Geotechnical Study for Pond 6-7-8, Napa Plant Site Restoration

FIELD EXPLORATION

As part of the geotechnical studies, one exploratory boring (B-1) was drilled near the east end of the interior levee between Ponds 7 and 7A on November 16, 2006. Two additional exploratory borings (B-3 and B-4) were drilled near Milton Road along the eastern boundary of Pond 8 on June 18, 2007. The locations of the soil borings are shown on Figures B-1 through B-3, Site Plan and Boring Location Plan. Note that boring designation B-2 was not used. URS obtained the soil boring permits from the Napa County Department of Environmental Management (NCDEM). Underground Services Alert was notified at least 48 hours prior to the scheduled drilling dates to clear the underground utility lines. The site is clear of any underground or above-ground utility lines.

Each boring extended to a depth of about 30 feet below the existing ground surface (bgs). The borings were drilled using a Minuteman drill rig owned and operated by Access Soil Drilling Inc. of San Mateo, California. The borings were advanced using the hollow-stem auger drilling technique with a 4-inch solid stem auger and a 2-½-inch-diameter drag bit on drill rods. Mr. Kyle Wolfe and Mr. Stephan Leung of URS logged the soil cuttings and samples in the field in accordance with the Unified Soil Classification System as the drilling proceeded. In addition, URS collected four bulk samples from the proposed levee excavation areas near Ponds 7 and 7A in either 5-gallon buckets or 1-gallon zip-top bags. The locations of the bulk samples are also shown on Figures B-1 and B-2. These bulk samples were collected to evaluate the suitability of the in-situ materials as the proposed fills.

Soil samples were obtained at selected depths in the boring by advancing the sampler into the soil at the bottom of the borehole. Three types of sampling equipment were utilized:

- Modified California Sampler - 2-inch I.D., 2-½-inch O.D., split-barrel sampler equipped with three thin brass tube liners, each 6 inches long.
- California Sampler - 2-½-inch I.D., 3-inch O.D., split-barrel sampler equipped with three thin brass tube liners, each 6 inches long
- Shelby Tube Thin Wall Sampler – 2.86 inch I.D., 3-inch O.D., 30-inch long sampler.

The Modified California and California samplers were threaded to fit a cutting shoe on one end and a check-valve connection at the other end. After the borehole was drilled to the specified depth, the sampler mounted on the drill rods was lowered to the bottom, seated, and then driven into the soil with a manual 140-pound safety hammer falling approximately 30 inches for each blow. The number of hammer blows required to advance the sampler each of the three successive 6-inch increments was counted in the field. The number of blows required to advance the sampler the last 12 inches was recorded as the penetration resistance (blows-per-foot). These blowcounts were used to determine density and consistency of the soils. The Shelby tube sampler was advanced using a hydraulic push method. The gauge pressure to advance the sampler was monitored during and recorded following the push.

Soil recovered from the Modified California and California samplers were retained in the thin brass liners. When the sampler was brought to the surface, the liners were taken from the sample barrel and sealed at both ends with plastic caps. The Shelby tube samples were retained in the sampler tube and sealed at both ends.

After drilling and sampling, the boreholes were backfilled with neat cement grout in conformance with the NCDEM requirements. Drill cuttings and wash water were spread on the site away from the pond. The soil samples collected in the field were taken to Signet Labs in Hayward, California, for further visual examination and testing.

The logs of borings were prepared based on the field logs, visual examination and laboratory test results. The logs of borings attached at the end of this Appendix show the soil classifications of the subsurface strata encountered, locations where soil samples were obtained, type of sampler used, sampling resistance, and the results of several laboratory tests.

LABORATORY TESTING

Representative soil samples obtained from the exploratory borings were tested at Signet Labs in Hayward, California, to evaluate their engineering properties for use in the analyses. The following laboratory tests were performed on selected soil samples:

- Moisture content (ASTM D2216),
- Dry density (ASTM D2937),
- Unconfined compressive strength (ASTM D2166),
- One-dimensional consolidation (ASTM D2435), and
- Atterberg limits (ASTM D4318).

Results of moisture content, dry density, unconfined compressive strength and Atterberg limit determinations are presented in the logs of borings at the corresponding sample depths, together with the resistance-to-penetration of the sampler (blow count). The results of the laboratory test results are shown on Tables B-1 and B-2 at the end of this Appendix.

SUBSURFACE SOIL CONDITIONS

The subsurface soil encountered in soil boring B-1 consists of an 8 feet thick levee fill layer. The fill material consists of high plasticity clay silt and fat clay. It is URS' understanding that these materials were dredged from the adjacent ponds at the time of the levee construction. The fill layer is underlain with a 20 feet thick fat silty clay layer. A 2 feet thick medium to high plasticity clayey silt layer was encountered at the bottom of the boring.

URS was not able to drill additional borings around Ponds 6 and 6A due to difficulties in accessing the site. The idealized soil profile developed from the boring B-1 was assumed to be applicable for Ponds 6/6A and 7/7A. The engineering parameters of the idealized soil profile for Ponds 6/6A and 7/7A are presented in Table 1.

Table 1
Idealized Soil Profile for Ponds 6/6A and 7/7A

Soil Type	Thickness (feet)	Unit Weight (pcf)	Cohesion (psf)	Friction Angle (deg)
Fill: Clayey Silt/Fat Clay	8	95	700	0
Alluvium: Fat Clay	16	90	125	0
Silty Clay	4	120	880	0
Clayey Silt	2	125	2750	0

The subsurface soil encountered in soil borings B-3 and B-4 consists of about a 7 feet thick soft to medium stiff silty clay layer underlain by very soft to soft fat clay to the bottom of the boring. The engineering parameters of the idealized soil profile developed for Pond 8 from borings B-3 and B-4 are presented in Table 2.

Table 2
Idealized Soil Profile for Pond 8

Soil Type	Thickness (feet)	Unit Weight (pcf)	Cohesion (psf)	Friction Angle (deg)
Silty Clay/Fat Clay	30	125	250	0

GROUNDWATER CONDITIONS

Groundwater level was not recorded in the field during the field investigations. However, it is URS' opinion that it fluctuates with the water level in the ponds.

SLOPE STABILITY

Methodology and Assumptions

URS evaluated the appropriate side slopes for the proposed levees improvements at Ponds 6-7-8 using the idealized soil profile developed for the project based on the results of the subsurface investigation. URS performed the slope stability analyses of the typical levee cross sections using UTEXAS3 Computer Program by S. G. Wright (1991) and using Spencer's Method.

As discussed above, the levees at Ponds 6-7-8 are predominantly supported by soft to medium stiff clayey soils. The undrained shear strength of soft to medium stiff clay is generally weaker than the drained shear strength due to excess porewater pressure. It is URS opinion that the end-of-construction condition using the undrained shear strengths represents the critical condition. The long-term service condition of the levee after the excess porewater pressure dissipated would be represented by the drained shear strength. URS developed the idealized levee cross sections for the slope stability analysis based on the maximum proposed levee fill with respect to the existing grade at the levee crest. This represents the critical levee configuration from the slope stability standpoint. Analysis was performed for both circular and wedge-shaped failure surfaces.

URS assumed that the proposed fill material has a friction angle of 34 degrees and a total unit weight of 140 pcf. This assumption was based on a review of the proposed fill material from the existing borrow sources and engineering judgment.

For Ponds 6/6A and 7/7A, the critical levee configuration requires 4 feet of additional fill to raise the levee from the Elevation[1] 6 to 10 feet. The groundwater table (GWT) configuration representing the service conditions varies linearly from the Elevation of 5.0 feet to 5.5 feet across the levee. The above scenario was modeled in three different ways represented by three different cases listed below. A drainage canal is located on the eastern side of Pond 7. Based on the current design, the bottom of the canal is planned to be lowered from the Elevation 2 to 0 feet. This scenario formed Case 4 of the slope stability analyses performed for the project. Accordingly, the following four cases were analyzed:

1. Placement of 4 feet of additional fill to raise the levee crest from the Elevation 6 to 10 feet. Analysis was performed using a circular failure surface.
2. Placement of 4 feet of additional fill to raise the levee crest from the Elevation 6 to 10 feet. Analysis was performed using a wedge-shaped failure surface.
3. Placement of 2 feet of additional fill to raise the levee crest from the Elevation 6 to 8 feet. Analysis was performed using a wedge-shaped failure surface.
4. Placement of 2 feet of additional fill to raise the levee crest from the Elevation 6 to 8 feet. Waterside ground surface at Ponds 6/6A and 7/7A was lowered from the Elevation 2 to 0 feet. Analysis was performed using a wedge-shaped failure surface.

For Pond 8, the selected idealized levee cross-section was modeled using three different thicknesses of new fill resulting in three cases. In addition, the third scenario was evaluated using both circular and non-circular failure surfaces. Therefore, a total of 4 cases as listed below were analyzed.

1. Placement of 1.5 feet of new fill to raise the levee crest from the Elevation 5.5 to 7 feet.
2. Placement of 2.5 feet of new fill to raise the levee crest from the Elevation 5.5 to 8 feet.

1. The vertical datum is NAV88

3. Placement of 4.5 feet of new fill to raise the levee crest from the Elevation 5.5 to 10 feet. Analysis was performed using a circular failure surface.
4. Placement of 4.5 feet of new fill to raise the levee crest from the Elevation 5.5 to 10 feet. Analysis was performed using a wedge-shaped failure surface.

The GWT at Pond 8 was modeled at the Elevation 5.5 feet on the waterside and at the Elevation 4.5 ft on the landside. The GWT varies linearly from the Elevation 5.5 to 4.5 feet across the levee. In all cases, the side slope of 2:1 (Horizontal : Vertical) was used.

Stability Criteria

The minimum factor of safety (F.S.) for levee slope stability evaluation as recommended by the U.S. Army Corps of Engineers' Engineering Manual entitled "EM 1110-2-1913, Engineering and Design - Design and Construction of Levees," dated April 30, 2000 is 1.3 for the end-of-construction stability.

Results and Recommendations

The results of the slope stability analyses for the above four cases for Ponds 6/6A and 7/7A are summarized in Table 3. The potential failure planes are presented on Figures B-4 through B-7. Based on the results of the slope stability analyses, Case 2 results in F.S. less than 1.3. URS re-evaluated the levee slope stability of Case 2 with 2 feet of fill, shown as Case 3 on Table 3. The resulting minimum F.S. for Case 3 is higher than the minimum required F.S. of 1.3 for the end-of-construction condition. Therefore, URS recommends limiting the total height of new fill to 2 feet or less. Case 4 also satisfies the minimum F.S. criterion. Therefore, it is URS' opinion that slope stability failure is not a major concern for Ponds 6/6A and 7/7A side slopes, provided the height of additional fill is limited to 2 feet.

Table 3

Slope Stability Analysis Results - Ponds 6/6A and 7/7A

Case No.	Thickness of Fill (feet)	Finished Levee Elevation (feet)	Failure Surface	F.S.
1	4	10	Circular	2.1
2	4	10	Wedge-shaped	1.1
3	2	8	Wedge-shaped	1.4
4	2	8	Wedge-shaped	1.3

The results of the slope stability analyses for Pond 8 are summarized in Table 4 and shown on Figures B-8 through B-11. Since the resulting minimum F.S. for the cases analyzed are higher than the minimum required F.S. of 1.3 for the end-of-construction condition, it is URS' opinion that slope stability failure is not a major concern for Pond 8 side slopes.

Table 4
Slope Stability Analysis Results – Pond 8

Case No.	Thickness of New Fill	Finished Levee Elevation (feet)	Failure Surface	F.S.
1	1.5	7	Circular	4.3
2	2.5	8	Circular	2.9
3	4.5	10	Circular	1.9
4	4.5	10	Wedge-Shaped	1.8

Based on the above results, URS recommends the following for the design and construction of the levees for Ponds 6-7-8:

- The height of additional fill placed on the top of levees at Ponds 6/6A and 7/7A be limited to 2 feet. This limitation does not apply to the Pond 8 levees; and
- Side slopes of 2H:1V or flatter be used in the design of the levees.

SETTLEMENT ANALYSIS

Methodology and Assumptions

Two types of settlement resulting from the levee improvements were estimated. The first type consists of the immediate settlement corresponding to the instantaneous "elastic" compression of the soil when subjected to loading. The second consists of the long-term consolidation settlement that corresponds to the slow volume change associated with the excess pore pressure dissipation as the soil is subjected to a sustained load.

URS estimated the immediate settlements at Ponds 6-7-8 using the equations developed by Timoshenko and Goodier (1951). Long-term settlements due to consolidation of the underlying compressible clayey soil layers were estimated using Terzaghi's principles of one-dimensional consolidation. For Ponds 6/6A and 7/7A, the consolidation parameters were developed based on the correlations with specific index properties from the laboratory test results. The consolidation parameters for Pond 8 were developed based on the results of a consolidation test and the correlations with specific index properties.

Results and Recommendations

Based on the results of the above analysis, the immediate settlement due to the levee improvements was estimated to be on the order of 2 inches and are therefore not considered a concern. The consolidation settlement at Ponds 6-7-8 was estimated to be on the order of approximately 2.5 feet due to 2 feet of additional fill. Based on the nature of

the clayey soil below the levees and the rate of the consolidation settlement, it is URS' opinion that consolidation settlement will take much longer than the service life of the levees to be completed. URS estimates that about 20 percent of the consolidation settlement estimated above will occur during the construction period. The post-construction consolidation settlement may necessitate periodic monitoring of the levees and sporadic repairs, but is not likely to adversely affect the integrity of the levees. It is URS recommendation that the finish grade elevation of the levee crests be monitored periodically for ground surface settlement and integrity of the side slopes. Additional fill or minor repair work may be required to maintain the performance of the levees.

BEARING CAPACITY

Methodology and Assumptions

Bearing capacity is the capacity of soil to support the loads applied to the ground. The bearing capacity of soil is the maximum average contact pressure between the foundation and the soil which will not produce shear failure in the supporting soil. Ultimate bearing capacity is the theoretical maximum pressure which can be supported. Allowable bearing capacity is the ultimate bearing capacity divided by a factor of safety.

The bearing capacity at Ponds 6-7-8 was estimated using a simplified form of the bearing capacity equation developed by Terzaghi (1943). Since the shallow foundations are likely to be supported by the fat clay layer identified in Table 1, an undrained cohesion of 125 psf and a bearing capacity factor of 5.14 corresponding to a friction angle of 0^0 (Vesic, 1973) was used in the analysis resulting in an ultimate bearing capacity of approximately 640 psf.

Results and Recommendations

Based on the above analysis, the following allowable bearing pressures are recommended at the pond elevation for Ponds 6-7-8:

Dead Loads	200 psf (Factor of Safety 3)
Dead and Live Loads	250 psf (Factor of Safety of 2.5)
All Loads, including Wind or Seismic:	320 psf (Factor of Safety of 2.0)

PILE FOUNDATIONS

Methodology and Assumptions

The maintenance bridges at Pond 7/7A are proposed to be supported on pile foundations. Given the environmental concerns at the project site, the current preference is to use timber piles. Tapered timber piles of 12 inches in diameter at the top, 8 inches in diameter at the bottom, and 45 feet long will be used at the site.

URS performed axial capacity analysis to determine the minimum length of the timber piles required to support the axial loads provided by the Structural Engineer. The idealized soil profile developed for Ponds 6/6A and 7/7A (Table 1) was used in the axial capacity analysis. The relationship between the adhesion factors and shear strength of

soils developed by Tomlinson (1971) was used to calculate the unit skin friction and, therefore, the axial capacity of the selected pile.

In addition, lateral capacity analyses were performed for the selected timber pile at Ponds 7/7A. Soil-pile interaction under axial and lateral loading was modeled using the nonlinear Winkler foundation models. The computer program LPILE Plus Version 5.0 by Ensoft, Inc. was utilized to analyze the individual pile response to the applied lateral and axial loads with a series of nonlinear springs that are internally generated by the program as a function of the soil properties. Pile properties used in the analyses include length, diameter, moment of inertia, area, and modulus of elasticity. The piles were modeled using pinned-head conditions. Table 5 shows the three loading scenarios that were analyzed.

Results and Recommendations

Based on the results of the axial capacity analyses, a minimum embedded length of 25 feet is required for the selected tapered timber pile at Ponds 7/7A to provide an allowable axial capacity of 12 kips per pile.

Based on the results of the lateral capacity analyses tabulated on Table 5, the lateral deflections calculated at the top of the pier satisfy the 1 inch criterion for all the cases analyzed.

Table 5
Lateral Capacity Analysis

Case No.	Free Height of Pile Above Ground Surface (feet)	Lateral Force at Pile Head (kips)	Pier Head Deflection (inches)
1	2.5	4.5	0.40
2	8.0	0.3	0.04
3	8.0	0.2	0.03

Therefore, it is URS recommendation that a minimum embedded length of 25 feet be used to obtain the required allowable pier capacity of 12 kips at the maintenance bridges proposed to be constructed at Ponds 7/7A.

These analyses were performed exclusively for the proposed pile-supported structures at Ponds 7/7A and are not applicable to the other portions of the project site. Pile-supported structures are not currently proposed to be constructed at Ponds 6/6A and 8. URS can provide recommendations for pile foundations at Ponds 6/6A and 8 in the future, if needed.

SEEPAGE ANALYSIS

Methodology and Assumptions

Seepage is the flow of a fluid through soil pores. When the seepage velocity reaches the critical level, erosion can occur because of the frictional drag exerted on the soil particles. Based on a review of the subsurface conditions encountered at Ponds 6-7-8, the levees at the project site are underlain with clayey soil with relatively low permeability. Given the nature of the subsurface conditions, a detailed quantitative seepage analysis was not deemed necessary for the project and a qualitative assessment was made.

Results and Recommendations

As stated above, the levees at the project site are underlain with primarily cohesive materials with relatively low permeability. It is URS' opinion that seepage through the existing levee is minimal and if any, has been stabilized over the years. This will not adversely affect the integrity of the levees.

LIQUEFACTION POTENTIAL

Methodology and Assumptions

Liquefaction is a phenomenon whereby saturated sediments temporarily lose shear strength and collapse. This condition is caused by cyclic loading during earthquake shaking that generates high porewater pressures within the sediments and results in a drastic reduction in the soil strength. Under some circumstances soil may behave similar to a viscous liquid, thus the term "liquefaction".

The soil most susceptible to liquefaction is loose, cohesionless, granular soil below the water table and within about 50 feet of the ground surface. Liquefaction can result in loss of foundation support and settlement of overlying structures, ground subsidence and translation due to lateral spreading, and differential settlement of affected deposits.

Results and Recommendations

Based on the subsurface conditions encountered during the geotechnical investigation, the site consists primarily of cohesive materials that are not considered potentially liquefiable. Therefore, it is URS' opinion that the geologic hazard due to liquefaction is negligible at the project site.

REFERENCES

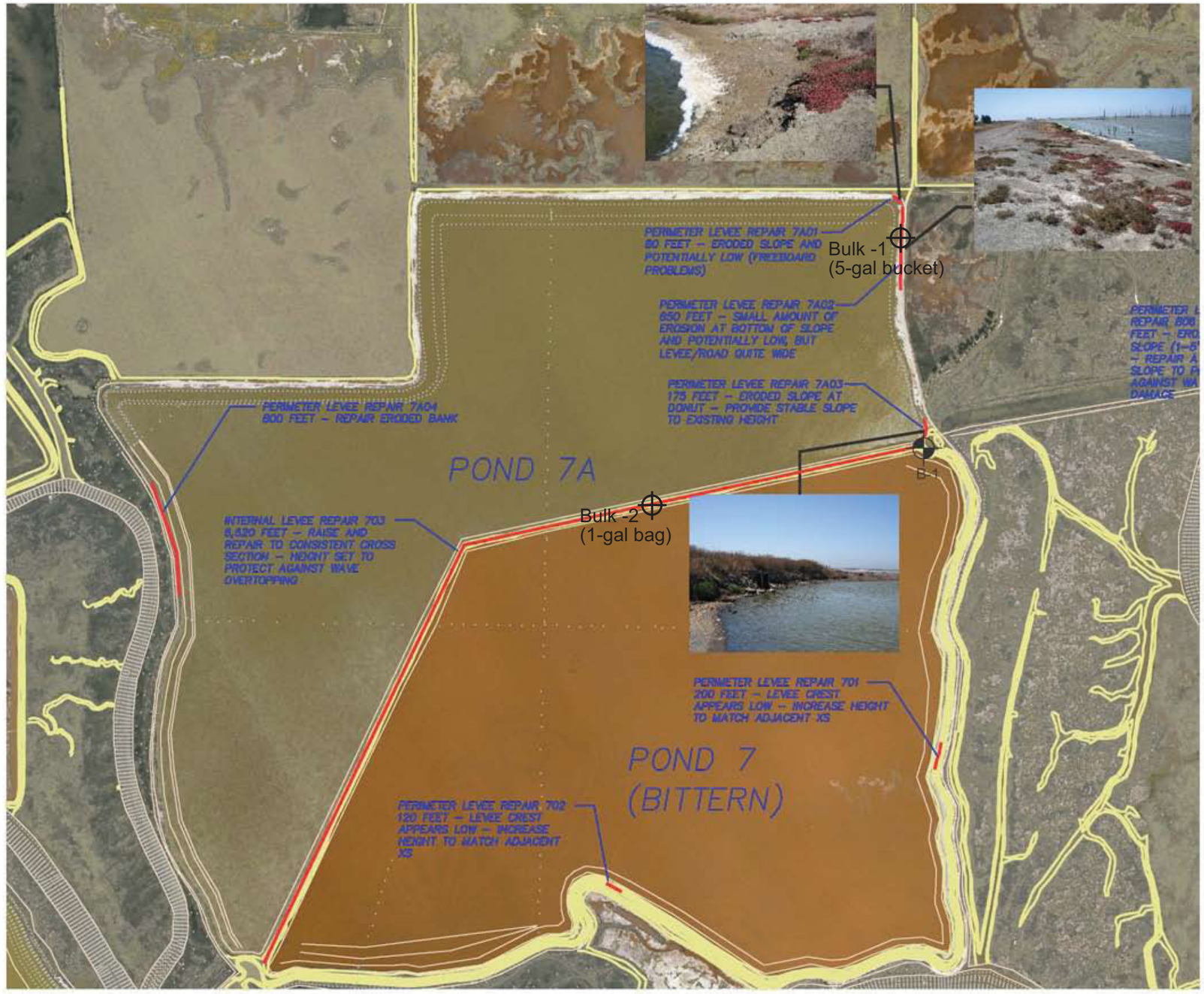
Terzahgi, K., 1943, Theoretical Soil Mechanics, John Wiley & Sons, New York, pp. 510.

Timoshenko, S. and Goodier, J.N., 1951, Theory of Elasticity, 2nd Edition, McGraw-Hill, New York, pp. 506.

Tomlinson, M.J., 1971, Some Effects of Pile Driving on Skin Friction, Proc. Conference on Behaviour of Piles, ICE, London, pp. 107-114.

Vesic, A.S., 1973, Analysis of Ultimate Loads of Shallow Foundations, JSMFD, ASCE, vol. 99, SM1, January, pp.45-73.

Wright, S.G., 1991, Limit Equilibrium Slope Stability Equations Used in the Computer Program UTEXAS3, Geotechnical Engineering Software GS 91-2, Geotechnical Engineering Center, University of Texas, Austin.



Levee Improvement Area

B-1 Boring Location

Bulk Samples

URS	Napa Salt Marsh Restoration Ponds 6-7-8 American Canyon, CA Project No. 26815678	SITE PLAN & BORING LOCATION PLAN-1	Figure B-1

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Levee Improvement Area

Bulk Samples

URS	Napa Salt Marsh Restoration Ponds 6-7-8 American Canyon, CA Project No. 26815678	SITE PLAN & BORING LOCATION PLAN-2	Figure B-2

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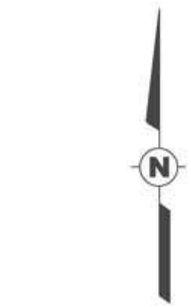


800' 0 800' 1600'

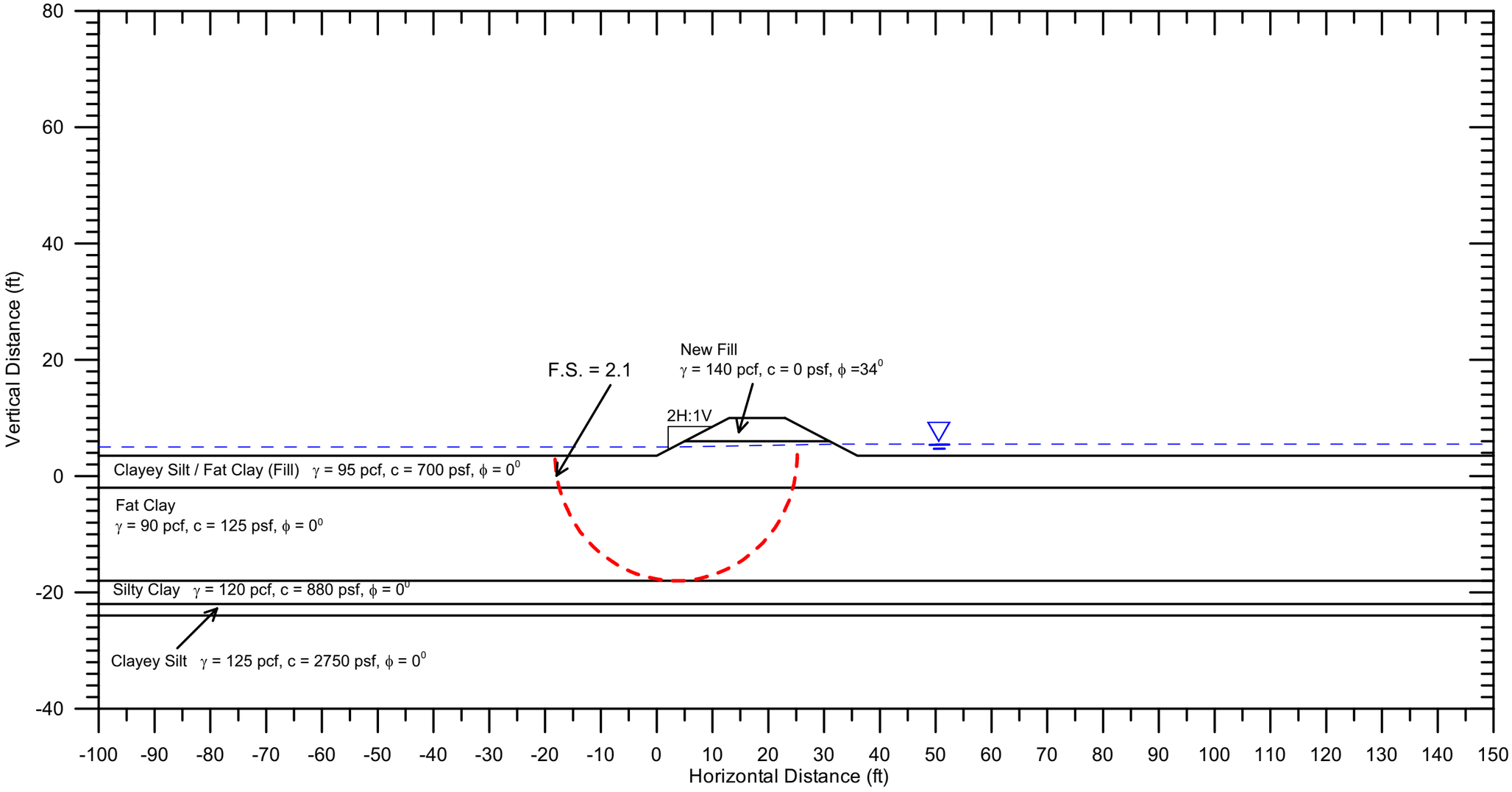
SCALE: 1"= 800'

Levee Improvement Area

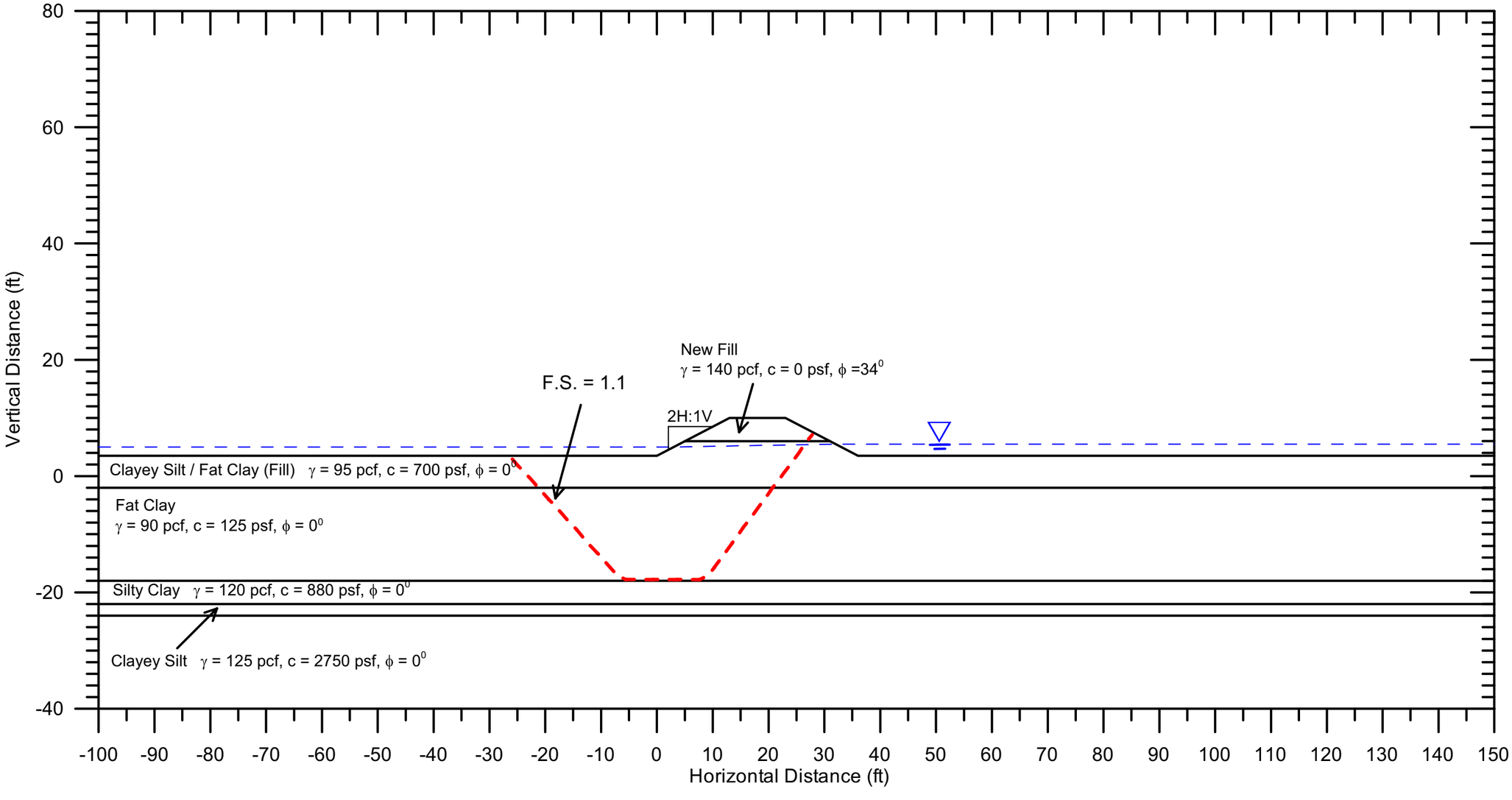
Soil Borings

Note: Boring designation 'B-2' was not used.

URS	Napa Salt Marsh Restoration Ponds 6-7-8 American Canyon, CA Project No. 26815678	SITE PLAN & BORING LOCATION PLAN-3	Figure B-3



URS	Napa Plant Site American Canyon, CA Project No. 26815678	SLOPE STABILITY RESULTS NAPA PLANT SITE PONDS 6 & 7 CROSS SECTION 7-03 LEVEE	Figure B-4



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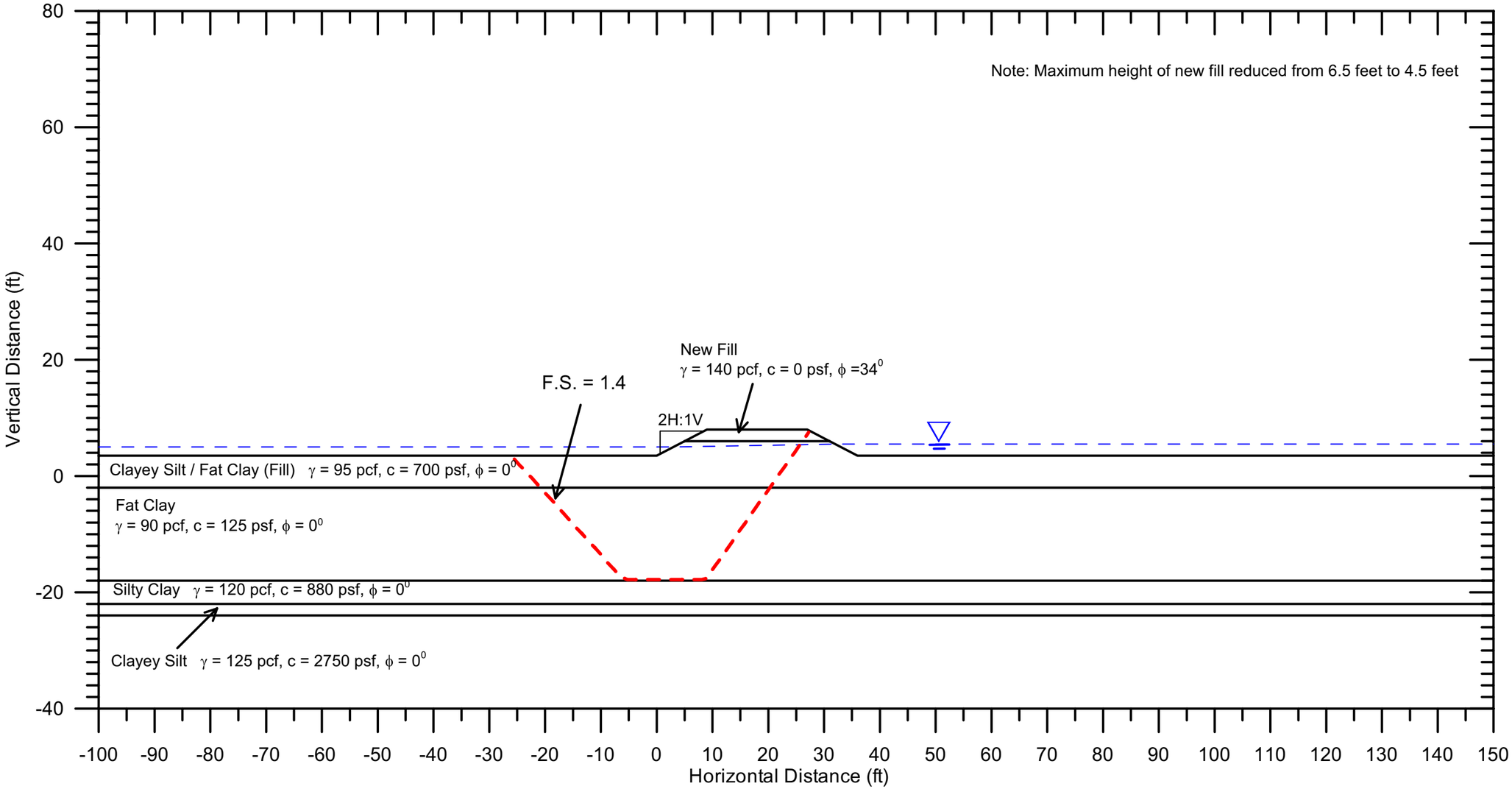

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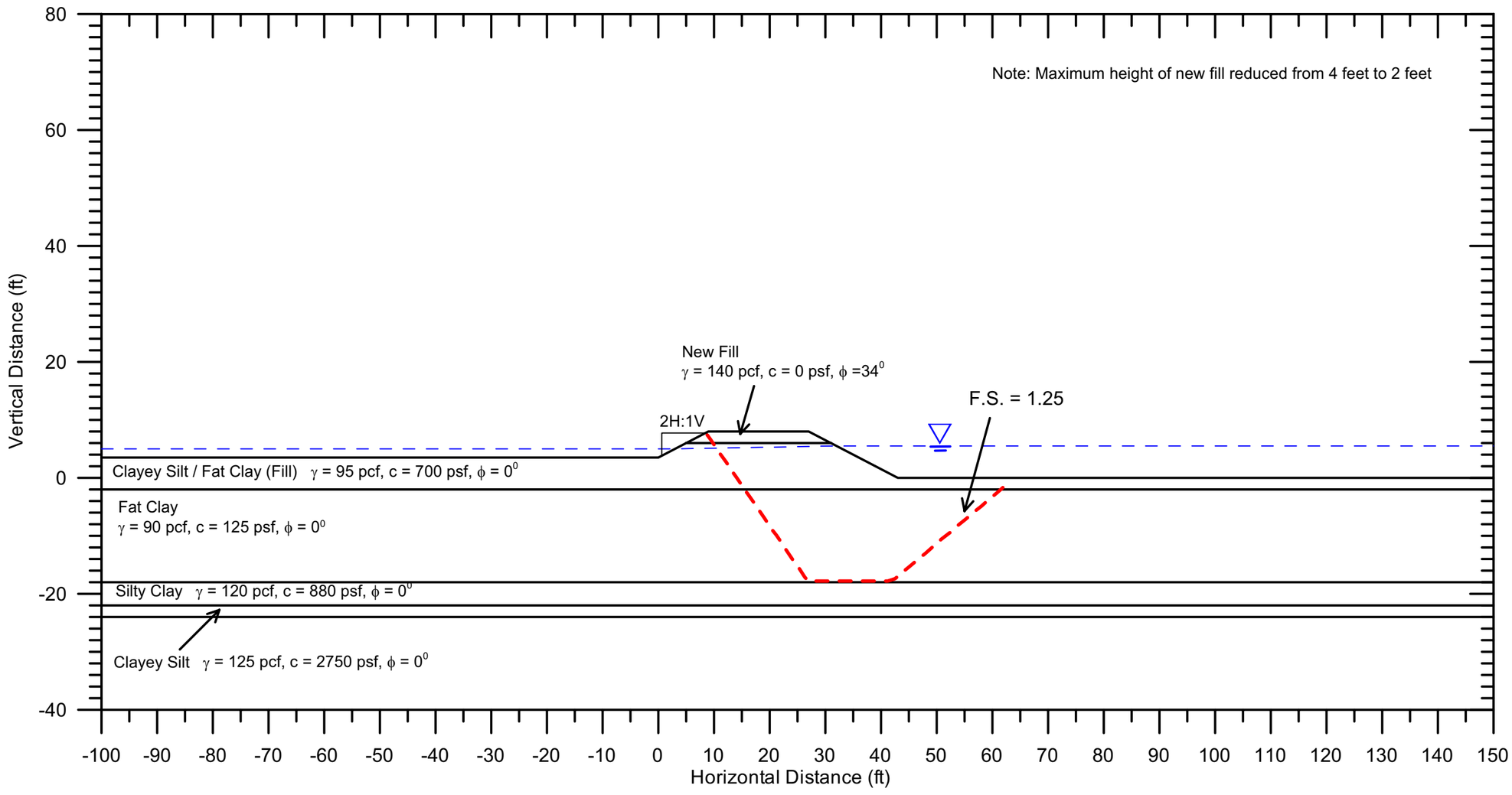
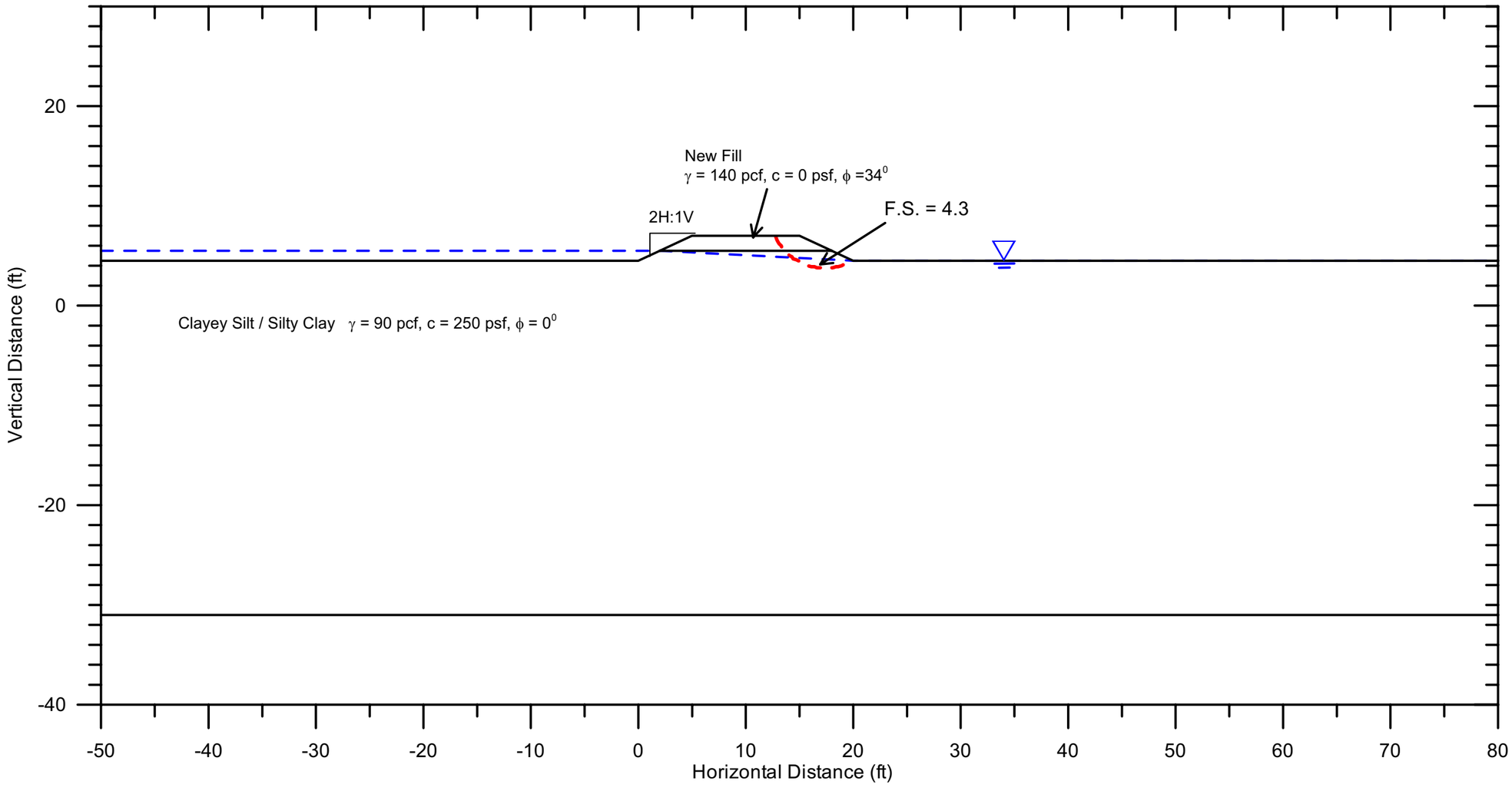
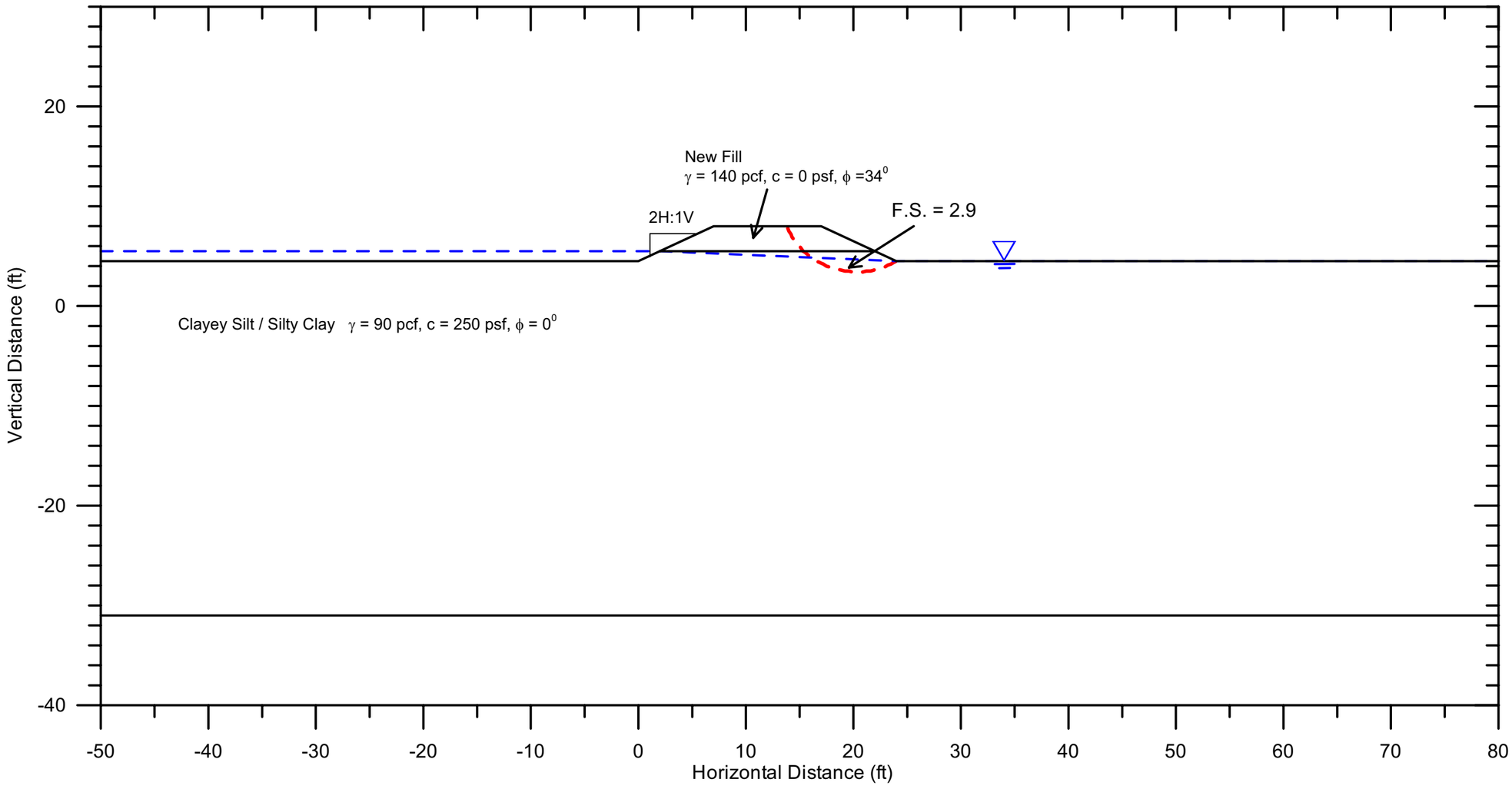


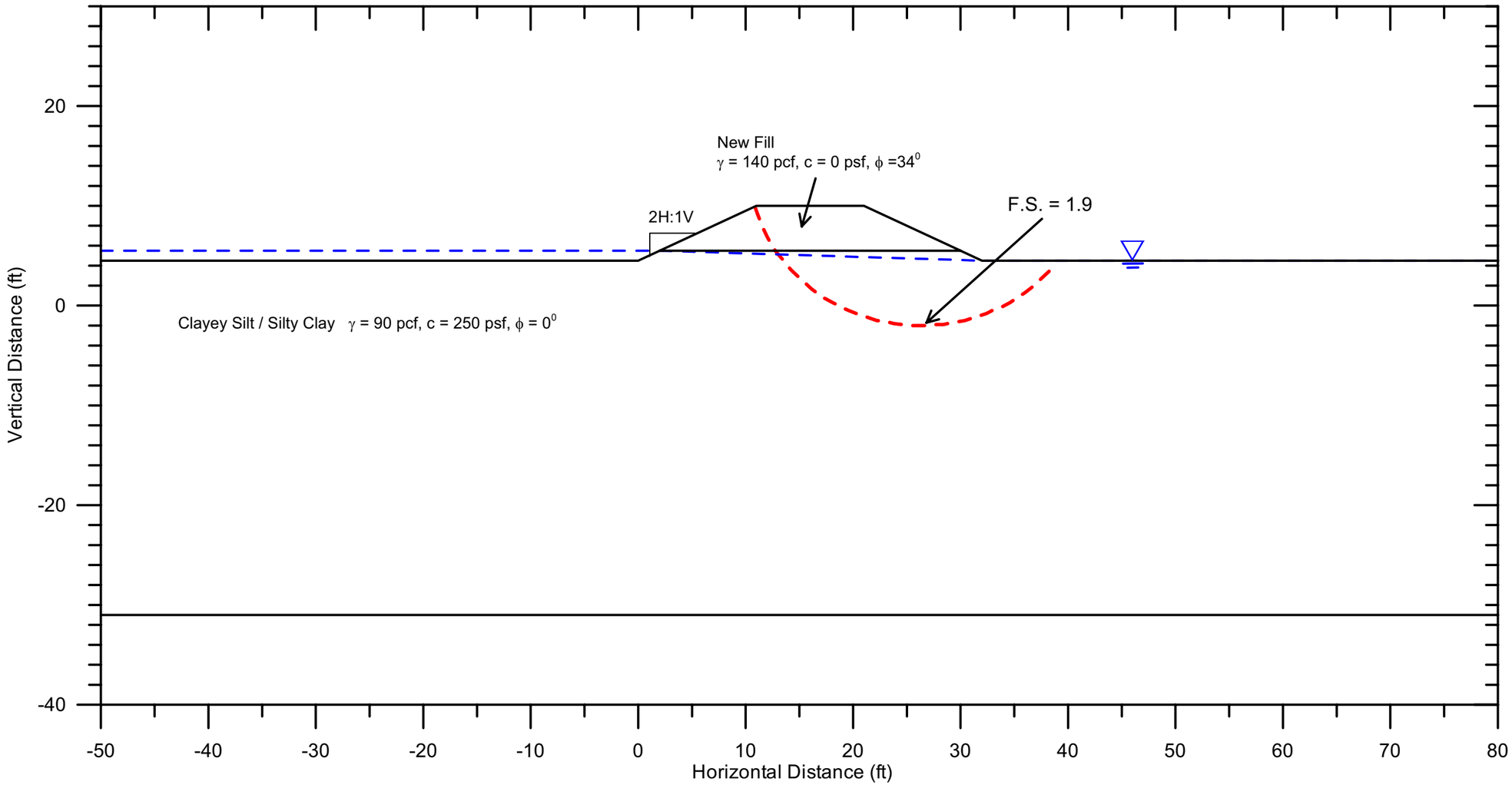
URS	Napa Plant Site American Canyon, CA Project No. 26815678	SLOPE STABILITY RESULTS NAPA PLANT SITE PONDS 6 & 7 CROSS SECTION 7-03 LEVEE	Figure B-7



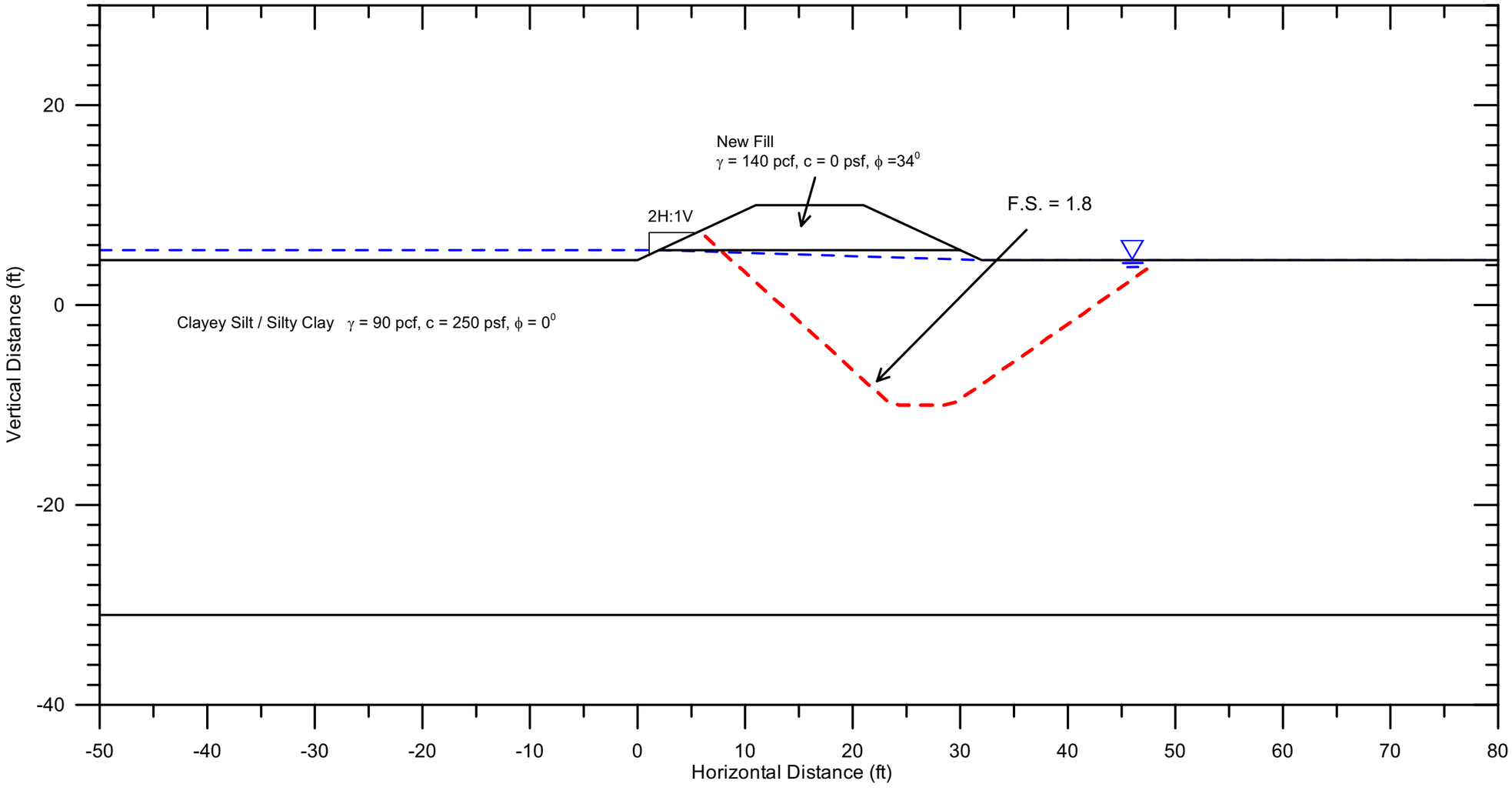
URS	Napa Plant Site American Canyon, CA Project No. 26815678	SLOPE STABILITY RESULTS NAPA PLANT SITE POND 8 CROSS SECTION 8-07 LEVEE (CREST ELEVATION: 7 FT)	Figure B-8



URS	Napa Plant Site American Canyon, CA Project No. 26815678	SLOPE STABILITY RESULTS NAPA PLANT SITE POND 8 CROSS SECTION 8-07 LEVEE (CREST ELEVATION: 8 FT)	Figure B-9



URS	Napa Plant Site American Canyon, CA Project No. 26815678	SLOPE STABILITY RESULTS NAPA PLANT SITE POND 8 CROSS SECTION 8-07 LEVEE (CREST ELEVATION: 10 FT)	Figure B-10



URS	Napa Plant Site American Canyon, CA Project No. 26815678	SLOPE STABILITY RESULTS NAPA PLANT SITE POND 8 CROSS SECTION 8-07 LEVEE (CREST ELEVATION: 10 FT)	Figure B-11

Project: Napa Salt Marsh Restoration , Ponds 6-7-8
Project Location: Napa, California
Project Number: 26815678

Key to Log of Boring

Elevation feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	Sampling Resistance	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Unconfined Compressive Strength, psf	REMARKS AND OTHER TESTS
1	2	3	4	5	6	7	8	9	10	11	12

COLUMN DESCRIPTIONS

1 **Elevation:** Elevation in feet referenced to specified datum.

2 **Depth:** Depth in feet below the ground surface.

3 **Sample Type:** Type of soil sample collected at depth interval shown; sampler symbols are explained below.

4 **Sample Number:** Sample identification number.

5 **Sampling Resistance:** Number of blows required to advance driven sampler 12 inches beyond first 6-inch interval, or distance noted, using a 140-lb hammer with a 30-inch drop; or down-pressure for pushed sampler.

6 **Recovery:** Percentage of driven or pushed sample length recovered; "NA" indicates data not recorded.

7 **Graphic Log:** Graphic depiction of subsurface material encountered; typical symbols are explained below.

8 **Material Description:** Description of material encountered; may include density/consistency, moisture, color, and grain size.

9 **Water Content:** Water content of soil sample measured in laboratory, expressed as percentage of dry weight of specimen.

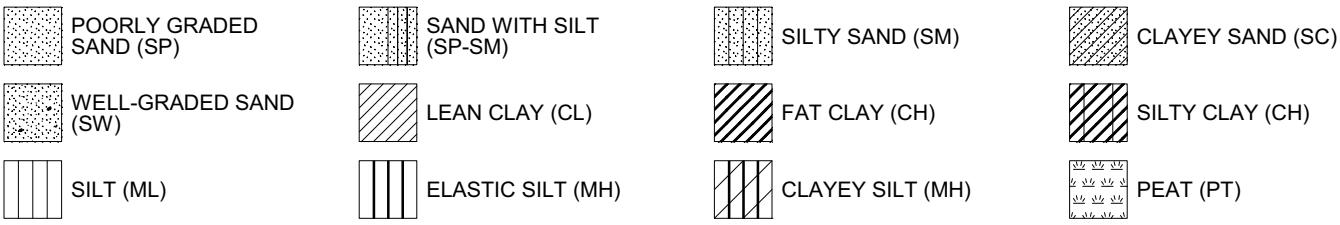
10 **Dry Unit Weight:** Dry weight per unit volume of soil measured in laboratory, expressed in pounds per cubic feet (pcf).

11 **Unconfined Compressive Strength:** Unconfined compressive strength of soil sample measured in laboratory, expressed in psf.

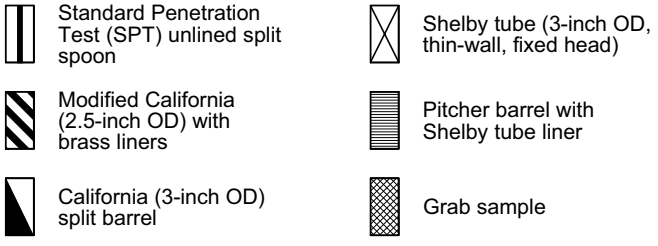
12 **Remarks and Other Tests:** Comments and observations regarding drilling or sampling made by driller or field personnel. Other field and lab test results, using the following abbreviations:

CONS	One-dimensional consolidation test
LL	Liquid Limit (from Atterberg Limits)
PI	Plasticity Index (from Atterberg Limits), NP=nonplastic
WA	Wash on #200, percent passing #200 sieve

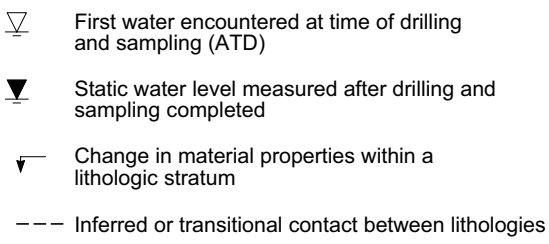
TYPICAL MATERIAL GRAPHIC SYMBOLS



TYPICAL SAMPLER GRAPHIC SYMBOLS



OTHER GRAPHIC SYMBOLS



GENERAL NOTES

1. Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive; actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.

2. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

Project: Napa Salt Marsh Restoration, Ponds 6-7-8
Project Location: Napa, California
Project Number: 26815678

Log of Boring B-1

Sheet 1 of 1

Date(s) Drilled	**11/16/06**	Logged By	**K. Wolfe**	Checked By	**A. Ooraikul**
Drilling Method	**Solid Flight Auger**	Drill Bit Size/Type	**4-inch solid-stem auger bit**	Total Depth of Borehole	**30.0 feet**
Drill Rig Type	**Minuteman Portable Rig**	Drilling Contractor	**Access Soil Drilling**	Surface Elevation	**Not available**
Groundwater Level(s)	**Not recorded**	Sampling Method(s)	**Grab, Modified California**	Hammer Data	**Downhole hammer; 140 lbs, 30-inch drop**
Borehole Backfill	**Neat cement grout**	Location	**East end of interior levee between Ponds 7 and 7A**		

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	Sampling Resistance, blows / foot	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Unconfined Compressive Strength, psf	REMARKS AND OTHER TESTS
	0	GRAB	1				CLAYEY SILT (MH) [Fill] Medium stiff to stiff, moist, dark brown, high plasticity, trace roots				Start at 09:45. Cutting from 1-3 ft collected in bag.
			1-1	6	100			60.5	60	2190	LL=98, PI=56
	5		1-2	7	100		FAT CLAY (CH) [Fill] Soft to medium stiff, moist, dark gray with black and orange mottles, high plasticity	68.8	56	850	
							FAT CLAY (CH) Very soft, wet, dark gray with black mottles, high plasticity				
	10		1-3	3	100			85.6	49	280	
	15		1-4	2	100			105.5	44	160	LL=95, PI=61
	20		1-5	2	100		With highly decayed wood fragments	115.2	40	330	
	25		1-6	9	100		SILTY CLAY (CH) Medium stiff, moist, dark bluish gray, high plasticity	27.6	96	1760	LL=53, PI=38
			1-7	31	100		CLAYEY SILT (ML/MH) Very stiff, moist, tan-brown, medium to high plasticity	24.6	100	5520	
	30						Bottom of boring at 30.0 feet				End drilling at 12:00.
	35										

Report: GEO_10B1_OAK; File: OAK_NAPASALT.GPJ; 12/14/2006 B-01

Project: Napa Salt Marsh Restoration Project - Pond 8
Project Location: Napa, California
Project Number: 26815678

Log of Boring B-3

Sheet 1 of 1

Date(s) Drilled	**6/18/07**	Logged By	**S. Leung**	Checked By	**S. Upadhyaya**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**4-inch-dia. auger, 2-1/2-inch bit**	Total Depth of Borehole	**31.5 feet**
Drill Rig Type	**Minuteman Portable Rig**	Drilling Contractor	**Access Soil Drilling, Inc.**	Surface Elevation	**Not available**
Groundwater Level(s)	**Not measured**	Sampling Method(s)	**Standard California**	Hammer Data	**Manual hammer; 140 lbs, 30-inch drop**
Borehole Backfill	**Neat cement grout**	Location	**End of Milton Road, approx. 300 ft west of road**		

Elevation feet / Depth, feet	SAMPLES: Type / Number	Sampling Resistance, blows / foot	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Unconfined Compressive Strength, psf	REMARKS AND OTHER TESTS
0					SILTY CLAY (CH) Soft to medium stiff, moist, brown, high plasticity, trace rootlets, trace mottled brown				Start at 10:15.
	3-1 3-2	7	50			78.1	48.5	600	LL=91, PI=53
5	3-3 3-4	3	50		Becomes very soft, wet to saturated, gray to dark gray, with trace dark brown nodules				
10	3-5 3-6	4	45		FAT CLAY (CH) Very soft to soft, saturated, gray to dark gray, high plasticity, with black nodules, trace rootlets				
15	3-7 3-8	4	50		CLAYEY SILT (MH) Soft, saturated, dark greenish gray, high plasticity, with black nodules	110.8	41.4	640	
20	3-9 3-10	2	60		Increase in quantity of black nodules				LL=86, PI=45
25	3-11 3-12	5	60		Becomes stiff	111.9	40.7	2420	
30	3-13 3-14	5	65						
35					Bottom of boring at 31.5 feet				End drilling at 12:45.

Report: GEO_10B1_OAK; File: OAK_NAPAPND8.GPJ; 7/26/2007 B-03

URS

Project: Napa Salt Marsh Restoration Project - Pond 8
Project Location: Napa, California
Project Number: 26815678

Log of Boring B-4

Sheet 1 of 1

Date(s) Drilled	**6/18/07**	Logged By	**S. Leung**	Checked By	**S. Upadhyaya**
Drilling Method	**Solid Stem Auger**	Drill Bit Size/Type	**4-inch-dia. auger, 2-1/2-inch bit**	Total Depth of Borehole	**31.5 feet**
Drill Rig Type	**Minuteman Portable Rig**	Drilling Contractor	**Access Soil Drilling, Inc.**	Surface Elevation	**Not available**
Groundwater Level(s)	**Not measured**	Sampling Method(s)	**Modified California, Shelby Tube**	Hammer Data	**Manual hammer; 140 lbs, 30-inch drop**
Borehole Backfill	**Neat cement grout**	Location	**Approx. 700 ft west of Milton Road at levee crest**		

Elevation feet / Depth, feet	SAMPLES Type / Number	Sampling Resistance, blows / foot	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Unconfined Compressive Strength, psf	REMARKS AND OTHER TESTS
0					CLAYEY SILT (MH) Very soft to soft, wet, dark gray, high plasticity, trace fine-grained sand, trace rootlets, trace dark brown nodules				Start at 15:00.
5	4-1 4-2	3	50						LL=74, PI=36
10	4-3 4-4	2	60		FAT CLAY (CH) Very soft to soft, wet to saturated, dark gray, high plasticity, trace rootlets, trace dark brown nodules	86.0	48.1	470	
15	4-5	Push	85		CLAYEY SILT (MH) Very soft to soft, saturated, dark gray, high plasticity, trace rootlets, trace dark brown nodules	229.5 326.8	20.4 15.7		CONS LL=112, PI=66 CONS
20	4-6	Push	95		FAT CLAY (CH) Very soft, saturated, dark gray, high plasticity, trace dark brown nodules	87.9	48.5	340	
25	4-7	Push	75		Becomes very soft to soft, greenish gray				
30	4-8 4-9	3	65			74.3	56.0	510	
35					Bottom of boring at 31.5 feet				End drilling at 17:35.

Report: GEO_10B1_OAK; File: OAK_NAPAPND8.GPJ; 7/26/2007 B-04

URS

TABLE B-1
SUMMARY OF SOIL LABORATORY DATA
Ponds 6-7-8

Sample Information				USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, pcf	Atterberg Limits			Unconfined Compression		Other Tests
Boring Number	Sample Number	Depth, feet	Elevation, feet MSL				LL	PL	PI	Unconfined Compressive Strength, psf	Strain at Failure, %	
B-1	1-2	2.5-3	NA	MH			98	42	56			
B-1	1-3	3-3.5	NA	MH	60.5	60				2190	5.2	
B-1	2-3	6-6.5	NA	CH	68.8	56				850	8.2	
B-1	3-3	11-11.5	NA	CH	85.6	49				280	7.7	
B-1	4-2	15.5-16	NA	CH			95	34	61			
B-1	4-3	16-16.5	NA	CH	105.5	44				160	7.2	
B-1	5-3	21-21.5	NA	CH	115.2	40				330	3.1	
B-1	6-2	25.5-26	NA	CH			53	15	38			
B-1	6-3	26-26.5	NA	CH	27.6	96				1760	10.0	
B-1	7-3	29.5-30	NA	ML/MH	24.6	100				5520	7.2	

NOTE: The laboratory tests were performed in general accordance with the following standards:

Water Content - ASTM Test Method D2216
Dry Unit Weight - ASTM Test Method D2937
Atterberg Limits - ASTM Test Method D4318
Unconfined Compression Test - ASTM Test Method D2166

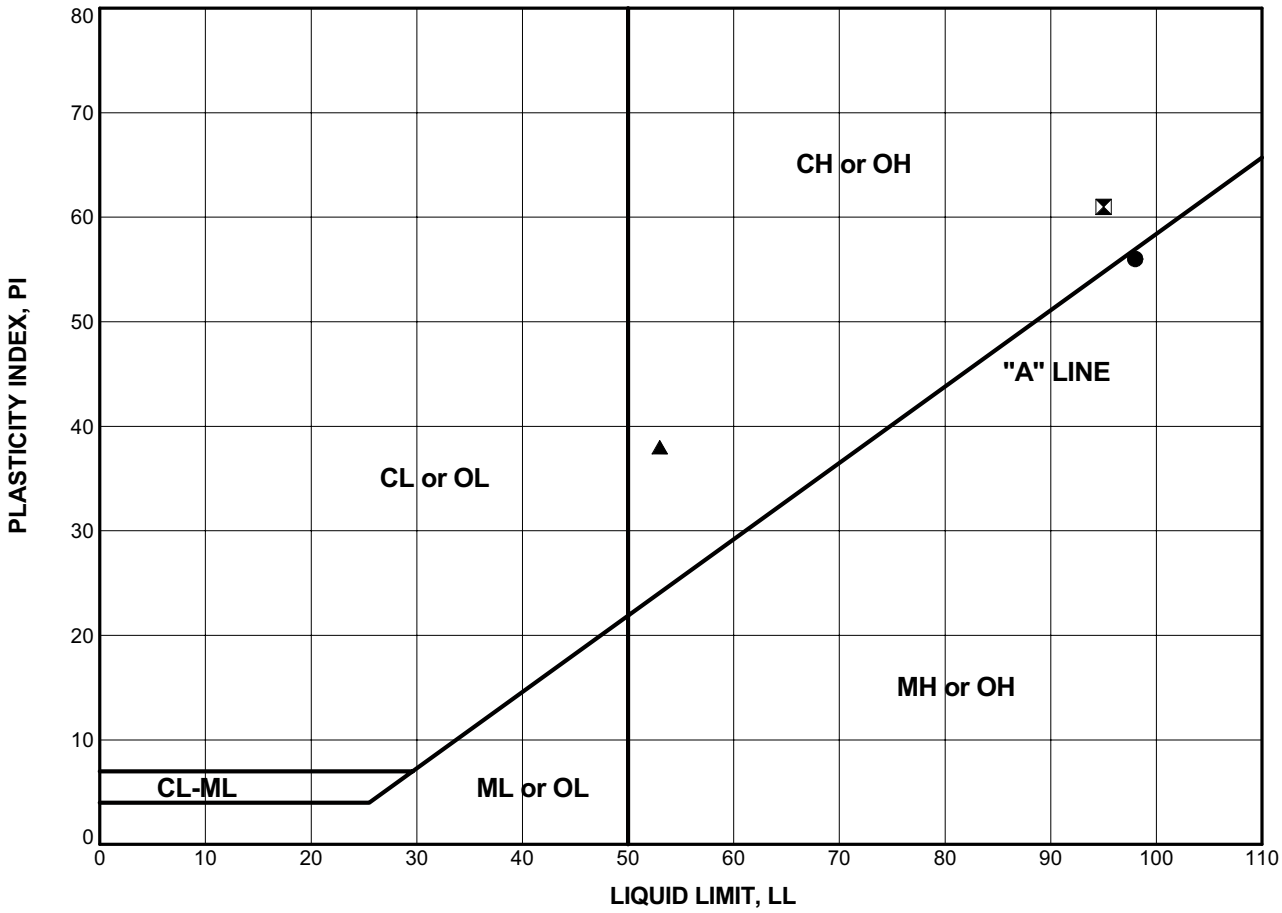
Napa Salt Marsh Restoration
Napa, California

TABLE B-2
SUMMARY OF SOIL LABORATORY DATA

Sample Information				USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, pcf	Atterberg Limits			Unconfined Compression		Other Tests
Boring Number	Sample Number	Depth, feet	Elevation, feet MSL				LL	PL	PI	Unconfined Compressive Strength, psf	Strain at Failure, %	
B-3	3-1	2-2.5	NA	CH			91	38	53			
B-3	3-2	2.5-3	NA	CH	78.1	48.5				600	8.0	
B-3	3-7	15-15.5	NA	MH	110.8	41.4				640	8.0	
B-3	3-10	20.5-21	NA	MH			86	41	45			
B-3	3-11	25-25.5	NA	MH	111.9	40.7				2420	10.5	
B-4	4-1	5-5.5	NA	MH			74	38	36			
B-4	4-3	10-10.5	NA	CH	86.0	48.1				470	7.8	
B-4	4-5	15-17	NA	MH	229.5	20.4	112	46	66			CONS
B-4	4-5	15-17	NA	MH	326.8	15.7						CONS
B-4	4-6	20-22	NA	CH	87.9	48.5				340	15.0	
B-4	4-9	30.5-31	NA	CH	74.3	56.0				510	10.3	

NOTE: The laboratory tests were performed in general accordance with the following standards:

Water Content - ASTM Test Method D 2216
Dry Unit Weight - ASTM Test Method D 2937
Atterberg Limits - ASTM Test Method D 4318
Unconfined Compression Test - ASTM Test Method D 2166
One-Dimensional Consolidation Test - ASTM Test Method D 2435



Boring Number	Sample Number	Depth (feet)	Test Symbol	Water Content (%)	LL	PL	PI	Classification
B-1	1-2	2.5-3	●		98	42	56	Clayey Silt (MH)
B-1	4-2	15.5-16	⊠		95	34	61	Fat Clay (CH)
B-1	6-2	25.5-26	▲		53	15	38	Silty Clay (CH)

Napa Salt Marsh Restoration
Napa, California
26815678

Ponds 6-7-8
PLASTICITY CHART

Report: ATTERBERG_PLOT_12 PTS; File: OAK_NAPASALT.GPJ; 12/14/2006 B-01

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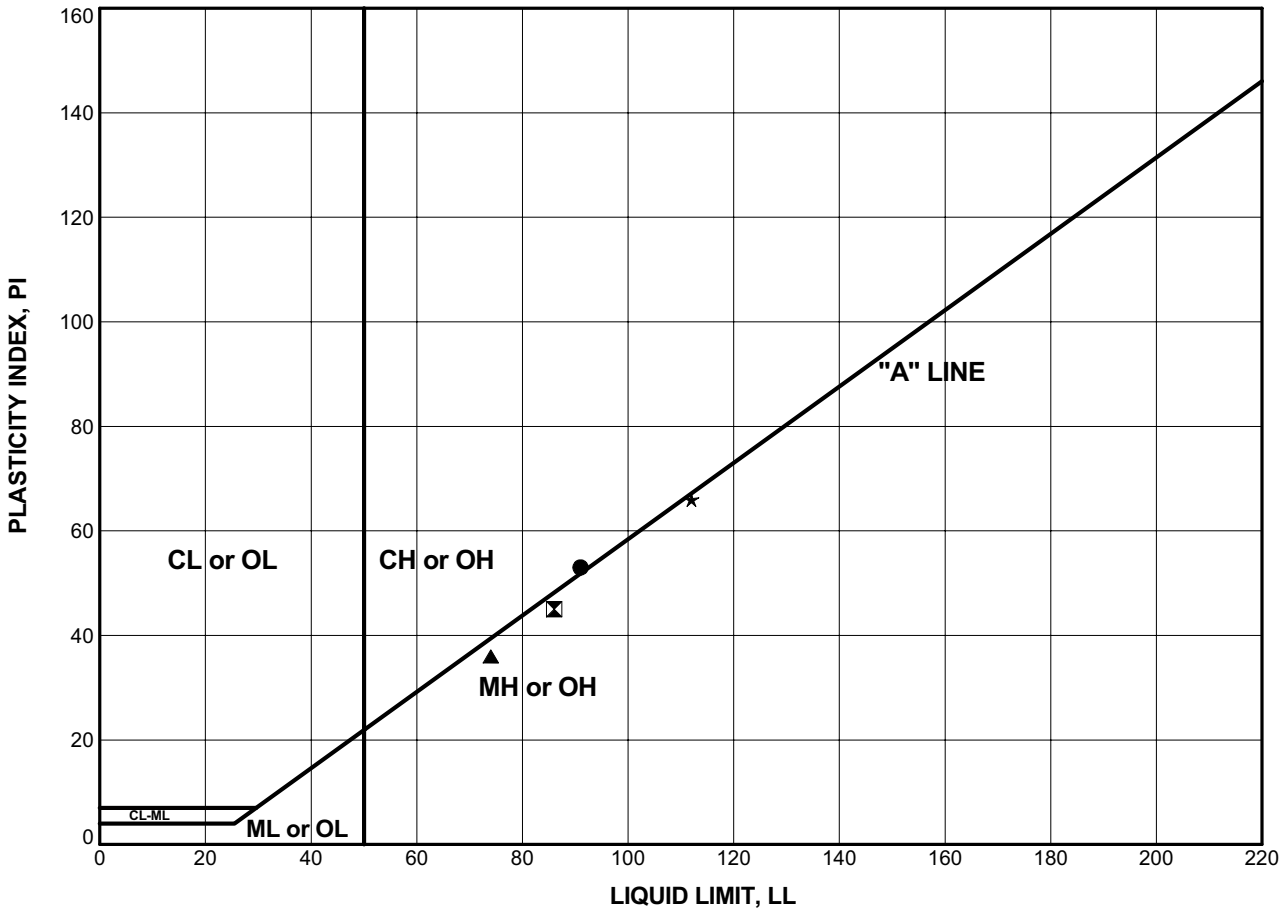


Boring Number	Sample Number	Depth (feet)	Test Symbol	Water Content (%)	LL	PL	PI	Classification
B-3	3-1	2-2.5	●		91	38	53	Silty Clay (CH)
B-3	3-10	20.5-21	⧓		86	41	45	Clayey Silt (MH)
B-4	4-1	5-5.5	▲		74	38	36	Clayey Silt (MH)
B-4	4-5	15-17	★	229.5	112	46	66	Clayey Silt (MH)

Napa Salt Marsh Restoration Project - Pond 8
Napa, California
26815678

Ponds 6-7-8
PLASTICITY CHART

URS

Report: ATTERBERG_PLOT_HIGH_12 PTS; File: OAK_NAPAPND8.GPJ; 7/26/2007

UNCONFINED COMPRESSION TEST - Uc
ASTM D-2166

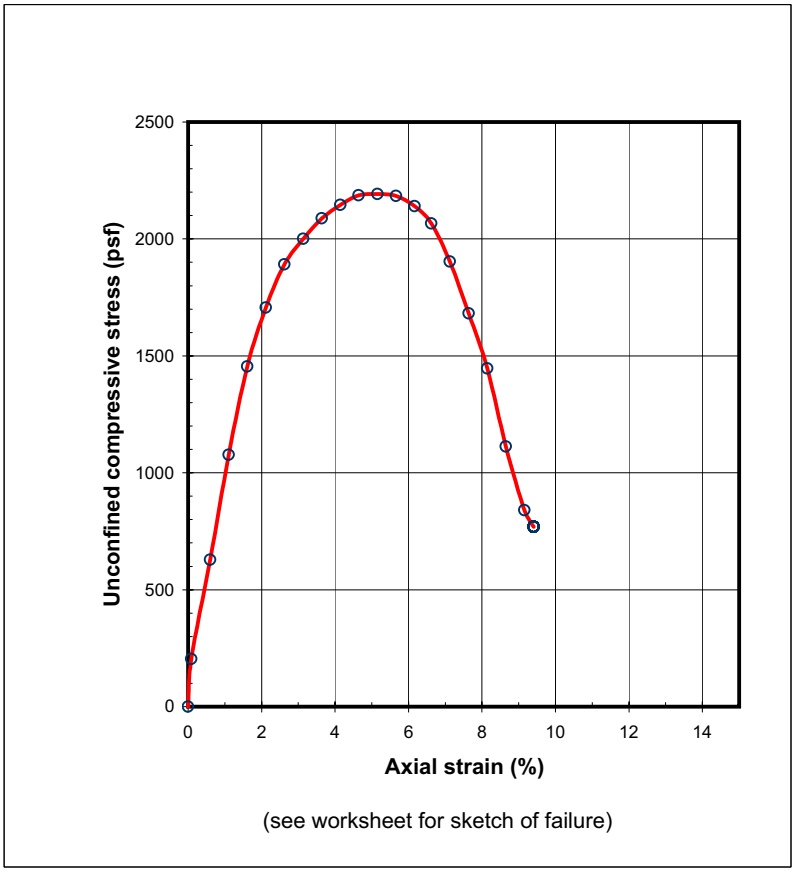
Client : URS
Project : Napa Salt Marsh Restoration Project
Job No. : 26815678.00100
Boring # : B-1-1
Sample # : 3
Depth (ft) : 3-3.5
Date tested : 12/03/06
Soil (Visual Description) : Undisturbed brown clay

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Specimen:
Total wt. = 351.3 gms
Ht. = 4.77 in
Ave dia. = 1.920 in
Area = 2.896 sq.in
Volume = 226.4 c.c.
Shearing rate = 0.05 inch/min
Shearing rate = 1.00 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 1.794
Ht/Dia ratio = 2.48
Moisture = 60.5 %
Total density = 96.8 pcf
Dry density = 60.3 pcf
Saturation = 91.1 %
Unconfined compressive strength = 2191 psf
Shear strength = 1096 psf
Strain @ failure = 5.15 %

Dial Read.	Load Read.	Axial Strain (%)	Unconfined Compressive Stress (psf)
0.004	4.1	0.09	204.0
0.028	12.7	0.60	628.6
0.053	21.9	1.10	1076.5
0.077	29.7	1.61	1454.0
0.101	35.1	2.12	1706.8
0.125	39.1	2.63	1891.1
0.149	41.5	3.13	2000.2
0.174	43.6	3.64	2088.0
0.198	45.0	4.15	2146.2
0.222	46.1	4.65	2186.7
0.246	46.5	5.15	2191.4
0.270	46.6	5.66	2183.4
0.294	45.9	6.17	2140.4
0.316	44.5	6.62	2066.6
0.340	41.2	7.13	1902.9
0.364	36.6	7.64	1681.8
0.389	31.7	8.14	1446.6
0.413	24.5	8.65	1111.9
0.437	18.6	9.16	839.7
0.449	17.1	9.41	769.6



(see worksheet for sketch of failure)

UNCONFINED COMPRESSION TEST - Uc
ASTM D-2166

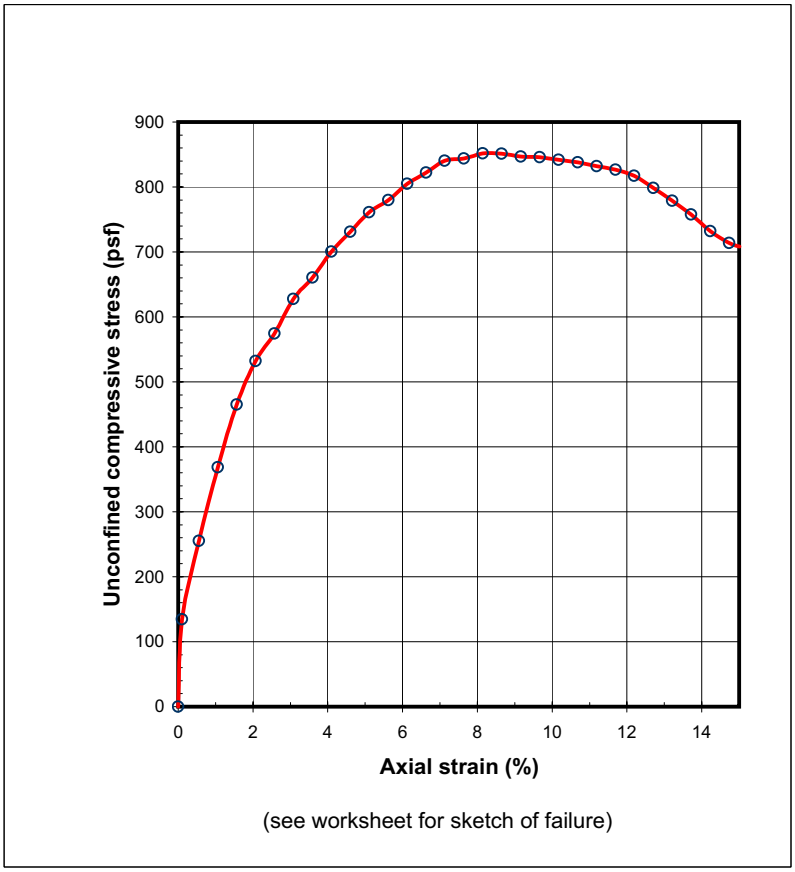
Client : URS
Project : Napa Salt Marsh Restoration Project
Job No. : 26815678.00100
Boring # : B-1-2
Sample # : 3
Depth (ft) : 6-6.5
Date tested : 12/03/06
Soil (Visual Description) : Undisturbed brown clay

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Specimen:
Total wt. = 341.3 gms
Ht. = 4.71 in
Ave dia. = 1.920 in
Area = 2.896 sq.in
Volume = 223.6 c.c.
Shearing rate = 0.05 inch/min
Shearing rate = 1.00 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 1.986
Ht/Dia ratio = 2.45
Moisture = 68.8 %
Total density = 95.3 pcf
Dry density = 56.4 pcf
Saturation = 93.6 %
Unconfined compressive strength = 852 psf
Shear strength = 426 psf
Strain @ failure = 8.15 %

Dial Read.	Load Read.	Axial Strain (%)	Unconfined Compressive Stress (psf)
0.005	2.7	0.10	134.6
0.026	5.2	0.55	255.1
0.050	7.5	1.06	368.3
0.074	9.5	1.57	465.2
0.098	10.9	2.07	532.1
0.121	11.9	2.58	574.2
0.145	13.0	3.08	627.8
0.169	13.8	3.59	660.6
0.193	14.7	4.10	700.2
0.217	15.4	4.60	730.9
0.241	16.1	5.11	761.2
0.265	16.6	5.62	779.8
0.289	17.2	6.13	804.9
0.312	17.7	6.63	822.3
0.336	18.2	7.13	840.5
0.360	18.4	7.64	843.9
0.384	18.6	8.15	851.5
0.408	18.7	8.66	851.3
0.432	18.7	9.16	846.6
0.455	18.8	9.67	846.0
0.479	18.8	10.18	841.7
0.503	18.9	10.68	837.8
0.527	18.8	11.19	831.8
0.551	18.8	11.70	826.4
0.574	18.7	12.20	817.0
0.598	18.4	12.70	798.5
0.622	18.0	13.21	778.8
0.646	17.7	13.72	757.9
0.670	17.2	14.23	732.0
0.694	16.8	14.73	713.6
0.707	16.8	15.01	708.6



(see worksheet for sketch of failure)

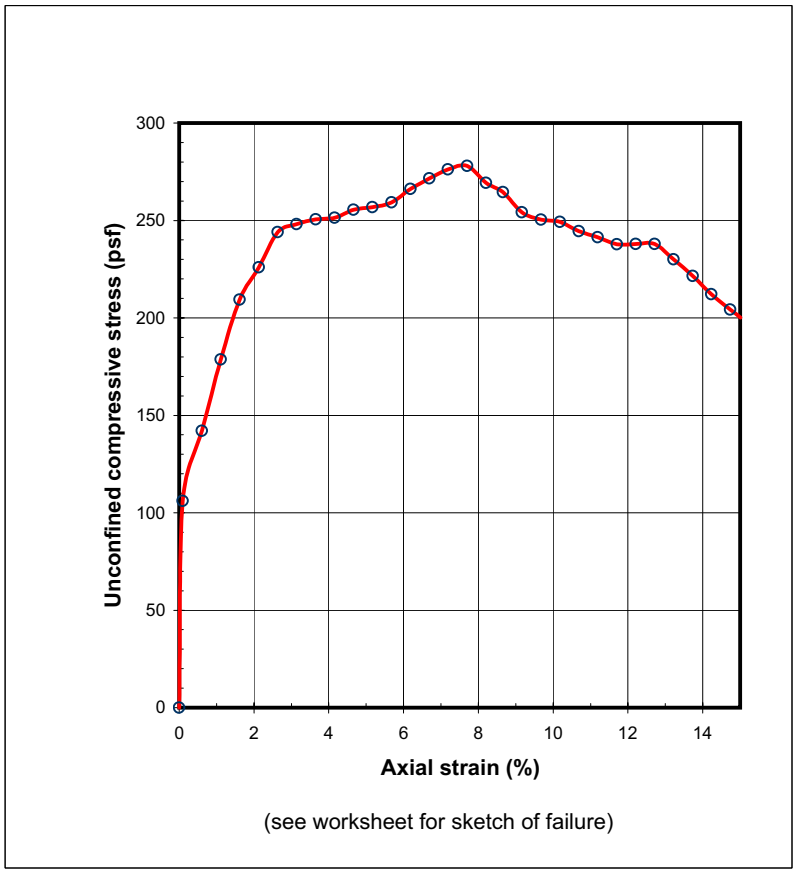
UNCONFINED COMPRESSION TEST - Uc
ASTM D-2166

Client : URS
Project : Napa Salt Marsh Restoration Project
Job No. : 26815678.00100
Boring # : B-1-3
Sample # : 3
Depth (ft) : 11-11.5
Date tested : 12/03/06
Soil (Visual Description) : Undisturbed dark olive gray clay

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Specimen:
Total wt. = 329.4 gms
Ht. = 4.78 in
Ave dia. = 1.920 in
Area = 2.896 sq.in
Volume = 226.9 c.c.
Shearing rate = 0.05 inch/min
Shearing rate = 1.00 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 2.452
Ht/Dia ratio = 2.49
Moisture = 85.6 %
Total density = 90.6 pcf
Dry density = 48.8 pcf
Saturation = 94.3 %
Unconfined compressive strength = 278 psf
Shear strength = 139 psf
Strain @ failure = 7.70 %



(see worksheet for sketch of failure)

Dial Read.	Load Read.	Axial Strain (%)	Unconfined Compressive Stress (psf)
0.005	2.1	0.10	106.0
0.029	2.9	0.61	142.0
0.053	3.6	1.11	178.6
0.077	4.3	1.62	209.3
0.102	4.6	2.13	225.9
0.126	5.0	2.64	243.9
0.150	5.2	3.14	248.2
0.174	5.2	3.65	250.6
0.199	5.3	4.16	251.4
0.223	5.4	4.66	255.5
0.247	5.4	5.17	256.8
0.271	5.5	5.68	259.3
0.296	5.7	6.18	266.2
0.320	5.9	6.69	271.7
0.344	6.0	7.19	276.2
0.368	6.1	7.70	278.0
0.392	5.9	8.20	269.3
0.414	5.8	8.66	264.6
0.438	5.6	9.17	254.1
0.462	5.6	9.67	250.4
0.487	5.6	10.18	249.3
0.511	5.5	10.69	244.6
0.535	5.5	11.20	241.3
0.559	5.4	11.70	237.8
0.584	5.5	12.21	237.9
0.608	5.5	12.72	238.0
0.632	5.3	13.22	230.1
0.656	5.2	13.73	221.6
0.680	5.0	14.23	212.1
0.704	4.8	14.74	204.3
0.717	4.7	15.01	200.1

UNCONFINED COMPRESSION TEST - Uc
ASTM D-2166

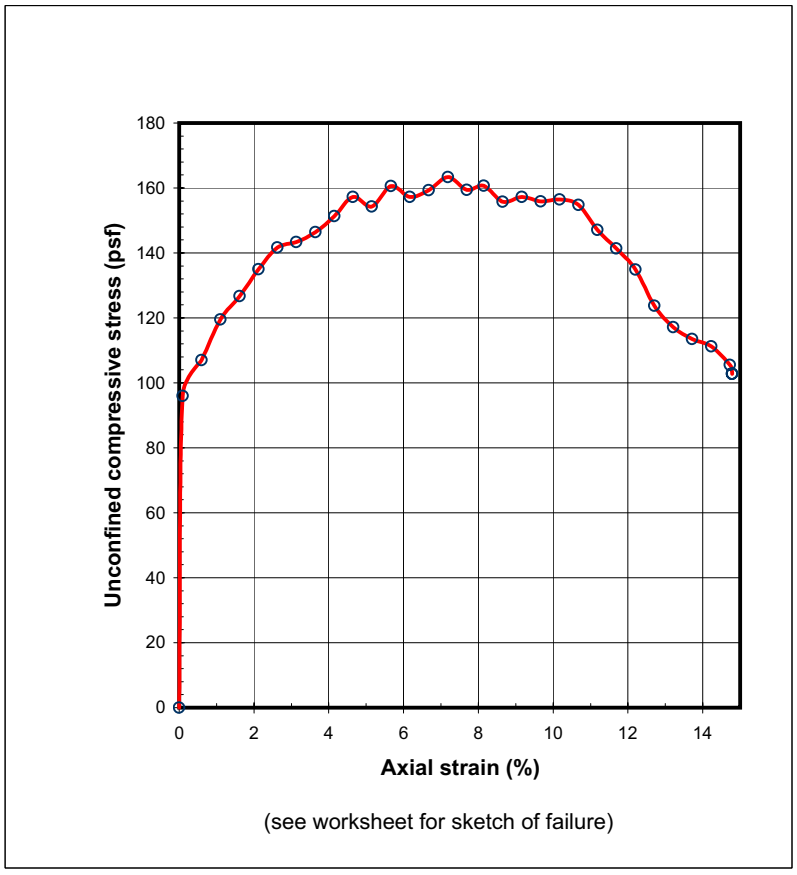
Client : URS
Project : Napa Salt Marsh Restoration Project
Job No. : 26815678.00100
Boring # : B-1-4
Sample # : 3
Depth (ft) : 16-16.5
Date tested : 12/03/06
Soil (Visual Description) : Undisturbed dark gray clay

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Specimen:
Total wt. = 300.2 gms
Ht. = 4.51 in
Ave dia. = 1.900 in
Area = 2.836 sq.in
Volume = 209.6 c.c.
Shearing rate = 0.05 inch/min
Shearing rate = 1.00 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 2.874
Ht/Dia ratio = 2.37
Moisture = 105.5 %
Total density = 89.4 pcf
Dry density = 43.5 pcf
Saturation = 99.1 %
Unconfined compressive strength = 163 psf
Shear strength = 82 psf
Strain @ failure = 7.18 %

Dial Read.	Load Read.	Axial Strain (%)	Unconfined Compressive Stress (psf)
0.004	1.9	0.10	95.9
0.027	2.1	0.60	107.0
0.050	2.4	1.11	119.5
0.073	2.5	1.61	126.7
0.096	2.7	2.12	135.0
0.119	2.9	2.63	141.7
0.141	2.9	3.14	143.3
0.164	3.0	3.64	146.4
0.187	3.1	4.15	151.3
0.210	3.2	4.65	157.3
0.232	3.2	5.16	154.3
0.255	3.4	5.66	160.6
0.278	3.3	6.17	157.2
0.301	3.4	6.68	159.3
0.324	3.5	7.18	163.4
0.347	3.4	7.69	159.4
0.367	3.4	8.15	160.7
0.390	3.4	8.65	155.8
0.413	3.4	9.16	157.3
0.436	3.4	9.67	155.9
0.459	3.4	10.17	156.5
0.482	3.4	10.68	154.8
0.504	3.3	11.19	147.1
0.527	3.2	11.69	141.4
0.550	3.0	12.20	134.9
0.573	2.8	12.71	123.8
0.596	2.7	13.21	117.2
0.619	2.6	13.72	113.5
0.642	2.6	14.23	111.3
0.664	2.4	14.73	105.5
0.667	2.4	14.79	102.7



(see worksheet for sketch of failure)

UNCONFINED COMPRESSION TEST - Uc
ASTM D-2166

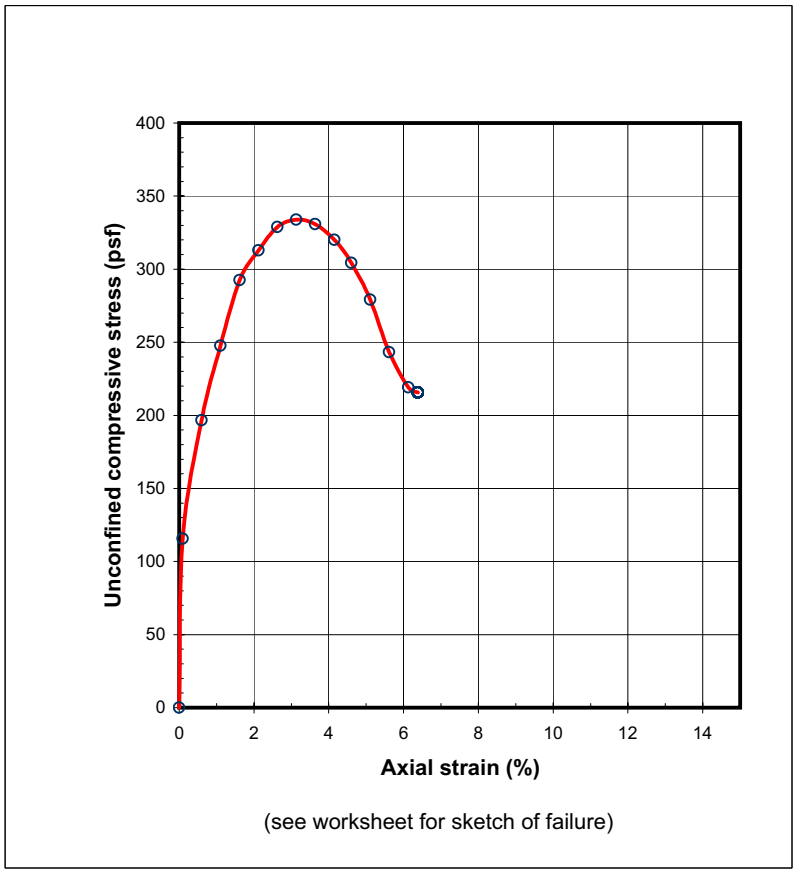
Client : URS
Project : Napa Salt Marsh Restoration Project
Job No. : 26815678.00100
Boring # : B-1-5
Sample # : 3
Depth (ft) : 21-21.5
Date tested : 12/03/06
Soil (Visual Description) : Undisturbed dark olive gray clay

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Specimen:
Total wt. = 302.1 gms
Ht. = 4.69 in
Ave dia. = 1.897 in
Area = 2.826 sq.in
Volume = 217.2 c.c.
Shearing rate = 0.05 inch/min
Shearing rate = 1.00 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 3.177
Ht/Dia ratio = 2.47
Moisture = 115.2 %
Total density = 86.8 pcf
Dry density = 40.3 pcf
Saturation = 97.9 %
Unconfined compressive strength = 334 psf
Shear strength = 167 psf
Strain @ failure = 3.13 %

Dial Read.	Load Read.	Axial Strain (%)	Unconfined Compressive Stress (psf)
0.004	2.3	0.09	115.6
0.028	3.9	0.60	196.5
0.052	4.9	1.11	247.6
0.076	5.8	1.61	292.5
0.099	6.3	2.12	312.9
0.123	6.6	2.63	328.8
0.147	6.8	3.13	334.0
0.171	6.7	3.64	330.8
0.195	6.6	4.15	320.1
0.216	6.3	4.60	304.4
0.240	5.8	5.11	279.1
0.263	5.1	5.61	243.2
0.287	4.6	6.12	219.2
0.299	4.5	6.38	215.6



(see worksheet for sketch of failure)

UNCONFINED COMPRESSION TEST - Uc
ASTM D-2166

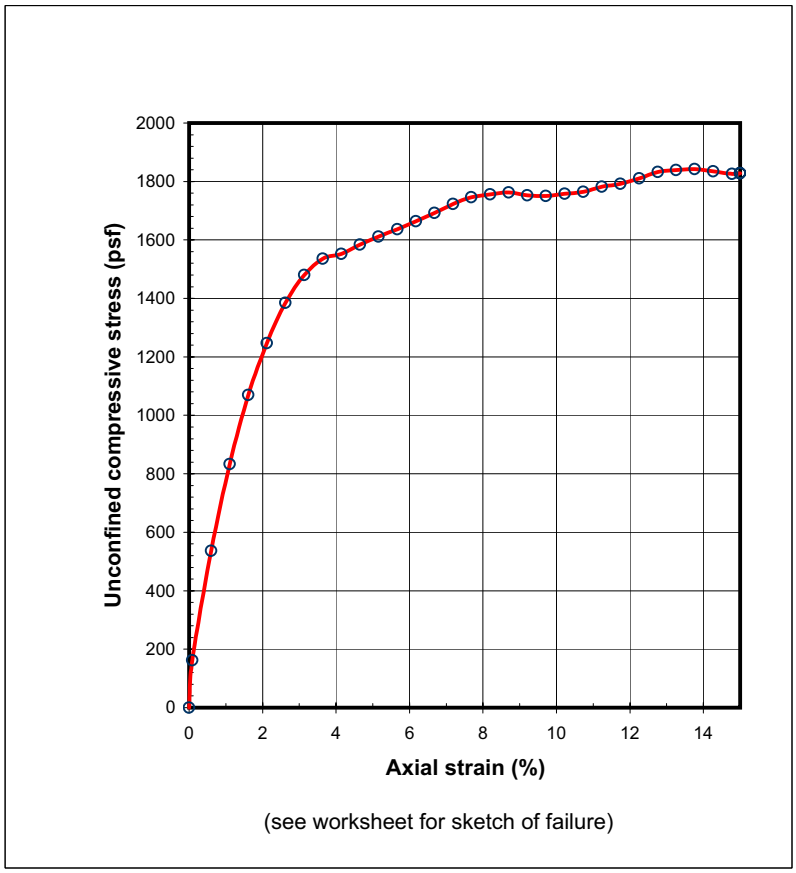
Client : URS
Project : Napa Salt Marsh Restoration Project
Job No. : 26815678.00100
Boring # : B-1-6
Sample # : 3
Depth (ft) : 26-26.5
Date tested : 12/03/06
Soil (Visual Description) : Undisturbed dark olive gray clay

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Specimen:
Total wt. = 439.1 gms
Ht. = 4.77 in
Ave dia. = 1.907 in
Area = 2.856 sq.in
Volume = 223.3 c.c.
Shearing rate = 0.05 inch/min
Shearing rate = 1.00 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 0.752
Ht/Dia ratio = 2.50
Moisture = 27.6 %
Total density = 122.7 pcf
Dry density = 96.2 pcf
Saturation = 99.1 %
Unconfined compressive strength = 1755 psf
Shear strength = 878 psf
Strain @ failure = 10.00 %

Dial Read.	Load Read.	Axial Strain (%)	Unconfined Compressive Stress (psf)
0.004	3.2	0.09	161.8
0.029	10.7	0.60	536.1
0.053	16.7	1.10	832.6
0.077	21.6	1.61	1069.2
0.101	25.3	2.12	1247.4
0.125	28.2	2.62	1385.1
0.149	30.3	3.13	1479.7
0.174	31.6	3.64	1535.6
0.198	32.1	4.15	1552.4
0.222	33.0	4.65	1583.9
0.246	33.7	5.16	1611.5
0.270	34.4	5.67	1636.7
0.295	35.2	6.17	1663.6
0.319	36.0	6.68	1692.2
0.343	36.8	7.19	1723.5
0.367	37.5	7.69	1746.1
0.391	37.9	8.19	1755.4
0.415	38.3	8.70	1762.7
0.439	38.3	9.21	1752.2
0.463	38.5	9.72	1750.1
0.488	38.8	10.22	1758.3
0.512	39.2	10.73	1764.9
0.536	39.8	11.24	1782.6
0.560	40.3	11.75	1791.7
0.584	40.9	12.25	1810.4
0.609	41.7	12.76	1832.9
0.632	42.0	13.26	1838.8
0.657	42.4	13.76	1842.7
0.681	42.5	14.27	1834.7
0.705	42.5	14.78	1825.9
0.716	42.7	15.00	1828.1



(see worksheet for sketch of failure)

UNCONFINED COMPRESSION TEST - Uc
ASTM D-2166

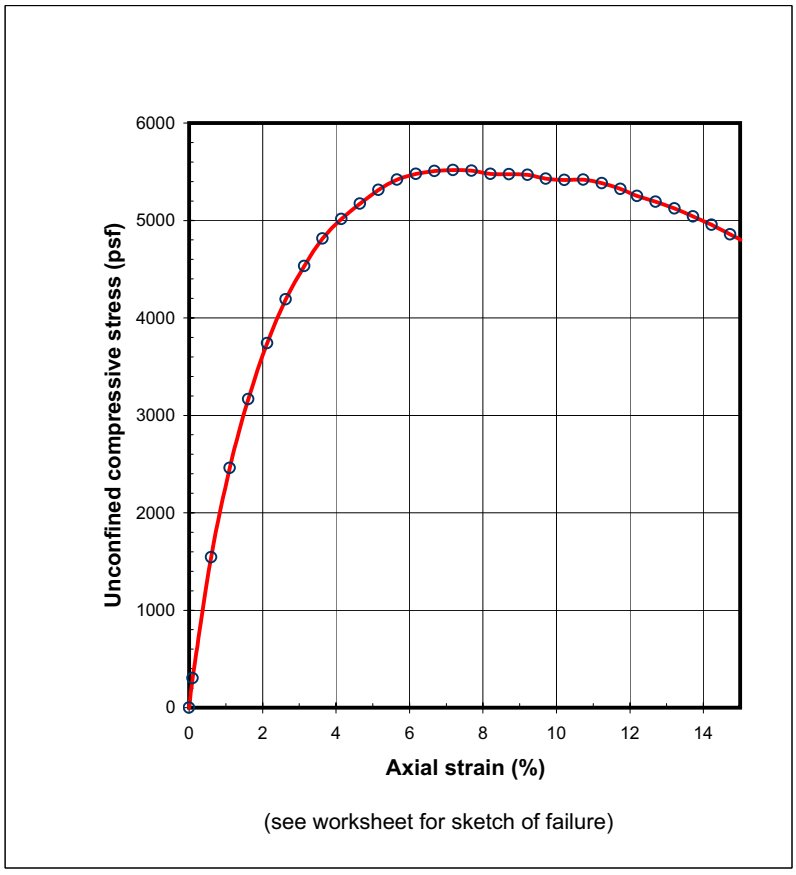
Client : URS
Project : Napa Salt Marsh Restoration Project
Job No. : 26815678.00100
Boring # : B-1-7
Sample # : 3
Depth (ft) : 29.5-30
Date tested : 12/03/06
Soil (Visual Description) : Undisturbed brown clay

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Specimen:
Total wt. = 443.2 gms
Ht. = 4.69 in
Ave dia. = 1.917 in
Area = 2.886 sq.in
Volume = 221.8 c.c.
Shearing rate = 0.05 inch/min
Shearing rate = 1.00 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 0.683
Ht/Dia ratio = 2.45
Moisture = 24.6 %
Total density = 124.7 pcf
Dry density = 100.1 pcf
Saturation = 97.0 %
Unconfined compressive strength = 5516 psf
Shear strength = 2758 psf
Strain @ failure = 7.19 %

Dial Read.	Load Read.	Axial Strain (%)	Unconfined Compressive Stress (psf)
0.004	6.1	0.09	302.7
0.028	31.1	0.60	1542.6
0.052	49.9	1.11	2460.1
0.076	64.5	1.62	3165.5
0.100	76.6	2.12	3741.0
0.123	86.3	2.63	4190.8
0.147	93.8	3.14	4531.4
0.171	100.2	3.64	4815.1
0.194	104.9	4.14	5015.0
0.218	108.7	4.65	5171.7
0.242	112.3	5.16	5315.1
0.266	115.2	5.67	5419.4
0.290	117.0	6.17	5477.9
0.313	118.3	6.68	5508.6
0.337	119.1	7.19	5515.6
0.361	119.6	7.69	5509.9
0.385	119.6	8.20	5478.3
0.408	120.2	8.71	5474.3
0.432	120.7	9.22	5467.2
0.456	120.5	9.71	5428.5
0.479	120.9	10.22	5415.1
0.503	121.7	10.73	5419.8
0.527	121.6	11.24	5383.4
0.551	120.9	11.74	5324.4
0.572	119.9	12.20	5251.3
0.596	119.2	12.70	5191.3
0.620	118.4	13.22	5124.3
0.643	117.1	13.72	5041.3
0.667	115.8	14.23	4955.2
0.691	114.2	14.73	4858.2
0.704	113.2	15.01	4800.5



(see worksheet for sketch of failure)

UNCONFINED COMPRESSION TEST - Uc
ASTM D-2166

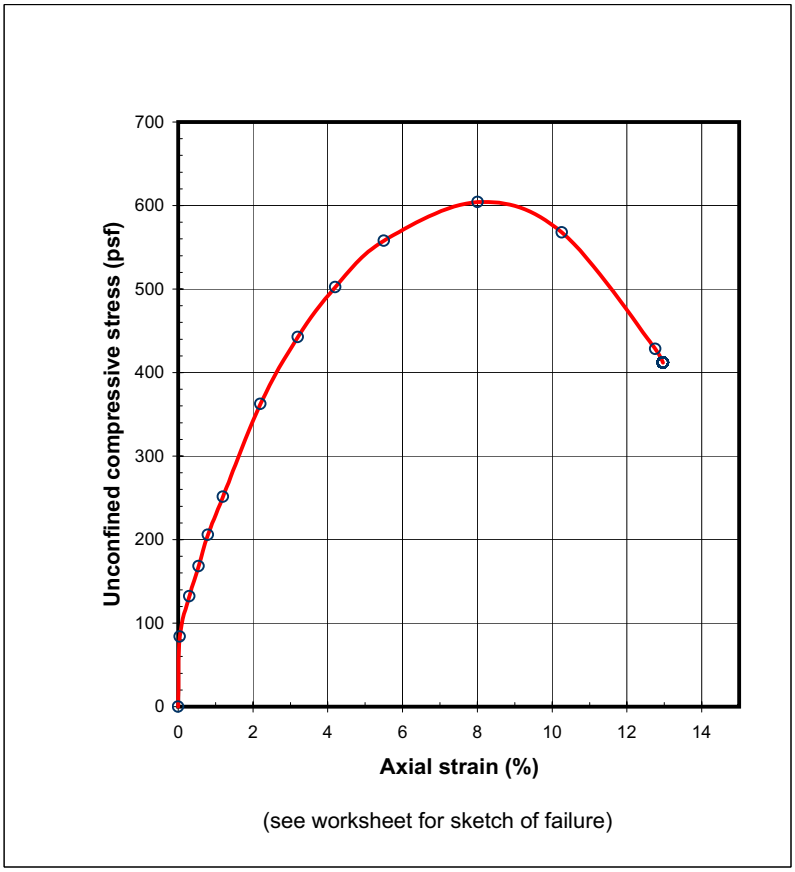
Client : URS
Project : Napa Salt Marsh Restoration Project
Job No. : 26815678.00100
Boring # : B-3
Sample # : 2
Depth (ft) : 2.5-3
Date tested : 07/07/07
Soil (Visual Description) : Undisturbed mottled brown silty clay with organics

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Specimen:
Total wt. = 602.1 gms
Ht. = 5.88 in
Ave dia. = 2.397 in
Area = 4.513 sq.in
Volume = 434.9 c.c.
Shearing rate = 0.08 inch/min
Shearing rate = 0.75 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 2.472
Ht/Dia ratio = 2.45
Moisture = 78.1 %
Total density = 86.4 pcf
Dry density = 48.5 pcf
Saturation = 85.2 %
Unconfined compressive strength = 604 psf
Shear strength = 302 psf
Strain @ failure = 8.01 %

Dial Read.	Load Read.	Axial Strain (%)	Unconfined Compressive Stress (psf)
0.003	2.6	0.04	83.9
0.017	4.2	0.30	132.4
0.032	5.3	0.54	168.1
0.047	6.5	0.80	205.8
0.070	8.0	1.19	251.5
0.129	11.6	2.20	362.5
0.188	14.3	3.20	442.4
0.247	16.4	4.20	502.4
0.323	18.5	5.50	557.7
0.471	20.6	8.01	604.1
0.603	19.8	10.26	568.0
0.750	15.4	12.76	428.4
0.762	14.8	12.96	412.0



(see worksheet for sketch of failure)

UNCONFINED COMPRESSION TEST - Uc
ASTM D-2166

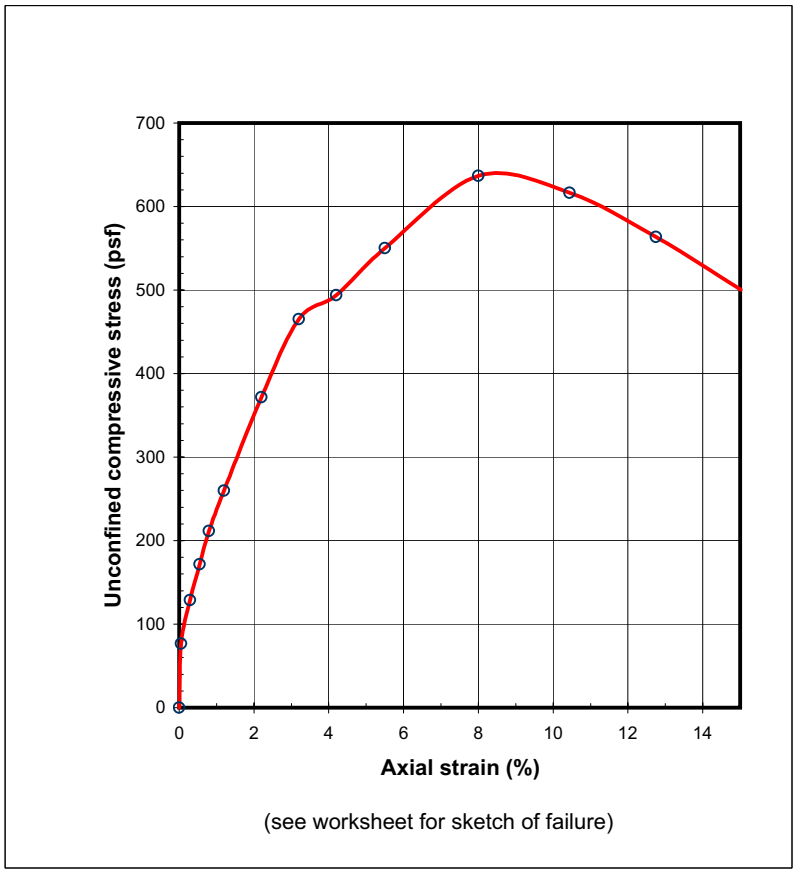
Client : URS
Project : Napa Salt Marsh Restoration Project
Job No. : 26815678.00100
Boring # : B-3
Sample # : 7
Depth (ft) : 15-15.5
Date tested : 07/07/07
Soil (Visual Description) : Undisturbed gray clay with organics

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Specimen:
Total wt. = 494.8 gms
Ht. = 4.92 in
Ave dia. = 2.363 in
Area = 4.388 sq.in
Volume = 353.8 c.c.
Shearing rate = 0.07 inch/min
Shearing rate = 0.75 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 3.070
Ht/Dia ratio = 2.08
Moisture = 110.8 %
Total density = 87.3 pcf
Dry density = 41.4 pcf
Saturation = 97.4 %
Unconfined compressive strength = 637 psf
Shear strength = 318 psf
Strain @ failure = 8.00 %

Dial Read.	Load Read.	Axial Strain (%)	Unconfined Compressive Stress (psf)
0.002	2.3	0.05	76.6
0.014	3.9	0.29	128.7
0.027	5.3	0.55	171.5
0.039	6.5	0.79	211.6
0.059	8.0	1.20	259.9
0.108	11.6	2.20	371.7
0.157	14.6	3.20	465.2
0.207	15.7	4.20	493.8
0.271	17.7	5.50	550.2
0.393	21.1	8.00	636.9
0.514	21.0	10.44	616.3
0.627	19.7	12.75	563.7
0.739	17.9	15.02	500.2



(see worksheet for sketch of failure)

UNCONFINED COMPRESSION TEST - Uc
ASTM D-2166

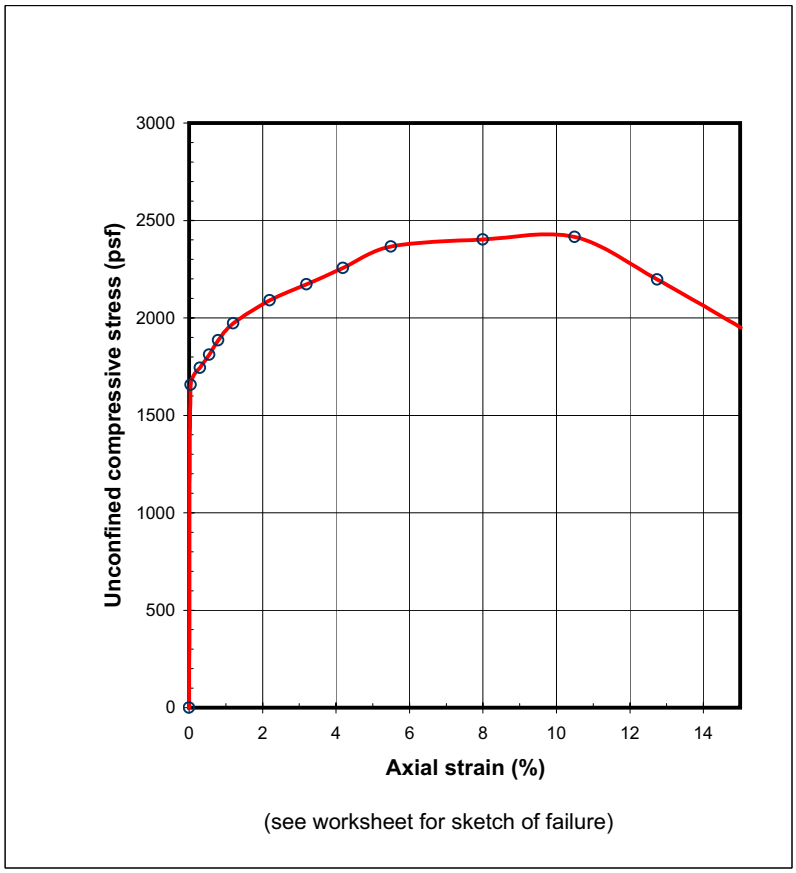
Client : URS
Project : Napa Salt Marsh Restoration Project
Job No. : 26815678.00100
Boring # : B-3
Sample # : 11
Depth (ft) : 25-25.5
Date tested : 07/07/07
Soil (Visual Description) : Undisturbed gray clay with organics

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Specimen:
Total wt. = 556.9 gms
Ht. = 5.88 in
Ave dia. = 2.307 in
Area = 4.181 sq.in
Volume = 402.8 c.c.
Shearing rate = 0.08 inch/min
Shearing rate = 0.75 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 3.138
Ht/Dia ratio = 2.55
Moisture = 111.9 %
Total density = 86.3 pcf
Dry density = 40.7 pcf
Saturation = 96.3 %
Unconfined compressive strength = 2415 psf
Shear strength = 1208 psf
Strain @ failure = 10.49 %

Dial Read.	Load Read.	Axial Strain (%)	Unconfined Compressive Stress (psf)
0.003	48.1	0.05	1656.2
0.017	50.8	0.29	1743.3
0.032	52.9	0.55	1810.6
0.047	55.2	0.80	1885.1
0.071	57.9	1.20	1971.4
0.129	62.0	2.19	2089.7
0.188	65.2	3.19	2172.6
0.247	68.3	4.19	2255.5
0.323	72.7	5.49	2366.5
0.470	75.8	7.99	2402.9
0.617	78.3	10.49	2415.4
0.750	73.1	12.75	2196.4
0.883	66.6	15.02	1950.0



(see worksheet for sketch of failure)

UNCONFINED COMPRESSION TEST - Uc
ASTM D-2166

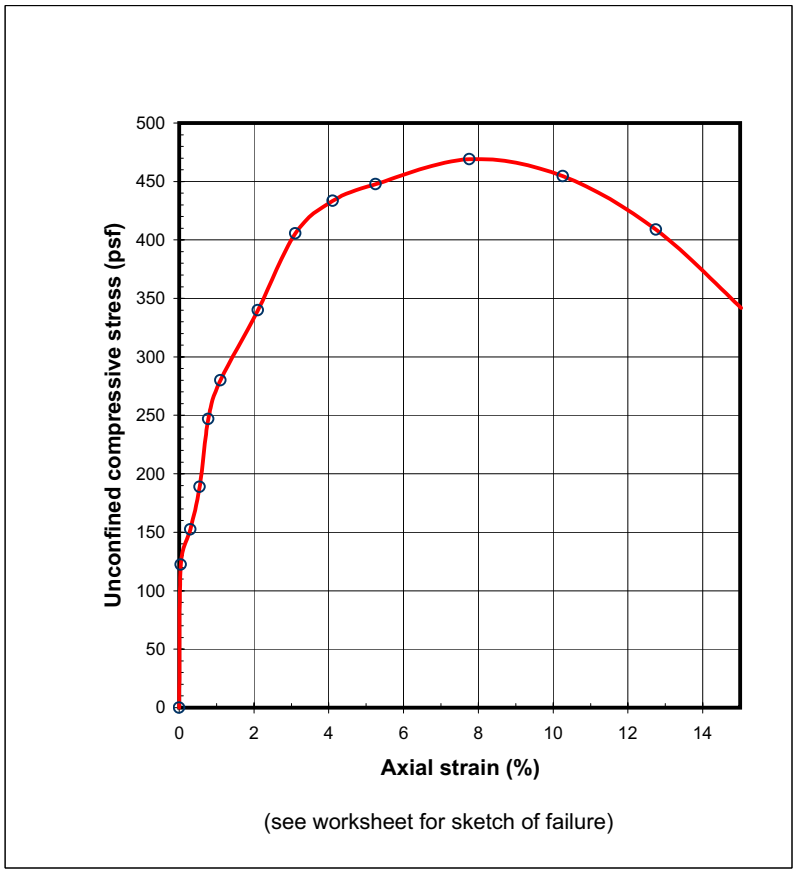
Client : URS
Project : Napa Salt Marsh Restoration Project
Job No. : 26815678.00100
Boring # : B-4
Sample # : 3
Depth (ft) : 10-10.5
Date tested : 07/07/07
Soil (Visual Description) : Undisturbed olive gray clay with organics

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Specimen:
Total wt. = 266.4 gms
Ht. = 4.04 in
Ave dia. = 1.890 in
Area = 2.807 sq.in
Volume = 185.8 c.c.
Shearing rate = 0.04 inch/min
Shearing rate = 1.00 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 2.504
Ht/Dia ratio = 2.14
Moisture = 86.0 %
Total density = 89.5 pcf
Dry density = 48.1 pcf
Saturation = 92.8 %
Unconfined compressive strength = 469 psf
Shear strength = 234 psf
Strain @ failure = 7.76 %

Dial Read.	Load Read.	Axial Strain (%)	Unconfined Compressive Stress (psf)
0.002	2.4	0.04	122.3
0.012	3.0	0.30	152.4
0.022	3.7	0.55	188.8
0.031	4.8	0.78	246.8
0.045	5.5	1.11	280.1
0.085	6.8	2.10	339.9
0.126	8.2	3.11	405.7
0.166	8.8	4.11	433.6
0.212	9.2	5.26	447.8
0.313	9.9	7.76	469.0
0.414	9.9	10.26	454.6
0.515	9.1	12.75	408.9
0.607	7.8	15.03	341.8



(see worksheet for sketch of failure)

UNCONFINED COMPRESSION TEST - Uc
ASTM D-2166

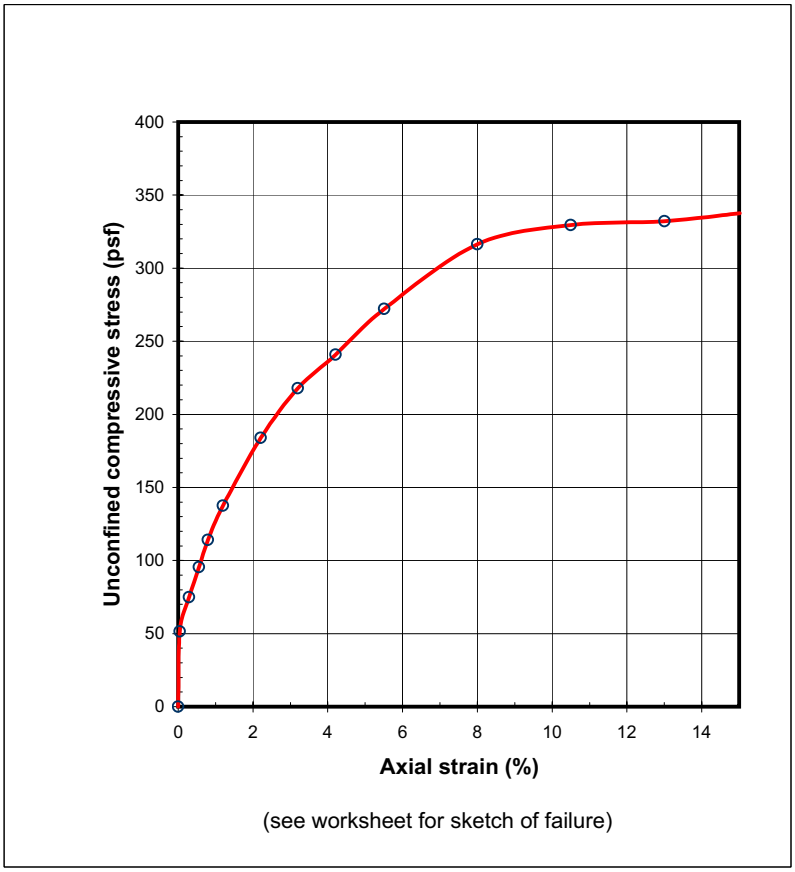
Client : URS
Project : Napa Salt Marsh Restoration Project
Job No. : 26815678.00100
Boring # : B-4
Sample # : 6
Depth (ft) : 20-22
Date tested : 07/07/07
Soil (Visual Description) : Undisturbed olive gray clay

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

Specimen:
Total wt. = 862.3 gms
Ht. = 5.69 in
Ave dia. = 2.840 in
Area = 6.337 sq.in
Volume = 590.9 c.c.
Shearing rate = 0.06 inch/min
Shearing rate = 1.00 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 2.476
Ht/Dia ratio = 2.00
Moisture = 87.9 %
Total density = 91.1 pcf
Dry density = 48.5 pcf
Saturation = 95.8 %
Unconfined compressive strength = 338 psf
Shear strength = 169 psf
Strain @ failure = 15.01 %

Dial Read.	Load Read.	Axial Strain (%)	Unconfined Compressive Stress (psf)
0.003	2.3	0.05	51.5
0.017	3.3	0.29	75.0
0.031	4.2	0.55	95.4
0.045	5.1	0.80	114.1
0.068	6.1	1.20	137.5
0.125	8.3	2.20	183.8
0.182	9.9	3.20	217.8
0.239	11.1	4.21	240.8
0.313	12.7	5.51	272.2
0.455	15.1	8.00	316.3
0.598	16.2	10.50	329.5
0.740	16.8	13.00	332.1
0.854	17.5	15.01	337.5



(see worksheet for sketch of failure)

UNCONFINED COMPRESSION TEST - Uc
ASTM D-2166

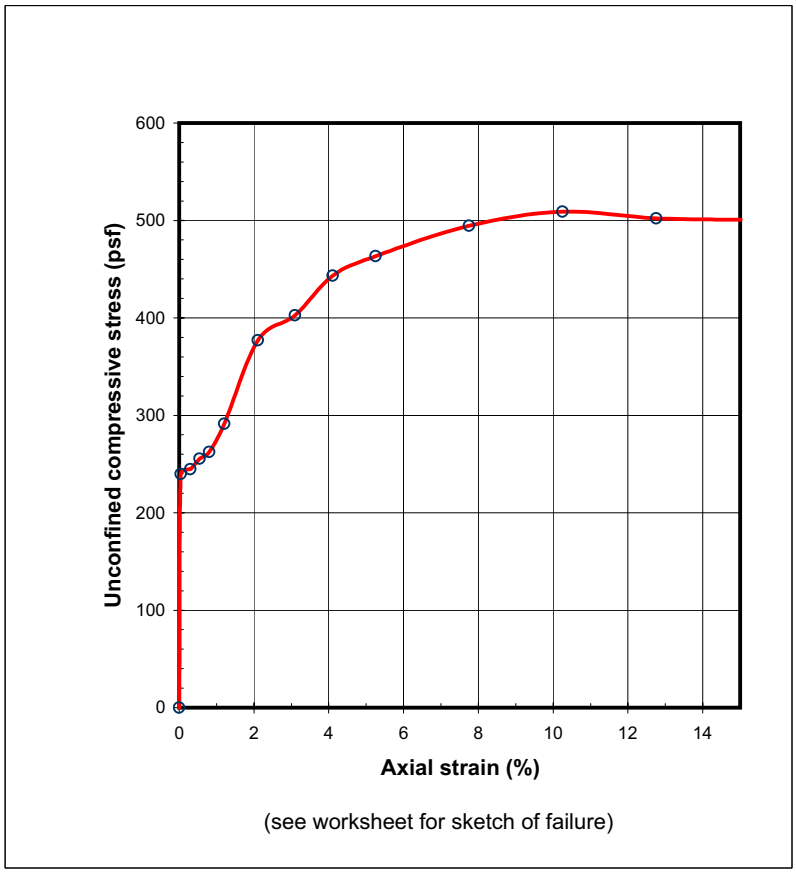
Client : URS
Project : Napa Salt Marsh Restoration Project
Job No. : 26815678.00100
Boring # : B-4
Sample # : 9
Depth (ft) : 30.5-31
Date tested : 07/07/07
Soil (Visual Description) : Undisturbed olive gray clay

Dial factor = 1.0 in/unit
Load factor = 1.0 lb/unit

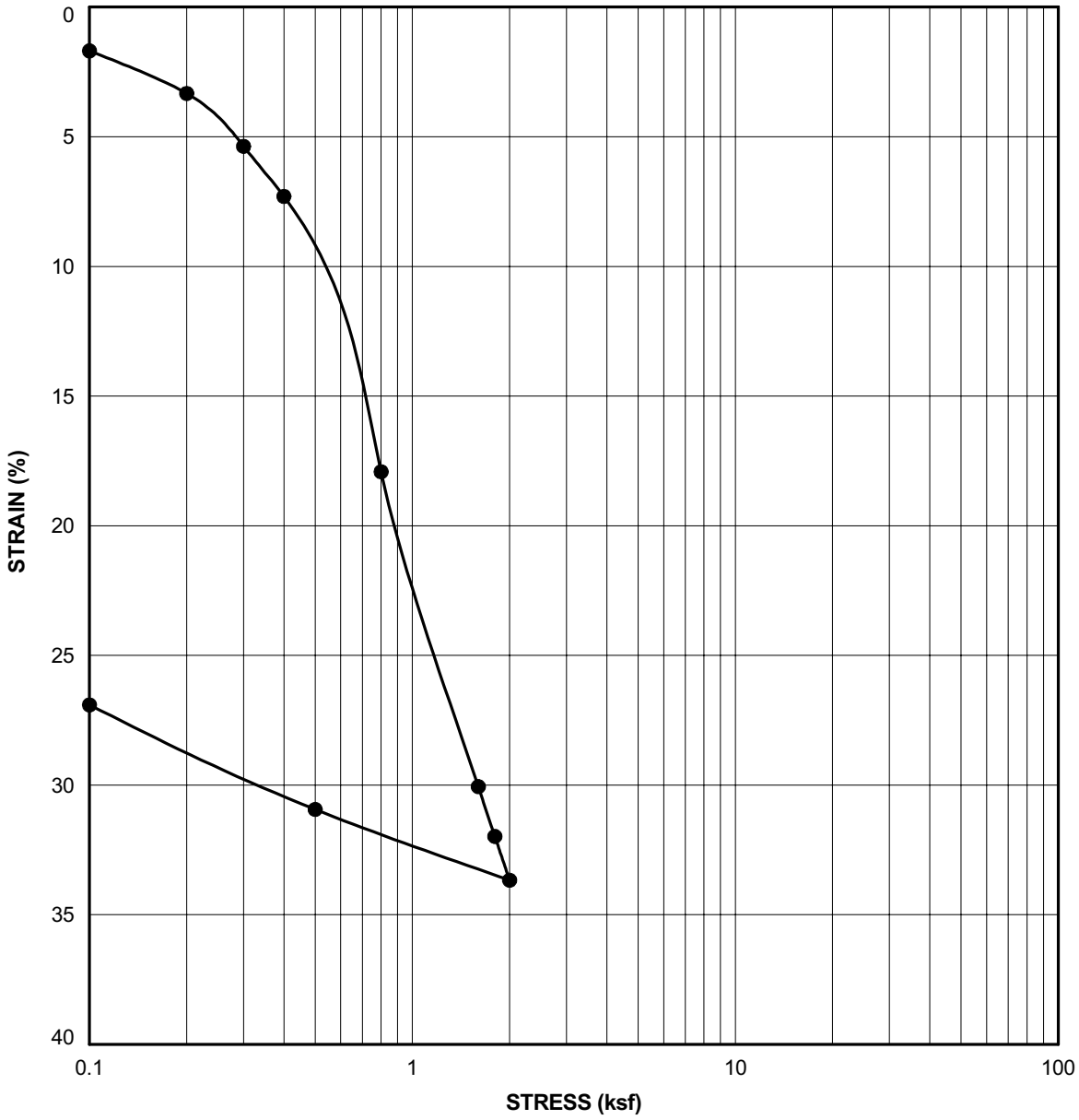
Specimen:
Total wt. = 269.5 gms
Ht. = 3.72 in
Ave dia. = 1.897 in
Area = 2.826 sq.in
Volume = 172.3 c.c.
Shearing rate = 0.04 inch/min
Shearing rate = 1.00 %/min
Gs (assumed) = 2.70

Test Report:
Void ratio = 2.009
Ht/Dia ratio = 1.96
Moisture = 74.3 %
Total density = 97.6 pcf
Dry density = 56.0 pcf
Saturation = 99.8 %
Unconfined compressive strength = 509 psf
Shear strength = 255 psf
Strain @ failure = 10.25 %

Dial Read.	Load Read.	Axial Strain (%)	Unconfined Compressive Stress (psf)
0.002	4.7	0.04	239.8
0.011	4.8	0.30	244.6
0.020	5.0	0.55	255.5
0.030	5.2	0.80	262.5
0.045	5.8	1.20	291.2
0.078	7.6	2.10	377.1
0.115	8.2	3.10	402.6
0.153	9.1	4.11	443.5
0.196	9.6	5.26	463.3
0.288	10.5	7.75	494.4
0.381	11.1	10.25	509.2
0.475	11.3	12.76	502.1
0.559	11.6	15.02	500.7



(see worksheet for sketch of failure)



Boring B-4 Sample No. 4-5 15-17 ft

Description	Liquid Limit	Plasticity Index	Specific Gravity	Diameter (inches)
Clayey Silt (MH)	112	66	2.70 *	2.420

* = assumed value

	Water Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio	Sample Height (inches)
Initial	229.5	20.4	85.4	7.258	1.000
Final	171.8	27.9	92.1	5.037	0.731

Report: CONSOL; File: OAK_NAPAPND8.GPJ; 7/26/2007

Napa Salt Marsh Restoration Project - Pond 8
Napa, California
26815678

CONSOLIDATION TEST

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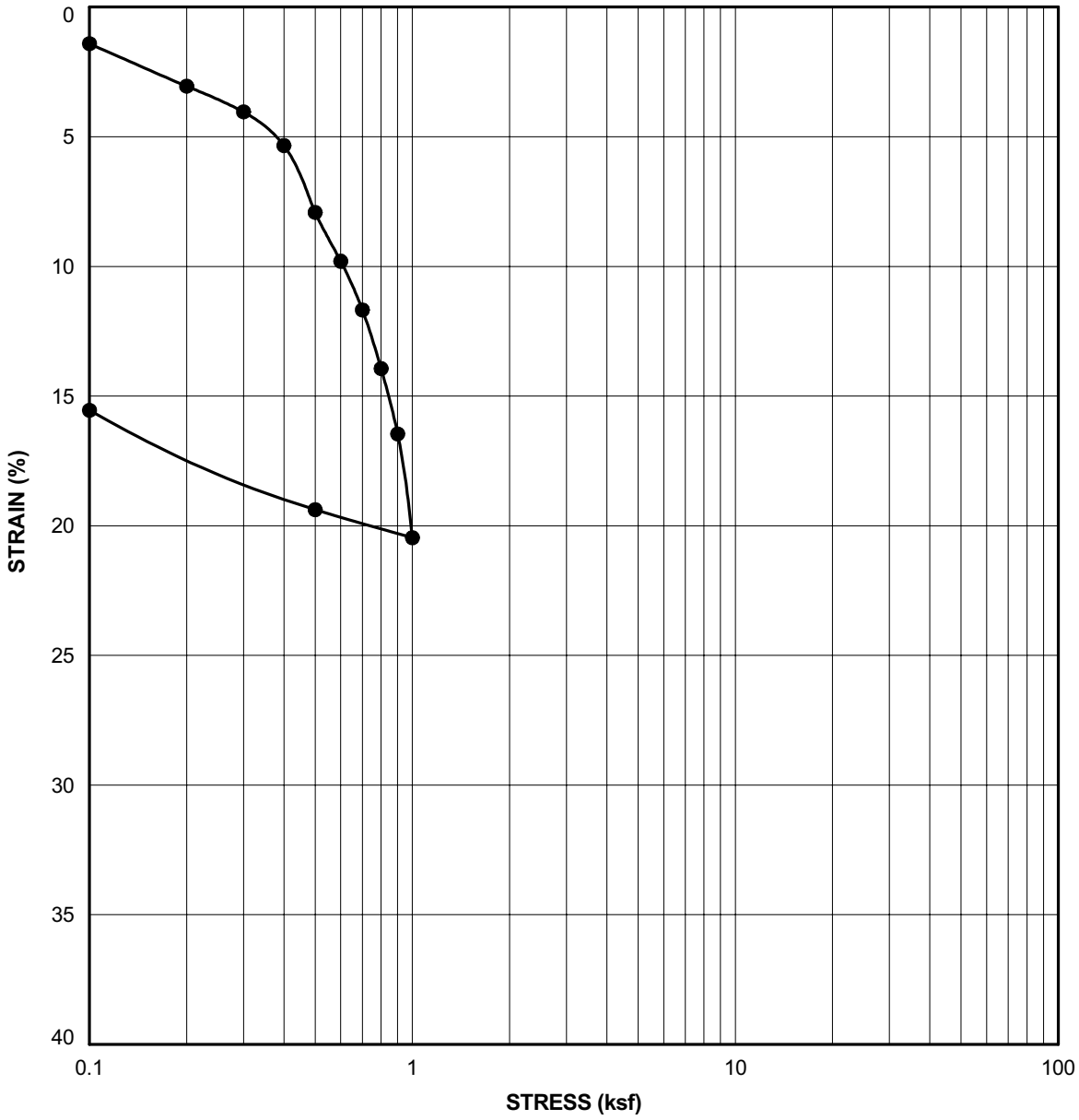

Boring B-4 Sample No. 4-5 15-17 ft

Description	Liquid Limit	Plasticity Index	Specific Gravity	Diameter (inches)
Clayey Silt (MH)			2.70 *	2.420

* = assumed value

	Water Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio	Sample Height (inches)
Initial	326.8	15.7	90.5	9.750	1.000
Final	507.8	18.6	170.2	8.057	0.842

Napa Salt Marsh Restoration Project - Pond 8
Napa, California
26815678

CONSOLIDATION TEST

URS

Report: CONSOL; File: OAK_NAPAPND8.GPJ; 7/26/2007 B-04