Report
Geotechnical Engineering Services
East Lake Sammamish Master Plan Trail
South Sammamish Segment B
Inglewood Hill Road Parking Lot
Proposed Retaining Walls
Sammamish, Washington

February 10, 2016
ICE File No. 0105-010

Prepared For:
Parametrix

Prepared By:
Icicle Creek Engineers, Inc.

ICICLE CREEK
ENGINEERS
Geotechnical, Geologic and Environmental Services

February 10, 2016

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We are pleased to submit an electronic copy (pdf) and two original copies of our *Report, Geotechnical Engineering Services, East Lake Sammamish Master Plan Trail, South Sammamish Segment B, Inglewood Hill Road Parking Lot, Proposed Retaining Walls, Sammamish, Washington*. Icicle Creek Engineers' services were completed in general accordance with Parametrix Amendment Nos. 4, 5, 7 and 8 to Subconsultant Agreement for Professional Services, and were authorized in writing by John Perlic, Transportation Division Manager for Parametrix, on August 6, 2013, February 6, 2014, December 2, 2014 and March 31, 2015. Our report was submitted in draft form for your review and comment on February 10, 2016 (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

Exhibit 12
SSDP2016-00414
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SAMMAMISH, WASHINGTON

1.0 INTRODUCTION

This report summarizes the results of Icicle Creek Engineers' (ICE's) geotechnical engineering services related to the design of retaining walls for the proposed expansion of the existing Inglewood Hill Road parking lot located at about Stations 469+00 to 472+00 along the South Sammamish Segment B of King County's East Lake Sammamish Trail (ELST) in Sammamish, Washington. We understand that retaining walls will be needed to improve the space and access for the existing parking lot. The project site is shown relative to nearby physical features on the Vicinity Map, Figure 1. The proposed layout of the parking lot and retaining walls is shown on the Site Plan, Figure 2.

2.0 PROJECT DESCRIPTION

Phoebe Johannessen of Parametrix, the project engineer, provided ICE with the following documents related to the project:

- Parametrix, September 2015, *Inglewood Hill Parking Lot Plan, East Lake Sammamish Trail*, 60% Review Submittal, sheet AL1.
- Parametrix, undated, A-Line, B-Line and C-Line profiles, scale (horizontal and vertical) 1 inch = 20 feet.

Based on our review of these plans, the primary walls ("A-Line" and "B-Line" shown in red on Figure 2) will be constructed to retain fill up to 30-feet high (at about A-Line Station 10+40). The A-Line wall (Parking Lot Wall) and the B-Line wall (Pedestrian Ramp Wall) are situated to provide pedestrian ramp access down to the ELST from the parking lot. For this reason, the walls are tiered where they parallel the ELST. At the south end of the parking area, the A-Line wall wraps back to the east to tie into East Lake Sammamish Parkway NE; this results in an increasing "slope" separation inclined at about 1.25H:1V (horizontal to vertical - 40 degrees/84 percent grade) at Station 10+30. At the north end of the parking area, the B-Line wall wraps back to tie into East Lake Sammamish Parkway NE to form a "Plaza" and covered picnic area with a wall that is about up to 20-feet high. The C-Line wall is the existing ELST Trail wall.

Other retaining walls may be required as the design progresses such as between the Plaza and East Lake Sammamish Parkway NE. A Gravity Block Wall (GBW) may be considered for this application.

3.0 SCOPE OF SERVICES

The purpose of our services was to explore subsurface soil and groundwater conditions in the proposed parking lot area as a basis for providing geotechnical recommendations for retaining wall design. Specifically, our services included the following:

- Review available information including regional geologic mapping by the US Geological Survey and test borings completed by ICE in 2013 for the ELST project and a test boring completed by others in 1991 in East Lake Sammamish Parkway NE adjacent to the parking lot area.
- Complete a field reconnaissance of the existing parking lot and adjacent areas.
- Explore subsurface soil and groundwater conditions by drilling five test borings.

- Install piezometers in two of the test borings to monitor depth to groundwater.
- Complete laboratory tests with the appropriate ASTM standards (moisture content determination) on selected soil samples from the test borings.
- 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 groundwater conditions at the proposed parking lot site.
- Provide recommendations for earthwork including suitability of on-site soils for use as Structural Fill, constraints for wet weather construction and structural fill criteria.
- Provide recommendations for the preferred retaining wall type including Structural Earth Wall (SEW) or Gravity Block Wall (GBW) including preliminary global stability analysis at the critical sections.
- Provide recommendations for parking lot subgrade preparation.

4.0 GEOLOGIC SETTING

Based on regional geologic mapping by the USGS (1992, D.B. Booth and J.P. Minard, *Geologic Map of the Issaquah 7.5' Quadrangle, King County, Washington*, Miscellaneous Field Studies Map 2206), the project site is underlain by Recessional Outwash. Recessional Outwash typically consists of medium dense sand and gravel with variable amounts of silt. We expect that the Recessional Outwash is underlain by glacially-overridden sediment referred to as Pre-Fraser Sediments. The Pre-Fraser Sediments typically consist of dense to very dense sand or gravel with variable amounts of silt or stiff to hard silt with variable amounts of sand and occasional gravel.

Based on our site observations and review of historical aerial photographs, the parking lot site has a long history of grading related to the existing parking lot, East Lake Sammamish Parkway NE and the ELST/abandoned rail line. For this reason, we expect that areas of soil fill of unknown quality are present.

5.0 SITE CONDITIONS

5.1 SURFACE CONDITIONS

Jeff Schwartz and/or Brian Beaman of ICE have used the existing parking lot numerous times for access parking related to other aspects of ELST work during the past three years and most recently for services related to the current study, including a utility locate on September 22, 2015, drilling test borings on September 29 and October 2, 2015, and groundwater level measurements on January 25, 2016.

The parking lot site is located in a "benched" (graded) hillside area between East Lake Sammamish Parkway NE and the ELST. Based on our review of historic maps the ELST/rail line was constructed sometime prior to 1897 (USGS topographic map dated 1897 shows the rail line). Based on historical aerial photographs, East Lake Sammamish Parkway NE was constructed prior to 1945 (US Army Corps of Engineers, 1945 aerial photograph which is the earliest available aerial photograph for the area). The existing parking lot, including the underground concrete stormwater vault, appears to have been constructed in 2009 (Google Earth, aerial photograph dated April 30, 2009).

Currently, the west shoulder of East Lake Sammamish Parkway NE is at about Elevation 76 to 80 feet then descends as a 2H:1V fill embankment to the existing parking lot which is at about Elevation 70 feet. Access to the parking lot is at the north end. Vehicle parking is typically on the concrete lid of the stormwater vault, but other random parking is available in the gravel-surfaced area which varies from 30 to 50 feet in width, widening to the north where the access road is located. From the west edge of the parking lot area, the ground surface slope down to the ELST which is at about Elevation 44 to 46 feet in this area. A graveled surface trail, about 6-feet wide, has been cut into the slope as a descending traverse to provide foot and bicycle access to the ELST from the parking lot.

South of the existing parking lot, where the proposed parking lot will extend into, there is currently an oversteepened (1.25H:1V) fill embankment for the west shoulder of East Lake Sammamish Parkway NE. The fill embankment is about 35-feet high extending down to the ELST and is vegetated with dense brush and scattered trees.

No surface water or groundwater seepage has been observed in the existing parking lot or ELST area during our numerous site visits.

5.2 SUBSURFACE CONDITIONS

5.2.1 General

ICE evaluated subsurface conditions at the proposed parking lot site by drilling four test borings (Borings B-102 through B-105) to depths ranging from about 26.5 to 30.4 feet using track-mounted drill equipment on September 29, 2015. Another test boring (Boring B-101) was drilled using portable drill equipment to a depth of about 14.5 feet on October 2, 2015. The five test boring locations are shown on Figure 2. A description of the field exploration program, including the test boring logs, is presented in Appendix A. The laboratory testing program is described in Appendix B.

The purpose of the test borings was to evaluate the fill thickness, the underlying native soil deposits and groundwater conditions. Our knowledge of subsurface conditions in the project site area was supplemented by borings completed for a previous study by ICE for the ELST (2013 – Boring B-72) and by others (Sammamish Plateau Water and Sewer District, 1991, Boring B-1). The locations of these borings are shown on Figure 2.

5.2.2 Soil and Groundwater Conditions

A summary of soil types encountered in the test borings is presented below.

Fill – Loose to medium dense (typically medium dense) sand with variable amounts of silt and gravel and loose to medium dense gravel with variable amounts of silt, sand and cobbles. A fragment of wire was encountered in the Fill in Boring B-102. Drain rock (1¼-inch uniform washed rock) was encountered at a depth of about 6 to 8 feet in Boring B-103.

Recessional Outwash – Medium dense to dense silty sand with variable amounts of gravel and medium dense to dense gravel or gravel with variable amounts of silt, sand and cobbles.

Pre-Fraser Sediments – Dense to very dense silty sand (encountered in Boring B-103 at a depth of about 23 feet and Boring B-104 at a depth of about 17.5 feet).

Boring B-72, completed in 2013 by ICE for the ELST South Sammamish Segment B) is located in the west shoulder of the ELST. Boring B-72 encountered about 8 feet of Fill underlain by Recessional Outwash.

Boring B-1(SPSWD), completed in 1991 by the Sammamish Plateau Sewer and Water District, is located in the shoulder area of East Lake Sammamish Parkway NE adjacent to the parking lot site. Boring B-1(SPWSD) encountered about 9½ feet of Recessional Outwash consisting of medium dense to dense gravel with sand and variable amounts of silt.

In most of the test borings, including the test borings by others, we observed high Standard Penetration Test (SPT) blow counts within the Recessional Outwash. It is likely that these blow counts are not representative of the actual density of the Recessional Outwash because of the presence of gravel and occasional cobbles.

The following is a summary of the existing fill and groundwater conditions (at the time of drilling) encountered in the test borings.

Boring Number	Fill Thickness (feet)	Depth to Groundwater (feet)
B-101	0	None
B-102	13	None
B-103	8	None
B-104	5	None
B-105	9	None
B-72	8	13
B-1(SPWSD)	0	None

Groundwater monitoring wells (piezometers) were installed in Boring B-103 and B-105; no groundwater was measured in the piezometers on January 25, 2016. Details of the piezometer installation and subsequent groundwater measurements are shown on the boring logs in Appendix A.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 GENERAL

The proposed parking lot expansion will involve placement of new fill to create additional space. We expect that Structural Earth Walls (SEWs) will be the primary walls because of the need to place fill with lessor cut; primarily along the north, west and south perimeter of the proposed parking lot (labeled as the A-Line and B-Line on Figure 2). A Gravity Block Wall (GBW) may be a satisfactory solution to replace support of the East Lake Sammamish Parkway NE fill embankment cut, as needed, to gain space along the east perimeter of the proposed parking lot.

Based on the results of the test borings, the existing fill and underlying native soils appear to be generally adequate for support of SEWs and GBWs.

6.2 STRUCTURAL EARTH WALLS

6.2.1 General

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, reinforced with layers of geotextile fabric, and a Concrete Block Unit (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, a 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 4 feet for a level backslope and 2 feet for a 2H:1V backslope. The CBU supplier should be contacted regarding the height of cut that can be faced with CBUs.

6.2.2 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	125	125
Phi (degrees)	32	34	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 2016 Washington State Department of Transportation (WSDOT) Standard Specifications 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 an allowable soil bearing capacity of 2,500 psf for wall and Reinforced Fill Zone subgrade.

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	Wall Height/20 or 1 foot, whichever is greater
3H:1V	Wall Height/10 or 1 foot, whichever is greater
2H:1V	Wall Height/7 or 1 foot, whichever is greater

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 (FOS) 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/groundwater conditions.

If SEWs are subject to the influence of traffic loading or nearby retaining walls within 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.

6.2.3 SEW Subgrade Preparation

SEW subgrade preparation typically consists of first excavating the Leveling Course Pad, 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 generally defined by probe penetration of less than 6 inches.

6.2.4 Slope Stability Analysis (Global Stability)

Global stability analysis was completed using the computer application Slide 6.0 (RocScience, Version 6.038, January 6, 2016). This computer application has the capability of comprehensive slope stability analysis along with sensitivity and probabilistic analysis. Global stability analysis was completed using the Bishop Simplified Method under static and dynamic (seismic/earthquake) conditions.

The following is a summary of the soil strength parameters used in our analysis.

Soil Type	Moist Unit Weight (pcf)	Φ (degrees)	C (psf)
Reinforced Fill	125	40	2,000
Existing Fill	125	34	0
Recessional Outwash	125	38	100

Reinforced Fill - Fill enclosed within layers of geogrid reinforcement often referred to as the Reinforced Fill Zone (RFZ).
Existing Fill and Recessional Outwash - Existing structural fill and suitable (medium dense or dense) undisturbed soils.
Peak ground acceleration = 0.30g
Φ = angle of internal friction
C = cohesion

In stability analyses, the relative stability of a slope is expressed in terms of a FOS against sliding for the most likely potential failure surface. A FOS of 1.0 corresponds to the conditions in which the resisting and the driving forces are equal (equilibrium conditions), and failure would theoretically be imminent as the result of a decrease in the resisting force or an increase in the driving force. A FOS greater than 1.0 indicates that the forces tending to resist sliding are greater than the forces tending to cause sliding. For SEW global stability, a minimum static FOS of 1.5 is considered adequate. A dynamic (seismic) FOS of 1.1 is considered adequate.

ICE selected four critical sections (shown on Figure 2) along the C-Line alignment that include the proposed Parking Lot Wall and Pedestrian Ramp Wall, and the existing Trail Wall at Stations 468+25, 469+50, 470+75 and 471+75 where the ground configuration and wall geometry was such that global stability analysis was deemed appropriate. We analyzed the static and seismic (earthquake) stability of the Full Slope, Upper Slope and Lower Slope failure condition at each critical section. The graphical output for global stability analysis of these four critical sections (static and seismic) is included in Appendix C. The following table summarizes the results of this analysis.

Station	Slope Condition	FOS (static)	FOS (seismic)
468+25	Full	1.633	1.235
"	Upper	1.743	1.374
"	Lower	1.634	1.307
469+50	Full	1.600	1.164
"	Upper	1.419	1.104
"	Lower	1.363	1.044
470+75	Full	2.014	1.458
"	Upper	1.846	1.431
"	Lower	2.000	1.573
471+75	Full	1.766	1.335
"	Upper	1.493	1.188
"	Lower	2.018	1.574

Based on our analysis, it is our opinion that the wall sections reviewed for this project have been designed with an adequate FOS with respect to global stability contingent on the following:

- The Parking Lot Wall and Pedestrian Ramp Wall should be combined as a single, tiered wall with a minimum geogrid length of 21 feet for the Pedestrian Ramp Wall.

6.3 GRAVITY BLOCK WALLS

6.3.1 Design Considerations

As previously mentioned, a GBW is being considered as a method to resupport the toe of the East Lake Sammamish Parkway NE embankment should a cut in this slope be needed to enlarge the parking area. A GBW (ICE used the UltraBlock™ wall system as a design model) is considered a "gravity wall" that is comprised of several components including the following:

Prefabricated Modular Units (PMUs) – *Full Block* measuring 5-feet long 2.5-feet high and 2.5-feet wide, 4,320 pounds; *Cap Block* measuring 5-feet long, 1.25-feet high and 2-5 feet wide, 2,150 pounds.

Drainage Fill / Drainage Composite – Drainage Fill consists of free-draining aggregate that is placed behind the PMUs such as 2016 WSDOT Standard Specifications Section 9-03.9(2) (Permeable Ballast). If a Drainage Composite, such as Strata 350, Synteen 55, or equal, is used, we recommend combining the Drainage Fill and Drainage Composite. The Drainage Composite is not a substitute for the Drainage Fill, however, Drainage Fill alone is satisfactory.

Retained Soil – The native soil where cuts are made into existing slopes.

Leveling Pad / Wall Foundation – Compacted and free-draining crushed rock such as the 2016 WSDOT Standard Specifications Section 9-03.9(3) (Base Course) pad upon which the PMUs are placed.

Embedment – The minimum depth (0.5 foot) to which the base PMU is embedded into the ground.

Foundation Subgrade – Medium dense or better, existing fill or native soil, or structural fill that extends to the competent native soils.

Drain Pipe – 4-inch diameter, smooth-walled perforated PVC pipe placed at the base of the wall that discharges by gravity to a suitable location.

Drainage Swale – A small depression adjacent to the top of the wall to collect surface water runoff to the Drainage Fill.

Geotextile Filter – A non-woven geotextile fabric, such as Tencate Mirafi 180N or equal, which is placed between the Retained Soil and the Drainage Fill.
Backslope – The ground surface slope behind (uphill from) the wall.
Foreslope – The ground surface slope in front of the wall.
Tilt – The inclination of the face of the wall (1H:8V, horizontal to vertical).

6.3.2 Slope Stability Analysis (Global Stability)

Our global stability analysis of the GBW system was completed by using UltraBlock™ Retaining Wall Software Version 3.1.13029.1447, design method National Concrete Masonry Association (NCMA)-09, 3rd Addition, provided to ICE by Rick Ianello of UltraBlock, Inc. This software has the capability of completing a full analysis (sliding, bearing, overturning, overall stability and compound stability) of wall sections, considering the site topography and soil conditions. For the purpose of this analysis, ICE selected a probable "worst-case" (critical) section with a wall height of 6 feet and cut into an existing fill embankment for East Lake Sammamish Parkway NE which slopes at 1.5H:1V (about 33 degrees).

The following is a summary of the soil strength parameters used in our analysis.

Soil Type	Moist Unit Weight (pcf)	Φ (degrees)	C (psf)
Retained Soil [1]	125	34	0
Foundation Subgrade	125	34	0

[1] Drainage Fill that is placed between the PMUs and the Retained Soil should consist of "Permeable Ballast" consistent with the 2016 WSDOT Standard Specifications Section 9-03.9(2).
Φ = angle of internal friction
C = cohesion

For the section geometry, we used the following input parameters:

Design Height (maximum)	6 feet
Tilt	1H:8V
Embedment	0.5 foot
Leveling Pad Thickness	0.5 foot
Backslope Angle	1.5H:1V (33 degrees)
Foreslope Angle	Level (0 degrees)
Peak Ground Acceleration[1]	0.34g

[1] For seismic evaluation

The general minimum FOS (static) for gravity wall structures is 1.5 for sliding and overturning, and 2.0 for bearing. The FOS for seismic conditions is typically acceptable at 75 percent of the static FOS.

The output file for the GBW (UltraBlock™ wall) system is included in Appendix D.

Based on our analysis, UltraBlock™ walls up to 6 feet in height (includes the 0.5 foot embedment) with up to a 1.5H:1V backslope may be used. A diagram showing the primary wall structure components for the UltraBlock™ wall is included in Appendix D. A summary of the FOS results is presented below:

Wall Condition	FOS (static)	FOS (seismic)
Sliding	2.48	1.94
Bearing	15.40	13.47
Overturning	3.72	3.11
Compound Stability[1]	16.30	OK (>1.0)
Global Stability[2]	1.31	OK (>1.0)

[1] Compound stability relates to overall slope failure through the face of the wall.

[2] Global stability relates to a slope failure below the base of the wall.

6.4 CONSTRUCTION CONSIDERATIONS

6.4.1 General

The proposed parking lot is located in an area with a long history of site use being sandwiched in between the former rail line (ELST) and East Lake Sammamish Parkway NE with recent use (and related grading) for the existing parking lot. For this reason, it is possible the unsuitable fill may be encountered and would require excavation and removal or compaction.

We recommend that during grading the subgrade should 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 the final grade (outside of wall foundation areas), and replaced with Structural Fill.

It is important to note that the underlying soil conditions (Recessional Outwash) have a relatively high moisture content and may be difficult, if not impossible, to compact during extended periods of wet weather. Earthwork should be scheduled during the normally drier months, unless project delays and extra costs associated with maintaining an adequate trail subgrade for use by heavy construction equipment are acceptable.

6.4.2 Structural Fill - Mass Grading Application

6.4.2.1 General

New fill should be placed as Structural Fill. Structural Fill material should be free of debris, organic material 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.

6.4.2.2 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.

6.4.2.3 Gravel Borrow

We recommend that Structural Fill consist of Gravel Borrow for the Reinforced Fill Zone for SEWs. Gravel Borrow should conform with Section 9-03.14(1) of the 2016 WSDOT Standard Specifications.

6.4.2.4 Reuse of On-Site Materials

The site soils (Fill, Recessional Outwash and Pre-Fraser Sediments) 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 6.2.2 for material specifications).

Soil containing more than 10 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.

6.4.2.5 Placement and Compaction

All Structural Fill placed in Parking Lot area should be compacted to at least 95 percent of the Maximum Dry Density (MDD) 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 Parking Lot area 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 five 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 five percent fines, or quarry spalls (Section 9-13.3, 2016 WSDOT Standard Specifications). 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.

6.4.2.6 Fill Settlement

Most of the Structural Fill placed for the Parking Lot area 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 Structural Fill is placed. Some settlement will also occur within the Structural Fill itself, especially where the Structural Fill thickness is greater than 5 feet. We estimate that the maximum amount of settlement within the Structural Fill will be about 1 percent of the Structural Fill thickness. Thus, for a 5-foot Structural Fill section, settlements on the order of ½ to 1 inch might occur.

6.4.3 Cut and Fill Slopes

6.4.3.1 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 soil that may be several feet thick. The loose soil will be subject to localized raveling and sloughing and must therefore be sloped no steeper than 3H:1V or covered with quarry spalls or a suitable Turf Reinforcement Mat (TRM) consisting of straw, coir (coconut) and jute for the purpose of stabilization.

Where cut benches are required (cut slopes more than 10-feet high), 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 five percent.

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. Loose to medium dense Fill soils classify as a Type C soil (OSHA 1926 Subpart P, Appendix A and B; OSHA Technical Manual, Section V, Chapter 2, sections V and VIII, dated January 20, 1999) and may be inclined (temporary slope) as steep as 1.5H:1V. The medium dense Recessional Outwash and dense to very dense Pre-Fraser Sediments classify as a Type B soil and may be inclined (temporary slope) as steep as 1H:1V (OSHA, as described above). Flatter slopes may be required where groundwater seepage occurs and dewatering may be required to lower the groundwater table below the base of the excavation. Alternatively, shoring may be used where the excavation is more than 4-feet deep.

6.4.3.2 Fill Slopes

Structural Fill slopes may be sloped at 2H:1V or flatter. All surfaces which will receive Structural Fill should be properly stripped of vegetation and organic material prior to placing Structural Fill. Structural 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 Structural Fill in a series of 4- to 8-foot-wide horizontal benches cut into the slope. The Structural Fill should be placed in horizontal lifts. We recommend that Structural 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 mat or blanket such as Tensar® Hydramax™, EroNet™, BioNet® or VMax® products, as appropriate.

6.4.4 Shored Excavations

It may be necessary to support the temporary excavations to maintain the integrity of the surrounding undisturbed soils and to reduce disruption of adjacent areas, as well as to protect the personnel working within the excavation. Because of the diversity of available shoring systems and construction techniques, the design of temporary shoring is most appropriately left up to the contractor proposing to complete the installation. We recommend that the shoring be designed by a licensed Professional Engineer in Washington, and that the PE-stamped shoring plans and calculations be submitted to the Project Engineer for review and comment prior to construction.

Shoring can be designed using active soil pressures. We recommend that temporary shoring be designed using a lateral pressure equal to an equivalent fluid density of 40 pcf, for conditions with a level ground surface adjacent to the excavation. If the ground within 5 feet of the excavation rises at an inclination of 1H:1V or steeper, the shoring should be designed using an equivalent fluid density of 75 pcf. For adjacent slopes flatter than 1H:1V, soil pressures can be interpolated between this range of values. Other conditions should be evaluated on a case-by-case basis. Internally-braced shoring may be designed using a uniform lateral soil pressure equal to 35H where H is the height of the excavation to be shored.

These lateral soil pressures do not include traffic or construction surcharges that should be added separately, if appropriate. It is typical for shoring to be designed for a traffic influence equal to a uniform lateral pressure of 240 psf acting over a depth of 10 feet from the ground surface. More conservative pressure values should be used if the designer deems them appropriate. These soil pressure recommendations are predicated upon the construction being essentially dewatered; therefore, hydrostatic water pressures are not included.

7.0 ADDITIONAL SERVICES

7.1 REVIEW OF PLANS AND SPECIFICATIONS

We recommend that ICE be retained to review those portions of the plans and specifications that pertain to earthwork and foundation construction prior to completion of the 90 percent drawings, to evaluate whether they are in accordance with the recommendations presented in this report.

7.2 CONSTRUCTION OBSERVATION

We recommend that ICE be retained to observe the geotechnical aspects of construction, particularly the foundation installation and fill placement and compaction. This observation would allow us to evaluate subsurface conditions as they are exposed during construction and to determine that work is accomplished in accordance with our recommendations. If conditions encountered during construction differ from those anticipated, we can provide recommendations for the conditions actually encountered.

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 widely-spaced 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 that 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 trust this report meets your present needs. Please call if you have any questions.

Yours very truly,
Icicle Creek Engineers, Inc.

Kathy S. Killman, LEG
Principal Engineering Geologist

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

Document ID: 0105010.parkinglotrep

FIGURES

VICINITY MAP - INGLEWOOD HILL ROAD PARKING LOT

EAST LAKE SAMMAMISH MASTER PLAN TRAIL

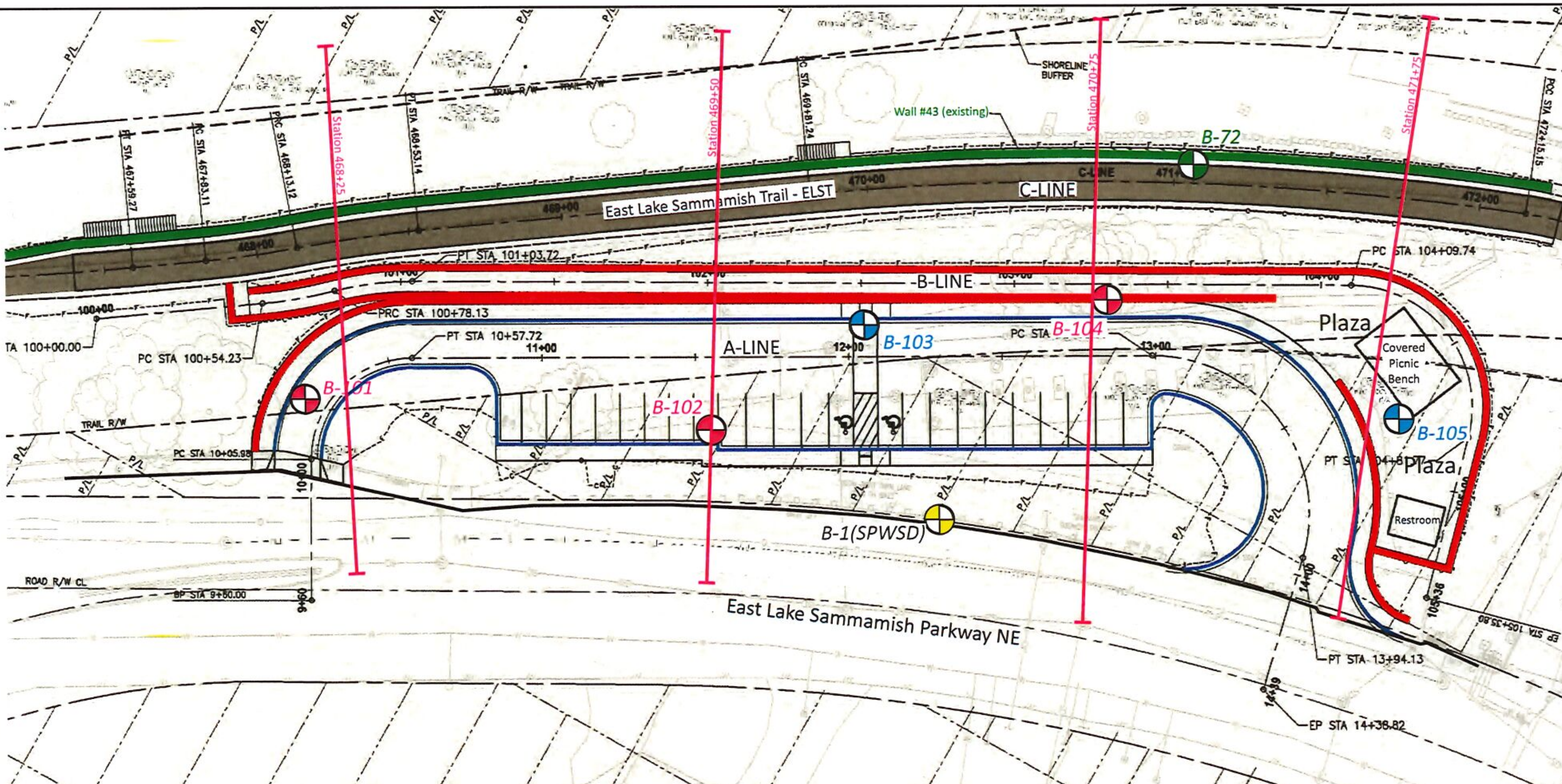
King County

ICICLECREEK ENGINEERS

29335 NE 20th Street
Carnation, Washington 98014
(425) 333-0093

SCALE: AS SHOWN	ICE FILE NO.
DESIGNED: --	0105-010
DRAWN: --	Figure
CHECKED: KSK	1
DATE:	

Exhibit 12
SSDP2016-00414
000111



Base Map Reference: Parametrix, September 2015, *East Lake Sammamish Master Plan Trail, Inglewood Hill Road Parking Lot, Parking Lot Plan*, scale 1 inch = 40 feet.

0 50 100
Approximate Scale in Feet

EXPLANATION

B-101	Test Boring (ICE, 2015)
B-72	Test Boring (ICE, 2013)
B-103	Test Boring/Piezometer (ICE, 2015)
B-1 (SPWSD)	Test Boring by others (City of Sammamish/Sammamish Plateau Water and Sewer District)
(red line)	Proposed Structural Earth Wall
Station 470+75	Location of Global Stability Analysis Critical Sections

VICINITY MAP - INGLEWOOD HILL ROAD PARKING LOT
EAST LAKE SAMMAMISH MASTER PLAN TRAIL
King County

ICICLECREEK ENGINEERS
29335 NE 20th Street
Carnation, Washington 98014
(425) 333-0093

SCALE: AS SHOWN
DESIGNED: --
DRAWN: BRB
CHECKED: KSK
DATE: 02/10/16

ICE FILE NO. 0105-010
Figure 2

Exhibit 12
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000112

APPENDIX A

FIELD EXPLORATION PROGRAM

APPENDIX A

A.0 FIELD EXPLORATION PROGRAM

A.1 FIELD RECONNAISSANCE

Jeff Schwartz of ICE completed a field reconnaissance of the proposed Inglewood Hill Road Parking Lot and adjacent areas on September 22, 29, and October 2, 2015. The field reconnaissance included the following:

- Observation and preliminary evaluation of man-made features including the existing conditions of East Lake Sammamish Parkway NE, the parking lot and the East Lake Sammamish Trail.
- Reconnaissance and mapping included photograph documentation of the existing conditions and test boring locations.

A.2 TEST BORINGS

Subsurface conditions were evaluated based on published and unpublished geologic information for the area, including a test boring completed for a previous study by ICE for the ELST (2013 – Boring B-72).

ICE completed four test borings (Borings B-102 through B-105) to depths ranging from about 26.5 to 30.4 feet using a track-mounted excavator on September 29, 2015. A fifth test boring (Boring B-101) was drilled using portable drill equipment to a depth of about 14.5 feet on October 2, 2015. The drilling equipment is owned and operated by Boretec, Inc. of Valleyford, Washington. The test boring locations are shown on Figure 2.

The explorations were continuously observed by an engineering geologist from ICE who classified the soils, obtained representative soil samples, observed groundwater conditions and prepared a detailed log of each exploration. After completion, the test borings were either backfilled in general accordance with Washington State Department of Ecology (Ecology) guidelines, or piezometers were installed as described in Section A.3. Soil cuttings from the test borings were hauled off-site by Boretec. The ground surface was restored and protected from erosion by smoothing and compacting the surface.

The soil consistencies noted on the 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-6. 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. The laboratory testing program for soil samples obtained from the test borings is described in Appendix B.

Elevations of the test borings as shown on the boring logs are based on the plan provided by Parametrix (NAVD88 vertical datum, Parametrix, September 2015).

A.3 GROUNDWATER OBSERVATIONS

Groundwater observations as noted on the boring logs (for test borings where no piezometer was installed) are based on our observations of the soil samples and drilling equipment, or by direct observation or measurement through the auger during drilling.

Piezometers (for measuring groundwater) were installed in two of the test borings, including Borings B-103 and B-105. Piezometer installation was completed in general accordance with Ecology requirements; installation details are shown on the respective boring logs in this appendix.

The depth to groundwater was measured in the piezometers using an electric water level indicator (manual readings) on September 29, 2015 and January 25, 2016. These manual groundwater measurements are shown on the boring logs in this appendix.

Unified Soil Classification System

MAJOR DIVISIONS			Soil Classification and Generalized Group Description	
Coarse-Grained Soils More than 50% retained on the No. 200 sieve	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
		SAND WITH FINES	SM	Sand and silt mixtures
			SC	Sand and clay mixtures
Fine-Grained Soils More than 50% passing the No. 200 sieve	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
		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

EXPLANATION FOR BORING LOGS - INGLEWOOD HILL ROAD PARKING LOT
EAST LAKE SAMMAMISH MASTER PLAN TRAIL

King County

ICICLECREEK ENGINEERS
29335 NE 20th Street
Carnation, Washington 98014
(425) 333-0093

SCALE: No Scale
DESIGNED: --
DRAWN: --
CHECKED: KSK

ICE FILE NO. 0105-010
Figure A-1

BRB:10/02/15

Boring B-101

N47.62257; W122.06989

Approximate Ground Surface Elevation: 71 feet

Depth in Feet	Soil Profile: Description	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	Comments/ Groundwater Observations
0	Dark brown silty fine to medium SAND with occasional gravel (medium dense, moist)(drill cuttings) (Recessional Outwash)		SM					Bentonite Backfill
	Light reddish-yellow silty fine to medium SAND with a trace of gravel (dense*, moist) (Recessional Outwash)		SM	36*				
5			SM	49*				
	Light brown silty fine to coarse GRAVEL with sand (very dense*, moist) (Recessional Outwash)		GM	51*				
10			GM	50/5"*				
				50/6"*				
15	Boring completed at about 14½ feet on October 2, 2015 * Blow count may not be representative because of the presence of gravel and cobbles							No groundwater observed at the time of drilling
20								
25								
30								
35								
40								

Logged by: JMS

Project Name: King County Parks ELST

ICE File No. 0105-010

See Figure A-1 for explanation of symbols

BRB:10/02/15

Logged by: JMS

Project Name: King County Parks ELST

ICE File No. 0105-010

Boring B-102

N47.62291; W122.07015

Approximate Ground Surface Elevation: 69 feet

Depth in Feet	Soil Profile – Description	Group Symbol	Blow Count	Laboratory Testing	Comments/ Groundwater Observations
0	Dark brown silty fine to coarse GRAVEL with sand (loose, moist) (Fill)				
~4		GM	8	MC	Bentonite Backfill
~6	grades to brown and medium dense	GM	20	MC	
~8.5	Brown fine to coarse GRAVEL with silt, sand, occasional cobbles and a fragment of wire (dense to very dense, moist) (Fill)				
~11		GP-GM	50*	MC	
~13.5	Brown fine to coarse GRAVEL with sand, trace of silt and occasional cobbles (dense*, moist) (Recessional Outwash)				
~16		GP	40*	MC	
~20.5		GP?	43*		
~26	grades to very dense*	GP	61*	MC	No groundwater observed at the time of drilling
26½	Boring completed at about 26½ feet on September 29, 2015 * Blow count may not be representative because of the presence of gravel and cobbles				

Penetration Resistance (Blows/foot - ●) 20 40 60 80; Moisture Content (Percent - ■) 20 40 60 80

See Figure A-1 for explanation of symbols

Icicle Creek Engineers

Boring Log - Figure A-3

Exhibit 12
SSDP2016-00414
000118

BRB:10/02/15

Logged by: JMS

Project Name: King County Parks ELST

ICE File No. 0105-010

Boring B-103

N47.62299; W122.07041

Approximate Ground Surface Elevation: 67.5 feet

Depth in Feet	Soil Profile: Description	Group Symbol	Blow Count	Laboratory Testing	Comments/ Groundwater Observations
0	Brown silty fine to medium SAND with occasional gravel (medium dense, moist) (Fill)				Flush Grade Steel Monument; Concrete Plug
~4		SM	20	MC	
5	Brown fine to medium SAND with silt and occasional gravel (medium dense, moist) (Fill)	SM	17	MC	
	Gray coarse GRAVEL (medium dense, moist) (Fill - possible drain rock)	GP			Bentonite Backfill
	Brown and gray fine to coarse GRAVEL with silt and sand medium dense, moist) (Recessional Outwash)				
10	layer of coarse gravel at about 12 feet	GP-GM	22	MC	1¼-inch PVC Solid Pipe
	Light brown silty fine to medium SAND with gravel (medium dense, moist) (Recessional Outwash)				
15		SM	28	MC	
20	grades to loose	SM	9	MC	Sand Backfill
	Light brown silty fine to medium SAND (very dense, moist) (Pre-Fraser Sediments)				1¼-inch PVC Slotted Pipe
25		SM	54	MC	
30		SM	50/5"	MC	
	Boring completed at about 30.9 feet on September 29, 2015				No groundwater observed at the time of drilling or measured on 01/25/16
	* Blow count may not be representative because of the presence of gravel and cobbles				
35					
40					

Penetration Resistance (Blows/foot - ●) 20 40 60 80; Moisture Content (Percent - ■) 20 40 60 80

See Figure A-1 for explanation of symbols

BRB:10/02/15

Boring B-104

N47.62319; W122.07059

Approximate Ground Surface Elevation: 62 feet

Logged by: JMS

Project Name: King County Parks ELST

ICE File No. 0105-010

Depth in Feet	Soil Profile – Description	Group Symbol	Blow Count	Laboratory Testing	Comments/ Groundwater Observations
0	Dark gray fine to coarse GRAVEL with sand and a trace of silt (medium dense, moist) (drill cuttings) (Fill)	GP-GW			Bentonite Backfill
	bark mulch from 2 to 2.5 feet				
5	Light brown silty fine to medium SAND with gravel (dense*, moist) (Recessional Outwash)	SM	36*	MC	
		SM	33*	MC	
10		SM	31*	MC	
	Brown fine to coarse GRAVEL with silt and sand (medium dense to dense*, moist) (Recessional Outwash)				
15		GP-GM	30*	MC	
	Brown fine to medium SAND with silt and gravel (dense, moist) (Pre-Fraser Sediments)				
20		SP-SM	40	MC	
25	grades to very dense	SP-SM	57	MC	
30		SP-SM	50/5"	MC	No groundwater observed at the time of drilling
	Boring completed at about 30.4 feet on September 29, 2015				
	* Blow count may not be representative because of the presence of gravel and cobbles				
35					
40					

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

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

See Figure A-1 for explanation of symbols

Boring B-105

N47.62343; W122.07062

Approximate Ground Surface Elevation: 67.5 feet

BRB:10/02/15

Logged by: JMS

Project Name: King County Parks ELST

ICE File No. 0105-010

Depth in Feet	Soil Profile – Description	Group Symbol	Blow Count	Laboratory Testing	Comments/ Groundwater Observations
0	Brown silty fine to medium SAND with gravel (loose, moist) (Fill)				Flush Grade Steel Monument; Concrete Plug
		SM	9	MC	
5	grades to medium dense	SM	13	MC	Bentonite Backfill
	grades to dense*	SM?	44*		
	Brownish-gray fine to coarse GRAVEL with silt and sand dense*, moist) (Recessional Outwash)				
10		GP-GM	13	MC	1¼-inch PVC Solid Pipe
	Reddish-yellow silty fine to medium SAND with occasional gravel (medium dense, moist) (Recessional Outwash)				
15		SM	17	MC	Sand Backfill
20	grades to dense*	SM	35*	MC	1¼-inch PVC Slotted Pipe
25	grades to medium dense	SM	25	MC	
	Boring completed at about 26½ feet on September 29, 2015				No groundwater observed at the time of drilling or measured on 01/25/16

* Blow count may not be representative because of the presence of gravel and cobbles

Penetration Resistance (Blows/foot - ●) 20 40 60 80; Moisture Content (Percent - ■) 20 40 60 80

See Figure A-1 for explanation of symbols

APPENDIX B

LABORATORY TESTING PROGRAM

APPENDIX B

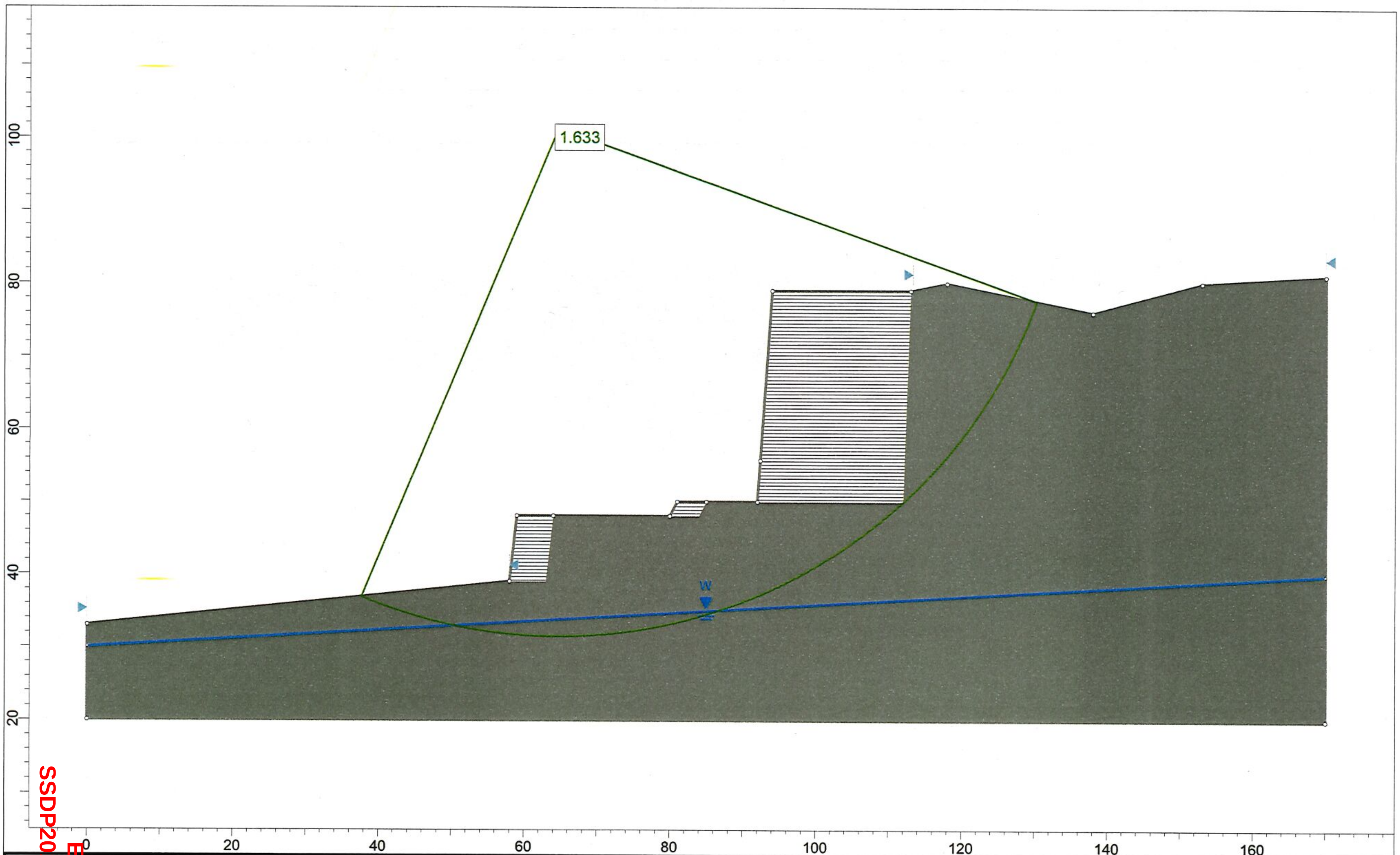
B.0 LABORATORY TESTING PROGRAM

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.

APPENDIX C

GLOBAL STABILITY SUMMARY SHEETS

STRUCTURAL EARTH WALLS



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rocscience SLIDEINTERPRET 6.038

Exhibit 12
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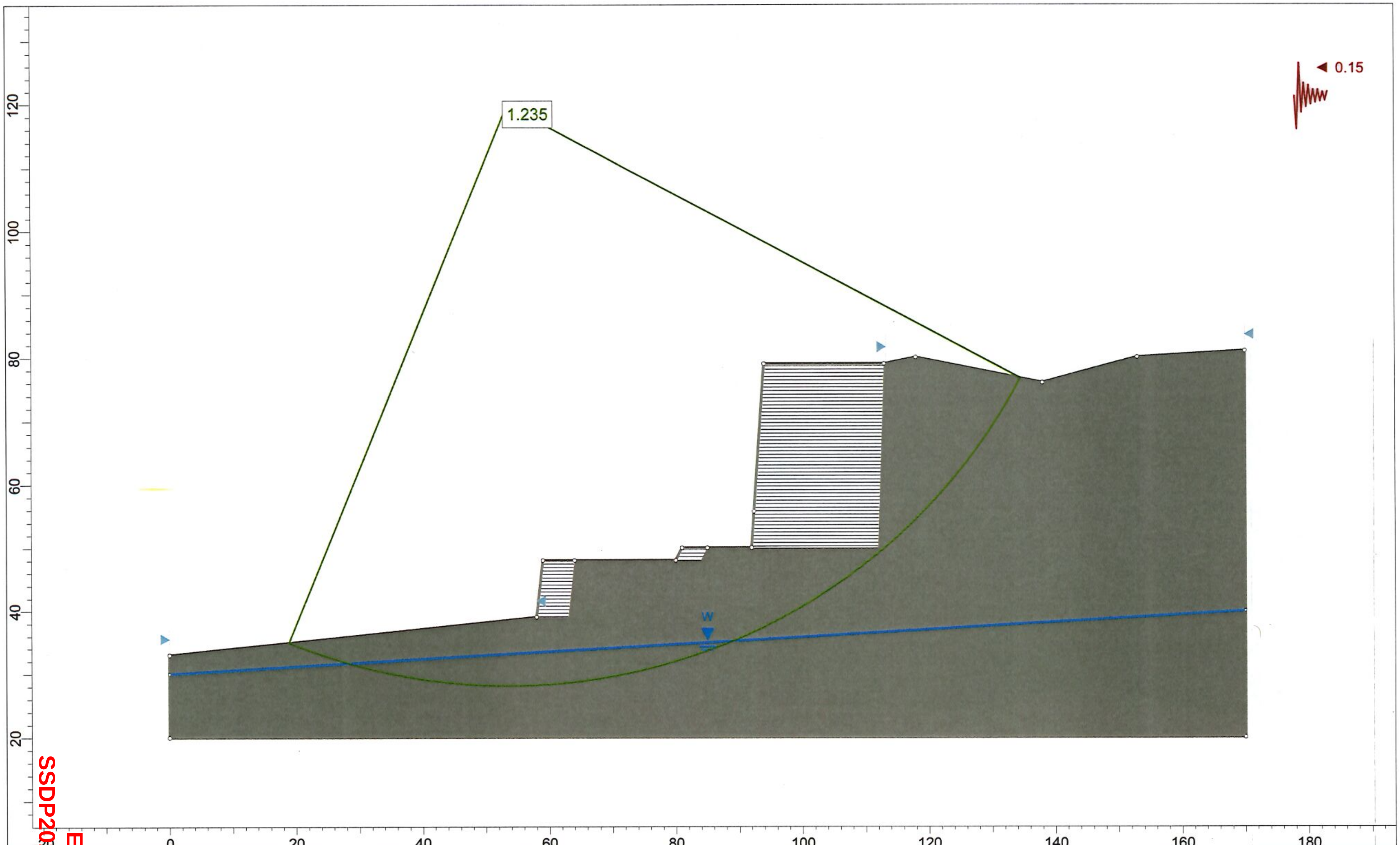

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SLIDEINTERPRET 6.038

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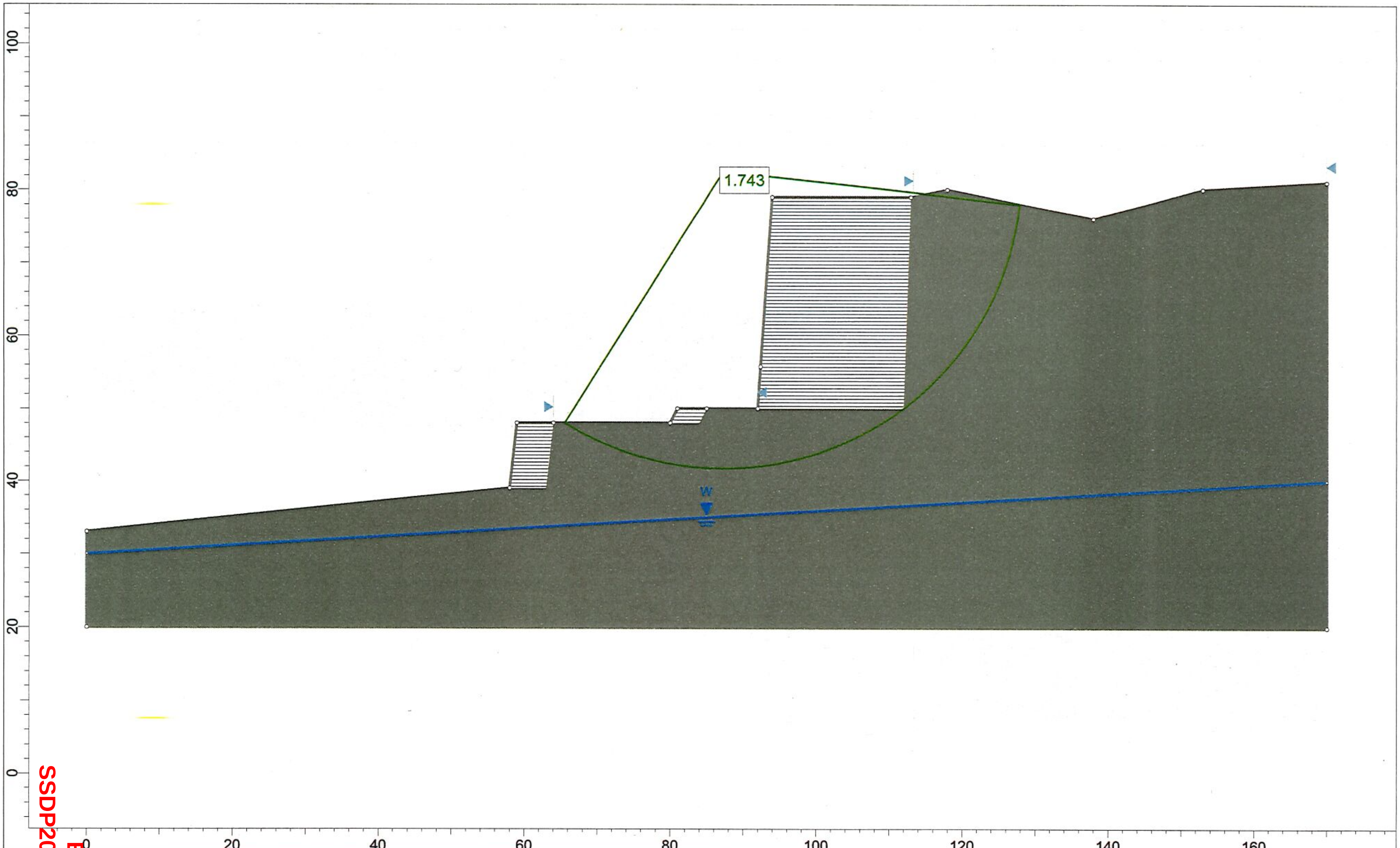

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Company	Icicle Creek Engineers		
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SLIDEINTERPRET 6.038

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SSDP2016-00414
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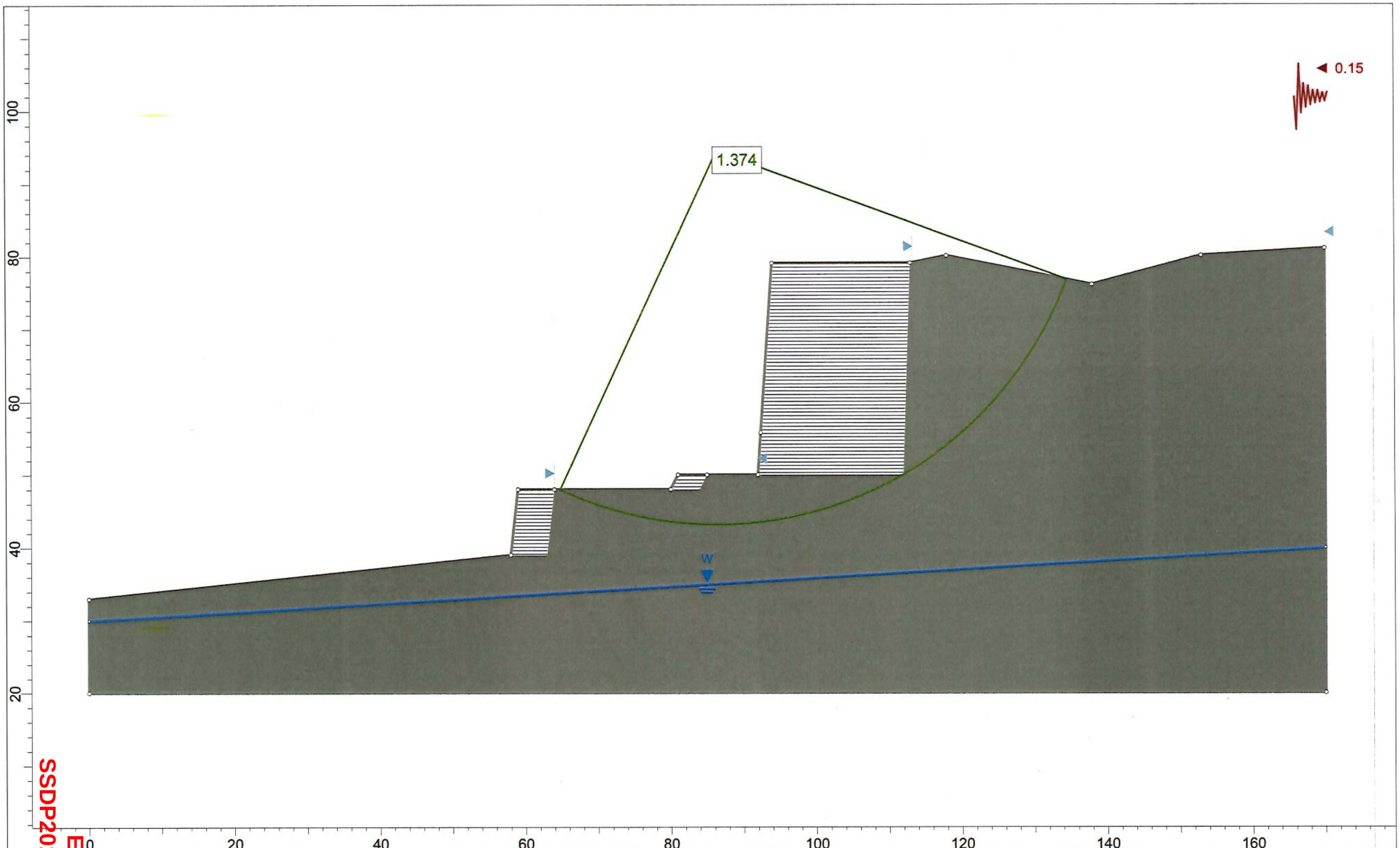

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Analysis Description	Upper Slope - SEISMIC		
Drawn By	BRB	Scale	1:218
Company	Icicle Creek Engineers		
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SLIDEINTERPRET 6.038

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SSDP2016-00414
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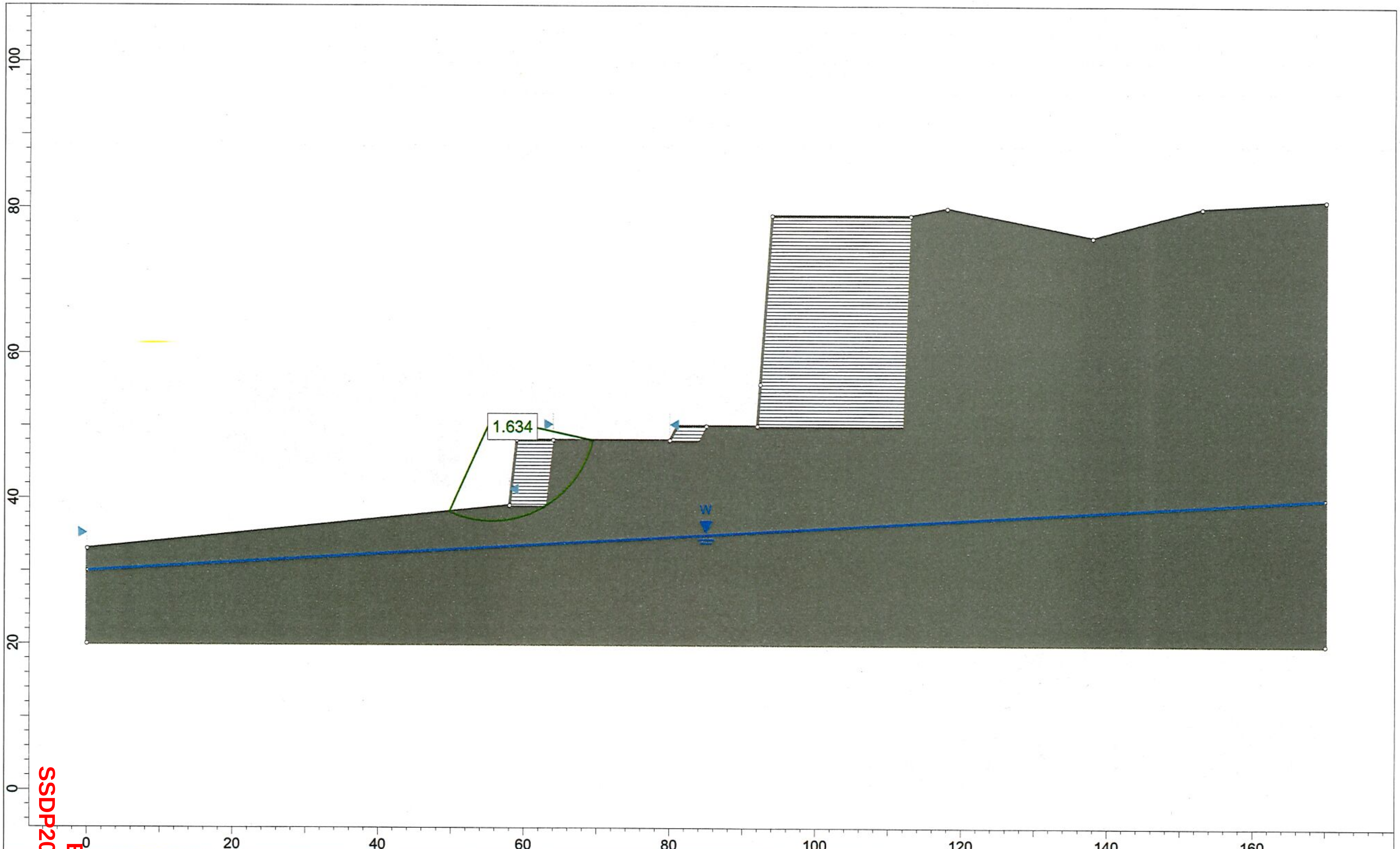

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Analysis Description	Lower Slope - STATIC		
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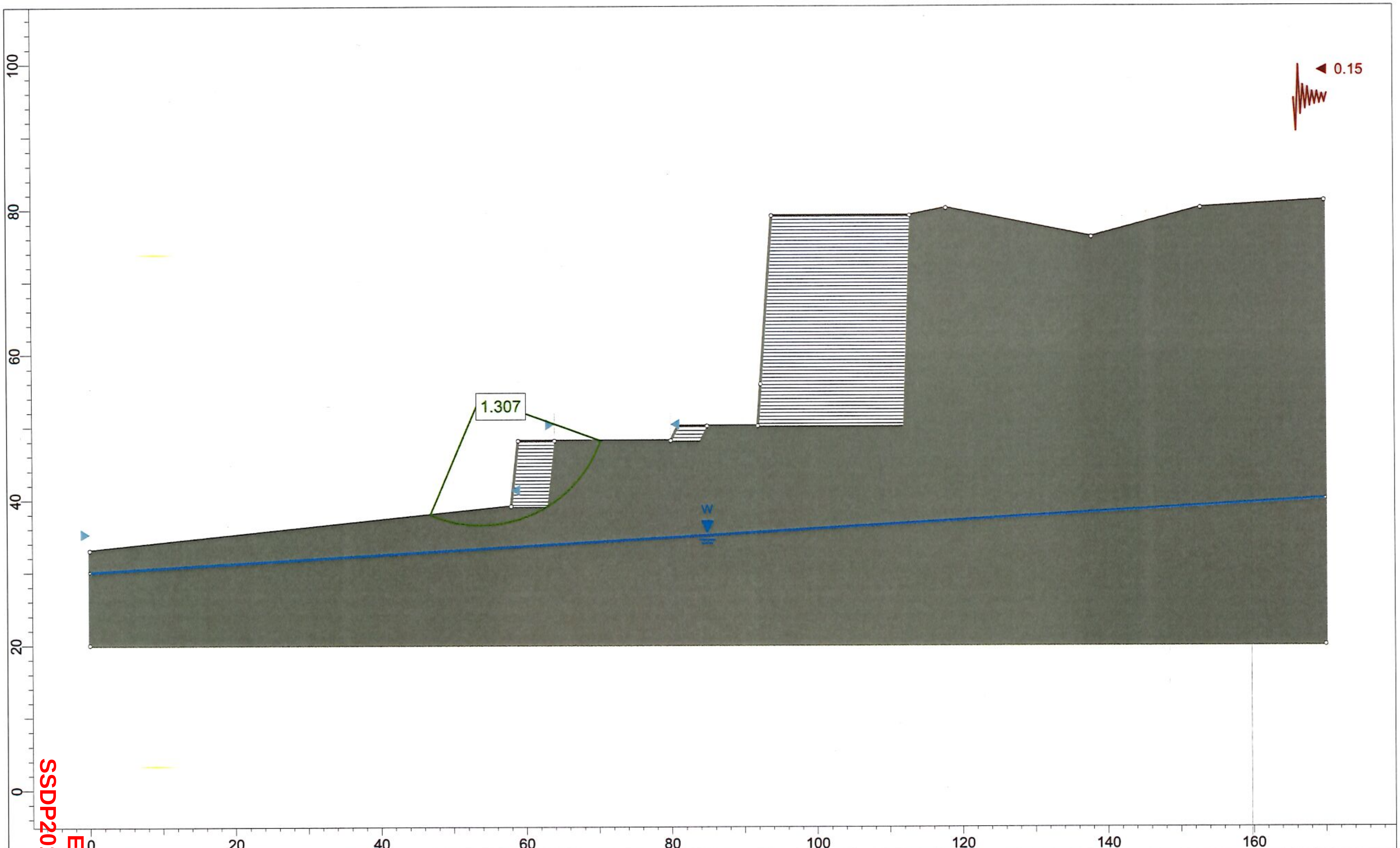
SLIDEINTERPRET 6.038



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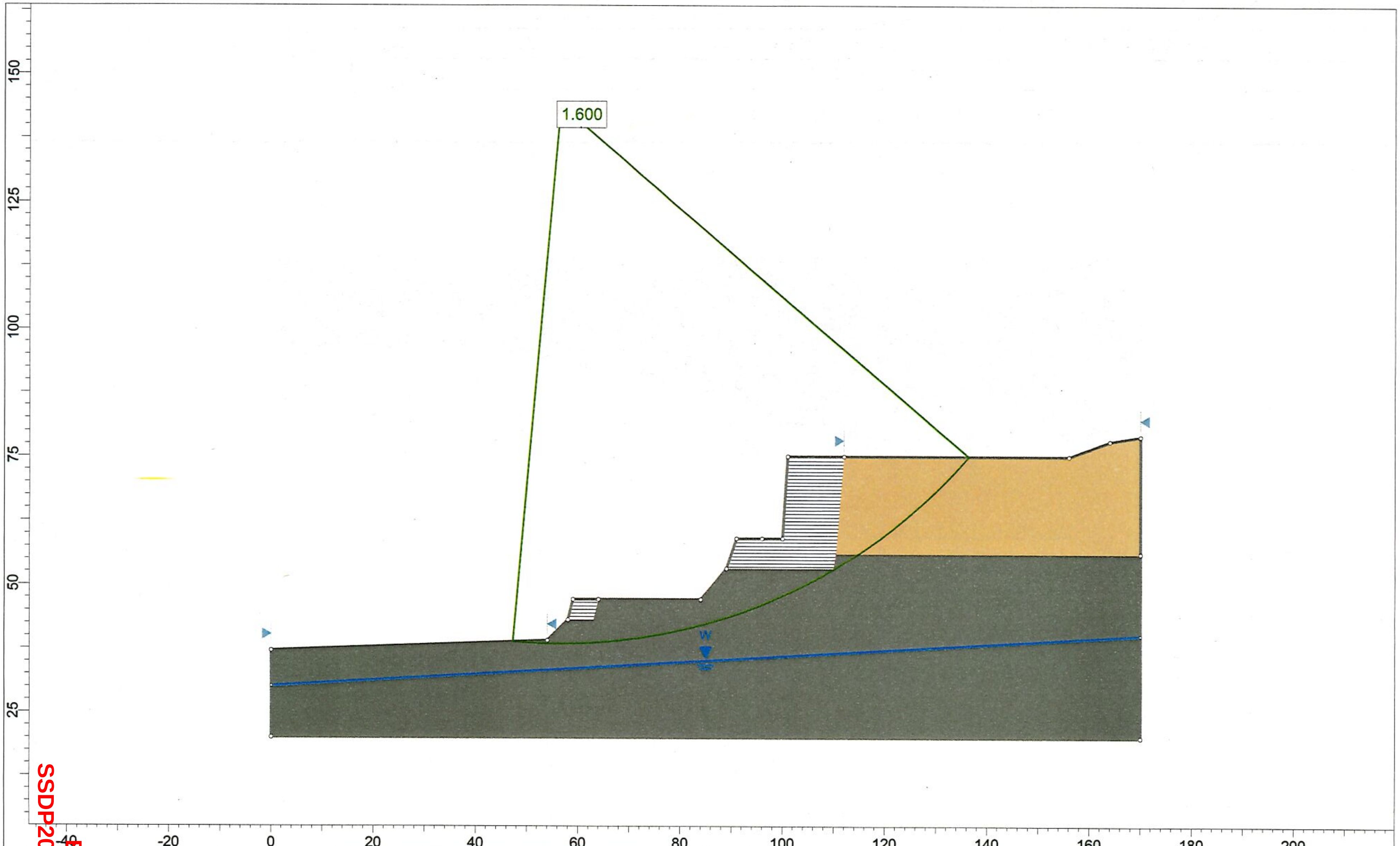
SLIDEINTERPRET 6.038



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SLIDEINTERPRET 6.038

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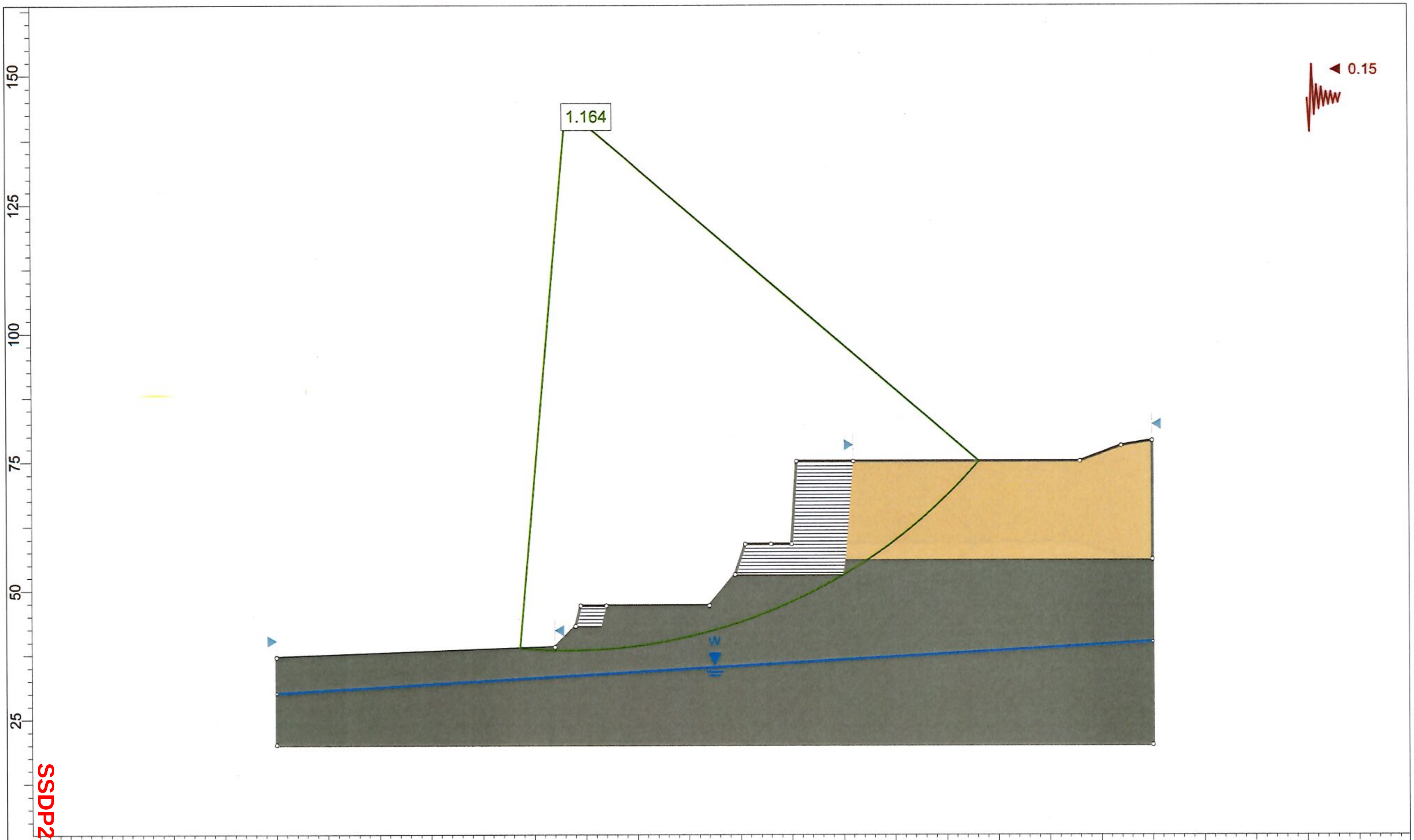

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SLIDEINTERPRET 6.038

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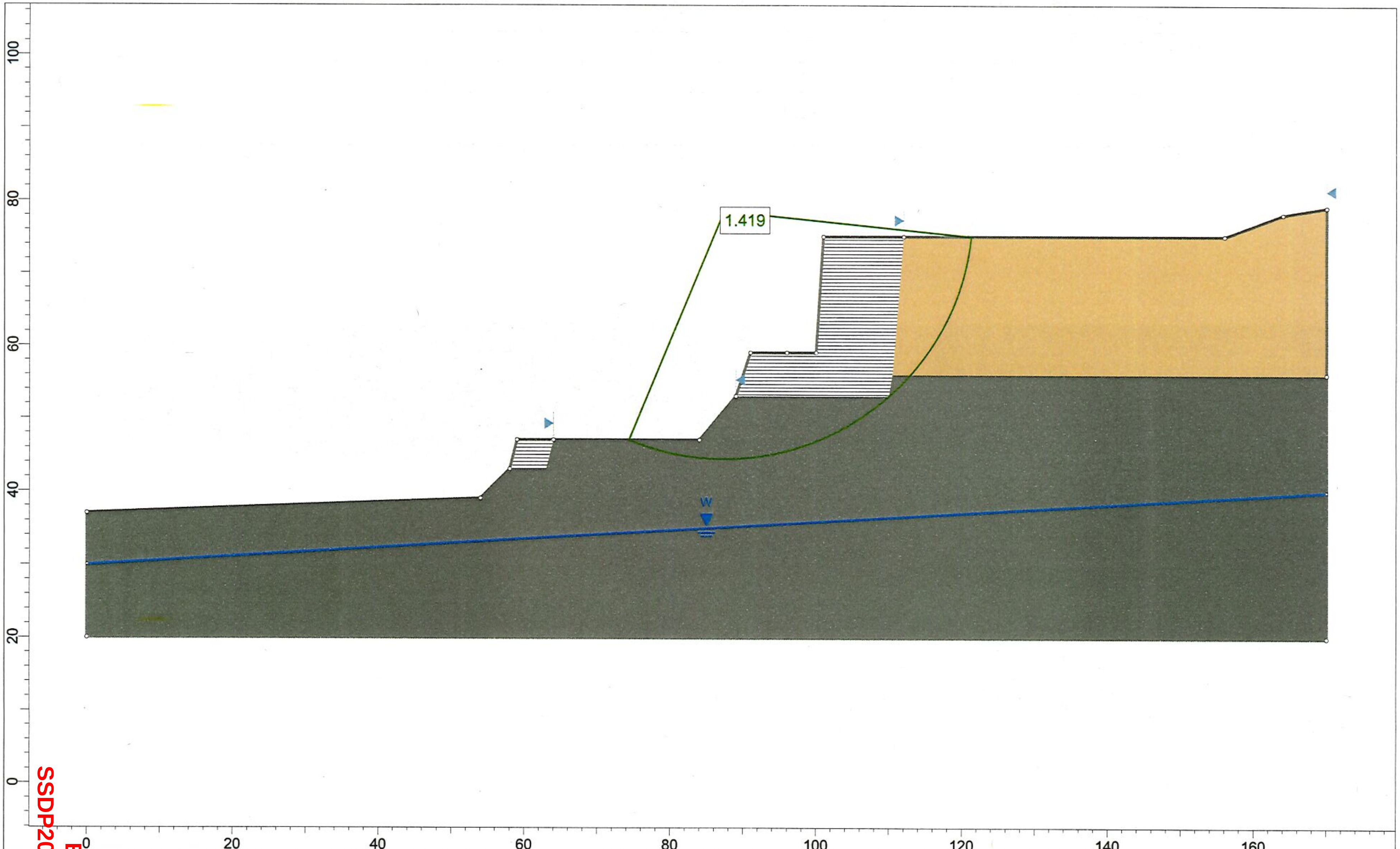

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SLIDEINTERPRET 6.038

Exhibit 12
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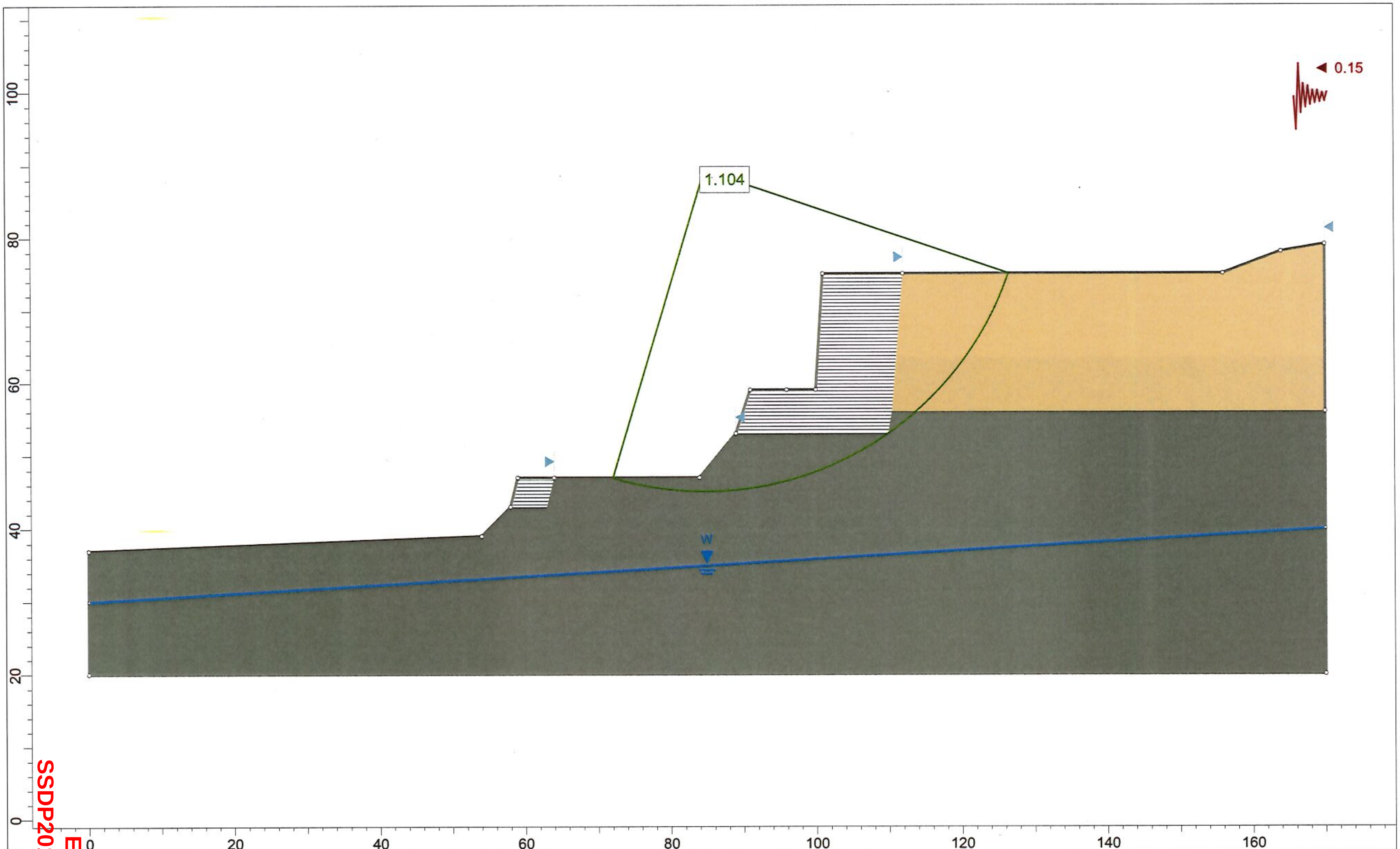
000133



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SLIDEINTERPRET 6.038

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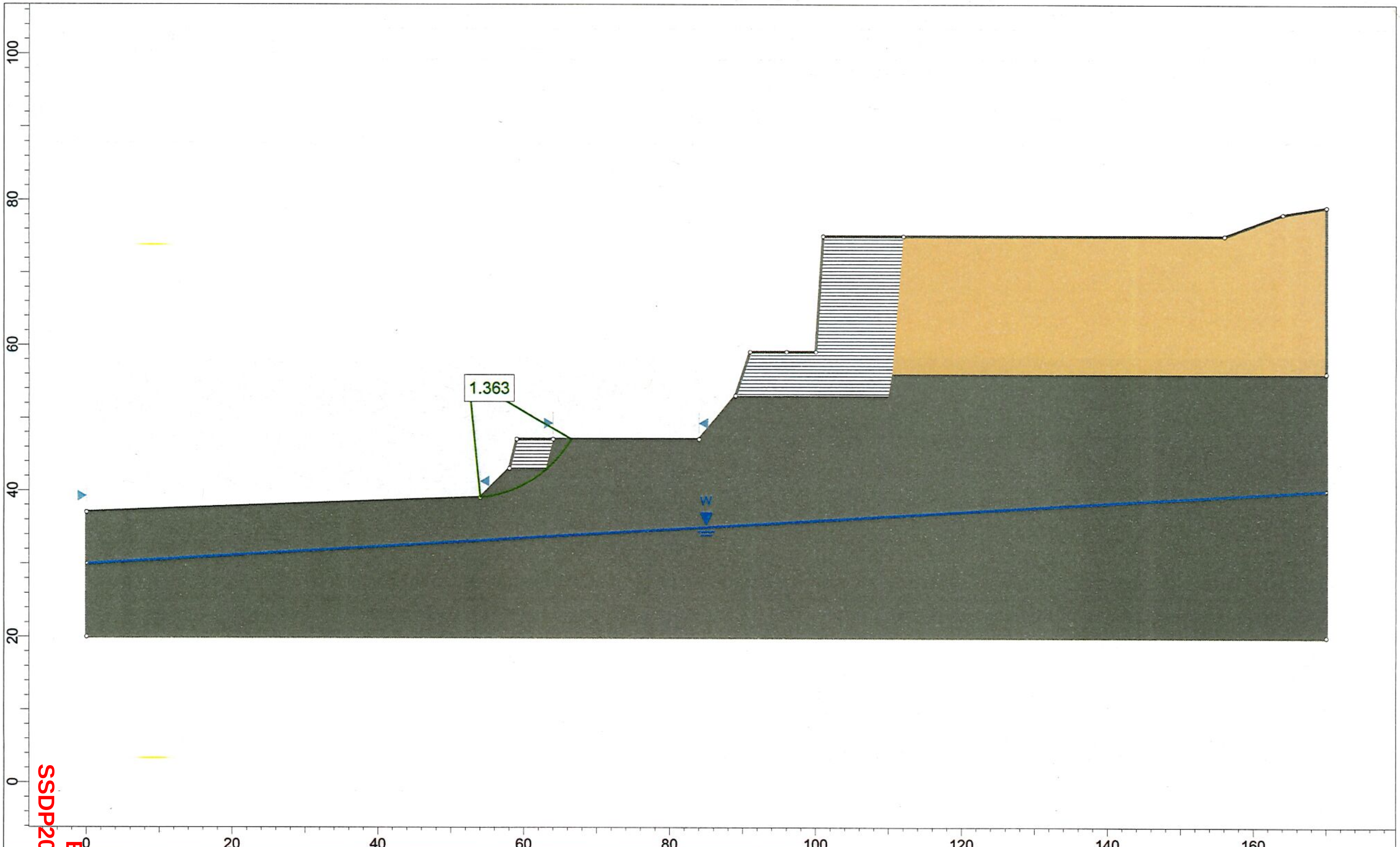
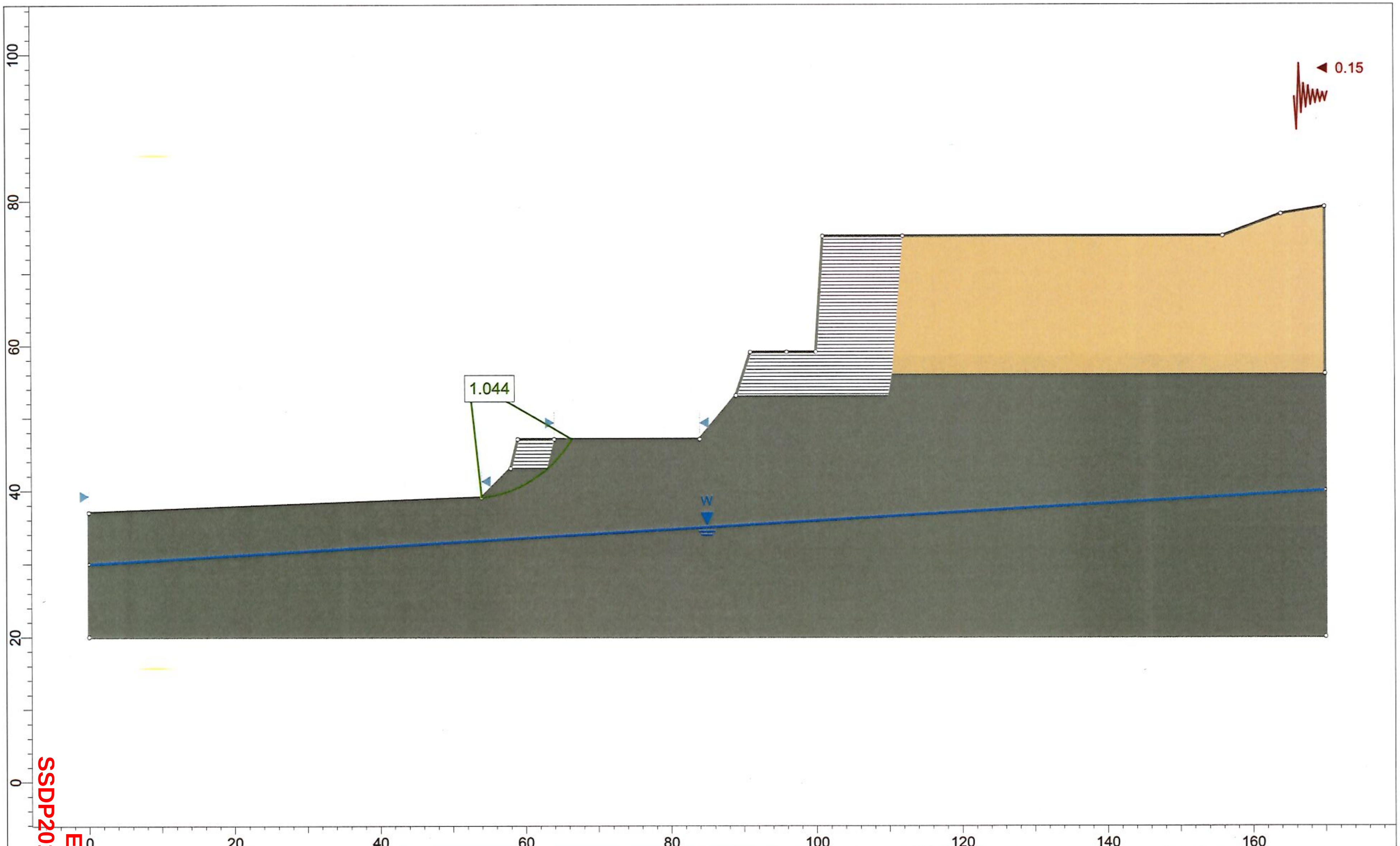


Project	STATION 469+50 - Inglewood Hill Parking Lot		
Analysis Description	Lower Slope - STATIC		
Drawn By	BRB	Scale	1:218
Company	Icicle Creek Engineers		
Date	2/2/2016, 7:25:55 AM	File Name	Lower Slope.53.STATIC.slim

SLIDEINTERPRET 6.038

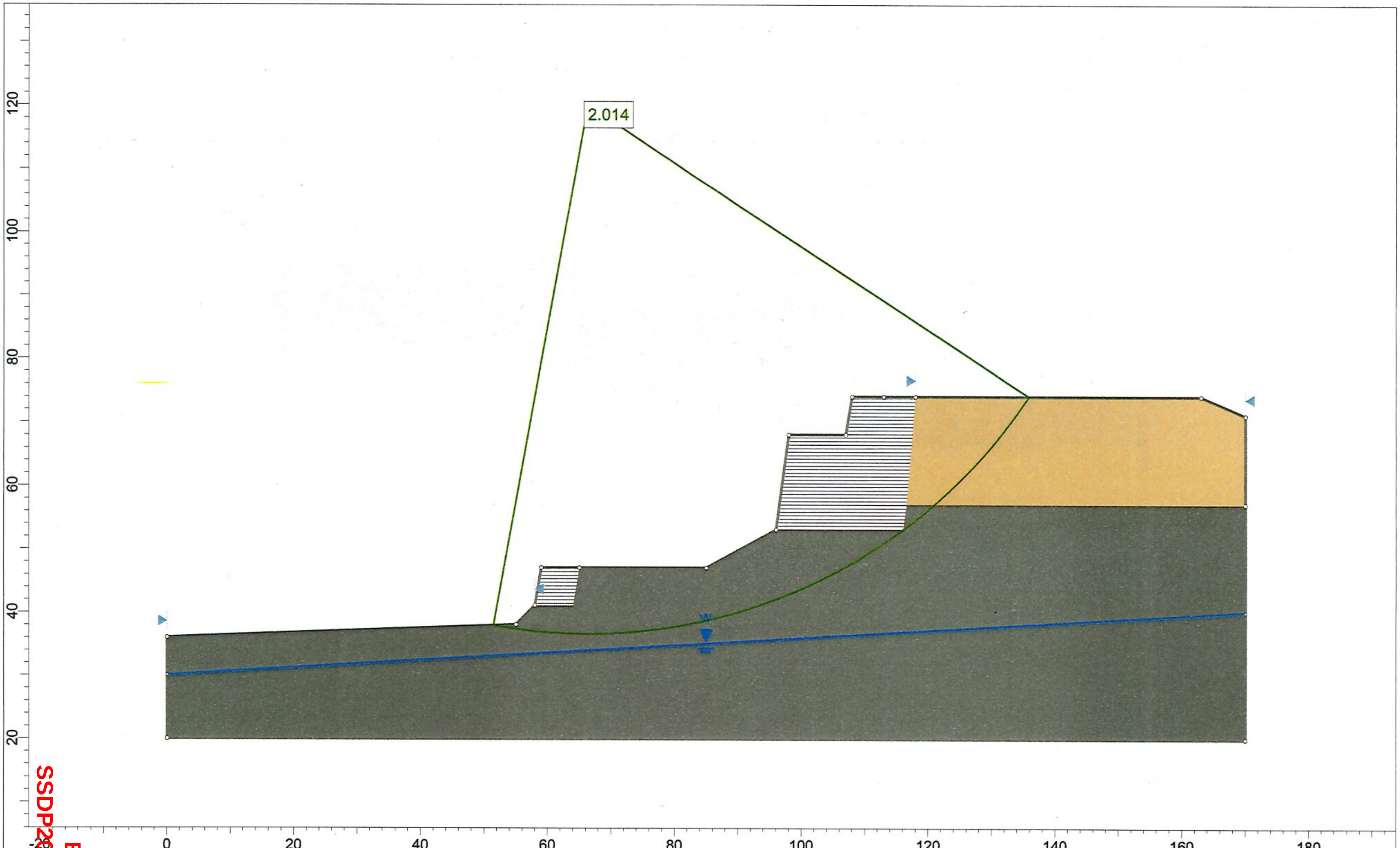
Exhibit 12
SSDP2016-00414
000135



Project	STATION 469+50 - Inglewood Hill Parking Lot		
Analysis Description	Lower Slope - SEISMIC		
Drawn By	BRB	Scale	1:218
Company	Icicle Creek Engineers		
Date	2/2/2016, 7:25:55 AM	File Name	Lower Slope.53.SEISMIC.slim

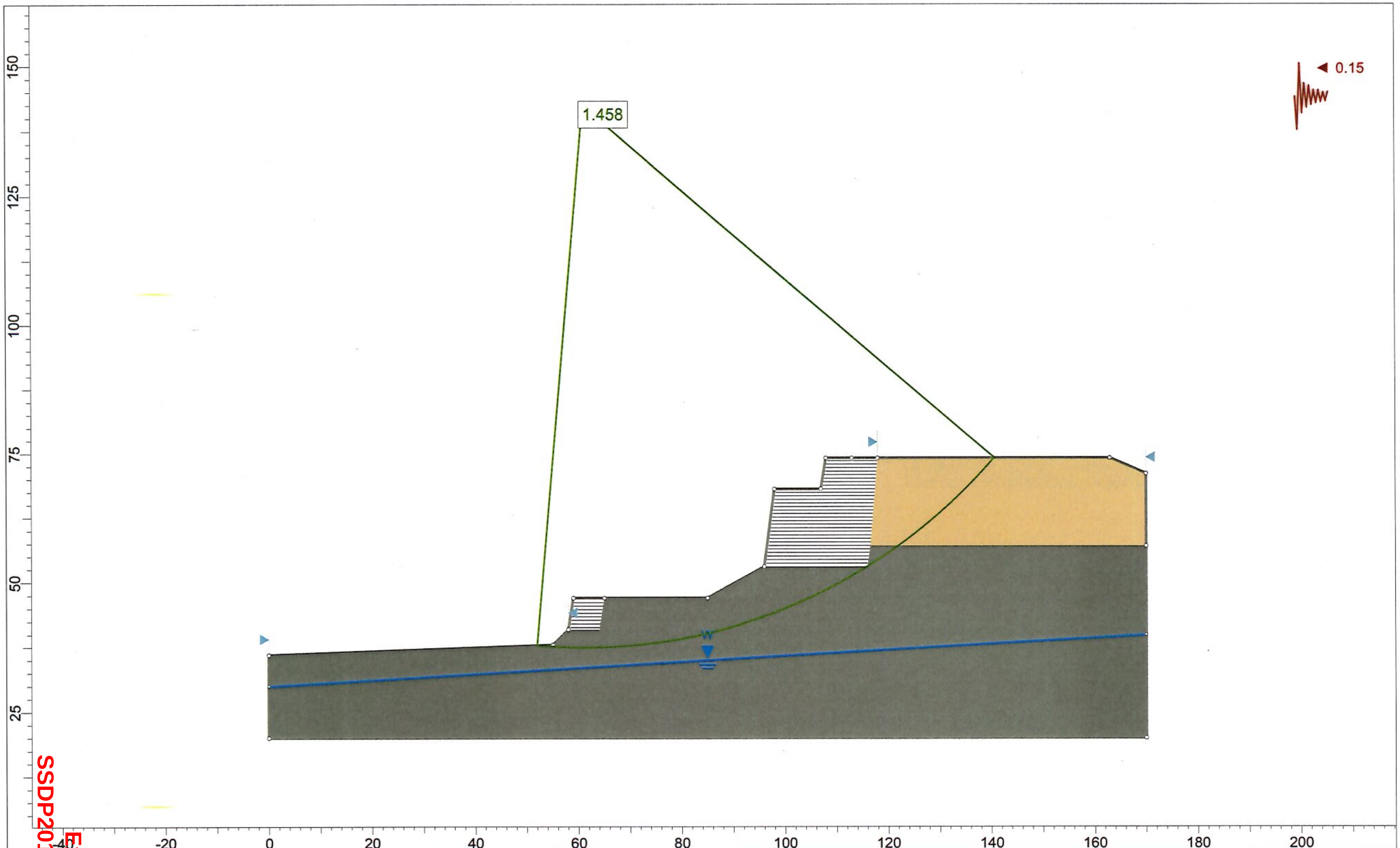
SLIDEINTERPRET 6.038

Exhibit 12
SSDP2016-00414
000136



Project	STATION 470+75 - Inglewood Hill Parking Lot
Analysis Description	Full Slope - STATIC
Drawn By BRB	*Scale* 1:251
Company	Icicle Creek Engineers
Date	2/1/2016, 7:24:10 PM
File Name	Full Slope.53.Static.slim

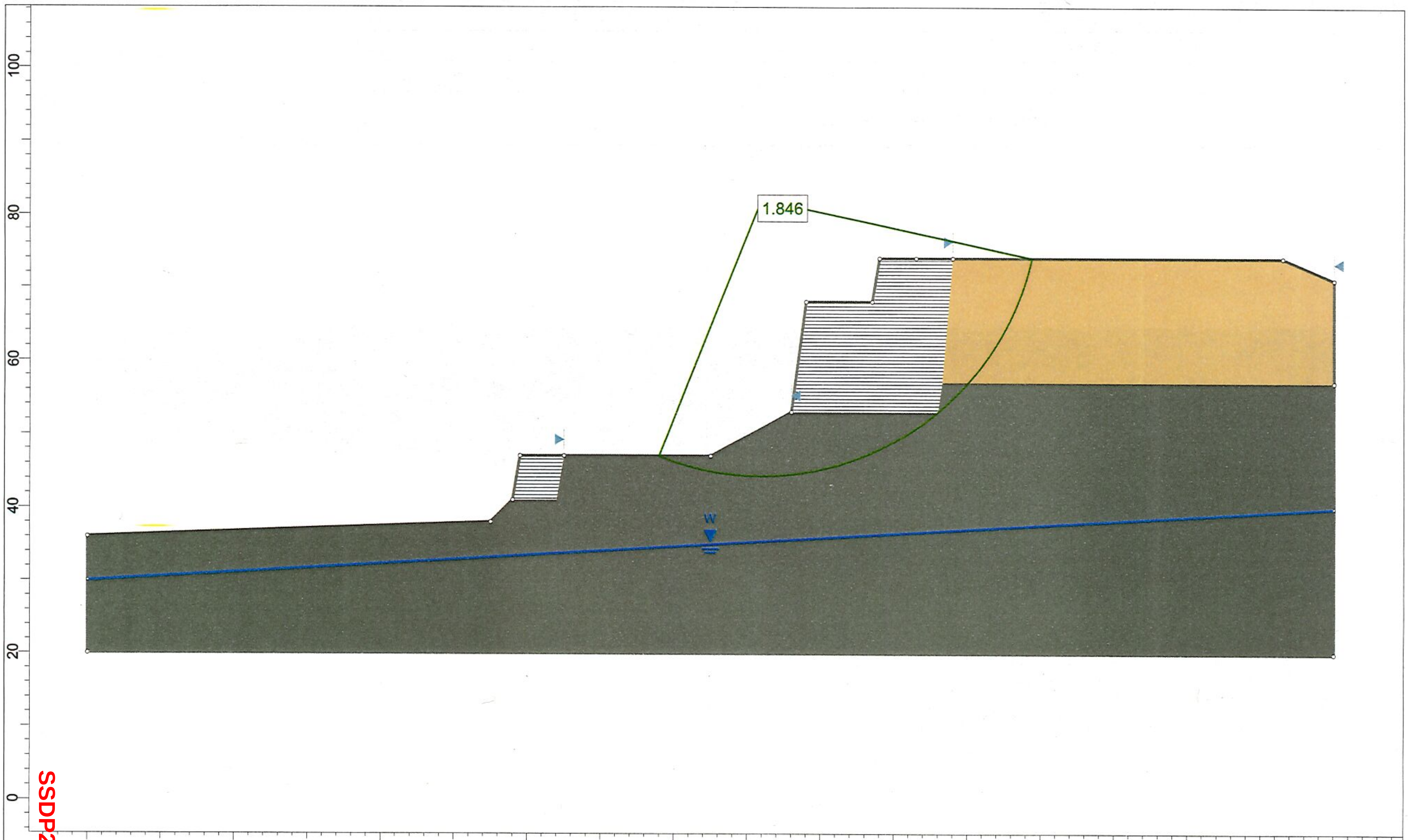
SLIDEINTERPRET 6.038



Project	STATION 470+75 - Inglewood Hill Parking Lot		
Analysis Description	Full Slope - SEISMIC		
Drawn By BRB	*Scale* 1:308	*Company*	Icicle Creek Engineers
Date	2/1/2016, 7:24:10 PM	*File Name*	Full Slope.53.Seismic.slim

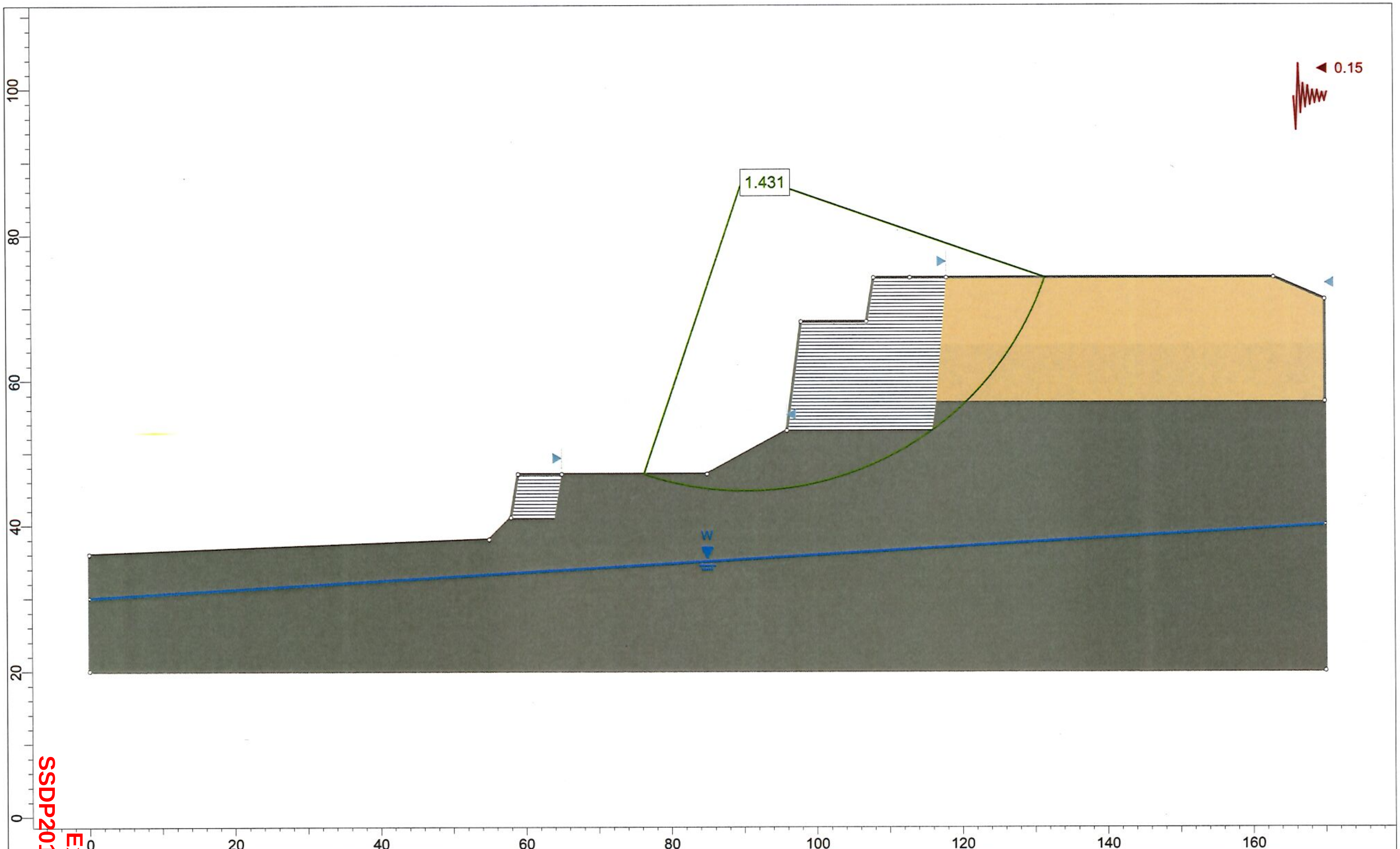
SLIDEINTERPRET 6.038

Exhibit 12
SSDP2016-00414
000138



Project	STATION 470+75 - Inglewood Hill Parking Lot		
Analysis Description	Upper Slope - STATIC		
Drawn By	BRB	*Scale*	1:218
Company	Icicle Creek Engineers		
Date	2/1/2016, 7:24:10 PM	*File Name*	Upper Slope.53.Static.slim

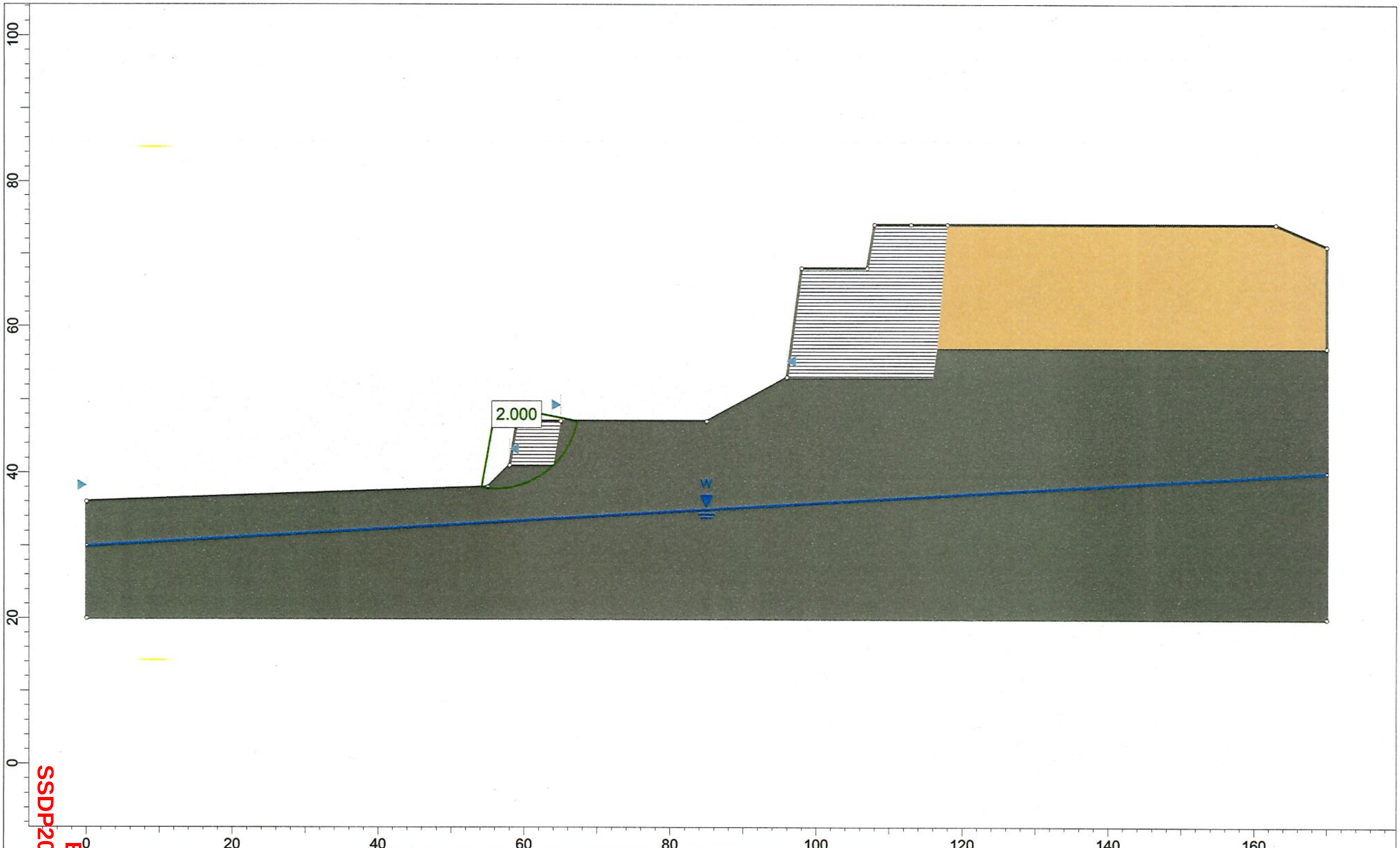
SLIDEINTERPRET 6.038



Project	STATION 470+75 - Inglewood Hill Parking Lot		
Analysis Description	Upper Slope - SEISMIC		
Drawn By: BRB	Scale: 1:218	Company: Icicle Creek Engineers	
Date: 2/1/2016, 7:24:10 PM		File Name: Upper Slope.53.Seismic.slim	

SLIDEINTERPRET 6.038

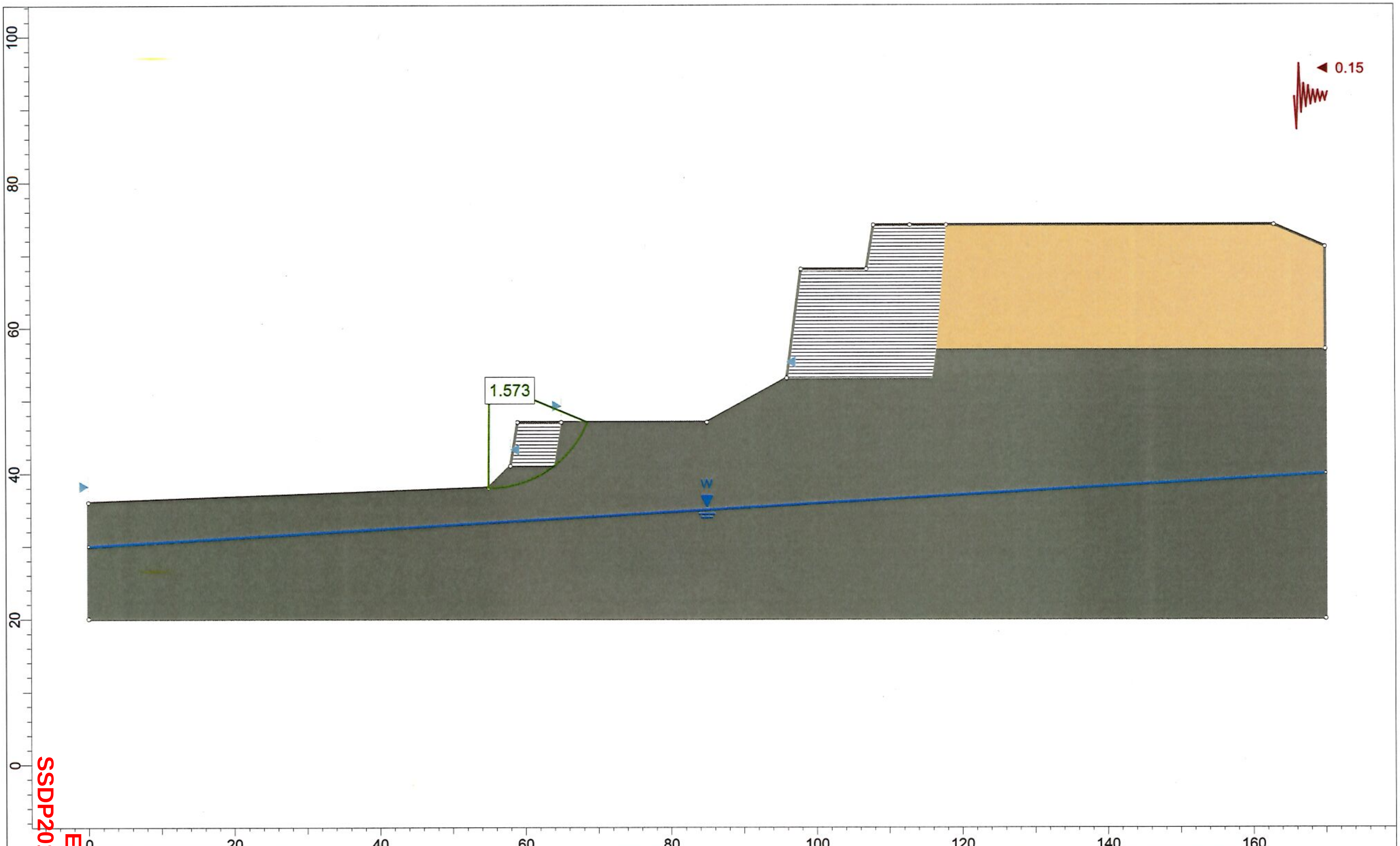
Exhibit 12
SSDP2016-00414
000140



Project	STATION 470+75 - Inglewood Hill Parking Lot		
Analysis Description	Lower Slope - STATIC		
Drawn By	BRB	Scale	1:218
Company	Icicle Creek Engineers		
Date	2/1/2016, 7:24:10 PM	File Name	Lower Slope.53.Static.slim

SLIDEINTERPRET 6.038

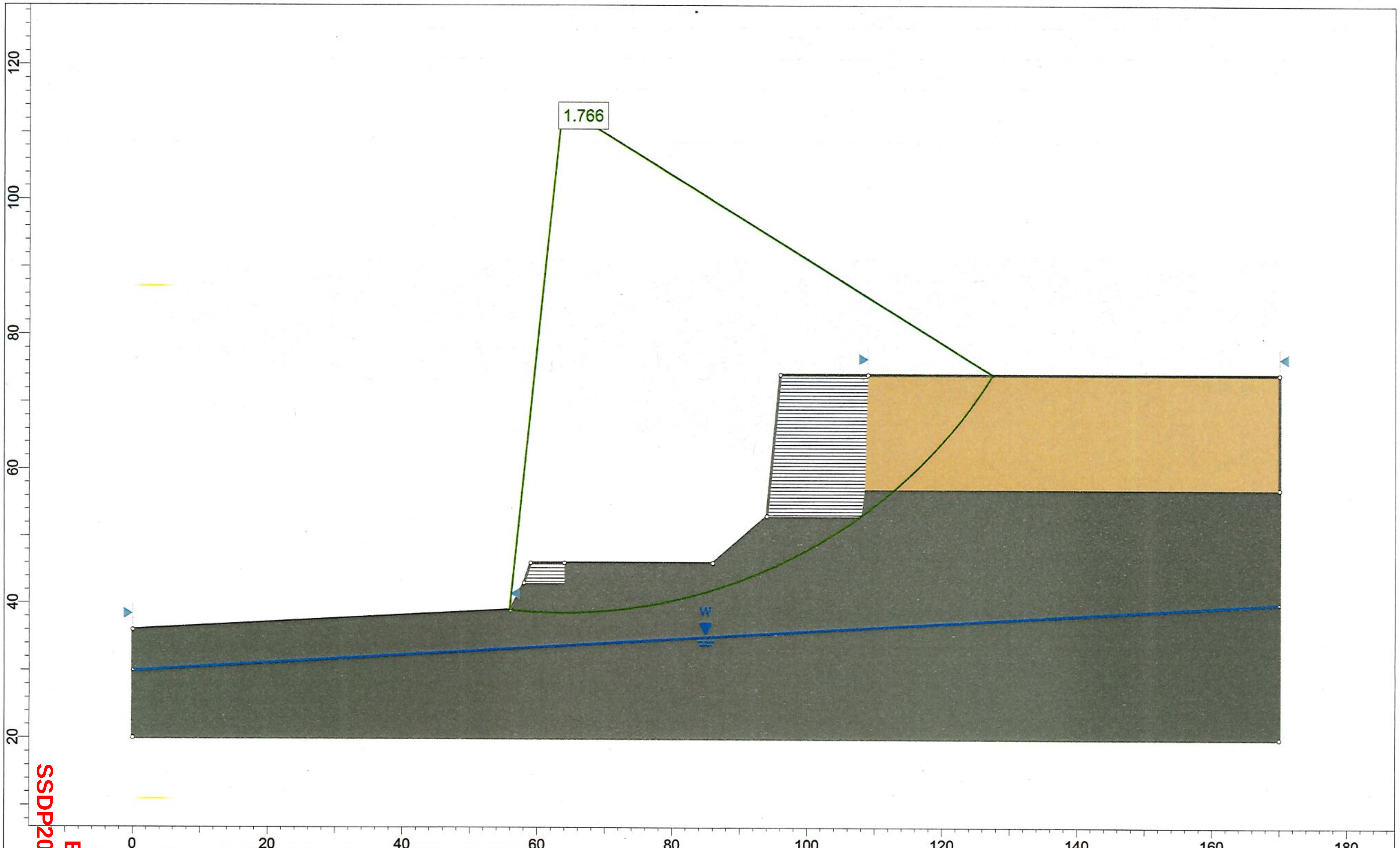
Exhibit 12
SSDP2016-00414
000141



Project	STATION 470+75 - Inglewood Hill Parking Lot		
Analysis Description	Lower Slope - SEISMIC		
Drawn By	BRB	Scale	1:218
Company	Icicle Creek Engineers		
Date	2/1/2016, 7:24:10 PM	File Name	Lower Slope.53.Seismic.slim

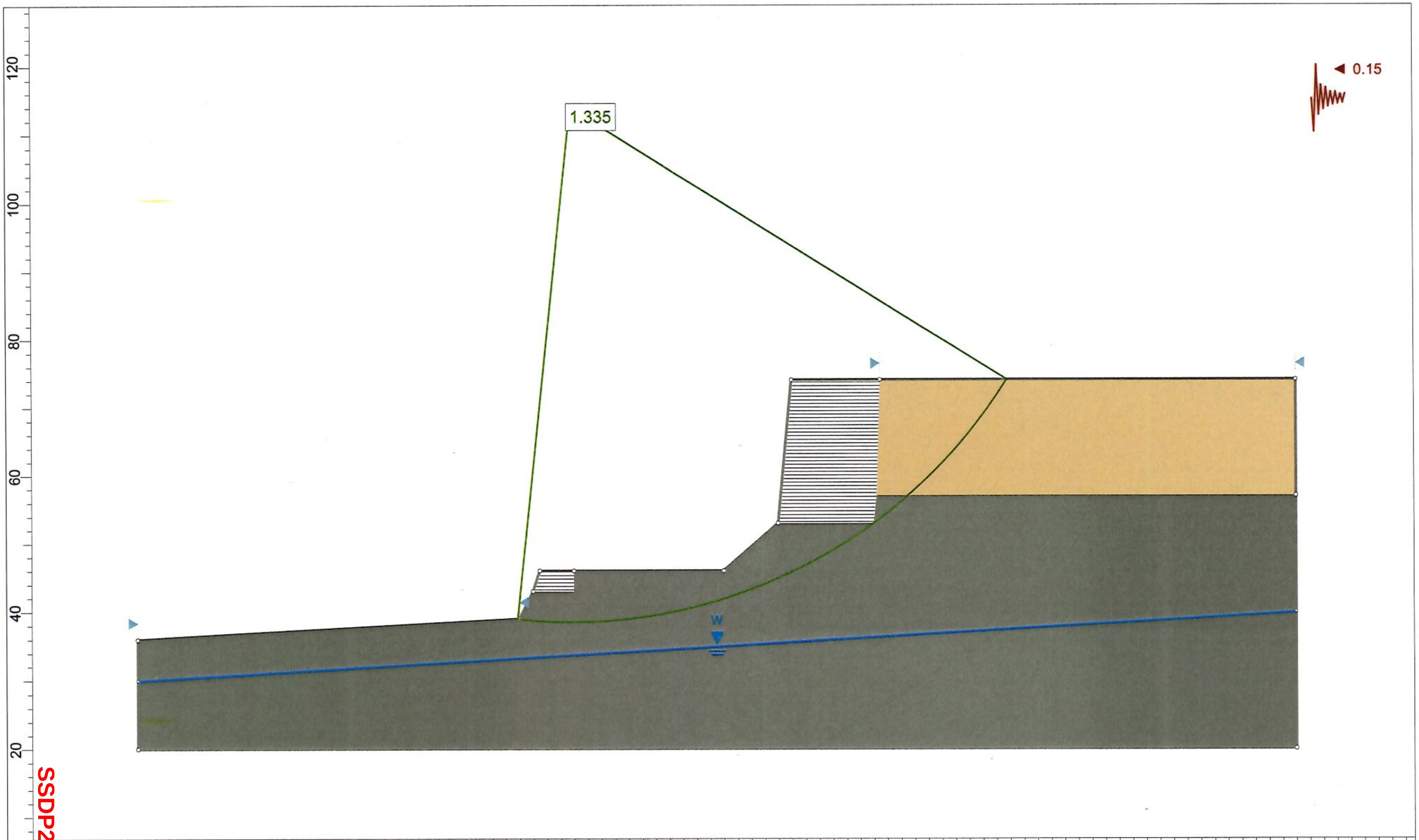
SLIDEINTERPRET 6.038

Exhibit 12
SSDP2016-00414
000142



Project	STATION 471+75 - Inglewood Hill Parking Lot		
Analysis Description	Full Slope - STATIC		
Drawn By	BRB	Scale	1:236
Company	Icicle Creek Engineers		
Date	2/2/2016, 6:46:04 AM	File Name	Full Slope.STATIC.slim

SLIDEINTERPRET 6.038

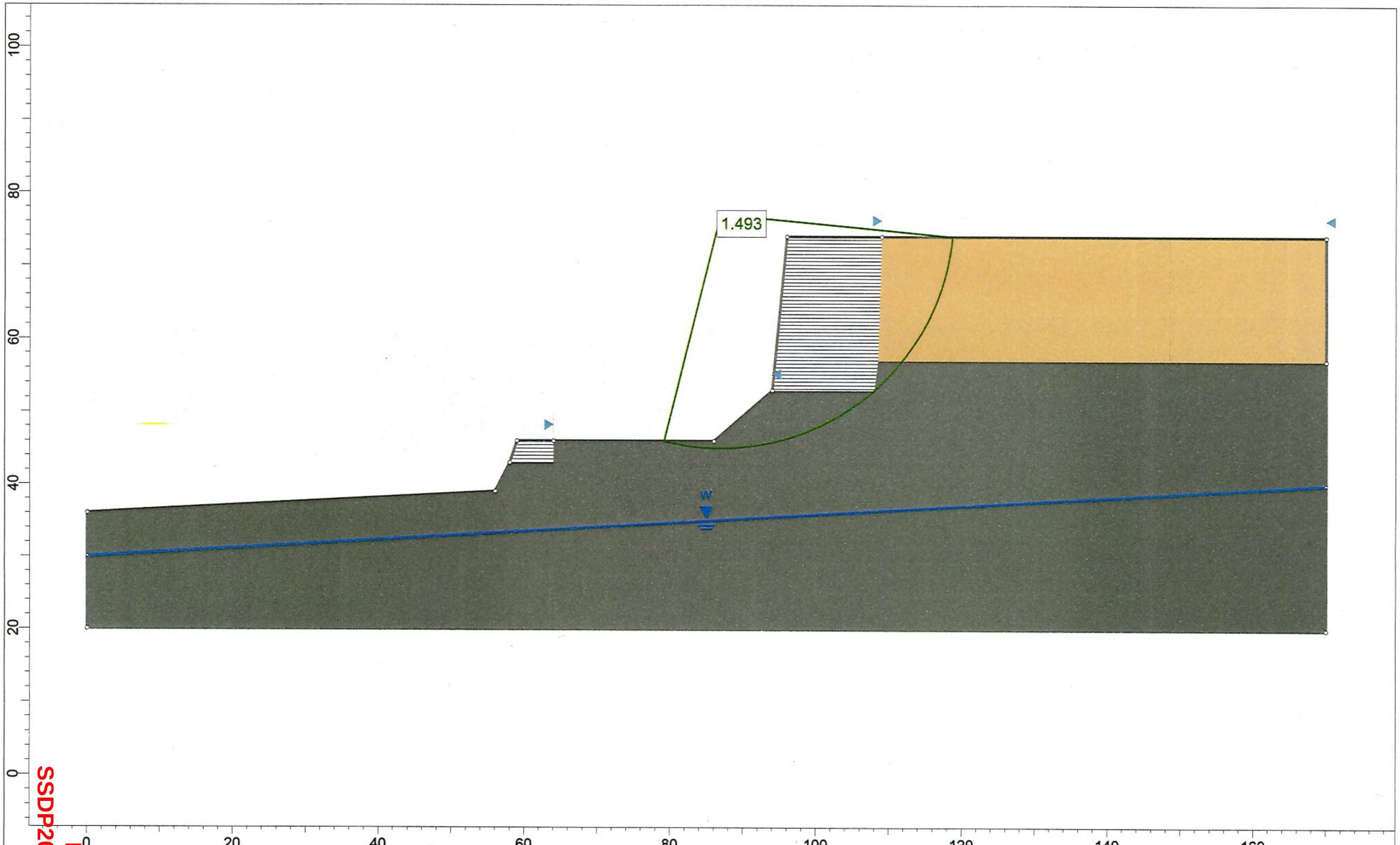


Project	STATION 471+75 - Inglewood Hill Parking Lot		
Analysis Description	Full Slope - SEISMIC		
Drawn By BRB	*Scale* 1:236	*Company*	Icicle Creek Engineers
Date	2/2/2016, 6:46:04 AM	*File Name*	Full Slope.SEISMIC.slim

rocscience

SLIDEINTERPRET 6.038

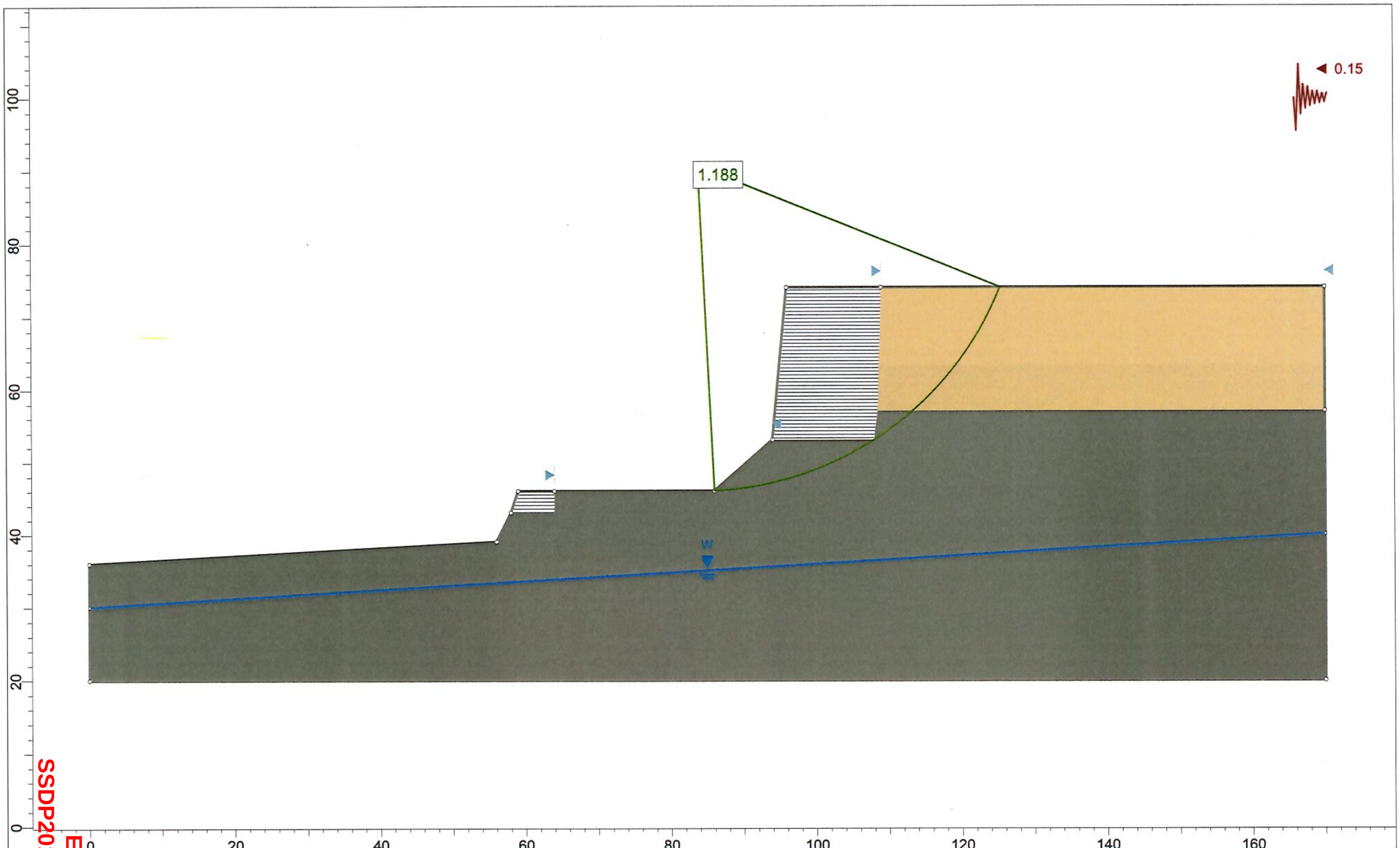
Exhibit 12
SSDP2016-00414
000144



Project	STATION 471+75 - Inglewood Hill Parking Lot		
Analysis Description	Upper Slope - STATIC		
Drawn By	BRB	Scale	1:218
Company	Icicle Creek Engineers		
Date	2/2/2016, 6:46:04 AM	File Name	Upper Slope.STATIC.slim

SLIDEINTERPRET 6.038

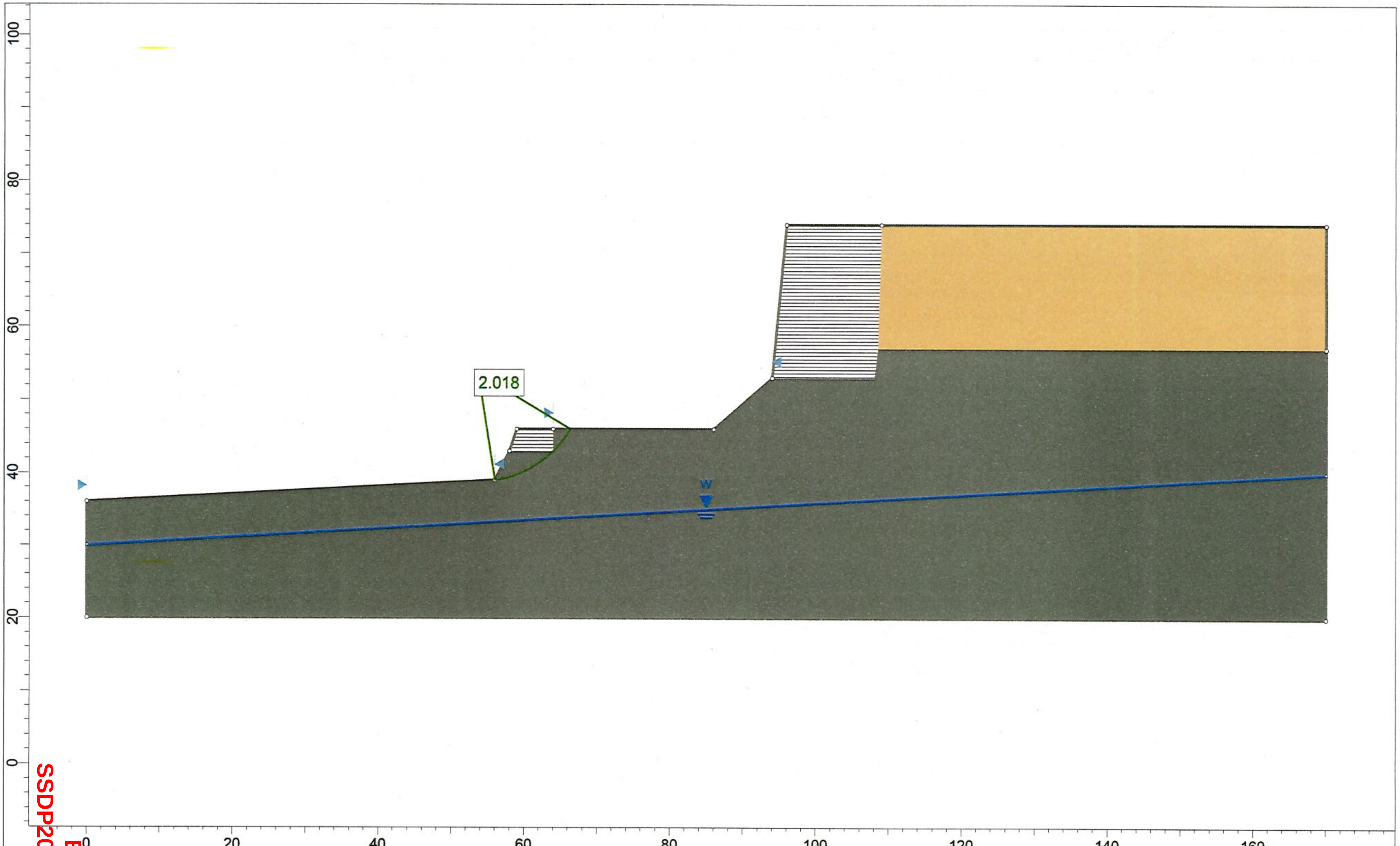
Exhibit 12
SSDP2016-00414
000145



Project	STATION 471+75 - Inglewood Hill Parking Lot		
Analysis Description	Upper Slope - SEISMIC		
Drawn By	BRB	Scale	1:218
Company	Icicle Creek Engineers		
Date	2/2/2016, 6:46:04 AM		
File Name	Upper Slope.SEISMIC.slim		

SLIDEINTERPRET 6.038

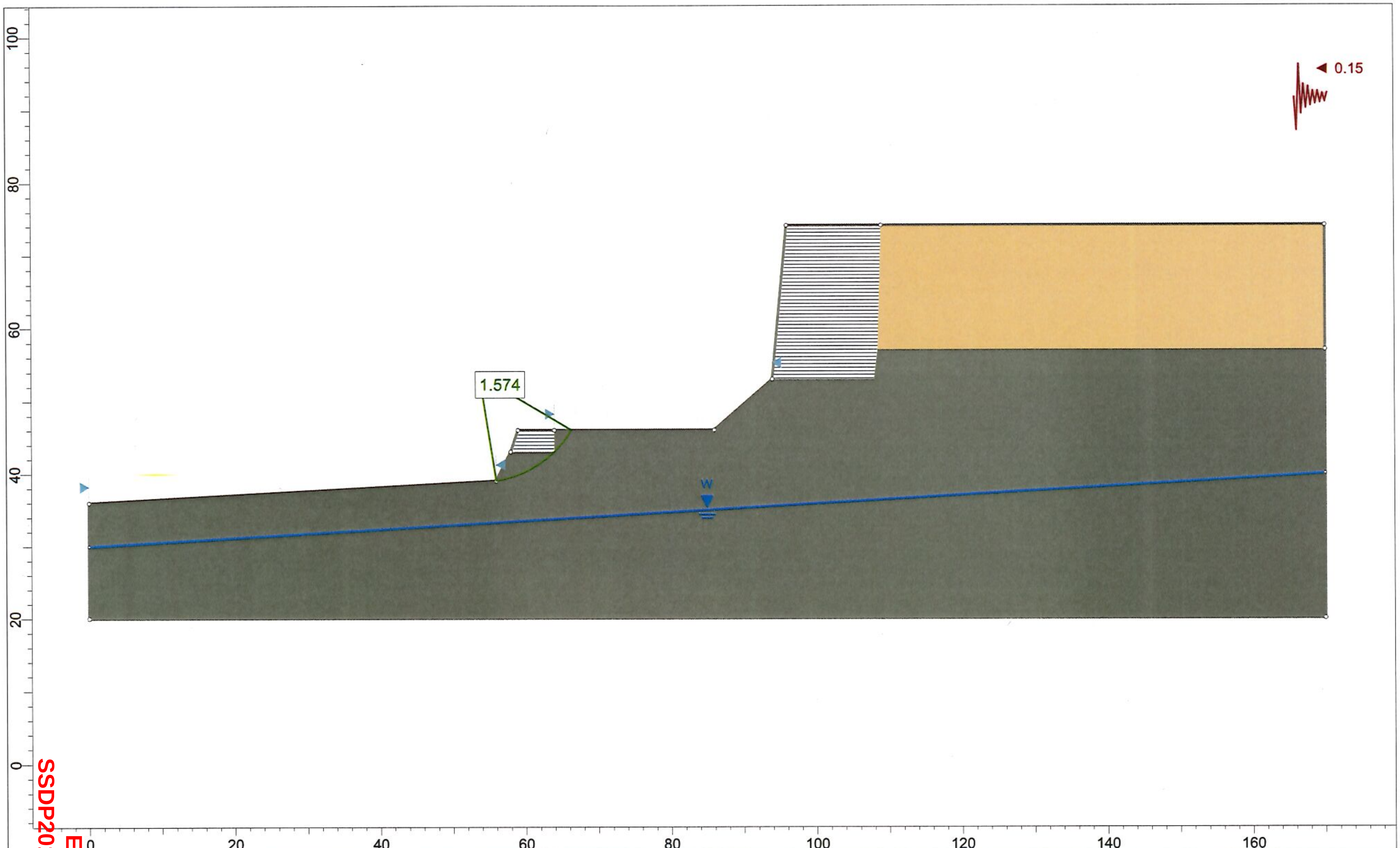
Exhibit 12
SSDP2016-00414
000146



Project	STATION 471+75 - Inglewood Hill Parking Lot		
Analysis Description	Lower Slope - STATIC		
Drawn By	BRB	Scale	1:218
Company	Icicle Creek Engineers		
Date	2/2/2016, 6:46:04 AM	File Name	Lower Slope.STATIC.slim

SLIDEINTERPRET 6.038

Exhibit 12
SSDP2016-00414
000147



Project	STATION 471+75 - Inglewood Hill Parking Lot		
Analysis Description	Lower Slope - SEISMIC		
Drawn By	BRB	Scale	1:218
Company	Icicle Creek Engineers		
Date	2/2/2016, 6:46:04 AM	File Name	Lower Slope.SEISMIC.slim

SLIDEINTERPRET 6.038

Exhibit 12
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000148

APPENDIX D

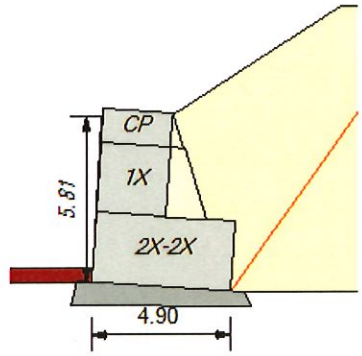
INTERNAL STABILITY SUMMARY SHEEET

GRAVITY BLOCK WALLS

ULTRABLOCK, INC.

UltraWall

UltraWall v3.3 Build 14226



Project: Inglewood Hill Road Parking Lot
Location: ELST and East Lake Sammamish Parkway NE
Designer: BRB/ICE
Date: 1/26/2016
Section: Section 1
Design Method: NCMA_09_3rd_Ed
Design Unit: Ultrablock

Seismic Acc: 0.170

SOIL PARAMETERS	φ	coh	γ
Retained Soil:	34 deg	0 psf	125 pcf
Foundation Soil:	34 deg	0 psf	125 pcf
Leveling Pad: Crushed Stone			

GEOMETRY

Design Height:	6.00 ft	Live Load:	0 psf
Wall Batter/Tilt:	0.00/ 4.00 deg	Live Load Offset:	0.00 ft
Embedment:	0.50 ft	Live Load Width:	100 ft
Leveling Pad Depth:	0.50 ft	Dead Load:	0 psf
Slope Angle:	33.0 deg	Dead Load Offset:	0.0 ft
Slope Length:	6.0 ft	Dead Load Width:	100 ft
Slope Toe Offset:	0.0 ft	Leveling Pad Width:	5.92 ft

FACTORS OF SAFETY (Static / Seismic)

Sliding:	1.50 / 1.125	Overturning:	1.50 / 1.125
Bearing:	2.00 / 1.5		

RESULTS (Static / Seismic)

FoS Sliding:	2.48 (lvlpd) / 1.94	FoS Overturning:	3.72 / 3.11
Bearing:	1023.22 / 1169.96	FoS Bearing:	15.40 / 13.47

Name	Elev.	ka	kae	Pa	Pae	Pir	- PaC	FSsl	FoS OT	siesFSsl	FoS SeisOT
CP	4.90	0.514	0.755	38	55	26	0	100.00	44.03	100.00	14.23
1X	2.45	0.514	0.755	401	589	78	0	47.93	3.72	28.44	1.85
2X-2X	0.00	0.782	0.906	1852	2147	182	0	2.48[2.77]	4.45	1.94[2.22]	3.11

Note: Calculations are for Preliminary use only and should not be used for construction without the review of a qualified professional.

Exhibit 12
SSDP2016-00414
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