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MEMORANDUM

To:	Bill Faisst, PE Brown and Caldwell Erik Zalkin, PE Brown and Caldwell
From:	Robert A. Kahl, PE, GE Jacobs Associates
Job No.:	5003.0
Date:	September 6, 2013
Project:	City of Pittsburg Water Treatment Plant Capital Improvement Project
Subject:	Addendum 1 to Geotechnical Engineering Investigation Report
Reference A:	Geotechnical Engineering Investigation Report City of Pittsburg Water Treatment Plant Capital Improvements Project Pittsburg, California Prepared by: Jacobs Associates Dated: June 13, 2013

1 Introduction

Jacobs Associates prepared a Geotechnical Engineering Investigation for City of Pittsburg's Water Treatment Plant Capital Improvements Project (Reference A). This addendum to the Reference A Report presents the finding and recommendations from our geotechnical engineering investigation of:

- Existing berm between the Upper and Lower Ponds.
- New15-foot high Upper Pond Partition Wall (to bisect the Upper Pond along a north-south axis).

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2 Additional Geotechnical Field Investigation and Laboratory Testing

2.1 Additional Project Borings

Five additional borings (Borings B-11 through B-15) and one deepened existing boring (Boring B-7) were drilled on July 15, 2013. Borings B-7, B-13, and B-14 were drilled using a truck-mounted Mobile B-24 drill rig equipped with a 5-inch-diameter continuous flight solid-stem auger. Borings B-15, B-16 and B-17 were drilled with a portable Minuteman drill rig equipped with 3-inch-diameter continuous flight solid auger.

Five additional borings and one deepened existing boring (Boring B-7) were drilled along the berm between the Upper Pond and Lower Pond and within the Upper Pond. Boring B-7, B-11 and Boring B-12 were drilled along the berm between the Upper Pond and Lower Pond. Borings B-13, B-14 and B-15 were drilled within the vicinity of the planned Upper Pond retaining wall alignment. The borings were drilled on July 15, 2013 (see Figure 1 for project boring locations).

Boring B-7 was deepened from a depth of 20 feet to a depth of 35.5 feet. Borings B-11 and B-12 and B-13 were drilled to depths 26½ and 35½ feet, respectively. Boring B-14, B-15 and B-16 were drilled to depths of 16½ feet, 18 feet, and 16½ feet, respectively.

Sampling methods for the above borings are described in the Reference A report. Descriptions of soils are provided project test boring logs are based on observations during drilling and sampling and on the results of laboratory tests. Logs of test borings drilled along the berm and within the upper pond described above, are provided in Appendix A of this Addendum.

2.2 Additional Laboratory Tests

Moisture contents, unit weight, Atterberg limits, grain size analysis, unconfined compression, and direct shear tests were performed on the on samples retrieved from the Berm and Upper Pond borings to evaluate their characteristics and engineering properties. The results of these tests are summarized on the boring logs and in Appendix A and as test result figures in Appendix B of this Addendum.

3 Geotechnical Findings and Analysis

3.1 Subsurface Soil and Groundwater Conditions

The subsurface soil and groundwater conditions within the Berm along the dirt road between the Upper and Lower Ponds and within the Upper Pond as evaluated by the additional test borings (including related laboratory testing herein) and by the geotechnical research in the Reference A report are presented as geotechnical data.

Selected subsurface data encountered within the Berm and Upper Pond borings are presented in Table 1.

Table 1. Partial Summary of Berm and Upper Pond Boring Data

Project Test Boring[1]	Location[2]	Approx. Ground Surface El.[2] (ft)	Boring Depth (ft)	Pond Sludge[3]	
				Approx. Sludge Thickness (ft)	Approx. Sludge Bottom El.[2] (ft)
B-7	Middle of Berm Between Upper and Lower Ponds	160	35½	-[4]	
B-11	East End of Berm Between Upper and Lower Ponds	160	26½	-[4]	
B-12	West End of Berm Between Upper and Lower Ponds	162½	35½	-[4]	
B-13	Northern Area of Upper Pond	149	25	10	139
B-14	Middle Area of Upper Pond	147½	25	5	142½
B-15	Southern Area of Upper Pond	149	6	4	145

[1] See mapped boring locations in Figure 1, and boring logs in Appendices A.
[2] Elevations are approximate and based on site map provided by Brown and Caldwell (2013)
[3] Pond sludge includes very soft, wet organic clay (i.e. pond sludge) and underlying soft native soils.
[4] Borings drilled along the berm between the Upper Pond and Lower Pond Berm did not encounter pond sludge.

3.2 Groundwater Conditions

With the exception of the wet pond sludge encountered within the Upper Pond borings, no groundwater was encountered during the drilling of the berm and Upper Pond test borings. It should be noted however that prior to construction of the existing Upper Pond, a creek (possibly seasonal) flowed from north to south through the current Upper Pond site.

3.3 Berm Slope Stability Analysis

The berm slopes adjacent to Upper Pond and Lower Pond were evaluated for stability using Rocscience Inc.'s interactive slope stability program for soil.

The following input was used to evaluate the berm slope stability:

Table 2. Berm Slope Stabiltiy Input Values

Property	Layer 1 (fill – m. stiff clay)	Layer 2 (m. stiff lean clay w/sand)	Layer 3 (v. stiff lean clay with sand)
Color I.D.	Yellow	Green	Orange
Unit Weight	120 pcf	125 pcf	130 pcf
Cohesion	900 psf	1,300 psf	2,200 psf
Friction Angle	0°	0°	0°
Water Surface[1]	Water Table	Water Table	Water Table

[1] Water table level is shown on slope stability cross-sections in Appendix C.

The results of the slope stability analysis are presented in Appendix C of this Addendum. The slope stability analysis indicates the of the Upper Pond berm slope has a minimum factor of safety of approximately 2.75 and the Lower Pond berm slope has a minimum factor of safety of 3.20.

4 Conclusions

The slope stability analysis of the berm between the Upper Pond and Lower Pond is stable under anticipated Upper Pond water levels. In addition, it is our professional engineering opinion that the planned Upper Pond Partition Wall is feasible from a geotechnical engineering standpoint. The geotechnical data collected in the Upper Pond and Berm (presented in Section 2 and Appendices A and B) do not pose any geotechnical-related flaws to the project. Nonetheless, the subsurface conditions require attention and coordination with designers and contractors in order to design and construct the project in a safe and economic manner and to insure the project’s useful long-term performance.

The following is a summary of geotechnical challenges for the planned Upper Pond Partition Wall:

- Excavation of existing pond sludge and soft soils to expose stiff to very stiff fill and native clays.
- Potential local dewatering associated with perched water and former creek flow.
- Placement of engineered fill to raise pond bottom to design elevation and provide support for construction equipment (e.g., drill rig, excavators).
- Proper compaction of pond bottom to provide adequate foundation support for construction of planned Partition Wall.
- Cut and/or fill grading of Upper Pond slopes.
- Unidentified, buried, man-made obstructions.
- Soil corrosivity.

In Section 5, we provide recommendations to facilitate design, construction, and useful long-term performance of the planned Partition Wall.

5 Recommendations for Upper Pond Partition Wall

Geotechnical engineering recommendations provided herein are for design, construction, and useful long-life performance of the planned Upper Pond Partition Wall.

5.1 Sludge Removal

Project borings (Borings B-13 and Boring B-14) encountered wet sludge with moisture contents as high as 242%. Underlying the sludge was soft native clay. The sludge and soft clay within the upper pond should be over-excavated to expose native stiff to very stiff clays. Sludge and underlying soft clay should be removed from site.

5.2 Site Preparation

The pond bottom should be should be scarified to a depth of 12 inches, moisture conditioned (if necessary), and compacted to a minimum of 95% relative density per ASTM D1557.

5.3 Pond Bottom Elevation

The pond bottom slopes down toward the berm. The prepared bottom pond bottom elevation (i.e., after site preparation described above) is anticipated to range from about Elevation 138 feet near the north end (i.e., at Boring B-13), Elevation 142 near the middle of the pond (i.e., at Boring B-14), to about Elevation 144 near the south end of the pond (i.e., at Boring B-14).

5.4 Creek

Historic photographs and topographic maps show a seasonal creek which flowed through the current Upper Pond site. Flows associated with the creek (if encountered) will need to be collected and pumped around the Upper Pond during construction of the Upper Pond retaining wall.

5.5 Upper Pond Partition Wall Foundation

The new Upper Pond Partition wall will retain 15 feet of water head. In addition, the Upper Pond Partition wall will need to resisted loading associated with pond wave action and seismic loading.

To mitigate differential foundation settlement, lateral sliding, and overturning forces associated with the 15-foot high hydrostatic loads, wave loads, and seismic loads; we recommend that the retaining wall footing be supported on drilled cast-in place steel-reinforced concrete.

We recommend that the drilled piers foundations be a minimum of 24-inch to 30-inch in diameter. The piers should be staggered (i.e., offset) along each side of the retaining wall footing. Drilled cast-in-place straight shaft piers should be designed using an allowable skin friction (C_A) of 750 psf. The upper 2 feet of the pier and the bottom one diameter of the pier should be neglected.

When calculating the lateral bearing capacity, the upper 2 feet of the pier should be neglected and a bearing area of 1.5 times the pier diameter may be used. Piers should be continuously reinforced and designed with a maximum length-to-diameter ratio of 15 to 1.

5.5.1 Pier Load-deflection Analysis

Lateral load resistance can be provided by piers and embedded foundation elements of the structure. Lateral load resistance of pier foundations should be evaluated by load deflection analysis rather than ultimate soil resistance. Lateral resistance of piles is dependent on the stiffness of the pier, modulus of subgrade reaction of the surrounding soil, allowable deflection, and the moment induced in the pier. For purposes of this analysis, the parameters given in Table 3 may be used for the surrounding soil.

Table 3. Soil Parameters for Single-Pile Deflections Analysis

Subsurface Soil	Depth (ft)	S_u* (psi)	Φ° †	Unit Weight (pci)	E_{50} ‡
Stiff Clay	0 to 12	5	0	0.030	0.01
Stiff/ Very Stiff Clay	12 to 20	10	0	0.039	0.007

* Undrained shear strength in pounds per square inch.
† Angle of internal friction
‡ Values of strain at 50% of the undrained shear strength.

Upon request, Jacobs Associates will analyze pier deflection using the soil parameters above and design loading provided by Brown and Caldwell.

5.5.2 Drilled Pier Construction

Pier holes need not be cased unless the seepage is encountered; pier hole sloughs, or is otherwise unstable. All pier holes should be dry and reasonably free of loose soil fall-in prior to installing reinforcement steel and concreting. Caution should be taken when concreting pier holes spaced closer than three diameters, center to center, so that the pressure head from the wet concrete in one pier hole does not cause the adjacent pier hole to cave in. This can be accomplished by: concreting the pier holes as they are completed; concreting each pier hole a few feet at a time; or maintaining at least three pier diameter spacing center to center. Care must be taken during construction to avoid “mushrooming” at the top of the piers. A Guideline to Specifications for Drilled Piers will be provided upon request.

Groundwater levels near and underlying the site may fluctuate depending on seasonal rainfall and other factors not evident at the time of our investigation. Pier holes below groundwater will require special consideration (i.e., dewatering and/or casing and/or tremie concrete placement) during construction.

The bottom of pier excavations should be reasonably free of loose cuttings and soil fall-in prior to installing reinforcing steel and placing concrete. Any accumulated water in the pier excavations should be pumped out prior to concrete placement or the concrete should be tremied to the bottom of the hole. In addition, it is preferable that the pier holes should not be left overnight or longer than eight hours prior to concreting. In the event that casing is required due to sloughing or excess groundwater inflow, the casing diameter should be the same as the pier hole diameter. When filling a cased pier hole, a minimum depth of concrete of at least 5 feet must be maintained in the casing at all times while the casing is being pulled out of the pier hole. Casing should not be left in any pier hole.

In order to assure that the drilled piers are founded within the soil conditions for which they are designed, Jacobs Associates should observe and document the condition of pier excavations prior to placing reinforcing steel or concrete.

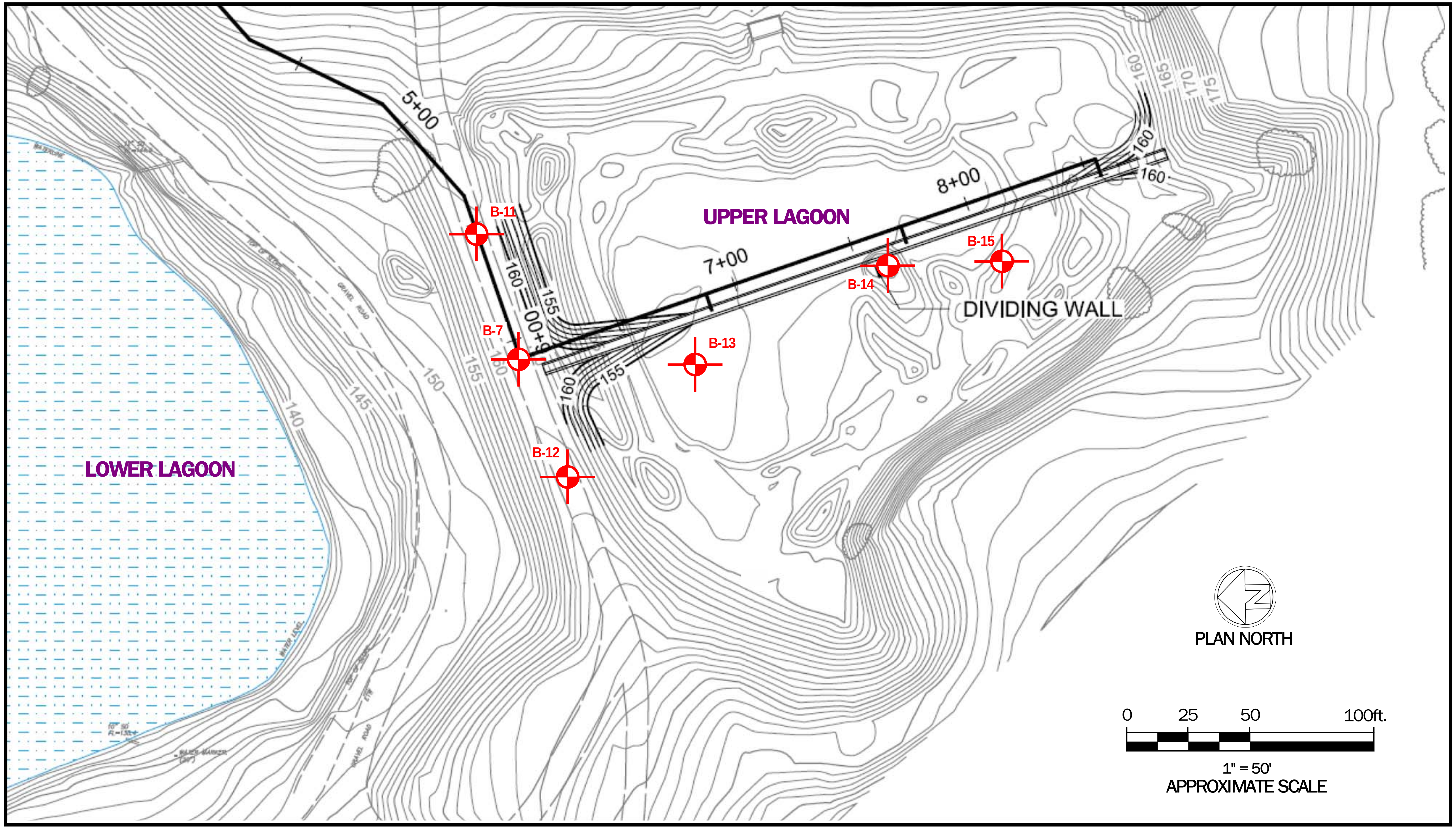
All drilled piers should be structurally connected to wall footing which will serve to transmit loads to the piers and to provide lateral and overturning restraint. The wall footing should be properly reinforced to transmit both vertical and lateral loads.

Drilled piers designed and constructed according to the above recommendations are expected to experience small elastic settlements due to the weight of the structure. Estimated total settlement is on the order of 0.5 inch, and total differential settlement should be less than one half of the aforementioned total.

6 Closure

We appreciate the opportunity to provide this Project addendum to the Brown and Caldwell. Please contact us if you have any questions about this memorandum or need any other geotechnical assistance with this project.

Figures



LEGEND:

B-1 - Project test boring (logs in Appendix B)

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Boring Location Map

Figure

1

Appendix A

LOG OF BORING B-7 ①

LOCATION: Between upper and lower ponds (see Figure 2).

GROUND SURFACE: Approx. El. 160' ④

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	GROUNDWATER ③	DESCRIPTION ②	% MOISTURE %	DRY DENSITY lbs./ft.³	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE: Gravel (>#4 sieve) %	GRAIN SIZE: Sand (#4 to #200 sieve) %	GRAIN SIZE: Fines (<#200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH kips/ft.²	DIRECT SHEAR: Cohesion p.s.f.	DIRECT SHEAR: Internal Friction Angle
	1		9		**SANDY LEAN CLAY (CL) - FILL** - dark gray and dark yellowish brown - trace gravel, sandier with depth - medium stiff	21	100	47	25	2	36	62	3.96		
5	2		10		- gravel at 5' to 6' (per driller)										
	3		11		**LEAN CLAY WITH SAND (CL) - FILL** - dark yellowish brown - fine to medium sand - medium stiff - moist	21 20	96 105	36	16				1.92	220	19°
10	4		7												
15	5		10		- dark gray mottling - very moist	22	106						1.19		
	6		6		**LEAN CLAY WITH SAND (CL)** - very dark bluish gray - fine to coarse sand, trace gravel - medium stiff to stiff - moist	27									
20	7		15			25	101						2.28		
	8		11												
25															

BORING CONTINUED AT 26 FEET ON FIGURE A-1 (2 OF 2)

NOTES
① Drilled 03/14/13 and 07/15/13 using a Mobile B-24, 5" diameter solid stem augers, and a 30" drop by 140 lb. cathead sampling hammer.
② See report text and figures in Appendices A and C for definitions, lab test results, and additional soil descriptions.
③ Free groundwater level not encountered during or after drilling. Static equilibrium groundwater depth is unknown.
④ Surface elevation approximated from plans provided by Brown and Caldwell (4/22/13).

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Log of Boring B-7

Figure
A-1
(1 of 2)

LOG OF BORING B-7 (Continued)[1]

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	GROUNDWATER	DESCRIPTION	% MOISTURE %	DRY DENSITY lbs./ft.³	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE: Gravel (>#4 sieve) %	GRAIN SIZE: Sand (#4 to #200 sieve) %	GRAIN SIZE: Fines (<#200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH kips/ft.²	DIRECT SHEAR: Cohesion p.s.f.	DIRECT SHEAR: Internal Friction Angle
					BORING CONTINUED FROM 26 FEET ON FIGURE A-1 (1 OF 2)										
					SANDY LEAN CLAY (CL)										
	9		25		- dark yellowish brown - fine to coarse sand, trace fine gravel - few to little caliche - very stiff - moist to dry	21	110								
30															
	10		45		- dark yellowish/reddish brown - fine to medium sand	15	115								
35	11		26												
					BOTTOM OF BORING AT 35 ½ FEET										
40															
45															
50															

NOTES

① See notes on Figure B-1 (1 of 2).

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Log of Boring B-7

Figure **A-1** (2 of 2)

LOG OF BORING B-11[1]

LOCATION: Between upper and lower ponds, approx. 60' e/o B-7 (see Figure 2).

GROUND SURFACE: Approx. El. 160'[4]

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	GROUNDWATER ③	DESCRIPTION ②	MOISTURE %	DRY DENSITY lbs./ft.³	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE: Gravel (>#4 sieve) %	GRAIN SIZE: Sand (#4 to #200 sieve) %	GRAIN SIZE: Fines (<#200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH kips/ft.²	DIRECT SHEAR: Cohesion p.s.f.	DIRECT SHEAR: Internal Friction Angle
					GRAVELLY LEAN CLAY WITH SAND (CL) - FILL - dark brown - fine to coarse sand, fine to coarse gravel - dry										
5	1		6		**SANDY LEAN CLAY (CL) - FILL** - dark yellowish/grayish brown - fine to medium sand, trace fine gravel - medium stiff to stiff - dry to moist	16				2	42	56 (FINES: 28% Silt, 28% Clay)			
10	2		16			19	101								
					- cobbles/gravels encountered while drilling from 14' to 15'										
15	3		21		**CLAYEY SAND (SC)** - dark grayish/yellowish brown - fine sand - little to some caliche - very dense - moist/dry	18	106							235	40°
20	4		38												
25	5		30		**LEAN CLAY WITH SAND (CL)** - orangish brown - fine sand - little caliche - hard - dry	20									
					BOTTOM OF BORING AT 26 ½ FEET										

NOTES

① Drilled 07/15/13 using a Mobile B-24, 5" diameter solid stem augers, and a 30" drop by 140 lb. cathead sampling hammer.
② See report text and figures in Appendices A and C for definitions, lab test results, and additional soil descriptions.
③ Free groundwater level not encountered during or after drilling. Static equilibrium groundwater depth is unknown.
④ Surface elevation approximated from plans provided by Brown and Caldwell (4/22/13).

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Log of Boring B-11

Figure A-2

LOG OF BORING B-12 ①

LOCATION: Between upper and lower ponds, approx. 50' w/o B-7 (see Figure 2).

GROUND SURFACE: Approx. El. 160' ④

DEPTH (feet)	SAMPLE NO.	TYPE	PENETRATION RESISTANCE (blows/ft.)	GROUNDWATER ③	DESCRIPTION ②	MOISTURE (%)	DRY DENSITY (lbs./ft.³)	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE: Gravel (>#4 sieve) %	GRAIN SIZE: Sand (#4 to #200 sieve) %	GRAIN SIZE: Fines (<#200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH (kips/ft.²)	DIRECT SHEAR: Cohesion (p.s.f.)	DIRECT SHEAR: Internal Friction Angle
					GRAVELLY LEAN CLAY WITH SAND (CL) - FILL - dark brown - fine to coarse sand, fine to coarse gravel - dry										
					SANDY LEAN CLAY (CL) - FILL - reddish/orangish brown - fine to medium sand, trace fine gravel - medium stiff - dry										
5	1		7			17	99								
	2		5			19									
					SANDY LEAN CLAY (CL) - FILL - light reddish brown with dark brownish gray mottling - fine to medium sand - stiff - dry to moist										
10	3		16			18 22	106 96			2	40	58 (FINES: 28% Silt, 30% Clay)	2.65		27°
	4		9												
15	5		14		- coarse gravel/piece of cobble (~2.5") in shoe of sample barrel - moist										
					- cobbles/gravels encountered while drilling from 16' to 18'										
					LEAN CLAY (CL) - dark bluish gray - few to little fine sand - medium stiff/stiff - moist										
20	6		8					40	21						
25															

BORING CONTINUED AT 26 FEET ON FIGURE A-3 (2 OF 2)

NOTES

① Drilled 07/15/13 using a Mobile B-24, 5" diameter solid stem augers, and a 30" drop by 140 lb. cathead sampling hammer.
② See report text and figures in Appendices A and C for definitions, lab test results, and additional soil descriptions.
③ Free groundwater level not encountered during or after drilling. Static equilibrium groundwater depth is unknown.
④ Surface elevation approximated from plans provided by Brown and Caldwell (4/22/13).

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	GROUNDWATER	LOG OF BORING B-12 (Continued)① DESCRIPTION	% MOISTURE %	DRY DENSITY lbs./ft.³	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE Gravel (>#4 sieve) %	Sand (#4 to #200 sieve) %	Fines (<#200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH kips/ft.²	DIRECT SHEAR Cohesion p.s.f.	Internal Friction Angle
					BORING CONTINUED FROM 26 FEET ON FIGURE B-3 (1 OF 2)										
					SANDY LEAN CLAY (CL) - dark grayish brown - fine sand, trace fine gravel - stiff - moist										
	7		18			27	98						3.65		
30	8		14												
					LEAN CLAY (CL) - yellowish brown - few sand - very stiff - moist										
	9		26			21	107								
35	10		17												
					BOTTOM OF BORING AT 35 ½ FEET										
40															
45															
50															

NOTES

① See notes on Figure B-12 (1 of 2).

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Log of Boring B-12

Figure
A-3
(2 of 2)

LOG OF BORING B-13 ①

LOCATION: North end of upper pond (see Figure 2).

GROUND SURFACE: Approx. El. 148.5' ④

DEPTH feet	SAMPLE NO.	TYPE	PENETRATION RESISTANCE blows/ft.	GROUNDWATER ③	DESCRIPTION ②	% MOISTURE %	DRY DENSITY lbs./ft.³	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE: Gravel (>#4 sieve) %	GRAIN SIZE: Sand (#4 to #200 sieve) %	GRAIN SIZE: Fines (<#200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH kips/ft.²	DIRECT SHEAR: Cohesion p.s.f.	DIRECT SHEAR: Internal Friction Angle
					ORGANIC CLAY (OH) - black/very dark gray - few to little fine sand - very soft - wet										
	1					219									
5	2		2			242	21								
					LEAN CLAY WITH SAND (CL) - very dark gray - fine sand, few silt - soft - moist										
	3		4					45	26						
10					**SANDY LEAN CLAY (CL)** - dark grayish brown - fine sand, trace coarse gravel - stiff - moist										
	4		17			19	111						4.36		
	5		13			16									
15					- coarse gravel present (plugged SPT, no sample retrieved) - cobbles/gravels encountered while drilling around 14 ½ feet										
	NSR		14												
					BOTTOM OF BORING AT 16 ½ FEET										
20															
25															

NOTES

① Drilled 07/15/13 using a tripod minuteman with 4" diameter solid stem augers, and a 30" drop by 140 lb. cathead sampling hammer.
② See report text and figures in Appendices A and C for definitions, lab test results, and additional soil descriptions.
③ Free groundwater level not encountered during or after drilling. Static equilibrium groundwater depth is unknown.
④ Surface elevation approximated from plans provided by Brown and Caldwell (4/22/13).

LOG OF BORING B-14 ①

LOCATION: Middle of upper pond (see Figure 2).

GROUND SURFACE: Approx. El. 147.5' ④

DEPTH (feet)	SAMPLE NO.	TYPE	PENETRATION RESISTANCE (blows/ft.)	GROUNDWATER ③	DESCRIPTION ②	% MOISTURE (%)	DRY DENSITY (lbs./ft.³)	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE: Gravel (>#4 sieve) %	GRAIN SIZE: Sand (#4 to #200 sieve) %	GRAIN SIZE: Fines (<#200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH (kips/ft.²)	DIRECT SHEAR: Cohesion (p.s.f.)	DIRECT SHEAR: Internal Friction Angle
					ORGANIC CLAY (OH) - black/very dark gray - wet										
	1				**LEAN/FAT CLAY (CL/CH)** - very dark gray - few fine sand and silt - moist	38									
5	2		17		**LEAN CLAY WITH SAND (CL)** - grayish brown - fine sand, trace gravel - stiff to very stiff - moist	20	107						4.44		
	3		15					41	21						
10	4		24		**SANDY LEAN CLAY (CL)** - dark yellowish brown - fine to coarse sand, trace coarse gravel - very stiff - moist/dry	19	110								
	5		16												
15	6		31		- little caliche	22	106			0	36	64 (FINES: 30% Silt, 34% Clay)			
	7		27		- 6" layer of reddish brown clayey sand (SC) at 17'										
20					**BOTTOM OF BORING AT 18 FEET**										
25															

NOTES

① Drilled 07/15/13 using a tripod minuteman with 4" diameter solid stem augers, and a 30" drop by 140 lb. cathead sampling hammer.
② See report text and figures in Appendices A and C for definitions, lab test results, and additional soil descriptions.
③ Groundwater seepage measured at 17' at end of drilling. Static equilibrium groundwater depth is unknown.
④ Surface elevation approximated from plans provided by Brown and Caldwell (4/22/13).

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Log of Boring B-14

Figure **A-5**

DEPTH (feet)	SAMPLE NO.	TYPE	PENETRATION RESISTANCE (blows/ft.)	GROUNDWATER ③	LOG OF BORING B-15 ① LOCATION: South end of upper pond (see Figure 2). GROUND SURFACE: Approx. El. 149' ④ DESCRIPTION ②	% MOISTURE (%)	DRY DENSITY (lbs./ft.³)	LIQUID LIMIT	PLASTICITY INDEX	GRAIN SIZE: Gravel (>#4 sieve) %	GRAIN SIZE: Sand (#4 to #200 sieve) %	GRAIN SIZE: Fines (<#200 sieve) %	UNCONFINED COMPRESSIVE STRENGTH (kips/ft.²)	DIRECT SHEAR: Cohesion (p.s.f.)	DIRECT SHEAR: Internal Friction Angle
					LEAN/FAT CLAY (CL/CH) - dark brownish gray - few sand - moist										
	1					28									
5	2		19		**LEAN CLAY WITH SAND (CL)** - grayish brown - fine to medium sand - stiff - moist/dry	22	103						3.91		
	3		14												
10	4		18		**SANDY LEAN CLAY (CL)** - yellowish brown/light brown - fine sand - very stiff - dry	22									
15	4		32		- hard - few to little caliche - layer of yellowish brown SC at 16'										
					BOTTOM OF BORING AT 16 ½ FEET										
20															
25															

NOTES
① Drilled 07/15/13 using a tripod minuteman with 4" diameter solid stem augers, and a 30" drop by 140 lb. cathead sampling hammer.
② See report text and figures in Appendices A and C for definitions, lab test results, and additional soil descriptions.
③ Free groundwater level not encountered during or after drilling. Static equilibrium groundwater depth is unknown.
④ Surface elevation approximated from plans provided by Brown and Caldwell (4/22/13).

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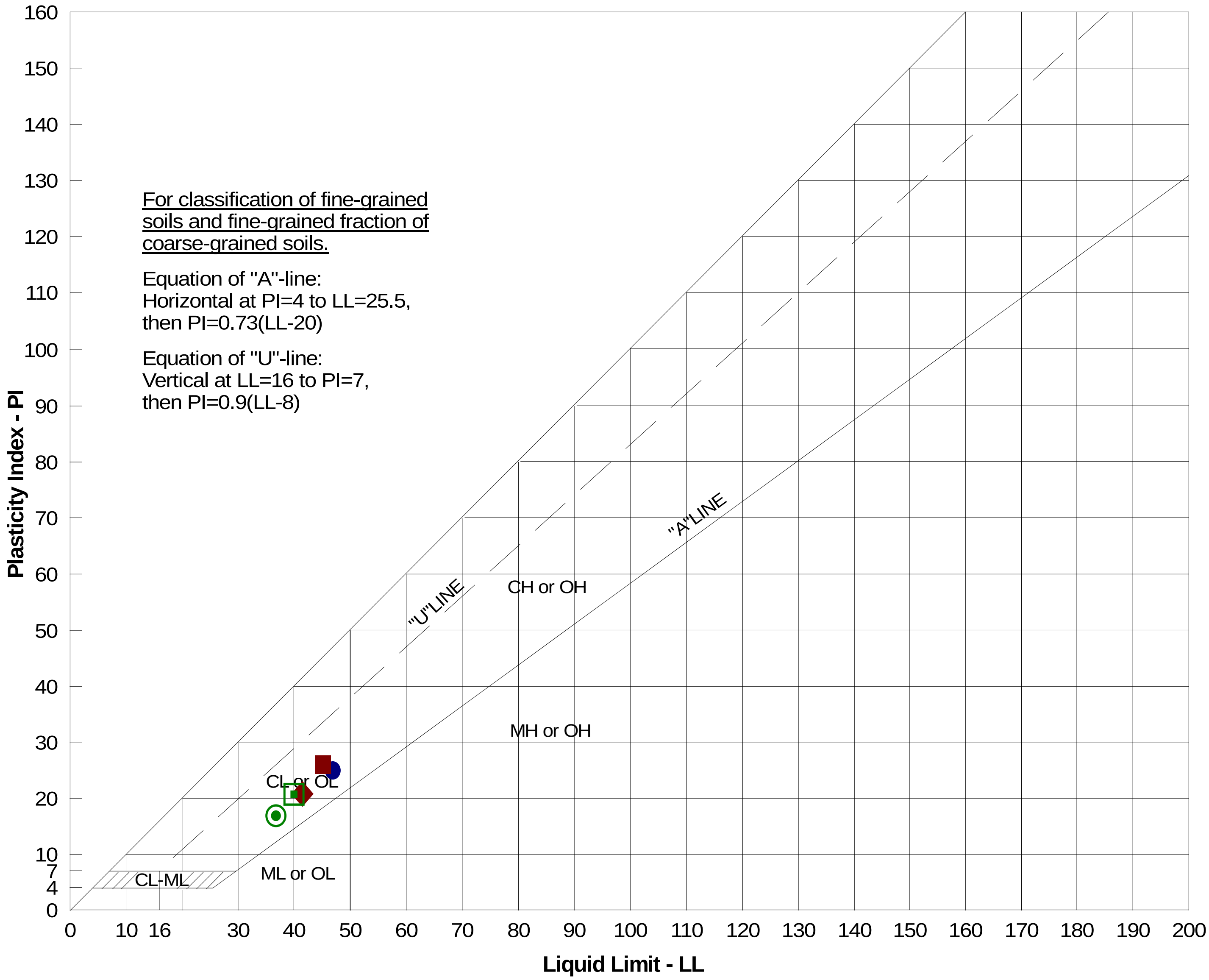
Log of Boring B-15

Figure
A-6

Appendix B



TEST SYMBOL	SAMPLE NO.	DEPTH (ft)	LIQUID LIMIT - LL	PLASTICITY INDEX - PI	GROUP SYMBOL*
●	B-7-1	3-3½	47	25	CL
⦿	B-7-3	8-8½	36	16	CL
▣	B-12-6	15-16	40	21	CL
■	B-13-3	6½-8	45	26	CL
◆	B-14-3	6½-8	41	21	CL

* Classification of fines < 0.425mm

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Water Treatment Plant Improvements Project
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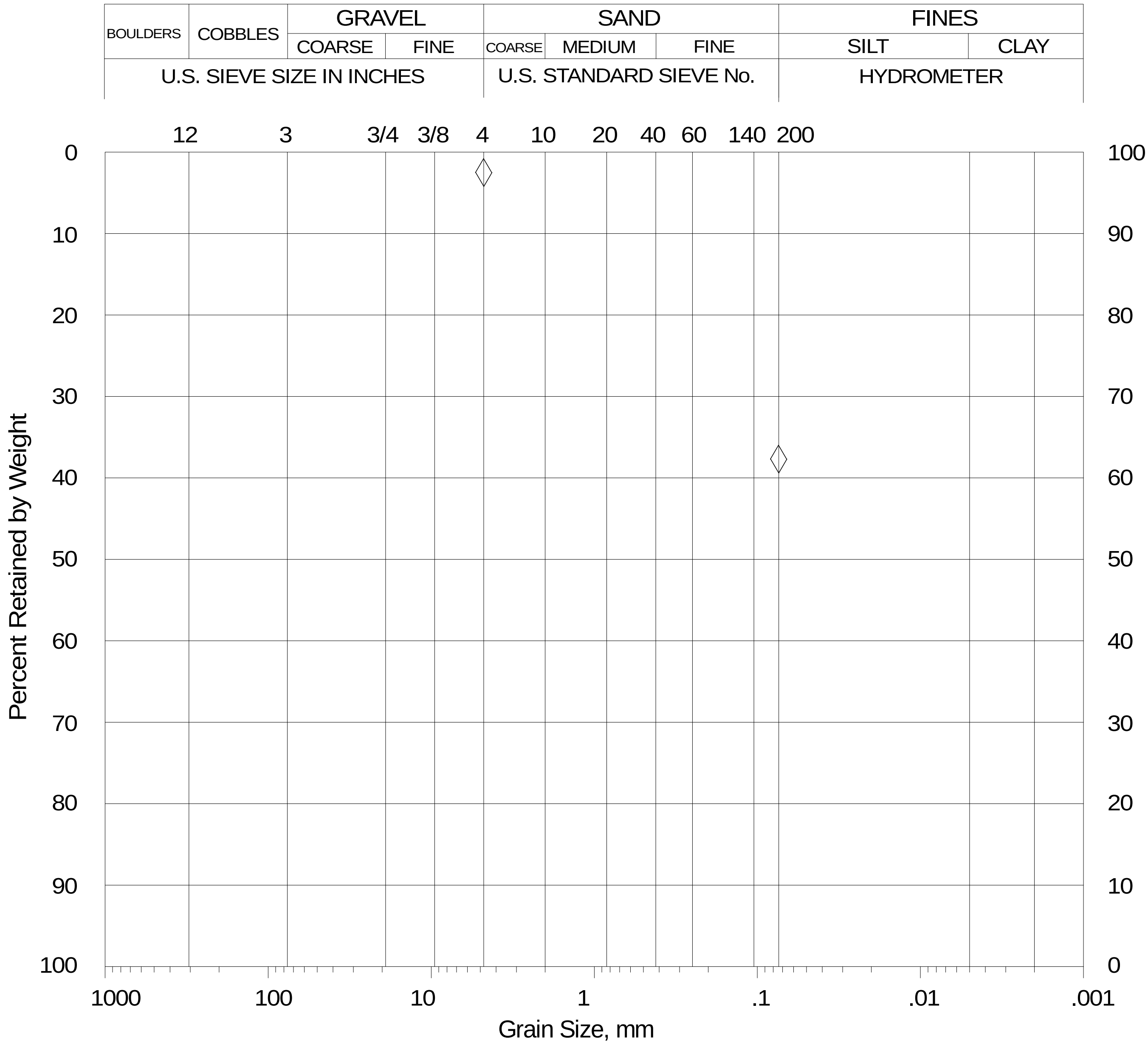
Plasticity Index

Figure **B-1**



TEST SYMBOL	BORING SAMPLE NO.	DEPTH (ft)	GROUP SYMBOL	DESCRIPTION (based on grain size)
◊	B-7-1	3-3½	CL	sandy lean clay

NOTE: The largest particle (grain) size that could have been sampled from our borings by our sample barrels is a function of the inside diameter of the sample barrels used (see Figure A-1). Therefore, there may be larger particles (e.g., coarse gravel, cobbles or boulders) in the soils sampled than reflected on the boring logs and grain size distribution curves provided in this report.

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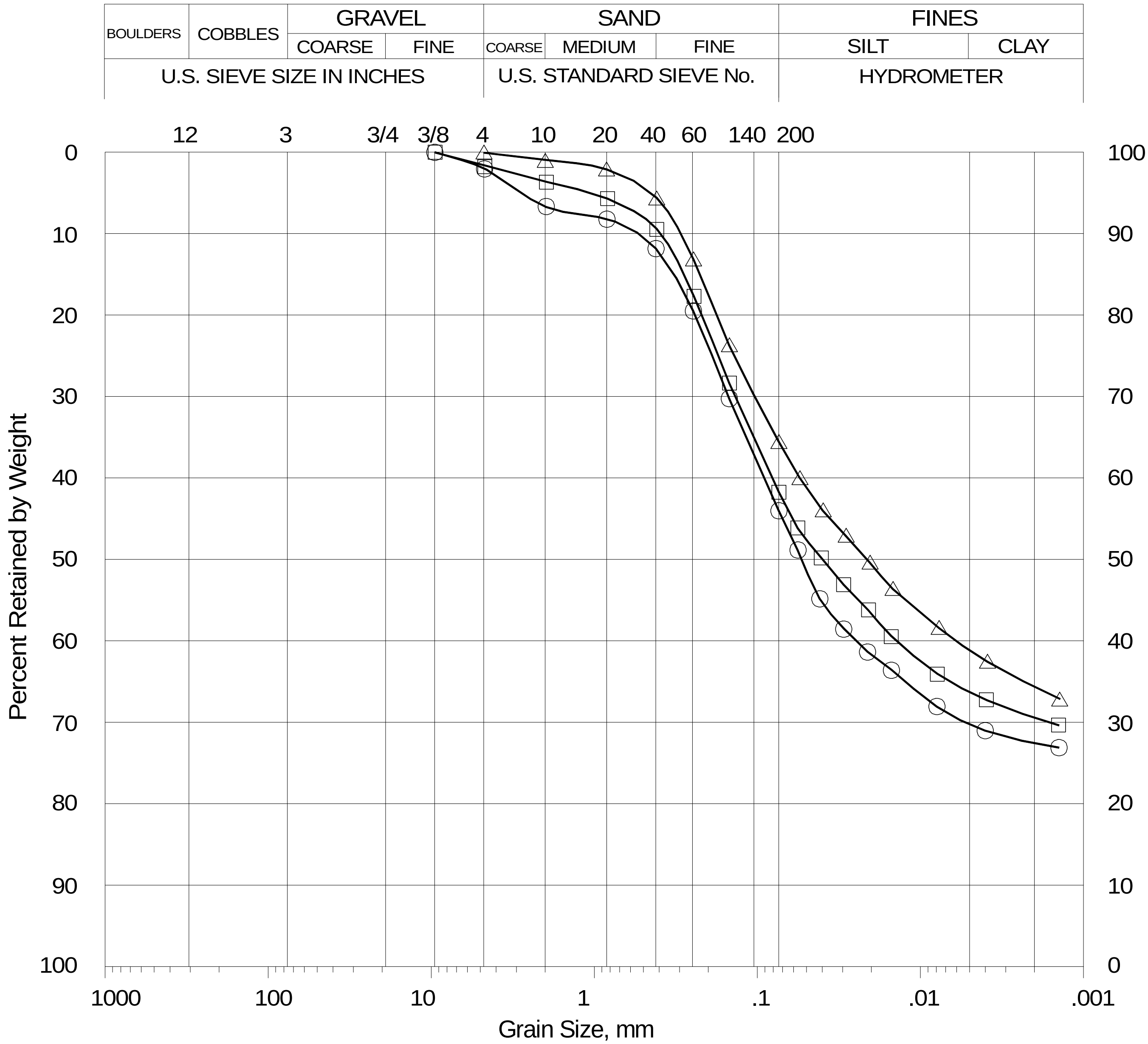
Grain Size

Figure **B-2** (1 of 2)



TEST SYMBOL	SAMPLE NO.	DEPTH (ft)	GROUP SYMBOL	USCS DESCRIPTION (based on grain size)
○	B11-1	5-6½	CL	sandy lean clay
□	B12-3	11-11½	CL	sandy lean clay
△	B14-6	15½-16	CL	sandy lean clay

NOTE: The largest particle (grain) size that could have been sampled from our borings by our sample barrels is a function of the inside diameter of the sample barrels used (see Figure A-1). Therefore, there may be larger particles (e.g., coarse gravel, cobbles or boulders) in the soils sampled than reflected on the boring logs and grain size distribution curves provided in this report.

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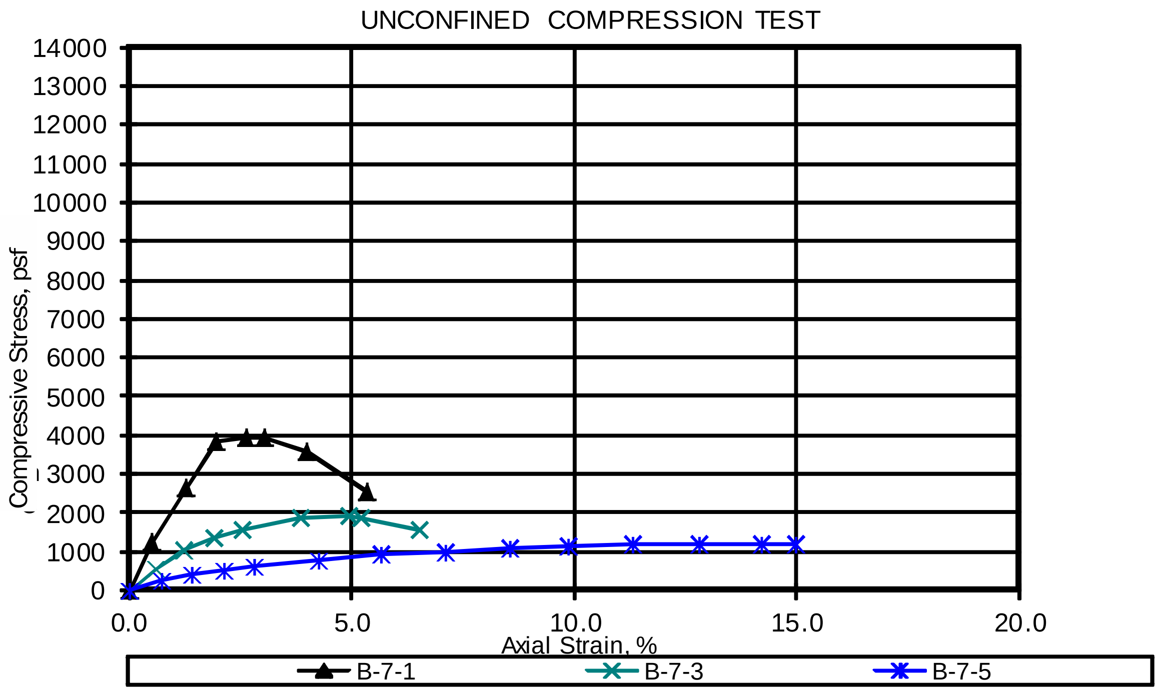
Grain Size

Figure

B-2

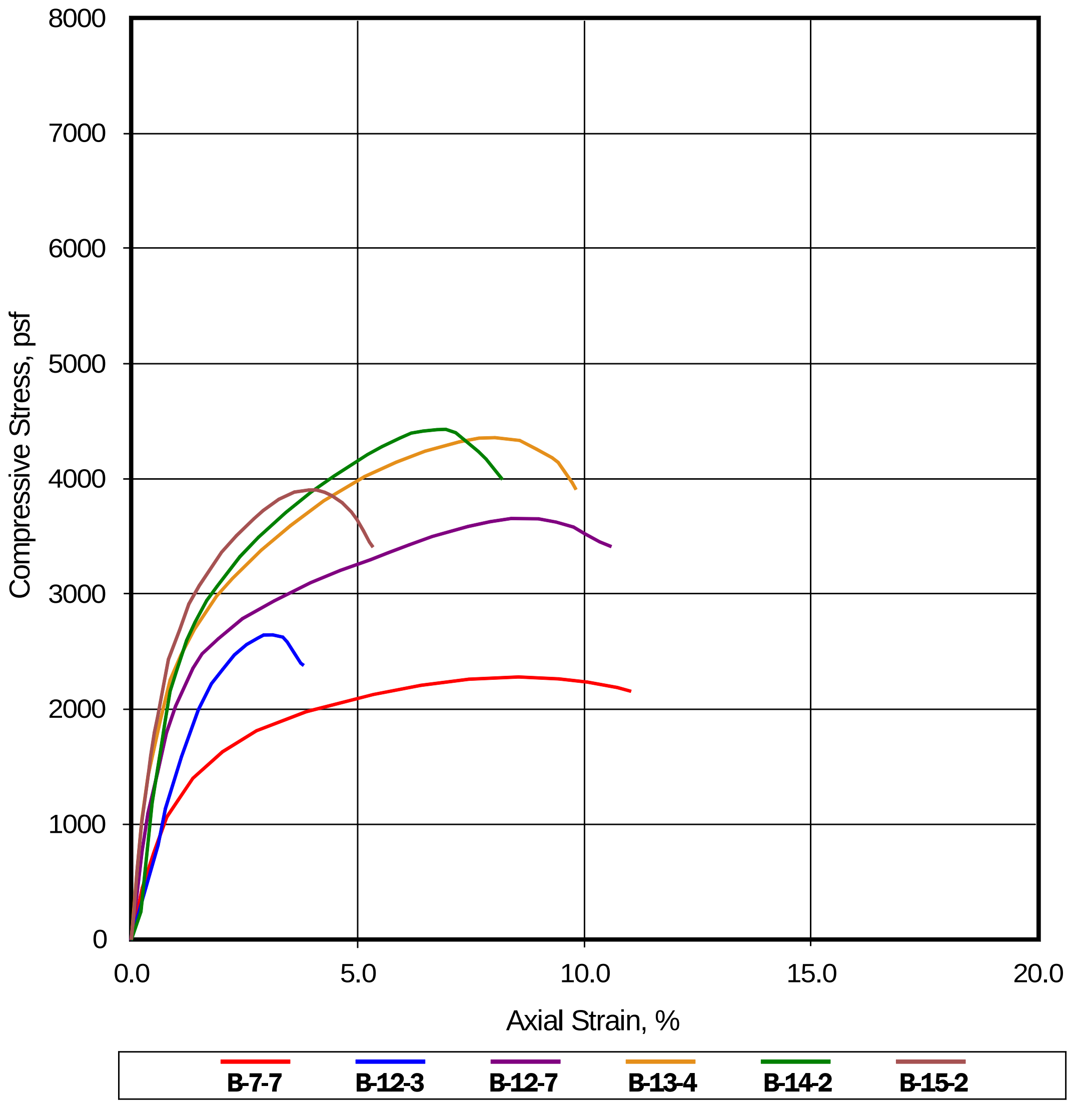
(2 of 2)



BORING SAMPLE NO.	B-7-1	B-7-3	B-7-5
MAXIMUM UNCONFINED STRESS, psf	3,958	1,920	1,187
%STRAIN @ PEAK STRESS	3.0	4.9	12.8
DEPTH, ft.	3-3½	8-8½	14½-15
WATER CONTENT, %	21	20	22
DRY DENSITY, pcf	100	105	106
SATURATION, %	81	89	99

Maximum Unconfined Stress cut-off = 15% strain
Average Strain Rate = 0.07 in/min.

UNCONFINED COMPRESSION TEST



BORING SAMPLE NO.	B-7-7	B-12-3	B-12-7	B-13-4	B-14-2	B-15-2
MAXIMUM UNCONFINED STRESS*, psf	2283	2652	3653	4362	4437	3911
%STRAIN @ PEAK STRESS	8.6	3.0	8.6	8.2	6.9	4.1
DEPTH, ft.	21-21½	10½-11	28½-29	11-11½	6-6½	6-6½
WATER CONTENT, %	25	18	27	19	20	22
DRY DENSITY, pcf	101	106	98	111	107	103
SATURATION, %	100	83	100	98	92	92

*Maximum Unconfined Stress cut-off = 15% strain
Average Strain Rate = 0.08 in/min.

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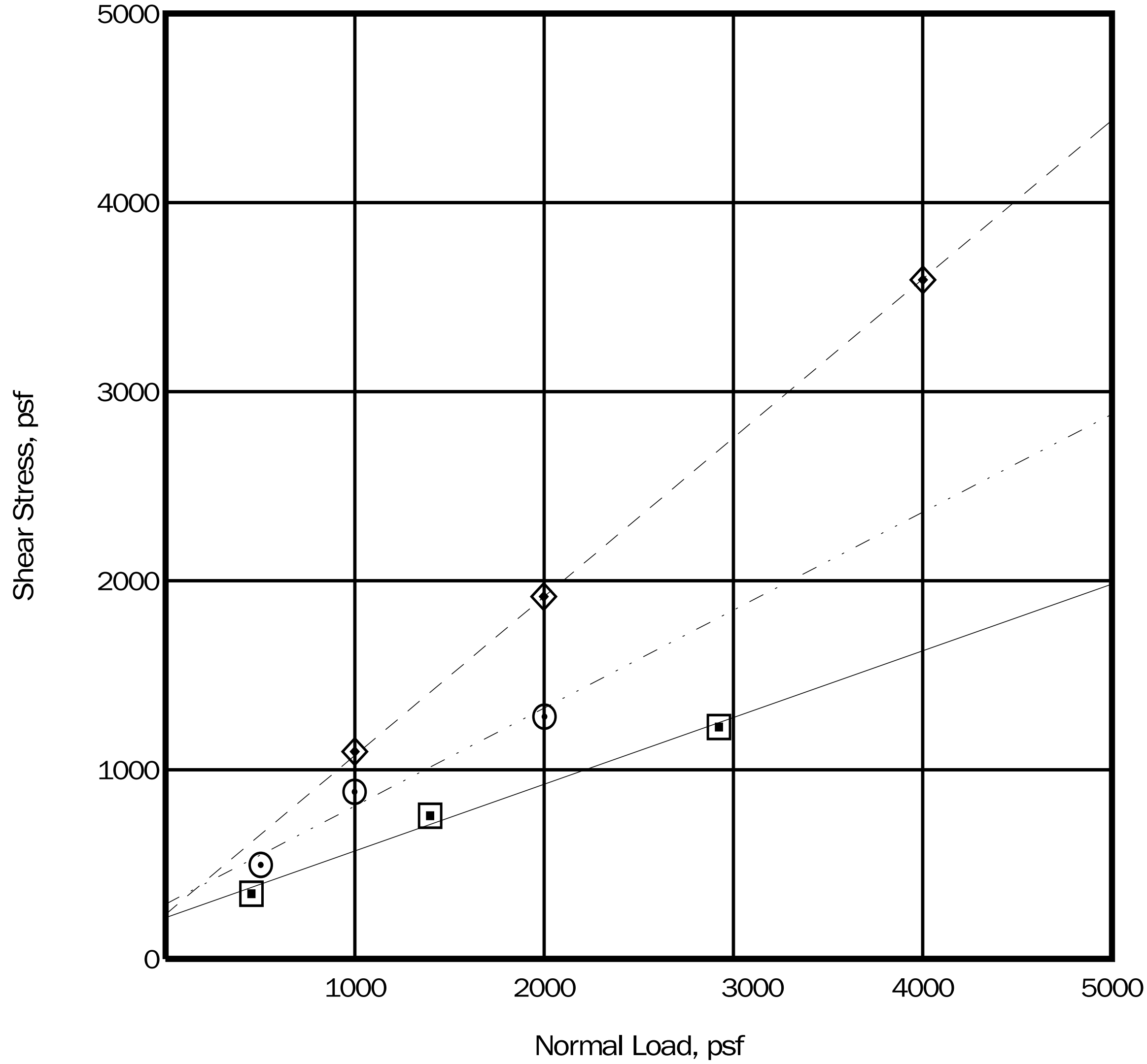
Unconfined Compression

Figure **B-3**
(2 of 2)



TEST SYMBOL	GRAPH LINE	BORING SAMPLE NO.	DEPTH (ft)	APPARENT COHESION (p.s.f.)	INTERNAL FRICTION ANGLE (degrees)	AVE. DRY DENSITY (pcf)/ MOISTURE CONTENT (%)	
						BEFORE TEST	AFTER TEST
⊡	———	B-7-3	7½-8	220	19	96/21	99/25
◈	— — —	B-11-3	18½-19	235	40	106/18	106/20
⊙	— · · —	B-12-3	11-11½	289	27	96/22	96/27

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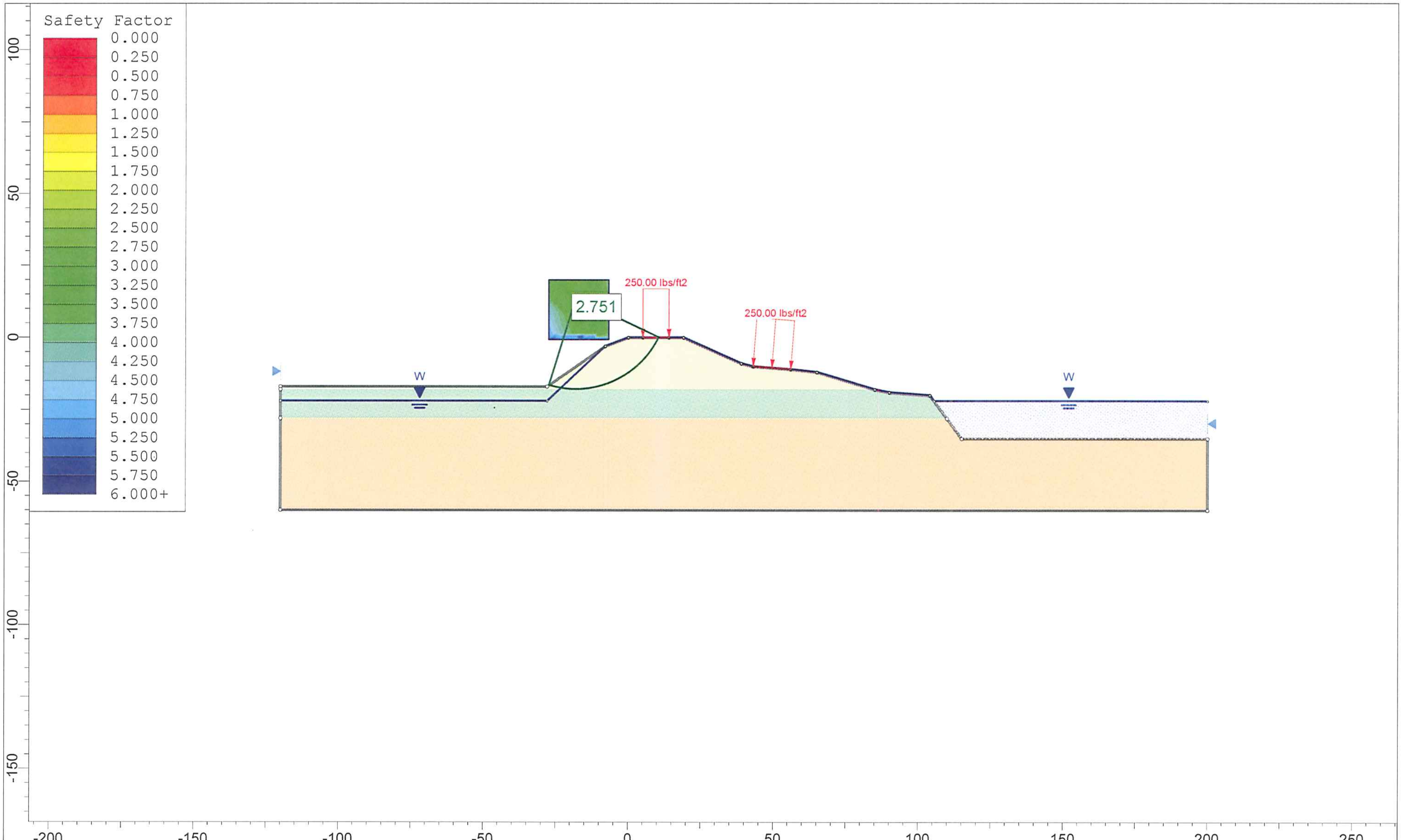
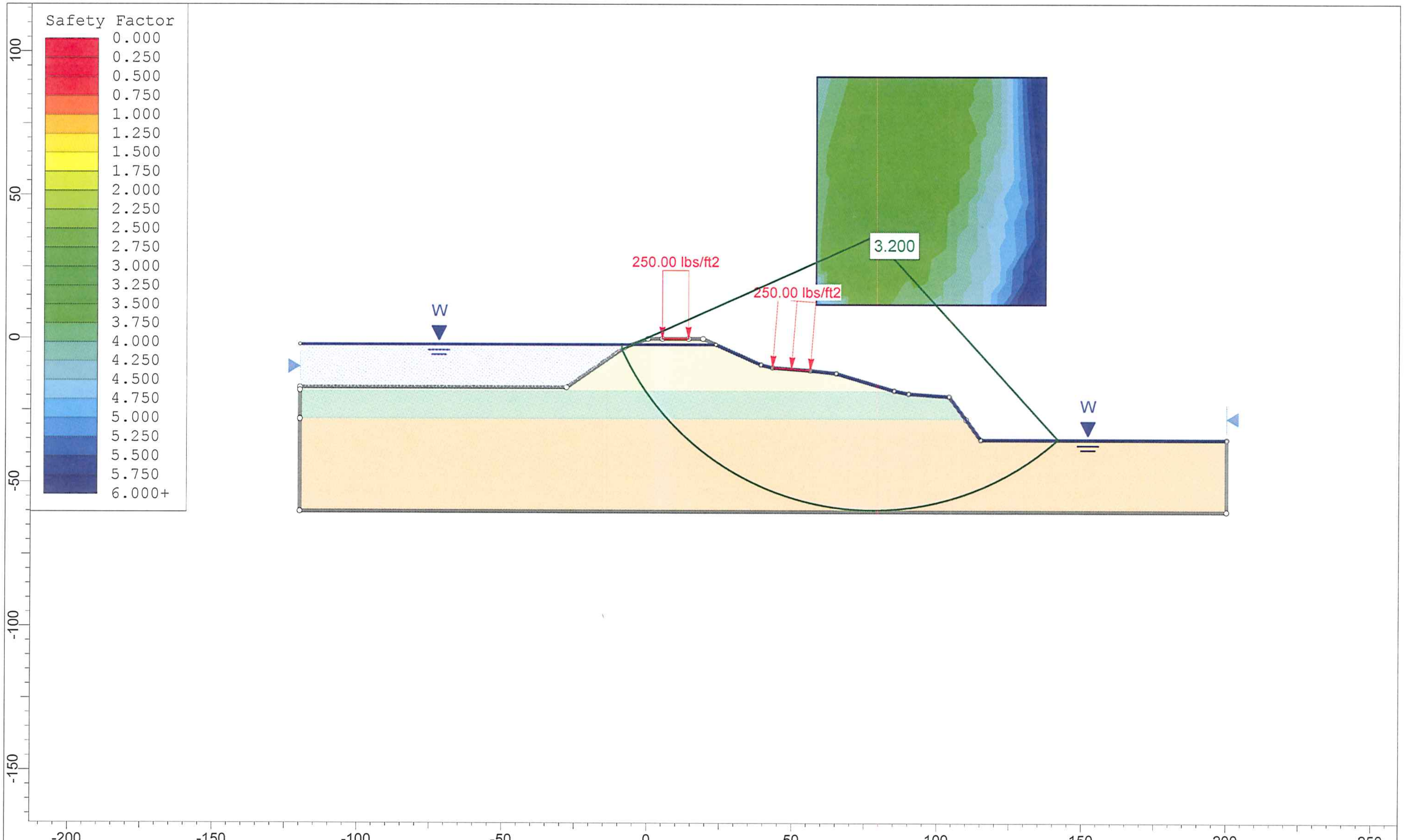
Direct Shear

Figure
B-4

Appendix C



rocscience	*Project* SLIDE - An Interactive Slope Stability Program		
	Analysis Description		
	Drawn By	*Scale* 1:550	*Company*
SLIDEINTERPRET 6.023	*Date* 7/30/2013, 2:23:14 PM		*File Name* Pittsburg Berm-1 drain Lpond.slim



Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By		*Scale* 1:550	*Company*
Date 7/30/2013, 2:23:14 PM		*File Name* Pittsburg Berm-1 drain Upond.slim	

SLIDEINTERPRET 6.023