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Geotechnical Investigation

Proposed Indoor Aquatic and Recreation Facility
2775, 2785 Palladium Drive; and
Block 244 Plan 4M 1687
Ottawa, Ontario
Revision 2

Prepared for:

Palladium Resort Development Limited Partnership
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1 INTRODUCTION

LRL Associates Ltd. (LRL) was retained by Palladium Resort Development Limited Partnership to perform a geotechnical investigation for a proposed indoor aquatic and recreation facility, to be located at 2775, 2785 Palladium Drive, and Block 244 Plan 4M 1687, Ottawa, Ontario.

The purpose of the investigation was to identify the subsurface conditions across the site by the completion of a borehole drilling program. Based on the visual and factual information obtained, this report will provide guidelines on the geotechnical engineering aspects of the design of the project, including construction considerations.

This report has been prepared in consideration of the terms and conditions noted above. Should there be any changes in the design features, which may relate to the geotechnical recommendations provided in the report, LRL should be advised in order to review the report recommendations.

2 SITE AND PROJECT DESCRIPTION

The site under investigation is located at 2775 and 2785 Palladium Drive, and Block 244 Plan 4M 1687 (Culdaff Road), Ottawa ON. Currently the site is vacant, with no structures present. The site is bound by Palladium Drive to the east, 425 Derreen Avenue and 2765 Palladium Drive to the south, Culdaff Road to the west, and vacant land to the north. Topography of the site is considered relatively flat; and is vegetated with wild overgrown grasses and small shrubs. The site has about 144 m of frontage along Palladium Drive. The site location is presented in Figure 1 included in **Appendix A**.

At the time of generating this report, it is understood that development will consist of construction of an indoor aquatic centre, support building (1-storey), a hotel building (7-storey), and a family entertainment centre (2-storey) and on-grade parking. Specific details about founding elevations and information pertaining to basement levels, if any; are not available at this time.

3 PROCEDURE

The fieldwork for this investigation was carried out between March 31 and April 10, 2025, and May 26, 2026. Prior to the fieldwork, the site was cleared for the presence of any underground services and utilities. A total of twenty-nine (29) boreholes, labelled BH1 through BH29, were drilled onsite at pre-determined locations, approved by the client, to get a general representation of the site's underlying soil conditions. The approximate locations of the boreholes are shown in Figure 2 included in **Appendix A**.

The boreholes were advanced using a track mount drill rig equipped with 200 mm diameter continuous flight hollow stem auger supplied and operated by George Downing Estate Drilling Ltd. A "two man" crew experienced with geotechnical drilling operated the drill rig and equipment.

Sampling of the overburden materials encountered in the boreholes was carried out at regular depth intervals using a 50.8 mm diameter drive open conventional spoon sampler in conjunction with standard penetration testing (SPT) "N" values. The SPT were conducted following the method **ASTM D1586** and the results of SPT, in terms of the

number of blows per 0.3 m of split-spoon sampler penetration after first 0.15 m designated as “N” value.

The boreholes were advanced to depths ranging between 2.45 and 10.67 m below (existing) ground surface (bgs). NQ-size bedrock coring was carried out in five (5) of the boreholes after practical auger refusal. Upon completion, the boreholes were backfilled using the overburden cuttings.

Piezometers were installed in eight (8) of the boreholes to measure the static groundwater elevation. These consisted of ¾” PVC pipe with slotted bottoms, backfilled with silica sand, and sealed with bentonite.

The fieldwork was supervised throughout by a member of our engineering staff who oversaw the drilling activities, cared for the samples obtained and logged the subsurface conditions encountered within each of the boreholes. All soil samples collected from the boreholes were placed and sealed in plastic bags to prevent moisture loss. The recovered soil samples collected from the boreholes were classified based on visual examination of the materials recovered and the results of the in-situ testing.

Furthermore, all boreholes were located using a Garmin Etrex Legend GPS (Global Positioning System) receiver using NAD 83 datum (North American Datum). Existing grade elevations at the borehole locations were determined by interpolating from the site’s topographic survey. Ground surface elevations of the boring locations are shown on their respective borehole logs.

4 SUBSURFACE SOIL AND GROUNDWATER CONDITIONS

4.1 General

A review of local surficial geology maps provided by the Department of Energy, Mines and Resources Canada suggest that the surficial geology for this site is located at the transition between “Pre-Champlain Sea Deposits” consisting of Glacial Till, and “Champlain Sea Deposits” consisting of blue-grey clay, silt, silty clay, and uniform fine buff sand.

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 in-situ laboratory testing. The soil descriptions presented in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification and identification of soil were conducted according to the procedure **ASTM D2487** and judgement, and LRL 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 the boreholes are given in their respective logs presented in **Appendix B**. A greater explanation of the information presented in the borehole logs can be found in **Appendix C** of this report. These logs indicate the subsurface conditions encountered at a specific test location only. Boundaries between zones on the logs are often not distinct, but are rather transitional and have been interpreted as such.

4.2 Topsoil

Topsoil of thickness ranging from 100 to 400 mm was found at the surface at boring locations BH1 – BH14, BH16 – BH21, and BH23. It can generally be described as being sandy with black organic materials.

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

4.3 Loam

At the surface of BH25 – BH29, loam was encountered and extended to depths ranging between 0.61 and 2.43 m bgs. Generally, this material consisted of a silty and clayey material, with organic material.

4.4 Fill Material

Underlying the topsoil in BH2, BH7 – BH10, BH13, BH14, BH17, and BH21 a layer of fill material was encountered and extended to depths between 0.76 and 2.21 m bgs. This material can generally be described as a mixture of silt-sand-clay with some gravel, brown, and moist. SPTs were carried out in the fill material and the “N” values were found to range between 3 and 50, indicating the layer is very loose to very dense. The natural moisture contents were found to range between 13 and 31%.

4.5 Sand and Silt

Underlying the topsoil in BH1, and the fill material in BH2, a layer of sand and silt was encountered, and extended to a depth of 3.66 m bgs. The material can be described as having trace clay, trace gravel sized stone, moist and grey. The “N” values were found to range between 4 and 50+ indicating the material is loose to very dense. The natural moisture contents were found to range between 7 and 14%.

4.6 Sandy Silt

Underlying the topsoil in BH3 and BH11, and the fill material in BH7, a layer of sandy silt was encountered and extended to depths ranging between 2.45 and 3.66 m bgs. The material can be described as having some clay, some gravel sized stone, brown, and moist. The “N” values were found to range between 4 and 50+ indicating the material is loose to very dense. The natural moisture contents were found to range between 16 and 47%.

4.7 Silty Sand

Underlying the topsoil in BH4 – BH6, BH18, BH22 and BH23, and the silty clay in BH9, BH13, BH14, BH16, BH19, a layer of silty sand was encountered and extended to depths ranging between 2.21 and 9.15 m bgs. The material can generally be described as having trace clay, brown, and moist to wet. The “N” values were found to range between 1 and 50+ indicating the material is very loose to very dense. The natural moisture contents were found to range between 6 and 33%.

4.8 Silty Clay

Underlying the topsoil in BH12, BH19, BH20, the fill material in BH8 – BH10, BH13, BH14, BH17, and BH21, the clayey silt in BH15, the silty sand in BH16, and the loam in BH25 and BH28, a layer of silty clay was encountered and extended to depths ranging between 2.89 and 5.64 m bgs. The material can generally be described as having some sand, grey, and moist. The “N” values were found to range between 1 and 50+ indicating the

material is very soft to hard. The natural moisture contents were found to range between 13 and 53%.

4.9 Clayey Silt

At the surface of BH15, and underlying the silty sand in BH18 and BH22, a layer of clayey silt was encountered and extended to depths ranging between 1.45 and 5.64 m bgs. The material can generally be described as having some sand, greyish brown, and moist. The "N" values were found to range between 1 and 8 indicating the material is very loose to loose. The natural moisture contents were found to range between 19 and 47%

4.10 Silt

Underlying the clayey silt in BH22, the silty clay in BH25, and the loam in BH26 and BH27 a layer of silt was encountered and extended to a depth of 7.72 m bgs. The material can be described as having trace clay, trace sand, grey, and wet. The "N" values were found to range between 2 and 12, indicating the material is very loose to compact. The natural moisture content was found to be 24%.

4.11 Refusal

Practical auger refusal over bedrock or large boulders was encountered at boring locations BH1, BH3 – BH5, BH9, BH12 – BH20, and BH23 at depths ranging between 2.45 and 9.15 m bgs.

4.12 Limestone Bedrock

After practical auger refusal, NQ-size rock coring was carried out in five (5) boreholes.

The Rock Quality Designation (RQD) was determined after the rock was cored, this is done by summing the lengths of the intact recovered cores which are greater than 100 mm in length, and dividing by the total length of the core run. The RQD values, expressed as a percent, ranged from 66 to 100%, indicating the rock was fair to excellent quality.

The bedrock formation in this area can be described at consisting of limestone, with shaly partings, and grey to dark grey.

Four (4) rock core samples were selected to determine the unconfined compressive strengths at various depths. The results are summarized below in **Table 1.**

Table 1: Unconfined Compressive Strength of Select Rock Cores

Sample			Bedrock Type	Strength (MPa)
Borehole	Core #	Depth (m)		
BH5	1	4.1	Limestone	109.5
BH14	2	8.6	Limestone	119.6
BH23	3	6.8	Limestone	115.9

4.13 Laboratory Analysis

Seven (7) soil samples were collected for laboratory gradation analyses. The gradation analyses comprised of sieve and hydrometer were conducted following the procedure **ASTM D422.** Details of laboratory analyses are reflected in **Table 2**.

Table 2: Gradation Analysis Summary

Sample Location	Depth (m)	Percent for Each Soil Gradation							Estimated Hydraulic Conductivity K (m/s)
		Gravel		Sand			Silt (%)	Clay (%)	
		Coarse (%)	Fine (%)	Coarse (%)	Medium (%)	Fine (%)			
BH1	1.5-2.1	0.0	5.7	4.5	13.1	31.9	35.1	9.7	5×10^{-5}
BH2	2.3-2.9	11.8	8.2	4.3	11.3	29.4	26.8	8.2	5×10^{-5}
BH3	1.5-2.1	0.0	2.5	2.2	2.7	19.8	58.7	14.1	5×10^{-5}
BH9	4.6-5.2	0.0	0.0	0.1	0.3	1.7	87.5	10.4	5×10^{-6}
BH18	3.1-3.7	0.0	4.4	2.3	5.1	13.8	50.6	23.8	5×10^{-7}
BH22	3.1-3.7	0.0	0.0	0.0	0.2	5.4	66.1	28.3	5×10^{-7}
BH22	6.1-6.7	0.0	0.0	0.0	0.0	3.9	88.9	7.2	5×10^{-6}

Atterberg limits and moisture contents were conducted on four (4) split spoon soil samples.

A summary of these values are provided below in **Table 3**.

Table 3: Summary of Atterberg Limits and Water Contents

Sample Location	Parameter					
	Depth (m)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Water Content (%)	USCS Group Symbol
BH8	0.8-1.4	41	19	22	30	OL
BH12	4.6-5.2	51	23	28	50	CH
BH17	2.3-2.9	54	24	30	51	CH
BH22	3.1-3.7	40	19	21	37	CL

The laboratory reports can be found in **Appendix D** of this report.

4.14 Groundwater Conditions

Eight (8) piezometers were installed in select boreholes to measure the static groundwater level. The groundwater was measured on April 23 and May 15, 2025, and May 26, 2026. The water levels can be found on their respective Borehole Logs, attached in **Appendix B.**

It should be noted that groundwater levels could fluctuate with seasonal weather conditions, (i.e.: rainfall, droughts, spring thawing) and due to construction activities at or near the vicinity of the site.

5 GEOTECHNICAL CONSIDERATIONS

This section of the report provides general geotechnical recommendations for the design aspect of the project based on our interpretation of the information gathered from the boreholes performed at this site and from the project requirements.

This section will detail design parameters for the specific requirements and limitations with regard to allowable foundation bearing pressure and depth, and grade raise restrictions.

5.1 Foundations

Based on the subsurface soil conditions established at this site, it is expected that the footings for the proposed buildings will be founded at a minimum, below the frost penetration depth, overlying the native sand and silt, silty sand, sandy silt, and/or silty clay. Therefore, all material including incompetent native soil should be removed from the proposed footprints down to the required founding depth.

5.2 Shallow Foundation

Conventional strip and column footings founded on the above-mentioned native materials may be designed using a maximum allowable bearing pressure of **120 kPa** for serviceability limit state **(SLS)** and **175 kPa** for ultimate limit state **(ULS)** factored bearing resistance. The factored ULS value includes the geotechnical resistance factor of 0.5. The maximum allowable grade raise for this site is 3.0 m above existing grade.

The below **Table 4** indicates the expected bearing strata for each building and the proposed Underside of Footing (USF) elevation.

Table 4: Expected Bearing Strata and USF Elevations

Building	Expected Bearing Strata	USF Elevation (m)
Hotel	Sandy Silt to Silty Sand	106.95
Family Entertainment Building	Silty Clay	106.95
Support Building	Silty Sand	103.15
Indoor Aquatic Facility	Silty Sand, Clayey Silt, Silty Clay	106.95

In-situ field testing is required to check the strength and stability of the footings subgrade. Any incompetent subgrade areas as identified from in-situ testing must be sub-excavated and backfilled with approved structural fill. Similarly, any soft or wet areas should also be sub-excavated and backfilled with approved structural fill only. Prior to placing any approved structural fill, the subgrade should be inspected and approved by geotechnical engineer or qualified geotechnical personnel. The bearing pressure is contingent on the water level being 0.3 m below the underside footing elevation in order to have a stable and dry subgrade during construction.

Prior to pouring footings concrete, the subgrade should be inspected and approved by a geotechnical engineer or a representative of geotechnical engineer.

5.3 Structural Fill

Following the subgrade inspection by geotechnical engineer some over-excavation may be required to reach a suitable bearing surface. The over-excavated area shall be replaced with structural fill, consisting of Granular B Type II. The structural fill should be placed over undisturbed native soils in layers not exceeding 300 mm and compacted to 98% of its Standard Proctor Maximum Dry Density (SPMDD) within ±2% of its optimum moisture content. In order to allow the spread of load beneath the footings and to prevent undermining during construction, the structural fill should extend minimum 1.0 m beyond the outside edges of the footings and then outward and downward at 1 horizontal to 1 vertical profile (or flatter) over a distance equal to the depth of the structural fill below the footing. Furthermore, the structural fill must be tested to ensure that the specified compaction level is achieved.

5.4 Lateral Earth Pressure

The following equation should be used to estimate the intensity of the lateral earth pressure against any earth retaining structure/foundation walls.

$$P = K (\gamma h + q)$$

Where;

P = Earth pressure at depth h;

K = Appropriate coefficient of earth pressure;

γ = Unit weight of compacted backfill, adjacent to the wall;

h = Depth (below adjacent to the highest grade) at which P is calculated;

q = Intensity of any surcharge distributed uniformly over the backfill surface (usually surcharge from traffic, equipment or soil stockpiled and typically considered 10 kPa).

The coefficient of earth pressure at rest (K_0) should be used in the calculation of the earth pressure on the storm water manhole/basement walls, which are expected to be rather rigid and not to deflect.

The above expression assumes that perimeter drainage system prevents the build-up of any hydrostatic pressure behind the foundation wall.

Table 5 below provides various material types and their respective earth pressure properties.

Table 5: Material and Earth Pressure Properties

Type of Material	Bulk Density (kN/m^3)	Friction Angle (Φ)	Pressure Coefficient		
			At Rest (K_0)	Active (K_A)	Passive (K_P)
Granular A	23.0	34	0.44	0.28	3.53
Granular B Type I	20.0	31	0.49	0.32	3.12
Granular B Type II	23.0	32	0.47	0.31	3.25
Silty Sand/Sandy Silt/Silt and Sand	17.5	31	0.49	0.32	3.12

Silt and Clay	18.0	25	0.52	0.41	2.46

5.5 Settlement

The estimated total settlement of the shallow foundations, designed using the recommended serviceability limit state capacity value, as well as other recommendations given above, will be less than 25 mm. The differential settlement between adjacent column footings is anticipated to be 15 mm or less.

5.6 Seismic

A site-specific geophysical investigation completed by Geophysics GPR International Inc. utilizing the Multi-channel Analysis of Surface Waves (MASW) and Spatial AutoCorrelation (SPAC) methods was completed to evaluate the seismic shear wave velocity profile of the site. Based on the measured average shear wave velocity within the upper 30 m (VS30) of approximately **497 m/s**, the site is classified as **Site Class C** in accordance with Table 4.1.8.4.-B of the National Building Code of Canada (2020) and the Ontario Building Code.

A copy of the MASW report is attached in **Appendix E.**

5.7 Potential for Liquefaction

As recommended in Canadian Foundation Engineering Manual 4th edition (*Bray et al. 2004)*, the following criteria can be used to determine liquefaction susceptibility of fine grained soils.

- $w/w_L \geq 0.85$ and $I_p \leq 12$: Susceptible to liquefaction or cyclic mobility
- $w/w_L \geq 0.8$ and $12 \leq I_p \leq 20$: Moderately susceptible to liquefaction or cyclic mobility
- $w/w_L < 0.8$ and $I_p \leq 20$: No liquefaction or cyclic mobility, but may undergo significant deformations if cyclic shear stress > static undrained shear strength.

Based on the above criteria and the determined laboratory results, liquefaction is not a concern for this site.

5.8 Frost Protection

All exterior footings for any heated structure exposed to frost conditions should have a minimum of 1.5 m of earth cover. Footings for any unheated structures, signage or lighting, and where snow will be cleared, 1.8 m of earth cover is required. Alternatively, the required frost protection could be provided using a combination of earth cover and extruded polystyrene insulation. Detailed guidelines for footing insulation frost protection can be provided upon request.

In the event that foundations are to be constructed during winter months, the foundation soils are required to be protected from freezing temperatures using suitable construction techniques. The base of all excavations should be insulated from freezing temperatures immediately upon exposure, until heat can be supplied to the building interior and the footings have sufficient soil cover to prevent freezing of the subgrade soils.

5.9 Foundation Drainage

Permanent perimeter drainage is only required for buildings where basements or whenever any open spaces located below the finish ground are being considered.

If required, foundation drainage shall consist of a perforated corrugated polyethylene drainage pipe (100 mm minimum), pre-wrapped with geotextile knitted sock conforming to **OPSS 1840** should be embedded in a 300 mm surround layer of 19 mm clear stone and set adjacent to the perimeter footings. The drainage pipe may be tied into the basement drainage system, and be connected positively to a suitable outlet, such as a sump pit or storm sewer.

In order to minimize ponding of water adjacent to the foundation walls, roof water should be controlled by a roof drainage system that directs water away from the building to prevent ponding of water adjacent to the foundation wall. The exterior grade should be sloped away from the building to promote water drainage away from the foundation walls.

5.10 Foundation Walls Backfill (Shallow Foundations)

To prevent possible foundation frost jacking and lateral loading, the backfill material against any foundation walls, grade beams, isolated walls, or piers should consist of free draining, non-frost susceptible material such as sand or sand and gravel meeting OPSS Granular B Type II or I, or a Select Subgrade Material (SSM).

The foundation wall backfill should be compacted to minimum 95% of its SPMDD using light compaction equipment, where no loads will be set over top. The compaction shall be increased to 98% of its SPMDD under walkways, slabs or paved areas close to the foundation or retaining walls. Backfilling against foundation walls should be carried out on both sides of the wall at the same time where applicable.

5.11 Slab-on-grade Construction

All fill, organic or otherwise deleterious material shall be removed from the proposed buildings' footprint. The exposed subgrade should then be inspected and approved by a qualified geotechnical personnel.

Any underfloor fill needed to raise the general floor grade shall consist of OPSS Granular B Type II or I, SSM or approved on-site earth borrow, compacted to 98% of its SPMDD. A 200 mm Granular A meeting the **OPSS 1010** shall be placed underneath the slab and compacted to 98% of its SPMDD. Alternatively, if wet condition persists, 200 mm thickness of 19 mm clear stone meeting the **OPSS 1004** requirements shall be used instead of Granular A.

It is also recommended that the area of extensive exterior slab-on-grade (sidewalks, ramp etc.) shall be constructed using Granular A base of thickness 150 mm with incorporating subdrain facilities. The modulus of subgrade reaction (ks) for the design of the slabs set over competent native soil/structural fill is **24 MPa/m.**

In order to further minimize and control cracking, the floor slab shall be provided with wire or fibre mesh reinforcement and construction or control joints. The construction or control joints should be spaced equal distance in both directions and should not exceed 4.5 m. The wire or fibre mesh reinforcement shall be carried out through the joints.

5.12 Corrosion Potential and Cement Type

Three (3) soil samples were submitted to Paracel Laboratories Ltd. for chemical testing. The following **Table 6** below summarizes the results.

Table 6: Results of Chemical Analysis

Sample Location	Depth (m)	pH	Sulphate (µg/g)	Chloride (µg/g)	Resistivity (Ohm.cm)
BH8	2.3 – 2.9	7.39	66	<10	3,820
BH12	1.5 – 2.1	7.59	105	<10	3,730
BH21	3.0 – 3.6	7.39	23	41	3,840

Based on the CAN/CSA-A23.1 standards (Concrete Materials and Methods of Concrete Construction), a sulphate concentration of less than 1000 µg/g falls within the negligible category for sulphate attack on buried concrete. The test results from soil samples were below the noted threshold. As such, buried concrete for footings and foundations walls will not require any special additive to resist sulphate attack and the use of normal Portland cement is acceptable.

The pH, resistivity and chloride concentration provide an indication of the degree of corrosiveness of the sub-surface environment. Based on the above results, the soil resistivity falls within the corrosive range. Any buried steel used for this project shall be corrosive resistant.

5.13 Tree Planting

The subject site is underlain by fine-grained soils characteristic of the Champlain Sea deposits commonly encountered throughout the Ottawa area. In accordance with the City of Ottawa's *Tree Planting in Sensitive Marine Clay Soils - 2017 Guidelines*, clay soils with a modified Plasticity Index (PI) not exceeding 40% are considered to have a low to moderate potential for moisture-induced volume change, whereas soils with a PI greater than 40% are considered to have a high potential for volume change.

Laboratory Atterberg Limits testing completed as part of this investigation yielded Plasticity Index values of 21, 22, 28, and 30%. As all tested samples exhibited PI values below 40%, the clay soils encountered at the site are considered to be low to moderate plasticity sensitive marine clays for the purposes of the City of Ottawa tree planting guidelines.

Based on the available geotechnical information, tree planting within the development may be undertaken in accordance with the reduced setback provisions outlined in the City guidelines, provided all associated requirements are satisfied. These requirements include appropriate footing embedment depths, adequate rooting soil volumes, nominal reinforcement of foundation walls, and grading that promotes moisture retention within the tree root zone.

Small and medium-sized tree species may therefore be considered throughout the development, subject to review by the project landscape architect and compliance with all applicable municipal requirements. Tree species selection, planting locations, and tree-to-foundation setbacks should be finalized during detailed design in accordance with the current requirements of the City of Ottawa.

Based on the test results obtained during this investigation, no areas of high-plasticity clay (PI > 40%) were identified within the tested strata. Accordingly, the more restrictive tree planting setbacks applicable to highly plastic marine clays are not anticipated to govern development of the subject site.

5.14 Groundwater Considerations for Sanitary Sewer Design

Groundwater levels encountered during the geotechnical investigation indicate that the seasonally high groundwater table may be located above portions of the proposed sewer infrastructure. As such, groundwater infiltration into the sewer system should be considered during the design.

In accordance with Section 2.9 of the Ministry of the Environment, Conservation and Parks (MECP) CLI ECA Design Criteria, sanitary sewer systems installed more than 0.6 m below the Seasonally High Groundwater Table (SHGWT) should be designed to minimize infiltration. Sewer pipes, joints, service connections, and maintenance holes should be selected and constructed to withstand hydrostatic pressures associated with the anticipated groundwater conditions without leakage. The sewer system components should be designed to resist a pressure equal to at least 1.25 times the groundwater head acting on the system.

Based on the groundwater conditions encountered during the subsurface investigation, the proposed sewer infrastructure is anticipated to be subject to groundwater pressures. Accordingly, watertight pipe materials, gasketed joints, and maintenance hole systems designed for high groundwater conditions should be utilized to minimize infiltration and inflow to the municipal sewer system.

6 EXCAVATION AND BACKFILLING REQUIREMENTS

6.1 Excavation

It is anticipated that any depth of excavation onsite will not be extend below about 4.0 m bgs. Excavation must be carried out in accordance with Occupational Health and Safety Act and Regulations for construction Projects.

According to the Ontario's Occupational Health and Safety Act (OHSA), O. Reg. 213/91 and its amendments, the surficial overburden expected to be excavated into at this site can be classified as Type 3. Therefore, shallow temporary excavations can be cut at 1 horizontal to 1 vertical (1H: 1V) for a fully drained excavation starting at the base of the excavation and as per requirements of the OHSA regulations.

Any excavation not able to be sloped shall be shored. It is recommended to be designed by a design/build contractor who specializes in shoring.

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 open excavation.

6.2 Groundwater Control

Based on the subsurface conditions encountered at this site, some minor groundwater seepage or infiltration from the native soils into the shallow temporary excavations during construction is expected, if any. However, it is anticipated that pumping from open sumps should be sufficient to control groundwater inflow. Any groundwater seepage or infiltration entering the excavation should be removed from the excavation by pumping from sumps within the excavations. Surface water runoff into the excavation should be minimized and diverted away from the excavation if possible.

A permit to take water (PTTW) is required from Ministry of Environment and Climate Change (MOECC), Ontario Reg. 387/04, if more than 400,000 litres per day of groundwater will be pumped during a construction period less than 30 days. Registration in the Environmental Activity and Sector Registry (EASR) is required when the takings of ground water and storm water for the purpose of dewatering construction projects range between 50,000 and 400,000 litres per day.

The actual amount of groundwater inflow into open excavations will depend on several factors such as the contractor's schedule, rate of excavation, the size of excavation, depth below the groundwater level, and at the time of year which the excavation is executed. It is expected that pumping rates will be less than 50,000 litres per day. As such, EASR registration is not required for the construction at this site.

6.3 Pipe Bedding Requirements

It is anticipated that the subgrade material for any underground services required as part of this project will be founded over sand and silt, silty sand, sandy silt, and/or silty clay. Any sub-excavation of disturbed soil should be removed and replaced with a Granular A, Granular B Type II or I or approved equivalent, laid in loose lifts of thickness not exceeding 300 mm and compacted to 95% of its SPMDD. Bedding, thickness of cover material and compaction requirements for any pipes should conform to the manufacturers design requirements and to the detailed installations outlined in the Ontario Provincial Standard Specifications (OPSS) and any applicable standards or requirements. At minimum, a 150 mm thick layer of Granular A shall be used as pipe bedding, at the springline of the pipe, and a 300 mm thick layer above the obvert of the pipe.

If sewers are required to be founded below the groundwater table the native materials may be sensitive to disturbances. Therefore, special precautions should be taken in these areas to stabilize and confine the base of the excavation such as using recompression (thicker bedding) and/or dewatering methods (pumping). In order to properly compact the bedding, the water table should be kept at least 300 mm below the base of the excavation at all time during the installation of any sewers and structures.

As an alternative to Granular A bedding and only where wet conditions are encountered, the use of "clear stone" bedding, such as 19 mm clear stone, **OPSS 1004**, may be considered only in conjunction with a suitable geotextile filter (such as terrafix 270R or approved equivalent). Without proper filtering, there may be entry of fines from native soils and trench backfill into the bedding, which could result in loss of support to the pipes and possible surface settlements. The sub-bedding, bedding and cover materials should be compacted in maximum 300 mm thick lifts to at least 95% of its SPMDD within ±2% of its optimum moisture content using suitable vibratory compaction equipment.

6.4 Trench Backfill

All service trenches should be backfilled using compactable material, free of organics, debris and large cobbles or boulders. Acceptable native materials (if encountered and where possible) should be used as backfill between the roadway subgrade level and the depth of seasonal frost penetrations (i.e. 1.8 m below finished grade) in order to reduce the potential for differential frost heaving between the new excavated trench and the adjacent section of roadway. Where native backfill is used, it should match the native materials exposed on the trench walls. Backfill below the zone of seasonal frost penetration could consist of either acceptable native material or imported granular material

conforming to OPSS Granular B Type II or I. Any boulders larger than 150 mm in size should not be used as trench backfill.

To minimize future settlement of the backfill and achieve an acceptable subgrade for the roadway, the trench should be compacted in maximum 300 mm thick lifts to at least 95% of its 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.

For trenches carried out in existing paved areas, transitions should be constructed to ensure that proper compaction is achieved between any new pavement structure and the existing pavement structure to minimize potential future differential settlement between the existing and new pavement structure. 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 are provided to the excavation. Where asphaltic concrete is present, it should be cut back to a minimum of 150 mm from the edge of the excavation to allow for proper compaction between the new and existing pavement structures.

7 REUSE OF ON-SITE SOILS

The existing surficial overburden soils consist mostly of sand and silt, silty sand, sandy silt, and/or silty clay. These materials are considered to be frost susceptible and should not be used as backfill material, except for landscaping purposes where no loads will be applied.

It should be noted that the adequacy of any material for reuse as backfill will depend on its water content at the time of its use and on the weather conditions prevailing prior to and during that time. Therefore, all excavated materials to be reused shall be stockpiled in a manner that will prevent any significant changes in their moisture content, especially during wet conditions. Any excavated materials proposed for reuse should be stockpiled in a manner to promote drying and should be inspected and approved for reuse by a geotechnical engineer.

Any imported material shall conform to OPSS Granular B – Type II or I, SSM, or an approved equivalent.

8 RECOMMENDED PAVEMENT STRUCTURE

The following **Table 7** presents the recommended pavement structures to be constructed over a stable subgrade.

Table 7: Recommended Pavement Structure

Course	Material	Thickness (mm)	
		Light Duty Parking Area (mm)	Heavy Duty Parking Area (Access Roads, Fire Routes and Trucks) (mm)
Surface	HL3/SP12.5 A/C	50	40
Binder	HL8/SP19.0 A/C	-	50
Base course	Granular A	150	150

Sub base	Granular B Type II	300	450
Total:		500	690

Performance Graded Asphaltic Cement (PGAC) **58-34** is recommended for this project.

The base and subbase granular materials shall conform to **OPSS 1010** material specifications. Any proposed materials shall be tested and approved by a geotechnical engineer prior to delivery to the site and shall be compacted to 98% of its SPMDD. Asphaltic concrete shall conform to **OPSS 1150** and be placed and compacted to at least 93% of the Marshall Density. The mix and its constituents shall be reviewed, tested and approved by a geotechnical engineer prior to delivery to the site.

8.1 Paved Areas & Subgrade Preparation

The access lanes and parking areas shall be stripped of organics/vegetation, debris and other obvious objectionable material. Following the backfilling and satisfactory compaction of any underground service trenches up to the subgrade level, the subgrade shall be shaped, crowned and proof-rolled. A loaded Tandem axle, dual wheel dump truck or approved equivalent heavy duty smooth drum roller shall be used for proof-rolling. Any resulting loose/soft areas should be sub-excavated down to an adequate bearing layer and replaced with approved backfill.

The preparation of subgrade shall be scheduled and carried out in manner so that a protective cover of overlying granular material (if required) is placed as quickly as possible in order to avoid unnecessary circulation by heavy equipment, except on unexcavated or protected surfaces. Frost protection of the surface shall be implemented if works are carried out during the winter season.

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. 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 the curb/edge of pavement line but be extended beyond the curb.

9 INSPECTION SERVICES

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

All footing areas and any structural fill areas for the proposed structures should be inspected by LRL to ensure that a suitable subgrade has been reached and properly prepared. The placing and compaction of any granular materials beneath the foundations and slab-on-grade should be inspected to ensure that the materials used conform to the grading and compaction specifications.

The subgrade for the pavement areas and underground services should be inspected and approved by geotechnical personnel. In-situ density testing should be carried out on the pavement granular materials, pipe bedding and backfill to ensure the materials meet the specifications for required compaction.

If footings are to be constructed during winter season, the footing subgrade should be protected from freezing temperatures using suitable construction techniques.

10 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 or its use by a third party beyond the client specifically listed in the report is neither intended nor authorized by LRL 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 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 boring locations only. Boundaries between zones presented on the borehole are often not distinct but transitional and were interpreted. 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 a field verification of the subsurface soil conditions at the time of construction.

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

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 the undersigned.

Yours truly,
LRL Associates Ltd.



Brad Johnson, P.Eng.
Geotechnical Engineer

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LRL
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PROJECT

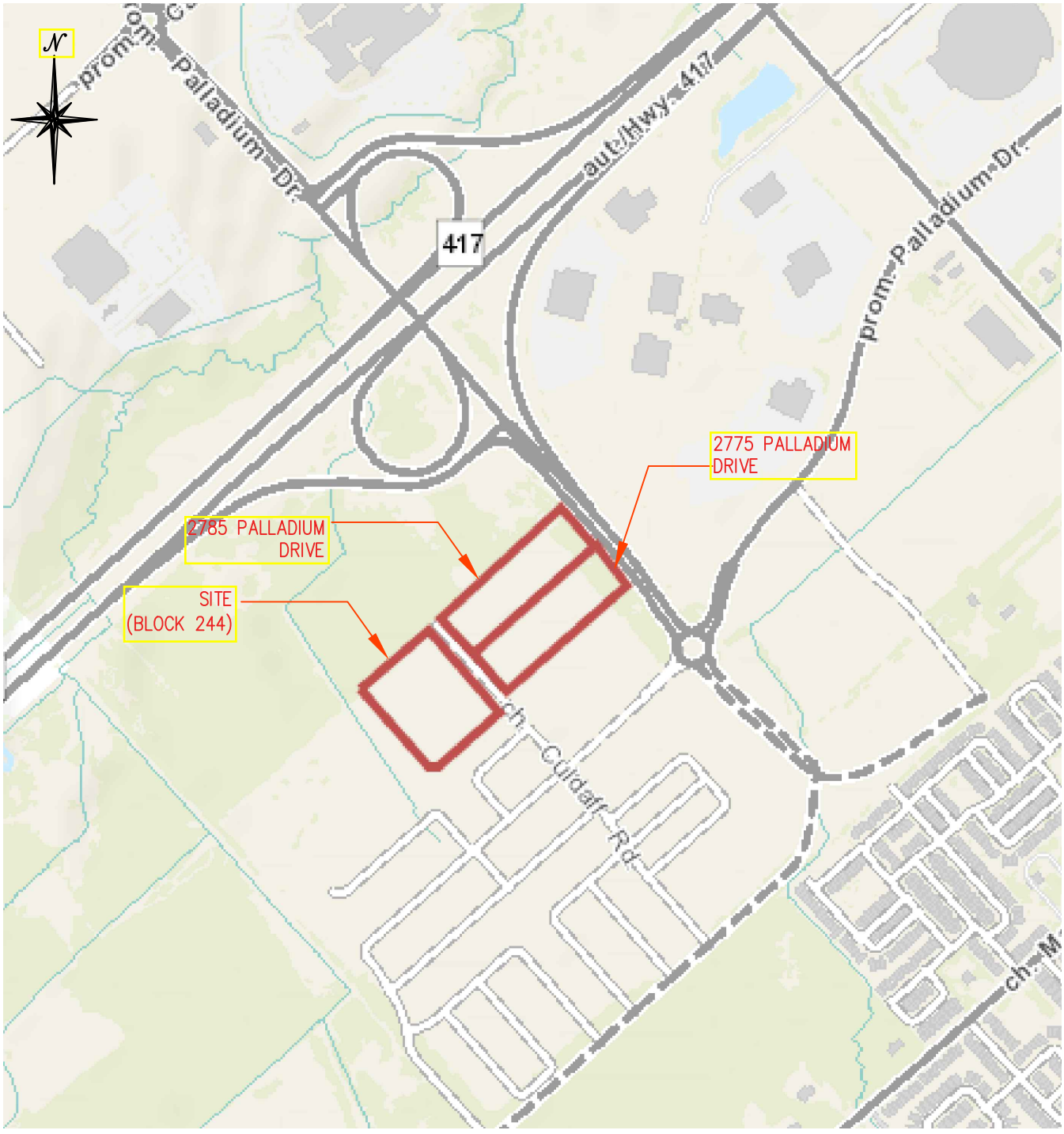
GEOTECHNICAL INVESTIGATION
2775 & 2785 PALLADIUM DRIVE,
AND BLOCK 244 PLAN 4M1687
OTTAWA, ONTARIO

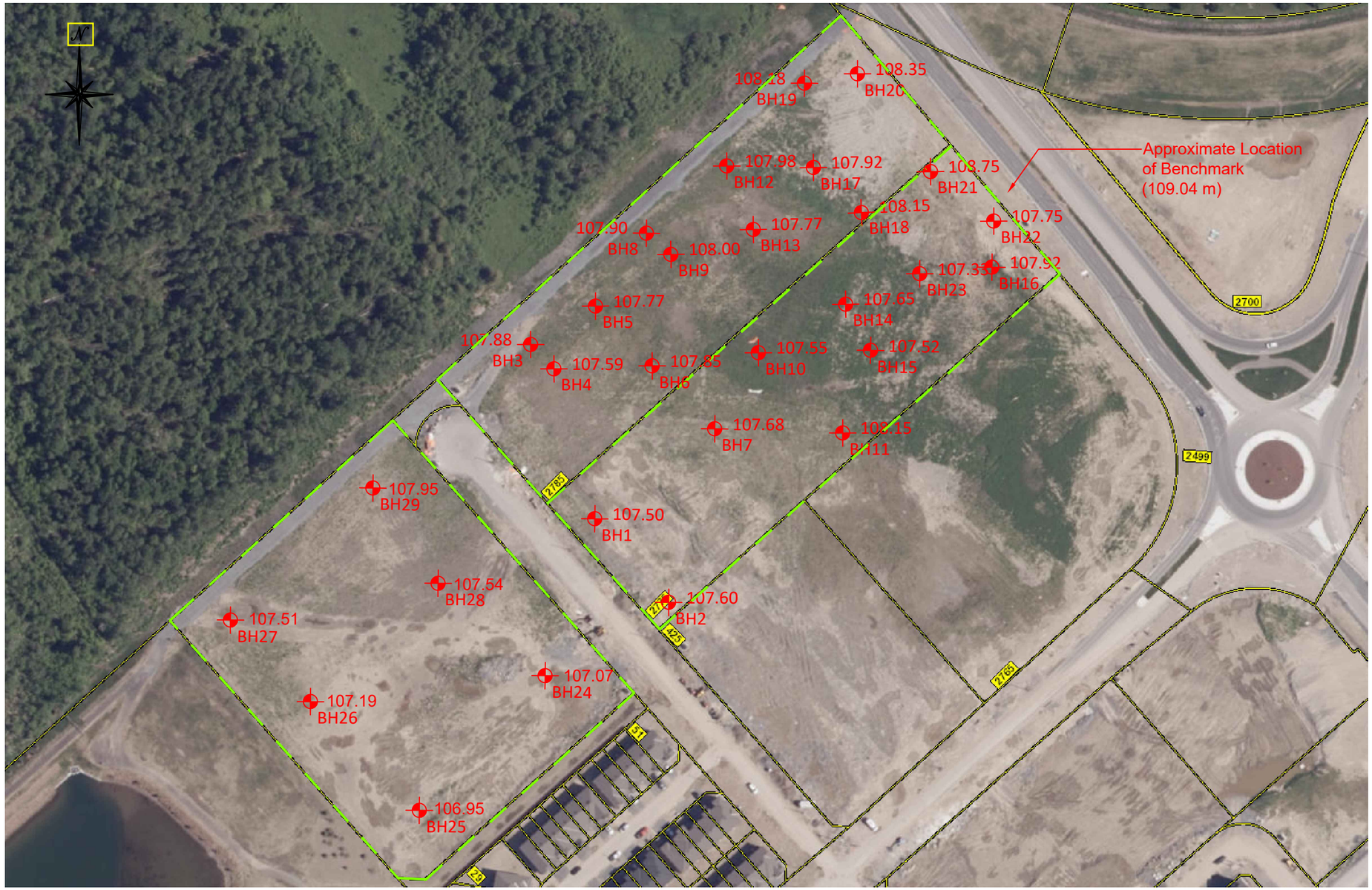
DRAWING TITLE

SITE LOCATION
SOURCE: GEOOTTAWA

CLIENT	DATE	PROJECT
PALLADIUM RESORT DEVELOPMENT LIMITED PARTNERSHIP	JUNE 2026	240720

FIGURE 1





LEGEND

(XXX) BHXX — Approximate Borehole Location (Groundsurface Elevation)

Property Line

150m 75 0 150 300m

SCALE: 1:7500

No.	REVISIONS	BY	DATE
01	ISSUED FOR REVIEW	BJ	09/06/26

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CLIENT
PALLADIUM RESORT DEVELOPMENT LIMITED PARTNERSHIP

DESIGNED BY:	DRAWN BY:	APPROVED BY:
BJ	BJ	BJ

PROJECT
GEOTECHNICAL INVESTIGATION
2775, 2785 PALLADIUM DRIVE &
BLOCK 244 PLAN 4M1687
OTTAWA , ONTARIO

DRAWING TITLE
BOREHOLE LOCATIONS

PROJECT NO.
240720

DATE
JUNE 2026

FIGURE2

APPENDIX B
Borehole Logs

Borehole Log: BH-1

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 04, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)
0 / 0	Ground Surface	107.50					
0 / 0	**TOPSOIL** About 200 mm thick.	0.00					
1 / 0	**SAND and SILT** trace clay, trace gravel sized stone, moist, grey, loose to compact.				SS1	4	33
3 / 1					SS2	5	50
5 / 2					SS3	7	83
8 / 2					SS4	25	75
10 / 3					SS5	50+	75
12 / 4	End of Borehole Borehole terminated after practical auger refusal	103.82 3.68					

Shear Strength (kPa) 50 150 — SPT N Value (Blows/0.3 m) 20 40 60 80: 4, 5, 7, 25, 50+

Water Content (%) 25 50 75 — Liquid Limit (%) 25 50 75: 14, 16, 7

Water Level (Standpipe or Open Borehole): 2.10 m bgs - Apr 23. 2025; 1.80 m bgs - May 15, 2025

Easting: 5015479 **Northing:** 426601

Site Datum: Site Benchmark

Groundsurface Elevation: 107.50 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log: BH-2

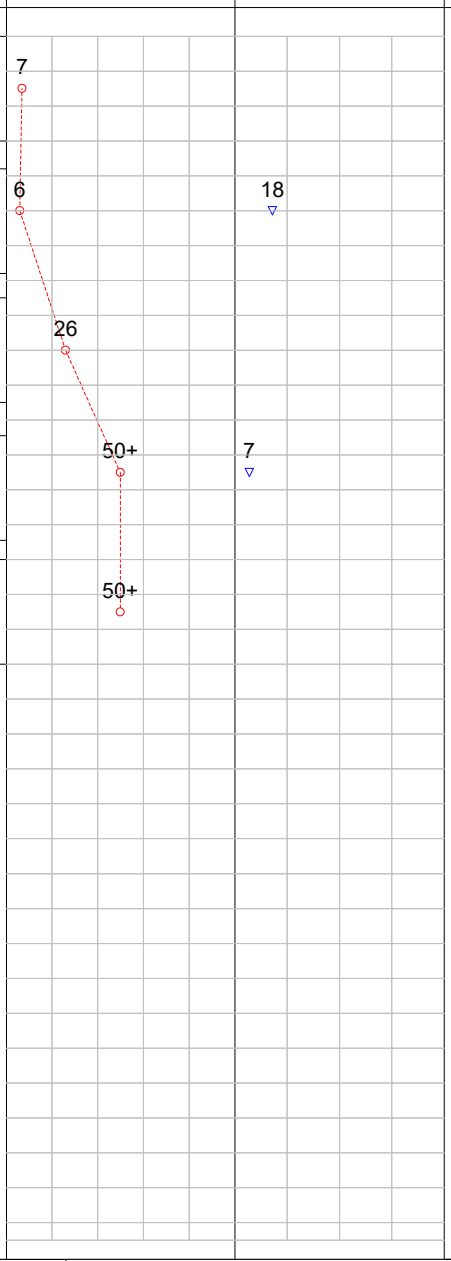
Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 07, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)
0 / 0	Ground Surface	107.60					
0	**TOPSOIL** About 200 mm thick.	0.00					
1	**FILL MATERIAL** silt-sand-clay, trace gravel, moist, brown, loose.				SS1	7	38
2							
3 / 1					SS2	6	58
4		106.15					
5	**SAND and SILT** trace clay, trace gravel sized stone, moist, brown, compact to very dense.	1.45			SS3	26	33
6 / 2							
7							
8					SS4	50+	58
9							
10 / 3					SS5	50+	0
11							
12		103.94					
13 / 4	End of Borehole	3.66					
14							
15							
16 / 5							
17							
18							
19							
20 / 6							
21							
22							



Water Level (Standpipe or Open Borehole)

Easting: 5015445 **Northing:** 426631

Site Datum: Site Benchmark

Groundsurface Elevation: 107.60 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log: BH-3

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 04, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)
0 / 0	Ground Surface	107.88					
0 / 0	**TOPSOIL** About 150 mm thick.	0.00					
1 / 0	**SANDY SILT** some clay, trace gravel sized stone, brown, moist, loose to compact.				SS1	4	25
3 / 1					SS2	9	38
5 / 1					SS3	14	50
7 / 2							
8 / 2		105.43			SS4	50+	33
8 / 2	End of Borehole Borehole terminated after practical auger refusal	2.45					

Shear Strength (kPa) 50 150 — SPT N Value (Blows/0.3 m) 20 40 60 80: 4, 9, 14, 50+

Water Content (%) 25 50 75 — Liquid Limit (%) 25 50 75: 47, 19

Water Level (Standpipe or Open Borehole)

Easting: 5015557 **Northing:** 426579

Site Datum: Site Benchmark

Groundsurface Elevation: 107.88 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log: BH-4

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 04, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)
0 / 0	Ground Surface	107.59					
0 / 0	**TOPSOIL** About 175 mm thick.	0.00					
0 / 0	**SILTY SAND** trace clay, trace gravel sized stone, brown, moist, loose to dense.				SS1	3	29
3 / 1					SS2	31	83
5 / 2					SS3	17	50
7 / 2					SS4	6	100
10 / 3					SS5	50+	33
10 / 3		104.39					
11 / 3	End of Borehole Borehole terminated after practical auger refusal	3.20					

Shear Strength (kPa) 50 150 | SPT N Value (Blows/0.3 m) 20 40 60 80: 3, 31, 17, 6, 50+

Water Content (%) 25 50 75 | Liquid Limit (%) 25 50 75: 26, 6

Water Level (Standpipe or Open Borehole)

Easting: 5015549 **Northing:** 426589

Site Datum: Site Benchmark

Groundsurface Elevation: 107.59 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log: BH-5

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 03, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth (m)	Sample Number	N or RQD	Recovery (%)
0 / 0	Ground Surface	107.77			
0	**TOPSOIL** About 150 mm thick.	0.00			
1	**SILTY SAND** some clay, brown, moist, loose to dense.		SS1	5	25
2			SS2	5	33
3 / 1			SS3	4	55
4			SS4	50	55
5 / 2			SS5	50+	0
6		104.57			
7 / 3	**LIMESTONE BEDROCK** grey, weathered at surface.	3.20	RC1	66	100
8					
9					
10 / 4			RC2	100	97
11					
12					
13 / 5					
14					
15			RC3	67	100
16 / 6					
17					
18					
19					
20					
21					
22					

Shear Strength (kPa) 50 150

SPT N Value (Blows/0.3 m) 20 40 60 80

SS1: 5 — SS2: 5 — SS3: 4 — SS4: 50 — SS5: 50+

Water Content (%) 25 50 75

Liquid Limit (%) 25 50 75

SS2: 23 — SS4: 22

Water Level (Standpipe or Open Borehole)

2.00 m bgs - Apr 23, 2025

2.25 m bgs - May 15, 2025

Easting: 5015570 **Northing:** 426604

Site Datum: Site Benchmark

Groundsurface Elevation: 107.77 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log (continued): BH-5

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 03, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

SUBSURFACE PROFILE		SAMPLE DATA						Shear Strength (kPa) × 50 150 / SPT N Value ○ (Blows/0.3 m) ○ 20 40 60 80	Water Content ▽ (%) ▽ 25 50 75 / Liquid Limit □ (%) □ 25 50 75	Water Level (Standpipe or Open Borehole)
Depth	Soil Description	Elev./Depth (m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)			
23					RC3	67				
24										
25		100.05								
26 8	End of Borehole	7.72								
27										
28										
29 9										
30										
31										
32 10										
33										
34										
35										
36 11										
37										
38										
39 12										
40										
41										
42 13										
43										
44										
45										

NOTES

Borehole Log: BH-6

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 03, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)
0 / 0	Ground Surface	107.85					
0 / 0	**TOPSOIL** About 150 mm thick.	0.00					
0 / 0	**SILTY SAND** some clay, some gravel sized stone, brown, moist, loose to compact.				SS1	6	54
3 / 1					SS2	8	54
6 / 2					SS3	6	38
8 / 2					SS4	6	38
11 / 3					SS5	21	50
12 / 4		104.19					
13 / 4	End of Borehole	3.66					

Shear Strength (kPa) 50 150 — SPT N Value (Blows/0.3 m) 20 40 60 80: 6, 8, 6, 6, 21

Water Content (%) 25 50 75 — Liquid Limit (%) 25 50 75: 23, 18, 18

Water Level (Standpipe or Open Borehole)

Easting: 5015548 **Northing:** 426623

Site Datum: Site Benchmark

Groundsurface Elevation: 107.85 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log: BH-7

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 03, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

SUBSURFACE PROFILE / SAMPLE DATA

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) 50 150 / SPT N Value (Blows/0.3 m) 20 40 60 80	Water Content (%) 25 50 75 / Liquid Limit (%) 25 50 75	Water Level (Standpipe or Open Borehole)
0	Ground Surface	107.68								
0	**TOPSOIL** About 150 mm thick.	0.00								
1	**FILL MATERIAL** silt-sand-clay, some gravel, brown, moist, loose to very dense.				SS1	9	67	9	13	
3					SS2	50	33	50		
5	**SANDY SILT** some clay, some gravel sized stone, moist, compact.	106.23 / 1.45			SS3	6	58	6	19	
8					SS4	17	42	17		
10					SS5	50+	50	50+		
12	End of Borehole	104.02 / 3.66								

Depth scale: ft 0–22, m 0–6

Water Level: 1.75 m bgs - Apr 23, 2025; 1.80 m bgs - May 15, 2025

Easting: 5015520 **Northing:** 426650

Site Datum: Site Benchmark

Groundsurface Elevation: 107.68 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log: BH-8

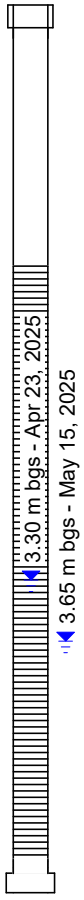
Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 07, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) / SPT N Value (Blows/0.3 m)	Water Content (%) / Liquid Limit (%)	Water Level (Standpipe or Open Borehole)
0 ft / 0 m	Ground Surface	107.90								
0	**TOPSOIL** About 150 mm thick.	0.00								
1	**FILL MATERIAL** silt-clay, some organics, brown, moist, very loose.				SS1	3	50	3		
2										
3 / 1					SS2	3	75	3	3041	
4										
5					SS3	3	50	3	30	
6										
7 / 2		105.69								
8	**SILTY CLAY** some sand, some gravel sized stone, moist, firm to hard.	2.21			SS4	8	42	8		
9										
10 / 3					SS5	7	66	7	27	
11										
12										
13 / 4					SS6	12	71	12		
14										
15					SS7	31	75	31	18	
16 / 5										
17		102.72								
18	End of Borehole	5.18								
19										
20 / 6										
21										
22										



Easting: 5015601 **Northing:** 426625

Site Datum: Site Benchmark

Groundsurface Elevation: 107.90 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log: BH-9

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 03, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth (m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)
0 / 0	Ground Surface	108.00					
0 / 0	**TOPSOIL** About 150 mm thick.	0.00					
1 / 0	**FILL MATERIAL** sand-clay, some silt, some organics, brown, moist, very loose.				SS1	3	50
3 / 1					SS2	3	75
5 / 1		106.55					
5 / 2	**SILTY CLAY** some sand, some gravel sized stone, moist, soft to firm.	1.45			SS3	2	50
8 / 2					SS4	8	42
9 / 3		105.11					
10 / 3	**SILTY SAND** trace clay, some gravel sized stone, grey, wet, loose to dense.	2.89			SS5	5	66
16 / 5					SS6	41	75
20 / 6		101.68			SS7	56	75
21 / 6	**LIMESTONE BEDROCK** weathered at surface, grey.	6.32					

Shear Strength (kPa) 50 150 | **SPT N Value** (Blows/0.3 m) 20 40 60 80

Water Content (%) 25 50 75 | **Liquid Limit** (%) 25 50 75

SPT N Value: 3, 3, 2, 8, 5, 41, 56

Water Content / Liquid Limit: 31, 23, 19

Water Level (Standpipe or Open Borehole)

Easting: 5015604 **Northing:** 426637

Site Datum: Site Benchmark

Groundsurface Elevation: 108.00 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log (continued): BH-9

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 03, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

SUBSURFACE PROFILE		SAMPLE DATA									
Depth	Soil Description	Elev./Depth (m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) 50 150 / SPT N Value (Blows/0.3 m) 20 40 60 80	Water Content (%) 25 50 75 / Liquid Limit (%) 25 50 75	Water Level (Standpipe or Open Borehole)
23					RC1	76	100			
24										
25										
26 8										
27					RC2	95	86			
28										
29 9										
30		98.85								
	End of Borehole	9.15								
31										
32										
33 10										
34										
35										
36 11										
37										
38										
39 12										
40										
41										
42 13										
43										
44										
45										

NOTES

Borehole Log: BH-10

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 07, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) 50–150 / SPT N Value (Blows/0.3 m) 20–80	Water Content (%) 25–75 / Liquid Limit (%) 25–75	Water Level (Standpipe or Open Borehole)
0 ft / 0 m	Ground Surface	107.55								
0 – 1	**TOPSOIL** About 150 mm thick. **FILL MATERIAL** sand-clay, some silt, some organics, brown, moist, very loose.	0.00			SS1	6	67	6	16	
3 – 4					SS2	10	67	10		
5 – 6					SS3	7	58	7	22	
7 – 8	**SILTY CLAY** some sand, some gravel sized stone, moist, soft to firm.	105.34 2.21			SS4	3	42	3		
10 – 11					SS5	5	53	5	13	
12 – 13	End of Borehole	103.89 3.66								

Easting: 5015553 **Northing:** 426678

Site Datum: Site Benchmark

Groundsurface Elevation: 107.55 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log: BH-11

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 07, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) / SPT N Value (Blows/0.3 m)	Water Content (%) / Liquid Limit (%)	Water Level (Standpipe or Open Borehole)
0 ft / 0 m	Ground Surface	108.15								
0 – 1 ft	**TOPSOIL** About 450 mm thick.	0.00			SS1	7	42	7		
		107.70								
1 – 3 ft	**SANDY SILT** some clay, some gravel sized stone, brown, moist, loose to compact.	0.45			SS2	5	42	5	22	
2 – 6 ft					SS3	11	58	11		
3 – 8 ft					SS4	9	38	9	16	
3 – 11 ft					SS5	5	0	5		
		104.49								
4 – 12 ft	End of Borehole	3.66								

Easting: 5015515 **Northing:** 426713

Site Datum: Site Benchmark

Groundsurface Elevation: 108.15 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log: BH-12

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 07, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) / SPT N Value (Blows/0.3 m)	Water Content (%) / Liquid Limit (%)	Water Level (Standpipe or Open Borehole)
0 ft / 0 m	Ground Surface	107.98								
0	**TOPSOIL** About 150 mm thick.	0.00								
1	**SILTY CLAY** some sand, some gravel sized stone at deeper depths, brownish grey, moist, soft to firm.				SS1	2	50	2	25	
2										
3 / 1					SS2	3	100	3		
4										
5					SS3	2	100	2	51	
6 / 2										
7										
8					SS4	1	42	1		
9										
10 / 3					SS5	6	25	6	18	
11										
12										
13 / 4										
14										
15					SS6	4	58	4	51 50	
16										
17 / 5										
18		102.34								
19	**SILTY SAND** brown, wet, compact to very dense.	5.64								
20 / 6										
21					SS7	12	100	12	22	
22										

Easting: 5015625 **Northing:** 426656

Site Datum: Site Benchmark

Groundsurface Elevation: 107.98 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log (continued): BH-12

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 07, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

SUBSURFACE PROFILE		SAMPLE DATA								
Depth	Soil Description	Elev./Depth (m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) 50 150 / SPT N Value (Blows/0.3 m) 20 40 60 80	Water Content (%) 25 50 75 / Liquid Limit (%) 25 50 75	Water Level (Standpipe or Open Borehole)
8										
9					SS8	58	50	58		
10		99.66								
11	End of Borehole Borehole terminated after practical auger refusal	8.32								
12										
13										

NOTES

Borehole Log: BH-13

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 07, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth (m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) / SPT N Value (Blows/0.3 m)	Water Content (%) / Liquid Limit (%)	Water Level (Standpipe or Open Borehole)
0 ft / 0 m	Ground Surface	107.77								
	TOPSOIL About 175 mm thick.	0.00								
	FILL MATERIAL silt-clay, some sand, some organics, brown, moist, very loose.				SS1	3	29	3	31	
3 ft / 1 m					SS2	2	33	2		
		106.32								
	SILTY CLAY trace sand, some gravel sized stone, grey, wet, soft to firm.	1.45			SS3	1	21	1	26	
6 ft / 2 m					SS4	2	100	2		
9 ft / 3 m					SS5	8	75	8	19	
12 ft / 4 m		103.65								
	SILTY SAND trace clay, grey, moist, compact to dense.	4.12			SS6	28	83	28		
15 ft / 5 m										
18 ft / 6 m					SS7	36	71	36	17	
		100.86								
		6.91								

Easting: 5015605 **Northing:** 426670

Site Datum: Site Benchmark

Groundsurface Elevation: 107.77 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log (continued): BH-13

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 07, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

SUBSURFACE PROFILE		SAMPLE DATA						Shear Strength (kPa) × 50 150 × SPT N Value ○ (Blows/0.3 m) ○ 20 40 60 80	Water Content (%) ▽ 25 50 75 ▽ Liquid Limit (%) □ 25 50 75 □	Water Level (Standpipe or Open Borehole)
Depth	Soil Description	Elev./Depth (m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)			
23	End of Borehole Borehole terminated after practical auger refusal									
24										
25										
26	8									
27										
28										
29	9									
30										
31										
32	10									
33										
34										
35										
36	11									
37										
38										
39	12									
40										
41										
42	13									
43										
44										
45										

NOTES

Borehole Log: BH-14

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 03, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)
0 / 0	Ground Surface	107.65					
0	**TOPSOIL** About 50 mm thick.	0.00					
1	**FILL MATERIAL** sand, trace gravel, dry, very loose.	106.89			SS1	2	8
2		0.76					
3 / 1	**SILTY CLAY** trace sand, some gravel sized stone, brown, wet, soft to firm.				SS2	3	8
5							
6 / 2					SS3	5	25
7							
8					SS4	4	0
9							
10 / 3					SS5	4	4
11							
12							
13 / 4		103.53					
14	**SILTY SAND** trace clay, brown, wet, compact.	4.12					
15							
16 / 5					SS6	21	71
17							
18							
19		101.77					
20 / 6	**LIMESTONE BEDROCK** grey, hard.	5.88			RC1	80	100
21							
22					RC2	83	100

Shear Strength (kPa) 50 150

SPT N Value (Blows/0.3 m) 20 40 60 80

Water Content (%) 25 50 75

Liquid Limit (%) 25 50 75

Water Level (Standpipe or Open Borehole)

SPT N Value: 2, 3, 5, 4, 4, 21

Water Content: 21, 26, 22

Easting: 5015560 **Northing:** 426697

Site Datum: Site Benchmark

Groundsurface Elevation: 107.65 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log (continued): BH-14

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 03, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

SUBSURFACE PROFILE		SAMPLE DATA									
Depth	Soil Description	Elev./Depth (m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) 50 150 / SPT N Value (Blows/0.3 m) 20 40 60 80	Water Content (%) 25 50 75 / Liquid Limit (%) 25 50 75	Water Level (Standpipe or Open Borehole)
23										
24										
25										
26 8										
27										
28					RC3	85	100			
29										
30 9		98.45								
	End of Borehole	9.20								
31										
32										
33 10										
34										
35										
36 11										
37										
38										
39 12										
40										
41										
42 13										
43										
44										
45										

NOTES

Borehole Log: BH-15

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 09, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) / SPT N Value (Blows/0.3 m)	Water Content (%) / Liquid Limit (%)	Water Level (Standpipe or Open Borehole)
0 ft / 0 m	Ground Surface	107.52								
0 – 3.3 ft / 0 – 1 m	**CLAYEY SILT** organics, brown, moist, very loose.	0.00			SS1	1	8	1		
3.3 – 5.2 ft / 1 – 1.6 m		106.07			SS2	2	29	2		
5.2 – 10.5 ft / 1.6 – 3.2 m	**SILTY CLAY** some sand, some gravel sized stone, grey, moist, firm.	1.45			SS3	3	53	3	34	
					SS4	9	33	9		
10.5 – 11.2 ft / 3.2 – 3.4 m	**LIMESTONE BEDROCK**	104.32 3.20			SS5	50+	50	50+	14	
11.2 ft / 3.4 m	End of Borehole	104.01 3.51								

Easting: 5015573 **Northing:** 426723

Site Datum: Site Benchmark

Groundsurface Elevation: 107.52 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log: BH-16

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 08, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth (m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) / SPT N Value (Blows/0.3 m)	Water Content (%) / Liquid Limit (%)	Water Level (Standpipe or Open Borehole)
0 / 0	Ground Surface	108.05								
0 / 0	**TOPSOIL** about 100 mm thick.	0.00								
1 /	**SILTY SAND** brown, dry, very loose.				SS1	3	17	3	23	
2 /										
3 / 1					SS2	2	0	2		
4 /										
5 /					SS3	2	42	2	28	
6 / 2										
7 /		105.84								
7 /	**SILTY CLAY** some sand, brownish grey, moist, firm.	2.21			SS4	5	13	5		
8 /										
9 /										
10 / 3					SS5	5	46	5	26	
11 /										
12 /										
13 / 4		103.93								
14 /	**SILTY SAND** some sand, brown, moist.	4.12								
15 /										
16 /					SS6	9	67	9		
17 / 5										
18 /										
19 /										
20 / 6		101.90			SS7	50+	50	50+	28	
21 /	End of Borehole Borehole terminated after practical auger refusal	6.15								
22 /										

Easting: 5015551 **Northing:** 426741

Site Datum: Site Benchmark

Groundsurface Elevation: 108.05 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log: BH-17

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: March 31, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth (m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) / SPT N Value (Blows/0.3 m)	Water Content (%) / Liquid Limit (%)	Water Level (Standpipe or Open Borehole)
0 ft / 0 m	Ground Surface	107.92								
0	**TOPSOIL** about 150 mm thick.	0.00								
1	**FILL MATERIAL** silt-sand, some clay, brown, moist, very loose to loose.				SS1	3	25	3		
2										
3 / 1					SS2	3	0	3		
4		106.47								
5	**SILTY CLAY** some sand, some gravel sized stone, brownish grey, moist, soft to stiff.	1.45			SS3	9	25	9		
6 / 2										
7					SS4	2	92	2	51 54	
8										
9										
10 / 3					SS5	5	25	5		
11										
12										
13 / 4										
14										
15										
16					SS6	9	67	9	27	
17 / 5										
18		102.28								
19	**SILT** some clay, brown, wet, loose to compact.	5.64								
20 / 6					SS7	10	75	10		
21										
22										

Easting: 5015616 **Northing:** 426695

Site Datum: Site Benchmark

Groundsurface Elevation: 107.92 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log (continued): BH-17

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: March 31, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

SUBSURFACE PROFILE		SAMPLE DATA									
Depth	Soil Description	Elev./Depth (m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) 50 150 / SPT N Value (Blows/0.3 m) 20 40 60 80	Water Content (%) 25 50 75 / Liquid Limit (%) 25 50 75	Water Level (Standpipe or Open Borehole)
8		99.84			SS8	5	50	5	21	
9	**LIMESTONE BEDROCK** hard, grey.	8.08			RC1	88	100			
10					RC2	86	97			
11	End of Borehole	97.25 10.67								
12										
13										

NOTES

Borehole Log: BH-18

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 09, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth (m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) / SPT N Value (Blows/0.3 m)	Water Content (%) / Liquid Limit (%)	Water Level (Standpipe or Open Borehole)
0 ft / 0 m	Ground Surface	108.15								
0 – 2 ft	**TOPSOIL** about 100 mm thick. **SILTY SAND** brown, dry, loose.	0.00			SS1	6	54	6	33	
3 – 4 ft					SS2	4	63	4		
5 – 6 ft					SS3	8	0	8		
7 ft / 2 m		105.94								
7 – 10 ft	**CLAYEY SILT** some sand, trace gravel sized stone, brownish grey, moist, firm.	2.21			SS4	3	67	3	19	
10 – 12 ft					SS5	4	67	4	29	
15 – 16 ft					SS6	8	8	8	47	
18 ft / 6 m		102.51								
18 – 21 ft	**SILTY SAND** some sand, brown, moist compact	5.64			SS7	11	71	11	37	
22 ft										

Easting: 5015573 **Northing:** 426723

Site Datum: Site Benchmark

Groundsurface Elevation: 108.15 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log (continued): BH-18

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 09, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

SUBSURFACE PROFILE		SAMPLE DATA						Shear Strength (kPa) 50 150 / SPT N Value (Blows/0.3 m) 20 40 60 80	Water Content (%) 25 50 75 / Liquid Limit (%) 25 50 75	Water Level (Standpipe or Open Borehole)
Depth	Soil Description	Elev./Depth (m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)			
25		100.48								
		7.67								
	End of Borehole									
26	Borehole terminated after practical auger refusal									
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										
41										
42										
43										
44										
45										

NOTES

Borehole Log: BH-19

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: March 31, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth (m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) / SPT N Value (Blows/0.3 m)	Water Content (%) / Liquid Limit (%)	Water Level (Standpipe or Open Borehole)
0 ft / 0 m	Ground Surface	108.18								
0	**TOPSOIL** about 100 mm thick.	0.00								
1	**SILTY CLAY** some sand, some gravel sized stone, brownish grey, moist, firm.				SS1	5	50	5		
2										
3 / 1					SS2	8	38	8	20	
4										
5					SS3	4	53	4		
6 / 2										
7					SS4	7	79	7	19	
8										
9					SS5	8	67	8		
10 / 3										
11										
12										
13 / 4										
14										
15					SS6	4	100	4	47	
16										
17 / 5										
18		102.54								
19	**SILTY SAND** some clay, brown, moist, compact.	5.64								
20 / 6					SS7	11	53	11		
21										
22										

Water Level: 4.85 m bgs - Apr 23, 2025; 4.60 m bgs - May 15, 2025

Easting: 5015662 **Northing:** 426696

Site Datum: Site Benchmark

Groundsurface Elevation: 108.18 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log (continued): BH-19

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: March 31, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

SUBSURFACE PROFILE		SAMPLE DATA								
Depth	Soil Description	Elev./Depth (m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) 50 150 / SPT N Value (Blows/0.3 m) 20 40 60 80	Water Content (%) 25 50 75 / Liquid Limit (%) 25 50 75	Water Level (Standpipe or Open Borehole)
23										
24										
25								50+	24	
26 8					SS8	50+	33			
27										
28										
29 9										
30		99.03								
	End of Borehole	9.15								
31	Borehole terminated after practical auger refusal									
32 10										
33										
34										
35										
36 11										
37										
38										
39 12										
40										
41										
42 13										
43										
44										
45										

NOTES

Borehole Log: BH-20

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 10, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) / SPT N Value (Blows/0.3 m)	Water Content (%) / Liquid Limit (%)	Water Level (Standpipe or Open Borehole)
0 ft / 0 m	Ground Surface	108.35								
0	**TOPSOIL** About 150 mm thick.	0.00								
1	**SILTY CLAY** some sand, grey, moist, firm to stiff.				SS1	5	50	5	19	
2										
3 / 1					SS2	10	42	10		
4										
5					SS3	9	29	9	28	
6 / 2										
7					SS4	5	17	5		
8										
9										
10 / 3					SS5	10	25	10	25	
11										
12		104.11								
13 / 4	End of Borehole	4.24								
14	Borehole terminated after practical auger refusal									
15										
16										
17 / 5										
18										
19										
20 / 6										
21										
22										

Easting: 5015655 **Northing:** 426721

Site Datum: Site Benchmark

Groundsurface Elevation: 108.35 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log: BH-21

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 02, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)
0 / 0	Ground Surface	108.75					
0 / 0	**TOPSOIL** About 200 mm thick.	0.00					
1 / 0	**FILL MATERIAL** sand-clay, some silt, organics, brownish grey, moist, loose.				SS1	6	38
2 / 0							
3 / 1					SS2	4	29
4 / 1		107.30					
5 / 1	**SILTY CLAY** some sand, some gravel sized stone, ocassional boulders	1.45			SS3	50+	17
6 / 2							
7 / 2							
8 / 2					SS4	10	0
9 / 2							
10 / 3					SS5	5	12
11 / 3							
12 / 3							
13 / 4							
14 / 4							
15 / 4	Casing advanced through boulders, unable to auger past 4.6 m bgs.				SS6	50+	0
16 / 5							
17 / 5							
18 / 5							
19 / 5							
20 / 6							
21 / 6							
22 / 6							

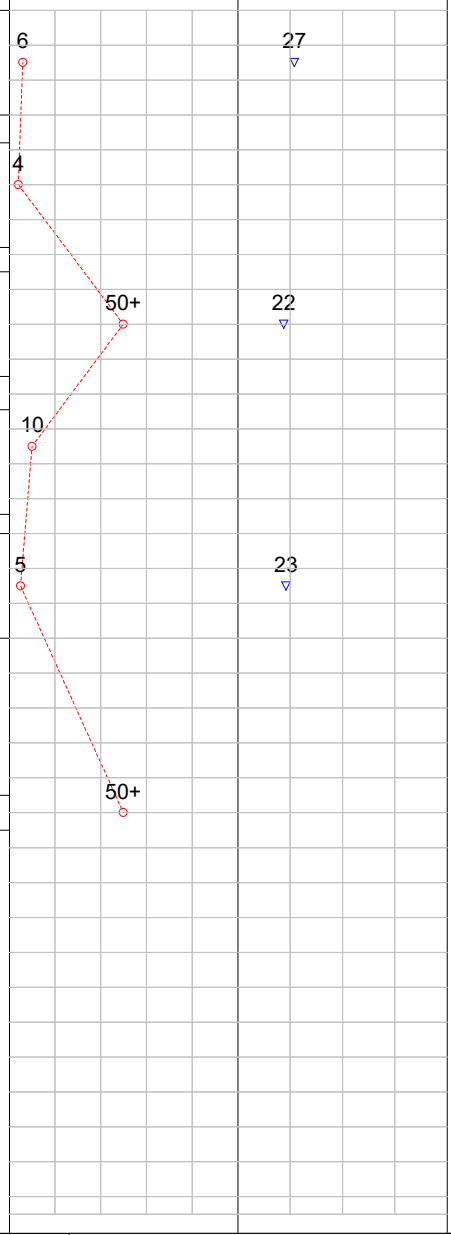
Shear Strength (kPa) 50 150

SPT N Value (Blows/0.3 m) 20 40 60 80

Water Content (%) 25 50 75

Liquid Limit (%) 25 50 75

Water Level (Standpipe or Open Borehole)



Easting: 5015124 **Northing:** 426743

Site Datum: Site Benchmark

Groundsurface Elevation: 108.75 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log (continued): BH-21

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 02, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

SUBSURFACE PROFILE		SAMPLE DATA								
Depth	Soil Description	Elev./Depth (m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) 50 150 / SPT N Value (Blows/0.3 m) 20 40 60 80	Water Content (%) 25 50 75 / Liquid Limit (%) 25 50 75	Water Level (Standpipe or Open Borehole)
25	End of Borehole	101.13 7.62								

NOTES

Borehole Log: BH-22

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 10, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) / SPT N Value (Blows/0.3 m)	Water Content (%) / Liquid Limit (%)	Water Level (Standpipe or Open Borehole)
0 ft / 0 m	Ground Surface	107.75								
0 – 2 ft	NO SAMPLE RECOVERED	0.00			SS1	2	0	2		
2 – 4 ft					SS2	4	0	4		
4 – 5 ft		106.25								
5 – 8 ft	**SILTY SAND** brown, moist, very loose.	1.50			SS3	3	42	3	21	
8 – 9 ft					SS4	2	92	2		
9 – 10 ft		104.78								
10 – 12 ft	**CLAYEY SILT** some sand, greyish brown, moist, very loose to loose.	2.97			SS5	2	92	2	37 40	
12 – 13 ft		103.63								
13 – 14 ft	**SILT** trace clay, trace sand, grey, wet, very loose	4.12								
14 – 16 ft					SS6	6	100	6		
16 – 20 ft										
20 – 21 ft					SS7	2	100	2	24	
21 – 22 ft										

Easting: 5015591 **Northing:** 426765

Site Datum: Site Benchmark

Groundsurface Elevation: 107.75 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log (continued): BH-22

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 10, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

SUBSURFACE PROFILE		SAMPLE DATA								
Depth	Soil Description	Elev./Depth (m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) 50 150 / SPT N Value (Blows/0.3 m) 20 40 60 80	Water Content (%) 25 50 75 / Liquid Limit (%) 25 50 75	Water Level (Standpipe or Open Borehole)
23										
24										
25										
		100.03			SS8	50+		50+		
		7.72								
26	End of Borehole									
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										
41										
42										
43										
44										
45										

8 9 10 11 12 13

NOTES

Borehole Log: BH-23

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 8, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)
0 / 0	Ground Surface	107.33					
0	**TOPSOIL** about 150 mm thick.	0.00					
1	**SILTY SAND** trace clay, brown, moist to wet, very loose to dense.				SS1	10	33
3 / 1					SS2	1	4
5					SS3	1	0
6 / 2							
8					SS4	2	17
9							
10 / 3					SS5	38	33
12							
13 / 4							
15					SS6	8	67
16 / 5							
17							
18							
19							
20 / 6					SS7	9	50
21		100.73					
22	**LIMESTONE BEDROCK** grey, hard.	6.60			RC1	69	100

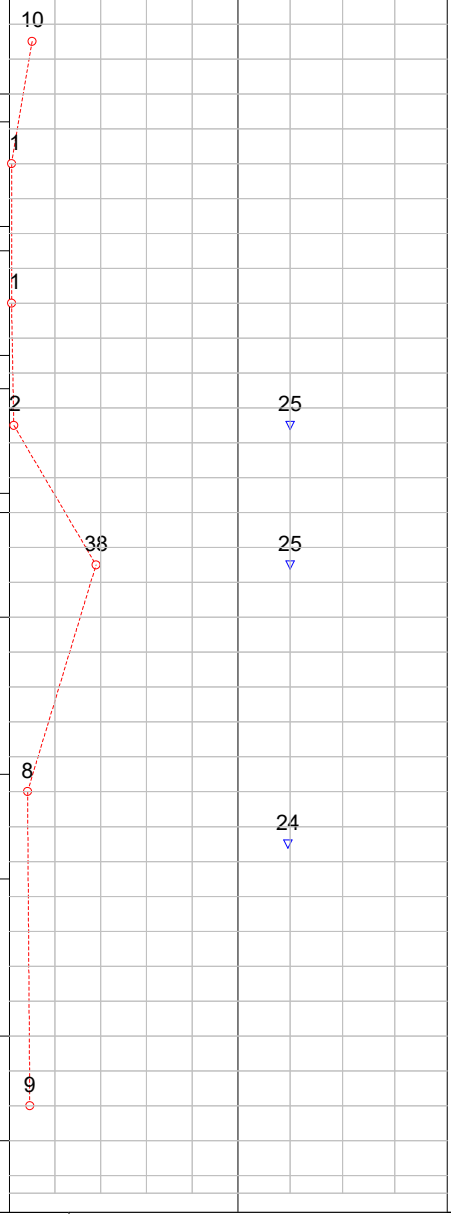
Shear Strength (kPa) 50 150

SPT N Value (Blows/0.3 m) 20 40 60 80

Water Content (%) 25 50 75

Liquid Limit (%) 25 50 75

Water Level (Standpipe or Open Borehole)



Easting: 5015575 **Northing:** 426723

Site Datum: Site Benchmark

Groundsurface Elevation: 107.33 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log (continued): BH-23

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: April 8, 2025 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

SUBSURFACE PROFILE		SAMPLE DATA						Shear Strength (kPa) 50 150 / SPT N Value (Blows/0.3 m) 20 40 60 80	Water Content (%) 25 50 75 / Liquid Limit (%) 25 50 75	Water Level (Standpipe or Open Borehole)
Depth	Soil Description	Elev./Depth (m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)			
23					RC1	69				
24					RC2	91	100			
25										
26 – 8										
27					RC3	95	100			
28										
29 – 9										
30	End of Borehole	98.26 9.07								
31										
32										
33 – 10										
34										
35										
36 – 11										
37										
38										
39 – 12										
40										
41										
42 – 13										
43										
44										
45										

NOTES

Borehole Log: BH-24

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: May 26, 2026 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)
0 / 0	Ground Surface	107.07					
0 – 3 / 0 – 1	**CLAY** trace gravel, trace of organic, becomes silty around 2.4 m bgs, compact to loose, moist, brown.	0.00			SS1	19	79
					SS2	4	58
		105.86					
4 – 10 / 1 – 3	**SILT** loose, moist, brown. -bedrock in tip of spoon in SS5	1.21			SS3	4	92
					SS4	4	96
					SS5	50+	50
		104.03					
10	End of Borehole	3.04					

Shear Strength (kPa) 50 150

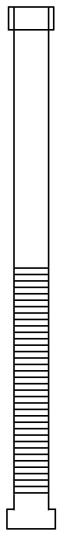
SPT N Value (Blows/0.3 m) 20 40 60 80

Water Content (%) 25 50 75

Liquid Limit (%) 25 50 75

Water Level (Standpipe or Open Borehole)





Easting: 5015417 **Northing:** 426577

Site Datum: Site Benchmark

Groundsurface Elevation: 107.07 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Standpipe was found to be dry - May 29, 2026

Borehole Log: BH-25

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: May 26, 2026 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) / SPT N Value (Blows/0.3 m)	Water Content (%) / Liquid Limit (%)	Water Level (Standpipe or Open Borehole)
0 ft / 0 m	Ground Surface	106.95								
0 – 3 ft	**LOAM** clayey, trace of organics, trace of gravel, loose, moist, brown.	0.00 / 106.34			SS1	7	38	7		
3 – 6 ft (1 – 2 m)	**SILTY CLAY** soft, moist, brown.	0.61 / 105.12			SS2	5	29	5		
					SS3	5	21	5		
6 – 9 ft (2 – 3 m)	**SILT** trace of clay, very loose to compact, brown.	1.83 / 103.91			SS4	3	50	3		
					SS5	12	75	12		
10 ft / 3 m	End of Borehole	3.04								

Easting: 5015367 **Northing:** 426516

Site Datum: Site Benchmark

Groundsurface Elevation: 106.95 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log: BH-26

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: May 26, 2026 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) / SPT N Value (Blows/0.3 m)	Water Content (%) / Liquid Limit (%)	Water Level (Standpipe or Open Borehole)
0 ft / 0 m	Ground Surface	107.19								
0 – 3 ft	**LOAM** clayey, gravelly, trace of organics, loose, moist, brown.	0.00			SS1	7	38	7		
3 – 4 ft					SS2	5	29	5		
		105.98								
4 – 10 ft	**SILT** trace of gravel, trace of clay, moist to saturated with increased depth, greyish brown, very loose to compact.	1.21			SS3	5	21	5		
					SS4	3	50	3		
					SS5	12	75	12		
		104.15								
10 ft / 3 m	End of Borehole	3.04								

Easting: 5015404 **Northing:** 426480

Site Datum: Site Benchmark

Groundsurface Elevation: 107.19 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log: BH-27

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: May 26, 2026 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)
0 / 0	Ground Surface	107.51					
0 – 6 / 0 – 2	**LOAM** clayey, traces of organics, traces of gravel, loose, moist, brown, traces of rock from 1.2 to 1.8 m.	0.00			SS1	6	50
					SS2	4	50
					SS3	50+	17
		105.68					
6 – 10 / 2 – 3	**SILT** loose to compact, moist to saturated, greyish brown.	1.83			SS4	10	21
					SS5	8	75
		104.47					
10 / 3	End of Borehole	3.04					

Shear Strength (kPa) 50 150

SPT N Value (Blows/0.3 m) 20 40 60 80

SS1: 6; SS2: 4; SS3: 50+; SS4: 10; SS5: 8

Water Content (%) 25 50 75

Liquid Limit (%) 25 50 75

Water Level (Standpipe or Open Borehole)

2.13 m bgs - May 29, 2026

Easting: 5015440 **Northing:** 426445

Site Datum: Site Benchmark

Groundsurface Elevation: 107.51 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log: BH-28

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: May 26, 2026 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)	Shear Strength (kPa) / SPT N Value (Blows/0.3 m)	Water Content (%) / Liquid Limit (%)	Water Level (Standpipe or Open Borehole)
0 ft / 0 m	Ground Surface	107.54								
0 – 2 ft / 0 – 1 m	**LOAM** silty, some organics and gravel, becoming clayey with increased depth, compact, moist, brown.	0.00 – 106.93			SS1	12	33	12		
2 – 6 ft / 1 – 2 m	**SILTY CLAY** firm, moist, grey.	0.61 – 105.71			SS2	7	54	7		
					SS3	8	33	8		
6 – 10 ft / 2 – 3 m	**CLAYEY SILT** very loose to loose, moist, greyish brown.	1.83 – 104.50			SS4	2	14	2		
					SS5	9	9	9		
10 ft / 3 m	End of Borehole	3.04								

Easting: 5015458 **Northing:** 426533

Site Datum: Site Benchmark

Groundsurface Elevation: 107.54 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Borehole Log: BH-29

Project No.: 240720 **Project:** Geotechnical Investigation

Client: Palladium Resort Dev. LTD Partnership **Location:** Palladium Drive, Ottawa ON

Date: May 26, 2026 **Field Personnel:** KB

Driller: George Downing Estate Drilling. **Drilling Equipment:** Track Mount CME 75 **Drilling Method:** Hollow Stem Auger

Depth (ft / m)	Soil Description	Elev./Depth(m)	Lithology	Type	Sample Number	N or RQD	Recovery (%)
0 / 0	Ground Surface	107.95					
0 / 0	**LOAM** silty, some organics and gravel, becoming clayey with increased depth, very loose to loose, moist, brown.	0.00			SS1	9	25
3 / 1					SS2	8	71
5 / 2					SS3	4	37
7 / 2					SS4	3	50
8 / 3	**CLAYEY SILT** very loose, grey, moist.	105.52 2.43			SS5	1	67
10 / 3	End of Borehole	104.91 3.04					

Shear Strength (kPa) 50 150

SPT N Value (Blows/0.3 m) 20 40 60 80

Water Content (%) 25 50 75

Liquid Limit (%) 25 50 75

Water Level (Standpipe or Open Borehole)

Easting: 5015500 **Northing:** 426509

Site Datum: Site Benchmark

Groundsurface Elevation: 107.95 m **Top of Riser Elev.:** NA

Hole Diameter: 200mm

NOTES:

No water encountered while drilling.

Standpipe found to be dry - May 29, 2026

APPENDIX C

Symbols and Terms used in Borehole Logs

Symbols and Terms Used on Borehole and Test Pit Logs

1. Soil Description

The soil descriptions presented in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification and identification of soil involves some judgement and LRL Associates Ltd. does not guarantee descriptions as exact, but infers accuracy to the extent that is common in current geotechnical practice. Boundaries between zones on the logs are often not distinct but transitional and were interpreted.

a. Proportion

The proportion of each constituent part, as defined by the grain size distribution, is denoted by the following terms:

Term	Proportions
"trace"	1% to 10%
"some"	10% to 20%
prefix (i.e. "sandy" silt)	20% to 35%
"and" (i.e. sand "and" gravel)	35% to 50%

b. Compactness and Consistency

The state of compactness of granular soils is defined on the basis of the Standard Penetration Number (N) as per ASTM D-1586. It corresponds to the number of blows required to drive 300 mm of the split spoon sampler using a metal drop hammer that has a weight of 62.5 kg and free fall distance of 760 mm. For a 600 mm long split spoon, the blow counts are recorded for every 150 mm. The "N" value is obtained by adding the number of blows from the 2nd and 3rd count. Technical refusal indicates a number of blows greater than 50.

The consistency of clayey or cohesive soils is based on the shear strength of the soil, as determined by field vane tests and by a visual and tactile assessment of the soil strength.

The state of compactness of granular soils is defined by the following terms:

State of Compactness Granular Soils	Standard Penetration Number "N"	Relative Density (%)
Very loose	0 – 4	<15
Loose	4 – 10	15 – 35
Compact	10 - 30	35 – 65
Dense	30 - 50	65 - 85
Very dense	> 50	> 85

The consistency of cohesive soils is defined by the following terms:

Consistency Cohesive Soils	Undrained Shear Strength (C_u) (kPa)	Standard Penetration Number "N"
Very soft	<12.5	<2
Soft	12.5 - 25	2 - 4
Firm	25 - 50	4 - 8
Stiff	50 - 100	8 - 15
Very stiff	100 - 200	15 - 30
Hard	>200	>30

c. Field Moisture Condition

Description (ASTM D2488)	Criteria
Dry	Absence of moisture, dusty, dry to touch.
Moist	Dump, but not visible water.
Wet	Visible, free water, usually soil is below water table.

2. Sample Data

a. Elevation depth

This is a reference to the geodesic elevation of the soil or to a benchmark of an arbitrary elevation at the location of the borehole or test pit. The depth of geological boundaries is measured from ground surface.

b. Type

Symbol	Type	Letter Code
	Auger	AU
	Split Spoon	SS
	Shelby Tube	ST
	Rock Core	RC

c. Sample Number

Each sample taken from the borehole is numbered in the field as shown in this column.

LETTER CODE (as above) – Sample Number.

d. Recovery (%)

For soil samples this is the percentage of the recovered sample obtained versus the length sampled. In the case of rock, the percentage is the length of rock core recovered compared to the length of the drill run.

3. Rock Description

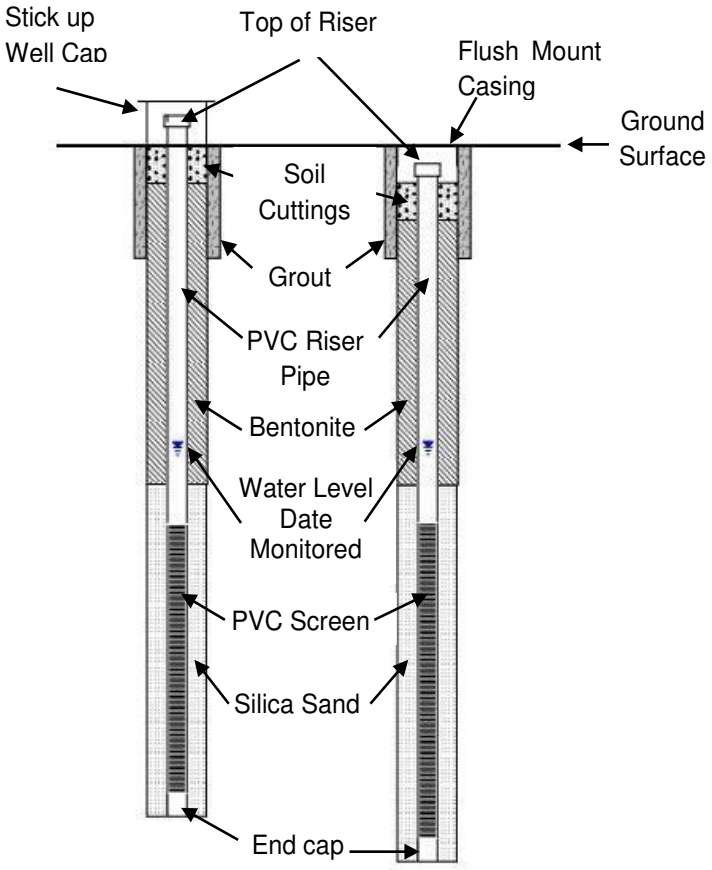
Rock Quality Designation (RQD) is a rough measure of the degree of jointing or fracture in a rock mas. The RQD is calculated as the cumulative length of rock pieces recovered having lengths of 100 mm or more divided by the length of coring. The qualitative description of the bedrock based on RQD is given below.

Rock Quality Designation (RQD) (%)	Description of Rock Quality
0 –25	Very poor
25 – 50	Poor
50 – 75	Fair
75 – 90	Good
90 – 100	Excellent

Strength classification of rock is presented below.

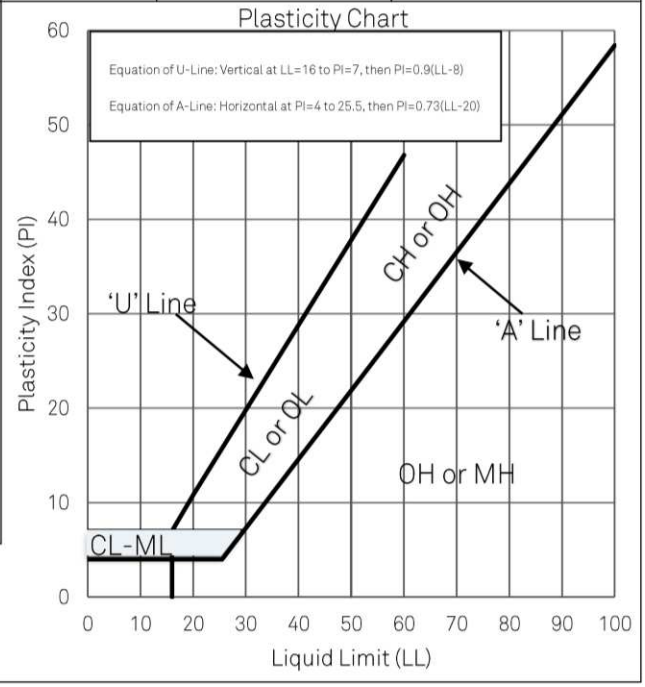
Strength Classification	Range of Unconfined Compressive Strength (MPa)
Extremely weak	< 1
Very weak	1 – 5
Weak	5 – 25
Medium strong	25 – 50
Strong	50 – 100
Very strong	100 – 250
Extremely strong	> 250

4. General Monitoring Well Data



5. Classification of Soils for Engineering Purposes (ASTM D2487)

(United Soil Classification System)

Major divisions			Group Symbol	Typical Names	Classification Criteria		
Coarse-grained soils More than 50% retained on No. 200 sieve* (>0.075 mm)	Gravels More than 50% of coarse fraction retained on No. 4 sieve(4.75 mm)	Clean gravels <5% fines	GW	Well-graded gravel	If 15% sand add "with sand" to group name.	Classification on basis of percentage of fines: Less than 5% pass No. 200 sieve - GW, GP, SW, SP More than 12% pass No. 200 sieve - GM, GC, SM, SC 5 to 12% pass No. 200 sieve - Borderline classifications, use of dual symbols	$C_u = \frac{D_{60}}{D_{10}} \geq 4$; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			GP	Poorly graded gravel			Not meeting either Cu or Cc criteria for GW
		Gravels with >12% fines	GM	Silty gravel			Atterberg limits below "A" line or PI less than 4 → Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			GC	Clayey gravel			Atterberg limits on or above "A" line and PI > 7 → If fines are organic add "with orgnic fines" to group name
	Sands 50% or more of coarse fraction passes No. 4 sieve(<4.75 mm)	Clean sands <5% fines	SW	Well-graded sand	If 15% gravel add "with gravel to group name		$C_u = \frac{D_{60}}{D_{10}} \geq 6$; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			SP	Poorly graded sand			Not meeting either Cu or C ccriteria for SW
		Sands with >12% fines	SM	Silty sand			Atterberg limits below "A" line or PI less than 4 → Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			SC	Clayey sand			Atterberg limits on or above "A" line and PI > 7 → If fines are organic add "with orgnic fines" to group name
Fine-grained soils50% or more passes No. 200 sieve* (<0.075 mm)	Silts and Clays Liquid Limit <50%	Inorganic	ML	Silt	If 15 to 29% coarse-grained, add "with sand" or "with gravel" as appropriate. If > 30% coarse-grained, add "sandy" or "gravelly" as appropriate. Class as organic when oven dried liquid limit is < 75% of undried liquid limit.		
			CL	Lean Clay -low plasticity			
		Organic	OL	Organic clay or silt (Clay plots above 'A' Line)			
	Silts and Clays Liquid Limit >50%	Inorganic	MH	Elastic silt			
			CH	Fat Clay -high plasticity			
		Organic	OH	Organic clay or silt (Clay plots above 'A' Line)			
	Highly Organic Soils		PT	Peat, muck and other highly organic soils			

APPENDIX D
Laboratory Results

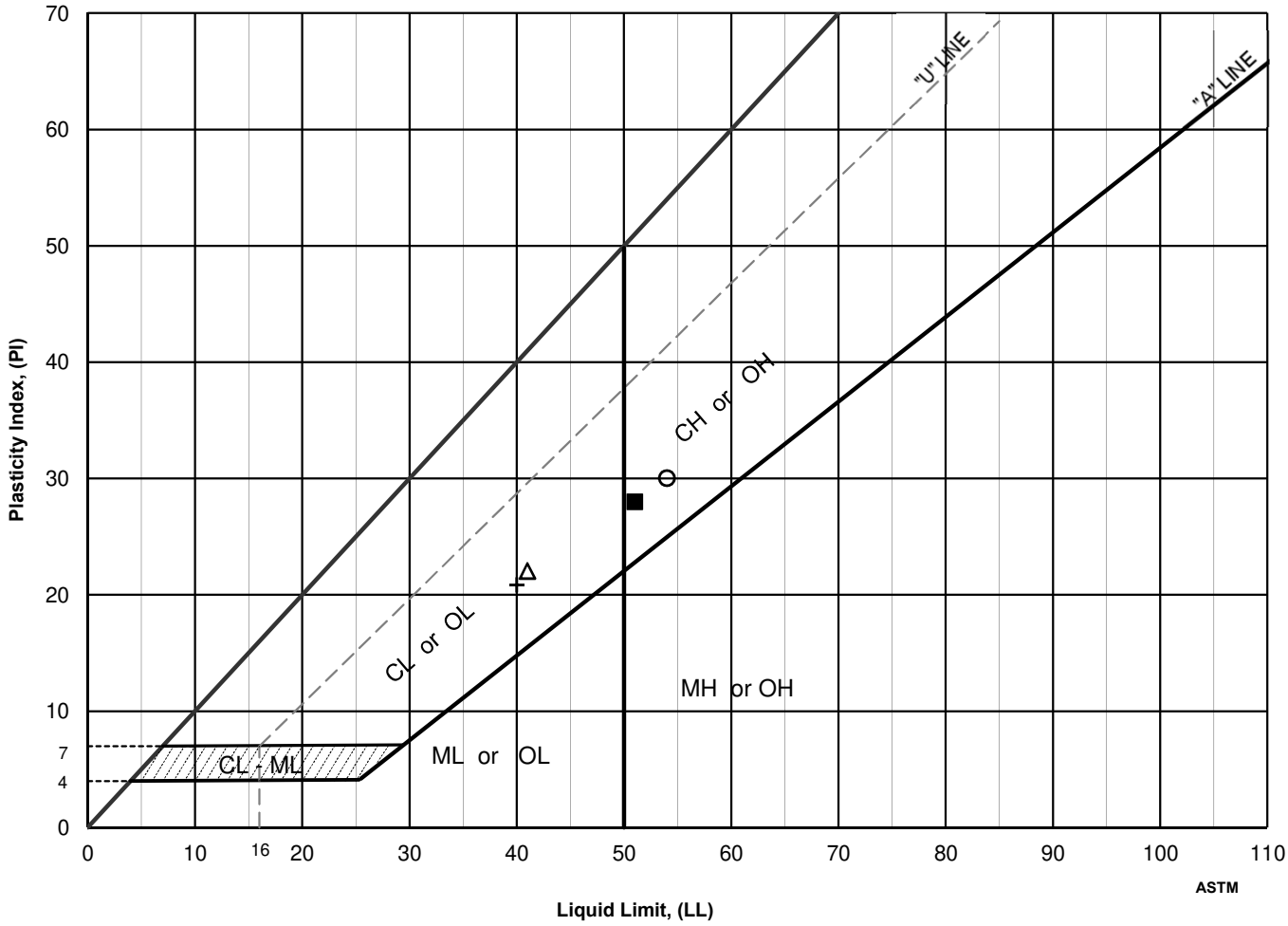
LRL Associates Ltd.

Plasticity Index

ASTM D 4318 / LS-703/704

Client:	Palladium Resort Dev. LTD Partnership	**O.:**	240720
Project:	Geotechnical Investigation	**Report No.:**	1
Location:	Palladium Drive, Kanata, ON.	**Date:**	March 31, 2025

Plasticity Chart



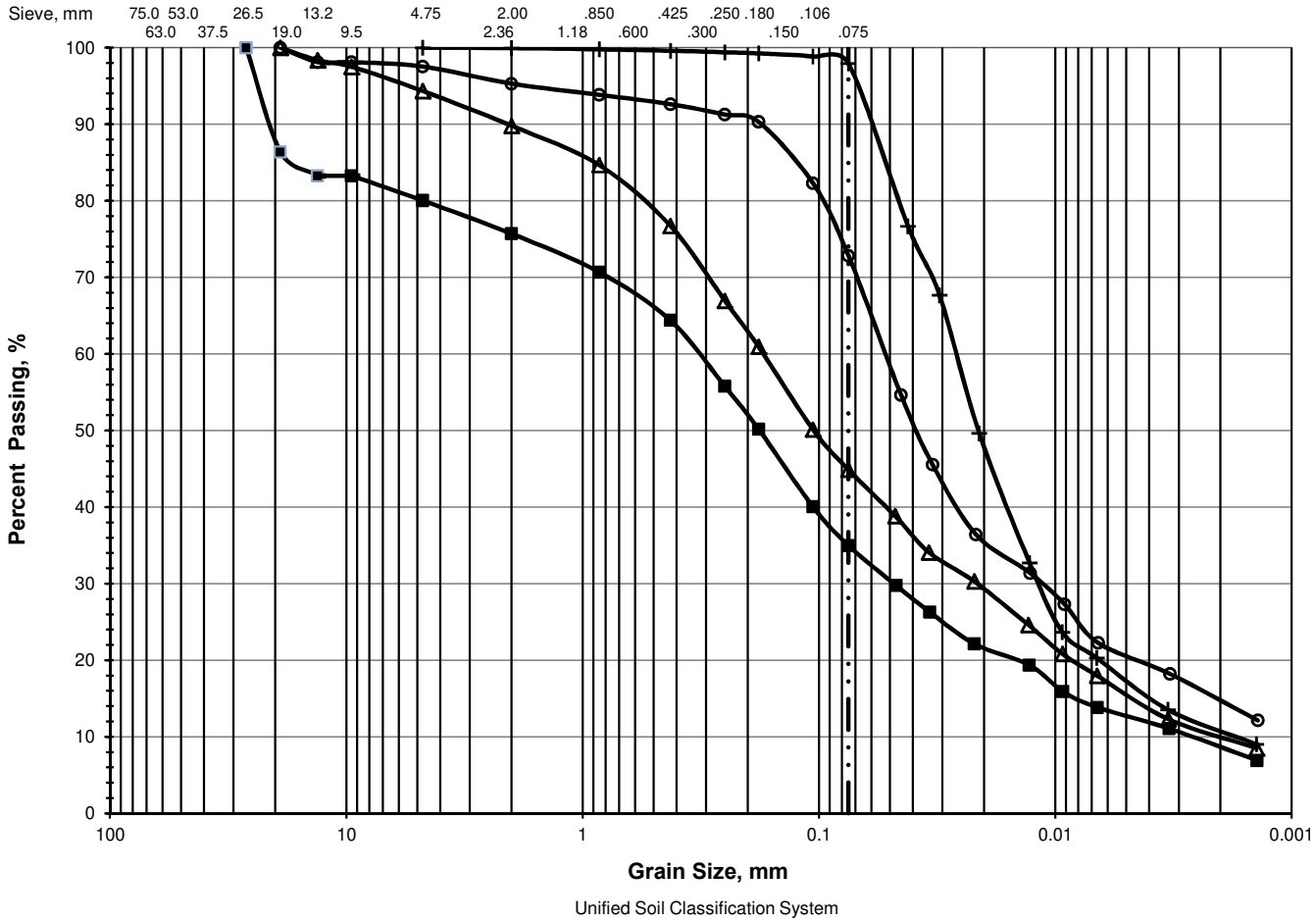
	Location	Sample	Depth, m	Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Activity Number	USCS
△	BH 8	SS-2	0.76 - 1.37	30	41	19	22	0.51	n/d	OL
■	BH 12	SS-6	4.57 - 5.18	50	51	23	28	0.95	n/d	CH
○	BH 17	SS-4	2.29 - 2.90	51	54	24	30	0.90	n/d	CH
+	BH 22	SS-5	3.05 - 3.66	37	40	19	21	0.88	0.74	CL

LRL Associates Ltd.

Particle Size Analysis

ASTM D 422 / LS-702

Client:	Palladium Resort Dev. LTD Partnership	**File No.:**	240720
Project:	Geotechnical Investigation	**Report No.:**	2
Location:	Palladium Drive, Kanata, ON.	**Date:**	March 31, 2025



Unified Soil Classification System

	> 75 mm	% GRAVEL		% SAND			% FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
△	0.0	0.0	5.7	4.5	13.1	31.9	35.1	9.7
■	0.0	11.8	8.2	4.3	11.3	29.4	26.8	8.2
○	0.0	0.0	2.5	2.2	2.7	19.8	58.7	14.1
+	0.0	0.0	0.0	0.1	0.3	1.7	87.5	10.4

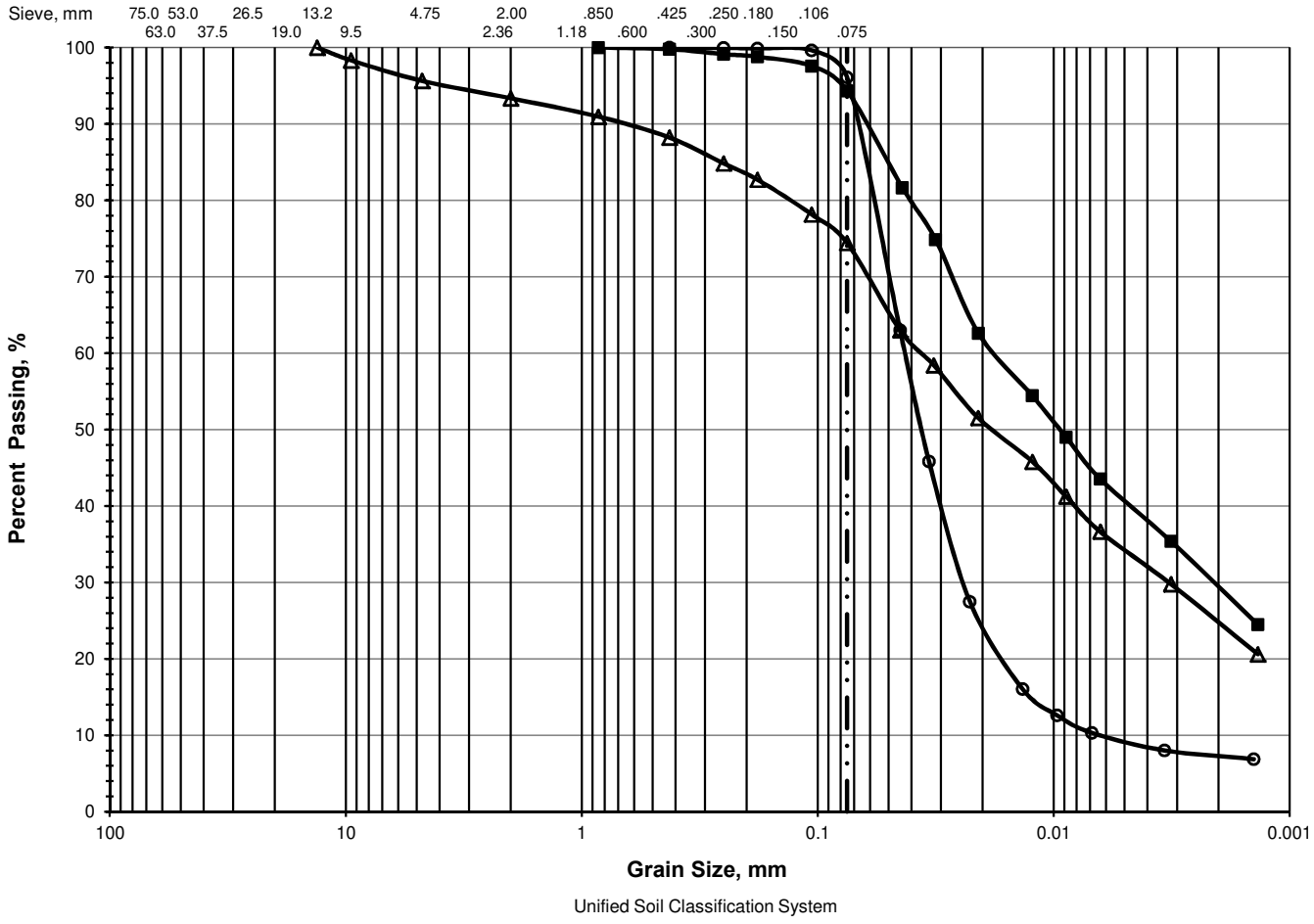
	Location	Sample	Depth, m	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
△	BH 1	SS-3	1.52 - 2.13	0.1736	0.1052	0.0215	0.0049	0.0022	1.2	78.9
■	BH 2	SS-4	2.29 - 2.90	0.3360	0.1786	0.0484	0.0081	0.0028	2.5	120.0
○	BH 3	SS-3	1.52 - 2.13	0.0538	0.0388	0.0115	0.0023			
+	BH 9	SS-6	4.57 - 5.18	0.0267	0.0212	0.0118	0.0041	0.0018	2.9	14.8

LRL Associates Ltd.

Particle Size Analysis

ASTM D 422 / LS-702

Client:	Palladium Resort Dev. LTD Partnership	**J.:** 240720	
Project:	Geotechnical Investigation	**Report No.:**	3
Location:	Palladium Drive, Kanata, ON.	**Date:**	March 31, 2025



Unified Soil Classification System

	> 75 mm	% GRAVEL		% SAND			% FINES	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
△	0.0	0.0	4.4	2.3	5.1	13.8	50.6	23.8
■	0.0	0.0	0.0	0.0	0.2	5.4	66.1	28.3
○	0.0	0.0	0.0	0.0	0.0	3.9	88.9	7.2

	Location	Sample	Depth, m	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
△	BH 18	SS-5	3.05 - 3.66	0.0365	0.0186	0.0033				
■	BH 22	SS-5	3.05 - 3.66	0.0181	0.0095	0.0023				
○	BH 22	SS-7	6.10 - 6.71	0.0428	0.0364	0.0241	0.0124	0.0064	2.1	6.7

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Certificate of Analysis

LRL Associates Ltd.
5430 Canotek Road
Ottawa, ON K1J 9G2
Attn: Brad Johnson

Client PO:
Project: 240720
Custody: 78093

Report Date: 29-Apr-2025
Order Date: 23-Apr-2025

Order #: 2517240

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

Paracel ID	Client ID
2517240-01	BH8 SS4 7.5-9.5'
2517240-02	BH12 SS3 5-7'
2517240-03	BH21 SS5 10-12'

Approved By:



Mark Foto, M.Sc.
Laboratory Director

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC, water extraction	24-Apr-25	24-Apr-25
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	25-Apr-25	25-Apr-25
Resistivity	EPA 120.1 - probe, water extraction	25-Apr-25	25-Apr-25
Solids, %	CWS Tier 1 - Gravimetric	28-Apr-25	29-Apr-25

Certificate of Analysis

Report Date: 29-Apr-2025

Client: **LRL Associates Ltd.**

Order Date: 23-Apr-2025

Client PO:

Project Description: 240720

	Client ID:	BH8 SS4 7.5-9.5'	BH12 SS3 5-7'	BH21 SS5 10-12'	-		
	Sample Date:	09-Apr-25 09:00	09-Apr-25 12:00	09-Apr-25 12:00	-	-	-
	Sample ID:	2517240-01	2517240-02	2517240-03	-		
	Matrix:	Soil	Soil	Soil	-		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	76.6	73.6	79.9	-	-	-
General Inorganics							
pH	0.05 pH Units	7.39	7.59	7.39	-	-	-
Resistivity	0.1 Ohm.m	38.2	37.3	38.4	-	-	-
Anions							
Chloride	10 ug/g	<10	<10	41	-	-	-
Sulphate	10 ug/g	66	105	23	-	-	-

Certificate of Analysis

Report Date: 29-Apr-2025

Client: **LRL Associates Ltd.**

Order Date: 23-Apr-2025

Client PO:

Project Description: 240720

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions								
Chloride	ND	10	ug/g					
Sulphate	ND	10	ug/g					
General Inorganics								
Resistivity	ND	0.1	Ohm.m					

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	28.7	10	ug/g	24.8			14.4	35	
Sulphate	55.4	10	ug/g	51.8			6.8	35	
General Inorganics									
pH	12.12	0.05	pH Units	12.16			0.3	2.3	
Resistivity	43.1	0.1	Ohm.m	43.0			0.2	20	
Physical Characteristics									
% Solids	77.4	0.1	% by Wt.	79.8			3.0	25	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	127	10	ug/g	24.8	102	82-118			
Sulphate	150	10	ug/g	51.8	98.5	80-120			

Certificate of Analysis

Report Date: 29-Apr-2025

Client: **LRL Associates Ltd.**

Order Date: 23-Apr-2025

Client PO:

Project Description: 240720

Qualifier Notes:

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 unlesss otherwise noted.

Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

Any use of these results implies your agreement that our total liabilty in connection with this work, however arising, shall be limited to the amount paid by you for this work, and that our employees or agents shall not under any circumstances be liable to you in connection with this work.

APPENDIX E
MASW REPORT

GEOPHYSICS GPR INTERNATIONAL INC.

May 25th, 2026

Transmitted by email : bjohnson@lrl.ca
Our ref. : GPR26-07134

Mr. Brad Johnson, P.Eng.
Geotechnical Engineer
LRL Engineering
5430 Canotek Road
Ottawa ON

Subject: Shear Wave Velocity Sounding for the Site Designation Determination
2775 - 2785 Palladium Drive, Stittsville, Ottawa (ON)

[Project #: 240720]

Dear Mr. Johnson,

Geophysics GPR International inc. has been mandated by LRL Engineering to carry out a seismic survey at 2775 - 2785 Palladium Drive, in Ottawa (ON). The geophysical investigations used the Multi-channel Analysis of Surface Waves (MASW) with the Spatial AutoCorrelation (SPAC), and the seismic refraction method. From the subsequent results, the seismic shear wave velocity values were calculated for the soils and the rock, to determine the Site Designation.

The surveys were conducted May 20th, 2026, by Mr. Zak Castonguay, tech. and Mr. Ashton Giroux. Figure 1 shows the regional location of the site and Figure 2 illustrates the location of the seismic spreads. Both figures are presented in the Appendix.

The following paragraphs briefly describe the principles of the testing method, the survey design, and the results presented in table and graph.

MASW Principle

The *Multi-channel Analysis of Surface Waves* (MASW) and the *SPatial AutoCorrelation* (SPAC or MAM for *Microtremors Array Method*) are seismic methods used to evaluate the shear wave velocities of subsurface materials through the analysis of the dispersion properties of the Rayleigh surface wave. The MASW is considered an "active" method, as the seismic signal is induced at known location and time in the geophones' spread axis. Conversely, the SPAC is considered a "passive" method, using the low frequency "signals" produced far away. The method can also be used with "active" seismic source records. The SPAC method generally allows deeper V_S soundings. Its dispersion curve can then be merged with the one of higher frequency from the MASW to calculate a more complete inversion. The dispersion properties are expressed as a change of velocities with respect to frequencies. Surface wave energy will decay exponentially with depth. Lower frequency surface waves will travel deeper and thus be more influenced by deeper velocity layering than the shallow higher frequency waves. The inversion of the Rayleigh wave dispersion curve yields a shear wave (V_S) velocity depth profile (sounding).

Figure 3 schematically outlines the basic operating procedure for the MASW method. Figure 4 illustrates an example of one of the MASW/SPAC records, a corresponding spectrogram analysis and resulting 1D V_S model.

INTERPRETATION

The main processing sequence involved data inspection and edition when required; spectral analysis (from MASW and SPAC); picking the fundamental mode; and 1D inversion of the MASW and SPAC shot records using the SeisImagerSW™ software. The data inversions used a nonlinear least squares algorithm.

In theory, all the shot records for a given seismic spread should produce a similar shear-wave velocity profile. In practice, however, differences can arise due to energy dissipation, local surface seismic velocities variations, and/or dipping of overburden layers or rock. In general, the precision of the calculated seismic shear wave velocities (V_S) is around 15% or better.

More detailed descriptions of these methods are presented in *Shear Wave Velocity Measurement Guidelines for Canadian Seismic Site Characterization in Soil and Rock*, Hunter, J.A., Crow, H.L., et al., Geological Surveys of Canada, General Information Product 110, 2015.

SURVEY DESIGN

The seismic acquisition layouts were located at the north extremity of the property, as the soils thickness was identified as maximal per previous boreholes (Figure 2). The geophone spacing was 3.0 metres for the main seismic line, using 24 geophones. A second seismic spread with geophones spacing of 1.0 metre was dedicated to the near surface materials. The seismic records were produced with a GEODE seismograph (from Geometrics), and the geophones were 4.5 Hz.

The seismic records counted 4096 data, sampled at 1000 µs for the MASW surveys, and at 31 µs for the seismic refraction ones. The records included a pre-trigged portion of 10 ms. A 9 kg sledgehammer was used as the energy source, with impacts being recorded off both ends of the seismic spreads. A stacking procedure was also used to improve the Signal / Noise ratio for the seismic records. The shear wave depth sounding can be considered as the average of the bulk area within the geophone spread, especially for its central half-length.

RESULTS

From seismic refraction, the seismic velocity (V_S) of the rock was calculated at 2335 m/s for the sound portion. This parameter was used for geophysical models, prior to the MASW results inversions. The MASW calculated V_S results are illustrated at Figure 5. Some very low to low seismic velocities were calculated for the soils.

The $\overline{V}_{S30}$ value results from the harmonic average of the shear wave velocities, from the surface to 30 metres deep. It is calculated by dividing the total depth of interest (30 metres) by the sum of the time spent in each velocity layer from the surface down to 30 metres, as:

$$\bar{V}_{S30} = \frac{\sum_{i=1}^{N} H_i}{\sum_{i=1}^{N} {}^{H_i}/_{V_i}} \quad | \quad \sum_{i=1}^{N} H_i = 30 \text{ m}$$

(N: number of layers; H_i : thickness of layer "*i*" ; V_i : V_S of layer "*i*")

Thus, the $\overline{V}_{S30}$ value represents the seismic shear wave velocity of an equivalent homogeneous single layer response, between the surface and 30 metres deep.

The calculation of the $\overline{V}_{S30}$ value is presented at Table 1. The Site Designation of the actual site is X_{497}, corresponding to Site Class "C". These Site Designation and Class could be revised depending on a geotechnical assessment results of the low seismic velocities soils.

CONCLUSION

Geophysical surveys were carried out to identify the Site Designation at 2775 - 2785 Palladium Drive, in Stittsville, Ottawa (ON). The seismic surveys used the MASW and SPAC analysis to calculate the $\overline{V}_{S30}$ value. Its calculation is presented at Table 1.

For the actual site, the Site Designation is X_{497}, corresponding to the Site Class "C" ($360 < \overline{V}_{S30} \leq 760$ m/s), as determined through the MASW and SPAC methods, Table 4.1.8.4.-B of the NBC (2020), and the Building Code, O. Reg. 163/24.

It must be noted that some very low to low seismic velocities were calculated for the soils, from the surface to the rock. A geotechnical assessment of these materials could be required for the potential of liquefaction, the clay's degree of sensitivity, and other critical parameters.

It must also be noted that other geotechnical information gleaned on site; including the presence of liquefiable soils, very soft clays, high moisture content etc. (cf. Tables 4.1.8.4.-A and 4.1.8.4.-B of the NBC 2020) can supersede the Site Classification and the Site Designation provided in this report, based on the $\overline{V}_{S30}$ value.

The V_S values calculated are representative of the in situ materials and are not corrected for the total and effective stresses.

Hoping the whole to your satisfaction, we remain yours truly,

Jean-Luc Arsenault, M.A.Sc., P.Eng.
Senior Project Manager

LICENSED PROFESSIONAL ENGINEER
2026-05-25
J.-L. ARSENAULT
100148122
PROVINCE OF ONTARIO



Figure 1: Regional location of the Site
(Source : OpenStreetMap©)



Figure 2: Location of the seismic spreads
(source: *Google Earth™*)

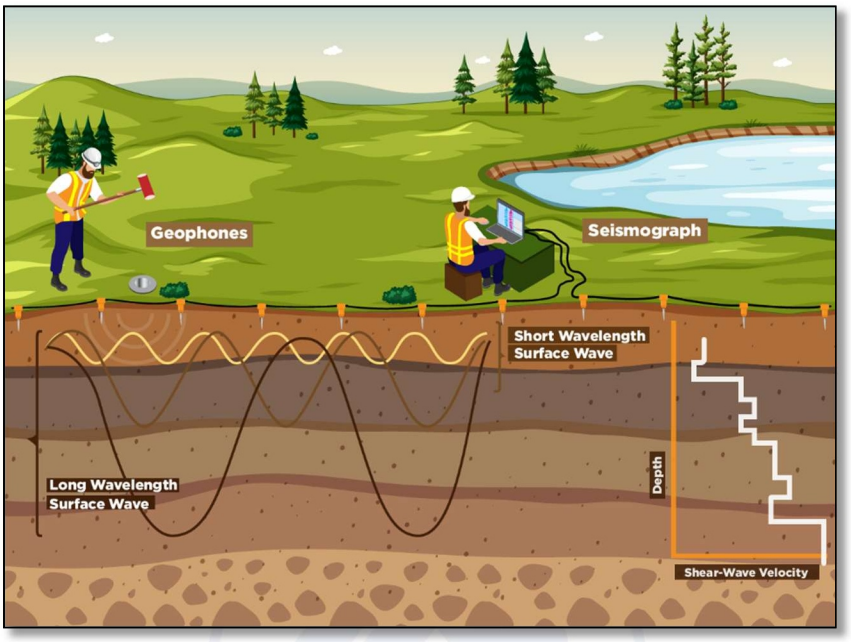

Figure 3: MASW Operating Principle

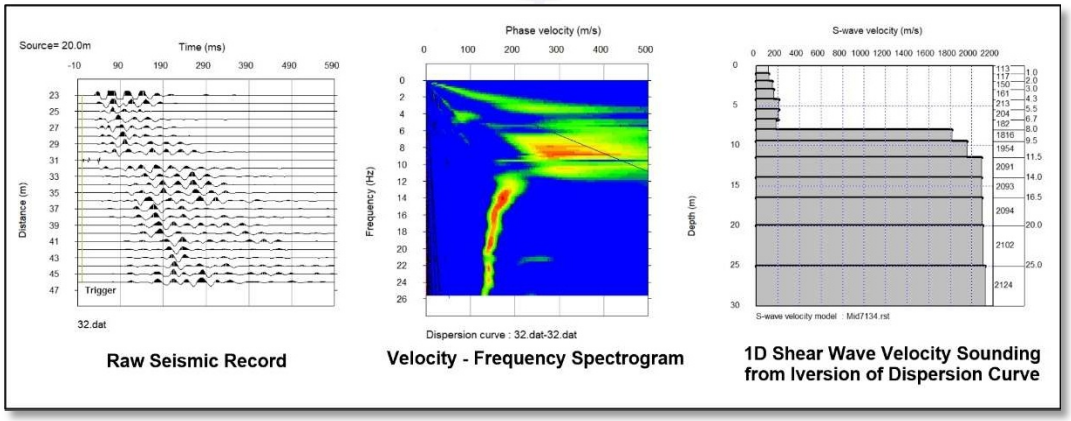

Figure 4: Example of a MASW/SPAC record, Phase Velocity - Frequency curve of the Rayleigh wave and resulting 1D Shear Wave Velocity Model

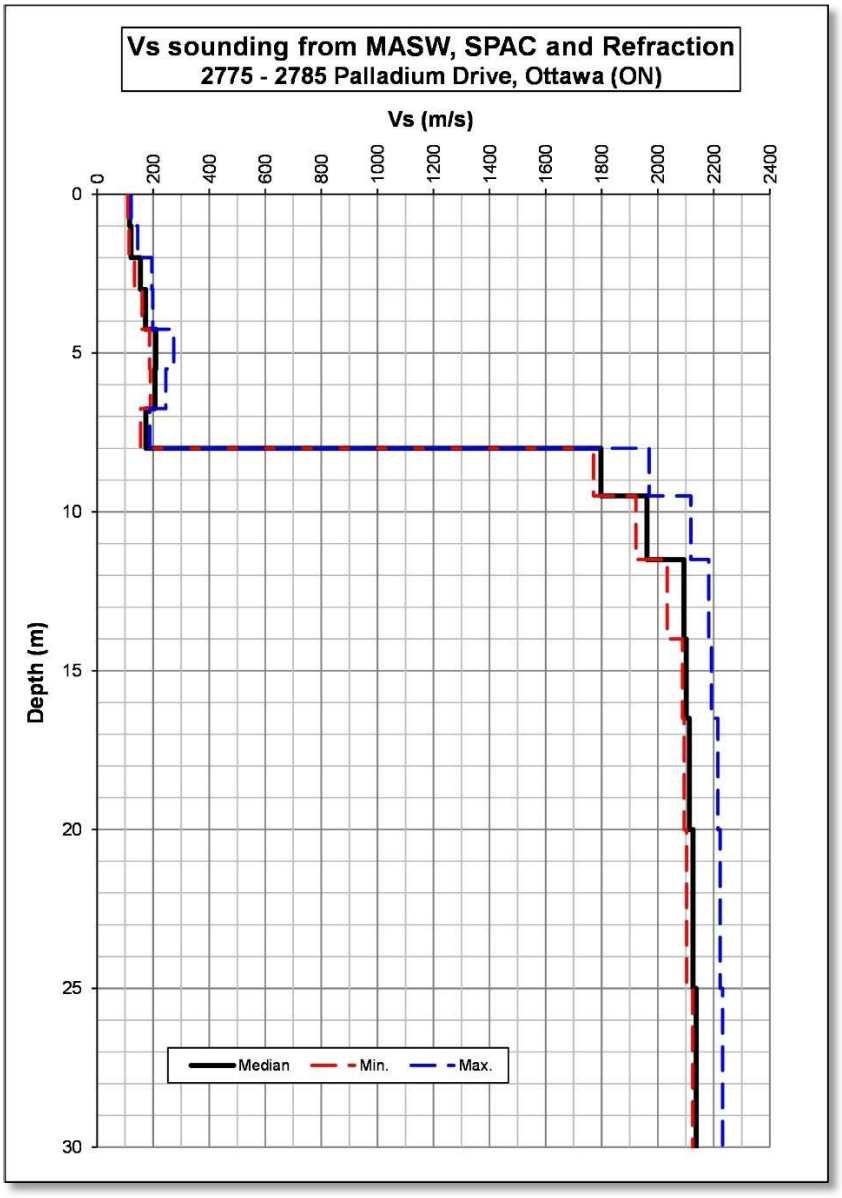

Figure 5: MASW Shear-Wave Velocity Sounding

TABLE 1

$\bar{V}_{S30}$ Calculation for the Site Designation (actual site)

Depth	Vs			Thickness	Cumulative Thickness	Delay for med. Vs	Cumulative Delay	Vs at given Depth
	Min.	Median	Max.					
(m)	(m/s)	(m/s)	(m/s)	(m)	(m)	(s)	(s)	(m/s)
0	**109.6**	**116.1**	**122.0**	**Grade Level (May 20th, 2026)**				
1.00	**113.8**	**121.2**	**145.3**	1.00	1.00	0.008610	0.008610	116.1
2.00	**133.0**	**154.8**	195.0	1.00	2.00	0.008248	0.016858	118.6
3.00	**160.2**	**172.7**	198.4	1.00	3.00	0.006461	0.023318	128.7
4.25	187.2	209.8	273.8	1.25	4.25	0.007236	0.030555	139.1
5.50	189.8	206.5	244.8	1.25	5.50	0.005957	0.036512	150.6
6.75	**155.4**	**174.1**	187.5	1.25	6.75	0.006053	0.042564	158.6
8.00	1771.0	1797.6	1969.6	1.25	8.00	0.007181	0.049745	160.8
9.50	1922.1	1961.6	2117.9	1.50	9.50	0.000834	0.050580	187.8
11.50	2034.1	2093.8	2182.0	2.00	11.50	0.001020	0.051599	222.9
14.00	2088.2	2101.8	2191.5	2.50	14.00	0.001194	0.052793	265.2
16.50	2094.2	2112.7	2214.6	2.50	16.50	0.001189	0.053983	305.7
20.00	2103.0	2126.0	2222.4	3.50	20.00	0.001657	0.055640	359.5
25.00	2124.5	2136.6	2231.1	5.00	25.00	0.002352	0.057991	431.1
30				5.00	30.00	0.002340	0.060332	497.3

V_{S30} (m/s)	**497.3**
Class	**C (1)**

(1) A geotechnical assessment of the soils with low seismic velocities could be required.