwood (S&H), Standard Penetration Test (SPT), Shelby Tube (ST)

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION		LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
					Ground Surface Elevation: +105 feet[2]							
1–2				SC	CLAYEY SAND with GRAVEL (SC) olive-brown, medium dense, moist trace brick and subangular gravel	FILL						
3–4	S&H		13		LL = 20, PI = NP							
5–6	SPT		3		very loose							
7–8	SPT		7		loose, with serpentinite fragments					25.9	13.7	
9–10												
11	S&H		5									
12	SPT		5	CH	CLAY (CH) gray, soft, wet, with shell fragments (4/30/07 at 1:40 pm)	BAY MUD						
13–16												
17–18	ST		50 to 75 psi		Consolidation Test, see Figure B-1		TxUU	1,050	275		66.8	60
19–24												
25–26	ST		50 to 75 psi		Consolidation Test, see Figure B-2						57.6	66
27–30												

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Project No.: 4086.17 Figure: A-1a

TEST GEOTECH LOG 408617.GPJ TR.GDT 7/17/07

PROJECT: BLOCK 32
MISSION BAY
San Francisco, California

Log of Boring B32-1

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
31					CLAY (CH) (continued)						
32											
33											
34											
35	ST		0 to 75 psi	CH							
36											
37											
38											
39											
40											
41											
42					BAY MUD						
43					CLAYEY SAND (SC) yellow-brown, medium dense, wet						
44											
45	SPT		26	SC							
46											
47											
48					CLAY (CL) olive, stiff to very stiff, wet, with trace silt						
49											
50	SPT		16	CL							
51											
52											
53											
54											
55	S&H		30		CLAYEY SAND (SC) yellow-brown, medium dense to dense, wet						
56				SC							
57											
58											
59					SILTY SAND (SM) orange-brown, medium dense, wet						
60	SPT		28		COLMA				14.9	24.7	

TEST GEOTECH LOG 4086I7.GPJ TR.GDT 7/17/07

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Project No.: 4086.17

Figure: A-1b

PROJECT: BLOCK 32 MISSION BAY San Francisco, California

Log of Boring B32-1

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value	LITHOLOGY	MATERIAL DESCRIPTION		LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
61	SPT		28	SM	SILTY SAND (SM) (continued)							
62					SAND with CLAY (SP-SC) orange-brown, very dense, wet, trace fines, medium grained sand							
63												
64												
65	SPT		46/ 5.5"							11.7	22.8	
66												
67												
68												
69												
70	SPT		56							8.8	22.6	
71												
72				SP-SC		COLMA						
73												
74												
75	SPT		59									
76												
77												
78												
79												
80	SPT		56		olive, fine-grained sand							
81												
82												
83					SERPENTINITE intensely fractured, weak, moderately weathered, moderately hard							
84												
85	SPT		88/ 3"			BEDROCK						
86												
87												
88												
89												
90	SPT		56		plastic, soft							

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Project No.: 4086.17 Figure: A-1c

TEST GEOTECH LOG 408617.GPJ TR.GDT 7/17/07

PROJECT: BLOCK 32
MISSION BAY
San Francisco, California

Log of Boring B32-1

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
91	SPT		56		SERPENTINITE (continued)						
92											
93											
94	SPT		50/3"		friable, low hardness						
95											
96											
97											
98											
99	SPT		50/3"		weak						
100											
101											
102											
103											
104											
105											
106											
107											
108											
109											
110											
111											
112											
113											
114											
115											
116											
117											
118											
119											
120											

BEDROCK

Boring terminated at a depth of 99.25 feet.
Boring backfilled with cement grout.
Groundwater encountered at a depth of 12.5 feet at 1:40 pm on 4/30/07

[1] S&H blow counts converted to SPT N-values using a factor of 0.6.
[2] Elevation based on San Francisco City Datum plus 100 feet.

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Project No.: 4086.17
Figure: A-1d

TEST GEOTECH LOG 408617.GPJ TR.GDT 7/17/07

PROJECT:	BLOCK 32 MISSION BAY San Francisco, California	**Log of Boring B32-2** PAGE 1 OF 3
Boring location:	See Site Plan, Figure 2	Logged by: J. Wong
Date started:	4/27/07	Date finished: 4/30/07
Drilling method:	Rotary Wash	
Hammer weight/drop:	140 lbs./30 inches	Hammer type: Rope and Cathead
Sampler:	Sprague & Henwood (S&H), Standard Penetration Test (SPT), Shelby Tube (ST)	

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION		LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
					Ground Surface Elevation: +101 feet[2]							
1–4	S&H		12	SC	SAND with CLAY (SP-SC) gray-brown, medium dense, moist, with traces of brick and angular gravel							
5–7	SPT		14	SC	CLAYEY SAND (SC) yellow-brown, medium dense, moist, with fragments of bricks	FILL						
8	SPT		4	SC	▽ (4/27/07 at 2:45 pm) olive-brown, very loose to loose, wet							
9–10												
11	SPT		2	SC	very loose							
12–13	ST		0 to 75 psi	CH	CLAY (CH) gray, soft, wet, with shell fragments							
14–18												
19–21	ST		50 to 150 psi	CH		BAY MUD	TxUU	850	345		59.1	65
22–28												
29–30	ST											

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Project No.: 4086.17 | Figure: A-2a

TEST GEOTECH LOG 408617.GPJ TR.GDT 7/17/07

PROJECT: BLOCK 32
MISSION BAY
San Francisco, California

Log of Boring B32-2

DEPTH (feet)	Sampler Type	Sample	SPT N-Value¹	LITHOLOGY	MATERIAL DESCRIPTION		Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
31	ST		0 to 150 psi		CLAY (CH) (continued) sandy at 30.5 feet	BAY MUD						
35	S&H		4	CH	soft to medium stiff							
40	ST		100 to 300 psi	SP	SAND (SP) gray, wet							
42					CLAY (CL) olive, very stiff, wet							
45	S&H		16	CL			TxUU	1,650	1,540		29.6	94
50	S&H		13		stiff							
53					CLAYEY SAND (SC) yellow-brown, dense, wet	COLMA						
55	SPT		34	SC						18.7	22.0	
59	SPT		31									

SAMPLES

LABORATORY TEST DATA

TEST GEOTECH LOG 4086I7.GPJ TR.GDT 7/17/07

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Project No.: 4086.17

Figure: A-2b

PROJECT: BLOCK 32
MISSION BAY
San Francisco, California

Log of Boring B32-2

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
61	SPT		31	SC	CLAYEY SAND (SC) (continued)						
62					COLMA						
63					SERPENTINITE intensely fractured, friable, moderately weathered, low harness						
64	SPT		50/ 3"								
65											
66											
67											
68											
69	SPT		50/ 4.5"		BEDROCK						
70											
71											
72											
73											
74											
75											
76											
77											
78											
79											
80											
81											
82											
83											
84											
85											
86											
87											
88											
89											
90											

Boring terminated at a depth of 69.4 feet.
Boring backfilled with cement grout.
Groundwater encountered at 8 feet at 2:45 pm on 4/27/07

[1] S&H blow counts converted to SPT N-values using a factor of 0.8.
[2] Elevation based on San Francisco City Datum plus 100 feet.

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Project No.: 4086.17
Figure: A-2c

TEST GEOTECH LOG 408617.GPJ TR.GDT 7/17/07

PROJECT:	BLOCK 32 MISSION BAY San Francisco, California	**Log of Boring B32-3** PAGE 1 OF 3

Boring location: See Site Plan, Figure 2 | Logged by: J. Wong

Date started: 4/25/07 | Date finished: 4/26/07

Drilling method: Rotary Wash

Hammer weight/drop: 140 lbs./30 inches | Hammer type: Rope and Cathead

Sampler: Sprague & Henwood (S&H), Standard Penetration Test (SPT), Shelby Tube (ST)

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION Ground Surface Elevation: +99.5 feet[2]		LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
1					CLAYEY SAND with GRAVEL (SC) dark gray, loose, moist, with fragments of brick and concrete	FILL						
2												
3	S&H		5	SC								
4												
5					olive-brown, trace gravel							
6	SPT		9									
7					▽ (4/25/07 at 3:30 pm)							
8	SPT		4	CL	CLAY (CL) black, soft to medium stiff, wet, majority of sample is wood							
9												
10					CLAYEY SAND with GRAVEL (SC) dark brown, loose, wet, with fragments of bricks							
11	S&H		6	SC						13.8	23.6	
12	SPT		9									
13					CLAY (CH) gray, soft, wet, with shell fragments	BAY MUD						
14												
15												
16												
17												
18	ST		50 psi									
19												
20												
21				CH								
22												
23												
24												
25	ST		75 psi		Consolidation Test, see Figure B-3						50.9	71
26												
27												
28												
29												
30												

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Project No.: 4086.17 | Figure: A-3a

TEST GEOTECH LOG 408617.GPJ TR.GDT 7/17/07

PROJECT: BLOCK 32 MISSION BAY San Francisco, California

Log of Boring B32-3

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
31				CH	CLAY (CH) (continued)						
32					BAY MUD						
33											
34											
35	ST		100 to 250 psi								
36				SP	SAND (SP) gray, wet						
37											
38											
39											
40	SPT		51	CL	CLAY with GRAVEL (CL) yellow-brown with olive mottling, hard, wet						
41											
42					CLAYSTONE intensely fractured, weak, moderately weathered, low hardness						
43											
44	SPT		50/ 3"								
45											
46											
47											
48											
49											
50	SPT		64		plastic						
51					BEDROCK						
52					SHALE intensely fractured, friable, moderately weathered, low hardness						
53											
54	SPT		50/ 5"								
55											
56											
57											
58											
59											
60	SPT		69		plastic						

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Project No.: 4086.17 Figure: A-3b

TEST GEOTECH LOG 4086I7.GPJ TR.GDT 7/17/07

PROJECT: BLOCK 32
MISSION BAY
San Francisco, California

Log of Boring B32-3

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
60	SPT		69		SHALE (continued)						
61											
62											
63											
64	SPT		50/3"		friable						
65											
66											
67											
68											
69	SPT		50/3"		BEDROCK						
70											
71											
72											
73											
74											
75											
76											
77											
78											
79											
80											
81											
82											
83											
84											
85											
86											
87											
88											
89											
90											

Boring terminated at a depth of 69.25 feet.
Boring backfilled with cement grout.
Groundwater encountered at 7 feet at 3:30 pm on 4/25/07.

[1] S&H blow counts converted to SPT N-values using a factor of 0.6.
[2] Elevation based on San Francisco City Datum plus 100 feet.

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Project No.: 4086.17
Figure: A-3c

TEST GEOTECH LOG 408617.GPJ TR.GDT 7/17/07

PROJECT:	BLOCK 32 MISSION BAY San Francisco, California	**Log of Boring B32-4** PAGE 1 OF 2

Boring location: See Site Plan, Figure 2 | Logged by: J. Wong

Date started: 4/25/07 | Date finished: 4/25/07

Drilling method: Rotary Wash

Hammer weight/drop: 140 lbs./30 inches | Hammer type: Rope and Cathead

Sampler: Sprague & Henwood (S&H), Standard Penetration Test (SPT), Shelby Tube (ST)

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION Ground Surface Elevation: +96 feet[2]		LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
1				SC	CLAYEY SAND with GRAVEL (SC) olive-brown, medium dense, moist, with Serpentinite fragments and subangular gravel	FILL						
2												
3	S&H		17									
4												
5				SC	CLAYEY SAND (SC) olive-brown, medium dense, moist, with brick and concrete fragments							
6	SPT		16							14.4	10.8	
7					▽ (4/25/07 at 8:30 am)							
8	S&H		19		wet, with gravel LL = 28, PI = 10							
9												
10												
11	SPT		13							13.3	17.0	
12												
13												
14												
15				CH	CLAY (CH) gray, soft, wet, with shell fragments	BAY MUD						
16												
17					Consolidation Test, see Figure B-4							
18	ST		50 psi								71.3	58
19												
20												
21												
22												
23												
24												
25	ST		50 to 250 psi				PP		2,500			
26					CLAY (CL) yellow-brown, stiff, wet, with trace fine-grained sand							
27				CL								
28												
29	S&H		13									
30												

Treadwell&Rollo

Project No.: 4086.17 | Figure: A-4a

TEST GEOTECH LOG 408617.GPJ TR.GDT 7/17/07

PROJECT: BLOCK 32
MISSION BAY
San Francisco, California

Log of Boring B32-4

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
31	S&H		13	CL	CLAY (CL) (continued)						
32											
33					CLAYSTONE intensely fractured, plastic, moderately weathered, soft						
34	S&H		50/ 6"								
35											
36											
37											
38					SERPENTINITE intensely fractured, plastic, moderately weathered, soft						
39	SPT		50/ 5.5"								
40											
41											
42											
43					SHALE intensely fractured, friable, moderately weathered, moderately hard						
44	SPT		50/ 4.5"								
45											
46											
47											
48											
49	SPT		50/ 4"								
50											
51											
52											
53											
54	SPT		50/ 0.5"								
55											
56											
57											
58											
59											
60											

BEDROCK

Boring terminated at a depth of 54 feet.
Boring backfilled with cement grout.
Groundwater encountered at 7 feet at 8:30 am on 4/25/07.

[1] S&H blow counts converted to SPT N-values using a factor of 0.6.
[2] Elevation based on San Francisco City Datum plus 100 feet.

Treadwell&Rollo

Project No.: 4086.17
Figure: A-4b

TEST GEOTECH LOG 408617.GPJ TR.GDT 7/17/07

PROJECT:	BLOCK 32 MISSION BAY San Francisco, California	**Log of Boring B32-5** PAGE 1 OF 2

Boring location: See Site Plan, Figure 2 | Logged by: J. Wong

Date started: 4/26/07 | Date finished: 4/27/07

Drilling method: Rotary Wash

Hammer weight/drop: 140 lbs./30 inches | Hammer type: Rope and Cathead

Sampler: Sprague & Henwood (S&H), Standard Penetration Test (SPT), Shelby Tube (ST)

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION Ground Surface Elevation: +93 feet[2]		LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
1				CL	SANDY CLAY with GRAVEL (CL) olive-brown, stiff, wet, with fragments of concrete and brick, traces angular to subangular gravels	FILL						
2					▽ (4/27/07 at 7:00 am)							
3	S&H		15									
4												
5				SC	CLAYEY SAND with GRAVEL (SC) olive-brown, loose, wet, with brick							
6	SPT		7									
7												
8	SPT		18		medium dense					18.7	12.1	
9												
10	S&H		50/3"		concrete obstruction at 10.5 feet							
11												
12	SPT		4	CH	CLAY (CH) gray, soft to medium stiff, wet, with shell fragments	BAY MUD						
13												
14	ST		75 to 100 psi									
15				SP	SAND (SP) gray, wet							
16												
17				SC	CLAYEY SAND (SC) olive, medium dense, wet							
18	SPT		21									
19												
20	SPT		9		CLAY with SAND (CL) olive with red-brown mottling, stiff, wet							
21												
22				CL								
23												
24					orange-brown, very stiff		TxUU	850	4,450		15.7	118
25	S&H		26									
26												
27												
28				CL	CLAY (CL) yellow-brown with orange-brown mottling, hard, wet, with bedrock fragments							
29												
30	SPT		35									

Treadwell&Rollo

Project No.: 4086.17 | Figure: A-5a

TEST GEOTECH LOG 408617.GPJ TR.GDT 7/17/07

PROJECT: BLOCK 32
MISSION BAY
San Francisco, California

Log of Boring B32-5

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
31	SPT		35	CL	CLAY (CL) (continued)						
32					SERPENTINITE intensely fractured, friable, deeply weathered, low hardness						
33											
34	SPT		50/ 5.5"								
35											
36											
37											
38											
39	SPT		50/ 5"								
40											
41											
42											
43											
44	SPT		50/ 5"								
45											
46											
47											
48											
49											
50											
51											
52											
53											
54											
55											
56											
57											
58											
59											
60											

BEDROCK

Boring terminated at a depth of 44.4 feet.
Boring backfilled with cement grout.
Groundwater encountered at 2.5 feet at 7:00 am on 4/27/07.

[1] S&H blow counts converted to SPT N-values using a factor of 0.6.
[2] Elevation based on San Francisco City Datum plus 100 feet.

Treadwell&Rollo

Project No.: 4086.17
Figure: A-5b

TEST GEOTECH LOG 4086I7.GPJ TR.GDT 7/17/07

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions		Symbols	Typical Names
Coarse-Grained Soils (more than half of soil > no. 200 sieve size	Gravels (More than half of coarse fraction > no. 4 sieve size)	GW	Well-graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (More than half of coarse fraction < no. 4 sieve size)	SW	Well-graded sands or gravelly sands, little or no fines
		SP	Poorly-graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
Fine -Grained Soils (more than half of soil < no. 200 sieve size)	Silts and Clays LL = < 50	ML	Inorganic silts and clayey silts of low plasticity, sandy silts, gravelly silts
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
		OL	Organic silts and organic silt-clays of low plasticity
	Silts and Clays LL = > 50	MH	Inorganic silts of high plasticity
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic silts and clays of high plasticity
Highly Organic Soils		PT	Peat and other highly organic soils

GRAIN SIZE CHART

Classification	Range of Grain Sizes	
	U.S. Standard Sieve Size	Grain Size in Millimeters
Boulders	Above 12"	Above 305
Cobbles	12" to 3"	305 to 76.2
Gravel	3" to No. 4	76.2 to 4.76
coarse	3" to 3/4"	76.2 to 19.1
fine	3/4" to No. 4	19.1 to 4.76
Sand	No. 4 to No. 200	4.76 to 0.074
coarse	No. 4 to No. 10	4.76 to 2.00
medium	No. 10 to No. 40	2.00 to 0.420
fine	No. 40 to No. 200	0.420 to 0.074
Silt and Clay	Below No. 200	Below 0.074

SAMPLE DESIGNATIONS/SYMBOLS

- Sample taken with split-barrel sampler other than Standard Penetration Test sampler. Darkened area indicates soil recovered
- Classification sample taken with Standard Penetration Test sampler
- Undisturbed sample taken with thin-walled tube
- Disturbed sample
- Sampling attempted with no recovery
- Core sample
- Analytical laboratory sample
- Sample taken with Direct Push sampler

▽ Unstabilized groundwater level

▼ Stabilized groundwater level

SAMPLER TYPE

C Core barrel

CA California split-barrel sampler with 2.5-inch outside diameter and a 1.93-inch inside diameter

D&M Dames & Moore piston sampler using 2.5-inch outside diameter, thin-walled tube

O Osterberg piston sampler using 3.0-inch outside diameter, thin-walled Shelby tube

PT Pitcher tube sampler using 3.0-inch outside diameter, thin-walled Shelby tube

S&H Sprague & Henwood split-barrel sampler with a 3.0-inch outside diameter and a 2.43-inch inside diameter

SPT Standard Penetration Test (SPT) split-barrel sampler with a 2.0-inch outside diameter and a 1.5-inch inside diameter

ST Shelby Tube (3.0-inch outside diameter, thin-walled tube) advanced with hydraulic pressure

BLOCK 32
MISSION BAY
San Francisco, California

CLASSIFICATION CHART

Treadwell&Rollo

Date 06/01/07 | Project No. 4086.17 | Figure A-6

I FRACTURING

Intensity	Size of Pieces in Feet
Very little fractured	Greater than 4.0
Occasionally fractured	1.0 to 4.0
Moderately fractured	0.5 to 1.0
Closely fractured	0.1 to 0.5
Intensely fractured	0.05 to 0.1
Crushed	Less than 0.05

II HARDNESS

1. **Soft** - reserved for plastic material alone.
2. **Low hardness** - can be gouged deeply or carved easily with a knife blade.
3. **Moderately hard** - can be readily scratched by a knife blade; scratch leaves a heavy trace of dust and is readily visible after the powder has been blown away.
4. **Hard** - can be scratched with difficulty; scratch produced a little powder and is often faintly visible.
5. **Very hard** - cannot be scratched with knife blade; leaves a metallic streak.

III STRENGTH

1. **Plastic** or very low strength.
2. **Friable** - crumbles easily by rubbing with fingers.
3. **Weak** - an unfractured specimen of such material will crumble under light hammer blows.
4. **Moderately strong** - specimen will withstand a few heavy hammer blows before breaking.
5. **Strong** - specimen will withstand a few heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments.
6. **Very strong** - specimen will resist heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments.

IV WEATHERING - The physical and chemical disintegration and decomposition of rocks and minerals by natural processes such as oxidation, reduction, hydration, solution, carbonation, and freezing and thawing.

D. **Deep** - moderate to complete mineral decomposition; extensive disintegration; deep and thorough discoloration; many fractures, all extensively coated or filled with oxides, carbonates and/or clay or silt.

M. **Moderate** - slight change or partial decomposition of minerals; little disintegration; cementation little to unaffected. Moderate to occasionally intense discoloration. Moderately coated fractures.

L. **Little** - no megascopic decomposition of minerals; little of no effect on normal cementation. Slight and intermittent, or localized discoloration. Few stains on fracture surfaces.

F. **Fresh** - unaffected by weathering agents. No disintegration of discoloration. Fractures usually less numerous than joints.

ADDITIONAL COMMENTS:

V CONSOLIDATION OF SEDIMENTARY ROCKS: usually determined from unweathered samples. Largely dependent on cementation.

U = unconsolidated
P = poorly consolidated
M = moderately consolidated
W = well consolidated

VI BEDDING OF SEDIMENTARY ROCKS

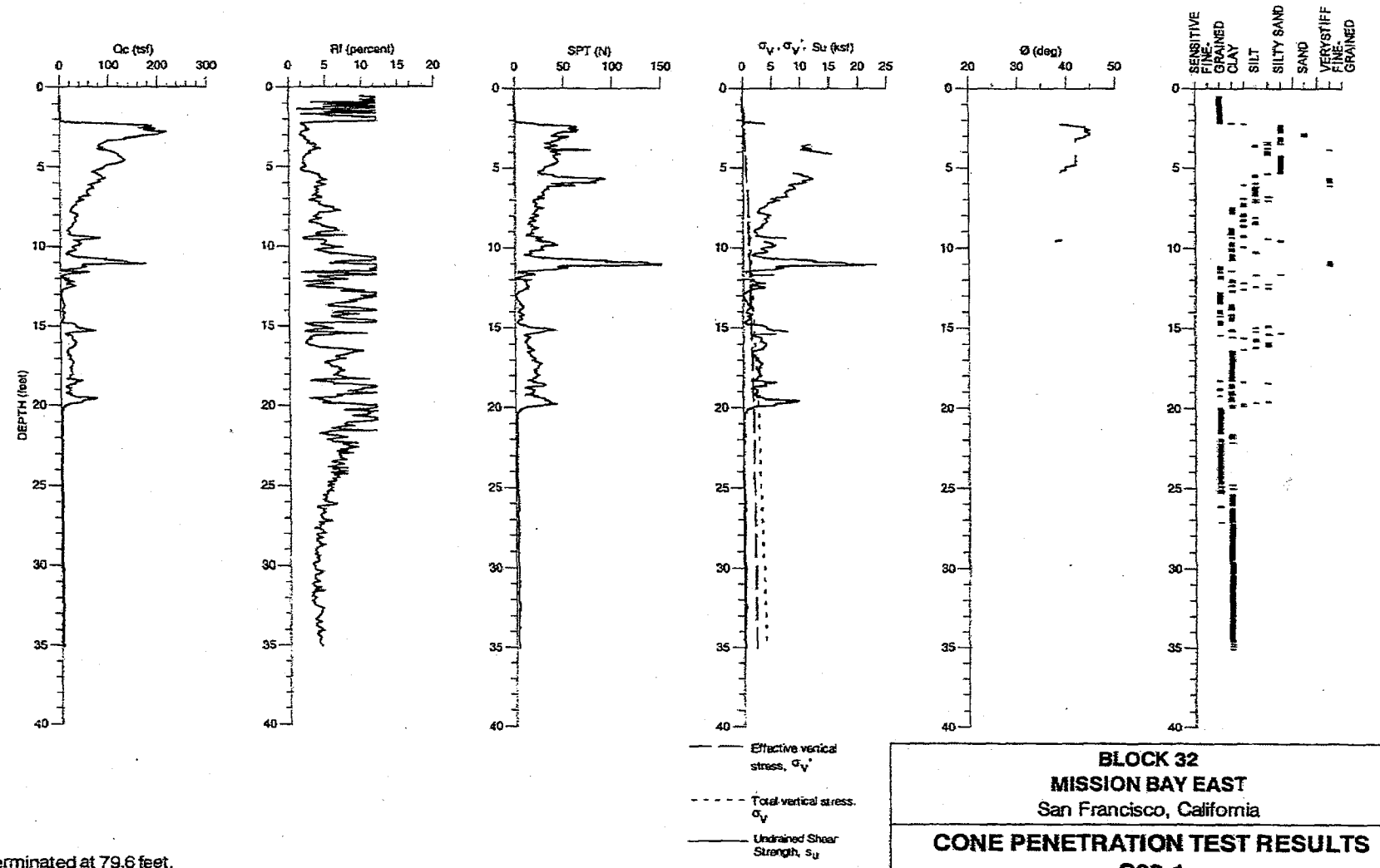
Splitting Property	Thickness	Stratification
Massive	Greater than 4.0 ft.	very thick-bedded
Blocky	2.0 to 4.0 ft.	thick bedded
Slabby	0.2 to 2.0 ft.	thin bedded
Flaggy	0.05 to 0.2 ft.	very thin-bedded
Shaly or platy	0.01 to 0.05 ft.	laminated
Papery	less than 0.01	thinly laminated

BLOCK 32
MISSION BAY EAST
San Francisco, California

PHYSICAL PROPERTIES CRITERIA FOR ROCK DESCRIPTIONS

Treadwell&Rollo

Date 07/18/07 | Project No. 4086.17 | Figure A-7



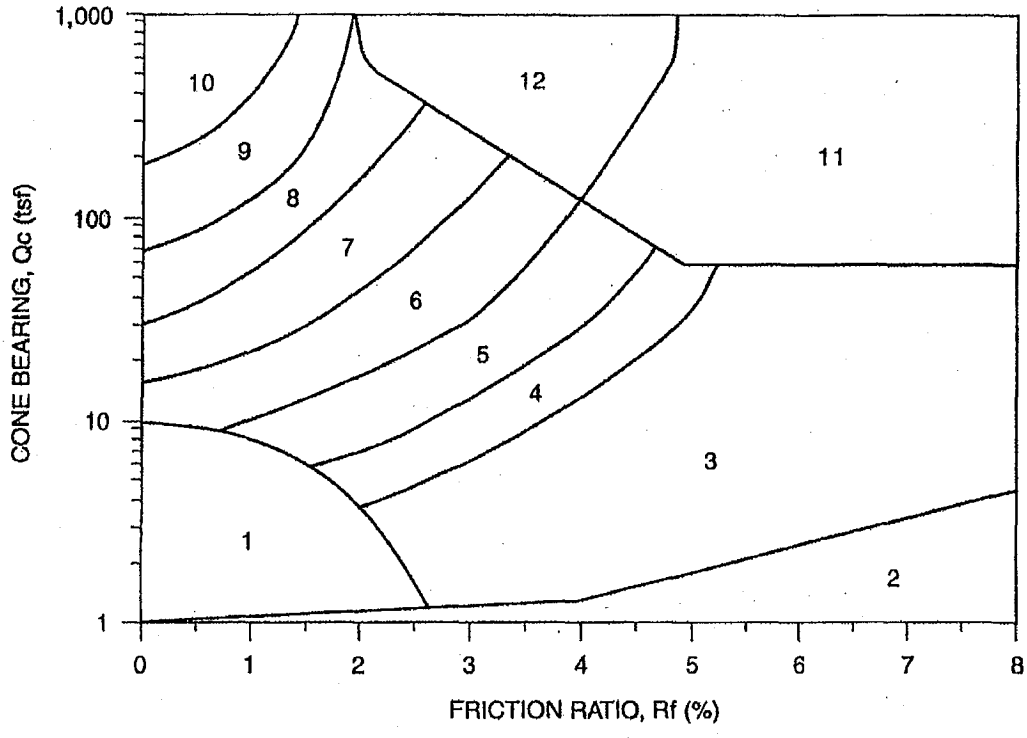
Terminated at 79.6 feet.
Groundwater assumed to be at a depth of 7.0 feet bgs
Date performed: 08/08/06.
Elevation: 100.6 feet, Datum: San Francisco City Datum +100 feet.

BLOCK 32
MISSION BAY EAST
San Francisco, California

CONE PENETRATION TEST RESULTS
C32-1

Date 07/18/07	Project No. 4086.17	Figure A-8

Treadwell&Rollo



ZONE	Qc/N[1]	Su Factor (Nk)[2]	SOIL BEHAVIOR TYPE[1]
1	2	15 (10 for Qc ≤ 9 tsf)	Sensitive Fine-Grained
2	1	15 (10 for Qc ≤ 9 tsf)	Organic Material
3	1	15 (10 for Qc ≤ 9 tsf)	CLAY
4	1.5	15	SILTY CLAY to CLAY
5	2	15	CLAYEY SILT to SILTY CLAY
6	2.5	15	SANDY SILT to CLAYEY SILT
7	3	---	SILTY SAND to SANDY SILT
8	4	---	SAND to SILTY SAND
9	5	---	SAND
10	6	---	GRAVELLY SAND to SAND
11	1	15	Very Stiff Fine-Grained (*)
12	2	---	SAND to CLAYEY SAND (*)

(*) Overconsolidated or Cemented
Qc = Tip Bearing
Fs = Sleeve Friction
Rf = Fs/Qc x 100 = Friction Ratio

Note: Testing performed in accordance with ASTM D3441.

References: 1. Robertson, 1986, Olsen, 1988.
2. Bonaparte & Mitchell, 1979 (young Bay Mud Qc ≤9).
Estimated from local experience (fine-grained soils Qc > 9).

BLOCK 32
MISSION BAY EAST
San Francisco, California

CLASSIFICATION CHART FOR CONE PENETRATION TESTS

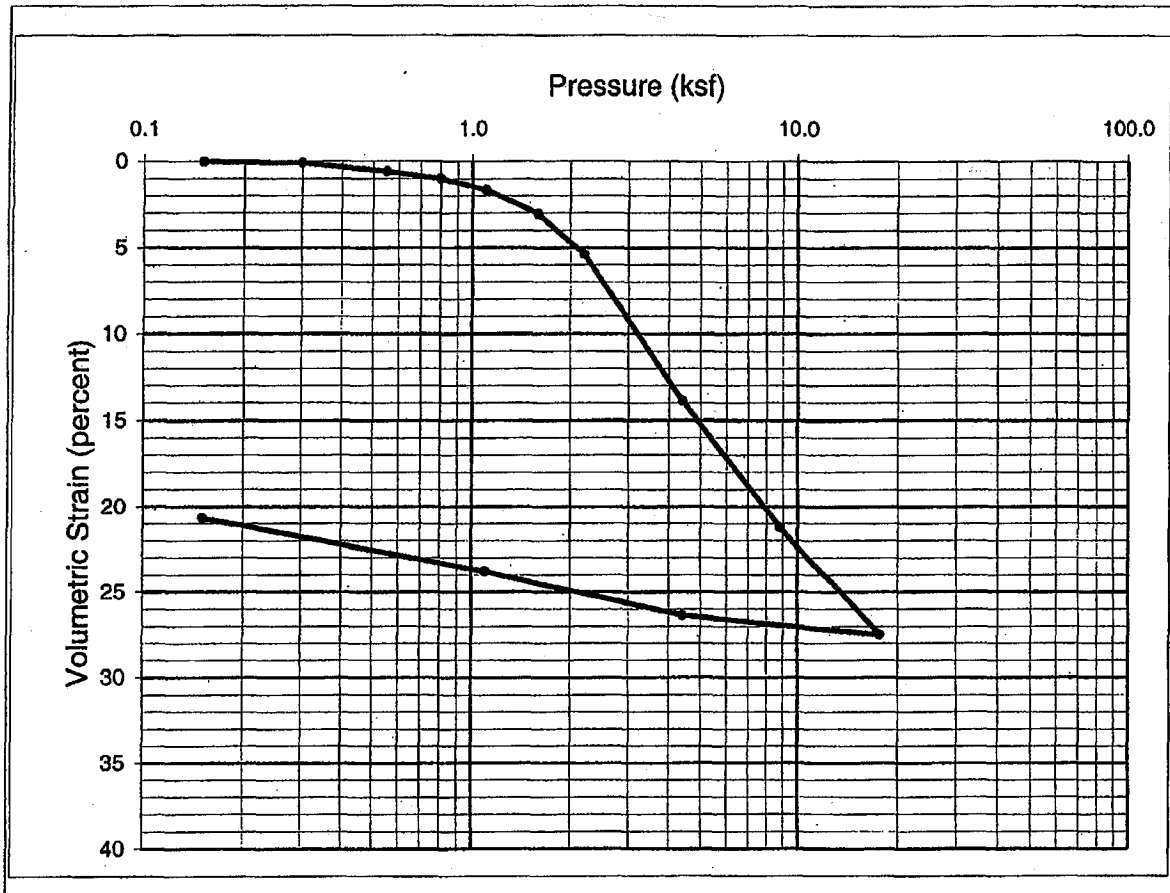
Treadwell&Rollo

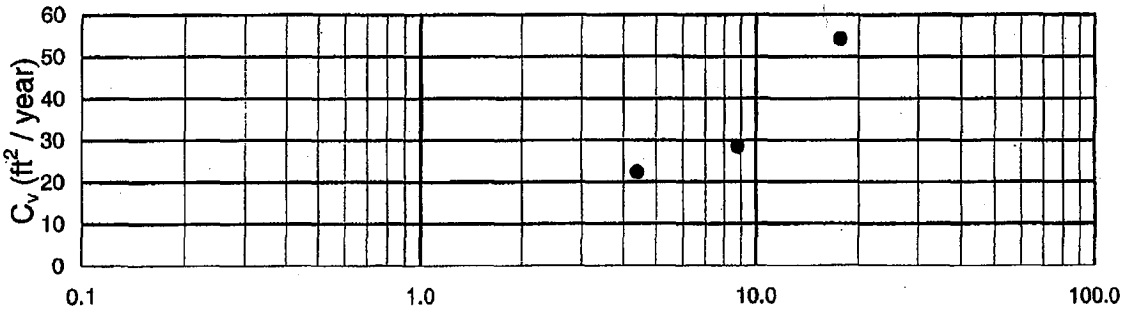
Date 07/18/07 | Project No. 4086.17 | Figure A-9

SARIMIENTO

APPENDIX B

Laboratory Test Results from Previous Investigations by Treadwell & Rollo





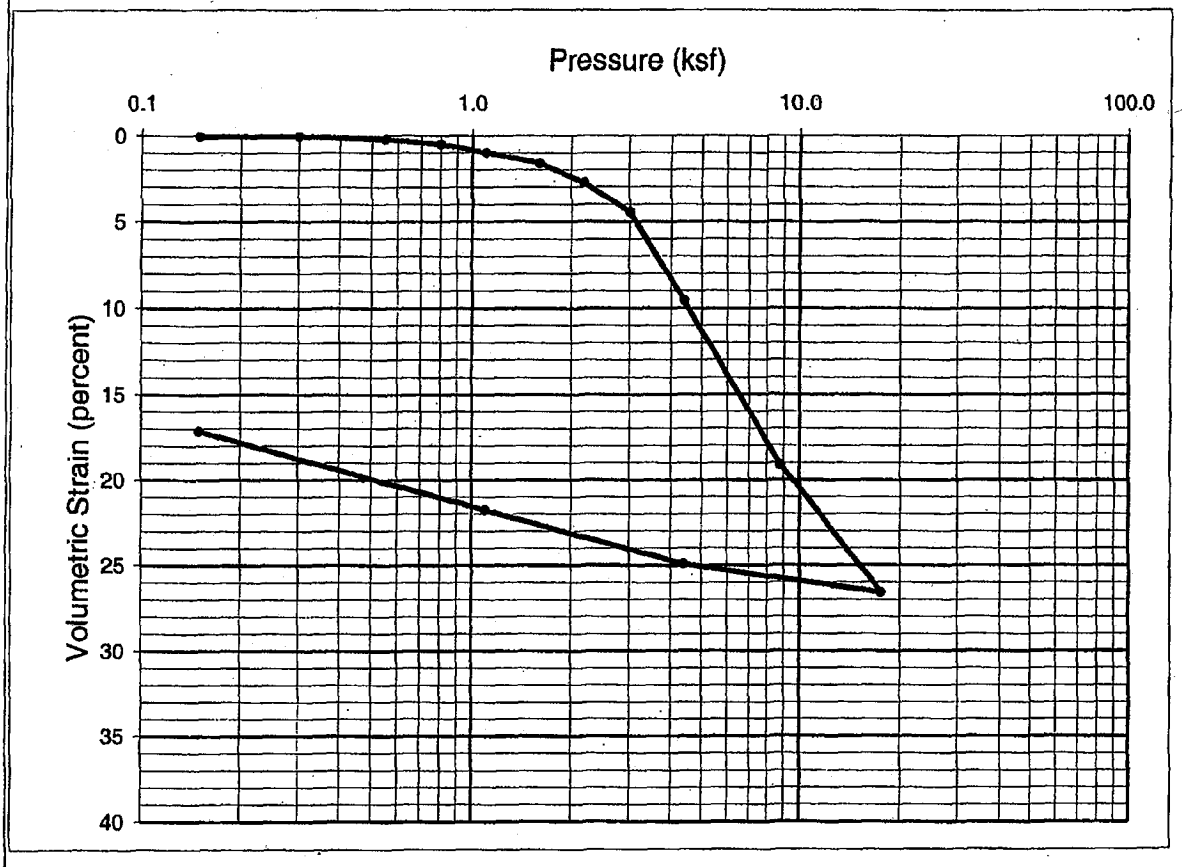
Sampler Type: Shelby Tube				Condition	Before Test		After Test	
Diameter (in)	2.41	Height (in)	1.00	Water Content	w_o	58.6 %	w_f	42.3 %
Overburden Pressure, p_o	1,700	psf		Void Ratio	e_o	1.66	e_f	1.14
Preconsol. Pressure, p_c	1,900	psf		Saturation	S_o	95 %	S_f	100 %
Compression Ratio, C_{ec}	0.26			Dry Density	γ_d	63 pcf	γ_d	79 pcf
Compression Ratio, C_{er}	0.04					G_s 2.70	(assumed)	
Classification CLAY (CH), gray				Source	B30-1 @ 28'			

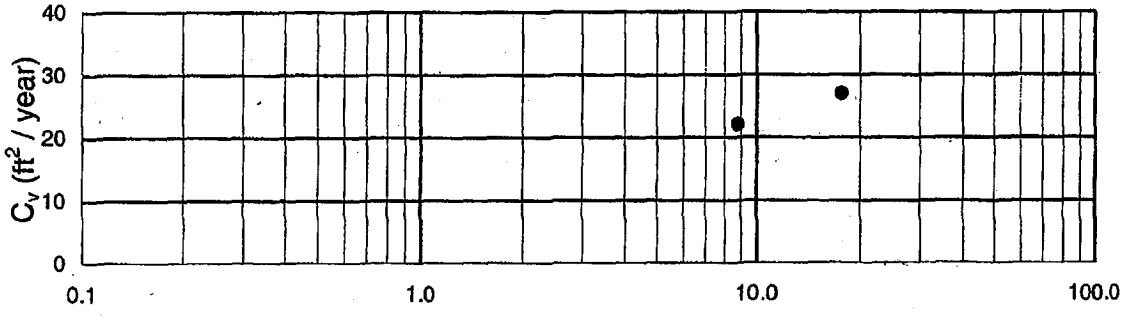
BLOCK 30 - MISSION BAY
San Francisco, California

CONSOLIDATION TEST REPORT

Treadwell&Rollo

Date 09/26/07 | Project No. 4086.16 | Figure B-1





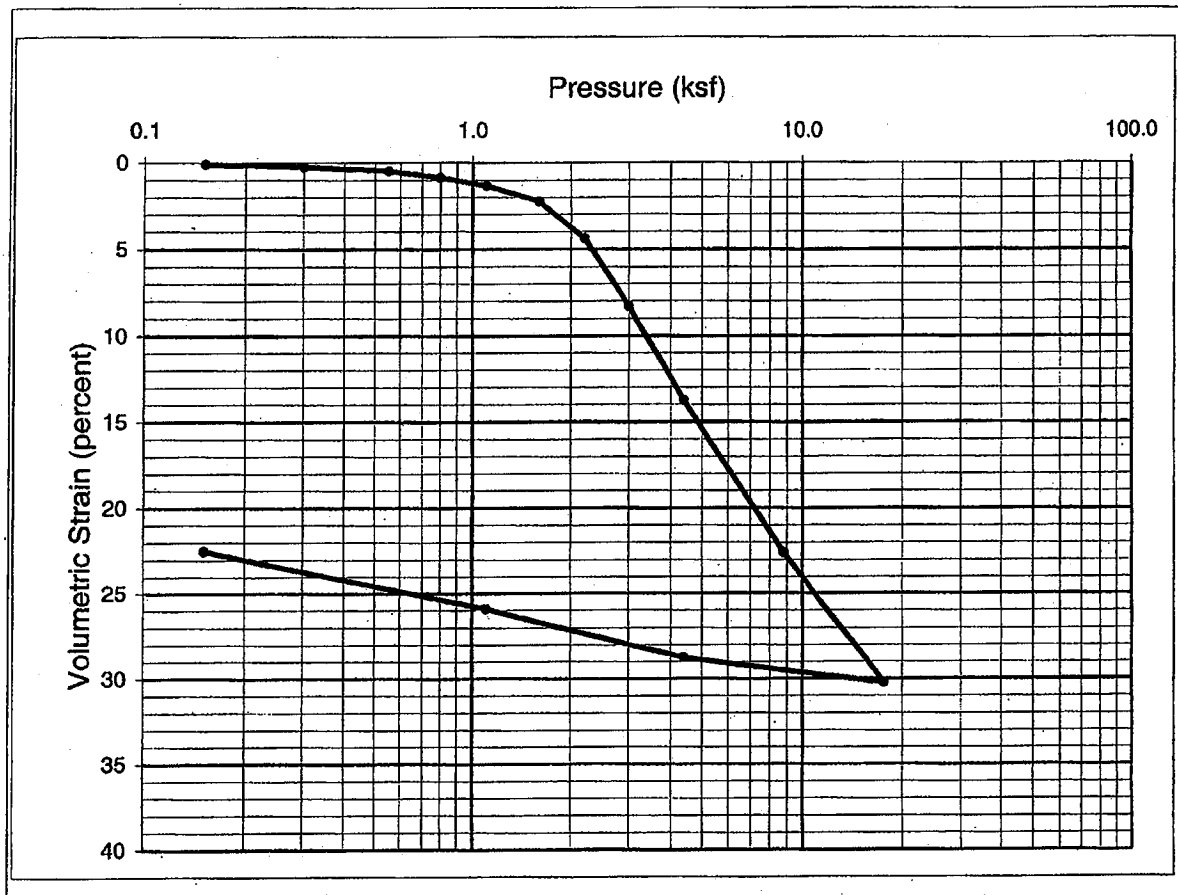
Sampler Type: Shelby Tube				Condition		Before Test		After Test	
Diameter (in)	2.41	Height (in)	1.01	Water Content	w_o	63.4 %		w_f	47.7 %
Overburden Pressure, p_o	1,800 psf			Void Ratio	e_o	1.73		e_f	1.29
Preconsol. Pressure, p_c	2,100 psf			Saturation	S_o	99 %		S_f	100 %
Compression Ratio, C_{cc}	0.31			Dry Density	γ_d	62 pcf		γ_d	74 pcf
Compression Ratio, C_{cr}	0.05						G_s	2.70	(assumed)
Classification CLAY (CH), gray				Source		B30-3 @ 24'			

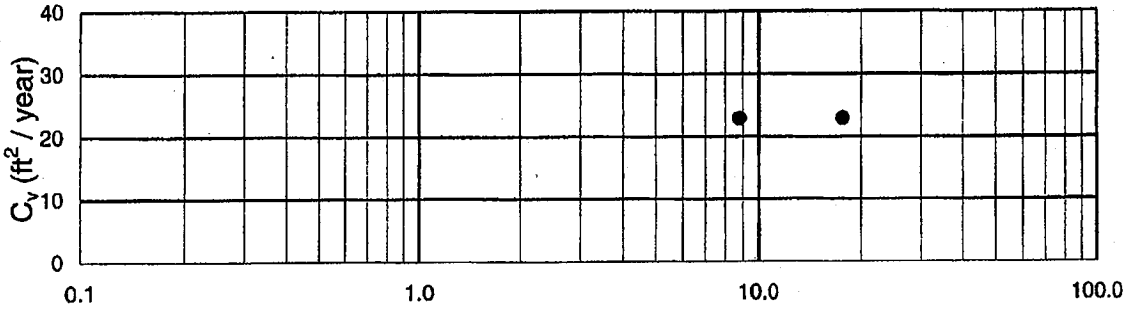
BLOCK 30 - MISSION BAY
San Francisco, California

CONSOLIDATION TEST REPORT

Treadwell&Rollo

Date 09/26/07 | Project No. 4086.16 | Figure B-2





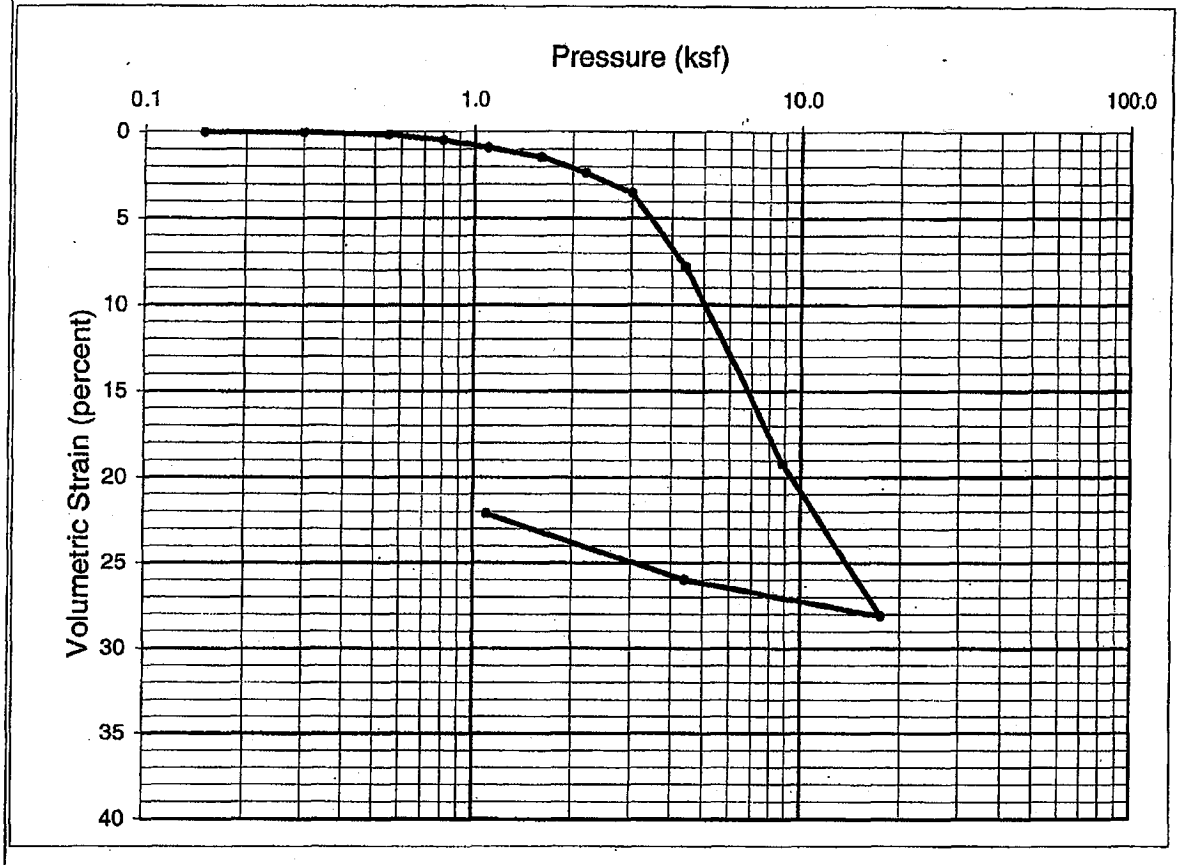
Sampler Type: Shelby Tube				Condition		Before Test		After Test	
Diameter (in)	2.41	Height (in)	1.01	Water Content	w_o	72.0 %	w_f	48.3 %	
Overburden Pressure, p_o	2,550	psf		Void Ratio	e_o	1.96	e_f	1.30	
Preconsol. Pressure, p_c	2,600	psf		Saturation	S_o	99 %	S_f	100 %	
Compression Ratio, C_{ec}	0.29			Dry Density	γ_d	57 pcf	γ_d	73 pcf	
Compression Ratio, C_{er}	0.05						G_s	2.70	(assumed)
Classification CLAY (CH), gray				Source		B30-3 @ 44'			

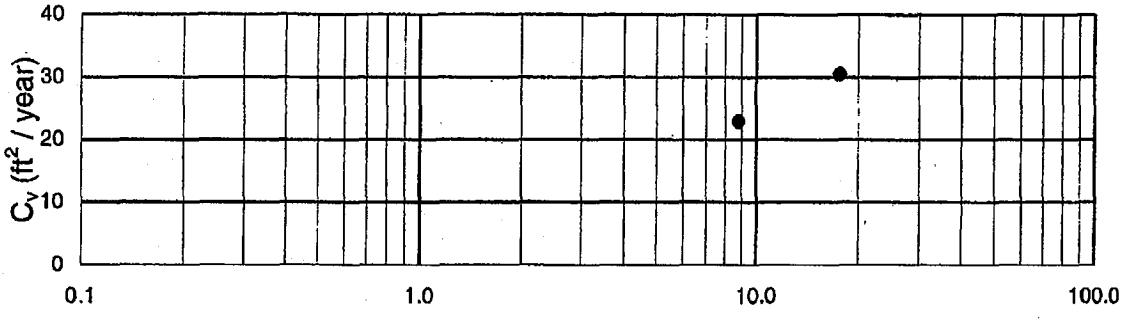
BLOCK 30 - MISSION BAY
San Francisco, California

CONSOLIDATION TEST REPORT

Treadwell&Rollo

Date 09/26/07 | Project No. 4086.16 | Figure B-3





Sampler Type: Shelby Tube			Condition		Before Test		After Test	
Diameter (in) 2.41	Height (in)	1.01	Water Content	w_o	74.4 %	w_f	56.3 %	
Overburden Pressure, p_o	2,450	psf	Void Ratio	e_o	2.02	e_f	1.52	
Preconsol. Pressure, p_c	3,300	psf	Saturation	S_o	100 %	S_f	100 %	
Compression Ratio, C_{ec}	0.35		Dry Density	γ_d	56 pcf	γ_d	67 pcf	
Compression Ratio, C_{er}	0.06					G_s	2.70	(assumed)
Classification CLAY (CH); gray			Source		B30-4 @ 39'			

BLOCK 30 - MISSION BAY
San Francisco, California

CONSOLIDATION TEST REPORT

Treadwell&Rollo

Date 09/26/07 | Project No. 4086.16 | Figure B-4

SIEVE ANALYSIS

Sample Information

Sample Identification: B30-3 at 16.5 feet
Soil Description: Clayey Gravel with Sand (GC), dark gray/green/brown
Date of Test: 5/27/2007
Test Performed by: EG

Fines Content Analysis (Wash Sieve)

Weight of Sieve (gm)	108.0
Dry Wt. Soil + Sieve (gm) (before washing)	475.1
Dry Wt. Soil + Sieve (gm) (after washing)	425.2
Dry Wt. Soil (gm)	317.2
% Passing No. 200 Sieve	13.6

Sieve Analysis Test Results

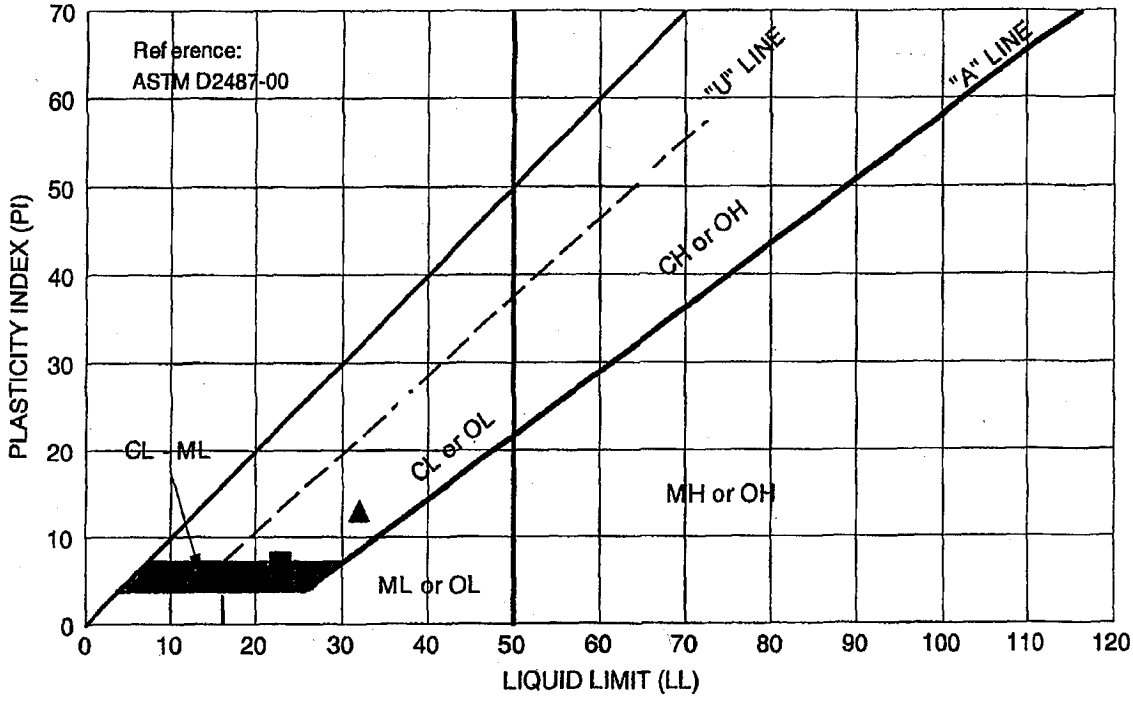
Sieve Opening (mm)	Sieve No.	Weight of Sieve (gm)	Weight of Soil + Sieve (gm)	Weight of Soil Retained (gm)	Percent Retained	Cumulative Percent Retained	Percent Passing
38.1	1-1/2	0.0	0.0	0.0	0.0%	0.0%	100.0%
19.05	3/4	926.1	999.9	73.8	20.1%	20.1%	79.9%
9.525	3/8	899.8	966.3	66.5	18.1%	38.3%	61.7%
4.76	4	873.3	926.0	52.7	14.4%	52.6%	47.4%
2.36	8	1043.2	1076.0	32.8	8.9%	61.6%	38.4%
1.18	16	961.2	987.0	25.8	7.0%	68.6%	31.4%
0.6	30	945.2	965.9	20.7	5.6%	74.2%	25.8%
0.3	50	927.7	945.9	18.2	5.0%	79.2%	20.8%
0.149	100	713.5	729.0	15.5	4.2%	83.4%	16.6%
0.074	200	719.2	729.8	10.6	2.9%	86.3%	13.7%
Fines	Pan	376.8	377.1	0.3	13.7%	100.0%	0.0%

Total Weight of Sample on Sieves (gm) 316.9

Total Weight of Sample (including washed soil) 366.8

Client: TREADWELL & ROLLO
Project Name: Block 30
Project Number: 4086.16

GEO ENGINEERING SERVICES
11 Driftwood Court, Pacifica California 94044
tel 650.359.4260 fax 650.359.2911



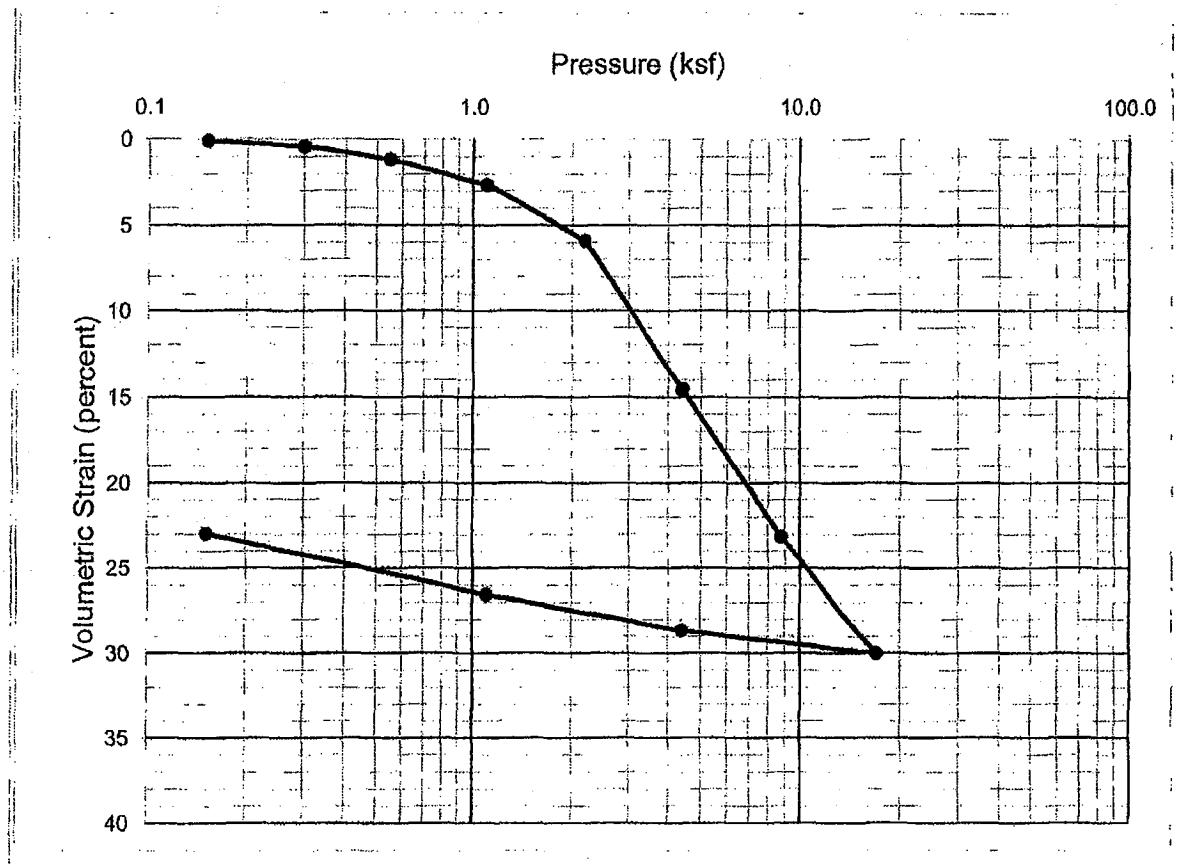
Symbol	Source	Description and Classification	Natural M.C. (%)	Liquid Limit (%)	Plasticity Index (%)	% Passing #200 Sieve
●	B30-1 at 3 feet	SANDY SILT CLAY with GRAVEL (CL-ML), olive-gray	--	26	5	--
▲	B30-2 at 10 feet	CLAYEY SAND with GRAVEL (SC), green-gray	--	32	13	--
■	B-30-5 at 11.5 feet	SANDY SILTY CLAY (CL-ML), gray	--	23	7	--

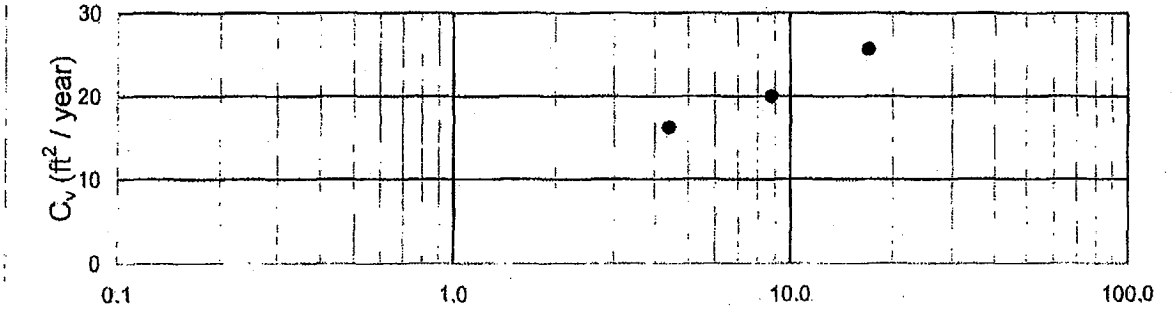
BLOCK 30
MISSION BAY
San Francisco, California

PLASTICITY CHART

Treadwell&Rollo

Date 09/25/07 | Project No. 4086.16 | Figure B-6





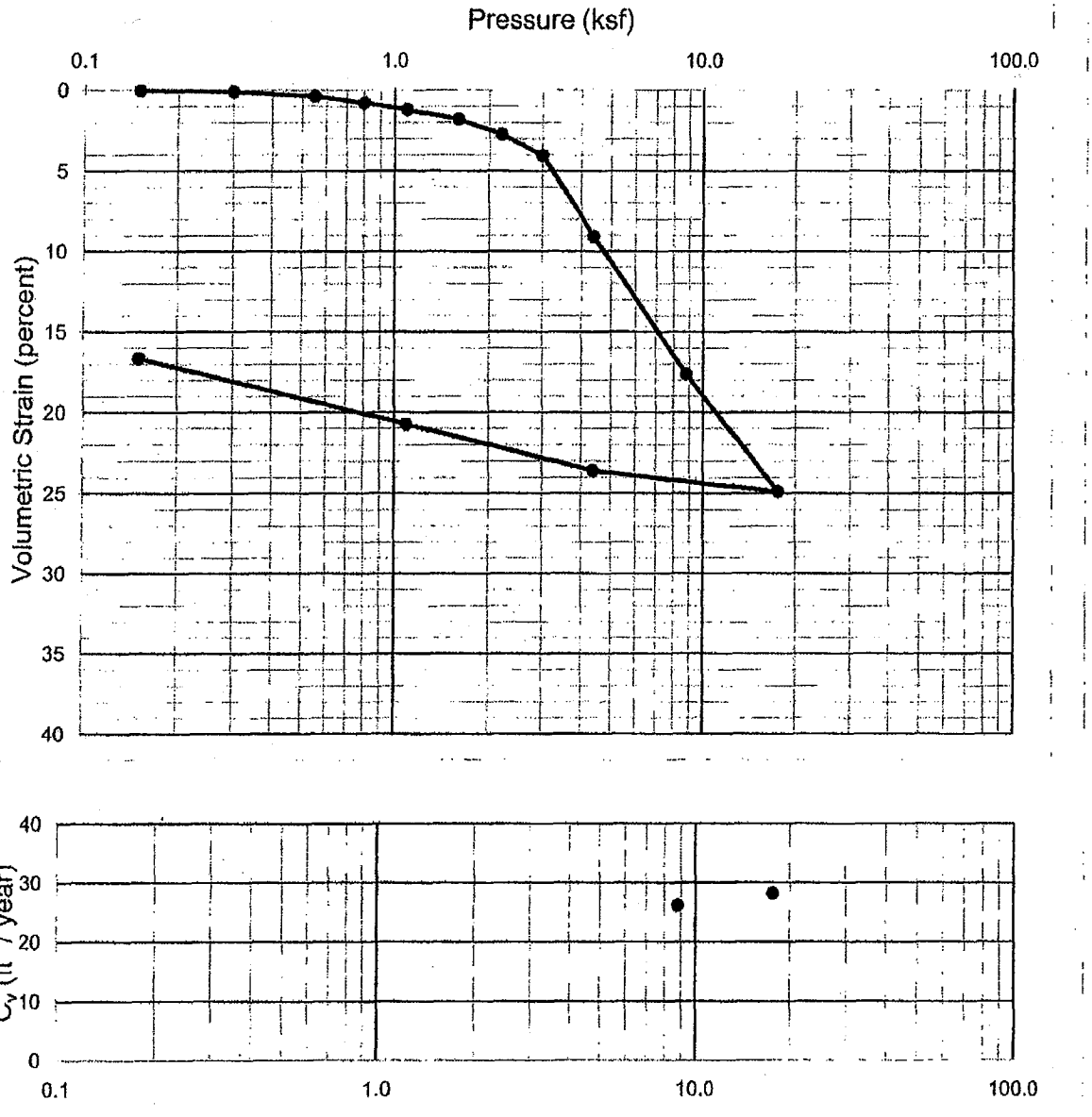
Sampler Type: Shelby Tube				Condition	Before Test			After Test	
Diameter (in)	2.41	Height (in)	1.00	Water Content	w_o	66.8 %	w_f	43.9	%
Overburden Pressure, p_o	1,650	psf		Void Ratio	e_o	1.83	e_f	1.18	
Preconsol. Pressure, p_c	2,000	psf		Saturation	S_o	98 %	S_f	100	%
Compression Ratio, C_{cc}	0.31			Dry Density	γ_d	60 pcf	γ_d	77	pcf
Recompression Ratio, C_{cr}	0.04						G_s	2.70	(assumed)
Classification CLAY (CH)				Source	B32-1 @ 16.5'				

Block 32 - Mission Bay East
San Francisco, California

Treadwell&Rollo

CONSOLIDATION TEST REPORT

Date 07/19/07 | Project No. 4086.17 | Figure B-1



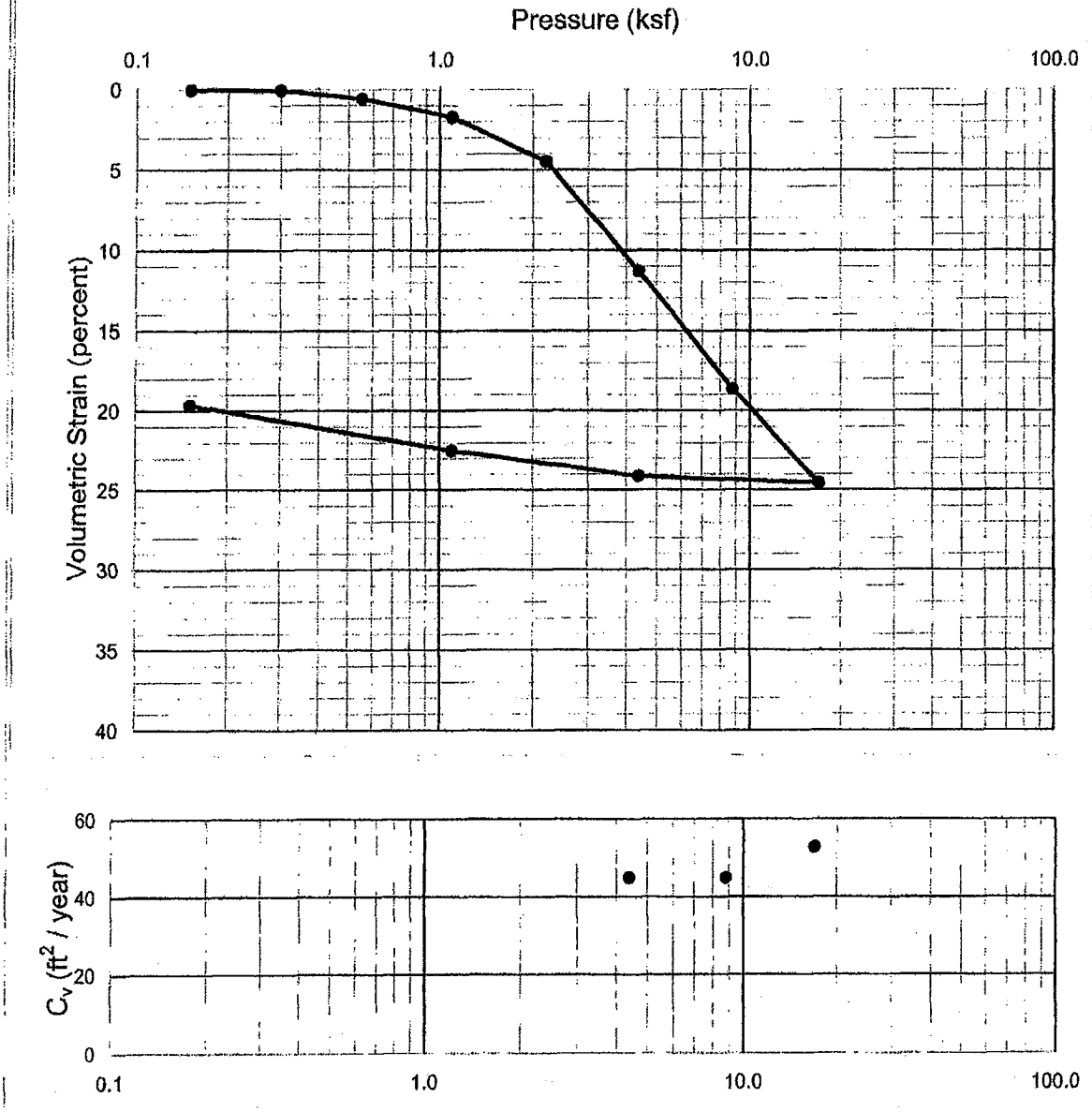
Sampler Type: Shelby Tube				Condition	Before Test			After Test		
Diameter (in)	2.42	Height (in)	1.01	Water Content	w_o	57.6	%	w_f	43.3	%
Overburden Pressure, p_o	1,900	psf		Void Ratio	e_o	1.56		e_f	1.17	
Preconsol. Pressure, p_c	2,900	psf		Saturation	S_o	100	%	S_f	100	%
Compression Ratio, C_{cc}	0.29			Dry Density	γ_d	66	pcf	γ_d	78	pcf
Recompression Ratio, C_{cr}	0.05							G_s	2.70	(assumed)
Classification	CLAY (CH), gray				Source	B32-1 @ 24'				

Block 32 - Mission Bay East
San Francisco, California

Treadwell&Rollo

CONSOLIDATION TEST REPORT

Date 07/26/07 | Project No. 4086.17 | Figure B-2



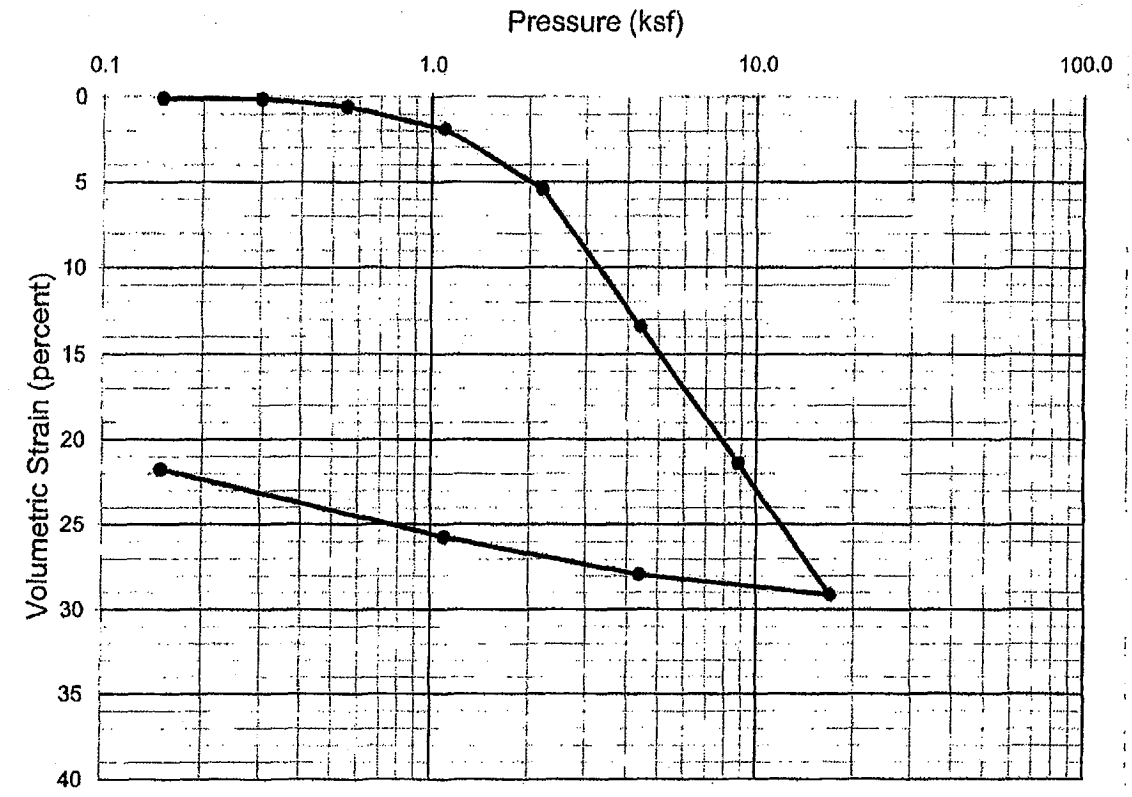
Sampler Type: Shelby Tube				Condition		Before Test			After Test	
Diameter (in)	2.41	Height (in)	1.00	Water Content	w_o	50.9	%	w_f	35.9	%
Overburden Pressure, p_o	1,600	psf		Void Ratio	e_o	1.39		e_f	0.97	
Preconsol. Pressure, p_c	2,000	psf		Saturation	S_o	99	%	S_f	100	%
Compression Ratio, C_{cc}	0.25			Dry Density	γ_d	71	pcf	γ_d	86	pcf
Recompression Ratio, C_{cr}	0.03							G_s	2.70	(assumed)
Classification	CLAY (CH), gray			Source		B32-3 @ 24'				

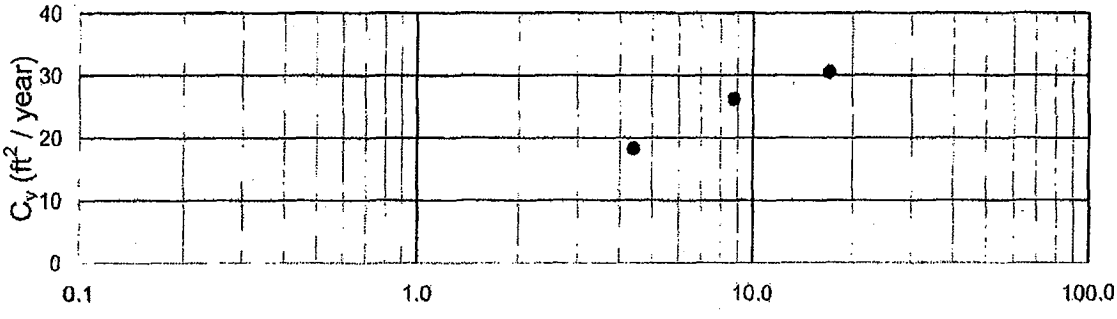
Block 32 - Mission Bay East
San Francisco, California

CONSOLIDATION TEST REPORT

Treadwell&Rollo

Date 07/26/07 | Project No. 4086.17 | Figure B-3





Sampler Type: Shelby Tube				Condition		Before Test			After Test	
Diameter (in)	2.41	Height (in)	1.01	Water Content	w_o	50.9 %		w_f	49.4 %	
Overburden Pressure, p_o	1,350	psf		Void Ratio	e_o	1.93		e_f	1.33	
Preconsol. Pressure, p_c	1,700	psf		Saturation	S_o	100 %		S_f	100 %	
Compression Ratio, C_{cc}	0.28			Dry Density	γ_d	58 pcf		γ_d	72 pcf	
Recompression Ratio, C_{rc}	0.05							G_s	2.70	(assumed)
Classification	CLAY (CH), gray			Source		B32-4 @ 16.5'				

Block 32 - Mission Bay East
San Francisco, California

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CONSOLIDATION TEST REPORT

Date	07/26/07	Project No.	4086.17	Figure	B-4

APPENDIX C

Log of Boring and CPTs from Current Investigation

PROJECT: **BLOCKS 29-32 PUBLIC IMPROVEMENTS MISSION BAY**
San Francisco, California

Log of Boring B31-1

Boring location: See Site Plan, Figure 2
Logged by: S. Maghsoudi
Date started: 1/24/08 Date finished: 1/24/08
Drilling method: Rotary Wash
Hammer weight/drop: 140 lbs./30-inches Hammer type: Automatic Safety Hammer
Sampler: Sprague & Henwood (S&H), Standard Penetration Test (SPT), Shelby Tube (ST)

DEPTH (feet)	SAMPLES: Sampler Type	Sample	Blows/ 6"	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
						Ground Surface Elevation: 102 feet[2]						
1						SILTY SAND with GRAVEL (SM) dark brown, medium dense, moist						
2	S&H		17 18 24	29								
3												
4					SM							
5	S&H		1 4 6	7		loose				23.0	20.0	
6												
7												
8												
9												
10	SPT		1 2 2	3	SC-SM	SILTY, CLAYEY SAND with GRAVEL (SC-SM) olive, very loose, moist 01/24/08 at 9:20 am						
11												
12												
13												
14												
15						SILT (MH) gray, very soft, wet						
16	SPT		0	0								
17												
18												
19												
20												
21	ST			50 psi	MH	soft, with shell fragments Consolidation Test, see Figure D-1					61.5	64
22												
23												
24												
25												
26												
27												
28												
29	ST			50 psi		LL = 79, PI = 26 Consolidation Test, see Figure D-2					89.3	48
30												

FILL

BAY MUD

LABORATORY TEST DATA

Treadwell&Rollo

Project No.: 3347.01 Figure: C-1a

TEST GEOTECH LOG 334701.GPJ TR.GDT 4/2/08

PROJECT: **BLOCKS 29-32 PUBLIC IMPROVEMENTS MISSION BAY**
San Francisco, California

Log of Boring B31-1

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/ 6"	SAMPLES: SPT N-Value¹	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
31	ST			50 psi	MH	SILT (MH) (continued)					89.3	48
32												
33												
34												
35												
36												
37												
38												
39	ST			50 psi		Consolidation Test, see Figure D-3					76.8	55
40												
41												
42												
43												
44												
45						SANDY CLAY (CL) yellow-brown, very stiff, wet						
46												
47												
48			9									
49	SPT		9	24								
50			11		CL							
51												
52												
53			6									
54	SPT		6	18						77.9	24.9	
55			9									
56												
57						CLAYEY SAND (SC) yellow-brown, dense, wet						
58			9		SC							
59	SPT		13	36						26.8	16.8	95
60			17									

BAY MUD

Treadwell&Rollo

Project No.: 3347.01 | Figure: C-1b

TEST GEOTECH LOG 334701.GPJ TR.GDT 4/2/08

PROJECT: **BLOCKS 29-32 PUBLIC IMPROVEMENTS**
MISSION BAY
San Francisco, California

Log of Boring B31-1

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/ 6"	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
61						CLAYEY SAND (SC) (continued)						
62												
63			11									
64	SPT		13	42						14.6	25.5	
65			20									
66												
67												
68			17			very dense						
69	SPT		25	68								
70			32		SC							
71												
72												
73												
74												
75												
76												
77												
78												
79												
80						at 79 to 80 feet, driller report change in soil condition to clay						
81												
82												
83												
84												
85												
86												
87												
88												
89												
90												

Boring terminated at a depth of 80 feet below ground surface.
Boring backfilled with cement grout.
Groundwater encountered at a depth of 10.4 feet during drilling

[1] S&H and SPT blow counts for the last two increments were converted to SPT N-Values using factors of 0.7 and 1.2, respectively to account for sampler type and hammer energy.
[2] Elevations based on San Francisco City datum plus 100 feet.

Treadwell&Rollo

Project No.: 3347.01
Figure: C-1c

TEST GEOTECH LOG 334701.GPJ. TR.GDT 4/2/08

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions		Symbols	Typical Names
Coarse-Grained Soils (more than half of soil > no. 200 sieve size)	Gravels (More than half of coarse fraction > no. 4 sieve size)	GW	Well-graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (More than half of coarse fraction < no. 4 sieve size)	SW	Well-graded sands or gravelly sands, little or no fines
		SP	Poorly-graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
Fine -Grained Soils (more than half of soil < no. 200 sieve size)	Silts and Clays LL = < 50	ML	Inorganic silts and clayey silts of low plasticity, sandy silts, gravelly silts
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
		OL	Organic silts and organic silt-clays of low plasticity
	Silts and Clays LL = > 50	MH	Inorganic silts of high plasticity
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic silts and clays of high plasticity
Highly Organic Soils		PT	Peat and other highly organic soils

GRAIN SIZE CHART

Classification	Range of Grain Sizes	
	U.S. Standard Sieve Size	Grain Size in Millimeters
Boulders	Above 12"	Above 305
Cobbles	12" to 3"	305 to 76.2
Gravel	3" to No. 4	76.2 to 4.76
coarse	3" to 3/4"	76.2 to 19.1
fine	3/4" to No. 4	19.1 to 4.76
Sand	No. 4 to No. 200	4.76 to 0.075
coarse	No. 4 to No. 10	4.76 to 2.00
medium	No. 10 to No. 40	2.00 to 0.420
fine	No. 40 to No. 200	0.420 to 0.075
Silt and Clay	Below No. 200	Below 0.075

Unstabilized groundwater level

Stabilized groundwater level

SAMPLE DESIGNATIONS/SYMBOLS

Sample taken with Sprague & Henwood split-barrel sampler with a 3.0-inch outside diameter and a 2.43-inch inside diameter. Darkened area indicates soil recovered

Classification sample taken with Standard Penetration Test sampler

Undisturbed sample taken with thin-walled tube

Disturbed sample

Sampling attempted with no recovery

Core sample

Analytical laboratory sample

Sample taken with Direct Push sampler

Sonic

SAMPLER TYPE

C Core barrel

CA California split-barrel sampler with 2.5-inch outside diameter and a 1.93-inch inside diameter

D&M Dames & Moore piston sampler using 2.5-inch outside diameter, thin-walled tube

O Osterberg piston sampler using 3.0-inch outside diameter, thin-walled Shelby tube

PT Pitcher tube sampler using 3.0-inch outside diameter, thin-walled Shelby tube

S&H Sprague & Henwood split-barrel sampler with a 3.0-inch outside diameter and a 2.43-inch inside diameter

SPT Standard Penetration Test (SPT) split-barrel sampler with a 2.0-inch outside diameter and a 1.5-inch inside diameter

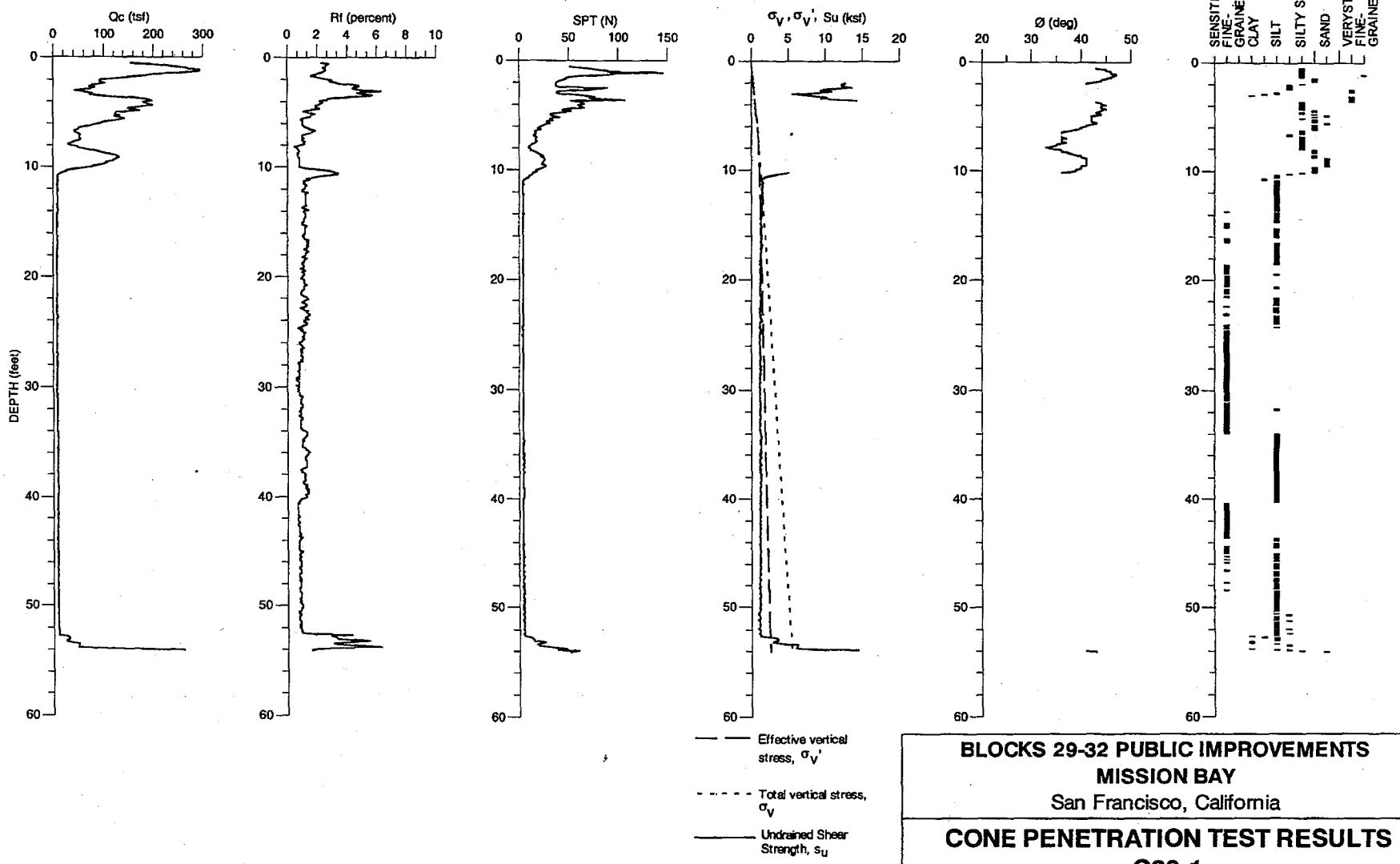
ST Shelby Tube (3.0-inch outside diameter, thin-walled tube) advanced with hydraulic pressure

BLOCKS 29-32 PUBLIC IMPROVEMENTS
MISSION BAY
San Francisco, California

CLASSIFICATION CHART

Treadwell&Rollo

Date 04/02/08 | Project No. 3347.01 | Figure C-2



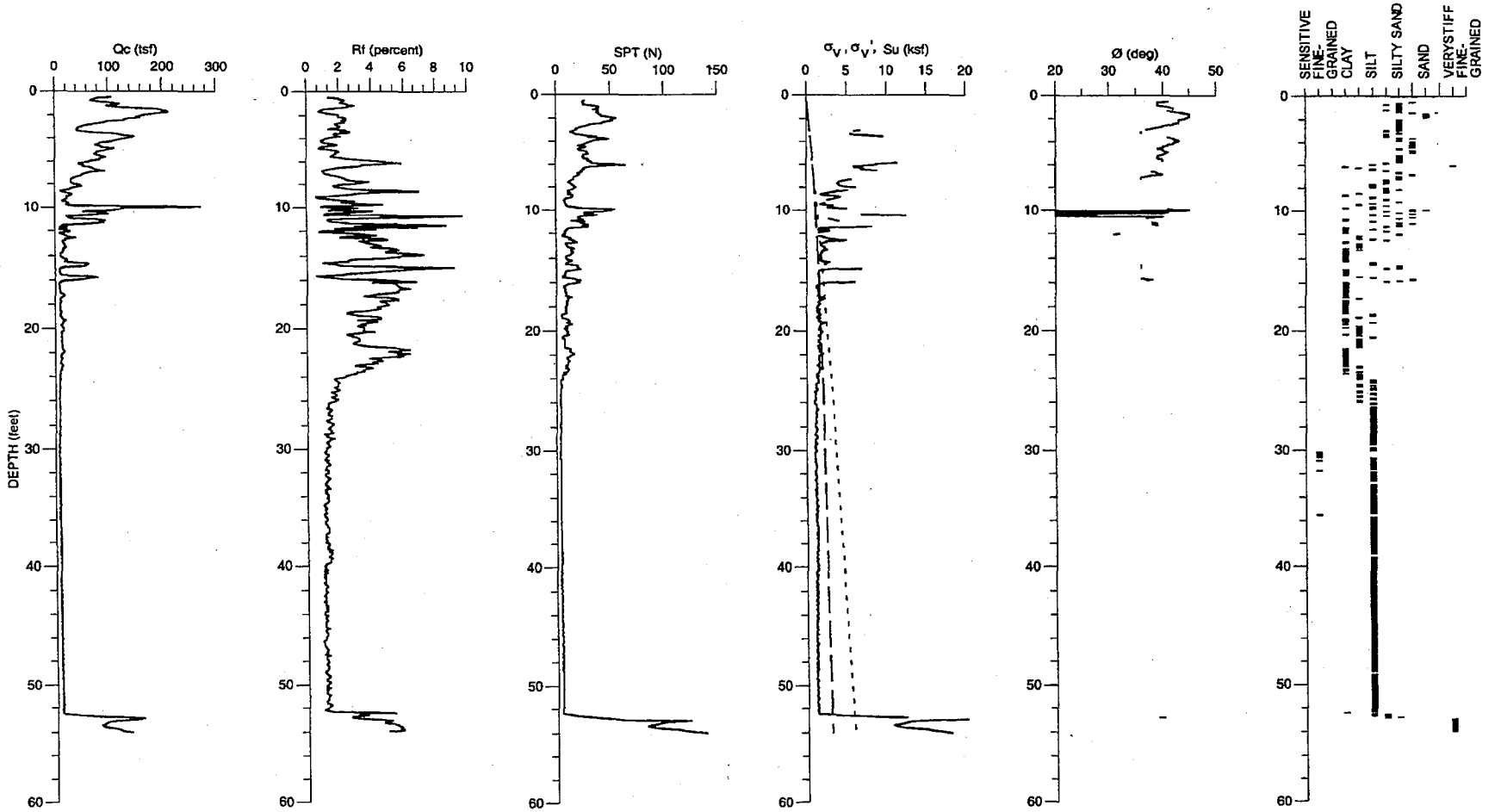
Terminated at 54.0 feet.
Date performed: 1/24/08.
Ground surface elevation: 101.9 feet, San Francisco City Datum plus 100 feet.

BLOCKS 29-32 PUBLIC IMPROVEMENTS
MISSION BAY
San Francisco, California

CONE PENETRATION TEST RESULTS
C29-1

Date 04/02/08	Project No. 3347.01	Figure C-3

Treadwell&Rollo



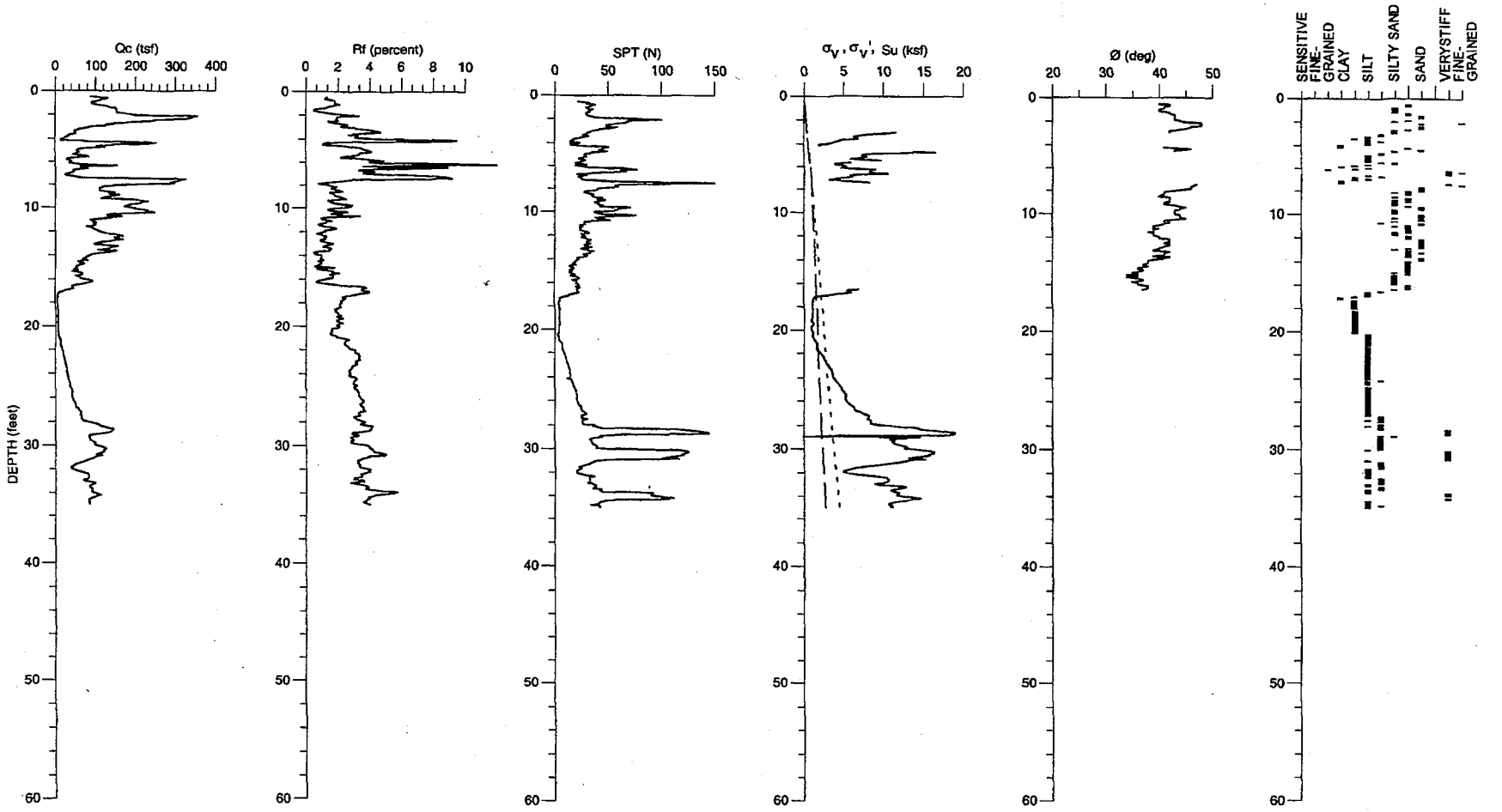
Terminated at 54.0 feet.
Date performed: 1/24/08.
Ground surface elevation: 101.9 feet, San Francisco City Datum plus 100 feet.

BLOCKS 29-32 PUBLIC IMPROVEMENTS
MISSION BAY
San Francisco, California

CONE PENETRATION TEST RESULTS
C29-2

Date 04/02/08	Project No. 3347.01	Figure C-4

Treadwell&Rollo



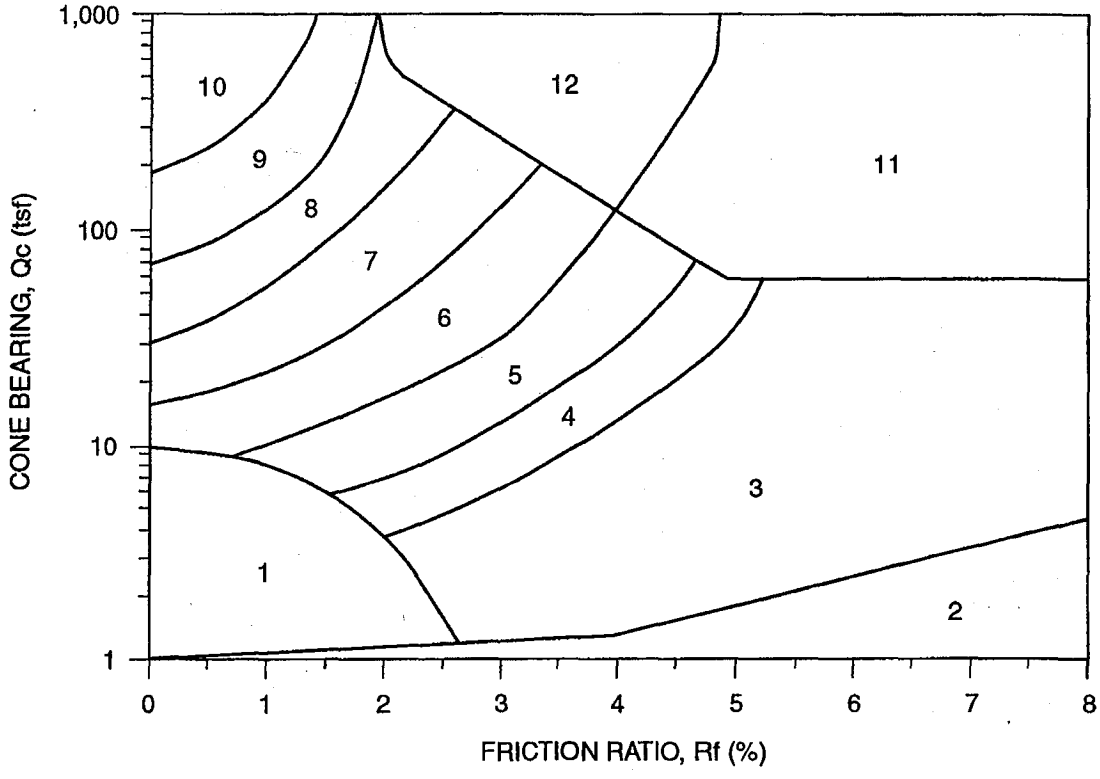
Terminated at 35.0 feet.
Date performed: 1/24/08.
Ground surface elevation: 102.2 feet, San Francisco City Datum plus 100 feet.

BLOCKS 29-32 PUBLIC IMPROVEMENTS
MISSION BAY
San Francisco, California

CONE PENETRATION TEST RESULTS
C31-1

Date 04/02/08	Project No. 3347.01	Figure C-5

Treadwell&Rollo



ZONE	Qc/N[1]	Su Factor (Nk)[2]	SOIL BEHAVIOR TYPE[1]
1	2	15 (10 for Qc ≤ 9 tsf)	Sensitive Fine-Grained
2	1	15 (10 for Qc ≤ 9 tsf)	Organic Material
3	1	15 (10 for Qc ≤ 9 tsf)	CLAY
4	1.5	15	SILTY CLAY to CLAY
5	2	15	CLAYEY SILT to SILTY CLAY
6	2.5	15	SANDY SILT to CLAYEY SILT
7	3	---	SILTY SAND to SANDY SILT
8	4	---	SAND to SILTY SAND
9	5	---	SAND
10	6	---	GRAVELLY SAND to SAND
11	1	15	Very Stiff Fine-Grained (*)
12	2	---	SAND to CLAYEY SAND (*)

(*) Overconsolidated or Cemented
Qc = Tip Bearing
Fs = Sleeve Friction
Rf = Fs/Qc x 100 = Friction Ratio

Note: Testing performed in accordance with ASTM D3441.

References: 1. Robertson, 1986, Olsen, 1988.
2. Bonaparte & Mitchell, 1979 (young Bay Mud Qc ≤9).
Estimated from local experience (fine-grained soils Qc > 9).

BLOCKS 29-32 PUBLIC IMPROVEMENTS
MISSION BAY
San Francisco, California

CLASSIFICATION CHART FOR CONE PENETRATION TESTS

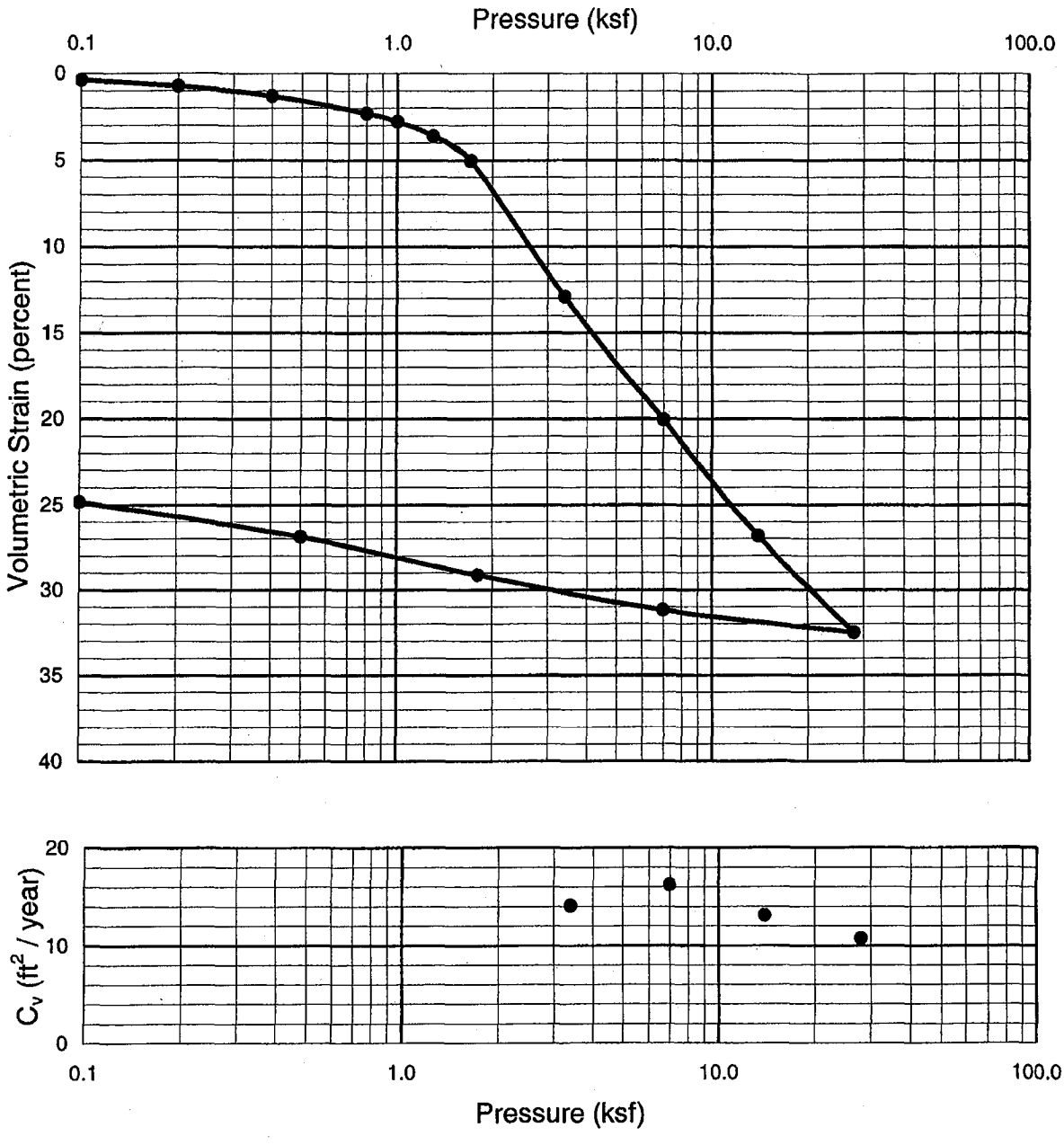
Treadwell&Rollo

Date 04/02/08	Project No. 3347.01	Figure C-6

SARIMENTO

APPENDIX D

Laboratory Test Results from Current Investigation



Sampler Type: Shelby Tube (ST)			Condition	Before Test		After Test	
Diameter (in) 2.42	Height (in) 1.00		Water Content	w_o	61.5 %	w_f	39.3 %
Overburden Pressure, p_o 1,770 psf			Void Ratio	e_o	1.66	e_f	1.00
Preconsol. Pressure, p_c 1,770 psf			Saturation	S_o	100 %	S_f	100 %
Compression Ratio, C_{ec} 0.24			Dry Density	γ_d	64 pcf	γ_d	84 pcf
LL --	PL --		PI --		G_s 2.70 (assumed)		
Classification SILT (MH), gray			Source B31-1 at 20 feet				

BLOCKS 29-32 PUBLIC IMPROVEMENTS
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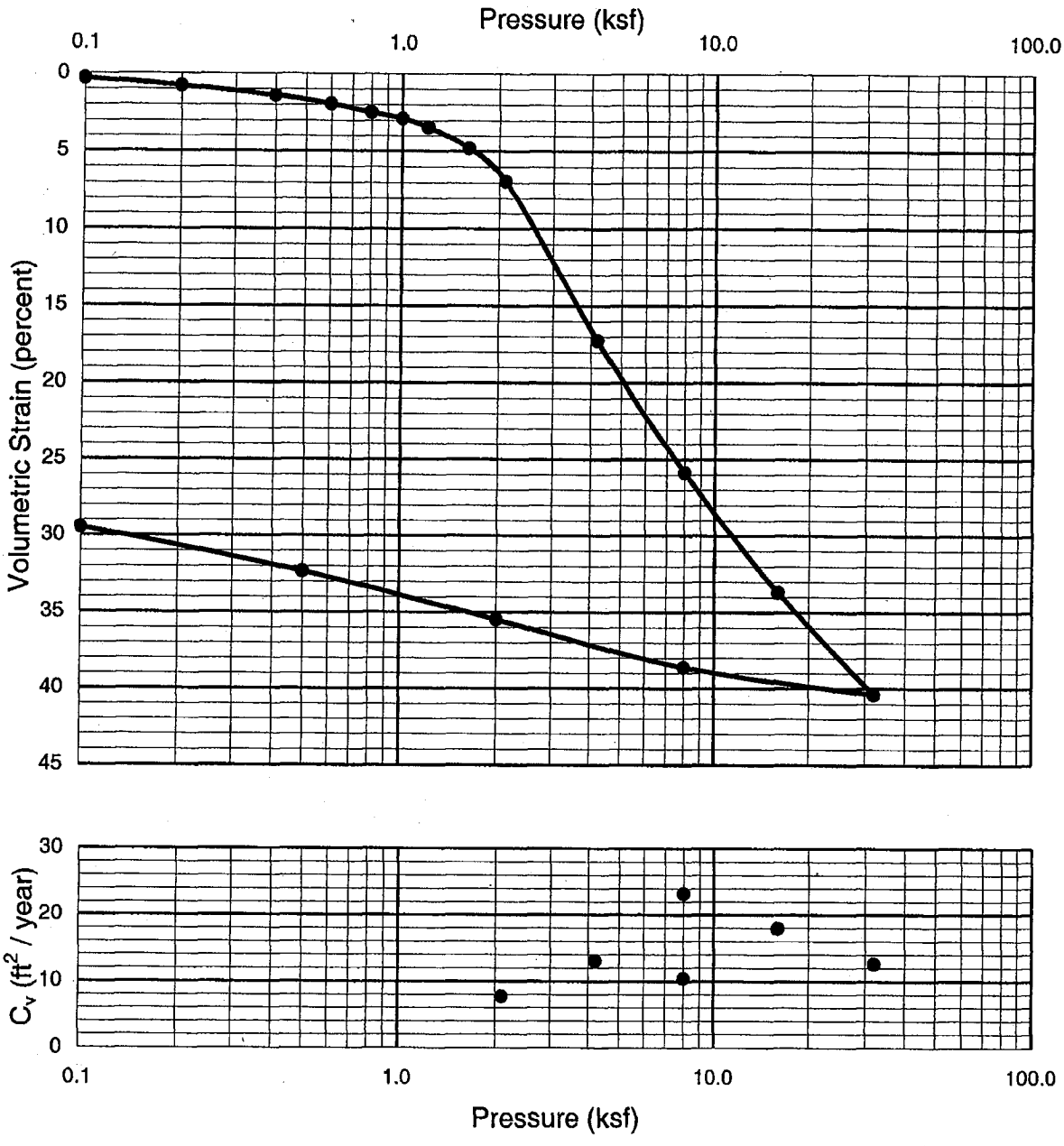
CONSOLIDATION TEST REPORT

Treadwell&Rollo

Date 04/02/08 | Project No. 3347.01 | Figure D-1



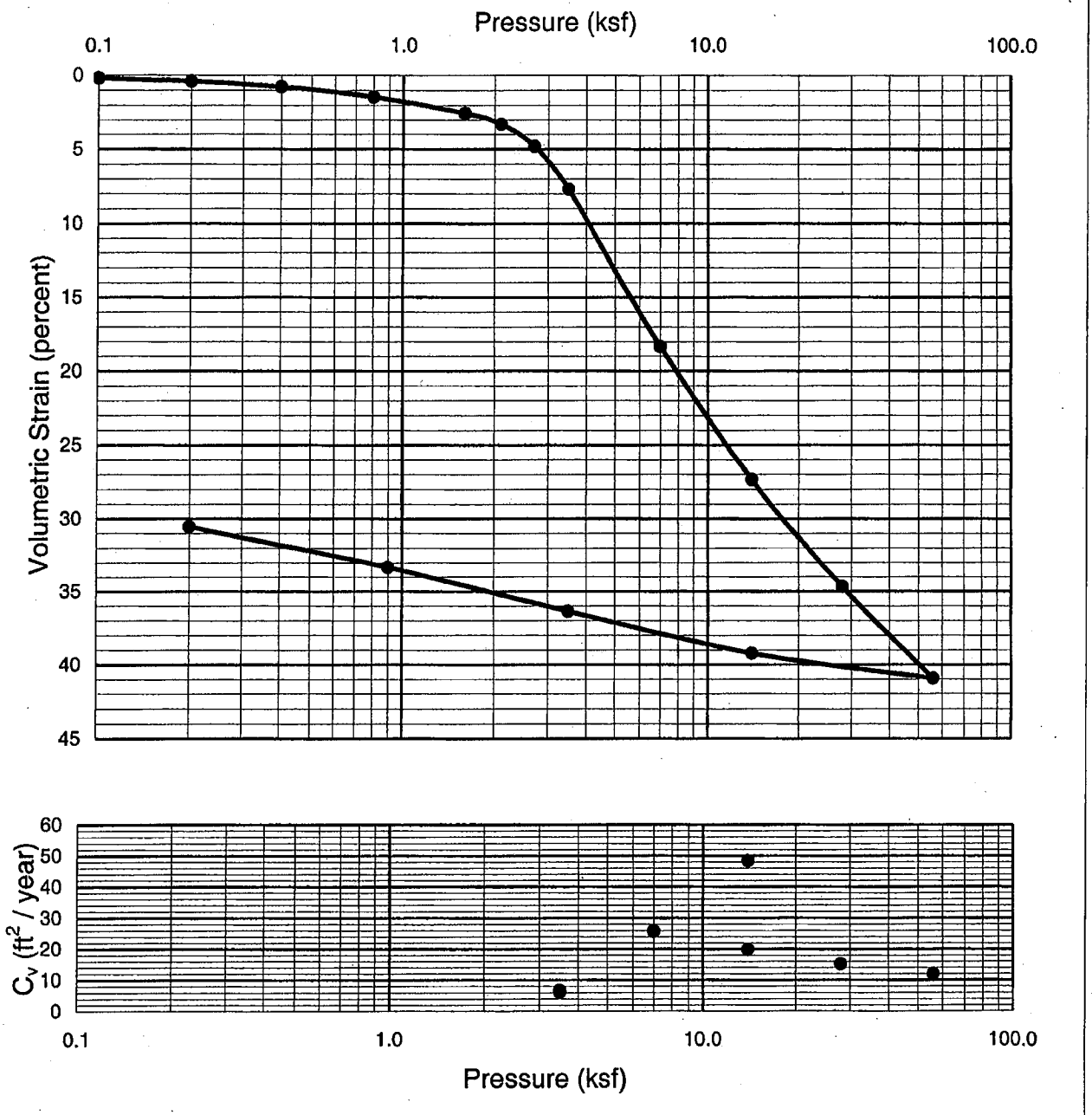
Sampler Type: Shelby Tube (ST)			Condition	Before Test		After Test	
Diameter (in) 2.42	Height (in) 1.00		Water Content	w_o	89.3 %	w_f	56.4 %
Overburden Pressure, p_o	2,000 psf		Void Ratio	e_o	2.49	e_f	1.46
Preconsol. Pressure, p_c	2,000 psf		Saturation	S_o	97 %	S_f	100 %
Compression Ratio, $C_{\varepsilon c}$	0.34		Dry Density	γ_d	48 pcf	γ_d	69 pcf
LL 79	PL 53	PI 26		G_s	2.70 (assumed)		
Classification SILT (MH), gray		Source B31-1 at 28 feet					

BLOCKS 29-32 PUBLIC IMPROVEMENTS
MISSION BAY
San Francisco, California

CONSOLIDATION TEST REPORT

Treadwell&Rollo

Date 04/02/08 | Project No. 3347.01 | Figure D-2



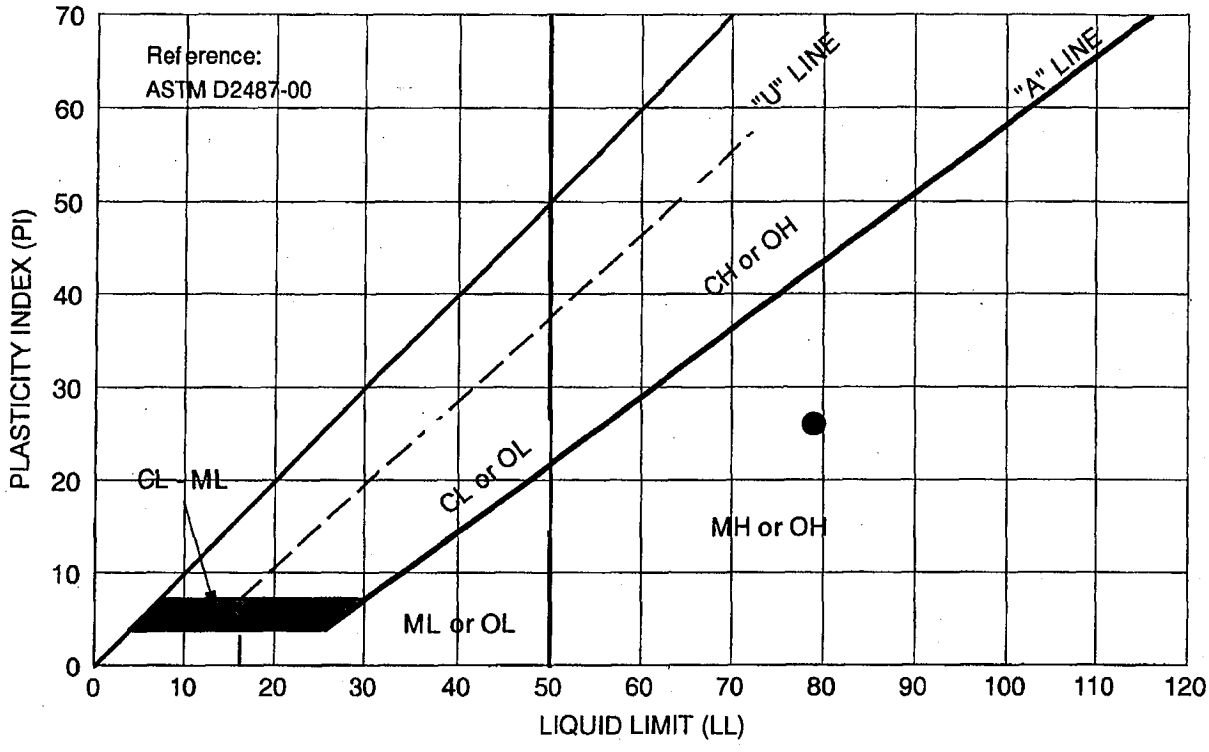
Sampler Type: Standard Penetration Test			Condition		Before Test		After Test	
Diameter (in) 2.42	Height (in) 1.00		Water Content	w_o	76.8 %	w_f	43.8 %	
Overburden Pressure, p_o 2,600 psf			Void Ratio	e_o	2.08	e_f	1.14	
Preconsol. Pressure, p_c 2,900 psf			Saturation	S_o	100 %	S_f	100 %	
Compression Ratio, C_{ec} 0.35			Dry Density	γ_d	55 pcf	γ_d	79 pcf	
LL --	PL --	PI --		G_s 2.70 (assumed)				
Classification SILT (MH), gray		Source B31-1 at 38 feet						

BLOCKS 29-32 PUBLIC IMPROVEMENTS
MISSION BAY
San Francisco, California

CONSOLIDATION TEST REPORT

Treadwell&Rollo

Date 04/02/08 | Project No. 3347.01 | Figure D-3



Symbol	Source	Description and Classification	Natural M.C. (%)	Liquid Limit (%)	Plasticity Index (%)	% Passing #200 Sieve
●	B31-1 at 31 feet	SILT (MH), gray	--	79	26	--

BLOCKS 29-32 PUBLIC IMPROVEMENTS
MISSION BAY
San Francisco, California

PLASTICITY CHART

Treadwell&Rollo

Date 03/20/08 | Project No. 3347.01 | Figure D-4

APPENDIX E

Corrosion Test Results and Brief Evaluation

California State Certified Laboratory No.2153

C E R C O
analytical, inc.

4 February, 2008

Job No.0801244
Cust. No.10727

3942-A Valley Avenue
Pleasanton, CA 94566-4715
925.462.2771 • Fax: 925.462.2775
www.cercoanalytical.com

Ms. Serena Jang
Treadwell & Rollo
555 Montgomery Street, Suite 1300
San Francisco, CA 94111

Subject: Project No.: 3347.01
Project Name: Blocks 29-32, Mission Bay
Corrosivity Analysis – ASTM Test Methods

Dear Ms. Jang:

Pursuant to your request, CERCO Analytical has analyzed the soil samples submitted on January 30, 2008. Based on the analytical results, a brief evaluation is enclosed for your consideration.

Based upon the resistivity measurement, this sample is classified as "corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentration is 35 mg/kg. Because the chloride ion concentration is less than 300 mg/kg, it is determined to be insufficient to attack steel embedded in a concrete mortar coating.

The sulfate ion concentration is 120 mg/kg and is determined to be insufficient to damage reinforced concrete structures and cement mortar-coated steel at this location.

The pH of the soil is 8.3 which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

The redox potential is 440-mV, which is indicative of aerobic soil conditions.

This corrosivity evaluation is based on general corrosion engineering standards and is non-specific in nature. For specific long-term corrosion control design recommendations or consultation, please *call JDH Corrosion Consultants, Inc. at (925) 927-6630.*

We appreciate the opportunity of working with you on this project. If you have any questions, or if you require further information, please do not hesitate to contact us.

Very truly yours,
CERCO ANALYTICAL, INC.

J. Darby Howard, Jr., P.E.
President

JDH/jdl
Enclosure

California State Certified Laboratory No.2153

CERCO analytical, inc.

3942-A Valley Avenue
Pleasanton, CA 94566-4715
925.462.2771 • Fax: 925.462.2775
www.cercoanalytical.com

Client: Treadwell & Rollo
Client's Project No.: 3347.01
Client's Project Name: Blocks 29-32, Mission Bay
Date Sampled: 24-Jan-08
Date Received: 30-Jan-08
Matrix: Soil
Authorization: Signed Chain of Custody

Date of Report: 4-Feb-2008

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Conductivity (umhos/cm)*	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
0801224-001	B31-1 @ #1 A-3'	440	8.3	-	2,000	-	35	120

Method:	ASTM D1498	ASTM D4972	ASTM D1125M	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Detection Limit:	-	-	10	-	50	15	15
Date Analyzed:	31-Jan-2008	1-Feb-2008	-	31-Jan-2008	-	1-Feb-2008	1-Feb-2008

* Results Reported on "As Received" Basis

Cheryl McMillen
Laboratory Director

Quality Control Summary - **All laboratory quality control parameters were found to be within established limits**

DISTRIBUTION

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QUALITY CONTROL REVIEWER:

Lori A. Simpson
Geotechnical Engineer