Appendix G

Geotechnical Report

ICICLE CREEK
ENGINEERS
Geotechnical, Geologic and Environmental Services

Technical Memorandum

To: Phoebe Johannessen, PE, Parametrix

From: Brian Beaman, PE, LHG

Date: December 20, 2012

ICE File No: 0105-007

Subject: North Sammamish Segment, East Lake Sammamish Trail
Ground Water Conditions and Stormwater Infiltration

At your request, Icicle Creek Engineers (ICE) has further evaluated ground water conditions along the North Sammamish Segment of the East Lake Sammamish Trail (ELST). ICE previously completed a geotechnical evaluation of the North Sammamish Segment, including an evaluation of ground water conditions, as described in Section 5.2.3 of our report dated November 11, 2012. We understand that King County has requested additional information related to seasonal ground water levels as this condition is a design consideration for stormwater infiltration facilities.

ICE completed the test borings for this project in mid-April 2012. In our opinion, mid-April would be the approximate seasonal high for ground water levels in this area. Ground water, as noted on the boring logs, was observed/measured at the time of drilling these test borings. No ground water monitoring wells or piezometers were installed.

We expect that ground water levels are generally highly variable for the full length of the North Sammamish Segment; for this reason we did not interpolate a ground water level between test borings as shown on Figures 2 through 28 of our November 2012 report. The geologic conditions between test borings were reasonably mappable, and therefore were interpreted between test borings as shown on Figures 2 through 28. The occurrence of ground water is directly related to the geologic conditions. However, the mappable geologic units (Older Alluvium, Glacial Till and Olympia Beds) consist of interlayered silts, silty sands and sands. These layers tend to be random and discontinuous; for this reason, ground water may be encountered at one location at a certain depth, and may be absent at the same depth at a location only a few tens of feet away.

We expect that most if not all of the existing trail stormwater runoff has dispersed and infiltrated into the "shallowest" ground water receptor. This is often referred to as a perched ground water condition. Our test borings suggested that this perched ground water condition is highly variable. Most likely, stormwater runoff from the existing trail has been occurring as surface water runoff to trailside ditches that conveys this water to the present culvert (stream) crossings. Some water is infiltrating, and enters the perched ground water system. Because most of this segment of trail traverses a slope area, the perched ground water system appears to be relatively efficient in conveying this shallow subsurface water to Lake Sammamish.

Much of the previous text in this technical memorandum is intended to provide direction to the design team and King County when planning for stormwater disposal. As interpreted and described in our November 2012 report, the subsurface geologic conditions are complex, but reasonably well understood. The occurrence of ground water is equally well understood, but is localized, at various depths within the surficial looser soils and within the more permeable layers of the native geologic units.

In our opinion, using infiltration trenches to disperse and infiltrate stormwater runoff from the new trail is a preferred method. The existing trail has been serving this function reasonably well in a more natural condition.

Standard methods of ground water infiltration/mounding analysis and potential impacts related to new infiltration facilities could be completed using the computer application MODRET – **Mod**el to Design **Ret**ention Ponds; however in our opinion this analysis would not be representative of the actual future conditions. This is because of the heterogeneity of the native soil deposits that underlie this area. Our input of parameters for soil and hydrologic conditions would simply be an "educated guess" (the basic model for MODRET assumes uniform conditions with identifiable boundaries). Therefore, the results of the MODRET analysis would be one of several hundred possibilities, obviously some of this analysis could be shown to be favorable for the project plans.

In our opinion, more emphasis should be placed on "past-performance" conditions for stormwater disposal engineering design. The existing trail appears to be handling stormwater runoff adequately. A preference would be to plan stormwater disposal facilities by providing a better path to the subsurface (infiltration trenches). Localized mitigation can be evaluated and installed at a later time if stormwater and seepage problems are observed in local areas during new trail operation. This issue of future stormwater disposal problems and repair will occur regardless of the intensity of the design studies because of the complexity of the underlying geologic conditions along the North Sammamish Segment.

It is interesting to note that most of the wetlands and areas of wet ditches were observed on the uphill (east) side of the trail. It appears that the presence of the fill for the existing railroad grade has slowed the movement of shallow ground water downslope. Fill tends to compress shallow soils that effectively reduce the permeability of the underlying native soils, especially the Older Alluvium. It is possible that installing deeper and "improved" stormwater infiltration systems may cause the existing wetlands to drain (dry out). Care should be taken when planning infiltration facilities that may be hydrologically connected to wetland areas.

Submitted via email (pdf) and surface mail (3 copies)

Report
Geotechnical Engineering Services
North Sammamish Segment
East Lake Sammamish Trail
Sammamish, Washington

November 12, 2012
ICE File No. 0105-007

Prepared For:
Parametrix

Prepared By:
Icicle Creek Engineers, Inc.

ICICLE CREEK
ENGINEERS
Geotechnical, Geologic and Environmental Services

November 12, 2012

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We are pleased to submit two copies of our *Report, Geotechnical Engineering Services, North Sammamish Segment – East Lake Sammamish Trail, Sammamish, Washington*. Icicle Creek Engineers' services were completed in general accordance with the Parametrix Subconsultant Agreement for Professional Services, and were authorized in writing by Steven Aisaka, Operations Manager for Parametrix, on April 4, 2012. Our report was submitted in draft form for your review and comment on May 7, 2012 (30% design) and November 4, 2012 (60% design).

Please contact us if you require additional information or an interpretation of the information presented in this report. We appreciate the opportunity to be of service to you.

Yours very truly,

Icicle Creek Engineers, Inc.

Kathy S. Killman, LEG
Principal Engineering Geologist

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Attachments

TABLE OF CONTENTS

Page/Figure Number

FIGURES

APPENDICES

REPORT
GEOTECHNICAL ENGINEERING SERVICES
NORTH SAMMAMISH SEGMENT – EAST LAKE SAMMAMISH TRAIL
SAMMAMISH, WASHINGTON
FOR
PARAMETRIX

1.0 INTRODUCTION

This report presents the results of Icicle Creek Engineers' (ICE's) geotechnical engineering services for preliminary design related to the proposed North Sammamish Segment of the East Lake Sammamish Trail (referred to in this report as the "North Sammamish Segment") that extends north for about 2.6 miles from about Kokomo Drive (in the vicinity of Inglewood Hill Road) to the Sammamish/Redmond city limit boundary. The general location of the project alignment is shown on the Vicinity Map, Figure 1. A plan and profile view of the alignment is shown on the ELST Plans and Profiles, Figures 2 through 28.

2.0 PROJECT DESCRIPTION

Yammie Ho of Parametrix, the project engineer, provided ICE with the following design documents for our use and review:

- Parametrix, July 2012 (60% review submittal), *East Lake Sammamish Master Plan Trail Design,* North Sammamish Segment, sheets G1 to G7, CS1 and CS2, TE1 to TE13, TD1, SP1 to SP13, AL1 to AL27, SD1 to SD3, DD1, FP1 and FP2, DP1 to DP10, WP1 to WP13, WD1, S1 and S2, PS1 to PS11, MD1 to MD3, and MP1 to MP5.

Based on our review of the project design plans and discussions/email correspondence with Ms. Ho, the North Sammamish Segment will follow a former rail line that is between and parallels East Lake Sammamish Parkway (SE and NE) and the Lake Sammamish waterfront. The rail line (tracks and ties) were removed several years ago as King County converted (railbanked) the former rail line into an approximately 10-foot wide, gravel-surfaced trail which provided temporary access for the public.

The current plan is to widen the trail to 16 feet (12-foot paved surface and 2-foot shoulders). While the existing trail right-of-way (ROW) is relatively wide (50 to 100 feet), wetland areas and steep slopes (including the road embankment for East Lake Sammamish Parkway in local areas), along with other local modifications (landscape walls, driveways, and other) within the ROW by adjacent property owners, limit the space needed to accomplish the trail widening.

To widen the trail, additional fill (up to 8-feet thick) will be required in local areas, typically on the downhill (west) side of the existing trail (but not exclusively). The fill will be placed so as to widen the existing fill prism of the rail line. Some of this fill may be placed on open fill slopes, depending on available space. In other areas where space is limited (wetlands, etc.), retaining walls will be used to retain the fill; the proposed locations of these retaining walls are shown on Figures 2 through 28. We understand that Structural Earth Walls (SEW) using Concrete Block Units (CBUs) have been successfully used along other finished and full design segments of the East Lake Sammamish Trail. A Soldier Pile Wall will also be needed to retain a cut slope up to 10 feet in height, from about Station 562+80 to 568+75.

Additional water runoff will result from trail widening. At this time, stormwater runoff disposal by infiltration trenches is being considered in areas along the south part this trail segment, generally from about Station 472+75 to 532+00. The specific planned locations of these infiltration trenches are shown on Figures 2, 3, 4, and 10 through 14. In other areas in the south part of the trail segment (where practical), and entirely within the north part of the trail segment from about Station 532+00 to 599+40,

stormwater runoff will be collected in a paralleling open ditch and routed to stream crossings which is similar to the current method of stormwater disposal for the existing trail.

Four box (fish-passage) culverts are planned at Stations 503+26, 525+61, 528+12 and 539+14. Wing walls are planned on the inlet and outlet ends of each box culvert. The box culverts will each be 6-feet wide and 16-feet long, and range from 4 to 7 feet in height. Based on the design plans (sheets FP1 and FP2), the base of the culvert will be placed about 2 feet below the existing stream crossing grade. The base of the culvert will be filled with "streambed sediment."

3.0 SCOPE OF SERVICES

The purpose of our services was to explore subsurface soil and ground water conditions along the North Sammamish Segment as a basis for providing geotechnical recommendations for project design. Specifically, our services included the following:

- Review readily available geologic, critical areas and geotechnical data, along with the 60 percent design plans.
- Complete a geologic reconnaissance of the North Sammamish Segment with emphasis on existing fill slopes where retaining walls and infiltration facilities are proposed.
- Explore subsurface soil and ground water conditions by drilling 40 test borings with track-mounted drill equipment to depths ranging from about 9 to 16½ feet.
- Complete laboratory tests with the appropriate ASTM standards on selected soil samples from the test borings. The laboratory testing program included moisture content determination, grain-size analysis and Atterberg limits.
- Evaluate pertinent physical and engineering characteristics of the soils based on our observations and site knowledge, test borings and laboratory test results.
- Describe and characterize soil and ground water conditions along the North Sammamish Segment.
- Provide recommendations for slope support mechanisms such as structural walls (SEW and soldier pile), including allowable bearing pressures, active and passive lateral soil pressures, and embedment depth, when applicable.
- Provide recommendations for unsuitable soil excavation where soft and/or organic soils may be encountered at SEW foundation subgrade (leveling course zone).
- Provide recommendations for box culverts (fish passage), including foundation support and lateral earth pressures.
- Provide recommendations for earthwork including suitability of on-site soils for use as structural fill, constraints for wet weather construction, structural fill criteria and construction dewatering.
- Provide recommendations for trail subgrade preparation, where appropriate.
- Evaluate soil infiltration characteristics by using methods described in the Washington State Department of Ecology's February 2005 Stormwater Management Manual for Western Washington. This evaluation also considered slope stability and impacts to downhill structures.
- Provide recommendations for short-term and long-term (design) infiltration rate(s).

4.0 GEOLOGIC SETTING AND REGIONAL HYDROGEOLOGY

4.1 GEOLOGIC SETTING

The surficial geologic units along the North Sammamish Segment were mapped based on published geologic information, review of aerial photographs, field reconnaissance and test borings. The most recent regional geologic mapping in the site area was conducted by the US Geological Survey (USGS - Booth, D.B. and Minard, J.P., 1992, "Geologic Map of the Issaquah 7.5' Quadrangle, King County, Washington," Miscellaneous Field Studies, Map MF-2206, scale 1 inch = 2,000 feet).

The geology and landforms of the site area are the result of preglacial volcanism, and interglacial, glacial and postglacial events within the Puget Sound area. Bedrock underlies the entire site area, though at a depth of several tens or hundreds of feet.

Native soils composed of interglacial, glacial and postglacial deposits overlie the bedrock. The most recent glaciation, the Vashon Stade of the Fraser glaciation, covered the entire site area with up to 3,000 feet of ice at its maximum extent. The Vashon ice sheet completely melted from the site area approximately 13,500 to 15,000 years ago.

Before the Vashon Stade, interglacial and glacial soils were deposited over a period of several tens of thousands of years and are referred to as Pre-Fraser deposits. These deposits in the project area are referred to as Olympia Beds. Olympia Beds have been overridden by glacial ice and are typically in dense to very dense (granular soils) or very stiff to hard (cohesive soils) condition. Vashon age Glacial Till (often referred to as "hardpan") was deposited directly at the base of the glacier on top of the Olympia Beds. Glacial Till is typically in a dense to very dense condition also as a result of being overridden by glacial ice.

More recent soil deposition, such as the Older Alluvium in the project area, were deposited over the Olympia Beds or Glacial Till along the margins of the melting ice sheet that occupied the Sammamish valley. Older Alluvium is typically in a loose to medium dense (granular soils) or soft to medium stiff (cohesive soils) condition (not overridden by glacial ice).

Recent sedimentation and human activities (cuts and fills) have modified the land surface along the North Sammamish Segment alignment. Human activities, primarily the original rail line construction and other modifications for driveways, homes, etc., have resulted in regrading (cuts and fills) of the ground surface along the alignment. The native soils, described above, typically are mantled with fill, and weathered soils derived from the native soils (usually about 2- to 5-feet thick). Fill and weathered soils are typically in a loose to medium dense or soft to medium stiff condition.

The native soil units along the North Sammamish Segment alignment are summarized as follows.
Older Alluvium – Older Alluvium is described by the USGS (1992) as *moderately sorted cobble gravel, pebbly sand, and sandy silt.*
Glacial Till – Glacial Till is described by the USGS (1992) as *compact diamict containing subrounded to rounded clasts, glacially transported and deposited*.
Olympia Beds – Olympia Beds are described by the USGS (1992) as consisting of *peat, lacustrine and fluvial deposits*.

Fill and weathered soils (Topsoil and Colluvium) are not described by the USGS, but do occur as surficial soils along the North Sammamish Segment as described later in this report.

4.2 REGIONAL HYDROGEOLOGY

The project location, paralleling the Lake Sammamish beachfront area along the toe of a hillside area, provides an ideal condition for emerging ground water as springs and seepage. The native soils that underlie the hillside above the North Sammamish Segment likely contain multiple layers of ground water zones. These zones, or "layers" of subperched ground water, have been truncated by glacial and post-glacial erosion (hence the hillside) with this ground water emerging as springs and seepage in local areas along the trail alignment. Based on our test borings, we expect that ground water occurs relatively shallow (typically less than 15-feet deep) and is at the surface in local areas (primarily ditches) along most of the North Sammamish Segment alignment, depending on topography, the underlying soil conditions and elevation of the trail above the lake.

5.0 SITE CONDITIONS

5.1 SURFACE CONDITIONS

Surface conditions were evaluated based on geologic reconnaissance that occurred on April 17, 18 and 19 and May 2 and 4, 2012 by Brian Beaman and Jeff Schwartz of ICE. The weather during this time period was seasonably cool, though dry. The weather preceding our geologic reconnaissance was relatively normal, though January through March 2012 were very wet.

The North Sammamish Segment parallels the Lake Sammamish waterfront at the toe of a hillside at about Elevation 44 to 47½ feet (NAVD88 vertical datum, Parametrix, July 2012, sheets AL1 to AL27). The level of Lake Sammamish ranges from about 27 to 30 feet according USGS records from 2008 to 2012 (http://nwis.waterdata.usgs.gov).

Because the trail is located at the base of the hillside, the uphill (east) side of the trail rises to East Lake Sammamish Parkway in most areas. In some areas, the trail hillside has been cut into the hillside or the fill embankment for East Lake Sammamish Parkway has created oversteepened areas (65 to over 100 percent grade) as shown on Figures 2 through 28. In other areas along the uphill (east) side of the trail, the hillside is natural, sometime nearly level, or gently to moderately sloping (less than 40 percent grade), the less steep to level areas often occupied by "wetlands" (wetlands have been identified by others). Typically, the existing trail surface is "raised" as would be expected for standard rail line construction, with ditch lines paralleling the east (uphill) shoulder of the existing trail.

The downhill (west) side of the existing trail is typically a fill embankment ranging up to 8 feet in height. In some areas, especially where development has occurred, this embankment has been modified by the construction of "landscape walls" typically 2 to 6 feet in height. Landscape walls refer to non-structural or marginally engineered walls that are often used to face cuts, in these cases, the cuts are in the toe of the existing trail embankment. A 6- to 18-foot high Ecology block wall (gravity structure) is located at about Stations 518+40 to 527+50. In some areas, the existing trail surface is at or near grade with the area to the west.

Very little residential development has occurred along the uphill (east) side of the North Sammamish Segment; this limited development is likely because of the very close proximity of East Lake Sammamish Parkway and shoreline development restrictions. In local areas, the fill embankment for East Lake Sammamish Parkway toes out at the trail. We observed the use of rock spalls on the surface of the road embankment in local areas, at approximate Stations 488+75, 489+50, 491+75, 492+10, 552+00, 552+50 and 575+75. The rock spalls were likely used as fill slope stabilization measures as some of these embankments are inclined at up to 70 percent grade (1.4H:1V – Horizontal:Vertical). It appears that the proposed trail improvements do not encroach into these areas of rock spall surfacing of embankments.

Residential development, including access roads/driveways, parking areas, landscape areas, houses and cabins occur frequently along the west (downhill) side of the North Sammamish Segment. In some areas, the beachfront is within a few tens of feet of the current trail. Other areas are natural; forested and undeveloped. The downhill (west) side of the North Sammamish Segment is notably "drier" (lack of surface water) than the uphill (east) side of the trail.

We did not observe evidence of landslides or severe erosion on either side of the North Sammamish Segment alignment. Most landslides, should they occur, and are somewhat frequent on the hillside east of East Lake Sammamish Parkway, are typically blocked by the roadway and do not reach the trail area.

5.2 SUBSURFACE CONDITIONS

5.2.1 General

Subsurface conditions were evaluated based on published and unpublished geologic information for the area, including an on-line database of test borings maintained by the Washington State Department of Natural Resources (https://fortress.wa.gov/dnr/geology/?Site=subsurf). ICE also completed 40 test borings (Borings B-1 through B-40) along the alignment, primarily targeted at proposed SEW, soldier pile wall and stormwater infiltration (trench) locations. The test borings ranged from 9- to 16½-feet deep. The locations of the test borings are shown on Figures 2 through 28. In addition, we completed soil probes in proposed retaining wall areas where equipment access was restricted. Our field exploration program is described in Appendix A, along with our test boring logs. Details of the laboratory testing program, along with the test results, are presented in Appendix B.

In general, our test borings encountered conditions consistent with the regional geologic mapping by the USGS (1992). It is important to note that our interpretation of subsurface conditions as shown on Figures 2 through 28 is along the centerline of the trail. For this reason, the rail line embankment fill is shown on the profiles. SEW wall locations will typically be offset from trail centerline where no rail line embankment fill is present.

5.2.2 Soil Conditions

Our test borings encountered all of the previously described native soils, including Older Alluvium, Glacial Till and Olympia Beds. We also encountered surficial or near surface deposits of Fill, Topsoil and Colluvium, and Buried Topsoil (only the Fill is shown on Figures 2 through 28).

The following is a generalized description of the surficial and native soils encountered in the test borings:

Fill – Most of the test borings (Borings B-1, B-3, B-5 to B-9, B-11, B-12, B-14, B-16, B-18 to B-21, B-23 to B-25 and B-27 to B-40) were completed at the top edge of the railroad embankment fill pad because of fences or slopes. For this reason, most of the test borings are not directly on the proposed wall alignments and penetrate the surface fill that comprises the railroad embankment. Fill soils (often referred to as Railroad Embankment Fill in this report) will not likely be encountered during the excavation for the leveling course for the SEWs, so this factor should be kept in mind when reviewing the boring logs in this report.

Railroad Embankment Fill typically consists of very loose to medium dense (typically loose) fine to coarse silty gravel or gravel with silt with variable amounts of sand. A 1½-foot thick layer of bark mulch was encountered in Boring B-40. The Fill ranged from about 1½- to 6½-feet thick with an average thickness of about 2½ feet.

Topsoil and Colluvium – Borings B-2, B-4, B-10, B-13 **,**B-15, B-17, B-22 and B-26 were completed adjacent to the Railroad Embankment (closer to the proposed SEW or soldier pile wall alignments) and provide a reasonable characterization of the Topsoil and Colluvium that mantle most of the proposed retaining wall areas. Topsoil and Colluvium (Colluvium is weathered soil derived from the underlying native soils) were characterized as being black or dark brown with variable amounts of roots. Topsoil and Colluvium typically consist of very soft to soft silt with variable amounts of sand and gravel, or very loose to medium dense silty sand or sand with silt and variable amounts of gravel, or silty gravel. The Topsoil and Colluvium ranged from about 2- to 3-feet thick with an average thickness of about 2½ feet.

We also completed a series of soil probes using a ½-inch diameter steel rod along the proposed retaining wall locations, where direct access to this area was not practical using the drill equipment. Probe depths, suggesting the thickness of the Topsoil and Colluvium, averaged about 2 feet.

Buried Topsoil – Buried Topsoil was encountered in Borings B-14, B-39 and B-40. Buried Topsoil occurs when Fill is placed over the ground surface that has not been stripped of organic material (the former topsoil) and generally consists of dark brown or black stiff silt with variable amounts of sand, gravel and roots or loose silty sand with gravel.

Older Alluvium – Older Alluvium was the most common near-surface native soil encountered in the test borings. Older Alluvium typically underlies the surficial soils and consists of loose to medium dense sand, sand with silt and silty sand with variable amounts of gravel. Layers of soft to stiff silt, sandy silt and sandy clay were encountered within the Older Alluvium, in the area of Borings B-20, B-26 through B-30, B-34, B-35, B-38 and B-39. Thin layers (1 inch to 1 foot) of soft peat were encountered within the Older Alluvium in Borings B-8, B-28, B-30 and B-35.

Glacial Till – Glacial Till was encountered in Borings B-32, B-33 and B-36 near the north end of the North Sammamish Segment. Glacial Till consists of dense to very dense silty sand with gravel and silty gravel with sand and cobbles. Cobbles and boulders may be encountered within Glacial Till. Olympia Beds were encountered beneath the Glacial Till in Borings B-32 and B-33; the Glacial Till extended to the completion depth of Boring B-36 (11½ feet).

Olympia Beds – Olympia Beds were encountered at depth in many of the test borings and generally consists of dense to very dense (though a medium dense layer was encountered in Borings B-19 and B-22) sand with silt and silty sand with variable amounts of gravel or (less common) very stiff to hard silt. Olympia Beds were typically encountered at depth beneath the Glacial Till or the Older Alluvium, and extended to the completion depth of the boring.

5.2.3 Ground Water Conditions

Ground water was encountered in about half of the test borings. Ground water ranged in depth from about 4½ to 14½ feet, with an average depth of about 11 feet as shown on Figures 2 through 28. Ground water likely is present at the remainder of the test boring locations but was not observed because of the relatively shallow depth of the borings, or the low permeability soils that were often encountered that tend to be slow in releasing ground water at the time of drilling.

We observed several areas of ground water springs and seepage (known wetlands, water in ditch lines and wetland type vegetation), typically along the east (uphill) side of the North Sammamish Segment.

5.3 SLOPE STABILITY

We did not observe areas where the existing Railroad Embankment Fill pad appeared to be failing.

As previously described, cuts for the existing trail have been made in the hillside or fill slopes created for the west shoulder of East Lake Sammamish Parkway. These cuts and fill have created oversteepened areas (1 to 1.5H:1V - 65 to over 100 percent grade) as shown on Figures 2 through 28. None of the cut slope areas appeared to be unstable at the time of our field work.

At several locations, we observed that the embankment for East Lake Sammamish Parkway toes out at the east (uphill) side of the trail. In these areas, the road embankment was relatively steep (1.5H:1V – 65 to 70 percent grade). These road embankment areas appeared to be stable, though in some cases

had been covered with quarry spalls (at approximate Stations 488+75, 489+50, 491+75, 492+10, 552+00, 552+50 and 575+75) which is an indicator of past slope instability.

Along the downhill (west) side of the Railroad Fill Embankment, we observed the Fill to extend down onto the native slope, creating a slope that is less than 4-feet to over 8-feet high (more typically about 5-feet high). No current evidence of slope instability was observed in these areas.

6.0 INFILTRATION ANALYSIS

6.1 GENERAL

Infiltration analysis was completed in general accordance with Method 2 (USDA Soil Textural Classification), and Method 3 (ASTM Gradation Testing D_{10} Method) as described in the Washington State Department of Ecology's February 2005 Stormwater Management Manual for Western Washington Manual (SMMWW). The particle size distribution reports are presented in Appendix B.

6.2 METHOD 2 – USDA SOIL TEXTURAL CLASSIFICATION

The following is a summary of our infiltration analysis using the USDA Soil Textural Classification:

Test Boring Location	Sample Depth (feet)	USDA Type	Soil Infiltration Rate (iph)*
B-2	5	Loamy Sand	2 / 0.5
B-4	2½-5	Loamy Sand	2 / 0.5
B-4	7½	Loamy Sand	2 / 0.5
B-14	2½	Loamy Sand	2 / 0.5
B-14	3	Sand	8 / 2
B-14	5	Loamy Sand	2 / 0.5
B-16	5	Sand	8 / 2
B-16	10	Loamy Sand	2 / 0.5
B-19	5	Loamy Sand	2 / 0.5
B-19	10	Loamy Sand	2 / 0.5
B-27	5	Sandy Loam	1 / 0.25
B-27	10	Silt Loam	0.5 / 0.13
B-32	5	Loamy Sand	2 / 0.5
B-32	10	Silt Loam	0.5 / 0.13

* Short-term (field) infiltration rate / long-term (design) infiltration rate (includes correction factor to account for maintenance and biofouling). The long-term infiltration rate should be used for design (sizing) infiltration facilities.

6.3 METHOD 3 – ASTM GRADATION TESTING

The following is a summary of our infiltration analysis using Method 3 (ASTM Gradation Testing (D_{10} Method):

Test Boring Location	Sample Depth (feet)	D_{10}	Long Term Soil Infiltration Rate (iph)
B-2	5	< 0.05	< 0.8
B-4	2 ½-5	< 0.05	< 0.8
B-4	7½	< 0.05	< 0.8
B-14	2½	< 0.05	< 0.8
B-14	3	0.05	0.8
B-14	5	<0.05	<0.8
B-16	5	0.05	0.8
B-16	10	<0.05	<0.8
B-19	5	<0.05	<0.8
B-19	10	<0.05	< 0.8
B-27	5	< 0.05	<0.8
B-27	10	<< 0.05	0
B-32	5	< 0.05	< 0.8
B-32	10	<< 0.05	0

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 GENERAL

Based on our geologic reconnaissance, field explorations and analyses, we conclude that proposed improvements for trail widening related to the geotechnical conditions along the North Sammamish Segment are feasible. As previously described, the improvements most sensitive to the geotechnical conditions are related to SEW and soldier pile wall design and stormwater runoff infiltration or dispersion.

Some overexcavation of the Topsoil and Colluvium will likely be required in order to support SEWs (and other walls that require foundation support) on a reasonably firm and uniform soil type. In the test borings, the Topsoil and Colluvium averaged about 2½-feet thick and ranged from 2- to 3-feet thick. The actual amount of overexcavation should be a field decision depending on the surficial soils encountered.

Because most of the near surface soils are “granular” (sandy), it is likely that most of the settlements from new fill will occur rapidly (within a few weeks) once the fill is placed. Obviously, holding off as long as possible to place the pavement surfacing would help the performance of the pavement section where there is overlapping new fill and the existing Railroad Embankment Fill.

The Soldier Pile Wall that is proposed between Stations 562+80 and 568+75 is underlain by some of the more competent soils along the alignment.

Stormwater runoff infiltration is possible, though the infiltration rate is relatively low because of the relatively high silt content in the soils. However, based on our observations, considerable amounts of ground water are flowing through this area and appear to be in equilibrium with the present environment. Any water collected by ditches should be routed to stream crossings. Introduction of additional water into the ground may affect downslope properties. To the extent that this is possible, we recommend edge drains and/or dispersion of water runoff to the west (downhill) side of the North Sammamish Segment or routing collected water in ditchlines that discharge to existing stream tributary

drainages. Small amounts of collected water or runoff introduced into the ground are more likely to have less impact on the existing conditions compared with collecting large amounts of surface runoff and trying to dispose of this water at specific locations.

7.2 STRUCTURAL EARTH WALLS

7.2.1 General

Structural Earth Walls (SEWs) are typically used in fill applications where sufficient space is available for fill placement within the Reinforced Fill Zone. The SEW system consists of a Reinforced Fill Zone, often reinforced with layers of geotextile fabric depending on the wall height, and a CBU facing which is usually connected (pinned) with the Reinforced Fill Zone geogrid reinforcement layers. The CBUs are typically supported on a Leveling Course Pad of crushed rock to provide uniform support and to allow for easier installation (leveling).

In cut sections, an SEW application is treated as a slope "facing" (such as a rockery) and is not regarded as a structural solution for cut slope retention. As a general guideline, a slope facing can typically be used for competent cut materials to heights of up to 8 feet for a level backslope and 6 feet for a 2H:1V backslope. The CBU supplier should be contacted regarding the height of cut that can be faced with CBUs.

7.2.2 SEW Design Parameters

SEW internal design (geogrid type, length and spacing, Reinforced Fill Zone soil material and compaction specification, drainage) should be completed by the SEW material supplier. To assist in this design, we recommend the following soil parameters.

Parameter	Reinforced Fill Zone	Retained Soil	Foundation Soil
Unit Weight (pcf)	125	120	125
Phi (degrees)	32	32	34
Cohesion (psf)	0	0	200

pcf = pounds per cubic foot; psf = pounds per square foot

We strongly recommend that the Reinforced Fill Zone consist of free-draining soil such as Gravel Borrow as described in the 2012 Washington State Department of Transportation (WSDOT) Standard Specification Section 9-03.14(1). The on-site soils contain a relatively high percentage of fines and may not be suitable for use in the Reinforced Fill Zone.

We recommend using and allowable soil bearing capacity of 2,500 psf.

The design heights of SEWs should include the aboveground wall heights as well as the full embedment depths of the walls down to the Leveling Course Pad. The minimum embedment depth is as follows:

Slope in Front of Wall	Minimum Embedment Depth (feet)
Horizontal	H/20 or 1 foot, whichever is greater
3H:1V	H/10 or 1 foot, whichever is greater
2H:1V	H/7 or 1 foot, whichever is greater

H:V = horizontal to vertical H = Wall Height

The minimum embedment depth assumes use of a 6-inch thick, free-draining crushed rock leveling pad. The wall embedment could be further reduced to 0.5 feet if the leveling pad thickness is increased to 1 foot, or if non-frost susceptible soils are observed at wall subgrade at the time of construction.

Depending on the SEW type and height, geogrid reinforcement of the backfill may not be required and should be discussed with the SEW material supplier. For any height of SEW, we recommend the use of free-draining soil for backfill to provide adequate drainage.

SEWs should be designed with minimum factors of safety of 1.5 for sliding and pullout of reinforcing elements and 2.0 for overturning. If proprietary wall systems are used, the wall manufacturer is responsible for evaluating these items. However, we recommend that proprietary wall system designs be reviewed by a qualified geotechnical engineer to evaluate if valid assumptions were used relative to material properties and other factors such as site specific topography and soil/ground water conditions.

If SEWs are subject to the influence of traffic loading or nearby retaining walls with a horizontal distance equal to the height of the SEW, the walls should be designed for the additional horizontal pressure using appropriate design methods. A common practice is to assume a surcharge loading equivalent to 2 feet of additional fill to simulate traffic loads.

7.2.3 SEW Subgrade Preparation

7.2.3.1 General

SEW subgrade preparation typically consists of first excavating the Leveling Course Pad for the SEW, followed by additional excavation for the Reinforced Fill Zone. We recommend that the subgrade be evaluated by probing by a representative of our firm. Acceptable Leveling Course Pad and Reinforced Fill Zone subgrade is defined by probe penetration of less than 12 inches.

7.2.3.2 Leveling Course Pad Subgrade Special Conditions

Special Condition 1 - Where subgrade soils cannot be adequately compacted, or where soft, loose or disturbed soil is present, these areas should be excavated to expose competent material or to a maximum depth of 18 inches below subgrade, and replaced with Structural Fill (Structural Fill is described in **Section 7.5.2**). Alternatively, a geotextile soil reinforcement fabric such as TenCate Mirafi RS380i, or equivalent, may be placed over the soft, loose or disturbed subgrade, rather than overexcavation.

Special Condition 2 - Where subgrade preparation exposes topsoil or other organic soils (such as peat or organic silt), these organic soils should be removed and replaced with Structural Fill. We expect the thickness of topsoil or other organic soils to be less than 18 inches. It should be a field decision by the geotechnical engineer for the method of subgrade improvement should topsoil or other organic soils exceed 18 inches in thickness.

Special Condition 3 – Where ground water or wet subgrade is encountered at the base of the excavation, quarry spalls as defined by Section 9-13.6 of the 2012 WSDOT Standard Specifications may be used to provide a stable base on which to place Structural Fill. We recommend placing a nonwoven geotextile soil separation fabric such as TenCate Mirafi 180N, or equivalent, on the subgrade to reduce the loss of this rock material into the underlying soils.

7.2.3.3 Reinforced Fill Zone Subgrade Preparation

Special Conditions 2 and 3, described above, apply to the preparation of subgrade for the Reinforced Fill Zone.

7.3 SOLDIER PILE WALL

7.3.1 Soldier Pile Wall Design Parameters

We recommend that the Soldier Pile Wall be designed using the earth pressure diagram shown on Earth Pressure Diagram, Figure 29 in accordance with the AASHTO Load and Resistance Factor Design (LRFD) approach. The earth pressures presented in Figure 29 are for a full height cantilever soldier pile wall for the Service, Strength and Extreme Limit states. The recommended resistance factors and seismic earth pressure are also presented in Figure 29.

7.3.2 Soldier Pile Wall Lagging

We recommend timber lagging be sized using the procedures outlined in the Federal Highway Administration's Geotechnical Circular No. 4. The soils at the planned Soldier Pile Wall site are considered "competent soils."

The space behind the lagging should be filled with a permeable soil. Lagging should be installed as soon as practical where clean sand or gravel is present and caving conditions are likely.
The earth pressure diagram presented in Figure 29 can be used to design lagging for the Soldier Pile Wall. However, we recommend applying a moment reduction factor of 0.5 to the bending moments when using the earth pressure diagram.

7.3.3 Soldier Pile Wall Drainage

The earth pressure diagram shown in Figure 29 assumes drained conditions immediately behind the wall. Therefore, an appropriate drainage system (underdrain) should be included in the design to prevent hydrostatic pressures from developing behind the Soldier Pile Wall. Water will tend to drain from gaps between the lagging. We recommend a vertical spacing of 3/8 inch to allow seepage to flow to the face of the lagging.

7.3.4 Soldier Pile Wall Constructibility

Dense native soils, cobbles or boulders may be encountered while drilling the soldier pile shafts. The contractor should be prepared to utilize drilling methods which can penetrate through these materials where encountered.

Some of the surficial soils are in a loose condition and may contain perched ground water or deeper ground water zones within the Older Alluvium or Olympia Beds. This loose and/or wet material could tend to cave into the shaft excavation. The contractor should be prepared to complete the shaft excavation in such a way that caving is prevented (e.g., casing).

Temporary slopes may be necessary during installation of lagging. Temporary cut slopes of 1.5H:IV or flatter may be used provided that no significant ground water seepage is encountered. Flatter cut slopes are recommended when significant seepage is encountered or if caving is persistent. In any case, it is the sole responsibility of the contractor to follow WISHA (Washington State Industrial Safety and Health Act) regulations for excavations and shoring.

7.4 BOX (FISH PASSAGE) CULVERTS

7.4.1 Foundation Support

We expect that the box culverts and wing walls will be founded on medium dense or better soil. Foundations designed for these soil conditions may be proportioned using an allowable bearing pressure of 2,500 psf. This allowable bearing pressure includes a factor of safety of 3.0. The anticipated settlement of the foundation designed for this allowable bearing capacity is less than 1 inch. This allowable bearing pressure may be increased by one-third for short-term transient loads such as seismic.

7.4.2 Lateral Earth Pressures

For buried structures that are free to displace laterally, active soil pressures may be used for design. An equivalent fluid pressure of 35 pcf may be used to calculate active lateral earth pressures on the culvert walls and wingwalls. The equivalent fluid pressure does not include line load surcharge.

If buried structures are fixed against lateral deflection, at-rest pressures will be appropriate for design. An equivalent, at-rest fluid pressure of 50 pcf may be used to calculate at-rest earth pressures on the culvert walls. This equivalent fluid pressure does not include live load surcharge.

As needed, an equivalent fluid pressure of 300 pcf may be used to resist the active lateral pressures.

7.5 EARTHWORK

7.5.1 General

Where the trail widening crosses areas underlain by soft organic soils or loose wet weathered soil (Topsoil and Colluvium), we recommend that the organic soils and/or loose wet weathered soil be removed. This may require excavation of 2 to 3 feet of unsuitable soil. Where the trail widening fill will be 3 feet or more in height, the Topsoil and Colluvium may be left in place, although vegetation must be cut at the ground surface and removed.

Where weathered or native soils are exposed at trail subgrade, we recommend that the subgrade be evaluated by proofrolling and/or probing by a representative of our firm. Where subgrade soils cannot be adequately compacted, or where soft or disturbed soil is present, these areas should be excavated to expose competent material or to a maximum depth of 2 feet below final trail grade, and replaced with structural fill.

7.5.2 Structural Fill

7.5.2.1 General

All new fill for the trail should be placed as compacted Structural Fill. All Structural Fill material should be free of debris, organic contaminants and rock fragments larger than 6 inches. The suitability of material for use as Structural Fill will depend on the gradation and moisture content of the soil. As the amount of fines (portion of 3/4-inch minus soil particles passing the US Standard No. 200 sieve) increases, soil becomes increasingly sensitive to small changes in moisture content and adequate compaction becomes more difficult to achieve.

7.5.2.2 Unclassified Fill

We recommend that unclassified imported fill consist primarily of granular material with less than 30 percent passing the US Standard No. 200 sieve. Unclassified material will be sensitive to changes in moisture content and compaction will be difficult or impossible to achieve during wet weather. We recommend that unclassified material be used as Structural Fill only during dry weather conditions when proper moisture conditioning can be achieved.

7.5.2.3 Gravel Borrow

We recommend that Gravel Borrow conform with Section 9-03.14(1) of the 2012 WSDOT Standard Specifications. We recommend that Structural Fill consist of Gravel Borrow for the Reinforced Fill Zone for SEWs.

7.5.2.4 Reuse of On-Site Materials

The native soils (Glacial Till, Older Alluvium and Olympia Beds) may be reused for Structural Fill during periods of extended dry weather, though may be of limited use within the Reinforced Fill Zone (for SEWs) depending on the fines content (see **Section 7.2.3.3** for material specifications).

Soil containing more than 20 percent organic material (roots, forest duff and topsoil) should only be used in landscaping areas or for other purposes where specific compaction criteria is not required.

7.5.2.5 Base and Drainage Layer

We recommend that base and drainage layer material for the pavement section consist of Gravel Borrow as described above with the further restriction that the Gravel Borrow contain no more than 5 percent fines (based on the fraction of ¾-inch-minus material passing the US Standard No. 200 sieve).

7.5.2.6 Placement and Compaction

All Structural Fill placed in trail and shoulder areas should be compacted to at least 95 percent of the MDD) determined in accordance with ASTM Test Method D 1557. Waste fill in landscaping areas need only be compacted to the extent required for trafficability of construction equipment and erosion control.

As a guideline, we recommend that Structural Fill for the trail be placed in horizontal lifts which are 10 inches or less in loose thickness. The actual lift thickness will be a function of the fill quality and size of the compaction equipment used. Each lift should be compacted to the required specification before placing subsequent layers.

For placement during wet weather or on wet subgrades, Structural Fill should contain no more than 5 percent fines. Structural Fill placement over wet ground should commence with an initial lift of about 12 to 18 inches of clean sand and gravel with less than 5 percent fines, or quarry spalls (Section 9-13.3, 2012 WSDOT Standard Specification. During dry weather, the fines content may be up to about 30 percent, provided that the fill can be moisture-conditioned and compacted to the degree specified below.

We recommend that a representative from our firm observe the preparation for, placement, and compaction of Structural Fill. An adequate number of in-place density tests should be completed in the fill to evaluate if the desired degree of compaction is being achieved.

Nonstructural Fill placed in landscape and waste-fill areas where the existing surface slope is no steeper than 4H:1V needs to be compacted only to the degree required for trafficability of construction equipment and effective surface drainage/erosion control. All Nonstructural Fills should be sloped no steeper than 4H:1V. Nonstructural Fill is very susceptible to erosion. Therefore, we recommend that all Nonstructural Fill areas be immediately seeded, planted, or otherwise protected from erosion.

7.5.3 Fill Settlement

Most of the trail widening fill will be underlain by loose to dense or soft to stiff soils. Settlement of these underlying soils is expected to range from ½ to 1 inch and should occur rapidly as fill is placed. Some settlement will also occur within the fill itself, especially where the fill thickness is greater than 5 feet. We estimate that the maximum amount of settlement within the fill would be no more than 1 percent of the fill thickness. Thus, for a 5-foot fill section, settlements on the order of ½ to 1 inch might occur. Therefore, we recommend placing the final trail pavement at least three weeks after placement of fill where the fill thickness is greater than 5 feet.

7.5.4 Construction Dewatering

It is possible the excavation dewatering may be required in local areas along the trail alignment. The box culvert locations could also be likely areas of shallow ground water. The level and amount of

ground water will depend on when earthwork occurs. In the late Winter and early Spring, ground water levels and stream flow would be highest.

Because of the complex layering (discontinuous layers of variably permeable soils) pockets of ground water seepage will likely be encountered, we expect that pumping from a sump within the trench may be used for small to moderate amounts of ground water seepage. Well points or pumped wells will be necessary if large amounts of ground water seepage are encountered. We recommend that the contractor be required to submit a proposed dewatering system design and plan layout to the project engineer for review and comment prior to beginning construction.

7.5.5 Cut and Fill Slopes

7.5.5.1 Cut Slopes

Temporary cuts less than 4 feet in height may be made near-vertical in medium dense or better soil. Temporary cuts greater than 4 feet in height may be made at 1H:1V or flatter.

Permanent cut slopes should be inclined no steeper than 2H:1V. We recommend constructing a bench on all cut slopes for every 15 feet of vertical height of slope face.

Some of the upper portions of cut slopes will expose loose weathered soil that may be several feet thick. The weathered soil will be subject to localized raveling and sloughing and must therefore be sloped no steeper than 3H:1V.

Where cut benches are required, the benches should be sloped downward into the hill to allow for collection of surface water runoff. We recommend that the benches be sloped no steeper than 5 percent if practical.

Maintenance of safe working conditions, including temporary excavation stability, is the responsibility of the contractor. All excavations more than 4 feet in depth should be sloped in accordance with Part N of WAC 296-155 or be shored. The loose to medium dense Fill and Older Alluvium soils classify as a Type C soil and may be inclined (temporary slope) as steep as 1.5H:1V. The dense Older Alluvium and Glacial Till soils classify as a Type B soil and may be inclined (temporary slope) as steep as 1H:1V. Flatter slopes may be required where ground water seepage occurs and dewatering may be required to lower the ground water table below the base of the excavation. Alternatively, trench boxes may be used where the excavation is more than 4 feet deep.

7.5.5.2 Fill Slopes

Structural Fill slopes may be sloped at 2H:1V or flatter. All surfaces which will receive fill should be properly stripped of vegetation and organic matter prior to placing fill. Fill placed on existing slopes which are steeper than 4H:1V should be properly keyed into the native slope surface. This can be accomplished by constructing the fill in a series of 4- to 8-foot-wide horizontal benches cut into the slope. The fill should be placed in horizontal lifts. We recommend that fill be placed on the cut benches as soon as possible following construction of the benches.

Steeper (1V to 1.5H:1V) Structural Fill slopes are possible provided that these slopes are covered with quarry spalls or a permanent erosion control fabric such as North American Green C350, or equivalent.

7.6 STORMWATER INFILTRATION

7.6.1 General

In summary, field infiltration rates obtained using USDA Soil Textural Classification and ASTM Gradation Testing (D_{10} Method) suggest that the surficial soils can provide for some stormwater infiltration, but at

a relatively low rate. Because of the width of the trail area (small) compared to its length, stormwater dispersion may be considered. Stormwater dispersion is effective where the ground surface is mantled with a thin layer of poorly-drained soil (such as Fill, Topsoil and Colluvium) and sufficient distance is maintained from developed areas.

7.6.2 Stormwater Infiltration Rate

Based on the 30 percent design plans, stormwater infiltration is proposed in the vicinity of Test Borings B-2, B-4, B-14, B16, B-19, B-27 and B-32. Based on our infiltration analysis summarized in **Section 6.0** of this report, the shallow soils (2½ to 10 feet deep) have a relatively low infiltration rate. **At this time, we recommend a short-term (field) infiltration rate of 2 iph and a long-term (design) infiltration rate of 0.5 iph.**

8.0 USE OF THIS REPORT

We have prepared this report for use by Parametrix in the design of a portion of the project. The data and report should be provided to prospective contractors for bidding or estimating purposes, but our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

If there are significant changes in the grades, configurations or types of facilities to be constructed, the conclusions and recommendations presented in this report may not be fully applicable. When the design has been finalized, we recommend that we be retained to review those portions of the specifications and drawings which relate to geotechnical considerations to see that our recommendations have been interpreted and implemented as intended.

Variations in subsurface conditions are possible between the locations of the explorations. Variations may also occur with time. Some contingency for unanticipated conditions should be included in the project budget and schedule. Sufficient observation, testing and consultation should be provided by our firm during construction to evaluate whether the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions during the work differ from those anticipated, and to evaluate whether or not earthwork and foundation installation activities comply with the contract plans and specifications.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in this area at the time the report was prepared. No warranty or other conditions, express or implied, should be understood.

****

We appreciate the opportunity to be of service to you on this project. If there are any questions concerning this report or if we can provide additional services, please call.

Yours very truly,
Icicle Creek Engineers, Inc.

Kathy S. Killman, LEG
Principal Engineering Geologist

Brian R. Beaman, PE, LEG, LHG
Principal Engineer/Hydrogeologist

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FIGURES

BRB:05/05/12

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Scale in Feet

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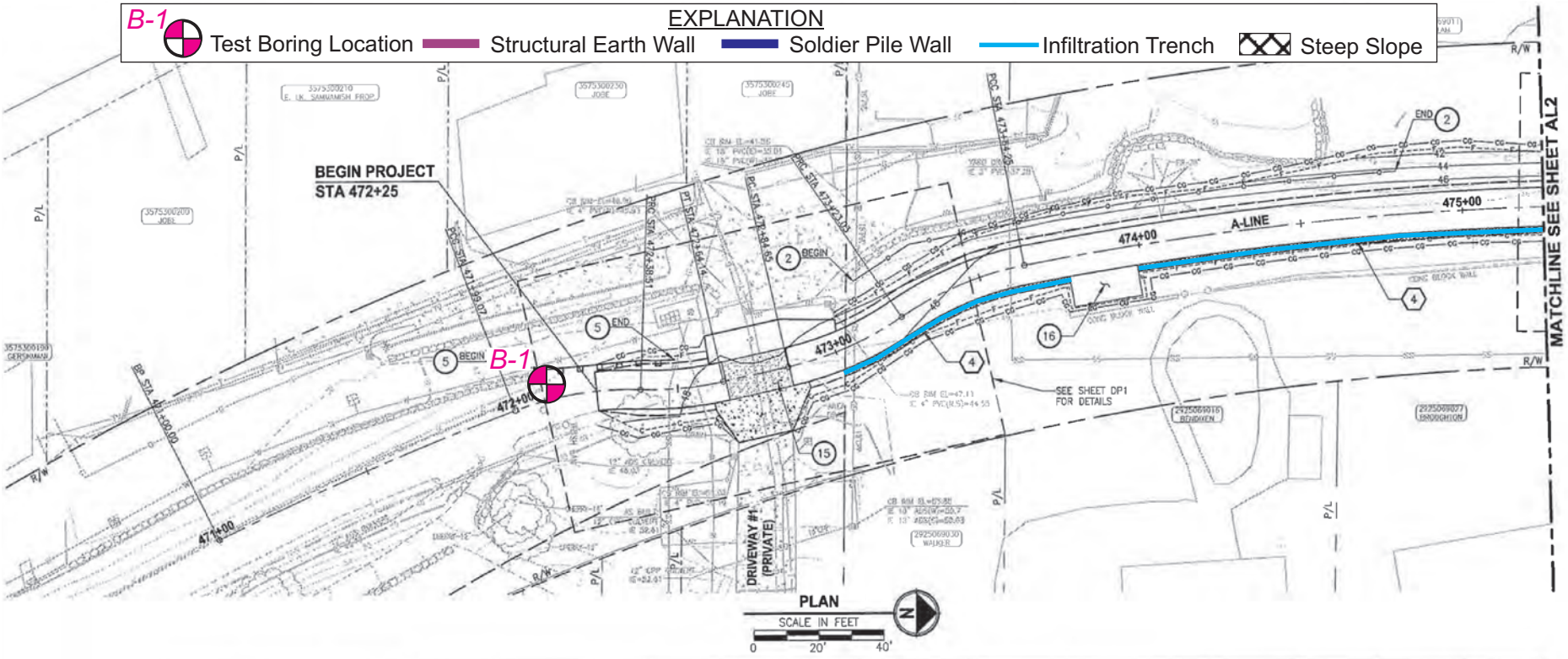
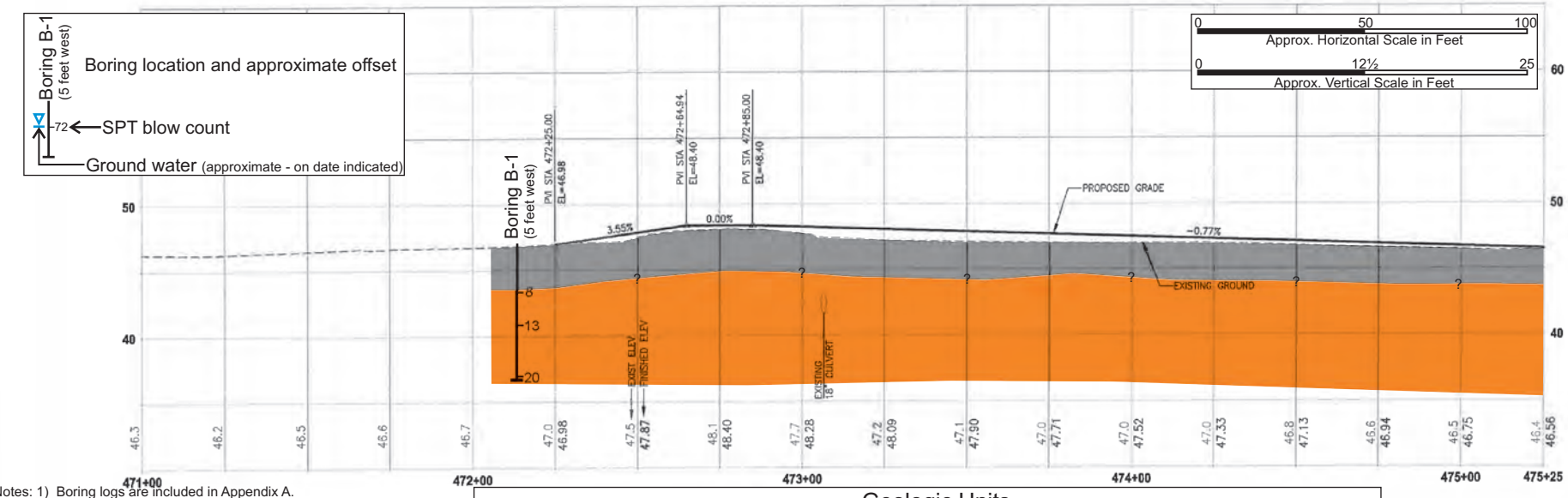
Vicinity Map - Figure 1





Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

Geologic Units
Fill
Older Alluvium
Glacial Till
Olympia Beds

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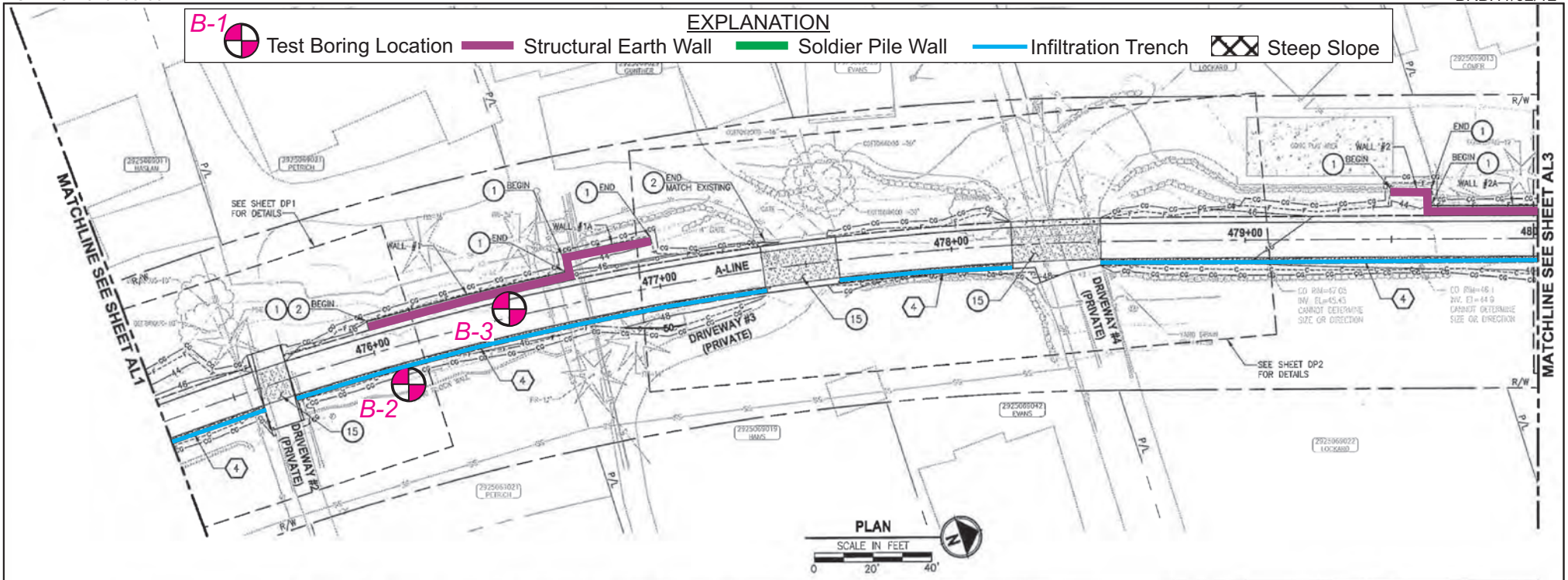
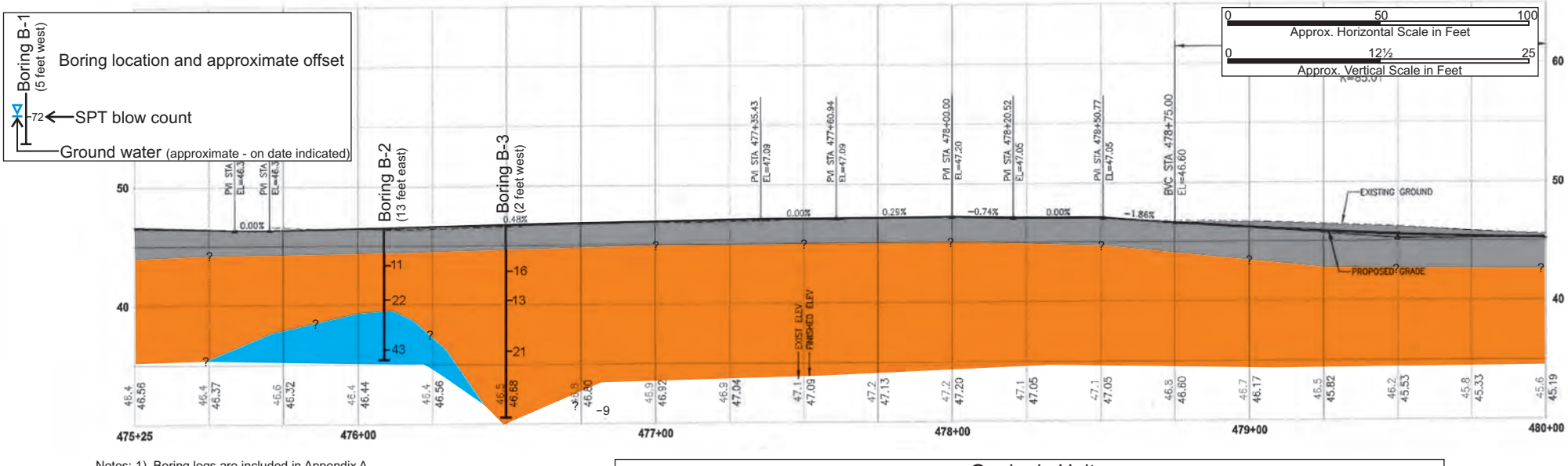
ELST Plan and Profile - Figure 2





Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

Geologic Units
Fill | Older Alluvium | Glacial Till | Olympia Beds

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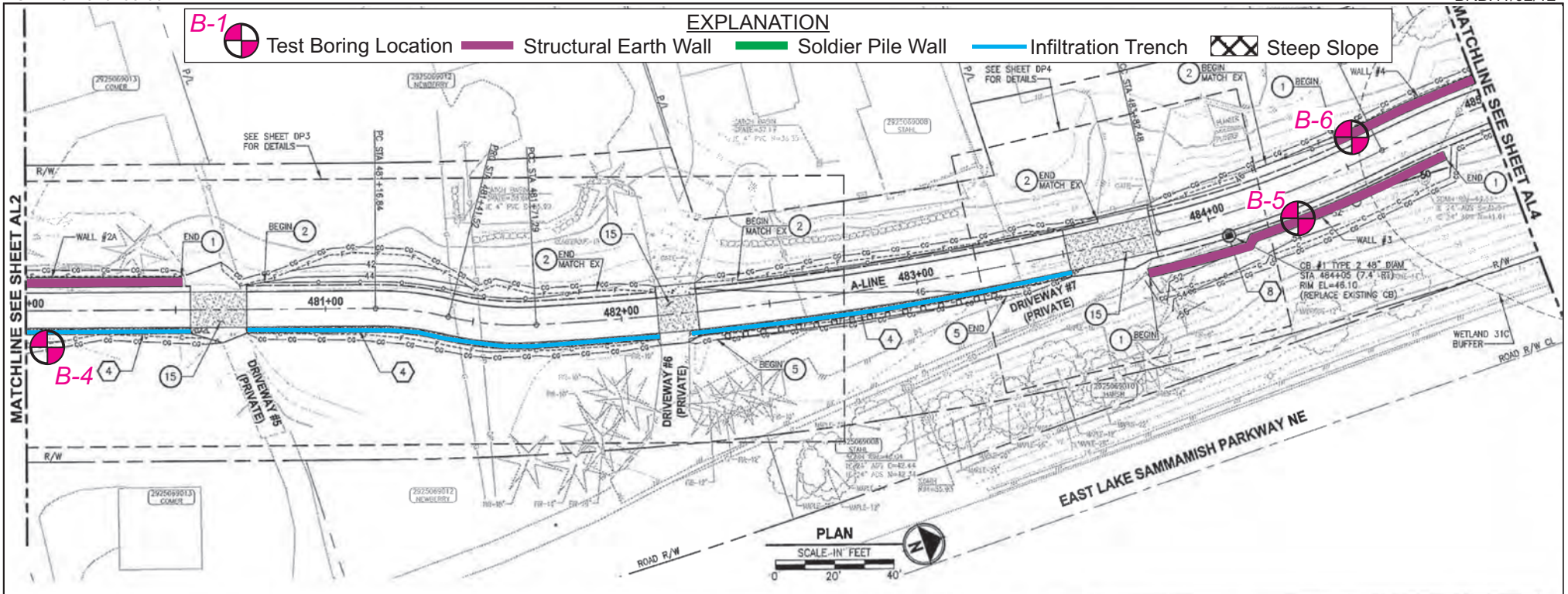
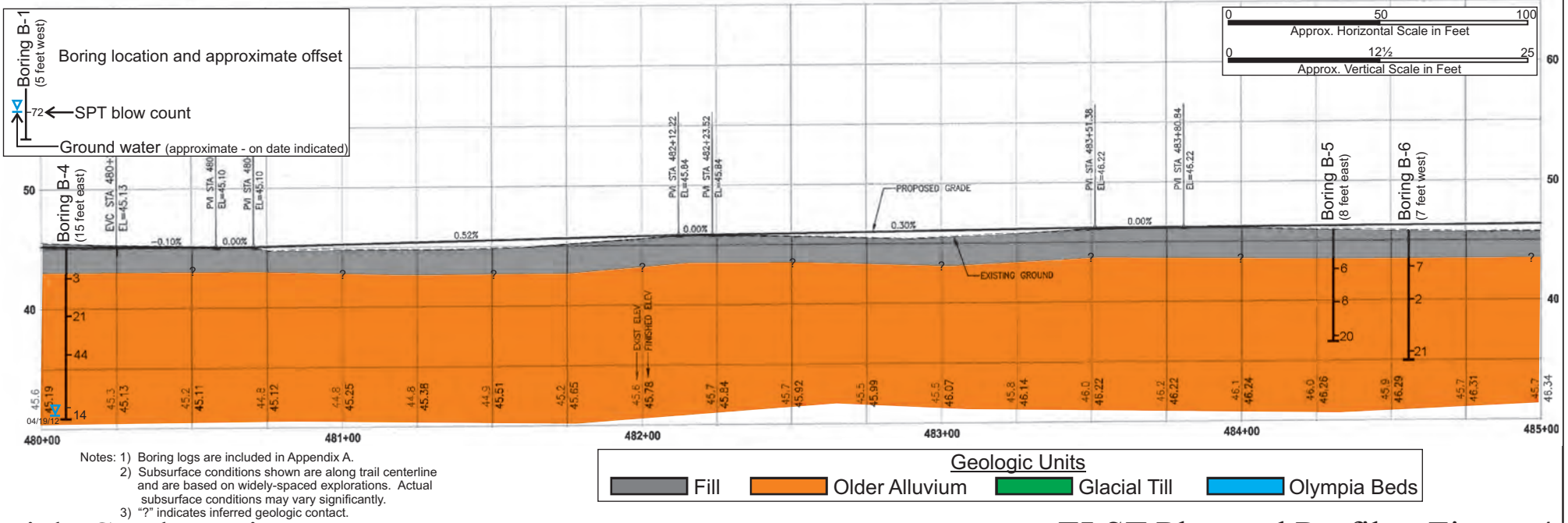
ELST Plan and Profile - Figure 3





Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

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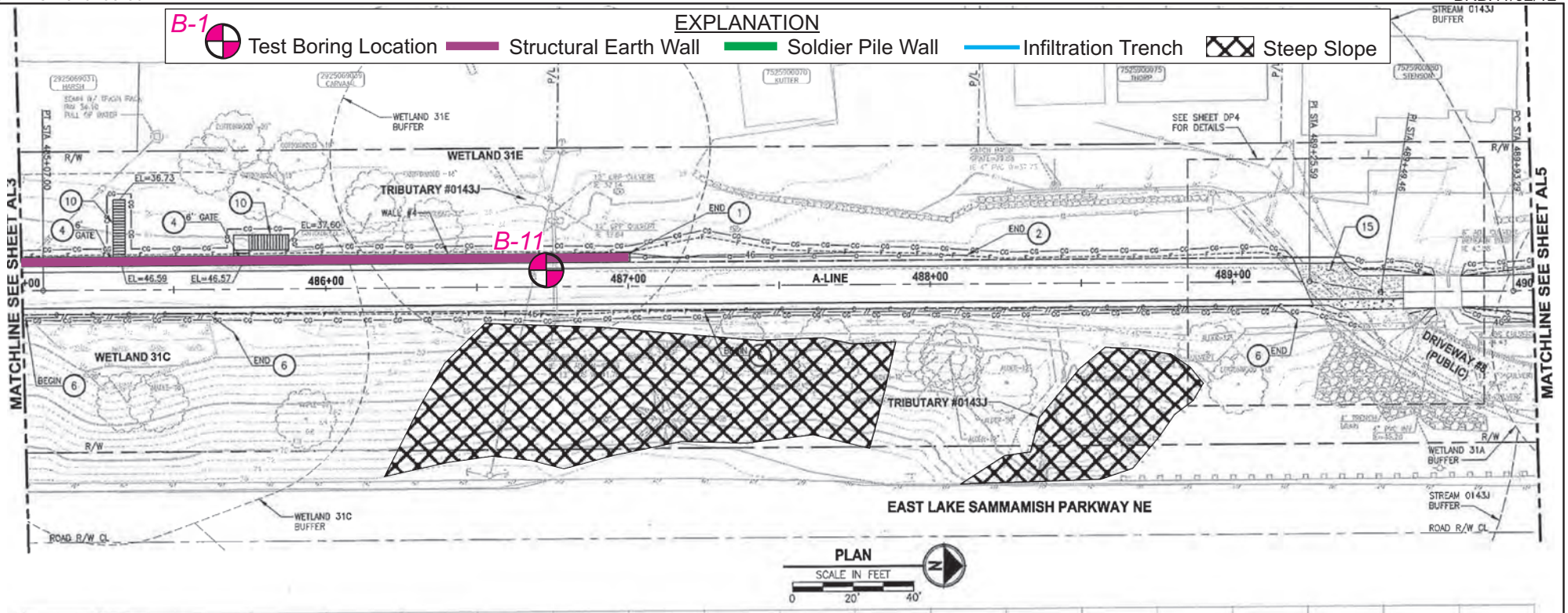
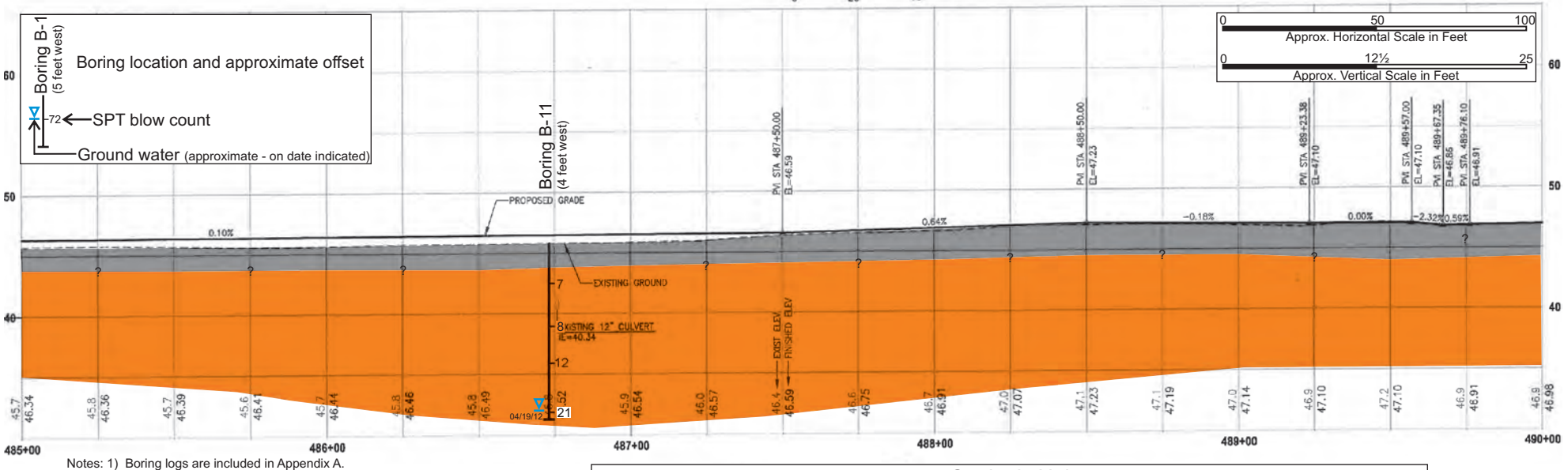
ELST Plan and Profile - Figure 4





Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

Geologic Units
Fill | Older Alluvium | Glacial Till | Olympia Beds

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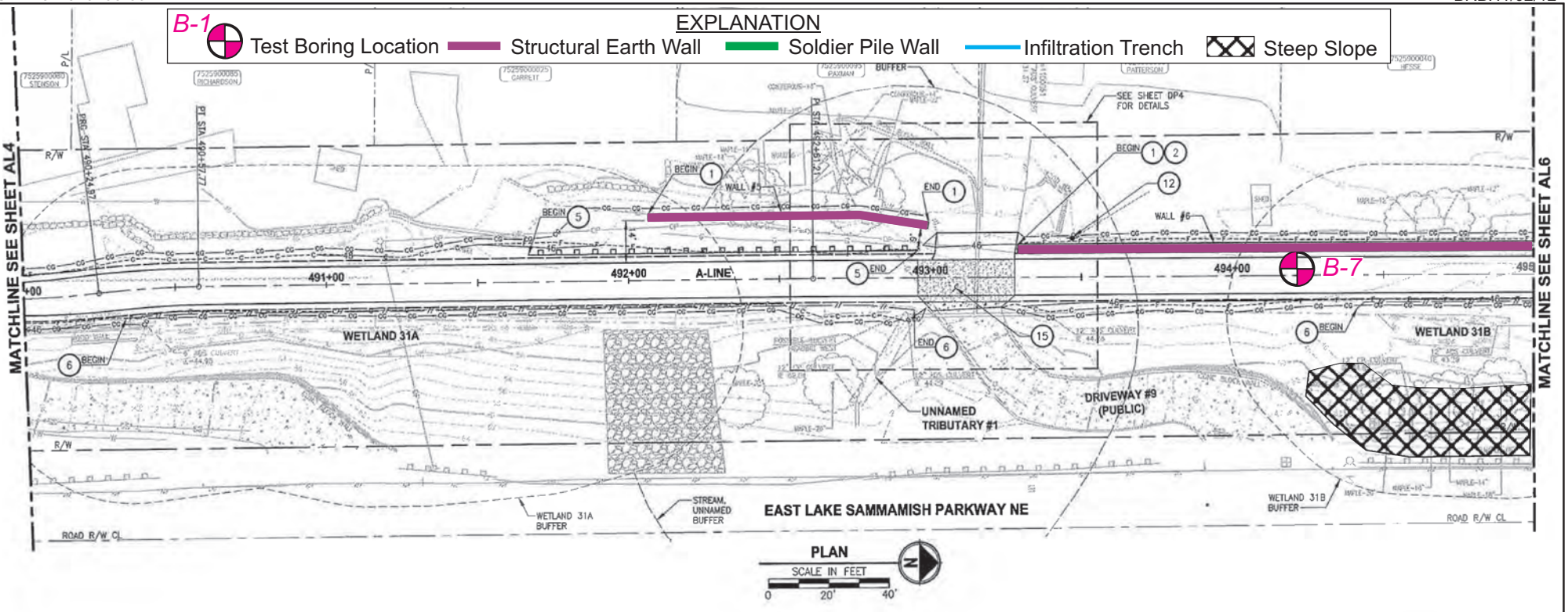
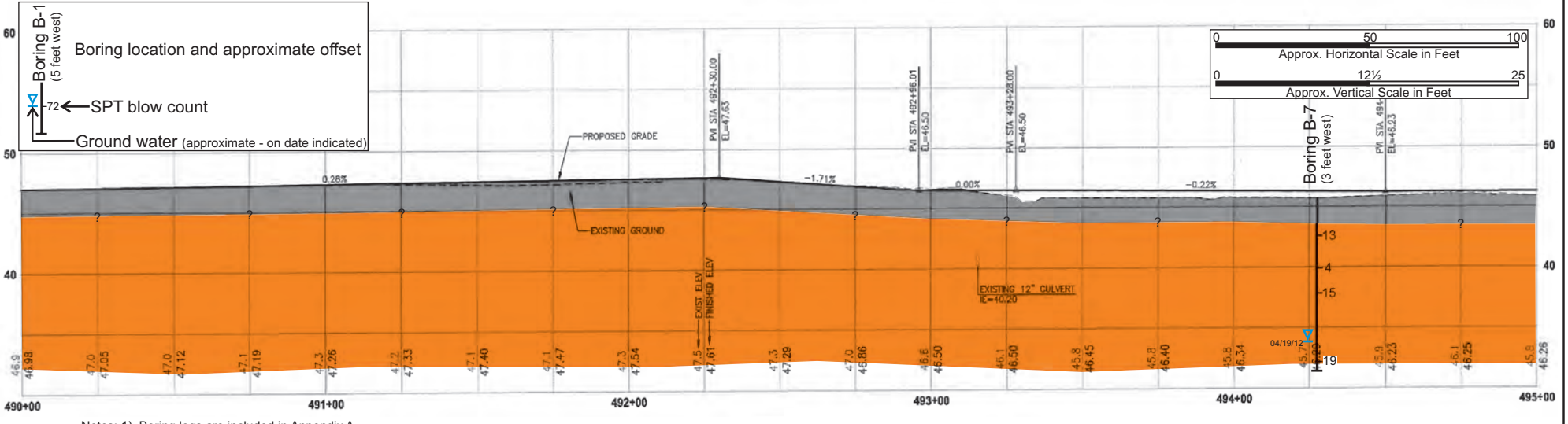
ELST Plan and Profile - Figure 5



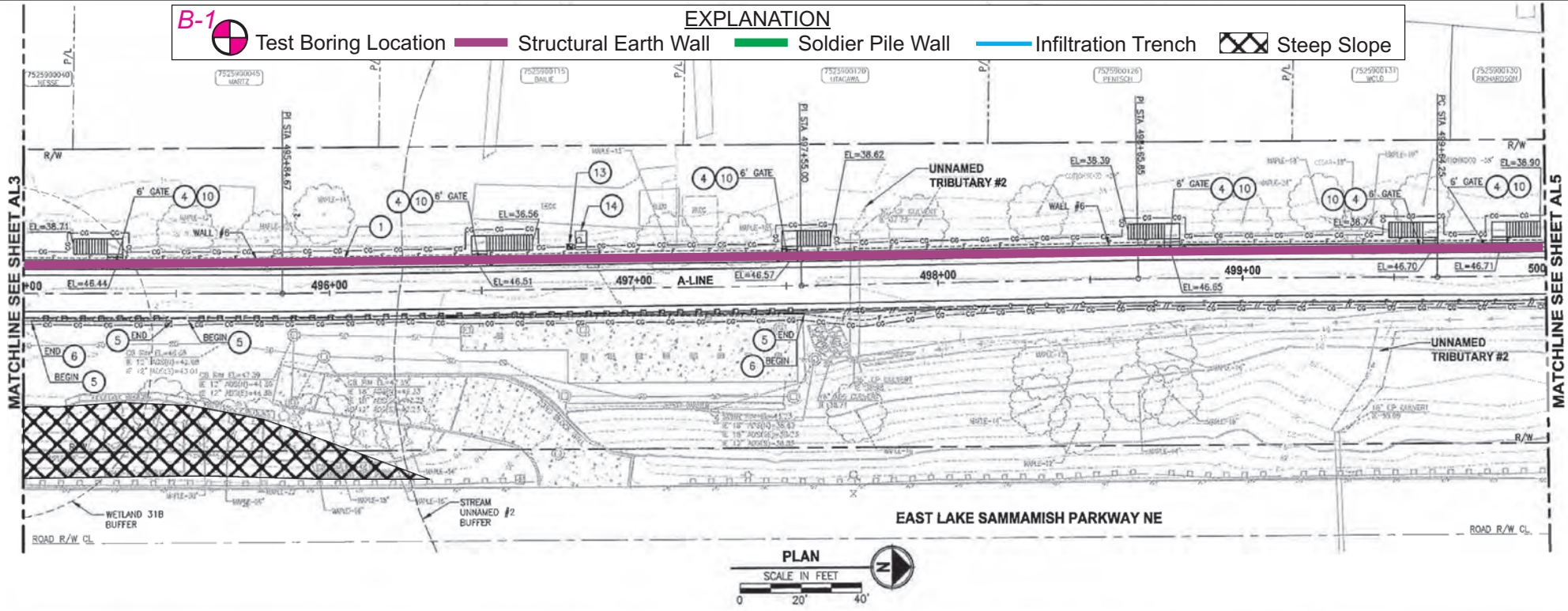


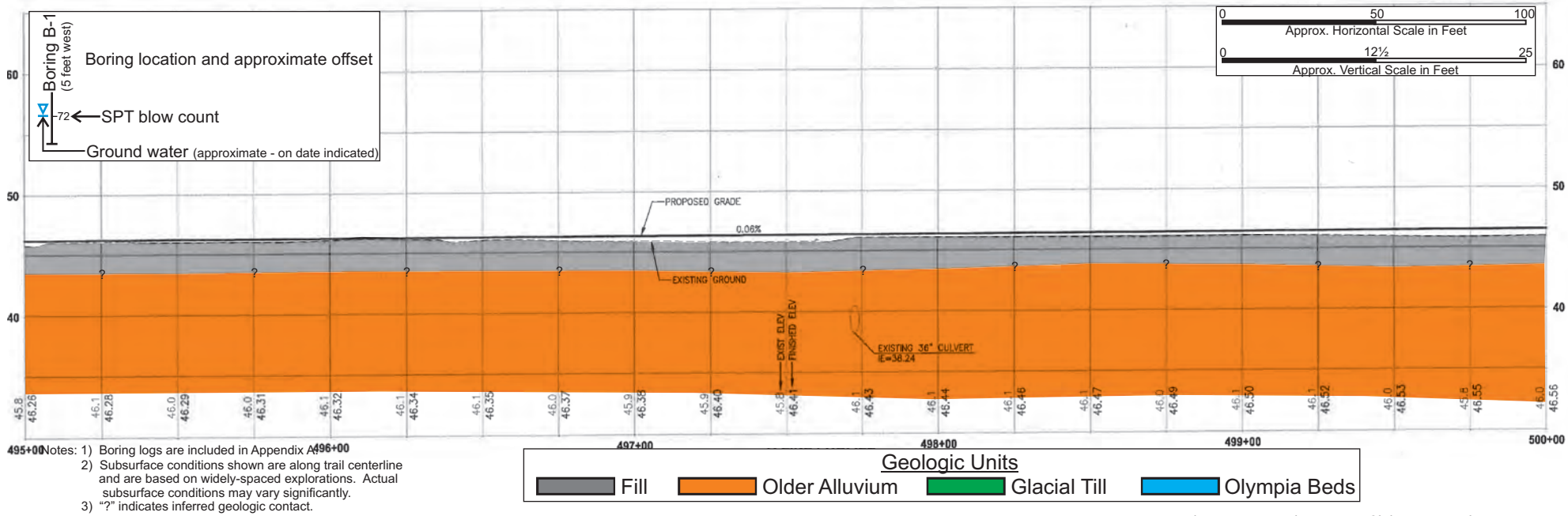
Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

Geologic Units
Fill Older Alluvium Glacial Till Olympia Beds

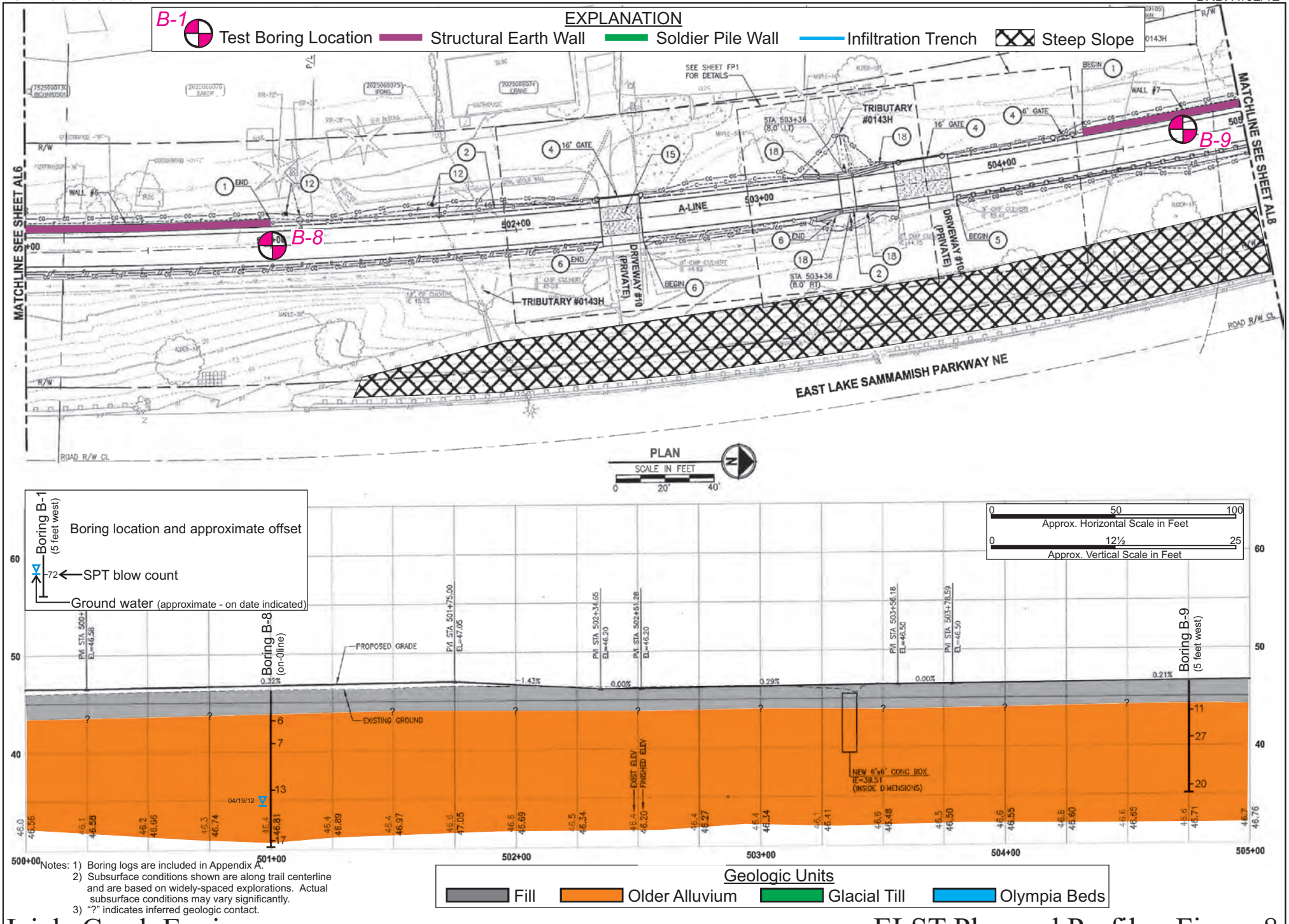
Icicle Creek Engineers

ELST Plan and Profile - Figure 6





Notes: 1) Boring logs are included in Appendix A
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.



Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

Geologic Units
Fill | Older Alluvium | Glacial Till | Olympia Beds

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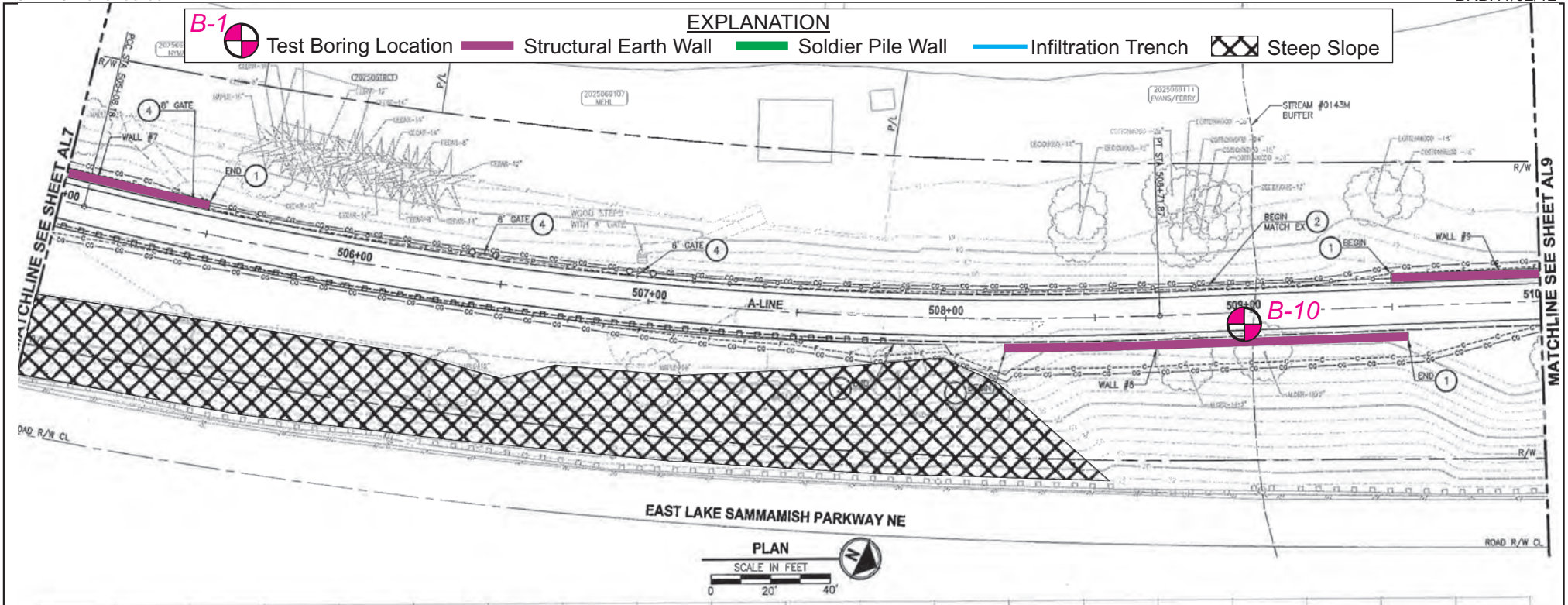
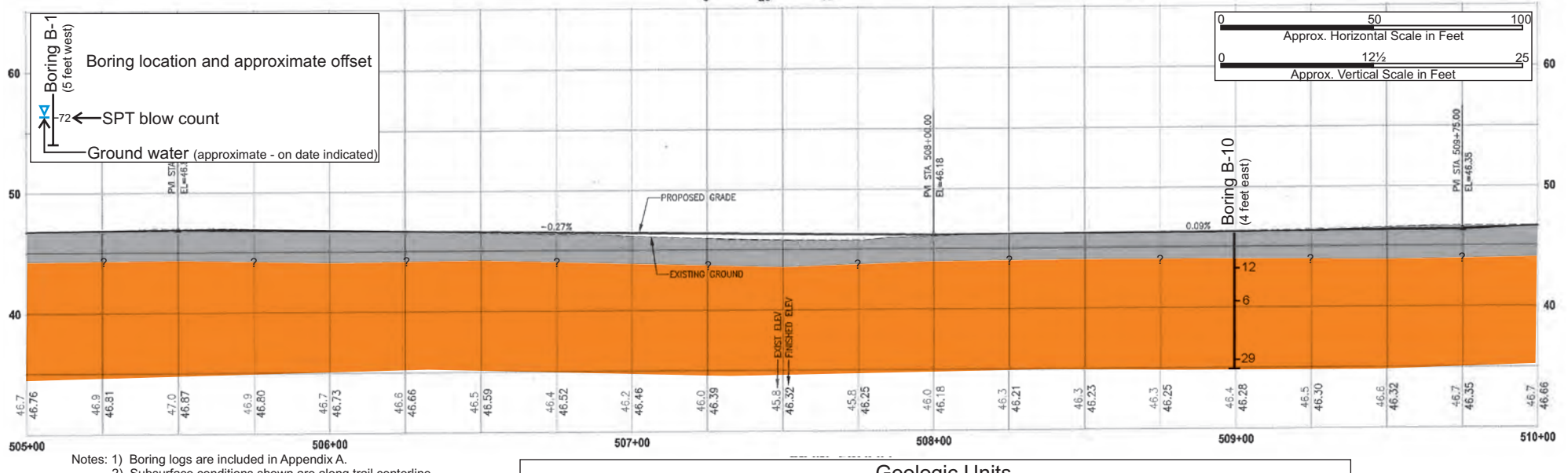
ELST Plan and Profile - Figure 8





Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

Geologic Units
Fill | Older Alluvium | Glacial Till | Olympia Beds

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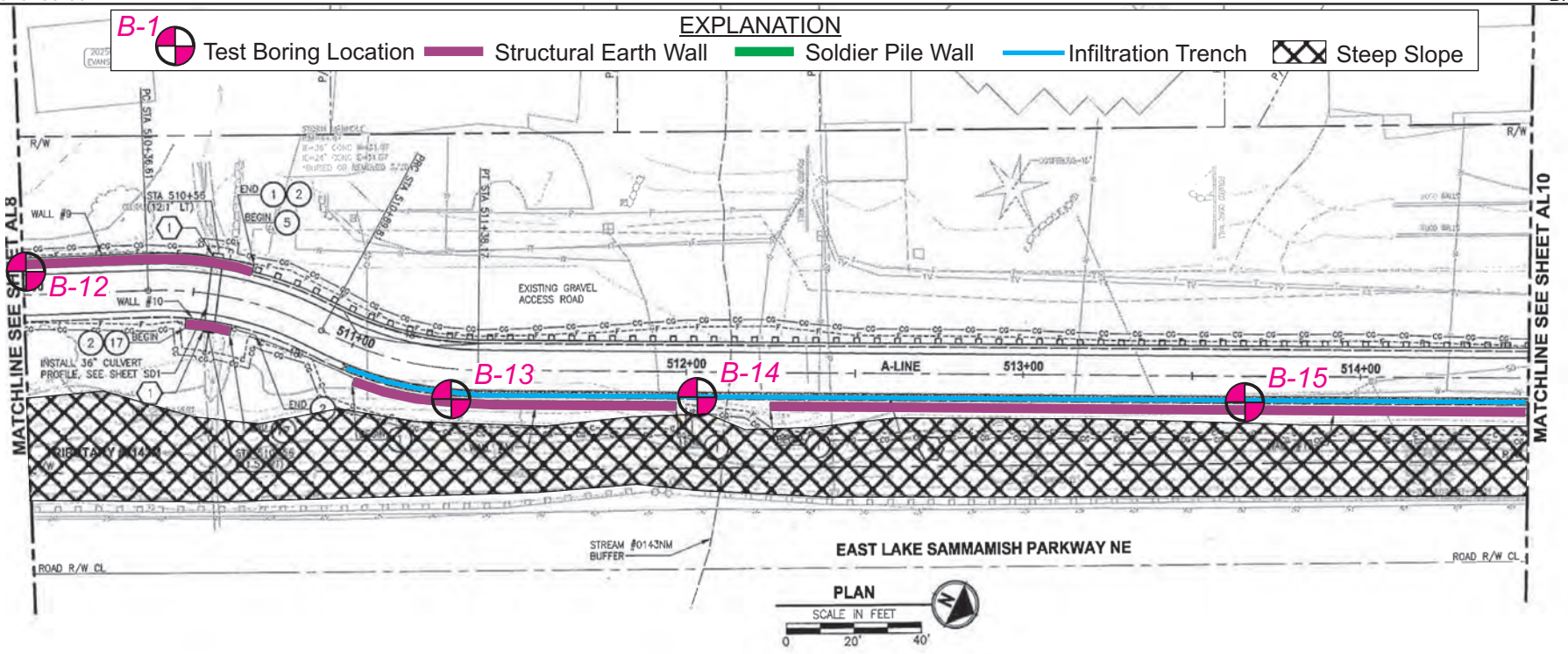
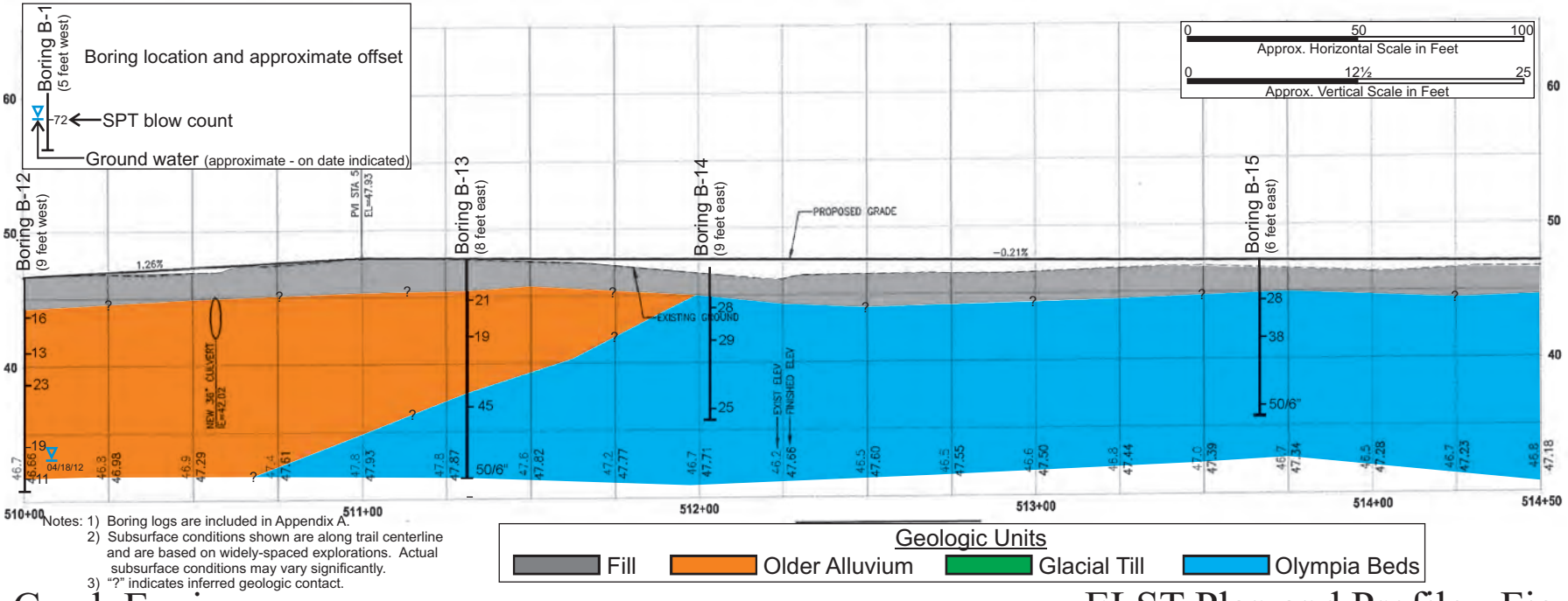
ELST Plan and Profile - Figure 9



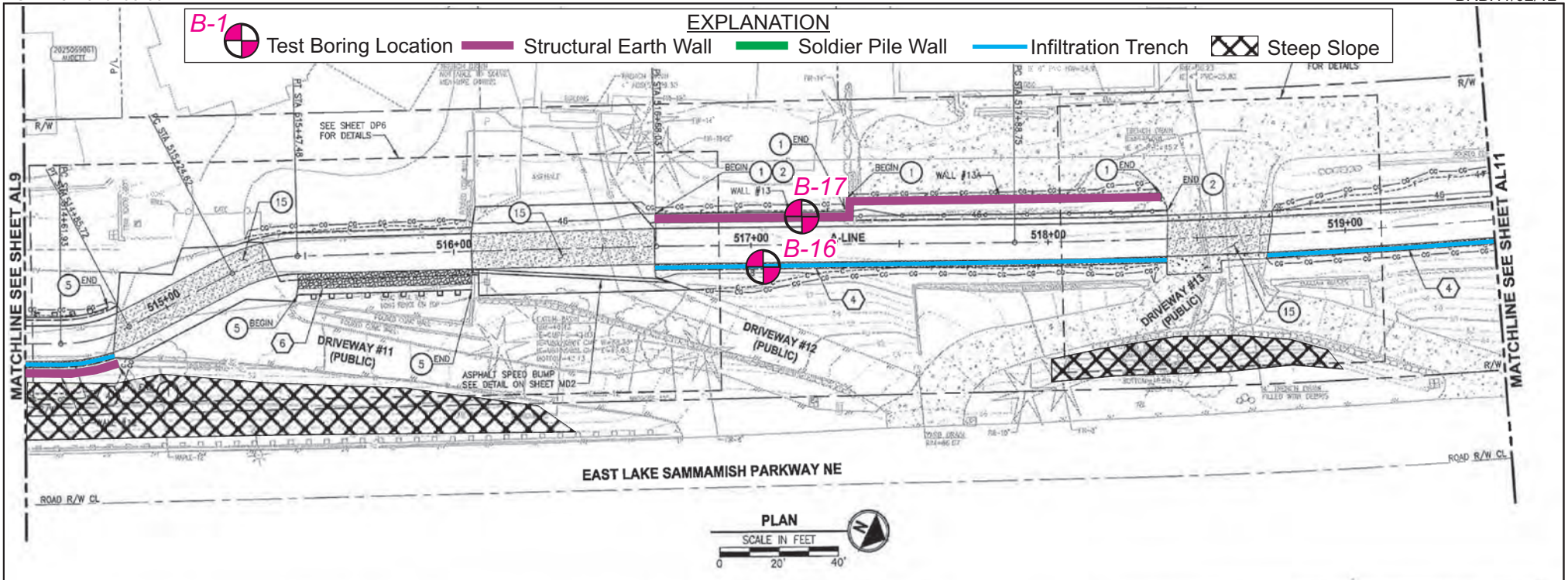


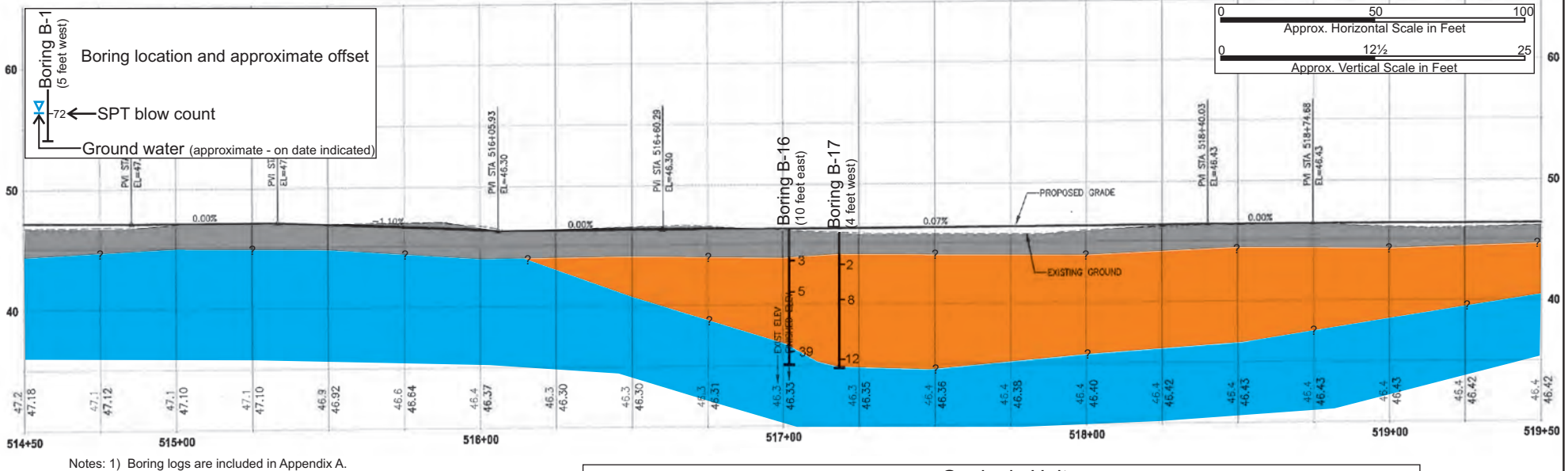
Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

Geologic Units
Fill | Older Alluvium | Glacial Till | Olympia Beds

Icicle Creek Engineers

ELST Plan and Profile - Figure 10



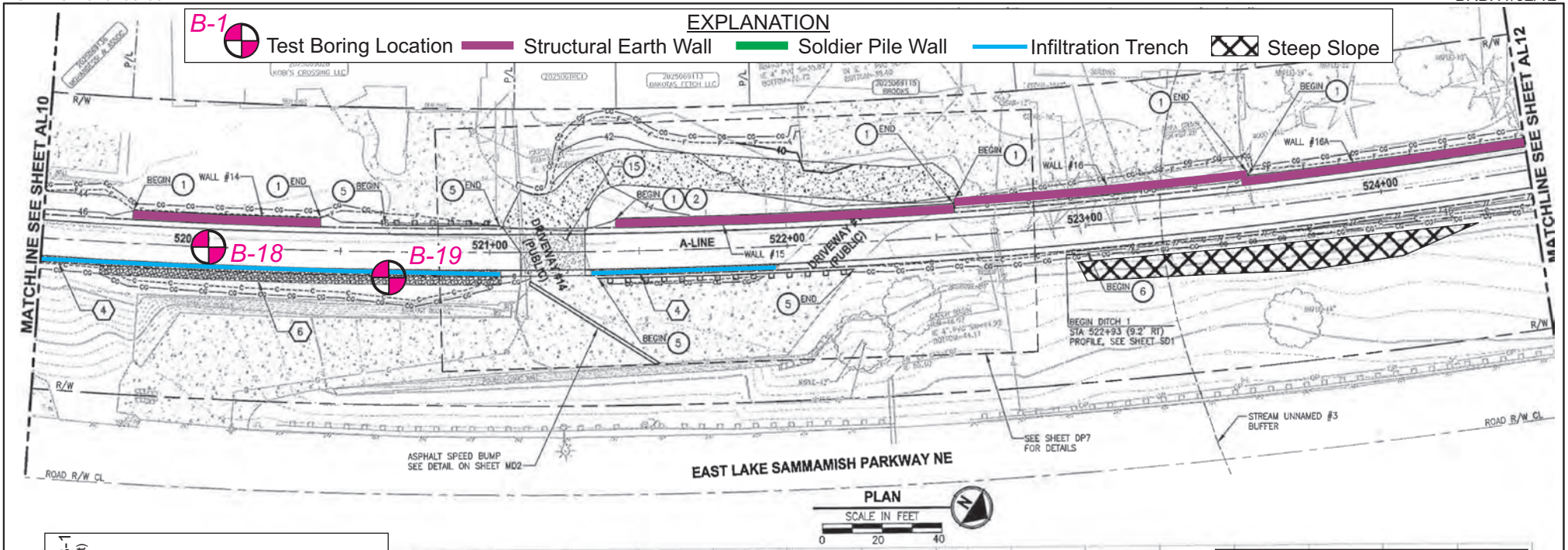


Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

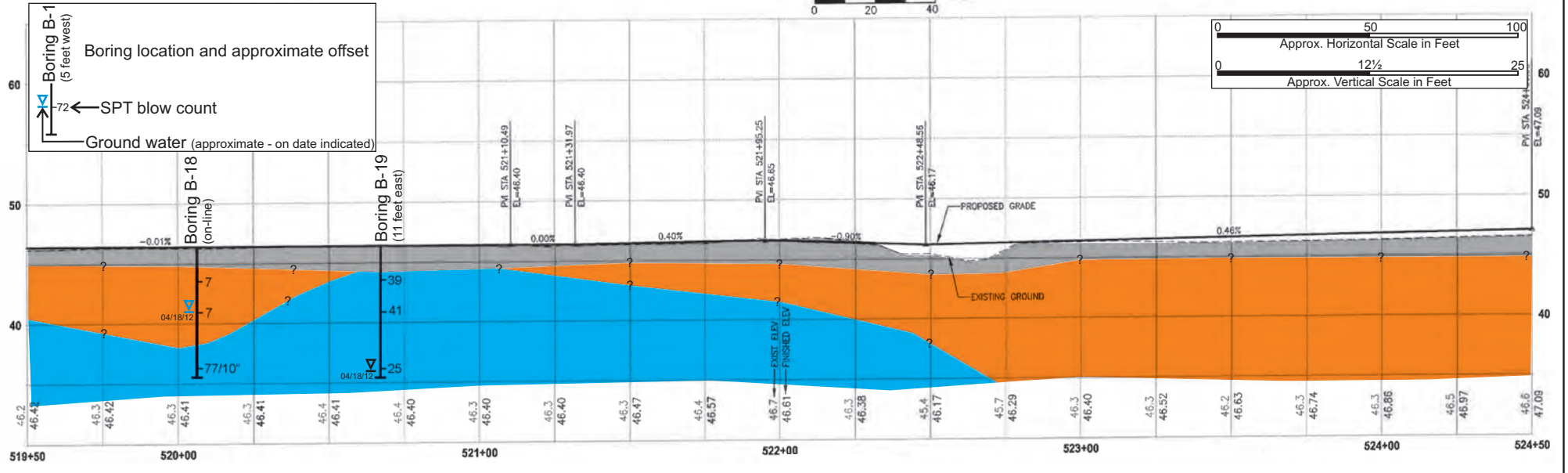
Geologic Units
Fill | Older Alluvium | Glacial Till | Olympia Beds

Icicle Creek Engineers

ELST Plan and Profile - Figure 11



PLAN
SCALE IN FEET
0 20 40

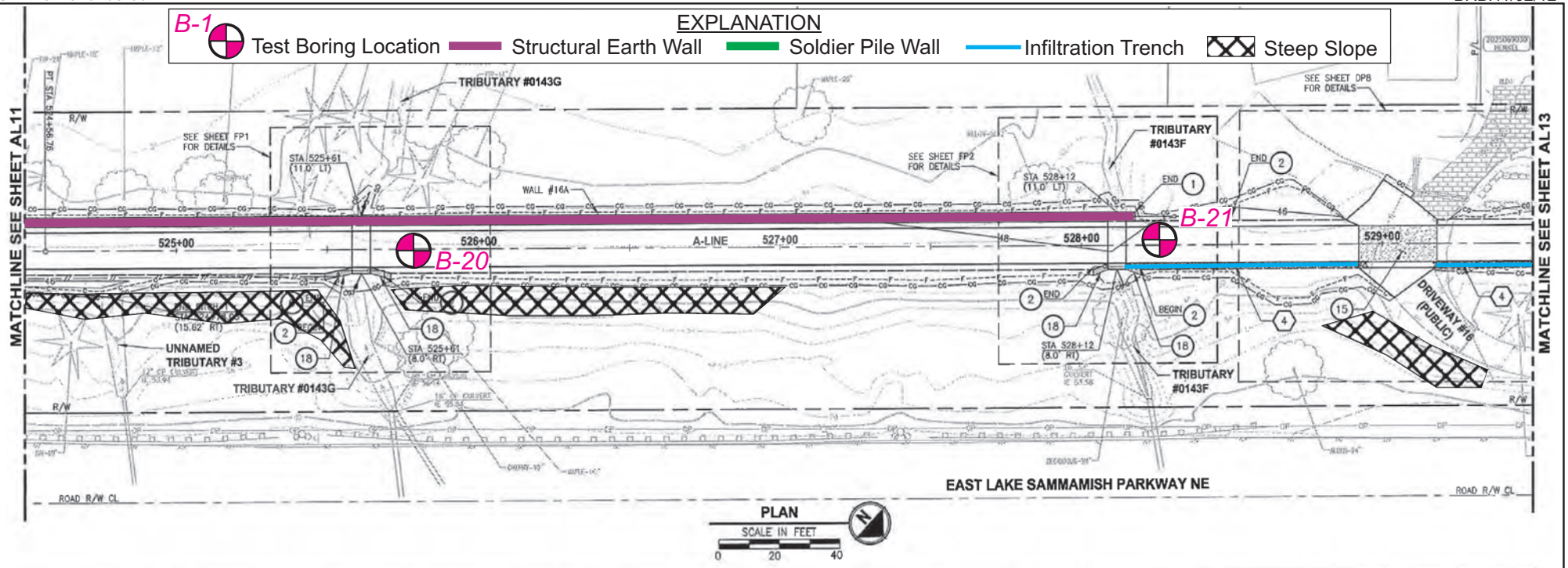


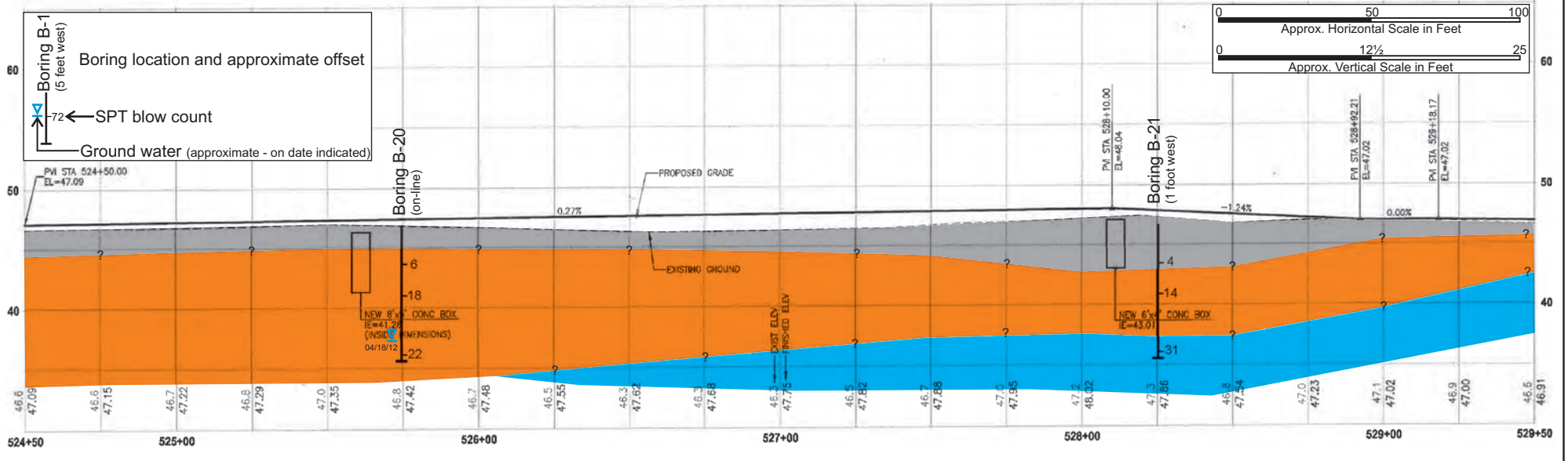
Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

Geologic Units
Fill | Older Alluvium | Glacial Till | Olympia Beds

Icicle Creek Engineers

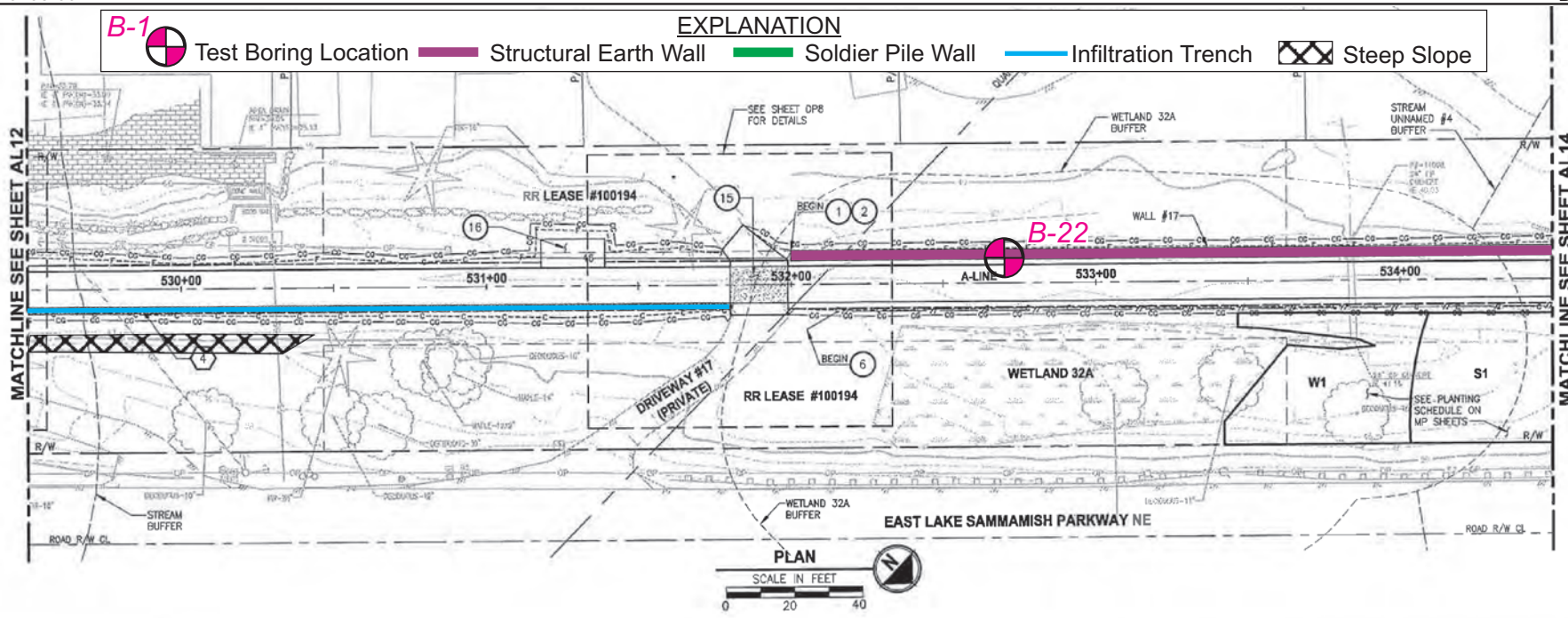
ELST Plan and Profile - Figure 12

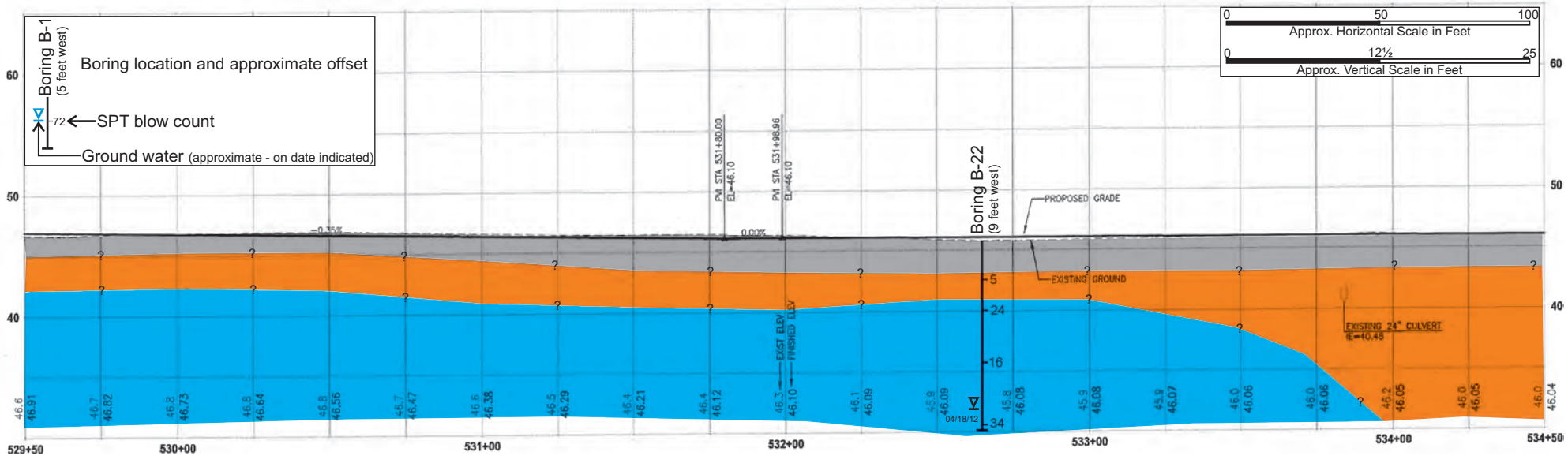




Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

Geologic Units
Fill | Older Alluvium | Glacial Till | Olympia Beds



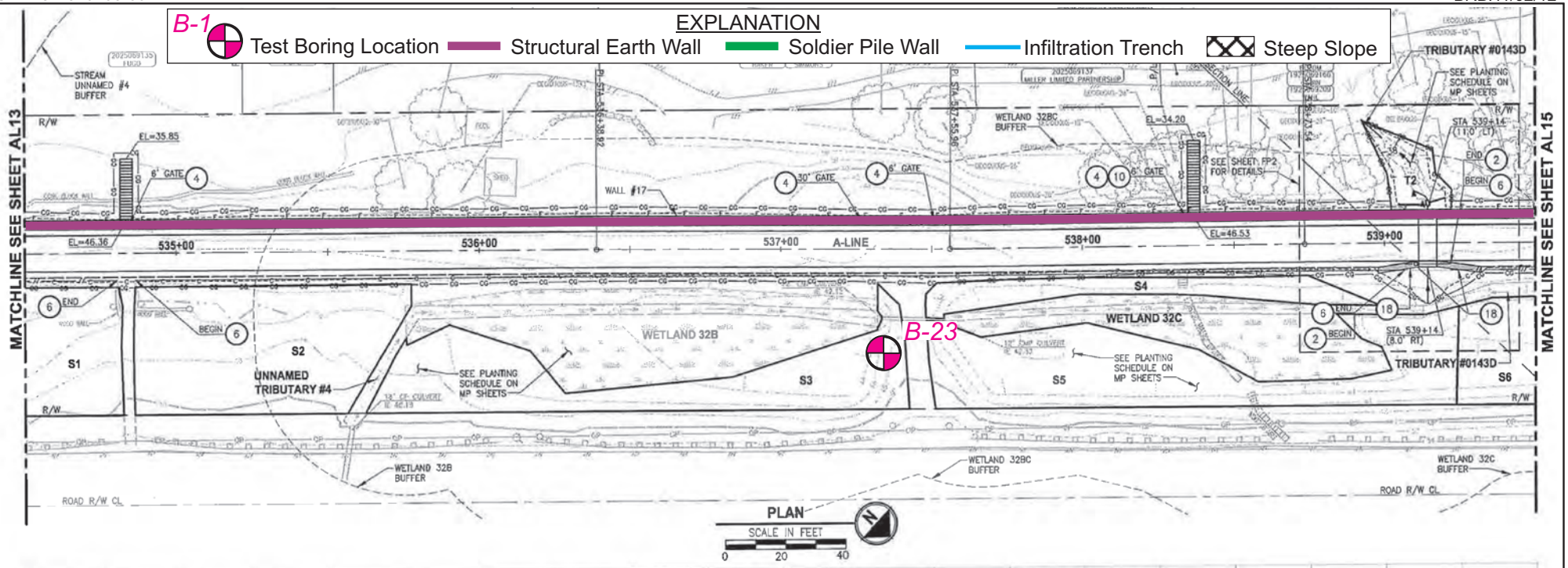


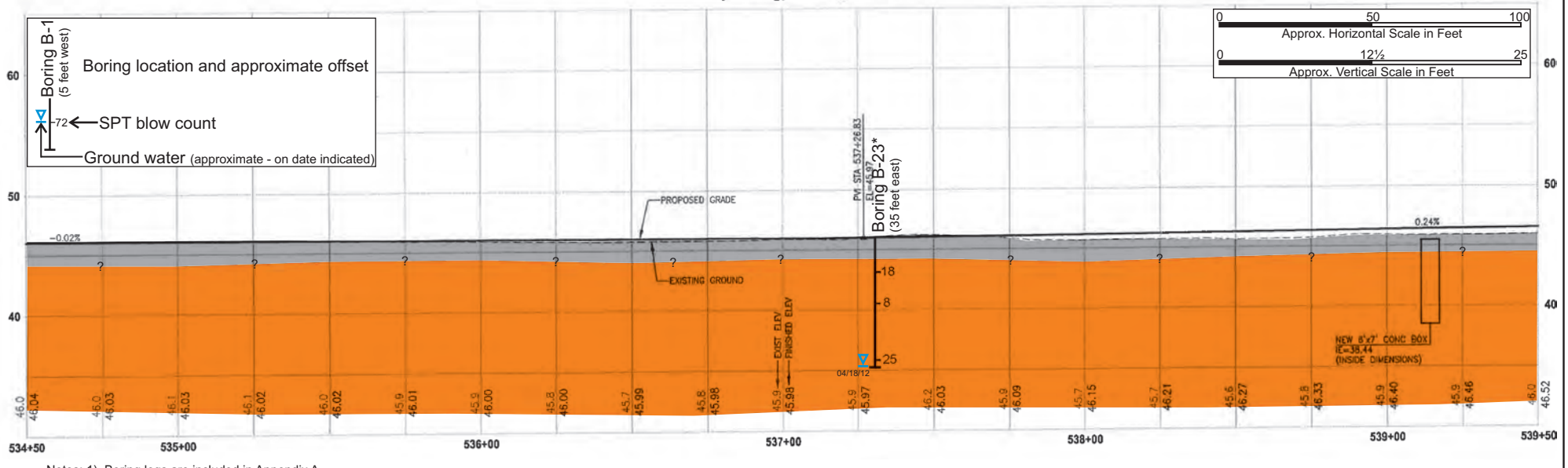
Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

Geologic Units
Fill | Older Alluvium | Glacial Till | Olympia Beds

Icicle Creek Engineers

ELST Plan and Profile - Figure 14



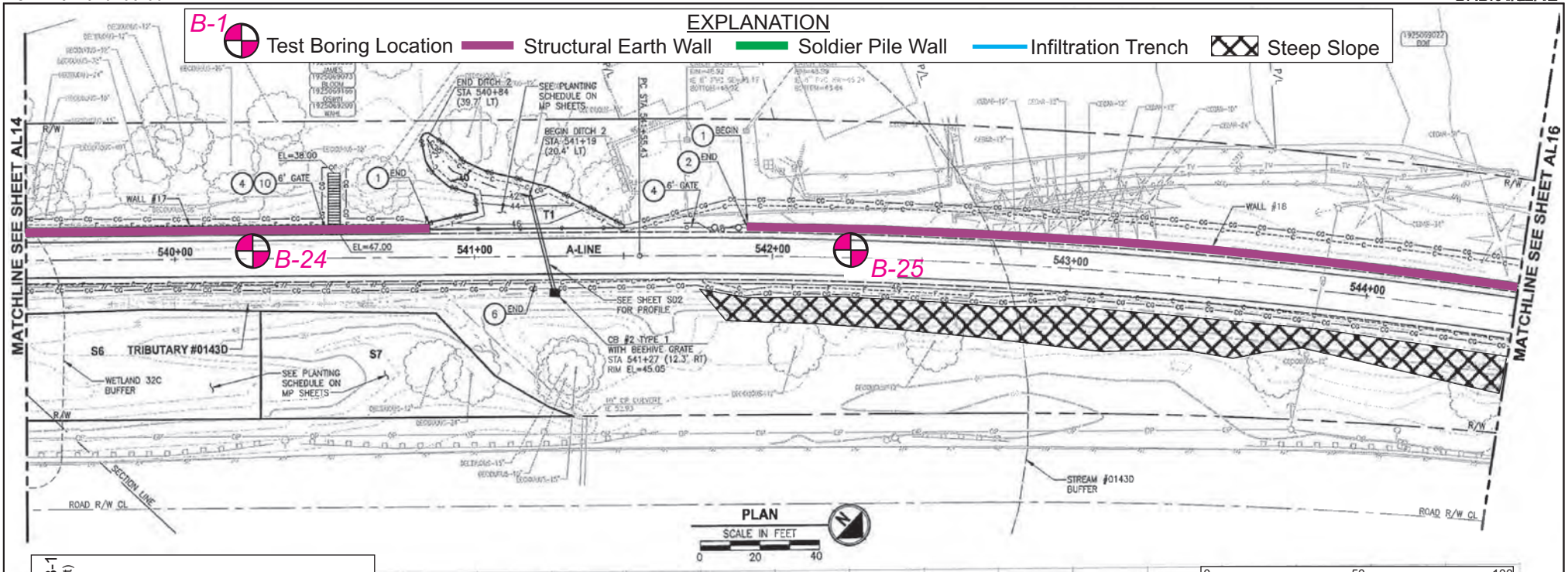


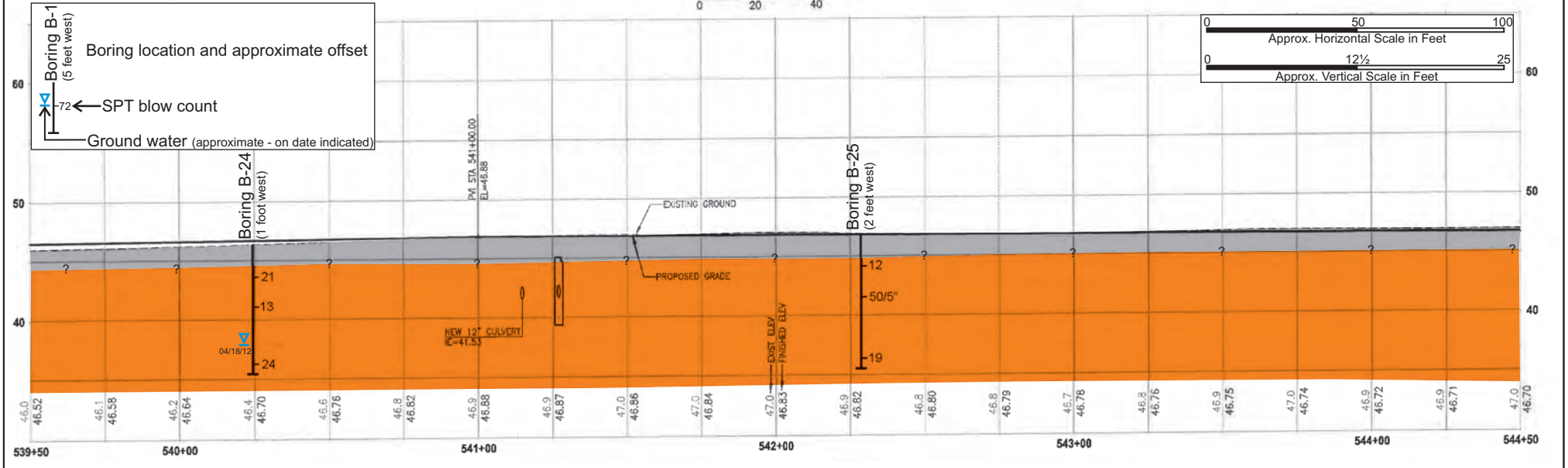
Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.
4) Boring B-23 may not be representative of trail subsurface conditions because of the large offset.

Geologic Units
Fill | Older Alluvium | Glacial Till | Olympia Beds

Icicle Creek Engineers

ELST Plan and Profile - Figure 15



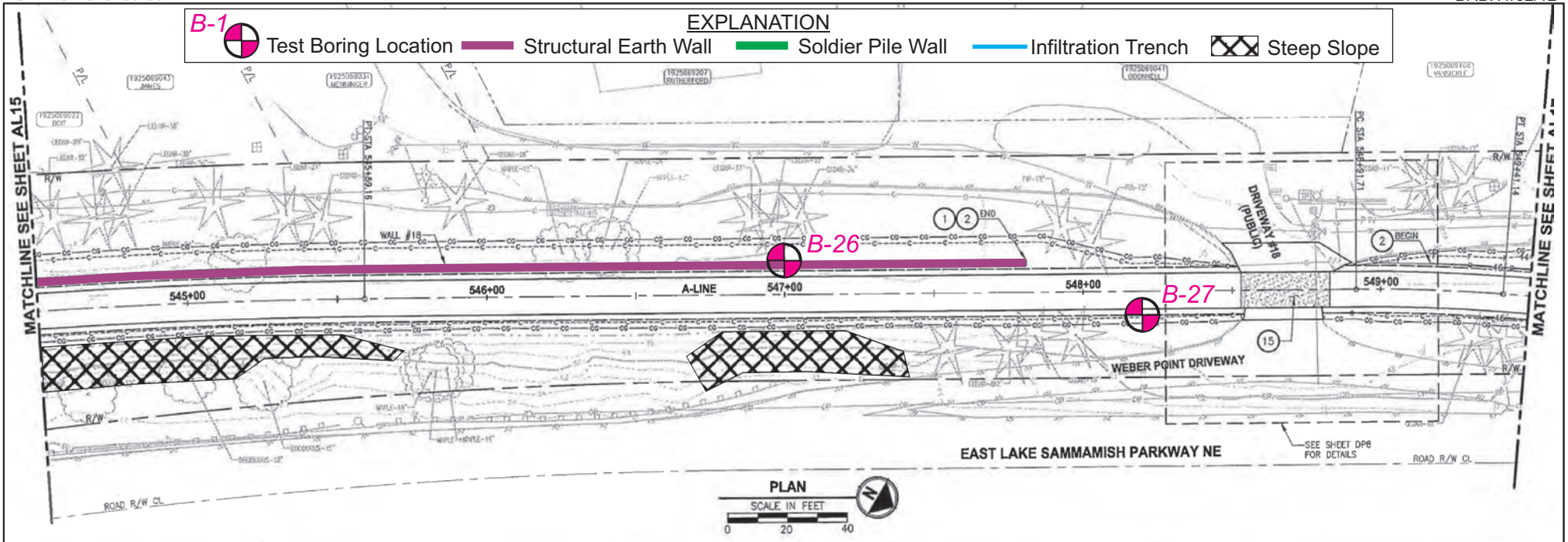


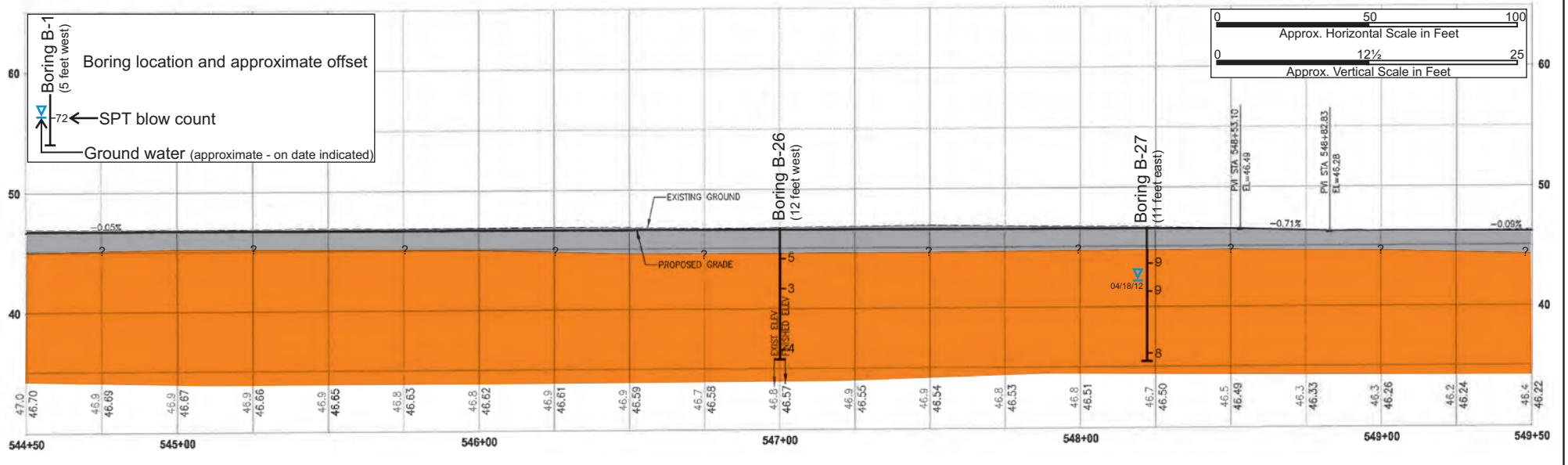
Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

Geologic Units
Fill | Older Alluvium | Glacial Till | Olympia Beds

Icicle Creek Engineers

ELST Plan and Profile - Figure 16



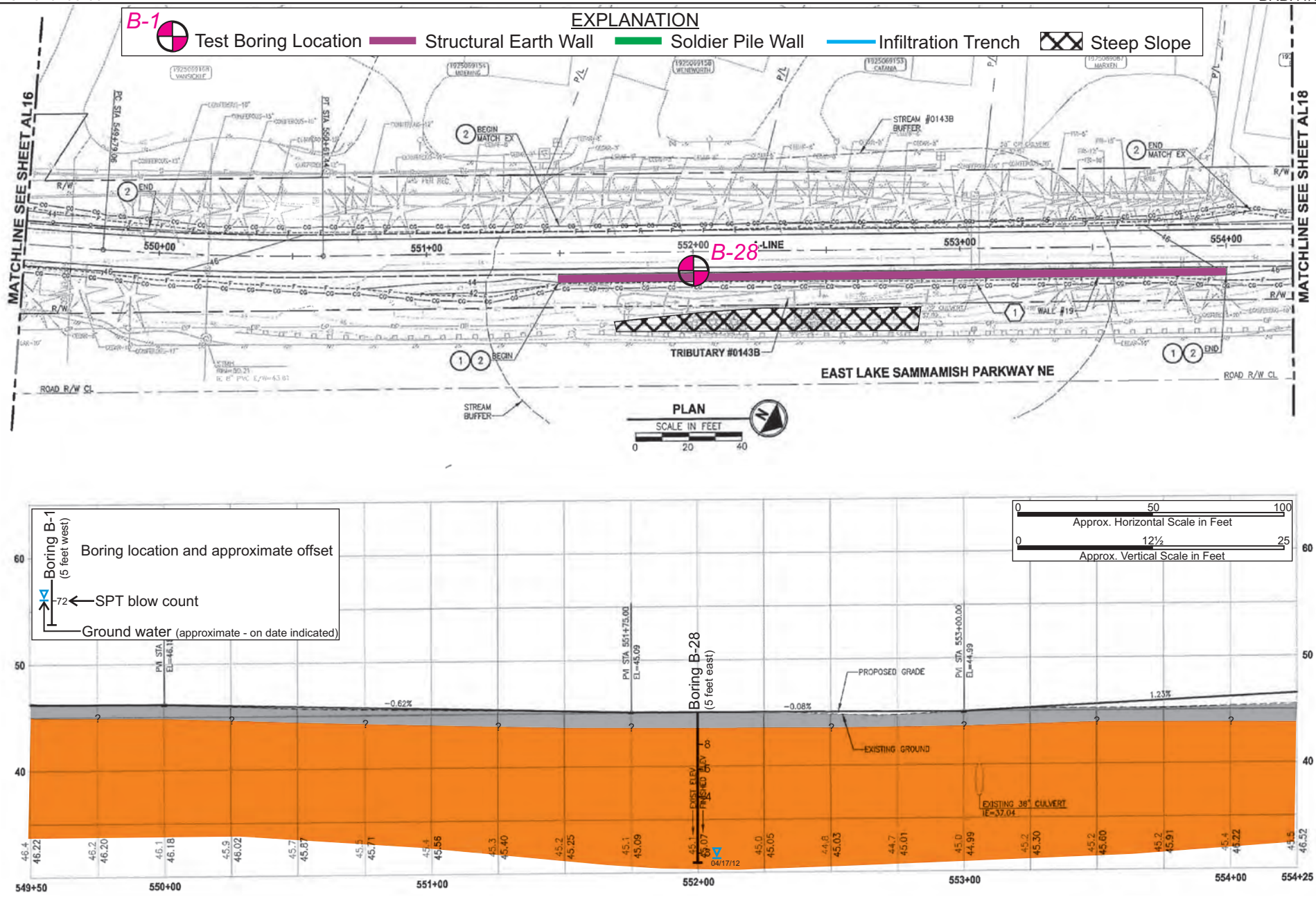


Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

Geologic Units
Fill | Older Alluvium | Glacial Till | Olympia Beds

Icicle Creek Engineers

ELST Plan and Profile - Figure 17

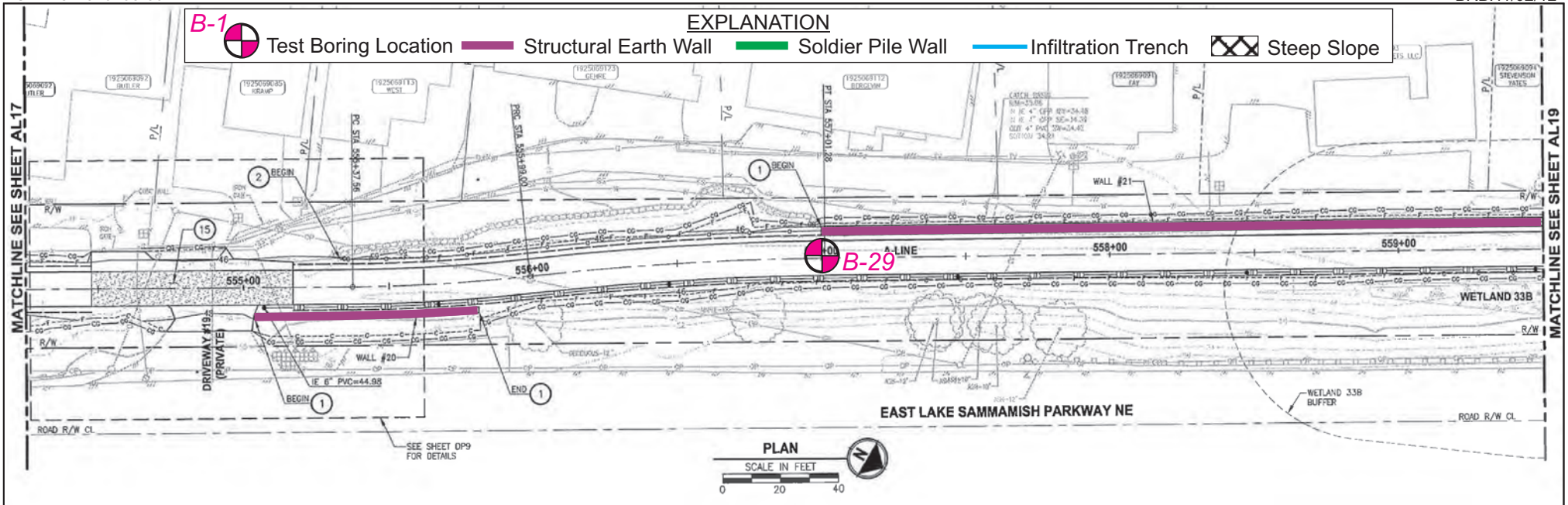


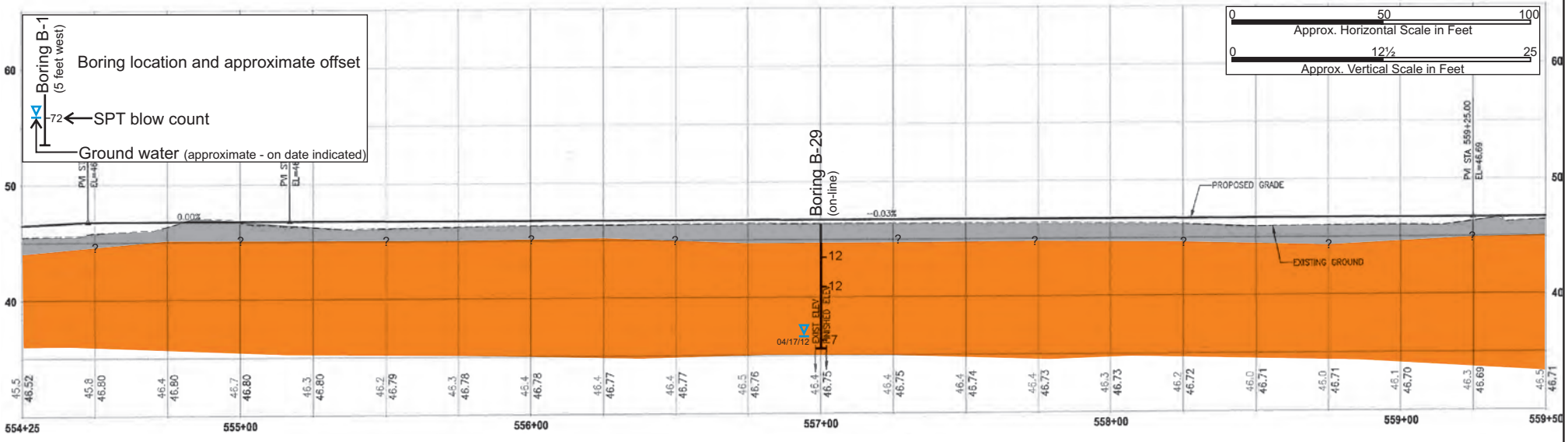
Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

Geologic Units
Fill | Older Alluvium | Glacial Till | Olympia Beds

Icicle Creek Engineers

ELST Plan and Profile - Figure 18



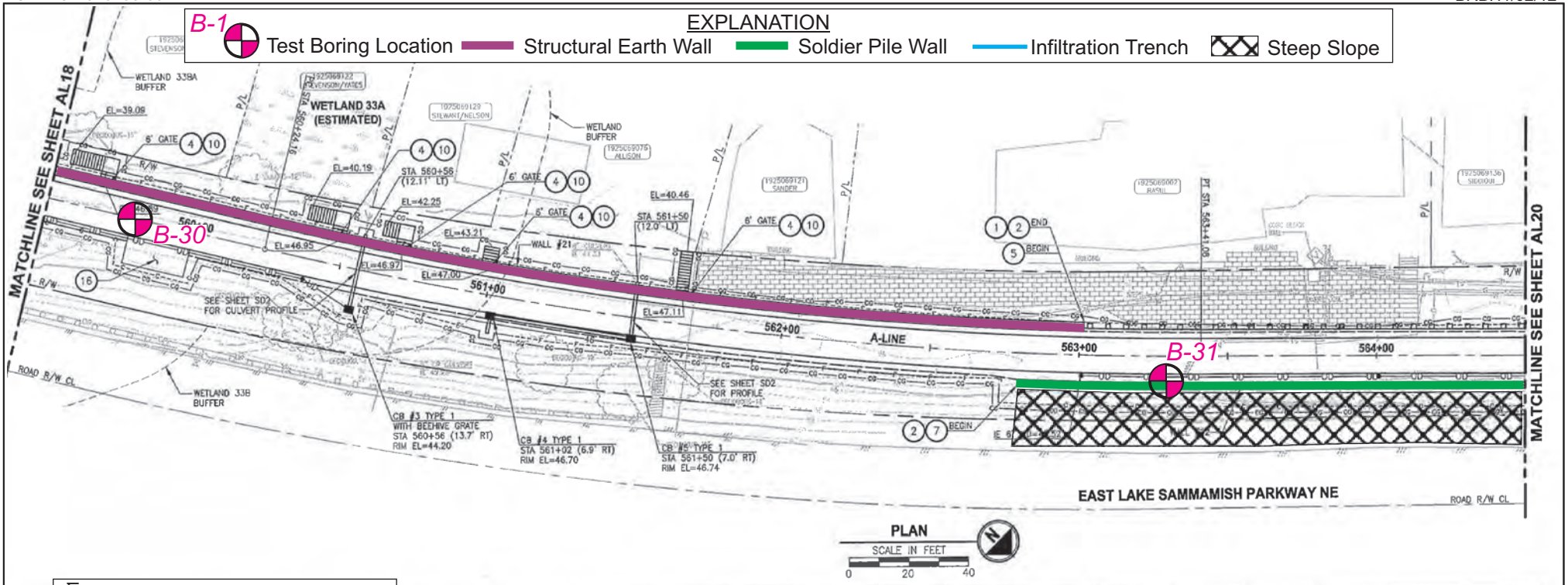


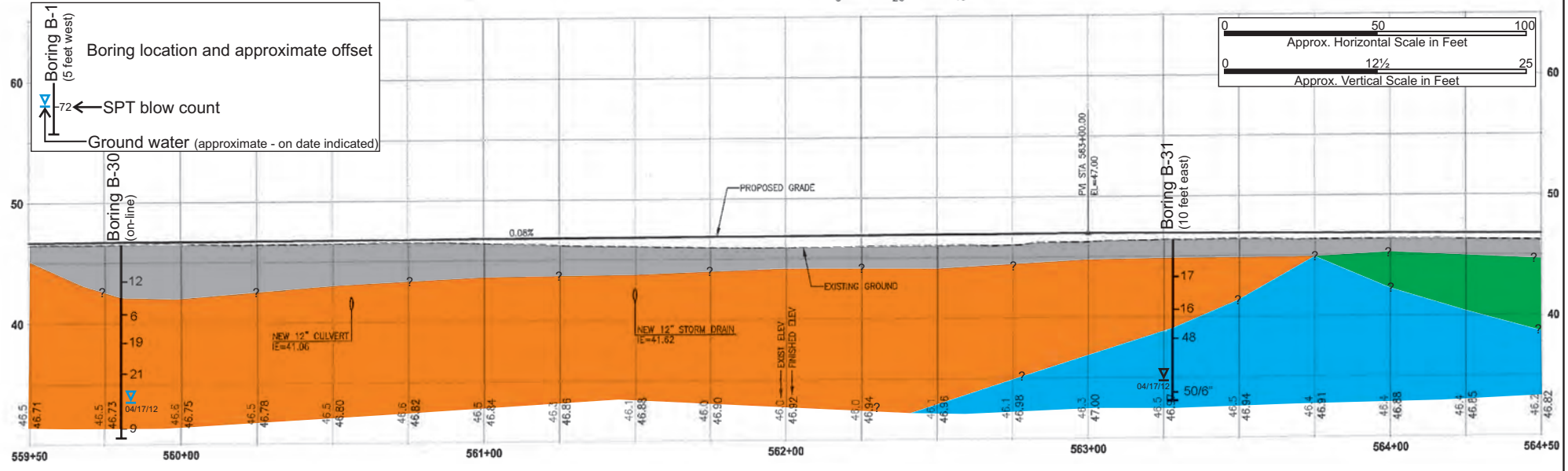
Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

Geologic Units
Fill | Older Alluvium | Glacial Till | Olympia Beds

Icicle Creek Engineers

ELST Plan and Profile - Figure 19



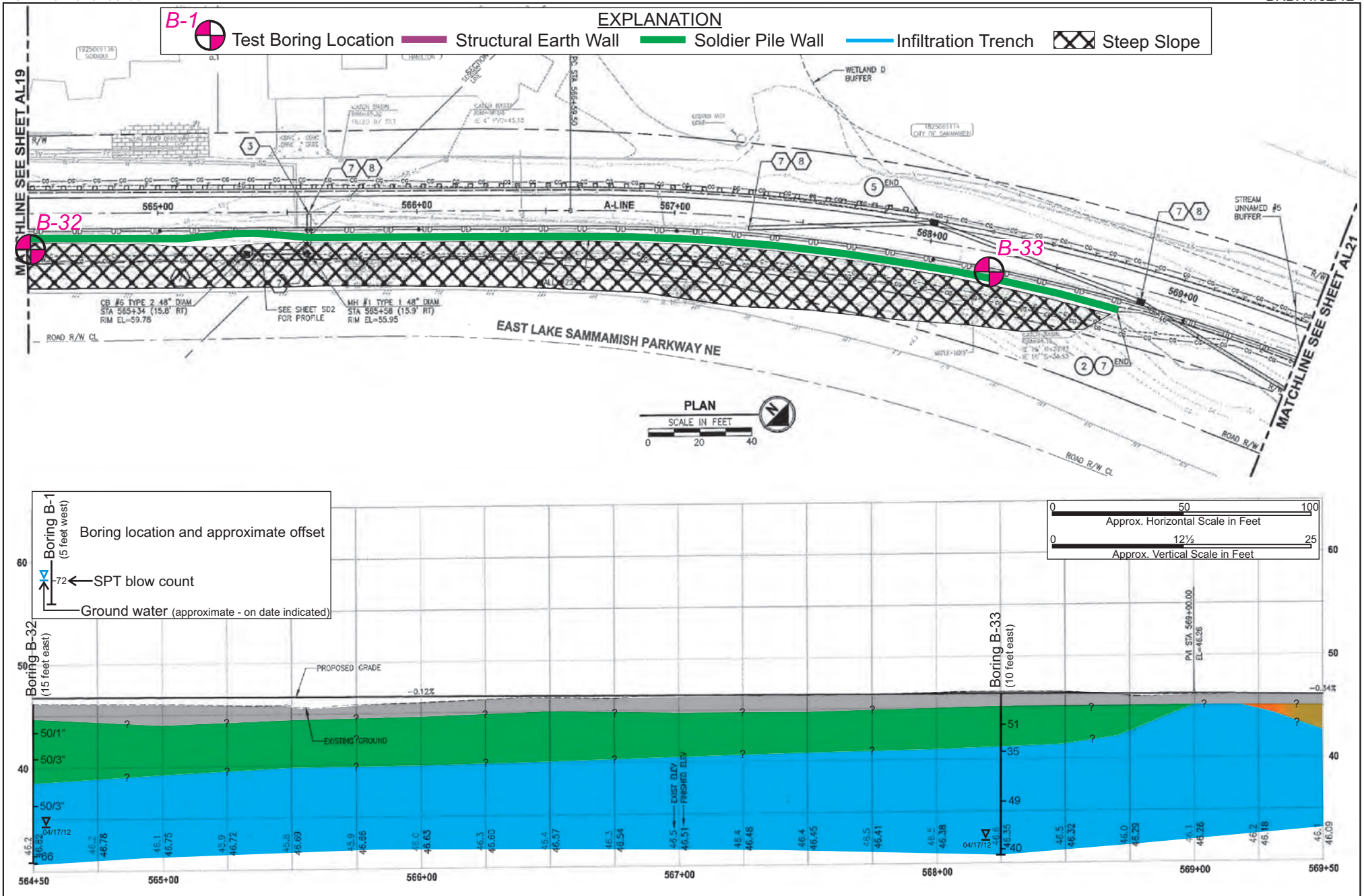


Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

Geologic Units
Fill | Older Alluvium | Glacial Till | Olympia Beds

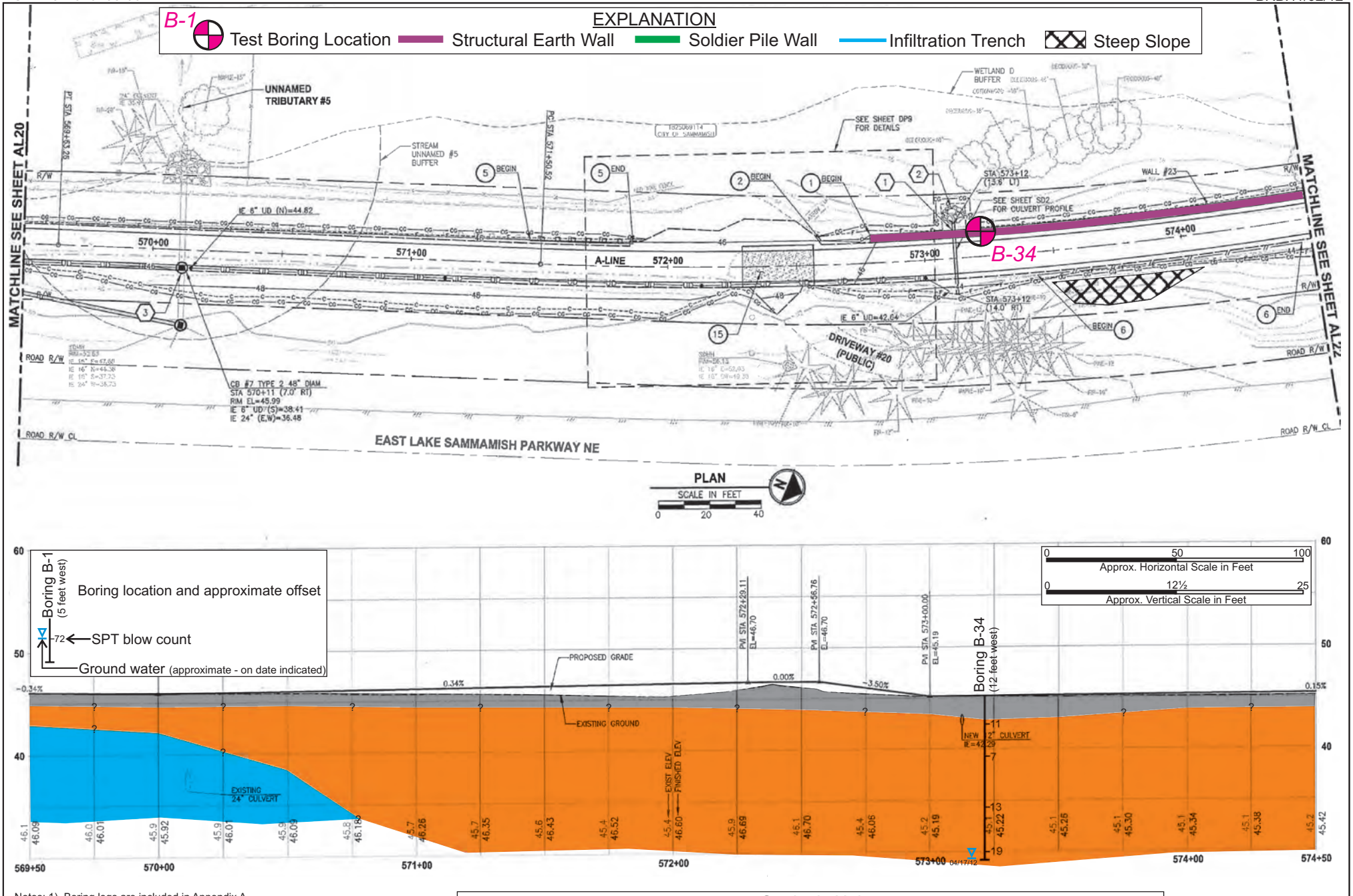
Icicle Creek Engineers

ELST Plan and Profile - Figure 20



Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

Geologic Units
Fill Older Alluvium Glacial Till Olympia Beds

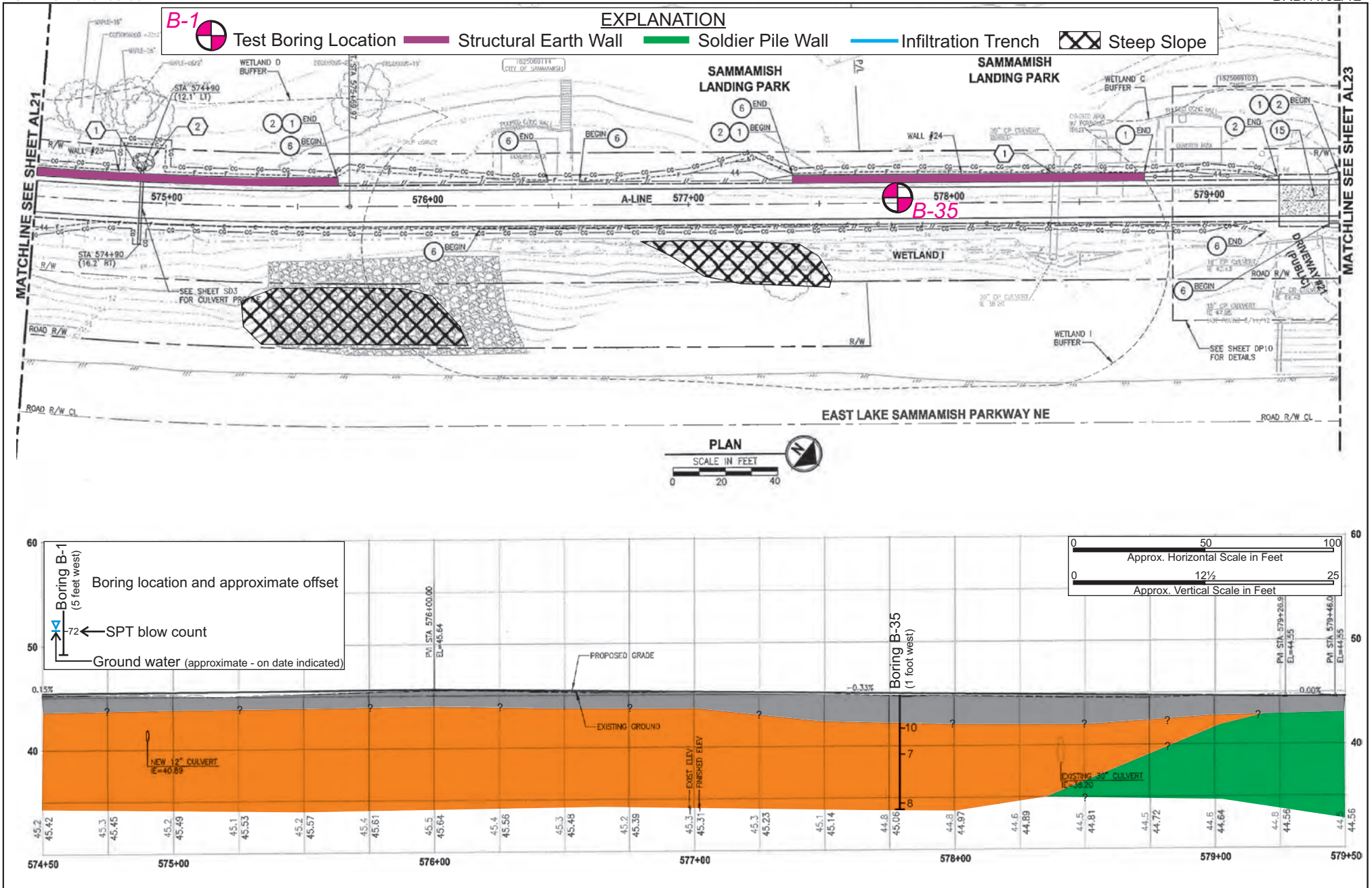


Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

Geologic Units
Fill | Older Alluvium | Glacial Till | Olympia Beds

Icicle Creek Engineers

ELST Plan and Profile - Figure 22

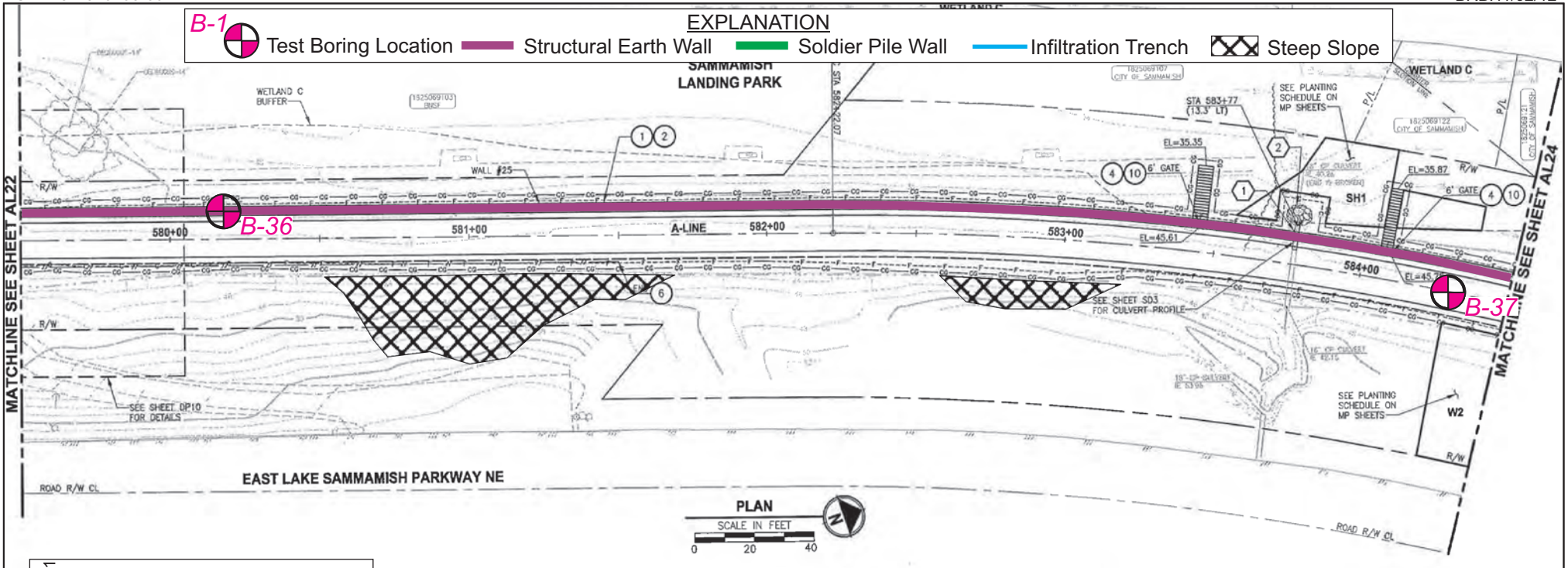


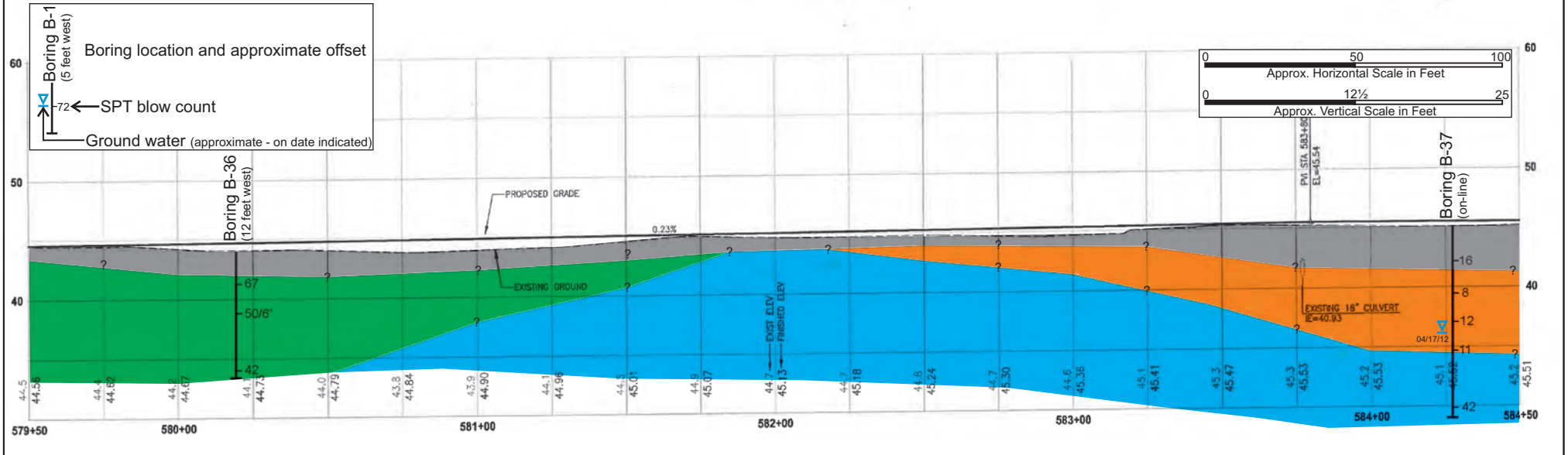
Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

Geologic Units
Fill Older Alluvium Glacial Till Olympia Beds

Icicle Creek Engineers

ELST Plan and Profile - Figure 23



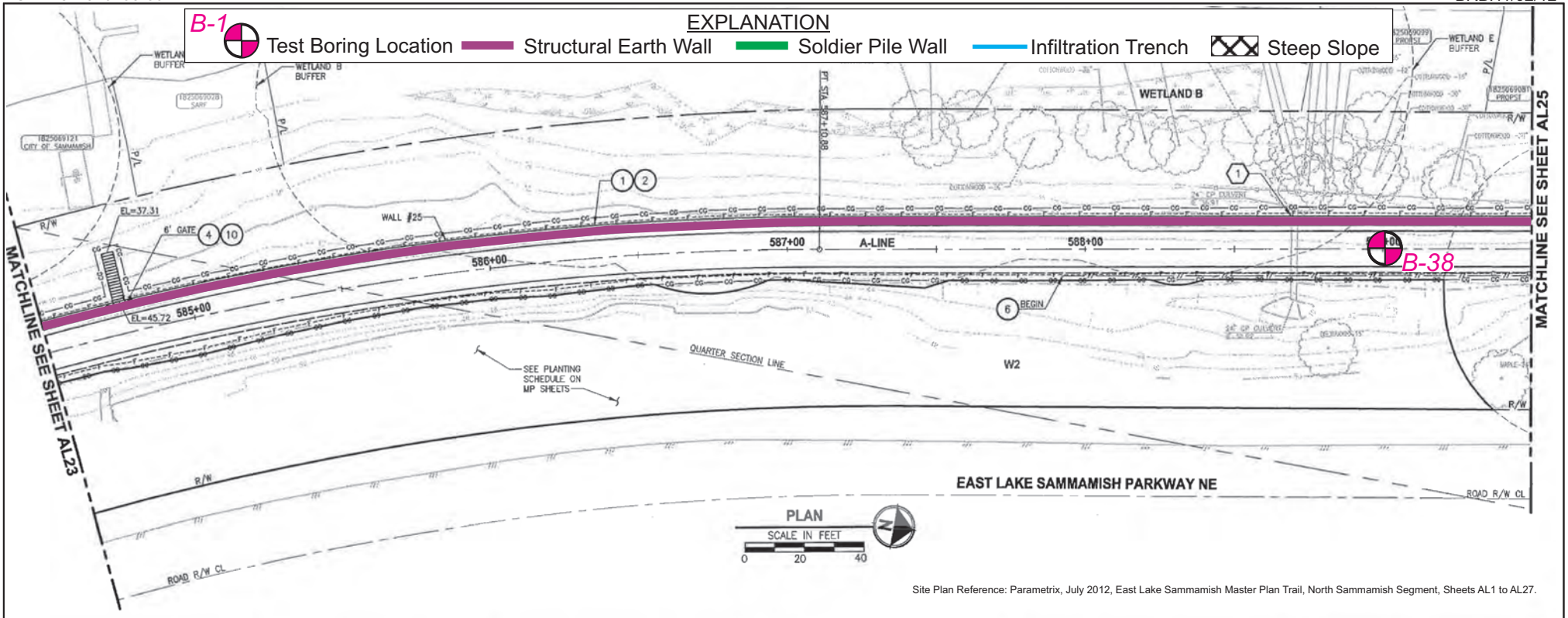


Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

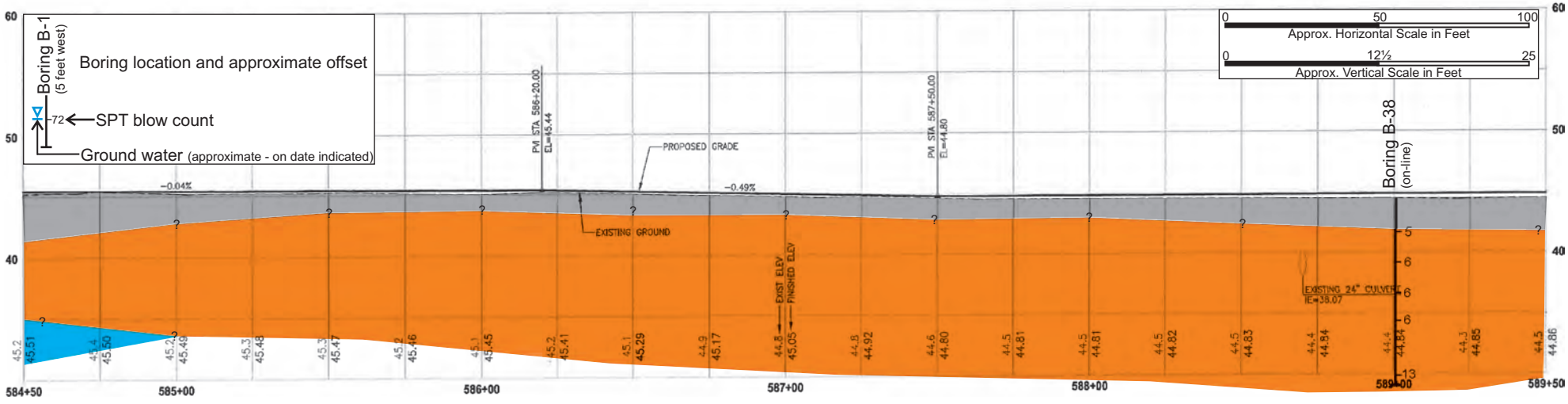
Geologic Units
Fill | Older Alluvium | Glacial Till | Olympia Beds

Icicle Creek Engineers

ELST Plan and Profile - Figure 24



Site Plan Reference: Parametrix, July 2012, East Lake Sammamish Master Plan Trail, North Sammamish Segment, Sheets AL1 to AL27.

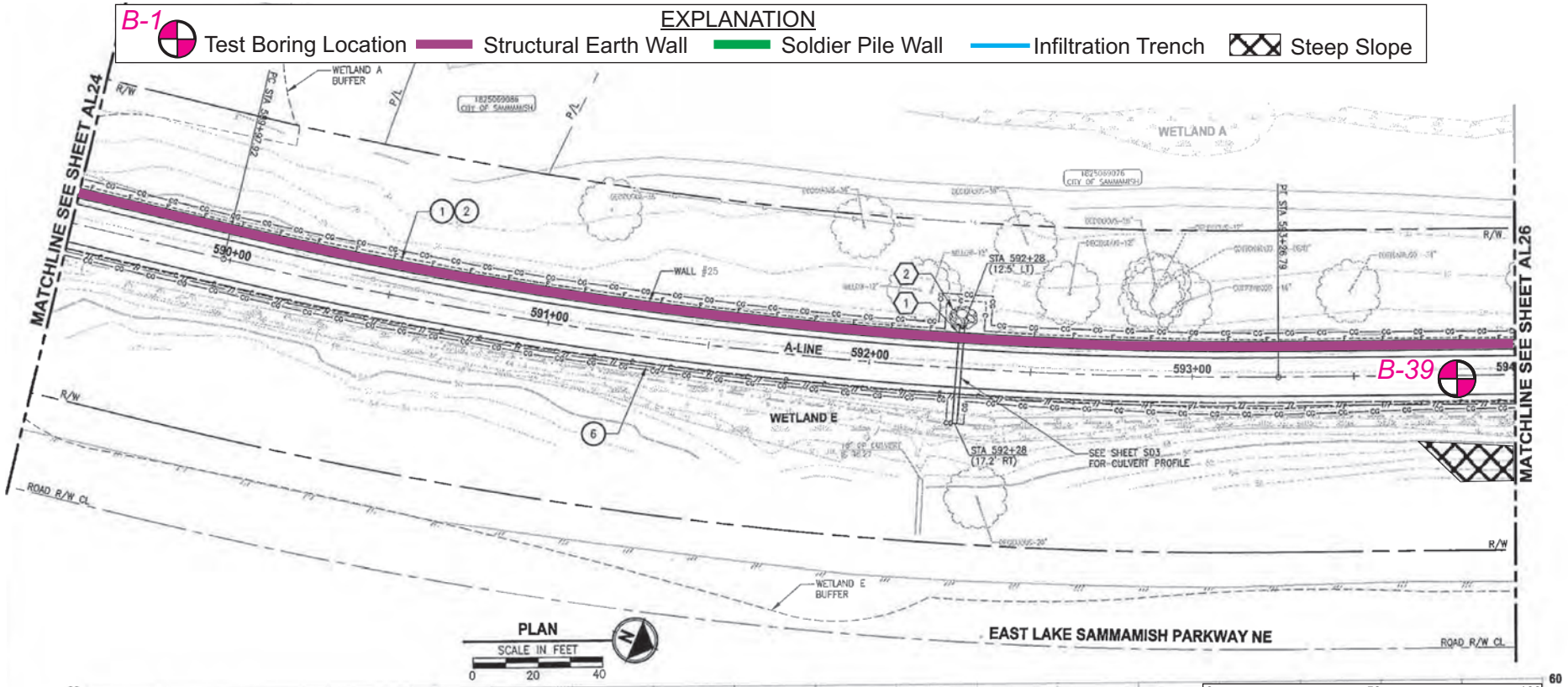


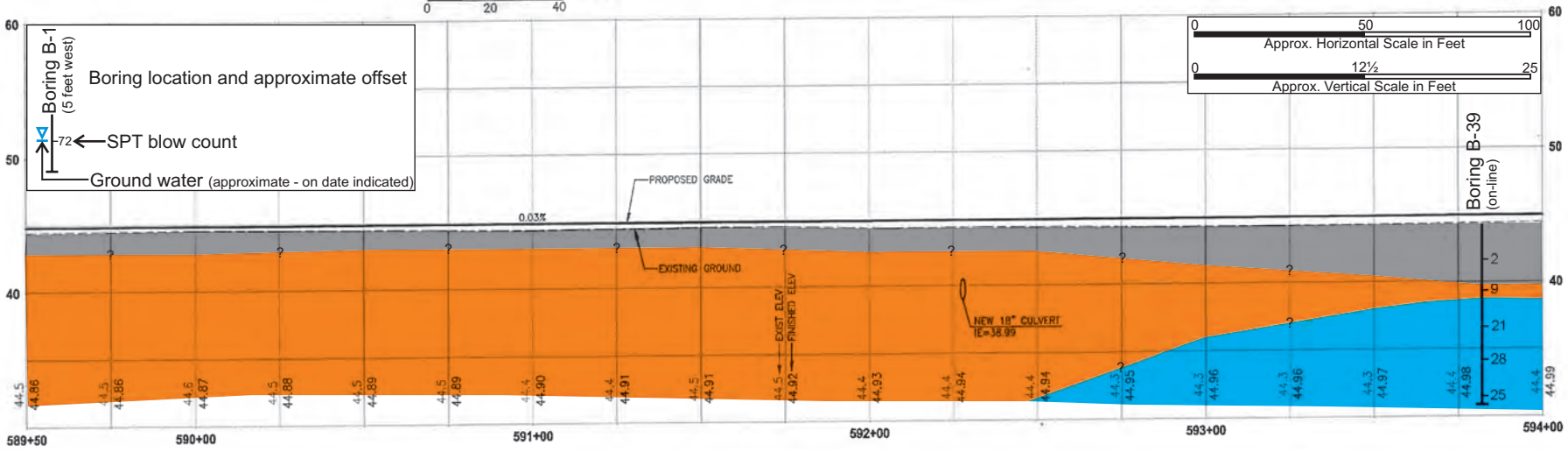
Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

Geologic Units
Fill | Older Alluvium | Glacial Till | Olympia Beds

Icicle Creek Engineers

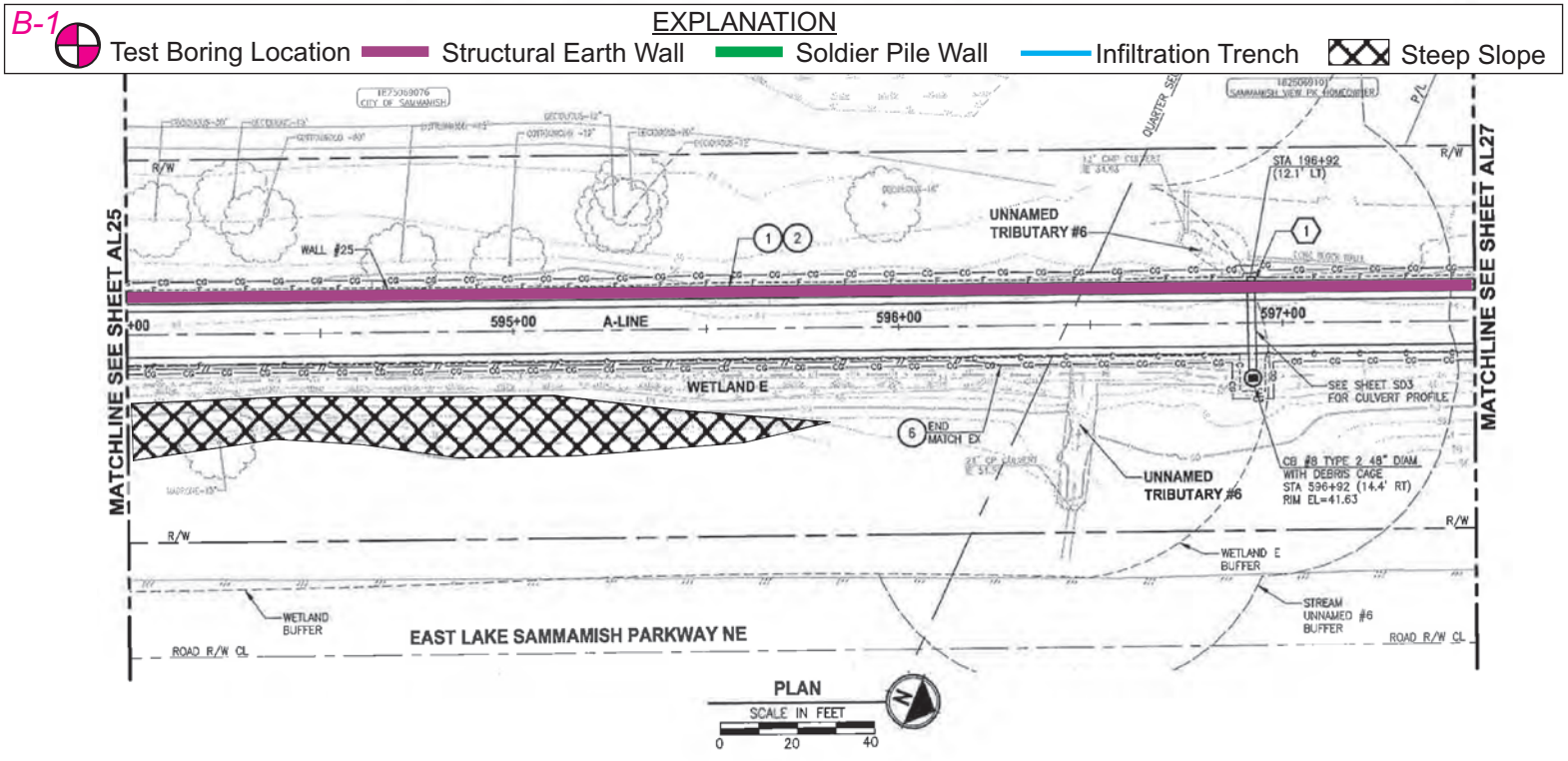
ELST Plan and Profile - Figure 25

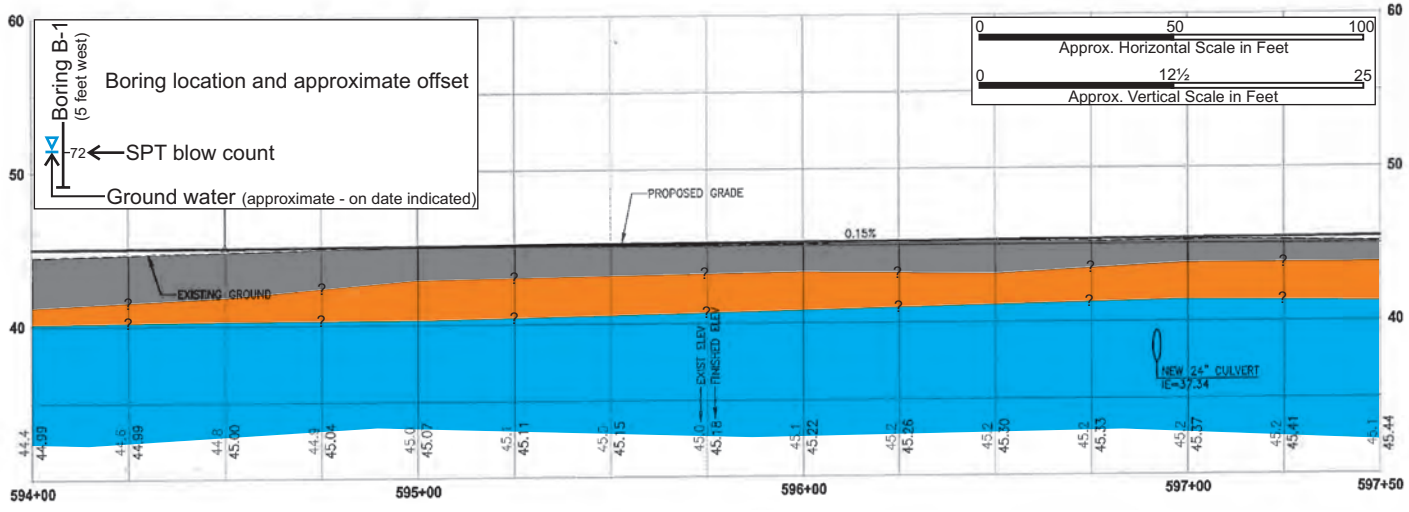




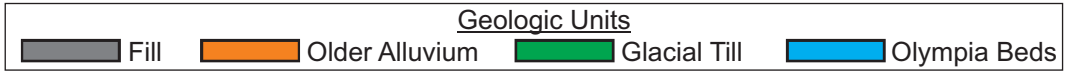
Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

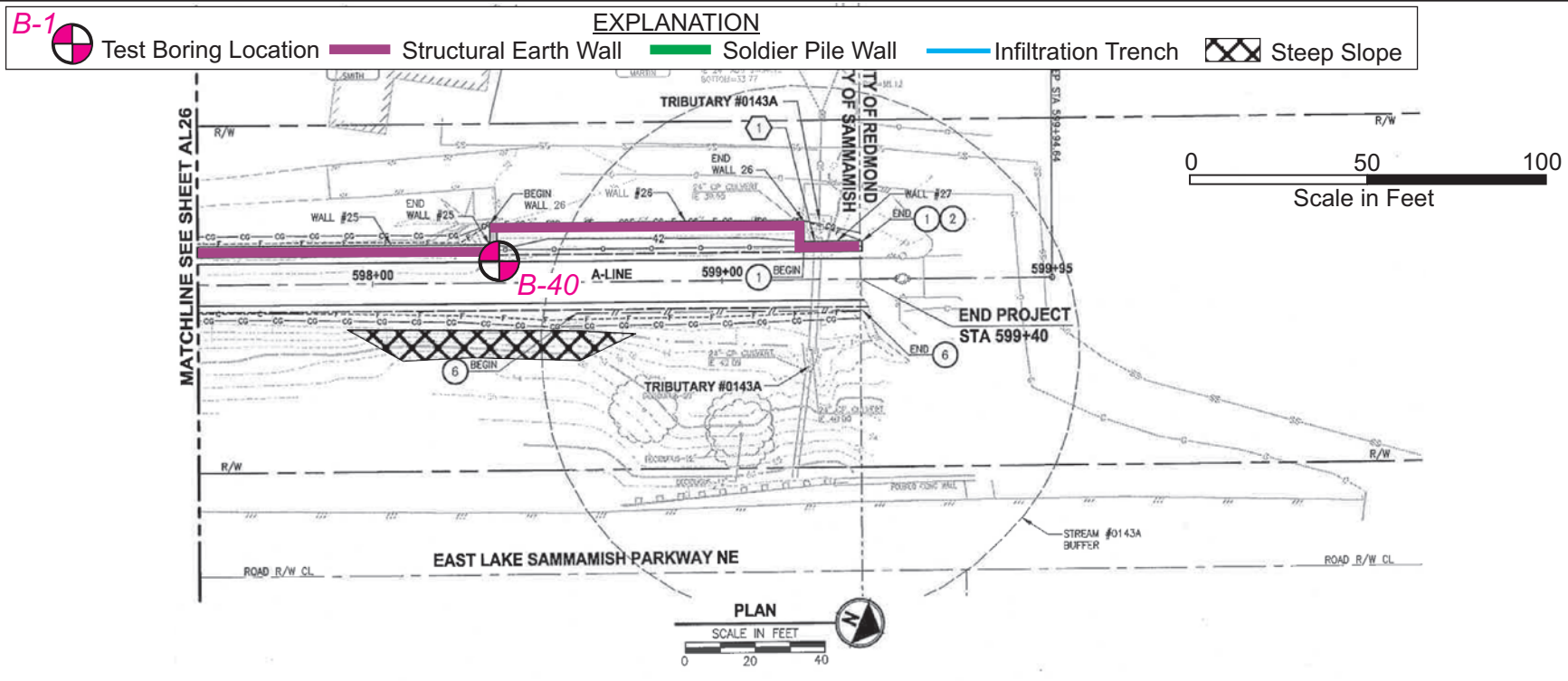
Geologic Units
Fill
Older Alluvium
Glacial Till
Olympia Beds

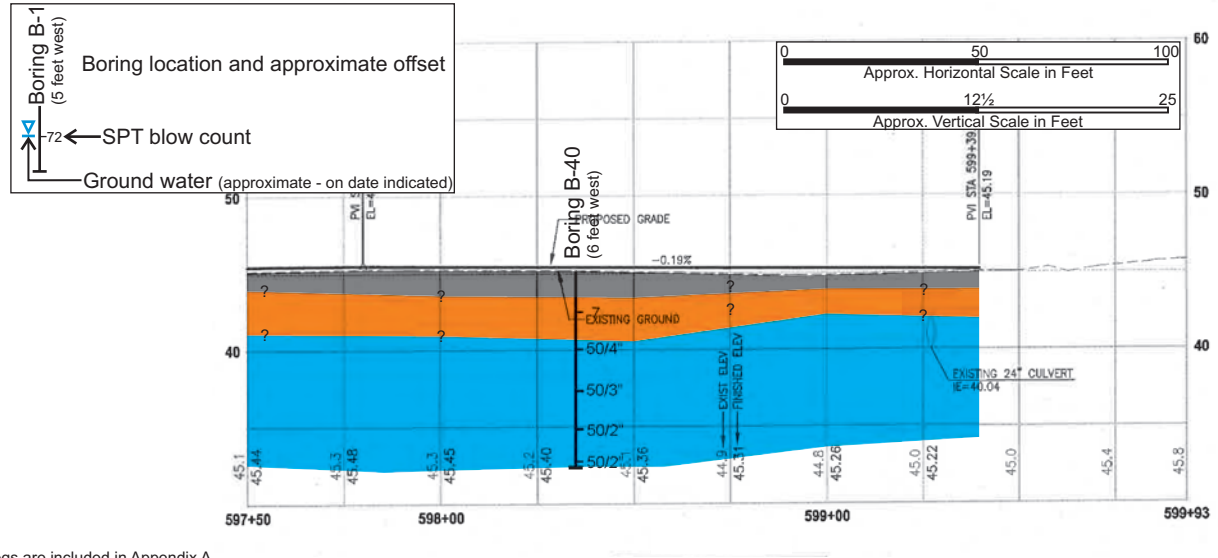




Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.





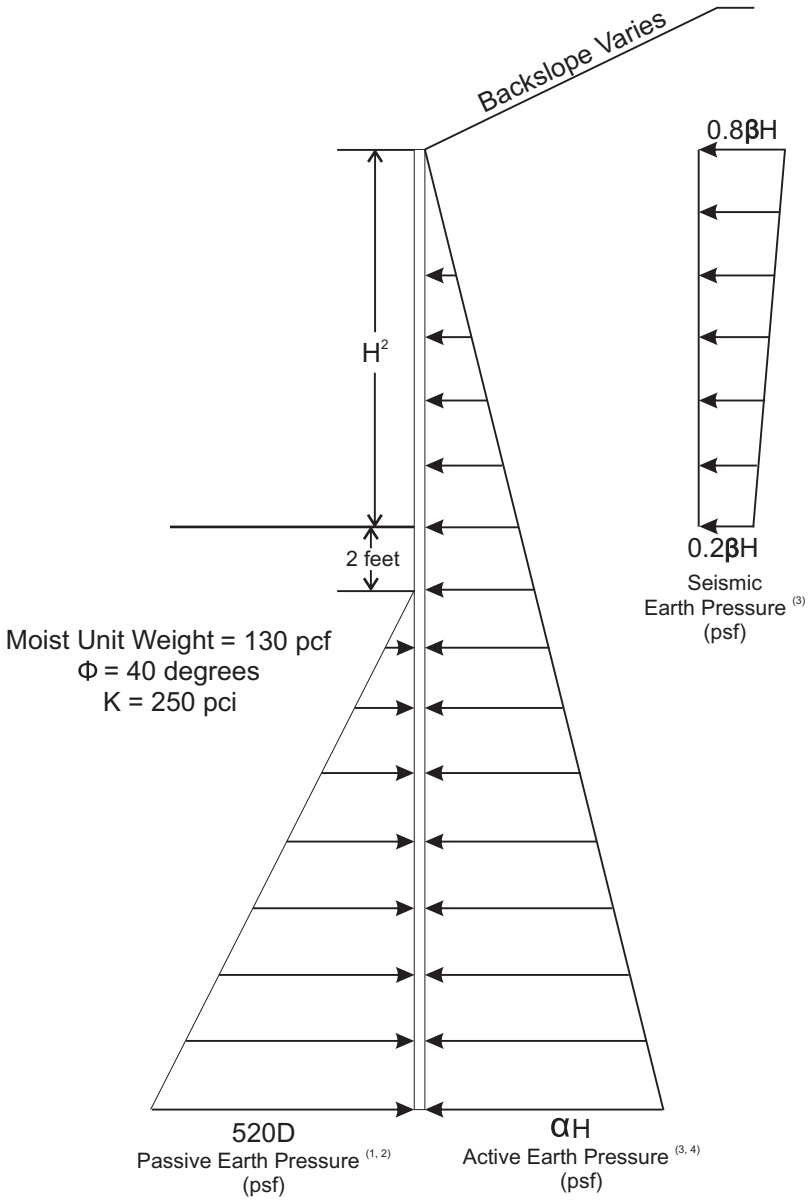


Notes: 1) Boring logs are included in Appendix A.
2) Subsurface conditions shown are along trail centerline and are based on widely-spaced explorations. Actual subsurface conditions may vary significantly.
3) "?" indicates inferred geologic contact.

Geologic Units
Fill | Older Alluvium | Glacial Till | Olympia Beds

Icicle Creek Engineers

ELST Plan and Profile - Figure 28



Backslope Condition	α	β
Level	35	18
5H:1V	40	20
2H:1V	52	26
1.5H:1V	77	38

(H:V - horizontal to vertical)

Limit State	Passive Resistance Factor
Strength	0.75
Service	1.0
Extreme	1.0

NOTES
1) Passive earth pressure shown in an ultimate (unfactored) value and should be applied over 2½ times the soldier pile diameter using the appropriate resistance factor.
2) Passive earth pressure and wall height should start 2 feet below the ground surface. No ground water is assumed.
3) Active and seismic earth pressures act over the pile spacing above the base of the wall.
4) Active earth pressures act over one pile diameter below the base of the wall.

psf = pounds per square foot; pcf = pounds per cubic foot; pci = pounds per cubic inch

Soldier Pile Wall
Earth Pressure Diagram - Figure 29

APPENDIX A

FIELD EXPLORATION PROGRAM

APPENDIX A

A.0 FIELD EXPLORATION PROGRAM

A.1 GEOLOGICAL RECONNAISSANCE

ICE completed geological reconnaissance on April 17, 18 and 19, and May 2 and 4, 2012. The reconnaissance and mapping, completed by Brian Beaman, PE, LEG, LHG and Jeff Schwartz, LEG, included the following:

- Observation and preliminary evaluation of man-made features including road and trail embankments (cuts and fills), ditchlines, oversteepened areas and overall existing trail conditions.
- Shallow explorations using a soil probe (½-inch diameter steel rod) in retaining wall areas to evaluate the thickness of Topsoil and Colluvium.
- Reconnaissance and mapping included photograph documentation of the existing trail conditions and test boring locations.

A.2 TEST BORINGS

Subsurface conditions along the North Sammamish Segment were explored by drilling 40 test borings (Borings B-1 through B-40) to depths of about 9 to 16½ feet. The test borings were drilled on April 17 through 19, 2012 using track-mounted, hollow-stem auger drilling equipment owned and operated by Bortec, Inc. of Valleyford, Washington. The locations of the test borings are shown on Figures 2 through 28.

The explorations were continuously observed by a geologist from ICE who classified the soils, obtained representative soil samples, observed ground water conditions and prepared a detailed log of each exploration. Ground water observations as noted on the boring logs are based on our observations of the soil samples and drilling equipment, or by direct measurement through the auger using an electric water level indicator. After completion, the test borings were backfilled in general accordance with Washington State Department of Ecology guidelines.

The soil consistencies noted on the test boring logs are based on the conditions observed, our experience and judgement, and blow count data obtained during drilling. Representative samples were obtained from the test borings by collecting soil samples at 2½- or 5-foot depth intervals using a 1.5-inch inside diameter split barrel (SPT – Standard Penetration Test) sampler. The sampler was driven 18 inches, if possible, by a 140-pound weight falling a minimum vertical distance of 30 inches. The number of blows required to drive the sampler the last 12 inches, or other indicated distance, was recorded on the boring log.

Soils encountered were classified in general accordance with the classification system described in Figure A-1. The boring logs are presented in Figures A-2 through A-41.

The boring logs are based on our interpretation of the field and laboratory data and indicate the various types of soil encountered. They also indicate the depths at which the soil characteristics change, although the change might actually be gradual. If the change occurred between samples in the boring, it was interpreted.

Elevations of the test borings as shown on the boring logs are based on plans and profiles provided by Parametrix (NAVD88 vertical datum, Parametrix, July 2012, sheets AL1 to AL27).

Unified Soil Classification System

MAJOR DIVISIONS			Soil Classification and Generalized Group Description	
Coarse-Grained Soils	GRAVEL More than 50% of coarse fraction retained on the No. 4 sieve	CLEAN GRAVEL	GW	Well-graded gravels
			GP	Poorly-graded gravels
		GRAVEL WITH FINES	GM	Gravel and silt mixtures
			GC	Gravel and clay mixtures
	SAND More than 50% of coarse fraction passes the No. 4 sieve	CLEAN SAND	SW	Well-graded sand
			SP	Poorly-graded sand
More than 50% retained on the No. 200 sieve		SAND WITH FINES	SM	Sand and silt mixtures
			SC	Sand and clay mixtures
Fine-Grained Soils	SILT AND CLAY Liquid Limit less than 50	INORGANIC	ML	Low-plasticity silts
			CL	Low-plasticity clays
		ORGANIC	OL	Low plasicity organic silts and organic clays
	SILT AND CLAY Liquid Limit greater than 50	INORGANIC	MH	High-plasticity silts
			CH	High-plasticity clays
More than 50% passing the No. 200 sieve		ORGANIC	OH	High-plasticity organic silts and organic clays
Highly Organic Soils	Primarily organic matter with organic odor		PT	Peat

Notes: 1) Soil classification based on visual classification of soil is based on ASTM D 2488.
2) Soil classification using laboratory tests is based on ASTM D 2487.
3) Description of soil density or consistency is based on interpretation of blow count data and/or test data.

Soil Particle Size Definitions

Component	Size Range
Boulders	Coarser than 12 inch
Cobbles	3 inch to 12 inch
Gravel	3 inch to No. 4 (4.78 mm)
Coarse	3 inch to 3/4 inch
Fine	3/4 inch to No. 4 (4.78 mm)
Sand	No. 4 (4.78 mm) to No. 200 (0.074mm)
Coarse	No. 4 (4.78 mm) to No. 10 (2.0 mm)
Medium	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Finer than No. 200 (0.074 mm)

Soil Moisture Modifiers

Soil Moisture	Description
Dry	Absence of moisture
Moist	Damp, but no visible water
Wet	Visible water

Key to Boring Log Symbols

Sampling Method	Boring Log Symbol	Description
Blows required to drive a 2.4 inch I.D. split-barrel sampler 12-inches or other indicated distance using a 300-pound hammer falling 30 inches.	34	Location of relatively undisturbed sample
	12	Location of disturbed sample
	21	Location of sample attempt with no recovery
Blows required to drive a 1.5-inch I.D. split barrel sampler (SPT - Standard Penetration Test) 12-inches or other indicated distance using a 140-pound hammer falling 30 inches.	14	Location of sample obtained in general accordance with Standard Penetration Test (ASTM D-1586) test procedures.
	30	Location of SPT sampling attempt with no recovery.
Pushed Sampler	P	Sampler pushed with the weight of the hammer or against weight of the drilling rig.
Grab Sample	G	Sample obtained from drill cuttings.

Note: The lines separating soil types on the logs represents approximate boundaries only. The actual boundaries may vary or be gradual.

Laboratory Tests

Test	Symbol
Moisture Content	MC
Density	DN
Grain Size	GS
Percent Fines	PF
Atterberg Limits	AL
Hydrometer Analysis	HA
Consolidation	CN
Compaction	CP
Permeability	PM
Unconfined Compression	UC
Unconsolidated Undrained TX	UU
Consolidated Undrained TX	CU
Consolidated Drained TX	CD
Chemical Analysis	CA

BRB:04/25/12

Boring B-1

Station 472+20, 5 feet west; 47.623485, -122.070973

Approximate Ground Surface Elevation: ~47 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Soil Profile: Graphic Log	Sample Data: Group Symbol	Sample Data: Blow Count	Sample Data: Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Brown silty fine to medium SAND with gravel (loose, moist) (FILL) (drill cuttings)		SM					
1								
2	Dark brown to black silty fine to medium SAND with gravel (loose, moist) (FILL) (drill cuttings)		SM					
3			SM					
4	Brown silty fine SAND with a trace of gravel (medium dense, moist) (OLDER ALLUVIUM)		SM	8		●		
5								Bentonite Backfill →
6	Brown silty fine SAND with gravel (medium dense, moist) (OLDER ALLUVIUM)		SM	13		●■	MC	
7								
8								
9								
10			SM	20		●■	MC	
11								
12	Boring completed at 11.5 feet on April 19, 2012							No ground water encountered at the time of drilling
13								
14								
15								
16								
17								
18								
19								
20								

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-2

Station 476+10, 13 feet east; 47.624565, -122.071151

Approximate Ground Surface Elevation: ~47 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown SILT with sand and gravel (very soft, moist) (TOPSOIL) (drill cuttings)		ML					
3	Brown silty fine to medium SAND with a trace of gravel (medium dense, moist) (OLDER ALLUVIUM)		SM	11		● ■	MC	
6	Brown silty fine to coarse GRAVEL with sand (medium dense, moist) (OLDER ALLUVIUM)		GM	22		● ■	MC, GS	Bentonite Backfill →
11	Brown silty fine to medium SAND with gravel (dense, moist) (OLYMPIA BEDS)		SM	43		●		
11.5	Boring completed at 11.5 feet on April 19, 2012							No ground water observed at the time of drilling

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-3

Station 476+50, 2 feet west; 47.624651, -122.071221

Approximate Ground Surface Elevation: ~47 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown silty fine to medium SAND with gravel (loose, moist) (FILL) (drill cuttings)		SM					
2	Brown silty fine to medium SAND with a trace of gravel (medium dense, moist) (OLDER ALLUVIUM)		SM	16		●		
5	grades to with gravel		SM	13		■●	MC	Bentonite Backfill
10	grades to orangish-brown and brown with occasional silt layers less than 1-inch thick		SM	21		■●	MC	
12	grades to loose at about 12 feet based on drilling rate							
15	grades to moist to wet		SM	9		●		
16	Boring completed at 16.5 feet on April 19, 2012							No ground water observed at the time of drilling

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-4

Station 480+00, 15 feet east; 47.625576, -122.070861

Approximate Ground Surface Elevation: ~45 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) / Moisture Content (Percent - ■)	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown silty fine to medium SAND with gravel (very loose, moist) (TOPSOIL) (drill cuttings)		SM					
3	Brown silty fine to medium SAND with gravel (very loose, moist) (OLDER ALLUVIUM)		SM	3		● ■	MC, GS	
5	grades to medium dense		SM	21		■ ●	MC, GS	Bentonite Backfill
8	Brown silty fine to coarse SAND with gravel (dense, moist) (OLDER ALLUVIUM)		SM	44*		■ ●	MC, GS	
11	Brown fine to coarse GRAVEL with silt and sand (medium dense, moist to wet) (OLDER ALLUVIUM)		GP-GM	14		■ ●	MC	
14	Boring completed at 14.0 feet on April 19, 2012							Ground water measured at about 14 feet at the time of drilling
	* Blow count may not be representative because of the presence of gravel							

Penetration Resistance (Blows/foot - ●): 20 40 60 80

Moisture Content (Percent - ■): 20 40 60 80

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-5

Station 484+30, 8 feet east; 47.626781, -122.070475

Approximate Ground Surface Elevation: ~46 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown to black silty fine to medium SAND with gravel and fine roots (loose, moist) (FILL) (drill cuttings)		SM					
3	Brown silty fine to medium SAND with a trace of gravel (loose, moist) (OLDER ALLUVIUM)		SM	6		●		Bentonite Backfill
5			SM	8		●		
7	Mottled light grayish-brown and orangish-brown silty fine to medium SAND with gravel (medium dense, moist) (OLDER ALLUVIUM)		SM	20		■ ●	MC	
9	Boring completed at 9.0 feet on April 19, 2012							No ground water observed at the time of drilling
20								

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-6

Station 484+55, 7 feet west; 47.626813, -122.070485

Approximate Ground Surface Elevation: ~46 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Soil Profile: Graphic Log	Sample Data: Group Symbol	Sample Data: Blow Count	Sample Data: Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown fine GRAVEL with silt, sand and roots (loose, moist) (FILL) (drill cuttings)		GP-GM					
1								
2	Black fine GRAVEL with sand and a trace of silt (loose, moist) (FILL) (drill cuttings)		GP					
3	Mottled orangish-brown and brown silty fine to medium SAND with gravel (loose, moist) (OLDER ALLUVIUM)		SM	7		●		
4								
5	grades to brown and very loose		SM	2		● ■	MC	Bentonite Backfill →
6								
7	Brown fine to medium SAND with silt and gravel (medium dense, moist) (OLDER ALLUVIUM)							
8								
9								
10			SP-SM	21		■ ●	MC	
11								
12	Boring completed at 11.5 feet on April 19, 2012							No ground water observed at the time of drilling
13								
14								
15								
16								
17								
18								
19								
20								

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-7

Station 494+30, 3 feet west; 47.629408, -122.070569

Approximate Ground Surface Elevation: ~46 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Soil Profile: Graphic Log	Sample Data: Group Symbol	Sample Data: Blow Count	Sample Data: Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown fine GRAVEL with silt, sand and roots (loose, moist) (FILL) (drill cuttings)		GP-GM					
1	Black fine GRAVEL with sand and a trace of silt (loose, moist) (FILL) (drill cuttings)		GP					
2	Brown silty fine to medium SAND with occasional gravel (medium dense, moist) (OLDER ALLUVIUM)							
3			SM	13		●		
4								
5	grades to mottled dark brown and brown and very loose to loose		SM	4		● ■	MC	Bentonite Backfill
6								
7								
8	Brown fine GRAVEL with silt and sand (medium dense, wet) (OLDER ALLUVIUM)		GP-GM	15		■ ●	MC	
9								
10	Brown fine to medium SAND with silt and gravel (medium dense, wet) (OLDER ALLUVIUM)							
11								
12								
13			SP-SM	19		●		Ground water measured at about 12.5 feet at the time of drilling
14	Boring completed at 14.0 feet on April 19, 2012							
15								
16								
17								
18								
19								
20								

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-8

Station 501+00, on-line; 47.631347, -122.07071

Approximate Ground Surface Elevation: ~46½ feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Description	Graphic Log	Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown fine GRAVEL with silt, sand and roots (loose, moist) (FILL) (drill cuttings)		GP-GM					
1	Black fine GRAVEL with sand and a trace of silt (loose, moist) (FILL) (drill cuttings)		GP					
2								
3	Brown silty fine to medium SAND with occasional gravel (loose, moist) (OLDER ALLUVIUM)		SM	6		●		
4								
5								Bentonite Backfill →
6	grades to mottled brown and orangish-brown 1-inch thick black PEAT layer at about 6 feet		SM	7		● ■	MC	
7								
8								
9								
10								
11	grades to brown, medium dense, with a trace of gravel and moist to wet		SM	13		●	MC	
12								Ground water measured at about 12.4 feet at the time of drilling
13	Brown fine to medium SAND with silt and occasional gravel (medium dense, wet) (OLDER ALLUVIUM)							
14								
15								
16			SP-SM	17		●		
17	Boring completed at 16.5 feet on April 19, 2012							
18								
19								
20								

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-9

Station 504+75, 5 feet west; 47.632273, -122.07092

Approximate Ground Surface Elevation: ~47 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown to black fine GRAVEL with silt and sand (loose, moist) (FILL) (drill cuttings)		GP-GM					
3	Brown silty fine to coarse GRAVEL with sand (medium dense, moist) (FILL)		GM	11		■ ●	MC	
4	Brown silty fine to medium SAND with gravel (medium dense, moist) (OLDER ALLUVIUM)							
5			SM	27		■ ●	MC	Bentonite Backfill
10			SM	20		■ ●	MC	
11.5	Boring completed at 11.5 feet on April 19, 2012							No ground water observed at the time of drilling

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-10

Station 509+00, 4 feet east; 47.633395, -122.071503

Approximate Ground Surface Elevation: ~46½ feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Soil Profile: Graphic Log	Sample Data: Group Symbol	Sample Data: Blow Count	Sample Data: Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown silty fine to medium SAND with gravel (loose, moist) (TOPSOIL) (drill cuttings)		SM					
2	Brown silty fine to medium SAND with occasional gravel and roots (medium dense, moist) (OLDER ALLUVIUM)		SM	12		●		
4	Brown fine to medium SAND with silt and occasional gravel (loose, moist) (OLDER ALLUVIUM)		SP-SM	6		● ■	MC	Bentonite Backfill →
8	Brown silty fine SAND with gravel (medium dense, moist) (OLDER ALLUVIUM)		SM	29		■ ●	MC	
11.5	Boring completed at 11.5 feet on April 19, 2012							No ground water observed at the time of drilling

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-11

Station 486+70, 4 feet west; 47.644626, -122.083576

Approximate Ground Surface Elevation: ~46 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown fine GRAVEL with silt, sand and fine roots (loose, moist) (FILL) (drill cuttings)		GP-GM					
1	Black fine GRAVEL with sand and a trace of silt (loose, moist) (FILL) (drill cuttings)		GP					
2	Mottled orangish-brown and brown silty fine to medium SAND with gravel (loose, moist) (OLDER ALLUVIUM)							
3			SM	7		●		
4								
5	grades to brown		SM	8		● ■	MC	Bentonite Backfill
6								
7								
8	Brown fine to coarse SAND with silt and gravel (medium dense, moist to wet) (OLDER ALLUVIUM)		SP-SM	12		●		
9								
10								
11	Brown fine to coarse GRAVEL with silt and sand (medium dense, wet) (OLDER ALLUVIUM)							
12								Ground water measured at about 12.4 feet at the time of drilling
13			GP-GM	21		●		
14	Boring completed at 14.0 feet on April 19, 2012							
15								
16								
17								
18								
19								
20								

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-12

Station 510+00, 9 feet west; 47.633608, -122.071722

Approximate Ground Surface Elevation: ~46½ feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown silty GRAVEL with sand (loose, moist) (FILL) (drill cuttings)		GM					
2	Brown silty fine SAND with gravel (medium dense, moist) (OLDER ALLUVIUM)		SM	16		●		
5			SM	13		■ ●	MC	Bentonite Backfill
8	Brown fine SAND with silt and occasional gravel (medium dense, moist) (OLDER ALLUVIUM)		SP-SM	23		■ ●	MC	
11	Brown silty fine to medium SAND with a trace of gravel (medium dense, wet) (OLDER ALLUVIUM)		SM	19		■ ●	MC	
14	Brown fine to medium SAND with silt and occasional gravel (medium dense, wet) (OLDER ALLUVIUM)		SP-SM					Ground water measured at about 14.3 feet at the time of drilling
16			SP-SM	11		●		
17	Boring completed at 16.5 feet on April 18, 2012							
20								

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-13

Station 511+30, 8 feet east; 47.633958, -122.071829

Approximate Ground Surface Elevation: ~48 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown silty GRAVEL with sand and roots (loose, moist) (TOPSOIL and COLLUVIUM) (drill cuttings)		GM					
3	Light brown fine SAND with silt and gravel (medium dense, moist) (OLDER ALLUVIUM)		SP-SM	21		■ ●	MC	
6			SP-SM	19		■ ●	MC	Bentonite Backfill →
10	Light brown fine SAND with silt and gravel (dense, moist) (OLYMPIA BEDS)		SP-SM					
11	Light brown silty fine SAND (dense, moist) (OLYMPIA BEDS)		SM	45		●		
11	Light brown fine SAND with silt and gravel (dense, moist) (OLYMPIA BEDS)		SP-SM					
15			SP-SM	50/6”		●		
16	Boring completed at 15.5 feet on April 18, 2012							No ground water observed at the time of drilling

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-14

Station 512+05, 9 feet east; 47.63412, -122.071993

Approximate Ground Surface Elevation: ~47 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown silty GRAVEL with sand, cobbles and roots (loose, moist) (FILL) (drill cuttings)		GM					
2	Dark brown silty fine to coarse SAND with gravel and roots (medium dense, moist) (BURIED TOPSOIL) (drill cuttings)		SM			■	MC, GS	
3	Light grayish-brown fine SAND with silt and gravel (medium dense, moist) (OLYMPIA BEDS)		SP-SM	28		■ ●	MC, GS	
5	Gray silty fine to medium SAND with gravel (medium dense, moist) (OLYMPIA BEDS)		SM	29		■ ●	MC, GS	Bentonite Backfill →
8	Gray fine to medium SAND with silt and gravel (medium dense, moist) (OLYMPIA BEDS)		SP-SM	25		■ ●	MC	
11.5	Boring completed at 11.5 feet on April 18, 2012							No ground water observed at the time of drilling

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-15

Station 513+65, 6 feet east; 47.634588, -122.072314

Approximate Ground Surface Elevation: ~47½ feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown silty fine SAND with occasional gravel (loose, moist) (TOPSOIL and COLLUVIUM) (drill cuttings)		SM					
1	Dark brown sandy SILT with occasional gravel and fine roots (soft to medium stiff, moist) (TOPSOIL) (drill cuttings)		ML					
2								
3	Orangish-brown silty fine SAND with occasional gravel (medium dense, moist) (OLYMPIA BEDS)		ML SM	28		■ ●	MC	
4								
5	Brown silty fine to coarse SAND with gravel (dense, moist to wet) (OLYMPIA BEDS)		SM	38		■ ●	MC	Bentonite Backfill →
6								
7								
8								
9								
10			SM	50/6"*		●		
11								
12	Boring completed at 11.5 feet on April 18, 2012							No ground water observed at the time of drilling
13	* Blow count may not be representative because of the presence of gravel							
14								
15								
16								
17								
18								
19								
20								

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-16

Station 517+05, 10 feet east; 47.635348, -122.072999

Approximate Ground Surface Elevation: ~46½ feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown fine to medium SAND with silt and gravel (very loose, moist) (FILL) (drill cuttings)		SP-SM					
3	Orangish-brown fine SAND with silt and gravel (very loose, moist) (OLDER ALLUVIUM)		SP-SM	3		● ■	MC	
5	grades to loose		SP-SM	5		● ■	MC, GS	Bentonite Backfill →
10	Brown silty fine to coarse SAND with gravel (dense, moist) (OLYMPIA BEDS)		SM	39		■ ●	MC, GS	
11.5	Boring completed at 11.5 feet on April 18, 2012							No ground water observed at the time of drilling

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-17

Station 517+20, 4 feet west; 47.635369, -122.073085

Approximate Ground Surface Elevation: ~46½ feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown to black silty fine to medium SAND with gravel and fine roots (very loose, moist) (TOPSOIL and FILL) (drill cuttings)		SM					
3	Light brown silty fine to medium SAND with occasional gravel (very loose, moist) (OLDER ALLUVIUM)		SM	2		● ■	MC	
5	Brown fine to coarse SAND with gravel and a trace of silt (loose, moist) (OLDER ALLUVIUM)		SP/SW	8		●		Bentonite Backfill →
6	Brown silty fine to medium SAND with gravel (loose, moist) (OLDER ALLUVIUM)		SM					
10	grades to medium dense		SM	12		●	MC	
11.5	Boring completed at 11.5 feet on April 18, 2012							No ground water observed at the time of drilling

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-18

Station 520+05, on-line; 47.636057, -122.07362

Approximate Ground Surface Elevation: ~46½ feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0–1	Dark brown silty GRAVEL with sand (loose, moist) (FILL) (drill cuttings)		GM					
2–4	Mottled brown and black silty fine to medium SAND with occasional gravel (loose, moist) (OLDER ALLUVIUM)		SM	7		●		
5	Brown fine to medium SAND with silt (loose, wet) (OLDER ALLUVIUM)		SP-SM					
6–8	Mottled orangish-brown and brownish-gray silty fine to medium SAND with gravel (loose, wet) (OLDER ALLUVIUM)		SM	7		● ■	MC	Ground water measured at about 5.3 feet at the time of drilling; Bentonite Backfill
9–11	Grayish-brown silty fine to medium SAND with gravel (very dense, moist) (OLYMPIA BEDS)		SM	77/10”		■ ●	MC	
12–20	Boring completed at 11.5 feet on April 18, 2012							

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-19

Station 520+65, 11 feet east; 47.636197, -122.073704

Approximate Ground Surface Elevation: ~46½ feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Description	Graphic Log	Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Gray coarse GRAVEL with a trace of silt and sand (loose, dry to moist) (FILL) (drill cuttings)		GP					
3	Brown fine to medium SAND with silt and gravel (dense, moist) (OLYMPIA BEDS)		SP-SM	39		■ ●	MC	
5	Brown silty fine to medium SAND with gravel (dense, moist) (OLYMPIA BEDS)		SM	41		■ ●	MC, GS	Bentonite Backfill
10	grades to medium dense and moist to wet		SM	25		■ ●	MC, GS	
11.3								Ground water measured at about 11.3 feet at the time of drilling
11.5	Boring completed at 11.5 feet on April 18, 2012							

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-20

Station 525+75, on-line; 47.63662, -122.074224

Approximate Ground Surface Elevation: ~47 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown to black silty GRAVEL with sand (loose, moist) (FILL) (drill cuttings)		GM					
2	Mottled orangish-brown, brown and dark brown sandy SILT and silty fine SAND, with a trace of gravel and small fragment of organic material (medium stiff/loose, moist) (OLDER ALLUVIUM)		ML/SM	6		● ■	MC	
5	Mottled brown and orangish-brown silty fine to medium SAND with gravel (medium dense, moist) (OLDER ALLUVIUM)		SM	18		■ ●	MC	Bentonite Backfill
9	Brown fine to medium SAND with silt and gravel (medium dense, wet) (OLDER ALLUVIUM)		SP-SM	22		●		Ground water measured at about 9 feet at the time of drilling
11.5	Boring completed at 11.5 feet on April 18, 2012							

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-21

Station 528+25, 1 foot west; 47.637745, -122.075775

Approximate Ground Surface Elevation: ~47 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Soil Profile: Graphic Log	Sample Data: Group Symbol	Sample Data: Blow Count	Sample Data: Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Brown to gray silty fine to medium SAND with gravel (very loose, moist) (FILL) (drill cuttings)		SM					
3	grades to loose		SM	4		●		
4	Brown silty fine to medium SAND with gravel (medium dense, moist) (OLDER ALLUVIUM)							
5								Bentonite Backfill →
6			SM	14		■ ●	MC	
9	Brown fine to medium SAND with silt and gravel (dense, moist) (OLYMPIA BEDS)							
10			SP-SM	31		■ ●	MC	
11	Boring completed at 11.5 feet on April 18, 2012							No ground water observed at the time of drilling
20								

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-22

Station 532+65, 9 feet west; 47.63662, -122.074224

Approximate Ground Surface Elevation: ~46 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown to black sandy SILT with fine roots (soft, moist) (TOPSOIL) (drill cuttings)		ML					
2	becomes medium stiff at about 2.5 feet							
3	Brown silty fine to medium SAND (loose, wet) (OLDER ALLUVIUM)		SM	5		●		
5	Mottled brown, gray and orangish-brown SILT with a trace of fine roots (very stiff, moist) (OLYMPIA BEDS)		ML					
6	Orangish-brown silty fine to coarse SAND with gravel (medium dense, moist) (OLYMPIA BEDS)		SM	24		■ ●	MC	Bentonite Backfill
8	Mottled brown, gray and orangish-brown SILT (very stiff, moist) (OLYMPIA BEDS)		ML					
11	Gray silty fine to medium SAND (medium dense, wet) (OLYMPIA BEDS)		SM	16		■ ●	MC	Ground water measured at about 13.5 feet at the time of drilling
16	grades to dense and with occasional gravel		SM	34		■ ●	MC	
16.5	Boring completed at 16.5 feet on April 18, 2012							
20								

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-23

Station 537+30, 35 feet east; 47.639643, -122.078251

Approximate Ground Surface Elevation: ~46 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown silty fine to medium SAND with gravel (loose, moist) (FILL) (drill cuttings)		SM					
3	grades to medium dense concrete fragments encountered from about 2.5 to 6.5 feet		SM	18		●		
6	grades to loose		SM	8		● ■	MC	Bentonite Backfill
7	Orangish-brown fine to coarse SAND with occasional gravel and a trace of silt (medium dense, moist) (OLDER ALLUVIUM)							
11			SP/SW	25		■ ●	MC	Ground water measured at about 11.5 feet at the time of drilling
12	Boring completed at 11.5 feet on April 18, 2012							

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-24

Station 540+25, 1 foot west; 47.640162, -122.079094

Approximate Ground Surface Elevation: ~46½ feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown silty fine to coarse GRAVEL with sand and abundant fine roots (loose, moist) (FILL) (drill cuttings)		GM					
1								
2	boulder encountered at about 2.5 feet based on drill action							
3	Brown silty fine to coarse SAND with gravel (medium dense, moist) (OLDER ALLUVIUM)		SM	21		●		
4								
5	Brown silty fine SAND with a trace of gravel and occasional roots (medium dense, moist) (OLDER ALLUVIUM)		SM	13		■ ●	MC	Bentonite Backfill →
6								
7								
8								Ground water measured at about 8.3 feet at the time of drilling
9	Gray silty fine SAND with gravel (medium dense, moist to wet) (OLDER ALLUVIUM)							
10			SM	24		■ ●	MC	
11								
12	Boring completed at 11.5 feet on April 18, 2012							
13								
14								
15								
16								
17								
18								
19								
20								

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-25

Station 542+30, 2 feet west; 47.640496, -122.079768

Approximate Ground Surface Elevation: ~47 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown silty fine to coarse GRAVEL with sand (loose, moist) (FILL) (drill cuttings)		GM					
2	Layered brown silty fine to medium SAND with occasional gravel and brown fine to medium SAND with silt and occasional gravel (medium dense, moist) (OLDER ALLUVIUM)		SM/ SP-SM	12		●■	MC	
5			SM/ SP-SM	*50/5"		●		Bentonite Backfill →
10			SM/ SP-SM	19		■●	MC	
12	Boring completed at 11.5 feet on April 18, 2012 * Blow count may not be representative because of the presence of gravel							No ground water observed at the time of drilling
20								

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-26

Station 547+00, 12 feet west; 47.641591, -122.080881

Approximate Ground Surface Elevation: ~46½ feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Brown fine to coarse GRAVEL (loose, moist) (FILL) (drill cuttings)		GP					
1	Dark brown to black gravelly SILT with occasional gravel (soft, moist) (TOPSOIL)		ML					
2	Mottled light grayish-brown and light orangish-brown SILT (medium stiff, moist) (OLDER ALLUVIUM)							
3			ML	5		●	AL	
4								
5								Bentonite Backfill →
6	grades to soft, laminated and clayey		ML	3		● ■	MC AL	
7								
8								
9								
10	Mottled gray and brown silty fine SAND and sandy SILT (very loose to loose/soft to medium stiff, moist to wet) (OLDER ALLUVIUM)							
11			SM/ML	4		● ■	MC	
12	Boring completed at 11.5 feet on April 18, 2012							Ground water not measured at the time of drilling due to borehole collapse
13								
14								
15								
16								
17								
18								
19								
20								

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-27

Station 548+20, 11 feet east; 47.641856, -122.081034

Approximate Ground Surface Elevation: ~46½ feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown silty GRAVEL with sand (loose, moist) (FILL) (drill cuttings)		GM					
3	Brown sandy SILT (stiff, moist) (OLDER ALLUVIUM)		ML	9		● ■	MC	
5								Ground water measured at about 4.5 feet at the time of drilling
6	grades to dark brown abundant organic material, clayey		ML					
6	Brownish-gray silty fine to medium SAND (loose, moist to wet) (OLDER ALLUVIUM)		SM	9		● ■	MC, GS AL	Bentonite Backfill
10	Mottled gray and brown silty fine to medium SAND and sandy SILT (loose/medium stiff to stiff, moist to wet) (OLDER ALLUVIUM)		SM/ML	8		● ■	MC, GS	
11.5	Boring completed at 11.5 feet on April 18, 2012							

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-28

Station 552+00, 5 feet east; 47.642766, -122.08185

Approximate Ground Surface Elevation: ~45 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown GRAVEL with silt and sand (loose, moist) (FILL) (drill cuttings)		GP-GM					
1	COBBLES (FILL) (drill cuttings)							
2	Brown silty fine SAND with a trace of organic material (loose, moist) (OLDER ALLUVIUM)							
3			SM	8		●		
4								
5								Bentonite Backfill
6			SM	5		● ■	MC	
7								
8	Dark brown/black PEAT (soft to medium stiff, moist) (OLDER ALLUVIUM)		PT					
9	Brownish-gray silty fine SAND (very loose to loose, moist) (OLDER ALLUVIUM)		SM	4		● ■	MC	
10								
11								
12								
13	Gray SILT with occasional organic material (soft, wet) (OLDER ALLUVIUM)		ML			■	MC	
	Dark brown/black PEAT (soft, wet) (OLDER ALLUVIUM)		PT	3		● ■ 230%	MC	Ground water measured at about 13.5 feet at the time of drilling
14	Boring completed at 14.0 feet on April 17, 2012							
15								
16								
17								
18								
19								
20								

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-29

Station 557+00, on-line; 47.64392, -122.082967

Approximate Ground Surface Elevation: ~46½ feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown silty GRAVEL with sand (loose, moist) (FILL) (drill cuttings)		GM					
2	Mottled light grayish-brown and orangish-brown silty fine SAND with occasional gravel (medium dense, moist) (OLDER ALLUVIUM)		SM	12		● ■	MC	
5	Mottled light grayish-brown and orangish-brown clayey SILT with sand (stiff, moist) (OLDER ALLUVIUM)		ML	12		● ■	MC AL	Bentonite Backfill
10	grades to brown, medium stiff and moist to wet		ML	7		●	AL	Ground water measured at about 9 feet at the time of drilling
11.5	Boring completed at 11.5 feet on April 17, 2012							

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-30

Station 559+80, on-line; 47.644461, -122.083437

Approximate Ground Surface Elevation: ~46½ feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Brown silty fine GRAVEL with sand (loose, moist) (FILL) (drill cuttings)		GM					
1	Dark brown and black fine to medium SAND with silt and gravel (medium dense, moist) (FILL)							
2								
3			SP-SM	12		●		
4	Dark brownish-gray sandy SILT with gravel (medium stiff, wet) (OLDER ALLUVIUM)							
5								Bentonite Backfill
6			ML			■	MC	
	Black PEAT (medium stiff, moist)		PT	6		■	MC	
7	Brown fine to coarse SAND with silt (medium dense, moist) (OLDER ALLUVIUM)							
8								
9			SP-SM	19		●		
10								
11			SP-SM	21		■●	MC	
12								
13	grades to wet							Ground water measured at about 13.3 feet at the time of drilling
14	Light brown sandy SILT (stiff, wet) (OLDER ALLUVIUM)							
15								
16			ML	9		●		
17	Boring completed at 16.5 feet on April 17, 2012							
18								
19								
20								

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-31

Station 563+30, 10 feet east; 47.645325, -122.084418

Approximate Ground Surface Elevation: ~46½ feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown silty fine to coarse GRAVEL with sand (loose, moist) (FILL) (drill cuttings)		GM					
2	Mottled brown and orangish-brown silty fine SAND with a trace of gravel (medium dense, moist) (OLDER ALLUVIUM)		SM	17		● ■	MC	Bentonite Backfill
6	Brown fine to coarse SAND with silt (medium dense, moist to wet) (OLDER ALLUVIUM)		SP-SM	16		● ■	MC	
7	Brown fine to coarse SAND with silt and a trace of gravel (dense, moist to wet) (OLYMPIA BEDS)		SP-SM	48		■ ●	MC	
9	grades to with gravel at about 9 feet based on drill action							
11	Brown silty fine to medium SAND with gravel (very dense, wet) (OLYMPIA BEDS)		SM	50/6"				Ground water measured at about 11.5 feet at the time of drilling
13	Boring completed at 13.0 feet on April 17, 2012							

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-32

Station 564+50, 15 feet east; 47.645547, -122.084761

Approximate Ground Surface Elevation: ~46½ feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Soil Profile: Graphic Log	Sample Data: Group Symbol	Sample Data: Blow Count	Sample Data: Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown silty GRAVEL with sand and cobbles (loose, moist) (FILL) (drill cuttings)		GM					
1								
2	Gray silty fine to coarse GRAVEL with sand and cobbles (very dense, moist) (GLACIAL TILL)		GM	50/1”				
3								
4								
5			GM	50/3”		■	MC, GS	Bentonite Backfill
6								
7								
8	Light brown sandy SILT (hard, moist to wet) (OLYMPIA BEDS)							
9								
10			ML	50/3”		■	MC, GS	
11								
12								Ground water measured at about 12 feet at the time of drilling
13								
14	Light brown SILT with variable amounts of sand (hard, wet) (OLYMPIA BEDS)							
15								
16			ML	66		■ ●	MC	
17	Boring completed at 16.5 feet on April 17, 2012							
18								
19								
20								

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-33

Station 568+25, 10 feet east; 47.646307, -122.085771

Approximate Ground Surface Elevation: ~46½ feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown silty GRAVEL with sand (loose, moist) (FILL) (drill cuttings)		GM					
2	Brown fine to medium SAND with silt (medium dense, moist) (FILL)		SP-SM					
3	Light brown silty fine SAND with gravel (very dense, moist) (GLACIAL TILL)		SM	51		●		
5	Light brown SILT (hard, moist) (OLYMPIA BEDS)		ML			■	MC	Bentonite Backfill
6	Light brown fine to medium SAND with silt (dense, moist) (OLYMPIA BEDS)		SP-SM	35		■ ●	MC	
11	grades to fine SAND with silt		SP-SM	49		■ ●	MC	
13	grades to wet at about 13 feet							Ground water measured at about 13.5 feet at the time of drilling
16	grades to fine to medium SAND with silt		SP-SM	40		●		
16.5	Boring completed at 16.5 feet on April 17, 2012							
20								

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-34

Station 573+20, 12 feet west; 47.647509, -122.086691

Approximate Ground Surface Elevation: ~45 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown silty GRAVEL with sand (loose, moist) (FILL) (drill cuttings)		GM					
3	Mottled light brown and light orangish-brown SILT with a trace of sand, gravel and fine black organic fragments (stiff, moist) (OLDER ALLUVIUM)		ML	11		●		
5	Brown to black fine to medium SAND with silt and occasional organic material (loose, moist) (OLDER ALLUVIUM)		SP-SM					
6	Mottled light grayish-brown and light orangish-brown SILT with sand and gravel (medium stiff, moist) (OLDER ALLUVIUM)		ML	7		● ■	MC	Bentonite Backfill
10	Brown silty fine SAND with occasional gravel (medium dense, moist) (OLDER ALLUVIUM)		SM	13		● ■	MC	
15			SM	19		● ■	MC	
16.5	Boring completed at 16.5 feet on April 17, 2012							Ground water measured at about 16.5 feet at the time of drilling

See Figure A-1 for explanation of symbols

JMS:04/25/12

Boring B-35

Station 577+80, 1 foot west; 47.648554, -122.087803

Approximate Ground Surface Elevation: ~45 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown silty GRAVEL with sand (loose to medium dense, moist) (FILL) (drill cuttings)	GM	GM					
3	Mottled light brown and light orangish-brown sandy SILT and CLAY with a trace of fine roots and scattered organic material (stiff, moist) (OLDER ALLUVIUM)	ML/CL	ML/CL	10		●		
5								Bentonite Backfill
6	grades to medium stiff	ML/CL	ML/CL	7		● ■	MC AL	
10	grades to medium stiff to stiff with a trace of fine black organic material	ML/CL						
11	1-inch thick black PEAT layer	ML/CL						
11	Orangish-brown fine ro medium SAND with silt (loose, moist) (OLDER ALLUVIUM)	SP-SM	SP-SM	8		● ■	MC AL	
11.5	Boring completed at 11.5 feet on April 17, 2012							No ground water encountered at the time of drilling

See Figure A-1 for explanation of symbols

BRB:04/23/12

Boring B-36

Station 580+20, 12 feet west; 47.649061, -122.088447

Approximate Ground Surface Elevation: ~44 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown silty fine SAND with gravel and occasional boulders (loose, moist) (FILL) (drill cuttings)		SM					
2	Light brown silty fine SAND with occasional fine gravel (very dense, moist) (GLACIAL TILL)		SM	67				Bentonite Backfill
6	grades to light grayish-brown		SM	50/6"		■ ●	MC	
11	grades to dense		SM	42		■ ●	MC	
11.5	Boring completed at 11.5 feet on April 17, 2012							No ground water encountered at the time of drilling

See Figure A-1 for explanation of symbols

BRB:04/23/12

Boring B-37

Station 584+30, on-line; 47.649931, -122.089424

Approximate Ground Surface Elevation: ~45 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown silty fine to coarse GRAVEL with sand (loose, moist) (FILL)		GM					
4	grades to medium dense		GM	16		●		
4	Mottled brown and orangish-brown silty fine to medium SAND with gravel (loose, moist to wet) (OLDER ALLUVIUM)							
6			SM	8		●■	MC	Bentonite Backfill
8	grades to medium dense		SM	12		●		Ground water measured at about 8.5 feet at the time of drilling
11	grades to brown		SM	11		●■	MC	
12	Gray silty fine to medium SAND with gravel (dense, wet) (OLYMPIA BEDS)							
16			SM	42		●		
16.5	Boring completed at 16.5 feet on April 17, 2012							

See Figure A-1 for explanation of symbols

BRB:04/23/12

Boring B-38

Station 589+00, on-line; 47.651128, -122.08995

Approximate Ground Surface Elevation: ~45 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Dark brown silty fine to coarse GRAVEL with sand (loose, moist) (FILL) (drill cuttings)		GM					
3	Brown fine to medium SAND with a trace of silt (loose, moist) (OLDER ALLUVIUM)		SP					
4	Mottled light brown and light gray SILT with a trace of fine gravel (medium stiff, moist) (OLDER ALLUVIUM)		ML	5		●		
5	Brown sandy CLAY with a trace of fine gravel and occasional fragments of fine black organic material (medium stiff, moist) (OLDER ALLUVIUM)							
6			CL	6		● ■	MC AL	Bentonite Backfill →
8	grades to mottled light brown and orangish-brown with a trace of fine roots		CL	6		● ■	MC AL	
10	Dark brown fine SAND with silt (medium dense, moist) (OLDER ALLUVIUM)		SP-SM					
11	Mottled light brown and orangish-brown sandy SILT (stiff, moist) (OLDER ALLUVIUM)		ML	6		● ■	MC	
15	grades to wet at about 15 feet							
15	Thinly-layered (laminated) light brown SILT and dark brown ORGANIC SILT (stiff, moist to wet) (OLDER ALLUVIUM)		ML/OL					
16	Gray SILT with occasional organic material and fine gravel (stiff, moist to wet) (OLDER ALLUVIUM)		ML			■	MC	
16	Light brown fine to medium SAND with occasional gravel (medium dense, moist to wet) (OLDER ALLUVIUM)		SM	13		● ■	MC	
16.5	Boring completed at 16.5 feet on April 17, 2012							No ground water encountered at the time of drilling
20								

See Figure A-1 for explanation of symbols

BRB:04/23/12

Boring B-39

Station 593+80, on-line; 47.652476, -122.090494

Approximate Ground Surface Elevation: ~44 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) / Moisture Content (Percent - ■)	Laboratory Testing	Backfill - Ground Water Data
0	Crushed Rock (FILL) (drill cuttings)							
1	Dark brown silty fine to coarse SAND with gravel (very loose, moist) (FILL) abundant fine roots to 1 foot		SM	2		●		
5	Dark brown SILT with abundant roots (stiff, moist) (BURIED TOPSOIL)		ML					
	Mottled light brown and dark brown SILT with occasional roots (stiff, moist) (OLDER ALLUVIUM)		ML					
6	Brown silty fine to medium SAND with occasional gravel (loose, moist) (OLDER ALLUVIUM)		SM	9		● ■	MC	Bentonite Backfill →
7	Mottled light brown and orangish-brown SILT (very stiff, moist) (OLYMPIA BEDS)							
8			ML	21		● ■	MC	
11	grades to light gray with laminations of fine sand		ML	28		● ■	MC AL	
13			ML	25		● ■	MC	
14	Boring completed at 14.0 feet on April 17, 2012							No ground water encountered at the time of drilling
15								
16								
17								
18								
19								
20								

See Figure A-1 for explanation of symbols

BRB:04/23/12

Boring B-40

Station 598+35, 6 feet west; 47.653628, -122.09134

Approximate Ground Surface Elevation: ~45 feet

Logged by: JMS

Project Name: East Lake Sammamish Trail - North Sammamish Segment

ICE Project No. 0105-007

Depth in Feet	Soil Profile: Description	Graphic Log	Sample Data: Group Symbol	Blow Count	Sample Location	Penetration Resistance (Blows/foot - ●) 20 40 60 80 / Moisture Content (Percent - ■) 20 40 60 80	Laboratory Testing	Backfill - Ground Water Data
0	Bark (mulch) (loose, moist) (FILL) (drill cuttings)							
2	Dark brown silty fine to medium SAND with occasional gravel (loose, moist) (BURIED TOPSOIL) (drill cuttings)		SM					
3	Light brown silty fine SAND with occasional fine gravel (loose, moist) (OLDER ALLUVIUM)		SM	7		●		
5	Light brown sandy SILT with a trace of fine gravel (hard, moist) (OLYMPIA BEDS)		ML	50/4”		■ ●	MC	Bentonite Backfill
7	Light brown silty fine SAND with gravel (very dense, moist) (OLYMPIA BEDS)		SM	50/3”		●		
10	grades to gray		SM	50/2”		■ ●	MC	
12			SM	50/2”		■ ●	MC	
13	Boring completed at 12.7 feet on April 17, 2012							No ground water encountered at the time of drilling

See Figure A-1 for explanation of symbols

APPENDIX B

LABORATORY TESTING PROGRAM

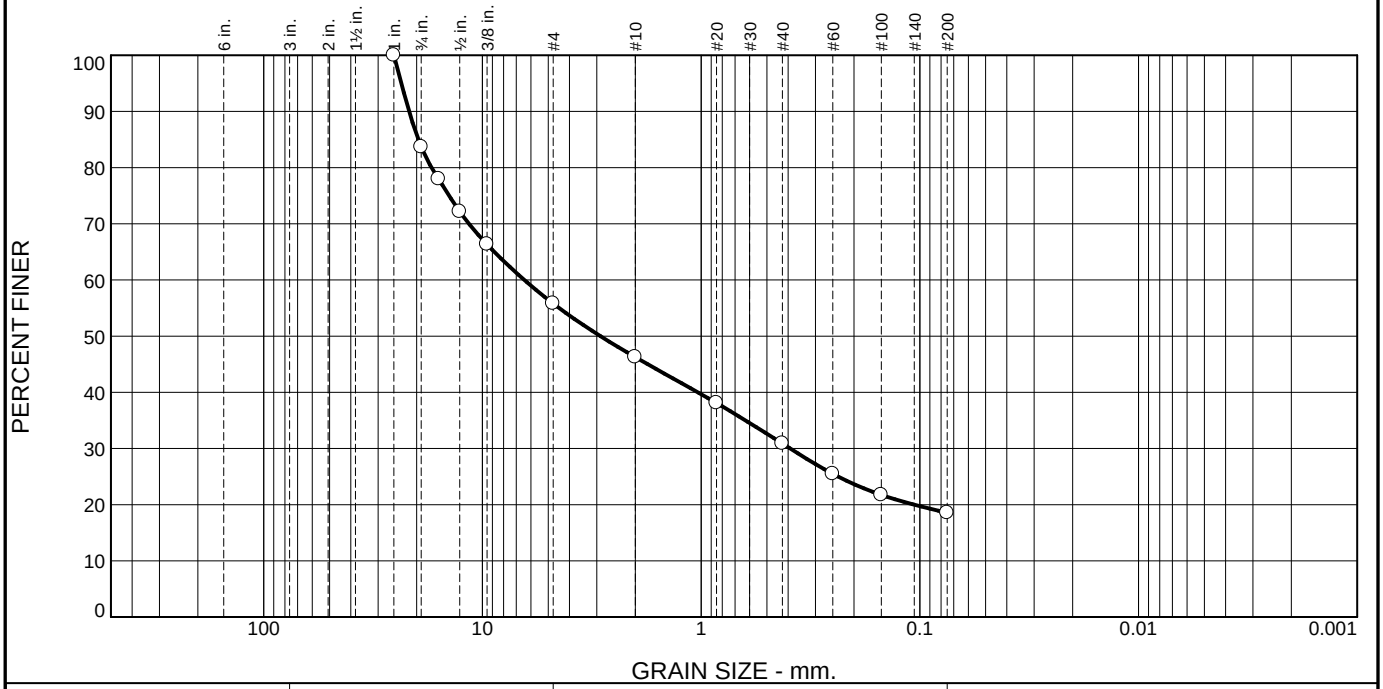
APPENDIX B

B.0 LABORATORY TESTING PROGRAM

The soil samples obtained from the test borings were returned to Icicle Creek Engineers laboratory for further visual examination and laboratory testing. Selected samples were tested to determine moisture content in general accordance with ASTM Test Method D 2216. The results of the moisture content tests are presented on the boring logs in Appendix A.

The laboratory testing program included particle size distribution (grain size analysis) by ASTM Test Methods C 117 (modified) and C 136, and Atterberg Limits (ASTM Test Method D 4318). The test results are presented on Figures B-1 through B-14 (particle size distribution) and Figure B-15 (Atterberg Limits – Liquid and Plastic Limits Test Report).

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	16.3	27.9	9.5	15.4	12.3	18.6	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
3/4"	83.7		
5/8"	78.0		
1/2"	72.2		
3/8"	66.3		
#4	55.8		
#10	46.3		
#20	38.1		
#40	30.9		
#60	25.5		
#100	21.7		
#200	18.6		

* (no specification provided)

Material Description

Brown silty fine to coarse GRAVEL with SAND (GM)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= GM **AASHTO (M 145)=**

Coefficients

D_{90}= 21.6320 D_{85}= 19.6489 D_{60}= 6.4371
D_{50}= 2.8880 D_{30}= 0.3913 D_{15}=
D_{10}= C_u= C_c=

Remarks

Sampled 4/19/12 JMS
Tested 4/23/12 to 4/30/12 SAW and HAL

Date Received: **Date Tested:** 4/25/12-4/30/12

Tested By: SAW/HAL

Checked By: KSK

Title: Principal Eng Geologist

Source of Sample: Test Borings **Depth:** 5 feet **Date Sampled:** 4/19/12
Sample Number: Boring B-2, S-2

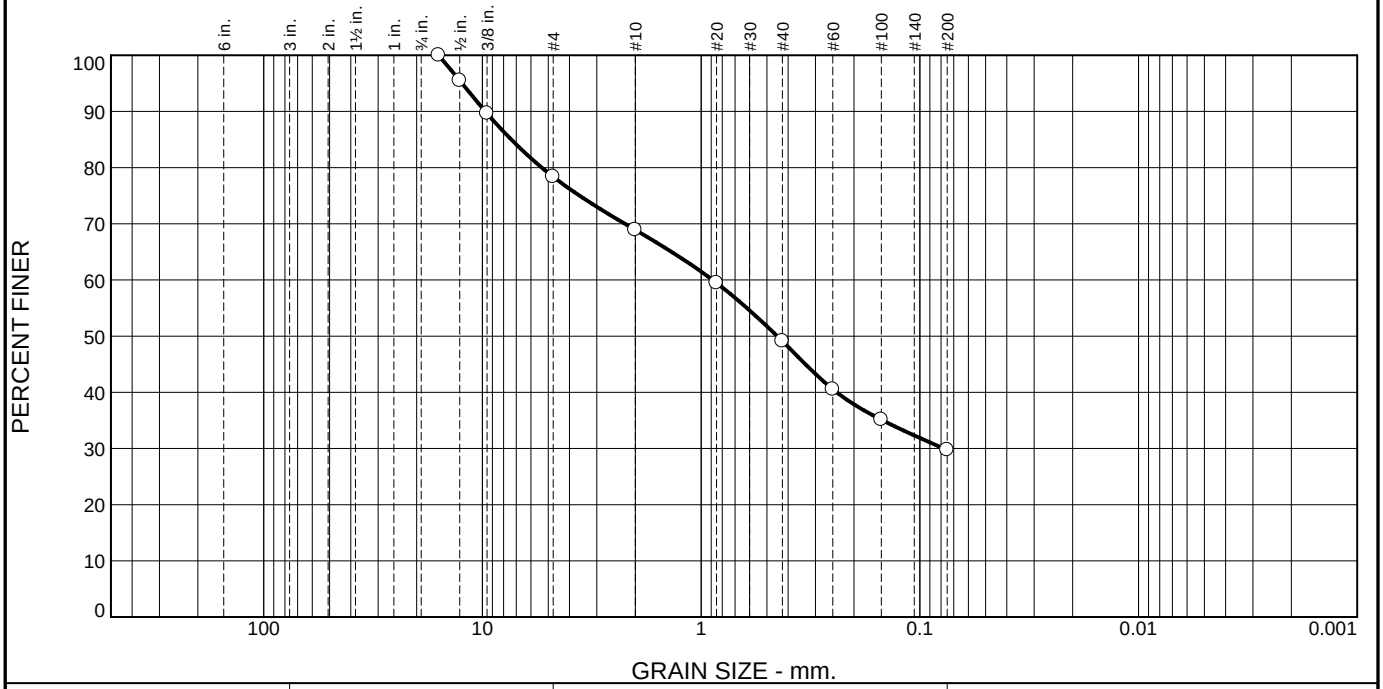
ICICLE CREEK ENGINEERS, INC.

Carnation, WA

Client: Parametrix and King County
Project: East Lake Sammamish Trail - North Sammamish Segment

Project No: 0105-007 **Figure** B-1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	21.6	9.5	19.8	19.4	29.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
5/8"	100.0		
1/2"	95.5		
3/8"	89.6		
#4	78.4		
#10	68.9		
#20	59.5		
#40	49.1		
#60	40.5		
#100	35.1		
#200	29.7		

* (no specification provided)

Material Description

Brown silty fine to medium SAND with gravel (SM)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=**

Coefficients

D_{90}= 9.7015 D_{85}= 7.3861 D_{60}= 0.8866
D_{50}= 0.4487 D_{30}= 0.0778 D_{15}=
D_{10}= C_u= C_c=

Remarks

Sampled 4/19/12 JMS
Tested 4/23/12 to 4/30/12 SAW and HAL

Date Received: **Date Tested:**

Tested By: SAW/HAL

Checked By: KSK

Title: Principal Eng Geologist

Source of Sample: Test Borings **Depth:** 2.5 - 5 feet **Date Sampled:** 4/19/12
Sample Number: Boring B-4, S-1b/2

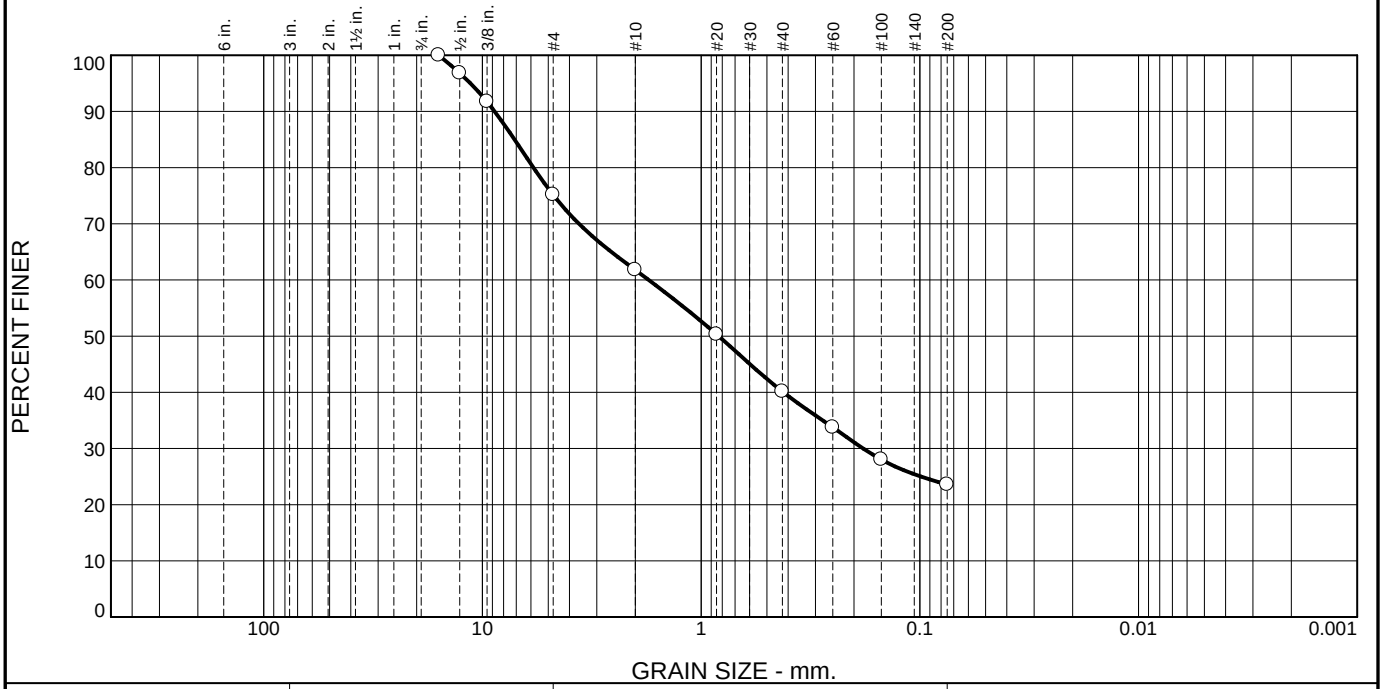
ICICLE CREEK ENGINEERS, INC.

Carnation, WA

Client: Parametrix and King County
Project: East Lake Sammamish Trail - North Sammamish Segment

Project No: 0105-007 **Figure** B-2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	24.8	13.4	21.7	16.5	23.6	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
5/8"	100.0		
1/2"	96.8		
3/8"	91.7		
#4	75.2		
#10	61.8		
#20	50.3		
#40	40.1		
#60	33.8		
#100	28.0		
#200	23.6		

* (no specification provided)

Material Description

Brown silty fine to medium SAND with gravel (SM)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=**

Coefficients

D_{90}= 8.7954 D_{85}= 7.1360 D_{60}= 1.7368
D_{50}= 0.8318 D_{30}= 0.1815 D_{15}=
D_{10}= C_u= C_c=

Remarks

Sampled 4/19/12 JMS
Tested 4/23/12 to 4/30/12 SAW and HAL

Date Received: **Date Tested:** 4/25/12-4/30/12

Tested By: SAW/HAL

Checked By: KSK

Title: Principal Eng Geologist

Source of Sample: Test Borings **Depth:** 7.5 feet **Date Sampled:** 4/19/12
Sample Number: Boring B-4, S-3

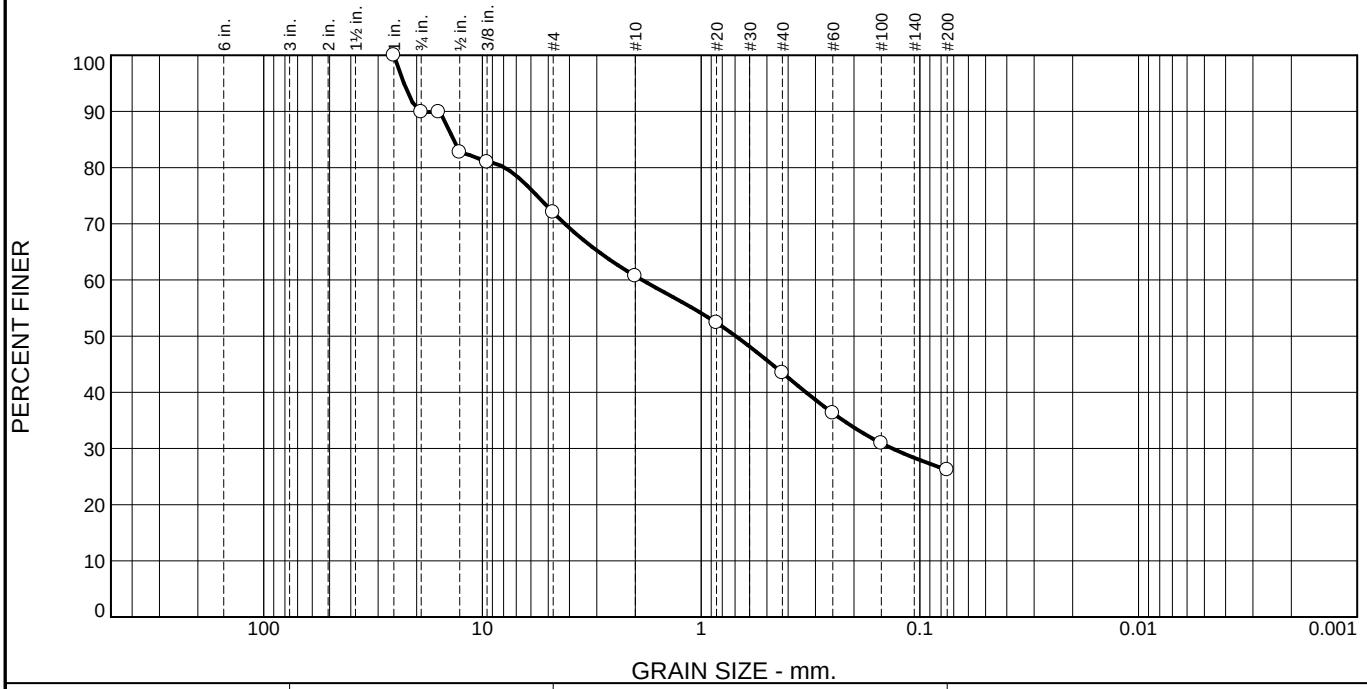
ICICLE CREEK ENGINEERS, INC.

Carnation, WA

Client: Parametrix and King County
Project: East Lake Sammamish Trail - North Sammamish Segment

Project No: 0105-007 **Figure** B-3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.1	17.9	11.3	17.2	17.3	26.2	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
3/4"	89.9		
5/8"	89.9		
1/2"	82.7		
3/8"	81.0		
#4	72.0		
#10	60.7		
#20	52.4		
#40	43.5		
#60	36.3		
#100	31.0		
#200	26.2		

* (no specification provided)

Material Description

Dark brown silty fine to medium SAND with gravel (SM)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=**

Coefficients

D_{90}= 19.3120 D_{85}= 13.5851 D_{60}= 1.8605
D_{50}= 0.6945 D_{30}= 0.1335 D_{15}=
D_{10}= C_u= C_c=

Remarks

Sampled 4/18/12 JMS
Tested 4/23/12 to 4/30/12 SAW and HAL

Date Received: **Date Tested:** 4/25/12-4/30/12

Tested By: SAW/HAL

Checked By: KSK

Title: Principal Eng Geologist

Source of Sample: Test Borings **Depth:** 2.5 feet **Date Sampled:** 4/18/12
Sample Number: Boring B-14, S-1a

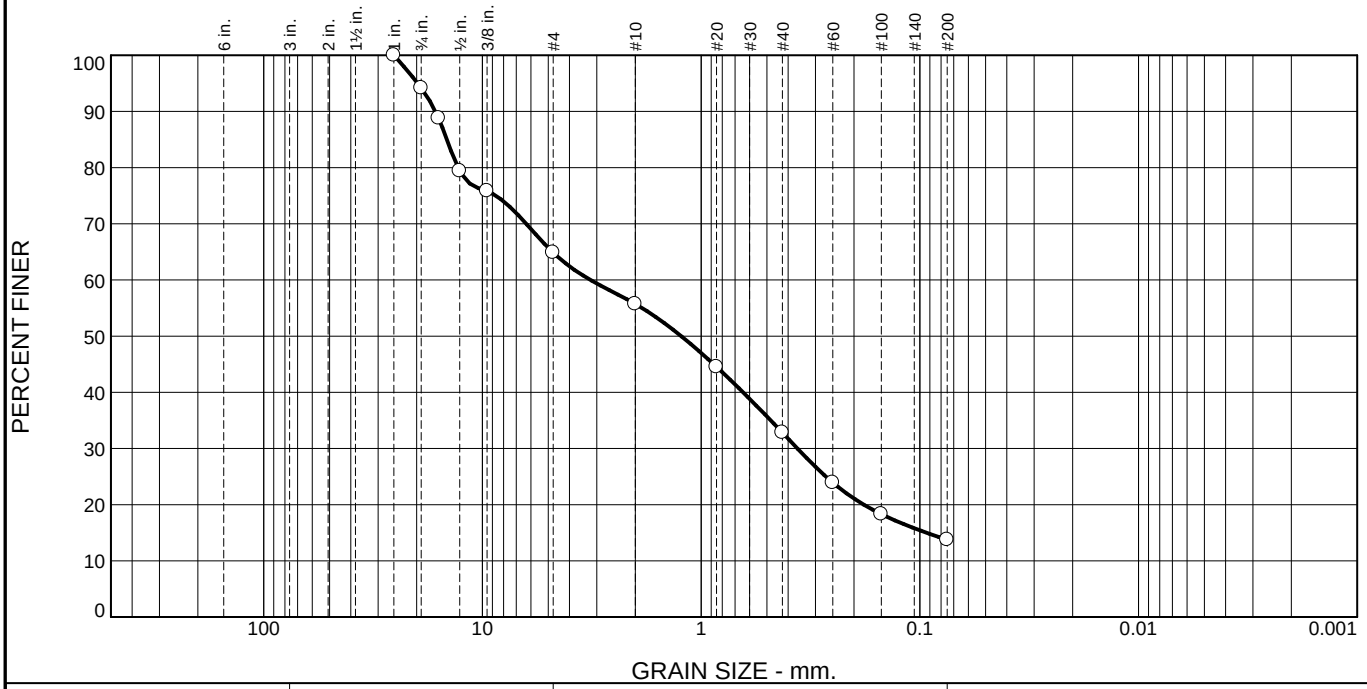
ICICLE CREEK ENGINEERS, INC.

Carnation, WA

Client: Parametrix and King County
Project: East Lake Sammamish Trail - North Sammamish Segment

Project No: 0105-007 **Figure** B-4

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	5.9	29.2	9.2	22.9	19.1	13.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
3/4"	94.1		
5/8"	88.8		
1/2"	79.4		
3/8"	75.8		
#4	64.9		
#10	55.7		
#20	44.5		
#40	32.8		
#60	23.9		
#100	18.3		
#200	13.7		

* (no specification provided)

Material Description

Light grayish-brown fine to medium SAND with silt and gravel (SP-SM)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=**

Coefficients

D_{90}= 16.3968 D_{85}= 14.5520 D_{60}= 3.2062
D_{50}= 1.2330 D_{30}= 0.3627 D_{15}= 0.0931
D_{10}= C_u= C_c=

Remarks

Sampled 4/18/12 JMS
Tested 4/23/12 to 4/30/12 SAW and HAL

Date Received: **Date Tested:** 4/25/12-4/30/12

Tested By: SAW/HAL

Checked By: KSK

Title: Principal Eng Geologist

Source of Sample: Test Borings **Depth:** 3 feet **Date Sampled:** 4/18/12
Sample Number: Boring B-14, S-1b

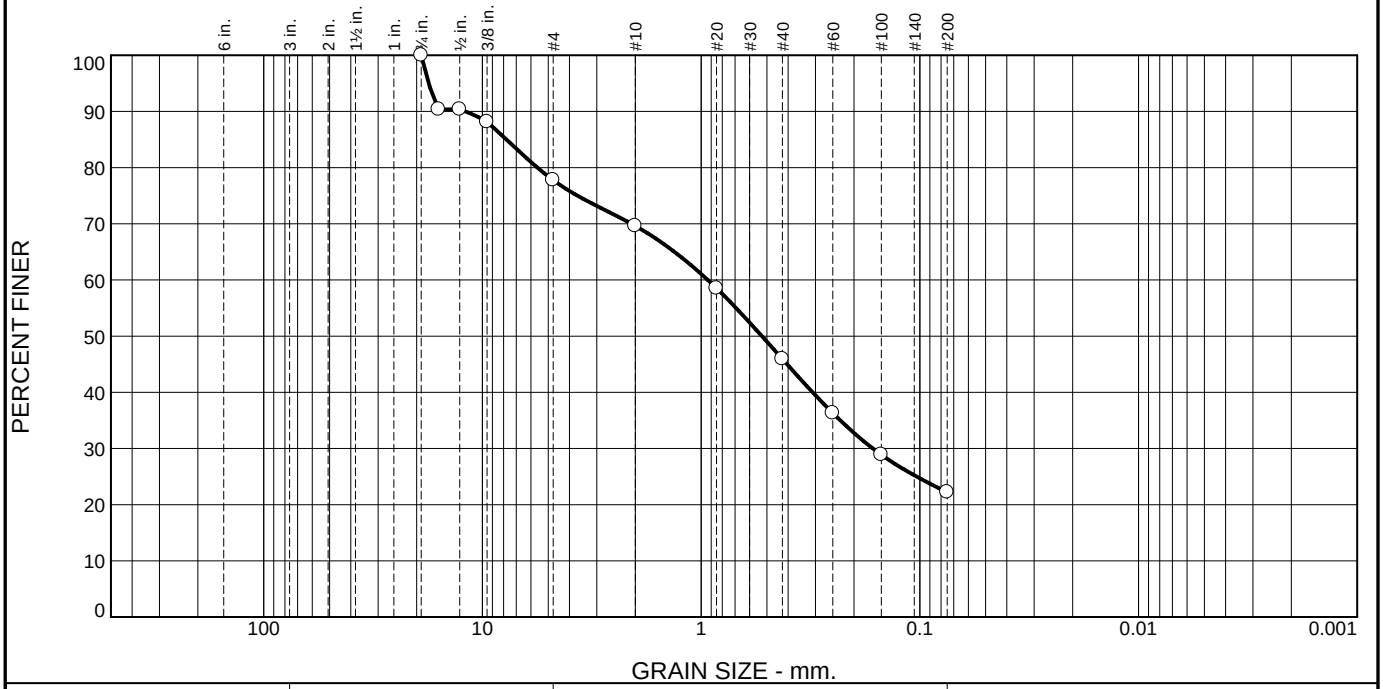
ICICLE CREEK ENGINEERS, INC.

Carnation, WA

Client: Parametrix and King County
Project: East Lake Sammamish Trail - North Sammamish Segment

Project No: 0105-007 **Figure** B-5

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	22.2	8.2	23.7	23.7	22.2	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
5/8"	90.4		
1/2"	90.4		
3/8"	88.1		
#4	77.8		
#10	69.6		
#20	58.5		
#40	45.9		
#60	36.3		
#100	28.9		
#200	22.2		

* (no specification provided)

Material Description

Light grayish-brown silty fine to medium SAND with gravel (SM)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 11.9482 D_{85}= 7.7690 D_{60}= 0.9324
D_{50}= 0.5271 D_{30}= 0.1639 D_{15}=
D_{10}= C_u= C_c=

Remarks

Sampled 4/18/12 JMS
Tested 4/23/12 to 4/30/12 SAW and HAL

Date Received: **Date Tested:** 4/25/12-4/30/12

Tested By: SAW/HAL

Checked By: KSK

Title: Principal Eng Geologist

Source of Sample: Test Borings **Depth:** 5 feet **Date Sampled:** 4/18/12
Sample Number: Boring B-14, S-2

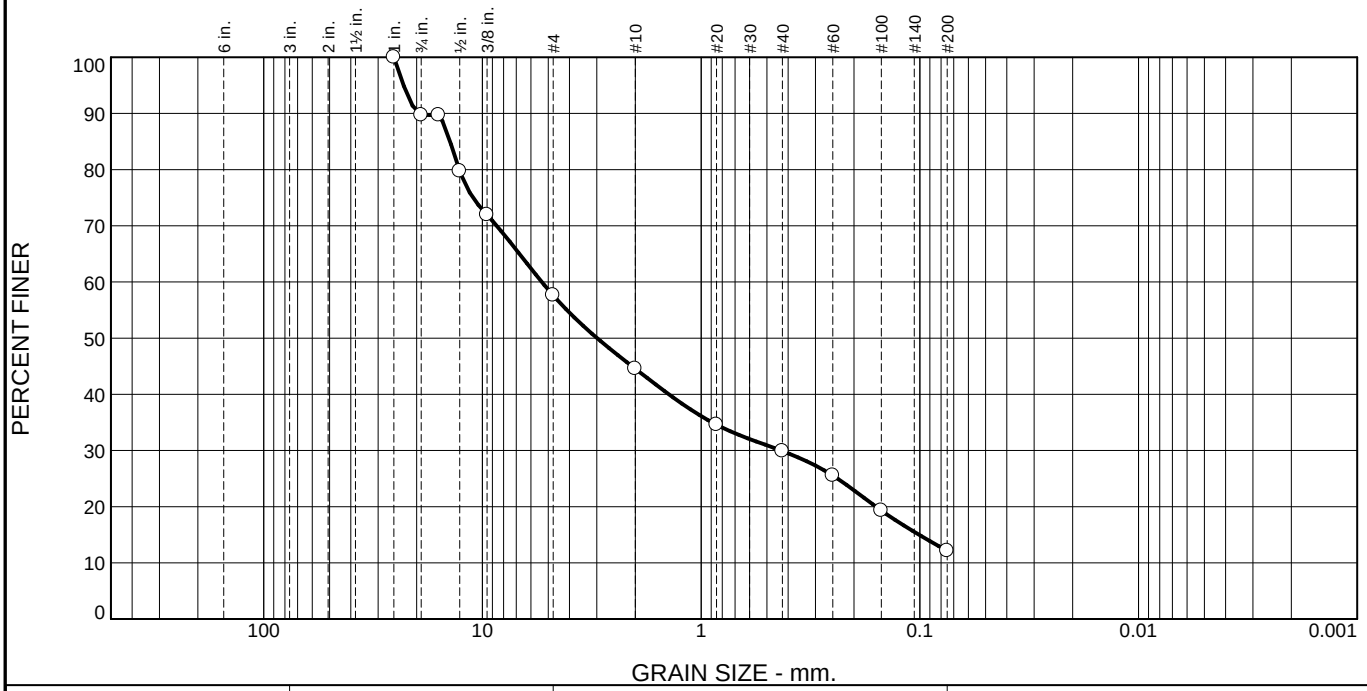
ICICLE CREEK ENGINEERS, INC.

Carnation, WA

Client: Parametrix and King County
Project: East Lake Sammamish Trail - North Sammamish Segment

Project No: 0105-007 **Figure** B-6

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.3	32.1	13.1	14.6	17.8	12.1	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
3/4"	89.7		
5/8"	89.7		
1/2"	79.8		
3/8"	72.0		
#4	57.6		
#10	44.5		
#20	34.6		
#40	29.9		
#60	25.5		
#100	19.3		
#200	12.1		

* (no specification provided)

Material Description

Orangish-brown fine to medium SAND with silt and gravel (SP-SM)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=**

Coefficients

D_{90}= 19.6065 D_{85}= 14.0572 D_{60}= 5.3504
D_{50}= 2.9907 D_{30}= 0.4312 D_{15}= 0.1008
D_{10}= C_u= C_c=

Remarks

Sampled 4/18/12 JMS
Tested 4/23/12 to 4/30/12 SAW and HAL

Date Received: **Date Tested:** 4/25/12/-4/30/12

Tested By: SAW/HAL

Checked By: KSK

Title: Principal Eng Geologist

Source of Sample: Test Borings **Depth:** 5 feet **Date Sampled:** 4/18/12
Sample Number: Boring B-16, S-2

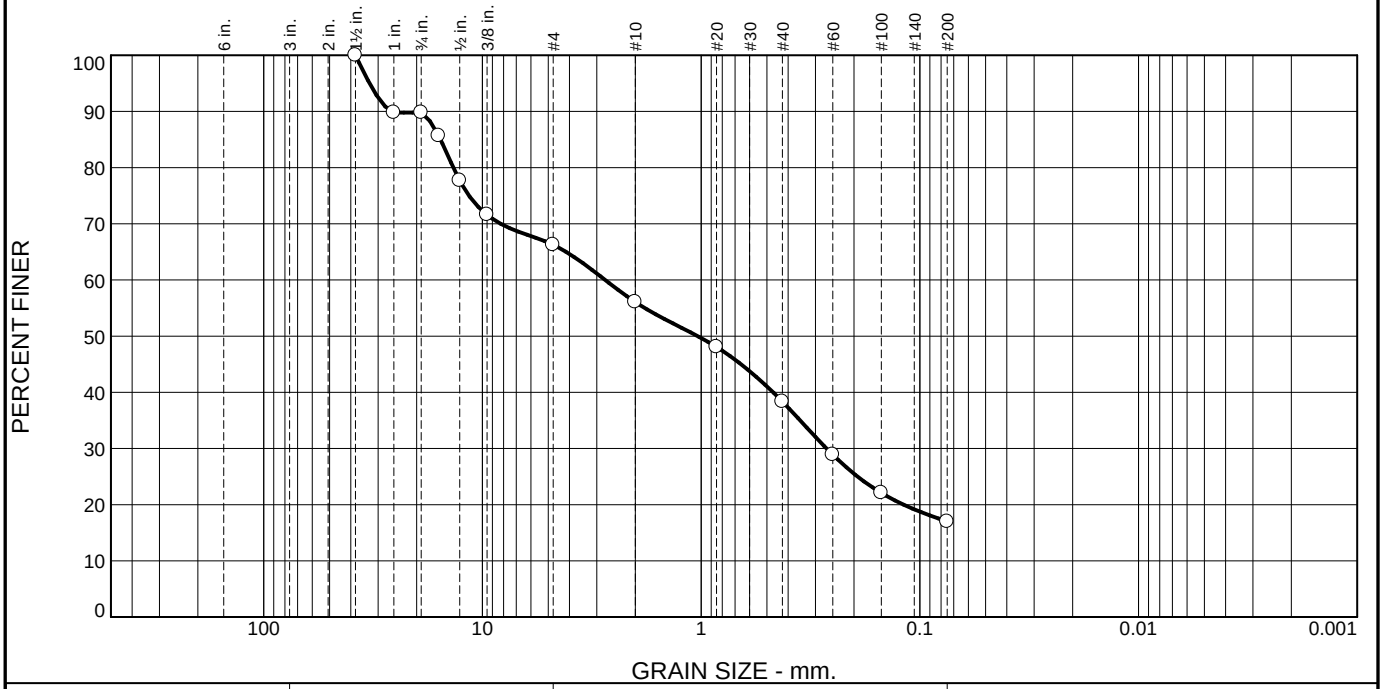
ICICLE CREEK ENGINEERS, INC.

Carnation, WA

Client: Parametrix and King County
Project: East Lake Sammamish Trail - North Sammamish Segment

Project No: 0105-007 **Figure** B-7

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.2	23.5	10.2	17.8	21.3	17.0	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5"	100.0		
1"	89.8		
3/4"	89.8		
5/8"	85.7		
1/2"	77.7		
3/8"	71.6		
#4	66.3		
#10	56.1		
#20	48.1		
#40	38.3		
#60	28.9		
#100	22.1		
#200	17.0		

* (no specification provided)

Material Description

Brown silty fine to medium SAND with gravel (SM)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=**

Coefficients

D_{90}= 26.0705 D_{85}= 15.5598 D_{60}= 2.7466
D_{50}= 1.0368 D_{30}= 0.2671 D_{15}=
D_{10}= C_u= C_c=

Remarks

Sampled 4/18/12 JMS
Tested 4/23/12 to 4/30/12 SAW and HAL

Date Received: **Date Tested:** 4/25/12-4/30/12

Tested By: SAW/HAL

Checked By: KSK

Title: Principal Eng Geologist

Source of Sample: Test Borings **Depth:** 10 feet **Date Sampled:** 4/18/12
Sample Number: Boring B-16, S-3

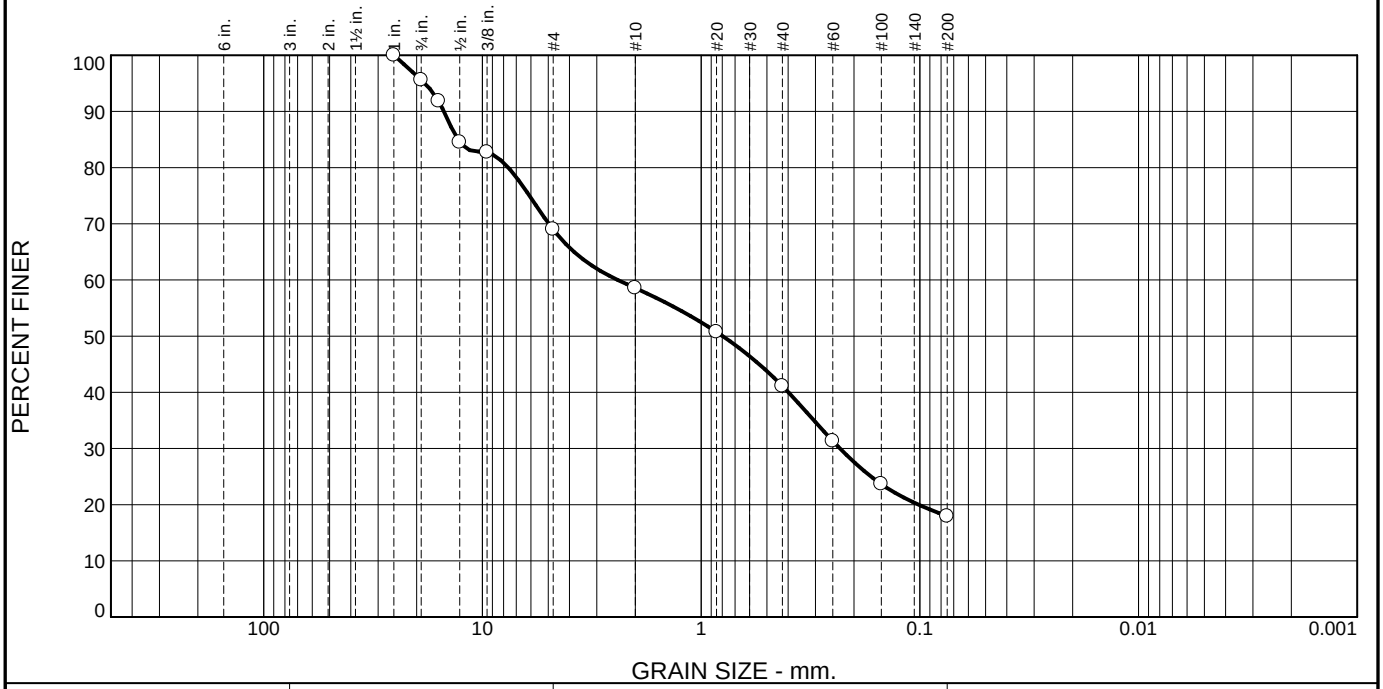
ICICLE CREEK ENGINEERS, INC.

Carnation, WA

Client: Parametrix and King County
Project: East Lake Sammamish Trail - North Sammamish Segment

Project No: 0105-007 **Figure** B-8

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.4	26.6	10.4	17.5	23.2	17.9	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
3/4"	95.6		
5/8"	91.8		
1/2"	84.5		
3/8"	82.7		
#4	69.0		
#10	58.6		
#20	50.7		
#40	41.1		
#60	31.3		
#100	23.7		
#200	17.9		

* (no specification provided)

Material Description

Brown silty fine to medium SAND with gravel (SM)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=**

Coefficients

D_{90}= 15.0141 D_{85}= 12.9591 D_{60}= 2.4047
D_{50}= 0.7968 D_{30}= 0.2318 D_{15}=
D_{10}= C_u= C_c=

Remarks

Sampled 4/18/12 JMS
Tested 4/23/12 to 4/30/12 SAW and HAL

Date Received: **Date Tested:** 4/25/12-4/30/12

Tested By: SAW/HAL

Checked By: KSK

Title: Principal Eng Geologist

Source of Sample: Test Borings **Depth:** 5 feet **Date Sampled:** 4/18/12
Sample Number: Boring B-19, S-2

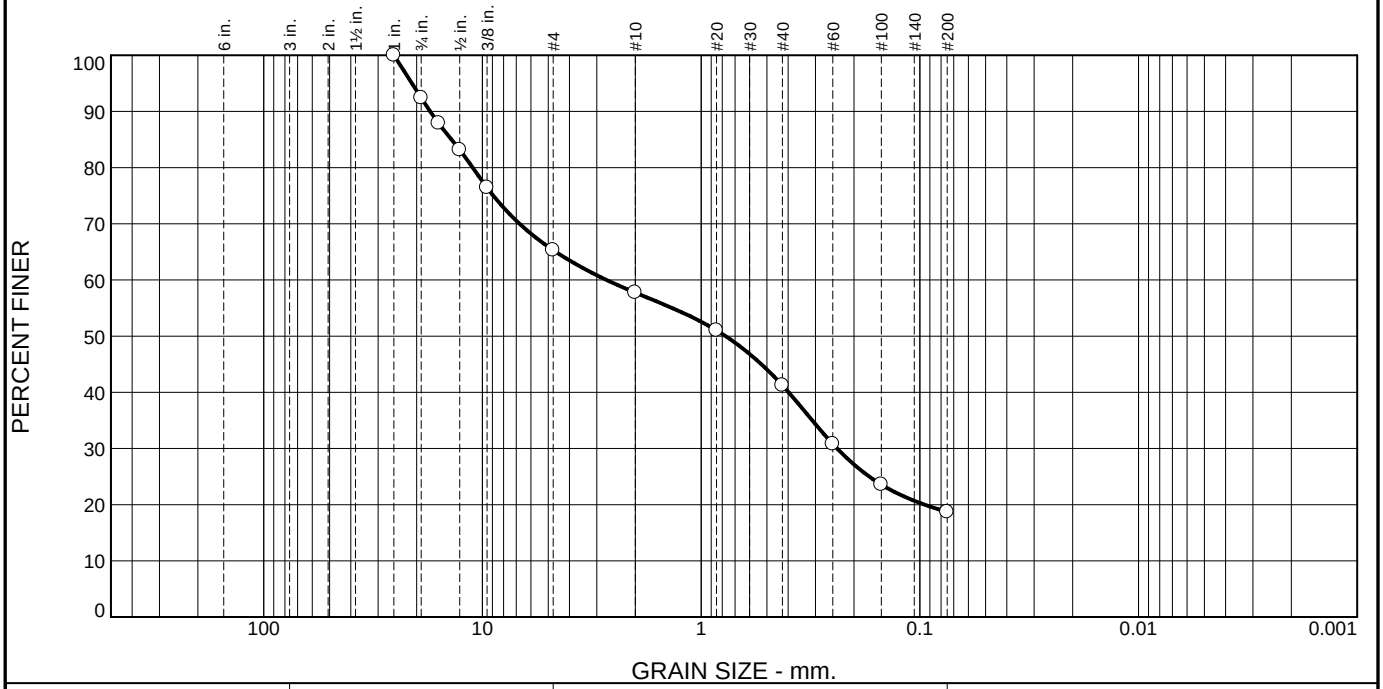
ICICLE CREEK ENGINEERS, INC.

Carnation, WA

Client: Parametrix and King County
Project: East Lake Sammamish Trail - North Sammamish Segment

Project No: 0105-007 **Figure** B-9

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	7.6	27.1	7.6	16.5	22.5	18.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
3/4"	92.4		
5/8"	87.9		
1/2"	83.2		
3/8"	76.4		
#4	65.3		
#10	57.7		
#20	51.0		
#40	41.2		
#60	30.8		
#100	23.6		
#200	18.7		

* (no specification provided)

Material Description

Brown silty fine to medium SAND with gravel (SM)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=**

Coefficients

D_{90}= 17.3393 D_{85}= 13.8582 D_{60}= 2.7064
D_{50}= 0.7735 D_{30}= 0.2389 D_{15}=
D_{10}= C_u= C_c=

Remarks

Sampled 4/18/12 JMS
Tested 4/23/12 to 4/30/12 SAW and HAL

Date Received: **Date Tested:** 4/25/12-4/30/12

Tested By: SAW/HAL

Checked By: KSK

Title: Principal Eng Geologist

Source of Sample: Test Borings **Depth:** 10 feet **Date Sampled:** 4/18/12
Sample Number: Boring B-19, S-3

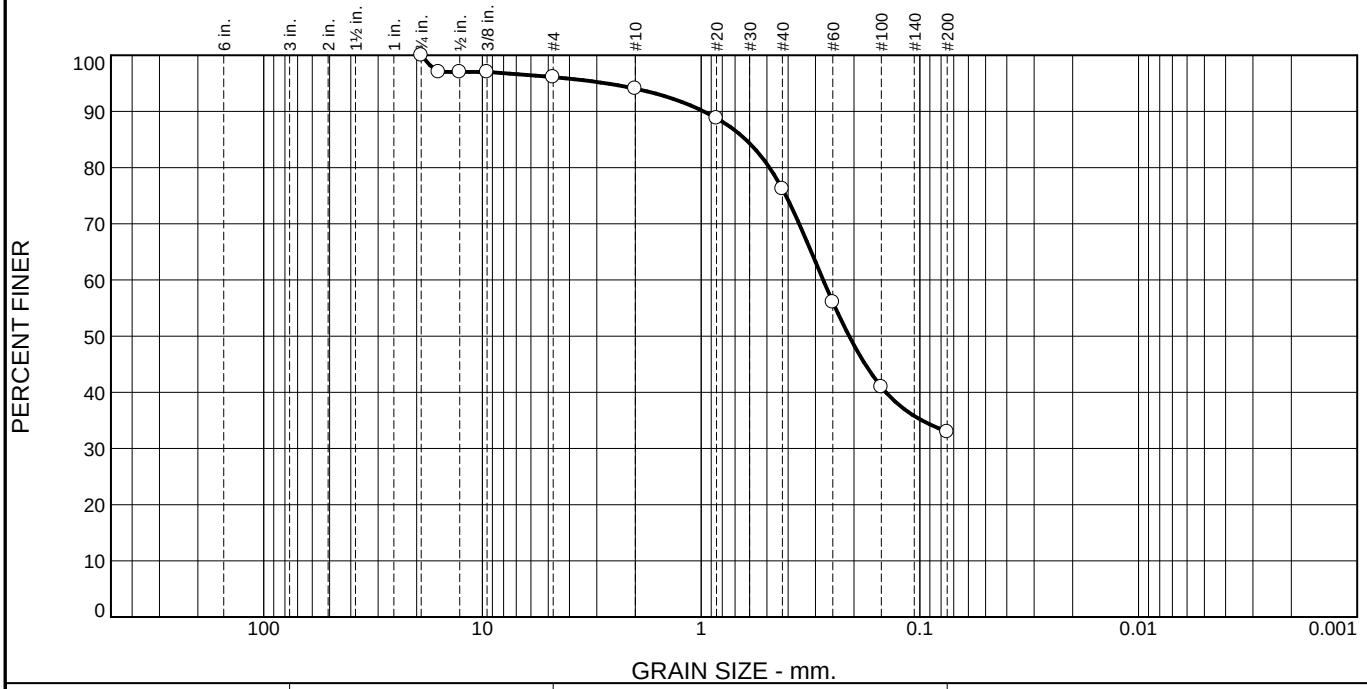
ICICLE CREEK ENGINEERS, INC.

Carnation, WA

Client: Parametrix and King County
Project: East Lake Sammamish Trail - North Sammamish Segment

Project No: 0105-007 **Figure** B-10

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.9	2.0	17.9	43.2	33.0	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
5/8"	97.0		
1/2"	97.0		
3/8"	97.0		
#4	96.1		
#10	94.1		
#20	88.8		
#40	76.2		
#60	56.1		
#100	41.0		
#200	33.0		

* (no specification provided)

Material Description

Dark brown silty fine to medium SAND with a trace of gravel (SM)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SM **AASHTO (M 145)=**

Coefficients

D_{90}= 0.9721 D_{85}= 0.6249 D_{60}= 0.2767
D_{50}= 0.2103 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sampled 4/18/12 JMS
Tested 4/23/12 to 4/30/12 SAW and HAL

Date Received: **Date Tested:** 4/25/12-4/30/12

Tested By: SAW/HAL

Checked By: KSK

Title: Principal Eng Geologist

Source of Sample: Test Borings **Depth:** 5 feet **Date Sampled:** 4/18/12
Sample Number: Boring B-27, S-2b

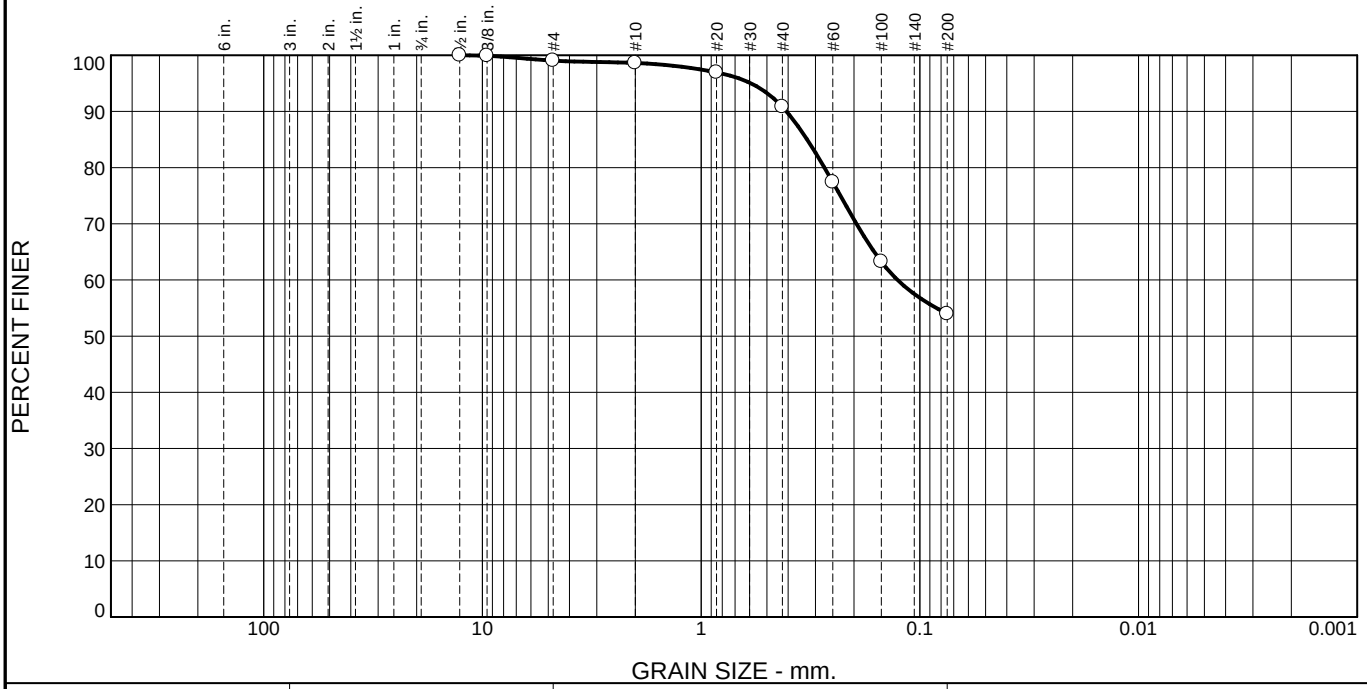
ICICLE CREEK ENGINEERS, INC.

Carnation, WA

Client: Parametrix and King County
Project: East Lake Sammamish Trail - North Sammamish Segment

Project No: 0105-007 **Figure** B-11

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.0	0.4	7.8	36.8	54.0	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1/2"	100.0		
3/8"	99.9		
#4	99.0		
#10	98.6		
#20	96.9		
#40	90.8		
#60	77.4		
#100	63.3		
#200	54.0		

* (no specification provided)

Material Description

Mottled gray and brown sandy SILT (ML)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= ML **AASHTO (M 145)=**

Coefficients

D_{90}= 0.4070 D_{85}= 0.3274 D_{60}= 0.1265
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sampled 4/18/12 JMS
Tested 4/23/12 to 4/30/12 SAW and HAL

Date Received: **Date Tested:** 4/25/12-4/30/12

Tested By: SAW/HAL

Checked By: KSK

Title: Principal Eng Geologist

Source of Sample: Test Borings **Depth:** 10 feet **Date Sampled:** 4/18/12
Sample Number: Boring B-27, S-3

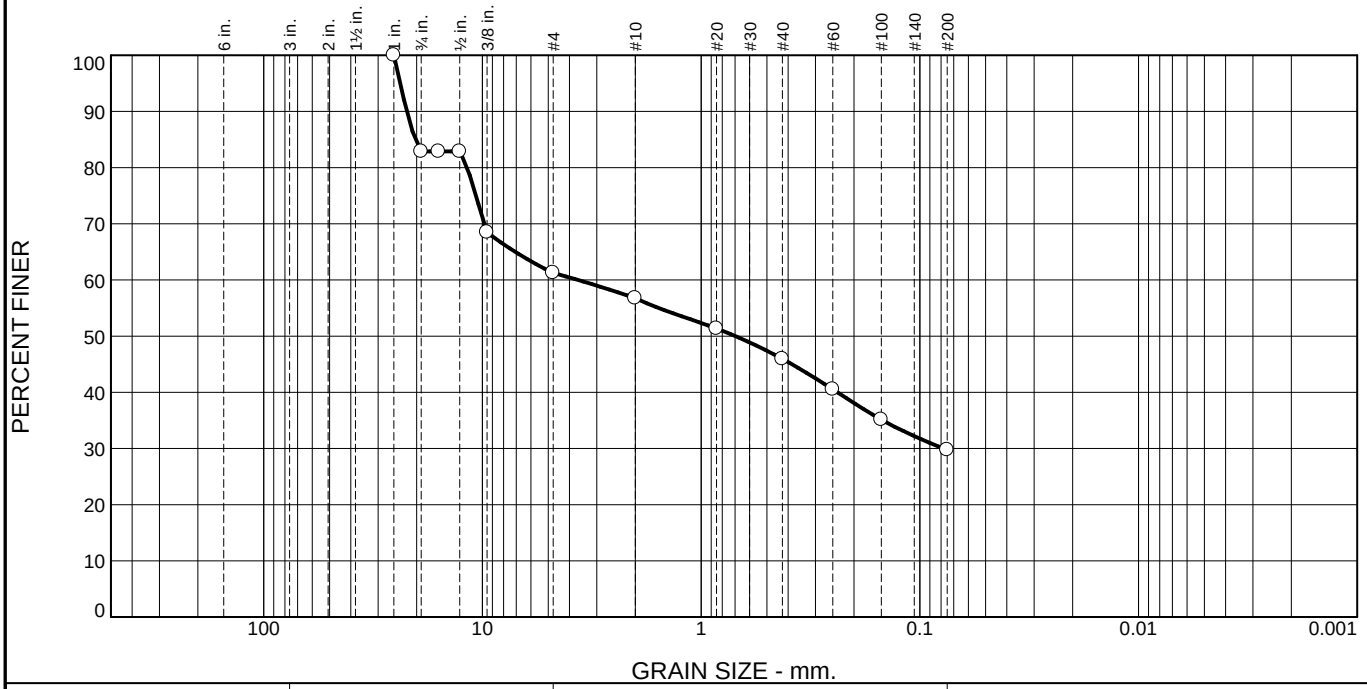
ICICLE CREEK ENGINEERS, INC.

Carnation, WA

Client: Parametrix and King County
Project: East Lake Sammamish Trail - North Sammamish Segment

Project No: 0105-007 **Figure** B-12

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	17.1	21.6	4.5	10.9	16.2	29.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
3/4"	82.9		
5/8"	82.9		
1/2"	82.9		
3/8"	68.5		
#4	61.3		
#10	56.8		
#20	51.4		
#40	45.9		
#60	40.5		
#100	35.1		
#200	29.7		

* (no specification provided)

Material Description

Dark brown silty fine to coarse GRAVEL with sand (GM)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= GM **AASHTO (M 145)=**

Coefficients

D_{90}= 22.1716 D_{85}= 20.2684 D_{60}= 3.6561
D_{50}= 0.6965 D_{30}= 0.0780 D_{15}=
D_{10}= C_u= C_c=

Remarks

Sampled 4/17/12 JMS
Testeb 4/23/12 to 4/30/12 SAW and HAL

Date Received: **Date Tested:** 4/25/12-4/30/12

Tested By: SAW/HAL

Checked By: KSK

Title: Principal Eng Geologist

Source of Sample: Test Borings **Depth:** 5 feet **Date Sampled:** 4/17/12
Sample Number: Boring B-32, S-2

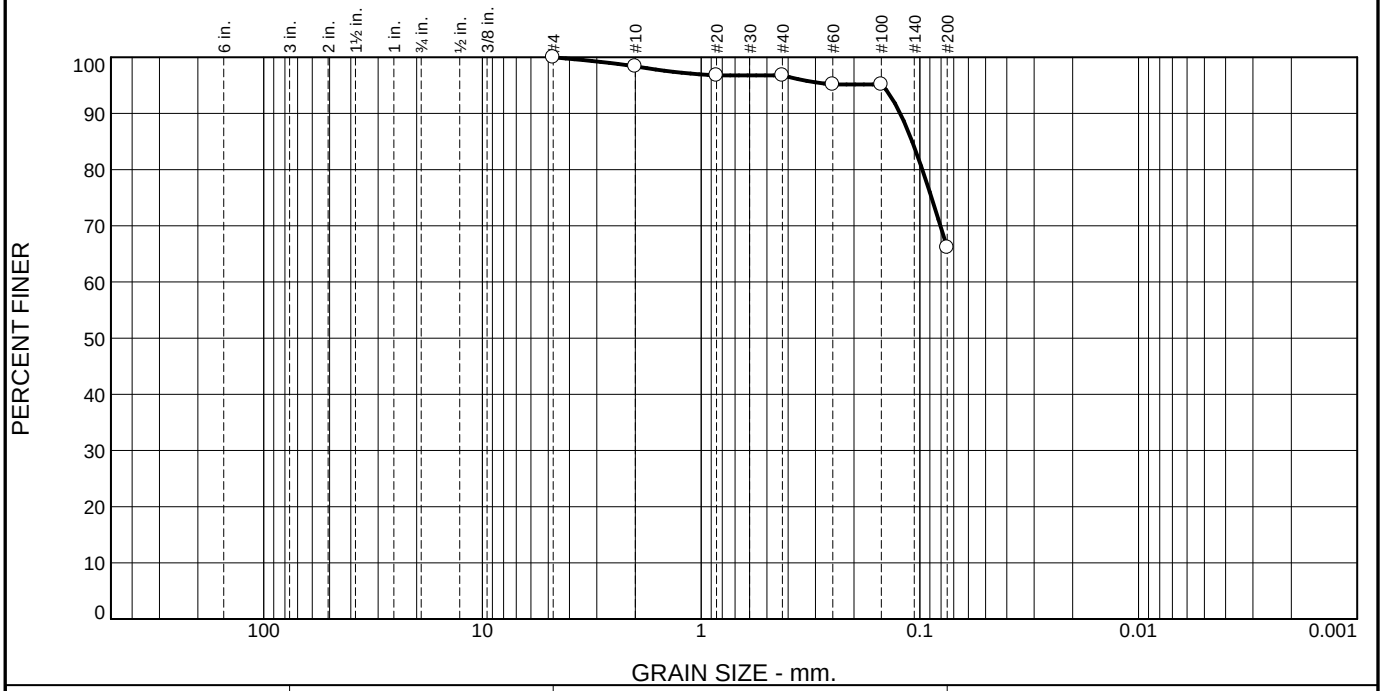
ICICLE CREEK ENGINEERS, INC.

Carnation, WA

Client: Parametrix and King County
Project: East Lake Sammamish Trail - North Sammamish Segment

Project No: 0105-007 **Figure** B-13

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	1.6	1.6	30.7	66.1	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	98.4		
#20	96.8		
#40	96.8		
#60	95.2		
#100	95.2		
#200	66.1		

* (no specification provided)

Material Description

Light brown sandy SILT (ML)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= ML **AASHTO (M 145)=**

Coefficients

D_{90}= 0.1229 D_{85}= 0.1084 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sampled 4/17/12 JMS
Tested 4/23/12 to 4/30/12 SAW and HAL

Date Received: **Date Tested:** 4/25/12-4/30/12

Tested By: SAW/HAL

Checked By: KSK

Title: Principal Eng Geologist

Source of Sample: Test Borings **Depth:** 10 feet **Date Sampled:** 4/17/12
Sample Number: Boring B-32, S-3

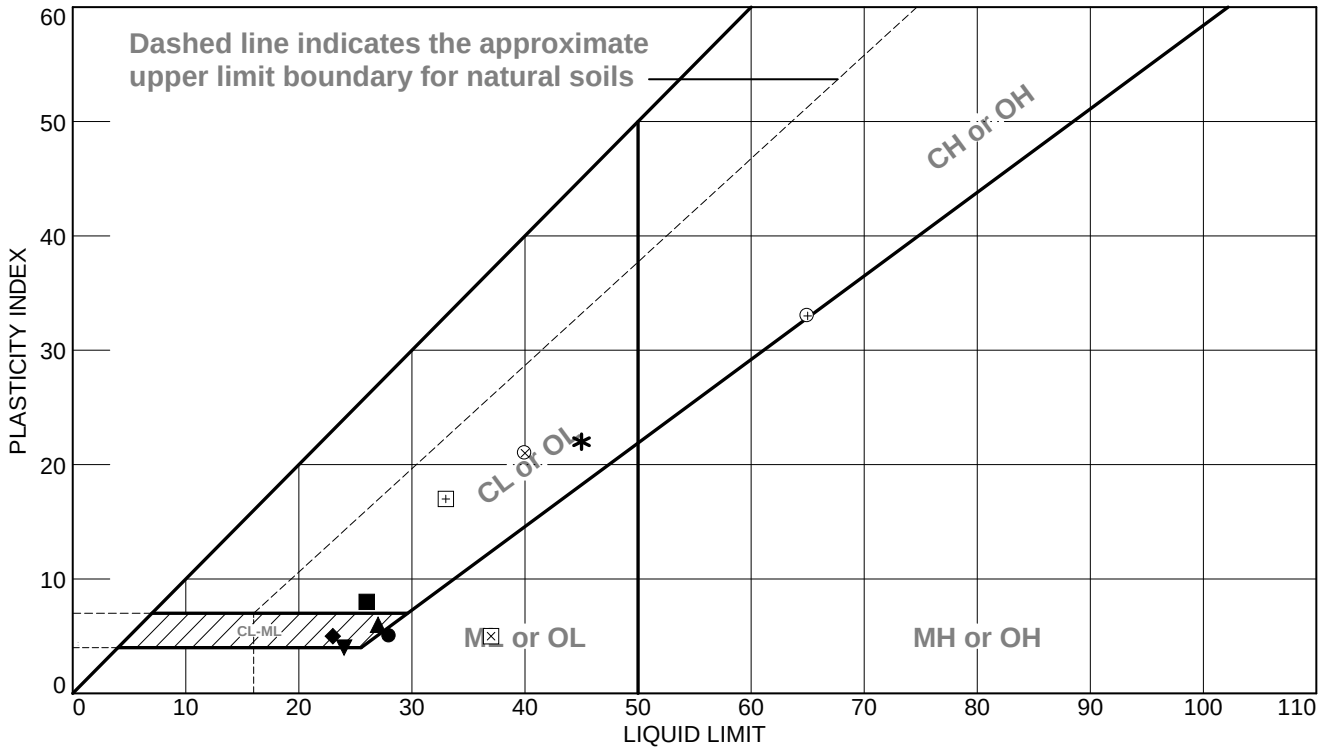
ICICLE CREEK ENGINEERS, INC.

Carnation, WA

Client: Parametrix and King County
Project: East Lake Sammamish Trail - North Sammamish Segment

Project No: 0105-007 **Figure** B-14

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Test Borings	B-26, S-1	2.5 feet		23	28	5	
■	Test Borings	B-26, S-2	5 feet		18	26	8	
▲	Test Borings	B-27, S-2a	5 feet		21	27	6	
◆	Test Borings	B-29, S-2	5 feet		18	23	5	
▼	Test Borings	B-29, S-3	10 feet		20	24	4	
✱	Test Borings	B-35, S-2	5 feet		23	45	22	
⊕	Test Borings	B-35, S-3	10 feet		32	65	33	
⊞	Test Borings	B-38, S-2	5 feet		16	33	17	
⊗	Test Borings	B-38, S-3	7.5 feet		19	40	21	
☒	Test Borings	B-39, S-4	10 feet		32	37	5	

ICICLE CREEK ENGINEERS, INC.

Carnation, WA

Client: Parametrix and King County

Project: East Lake Sammamish Trail - North Sammamish Segment

Project No.: 0105-007 **Figure** B-15

Tested By: JMS **Checked By:** KSK