Rainsong Development – Phase 2

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Geotechnical Investigation

Project Location:
Lockhart Road and Yonge Street, Barrie, Ontario

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1. Introduction

This report presents the results of a geotechnical investigation carried out for the proposed Rainsong Phase 2 Residential Subdivision in the City of Barrie, Ontario. The work was authorized by Lukas Reale of Great Gulf courtesy of Rainsong Land Development Inc.

The proposed development is located at the northwest quadrant of Lockhart Road and Yonge Street in the City of Barrie, Ontario. The project involves the development of a proposed residential subdivision together with the necessary municipal infrastructure such as roads, sewers, water and other services. As part of this development plan, two school/institutional blocks (6.39 ha in total) are proposed on the east side of the site.

The purpose of the geotechnical investigation was to determine the subsurface soil and groundwater conditions at the site and based on this information, to provide an engineering report with geotechnical recommendations pertaining to the design and construction of the proposed residential development.

The comments and recommendations given in this report are based on the assumption that the above-described design concept will proceed into construction. If changes are made either in the design phase or during construction, this office must be retained to review these modifications. The result of this review may be a modification of our recommendations, or it may require additional field or laboratory work to check whether the changes are acceptable from a geotechnical viewpoint.

2. Site Description

The Site is bounded by agricultural land to the north, Yonge Street to the east, Lockhart Road to the south and farmland to the west (some of which is currently in the process of being re-developed for residential land use).

The overall topography of the site is relatively flat, with a very slight upwards slope towards the north. An existing residential lot is located in the middle of the Site (North-South) on Yonge Street.

3. Fieldwork

The fieldwork was carried out during the period between January 10 and 14, 2022, and comprised twenty-four (24) sampled boreholes, designated as Borehole BH1 to Borehole BH24, put down at the approximate locations shown on the attached Borehole Location Plan (Drawing No. 1).

The boreholes were advanced to depths ranging from 6.7 to 9.7 m below existing grade using continuous flight solid or hollow stem auger equipment owned and operated by a specialist drilling contractor. In each borehole, samples were recovered using a conventional split spoon equipment and standard penetration test method.

Water levels were observed in the open boreholes during the course of the fieldwork. In addition, monitoring wells were installed in four (4) boreholes to establish the stabilized groundwater level at the site.

The fieldwork was supervised throughout by an EXP geotechnical engineer who directed the drilling and sampling operations, prepared borehole logs, made groundwater observations during and upon completion of drilling, and processed the recovered samples. In the laboratory, the samples were classified as to their olfactory, visual and textural characteristics. Natural moisture content tests were carried out on all recovered samples, with results presented on the Log of Borehole sheets. In addition, grain size analysis was carried out on representative samples.

Borehole locations and ground surface elevations were located in the field by EXP. The ground surface elevation at each borehole location was referenced to local geodetic benchmark.

4. Subsurface Conditions

4.1 Subsoils

The detailed soil profiles encountered in each borehole and the results of laboratory moisture content are indicated on the attached borehole logs (Drawing Nos. 2 to 25). It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect transition zones, for the purpose of geological design and should not be interpreted as exact planes of geological change. The "Notes on Sample Description" preceding the borehole logs are an integral part of and should be read in conjunction with this report.

The stratigraphy at the site, as revealed in the sampling completed within the boreholes generally comprised surficial topsoil, overlaying deposits of either clayey silt or silty sand to sandy silt, overlaying sand.

A brief description of the soil profile, in general order of depth (listed in metres below grade, unless otherwise noted), follows:

Topsoil

A surficial layer of topsoil 75 to 200 mm thick was encountered in most boreholes. Boreholes BH19 and BH20 did not have topsoil at surface. However, given use of the property for agricultural purposes disturbed (ploughed) soil should be expected to typical ploughing depths of up to 600 mm.

It should be noted that topsoil and disturbed (ploughed) soil measurements were carried out at the borehole locations only and could differ at other locations on the site. Consequently, topsoil and disturbed (ploughed) soil quantities should not be established from the information provided at the borehole locations. If required, a more detailed test pit program should be carried out to more accurately quantify the amount of topsoil and disturbed (ploughed) soil to be removed for construction purposes.

Clayey Silt

Boreholes BH2, BH3, BH6, BH7, BH8, BH13, BH14, BH19 and BH21 all encountered a clayey silt deposit beneath the surficial topsoil layer. As previously mentioned, Boreholes BH19 and BH20 encountered this layer at surface. The clayey silt layer extended to depths between 1.0 and 2.2 m. This layer is predominantly characterized by silt with significant fraction of cohesive clay content and some to frequent amounts of sand and was generally a brown colour. The N-values in this layer ranged from 2 to 9 which indicate a very loose to loose state of compactness. Moisture content analysis yielded results between 10% and 46% indicating the material is in a moist to saturated state at the time of investigation.

One grain size analysis test was performed on this material, which yielded 6% gravel, 50% sand and 30% silt and 18% clay (see Appendix A for laboratory test results). While this sample does contain a high proportion of sand content by mass, the cohesive behavior of the material is governed by the high proportion of fine-grained material.

Silty Sand to Sandy Silt

Boreholes BH1, BH4, BH5, BH9, BH10 through BH12, BH15 through BH 18, and BH22 through BH 24 all encountered a silty sand to sandy silt deposit underlying the surficial topsoil layer. This layer was also encountered underlying the clayey silt deposit in boreholes BH2, BH3, BH6, BH7, BH8, BH13, BH14, BH19 and BH 21. This layer extended to depths between 1.5 m to termination depths of 6.7 m. Boreholes BH1, BH10, BH11, BH15, BH16, and BH17 all terminated in this layer. This layer is predominantly characterized by varying amounts of silt and sand with trace amounts of gravel and/or clay and was generally a brown colour. At shallow depths between 0.0 and 2.0 m the N-Values ranged from 2 to 25, indicating a very loose to compact compactness. At depths greater than 2.0 m and N-Values were between 15 and 60 indicated a compact to very dense state of compactness. Moisture content analysis yielded results between 4% and 22% indicating the material was moist to wet at the time of investigation.

Two grain size analyses test were performed on this material, yielding 11 - 13% gravel, 45 - 50% sand and 24 - 26% silt and 10 – 19% clay (see Appendix A for laboratory test results).

Sand

Excluding the boreholes that previously terminated in the silty sand deposit (BH1, BH10, BH11, BH15, BH16, and BH17), all borehole locations encountered a sand layer underlying the silty sand or clayey silt strata. This layer extended to the termination depths of all boreholes - either of 6.7 m or 9.7 m. This layer is characterized as brown to grey, coarse-grained sand with trace to some gravel and/or silt. The N-values in this layer ranged from 25 to greater than 50 for 150 mm, indicating the material is in a compact to very dense state The moisture conditions encountered were damp to wet and the natural moisture

contents of the recovered samples ranged from 3 to 22% indicating the material was encountered in a moist to saturated state. Water level readings observed were recorded in this layer.

One grain size analysis test was performed on this material, yielding 7% gravel, 58% sand and 17% silt and 18% clay (see Appendix A for laboratory test results).

Soil Bulking Factors

The soil bulking factors (i.e., volume after excavation/volume before excavation) for the on-site excavated materials are typically in the range of 1.1 to 1.2 for the granular soil (i.e., sand) and 1.2 to 1.3 for the cohesive soils (i.e., silt and tills).

4.2 Groundwater

Groundwater conditions were observed in the open boreholes during the course of the fieldwork. At the time of investigation groundwater was encountered at depths ranging between 2.4 m and 7.0 m below the existing grade. Groundwater was encountered in the majority of boreholes. Boreholes BH1, BH4 through 6, BH8, BH9, and BH11 were all dry at the time of investigation.

Four boreholes, BH2, BH10, BH12, and BH21, were outfitted with a piezometer/monitoring well to observe long term groundwater conditions. Installations were observed to be 8.6, 7.0, 6.6, and 4.4 m respectively. EXP returned to site on January 27, 2022, and water levels were observed to be 9.1, 6.6, 6.4, and 3.2 m respectively,

Seasonal fluctuation of the groundwater levels at the site should be anticipated.

5. Engineering Discussion and Recommendations

5.1 General

The project involves the proposed design and construction of a residential subdivision development known as Rainsong Phase 2, which will include residential dwellings, a school block, an institutional block, roads, sewers, watermains and other municipal utilities. At the time of this investigation, final development plan had not been established. Consequently, the geotechnical assessment addresses general development of the site.

5.2 Site Grading

Final site grades had not been established at the time of this investigation. However, it is anticipated that some regrading (cut and fill operations) will be carried out at the site.

The following procedures are recommended for the construction of cut and fill operation for roads and building areas at the site, where required:

1. All topsoil, organic, fill/debris or deleterious materials should be removed.
2. The exposed subgrade surface should be proofrolled with a heavy roller and inspected by geotechnical personnel from EXP Services Inc. Any soft or loose spots encountered during the process should be subexcavated and replaced with approved on-site or imported materials, compacted to 100% standard Proctor maximum dry density (SPMDD).
3. The area can then be brought up to the final subgrade level with approved on-site or imported material. The material should be placed in lifts not exceeding 300 mm and compacted to at least 95% SPMDD to within 300 mm of final subgrade level for the roads. The upper 300 mm of final subgrade level should be compacted to at least 98% SPMDD. Compaction to 100% SPMDD is recommended within the proposed building/housing envelopes.
4. Fill slopes should not be steeper than two horizontal to one vertical and should be protected from surface erosion with sodding.
5. All backfilling and compaction operations must be supervised on a full-time basis by geotechnical personnel from EXP Services Inc. to approve material and ensure the specified degree of compaction has been obtained.

5.3 Sewer and Watermain Installation

5.3.1 Excavation and Groundwater Control

The sewer trenches are expected to extend 4 to 9 m below existing grade. Based on the results of the investigation, excavation will generally be carried out within the native silty sand or sand deposits.

It is considered that excavation may be carried out in open cuts using conventional equipment. Side slopes of temporary excavation must conform to the Occupational Health and Safety Act (OHSA) and local regulations. Within the meaning of OHSA, the silty sand and sand deposits are classified as Type 3 soils. Locally, within the variable surficial deposits where loose/soft materials are encountered, or within zones of persistent seepage at depth, it may be necessary to flatten the side slopes.

In general, for excavation carried out within the silty sand and sand, it is our opinion that any dewatering efforts will be required. Seepage/surface water which enters the trench excavation should be controlled and removed by conventional well point or sump pumping techniques in conjunction with oversized excavations.

It is further recommended that test pits be excavated to the proposed invert levels along the proposed sewer alignment in these areas prior to final tendering in order to further assess the dewatering requirement. Prospective contractors are encouraged to attend in order to evaluate the effectiveness of dewatering using their own equipment. Wells or interlocking sheet piping should be designed and installed by specialist contractors.

5.3.2 Pipe Bedding

It is anticipated that sewer pipes with inverts located at a depth of 4 to 9 m below the existing grade will be founded in the native silty sand or sand. The pipe bedding material will be dependent on the founding material.

In general, the pipe bedding may consist of a minimum thickness of 150 mm of compacted OPSS Granular “A” material.

The bases of the excavation in competent native soils should remain firm and stable provided adequate groundwater control is implemented and excavations are not left open for extended periods of time and the work is done in accordance with good construction practice.

The bedding material should be placed in thin lifts not more than 150 mm thick and compacted to at least 95% SPMDD. Particular attention should be given to ensure material placed beneath the bottom quadrants of the pipe is adequately compacted.

Backfill within a 300 mm thick zone above the pipe should also consist of granular material which can be more readily compacted with light equipment to avoid damaging the pipes.

5.3.3 Backfilling Operations

The existing native silty sand and sand soils which are not contaminated with topsoil and other obviously unsuitable material may be reused as trench backfill if the moisture content are within 2 percent of their optimum values. In this regard, the majority of the excavated soils are generally suitable for reuse as backfill.

Excavated topsoil and clayey silts should not be used for trench backfilling purposes. This material may be used for general landscaping purposes. The topsoil may also be used in open parklands subject to approval by the City of Barrie.

Any organic or excessively wet or otherwise deleterious material should not be used for backfill purposes. Any shortfall of suitable on-site excavated material can be made up with imported clean approved fill or granular material, OPSS select subgrade material or Granular 'B' Type I.

In general, the native silty sand clayey silt is not free draining and therefore should not be used where this characteristic is required, or in confined areas. Imported granular material conforming to OPSS Granular 'B' Type I would also be suitable for these purposes.

In areas where substantial cutting and filling is required, the compaction of the backfill should be monitored on full-time basis by a representative of this office.

All backfilling and compaction operations must be closely examined by representatives of this office to ensure uniform compaction to specification requirements, especially in the vicinity of manholes and catchbasins, near the ends of compaction runs, and in all areas that are not readily accessible to compaction equipment. All backfilling should be placed in maximum 300 mm horizontal lifts and uniformly compacted to 95 % SPMDD. Within the upper 300 mm of road subgrade, the fill material should be compacted to at least 98 % SPMDD. Smaller lifts may be required depending on the size of compaction equipment used by the contractor and the moisture content of fill at the time of construction.

To minimize potential problems, backfilling operations should follow closely after excavation so that only minimal length of trench slope is exposed. This will minimize wetting of the subgrade material. Should construction extend to the winter season, particular attention should be given to ensure that frozen material is not used as backfill.

5.3.4 Sedimentation Control

All sediment control fencing should be installed in accordance with Barrie Standard Detail 1233 – Siltation Control Fencing and the City of Barrie Site Alteration By-Law (2014-100).

5.4 Residential Development

5.4.1 Residential Foundation Considerations

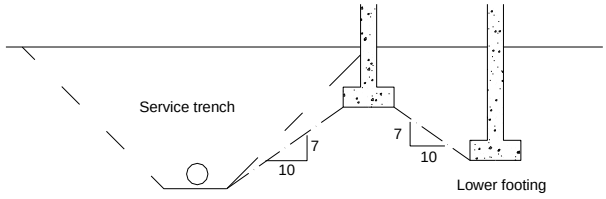
Based on the results of the boreholes drilled at the site, it's considered that the proposed building construction for the residential development may be supported on conventional spread and strip footings as detailed in the following table, subject to inspection by EXP during construction. Multiple depths are indicated in areas of variable conditions. An appropriate depth should be selected based on the final design.

Table 1: Footing Design Parameters – Residential Building Lots

Borehole No.	Depth to Founding Soil (m)	SLS Bearing Capacity (kPa)	ULS Bearing Capacity (kPa)
BH1	1.5	150	225
BH2	1.5	150	225
BH3	2.2	75	150
BH4	2.2 / 3.0	75 / 150	150 / 225
BH5	2.2	100	175
BH6	1.5	100	175
BH7	1.5 / 2.2	75 / 150	150 / 225
BH8	1.5	250	375
BH10	2.2	250	375
BH11	2.2	100	175
BH12	1.5	150	225
BH13	2.2	100	175
BH14	2.2	150	225
BH15	2.2	75	150
BH19	4.0	150	225
BH20	2.2	150	225
BH21	1.5 / 2.2	75 / 150	150 / 225

5.4.1.1 Foundation General

Footings which are to be placed at different elevations should be located such that the higher footings are set below a line drawn up at 10 horizontal to 7 vertical from the near edge of the lower footing, as indicated on the following sketch:



FOOTINGS NEAR SERVICE TRENCHES OR AT DIFFERENT ELEVATIONS

All footings exposed to seasonal freezing conditions should be protected from frost action by at least 1.2 m of soil cover or equivalent insulation, depending on the final design requirements.

The total and differential settlements of well designed and constructed footings placed in accordance with the above recommendations, are expected to be less than 25 mm and 20 mm, respectively.

It should be noted that the recommended bearing capacities have been calculated by **exp** from the borehole information for the design stage only. The investigation and comments are necessarily ongoing as new information on underground conditions becomes available. For example, it should be appreciated that modifications to bearing levels may be required if unforeseen subsoil conditions are revealed after the excavation is exposed to full view or if final design decisions differ from those assumed in this report. For this reason this office should be retained to review final foundation drawings and to examine footing conditions.

5.4.2 Soil Adfreezing

The excavated native silty soils are generally moist and considered to have some soil adfreezing potential. As such, it is our opinion that these materials should not be used in backfill around and inside the garage foundations. It is recommended that imported sand or sand and gravel (Granular 'B' Type I) material be used for this purpose.

Where the native material is used as backfill around the garage, it is recommended that the outside of the garage foundations be wrapped with a folded polyurethane sheet to eliminate contact between the

concrete foundation and silty soil. In addition, styrofoam insulation should be used inside the garage walls and below the floor slab to prevent frost heave.

5.4.3 Floor Slab Construction and Permanent Drainage

The floor slab may be constructed as a slab-on-grade on a properly prepared subgrade (i.e., on native undisturbed soils or engineered fill). In this regard, all topsoil and other obviously unsuitable material should be removed from the entire underfloor area and the exposed subgrade thoroughly proofrolled. Any soft spots detected should be sub-excavated and the area brought up to design grades using approved clean fill in the manner described in the "Site Grading" section of this report.

A 200 mm layer of 19 mm clear stone should be placed between the prepared subgrade and the floor slab to serve as a moisture barrier.

It is recommended that the foundation walls be covered with a bituminous damp-proofing spray and a drainage sheet. In addition, a weeping tile surrounded with 300 mm of 19 mm clear stone and wrapped with a filter cloth should be installed around the perimeter of the basement at footing level and connected to a frost-free outlet.

5.4.4 Earth Pressure on Subsurface Walls

The lateral earth pressure acting on the basement walls may be calculated from the following equation:

$$p = k(\gamma h + q)$$

Where: p = the pressure on kPa acting against any subsurface wall at depth, h, below the ground surface;

k = the earth pressure coefficient considered to be appropriate for the subsurface walls, for this case, 0.4;

γ = the bulk unit weight of the retained free draining granular backfill;

21 KN/m3

h = the depth in m below the ground surface at which the pressure, p, is to be computed; and

q = the value of any adjacent surcharge in kPa which may be acting close to the wall.

The above expression assumes that adequate drainage is provided and there will be no significant build-up of hydrostatic pressure behind the basement wall.

5.5 School Block and Institutional Block

The borehole advanced in the proposed elementary school area (BH9), indicate that an SLS design bearing capacity of 200 kPa (factored ULS of 300 kPa) at a depth of 1.5 m may be used for preliminary purposes. In the proposed institutional block (BH16 through BH18 and BH22 through BH24), the preliminary design can be based on an SLS bearing capacity of 250 kPa at a depth of 2.2 m below grade (375 kPa ULS – factored).

The total and differential settlements of well designed and constructed footings placed in accordance with the above recommendations, are expected to be less than 25 mm and 20 mm, respectively. All footings exposed to seasonal freezing conditions should be protected from frost action by at least 1.2 m of soil cover or equivalent insulation, depending on the final design requirements.

We do not anticipate any major groundwater control difficulties for foundation construction at the site and any water infiltration should be handled using conventional sump pumping techniques.

The floor slab may be constructed as a slab-on-grade on a properly prepared subgrade (i.e., on native undisturbed soils). In this regard, all topsoil and other obviously unsuitable material should be removed from the entire underfloor area and the exposed subgrade thoroughly proofrolled. Any soft spots detected should be sub-excavated and the area brought up to design grades using approved clean fill placed in 300 mm thick lifts and compacted to at least 98 % of its SPMDD. A 200 mm layer of 19 mm clear stone should be placed between the prepared subgrade and the floor slab to serve as a moisture barrier. The structure should be provided with a perimeter drainage system at footing level and any walls below ground surface level should be dampproofed.

When more detailed conceptual design information is available, a more detailed soils investigation should be carried out to provide geotechnical parameters for final design and construction of the proposed development.

5.6 Pavement Construction

The recommended pavement structures provided in Table 3 are based upon an estimate of the subgrade soil properties determined from visual examination and textural classification of the soil samples. Consequently, the recommended pavement structures should be considered for preliminary design purposes only. A functional design life of fifteen years has been used to establish the pavement recommendations. This represents the number of years to the first rehabilitation, assuming regular maintenance is carried out. Other thickness combinations can be used provided the Granular Base Equivalency (GBE) is maintained and any minimum component thickness specified by the City of Barrie.

Table 3
Recommended Pavement Structure Thickness

Pavement Layer	Compaction Requirements	Local Residential Roadways	Collector Residential Roadways
Asphaltic Concrete (OPSS 1150)	92 – 96.5 % Maximum Relative Density	40 mm HL3 70 mm HL8	40 mm HL3 100 mm HL8
19 mm Crusher-Run Limestone or Sand and Gravel Material (OPSS Granular 'A')	100% SPMDD*	150 mm	150 mm
50 mm Crusher-Run Limestone or Sand and Gravel Material (OPSS Granular 'B')	100% SPMDD *	400 mm	500 mm

* Denotes standard Proctor maximum dry density, ASTM-D698

The subgrade must be compacted to 98 % SPMDD for at least the upper 300 mm unless accepted by EXP.

The foregoing design assumes that construction is carried out during dry periods and that the subgrade is stable under the load of construction equipment. If construction is carried out during wet weather, and heaving or rolling of the subgrade is experienced, additional thickness of sub-base course material may be required.

The long-term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure that uniform subgrade moisture and density conditions are achieved. In addition, the need for adequate drainage cannot be over-emphasized. The finished pavement surface and underlying subgrade should be free of depressions and should be sloped to provide effective surface drainage toward catchbasins. Surface water should not be allowed to pond adjacent to the outside edges of pavement areas. Subdrains should be installed to intercept excess subsurface moisture and prevent subgrade softening.

Additional comments on the construction of roadways are as follows:

1. As part of the subgrade preparation, proposed roadways should be stripped of topsoil and other obviously unsuitable material. Fill required to raise the grades to design elevations should be organic-free and at a moisture content which will permit compaction to the densities indicated. The subgrade should be properly shaped, crowned then proofrolled in the full-time presence of a

representative of this office. Soft or spongy subgrade areas should be subexcavated and properly replaced with suitable approved backfill compacted to 95% SPMDD.

2. Longitudinal subdrains should be installed along the curbs since the subgrade will comprise poorly drained silty or clayey soils.

3. To minimize the problems of differential movement between the pavement and catchbasins/manhole due to frost action, the backfill around the structures should consist of free-draining granular.

4. The most severe loading conditions on light-duty pavement areas and the subgrade may occur during construction. Consequently, special provisions such as restricted lanes, half-loads during paving, etc. may be required, especially if construction is carried out during unfavorable weather.

5.7 Seismic Site Classification

Based on the results of the geotechnical investigation, the Site can be classified as a Class D for seismic site response. Acceleration-based coefficient Fa for a spectral acceleration event with a period of 0.2 s (Sa(0.2)) ranges from 1.0 to 1.3, Velocity-based coefficients for an event with a spectral acceleration of 1.0 s (Sa(1.0)) ranges from 1.1 to 1.4.

6. General Comments

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

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

More specific information with respect to the conditions between samples, or the lateral and vertical extent of materials may become apparent during excavation operations. The interpretation of the borehole information must, therefore, be validated during excavation operations. Consequently, during the future development of the property, conditions not observed during this investigation may become apparent; should this occur, EXP Services Inc. should be contacted to assess the situation, and additional testing and reporting may be required. Trow has qualified personnel to provide assistance in regards to future geotechnical and environmental issues related to this property.

Yours truly,

EXP Services Inc.

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Appendix A:
Grain Size Analyses

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Grain Size Analysis Report

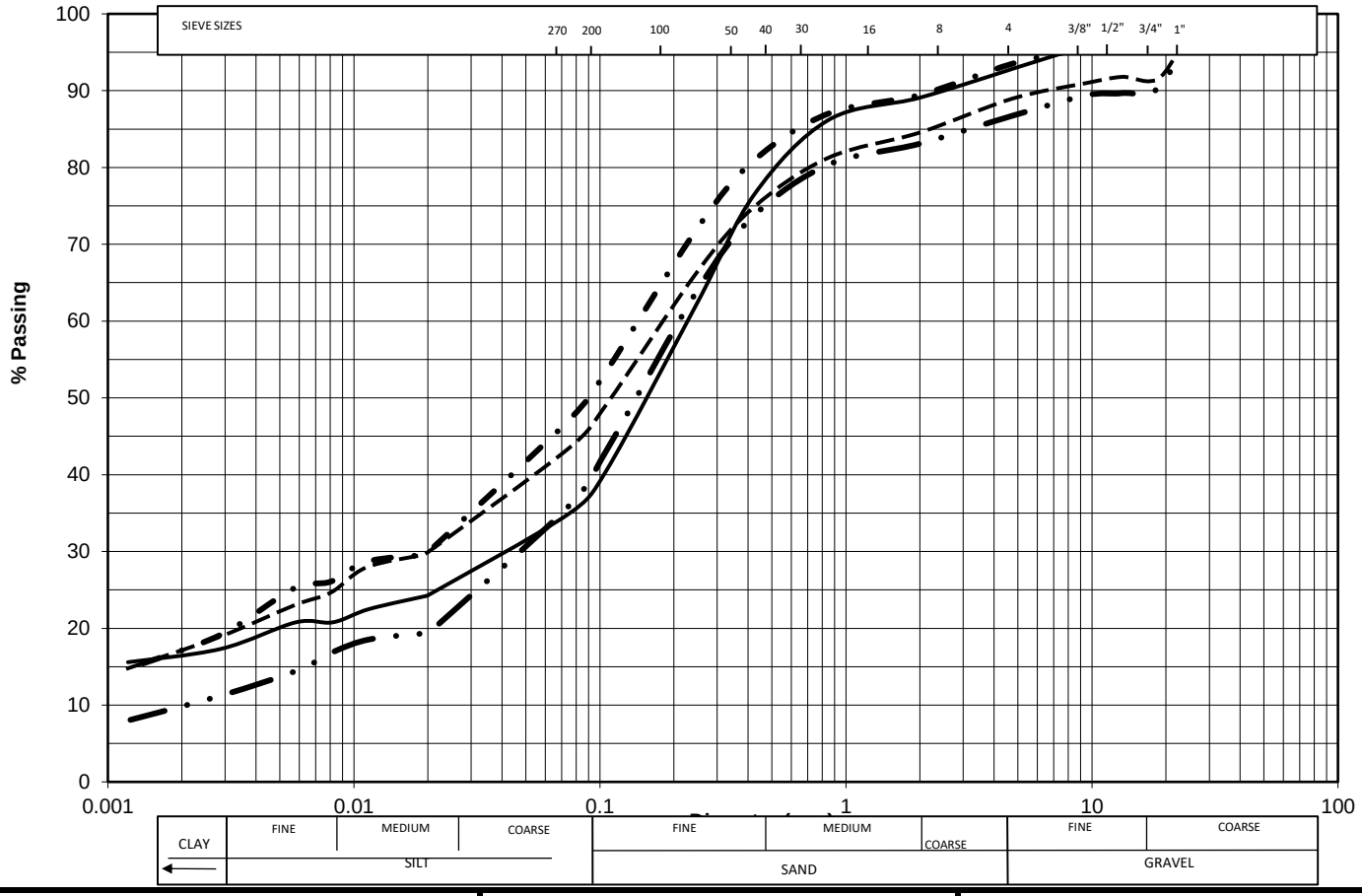
Project Name: Rainsong Development Phase 2
Project No.: BAR-21014976-A1
Client: Great Gulf

Figure No.: 20
Date Tested: January 27, 2022
Date Sampled: Jan10-14, 2022

SAMPLE INFORMATION

Material	Borehole No. and Sample No.	Sample Depth	Material Description	Graph Line Type
1	RS2 SS3	1.5 - 2.1 m	Sand, some Silt and Clay, trace Gravel	
2	RS10 SS8	7.6 - 8.2	Silty Sand, some Clay and Gravel	
3	RS19 SS2	0.7 - 1.3 m	Silty Sand, Some Clay, Trace Gravel	
4	BH23 SS4	2.3 - 2.9 m	Sand with Silt and Gravel, Trace Clay	

Sieve Analysis



DISTRIBUTION:
Great Gulf

Prepared By:
Eli Knegt

Checked By:
Richard Blair, P. Eng.

Drawings:
Notes on Sample Description
Borehole Location Plan
Borehole Logs

Notes On Sample Descriptions

1. All sample descriptions included in this report follow the Unified Soil Classification System (USCS) as outlined by the Ministry of Transportation. Different classification systems may be used by others; one such system is the International Society for Soil Mechanics and Foundation Engineering (ISSMFE), as outlined in the Canadian Foundation Engineering Manual. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

UNIFIED SOIL CLASSIFICATION

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (75 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Notes On Sample Descriptions

4. The following table gives a description of the soil based on particle sizes. With the exception of those samples where grain size analyses have been performed, all samples are classified visually. The accuracy of visual examination is not sufficient to differentiate between this classification system or exact grain size.

Soil Classification		Terminology	Proportion
Clay and Silt	<0.075 mm		
Sand	0.075 to 4.75 mm	“trace” (e.g. Trace sand)	0% to 10%
Gravel	4.75 to 75 mm	“some” (e.g. Some sand)	10% to 20%
Cobbles	75 to 200 mm	with (e.g. with sand)	20% to 35%
Boulders	>200 mm	and (e.g. and sand)	35% to 50%

For a given material listed as an adjective (e.g. silty sand) means the predominant grain size is sand sized with 30 to 40% silt sized particles.

The compactness of Cohesionless soils and the consistency of the cohesive soils are defined by the following:

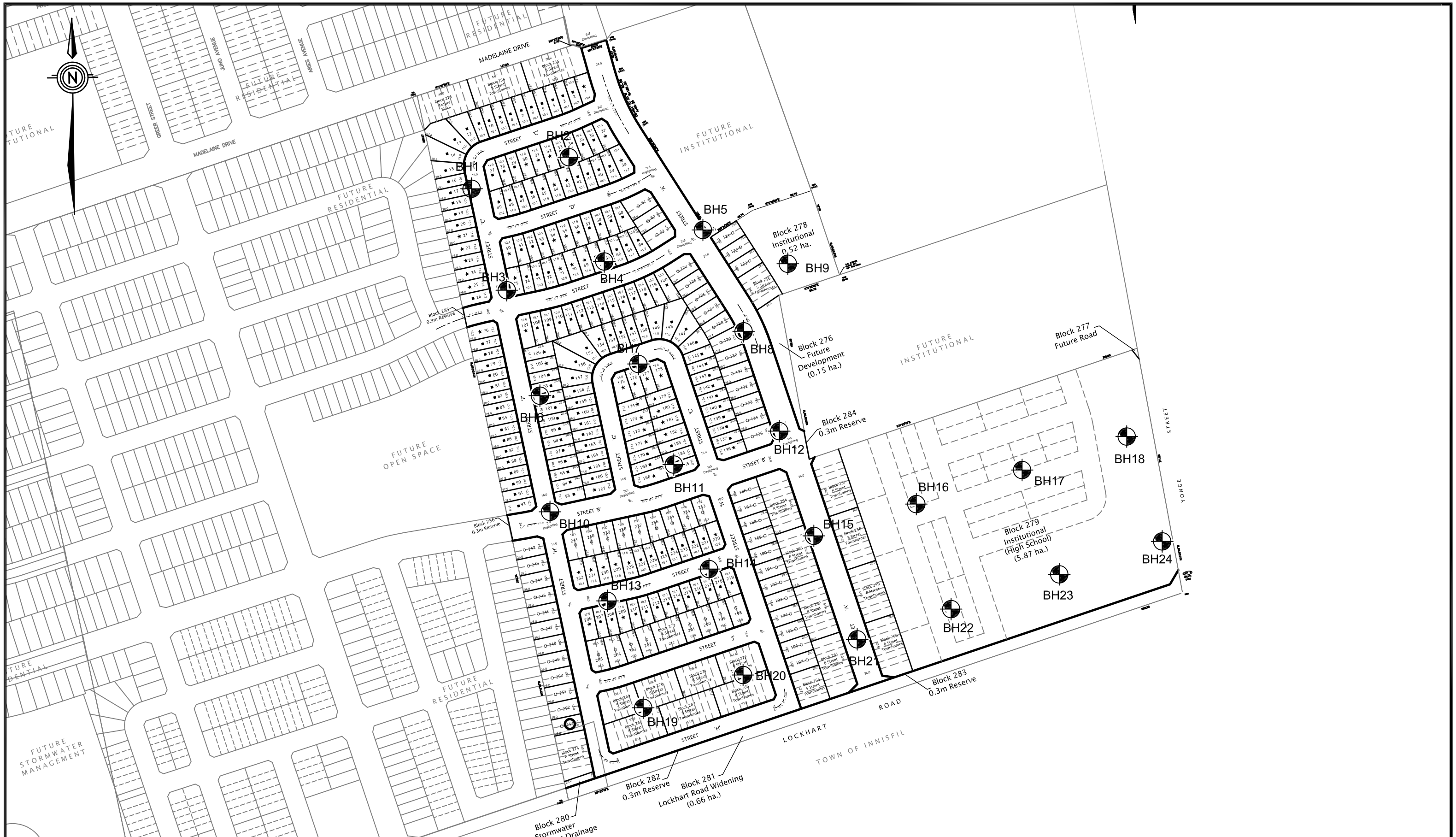
Cohesionless Soil		Cohesive Soil		
Compactness	**Standard Penetration Resistance “N” value Blows/ 0.3 m**	**Consistency**	**Undrained Shear Strength (kPa)**	**‘N’ Values**
Very Loose	0 to 4	Very soft	<12	<2
Loose	4 to 10	Soft	12 to 25	2 to 4
Compact	10 to 30	Firm	25 to 50	4 to 8
Dense	30 to 50	Stiff	50 to 100	8 to 15
Very Dense	Over 50	Very Stiff	100 to 200	15 to 30
		Hard	>200	>30

5. **ROCK CORING**

Where rock drilling was carried out, the term RQD (Rock Quality Designation) is used. The RQD is an indirect measure of the number of fractures and soundless of the rock mass. It is obtained from the rock cores by summing the length of the core covered, counting only those pieces of sound core that are 100 mm or more length. The RQD value is expressed as a percentage and is the ratio of the summed core lengths to the total length of core run. The classification based on the RQD value is given below.

RQD Classification	RQD (%)
Very Poor Quality	<25
Poor Quality	25 to 50
Fair Quality	50 to 75
Good Quality	75 to 90
Excellent Quality	90 to 100

Recovery Designation: $$\% \text{ Recovery} = \frac{\text{Length of Core Per Run}}{\text{Total Length of Run}} \times 100$$



NOTES:
1. THE BOUNDARIES AND SOIL TYPES HAVE BEEN ESTABLISHED ONLY AT BOREHOLE LOCATIONS. BETWEEN BOREHOLES THEY ARE ASSUMED AND MAY BE SUBJECT TO CONSIDERABLE ERROR.
2. SOIL SAMPLES WILL BE RETAINED IN STORAGE FOR 1 MONTH AND THEN DESTROYED UNLESS CLIENT ADVISES THAT AN EXTENDED TIME PERIOD IS REQUIRED.
3. GROUND SURFACE ELEVATIONS AT THE BOREHOLE LOCATIONS WERE DERIVED FROM CAN-NET ELEVATIONS WITH THE USE OF A TRIMBLE TSC3 CONTROLLER.
4. BOREHOLE ELEVATIONS SHOULD NOT BE USED TO ESTABLISH GRADES.
5. THIS DRAWING SHOULD BE REPRODUCED IN COLOUR.
6. BASE PLAN PRODUCED GOOGLE EARTH SATELLITE IMAGERY.

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PROJECT TITLE AND LOCATION:
GEOTECHNICAL INVESTIGATION
FOR RAINSONG PHASE 2
LOCKHART RD & YONGE ST., BARRIE
ONTARIO

DRAWING TITLE:
BOREHOLE LOCATION PLAN

PROJECT#: BAR-21014976-A1	DWN.: TM
SCALE: NOT TO SCALE	CHKD.: LK
DATE: JAN. 2022	DWG. No.: 1

Log of Borehole BH1

Project No. BAR-21014976-A1 | Figure No. 2

Project: Rainsong Phase 2 | Sheet No. 1 of 1

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910595.478N 609124.391E

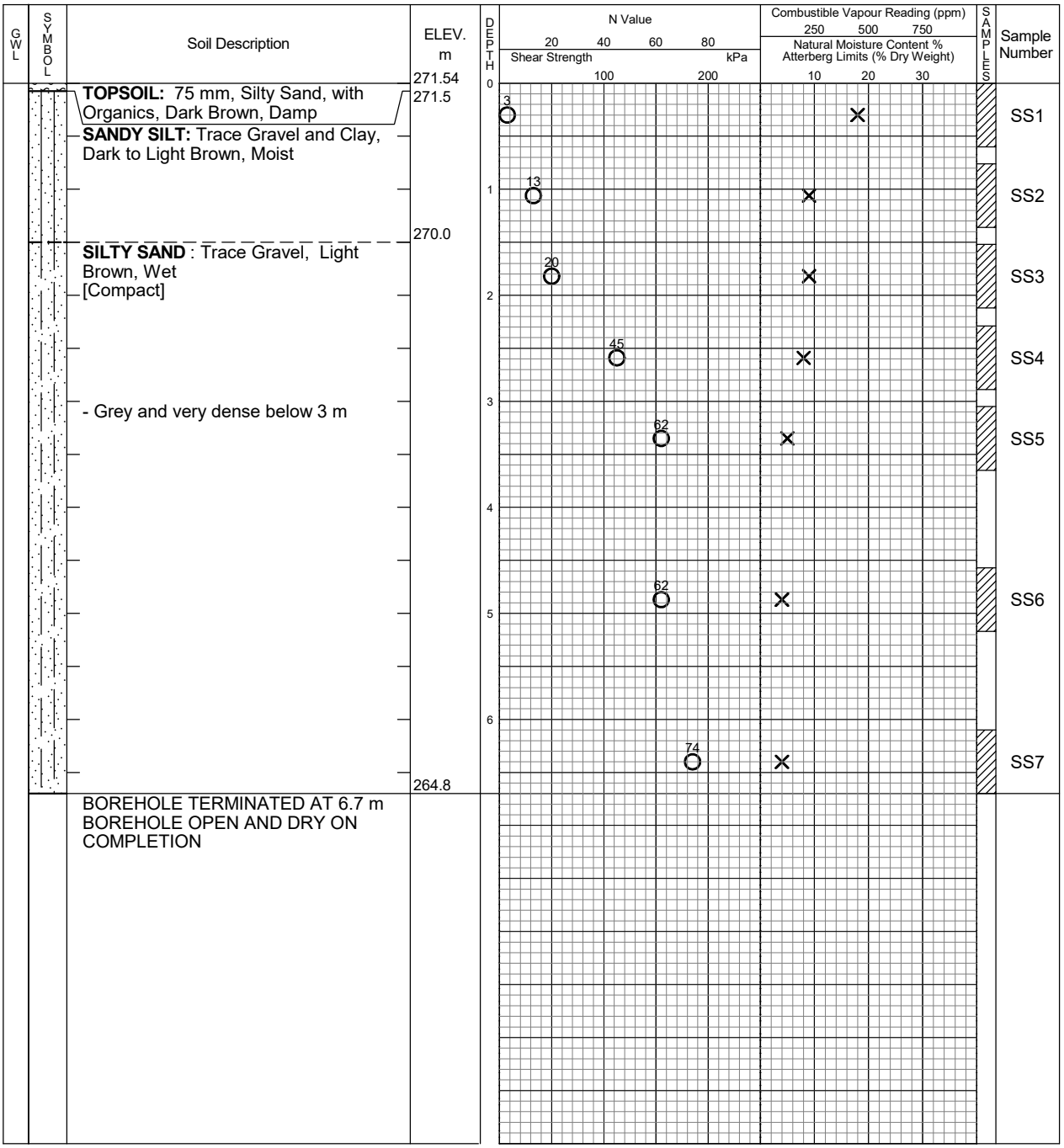
Date Drilled: Jan 13, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from EXP before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 13, 2021	Dry	Open

Log of Borehole BH10

Project No. BAR-21014976-A1 | Figure No. 11

Project: Rainsong Phase 2 | Sheet No. 1 of 2

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910368.51N 609724.814E

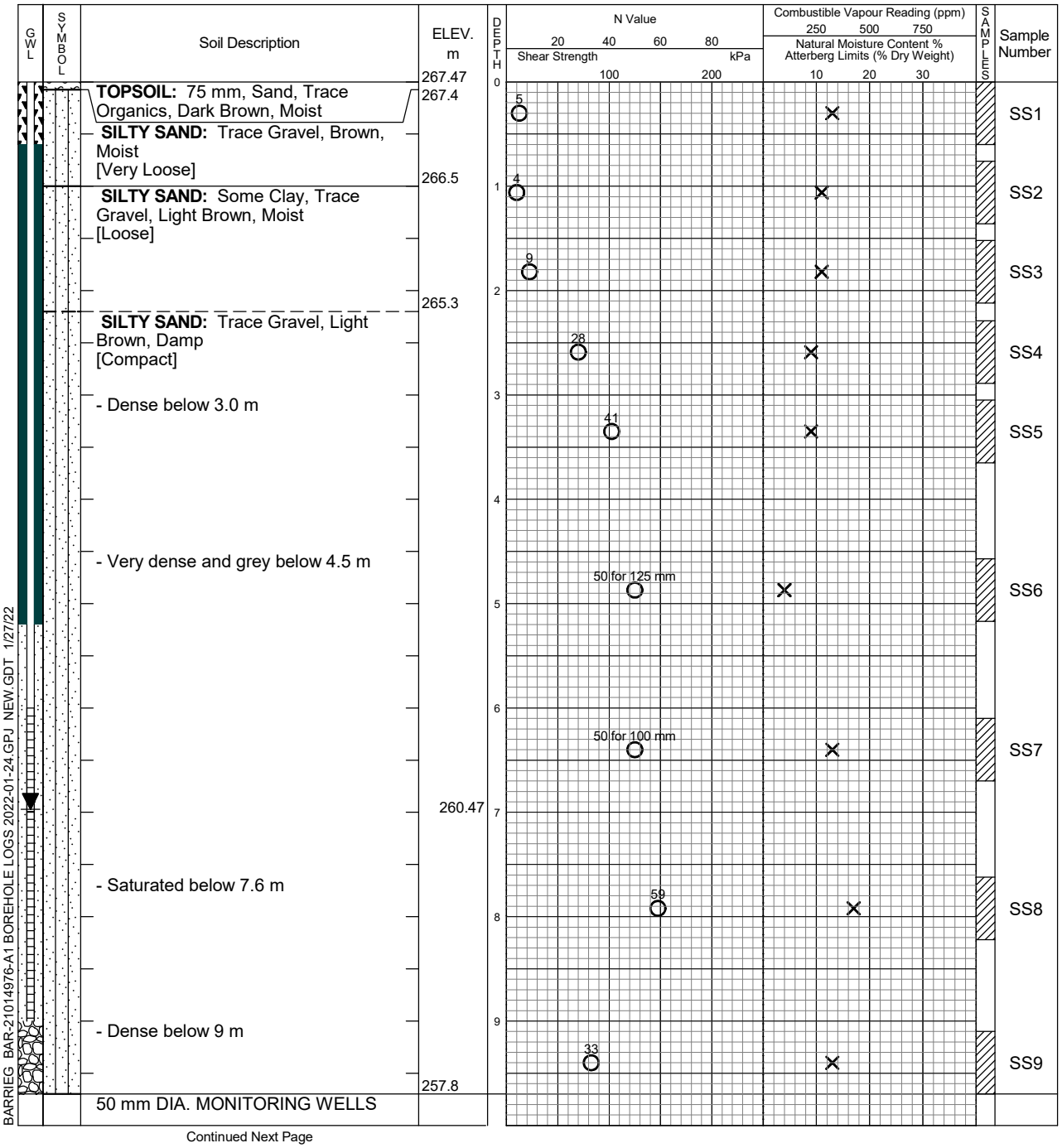
Date Drilled: Jan 12, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



BARRIEG BAR-21014976-A1 BOREHOLE LOGS 2022-01-24.GPJ NEW.GDT 1/27/22

Continued Next Page

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See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 12, 2021	7	8.5

Log of Borehole BH10

Project No. BAR-21014976-A1 Figure No. 11

Project: Rainsong Phase 2 Sheet No. 2 of 2

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength (kPa)	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Sample Number
		INSTALLED TO 9.7 m WITH WATER AT 6.9 m	257.47		N Value: 20 40 60 80; Shear Strength: 100 200 kPa	250 500 750; 10 20 30		

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See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 12, 2021	7	8.5

Log of Borehole BH11

Project No. BAR-21014976-A1 | Figure No. 12

Project: Rainsong Phase 2 | Sheet No. 1 of 1

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910120.344N 609281.656E

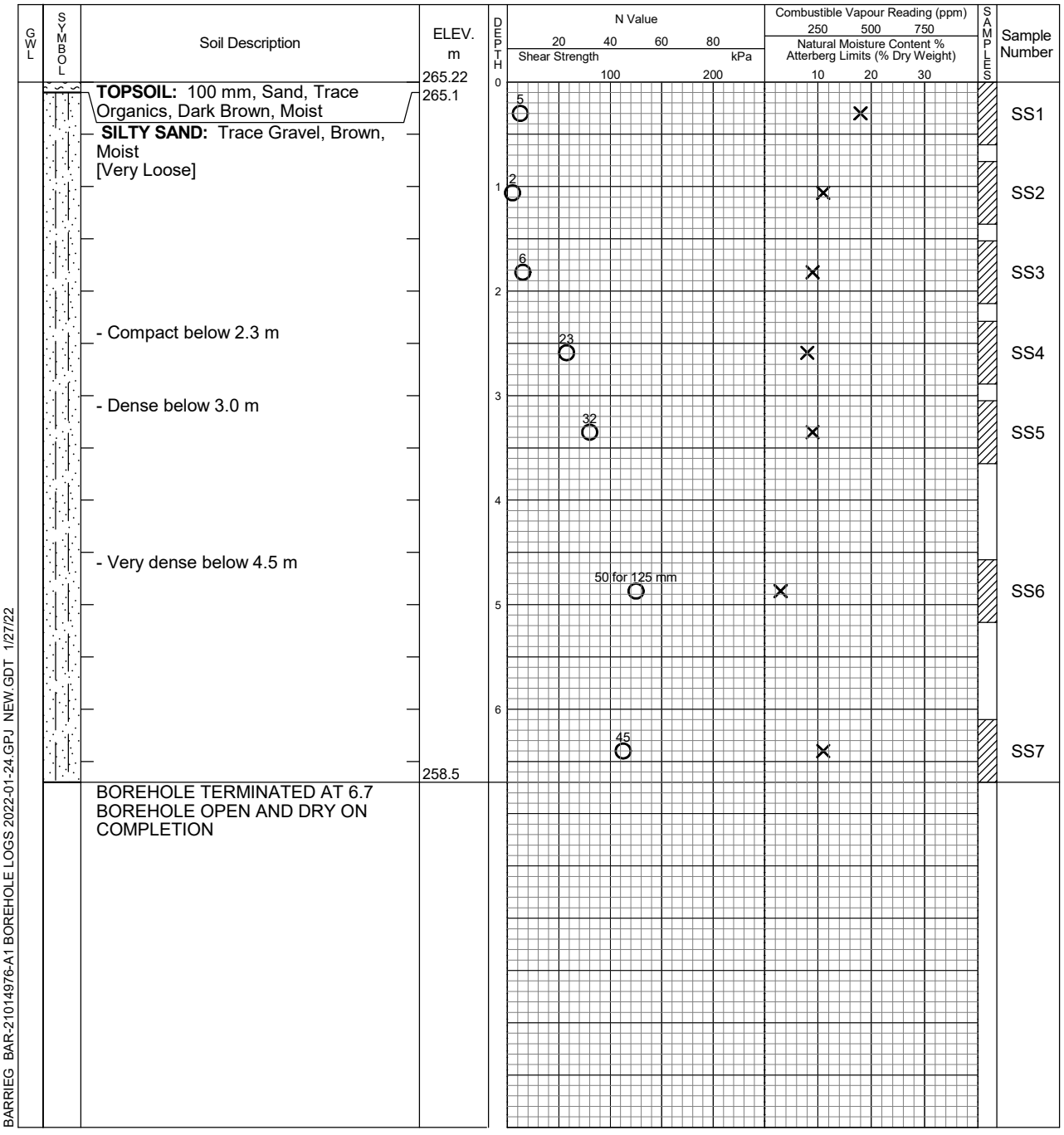
Date Drilled: Jan 12, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 12, 2021	Dry	Open

Log of Borehole BH12

Project No. BAR-21014976-A1 | Figure No. 13

Project: Rainsong Phase 2 | Sheet No. 1 of 2

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910624.392N 609213.551E

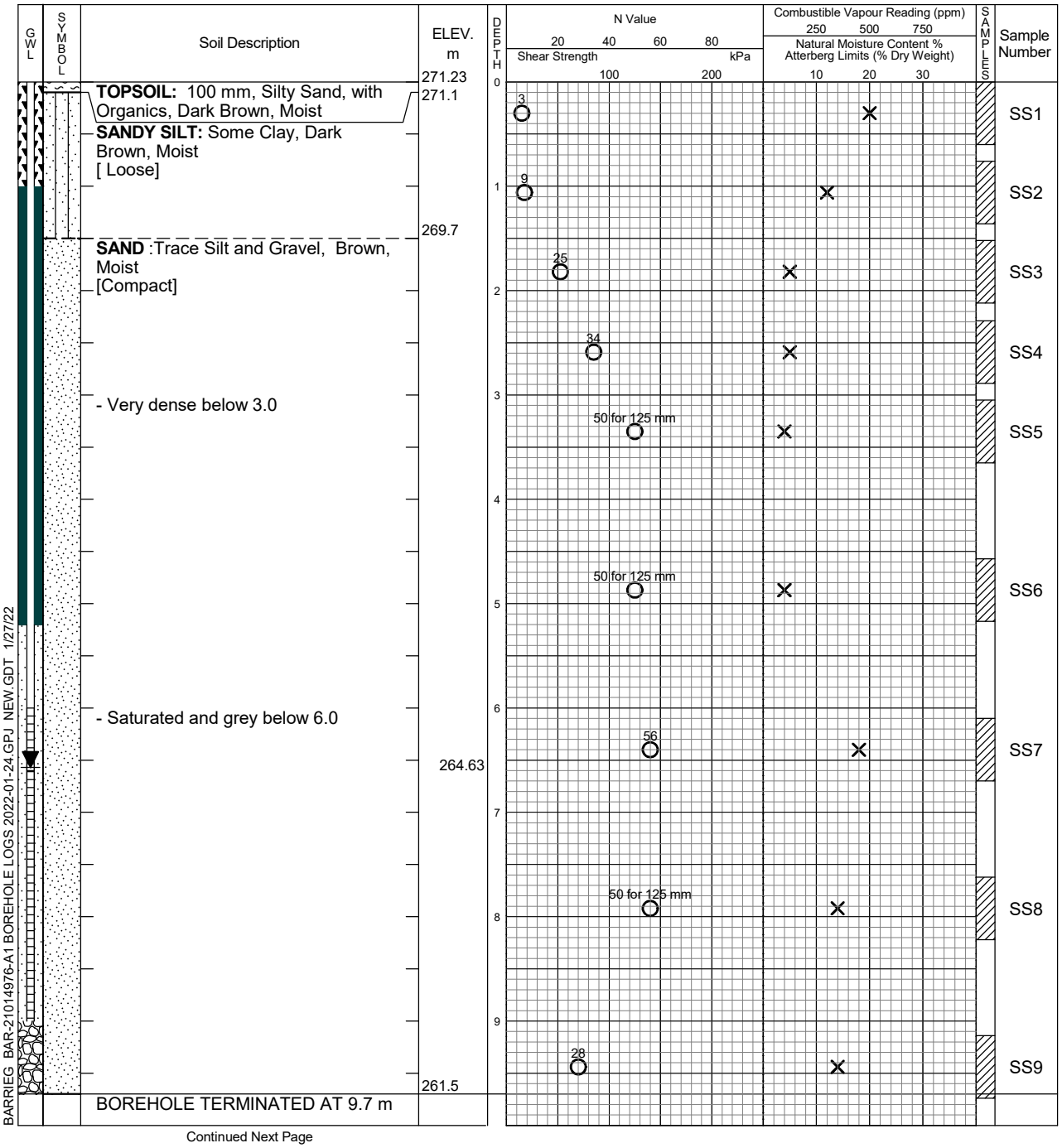
Date Drilled: Jan 12, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



BARRIEG BAR-21014976-A1 BOREHOLE LOGS 2022-01-24.GPJ NEW.GDT 1/27/22

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See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 12, 2021	6.6	7.6

Log of Borehole BH12

Project No. BAR-21014976-A1 Figure No. 13

Project: Rainsong Phase 2 Sheet No. 2 of 2

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Sample Number
		BOREHOLE OPEN TO 7.6 m WITH WATER AT 6.6 m	261.23		N Value: 20 40 60 80; Shear Strength kPa: 100 200	Combustible Vapour Reading (ppm): 250 500 750; Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30		

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See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 12, 2021	6.6	7.6

Log of Borehole BH13

Project No. BAR-21014976-A1 | Figure No. 14

Project: Rainsong Phase 2 | Sheet No. 1 of 1

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910149.997N 609373.237E

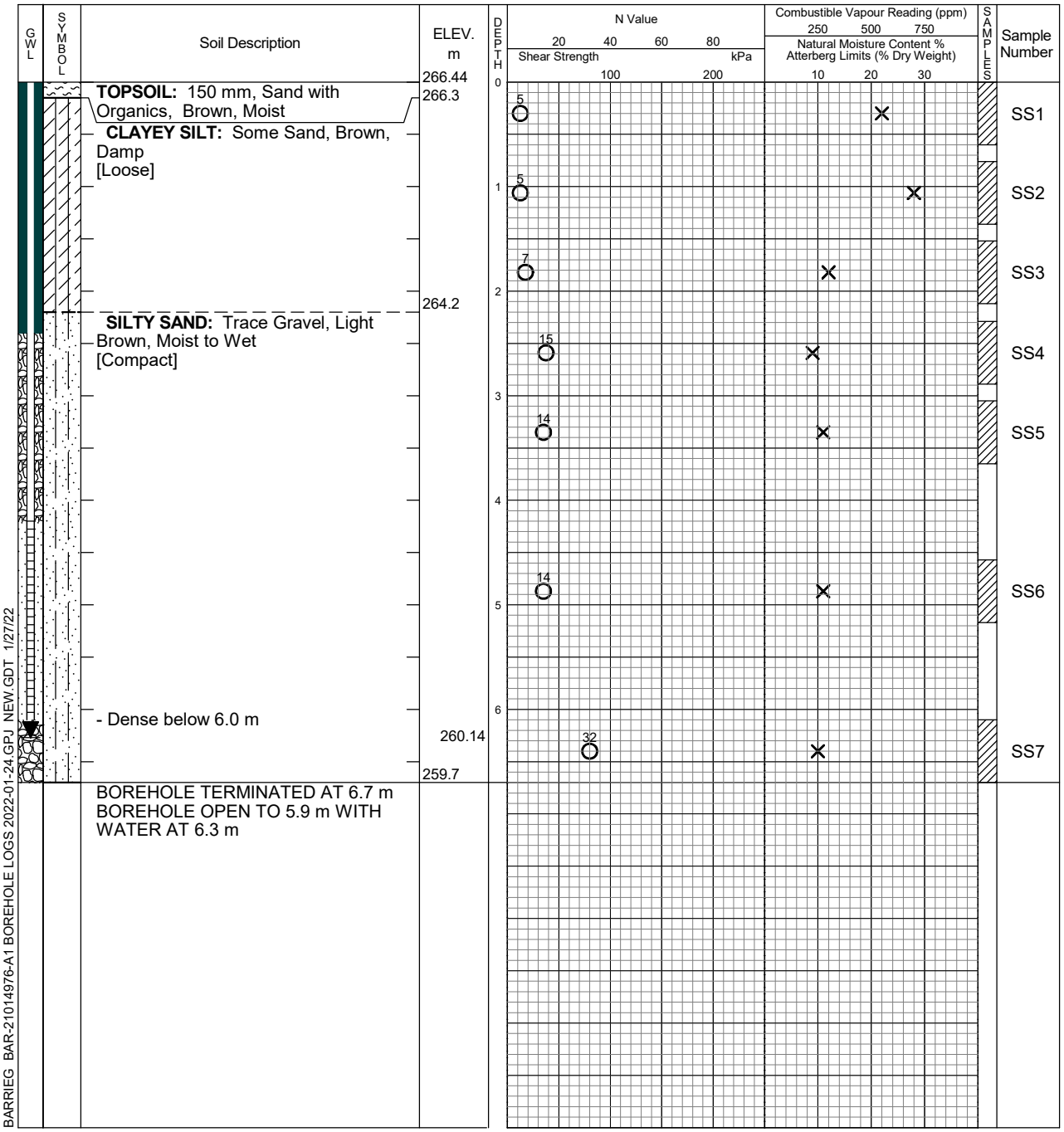
Date Drilled: Jan 11, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from EXP before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 11, 2021	6.3	5.9

Log of Borehole BH14

Project No. BAR-21014976-A1 | Figure No. 15

Project: Rainsong Phase 2 | Sheet No. 1 of 1

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910182.694N 609477.746E

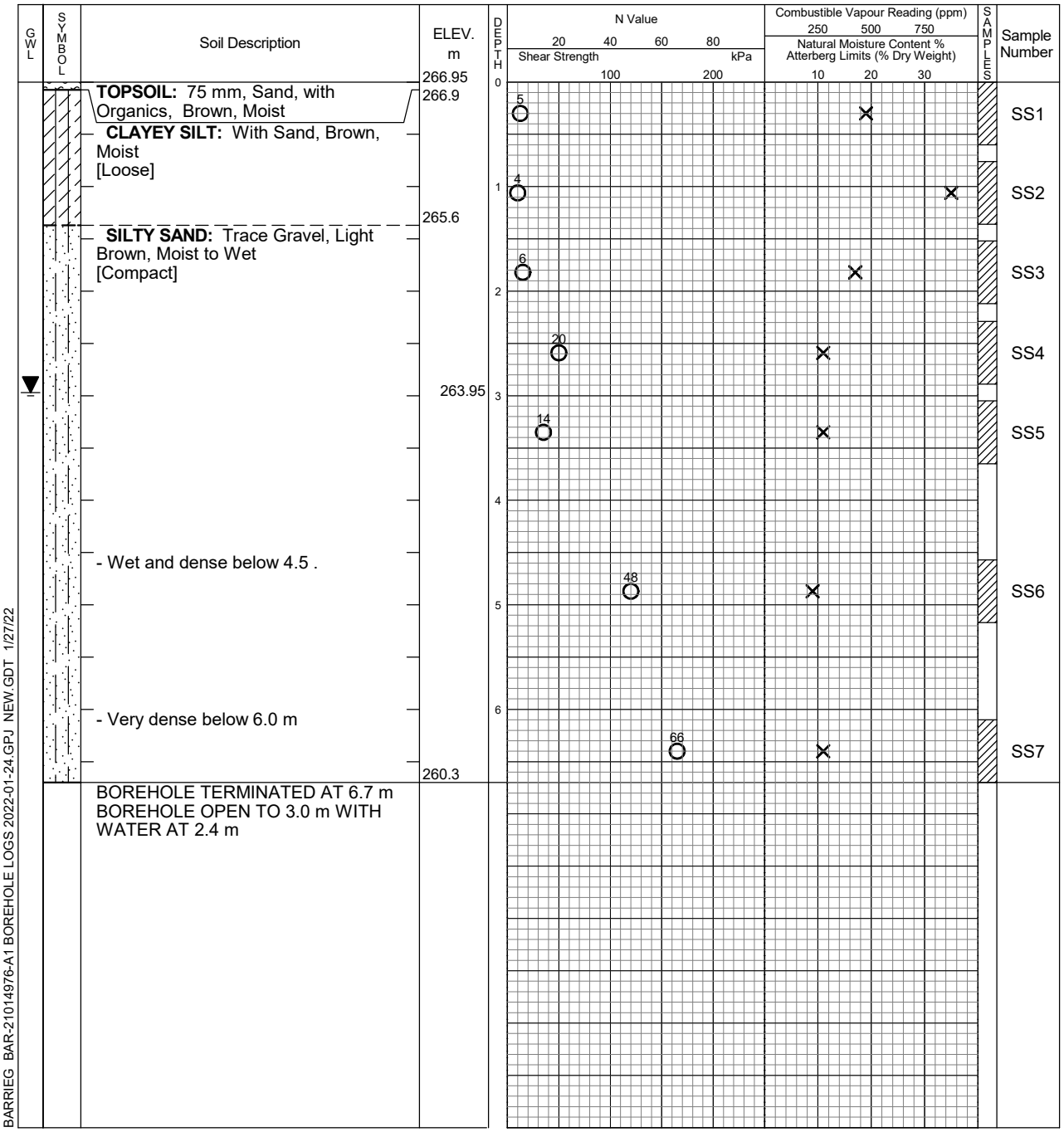
Date Drilled: Jan 11, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 11, 2021	3.0	Open

Log of Borehole BH15

Project No. BAR-21014976-A1 | Figure No. 61

Project: Rainsong Phase 2 | Sheet No. 1 of 1

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910210.371N 609563.878E

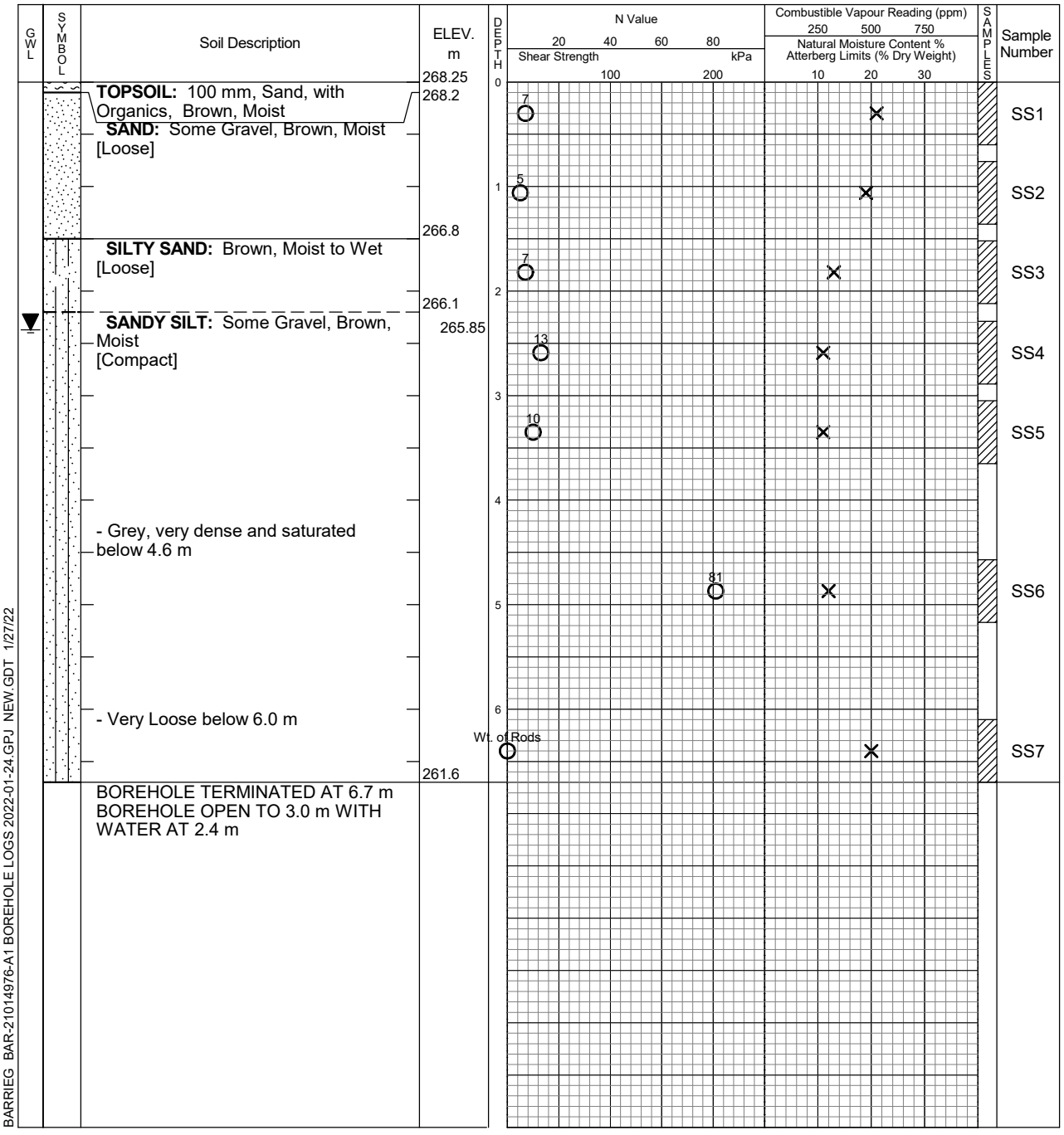
Date Drilled: Jan 10, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from EXP before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 10, 2021	2.4	3.0

Log of Borehole BH16

Project No. BAR-21014976-A1 | Figure No. 17

Project: Rainsong Phase 2 | Sheet No. 1 of 1

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910242.183N 609662.955E

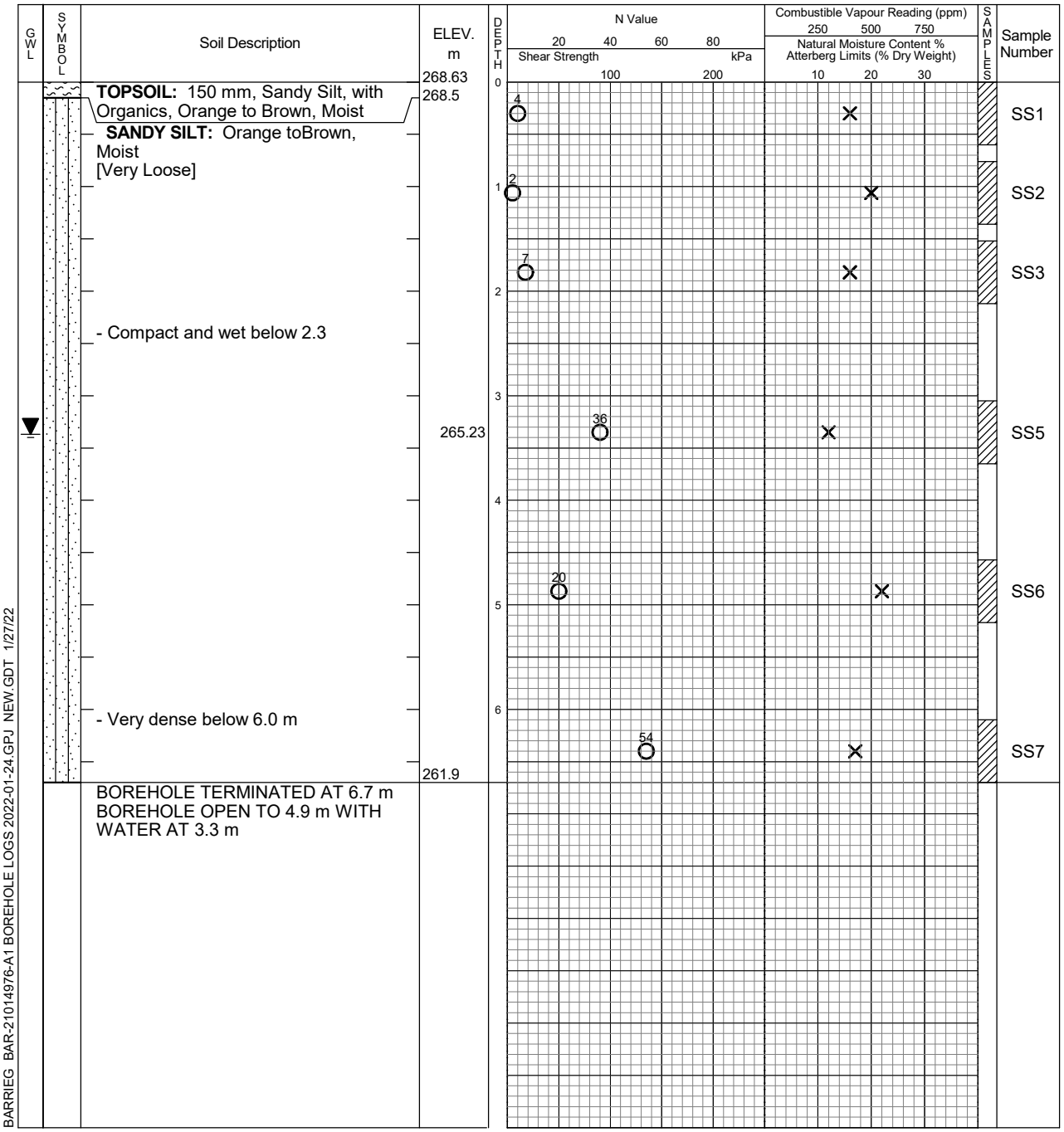
Date Drilled: Jan 10, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 10, 2021	3.4	4.9

Log of Borehole BH17

Project No. BAR-21014976-A1 | Figure No. 18

Project: Rainsong Phase 2 | Sheet No. 1 of 1

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910272.408N 609757.322E

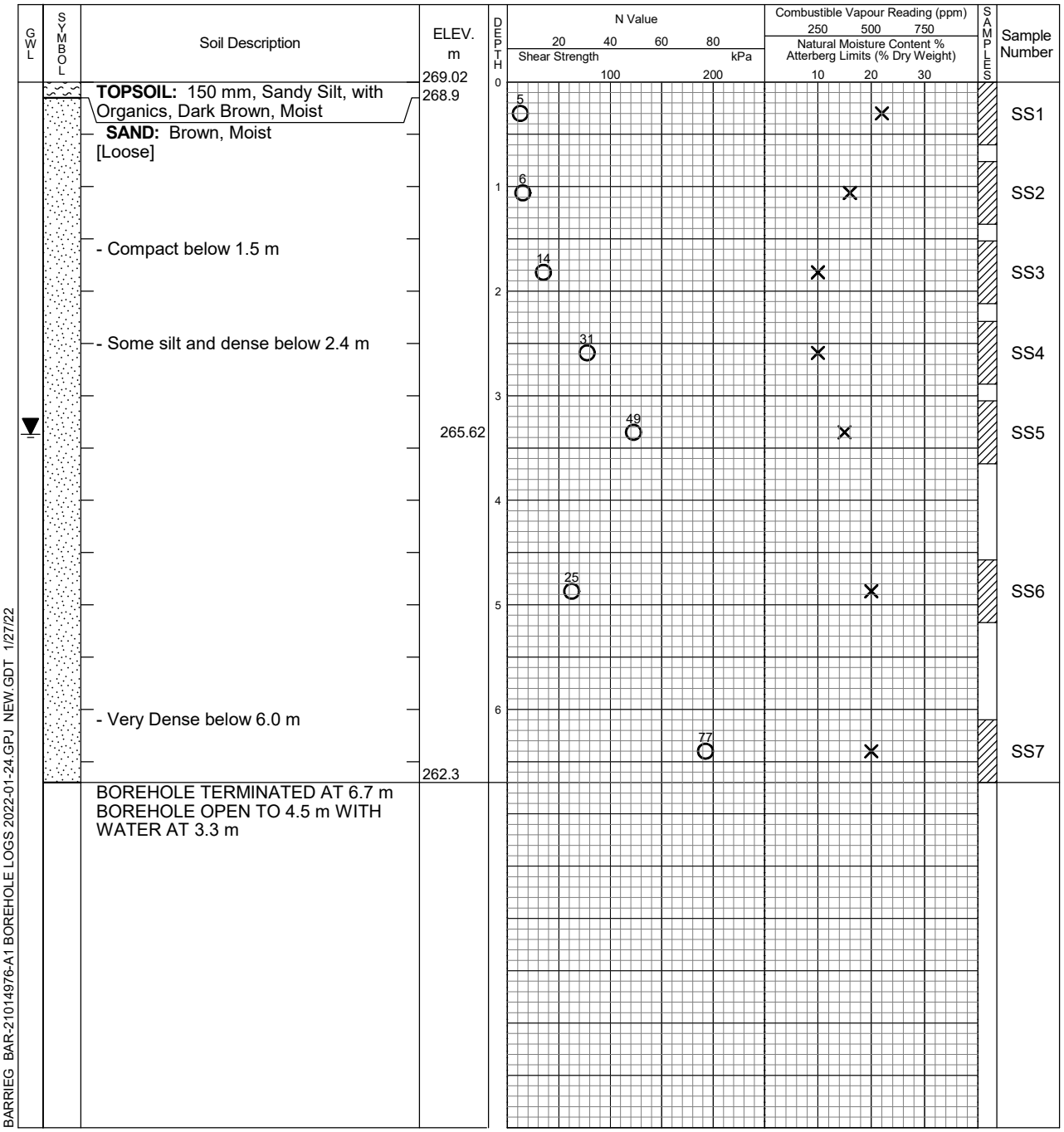
Date Drilled: Jan 10, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from EXP before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 10, 2021	3.4	4.6

Log of Borehole BH18

Project No. BAR-21014976-A1 | Figure No. 19

Project: Rainsong Phase 2 | Sheet No. 1 of 1

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910502.47N 609156.663E

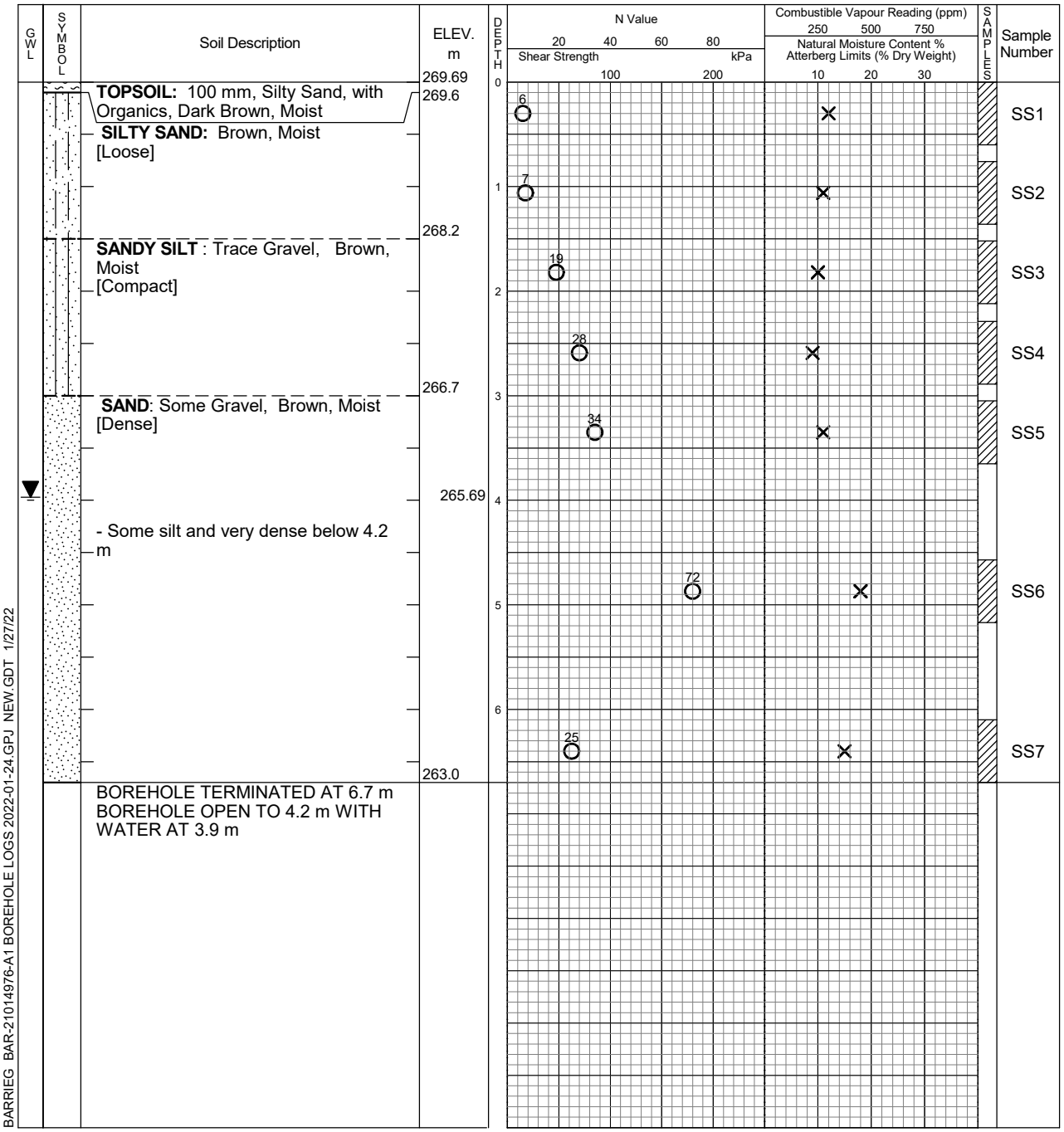
Date Drilled: Jan 10, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from EXP before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 10, 2021	4.0	4.3

Log of Borehole BH19

Project No. BAR-21014976-A1 | Figure No. 20

Project: Rainsong Phase 2 | Sheet No. 1 of 1

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910528.884N 609246.033E

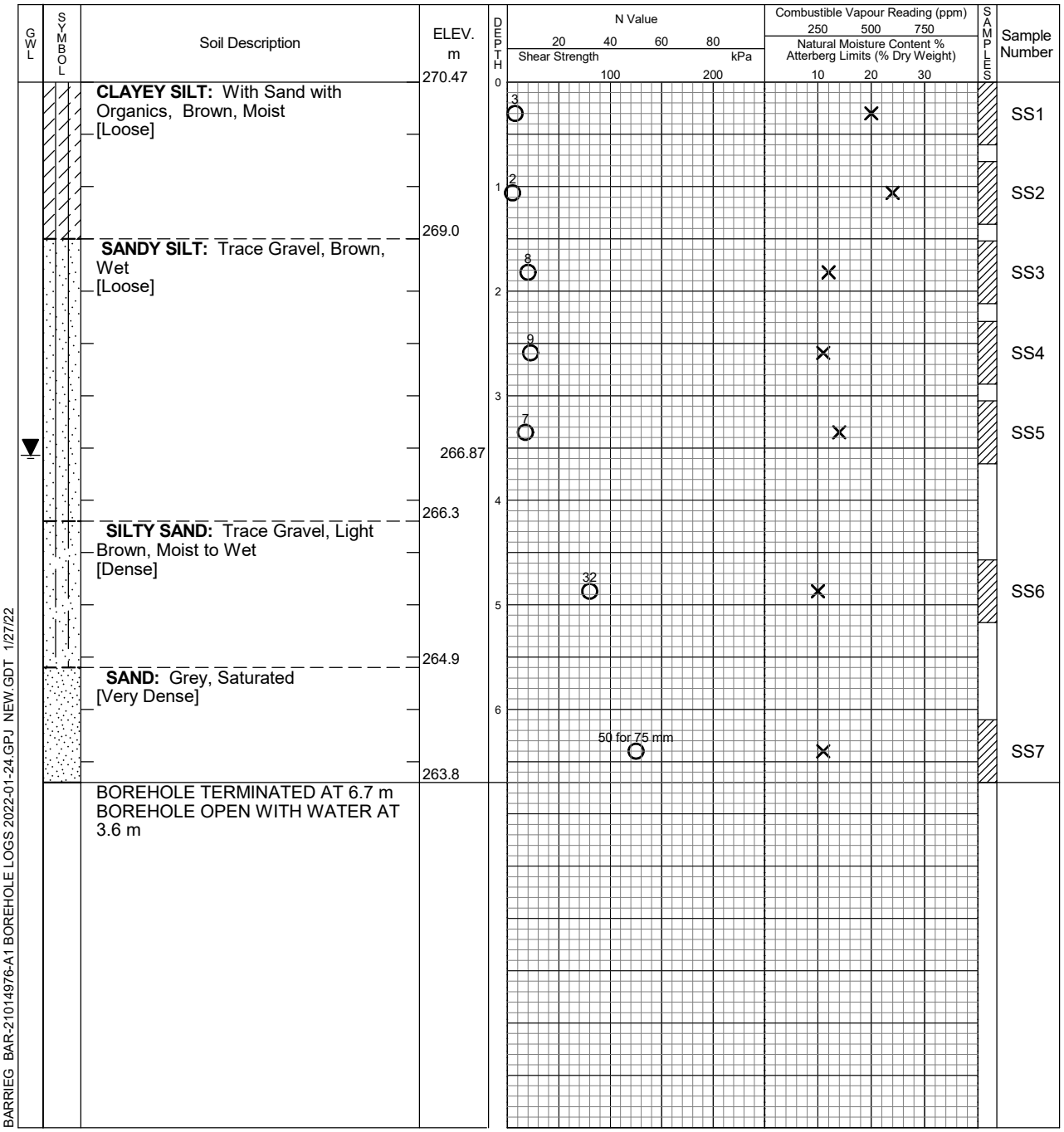
Date Drilled: Jan 11, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 11, 2021	3.6	Open

Log of Borehole BH2

Project No. BAR-21014976-A1 | Figure No. 3

Project: Rainsong Phase 2 | Sheet No. 1 of 2

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910299.517N 609196.332E

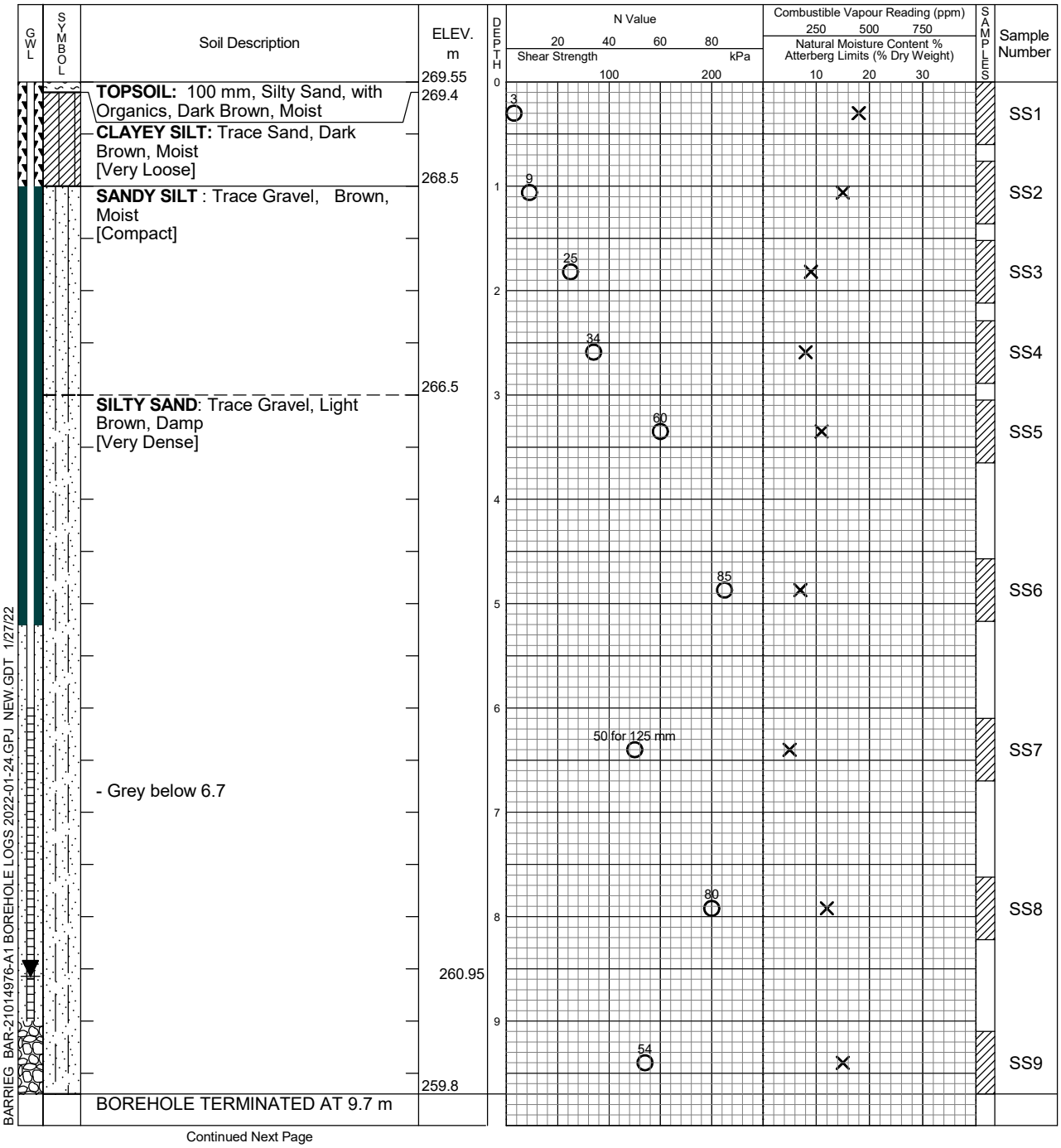
Date Drilled: Jan 13, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from EXP before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 13, 2021	8.6	Open

Log of Borehole BH21

Project No. BAR-21014976-A1 | Figure No. 22

Project: Rainsong Phase 2 | Sheet No. 1 of 2

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910405.921N 609187.011E

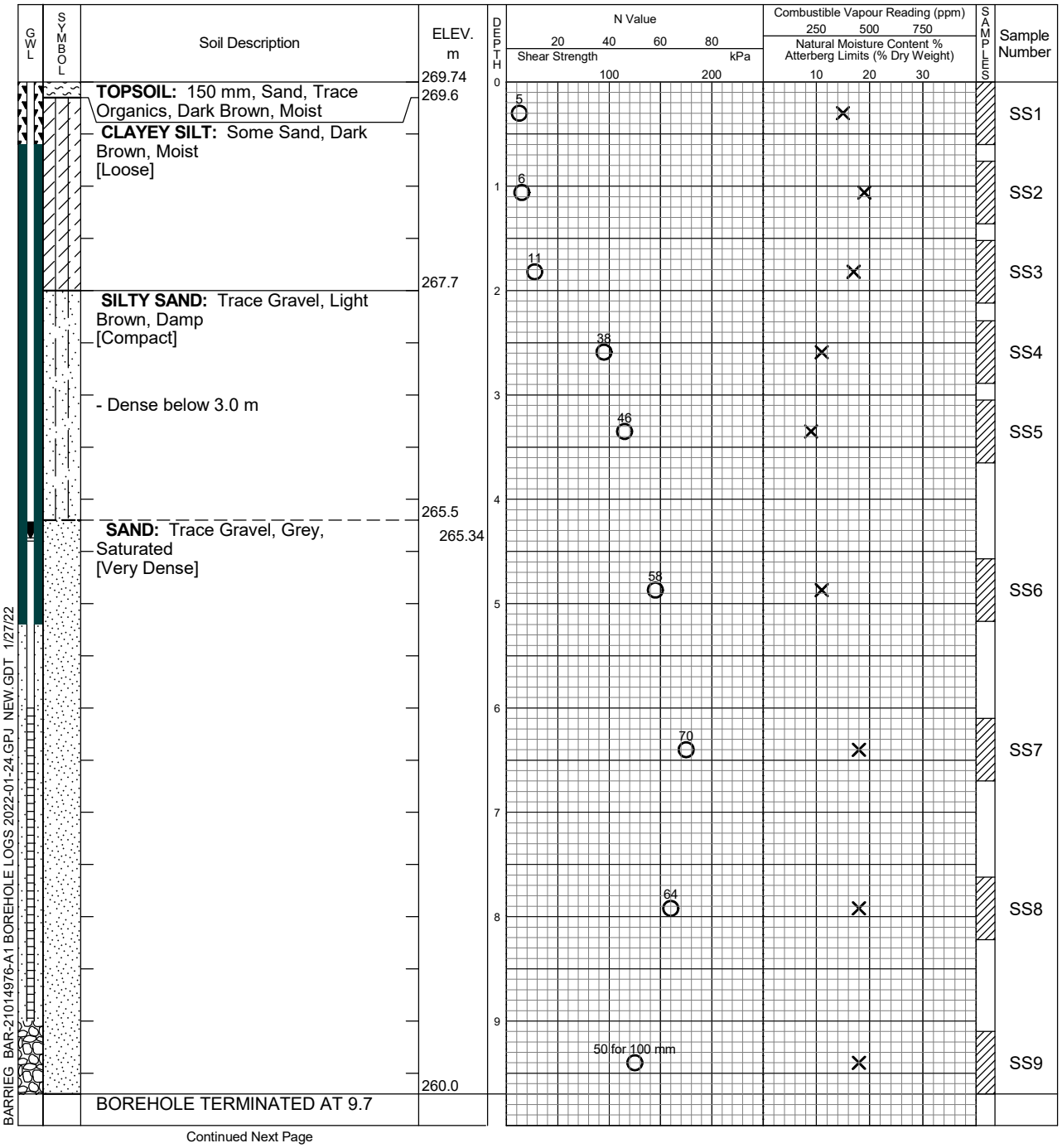
Date Drilled: Jan 12, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



BARRIEG BAR-21014976-A1 BOREHOLE LOGS 2022-01-24.GPJ NEW.GDT 1/27/22

Continued Next Page

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Borehole data requires interpretation assistance from EXP before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 12, 2021	4.4	8.1

Log of Borehole BH2

Project No. BAR-21014976-A1 Figure No. 3

Project: Rainsong Phase 2 Sheet No. 2 of 2

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Sample Number
		WATER AT 8.6 m	259.55		20 40 60 80 / 100 200	250 500 750 / 10 20 30		

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Borehole data requires interpretation assistance from EXP before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 13, 2021	8.6	Open

Log of Borehole BH20

Project No. BAR-21014976-A1 | Figure No. 21

Project: Rainsong Phase 2 | Sheet No. 1 of 1

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910557.738N 609336.255E

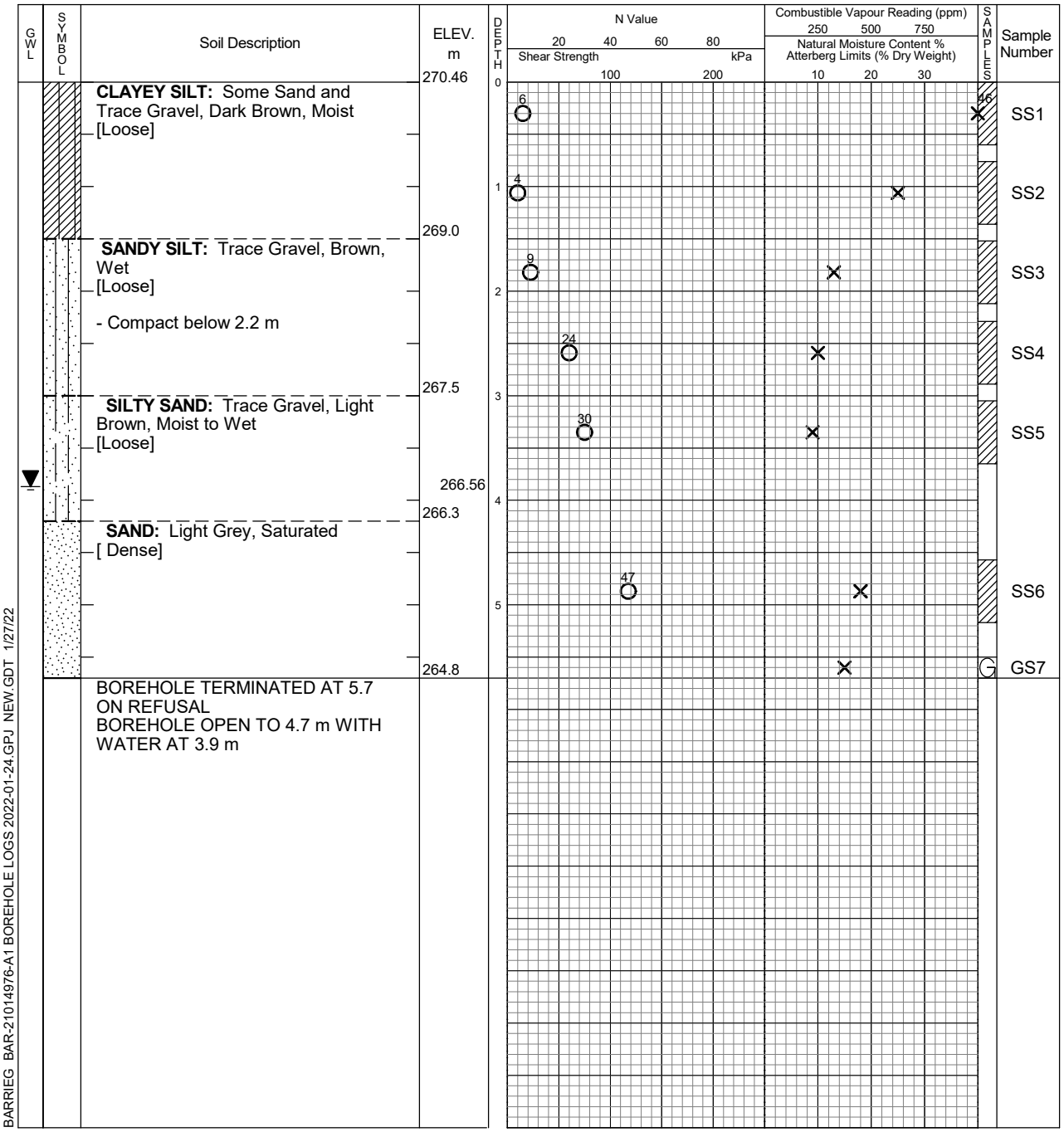
Date Drilled: Jan 11, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from EXP before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 11, 2021	3.9	4.7

Log of Borehole BH21

Project No. BAR-21014976-A1 Figure No. 22

Project: Rainsong Phase 2 Sheet No. 2 of 2

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Sample Number
		BOREHOLE OPEN TO 8.1 m WITH WATER AT 4.4 m	259.74		20 40 60 80 / 100 200	250 500 750 / 10 20 30		

BARRIEG BAR-21014976-A1 BOREHOLE LOGS 2022-01-24.GPJ NEW.GDT 1/27/22

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Borehole data requires interpretation assistance from EXP before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 12, 2021	4.4	8.1

Log of Borehole BH22

Project No. BAR-21014976-A1 | Figure No. 23

Project: Rainsong Phase 2 | Sheet No. 1 of 1

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910434.97N 609277.339E

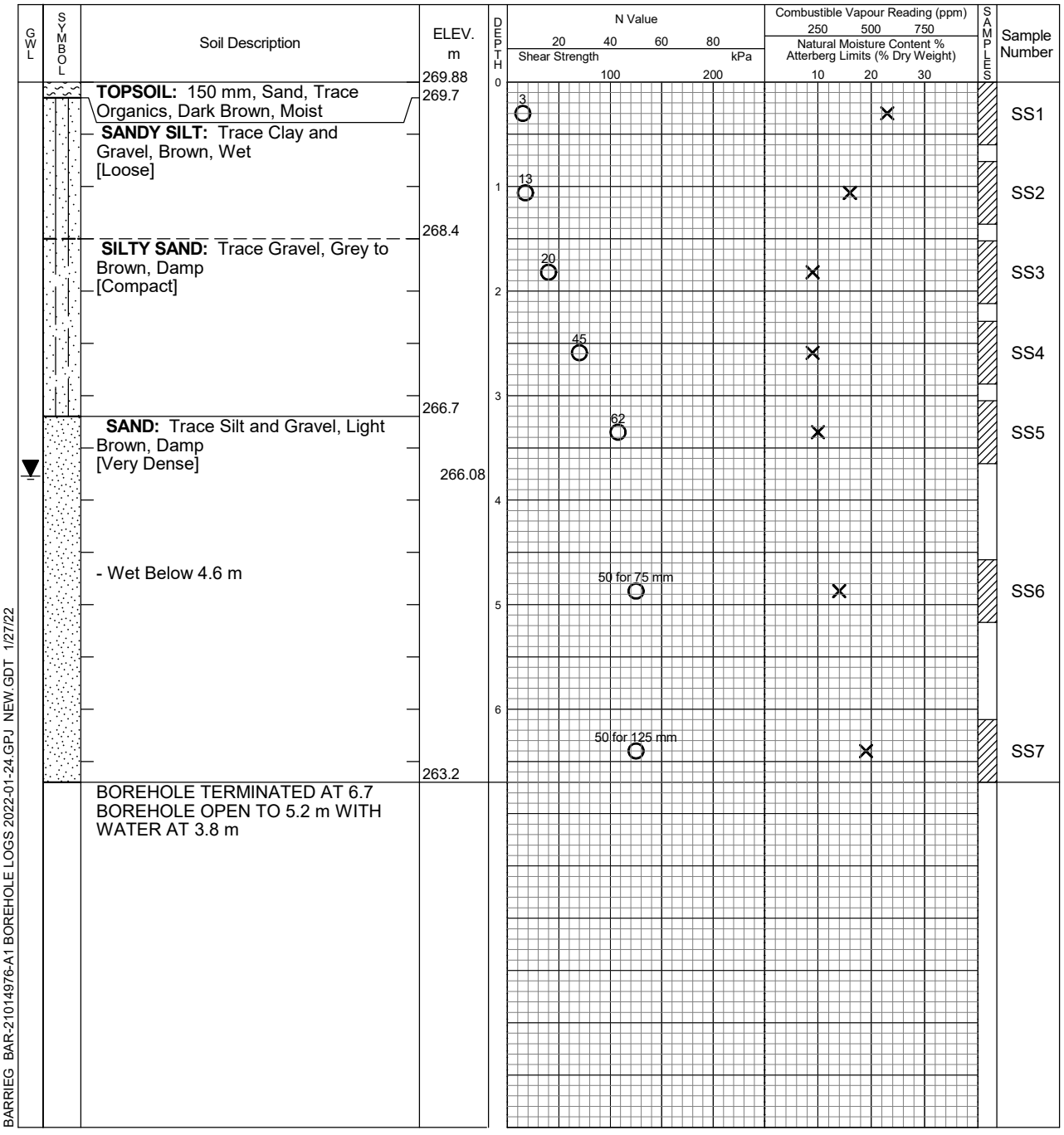
Date Drilled: Jan 12, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from EXP before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 12, 2021	3.8	5.2

Log of Borehole BH23

Project No. BAR-21014976-A1 | Figure No. 24

Project: Rainsong Phase 2 | Sheet No. 1 of 1

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910464.924N 609373.668E

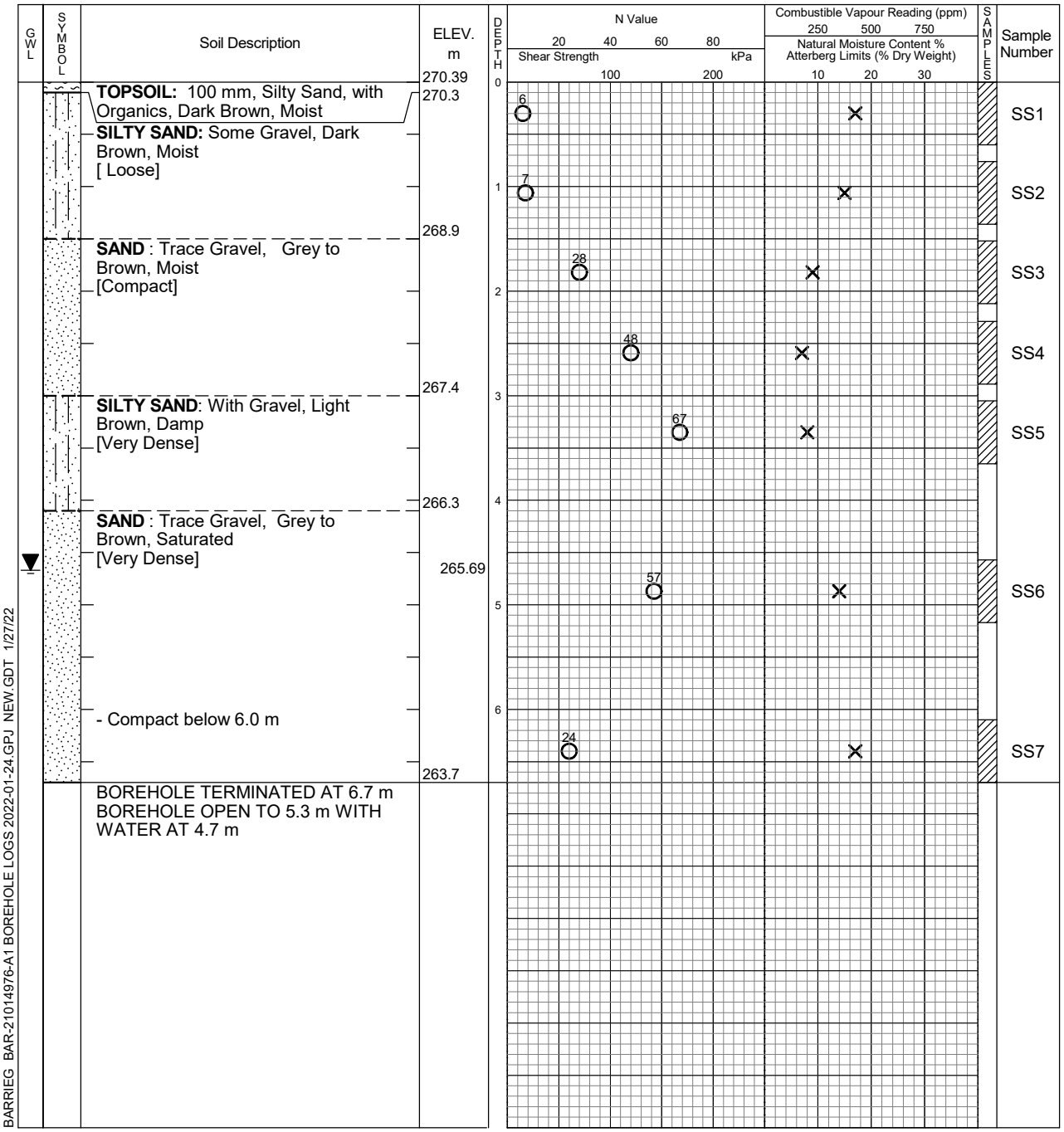
Date Drilled: Jan 10, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from EXP before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 10, 2021	4.7	5.3

Log of Borehole BH24

Project No. BAR-21014976-A1 | Figure No. 25

Project: Rainsong Phase 2 | Sheet No. 1 of 1

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910526.783N 609414.189E

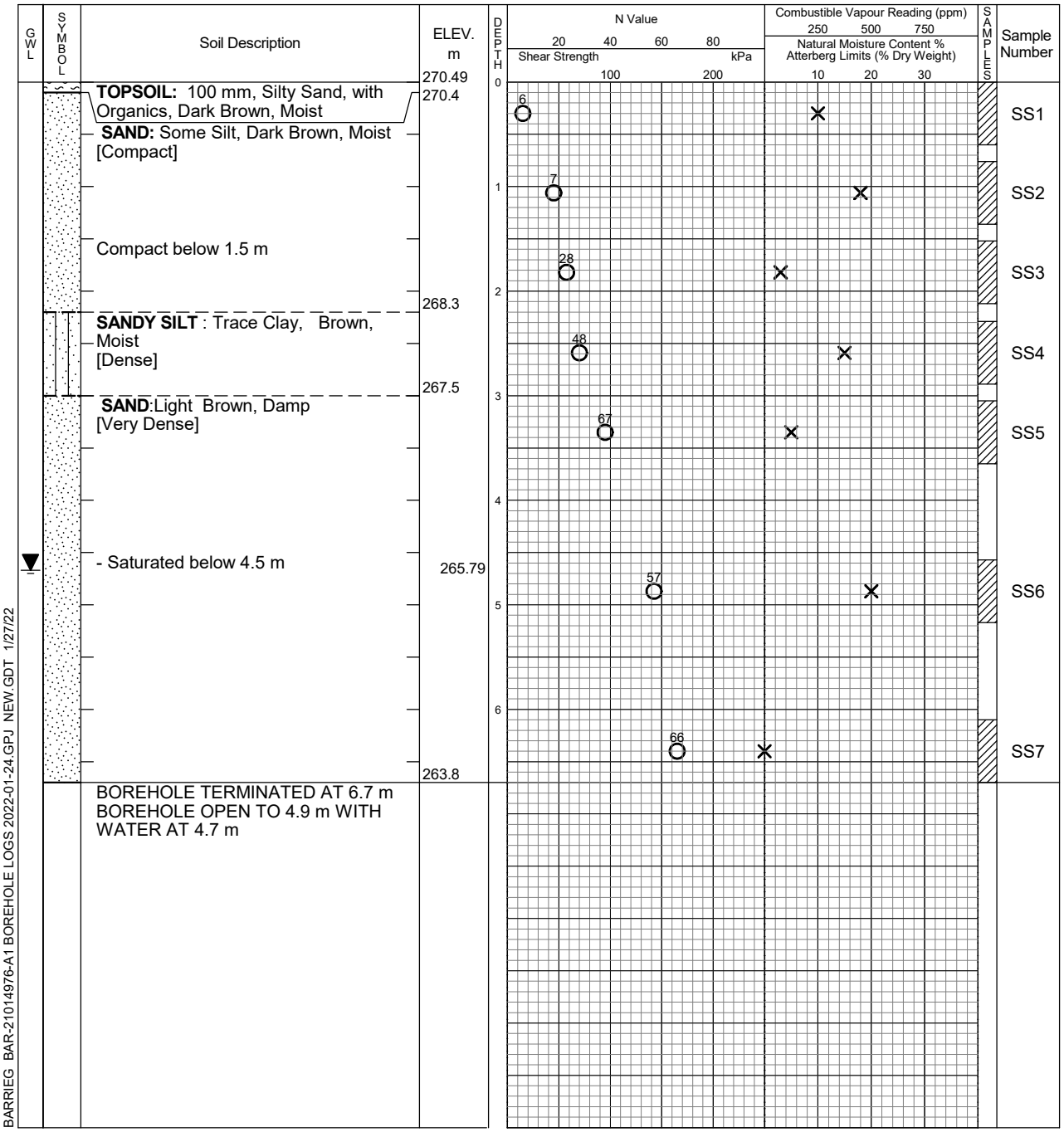
Date Drilled: Jan 10, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from EXP before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 10, 2021	4.7	4.9

Log of Borehole BH3

Project No. BAR-21014976-A1 | Figure No. 4

Project: Rainsong Phase 2 | Sheet No. 1 of 1

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910342.787N 609309.678E

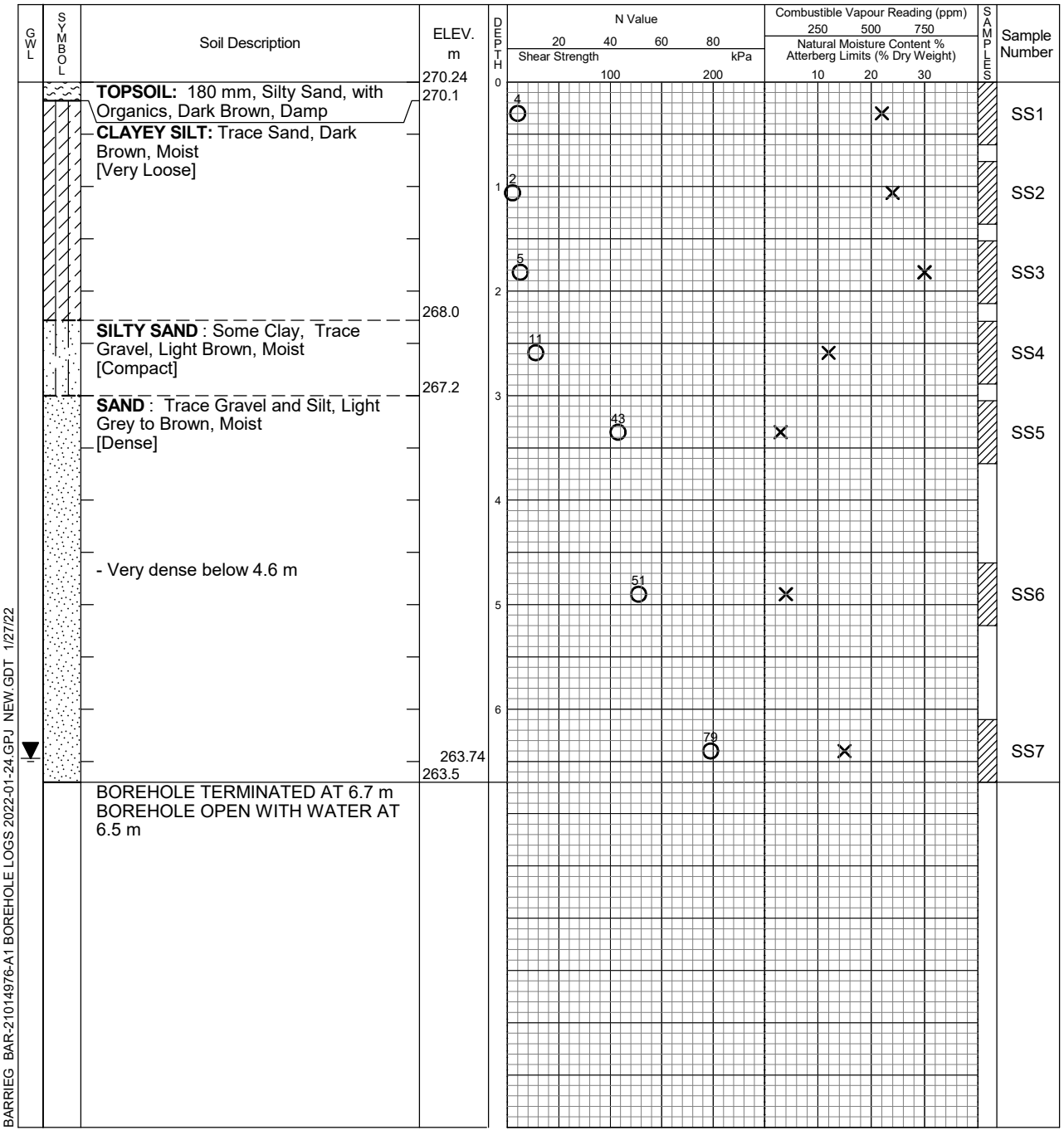
Date Drilled: Jan 13, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from EXP before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 13, 2021	6.5	5.6

Log of Borehole BH4

Project No. BAR-21014976-A1 | Figure No. 5

Project: Rainsong Phase 2 | Sheet No. 1 of 1

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910373.394N 609406.372E

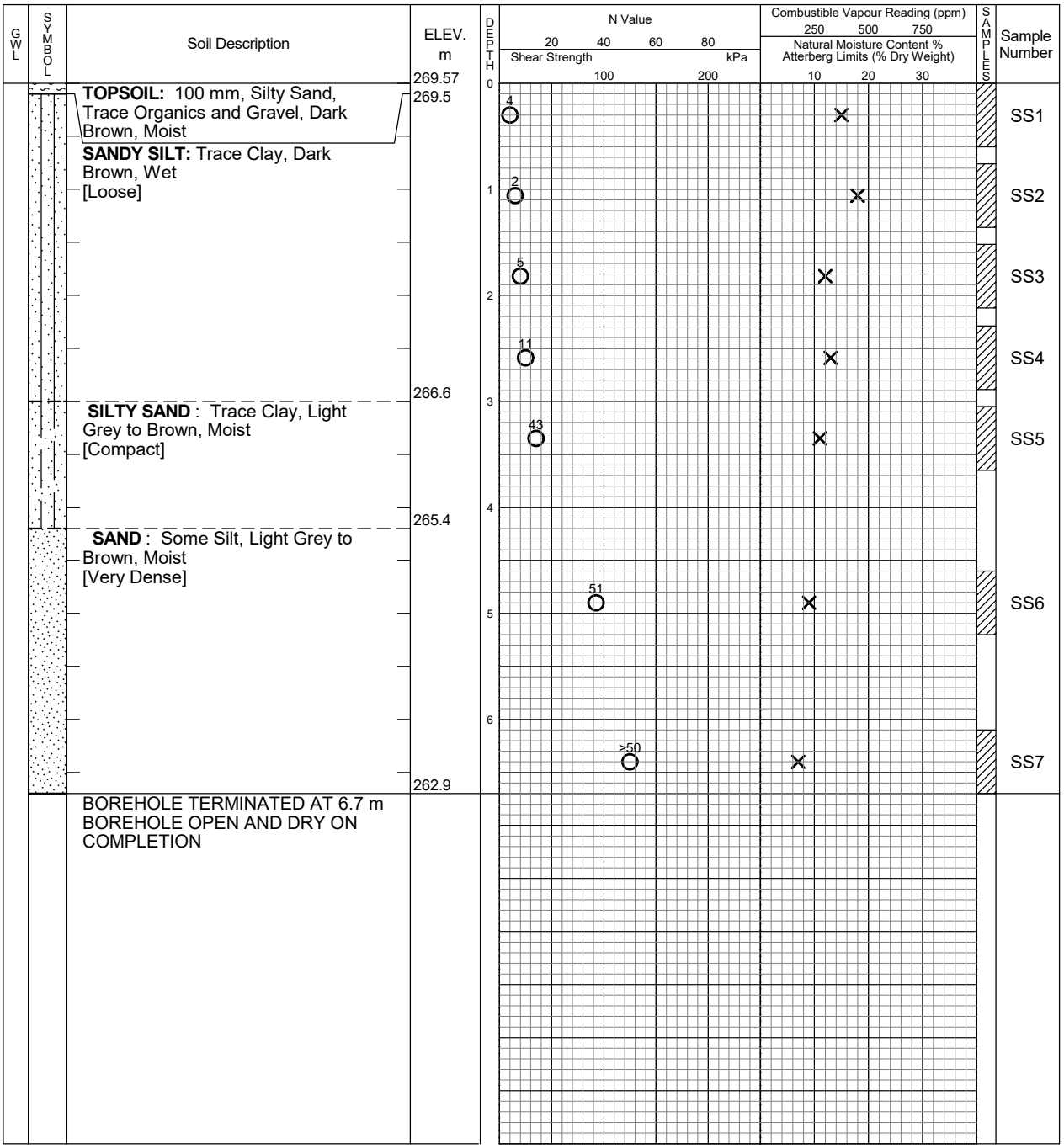
Date Drilled: Jan 14, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from EXP before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 14, 2021	Dry	6.1

Log of Borehole BH5

Project No. BAR-21014976-A1 | Figure No. 6

Project: Rainsong Phase 2 | Sheet No. 1 of 1

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910217.918N 609249.024E

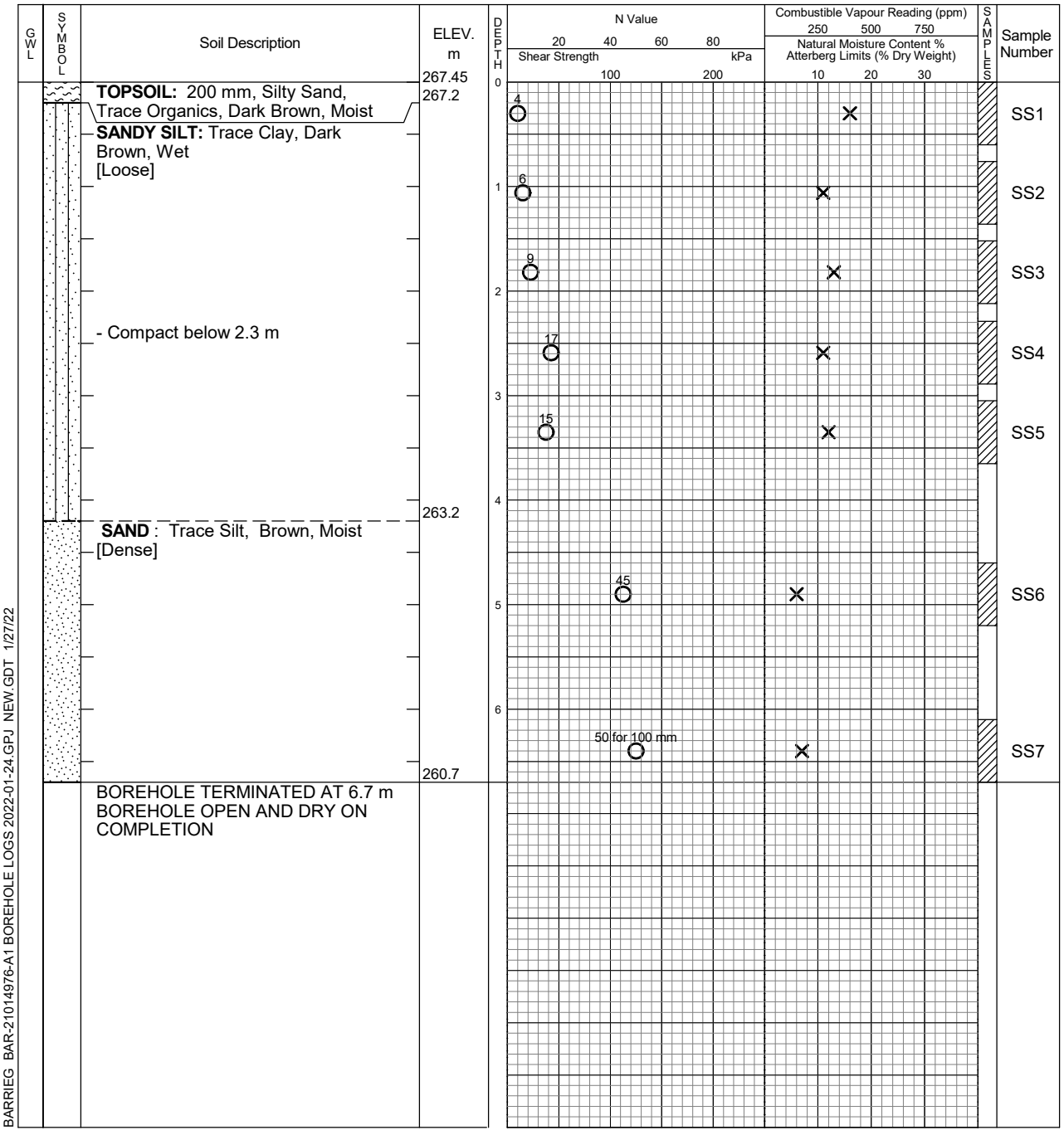
Date Drilled: Jan 14, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from EXP before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 14, 2021	Dry	6.1

Log of Borehole BH6

Project No. BAR-21014976-A1 | Figure No. 7

Project: Rainsong Phase 2 | Sheet No. 1 of 1

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910247.102N 609341.975E

Date Drilled: Jan 13, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m	Sample Number
	266.42	
TOPSOIL: 75 mm, Sand, with Organics, Brown, Moist	266.3	
CLAYEY SILT: Some Sand and Trace Gravel, Brown, Moist [Loose]		SS1
		SS2
	264.9	
SANDY SILT: Trace Clay and Gravel, Light Brown, Moist [Compact]		SS3
	264.2	
SAND: Trace Silt and Gravel, Light Brown, Moist [Very Dense]		SS4
		SS5
		SS6
		SS7
	259.7	
BOREHOLE TERMINATED AT 6.7 m BOREHOLE OPEN AND DRY		

N Value: 7, 5, 14, 25, 63, 55, 51

Shear Strength (kPa): 100, 200

Combustible Vapour Reading (ppm): 250, 500, 750

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10, 20, 30

DEPTH: 0, 1, 2, 3, 4, 5, 6

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Borehole data requires interpretation assistance from EXP before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 13, 2021	Dry	Open

Log of Borehole BH7

Project No. BAR-21014976-A1 | Figure No. 8

Project: Rainsong Phase 2 | Sheet No. 1 of 1

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910277.52N 609438.1E

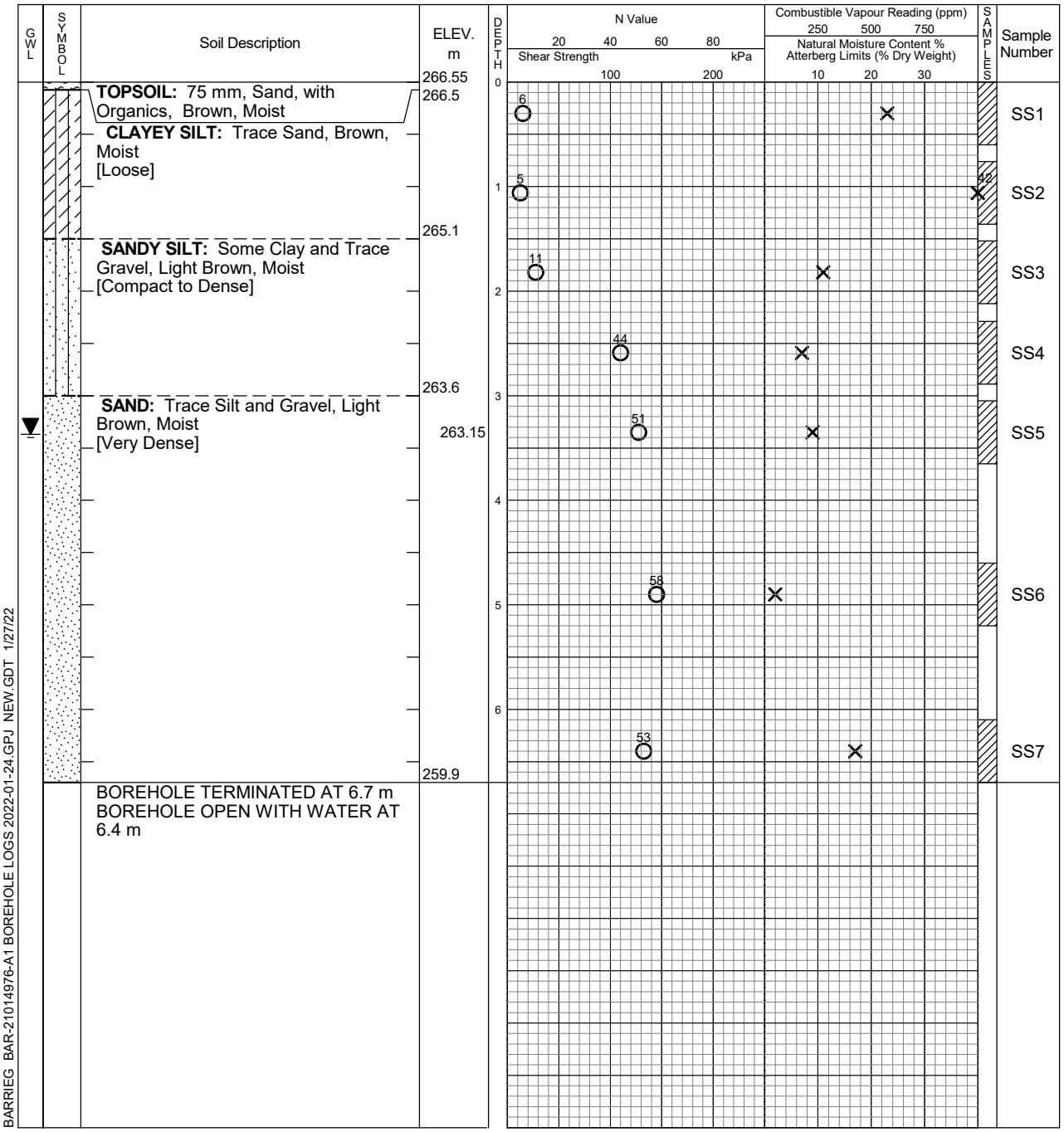
Date Drilled: Jan 13, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from EXP before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 13, 2021	3.4	Open

Log of Borehole BH8

Project No. BAR-21014976-A1 | Figure No. 9

Project: Rainsong Phase 2 | Sheet No. 1 of 1

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910306.643N 609532.016E

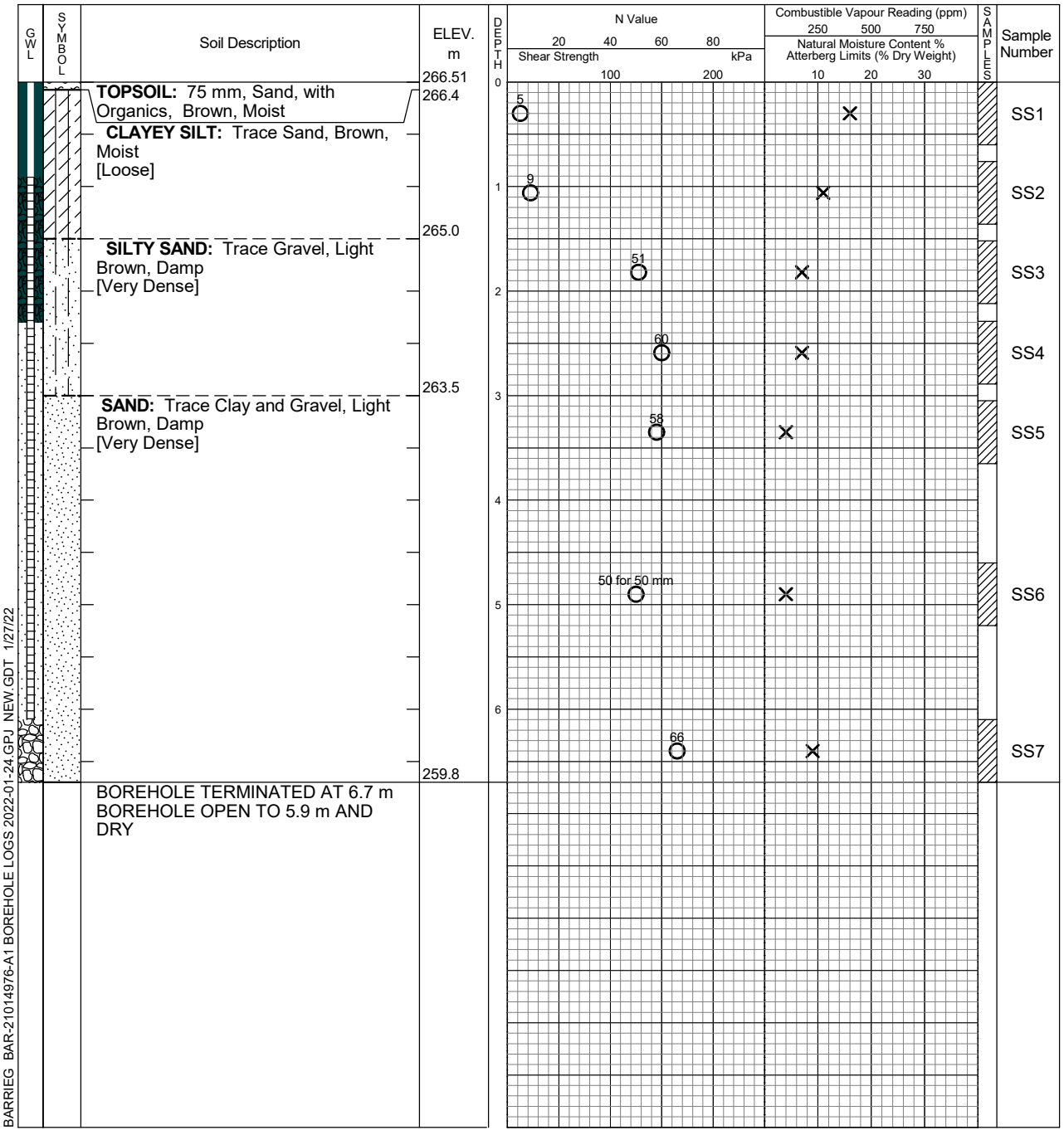
Date Drilled: Jan 13, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



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Borehole data requires interpretation assistance from EXP before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 13, 2021	Dry	5.9

Log of Borehole BH9

Project No. BAR-21014976-A1 | Figure No. 10

Project: Rainsong Phase 2 | Sheet No. 1 of 1

City/ Municipality: Yonge and Lockhart, Barrie, ON

Location: 17T 4910337.845N 609629.026E

Date Drilled: Jan 14, 2021

Drill Type: Track-Mount, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	Sample Number
			266.83	0	
		TOPSOIL: 100 mm, Silty Sand, Trace Organics, Dark Brown, Moist	266.7		
		SILTY SAND: Some Gravel, Dark Brown, moist [Loose]			SS1
				1	SS2
			265.3		
		SANDY SILT: Trace Clay, Dark Brown, Wet [Compact]		2	SS3
		- Dense below 2.5 m			SS4
				3	SS5
			262.6	4	
		SAND : Trace Gravel, Brown, Moist [Very Dense]		5	SS6
		- Saturated below 6.0 m		6	SS7
			260.1		
		BOREHOLE TERMINATED AT 6.7 m BOREHOLE OPEN AND DRY ON COMPLETION			

N Value: 20 40 60 80 | Shear Strength: 100 200 kPa

Combustible Vapour Reading (ppm): 250 500 750 | Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

SAMPLES

6 | 7 | 25 | 45 | 39 | 50 for 125 mm | 50 for 100 mm

BARRIEG BAR-21014976-A1 BOREHOLE LOGS 2022-01-24.GPJ NEW.GDT 1/27/22

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Borehole data requires interpretation assistance from EXP before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions.

Time	Water Level (m)	Depth to Cave (m)
Jan 14, 2021	Dry	Open