GEI Consultants

Consulting Engineers and Scientists

Slope Stability Report

Alta Subdivision Phase 2

Town of the Blue Mountains, Ontario

Submitted to:
Tabera Ltd.

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1. Introduction

GEI Consultants (GEI) was retained by Lorne Shiff of Tabera Ltd. to complete a supplemental subsurface investigation and carry out a slope stability study for the proposed Alta Subdivision Phase 2 residential development in the Town of the Blue Mountains, Ontario. A site location plan is enclosed as Figure 1.

The site is approximately 30 hectares in size and is bounded by Hidden Lake Road to the north and Alta Road (and existing residential lands) to the south. The site is located at the base of an escarpment slope that is present along the southwestern property boundary and is located at the top of another slope near the northern and eastern property boundary. The property is currently primarily lightly vegetated and also contains an apple orchard along the eastern property boundary. A single-family residential home had previously been present on the property but has recently been demolished. An aerial image of the site from 2010 is included as Figure 2A.

GEI was previously retained to carry out a geotechnical investigation and report for Alta Subdivision, Phase 2:

- *"Geotechnical Investigation, Alta Subdivision Phase 2, Town of the Blue Mountains, Ontario,"* Project No. 2101271, dated July 23, 2021.

The report included slope stability considerations and a preliminary assessment for developing lots near the northern and eastern escarpment slopes located on the site. The assessment was based on a topographic survey with 2.5 metre contours.

After the report was issued, a site meeting was held with GEI, the civil engineer (Crozier Consulting Engineers), and the Town of the Blue Mountains to discuss the proposed SWMP near the northern slope.

It is understood that the Town has concerns about the stable slope setback relative to the proposed footprint of the SWMP, and about the potential for piping erosion as the nearest borehole (Borehole 4) encountered sand deposits below grade. The slope in the area has local inclinations as steep as 1 horizontal to 1 vertical based on visual observations, which typically indicates a bedrock slope instead of sands. The Town's Conditions to Draft Plan Approval include the following requirement: "*Prior to final approval, the Owner prepares a Slope Stability study for the development of any structures that back on to slopes by a qualified consultant to the satisfaction of the GSCA and the Town of Blue Mountains. The recommendations of that study shall be incorporated into the Subdivision Agreement*."

During the supplemental subsurface investigation, GEI completed a visual slope inspection near the proposed SWMP and excavated six (6) test pits. It was noted during the inspection

that additional erosion had occurred in the proposed area of the SWMP, and the top of slope position appeared to be set back farther compared to the topographic survey available at that time. Additional surveying was then completed to confirm the extent of erosion and top of slope location across the site, and the SWMP location was moved elsewhere on site.

The purpose of this slope stability study was to determine the slope and erosion hazard limits (slope stability setbacks for new development) for the northern slope across the site, relative to Grey Sauble Conservation Authority (GSCA) policy guidelines.

Revision 1 of this slope stability report as prepared to update the figures with the latest site plan and to address comments from GSCA.

2. Site Description and Slope Conditions

2.1 Northern Slope (Nipissing Ridge)

A visual inspection of the slope and site area was conducted on November 2, 2021, by Bo Hwang, a senior field technician at GEI Consultants. General information pertaining to the existing slope features, such as slope profile, drainage, vegetation cover, structures, erosion features and slope slide features were obtained. A summary of the results of the visual inspection is presented below. Photographs taken during this site visit are provided as Appendix D and the MNR Slope Inspection and Slope Rating Forms are included as Appendix E.

The site is located within the Georgian Bay Fringe watershed, in the jurisdiction of the Grey Sauble Conservation Authority (GSCA). The property is currently undeveloped but formerly contained a house on the tableland which was been demolished. A slope is located along the north limit of the site with a height ranging from approximately 15 to 26 metres and typical inclinations of 2.3 horizontal to 1 vertical or flatter. Hidden Lake Road runs from east to west along the bottom of the slope. The slope is part of the Nipissing Ridge post-glacial shoreline, which is regulated by GSCA.

The tableland is vegetated with grasses, shrubs, and some large vertical trees. The slope is vegetated with large, mostly vertical trees and some undergrowth. The slope predominantly consists of bedrock with nominal soil overburden. The boreholes, test pits and visual observations on the tableland and near the slope crest encountered topsoil overlying thin deposits of silty sand or silt and clay, underlain by shale bedrock.

There are two distinct drainage gully features at this site, both located in Block 61 shown on Figure 3. Both gullies cut back into the tableland compared to the top of slope location across the rest of the site. The western gully is larger with more gradual side slopes. No running water was observed down the gully, and only localized areas of minor erosion were observed. The western gully side slopes are typically flatter than 2H:1V with some localized steeper areas closer to 1H:1V.

The eastern gully is smaller in width but contains flowing water and active erosion, consisting of undercutting, scarps, exposed soil and roots, and exposed bedrock along the bottom of the channel. The side slopes and scarps are near vertical in some localized areas. It appears that concentrated runoff from the tableland flows over the slope and down the eastern gully. Some slumping of soil was observed from the over-steepened scarp faces.

No signs of erosion or slope instability were observed outside of the drainage gully areas.

For a collective view of the slope, the Rating Value obtained from the MNR Slope Rating Form was 30, which indicates a slight potential for slope instability. The slope is considered to have a moderate potential for instability near the drainage gullies due to local erosion and over-steepening.

2.2 Southern Channel Slope

A small channel / watercourse is also located south of the site. Based on visual observations, the channel side slopes have inclinations of about 2.5 horizontal to 1 vertical or flatter, the height ranges from about 3 to 7 metres, and only a small flow of water was observed. The flows are restricted by a culvert upstream that crosses beneath Alta Road and the bankfull width is less than 5 metres wide. No signs of concentrated runoff were observed entering the channel, and no erosion was observed within the channel. No signs of slope instability were observed.

Photographs from within the channel are included in Appendix D and an MNR Slope Rating Form for the channel and small slope is included in Appendix E. The rating value obtained was 32, indicating a slight potential for slope instability.

3. Procedures and Methodology

Prior to the commencement of drilling activities, the locations of underground utilities including natural gas, electrical, telephone, water, etc. were marked out by public and private utility locating companies. The fieldwork for the drilling program was carried out on May 25, 2021. A total of ten boreholes (Boreholes 1 to 10) were advanced on site using a track-mounted drill rig. To advance the boreholes, continuous flight solid stem augers and standard soil sampling equipment was utilized. All samples were collected as per ASTM D1586 *Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils* to assess the strength characteristics of the substrate. Six (6) test pits were excavated as part of the supplemental investigation using a Kubota Excavator operated by a subcontractor retained directly by the client.

The boreholes were advanced to depths of 6.2 to 6.6 metres below existing grade, and the test pits extended to depths of 2.0 to 2.5 metres below grade. The horizontal locations were laid out in the field by GEI prior to the drilling operations and the locations are shown on Figures 2A (2010 aerial image) and 2B (proposed site plan). The test pit locations are shown on Figure 3. Ground surface elevations of the boreholes were measured using survey equipment in reference to a local site benchmark (top spindle of fire hydrant #132 located at the Alta Road cul-de-sac) with an assumed elevation of 100.0 metres. The GPS coordinates of the borehole and test pit locations were measured with a handheld GPS unit and were referenced to the NAD 83 geodetic datum.

The field staff examined and classified characteristics of the soils encountered in the boreholes and test pits, made groundwater observations during and upon completion of the drilling / excavating, recorded observations of borehole / test pit construction, and processed the recovered samples. Soil sampling was conducted at regular intervals for the full depth of the borehole. The boreholes and test pits were backfilled upon completion. All recovered soil samples were logged in the field, carefully packaged and transported to the laboratory for more detailed examination and classification. In the laboratory, the samples were classified as to their visual and textural characteristics and geotechnical laboratory testing was carried out with the results included in Appendix B. Six (6) monitoring wells were installed in selected boreholes to facilitate long-term groundwater monitoring. Monitoring well construction is shown on the borehole logs in Appendix A.

4. Subsurface Conditions

4.1 General Overview

The detailed soil profiles encountered in the boreholes are indicated on the attached borehole logs in Appendix A and the geotechnical laboratory results are included in Appendix B. Test pit logs are provided in Appendix C. The borehole locations are shown on Figures 2A and 2B and the test pit locations are shown on Figure 3.

It should be noted that the conditions indicated on the borehole logs are for specific locations only and can vary beyond and between the borehole locations. It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones and should not be interpreted as exact planes of geological change.

In addition, the descriptions provided in the borehole logs are inferred from a variety of factors, including visual observations of the soil samples retrieved, laboratory testing, measurements prior to and after drilling, and the drilling process itself (speed of drilling, shaking/grinding of the augers, etc.). The passage of time also may result in changes in conditions interpreted to exist at locations where sampling was conducted.

4.2 Stratigraphy

4.2.1 Topsoil and Earth Fill

Boreholes 1 to 3 and 5 to 10 encountered a topsoil layer at the ground surface that ranged from 100 to 300 mm thick. Test Pits 1 to 6 encountered a 200 to 300 mm thick topsoil layer at the ground surface.

Borehole 4 encountered earth fill at the ground surface that extended to a depth of 3.1 metres below grade (local Elev. 87.9 metres). The upper 0.8 metres of the earth fill consisted of limestone gravel, transitioning to limestone screenings from 0.8 to 1.5 metres below grade, and then transitioning to silty sand with trace clay and trace gravel from 1.5 to 3.1 metres below grade. The earth fill was generally grey to brown and moist, becoming wet near a depth of 2.7 metres below grade. The Standard Penetration Test (SPT) results ("N" Values) measured in the earth fill ranged from 4 to 26 blows per 300 mm of penetration, indicating a loose to compact (but generally loose) relative density.

4.2.2 Native Soils

A native cohesionless deposit of gravelly sand with some silt was encountered in Borehole 4 underlying the earth fill at a depth of 3.1 metres below grade (local Elev. 87.9 metres) and extended to a depth of 4.6 metres below grade (local Elev. 86.4 metres). At a depth of 4.6 metres below grade, a cohesionless deposit of silty fine sand with trace clay was encountered that extended beyond the vertical depth of exploration at 6.6 metres below grade (local Elev. 84.4 metres). The cohesionless deposits were brown to grey and wet. The SPT "N" Values measured in the deposits were 43 to greater than 100 blows per 300 mm of penetration, indicating a dense to very dense relative density. Borehole 4 was advanced near the slope at the northwestern part of the site, in an area with a lower grade than most other parts of the tableland.

Underlying the topsoil, all other boreholes (Boreholes 1 to 3 and 5 to 10) encountered cohesive deposits consisting of silt and clay to silty clay with trace sand. The silt and clay extended to depths of 2.3 to 4.6 metres below grade (local Elev. 96.2 to 88.8 metres) and the upper 0.8 metres of the clay and silt was weathered in each borehole. In Boreholes 1 to 3, 5 and 6, the upper 0.8 to 2.3 metres of the clay and silt was mottled red and moist, and was likely derived from Queenston Formation Bedrock (red shale). The lower zones of the clay and silt in these boreholes and the entire depth of the clay and silt in Boreholes 7 to 10 was mottled brown and moist, and was likely derived from Georgian Bay Formation bedrock. The SPT "N" Values measured in the unweathered clay and silt ranged from 6 to 74 blows per 300 mm of penetration indicating a firm to hard (but generally stiff to very stiff) consistency.

Test Pits 2 to 5 encountered cohesionless deposits of silty sand with trace gravel, to silty gravelly sand with some cobbles underneath the topsoil layer. The cohesionless soils extended to depths of 1.2 to 2.2 metres below grade, and were brown and moist.

Underlying the topsoil in Test Pits 1 and 6, and underlying the cohesionless soils in Test Pits 3 to 5, cohesive deposits of silt and clay were encountered that extended to depths of 1.6 to 2.3 metres below grade. The silt and clay contained some bedrock fragments in Test Pits 5 and 6, and was derived from Georgian Bay Formation bedrock. The silt and clay was moist and typically brown, grey, or mottled grey.

The silt and clay in Test Pit 1 was underlain by wet silty gravelly sand, which extended beyond the depth of excavation at 2.5 metres below grade. The deposit was brown.

4.2.3 Inferred Bedrock

Inferred bedrock of the Georgian Bay Formation was encountered underlying the silt and clay overburden in Boreholes 1 to 3 and 5 to 10. The bedrock was inferred to be highly to partially weathered based on the samples recovered in the split spoon sampler. Bedrock coring to confirm the presence of bedrock and the extent of weathering was beyond the scope of work. The depths of inferred bedrock and method of identification are summarized below:

Borehole	Ground Surface Local Elevation (m)	Depth / Local Elevation (m) of Inferred Bedrock	Method of Inferred Bedrock Identification
BH 1	95.43	3.1 / 92.4	Recovered samples, auger grinding, split spoon bouncing
BH 2	98.53	2.3 / 96.2	
BH 3	99.35	4.6 / 94.8	
BH 4	90.92	Not encountered	Not encountered
BH 5	97.41	2.3 / 95.1	Recovered samples, auger grinding, split spoon bouncing
BH 6	98.79	3.1 / 95.7	
BH 7	94.28	3.1 / 91.2	
BH 8	97.00	3.1 / 94.0	
BH 9	91.12	2.3 / 88.8	
BH 10	95.24	4.6 / 90.7	

The Georgian Bay Formation consists of shale with limestone interbeds. Zones of highly / fully weathered bedrock typically have a soil-like matrix (similar to hard and overconsolidated soil) but may contain occasional bedrock fragments and possibly some intermittent slabs of intact shale and limestone. Partially weathered bedrock can range in amount of weathering, from a soil-like matrix with occasional rock fragments to solid bedrock with almost no soil-like matrix but low Rock Quality Designation and frequent jointing.

Exposed shale bedrock was observed along the bottom of the eastern gully channel during the visual slope inspection.

4.3 Groundwater

Unstabilized groundwater level measurements and cave measurements were taken upon completion of drilling of each borehole as shown on the borehole logs in Appendix A. These measurements provide a rough estimate of the possible excavation and temporary groundwater control constructability considerations that may arise. The boreholes remained open upon completion. Unstabilized groundwater was encountered at a depth of 2.7 metres below grade in Borehole 4 in the earth fill and cohesionless deposits, but was encountered at depths of 4.6 metres below grade or was dry in the other boreholes.

Monitoring wells were installed in Boreholes 1, 2, 4 to 6 and 10 to facilitate the measurements of long-term, stabilized groundwater levels. The 50 mm diameter PVC wells had 1.5 to 3.0-metre-long screens. A summary of the groundwater level measurements is presented below:

Monitoring Well	Screened Location		Strata Screened	Depth / Local Elevation (m) of Groundwater Table	
	Depth (m)	Local Elev. (m)		June 3, 2021	July 5, 2021
1	4.6 to 6.1	90.8 to 89.3	Inferred Weathered Bedrock	2.47 / 92.96	2.33 / 93.10
2	3.0 to 6.0	95.5 to 92.5		0.45 / 98.08	0.28 / 98.25
4	4.6 to 6.1	86.3 to 84.8	Gravelly Sand to Silty Sand	2.87 / 88.05	2.59 / 88.33
5	4.6 to 6.1	92.8 to 91.3	Inferred Weathered Bedrock	3.86 / 93.55	2.68 / 94.73
6	3.0 to 6.0	95.8 to 92.8		1.13 / 97.66	0.96 / 97.83
10	4.6 to 6.1	90.6 to 89.1	Silt & Clay; Inferred Weathered Bedrock	2.30 / 92.94	2.37 / 92.87

Based on the above groundwater level measurements and moisture contents of the recovered soil samples, the prevailing groundwater table is located approximately 0.3 to 1 metre below grade in the southwestern part of the site to be developed (i.e. at Monitoring Wells 2 and 6). These wells were also installed closer to the escarpment are at a higher elevation than the other wells. The groundwater table is located approximately 2.3 to 2.7 metres below grade in the remaining area of the site to be developed (i.e. in Monitoring Wells 1, 4, 5 and 10). It is expected that groundwater generally flows to the northeast.

The groundwater level will change based on seasonal fluctuations. GEI is measuring the water levels once per month for a year to determine the seasonally high groundwater elevation, with the results provided in a separate letter report.

The silt and clay deposits predominantly encountered beneath the site contain more than 95% fines and have a low permeability, precluding the free flow of water. The upper zones of the inferred weathered bedrock consist of a soil-like matrix and will also preclude the free flow of water. The cohesionless earth fill and gravelly sand deposits encountered in Borehole 4 will allow for the free flow of water when wet.

5. Slope Stability Analysis and Discussion

5.1 Soil Strength Design Parameters

Soil strength parameters for the soil stratum encountered on site were estimated based on published information, empirical correlations for cohesionless soils relating SPT "N" values, soil type, unit weight and effective friction angle, and our experience on other slope evaluation projects. Bedrock is impenetrable such that slip surfaces do not pass through the shale bedrock. The values for use in the slope stability models at this site are as follows:

Stratum	γ - Bulk Unit Weight (kN/m^3)	φ - Friction Angle (degrees)	c' – Effective Cohesion (kPa)
Earth Fill	19.0	30	0
Silt & Clay	18.0	28	6
Silty Sand	19.0	30	0
Dense Sands	20.0	36	0
Bedrock	23	Impenetrable	

The estimated soil strength parameters are also indicated on the results of the slope stability analyses within Appendices F and G. The soil strength parameters are based on effective stress analysis for long-term slope stability. It is considered that these soil properties are conservative, and the site soils are stronger. Furthermore, other effects which can increase the stability of the slope, such as negative pore water pressures within unsaturated soils (matric suction), and root mat reinforcement, have not been modelled.

5.2 Slope Geometry, Material Boundaries and Groundwater

The following drawings were provided to GEI and were combined to create an updated topographic surface with 0.5 metre contours and plan view for the slope stability analysis:

- File Name: *"JoeTOPO – ALTA PHASE 2 – lots 6-10,"* field work completed on December 14, 2021, by JoeTOPO Surveys and CADD Inc.
- *"Draft Plan of Subdivision of Part of Lots 23 & 24, Concession 4, Blocks 67, 72, 73 and Part of Blocks 75 & 76 and Part of Alta Road, Registered Plan 1127, Town of the Blue Mountains,"* Revised February 11, 2022, by Pascuzzo Planning Inc.
- *"Preliminary SWM Pond Grading Plan,"* Fig. 10, Project No. 119-2528-207, dated June 28, 2021, by Crozier Consulting Engineers.

The slope geometry for the analysis was determined by cutting six (6) cross sections from the topographic survey created for the site as shown as Figure 3. The cross-sections were taken such that they intersected various locations of the slope, generally along the most critical slope sections (smallest distance between the slope crest and the slope toe) and through the drainage gullies that extend down the slope in Block 61. The detailed cross-sections with inferred stratigraphic boundaries are provided in Appendix F.

Chapter 10 of the GSCA guideline defines the Top of Slope as *"…the point of the slope where the downward inclination of the land begins, or the upward inclination of the land levels off. This point is situated at a higher topographic elevation of land than the remainder of the slope."* The top of slope location across the site shown on Figure 3 was interpreted by GEI using the topographic contours, cross-sections and GSCA definition. It must be noted that GSCA has the final say in the top of slope location, which may include physically staking the location at the site.

The material boundaries were modelled using the subsurface conditions encountered in Boreholes 1, 4, and 9 which were advanced near the slope crest, as well as Test Pits 1 to 6 that were excavated near / within Block 61. In Boreholes 1 and 9, silt and clay extended to depths of 2.3 to 3.1 metres below grade and was underlain by inferred bedrock. In Borehole 4, 3.1 metres of earth fill was underlain by dense to very dense cohesionless deposits that extended beyond the depth of investigation.

Monitoring wells were installed in Boreholes 1 and 4, and the stabilized groundwater level was measured to be about 2.3 to 2.6 metres below grade. It is typical for groundwater to loosely mimic the surface topography of the slope, and the groundwater elevations on the cross-sections reflect this assumption.

It is understood that small seeps were noted within the EIS for Nipissing Ridge. The groundwater table was modelled based on the monitoring well readings for the upper soil overburden at the top of the northern slope. The lower parts of the slope consist of bedrock with nominal soil overburden, and the minor seepage (assumed from the bedrock) will not impact instability.

5.3 Slope Stability Setbacks & Policy

The Grey Sauble Conservation Authority (GSCA) provides policy requirements and technical guidance for developments within slope and erosion hazard zones based on the following documents:

- "*Policies for the Administration of the Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation, Ontario Regulation 151/06,*" by GSCA, revised January 13, 2010; and

- "*Technical Guide on River and Stream Systems: Erosion Hazard Limit*", by the MNRF, dated 2002.

Grey County maps shows that this northern slope is regulated by the GSCA but is not associated with a lake or watercourse and falls under *Section 8.4: Other Slope Hazards* in the GSCA policy guideline. It is understood the northern slope is part of the Nipissing Ridge post-glacial shoreline. The following allowances apply to most of the northern slope:

- Stable Slope Allowance: This setback is associated with determining the inclination of the slope that achieves a minimum factor of safety of 1.5. In some cases, the existing slope inclination may meet this minimum requirement. In lieu of detailed geotechnical engineering analysis, a conservative estimate for the stable slope inclination of 3H : 1V can be applied for most soils, or 5H : 1V for sandy soils.
- Erosion Access Allowance: An additional 6 metre allowance is applied to allow for emergency access, routine maintenance of the slope and potential erosion areas, and to create an additional buffer between the development and the potential riverine erosion hazard.

It is noted that flowing water and active erosion was observed in the eastern drainage feature / gully that extends down the slope in Block 61. This is not a permanent watercourse, but a toe erosion allowance was considered for the slope areas along the drainage gully to account for continued erosion over the long-term. It appears that the eroding eastern drainage gully has increased in size over time based on a review of aerial images and previous topographic plans. A toe erosion allowance must also be considered for the slope and channel south of the property.

The stable slope allowance (along most of the northern slope) and the toe erosion allowance plus stable slope allowance (along parts of the drainage gullies in Block 61 and along the southern channel slope) combine to form the Long Term Stable Top of Slope, also known as the erosion/slope hazard limit. The additional 6 metre access allowance is for planning purposes and the total setback (combining all components) defines the limit of new development for the valley system. An LTSTOS model is shown on Figure 4.

It is noted that GSCA and MNRF guidelines allow a factor of safety between 1.3 to 1.5 for active (e.g. residential) land use when determining the stable slope allowance. Active land use is applicable for the proposed residential development at this site as summarized below.

Land Uses	Design Minimum Factor of Safety
Passive: no buildings near slope; farm field, bush, forest, timberland, woods, wasteland, badlands, tundra.	1.10

Land Uses	Design Minimum Factor of Safety
Light: no habitable structures near slope; recreational parks, golf courses, buried small utilities, tile beds, barns, garages, swimming pools, sheds, satellite dishes, dog houses.	1.20 to 1.30
Active: habitable or occupied structures near slope; residential, commercial, and industrial buildings, retaining walls, storage/warehousing of non-hazardous substances.	1.30 to 1.50
Infrastructure and Public Use: public use structures or buildings (i.e. hospitals, schools, stadiums), cemeteries, bridges, high voltage power transmission lines, towers, storage/warehousing of hazardous materials, waste management areas.	1.40 to 1.50

Based on these policy guidelines and standard engineering practice, a minimum factor of safety of 1.5 is required to determine the stable slope inclination.

5.4 Analysis of Existing Slope Stability Conditions (Northern Slope)

Stability analyses were carried out using the commercially available computer program *Slide2* (Version 9.020) provided by RocScience Inc. The slope stability analyses were based on a force and moment limit equilibrium analysis using the Spencer method. This method of analysis calculates the minimum factor of safety (resisting versus driving forces) for numerous circular surfaces. The circular surfaces are centred on points on a grid with a set number of radius distances to be calculated for each centre. A factor of safety of 1.0 indicates the slope is at a point of pending failure since the resisting forces are equal to the driving forces.

The results of the *Slide2* slope stability analysis for existing conditions is provided within Appendix F. The stability analysis determined the following factors of safety for existing conditions:

Cross-Section Location	Slope Height (m)	Existing Slope Inclination	Existing Slope Stability Factor of Safety
1-1	25.8	2.3H : 1V	2.0
2-2	21.3	2.3H : 1V	2.1
3-3	3.2 (localized to drainage gully)	2.0H : 1V	2.0
4-4	12.0 (upper part of drainage gully)	3.6H : 1V	2.1
5-5	15.6	3.3H : 1V	1.9
6-6	15.0	3.7H : 1V	3.5

The existing factors of safety (FOS) are 1.9 or greater, which is expected based on the relatively flat slope inclinations and typically shallower overburden over bedrock. The northern slope exceeds the required FOS of 1.5 per the GSCA guidelines and is therefore considered stable over the long-term for Cross-Sections 1, 2 and 4 to 6. An exception is Cross-Section 3 through the eastern drainage gully, which requires a toe erosion allowance and additional setbacks as discussed below.

5.5 Analysis for Stable Slope Conditions and Setbacks (Northern Slope)

5.5.1 Toe Erosion Allowance

The toe erosion allowance is a horizontal distance typically measured out from the bankfull width of a watercourse, existing water level of the watercourse, or bottom of the watercourse channel as deemed appropriate based on site specific conditions. The toe erosion allowance applied is based on numerous considerations such as: proximity of the watercourse to the slope toe, the presence of existing erosion, average and peak velocity within the watercourse, susceptibility of the soils at the slope toe to erosion, extent of vegetation, fluvial geomorphological processes, etc. Due to the varied and complex nature of determining toe erosion, multiple simplified methods are available for determining this toe erosion allowance, including:

- Using a value of 15 metres if no information is available;
- Use of an average annual recession rate based on a minimum of 25 years data, and extrapolated to a 100-year planning horizon;
- A fluvial geomorphological study based on a minimum of 25 years of record;
- Use of the table "*Determination of Toe Erosion Allowance*" provided within MNR technical guidelines (2002) as provided below.

For the purposes of determining the toe erosion allowance for the drainage gully at this site, the MNR table provided below was used:

Minimum Toe Erosion Allowance – River within 15 Metres of Slope Toe				
Native Soil Structure at Slope Toe	**Evidence of Active Erosion or Bankfull Flow Velocity > Competent Flow Velocity**	**No evidence of Active Erosion or Flow Velocity << Competent Flow Velocity**		
		Bankfull Width		
		< 5 metres	**5 to 30 metres**	**> 30 metres**
Hard Rock	0 to 2 metres	0 metres	0 metres	1 metres

Minimum Toe Erosion Allowance – River within 15 Metres of Slope Toe				
Native Soil Structure at Slope Toe	**Evidence of Active Erosion or Bankfull Flow Velocity > Competent Flow Velocity**	**No evidence of Active Erosion or Flow Velocity << Competent Flow Velocity**		
		Bankfull Width		
		< 5 metres	**5 to 30 metres**	**> 30 metres**
Soft Rock or Cobbles/Boulders	2 to 5 metres	0 metres	1 metres	3 metres
Stiff to Hard Cohesive Soil, Coarse Granulars or Glacial Tills	5 to 8 metres	1 metres	2 metres	4 metres
Soft/Firm Cohesive Soil, Fine Granular or Fill	8 to 15 metres	1 to 2 metres	5 metres	7 metres

The borehole results and visual slope inspection indicate that the sidewalls of the eastern drainage gully consist of stiff silt and clay, underlain by bedrock. Flowing water and active erosion were observed during the inspection, which suggests a toe erosion allowance of 5 to 8 metres. It is assumed that the drainage feature contains intermittent flows and is not a permanent watercourse feature, therefore a 5 metre toe erosion allowance (the lower end of the range) was selected.

The toe erosion allowance is not required for most of the slope (no watercourse at the bottom) nor for parts of the western drainage gully where erosion is not occurring.

5.5.2 Stable Slope Inclination

As previously noted, GSCA and MNRF guidelines allow a factor of safety between 1.3 to 1.5 for active (e.g. residential) land use when determining the LTSTOS position, which is applicable for the proposed residential development at this site. Based on these policy guidelines and standard engineering practice, a minimum factor of safety of 1.5 is required to determine the stable slope inclination.

The northern slope in its existing condition exceeds the required FOS of 1.5 per the GSCA guidelines and is therefore considered stable over the long-term for Cross-Sections 1, 2 and 4 to 6.

After the 5 metre toe erosion allowance was applied at Cross-Section 3, trial slope models were created which decreased the slope inclination by increments of approximately 0.1H to 1V until a factor of safety (FOS) of 1.5 or greater was obtained. A stable slope inclination of 2.0 horizontal to 1 vertical is recommended for the over-steepened drainage gully areas. Although the FOS exceeds 1.5 at this inclination, it accounts for variability encountered in the nearby boreholes and test pits (e.g. thicker zones of earth fill or silty sand may exist at grade) and for

potential fluctuations in the groundwater table. The results of the analysis are provided in Appendix G and are summarized below.

Cross-Section Location	Stable Slope Inclination to Achieve a Minimum Factor of Safety of 1.5
1-1	2.3H : 1V (existing slope)
2-2	2.3H : 1V (existing slope)
3-3	2.0H : 1V
4-4	3.6H : 1V (existing slope)
5-5	3.3H : 1V (existing slope)
6-6	3.7H : 1V (existing slope)

Shale bedrock is not prone to deep seated slope stability failures like soil is. The failure mechanism within shale bedrock is typically associated with discrete jointing, and not Mohr-Coulomb strength parameters that are modelled within limit equilibrium slope stability models. Jointing in shale bedrock of the Georgian Bay Formation is usually aligned horizontally along the bedding planes of the rock, with intermittent vertical orthogonal joints. These joints are not conducive for wedge style failures, and therefore do not need to be considered in the determination of a stable slope inclination.

What causes "*failure*" in shale bedrock is that it is susceptible to erosion when exposed to the environment (wind, rain, runoff, etc.). The effects of erosion on shale exposed on a slope due to the elements occur until the slope effectively self-stabilizes, which depending on many site-specific conditions, typically ranges between 1.0 to 1.4H to 1V. It is very important to note that there is no analytical way to relate a slope inclination in shale bedrock to a factor of safety.

No guidance on stable slope inclinations in bedrock is provided within GSCA guidelines. The document *"Slope Stability Definition & Determination Guide"* by Credit Valley Conservation (2014) indicates that the stable slope allowance in shale bedrock is 1.4 horizontal to 1 vertical for an equivalent FOS of 1.5. Inferred bedrock extends down most of the northern slope face at Alta Subdivision and has inclinations of 2.3 horizontal to 1 vertical or flatter, which is considered stable over the long-term per the CVC guideline.

5.5.3 Long-Term Stable Top of Slope

The Long-Term Stable Top of Slope (LTSTOS) position (also called the slope / erosion hazard limit per the GSCA policy guidelines) for a factor of safety of 1.5 is determined by the combination of both the stable slope inclination that achieves a factor of safety of 1.5 combined with the toe erosion allowance (only applicable for Cross-Section 3 and the eastern drainage gully). A schematic sketch visually illustrating how the LTSTOS is determined is provided as

Figure 4. The LTSTOS position is shown in plan view on Figure 3 and in cross-section view on the slope stability models in Appendices F and G. The results are summarized in the table below.

Cross-Section Location	Approximate Distance from Existing Top of Slope to LTSTOS Position
1-1	Coincides with Existing Top of Slope
2-2	
3-3	5.2 metres
4-4	Coincides with Existing Top of Slope
5-5	
6-6	

The LTSTOS position coincides with the existing top of slope across most of the site (i.e. the slope is stable in the long-term). A setback of 5.2 metres was calculated for Cross-Section 3 based on the toe erosion and stable slope allowances. It is noted that the existing top of slope for Nipissing Ridge to the east of the site is located about 45 to 100 metres east of the property lines (i.e. Lots 12 to 16), and there are no concerns for slope instability along the eastern property line.

The above setbacks of the LTSTOS positions are applicable only for the location of the cross-sections. Interpolation of the LTSTOS positions was completed based on engineering judgement to address a variety of factors including (but not limited to): location of the slope crest, slope inclination and height, and proximity to the drainage gullies with active erosion. The 5.2 metre setback was applied along the full length of the eastern drainage gully and in select locations of the western gully with localized steeper side slopes or localized erosion, shown on Figure 3. This accounts for potential continued erosion over the long-term. The LTSTOS was also applied to these areas such that the tableland peninsulas between / beside the gullies are avoided for development.

It must also be noted that significant changes in tableland drainage patterns could affect the LTSTOS position beyond what is shown on Figure 3. If more concentrated runoff is directed down the slope face, increased erosion could occur within the existing drainage gullies or new gullies could form on the slope, and the LTSTOS position could be set back farther than shown on Figure 3.

The civil engineer should review the drainage patterns for the site and design the stormwater system to ensure that concentrated runoff is not permitted to flow unchecked over the slope or into the existing gullies. It is expected that the gully erosion will be reduced if the runoff is re-directed away from the slope. The civil engineer should also address the need for erosion

protection measures such as rip rap lining within the gullies and at any proposed SWMP outlet locations depending on the final stormwater system configuration, to ensure long-term erosion is prevented. A monitoring plan is recommended at the gully and outlet locations to ensure erosion will be controlled.

GEI should be provided with the final design drawings and erosion protection measure details for review. If the concentrated runoff will not be controlled or erosion protection measures will not be installed, the toe erosion allowance may need to be increased for the eastern gully, and the LTSTOS setback might be increased.

5.5.4 Erosion Access Allowance

Section 8.4.8 of the GSCA policy guideline states: *"Buildings or Structures associated with new multi-lot or multi-unit uses (residential / industrial / commercial / institutional) … may be permitted within the Slope Hazard Allowance in accordance with the policies in Section 8.4.2, provided that all building lots … are set back, in their entirety, a minimum of 6 metres (20 feet) from the Stable Slope Line."* This 6 metre erosion access allowance is a planning setback to allow for emergency access, routine maintenance of the slope and potential erosion areas, and to create an additional buffer between the development and the potential erosion hazard. The same erosion access allowance of 6 metres applies when a toe erosion allowance is incorporated into the setback.

The 6 metre erosion access allowance will apply beyond the LTSTOS position shown on Figure 3 across the site, but was not included on the drawing because it is for planning purposes and is not derived from technical analysis. Based on a review of the February 11, 2022, site plan from Pascuzzo Planning Inc., it appears that all lot lines are set back 6 metres from the LTSTOS to account for the erosion access allowance. It is also understood that the dwellings have a minimum 9 metre rear yard setback from the rear lot lines.

5.6 Southern Channel Slope

GEI completed a visual slope inspection along the channel / small watercourse to the south of the property. A summary of the conditions is below.

- The channel side slope inclinations are 2.5 horizontal to 1 vertical of flatter, based on visual observations and on the topographic survey with contours in the area.
- The slope height ranges from approximately 3 to 7 metres. The slope is moderately to heavily vegetated with shrubs, grasses, and trees.
- Only a small flow of water was observed, with a bankfull width of less than 5 metres. There is an upstream culvert beneath Alta Road that restricts / throttles flows through the channel.

- No signs of concentrated runoff, slope toe / channel erosion, or slope instability were observed. The MNR Slope Rating was 32, indicating only a slight potential for instability.
- Boreholes advanced near the channel encountered 3 metres of very stiff to hard silt and clay, underlain by bedrock of the Georgian Bay Formation. It is expected that the channel bottom and lower parts of the slope consist of nominal / thin overburden underlain by bedrock.

The detailed analysis from the northern slope calculated that the very stiff to hard silt and clay slopes are stable (have a factor of safety greater than 1.5) for slope inclinations of 2 horizontal to 1 vertical. The southern channel side slopes are therefore stable for long term conditions with inclinations of 2.5H:1V or flatter. Based on the assumed bedrock channel bottom, no signs of erosion, and a bankfull width of less than 5 metres, the toe erosion allowance along the channel is 0 metres per the table in Section 5.5.1.

It is therefore concluded that the Long-Term Stable Top of Slope (LTSTOS) coincides with the existing top of slope along the southern channel slope. As discussed in Section 5.5.4, the 6-metre erosion access allowance will apply beyond the LTSTOS / existing top of slope position.

5.7 General Slope Considerations for Construction

For any work conducted in near proximity to the slopes, the following recommendations should be followed during construction:

- Construction and restoration activities should be conducted in a manner which does not result in surface erosion of the slope;
- Site grading and drainage should be designed to prevent direct concentrated or channelized surface runoff from flowing directly over the slope, as is currently occurring at the eastern drainage gully;
- Water drainage from down-spouts, sumps, road drainage and the like should not be permitted to flow over the slope, but be directed towards the front of the dwellings or extended down the slope to areas where the erosive energy can be dissipated (e.g. rip-rap splash pads). Erosion control measures must be installed at any SMWP outlets near the slope to prevent long-term erosion;
- A healthy vegetative cover should be maintained on the slope. Any slope areas disturbed by construction should be restored with suitable native vegetation as soon as possible;

- The slope should not be further steepened and fill materials (including landscape debris, soil, building materials, etc.) should not be placed on the slope or within 3 metres of the slope crest; and
- A sedimentation control fence (silt fence) should be erected around work areas prior to the commencement of site works.

The Town of the Blue Mountains also previous expressed concerns about piping erosion beneath the SWMP due to the wet sands encountered in Borehole 4 and Test Pits 1 and 2. The SWMP has since moved to a new area and no seepage was observed from the western gully slope face during the slope inspection. Piping erosion is not considered to be an issue for the slope or development near Borehole 4 or Test Pits 1 and 2, as any residential structures will be set back beyond the slope / erosion hazard limit.

6. Limitations and Conclusions

6.1 Limitations

The recommendations and comments provided are necessarily on-going as new information of underground conditions becomes available. More specific information with respect to the conditions between samples, or the lateral and vertical extent of materials may become apparent during excavation operations. The interpretation of the borehole information must, therefore, be validated during excavation operations. Consequently, conditions not observed during this investigation may become apparent. Should this occur, GEI should be contacted to assess the situation and additional testing and reporting may be required.

GEI should be retained for a general review of the final design drawings and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, GEI will assume no responsibility for interpretation of the recommendations in the report.

The comments given in this report are intended only for the guidance of the design engineers. The number of boreholes required to determine the localized underground conditions between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc. could be greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

This report was prepared by GEI for the account of Tabera Ltd. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. GEI accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this project.

6.2 Conclusion

It is recognized that municipal/regional governing bodies, in their capacity as the planning and building authority under Provincial statues, will make use of and rely upon this report, cognizant of the limitations thereof, both as are expressed and implied.

We trust this report is complete within our terms of reference, and the information presented is sufficient for your present purposes. If you have any questions, or when we may be of further assistance, please do not hesitate to contact our office.

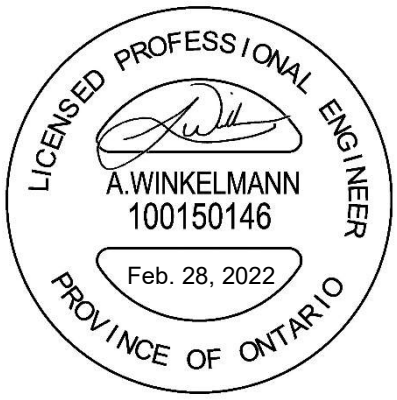
Yours Truly,

GEI Consultants

Prepared By:

Russell Wiginton, P.Eng.
Senior Geotechnical Engineer

Reviewed By:



Alexander Winkelmann, P.Eng.
Geotechnical and Earth Sciences Manager

Figures

Site Location Plan

Borehole Location Plans

Cross-Section and LTSTOS Location Plan

Long Term Stable Slope Crest Model

NOTES:
1. Coordinate System: NAD 1983 UTM Zone 17N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry
© Queen's Printer for Ontario, 2021.

Legend

- Subject Lands
- Highway
- Road
- Watercourse
- Waterbody
- Wooded Area

N

0 500 1,000 m

1:50,000

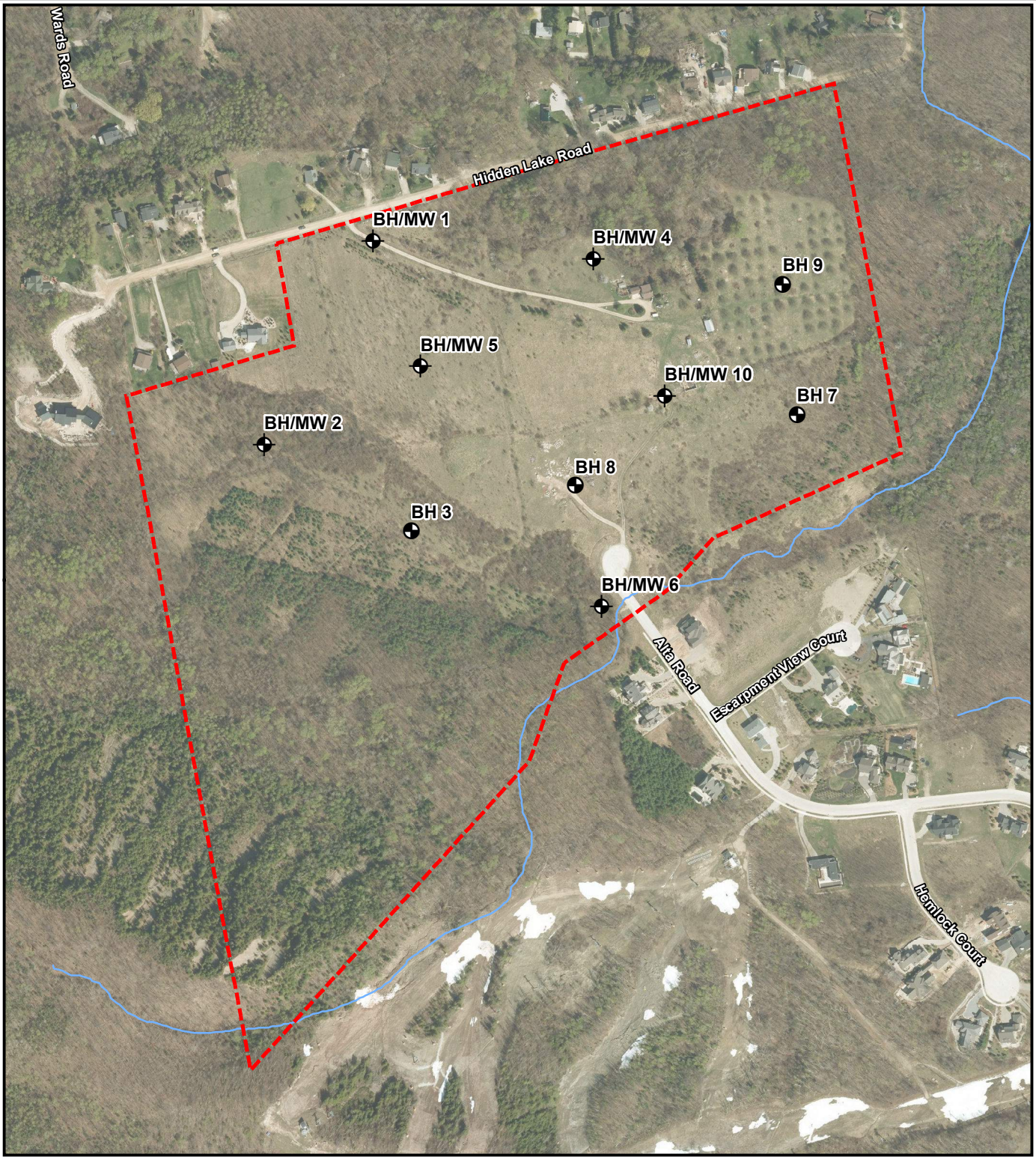
Alta Subdivision – Phase 2
Town of the Blue Mountains, ON

Tabera Ltd.

GEI Consultants

SITE LOCATION PLAN

Project 2101271 | July, 2021 | Fig. 1



NOTES:
1. Coordinate System: NAD 1983 UTM Zone 17N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
3. Orthoimagery © First Base Solutions, 2021. Imagery taken in 2010.

Legend

- Subject Lands
- Approximate Borehole and Monitoring Well Location
- Approximate Borehole Location
- Watercourse

N

0 50 100 m

1:5,000

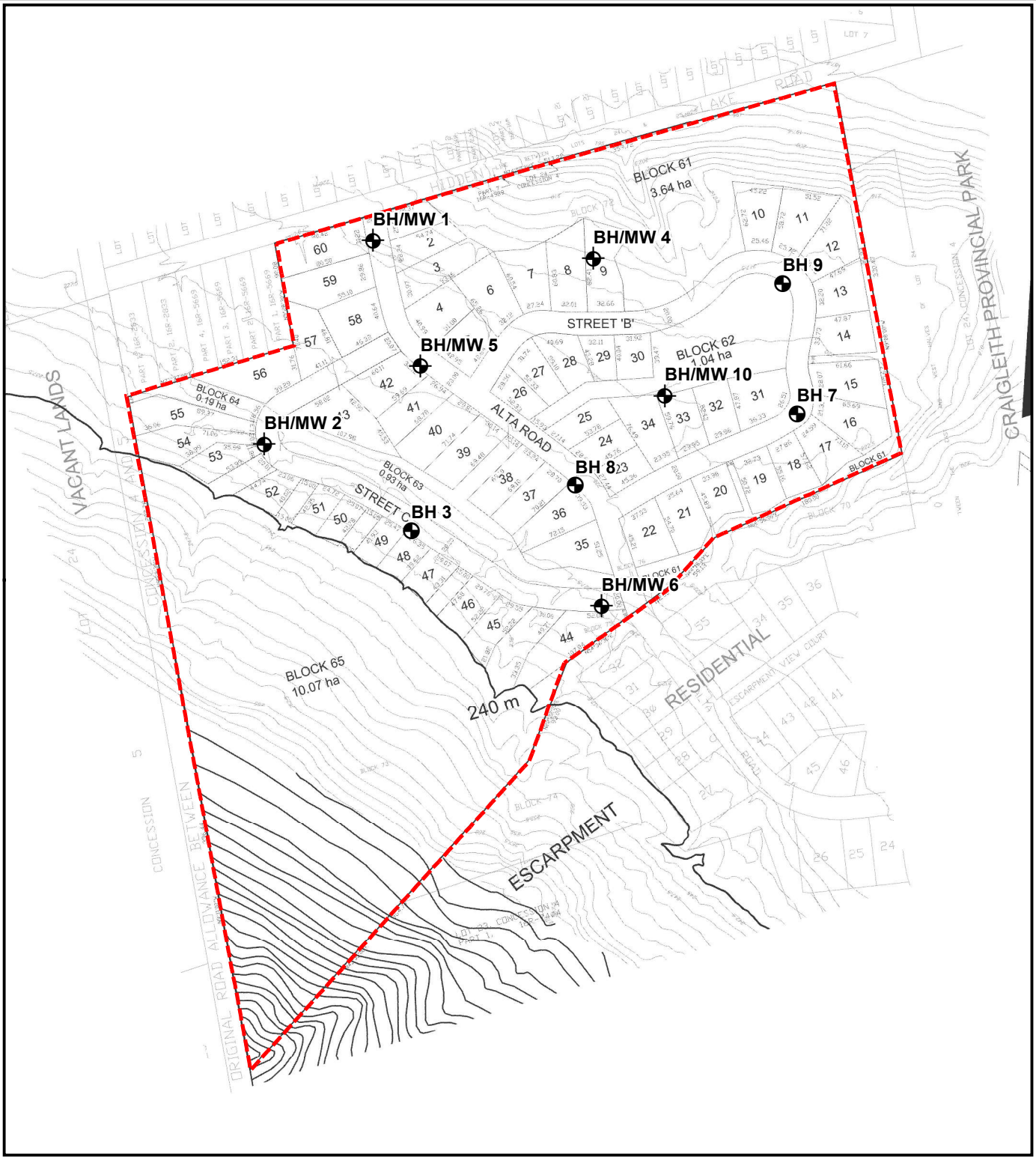
Alta Subdivision – Phase 2
Town of the Blue Mountains, ON

Tabera Ltd.

GEI Consultants

BOREHOLE LOCATION PLAN (AERIAL IMAGE)

Project 2101271 | July, 2021 | Fig. 2A



NOTES:

1. Coordinate System: NAD 1983 UTM Zone 17N.
2. Draft Plan of Subdivision, dated February 11, 2022, by Pascuzzo Planning Inc.

Legend

- Subject Lands
- Approximate Borehole and Monitoring Well Location
- Approximate Borehole Location

N

0 50 100 m

1:5,000

Alta Subdivision – Phase 2
Town of the Blue Mountains, ON

Tabera Ltd.

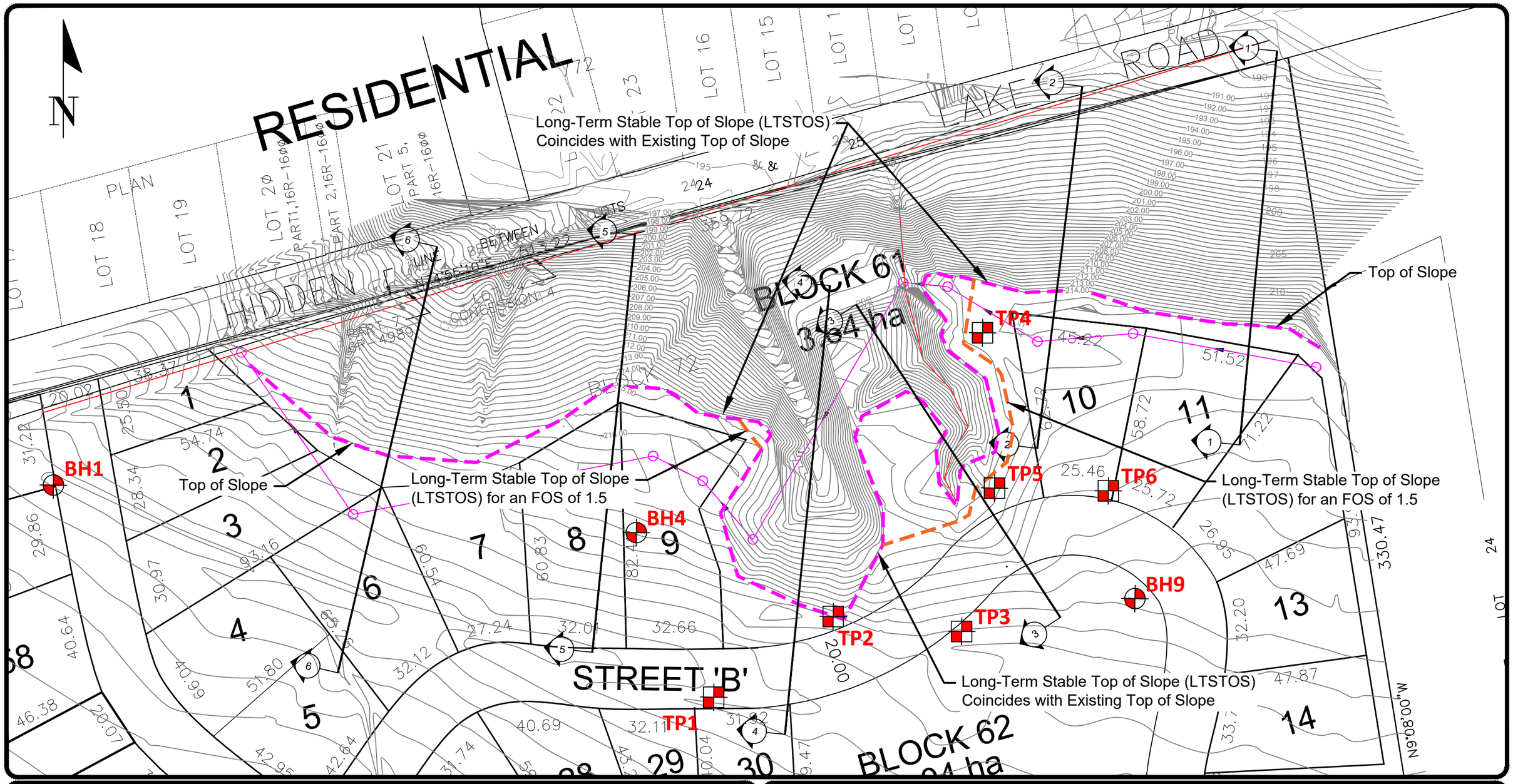
GEI Consultants

Project 2101271

BOREHOLE LOCATION PLAN
(PROPOSED SITE PLAN)

February 2022

Fig. 2B



Legend:

- Cross - Section Location
- Approx. Borehole Location
- Approx. Test Pit Location
- LTSTOS Position for FOS of 1.5
- Top of Slope

References:

1. *"JoeTOPO - ALTA PHASE 2- lots 6-10."*
2. *"Draft Plan of Subdivision,"* Revised Feb. 11, 2022, by Pascuzzo Planning Inc.
3. *"Preliminary SWM Pond Grading Plan,"* Fig. 10, by Crozier Consulting.

GEI Consultants
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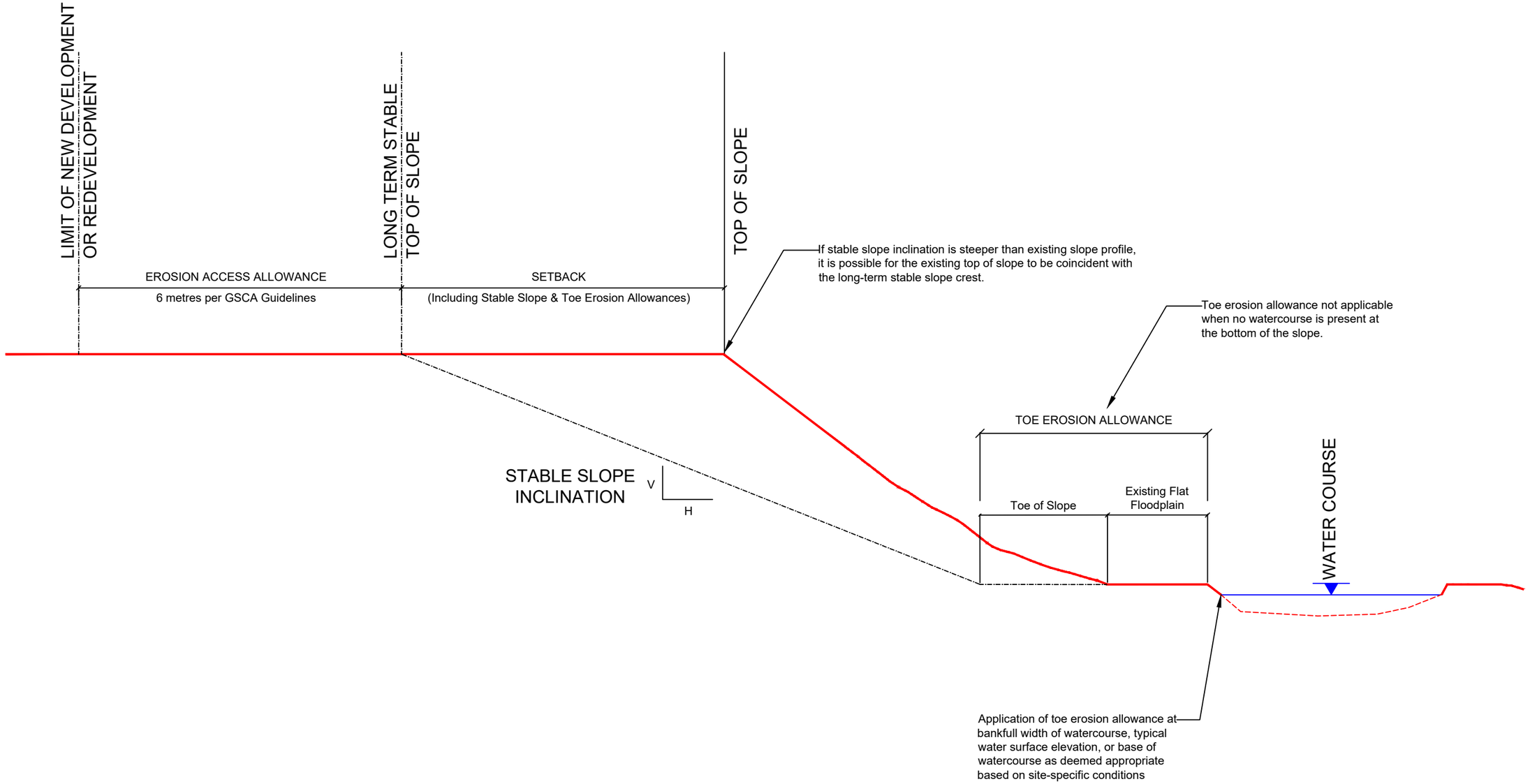
Project: Alta Subdivision Phase 2			
Title: Cross-Section and LTSTOS Location Plan			
Approved by: A.W.	Date: February 2022	Project No.: 2101271	
Drawn by: R.W.	Scale: 1:1250	Figure No.: 3	



GEI Consultants
647 Welham Rd, Unit 14, Barrie, ON, L4N 0B7
P: (705) 719-7994

Project: Alta Subdivision Phase 2			
Title: Long Term Stable Top of Slope Model			
Approved by: A.W.	Date: February 2022	Project No.: 2101270	
Drawn by: R.W.	Scale: N.T.S	Figure No.: 4	

Appendix A

Borehole Logs

RECORD OF BOREHOLE No. 1

Project Number:	**2101271**				
Project Client:	**Tabera Ltd**				
Project Name:	**Alta Subdivision**	Drilling Method:	**Solid Stem Augers**	Drilling Machine:	**Track Mount**
Project Location:	**Blue Mountain, Ontario**	Logged By:	**BH**	Northing: **4931233**	Date Started: **2021-05-25**
Drilling Location:	**See Borehole Location Plan**	Reviewed By:	**AW**	Easting: **550912**	Date Completed: **2021-05-25**

GEI Consultants

Lithology Plot	DESCRIPTION (Local 95.43m)	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Shear Strength Testing (kPa) / Penetration Testing (SPT ○, DCPT ●)	LAB TESTING: Combustible Organic Vapour (ppm), Combustible Organic Vapour (%LEL), Total Organic Vapour (ppm), Atterberg Limits (PL, LL), Water Content (%)	Instrumentation Installation	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
	Topsoil = 300mm (0.3 / 95.1)					0	95							
	WEATHERED SILTY CLAY, Trace Sand, Firm, Mottled Red, Moist (Queenston Formation Bedrock Derived) (0.8 / 94.7)	SS	1	100	5			5	4					
	SILT & CLAY, Trace Sand, Stiff, Mottled Brown, Moist (Georgian Bay Formation Bedrock Derived)	SS	2	100	9	1	94	9	16					
	- - - Very Stiff - - -	SS	3	100	25			25	20		0	3	59	38
	- - - Hard - - -	SS	4	100	45	2	93	45	17					
	(3.1 / 92.4)													
	Georgian Bay Formation Bedrock (Partially Weathered)	SS	5	100	100+	3	92	100+ →	9					
		SS	6	100	100+	4	91	100+ →	10					
	(6.3 / 89.2)	SS	7	100	100+	5	90	100+ →	16		Wet sand seam			
	Borehole Ends @ 6.3m					6								

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Groundwater depth encountered on completion of drilling: **6.1m**

Cave depth after auger removal: **Open**

Groundwater depth observed on **June 3/21** at a depth of: **2.47m**

Observed on **July 5/21** at a depth of: **2.33m**

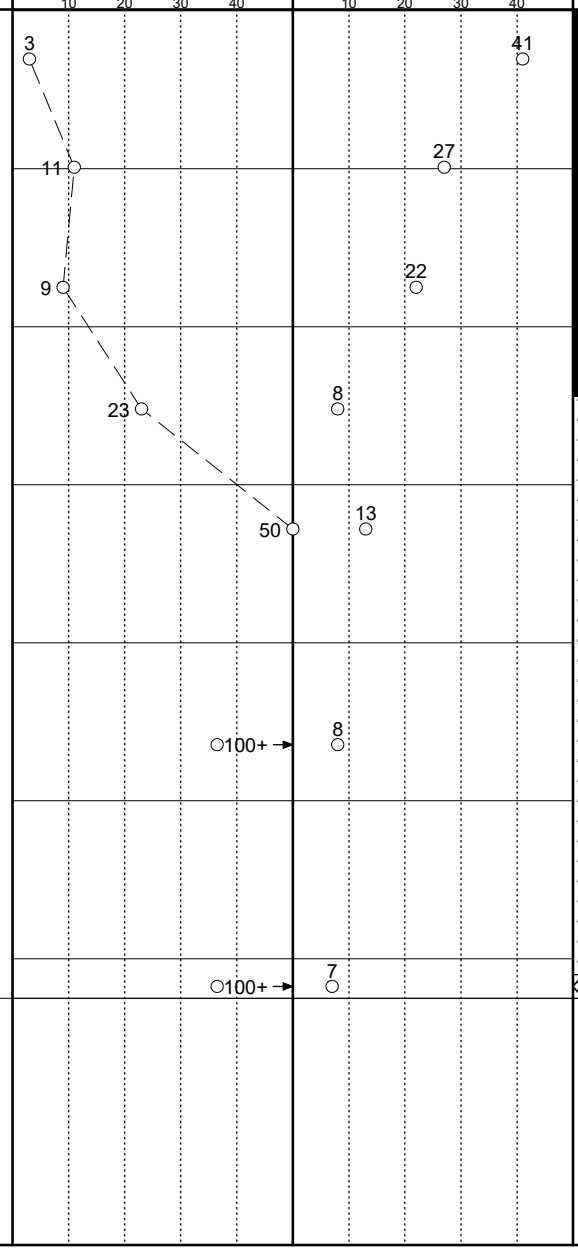
Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :50**

RECORD OF BOREHOLE No. 2

Project Number:	**2101271**				
Project Client:	**Tabera Ltd**				
Project Name:	**Alta Subdivision**	Drilling Method:	**Solid Stem Augers**	Drilling Machine:	**Track Mount**
Project Location:	**Blue Mountain, Ontario**	Logged By:	**BH**	Northing: **4931105**	Date Started: **2021-05-25**
Drilling Location:	**See Borehole Location Plan**	Reviewed By:	**AW**	Easting: **550838**	Date Completed: **2021-05-25**

Lithology Plot	DESCRIPTION (Local 98.53m)	Sample Type	Sample Number	Recovery (%)	SPT "N" Value
	Topsoil = 300mm (0.3 / 98.2)	SS	1	100	3
	- - - Weathered - - - (0.8 / 97.8)				
	SILTY CLAY, Trace Sand, Stiff, Mottled Red, Moist (Queenston Formation Bedrock Derived) (1.5 / 97.0)	SS	2	100	11
	SILT & CLAY, Trace Sand, Stiff, Mottled Brown, Moist (Georgian Bay Formation Bedrock Derived) (2.3 / 96.2)	SS	3	100	9
	Georgian Bay Formation Bedrock (Highly Weathered)	SS	4	100	23
		SS	5	100	50
	Georgian Bay Formation Bedrock (Partially Weathered) (4.6 / 94.0)	SS	6	100	100+
	(6.3 / 92.3)	SS	7	100	100+
	Borehole Ends @ 6.3m				



COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL

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Groundwater depth encountered on completion of drilling: **Dry**

Cave depth after auger removal: **Open**

Groundwater depth observed on **June 3/21** at a depth of: **0.45m**

Observed on **July 5/21** at a depth of: **0.28m**

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :50**

RECORD OF BOREHOLE No. 3

GEI Consultants

Project Number:	**2101271**				
Project Client:	**Tabera Ltd**				
Project Name:	**Alta Subdivision**	Drilling Method: **Solid Stem Augers**		Drilling Machine: **Track Mount**	
Project Location:	**Blue Mountain, Ontario**	Logged By: **BH**	Northing: **4931006**	Date Started: **2021-05-25**	
Drilling Location:	**See Borehole Location Plan**	Reviewed By: **AW**	Easting: **550982**	Date Completed: **2021-05-25**	

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)
	Local 99.35m						
	0.2 Topsoil = 180mm 99.2						
	- - - Weathered - - -	SS	1	100	4		
	0.8 98.6						
	SILTY CLAY, Trace Sand, Stiff, Mottled Red, Moist (Queenston Formation Bedrock Derived)	SS	2	100	9	1	98
		SS	3	100	6	2	97
	2.3 97.1						
	SILT & CLAY, Trace Sand, Very Stiff, Mottled Brown, Moist (Georgian Bay Formation Bedrock Derived)	SS	4	100	24	3	96
		SS	5	100	24	4	95
	4.6 94.8						
	Georgian Bay Formation Bedrock (Partially Weathered)	SS	6	100	100+	5	94
	6.3 93.1	SS	7	100	100+	6	
	Borehole Ends @ 6.3m						

FIELD TESTING

Shear Strength Testing (kPa)
× Other Test
+ Pocket Penetrometer
▲ Field Vane (Intact)
△ Field Vane (Remolded)
40 80 120 160

Penetration Testing
○ SPT ● DCPT
10 20 30 40

SPT "N" Value: 4, 9, 6, 24, 24, 100+, 100+

LAB TESTING

△ Combustible Organic Vapour (ppm)
▲ Combustible Organic Vapour (%LEL)
✳ Total Organic Vapour (ppm)
100 200 300 400

Atterberg Limits
PL ○ Water Content (%) LL
10 20 30 40

Water Content (%): 40, 24, 21, 21, 21, 9, 16

Instrumentation Installation

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL

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Groundwater depth encountered on completion of drilling: **4.6m**

Cave depth after auger removal: **Open**

Groundwater depth observed on at a depth of:

Observed on at a depth of:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

RECORD OF BOREHOLE No. 4

GEI Consultants

Project Number:	**2101271**				
Project Client:	**Tabera Ltd**				
Project Name:	**Alta Subdivision**	Drilling Method: **Solid Stem Augers**		Drilling Machine: **Track Mount**	
Project Location:	**Blue Mountain, Ontario**	Logged By: **BH**	Northing: **4931217**	Date Started: **2021-05-25**	
Drilling Location:	**See Borehole Location Plan**	Reviewed By: **AW**	Easting: **551107**	Date Completed: **2021-05-25**	

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	GR	SA	SI	CL
	Local 90.92m										
	FILL: Limestone Gravel	SS	1	100	4	0	90				
	0.8 — 90.2										
	FILL: Limestone Screenings	SS	2	100	6	1	90				
	1.5 — 89.4										
	FILL: Silty Sand, Trace Clay, Trace Gravel, Loose, Brown, Moist	SS	3	100	4	2	89	3	66	22	9
	- - - Silt & Sand, Wet - - -	SS	4	100	26	3	88				
	3.1 — 87.9										
	GRAVELLY SAND, Some Silt, Very Dense, Brown, Wet	SS	5	100	100+	4	87				
	4.6 — 86.4										
	SILTY FINE SAND, Trace Clay, Very Dense, Grey, Wet	SS	6	100	100+	5	86				
	6.6 — 84.4	SS	7	100	43	6	85	0	69	23	8
	Borehole Ends @ 6.6m										

FIELD TESTING — Shear Strength Testing (kPa): Other Test, Pocket Penetrometer, Field Vane (Intact), Field Vane (Remolded); Penetration Testing: SPT, DCPT

LAB TESTING — Combustible Organic Vapour (ppm), Combustible Organic Vapour (%LEL), Total Organic Vapour (ppm); Atterberg Limits (PL, LL); Water Content (%)

Instrumentation Installation

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

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Groundwater depth encountered on completion of drilling: **2.7m**

Cave depth after auger removal: **Open**

Groundwater depth observed on **June 3/21** at a depth of: **2.87m**

Observed on **July 5/21** at a depth of: **2.59m**

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

RECORD OF BOREHOLE No. 5

GEI Consultants

Project Number:	**2101271**				
Project Client:	**Tabera Ltd**				
Project Name:	**Alta Subdivision**	Drilling Method:	**Solid Stem Augers**	Drilling Machine:	**Track Mount**
Project Location:	**Blue Mountain, Ontario**	Logged By:	**BH**	Northing: **4931122**	Date Started: **2021-05-25**
Drilling Location:	**See Borehole Location Plan**	Reviewed By:	**AW**	Easting: **550954**	Date Completed: **2021-05-25**

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)
	Local 97.41m						
	0.2 Topsoil = 180mm 97.2					0	97
	WEATHERED SILTY CLAY, Trace Sand, Firm, Mottled Red, Moist (Queenston Formation Bedrock Derived)	SS	1	100	4		
	0.8 96.7					1	96
	SILT & CLAY, Trace Sand, Stiff, Mottled Brown, Moist (Georgian Bay Formation Bedrock Derived)	SS	2	100	11		
	- - - Very Stiff - - -	SS	3	100	20	2	95
	2.3 95.1						
	Georgian Bay Formation Bedrock (Highly Weathered)	SS	4	100	32		
	3.1 94.4					3	94
	Georgian Bay Formation Bedrock (Partially Weathered)	SS	5	100	100+		
		SS	6	100	100+	4	93
						5	92
	6.2 91.2	SS	7	100	100+	6	
	Borehole Ends @ 6.2m						

FIELD TESTING

Shear Strength Testing (kPa)

× Other Test
\+ Pocket Penetrometer
▲ Field Vane (Intact)
△ Field Vane (Remolded)

40 80 120 160

Penetration Testing

○ SPT ● DCPT

10 20 30 40

4, 11, 20, 32, 100+, 100+, 100+

LAB TESTING

△ Combustible Organic Vapour (ppm)
▲ Combustible Organic Vapour (%LEL)
✳ Total Organic Vapour (ppm)

100 200 300 400

Atterberg Limits

PL ○ Water Content (%) LL

10 20 30 40

24, 24, 19, 16, 8, 7, 7

Instrumentation Installation

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL

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T : (705) 719-7994
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Groundwater depth encountered on completion of drilling: **Dry**

Cave depth after auger removal: **Open**

Groundwater depth observed on **June 3/21** at a depth of: **3.86m**

Observed on **July 5/21** at a depth of: **2.68m**

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :50**

RECORD OF BOREHOLE No. 6

GEI Consultants

Project Number:	**2101271**				
Project Client:	**Tabera Ltd**				
Project Name:	**Alta Subdivision**	Drilling Method: **Solid Stem Augers**		Drilling Machine: **Track Mount**	
Project Location:	**Blue Mountain, Ontario**	Logged By: **BH**	Northing: **4930961**	Date Started: **2021-05-25**	
Drilling Location:	**See Borehole Location Plan**	Reviewed By: **AW**	Easting: **551101**	Date Completed: **2021-05-25**	

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)
	Local 98.79m						
	0.1 98.7 Topsoil = 100mm						
	- - - Weathered - - -	SS	1	100	6		
	0.8 98.0						
	SILTY CLAY, Trace Sand, Firm, Mottled Red, Moist (Queenston Formation Bedrock Derived)	SS	2	100	6	1	98
	- - - Stiff - - -	SS	3	100	13	2	97
	2.3 96.5						
	SILT & CLAY, Trace Sand, Very Stiff, Mottled Brown, Moist (Georgian Bay Formation Bedrock Derived)	SS	4	100	20	3	96
	3.1 95.7						
	Georgian Bay Formation Bedrock (Highly Weathered)	SS	5	100	55	4	95
	4.6 94.2						
	Georgian Bay Formation Bedrock (Partially Weathered)	SS	6	100	100+	5	94
	6.3 92.5	SS	7	100	100+	6	93
	Borehole Ends @ 6.3m						

FIELD TESTING
Shear Strength Testing (kPa)
× Other Test
+ Pocket Penetrometer
▲ Field Vane (Intact)
△ Field Vane (Remolded)
40 80 120 160
Penetration Testing
○ SPT ● DCPT
10 20 30 40

LAB TESTING
△ Combustible Organic Vapour (ppm)
▲ Combustible Organic Vapour (%LEL)
✳ Total Organic Vapour (ppm)
100 200 300 400
Atterberg Limits
PL ○ Water Content (%) LL
10 20 30 40

Instrumentation Installation

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
0	1	28	71

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Groundwater depth encountered on completion of drilling: **Dry**

Cave depth after auger removal: **Open**

Groundwater depth observed on **June 3/21** at a depth of: **1.13m**

Observed on **July 5/21** at a depth of: **0.96m**

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :50**

RECORD OF BOREHOLE No. 7

GEI Consultants

Project Number:	**2101271**				
Project Client:	**Tabera Ltd**				
Project Name:	**Alta Subdivision**	Drilling Method: **Solid Stem Augers**		Drilling Machine: **Track Mount**	
Project Location:	**Blue Mountain, Ontario**	Logged By: **BH**	Northing: **4931080**	Date Started: **2021-05-25**	
Drilling Location:	**See Borehole Location Plan**	Reviewed By: **AW**	Easting: **551287**	Date Completed: **2021-05-25**	

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)
	Local 94.28m						
	0.2 94.1 Topsoil = 180mm	SS	1	100	6	0	94
	- - - Weathered - - -						
	0.8 93.5 SILT & CLAY, Trace Sand, Stiff, Mottled Brown, Moist (Georgian Bay Formation Bedrock Derived)	SS	2	100	12	1	93
	- - - Very Stiff - - -	SS	3	100	28	2	92
	- - - Hard - - -	SS	4	100	46	3	91
	3.1 91.2 Georgian Bay Formation Bedrock (Partially Weathered)	SS	5	100	71	4	90
		SS	6	100	100+	5	89
	6.3 88.0	SS	7	100	100+	6	
	Borehole Ends @ 6.3m						

FIELD TESTING
Shear Strength Testing (kPa)
× Other Test
+ Pocket Penetrometer
▲ Field Vane (Intact)
△ Field Vane (Remolded)
40 80 120 160
Penetration Testing
○ SPT ● DCPT
10 20 30 40
Field values: 6, 12, 28, 46, 71→, 100+→, 100+→

LAB TESTING
△ Combustible Organic Vapour (ppm)
▲ Combustible Organic Vapour (%LEL)
✳ Total Organic Vapour (ppm)
100 200 300 400
Atterberg Limits
PL LL
○ Water Content (%)
10 20 30 40
Lab values: 27, 22, 17, 10, 11, 9, 8

Instrumentation Installation

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL

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Groundwater depth encountered on completion of drilling: **Dry**
Cave depth after auger removal: **Open**
Groundwater depth observed on at a depth of:
Observed on at a depth of:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :50**

RECORD OF BOREHOLE No. 8

GEI Consultants

Project Number:	**2101271**				
Project Client:	**Tabera Ltd**				
Project Name:	**Alta Subdivision**	Drilling Method:	**Solid Stem Augers**	Drilling Machine:	**Track Mount**
Project Location:	**Blue Mountain, Ontario**	Logged By:	**BH**	Northing: **4931071**	Date Started: **2021-05-25**
Drilling Location:	**See Borehole Location Plan**	Reviewed By:	**AW**	Easting: **551087**	Date Completed: **2021-05-25**

Lithology Plot	DESCRIPTION (Local 97.00m)	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)
	0.2 Topsoil = 150mm 96.9						
	- - - Weathered - - -	SS	1	100	6		
	0.8 96.2						
	SILT & CLAY, Trace Sand, Stiff, Mottled Brown, Moist (Georgian Bay Formation Bedrock Derived)	SS	2	100	13	1	96
	- - - Very Stiff - - -	SS	3	100	26	2	95
	- - - Hard - - -	SS	4	100	35		
	3.1 94.0					3	94
	Georgian Bay Formation Bedrock (Highly Weathered)	SS	5	100	41	4	93
	4.6 92.4						
	Georgian Bay Formation Bedrock (Partially Weathered)	SS	6	100	100+	5	92
	6.3 90.8	SS	7	100	100+	6	91
	Borehole Ends @ 6.3m						

FIELD TESTING
Shear Strength Testing (kPa)
× Other Test; + Pocket Penetrometer; ▲ Field Vane (Intact); △ Field Vane (Remolded)
40 80 120 160
Penetration Testing
○ SPT ● DCPT
10 20 30 40

LAB TESTING
△ Combustible Organic Vapour (ppm)
▲ Combustible Organic Vapour (%LEL)
✳ Total Organic Vapour (ppm)
100 200 300 400
Atterberg Limits
PL ○ Water Content (%) LL
10 20 30 40

Instrumentation Installation	COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
	GR	SA	SI	CL

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Groundwater depth encountered on completion of drilling: **Dry**
Cave depth after auger removal: **Open**
Groundwater depth observed on at a depth of:
Observed on at a depth of:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :50**

RECORD OF BOREHOLE No. 9

GEI Consultants

Project Number: **2101271**
Project Client: **Tabera Ltd**
Project Name: **Alta Subdivision**
Project Location: **Blue Mountain, Ontario**
Drilling Location: **See Borehole Location Plan**

Drilling Method: **Solid Stem Augers** Drilling Machine: **Track Mount**
Logged By: **BH** Northing: **4931195** Date Started: **2021-05-25**
Reviewed By: **AW** Easting: **551274** Date Completed: **2021-05-25**

Lithology Plot	DESCRIPTION (Local 91.12m)	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING (Shear Strength Testing (kPa); Penetration Testing SPT/DCPT)	LAB TESTING (Combustible Organic Vapour (ppm); Combustible Organic Vapour (%LEL); Total Organic Vapour (ppm); Atterberg Limits; Water Content (%))	Instrumentation Installation	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
	0.2 Topsoil = 150mm 91.0					0	91							
	- - - Weathered - - -	SS	1	100	13			13	24					
	0.8 90.4					1	90	13	24					
	SILT & CLAY, Trace Sand, Stiff, Mottled Brown, Moist (Georgian Bay Formation Bedrock Derived)	SS	2	100	13									
	- - - Very Stiff - - -	SS	3	100	19			19	22		0	1	51	47
	2.3 88.8					2	89							
	Georgian Bay Formation Bedrock (Partially Weathered)	SS	4	100	47			47	19					
		SS	5	100	100+	3	88	100+ →	9					
						4	87							
		SS	6	100	100+			100+ →	8					
						5	86							
	6.3 84.9	SS	7	100	100+	6	85	100+ →	7					
	Borehole Ends @ 6.3m													

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Groundwater depth encountered on completion of drilling: **Dry**
Cave depth after auger removal: **Open**
Groundwater depth observed on at a depth of:
Observed on at a depth of:

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

RECORD OF BOREHOLE No. 10

GEI Consultants

Project Number: **2101271**
Project Client: **Tabera Ltd**
Project Name: **Alta Subdivision**
Project Location: **Blue Mountain, Ontario**
Drilling Location: **See Borehole Location Plan**

Drilling Method: **Solid Stem Augers** Drilling Machine: **Track Mount**
Logged By: **BH** Northing: **4931096** Date Started: **2021-05-25**
Reviewed By: **AW** Easting: **551170** Date Completed: **2021-05-25**

Lithology Plot	DESCRIPTION (Local 95.24m)	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)
	Topsoil = 300mm (0.3 / 94.9)	SS	1	100	7	0	95
	- - - Weathered - - - (0.8 / 94.5)						
	SILT & CLAY, Trace Sand, Stiff, Mottled Brown, Moist (Georgian Bay Formation Bedrock Derived)	SS	2	100	10	1	94
	- - - Very Stiff - - -	SS	3	100	23	2	93
	- - - Hard - - -	SS	4	100	42		
	(4.6 / 90.7)	SS	5	100	47	3	92
	Georgian Bay Formation Bedrock (Partially Weathered)	SS	6	100	100+	4	91
						5	90
	(6.6 / 88.7)	SS	7	100	100+	6	89
	Borehole Ends @ 6.6m						

FIELD TESTING
Shear Strength Testing (kPa)
× Other Test
+ Pocket Penetrometer
▲ Field Vane (Intact)
△ Field Vane (Remolded)
40 80 120 160
Penetration Testing
○ SPT ● DCPT
10 20 30 40

LAB TESTING
△ Combustible Organic Vapour (ppm)
▲ Combustible Organic Vapour (%LEL)
✳ Total Organic Vapour (ppm)
100 200 300 400
Atterberg Limits
PL ○ Water Content (%) LL
10 20 30 40

Instrumentation Installation

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL

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Groundwater depth encountered on completion of drilling: **Dry**
Cave depth after auger removal: **Open**
Groundwater depth observed on **June 3/21** at a depth of: **2.30m**
Observed on **July 5/21** at a depth of: **2.37m**

Borehole details presented do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified geotechnical engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Boring Log'.

Scale: **1 :50**

Appendix B

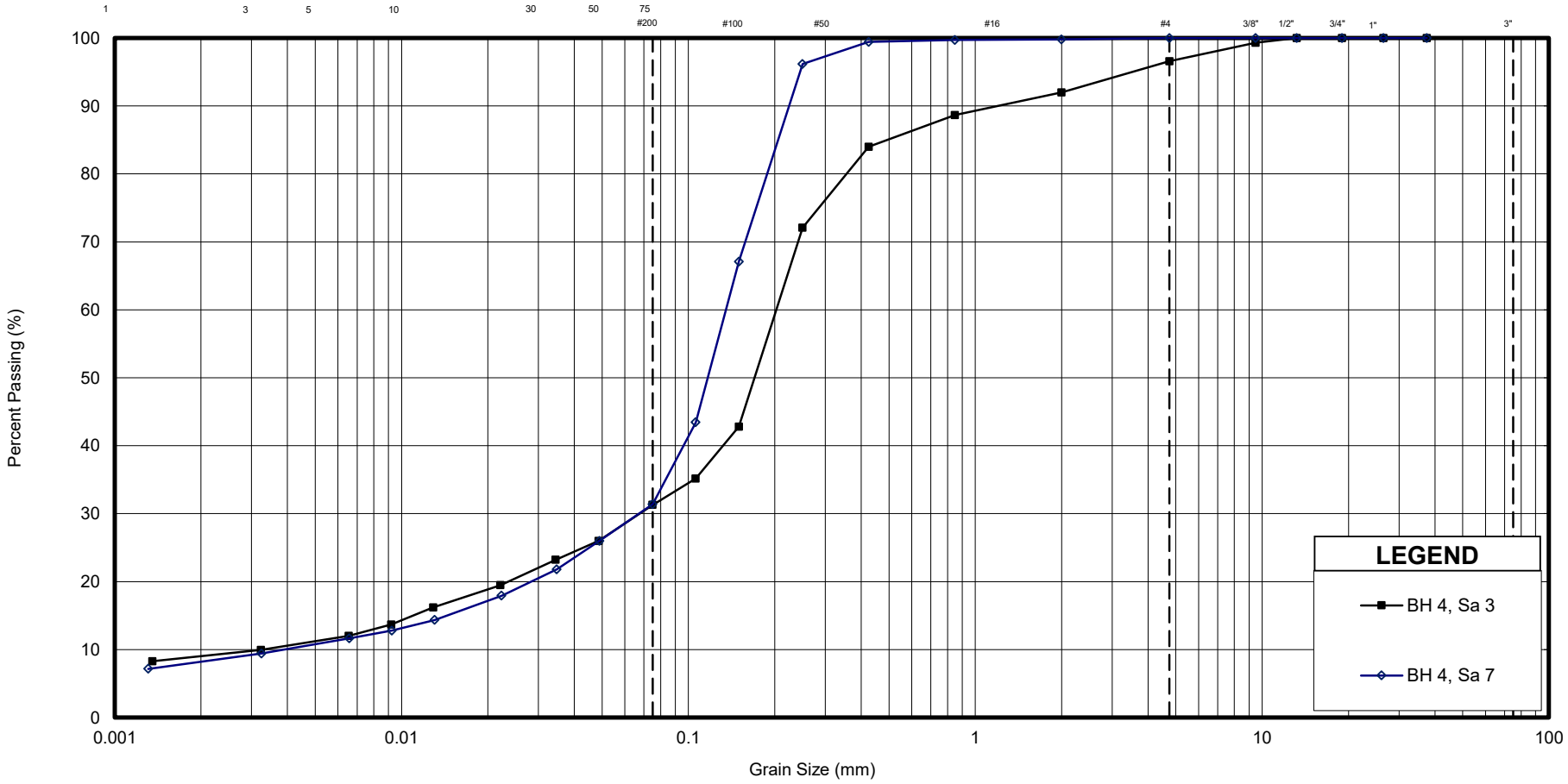
Geotechnical Laboratory Data

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse

GRAIN SIZE IN MICROMETERS

SIEVE DESIGNATION (IMPERIAL)



Sample	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
BH 4, Sa 3	SILTY SAND, Trace Clay, Trace Gravel	3	66	22	9	0.003	0.067	0.20	61.5	6.8
BH 4, Sa 7	SILTY SAND, Trace Clay	0	69	23	8	0.004	0.067	0.14	34.6	8.6

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GRAIN SIZE DISTRIBUTION - Alta Subdivision Phase 2

SILTY SAND

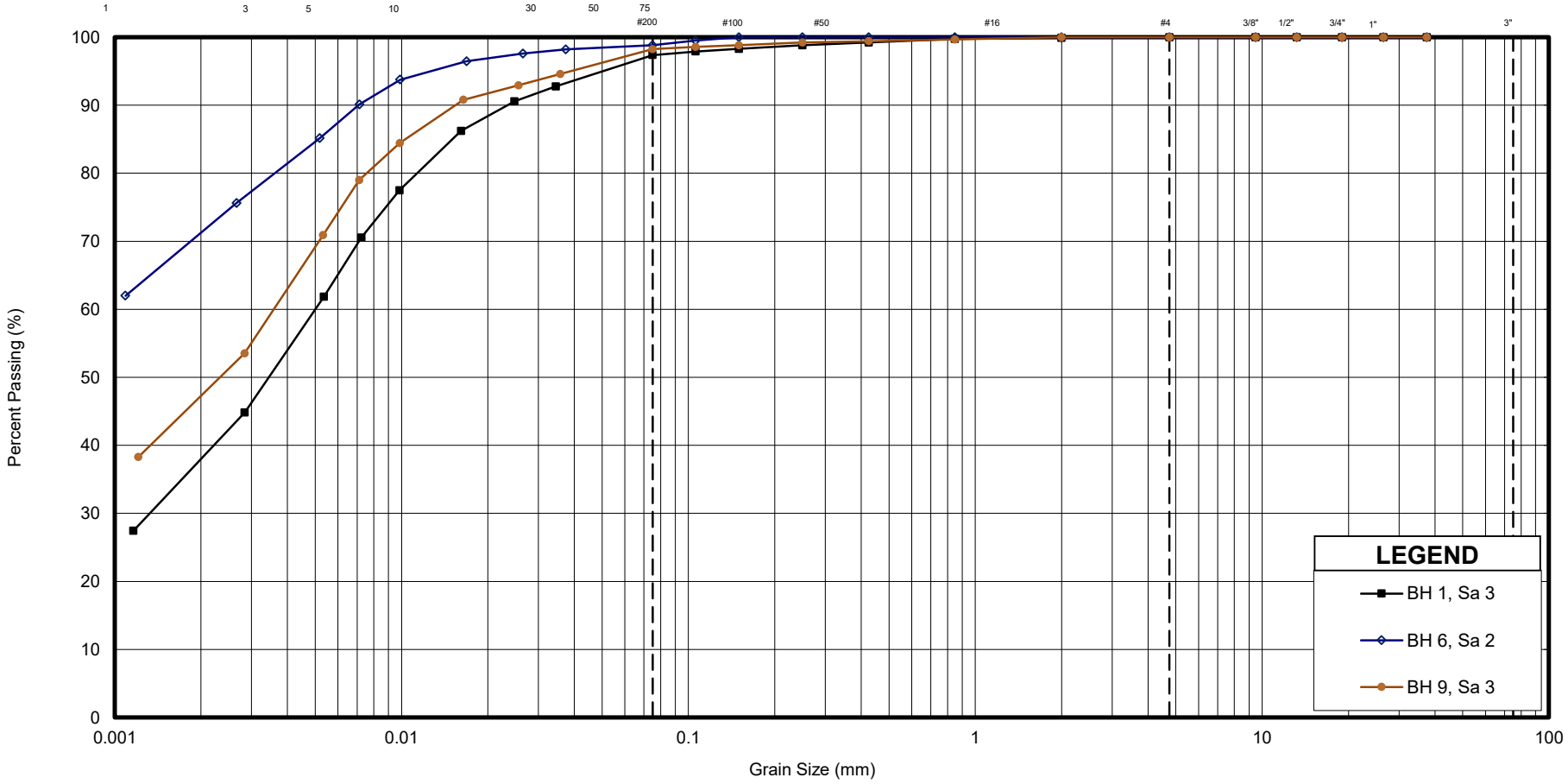
FIGURE No.	B1
REF. No.	2101271
DATE	July 2021

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse

GRAIN SIZE IN MICROMETERS

SIEVE DESIGNATION (IMPERIAL)



Sample	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
BH 1, Sa 3	SILT & CLAY, Trace Sand	0	3	59	38	-	0.001	0.005	-	-
BH 6, Sa 2	SILTY CLAY, Trace Sand	0	1	28	71	-	-	-	-	-
BH 9, Sa 3	SILT & CLAY, Trace Sand	0	2	51	47	-	-	0.004	-	-

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GRAIN SIZE DISTRIBUTION - Alta Subdivision Phase 2

SILT & CLAY to SILTY CLAY

FIGURE No.	B2
REF. No.	2101271
DATE	July 2021

Appendix C

Test Pit Logs

TEST PIT LOG 1

Project Name:	Alta Subdivision Phase II	Test Pit #:	1
Project #:	2101271	Date/Time:	Nov. 2, 2021
Project Loc.:	Blue Mountains	Inspector:	Bo
Client:	Tabera Ltd.	Weather:	Snow, 1°C
Contractor:		Equipment:	Kubota Excavator
Northing:	4931162	Easting:	551133

Depth (m)		Symbol	Stratigraphy	Samples	Notes
Top	Bottom				
0	0.3		Topsoil		
0.3	1.6		Silt & Clay, Trace Sand, Brown, Moist	0.8m	
1.6	2.5		Silty Gravelly Sand, Brown, Wet	1.6m 2.5m	Flowing wet sand at bottom of test pit

Additional Notes

Seepage:	At 1.6m Below Grade
Caving:	At 1.6m Below Grade
Other:	

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TEST PIT LOG 2

Project Name:	Alta Subdivision Phase II	Test Pit #:	2
Project #:	2101271	Date/Time:	Nov. 2, 2021
Project Loc.:	Blue Mountains	Inspector:	Bo
Client:	Tabera Ltd.	Weather:	Snow, 1°C
Contractor:		Equipment:	Kubota Excavator
Northing:	4931189	Easting:	551173

Depth (m)		Symbol	Stratigraphy	Samples	Notes
Top	Bottom				
0	0.3		Topsoil		
0.3	2.2		Silty Gravelly Sand, Some Cobbles, Brown, Moist	2.0m	Bucket Refusal at 2.2m

Additional Notes

Seepage:	Dry
Caving:	Open
Other:	Bucket Refusal at 2.2m

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TEST PIT LOG 3

Project Name:	Alta Subdivision Phase II	Test Pit #:	3
Project #:	2101271	Date/Time:	Nov. 2, 2021
Project Loc.:	Blue Mountains	Inspector:	Bo
Client:	Tabera Ltd.	Weather:	Snow, 1°C
Contractor:		Equipment:	Kubota Excavator
Northing:	4931184	Easting:	551216

Depth (m)		Symbol	Stratigraphy	Samples	Notes
Top	Bottom				
0	0.2		Topsoil		
0.2	1.3		Silty Sand, Trace Gravel, Brown, Moist	0.8m	
1.3	2.2		Silt & Clay, Trace Sand, Trace Gravel, Grey, Moist	2.0m	Bucket Refusal at 2.2m

Additional Notes

Seepage:	Seepage Encountered from Topsoil Layer Near Ground Surface
Caving:	Open
Other:	Bucket Refusal at 2.2m on Possible Bedrock

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TEST PIT LOG 4

Project Name:	Alta Subdivision Phase II	Test Pit #:	4
Project #:	2101271	Date/Time:	Nov. 2, 2021
Project Loc.:	Blue Mountains	Inspector:	Bo
Client:	Tabera Ltd.	Weather:	Snow, 1°C
Contractor:		Equipment:	Kubota Excavator
Northing:	4931284	Easting:	551223

Depth (m)		Symbol	Stratigraphy	Samples	Notes
Top	Bottom				
0	0.2		Topsoil		
0.2	1.8		Silty Sand, Trace Gravel, Brown, Moist	1.0m	
1.8	2.3		Silt & Clay, Trace Sand, Grey, Moist	2.0m	

Additional Notes

Seepage:	Dry
Caving:	Open
Other:	

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TEST PIT LOG 5

Project Name:	Alta Subdivision Phase II	Test Pit #:	5
Project #:	2101271	Date/Time:	Nov. 2, 2021
Project Loc.:	Blue Mountains	Inspector:	Bo
Client:	Tabera Ltd.	Weather:	Snow, 1°C
Contractor:		Equipment:	Kubota Excavator
Northing:	4931232	Easting:	551227

Depth (m)		Symbol	Stratigraphy	Samples	Notes
Top	Bottom				
0	0.3		Topsoil		
0.3	1.2		Silty Sand, Trace Gravel, Trace Clay, Brown, Moist	0.8m	
1.2	2.0		Silt & Clay, Trace Sand, Some Bedrock Fragments, Mottled Grey, Moist (Georgian Bay Formation Derived)	2.0m	

Additional Notes

Seepage:	Dry
Caving:	Open
Other:	

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TEST PIT LOG 6

Project Name:	Alta Subdivision Phase II	Test Pit #:	6
Project #:	2101271	Date/Time:	Nov. 2, 2021
Project Loc.:	Blue Mountains	Inspector:	Bo
Client:	Tabera Ltd.	Weather:	Snow, 1°C
Contractor:		Equipment:	Kubota Excavator
Northing:	4931231	Easting:	551265

Depth (m)		Symbol	Stratigraphy	Samples	Notes
Top	Bottom				
0	0.2		Topsoil		
0.2	2.2		Silt & Clay, Trace Sand, Some Bedrock Fragments, Mottled Grey, Moist (Georgian Bay Formation Derived)	0.5m 2.0m	Very Hard to Dig

Additional Notes

Seepage:	Dry
Caving:	Open
Other:	

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Appendix D

Slope Photographs

PHOTOGRAPH 1

GEI 2021

Description:
A view of the tableland facing the slope crest near the western drainage gully. The slope is well vegetated.

PHOTOGRAPH 2

GEI 2021

Description:
A view of the well vegetated slope from within the western drainage gully. No water was observed in the western gully. A few localized areas of minor erosion were observed.

PHOTOGRAPH 3

GEI 2021

Description:
A view of the well vegetated slope profile along the western drainage gully.

PHOTOGRAPH 4

GEI 2021

Description:
A general view of the typical slope profile.

PHOTOGRAPH 5

GEI 2021

Description:
A view of the well vegetated slope crest and upper slope face to the east of the eastern gully. No signs of slope instability were observed.

PHOTOGRAPH 6

GEI 2021

Description:
Another view of the slope. Hidden Lake Road is visible through the trees at the bottom of the slope.

PHOTOGRAPH 7

GEI 2021

Description:
Looking up the slope from the bottom of the eastern drainage gully. Flowing water and active erosion are visible. The sidewalls consist of silty sand, then silt and clay, then bedrock (visible along the bottom of the channel).

PHOTOGRAPH 8

GEI 2021

Description:
Another view of the eastern drainage gully, which is extending into the tableland.

PHOTOGRAPH 9

GEI 2021

Description:
A view of the eastern drainage gully looking south toward the southern extent where the gully extends back into the tableland.

PHOTOGRAPH 10

GEI 2020 – Southern Channel

Description:
A view of the southern channel and small slope associated with a small watercourse. The slope has relatively flat side slopes and no erosion was observed.

PHOTOGRAPH 11

GEI 2020 – Southern Channel

Description:
A view of the small stream at the bottom of the channel. Flows are restricted by an upstream culvert.

PHOTOGRAPH 12

GEI 2020 – Southern Channel

Description:
A general view of the slopes along the channel / small watercourse.

Appendix E

MNRF Slope Rating Chart and Slope Inspection Record

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SLOPE INSPECTION FORM

Northern Slope (Nipissing Ridge)

File No: 2101271

File Name: Alta Phase 2, Blue Mountains

Inspection Date: Nov. 2, 2021

Inspected By (name)**:** Bo Hwang

Weather (circle)**:** ☐ sunny ☐ partly cloudy ☐ overcast ☐ calm ☐ breezy ☐ windy

☐ clear ☐ fog ☐ rain ☒ snow ☒ cold ☐ cool ☐ warm ☐ hot

Est. Air Temp. (°C): 3 C

Site Location / Directions (describe main roads, features)**:**

Northern slope at Alta Subdivision Phase 2 - south of Hidden Lake Road.

Site Location Sketch:

See Fig. 1 in report

Property Ownership (name, address, phone)**:**

Legal Description:

Lot _____

Concession _____

Township _____

County _____

Watershed: Georgian Bay Fringe

Governing Regional Body: Town of the Blue Mountains

Governing Conservation Authority: Grey Sauble CA

Current Land Use (circle and describe)**:**

☐ Vacant – Field, bush, woods, forest, wilderness, tundra

☒ Passive – Recreational parks, golf courses, non-habitable structures, buried utilities, swimming pools

☐ Active – Habitable structures, residential, commercial, industrial, warehousing, storage

☐ Infrastructure/Public Use – Stadiums, hospitals, schools, bridges, high voltage power lines, waste management sites

SLOPE DATA

Height ☐ 3 - 6 m ☐ 6 - 10 m ☒ 10 - 15 m ☐ 15 - 20 m
☐ 20 - 25 m ☒ 25 - 30 m ☐ >30 m
Estimated height (m): 15 to 26 m typically

Inclination / Shape ☐ 4:1 or flatter (25% / 14°) ☐ Up to 3:1 (33% / 18.5°) ☒ Up to 2:1 (50% / 26.5°)
☐ Up to 1:1 (100% / 45°) ☐ Up to 0.5:1 (200% / 63.5°) ☐ Steeper than 0.5:1 (>63.5°)
Most of the slope is flatter than 2H:1V. Localized areas are steeper along the drainage gullies.

SLOPE DRAINAGE (describe):

TOP

Sheet drainage from the slope crest flows over the slope. Also, concentrated runoff was actively flowing down the slope at the eastern drainage gully.

FACE

Sheet drainage across most of the slope. Flowing water down the eastern gully.

BOTTOM

Roadside ditch along Hidden Lake Road, no watercourse.

SLOPE SOIL STRATIGRAPHY (describe, positions, thicknesses, types):

TOP

Mostly topsoil then silt and clay deposits. Some test pits near the eastern gully encountered silty sand over silt and clay. Borehole 4 encountered earth fill.

FACE

Typically silt and clay underlain by bedrock at depths of about 2.5 to 4 metres below grade. Most of the slope is expected to consist of bedrock, with nominal soil overburden.

BOTTOM

Some nominal overburden overlying bedrock.

WATER COURSE FEATURES (circle and describe)**:**

SWALES, GULLIES, DITCHES, CHANNELS

There is a large western drainage gully (no flowing water, minor localized erosion) and a smaller eastern gully (flowing water and active erosion).

STREAMS, CREEKS, RIVERS

PONDS, BAYS, LAKES

SPRINGS, SEEPS, MARHSY GROUND

Some marshy ground on the tableland near the top of the eastern gully, likely concentrated runoff that will flow down the slope face.

VEGETATION COVER (grasses, weeds, shrubs, saplings, trees):

TOP

Grasses, shrubs, large vertical trees.

FACE

Well vegetated with large and mostly vertical trees, some undergrowth.

BOTTOM

Well vegetated with large and mostly vertical trees, some undergrowth.

STRUCTURES (buildings, walls, fences, sewers, roads, stairs, decks, towers):

TOP

None observed.

FACE

None observed.

BOTTOM

Hidden Lake Road runs along the bottom of the slope.

EROSION FEATURES (scour, undercutting, bare areas, piping, rills, gully):

TOP

The drainage gullies extend back into the tableland compared to the surrounding slope crest position across the rest of the site.

FACE

Active erosion down the eastern gully from flowing water - erosion scarps, exposed soil and roots, undercutting, exposed bedrock along the bottom of the channel.

Minor and localized erosion is some locations down the western gully.

No erosion observed elsewhere on the slope.

BOTTOM

None observed.

SLOPE SLIDE FEATURES (tension cracks, scarps, slumps, bulges, grabens, ridges, bent trees)**:**

TOP

None observed.

FACE

Most of the slope - none observed.

Along the eastern gully - some slumping and scarps due to the active erosion.

BOTTOM

None observed.

GEI Consultants

SLOPE RATING FORM

Northern Slope (Nipissing Ridge)

Site Location: Alta Subdivision - Phase 2
Property Owner:
Inspected By: Bo Hwang

File No: 2101271
Inspection Date: Nov. 2, 2021
Weather: Cold

				Rating Value	
1.	**SLOPE INSPECTION**				
		Degrees	***Horiz. : Vert.***		
	a)	18 or less	3 : 1 or flatter	0	☐
	b)	18 to 26	2 : 1 to 3 : 1	6	☒
	c)	more than 26	steeper than 2 : 1	16	☐
2.	**SOIL STRATIGRAPHY**				
	a)	Shale, Limestone, Granite (Bedrock)		0	☐
	b)	Sand, Gravel		6	☐
	c)	Glacial Till		9	☐
	d)	Clay, Silt		12	☒
	e)	Fill		16	☐
	f)	Leda Clay		24	☐
3.	**SEEPAGE FROM SLOPE FACE**				
	a)	None or Near bottom only		0	☒
	b)	Near mid-slope only		6	☐
	c)	Near crest only or from several levels		12	☐
4.	**SLOPE HEIGHT**				
	a)	2 metres or less		0	☐
	b)	2.1 to 5 metres		2	☐
	c)	5.1 to 10 metres		4	☐
	d)	Greater than 10 metres		8	☒
5.	**VEGETATION COVER ON SLOPE FACE**				
	a)	Well vegetated; heavy shrubs or forested with mature trees		0	☒
	b)	Light vegetation; Mostly grass, weeds, occasional trees, shrubs		4	☐
	c)	No vegetation; bare		8	☐
6.	**TABLELAND DRAINAGE**				
	a)	Tableland flat, no apparent drainage over slope		0	☐
	b)	Minor drainage over slope, no active erosion		2	☐
	c)	Drainage over slope, active erosion, gullies		4	☒
7.	**PROXIMITY OF WATERCOURSE TO SLOPE TOE**				
	a)	15 metres or more from slope toe		0	☒
	b)	Less than 15 metres from slope toe		6	☐
8.	**PREVIOUS LANDSLIDE ACTIVITY**				
	a)	No		0	☒
	b)	Yes		6	☐
				TOTAL	
	SLOPE INSTABILITY RATING	**RATING VALUE TOTAL**	**INVESTIGATION REQUIREMENTS**	30	
1.	Low potential	<24	Site inspection only, confirmation, report letter.		
2.	Slight potential	25-35	Site inspection and surveying, preliminary study, detailed report.		
3.	Moderate potential	>35	Boreholes, piezometers, lab tests, surveying, detailed report.		

NOTES:
a) Choose only one from each category; compare total rating value with above requirements.
b) If there is a water body (stream, creek, river, pond, bay, lake) at the slope toe; the potential for toe erosion and undercutting should be evaluated in detail and, protection provided if required.

GEI Consultants

SLOPE RATING FORM

Southern Channel / Slope

Site Location: Alta Subdivision - Phase 2 _____ File No: 2101271 _____
Property Owner: _____ Inspection Date: _____
Inspected By: _____ Weather: Cold _____

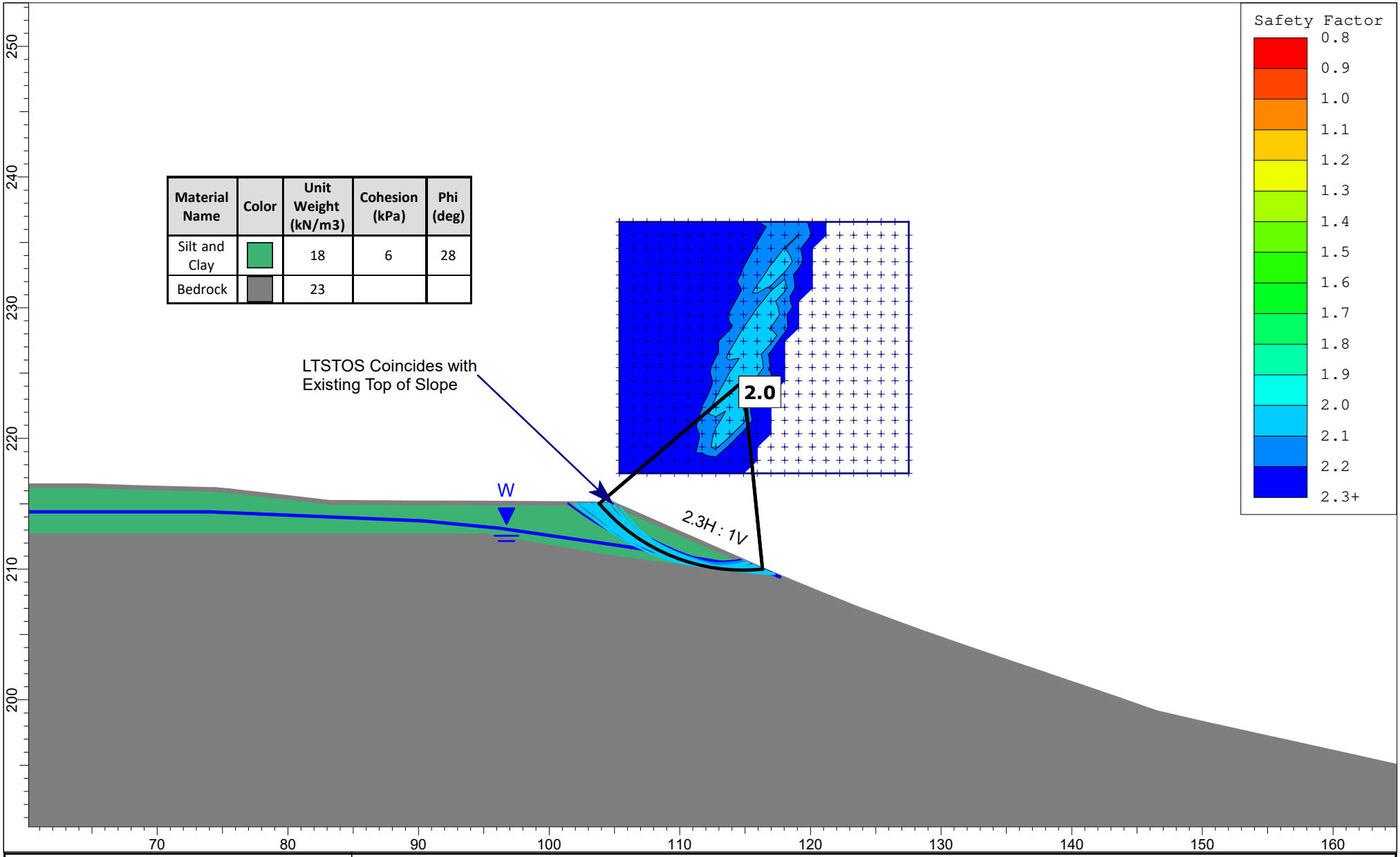
				Rating Value	
1.	**SLOPE INSPECTION**				
		Degrees	***Horiz. : Vert.***		
	a)	18 or less	3 : 1 or flatter	0	☐
	b)	18 to 26	2 : 1 to 3 : 1	6	☒
	c)	more than 26	steeper than 2 : 1	16	☐
2.	**SOIL STRATIGRAPHY**				
	a)	Shale, Limestone, Granite (Bedrock)		0	☐
	b)	Sand, Gravel		6	☐
	c)	Glacial Till		9	☐
	d)	Clay, Silt		12	☒
	e)	Fill		16	☐
	f)	Leda Clay		24	☐
3.	**SEEPAGE FROM SLOPE FACE**				
	a)	None or Near bottom only		0	☒
	b)	Near mid-slope only		6	☐
	c)	Near crest only or from several levels		12	☐
4.	**SLOPE HEIGHT**				
	a)	2 metres or less		0	☐
	b)	2.1 to 5 metres		2	☐
	c)	5.1 to 10 metres		4	☒
	d)	Greater than 10 metres		8	☐
5.	**VEGETATION COVER ON SLOPE FACE**				
	a)	Well vegetated; heavy shrubs or forested with mature trees		0	☐
	b)	Light vegetation; Mostly grass, weeds, occasional trees, shrubs		4	☒
	c)	No vegetation; bare		8	☐
6.	**TABLELAND DRAINAGE**				
	a)	Tableland flat, no apparent drainage over slope		0	☒
	b)	Minor drainage over slope, no active erosion		2	☐
	c)	Drainage over slope, active erosion, gullies		4	☐
7.	**PROXIMITY OF WATERCOURSE TO SLOPE TOE**				
	a)	15 metres or more from slope toe		0	☐
	b)	Less than 15 metres from slope toe		6	☒
8.	**PREVIOUS LANDSLIDE ACTIVITY**				
	a)	No		0	☒
	b)	Yes		6	☐
				TOTAL	
				32	

	SLOPE INSTABILITY RATING	**RATING VALUE TOTAL**	**INVESTIGATION REQUIREMENTS**
1.	Low potential	<24	Site inspection only, confirmation, report letter.
2.	Slight potential	25-35	Site inspection and surveying, preliminary study, detailed report.
3.	Moderate potential	>35	Boreholes, piezometers, lab tests, surveying, detailed report.

NOTES:
a) Choose only one from each category; compare total rating value with above requirements.
b) If there is a water body (stream, creek, river, pond, bay, lake) at the slope toe; the potential for toe erosion and undercutting should be evaluated in detail and, protection provided if required.

Appendix F

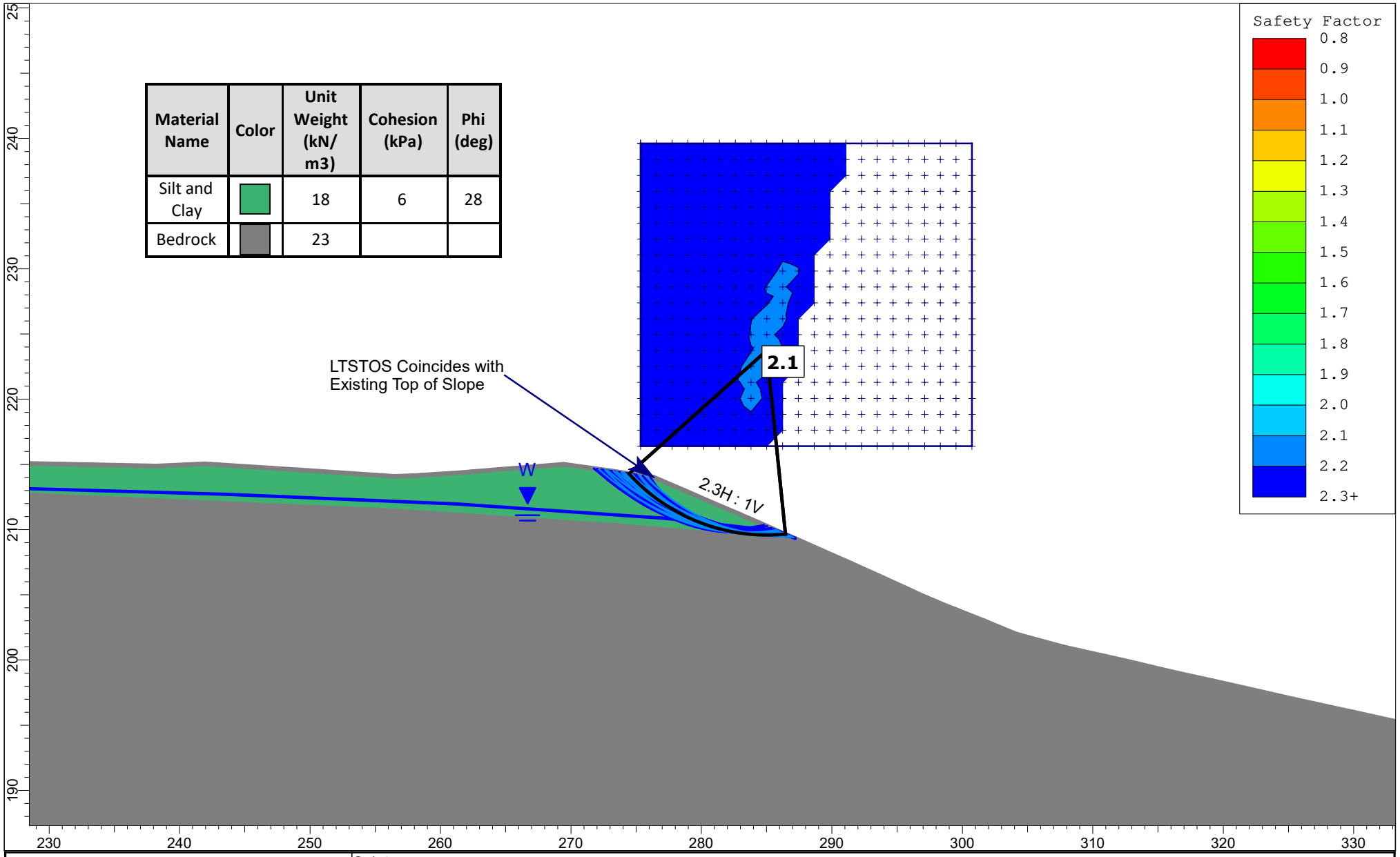
Slope Stability Analysis – Existing Conditions



GEI Consultants	Project: Alta Subdivision Phase 2		
	Analysis Description: Section 1 - Existing Conditions		
	Drawn By: RW	Scale: 1:400	Company: GEI
	Date: 1/20/2022		Project No.: 2101271

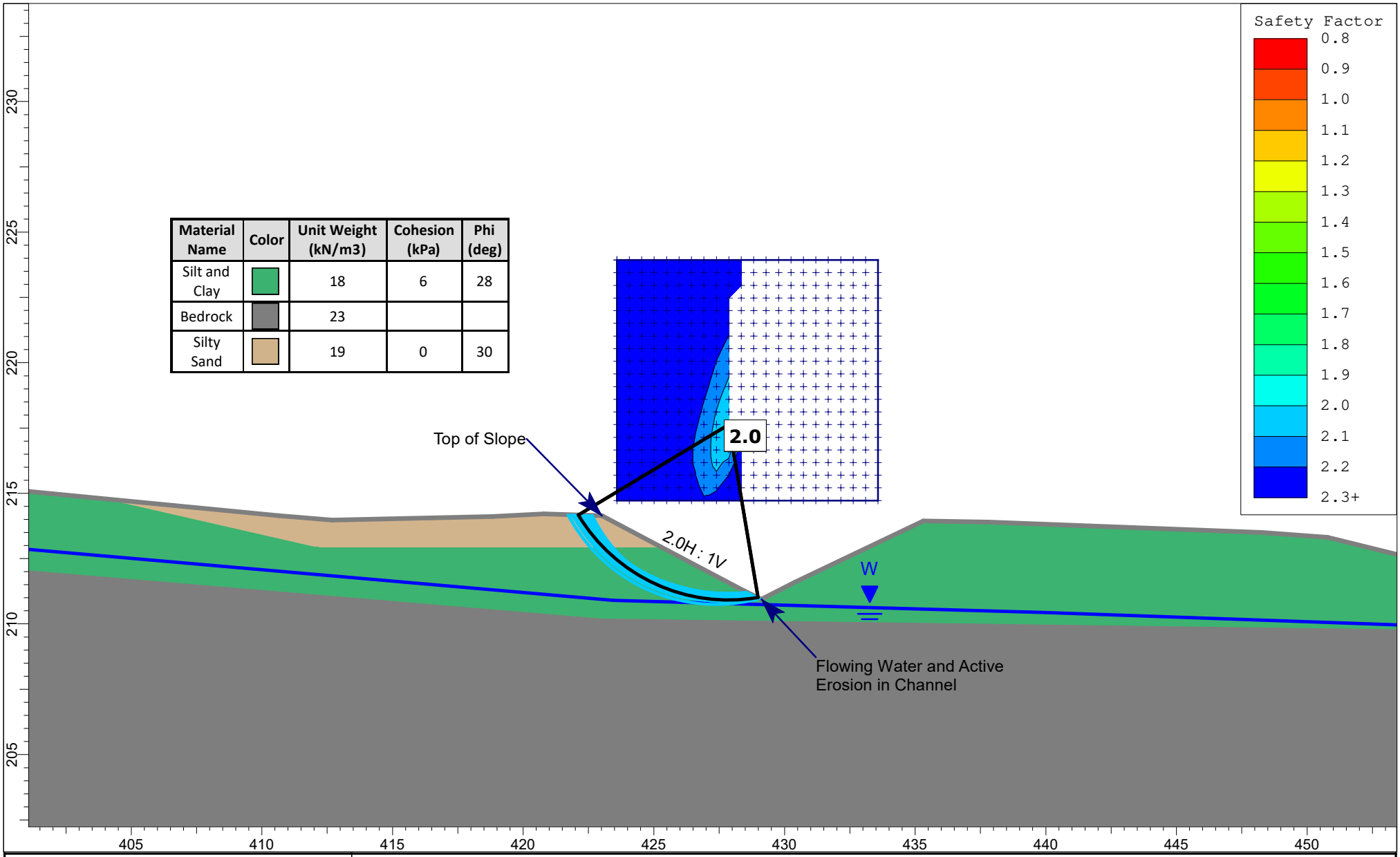
SLIDEINTERPRET 9.020

Material Name	Color	Unit Weight (kN/m3)	Cohesion (kPa)	Phi (deg)
Silt and Clay		18	6	28
Bedrock		23		



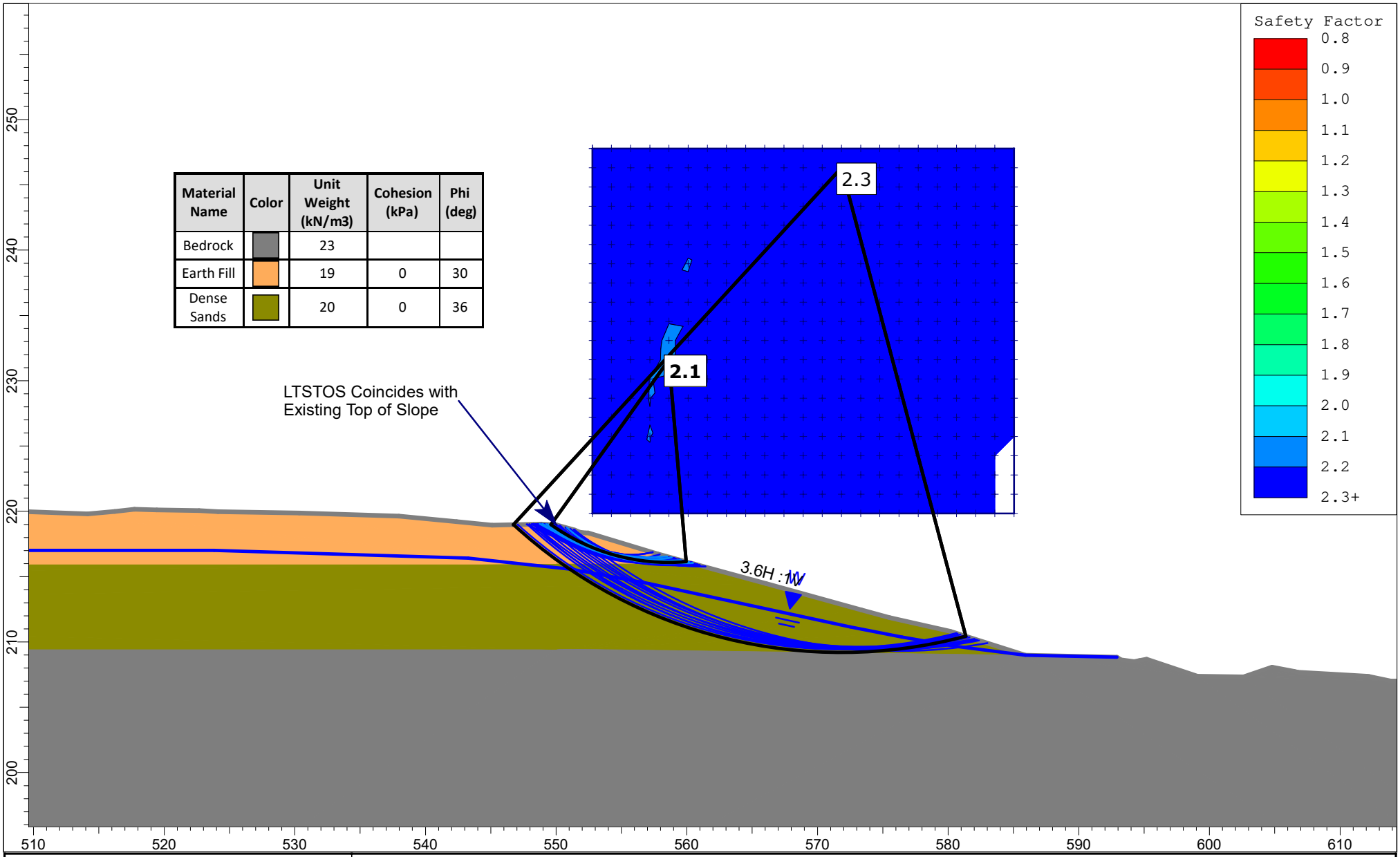
GEI Consultants	Project: Alta Subdivision Phase 2		
	Analysis Description: Section 2 - Existing Conditions		
	Drawn By: RW	Scale: 1:400	Company: GEI
	Date: 1/20/2022		Project No.: 2101271

SLIDEINTERPRET 9.020



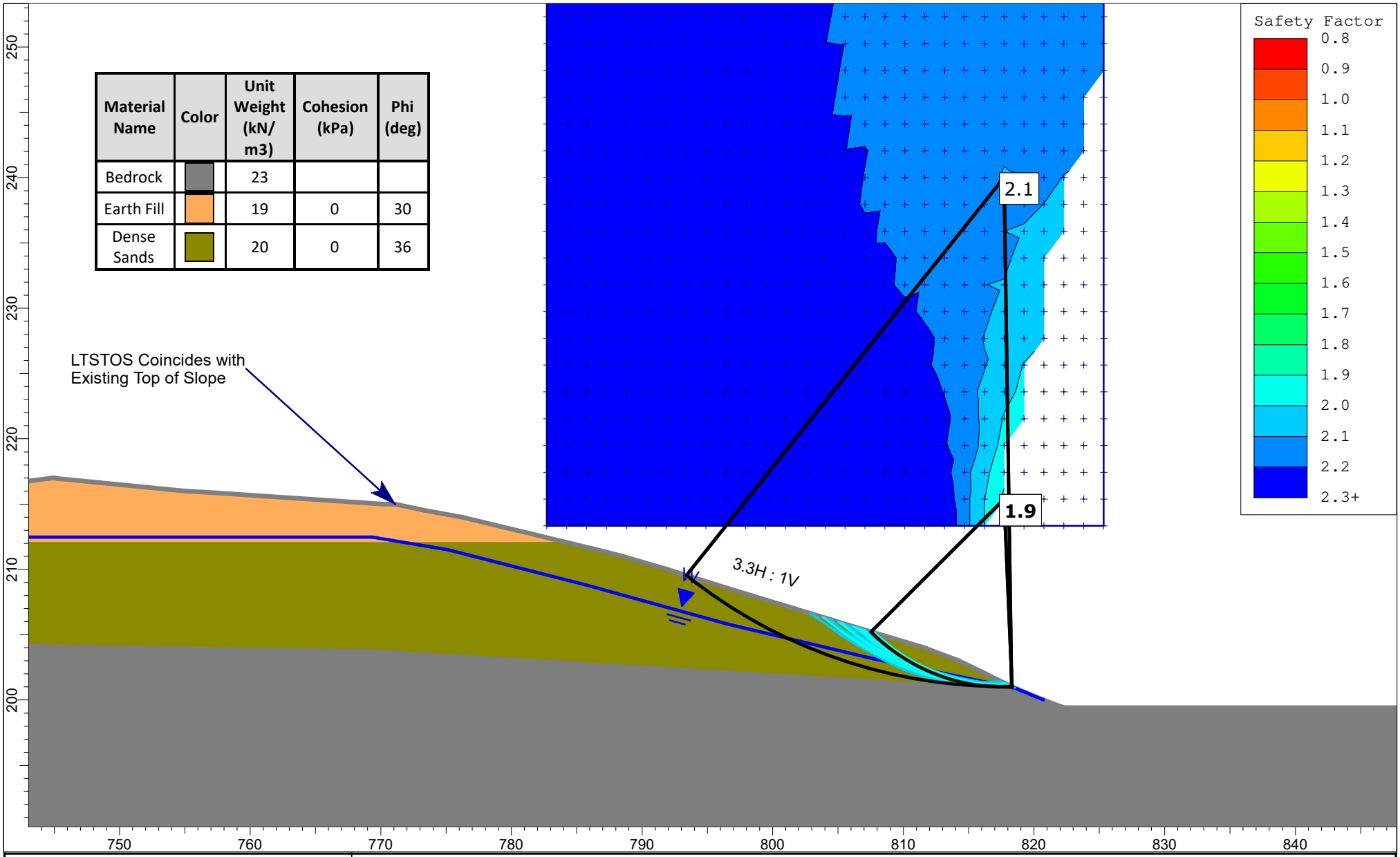
GEI Consultants	Project: Alta Subdivision Phase 2		
	Analysis Description: Section 3 - Existing Conditions		
	Drawn By: RW	Scale: 1:200	Company: GEI
	Date: 1/20/2022		Project No.: 2101271

SLIDEINTERPRET 9.020



GEI Consultants	Project	Alta Subdivision Phase 2	
	Analysis Description	Section 4 - Existing Conditions	
	Drawn By: RW	Scale: 1:400	Company: GEI
	Date: 1/20/2022		Project No.: 2101271

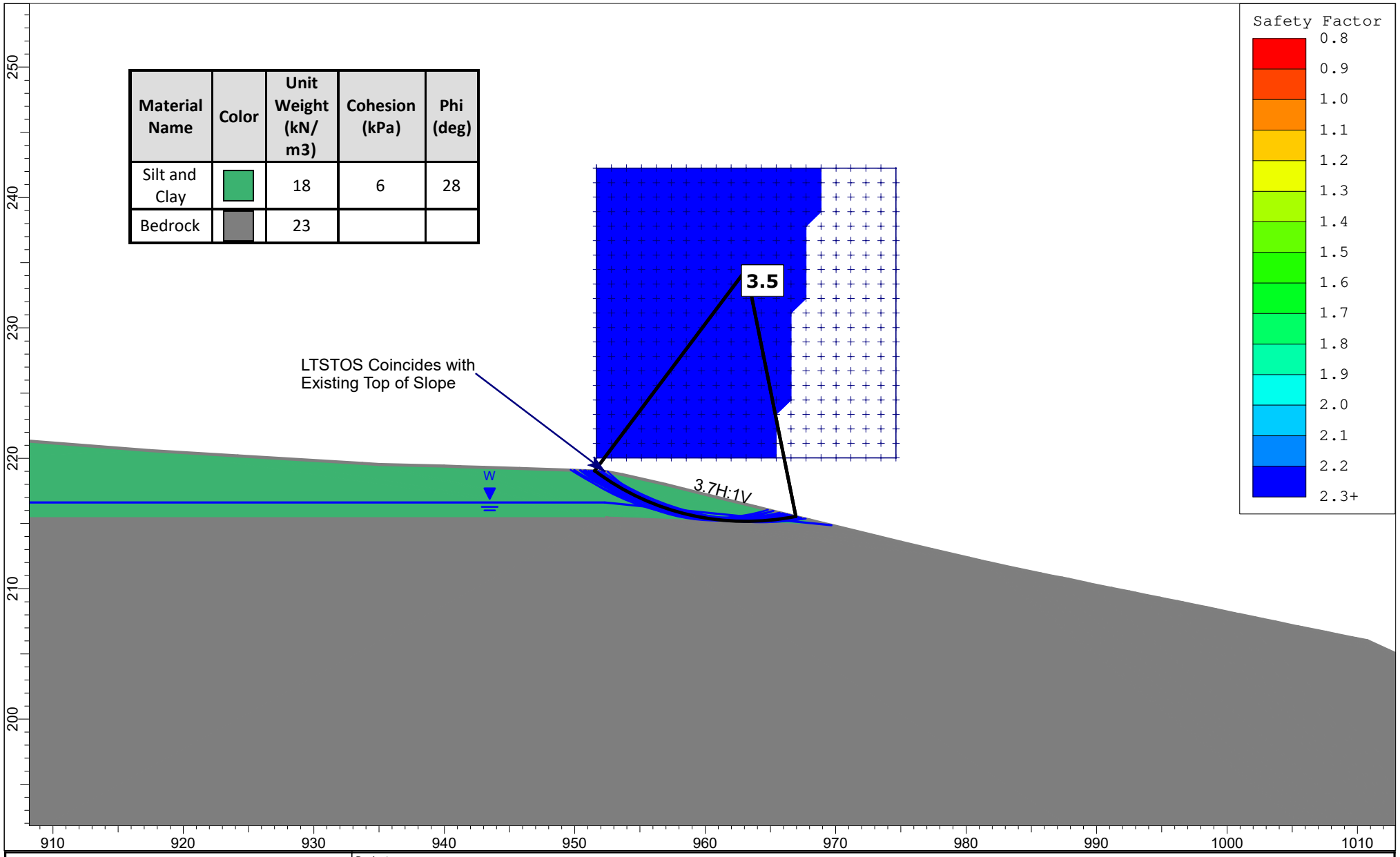
SLIDEINTERPRET 9.020



GEI Consultants	Project: Alta Subdivision Phase 2		
	Analysis Description: Section 5 - Existing Conditions		
	Drawn By: RW	Scale: 1:400	Company: GEI
	Date: 1/20/2022		Project No.: 2101271

SLIDEINTERPRET 9.020

Material Name	Color	Unit Weight (kN/ m3)	Cohesion (kPa)	Phi (deg)
Silt and Clay		18	6	28
Bedrock		23		



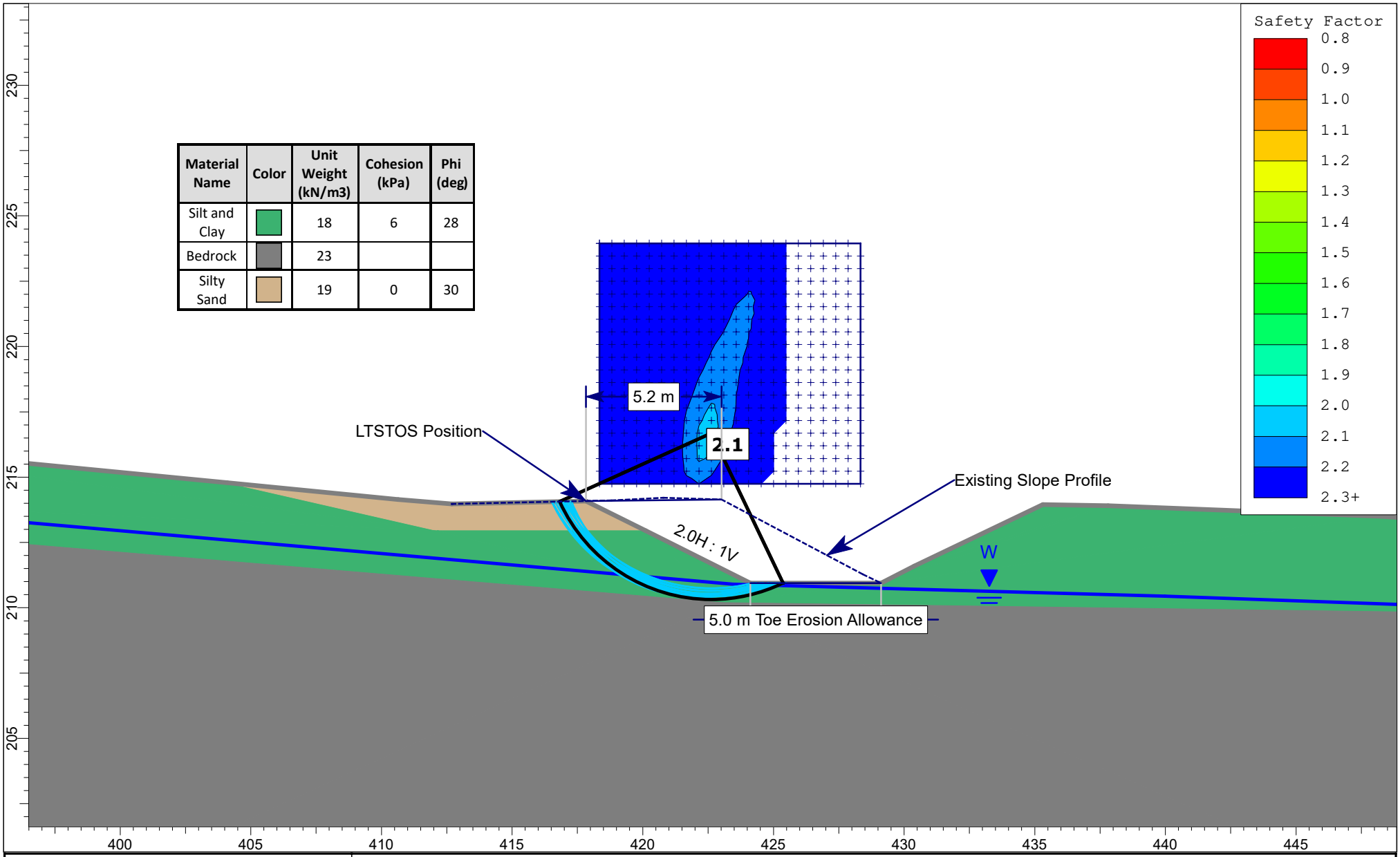
GEI Consultants

SLIDEINTERPRET 9.020

Project	Alta Subdivision Phase 2		
Analysis Description	Section 6 - Existing Conditions		
Drawn By	RW	Scale	1:400
Company	GEI		
Date	1/20/2022	Project No.	2101271

Appendix G

Slope Stability Analysis – LTSTOS Position for FOS of 1.5



GEI Consultants

SLIDEINTERPRET 9.020

Project	Alta Subdivision Phase 2		
Analysis Description	Section 3 - LTSTOS Position for FOS of 1.5		
Drawn By	RW	Scale	1:200
Company	GEI		
Date	1/20/2022	Project No.	2101271