

**GEOTECHNICAL INVESTIGATION REPORT
PROPOSED EXTERIOR IMPROVEMENTS
LOMBARDY PUBLIC SCHOOL
596 HIGHWAY 15
LOMBARDY, ONTARIO**

Prepared for

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1 INTRODUCTION

WSP Canada Inc. (WSP) retained the services of Lascelles Engineering & Associates Ltd. (Lascelles) to conduct a geotechnical investigation for the proposed exterior improvements to be carried out at the Lombardy Public School located at 596 Highway 15, Lombardy, Ontario.

The purpose of the investigation was to identify the subsurface soil conditions within the project by means of a limited number of boreholes, and based on the factual information obtained, to provide guidelines from the geotechnical engineering aspects of the design of the proposed pavement design and drainage improvements.

Should there be any changes in the design features, which may relate to the guidelines provided in the report, Lascelles Engineering & Associates Ltd. should be advised in order to review the report recommendations.

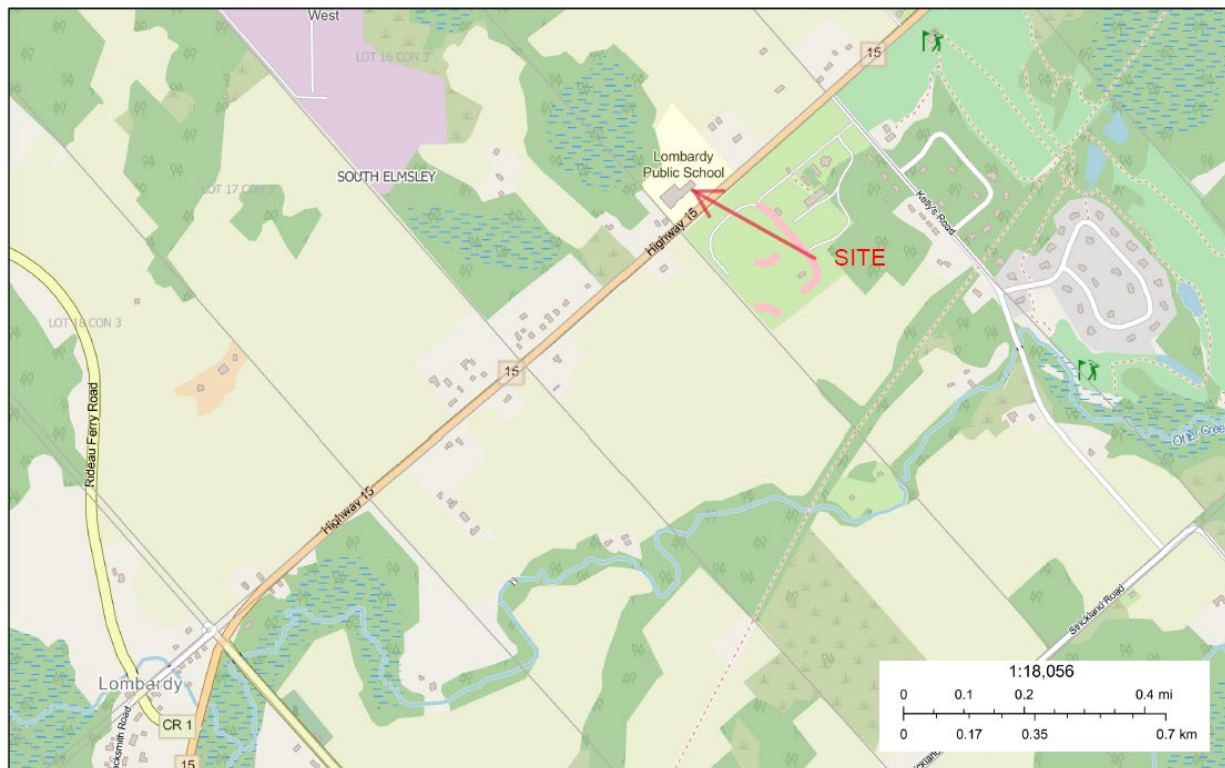
2 PROJECT AND SITE

The school property under investigation is civically known as 596 Highway 15, Lombardy, Ontario and is located approximately 1.5km northeast of the hamlet of Lombardy, Ontario; refer to **Figure 1** for the location of the property. It legally described as Part of Lot 15, Concession 3, Being Part 1 of Referenced Plan 28R8308, within the Geographic Township of South Elmsley, now the Township of Rideau Lakes.

The site has a rectangular shape which is approximately 210m wide fronting Highway 15 by 242m deep for a total approximate area of 5.08 ha. The site is located within a rural setting, where the school is serviced by a private well and sewage system. The terrain of the site is relatively flat with elevations varying from 133m to 130m, gently sloping southerly.

Currently, the property is occupied with a public school, where the building, as well as paved parking areas and the bus stop, are located in the southwestern portion of the site. The sewage systems are located to the southeast and northwest. The majority of the northern part of the property are the play grounds consisting of a baseball court, a baseball and soccer field and other playground equipment. The northwest portion of the property is forested. Access to the school are from two entrances from Highway 15.

Figure 1. Site Location



It is understood that the proposed project will consist of redesigning the layout of the site's entrances that would include removing one and creating a new entrance further to the north, which will also include a road widening for a left turning lane. Furthermore, redesigning the layout of the bus/fire and access lanes and parking areas, where a new parking area is proposed at the location of the existing sewage system. Consequently, the existing sewage system will be decommissioned. A new sewage system will be constructed at the back of the play areas, where a small forested area is currently located. Finally, the project will include drainage improvement and stormwater management to accommodate the said site improvements. A conceptual plan of the project prepared by WSP is included as part of **Appendix A**.

3 PROCEDURE

A geotechnical drilling program was carried out on May 6 and 7, 2021, and consisted of drilling twenty (20) boreholes at the pre-determined locations provided by the WSP, or determined on-site by WSP's hydrogeologist as presented in **Appendix A**. Prior to any fieldwork, the borehole locations were cleared for the presence of any underground services and utilities. Ten (10) boreholes (P_BH1 to 5 and P_BH11 to 15) were drilled in the proposed parking lot, bus lane, fire lane; five (5) boreholes (P_BH16 and P_BH17 to 20) were drilled within the proposed sewage system areas of which P_BH17 and P_BH20 were completed as monitoring wells; Finally, five (5) boreholes (P_BH6 to P_BH10) were drilled along Highway 15 covering the road widening for the new entrance.

The boreholes were advanced using a rubber track-mounted drill rig equipped with continuous hollow stem augers supplied and operated by George Downing Estate Drilling Limited. A "two-man" crew experienced with geotechnical drilling operated the drill rig and equipment. The boreholes were drilled through the overburden material and down to auger refusal over inferred bedrock.

Sampling of the overburden materials encountered in those boreholes was carried out at 0.75m depth intervals using a 50mm diameter drive open conventional split spoon sampler in conjunction with standard penetration testing ("N" value). The recovered soil samples collected from each split spoon were placed and sealed in plastic bags to prevent the evaporation of their moisture content. All recovered soil samples were classified based on visual and tactile examination and the results of the in-situ testing (standard penetration test). They were logged and stored before being transported to our office for further examination by our geotechnical engineers. Some samples were also kept in glass jars for potential subsequent environmental testing. Upon completion, all boreholes were backfilled using the soil cuttings brought up by the augers and lightly compacted and topped with cold patch for those drilled over paved areas.

The fieldwork was supervised throughout by a member of our engineering staff who supervised the drilling of the boreholes, coordinated the testing of the materials, cared for the samples collected and logged the subsurface conditions encountered at each location. It is noted that a WSP representative was also on-site during the installation of the monitoring wells. All samples collected during this project will be kept in storage for a period of six (6) months, at which time, they will be disposed of unless a written or verbal notice is received, requesting otherwise.

Standpipes were installed in eight (8) of the boreholes prior to backfilling them to measure the static groundwater level in the area. The standpipes consisted of 20mm diameter PVC pipes that were slotted and placed within the overburden.

Initially, there were three (3) monitoring wells (P_BHWMW-1 to P_BHWMW3) that were proposed near the forest. However, upon obtaining shallow refusal (less than 1.5m bgs) at the location of P_BHWMW-2 and P_BHWMW-3, WSP representative instructed that no monitoring would be needed at those boreholes. Instead, he requested an additional monitoring well (P_BHWMW4) be installed along the west property line. Nevertheless, standpipes were installed at the location of P_BHWMW2 and P_BHWMW3 to obtain the static water level. It is noted that no sampling was conducted for MW-4 as instructed by WSP representative.

The monitoring well installed at P_BHWMW-1 and P_BHWMW-4 consisted of 50mm diameter PVC screen of 0.9m to 1.5m in length. The annular space around the screen was backfilled with pre-washed and graded silica sand up to approximately 450mm above the screened portion of the well. The remaining annular space around the solid PVC riser was backfilled with bentonite pellets soil cutting to create a seal over the graded silica sand to avoid surface water infiltration. A monument steel lockable protective casing was installed over the PVC riser and grouted into place. The detailed construction of the monitoring well is presented on the borehole logs attached in **Appendix B**. A well record was prepared by George Downing Estates Drilling Inc. and was provided to the client as well as included in **Appendix B**.

On May 13, 2021, Lascelles staff return to the site to survey the vertical and horizontal geodetic position of all boreholes using a GPS (Global Positioning System) receiver (Trimble/ Spectra Precision SP60 GNSS) using NAD 83 datum (North American Datum). Furthermore, the groundwater levels within the standpipes and monitoring wells were measured using a water

meter. The easting, northing, elevation and groundwater level for each borehole are included in the borehole logs attached in **Appendix B**.

Finally, on May 19, 2021, Lascelles staff carried out two (2) in-situ permeameter testings using a standard ETC Pask Permeameter device. Two (2) test holes (P_PERM1 and P_PERM2) were drilled at depths of 0.75m and 0.95m, respectively. The diameter of the two test holes is approximately 140mm. The purpose of this test is to estimate the field saturated hydraulic conductivity of the overburden soil for stormwater management design. The two test holes are shown on the drawing presented in **Appendix A**.

4 SUBSURFACE SOIL AND GROUNDWATER CONDITIONS

4.1 General

A review of the surficial geology maps for this area suggests that the site would be underlain by a thin (less than 1m thick) glacial till mantling bedrock formation. The till would be discontinuous with pockets of sand and gravel or silty clay in low lying areas. The bedrock would belong to the March Formation consisting of interbedded quartz sandstone, sandy dolostone and dolostone.

The subsurface conditions encountered in the boreholes were classified based on visual and tactile examination of the materials recovered from the boreholes and the results of the in-situ testing and field observations. The soil descriptions presented in this report are based on commonly accepted methods of classification and identification of soil employed in geotechnical practice. Classification and identification of soil involves judgement, and Lascelles does not guarantee descriptions as exact but infers accuracy to the extent that is common in current geotechnical practice.

The subsurface soil conditions encountered at each borehole location are given in the Borehole Logs presented in **Appendix B**. These logs indicate the subsurface conditions encountered at specific test locations only. Boundaries between zones on the logs are often not distinct but are rather transitional and have been interpreted.

4.2 Pavement Structure

P_BH1 and P_BH13 to P_BH15, which are located in the paved area, encountered a pavement structure consisting of 50 to 60mm of asphaltic concrete resting over 300 to 460mm of granular crushed stone. The pavement structure was found resting over fill material.

P_BH6 to P_BH10 were drilled along Highway 15. Of which, P_BH7 and P_BH9 were drilled over the pavement section of the Highway, while P_BH6, P_BH8 and P_BH10 were drilled in the shoulder. The pavement structure measured in P_BH7 and P_BH9 consisted of 130mm of asphaltic concrete resting over 410mm to 560mm of granular crushed stone. The granular base measured along the shoulder was 610mm in all boreholes. The pavement structure was found resting over fill in all boreholes.

4.3 Topsoil

P_BH2 to P_BH5, P_BH11, P_BH12, P_BH16 and P_BHBMW1 to P_BHBMW4 were drilled within the landscape areas of the site and therefore encountered a layer of topsoil at the surface. The thickness of the topsoil was measured to be between 150mm to 610mm and described as dark brown sandy loam.

The material classified as topsoil was based on colour and the presence of organic materials and is intended as identification for geotechnical purposes only. This does not constitute a statement as to the suitability of this layer for cultivation and sustaining plant growth.

4.4 Fill

A layer of fill material was encountered in all boreholes, except for P_BH3, P_BH5, P_BH16, and P_BHBMW1 to P_BHBMW4. The fill is found either underlying the topsoil or the pavement structure. In boreholes drilled within the school property, the fill is generally described as a mix of sand and gravel with traces of silt and clay, brown in colour, loose to compact and moist. At some locations, it also contains some cobbles, boulders and organics (e.g., P_BH11) or granular crushed stones (e.g., P_BH13 to P_BH15). It is anticipated that the fill originated from the site and would consist of disturbed glacial till. It is noted that in P_BH4, the fill consists of fine to medium grained sand, brown in colour, loose and wet, which would be related to the adjacent sewage field bed.

In P_BH6 to P_BH10, which were drilled along Highway 15, the fill was 0.10m to 2.29m thick and was found rest either over glacial till or the inferred bedrock. It consisted of sand and gravel with traces of asphalt, crushed stone, as well as some organics, in a compact state of packing and moist.

Two (2) representative samples of the fill material were sent to the laboratory for sieve analysis. A summary of the results is presented in **Table 1** below, while the laboratory reports are presented in **Appendix C**.

Table 1: Fill gradation analysis summary

Borehole	Sample	Depth (m)	Parameters			
			Gravel (%)	Sand (%)	Silt/Clay (%)	Hydraulic Conductivity (cm/s)
P_BH7	SS-2	0.95	20.1	57.1	22.7	2.57×10^{-4}
P_BH10	SS-3	1.80	9.70	52.6	37.7	1.33×10^{-4}

For the most part, the gradation curves suggest a well graded mix of gravel, sand, silt/clay and is likely disturbed glacial till. The sieve analysis reveals that the soil contains 9.7 to 20.1 % of gravel, 52.6 to 57.1 % of sand and 22.7 to 37.7 % silt and clay. The samples would be classified as SM as per the unified soil classification system. It should be noted that the gravel portion of the gradation analysis may be misrepresented considering the samples were taken using the split spoon sampler (50mm diameter), where only limited gravel could actually be sampled. Consequently, the gravel content within the fill matrix is anticipated to be higher than 15 to 20% or more. It is noted that within glacial till deposits, the proportion of its matrix can vary along horizontal and vertical profiles.

4.5 Sand to Sand-Silt

A thin sand-silt deposit was encountered in boreholes P_BH1 and P_BH4. The layer is described as medium to fine grained sand, transitioning to sandy silt, brown in colour with oxidation stains near the surface, loose to compact and wet. This layer extended 0.76m to 2.13m bgs and was found resting over glacial till, except for P_BH1, which was found resting over a silty clay layer.

A representative sample of the sand deposit was submitted to the laboratory for a sieve analysis. The sieve analysis reveals that the soil contains 0 % of gravel, 85.2% of sand and

14.8% silt and clay. The samples would be classified as SM as per the unified soil classification system. The laboratory report is presented in **Appendix C**.

4.6 Silty Clay

A thin layer (approx. 300mm) of clay was encountered in MW-1 only. The layer is described as silty clay, greyish brown in colour, very stiff and moist. The layer extended to 1.68m bgs and was found resting over the glacial till.

4.7 Glacial Till

A glacial till deposit was encountered in all boreholes, except BH-1, BH-7, and BH-10. The till was described as silty sand with some gravel, brown to greyish brown in colour, compact near the surface, becoming very dense with depth and moist. The glacial till extends between 0.91m to 3.20m bgs and was found resting over inferred bedrock.

Four (4) representative samples of the glacial till were sent to the laboratory for sieve or hydrometer analysis. A summary of the results is presented in **Table 2** below, while the laboratory reports are presented in **Appendix C**.

Table 2: Till gradation analysis summary

Borehole	Sample	Depth (m)	Parameters				
			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Hydraulic Conductivity (cm/s)
P_BH14	SS-3	1.80	11.3	49.8	38.9		1.95×10^{-4}
P_BH3	SS-2	1.06	10.6	43.5	37.9	8.0	2.10×10^{-5}
P_BH3MW3	SS-2	1.06	1.70	43.5	35.8	19.0	5.70×10^{-5}
P_BH3MW1	SS-4	2.60	11.5	43.7	33.8	11.0	2.10×10^{-5}

As noted for the fill, the gradation curves of the till suggest a well graded mix of gravel, sand, silt with traces of clay. The analysis reveal that the soil contains 1.70 to 11.5 % of gravel, 43.5 to 49.8 % of sand, 33.8 to 38.9 % silt and 8.0 to 19.0 % of clay. The samples would be classified as SM as per the unified soil classification system. It should be noted that the gravel portion of the gradation analysis may be misrepresented considering the samples were taken using the split spoon sampler (50mm diameter), where only limited gravel could actually be sampled. Consequently, the gravel content within the glacial till would be higher than reported. It is noted

that within glacial till deposits, the proportion of its matrix can vary along horizontal and vertical profiles.

4.8 Inferred Bedrock

Auger refusal over inferred bedrock was obtained at all borehole locations. No rock coring was carried out to confirm the presence of the bedrock or its quality. The depth of the inferred bedrock was measured to range from 0.91m to 3.20m bgs, or elevation from 130.72 to 128.05m. Considering that the auger did not penetrate the bedrock or very slightly, it is anticipated that there would be very little weathering at the bedrock surface.

4.9 Groundwater Conditions

The static water level was measured using a water meter on May 13, 2021, within the standpipes or monitoring wells installed within P-BH2 to P_BH5, P_BH11, P_BH12, and P_BH13. The results are shown on the borehole logs presented in **Appendix B**. The depth of the groundwater was generally found to be within 1m from ground surface at most locations. The Elevation of the groundwater varies between 131.21m to 130.39m. It appears that the groundwater flows westerly in the northern portion of the site, while southerly (towards roadside ditch) in the southern portion.

It is noted that P_BH13 was screened between a silty clay layer and the bedrock; however, its groundwater level is similar to the surrounding monitoring wells or boreholes. This indicates that the clay layer encountered in this area is localized and does not provide an isolation between the upper sand layer and the lower bedrock. It should be further noted that groundwater levels could fluctuate with seasonal weather conditions (e.g., rainfall, droughts, spring thawing) as well as from any presence of existing ditches, slopes and underground services trenches at or in the vicinity of the site, including mounding from the existing sewage field bed.

4.10 Permeameter Testing

“Field saturated” hydraulic conductivity, K_{fs} , of the glacial till deposit was calculated using the “Constant Head Well Permeameter” (CHWP) method proposed by (Reynolds 1993; Elrick and

Reynolds, 1986). A Standard ETC Pask Permeameter was used to perform permeater tests on two test holes (P_PERM1 and P_PERM2). The results show that the glacial till deposit has field saturated hydraulic conductivity ranging from 4.29×10^{-5} cm/sec to 5.28×10^{-5} cm/sec.

5 GEOTECHNICAL CONSIDERATIONS

5.1 General

This section of the report provides engineering guidelines from the geotechnical design aspects of the project based on Lascelles' interpretation and review of the information obtained from the boreholes, as well as the specific project requirements.

It is understood that the proposed project will consist of redesigning of the layout the site's entrances that would include removing one and creating a new entrance further to the north, which will also include a road widening for the left turning lane. Furthermore, redesigning the layout of the bus/fire and access lanes and parking areas, where a new parking area is proposed at the location of the existing sewage system. Consequently, the existing sewage system will be decommissioned. A new sewage system will be constructed at the back of the play areas, where a small forested area is currently located. Finally, the project will also include drainage improvement and stormwater management to accommodate the said site improvements. A conceptual plan of the project prepared by WSP is included as part of **Appendix A**.

5.2 Pavement Design

The asphalt surface of the existing access lanes and parking areas appear to be in fair to good conditions, except for areas near the western entrance where extensive cracks, potholes, deterioration and pavement pumping were observed. If the new parking area and access/bus lanes are being contemplated with drainage improvements, it is doubtful that any existing asphalt can be salvaged due to the changes in elevation.

It is anticipated that the subgrade soils for the new parking and access roads will consist of mostly sandy fill, native glacial till or shallow bedrock, which will be acceptable once all organic material, objectionable fill or other deleterious material are removed from the subgrade area. For the predictable performance of the pavement areas, the recommended pavement structures

for the proposed light (parking areas) and heavy-duty (fire route/bus lanes) access lanes are provided below.

For light vehicle access lanes and parking areas, the pavement structure should consist of:

- 50 millimetres of hot mix asphaltic concrete surface layer (HL3 or Superpave 12.5); over
- 150 millimetres of OPSS Granular A base; over
- 300 millimetres of OPSS Granular B, Type II subbase

For heavy-duty access lanes, the pavement structure should consist of:

- 40 millimetres of hot mix asphaltic concrete surface layer (HL3 or Superpave 12.5), over
- 50 millimetres of hot mix asphaltic concrete binder layer (HL8 or Superpave 19.0) over
- 150 millimetres of OPSS Granular A base over
- 350 millimetres of OPSS Granular B, Type II subbase

It is very likely that the existing pavement structure could be contaminated with fines in areas due to its age. Nevertheless, it does not meet the minimum recommend thickness. Consequently, it is recommended that it be removed and replaced with new granular crushed stone. Attempts could be made to salvage the existing granular base and stockpile it in order to properly sample and test the crushed stone to confirm if it would meet OPSS Granular B Type II gradation requirements. Alternately, this material could be used as Select Subgrade material where areas of the site would need to be raised. The existing asphalt layer should be removed and sent to be recycled or pulverized within the existing granular based to be reused as noted above.

With regard to the road widening for Highway 15 required for the new entrance, the recommended pavement structure should consist of:

- 50 millimetres of hot mix asphaltic concrete surface layer (HL4 or Superpave 12.5); over
- 80 millimetres of hot mix asphaltic concrete binder layer (HL8 or Superpave 19.0); over,
- 150 millimetres of OPSS Granular A base; over
- 550 millimetres of OPSS Granular B, Type II subbase

The base and subbase granular materials should conform to OPSS Form 1010 material specifications. Prior to importing any granular material onto the site, it should be tested and approved by a geotechnical engineer. Compaction of the granular pavement materials should be carried out in maximum 200mm thick loose lifts to 100% of its SPMDD using suitable vibratory compaction equipment.

The asphaltic cement should consist of PG 58-34. The Job Mix Formula (JMF) of the asphaltic concrete should be in accordance with OPSS 1150 and OPSS.MUNI 1151 for Material Specification for Hot Mix Asphalt and Superpave. The asphaltic concrete should be placed in accordance with OPSS 310 for Construction Specification for Hot Mix Asphalt. The asphaltic concrete should be compacted to a minimum of 92% of the Maximum Relative Density. The JMF and its constituents should be reviewed, tested and approved by a geotechnical engineer prior to delivery to the site.

5.3 Paved Areas, Subgrade Preparation and Reinstatement

Once the footprint of the proposed access lanes, parking areas or road widening area have been stripped of the existing pavement structure, as well as topsoil, debris and other obvious objectionable material, down to the subgrade level, the subgrade should be inspected by a geotechnical engineer. Following the backfilling and satisfactory compaction of any underground service trenches up to the subgrade level, the subgrade should be shaped, crowned and proof-rolled using a heavy roller with any resulting soft areas sub-excavated down to an adequate bearing layer and replaced with approved backfill. Following approval of the preparation of the subgrade, the new pavement structure may be placed.

Any materials used as selected subgrade should be approved by the geotechnical engineer before placement within the roadway and should meet the OPSS requirements for "Select Subgrade Material". These materials should be placed in maximum 300mm thick loose lifts and compacted to at least 95 percent of its SPMDD using suitable compaction equipment.

If the roadway/parking subgrade is disturbed or wetted due to construction operations or precipitation, the granular thicknesses given above may not be adequate, and it may be necessary to increase the thickness of the Granular B Type II subbase and/or incorporate a non-woven geotextile separator between the roadway subgrade surface and the granular subbase material. The proper manner to deal with this issue will be addressed upon field review by geotechnical engineer.

The preparation of the subgrade should be scheduled and carried out in such a manner that a protective cover of overlying granular material is placed as quickly as possible in order to avoid unnecessary circulation by heavy equipment over the subgrade. Frost protection of the surface should be implemented (i.e., insulated tarps, etc.) if works are carried out during the winter months.

Transitions should be constructed to ensure that proper compaction is achieved between the new road structure and the existing road structure, which will prevent potential future differential settlement between the two. The transition should start at the subgrade level and extend to the underside of the asphaltic concrete level (if any) at a 1 horizontal to 1 vertical slope. This is especially important where trench boxes are used and where no side slopes is provided to the excavation. Where asphaltic concrete is present, it shall be cut back to a minimum of 150mm from the edge of the excavation to allow for proper compaction between the new and existing pavement structures.

If the asphaltic concrete surface of a roadway is affected by the excavating process, the damaged zones should be saw cut and any damaged or loose pieces of asphaltic concrete should be removed down to the base course or its entire depth, where only one layer exist. The existing base should be scarified and proof-rolled with any soft areas excavated and replaced to the proper level with new OPSS Granular A. Where two layers of asphalt exist on a road, the surface course should be grinded over a width of 150mm to allow the new surface course to

overlap the binder layer and not create one straight vertical joint. For major roads, this overlap should be increased to 300mm.

The performance of the pavement structure is highly dependent on the subsurface groundwater conditions and maintaining the subgrade and pavement structure in a dry condition. To intercept excess subsurface water within the pavement structure granular materials, sub-drains with suitable outlets should be installed below the pavement structure subgrade if adequate overland flow drainage is not provided (i.e., ditches). The surface of the pavement should be properly graded to direct runoff water towards suitable drainage features. It is recommended that the lateral extent of the subbase and base layers not be terminated vertically, immediately behind any proposed curb/edge of pavement line but be extended beyond the curb.

5.4 Excavation, Groundwater Control and Trench Backfilling

In the event, where storm sewers would be required for drainage improvement as part of this project, it is not anticipated that they would extend more than 2.5m bgs. The predominant soil type underlying the project consists of a layer of existing pavement structure, sandy fill, glacial till and bedrock. The depth of overburden at the site varies between 0.91m to 3.20m bgs.

Based on the subsurface soil conditions encountered at this site and according to the Ontario's Occupational Health and Safety Act (OHSA), O. Reg. 213/91 and its amendments, surficial shallow temporary excavation through noted overburden can be classified as Type 3 for fully drained excavations. Therefore, shallow temporary excavation in the overburden soil classified as Type 3 can be cut at 1 horizontal to 1 vertical for a fully drained excavation starting at the base of the excavation or the bedrock surface and as per requirements of the OHSA regulations.

The listed slopes are for fully drained excavations. Much gentler slopes could be required if the excavations are not fully drained and for those extending below the water table. Any excavated material stockpiled near an excavation or trench should be stored at a distance equal to or greater than the depth of the excavation/trench, and construction equipment traffic should be limited near any open excavation.

In the event that the aforementioned slopes are not possible to achieve due to space restrictions, the excavation should be shored according to OHSA O. Reg. 213/91 and its amendments. A geotechnical engineer should design and approve the shoring and establish the shoring depth under the excavation profile. The excavation for the underground services could be carried out within tightly fitting, braced steel trench boxes, approved by a professional engineer.

Rock excavation may be required for the installation/changing of any proposed sewer. It is anticipated that any weathered portion of the bedrock may be excavated using a large excavator and that the remaining sound bedrock will require the use of high energy hoe-rams.

The slopes of the rock excavation may be vertical with a 1m wide bench at the soil-rock interface on all sides of the excavation. Any loose pieces of rock from the sidewalls of the excavation should be removed, and the bottom of the excavation should be sufficiently flattened and exempt of rock ledges.

A condition survey of any nearby structures and services should be undertaken prior to commencing any construction. In view of the potential for vibration during excavating and removal of the bedrock, it is recommended that the excavation activities be monitored throughout the project by a vibration specialist engineer or consultant and that the vibration limits be established based on the local conditions and nearby structures to ensure that ground vibration are not exceeded.

Groundwater seepage and infiltration entering shallow and temporary excavations performed within the overburden soil and surficial bedrock should be mitigated by pumping from sumps installed in the excavation. Surface water runoff into the excavation should be avoided and diverted away from the excavation.

Bedding, thickness of cover material and compaction requirements for the storm sewers should conform to the manufacturers' design requirements and to the requirements and detailed installations outlined in the Ontario Provincial Standard Specifications (OPSS) as well as to any recommendations from the local Township. The minimum bedding thickness should be 150mm of OPSS Granular A compacted to at least 95% SPMDD with appropriate equipment.

All service trenches should be backfilled using compactable material, free of organics, debris and large cobbles or boulders. Acceptable native materials should be used as a backfill between the roadway subgrade level and the depth of seasonal frost penetrations (i.e., 1.8 metres below finished grade) in order to reduce the potential for differential frost heaving between the newly excavated trench and the adjacent section of roadway. Where native backfill is used, it should match the native materials exposed on the trench walls. Any cobbles larger than 150 millimetres in size should not be used as trench backfill. Backfill below the zone of seasonal frost penetration could consist of either acceptable native material or imported granular material conforming at minimum to OPSS Granular B Type I.

Where two different frost susceptible soil types are used in the trench backfill, frost tapers should be provided. The minimum frost taper should consist of cutting back the side slope of the trench to 3 horizontal to 1 vertical profile starting at 1.2m below the finish grade.

To minimize future settlement of the backfill and achieve an acceptable subgrade for the roadway, the trench should be compacted in maximum 300mm thick lifts to at least 95 percent of the SPMDD. The specified density may be reduced where the trench backfill is not located within or in close proximity to existing roadways or any other structures. Refer to section 5.3 for backfilling and reinstatement of road pavement structure.

6 POTENTIAL OF CORROSIVE ENVIRONMENT

6.1 Sulphate Attack on Buried Concrete

Two samples of the native till were submitted to Paracel Laboratories Ltd., an accredited chemical analysis laboratory, for analysis of sulphate content within the overburden. The samples were collected from P_BH2 (SS3) and P_BH13 (SS33). The results of the analysis revealed that the till has a sulphate content of 28 to 78 µg/g (0.0028% to 0.0078%). The laboratory Certificates of Analysis are presented in **Appendix D**.

Based on the CAN/CSA - A23.1 standards (Concrete Materials and Methods of Concrete Construction), a sulphate concentration of 0.1% (1000 µg/g) or less in soil, fall within the negligible category for sulphate attack on buried concrete. As such, buried concrete for footings and foundation walls will not require any special additive to resist sulphate attack, and the use of normal Portland cement is acceptable.

6.2 Corrosivity Analysis for Buried Steel

The sample collected from BH-13 (SS-3) was also submitted for chemical analysis that included pH, Chloride, Resistivity and Sulphide. The purpose of this testing was to assess the potential for a corrosive environment on any buried steel. The laboratory Certificates of Analysis are presented in **Appendix D**.

The potential for an aggressive corrosive soil environment was established in reviewing the above measured parameters and according to the standard provided by the American Water Works Association (AWWA) C-105/A21.5-10. Based on the noted standard, corrosion protection for buried steel is only required where a corrosivity index of 10 or greater is encountered. Based on the results, the calculated corrosivity index was found to be below 10. As such, any buried steel as part of this project would not require any special or specific corrosion protection measures with respect to cast iron pipes.

7 ENVIRONMENTAL SOIL QUALITY

During the drilling process, the recovered soil samples were logged, labelled and examined in the field for visual and olfactory characteristics and any evidence of petroleum hydrocarbon and/or chemical impact. Furthermore, the soil headspace vapour concentrations will be screened using an RKI Model Eagle II portable gas detector equipped with a dual sensor, photoionization (PID) sensor for detecting VOC gases and thermal conductivity (TC) sensor for detecting hydrocarbons.

Our observations during drilling activities and the recovered soil samples did not reveal any visual or olfactory evidence of petroleum hydrocarbon contamination and/or chemical impact in any of the test pits. All headspace vapour of recovered soil samples yielded non-detectable readings of VOC and hydrocarbons

Nonetheless, a total of five (5) soil samples were selected for laboratory analysis. The samples selected were representative of both soil types encountered at the Site and represented a worst-case scenario or at the location where excess soil is anticipated. The soil samples were submitted to Paracel Laboratories Ltd. for the analysis of one or more of the following parameters: Petroleum Hydrocarbons (PHC) for Fraction 1 ($C_6 - C_{10}$), Fraction 2 ($>C_{11} - C_{16}$), Fraction 3 ($>C_{16} - C_{34}$) and Fraction 4 ($>C_{34}$), BTEX (i.e., Benzene, Toluene, Ethylbenzene and Xylene, Polycyclic Aromatic Hydrocarbons (PAH) and heavy metals and Inorganic (M&I). A Sampling and Analysis Plan are summarized in **Table 3.** below.

Table 3: Sampling and Analysis Plan.

Sample ID	Investigation Depths (m bgs)	Test Parameters		
		PHC F1-F4 & BTEX	M&I	PAH
P_BH11 SS2	1.06		x	
P_BH13 SS2	1.06		x	
P_BH15 SS2	1.83		x	
P_BH17 SS2	1.06	x	x	x
P_BH19 SS2	1.06	x		x

Note:

Investigation Depths: the sampling depths of soil samples retrieved from the boreholes.
 x: Analyzed parameters.

Test Parameters:

PHC F1 – F4: Petroleum Hydrocarbons F1 to F4
BTEX: Benzene, Toluene, Ethylbenzene and Xylene
PAH: Polycyclic Aromatic hydrocarbon
M&I: Metals and Inorganics

The laboratory results were compared with O. Reg. 153/04 - MOE's Soil, Groundwater and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act (April 2011). The criteria provided as part of TABLE 2 – Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition, for Institutional Property Use, and for medium/coarse-textured soils.

In reviewing the laboratory results, the concentrations of PHCs, BTEX, PAHs, and M&I in the analyzed soil samples meet with the guidelines of Table 2 SCS. The results and the laboratory "Certificates of Analysis" are attached in **Appendix D**.

It is imperative to note that the purpose of the soil laboratory analysis performed for this project is to provide a general view of the subsurface soil condition of the site. The analysis should not be considered a warranty that the subject property is free from any and all contaminants from former and current practices. Should excess soil be generated during construction, it is recommended that a qualified person (QP) be retained to prepare a Soil Management Plan (SMP) in accordance with O. Reg. 406/19.

8 CONSTRUCTION CONSIDERATION

The engagement of the services of the geotechnical consultant during construction is recommended to confirm that the subsurface conditions throughout the proposed construction do not materially differ from those given in the report and that the construction activities do not adversely affect the intent of the design.

The subgrade for the pavement areas and sewers should be inspected and approved by geotechnical personnel. In-situ density testing should be carried out on granular pavement materials, pipe bedding and backfill to ensure the materials meet the specifications from a compaction point of view.

The recommendations presented in this limited geotechnical report are applicable only to the project described in the report. Any changes to the project will require a review by Lascelles

Engineering & Associates Ltd., to ensure compatibility with the recommendations contained in this report.

9 REPORT CONDITIONS AND LIMITATIONS

It is stressed that the information presented in this report is provided for the guidance of the designers and is intended for this project only. The use of this report as a construction document is neither intended nor authorized by Lascelles Engineering & Associates Ltd. Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data as it affects their construction techniques, schedule, safety and equipment capabilities.

The professional services for this project include only the geotechnical aspects of the subsurface conditions at this site. The presence or implications of possible subsurface contamination resulting from previous uses or activities at this site or adjacent properties and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this report.

The recommendations provided in this report are based on subsurface data obtained at the specific test locations only. Experience indicates that the subsurface soil and groundwater conditions can vary significantly between and beyond the test locations. For this reason, the recommendations given in this report are subject to field verification of the subsurface soil conditions at the time of construction.

The report recommendations are applicable only to the project described in the report. Any changes to the project will require a review by Lascelles Engineering & Associates Ltd., to ensure compatibility with the recommendations contained in this project.

It is imperative to note that the purpose of the soil laboratory analysis performed for this project is to provide a general view of the subsurface soil condition of the site. The analysis should not be considered a warranty that the subject property is free from any and all contaminants from former and current practices. Should excess soil be generated during construction, it is

recommended that a qualified person (QP) be retained to prepare a Soil Management Plan (SMP) in accordance with O. Reg. 406/19.

We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report or if we may be of further services to you, please do not hesitate to contact our office.

Yours truly,
Lascalles Engineering & Associates Ltd.

Prepared by:



Shuang Chang, M.A.Sc., P.Eng.

Reviewed by:



Mario Elie, Project Manager



Appendix A

Borehole Location Plan

Appendix B

Borehole Logs & Well Records



PROJECT: Geotechnical Investigation - Lombardy Public School
 CLIENT: WSP Global Inc.
 LOCATION: 596 ON-15, Lombardy, Ontario
 DATE: May 6, 2021

RECORD OF BOREHOLE: P_BH1

PROJECT No.: 210156
 LOGGED BY: S.C.
 DRILLER: George Downing Estate Drilling Ltd
 DRILLING EQUIPMENT: Track-mounted CME55
 DRILLING METHOD: Hollow Stem Auger

SOIL PROFILE		SAMPLES					SHEAR STRENGTH (kPa)	STANDARD PENETRATION TEST RESISTANCE PLOT	WATER CONTENT %	WATER LEVEL
DEPTH (m)	DESCRIPTION	ELEV.	NUMBER	TYPE	N-VAL/RQD	RECOVERY				
0.0	Ground Surface	131.99								
0.0	Pavement Structure: 50mm asphalt concrete over 460mm granular crushed stone.	0.00								
1.0			SS1		24	100%		24		
2.0	Fill: Sand and gravel with trace of silt and clay, brown in colour, compact and moist.	131.48								
0.51		0.51								
3.0			SS2		20	35%		20		
1.0	Auger refusal over inferred bedrock at 1.27m bgs.									
4.0		130.72								
1.27	End of Borehole	1.27								
5.0										
6.0										
7.0										
8.0										
9.0										
10.0										
11.0										
12.0										
13.0										
14.0										
15.0										
16.0										

Easting: 415115
 Site Datum: Geodetic
 Top of Casing Elev.: NA
 Borehole Diameter: 200mm

Northing: 4965313
 Groundsurface Elev.: 131.99m
 Top of Riser Elev.: NA
 Monitoring Well Diameter: NA

COMMENTS:



PROJECT: Geotechnical Investigation - Lombardy Public School
 CLIENT: WSP Global Inc.
 LOCATION: 596 ON-15, Lombardy, Ontario
 DATE: May 6, 2021

RECORD OF BOREHOLE: P_BH2

PROJECT No.: 210156
 LOGGED BY: S.C.
 DRILLER: George Downing Estate Drilling Ltd
 DRILLING EQUIPMENT: Track-mounted CME55
 DRILLING METHOD: Hollow Stem Auger

SOIL PROFILE		SAMPLES					SHEAR STRENGTH		WATER CONTENT	WATER LEVEL
DEPTH (m)	DESCRIPTION	ELEV.	NUMBER	TYPE	N-VAL/RQD	RECOVERY	STANDARD PENETRATION TEST	RESISTANCE PLOT		
0.0	Ground Surface	131.75								
0.0	Topsoil: 200mm dark brown sandy loam.	131.55								
0.20	Fill: Sand and gravel with trace of silt and clay, presence of rock fragment, brown in colour, loose to dense, and moist.	131.55	SS1		5	100%	5			
1.0										
2.0										
3.0										
4.0										
5.0										
5.20	Glacial Till: Silty sand with some gravel, brown in colour, compact to very dense, and moist to wet.	130.23	SS2		34	5%	34			
6.0										
7.0										
7.29	Auger refusal over inferred bedrock at 2.29m bgs.	129.46	SS3		21	100%	21			
8.0										
9.0										
10.0										
11.0										
12.0										
13.0										
14.0										
15.0										
16.0										
	End of Borehole	129.46								

0.91 m
 (05/13/2021)

Easting: 415144
 Site Datum: Geodetic
 Top of Casing Elev.: NA
 Borehole Diameter: 200mm

Northing: 4965344
 Groundsurface Elev.: 131.75m
 Top of Riser Elev.: NA
 Monitoring Well Diameter: NA

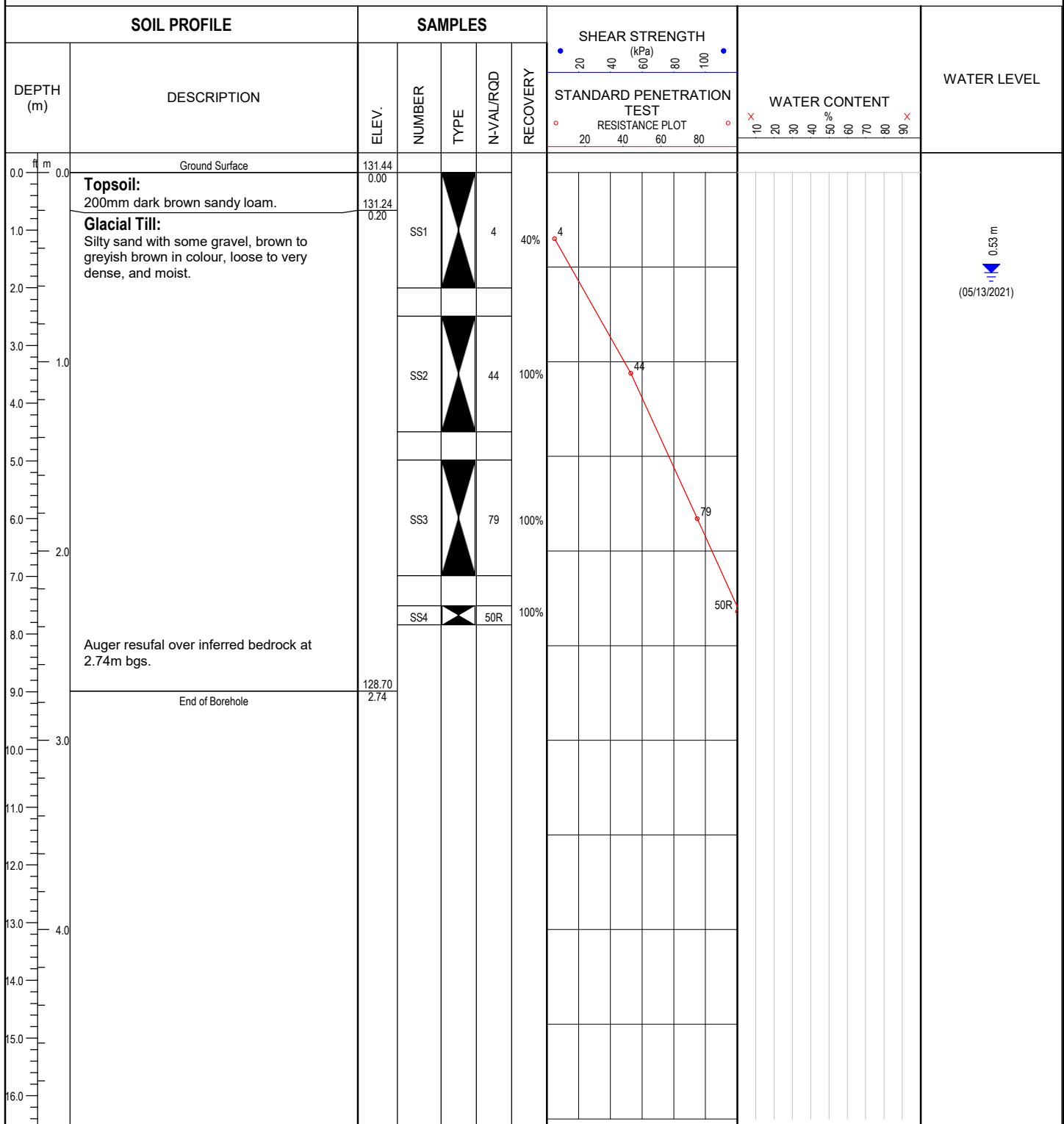
COMMENTS:



PROJECT: Geotechnical Investigation - Lombardy Public School
 CLIENT: WSP Global Inc.
 LOCATION: 596 ON-15, Lombardy, Ontario
 DATE: May 6, 2021

RECORD OF BOREHOLE: P_BH3

PROJECT No.: 210156
 LOGGED BY: S.C.
 DRILLER: George Downing Estate Drilling Ltd
 DRILLING EQUIPMENT: Track-mounted CME55
 DRILLING METHOD: Hollow Stem Auger



Easting: 415177
 Site Datum: Geodetic
 Top of Casing Elev.: NA
 Borehole Diameter: 200mm

Northing: 4965374
 Groundsurface Elev.: 131.44m
 Top of Riser Elev.: NA
 Monitoring Well Diameter: NA

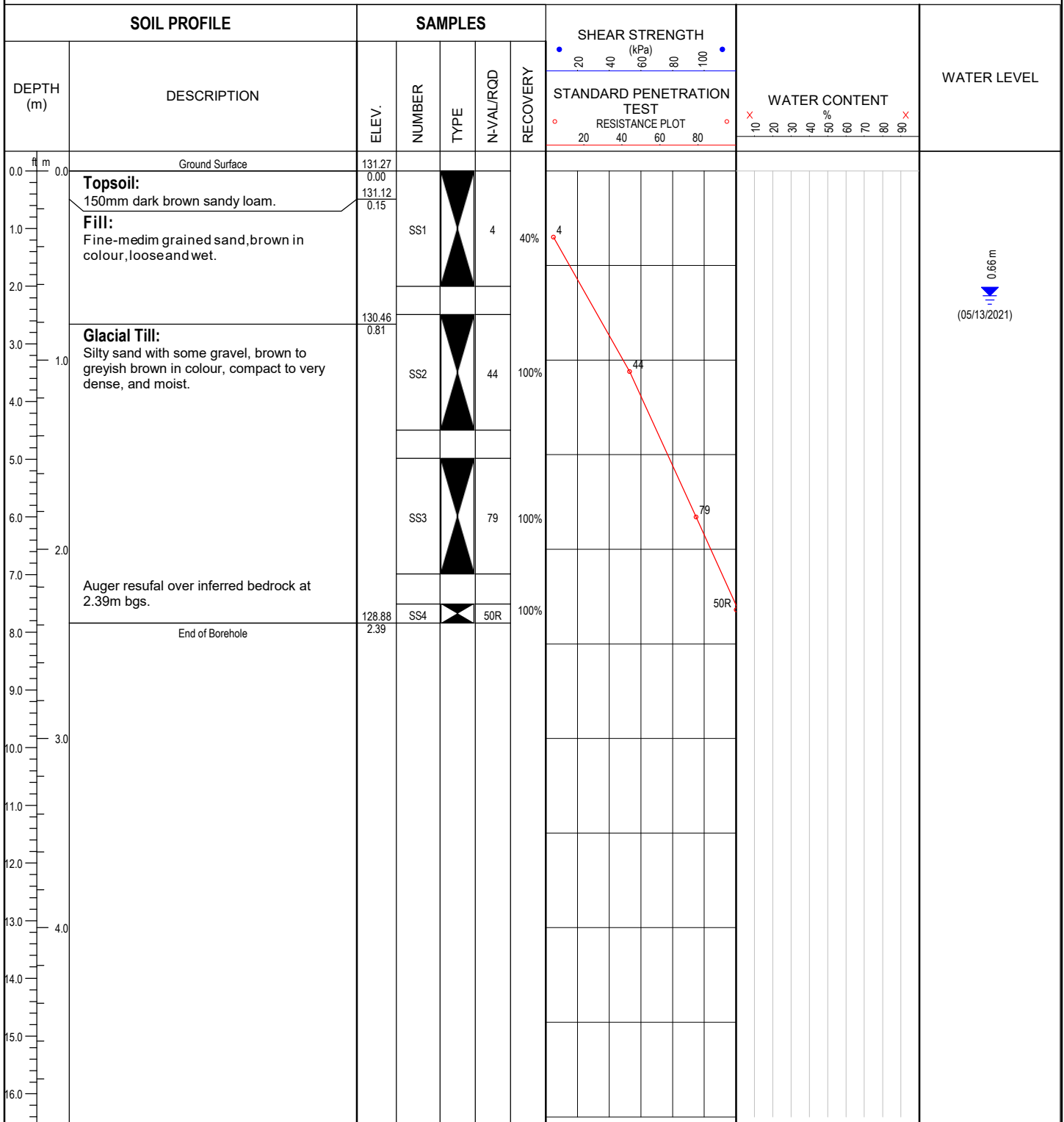
COMMENTS:



PROJECT: Geotechnical Investigation - Lombardy Public School
 CLIENT: WSP Global Inc.
 LOCATION: 596 ON-15, Lombardy, Ontario
 DATE: May 6, 2021

RECORD OF BOREHOLE: P_BH4

PROJECT No.: 210156
 LOGGED BY: S.C.
 DRILLER: George Downing Estate Drilling Ltd
 DRILLING EQUIPMENT: Track-mounted CME55
 DRILLING METHOD: Hollow Stem Auger



0.66 m

 (05/13/2021)

Easting: 415201
 Site Datum: Geodetic
 Top of Casing Elev.: NA
 Borehole Diameter: 200mm

Northing: 4965355
 Groundsurface Elev.: 131.27m
 Top of Riser Elev.: NA
 Monitoring Well Diameter: NA

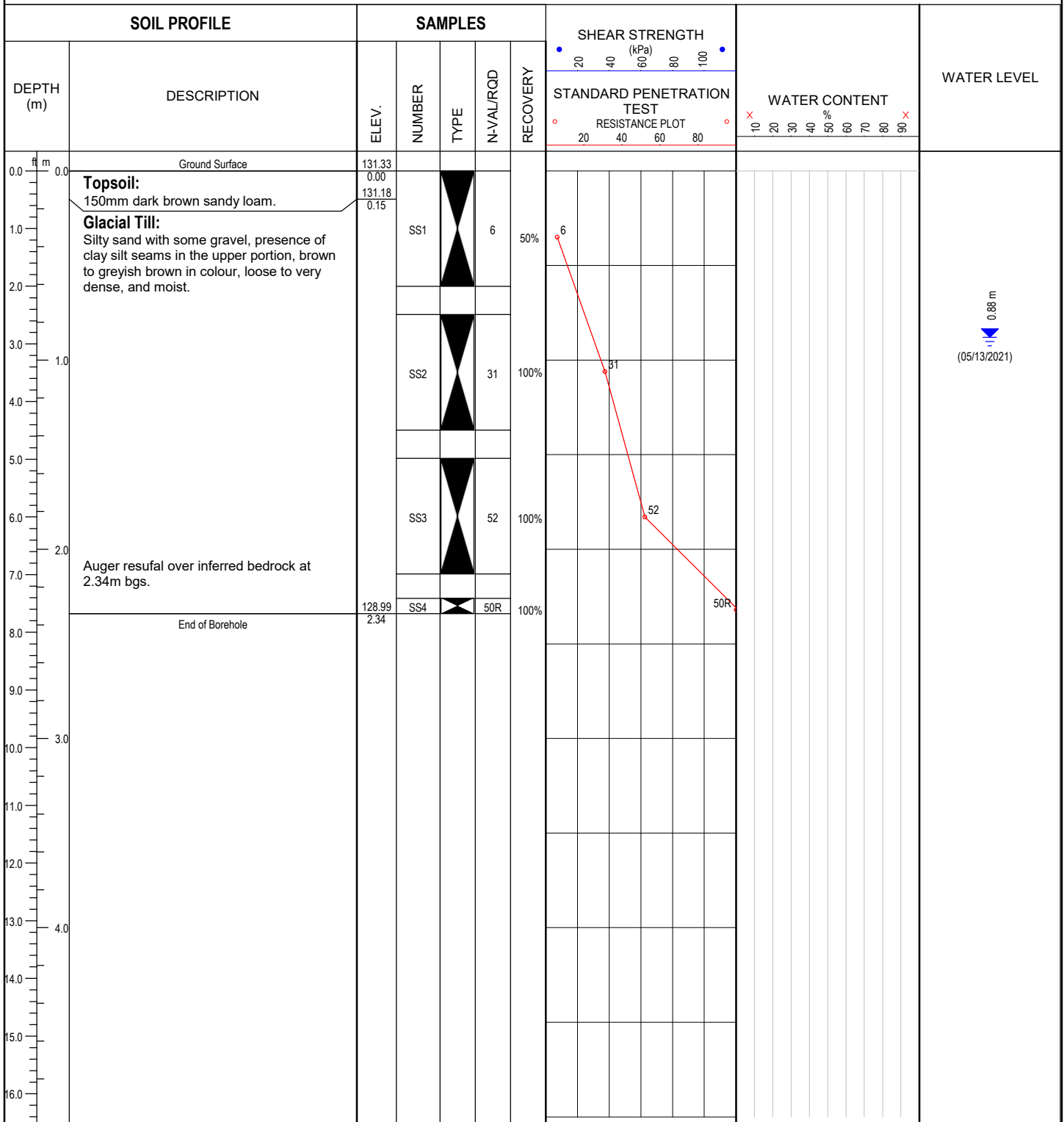
COMMENTS:



PROJECT: Geotechnical Investigation - Lombardy Public School
 CLIENT: WSP Global Inc.
 LOCATION: 596 ON-15, Lombardy, Ontario
 DATE: May 6, 2021

RECORD OF BOREHOLE: P_BH5

PROJECT No.: 210156
 LOGGED BY: S.C.
 DRILLER: George Downing Estate Drilling Ltd
 DRILLING EQUIPMENT: Track-mounted CME55
 DRILLING METHOD: Hollow Stem Auger



Easting: 415220
 Site Datum: Geodetic
 Top of Casing Elev.: NA
 Borehole Diameter: 200mm

Northing: 4965335
 Groundsurface Elev.: 131.33m
 Top of Riser Elev.: NA
 Monitoring Well Diameter: NA

COMMENTS:



PROJECT: Geotechnical Investigation - Lombardy Public School
 CLIENT: WSP Global Inc.
 LOCATION: 596 ON-15, Lombardy, Ontario
 DATE: May 7, 2021

RECORD OF BOREHOLE: P_BH6

PROJECT No.: 210156
 LOGGED BY: S.C.
 DRILLER: George Downing Estate Drilling Ltd
 DRILLING EQUIPMENT: Track-mounted CME55
 DRILLING METHOD: Hollow Stem Auger

SOIL PROFILE		SAMPLES					SHEAR STRENGTH		WATER CONTENT	WATER LEVEL
DEPTH (m)	DESCRIPTION	ELEV.	NUMBER	TYPE	N-VAL/RQD	RECOVERY	STANDARD PENETRATION TEST RESISTANCE PLOT			
0.0	Ground Surface	132.26								
0.0	Granular Bases: 610mm granular crushed stone	0.00								
1.0			SS1		20	75%	20			
2.0		131.65								
2.0	Fill: Sand and gravel mixed with trace of old asphalt, granular crushed stones and organics, brown in colour, compact and moist.	0.61								
3.0			SS2		21	10%	21			
4.0										
5.0		130.74								
5.0	Glacial Till: Silty sand with trace gravel and clay, brown in colour, loose, and very moist.	1.52								
6.0			SS3		3	100%	3			
6.0	Auger refusal over inferred bedrock at 2.03m bgs.	130.23								
7.0	End of Borehole	2.03								
8.0										
9.0										
10.0										
11.0										
12.0										
13.0										
14.0										
15.0										
16.0										

Easting: 415241
 Site Datum: Geodetic
 Top of Casing Elev.: NA
 Borehole Diameter: 200mm

Northing: 4965321
 Groundsurface Elev.: 132.26m
 Top of Riser Elev.: NA
 Monitoring Well Diameter: NA

COMMENTS:



PROJECT: Geotechnical Investigation - Lombardy Public School
 CLIENT: WSP Global Inc.
 LOCATION: 596 ON-15, Lombardy, Ontario
 DATE: May 7, 2021

RECORD OF BOREHOLE: P_BH7

PROJECT No.: 210156
 LOGGED BY: S.C.
 DRILLER: George Downing Estate Drilling Ltd
 DRILLING EQUIPMENT: Track-mounted CME55
 DRILLING METHOD: Hollow Stem Auger

SOIL PROFILE		SAMPLES					SHEAR STRENGTH (kPa)	STANDARD PENETRATION TEST RESISTANCE PLOT	WATER CONTENT %	WATER LEVEL
DEPTH (m)	DESCRIPTION	ELEV.	NUMBER	TYPE	N-VAL/RQD	RECOVERY				
0.0	Ground Surface	132.52								
0.0	Pavement Structure: 130mm asphaltic concrete over 410mm granular crushed stone.	0.00								
1.0			SS1		60	75%		60		
2.0	Fill: Sand and gravel mixed with trace of old asphalt, granular crushed stone and organics, brown in colour, compact to loose and moist.	131.98								
3.0		0.54	SS2		18	10%		18		
4.0										
5.0			SS3		9	100%		9		
6.0										
7.0	Auger refusal over inferred bedrock at 2.18m bgs.	130.34								
8.0	End of Borehole	2.18								
9.0										
10.0										
11.0										
12.0										
13.0										
14.0										
15.0										
16.0										

Easting: 415249
 Site Datum: Geodetic
 Top of Casing Elev.: NA
 Borehole Diameter: 200mm

Northing: 4965322
 Groundsurface Elev.: 132.52m
 Top of Riser Elev.: NA
 Monitoring Well Diameter: NA

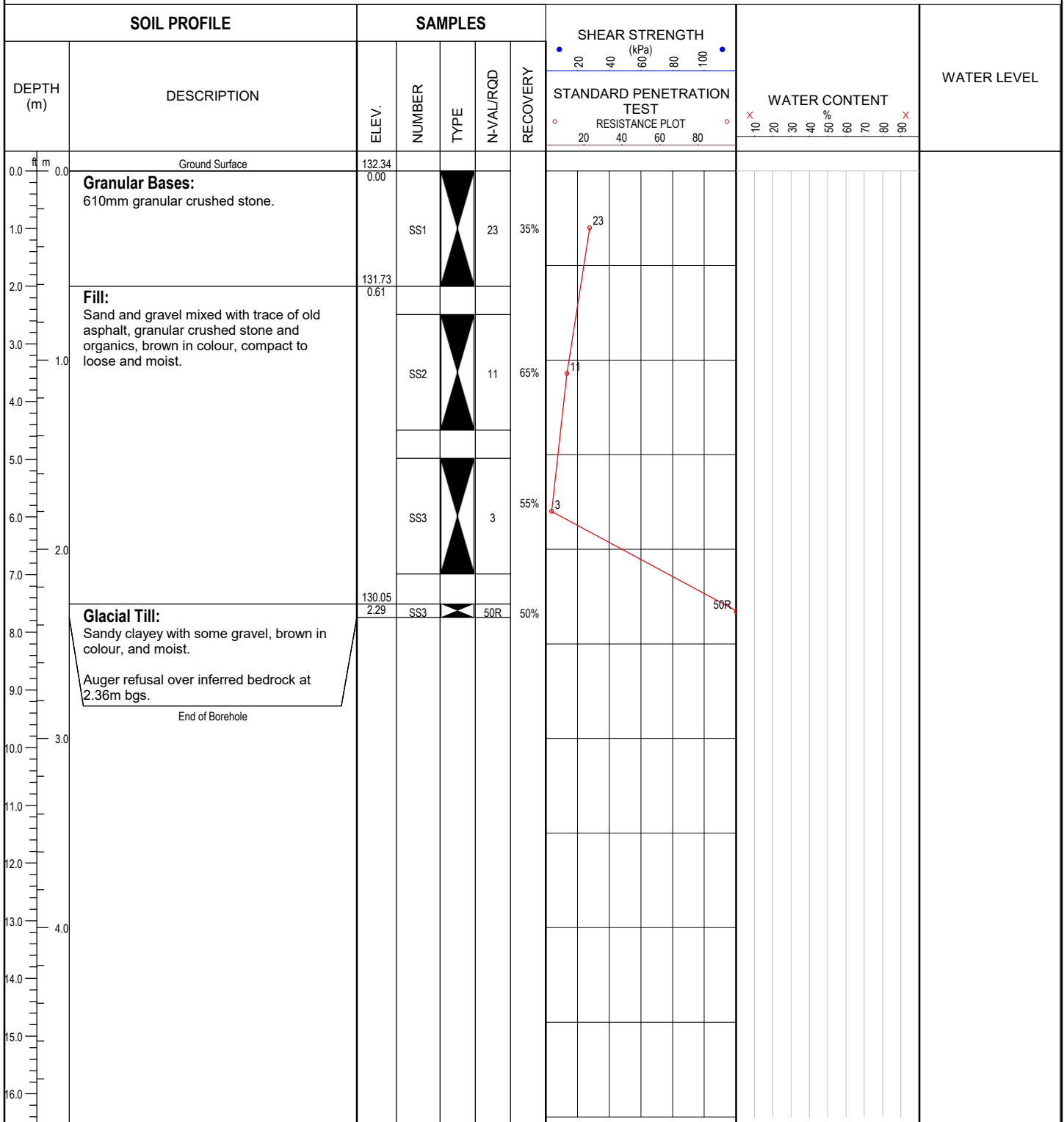
COMMENTS:



PROJECT: Geotechnical Investigation - Lombardy Public School
 CLIENT: WSP Global Inc.
 LOCATION: 596 ON-15, Lombardy, Ontario
 DATE: May 7, 2021

RECORD OF BOREHOLE: P_BH8

PROJECT No.: 210156
 LOGGED BY: S.C.
 DRILLER: George Downing Estate Drilling Ltd
 DRILLING EQUIPMENT: Track-mounted CME55
 DRILLING METHOD: Hollow Stem Auger



Easting: 415264
 Site Datum: Geodetic
 Top of Casing Elev.: NA
 Borehole Diameter: 200mm

Northing: 4965325
 Groundsurface Elev.: 132.34m
 Top of Riser Elev.: NA
 Monitoring Well Diameter: NA

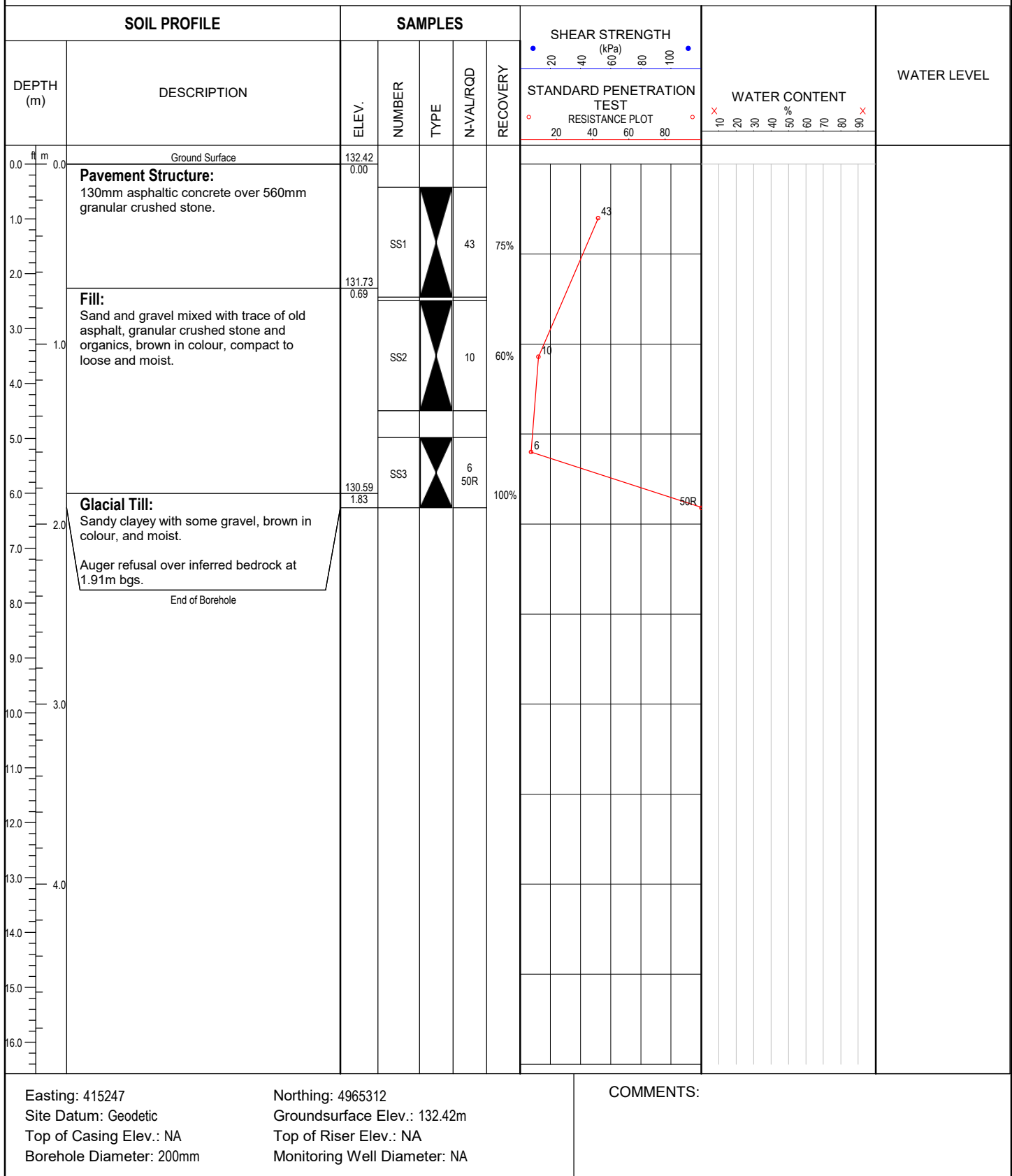
COMMENTS:



PROJECT: Geotechnical Investigation - Lombardy Public School
CLIENT: WSP Global Inc.
LOCATION: 596 ON-15, Lombardy, Ontario
DATE: May 7, 2021

RECORD OF BOREHOLE: P_BH9

PROJECT No.: 210156
LOGGED BY: S.C.
DRILLER: George Downing Estate Drilling Ltd
DRILLING EQUIPMENT: Track-mounted CME55
DRILLING METHOD: Hollow Stem Auger

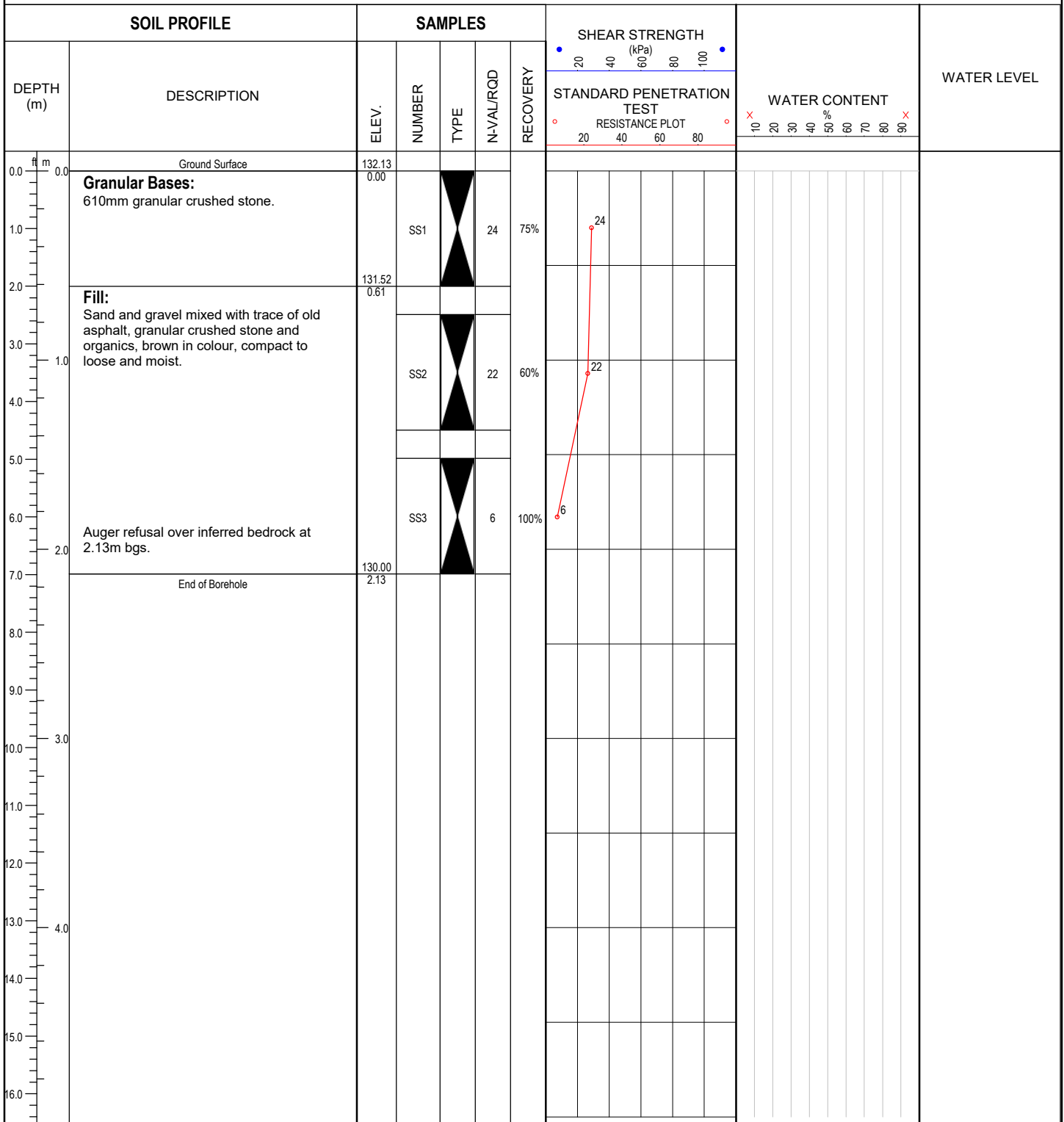




PROJECT: Geotechnical Investigation - Lombardy Public School
 CLIENT: WSP Global Inc.
 LOCATION: 596 ON-15, Lombardy, Ontario
 DATE: May 7, 2021

RECORD OF BOREHOLE: P_BH10

PROJECT No.: 210156
 LOGGED BY: S.C.
 DRILLER: George Downing Estate Drilling Ltd
 DRILLING EQUIPMENT: Track-mounted CME55
 DRILLING METHOD: Hollow Stem Auger



Easting: 415227
 Site Datum: Geodetic
 Top of Casing Elev.: NA
 Borehole Diameter: 200mm

Northing: 4965290
 Groundsurface Elev.: 132.13m
 Top of Riser Elev.: NA
 Monitoring Well Diameter: NA

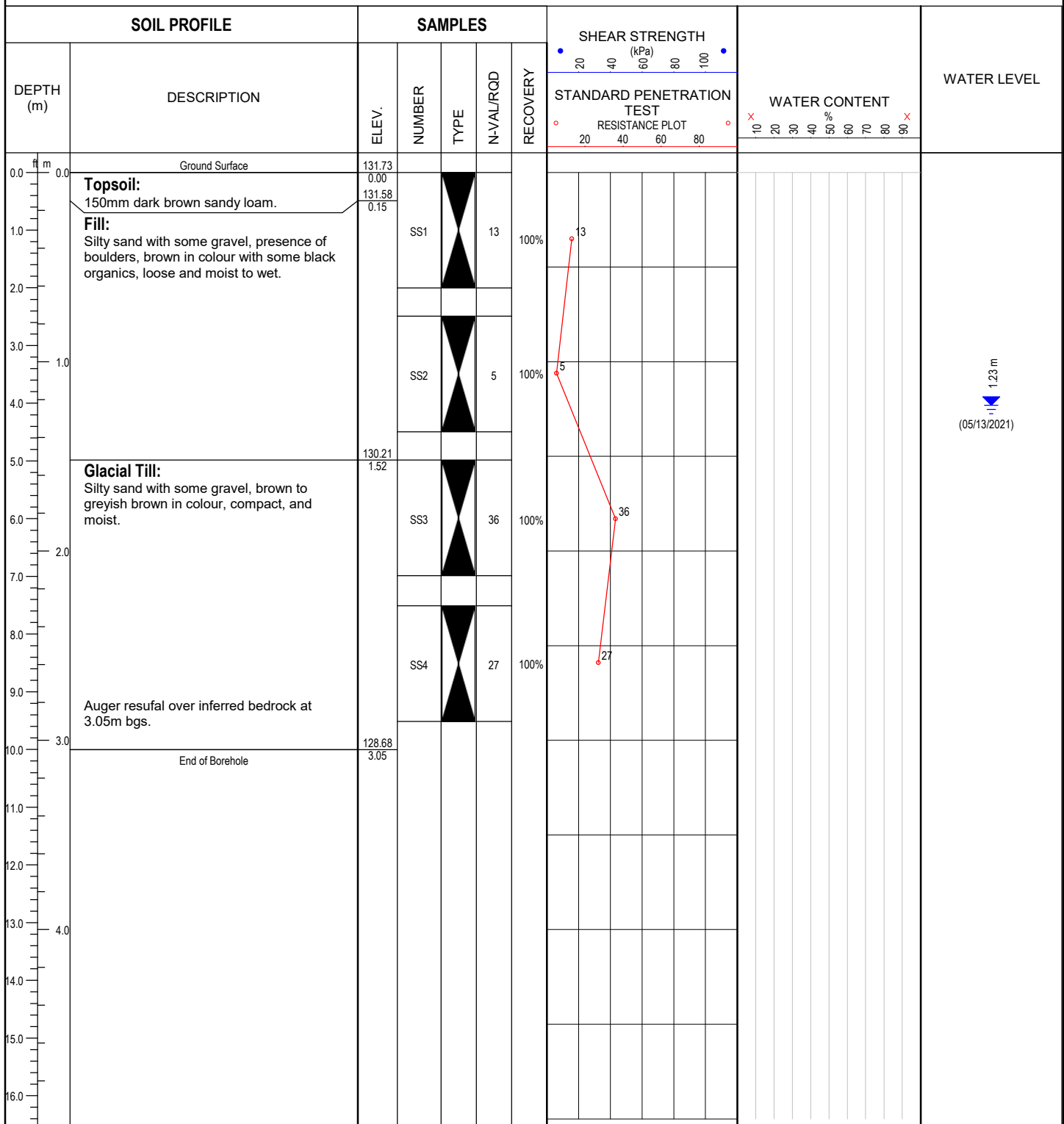
COMMENTS:



PROJECT: Geotechnical Investigation - Lombardy Public School
 CLIENT: WSP Global Inc.
 LOCATION: 596 ON-15, Lombardy, Ontario
 DATE: May 6, 2021

RECORD OF BOREHOLE: P_BH11

PROJECT No.: 210156
 LOGGED BY: S.C.
 DRILLER: George Downing Estate Drilling Ltd
 DRILLING EQUIPMENT: Track-mounted CME55
 DRILLING METHOD: Hollow Stem Auger



Easting: 415185
 Site Datum: Geodetic
 Top of Casing Elev.: NA
 Borehole Diameter: 200mm

Northing: 4965328
 Groundsurface Elev.: 131.73m
 Top of Riser Elev.: NA
 Monitoring Well Diameter: NA

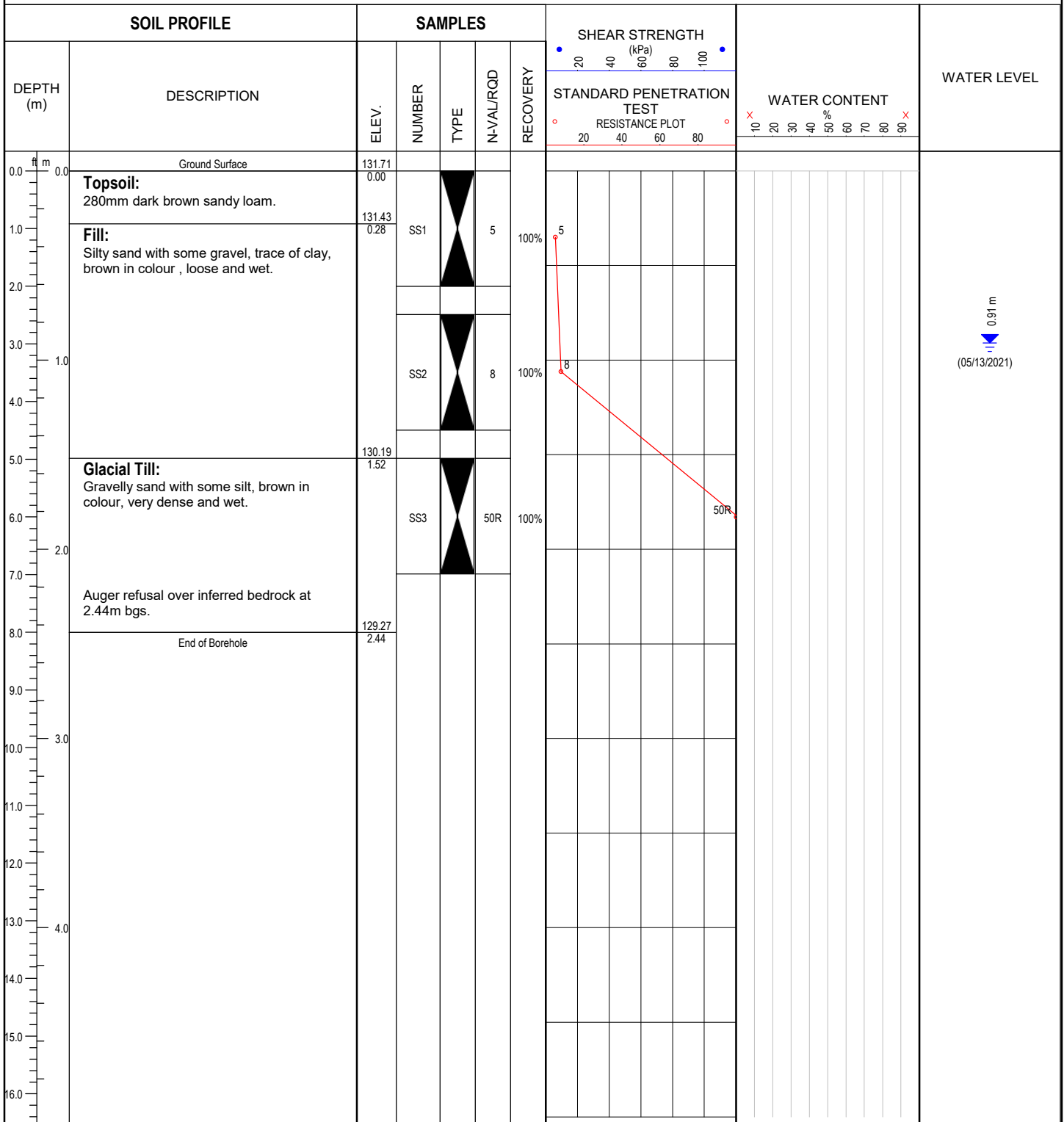
COMMENTS:



PROJECT: Geotechnical Investigation - Lombardy Public School
 CLIENT: WSP Global Inc.
 LOCATION: 596 ON-15, Lombardy, Ontario
 DATE: May 6, 2021

RECORD OF BOREHOLE: P_BH12

PROJECT No.: 210156
 LOGGED BY: S.C.
 DRILLER: George Downing Estate Drilling Ltd
 DRILLING EQUIPMENT: Track-mounted CME55
 DRILLING METHOD: Hollow Stem Auger



0.91 m

 (05/13/2021)

Easting: 415161
 Site Datum: Geodetic
 Top of Casing Elev.: NA
 Borehole Diameter: 200mm

Northing: 4965299
 Groundsurface Elev.: 131.71m
 Top of Riser Elev.: NA
 Monitoring Well Diameter: NA

COMMENTS:



PROJECT: Geotechnical Investigation - Lombardy Public School
 CLIENT: WSP Global Inc.
 LOCATION: 596 ON-15, Lombardy, Ontario
 DATE: May 6, 2021

RECORD OF BOREHOLE: P_BH13

PROJECT No.: 210156
 LOGGED BY: S.C.
 DRILLER: George Downing Estate Drilling Ltd
 DRILLING EQUIPMENT: Track-mounted CME55
 DRILLING METHOD: Hollow Stem Auger

SOIL PROFILE		SAMPLES					SHEAR STRENGTH (kPa)	STANDARD PENETRATION TEST RESISTANCE PLOT	WATER CONTENT %	WATER LEVEL
DEPTH (m)	DESCRIPTION	ELEV.	NUMBER	TYPE	N-VAL/RQD	RECOVERY				
0.0	Ground Surface	131.91								
0.0	Pavement Structure: 65mm asphaltic concrete over 300mm granular crushed stone	0.00								
1.0	Fill: Silty sand mixed with some gravel and granular crushed stones, dark brown in colour, loose, and moist to wet.	131.54	SS1		23	100%		23		
2.0		0.37			10			10		
3.0			SS2		9	100%		9		
4.0										
5.0	Glacial Till: Silty sand with some gravel, compact and very moist.	130.39								
6.0		1.52	SS3		10	100%		10		
7.0	Auger refusal over inferred bedrock at 1.88m bgs.	130.03								
8.0		1.88								
9.0	End of Borehole									
10.0										
11.0										
12.0										
13.0										
14.0										
15.0										
16.0										

Easting: 415123
 Site Datum: Geodetic
 Top of Casing Elev.: NA
 Borehole Diameter: 200mm

Northing: 4965273
 Groundsurface Elev.: 131.91m
 Top of Riser Elev.: NA
 Monitoring Well Diameter: NA

COMMENTS:



PROJECT: Geotechnical Investigation - Lombardy Public School
 CLIENT: WSP Global Inc.
 LOCATION: 596 ON-15, Lombardy, Ontario
 DATE: May 6, 2021

RECORD OF BOREHOLE: P_BH14

PROJECT No.: 210156
 LOGGED BY: S.C.
 DRILLER: George Downing Estate Drilling Ltd
 DRILLING EQUIPMENT: Track-mounted CME55
 DRILLING METHOD: Hollow Stem Auger

SOIL PROFILE		SAMPLES					SHEAR STRENGTH (kPa)	STANDARD PENETRATION TEST RESISTANCE PLOT	WATER CONTENT %	WATER LEVEL
DEPTH (m)	DESCRIPTION	ELEV.	NUMBER	TYPE	N-VAL/RQD	RECOVERY				
0.0	Ground Surface	131.87								
0.0	Pavement Structure: 60mm asphaltic concrete over 300mm granular crushed stone	0.00								
1.0	Fill: Silty sand with some gravel, brown in colour, loose, and moist.	131.51	SS1		16	60%	9			
2.0		0.36								
3.0	Glacial Till: Silty sand with some gravel, greyish brown in colour, compact to very dense, and moist to very moist.	131.11	SS2		13	90%	13			
4.0		0.76								
5.0										
6.0			SS3		40	100%	40			
7.0										
8.0										
9.0			SS4		53	100%	53			
10.0	Auger refusal over inferred bedrock at 2.90m bgs.	128.97								
11.0		2.90								
12.0	End of Borehole									
13.0										
14.0										
15.0										
16.0										

Easting: 415092
 Site Datum: Geodetic
 Top of Casing Elev.: NA
 Borehole Diameter: 200mm

Northing: 4965246
 Groundsurface Elev.: 131.87m
 Top of Riser Elev.: NA
 Monitoring Well Diameter: NA

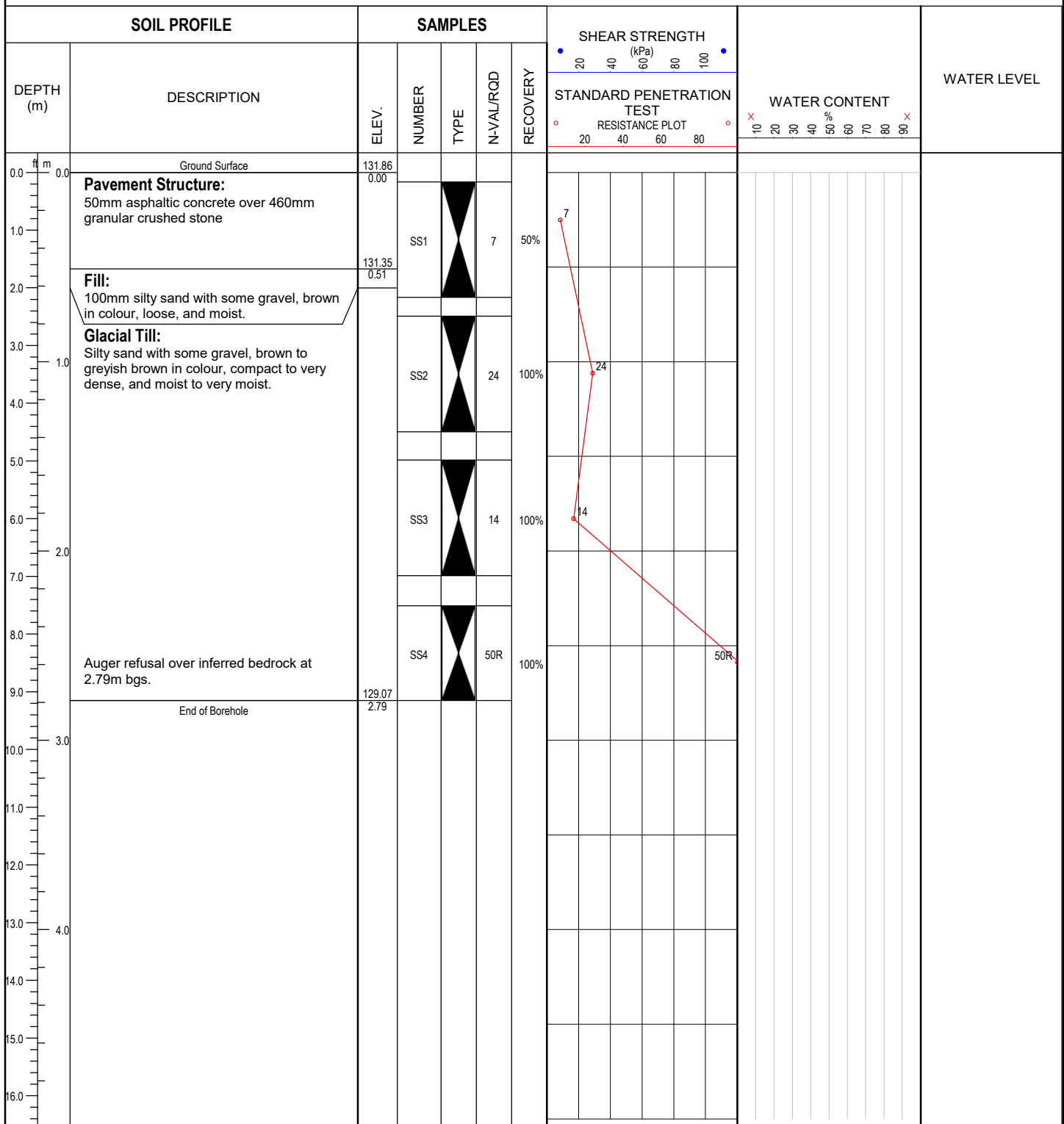
COMMENTS:



PROJECT: Geotechnical Investigation - Lombardy Public School
CLIENT: WSP Global Inc.
LOCATION: 596 ON-15, Lombardy, Ontario
DATE: May 6, 2021

RECORD OF BOREHOLE: P_BH15

PROJECT No.: 210156
LOGGED BY: S.C.
DRILLER: George Downing Estate Drilling Ltd
DRILLING EQUIPMENT: Track-mounted CME55
DRILLING METHOD: Hollow Stem Auger



Easting: 415092
Site Datum: Geodetic
Top of Casing Elev.: NA
Borehole Diameter: 200mm

Northing: 4965218
Groundsurface Elev.: 131.86m
Top of Riser Elev.: NA
Monitoring Well Diameter: NA

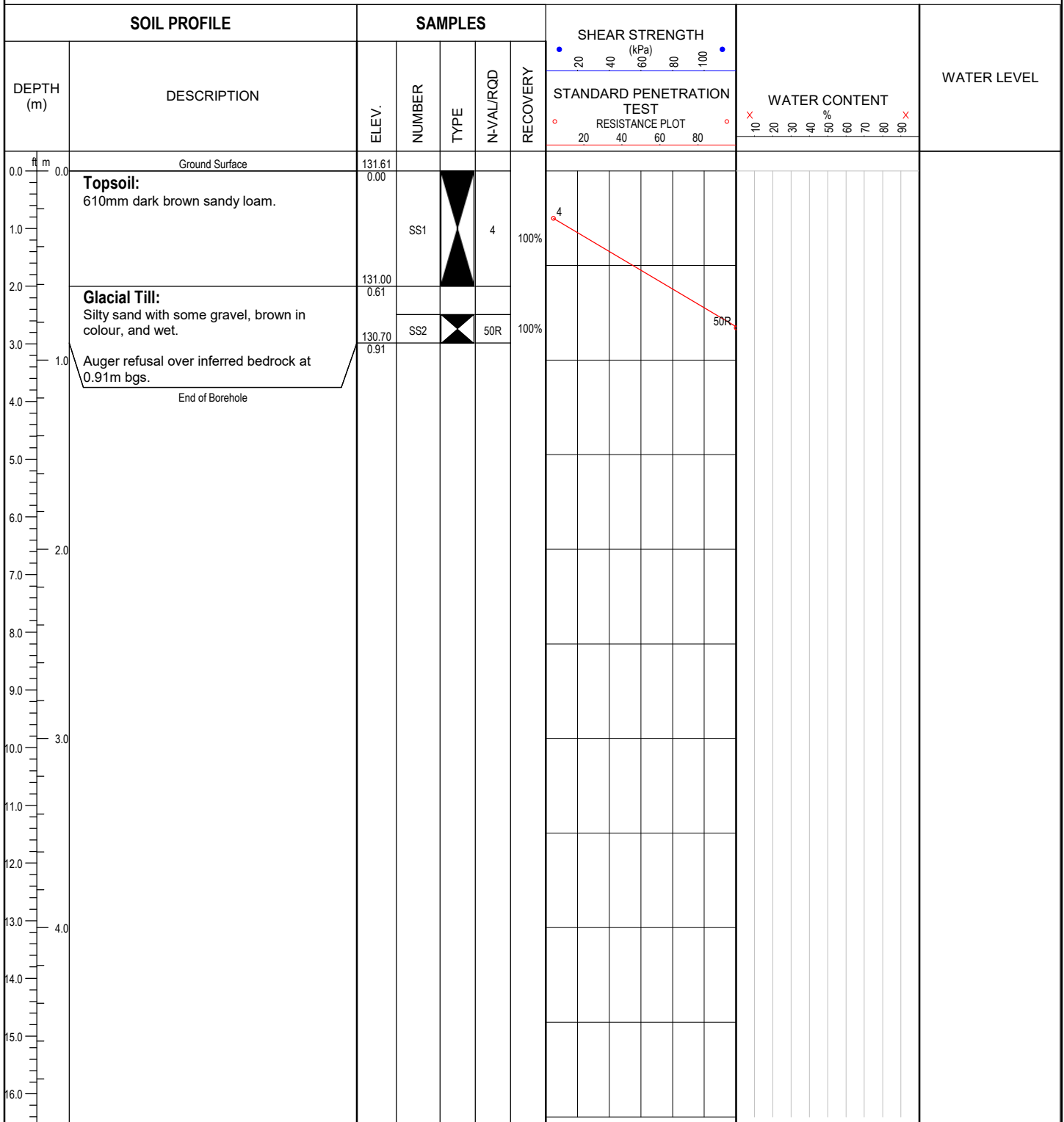
COMMENTS:



PROJECT: Geotechnical Investigation - Lombardy Public School
 CLIENT: WSP Global Inc.
 LOCATION: 596 ON-15, Lombardy, Ontario
 DATE: May 6, 2021

RECORD OF BOREHOLE: P_BH16

PROJECT No.: 210156
 LOGGED BY: S.C.
 DRILLER: George Downing Estate Drilling Ltd
 DRILLING EQUIPMENT: Track-mounted CME55
 DRILLING METHOD: Hollow Stem Auger



Easting: 415106
 Site Datum: Geodetic
 Top of Casing Elev.: NA
 Borehole Diameter: 200mm

Northing: 4965325
 Groundsurface Elev.: 131.61m
 Top of Riser Elev.: NA
 Monitoring Well Diameter: NA

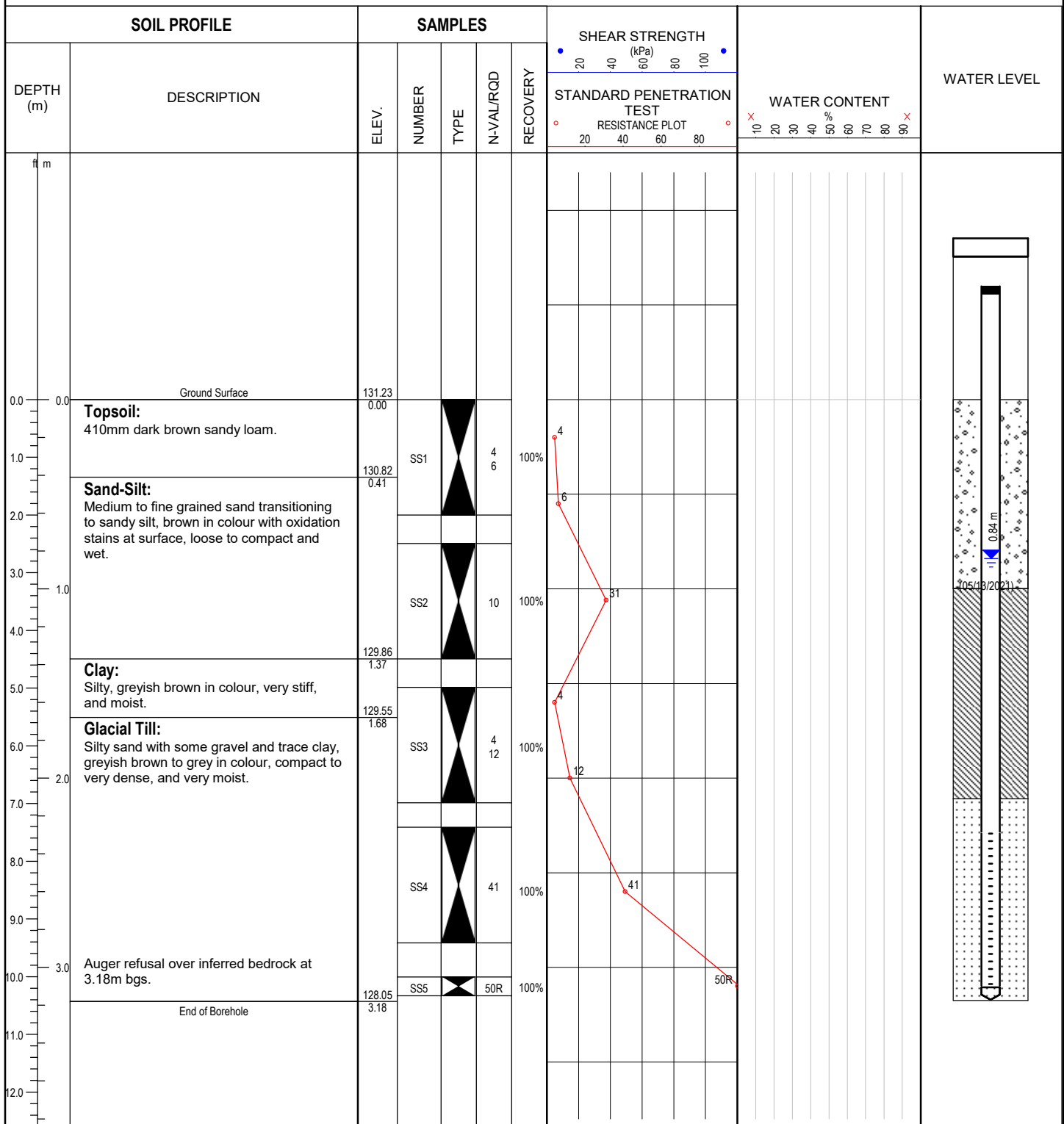
COMMENTS:



PROJECT: Geotechnical Investigation - Lombardy Public School
 CLIENT: WSP Global Inc.
 LOCATION: 596 ON-15, Lombardy, Ontario
 DATE: May 6, 2021

RECORD OF BOREHOLE: P_BHMW1

PROJECT No.: 210156
 LOGGED BY: S.C.
 DRILLER: George Downing Estate Drilling Ltd
 DRILLING EQUIPMENT: Track-mounted CME55
 DRILLING METHOD: Hollow Stem Auger



Easting: 415020
 Site Datum: Geodetic
 Top of Casing Elev.: 132.38m
 Borehole Diameter: 200mm

Northing: 4965321
 Groundsurface Elev.: 131.23m
 Top of Riser Elev.: NA
 Monitoring Well Diameter: 50mm

COMMENTS:



PROJECT: Geotechnical Investigation - Lombardy Public School
 CLIENT: WSP Global Inc.
 LOCATION: 596 ON-15, Lombardy, Ontario
 DATE: May 6, 2021

RECORD OF BOREHOLE: P_BHMW2

PROJECT No.: 210156
 LOGGED BY: S.C.
 DRILLER: George Downing Estate Drilling Ltd
 DRILLING EQUIPMENT: Track-mounted CME55
 DRILLING METHOD: Hollow Stem Auger

SOIL PROFILE		SAMPLES					SHEAR STRENGTH		WATER CONTENT	WATER LEVEL
DEPTH (m)	DESCRIPTION	ELEV.	NUMBER	TYPE	N-VAL/RQD	RECOVERY	20	40		
0.0	Ground Surface	131.99								
0.0	Topsoil: 180mm dark brown sandy loam.	131.81								
0.18	Sand: Medium to fine grained sand, brown in colour, loose and moist.	131.81	SS1		8	100%	8			
0.76	Glacial Till: Silty sand with some gravel and trace clay, drak brown in colour, loose, and wet.	131.23								
1.0		0.76	SS2		6	50%	6			
1.47	Auger refusal over inferred bedrock at 1.47m bgs.	130.52								
1.47	End of Borehole	1.47								
2.0										
3.0										
4.0										
5.0										
6.0										
7.0										
8.0										
9.0										
10.0										
11.0										
12.0										
13.0										
14.0										
15.0										
16.0										

Easting: 415044
 Site Datum: Geodetic
 Top of Casing Elev.: NA
 Borehole Diameter: 200mm

Northing: 4965389
 Groundsurface Elev.: 131.99m
 Top of Riser Elev.: NA
 Monitoring Well Diameter: NA

COMMENTS:

0.76 m
 (05/13/2021)



PROJECT: Geotechnical Investigation - Lombardy Public School
 CLIENT: WSP Global Inc.
 LOCATION: 596 ON-15, Lombardy, Ontario
 DATE: May 6, 2021

RECORD OF BOREHOLE: P_BHWM3

PROJECT No.: 210156
 LOGGED BY: S.C.
 DRILLER: George Downing Estate Drilling Ltd
 DRILLING EQUIPMENT: Track-mounted CME55
 DRILLING METHOD: Hollow Stem Auger

SOIL PROFILE		SAMPLES					SHEAR STRENGTH		WATER CONTENT	WATER LEVEL
DEPTH (m)	DESCRIPTION	ELEV.	NUMBER	TYPE	N-VAL/RQD	RECOVERY	STANDARD PENETRATION TEST	RESISTANCE PLOT		
0.0	Ground Surface	131.54								
0.0	Topsoil: 510mm dark brown sandy loam.	0.00								
1.0			SS1		3	100%				
2.0	Sand: Medium grained, brown in colour, and moist.	131.03								
2.0		0.51								
3.0	Glacial Till: Silty sand with some clay and trace gravel, greyish brown in colour and wet.	130.73								
3.0		0.81	SS2		50R	100%				
4.0	Auger refusal over inferred bedrock at 1.40m bgs.									
4.0		130.14								
5.0	End of Borehole	1.40								
6.0										
7.0										
8.0										
9.0										
10.0										
11.0										
12.0										
13.0										
14.0										
15.0										
16.0										

Easting: 415047
 Site Datum: Geodetic
 Top of Casing Elev.: NA
 Borehole Diameter: 200mm

Northing: 4965348
 Groundsurface Elev.: 131.54m
 Top of Riser Elev.: NA
 Monitoring Well Diameter: NA

COMMENTS:

0.8 m

 (05/13/2021)



PROJECT: Geotechnical Investigation - Lombardy Public School
CLIENT: WSP Global Inc.
LOCATION: 596 ON-15, Lombardy, Ontario
DATE: May 6, 2021

RECORD OF BOREHOLE: P_BHMW4

PROJECT No.: 210156
LOGGED BY: S.C.
DRILLER: George Downing Estate Drilling Ltd
DRILLING EQUIPMENT: Track-mounted CME55
DRILLING METHOD: Hollow Stem Auger

SOIL PROFILE		SAMPLES								
DEPTH (m)	DESCRIPTION	ELEV.	NUMBER	TYPE	N-VAL/RQD	RECOVERY	SHEAR STRENGTH (kPa)	WATER CONTENT		WATER LEVEL
							STANDARD PENETRATION TEST RESISTANCE PLOT			
									%	
0.0	Ground Surface	131.67								
0.0	Topsoil: 200mm dark brown sandy loam.	0.00								
1.0	Sand-Silt: Sand and silt mixed with some clay. brown to grey, and moist to wet. Note: No sample was collected.	131.47								
2.0		0.20								
3.0										
4.0										
5.0										
6.0										
7.0		129.54								
8.0	Glacial Till: Silty sand till with some gravel and trace clay, grey in colour, dense to very dense, and very moist. Note: No sample was collected.	2.13								
9.0										
10.0	Auger refusal over inferred bedrock at 3.20m bgs.									
11.0	End of Borehole	128.47								
12.0		3.20								

Easting: 415011
Site Datum: Geodetic
Top of Casing Elev.: 132.71m
Borehole Diameter: 200mm

Northing: 4965287
 Groundsurface Elev.: 131.57m
 Top of Riser Elev.: NA
 Monitoring Well Diameter: 50mm

COMMENTS:

All measurements recorded in: ☒ Metric ☐ Imperial

Follow instructions on the front and back of this form. Print or Type

Well Tag No. of Deepest Well: (Print Well Tag No.)

A198827

Well No. on Drawing of Deepest Well:

MW4

☐ Dewatering wells

☒ Test holes

No. of wells reported 2

Page 1 of 1

Well Cluster Location Information

Address of Well Location (Street Number(s)/Name(s), RR, if available)		Lot(s)	Concession(s)	Geographic Township	County/District/Upper Tier Municipality
596 ON-15/LOMBARDY HIGH SCHOOL					LEEDS + GRENVILLE/RIDEAU/LAKES
City, Town, Village or Hamlet		Province	GPS Unit Make	Model	Unit Mode of Operation
LOMBARDY		Ontario	GARMIN	ETREX	<input type="checkbox"/> Undifferentiated <input checked="" type="checkbox"/> Averaged
<input type="checkbox"/> Differentiated, specify: _____					

Mandatory Attachments/Additional Information

- ☒ Land Owner Consent Form must be attached.
☒ Detailed Drawing of All Well Locations must be attached.
I, the person constructing the well, will promptly submit to the Director, on request, any additional information in my custody or control related to any well in the well cluster that I have constructed.

Signature of Technician/Contractor

2021/06/04

Date (yyyy/mm/dd)

Well Details

Well # on Drawing	UTM Coordinates				Hole Depth (m/ft)	Hole Diameter (cm/in)	Method of Construction	Casing Material; Diameter (cm/in)	Casing (m/ft)		Screen Interval (m/ft)		Annular Space Material (m/ft)			Overburden/Bedrock or Abandonment Filing Material Intervals (m/ft)	Static Water Level (m/ft)	Date of Completion (yyyy/mm/dd)
	Zone	Easting	Northing						From	To	From	To	From	To	Material:			
MW1	18	415020	4965325		3.05	20.3	HSA	5.08	0	2.13	2.13	3.05	1.83	1.83	BENTONITE	TILL	0.84	2021/05/06
MW4	18	415011	4965290		3.05	20.3	HSA	5.08	0	1.52	1.52	3.05	0	1.2	BENTONITE	TILL	1.18	2021/05/06

Well Contractor and Well Technician Information

Business Name of Well Contractor		Business Address (Street Number/Name, RR)		Municipality	Province
GEORGE DOWNING ESTATE DRILLING LTD		410 RUE PRINCIPALE		GRENVILLE-SUR-LA-ROUGE	QC
Postal Code	Bus. Telephone No.	Well Contractor's Licence No.	Business E-mail Address		
J1B1B1	(819) 242-6469	1844	info@foragedowningdrilling.com		
Name of Well Technician (First Name, Last Name)		Well Technician's Licence No.	Signature of Well Technician		Date Submitted (yyyy/mm/dd)
STEPHEN DOWNING		3326			2021/06/04

Date First Well in Cluster Constructed or Abandoned (yyyy/mm/dd)

2021/05/06

Date Last Well in Cluster Completed (yyyy/mm/dd)

2021/05/06

Ministry Use Only

Date Received (yyyy/mm/dd)

Audit No.

C 52849

Well Abandonment

Person Abandoning the Wells:

Name N/A

(Print or Type) - See instruction 11 on the back of this form

Comments:

PERMISSION TO FILE A WELL CLUSTER RECORD

leave with onsite technician, for clusters only

Our firm was recently contracted to either install or abandon groundwater monitoring wells at your property. When this type of well is installed or abandoned, provincial law requires us to file a well record with the Ministry of Environment.

The well record does not provide any information about your property use, your business, or information about the structural or environmental qualities of your property. The purpose of the record is simply to inform the Ministry that a well exists at this location, and provide details illustrating that the well has been properly constructed or decommissioned.

We can file a single record for each well, but it is more economical to file one record for the entire cluster of wells. In order to file this "cluster record", we are required to obtain written permission from the owner of the land. [Ref: Reg 903 16.4(1)4]

It would be greatly appreciated if you would sign and return the following, so that we can comply with the legislation and file the well record. Scanned, emailed or faxed copies are acceptable.

I hereby authorize George Downing Estate Drilling / Eastern Ontario Diamond Drilling to file a cluster of wells installed at the address below

Well Location Information

Street Address : 596 Highway 15
(if no address) Lot & Concession : NA
County/District/Municipality : Leeds & Grenville/Rideau Lakes
City/Town/Village : Lombardy, Ontario
Postal Code : K0G 1L0
Well Tag Number : A198827 Number of Wells : 2
Audit No. : C52849 Wells : MW1, MW4

Property Owners's Information

Company Name (if applicable): Upper Canada District School Board
Name: Peter Bosch
Mailing Address: 225 Central Avenue West
Brockville, ON, K6V 5X1
Email Address : peter.bosch@ucdsb.on.ca
Phone Number : 613-349-9808

Signature : Peter Bosch

Digitally signed by Peter Bosch
Date: 2021.05.21 06:24:24 -04'00'

This form is to be completed by the person who constructs or abandons test holes or dewatering wells that form all or part of a well cluster. If this form is being used to report any well abandonment, these wells must have been previously reported as part of a single well cluster.

Note: For well cluster records, only the owners of the land on which the wells are situated are to give written consent. If the well purchaser (e.g. a consultant who hires the driller) is not the owner of the land, then the well purchaser cannot sign the consent form.

By signing this form, land owners are providing consent to use one well record to report a well cluster of test holes or dewatering wells in accordance with section 16.4 of Regulation 903 made under the *Ontario Water Resources Act*.

This completed **Well Record for Well Cluster Part 2 - Land Owner Consent** must be attached to Parts 1 and 3.

* Please PRINT if completing by hand.

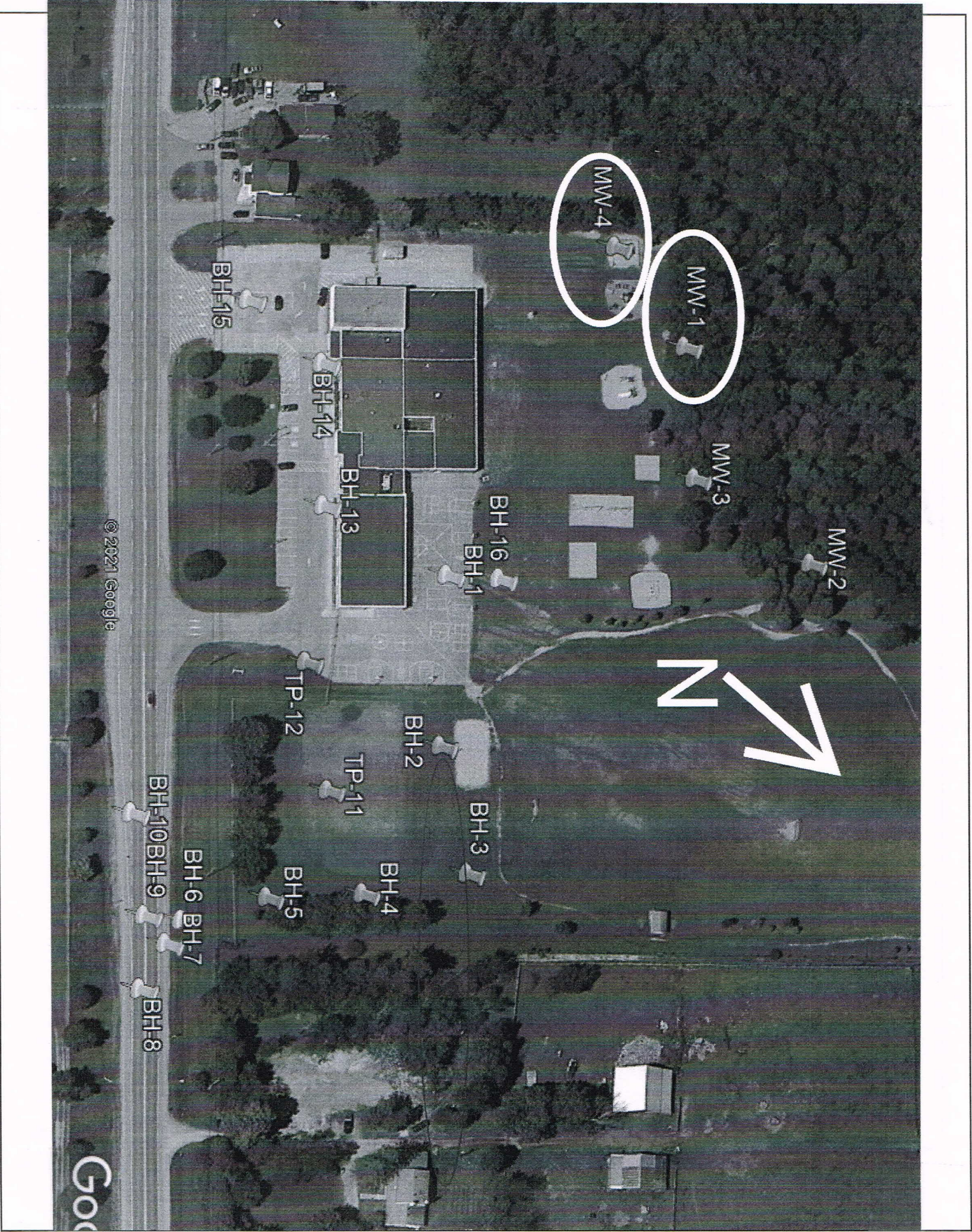
Well Tag Number: # A198827

"Well Record for Well Cluster" Audit Number: # C52849

[illegible]

Note: This Well Record for Well Cluster Part 3 - Detailed Drawing of all Well Locations, must be attached to Parts 1 and 2. The drawing must include all property boundaries, an arrow indicating the North direction, all named roads and sufficient measurements to locate all wells in the cluster in relation to fixed points. The drawing must show the location of each well and each well must be numbered on the drawing to match number used for that well on the Well Record for Well Cluster Parts 1 and 2. The well with the well tag must be clearly identified on the Drawing.
UTM coordinates should appear beside each well, if space permits. Additional comments on wells can be included on the drawing

Well Tag Number: # A198 827
"Well Record for Well Cluster" Form Audit Number: # C52849

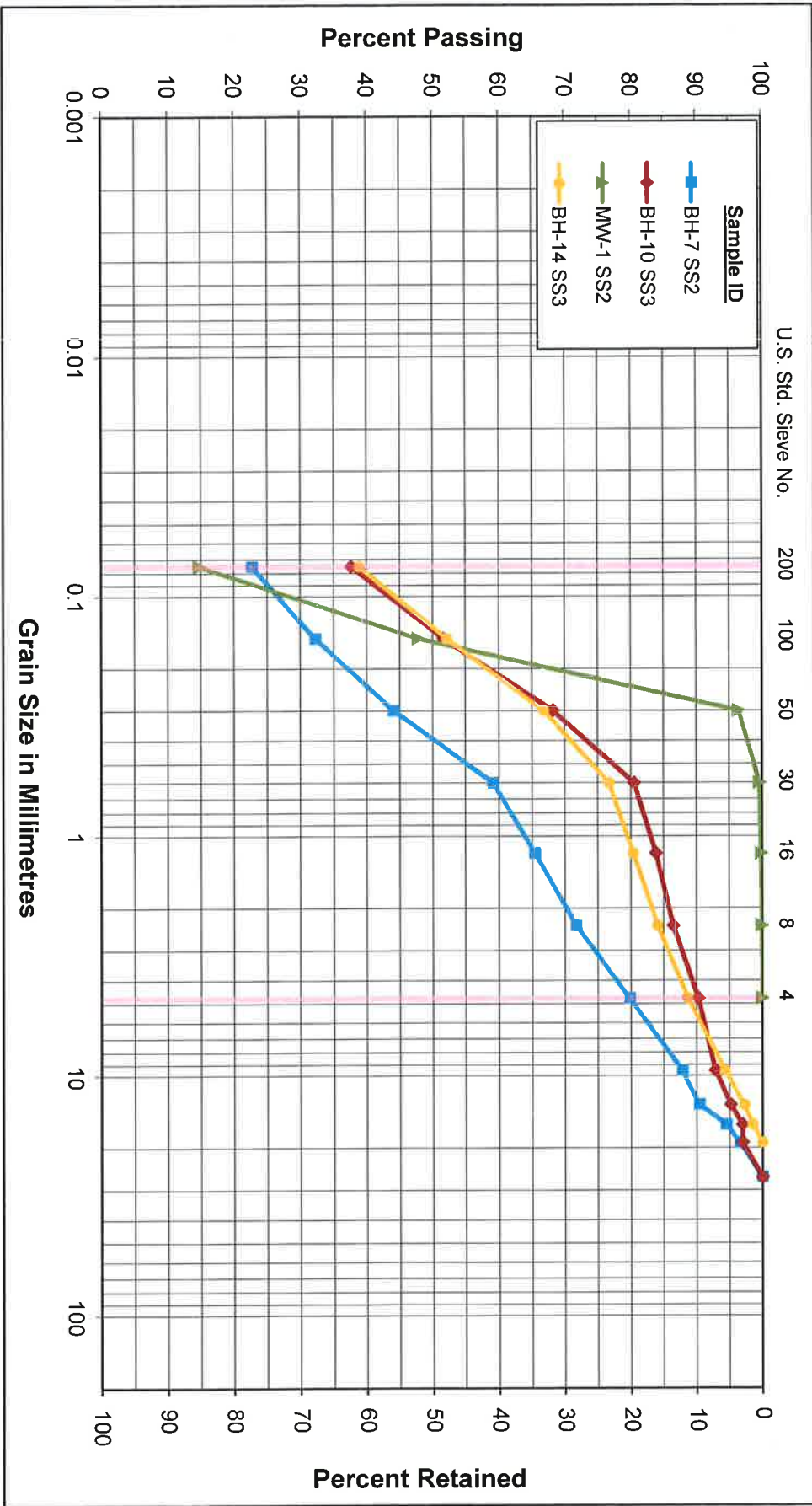


Appendix C

Laboratory Reports

Unified Soil Classification System

SAND			Gravel		
CLAY & SILT	Fine	Medium	Coarse	Fine	Coarse



GRAIN SIZE DISTRIBUTION

Lascelles Engineering Associates, File # 210156

Lombardy Public School

Figure No.

Project No. 121621867

**Stantec**2781 Lancaster Road
Ottawa ON, K1B 1A7**Sieve Analysis**

LS 602

ASTM C136

Client: **Lascalles Engineering Associates, File # 210156**
 Project: **Lombardy Public School**
 Material Type: **Soils / Aggregates:**
 Proposed Use: **Fill/Granulars**
 Source: **BH-7**
 Sample Number: **SS2**
 Sampled Depth: **3.5'**
 Sampled By: **Lascalles Engineering Associates**
 Date Sampled: **May 6, 2021**

Project Number: **121621867**

Tested By: **Denis Rodriguez**
 Date Tested: **May 20, 2021**

Sieve Test Data			Wash Test Data				
Sample Weight Before Sieve, (g):		733.1	Sample Weight Before Wash, (g):		293.0	Corrected	
Sample Weight After Sieve, (g):		732.3	Sample Weight After Wash, (g):		218.2		
Percent Loss In Sieve, (%):		0.11	Percent Passing No. 200, (%):		25.5	20.4	
Sieve Analysis							
Sieve No.	Size of Opening		Weight Retained g	Cumulative Weight Retained g	Percent Passing %	No Envelope	
	Inches	mm				Minimum	Maximum
	6	150					
	4	106					
	3	76.2					
	2	53.0					
	1.5	37.5					
	1	26.5	0.0	0.0	100.0		
	3/4	19.0	24.6	24.6	96.6		
	5/8	16.0	16.0	40.6	94.5		
	1/2	13.2	29.7	70.3	90.4		
	3/8	9.5	18.6	88.9	87.9		
+4	0.187	4.75	58.7	147.6	79.9		
		- 4.75	584.7	732.3			
8	0.0937	2.36		29.8	71.7		
16	0.0469	1.18		52.9	65.4		
30	0.234	0.600		76.0	59.2		
50	0.0117	0.300		131.2	44.1		
100	0.0059	0.150		174.6	32.3		
200	0.0029	0.075		209.6	22.7		
		Pan		217.8			
Classification of Sample:			% Gravel:	20.1	% Sand:	57.1	% Silt & Clay: 22.7



Remarks:

Reviewed By:

*Brian P. ...*Date: **May 25, 2021**

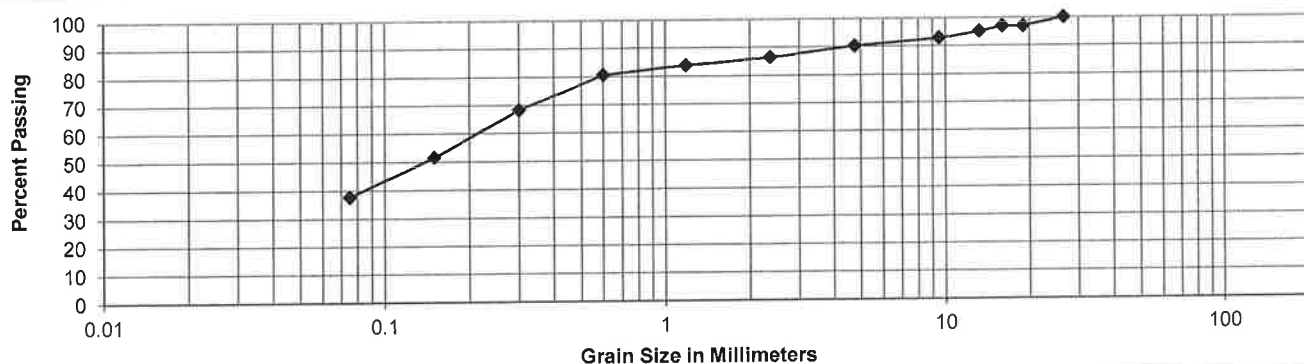
**Stantec**2781 Lancaster Road
Ottawa ON, K1B 1A7**Sieve Analysis****LS 602****ASTM C136**

Client: **Lascelles Engineering Associates, File # 210156**
 Project: **Lombardy Public School**
 Material Type: **Soils / Aggregates:**
 Proposed Use: **Fill/Granulars**
 Source: **BH-10**
 Sample Number: **SS3**
 Sampled Depth: **6'**
 Sampled By: **Lascelles Engineering Associates**
 Date Sampled: **May 6, 2021**

Project Number: **121621867**

Tested By: **Denis Rodriguez**
 Date Tested: **May 20, 2021**

Sieve Test Data			Wash Test Data					
Sample Weight Before Sieve, (g):		939.4	Sample Weight Before Wash, (g):		257.1	Corrected		
Sample Weight After Sieve, (g):		938.4	Sample Weight After Wash, (g):		157.5			
Percent Loss In Sieve, (%):		0.11	Percent Passing No. 200, (%):		38.7	35.0		
Sieve Analysis								
Sieve No.	Size of Opening		Weight Retained g	Cumulative Weight Retained g	Percent Passing %	No Envelope		
	Inches	mm				Minimum	Maximum	
	6	150						
	4	106						
	3	76.2						
	2	53.0						
	1.5	37.5						
	1	26.5	0.0	0.0	100.0			
	3/4	19.0	28.1	28.1	97.0			
	5/8	16.0	0.0	28.1	97.0			
	1/2	13.2	16.9	45.0	95.2			
	3/8	9.5	22.2	67.2	92.8			
+4	0.187	4.75	23.9	91.1	90.3			
		- 4.75	847.3	938.4				
8	0.0937	2.36		10.9	86.5			
16	0.0469	1.18		18.3	83.9			
30	0.234	0.600		27.8	80.5			
50	0.0117	0.300		62.9	68.2			
100	0.0059	0.150		110.0	51.7			
200	0.0029	0.075		149.8	37.7			
		Pan		157.1				
Classification of Sample:			% Gravel:	9.7	% Sand:	52.6	% Silt & Clay:	37.7



Remarks:

Reviewed By:

Brian Proulx

Date:

May 25, 2021

**Stantec**2781 Lancaster Road
Ottawa ON, K1B 1A7**Sieve Analysis**

LS 602

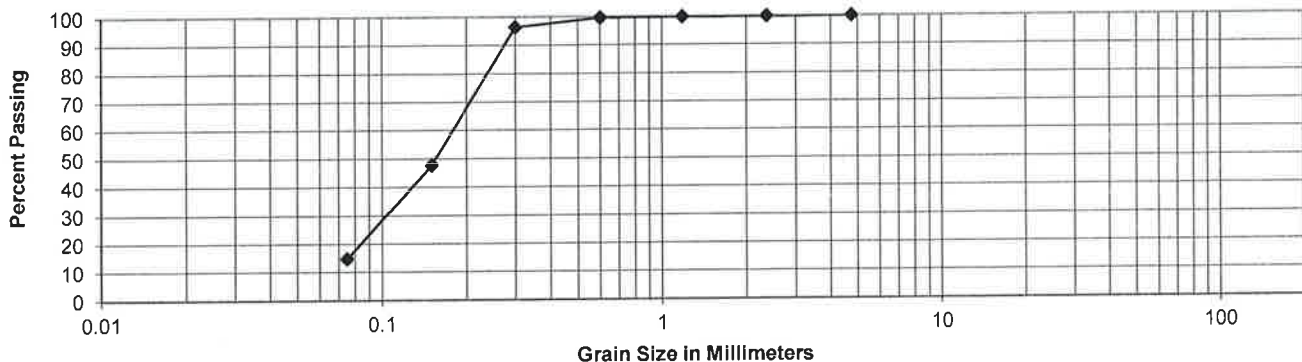
ASTM C136

Client: **Lascelles Engineering Associates, File # 210156**
 Project: **Lombardy Public School**
 Material Type: **Soils / Aggregates:**
 Proposed Use: **Fill/Granulars**
 Source: **MW-1**
 Sample Number: **SS2**
 Sampled Depth: **3.5'**
 Sampled By: **Lascelles Engineering Associates**
 Date Sampled: **May 5, 2021**

Project Number: **121621867**

Tested By: **Denis Rodriguez**
 Date Tested: **May 20, 2021**

Sieve Test Data			Wash Test Data					
Sample Weight Before Sieve, (g):		465.4	Sample Weight Before Wash, (g):		261.9	Corrected		
Sample Weight After Sieve, (g):		465.4	Sample Weight After Wash, (g):		238.0			
Percent Loss In Sieve, (%):		0.00	Percent Passing No. 200, (%):		9.1	9.1		
Sieve Analysis								
Sieve No.	Size of Opening		Weight Retained g	Cumulative Weight Retained g	Percent Passing %	No Envelope		
	Inches	mm				Minimum	Maximum	
	6	150						
	4	106						
	3	76.2						
	2	53.0						
	1.5	37.5						
	1	26.5						
	3/4	19.0						
	5/8	16.0						
	1/2	13.2						
	3/8	9.5						
+4	0.187	4.75	0.0	0.0	100.0			
		- 4.75	465.4	465.4				
8	0.0937	2.36		0.1	100.0			
16	0.0469	1.18		0.4	99.8			
30	0.234	0.600		1.0	99.6			
50	0.0117	0.300		9.4	96.4			
100	0.0059	0.150		136.5	47.9			
200	0.0029	0.075		223.2	14.8			
		Pan		237.9				
Classification of Sample:			% Gravel:	0.0	% Sand:	85.2	% Silt & Clay:	14.8



Remarks:

Reviewed By:

Brian Prewitt

Date: May 25, 2021

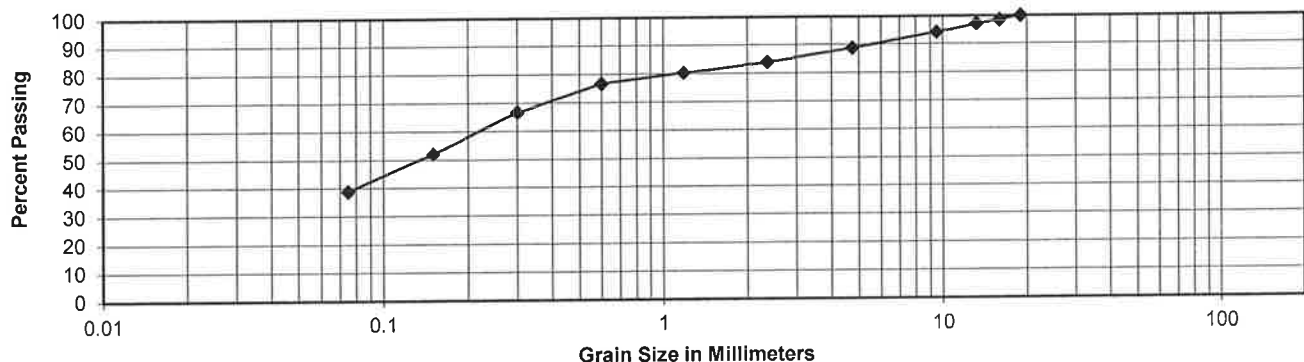
**Stantec**2781 Lancaster Road
Ottawa ON, K1B 1A7**Sieve Analysis****LS 602****ASTM C136**

Client: **Lascelles Engineering Associates, File # 210156**
 Project: **Lombardy Public School**
 Material Type: **Soils / Aggregates:**
 Proposed Use: **Fill/Granulars**
 Source: **BH-14**
 Sample Number: **SS3**
 Sampled Depth: **6'**
 Sampled By: **Lascelles Engineering Associates**
 Date Sampled: **May 5, 2021**

Project Number: **121621867**

Tested By: **Denis Rodriguez**
 Date Tested: **May 20, 2021**

Sieve Test Data				Wash Test Data				
Sample Weight Before Sieve, (g):		849.2		Sample Weight Before Wash, (g):		250.6		
Sample Weight After Sieve, (g):		848.4		Sample Weight After Wash, (g):		152.3		
Percent Loss In Sieve, (%):		0.09		Percent Passing No. 200, (%):		39.2		
						34.8		
Sieve Analysis								
Sieve No.	Size of Opening		Weight Retained g	Cumulative Weight Retained g	Percent Passing %	No Envelope		
	Inches	mm				Minimum	Maximum	
	6	150						
	4	106						
	3	76.2						
	2	53.0						
	1.5	37.5						
	1	26.5						
	3/4	19.0	0.0	0.0	100.0			
	5/8	16.0	12.5	12.5	98.5			
	1/2	13.2	10.9	23.4	97.2			
	3/8	9.5	25.0	48.4	94.3			
+4	0.187	4.75	47.4	95.8	88.7			
		- 4.75	752.6	848.4				
8	0.0937	2.36		13.1	84.1			
16	0.0469	1.18		23.6	80.4			
30	0.234	0.600		34.0	76.7			
50	0.0117	0.300		62.0	66.8			
100	0.0059	0.150		103.2	52.2			
200	0.0029	0.075		140.8	38.9			
		Pan		151.9				
Classification of Sample:			% Gravel:	11.3	% Sand:	49.8	% Silt & Clay:	38.9



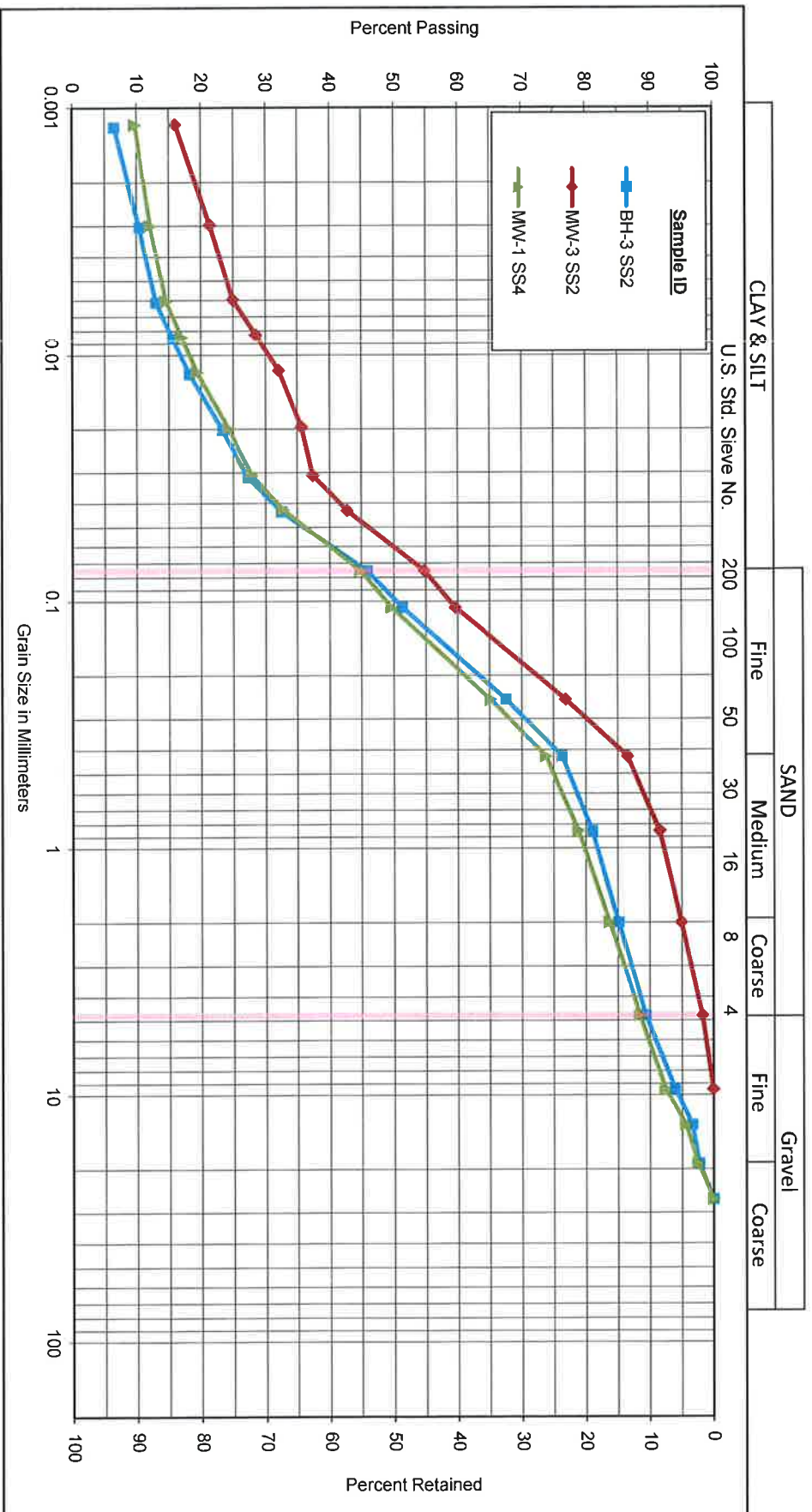
Remarks:

Reviewed By:

Brian Prewett

Date: May 25, 2021

Unified Soil Classification System



Sample ID	Depth	% Gravel	% Sand	% Silt	% Clay
BH-3 SS2	3.5'	10.6	43.5	37.9	8.0
MW-3 SS2	3.5'	1.7	43.5	35.8	19.0
MW-1 SS4	8.5'	11.5	43.7	33.8	11.0

GRAIN SIZE DISTRIBUTION

Figure No.

Lascelles Engineering Associates, File # 210156

Lombardy Public School



Project No. 121621867



Particle-Size Analysis of Soils

LS702

AASHTO T88

PROJECT DETAILS

Client:	Lascalles Engineering Associates, File # 210156	Project No.:	121621867
Project:	Lombardy Public School	Test Method:	LS702
Material Type:	Soil	Sampled By:	Lascalles Engineering Associates
Source:	BH-3	Date Sampled:	May 5, 2021
Sample No.:	SS2	Tested By:	Denis Rodriguez
Sample Depth	3.5'	Date Tested:	May 20, 2021

SOIL INFORMATION

Liquid Limit (LL)	
Plasticity Index (PI)	
Soil Classification	
Specific Gravity (G _s)	2.750
Sg, Correction Factor (α)	0.978
Mass of Dispersing Agent/Litre	40 g

CALCULATION OF DRY SOIL MASS

Oven Dried Mass (W _o), (g)	71.09
Air Dried Mass (W _a), (g)	71.38
Hygroscopic Corr. Factor (F=W _a /W _o)	0.9959
Air Dried Mass in Analysis (M _a), (g)	64.26
Oven Dried Mass in Analysis (M _o), (g)	64.00
Percent Passing 2.0 mm Sieve (P ₂₀), (%)	85.12
Sample Represented (W), (g)	75.19

WASH TEST DATA

Oven Dry Mass in Hydrometer Analysis (g)	64.00
Sample Weight after Hydrometer and Wash (g)	31.36
Percent Passing No. 200 Sieve (%)	51.0
Percent Passing Corrected (%)	43.41

PERCENT LOSS IN SIEVE

Sample Weight Before Sieve (g)	946.30
Sample Weight After Sieve (g)	945.20
Percent Loss in Sieve (%)	0.12

SIEVE ANALYSIS

Sieve Size mm	Cum. Wt. Retained	Percent Passing
75.0		100.0
63.0		100.0
53.0		100.0
37.5		100.0
26.5	0.0	100.0
19.0	21.0	97.8
13.2	31.5	96.7
9.5	57.4	93.9
4.75	100.4	89.4
2.00	140.8	85.1
Total (C + F) ¹	945.20	
0.850	3.06	81.05
0.425	6.62	76.32
0.250	13.20	67.56
0.106	25.38	51.36
0.075	29.52	45.86
PAN	31.31	

Note 1: (C + F) = Coarse + Fine

HYDROMETER DETAILS

Volume of Bulb (V _B), (cm ³)	63.0
Length of Bulb (L ₂), (cm)	14.47
Length from 'V' Reading to Top of Bulb (L ₁), (cm)	10.29
Scale Dimension (h _s), (cm/DIV)	0.155
Cross-Sectional Area of Cylinder (A), (cm ²)	27.25
Meniscus Correction (H _m), (g/L)	1.0

START TIME 9:33 AM

HYDROMETER ANALYSIS

Date	Time	Elapsed Time T Mins	H _u Divisions g/L	H _c Divisions g/L	Temperature T _e °C	Corrected Reading R = H _u - H _c g/L	Percent Passing P %	L cm	η Poise	K	Diameter D mm
20-May-21	9:34 AM	1	32.0	7.0	22.5	25.0	32.53	11.25404	9.50295	0.012894	0.04325
20-May-21	9:35 AM	2	28.0	7.0	22.5	21.0	27.33	11.87404	9.50295	0.012894	0.03142
20-May-21	9:38 AM	5	25.0	7.0	22.5	18.0	23.42	12.33904	9.50295	0.012894	0.02025
20-May-21	9:48 AM	15	21.0	7.0	22.5	14.0	18.22	12.95904	9.50295	0.012894	0.01196
20-May-21	10:03 AM	30	19.0	7.0	22.5	12.0	15.62	13.26904	9.50295	0.012894	0.00857
20-May-21	10:33 AM	60	17.0	7.0	22.5	10.0	13.01	13.57904	9.50295	0.012894	0.00613
20-May-21	1:43 PM	250	15.0	7.0	22.5	8.0	10.4102	13.88904	9.50295	0.012894	0.00304
21-May-21	1:32 PM	1679	12.0	7.0	22.0	5.0	6.5064	14.35404	9.61570	0.012970	0.00120

Remarks:

Reviewed By: *Brian Record*

Date: *May 25/2021*



Particle-Size Analysis of Soils

LS702

AASHTO T88

PROJECT DETAILS

Client:	Lascelles Engineering Associates, File # 210156	Project No.:	121621867
Project:	Lombardy Public School	Test Method:	LS702
Material Type:	Soil	Sampled By:	Lascelles Engineering Associates
Source:	MMW-3	Date Sampled:	May 5, 2021
Sample No.:	SS2	Tested By:	Denis Rodriguez
Sample Depth	3.5'	Date Tested:	May 20, 2021

WASH TEST DATA

Oven Dry Mass in Hydrometer Analysis (g)	52.16
Sample Weight after Hydrometer and Wash (g)	23.35
Percent Passing No. 200 Sieve (%)	55.2
Percent Passing Corrected (%)	52.46

PERCENT LOSS IN SIEVE

Sample Weight Before Sieve (g)	187.40
Sample Weight After Sieve (g)	187.20
Percent Loss in Sieve (%)	0.11

SOIL INFORMATION

Liquid Limit (LL)	
Plasticity Index (PI)	
Soil Classification	
Specific Gravity (G _s)	2.750
Sg. Correction Factor (α)	0.978
Mass of Dispersing Agent/Litre	40 g

CALCULATION OF DRY SOIL MASS

Oven Dried Mass (W _o), (g)	59.18
Air Dried Mass (W _a), (g)	59.78
Hygroscopic Corr. Factor (F=W _a /W _o)	0.9900
Air Dried Mass in Analysis (M _a), (g)	52.69
Oven Dried Mass in Analysis (M _o), (g)	52.16
Percent Passing 2.0 mm Sieve (P ₂₀), (%)	94.98
Sample Represented (W _v), (g)	54.92

SIEVE ANALYSIS

Sieve Size mm	Cum. Wt. Retained	Percent Passing
75.0		100.0
63.0		100.0
53.0		100.0
37.5		100.0
26.5		100.0
19.0		100.0
13.2		100.0
9.5	0.0	100.0
4.75	3.2	98.3
2.00	9.4	95.0
Total (C + F) ¹	187.20	
0.850	1.85	91.62
0.425	4.63	86.55
0.250	9.95	76.87
0.106	19.40	59.66
0.075	22.09	54.76
PAN	23.15	

Note 1: (C + F) = Coarse + Fine

HYDROMETER DETAILS

Volume of Bulb (V _B), (cm ³)	63.0
Length of Bulb (L ₂), (cm)	14.47
Length from '0' Reading to Top of Bulb (L ₁), (cm)	10.29
Scale Dimension (h _s), (cm/Div)	0.155
Cross-Sectional Area of Cylinder (A), (cm ²)	27.25
Meniscus Correction (H _m), (g/L)	1.0

START TIME 9:20 AM

HYDROMETER ANALYSIS

Date	Time	Elapsed Time T Mins	H _s Divisions g/L	H _c Divisions g/L	Temperature T _c °C	Corrected Reading R = H _s - H _c g/L	Percent Passing P %	L cm	η Poise	K	Diameter D mm
20-May-21	9:21 AM	1	31.0	7.0	24.0	24.0	42.76	11.40904	9.17830	0.012671	0.04280
20-May-21	9:22 AM	2	23.0	7.0	24.0	21.0	37.41	11.87404	9.17830	0.012671	0.03087
20-May-21	9:25 AM	5	27.0	7.0	24.0	20.0	35.63	12.02904	9.17830	0.012671	0.01965
20-May-21	9:35 AM	15	25.0	7.0	23.5	18.0	32.07	12.33904	9.28431	0.012744	0.01156
20-May-21	9:50 AM	30	23.0	7.0	23.5	16.0	28.51	12.64904	9.28431	0.012744	0.00828
20-May-21	10:20 AM	60	21.0	7.0	23.0	14.0	24.94	12.95904	9.39251	0.012818	0.00596
20-May-21	1:30 PM	250	19.0	7.0	22.5	12.0	21.38	13.26904	9.50295	0.012894	0.00297
21-May-21	1:31 PM	1691	18.0	7.0	22	9.0	16.03	13.73404	9.61570	0.012970	0.00117

Remarks:

Reviewed By: Brian Ruest

Date: May 25/2021



Particle-Size Analysis of Soils

LS702

AASHTO T88

PROJECT DETAILS

Client:	Lascelles Engineering Associates, File # 210156	Project No.:	121621867
Project:	Lombardy Public School	Test Method:	LS702
Material Type:	Soil	Sampled By:	Lascelles Engineering Associates
Source:	MM-1	Date Sampled:	May 5, 2021
Sample No.:	SS4	Tested By:	Denis Rodriguez
Sample Depth	8.5'	Date Tested:	May 20, 2021

WASH TEST DATA

Oven Dry Mass in Hydrometer Analysis (g)	67.54
Sample Weight after Hydrometer and Wash (g)	34.01
Percent Passing No. 200 Sieve (%)	49.6
Percent Passing Corrected (%)	41.56

PERCENT LOSS IN SIEVE

Sample Weight Before Sieve (g)	1113.50
Sample Weight After Sieve (g)	1112.10
Percent Loss in Sieve (%)	0.13

SOIL INFORMATION

Liquid Limit (LL)	
Plasticity Index (PI)	
Soil Classification	
Specific Gravity (G _s)	2.750
Sg. Correction Factor (α)	0.978
Mass of Dispersing Agent/litre	40

CALCULATION OF DRY SOIL MASS

Oven Dried Mass (W _o), (g)	77.42
Air Dried Mass (W _a), (g)	77.70
Hygroscopic Corr. Factor (F=W _a /W _o)	0.9964
Air Dried Mass in Analysis (M _a), (g)	67.78
Oven Dried Mass in Analysis (M _o), (g)	67.54
Percent Passing 2.0 mm Sieve (P ₂₀), (%)	83.73
Sample Represented (W), (g)	80.66

HYDROMETER DETAILS

Volume of Bulb (V _b), (cm ³)	63.0
Length of Bulb (L ₂), (cm)	14.47
Length from '0' Reading to Top of Bulb (L ₁), (cm)	10.29
Scale Dimension (h _s), (cm/Div)	0.155
Cross-Sectional Area of Cylinder (A), (cm ²)	27.2
Meniscus Correction (H _m), (g/L)	1.0

START TIME 9:14 AM

HYDROMETER ANALYSIS

Date	Time	Elapsed Time T Mins	H _s Divisions g/L	H _c Divisions g/L	Temperature T _c °C	Corrected Reading R = H _s - H _c g/L	Percent Passing P %	L cm	η Poise	K	Diameter D mm
20-May-21	9:15 AM	1	34.0	7.0	23.0	27.0	32.75	10.94191	9.39251	0.012818	0.04240
20-May-21	9:16 AM	2	30.0	7.0	23.0	23.0	27.90	11.56191	9.39251	0.012818	0.03082
20-May-21	9:19 AM	5	27.0	7.0	23.0	20.0	24.26	12.02691	9.39251	0.012818	0.01988
20-May-21	9:29 AM	15	23.0	7.0	23.0	16.0	19.41	12.64691	9.39251	0.012818	0.01177
20-May-21	9:44 AM	30	21.0	7.0	22.5	14.0	16.98	12.95691	9.50295	0.012894	0.00847
20-May-21	10:14 AM	60	19.0	7.0	22.5	12.0	14.56	13.26691	9.50295	0.012894	0.00606
20-May-21	1:24 PM	250	17.0	7.0	22.5	10.0	12.13	13.57691	9.50295	0.012894	0.00300
21-May-21	1:30 PM	1696	15.0	7.0	22	8.0	9.70	13.88691	9.61570	0.012970	0.00117

Remarks:

Reviewed By: Brian P. West

Date: May 25, 2021

SIEVE ANALYSIS

Sieve Size mm	Cum. Wt Retained	Percent Passing
75.0		100.0
63.0		100.0
53.0		100.0
37.5		100.0
26.5	0.0	100.0
19.0	27.0	97.6
13.2	48.6	95.6
9.5	84.3	92.4
4.75	128.6	88.5
2.00	161.2	83.7
Total (C + F)¹	1112.10	
0.850	3.91	78.88
0.425	8.02	73.78
0.250	14.96	65.18
0.106	27.47	49.67
0.075	31.37	44.84
PAN	33.84	

Note 1: (C + F) = Coarse + Fine

Appendix D

Laboratory - “Certification of Analysis”

Certificate of Analysis

Lascelles Engineering Ltd.

1010 Spence Ave, Unit 1014
Hawkesbury, ON K6A 3H9
Attn: Shuang Chang

Client PO:
Project: 210156
Custody: 130164

Report Date: 26-May-2021
Order Date: 19-May-2021

Order #: 2121358

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2121358-01	BH-11 SS2
2121358-02	MW-3 SS2
2121358-03	MW-1 SS3
2121358-04	BH-15 SS2
2121358-05	BH-13 SS2
2121358-06	BH-13 SS3
2121358-07	BH-2 SS3

Approved By:



Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Client: Lascelles Engineering Ltd.

Client PO:

Report Date: 26-May-2021

Order Date: 19-May-2021

Project Description: 210156

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC, water extraction	21-May-21	21-May-21
Boron, available	MOE (HWE), EPA 200.7 - ICP-OES	25-May-21	25-May-21
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	19-May-21	20-May-21
Chromium, hexavalent - soil	MOE E3056 - Extraction, colourimetric	19-May-21	25-May-21
Conductivity	MOE E3138 - probe @25 °C, water ext	21-May-21	21-May-21
Cyanide, free	MOE E3015 - Auto Colour, water extraction	19-May-21	20-May-21
Mercury by CVAA	EPA 7471B - CVAA, digestion	25-May-21	25-May-21
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	21-May-21	21-May-21
PHC F1	CWS Tier 1 - P&T GC-FID	19-May-21	20-May-21
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	19-May-21	20-May-21
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	25-May-21	25-May-21
REG 153: PAHs by GC-MS	EPA 8270 - GC-MS, extraction	19-May-21	20-May-21
Resistivity	EPA 120.1 - probe, water extraction	21-May-21	21-May-21
SAR	Calculated	25-May-21	25-May-21
Solids, %	Gravimetric, calculation	20-May-21	26-May-21

Certificate of Analysis

Report Date: 26-May-2021

Client: Lascelles Engineering Ltd.

Order Date: 19-May-2021

Client PO:

Project Description: 210156

	Client ID:	BH-11 SS2	MW-3 SS2	MW-1 SS3	BH-15 SS2
	Sample Date:	05-May-21 09:00	05-May-21 09:00	05-May-21 09:00	05-May-21 09:00
	Sample ID:	2121358-01	2121358-02	2121358-03	2121358-04
	MDL/Units	Soil	Soil	Soil	Soil

Physical Characteristics

% Solids	0.1 % by Wt.	81.3	86.9	88.1	92.2
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General Inorganics

SAR	0.01 N/A	0.03	0.09	0.06	0.81
Conductivity	5 uS/cm	66	127	93	117
Cyanide, free	0.03 ug/g dry	<0.03 [2]	<0.03 [2]	<0.03 [2]	<0.03 [2]
pH	0.05 pH Units	7.28	7.53	7.78	7.84

Metals

Antimony	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Arsenic	1.0 ug/g dry	3.7	2.3	2.1	2.2
Barium	1.0 ug/g dry	111	81.8	42.4	52.9
Beryllium	0.5 ug/g dry	0.7	<0.5	<0.5	<0.5
Boron	5.0 ug/g dry	6.7	<5.0	<5.0	<5.0
Boron, available	0.5 ug/g dry	<0.5	<0.5	<0.5	<0.5
Cadmium	0.5 ug/g dry	<0.5	<0.5	<0.5	<0.5
Chromium	5.0 ug/g dry	29.9	16.2	9.7	11.0
Chromium (VI)	0.2 ug/g dry	0.4	0.3	<0.2	<0.2
Cobalt	1.0 ug/g dry	5.0	4.7	3.1	3.8
Copper	5.0 ug/g dry	16.6	13.4	7.1	9.9
Lead	1.0 ug/g dry	6.1	3.4	2.6	3.0
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	<0.1
Molybdenum	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Nickel	5.0 ug/g dry	12.7	9.2	5.7	6.9
Selenium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Silver	0.3 ug/g dry	<0.3	<0.3	<0.3	<0.3
Thallium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Uranium	1.0 ug/g dry	<1.0	<1.0	<1.0	<1.0
Vanadium	10.0 ug/g dry	39.7	26.0	16.4	19.9
Zinc	20.0 ug/g dry	21.1	<20.0	<20.0	<20.0

Volatiles

Benzene	0.02 ug/g dry	-	-	-	<0.02 [1]
Ethylbenzene	0.05 ug/g dry	-	-	-	<0.05 [1]
Toluene	0.05 ug/g dry	-	-	-	<0.05 [1]
m,p-Xylenes	0.05 ug/g dry	-	-	-	<0.05 [1]
o-Xylene	0.05 ug/g dry	-	-	-	<0.05 [1]
Xylenes, total	0.05 ug/g dry	-	-	-	<0.05 [1]

Certificate of Analysis

Report Date: 26-May-2021

Client: Lascelles Engineering Ltd.

Order Date: 19-May-2021

Client PO:

Project Description: 210156

	Client ID:	BH-11 SS2	MW-3 SS2	MW-1 SS3	BH-15 SS2
	Sample Date:	05-May-21 09:00	05-May-21 09:00	05-May-21 09:00	05-May-21 09:00
	Sample ID:	2121358-01	2121358-02	2121358-03	2121358-04
	MDL/Units	Soil	Soil	Soil	Soil
Toluene-d8	Surrogate	-	-	-	117% [1]

Hydrocarbons

F1 PHCs (C6-C10)	7 ug/g dry	-	-	-	<7 [1]
F2 PHCs (C10-C16)	4 ug/g dry	-	-	-	<4
F3 PHCs (C16-C34)	8 ug/g dry	-	-	-	<8
F4 PHCs (C34-C50)	6 ug/g dry	-	-	-	<6

Semi-Volatiles

Acenaphthene	0.02 ug/g dry	-	-	-	<0.02
Acenaphthylene	0.02 ug/g dry	-	-	-	<0.02
Anthracene	0.02 ug/g dry	-	-	-	<0.02
Benzo [a] anthracene	0.02 ug/g dry	-	-	-	<0.02
Benzo [a] pyrene	0.02 ug/g dry	-	-	-	<0.02
Benzo [b] fluoranthene	0.02 ug/g dry	-	-	-	<0.02
Benzo [g,h,i] perylene	0.02 ug/g dry	-	-	-	<0.02
Benzo [k] fluoranthene	0.02 ug/g dry	-	-	-	<0.02
Chrysene	0.02 ug/g dry	-	-	-	<0.02
Dibenzo [a,h] anthracene	0.02 ug/g dry	-	-	-	<0.02
Fluoranthene	0.02 ug/g dry	-	-	-	<0.02
Fluorene	0.02 ug/g dry	-	-	-	<0.02
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	-	-	-	<0.02
1-Methylnaphthalene	0.02 ug/g dry	-	-	-	<0.02
2-Methylnaphthalene	0.02 ug/g dry	-	-	-	<0.02
Methylnaphthalene (1&2)	0.04 ug/g dry	-	-	-	<0.04
Naphthalene	0.01 ug/g dry	-	-	-	<0.01
Phenanthrene	0.02 ug/g dry	-	-	-	<0.02
Pyrene	0.02 ug/g dry	-	-	-	<0.02
2-Fluorobiphenyl	Surrogate	-	-	-	90.5%
Terphenyl-d14	Surrogate	-	-	-	116%

Certificate of Analysis

Report Date: 26-May-2021

Client: Lascelles Engineering Ltd.

Order Date: 19-May-2021

Client PO:

Project Description: 210156

Client ID:	BH-13 SS2	BH-13 SS3	BH-2 SS3	-
Sample Date:	05-May-21 09:00	05-May-21 09:00	05-May-21 09:00	-
Sample ID:	2121358-05	2121358-06	2121358-07	-
MDL/Units	Soil	Soil	Soil	-
Physical Characteristics				
% Solids	0.1 % by Wt.	92.0	85.8	91.9
General Inorganics				
pH	0.05 pH Units	-	7.79	-
Resistivity	0.10 Ohm.m	-	37.8	-
Anions				
Chloride	5 ug/g dry	-	52	-
Sulphate	5 ug/g dry	-	78	28
Volatiles				
Benzene	0.02 ug/g dry	<0.02 [1]	-	-
Ethylbenzene	0.05 ug/g dry	<0.05 [1]	-	-
Toluene	0.05 ug/g dry	<0.05 [1]	-	-
m,p-Xylenes	0.05 ug/g dry	<0.05 [1]	-	-
o-Xylene	0.05 ug/g dry	<0.05 [1]	-	-
Xylenes, total	0.05 ug/g dry	<0.05 [1]	-	-
Toluene-d8	Surrogate	120% [1]	-	-
Hydrocarbons				
F1 PHCs (C6-C10)	7 ug/g dry	<7 [1]	-	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	-	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	-	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	-	-
Semi-Volatiles				
Acenaphthene	0.02 ug/g dry	<0.02	-	-
Acenaphthylene	0.02 ug/g dry	<0.02	-	-
Anthracene	0.02 ug/g dry	0.09	-	-
Benzo [a] anthracene	0.02 ug/g dry	0.05	-	-
Benzo [a] pyrene	0.02 ug/g dry	0.04	-	-
Benzo [b] fluoranthene	0.02 ug/g dry	0.04	-	-
Benzo [g,h,i] perylene	0.02 ug/g dry	0.02	-	-
Benzo [k] fluoranthene	0.02 ug/g dry	0.03	-	-
Chrysene	0.02 ug/g dry	0.06	-	-
Dibenzo [a,h] anthracene	0.02 ug/g dry	<0.02	-	-
Fluoranthene	0.02 ug/g dry	0.19	-	-
Fluorene	0.02 ug/g dry	0.04	-	-
Indeno [1,2,3-cd] pyrene	0.02 ug/g dry	0.02	-	-
1-Methylnaphthalene	0.02 ug/g dry	<0.02	-	-

Certificate of Analysis

Report Date: 26-May-2021

Client: Lascelles Engineering Ltd.

Order Date: 19-May-2021

Client PO:

Project Description: 210156

		Client ID:	BH-13 SS2	BH-13 SS3	BH-2 SS3	-
		Sample Date:	05-May-21 09:00	05-May-21 09:00	05-May-21 09:00	-
		Sample ID:	2121358-05	2121358-06	2121358-07	-
	MDL/Units		Soil	Soil	Soil	-
2-Methylnaphthalene	0.02 ug/g dry		<0.02	-	-	-
Methylnaphthalene (1&2)	0.04 ug/g dry		<0.04	-	-	-
Naphthalene	0.01 ug/g dry		0.03	-	-	-
Phenanthrene	0.02 ug/g dry		0.26	-	-	-
Pyrene	0.02 ug/g dry		0.12	-	-	-
2-Fluorobiphenyl	Surrogate		99.4%	-	-	-
Terphenyl-d14	Surrogate		121%	-	-	-

Certificate of Analysis

Report Date: 26-May-2021

Client: Lascelles Engineering Ltd.

Order Date: 19-May-2021

Client PO:

Project Description: 210156

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	5	ug/g						
Sulphate	ND	5	ug/g						
General Inorganics									
Conductivity	ND	5	uS/cm						
Cyanide, free	ND	0.03	ug/g						
Resistivity	ND	0.10	Ohm.m						
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Metals									
Antimony	ND	1.0	ug/g						
Arsenic	ND	1.0	ug/g						
Barium	ND	1.0	ug/g						
Beryllium	ND	0.5	ug/g						
Boron, available	ND	0.5	ug/g						
Boron	ND	5.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium (VI)	ND	0.2	ug/g						
Chromium	ND	5.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	5.0	ug/g						
Lead	ND	1.0	ug/g						
Mercury	ND	0.1	ug/g						
Molybdenum	ND	1.0	ug/g						
Nickel	ND	5.0	ug/g						
Selenium	ND	1.0	ug/g						
Silver	ND	0.3	ug/g						
Thallium	ND	1.0	ug/g						
Uranium	ND	1.0	ug/g						
Vanadium	ND	10.0	ug/g						
Zinc	ND	20.0	ug/g						
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g						
Acenaphthylene	ND	0.02	ug/g						
Anthracene	ND	0.02	ug/g						
Benzo [a] anthracene	ND	0.02	ug/g						
Benzo [a] pyrene	ND	0.02	ug/g						
Benzo [b] fluoranthene	ND	0.02	ug/g						
Benzo [g,h,i] perylene	ND	0.02	ug/g						
Benzo [k] fluoranthene	ND	0.02	ug/g						
Chrysene	ND	0.02	ug/g						
Dibenzo [a,h] anthracene	ND	0.02	ug/g						
Fluoranthene	ND	0.02	ug/g						
Fluorene	ND	0.02	ug/g						
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g						
1-Methylnaphthalene	ND	0.02	ug/g						
2-Methylnaphthalene	ND	0.02	ug/g						
Methylnaphthalene (1&2)	ND	0.04	ug/g						
Naphthalene	ND	0.01	ug/g						
Phenanthrene	ND	0.02	ug/g						
Pyrene	ND	0.02	ug/g						
Surrogate: 2-Fluorobiphenyl	1.08		ug/g		80.8	50-140			
Surrogate: Terphenyl-d14	1.61		ug/g		120	50-140			
Volatiles									
Benzene	ND	0.02	ug/g						

Certificate of Analysis

Report Date: 26-May-2021

Client: Lascelles Engineering Ltd.

Order Date: 19-May-2021

Client PO:

Project Description: 210156

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Ethylbenzene	ND	0.05	ug/g						
Toluene	ND	0.05	ug/g						
m,p-Xylenes	ND	0.05	ug/g						
o-Xylene	ND	0.05	ug/g						
Xylenes, total	ND	0.05	ug/g						
Surrogate: Toluene-d8	9.44		ug/g		118	50-140			

Certificate of Analysis

Report Date: 26-May-2021

Client: Lascelles Engineering Ltd.

Order Date: 19-May-2021

Client PO:

Project Description: 210156

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	53.7	5	ug/g dry	51.6			4.1	20	
Sulphate	79.3	5	ug/g dry	77.9			1.8	20	
General Inorganics									
SAR	5.33	0.01	N/A	5.46			2.4	30	
Conductivity	1120	5	uS/cm	1120			0.3	5	
Cyanide, free	ND	0.03	ug/g dry	ND			NC	35	
pH	9.25	0.05	pH Units	9.25			0.0	2.3	
Resistivity	84.1	0.10	Ohm.m	85.5			1.7	20	
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND			NC	40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND			NC	30	
F3 PHCs (C16-C34)	ND	8	ug/g dry	ND			NC	30	
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND			NC	30	
Metals									
Antimony	2.3	1.0	ug/g dry	ND			NC	30	
Arsenic	2.3	1.0	ug/g dry	1.8			23.9	30	
Barium	37.9	1.0	ug/g dry	28.2			29.4	30	
Beryllium	ND	0.5	ug/g dry	ND			NC	30	
Boron, available	ND	0.5	ug/g dry	ND			NC	35	
Boron	ND	5.0	ug/g dry	ND			NC	30	
Cadmium	ND	0.5	ug/g dry	ND			NC	30	
Chromium (VI)	ND	0.2	ug/g dry	ND			NC	35	
Chromium	11.5	5.0	ug/g dry	10.0			13.8	30	
Cobalt	3.4	1.0	ug/g dry	2.8			17.7	30	
Copper	12.9	5.0	ug/g dry	11.8			9.6	30	
Lead	128	1.0	ug/g dry	95.0			29.5	30	
Mercury	ND	0.1	ug/g dry	ND			NC	30	
Molybdenum	ND	1.0	ug/g dry	ND			NC	30	
Nickel	6.2	5.0	ug/g dry	5.6			9.6	30	
Selenium	ND	1.0	ug/g dry	ND			NC	30	
Silver	ND	0.3	ug/g dry	ND			NC	30	
Thallium	ND	1.0	ug/g dry	ND			NC	30	
Uranium	ND	1.0	ug/g dry	ND			NC	30	
Vanadium	21.6	10.0	ug/g dry	20.0			7.9	30	
Zinc	31.6	20.0	ug/g dry	27.8			13.0	30	
Physical Characteristics									
% Solids	99.3	0.1	% by Wt.	99.7			0.4	25	
Semi-Volatiles									
Acenaphthene	ND	0.02	ug/g dry	ND			NC	40	
Acenaphthylene	ND	0.02	ug/g dry	ND			NC	40	
Anthracene	ND	0.02	ug/g dry	ND			NC	40	
Benzo [a] anthracene	0.023	0.02	ug/g dry	0.025			11.7	40	
Benzo [a] pyrene	0.022	0.02	ug/g dry	0.024			7.5	40	
Benzo [b] fluoranthene	0.022	0.02	ug/g dry	0.027			18.9	40	
Benzo [g,h,i] perylene	ND	0.02	ug/g dry	ND			NC	40	
Benzo [k] fluoranthene	ND	0.02	ug/g dry	ND			NC	40	
Chrysene	ND	0.02	ug/g dry	0.031			NC	40	
Dibenzo [a,h] anthracene	ND	0.02	ug/g dry	ND			NC	40	
Fluoranthene	0.063	0.02	ug/g dry	0.085			29.5	40	
Fluorene	ND	0.02	ug/g dry	ND			NC	40	
Indeno [1,2,3-cd] pyrene	ND	0.02	ug/g dry	ND			NC	40	
1-Methylnaphthalene	ND	0.02	ug/g dry	ND			NC	40	
2-Methylnaphthalene	ND	0.02	ug/g dry	ND			NC	40	
Naphthalene	ND	0.01	ug/g dry	ND			NC	40	
Phenanthrene	0.049	0.02	ug/g dry	0.070			35.0	40	

Certificate of Analysis

Report Date: 26-May-2021

Client: Lascelles Engineering Ltd.

Order Date: 19-May-2021

Client PO:

Project Description: 210156

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Pyrene	0.045	0.02	ug/g dry	0.059			28.2	40	
Surrogate: 2-Fluorobiphenyl	1.40		ug/g dry		96.1	50-140			
Surrogate: Terphenyl-d14	1.66		ug/g dry		114	50-140			
Volatiles									
Benzene	ND	0.02	ug/g dry	ND			NC	50	
Ethylbenzene	ND	0.05	ug/g dry	ND			NC	50	
Toluene	ND	0.05	ug/g dry	ND			NC	50	
m,p-Xylenes	ND	0.05	ug/g dry	ND			NC	50	
o-Xylene	ND	0.05	ug/g dry	ND			NC	50	
Surrogate: Toluene-d8	9.71		ug/g dry		117	50-140			

Certificate of Analysis

Report Date: 26-May-2021

Client: Lascelles Engineering Ltd.

Order Date: 19-May-2021

Client PO:

Project Description: 210156

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	142	5	ug/g	51.6	90.2	82-118			
Sulphate	165	5	ug/g	77.9	87.0	80-120			
General Inorganics									
Cyanide, free	0.250	0.03	ug/g	ND	83.4	70-130			
Hydrocarbons									
F1 PHCs (C6-C10)	199	7	ug/g	ND	99.6	80-120			
F2 PHCs (C10-C16)	60	4	ug/g	ND	68.5	60-140			
F3 PHCs (C16-C34)	210	8	ug/g	ND	98.5	60-140			
F4 PHCs (C34-C50)	125	6	ug/g	ND	92.9	60-140			
Metals									
Antimony	47.1	1.0	ug/g	ND	93.4	70-130			
Arsenic	58.4	1.0	ug/g	ND	115	70-130			
Barium	56.5	1.0	ug/g	11.3	90.4	70-130			
Beryllium	54.5	0.5	ug/g	ND	109	70-130			
Boron, available	5.02	0.5	ug/g	ND	100	70-122			
Boron	51.3	5.0	ug/g	ND	99.9	70-130			
Cadmium	40.4	0.5	ug/g	ND	80.8	70-130			
Chromium (VI)	4.4	0.2	ug/g	ND	89.0	70-130			
Chromium	61.7	5.0	ug/g	ND	115	70-130			
Cobalt	57.4	1.0	ug/g	1.1	113	70-130			
Copper	58.8	5.0	ug/g	ND	108	70-130			
Lead	94.9	1.0	ug/g	38.0	114	70-130			
Mercury	1.70	0.1	ug/g	ND	113	70-130			
Molybdenum	56.2	1.0	ug/g	ND	112	70-130			
Nickel	56.9	5.0	ug/g	ND	109	70-130			
Selenium	53.7	1.0	ug/g	ND	107	70-130			
Silver	31.9	0.3	ug/g	ND	63.8	70-130			
Thallium	40.3	1.0	ug/g	ND	80.6	70-130			
Uranium	49.8	1.0	ug/g	ND	99.3	70-130			
Vanadium	67.2	10.0	ug/g	ND	118	70-130			
Zinc	64.7	20.0	ug/g	ND	107	70-130			
Semi-Volatiles									
Acenaphthene	0.175	0.02	ug/g	ND	96.4	50-140			
Acenaphthylene	0.121	0.02	ug/g	ND	66.7	50-140			
Anthracene	0.135	0.02	ug/g	ND	74.2	50-140			
Benzo [a] anthracene	0.139	0.02	ug/g	0.025	62.5	50-140			
Benzo [a] pyrene	0.144	0.02	ug/g	0.024	66.0	50-140			
Benzo [b] fluoranthene	0.170	0.02	ug/g	0.027	79.0	50-140			
Benzo [g,h,i] perylene	0.143	0.02	ug/g	ND	78.8	50-140			
Benzo [k] fluoranthene	0.160	0.02	ug/g	ND	88.0	50-140			
Chrysene	0.176	0.02	ug/g	0.031	80.1	50-140			
Dibenzo [a,h] anthracene	0.133	0.02	ug/g	ND	73.3	50-140			
Fluoranthene	0.166	0.02	ug/g	0.085	44.7	50-140			QM-06
Fluorene	0.143	0.02	ug/g	ND	78.6	50-140			
Indeno [1,2,3-cd] pyrene	0.134	0.02	ug/g	ND	74.0	50-140			
1-Methylnaphthalene	0.155	0.02	ug/g	ND	85.7	50-140			
2-Methylnaphthalene	0.148	0.02	ug/g	ND	81.6	50-140			

Certificate of Analysis

Report Date: 26-May-2021

Client: Lascelles Engineering Ltd.

Order Date: 19-May-2021

Client PO:

Project Description: 210156

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Naphthalene	0.177	0.01	ug/g	ND	97.4	50-140			
Phenanthrene	0.168	0.02	ug/g	0.070	54.0	50-140			
Pyrene	0.161	0.02	ug/g	0.059	55.9	50-140			
Surrogate: 2-Fluorobiphenyl	1.11		ug/g		76.4	50-140			
Surrogate: Terphenyl-d14	1.36		ug/g		93.9	50-140			
Volatiles									
Benzene	4.35	0.02	ug/g	ND	109	60-130			
Ethylbenzene	4.63	0.05	ug/g	ND	116	60-130			
Toluene	4.66	0.05	ug/g	ND	116	60-130			
m,p-Xylenes	9.53	0.05	ug/g	ND	119	60-130			
o-Xylene	4.64	0.05	ug/g	ND	116	60-130			
Surrogate: Toluene-d8	7.93		ug/g		99.1	50-140			

Certificate of Analysis

Client: Lascelles Engineering Ltd.

Client PO:

Report Date: 26-May-2021

Order Date: 19-May-2021

Project Description: 210156

Qualifier Notes:

Sample Qualifiers :

- 1 : Holding time had been exceeded upon receipt of the sample at the laboratory.
- 2 : This analysis was conducted after the accepted holding time had been exceeded.

QC Qualifiers :

QM-06 : Due to noted non-homogeneity of the QC sample matrix, the spike recoveries were out side the accepted range. Batch data accepted based on other QC.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.
NC: Not Calculated

Soil results are reported on a dry weight basis when the units are denoted with 'dry'.
Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.
- When reported, data for F4G has been processed using a silica gel cleanup.

Subcontracted Analysis

Lascelles Engineering Ltd.

1010 Spence Ave, Unit 1014
Hawkesbury, ON K6A 3H9
Attn: Shuang Chang

Tel: (613) 632-0241
Fax: (613) 632-0241

Paracel Report No **2121358**

Client Project(s): **210156**

Client PO:

Reference: **Standing Offer**

CoC Number: **130164**

Order Date: 19-May-21
Report Date: 26-May-21

Sample(s) from this project were subcontracted for the listed parameters. A copy of the subcontractor's report is attached

Paracel ID	Client ID	Analysis
2121358-06	BH-13 SS3	Sulphide, solid

**SGS Canada Inc.**

P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - K0L 2H0
Phone: 705-652-2000 FAX: 705-652-6365

Paracel Laboratories

Attn : Dale Robertson

300-2319 St.Laurent Blvd.
Ottawa, ON
K1G 4K6, Canada

Phone: 613-731-9577
Fax:613-731-9064

31-May-2021

Date Rec. : 20 May 2021
LR Report: CA12772-MAY21
Reference: Project#: 2121358

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Sample ID	Sample Date & Time	Sulphide (Na ₂ CO ₃) %
1: Analysis Start Date		28-May-21
2: Analysis Start Time		14:51
3: Analysis Completed Date		28-May-21
4: Analysis Completed Time		16:38
5: QC - Blank		< 0.04
6: QC - STD % Recovery		119%
7: QC - DUP % RPD		ND
8: RL		0.02
9: BH-13 SS3	05-May-21	< 0.04

RL - SGS Reporting Limit
ND - Not Detected

Kimberley Didsbury
Project Specialist,
Environment, Health & Safety