APPENDIX B: GROUNDWATER LEVEL OBSERVATIONS

Appendix B

Groundwater Level Observations

CONTENTS

Table B-1 - Maximum Observed Groundwater Elevations

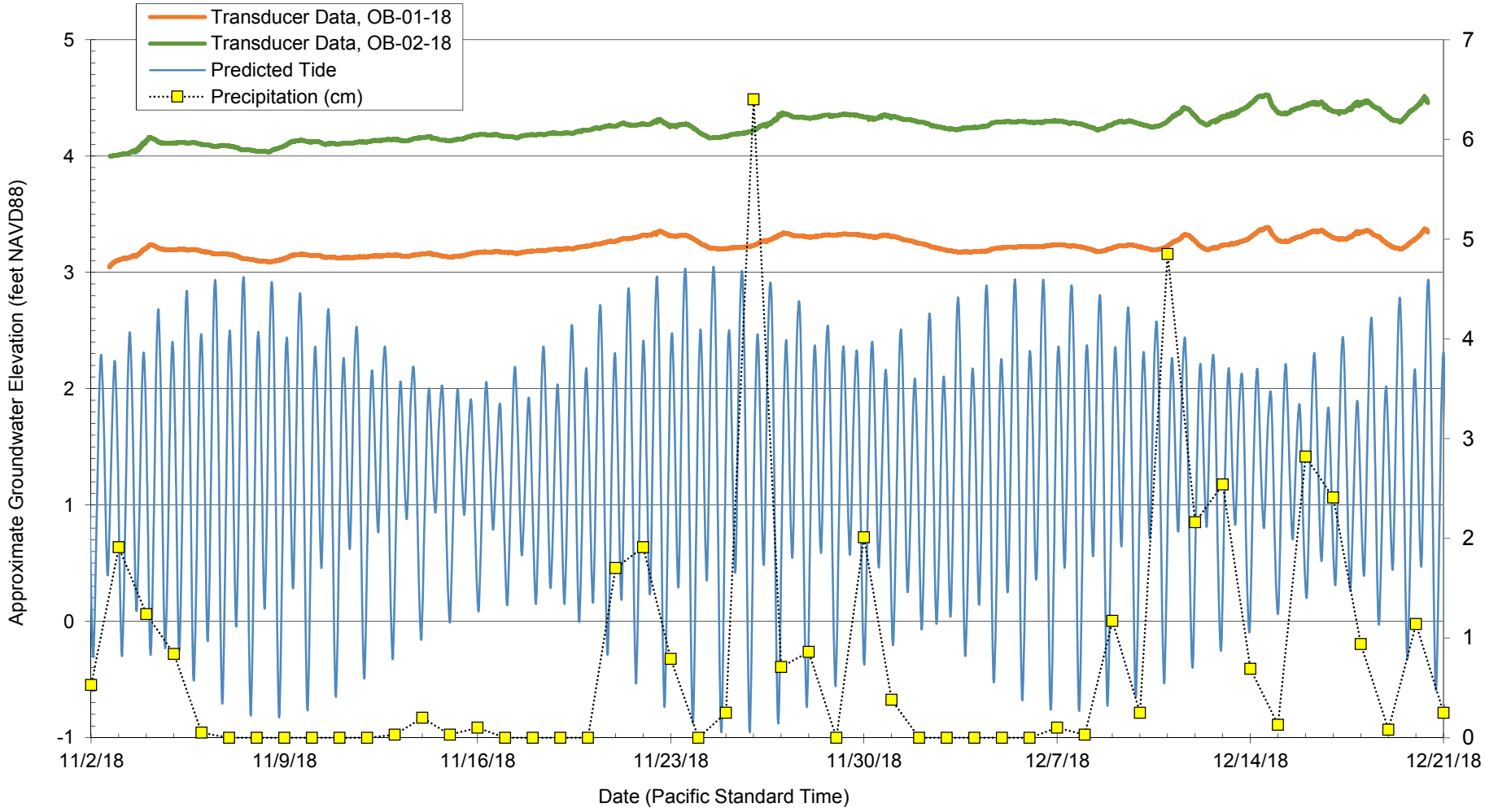
Well I.D.	Well Depth	Ground Surface Elevation	Maximum Observed Groundwater Elevation	Minimum Observed Depth to Groundwater	Date of Observation
	meters	meters	meters	meters	
OB-01-18	11.1	5.5	3.3	2.2	12/20/2018
OB-02-18	6.6	6.0	5.8	0.2	12/20/2018
MH-1-18	4.6	5.9	4.8	1.1	12/19/2018
MH-2-18	4.6	5.0	3.5	1.6	12/19/2018
MH-3-18	4.6	6.3	5.5	0.8	12/19/2018
MH-4-18	4.6	4.4	3.5	0.9	12/19/2018
MH-5-18	4.6	5.6	4.6	1.0	12/19/2018
MH-6-18	4.6	5.1	4.1	1.0	12/19/2018
MH-7-18	4.6	5.4	4.3	1.1	12/19/2018

NOTES:

Wells OB-01-18 and OB-02-18 were monitored using electronic dataloggers from November 2, 2018, to December 21, 2018 (see Figure B-1).

Wells MH-1-18 through MH-7-18 were monitored my BergerABAM on a quarterly basis from March 28, 2018, to December 18, 2018.

File: 101575Hydrograph.xlsx Date: 3/29/2019 Author: PVH



NOTES

1. Observation wells were installed to approximately 11.3 and 4.6 m below grade at borings OB-01-18 and OB-02-18, respectively.
2. Approximate grade elevations at OB-01-18 (5.5 m) and OB-02-18 (6.0 m) were estimated from a ground surface contour plan provided by Ausenco in 2017.
3. Tidal predictions obtained from https://tidesandcurrents.noaa.gov/noaatidepredictions.html?id=9441187 for Aberdeen, WA.
4. Precipitation data was recorded at the Hoquiam Bowerman Airport (NOAA Station ID USW00094225). Data available from https://www.ncdc.noaa.gov/cdo-web/datatools/findstation.

Potash Export Terminal
Grays Harbor
Hoquiam, Washington

MEASURED GROUNDWATER AND PREDICTED TIDE ELEVATIONS

March 2019 101575-004

SHANNON & WILSON, INC.
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FIG. B-1

FIG. B-1

APPENDIX C: EXISTING SUBSURFACE DATA

Appendix C

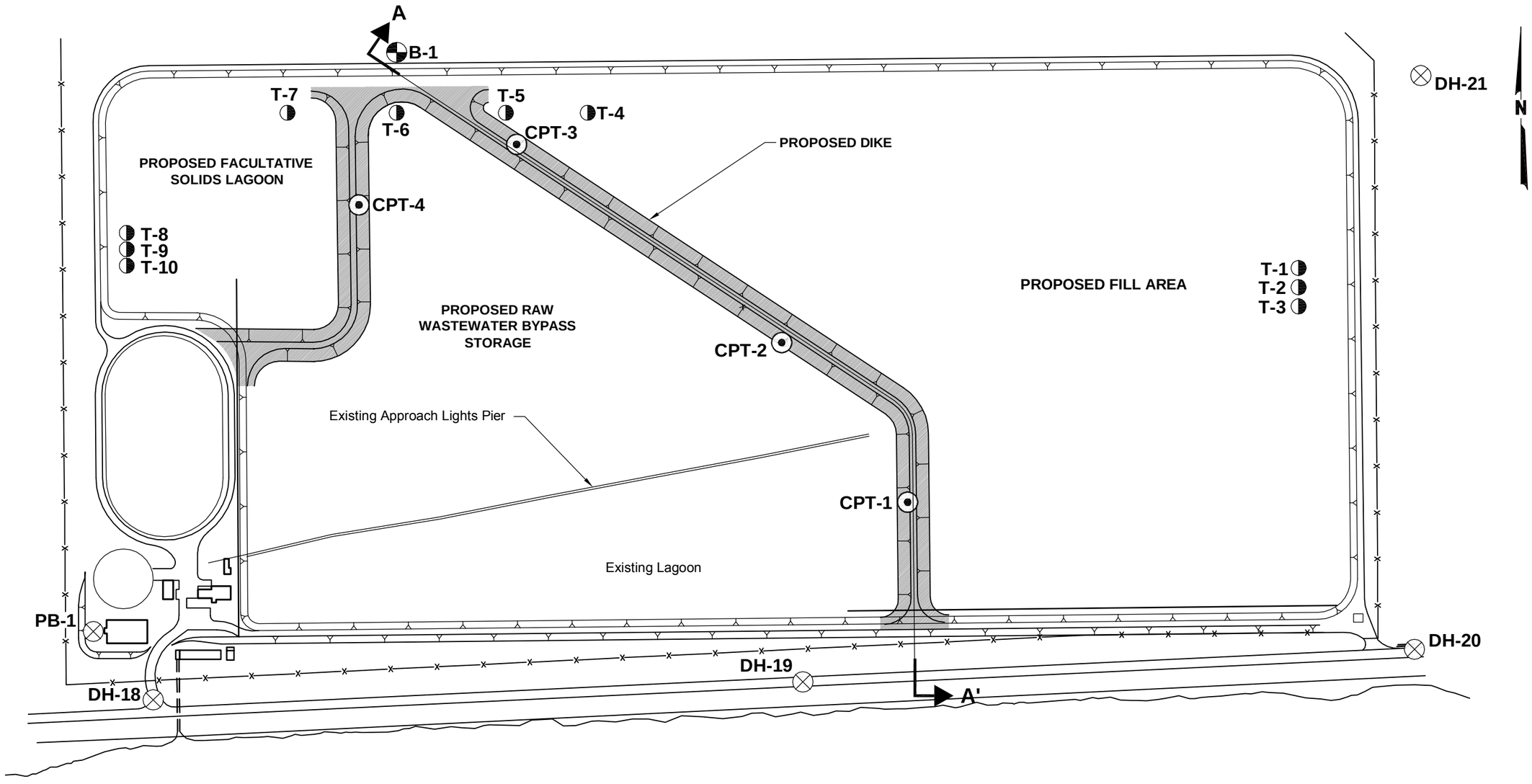
Existing Subsurface Data

CONTENTS

APPENDIX C: EXISTING SUBSURFACE DATA

SHANNON & WILSON, INC. (2008) DATA

Shannon & Wilson, Inc., 2008, Geotechnical report, wastewater treatment facility biosolids lagoon project, Hoquiam, Washington: Report prepared by Shannon & Wilson, Inc., Seattle, Wash., 21-1-21000-001, for HDR Engineering, Inc., December.



0 200 400

Scale in Feet

NOTE

Figure adapted from file *00C-BP01-01.dwg* and *00C-BP01-02.dwg* received 12/12/2008.

LEGEND

B-1 Boring Designation and Approximate Location

CPT-1 Cone Penetration Test Designation and Approximate Location

PB-1 Previous Boring Designation and Approximate Location (by Others)

T-1 Previous Test Pile Designation and Approximate Location (Shannon & Wilson, 1993)

A Generalized Subsurface Profile (See Figure 3)

Wastewater Treatment Facility
Biosolids Lagoon Project
Hoquiam, Washington

SITE AND EXPLORATION PLAN

December 2008 21-1-21000-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 2

Filename: J:\21\21000-001\2008-December Report\21-1-21000-001 fig 2 (Current).dwg Date: 12-19-2008 Login: cnt

Total Depth:	*46.5 ft.*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*4 in.*
Top Elevation:	*~ 10 ft.*	Easting:		Drilling Company:	*Gregory Drilling*	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	*Truck Rig*	Hammer Type:	
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Loose to very loose, gray, silty, fine SAND; wet; laminated, scattered wood fragments; SM.

11.5

Very soft, black to dark gray, clayey, organic SILT; moist; bedded, scattered wood and shell fragments, abundant organics; OH.

17.0

Very soft, dark to light gray, trace to slightly fine sandy, clayey silt; moist; bedded, scattered wood and shell fragments, increasing frequency of sand seams with depth; ML.

31.5

Medium dense, dark gray, slightly silty to silty, fine SAND; wet; widely scattered silt seams, wood fragments, and shell fragments; SP-SM/SM.

46.5

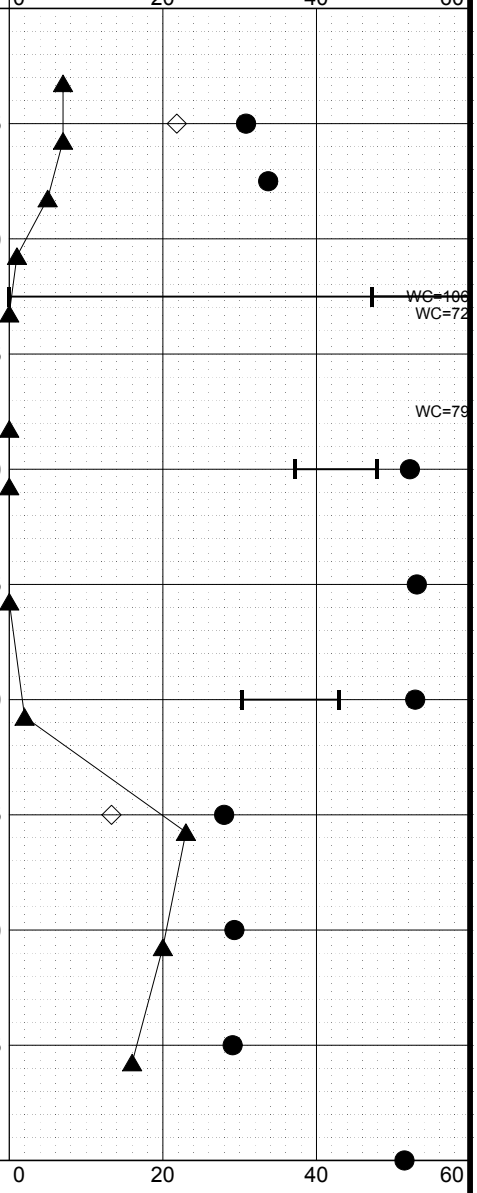
BOTTOM OF BORING
COMPLETED 5/28/2008

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

Ground Water: None Observed During Drilling

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

LEGEND

* Sample Not Recovered
Standard Penetration Test
Thin Wall Sample

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
3. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
4. Groundwater level, if indicated above, is for the date specified and may vary.
5. USCS designation is based on visual-manual classification and selected lab testing.

Wastewater Treatment Facility
Biosolids Lagoon Project
Hoquiam, Washington

LOG OF BORING B-1

June 2008 21-1-21000-001

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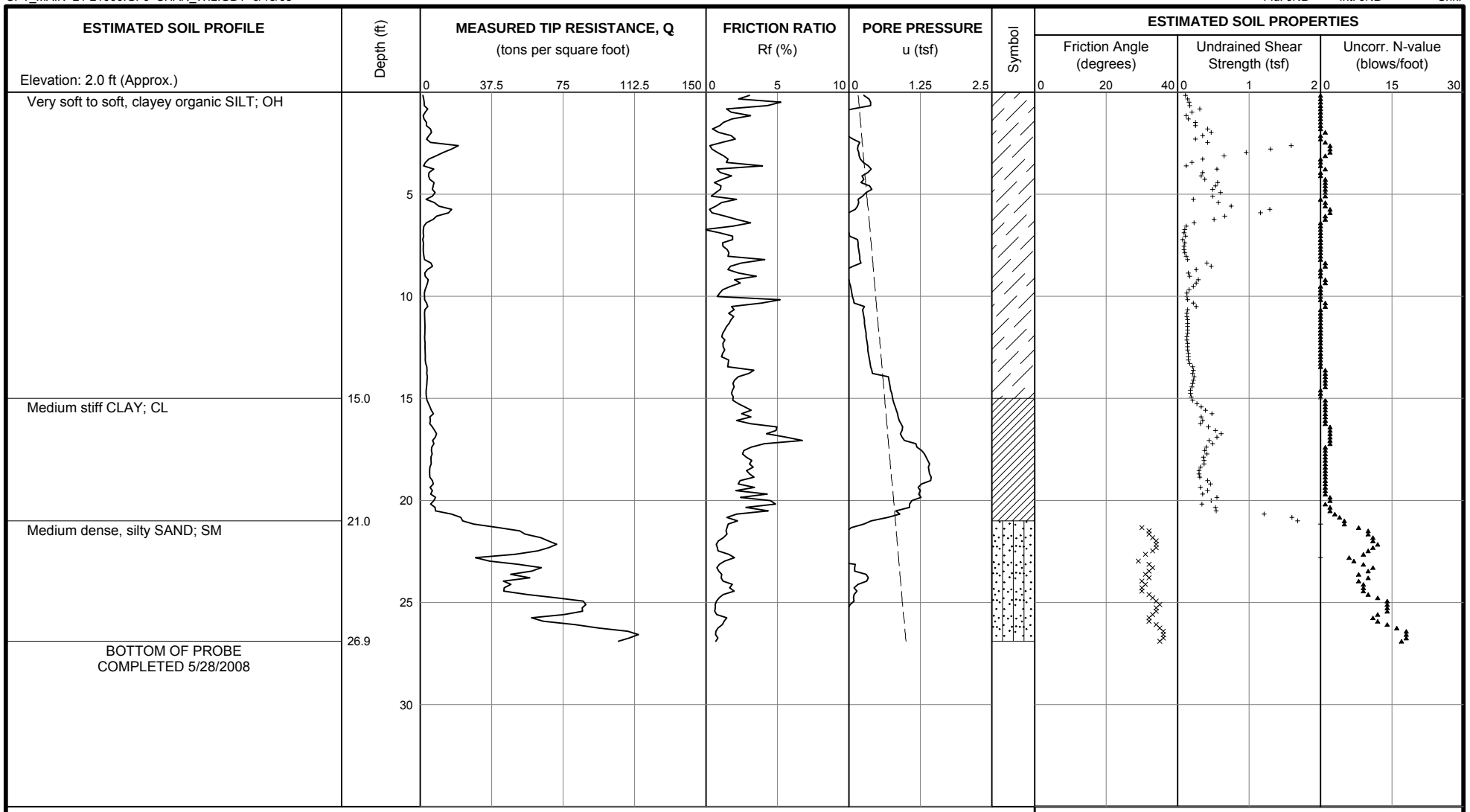
Geotechnical and Environmental Consultants

FIG. A-2

MASTER LOG E 21-21000.GPJ SHAN_WIL.GDT 6/18/08 Log: JNB Rev: JNB Typ: LKD



NOTES:

1. The stratification lines represent the approximate boundaries between soil types; the transition may be gradual.
2. The estimated soil properties are based on analyses performed using published correlations and equations. The method used for estimating the properties listed above are:

Property	Method
Friction Angle	Durgunoglu & Mitchell
Uncorrected N-Value (N60)	Robertson & Campanella
Undrained Shear Strength	$\frac{Qt - \sigma v}{Nkt}$ where: Qt = Corrected Cone Bearing, Nkt = 12.5, σv = Total Overburden Stress

3. Log of probe is based on piezocone probe data provided by Northwest Cone Exploration.
4. The pore pressure was measured behind the tip of the penetrometer. Hydrostatic pore pressure based on the estimated groundwater depth is also shown above (dashed line).

Wastewater Treatment Facility
Biosolids Lagoon Project
Hoquiam, Washington

LOG OF PROBE CPT-1

June 2008 21-1-21000-001

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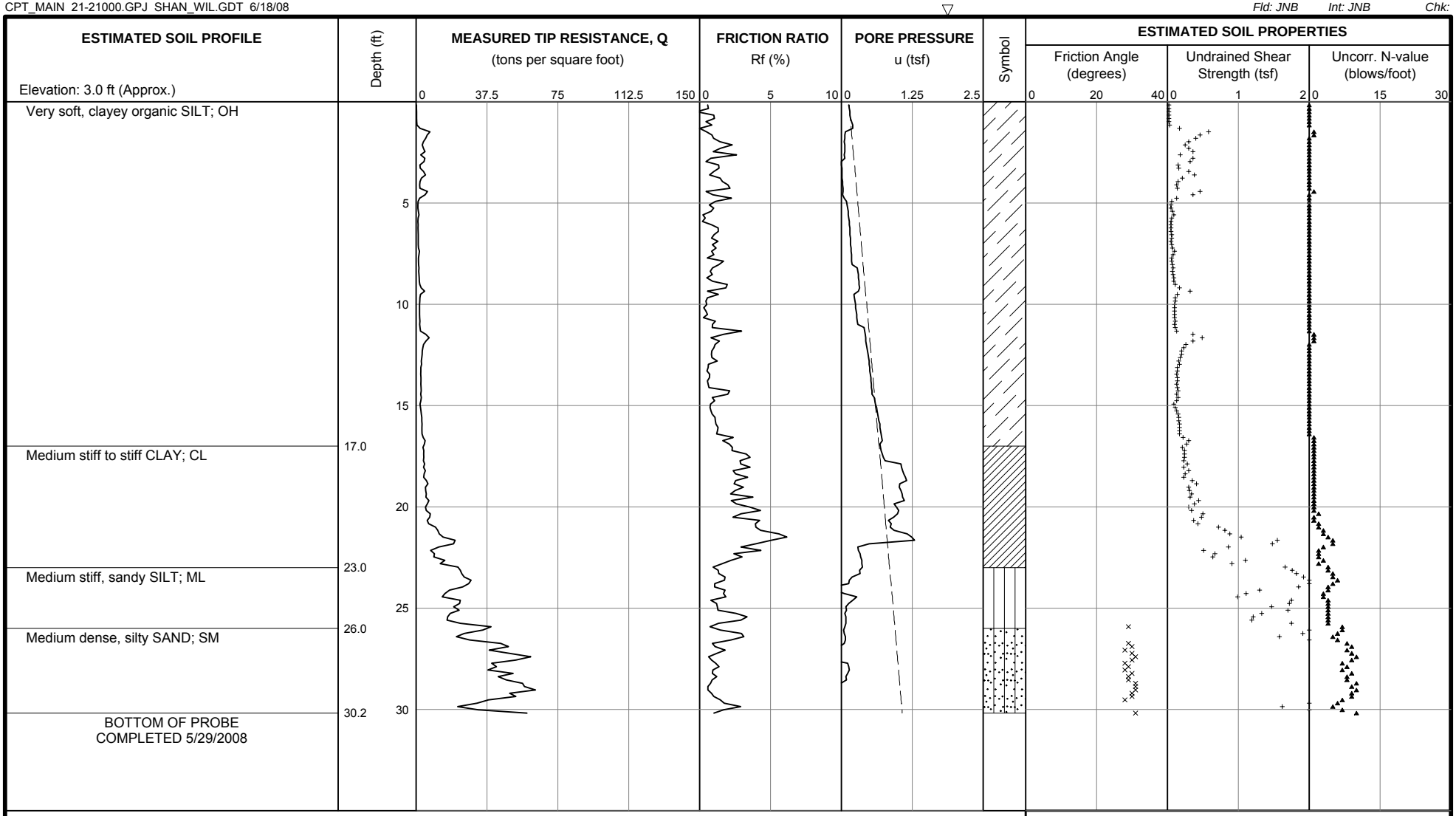
FIG. A-3

FIG. A-3



NOTES:

1. The stratification lines represent the approximate boundaries between soil types; the transition may be gradual.
2. The estimated soil properties are based on analyses performed using published correlations and equations. The method used for estimating the properties listed above are:

Property	Method
Friction Angle	Durgunoglu & Mitchell
Uncorrected N-Value (N60)	Robertson & Campanella
Undrained Shear Strength	$\frac{Qt - \sigma v}{Nkt}$ where: Qt = Corrected Cone Bearing, Nkt = 12.5, σv = Total Overburden Stress

3. Log of probe is based on piezocone probe data provided by Northwest Cone Exploration.
4. The pore pressure was measured behind the tip of the penetrometer. Hydrostatic pore pressure based on the estimated groundwater depth is also shown above (dashed line).

Wastewater Treatment Facility
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Hoquiam, Washington

LOG OF PROBE CPT-2

June 2008 21-1-21000-001

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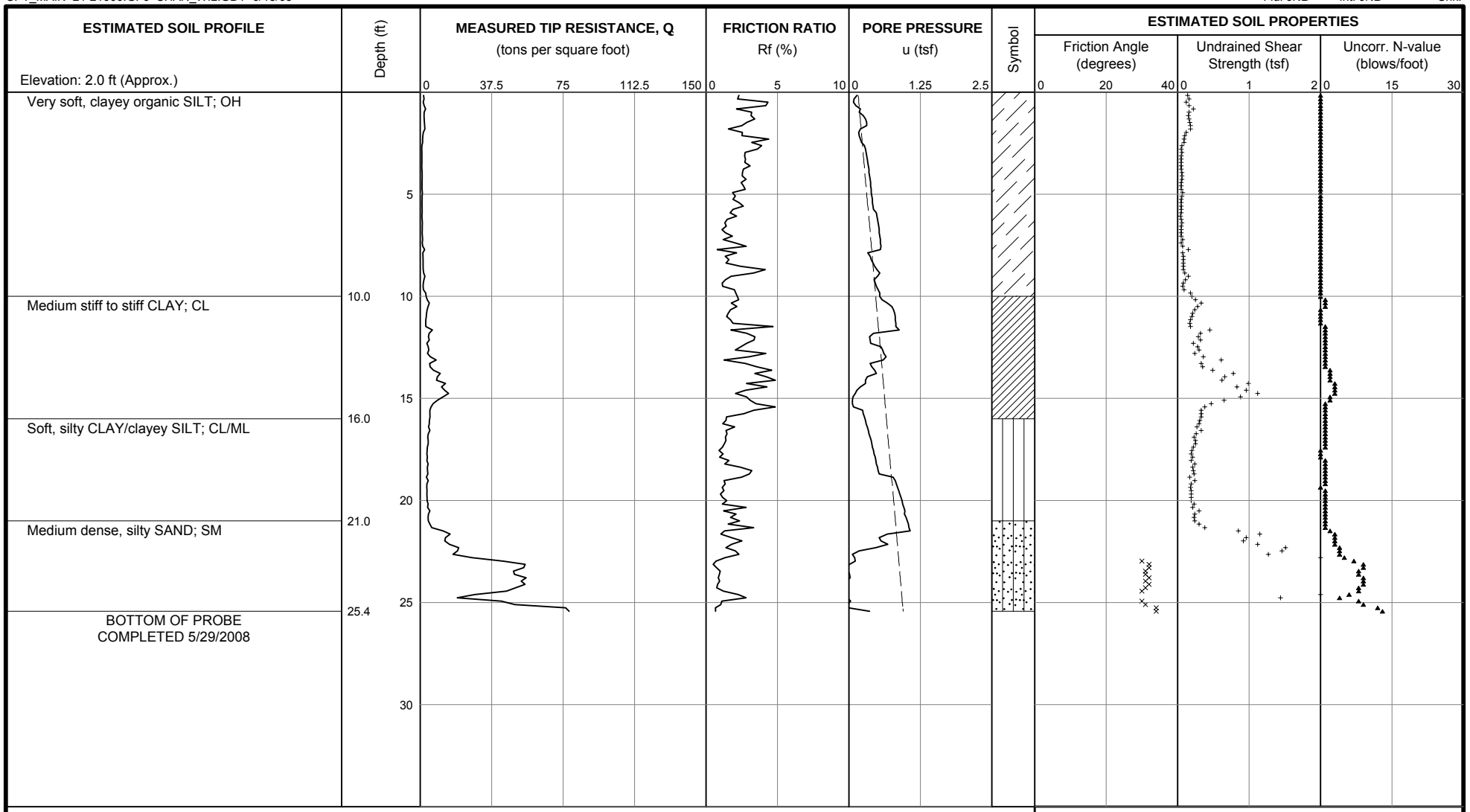
FIG. A-4

FIG. A-4



NOTES:

1. The stratification lines represent the approximate boundaries between soil types; the transition may be gradual.
2. The estimated soil properties are based on analyses performed using published correlations and equations. The method used for estimating the properties listed above are:

Property	Method
Friction Angle	Durgunoglu & Mitchell
Uncorrected N-Value (N60)	Robertson & Campanella
Undrained Shear Strength	$\frac{Qt - \sigma v}{Nkt}$ where: Qt = Corrected Cone Bearing, Nkt = 12.5, σv = Total Overburden Stress

3. Log of probe is based on piezocone probe data provided by Northwest Cone Exploration.
4. The pore pressure was measured behind the tip of the penetrometer. Hydrostatic pore pressure based on the estimated groundwater depth is also shown above (dashed line).

Wastewater Treatment Facility
Biosolids Lagoon Project
Hoquiam, Washington

LOG OF PROBE CPT-3

June 2008 21-1-21000-001

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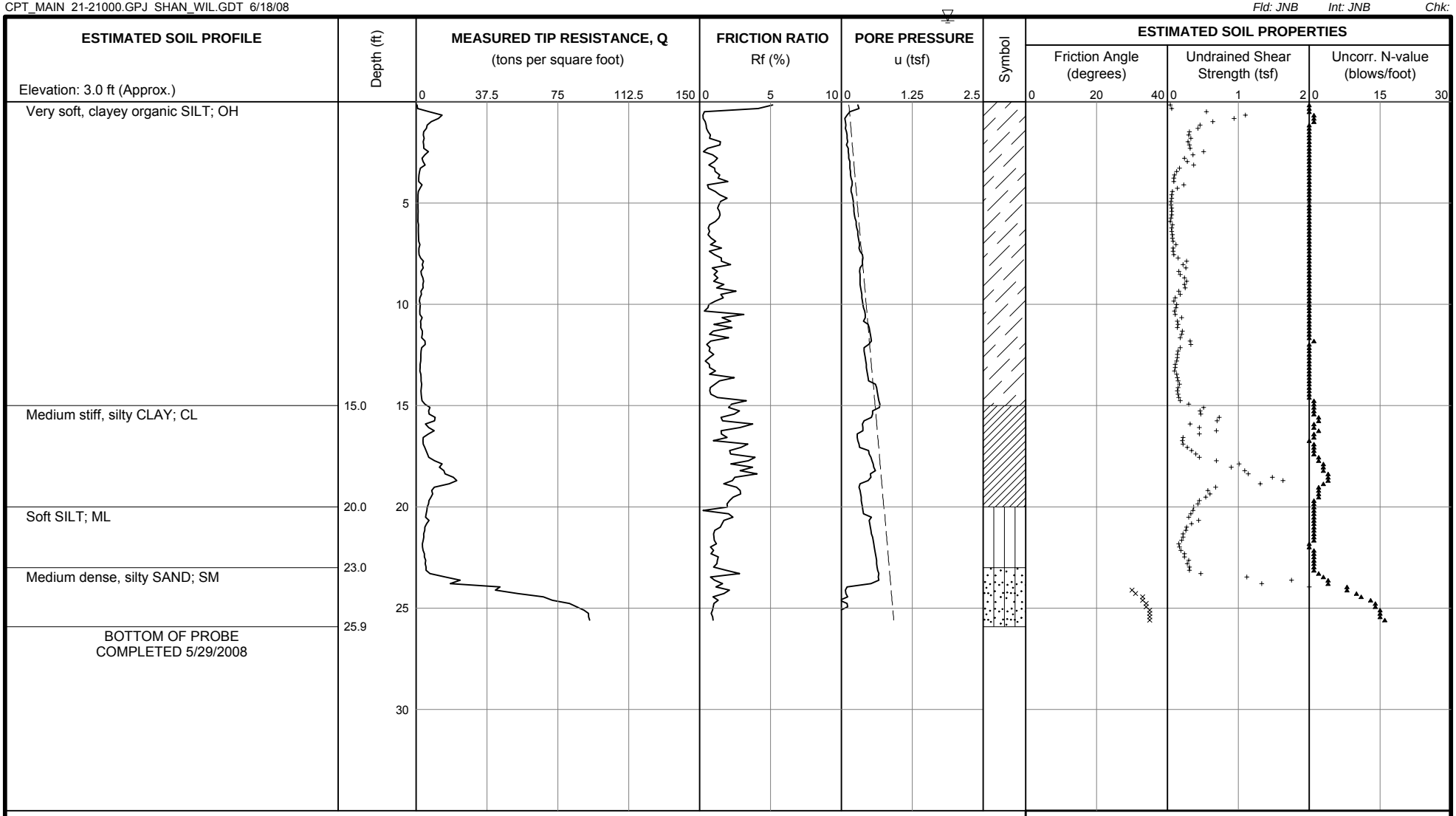
FIG. A-5

FIG. A-5



NOTES:

1. The stratification lines represent the approximate boundaries between soil types; the transition may be gradual.
2. The estimated soil properties are based on analyses performed using published correlations and equations. The method used for estimating the properties listed above are:

Property	Method
Friction Angle	Durgunoglu & Mitchell
Uncorrected N-Value (N60)	Robertson & Campanella
Undrained Shear Strength	$\frac{Qt - \sigma v}{Nkt}$ where: Qt = Corrected Cone Bearing, Nkt = 12.5, σv = Total Overburden Stress

3. Log of probe is based on piezocone probe data provided by Northwest Cone Exploration.
4. The pore pressure was measured behind the tip of the penetrometer. Hydrostatic pore pressure based on the estimated groundwater depth is also shown above (dashed line).

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Hoquiam, Washington

LOG OF PROBE CPT-4

June 2008 21-1-21000-001

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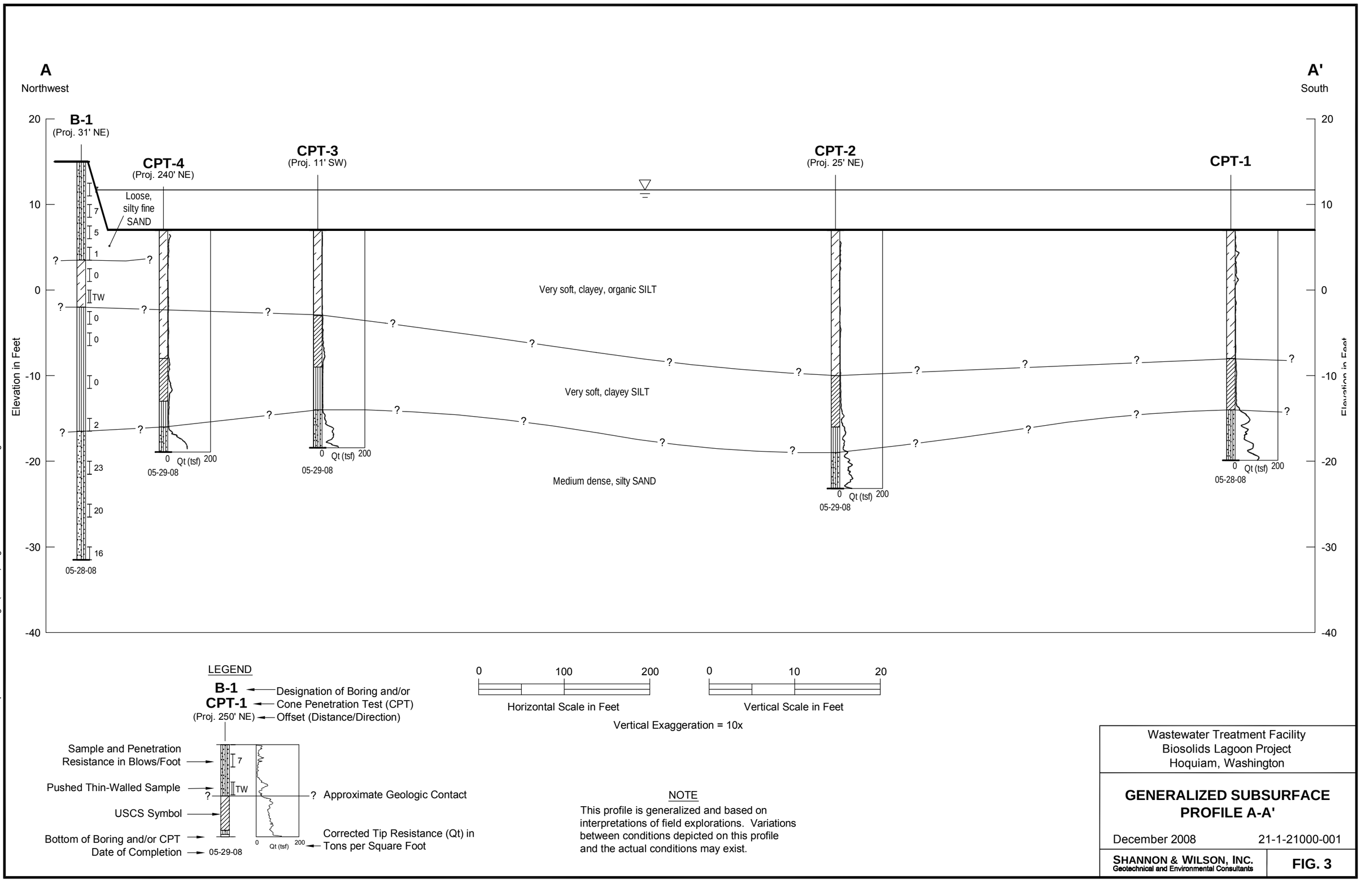
FIG. A-6

FIG. A-6



LEGEND

B-1 ← Designation of Boring and/or
CPT-1 ← Cone Penetration Test (CPT)
(Proj. 250' NE) ← Offset (Distance/Direction)

Vertical Exaggeration = 10x

NOTE

This profile is generalized and based on interpretations of field explorations. Variations between conditions depicted on this profile and the actual conditions may exist.

Wastewater Treatment Facility
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Hoquiam, Washington

GENERALIZED SUBSURFACE PROFILE A-A'

December 2008 21-1-21000-001

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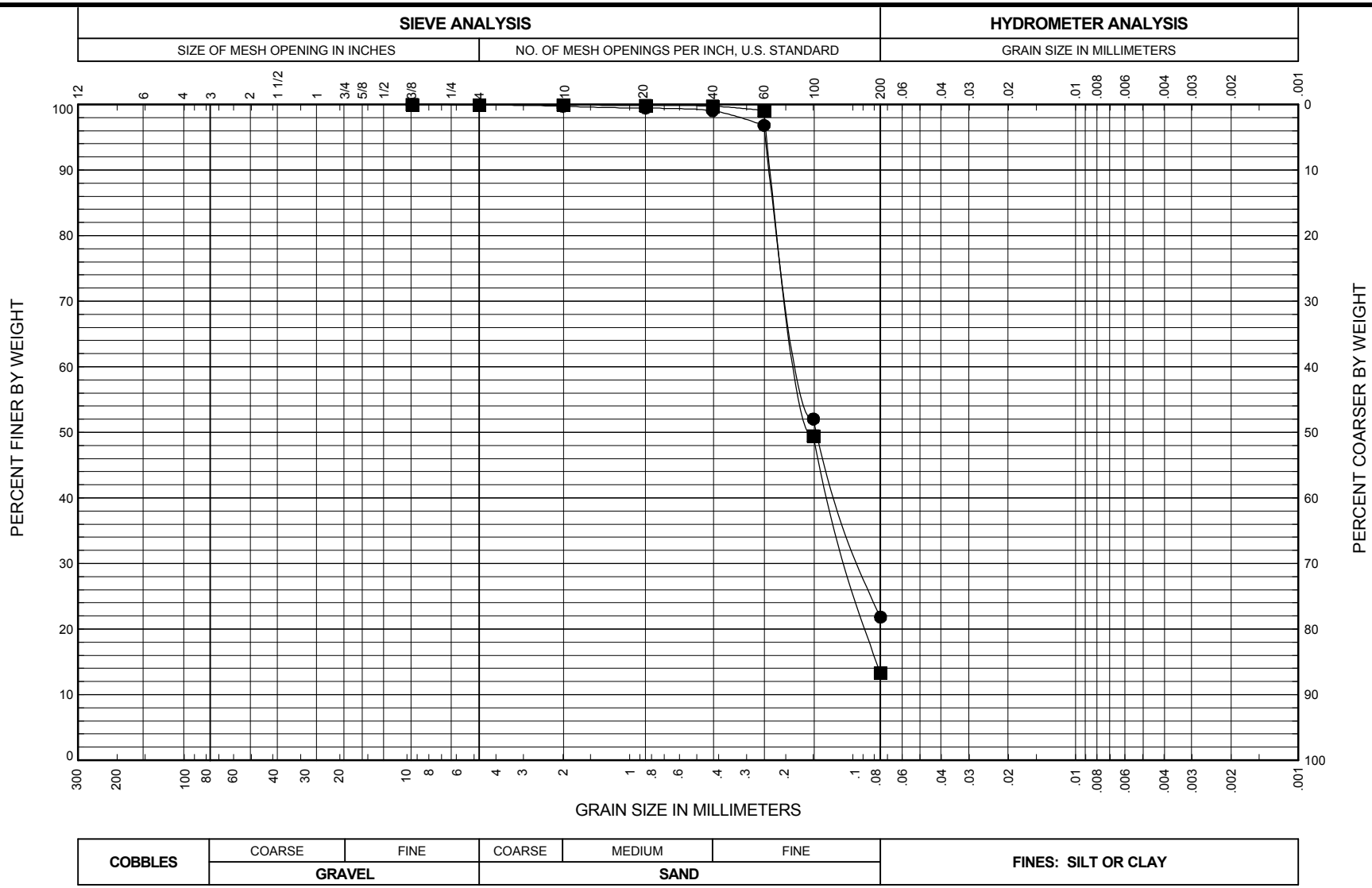
FIG. 3

Filename: J:\21\21000-001\2008-December Report\21-1-21000-001 Fig 3 (Current).dwg Date: 12-19-2008 Login: cnt



BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SAMPLE DESCRIPTION	FINES %	NAT. W.C. %	LL %	PL %	PI %
● B-1, S-2	5.0	SM	Gray, silty SAND, trace of gravel	21.8	30.8			
■ B-1, S-11	35.0	SM	Gray, silty SAND, trace of gravel; trace of organics	13.3	28.0			

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GRAIN SIZE DISTRIBUTION
BORING B-1

December 2008 21-1-21000-001

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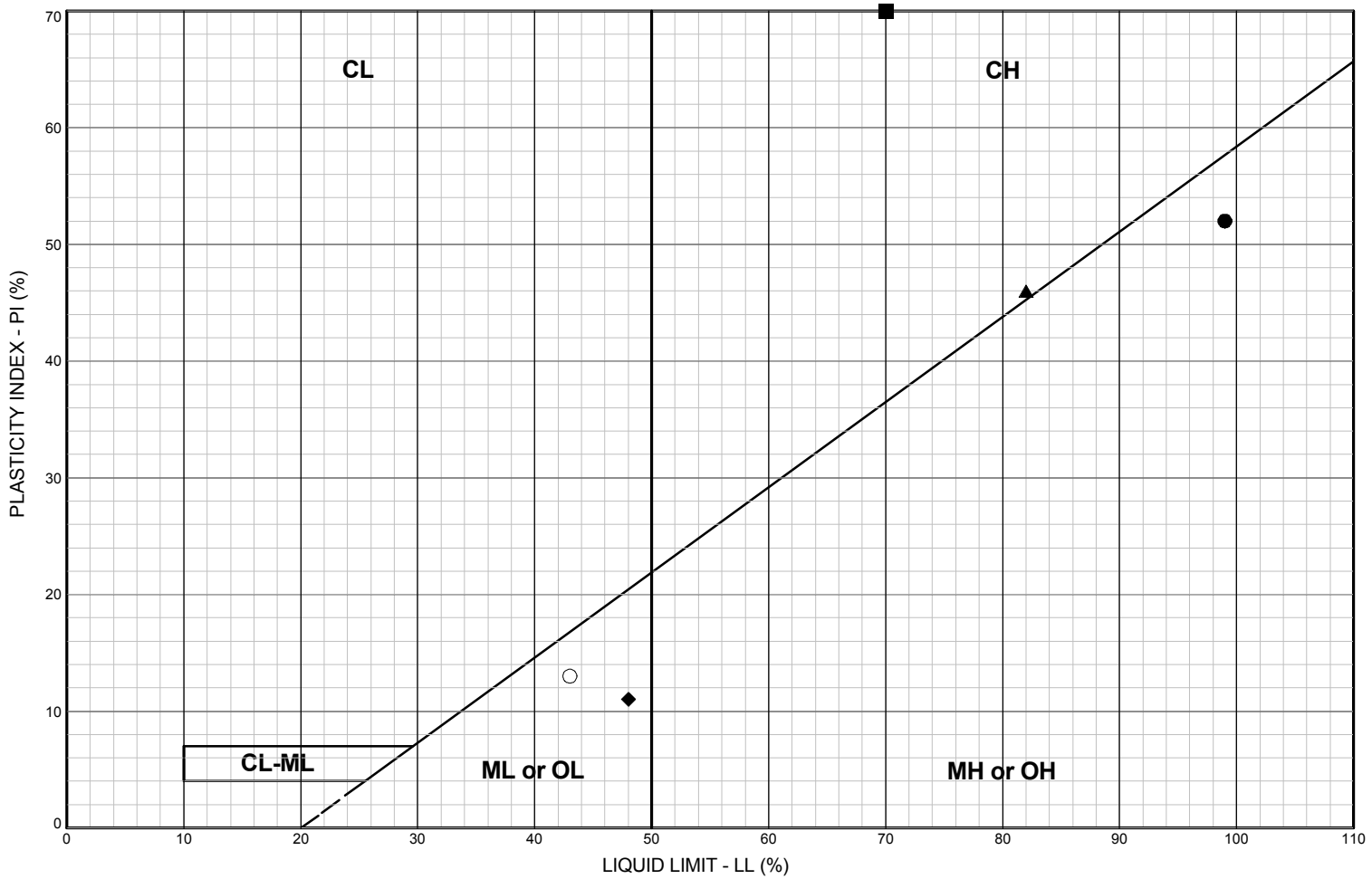
FIG. B-1

FIG. B-1

GSA MAIN 21-21000.GPJ SHAN_WIL.GDT 12/10/08



LEGEND

CL: Low plasticity inorganic clays; sandy and silty clays

CH: High plasticity inorganic clays

ML or OL: Inorganic and organic silts and clayey silts of low plasticity

MH or OH: Inorganic and organic silts and clayey silts of high plasticity

CL-ML: Silty clays and clayey silts

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	LL %	PL %	PI %	NAT. W.C. %	PASS. #200, %
● B-1, S-5	12.5	MH/OH	Dark gray-brown, clayey, organic SILT; abundant organics	99	47	52	105.9	
■ B-1, S-5	12.5	OH	Organic limit- oven dried liquid limit 71% of natural liquid limit	70	NP	70		
▲ B-1, S-6	15.8	CH/OH	Black, silty, organic CLAY	82	36	46	88.1	
◆ B-1, S-8	20.0	ML	Gray, clayey SILT, trace of fine sand	48	37	11	52.2	
○ B-1, S-10	30.0	ML	Gray, slightly fine sandy, clayey SILT; trace of wood fragments	43	30	13	52.9	

Wastewater Treatment Facility
Biosolids Lagoon Project
Hoquiam, Washington

PLASTICITY CHART
BORING B-1

December 2008 21-1-21000-001

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FIG. B-2

FIG. B-2

ONE DIMENSIONAL CONSOLIDATION TEST NO. 1
SUMMARY OF TEST DATA

Boring	B-1	Tested By / Date	JFL 6/17/08
Sample	S-7	Calc. By / Date	JFL 6/19/08
Depth, ft	15.8	Check By / Date	AJC 6/23/08

CLASSIFICATION:
Soft, black, silty, organic CLAY; moist; abundant organics; micaceous; CH/OH. (Estimated Specific Gravity does not take organics into account)

SAMPLE DATA:

Spec. Grav. (est.) :	2.65
Liquid Limit :	82
Plastic Limit :	36
Plasticity Index :	46
Specimen :	UNDISTURBED

SPECIMEN DATA:

	Before Test	After Test
Height, inches :	.785	.616
Diameter, inches :	2.508	2.508
Wet Density, pcf :	95.1	105.2
Dry Density, pcf :	52.8	67.3
Water Content, % :	80.1	56.4
Void Ratio :	2.129	1.458
Saturation, % :	100	102

Spec Load kg	d 100 0.01mm	Defl Corr 0.01mm	Consol Pressure tsf	Settlement %	Void Ratio	t 50 min.	d 50 0.01mm	Coeff of Consol cm2/sec	Coeff of Perm cm/sec
.1	3.0	.4	.03	.1	2.129	.3	2.7	1.09E-02	
.2	7.2	1.6	.06	.3	2.124	.4	6.2	8.12E-03	3.80E-07
.4	16.7	4.0	.13	.6	2.113	.3	14.1	1.08E-02	5.99E-07
.8	30.4	7.7	.26	1.1	2.098	.3	26.3	1.07E-02	4.16E-07
1.6	51.5	15.7	.51	1.8	2.077	.3	45.2	1.06E-02	2.70E-07
3.2	87.1	25.1	1.03	3.1	2.036	.4	75.1	7.75E-03	1.98E-07
6.4	262.6	33.2	2.06	11.5	1.773	1.4	182.3	2.00E-03	1.63E-07
1.6	243.2	28.0	.51	10.8	1.795	.2	250.2	1.29E-02	
.4	204.2	22.2	.13	9.1	1.847	1.4	221.2	1.89E-03	
.1	167.3	17.7	.03	7.5	1.898	3.7	185.9	7.39E-04	
.4	170.7	18.9	.13	7.6	1.895	.4	169.4	6.97E-03	7.98E-08
1.6	204.7	24.3	.51	9.1	1.850	.9	190.0	3.05E-03	1.13E-07
6.4	287.8	33.4	2.06	12.8	1.733	.6	251.4	4.31E-03	1.04E-07
12.8	439.2	39.7	4.11	20.0	1.505	1.4	368.0	1.63E-03	5.76E-08
25.6	585.0	46.5	8.23	27.0	1.287	1.2	515.0	1.59E-03	2.70E-08
6.4	563.2	40.3	2.06	26.2	1.311	.4	569.2	4.40E-03	
1.6	519.0	30.3	.51	24.5	1.365	1.7	537.0	1.07E-03	
.4	457.7	27.8	.13	21.6	1.458	3.5	488.0	5.52E-04	

Wastewater Treatment Facility
Biosolids Lagoon Project
Hoquiam, Washington

CONSOLIDATION TEST
Boring B-1, Sample S-7, Depth 15.8'

June 2008 21-1-21000-001

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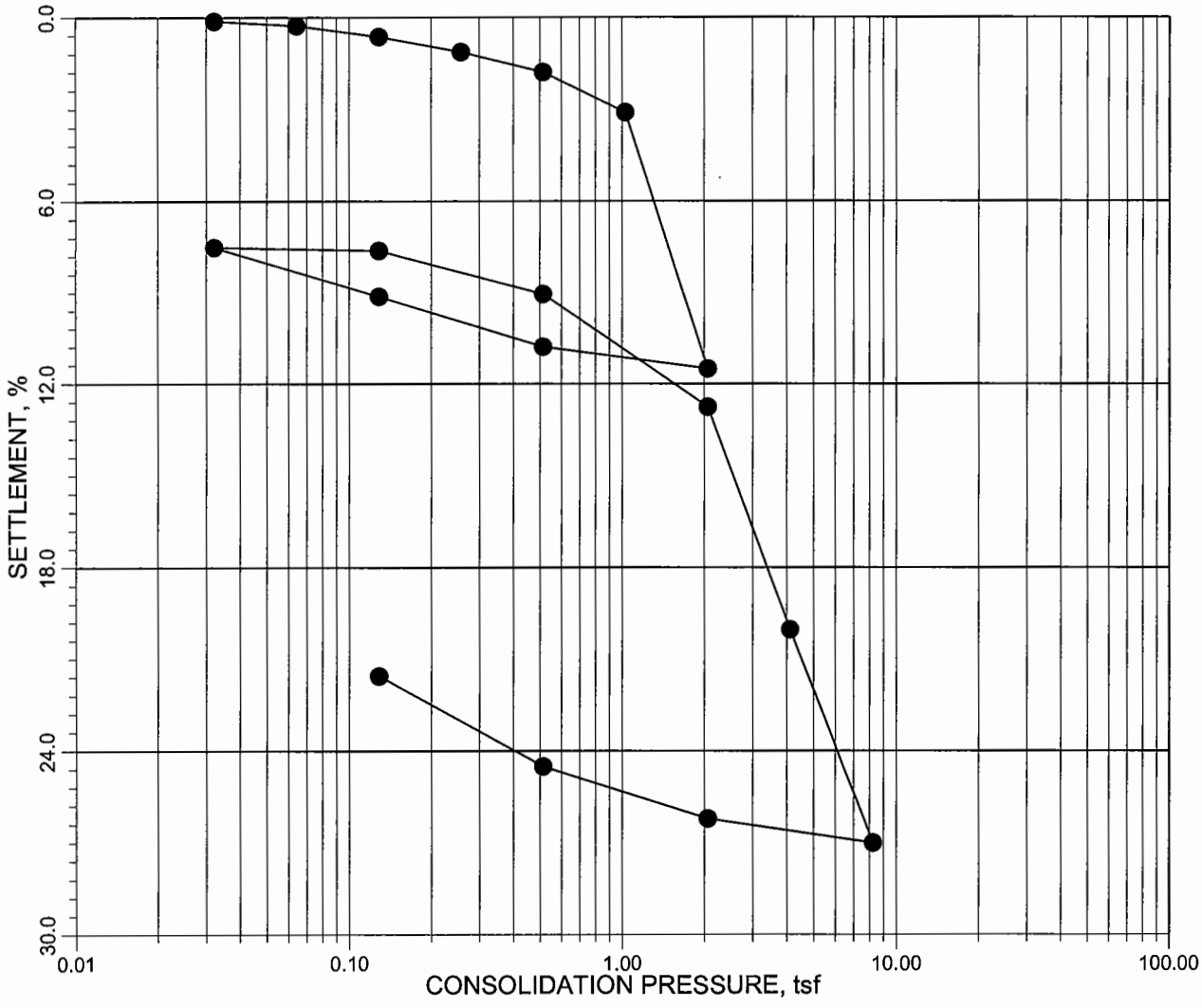
FIG. B-3(1/8)

I:\Groups\Lab\LabPrgm\Projects\21-21000\B1S7158.ODC :: 6/20/2008 2:06:58 PM

ONE DIMENSIONAL CONSOLIDATION TEST NO. 1
SETTLEMENT VS LOG10(CONSOLIDATION PRESSURE)

Boring	B-1
Sample	S-7
Depth, ft	15.8

Tested By / Date JFL 6/17/08
Calc. By / Date JFL 6/19/08
Check By / Date AJZ 6/23/08



Wastewater Treatment Facility
Biosolids Lagoon Project
Hoquiam, Washington

CONSOLIDATION TEST
Boring B-1, Sample S-7, Depth 15.8'

June 2008 21-1-21000-001

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

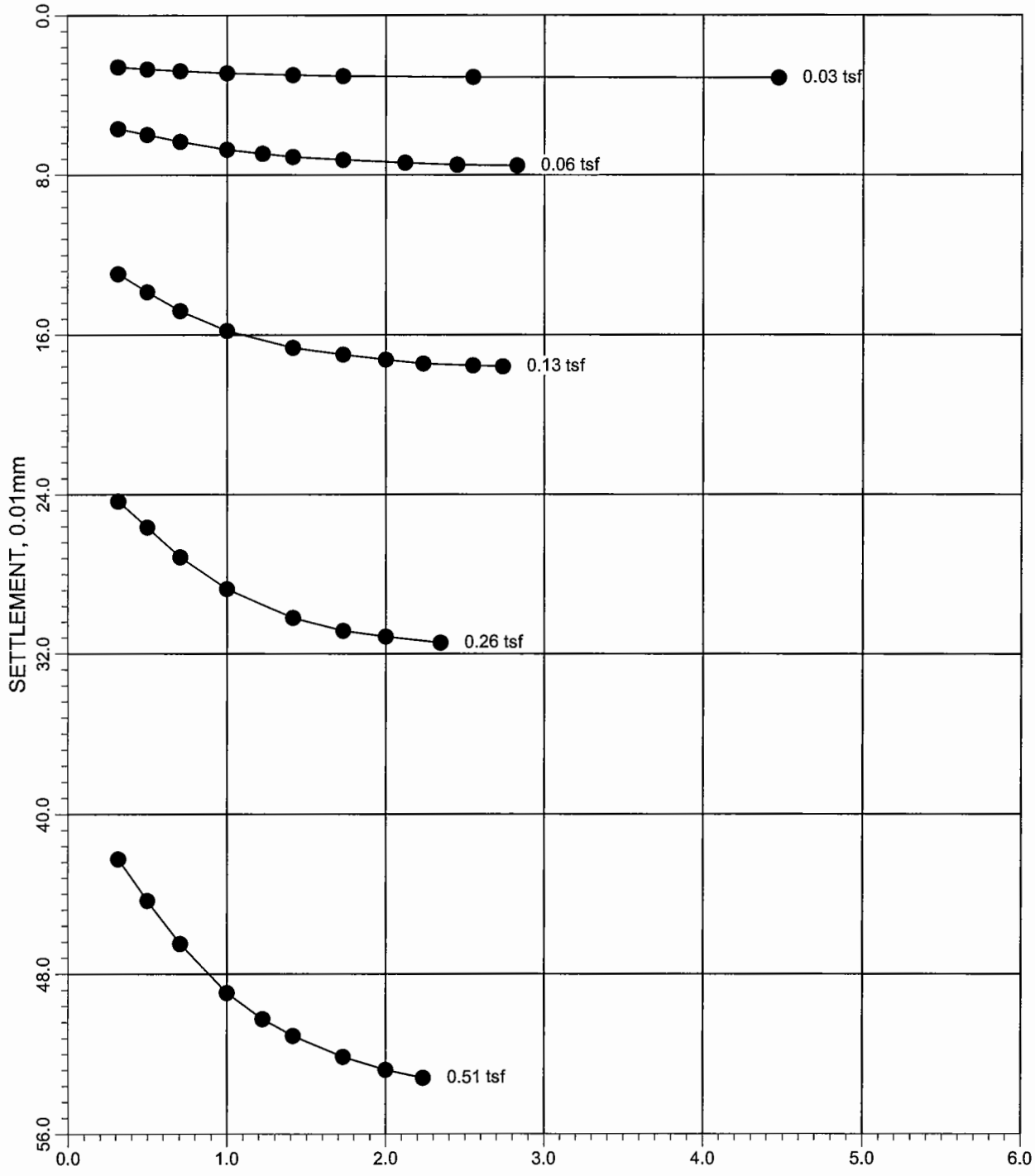
FIG. B-3(2/8)

I:\Groups\Lab\LabFrgm\Projects\21-21000\B1S7158.ODC :: 6/20/2008 2:58:23 PM

ONE DIMENSIONAL CONSOLIDATION TEST NO. 1
SETTLEMENT VS SQR ROOT(TIME)

Boring	B-1
Sample	S-7
Depth, ft	15.8

Tested By / Date JFL 6/17/08
Calc. By / Date JFL 6/19/08
Check By / Date ATC 6/23/08



Wastewater Treatment Facility
Biosolids Lagoon Project
Hoquiam, Washington

CONSOLIDATION TEST
Boring B-1, Sample S-7, Depth 15.8'

June 2008 21-1-21000-001

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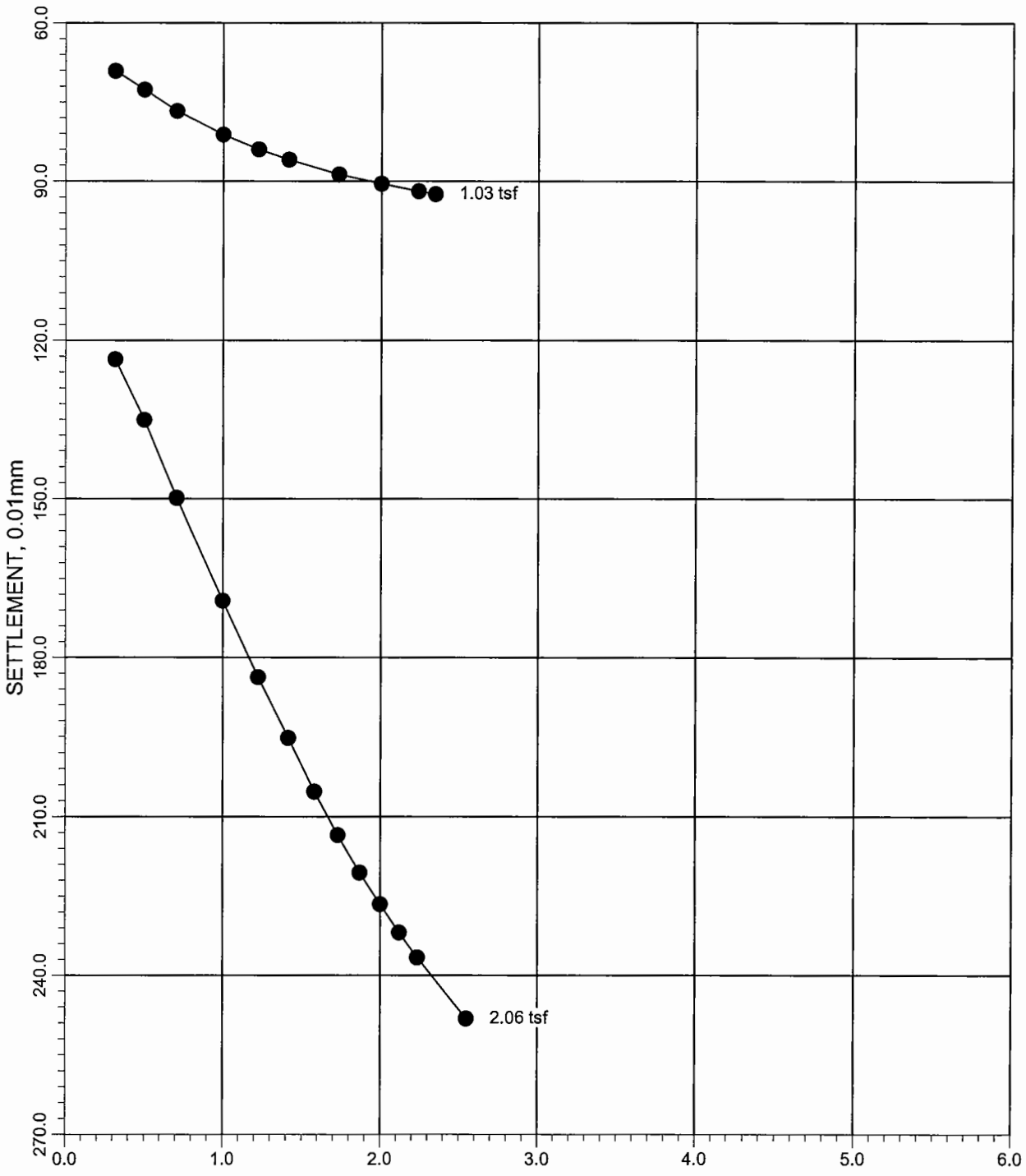
FIG. B-3(3/8)

I:\Groups\Lab\LabPrgm\Projects\21-21000\B1S7158.ODC :: 6/20/2008 2:58:39 PM

ONE DIMENSIONAL CONSOLIDATION TEST NO. 1
SETTLEMENT VS SQR ROOT(TIME)

Boring	B-1
Sample	S-7
Depth, ft	15.8

Tested By / Date JFL 6/17/08
Calc. By / Date JFL 6/19/08
Check By / Date AJZ 6/23/08



Wastewater Treatment Facility
Biosolids Lagoon Project
Hoquiam, Washington

CONSOLIDATION TEST
Boring B-1, Sample S-7, Depth 15.8'

June 2008 21-1-21000-001

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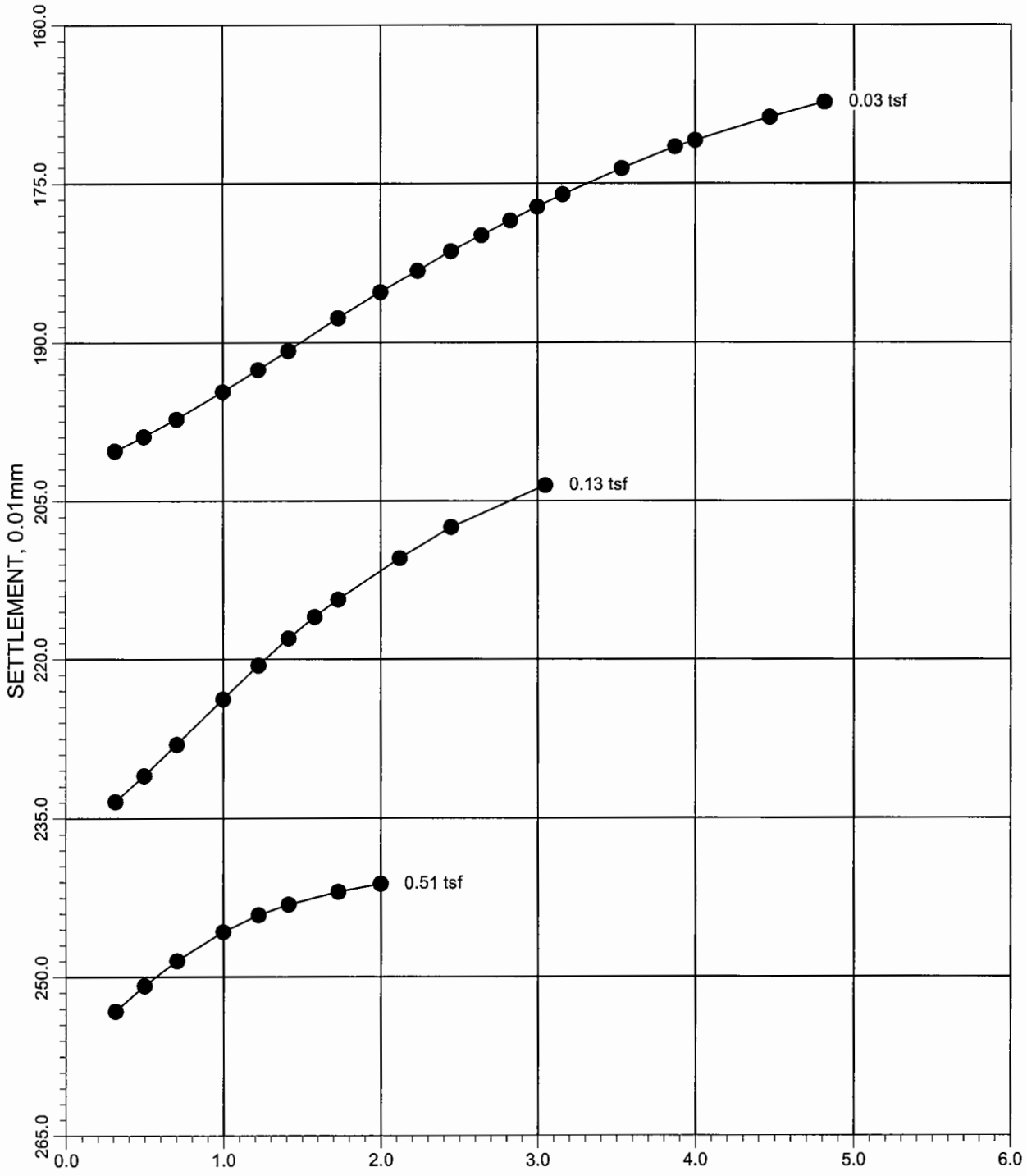
FIG. B-3(4/8)

I:\Groups\Lab\LabPrgm\Projects\21-21000\B1S7158.ODC :: 6/20/2008 2:58:54 PM

ONE DIMENSIONAL CONSOLIDATION TEST NO. 1
SETTLEMENT VS SQR ROOT(TIME)

Boring	B-1
Sample	S-7
Depth, ft	15.8

Tested By / Date JFL 6/17/08
Calc. By / Date JFL 6/19/08
Check By / Date AJZ 6/23/08



Wastewater Treatment Facility
Biosolids Lagoon Project
Hoquiam, Washington

CONSOLIDATION TEST
Boring B-1, Sample S-7, Depth 15.8'

June 2008 21-1-21000-001

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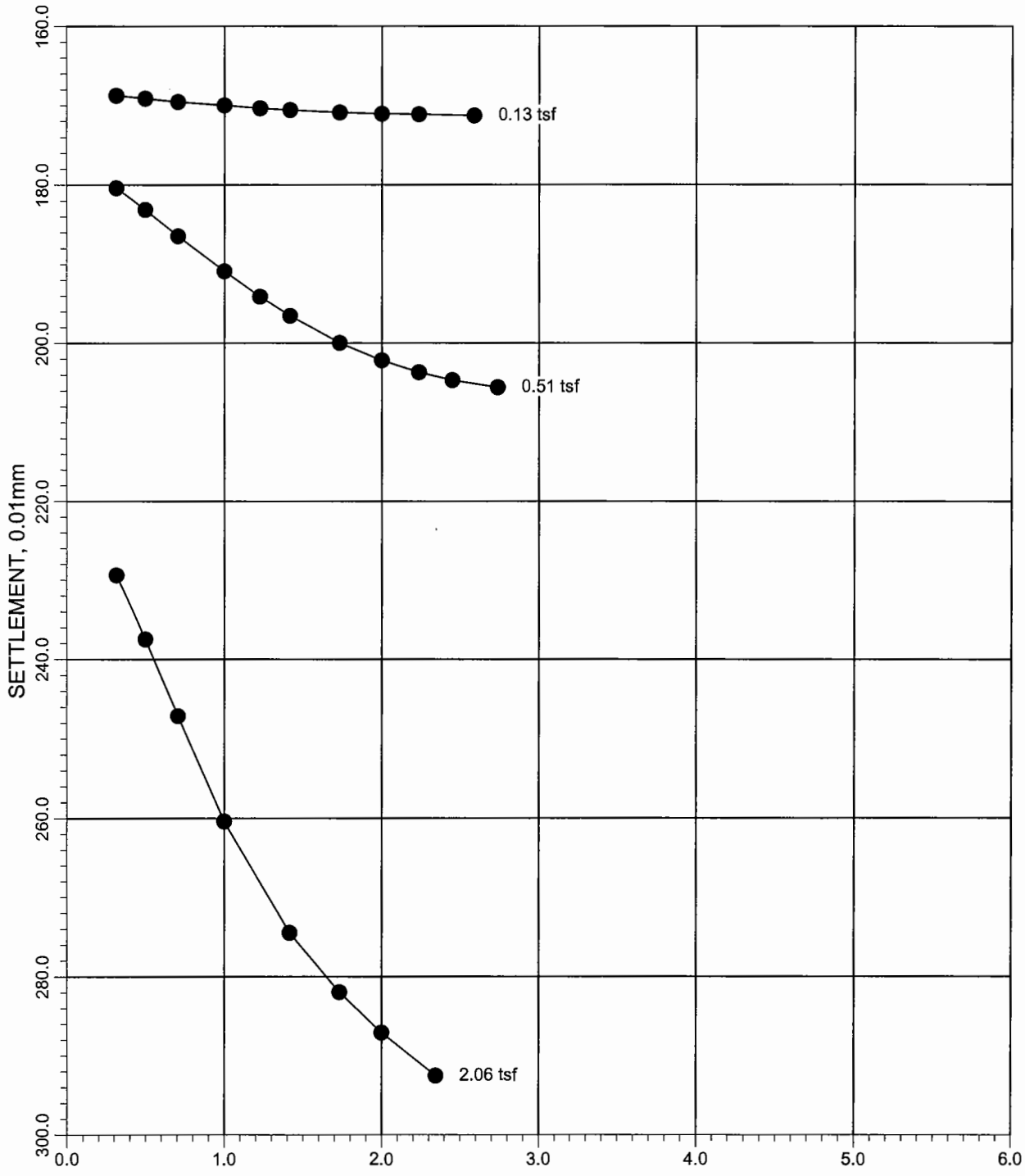
FIG. B-3(5/8)

ONE DIMENSIONAL CONSOLIDATION TEST NO. 1
SETTLEMENT VS SQR ROOT(TIME)

Boring	B-1
Sample	S-7
Depth, ft	15.8

Tested By / Date JFL 6/17/08
Calc. By / Date JFL 6/19/08
Check By / Date AJZ 6/23/08



Wastewater Treatment Facility
Biosolids Lagoon Project
Hoquiam, Washington

CONSOLIDATION TEST
Boring B-1, Sample S-7, Depth 15.8'

June 2008 21-1-21000-001

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

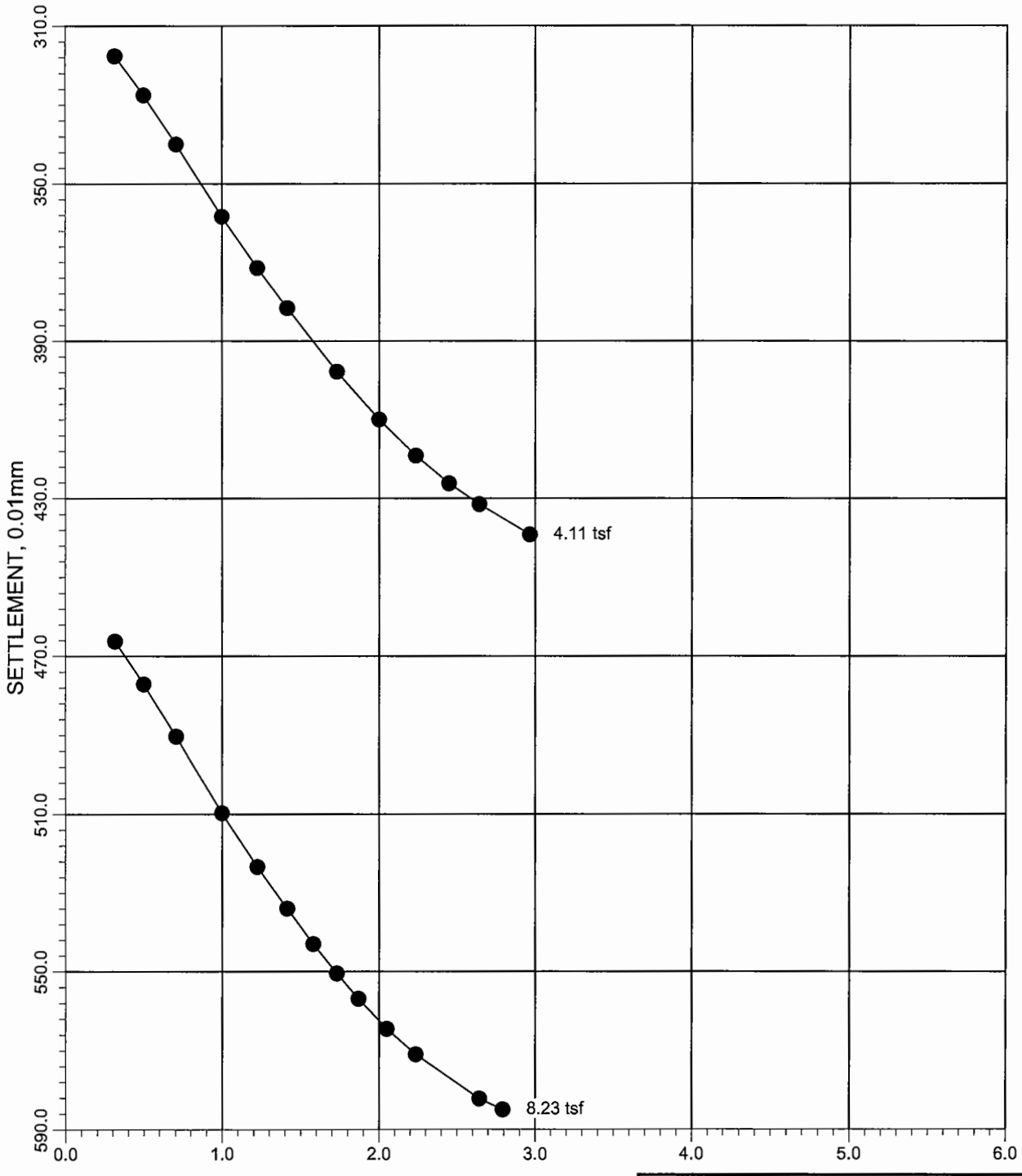
FIG. B-3(6/8)

I:\Groups\Lab\LabPrgm\Projects\21-21000\B1S7158.ODC :: 6/20/2008 2:59:06 PM

ONE DIMENSIONAL CONSOLIDATION TEST NO. 1
SETTLEMENT VS SQR ROOT(TIME)

Boring	B-1
Sample	S-7
Depth, ft	15.8

Tested By / Date JFL 6/17/08
Calc. By / Date JFL 6/19/08
Check By / Date APZ 6/23/08



Wastewater Treatment Facility
Biosolids Lagoon Project
Hoquiam, Washington

CONSOLIDATION TEST
Boring B-1, Sample S-7, Depth 15.8'

June 2008 21-1-21000-001

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. B-3(7/8)

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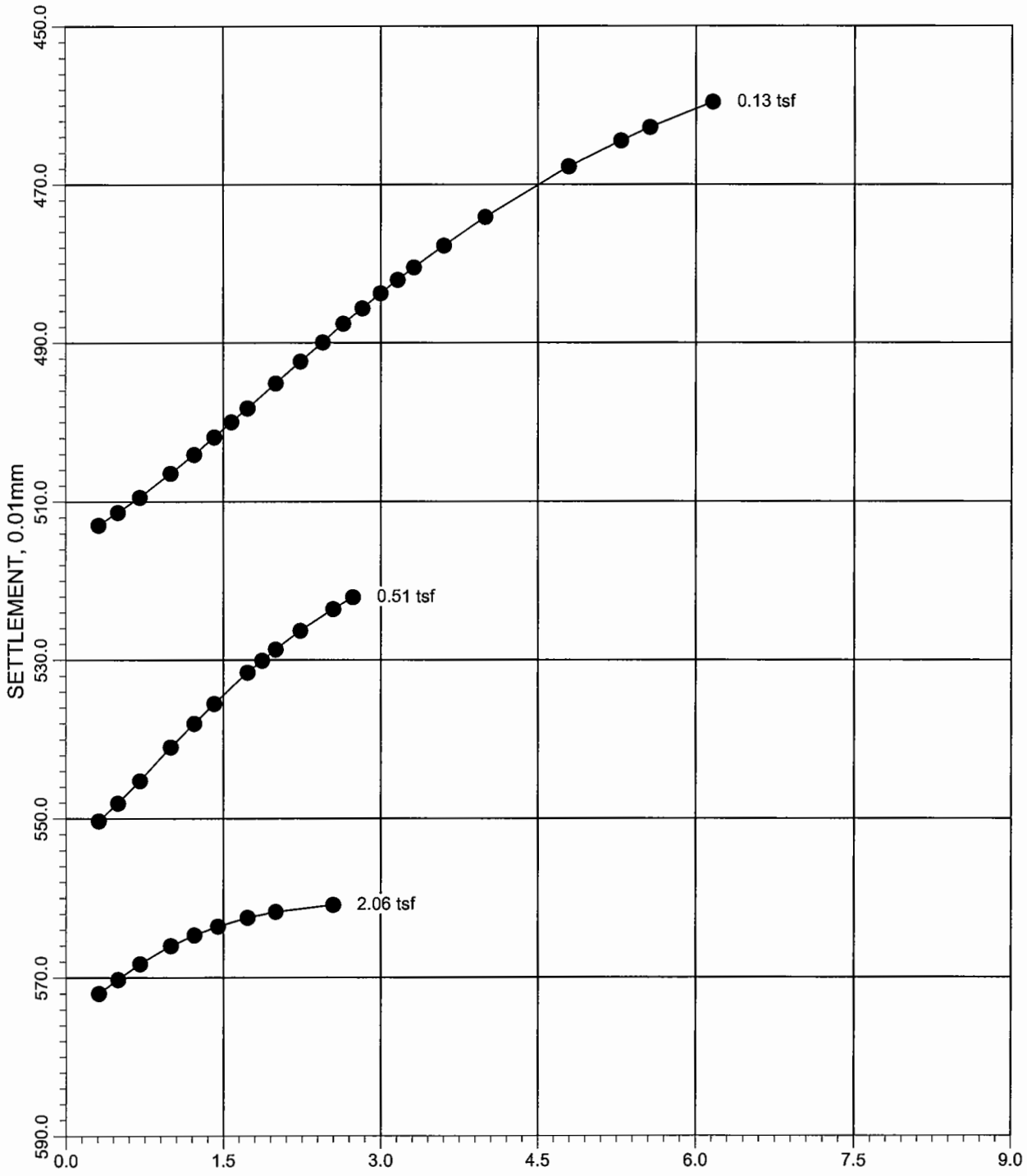
ONE DIMENSIONAL CONSOLIDATION TEST NO. 1
SETTLEMENT VS SQR ROOT(TIME)

Boring	B-1
Sample	S-7
Depth, ft	15.8

Tested	By / Date	JFL 6/17/08
Calc.	By / Date	JFL 6/19/08
Check	By / Date	ATZ 6/23/08



Wastewater Treatment Facility
Biosolids Lagoon Project
Hoquiam, Washington

CONSOLIDATION TEST
Boring B-1, Sample S-7, Depth 15.8'

June 2008 21-1-21000-001

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. B-3(8/8)

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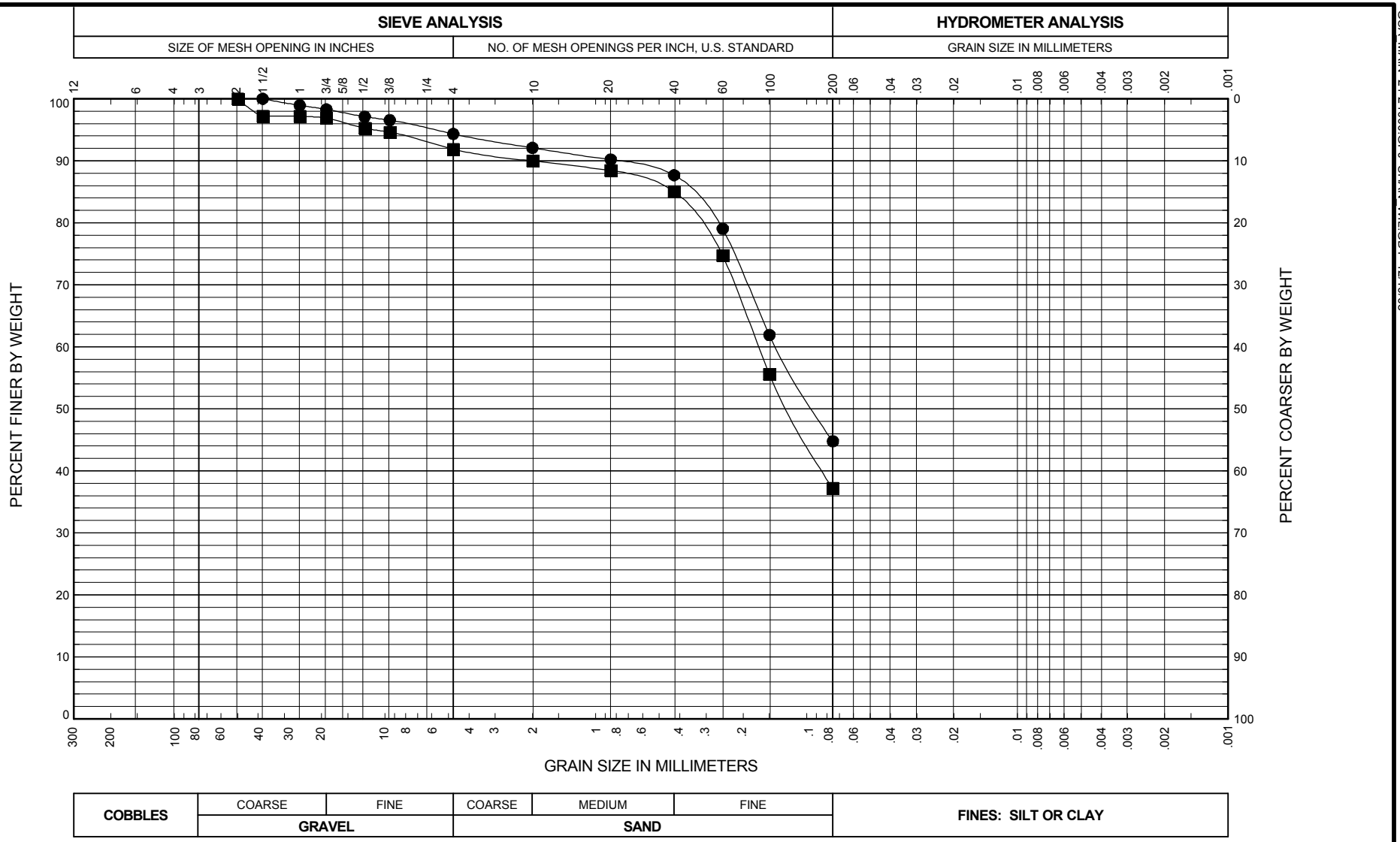


BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SAMPLE DESCRIPTION	FINES %	NAT. W.C. %	LL %	PL %	PI %
● 11/10/2008 S-2	0.0	SM	Gray-brown, slightly gravelly, silty SAND; numerous organics	44.8	32.5			
■ 11/10/2008 S-3	0.0	SM	Gray-brown, slightly gravelly, silty SAND; numerous organics	37.2	28.0			

Wastewater Treatment Facility
Biosolids Lagoon Project
Hoquiam, Washington

GRAIN SIZE DISTRIBUTION
PROPOSED FILL MATERIAL

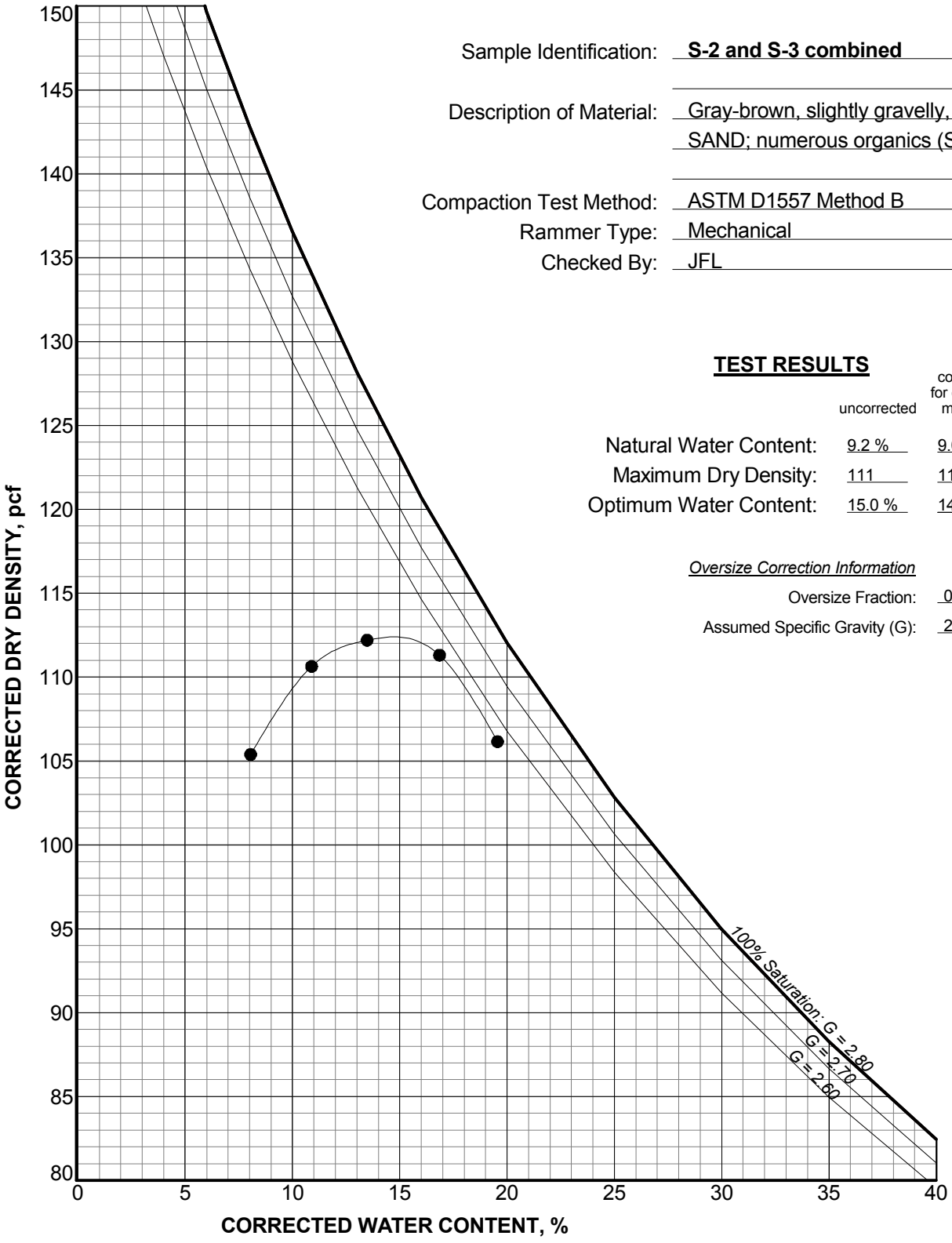
December 2008 21-1-21000-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-4

FIG. B-4

GSA MAIN 21-21000.GPJ SHAN_WIL.GDT 12/10/08



Sample Identification: **S-2 and S-3 combined**

Description of Material: Gray-brown, slightly gravelly, silty SAND; numerous organics (SM)

Compaction Test Method: ASTM D1557 Method B

Rammer Type: Mechanical

Checked By: JFL

TEST RESULTS

	uncorrected	corrected for oversize material
Natural Water Content:	9.2 %	9.0 %
Maximum Dry Density:	111	113
Optimum Water Content:	15.0 %	14.5 %

Oversize Correction Information

Oversize Fraction: 0.05

Assumed Specific Gravity (G): 2.7

OTHER TEST RESULTS

GRAIN SIZE ANALYSES:

% Gravel: 5.7

% Sand: 49.6

% Fines: 44.8

Wastewater Treatment Facility
Biosolids Lagoon Project
Hoquiam, Washington

MOISTURE-DENSITY TEST PROPOSED FILL MATERIAL

December 2008 21-1-21000-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

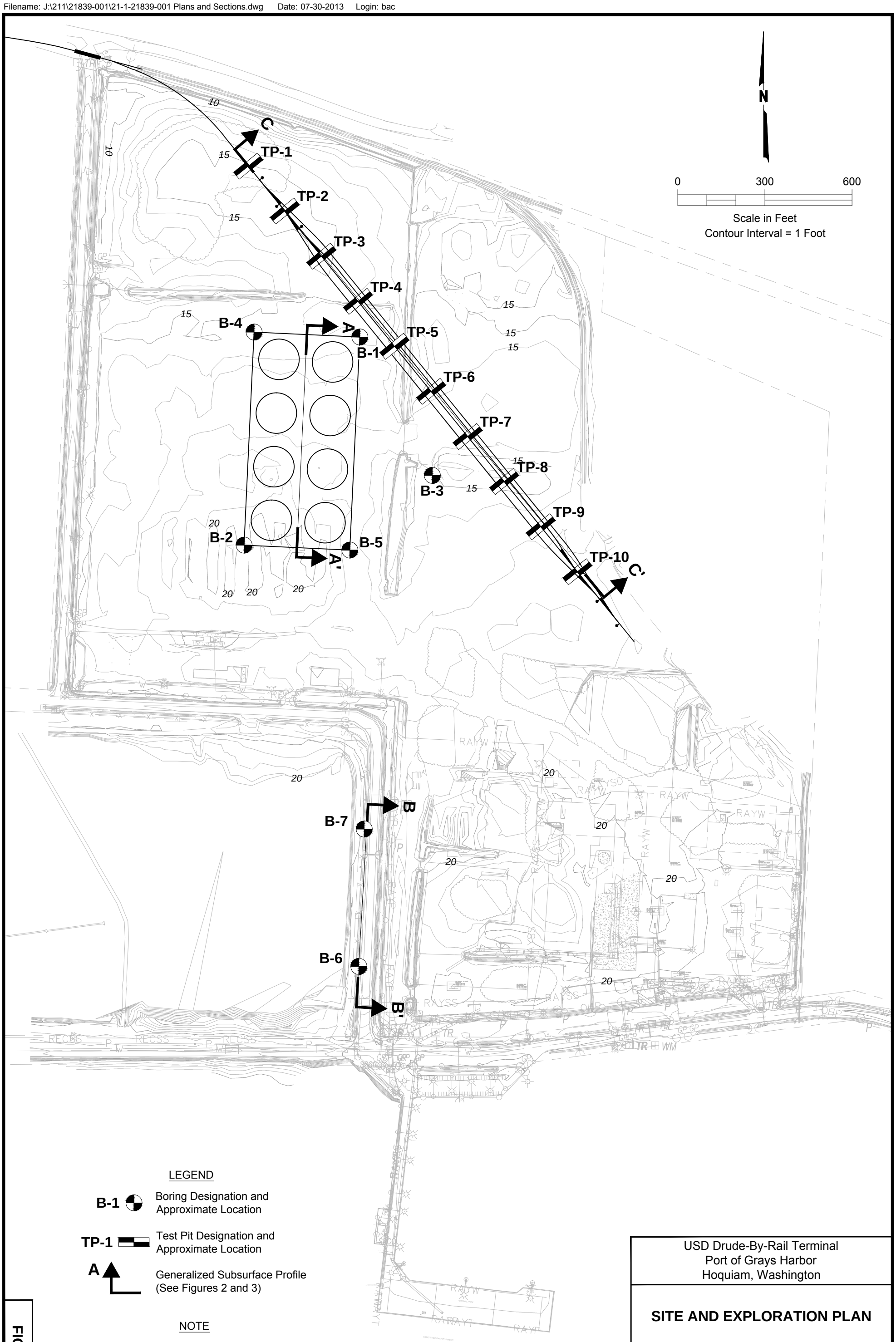
FIG. B-5

APPENDIX C: EXISTING SUBSURFACE DATA

SHANNON & WILSON, INC. (2013) DATA

Shannon & Wilson, Inc., 2013, Draft geotechnical report, USD crude-by-rail terminal, Port of Grays Harbor, Hoquiam, Washington: Report prepared by Shannon & Wilson, Inc., Seattle, Wash., 21-1-21839-001, for HDR Engineering, Inc., September.

Filename: J:\211\21839-001\21-1-21839-001 Plans and Sections.dwg Date: 07-30-2013 Login: bac



LEGEND

B-1 Boring Designation and Approximate Location

TP-1 Test Pit Designation and Approximate Location

A Generalized Subsurface Profile (See Figures 2 and 3)

NOTE

This figure is adapted from client files, *"GH TRACK AND PAD POINTS.dwg"* and *"11161 3-16-12.dwg",* dated 4-30-13.

USD Drude-By-Rail Terminal
Port of Grays Harbor
Hoquiam, Washington

SITE AND EXPLORATION PLAN

August 2013 21-1-21839-001

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2

FIG. 2

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

JOB NO: 21-1-21839-001 DATE: 4-15-13 LOCATION: See Site and Exploration Plan

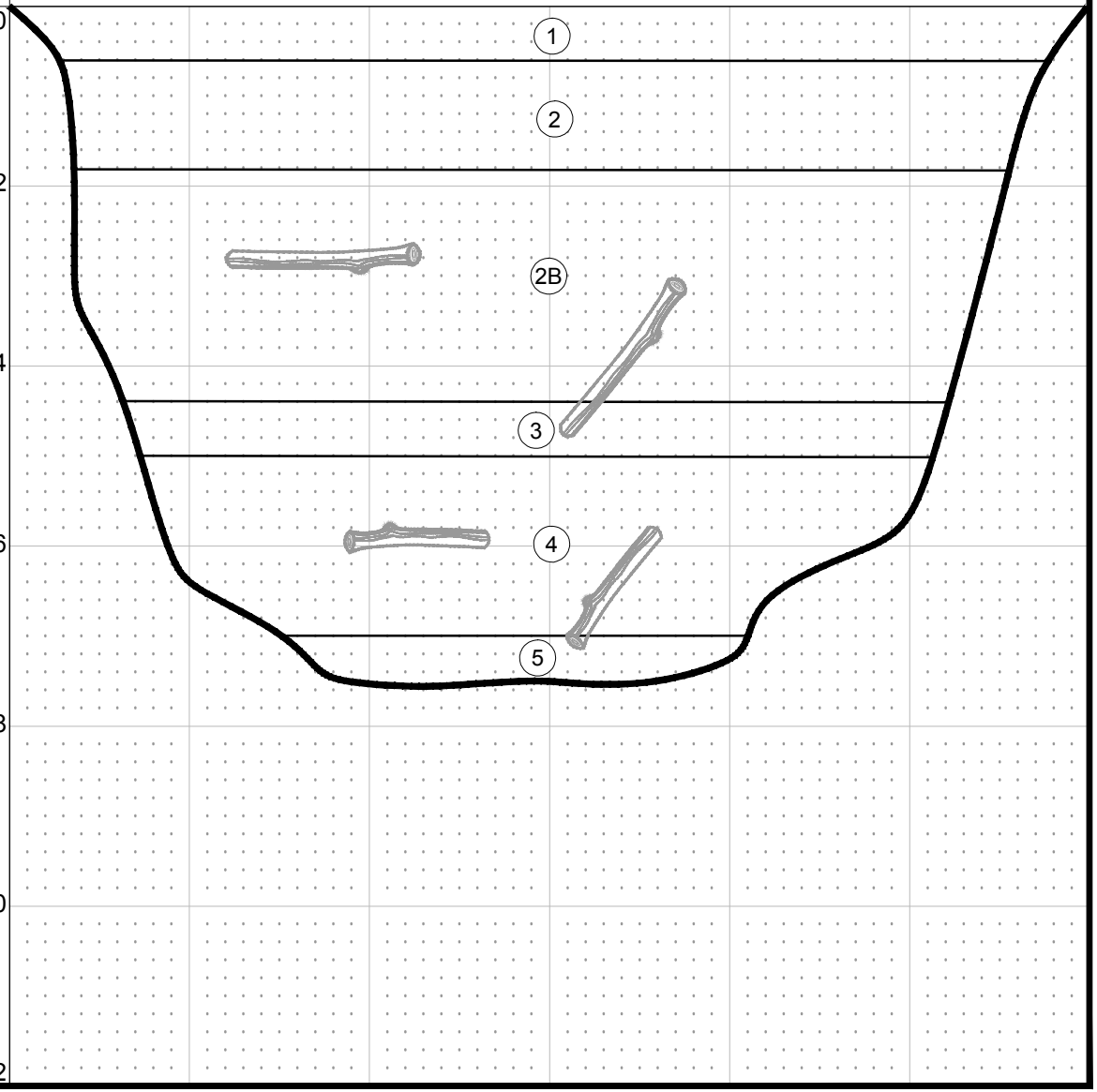
PROJECT: Port of Grays Harbor Terminal

LOG OF TEST PIT TP-1 (HDR #5)

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Very loose, reddish-brown, gravelly, silty SAND; moist ; abundant root fragments; (Hf) SM.			S-1	0
(2) Very soft, reddish-brown, slightly sandy, clayey SILT; moist; (Hf) ML.			S-2	2
(3) Very loose, brown, slightly clayey, silty SAND; moist; abundant wood chips / organics; (Hf).			S-3	
(4) Medium dense, gray, sandy, silty GRAVEL; wet; gravel is quarry spalls; (Hf) GM.	▽		S-4	4
(5) Very loose, brown, sandy GRAVEL; wet; gravel is quarry spalls; abundant timber and wood chips; GP.			S-5	6
(6) Very soft, light brown, silty CLAY; moist; wood fragments; (Holocene Tidal Deposits).			S-6	8
				10
				12

Sketch of North Pit Side

Surface Elevation: Approx. ___ Ft.



NOTES

1. Abundant 4'- to 6'-long timber and wood chips from 2.5 to 4.4 and 5 to 7 feet.
2. Groundwater filled excavation up to 5 feet below ground surface.

FIG. A-2

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

LOG OF TEST PIT TP-2 (HDR #6)

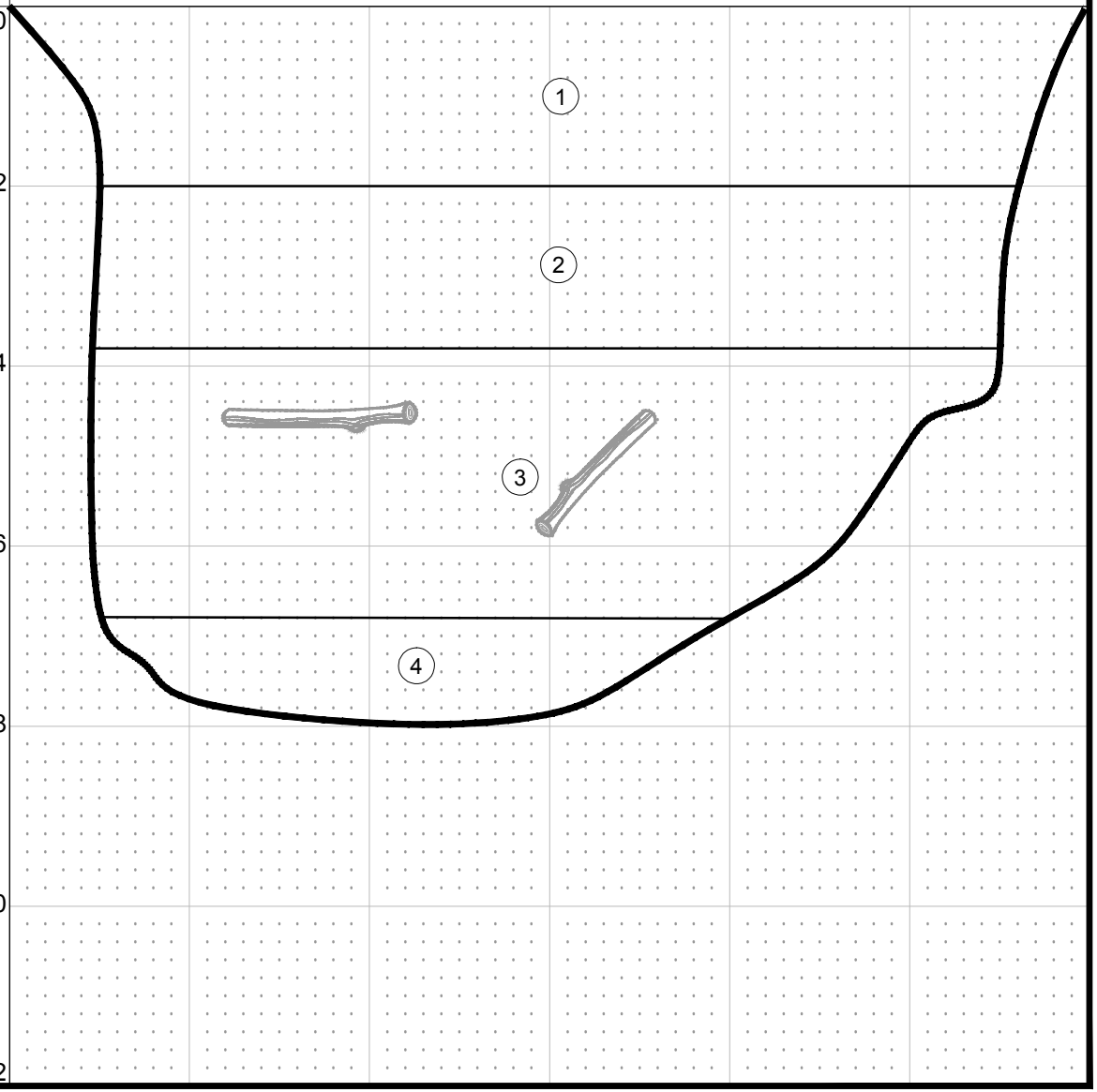
JOB NO: 21-1-21839-001 DATE: 4-15-13 LOCATION: See Site and Exploration Plan

PROJECT: Port of Grays Harbor Terminal

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Very soft, reddish-brown, slightly sandy, gravelly, clayey SILT; (Hf) ML.	▽		S-1	0
(2) Medium dense, gray, silty, gravelly SAND; moist; gravel is quarry spalls; (Hf) SM.			S-2	2
(3) Very loose, brown, wood waste with GRAVEL; wet; scattered logs and wood chips; (Hf) GP.			S-3	4
(4) Very soft, light brown, slightly sandy, silty CLAY; moist; CL.			S-4	6
				8
				10
				12

Sketch of North Pit Side

Surface Elevation: Approx. ___ Ft.



NOTES

1. Wood waste layer 3.8 to 6.8 feet contains scattered 2'- to 6'-long logs.
2. Groundwater filled excavation to 4 feet below ground surface.

FIG. A-3

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

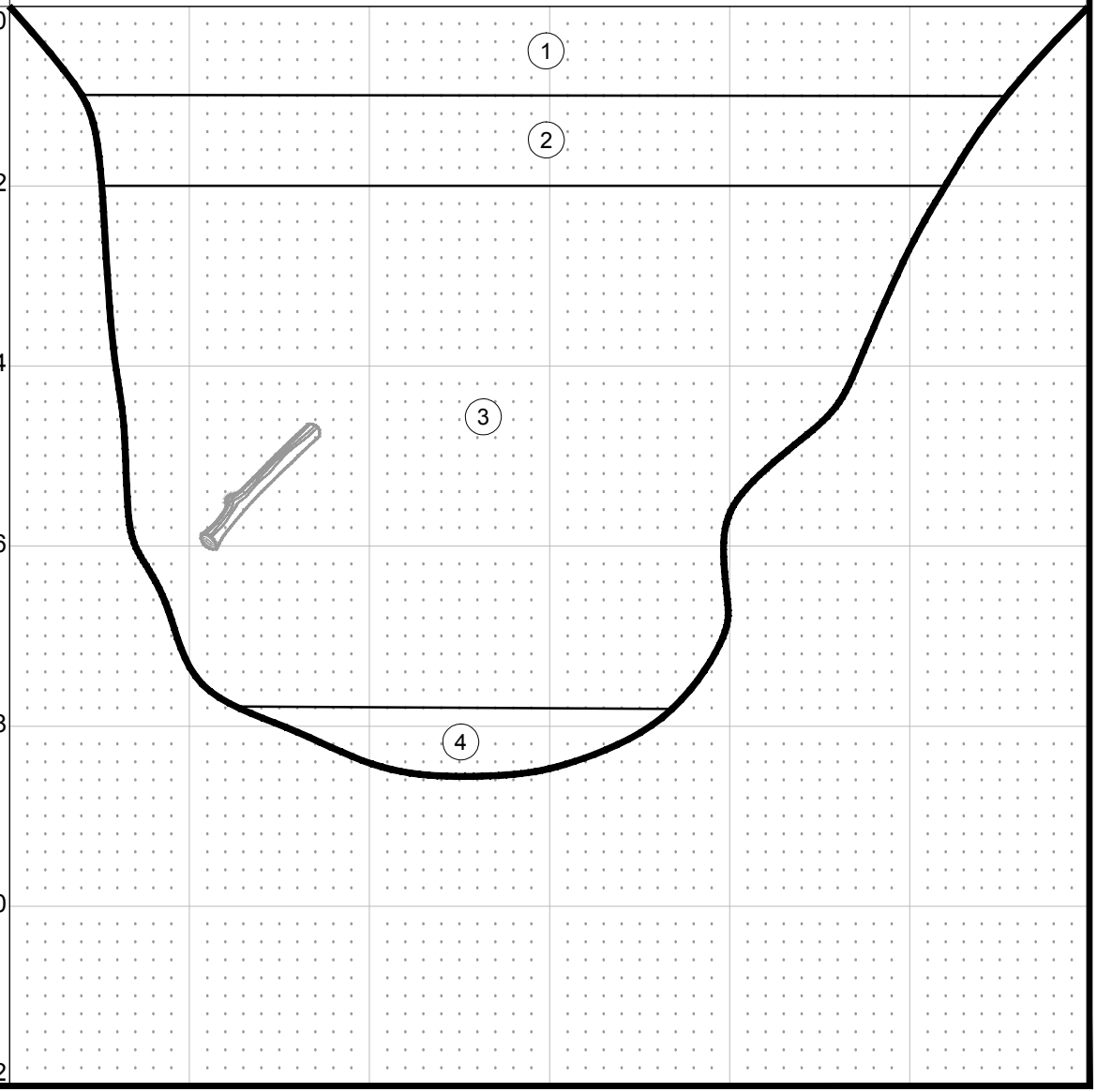
JOB NO: 21-1-21839-001 DATE: 4-15-13 LOCATION: See Site and Exploration Plan

PROJECT: Port of Grays Harbor Terminal

LOG OF TEST PIT TP-3 (HDR #7)

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Very soft, reddish-brown, slightly sandy, gravelly, silty CLAY; moist; (Hf) CL.			S-1	0
(2) Medium dense, gray, silty, gravelly SAND/sandy GRAVEL; moist; gravel is quarry spalls; (Hf) SM/GM.			S-2	2
(3) Very loose, brown, wood waste with sandy GRAVEL; wet; scattered 2'- to 4'-long logs; (Hf) GP.			S-3	4
(4) Very soft, light brown, slightly sandy, silty CLAY; moist; CL.	▽		S-4	6, 8, 10, 12

Sketch of West Pit Side — Surface Elevation: Approx. ___ Ft.



NOTES

1. Wood waste layer contains scattered 2'- to 4'-long logs, less frequent.
2. Groundwater filled excavation to 6.0 feet below ground surface.

FIG. A-4

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

JOB NO: 21-1-21839-001 DATE: 4-15-13 LOCATION: See Site and Exploration Plan

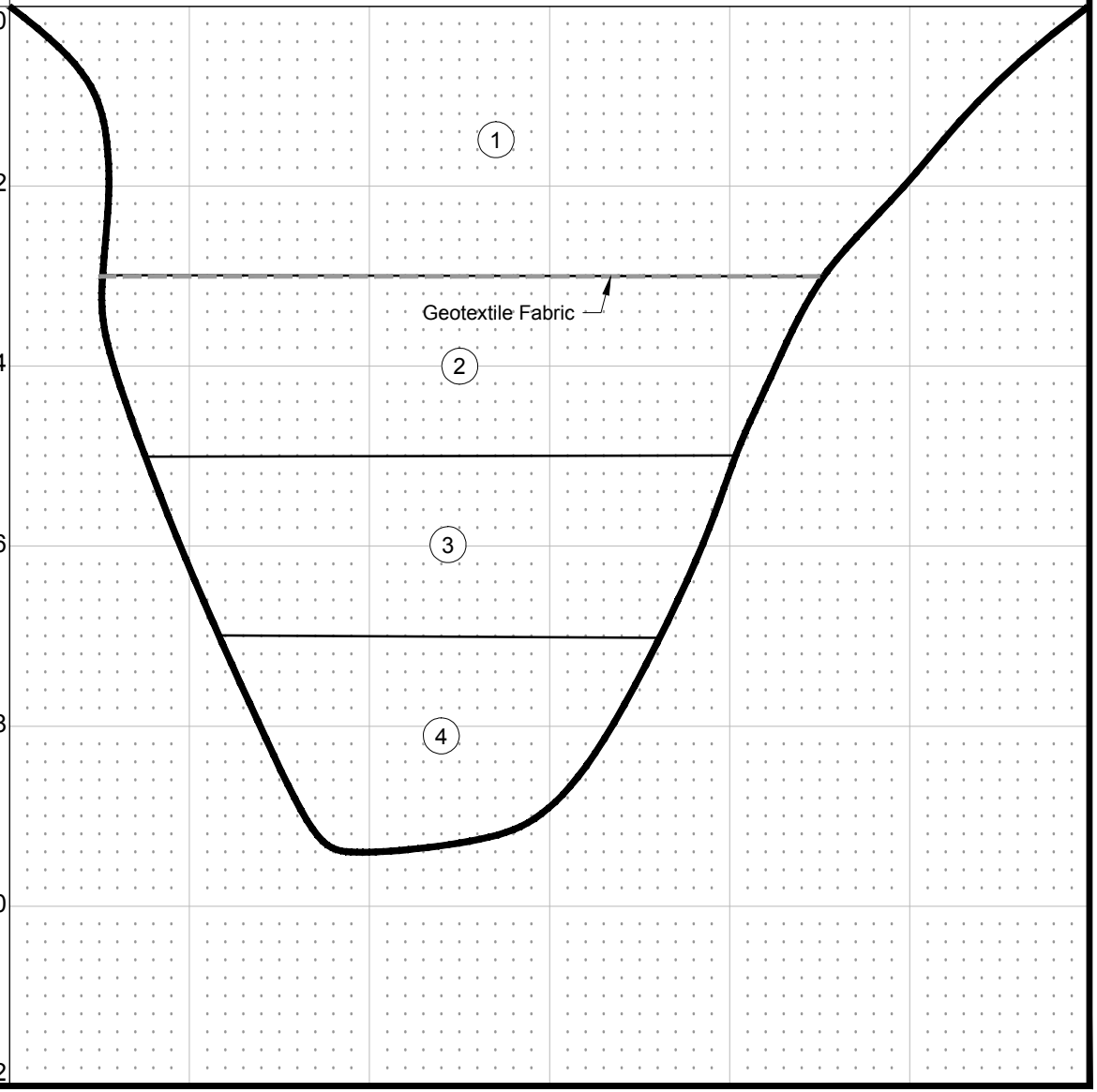
PROJECT: Port of Grays Harbor Terminal

LOG OF TEST PIT TP-4 (HDR #8)

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Medium dense to dense, brown, sandy GRAVEL; moist; abundant root fragments, gravel is road gravel; (Hf) GP.	▽		S-1	0
(2) Loose, reddish-brown, silty SAND; abundant iron-oxide staining; (Hf) SM.				2
(3) Loose, gray, slightly silty, gravelly SAND; moist to wet; (Hf) SM.			S-2	4
(4) Very soft, gray to black, slightly sandy, silty CLAY; moist; (Holocene Tidal Deposits) CL.			S-3	6
			S-4	8
				10
				12

Sketch of West Pit Side

Surface Elevation: Approx. ___ Ft.



NOTES

1. Geotextile fabric at 3.0 feet below ground surface.
2. Groundwater flowed into excavation less than 1 gallon per minute.

FIG. A-5

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

JOB NO: 21-1-21839-001 DATE: 4-15-13 LOCATION: See Site and Exploration Plan

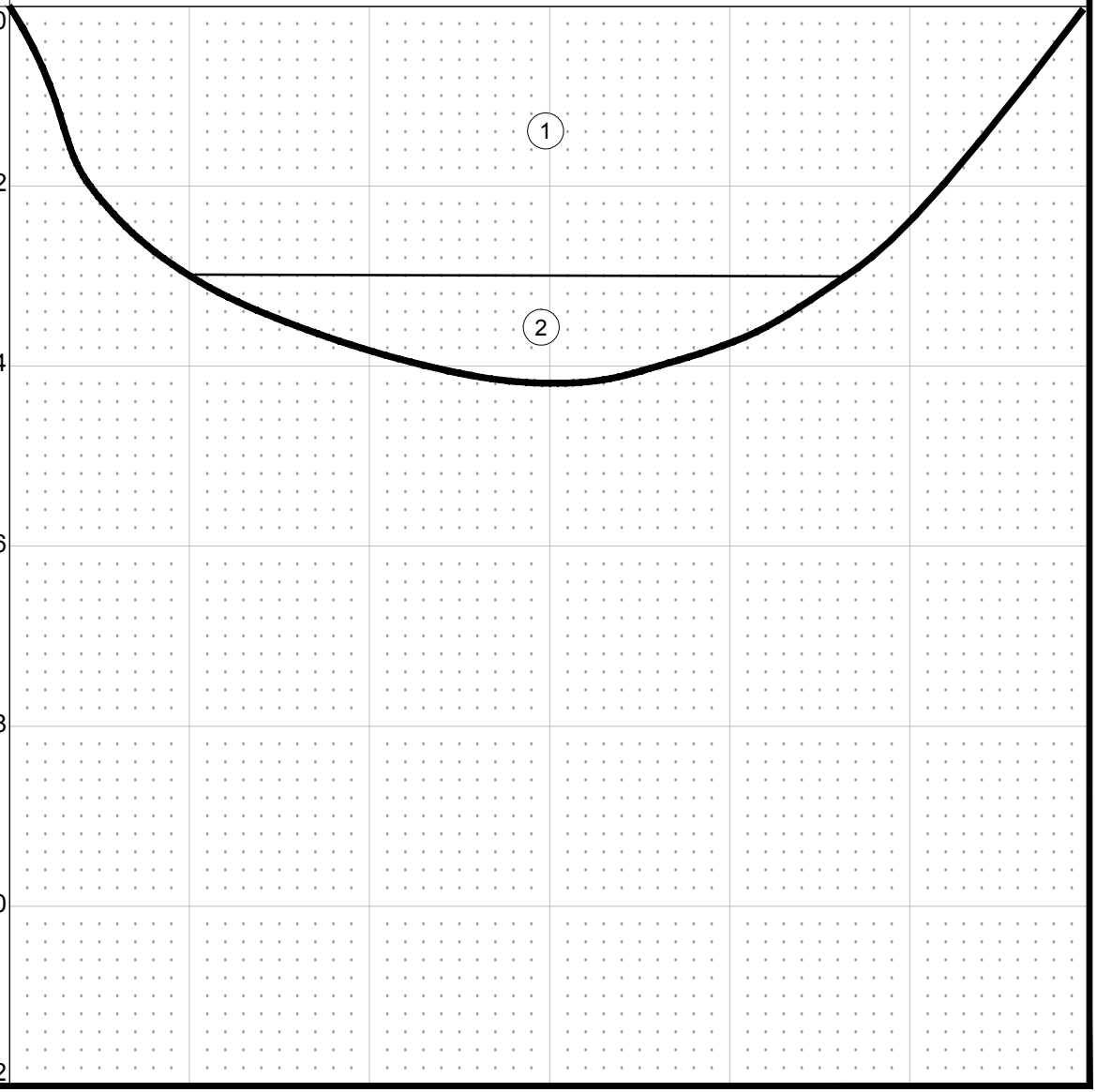
PROJECT: Port of Grays Harbor Terminal

LOG OF TEST PIT TP-5 (HDR #9)

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Dense, brown, sandy GRAVEL; moist; abundant root fragments, gravel is quarry spalls; (Hf) GP.			S-1	0
(2) Very soft, light gray, slightly sandy, clayey SILT; moist; scattered wood fragments; (Holocene Tidal Deposits) ML.	▽		S-2	2
				4
				6
				8
				10
				12

Sketch of South Pit Side

Surface Elevation: Approx. ___ Ft.



NOTE

Groundwater filled excavation to 3.0 feet below ground surface.

FIG. A-6

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

LOG OF TEST PIT TP-6 (HDR #10)

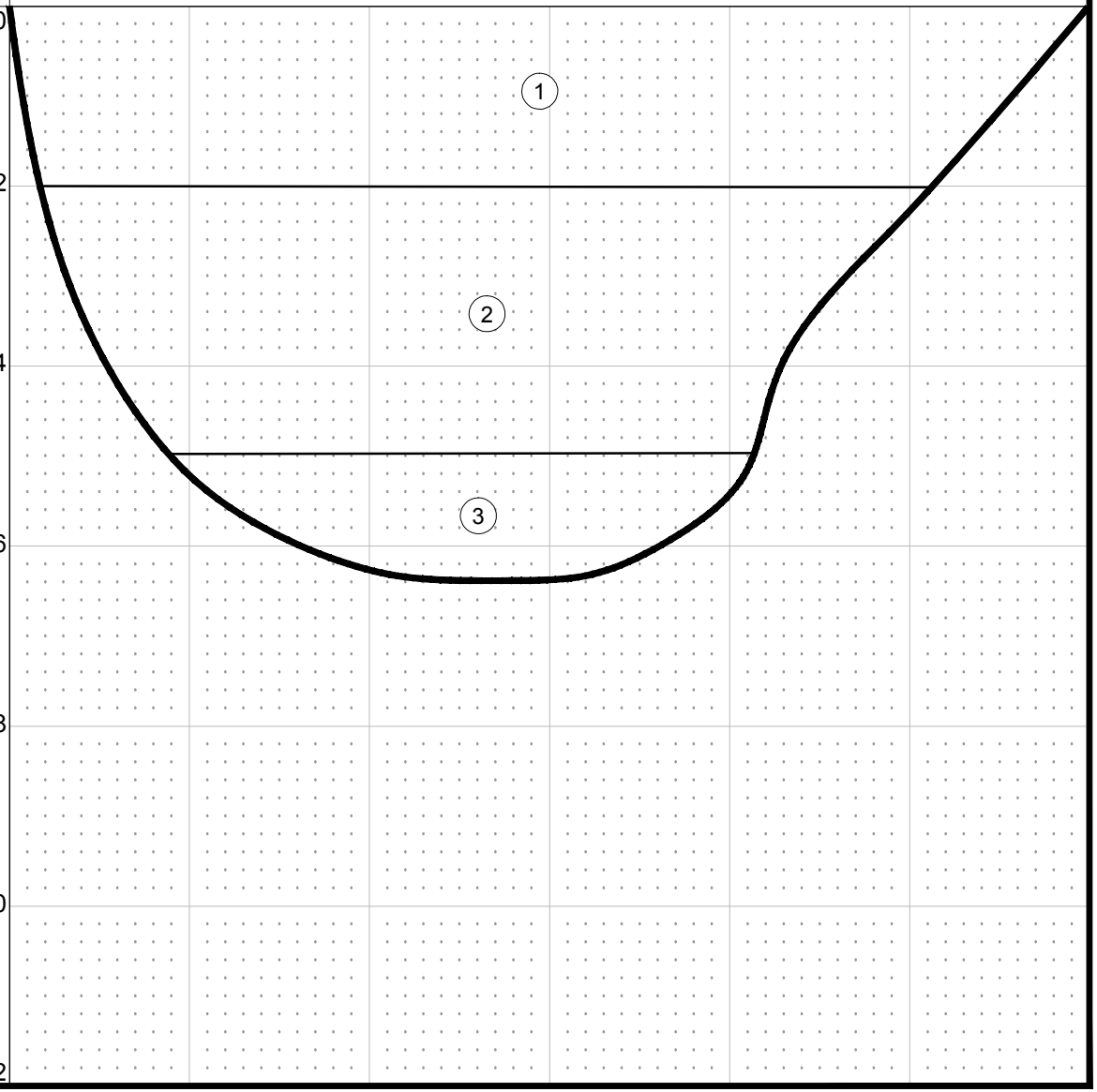
JOB NO: 21-1-21839-001 DATE: 4-15-13 LOCATION: See Site and Exploration Plan

PROJECT: Port of Grays Harbor Terminal

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Dense, gray, sandy GRAVEL; moist; gravel is crushed rock; (Hf) GP.			S-1	0
(2) Very dense, gray, quarry rock (0.3' to 0.8' diameter) and GRAVEL; (Hf).			S-2	2
(3) Very soft, gray to dark gray, slightly sandy, clayey SILT; moist; ML.	▽		S-3	4
				6
				8
				10
				12

Sketch of South Pit Side

Surface Elevation: Approx. ___ Ft.



NOTE

Groundwater filled excavation to 5.0 feet below ground surface.

FIG. A-7

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

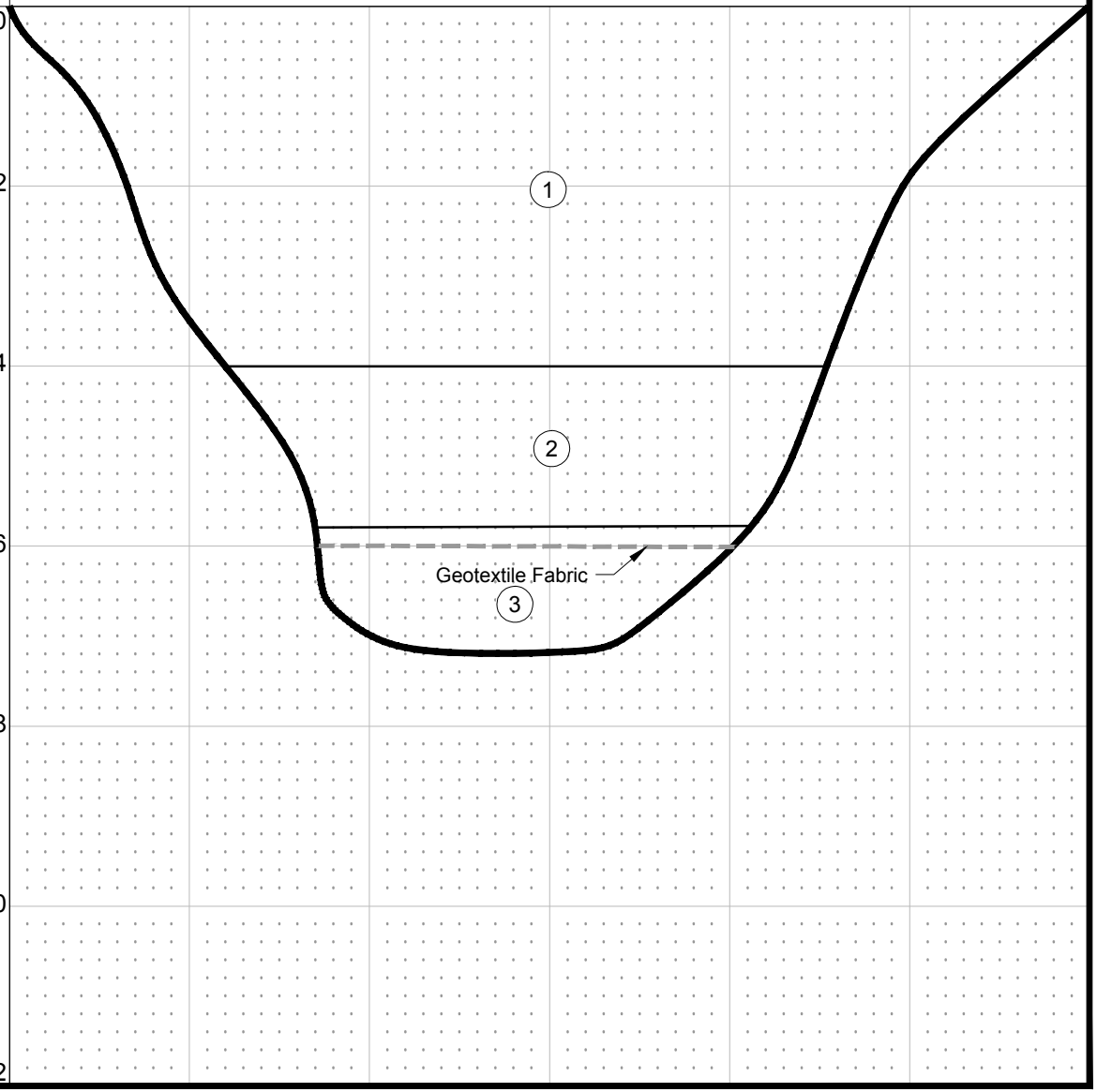
JOB NO: 21-1-21839-001 DATE: 4-15-13 LOCATION: See Site and Exploration Plan

PROJECT: Port of Grays Harbor Terminal

LOG OF TEST PIT TP-7 (HDR #11)

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Very dense, gray, sandy GRAVEL; moist; abundant root fragments and wood chips; gravel is imported crushed rock; (Hf) GP.			S-1	0
(2) Very dense, gray, crushed quarry rock (0.2' to 0.5' diameter); (Hf).				2
(3) Very soft, light gray, slightly sandy, clayey SILT; moist; (Holocene Tidal Deposits) ML.			S-2	4
	▽		S-3	6
				8
				10
				12

Sketch of NorthwestPit Side Surface Elevation: Approx. ___ Ft.



NOTES

1. Geotextile fabric at 6.0 feet.
2. Groundwater filled excavation to 6.0 feet below ground surface.

FIG. A-8

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

LOG OF TEST PIT TP-8 (HDR #12)

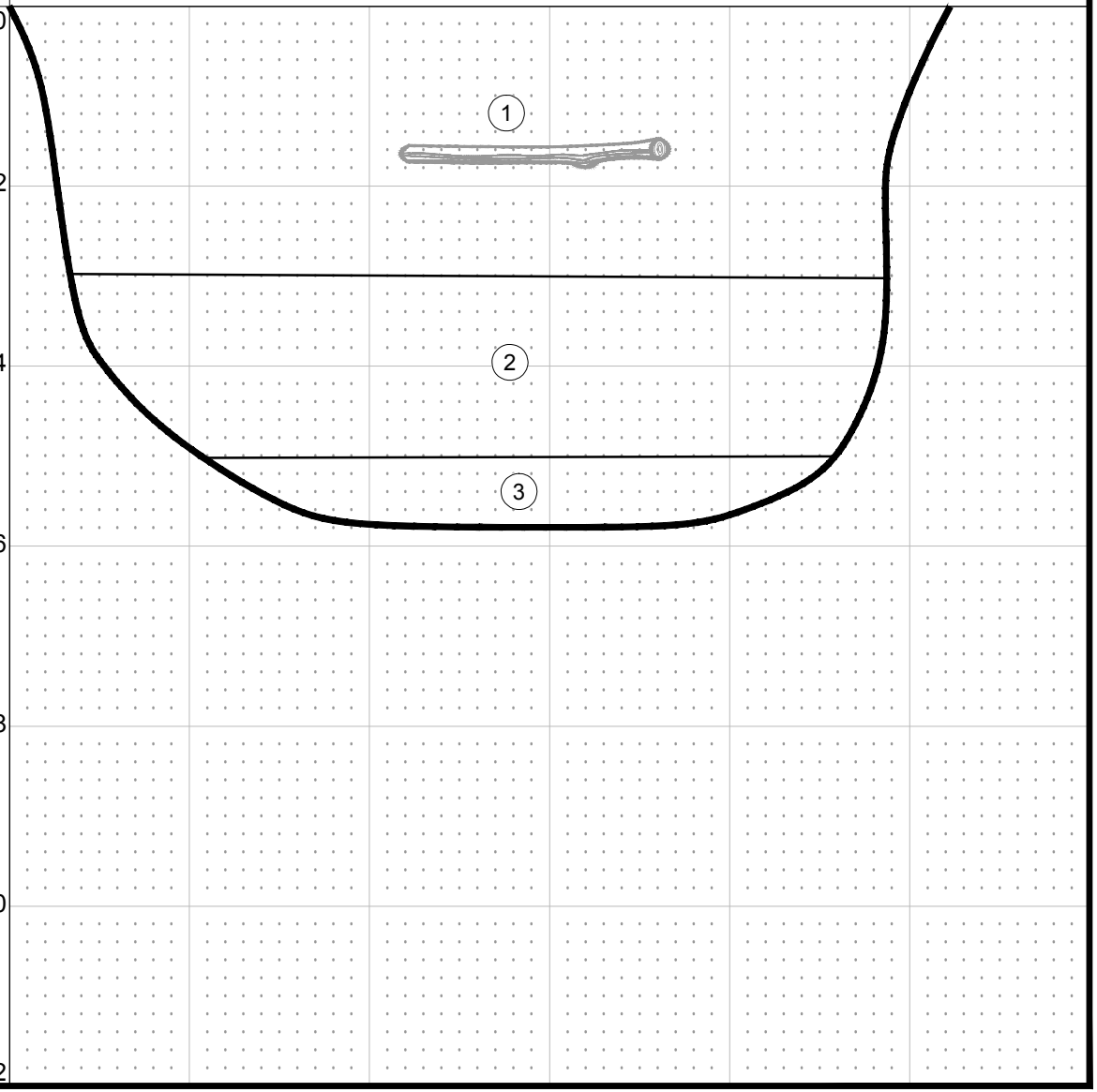
JOB NO: 21-1-21839-001 DATE: 4-15-13 LOCATION: See Site and Exploration Plan

PROJECT: Port of Grays Harbor Terminal

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Very loose, brown wood chips and wood fragments; scattered 4' to 6' logs.			S-1	0
(2) Loose, gray, silty SAND; moist; to wet; SM.				2
(3) Very soft, gray, sandy, clayey SILT; moist; scattered root fragments; ML.	▽		S-2	4
			S-3	6
				8
				10
				12

Sketch of West Pit Side

Surface Elevation: Approx. ___ Ft.



NOTE

Groundwater flow less than 1.0 gallon per minute into excavation.

FIG. A-9

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

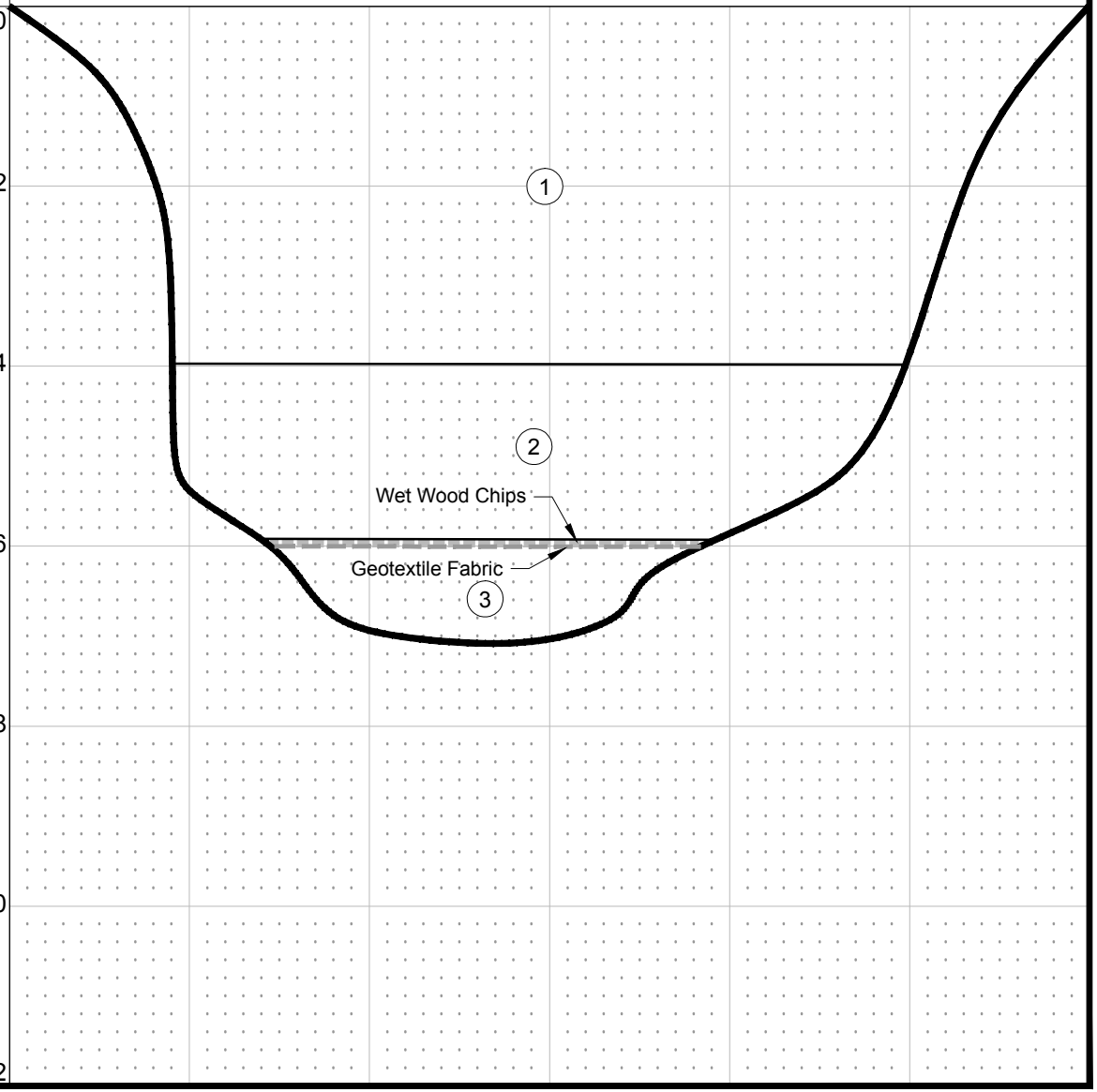
LOG OF TEST PIT TP-9 (HDR #13)

JOB NO: 21-1-21839-001 DATE: 4-15-13 LOCATION: See Site and Exploration Plan

PROJECT: Port of Grays Harbor Terminal

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Dense, brown, sandy GRAVEL; moist; gravel is imported crushed rock; (Hf) GP.			S-1	0
(2) Very dense, gray, imported crushed quarry rock; wet; GP.	▽			2
(3) Loose, gray, silty SAND; wet; SM.			S-2	4
			S-3	6
			S-4	
				8
				10
				12

Sketch of West Pit Side — Surface Elevation: Approx. ___ Ft.



NOTES

1. Geotextile fabric at 6.0 feet.
2. Groundwater filled excavation to 2.0 feet below ground surface.

FIG. A-10

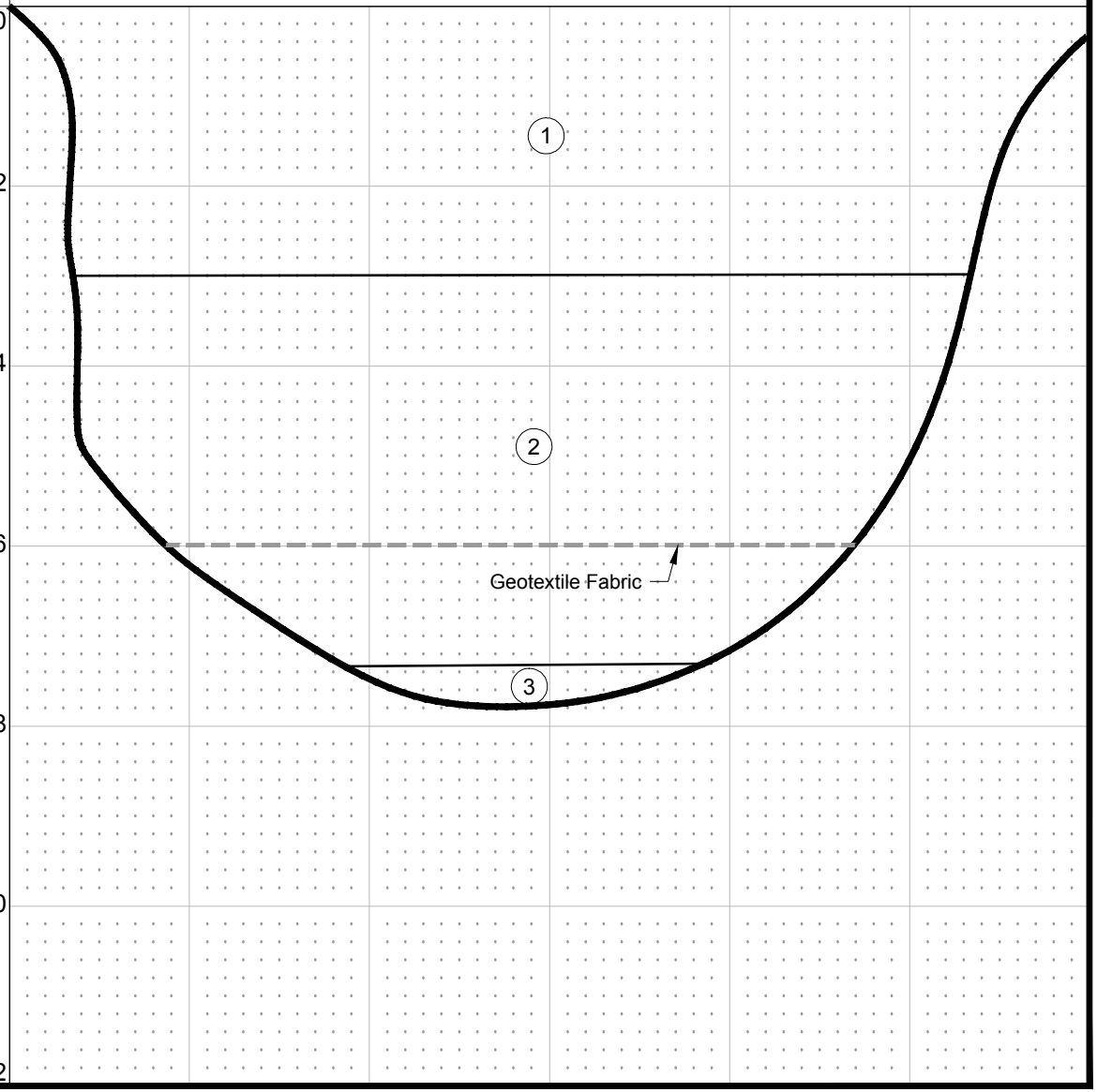
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

LOG OF TEST PIT TP-10 (HDR #14)

JOB NO: 21-1-21839-001 DATE: 4-15-13 LOCATION: See Site and Exploration Plan

PROJECT: Port of Grays Harbor Terminal

SOIL DESCRIPTION	Ground Water	% Water Content	Samples	Depth, Ft.
(1) Dense, brown, slightly silty, sandy GRAVEL; moist; gravel is imported crushed rock; (Hf) GP.			S-1	0
(2) Very dense, gray, imported crushed quarry rock; moist to wet; (Hf) GP.				2
(3) Loose, gray, silty SAND; moist to wet; SM.			S-2	4
	▽			6
			S-3	8
				10
				12



NOTES

1. Geotextile fabric at 6.0 feet.
2. Groundwater flow less than 1 gallon per minute into excavation.

FIG. A-11

Total Depth:	*181 ft.*	Northing:		Drilling Method:	*HSA and Mud Rotary*	Hole Diam.:	*6 in.*
Top Elevation:	*~*	Easting:		Drilling Company:	*Gregory Drilling*	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	*Track CME*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Very dense, gray to brown, sandy GRAVEL; moist; (Hf) GP.

5.0

Very soft to soft, greenish-gray to gray-black, clayey SILT to silty CLAY; moist; scattered interbedded, silty sand at 8 feet and from 30 to 31.5 feet; organic clay from 12.5 to 17 feet; (Estuarine Deposits) (He) ML/CL/OH.

31.5

Very loose to very soft, greenish-gray, interbedded, silty SAND with clayey SILT; moist to wet; (Estuarine Deposits) (He) SM/ML.

50.0

Loose to dense, gray, silty SAND; moist to wet; sandy silt interbed from 80 to 81.5 feet, scattered wood fragments from 60 to 61.5 feet; (Alluvium) (Ha) SM.

90.0

Very soft to medium dense, gray, interbedded, silty SAND and sandy SILT with silt layer from 90 to 91.5 feet; (Alluvium) (Ha) SM/ML.

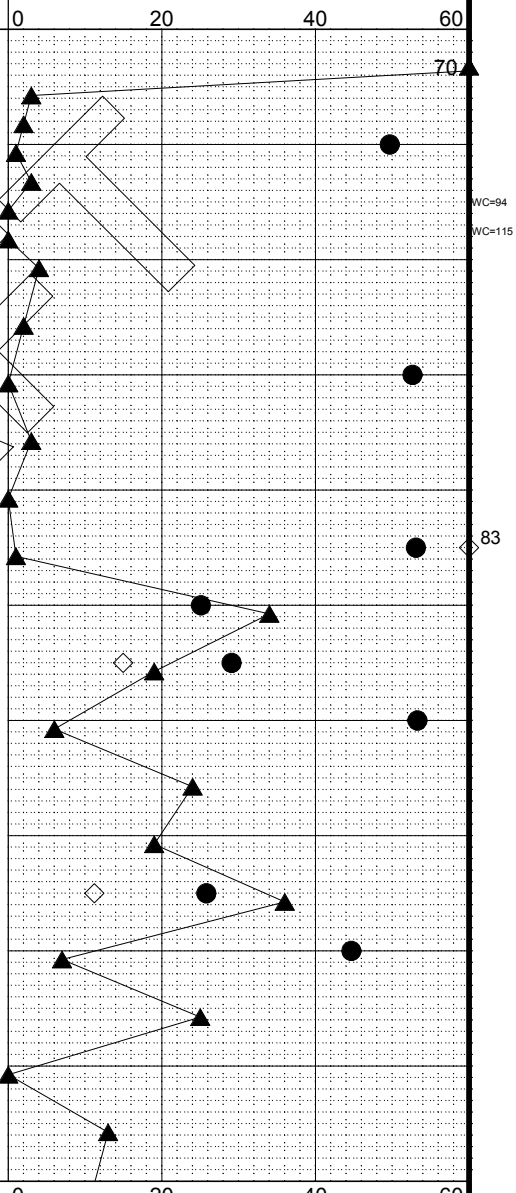
CONTINUED NEXT SHEET

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

During Drilling ▽

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

▽ Ground Water Level ATD

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ⊢●⊣ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

USD Crude-by-Rail Project
Port of Grays Harbor
Hoquiam, Washington

LOG OF BORING B-1

September 2013 21-1-21839-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-12
Sheet 1 of 2

MASTER_LOG_E 21-21839.GPJ SHAN_WIL.GDT 3/24/14 Log: AJD Rev: AJD Typ: LKN

Total Depth:	*181 ft.*	Northing:		Drilling Method:	*HSA and Mud Rotary*	Hole Diam.:	*6 in.*
Top Elevation:	*~*	Easting:		Drilling Company:	*Gregory Drilling*	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	*Track CME*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*

0 20 40 60

110.0 — Very soft to soft, gray, clayey SILT and silty CLAY with medium dense, silty sand seam from 141 to 141.5 feet; moist; (Estuarine Deposits) (He) ML/CL.

158.0 — Dense to very dense, gray, sandy GRAVEL; wet; scattered cobbles; (Recessional Outwash) (Qvro) GP.

181.0 — BOTTOM OF BORING COMPLETED 4/2/2013

50/5"

80

85

50/6"

LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

Ground Water Level ATD

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ⊢●⊣ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

USD Crude-by-Rail Project
Port of Grays Harbor
Hoquiam, Washington

LOG OF BORING B-1

September 2013 21-1-21839-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-12
Sheet 2 of 2

MASTER_LOG_E 21-21839.GPJ SHAN_WIL.GDT 3/24/14 Log: AJD Rev: AJD Typ: LKN

Total Depth:	*170 ft.*	Northing:		Drilling Method:	*HSA and Mud Rotary*	Hole Diam.:	*6 in.*
Top Elevation:	*~*	Easting:		Drilling Company:	*Gregory Drilling*	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	*Track CME*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Medium dense to very dense, gray to dark gray, sandy GRAVEL to silty SAND; moist to wet; (Hf) GP/SM.

7.5

Loose to medium dense, gray, silty SAND; moist to wet; organic, silty clay seam from 10 to 10.5 feet; (Estuarine Deposits) (He) SM.

14.0

Very soft, gray to black from 20 to 25.5 feet, sandy SILT to silty CLAY with organic-rich clay from 20 to 25.5 feet (OH); moist; (Alluvium) (Ha) ML/CL.

40.0

Loose to dense, gray, silty SAND; moist to wet; (Estuarine Deposits) (He) SM.

80.5

Loose (from 80.5 to 86.5 feet) to very soft, gray, clayey SILT to silty CLAY with loose, gray, silty SAND layer from 140 to 141.5 feet (SM); moist; (Estuarine Deposits) (He) ML/CL.

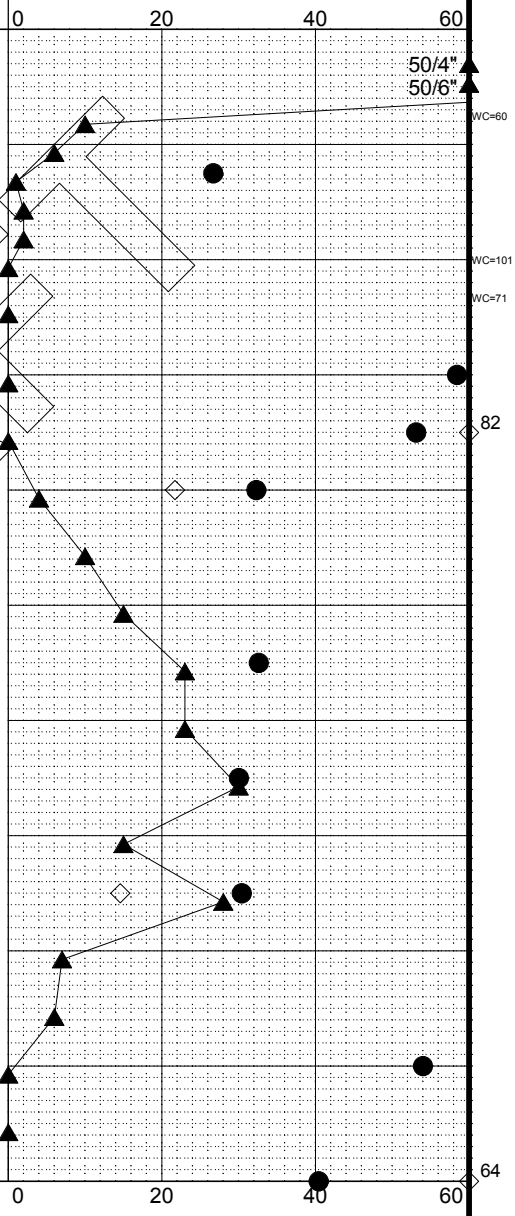
CONTINUED NEXT SHEET

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

During Drilling ▽

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

Thin Wall Sample

▽ Ground Water Level ATD

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ⊢●⊣ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

USD Crude-by-Rail Project
Port of Grays Harbor
Hoquiam, Washington

LOG OF BORING B-2

September 2013 21-1-21839-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-13
Sheet 1 of 2

MASTER_LOG_E 21-21839.GPJ SHAN_WIL.GDT 3/24/14 Log: AJD Rev: AJD Typ: LKN

Total Depth:	*170 ft.*	Northing:		Drilling Method:	*HSA and Mud Rotary*	Hole Diam.:	*6 in.*
Top Elevation:	*~*	Easting:		Drilling Company:	*Gregory Drilling*	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	*Track CME*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*

0 20 40 60

25 26 27 28 29 30 31 32 33 34 35 36 37 38

110 120 130 140 150 160 170 180 190

153.0 Very dense, gray, sandy GRAVEL; wet; (Recessional Outwash) (Qvro) GP.

74 87 50/6"

170.0 BOTTOM OF BORING COMPLETED 4/4/2013

0 20 40 60

LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

Thin Wall Sample

Ground Water Level ATD

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ⊢●⊣ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

USD Crude-by-Rail Project
Port of Grays Harbor
Hoquiam, Washington

LOG OF BORING B-2

September 2013 21-1-21839-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-13
Sheet 2 of 2

MASTER_LOG_E 21-21839.GPJ SHAN_WIL.GDT 3/24/14 Log: AJD Rev: AJD Typ: LKN

Total Depth:	*66.5 ft.*	Northing:		Drilling Method:	*HSA and Mud Rotary*	Hole Diam.:	*6 in.*
Top Elevation:	*~*	Easting:		Drilling Company:	*Gregory Drilling*	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	*Track CME*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*

0 20 40 60

Medium dense, gray to black, silty, sandy GRAVEL; wet; (Hf) GM.

5.0

Very soft, dark gray to black, organic-rich, silty CLAY; with wet, silty sand seam from 12.5 to 13 feet; moist; (Estuarine Deposits) (He) OH/CL.

26.5

Very loose to soft, gray, interbedded, silty SAND with clayey SILT; moist; scattered silty clay seams from 35 to 55 feet; (Estuarine Deposits) (He) SM/ML.

58.0

Medium dense, gray, silty SAND; wet; (Alluvium) (Ha) SM.

66.5

BOTTOM OF BORING
COMPLETED 4/5/2013

During Drilling ▽

WC=64
WC=85
WC=77
92
WC=106
69

10 20 30 40 50 60 70 80 90

0 20 40 60

LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
Thin Wall Sample

Piezometer Screen and Sand Filter
Bentonite-Cement Grout
Bentonite Chips/Pellets
Bentonite Grout
▽ Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

USD Crude-by-Rail Project
Port of Grays Harbor
Hoquiam, Washington

LOG OF BORING B-3

September 2013 21-1-21839-001

SHANNON & WILSON, INC.
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FIG. A-14

Log: AJD Rev: AJD Typ: LKN

MASTER LOG E 21-21839.GPJ SHAN_WIL.GDT 3/24/14

Total Depth:	*170 ft.*	Northing:		Drilling Method:	*HSA and Mud Rotary*	Hole Diam.:	*6 in.*
Top Elevation:	*~*	Easting:		Drilling Company:	*Gregory Drilling*	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	*Track CME*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Very dense, black, sandy GRAVEL; wet; (Hf) GP.

5.0

Very soft, dark gray to black, organic-rich, silty CLAY; moist; (Estuarine Deposits) (He) OH/CL.

20.0

Very loose to very soft, gray, interbedded, silty SAND to clayey SILT/silty CLAY; moist; clay seams from 35 to 50 feet; (Estuarine Deposits) (He) SM/ML.

50.0

Loose to medium dense, gray, silty SAND with scattered sandy SILT interbeds from 55 to 85 feet; moist to wet; (Alluvium) (Ha) SM.

90.0

Very soft to medium stiff, gray, clayey SILT/silty CLAY with scattered silty sand seams; moist; (Estuarine Deposits) (He)

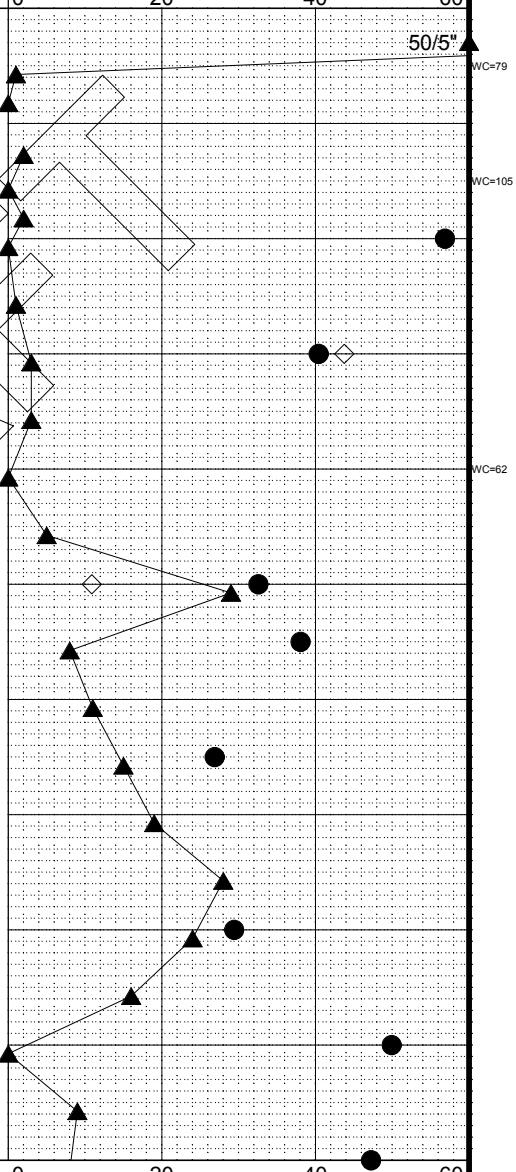
CONTINUED NEXT SHEET

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

During Drilling ▽

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ⊢●⊣ Liquid Limit

Natural Water Content

LEGEND

* Sample Not Recovered

▽ Ground Water Level ATD

2.0" O.D. Split Spoon Sample

Thin Wall Sample

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

USD Crude-by-Rail Project
Port of Grays Harbor
Hoquiam, Washington

LOG OF BORING B-4

September 2013 21-1-21839-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-15
Sheet 1 of 2

MASTER_LOG_E 21-21839.GPJ SHAN_WIL.GDT 3/24/14 Log: AJD Rev: AJD Typ: LKN

Total Depth:	*170 ft.*	Northing:		Drilling Method:	*HSA and Mud Rotary*	Hole Diam.:	*6 in.*
Top Elevation:	*~*	Easting:		Drilling Company:	*Gregory Drilling*	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	*Track CME*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*

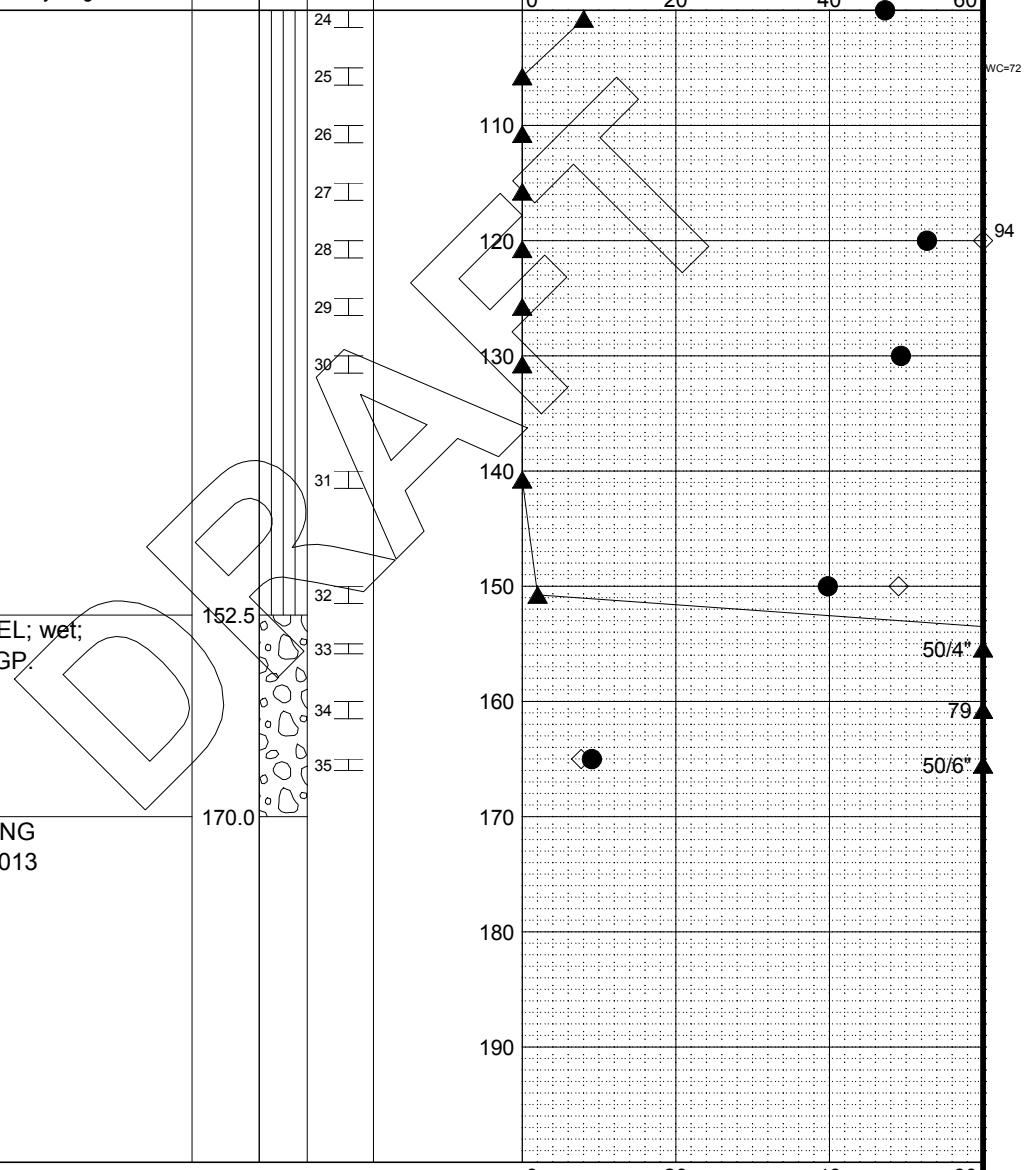
ML/CH/OH.

Very dense, gray, sandy GRAVEL; wet; (Recessional Outwash) (Qvro) GP.

152.5

170.0

BOTTOM OF BORING
COMPLETED 4/9/2013



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
Thin Wall Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

USD Crude-by-Rail Project
Port of Grays Harbor
Hoquiam, Washington

LOG OF BORING B-4

September 2013 21-1-21839-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-15
Sheet 2 of 2

MASTER_LOG_E 21-21839.GPJ SHAN_WIL.GDT 3/24/14 Log: AJD Rev: AJD Typ: LKN

Total Depth:	*176 ft.*	Northing:		Drilling Method:	*HSA and Mud Rotary*	Hole Diam.:	*6 in.*
Top Elevation:	*~*	Easting:		Drilling Company:	*Gregory Drilling*	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	*Track CME*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Medium dense to very dense, gray, sandy GRAVEL; wet; GP.

7.5

Very soft to soft, gray-black from 17.5 to 21.5 feet, slightly sandy, clayey SILT to silty CLAY, organic-rich, silty CLAY (OH) from 17.5 to 21.5 feet; moist; (Estuarine Deposits) (He) ML/CL.

31.5

Very soft to loose, gray, interbedded, clayey SILT/silty CLAY with scattered sand seams; (Estuarine Deposits) (He) ML/CL.

50.0

Medium dense, gray, silty SAND; moist to wet; scattered silty clay seams at 56 feet; (Alluvium) (Ha) SM.

76.5

Very soft to soft, gray, clayey SILT/silty CLAY; moist; medium dense, silty sand layer from 100 to 101.5 feet, scattered sand seams at 85 and 96.5 feet; (Estuarine Deposits) (He) ML/CL.

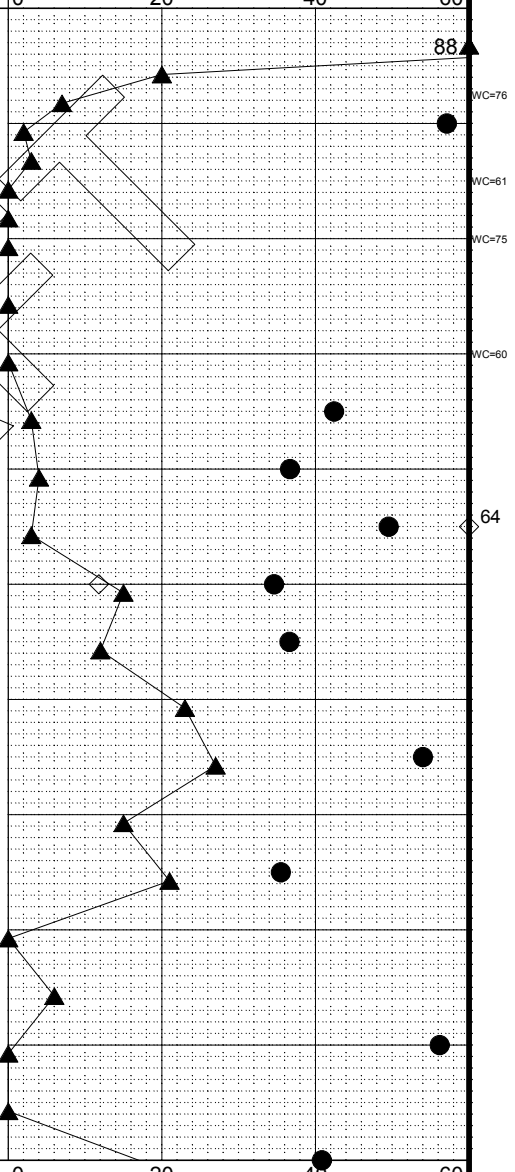
CONTINUED NEXT SHEET

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

During Drilling ▽

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

Thin Wall Sample

▽ Ground Water Level ATD

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ⊢●⊣ Liquid Limit

Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

USD Crude-by-Rail Project
Port of Grays Harbor
Hoquiam, Washington

LOG OF BORING B-5

September 2013 21-1-21839-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-16
Sheet 1 of 2

MASTER_LOG_E 21-21839.GPJ SHAN_WIL.GDT 3/24/14 Log: AJD Rev: AJD Typ: LKN

Total Depth:	*176 ft.*	Northing:		Drilling Method:	*HSA and Mud Rotary*	Hole Diam.:	*6 in.*
Top Elevation:	*~*	Easting:		Drilling Company:	*Gregory Drilling*	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	*Track CME*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

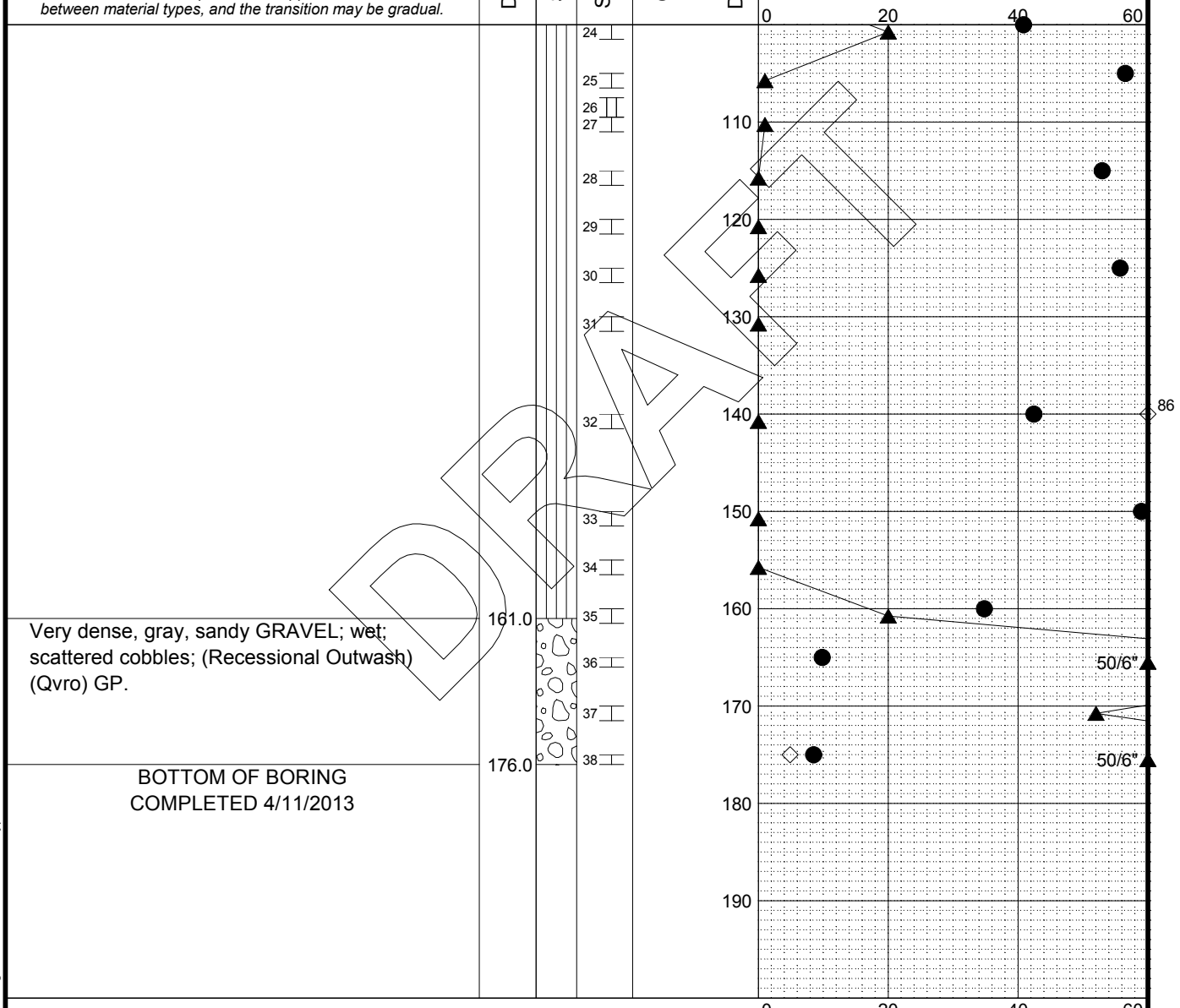
SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



Very dense, gray, sandy GRAVEL; wet; scattered cobbles; (Recessional Outwash) (Qvro) GP.

161.0

176.0

BOTTOM OF BORING
COMPLETED 4/11/2013

LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
Thin Wall Sample
Ground Water Level ATD

◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

USD Crude-by-Rail Project
Port of Grays Harbor
Hoquiam, Washington

LOG OF BORING B-5

September 2013 21-1-21839-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-16
Sheet 2 of 2

MASTER LOG E 21-21839.GPJ SHAN_WIL.GDT 3/24/14 Log: AJD Rev: AJD Typ: LKN

Total Depth:	*61.5 ft.*	Northing:		Drilling Method:	*HSA and Mud Rotary*	Hole Diam.:	*6 in.*
Top Elevation:	*~*	Easting:		Drilling Company:	*Gregory Drilling*	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	*Track CME*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Gravel roadway.

1.0

Very loose to loose, gray, silty SAND with scattered clayey silt and silty clay seams; wet; (Estuarine Deposits) (He) SM.

14.0

Very loose to loose, gray, silty SAND; wet; (Estuarine Deposits) (He) SM.

21.5

Very soft to soft, gray, interbedded, sandy, clayey SILT and silty CLAY, medium dense, silty sand layer from 45 to 46.5 feet; moist to wet (sand layer); (Estuarine Deposits) (He) ML/CL.

55.0

Medium dense, gray, silty SAND; wet; (Alluvium) (Ha) SM.

61.5

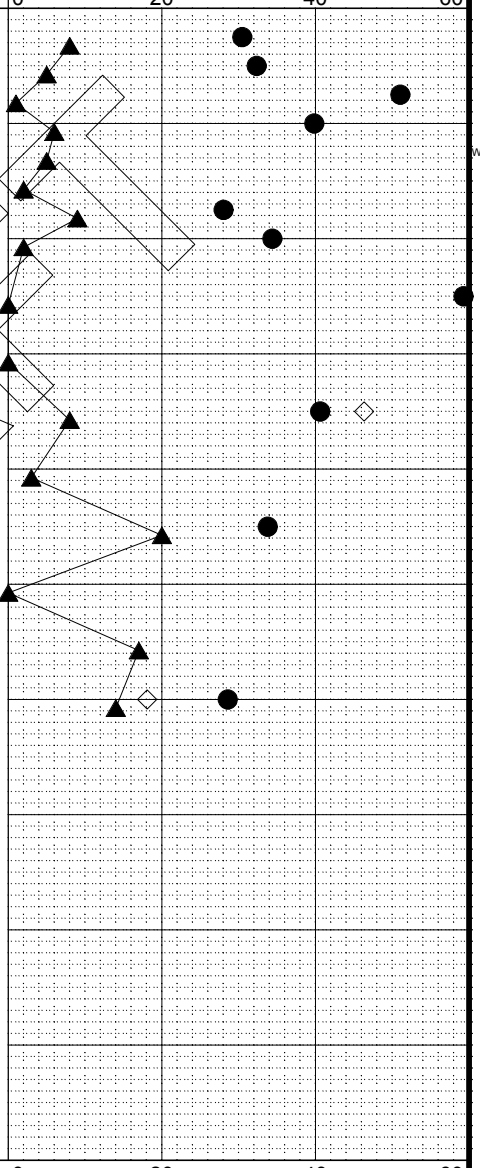
BOTTOM OF BORING
4/11/2013

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

During Drilling

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*



◇ % Fines (<0.075mm)
● % Water Content
Plastic Limit ⊢●⊣ Liquid Limit
Natural Water Content

LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
Piezometer Screen and Sand Filter
Bentonite-Cement Grout
Bentonite Chips/Pellets
Bentonite Grout
Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

USD Crude-by-Rail Project
Port of Grays Harbor
Hoquiam, Washington

LOG OF BORING B-6

September 2013 21-1-21839-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-17

Log: AJD Rev: AJD Typ: LKN

MASTER LOG E 21-21839.GPJ SHAN_WIL.GDT 3/24/14

Total Depth:	*61.5 ft.*	Northing:		Drilling Method:	*HSA and Mud Rotary*	Hole Diam.:	*6 in.*
Top Elevation:	*~*	Easting:		Drilling Company:	*Gregory Drilling*	Rod Diam.:	
Vert. Datum:		Station:		Drill Rig Equipment:	*Track CME*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between material types, and the transition may be gradual.

Depth, ft. | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE (blows/foot)

▲ Hammer Wt. & Drop: *140 lbs / 30 inches*

0 — 20 — 40 — 60

Gravel roadway. — 1.0

Loose to very loose, greenish-gray, silty SAND with silty clay seam from 5 to 5.3 feet; moist to wet; (Estuarine Deposits) (He) SM. — 6.5

Very soft, gray, interbedded, clayey SILT and silty CLAY (scattered silty sand seams); wet; (Estuarine Deposits) (He) ML/CL. — 14.0

Very soft, gray to black (from 15 to 21.5 feet), clayey SILT to silty CLAY, organic-rich silty clay from 15 to 21.5 feet; moist; (Estuarine Deposits) (He) ML/CL. — 31.5

Very soft to medium dense, gray, interbedded, silty SAND and slightly sandy, clayey SILT with scattered silty clay sams; (Estuarine Deposits) (He) SM/ML. — 55.0

Medium dense, gray, silty SAND; wet; (Alluvium) (Ha) SM. — 61.5

BOTTOM OF BORING
COMPLETED 4/11/2013

During Drilling ▽

0 — 20 — 40 — 60

◇ % Fines (<0.075mm)
● % Water Content

LEGEND

* Sample Not Recovered
⌶ 2.0" O.D. Split Spoon Sample
▽ Ground Water Level ATD

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. USCS designation is based on visual-manual classification and selected lab testing.

USD Crude-by-Rail Project
Port of Grays Harbor
Hoquiam, Washington

LOG OF BORING B-7

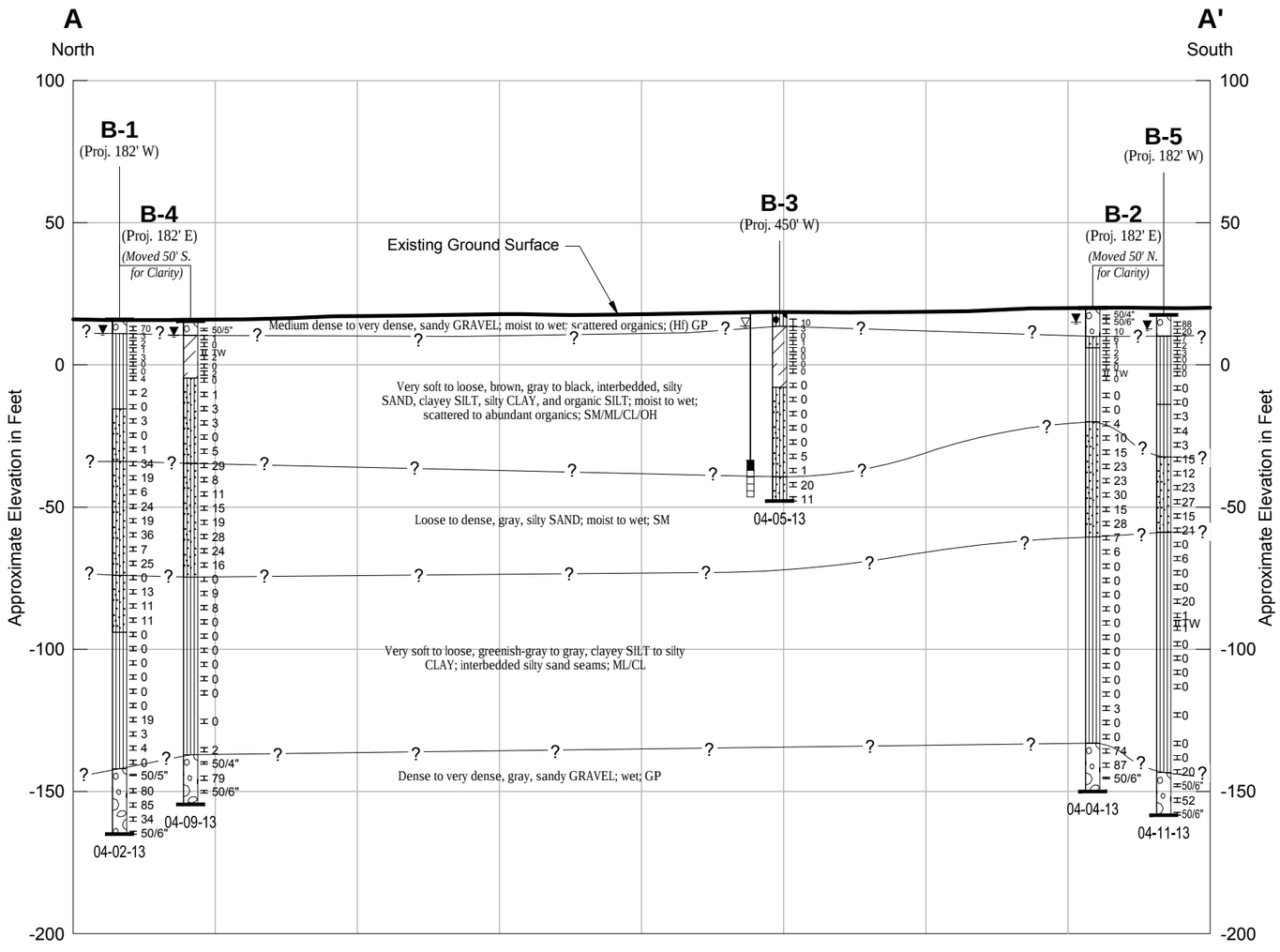
September 2013 — 21-1-21839-001

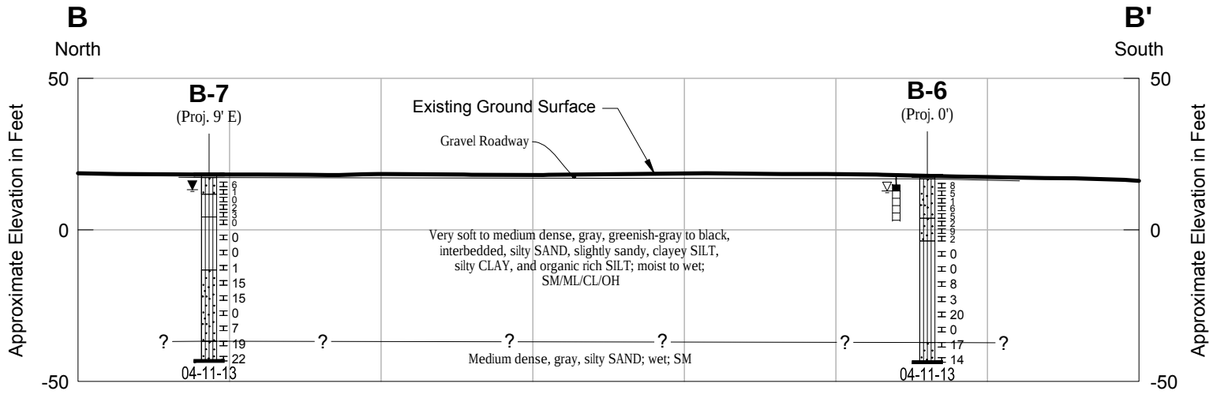
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-18

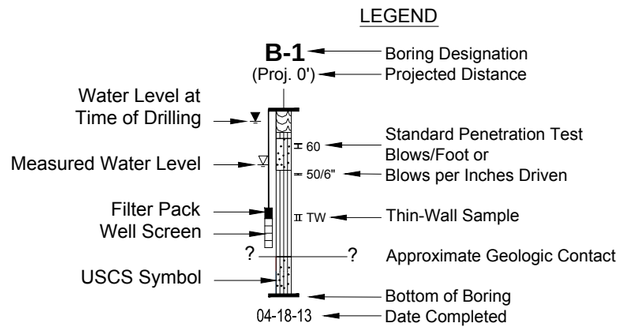
Log: AJD Rev: AJD Typ: LKN

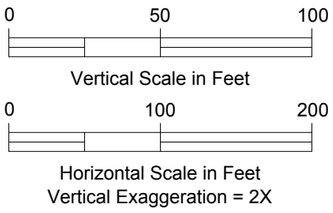
MASTER LOG E 21-21839.GPJ SHAN_WIL.GDT 3/24/14





LEGEND





NOTES

1. Ground surfaces are adapted from client file, *"11161 3-16-12.dwg"*, dated 4-30-2013.
2. These subsurface profiles are generalized from materials observed in soil borings. Variations may exist between profiles and actual conditions.

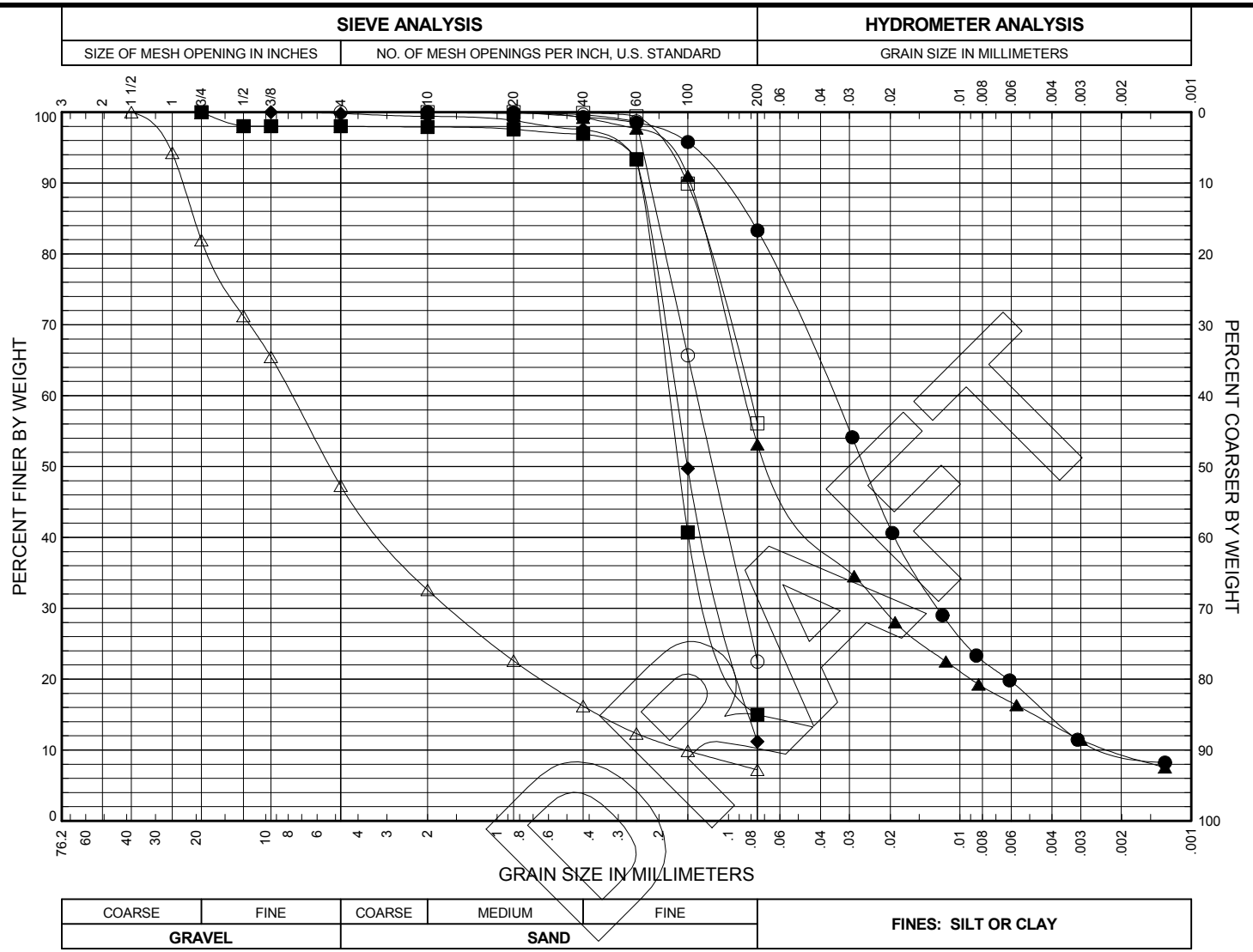
USD Crude-By-Rail Terminal
Port of Grays Harbor
Hoquiam, Washington

GENERALIZED SUBSURFACE PROFILES A-A' AND B-B'

August 2013 21-1-21839-001

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 3



LEGEND

USCS: Unified Soil Classification System

COBBLE REM %: Percentage of cobbles removed from specimen; based on pre-removal total dry mass

SG: Specific gravity of soil solids < No. 4 sieve per ASTM D854

NAT WC %: Natural water content

Cu: Coefficient of uniformity

Cc: Coefficient of curvature

ASTM DES: ASTM International test standard designation

*: ***Sample specimen weight did not meet required minimum mass for ASTM test method.***

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	GRAVEL %	SAND %	FINES %	COBBLE REM %	SG	NAT WC %	Cu	Cc	TEST BY	REVIEW BY	ASTM DES
● B-1, S-13	45.0	ML	Gray, clayey, fine sandy SILT		17	83.3			53.1			AKV	JFL	D422
■ B-1, S-15*	55.0	SM	Gray, silty, fine SAND, trace of fine gravel; trace of organics, trace of shell fragments	2	83	14.9			29.1			AKV	JFL	D422
▲ B-1, S-16	60.0	ML	Gray, fine sandy SILT, trace of clay		47	53.1			53.3			AKV	JFL	D422
◆ B-1, S-19	75.0	SP-SM	Gray, slightly silty, fine SAND; trace of organics, trace of shell fragments	0	89	11.2			25.8	2.3	0.9	AKV	JFL	D422
○ B-1, S-25	105.0	SM	Gray, silty, fine SAND; trace of organics, trace of shell fragments		78	22.5			35.4			AKV	JFL	D422
□ B-1, S-35	155.0	ML	Gray, fine sandy SILT; trace of organics		44	56.1			44.5			AKV	JFL	D422
△ B-1, S-39*	175.0	GW-GM	Gray, slightly silty, sandy GRAVEL	53	40	7.2			9.0	50.1	2.2	AKV	JFL	D422

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GRAIN SIZE DISTRIBUTION
BORING B-1

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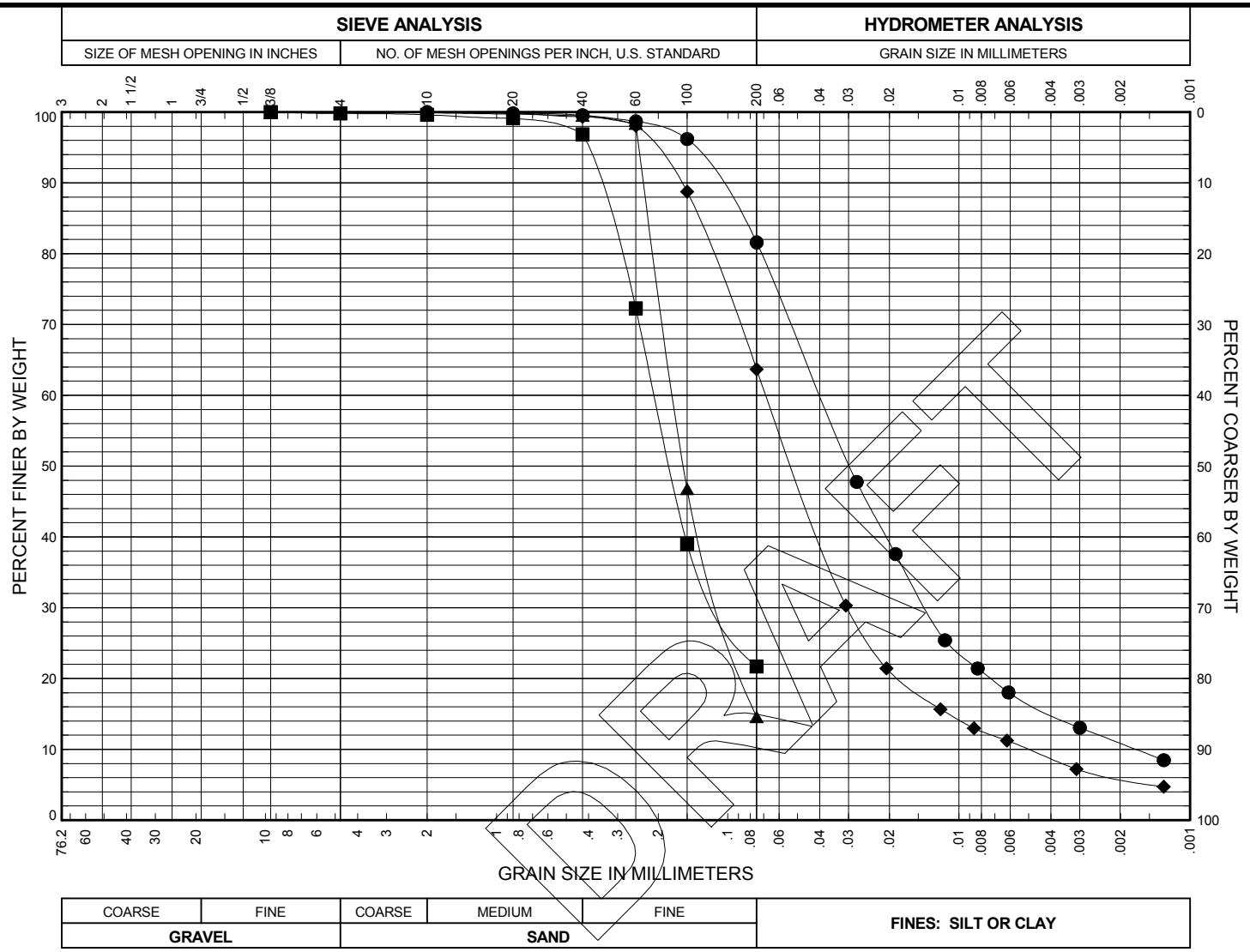
FIG. B-1
Sheet 1 of 1

FIG. B-1



LEGEND

USCS: Unified Soil Classification System

COBBLE REM %: Percentage of cobbles removed from specimen; based on pre-removal total dry mass

SG: Specific gravity of soil solids < No. 4 sieve per ASTM D854

NAT WC %: Natural water content

Cu: Coefficient of uniformity

Cc: Coefficient of curvature

ASTM DES: ASTM International test standard designation

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	GRAVEL %	SAND %	FINES %	COBBLE REM %	SG	NAT WC %	Cu	Cc	TEST BY	REVIEW BY	ASTM DES
● B-2, S-12	35.0	ML	Gray, fine sandy SILT, trace of clay; scattered organics		18	81.6			53.1			AKV	JFL	D422
■ B-2, S-13	40.0	SM	Gray, silty, fine SAND; scattered organics, scattered shell fragments	0	78	21.7			32.3			AKV	JFL	D422
▲ B-2, S-20	75.0	SM	Gray, silty, fine SAND; trace of fine organics		85	14.6			30.4			AKV	JFL	D422
◆ B-2, S-25	100.0	ML	Gray, fine sandy SILT; trace of organics, trace of shell fragments		36	63.7			40.4			AKV	JFL	D422

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GRAIN SIZE DISTRIBUTION
BORING B-2

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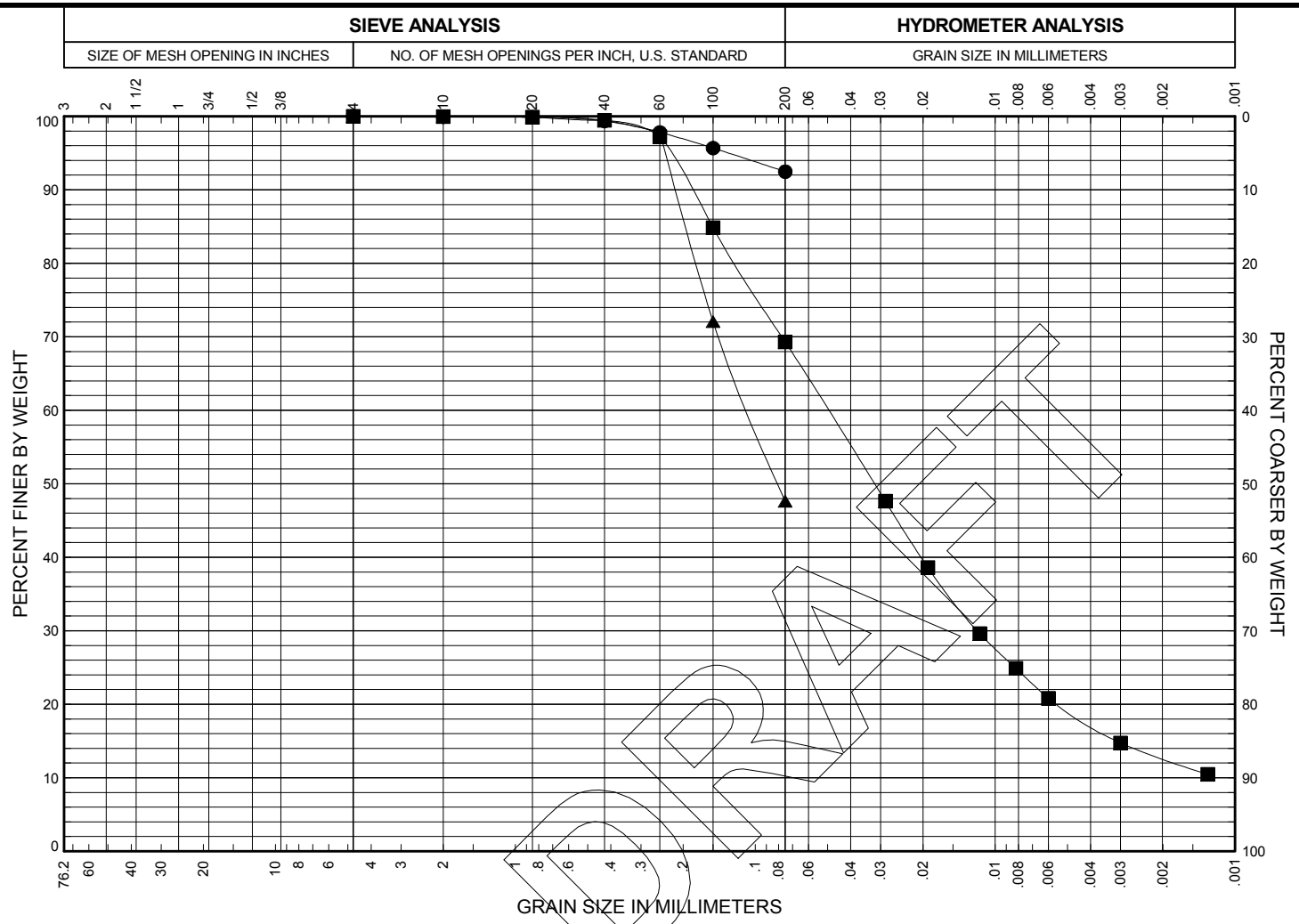
FIG. B-2
Sheet 1 of 1

FIG. B-2



LEGEND

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Cu: Coefficient of uniformity

Cc: Coefficient of curvature

ASTM DES: ASTM International test standard designation

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	GRAVEL %	SAND %	FINES %	COBBLE REM %	SG	NAT WC %	Cu	Cc	TEST BY	REVIEW BY	ASTM DES
● B-3, S-6	15.0	OH	Dark gray-brown, slightly fine sandy, organic SILT		8	92.5			106.0			AKV	JFL	D422
■ B-3, S-13	45.0	ML	Gray, fine sandy SILT		31	69.3			54.2			AKV	JFL	D422
▲ B-3, S-15	55.0	SM	Gray, silty, fine SAND; trace of organics, trace of shell fragments		52	47.6			40.4			AKV	JFL	D422

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GRAIN SIZE DISTRIBUTION
BORING B-3

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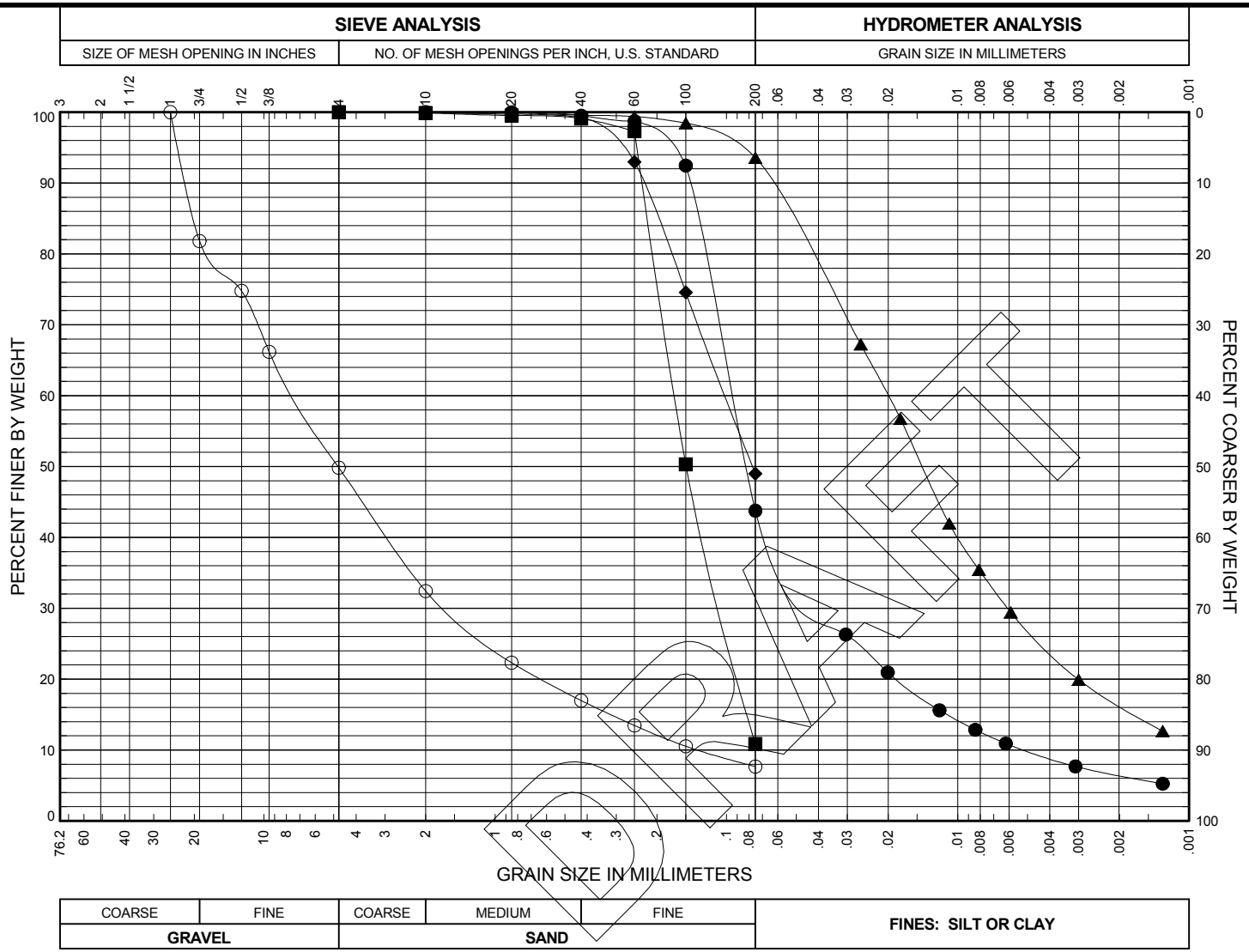
FIG. B-3
Sheet 1 of 1

FIG. B-3



LEGEND

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SG: Specific gravity of soil solids < No. 4 sieve per ASTM D854

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Cc: Coefficient of curvature

ASTM DES: ASTM International test standard designation

*: ***Sample specimen weight did not meet required minimum mass for ASTM test method.***

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	GRAVEL %	SAND %	FINES %	COBBLE REM %	SG	NAT WC %	Cu	Cc	TEST BY	REVIEW BY	ASTM DES
● B-4, S-10	30.0	SM	Gray, silty, fine SAND; scattered organics		56	43.8			40.4			AKV	JFL	D422
■ B-4, S-14	50.0	SP-SM	Gray, slightly silty, fine SAND; scattered organics		89	10.9			32.6	2.3	0.9	AKV	JFL	D422
▲ B-4, S-28	120.0	ML	Gray, slightly fine sandy, clayey SILT; scattered organics		6	93.6			52.7			AKV	JFL	D422
◆ B-4, S-32	150.0	SM	Gray, silty, fine SAND; scattered organics		51	49.0			39.8			AKV	JFL	D422
○ B-4, S-35*	165.0	GW-GM	Gray, slightly silty, sandy GRAVEL	50	42	7.7			9.1	55.4	2.7	AKV	JFL	D422

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BORING B-4

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FIG. B-4
Sheet 1 of 1

FIG. B-4

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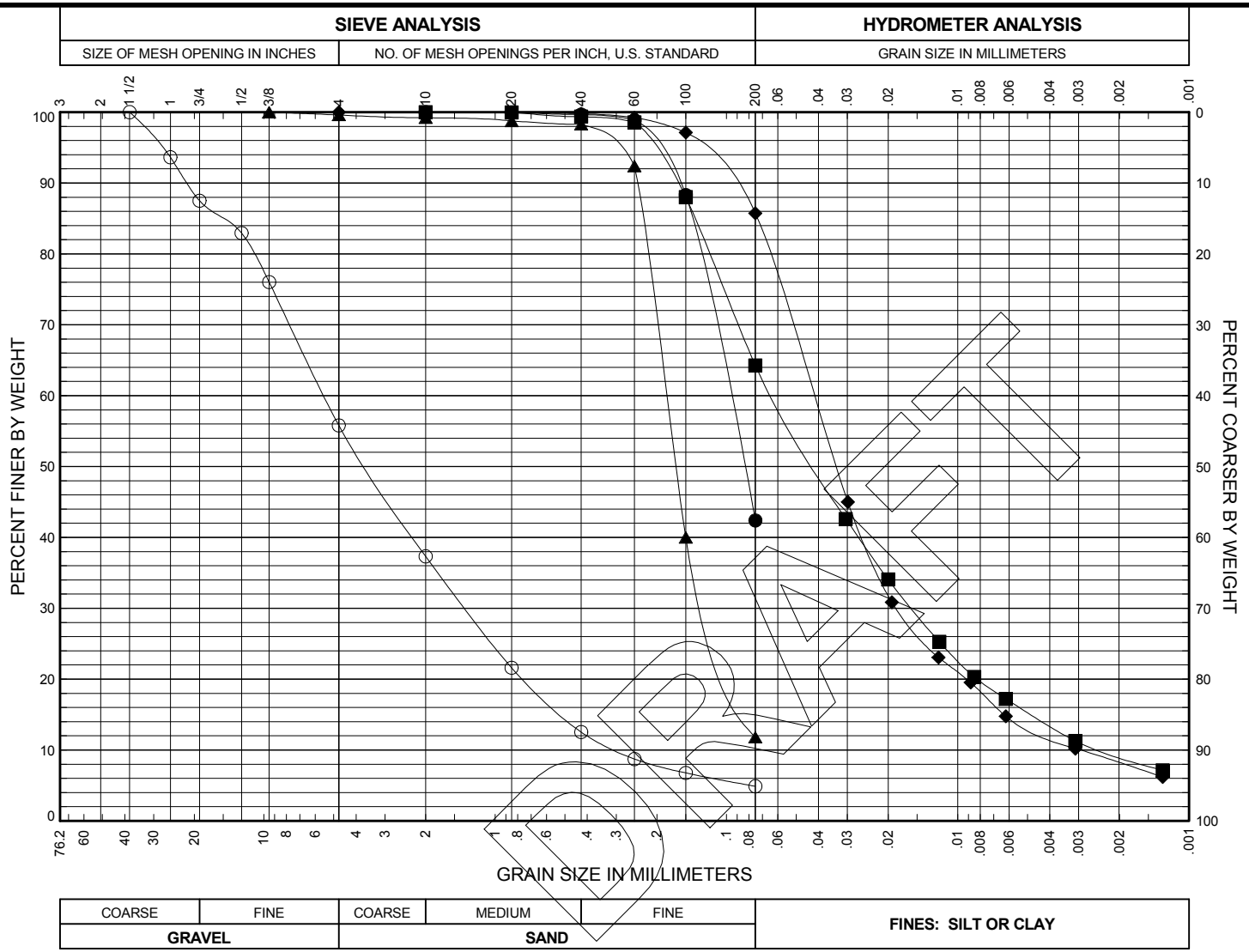

LEGEND

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SG: Specific gravity of soil solids < No. 4 sieve per ASTM D854

NAT WC %: Natural water content

Cu: Coefficient of uniformity

Cc: Coefficient of curvature

ASTM DES: ASTM International test standard designation

*: ***Sample specimen weight did not meet required minimum mass for ASTM test method.***

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	GRAVEL %	SAND %	FINES %	COBBLE REM %	SG	NAT WC %	Cu	Cc	TEST BY	REVIEW BY	ASTM DES
● B-5, S-11	35.0	SM	Gray, silty, fine SAND; trace of organics		58	42.4			42.4			AKV	JFL	D422
■ B-5, S-13	45.0	ML	Gray, fine sandy SILT		36	64.3			49.5			AKV	JFL	D422
▲ B-5, S-14	50.0	SP-SM	Gray, slightly silty, fine SAND; trace of organics	0	88	11.8			34.6	2.5	1.1	AKV	JFL	D422
◆ B-5, S-32	140.0	ML	Gray, clayey, fine sandy SILT		14	85.8			42.4			AKV	JFL	D422
○ B-5, S-38*	175.0	SW	Gray, gravelly SAND, trace of silt	44	51	4.9			8.5	18.4	1.1	AKV	JFL	D422

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GRAIN SIZE DISTRIBUTION
BORING B-5

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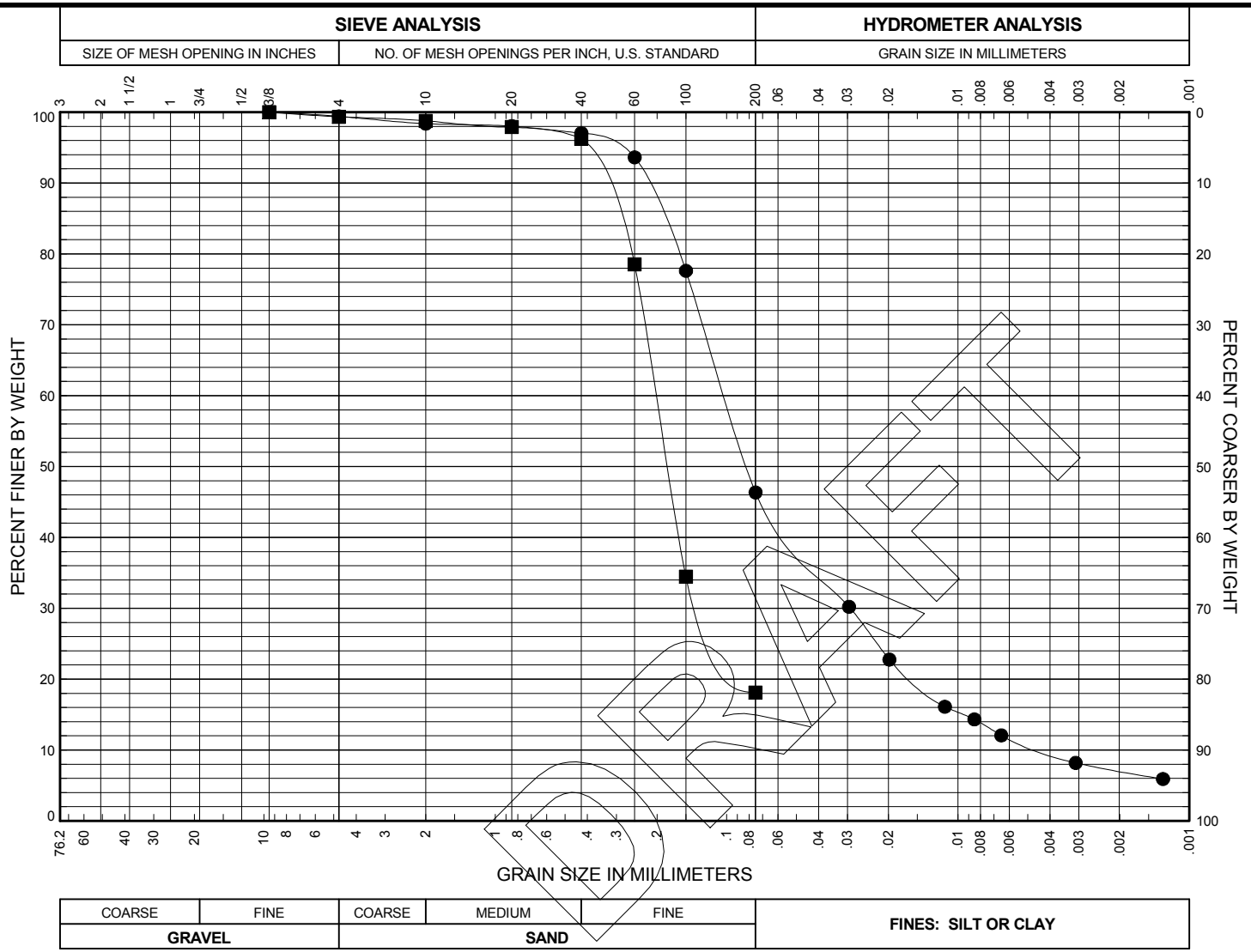
FIG. B-5
Sheet 1 of 1

FIG. B-5



LEGEND

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Cc: Coefficient of curvature

ASTM DES: ASTM International test standard designation

*: ***Sample specimen weight did not meet required minimum mass for ASTM test method.***

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	GRAVEL %	SAND %	FINES %	COBBLE REM %	SG	NAT WC %	Cu	Cc	TEST BY	REVIEW BY	ASTM DES
● B-6, S-11*	35.0	SM	Gray, silty, fine SAND, trace of fine gravel; trace of organics	1	53	46.3			40.6			AKV	JFL	D422
■ B-6, S-16	60.0	SM	Gray, silty, fine SAND, trace of fine gravel; trace of organics	1	81	18.1			28.6			AKV	JFL	D422

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BORING B-6

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FIG. B-6
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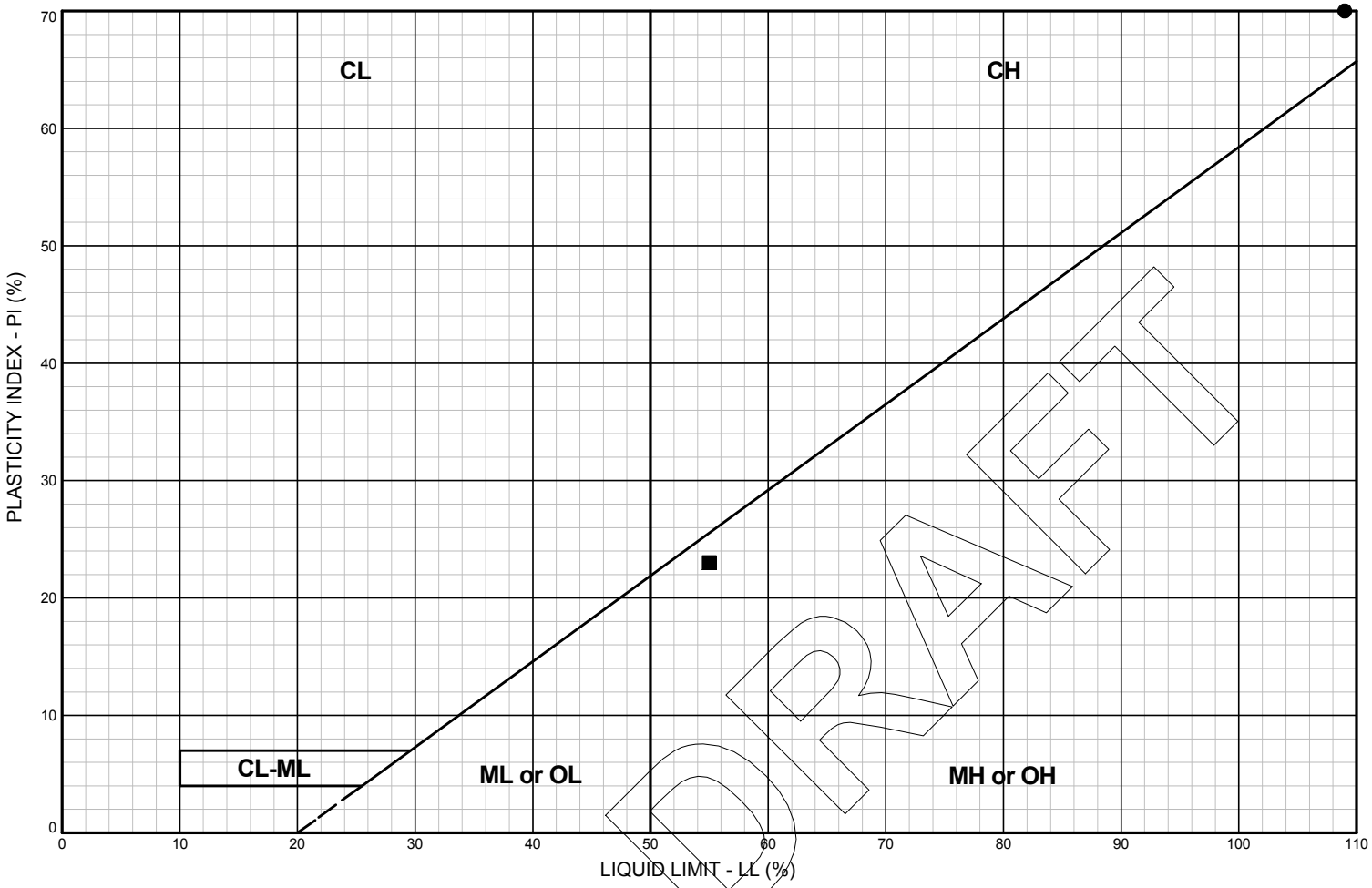
FIG. B-6



LEGEND

CL: Low plasticity inorganic clays; sandy and silty clays

CH: High plasticity inorganic clays

ML: Inorganic silts and clayey silts of low plasticity

MH: Inorganic silts and clayey silts of high plasticity

CL-ML: Silty clays and clayey silts

OL: Organic silts and clays of low plasticity

OH: Organic silts and clays of high plasticity

LL: Liquid limit

PL: Plastic limit

PI: Plasticity index; PI=LL-PL

NP: Nonplastic

V : Nonplastic

FINES %: Percentage of specimen mass passing the No. 200 sieve

NAT WC%: Natural water content

^,>>: Test value exceeds limit of graph

ASTM DES: ASTM International test standard designation

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	LL %	PL %	PI %	NAT WC %	FINES %	TEST BY	REVIEW BY	ASTM DES
● B-1, S-6	15.0	CH/OH	Dark gray-brown, silty CLAY/organic CLAY	109	39	70	94.5		AKV	JFL	D4318
■ B-1, S-29	125.0	MH	Gray, clayey SILT; trace to scattered fine organics	55	32	23	53.9		AKV	JFL	D4318

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PLASTICITY CHART
BORING B-1

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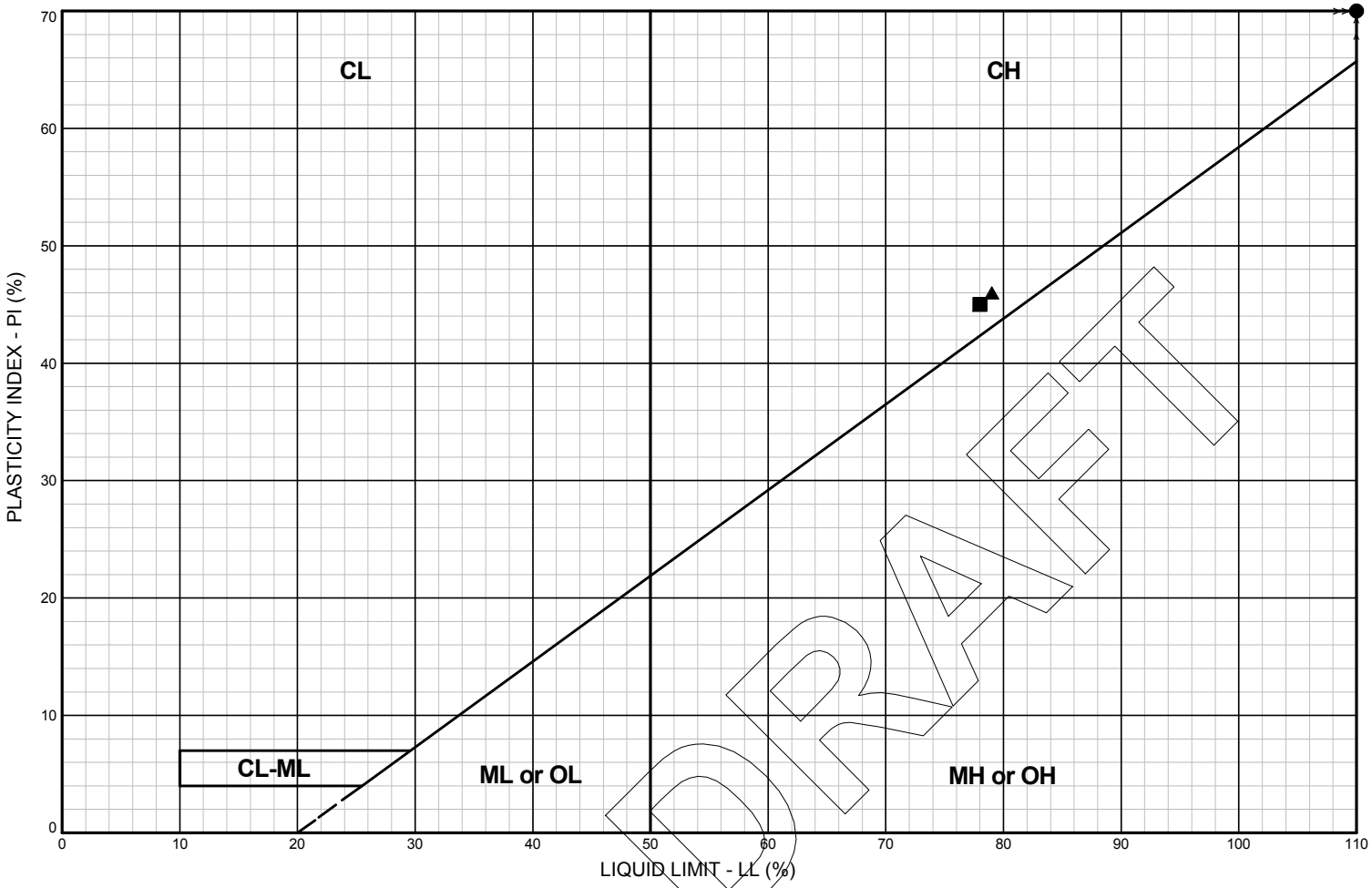
FIG. B-7
Sheet 1 of 1

FIG. B-7



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ASTM DES: ASTM International test standard designation

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	LL %	PL %	PI %	NAT WC %	FINES %	TEST BY	REVIEW BY	ASTM DES
● B-2, S-8	20.0	CH/OH	Dark gray-brown, silty CLAY/organic CLAY	113	41	72	100.8		AKV	JFL	D4318
■ B-2, S-9	23.3	CH/OH	Dark gray-brown, silty CLAY/organic CLAY	78	33	45	70.6		AKV	JFL	D4318
▲ B-2, S-31	130.0	CH/OH	Gray, silty CLAY/organic CLAY	79	33	46	58.6		AKV	JFL	D4318

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PLASTICITY CHART
BORING B-2

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FIG. B-8
Sheet 1 of 1

FIG. B-8

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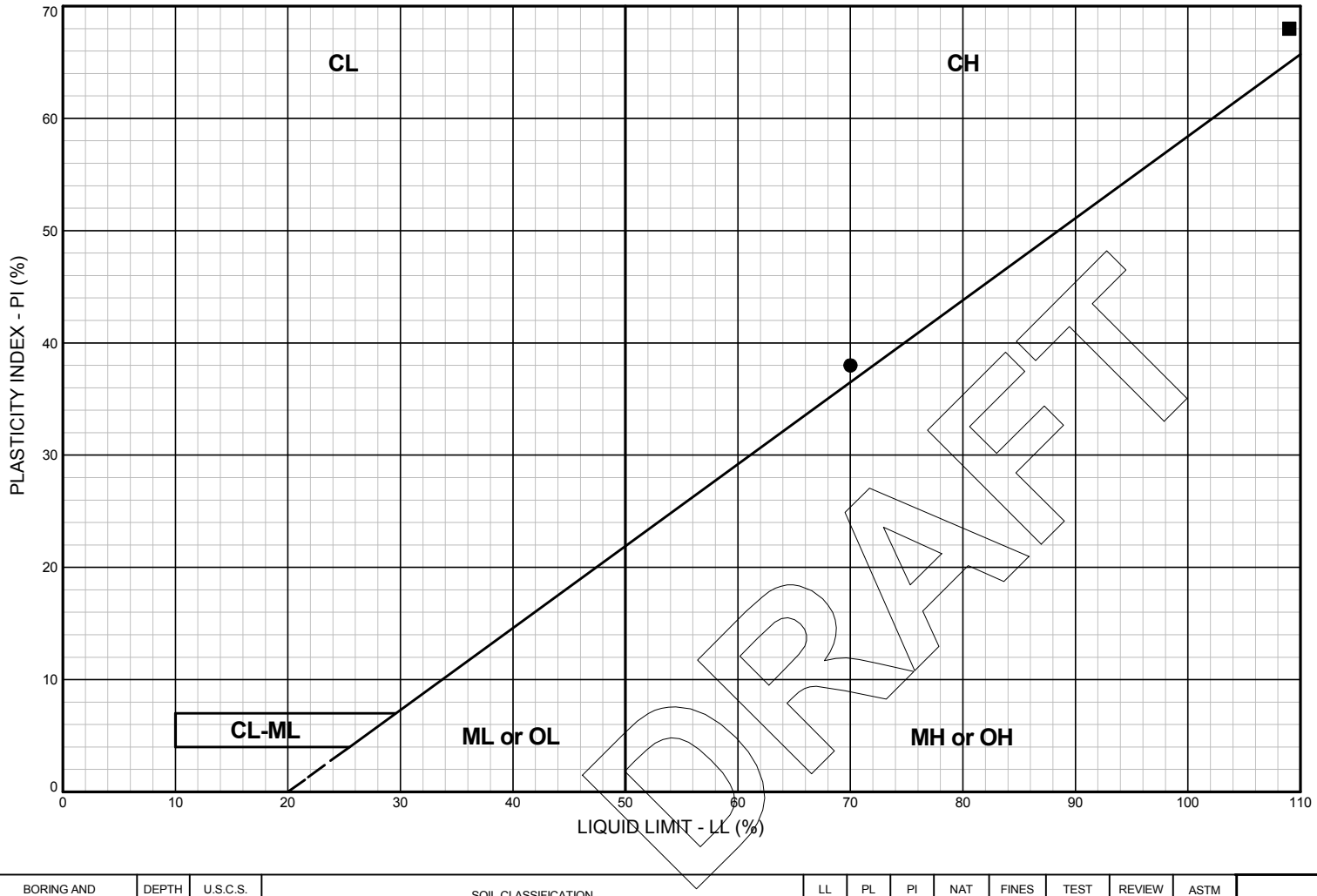

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BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	LL %	PL %	PI %	NAT WC %	FINES %	TEST BY	REVIEW BY	ASTM DES
● B-3, S-3	7.5	CH/OH	Gray, silty CLAY/organic CLAY	70	32	38	84.5		AKV	JFL	D4318
■ B-3, S-4	11.8	CH/OH	Gray-brown, silty CLAY/organic CLAY	109	41	68			AKV	JFL	D4318

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PLASTICITY CHART
BORING B-3

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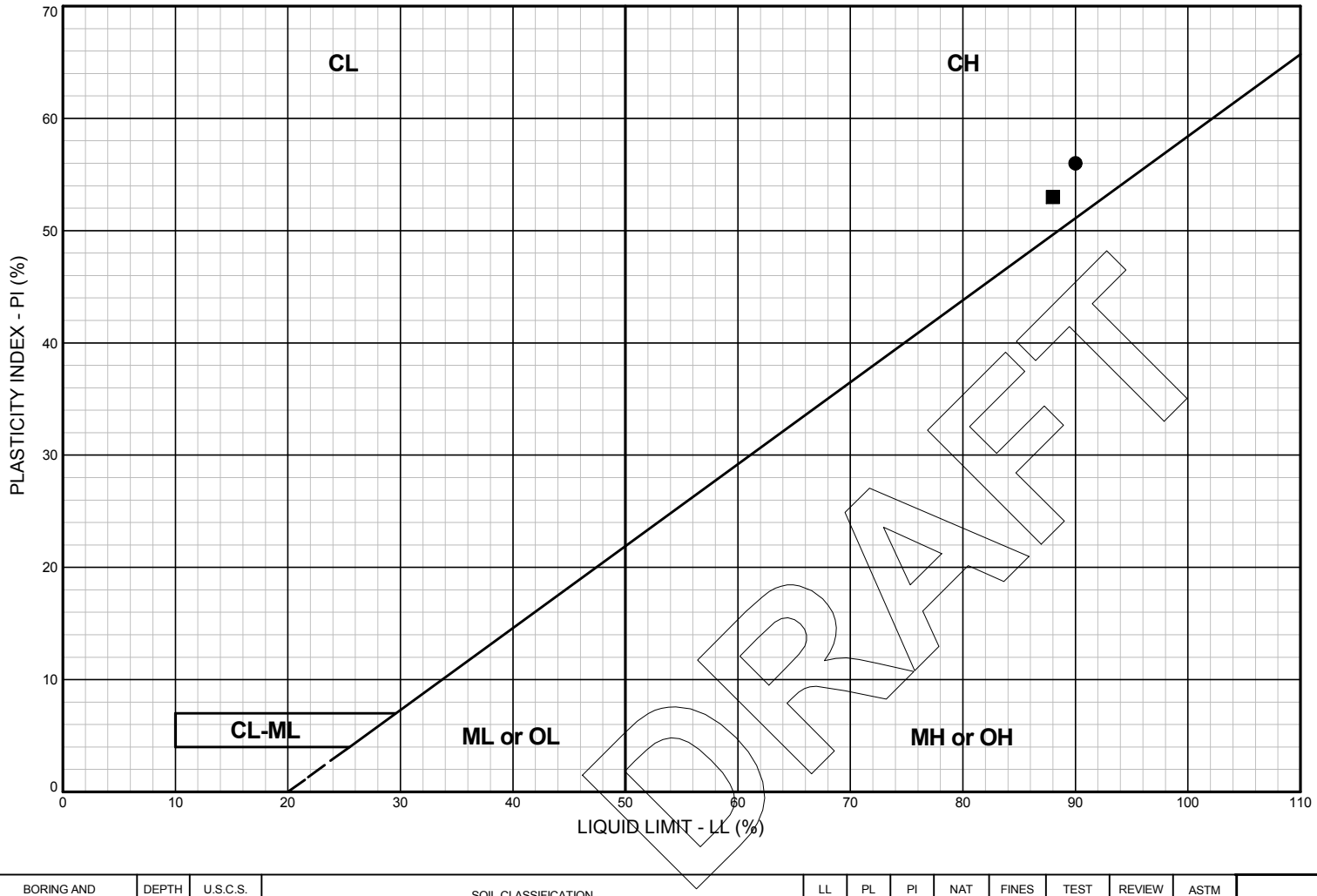
FIG. B-9
Sheet 1 of 1

FIG. B-9

AASHTO ATT MAIN 21-21839.GPJ SHAN WIL.GDT 9/10/13



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^,>>: Test value exceeds limit of graph

ASTM DES: ASTM International test standard designation

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	LL %	PL %	PI %	NAT WC %	FINES %	TEST BY	REVIEW BY	ASTM DES
● B-4, S-6	15.0	CH/OH	Dark gray-brown, silty CLAY/organic CLAY	90	34	56	105.2		AKV	JFL	D4318
■ B-4, S-25	105.0	CH/OH	Gray, silty CLAY/organic CLAY	88	35	53	72.4		AKV	JFL	D4318

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PLASTICITY CHART
BORING B-4

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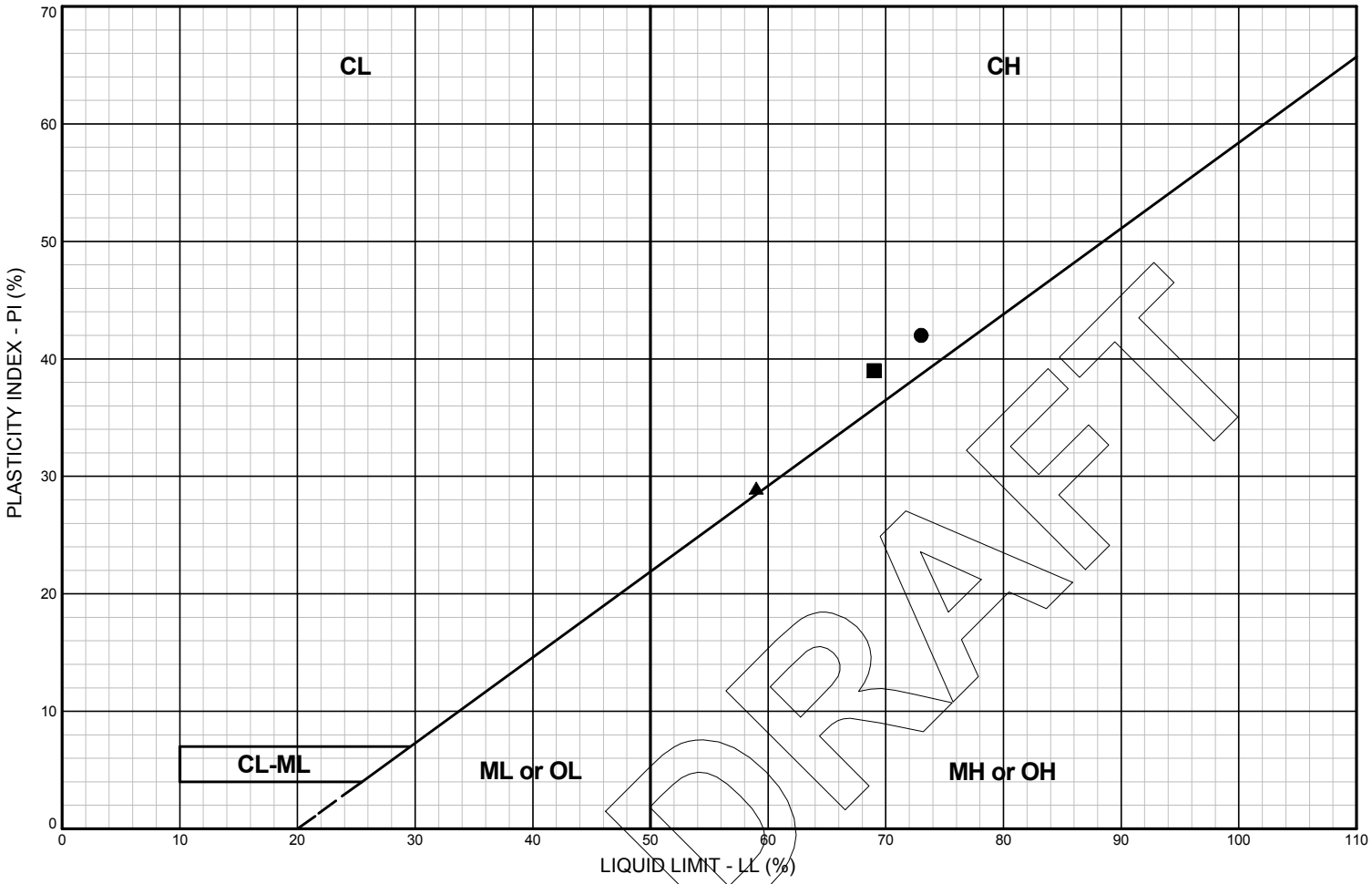
FIG. B-10
Sheet 1 of 1

FIG. B-10



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BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	LL %	PL %	PI %	NAT WC %	FINES %	TEST BY	REVIEW BY	ASTM DES
● B-5, S-8	20.0	CH/OH	Dark gray-brown, silty CLAY/organic CLAY	73	31	42	74.9		AKV	JFL	D4318
■ B-5, S-25	105.0	CH/OH	Gray, silty CLAY/organic CLAY	69	30	39	56.5		AKV	JFL	D4318
▲ B-5, S-26	108.2	CH/OH	Gray-brown, silty CLAY/organic CLAY	59	30	29			AKV	JFL	D4318

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PLASTICITY CHART
BORING B-5

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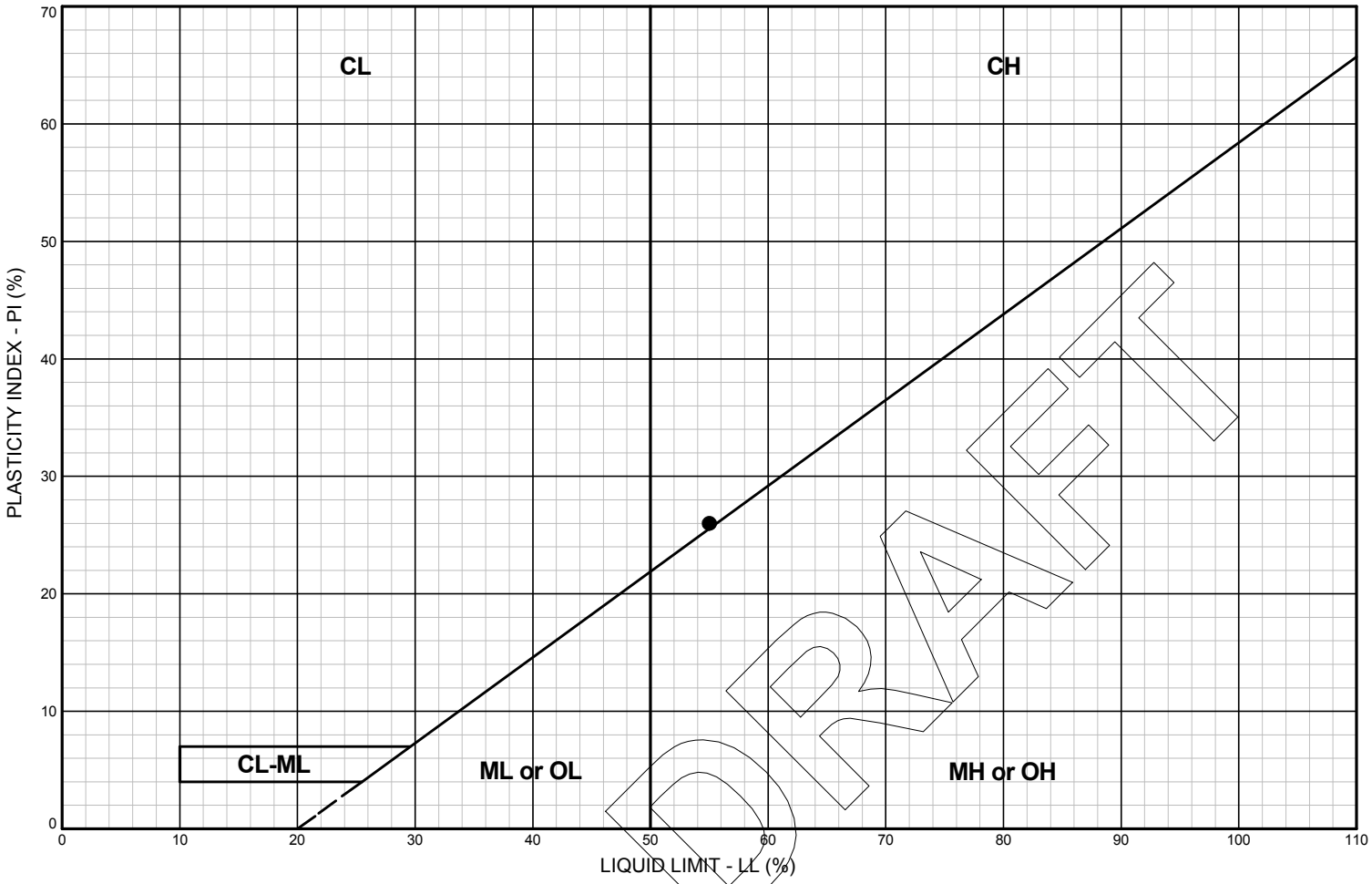
FIG. B-11
Sheet 1 of 1

FIG. B-11



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BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	LL %	PL %	PI %	NAT WC %	FINES %	TEST BY	REVIEW BY	ASTM DES
● B-6, S-9	25.0	CH/OH	Gray, silty CLAY/organic CLAY	55	29	26	59.3		AKV	JFL	D4318

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PLASTICITY CHART
BORING B-6

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FIG. B-12
Sheet 1 of 1

FIG. B-12

ONE DIMENSIONAL CONSOLIDATION TEST

Boring	B-2	Tested By	AKV
Sample	S-9	Calculated By	AKV
Depth, ft	23.3	Checked By	JFL

SAMPLE CLASSIFICATION:
Dark gray brown to black, organic SILT; specific gravity estimated - suggest organic content; OH

SAMPLE DATA:

Specific Gravity (estimated)	2.4
Liquid Limit	78
Plastic Limit	33
Plasticity Index	45

SPECIMEN DATA:	Before Inundation	First Load	Final Load
Height, inches	0.784	0.784	0.525
Diameter, inches	2.501	2.501	2.501
Sample Volume, cuin	3.853	3.853	2.580
Wet Density, pcf	98.9	98.9	120.1
Dry Density, pcf	58.9	58.9	88.0
Water Content, %	68%	68%	37%
Void Ratio	1.54	1.54	0.70
Saturation, %	100%	100%	100%

Increment	Applied Stress, tsf	ΔH at t_{100}, in	ΔH / H_o	Void Ratio	t_{50}, min	Coeff. of Comp., MPa^{-1}	Coeff. of Consol., cm^2/sec	Coeff. of Perm., cm/sec
1	0.13	0.001	0.1%	1.541	0.2	0.19	1.9E-02	1.4E-07
2	0.26	0.006	0.8%	1.523	0.8	1.51	3.9E-03	2.3E-07
3	0.52	0.015	2.0%	1.494	0.4	1.16	8.3E-03	3.7E-07
4	1.03	0.026	3.4%	1.458	0.3	0.72	9.8E-03	2.8E-07
5	2.06	0.074	9.4%	1.304	2.3	1.56	1.2E-03	7.6E-08
6	4.13	0.139	17.7%	1.093	2.1	1.07	1.2E-03	5.2E-08
7	1.03	0.144	18.3%	1.077	0.4	-0.05	5.6E-03	1.4E-08
8	0.26	0.128	16.3%	1.129	3.0	0.70	7.5E-04	2.5E-08
9	0.06	0.114	14.5%	1.175	24.7	2.47	9.5E-05	1.1E-08
10	0.26	0.115	14.6%	1.171	1.2	0.19	2.0E-03	1.8E-08
11	1.03	0.128	16.3%	1.130	1.0	0.57	2.4E-03	6.2E-08
12	4.13	0.152	19.3%	1.052	0.6	0.26	3.8E-03	4.6E-08
13	8.25	0.200	25.5%	0.894	2.2	0.40	8.9E-04	1.7E-08
14	16.51	0.249	31.7%	0.737	2.3	0.20	7.1E-04	7.3E-09
15	33.02	0.295	37.6%	0.588	2.7	0.09	5.0E-04	2.7E-09
16	8.25	0.300	38.2%	0.572	1.0	-0.01	1.2E-03	5.0E-10
17	2.06	0.2897	36.93%	0.604	6.7	0.054	1.9E-04	6.4E-10
18	0.52	0.2759	35.17%	0.649	26.1	0.302	5.1E-05	9.5E-10
19	0.13	0.2557	32.60%	0.714	196.4	1.764	7.3E-06	7.6E-10

NOTES:
1. Abbreviations:
   cm = centimeter
   cm^2 = square centimeter
   Coeff. = Coefficient
   Comp. = Compressibility
   Consol. = Consolidation
   cu in = cubic inch
   ft = feet
   H_o = initial height
   ΔH = change in height
   in = inch
   min = minute
   MPa = megapascal
   pcf = pounds per cubic foot
   Perm. = Permeability
   sec = second
   t_n = time at n% of primary consolidation
   tsf = tons per square foot

Port of Grays Harbor Terminal
Hoquiam, Washington

ONE DIMENSIONAL CONSOLIDATION TEST SUMMARY
BORING B-2, SAMPLE S-9 @23.3ft

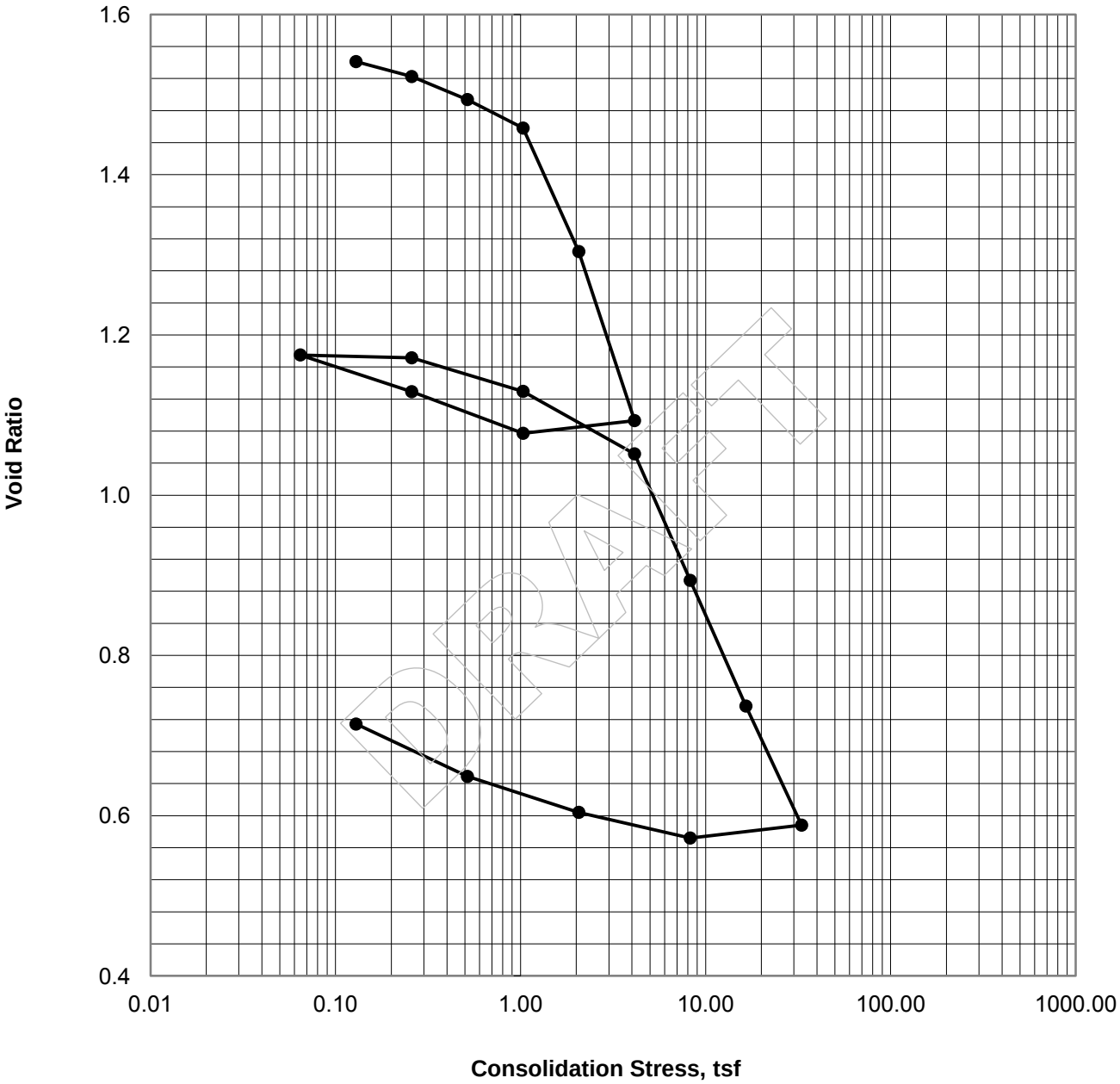
September 2013 21-1-21839-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-13

ONE DIMENSIONAL CONSOLIDATION TEST

Boring	B-2	Tested By	AKV
Sample	S-9	Calculated By	AKV
Depth, ft	23.3	Checked By	JFL



Maximum Load, tsf 33.02

NOTES:
1. Abbreviations:
ft = feet
tsf = tons per square foot

Port of Grays Harbor Terminal
Hoquiam, Washington

ONE DIMENSIONAL CONSOLIDATION
VOID RATIO vs STRESS PLOT
BORING B-2, SAMPLE S-9 @23.3ft

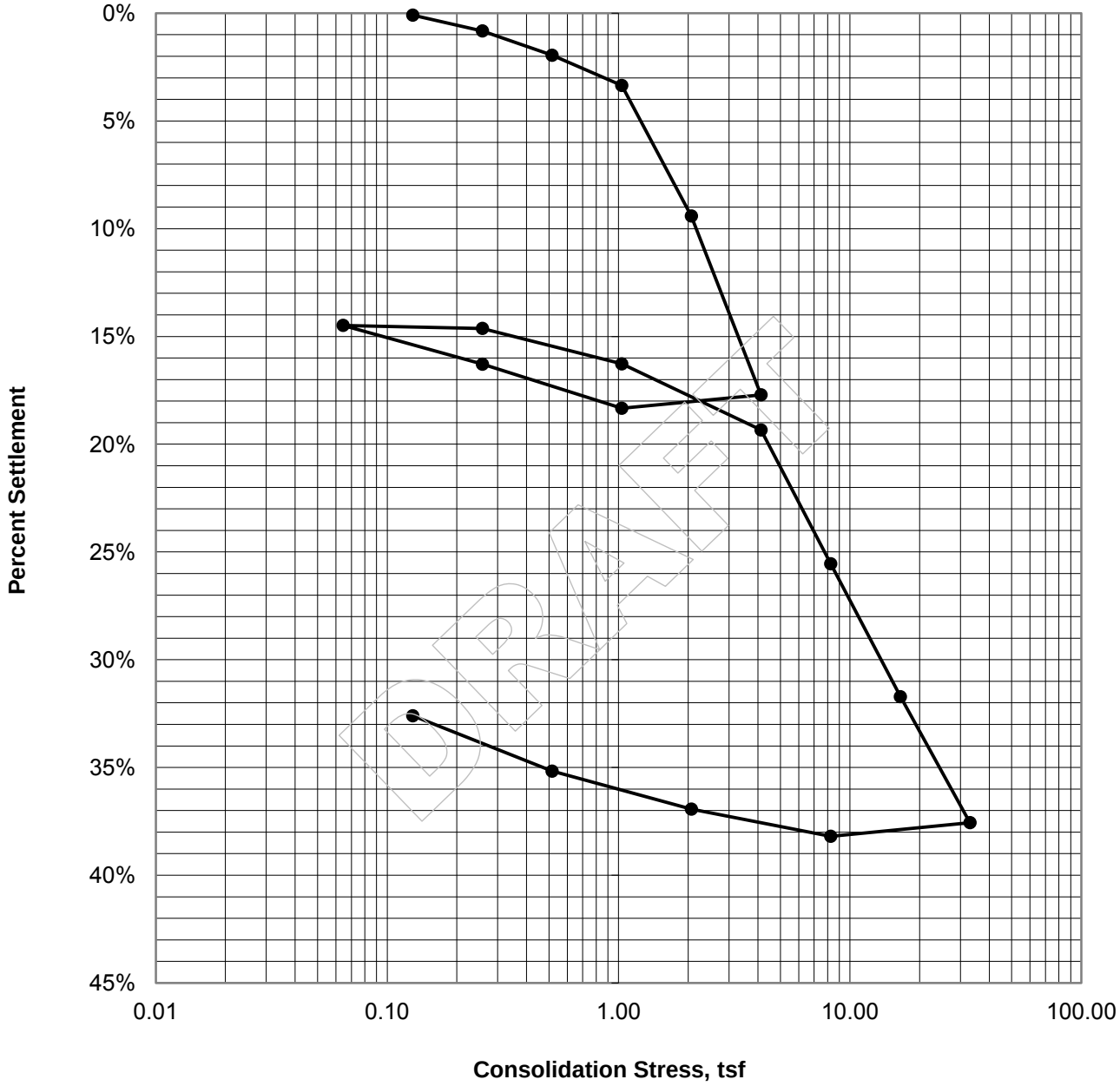
September 2013 21-1-21839-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-14

ONE DIMENSIONAL CONSOLIDATION TEST

Boring	B-2	Tested By	AKV
Sample	S-9	Calculated By	AKV
Depth, ft	23.3	Checked By	JFL



Maximum Load, tsf 33.02

NOTES:
1. Abbreviations:
ft = feet
tsf = tons per square foot

Port of Grays Harbor Terminal
Hoquiam, Washington

ONE DIMENSIONAL CONSOLIDATION PERCENT SETTLEMENT vs STRESS PLOT BORING B-2, SAMPLE S-9 @23.3ft

September 2013 21-1-21839-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-15

ONE DIMENSIONAL CONSOLIDATION TEST

Boring	B-3	Tested By	AKV
Sample	S-4	Calculated By	JFL
Depth, ft	11.8	Checked By	JFL

SAMPLE CLASSIFICATION:
Gray-brown, silty CLAY/organic CLAY; CH/OH

SAMPLE DATA:

Specific Gravity (estimated)	2.4
Liquid Limit	109
Plastic Limit	41
Plasticity Index	68

SPECIMEN DATA:	Before Inundation	First Load	Final Load
Height, inches	0.786	0.786	0.487
Diameter, inches	2.503	2.503	2.503
Sample Volume, cuin	3.867	3.867	2.396
Wet Density, pcf	91.8	91.7	113.6
Dry Density, pcf	47.3	47.2	76.3
Water Content, %	94%	94%	49%
Void Ratio	2.17	2.17	0.96
Saturation, %	100%	100%	100%

Increment	Applied Stress, tsf	ΔH at t_{100}, in	ΔH / H_o	Void Ratio	t_{50}, min	Coeff. of Comp., MPa^{-1}	Coeff. of Consol., cm^2/sec	Coeff. of Perm., cm/sec
1	0.10	0.000	0.0%	2.169	72.5	0.03	4.5E-05	4.8E-11
2	0.16	0.002	0.3%	2.161	1.3	1.31	2.5E-03	1.0E-07
3	0.32	0.010	1.3%	2.130	1.6	2.03	2.0E-03	1.2E-07
4	0.64	0.023	3.0%	2.076	1.5	1.76	2.0E-03	1.1E-07
5	1.29	0.058	7.4%	1.935	3.6	2.28	8.1E-04	5.9E-08
6	2.58	0.116	14.8%	1.702	5.6	1.89	4.5E-04	2.9E-08
7	5.15	0.178	22.7%	1.451	5.0	1.02	4.2E-04	1.6E-08
8	1.29	0.173	22.0%	1.472	2.9	0.06	6.7E-04	1.5E-09
9	0.32	0.152	19.3%	1.557	14.7	0.92	1.4E-04	5.1E-09
10	0.08	0.127	16.2%	1.656	94.3	4.26	2.4E-05	3.8E-09
11	0.32	0.129	16.4%	1.650	4.2	0.25	5.5E-04	5.1E-09
12	1.29	0.151	19.3%	1.559	4.2	0.98	5.3E-04	1.9E-08
13	5.15	0.192	24.5%	1.394	2.5	0.45	7.8E-04	1.3E-08
14	10.30	0.242	30.8%	1.192	6.7	0.41	2.5E-04	4.3E-09
15	20.61	0.294	37.5%	0.983	7.3	0.21	1.9E-04	1.8E-09
16	41.22	0.343	43.7%	0.786	8.8	0.10	1.3E-04	6.4E-10
17	10.30	0.3415	43.44%	0.793	6.9	0.002	1.5E-04	1.9E-11
18	1.29	0.3120	39.69%	0.912	40.3	0.138	2.8E-05	2.1E-10
19	0.32	0.2862	36.41%	1.016	431.9	1.124	2.9E-06	1.7E-10

NOTES:
1. Abbreviations:
   cm = centimeter
   cm^2 = square centimeter
   Coeff. = Coefficient
   Comp. = Compressibility
   Consol. = Consolidation
   cu in = cubic inch
   ft = feet
   H_o = initial height
   ΔH = change in height
   in = inch
   min = minute
   MPa = megapascal
   pcf = pounds per cubic foot
   Perm. = Permeability
   sec = second
   t_n = time at n% of primary consolidation
   tsf = tons per square foot

Port of Grays Harbor Terminal
Hoquiam, Washington

ONE DIMENSIONAL CONSOLIDATION TEST SUMMARY
BORING B-3, SAMPLE S-4 @11.8ft

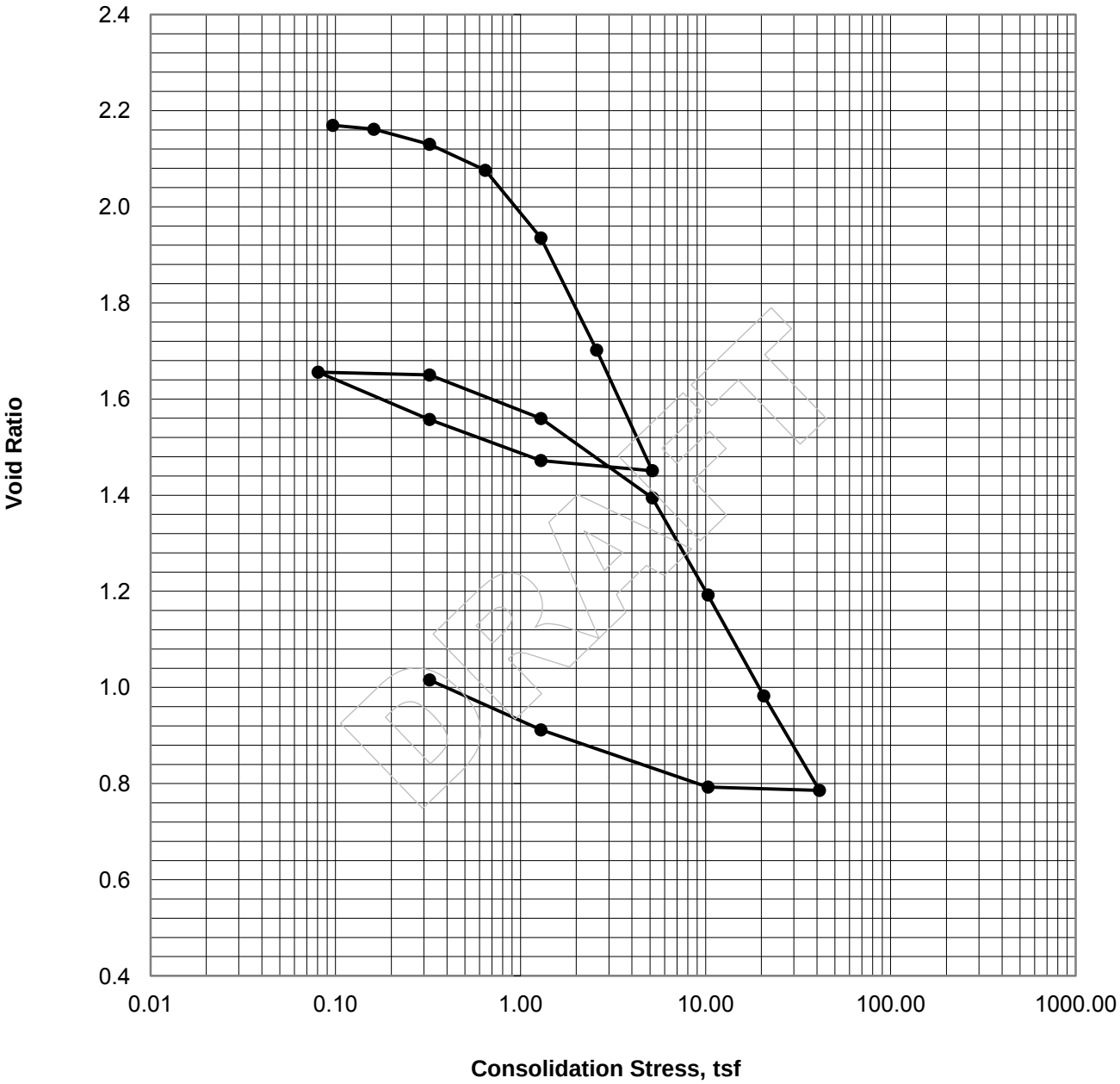
September 2013 21-1-21839-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-16

ONE DIMENSIONAL CONSOLIDATION TEST

Boring	B-3	Tested By	AKV
Sample	S-4	Calculated By	JFL
Depth, ft	11.8	Checked By	JFL



Maximum Load, tsf 41.22

NOTES:
1. Abbreviations:
ft = feet
tsf = tons per square foot

Port of Grays Harbor Terminal
Hoquiam, Washington

ONE DIMENSIONAL CONSOLIDATION
VOID RATIO vs STRESS PLOT
BORING B-3, SAMPLE S-4 @11.8ft

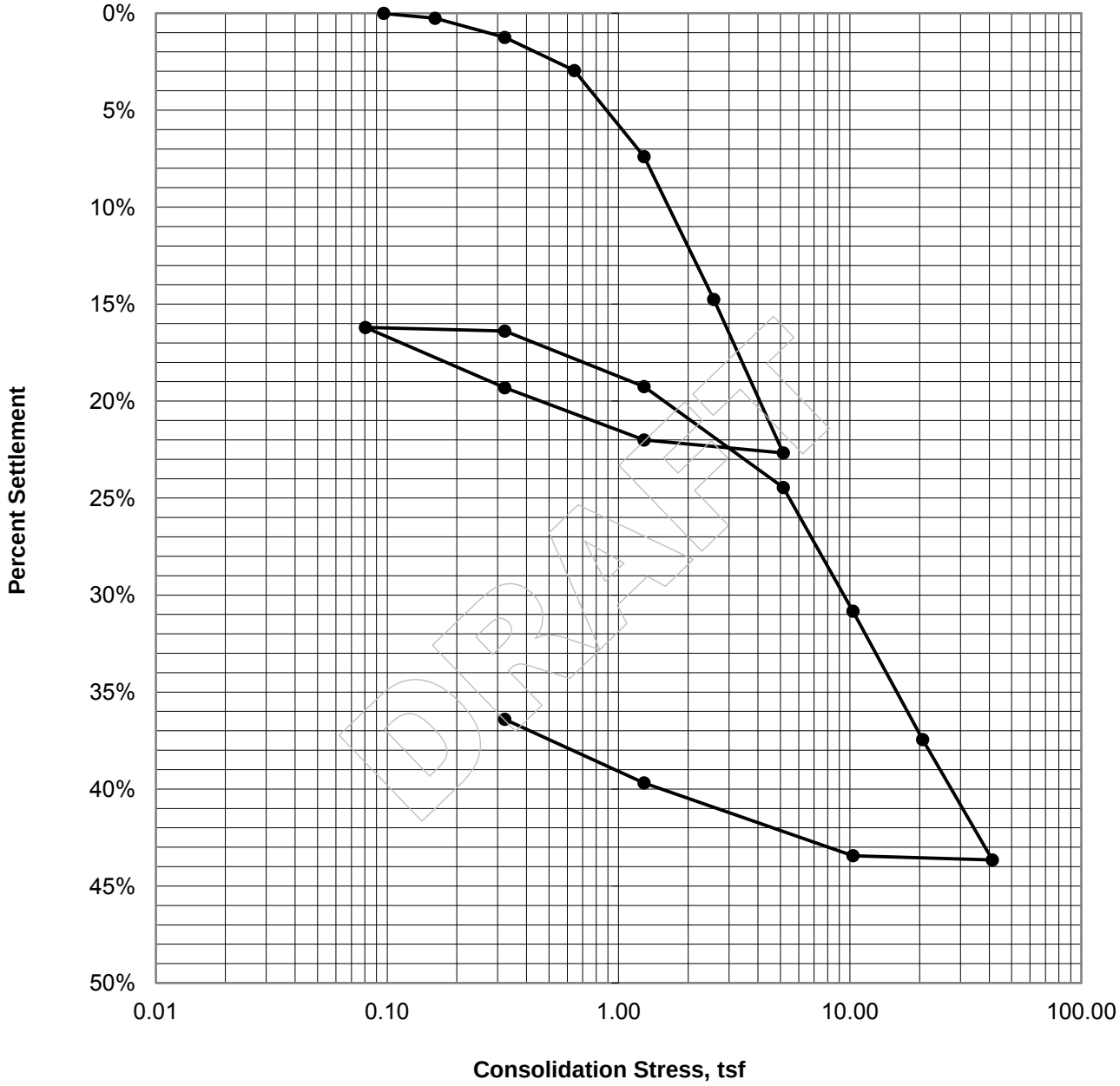
September 2013 21-1-21839-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-17

ONE DIMENSIONAL CONSOLIDATION TEST

Boring	B-3	Tested By	AKV
Sample	S-4	Calculated By	JFL
Depth, ft	11.8	Checked By	JFL



Maximum Load, tsf 41.22

NOTES:
1. Abbreviations:
ft = feet
tsf = tons per square foot

Port of Grays Harbor Terminal
Hoquiam, Washington

ONE DIMENSIONAL CONSOLIDATION PERCENT SETTLEMENT vs STRESS PLOT BORING B-3, SAMPLE S-4 @11.8ft

September 2013 21-1-21839-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-18

ONE DIMENSIONAL CONSOLIDATION TEST

Boring	B-5	Tested By	AKV
Sample	S-26	Calculated By	AKV
Depth, ft	108.2	Checked By	JFL

SAMPLE CLASSIFICATION:
Gray-brown, silty CLAY/organic CLAY; scattered organics; specific gravity estimated; CH/OH

SAMPLE DATA:

Specific Gravity (estimated)	2.6
Liquid Limit	59
Plastic Limit	30
Plasticity Index	29

SPECIMEN DATA:

	Before Inundation	First Load	Final Load
Height, inches	0.786	0.786	0.585
Diameter, inches	2.503	2.503	2.503
Sample Volume, cuin	3.870	3.870	2.877
Wet Density, pcf	103.9	103.9	121.7
Dry Density, pcf	67.5	67.4	90.8
Water Content, %	54%	54%	34%
Void Ratio	1.41	1.41	0.79
Saturation, %	100%	100%	100%

Increment	Applied Stress, tsf	ΔH at t_{100}, in	ΔH / H_o	Void Ratio	t_{50}, min	Coeff. of Comp., MPa^{-1}	Coeff. of Consol., cm^2/sec	Coeff. of Perm., cm/sec
1	0.16	0.001	0.1%	1.402	0.4	0.23	7.8E-03	7.2E-08
2	0.32	0.005	0.6%	1.391	0.4	0.70	8.7E-03	2.5E-07
3	0.64	0.010	1.2%	1.376	0.4	0.51	8.4E-03	1.8E-07
4	1.29	0.017	2.1%	1.355	0.2	0.34	1.4E-02	2.0E-07
5	2.58	0.026	3.3%	1.327	0.1	0.23	2.4E-02	2.3E-07
6	5.15	0.055	7.0%	1.237	0.4	0.37	7.3E-03	1.1E-07
7	1.29	0.065	8.3%	1.206	0.2	-0.08	1.6E-02	5.9E-08
8	0.32	0.054	6.9%	1.240	0.8	0.37	3.7E-03	6.1E-08
9	0.08	0.045	5.8%	1.267	2.1	1.14	1.4E-03	7.0E-08
10	0.32	0.045	5.7%	1.268	0.4	-0.07	7.2E-03	2.3E-08
11	1.29	0.054	6.9%	1.239	0.3	0.32	1.1E-02	1.5E-07
12	5.15	0.073	9.3%	1.181	0.1	0.16	1.9E-02	1.3E-07
13	10.30	0.116	14.8%	1.050	0.6	0.27	4.1E-03	4.9E-08
14	20.60	0.171	21.7%	0.883	0.5	0.17	4.2E-03	3.4E-08
15	41.20	0.223	28.3%	0.724	0.8	0.08	2.4E-03	9.9E-09
16	10.30	0.231	29.4%	0.698	0.7	-0.01	2.3E-03	1.2E-09
17	1.29	0.2127	27.05%	0.755	4.1	0.065	4.1E-04	1.6E-09
18	0.32	0.1972	25.08%	0.802	43.3	0.511	4.1E-05	1.2E-09

NOTES:
1. Abbreviations:
   cm = centimeter
   cm^2 = square centimeter
   Coeff. = Coefficient
   Comp. = Compressibility
   Consol. = Consolidation
   cu in = cubic inch
   ft = feet
   H_o = initial height
   ΔH = change in height
   in = inch
   min = minute
   MPa = megapascal
   pcf = pounds per cubic foot
   Perm. = Permeability
   sec = second
   t_n = time at n% of primary consolidation
   tsf = tons per square foot

Port of Grays Harbor Terminal
Hoquiam, Washington

ONE DIMENSIONAL CONSOLIDATION TEST SUMMARY
BORING B-5, SAMPLE S-26 @108.2ft

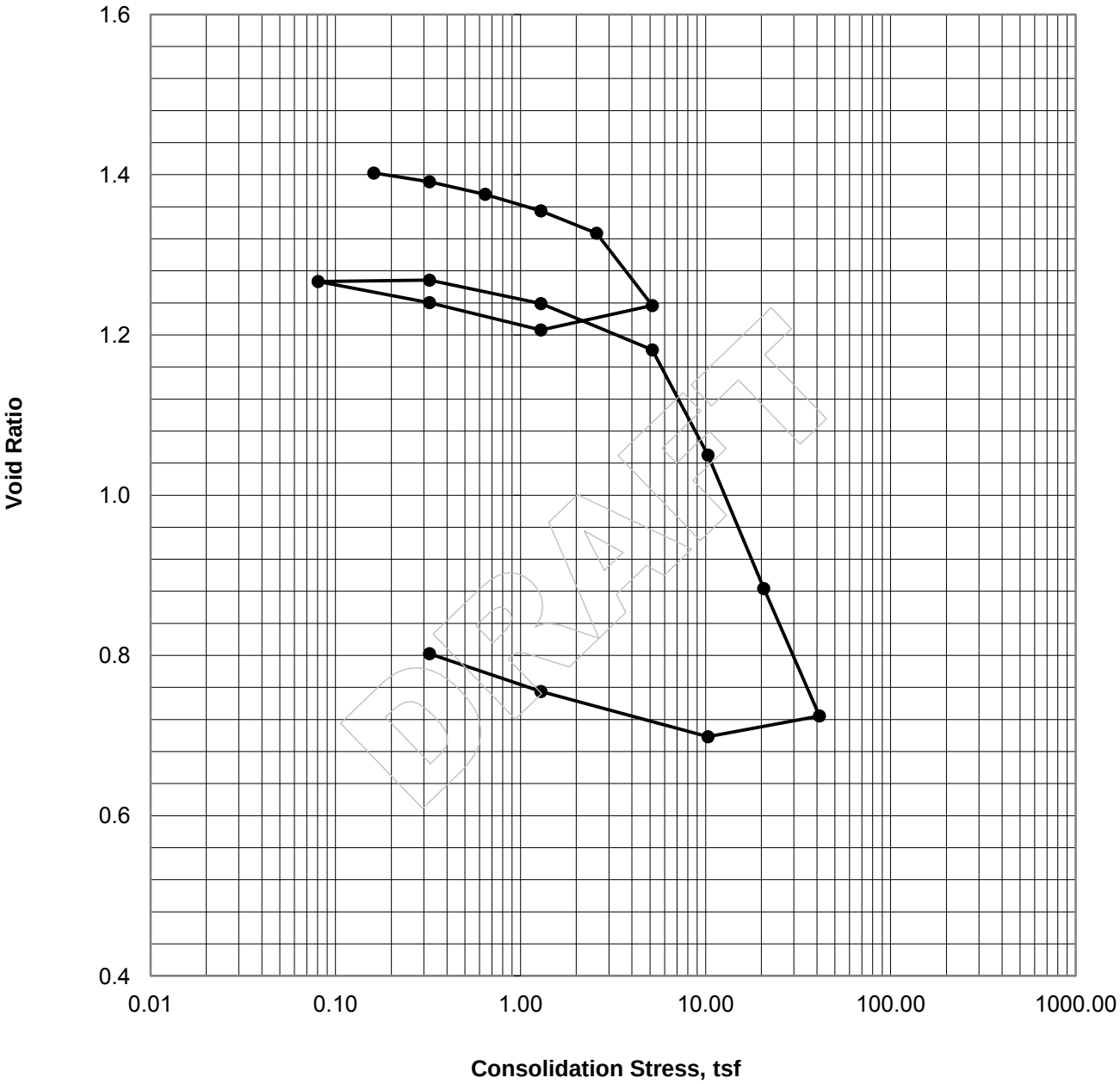
September 2013 21-1-21839-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-19

ONE DIMENSIONAL CONSOLIDATION TEST

Boring	B-5	Tested By	AKV
Sample	S-26	Calculated By	AKV
Depth, ft	108.2	Checked By	JFL



Maximum Load, tsf 41.20

NOTES:
1. Abbreviations:
   ft = feet
   tsf = tons per square foot

Port of Grays Harbor Terminal
Hoquiam, Washington

ONE DIMENSIONAL CONSOLIDATION
VOID RATIO vs STRESS PLOT
BORING B-5, SAMPLE S-26 @108.2ft

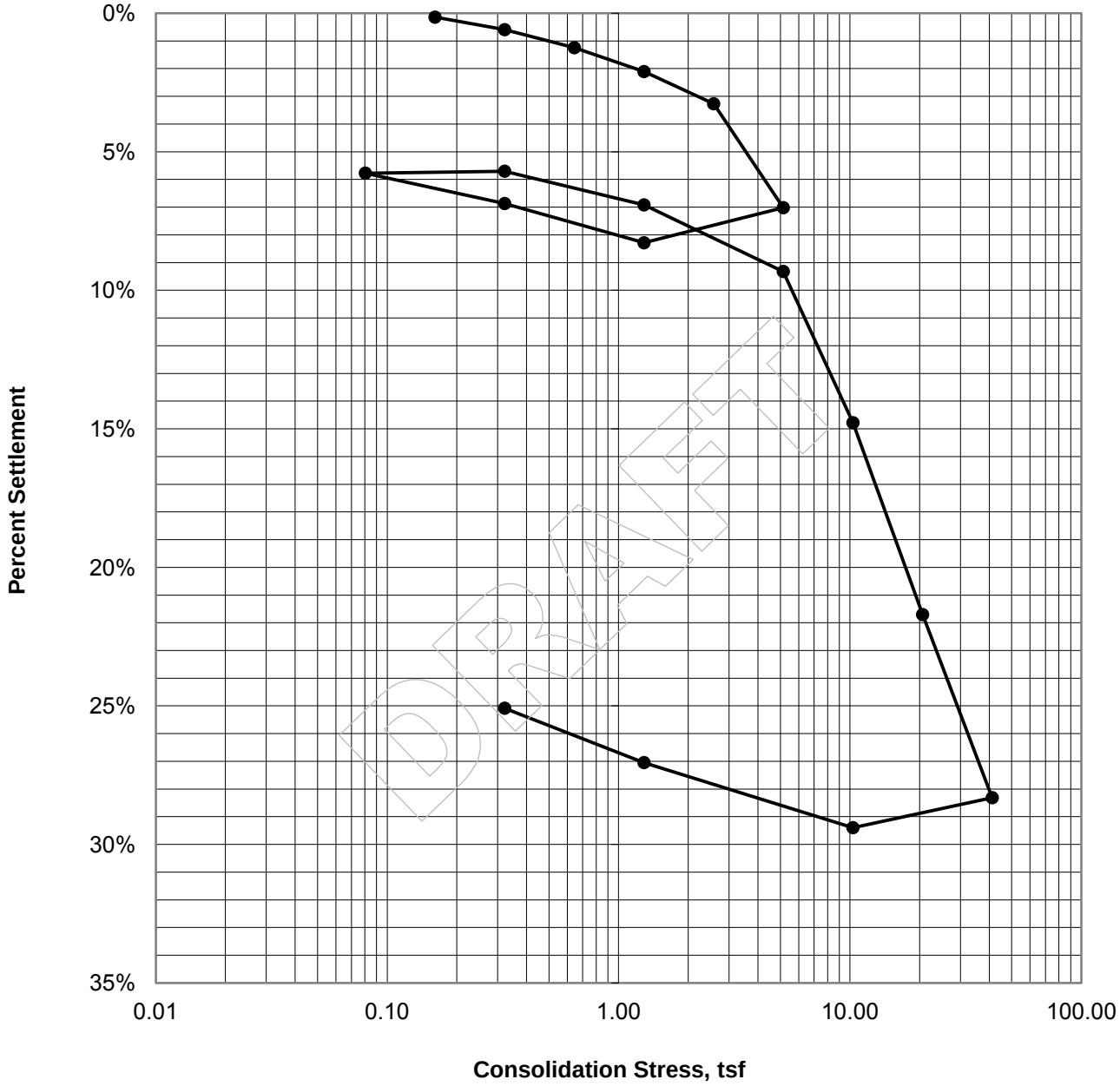
September 2013 21-1-21839-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-20

ONE DIMENSIONAL CONSOLIDATION TEST

Boring	B-5	Tested By	AKV
Sample	S-26	Calculated By	AKV
Depth, ft	108.2	Checked By	JFL



Maximum Load, tsf 41.20

NOTES:
1. Abbreviations:
ft = feet
tsf = tons per square foot

Port of Grays Harbor Terminal
Hoquiam, Washington

ONE DIMENSIONAL CONSOLIDATION PERCENT SETTLEMENT vs STRESS PLOT BORING B-5, SAMPLE S-26 @108.2ft

September 2013 21-1-21839-001

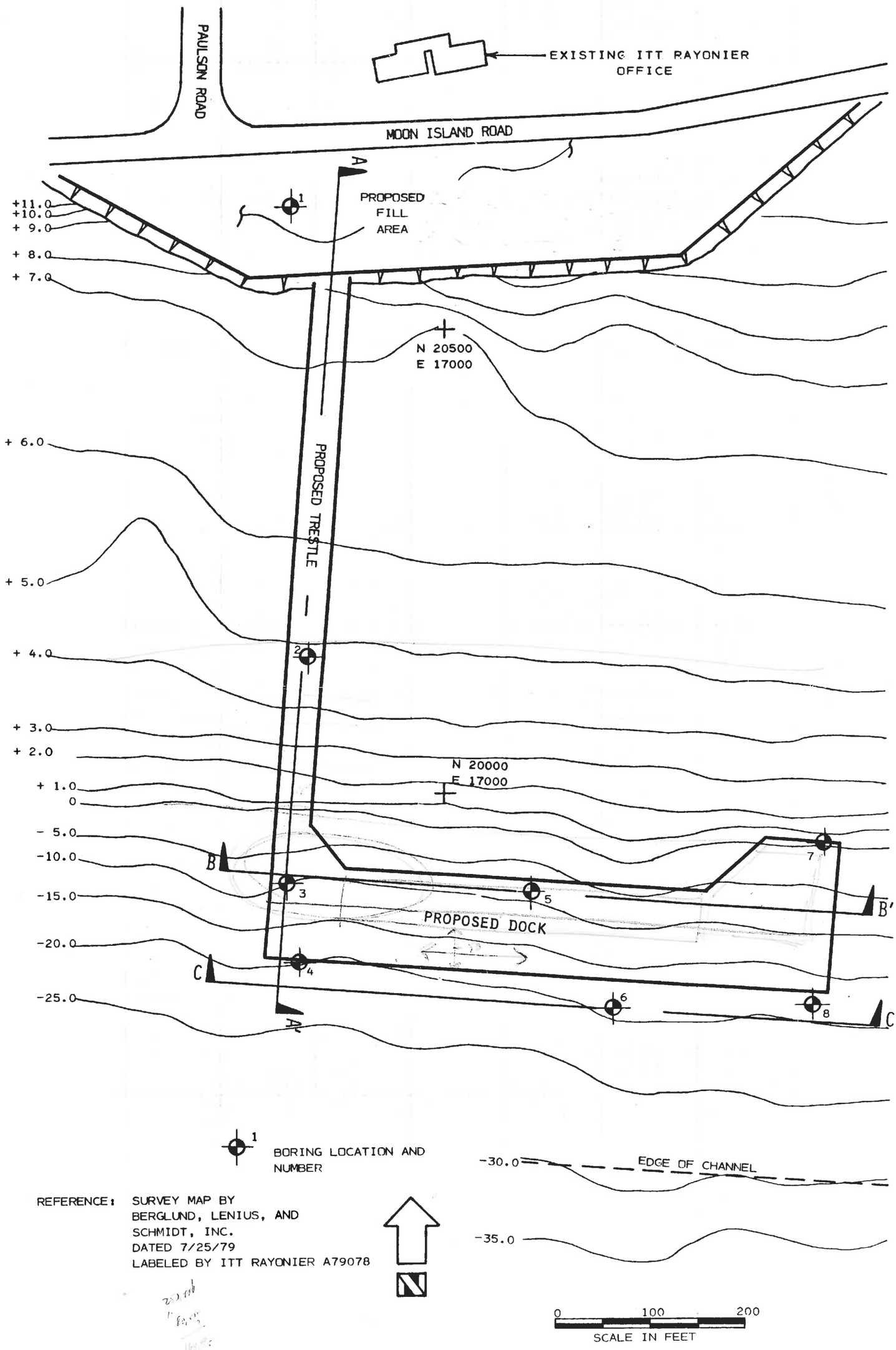
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-21

ROGER LOWE ASSOCIATES, INC. (1979-1980) DATA

Roger Lowe Associates, Inc., 1979-1980, Figures, boring logs, and laboratory test results from geotechnical reports for ITT Rayonier: Excerpts dated September 6, 1979 and January 25, 1980, 50 p., received by Shannon & Wilson, Inc. from Ausenco August 16, 2017.

ITT RAYONIER

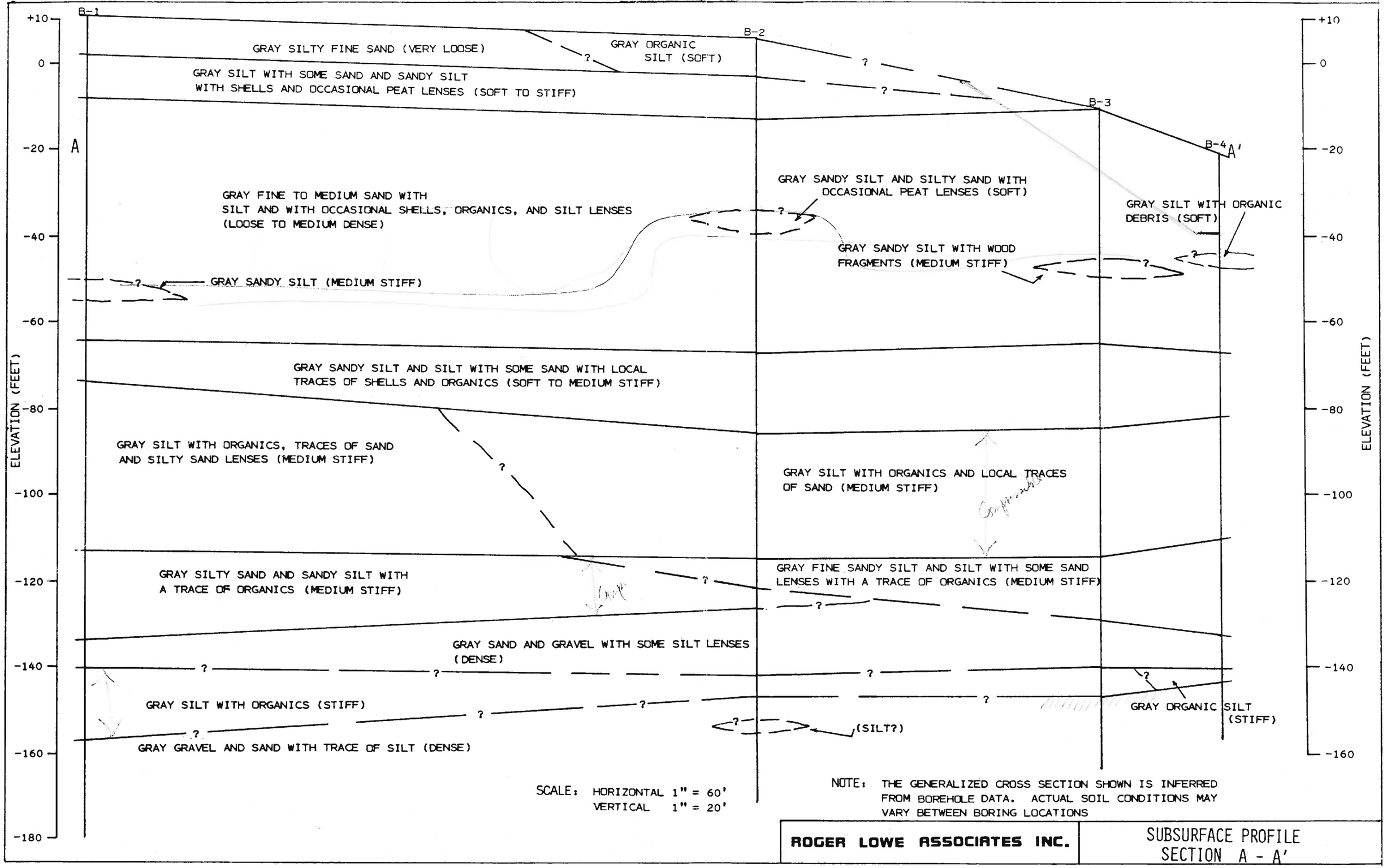


REFERENCE: SURVEY MAP BY
BERGLUND, LENIUS, AND
SCHMIDT, INC.
DATED 7/25/79
LABELED BY ITT RAYONIER A79078

AUGUST 31, 1979

PLATE 1

ROGER LOWE ASSOCIATES INC.	PLOT PLAN

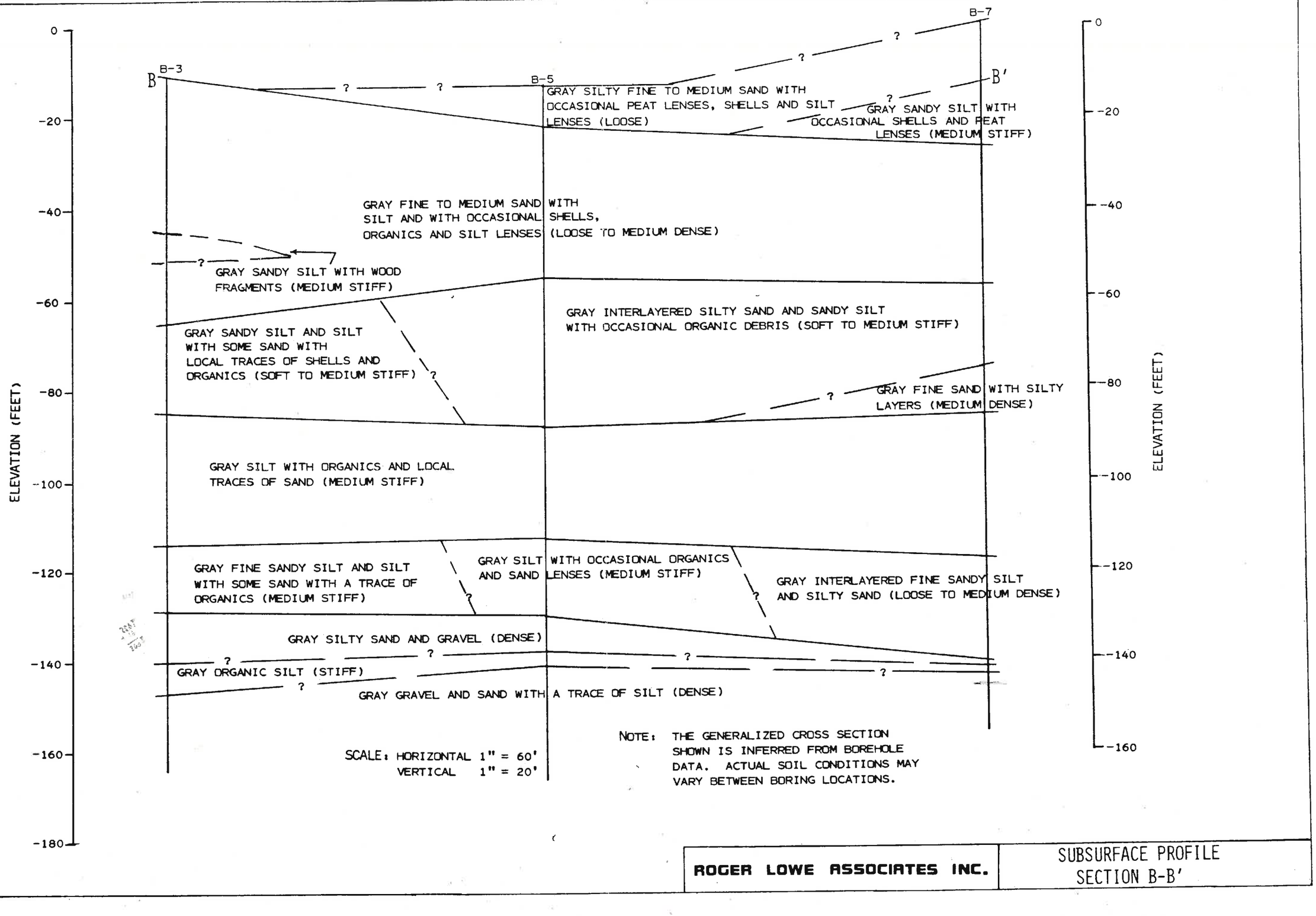


SCALE: HORIZONTAL 1" = 60'
VERTICAL 1" = 20'

NOTE: THE GENERALIZED CROSS SECTION SHOWN IS INFERRED FROM BOREHOLE DATA. ACTUAL SOIL CONDITIONS MAY VARY BETWEEN BORING LOCATIONS

ROGER LOWE ASSOCIATES INC.

SUBSURFACE PROFILE
SECTION A - A'

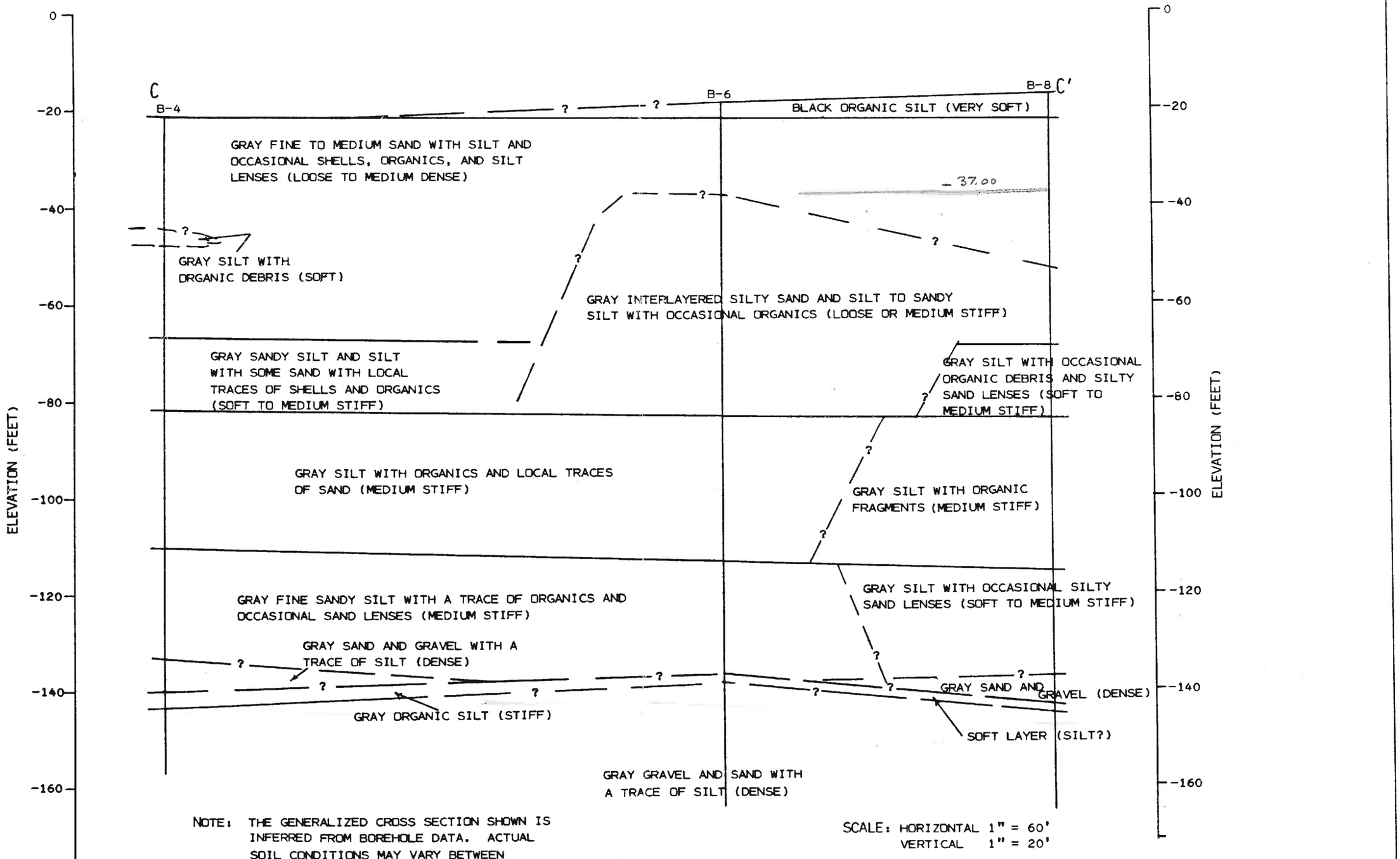


SCALE: HORIZONTAL 1" = 60'
VERTICAL 1" = 20'

NOTE: THE GENERALIZED CROSS SECTION SHOWN IS INFERRED FROM BOREHOLE DATA. ACTUAL SOIL CONDITIONS MAY VARY BETWEEN BORING LOCATIONS.

ROGER LOWE ASSOCIATES INC.

SUBSURFACE PROFILE
SECTION B-B'



NOTE: THE GENERALIZED CROSS SECTION SHOWN IS INFERRED FROM BOREHOLE DATA. ACTUAL SOIL CONDITIONS MAY VARY BETWEEN BORING LOCATIONS.

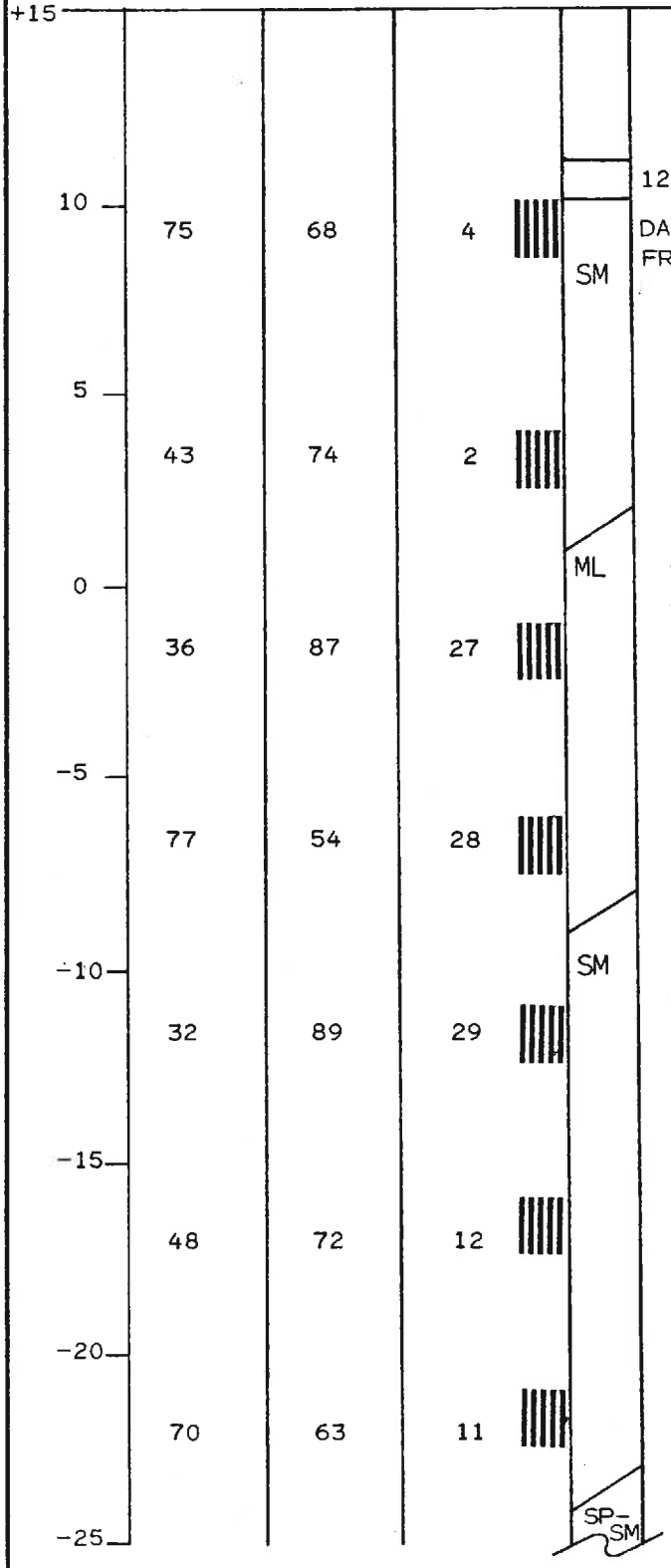
SCALE: HORIZONTAL 1" = 60'
VERTICAL 1" = 20'

ROGER LOWE ASSOCIATES INC.

SUBSURFACE PROFILE
SECTION C-C'

BORING ONE

LOCATION: N 20637
E 16837
ELEVATION: MLLW



*SAMPLER DRIVEN WITH 140 LB. DOWN HOLE HAMMER

12" COARSE GRAVEL PAD

DARK GRAY SILTY FINE SAND WITH SOME WOOD FRAGMENTS (VERY LOOSE, WET)

GRAY FINE SANDY SILT WITH SHELL FRAGMENTS AND TRACES OF WOOD AND MICA (STIFF, MOIST)

GRAY SILTY FINE SAND WITH WOOD. (LOOSE TO MEDIUM DENSE, WET)

GRAY FINE SAND WITH SOME SILT AND TRACES OF WOOD (LOOSE TO MEDIUM DENSE, WET)

ROGER LOWE ASSOCIATES INC. | LOG OF EXPLORATION

BORING ONE (CONTINUED)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-25	44	77	8	SP SM	
-30	28	94	23		SANDY SILT LAYERS
-35	50	72	9		
-40	31	89	60		
-45			19		
-50	57	69	14	ML	GRAY FINE SANDY SILT WITH A TRACE OF ORGANICS AND OCCASIONAL 1" FINE SAND LENSES (MEDIUM STIFF, MOIST)
-55	28	92	60	SM	GRAY SILTY FINE SAND WITH TRACES OF WOOD AND SMALL SHELL FRAGMENTS (MEDIUM DENSE TO DENSE, WET)
-60	28	89	51		
-65				ML	GRAY FINE SANDY SILT WITH A TRACE OF SHELLS (MEDIUM STIFF, MOIST)

BORING ONE (CONTINUED)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-65				ML	
	40	71	18		
-70					
	34	81	19		
				ML/OL	GRAY FINE SANDY SILT WITH A TRACE OF WOOD AND ORGANIC MATERIAL (SOFT, MOIST)
-75					
	41	74	6		
-80				SM	GRAY SILTY FINE SAND WITH SOME ORGANICS AND 1/2" INCLUSIONS OF LIGHT BROWN SILT (MEDIUM DENSE, MOIST)
	18	95	26		
				ML/OL	GRAY SILT WITH ORGANICS (MEDIUM STIFF, DAMP)
-85					
	70	54	17		
-90				SM	GRAY SILTY FINE SAND WITH A TRACE OF MICA (LOOSE TO MEDIUM DENSE, MOIST)
	52	69	12		
				ML/OL	GRAY SILT WITH SOME ORGANICS AND A TRACE OF FINE SAND (MEDIUM STIFF, MOIST)
-95					
	54	66	18		
-100					
	73	55	17		WOOD FRAGMENTS
-105					

BORING ONE (CONTINUED)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-105	50	70	13	ML/OL	
-110	68	57	17		
-115	47	70	9	ML/SM	GRAY FINE SANDY SILT AND SILTY FINE SAND WITH A TRACE OF ORGANICS (MEDIUM STIFF, DAMP)
-120			17		
-125	38	80	18		
-130	11	114	36	SM	GRAY SILTY FINE SAND WITH A TRACE OF ORGANICS AND OCCASIONAL COARSE SAND (MEDIUM DENSE, MOIST)
-135	39	79	32	GM	GRAY SILTY SAND AND GRAVEL WITH 1" TO 2" LENSES OF BROWN SILT (MEDIUM DENSE, MOIST)
-140				OL	

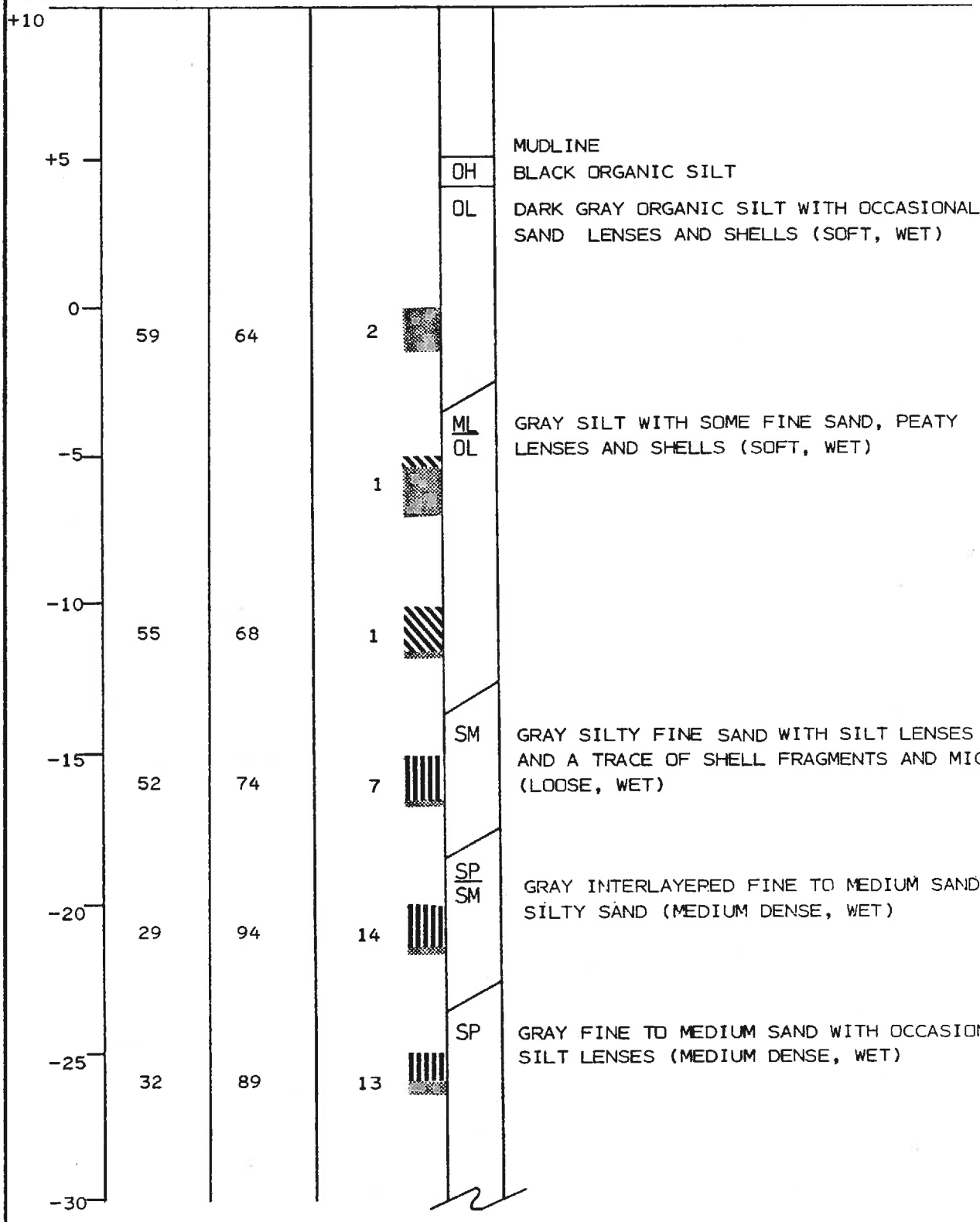
BORING ONE (CONTINUED)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-140				OL	
	62	59	8		GRAY AND GRAY BROWN ORGANIC SILT WITH OCCASIONAL PEAT LENSES (STIFF, MOIST)
-145					
	76	51	15		
-150					
	43	82	21		TRACE OF PEA GRAVEL
-155					
	33	86	22	SM ML	DARK GRAY SILTY FINE SAND (MEDIUM DENSE, MOIST)
-160					
			62/9"	GP SP	GRAY PEA GRAVEL AND COARSE SAND (MEDIUM DENSE TO DENSE, WET)
-165			111/6"		
-170			49		GRADES LESS SANDY WITH DEPTH
-175			26		NOTE: WATER LEVEL OBSERVED AT ELEVATION +9 DURING DRILLING.
-180			56		BORING TERMINATED AT ELEV. -181 ON 8-14-79

ROGER LOWE ASSOCIATES INC. | LOG OF EXPLORATION

BORING TWO

LOCATION: N 20144
E 16861
ELEVATION DATUM: MLLW



ROGER LOWE ASSOCIATES | LOG OF EXPLORATION

BORING TWO (CONTINUED)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-30	33	90	17	SP	
				ML SM	GRAY FINE SANDY SILT AND SILTY FINE SAND WITH OCCASIONAL PEAT LENSES (SOFT, WET)
-35	48	71	3		
				SP	GRAY FINE SAND WITH SILT LENSES (MEDIUM DENSE TO DENSE, WET)
-40	32	90	27		
-45			19		
-50	28	91	19		
-55				SM ML	GRAY INTERLAYERED SILTY FINE TO MEDIUM SAND AND SILT WITH OCCASIONAL PLANT FRAGMENTS (MEDIUM STIFF, WET)
-60	46	74	8		
-65					
				ML	GRAY SILT WITH SOME FINE SAND (SOFT TO MEDIUM STIFF, WET)
-70					

BORING TWO (CONTINUED)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-70	56	66	3	ML	
-75					
-80	37	76	3	SM/ML	GRAY INTERLAYERED SILTY FINE SAND AND SANDY SILT (SOFT, WET)
-85					
-90	58	63	5	OL	GRAY TO GRAY BROWN ORGANIC SILT WITH SOME PLANT FRAGMENTS (MEDIUM STIFF, WET)
-95					
-100	68	58	8		
-105					
-110					

BORING TWO (CONTINUED)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-110	55	62	7	OL	
-115				ML	GRAY SILT WITH SOME FINE SAND AND OCCASIONAL SHELLS (MEDIUM STIFF, WET)
-120	39	81	9		
					STIFFER DRILLING
				SM?	
-125					GRAVEL FELT
				GM GP	GRAY INTERBEDDED CLEAN AND SILTY FINE GRAVEL (DENSE, WET)
-130			36		
				SW	GRAY WELL GRADED SAND WITH OCCASIONAL DECAYED WOOD FRAGMENTS (MEDIUM DENSE TO DENSE, WET)
-135			34		
					GRADES MORE SILTY WITH DEPTH
			18		
-140				ML	GRAY SILT WITH OCCASIONAL PLANT FRAGMENTS (STIFF, WET)
-145			9		
				SM SP	GRAY SILTY FINE SAND (MEDIUM DENSE, WET)
-150					

BORING TWO (CONTINUED)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-150				SM/SP	
			110	SW GW	GRAY WELL GRADED SAND AND FINE GRAVEL (DENSE TO VERY DENSE, WET)
				ML?	SOFT LAYER APPROXIMATELY 2 FEET THICK.
				GW SW	GRAY GRAVEL AND COARSE SAND, LOCALLY SILTY (DENSE TO VERY DENSE, WET)
-155			84		
-160			58		
-165			50/6"		
-170			75/9"		
-175					

BORING TERMINATED AT ELEVATION -170.8

ON 8-10-79

BORING THREE

LOCATION: N 19912
E 16840
ELEVATION DATUM: MLLW

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-5					
-10					MUDLINE
				SM	BLACK AND GRAY SILTY FINE SAND WITH OCCASIONAL SHELL FRAGMENTS (VERY LOOSE, WET)
-15	40	82	4		
				SP/SM	GRAY SILTY FINE SAND INTERLAYERED WITH FINE TO MEDIUM SAND (LOOSE, WET)
-20	39	80	5		
-25	28	92	8		
-30	60	75	21		SILT LENSES
-35	28	88	13		
-40	29	87	13		SILT LENSES
-45	36	77	9		GRAY SANDY SILT LAYERS

ROGER LOWE ASSOCIATES INC. | LOG OF EXPLORATION

BORING THREE (CONTINUED)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-45				OL / ML	GRAY FINE SANDY SILT WITH WOOD FRAGMENTS (MEDIUM STIFF, WET)
-50	74	50	6	SP / SM	GRAY INTERLAYERED SILTY FINE SAND AND SAND WITH OCCASIONAL SILT LENSES (MEDIUM DENSE, WET)
-55	36	79	11		
-60	48	76	19		
-65			10		SMALL PIECES OF GRAVEL IN SAMPLER
-70			6	ML	GRAY FINE SANDY SILT (SOFT TO MEDIUM STIFF, WET)
-75	53	68	7		TRACE OF ORGANIC MATTER
-80	47	72	8		TRACE OF SHELLS
-85	46	72	9		

BORING THREE (CONTINUED)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-85				ML/OL	GRAY TO GRAY BROWN SILT WITH PLANT FRAGMENTS (MEDIUM STIFF, WET)
	66	59	11		
-90					
-95					
	59	62	16		TRACE OF FINE SAND
-100					
-105					
	64	57	9		
-110					
-115				ML	GRAY FINE SANDY SILT WITH OCCASIONAL PLANT FRAGMENTS (MEDIUM STIFF, MOIST TO WET)
-120	48	70	15		
-125					

ROGER LOWE ASSOCIATES INC. | LOG OF EXPLORATION

BORING THREE (CONTINUED)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-125				ML	
-130	28	105	65	SM	GRAY SILTY FINE TO MEDIUM SAND (MEDIUM DENSE TO DENSE, WET)
	04	134	48	GW SW	GRAY SAND AND GRAVEL (DENSE TO VERY DENSE, WET)
-135	15	122	100		
-140	35	91	10	ML OL	DARK GRAY FINE SANDY SILT WITH A TRACE TO SOME ORGANIC MATTER (SOFT, WET)
-145					
			71	GW SW	GRAY GRAVEL AND SAND WITH A TRACE TO SOME SILT (DENSE, WET)
-150					POSSIBLE ARTESIAN PRESSURE OBSERVED DURING DRILLING
			64		
-155					
-160					
			77		
-165					

BORING TERMINATED AT ELEVATION -164.0
ON 8-13-79

BORING FOUR

LOCATION: N 19821
E 16838

ELEVATION DATUM: MLLW

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-20					MUDLINE
	35	86	10	SP/SM	GRAY FINE TO MEDIUM SAND WITH SOME SILTY LENSES (LOOSE TO MEDIUM DENSE, WET)
-25					
	68	68	8		
-30					
	38	80	9		
-35					
	46	78	6		SILT LENSES
-40					
	58	67	6	ML	GRAY SILT WITH OCCASIONAL PLANT FRAGMENTS (SOFT, WET)
-45					
	42	81	15	SM/SP	GRAY SILTY FINE SAND WITH SOME SILTY LENSES (MEDIUM DENSE, WET)
-50					
	42	75	7		SILT LENSES
-55					
	56	68	7	ML/SM	GRAY SILT INTERLAYERED WITH SILTY FINE TO MEDIUM SAND (MEDIUM STIFF, WET)
-60					

ROGER LOWE ASSOCIATES INC. | LOG OF EXPLORATION

BORING FOUR (CONTINUED)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-60				ML SM	
			7		
-65				ML	GRAY FINE SANDY SILT WITH OCCASIONAL PLANT FRAGMENTS (SOFT TO MEDIUM STIFF, WET)
	47	67	7		
-70					
	58	66	8		
-75					
	47	70	8		
-80				ML OL	GRAY BROWN SILT WITH PLANT FRAGMENTS AND OCCASIONAL SANDY LENSES (MEDIUM STIFF TO STIFF, WET)
	43	73	11		
-85				OL	GRAY BROWN SILT WITH PLANT FRAGMENTS AND OCCASIONAL PEATY LENSES (STIFF, WET TO MOIST)
	98	46	8		PEAT LENSES
-90					
	57	63	10		
-95					
-100	69	55	10		

BORING FOUR (CONTINUED)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-100				OL	
-105	56	64	11		
-110				ML	GRAY FINE SANDY SILT WITH A TRACE OF ORGANICS (MEDIUM STIFF, WET TO MOIST)
-115	49	68	11		
-120					SAND LENSES
-125	39	78	15		
-130					
-135	07	127	73/11"	SW	GRAY SAND WITH SOME FINE GRAVEL AND A TRACE OF SILT (DENSE, WET)
-140					

BORING FOUR (CONTINUED)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-140	56	67	12	SW / OL	DARK GRAY AND BLACK ORGANIC SILT (STIFF TO VERY STIFF, MOIST)
	14	105	70/6"	SW / GW	GRAY SILTY SAND AND FINE GRAVEL (DENSE TO VERY DENSE, WET)
-145			70/6"		
-150			72		
-155			73/9"		
-160					

BORING TERMINATED AT ELEVATION -156.9

ON 8-2-79

ITT Rayonier

BORING FIVE

LOCATION: N 19900±
E 17100±
ELEVATION DATUM: MLLW

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-10				OH	MUDLINE BLACK ORGANIC SILT (VERY SOFT, WET)
-15	62	60	1	SM/ML	GRAY AND BLACK SILTY FINE TO MEDIUM SAND WITH OCCASIONAL PEATY LENSES AND SHELLS (LOOSE, WET)
-20	59	76	7		SANDY SILT LENSES
-25	51	70	10	SM/SP	GRAY INTERLAYERED FINE TO MEDIUM SAND AND SILTY SAND WITH OCCASIONAL WOOD FRAGMENTS AND SILT AND PEAT LENSES (MEDIUM DENSE, WET)
-30	30	91	16		
-35	27	92	17	SP	GRAY FINE TO MEDIUM SAND WITH OCCASIONAL SHELLS AND PLANT FRAGMENTS (MEDIUM DENSE, WET)
-40	33	89	7	SP/SM	GRAY INTERLAYERED FINE TO MEDIUM SAND AND SILTY SAND WITH OCCASIONAL SILT LENSES (LOOSE, WET)
-45					
-50	49	71	10		OCCASIONAL PLANT FRAGMENTS

ROGER LOWE ASSOCIATES | LOG OF EXPLORATION

BORING FIVE (Continued)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-50				SP/SM	
-55				SM/ML	GRAY INTERLAYERED FINE TO MEDIUM SILTY SAND AND FINE SANDY SILT WITH OCCASIONAL PLANT FRAGMENTS (SOFT, WET)
-60	33	79	9		
-65					
-70	41	78	5		
-75					
-80	51	70	4		GRADES MORE SILTY WITH DEPTH
-85					
-90	44	67	8	OL	GRAY TO GRAY BROWN SILT WITH ORGANIC FRAGMENTS AND OCCASIONAL PEATY LENSES (MEDIUM STIFF, WET)

BORING FIVE (Continued)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-90				OL	
-95	73	55	7		
-100					
-105	65	57	7		
-110					
				ML	GRAY SILT WITH OCCASIONAL PLANT FRAGMENTS (MEDIUM STIFF, WET)
-115	59	64	9		
-120					
-125	51	65	7		SAND LENSES
	41	72	15		GRADES MORE SANDY WITH DEPTH
-130					

BORING FIVE (Continued)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-130				ML/SM	GRAY SILTY FINE TO MEDIUM SAND WITH OCCASIONAL PLANT FRAGMENTS AND SILT LENSES (MEDIUM DENSE, WET)
-135	33	81	16		GRADES MORE SILTY WITH DEPTH
	43	79	16	OL	DARK GRAY AND BLACK ORGANIC SILT (STIFF, WET)
-140	21	94	69/11"	GW/SP	GRAY INTERLAYERED GRAVEL AND FINE TO MEDIUM SAND (DENSE, WET)
-145					
	11	123	58		
-150					
-155	06	129	72/11.5"		
-160	(?)		50/2"		
-165	11	130	149		
-170					

BORING TERMINATED AT ELEVATION -166.4

ON 8/7/79

ITT Rayonier

BORING SIX

LOCATION: N 19774
E 17177
ELEVATION DATUM: MLLW

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-15					
					MUDLINE
-20				OH	BLACK ORGANIC SILT (VERY SOFT, WET)
				SP SM	GRAY FINE TO MEDIUM SAND WITH SOME SILT LAYERS AND OCCASIONAL PEATY LENSES AND SHELLS (LOOSE TO MEDIUM DENSE WET)
-25	35	90	27		
-30	28	84	11		
-35	33	82	9		
				SM ML	GRAY INTERLAYERED SILTY FINE SAND AND SILT WITH OCCASIONAL PLANT FRAGMENTS (LOOSE, WET)
-40	57	65	8		
-45					
-50	39	75	11		
-55					

ROGER LOWE ASSOCIATES | LOG OF EXPLORATION

BORING SIX (Continued)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
55				SM/ML	
-60	23	95	15		
-65					
-70	34	78	8		
-75					
-80			5		
-85				OL	GRAY TO GRAY BROWN SILT WITH ORGANIC MATTER (SOFT TO MEDIUM STIFF, WET)
-90	59	60	11		
-95					

ITT Rayonier

BORING SIX (Continued)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-95				OL	
	62	62	10		LESS ORGANICS
-100					
-105					PEAT LENSES
	67	53	9		
-110					
				ML SM	GRAY FINE SANDY SILT (MEDIUM STIFF, WET)
-115					
	51	67	9		SAND LAYERS
-120					
-125					
	45	72	11		
-130					
	55	74	7		GRAY ORGANIC SILT LAYER
-135					

BORING SIX (Continued)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-135				ML SM	HARD DRILLING
	38	100	15		
				SW GW	GRAY SAND AND GRAVEL (VERY DENSE, WET)
-140					GRAVEL FELT
			58		GRAVEL FELT
-145					
			75/6"		
-150					
	18	118	106/8"		
-155					
-160					GRADES MORE GRAVELLY WITH DEPTH
	05	129	95		
-165					
-170					
-175					

BORING TERMINATED AT ELEVATION -163.6
ON 8/8/79

ITT Rayonier

BORING SEVEN

LOCATION: N 19946
E 17397

ELEVATION DATUM: MLLW

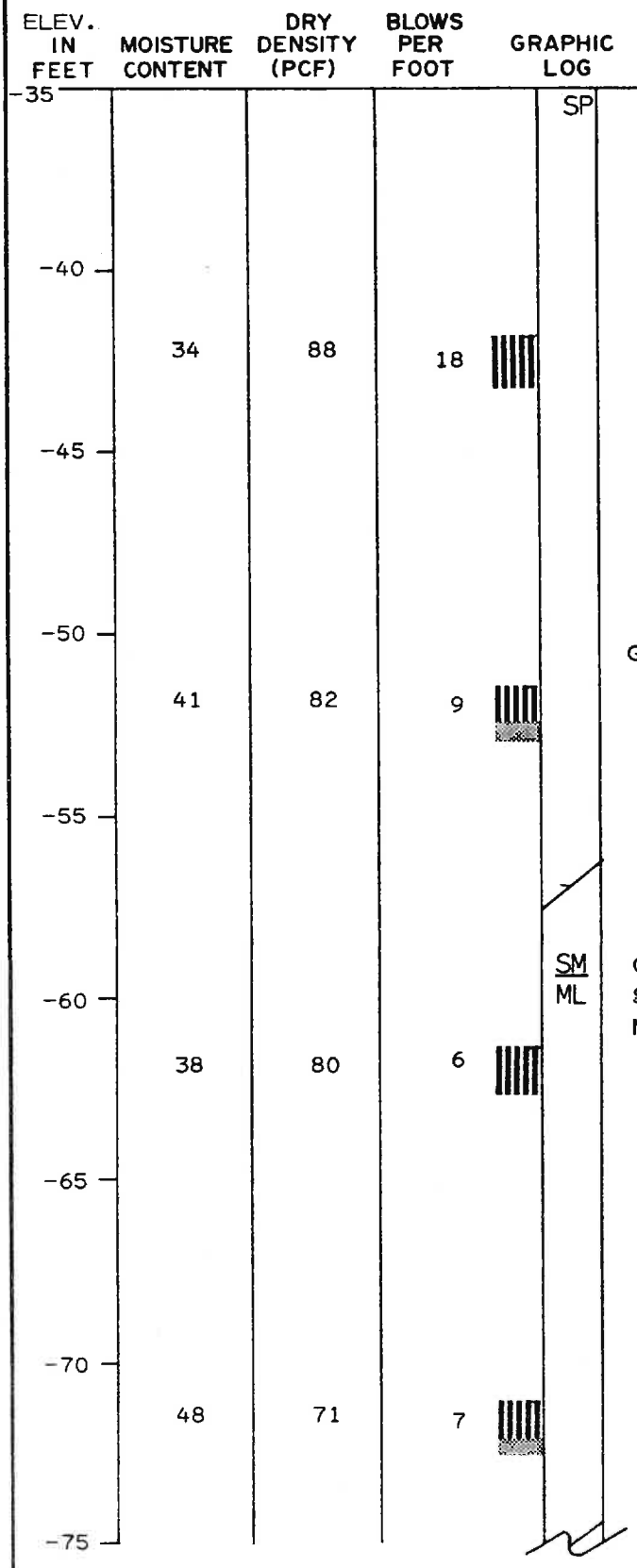
ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
+5					
0					MUDLINE
				SM SP	GRAY SILTY FINE TO MEDIUM SAND WITH SILT LENSES AND OCCASIONAL PLANT FRAGMENTS AND SHELLS (VERY LOOSE, WET)
	42	78	2		
-5					
	48	74	2		
-10					
	29	93	12		
-15				ML SM	GRAY FINE SANDY SILT WITH OCCASIONAL SHELLS AND PEATY LENSES (MEDIUM STIFF, WET)
	53	66	5		
-20					PEAT LENSES
	45	80	11		
-25					
				SP	GRAY FINE TO MEDIUM SAND WITH OCCASIONAL SILTY LENSES AND PLANT FRAGMENTS (MEDIUM DENSE, WET)
-30					
	28	98	30		
-35					

ROGER LOWE ASSOCIATES

LOG OF EXPLORATION

ITT Rayonier

BORING SEVEN (Continued)

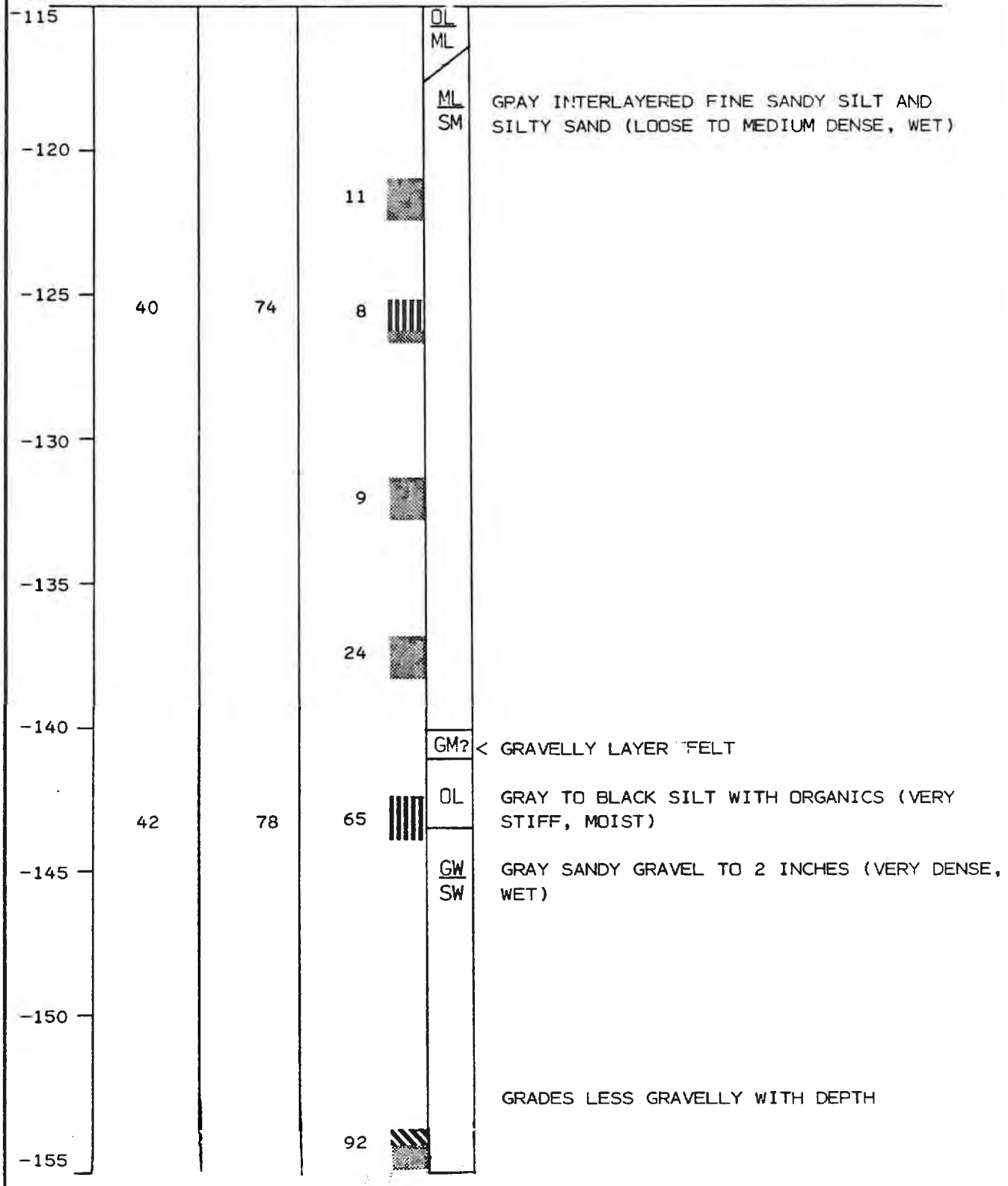


ROGER LOWE ASSOCIATES | LOG OF EXPLORATION

BORING SEVEN (Continued)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-75				SP/SM	GRAY FINE SAND WITH SILTY LAYERS (MEDIUM DENSE, WET)
-80	31	91	35		
-85				OL/ML	
-90	68	53	8		GRAY TO GRAY BROWN SILT WITH ORGANIC FRAGMENTS (MEDIUM STIFF, WET)
-95					
-100	71	54	10		
-105					GRADES LESS ORGANIC WITH DEPTH
-110	63	56	7		
-115					

BORING SEVEN (Continued)



BORING TERMINATED AT ELEVATION -155.3 ON 8/6/79

ROGER LOWE ASSOCIATES	LOG OF EXPLORATION

BORING EIGHT

LOCATION: N 19772
E 17392
ELEVATION DATUM: MLLW

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-10					
-15					MUDLINE
				OL	BLACK ORGANIC SILT (VERY SOFT, WET)
-20	41	69	8		
				SM/SP	GRAY AND BLACK FINE TO MEDIUM SAND WITH SOME SILT AND A TRACE OF MICA (MEDIUM DENSE, WET)
-25	30	93	20		
-30	31	91	11		OCCASIONAL WOOD FRAGMENTS
-35	35	81	8		SILT LENSES
-40	38	83	12		
-45	33	79	12		SILT LENSES
-50					

ROGER LOWE ASSOCIATES | LOG OF EXPLORATION

BORING EIGHT (CONTINUED)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-50					
	55	67	12	ML SM	GRAY INTERLAYERED FINE SANDY SILT AND SILTY FINE SAND WITH OCCASIONAL PLANT FRAGMENTS (SOFT TO STIFF, WET)
-55					
			6		
				SM	GRAY FINE TO MEDIUM SILTY SAND (LOOSE TO MEDIUM DENSE, WET)
-60					
	38	76	10		
-65				ML SM	GRAY FINE SANDY SILT (MEDIUM STIFF, WET)
	49	67	11		
				ML	GRAY SILT WITH OCCASIONAL PLANT FRAGMENTS (SOFT TO MEDIUM STIFF, WET)
-70					
	54	69	4		
-75					
	51	69	5		SILTY SAND LENSES
-80					
	39	77	7		
				OL	GRAY SILT WITH ORGANIC FRAGMENTS (MEDIUM STIFF, WET)
-85	74	54	10		
-90	57	62	8		

BORING EIGHT (CONTINUED)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-90				OL	
-95	81	50	11		
-100	65	58	11		
-105	54	67	11		
-110	51	66	10		
-115	51	64	8		
	52	68	10	ML	GRAY SILT (SOFT TO MEDIUM STIFF, WET)
-120			12		
-125			12		
-130					

BORING EIGHT (Continued)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-130	54	69	16	ML	SILTY SAND LENSES
					GRADES MORE SANDY AND STIFFER WITH DEPTH
-135	45	78	20		
	19	101	54/6"	SW	GRAY WELL GRADED SAND AND FINE GRAVEL
-140	10	129	92/11"	GW	TO 2" (DENSE TO VERY DENSE, WET)
				ML?	SOFT LAYER
-145	09	133	72/11"		
					GRADES LESS GRAVELLY WITH DEPTH
-150					
					COBBLEY, ROUGH DRILLING
-155	05	148	82/10"		
					COBBLEY, ROUGH DRILLING
-160					
			73		
-165					

BORING TERMINATED AT ELEVATION -164.9
ON 8-14-79

ITT Rayonier

January 25, 1980

BORING NINE

LOCATION: N 20385±
E 16815±
ELEVATION DATUM: MLLW

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT*	GRAPHIC LOG	SOIL DESCRIPTION
+15					*SAMPLER DRIVEN WITH 140 LB HAMMER
10					
	35	86	7	SM	DARK GRAY SILTY SAND (LOOSE, WET)
5					
	71	61	3	OL	GRAY ORGANIC SILT WITH A TRACE TO SOME CLAY (SOFT, WET)
0					
	67	60	4		SOME SHELLS
-5				SM	DARK GRAY SILTY FINE SAND (LOOSE, WET)
			10		
-10	33	89	13		
-15	35	85	27		
				SM	DARK GRAY SILTY FINE SAND WITH LOCAL THIN SILT LENSES AND OCCASIONAL WOOD CHIPS (LOOSE TO MEDIUM DENSE, WET)
-20	39	79	17		
-25			22		SAMPLER REDRIVEN AND DISTURBED SAMPLE TAKEN

ROGER LOWE ASSOCIATES INC. | LOG OF EXPLORATION

BORING NINE (continued)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-25					
-30					
-35			10		
-40	34	88	13		SOME COARSE SAND
-45	30	92	80		SOME SHELL AND WOOD FRAGMENTS
-50			39	SM/ML	GRAY INTERLAYERED SILTY FINE SAND AND FINE SANDY SILT (MEDIUM DENSE, WET)
-55	33	89	79	SP/SM	DARK GRAY FINE SAND AND SILTY FINE SAND WITH OCCASIONAL SHELLS (MEDIUM DENSE TO DENSE, WET)
-60	31	89	54		OCCASIONAL THIN SILT LENSES
-65	26	98	90	SP	DARK GRAY FINE SAND (MEDIUM DENSE TO DENSE, WET)

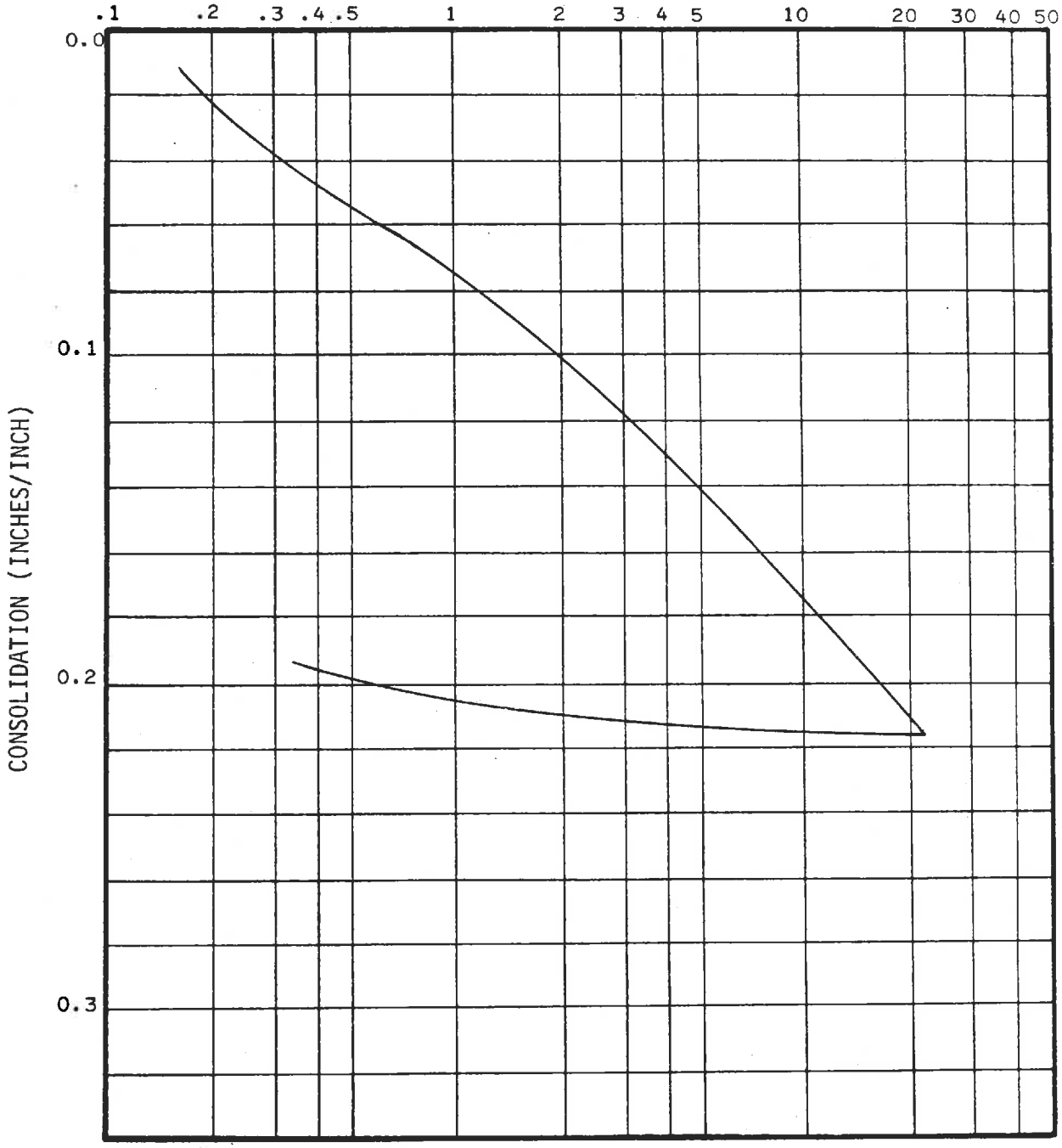
BORING NINE (continued)

ELEV. IN FEET	% MOISTURE CONTENT	DRY DENSITY (PCF)	BLOWS PER FOOT	GRAPHIC LOG	SOIL DESCRIPTION
-65					
	53	67	15	ML	GRAY SILT WITH TRACES OF FINE SAND AND ORGANICS AND LOCAL FINE SAND LENSES (MEDIUM STIFF TO STIFF, WET)
-70					
	46	72	17		
-75					
-80					

BORING TERMINATED AT ELEVATION -75.5

ON 1-6-80

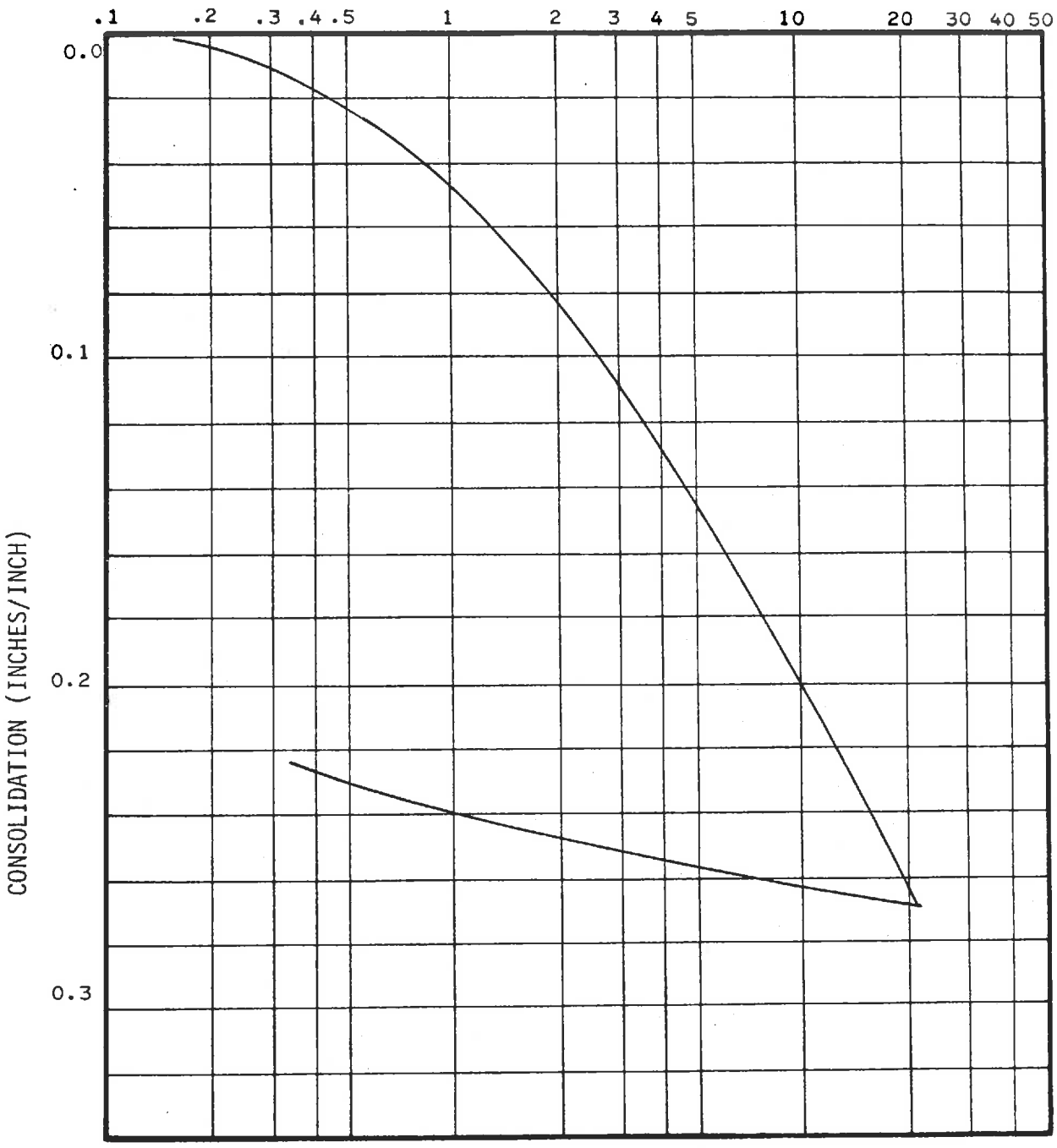
ITT Rayonier



KEY	BORING NUMBER	SAMPLE ELEV. (FT)	SOIL CLASSIFICATION	MOISTURE CONTENT (%)	DRY DENSITY (LBS/FT^3)
	B-1	-66	GRAY SANDY SILT	40	71

ROGER LOWE ASSOCIATES | CONSOLIDATION TEST RESULTS

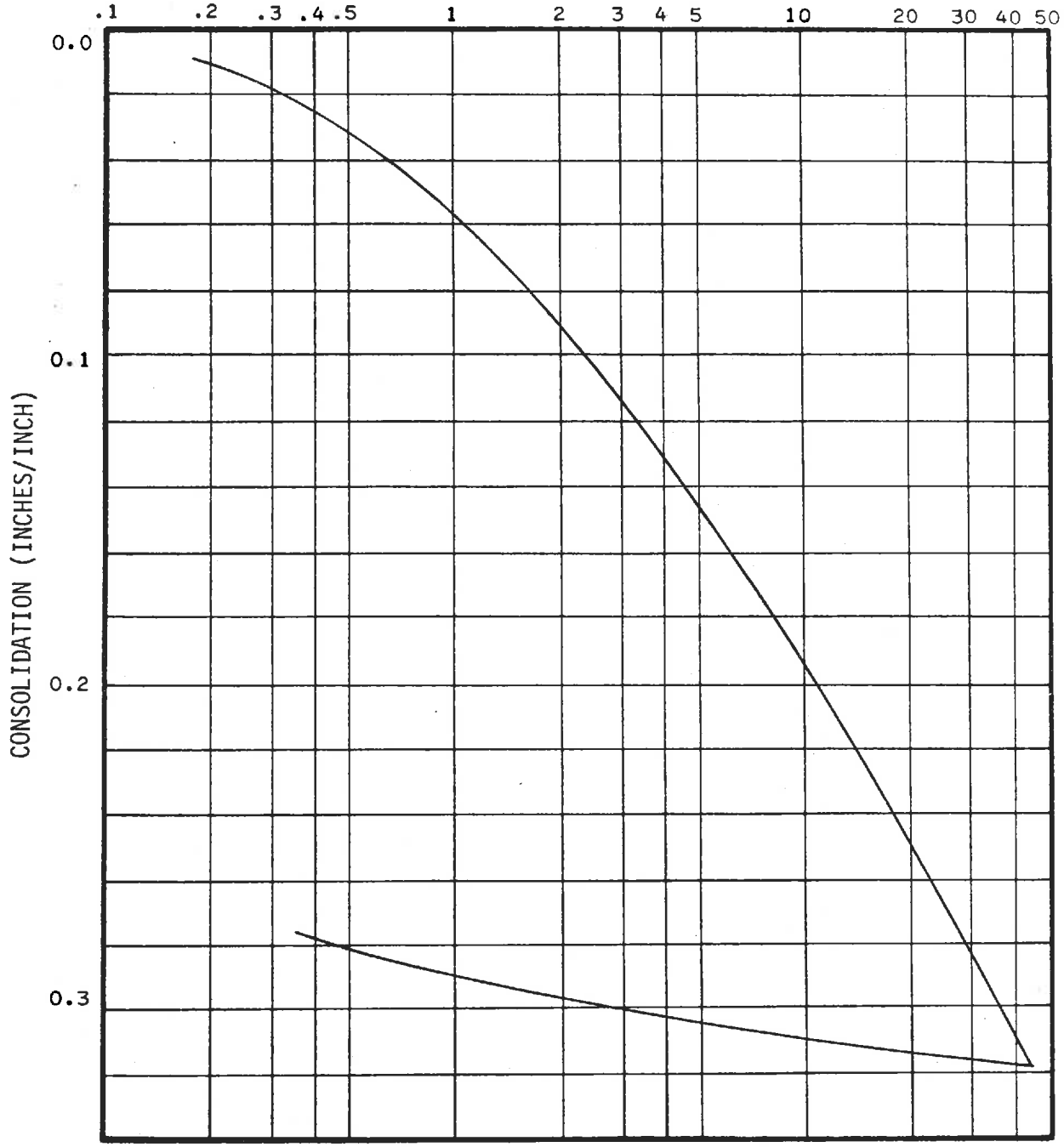
ITT Rayonier



KEY	BORING NUMBER	SAMPLE ELEV. (FT)	SOIL CLASSIFICATION	MOISTURE CONTENT (%)	DRY DENSITY (LBS/FT3)
	B-1	-86	GRAY SILT WITH ORGANICS	70	54

ROGER LOWE ASSOCIATES | CONSOLIDATION TEST RESULTS

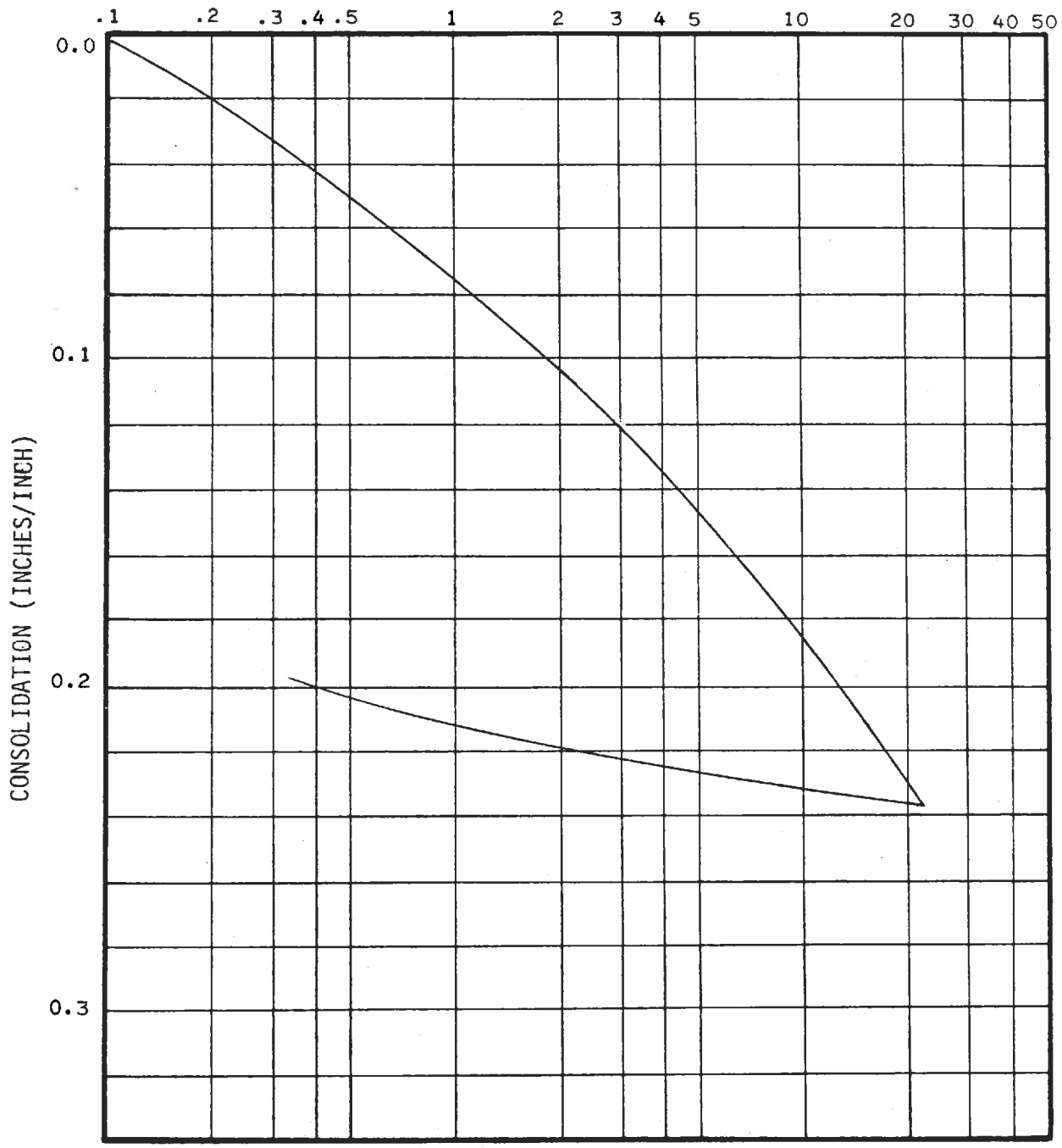
ITT Rayonier



KEY	BORING NUMBER	SAMPLE ELEV. (FT)	SOIL CLASSIFICATION	MOISTURE CONTENT (%)	DRY DENSITY (LBS/FT^3)
	B-1	-106	GRAY SILT WITH SOME SAND AND A TRACE OF ORGANICS	50	70

ROGER LOWE ASSOCIATES | CONSOLIDATION TEST RESULTS

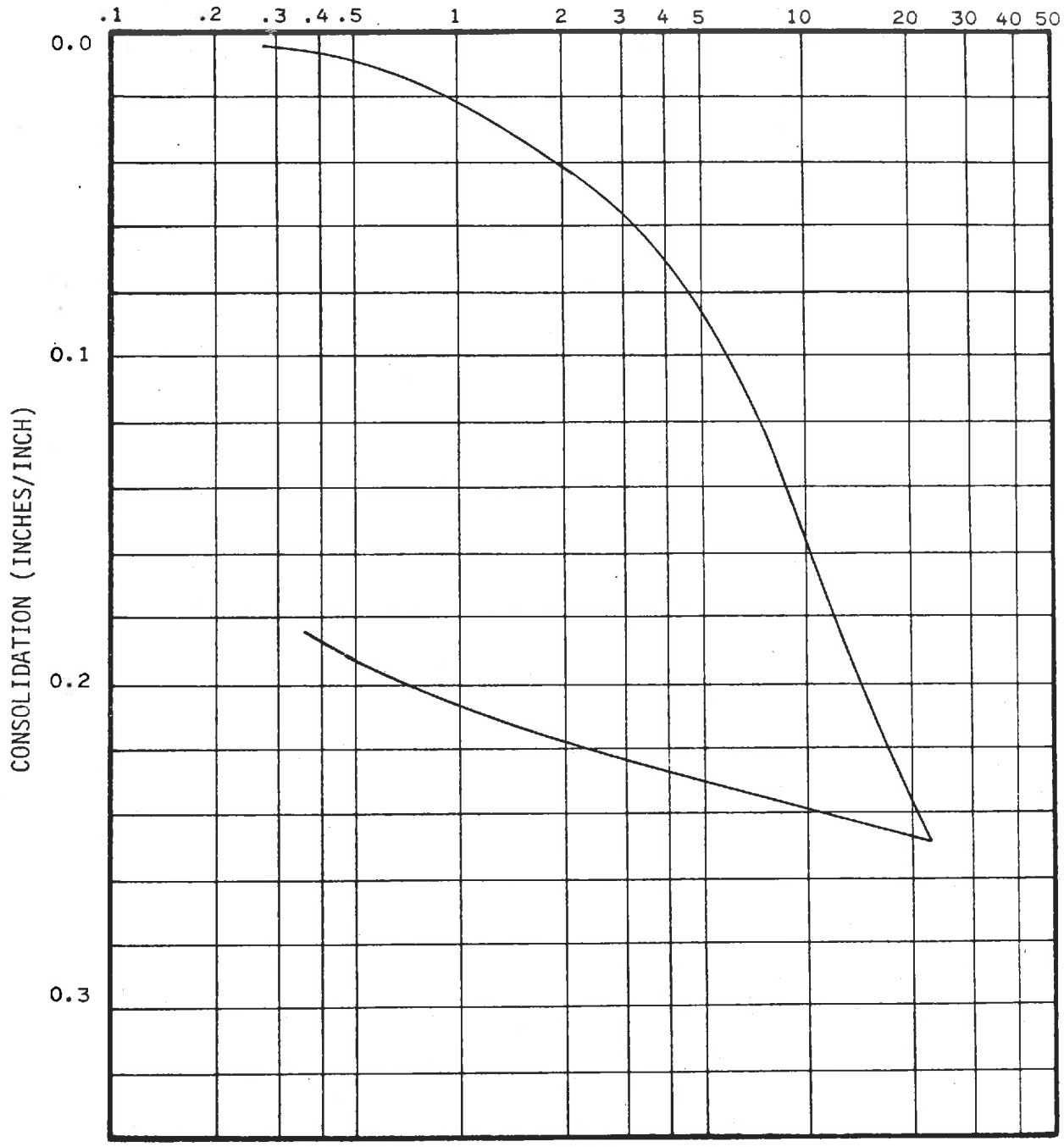
ITT Rayonier



KEY	BORING NUMBER	SAMPLE ELEV. (FT)	SOIL CLASSIFICATION	MOISTURE CONTENT (%)	DRY DENSITY (LBS/FT3)
	B-2	-80	GRAY SILTY SAND AND SANDY SILT	37	76

ROGER LOWE ASSOCIATES | CONSOLIDATION TEST RESULTS

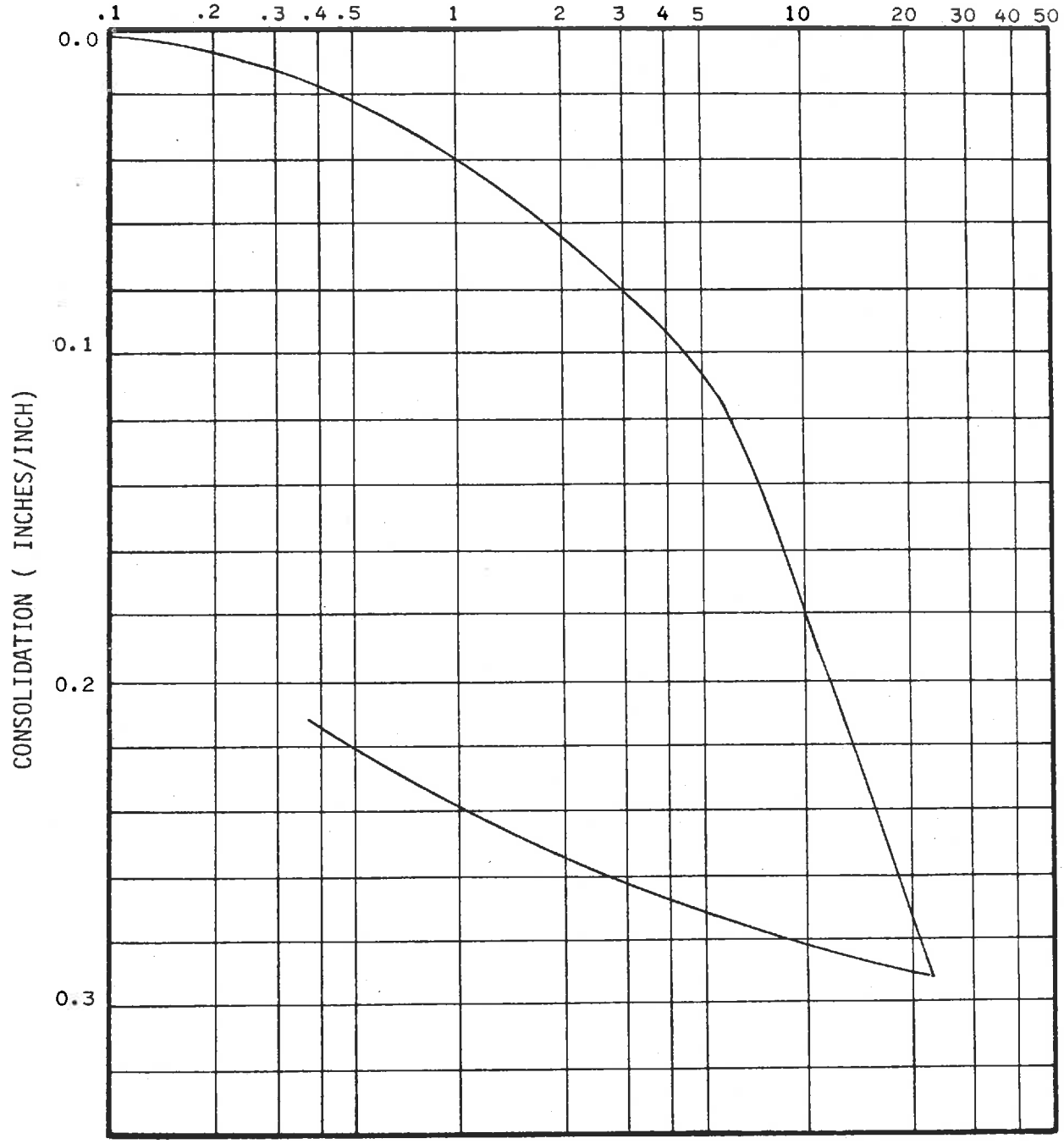
ITT Rayonier



KEY	BORING NUMBER	SAMPLE ELEV. (FT)	SOIL CLASSIFICATION	MOISTURE CONTENT (%)	DRY DENSITY (LBS/FT3)
	B-2	-100	GRAY ORGANIC SILT	68	58

ROGER LOWE ASSOCIATES | CONSOLIDATION TEST RESULTS

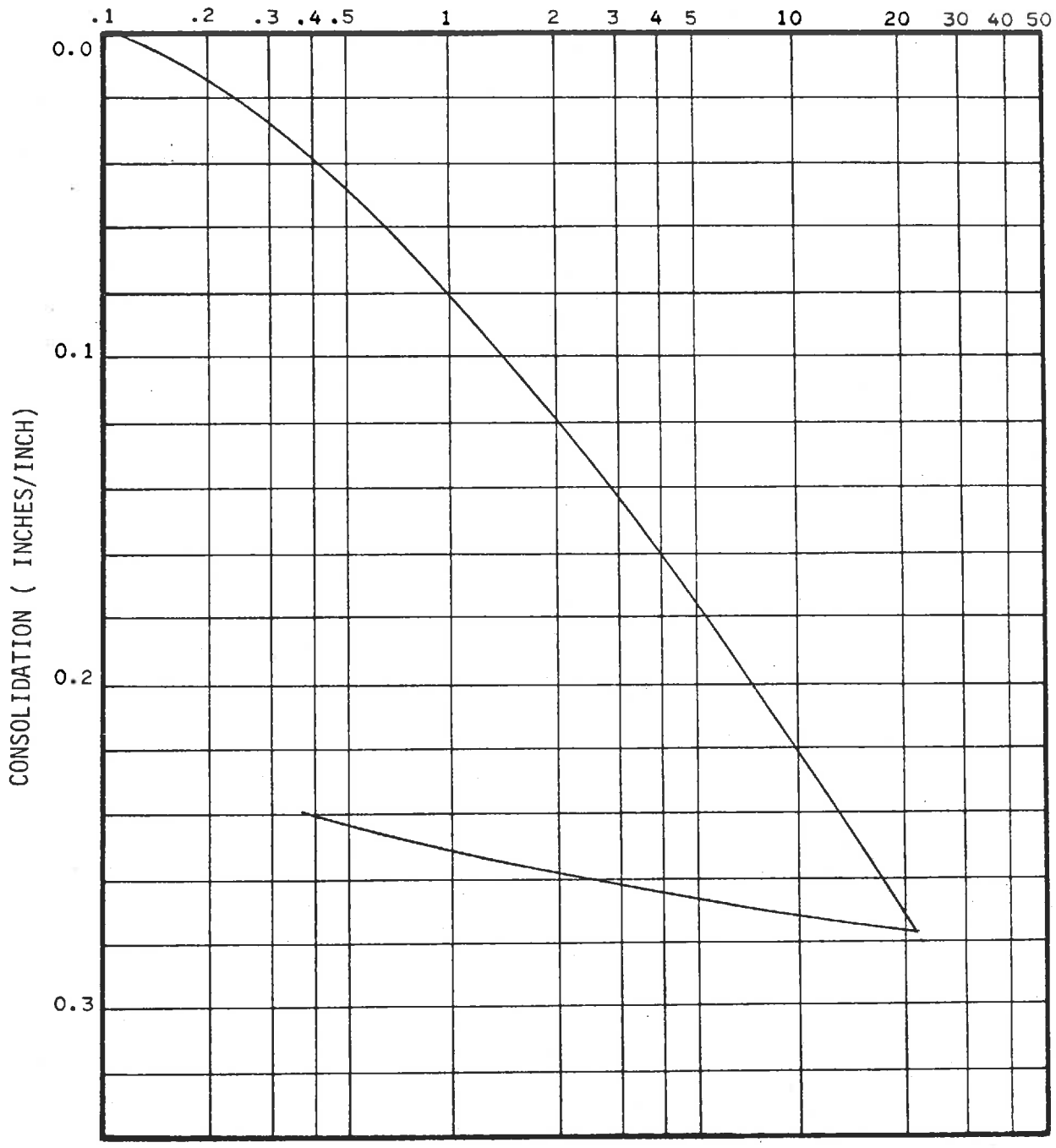
ITT Rayonier



KEY	BORING NUMBER	SAMPLE ELEV. (FT)	SOIL CLASSIFICATION	MOISTURE CONTENT (%)	DRY DENSITY (LBS/FT3)
	B-8	-94	GRAY SILT WITH ORGANICS	81	50

ROGER LOWE ASSOCIATES | CONSOLIDATION TEST RESULTS

ITT Rayonier



KEY	BORING NUMBER	SAMPLE ELEV. (FT)	SOIL CLASSIFICATION	MOISTURE CONTENT (%)	DRY DENSITY (LBS/FT3)
	B-8	-108	GRAY SILT WITH ORGANICS	51	66

ROGER LOWE ASSOCIATES | CONSOLIDATION TEST RESULTS

ROGER LOWE ASSOCIATES INC.

DIRECT SHEAR TEST RESULTS

ITT Rayonier

EXPLORATION NUMBER	SAMPLE ELEV. (MLLW)	MOISTURE CONTENT %	DRY DENSITY (LBS/FT^3)	NORMAL PRESSURE (LBS/FT^2)	SHEAR RATE* (IN./MIN.)	INDICATED STRENGTH (LBS/FT^2)	
						YIELD	PEAK **
B - 1	+ 4	43	74	520			500
B - 1	- 16	48	72	1000			810
B - 1	- 31	28	94	2010			1310
B - 1	- 41	31	89	3010			2280
B - 1	- 61	28	89	4020			3160
B - 1	- 86	70	54	2010			1180
B - 1	- 96	54	66	4020			1640
B - 1	-106	50	70	6020			3170
B - 2	- 15	52	74	1000			870
B - 2	- 25	32	89	2010			1360
B - 2	- 50	28	91	3010			2050
B - 2	- 60	46	74	4020			2340
B - 2	- 70	56	66	5020			2640
B - 2	- 80	37	76	6020			4110
B - 3	- 24	28	92	1000			790
B - 3	- 39	29	87	2010			1230
B - 3	- 58	48	76	3010			1560
B - 3	- 73	53	68	2010			1170
B - 3	- 78	47	72	6020			3470
B - 3	- 83	46	72	4020			2380

KEY: * ALL TESTS ARE RUN ON SATURATED SAMPLES AT A STRAIN RATE OF 0.05 INCHES PER MINUTE UNLESS NOTED OTHERWISE.

** TAKEN AT SHEAR STRAIN $\leq$ 10%

ROGER LOWE ASSOCIATES INC.

DIRECT SHEAR TEST RESULTS

ITT Rayonier

EXPLORATION NUMBER	SAMPLE ELEV. (MLLW)	MOISTURE CONTENT %	DRY DENSITY (LBS/FT^3)	NORMAL PRESSURE (LBS/FT^2)	SHEAR RATE* (IN./MIN.)	INDICATED STRENGTH (LBS/FT^2)	
						YIELD	PEAK**
B - 8	- 31	31	91	1110			720
B - 8	- 37	35	81	2220			1520
B - 8	- 42	38	83	3320			2160

KEY: *ALL TESTS ARE RUN ON SATURATED SAMPLES AT A STRAIN RATE OF 0.05 INCHES PER MINUTE UNLESS NOTED OTHERWISE.

**TAKEN AT SHEAR STRAIN $\leq$ 10%

APPENDIX D: GEOTECHNICAL LABORATORY TESTING

Appendix D

Geotechnical Laboratory Testing

CONTENTS

APPENDIX D: GEOTECHNICAL LABORATORY TESTING

D.1 INTRODUCTION

This appendix summarizes the geotechnical laboratory testing conducted for this Project. Laboratory tests were performed on selected soil samples retrieved from the borings. The laboratory testing program included a variety of tests to classify the soils and to provide data for engineering studies. Classification and index laboratory tests included visual classification and tests to determine natural water content, grain size distribution, Atterberg Limits, and consolidation testing.

D.1.1 Visual Classification

We visually classified soil samples retrieved from the borings using a system based on ASTM D2487-17, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System), and ASTM D2488-09a, Standard Recommended Practice for Description of Soils (Visual-Manual Procedure). We summarize our classification system in Appendix A. We assigned a Unified Soil Classification System (USCS) group name and symbol based on our visual classification of particles finer than 76.2 millimeters. We revised visual classifications using results of the index tests discussed below.

D.1.2 Water Content Determination

We tested the water content of selected samples in accordance with ASTM D2216-10, Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass. Comparison of the water content of a soil with its index properties can be useful in characterizing soil unit weight, consistency, compressibility, and strength. We present water content test results in the Laboratory Test Summary table in this appendix and graphically on Appendix A exploration logs.

D.1.3 Grain Size and Hydrometer Analyses

We performed three types of grain size distribution analyses:

- Combined Mechanical and Sedimentation
- Mechanical Sieve
- Percent Fine-Grained

We performed combined analyses (mechanical and sedimentation) on selected soil specimens to determine the grain size distribution of coarse- and fine-grained soil particles in accordance with ASTM D422-63 (2007)e2, Standard Test Method for Particle-Size

Analysis of Soils. We assumed a specific gravity of 2.7 for hydrometer calculations unless otherwise indicated on grain size distribution plots.

We performed mechanical sieve analyses on selected soil specimens to determine the grain size distribution of coarse-grained soil particles in accordance with ASTM C136/C136M-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

We determined the percent of fine-grained soil particles (fines content) of selected soil specimens in accordance with ASTM D1140-14, Standard Test Methods for Determining the Amount of Material Finer Than 0.075 mm (No. 200) Sieve in Soils by Washing.

D.1.4 Atterberg Limits

We determined soil plasticity by performing Atterberg Limits tests on selected samples in accordance with ASTM D4318-10e1, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils, Method A (Multi-Point Liquid Limit). The Atterberg Limits include liquid limit (LL), plastic limit (PL), and plasticity index (PI=LL-PL). These limits can assist soil classification, indicate soil consistency (when compared to natural water content), provide correlation to soil properties, evaluate clogging potential, and estimate liquefaction potential.

We present soil plasticity test results in the Laboratory Test Summary table and on plasticity charts in this appendix. Plasticity charts provide the LL, PL, PI, USCS group symbol, the sample description, water content, and percent passing the No. 200 sieve (if a grain size distribution analysis was performed). Soil plasticity test results are also shown graphically on Appendix A exploration logs.

D.1.5 One-Dimensional Consolidation Tests

We performed one-dimensional consolidation tests in a fixed-ring consolidometer on relatively undisturbed samples in accordance with ASTM D2435/D2435M-11, Standard Test Methods for One Dimensional Consolidation Properties of Soils Using Incremental Loading, Test Method B (loaded to 100% primary consolidation with time-deformation readings on all load increments). One-dimensional consolidation results presented in this appendix include a test summary, settlement plots, and incremental plots.

D.2 REFERENCES

ASTM International, 2017, Standard practice for classification of soils for engineering purposes (unified soil classification system), D2487-17: West Conshohocken, Pa., ASTM International, Annual book of standards, v. 04.08, soil and rock (I): D420 - D5876, 12 p., available: www.astm.org.

ASTM International, 2010, Standard test methods for laboratory determination of water (moisture) content of soil and rock by mass, D2216-10: West Conshohocken, Pa., ASTM International, Annual book of standards, v. 04.08, soil and rock (I): D420 - D5876, 7 p., available: www.astm.org.

ASTM International, 2007, Standard test method for particle-size analysis of soils, D422-63(2007)e2: West Conshohocken, Pa., ASTM International, Annual book of standards, v. 04.08, soil and rock (I): D420 - D5876, 8 p., available: www.astm.org.

ASTM International, 2014, Standard test method for sieve analysis of fine and coarse aggregates, C136-14/C136M-14: West Conshohocken, Pa., ASTM International, Annual book of standards, v. 04.02, concrete and aggregates, 5 p., available: www.astm.org.

ASTM International, 2014, Standard test methods for determining the amount of material finer than .075mm (no. 200) sieve in soils by washing, D1140-14: West Conshohocken, Pa., ASTM International, Annual book of standards, v. 04.08, soil and rock (I): D420 - D5876, 6 p., available: www.astm.org.

Table D-1 - Laboratory Terms

Abbreviations, Symbols, and Terms	Descriptions
%	Percent
*	Sample specimen weight did not meet required minimum mass for the test method
"	Inch
#	Test not performed by Shannon & Wilson, Inc. laboratory
ASTM Std.	ASTM International Standard
C_c	Coefficient of curvature
Clay size	Soil particles finer than 0.002 mm
cm	Centimeter
cm^2	Square centimeter
Coarse-grained	Soil particles coarser than 0.075 mm (cobble-, gravel- and sand-sized particles)
Cobbles	Soil particles finer than 305 mm and coarser than 76.2 mm
C_u	Coefficient of uniformity
CU	Consolidated-Undrained
e	Axial strain
Fine-grained	Soil particles finer than 0.075 mm (silt- and clay-sized particles)
ft	Feet
gm	Wet unit weight
Gravel	Soil particles finer than 76.2 mm and coarser than 4.75 mm
G_s	Specific gravity of soil solids
H_o	Initial height
DH	Change in height
DH_{load}	End of load increment deformation
in	Inch
in^3	Cubic inch
LL	Liquid Limit
min	Minute
mm	Millimeter
m_m	Micrometer
MC	Moisture content
MPa	Mega-Pascal
NP	Non-plastic
OC	Organic content
p	Total stress
p'	Effective stress
Pa	Pascal
pcf	Pounds per cubic foot

Table D-1 - Laboratory Terms

Abbreviations, Symbols, and Terms	Descriptions
PI	Plasticity Index
PL	Plastic Limit
psf	Pounds per square foot
psi	Pounds per square inch
q	Deviatoric stress
Sand	Soil particles finer than 4.75 mm and coarser than 0.075 mm
sec	Second
Silt	Soil particles finer than 0.075 mm and coarser than 0.002 mm
t_n	Time to n% primary consolidation
t_{load}	Duration of load increment
tsf	Short tons per square foot
USCS	Unified Soil Classification System
UU	Unconsolidated-Undrained
WC	Water content

Table D-2 - Sample Types

Abbreviations, Symbols, and Terms	Descriptions
2SS	2.5-inch Outside Diameter Split-Spoon Sample
2ST	2-inch Outside Diameter Thin-Walled Tube
3HSA	3-inch CME Hollow-Stem Auger Sampler
3SS	3-inch Outside Diameter Split-Spoon Sample
4SS	4-inch Inside Diameter Split-Spoon Sample
6SS	6-inch Inside Diameter Split-Spoon Sample
CA_MC	Modified California Sampler
CA_SPT	Standard Penetration Test (SPT)
CORE	Rock Core
DM	+3.25-inch Outside Diameter Split-Spoon Sample
DMR	3.25-inch Sampler with Internal Rings
GRAB	Grab Sample
GUS	3-inch Outside Diameter Gregory Undisturbed Sampler (GUS) Sample
OSTER	3-inch Outside Diameter Osterberg Sample
PITCHER	3-inch Outside Diameter Pitcher Sample
PMT	Pressuremeter Test (f=failed)
PO	Porter Penetration Test Sample
PT	2.5-inch Outside Diameter Thin-Walled Tube
ROCK	Rock Core Sample
SCORE	Soil Core (as in Sonic Core Borings)
SH1	1-inch Plastic Sheath
SH2	2-inch Plastic Sheath with Soil Recovery
SH3	2-inch Plastic Sheath with no Soil Recovery
SPT	2-inch Outside Diameter Split-Spoon Sample
SS	Split-Spoon
ST	3-inch Outside Diameter Thin-Walled Tube
STW	3-inch Outside Diameter Thin-Walled Tube
TEST	Sample Test Interval
TW	Thin Wall Sample
UNDIST	Undisturbed Sample
VANE	Vane Shear
WATER	Water Sample for Probe Logs
XCORE	Core Sample

Table D-3 - Laboratory Test Summary

General Sample Information							Grain Size and Density Analyses							Plasticity			
Boring	Top Depth (m)	Sample Numbe	Sample Type	SPT Blow Cour	USCS	WC (%)	% Gravel	% Sand	% Fines	% Clay-size	Cu	Cc	Gs	LL	PL	Soil Description	Consolidation Test Performed
H-01-18	2.5	S-1	SPT	72		9											
H-01-18	5.0	S-2	SPT	21		12											
H-01-18	8.5	S-3	SPT	2		45											
H-01-18	13.0	S-5	SPT	0		91											
H-01-18	13.6	S-5	SPT	0		76											
H-01-18	18.0	S-7	SPT	0	OH	61								74	36	Organic Silt	
H-01-18	20.0	S-8	SPT	1		54											
H-01-18	25.0	S-9	SPT	4	ML/MH	47			61							Sandy Silt	
H-01-18	30.0	S-10	SPT	0		48											
H-01-18	35.0	S-11	SPT	6		48											
H-01-18	40.0	S-12	SPT	28		31											
H-01-18	45.0	S-13	SPT	21	SM	39			22							Silty Sand	
H-01-18	50.0	S-14	SPT	26		28											
H-01-18	55.0	S-15	SPT	48		21											
H-01-18	60.0	S-16	SPT	31		35											
H-01-18	65.0	S-17	SPT	28		41											
H-01-18	70.0	S-18	SPT	33	SM	27	2*	84*	14*							Silty Sand	
H-01-18	75.0	S-19	SPT	36		28											
H-01-18	80.0	S-20	SPT	27		33											
H-01-18	85.0	S-21	SPT	22	SM	37			31							Silty Sand	
H-01-18	90.0	S-22	SPT	27		31											
H-01-18	95.0	S-23	SPT	18		36											
H-01-18	100.0	S-24	SPT	20		34											

Table D-3 - Laboratory Test Summary

General Sample Information							Grain Size and Density Analyses							Plasticity			
Boring	Top Depth (m)	Sample Numbe	Sample Type	SPT Blow Cour	USCS	WC (%)	% Gravel	% Sand	% Fines	% Clay-size	Cu	Cc	Gs	LL	PL	Soil Description	Consolidation Test Performed
H-01-18	105.0	S-25	SPT	34		40											
H-01-18	110.0	S-26	SPT	15		54											
H-01-18	115.0	S-27	SPT	5		45											
H-01-18	120.0	S-28	SPT	13		53											
H-01-18	123.1	S-29	GUS		CH	56								65	31	Fat Clay	✓
H-01-18	125.0	S-30	SPT	7		49											
H-01-18	130.0	S-31	SPT	37		31											
H-01-18	135.0	S-32	SPT	21		45											
H-01-18	140.0	S-33	SPT	9		48											
H-01-18	140.7	S-33	SPT	9		47											
H-01-18	145.0	S-34	SPT	14	OH	59								83	43	Organic Silt	
H-01-18	150.0	S-35	SPT	23		32											
H-01-18	150.9	S-35	SPT	23		26											
H-01-18	155.0	S-36	SPT	82		10											
H-01-18	160.0	S-37	SPT	84		8											
H-01-18	160.9	S-37	SPT	84		6											
H-01-18	165.0	S-38	SPT	50/5"		6											
H-01-18	170.0	S-39	SPT	50/4"		8											
H-01-18	175.0	S-40	SPT	53		8											
H-01-18	180.0	S-41	SPT	50/3"		7											
H-01A-18	13.7	S-2	GUS		MH	68								88	40	Elastic Silt	✓
H-02-18	2.5	S-1	SPT	41		12											
H-02-18	5.0	S-2	SPT	19		27											

Table D-3 - Laboratory Test Summary

General Sample Information							Grain Size and Density Analyses							Plasticity			
Boring	Top Depth (m)	Sample Numbe	Sample Type	SPT Blow Cour	USCS	WC (%)	% Gravel	% Sand	% Fines	% Clay-size	Cu	Cc	Gs	LL	PL	Soil Description	Consolidation Test Performed
H-02-18	5.9	S-2	SPT	19		9											
H-02-18	10.0	S-4	SPT	6	SM	38			46							Silty Sand	
H-02-18	12.5	S-5	SPT	10	SP-SM	18	27*	62*	11*							Poorly Graded Sand with Silt and Gravel	
H-02-18	15.0	S-6	SPT	8		26											
H-02-18	17.5	S-7	SPT	11		28											
H-02-18	20.0	S-8	SPT	9	SM	32			25							Silty Sand	
H-02-18	25.0	S-9	SPT	4	MH	50								52	34	Elastic Silt	
H-02-18	27.0	S-10	GUS		ML	45			72							Silt with Sand	
H-02-18	35.0	S-12	SPT	7		42											
H-02-18	40.0	S-13	SPT	7		40											
H-02-18	50.0	S-15	SPT	23		29											
H-02-18	55.0	S-16A	SPT	12	MH	56		10*	90*	21*				59	33	Elastic Silt	
H-02-18	55.8	S-16	SPT	12		27											
H-02-18	60.0	S-17	SPT	21		27											
H-02-18	65.0	S-18	SPT	21		32											
H-02-18	70.0	S-19	SPT	8		42											
H-02-18	75.0	S-20	SPT	17		32											
H-02-18	80.0	S-21	SPT	17		39											
H-02-18	85.0	S-22	SPT	27		27											
H-02-18	90.0	S-23	SPT	16	SM	35			46							Silty Sand	
H-02-18	95.0	S-24	SPT	0		39											
H-02-18	100.0	S-25	SPT	14		40											
H-02-18	105.0	S-26	SPT	21		46											

Table D-3 - Laboratory Test Summary

General Sample Information							Grain Size and Density Analyses							Plasticity			
Boring	Top Depth (m)	Sample Numbe	Sample Type	SPT Blow Cour	USCS	WC (%)	% Gravel	% Sand	% Fines	% Clay-size	Cu	Cc	Gs	LL	PL	Soil Description	Consolidation Test Performed
H-02-18	110.0	S-27	SPT	4	CH	57								82	34	Fat Clay	
H-02-18	115.0	S-29	SPT	2		44											
H-02-18	120.0	S-31	SPT	3		64											
H-02-18	125.0	S-32	SPT	2		54											
H-02-18	130.0	S-33	SPT	3		80											
H-02-18	140.0	S-34	SPT	3	ML	40			73							Silt with Sand	
H-02-18	150.0	S-35	SPT	50/5"		40											
H-02-18	160.0	S-36	SPT	90		9											
H-02-18	170.0	S-37	SPT	53		7											
H-02-18	175.0	S-38	SPT	23		3											
H-03-18	0.0	S-1	SPT	0		43											
H-03-18	5.0	S-2	SPT	4	ML	41								41	33	Silt with Sand	
H-03-18	10.0	S-3	SPT	33		32											
H-03-18	15.0	S-4	SPT	2	MH	51		36	64	17				50	30	Sandy Elastic Silt	
H-03-18	20.0	S-5	SPT	1		52											
H-03-18	25.0	S-6	SPT	0	ML	54			85							Silt with Sand	
H-03-18	30.0	S-7	SPT	9		44											
H-03-18	35.0	S-8	SPT	12	SM	40	0	60	39							Silty Sand	
H-03-18	40.0	S-9	SPT	15		44											
H-03-18	45.0	S-10	SPT	16		35											
H-03-18	50.0	S-11	SPT	0	ML	48			69					42	37	Sandy Silt	
H-03-18	55.0	S-12	SPT	0		50											
H-03-18	60.0	S-13	SPT	0		49											

Table D-3 - Laboratory Test Summary

General Sample Information							Grain Size and Density Analyses							Plasticity			
Boring	Top Depth (m)	Sample Numbe	Sample Type	SPT Blow Cour	USCS	WC (%)	% Gravel	% Sand	% Fines	% Clay-size	Cu	Cc	Gs	LL	PL	Soil Description	Consolidation Test Performed
H-03-18	65.0	S-14	SPT	10		45											
H-03-18	70.0	S-15	SPT	3		81											
H-03-18	75.0	S-16	SPT	2		75											
H-03-18	80.0	S-18	SPT	4		51											
H-03-18	85.0	S-19	SPT	2		66											
H-03-18	90.0	S-20	SPT	2		76											
H-03-18	95.0	S-21	SPT	7		51											
H-03-18	100.0	S-22	SPT	2		72											
H-03-18	105.0	S-23	SPT	7		48											
H-03-18	110.0	S-24	SPT	5	ML	37			56							Sandy Silt	
H-03-18	115.0	S-25	SPT	24		35											
H-03-18	120.0	S-26	SPT	24		41											
H-03-18	125.0	S-27	SPT	65		9											
H-03-18	130.0	S-28	SPT	59		9											
H-03-18	135.0	S-29	SPT	34		11											
H-03-18	140.0	S-30	SPT	92		28											
H-03-18	145.0	S-31	SPT	50/4"		11											
H-03-18	155.0	S-32	SPT	50/4"		10											
H-03-18	165.0	S-33	SPT	50/5"		9											
H-04-18	0.0	S-1	SPT	21		34											
H-04-18	2.5	S-2	SPT	18		31											
H-04-18	5.0	S-3	SPT	2		48											
H-04-18	7.5	S-4	SPT	7		49											

Table D-3 - Laboratory Test Summary

General Sample Information							Grain Size and Density Analyses							Plasticity			
Boring	Top Depth (m)	Sample Numbe	Sample Type	SPT Blow Cour	USCS	WC (%)	% Gravel	% Sand	% Fines	% Clay-size	Cu	Cc	Gs	LL	PL	Soil Description	Consolidation Test Performed
H-04-18	10.0	S-5	SPT	11	SM	32		77*	23*							Silty Sand	
H-04-18	12.5	S-6	SPT	10		36											
H-04-18	15.0	S-7	SPT	6	ML	44		42	58	15			3	34	31	Sandy Silt	
H-04-18	17.5	S-8	SPT	6		53											
H-04-18	22.5	S-9	SPT	23		29											
H-04-18	28.5	S-10	SPT	11	SM	29			31							Silty Sand	
H-04-18	33.5	S-11	SPT	3		46											
H-04-18	38.5	S-12	SPT	2		54											
H-04-18	39.0	S-12	SPT	2													
H-04-18	42.5	S-14	SPT	8	MH	54			88					63	35	Elastic Silt	
H-04-18	48.5	S-15	SPT	8		44											
H-04-18	49.0	S-15	SPT	8													
H-04-18	53.5	S-16	SPT	7	CH	65								85	37	Fat Clay	
H-04-18	54.0	S-16	SPT	7													
H-04-18	58.5	S-17	SPT	6		57											
H-04-18	59.0	S-17	SPT	6													
H-04-18	63.5	S-18	SPT	3		66											
H-04-18	68.5	S-19	SPT	5		64											
H-04-18	73.5	S-20	SPT	8		61											
H-04-18	78.5	S-21	SPT	12		45											
H-04-18	83.5	S-22	SPT	9	ML	39			65							Sandy Silt	
H-04-18	88.5	S-23	SPT	30		35											
H-04-18	93.5	S-24	SPT	38		28											

Table D-3 - Laboratory Test Summary

General Sample Information							Grain Size and Density Analyses							Plasticity			
Boring	Top Depth (m)	Sample Numbe	Sample Type	SPT Blow Cour	USCS	WC (%)	% Gravel	% Sand	% Fines	% Clay-size	Cu	Cc	Gs	LL	PL	Soil Description	Consolidation Test Performed
H-04-18	98.5	S-25	SPT	52		10											
H-04-18	108.5	S-27	SPT	8		16											
H-04-18	113.5	S-28	SPT	62		8											
H-05-18	0.0	S-1	SPT	3		55											
H-05-18	5.0	S-2	SPT	0	MH	55								53	34	Elastic Silt	
H-05-18	10.0	S-3	SPT	22		38											
H-05-18	15.0	S-4	SPT	13		58											
H-05-18	20.0	S-5	SPT	18		33											
H-05-18	25.0	S-6	SPT	10		48											
H-05-18	30.0	S-7	SPT	18		37											
H-05-18	33.5	S-8	SPT	8		40											
H-05-18	38.5	S-9	SPT	0		46											
H-05-18	43.5	S-10	SPT	3	MH	51								50	33	Elastic Silt	
H-05-18	48.5	S-11	SPT	0		50											
H-05-18	53.5	S-12	SPT	6		55											
H-05-18	58.5	S-13	SPT	4		50											
H-05-18	63.5	S-15	SPT	4	MH	67		1	99	36			3	61	33	Elastic Silt	
H-05-18	68.5	S-16	SPT	3		74											
H-05-18	73.5	S-17	SPT	2		53											
H-05-18	78.5	S-18	SPT	15	CH	56								86	36	Fat Clay	
H-05-18	83.5	S-19	SPT	5		46											
H-05-18	88.5	S-20	SPT	12		37											
H-05-18	93.5	S-21	SPT	9	MH	48			88							Elastic Silt	

Table D-3 - Laboratory Test Summary

General Sample Information							Grain Size and Density Analyses							Plasticity			
Boring	Top Depth (m)	Sample Numbe	Sample Type	SPT Blow Cour	USCS	WC (%)	% Gravel	% Sand	% Fines	% Clay-size	Cu	Cc	Gs	LL	PL	Soil Description	Consolidation Test Performed
H-05-18	98.5	S-22	SPT	21		33											
H-05-18	103.5	S-23	SPT	69		8											
H-05-18	108.5	S-24	SPT	16		43											
H-05-18	113.5	S-25	SPT	24		46											
H-05-18	118.5	S-26	SPT	47		9											
H-05-18	138.5	S-29	SPT	50/3"		9											
H-06-18	2.5	S-2	SPT	10		19											
H-06-18	5.0	S-3	SPT	10		28											
H-06-18	7.5	S-4	SPT	4		28											
H-06-18	10.0	S-5	SPT	0	OH	80								77	39	Organic Silt	
H-06-18	15.0	S-7	SPT	0		64											
H-06-18	15.5	S-7	SPT	0		47											
H-06-18	17.5	S-8	SPT	0	MH	61		11	89	18				64	40	Elastic Silt	
H-06-18	20.0	S-9	SPT	0		52											
H-06-18	25.0	S-10	SPT	1	SM	64			49							Silty Sand	
H-06-18	30.0	S-11	SPT	1		54											
H-06-18	35.0	S-12	SPT	19	SM	35		75	25							Silty Sand	
H-06-18	40.0	S-13	SPT	13		31											
H-06-18	50.0	S-15	3SS	37		29											
H-06-18	55.0	S-16	SPT	11		36											
H-06-18	60.0	S-17	SPT	28		25											
H-06-18	65.0	S-18	SPT	32		27											
H-06-18	70.0	S-19	SPT	23		36											

Table D-3 - Laboratory Test Summary

General Sample Information							Grain Size and Density Analyses							Plasticity			
Boring	Top Depth (m)	Sample Numbe	Sample Type	SPT Blow Cour	USCS	WC (%)	% Gravel	% Sand	% Fines	% Clay-size	Cu	Cc	Gs	LL	PL	Soil Description	Consolidation Test Performed
H-06-18	75.0	S-20	SPT	29		26											
H-06-18	80.0	S-21	SPT	13		44											
H-06-18	85.0	S-22	SPT	25		34											
H-06-18	90.0	S-23	SPT	20		37											
H-06-18	95.0	S-24	SPT	25		31											
H-06-18	100.0	S-25	SPT	32		28											
H-06-18	105.0	S-26	SPT	28		31											
H-06-18	110.0	S-27	SPT	2	MH	49								59	31	Elastic Silt	
H-06-18	115.0	S-28	SPT	1		56											
H-06-18	120.0	S-29	SPT	1		54											
H-06-18	125.0	S-30	SPT	0		49											
H-06-18	130.0	S-31	ST			55											
H-06-18	135.0	S-32	SPT	1		58											
H-06-18	140.0	S-33	SPT	1		55											
H-06-18	145.0	S-34	SPT	20		36											
H-06-18	150.0	S-35	SPT	7		39											
H-06-18	155.0	S-36	SPT	50/6"		10											
H-06-18	165.0	S-38	SPT	50		9											
H-06-18	170.0	S-39	SPT	50/5"		9											
H-06A-18	10.7	S-1	GUS		CH	80								80	32	Fat Clay	✓
H-06A-18	14.0	S-2	GUS		ML	49								48	40	Silt	✓
H-07-18	2.5	S-1	SPT	6		129											
H-07-18	7.5	S-3	SPT	7		64											

Table D-3 - Laboratory Test Summary

General Sample Information							Grain Size and Density Analyses							Plasticity			
Boring	Top Depth (m)	Sample Numbe	Sample Type	SPT Blow Cour	USCS	WC (%)	% Gravel	% Sand	% Fines	% Clay-size	Cu	Cc	Gs	LL	PL	Soil Description	Consolidation Test Performed
H-07-18	10.0	S-4	SPT	9		36											
H-07-18	12.5	S-5	SPT	7		72											
H-07-18	15.0	S-6	SPT	13		125											
H-07-18	17.5	S-7	SPT	2	OH	60								70	39	Organic Silt	
H-07-18	20.0	S-8	SPT	2		53											
H-07-18	25.0	S-9	SPT	3	ML	42		30	70	13			3	48	35	Sandy Silt	
H-07-18	31.0	S-10	SPT	11		34											
H-07-18	35.0	S-11	SPT	10		38											
H-07-18	40.0	S-12	SPT	12		35											
H-07-18	45.0	S-13	SPT	6		52											
H-07-18	50.0	S-14	SPT	17		42											
H-07-18	55.0	S-15	SPT	15		30											
H-07-18	60.0	S-16	SPT	6	SM	42			44							Silty Sand	
H-07-18	65.0	S-17	SPT	28		24											
H-07-18	70.0	S-18	SPT	19		29											
H-07-18	75.0	S-19	SPT	32		42											
H-07-18	80.0	S-20	SPT	32		31											
H-07-18	85.0	S-21	SPT	15	MH	44			59							Sandy Elastic Silt	
H-07-18	90.0	S-22	SPT	33	SM	28			19							Silty Sand	
H-07-18	95.0	S-23	SPT	28		30											
H-07-18	100.0	S-24	SPT	28		31											
H-07-18	105.0	S-25	SPT	32		33											
H-07-18	110.0	S-26	SPT	22		30											

Table D-3 - Laboratory Test Summary

General Sample Information							Grain Size and Density Analyses							Plasticity			
Boring	Top Depth (m)	Sample Numbe	Sample Type	SPT Blow Cour	USCS	WC (%)	% Gravel	% Sand	% Fines	% Clay-size	Cu	Cc	Gs	LL	PL	Soil Description	Consolidation Test Performed
H-07-18	115.0	S-27	SPT	10	MH	49								58	35	Elastic Silt with Sand	
H-07-18	125.0	S-29	SPT	12		51											
H-07-18	130.0	S-31	SPT	14		51											
H-07-18	135.0	S-32	SPT	13		54											
H-07-18	140.0	S-33	SPT	8		52											
H-07-18	145.0	S-34	SPT	13		52											
H-07-18	145.8	S-34	SPT	13		42											
H-07-18	150.0	S-35	SPT	26		30											
H-07-18	155.0	S-36	SPT	50/5.5"	SP-SM	9	40	49	11		72	1				Poorly Graded Sand with Silt and Gravel	
H-07-18	165.0	S-38	SPT	50/5"		10											
H-07-18	170.0	S-39	SPT	86		8											
H-07-18	175.0	S-40	SPT	50/4"		10											
H-07-18	180.0	S-41	SPT	50/3"		9											
H-08-18	5.0	S-3	3SS	4	OH	47	7	24	69	14				59	35	Organic Silt	
H-08-18	7.5	S-4	SPT	1		70											
H-08-18	10.0	S-5	SPT	1	SM	43		53*	47*							Silty Sand	
H-08-18	12.5	S-6	SPT	2		77											
H-08-18	15.0	S-7	SPT	1	OH	89								117	42	Organic Clay	
H-08-18	17.5	S-8	SPT	1		60											
H-08-18	20.0	S-9	SPT	1	MH	48			80					55	30	Elastic Silt with Sand	
H-08-18	23.6	SH-1	ST		MH	73		5	95					81	46	Elastic Silt	✓
H-08-18	25.0	S-10	SPT	1		69											
H-08-18	30.0	S-11	SPT	3		40											

Table D-3 - Laboratory Test Summary

General Sample Information							Grain Size and Density Analyses							Plasticity			
Boring	Top Depth (m)	Sample Numbe	Sample Type	SPT Blow Cour	USCS	WC (%)	% Gravel	% Sand	% Fines	% Clay-size	Cu	Cc	Gs	LL	PL	Soil Description	Consolidation Test Performed
H-08-18	35.0	S-12	SPT	1		35											
H-08-18	40.0	S-13	SPT	2		32											
H-09-18	2.5	S-1	SPT	32		19											
H-09-18	5.0	S-2	SPT	12		21											
H-09-18	7.5	S-3	SPT	4	SM	42			22							Silty Sand	
H-09-18	12.5	S-5	SPT	2		59											
H-09-18	15.0	S-6	SPT	0	OH	77								91	39	Organic Clay	
H-09-18	20.0	S-8	SPT	2	MH	59		4	96	16				59	36	Elastic Silt	
H-09-18	25.0	S-9	SPT	2		52											
H-09-18	30.0	S-10	SPT	19		35											
H-09-18	35.0	S-11	SPT	21		29											
H-09-18	40.0	S-12	SPT	21		36											
H-09-18	45.0	S-13	SPT	11		43											
H-09-18	50.0	S-14	SPT	18		34											
H-09-18	55.0	S-15	SPT	31	SP-SM	29			10							Poorly Graded Sand with Silt	
H-09-18	60.0	S-16	SPT	17		37											
H-09-18	65.0	S-17	SPT	26		33											
H-09-18	70.0	S-18	SPT	26		35											
H-09-18	75.0	S-19	SPT	22	SM	37			38							Silty Sand	
H-09-18	80.0	S-20	SPT	23		30											
H-09-18	85.0	S-21	SPT	0	MH	47								50	32	Elastic Silt	
H-09-18	90.0	S-22	SPT	4		50											
H-09-18	92.4	S-23	ST		MH	45								50	29	Elastic Silt	✓

Table D-3 - Laboratory Test Summary

General Sample Information							Grain Size and Density Analyses							Plasticity			
Boring	Top Depth (m)	Sample Numbe	Sample Type	SPT Blow Cour	USCS	WC (%)	% Gravel	% Sand	% Fines	% Clay-size	Cu	Cc	Gs	LL	PL	Soil Description	Consolidation Test Performed
H-09-18	95.0	S-24	SPT	11		45											
H-09-18	100.0	S-25	SPT	16		42											
H-09-18	105.0	S-26	SPT	7		71											
H-09-18	105.7	S-26	SPT	7		66											
H-09-18	110.0	S-27	SPT	0	MH	54								79	39	Elastic Silt	
H-09-18	115.0	S-28	SPT	2		67											
H-09-18	120.0	S-29	SPT	6		89											
H-09-18	125.0	S-30	SPT	0		56											
H-09-18	130.0	S-31	SPT	6		70											
H-09-18	135.0	S-32	SPT	2		44											
H-09-18	140.0	S-33	SPT	5		39											
H-09-18	145.0	S-34	SPT	13		40											
H-09-18	150.0	S-35	SPT	39		9											
H-09-18	155.0	S-36	SPT	88		50											
H-09-18	155.9	S-36	SPT	88		9											
H-09-18	160.0	S-37	SPT	54		10											
H-09-18	165.0	S-38	SPT	73		9											
H-09-18	170.0	S-39	SPT	50/5"		7											
H-09-18	175.0	S-40	SPT	50/4"		7											
H-09-18	180.0	S-41	SPT	90/11"		9											
OB-01-18	0.0	S-1	SPT	40		8											
OB-01-18	2.5	S-2	SPT	75	GW-GM	11	58*	35*	7.4*		70	3				Well-Graded Gravel with Silt and Sand	
OB-01-18	7.5	S-4	SPT	4	ML	60	0	33	66	18			3			Sandy Silt	

Table D-3 - Laboratory Test Summary

General Sample Information							Grain Size and Density Analyses							Plasticity			
Boring	Top Depth (m)	Sample Numbe	Sample Type	SPT Blow Cour	USCS	WC (%)	% Gravel	% Sand	% Fines	% Clay-size	Cu	Cc	Gs	LL	PL	Soil Description	Consolidation Test Performed
OB-01-18	10.0	S-5	SPT	2		68											
OB-01-18	12.5	S-6	SPT	5		63											
OB-01-18	15.0	S-7	SPT	1	OH	94								126	51	Organic Silt	
OB-01-18	17.5	S-8	SPT	1		60											
OB-01-18	20.0	S-9	SPT	1		52											
OB-01-18	25.0	S-10	SPT	1		60											
OB-01-18	30.0	S-11	SPT	10		39											
OB-01-18	35.0	S-12	SPT	3	ML	47			59							Sandy Silt	
OB-02-18	0.0	S-1	SPT	5	GW	10	64	35	2		7	2				Well-Graded Gravel with Sand	
OB-02-18	2.5	S-2	SPT	11		32											
OB-02-18	5.0	S-3	SPT	10	SM	31		66	34	8						Silty Sand	
OB-02-18	7.5	S-4	SPT	3		52											
OB-02-18	10.0	S-5	SPT	3		47											
OB-02-18	12.5	S-6	SPT	1		71											
OB-02-18	15.0	S-7	SPT	4	CH	58		6	94	19				61	29	Fat Clay	
OB-02-18	17.5	S-8	SPT	2		53											
OB-02-18	20.0	S-9	SPT	1		62											

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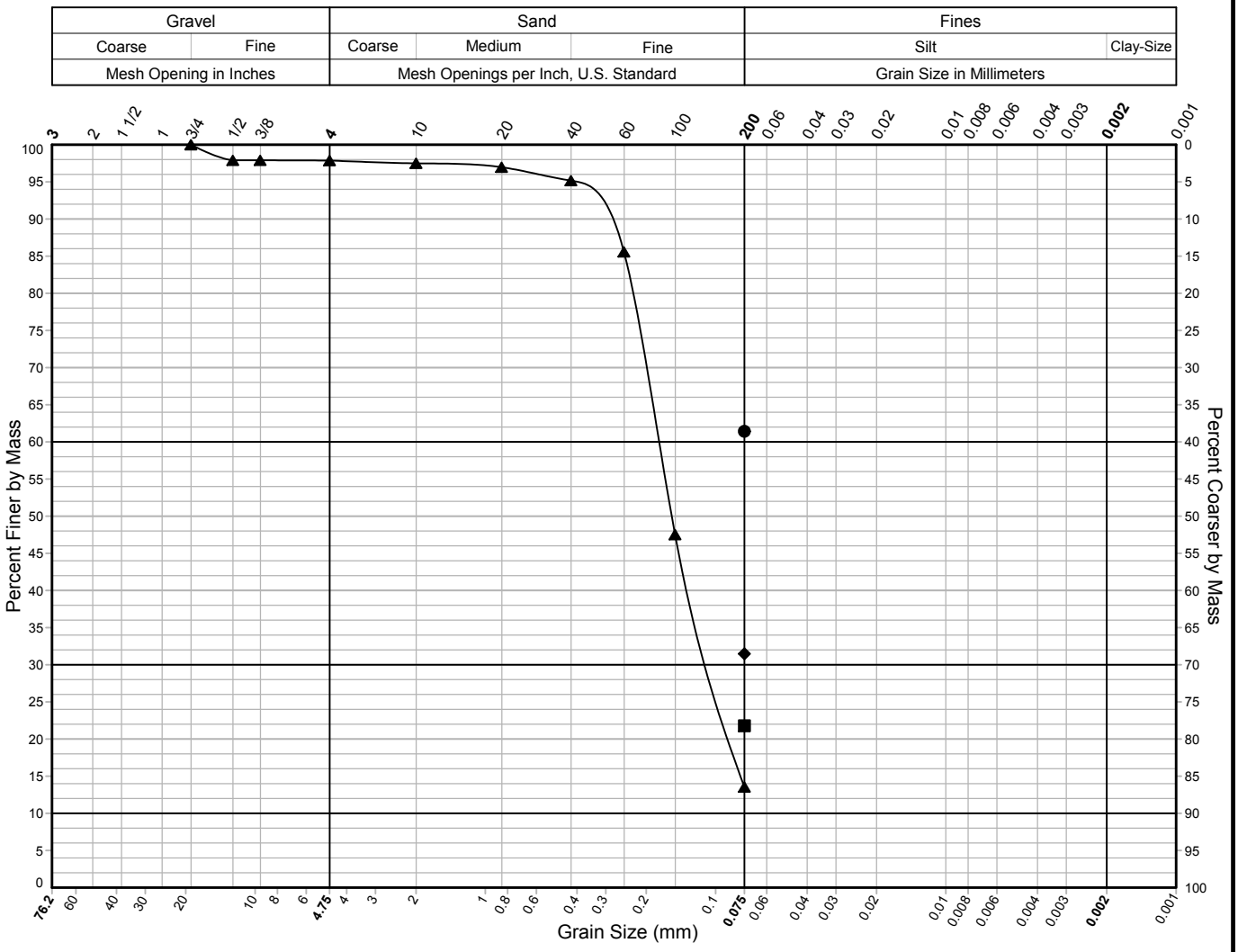
GRAIN SIZE DISTRIBUTION PLOT

Potash Export Facility
Grays Harbor
Hoquiam, Washington

BORING H-01-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	Gravel %	Sand %	Fines %	< 20µm %	< 2µm %	WC %	Tested By	Review By	ASTM Std.
● H-01-18, S-9*	25.0	ML/MH	Sandy Silt			61			47.0	AKV	AKV	D1140
■ H-01-18, S-13*	45.0	SM	Silty Sand			22			38.5	AKV	AKV	D1140
▲ H-01-18, S-18*	70.0	SM	Silty Sand	2	84	14			27.3	AKV	AKV	C136
◆ H-01-18, S-21	85.0	SM	Silty Sand			31			36.7	AKV	AKV	D1140

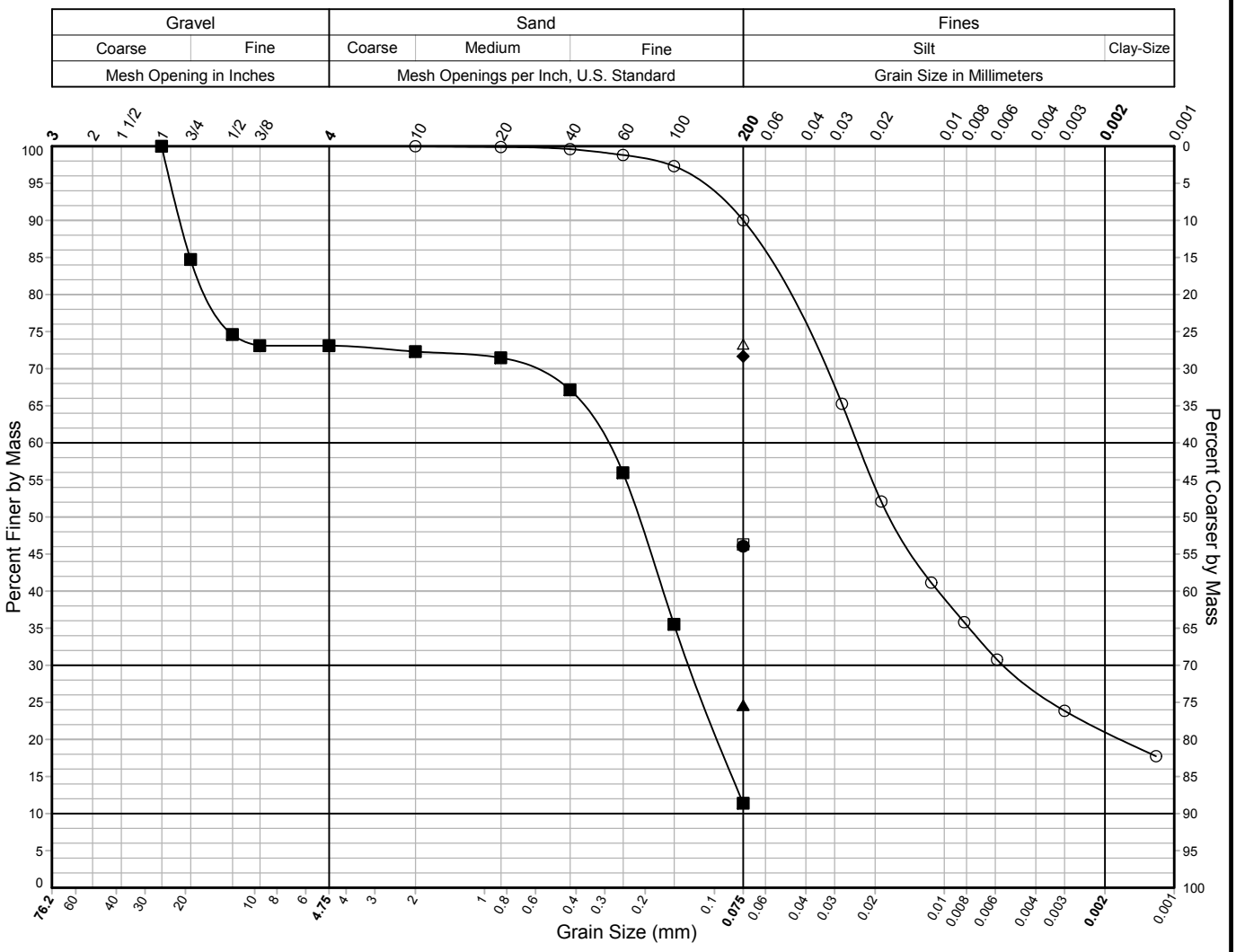
* *Test specimen did not meet minimum mass recommendations.*

SHANNON & WILSON, INC.

GRAIN SIZE DISTRIBUTION PLOT

Potash Export Facility
Grays Harbor
Hoquiam, Washington

BORING H-02-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	Gravel %	Sand %	Fines %	< 20µm %	< 2µm %	WC %	Tested By	Review By	ASTM Std.
● H-02-18, S-4	10.0	SM	Silty Sand			46			38.1	AKV	AKV	D1140
■ H-02-18, S-5*	12.5	SP-SM	Poorly Graded Sand with Silt and Gravel	27	62	11			18.0	AKV	AKV	C136
▲ H-02-18, S-8	20.0	SM	Silty Sand			25			32.0	AKV	AKV	D1140
◆ H-02-18, S-10	27.0	ML	Silt with Sand			72			45.2	AKV	AKV	D1140
○ H-02-18, S-16A	55.0	MH	Elastic Silt		10	90	54	21	55.5	MXC	AKV	D422
□ H-02-18, S-23	90.0	SM	Silty Sand			46			35.1	AKV	AKV	D1140
△ H-02-18, S-34	140.0	ML	Silt with Sand			73			40.4	AKV	AKV	D1140

* *Test specimen did not meet minimum mass recommendations.*

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GRAIN SIZE DISTRIBUTION PLOT

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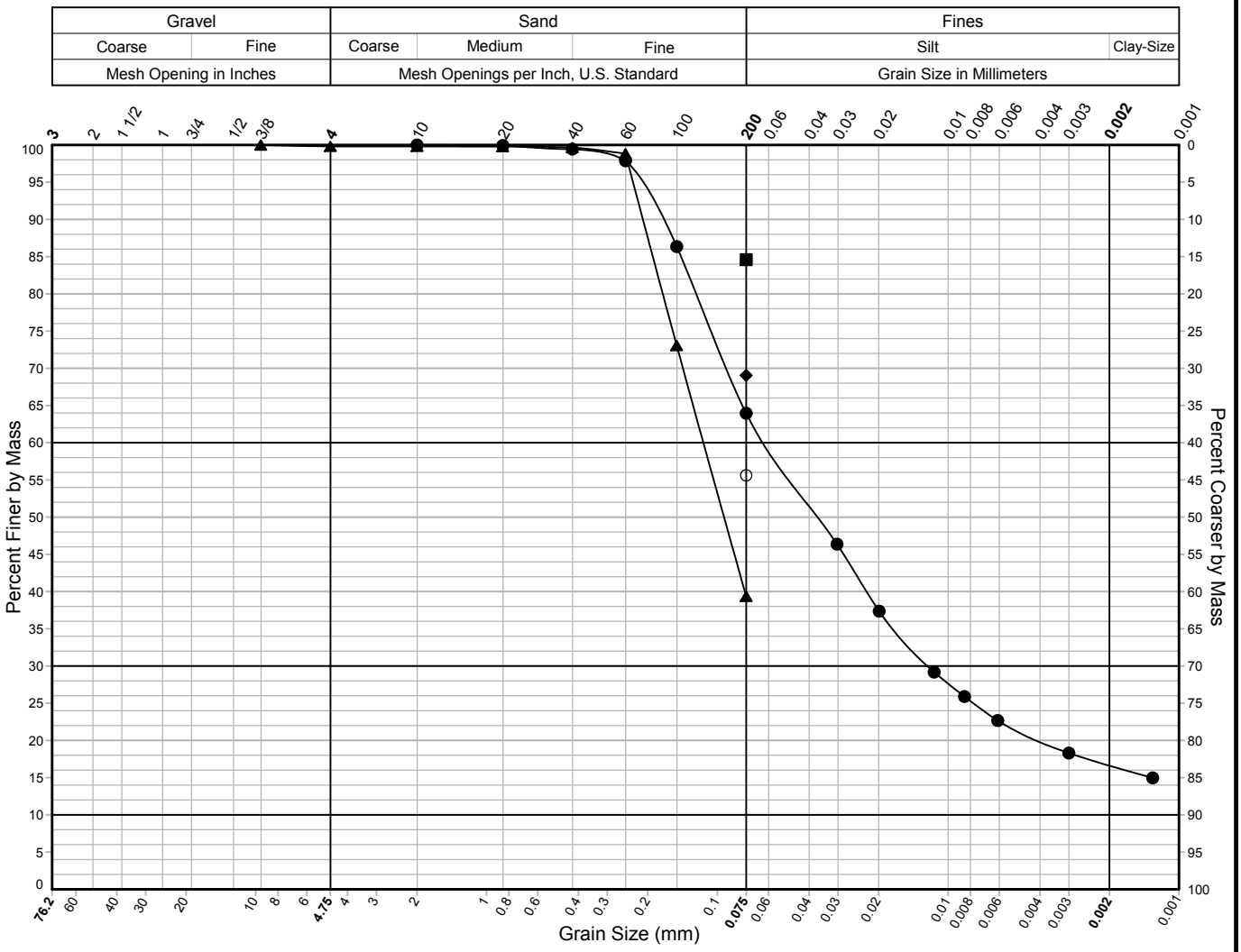
Grays Harbor
Hoquiam, Washington

BORING H-03-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	Gravel %	Sand %	Fines %	< 20µm %	< 2µm %	WC %	Tested By	Review By	ASTM Std.
● H-03-18, S-4	15.0	MH	Sandy Elastic Silt		36	64	37	17	50.9	MXC	AKV	D422
■ H-03-18, S-6	25.0	ML	Silt with Sand			85			54.0	AKV	AKV	D1140
▲ H-03-18, S-8*	35.0	SM	Silty Sand	0	60	39			40.1	AKV	AKV	C136
◆ H-03-18, S-11	50.0	ML	Sandy Silt			69			48.0	AKV	AKV	D1140
○ H-03-18, S-24	110.0	ML	Sandy Silt			56			37.4	AKV	AKV	D1140

* *Test specimen did not meet minimum mass recommendations.*

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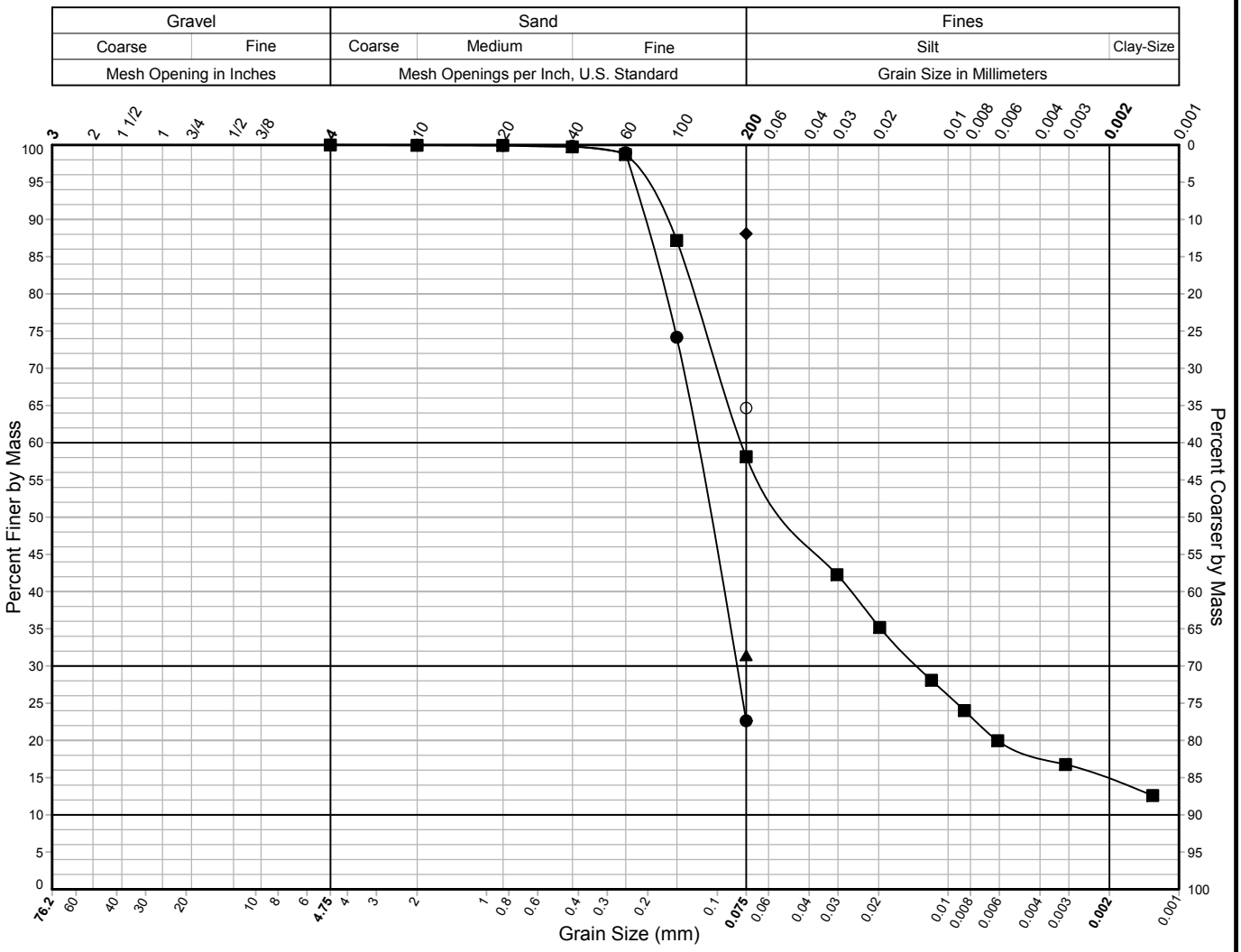
GRAIN SIZE DISTRIBUTION PLOT

Potash Export Facility
Grays Harbor
Hoquiam, Washington

BORING H-04-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	Gravel %	Sand %	Fines %	< 20µm %	< 2µm %	WC %	Tested By	Review By	ASTM Std.
● H-04-18, S-5*	10.0	SM	Silty Sand		77	23			32.1	AKV	AKV	C136
■ H-04-18, S-7	15.0	ML	Sandy Silt		42	58	35	15	43.7	MXC	AKV	D422
▲ H-04-18, S-10	28.5	SM	Silty Sand			31			29.1	AKV	AKV	D1140
◆ H-04-18, S-14	42.5	MH	Elastic Silt			88			54.4	AKV	AKV	D1140
○ H-04-18, S-22	83.5	ML	Sandy Silt			65			38.5	AKV	AKV	D1140

* *Test specimen did not meet minimum mass recommendations.*

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GRAIN SIZE DISTRIBUTION PLOT

Potash Export Facility
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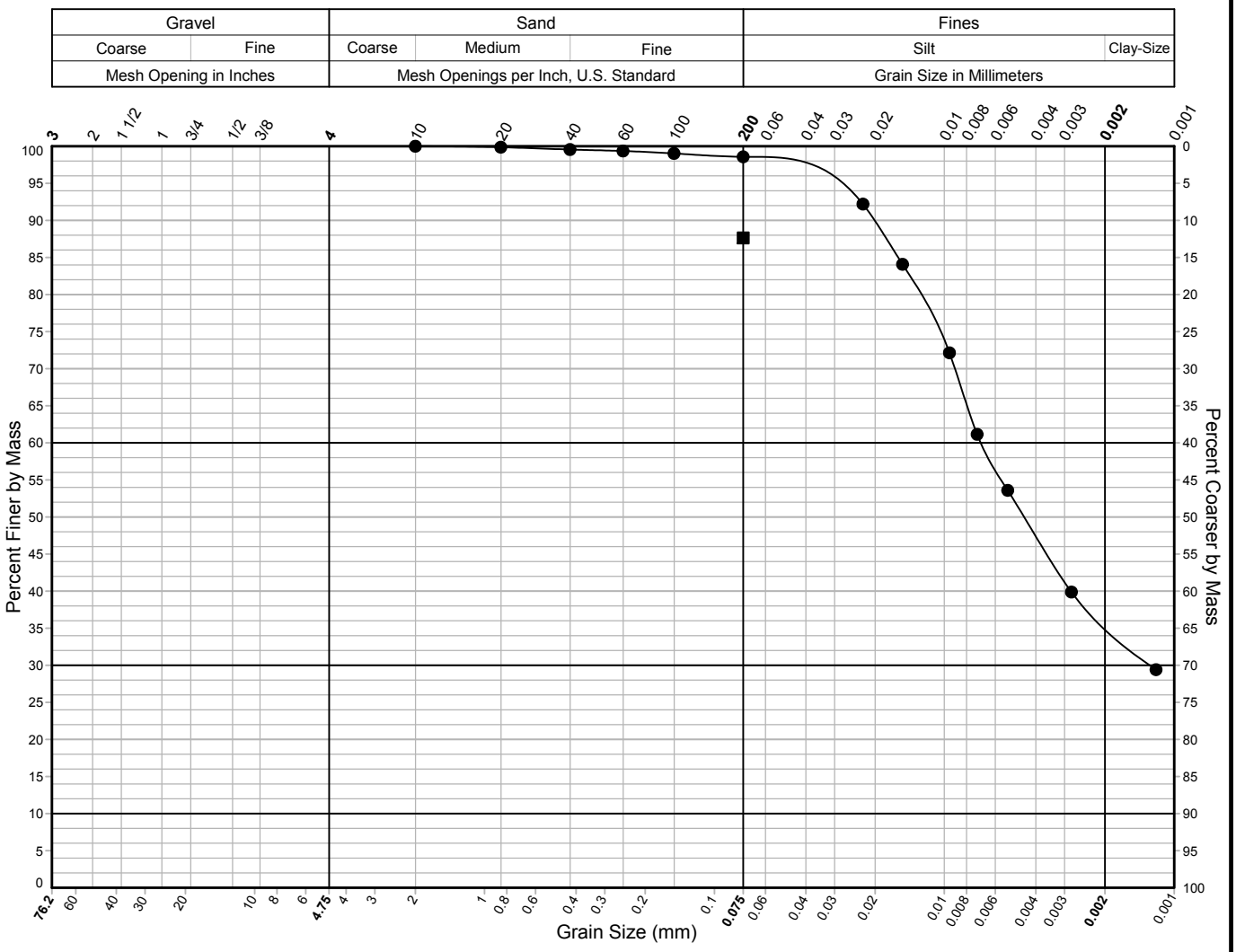
Hoquiam, Washington

BORING H-05-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	Gravel %	Sand %	Fines %	< 20µm %	< 2µm %	WC %	Tested By	Review By	ASTM Std.
● H-05-18, S-15	63.5	MH	Elastic Silt		1	99	90	36	66.7	MXC	AKV	D422
■ H-05-18, S-21	93.5	MH	Elastic Silt			88			47.8	AKV	AKV	D1140

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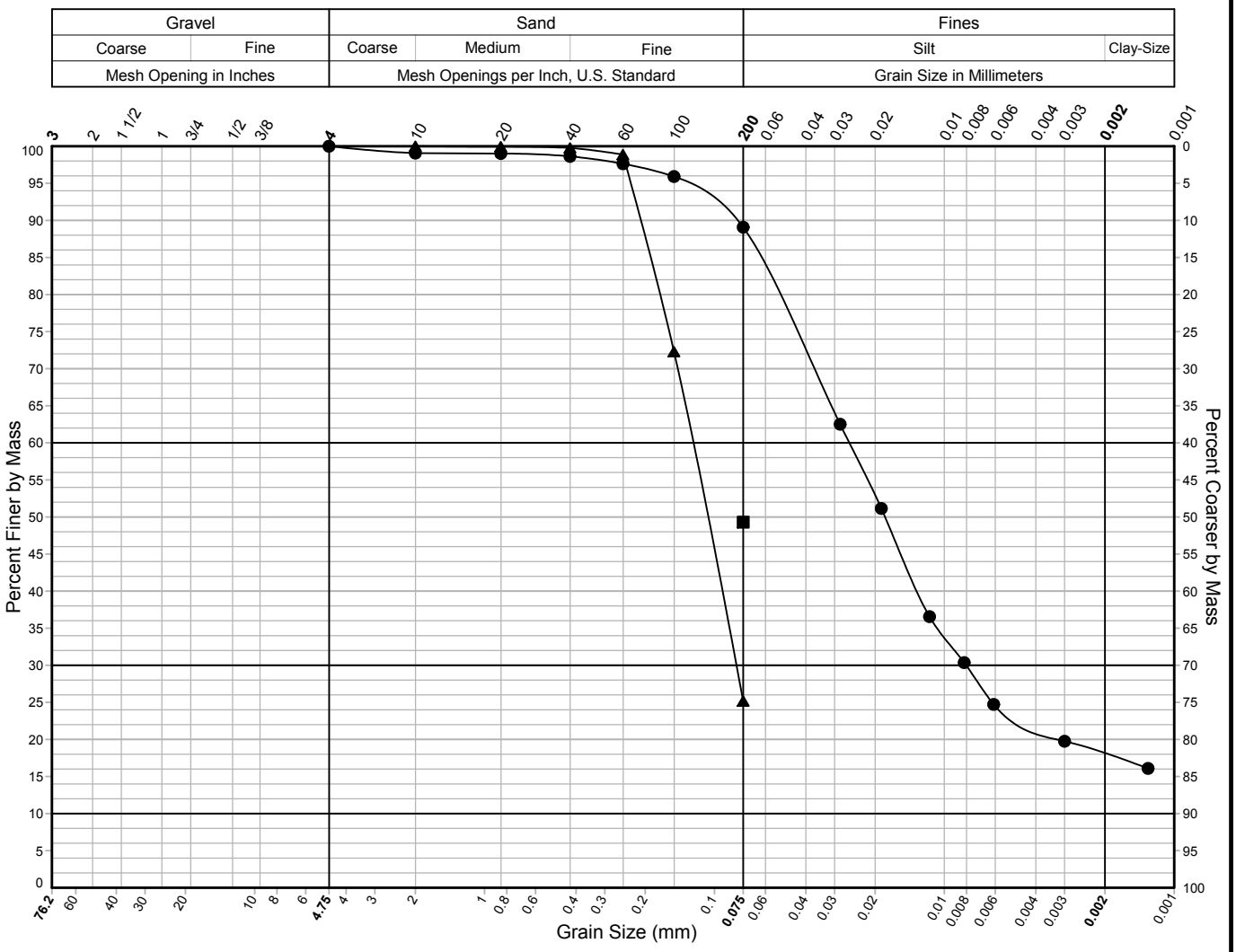
GRAIN SIZE DISTRIBUTION PLOT

Potash Export Facility
Grays Harbor
Hoquiam, Washington

BORING H-06-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	Gravel %	Sand %	Fines %	< 20µm %	< 2µm %	WC %	Tested By	Review By	ASTM Std.
● H-06-18, S-8	17.5	MH	Elastic Silt		11	89	53	18	60.6	MXC	AKV	D422
■ H-06-18, S-10	25.0	SM	Silty Sand			49			64.3	AKV	AKV	D1140
▲ H-06-18, S-12*	35.0	SM	Silty Sand		75	25			35.2	AKV	AKV	C136

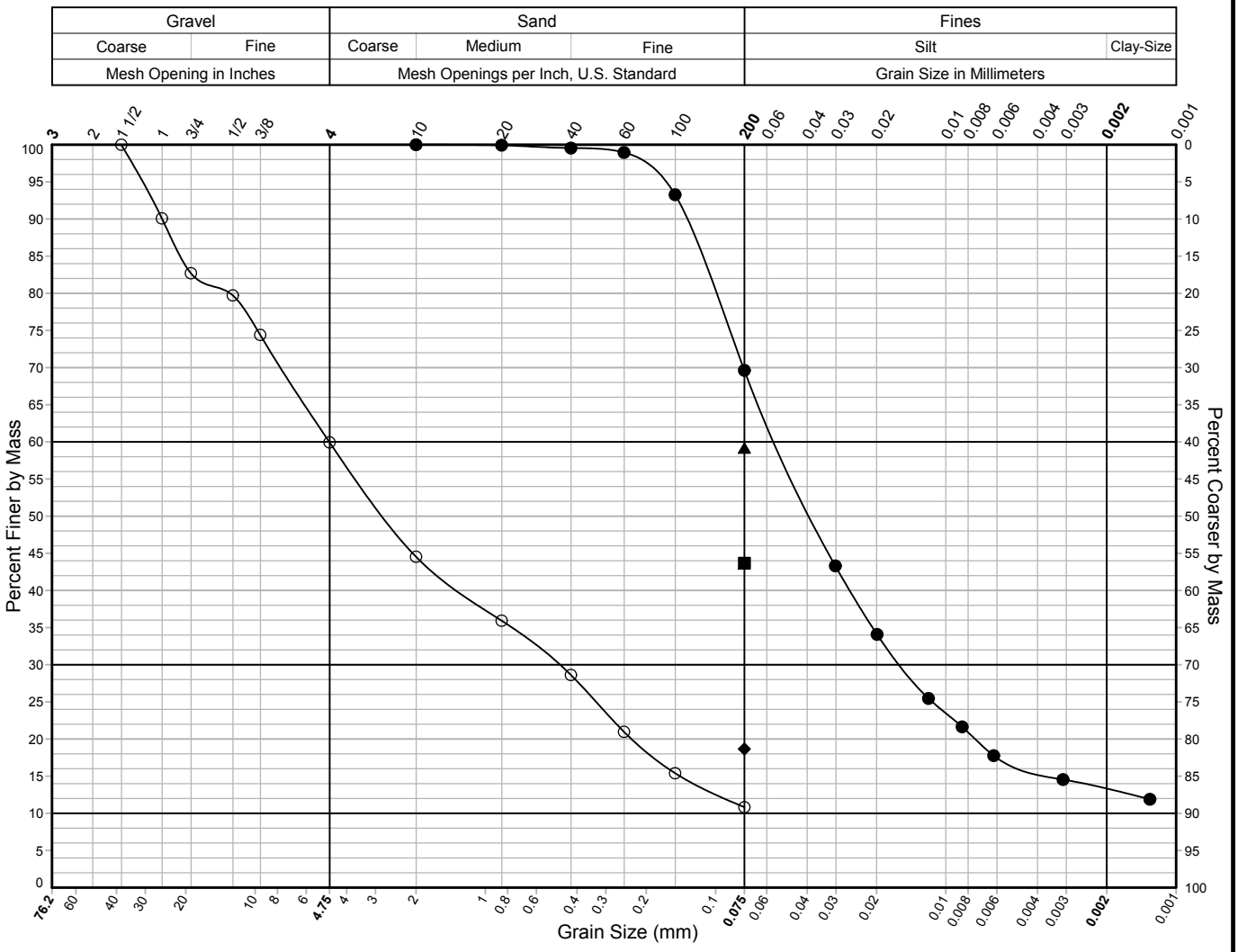
* *Test specimen did not meet minimum mass recommendations.*

SHANNON & WILSON, INC.

GRAIN SIZE DISTRIBUTION PLOT

Potash Export Facility
Grays Harbor
Hoquiam, Washington

BORING H-07-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	Gravel %	Sand %	Fines %	< 20µm %	< 2µm %	WC %	Tested By	Review By	ASTM Std.
● H-07-18, S-9	25.0	ML	Sandy Silt		30	70	34	13	42.3	MXC	AKV	D422
■ H-07-18, S-16	60.0	SM	Silty Sand			44			41.8	AKV	AKV	D1140
▲ H-07-18, S-21	85.0	MH	Sandy Elastic Silt			59			43.9	AKV	AKV	D1140
◆ H-07-18, S-22	90.0	SM	Silty Sand			19			28.2	AKV	AKV	D1140
○ H-07-18, S-36*	155.0	SP-SM	Poorly Graded Sand with Silt and Gravel	40	49	11			8.6	AKV	AKV	C136

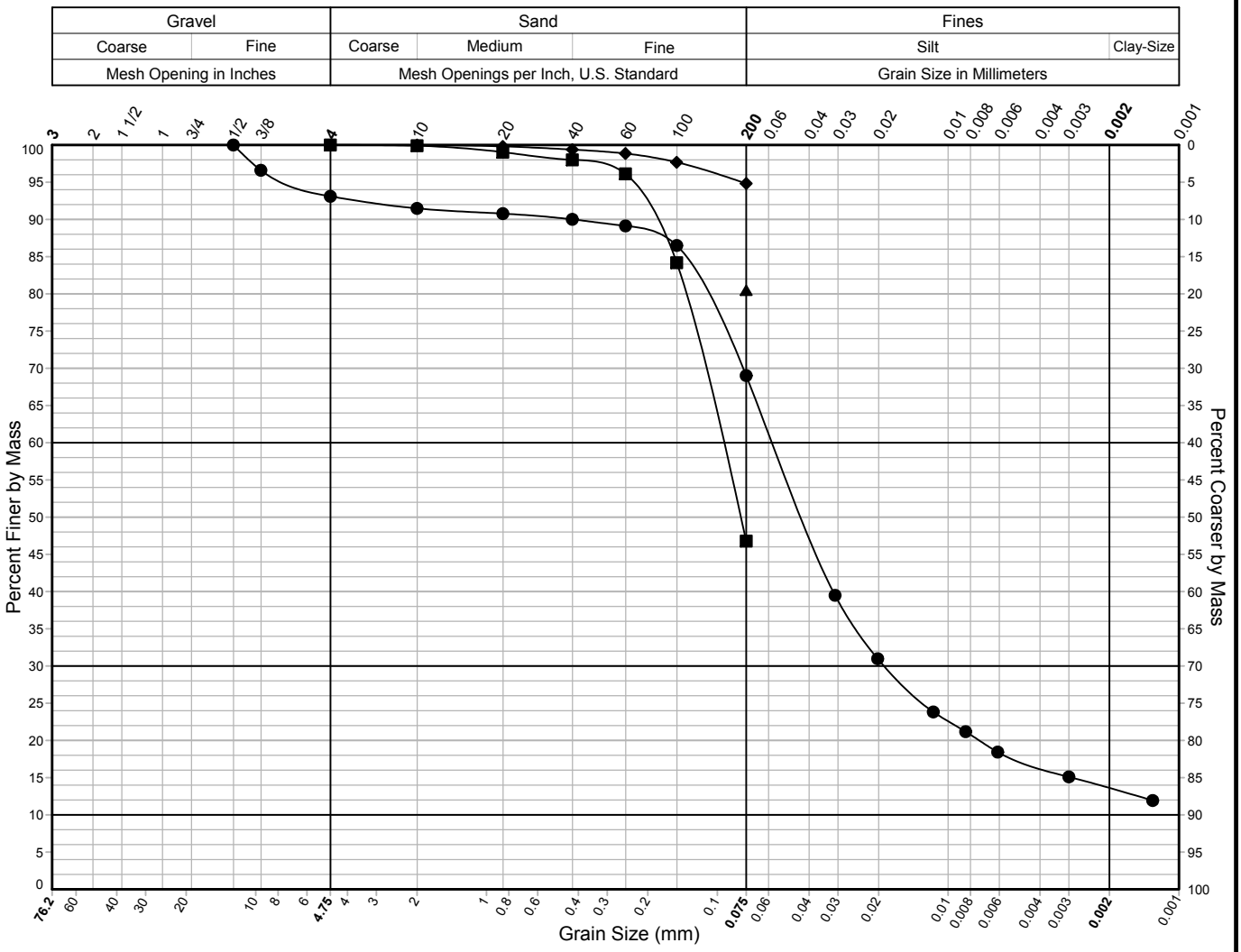
* *Test specimen did not meet minimum mass recommendations.*

SHANNON & WILSON, INC.

GRAIN SIZE DISTRIBUTION PLOT

Potash Export Facility
Grays Harbor
Hoquiam, Washington

BORING H-08-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	Gravel %	Sand %	Fines %	< 20µm %	< 2µm %	WC %	Tested By	Review By	ASTM Std.
● H-08-18, S-3*	5.0	OH	Organic Silt	7	24	69	31	14	47.1	MXC	AKV	D422
■ H-08-18, S-5*	10.0	SM	Silty Sand		53	47			42.9	AKV	AKV	C136
▲ H-08-18, S-9	20.0	MH	Elastic Silt with Sand			80			48.5	AKV	AKV	D1140
◆ H-08-18, SH-1*	23.6	MH	Elastic Silt		5	95			73.0	AKV	AKV	C136

* *Test specimen did not meet minimum mass recommendations.*

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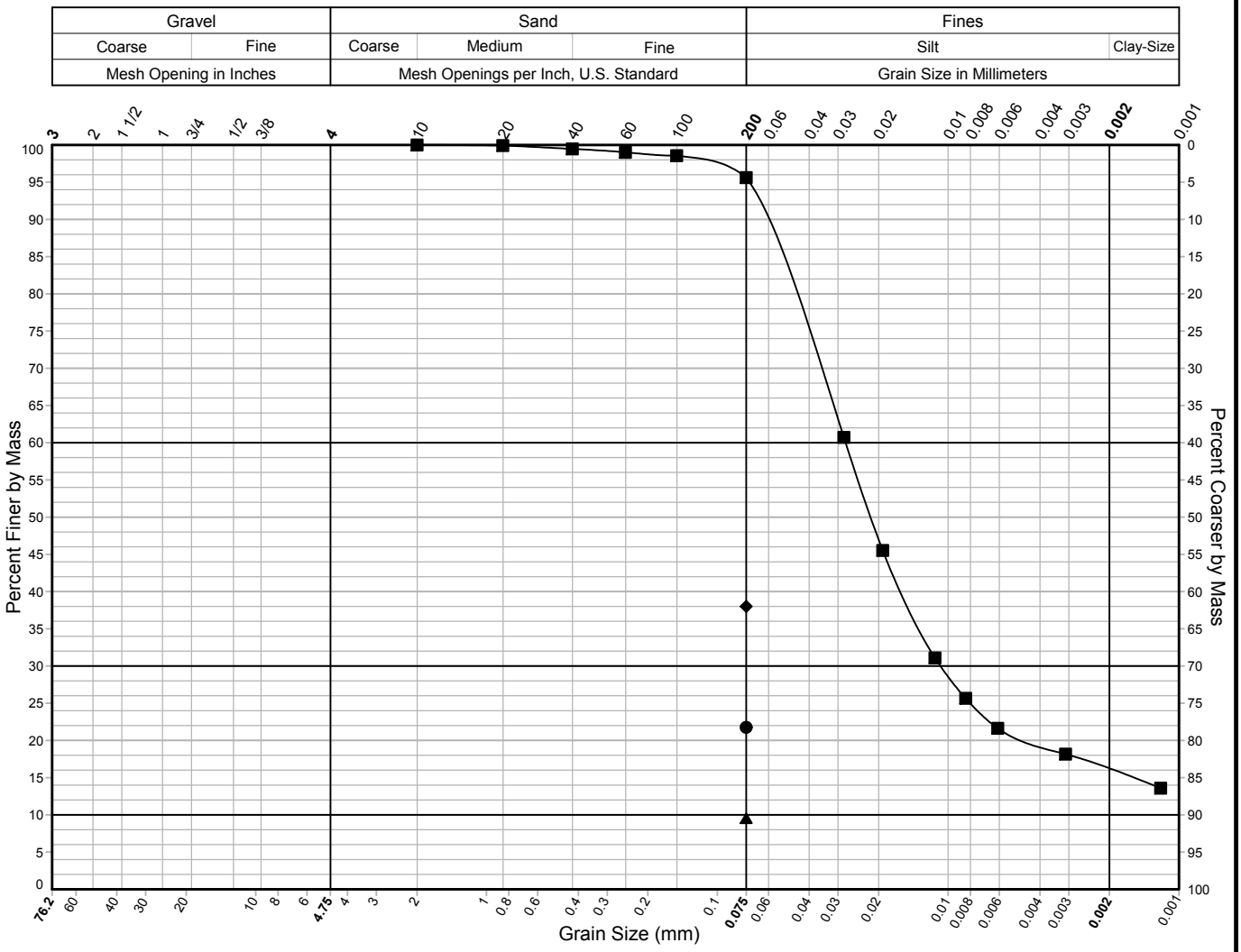
GRAIN SIZE DISTRIBUTION PLOT

Potash Export Facility
Grays Harbor
Hoquiam, Washington

BORING H-09-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	Gravel %	Sand %	Fines %	< 20µm %	< 2µm %	WC %	Tested By	Review By	ASTM Std.
● H-09-18, S-3*	7.5	SM	Silty Sand			22			42.2	AKV	AKV	D1140
■ H-09-18, S-8	20.0	MH	Elastic Silt		4	96	47	16	59.0	MXC	AKV	D422
▲ H-09-18, S-15	55.0	SP-SM	Poorly Graded Sand with Silt			9.5			29.5	AKV	AKV	D1140
◆ H-09-18, S-19	75.0	SM	Silty Sand			38			36.5	AKV	AKV	D1140

* *Test specimen did not meet minimum mass recommendations.*

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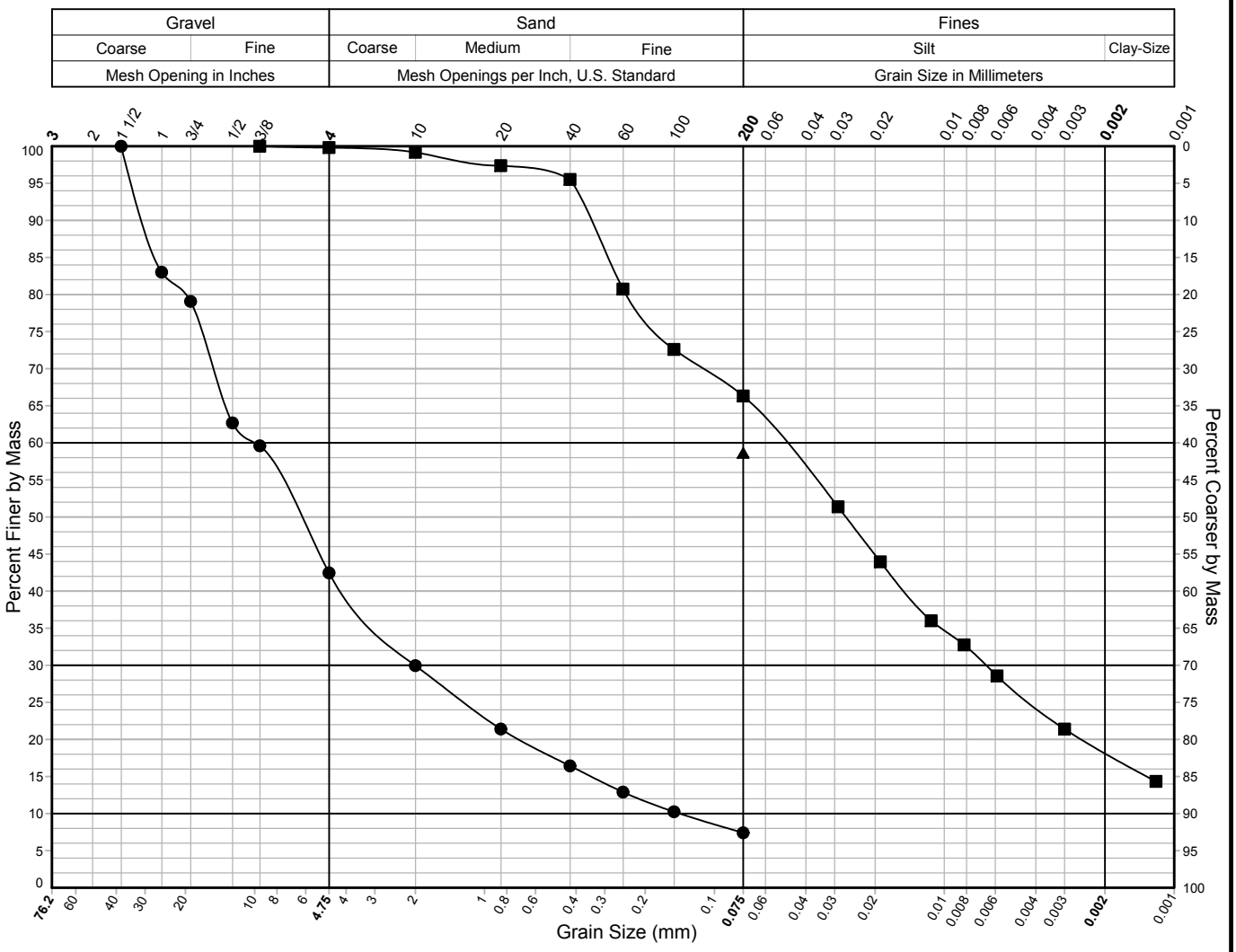
GRAIN SIZE DISTRIBUTION PLOT

Potash Export Facility
Grays Harbor
Hoquiam, Washington

BORING OB-01-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	Gravel %	Sand %	Fines %	< 20µm %	< 2µm %	WC %	Tested By	Review By	ASTM Std.
● OB-01-18, S-2*	2.5	GW-GM	Well-Graded Gravel with Silt and Sand	58	35	7.4			10.8	AKV	AKV	C136
■ OB-01-18, S-4*	7.5	ML	Sandy Silt	0	33	66	45	18	59.8	MXC	AKV	D422
▲ OB-01-18, S-12	35.0	ML	Sandy Silt			59			47.2	AKV	AKV	D1140

* *Test specimen did not meet minimum mass recommendations.*

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GRAIN SIZE DISTRIBUTION PLOT

Potash Export Facility
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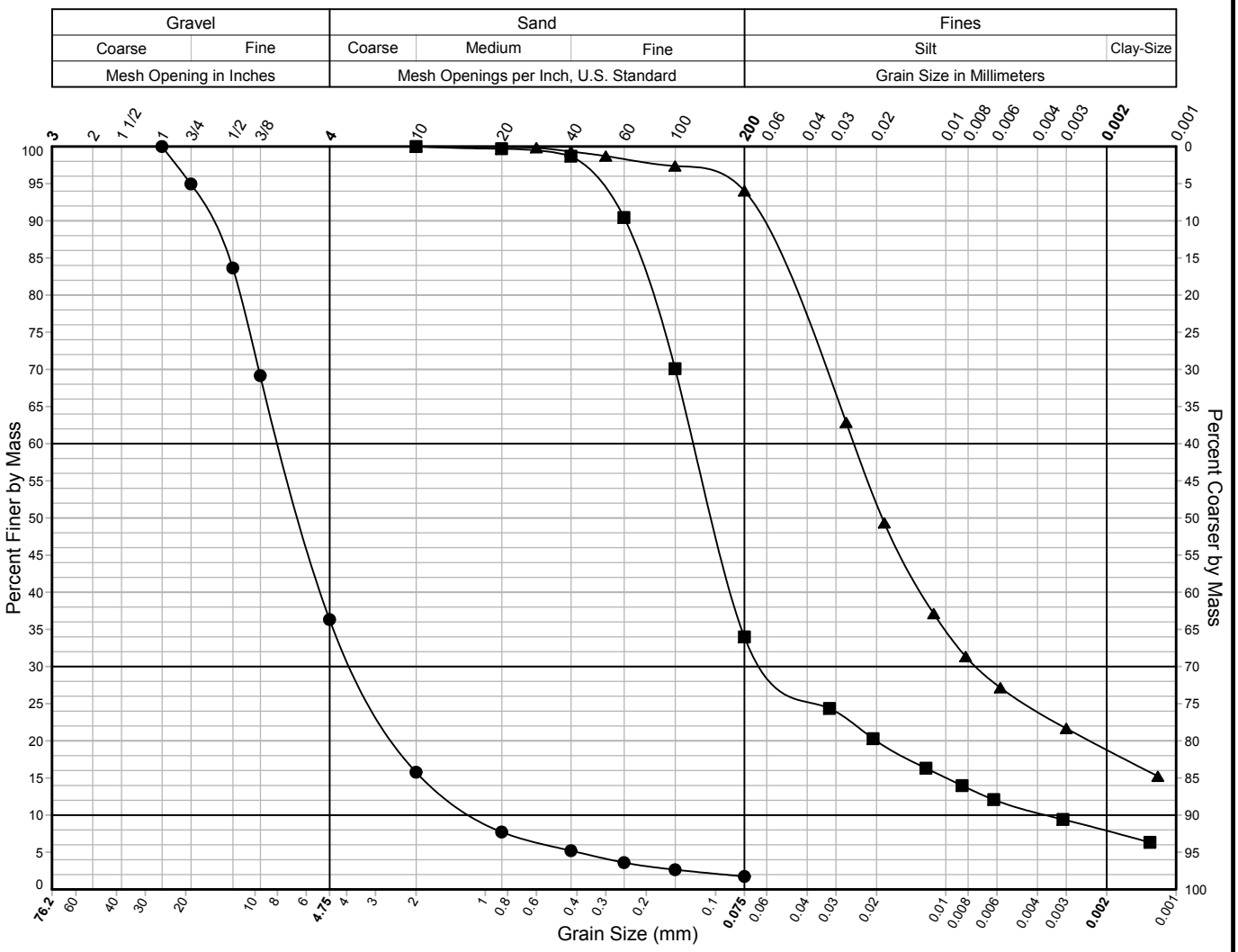
Hoquiam, Washington

BORING OB-02-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	Gravel %	Sand %	Fines %	< 20µm %	< 2µm %	WC %	Tested By	Review By	ASTM Std.
● OB-02-18, S-1*	0.0	GW	Well-Graded Gravel with Sand	64	35	1.7			10.5	AKV	AKV	C136
■ OB-02-18, S-3	5.0	SM	Silty Sand		66	34	20	8	31.1	MXC	AKV	D422
▲ OB-02-18, S-7	15.0	CH	Fat Clay		6	94	52	19	58.0	MXC	AKV	D422

* *Test specimen did not meet minimum mass recommendations.*

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PLASTICITY CHART

Potash Export Facility
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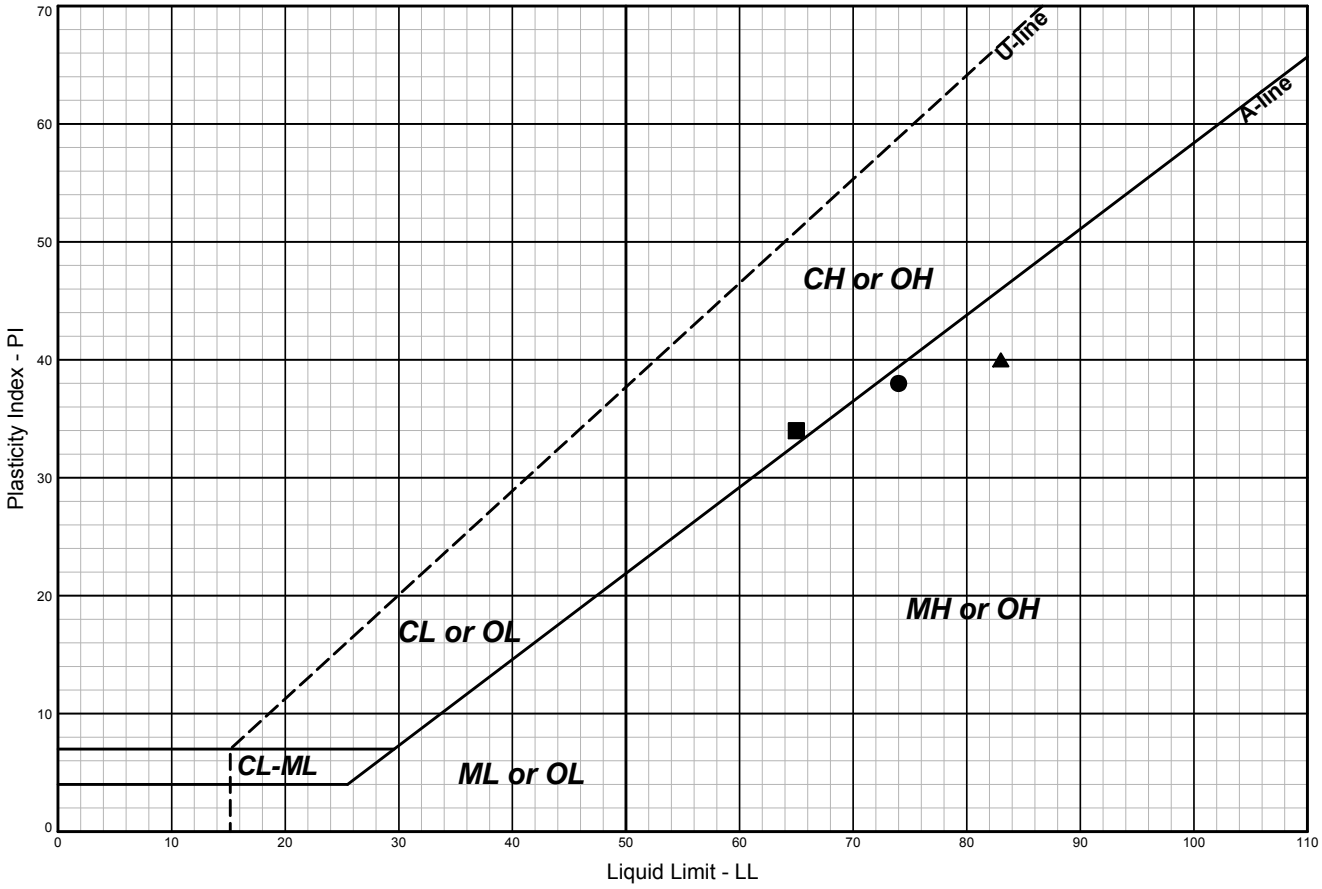
BORING H-01-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	LL	PL	PI	OLL	OLL/ LL	WC %	Gravel %	Sand %	Fines %	< 2µm %	Tested By	Review By	ASTM Std.
● H-01-18, S-7	18.0	OH	Organic Silt	74	36	38	51	0.69	61.1					AKV	AKV	D4318
■ H-01-18, S-29	123.1	CH	Fat Clay	65	31	34			55.7					AKV	AKV	D4318
▲ H-01-18, S-34	145.0	OH	Organic Silt	83	43	40	54	0.65	58.7					AKV	AKV	D4318

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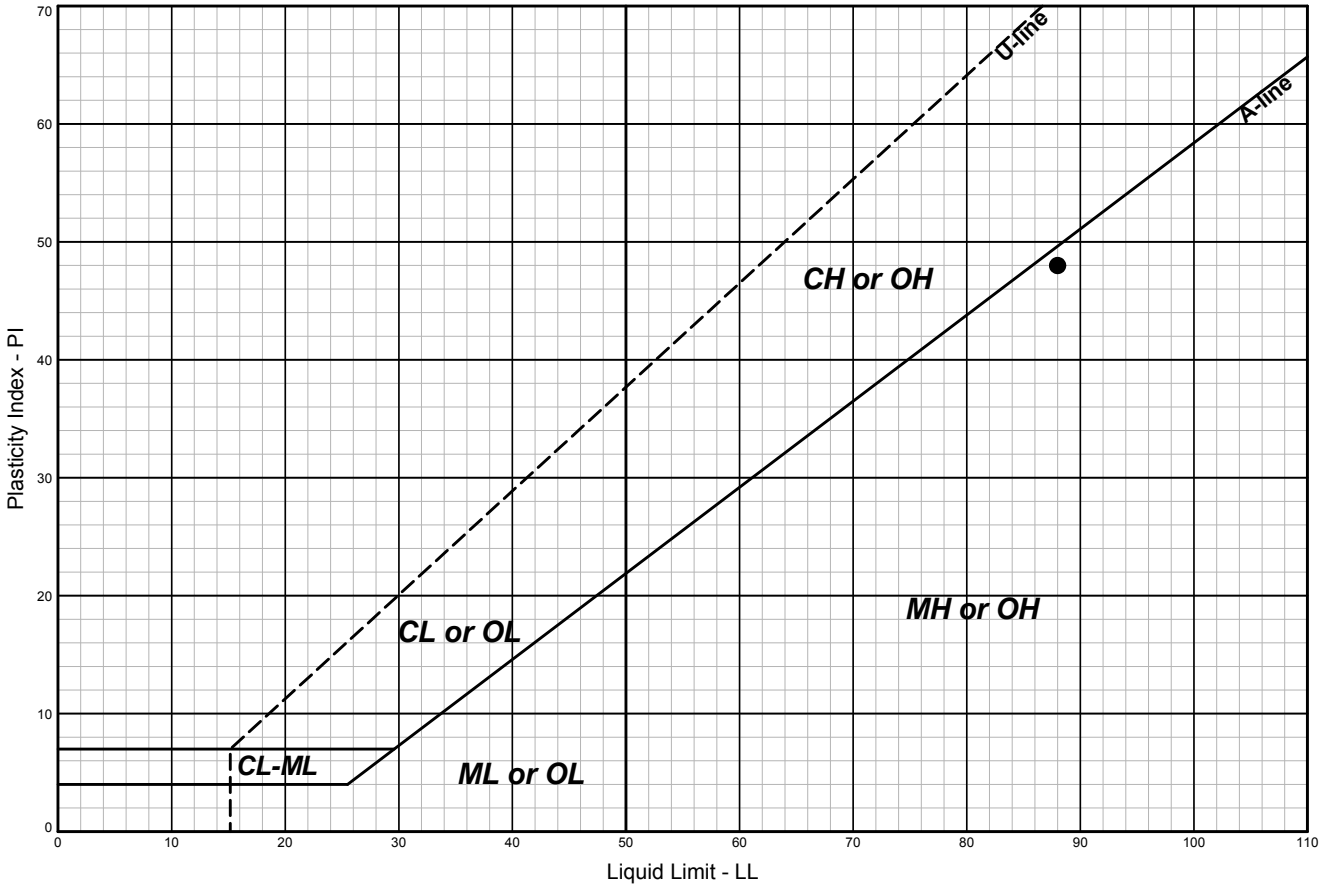
Hoquiam, Washington

BORING H-01A-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	LL	PL	PI	WC %	Gravel %	Sand %	Fines %	< 2µm %	Tested By	Review By	ASTM Std.
● H-01A-18, S-2	13.7	MH	Elastic Silt	88	40	48	67.7					AKV	AKV	D4318

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PLASTICITY CHART

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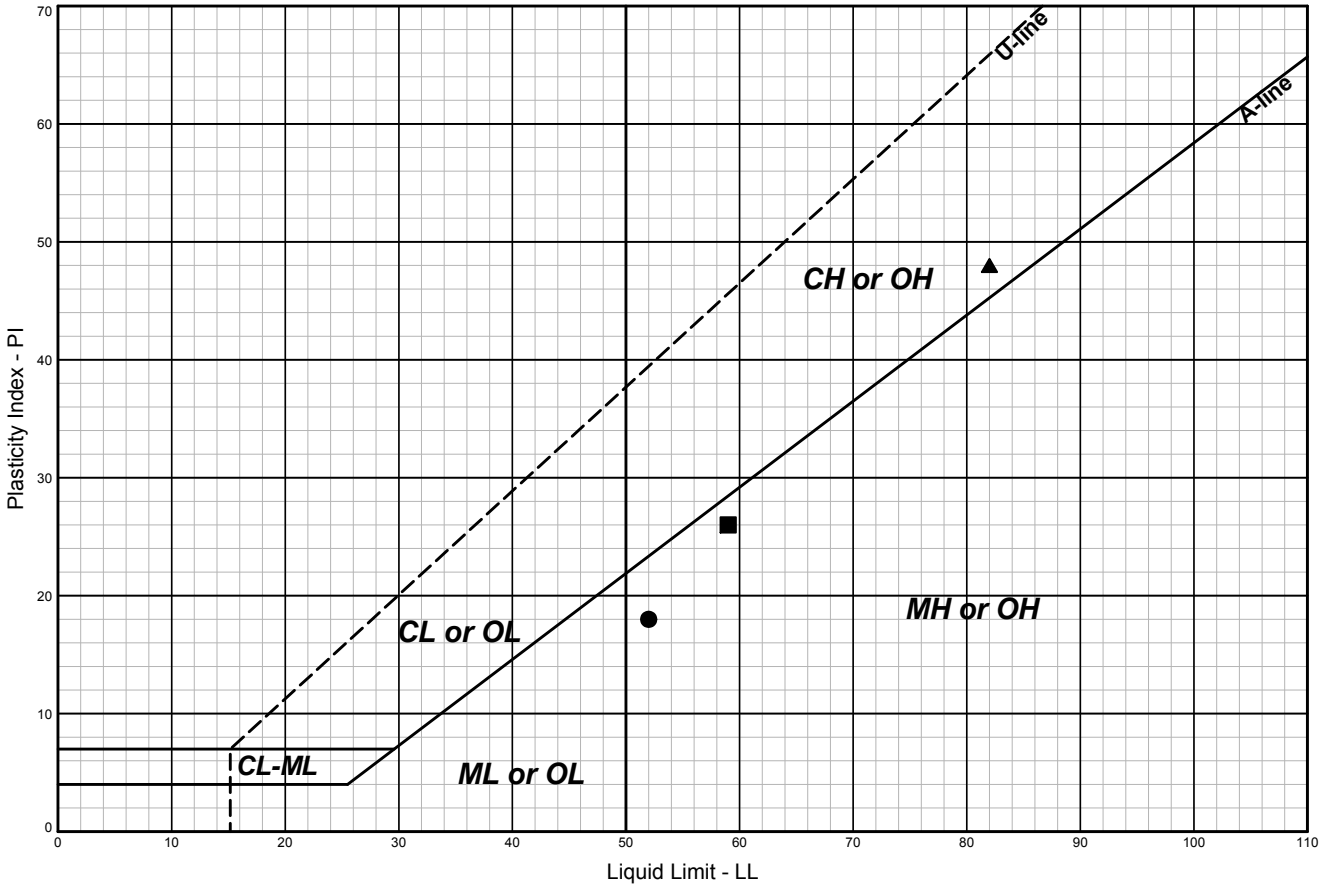
BORING H-02-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	LL	PL	PI	OLL	OLL/ LL	WC %	Gravel %	Sand %	Fines %	< 2µm %	Tested By	Review By	ASTM Std.
● H-02-18, S-9	25.0	MH	Elastic Silt	52	34	18	47	0.90	49.9					AKV	AKV	D4318
■ H-02-18, S-16A	55.0	MH	Elastic Silt	59	33	26			55.5		10	90	21	AKV	AKV	D4318
▲ H-02-18, S-27	110.0	CH	Fat Clay	82	34	48			57.4					AKV	AKV	D4318

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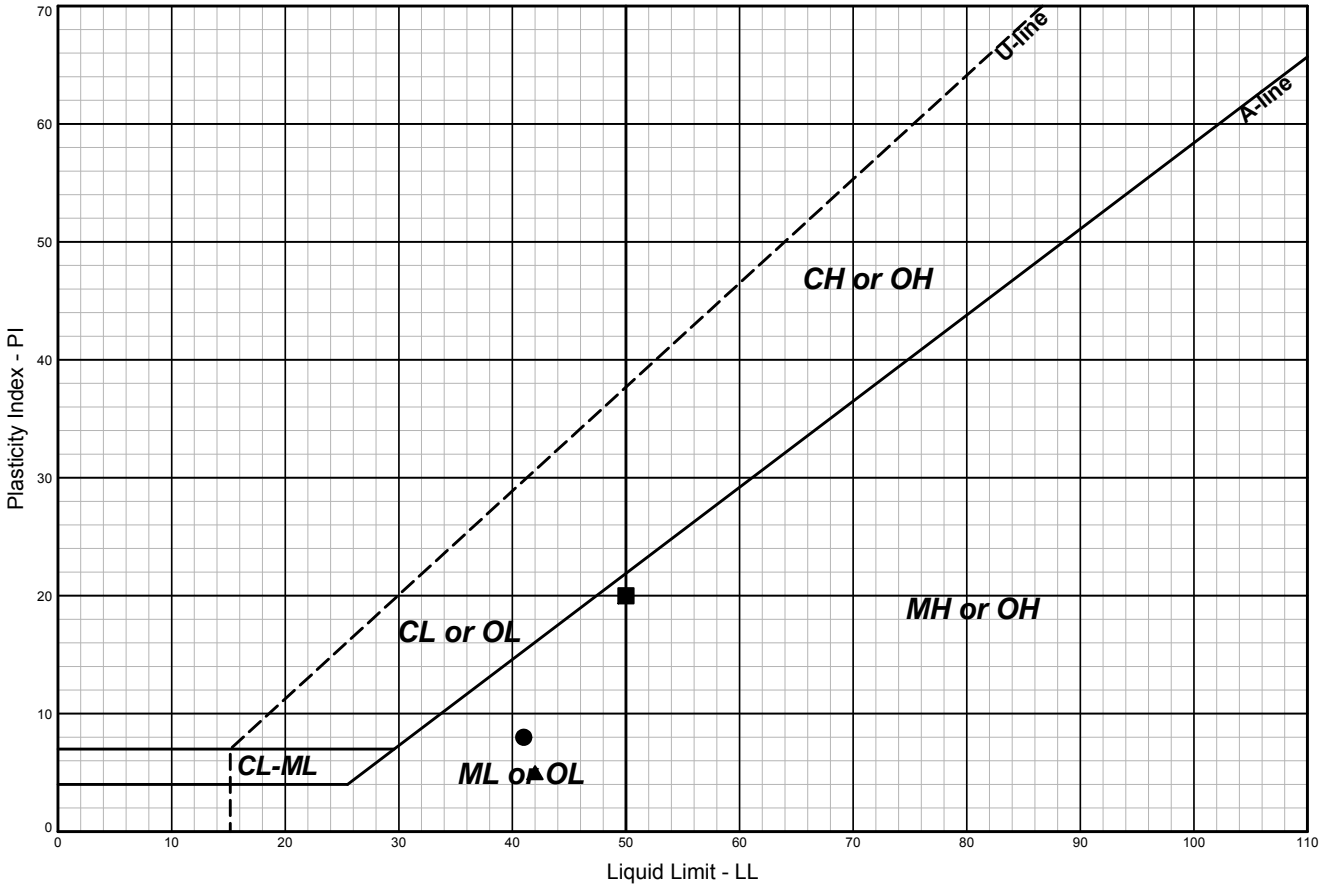
BORING H-03-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	LL	PL	PI	WC %	Gravel %	Sand %	Fines %	< 2µm %	Tested By	Review By	ASTM Std.
● H-03-18, S-2	5.0	ML	Silt with Sand	41	33	8	40.8					AKV	AKV	D4318
■ H-03-18, S-4	15.0	MH	Sandy Elastic Silt	50	30	20	50.9		36	64	17	AKV	AKV	D4318
▲ H-03-18, S-11	50.0	ML	Sandy Silt	42	37	5	48.0			69		AKV	AKV	D4318

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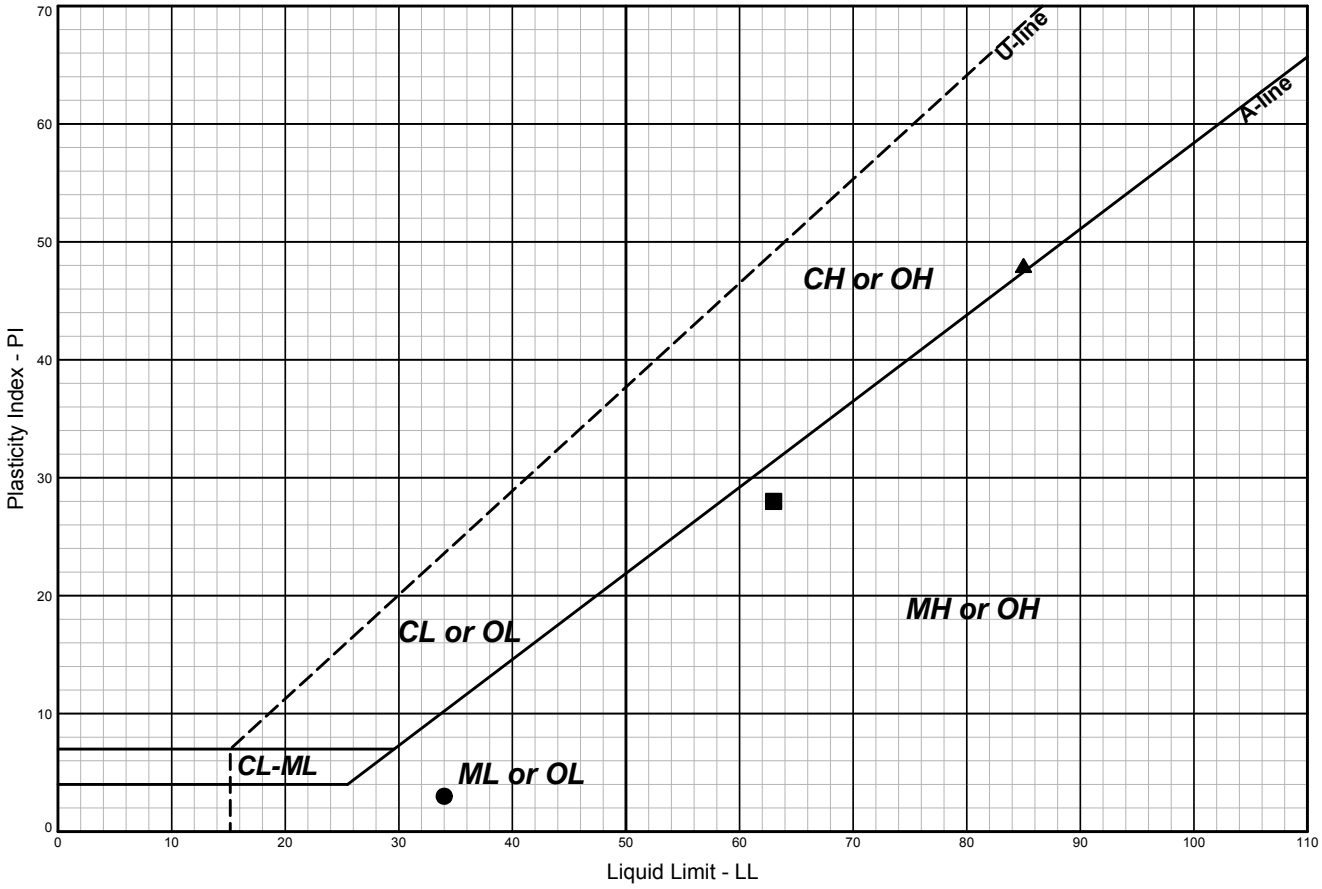
BORING H-04-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	LL	PL	PI	WC %	Gravel %	Sand %	Fines %	< 2µm %	Tested By	Review By	ASTM Std.
● H-04-18, S-7	15.0	ML	Sandy Silt	34	31	3	43.7		42	58	15	AKV	AKV	D4318
■ H-04-18, S-14	42.5	MH	Elastic Silt	63	35	28	54.4			88		AKV	AKV	D4318
▲ H-04-18, S-16	53.5	CH	Fat Clay	85	37	48	64.6					AKV	AKV	D4318

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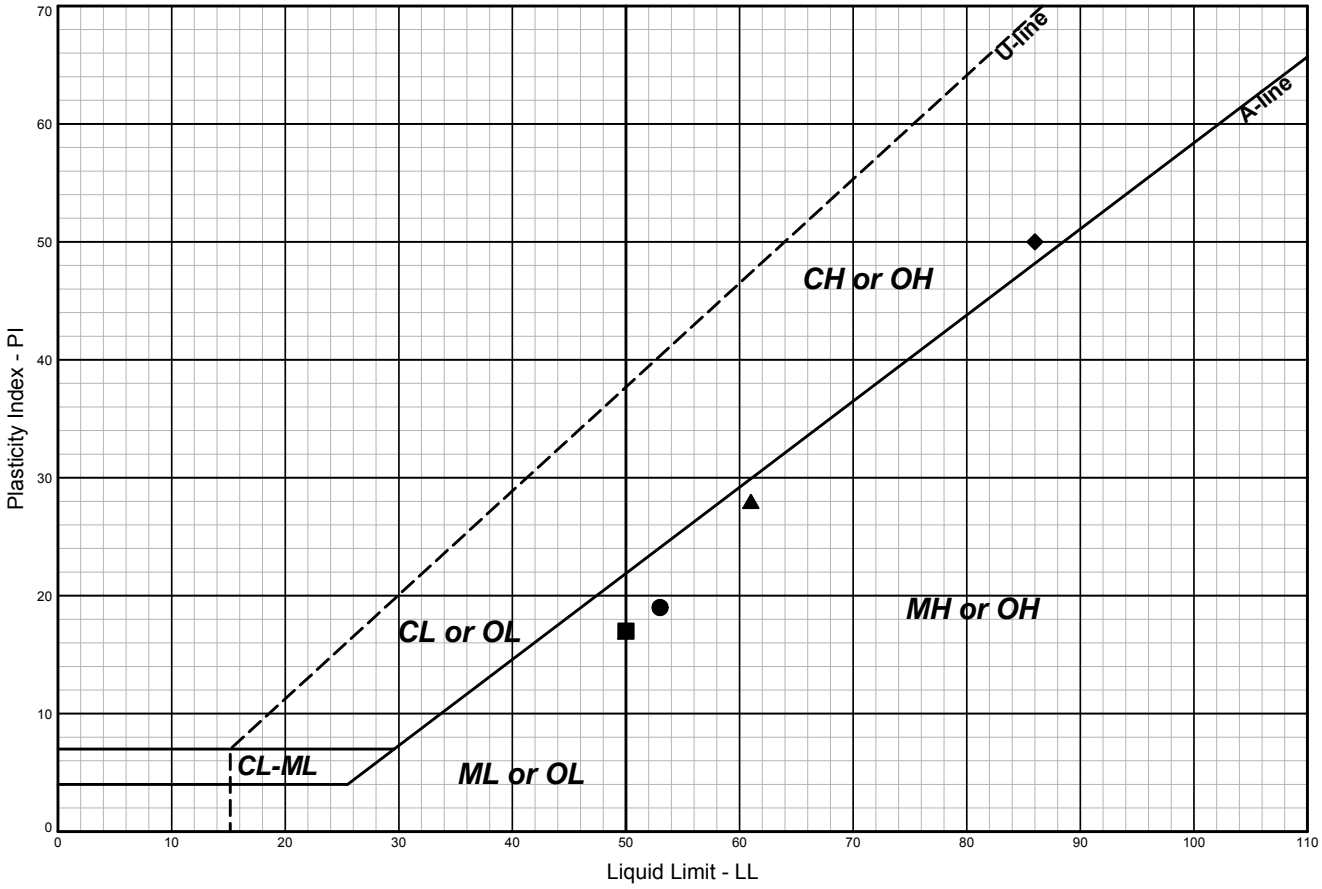
BORING H-05-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	LL	PL	PI	WC %	Gravel %	Sand %	Fines %	< 2µm %	Tested By	Review By	ASTM Std.
● H-05-18, S-2	5.0	MH	Elastic Silt	53	34	19	54.9					AKV	AKV	D4318
■ H-05-18, S-10	43.5	MH	Elastic Silt	50	33	17	51.5					AKV	AKV	D4318
▲ H-05-18, S-15	63.5	MH	Elastic Silt	61	33	28	66.7		1	99	36	AKV	AKV	D4318
◆ H-05-18, S-18	78.5	CH	Fat Clay	86	36	50	56.0					AKV	AKV	D4318

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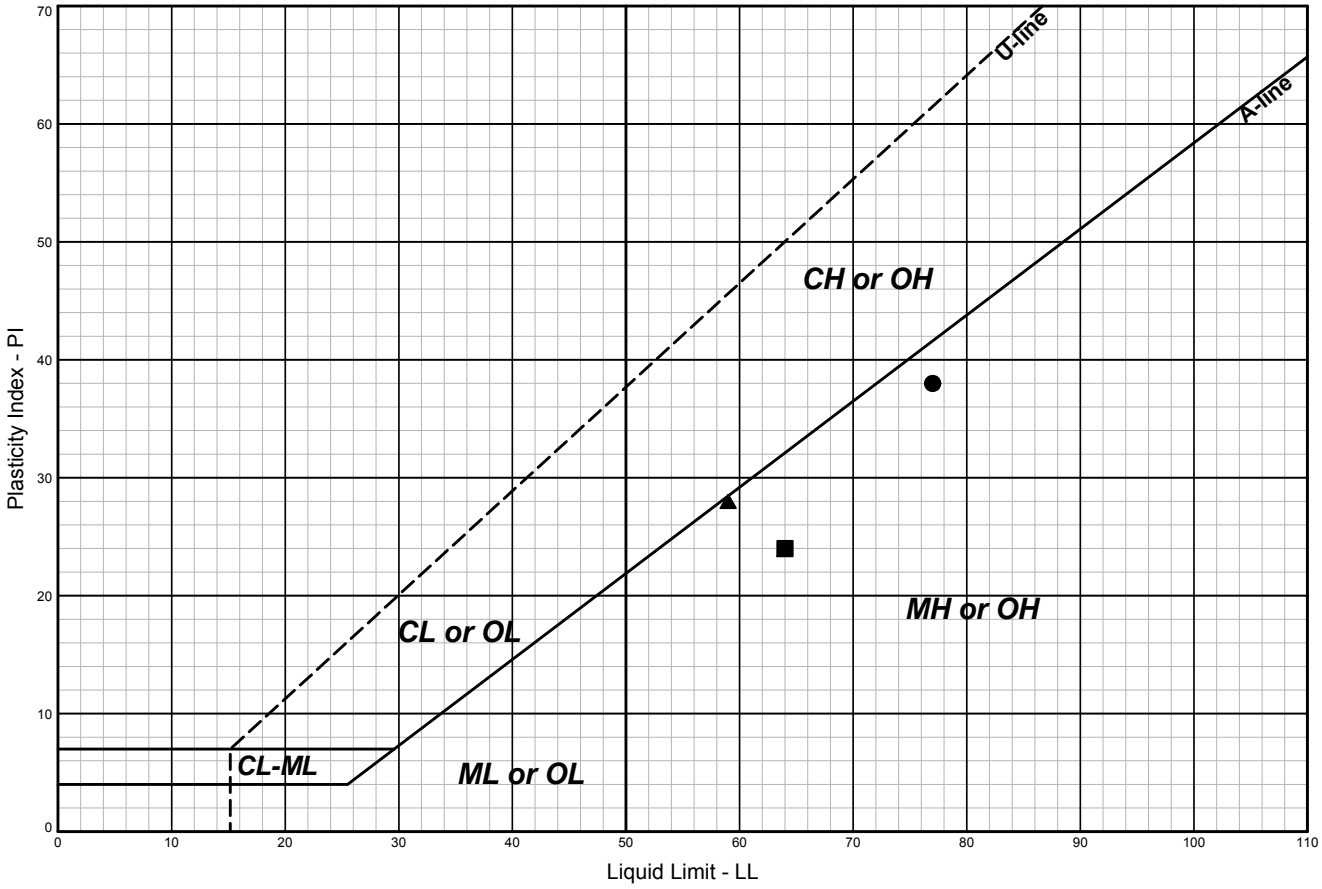
BORING H-06-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	LL	PL	PI	OLL	OLL/ LL	WC %	Gravel %	Sand %	Fines %	< 2µm %	Tested By	Review By	ASTM Std.
● H-06-18, S-5	10.0	OH	Organic Silt	77	39	38	54	0.70	79.8					AKV	AKV	D4318
■ H-06-18, S-8	17.5	MH	Elastic Silt	64	40	24			60.6		11	89	18	AKV	AKV	D4318
▲ H-06-18, S-27	110.0	MH	Elastic Silt	59	31	28			49.3					AKV	AKV	D4318

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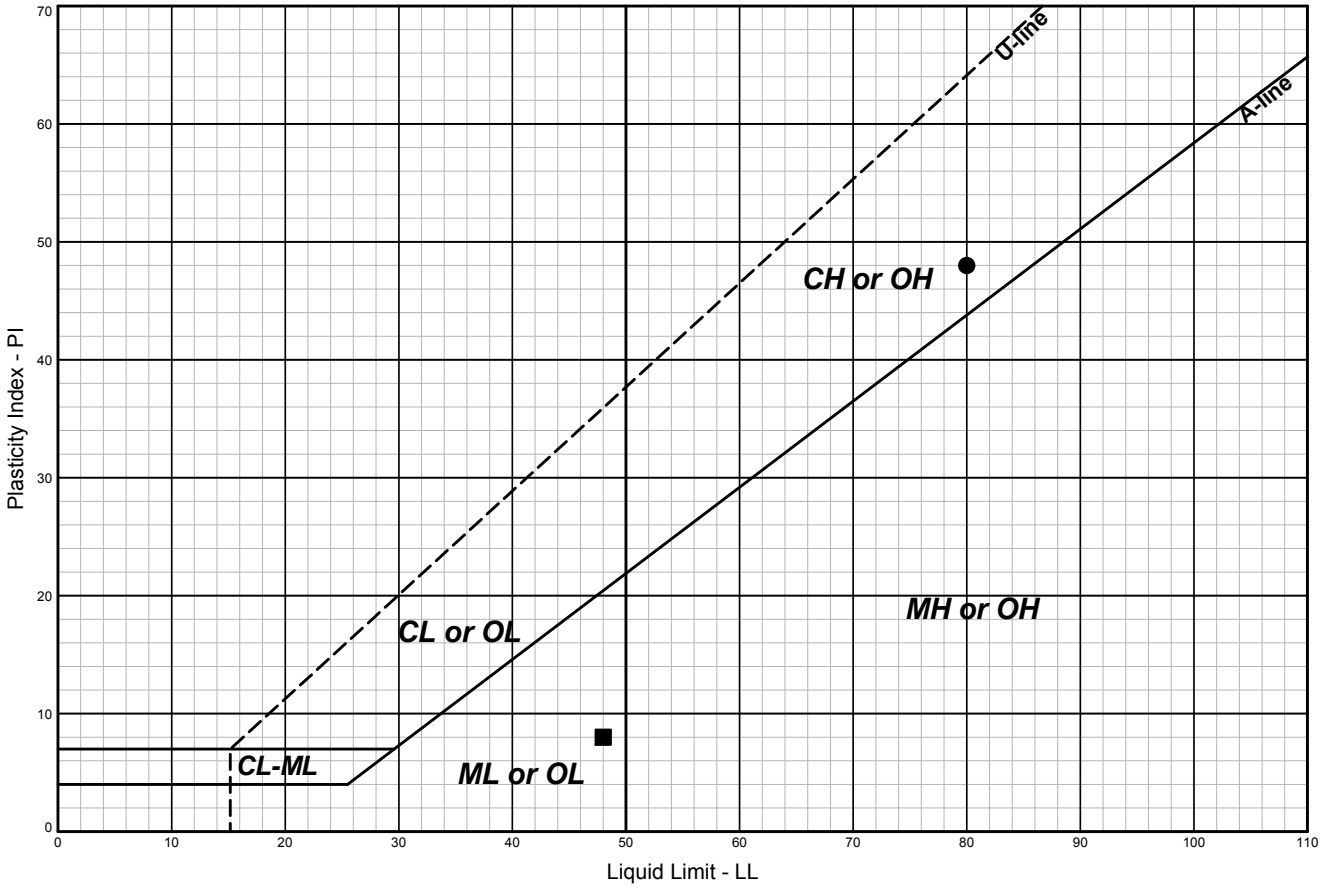
BORING H-06A-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	LL	PL	PI	WC %	Gravel %	Sand %	Fines %	< 2µm %	Tested By	Review By	ASTM Std.
● H-06A-18, S-1	10.7	CH	Fat Clay	80	32	48	79.7					AKV	AKV	T89,T90
■ H-06A-18, S-2	14.0	ML	Silt	48	40	8	48.7					AKV	AKV	T89,T90

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PLASTICITY CHART

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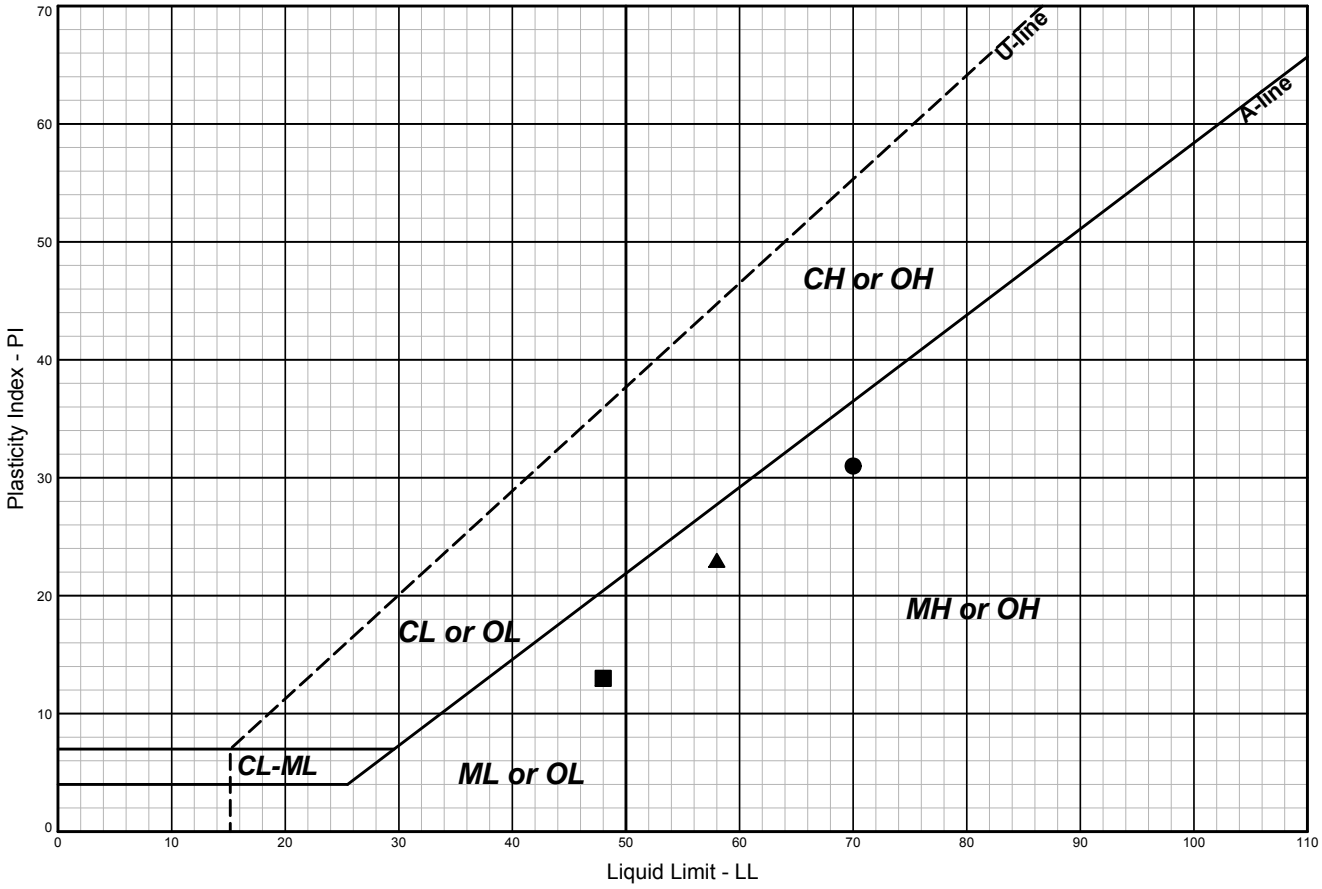
Hoquiam, Washington

BORING H-07-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	LL	PL	PI	OLL	OLL/ LL	WC %	Gravel %	Sand %	Fines %	< 2µm %	Tested By	Review By	ASTM Std.
● H-07-18, S-7	17.5	OH	Organic Silt	70	39	31	47	0.67	59.9					AKV	AKV	D4318
■ H-07-18, S-9	25.0	ML	Sandy Silt	48	35	13			42.3		30	70	13	AKV	AKV	D4318
▲ H-07-18, S-27	115.0	MH	Elastic Silt with Sand	58	35	23			48.8					AKV	AKV	D4318

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PLASTICITY CHART

Potash Export Facility
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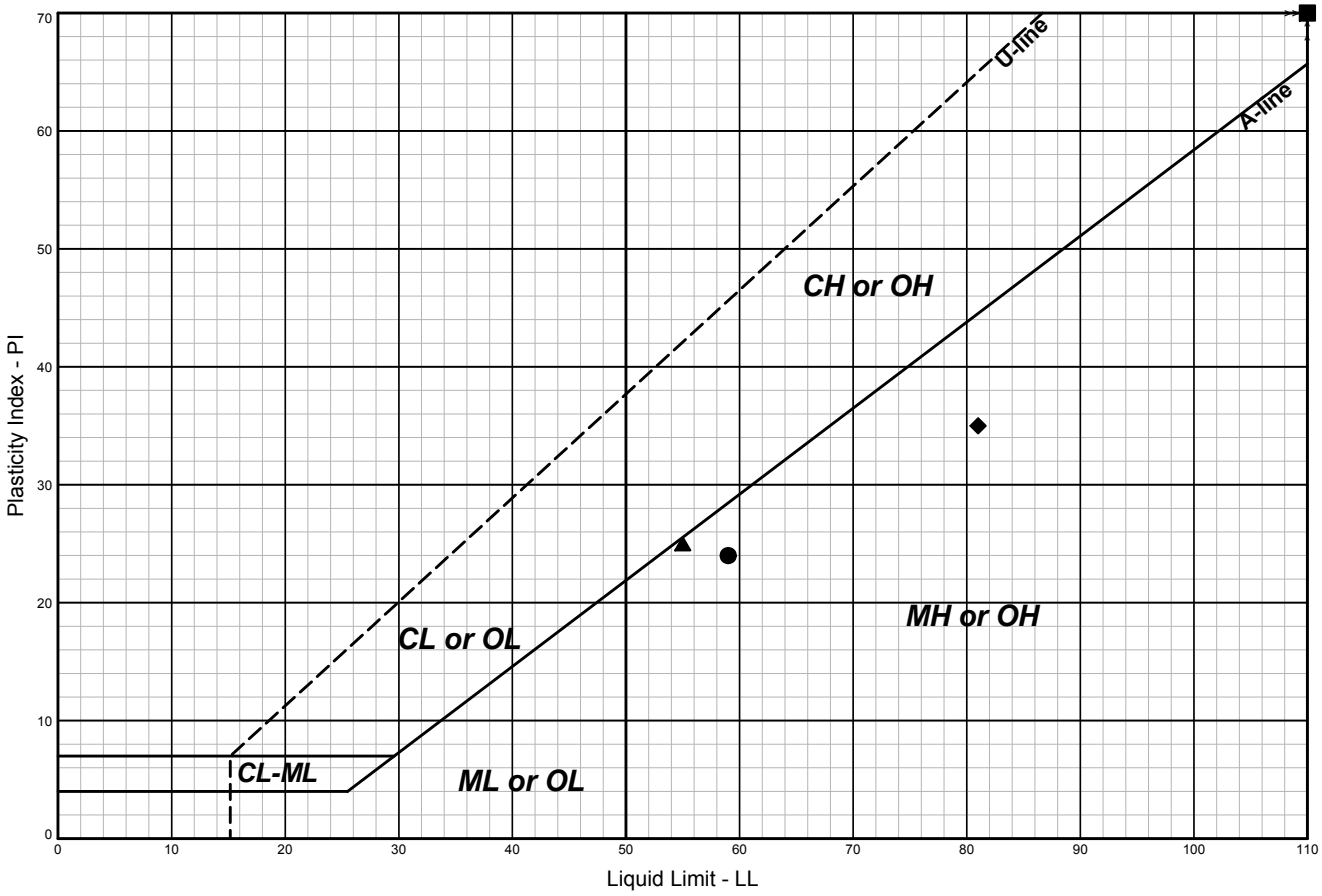
Hoquiam, Washington

BORING H-08-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	LL	PL	PI	OLL	OLL/ LL	WC %	Gravel %	Sand %	Fines %	< 2µm %	Tested By	Review By	ASTM Std.
● H-08-18, S-3	5.0	OH	Organic Silt	59	35	24	41	0.69	47.1	7	24	69	14	AKV	AKV	D4318
■ H-08-18, S-7	15.0	OH	Organic Clay	117	42	75	72	0.62	89.3					AKV	AKV	D4318
▲ H-08-18, S-9	20.0	MH	Elastic Silt with Sand	55	30	25			48.5			80		AKV	AKV	D4318
◆ H-08-18, SH-1	23.6	MH	Elastic Silt	81	46	35			73.0		5	95		AKV	AKV	D4318

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PLASTICITY CHART

Potash Export Facility
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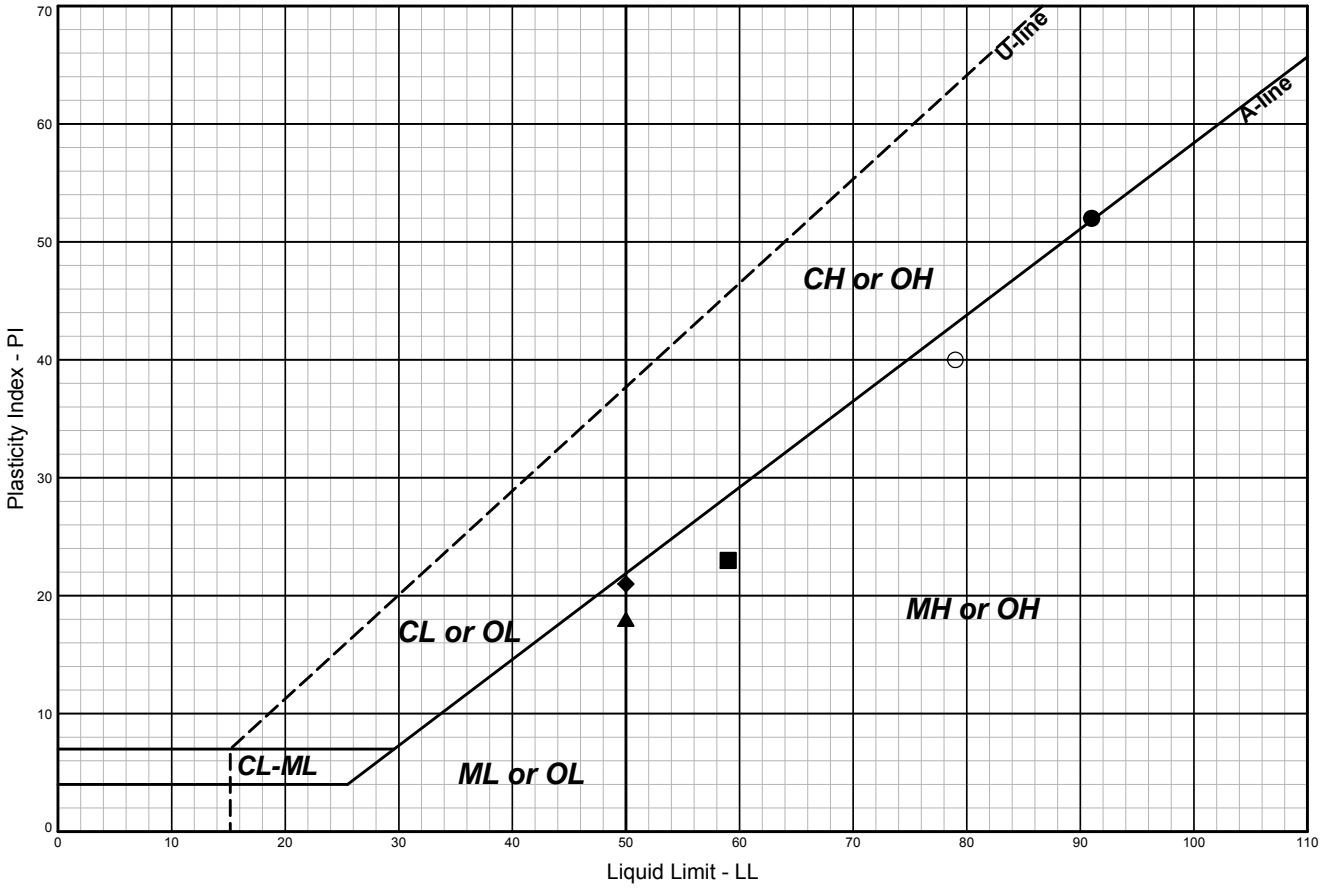
BORING H-09-18



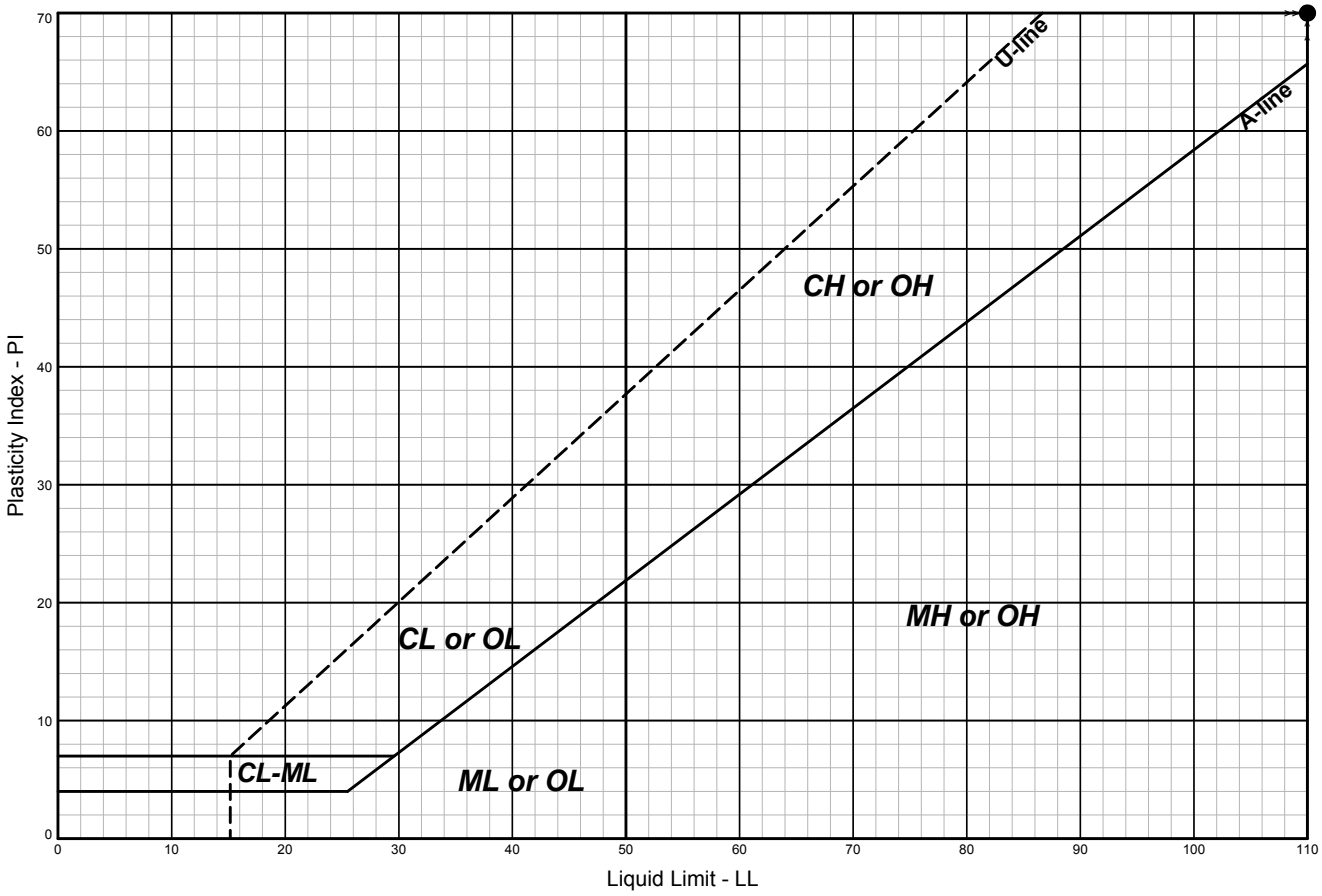
Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	LL	PL	PI	OLL	OLL/ LL	WC %	Gravel %	Sand %	Fines %	< 2µm %	Tested By	Review By	ASTM Std.
● H-09-18, S-6	15.0	OH	Organic Clay	91	39	52	62	0.68	77.4					AKV	AKV	D4318
■ H-09-18, S-8	20.0	MH	Elastic Silt	59	36	23	47	0.80	59.0		4	96	16	AKV	AKV	D4318
▲ H-09-18, S-21	85.0	MH	Elastic Silt	50	32	18			47.2					AKV	AKV	D4318
◆ H-09-18, S-23	92.4	MH	Elastic Silt	50	29	21			45.0					AKV	AKV	D4318
○ H-09-18, S-27	110.0	MH	Elastic Silt	79	39	40			53.6					AKV	AKV	D4318

SHANNON & WILSON, INC.

PLASTICITY CHART

Potash Export Facility
Grays Harbor
Hoquiam, Washington

BORING OB-01-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	LL	PL	PI	OLL	OLL/ LL	WC %	Gravel %	Sand %	Fines %	< 2µm %	Tested By	Review By	ASTM Std.
● OB-01-18, S-7	15.0	OH	Organic Silt	126	51	75	77	0.61	93.7					AKV	AKV	D4318

SHANNON & WILSON, INC.

PLASTICITY CHART

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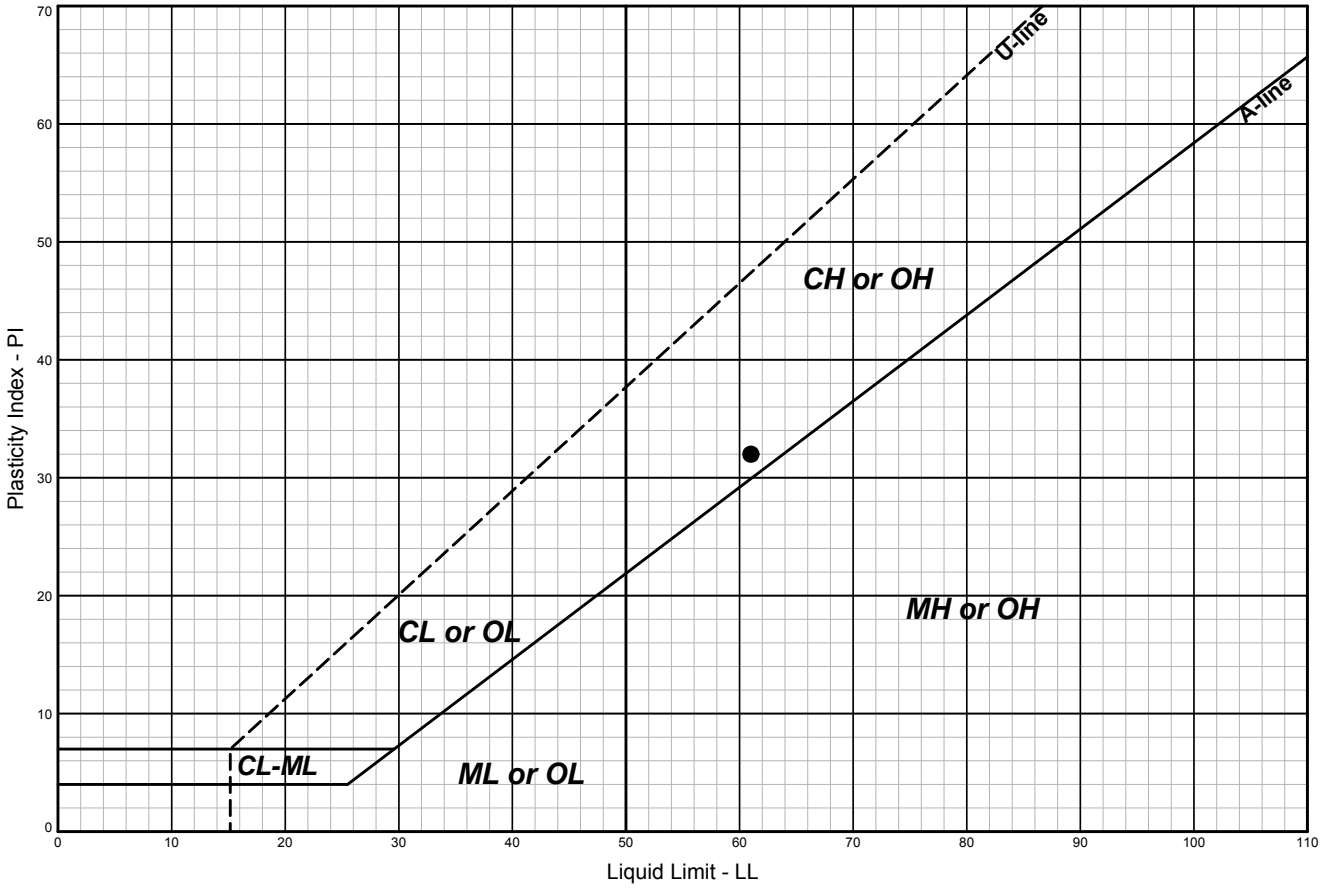
BORING OB-02-18



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	LL	PL	PI	WC %	Gravel %	Sand %	Fines %	< 2µm %	Tested By	Review By	ASTM Std.
● OB-02-18, S-7	15.0	CH	Fat Clay	61	29	32	58.0		6	94	19	AKV	AKV	D4318

ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

TEST SUMMARY
Boring H-01-18, Sample S-29, 123.1 ft

SPECIMEN DATA AND TEST RESULTS

Sample Classification:
Fat Clay (CH)

Specific Gravity, G_s (Assumed)	2.7
Liquid Limit, LL	65
Plastic Limit, PL	31
Plasticity Index, PI (LL - PL)	34
Fines Content	---
Organic Content	---
Initial Seating Load, g	50
Final Seating Load, g	200
ASTM Test Method	Method B
Coefficient of Consolidation Interpretation	Procedure 1

	Pre-Inundation	Final Load
Height, in	0.782	0.483
Diameter, in	2.500	2.500
Specimen Volume, in^3	3.836	2.373
Wet Unit Weight, pcf	98.5	129.5
Dry Unit Weight, pcf	60.5	97.9
Water Content	63%	32%
Void Ratio	1.78	0.72
Degree of Saturation	95%	100%

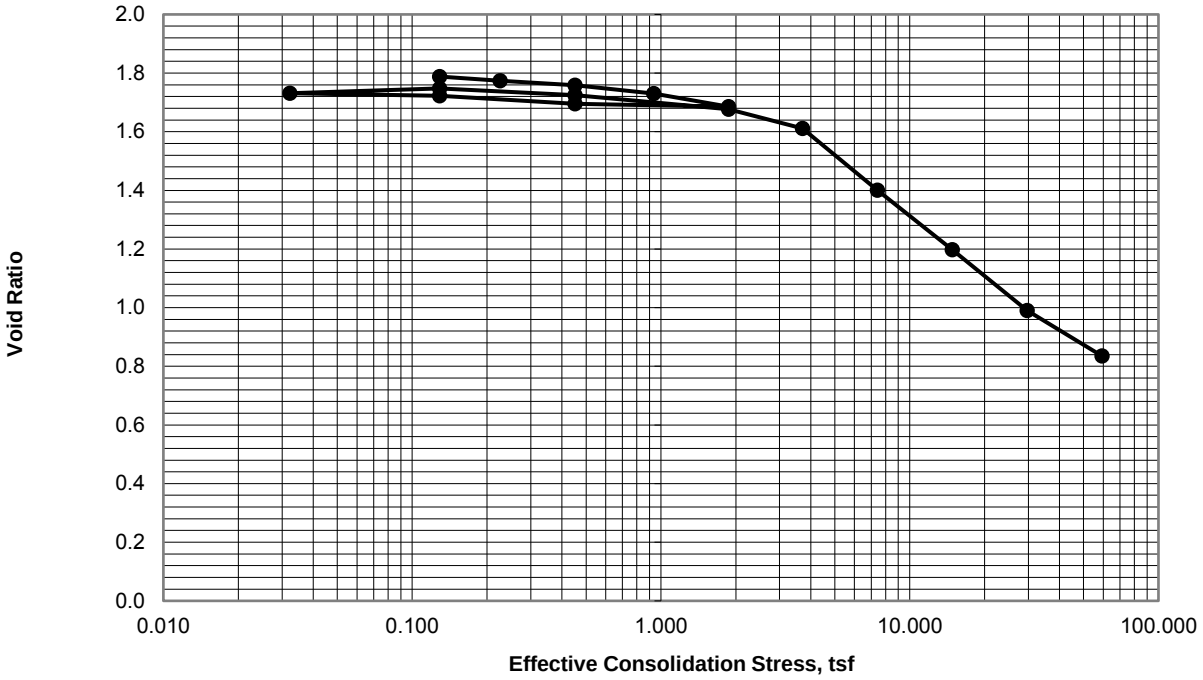
Load Increment Number	Applied Stress, tsf	t_{load}, min	t_{50}, min	ΔH_{load}, in	ΔH at t_{100}, in	$\Delta H/H_o$	Void Ratio	a_v, Mpa^{-1}	c_v, cm^2/s	k, cm/s
Seating										
1	0.13	1335	0.0	0.000	-0.001	-0.1%	1.788	-3.18E-01		
2	0.23	1035	0.5	0.005	0.003	0.4%	1.773	1.59E+00	6.81E-03	3.81E-07
3	0.45	155	0.4	0.011	0.007	0.9%	1.759	6.87E-01	8.70E-03	2.12E-07
4	0.94	285	0.3	0.021	0.015	1.9%	1.730	6.17E-01	1.14E-02	2.50E-07
5	1.87	3930	0.2	0.037	0.028	3.6%	1.685	5.02E-01	2.02E-02	3.64E-07
6	0.45	190	0.3	0.028	0.025	3.2%	1.695	7.32E-02	1.06E-02	2.83E-08
7	0.13	136	0.9	0.019	0.017	2.2%	1.722	8.80E-01	3.33E-03	1.07E-07
8	0.03	1515	8.7	0.011	0.015	1.9%	1.731	9.98E-01	3.59E-04	1.29E-08
9	0.13	1485	0.0	0.013	0.010	1.3%	1.748	-1.81E+00	3.95E-01	2.57E-05
10	0.45	945	0.4	0.021	0.017	2.1%	1.725	7.58E-01	7.94E-03	2.15E-07
11	1.87	215	0.2	0.039	0.030	3.9%	1.676	3.57E-01	1.59E-02	2.05E-07
12	3.71	1230	0.4	0.072	0.049	6.2%	1.611	3.71E-01	7.78E-03	1.06E-07
13	7.42	4245	2.6	0.137	0.108	13.8%	1.401	5.92E-01	9.74E-04	2.17E-08
14	14.85	1395	2.0	0.193	0.165	21.1%	1.198	2.85E-01	1.08E-03	1.26E-08
15	29.69	4320	2.4	0.252	0.223	28.5%	0.991	1.46E-01	7.33E-04	4.77E-09
16	59.39	855	2.1	0.298	0.267	34.1%	0.835	5.48E-02	7.17E-04	1.94E-09

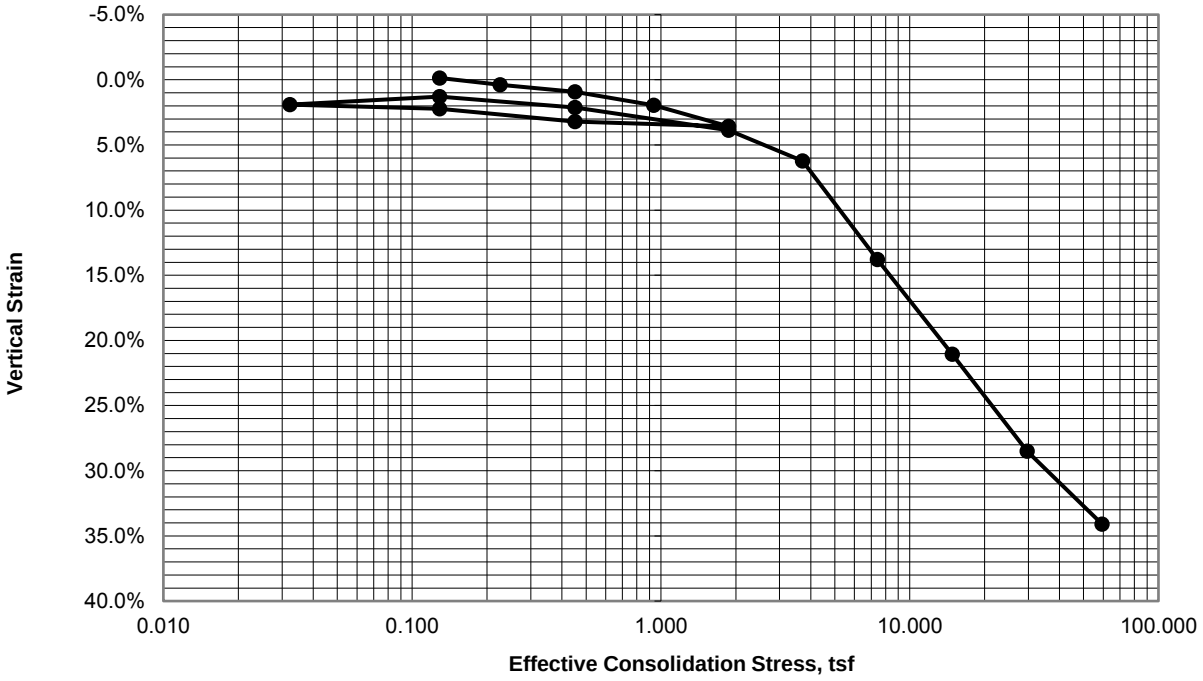
Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

CONSOLIDATION CURVES
Boring H-01-18, Sample S-29, 123.1 ft





Maximum Applied Effective Consolidation Stress, tsf = 59.39

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

SHANNON & WILSON, INC.
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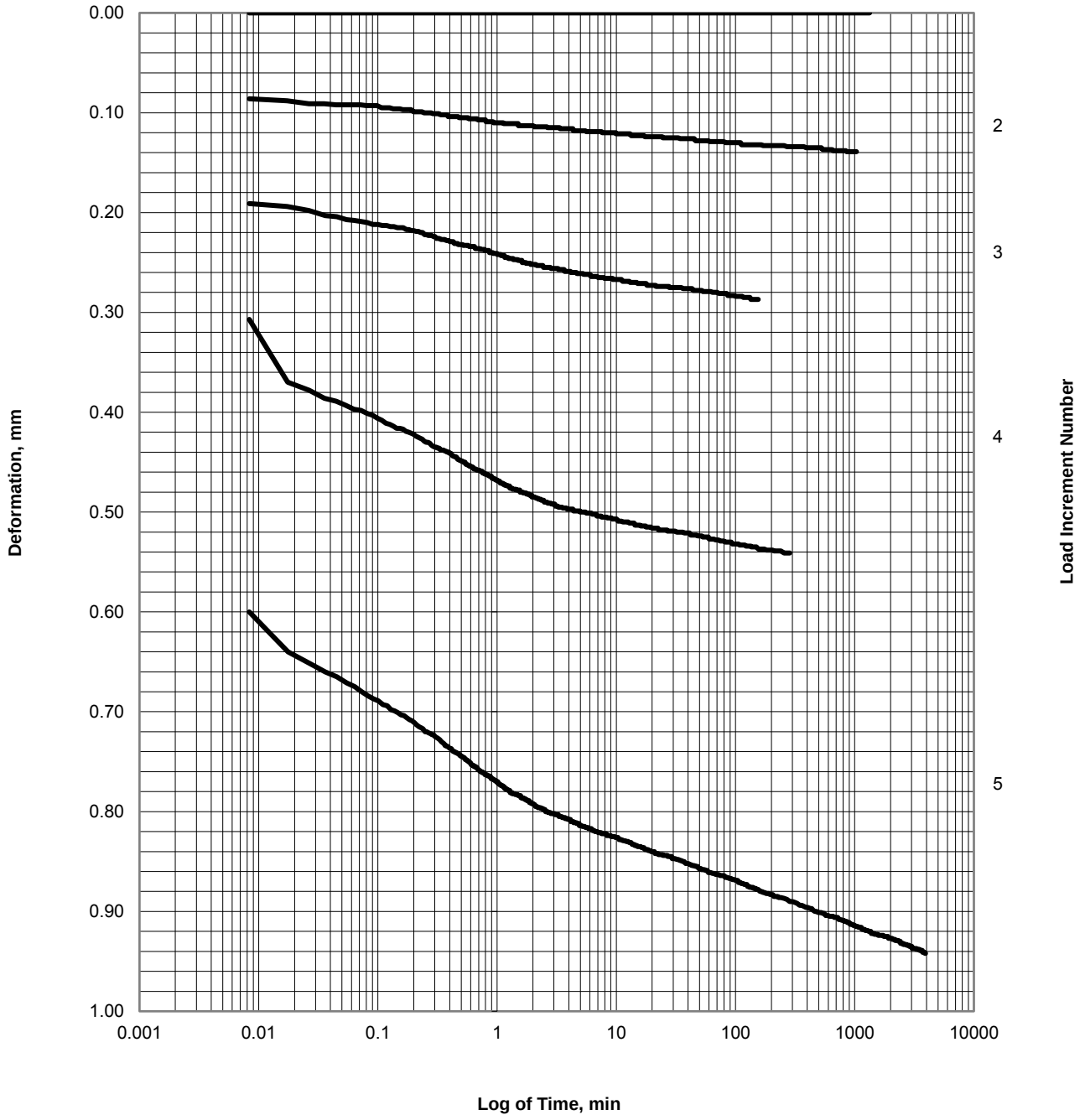
ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOAD INCREMENT TIME-DEFORMATION CURVES
Boring H-01-18, Sample S-29, 123.1 ft



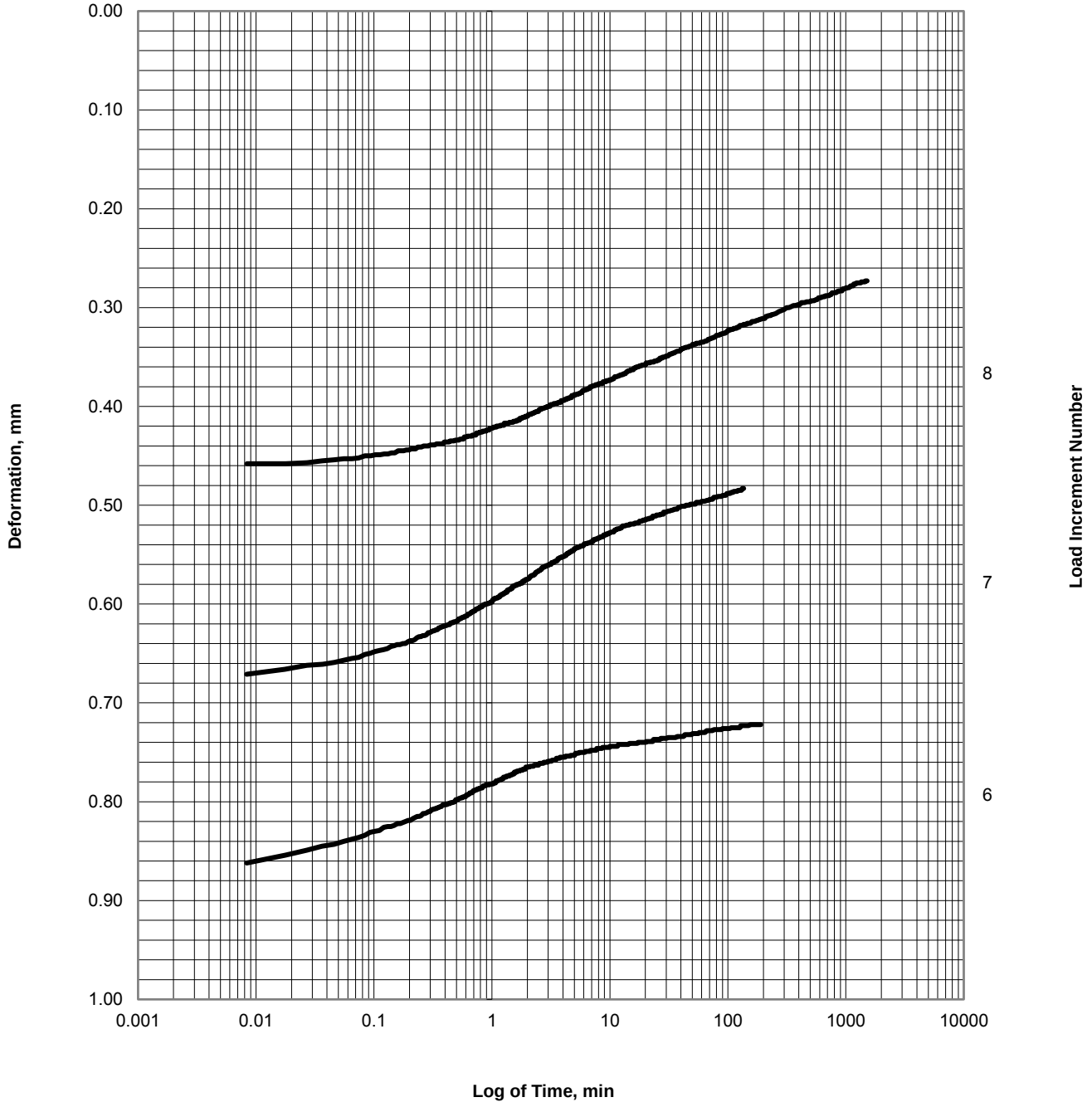
Load Sequence, tsf = 0.23, 0.45, 0.94, 1.87

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

UNLOAD INCREMENT TIME-DEFORMATION CURVES
Boring H-01-18, Sample S-29, 123.1 ft



Load Sequence, tsf = 0.45, 0.13, 0.03

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

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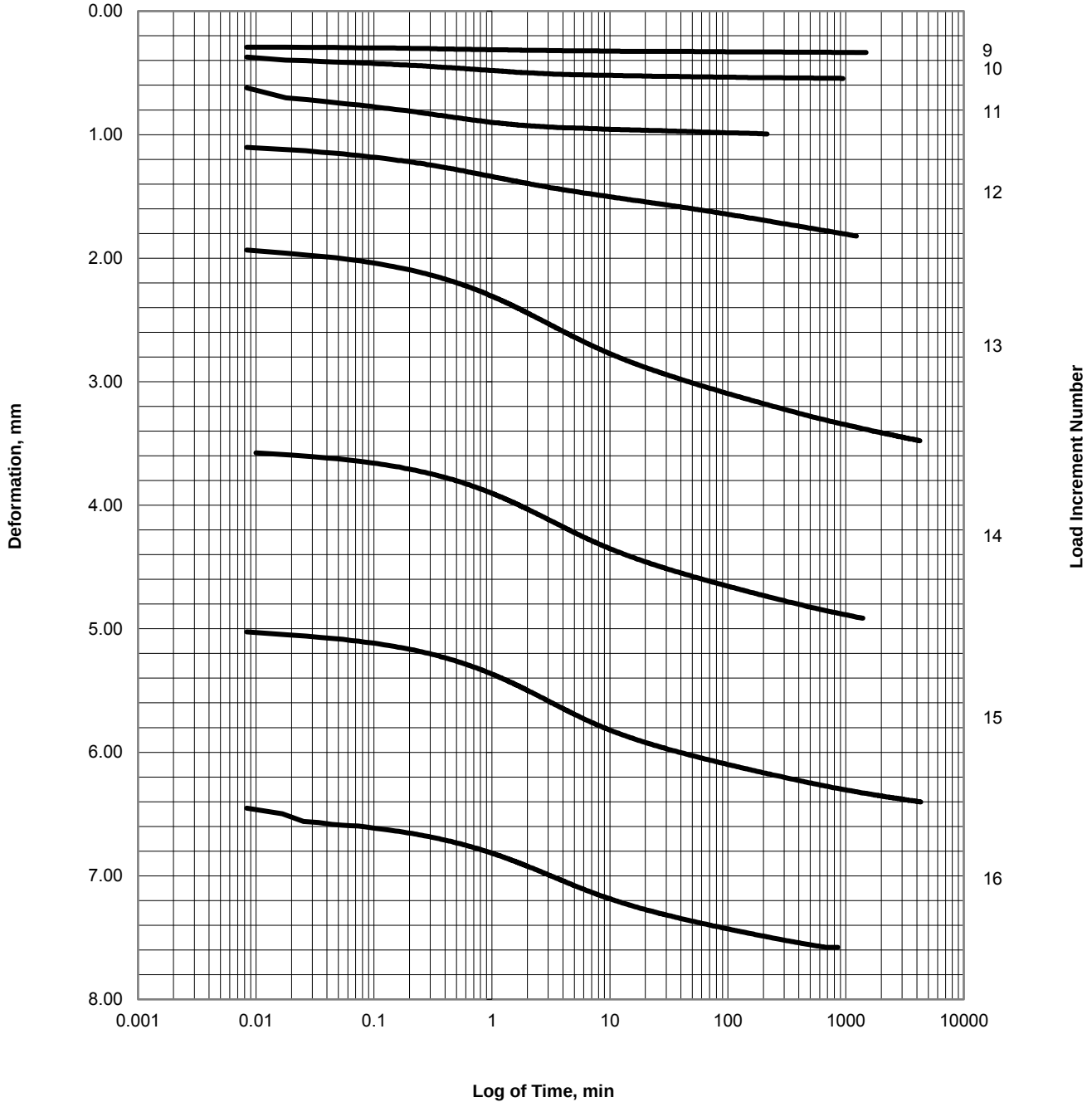
RE-LOAD INCREMENT TIME-DEFORMATION CURVES
BORING H-01-18, SAMPLE S-29, 123.1 ft



Load Sequence, tsf = 0.13, 0.45, 1.87, 3.71, 7.42, 14.85, 29.69, 59.39

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

CONSOL_v3.0_NOTB_H-01-18_S29_032919.xlsm 03/29/19

101575-004

ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

TEST SUMMARY
Boring H-01A-18, Sample S-2, 13.7 ft

SPECIMEN DATA AND TEST RESULTS

Sample Classification:
Elastic Silt with sand; pockets of organics and reeds running vertically (MH)

Specific Gravity, G_s (Assumed)	2.7
Liquid Limit, LL	88
Plastic Limit, PL	40
Plasticity Index, PI (LL - PL)	48
Fines Content	---
Organic Content	---
Initial Seating Load, g	50
Final Seating Load, g	50
ASTM Test Method	Method B
Coefficient of Consolidation Interpretation	Procedure 1

	Pre-Inundation	Final Load
Height, in	0.787	0.416
Diameter, in	2.506	2.506
Specimen Volume, in^3	3.881	2.049
Wet Unit Weight, pcf	92.4	129.8
Dry Unit Weight, pcf	52.1	98.6
Water Content	77%	32%
Void Ratio	2.24	0.71
Degree of Saturation	94%	100%

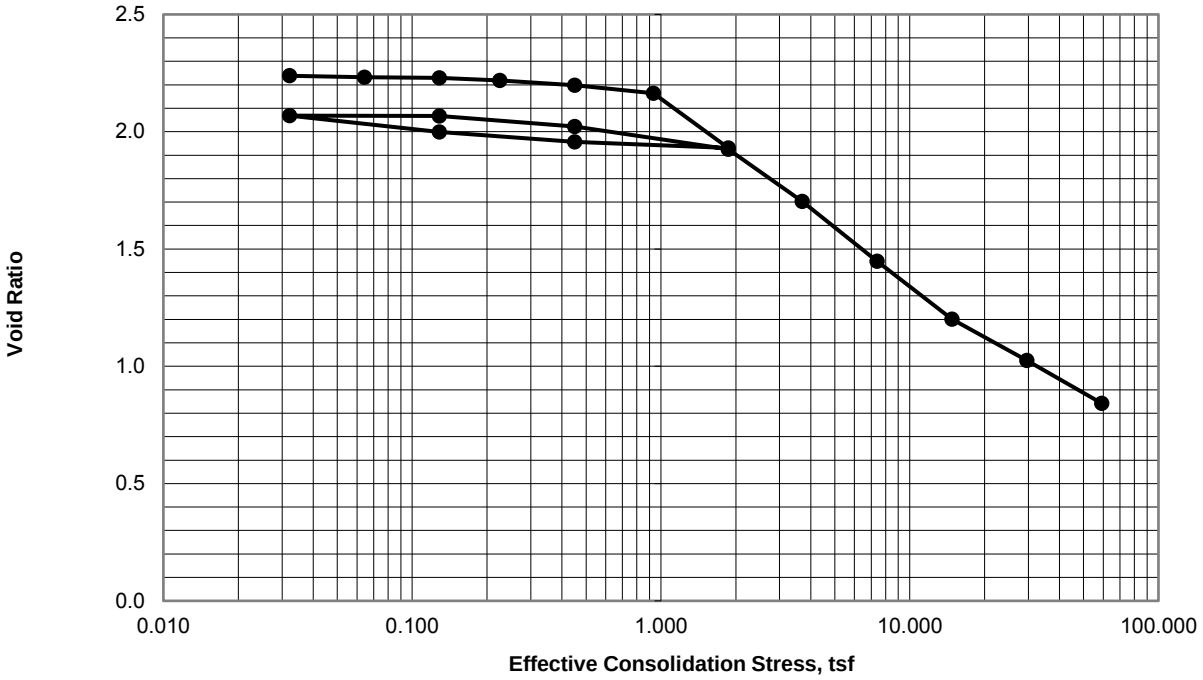
Load Increment Number	Applied Stress, tsf	t_{load}, min	t_{50}, min	ΔH_{load}, in	ΔH at t_{100}, in	$\Delta H/H_o$	Void Ratio	a_v, Mpa^{-1}	c_v, cm^2/s	k, cm/s
Seating										
1	0.03	0	0.0	0.000	0.000	0%	2.238	5.27E-02		
2	0.06	1035	0.5	0.004	0.001	0.2%	2.233	1.79E+00	6.92E-03	3.75E-07
3	0.13	450	0.4	0.007	0.002	0.3%	2.229	6.06E-01	8.42E-03	1.55E-07
4	0.22	3930	0.1	0.011	0.005	0.6%	2.218	1.18E+00	5.61E-02	2.00E-06
5	0.45	190	0.2	0.017	0.010	1.2%	2.199	9.18E-01	1.30E-02	3.64E-07
6	0.93	132	0.2	0.030	0.018	2.3%	2.164	7.41E-01	2.04E-02	4.63E-07
7	1.86	1500	0.6	0.087	0.075	9.5%	1.931	2.62E+00	5.22E-03	4.24E-07
8	0.45	1035	0.7	0.075	0.069	8.7%	1.957	1.94E-01	3.84E-03	2.49E-08
9	0.13	465	3.0	0.062	0.058	7.4%	1.999	1.38E+00	9.39E-04	4.31E-08
10	0.03	2400	38.4	0.046	0.041	5.3%	2.068	7.46E+00	7.54E-05	1.84E-08
11	0.13	360	0.6	0.049	0.042	5.3%	2.067	1.58E-01	5.19E-03	2.62E-08
12	0.45	3885	0.9	0.062	0.052	6.7%	2.023	1.43E+00	3.12E-03	1.43E-07
13	1.86	450	0.3	0.097	0.076	9.7%	1.926	7.18E-01	7.96E-03	1.86E-07
14	3.69	3090	2.1	0.164	0.130	16.5%	1.703	1.27E+00	1.18E-03	5.04E-08
15	7.39	1365	2.6	0.221	0.192	24.4%	1.448	7.19E-01	7.63E-04	1.99E-08
16	14.78	1680	3.1	0.276	0.252	32.1%	1.201	3.50E-01	5.26E-04	7.39E-09
17	29.56	1740	3.4	0.326	0.295	37.5%	1.025	1.24E-01	4.04E-04	2.23E-09
18	59.11	2610	4.6	0.372	0.339	43.1%	0.842	6.46E-02	2.52E-04	7.88E-10

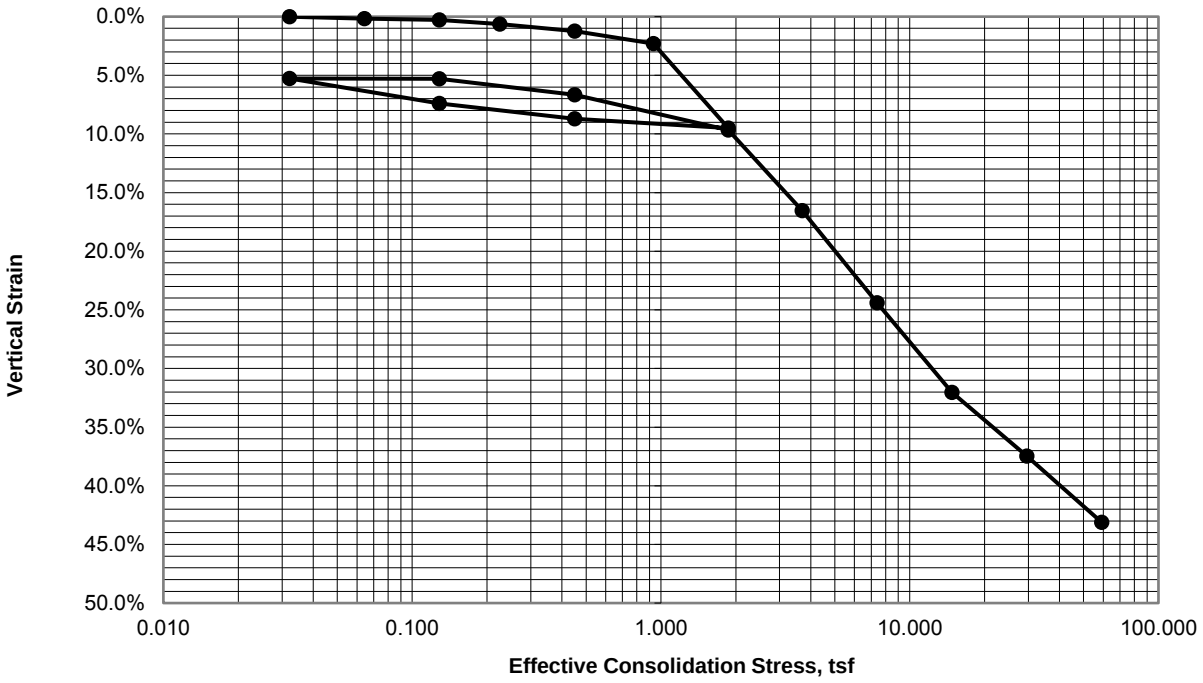
Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

CONSOLIDATION CURVES
Boring H-01A-18, Sample S-2, 13.7 ft





Maximum Applied Effective Consolidation Stress, tsf = 59.11

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

SHANNON & WILSON, INC.
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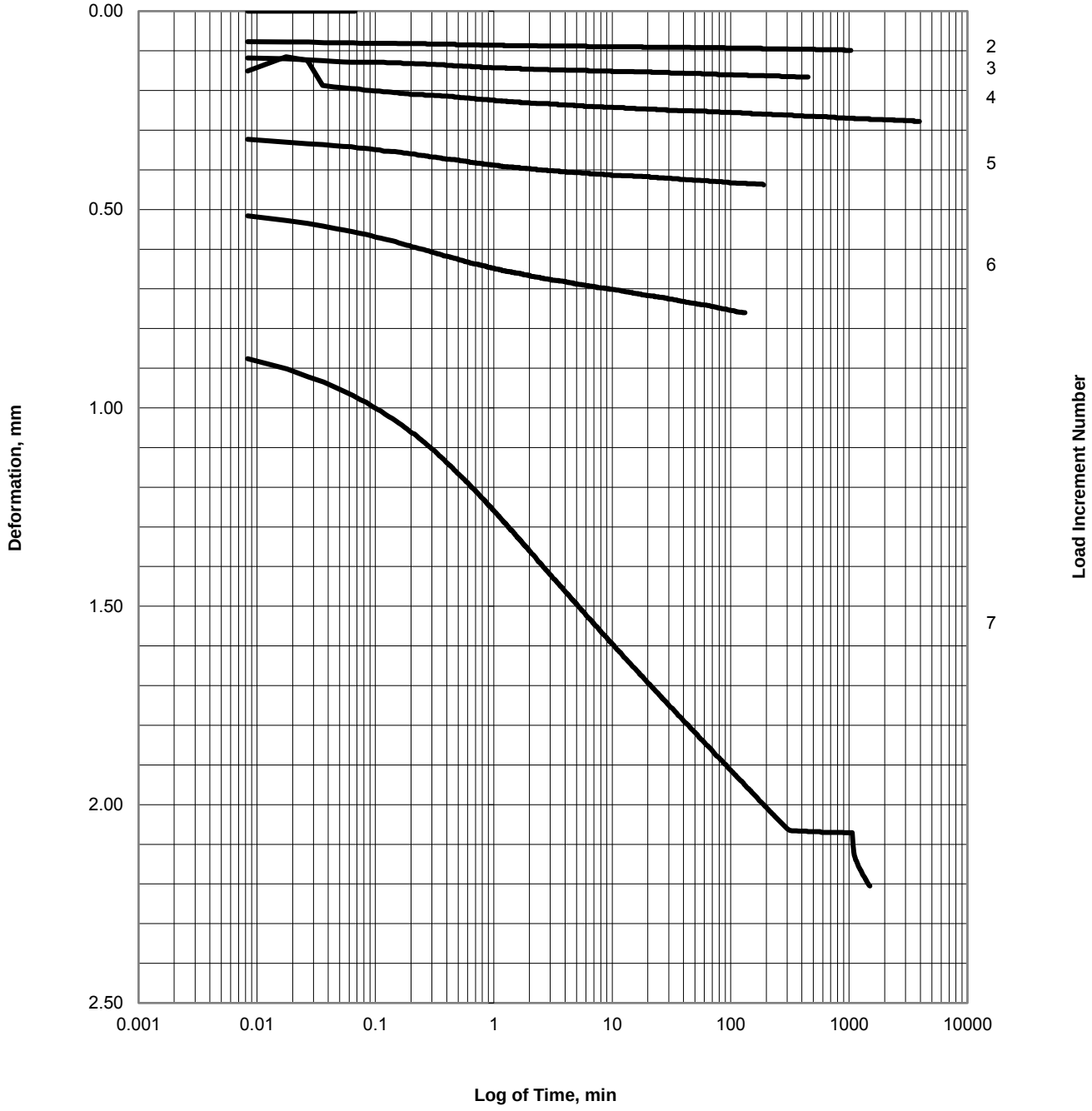
ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOAD INCREMENT TIME-DEFORMATION CURVES
Boring H-01A-18, Sample S-2, 13.7 ft



Load Sequence, tsf = 0.06, 0.13, 0.22, 0.45, 0.93, 1.86

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

CONSOL_v3.0_NOTB_H-01A-18_S-2_13.7ft_032919.xlsm 03/29/19

101575-004

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ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
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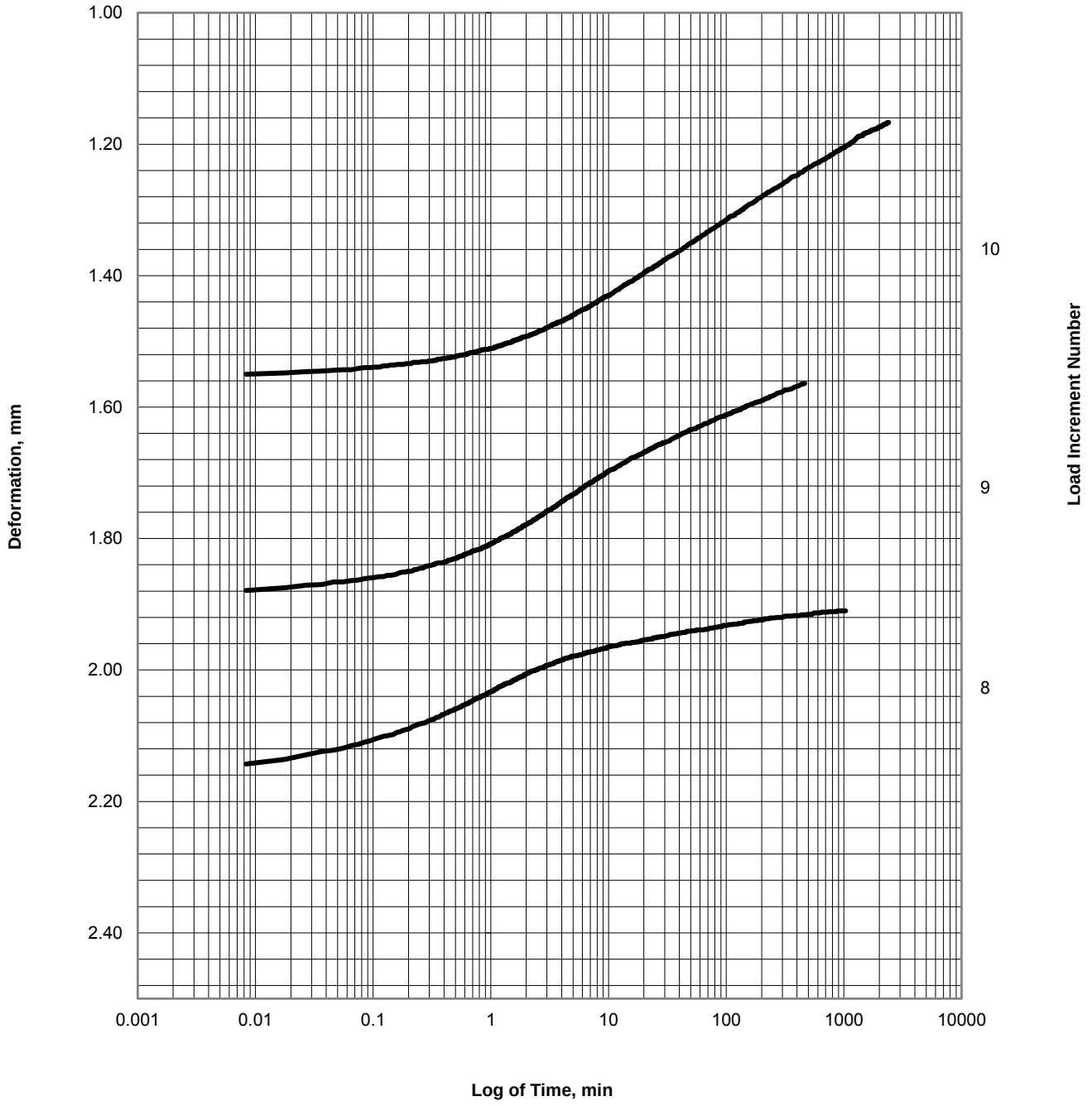
UNLOAD INCREMENT TIME-DEFORMATION CURVES
Boring H-01A-18, Sample S-2, 13.7 ft



Load Sequence, tsf = 0.45, 0.13, 0.03

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

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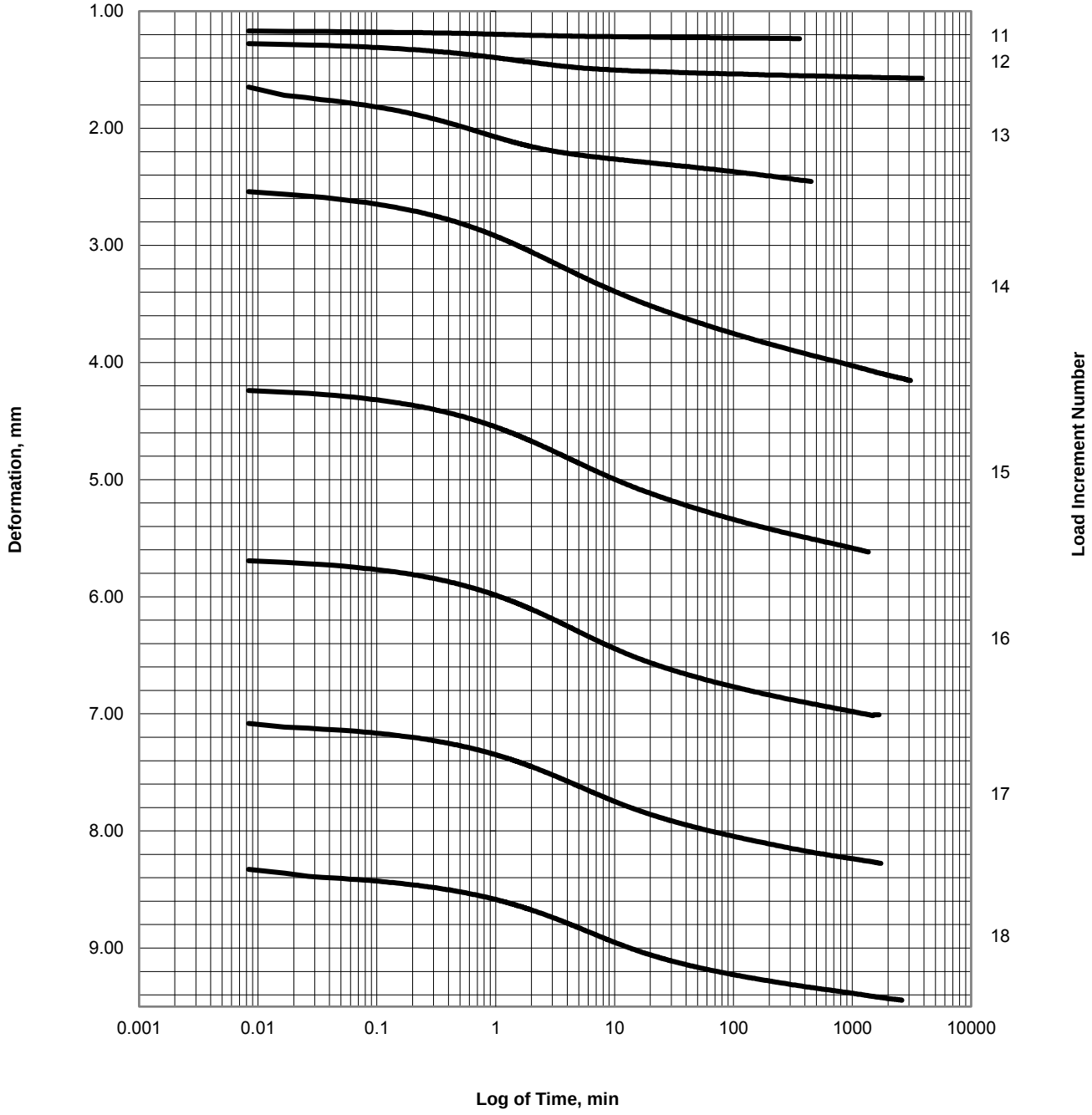
Hoquiam, Washington

RE-LOAD INCREMENT TIME-DEFORMATION CURVES
BORING H-01A-18, SAMPLE S-2, 13.7 ft



Load Sequence, tsf = 0.13, 0.45, 1.86, 3.69, 7.39, 14.78, 29.56, 59.11

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

CONSOL_v3.0_NOTB_H-01A-18_S-2_13.7ft_032919.xlsm 03/29/19

101575-004

ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

TEST SUMMARY
Boring H-06A-18, Sample S-1, 10.7 ft

SPECIMEN DATA AND TEST RESULTS

Sample Classification:
Fat Clay (CH)

Specific Gravity, G_s (Assumed)	2.7
Liquid Limit, LL	80
Plastic Limit, PL	32
Plasticity Index, PI (LL - PL)	48
Fines Content	---
Organic Content	---
Initial Seating Load, g	50
Final Seating Load, g	50
ASTM Test Method	Method B
Coefficient of Consolidation Interpretation	Procedure 1

	Pre-Inundation	Final Load
Height, in	0.785	0.408
Diameter, in	2.503	2.503
Specimen Volume, in^3	3.865	2.006
Wet Unit Weight, pcf	90.7	129.1
Dry Unit Weight, pcf	51.2	98.7
Water Content	77%	31%
Void Ratio	2.29	0.71
Degree of Saturation	91%	100%

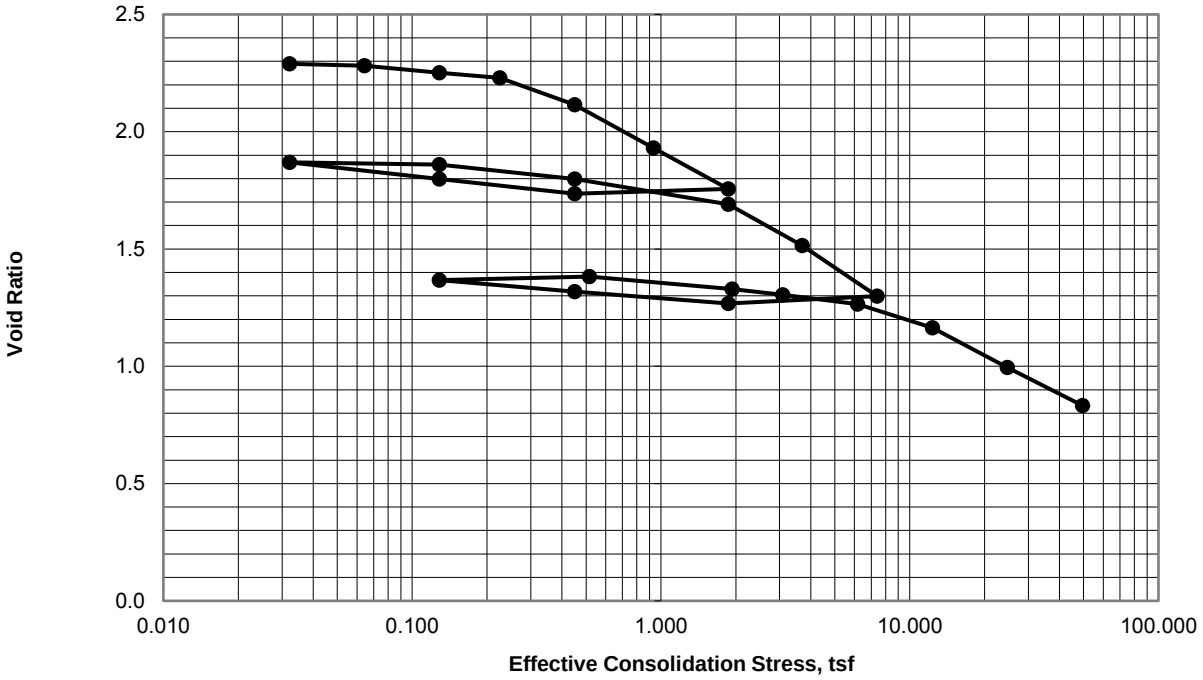
Load Increment Number	Applied Stress, tsf	t_{load}, min	t_{50}, min	ΔH_{load}, in	ΔH at t_{100}, in	$\Delta H/H_o$	Void Ratio	a_v, Mpa^{-1}	c_v, cm^2/s	k, cm/s
Seating										
1	0.03	1695	3.7	0.001	0.001	0.1%	2.289	8.03E-01	8.78E-04	2.10E-08
2	0.06	1200	0.2	0.005	0.002	0.3%	2.282	2.52E+00	1.74E-02	1.30E-06
3	0.13	1440	0.7	0.013	0.010	1.2%	2.252	4.90E+00	4.28E-03	6.26E-07
4	0.23	4695	0.8	0.025	0.015	1.9%	2.230	2.32E+00	4.18E-03	2.92E-07
5	0.45	5280	2.8	0.052	0.042	5.4%	2.116	5.31E+00	1.05E-03	1.70E-07
6	0.93	2880	4.0	0.100	0.086	11%	1.931	3.98E+00	6.82E-04	8.56E-08
7	1.87	435	3.0	0.148	0.128	16.3%	1.756	1.96E+00	7.95E-04	5.21E-08
8	0.45	98	1.1	0.137	0.133	16.9%	1.736	-1.50E-01	2.11E-03	1.12E-08
9	0.13	900	7.8	0.119	0.118	15%	1.798	2.01E+00	2.97E-04	2.14E-08
10	0.03	1635	38.8	0.102	0.101	12.8%	1.869	7.69E+00	6.26E-05	1.69E-08
11	0.13	330	2.5	0.107	0.103	13.1%	1.860	9.99E-01	1.01E-03	3.46E-08
12	0.45	3735	2.4	0.125	0.118	15%	1.799	1.98E+00	1.02E-03	6.88E-08
13	1.87	660	1.2	0.160	0.143	18.3%	1.691	7.98E-01	1.83E-03	5.11E-08
14	3.70	2325	3.9	0.208	0.185	23.6%	1.515	1.00E+00	5.11E-04	1.87E-08
15	7.40	7081	8.8	0.260	0.237	30.2%	1.299	6.11E-01	1.94E-04	4.61E-09
16	1.87	1440	1.0	0.251	0.244	31.1%	1.268	-5.82E-02	1.58E-03	3.93E-09
17	0.45	1890	8.1	0.236	0.232	29.6%	1.318	3.74E-01	1.97E-04	3.19E-09
18	0.13	5355	134.5	0.219	0.221	28.1%	1.367	1.57E+00	1.24E-05	8.23E-10
19	0.52	1365	3.1	0.225	0.217	27.6%	1.382	-4.15E-01	5.51E-04	9.47E-09
20	1.93	375	2.1	0.240	0.230	29.2%	1.329	3.91E-01	8.07E-04	1.30E-08
21	3.09	1080	1.9	0.247	0.236	30%	1.305	2.23E-01	8.39E-04	7.88E-09
22	6.18	510	1.1	0.259	0.245	31.2%	1.265	1.35E-01	1.38E-03	7.90E-09
23	12.36	2820	2.7	0.293	0.269	34.3%	1.164	1.70E-01	5.36E-04	3.94E-09
24	24.72	1350	4.0	0.334	0.309	39.4%	0.995	1.43E-01	3.21E-04	2.08E-09
25	49.44	4170	4.9	0.378	0.348	44.3%	0.833	6.87E-02	2.22E-04	7.50E-10

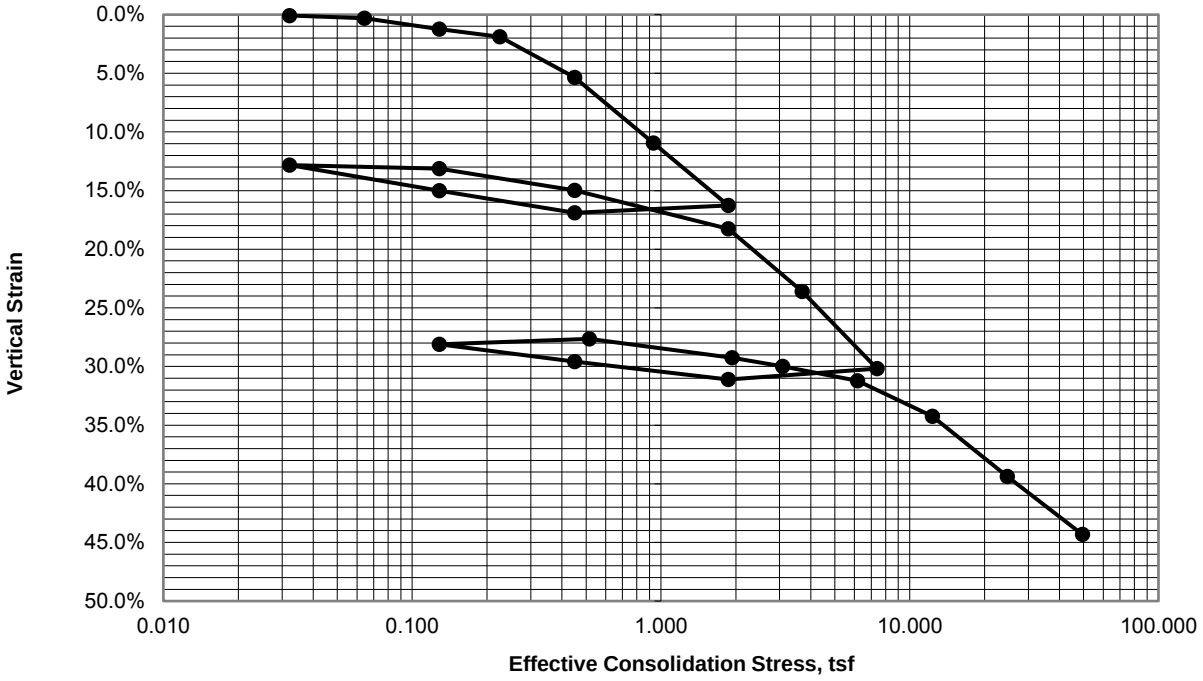
Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

CONSOLIDATION CURVES
Boring H-06A-18, Sample S-1, 10.7 ft





Maximum Applied Effective Consolidation Stress, tsf = 49.44

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

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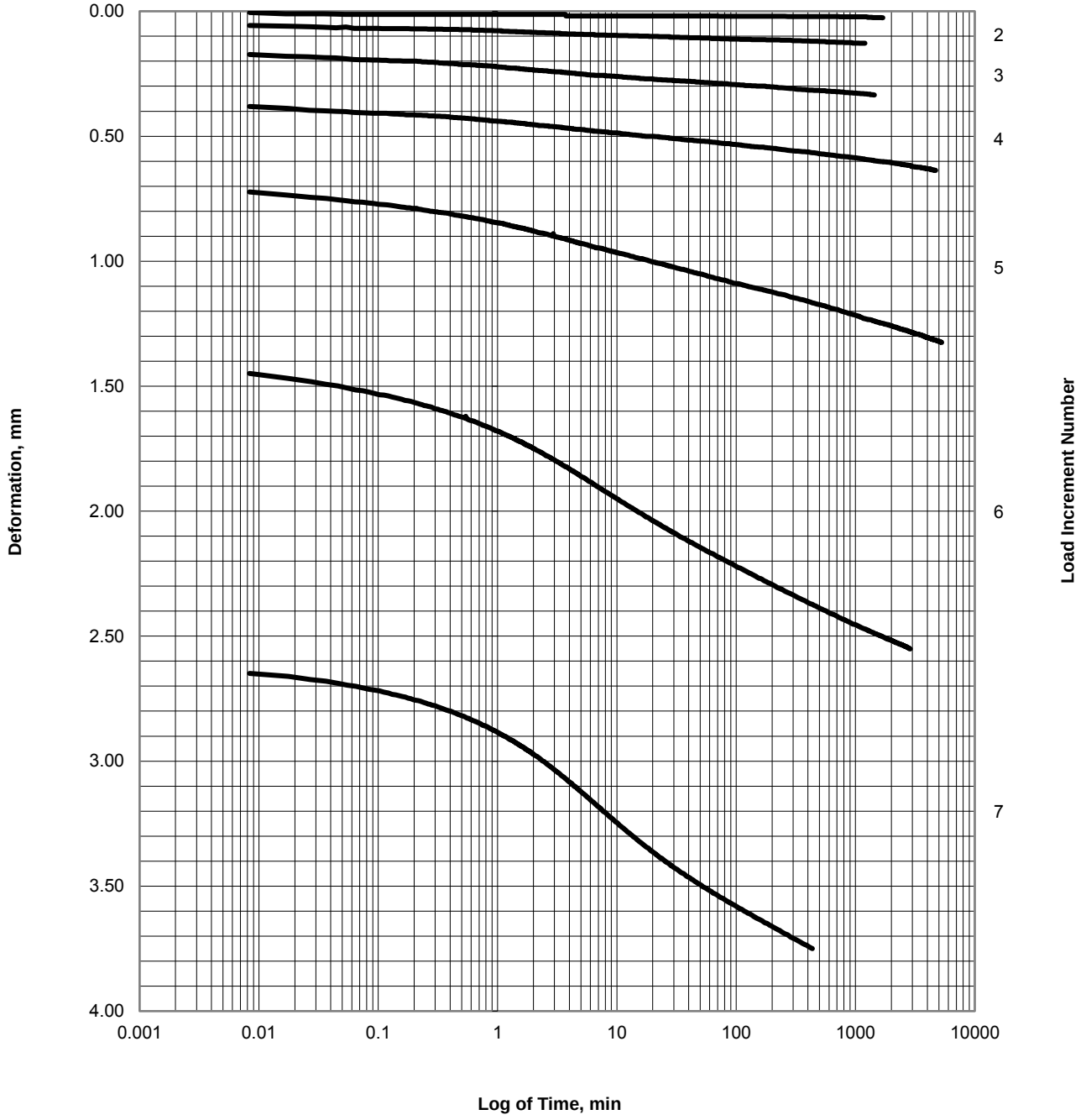
ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOAD INCREMENT TIME-DEFORMATION CURVES
Boring H-06A-18, Sample S-1, 10.7 ft



Load Sequence, tsf = 0.06, 0.13, 0.23, 0.45, 0.93, 1.87

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

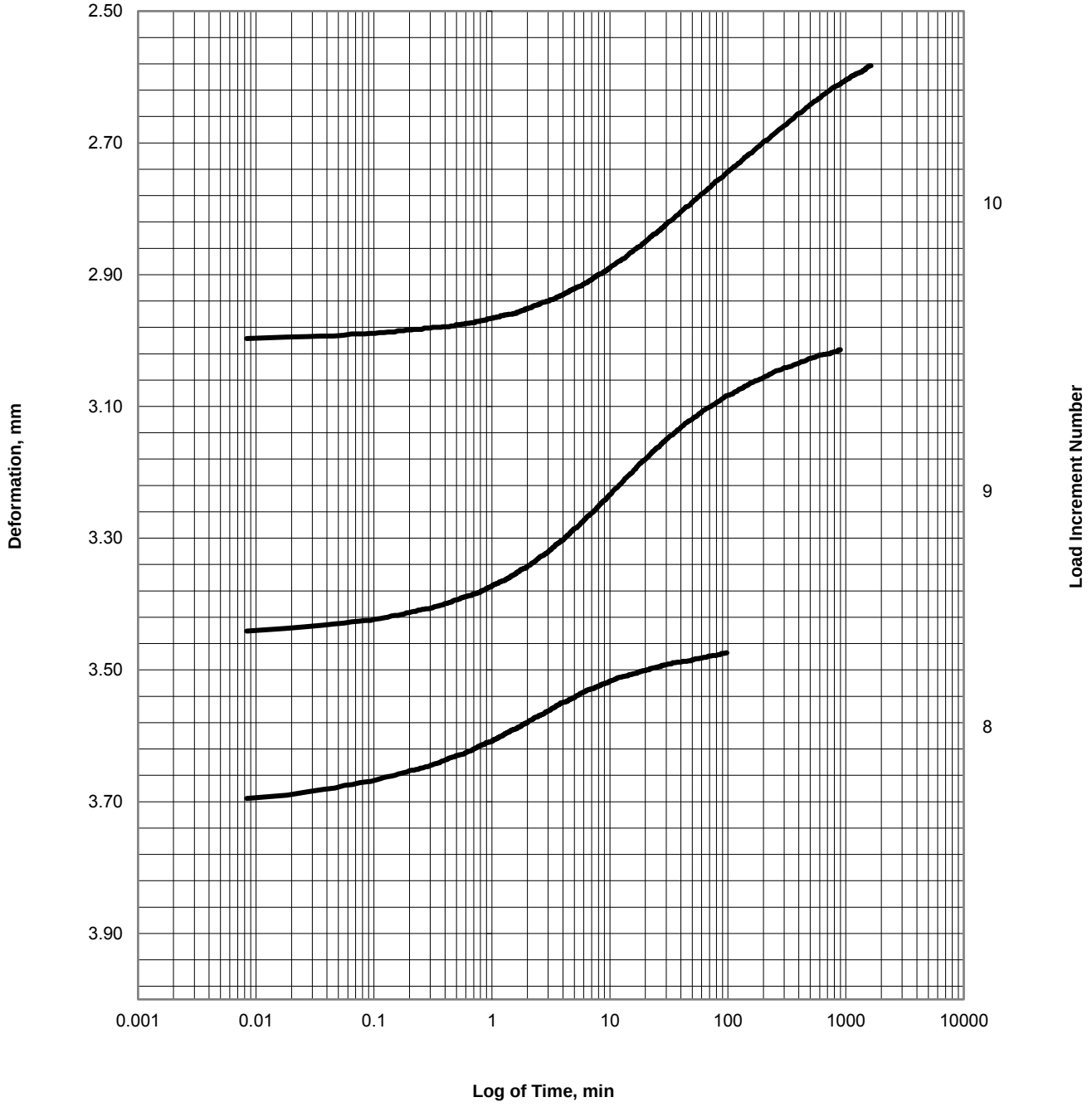
CONSOL_v3.0_NOTB_H-06A-18_S-1_10.7ft_012919.xlsm 03/29/19

101575-004

ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

UNLOAD INCREMENT TIME-DEFORMATION CURVES
Boring H-06A-18, Sample S-1, 10.7 ft



Load Sequence, tsf = 0.45, 0.13, 0.03

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

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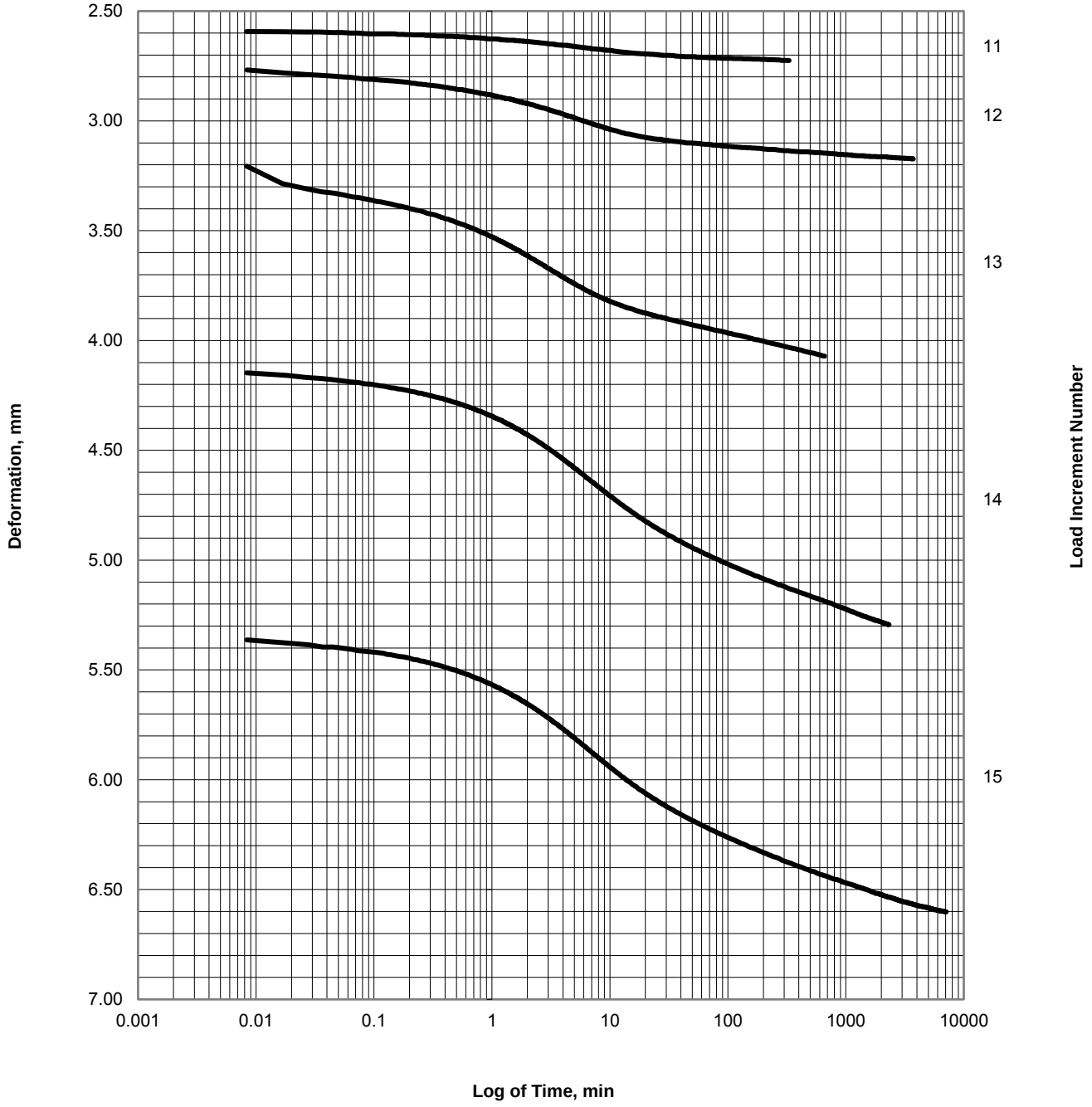
ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

RE-LOAD INCREMENT TIME-DEFORMATION CURVES
BORING H-06A-18, SAMPLE S-1, 10.7 ft



Load Sequence, tsf = 0.13, 0.45, 1.87, 3.7, 7.4

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

CONSOL_v3.0_NOTB_H-06A-18_S-1_10.7ft_012919.xlsm 03/29/19

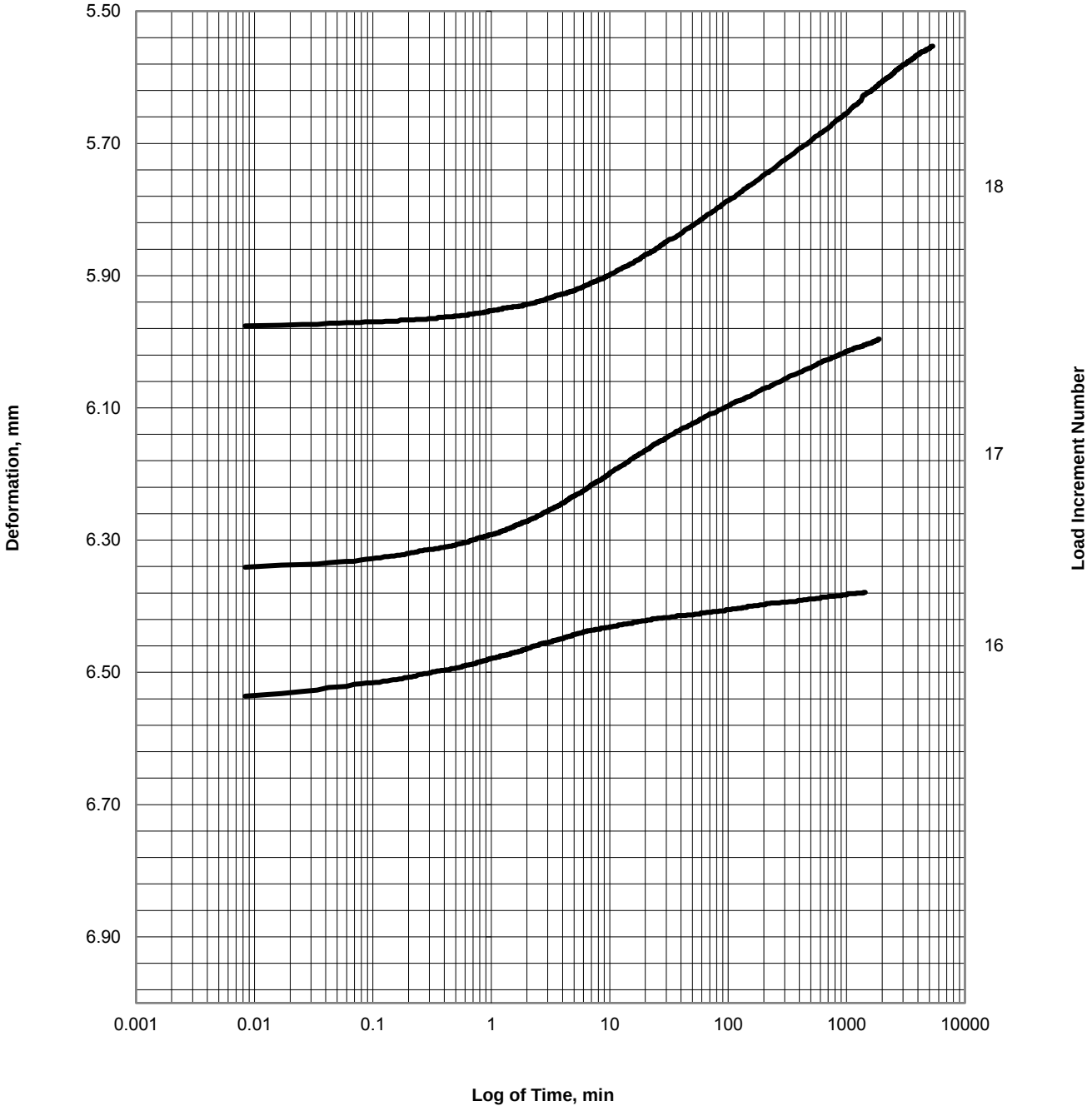
101575-004

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

RE-UNLOAD INCREMENT TIME-DEFORMATION CURVES
BORING H-06A-18, SAMPLE S-1, 10.7 ft



Load Sequence, tsf = 1.87, 0.45, 0.13

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

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ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

TEST SUMMARY
Boring H-06A-18, Sample S-2, 14 ft

SPECIMEN DATA AND TEST RESULTS

Sample Classification:
Sandy Silt (ML)

Specific Gravity, G_s (Assumed)	2.7
Liquid Limit, LL	48
Plastic Limit, PL	40
Plasticity Index, PI (LL - PL)	8
Fines Content	---
Organic Content	---
Initial Seating Load, g	50
Final Seating Load, g	50
ASTM Test Method	Method B
Coefficient of Consolidation Interpretation	Procedure 1

	Pre-Inundation	Final Load
Height, in	0.782	0.512
Diameter, in	2.503	2.503
Specimen Volume, in^3	3.849	2.518
Wet Unit Weight, pcf	101.1	130.5
Dry Unit Weight, pcf	66.3	101.4
Water Content	53%	29%
Void Ratio	1.54	0.66
Degree of Saturation	92%	100%

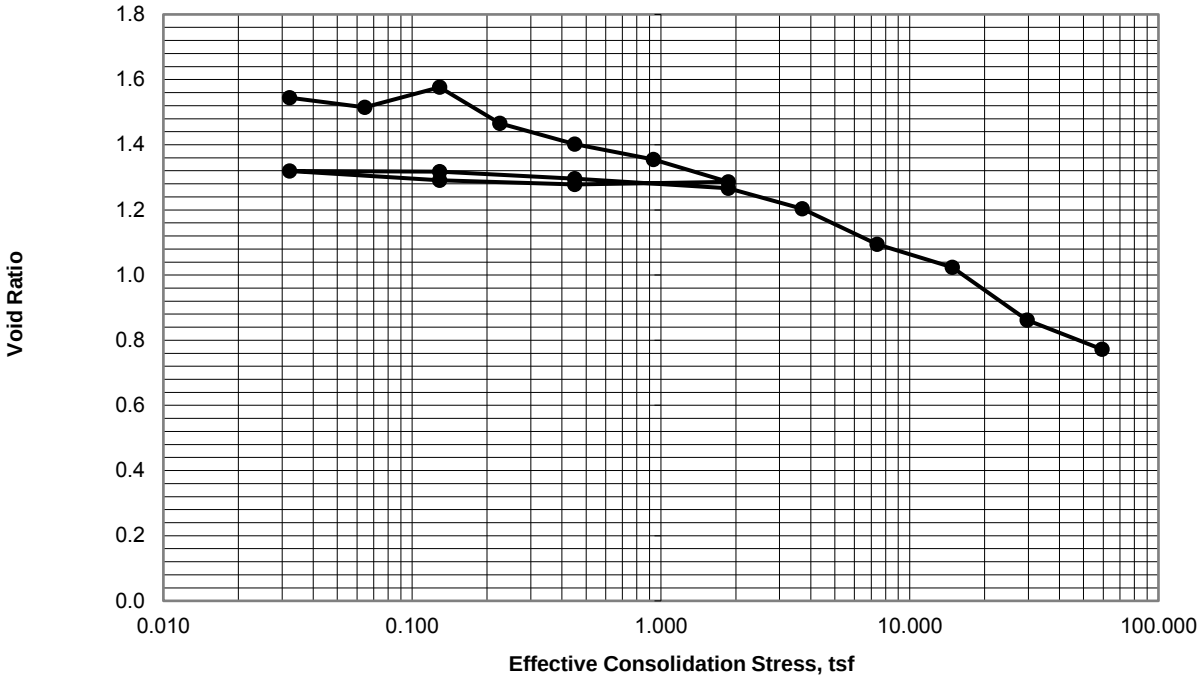
Load Increment Number	Applied Stress, tsf	t_{load}, min	t_{50}, min	ΔH_{load}, in	ΔH at t_{100}, in	$\Delta H/H_o$	Void Ratio	a_v, Mpa^{-1}	c_v, cm^2/s	k, cm/s
Seating										
1	0.03	1335	0.0	0.000	-0.001	-0.1%	1.544	-6.22E-01		
2	0.06	1035	0.4	0.012	0.008	1.1%	1.515	9.46E+00	7.82E-03	2.85E-06
3	0.13	160	0.5	0.021	-0.011	-1.4%	1.577	-1.00E+01	7.33E-03	2.86E-06
4	0.23	285	0.4	0.032	0.024	3%	1.465	1.20E+01	8.14E-03	3.72E-06
5	0.45	3930	0.1	0.052	0.043	5.5%	1.402	2.93E+00	2.25E-02	2.62E-06
6	0.93	195	0.1	0.069	0.058	7.4%	1.354	1.03E+00	2.58E-02	1.09E-06
7	1.87	128	0.1	0.094	0.079	10.1%	1.286	7.68E-01	2.34E-02	7.49E-07
8	0.45	1095	0.1	0.088	0.081	10.4%	1.279	-5.28E-02	1.78E-02	4.02E-08
9	0.13	405	0.1	0.081	0.077	9.9%	1.291	3.98E-01	2.15E-02	3.68E-07
10	0.03	1020	1.3	0.072	0.069	8.8%	1.319	3.04E+00	2.08E-03	2.71E-07
11	0.13	215	0.1	0.074	0.069	8.8%	1.318	1.38E-01	2.13E-02	1.24E-07
12	0.45	255	0.1	0.083	0.076	9.7%	1.296	7.14E-01	1.80E-02	5.43E-07
13	1.87	945	0.0	0.101	0.085	10.9%	1.266	2.19E-01	7.21E-02	6.74E-07
14	3.70	1440	0.1	0.127	0.104	13.3%	1.203	3.57E-01	3.16E-02	4.89E-07
15	7.40	4245	0.3	0.160	0.138	17.6%	1.094	3.07E-01	7.29E-03	9.96E-08
16	14.81	450	0.1	0.190	0.159	20.4%	1.024	9.94E-02	2.31E-02	1.08E-07
17	29.62	960	0.1	0.229	0.209	26.8%	0.861	1.14E-01	2.08E-02	1.15E-07
18	59.24	1845	0.1	0.271	0.237	30.3%	0.772	3.15E-02	1.54E-02	2.56E-08

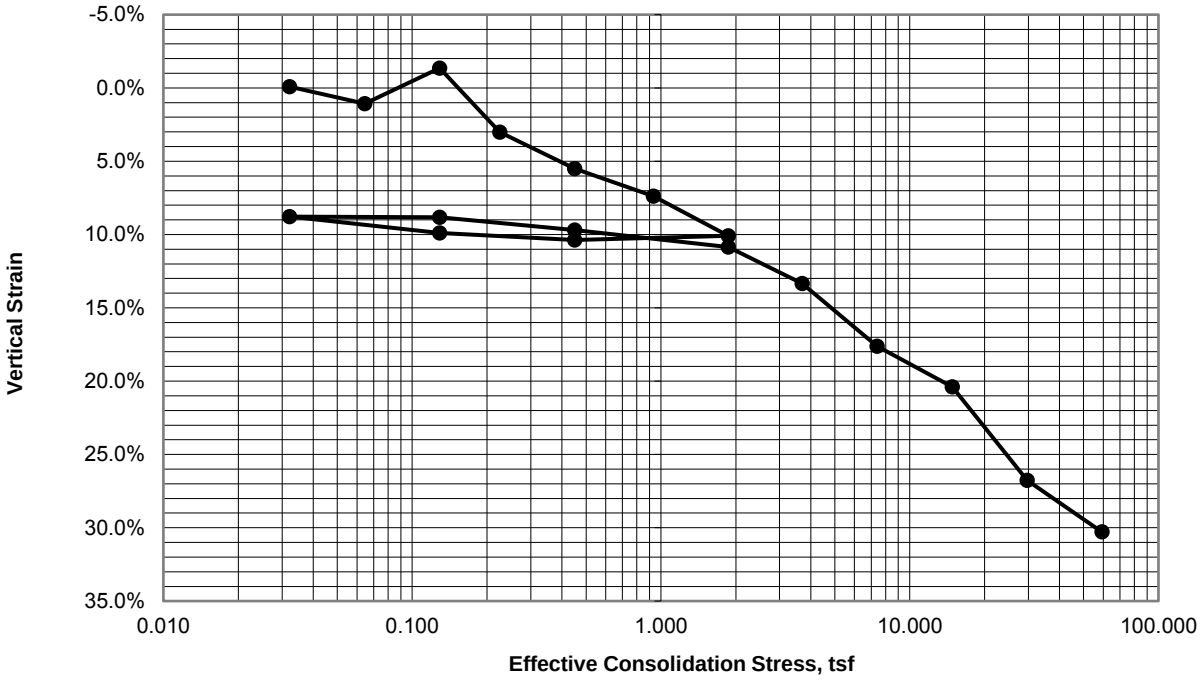
Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

CONSOLIDATION CURVES
Boring H-06A-18, Sample S-2, 14 ft





Maximum Applied Effective Consolidation Stress, tsf = 59.24

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

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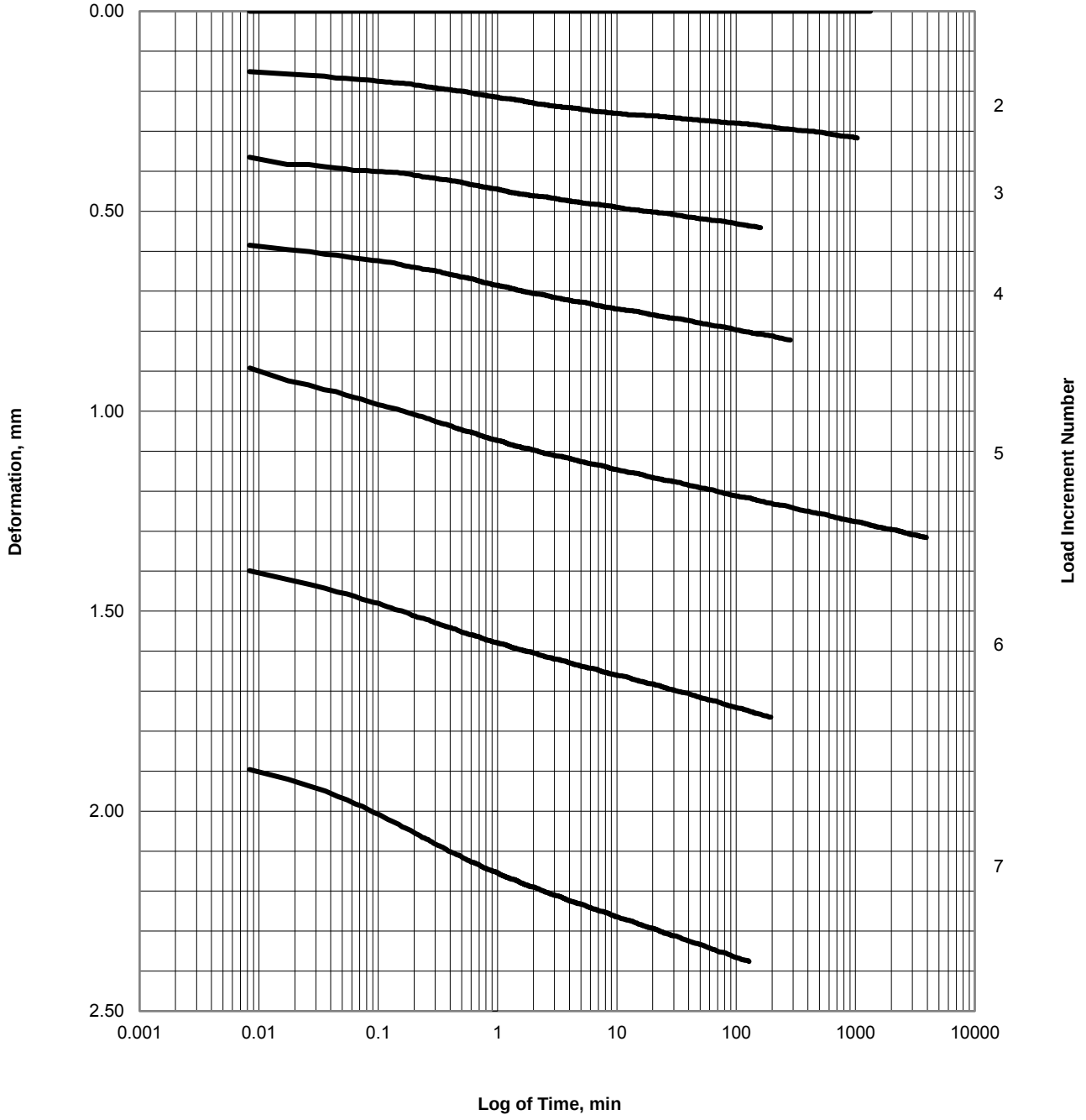
ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOAD INCREMENT TIME-DEFORMATION CURVES
Boring H-06A-18, Sample S-2, 14 ft



Load Sequence, tsf = 0.06, 0.13, 0.23, 0.45, 0.93, 1.87

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

CONSOL_v3.0_NOTB_H-06A-18_S-2_14ft_032919.xlsm 03/29/19

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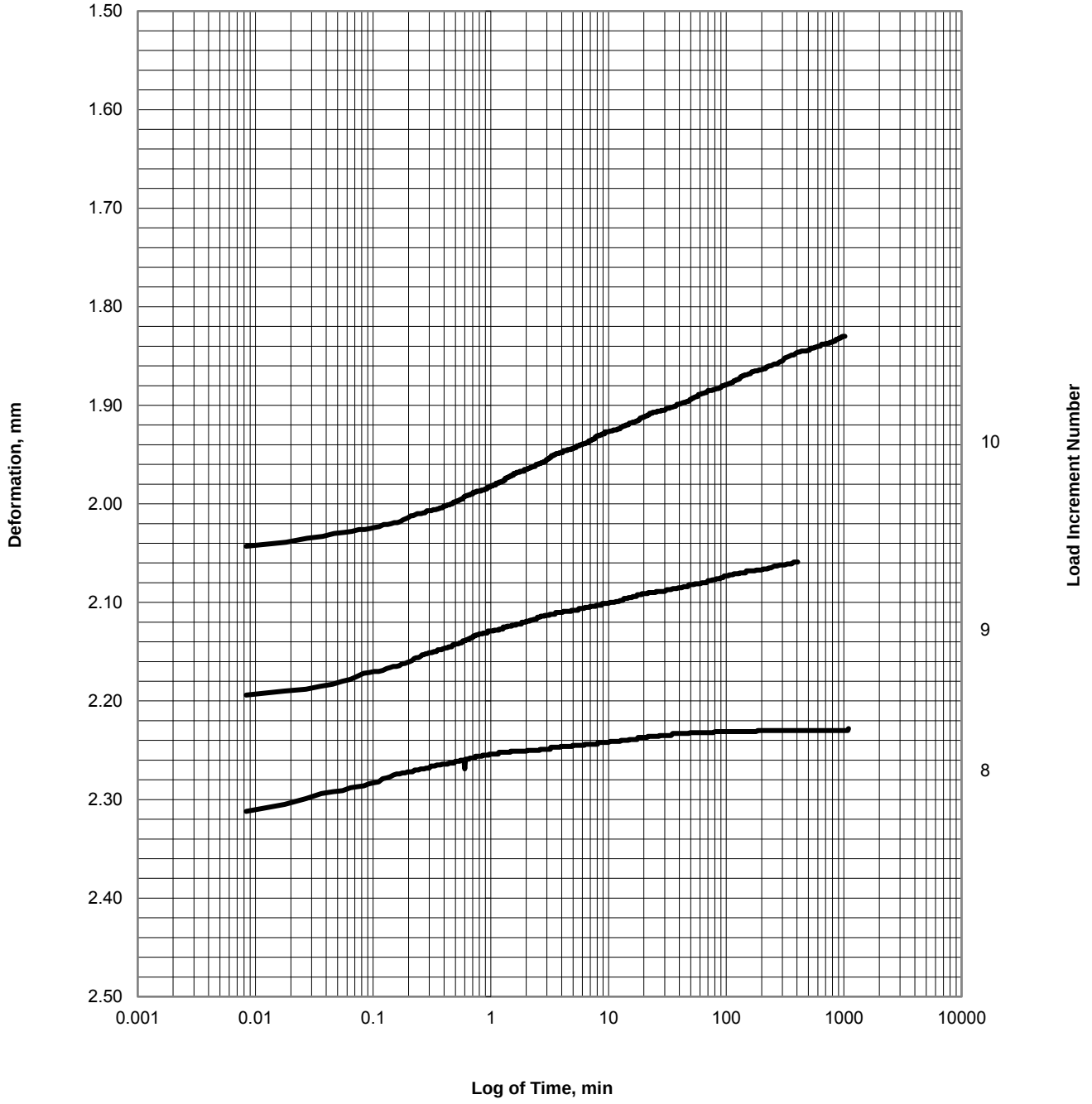
ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

UNLOAD INCREMENT TIME-DEFORMATION CURVES
Boring H-06A-18, Sample S-2, 14 ft



Load Sequence, tsf = 0.45, 0.13, 0.03

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

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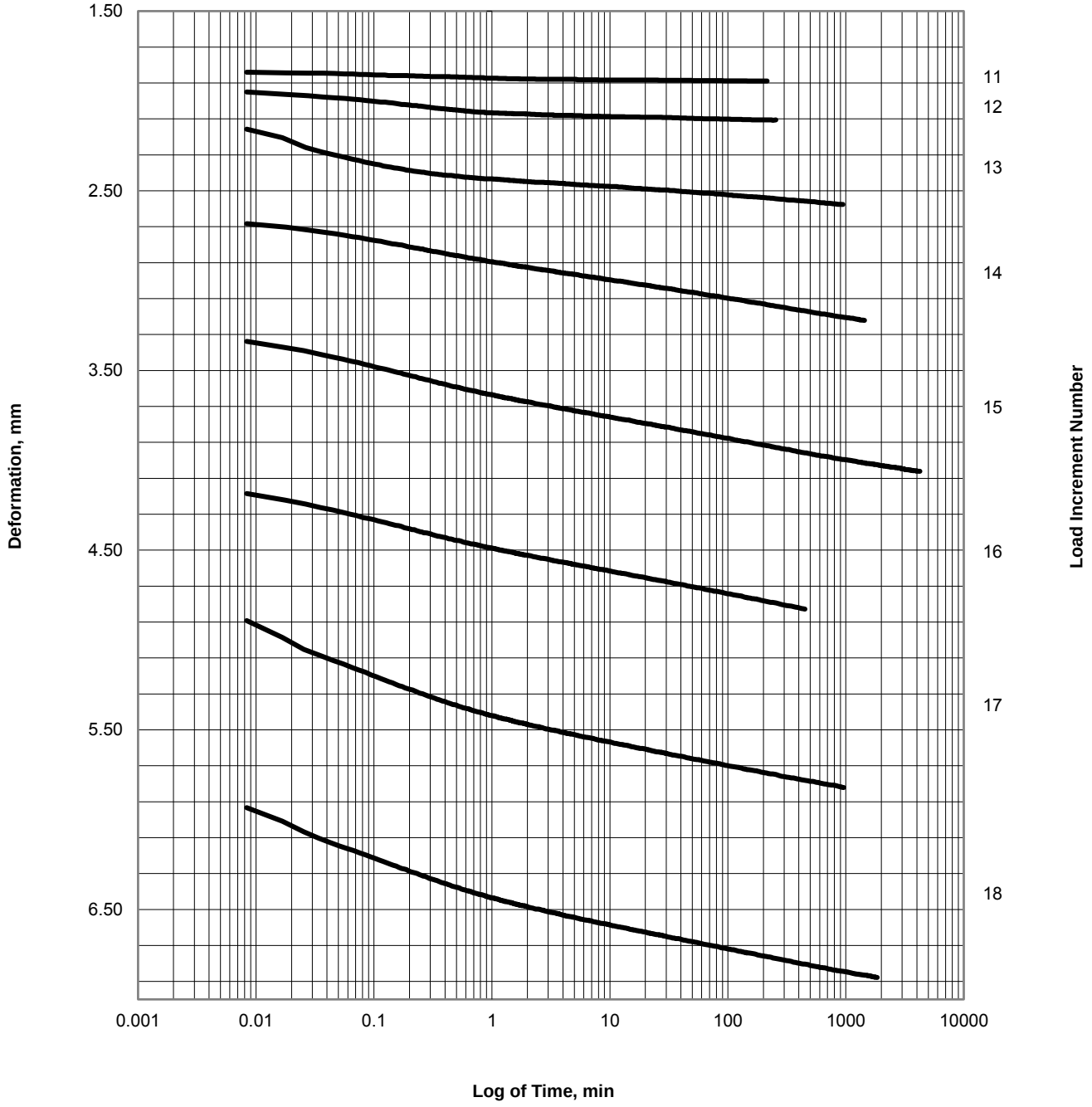
RE-LOAD INCREMENT TIME-DEFORMATION CURVES
BORING H-06A-18, SAMPLE S-2, 14 ft



Load Sequence, tsf = 0.13, 0.45, 1.87, 3.7, 7.4, 14.81, 29.62, 59.24

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

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ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

TEST SUMMARY
Boring H-08-18, Sample S-10, 23.6 ft

SPECIMEN DATA AND TEST RESULTS

Sample Classification:
Elastic Silt (MH)

Specific Gravity, G_s (Assumed)	2.7
Liquid Limit, LL	81
Plastic Limit, PL	47
Plasticity Index, PI (LL - PL)	34
Fines Content	---
Organic Content	---
Initial Seating Load, g	50
Final Seating Load, g	50
ASTM Test Method	Method B
Coefficient of Consolidation Interpretation	Procedure 1

	Pre-Inundation	Final Load
Height, in	0.779	0.417
Diameter, in	2.509	2.509
Specimen Volume, in^3	3.852	2.065
Wet Unit Weight, pcf	93.9	129.5
Dry Unit Weight, pcf	53.7	100.2
Water Content	75%	29%
Void Ratio	2.14	0.68
Degree of Saturation	94%	100%

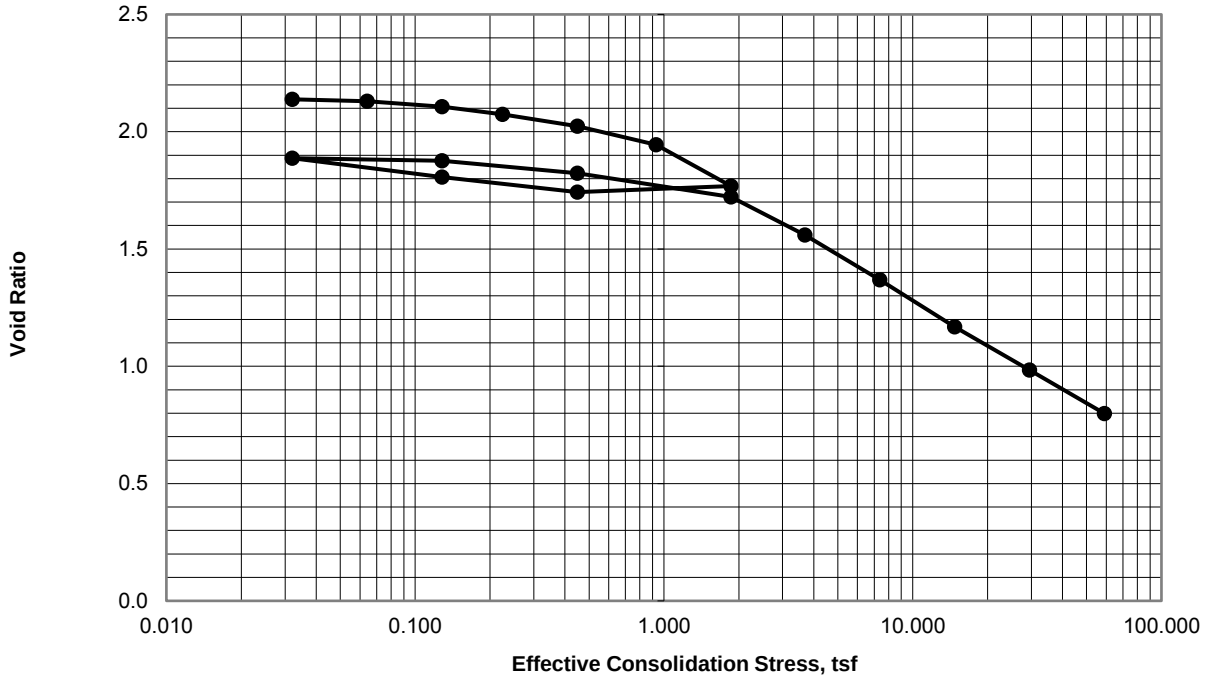
Load Increment Number	Applied Stress, tsf	t_{load}, min	t_{50}, min	ΔH_{load}, in	ΔH at t_{100}, in	$\Delta H/H_o$	Void Ratio	a_v, Mpa^{-1}	c_v, cm^2/s	k, cm/s
Seating										
1	0.03	195	0.1	0.000	0.000	0%	2.138	5.17E-02	2.53E-02	4.09E-08
2	0.06	126	0.2	0.004	0.002	0.3%	2.130	2.59E+00	1.68E-02	1.36E-06
3	0.13	118	0.3	0.012	0.008	1%	2.106	3.91E+00	9.76E-03	1.20E-06
4	0.22	990	0.3	0.023	0.016	2.1%	2.074	3.52E+00	1.03E-02	1.14E-06
5	0.45	82	0.2	0.037	0.028	3.7%	2.024	2.34E+00	1.54E-02	1.15E-06
6	0.93	235	0.2	0.065	0.048	6.2%	1.945	1.72E+00	1.37E-02	7.65E-07
7	1.86	1110	0.7	0.113	0.092	11.8%	1.769	1.97E+00	3.96E-03	2.60E-07
8	0.45	465	0.2	0.101	0.098	12.6%	1.742	-2.01E-01	1.30E-02	9.24E-08
9	0.13	2400	6.2	0.082	0.082	10.6%	1.807	2.13E+00	4.09E-04	3.12E-08
10	0.03	4245	21.0	0.064	0.062	8%	1.887	8.64E+00	1.26E-04	3.82E-08
11	0.13	450	0.5	0.070	0.065	8.3%	1.877	1.09E+00	5.02E-03	1.85E-07
12	0.45	960	0.6	0.087	0.078	10.1%	1.823	1.75E+00	4.51E-03	2.69E-07
13	1.86	240	0.3	0.120	0.103	13.3%	1.722	7.51E-01	9.70E-03	2.53E-07
14	3.68	1875	0.8	0.170	0.143	18.4%	1.560	9.22E-01	2.92E-03	9.70E-08
15	7.37	1365	1.0	0.221	0.191	24.5%	1.369	5.42E-01	1.98E-03	4.11E-08
16	14.73	1680	1.1	0.271	0.241	30.9%	1.169	2.84E-01	1.49E-03	1.75E-08
17	29.46	4365	1.1	0.319	0.286	36.8%	0.985	1.31E-01	1.28E-03	7.59E-09
18	58.93	4200	1.2	0.362	0.332	42.7%	0.799	6.58E-02	9.34E-04	3.04E-09

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

CONSOLIDATION CURVES
Boring H-08-18, Sample S-10, 23.6 ft



Maximum Applied Effective Consolidation Stress, tsf = 58.93

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

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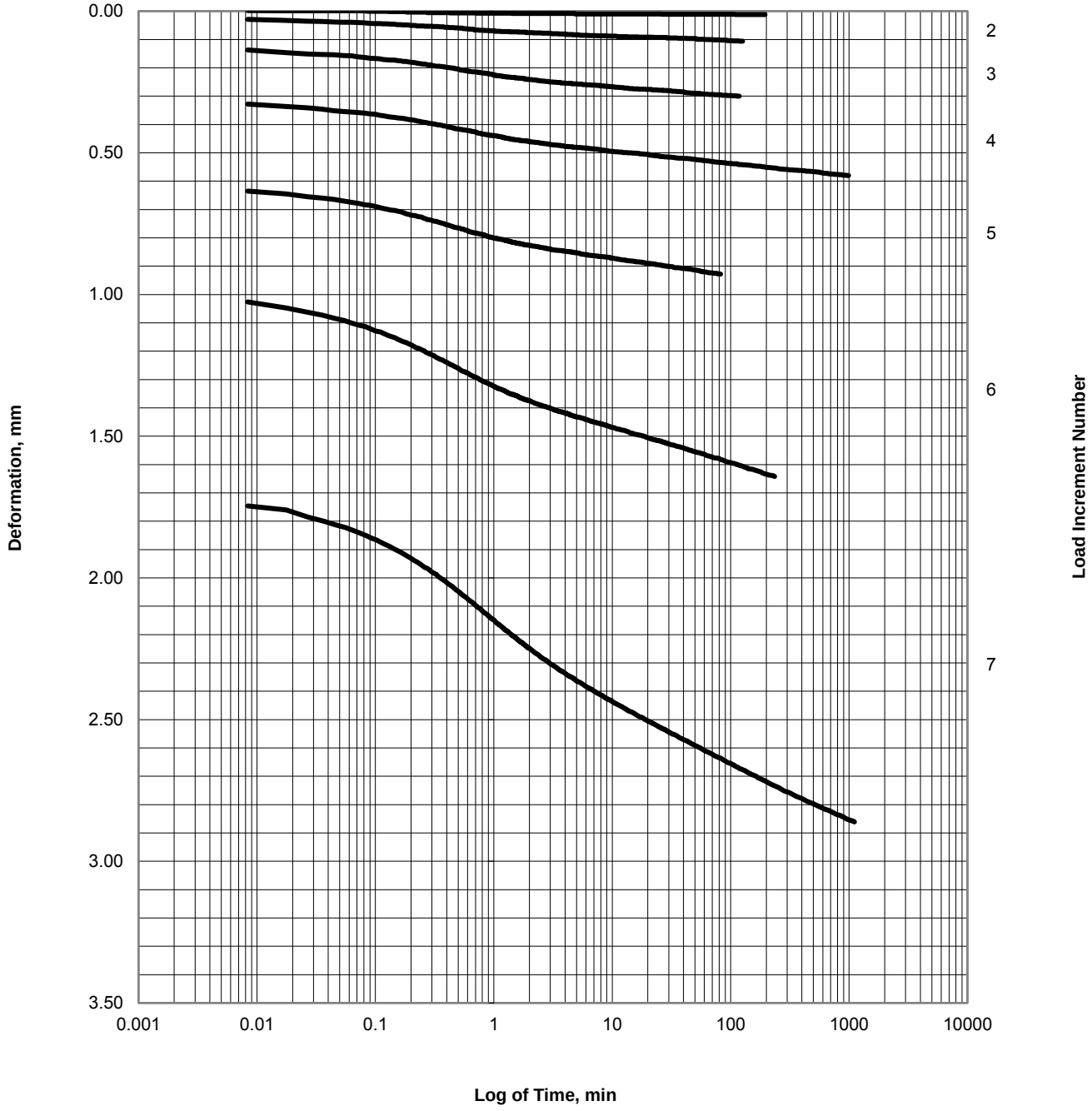
ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOAD INCREMENT TIME-DEFORMATION CURVES
Boring H-08-18, Sample S-10, 23.6 ft



Load Sequence, tsf = 0.06, 0.13, 0.22, 0.45, 0.93, 1.86

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

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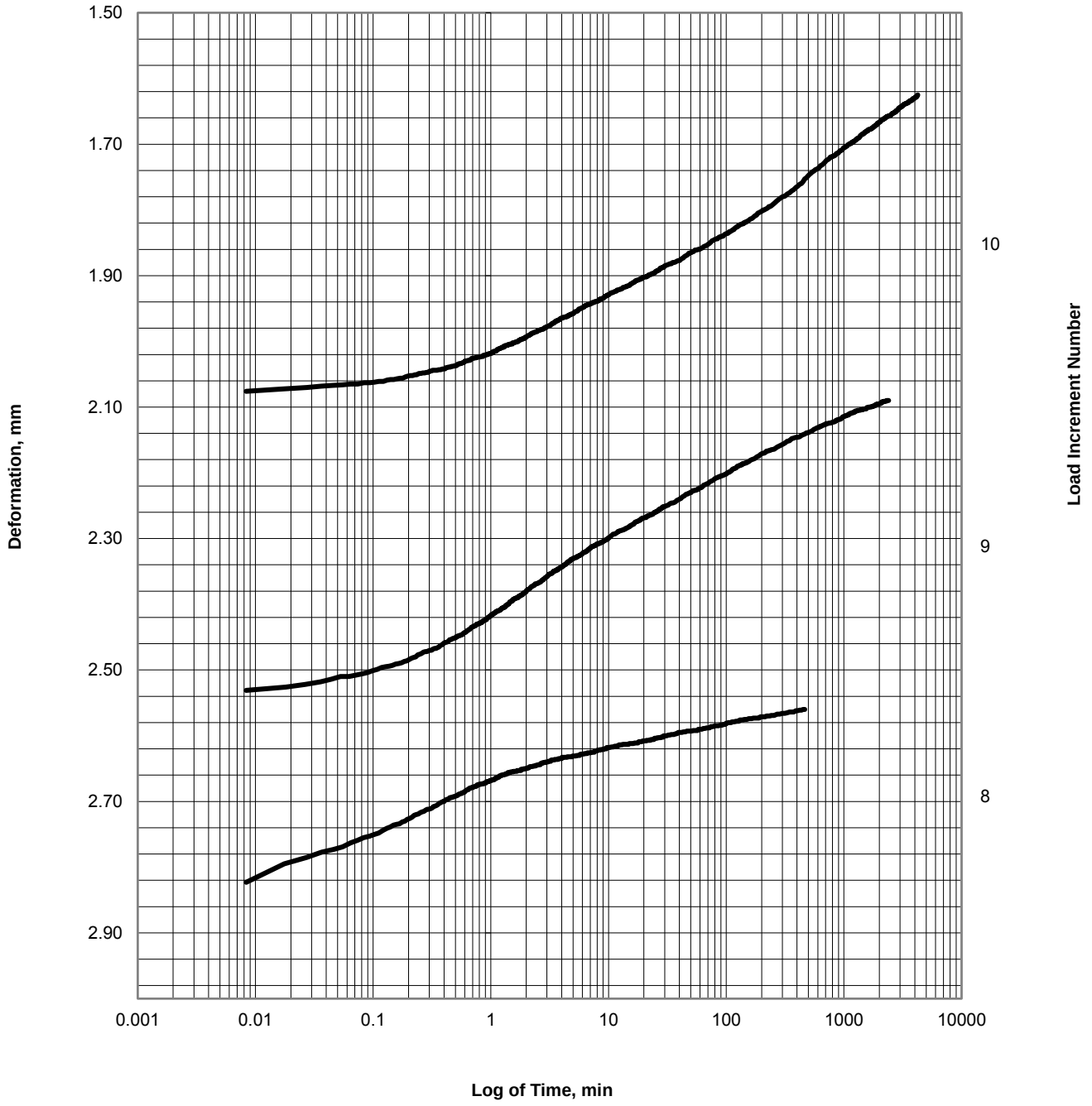
ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

UNLOAD INCREMENT TIME-DEFORMATION CURVES
Boring H-08-18, Sample S-10, 23.6 ft



Load Sequence, tsf = 0.45, 0.13, 0.03

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

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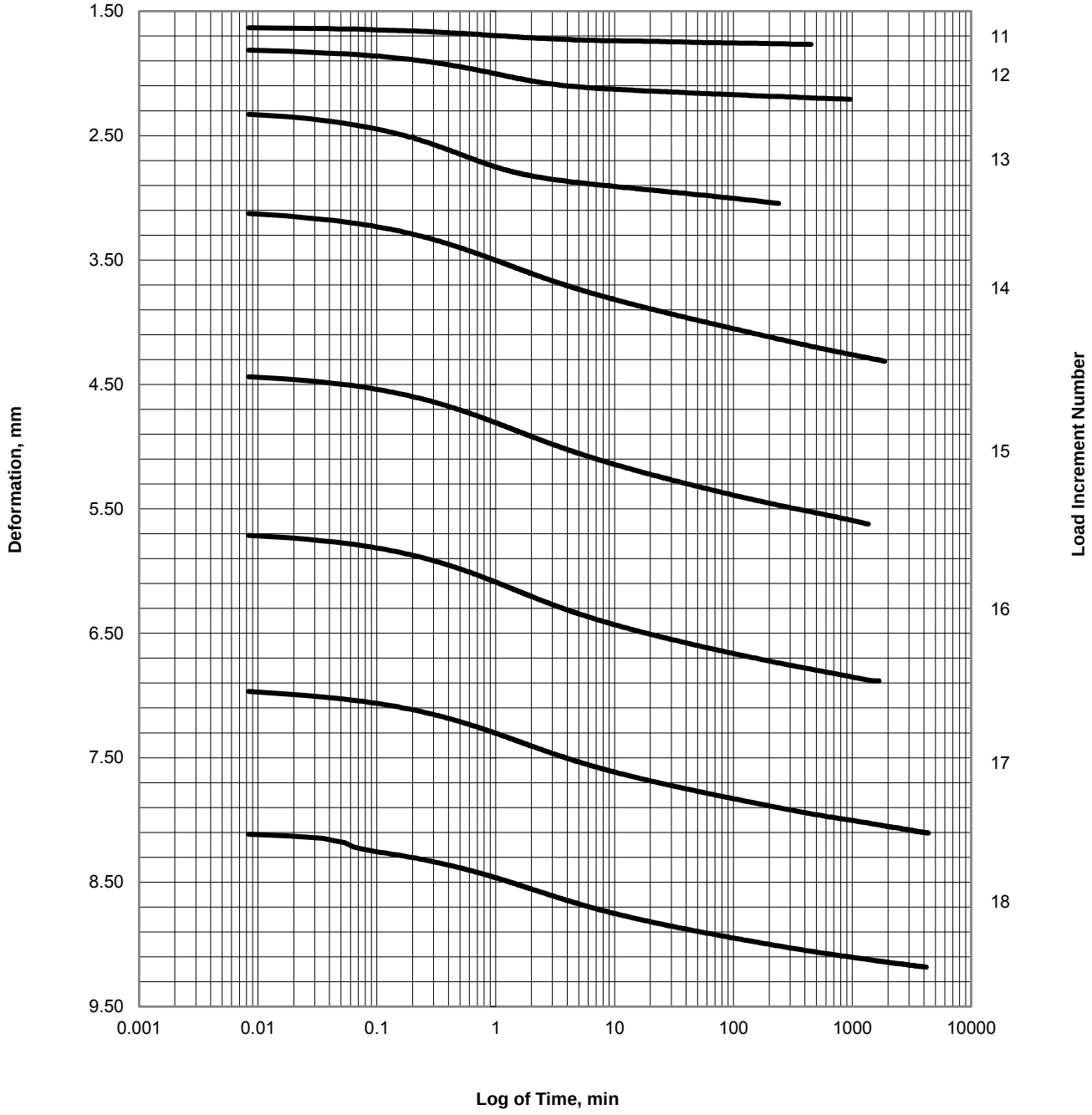
ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

RE-LOAD INCREMENT TIME-DEFORMATION CURVES
BORING H-08-18, SAMPLE S-10, 23.6 ft



Load Sequence, tsf = 0.13, 0.45, 1.86, 3.68, 7.37, 14.73, 29.46, 58.93

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

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ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

TEST SUMMARY
Boring H-09-18, Sample S-23, 92.7 ft

SPECIMEN DATA AND TEST RESULTS

Sample Classification:
Elastic Silt (MH)

Specific Gravity, G_s (Assumed)	2.7
Liquid Limit, LL	50
Plastic Limit, PL	29
Plasticity Index, PI (LL - PL)	21
Fines Content	---
Organic Content	---
Initial Seating Load, g	50
Final Seating Load, g	50
ASTM Test Method	Method B
Coefficient of Consolidation Interpretation	Procedure 1

	Pre-Inundation	Final Load
Height, in	0.778	0.539
Diameter, in	2.503	2.503
Specimen Volume, in^3	3.827	2.654
Wet Unit Weight, pcf	106.0	133.3
Dry Unit Weight, pcf	71.3	102.9
Water Content	49%	30%
Void Ratio	1.36	0.64
Degree of Saturation	96%	100%

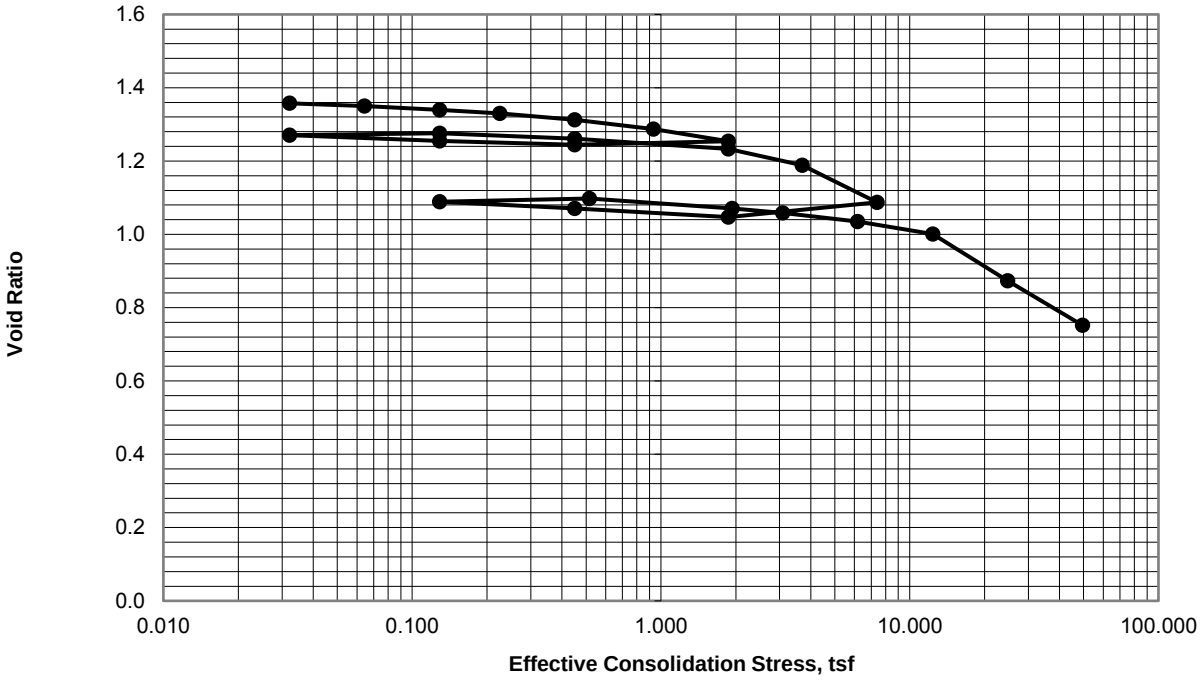
Load Increment Number	Applied Stress, tsf	t_{load}, min	t_{50}, min	ΔH_{load}, in	ΔH at t_{100}, in	$\Delta H/H_o$	Void Ratio	a_v, Mpa^{-1}	c_v, cm^2/s	k, cm/s
Seating										
1	0.03	1680	0.1	0.002	0.002	0.2%	1.358	1.71E+00	5.80E-02	4.11E-06
2	0.06	1200	0.1	0.005	0.004	0.5%	1.350	2.48E+00	2.64E-02	2.73E-06
3	0.13	142	0.1	0.010	0.008	1%	1.339	1.73E+00	3.54E-02	2.55E-06
4	0.23	1305	0.1	0.015	0.011	1.4%	1.330	9.70E-01	3.32E-02	1.35E-06
5	0.45	2805	0.1	0.024	0.016	2.1%	1.313	8.09E-01	2.97E-02	1.01E-06
6	0.93	1890	0.1	0.035	0.025	3.2%	1.287	5.51E-01	3.68E-02	8.60E-07
7	1.87	1245	0.1	0.050	0.036	4.6%	1.254	3.76E-01	5.43E-02	8.75E-07
8	0.45	4020	0.1	0.044	0.039	5%	1.244	-6.97E-02	3.13E-02	9.50E-08
9	0.13	420	0.1	0.039	0.036	4.6%	1.255	3.34E-01	2.17E-02	3.16E-07
10	0.03	2460	0.7	0.032	0.030	3.9%	1.271	1.77E+00	4.39E-03	3.38E-07
11	0.13	435	0.1	0.034	0.029	3.7%	1.275	-4.91E-01	3.67E-02	7.80E-07
12	0.45	104	0.1	0.040	0.034	4.3%	1.261	4.77E-01	3.01E-02	6.18E-07
13	1.87	900	0.1	0.054	0.043	5.5%	1.233	2.06E-01	4.43E-02	3.96E-07
14	3.70	5761	1.1	0.081	0.057	7.4%	1.188	2.53E-01	2.63E-03	2.93E-08
15	7.40	2940	0.7	0.119	0.091	11.6%	1.088	2.84E-01	3.76E-03	4.79E-08
16	1.87	510	0.2	0.112	0.104	13.3%	1.047	-7.58E-02	1.31E-02	4.67E-08
17	0.45	915	0.4	0.101	0.096	12.4%	1.071	1.72E-01	5.95E-03	4.90E-08
18	0.13	1290	3.2	0.091	0.090	11.6%	1.089	5.97E-01	7.75E-04	2.19E-08
19	0.52	225	0.2	0.095	0.087	11.2%	1.098	-2.39E-01	1.69E-02	1.90E-07
20	1.93	134	0.1	0.105	0.096	12.3%	1.071	1.98E-01	2.82E-02	2.62E-07
21	3.09	3870	0.1	0.111	0.100	12.9%	1.059	1.10E-01	3.13E-02	1.63E-07
22	6.18	8701	0.2	0.121	0.108	13.9%	1.035	8.04E-02	1.14E-02	4.36E-08
23	12.36	3030	0.1	0.151	0.119	15.3%	1.000	5.86E-02	2.27E-02	6.41E-08
24	24.72	2685	0.2	0.193	0.161	20.7%	0.873	1.08E-01	1.06E-02	5.59E-08
25	49.45	6001	0.6	0.239	0.201	25.8%	0.752	5.11E-02	2.87E-03	7.67E-09

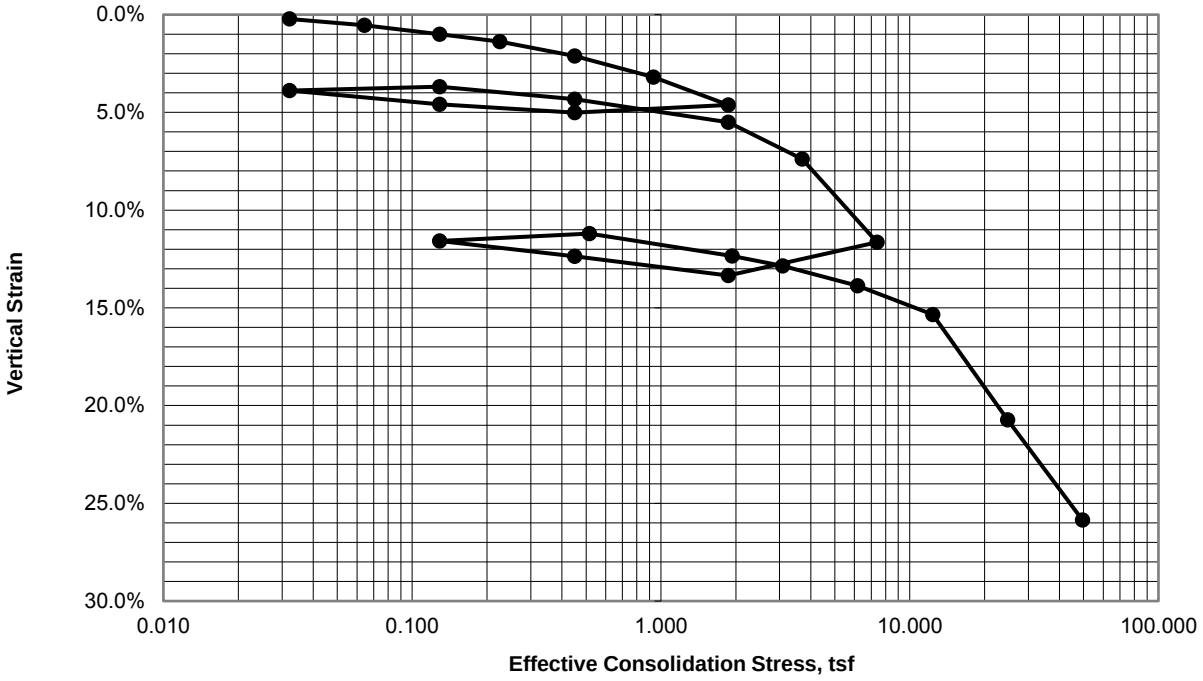
Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

CONSOLIDATION CURVES
Boring H-09-18, Sample S-23, 92.7 ft





Maximum Applied Effective Consolidation Stress, tsf = 49.45

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

CONSOL_v3.0_NOTB_H-09-18_S-23_92.7ft_032919.xlsm 03/29/19

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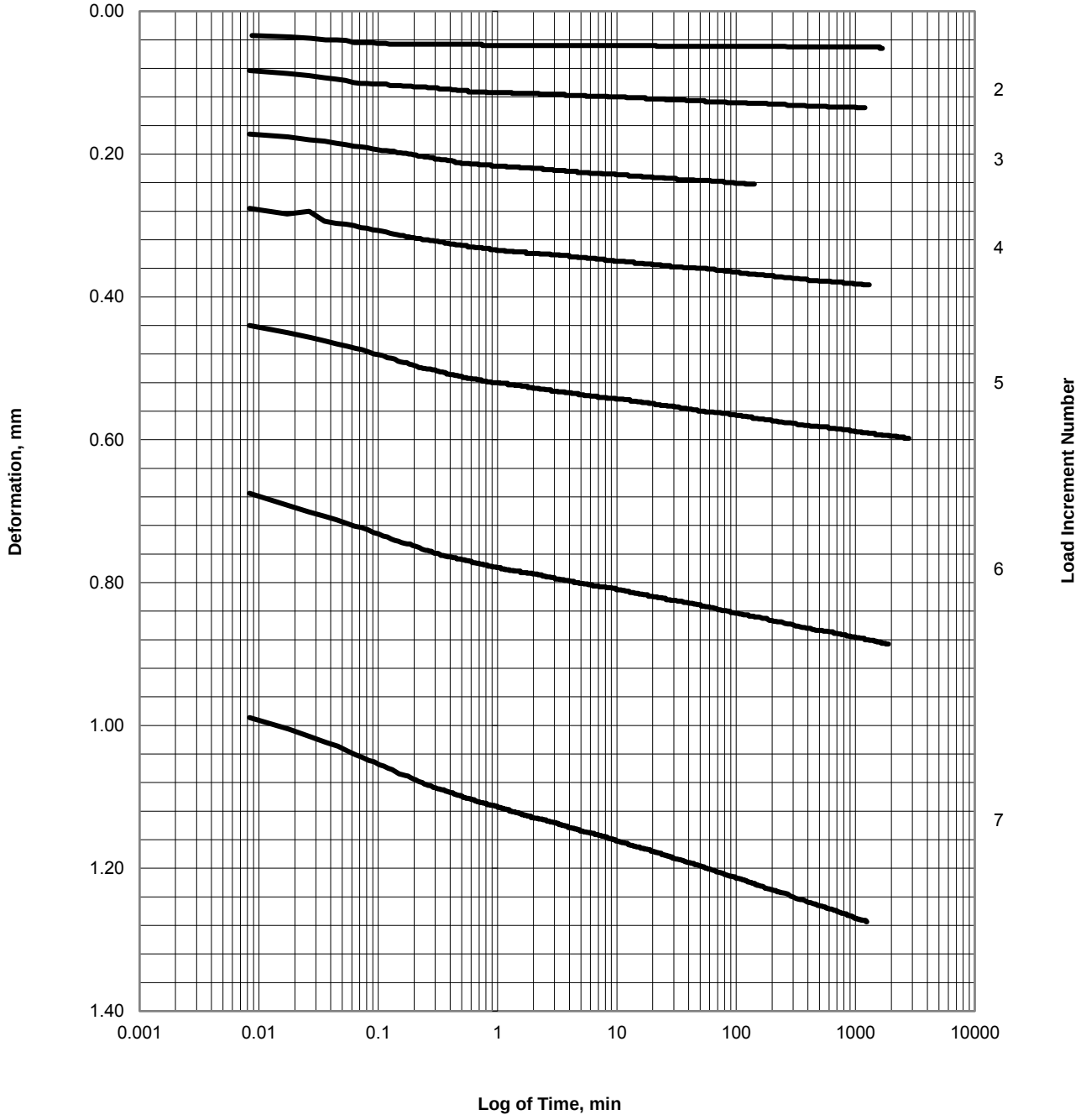
ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOAD INCREMENT TIME-DEFORMATION CURVES
Boring H-09-18, Sample S-23, 92.7 ft



Load Sequence, tsf = 0.06, 0.13, 0.23, 0.45, 0.93, 1.87

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

CONSOL_v3.0_NOTB_H-09-18_S-23_92.7ft_032919.xlsm 03/29/19

101575-004

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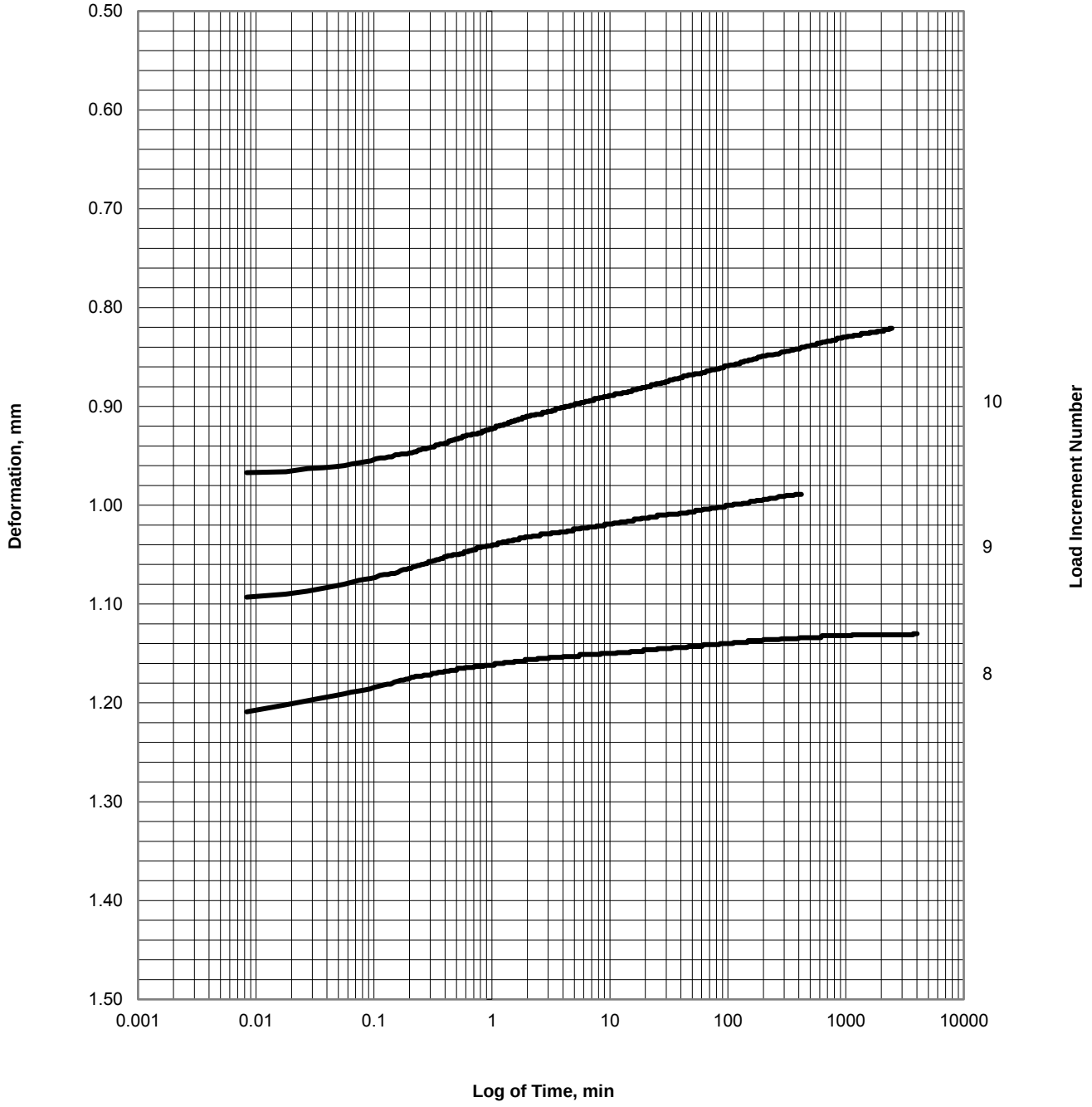
ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

UNLOAD INCREMENT TIME-DEFORMATION CURVES
Boring H-09-18, Sample S-23, 92.7 ft



Load Sequence, tsf = 0.45, 0.13, 0.03

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

CONSOL_v3.0_NOTB_H-09-18_S-23_92.7ft_032919.xlsm 03/29/19

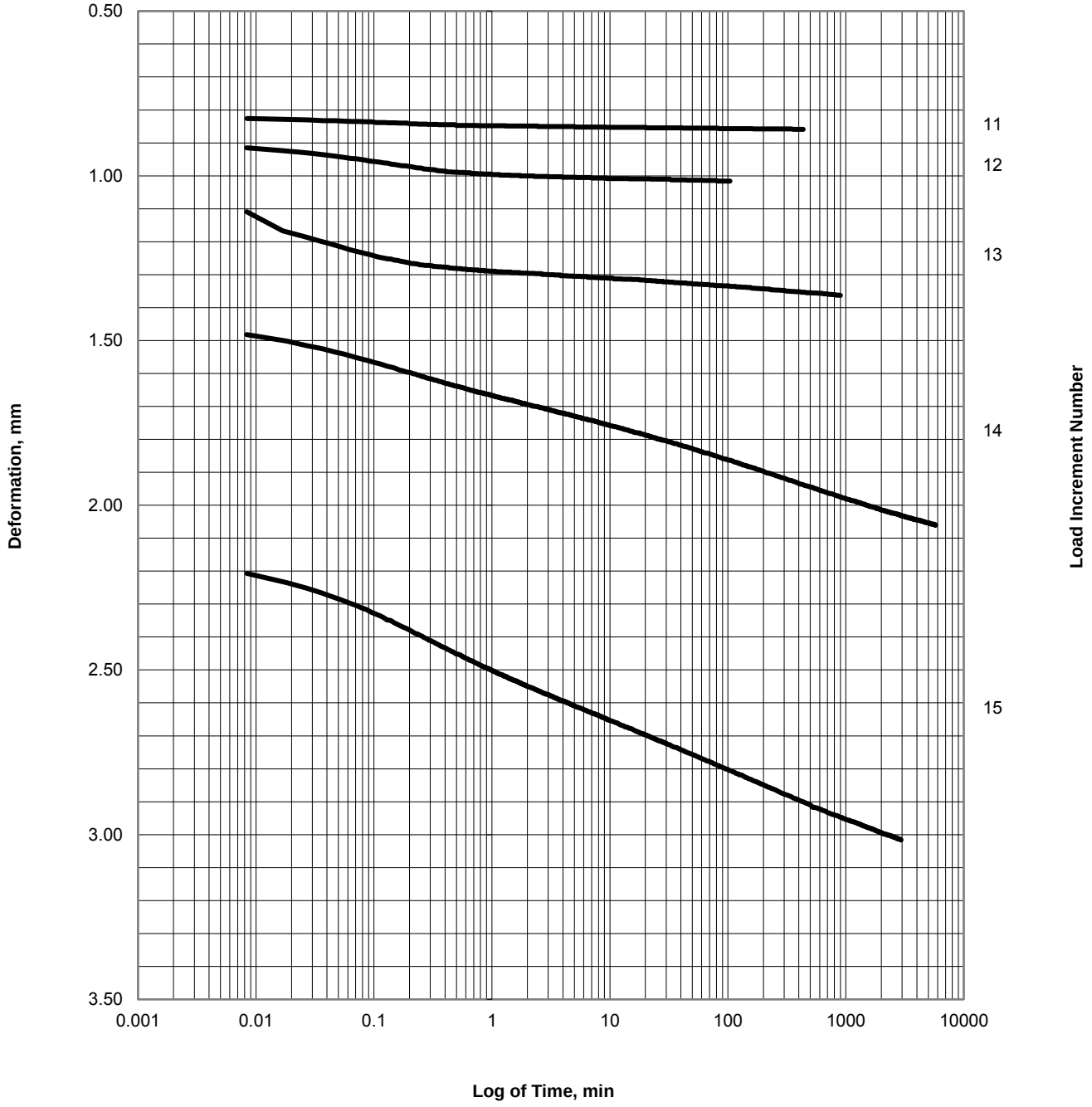
101575-004

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

ONE-DIMENSIONAL CONSOLIDATION

Potash Export Facility
Grays Harbor
Hoquiam, Washington

RE-LOAD INCREMENT TIME-DEFORMATION CURVES
BORING H-09-18, SAMPLE S-23, 92.7 ft



Load Sequence, tsf = 0.13, 0.45, 1.87, 3.7, 7.4

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

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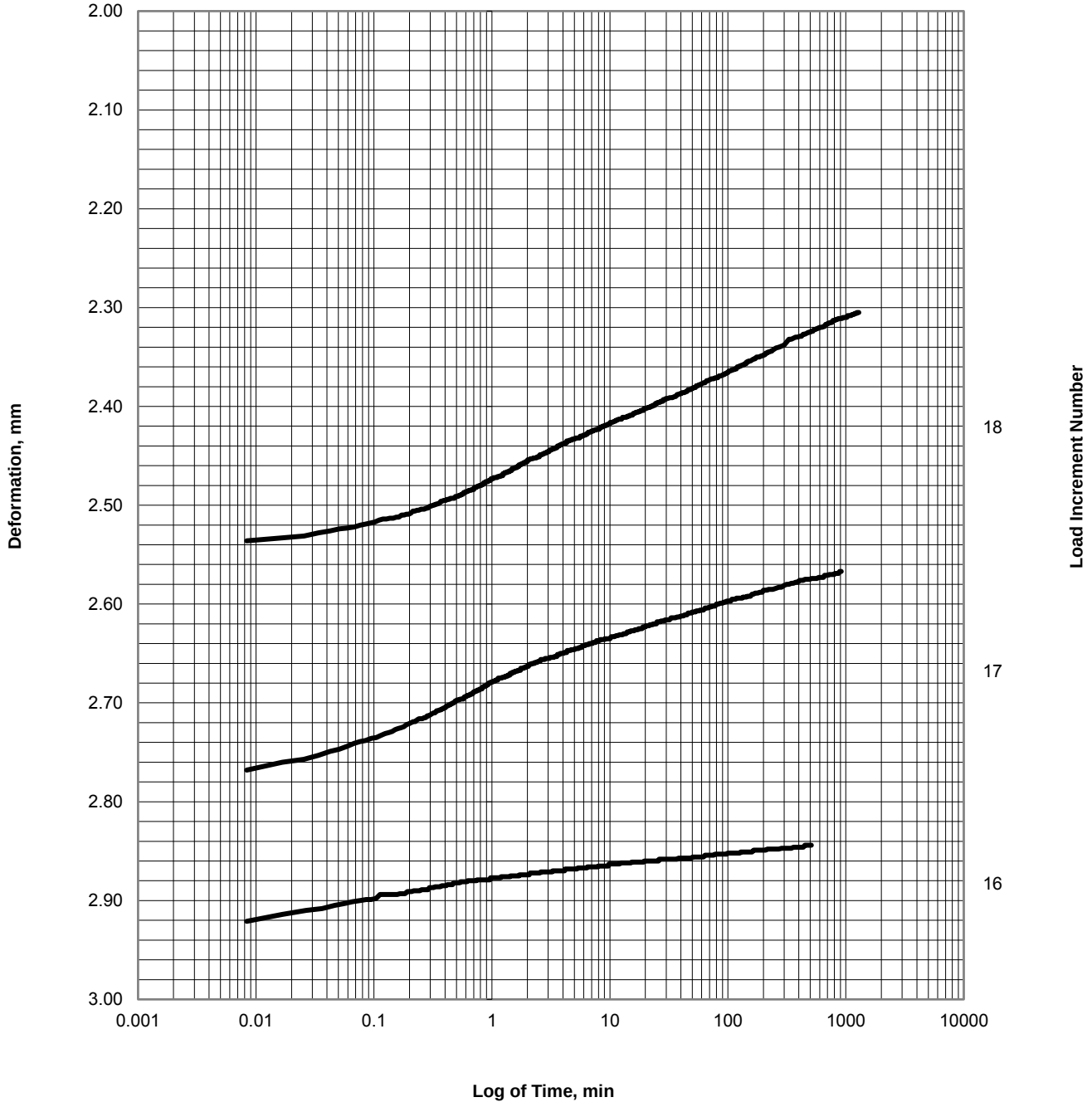
RE-UNLOAD INCREMENT TIME-DEFORMATION CURVES
BORING H-09-18, SAMPLE S-23, 92.7 ft



Load Sequence, tsf = 1.87, 0.45, 0.13

Specimen trimmed using a trimming turntable and indundated with distilled water.
Tested by AKV in accordance with ASTM D2435-11. Test initiated on 12/01/2018. Finalized by AKV.

SHANNON & WILSON, INC. • 400 NORTH 34TH STREET • SUITE 100 • SEATTLE, WASHINGTON • 98103 • MAIN 206-632-8020 • FAX 206-695-6777

IMPORTANT INFORMATION

Important Information

About Your Geotechnical Report

IMPORTANT INFORMATION

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors that were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining

IMPORTANT INFORMATION

your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims

being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland