Appendix A

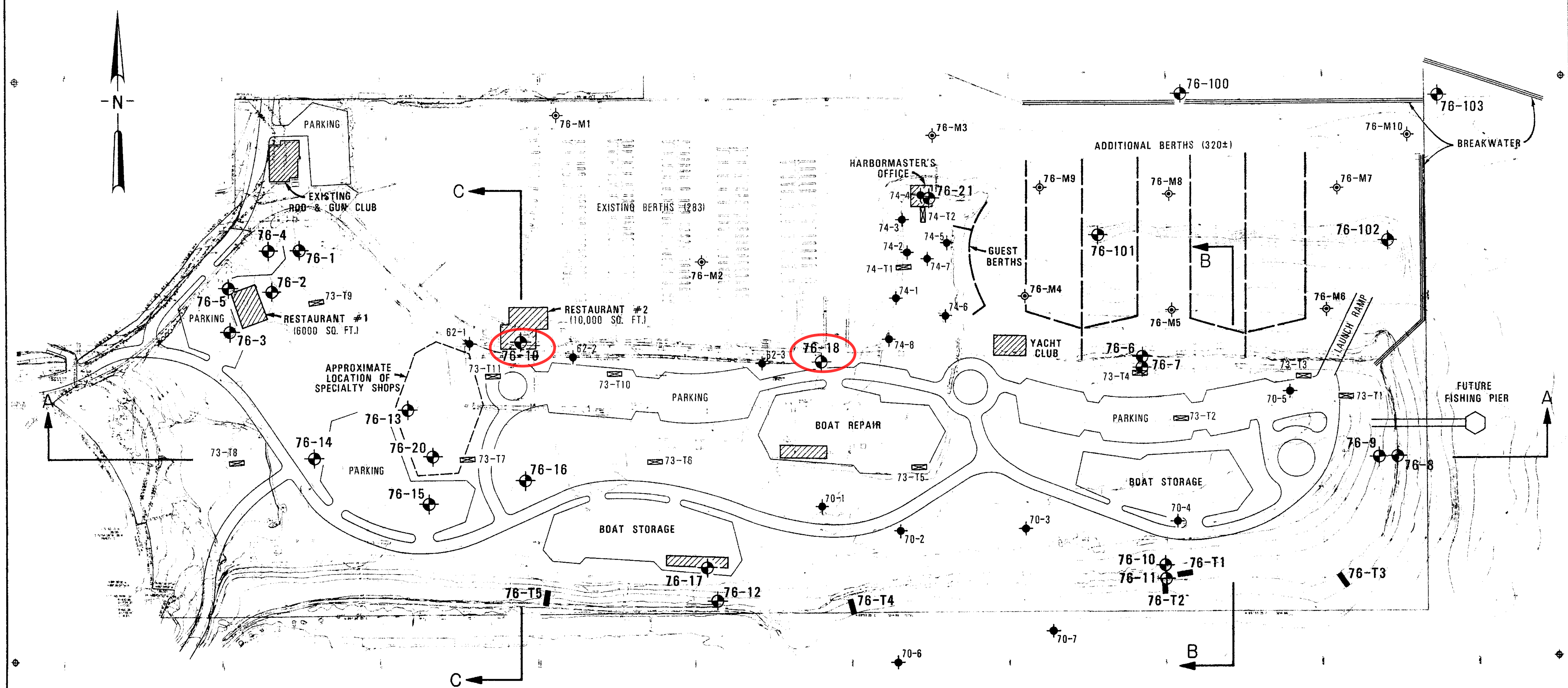
Available Geotechnical Information

Excerpts from 1976 Woodward-Clyde Consultants Geotechnical Investigation

Excerpts from 1980 DMJM As-Built Site Improvement Drawings

Excerpts from 2007 Treadwell & Rollo Geotechnical Investigation

2012 Treadwell & Rollo Geotechnical Study



N O T E S :

1) BASE MAP REDUCED FROM "HYDROGRAPHIC/TOPOGRAPHIC MAP OF OYSTER POINT MARINA" PREPARED BY TOWILL, INC. FOR BRIAN-KANGAS-FOULK & ASSOCIATES DATED MARCH 11, 1976

2) SITE DEVELOPMENT PLANS TAKEN FROM "PRELIMINARY MASTER PLAN – OYSTER POINT MARINA" BY ROYSTON, HANAMOTO, BECK, & ABEY DATED JUNE 15, 1976.

L E G E N D :

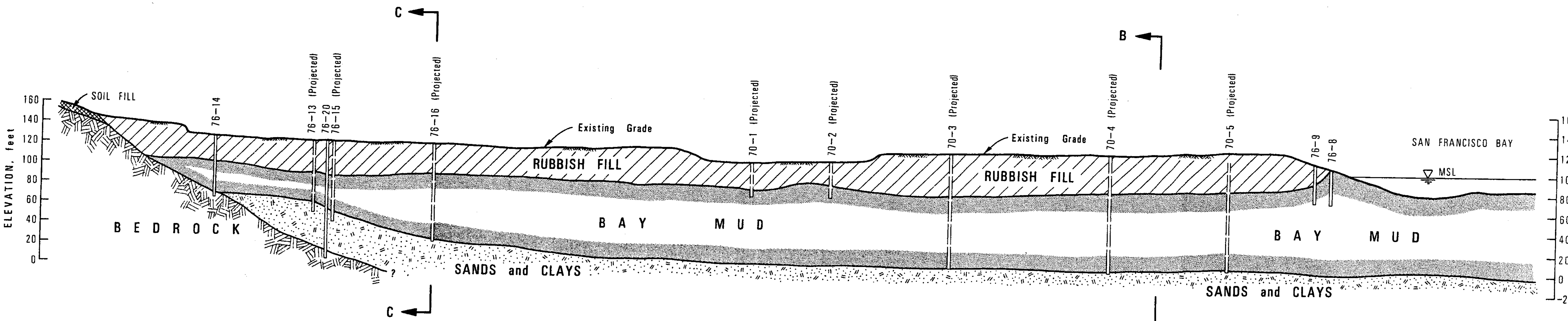
76-1	1976 BORINGS BY WOODWARD-CLYDE CONSULTANTS FOR PRESENT STUDY (25)
76-T1	1976 TEST TRENCHES BY WOODWARD-CLYDE CONSULTANTS FOR PRESENT STUDY (5)
76-M1	1976 MUDLINE SAMPLES BY WOODWARD-CLYDE CONSULTANTS FOR PRESENT STUDY (10)
74-1	1974 BORINGS BY HARLAN ENGINEERS
70-1	1970 BORINGS BY GRIBALDO, JONES & ASSOCIATES
62-1	1962 BORINGS BY JOHN A. BLUME & ASSOCIATES, ENGINEERS
74-T1	1974 TEST TRENCHES BY HARLAN ENGINEERS
73-T1	1973 TEST TRENCHES BY BERLOGAR, LONG & ASSOCIATES

0 100 200 300 400 500 600
Scale in Feet

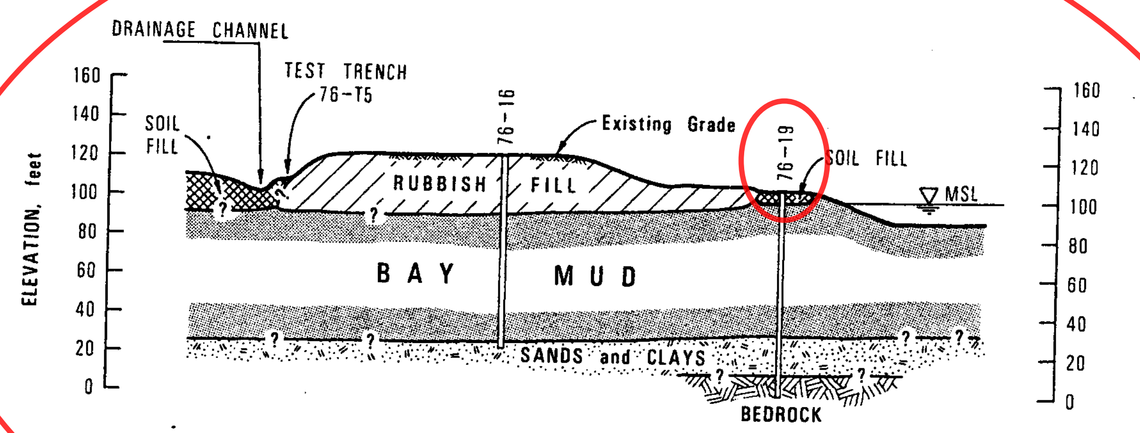
SITE EXPLORATION PLAN AND PROPOSED DEVELOPMENT
OYSTER POINT MARINA
South San Francisco, California

Project No. 13609A
WOODWARD-CLYDE CONSULTANTS

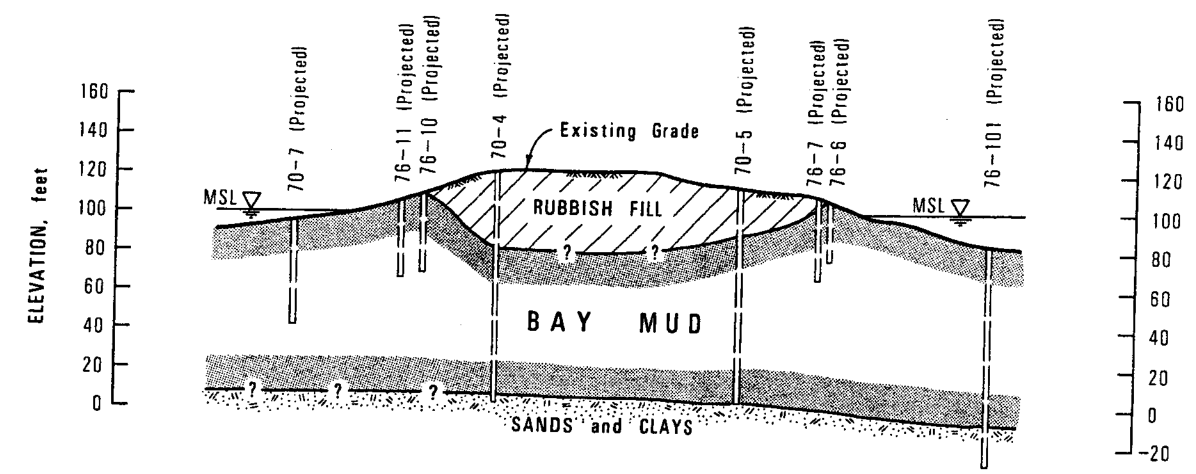
Figure 1



SECTION A – A



SECTION C – C



SECTION B – B

NOTES:

1) REFER TO FIGURE 1 FOR LOCATION AND ORIENTATION OF SECTIONS.

2) VERTICAL EXAGGERATION = 100 / 40 = 2.5x

3) THE RUBBISH FILL IS OVERLAIN BY A SOIL CAP OF VARYING THICKNESS, QUALITY AND COMPOSITION.

4) EXISTING SURFACE ELEVATIONS TAKEN FROM THE "HYDROGRAPHIC/TOPOGRAPHIC MAP OF OYSTER POINT MARINA" PREPARED BY TOWILL, INC. FOR BRIAN-KANGAS-FOULK & ASSOCIATES DATED MARCH 11, 1976.

5) THE IDEALIZED SOIL PROFILES ARE CONSTRUCTED BY DIRECT INTERPOLATION BETWEEN TEST BORINGS DRILLED AT VARYING SPACINGS. THE LINES DELINEATING THE VARIOUS SOIL AND ROCK TYPES WERE DONE FOR SCHEMATIC ILLUSTRATION PURPOSES ONLY. THE PROFILES SHOULD NOT BE CONSTRUED AS ACCURATE REPRESENTATIONS OF ACTUAL FIELD CONDITIONS.

LEGEND:

RUBBISH FILL
POORLY COMPACTED DOMESTIC AND LIGHT INDUSTRIAL SOLID WASTE INCLUDING NEWSPAPERS, CARDBOARD, CANS, ETC.

BAY MUD
SOFT, DARK GRAY SILTY CLAY

SANDS and CLAYS
MEDIUM DENSE TO DENSE SANDS AND SILTS AND MEDIUM STIFF TO HARD CLAYS

BEDROCK
SOFT TO MEDIUM HARD SHALE AND SANDSTONE

SOIL FILL
MODERATELY COMPACTED CLAYEY AND SILTY SANDS

0 100 200 300 400 500 600
Scale in Feet

IDEALIZED SOIL PROFILES
SECTIONS A-A, B-B, and C-C

OYSTER POINT MARINA
South San Francisco, California

Project No. 13609 A
WOODWARD-CLYDE CONSULTANTS

Figure 4

Project: OYSTER POINT MARINA South San Francisco, California	BORING LOG LEGEND SHEET

Date Drilled: ______________________ Hammer Weight: ______________________

Type of Boring: ______________________ Remarks: ______________________

Depth, Ft	Samples	Blows/Ft.	DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compressive Strength, psf

Surface Elevation:

Depth, Ft	Blows/Ft.	Description
5		2-INCH I.D. MODIFIED CALIFORNIA SAMPLER
		2½-INCH I.D. MODIFIED CALIFORNIA SAMPLER
10		3-INCH O.D. SHELBY TUBE SAMPLER
15	29	BLOW COUNT WITH A 140-LB. HAMMER FALLING 30 INCHES
	29*	BLOW COUNT WITH A DOWNHOLE HAMMER FALLING 12 INCHES THROUGH DRILLING FLUID
20	P	SAMPLER ADVANCED BY PUSHING
25	▽	WATER LEVEL MEASURED:
	ATD	At Time of Drilling
	6-4-76	On Date Indicated
30		

Job No. 13609A

WOODWARD-CLYDE CONSULTANTS

Figure A-1

Project: OYSTER POINT MARINA
South San Francisco, California

Log of Boring No. 76-17

Date Drilled: June 15, 1976
Type of Boring: 6" Auger
Hammer Weight:
Remarks:

Depth, Ft.	Samples	Blows/Ft.	DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compressive Strength, psf
			Surface Elevation: 122			
			CLAYEY SILT FILL: Poorly compacted, dry, brown			
			RUBBISH FILL			
			Rubbish mixed with soft clay			
			(FILL)			
			SILTY CLAY (CH) Soft, saturated, dark gray			
			With stringers of dark brown peat			
			(BAY MUD)			
			CLAYEY SAND (SC) Loose to medium dense, black			
			SAND (SP) Medium dense, greenish-gray			
			Dense, clayey			
			BOTTOM OF HOLE @ 122'			

Project: OYSTER POINT MARINA
South San Francisco, California

Log of Boring No. 76-18

Date Drilled: June 16, 1976
Type of Boring: 6" Auger
Hammer Weight:
Remarks:

Depth, Ft.	Samples	Blows/Ft.	DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compressive Strength, psf
			Surface Elevation: 104			
			1" Asphalt Over 8" Rock Base			
			SAND FILL: Poorly compacted			
			RUBBISH FILL			
			(FILL)			
			SILTY CLAY (CH) Soft, saturated, dark gray			
			(BAY MUD)			
			Soft to medium stiff			
			Medium stiff			
			(BAY MUD)			
			SILTY CLAY (CL) Medium stiff, black, with lenses of sand			
			CLAYEY SAND (SC) Medium dense, light green-gray			
			BOTTOM OF HOLE @ 112'			

Log of Boring No. 76-19

Project: OYSTER POINT MARINA, South San Francisco, California

Date Drilled: June 10, 1976

Type of Boring: 6" Auger

Hammer Weight: 140 lbs.

Remarks:

Surface Elevation: 105

Description

2" Asphalt Over 5" Rock Base

C L A Y E Y S A N D F I L L
Moderately compacted, moist, dark gray, with rock fragments and some rubbish

Soft clay and rubbish

(F I L L)

S I L T Y C L A Y (CH)
Very soft to soft, saturated, dark gray

(B A Y M U D)

LL = 67%, PI = 40%

Medium stiff

(B A Y M U D)

S I L T Y C L A Y (CH)
Stiff, saturated, green
UU TRIAXIAL TEST $\frac{1}{2}(\sigma_1-\sigma_3)_f$ = 800 psf

S I L T Y C L A Y (CL)
Very stiff, saturated, brown
Grades with depth to Fine Sandy Clay
UU TRIAXIAL TEST $\frac{1}{2}(\sigma_1-\sigma_3)_f$ = 1350 psf

S A N D (SP)
Medium dense, saturated, brown
With lenses of silty sand and sandy silt
Grades with depth to sandy silt (ML)

S H A L E
Soft, saturated, dark gray
Soft to medium hard
Medium hard
Medium hard to hard

BOTTOM OF HOLE @ 105'

Samples	Blows/Ft.	Moisture Content, %	Dry Density pcf	Unconfined Compressive Strength, psf
1	21	-	-	-
2	12	-	-	-
3	1	69	58	-
4	2*	58	64	200
5	2	59	61	500
6	2*	60	60	380
7	4*	52	64	570
8	18*	21	106	-
9	32	19	111	6870
10	19	23	103	-
11	32	-	-	-
12	68	-	-	-

Log of Boring No. 76-20

Project: OYSTER POINT MARINA, South San Francisco, California

Date Drilled: June 11, 1976

Type of Boring: 4-3/4" Rotary

Hammer Weight: 140 lbs.

Remarks:

Surface Elevation: 123

Description

C L A Y E Y S A N D F I L L
Moderately compacted, dry, brown

R U B B I S H F I L L

Rubbish fill mixed with soft clay and wood

(F I L L)

S I L T Y C L A Y (CH)
Soft, saturated, dark gray

LL = 72%, PI = 46%

(B A Y M U D)

F I N E C L A Y E Y S A N D (SC)

S I L T Y C L A Y (CL)
Very stiff, saturated, green

S A N D (SP)
Very dense, saturated, dark green-gray

F I N E S A N D Y C L A Y (CL)
Very stiff, saturated, brown
UU TRIAXIAL TEST $\frac{1}{2}(\sigma_1-\sigma_3)_f$ = 1910 psf

UU TRIAXIAL TEST $\frac{1}{2}(\sigma_1-\sigma_3)_f$ = 4830 psf

S I L T Y C L A Y (CL)
Hard, saturated, gray-brown
Very stiff, more plastic (CL-CH) with some sand
UU TRIAXIAL TEST $\frac{1}{2}(\sigma_1-\sigma_3)_f$ = 2330 psf

S I L T Y S A N D (SM)
Dense, saturated, brown

S A N D Y C L A Y (CL-SC)
Very stiff, saturated, mottled gray-brown, with rock fragments, probably highly weathered bedrock

S A N D S T O N E
Hard, damp, reddish-brown, with claystone inclusions

BOTTOM OF HOLE @ 117'

Samples	Blows/Ft.	Moisture Content, %	Dry Density pcf	Unconfined Compressive Strength, psf
1	43	-	-	-
2	16/9"	-	-	-
3	6	-	-	-
4	1	No Recovery		
5	3	54	64	590
6	6	51	66	470
7	29	22	104	5390
8	78	-	-	-
9	41	16	119	-
10	80	16	117	-
11	80	15	118	11,600
12	40	18	113	-
13	73/9"	-	-	-
14	90/6"	-	-	-

Proj. No. 13609A

WOODWARD-CLYDE CONSULTANTS

Figure A-16

Electrical Components deleted and/or changed per C.O. #1: 1/16/80
As Built 12/15/80

DMJM DANIEL, MANN, JOHNSON, & MENDENHALL
611 VETERANS BOULEVARD
REDWOOD CITY, CA. 94065 (415) 365-3900

PREPARED FOR
OYSTER POINT MARINA / PARK
SAN MATEO COUNTY HARBOR DISTRICT
CITY OF SOUTH SAN FRANCISCO

JOB TITLE: SITE IMPROVEMENTS AND ASSOCIATED WORK - STAGE 1
SHEET TITLE: UTILITY PLAN - CENTRAL & MOLE SECTIONS & DETAILS

DRAWN BY	JOB NO.
HDH	6226-1-1
CHECKED BY	SHEET NO.
WB	7 of 20
APPROVED BY	DATE
WCC	SEPTEMBER 10, 1979

GEOTECHNICAL INVESTIGATION
SOUTH SAN FRANCISCO FERRY TERMINAL
OYSTER POINT MARINA
South San Francisco, California

San Mateo Harbor County Harbor District
South San Francisco, California

10 October 2007
Project No. 4177.03

Treadwell&Rollo
Environmental and Geotechnical Consultants

6.2.1 Liquefaction, Lateral Spreading, and Differential Compaction

Saturated, cohesionless soil can liquefy as it experiences a temporary loss of shear strength created by a transient rise in excess pore pressure generated by strong ground motion. We conclude the sand layers present beneath the groundwater at the site are sufficiently dense and/or cohesive so that the potential for liquefaction and lateral spreading is low.

Cyclic densification of non-saturated loose to medium dense sand by earthquake vibrations can cause ground surface settlement (differential compaction). On the basis of a review of the Woodward-Clyde 1976 borings, it appears the sand above the groundwater within the proposed landside development area at the site, where explored, is sufficiently dense and/or cohesive so that the potential for cyclic densification and associated settlement is low.

6.2.2 Ground Rupture

Historically, ground surface ruptures closely follow the trace of geologically young faults. The site is not within an Earthquake Fault Zone, as defined by the Alquist-Priolo Earthquake Fault Zoning Act and no known active or potentially active faults exist on the site. Therefore, we conclude the risk of fault offset at the site from a known active fault is low. In a seismically active area, the remote possibility exists for future faulting in areas where no faults previously existed; however, we conclude the risk of surface faulting and consequent secondary ground failure is low.

7.0 DISCUSSION AND CONCLUSIONS

From a geotechnical standpoint, we conclude the site can be developed as planned, provided the recommendations presented in this report are incorporated into the project plans and specifications and implemented during construction. The primary geotechnical issues to be addressed for the project are settlement of the Bay Mud under the weight of existing fill and refuse material adjacent to the site (former Oyster Point landfill) and satisfactory foundation support for the proposed pier structure. Our conclusions regarding these and other issues are discussed in the remainder of this section.

7.1 Settlement

The results of our analyses indicate the Bay Mud is still consolidating under the weight of the existing fill and refuse material, which terminate at the shoreline. These results are consistent with the thickness of the Bay Mud and the length of time the fill has been in place. Consequently, even if no new fill is added to the site, settlement will continue to occur due to on-going primary consolidation and secondary compression (strain-related movements) of the Bay Mud. Where new fill is placed, a new cycle of primary consolidation will begin and additional settlement will occur. However, we understand only minor onshore fills in the vicinity of the ramp will be placed; the settlement associated with this additional fill is expected to be minor relative to the remaining settlement. Our estimates of the predicted future settlement versus time along the shoreline at the site over the next 50 years are shown on Figure 6. Differential settlement between the pile-supported pier structure and the shoreline should be anticipated. Exterior slabs and ramps attached to the pile-supported pier should be hinged to accommodate the anticipated differential settlement between the pier and shoreline. We understand asphalt or gravel pathways will extend perpendicularly from the ramp. Regular maintenance, such as the addition of fill or asphalt overlays should be anticipated for the pathways as the hinged slab rotates to reduce differential settlement between the ramp and pathway.

Although there is no fill directly over the Bay Mud within the proposed pier structure area, we anticipate settlement of the Bay Mud will occur near the shoreline due to the influence of the fill loads at the shoreline. We conclude the Bay Mud within approximately 50 feet of the shoreline is undergoing consolidation settlement due to the influence of the fill. Because of the anticipated settlement of the Bay Mud, we conclude that piles placed within 50 feet of the shoreline will experience downdrag loads. Downdrag is the additional load transferred to the piles when the Bay Mud surrounding the pile is consolidating. The downward movement of the compressible soil layer and the soil above it with respect to the pile imposes negative frictional stresses on the pile. These loads are discussed in Section 7.2.

7.2 Foundations

We anticipate excessive settlement would occur in the Bay Mud beneath the new pier loads if supported on a shallow foundation system. Therefore, we conclude a deep foundation system, consisting of driven piles primarily gaining support in the sand below the Bay Mud, is the most appropriate method for support of the pier. On the basis of discussions with Moffatt & Nichol, the project structural engineer, we understand two different sized steel pipe piles will be used to provide vertical and lateral support for the pier structure: 1) 36-inch-diameter pile with 3/4-inch-thick wall and 2) 42-inch-diameter with 1-inch-thick wall. We judge piles will gain support through a combination of friction between the soil and the pile shaft and end-bearing in the sand layer below the Bay Mud.

As discussed in Section 7.1, the fill and refuse from the Oyster Point landfill are consolidating the Bay Mud and causing ground surface settlement. The estimated settlement decreases with distance from the landfill. Piles located within 50 feet of the shoreline should be designed to support downdrag loads, in addition to the structural loads.

The settlement of properly installed driven piles, designed based on the recommendations presented herein, should be less than 1/2 inch. Differential settlement between adjacent pile caps should be less than 1/4 inch.

As discussed in Section 7.1, a hinged slab may be used to connect the pier to the shoreline; the hinged slab may be supported on a continuous footing bearing on the existing fill. The hinged slab should be designed to rotate and settle with the ground. The estimated settlement over the next 50 years along the shoreline is shown on Figure 6. The footing should be located outside the landfill, the approximate limits of which are shown on Figure 2. The landfill is covered with a clay cap; the bottom of the footing should not be located within 12 inches of the surface of the clay cap to prevent the excavation from disturbing the clay cap.

8.0 RECOMMENDATIONS

Our recommendations regarding foundation design, site preparation and grading, flexible pavement design, seismic design, and other geotechnical aspects of this project are presented in this section.

8.1 Foundations

The pier structure may be supported on 36-inch and 42-inch-diameter steel pipe piles with 3/4-inch and 1-inch-thick walls, respectively. Axial and lateral capacities for piles, as well as construction considerations are presented in Sections 8.1.1 through 8.1.3. Recommendations for footings are presented in Section 8.1.4.

8.1.1 Axial Load Resistance

The piles should gain support from friction between the sides of the pile and the soil and end-bearing in the sand below the Bay Mud. Piles should be driven a minimum of 10 feet into the sand below the Bay

Mud. The depth to the sand layer varies across the pier footprint; we estimate pile lengths will be on the order of about 100 to 105 feet (as measured from the mudline).

Recommended net allowable dead plus live load pile capacities for steel pipe pile driven a minimum of 10 feet into the sand below the Bay Mud are presented in Table 4. As discussed in Section 7.1, piles within 50 feet of the shoreline may be subjected to downdrag forces. We understand several of the 36-inch-diameter piles will be within this zone. We estimate the downdrag load on the 36-inch-diameter piles will be approximately 145 kips.

TABLE 4
Recommended Single Pile Capacity
Steel Pipe Piles
(10 feet embedment into sand below Bay Mud)

Pile Diameter/ Wall Thickness (inches, inches)	Downdrag Load[1] (kips)	NET $Q_{allowable}$[2,3] Dead plus Live (kips)
36/0.75	No Downdrag (beyond 50 feet from shoreline)	550
42/1.0	No Downdrag (beyond 50 feet from shoreline)	690
36/0.75	145	345

1 Downdrag load applies to piles located within 50 feet of the shoreline.
2 Net $Q_{allowable}$ includes downdrag load.
3 Loads on pile should not exceed ultimate structural capacity of pile. Check by multiplying load on pile by appropriate load factor and adding downdrag load.

For short term compressive axial loading conditions such as wind or seismic, the capacities shown on Table 3 may be increased by 1/3. The seismic uplift capacity should be considered to be equal to the allowable compressive axial capacity. To avoid capacity reduction due to group effects, piles should be spaced no closer than four pile widths, center to center.

8.1.2 Lateral Load Resistance

The piles should develop lateral resistance from the passive pressure acting on the upper portion of the piles and their structural rigidity. The allowable lateral capacity of the piles depends on:

- the pile stiffness
- the strength of the surrounding soil
- axial load on the pile
- the allowable deflection at the pile top and the ground surface
- the allowable moment capacity of the pile.

We developed deflection and moment profiles based on 0.5 and 1 inch of lateral deflection for both fixed- and free-head conditions for 36-inch- and 42-inch-diameter steel pipe piles. These curves are presented on Figures 7 through 10. These lateral capacities are for single piles only and assume the piles are coated to reduce corrosion potential in the upper 25 to 30 feet. If piles are placed within a spacing of six pile diameters, group reduction factors may apply and we should be consulted to provide the appropriate reduction factors. The moment profile for a single pile with an unfactored load should be used to check the design of individual piles in a group.

8.1.3 Pile Installation

Selection of driving equipment for this project should take into account the "matching" of the pile hammer with the pile size and length. The piles have large cross-sections, and special consideration should be given to selecting a hammer that can deliver enough energy to the tip of the piles to drive them efficiently without damaging them. If the pile cannot be driven to the desired tip elevation, pile jetting may be performed; however, jetting should only be allowed when approved by the geotechnical engineer. Alternatively, a vibratory hammer may be used to install the piles. The diesel or vibratory hammer specifications and proposed installation procedures should be submitted to both the structural and geotechnical engineer for review.

8.1.4 Footings

The hinged slab may be supported on a shallow continuous footing bottomed in fill. The footing may be designed for an allowable bearing pressure of 2,000 psf for dead plus live loads. The allowable bearing pressure may be increased by one-third for total loads, including wind or seismic forces. These values include factors of safety of at least 2.0 and 1.5 for dead plus live loads and total loads, respectively. Footings should be at least 18 inches wide and bottomed at least 18 inches below the lowest adjacent soil subgrade.

Lateral loads can be resisted by a combination of passive pressure acting on the vertical faces of the footings and friction along the base of the footings. Passive resistance may be calculated using an equivalent fluid weight of 250 pounds per cubic foot (pcf). The upper one foot of soil should be ignored unless it is confined by a slab or pavement. Frictional resistance should be computed using a base friction coefficient of 0.3. The passive resistance and base friction coefficient values include a factor of safety of at least 1.5.

8.2 Site Grading and Fill Placement

Prior to grading operations, any existing asphalt pavement, concrete slabs, and other improvements should be demolished and removed from areas to receive improvements. If acceptable from an environmental standpoint, existing asphalt pavement and concrete may be ground up and used in the fill. The asphalt and concrete should be broken into fragments smaller than three inches in least dimension and mixed with sufficient fine-grained material to reduce the size of voids. Where vegetation exists in areas to receive improvements, the upper few inches of soil containing roots and organic matter should be stripped. The stripped material can be stockpiled for future use in landscaping, if approved by the project architect.

The surface exposed by stripping and /or excavation should be:

- scarified to a minimum depth of six inches
- moisture conditioned to near optimum
- compacted to at least 90 percent relative compaction[9]

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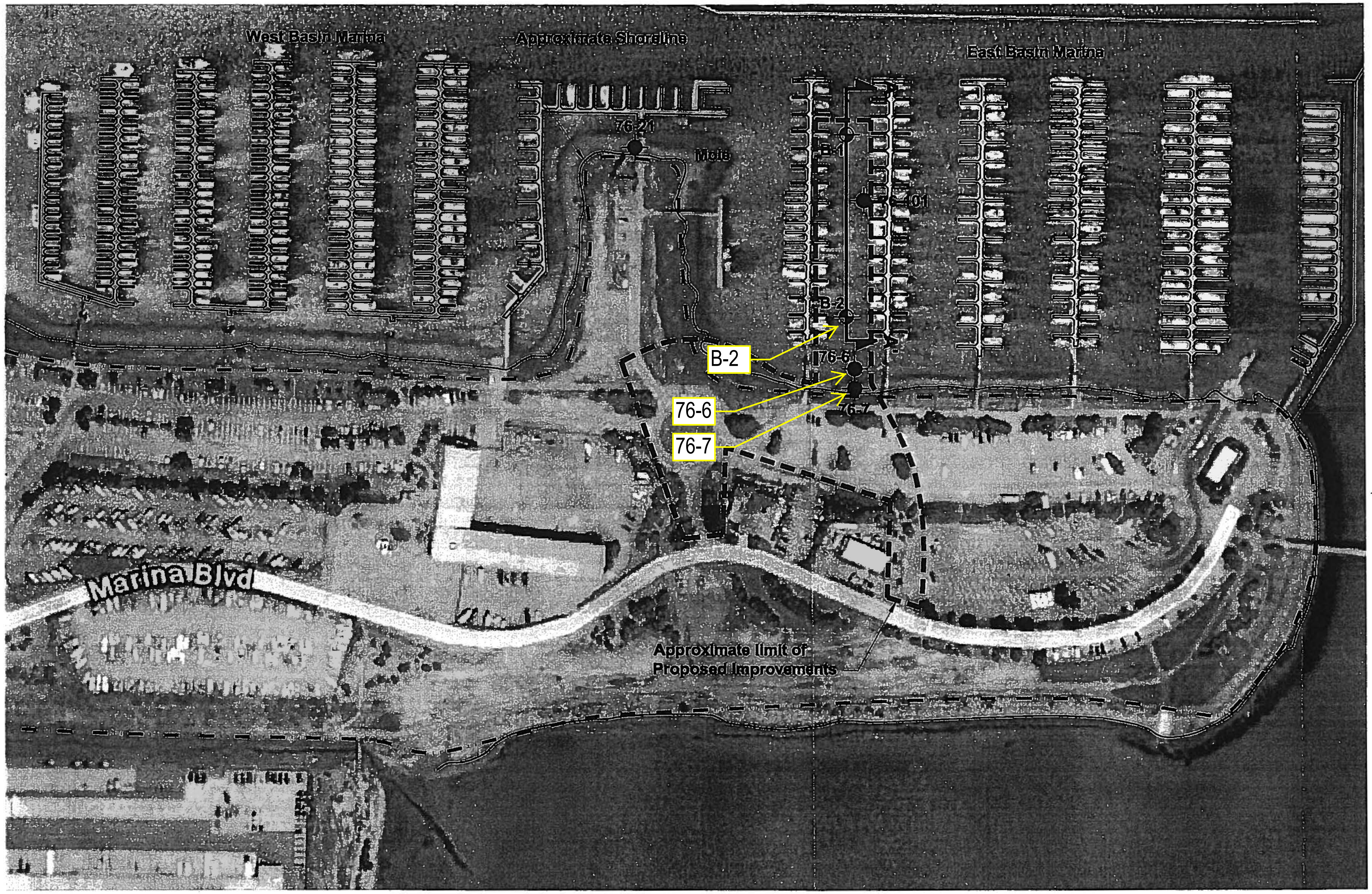
9 Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same material, as determined by the ASTM D1557 laboratory compaction procedure.



EXPLANATION

B-1 Approximate location of boring by Treadwell & Rollo, Inc., March 2007

76-101 Approximate location of boring by Woodward-Clyde Consultants, 1976

A A' Approximate location of idealized subsurface profile

Approximate limits of landfill

References:
1. Base map from Google Earth, 2007.
2. Oyster Point Marina, Breakwater Entrance, Reconfiguration, Existing Plan, by U.S. Army Corps of Engineers, San Francisco District, dated 23 February 2007.
3. Site Plan, Figure 2, Joint Technical Document, Oyster Point Landfill, South San Francisco, California, by PES Environmental, Inc., for Gabewell, dated March 2000.

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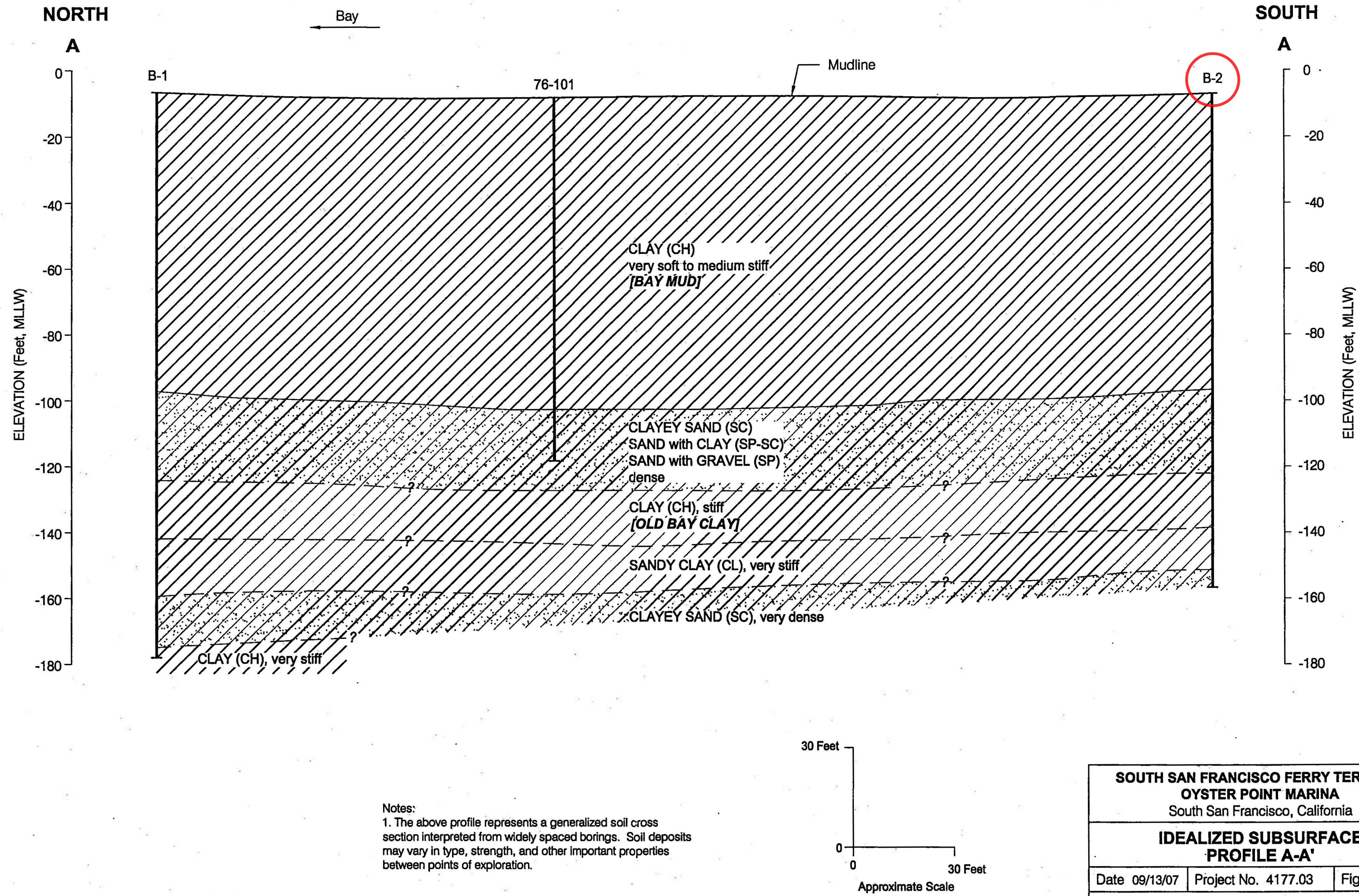
SOUTH SAN FRANCISCO FERRY TERMINAL
OYSTER POINT MARINA
South San Francisco, California

SITE PLAN

Date 03/29/07	Project No. 4177.03	Figure 2

Treadwell&Rollo



Notes:
1. The above profile represents a generalized soil cross section interpreted from widely spaced borings. Soil deposits may vary in type, strength, and other important properties between points of exploration.

SOUTH SAN FRANCISCO FERRY TERMINAL OYSTER POINT MARINA South San Francisco, California		
IDEALIZED SUBSURFACE PROFILE A-A'		
Date 09/13/07	Project No. 4177.03	Figure 3
Treadwell&Rollo		

R:\Trgraphics\4100's\4177.03\4177.03 idealized subsurface profile a-a'.dwg 10/11/07

APPENDIX A

Boring Logs and Classification Chart

PROJECT:	SOUTH SAN FRANCISCO FERRY TERMINAL OYSTER POINT MARINA South San Francisco, California	Log of Boring B-2 PAGE 1 OF 5

Boring location: See Site Plan, Figure 2

Logged by: A. Scavullo

Date started: 3/12/07 | Date finished: 3/13/07

Drilling method: Rotary Wash

Hammer weight/drop: 140 lbs./30 inches | Hammer type: Automatic Hammer

Sampler: Standard Penetration Test (SPT), Shelby Tube (ST)

LABORATORY TEST DATA

DEPTH (feet)	Sampler Type	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION Ground Surface Elevation: -6.8/ -6.5 feet[2](MLLW)	Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
0–1			CH	CLAY (CH) dark gray, very soft, wet, with shell fragments						
4	ST	0 psi			TxUU	120	70		70.1	58
9	ST	25 psi			TxUU	300	120		66.4	59
14	ST	25 psi			TxUU	490	210		67.6	60
17				grades soft						
19	ST	40 psi			TxUU	680	300		61.6	63
24	ST	<25 psi			TxUU	860	430		64.8	61
29	ST	200 psi			TxUU	1,050	430		77.0	55
30										

BAY MUD

Treadwell&Rollo

Project No.: 4177.03

Figure: A-2a

TEST GEOTECH LOG 417703.GPJ TR.GDT 10/11/07

PROJECT:	SOUTH SAN FRANCISCO FERRY TERMINAL OYSTER POINT MARINA South San Francisco, California	Log of Boring B-2

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: 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
30	ST		CH	CLAY (CH) (continued)						
34	ST	<25 psi			TxUU	1,430	420		76.1	55
39	ST	<25 psi			TxUU	1,630	440		61.2	64
44				grades mediums stiff						
45			CH	BAY MUD						
50	ST	<25 psi			TxUU	1,180	670		58.7	65
59	ST	<25 psi								
60										

Treadwell&Rollo

Project No.: 4177.03

Figure: A-2b

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
60–61	ST		<25 psi		CLAY (CH) (continued)						
61–69											
70	ST		25 psi			TxUU	2,590	800		56.1	67
75				CH	BAY MUD						
80	ST		25 psi			TxUU	2,970	870		52.5	69
81–90											

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
					CLAY (CH) (continued)						
91				SC	CLAYEY SAND (SC) olive-gray, medium dense, wet						
92											
93											
94											
95	ST		150-250 psi								
96											
97											
98											
99											
100	SPT		29						37.8		
101											
102											
103				SC							
104											
105											
106											
107											
108											
109											
110	SPT		27						14.4		
111											
112											
113											
114											
115				CH	CLAY (CH) gray, stiff, wet, with shall fragments [OLD BAY CLAY]						
116					OLD BAY CLAY						
117											
118				CH							
119											
120	SPT		13								

PROJECT:	SOUTH SAN FRANCISCO FERRY TERMINAL OYSTER POINT MARINA South San Francisco, California	Log of Boring B-2 PAGE 5 OF 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
121–132	SPT		13	CH	CLAY (CH) (continued) — OLD BAY CLAY						
133–143	ST		250 psi	CL	SANDY CLAY (CL) yellow-brown and gray-brown, very stiff, wet Consolidation Test, see Figure B-1	TxUU	6,060	3,720	53.9	17.3	113
144–148.5	ST		600 psi	SC	CLAYEY SAND(SC) brown, very dense, wet, with gravel	TxUU	6,970	5,260	13.8	18.8	110
149–150											

Boring was terminated at a depth of 148.5 feet.
Boring backfilled with cement grout.
Boring was performed over water.

[1] S&H and SPT blow counts verted to SPT-N values using factors of 0.8 and 1.33, respectively
[2] Elevation based on field measurements and published tide tables for Oyster Point Marina and survey data plus estimated silt accumulation

Treadwell&Rollo

Project No.: 4177.03 | Figure: A-2e

TEST GEOTECH LOG 417703.GPJ TR.GDT 10/11/07

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 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

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

SOUTH SAN FRANCISCO FERRY TERMINAL
OYSTER POINT MARINA
South San Francisco, California

Treadwell&Rollo

CLASSIFICATION CHART

Date 03/28/07 | Project No. 4177.03 | Figure A-3

APPENDIX C

Boring Logs by Others

Project: OYSTER POINT MARINA
South San Francisco, California

BORING LOG LEGEND SHEET

:e Drilled: ______ Hammer Weight: ______
Type of Boring: ______ Remarks: ______

Depth, Ft	Samples	Blows/Ft.	DESCRIPTION	Moisture Content, %	Dry Density pcf	Unconfined Compressive Strength, psf
			Surface Elevation:			
5			2-INCH I.D. MODIFIED CALIFORNIA SAMPLER			
			2½-INCH I.D. MODIFIED CALIFORNIA SAMPLER			
10			3-INCH O.D. SHELBY TUBE SAMPLER			
15		29	BLOW COUNT WITH A 140-LB. HAMMER FALLING 30 INCHES			
		29*	BLOW COUNT WITH A DOWNHOLE HAMMER FALLING 12 INCHES THROUGH DRILLING FLUID			
20		P	SAMPLER ADVANCED BY PUSHING			
25			▽ WATER LEVEL MEASURED:			
			ATD ← At Time of Drilling			
			6-4-76 ← On Date Indicated			

Job No. 13609A | WOODWARD-CLYDE CONSULTANTS | Figure A-1

Woodward-Clyde Consultants

Project: OYSTER POINT MARINA, South San Francisco, California	Log of Boring No. 76-6
Date Drilled: April 9, 1976	Hammer Weight:
Type of Boring: 6" Auger	Remarks:

Depth, Ft.	Samples	Blows/Ft.	DESCRIPTION	Moisture Content, %	Dry Density pcf	Unc Comp Strength, psf
			Surface Elevation: 107			
			CLAYEY GRAVEL FILL: Poorly compacted, contains large rock fragments			
5			SILTY CLAY FILL Poorly compacted, wet, dark gray, with trace of rock fragments			
			5-28-76 } Large rock fragments with clay (FILL)			
10						
			SILTY CLAY (CH) Soft, saturated, dark gray			
20						
			(BAY MUD)			
25						
30			BOTTOM OF HOLE @ 30'			
40						

Woodward-Clyde Consultants

Project: OYSTER POINT MARINA
South San Francisco, California

Log of Boring No. 76-7

Date Drilled: April 9, 1976

Hammer Weight: 140 lbs.

Type of Boring: 6" Auger

Remarks:

Surface Elevation: 111

Depth, Ft.	Samples	Blows/Ft.	DESCRIPTION	Moisture Content, %	Dry Density pcf	Unc. Comp Strength, psf
			SILTY CLAY FILL: Moderately compacted, moist, dark gray, with trace of rock fragments			
	1	7	RUBBISH FILL	-	-	-
5						
	2	11/9"	Metal spring	-	-	-
			5-28-76			
10						
	3	6	SANDY CLAY (CL-CH) Medium stiff, saturated, gray, with rock fragments (FILL)	-	-	-
	4	2	SILTY CLAY (CH) Soft, saturated, dark gray	No Recovery		
20						
	5	2		-	-	-
25						
	6	2	(BAY MUD)	No Recovery		
30						
	7	2		-	-	-
40						
	8	6		-	-	-
			BOTTOM OF HOLE @ 42'			

Note: Dock 8 and Dock 11 include Guide Piles only.

24 July 2012
Project 731556802

Mr. Christopher Devick
Moffatt & Nichol
2185 N. California Boulevard, Suite 500
Walnut Creek, California 94596

Subject: Geotechnical Studies
Oyster Point Marina
Docks 8 and 11 Modifications
South San Francisco, California

Dear Mr. Devick:

Treadwell & Rollo is pleased to present the results of our geotechnical studies for the proposed modifications to the existing Docks 8 and 11 at the Oyster Point Marina in South San Francisco, California. Our services were performed in general accordance with our proposal, dated 6 June 2012. We previously performed a geotechnical investigation for the recently opened South San Francisco Ferry Terminal; the results of that investigation are presented in our report dated 10 October 2007 (Revised 8 August 2008).

The site is east of U.S. Highway 101 (Bayshore Freeway) at the east half of Oyster Point Marina, as shown on Figure 1. The approximate location of Docks 8 and 11 are shown on Figure 2. We understand the modifications that are being made to Dock 8 (Guest Dock) do not require new piles; the existing piles are 12-inch square prestressed concrete piles. New 16-inch square prestressed concrete piles will be installed for the Dock 11 modifications. On the basis of information provided to us by Moffatt & Nichol, we understand the highest predicted tide will be at Elevation 9 feet[1] and the mudline in the vicinity of Docks 8 and 11 varies from Elevation -5 to -8 feet.

SCOPE OF SERVICES

The purpose of our studies was to evaluate subsurface conditions using available subsurface data from the site vicinity and develop geotechnical design criteria for the piles at Docks 8 and 11. No new subsurface investigation was performed for this phase of work.

We used the results of the previous subsurface exploration to develop conclusions and recommendations regarding:

- lateral deformation characteristics for new 16-inch square prestressed concrete piles for a free-head condition for Dock 11
- lateral deformation characteristics for the existing 12-inch square prestressed concrete piles for a free-head condition for Dock 8
- construction considerations.

[1] All elevations are referenced to Mean Lower Low Water (MLLW) Datum.

SUBSURFACE CONDITIONS

We used the results of our previous subsurface investigation at Oyster Point Marina in our current studies. The locations of the borings performed for that investigation are shown on Figure 2. Corresponding boring logs are presented in Appendix A.

The mudline varied from about Elevation -6 to -8 feet in the vicinity of Docks 8 and 11 at the time of our investigation. The results of our field investigation indicate the site is underlain by 88 to 98 feet of very soft to medium stiff compressible clay, locally referred to as Bay Mud. A medium dense to dense sand layer with varying amounts of fines and gravel was encountered below the underconsolidated[2] Bay Mud and extends to depths of about 115 to 118 feet below the mudline, corresponding to Elevations -122 to -125, respectively. Stiff clay (referred to as Old Bay Clay) was encountered below the sand layers. The thickness of this layer is about 17 to 18 feet. The Old Bay Clay is moderately compressible, but is overconsolidated. Beneath the Old Bay Clay are layers of very stiff sandy clay and very dense clayey sand that extend to the maximum depths explored of 148.5 and 171.5 feet in the two borings performed for the Ferry Terminal.

CONCLUSIONS AND RECOMMENDATIONS

We conclude Docks 8 and 11 may be supported by the existing 12-inch and new 16-inch square prestressed precast concrete piles, respectively, provided the anticipated pile deflection, induced moment, and shear are acceptable for the given loading conditions. Conclusions and recommendations regarding the lateral deformation characteristics and bending moments for piles and construction considerations are presented in the remainder of this section.

Lateral Load Resistance

The piles should develop lateral resistance from the soil passive pressure acting on the upper portion of the piles and their structural rigidity. The allowable lateral capacity of the piles depends on:

- the pile stiffness and fixity
- amount of free stand
- the strength of the surrounding soil
- axial load on the pile
- the allowable deflection at the pile top and the ground surface
- the allowable moment capacity of the pile.

We developed deflection, moment, and shear diagrams for the two pile types for a free-head condition. The analyses were performed using the highest predicted tide level provided by Moffatt & Nichol (Elevation 9 feet), as the point of lateral load application. We used the lowest mudline elevation

---

2 An underconsolidated clay has not yet achieved equilibrium under the existing load; a normally consolidated clay has completed consolidation under the existing load; and an overconsolidated clay has experienced a load greater than it is currently under.

(Elevation -8 feet) for our analyses, corresponding to approximately 17 feet of unsupported pile length (free stand). Moffatt & Nichol provided the estimated lateral loads and moments at the tops of the piles (at the high water line) for each dock. In our analyses, we used a lateral load of 3.6 kips and a moment of 90 kip-feet at Dock 8 and, a lateral load of 3.2 kips and a moment of 86.4 kip-feet at Dock 11. There were no additional axial loads applied except the self-weight of the pile. For our analyses, we used the software "LPile Plus 5.0.39 for Networks" by Ensoft and the input parameters presented in Table 1. The program linearly interpolates the input parameters from the top to the bottom of the layer.

TABLE 1
LPile Input Parameters

Soil Type	Elevation (feet, MLLW)	Effective Unit Weight (pounds per cubic foot, pcf)	Undrained Cohesion, c (pounds per square foot, psf)	Strain Factor (ε_{50})
Bay Mud (top)	-8	38	70	0.02
Bay Mud (bottom)	-98	38	1040	0.01

The results or our analyses for the 12-inch piles in terms of deflection, moment and shear are presented on Figures 3 through 5; similar plots are presented on Figures 6 through 8 for new 16-inch square concrete piles. The lateral capacities presented on these figures are for single piles only. If piles are placed within a spacing of six pile diameters, group reduction factors may apply and we should be consulted to provide the appropriate reduction factors. The moment profile for a single pile with an unfactored load should be used to check the design of individual piles in a group.

For the piles to achieve fixity, new piles should be embedded a minimum of 35 feet below the existing mud line for the 16-inch square precast prestressed concrete pile, corresponding to a tip elevation of approximately -43 feet.

Construction Considerations

If interbedded sand layers are encountered, it may be necessary to drive the piles. Selection of driving equipment for this project should take into account the "matching" of the pile hammer with the pile size, length, and potential for tension waves. The hammer specifications and proposed installation procedures should be submitted to both the structural and geotechnical engineer for review.

Because the piles will be embedded in Bay Mud, they may slide into the ground under their self-weight or under the combination of self-weight plus the weight of the hammer. If this is the case, the contractor should be prepared to "catch" the pile to stop it at the desired cutoff elevation. The pile should be held in place until the soil regains strength and can hold the pile; this may take several hours.

We trust the foregoing is sufficient for your needs. If you have any questions, please call.

Sincerely yours,
TREADWELL & ROLLO

REGISTERED PROFESSIONAL ENGINEER. CAROLYN E. RONAN NO. GE2741 Exp. 6/30/14 GEOTECHNICAL STATE OF CALIFORNIA

Cary E. Ronan, G.E.
Senior Project Manager

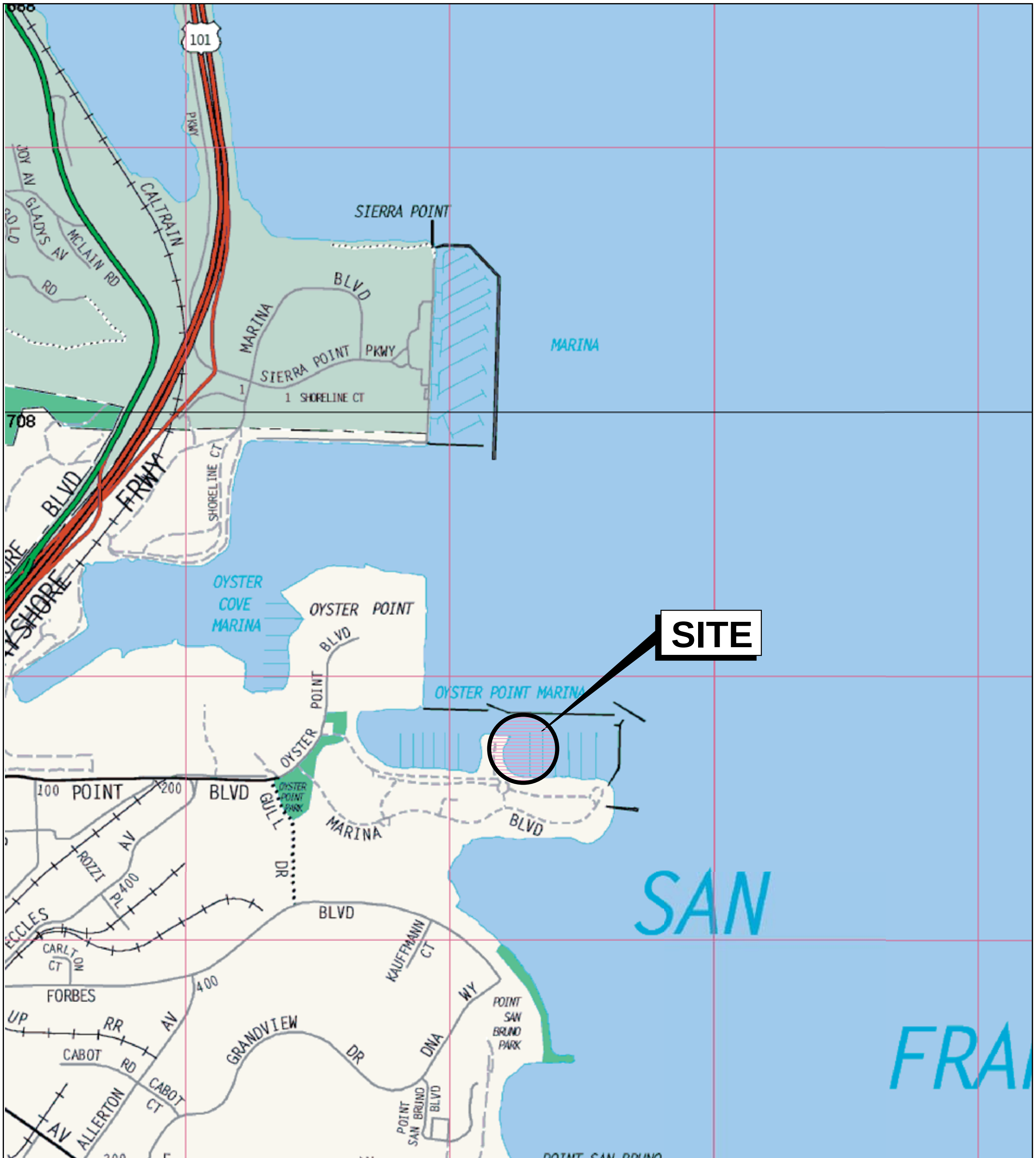
REGISTERED PROFESSIONAL ENGINEER. JOHN GOUCHON NO. 2282 Exp. 06/30/13 GEOTECHNICAL STATE OF CALIFORNIA

John Gouchon, G.E.
Senior Associate

731556802.01_CER_OP Breakwater Docks 8 and 11

Attachments: Figure 1 – Site Location Map
Figure 2 – Site Plan
Figures 3 through 8 – Deflection, Moment, and Shear Diagrams for12-inch and 16-inch square prestressed concrete piles
Appendix A – Boring Logs from Previous Investigation

FIGURES



Base map: The Thomas Guide
San Francisco County
1999

0 1/4 1/2 Mile

Approximate scale

OYSTER POINT MARINA
DOCKS 8 AND 11 MODIFICATIONS
South San Francisco, California

Treadwell&Rollo
A LANGAN COMPANY

SITE LOCATION MAP

Date 06/20/12	Project No. 731556802	Figure 1

EXPLANATION

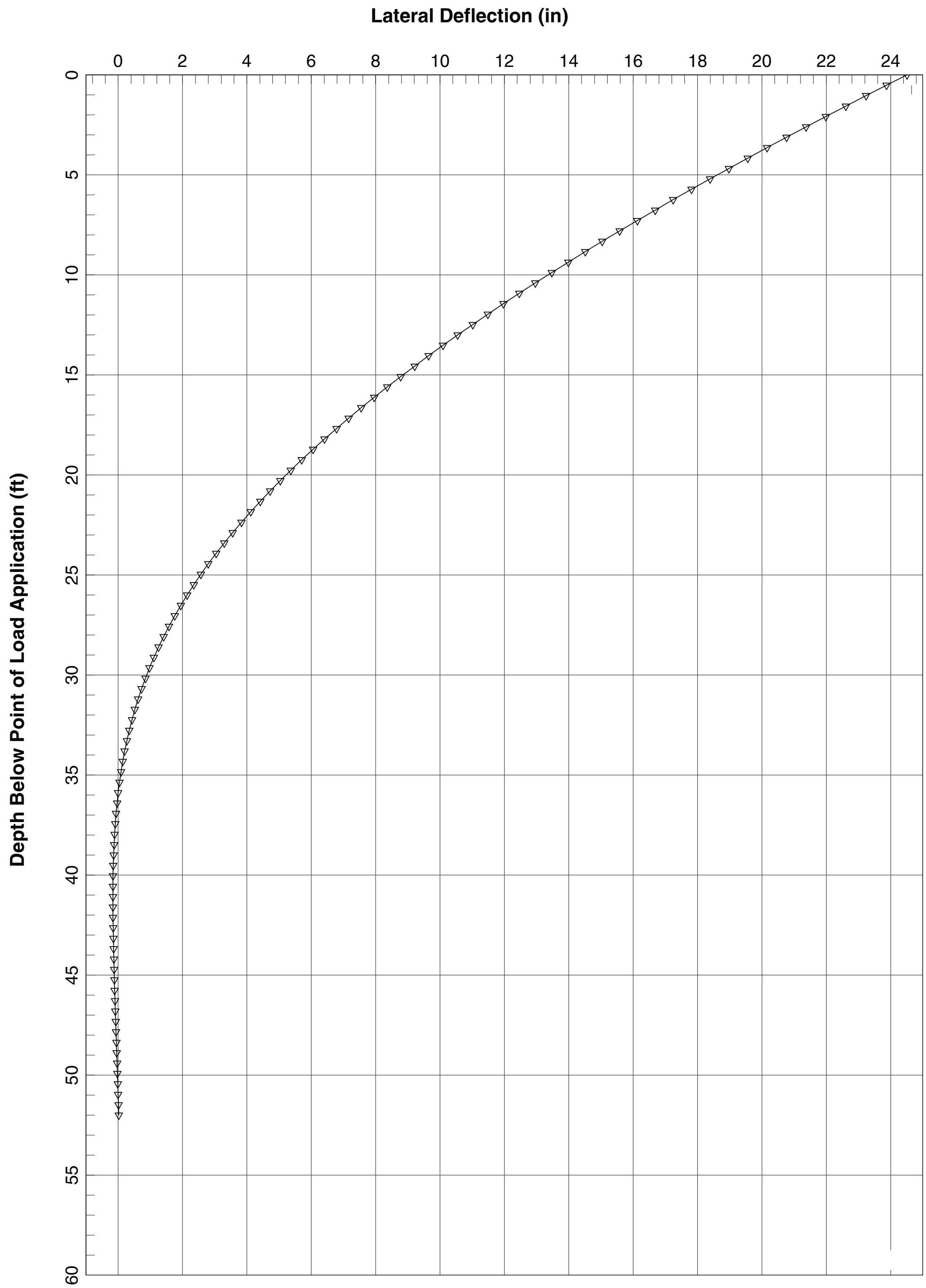
B-1 ⌖ Approximate location of boring by Treadwell & Rollo, Inc., March 2007

Reference: Base map from Google Earth, 2007.

0 200 Feet
Approximate scale

OYSTER POINT MARINA **DOCKS 8 AND 11 MODIFICATIONS** South San Francisco, California		
SITE PLAN		
Date 06/20/12	Project No. 731556802	Figure 2

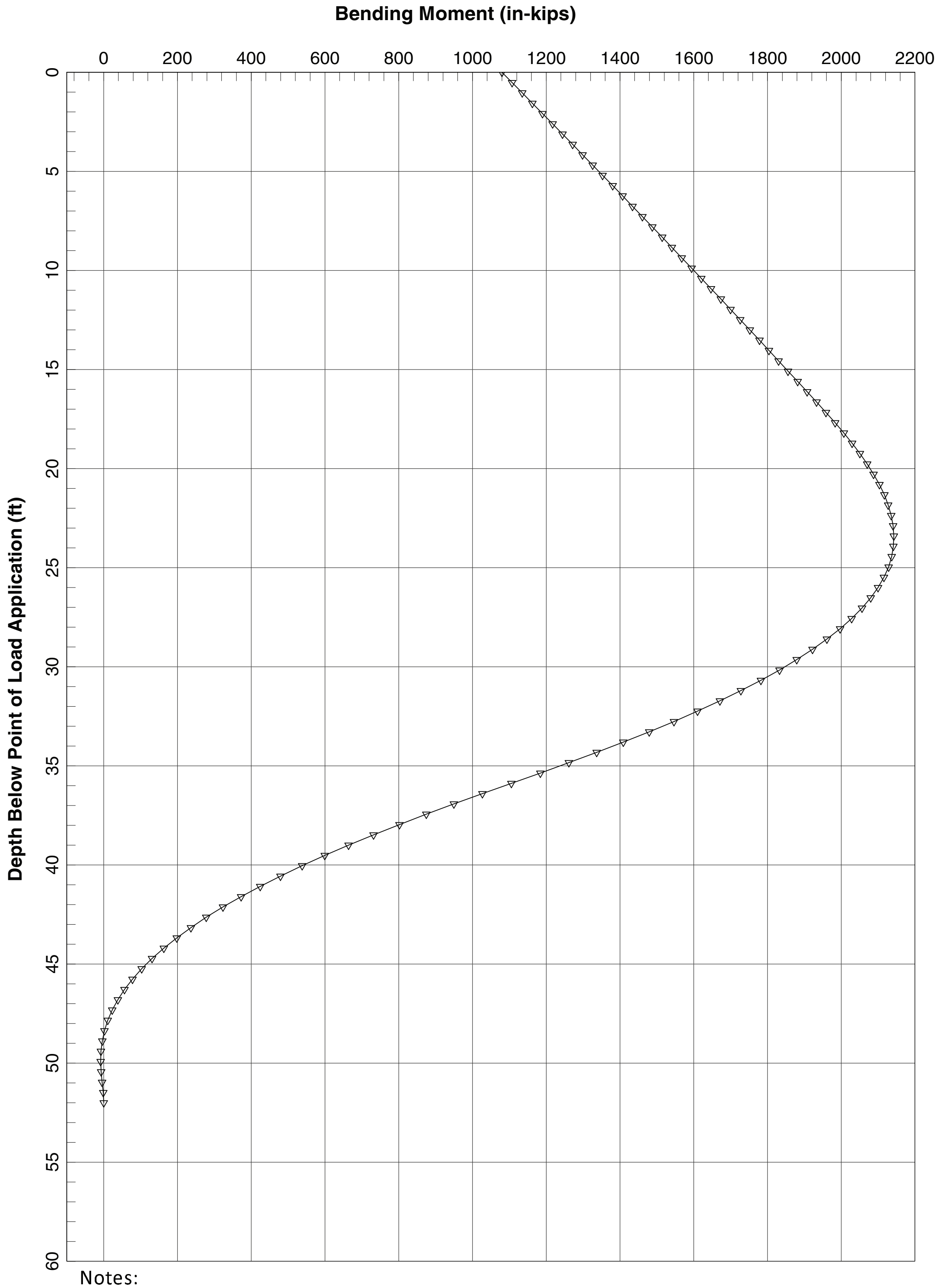
Treadwell&Rollo
A LANGAN COMPANY



Notes:

1. The profiles shown are for a single 12-inch diameter, 52 foot long prestressed precast concrete pile with an applied lateral load of 3.6 kips and moment of 90 kip-feet. The only axial compressive load is the self-weight of the pile.
2. The loads and moment are applied at Elevation 9 feet (MLLW).

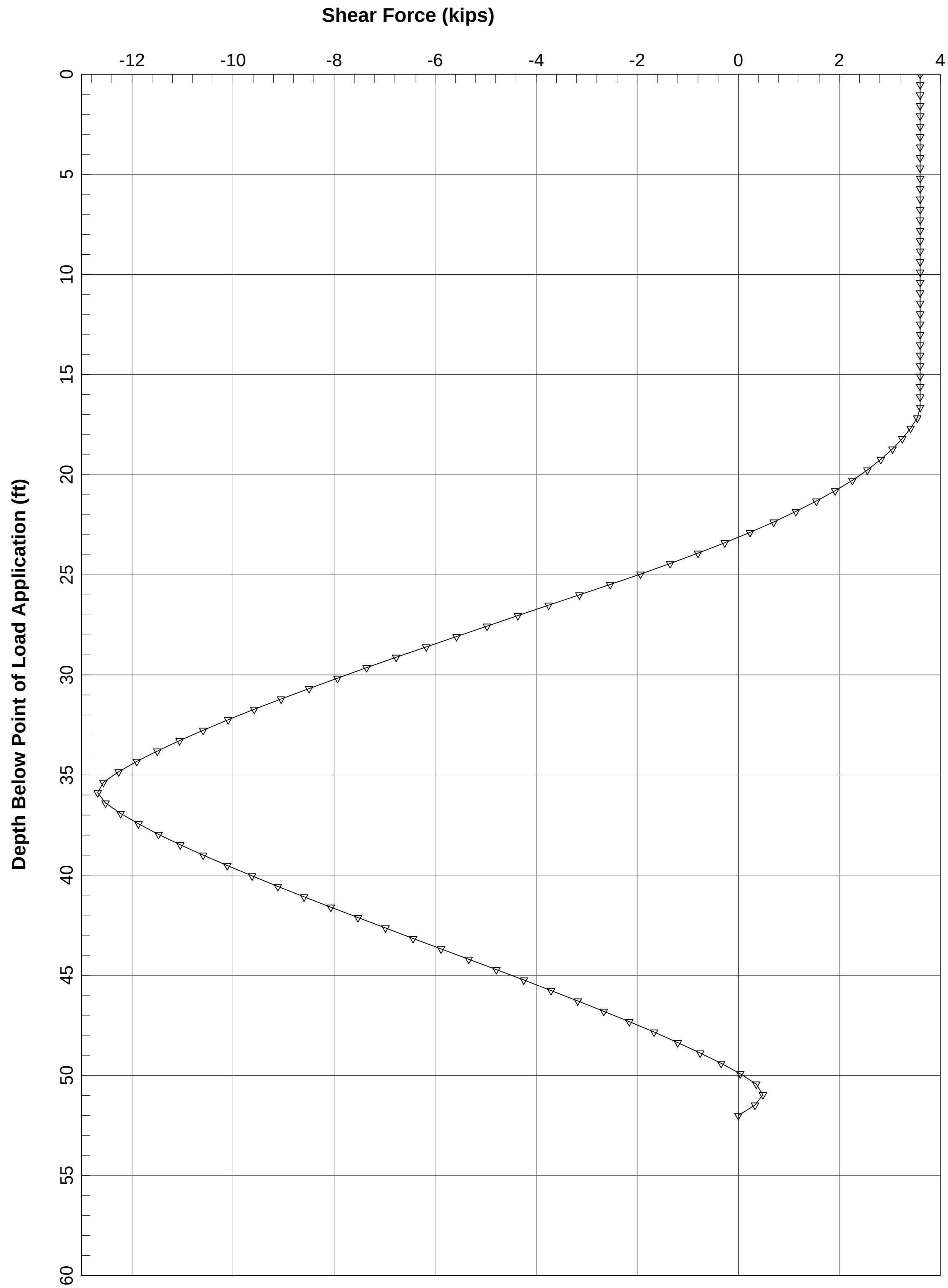
OYSTER POINT MARINA **DOCKS 8 AND 11 MODIFICATIONS** South San Francisco, California	**LATERAL DEFLECTION** **12-INCH SQUARE CONCRETE PILE** **FREE HEAD - DOCK 8**
Treadwell&Rollo A LANGAN COMPANY	Date 06/20/12 | Project No. 731556802 | Figure 3



Notes:

1. The profiles shown are for a single 12-inch diameter, 52 foot long prestressed precast concrete pile with an applied lateral load of 3.6 kips and moment of 90 kip-feet. The only axial compressive load is the self-weight of the pile.
2. The loads and moment are applied at Elevation 9 feet (MLLW).

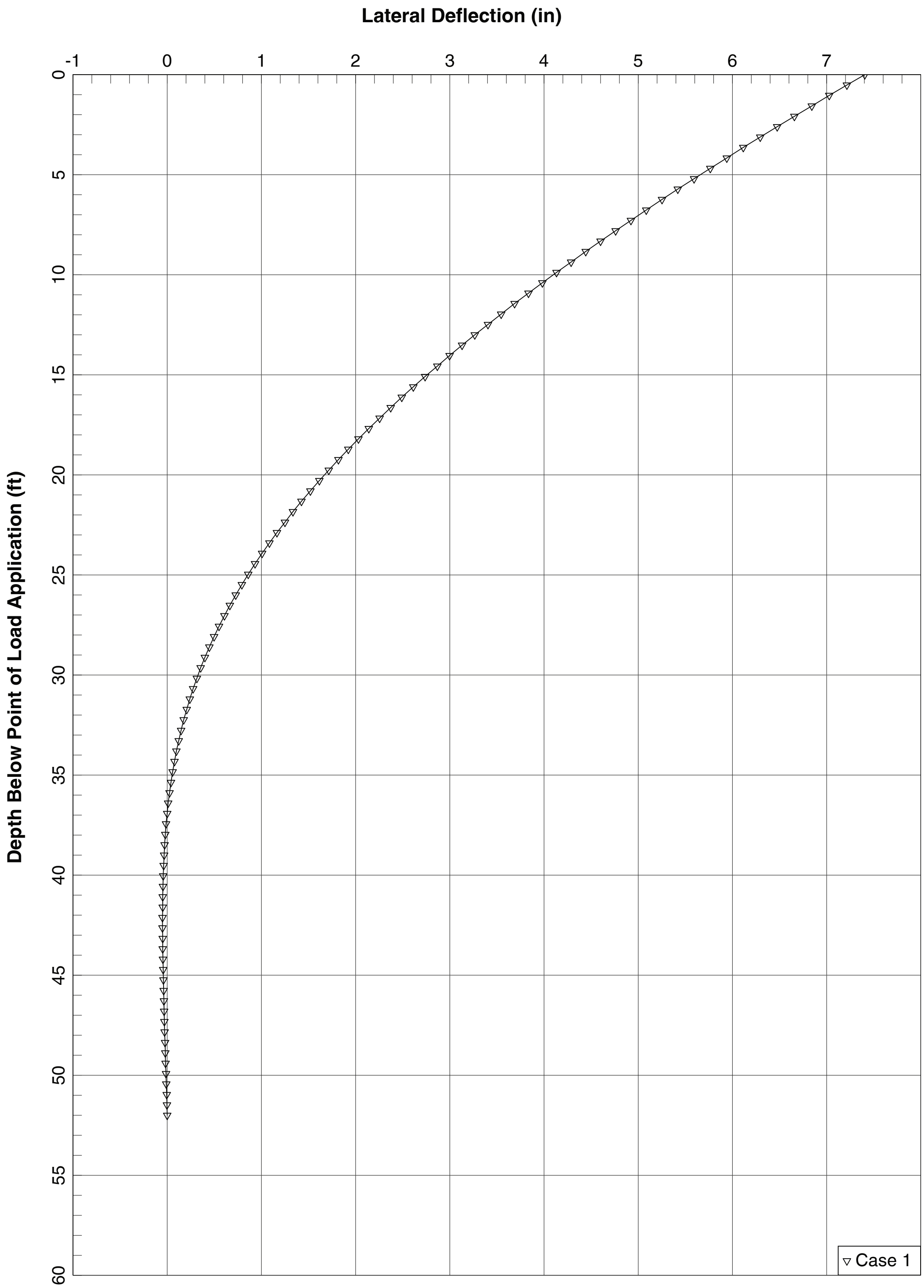
OYSTER POINT MARINA DOCKS 8 AND 11 MODIFICATIONS South San Francisco, California	BENDING MOMENT 12-INCH SQUARE CONCRETE PILE FREE HEAD - DOCK 8
Treadwell&Rollo A LANGAN COMPANY	Date 06/20/12 | Project No. 731556802 | Figure 4



Notes:

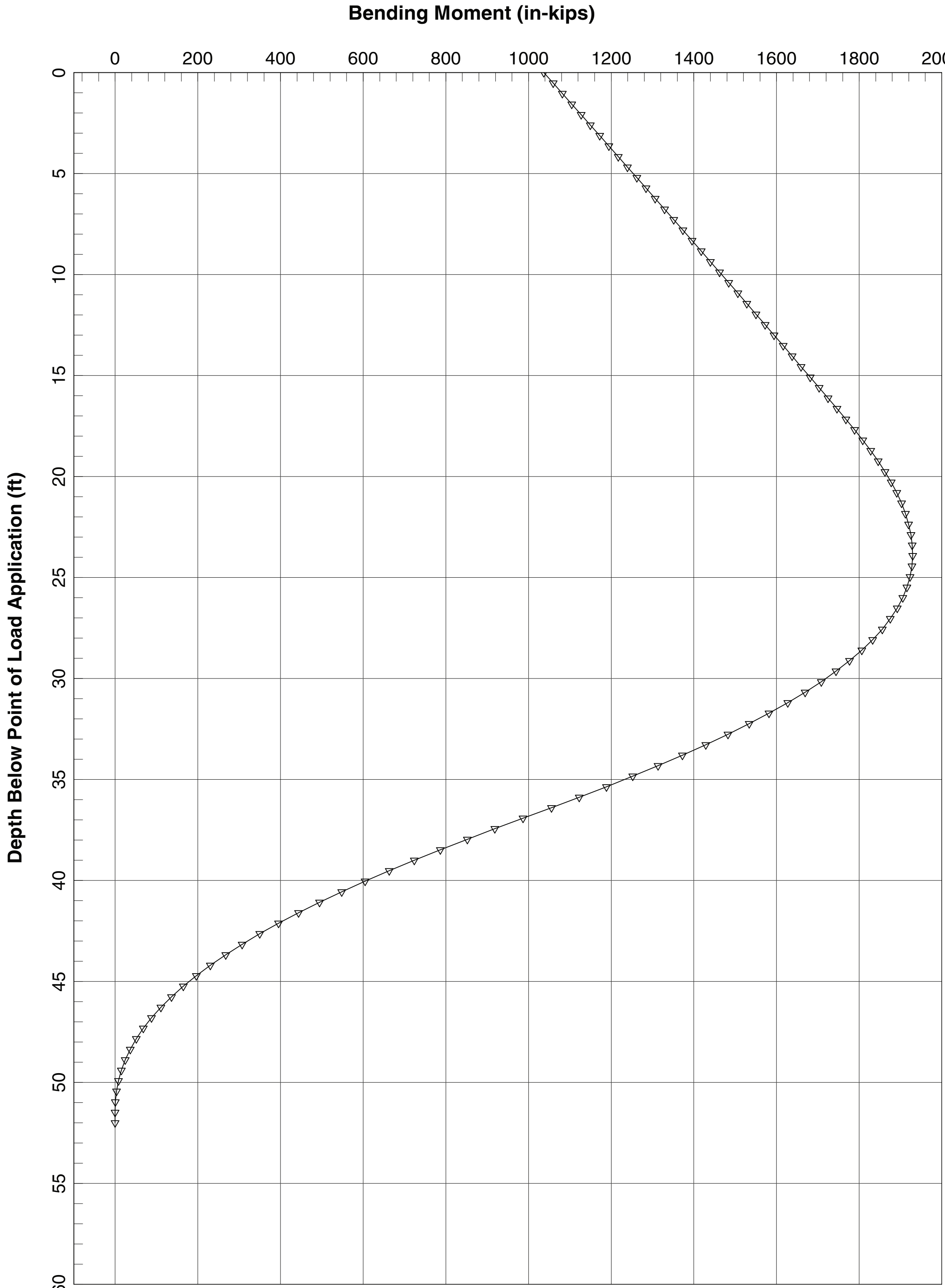
1. The profiles shown are for a single 12-inch diameter, 52 foot long prestressed precast concrete pile with an applied lateral load of 3.6 kips and moment of 90 kip-feet. The only axial compressive load is the self-weight of the pile.
2. The loads and moment are applied at Elevation 9 feet (MLLW).

OYSTER POINT MARINA **DOCKS 8 AND 11 MODIFICATIONS** South San Francisco, California	**SHEAR FORCE** **12-INCH SQUARE CONCRETE PILE** **FREE HEAD - DOCK 8**
Treadwell&Rollo A LANGAN COMPANY	Date 06/20/12 | Project No. 731556802 | Figure 5



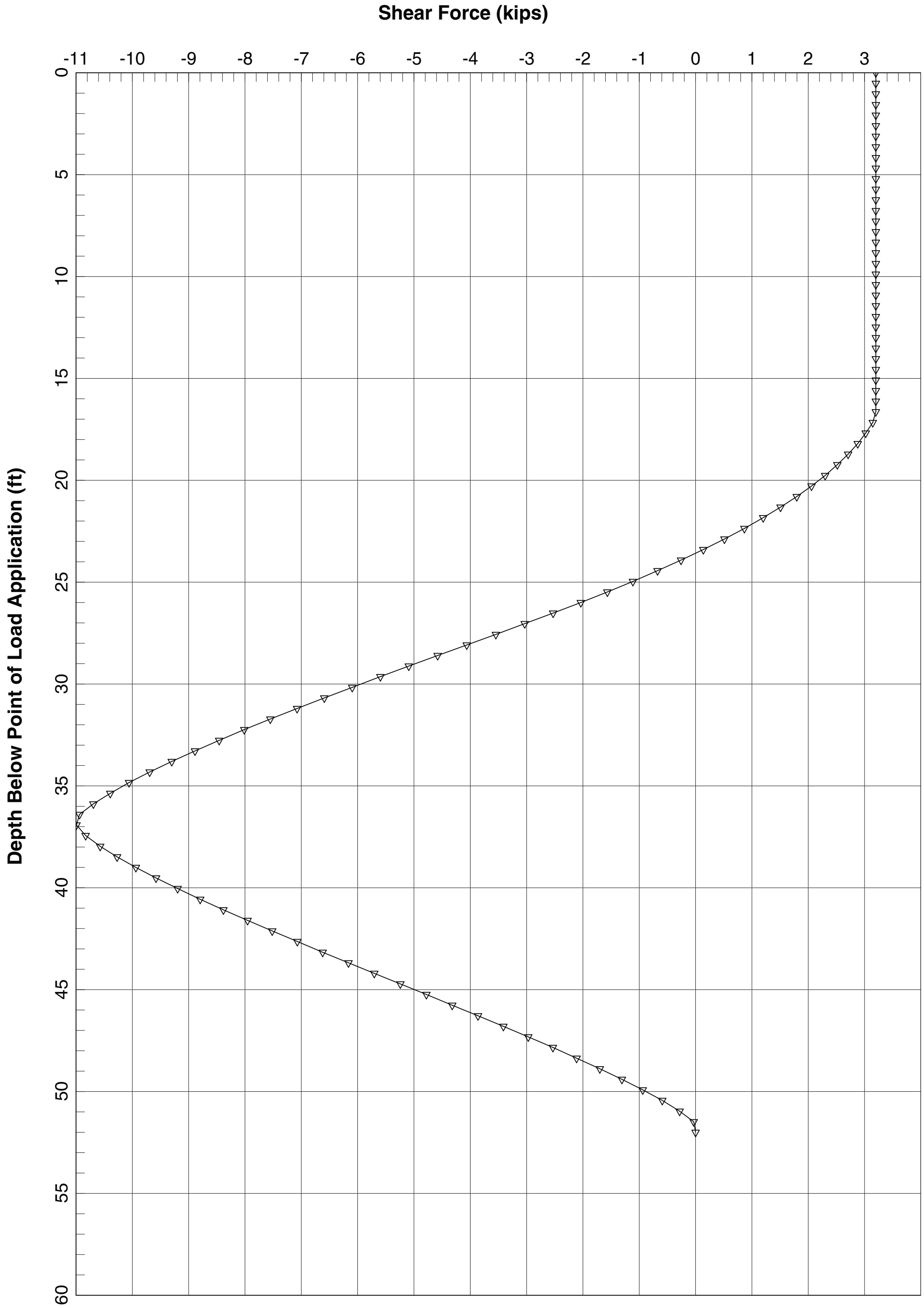
1. The profiles shown are for a single 16-inch diameter prestressed precast concrete pile with an applied lateral load of 3.2 kips and moment of 86.4 kip-feet. The pile should be embedded at least 35 feet below the mudline for fixity. The only axial compressive load is the self-weight of the pile.
2. The loads and moment are applied at Elevation 9 feet (MLLW).

OYSTER POINT MARINA **DOCKS 8 AND 11 MODIFICATIONS** South San Francisco, California Treadwell&Rollo *A LANGAN COMPANY*	**LATERAL DEFLECTION** **16-INCH SQUARE CONCRETE PILE** **FREE HEAD - DOCK 11** Date 06/20/12 | Project No. 731556802 | Figure 6



1. The profiles shown are for a single 16-inch diameter prestressed precast concrete pile with an applied lateral load of 3.2 kips and moment of 86.4 kip-feet. The pile should be embedded at least 35 feet below the mudline for fixity. The only axial compressive load is the self-weight of the pile.
2. The loads and moment are applied at Elevation 9 feet (MLLW).

OYSTER POINT MARINA **DOCKS 8 AND 11 MODIFICATIONS** South San Francisco, California	**BENDING MOMENT** **16-INCH SQUARE CONCRETE PILE** **FREE HEAD - DOCK 11**
Treadwell&Rollo A LANGAN COMPANY	Date 06/20/12 | Project No. 731556802 | Figure 7



1. The profiles shown are for a single 16-inch diameter prestressed precast concrete pile with an applied lateral load of 3.2 kips and moment of 86.4 kip-feet. The pile should be embedded at least 35 feet below the mudline for fixity. The only axial compressive load is the self-weight of the pile.
2. The loads and moment are applied at Elevation 9 feet (MLLW).

OYSTER POINT MARINA
DOCKS 8 AND 11 MODIFICATIONS
South San Francisco, California

Treadwell&Rollo
A LANGAN COMPANY

SHEAR FORCE
16-INCH SQUARE CONCRETE PILE
FREE HEAD - DOCK 11

Date 06/20/12 | Project No. 731556802 | Figure 8

APPENDIX A

Boring Logs from Previous Investigation

PROJECT:	SOUTH SAN FRANCISCO FERRY TERMINAL OYSTER POINT MARINA South San Francisco, California	Log of Boring B-1 PAGE 1 OF 6

Boring location: See Site Plan, Figure 2	Logged by: J. Nicoletto
Date started: 3/3/07	Date finished: 3/3/07
Drilling method: Rotary Wash	
Hammer weight/drop: 140 lbs./30 inches	Hammer type: Automatic Hammer
Sampler: Sprague & Henwood (S&H), Standard Penetration Test (SPT), Shelby Tube (ST)	

Ground Surface Elevation: -6.6/ -7.5 foot[1]

DEPTH (feet)	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
0–1					CH	CLAY (CH) dark gray, very soft, wet, with shell fragments [BAY MUD]						
7	ST			<25 psi			TxUU	220	160		71.0	58
12	ST			<25 psi			TxUU	400	190		72.5	54
13						grades soft						
15					CH	BAY MUD						
17	ST			<25 psi			TxUU	600	310		70.8	58
22	ST			<25 psi			TxUU	790	310		69.5	59
27	ST			<25 psi			TxUU	980	250		80.8	53
30												

LABORATORY TEST DATA

Treadwell&Rollo
A LANGAN COMPANY

Project No.: 4177.03 | Figure: A-1a

TEST GEOTECH LOG 417703.GPJ TR.GDT 4/7/11

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
						CLAY (CH) (continued)						
31												
32	ST			<25 psi			TxUU	1,170	420		80.1	53
33												
34												
35												
36						No recovery						
37	ST			<25 psi								
38												
39						grades medium stiff						
40												
41												
42	ST			<25 psi			TxUU	1,540	550		59.4	65
43												
44												
45					CH	BAY MUD						
46												
47												
48												
49												
50												
51												
52	ST			<25 psi								
53												
54												
55												
56												
57												
58												
59												
60												

PROJECT:	SOUTH SAN FRANCISCO FERRY TERMINAL OYSTER POINT MARINA South San Francisco, California	Log of Boring B-1 PAGE 3 OF 6

DEPTH (feet)	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
						CLAY (CH) (continued)						
61												
62	ST			<25 psi			TxUU	2,290	700		56.1	67
63												
64												
65												
66												
67												
68												
69												
70												
71												
72	ST			<25 psi								
73												
74												
75					CH	BAY MUD						
76												
77												
78												
79												
80												
81												
82												
83	ST			<25 psi								
84												
85												
86												
87												
88												
89												
90												

Treadwell&Rollo
A LANGAN COMPANY

Project No.: 4177.03

Figure: A-1c

PROJECT:	SOUTH SAN FRANCISCO FERRY TERMINAL OYSTER POINT MARINA South San Francisco, California	Log of Boring B-1 PAGE 4 OF 6

DEPTH (feet)	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
					CH	CLAY (CH) (continued)						
91					SC	CLAYEY SAND (SC) gray, dense, wet						
93	ST			<25 psi			TxUU	3,460	1,210		16.2	117
96	SPT			33						34.2		
102						color change to olive-brown						
104	SPT			43						21.5		
112					SP	SAND with GRAVEL (SP) olive-gray, dense, wet						
114						Particle Size Analysis, see Figure B-27						
115	SPT			45						4.1		
118					CH	CLAY (CH) gray, stiff, wet, with shell fragments high silt content [OLD BAY CLAY]						
120												

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Project No.: 4177.03 | Figure: A-1d

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DEPTH (feet)	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
					CH	CLAY (CH) (continued) — OLD BAY CLAY						
121												
122												
123												
124												
125	SPT			13								
126												
127												
128												
129												
130												
131												
132												
133												
134												
135												
136	ST			1,150 psi	CL	SANDY CLAY (CL) yellow-brown and gray-brown, very stiff, wet	TxUU	5,850	3,250		22.2	106
137												
138	S&H			27								
139												
140												
141												
142												
143												
144												
145												
146												
147												
148												
149												
150												

PROJECT:	SOUTH SAN FRANCISCO FERRY TERMINAL OYSTER POINT MARINA South San Francisco, California	Log of Boring B-1 PAGE 6 OF 6

DEPTH (feet)	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
151					CL	SANDY CLAY (CL) (continued)						
152						CLAYEY SAND (SC) brown, very dense, wet						
156	ST			1,750 psi			TxUU	7,400	7,700	28.2	16.6	115
160					SC							
163						grades with gravel from 163 to 169 feet						
169					CH	CLAY (CH) gray, very stiff, wet						
171	S&H			27			TxUU	8,340	3,340		22.6	105
180												

Boring was terminated at a depth of 171.5 feet.
Boring backfilled with cement grout.
Boring was performed over water.

[1] S&H and SPT blow counts verted to SPT-N values using factors of 0.8 and 1.33, respectively
[2] Elevation based on field measurements and published tide tables for Oyster Point Marina and survey data plus estimated silt accumulation

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Project No.: 4177.03 | Figure: A-1f

PROJECT:	SOUTH SAN FRANCISCO FERRY TERMINAL OYSTER POINT MARINA South San Francisco, California	Log of Boring B-2 PAGE 1 OF 5

Boring location: See Site Plan, Figure 2

Date started: 3/12/07 | Date finished: 3/13/07

Drilling method: Rotary Wash

Hammer weight/drop: 140 lbs./30 inches | Hammer type: Automatic Hammer

Sampler: Standard Penetration Test (SPT), Shelby Tube (ST)

Logged by: A. Scavullo

LABORATORY TEST DATA

Ground Surface Elevation: -6.8/ -6.5 foot[1]

DEPTH (feet)	Sampler Type	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
0–1				CH	CLAY (CH) dark gray, very soft, wet, with shell fragments (BAY MUD, 0–30 ft)						
4	ST		0 psi			TxUU	120	70		70.1	58
9	ST		25 psi			TxUU	300	120		66.4	59
14	ST		25 psi			TxUU	490	210		67.6	60
17					grades soft						
19	ST		40 psi			TxUU	680	300		61.6	63
24	ST		<25 psi			TxUU	860	430		64.8	61
29	ST		200 psi			TxUU	1,050	430		77.0	55

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Project No.: 4177.03 | Figure: A-2a

PROJECT:	SOUTH SAN FRANCISCO FERRY TERMINAL OYSTER POINT MARINA South San Francisco, California	Log of Boring B-2 PAGE 2 OF 5

DEPTH (feet)	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
	ST					CLAY (CH) (continued)						
31												
32												
33												
34	ST			<25 psi			TxUU	1,430	420		76.1	55
35												
36												
37												
38												
39	ST			<25 psi			TxUU	1,630	440		61.2	64
40												
41												
42												
43												
44						grades mediums stiff						
45					CH	BAY MUD						
46												
47												
48												
49												
50	ST			<25 psi			TxUU	1,180	670		58.7	65
51												
52												
53												
54												
55												
56												
57												
58												
59	ST			<25 psi								
60												

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Project No.:	Figure:
4177.03	A-2b

PROJECT:	SOUTH SAN FRANCISCO FERRY TERMINAL OYSTER POINT MARINA South San Francisco, California	Log of Boring B-2 PAGE 3 OF 5

DEPTH (feet)	SAMPLES: Sampler Type	Sample	Blows/ 6"	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
	ST			<25 psi		CLAY (CH) (continued)						
61												
62												
63												
64												
65												
66												
67												
68												
69												
70	ST			25 psi			TxUU	2,590	800		56.1	67
71												
72												
73												
74												
75					CH	BAY MUD						
76												
77												
78												
79												
80	ST			25 psi			TxUU	2,970	870		52.5	69
81												
82												
83												
84												
85												
86												
87												
88												
89												
90												

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Figure: A-2c

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PROJECT:	SOUTH SAN FRANCISCO FERRY TERMINAL OYSTER POINT MARINA South San Francisco, California	Log of Boring B-2 PAGE 4 OF 5

DEPTH (feet)	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
						CLAY (CH) (continued)						
91					SC	CLAYEY SAND (SC) olive-gray, medium dense, wet						
95	ST			150-250 psi								
100	SPT			29						37.8		
110	SPT			27						14.4		
115					CH	CLAY (CH) gray, stiff, wet, with shall fragments [OLD BAY CLAY] OLD BAY CLAY						
120	SPT			13								

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Figure: A-2d

PROJECT:	SOUTH SAN FRANCISCO FERRY TERMINAL OYSTER POINT MARINA South San Francisco, California	Log of Boring B-2 PAGE 5 OF 5

DEPTH (feet)	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
	SPT			13	CH	CLAY (CH) (continued)						
121–132					CH	OLD BAY CLAY						
133					CL	SANDY CLAY (CL) yellow-brown and gray-brown, very stiff, wet Consolidation Test, see Figure B-1						
135	ST			250 psi	CL		TxUU	6,060	3,720	53.9	17.3	113
144					SC	CLAYEY SAND(SC) brown, very dense, wet, with gravel						
147	ST			600 psi	SC		TxUU	6,970	5,260	13.8	18.8	110
148–150												

Boring was terminated at a depth of 148.5 feet.
Boring backfilled with cement grout.
Boring was performed over water.

[1] S&H and SPT blow counts verted to SPT-N values using factors of 0.8 and 1.33, respectively
[2] Elevation based on field measurements and published tide tables for Oyster Point Marina and survey data plus estimated silt accumulation

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