# APPENDIX

## BORING LOGS, SOIL TESTING LAB RESULTS, AND SOIL NAIL INSTALLATION PROCEDURES

Aspect consulting
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# Boring Log

| Project Number | Boring Number | Sheet |
|---|---|---|
| 070135 | B-1 | 1 of 2 |

Project Name: Fragaria Shoulder, Kitsap County, WA
Ground Surface Elev: ~119
Location: 47° 27' 40.04" N, 122° 32' 20.77" W
Driller/Equipment: Davies Drilling / HSA
Depth to Water (ft BGS):
Drilling Method/Hammer: SPT / Hammer Weight: 140 lbs / Hammer Drop: 30"
Start/Finish Date: 11/6/2007

| Depth / Elevation (feet) | Sample Type/ID | Blows/ 6" | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|
| | | | | **DRILL PAD FILL** | |
| 1 | | | | | 1 |
| 2 | | | | | 2 |
| 3 | | | | | 3 |
| 4 | | | | | 4 |
| 5 | | | | **ROAD FILL** | 5 |
| 6 | 1 | 3 4 4 | | Medium stiff, slightly moist, gravelly, sandy, clayey, SILT (ML), fine-coarse sand, fine-coarse gravel, trace fine organics, iron staining. Fill. | 6 |
| 7 | | | | Wood fragments found at bottom of fill. | 7 |
| 8 | 2 | 10 17 29 | | **PRE-FRASER NONGLACIAL LACUSTRINE DEPOSITS** | 8 |
| 9 | | | | Hard, slightly moist, clayey SILT (ML), massive texture. | 9 |
| 10 | | | | Sample becoming more silty and less clayey. | 10 |
| 11 | 3 | 7 12 19 | | | 11 |
| 12 | | | | | 12 |
| 13 | 4 | 10 11 15 | | | 13 |
| 14 | | | | Less clay, massive texture. | 14 |
| 15 | | | | | 15 |
| 16 | 5 | 8 14 24 | | | 16 |
| 17 | | | | | 17 |
| 18 | 6 | 8 16 21 | | Scattered pockets of light brown volcanic ash. | 18 |
| 19 | | | | | 19 |
| 20 | | | | **PRE-FRASER WETLAND DEPOSIT** | 20 |
| 21 | 7 | 26 50/4 | | Hard, slightly moist, brown PEAT (PT), fine grained, scattered wood fragments. | 21 |
| 22 | | | | **PRE-FRASER NONGLACIAL LACUSTRINE DEPOSIT** Hard, slightly moist, olive-greenish brown, SILT (ML), massive - blocky texture. | 22 |
| 23 | | | | | 23 |
| 24 | | | | | 24 |

Tests: N-value ▲ / Water Content % ★ (0, 10, 20, 30, 40, 50)

Sampler Type:
- No Recovery
- Split Spoon Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: SMJ
Approved by: DHM
Figure No. A- 2

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# Boring Log

| Project Number | Boring Number | Sheet |
|---|---|---|
| 070135 | B-1 | 2 of 2 |

Project Name: Fragaria Shoulder, Kitsap County, WA
Ground Surface Elev: ~119
Location: 47° 27' 40.04" N, 122° 32' 20.77" W
Driller/Equipment: Davies Drilling / HSA
Depth to Water (ft BGS):
Drilling Method/Hammer: SPT / Hammer Weight: 140 lbs / Hammer Drop: 30"
Start/Finish Date: 11/6/2007

| Depth / Elevation (feet) | Borehole Completion | Sample Type/ID | Tests | Blows/ 6" | N-value ▲ / Water Content % ★ (0 10 20 30 40 50) | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| 26 | | 8 | | 16 26 36 | | | Scattered pockets of volcanic ash from 25.5' - 26.5'. | 26 |
| 27 | | | | | | | Bottom of boring at 26.5 feet. Groundwater not encountered ATD. | 27 |
| 28 | | | | | | | Boring abandoned with drill sluff and bentonite chips. | 28 |
| 29 | | | | | | | | 29 |
| 30 | | | | | | | | 30 |
| 31 | | | | | | | | 31 |
| 32 | | | | | | | | 32 |
| 33 | | | | | | | | 33 |
| 34 | | | | | | | | 34 |
| 35 | | | | | | | | 35 |
| 36 | | | | | | | | 36 |
| 37 | | | | | | | | 37 |
| 38 | | | | | | | | 38 |
| 39 | | | | | | | | 39 |
| 40 | | | | | | | | 40 |
| 41 | | | | | | | | 41 |
| 42 | | | | | | | | 42 |
| 43 | | | | | | | | 43 |
| 44 | | | | | | | | 44 |
| 45 | | | | | | | | 45 |
| 46 | | | | | | | | 46 |
| 47 | | | | | | | | 47 |
| 48 | | | | | | | | 48 |
| 49 | | | | | | | | 49 |

Sampler Type:
No Recovery
Split Spoon Sampler

PID - Photoionization Detector (Headspace Measurement)
Static Water Level
Water Level (ATD)

Logged by: SMJ
Approved by: DHM
Figure No. A- 2

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# Boring Log

| Project Number | Boring Number | Sheet |
|---|---|---|
| 070135 | B-10 | 1 of 1 |

Project Name: Fragaria Shoulder, Kitsap County, WA
Ground Surface Elev:
Location: Just N of centerline, W of tel. pole #32 (E profile with B-9) / 47° 27' 40.04" N, 122° 32' 20.77" W
Driller/Equipment: Geologic Drill / Bobcat MT52
Depth to Water (ft BGS):
Drilling Method/Hammer: SPT / Hammer Weight: 140 lbs / Hammer Drop:
Start/Finish Date: 10/22/2008

| Depth / Elevation (feet) | Borehole Completion | Sample Type/ID | Tests | Blows/ 6" | N-value ▲ / Water Content % ★ (0 10 20 30 40 50) | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | 2" Asphaltic concrete pavement. | |
| | | | | | | | **ROAD FILL** Medium dense, moist, medium brown, slightly gravelly, sandy SILT (MH), high plasticity, contains organics. | |
| 1 | | | GSD, AL | 7 7 8 | | | | 1 |
| | | | | | | | **PRE-FRASER NONGLACIAL LACUSTRINE DEPOSITS** Stiff, moist, light brown/gray clayey SILT (ML), mostly light brown with sub-horizontal iron-stained bands, organic and iron flecks, and secondary iron staining. Strong gasoline-like odor near top. | |
| 2 | | | | | | | | 2 |
| 3 | | | | 5 8 11 | | | Becomes very stiff, gray CLAY (CL) with trace silt and ~1/2" spaced silty laminae. No odor. | 3 |
| 4 | | | | | | | | 4 |
| 5 | | | | 5 8 10 | | | | 5 |
| 6 | | | | | | | | 6 |
| 7 | | | | | | | Bottom of boring at 6.5' at 12:00. Backfilled with bentonite chips. | 7 |
| 8 | | | | | | | | 8 |
| 9 | | | | | | | | 9 |
| 10 | | | | | | | | 10 |
| 11 | | | | | | | | 11 |
| 12 | | | | | | | | 12 |
| 13 | | | | | | | | 13 |
| 14 | | | | | | | | 14 |

Sampler Type:
- No Recovery
- Split Spoon Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: AAE
Approved by: DHM
Figure No. A- 11

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# Boring Log

| Project Number | Boring Number | Sheet |
|---|---|---|
| 070135 | B-11 | 1 of 1 |

Project Name: Fragaria Shoulder, Kitsap County, WA
Ground Surface Elev:
Location: Just N of centerline (E of tel. pole #31 (Middle profile with B-3) / 47° 27' 40.04" N, 122° 32' 20.77" W
Driller/Equipment: Geologic Drill / Bobcat MT52
Depth to Water (ft BGS):
Drilling Method/Hammer: SPT / Hammer Weight: 140 lbs / Hammer Drop: 30"
Start/Finish Date: 10/22/2008

| Depth / Elevation (feet) | Borehole Completion | Sample Type/ID | Tests | Blows/ 6" | N-value / Water Content % (0 10 20 30 40 50) | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | 2" Asphaltic concrete pavement. | |
| 1 | | | | 14 6 5 | | | **ROAD FILL** Medium dense, moist, medium brown, gravelly, slightly silty SAND (SP-SM), contains organics, slight odor. | 1 |
| 2 | | | | | | | **DISTURBED PRE-FRASER NONGLACIAL LACUSTRINE DEPOSITS** Stiff, moist, light brown CLAY (CL), mottled with organics and iron staining (4"). | 2 |
| 3 | | | | 3 4 4 | | | Medium dense, moist, medium brown, slightly silty, gravelly SAND (SM). | 3 |
| 4 | | | | | | | Medium stiff, moist, light brownish-gray CLAY (CL), faint silty and iron-stained laminae, trace flattened coarse woody debris, faint 1/8" sandy lamina at ~3 ft bgs. | 4 |
| 5 | | | | 2 3 3 | | | Becomes gray to light/medium rusty brown. Top of sample is light gray-brown with secondary iron-stain mottling, lower 5" is gray with rusty red organic and iron-stained layers. | 5 |
| 6 | | | | | | | | 6 |
| 7 | | | | | | | **PRE-FRASER NONGLACIAL LACUSTRINE DEPOSITS** | 7 |
| 8 | | | GSD, AL | 6 10 13 | | | Very stiff, moist, gray silty CLAY to clayey SILT (CL/ML), massive, grades from dark, purplish gray at the top of sample to medium gray at the bottom. | 8 |
| 9 | | | | | | | Bottom of boring at 9' at 12:45. Backfilled with bentonite chips. | 9 |
| 10 | | | | | | | | 10 |
| 11 | | | | | | | | 11 |
| 12 | | | | | | | | 12 |
| 13 | | | | | | | | 13 |
| 14 | | | | | | | | 14 |

Sampler Type:
- No Recovery
- Split Spoon Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: AAE
Approved by: DHM
Figure No. A- 12

GEOTECH BORING LOG FRAGARIA SHOULDER.GPJ November 21, 2008

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# Boring Log

| Project Number | Boring Number | Sheet |
|---|---|---|
| 070135 | B-12 | 1 of 1 |

Project Name: Fragaria Shoulder, Kitsap County, WA
Ground Surface Elev:
Location: Just N of centerline, just W of tel. pole #31 (W profile with B-7) / 47° 27' 40.04" N, 122° 32' 20.77" W
Driller/Equipment: Geologic Drill / Bobcat MT52
Depth to Water (ft BGS):
Drilling Method/Hammer: SPT / Hammer Weight: 140 lbs / Hammer Drop: 30"
Start/Finish Date: 10/22/2008

| Depth / Elevation (feet) | Borehole Completion | Sample Type/ID | Tests | Blows/ 6" | N-value / Water Content % (0 10 20 30 40 50) | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | 5" Asphaltic concrete pavement. | |
| 1 | | | | 2<br>11<br>7 | | | **ROAD FILL**<br>Medium dense, moist, medium brown, slightly gravelly, slightly silty SAND (SM), contains small charcoal bits and pockets of iron staining, sand is f-c. | 1 |
| 2 | | | | | | | | 2 |
| 3 | | | | 11<br>12<br>9 | | | **PRE-FRASER NONGLACIAL FLUVIAL DEPOSITS**<br>Medium dense, moist, medium brown, slightly silty, gravelly SAND (SP-SM). Sand is mostly f, in lower 4" of sample is f-c. Thin organic-rich sandy layer (possible paleosol) at 3' (SM), 1/2" charcoal layer at 2.5'. | 3 |
| 4 | | | | | | | | 4 |
| 5 | | | GSD | 6<br>29<br>19 | | | Becomes dense and very gravelly, with faint bands of iron staining. | 5 |
| 6 | | | | | | | | 6 |
| 7 | | | | | | | **PRE-FRASER NONGLACIAL LACUSTRINE DEPOSITS**<br>Medium dense, moist, gray CLAY (CL), contains interbeds of silty laminae in lower 14", middle 7" is gray with sub-horizontal laminae of beige silt, iron staining, and brown organics, upper 3" is light brown, mottled clay with organics. | 7 |
| 8 | | | Blow counts may not be accurate due to hammer angle. | 6<br>8<br>13 | | | | 8 |
| 9 | | | | | | | | 9 |
| 10 | | | Blow counts may not be accurate due to hammer angle. | 7<br>9<br>13 | | | SAME (Gray clay with silty interbeds). | 10 |
| 11 | | | | | | | | 11 |
| 12 | | | | | | | Bottom of boring at 11.5' at 14:15. Backfilled with bentonite chips. | 12 |
| 13 | | | | | | | | 13 |
| 14 | | | | | | | | 14 |

Sampler Type:
- No Recovery
- Split Spoon Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: AAE
Approved by: DHM
Figure No. A- 13

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# Boring Log

| Project Number | Boring Number | Sheet |
|---|---|---|
| 070135 | B-2 | 1 of 2 |

Project Name: Fragaria Shoulder, Kitsap County, WA
Ground Surface Elev: ~122
Location: 47° 27' 40.04" N, 122° 32' 20.77" W
Driller/Equipment: Davies Drilling / HSA
Depth to Water (ft BGS):
Drilling Method/Hammer: SPT / Hammer Weight: 140 lbs / Hammer Drop: 30"
Start/Finish Date: 11/6/2007

| Sample Type/ID | Blows/6" | Material Type | Description | Depth (ft) |
|---|---|---|---|---|
| | | | **DRILL PAD FILL** | |
| 1 | 3 4 3 | | Loose, slightly moist, brown, slightly silty, gravelly SAND (SM), Fill. | |
| 2 | 1 3 3 | | **ROAD FILL** Slightly moist, light brown, slightly sandy, silty CLAY (CL), fine organics and wood/root debris. Fill. | |
| 3 | 5 11 17 | | **PRE-FRASER NONGLACIAL LACUSTRINE DEPOSIT** Very stiff, slightly moist, grayish-brown, slightly clayey SILT (ML), iron staining, horizontal bedding. color turns to gray/greensih-gray | |
| 4 | 6 12 19 | | color turns to gray | |
| 5 | 8 12 16 | | becoming more clayey Single steep high angled fracture. Discolored - black. | |
| 6 | 10 12 18 | | Very stiff, slightly moist, gray, slightly silty CLAY (CL), silt inclusions, massive texture. | |
| 7 | 28 50/5 | | **PRE-FRASER WETLAND DEPOSIT** Hard, slightly moist, brown, PEAT (PT), fine grained, with a few wood fragments. Very closely spaced, drilling-induced, subhorizontal fractures. | |
| | | | **PRE-FRASER NONGLACIAL LACUSTRINE DEPOSITS** Hard, slightly moist, olive green-brown, very silty CLAY (CL), trace fine organics, trace pockets of volcanic ash. | |

Depth / Elevation (feet): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24

Borehole Completion

Tests

N-value / Water Content % ★: 0 10 20 30 40 50

Sampler Type:
- No Recovery
- Split Spoon Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: SMJ
Approved by: DHM
Figure No. A- 3

GEOTECH BORING LOG FRAGARIA SHOULDER.GPJ November 21, 2008

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# Boring Log

| Project Number | Boring Number | Sheet |
|---|---|---|
| 070135 | B-2 | 2 of 2 |

Project Name: Fragaria Shoulder, Kitsap County, WA
Ground Surface Elev: ~122
Location: 47° 27' 40.04" N, 122° 32' 20.77" W
Driller/Equipment: Davies Drilling / HSA
Depth to Water (ft BGS):
Drilling Method/Hammer: SPT / Hammer Weight: 140 lbs / Hammer Drop: 30"
Start/Finish Date: 11/6/2007

| Depth / Elevation (feet) | Borehole Completion | Sample Type/ID | Tests | Blows/ 6" | N-value ▲ / Water Content % ★ (0 10 20 30 40 50) | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| 26 | | 8 | | 11 22 32 | | | | 26 |
| 27 | | | | | | | Bottom of boring at 26.5 feet. Groundwater not encountered ATD. | 27 |
| 28 | | | | | | | Boring abandoned with drill sluff and bentonite chips. | 28 |
| 29 | | | | | | | | 29 |
| 30 | | | | | | | | 30 |
| 31 | | | | | | | | 31 |
| 32 | | | | | | | | 32 |
| 33 | | | | | | | | 33 |
| 34 | | | | | | | | 34 |
| 35 | | | | | | | | 35 |
| 36 | | | | | | | | 36 |
| 37 | | | | | | | | 37 |
| 38 | | | | | | | | 38 |
| 39 | | | | | | | | 39 |
| 40 | | | | | | | | 40 |
| 41 | | | | | | | | 41 |
| 42 | | | | | | | | 42 |
| 43 | | | | | | | | 43 |
| 44 | | | | | | | | 44 |
| 45 | | | | | | | | 45 |
| 46 | | | | | | | | 46 |
| 47 | | | | | | | | 47 |
| 48 | | | | | | | | 48 |
| 49 | | | | | | | | 49 |

Sampler Type:
- No Recovery
- Split Spoon Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: SMJ
Approved by: DHM
Figure No. A- 3

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# Boring Log

| Project Number | Boring Number | Sheet |
|---|---|---|
| 070135 | B-3 | 1 of 3 |

Project Name: Fragaria Shoulder, Kitsap County, WA
Ground Surface Elev: ~126
Location: 47° 27' 40.04" N, 122° 32' 20.77" W
Driller/Equipment: Davies Drilling / HSA
Depth to Water (ft BGS):
Drilling Method/Hammer: SPT / Hammer Weight: 140 lbs / Hammer Drop: 30"
Start/Finish Date: 11/6/2007

| Sample Type/ID | Blows/6" | Material Type | Description | Depth (ft) |
|---|---|---|---|---|
| | | | 7" asphaltic concrete pavement. | |
| 1 | 10 11 5 | | **ROAD FILL** Loose, slightly moist, brown, slightly silty, gravelly SAND (SM). Fill becomes coarse with depth. | 1 |
| | | | | 2 |
| 2 | 20 12 5 | | | 3 |
| | | | **LAND SLIDE DEPOSITS** Stiff, slightly moist, light brown, slightly clayey SILT (ML), trace sand, abundant organics and wood debris. | 4 |
| 3 | 4 4 6 | | Stiff, slightly moist, brown/gray-brown, slightly silty CLAY (CL), scattered fine sand laminations from 5' - 5.5', abundant wood debris throughout. | 5 |
| | | | | 6 |
| | | | | 7 |
| | | | **PRE-FRASER NONGLACIAL LACUSTRINE DEPOSIT** | |
| 4 | 5 10 16 | | Very Stiff, slightly moist, gray/gray-green, CLAY (CL), trace silt, faint laminations visible from 7.5' - 8'. | 8 |
| | | | | 9 |
| 5 | 7 11 16 | | Occasional faint lamination, overall massive texture. | 10 |
| | | | | 11 |
| | | | | 12 |
| 6 | 7 13 22 | | | 13 |
| | | | | 14 |
| 7 | 11 18 24 | | Silt occurs as inclusions. | 15 |
| | | | | 16 |
| | | | | 17 |
| 8 | 7 13 21 | | Very stiff, slightly moist, gray, slightly sandy SILT (ML), very fine sand, faint laminations visible. | 18 |
| | | | | 19 |
| 9 | 8 15 23 | | Massive texture. | 20 |
| | | | | 21 |
| | | | | 22 |
| 10 | 10 15 24 | | Fine sand beginning to diminish | 23 |
| | | | | 24 |

Sampler Type:
- No Recovery
- Split Spoon Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: SMJ
Approved by: DHM
Figure No. A- 4

GEOTECH BORING LOG FRAGARIA SHOULDER.GPJ November 21, 2008

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# Boring Log

| Project Number | Boring Number | Sheet |
|---|---|---|
| 070135 | B-3 | 2 of 3 |

Project Name: Fragaria Shoulder, Kitsap County, WA
Ground Surface Elev: ~126
Location: 47° 27' 40.04" N, 122° 32' 20.77" W
Driller/Equipment: Davies Drilling / HSA
Depth to Water (ft BGS):
Drilling Method/Hammer: SPT / Hammer Weight: 140 lbs / Hammer Drop: 30"
Start/Finish Date: 11/6/2007

| Depth / Elevation (feet) | Sample Type/ID | Blows/ 6" | N-value / Water Content % | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|
| 26 | 11 | 8 12 18 | | | Sample turning from fine sandy SILT to clayey SILT. | 26 |
| 27–28–29 | | | | | **PRE-FRASER WETLANDS DEPOSIT** Very stiff, slightly moist, PEAT (PT), fine grain, very closely spaced, drilling-induced, subhorizontal fractures. | 27–28–29 |
| 30–31 | 12 | 30 50/4 | | | | 30–31 |
| 32–33–34 | | | | | **PRE-FRASER NONGLACIAL LACUSTRINE DEPOSIT** Hard, slightly moist, olive-greenish gray, clayey SILT (ML), thinly laminated to massive, occasional fine organic smears. | 32–33–34 |
| 35–36 | 13 | 10 18 24 | | | | 35–36 |
| 37–38–39 | | | | | Color changes to grayish dark brown, clay content decrases, overall massive texture. | 37–38–39 |
| 40–41 | 14 | 11 17 42 | | | Very thin bed of light brown volcanic ash. | 40–41 |
| 42–43–44 | | | | | | 42–43–44 |
| 45–46 | 15 | 11 21 50/5.5 | | | Laminations visible, abundant fine organics and seeds in bottom of shoe. | 45–46 |
| 47–48–49 | | | | | **PRE-FRASER WETLANDS DEPOSIT** Hard, slightly moist, brown, PEAT (PT), inclined bedding - five to six degrees, occasional thin laminations of fine sandy silt. | 47–48–49 |

Borehole Completion: Sand, Bentonite, Sand

Tests: PID - Photoionization Detector (Headspace Measurement)

Sampler Type:
- No Recovery
- Split Spoon Sampler

Static Water Level
Water Level (ATD)

Logged by: SMJ
Approved by: DHM
Figure No. A- 4

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# Boring Log

| Project Number | Boring Number | Sheet |
|---|---|---|
| 070135 | B-3 | 3 of 3 |

Project Name: Fragaria Shoulder, Kitsap County, WA
Ground Surface Elev: ~126
Location: 47° 27' 40.04" N, 122° 32' 20.77" W
Driller/Equipment: Davies Drilling / HSA
Depth to Water (ft BGS):
Drilling Method/Hammer: SPT / Hammer Weight: 140 lbs / Hammer Drop: 30"
Start/Finish Date: 11/6/2007

| Depth / Elevation (feet) | Borehole Completion | Sample Type/ID | Tests | Blows/ 6" | N-value ▲ / Water Content % ★ (0 10 20 30 40 50) | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| 51 | | 16 | | 40 50/5 | | | | 51 |
| 52 | | | | | | | Bottom of boring at 51.5 feet. Groundwater not encountered ATD. | 52 |
| 53 | | | | | | | Boring abandoned with drill sluff and bentonite chips. | 53 |
| 54 | | | | | | | | 54 |
| 55 | | | | | | | | 55 |
| 56 | | | | | | | | 56 |
| 57 | | | | | | | | 57 |
| 58 | | | | | | | | 58 |
| 59 | | | | | | | | 59 |
| 60 | | | | | | | | 60 |
| 61 | | | | | | | | 61 |
| 62 | | | | | | | | 62 |
| 63 | | | | | | | | 63 |
| 64 | | | | | | | | 64 |
| 65 | | | | | | | | 65 |
| 66 | | | | | | | | 66 |
| 67 | | | | | | | | 67 |
| 68 | | | | | | | | 68 |
| 69 | | | | | | | | 69 |
| 70 | | | | | | | | 70 |
| 71 | | | | | | | | 71 |
| 72 | | | | | | | | 72 |
| 73 | | | | | | | | 73 |
| 74 | | | | | | | | 74 |

Sampler Type:
- No Recovery
- Split Spoon Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: SMJ
Approved by: DHM
Figure No. A- 4

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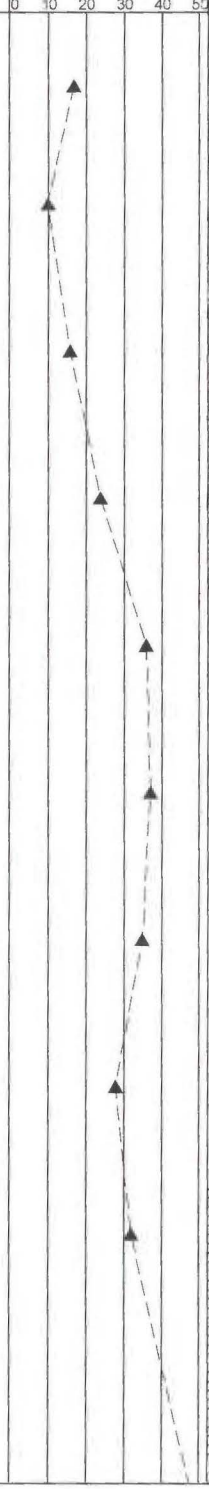
# Boring Log

| Project Number | Boring Number | Sheet |
|---|---|---|
| 070135 | B-4 | 1 of 3 |

Project Name: Fragaria Shoulder, Kitsap County, WA
Ground Surface Elev: ~125
Location: 47° 27' 40.04" N, 122° 32' 20.77" W
Driller/Equipment: Davies Drilling / HSA
Depth to Water (ft BGS):
Drilling Method/Hammer: SPT / Hammer Weight: 140 lbs / Hammer Drop: 30"
Start/Finish Date: 11/6/2007

| Depth / Elevation (feet) | Sample Type/ID | Blows/6" | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|
| | | | | 7" asphaltic concrete pavement. | |
| 1 | 1 | 7 9 8 | | **ROAD FILL** Loose, slightly moist, brown, slightly silty, gravelly SAND (SM), fine-coarse sand and gravel. (FILL) | 1 |
| 2 | | | | | 2 |
| 3 | 2 | 5 4 6 | | **LANDSLIDE DEPOSITS** Stiff, slightly moist, brown, slightly silty CLAY (CL), abundant fine organics and iron staining. | 3 |
| 4 | | | | | 4 |
| 5 | 3 | 3 7 9 | | Color change to yellow-reddish brown and decreasing silt content. | 5 |
| 6 | | | | | 6 |
| 7 | | | | Laminations become visible at bottom of unit. | 7 |
| 8 | 4 | 7 9 15 | | **PRE-FRASER NONGLACIAL LACUSTRINE DEPOSIT** Very stiff, slightly moist, gray, CLAY (CL), faint laminations visible, overall massive texture. | 8 |
| 9 | | | | | 9 |
| 10 | 5 | 7 15 21 | | Very stiff, slightly moist, gray, clayey SILT (ML), massive texture. | 10 |
| 11 | | | | | 11 |
| 12 | | | | | 12 |
| 13 | 6 | 9 16 21 | | Clayey silt grades to fine sandy silt. | 13 |
| 14 | | | | | 14 |
| 15 | 7 | 9 15 21 | | | 15 |
| 16 | | | | | 16 |
| 17 | | | | | 17 |
| 18 | 8 | 6 11 17 | | Fine sandy silt grades to clayey silt. | 18 |
| 19 | | | | | 19 |
| 20 | 9 | 6 12 20 | | Hard, slightly moist, gray, silty CLAY (CL), faint laminations, overall massive texture. | 20 |
| 21 | | | | | 21 |
| 22 | | | | | 22 |
| 23 | | | | | 23 |
| 24 | | | | | 24 |




Sampler Type:
- No Recovery
- Split Spoon Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: SMJ
Approved by: DHM
Figure No. A- 5

GEOTECH BORING LOG FRAGARIA SHOULDER.GPJ November 21, 2008

Aspect consulting
earth + water

# Boring Log

| Project Number | Boring Number | Sheet |
|---|---|---|
| 070135 | B-4 | 2 of 3 |

Project Name: Fragaria Shoulder, Kitsap County, WA
Ground Surface Elev: ~125
Location: 47° 27' 40.04" N, 122° 32' 20.77" W
Driller/Equipment: Davies Drilling / HSA
Depth to Water (ft BGS):
Drilling Method/Hammer: HSA / Hammer Weight: 140 lbs / Hammer Drop: 30"
Start/Finish Date: 11/6/2007

| Depth / Elevation (feet) | Borehole Completion | Sample Type/ID | Tests | Blows/ 6" | N-value ▲ / Water Content % ★ (0 10 20 30 40 50) | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| 26 | | 10 | | 32 50/3 | | | **PRE-FRASER WETLAND DEPOSIT** Hard, slightly moist, brown, PEAT (PT), fine grained, horizontal bedding. | 26 |
| 27 | | | | | | | | 27 |
| 28 | | | | | | | **PRE-FRASER NONGLACIAL LACUSTRINE DEPOSIT** Hard, slightly moist, olive-greenish brownish gray, slightly silty CLAY (CL), occasional fine organics, massive texture. | 28 |
| 29 | | | | | | | | 29 |
| 30 | | 11 | | 11 20 31 | | | | 30 |
| 31 | | | | | | | | 31 |
| 32 | | | | | | | | 32 |
| 33 | | | | | | | | 33 |
| 34 | | | | | | | Hard, slightly moist, olive-greenish brownish gray, silty CLAY (CL) to clayey SILT (ML), massive texture. | 34 |
| 35 | | 12 | | 10 16 31 | | | | 35 |
| 36 | | | | | | | | 36 |
| 37 | | | | | | | | 37 |
| 38 | | | | | | | | 38 |
| 39 | | | | | | | | 39 |
| 40 | | 13 | | 16 21 50 | | | | 40 |
| 41 | | | | | | | | 41 |
| 42 | | | | | | | | 42 |
| 43 | | | | | | | **PRE-FRASER WETLAND DEPOSIT** Hard, slightly moist, brown, PEAT (PT), fine grained with frequent wood fragments. | 43 |
| 44 | | | | | | | | 44 |
| 45 | | 14 | | 27 50/4 | | | | 45 |
| 46 | | | | | | | | 46 |
| 47 | | | | | | | | 47 |
| 48 | | | | | | | | 48 |
| 49 | | | | | | | **PRE-FRASER NONGLACIAL LACUSTRINE DEPOSIT** Hard, slightly moist, olive-greenish, brownish gray, slightly clayey SILT (ML) rich with fine | 49 |

Sampler Type:
- No Recovery
- Split Spoon Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: SMJ
Approved by: DHM
Figure No. A- 5

Aspect consulting
earth + water

# Boring Log

| Project Number | Boring Number | Sheet |
|---|---|---|
| 070135 | B-4 | 3 of 3 |

Project Name: Fragaria Shoulder, Kitsap County, WA
Ground Surface Elev: ~125
Location: 47° 27' 40.04" N, 122° 32' 20.77" W
Driller/Equipment: Davies Drilling / HSA
Depth to Water (ft BGS):
Drilling Method/Hammer: SPT / Hammer Weight: 140 lbs / Hammer Drop: 30"
Start/Finish Date: 11/6/2007

| Depth / Elevation (feet) | Borehole Completion | Sample Type/ID | Tests | Blows/ 6" | N-value / Water Content % (0 10 20 30 40 50) | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| 51 | | 15 | | 18 31 41 | | | organics and small amounts of wood fragments - predominately seeds. | 51 |
| 52 | | | | | | | Bottom of boring at 51.5' Groundwater not encountered ATD. | 52 |
| 53 | | | | | | | Boring abandoned with drill sluff and bentonite chips. | 53 |
| 54 | | | | | | | | 54 |
| 55 | | | | | | | | 55 |
| 56 | | | | | | | | 56 |
| 57 | | | | | | | | 57 |
| 58 | | | | | | | | 58 |
| 59 | | | | | | | | 59 |
| 60 | | | | | | | | 60 |
| 61 | | | | | | | | 61 |
| 62 | | | | | | | | 62 |
| 63 | | | | | | | | 63 |
| 64 | | | | | | | | 64 |
| 65 | | | | | | | | 65 |
| 66 | | | | | | | | 66 |
| 67 | | | | | | | | 67 |
| 68 | | | | | | | | 68 |
| 69 | | | | | | | | 69 |
| 70 | | | | | | | | 70 |
| 71 | | | | | | | | 71 |
| 72 | | | | | | | | 72 |
| 73 | | | | | | | | 73 |
| 74 | | | | | | | | 74 |

Sampler Type:
No Recovery
Split Spoon Sampler

PID - Photoionization Detector (Headspace Measurement)
Static Water Level
Water Level (ATD)

Logged by: SMJ
Approved by: DHM
Figure No. A- 5

Aspect consulting
earth + water

# Boring Log

| Project Number | Boring Number | Sheet |
|---|---|---|
| 070135 | B-5 | 1 of 1 |

Project Name: Fragaria Shoulder, Kitsap County, WA
Ground Surface Elev: ~134
Location: 47° 27' 40.04" N, 122° 32' 20.77" W
Driller/Equipment: Geologic Drill / Acker
Depth to Water (ft BGS):
Drilling Method/Hammer: SPT / Hammer Weight: 140 lbs / Hammer Drop: 30"
Start/Finish Date: 11/5/2007

| Sample Type/ID | Blows/6" | Water Content % ★ (N-value ▲) |
|---|---|---|
| 1 | 4 6 8 | 14 |
| 2 | 7 11 13 | 24 |
| 3 | 10 10 8 | 18 |
| 4 | 4 9 13 | 24 |
| 5 | 9 13 18 | 32 |
| 6 | 8 16 20 | 40 |
| 7 | 6 12 16 | 32 |

**TOPSOIL**
Very organic rich topsoil.

**COLLUVIUM**
Loose, slightly moist, gray-brown, silty, gravelly SAND (SM), fine-med. sand, fine-coarse gravel.
Stiff, slightly moist, gray-brown, slightly sandy, clayey SILT (ML).

**LANDSLIDE DEPOSITS**
Medium dense, slightly moist, light-brown, slightly silty, slightly gravelly, SAND (SM), fine sand, silt occurs in pockets, and iron staining throughout.

**PRE-FRASER NONGLACIAL LACUSTRINE DEPOSIT**
Very stiff, slightly moist, gray-brown, silty CLAY (CL), trace fine sand, trace iron staining.

Occasional thinly laminated deposits of silt - nearly horizontal.

Laminations in clay become more visible -nearly horizontal.

Bottom of Boring at 21.5'
Groundwater not encountered ATD.

Boring abandoned with drill sluff and bentonite chips.

Sampler Type:
- No Recovery
- Split Spoon Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: SMJ
Approved by: DHM
Figure No. A- 6

Aspect consulting
earth + water

# Boring Log

| Project Number | Boring Number | Sheet |
|---|---|---|
| 070135 | B-6 | 1 of 2 |

Project Name: Fragaria Shoulder, Kitsap County, WA
Ground Surface Elev: ~135
Location: 47° 27' 40.04" N, 122° 32' 20.77" W
Driller/Equipment: Geologic Drill / Acker
Depth to Water (ft BGS):
Drilling Method/Hammer: SPT / Hammer Weight: 140 lbs / Hammer Drop: 30"
Start/Finish Date: 11/5/2007

| Depth / Elevation (feet) | Borehole Completion | Sample Type/ID | Tests | Blows/ 6" | N-value ▲ / Water Content % ★ (0 10 20 30 40 50) | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | **TOPSOIL** Very organic rich topsoil. | 1 |
| 2 | | | | | | | **COLLUVIUM** Loose, slightly moist, light brown, gravelly, silty SAND (SM), fine-med. sand, fine-coarse gravel. | 2 |
| 3 | | 1 | | 3 4 4 | | | **LANDSLIDE DEPOSITS** Medium stiff, slightly moist, gray-brown, slightly clayey, sandy SILT (ML), fine sand, trace gravel. | 3 |
| 4 | | | | | | | | 4 |
| 5 | | | | | | | Unit becomes stiff, has broken-up/blocky appearance, abundant organic debris throughout, wood/root fragments. | 5 |
| 6 | | 2 | | 4 5 6 | | | | 6 |
| 7 | | | | | | | | 7 |
| 8 | | 3 | | 5 7 9 | | | | 8 |
| 9 | | | | | | | **PRE-FRASER NONGLACIAL LACUSTRINE DEPOSIT** Very stiff, slightly moist, gray, slightly silty CLAY (CL), silt occurs as thin laminations, occasional organic silt lamination. | 9 |
| 10 | | | | | | | | 10 |
| 11 | | 4 | | 5 10 12 | | | | 11 |
| 12 | | | | | | | | 12 |
| 13 | | 5 | | 5 8 9 | | | Increasing silt/very fine sand laminations - appear nearly horizontal. Bottom 3" of sample looks deformed. | 13 |
| 14 | | | | | | | | 14 |
| 15 | | | | | | | Grades hard, occasion silt laminations visible in clay matrix | 15 |
| 16 | | 6 | | 8 17 18 | | | | 16 |
| 17 | | | | | | | | 17 |
| 18 | | | | | | | | 18 |
| 19 | | | | | | | | 19 |
| 20 | | | | | | | Fewer laminations visible, overall massive texture. | 20 |
| 21 | | 7 | | 6 12 16 | | | | 21 |
| 22 | | | | | | | Bottom of boring at 21.5' Groundwater not encountered ATD. | 22 |
| 23 | | | | | | | Boring abandoned with drill sluff and bentonite chips. | 23 |
| 24 | | | | | | | | 24 |

Sampler Type:
- No Recovery
- Split Spoon Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: SMJ
Approved by: DHM
Figure No. A- 7

GEOTECH BORING LOG FRAGARIA SHOULDER.GPJ November 21, 2008

Aspect consulting
earth + water

# Boring Log

| Project Number | Boring Number | Sheet |
|---|---|---|
| 070135 | B-6 | 2 of 2 |

Project Name: Fragaria Shoulder, Kitsap County, WA
Ground Surface Elev: ~135
Location: 47° 27' 40.04" N, 122° 32' 20.77" W
Driller/Equipment: Geologic Drill / Acker
Depth to Water (ft BGS):
Drilling Method/Hammer: SPT / Hammer Weight: 140 lbs / Hammer Drop: 30"
Start/Finish Date: 11/5/2007

| Depth / Elevation (feet) | Borehole Completion | Sample Type/ID | Tests | Blows/ 6" | N-value / Water Content % ★ (0 10 20 30 40 50) | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| 26 | | | | | | | | 26 |
| 27 | | | | | | | | 27 |
| 28 | | | | | | | | 28 |
| 29 | | | | | | | | 29 |
| 30 | | | | | | | | 30 |
| 31 | | | | | | | | 31 |
| 32 | | | | | | | | 32 |
| 33 | | | | | | | | 33 |
| 34 | | | | | | | | 34 |
| 35 | | | | | | | | 35 |
| 36 | | | | | | | | 36 |
| 37 | | | | | | | | 37 |
| 38 | | | | | | | | 38 |
| 39 | | | | | | | | 39 |
| 40 | | | | | | | | 40 |
| 41 | | | | | | | | 41 |
| 42 | | | | | | | | 42 |
| 43 | | | | | | | | 43 |
| 44 | | | | | | | | 44 |
| 45 | | | | | | | | 45 |
| 46 | | | | | | | | 46 |
| 47 | | | | | | | | 47 |
| 48 | | | | | | | | 48 |
| 49 | | | | | | | | 49 |

Sampler Type:
No Recovery
Split Spoon Sampler

PID - Photoionization Detector (Headspace Measurement)
Static Water Level
Water Level (ATD)

Logged by: SMJ
Approved by: DHM
Figure No. A- 7

Aspect consulting
earth + water

# Boring Log

| Project Number | Boring Number | Sheet |
|---|---|---|
| 070135 | B-7 | 1 of 1 |

Project Name: Fragaria Shoulder, Kitsap County, WA
Ground Surface Elev:
Location: S shoulder, W of tel. pole #31 (West profile with B-12) / 47° 27' 40.04" N, 122° 32' 20.77" W
Driller/Equipment: Geologic Drill / Bobcat MT52
Depth to Water (ft BGS):
Drilling Method/Hammer: SPT / Hammer Weight: 140 lbs / Hammer Drop: 30"
Start/Finish Date: 10/22/2008

| Depth / Elevation (feet) | Borehole Completion | Sample Type/ID | Tests | Blows/ 6" | N-value ▲ / Water Content % ★ (0 10 20 30 40 50) | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| | | | | 4 3 2 | | | **SHOULDER FILL** Loose, moist, brown, slightly gravelly, slightly silty SAND (SP-SM), f-c sand, organic rich, dark brown at top grading to medium gray brown. | |
| 1 | | | | | | | | 1 |
| 2 | | | | | | | | 2 |
| | | | | 3 2 3 | | | **FILL WITH RUBBER TIRE PIECES** Loose, moist, medium brown, gravelly, slightly silty SAND (SP-SM), f-c (mostly f-m) sand, mottled with black/dark brown organics, fine to coarse sub-rounded gravels. | |
| 3 | | | | | | | | 3 |
| 4 | | | | | | | | 4 |
| 5 | | | | | | | | 5 |
| | | | | 2 1 2 | | | **SHOULDER FILL** Very loose, moist, medium rusty brown, gravelly, slightly silty SAND (SP-SM), trace organics. | |
| 6 | | | | | | | | 6 |
| 7 | | | | | | | | 7 |
| | | | | 3 3 2 | | | Becomes silty and possibly slightly clayey, with small pockets of iron staining. | |
| 8 | | | | | | | | 8 |
| 9 | | | | | | | | 9 |
| | | | | | | | **PRE-FRASER NONGLACIAL LACUSTRINE DEPOSITS** Stiff, moist, gray CLAY (CL). Beige and iron-stained orange silty laminae. Possibly CH. | |
| 10 | | | | 4 4 6 | | | | 10 |
| 11 | | | | | | | | 11 |
| 12 | | | | | | | | 12 |
| | | | | 3 5 4 | | | Massive gray clay. Gray clay with frequent silty, iron-stained, and organic-rich laminae. | |
| 13 | | | | | | | | 13 |
| 14 | | | | | | | | 14 |
| | | | | | | | Bottom of boring at 14' bgs at 9:30. Backfilled with bentonite chips. | |

Sampler Type:
- No Recovery
- Split Spoon Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: AAE
Approved by: DHM
Figure No. A- 8

GEOTECH BORING LOG FRAGARIA SHOULDER.GPJ November 21, 2008

Aspect consulting
earth + water

# Boring Log

| Project Number | Boring Number | Sheet |
|---|---|---|
| 070135 | B-8 | 1 of 1 |

Project Name: Fragaria Shoulder, Kitsap County, WA
Ground Surface Elev:
Location: S shoulder b/w tel. pole #31 & #32 (Middle profile with B-1 and B-3) / 47° 27' 40.04" N, 122° 32' 20.77" W
Driller/Equipment: Geologic Drill / Bobcat MT52
Depth to Water (ft BGS):
Drilling Method/Hammer: SPT / Hammer Weight: 140 lbs / Hammer Drop: 30"
Start/Finish Date: 10/22/2008

| Depth / Elevation (feet) | Borehole Completion | Sample Type/ID | Tests | Blows/ 6" | N-value / Water Content % (0 10 20 30 40 50) | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| | | | | 2 2 3 | | | **SHOULDER FILL** Loose, very moist, dark brown, silty, gravelly SAND (SM), contains f-c organics, sand is f-c, gravel is mostly f. | |
| 1 | | | | | | | | 1 |
| 2 | | | | | | | | 2 |
| | | | | 1 1 2 | | | Becomes very loose, slightly clayey, trace organics. | |
| 3 | | | | | | | | 3 |
| 4 | | | | | | | | 4 |
| 5 | | | | 1 1 2 | | | Becomes medium brown, with peaty organics, sand becomes f-m (mostly f). | 5 |
| 6 | | | | | | | | 6 |
| 7 | | | | | | | | 7 |
| | | | Gravel in tip of sampler likely limited recovery. | 3 5 6 | | | | |
| 8 | | | | | | | **DISTURBED PRE-FRASER NONGLACIAL LACUSTRINE DEPOSITS** Stiff, moist, light brown CLAY (CL), 2" sub-rounded oblong gravel in tip. | 8 |
| 9 | | | | | | | | 9 |
| 10 | | | | 5 9 14 | | | **PRE-FRASER NONGLACIAL LACUSTRINE DEPOSITS** Stiff, moist, gray CLAY (CL), trace silt, trace organic flecks and black organic staining. Clay contains faint silty laminae spaced ~1/2" to 1" apart | 10 |
| 11 | | | | | | | | 11 |
| 12 | | | | | | | Bottom of boring at 11.5' at 10:00. Backfilled with bentonite chips. | 12 |
| 13 | | | | | | | | 13 |
| 14 | | | | | | | | 14 |

Sampler Type:
- No Recovery
- Split Spoon Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: AAE
Approved by: DHM
Figure No. A- 9

Aspect consulting
earth + water

# Boring Log

| Project Number | Boring Number | Sheet |
|---|---|---|
| 070135 | B-9 | 1 of 1 |

Project Name: Fragaria Shoulder, Kitsap County, WA
Ground Surface Elev:
Location: S shoulder to W of tel. pole #32 (E profile with B-10) / 47° 27' 40.04" N, 122° 32' 20.77" W
Driller/Equipment: Geologic Drill / Bobcat MT52
Depth to Water (ft BGS):
Drilling Method/Hammer: SPT / Hammer Weight: 140 lbs / Hammer Drop: 30"
Start/Finish Date: 10/22/2008

| Depth / Elevation (feet) | Borehole Completion | Sample Type/ID | Tests | Blows/ 6" | N-value ▲ / Water Content % ★ (0 10 20 30 40 50) | Material Type | Description | Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| | | | | 2 2 2 | | | **SHOULDER FILL** Very loose, moist, medium-dark brown, slightly gravelly, silty SAND (SM), contains organics, sand is f-c (mostly f), gravels are sub-rounded. | |
| 1 | | | | | | | | 1 |
| 2 | | | | | | | | 2 |
| | | | | 8 11 11 | | | Becomes medium dense and possibly clayey, trace f gravel. | |
| 3 | | | | | | | | 3 |
| 4 | | | | | | | | 4 |
| 5 | | | Poor recovery due to broken 1" granite clast in tip of sampler | 6 8 7 | | | **DISTURBED PRE-FRASER NONGLACIAL LACUSTRINE DEPOSITS** Medium dense, moist, light brown silty CLAY to clayey SILT (CL/ML), distorted bands of iron staining. | 5 |
| 6 | | | | | | | | 6 |
| 7 | | | | | | | | 7 |
| | | | GSD, AL | 5 8 11 | ★ | | Mottling and bands of iron staining and organics, bands are distorted (likely landslide deposit). | |
| 8 | | | | | | | | 8 |
| 9 | | | | | | | Bottom of boring at 9' at 10:40. Backfilled with bentonite chips. | 9 |
| 10 | | | | | | | | 10 |
| 11 | | | | | | | | 11 |
| 12 | | | | | | | | 12 |
| 13 | | | | | | | | 13 |
| 14 | | | | | | | | 14 |

Sampler Type:
- No Recovery
- Split Spoon Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: AAE
Approved by: DHM
Figure No. A- 10

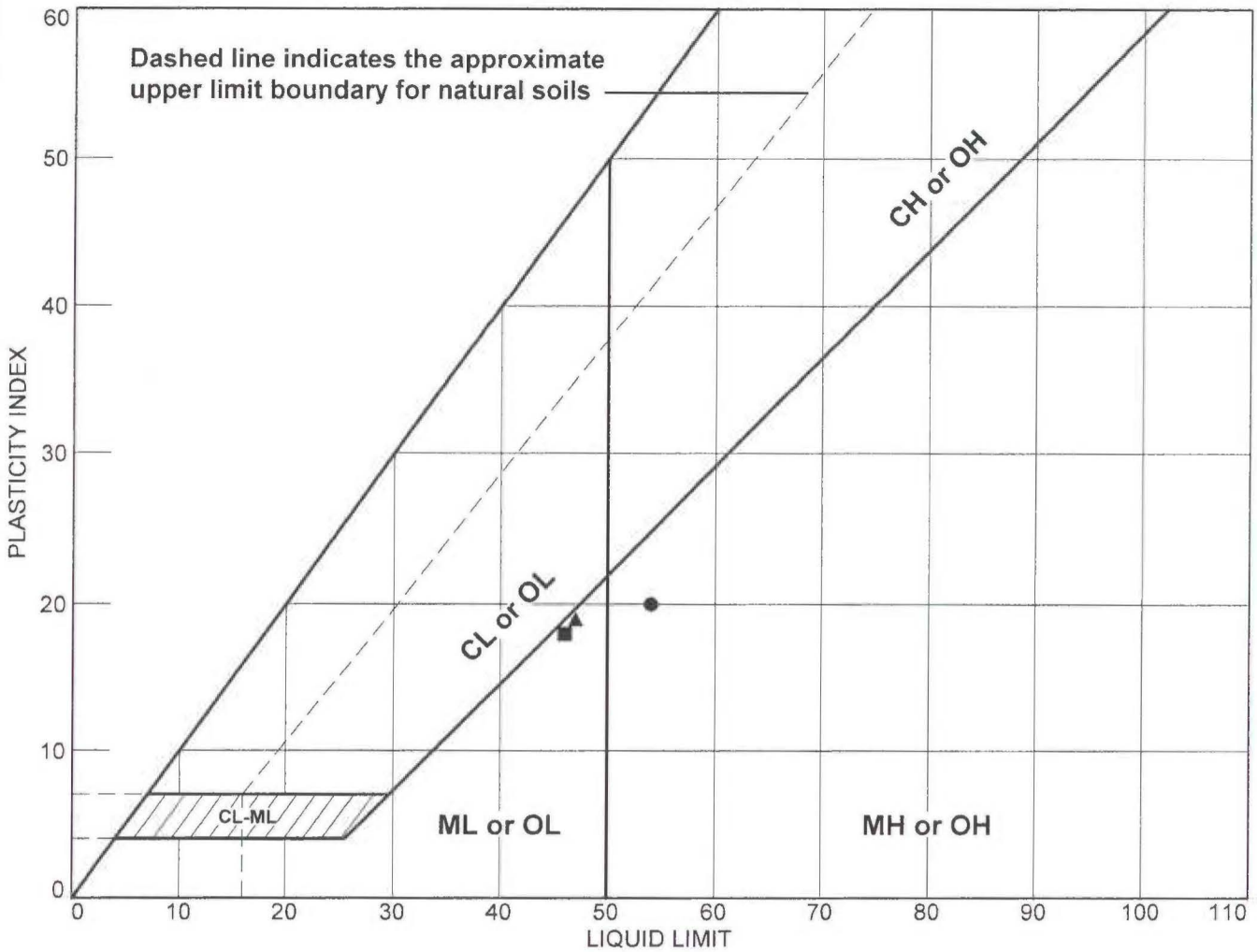
Hayre McElroy & Associates, LLC

# Moisture Contents

Kitsap County Fragraria Road 070135

| Lab # | Location | Depth (ft) | Date Received | Date of Test | Tare # | Wt of Tare | Tare+ Wet | Tare+ Dry | Moisture % |
|---|---|---|---|---|---|---|---|---|---|
| 6792 | B-10-0.5 | 0.5 | 11/3/2008 | 11/3/2008 | 3A | 214.0 | 398.4 | 351.8 | 33.8 |
| 6793 | B-11-7.5 | 7.5 | 11/3/2008 | 11/3/2008 | 7A | 87.4 | 423.1 | 341.3 | 32.2 |
| 6794 | B-9-7.5 | 7.5 | 11/3/2008 | 11/3/2008 | 2A | 217.9 | 544.3 | 460.7 | 34.4 |
| 6795 | B-12-5 | 5 | 11/3/2008 | 11/3/2008 | A5 | 598.8 | 974.6 | 928.4 | 14.0 |

# LIQUID AND PLASTIC LIMITS TEST REPORT




| SOIL DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SYMBOL | SOURCE | SAMPLE NO. | DEPTH | NATURAL WATER CONTENT (%) | PLASTIC LIMIT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX (%) | USCS |
| ● | | 6792 | 0.5 ft | 33.8 | 34 | 54 | 20 | MH |
| ■ | | 6793 | 7.5 ft | 32.2 | 28 | 46 | 18 | ML |
| ▲ | | 6794 | 7.5 ft | 34.4 | 28 | 47 | 19 | ML |

| | |
|---|---|
| **Hayre McElroy & Associates, LLC**<br><br>**Redmond, WA** | **Client:** Aspect Consulting<br>**Project:** Kitsap County Fragraria Road 070135<br><br>**Project No.:** 08-175 **Figure** |

**Tested By:** GG **Checked By:** JAM

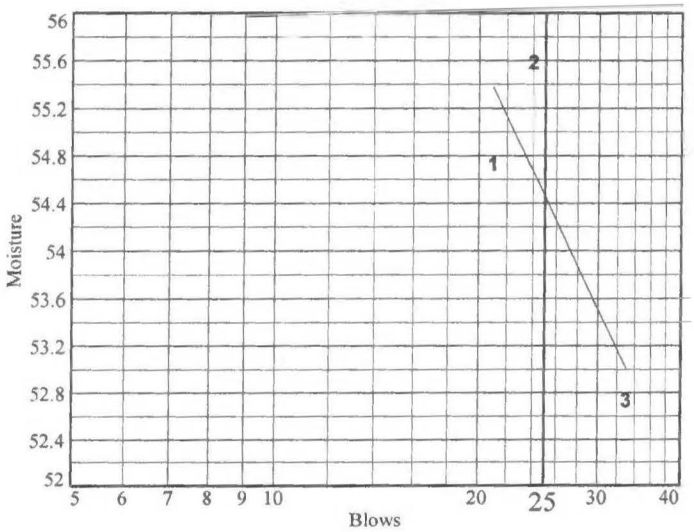
## LIQUID AND PLASTIC LIMIT TEST DATA

12/8/2008

**Client:** Aspect Consulting
**Project:** Kitsap County Fragraria Road 070135
**Project Number:** 08-175
**Location:** B-10-0.5
**Depth:** 0.5 ft
**Sample Number:** 6792
**Material Description:** Red Brown Silt (MH)
**USCS:** MH
**Tested by:** GG
**Checked by:** JAM

### Liquid Limit Data

| Run No. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Wet+Tare | 28.36 | 37.32 | 30.87 | | | |
| Dry+Tare | 22.29 | 27.97 | 24.04 | | | |
| Tare | 11.20 | 11.15 | 11.09 | | | |
| # Blows | 21 | 24 | 33 | | | |
| Moisture | 54.7 | 55.6 | 52.7 | | | |




Liquid Limit= 54
Plastic Limit= 34
Plasticity Index= 20
Natural Moisture= 33.8
Liquidity Index= 0.0

### Plastic Limit Data

| Run No. | 1 | 2 | 3 | 4 | |
|---|---|---|---|---|---|
| Wet+Tare | 17.95 | 17.13 | 17.47 | | |
| Dry+Tare | 16.18 | 15.60 | 15.87 | | |
| Tare | 11.07 | 11.14 | 11.20 | | |
| Moisture | 34.6 | 34.3 | 34.3 | | |

### Natural Moisture Data

| Wet+Tare | Dry+Tare | Tare | Moisture |
|---|---|---|---|
| 398.4 | 351.8 | 214.0 | 33.8 |

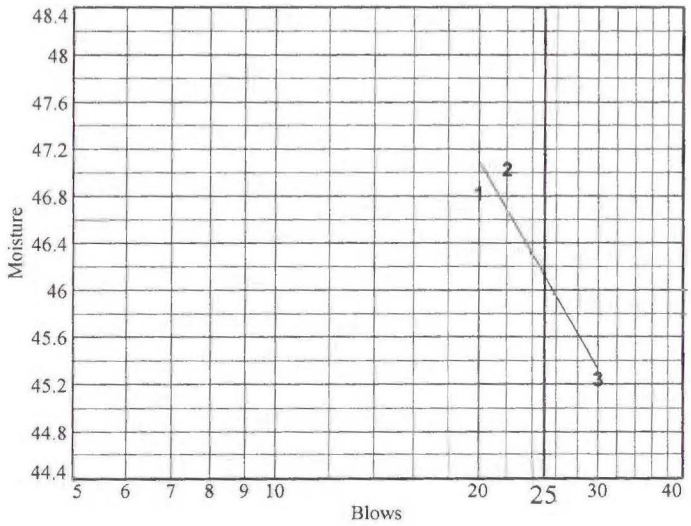
## LIQUID AND PLASTIC LIMIT TEST DATA

12/8/2008

**Client:** Aspect Consulting
**Project:** Kitsap County Fragraria Road 070135
**Project Number:** 08-175
**Location:** B-11-7.5
**Depth:** 7.5 ft
**Sample Number:** 6793
**Material Description:** Dark Gray Silt (ML)
**USCS:** ML
**Tested by:** GG
**Checked by:** JAM

### Liquid Limit Data

| Run No. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Wet+Tare | 29.93 | 32.23 | 34.39 | | | |
| Dry+Tare | 23.96 | 25.50 | 27.16 | | | |
| Tare | 11.21 | 11.19 | 11.18 | | | |
| # Blows | 20 | 22 | 30 | | | |
| Moisture | 46.8 | 47.0 | 45.2 | | | |




Liquid Limit= 46
Plastic Limit= 28
Plasticity Index= 18
Natural Moisture= 32.2
Liquidity Index= 0.2

### Plastic Limit Data

| Run No. | 1 | 2 | 3 | 4 | |
|---|---|---|---|---|---|
| Wet+Tare | 17.43 | 17.17 | 17.13 | | |
| Dry+Tare | 16.02 | 15.87 | 15.84 | | |
| Tare | 11.19 | 11.17 | 11.04 | | |
| Moisture | 29.2 | 27.7 | 26.9 | | |

### Natural Moisture Data

| Wet+Tare | Dry+Tare | Tare | Moisture |
|---|---|---|---|
| 423.1 | 341.3 | 87.4 | 32.2 |

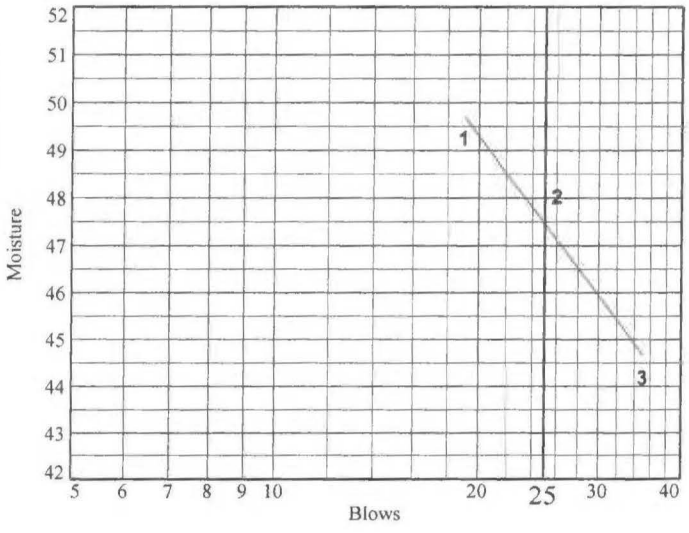
## LIQUID AND PLASTIC LIMIT TEST DATA

12/8/2008

**Client:** Aspect Consulting
**Project:** Kitsap County Fragraria Road 070135
**Project Number:** 08-175
**Location:** B-9-7.5
**Depth:** 7.5 ft
**Sample Number:** 6794
**Material Description:** Red Gray Silt (ML)
**USCS:** ML
**Tested by:** GG
**Checked by:** JAM

### Liquid Limit Data

| Run No. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Wet+Tare | 33.86 | 34.23 | 34.29 | | | |
| Dry+Tare | 27.17 | 27.53 | 27.94 | | | |
| Tare | 13.59 | 13.58 | 13.57 | | | |
| # Blows | 19 | 26 | 35 | | | |
| Moisture | 49.3 | 48.0 | 44.2 | | | |




Liquid Limit= 47
Plastic Limit= 28
Plasticity Index= 19
Natural Moisture= 34.4
Liquidity Index= 0.3

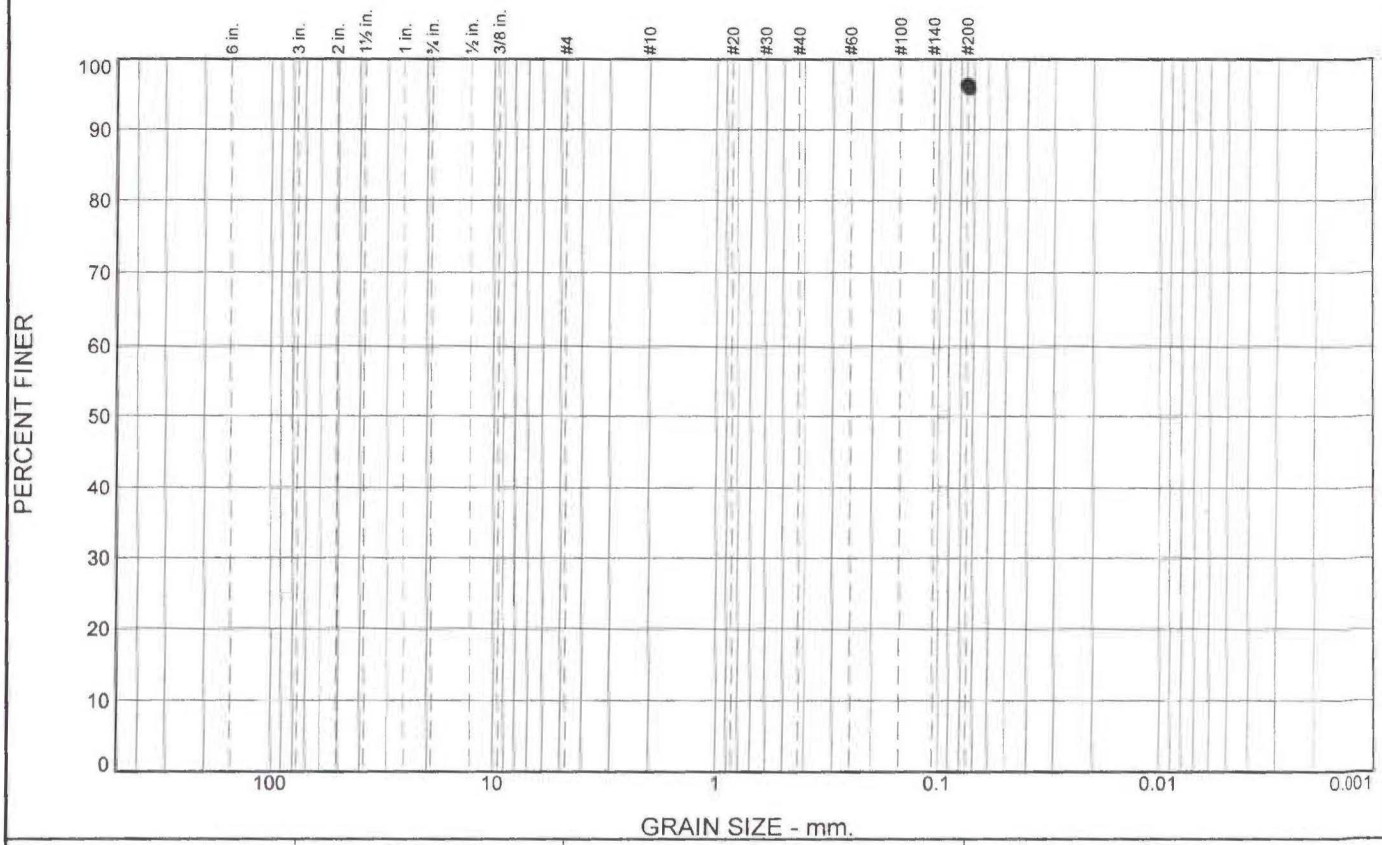
### Plastic Limit Data

| Run No. | 1 | 2 | 3 | 4 | |
|---|---|---|---|---|---|
| Wet+Tare | 17.25 | 17.25 | 17.25 | | |
| Dry+Tare | 15.91 | 15.93 | 15.95 | | |
| Tare | 11.20 | 11.21 | 11.24 | | |
| Moisture | 28.5 | 28.0 | 27.6 | | |

### Natural Moisture Data

| Wet+Tare | Dry+Tare | Tare | Moisture |
|---|---|---|---|
| 544.3 | 460.7 | 217.9 | 34.4 |

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| | | | | | | 96.4 | |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #200 | 96.4 | | |

* (no specification envelope)

**Material Description**

Red Brown Silt (MH)

**Atterberg Limits**

PL= 34 LL= 54 PI= 20

**Coefficients**

$D_{90}$= $D_{85}$= $D_{60}$=
$D_{50}$= $D_{30}$= $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= MH AASHTO=

**Remarks**

**Location:** B-10-0.5
**Sample Number:** 6792 **Depth:** 0.5 ft **Date:** 11/3/08

**Hayre McElroy & Associates, LLC**

**Redmond, WA**

**Client:** Aspect Consulting
**Project:** Kitsap County Fragraria Road 070135
**Project No:** 08-175 **Figure**

**Tested By:** GG

## GRAIN SIZE DISTRIBUTION TEST DATA

12/8/2008

**Client:** Aspect Consulting
**Project:** Kitsap County Fragraria Road 070135
**Project Number:** 08-175
**Location:** B-10-0.5
**Depth:** 0.5 ft **Sample Number:** 6792
**Material Description:** Red Brown Silt (MH)
**Date:** 11/3/08 **PL:** 34 **LL:** 54 **PI:** 20
**USCS Classification:** MH
**Tested by:** GG
**Material specification:** (no specification envelope)

### Sieve Test Data

Post #200 Wash Test Weights (grams): Dry Sample and Tare = 219.00
Tare Wt. = 214.00
Minus #200 from wash = 96.4%

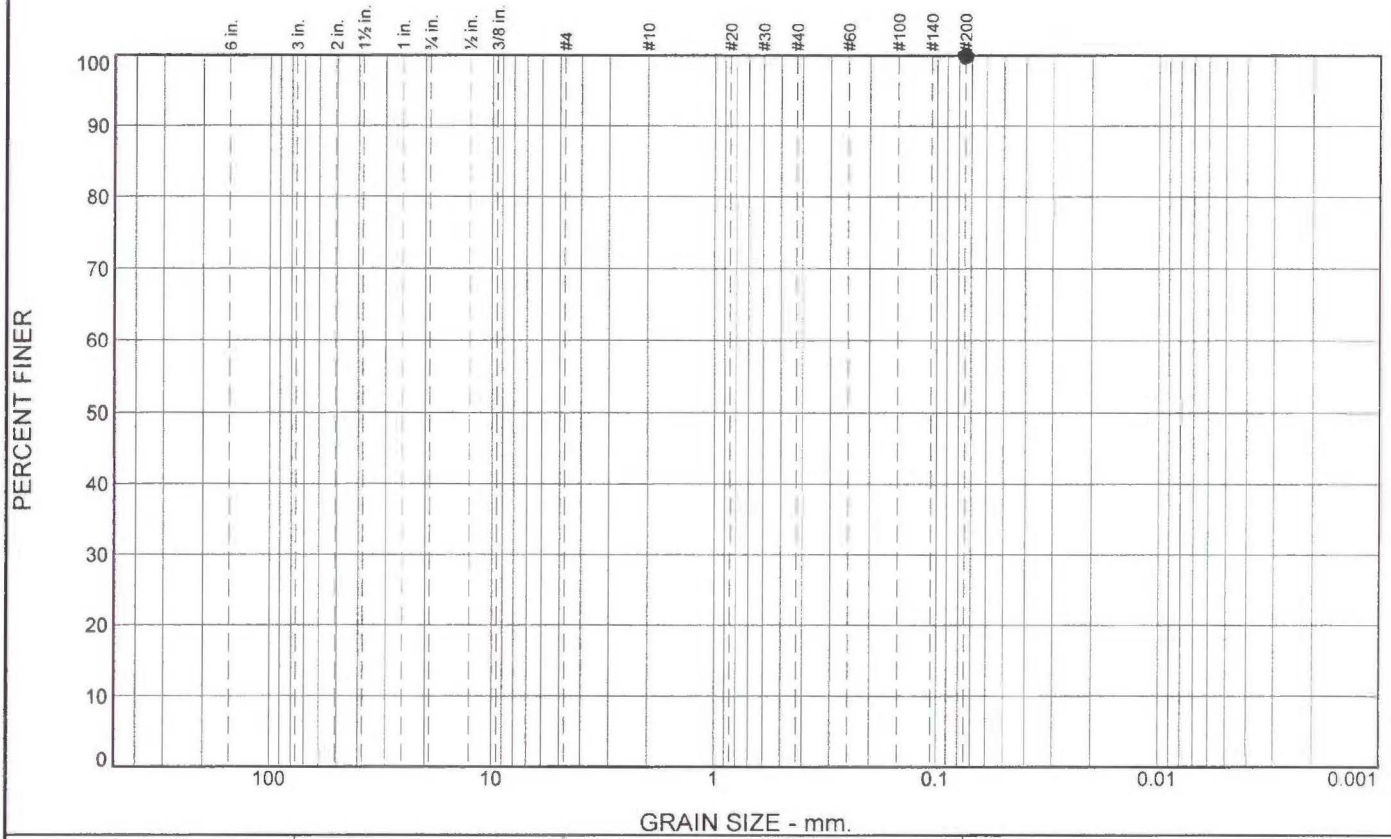
| Dry Sample and Tare (grams) | Tare (grams) | Sieve Opening Size | Weight Retained (grams) | Sieve Weight (grams) | Percent Finer | Lower Spec. Limit, % | Upper Spec. Limit, % | Deviation From Spec., % |
|---|---|---|---|---|---|---|---|---|
| 351.80 | 214.00 | | | | | | | |

### Fractional Components

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| | | | | | | | | | | 96.4 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| | | | | | | 100.0 | |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #200 | 100.0 | | |

* (no specification envelope)

**Material Description**

Dark Gray Silt (ML)

**Atterberg Limits**

PL= 28 LL= 46 PI= 18

**Coefficients**

$D_{90}$= $D_{85}$= $D_{60}$=
$D_{50}$= $D_{30}$= $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= ML AASHTO=

**Remarks**

**Location:** B-11-7.5
**Sample Number:** 6793 **Depth:** 7.5 ft **Date:** 11/3/08

**Hayre McElroy & Associates, LLC**

**Redmond, WA**

**Client:** Aspect Consulting
**Project:** Kitsap County Fragraria Road 070135
**Project No:** 08-175 **Figure**

**Tested By:** GG

## GRAIN SIZE DISTRIBUTION TEST DATA

12/8/2008

**Client:** Aspect Consulting
**Project:** Kitsap County Fragraria Road 070135
**Project Number:** 08-175
**Location:** B-11-7.5
**Depth:** 7.5 ft **Sample Number:** 6793
**Material Description:** Dark Gray Silt (ML)
**Date:** 11/3/08 **PL:** 28 **LL:** 46 **PI:** 18
**USCS Classification:** ML
**Tested by:** GG
**Material specification:** (no specification envelope)

### Sieve Test Data

**Post #200 Wash Test Weights (grams):** **Dry Sample and Tare =** 87.50
**Tare Wt. =** 87.40
**Minus #200 from wash =** 100.0%

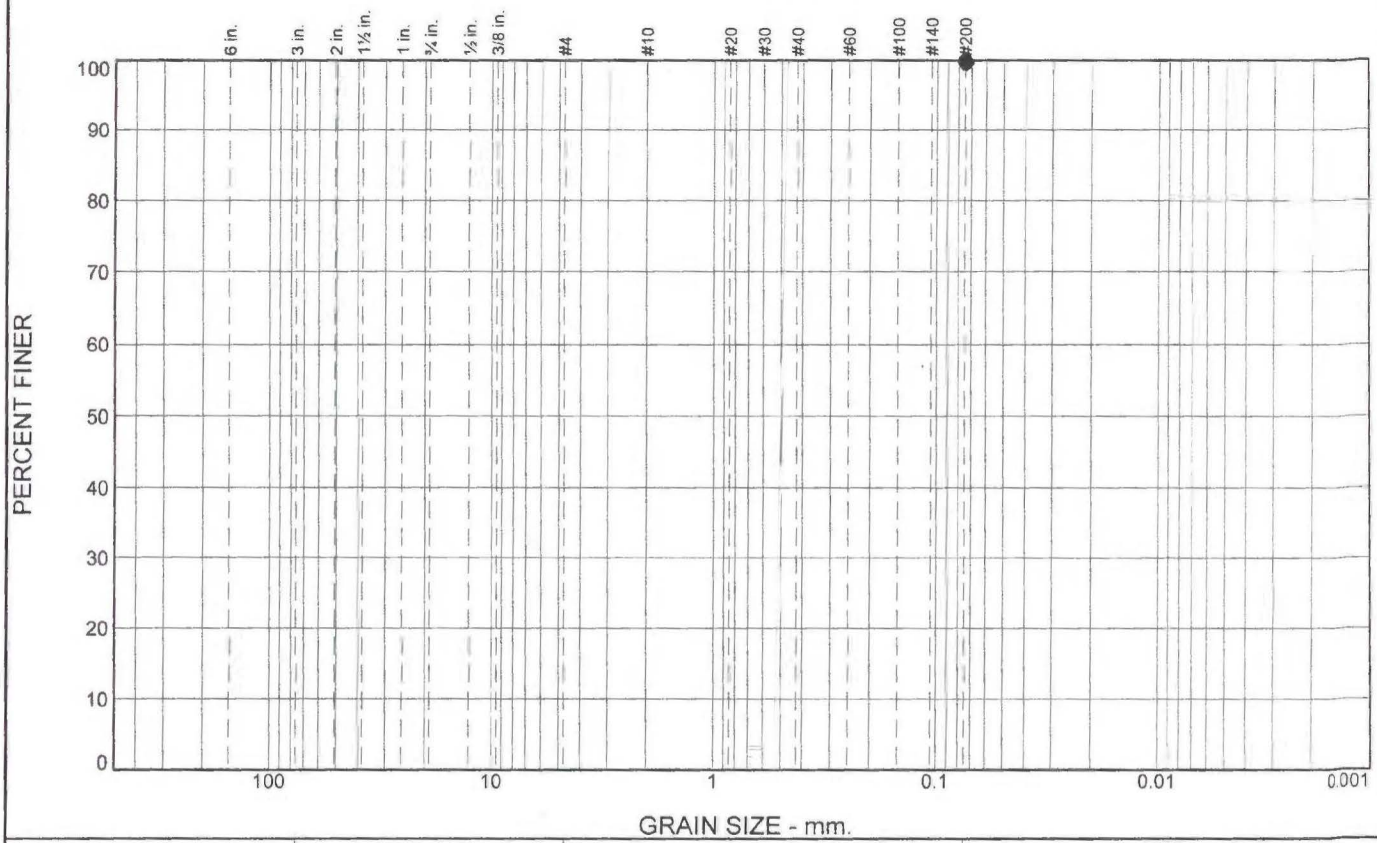
| Dry Sample and Tare (grams) | Tare (grams) | Sieve Opening Size | Weight Retained (grams) | Sieve Weight (grams) | Percent Finer | Lower Spec. Limit, % | Upper Spec. Limit, % | Deviation From Spec., % |
|---|---|---|---|---|---|---|---|---|
| 341.30 | 87.40 | | | | | | | |

### Fractional Components

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| | | | | | | | | | | 100.0 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| | | | | | | 99.9 | |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| #200 | 99.9 | | |

* (no specification envelope)

**Material Description**

Red Gray Silt (ML)

**Atterberg Limits**

PL= 28 LL= 47 PI= 19

**Coefficients**

$D_{90}$= $D_{85}$= $D_{60}$=
$D_{50}$= $D_{30}$= $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= ML AASHTO=

**Remarks**

**Location:** B-9-7.5
**Sample Number:** 6794 **Depth:** 7.5 ft **Date:** 11/3/08

**Hayre McElroy & Associates, LLC**

**Redmond, WA**

**Client:** Aspect Consulting
**Project:** Kitsap County Fragraria Road 070135
**Project No:** 08-175 **Figure**

**Tested By:** GG

## GRAIN SIZE DISTRIBUTION TEST DATA

12/8/2008

**Client:** Aspect Consulting
**Project:** Kitsap County Fragraria Road 070135
**Project Number:** 08-175
**Location:** B-9-7.5
**Depth:** 7.5 ft **Sample Number:** 6794
**Material Description:** Red Gray Silt (ML)
**Date:** 11/3/08 **PL:** 28 **LL:** 47 **PI:** 19
**USCS Classification:** ML
**Tested by:** GG
**Material specification:** (no specification envelope)

### Sieve Test Data

**Post #200 Wash Test Weights (grams):** **Dry Sample and Tare =** 218.20
**Tare Wt. =** 217.90
**Minus #200 from wash =** 99.9%

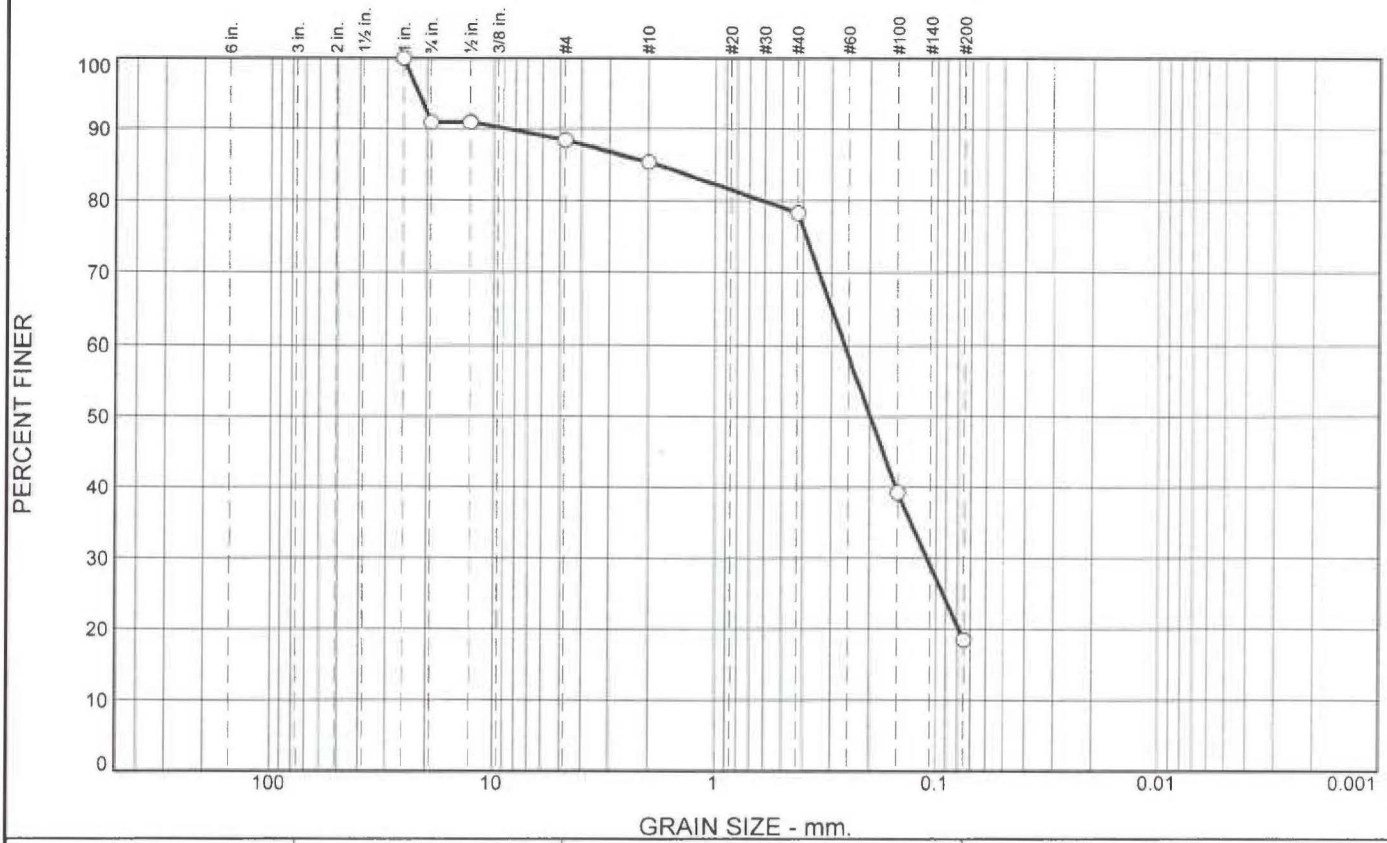
| Dry Sample and Tare (grams) | Tare (grams) | Sieve Opening Size | Weight Retained (grams) | Sieve Weight (grams) | Percent Finer | Lower Spec. Limit, % | Upper Spec. Limit, % | Deviation From Spec., % |
|---|---|---|---|---|---|---|---|---|
| 460.70 | 217.90 | | | | | | | |

### Fractional Components

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| | | | | | | | | | | 99.9 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

# Particle Size Distribution Report




| % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Coarse | Medium | Fine | * Silt | Clay |
| 0.0 | 9.0 | 2.6 | 3.0 | 7.1 | 59.8 | 18.5 | |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 1" | 100.0 | | |
| 3/4" | 91.0 | | |
| 1/2" | 91.0 | | |
| #4 | 88.4 | | |
| #10 | 85.4 | | |
| #40 | 78.3 | | |
| #100 | 39.3 | | |
| #200 | 18.5 | | |

* (no specification envelope)

**Material Description**

Brown Silty Sand (SM)

**Atterberg Limits**

PL= LL= PI=

**Coefficients**

$D_{90}$= 8.7726 $D_{85}$= 1.8309 $D_{60}$= 0.2609
$D_{50}$= 0.1998 $D_{30}$= 0.1101 $D_{15}$=
$D_{10}$= $C_u$= $C_c$=

**Classification**

USCS= AASHTO=

**Remarks**

**Location:** B-12-5
**Sample Number:** 6795 **Depth:** 5 ft **Date:** 11/4/08

**Hayre McElroy & Associates, LLC**

**Redmond, WA**

**Client:** Aspect Consulting
**Project:** Kitsap County Fragraria Road 070135
**Project No:** 08-175 **Figure**

**Tested By:** GG

## GRAIN SIZE DISTRIBUTION TEST DATA

12/8/2008

**Client:** Aspect Consulting
**Project:** Kitsap County Fragraria Road 070135
**Project Number:** 08-175
**Location:** B-12-5
**Depth:** 5 ft
**Sample Number:** 6795
**Material Description:** Brown Silty Sand (SM)
**Date:** 11/4/08
**Tested by:** GG
**Material specification:** (no specification envelope)

### Sieve Test Data

**Post #200 Wash Test Weights (grams):** Dry Sample and Tare = 868.40
Tare Wt. = 598.80
Minus #200 from wash = 18.2%

| Dry Sample and Tare (grams) | Tare (grams) | Sieve Opening Size | Weight Retained (grams) | Sieve Weight (grams) | Percent Finer | Lower Spec. Limit, % | Upper Spec. Limit, % | Deviation From Spec., % |
|---|---|---|---|---|---|---|---|---|
| 928.40 | 598.80 | 1" | 1469.80 | 1469.80 | 100.0 | | | |
| | | 3/4" | 1535.50 | 1505.70 | 91.0 | | | |
| | | 1/2" | 1420.10 | 1420.10 | 91.0 | | | |
| | | #4 | 1367.60 | 1359.20 | 88.4 | | | |
| | | #10 | 1184.90 | 1175.00 | 85.4 | | | |
| | | #40 | 971.20 | 947.70 | 78.3 | | | |
| | | #100 | 972.80 | 844.20 | 39.3 | | | |
| | | #200 | 1084.20 | 1015.70 | 18.5 | | | |

### Fractional Components

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 9.0 | 2.6 | 11.6 | 3.0 | 7.1 | 59.8 | 69.9 | | | 18.5 |

| $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|
| | | 0.0789 | 0.1101 | 0.1998 | 0.2609 | 0.6180 | 1.8309 | 8.7726 | 21.6641 |

| Fineness Modulus |
|---|
| 1.77 |

# Spiralnail Load Test Procedure

## *Introduction*

In soil reinforcement, for a retaining wall or an oversteepened slope, the spiralnail develops a mechanical bond with the soil through the clockwise twist of spiral ribs as it is pulled out in the wall active zone and pulled back in the resistance zone. The pullout in the active zone imparts a clockwise torque in the spiralnail against the soil in the resistance zone that cannot overcome the soil strength, weaker in the active zone, to drive the nail deeper because of the steep pitch of the spiral ribs. When the spiralnail is load tested, however, it is loaded in pullout along its entire length causing a counterclockwise twist resisted only by skin friction. Therefore, to load test the spiralnail performance in soil reinforcement, it must be locked against rotation while it is loaded in pullout as its axial displacement is measured. This provides a measure of the spiralnail mechanical bond with soil; and at the point of failure in pullout, it also provides the compound shear strength of the soil against the entire length of the nail. The Hilfiker spiralnail pullout load tester is designed to lock the nail against rotation at the same time as it loads the nail in pullout, while allowing sufficient distance for the maximum displacement typical of spiralnail and self compensating for the nail inclination angle with the tester base plate.

## *Description of load test apparatus*

The apparatus is comprised of the following seven component parts:

1. Spiralnail axial connection rod and tester attachment.
2. Dual ram attachment slide frame with steel shear pin.
3. Dual ram slide crutches with sharp conical legs.
4. Heavy base plate for crutches with steel anchor stakes.
5. Hydraulic dual rams, equalized, with 14-inch maximum extension.
6. Hydraulic hand pump with 25-psi digital and 100-psi analog pressure gauges, 10k-psi max.
7. Micrometer (0.001-inch, 2-inch extension) with adjustable mounting arms, magnetic base attachment and a heavy steel anchor post.

The hydraulic dual rams, pump and gauges are calibrated by an independent lab once a year or immediately after any repairs. Current calibration certificates and load chart are provided to the engineer a few days before the scheduled testing.

## *Load Tester Setup*

1. Engineer to select spiralnail to be tested in accordance with the plan notes and specifications, typically a minimum of 24-hours after driven or drill-driven.

2. Place the tester base plate over the spiralnail and shore in place as close to normal as possible to the nail axis flush against the soil, with the center hole of the plate centered over the nail. Caution! – The plate is very heavy. Use cut lumber to better distribute the plate reaction load over soft or loose soils.

3. Install fasten the appropriate tester connection rod (different styles) to the spiralnail. The rod should be straight and the shear pin holes should be pointing up and down.

4. Insert the dual ram slide crutches into the dual ram slide frame. The crutch legs (stored dry) should be clean and rust free and lightly oiled.

5. Fit the dual ram slide frame, with the crutch legs in place, over the spiralnail connection rod and line up over the shear pin hole in the rod as close as possible to the nail head. Leave sufficient distance for the rams to fit on each side. Insert the shear pin and secure with cotter pin.

6. Seat the rams, one on each side of the frame, with the push rods seated above the pointed crutch leg stands and the ram base seated inside the pockets on each side of the slide frame, held in place by elastic bands. The rams are interconnected with a Y-branch hydraulic hose fitting. Avoid twists and sharp bends in the hoses.

7. Inspect for major leaks and attach the hydraulic hose to the pump. The hose end must be clean and free of dirt or debris. Inspect the pump and gauges. The digital gauge is attached to a flexible hose to facilitate reading. Digital gauge should be handled with care and protected from accidental impacts. Check the gauge battery condition.

8. Pump the hydraulic pressure to 300-psi sustained seating pressure for 10-minutes.

9. Drive the anchor post for micrometer gauge safely in front of the base plate and at least 2-inches away from touching any part of the tester frame. Place the micrometer magnetic base on top of the steel post and turn to "on". Adjust and tighten the micrometer arm to reach over the base flange of the connecting rod.

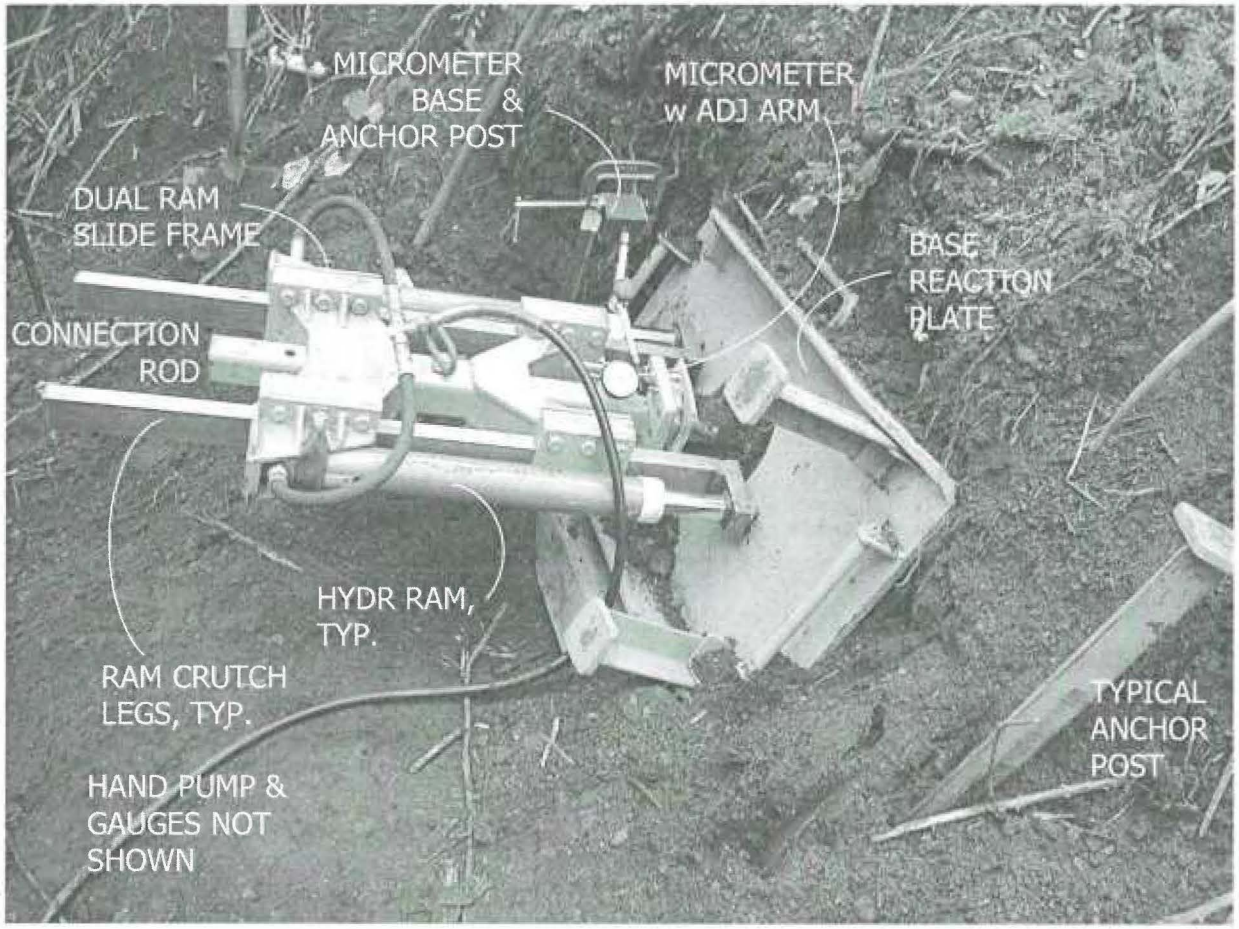
Fit the micrometer into the adjustable arm, hand tighten the holding screw, and place micrometer extension over the flange surface and normal to it, not too close to the edges. Read and record the starting position to 0.001-inch.

### *Loading and Data Recording*

Load the spiralnail in small pressure increments not to exceed 300-psi, then record the time of day to closest 1-minute and the micrometer gauge to 0.001-inch when both pressure and displacement gauges have stabilized – or as directed by the engineer in the field. Reduce the incremental pressure increases to 100 and 50-psi increments at 75 and 90-percent respectively of the anticipated maximum load pressure or as failure develops. In soft or loose soils, the incremental pressure increases shall be sustainable 50-psi or less.

When the micrometer gauge retracts near its maximum, read the pressure gauge then the micrometer recorded as gauge reset. Then quickly and safely adjust the micrometer arm close to the maximum gauge extension and read the gauge and record as reset and ready. Then pump the rams back to sustained reset pressure and read the micrometer again, record as gauge reset; then resume the loading.

Continually monitor the tester base plate and all other components during the testing for stability of the apparatus; support and adjust the setup as necessary.

Note: The small diameter of the standard 2.5-inch spiralnail generates much more intense bond loading than the traditional 6-inch diameter or larger grouted drift hole soil nails. Therefore, it is critical that the spiralnail for soil reinforcement be loaded very slowly and gradually over several hours in order to fully develop the passive resistance in the soil – unless the nail is being tested for dynamic loading or other reasons.

**SPIRALNAIL PULLOUT TEST APPARATUS**