Total Depth:	*55.32 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 4.7 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-57*	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, m | Symbol | Samples | Ground Water | Depth, m

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*

0 20 40 60

25 26 27 28 SH-2 29 30

31 32 33 34 35 36 37 38 39

32.92

Very soft, gray brown, *Elastic Silt (MH)* and *Silty Clay (CH)*; moist, trace fine sand; trace organics; laminated.
Estuarine Deposits (He)

- 15 cm thick lens of dark gray, wet, silty sand at 35.9 meters.

CONTINUED NEXT SHEET

0 20 40 60

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

LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3" O.D. Thin-Walled Tube
3" O.D. Split Spoon Sample
▽ Ground Water Level ATD

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.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-06-18

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FIG. A-8
Sheet 4 of 6

REV 3

Log: CTC Rev: EAB Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*55.32 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 4.7 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-57*	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 stiff, gray, *Sandy Silt (ML)* to medium dense, gray, *Silty Sand (SM)*; moist; fine sand; nonplastic; trace organics; laminated. Estuarine Deposits (He)

43.59

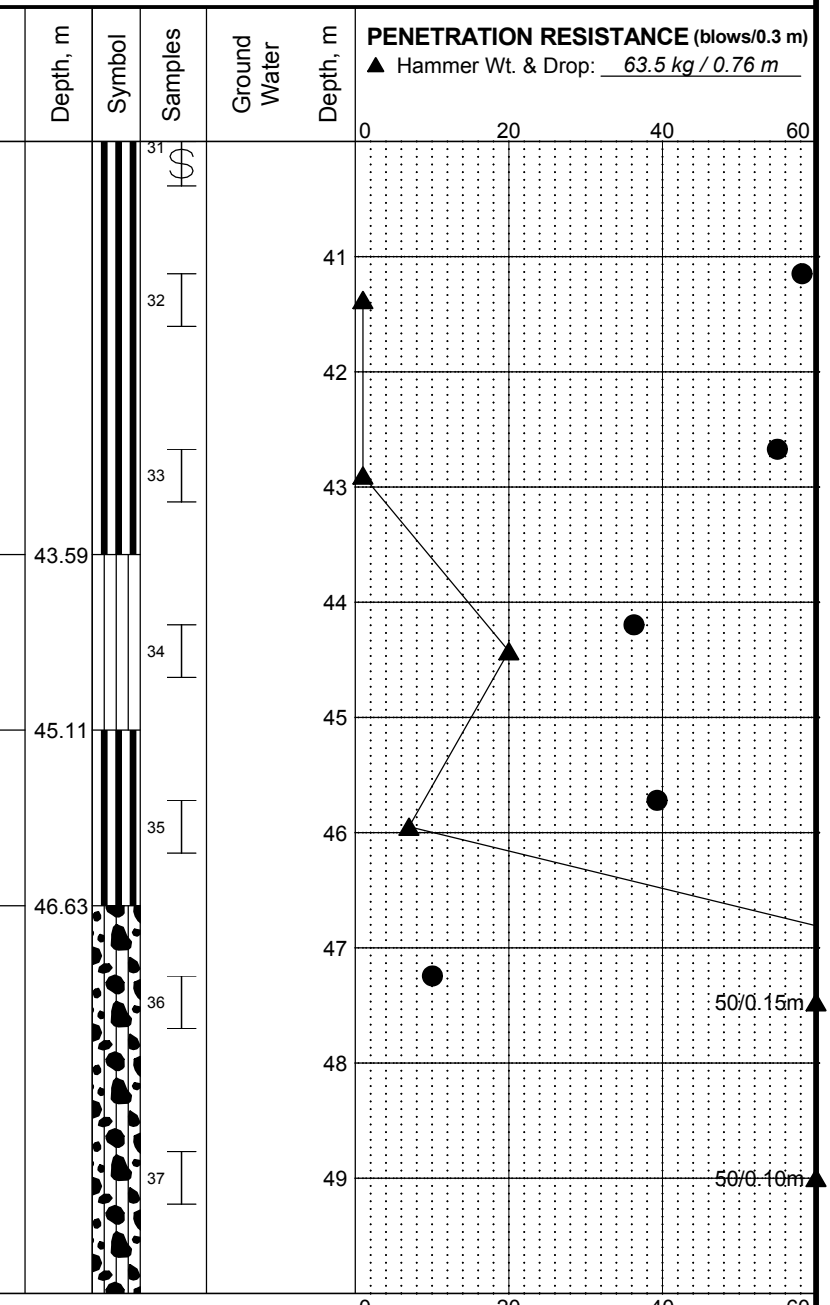
Medium stiff, gray, *Elastic Silt (MH)*; moist; trace fine sand; low to medium plasticity fines; trace organics and roots; laminated. Estuarine Deposits (He)

45.11

Very dense, dark gray brown, *Silty Gravel with Sand (GM)*; wet to moist; fine to coarse, subrounded gravel; medium to coarse sand; nonplastic fines; trace organics and roots. Advance Outwash (Qva)

46.63

CONTINUED NEXT SHEET



LEGEND

- * Sample Not Recovered
- 2.0" O.D. Split Spoon Sample
- 3" O.D. Thin-Walled Tube
- 3" 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. 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.

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FIG. A-8
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REV 3

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19 Log: CTC Rev: EAB Typ: LKN

Total Depth:	*55.32 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 4.7 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-57*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

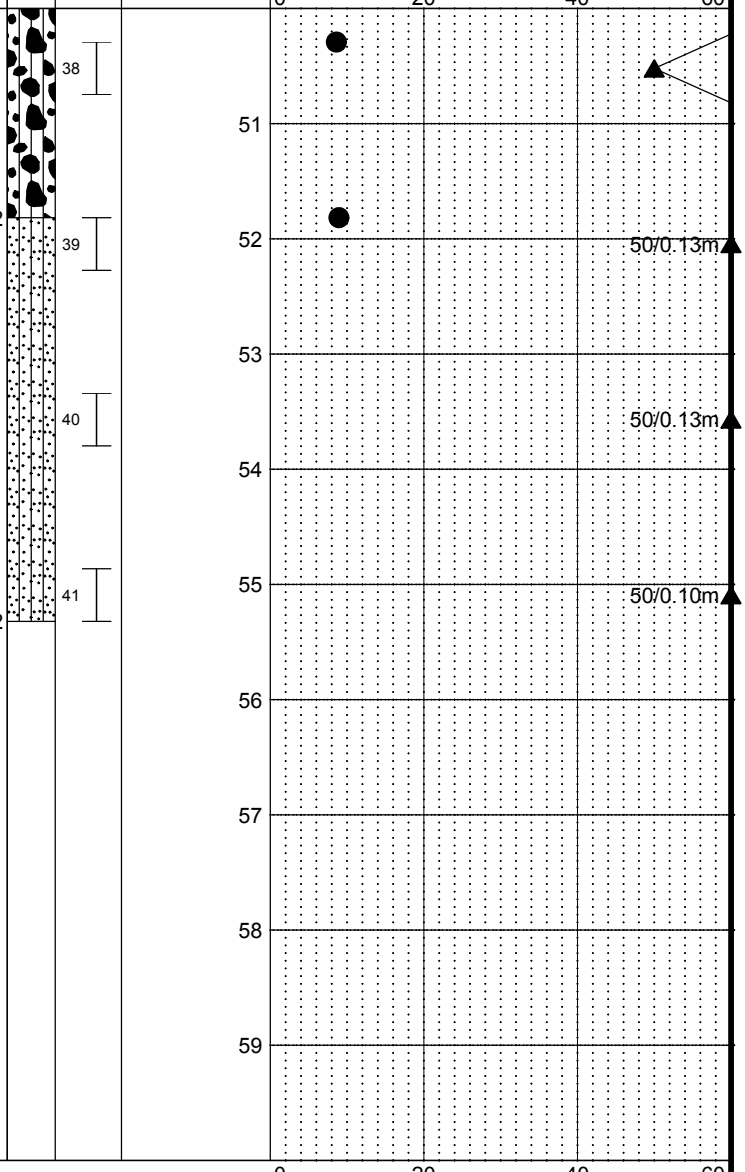
SOIL DESCRIPTION

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, m | Symbol | Samples | Ground Water | Depth, m

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



51.82

Very dense, gray, *Silty Sand with Gravel (SM)*; moist to wet; fine, subrounded gravel; medium to coarse sand; nonplastic fines.
Advance Outwash (Qva)

55.32

BOTTOM OF BORING
COMPLETED 11/2/2018

LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3" O.D. Thin-Walled Tube
3" 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. 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.

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FIG. A-8
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REV 3

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19 Log: CTC Rev: EAB Typ: LKN

Total Depth:	5.79 m	Northing:		Drilling Method:	Hollow Stem Auger	Hole Diam.:	0.20 m
Top Elevation:	~ 4.7 m	Easting:		Drilling Company:	Holt Services, Inc.	Rod Diam.:	4-1/4" ID
Vert. Datum:		Station:		Drill Rig Equipment:	Mobile Drill B-57	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.

Drill to 2.9 meters to push undisturbed tube samples.

Gray, *Silty Sand (SM)*; wet; fine to medium sand; nonplastic fines.
Alluvium (Ha)

3.05
3.11

Gray brown, *Silty Clay (CH)* to *Elastic Silt (MH)*; moist; fine sand; low plasticity; trace to few organics; laminated.
Estuarine Deposits (He)
- 3 cm thick lens of black, organic silt (OH) at 3.1 meters.

3.32
3.51
4.24

Gray brown, *Sandy Silt (ML)*; moist; fine sand; nonplastic to low plasticity fines; trace organics.
Estuarine Deposits (He)

5.79

Dark gray, *Elastic Silt (MH)* to *Elastic Silt with Sand (MH)*; wet; fine sand; few to little organics; trace shell fragments.

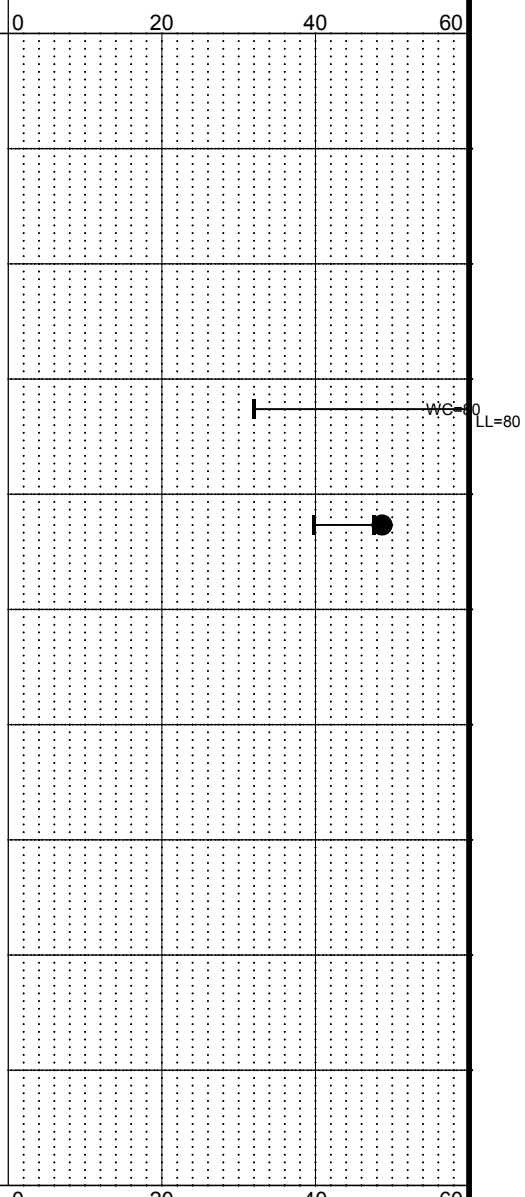
Gray, *Sandy Silt (ML)*; moist; fine sand; nonplastic fines; trace organics.

BOTTOM OF BORING
COMPLETED 11/14/2018

Depth, m | Symbol | Samples | Ground Water | Depth, m

Samples: 1 G, 2 G, 3 G

Ground Water: None Observed During Drilling



LEGEND

* Sample Not Recovered
3.0" O.D. GUS 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.
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FIG. A-9

REV 3

Log: RJS Rev: BMC Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*55.02 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 4.8 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	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 stiff, dark brown, *Organic Silt (OH)*; moist; trace fine sand; low to medium plasticity fines; mostly wood chips; faint petroleum scent. Fill (Hf)

1.52

Medium stiff, gray interior with brown exterior, *Organic Silt (OH)*; moist; low to medium plasticity fines; few to little wood chips and roots; readily oxidizes. Alluvium (Ha) / Fill (Hf)

2.13

Loose, gray interior with brown exterior, *Silty Sand (SM)*; moist to wet; fine sand; low to medium plasticity fines; trace to few organics; moderately oxidizes. Alluvium (Ha)

3.66

Medium stiff, gray interior with brown exterior, *Organic Silt (OH)*; moist; fine sand; low to medium plasticity fines; trace to few fibrous organics and wood fragments; readily oxidizes. Alluvium (Ha)

4.42

Stiff, gray and brown *Organic Silt with Sand (OH)*; moist; fine sand; low to medium plasticity fines; some to mostly wood fragments. Alluvium / Forest Soil (Ha)

5.18

Soft, gray interior with brown exterior, *Organic Silt (OH)*; moist; trace fine sand; medium plasticity; trace roots; readily oxidizes. Estuarine Deposits (He)

7.01

Soft, gray, *Sandy Silt (ML)*; moist; fine sand; low plasticity fines; trace to few organics; moderately oxidizes. Estuarine Deposits (He)

8.53

Medium dense, gray, *Silty Sand (SM)*; moist; fine sand; low plasticity fines; trace to few organics; moderately oxidizes above 10.7

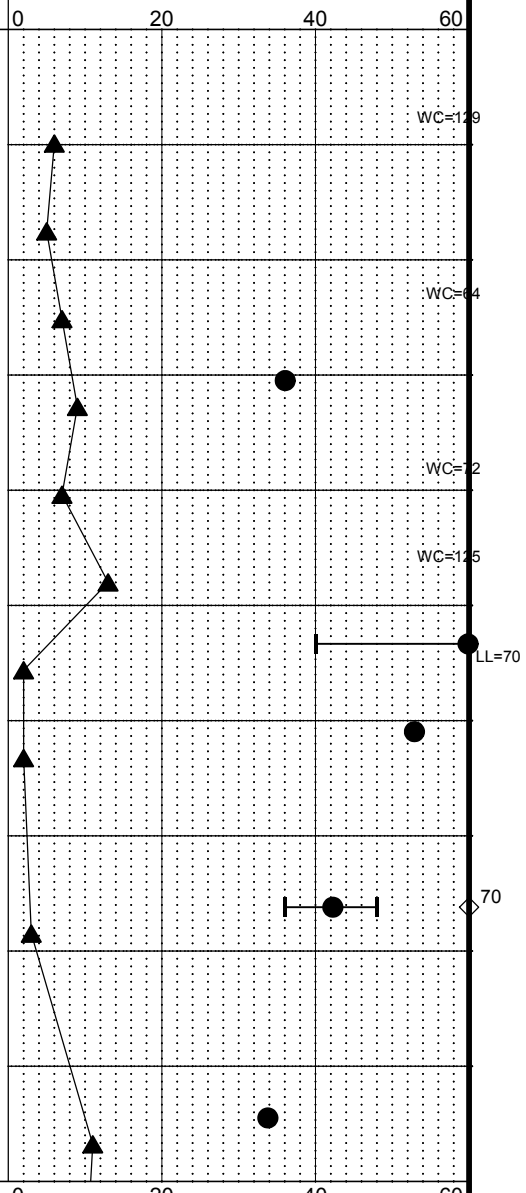
CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water | Depth, m

During Drilling

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3.0" O.D. GUS 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. 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.

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FIG. A-10
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REV 3

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19 Log: RBP Rev: EAB Typ: LKN

Total Depth:	*55.02 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 4.8 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	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.

meters.
Alluvium (Ha)

13.11

Medium stiff, gray, *Elastic Silt with Sand (MH)*; fine sand; trace fine organics; fine sand lenses throughout.
Alluvium (Ha)

14.63

Medium dense, gray, *Silty Sand (SM)*; moist; fine sand; low plasticity fines; trace organics.
Alluvium (Ha)
- Lens of red-brown silt at 15.4 meters.
- Drilled through wood from 15.7 to 16.8 meters.

17.68

Medium stiff, gray, *Sandy Elastic Silt (MH)* to loose, gray, *Silty Sand (SM)*; moist; fine sand; trace organics.
Alluvium (Ha)

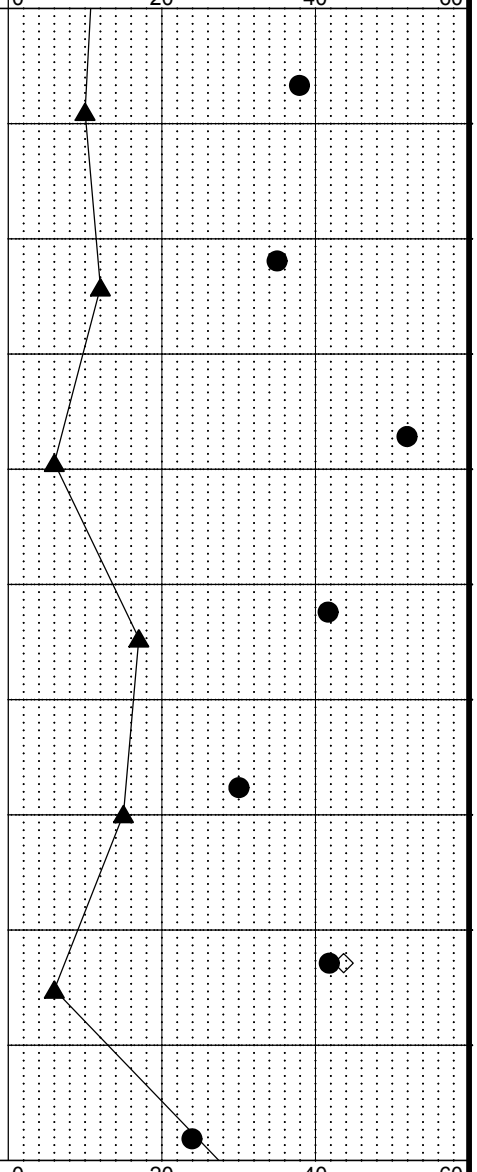
19.20

Medium dense, gray, *Poorly Graded Sand with Silt (SP-SM)*; moist; fine sand; low plasticity fines; trace organics and shell fragments.

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water | Depth, m

PENETRATION RESISTANCE (blows/0.3 m)
▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3.0" O.D. GUS 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. 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.

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FIG. A-10
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REV 3

Log: RBP Rev: EAB Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*55.02 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 4.8 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	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.

Alluvium (Ha)

20.73

Medium dense, gray, *Silty Sand (SM)*; moist; fine sand; low plasticity fines; trace organics.
Alluvium (Ha)
- Laminations of brown silt between 21.3 and 21.8 meters.

25.30

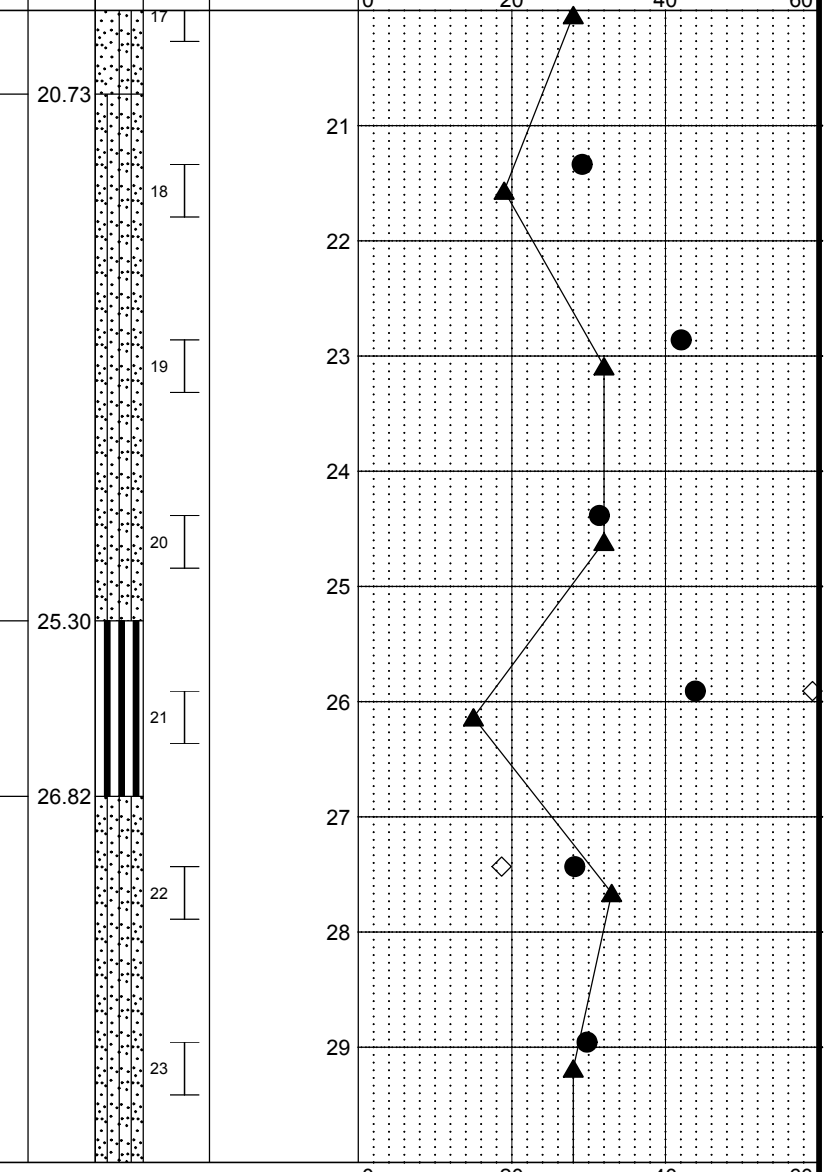
Soft, gray, *Sandy Elastic Silt (MH)*; moist; fine sand; low to medium plasticity fines; trace organics.
Alluvium (Ha)

26.82

Medium dense to dense, gray, *Silty Sand (SM)*; moist; fine sand; low to medium plasticity fines; trace fine organics and shell fragments.
Alluvium (Ha) / Estuarine Deposits (He)

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water | Depth, m



PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*

0 20 40 60

0 20 40 60

LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3.0" O.D. GUS 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. 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.
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FIG. A-10
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REV 3

MASTER_LOG_M 101575.GPJ SHAN_WIL.GDT 1/7/19 Log: RBP Rev: EAB Typ: LKN

Total Depth:	*55.02 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 4.8 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	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.

- Increase in shell fragment content and silt lenses < 12 mm thick below 29.9 meters.

34.44

Stiff, gray, *Elastic Silt with Sand*; moist; trace fine gravel; fine sand; low to medium plasticity fines; trace organics.
Estuarine Deposits (He)

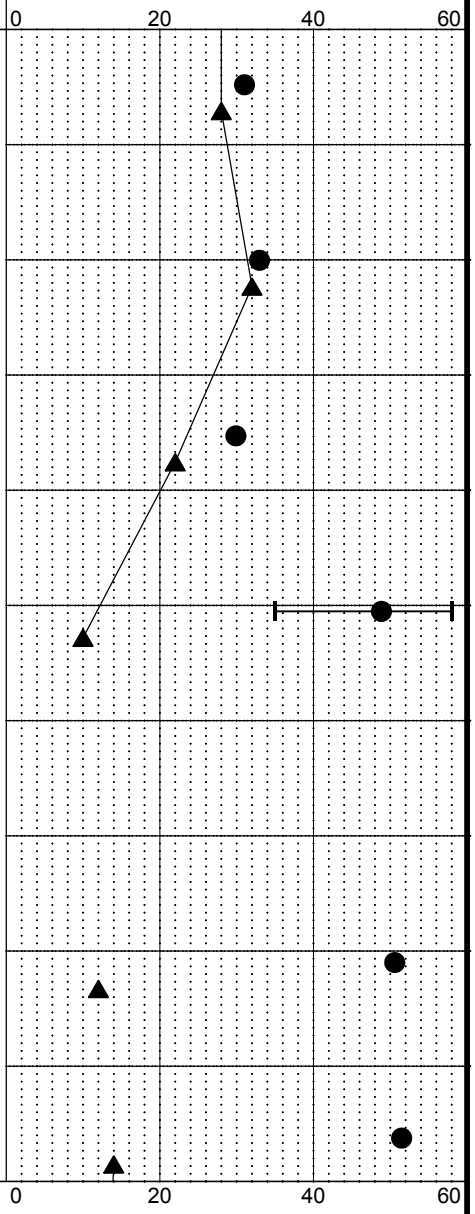
- Fine sand and silt laminations below 38.1 meters.

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water | Depth, m

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3.0" O.D. GUS 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. 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.

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FIG. A-10
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REV 3

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19 Log: RBP Rev: EAB Typ: LKN

Total Depth:	*55.02 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 4.8 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	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.

- Slight crumbly, platy structure below approximately 41.1 meters.

- Lens of fine gravel with sand (wet) from 43.7 to 44.4 meters.

Medium dense, gray, *Silty Sand (SM)*; wet; fine sand; low plasticity fines; trace organics. Alluvium (Ha)

44.65

Very dense, gray, *Poorly Graded Sand with Silt and Gravel (SP-SM)*; wet; some, fine to coarse, subangular to subrounded gravel; fine to coarse sand; low plasticity fines. Advance Outwash (Qva)

46.94

48.16

Very dense, gray, *Silty Gravel (GM)* to *Poorly Graded Gravel with Sand and Silt (GP-GM)*; wet; fine to coarse, subrounded to subangular gravel; fine to coarse sand; low plasticity fines. Advance Outwash (Qva)

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water | Depth, m

32 33 34 35 36 37*

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*

0 20 40 60

41 42 43 44 45 46 47 48 49

50/0.14m

50/0.13m

0 20 40 60

LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

3.0" O.D. GUS 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. 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.

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FIG. A-10
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REV 3

Log: RBP Rev: EAB Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*55.02 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 4.8 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	Hammer Type:	*Automatic*
Horiz. Datum:		Offset:		Other Comments:			

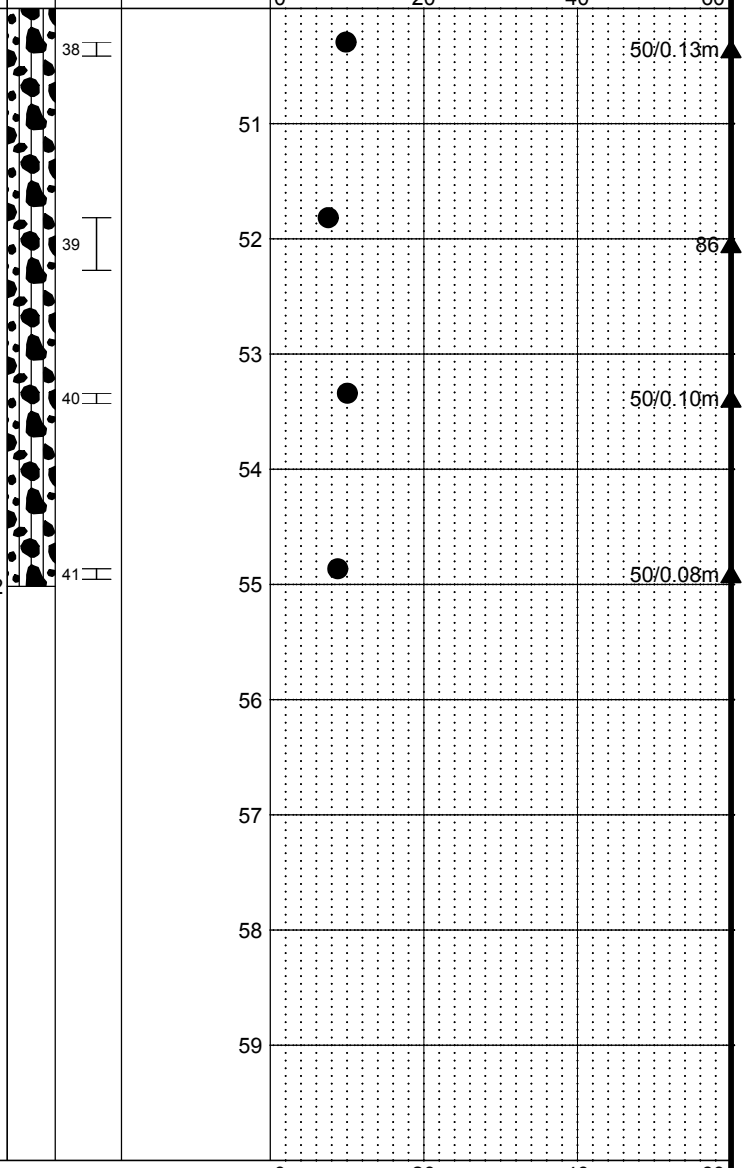
SOIL DESCRIPTION

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, m | Symbol | Samples | Ground Water | Depth, m

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



55.02

BOTTOM OF BORING
COMPLETED 11/1/2018

LEGEND

* Sample Not Recovered

2.0" O.D. Split Spoon Sample

3.0" O.D. GUS 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. 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.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-07-18

March 2019

101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-10
Sheet 6 of 6

REV 3

MASTER_LOG_M 101575.GPJ SHAN_WIL.GDT 1/7/19 Log: RBP Rev: EAB Typ: LKN

Total Depth:	12.65 m	Northing:		Drilling Method:	Hollow Stem Auger	Hole Diam.:	0.15 m
Top Elevation:	~ 5.5 m	Easting:		Drilling Company:	Holt Services, Inc.	Rod Diam.:	2-inch NWJ
Vert. Datum:		Station:		Drill Rig Equipment:	Mobile Drill B-57	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 dense, brown, *Poorly Graded Gravel with Silt and Sand (GP-GM)*; moist; subangular to angular, fine to coarse gravel and rock chips; fine to coarse sand; low plasticity fines; trace to few organics including woody fibers and pine needles.
Fill (Hf)

1.22

Loose, dark blue-gray interior with brown exterior, *Organic Silt with Sand (OH)*; wet; trace of fine, subangular gravel; fine sand; low to medium plasticity fines; trace to few organics including pine needles, wood chips, and fine fibers; readily oxidizes.
Fill (Hf) / Estuarine Deposits (He)

2.59

3.05

Very soft, dark blue-gray interior with brown exterior, *Organic Silt (OH)*; moist; trace fine sand; low to medium plasticity fines; readily oxidizes.
Estuarine Deposits (He)

4.57

Very loose, dark gray interior with brown exterior, *Silty Sand (SM)*; moist; fine sand; low to medium plasticity fines; trace to few organics organics; readily oxidizes; sulferous odor.
Estuarine Deposits (He)

5.79

Very soft, dark gray interior with brown exterior, *Organic Silt (OH)*; moist; trace fine sand; low to medium plasticity fines; trace to few organics; laminated; readily oxidizes.
Estuarine Deposits (He)

Very soft, gray, *Elastic Silt with Sand (MH)* grading to *Elastic Silt (MH)*; moist; fine sand; trace to few organics; trace to few organic-rich laminations.
Estuarine Deposits (He)
- 9 cm thick lens of silty fine to medium sand at 7.4 meters.

8.53

CONTINUED NEXT SHEET

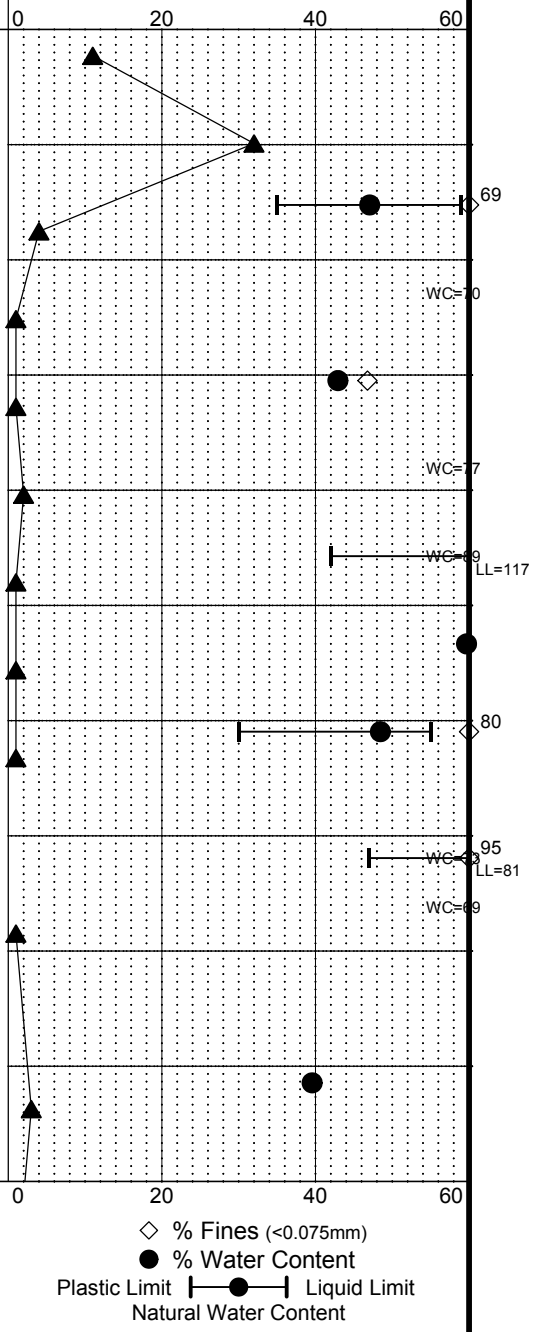
Depth, m | Symbol | Samples | Ground Water | Depth, m

Samples: 1, 2, 3, 4, 5, 6, 7, 8, 9, H-1, 10, 11

Ground Water: ▽ During Drilling

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: 63.5 kg / 0.76 m



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3" O.D. Split Spoon Sample
3" O.D. Thin-Walled Tube
▽ 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. 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.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-08-18

March 2019

101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-11
Sheet 1 of 2

REV 3

Log: CTC Rev: EAB Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*12.65 m*	Northing:		Drilling Method:	*Hollow Stem Auger*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 5.5 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-57*	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, m | Symbol | Samples | Ground Water | Depth, m

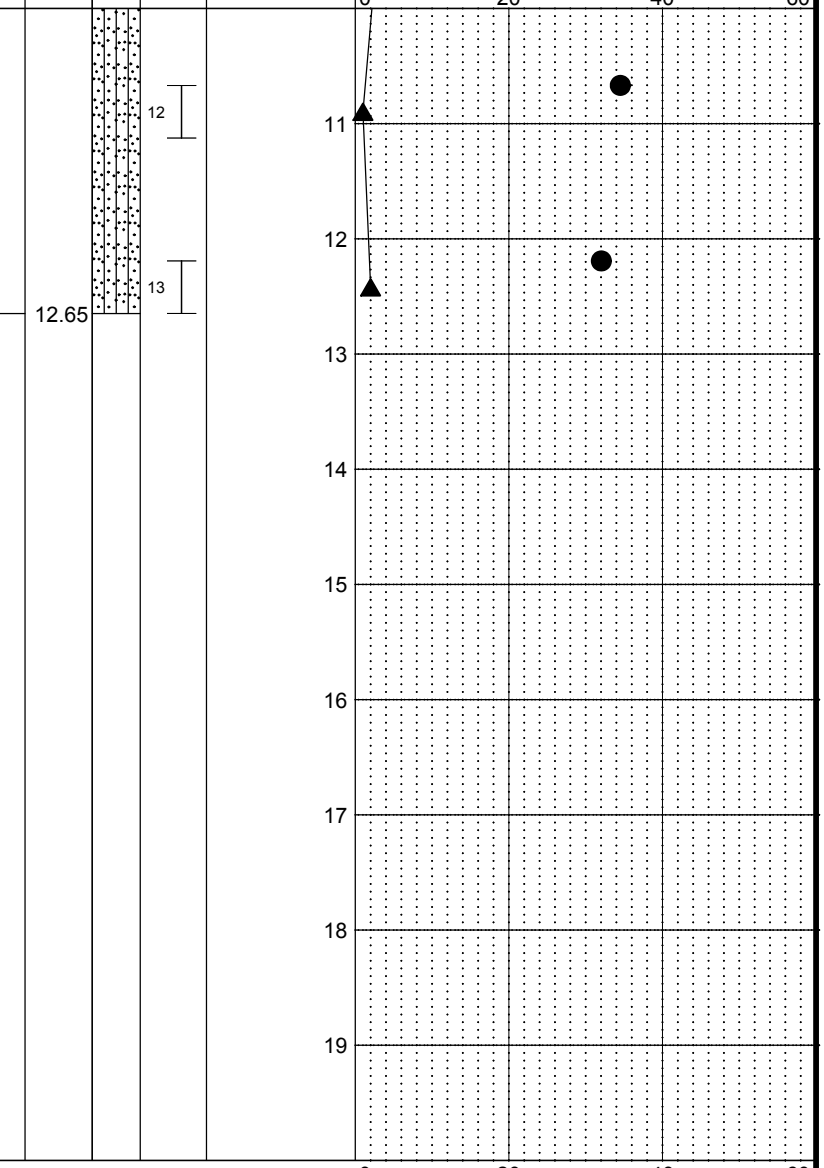
PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*

Very loose, gray grading to dark gray, *Silty Fine Sand (SM)*; wet; fine sand; trace fine organics and shell fragments; laminated. Estuarine Deposits (He)

12.65

BOTTOM OF BORING
COMPLETED 10/31/2018



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3" O.D. Split Spoon Sample
3" O.D. Thin-Walled Tube
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. 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.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-08-18

March 2019 | 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-11
Sheet 2 of 2

REV 3

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19 Log: CTC Rev: EAB Typ: LKN

Total Depth:	*55.29 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 5.5 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	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.

Dense, gray, *Silty Gravel with Sand (GM)*; moist; fine to coarse, subrounded gravel; fine to coarse sand; low plasticity fines; trace organics and pine needles, organic odor.
Fill (Hf)

1.58

Stiff, gray-brown, *Sandy Organic Silt (OH)* to *Silty Sand (SM)*; wet; fine sand; low to medium plasticity fines; trace woody and fibrous organics, sulfurous odor; moderately oxidizes.
Alluvium (Ha) / Fill (Hf)

2.13

Very loose to loose, gray-brown, *Silty Sand (SM)*; wet; fine; low to medium plasticity fines; trace to few fine organics, including wood fragments, sulferous odor.
Alluvium (Ha)

3.66

Soft, dark blue-gray interior with brown exterior, *Organic Silt with Sand (OH)*; wet; fine sand; low to medium plasticity fines; trace to few fibrous wood fragments and peat mats; laminated with silt and fine organics; readily oxidizes.
Estuarine Deposits (He)

4.42

Very soft, dark blue-gray interior with brown exterior, *Organic Silt (OH)* to *Elastic Silt (MH)*; moist; trace fine sand; low to medium plasticity fines; trace to few organics; readily oxidizes.
Estaurine Deposits (He)

5.79

Soft, gray, *Elastic Silt (MH)*; moist; trace fine sand; low to medium plasticity fines; trace to few organics; trace 3 cm thick OH lenses with some to mostly fibrous organics and roots.
Estuarine Deposits (He)

8.53

Medium dense, gray, *Silty Sand (SM)*; wet; fine sand; low plasticity fines; trace organics; trace silt lenses.

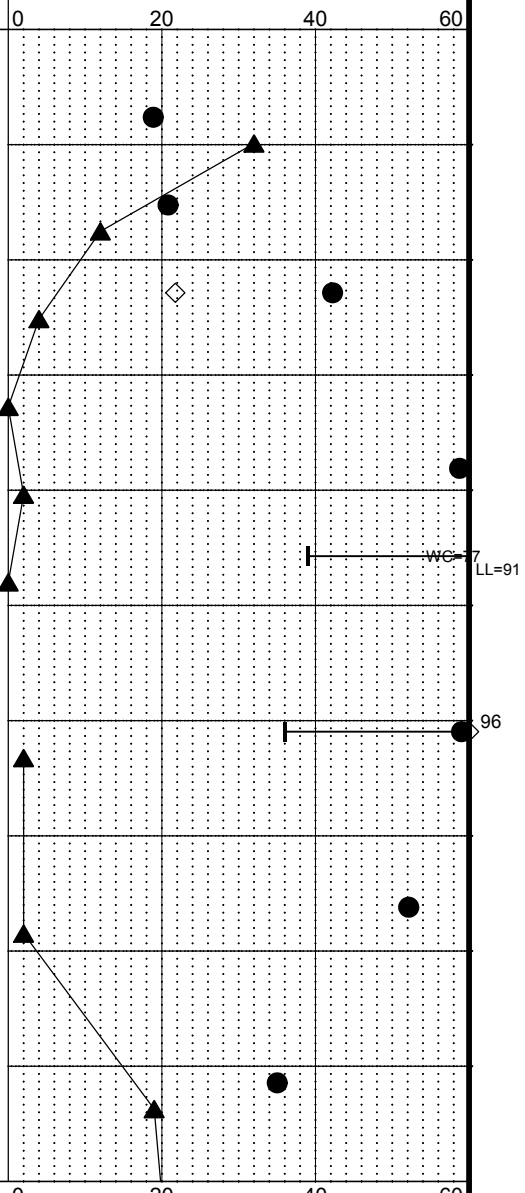
CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water | Depth, m

During Drilling ▽

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3" O.D. Thin-Walled Tube
▽ 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. 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.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-09-18

March 2019 | 101575-004

SHANNON & WILSON, INC.
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FIG. A-12
Sheet 1 of 6

REV 3

Log: BMC Rev: EAB Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*55.29 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 5.5 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	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.

Alluvium (Ha)

13.11

Stiff, gray, *Elastic Silt (MH)* interbedded with medium dense, gray, *Silty Sand (SM)*; moist to wet; fine sand; low to medium plasticity fines; trace organics; laminated.
Alluvium (Ha)

14.63

Medium dense to dense, gray, *Silty Sand (SM)* to *Poorly Graded Sand with Silt (SP-SM)*; moist to wet; fine sand; low plasticity fines; trace organics.
Alluvium (Ha)

- Trace shell fragments below 16.8 meters.

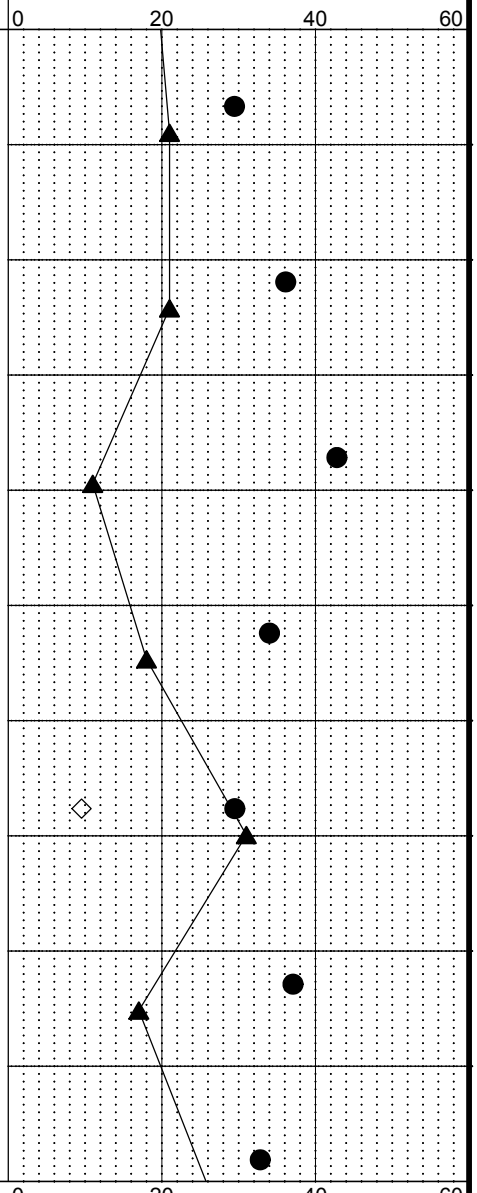
- 3 cm thick lenses of silt between 18.3 and 18.7 meters.

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water | Depth, m

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3" O.D. Thin-Walled Tube
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. 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.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-09-18

March 2019 | 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-12
Sheet 2 of 6

REV 3

MASTER_LOG_M 101575.GPJ SHAN_WIL.GDT 1/7/19 Log: BMC Rev: EAB Typ: LKN

Total Depth:	*55.29 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 5.5 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	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 soft to soft, gray, *Elastic Silt (MH)*; moist; trace to few fine sand; low to medium plasticity fines; trace organics.
Estuarine Deposits (He)

25.30

- Laminated with fine sand below 26.8 meters.

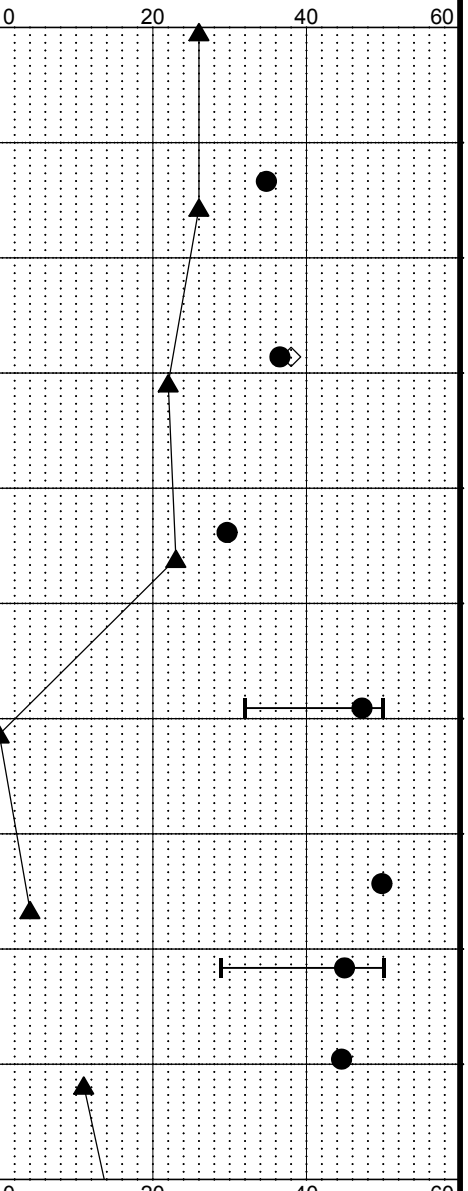
Stiff, gray, *Elastic Silt with Sand (MH)*; moist; fine sand; trace organics; laminated, slight platy texture.
Estuarine Deposits (He)

28.04

29.87

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water | Depth, m



LEGEND

- * Sample Not Recovered
- 2.0" O.D. Split Spoon Sample
- 3" O.D. Thin-Walled Tube
- 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. 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.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-09-18

March 2019 | 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-12
Sheet 3 of 6

REV 3

Log: BMC Rev: EAB Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*55.29 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 5.5 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	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.

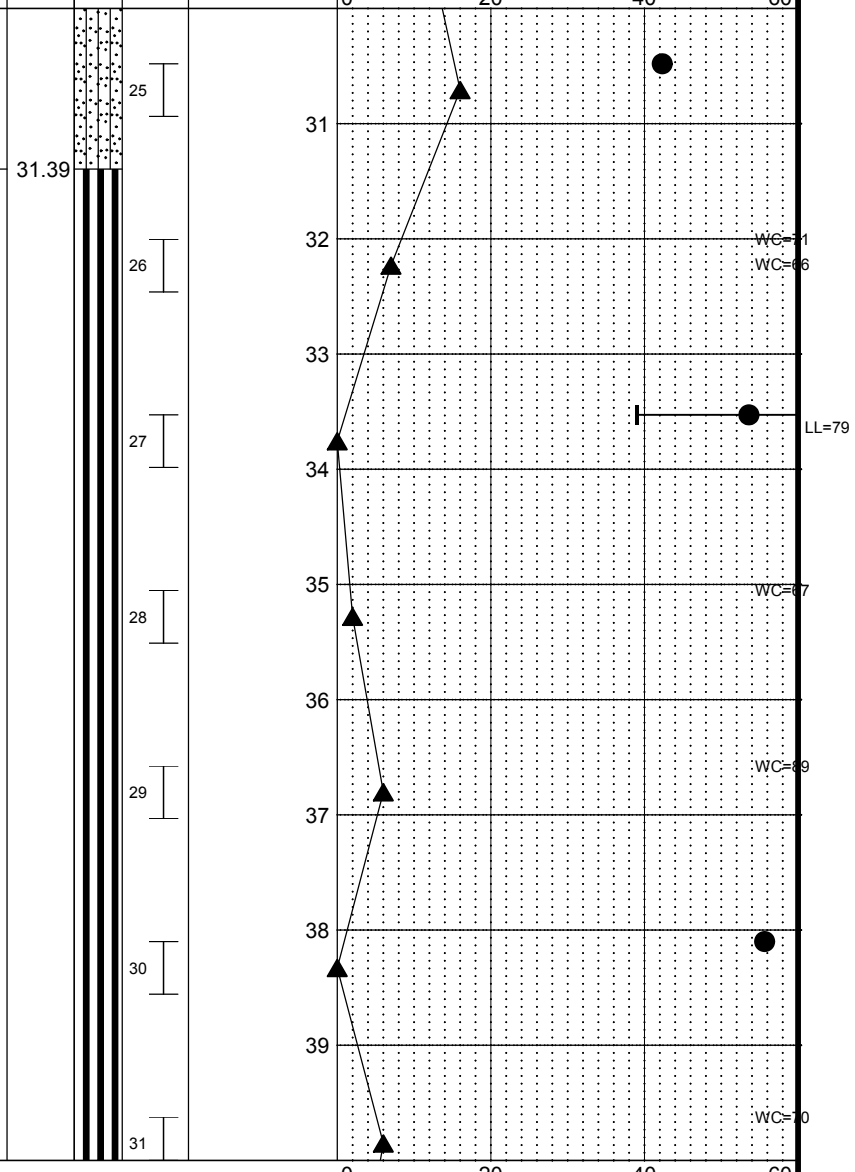
Medium dense, gray, *Silty Sand (SM)*; moist; fine sand; trace organics.
Estuarine Deposits (He)

31.39

Very soft to medium stiff, gray and brown, *Elastic Silt (MH)*; moist; trace to few fine sand; low to medium plasticity fines; few to little organics, including fibrous wood fragments and subvertical, throughgoing roots; peat laminations with slight platy and crumbly texture above 37.5 meters; organic odor.
Estuarine Deposits (He)

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water | Depth, m



LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3" O.D. Thin-Walled Tube
Ground Water Level ATD

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.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-09-18

March 2019 | 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-12
Sheet 4 of 6

REV 3

Log: BMC Rev: EAB Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*55.29 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 5.5 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	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.

Loose to medium dense, gray, *Silty Sand (SM)*; moist; fine sand; nonplastic fines; trace organics; laminated.
Alluvium (Ha)

42.06

Dense, gray, *Silty Gravel with Sand (GM)*; wet; fine, subrounded gravel; fine to coarse sand.
Alluvium (Ha)

45.11

Hard, gray, *Lean Clay (CL)*; moist; trace fine sand; low to medium plasticity fines.
Estuarine Deposits (He)
- Lens of poorly graded sand with silt less than 3 cm thick at 47.3 meters.

46.63

47.52

Very dense, gray and green, *Silty Gravel with Sand (GM)*; wet; fine to coarse, subrounded gravel; fine to coarse sand; nonplastic fines.
Advance Outwash (Qva)

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water | Depth, m

32 | 33 | 34 | 35 | 36 | 37

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*

0 20 40 60

41 42 43 44 45 46 47 48 49

88

0 20 40 60

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

LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3" O.D. Thin-Walled Tube
Ground Water Level ATD

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.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-09-18

March 2019 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-12
Sheet 5 of 6

REV 3

Log: BMC Rev: EAB Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*55.29 m*	Northing:		Drilling Method:	*Mud Rotary*	Hole Diam.:	*0.15 m*
Top Elevation:	*~ 5.5 m*	Easting:		Drilling Company:	*Holt Services, Inc.*	Rod Diam.:	*2-inch NWJ*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-58*	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 to coarse sand below 51.8 meters.

- Gravel become subangular below 53.3 meters.

BOTTOM OF BORING
COMPLETED 11/14/2018

Depth, m | Symbol | Samples | Ground Water | Depth, m

55.29

38
39
40
41

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*

0 20 40 60

51 52 53 54 55 56 57 58 59

73
50/0.13m
50/0.10m
90/0.28m

0 20 40 60

LEGEND

* Sample Not Recovered
2.0" O.D. Split Spoon Sample
3" O.D. Thin-Walled Tube
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. 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.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING H-09-18

March 2019 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-12
Sheet 6 of 6

REV 3

Log: BMC Rev: EAB Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*11.22 m*	Northing:		Drilling Method:	*Hollow Stem Auger*	Hole Diam.:	*0.20 m*
Top Elevation:	*~ 5.5 m*	Easting:		Drilling Company:	*Holt*	Rod Diam.:	*4-1/4" ID*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-57*	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, dark brown, *Well Graded Gravel with Silt and Sand (GW-GM)*; moist; fine to coarse, subangular gravel; fine to coarse sand; trace wood and organics.
Fill (Hf)

1.98

Loose, dark brown to gray brown, *Silty Sand (SM)*; moist; fine sand; trace to few wood and organics; interbedded 5 cm silt seams.
Alluvium (Ha)

3.05

Very soft to soft, dark gray to dark brown, *Organic Silt (OH)*; moist; trace fine sand; trace wood and fibrous organics; trace silty sand seams at 5-7 cm intervals; readliy oxidizes.
Estuarine Deposits (He)

5.79

Very soft, gray-brown, *Elastic Silt (MH)*; moist; trace fine sand; trace organics; trace shell fragments; grades coarser with depth.
Estuarine Deposits (He)

8.53

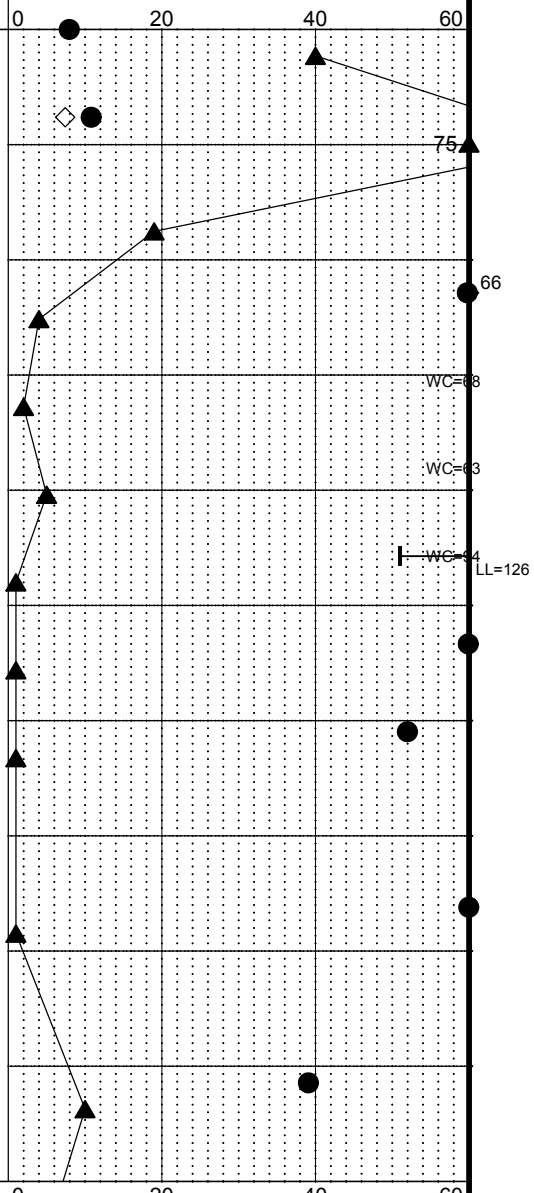
Soft to stiff, gray, *Sandy Elastic Silt (MH)*; moist; fine sand; low plasticity fines; interbedded 5 cm sand seams; trace organics, trace shell fragments.
Estuarine Deposits (He)

CONTINUED NEXT SHEET

Depth, m | Symbol | Samples | Ground Water | Depth, m

11/2/2018

PENETRATION RESISTANCE (blows/0.3 m)
▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*



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 in Well

◇ % 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. 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.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING OB-01-18

March 2019 | 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-13
Sheet 1 of 2

REV 3

Log: CTC Rev: SAW Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	*11.22 m*	Northing:		Drilling Method:	*Hollow Stem Auger*	Hole Diam.:	*0.20 m*
Top Elevation:	*~ 5.5 m*	Easting:		Drilling Company:	*Holt*	Rod Diam.:	*4-1/4" ID*
Vert. Datum:		Station:		Drill Rig Equipment:	*Mobile Drill B-57*	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, m | Symbol | Samples | Ground Water | Depth, m

PENETRATION RESISTANCE (blows/0.3 m)

▲ Hammer Wt. & Drop: *63.5 kg / 0.76 m*

0 20 40 60

12

11.22

BOTTOM OF BORING
COMPLETED 10/30/2018

11 12 13 14 15 16 17 18 19

0 20 40 60

◇ % 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 in Well

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.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING OB-01-18

March 2019 101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-13
Sheet 2 of 2

REV 3

Log: CTC Rev: SAW Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

Total Depth:	6.55 m	Northing:		Drilling Method:	Hollow Stem Auger	Hole Diam.:	0.20 m
Top Elevation:	~ 6.0 m	Easting:		Drilling Company:	Holt	Rod Diam.:	4-1/4" ID
Vert. Datum:		Station:		Drill Rig Equipment:	Mobile Drill B-57	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.

Loose, dark brown, *Well Graded Gravel (GW)*; moist; fine to coarse, subangular to subrounded gravel; fine to coarse sand; trace wood and organics.
Fill (Hf)

0.76

Medium dense, dark brown to gray and readily oxidizes, *Silty Sand with Gravel (SM)*; moist; fine to coarse, subangular gravel; fine to coarse sand; little wood fragments and trace organics; readily oxidizes.
Fill (Hf)

1.52

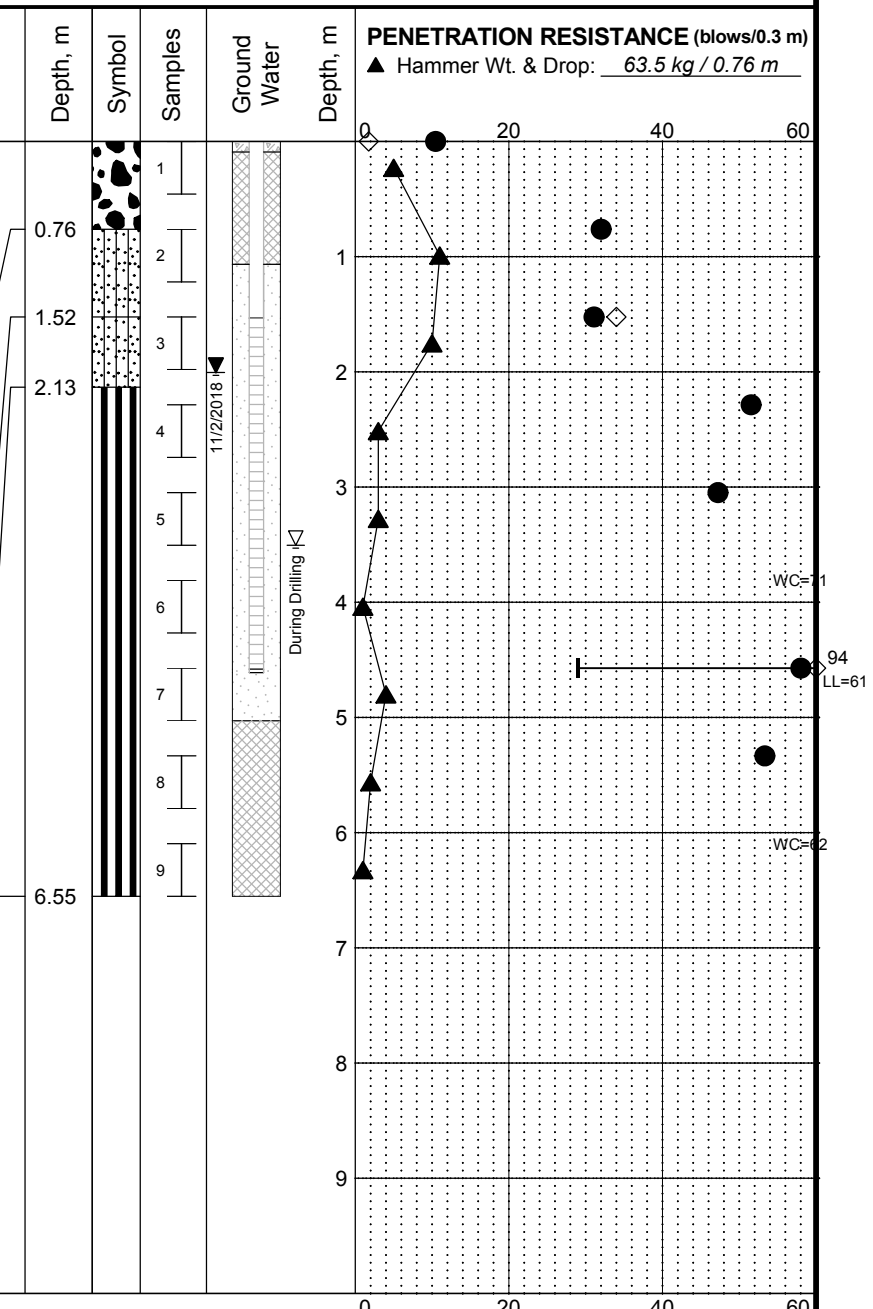
2.13

Loose, gray to dark gray, *Silty Sand (SM)*; moist; fine sand; low plasticity fines; trace wood and organics; readily oxidizes.
Alluvium (Ha)

Very soft to soft, gray, *Elastic Silt (MH)* and *Silty Clay(CH)*; moist to wet; trace to few fine sand; low plasticity fines; trace to few wood, roots, and organics; interbedded layers of brown organics; readily oxidizes.
Estuarine Deposits (He)

6.55

BOTTOM OF BORING
COMPLETED 10/29/2018



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
Ground Water Level in Well

◇ % 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. 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.

Potash Export Facility
Grays Harbor
Hoquiam, Washington

LOG OF BORING OB-02-18

March 2019

101575-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-14

REV 2

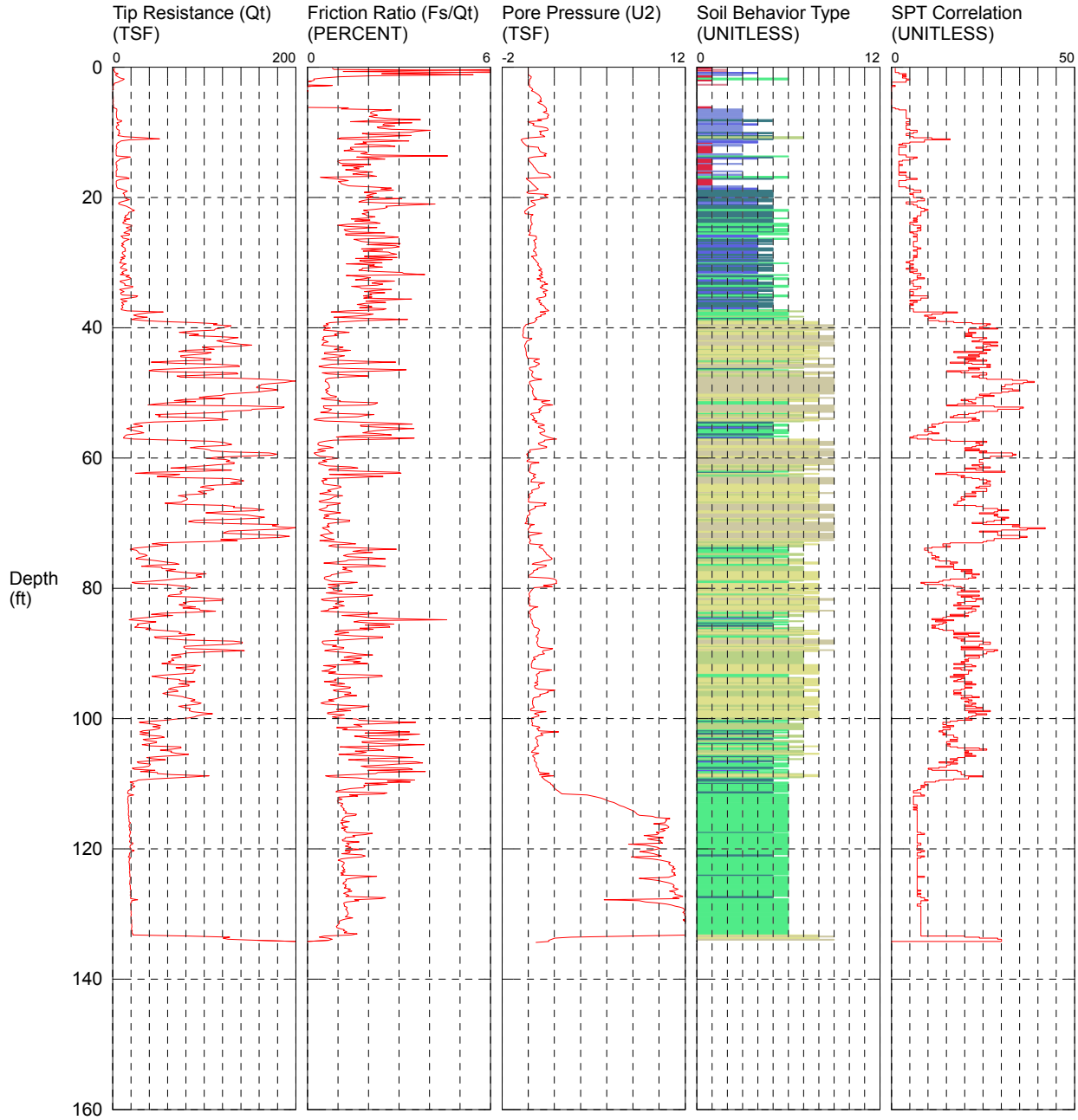
Log: CTC Rev: SAW Typ: LKN

MASTER_LOG_M_101575.GPJ SHAN_WIL.GDT 1/7/19

CPT-01

CPT CONTRACTOR: In Situ Engineering
CUSTOMER: Shannon and Wilson
LOCATION: Hoquiam
JOB NUMBER: 21-1-22400-001

OPERATOR: Okbay/Walsh
CONE ID: DDG1263
TEST DATE: 5/31/2017 8:28:44 AM
PREDRILL: 7.3 ft
BACKFILL: Bentonite Grout
SURFACE PATCH: Bentonite chips

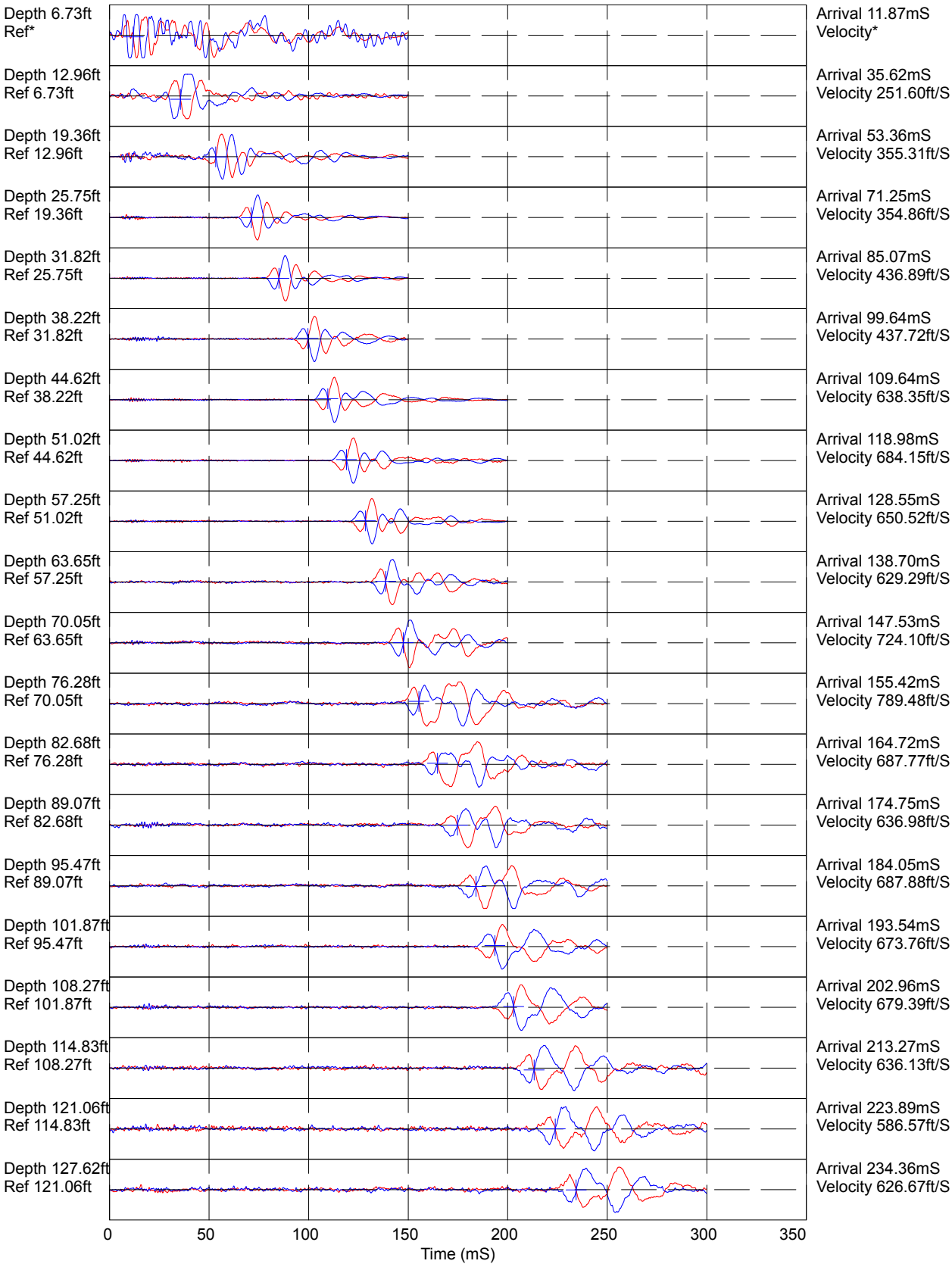


TOTAL DEPTH: 134.350 ft

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

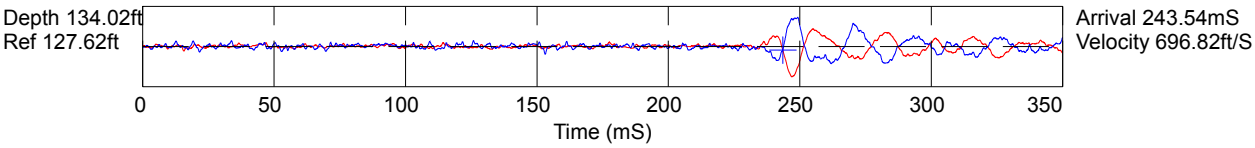
*SBT/SPT CORRELATION: UBC-1983

HOLE NUMBER: CPT-01



Hammer to Rod String Distance (ft): 2.79
* = Not Determined

HOLE NUMBER: CPT-01a

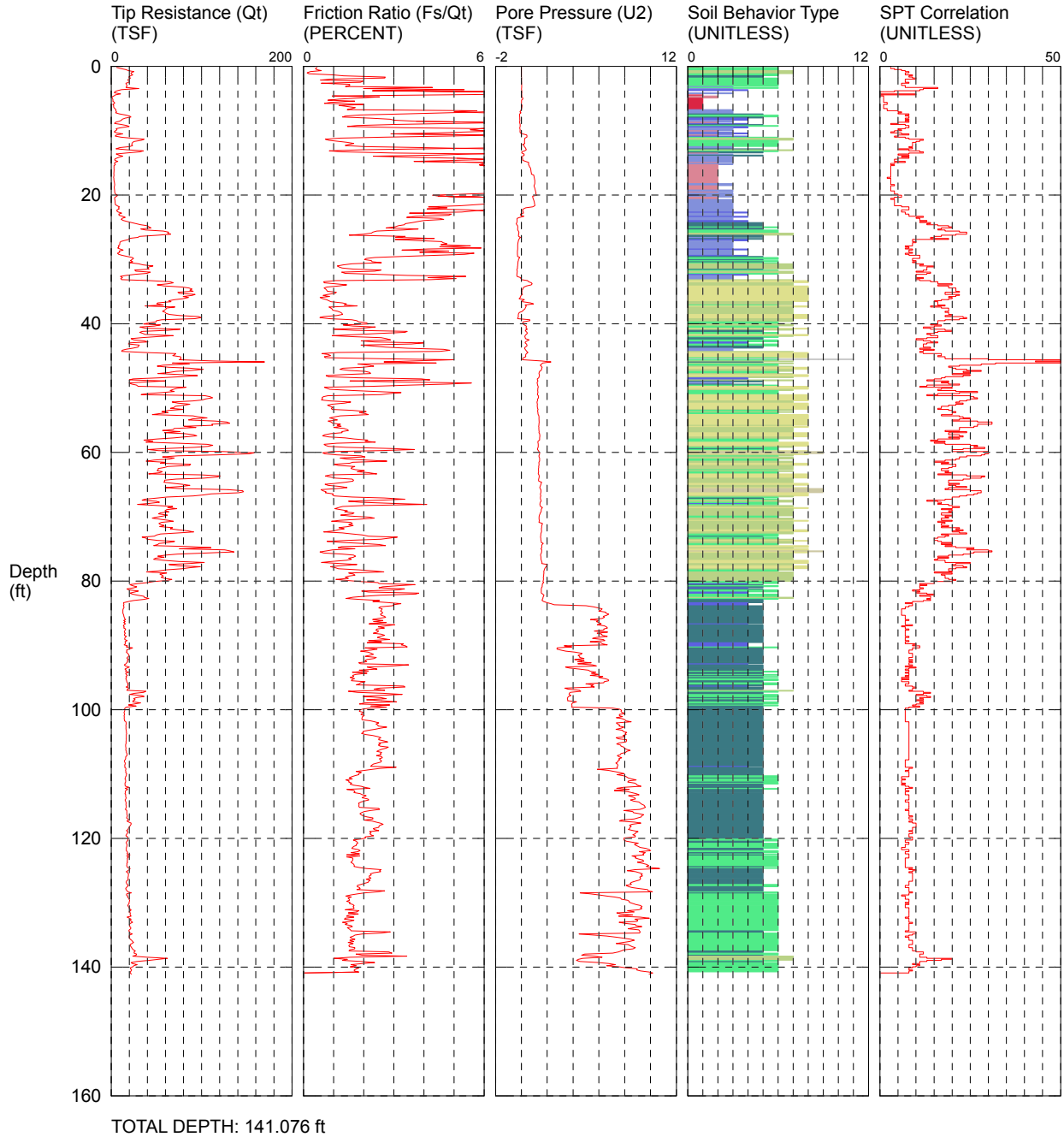


Hammer to Rod String Distance (ft): 2.79
* = Not Determined

CPT-02

CPT CONTRACTOR: In Situ Engineering
CUSTOMER: Shannon and Wilson....
LOCATION: Hoquiam
JOB NUMBER: 21-1-22400-001

OPERATOR: Okbay/Walsh
CONE ID: DDG1263
TEST DATE: 6/1/2017 10:54:57 AM
PREDRILL: 7.0 ft, (20ft East of CPT-02)
BACKFILL: Bentonite Grout
SURFACE PATCH: Bentonite chips

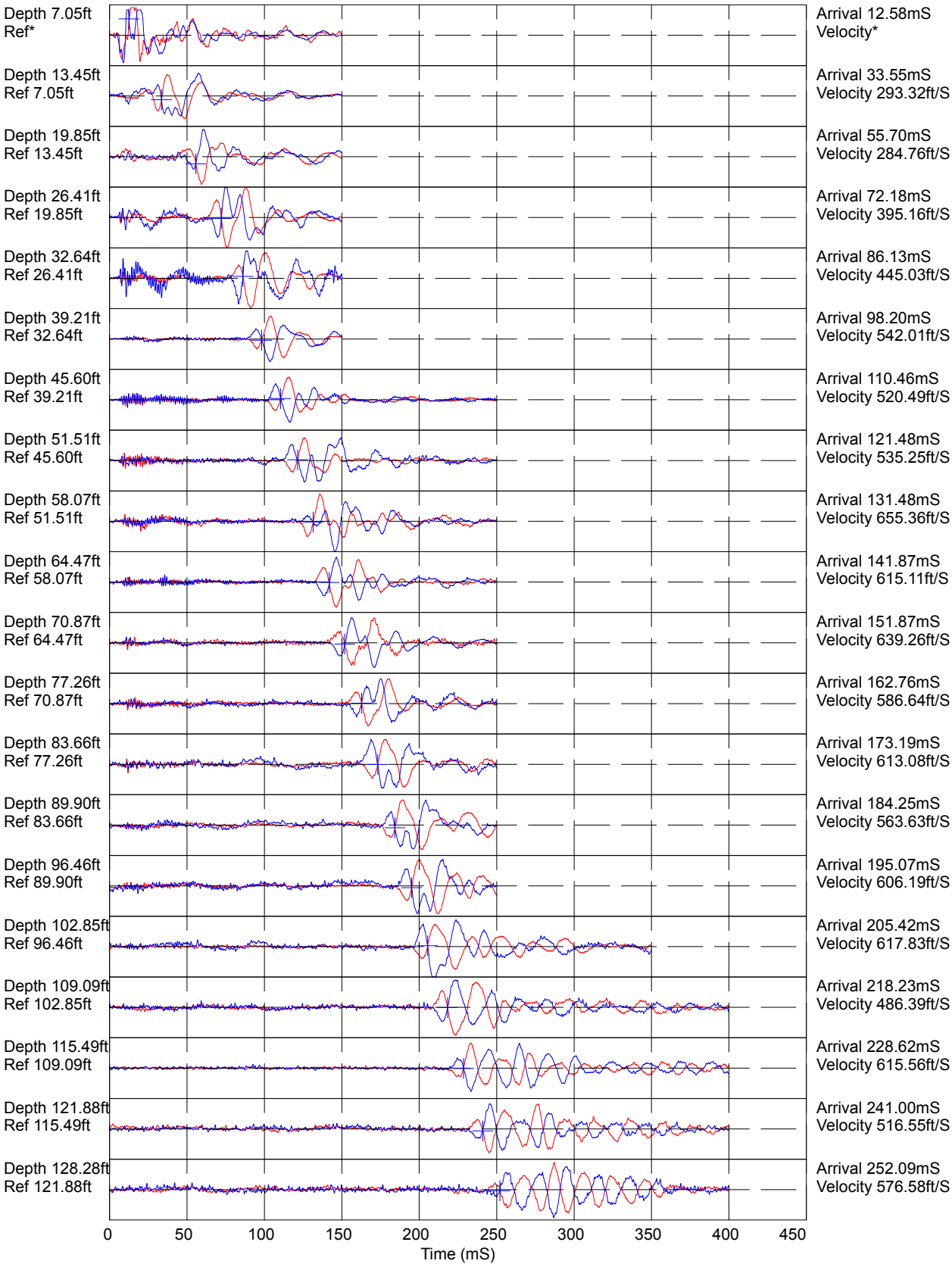


TOTAL DEPTH: 141.076 ft

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

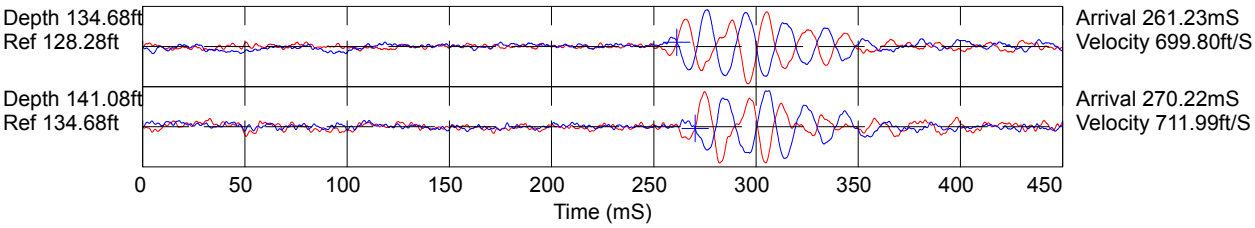
*SBT/SPT CORRELATION: UBC-1983

HOLE NUMBER: CPT-02



Hammer to Rod String Distance (ft): 2.79
* = Not Determined

HOLE NUMBER: CPT-02a

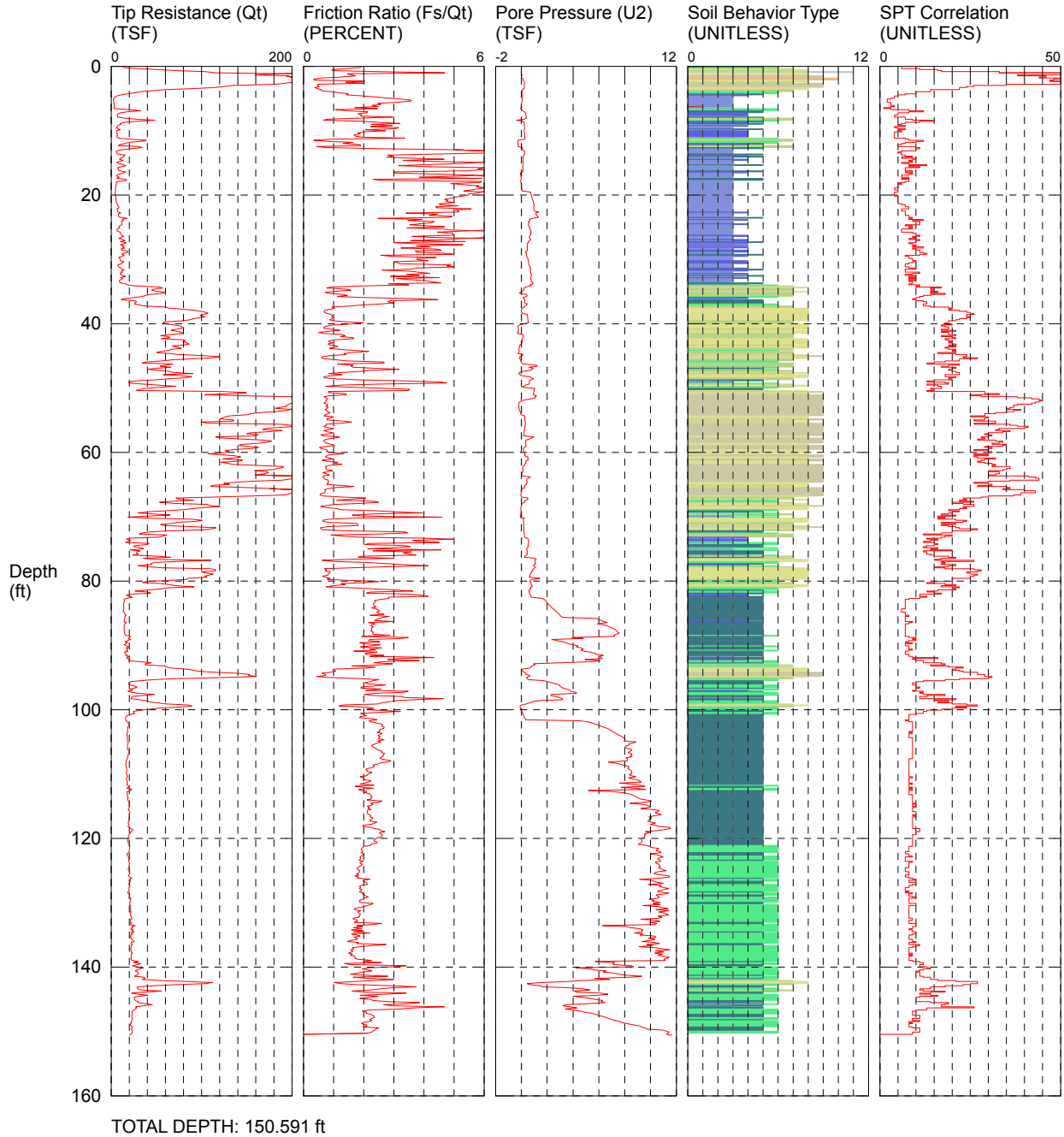


Hammer to Rod String Distance (ft): 2.79
* = Not Determined

CPT-03

CPT CONTRACTOR: In Situ Engineering
CUSTOMER: Shannon and Wilson
LOCATION: Hoquiam
JOB NUMBER: 21-1-22400-001

OPERATOR: Okbay/Walsh
CONE ID: DDG1263
TEST DATE: 5/31/2017 11:32:26 AM
PREDRILL: 7.0 ft
BACKFILL: Bentonite Grout
SURFACE PATCH: Bentonite chips

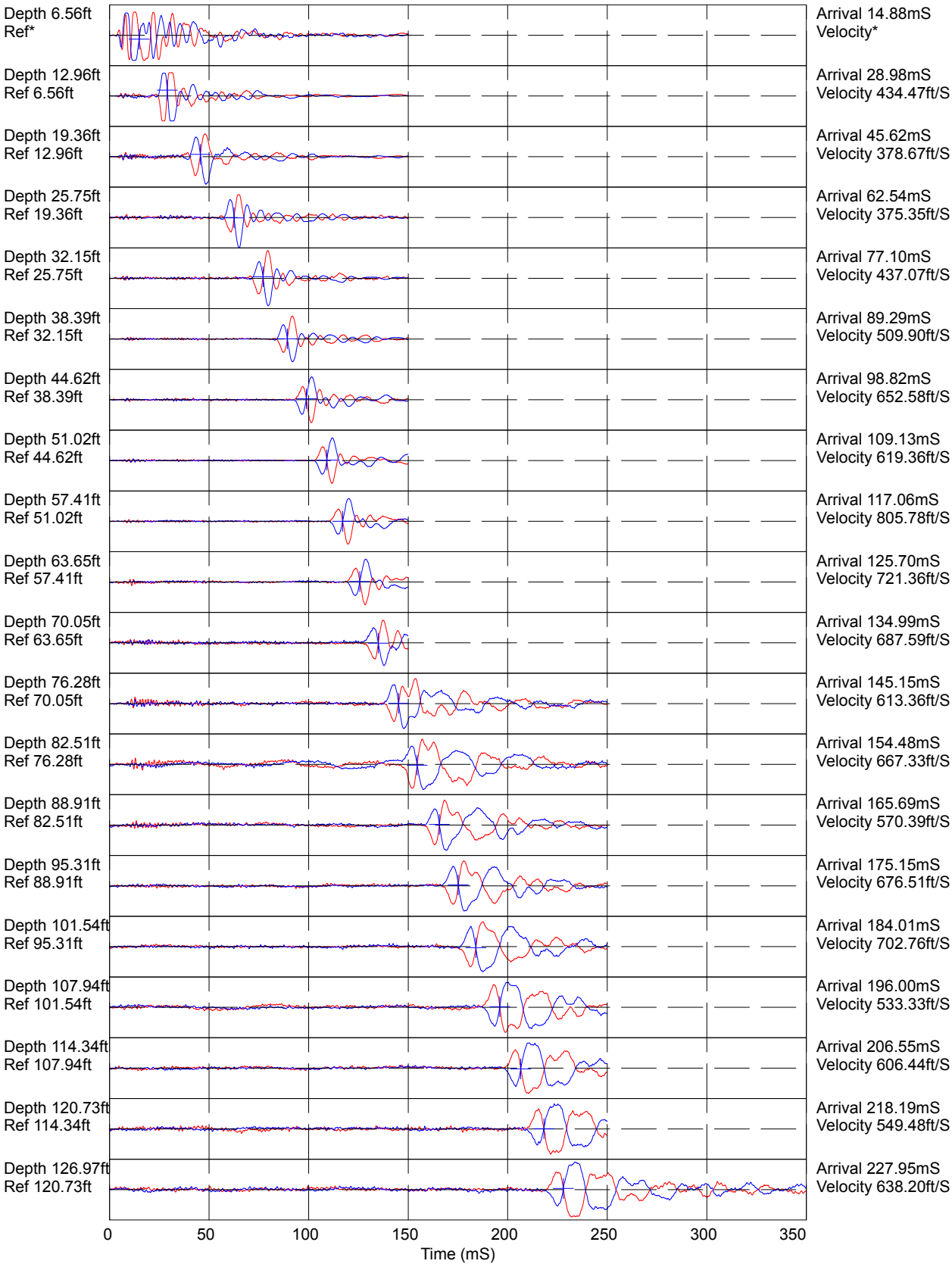


TOTAL DEPTH: 150.591 ft

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

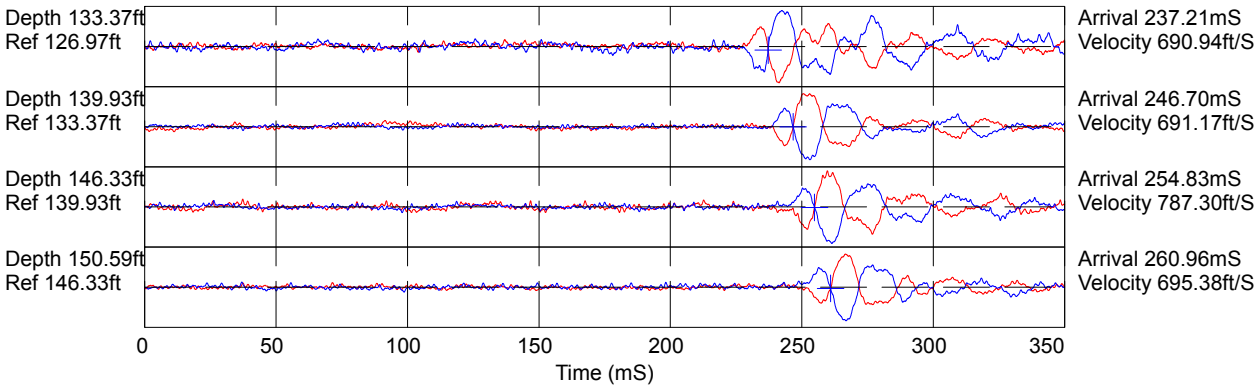
*SBT/SPT CORRELATION: UBC-1983

HOLE NUMBER: CPT-03



Hammer to Rod String Distance (ft): 2.79
* = Not Determined

HOLE NUMBER: CPT-03

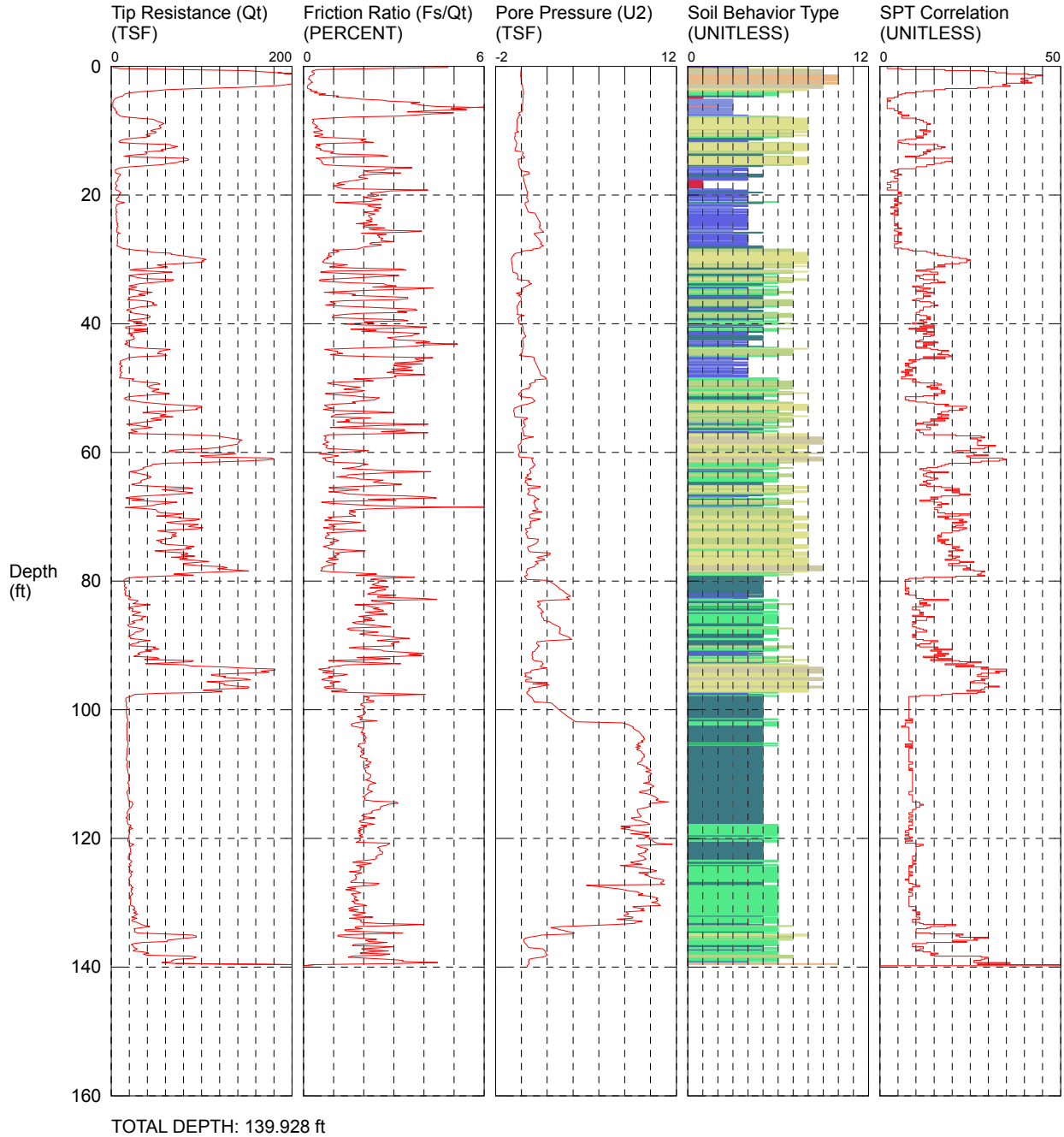


Hammer to Rod String Distance (ft): 2.79
* = Not Determined

CPT-04

CPT CONTRACTOR: In Situ Engineering
CUSTOMER: Shannon and Wilson
LOCATION: Hoquiam
JOB NUMBER: 21-1-22400-001

OPERATOR: Okbay/Walsh
CONE ID: DDG1263
TEST DATE: 5/30/2017 3:25:27 PM
PREDRILL: 5.5 ft
BACKFILL: Bentonite Grout
SURFACE PATCH: Bentonite chips

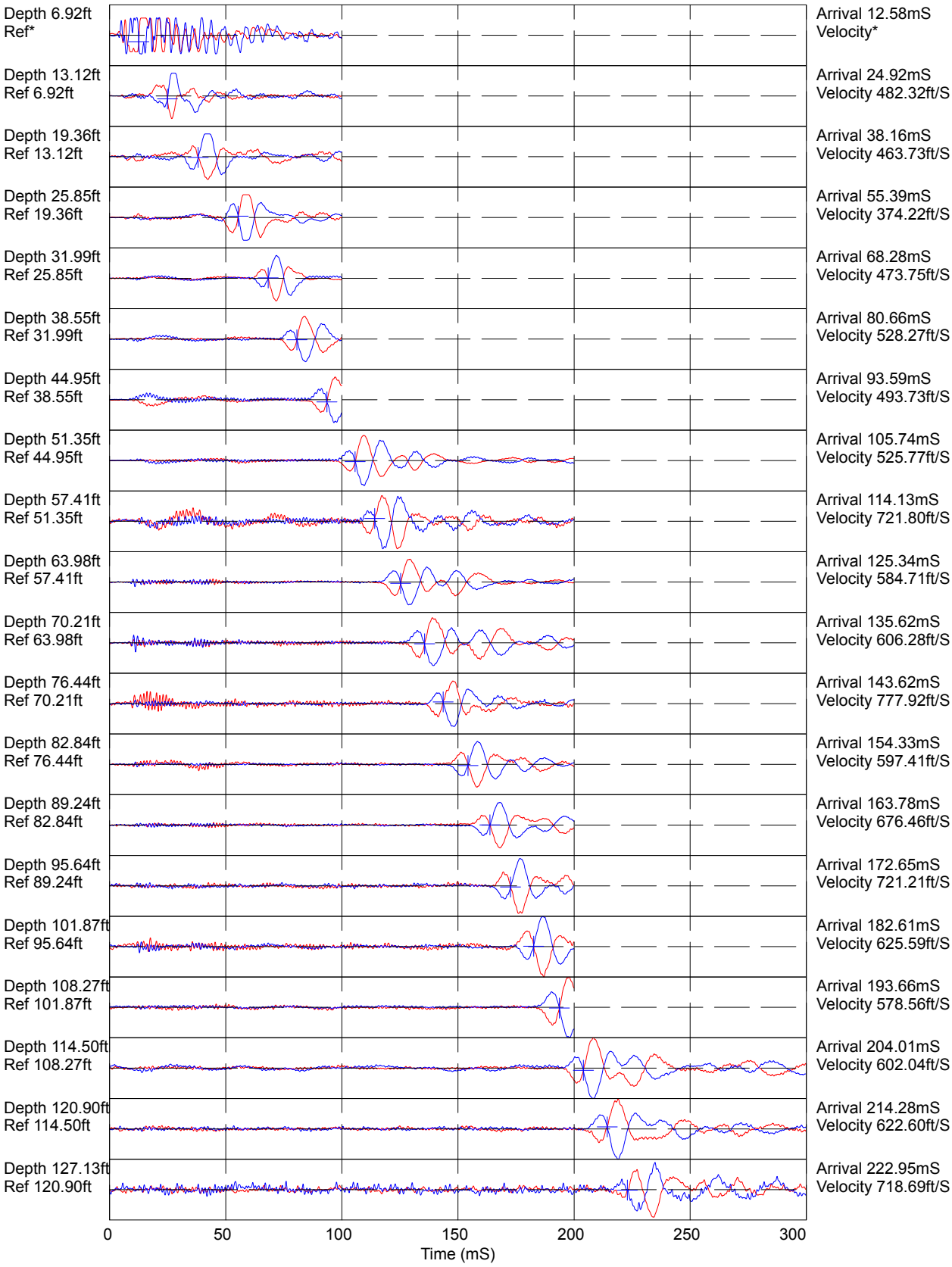


TOTAL DEPTH: 139.928 ft

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

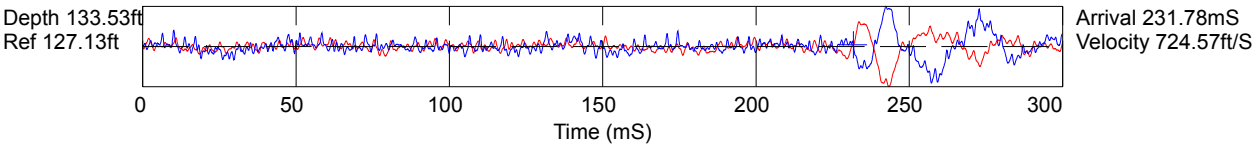
HOLE NUMBER: CPT-04



Hammer to Rod String Distance (ft): 2.79

* = Not Determined

HOLE NUMBER: CPT-04a

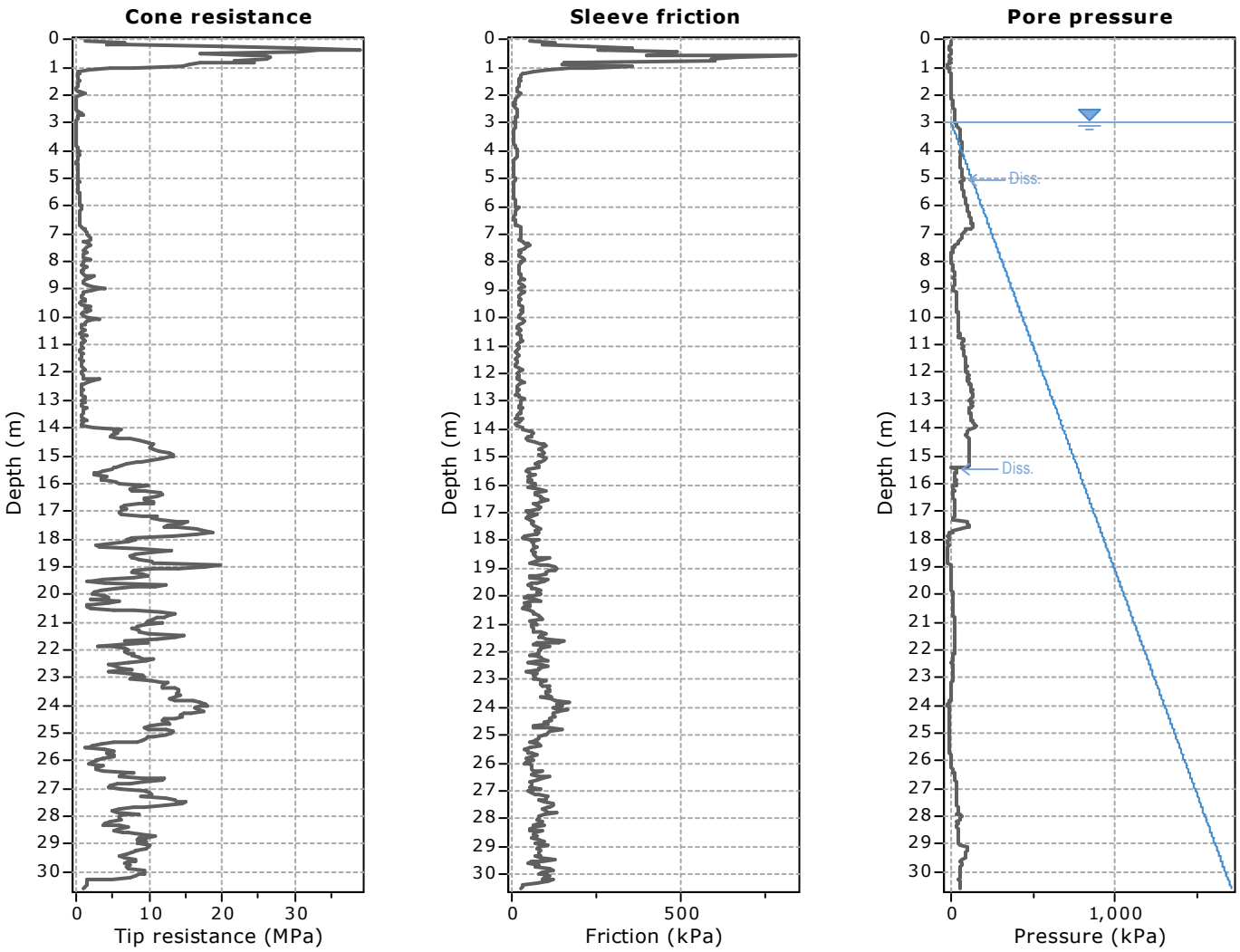


Hammer to Rod String Distance (ft): 2.79
* = Not Determined

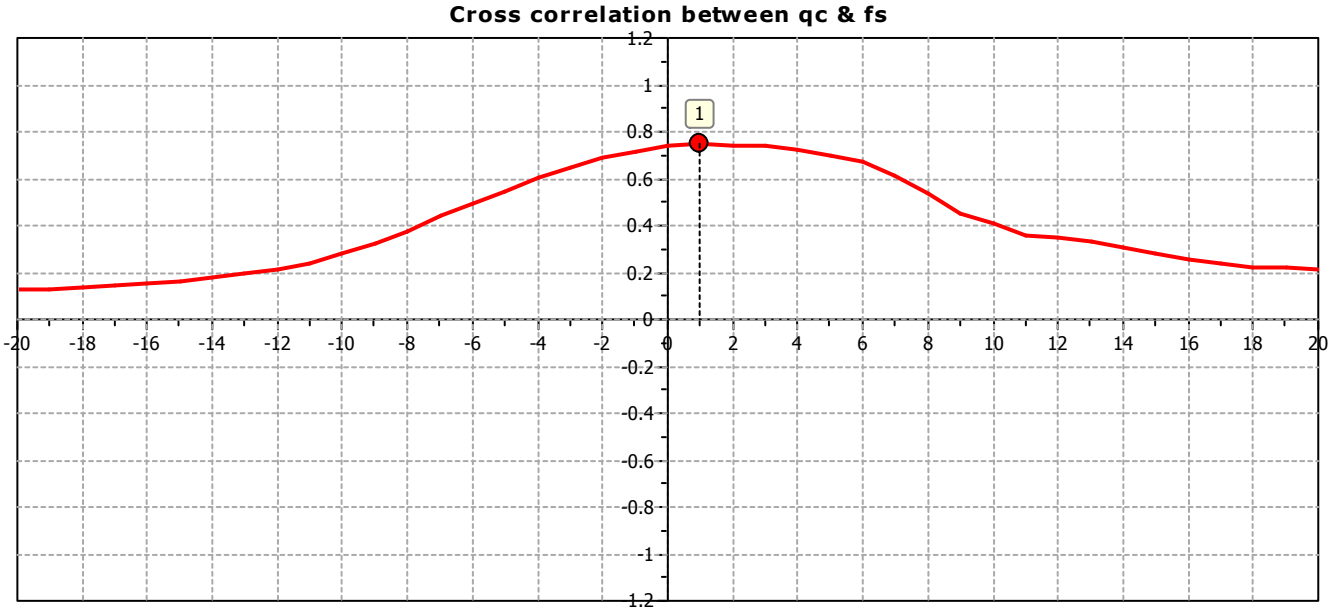
In Situ Engineering
Snohomish, WA
360-568-2807
www.insituengineering.com

CPT: cpt-05-18
Total depth: 30.60 m, Date: 12/14/2018
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

Project:
Location:



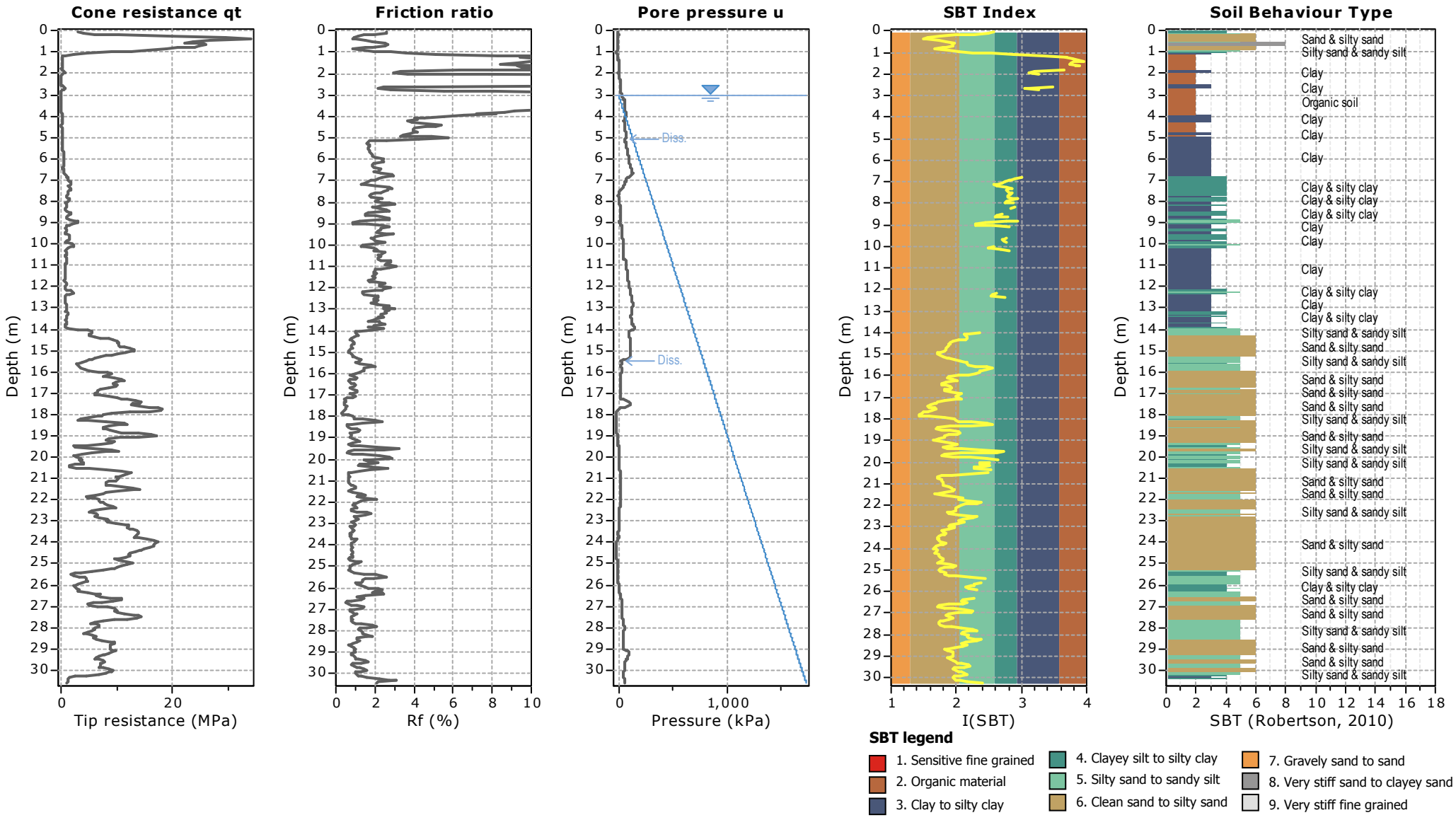
The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).



In Situ Engineering
Snohomish, WA
360-568-2807
www.insituengineering.com

CPT: cpt-05-18
Total depth: 30.60 m, Date: 12/14/2018
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

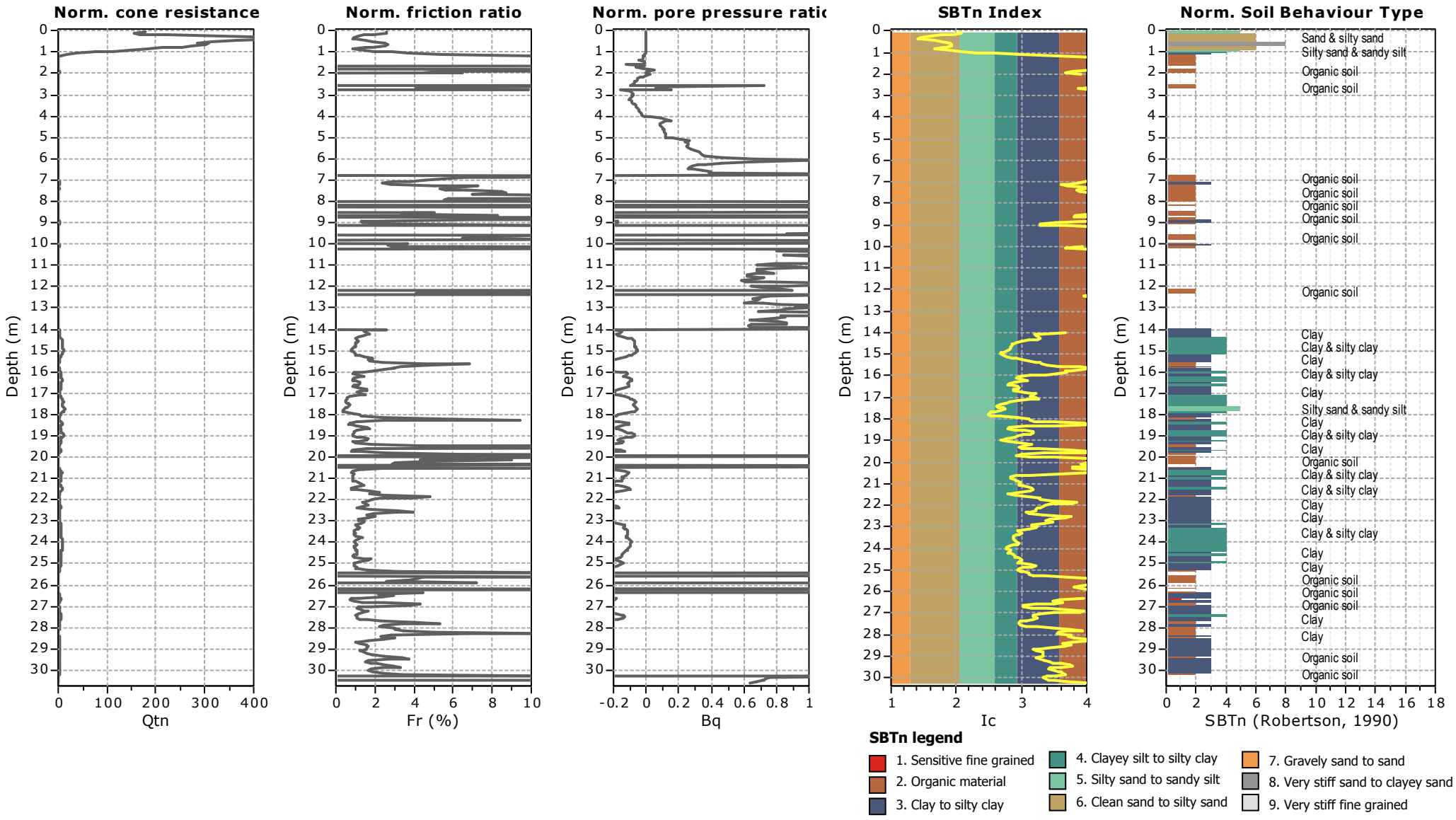
Project:
Location:



In Situ Engineering
Snohomish, WA
360-568-2807
www.insituengineering.com

CPT: cpt-05-18
Total depth: 30.60 m, Date: 12/14/2018
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

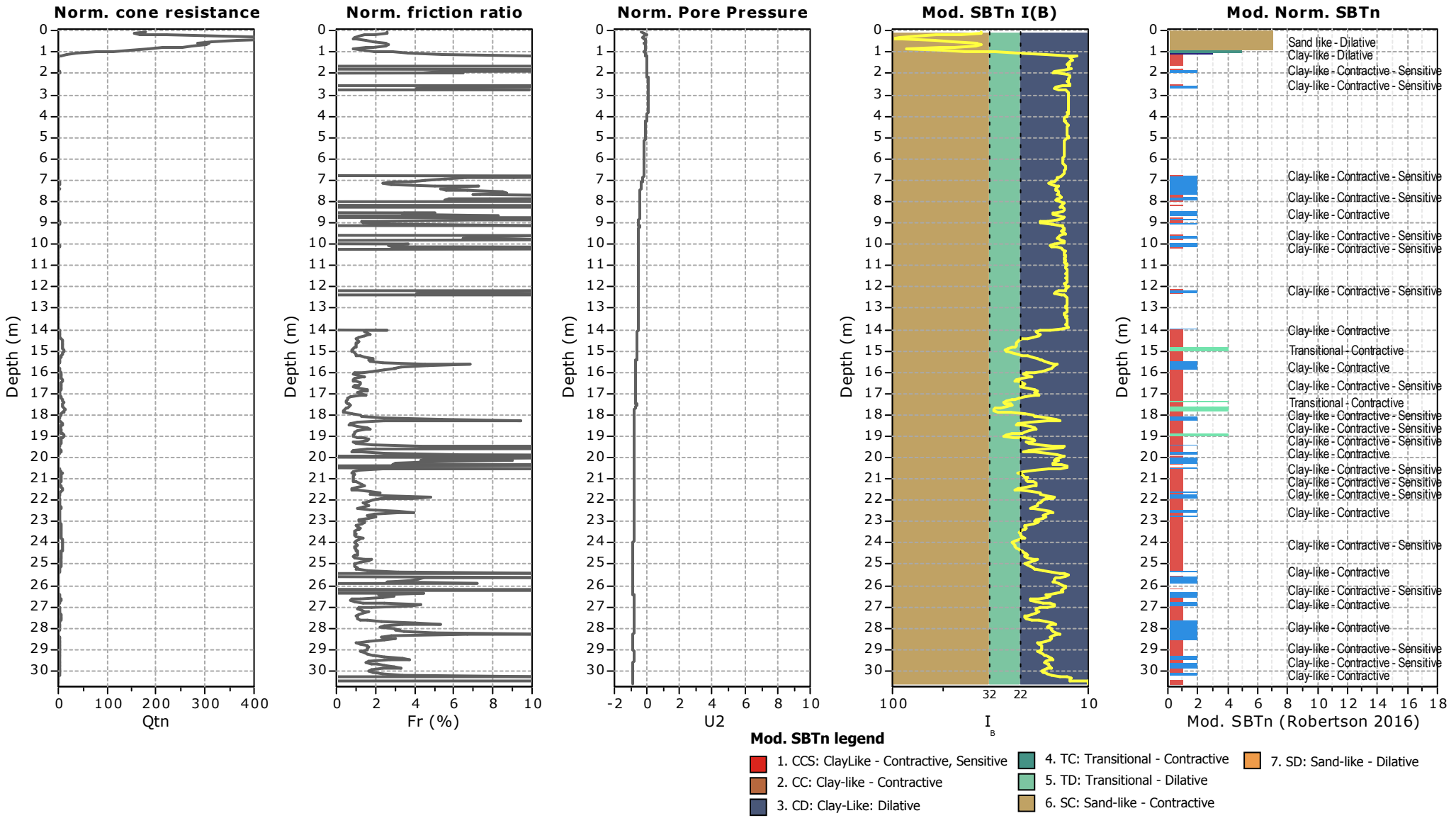
Project:
Location:



In Situ Engineering
Snohomish, WA
360-568-2807
www.insituengineering.com

CPT: cpt-05-18
Total depth: 30.60 m, Date: 12/14/2018
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

Project:
Location:



Dissipation Tests Results

Dissipation tests

Dissipation tests consists of stopping the piezocone penetration and observing porepressures (u) with elapsed time (t). The data are automatic recorded by the field computer and should take place until a minimum of 50% dissipation.

The porepressures are plotted as a function of square root of (t). The graphical technique suggested by Robertson and Campanella (1989), yields a value for t_{50}, which corresponds to the time for 50% consolidation.

The value of the coefficient of consolidation in the radial or horizontal direction c_h was then calculated by Houlsby and Teh's (1988) theory using the following equation:

$$c_h = \frac{T \times r^2 \times I_r^{0.5}}{t_{50}}$$

where:

T: time factor given by Houlsby and Teh's (1988) theory corresponding to the porepressure position
r: piezocone radius
I_r: stiffness index, equal to shear modulus G divided by the undrained strength of clay (S_u).
t_{50}: time corresponding to 50% consolidation

Permeability estimates based on dissipation test

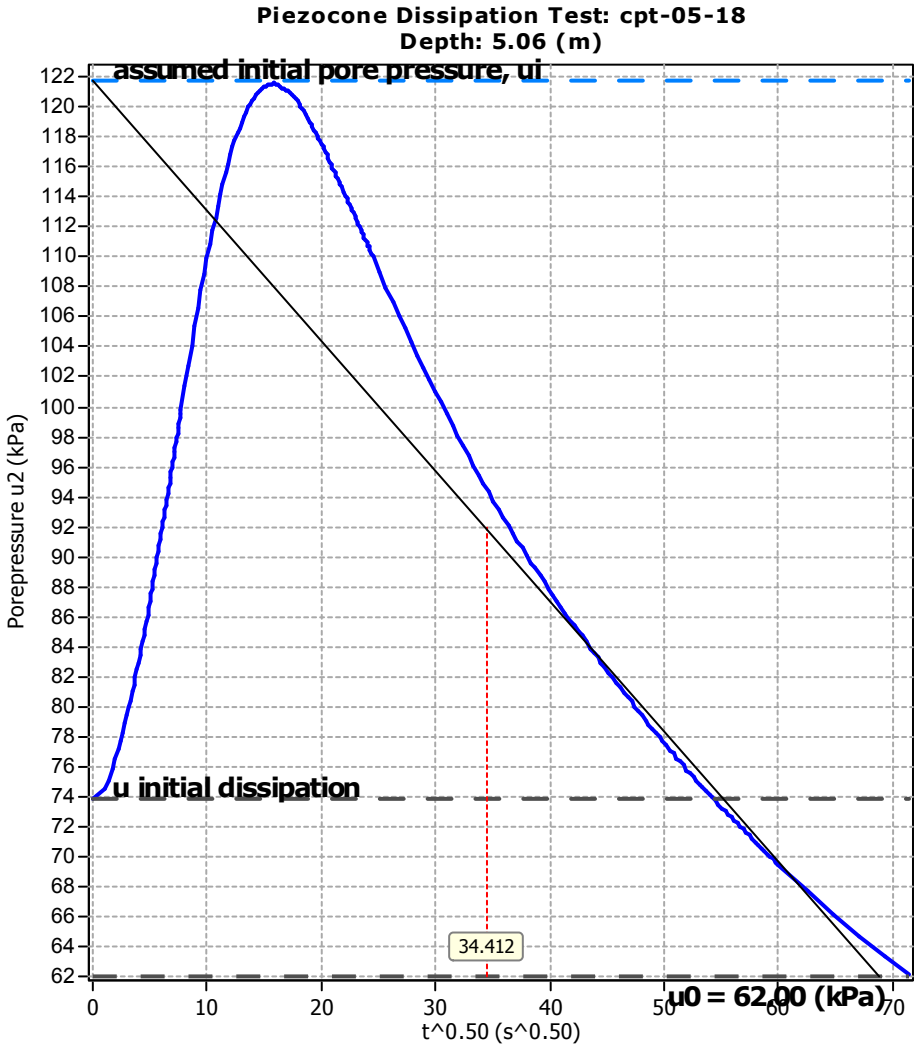
The dissipation of pore pressures during a CPTu dissipation test is controlled by the coefficient of consolidation in the horizontal direction (c_h) which is influenced by a combination of the soil permeability (k_h) and compressibility (M), as defined by the following:

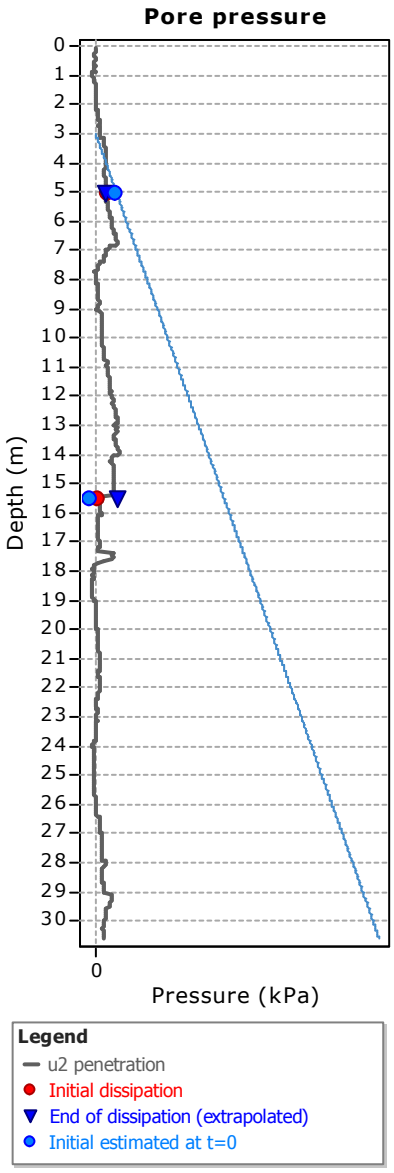
$$k_h = c_h \times \gamma_w / M$$

where: M is the 1-D constrained modulus and γ_w is the unit weight of water, in compatible units.

Tabular results

CPTU Borehole	Depth (m)	$(t_{50})^{0.50}$	t_{50} (s)	t_{50} (years)	G/S_u	c_h (m^2/s)	c_h (m^2/year)	M (MPa)	k_h (m/s)
cpt-05-18	5.06	34.4	1184	3.75E-005	100.00	7.06E-006	223	1.93	2.28E-007


Piezocone Dissipation Test: cpt-05-18
Depth: 5.06 (m)
assumed initial pore pressure, ui
u initial dissipation
34.412
u0 = 62.00 (kPa)
Porepressure u2 (kPa)
t^0.50 (s^0.50)


Pore pressure
Depth (m)
Pressure (kPa)
Legend
u2 penetration
Initial dissipation
End of dissipation (extrapolated)
Initial estimated at t=0

Dissipation Tests Results

Dissipation tests

Dissipation tests consists of stopping the piezocone penetration and observing porepressures (u) with elapsed time (t). The data are automatic recorded by the field computer and should take place until a minimum of 50% dissipation.

The porepressures are plotted as a function of square root of (t). The graphical technique suggested by Robertson and Campanella (1989), yields a value for t_{50}, which corresponds to the time for 50% consolidation.

The value of the coefficient of consolidation in the radial or horizontal direction c_h was then calculated by Houlsby and Teh's (1988) theory using the following equation:

$$c_h = \frac{T \times r^2 \times I_r^{0.5}}{t_{50}}$$

where:

T: time factor given by Houlsby and Teh's (1988) theory corresponding to the porepressure position
r: piezocone radius
I_r: stiffness index, equal to shear modulus G divided by the undrained strength of clay (S_u).
t_{50}: time corresponding to 50% consolidation

Permeability estimates based on dissipation test

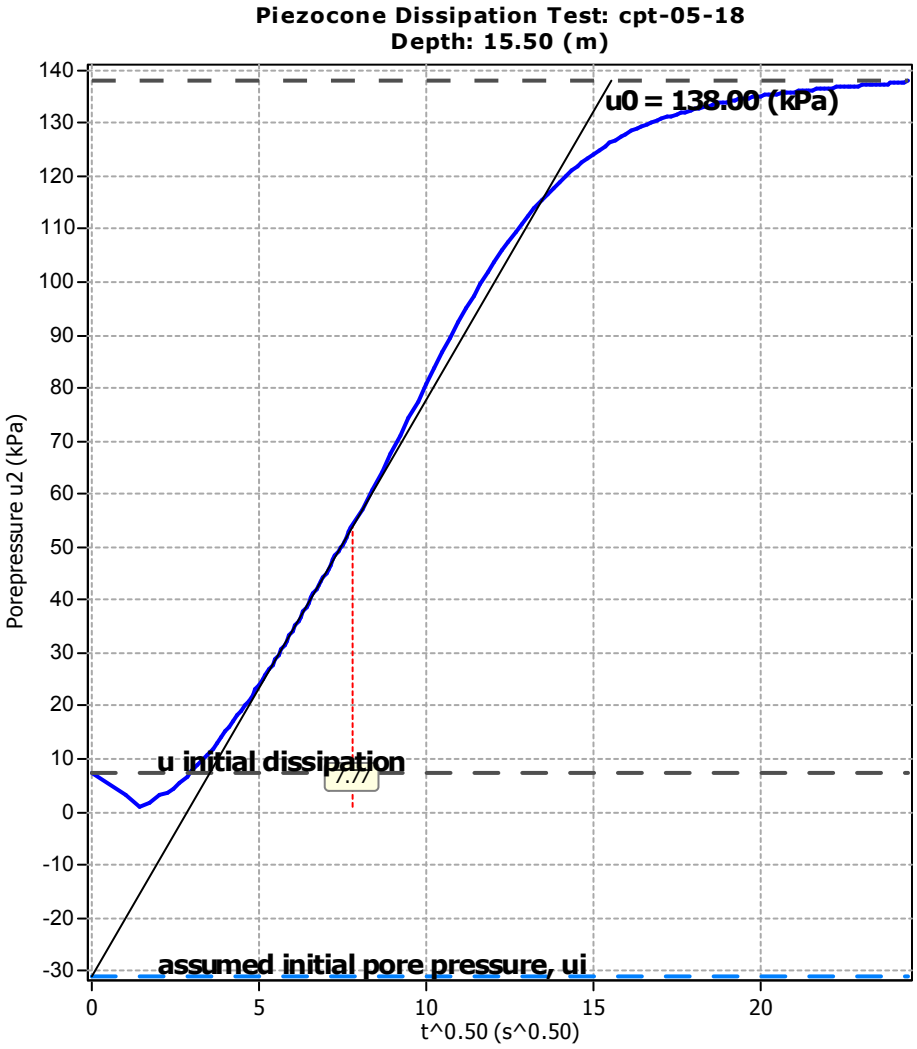
The dissipation of pore pressures during a CPTu dissipation test is controlled by the coefficient of consolidation in the horizontal direction (c_h) which is influenced by a combination of the soil permeability (k_h) and compressibility (M), as defined by the following:

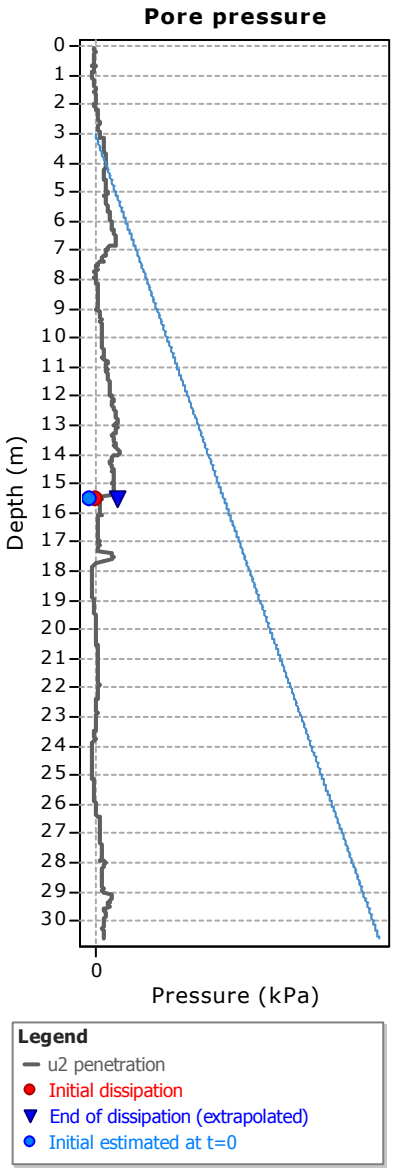
$$k_h = c_h \times \gamma_w / M$$

where: M is the 1-D constrained modulus and γ_w is the unit weight of water, in compatible units.

Tabular results

CPTU Borehole	Depth (m)	$(t_{50})^{0.50}$	t_{50} (s)	t_{50} (years)	G/S_u	c_h (m^2/s)	c_h (m^2/year)	M (MPa)	k_h (m/s)
cpt-05-18	15.50	7.8	60	1.91E-006	1174.91	4.74E-004	14961	7.02	4.22E-006

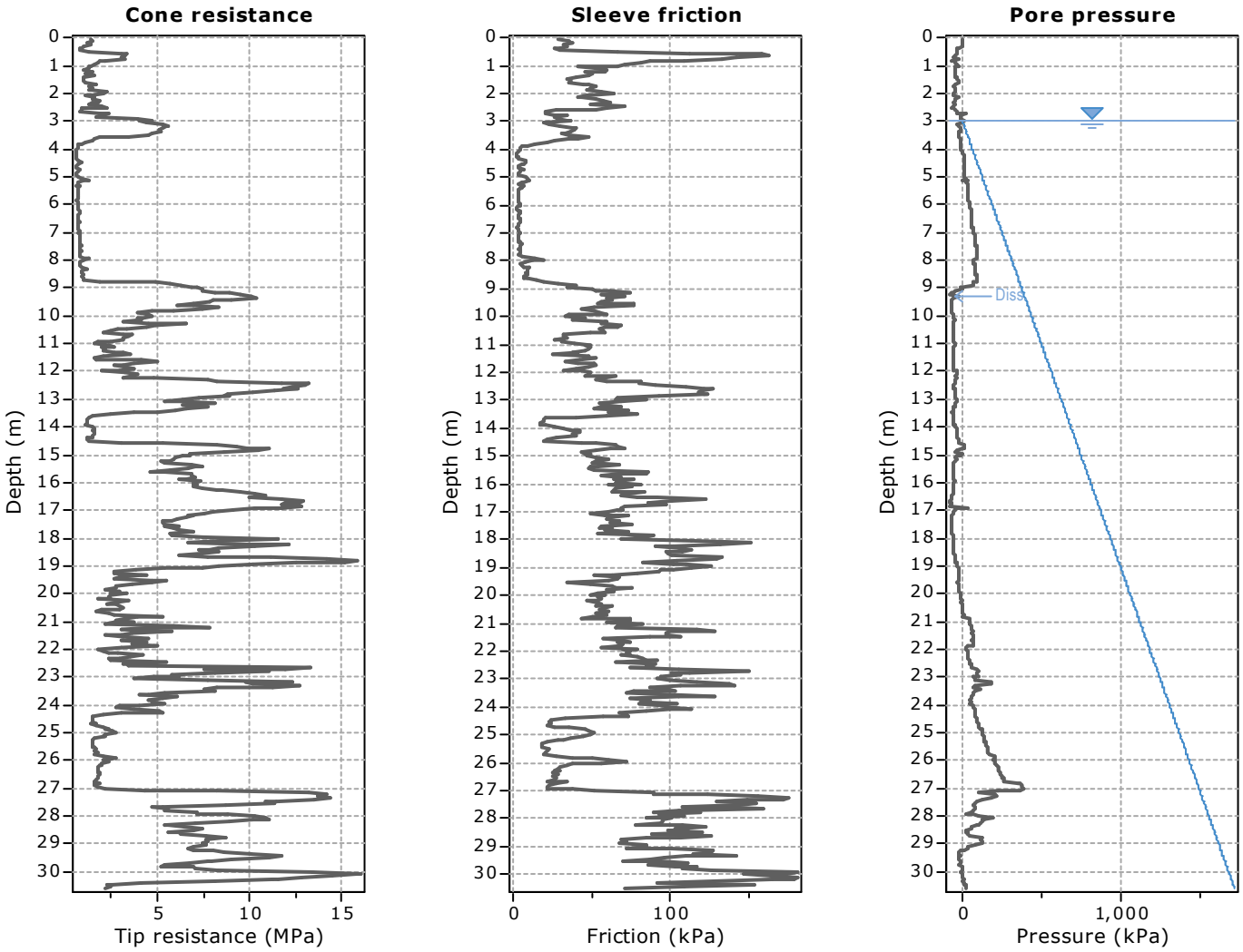

Piezocone Dissipation Test: cpt-05-18
Depth: 15.50 (m)
u0 = 138.00 (kPa)
u initial dissipation
assumed initial pore pressure, ui
Porepressure u2 (kPa)
t^0.50 (s^0.50)


Pore pressure
Depth (m)
Pressure (kPa)
Legend
u2 penetration
Initial dissipation
End of dissipation (extrapolated)
Initial estimated at t=0

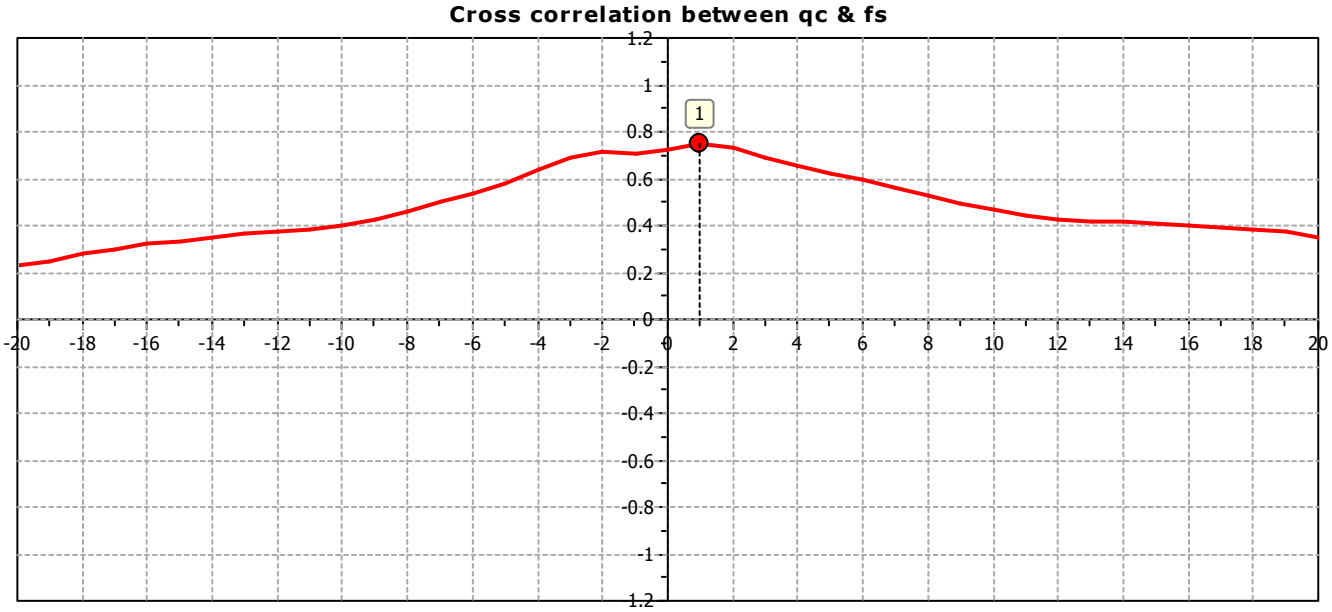
In Situ Engineering
Snohomish, WA
360-568-2807
www.insituengineering.com

CPT: CPT-07-18
Total depth: 30.60 m, Date: 12/14/2018
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

Project:
Location:



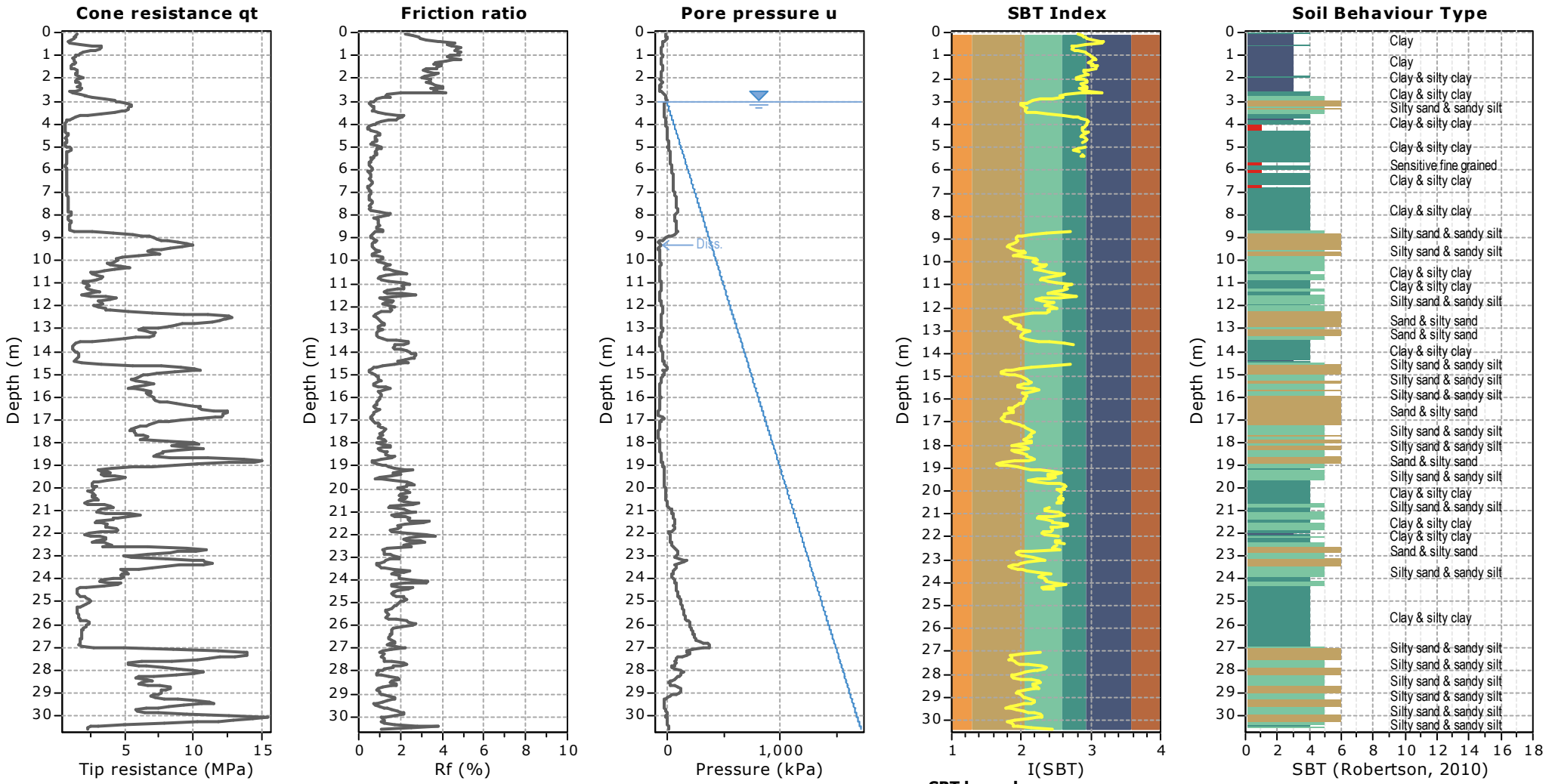
The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).



In Situ Engineering
Snohomish, WA
360-568-2807
www.insituengineering.com

Project:
Location:

CPT: CPT-07-18
Total depth: 30.60 m, Date: 12/14/2018
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown



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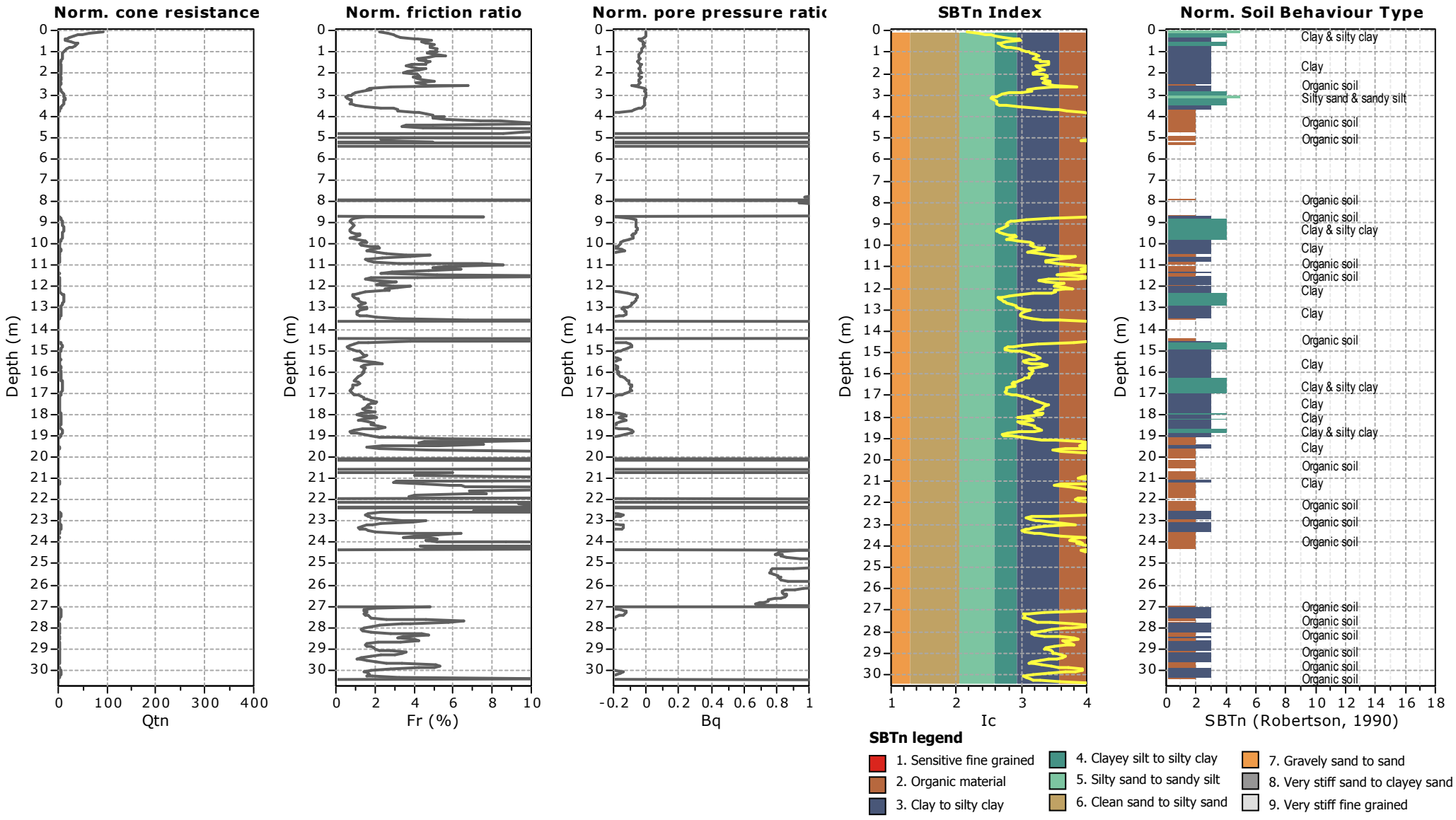
360-568-2807
www.insituengineering.com

Project:
Location:

CPT: CPT-07-18
Total depth: 30.60 m, Date: 12/14/2018
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown



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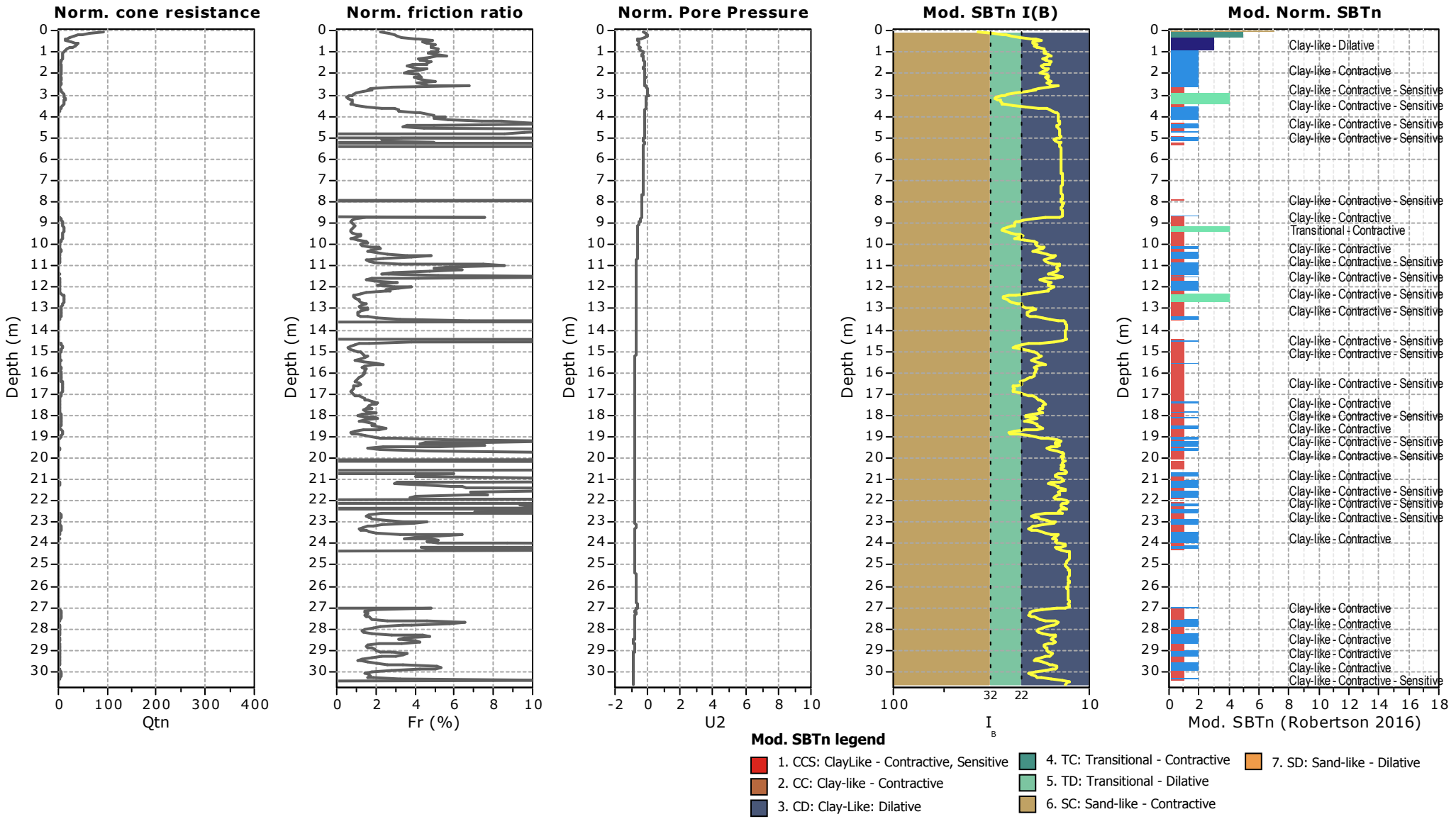
Project:
Location:

CPT: CPT-07-18
Total depth: 30.60 m, Date: 12/14/2018
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown



Dissipation Tests Results

Dissipation tests

Dissipation tests consists of stopping the piezocone penetration and observing porepressures (u) with elapsed time (t). The data are automatic recorded by the field computer and should take place until a minimum of 50% dissipation.

The porepressures are plotted as a function of square root of (t). The graphical technique suggested by Robertson and Campanella (1989), yields a value for t_{50}, which corresponds to the time for 50% consolidation.

The value of the coefficient of consolidation in the radial or horizontal direction c_h was then calculated by Houlsby and Teh's (1988) theory using the following equation:

$$c_h = \frac{T \times r^2 \times I_r^{0.5}}{t_{50}}$$

where:

T: time factor given by Houlsby and Teh's (1988) theory corresponding to the porepressure position
r: piezocone radius
I_r: stiffness index, equal to shear modulus G divided by the undrained strength of clay (S_u).
t_{50}: time corresponding to 50% consolidation

Permeability estimates based on dissipation test

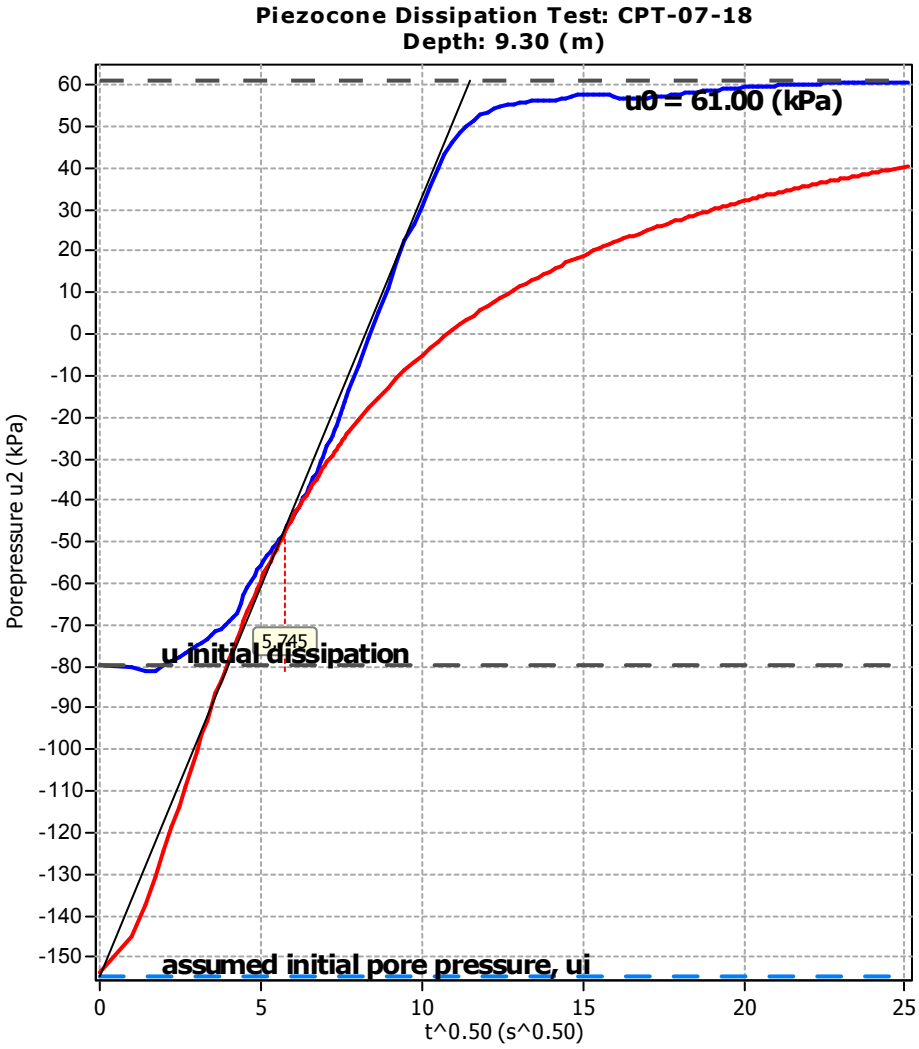
The dissipation of pore pressures during a CPTu dissipation test is controlled by the coefficient of consolidation in the horizontal direction (c_h) which is influenced by a combination of the soil permeability (k_h) and compressibility (M), as defined by the following:

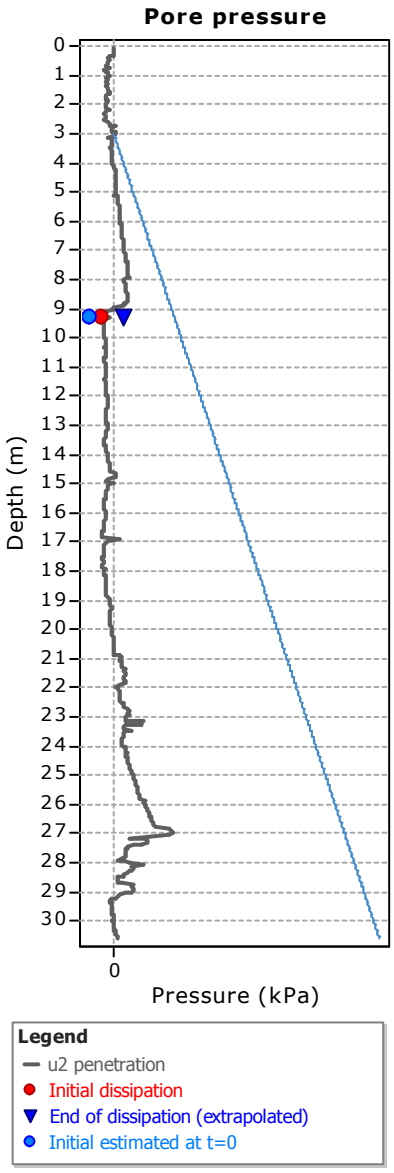
$$k_h = c_h \times \gamma_w / M$$

where: M is the 1-D constrained modulus and γ_w is the unit weight of water, in compatible units.

Tabular results

CPTU Borehole	Depth (m)	$(t_{50})^{0.50}$	t_{50} (s)	t_{50} (years)	G/S_u	c_h (m^2/s)	c_h (m^2/year)	M (MPa)	k_h (m/s)
CPT-07-18	9.30	5.7	33	1.05E-006	448.79	5.36E-004	16914	62.38	5.37E-007


Piezocone Dissipation Test: CPT-07-18
Depth: 9.30 (m)
u0 = 61.00 (kPa)
u initial dissipation
assumed initial pore pressure, ui
5.745
Porepressure u2 (kPa)
t^0.50 (s^0.50)


Pore pressure
Depth (m)
Pressure (kPa)
Legend
u2 penetration
Initial dissipation
End of dissipation (extrapolated)
Initial estimated at t=0

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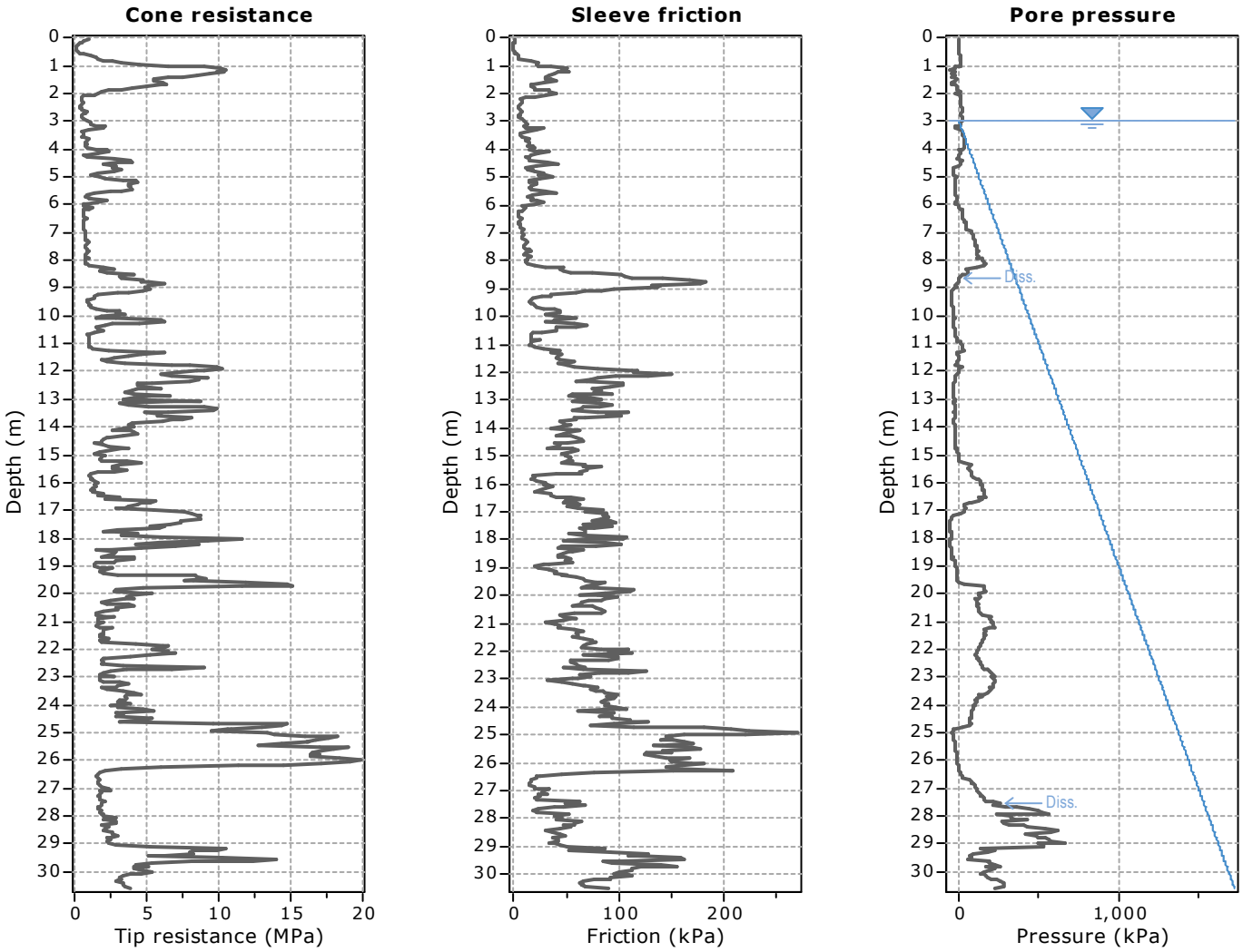
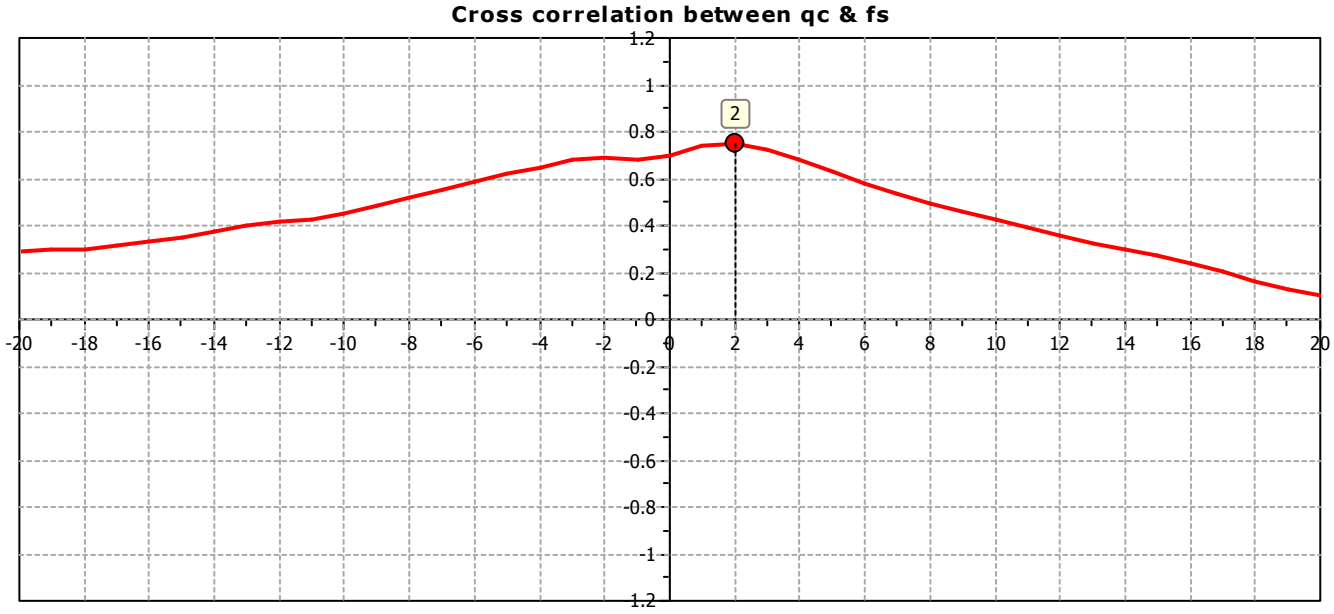
CPT: CPT-08-18
Total depth: 30.60 m, Date: 12/14/2018
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

Project:
Location:



The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).



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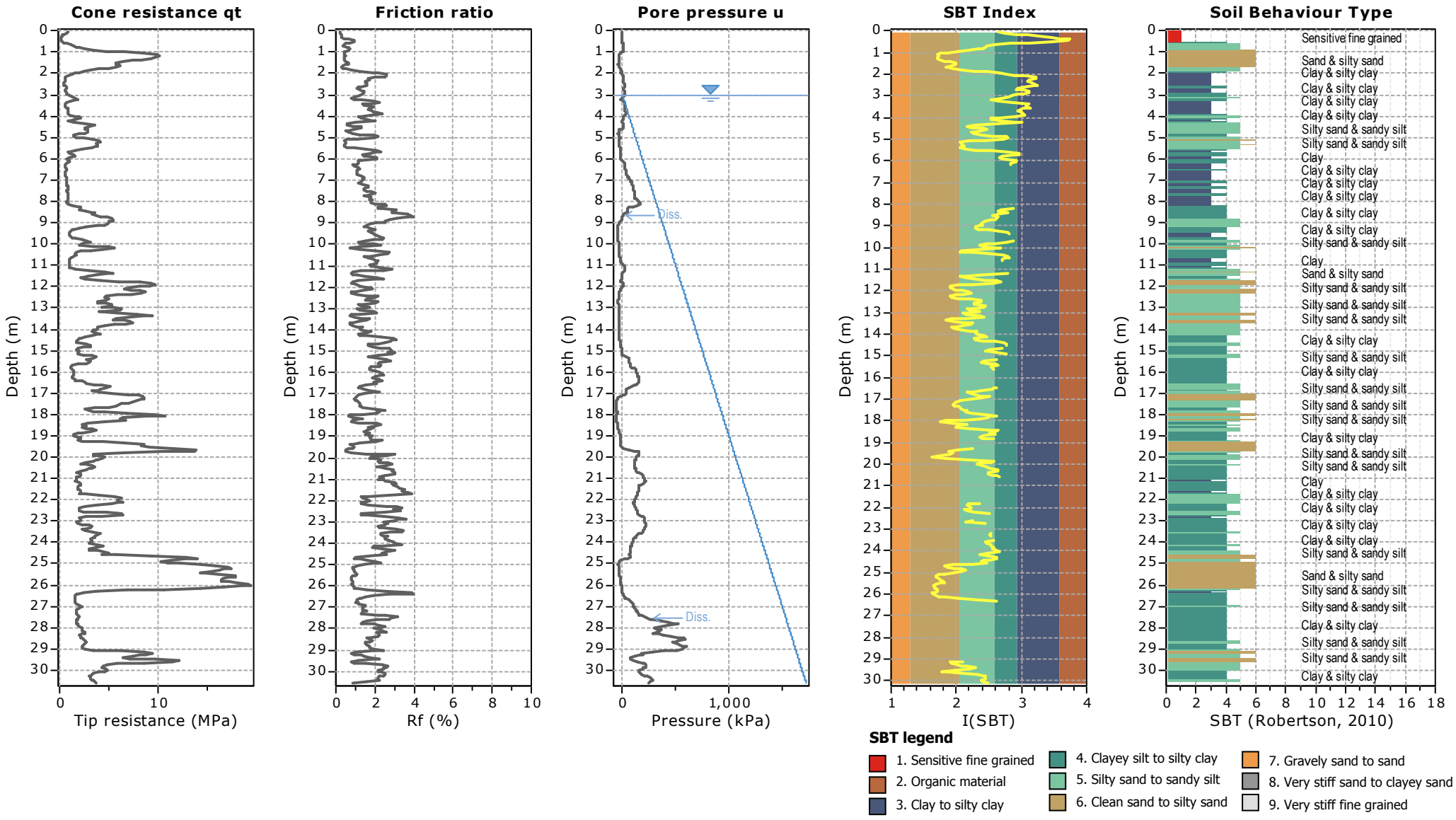
CPT: CPT-08-18
Total depth: 30.60 m, Date: 12/14/2018
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

Project:
Location:



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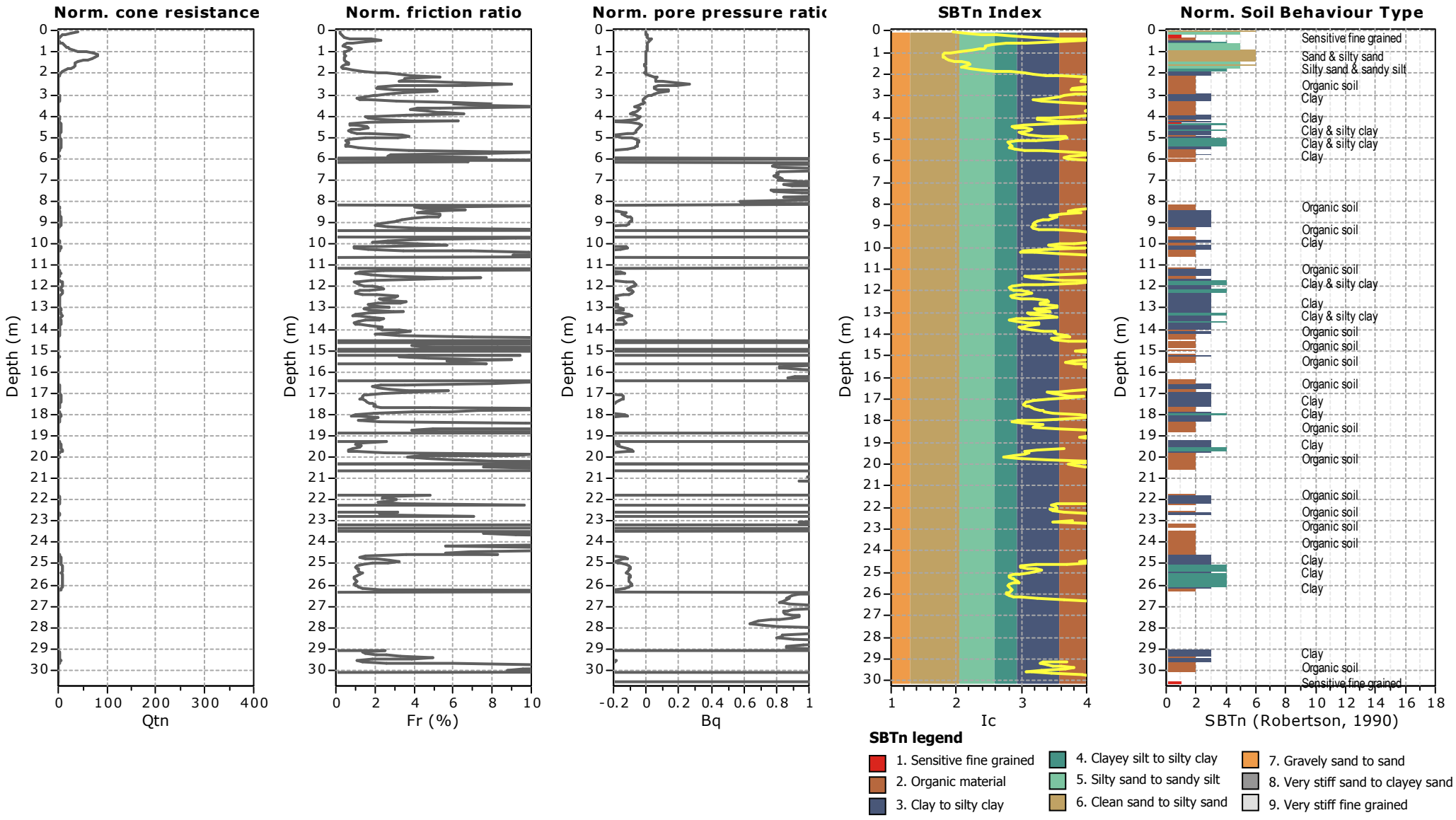
CPT: CPT-08-18
Total depth: 30.60 m, Date: 12/14/2018
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

Project:
Location:



In Situ Engineering
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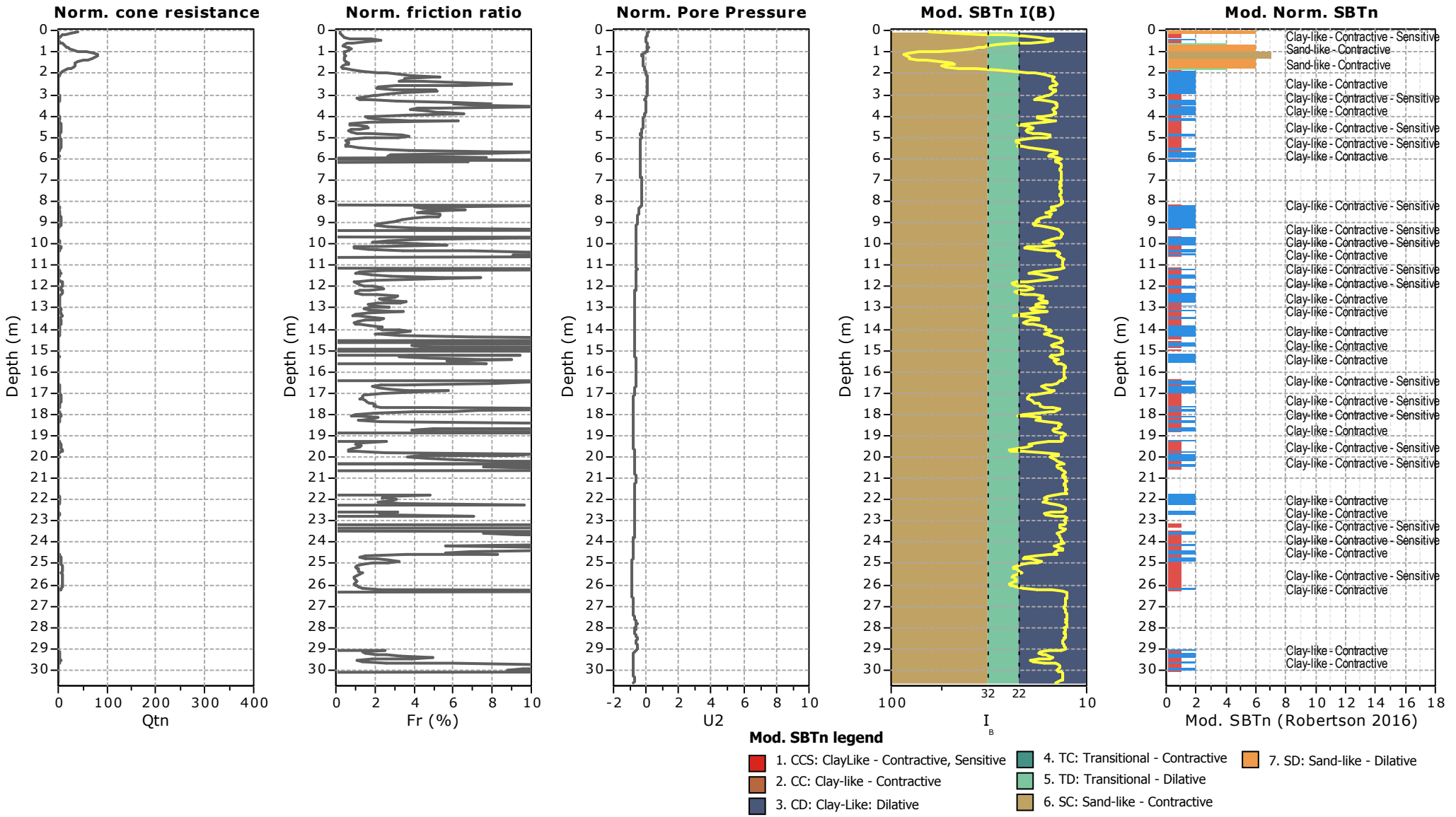
CPT: CPT-08-18
Total depth: 30.60 m, Date: 12/14/2018
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

Project:
Location:



Dissipation Tests Results

Dissipation tests

Dissipation tests consists of stopping the piezocone penetration and observing porepressures (u) with elapsed time (t). The data are automatic recorded by the field computer and should take place until a minimum of 50% dissipation.

The porepressures are plotted as a function of square root of (t). The graphical technique suggested by Robertson and Campanella (1989), yields a value for t_{50}, which corresponds to the time for 50% consolidation.

The value of the coefficient of consolidation in the radial or horizontal direction c_h was then calculated by Houlsby and Teh's (1988) theory using the following equation:

$$c_h = \frac{T \times r^2 \times I_r^{0.5}}{t_{50}}$$

where:

T: time factor given by Houlsby and Teh's (1988) theory corresponding to the porepressure position
r: piezocone radius
I_r: stiffness index, equal to shear modulus G divided by the undrained strength of clay (S_u).
t_{50}: time corresponding to 50% consolidation

Permeability estimates based on dissipation test

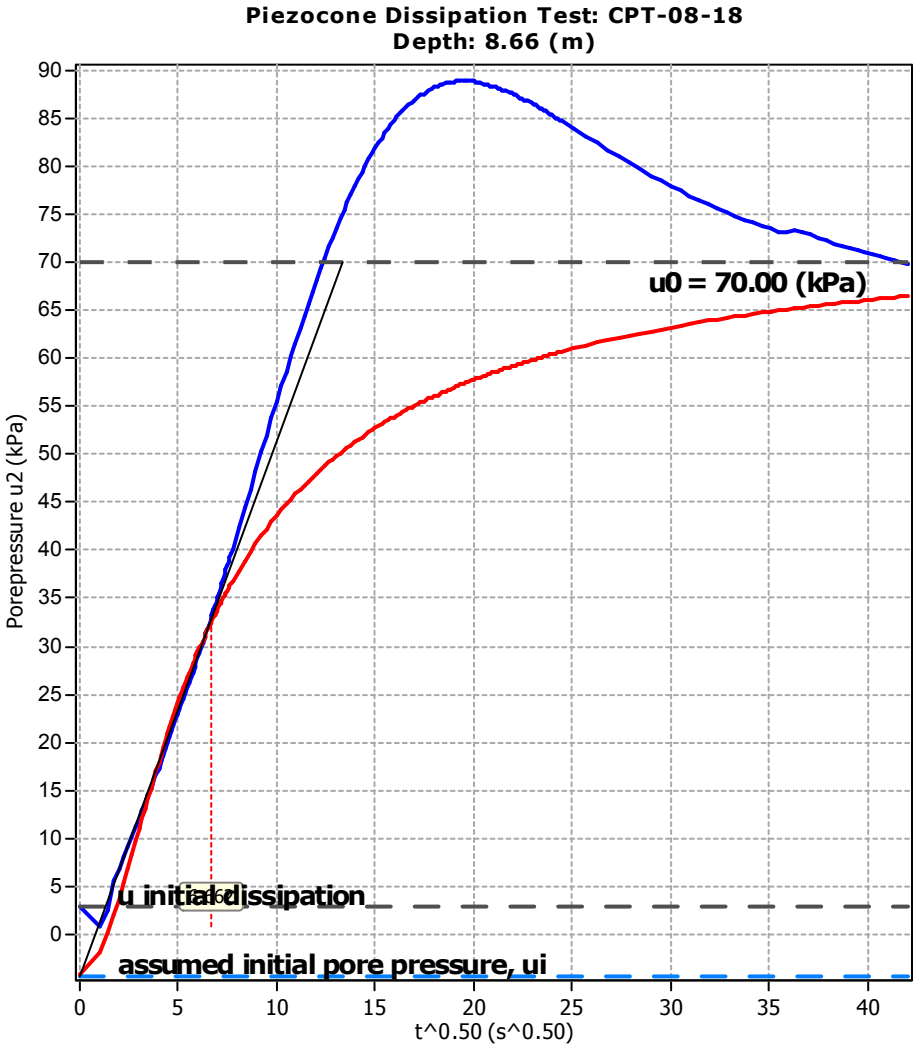
The dissipation of pore pressures during a CPTu dissipation test is controlled by the coefficient of consolidation in the horizontal direction (c_h) which is influenced by a combination of the soil permeability (k_h) and compressibility (M), as defined by the following:

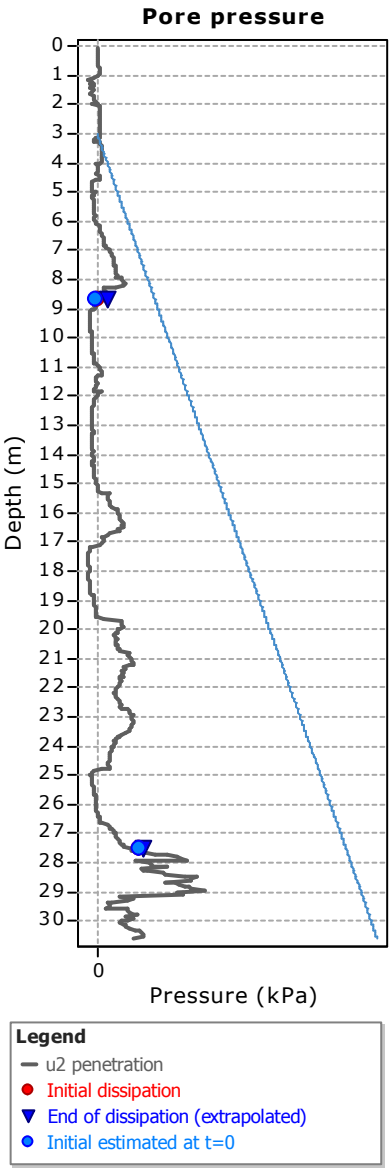
$$k_h = c_h \times \gamma_w / M$$

where: M is the 1-D constrained modulus and γ_w is the unit weight of water, in compatible units.

Tabular results

CPTU Borehole	Depth (m)	$(t_{50})^{0.50}$	t_{50} (s)	t_{50} (years)	G/S_u	c_h (m^2/s)	c_h (m^2/year)	M (MPa)	k_h (m/s)
CPT-08-18	8.66	6.7	44	1.41E-006	1041.49	6.08E-004	19163	9.97	3.81E-006


Piezocone Dissipation Test: CPT-08-18
Depth: 8.66 (m)
Porepressure u2 (kPa)
t^0.50 (s^0.50)
u0 = 70.00 (kPa)
u initial dissipation
assumed initial pore pressure, ui


Pore pressure
Depth (m)
Pressure (kPa)
Legend
u2 penetration
Initial dissipation
End of dissipation (extrapolated)
Initial estimated at t=0

Dissipation Tests Results

Dissipation tests

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where:

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t_{50}: time corresponding to 50% consolidation

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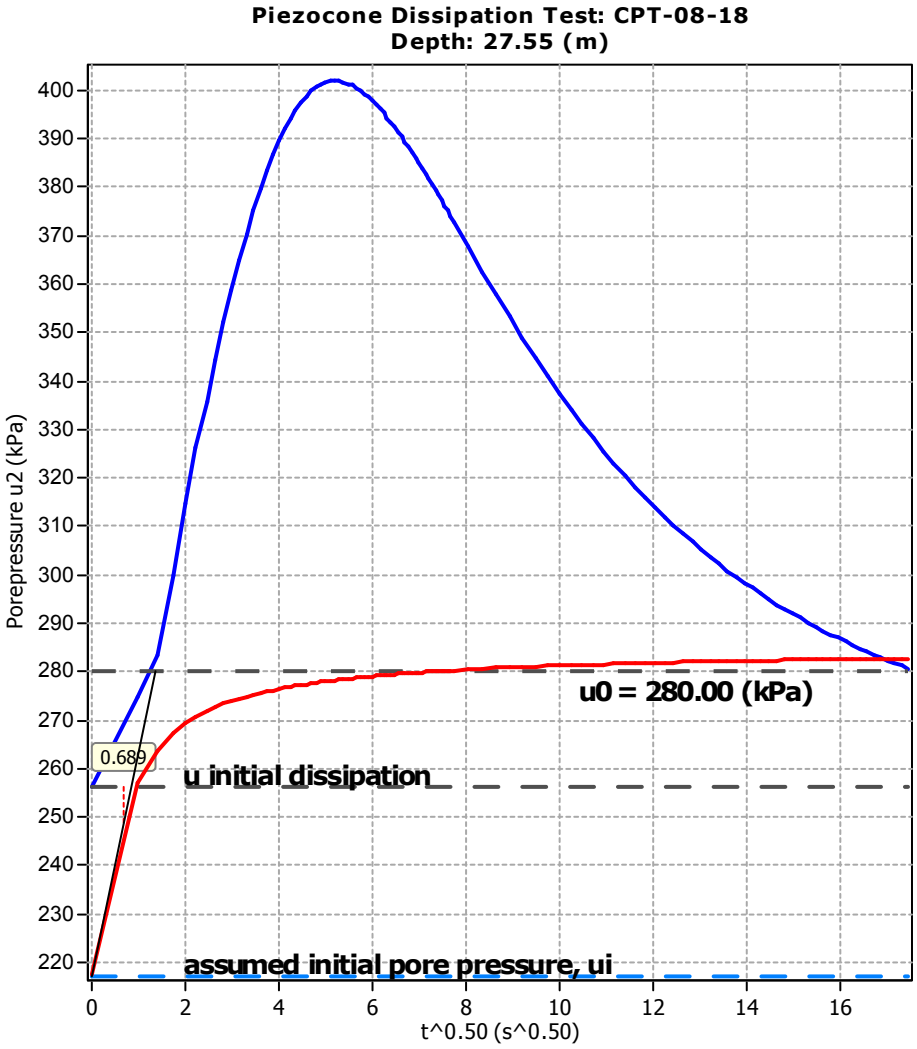
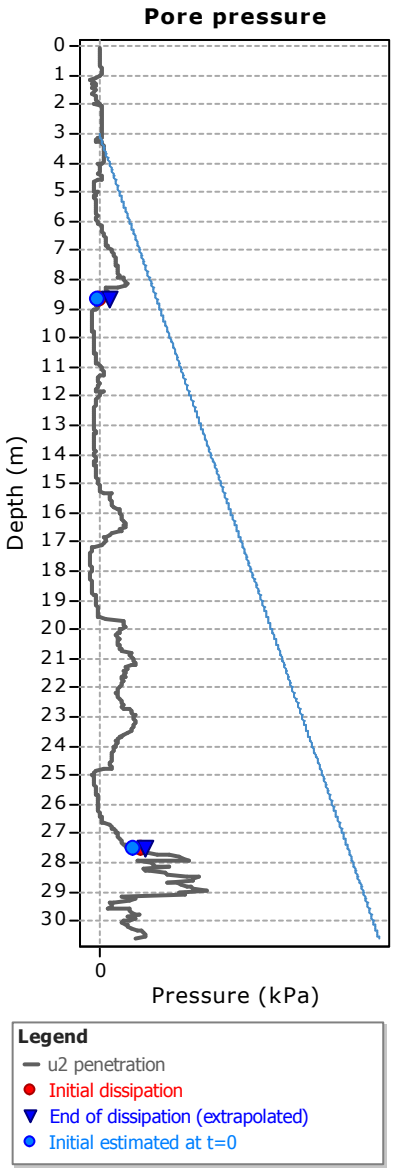
where: M is the 1-D constrained modulus and γ_w is the unit weight of water, in compatible units.

Tabular results

CPTU Borehole	Depth (m)	$(t_{50})^{0.50}$	t_{50} (s)	t_{50} (years)	G/S_u	c_h (m^2/s)	c_h (m^2/year)	M (MPa)	k_h (m/s)
CPT-08-18	27.55	0.7	0	1.50E-008	100.00	1.76E-002	555320	7.19	1.53E-004


Piezocone Dissipation Test: CPT-08-18
Depth: 27.55 (m)
Porepressure u2 (kPa)
t^0.50 (s^0.50)
u0 = 280.00 (kPa)
u initial dissipation
assumed initial pore pressure, ui
0.689


Pore pressure
Depth (m)
Pressure (kPa)
Legend
u2 penetration
Initial dissipation
End of dissipation (extrapolated)
Initial estimated at t=0

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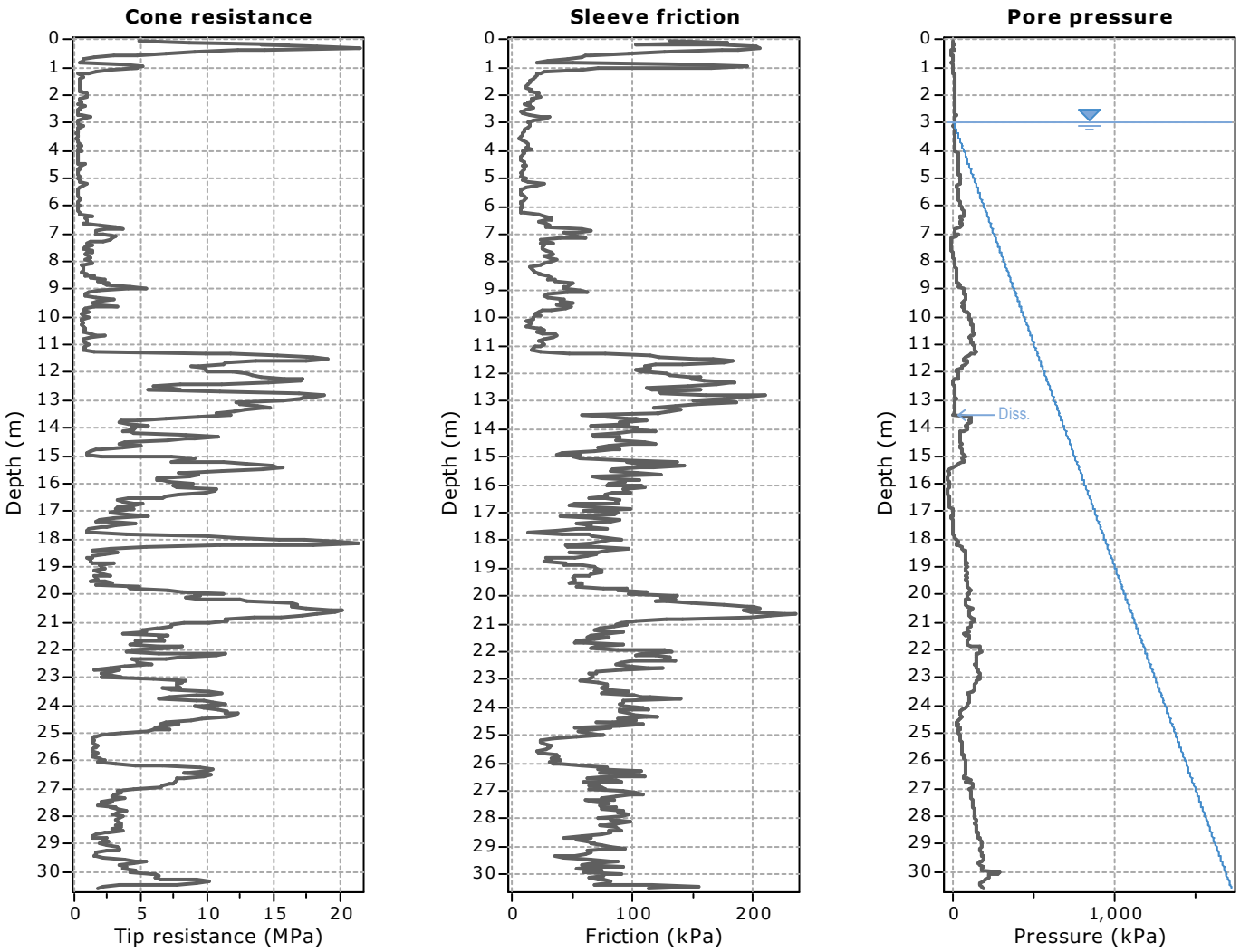
CPT: CPT-09-18
Total depth: 30.60 m, Date: 12/14/2018
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

Project:
Location:



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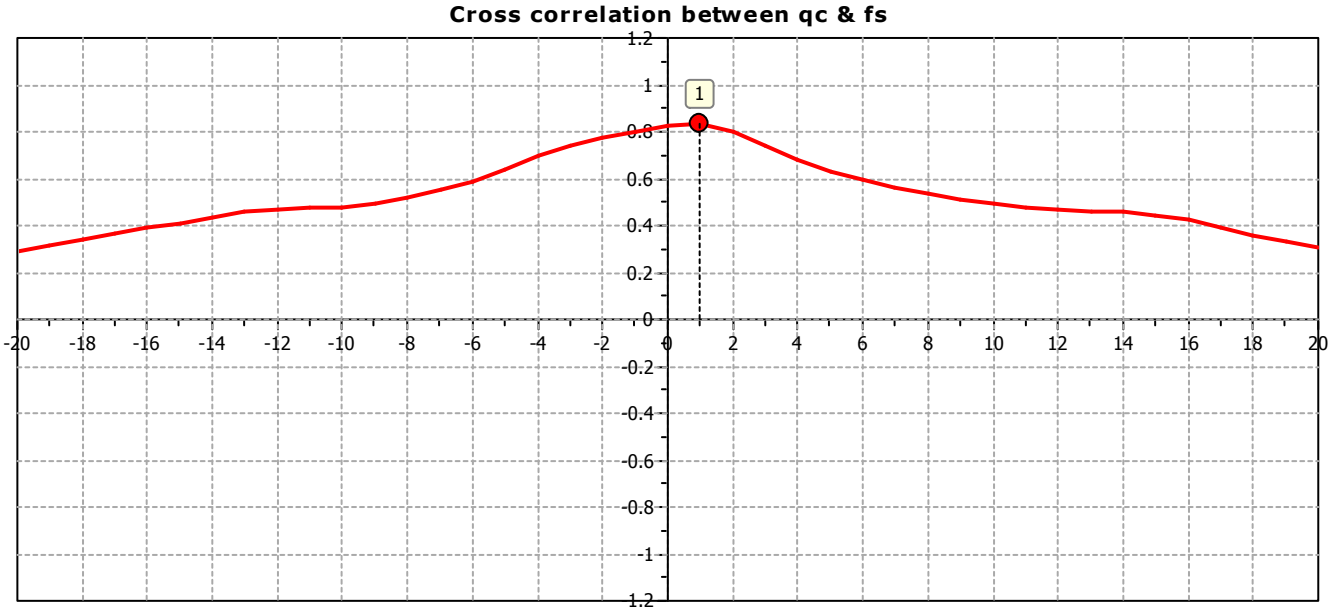

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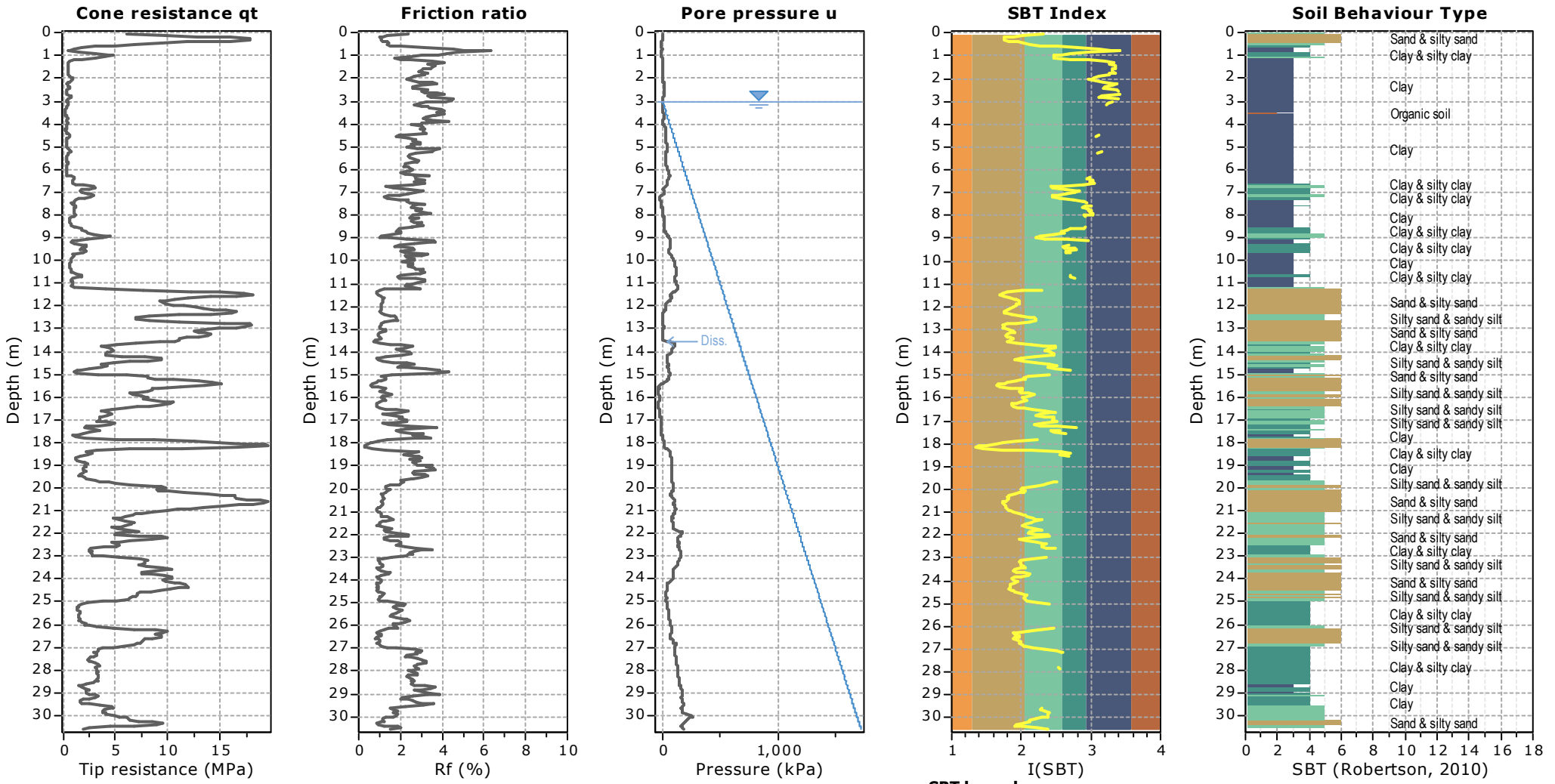
Project:
Location:

CPT: CPT-09-18
Total depth: 30.60 m, Date: 12/14/2018
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown



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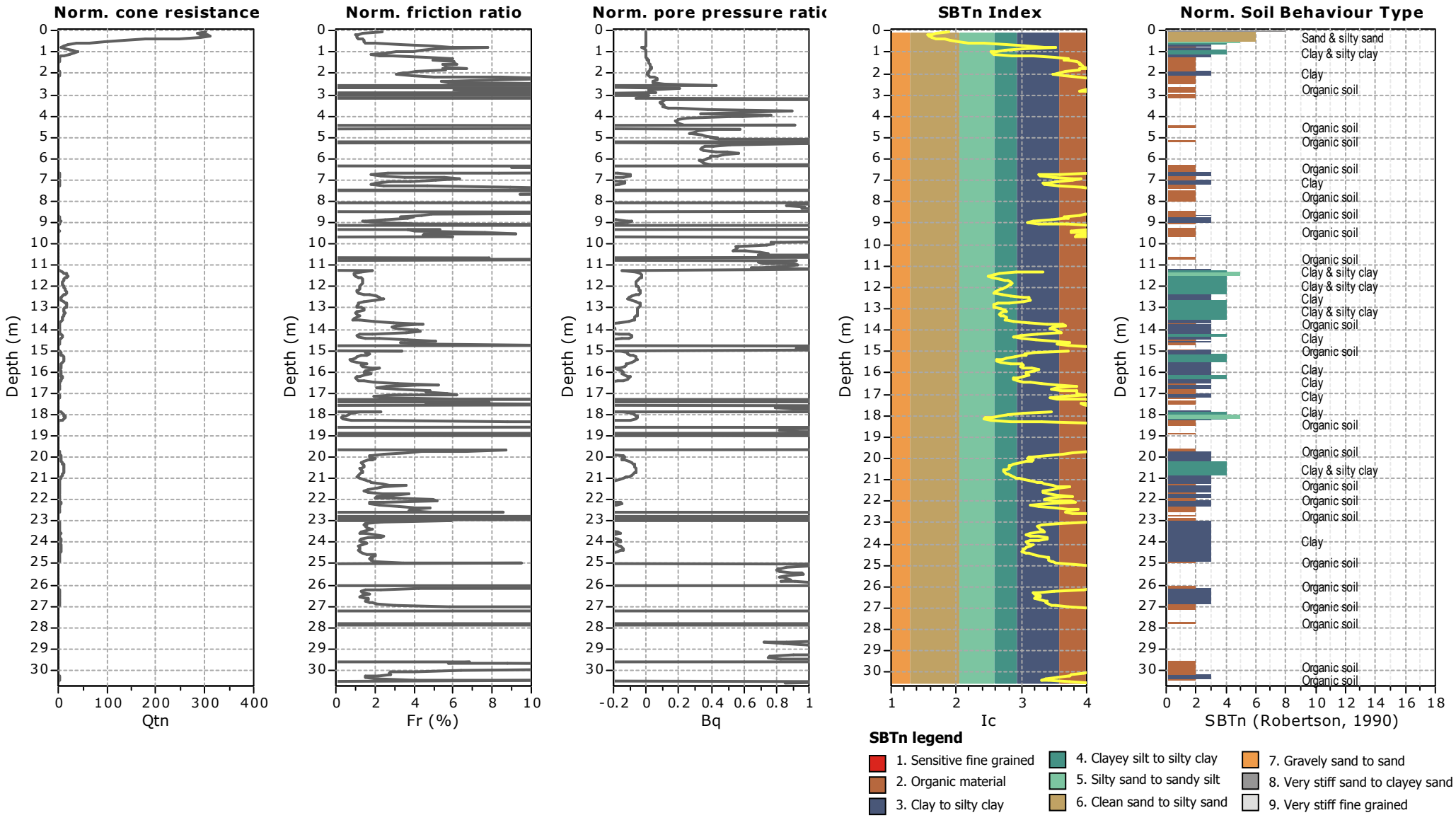
Project:
Location:

CPT: CPT-09-18
Total depth: 30.60 m, Date: 12/14/2018
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown



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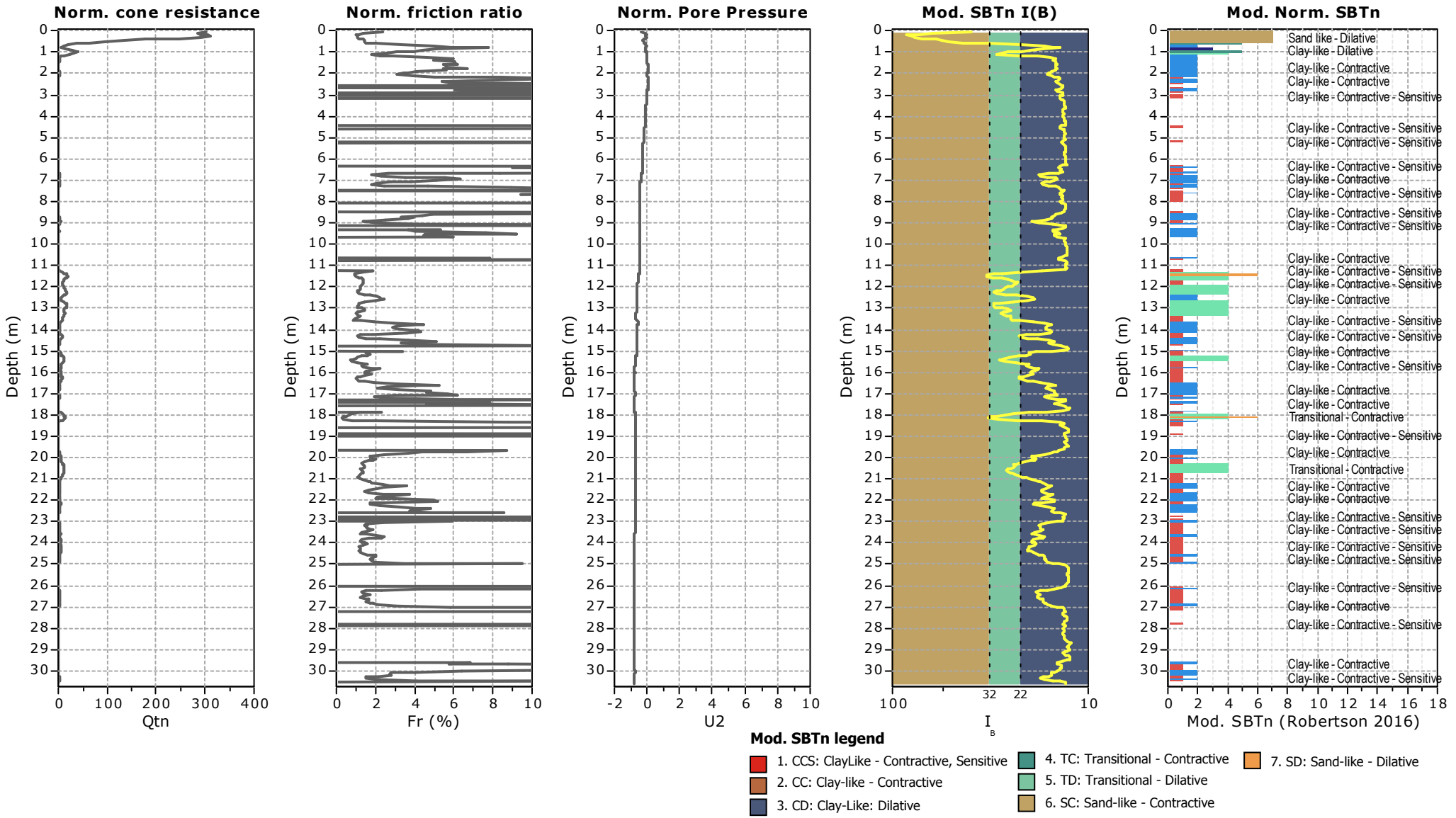
CPT: CPT-09-18
Total depth: 30.60 m, Date: 12/14/2018
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

Project:
Location:



Dissipation Tests Results

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where:

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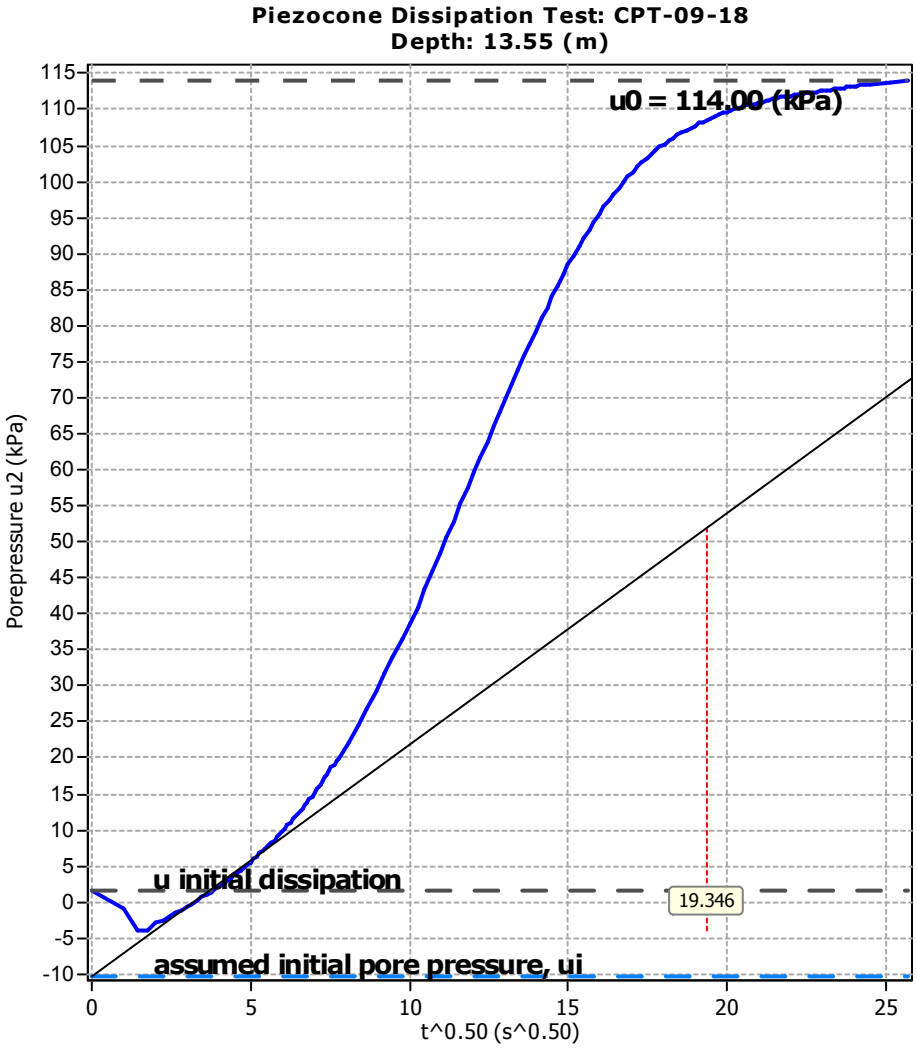
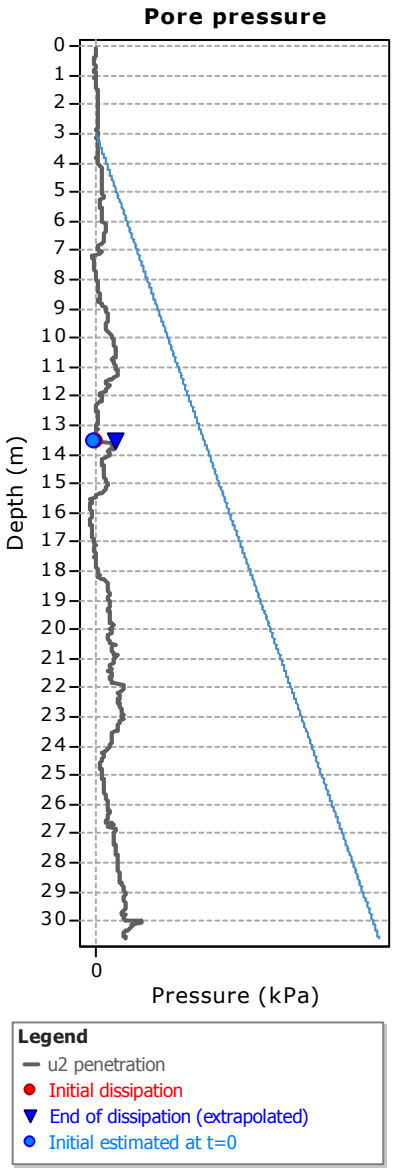
CPTU Borehole	Depth (m)	$(t_{50})^{0.50}$	t_{50} (s)	t_{50} (years)	G/S_u	c_h (m^2/s)	c_h (m^2/year)	M (MPa)	k_h (m/s)
CPT-09-18	13.55	19.3	374	1.19E-005	414.98	4.55E-005	1434	82.87	3.43E-008


Piezocone Dissipation Test: CPT-09-18
Depth: 13.55 (m)
u0 = 114.00 (kPa)
u initial dissipation
19.346
assumed initial pore pressure, ui
Porepressure u2 (kPa)
t^0.50 (s^0.50)


Pore pressure
Depth (m)
Pressure (kPa)
Legend
u2 penetration
Initial dissipation
End of dissipation (extrapolated)
Initial estimated at t=0