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A REPORT TO
TWO SISTERS RESPORTS CORP.

HYDROGEOLOGICAL ASSESSMENT
PROPOSED HOTEL DEVELOPMENT

PARLIAMENT OAK HOTEL
325 KING STREET
TOWN OF NIAGARA-ON-THE-LAKE

REFERENCE NO. 2405-W131

SEPTEMBER 17, 2024

DISTRIBUTION

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1.0 EXECUTIVE SUMMARY

Soil Engineers Ltd. (SEL) was retained by Two Sisters Resorts Corp. to conduct a hydrogeological assessment for the property with municipal address of 325 King Street, in the Twon of Niagara-on-the-Lake, Ontario (the Subject Site).

The Subject Site is located at the northwest corner of King Street and Centre Street intersection in the Town of Niagara-on-the-Lake. The Subject Site is bounded by Gage Street and residential properties to the north, King Street and residential and commercial properties to the east, Centre Street and residential and commercial properties to the and south, and Regent Street and residential properties to the west.

The Subject Site is currently occupied by an abandoned school building.

Based on a review of the architectural drawings prepared by Peter J. Lesdow, dated July 6, 2024, it is understood that all existing buildings will be demolished and redeveloped into a 4-storey hotel, with a 2-level underground parking and basement.

As per the architectural drawings, the Finished Floor Elevation (FFE) for the 2-level underground parking and basement is at El. 80.85 meters above sea level (masl). Based on the elevations of the boreholes advanced on the Subject Site, the existing ground surface is considered to be at El. 88.3 meters above sea level (masl). As such, the base of excavation, footing elevation, and base of the elevation pit are considered at El. 80.35, 79.65, and 79.35 masl, respectively, for excavation and construction of the 2-level underground parking and basement. Additionally, implementing a permeable shoring was assumed for the current assessment.

The current investigation reviled that:

- The Subject Site is located within the Physiographic Region of southern Ontario known as Iroquois Plain.
- The Subject Site is located within an area mapped as Fine-textured Glaciolacustrine deposits (8a), comprising of clay and silt
- The Subject Site is located within the West Lake Ontario Sub-watershed that falls in the Niagara Peninsula Conservation Authority (NPCA) jurisdiction, where there are no records for natural heritage features including wetland, water bodies, watercourses and ANSI within the Subject Site. One Mile Creek, Lake Ontario, and the Niagara River are located approximately 100 m southwest, 1.2 km northwest, and 700 m east of the Subject Site, respectively.
- The native soil beneath the Subject Site consists mainly of silt overlying silty clay and silty clay till extending to the maximum termination depth of investigated at 12.7 meters below ground surface (mbgs).

- The highest and lowest groundwater levels were measured at El. 86.7 masl and 80.6 masl, at BH/MWs 5 and 1, respectively during the monitoring period between June 6, 2024 and July 11, 2024, over three (3) monitoring events.
- Hydraulic conductivities of 1.0 x 10^{-6} m/sec (Freeze and Cherry, 1979), 1.3 x 10^{-8} m/sec (hydraulic conductivity testing from BH/MW 2S), and 1.1 x 10^{-8} m/sec (geomean of hydraulic conductivity testing from BH/MWs 1, 2D, 3, and 5) were considered for Earth Fill, Silt, and Silty Clay Till, respectively.
- One (1) set of groundwater samples were collected on July 11, 2024 and submitted for analysis and evaluation against the Niagara Region Sanitary and Combined Sewer Use By-Law parameters. A review of the results indicates that groundwater quality at BH/MW 1 meets the Niagara Region Sanitary and Combined Sewer Use By-Law Limits.
- Anticipated construction (short-term) dewatering from groundwater source for the proposed building could reach 24,000.0 L/day considering a safety factor of 2.0. Total anticipated flow rate will reach to a total flow rate of 216,000.0 L/day considering 30.7 mm rain fall storm event.
- Long-term foundation drainage flow from groundwater source considering a safety factor of 2.0 will reach 21,000.0 L/day for the proposed building. The total anticipated flow including infiltration reaches 26,100.0 L/day.
- The estimated short-term construction dewatering flow rates exceeds the MECP EASR threshold of 50,000 L/day. As such, posting an EASR with the MECP is required.
- The estimated long-term foundation drainage flow rate from groundwater source is below the MECP threshold 50,000 L/day. As such, filing PTTW with MECP is not required.
- Obtaining discharge agreement from the Niagara Region is required if short-term dewatering or long-term foundation drainage effluents are proposed to be conveyed to the region’s sewer system.
- The conceptual ZOI for dewatering reaches 2.9 m away from the dewatering area. There are no structures located within a conceptual ZOI for construction. As a such, no potential risk for ground settlement for the nearby structures is expected due to dewatering.
- Record review indicates that no natural heritage features including wetland, water bodies, watercourses and ANSI were identified on the Subject Site, and within the conceptual ZOI. As such, no impacts to natural heritage features are anticipated pertaining the proposed development.
- A review of the MECP well records confirmed that there are no records for water supply wells that are registered within 500 m of the Subject Site. As such, potential impacts to the groundwater users are no anticipated.

2.0 INTRODUCTION

2.1 Site Location and Project Description

Soil Engineers Ltd. (SEL) was retained by Two Sisters Resorts Corp. to conduct a hydrogeological assessment for the property with municipal address of 325 King Street, in the Twon of Niagara-on-the-Lake, Ontario (the Subject Site). The Subject Site is located at the northwest corner of King Street and Centre Street intersection in the Town of Niagara-on-the-Lake. The Subject Site is bounded by Gage Street and residential properties to the north, King Street and residential and commercial properties to the east, Centre Street and residential and commercial properties to the and south, and Regent Street and residential properties to the west. Location of the Subject Site is shown on **Drawing 1**.

The Subject Site is currently occupied by an abandoned school building.

Based on a review of the architectural drawings prepared by Peter J. Lesdow Architect, dated July 6, 2024, it is understood that all existing buildings will be demolished and redeveloped into a 4-storey hotel with two (2) levels of underground parking at the Subject Site.

2.2 Project Objectives

The current hydrogeological assessment report presents regional and local setting of the Subject Site. The findings of the fieldwork, including subsoil investigation, groundwater level monitoring. Additionally, groundwater quality assessment and hydraulic conductivity testing results are presented in the report. Potential needs for short-term dewatering and long-term foundation drainage control are assessed, and hydrogeological impacts of the proposed development to the nearby groundwater receptors including water supply wells, natural heritage features, and structures are assessed (if applicable). This report provides mitigation plans on the potential impacts of the proposed development to the groundwater receptors, and structures. Comments and recommendation are provided on any needs for applying for Permit to Take Water (PTTW), or posting Environmental Activity and Sector Registry (EASR) with the Ministry of the Environment, Conservation and Parks (MECP).

2.3 Scope of Work

The scope of work for the hydrogeological assessment is summarized below:

- *Background Review:* Available background geological and hydrogeological information for the Subject Site including topographic mapping, surface geological, natural heritage features databases, Town of Niagara-on-the-Lake official plans, Niagara Peninsula Conservation Authority (NPCA) regulated area plans, and MECP water well records were reviewed.
- *Fieldwork:* Fieldwork includes inspecting the Subject Site and surrounding properties with respect to the natural features, groundwater receptors, and structures, as well as installing and

developing the monitoring wells. Additionally, groundwater levels within the installed monitoring wells were monitored over three (3) monitoring events, in-situ hydraulic conductivity testing was completed within the installed monitoring wells. Additionally, one (1) set of groundwater samples were collected and submitted to a CALA laboratory to characterize groundwater quality in comparison with the Niagara Region Sanitary and Storm Sewer Use By-Law parameters.

- *Short-Term Dewatering Needs:* Based on a review of the available design drawings, findings of the current subsurface investigation, and recommendations provided in the geotechnical investigation report (if available), short-term dewatering flow rate including groundwater seepage, and anticipated water that should be collected over potential storm events was calculated. A mitigation plan was recommended to mitigate potential short-term dewatering impacts to the nearby groundwater receptors (including natural heritage features and water supply wells), and structures, if applicable.
- *Long-term foundation Drainage Control Requirement:* Based on a review of the available design drawings, findings of the current subsurface investigation, and recommendations provided in the geotechnical investigation report (if available), total long-term foundation drainage flow rate including groundwater seepage, and anticipated flow from infiltration source was estimated.
- *Permit Requirements:* Considering the estimated short-term construction dewatering and long-term foundation drainage flow rates, recommendations were provided on any need for applying for a PTTW or posting on the EASR with the MECP, and the Niagara Region, if required.

3.0 APPLICABLE REGULATIONS AND OFFICIAL PLANS

The regulations and policies relevant to this hydrogeological assessment and the location of the Subject Site within the official plans are summarized below.

3.1 Niagara Peninsula Conservation Authority (NPCA) Policies and Regulation (O. Reg. 155/06)

Under Section 28 of the Conservation Authorities Act, local conservation authorities are mandated to protect the health and integrity of the regional greenspace system, and to maintain or improve the hydrological and ecological functions performed by valley and stream corridors. The NPCA, through its regulatory mandate, is responsible for issuing permits under Ontario Regulation (O. Reg.) 155/06, Development, Interference with Wetlands and Alterations to Shorelines and Watercourses for development proposal or Site alteration work to shorelines and watercourses within the regulated areas.

NPCA Regulated Area online mapping was reviewed on July 18, 2024. It is our understanding that the Subject Site is not located within a NPCA Regulated Area. As such, it is anticipated that obtaining a permit from the NPCA under O. Reg. 155/06 will not be required for the proposed development.

3.2 Clean Water Act

The MECP mandates the protection of existing and future sources of drinking water under the Clean Water Act, 2006 (CWA). Initiatives under the CWA include the delineation of Wellhead Protection Areas (WHPAs), significant groundwater recharge areas (SGRAs) and Highly Vulnerable Aquifers (HVAs) as well as the assessment of drinking water quality and quantity threats within Source Protection Regions. Source Protection Plans are developed under the CWA and include the restriction and prohibition of certain types of activities and land uses within WHPAs.

Based on a review of a regional-scale source water protection mapping (Source Water Protection Information atlas) provided by the MECP on July 18, 2024, the Subject Site is not located within a WHPA area, Intake Protection Zone, Issue Contributing Area, Event Based Area, SGRA, and HVA.

3.3 Town of Niagara-on-the-Lake Official Plan

The Town of Niagara-on-the-Lake Official Plan sets up policies that deal with legislative and administrative concerns, guides physical growth, and addresses social, economic, and environmental concerns. The Official Plan provides land use planning designations and identifies areas of environmental significance where more stringent policies may apply for development applications.

The Town of Niagara-on-the-Lake Official Plan maps were reviewed for the current study with the results summarized as below:

- Schedule B (Land Use Plan) - A review of the map, dated July 2022, indicates that the Subject Site is located within an area designated as Open Space & Community Facilities.
- Schedule H (Archaeological Potential) - A review of the map, shows that the Subject Site is located within an area designated as an Area of Archaeological Potential.
- Schedule I-1 (Land Use) - A review of the map dated July 26, 2010, indicates that the Subject Site is located within an area designated as a Built-up Area.

4.0 METHODOLOGY

4.1 Borehole Advancement and Monitoring Well Installation

Drilling boreholes and construction of monitoring wells were conducted for geotechnical investigation by SEL on May 27 to 29, 2024. The program consisted of the drilling of five (5) boreholes (BH) and installation of five (5) monitoring wells for geotechnical and hydrogeological assessment purposes. The locations of the boreholes and monitoring wells are shown on **Drawing 2**.

Borehole drilling and monitoring well construction were completed by a licensed water well contractor, under the full-time supervision of a drilling supervisor from SEL. SEL's geotechnical supervisor logged the soil strata encountered during borehole advancement and collected representative soil samples for textural classification. The boreholes were drilled using a drill rig equipped with continuous flight, solid-stem augers. Detailed descriptions of the encountered subsoil and groundwater conditions are provided by SEL and presented on the borehole and monitoring well logs, on the enclosed **Appendix A**.

The monitoring wells were constructed using 50-mm diameter Trilock pipes and 1.5 m or 3.0 m long 10-slot well screens, which were installed in each of the selected geotechnical boreholes. Two (2) of the monitoring wells were equipped with monument casings and the remaining three (3) monitoring wells were equipped with flush-mount casing at the ground surface.

The UTM coordinates and ground surface elevations at the monitoring wells' locations, as well as the monitoring well construction details, are presented in **Table 4-1**. The ground surface elevations and horizontal coordinates at the monitoring well locations were determined at the time of the investigation, using a handheld Global Navigation Satellite System survey equipment (Trimble TSC3) which has an accuracy of ±0.05 m.

Table 4-1- Monitoring Well Installation Details

Monitoring Well ID	Installation Date	UTM Coordinates (m)		Ground El. (masl)	Screen Interval (mbgs)	Soil in the Screen Interval	Casing Dia. (mm)	Protective Casing Type
		Easting	Northing					
BH/MW 1	May 28, 2024	656270	4790612	87.6	10.8 – 12.3	Silty Clay Till	50	Flush mount
BH/MW 2D[1]	May 27, 2024	656323	4790675	87.4	9.2 – 12.2	Silty Clay Till	50	Monument
BH/MW 2S[2]	May 27, 2024	656322	4790674	87.4	4.6 – 6.1	Silt	50	Monument
BH/MW 3	May 29, 2024	656308	4790590	87.8	10.7 – 12.2	Silty Clay Till	50	Flush mount
BH/MW 5	May 27, 2024	656350	4790648	88.3	9.2 – 10.7	Silty Clay Till	50	Flush mount

Notes:
mbgs metres below ground surface
masl metres above sea level
[1] Deep Nested Monitoring Well
[2] Shallow Nested Monitoring well

4.2 MECP Water Well Records Review

MECP Water Well Records (WWRs) were reviewed for the registered wells located at the Subject Site and within 500 m radius of the Subject Site boundaries (Study Area). The water well records indicate that eleven (11) wells are located within the 500 m zone of influence Study Area relative to the Subject Site. The findings of the MECP well records are summarized in the **Section 5.6** of the current report.

4.3 Groundwater Monitoring

All five (5) installed monitoring wells were utilized to measure and monitor groundwater levels. Monitoring wells were developed, and the groundwater monitoring program confirmed the stabilized groundwater level beneath the Subject Site. The stabilized groundwater levels were manually measured over three (3) monitoring events from June 6, 2024 to July 11, 2024, with the results presented in **Section 7.1**.

4.4 In-Situ Hydraulic Conductivity Test

SEL has conducted in-situ hydraulic conductivity tests (falling head) at all five (5) BH/MWs. The in-situ hydraulic conductivity test (falling head and rising head) provides estimated hydraulic conductivity (K) for subsoil strata at the depths of the well screens. The monitoring wells were developed in advance of the tests. Well development involves the purging and removal of groundwater from each monitoring well to remove remnants of clay, silt and other debris introduced into the monitoring well during construction, and to induce the flow of formation groundwater through the well screens, thereby improving the transmissivity of the subsoil strata formation at the well screen depths.

The in-situ falling head hydraulic conductivity test involves the placement of a slug of known volume into the monitoring well, below the water table, to displace the groundwater level upward. The in-situ rising head hydraulic conductivity test involves removing a volume of water from the monitoring well to displace the groundwater level downward. The rate at which the water level recovers to static conditions (rising head/falling head) is tracked manually using a water level tape and a data logger. Slug tests in the monitoring wells with partially submerged screens may exabit double straight-line effect due to the filter pack drainage. Therefore, the data that represent the filter pack around the screen is eliminated during the interpretation of the slug test. The rate at which the water table recovers to static conditions is used to estimate the K value for the water-bearing strata formation at the well screen depth using the Bouwer and Rice method (1976). The findings for the hydraulic conductivity testing are presented in **Section 7.3** of the current report.

4.5 Groundwater Quality Assessment

Groundwater quality assessment was completed by SEL on July 11, 2024. One (1) set of groundwater samples were collected from one (1) selected monitoring well (BH/MW 1) to characterize its quality for evaluation against Niagara Region Sanitary and Combined Sewer Use By-Law parameters. This is performed to assess whether any anticipated dewatering effluent can be disposed of into the Niagara Region Sanitary and Combined Sewer system during construction, or following site development for any long-term foundation drainage. Based on the results, recommendations for any pre-treatment for any dewatering/drainage effluent can be developed, if required.

The sample analysis was performed by SGS Canada Inc. and the results of the analysis are discussed in **Section 7.4** of the current report.

4.6 Review of Regional Data and Available Reports for the Subject Site

The maps, data, and documents provided by the MECP, Ontario Geological Survey (OGS), Ministry of Natural Resource and Forestry (MNRF), and NPCA were reviewed. Additionally, an issued geotechnical report was reviewed at the time of preparation of the current hydrogeological assessment report, with the findings summarized in S**ections 5** and **6**.

5.0 REGIONAL AND LOCAL SITE SETTING

5.1 Regional Geology

The current understanding of the surface geological setting of the Subject Site is based on scientific work conducted by the OGS (OGS, 2003). The Subject Site is located within an area mapped as Fine-textured Glaciolacustrine deposits (8a), comprising of clay and silt. **Drawing 3** illustrates the mapped surficial geology for the Subject Site and the surrounding area.

The underlying bedrock at the Subject Site is the Queenston Formation, which consists of shale, limestone, dolostone, and siltstone (OGS, 2007).

5.2 Regional Physiography

The Subject Site is located within a regional physiography of southern Ontario known as Iroquois Plain. The Iroquois Plan within the vicinity of the Studt Alignment consists of clay plains. The lowland bordering Lake Ontario, when the last glacier was receding but still occupied the St. Lawrence Valley, was inundated by a body of water known as Lake Iroquois which emptied eastward at Rome, New York State. Its old shorelines, including cliffs, bars, beaches, and boulder pavements are easily identifiable features, while the undulating till plains above stand in strong contrast to the lake bottom which has been smoothed by wave action or lacustrine deposits. The latter area is the Iroquois plain which is discussed in this section, excluding the areas to the east which were flooded by Lake Iroquois but which, because of shallow soils, are treated elsewhere. The Iroquois plain extends around the western part of Lake Ontario, from the Niagara River to the Trent River, a distance of 190 miles, its width varying from a few hundred yards to about eight miles. Then it extends inland to include a large area in the Trent River valley. Conditions in the old lake plain vary greatly and it is convenient to divide it into a number of sub-sections for purposes of discussion (Chapman and Putnam, 1984). **Drawing 4** shows the location of the Subject Site within the regional physiography map.

5.3 Regional Topography and Drainage

A review of a regional topography map presented on **Drawing 5** indicates that topography of the Subject Site is relatively flat. The ground surface elevation ranges approximately between 87.4 metres above sea level (masl) and 88.3 masl based on ground surface elevations measured at the borehole and monitoring wells' locations.

5.4 Watershed Setting

The Subject Site is located within the West Lake Ontario Sub-watershed that falls in the Niagara Peninsula Conservation Authority (NPCA) jurisdiction.

5.5 Local Surface Water and Natural Heritage Features

MNRF database was reviewed for any natural heritage features including, watercourses, bodies of water, wetland features, Area of Natural and Scientific Interest (ANSI) and wooded areas. **Drawing 6** shows the location of the Subject Site within the surrounding Natural Heritage Features.

Record review indicates that there are no records for natural heritage features including wetland, water bodies, watercourses and ANSI within the Subject Site. Record review indicates that One Mile Creek is located approximately 100 m southwest of the Subject Site.

Lake Ontario and the Niagara River are located approximately 1.2 km to the northwest and 700 m to the east of the Subject Site, respectively. Record review indicates that there are no wetland features located in the vicinity of the Subject. Record of a wooded lot is located approximately 60 m southwest of the Subject Site.

5.6 Ground Water Resources (MECP Well Records)

MECP well record database was reviewed for records located within a radius of 500 m from the approximate Site boundary (Study Area). The records indicate that eleven (11) well records are located within the Study Area relative to the Subject Site boundaries. A summary of data obtained from records review is presented in **Table 5-1**.

The locations of the well records, based on the UTM coordinates provided by the records, are shown on **Drawing 7**. Details of the MECP water well records that were reviewed are provided in **Appendix B**.

Table 5-1 - MECP Well Record Summary

Water Use (Final Status)	
Status	**Number of Records**
Observation well	5
Unknown	2
Test Hole	2
Abandoned-Other	1
Monitoring and Test Hole	1

5.7 Active Permit to Take Water Application Record Review

MECP website was reviewed for any active PTTW application records within 1.0 km radius of the Subject Site on July 29, 2024. Record review indicates there one (1) active record for a PTTW within the Study Area.

Table 5-2 – Active PTTW Records Summary

Permit Number	Permit Holder	Purpose	Maximum L/day	Source Type	Distance from the Subject Site (km)
0366-AWZSTX	1814029 Ontario Inc.	Commercial	993,668.0	Surface Water	0.84

6.0 SOIL LITHOLOGY AND SUBSURFACE INVESTIGATION

The subsoil investigation has revealed that beneath the topsoil or pavement structure and a layer of earth fill, the Subject Site mainly comprises of silt overlying silty clay and silty clay till extending to the maximum termination depth of investigated at 12.7 mbgs. Information regarding borehole logs are presented in **Appendix A**. The approximate locations of boreholes are shown on **Drawing 2**. Additionally, a soil profile key plan and geological soil profiles are presented on **Drawings 8-1** and **8-2**, respectively. Based on a review of the geotechnical investigation report prepared by SEL, the stratigraphy beneath the investigated areas of the Subject Site generally consists of the followings:

6.1 Topsoil (BH/MWs 2D and 5)

Topsoil was contacted in BH/MWs 2D and 5 with an approximate thickness of 8 and 5 cm, respectively.

6.2 Pavement Structure (BH/MWs 1 and 3, and BH4)

The pavement structure consisted of asphalt ranging from 150 cm to 180 mm in thickness, overlaying granular fill ranging from 205 mm to 230 mm in thickness in BH/MWs 1 and 3, and BH4.

6.3 Earth Fill (All BH/MWs and BH4)

The layer of earth fill found, below the topsoil or pavement structure, in all BH/MWs and BH4 extended to depths ranging from 1.4 to 2.1 metres below ground surface (mbgs). The earth fill mainly consists of silt or silty clay with rootlets, gravel, and organic inclusions. The moisture contents for the retrieved subsoil samples ranges from 4% to 28% indicating damp to wet conditions.

6.4 Silt (All BH/MWs and BH4)

The native silt was contacted in all BH/MWs and BH4 beneath the earth fill layer and extended to depths ranging from 7.1 to 8.5 mbgs. The silt consists of some clay with a trace of sand. The silt is loose to very dense in consistency. The moisture contents for the retrieved subsoil samples range from 11 to 20%, indicating generally moist to wet conditions. Grain size analyses were performed on two (2) subsoil samples and the gradation is plotted in **Appendix A (Figure 6)**.

6.5 Silty Clay Till (All BH/MWs and BH4 except for BH/MW2S)

The native silty clay till was contacted in all BH/MWs, with the exception of BH/MW 2S, and BH4 beneath the silt layer and extended to the maximum termination depth of investigation ranging from 12.3 to 12.7 mbgs. The silty clay till consists of some sand and clay with a trace of gravel. The silty clay till is firm to hard in consistency. The moisture contents for the retrieved subsoil samples range from 9 to 25%, indicating generally samp to very moist conditions. A layer of silty clay was contacted within the silty

clay till at BH/MWs 3 and 5 and BH4 location. Grain size analyses were performed on one (1) sample of silty clay till and two (2) samples of silty clay. The gradations are plotted in **Appendix A (Figures 7** and **8)**.

7.0 LOCAL HYDROGEOLOGICAL STUDY

7.1 Monitoring Well Development and Groundwater Level Monitoring

The groundwater levels in the monitoring wells were measured, manually between June 6, 2024 and July 11, 2024 to record the fluctuation of the shallow groundwater table beneath the Subject Site.

Monitoring wells were developed and groundwater levels were monitored over three (3) monitoring events. SEL measured the groundwater levels using an interface probe (Solinst Interface Metre). A summary of the groundwater level observations and their corresponding elevations are provided in **Table 7-1**.

Table 7-1- A Summary of Groundwater Monitoring

MW ID	Unit	Groundwater Level		
		June 6, 2024	June 27, 2024	July 11, 2024
BH/MW 1	mbgs	5.2	7.0	5.7
	masl	82.4	80.6	81.9
BH/MW 2D[1]	mbgs	4.5	4.6	4.6
	masl	82.9	82.8	82.8
BH/MW 2S[2]	mbgs	3.9	4.0	4.0
	masl	83.5	83.4	83.4
BH/MW 3	mbgs	2.9	4.9	5.0
	masl	84.9	82.9	82.8
BH/MW 5	mbgs	1.6	6.5	6.0
	masl	86.7	81.8	82.3

Notes:
mbgs metres below ground surface
masl metres above sea level
[1] Deep Nested Monitoring Well
[2] Shallow Nested Monitoring well

As shown in **Table 7-1**, the highest and lowest groundwater levels were measured at El. 86.7 masl and 80.6 masl, at BH/MW 5 and 1, respectively. The highest fluctuation was recorded in BH/MW5, which is due to very low hydraulic conductivity of the soil within the screen interval. Additionally, a review of the groundwater table recorded in the deep and shallow nested monitoring wells BH/MW2D and BH/MW2S indicates a downward vertical hydraulic gradient beneath the Subject Site.

7.2 Shallow Groundwater Flow Pattern

Groundwater level elevations measured at the installed monitoring wells indicate that the existing development at the Subject Site is impacting the shallow groundwater flow pattern. However, based on the groundwater elevations measured on July 11, 2023, the interpretation suggests that it flows mainly in a northeasterly and southwesterly directions at the east and west portions of the Subject Site, respectively.

7.3 Single Well Response Test

All BH/MWs underwent a single well response testing (SWRTs) to assess the hydraulic conductivity (K) for saturated shallow aquifer or water bearing unit at the depths of the well screens. Each monitoring well was equipped with a digital transducer to record the fluctuation made to complete the SWRT. The results of the SWRT tests are presented in **Appendix C**, with a summary of the findings provided in **Table 7-2**.

Table 7-2- A Summary of Falling Head Hydraulic Conductivity Testing

Well ID	Ground El. (masl)	Monitoring Well Depth (mbgs)	Screen Interval (mbgs)	Screened Soil Strata	Hydraulic Conductivity (K in m/s)	Test Method
BH/MW 1	87.6	12.3	10.8 – 12.3	Silty Clay Till	4.4×10^{-9}	Falling Head Test
BH/MW 2D[1]	87.4	12.2	9.2 – 12.2	Silty Clay Till	2.3×10^{-9}	Falling Head Test
BH/MW 2S[2]	87.4	6.1	4.6 – 6.1	Silt	1.3×10^{-8}	Falling Head Test
BH/MW 3	87.8	12.2	10.7 – 12.2	Silty Clay Till	6.9×10^{-7}	Falling Head Test
BH/MW 5	88.3	10.7	9.2 – 10.7	Silty Clay Till	1.8×10^{-9}	Falling Head Test

Notes:
mbgs metres below ground surface
masl metres above sea level
[1] Deep Nested Monitoring Well
[2] Shallow Nested Monitoring well

7.4 Groundwater Quality

One (1) set of groundwater samples were collected for analysis from monitoring well BH/MW 1 on July 11, 2024 by SEL. The samples were submitted for analysis and evaluation against the Niagara Region Sanitary and Combined Sewer Use By-Law parameters. Upon sampling, all of the bottles were placed in a cooler for shipment to the analytical laboratory. Sample analysis was performed by SGS Canada Inc., which is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA). Results of the analysis are provided in **Appendix D**, with a discussion of the findings provided below. The chain of custody numbers for the submitted samples that underwent analysis are 039206 for BH/MW 1.

As per the protocols for Niagara Region Sewer Use analysis, a complete set of unfiltered groundwater samples were submitted to the laboratory with the results being presented as totals for various analyzed parameters.

The results of analysis for the unfiltered groundwater for BH/MW 1 indicate the samples meet the Niagara Region Sanitary and Combined Sewer Use By-Law.

These results suggest that any short-term construction dewatering, or long-term foundation drainage discharge would be acceptable for disposal to the Niagara Region sanitary and combined sewer, without any significant pre-treatment.

The final design for any temporary or long-term construction dewatering effluent pre-treatment system is the responsibility of the contractors responsible for the short-term construction dewatering discharge or of the water treatment system design specialist, or mechanical engineer, if required, for any long-term foundation drainage system for the completed underground structure.

8.0 DISCHARGE WATER CONTROL

8.1 A review of Proposed Development Plans

The architectural drawings prepared by Peter J. Lesdow, dated July 6, 2024 were reviewed for the current assessment. It is understood that the development will consist of a 4-storey hotel, with a 2-level underground parking and basement.

A review of the architectural drawings (drawing numbers A104 and A106) indicate that the footprint of the proposed 2-level underground parking and basement have an area of approximately 6,265 m^2. As such, an excavation box with approximate dimensions of 106 m x 59 m is considered for the current assessment.

Based on the elevations of the boreholes advanced on the Subject Site, the existing ground surface is considered to be at El. 88.3 masl. The FFE for the 2-level underground parking and basement, as per drawing number A301 of the architectural drawings is at an elevation of 80.85 masl.

8.2 A review of Geotechnical Investigation Report

A review of the Geotechnical Investigation report prepared by SEL Ltd. dated July 2024 indicates that:

- Upon demolition of the existing structures at the Subject Site, the cavities are to be backfilled prior to any site grading or construction activities.
- The existing earth fill is not suitable to be used for supporting footings, slab-on-grade, and pavement construction. The earth fill must be subexcavated, inspected, and sorted free of concentrated topsoil and organic inclusions, and other deleterious materials, if any.
- The excavation for the proposed development, including the 2-level underground parking and basement, is expected to have a finished floor elevation of El. 80.85 masl and the underside of footings at El. 79.65 masl.
- A pre-construction survey and a monitoring program is strongly recommended to be carried out for all adjacent structures prior to the commencement of construction or excavation activities.

8.3 Construction Dewatering Requirements

The assumed grading elevation is at El. 88.3 masl and as previously discussed, the FFE for the 2-level underground parking and basement is at El. 80.85 masl. As such, the base of excavation elevation is considered at El. 80.35 masl, which 0.5 m below the assumed FFE. Additionally, the deepest base of footing is assumed at El. 79.65 masl (1.2 m below the lowest assumed FFE). Proposed base of the elevation pit is not available for review at the time of preparation of the current report. As such, it is

assumed to be constructed approximately 1.5 m below the FFE of the proposed underground parking structure at El. 79.35 masl.

As a conservative approach, the groundwater level, recorded at 86.7 masl (BH/MW 5), is considered for the current assessment. The highest groundwater level is 6.35 m and 7.35 m above the base of bulk excavation and base of elevator pit, respectively. As such, groundwater seepage is anticipated during excavation and construction.

Shoring design is not available for review at the time of preparation of the current report. As such, permeable shoring system extending along the perimeter of the proposed excavation box has been considered to estimate the groundwater seepage flows for short-term dewatering and long-term foundation drainage. The assumptions considered for the dewatering flow rate calculations are summarized in **Table 8-1**.

Table 8-1- Summary of Proposed and Assumptions for Construction of the Underground Structure

Proposed Development	Approximate Underground Parking Dimensions (m)	Proposed FFE (masl)	Assumed Base of Excavation (masl)	Assumed Footing El. (masl)	Shallow Groundwater Level (masl)	Assumed Shoring System
4-Storey hotel with 2-Level Underground Parking and Basement	106.0 x 59.0	80.85	80.35*	79.65	86.7	Permeable Shoring

Notes:
mbgs metres below ground surface
masl metres above sea level
*Assumed 0.5 m below the proposed lowest FFE.

Hydraulic conductivities of 1.0 x 10^{-6} m/sec (Freeze and Cherry, 1979), 1.3 x 10^{-8} m/sec (hydraulic conductivity testing from BH/MW 2S), and 1.1 x 10^{-8} m/sec (geomean of hydraulic conductivity testing from BH/MWs 1, 2D, 3, and 5) were considered for Earth Fill, Silt, and Silty Clay Till, respectively.

The anticipated groundwater flow rates for short-term dewatering and long-term foundation drainage were estimated using a numerical analysis. Slide 9.025, released October 17, 2022, developed by Rocscience Inc. was used to compute the anticipated flow rates utilizing the Finite Element Modelling (FEM) method. The estimated groundwater flow rates along with reviewed plans (selected drawings) are presented in **Appendix E**.

Anticipated water through storm events should also be considered to estimate short-term dewatering flow rates. Considering the location of the Subject Site IDF curve provided by the Ministry of Transportation (MTO) was reviewed to estimate the anticipated flow during storm event. 30.7 mm storm event (2-year events for a duration of 3 hours) was considered for the current assessment with a summary presented in **Table 8-2**.

Table 8-2-Summary of Anticipated Short-Term Dewatering Flow Rates

Proposed Development	Groundwater Seepage (L/day)	Groundwater Seepage -S.F.* 2.0 (L/day)	Anticipated Flow over Storm Event (L/day)	Total Dewatering Flow Rates-S.F. 2.0 (L/day)
4-Storey hotel with 2-Level Underground Parking and Basement	12,000.0	24,000.0	192,000.0	216,000.0

*S. F: Safety Factor

Additionally, storm water flow considering 100-year storm event for a duration of 12 hours was considered to estimate the maximum storm water that can be collected during the excavation and construction period. The additional flow that can be expected in the occurrence of a 100-year storm event is approximately 638,000.0 L/day during construction.

8.4 Long-Term Foundation Drainage

Groundwater seepage and infiltration flow due to storm event should be collected for the post-construction underground parking structure. As such, a foundation drainage system should be designed to collect the anticipated flow. Proposed FFE for the 2-level underground parking and basement, and base of the drainage layer were considered at El. 80.85 and 80.35 masl. The highest groundwater level was also considered at El. 86.7 masl.

Anticipated flow considering 30.7 mm storm event (2-year events for a duration of 3 hours) was considered to estimate the total anticipated long-term foundation drainage flow rate. Summary of the estimated flow rates is presented in **Table 8-3**.

Table 8-3- Summary of Anticipated Long-Term Foundation Drainage Flow Rates

Proposed Development	Groundwater Seepage (L/day)	Groundwater Seepage -S.F.* 2.0 (L/day)	Anticipated Flow through Infiltration (L/day)	Total Foundation Drainage Flow Rates-S.F.* 2.0 (L/day)
4-Storey hotel with 2-Level Underground Parking and Basement	10,500.0	21,000.0	5,100.0	26,100.0

*S. F: Safety Factor

The above estimated flow rate does not include potential long-term flow for elevator pit, sump pit or any other localized structures that may extend below the drainage layer, assuming the above noted structures will be waterproofed for post-development structure.

8.5 Permit Requirements

- *Short-Term Construction Dewatering:* Water takings of more than 50,000 L/day but less than 400,000 L/day is to be registered on EASR, while water takings of more than 400,000 L/day require a PTTW issued by the MECP. If it is identified that an EASR or PTTW is required for the Subject Site, a hydrogeological assessment report will need to be submitted in support of the application. The estimated short-term construction dewatering flow rate from the groundwater

source reaches 24,000.0 L/day for construction of the proposed underground parking and basement structure considering a safety factor of 2.0, which is below the EASR threshold limit of 50,000 L/day. However, the total dewatering flow rate, including the flow from the anticipated storm event, is 216,000.0 considering a safety factor of 2.0, which is above the EASR threshold limit of 50,000 L/day and below the MECP PTTW threshold of 400,000.0 L/day. As such, posting EASR with the MECP is required. Additionally, obtaining discharge agreement from the Niagara Region is required if short-term dewatering effluent is proposed to be conveyed to the region's sewer system.

- *Long-Term Foundation Drainage:* If the estimated long-term foundation drainage flow from groundwater source exceeds MECP PTTW threshold limit of 50,000 L/day, applying for PTTW with MECP is required. The estimated long-term foundation drainage flow rate from groundwater source including a safety factor of 2.0 reaches 21,000.0 L/day for the proposed post-construction underground parking and basement. As such, filing PTTW with MECP is not required. However, obtaining discharge agreement from the Niagara Region is required if long-term foundation drainage effluent is proposed to be conveyed to the region's sewer system.

8.6 Zone of Influence (ZOI) Groundwater

The conceptual Zone of Influence (ZOI) for dewatering, also known as Radius of Influence (R_0), was calculated based on the anticipated maximum drawdown required and the highest hydraulic conductivity recorded at the Subject Site using Sichardt's relationship.

Equation: $R_0 = 3000*dH*K^{0.5}$

Where R_0: Zone of Influence for dewatering
dH: the drawdown (m)
K: the hydraulic conductivity (m/s)

Using the above equation, the conceptual ZOI could reach to 2.9 m away from the excavation and dewatering area.

8.7 Potential Dewatering Impacts and Mitigation Plan

8.7.1 Short-Term Discharge Water Quality

The dewatering system must be appropriately filtered in order to prevent the pumping of fines and loss of ground during the dewatering activities.

A review of the groundwater quality test results suggests groundwater quality meets the Niagara Region Sanitary and Combined Sewer Use By-Law Limits. As such, no significant pre-treatment is necessary to permit disposal of the dewatering effluent to the Region's sanitary and combined sewer system.

The final design for any temporary or long-term construction dewatering effluent pre-treatment system is the responsibility of contractors responsible for construction, or the water treatment system design specialists, if required.

8.7.2 Ground Settlement

The conceptual ZOI for dewatering reaches 2.9 m away from the dewatering area. There are no structures located within a conceptual ZOI for construction. As a such, no potential risk for ground settlement for the nearby structures is expected due to dewatering.

8.7.3 Surface Water, Wetlands and Areas of Natural Significance

Record review indicates that no natural heritage features including wetland, water bodies, watercourses and ANSI were identified on the Subject Site, and within the conceptual ZOI. As such, no impacts to natural heritage features are anticipated pertaining the proposed development.

8.7.4 Water Supply Wells and Zone of Influence

A review of the MECP well records confirmed that there are no records for water supply wells that are registered within 500 m of the Subject Site. As such, potential impacts to the groundwater users are no anticipated.

9.0 CONCLUSIONS AND RECOMMENDATIONS

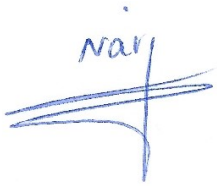
- The Subject Site is located within the Physiographic Region of southern Ontario known as Iroquois Plain.
- The Subject Site is located within an area mapped as Fine-textured Glaciolacustrine deposits (8a), comprising of clay and silt.
- The Subject Site is located within the West Lake Ontario Sub-watershed that falls in the Niagara Peninsula Conservation Authority (NPCA) jurisdiction, where there are no records for natural heritage features including wetland, water bodies, watercourses and ANSI within the Subject Site. One Mile Creek, Lake Ontario, and the Niagara River are located approximately 100 m southwest, 1.2 km northwest, and 700 m east of the Subject Site, respectively.
- The native soil beneath the Subject Site consists mainly of silt overlying silty clay and silty clay till extending to the maximum termination depth of investigated at 12.7 mbgs.
- The highest and lowest groundwater levels were measured at El. 86.7 masl and 80.6 masl, at BH/MWs 5 and 1, respectively during the monitoring period between June 6, 2024 and July 11, 2024, over three (3) monitoring events.
- Hydraulic conductivities of 1.0 x 10^{-6} m/sec (Freeze and Cherry, 1979), 1.3 x 10^{-8} m/sec (hydraulic conductivity testing from BH/MW 2S), and 1.1 x 10^{-8} m/sec (geomean of hydraulic conductivity testing from BH/MWs 1, 2D, 3, and 5) were considered for Earth Fill, Silt, and Silty Clay Till, respectively.
- One (1) set of groundwater samples were collected on July 11, 2024 and submitted for analysis and evaluation against the Niagara Region Sanitary and Combined Sewer Use By-Law parameters. A review of the results indicates that groundwater quality at BH/MW 1 meets the Niagara Region Sanitary and Combined Sewer Use By-Law Limits.
- Anticipated construction (short-term) dewatering from groundwater source for the proposed building could reach 24,000.0 L/day considering a safety factor of 2.0. Total anticipated flow rate will reach to a total flow rate of 216,000.0 L/day considering 30.7 mm rain fall storm event.
- Long-term foundation drainage flow from groundwater source considering a safety factor of 2.0 will reach 21,000.0 L/day for the proposed building. The total anticipated flow including infiltration reaches 26,100.0 L/day.
- The total estimated short-term construction dewatering flow rates exceeds the MECP EASR threshold of 50,000 L/day. As such, posting an EASR with the MECP is required.
- The estimated long-term foundation drainage flow rate from groundwater source is below the MECP threshold 50,000 L/day. As such, filing PTTW with MECP is not required.

- Obtaining discharge agreement from the Niagara Region is required if short-term dewatering or long-term foundation drainage effluents are proposed to be conveyed to the region's sewer system.
- The conceptual ZOI for dewatering reaches 2.9 m away from the dewatering area. There are no structures located within a conceptual ZOI for construction. As a such, no potential risk for ground settlement for the nearby structures is expected due to dewatering.
- Record review indicates that no natural heritage features including wetland, water bodies, watercourses and ANSI were identified on the Subject Site, and within the conceptual ZOI. As such, no impacts to natural heritage features are anticipated pertaining the proposed development.
- A review of the MECP well records confirmed that there are no records for water supply wells that are registered within 500 m of the Subject Site. As such, potential impacts to the groundwater users are no anticipated.

10.0 CLOSURE

We trust that the above-noted information is suitable for your review. If you have any questions regarding this information, please do not hesitate to contact the undersigned.

Yours truly,
SOIL ENGINEERS LTD.



Tarek Agha, B.Eng., E.I.T.
Project Manager

Narjes Alijani, M.Sc., P.Geo.
Department Manager-Hydrogeological Services

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7. Ministry of Natural Recourses and Forestry, 2024. Natural Heritage Interactive Map.
8. Town of Niagara-on-The-Lake Official Plan

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FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 542-2769

DRAWINGS 1 to 8

REFERENCE NO. 2405-W131

655800

656700

4791100

4790200

Niagara River (rivière Niagara)

One Mile Creek

DORCHESTER STREET

BUTLER STREET

WILLIAM STREET

MISSISSAGUA STREET

GAGE STREET

JOHNSON STREET

QUEEN STREET

PRIDEAUX STREET

DELATER STREET

RICARDO STREET

MELVILLE STREET

BYRON STREET

CENTRE STREET

GATE STREET

VICTORIA STREET

REGENT STREET

READ LANE

PLATOFF STREET

PICTON STREET

WELLINGTON STREET

QUEENS PARADE

CASTLEREAGH STREET

NELLES STREET

VETERANS LANE

SIMCOE STREET

JOHN STREET WEST

MARY STREET

ANNE STREET

WINDSOR CRCLE

KING STREET

JOHN STREET EAST

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Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Legend

- Approximate Boundary Of Subject Site
- Major Road
- Local Road
- Waterbody
- Watercourse

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Site Location Plan

Hydrogeological Assessment
Proposed Parliament Oak Hotel
325 King Street,
Town of Niagara-On-The-Lake

Reference No. 2405-W131

Date: July 22, 2024

Scale:

0 30 60 120 180 240 300
Metres

Drawing No. 1

656200 656300 656400

4790700 4790600

REGENT STREET

GAGE STREET

KING STREET

CASTLEREAGH STREET

CENTRE STREET

NELLES STREET

One Mile Creek

BH/MW 2D

BH/MW 2S

BH/MW 5

BH 4

BH/MW 1

BH/MW 3

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Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Legend

- Approximate Boundary Of Subject Site
- Major Road
- Local Road
- Watercourse
- Borehole (1)
- Borehole With Monitoring Well (5)

Soil Engineers Ltd.

Borehole and Monitoring Well Location Plan

Hydrogeological Assessment
Proposed Parliament Oak Hotel
325 King Street,
Town of Niagara-On-The-Lake

Reference No. 2405-W131

Date: July 29, 2024

Scale:
0 5 10 20 30 40 50
Metres

Drawing No. 2

656200

657100

4791100

4790200

DORCHESTER STREET
BUTLER STREET
WILLIAM STREET
MISSISSAGUA STREET
SIMCOE STREET
GAGE STREET
CENTRE STREET
GATE STREET
VICTORIA STREET
JOHNSON STREET
QUEEN STREET
FRONT STREET NORTH
PRIDEAUX STREET
DELATER STREET
BALL STREET
RICARDO STREET
MELVILLE STREET
BYRON STREET
READ LANE
PICTON STREET
QUEENS PARADE
PLATOFF STREET
DAVY STREET
CASTLEREAGH STREET
WELLINGTON STREET
REGENT STREET
NELLES STREET
VETERANS LANE
JOHN STREET WEST
MARY STREET
GEORGE MANOR
ANNE STREET
WINDSOR CIRCLE
KING STREET
JOHN STREET EAST
KARSAM COURT

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Legend

- Approximate Boundary of Subject Site
- Major Road
- Local Road
- 8a: Glaciolacustrine deep water deposits; consisting of clay, silt: foreshore/basinal
- 9: Glaciolacustrine nearshore and deltaic deposits; consisting of silt, sand: deltaic
- 19: Modern alluvium; consisting of clay, silt, sand, gravel: modern floodplain

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Surface Geology Map

Hydrogeological Assessment
Proposed Parliament Oak Hotel
325 King Street,
Town of Niagara-On-The-Lake

Reference No. 2405-W131

Date: July 22, 2024

Scale:
0 60 120 180 240 300
Metres

Drawing No. 3

656200

657100

4791100

4790200

DORCHESTER STREET
BUTLER STREET
WILLIAM STREET
MISSISSAGUA STREET
JOHNSON STREET
GAGE STREET
CENTRE STREET
GATE STREET
VICTORIA STREET
QUEEN STREET
FRONT STREET NORTH
PRIDEAUX STREET
DELATER STREET
BALL STREET
RICARDO STREET
MELVILLE STREET
BYRON STREET
READ LANE
PLATOFF STREET
REGENT STREET
PICTON STREET
QUEENS PARADE
DAVY STREET
CASTLEREAGH STREET
WELLINGTON STREET
NELLES STREET
VETERANS LANE
SIMCOE STREET
JOHN STREET WEST
MARY STREET
GEORGE MANOR
ANNE STREET
WINDSOR CIRCLE
KING STREET
JOHN STREET EAST
KARSAM COURT

Iroquois Plain

Clay Plains

Sand Plains

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Source: Chapman, L.J. and Putnam, D.F. 2007. Physiography of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 228 ISBN 978-1-4249-5158-1

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Legend

- Approximate Boundary of Subject Site
- Major Road
- Local Road
- Region Boundary
- Sand Plains
- Clay Plains

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Physiographic Map

Hydrogeological Assessment
Proposed Parliament Oak Hotel
325 King Street,
Town of Niagara-On-The-Lake

Reference No. 2405-W131

Date: July 22, 2024

Scale:

0 30 60 120 180 240 300

Metres

Drawing No. 4

655800

656700

4791100

4790200

Niagara River (rivière Niagara)

One Mile Creek

DORCHESTER STREET

BUTLER STREET

WILLIAM STREET

MISSISSAGUA STREET

SIMCOE STREET

JOHNSON STREET

GAGE STREET

CENTRE STREET

GATE STREET

VICTORIA STREET

JOHN STREET WEST

GEORGE MANOR

ANNE STREET

WINDSOR CIRCLE

KARSAM COURT

QUEEN STREET

FRONT STREET NORTH

PRIDEAUX STREET

DELATER STREET

BALL STREET

RICARDO STREET

MELVILLE STREET

BYRON STREET

PICTON STREET

QUEENS PARADE

READ LANE

PLATOFF STREET

DAVY STREET

REGENT STREET

CASTLEREAGH STREET

WELLINGTON STREET

NELLES STREET

VETERANS LANE

MARY STREET

KING STREET

JOHN STREET EAST

75

80

85

90

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Legend

- Approximate Boundary of Subject Site
- Major Road
- Local Road
- Waterbody
- Watercourse
- Ontario - 5 m

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Topographic Map

Hydrogeological Assessment
Proposed Parliament Oak Hotel
325 King Street,
Town of Niagara-On-The-Lake

Reference No. 2405-W131

Date: July 22, 2024

Scale:

0 30 60 120 180 240 300
Metres

Drawing No. 5

655500
656000
656500
657000
4791000
4790500
4790000

One Mile Creek
Niagara River (rivière Niagara)
DORCHESTER STREET
BUTLER STREET
WILLIAM STREET
MISSISSAGUA STREET
JOHNSON STREET
GAGE STREET
CENTRE STREET
GATE STREET
QUEEN STREET
FRONT STREET NORTH
PRIDEAUX STREET
DELATER STREET
BALL STREET
RICARDO STREET
MELVILLE STREET
BYRON STREET
READ LANE
PICTON STREET
QUEENS PARADE
PLATOFF STREET
DAVY STREET
REGENT STREET
VICTORIA STREET
CASTLEREAGH STREET
NELLES STREET
WELLINGTON STREET
VETERANS LANE
SIMCOE STREET
JOHN STREET WEST
GEORGE MANOR
ANNE STREET
MARY STREET
KING STREET
JOHN STREET EAST
WINDSOR CIRCLE
KARSAM COURT

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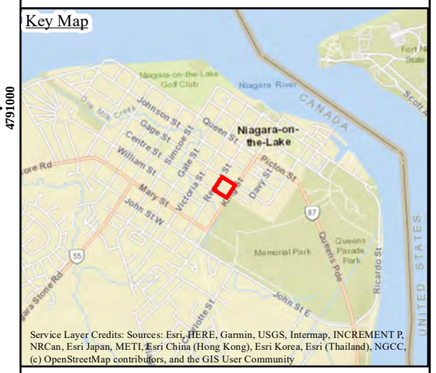

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Legend

- Approximate Boundary of Subject Site
- Major Road
- Local Road
- Watercourse
- Waterbody
- Wooded Area *Wooded Area*

Soil Engineers Ltd.

Natural Features and Protection Area Plan

Hydrogeological Assessment
Proposed Parliament Oak Hotel
325 King Street,
Town of Niagara-On-The-Lake

Reference No. 2405-W131

Date: July 22, 2024

Scale:

0 60 120 180 240 300
Metres

Drawing No. 6

655800

656700

4791100

4790200

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One Mile Creek

Niagara River (rivière Niagara)

DORCHESTER STREET
BUTLER STREET
MISSISSAGUA STREET
SIMCOE STREET
GATE STREET
GAGE STREET
CENTRE STREET
VICTORIA STREET
WILLIAM STREET
MARY STREET
JOHN STREET WEST
GEORGE MANOR
WINDSOR CIRCLE
ANNE STREET
KARSAM COURT
JOHNSON STREET
QUEEN STREET
PRIDEAUX STREET
FRONT STREET NORTH
RIVER BEACH DRIVE
DELATER STREET
TURNTABLE WAY
RICARDO STREET
MELVILLE STREET
BYRON STREET
PICTON STREET
READ LANE
HAINES LANE
WELLINGTON STREET
REGENT STREET
KING STREET
DAVY STREET
PLATOFF STREET
CASTLEREAGH STREET
NELLES STREET
VETERANS LANE
QUEENS PARADE
PARK COURT
JOHN STREET EAST

1 2 3 4 5 6 7 8 9 10 11

N

References: ESRI, DigitalGlobe, GeoEye, Earthstar Geograp -hics, CNES/Airbus Ds, USDA, USGS, AeroGRIS, IGN, and the GIS User Community produced by Soil Engineers Ltd. Copyright (c) Queen's Printer 2020. Water Well Information System Ministry of the Environment, Conservation and Parks, 2020

Key Map

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Legend

- Approximate Boundary of Subject Site
- 500 Metres From Subject Site Boundary
- Major Road
- Local Road
- Waterbody
- Watercourse
- Unknown (2)
- Abandoned-Other (1)
- Monitoring and Test Hole (1)
- Observation Wells (5)
- Test Hole (2)

Soil Engineers Ltd.

MECP Well Location Plan

Hydrogeological Assessment
Proposed Parliament Oak Hotel
325 King Street,
Town of Niagara-On-The-Lake

Reference No. 2405-W131

Date: July 22, 2024

Scale:

0 30 60 120 180 240 300
Metres

Drawing No. 7

656200
656300
656400
4790700
4790600
REGENT STREET
GAGE STREET
CASTLEREAGH STREET
KING STREET
CENTRE STREET
NELLES STREET
BH/MW 2D
BH/MW 2S
BH/MW 5
A'
BH 4
BH/MW 1
A
BH/MW 3
(Projected)
One Mile Creek
D:\Projects\2405-W131\

N

References: Ontario Ministry of Natural Resources and Forestry
Ⓒ Queen's Printer for Ontario, 2022

Key Map

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Legend

- Approximate Boundary of Subject Site
- A A' Cross Section
- Major Road
- Local Road
- Watercourse
- Borehole
- Borehole With Monitoring Well

Soil Engineers Ltd.

Cross-Section Plan

Hydrogeological Assessment
Proposed Parliament Oak Hotel
325 King Street,
Town of Niagara-On-The-Lake

Reference No. 2405-W131

Date: July 22, 2024

Scale:
0 5 10 20 30 40 50
Metres

Drawing No. 8-1

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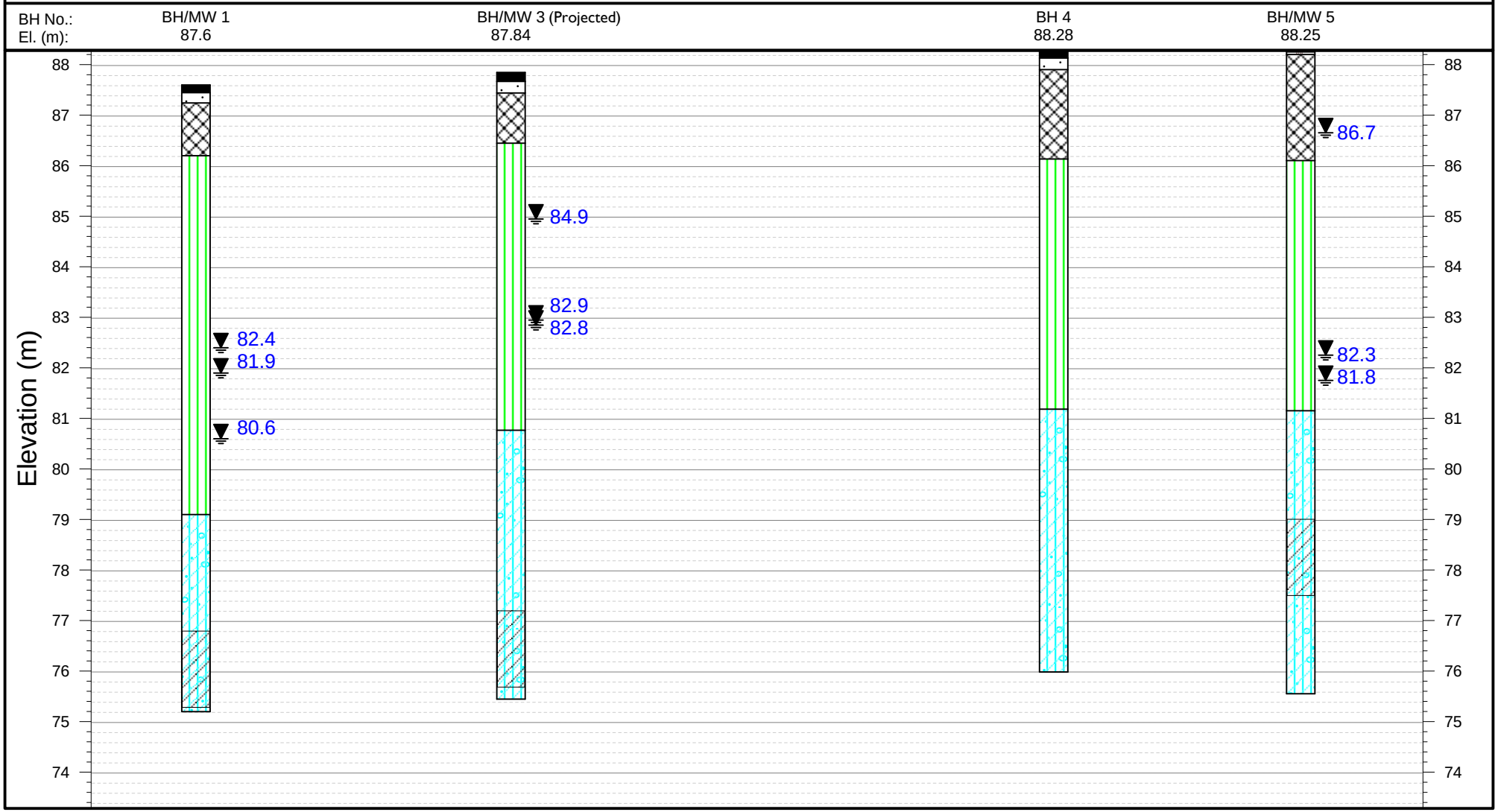
SUBSURFACE PROFILE
CROSS SECTION
DRAWING NO. 8-2
SCALE: AS SHOWN

JOB NO.: 2405-W131
REPORT DATE: July 2024
PROJECT DESCRIPTION: Proposed Parliament Oak Hotel
PROJECT LOCATION: 325 King Street, Town of Niagara-On-The-Lake

LEGEND

ASPHALT | GRANULAR | SILTY CLAY TILL | TOPSOIL
FILL | SILT | SCREEN

WATER LEVEL (STABILIZED)



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FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 542-2769

APPENDIX 'A'

BOREHOLE LOGS/MONITORING WELL LOGS
AND
GRAIN SIZE DISTRIBUTION GRAPH

REFERENCE NO. 2405-W131

JOB NO.: 2405-W131

LOG OF BOREHOLE:BH/MW 1

FIGURE NO.: 1

PROJECT DESCRIPTION: Proposed Parliament Oak Hotel

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 325 King Street, Town of Niagara-On-The-Lake

DRILLING DATE: May 28, 2024

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
87.6	Pavement Structure							
0.0	**150 mm ASPHALT**	1A			0		5	
	205 mm GRANULAR FILL	1B	DO	10			16	
	Brown							
	EARTH FILL	2	DO	8	1		16	
86.2	silty clay							
1.4		3	DO	42			16	
	Loose to very dense				2			
		4	DO	38			13	
		5	DO	10	3		20	
	SILT				4			
	clay layer	6A 6B	DO	8	5		18 24	
	gravelly sand layer	7A 7B	DO	27	6		17	
	some clay a trace of sand occ. cobbles and boulders				7			
		8	DO	50/15			18	
79.1					8			
8.5	Grey, hard	9	DO	50/13	9		11	
	SILTY CLAY TILL				10			
	a trace of sand to sandy a trace of gravel occ. cobbles and boulders	10	DO	37	11		13	
75.2					12			
12.4	**END OF BOREHOLE**	11	DO	50/15			14	
	Installed 50 mm Ø PVC monitoring well to 12.3 m with 1.5 m screen Sand backfill from 10.5 to 12.3 m Bentonite seal from 0.0 m to 10.5 m Provided with flushmount cover				13			
					14			
					15			

W.L. @ El. 82.4 masl on Jun 06, 2024
W.L. @ El. 80.6 masl on Jun 27, 2024
W.L. @ El. 81.9 masl on Jul 11, 2024

Soil Engineers Ltd.

JOB NO.: 2405-W131

LOG OF BOREHOLE:BH/MW 2D

FIGURE NO.: 2A

PROJECT DESCRIPTION: Proposed Parliament Oak Hotel

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 325 King Street, Town of Niagara-On-The-Lake

DRILLING DATE: May 27, 2024

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
87.4	Ground Surface							
0.0	**8 cm TOPSOIL**	1	DO	6	0		17	
	Dark brown **EARTH FILL** silt with rootlets and organic inclusion	2	DO	6	1		25	
86.0 / 1.4		3	DO	28	2		16	
	Compact to dense	4	DO	35	3		13	
		5	DO	34	4		15	
	SILT	6	DO	20	5		13	
	a trace of sand occ. clay seams	7	DO	22	6		15	
80.3 / 7.1		8	DO	6	8		17	
	Grey, firm to hard	9	DO	54	9		11	
	SILTY CLAY TILL	10	DO	68	11		13	
	some sand to sandy a trace of gravel occ. clay seams, cobbles and boulders	11	DO	50/13	12		13	
74.9 / 12.5	**END OF BOREHOLE**				13			
	Installed 50 mm Ø PVC monitoring well to 12.2 m with 3.0 m screen Sand backfill from 8.5 to 12.2 m Bentonite seal from 0.0 m to 8.5 m Provided with monument casing				14			
					15			

W.L. @ El. 82.9 masl on Jun 06, 2024
W.L. @ El. 82.8 masl on Jun 27, 2024
W.L. @ El. 82.8 masl on Jul 11, 2024

Soil Engineers Ltd.

JOB NO.: 2405-W131

LOG OF BOREHOLE:BH/MW 2S

FIGURE NO.: 2B

PROJECT DESCRIPTION: Proposed Parliament Oak Hotel

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 325 King Street, Town of Niagara-On-The-Lake

DRILLING DATE: May 27, 2024

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
87.4	Ground Surface							
0.0	**8 cm TOPSOIL**				0			
	Dark brown **EARTH FILL** silt with rootlets and organic inclusion				1			
86.0 1.4	Compact to dense				2			
	SILT				3			
					4			
	a trace of sand occ. clay seams				5			
81.3 6.1	**END OF BOREHOLE**				6			
	Installed 50 mm Ø PVC monitoring well to 6.1 m with 1.5 m screen Sand backfill from 4 to 6.1 m Bentonite seal from 0.0 m to 4 m Provided with monument casing				7			
					8			
					9			
	Straight augered to 6.1 and installed monitoring well				10			
					11			
					12			
					13			
					14			
					15			

W.L. @ El. 83.5 masl on Jun 06, 2024
W.L. @ El. 83.4 masl on Jun 27, 2024
W.L. @ El. 83.4 masl on Jul 11, 2024

Soil Engineers Ltd.

JOB NO.: 2405-W131

LOG OF BOREHOLE:BH/MW 3

FIGURE NO.: 3

PROJECT DESCRIPTION: Proposed Parliament Oak Hotel

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 325 King Street, Town of Niagara-On-The-Lake

DRILLING DATE: May 29, 2024

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
87.8	Pavement Structure							
0.0	**180 mm ASPHALT**				0			
	230 mm GRANULAR FILL							
	Brown	1	DO	14			4	
	EARTH FILL				1			
	silty clay	2	DO	11			26	
86.4								
1.4								
	Compact to dense	3	DO	40	2		14	
		4	DO	40			13	
		5	DO	25	3		11	
	SILT				4			
		6	DO	21	5		15	
	some clay				6			
	a trace of sand	7	DO	14			15	
80.7					7			
7.1								
	Grey, hard							
	gravelly sand	8A 8B	DO	33	8		18 12	
	SILTY CLAY TILL	9	DO	47	9		12	
					10			
		10A 10B	DO	59	11		17 19	
	a trace to some sand a trace of gravel occ. cobbles and boulders							
75.4		11	DO	50/15	12		9	
12.4	**END OF BOREHOLE**							
	Installed 50 mm Ø PVC monitoring well to 12.2 m with 1.5 m screen Sand backfill from 10.4 to 12.2 m Bentonite seal from 0.0 m to 10.4 m Provided with flushmount cover				13 14 15			

W.L. @ El. 84.9 masl on Jun 06, 2024
W.L. @ El. 82.9 masl on Jun 27, 2024
W.L. @ El. 82.8 masl on Jul 11, 2024

Soil Engineers Ltd.

JOB NO.: 2405-W131

LOG OF BOREHOLE:BH 4

FIGURE NO.: 4

PROJECT DESCRIPTION: Proposed Parliament Oak Hotel

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 325 King Street, Town of Niagara-On-The-Lake

DRILLING DATE: May 27, 2024

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
88.3	Pavement Structure							
0.0	**150 mm ASPHALT**	1A			0		7	
	230 mm GRANULAR FILL	1B	DO	8			13	
	Dark brown **EARTH FILL** silty clay with gravel, sand layers and organic inclusion	2	DO	15	1		10	
		3	DO	17	2		16	
86.2								
2.1	Compact to dense	4	DO	34			16	
		5	DO	40	3		16	
	SILT				4			
		6	DO	12	5		19	
	some clay a trace of sand	7	DO	15	6		17	
81.2								
7.1	Grey, firm to hard	8	DO	6	7		25	
	clay layer				8			
	SILTY CLAY TILL	9	DO	71/28	9		12	
	a trace of sand to sandy a trace of gravel occ. cobbles and boulders	10	DO	83/28	10		11	
76.0		11	DO	50/5	11		12	
12.3	**END OF BOREHOLE**				12			
					13			
					14			
					15			

Soil Engineers Ltd.

JOB NO.: 2405-W131

LOG OF BOREHOLE:BH/MW 5

FIGURE NO.: 5

PROJECT DESCRIPTION: Proposed Parliament Oak Hotel

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 325 King Street, Town of Niagara-On-The-Lake

DRILLING DATE: May 28, 2024

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
88.3	Ground Surface							
0.0	**5 cm TOPSOIL**	1	DO	8	0		14	
	Brown							
	EARTH FILL	2	DO	8	1		11	
	silty clay with gravel and organic inclusion	3	DO	9	2		28	
86.2								
2.1	Compact	4	DO	28	3		15	
		5	DO	26			15	
	SILT				4			
		6	DO	15	5		16	
	some clay a trace of sand	7	DO	15	6		18	
81.2					7			
7.1	Grey, firm to hard	8	DO	6	8		24	
	clay layer							
		9	DO	50/15	9		11	
	SILTY CLAY TILL				10			
		10	DO	39	11		13	
	some clay a trace of sand a trace of gravel occ. cobbles and boulders				12			
75.6		11	DO	30			17	
12.7	**END OF BOREHOLE**				13			
	Bentonite backfill from 11.3 m to 12.2 m Sand backfill from 10.7 m to 11.3 m Installed 50 mm Ø PVC monitoring well to 10.7 m with 1.5 m screen Sand backfill from 8.8 to 10.7 m Bentonite seal from 0.0 m to 8.8 m Provided with flushmount cover				14			
					15			

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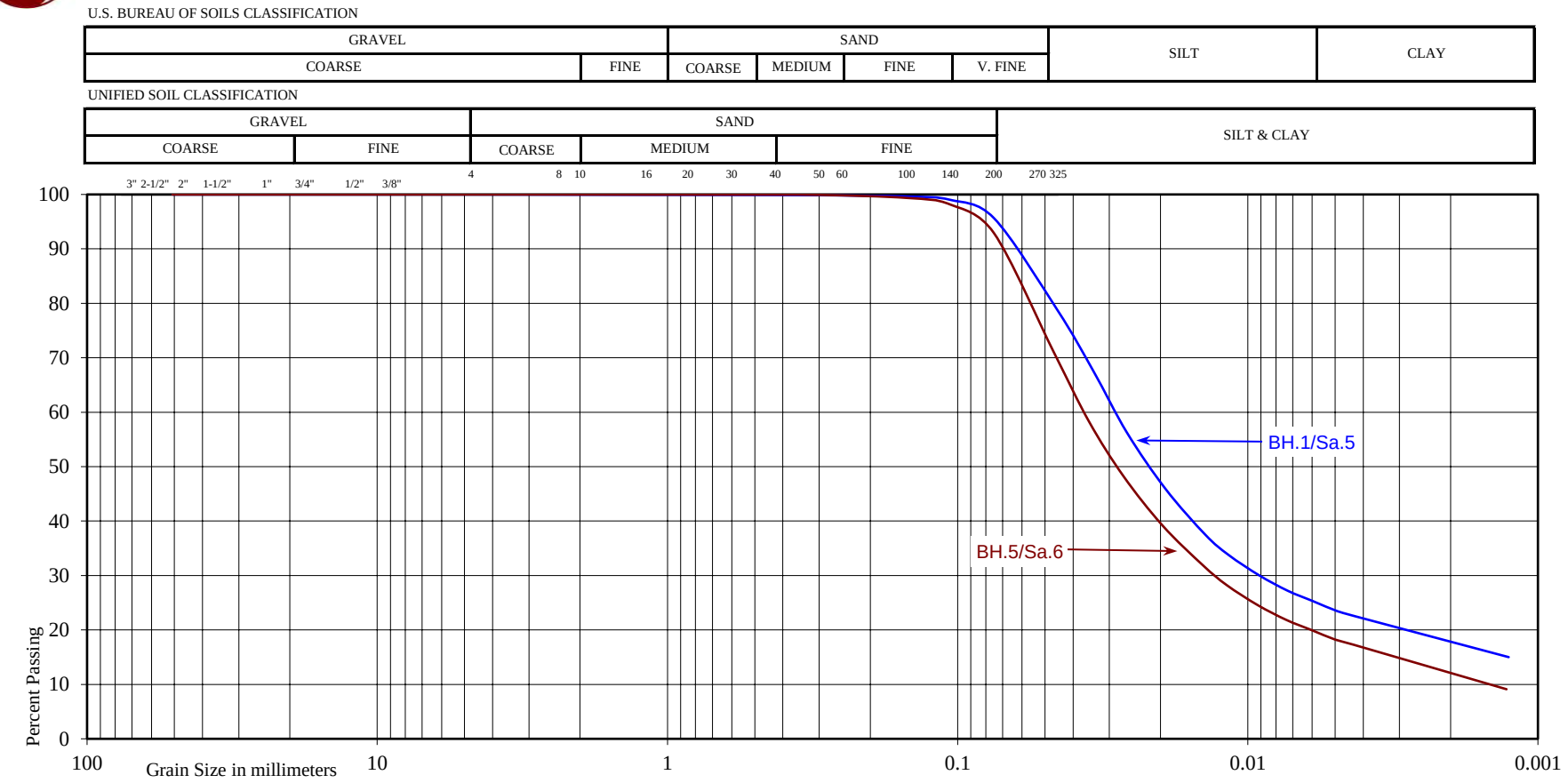
GRAIN SIZE DISTRIBUTION

Reference No: 2405-S131



Project:	Proposed Parliament Oak Hotel	
Location:	325 King Street, Town of Niagara-On-The-Lake	
Borehole No:	1	5
Sample No:	5	6
Depth (m):	3.3	4.8
Elevation (m):	84.3	83.5

BH./Sa.	1/5	5/6
Liquid Limit (%) =	-	-
Plastic Limit (%) =	-	-
Plasticity Index (%) =	-	-
Moisture Content (%) =	20	16
Estimated Permeability (cm./sec.) =	10^{-7}	10^{-6}

Classification of Sample [& Group Symbol]: SILT
some clay, a trace of sand

Figure: 6

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

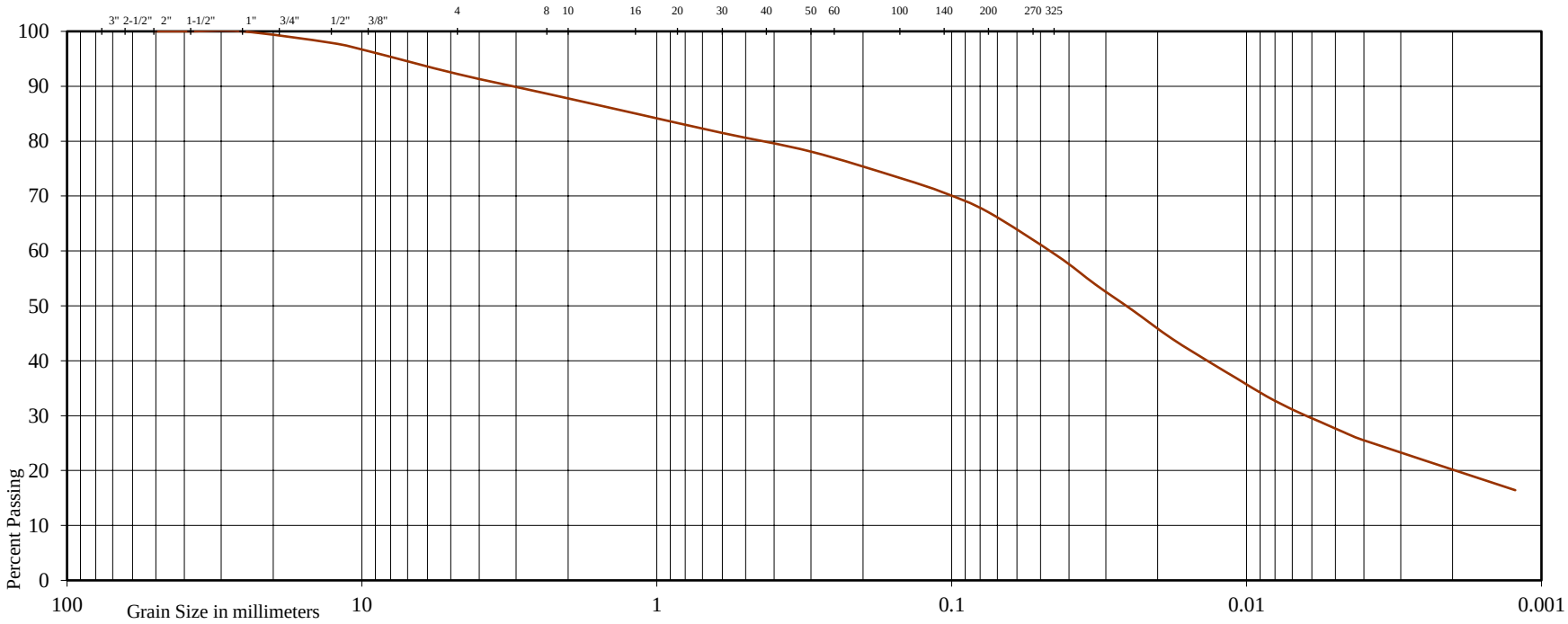
Reference No: 2405-S131

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Parliament Oak Hotel

Location: 325 King Street, Town of Niagara-On-The-Lake

Borehole No: 2D

Sample No: 8

Depth (m): 7.8

Elevation (m): 79.6

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = 17

Estimated Permeability (cm./sec.) = 10^{-7}

Classification of Sample [& Group Symbol]: SILTY CLAY, TILL
sandy, a trace of gravel

Figure: 7

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

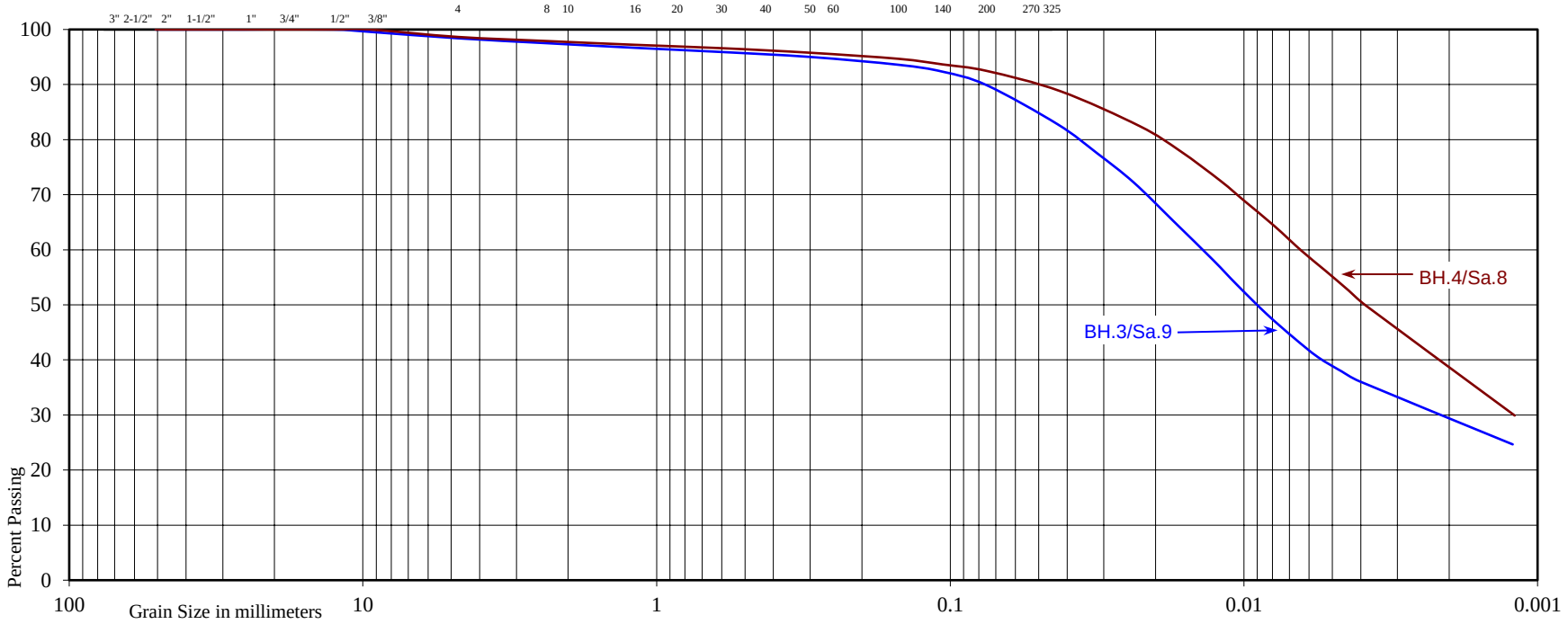
Reference No: 2405-S131

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Parliament Oak Hotel

Location: 325 King Street, Town of Niagara-On-The-Lake

Borehole No:	3	4
Sample No:	9	8
Depth (m):	9.4	7.8
Elevation (m):	78.4	80.5

BH./Sa.	3/9	4/8
Liquid Limit (%) =	33	41
Plastic Limit (%) =	18	20
Plasticity Index (%) =	15	21
Moisture Content (%) =	12	25
Estimated Permeability (cm./sec.) =	10^{-7}	10^{-7}

Classification of Sample [& Group Symbol]: SILTY CLAY
traces of sand and gravel

Figure: 8

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FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 542-2769

APPENDIX 'B'

MECP WATER WELL RECORDS SUMMARY

REFERENCE NO. 2405-W131

MECP Well Records Summary

WELL ID	MECP* WWR ID	Construction Method	Well Depth (m)**	Well Usage		Static Water Level (m)**	Top of Screen Depth (m)**	Bottom of Screen Depth (m)**	Date Completed
				Final Status	First Use				
1	7246884	Direct Push	4.7	Monitoring and Test Hole	Monitoring and Test Hole	-	1.7	4.7	2015-06-25
2	7246885	Direct Push	5.8	Test Hole	Monitoring and Test Hole	-	2.7	5.8	2015-06-25
3	7277433	-	-	-	-	-	-	-	2016-11-10
4	7287675	-	-	-	-	-	-	-	2016-12-05
5	7338641	Rotary (Convent.)	3.0	Observation Wells	Monitoring	2.1	1.5	3.0	2019-04-05
6	7357680	Rotary (Convent.)	4.6	Observation Wells	Monitoring	-	4.6	1.5	-
7	7357685	Rotary (Convent.)	4.6	Observation Wells	Monitoring	-	4.6	1.5	-
8	7363910	Boring	-	Observation Wells	Monitoring	-	-	9.1	2020-05-21
9	7363911	Boring	-	Observation Wells	Monitoring	-	-	9.1	2020-05-21
10	7379805	Boring	-	Test Hole	Test Hole	-	-	6.1	2020-11-03
11	7379971	-	-	Abandoned-Other	-	-	-	-	2020-05-12

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BARRIE	MISSISSAUGA	OSHAWA	NEWMARKET	MUSKOKA	HAMILTON
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FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 542-2769

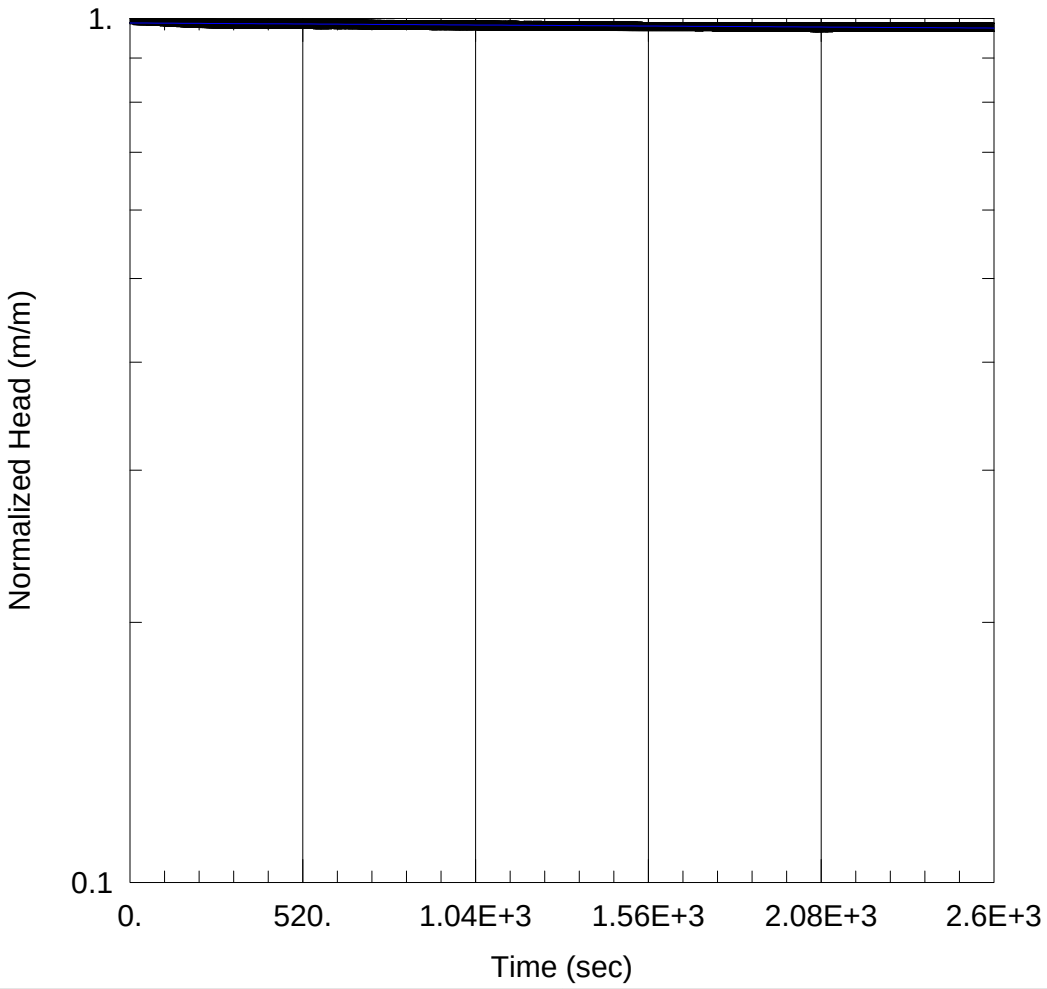
APPENDIX 'C'

IN-SITU HYDRAULIC CONDUCTIVITY TESTING DETAILS

REFERENCE NO. 2405-W131

Falling Head SWRT of BH/MW 1

Prepared By:	Prepared For:
Soil Engineers Ltd.	Two Sisters Resorts Corp.
Project:	**Location:**
2405-W131	325 King St



SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 4.4E-9 m/sec y0 = 0.5059 m

AQUIFER DATA

Saturated Thickness: 5.3 m Anisotropy Ratio (Kz/Kr): 1.

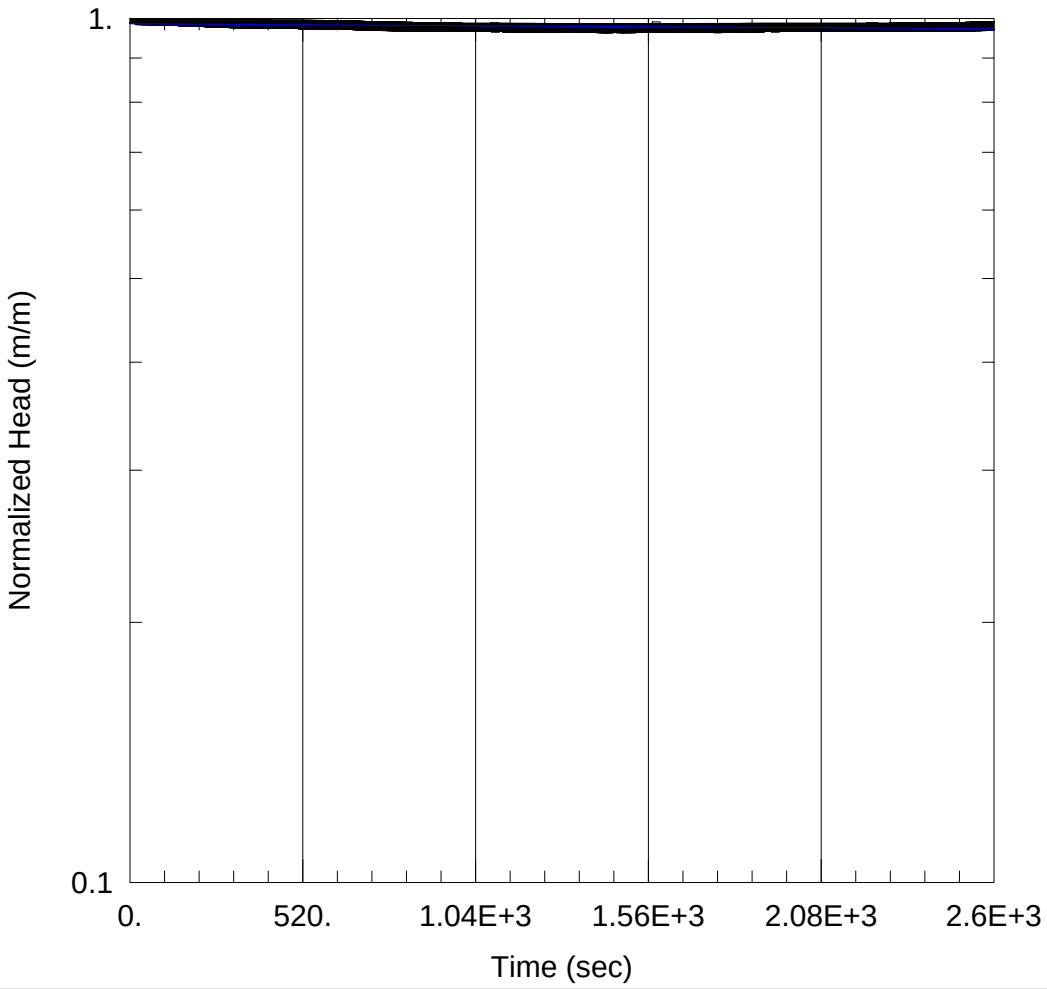
WELL DATA (BH/MW 1)

Initial Displacement: 0.512 m
Static Water Column Height: 5.3 m
Total Well Penetration Depth: 5.3 m
Screen Length: 1.5 m
Casing Radius: 0.0254 m
Well Radius: 0.0254 m

Soil Engineers Ltd.

Falling Head SWRT of BH/MW 2D

Prepared By:	Prepared For:
Soil Engineers Ltd.	Two Sisters Resorts Corp.
Project:	**Location:**
2405-W131	325 King St



SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 2.301E-9 m/sec y0 = 0.4978 m

AQUIFER DATA

Saturated Thickness: 7.7 m Anisotropy Ratio (Kz/Kr): 1.

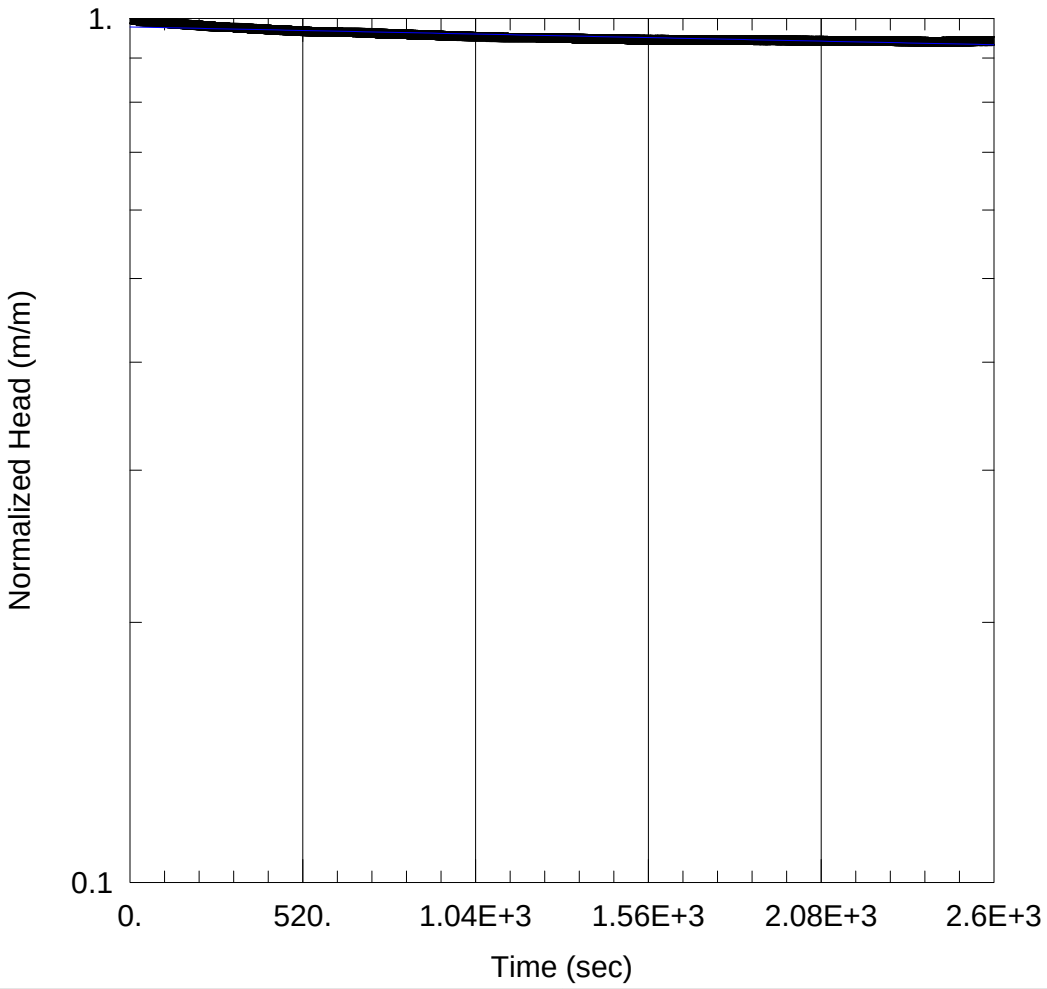
WELL DATA (BH/MW 2D)

Initial Displacement: 0.505 m
Static Water Column Height: 7.7 m
Total Well Penetration Depth: 7.7 m
Screen Length: 3. m
Casing Radius: 0.0254 m
Well Radius: 0.0254 m

Soil Engineers Ltd.

Falling Head SWRT of BH/MW 2S

Prepared By:	Prepared For:
Soil Engineers Ltd.	Two Sisters Resorts Corp.
Project:	**Location:**
2405-W131	325 King St



SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.311E-8 m/sec y0 = 0.4536 m

AQUIFER DATA

Saturated Thickness: 2.11 m Anisotropy Ratio (Kz/Kr): 1.

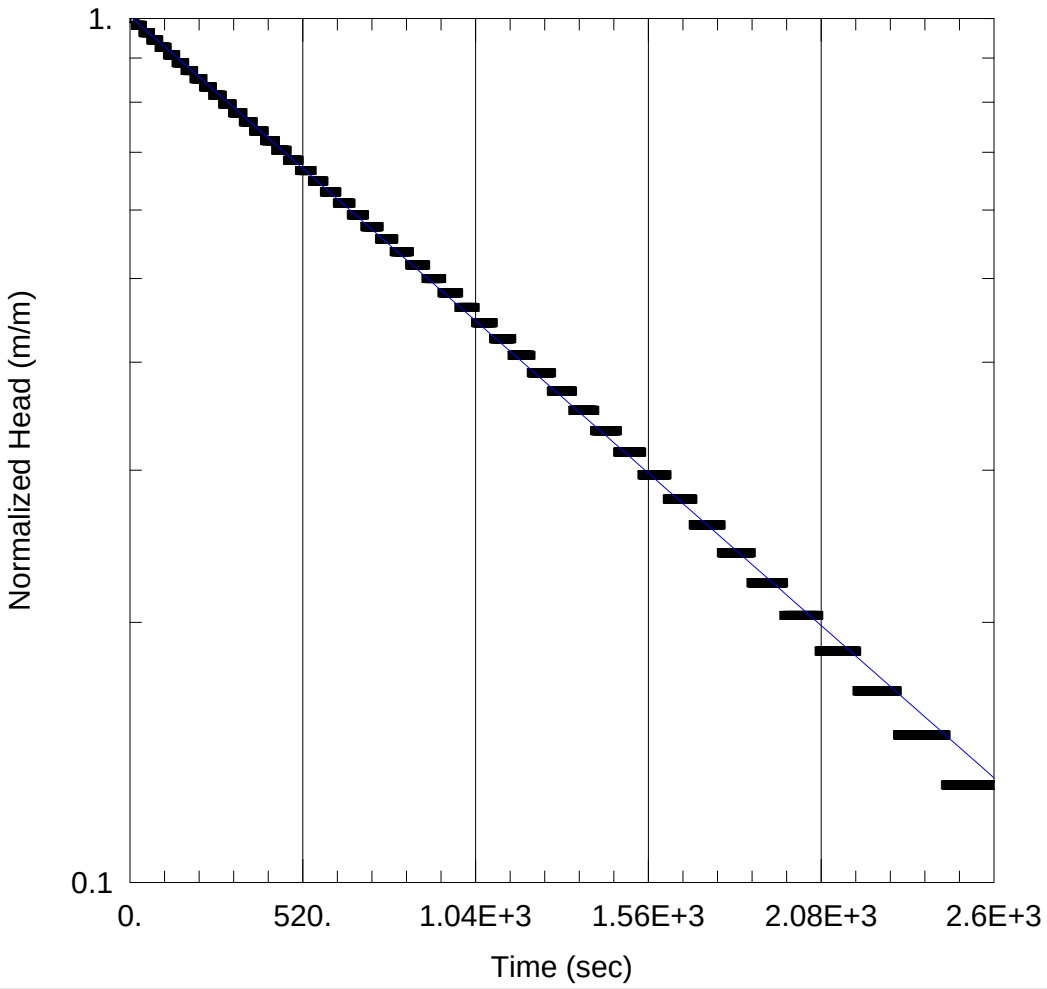
WELL DATA (BH/MW 2S)

Initial Displacement: 0.464 m
Static Water Column Height: 2.11 m
Total Well Penetration Depth: 2.11 m
Screen Length: 1.5 m
Casing Radius: 0.0254 m
Well Radius: 0.0254 m

Soil Engineers Ltd.

Falling Head SWRT of BH/MW 3

Prepared By:	Prepared For:
Soil Engineers Ltd.	Two Sisters Resorts Corp.
Project:	**Location:**
2405-W131	325 King St



SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 6.865E-7 m/sec y0 = 0.5433 m

AQUIFER DATA

Saturated Thickness: 7.26 m Anisotropy Ratio (Kz/Kr): 1.

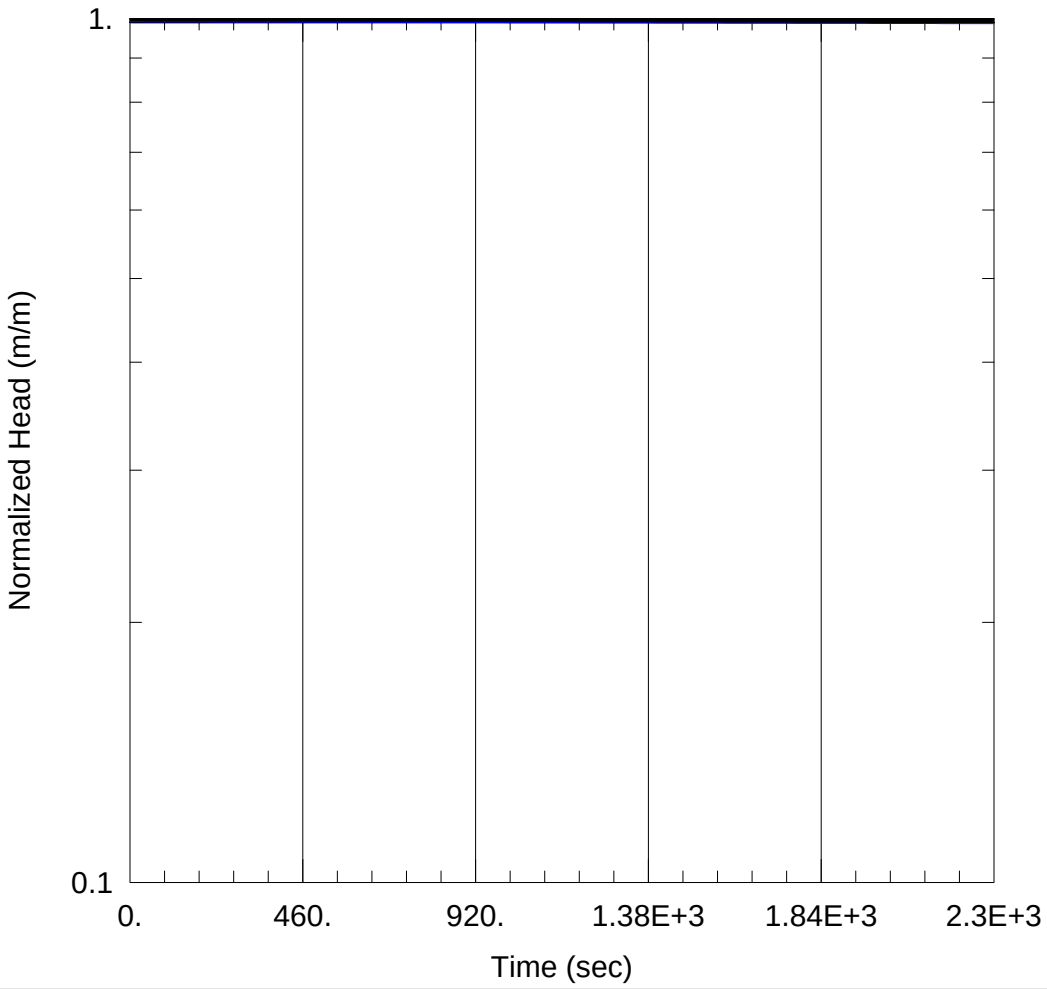
WELL DATA (BH/MW 3)

Initial Displacement: 0.54 m
Static Water Column Height: 7.26 m
Total Well Penetration Depth: 7.26 m
Screen Length: 1.5 m
Casing Radius: 0.0254 m
Well Radius: 0.0254 m

Soil Engineers Ltd.

Falling Head SWRT of BH/MW 5

Prepared By:	Prepared For:
Soil Engineers Ltd.	Two Sisters Resorts Corp.
Project:	**Location:**
2405-W131	325 King St



SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 1.802E-9 m/sec y0 = 0.5055 m

AQUIFER DATA

Saturated Thickness: 4.3 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH/MW 5)

Initial Displacement: 0.51 m
Static Water Column Height: 4.3 m
Total Well Penetration Depth: 4.3 m
Screen Length: 1.5 m
Casing Radius: 0.0254 m
Well Radius: 0.0254 m

Soil Engineers Ltd.

Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE
90 WEST BEAVER CREEK ROAD, SUITE 100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

BARRIE	MISSISSAUGA	OSHAWA	NEWMARKET	MUSKOKA	HAMILTON
TEL: (705) 721-7863	TEL: (905) 542-7605	TEL: (905) 440-2040	TEL: (905) 853-0647	TEL: (705) 684-4242	TEL: (905) 777-7956
FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 542-2769

APPENDIX 'D'

WATER QUALITY TEST RESULTS

REFERENCE NO. 2405-W131

FINAL REPORT

CA40111-JUL24 R1

2405-W131, 325 King St. Niagara On the Lake

Prepared for

Soil Engineers Ltd.

FINAL REPORT

CA40111-JUL24 R1

First Page

CLIENT DETAILS

Client	Soil Engineers Ltd.
Address	90 West Beaver Creek Rd Richmond, ON M1S 3A7. Canada
Contact	Gurkaranbir Singh
Telephone	519-731-6442
Facsimile	
Email	gurkaranbir.singh@soilengineersltd.com
Project	2405-W131, 325 King St. Niagara On the Lake
Order Number	
Samples	Solution (1)

LABORATORY DETAILS

Project Specialist	Maarit Wolfe, Hon.B.Sc
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	705-652-2000
Facsimile	705-652-6365
Email	Maarit.Wolfe@sgs.com
SGS Reference	CA40111-JUL24
Received	07/12/2024
Approved	07/22/2024
Report Number	CA40111-JUL24 R1
Date Reported	07/22/2024

COMMENTS

RL - SGS Reporting Limit

Temperature of Sample upon Receipt: 6 degrees C
Cooling Agent Present: yes
Custody Seal Present: yes

Chain of Custody Number: 039206

F-ewl spk high, within acceptable range for fluoride

BOD spike low, accepted based on all other QC

SIGNATORIES

Maarit Wolfe, Hon.B.Sc

TABLE OF CONTENTS

Client: Soil Engineers Ltd.
Project: 2405-W131, 325 King St. Niagara On the Lake
Project Manager: Gurkaranbir Singh
Samplers: JS

MATRIX: WATER

L1 = SANSEW / WATER / - - Niagara Sewer Use ByLaw - Sanitary and Combined Sewer Discharge - BL_27_2014

Sample Number	7
Sample Name	BH/MW1
Sample Matrix	Solution
Sample Date	11/07/2024

Parameter	Units	RL	L1	Result
General Chemistry				
Biochemical Oxygen Demand (BOD5)	mg/L	2	300	< 4 ↑
Total Suspended Solids	mg/L	2	350	3
Total Kjeldahl Nitrogen	as N mg/L	0.5	100	0.6
Metals and Inorganics				
Cyanide (total)	mg/L	0.01	1	< 0.01
Fluoride	mg/L	0.06	10	0.26
Sulphide	mg/L	0.02	1	< 0.02
Sulphate	mg/L	2	1500	100
Antimony (total)	mg/L	0.0009	5	0.0009
Arsenic (total)	mg/L	0.0002	1	0.0013
Cadmium (total)	mg/L	0.000003	0.7	0.000046
Chromium (total)	mg/L	0.00008	3	0.00040
Cobalt (total)	mg/L	0.000004	5	0.000693
Copper (total)	mg/L	0.001	3	< 0.001
Lead (total)	mg/L	0.00009	1	< 0.00009
Molybdenum (total)	mg/L	0.0004	5	0.0077
Nickel (total)	mg/L	0.0001	2	0.0024
Phosphorus (total)	mg/L	0.003	10	0.008
Selenium (total)	mg/L	0.00004	1	0.00022
Silver (total)	mg/L	0.00005	5	< 0.00005
Tin (total)	mg/L	0.00006	5	0.00095

Client: Soil Engineers Ltd.
Project: 2405-W131, 325 King St. Niagara On the Lake
Project Manager: Gurkaranbir Singh
Samplers: JS

MATRIX: WATER

L1 = SANSEW / WATER / - - Niagara Sewer Use ByLaw - Sanitary and Combined Sewer Discharge - BL_27_2014

Sample Number	7
Sample Name	BH/MW1
Sample Matrix	Solution
Sample Date	11/07/2024

Parameter	Units	RL	L1	Result
Metals and Inorganics (continued)				
Zinc (total)	mg/L	0.002	3	0.037
Oil and Grease				
Oil & Grease (total)	mg/L	2		< 2
Oil & Grease (animal/vegetable)	mg/L	4	150	< 4
Oil & Grease (mineral/synthetic)	mg/L	4	15	< 4
Other (ORP)				
pH	No unit	0.05	11.1	7.69
Mercury (total)	mg/L	0.00001	0.01	< 0.00001
Phenols				
4AAP-Phenolics	mg/L	0.002	1	< 0.002
VOCs				
Chloroform	mg/L	0.0005	0.04	< 0.0005
1,2-Dichlorobenzene	mg/L	0.0005	0.05	< 0.0005
1,4-Dichlorobenzene	mg/L	0.0005	0.08	< 0.0005
Methylene Chloride	mg/L	0.0005	0.21	< 0.0005
1,1,2,2-Tetrachloroethane	mg/L	0.0005	0.04	< 0.0005
Tetrachloroethylene (perchloroethylene)	mg/L	0.0005	0.05	< 0.0005
Trichloroethylene	mg/L	0.0005	0.05	< 0.0005

Client: Soil Engineers Ltd.
Project: 2405-W131, 325 King St. Niagara On the Lake
Project Manager: Gurkaranbir Singh
Samplers: JS

MATRIX: WATER

L1 = SANSEW / WATER / - - Niagara Sewer Use ByLaw - Sanitary and Combined Sewer Discharge - BL_27_2014

Sample Number	7
Sample Name	BH/MW1
Sample Matrix	Solution
Sample Date	11/07/2024

Parameter	Units	RL	L1	Result
VOCs - BTEX				
Benzene	mg/L	0.0005	0.01	< 0.0005
Ethylbenzene	mg/L	0.0005	0.16	< 0.0005
Toluene	mg/L	0.0005	0.2	< 0.0005
Xylene (total)	mg/L	0.0005	0.52	< 0.0005
m-p-xylene	mg/L	0.0005		< 0.0005
o-xylene	mg/L	0.0005		< 0.0005

EXCEEDANCE SUMMARY

No exceedances are present above the regulatory limit(s) indicated

QC SUMMARY

Anions by discrete analyzer

Method: US EPA 375.4 | Internal ref.: ME-CA-[ENVIEWL-LAK-AN-026

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Sulphate	DIO8037-JUL24	mg/L	2	<2	ND	20	108	80	120	109	75	125

Biochemical Oxygen Demand

Method: SM 5210 | Internal ref.: ME-CA-[ENVIEWL-LAK-AN-007

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Biochemical Oxygen Demand (BOD5)	BOD0027-JUL24	mg/L	2	< 2	3	30	109	70	130	61	70	130

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-[ENVISFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Cyanide (total)	SKA0119-JUL24	mg/L	0.01	<0.01	ND	10	92	90	110	95	75	125

QC SUMMARY

Fluoride by Specific Ion Electrode

Method: SM 4500 I Internal ref.: ME-CA-[ENVIEWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0312-JUL24	mg/L	0.06	<0.06	ND	10	103	90	110	117	75	125

Mercury by CVAAS

Method: EPA 7471A/SM 3112B I Internal ref.: ME-CA-[ENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury (total)	EHG0032-JUL24	mg/L	0.00001	< 0.00001	ND	20	107	80	120	120	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver (total)	EMS0117-JUL24	mg/L	0.00005	<0.00005	ND	20	104	90	110	97	70	130
Arsenic (total)	EMS0117-JUL24	mg/L	0.0002	<0.0002	3	20	95	90	110	95	70	130
Cadmium (total)	EMS0117-JUL24	mg/L	0.000003	<0.000003	11	20	97	90	110	106	70	130
Cobalt (total)	EMS0117-JUL24	mg/L	0.000004	<0.000004	0	20	92	90	110	96	70	130
Chromium (total)	EMS0117-JUL24	mg/L	0.00008	<0.00008	0	20	97	90	110	110	70	130
Copper (total)	EMS0117-JUL24	mg/L	0.001	<0.001	3	20	93	90	110	98	70	130
Molybdenum (total)	EMS0117-JUL24	mg/L	0.0004	<0.0004	2	20	100	90	110	104	70	130
Nickel (total)	EMS0117-JUL24	mg/L	0.0001	<0.0001	3	20	96	90	110	98	70	130
Lead (total)	EMS0117-JUL24	mg/L	0.00009	<0.00009	5	20	99	90	110	101	70	130
Phosphorus (total)	EMS0117-JUL24	mg/L	0.003	<0.003	13	20	97	90	110	NV	70	130
Antimony (total)	EMS0117-JUL24	mg/L	0.0009	<0.0009	1	20	98	90	110	114	70	130
Selenium (total)	EMS0117-JUL24	mg/L	0.00004	<0.00004	3	20	94	90	110	97	70	130
Tin (total)	EMS0117-JUL24	mg/L	0.00006	<0.00006	5	20	101	90	110	NV	70	130
Zinc (total)	EMS0117-JUL24	mg/L	0.002	<0.002	10	20	95	90	110	119	70	130

QC SUMMARY

Oil & Grease

Method: MOE E3401 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-019

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Oil & Grease (total)	GCM0293-JUL24	mg/L	2	<2	NSS	20	105	75	125			

Oil & Grease-AV/MS

Method: MOE E3401/SM 5520F | Internal ref.: ME-CA-[ENV]GC-LAK-AN-019

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Oil & Grease (animal/vegetable)	GCM0293-JUL24	mg/L	4	< 4	NSS	20	NA	70	130			
Oil & Grease (mineral/synthetic)	GCM0293-JUL24	mg/L	4	< 4	NSS	20	NA	70	130			

pH

Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0304-JUL24	No unit	0.05	NA	0		100			NA		

QC SUMMARY

Phenols by SFA

Method: SM 5530B-D | Internal ref.: ME-CA-IENVISFA-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
4AAP-Phenolics	SKA0123-JUL24	mg/L	0.002	<0.002	1	10	101	80	120	110	75	125

Sulphide by SFA

Method: SM 4500 | Internal ref.: ME-CA-IENVISFA-LAK-AN-008

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Sulphide	SKA0137-JUL24	mg/L	0.02	<0.02	ND	20	98	80	120	NA	75	125

Suspended Solids

Method: SM 2540D | Internal ref.: ME-CA-IENVIEWL-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Suspended Solids	EWL0327-JUL24	mg/L	2	< 2	0	10	102	90	110	NA		

QC SUMMARY

Total Nitrogen

Method: SM 4500-N C/4500-NO3- F | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-002

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Kjeldahl Nitrogen	SKA0136-JUL24	as N mg/L	0.5	<0.5	2	10	95	90	110	81	75	125

QC SUMMARY

Volatile Organics

Method: EPA 5030B/8260C | Internal ref.: ME-CA-[ENVIGC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1,2,2-Tetrachloroethane	GCM0244-JUL24	mg/L	0.0005	<0.0005	ND	30	100	60	130	98	50	140
1,2-Dichlorobenzene	GCM0244-JUL24	mg/L	0.0005	<0.0005	ND	30	99	60	130	97	50	140
1,4-Dichlorobenzene	GCM0244-JUL24	mg/L	0.0005	<0.0005	ND	30	99	60	130	96	50	140
Benzene	GCM0244-JUL24	mg/L	0.0005	<0.0005	ND	30	103	60	130	100	50	140
Chloroform	GCM0244-JUL24	mg/L	0.0005	<0.0005	ND	30	99	60	130	99	50	140
Ethylbenzene	GCM0244-JUL24	mg/L	0.0005	<0.0005	ND	30	98	60	130	96	50	140
m-p-xylene	GCM0244-JUL24	mg/L	0.0005	<0.0005	ND	30	97	60	130	95	50	140
Methylene Chloride	GCM0244-JUL24	mg/L	0.0005	<0.0005	ND	30	100	60	130	97	50	140
o-xylene	GCM0244-JUL24	mg/L	0.0005	<0.0005	ND	30	93	60	130	91	50	140
Tetrachloroethylene (perchloroethylene)	GCM0244-JUL24	mg/L	0.0005	<0.0005	ND	30	100	60	130	99	50	140
Toluene	GCM0244-JUL24	mg/L	0.0005	<0.0005	ND	30	99	60	130	98	50	140
Trichloroethylene	GCM0244-JUL24	mg/L	0.0005	<0.0005	ND	30	97	60	130	96	50	140

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Results relate only to the sample tested.
Data reported represent the sample as submitted to SGS. Solid samples expressed on a dry weight basis.
"Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.
Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the "Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act and Excess Soil Quality" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated.

SGS Canada Inc. statement of conformity decision rule does not consider uncertainty when analytical results are compared to a specified standard or regulation.

This report supersedes all previous versions.

-- End of Analytical Report --

SGS

Request for Laboratory Services and CHAIN OF CUSTODY

No: 039206

Industries & Environment - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

Page ____ of ____

Laboratory Information Section - Lab use only

Received By: EO
Received Date: 7/12/24 (mm/dd/yy)
Received Time: 10:50 (hr : min)
Received By (signature):
Custody Seal Present: Yes ☑ No ☐
Custody Seal Intact: Yes ☑ No ☐
Cooling Agent Present: Yes ☑ No ☐ Type: ICE
Temperature Upon Receipt (°C): 6 x 3
LAB LIMS #: CA40111-JUL24

REPORT INFORMATION

Company: SOIL ENG. LTD.
Contact: GURKARANBIR SINGH
Address: 90 West Beaver Creek Rd., Richmond Hill ON.
Phone: 519-731-6442
Fax:
Email: gurkaranbir.singh@soilengineers.ltd.com

INVOICE INFORMATION

☑ (same as Report Information)
Company:
Contact:
Address:
Phone:
Email:

Quotation #:
P.O. #: 2405-W131
Project #:
Site Location/ID: 325 King St., Niagara on the Lake

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days)
TAT's are quoted in business days (exclude statutory holidays & weekends).
Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days
PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date:

*NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

☐ O.Reg 153/04 ☐ O.Reg 406/19
☐ Table 1 ☐ Res/Park Soil Texture:
☐ Table 2 ☐ Ind/Com ☐ Coarse
☐ Table 3 ☐ Agri/Other ☐ Medium/Fine
☐ Table ____ Appx. ____
Soil Volume ☐ <350m3 ☐ >350m3

Other Regulations:
☐ Reg 347/558 (3 Day min TAT)
☐ PWQO ☐ MMER
☐ CCME ☐ Other:
☐ MISA
☐ ODWS Not Reportable *See note

Sewer By-Law:
☑ Sanitary
☑ Storm
Municipality: Niagara

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	M&I: Metals & Inorganics (incl CrVI, CN, Hg pH,(B(HWS),EC,SAR–soil) (Cl, Na–water)	M&I: Full Metals Suite (ICP metals plus B(HWS-soil only) Hg, CrVI	M&I: ICP Metals only Sb,As,Ba,Be,B,Cd, Cr,Co,Cu,Pb,Mo,Ni,Se,Ag,Tl,U,V,Zn	SVOC: PAHs only	SVOC: SVOCs all incl PAHs, ABNs, CPs	PCB: PCBs Total ☐ Aroclor ☐	PHC: F1-F4 + BTEX	PHC: F1-F4 only no BTEX	VOC: VOCs all incl BTEX	VOC: BTEX only	Pest: Pesticides Organochlorine or specify other	Other (please specify)	Other	Other	Other	Other: Sewer Use: Specify pkg:	Other: Water Characterization Pkg General ☐ Extended ☐	SPLP: Specify tests ☐ Metals ☐ VOC ☐ 1,4-Dioxane ☐ OCP ☐ ABN	TCLP: Specify tests ☐ M&I ☐ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ Ignit.	COMMENTS:
1	BH/MW 1	July 11, 2024	1:00pm	14	GW	N																			
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									

Observations/Comments/Special Instructions

Sampled By (NAME): GS Signature:
Relinquished by (NAME): GS Signature:
Date: July 11 2024 (mm/dd/yy)
Date: July 11 2024 (mm/dd/yy)

Pink Copy - Client
Yellow & White Copy - SGS

Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE
90 WEST BEAVER CREEK ROAD, SUITE 100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

BARRIE	MISSISSAUGA	OSHAWA	NEWMARKET	MUSKOKA	HAMILTON
TEL: (705) 721-7863	TEL: (905) 542-7605	TEL: (905) 440-2040	TEL: (905) 853-0647	TEL: (705) 684-4242	TEL: (905) 777-7956
FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 542-2769

APPENDIX 'E'

SHORT-TERM DEWATERING AND LONG-TERM FOUNDATION DRAINAGE FLOW RATE ESTIMATES AND REVIEWED PLANS

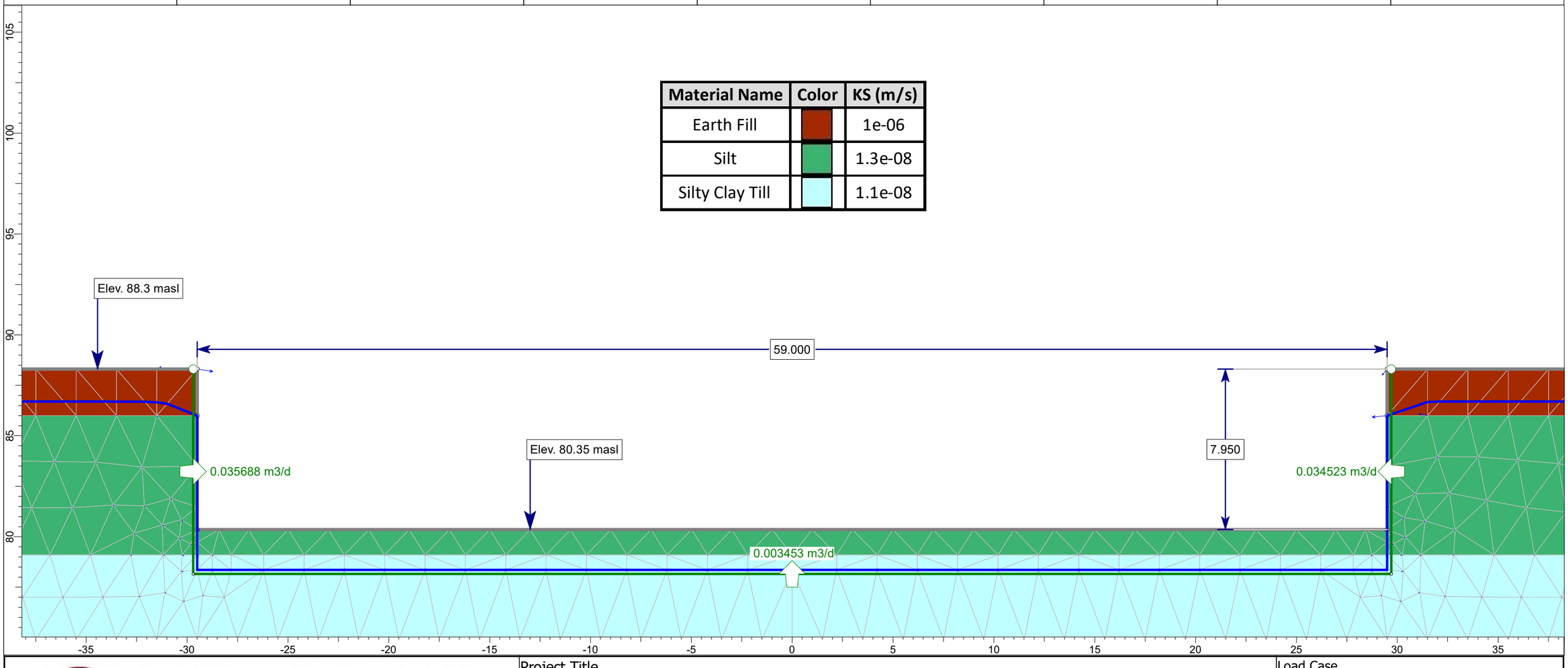
REFERENCE NO. 2405-W131

Groundwater Control Needs
Summary of Assumptions and Proposed Excavation Details

Proposed Excavation Location	Proposed Hotel Development
Shoring System	Permeable Shoring
Excavation Dimensions (m)	106.0 x 59.0

Ground Surface Elevation (masl)	Lowest Finished Floor Elevation (masl)	Base of Excavation (masl)	Base of Footings (masl)	Base of Elevator Pit (masl)	Groundwater Table (masl)	Groundwater Flow Rate (L/Day) - 2.0 SF	Storm Event Flow Rate (L/Day)	Total Construction Dewatering Flow Rate (L/Day) - 2.0 SF
88.3	80.85	80.35	79.65	79.35	86.7	24,000.0	192,000.0	216,000.0

Material Name	Color	KS (m/s)
Earth Fill		1e-06
Silt		1.3e-08
Silty Clay Till		1.1e-08



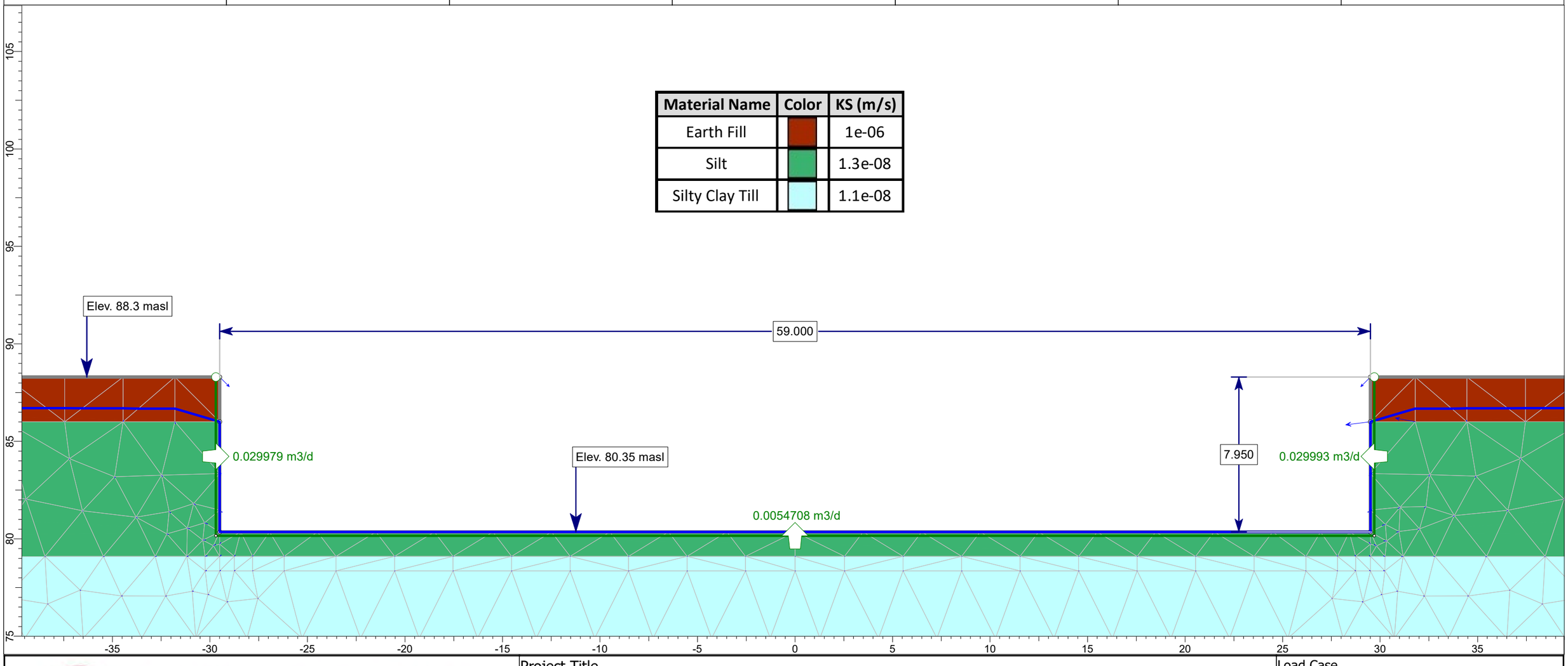
Soil Engineers Ltd.

Project Title	HG Assessment			Load Case	Short-Term Construction Dewatering
Location	325 King Street, NOTL				
Drawn By	TA	Checked By	NA	Scale	1:188
Date	2024-07-29, 11:38:14 AM			Reference No.	2405-W131
Drawing No.	1				

Groundwater Control Needs
Summary of Assumptions and Proposed Excavation Details

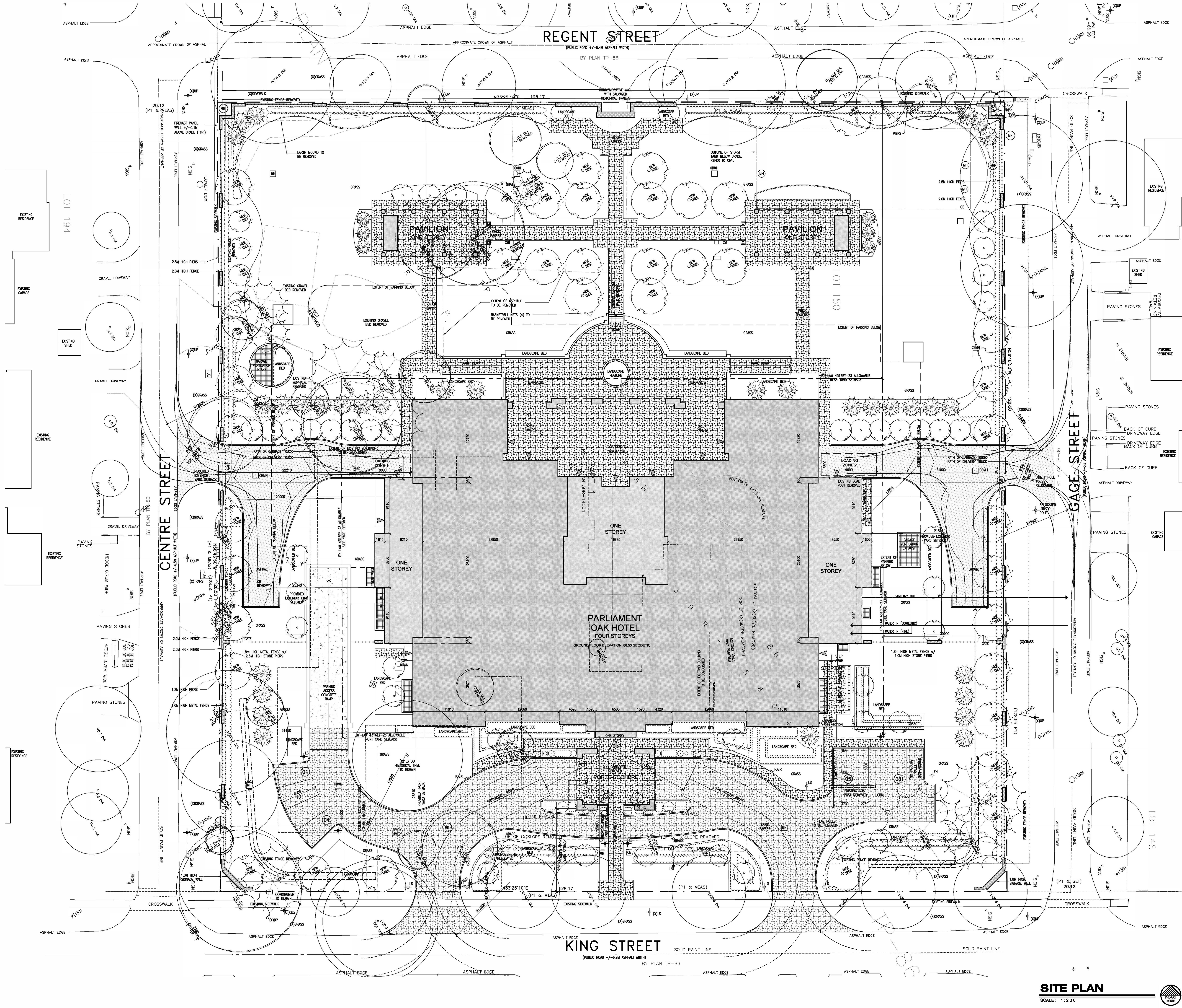
Proposed Excavation Location	Proposed Hotel Development
Shoring System	Permeable Shoring
Excavation Dimensions (m)	106.0 x 59.0

Ground Surface Elevation (masl)	Lowest Finished Floor Elevation (masl)	Base of Drainage Layer (masl)	GroundWater Table (masl)	Groundwater flow rate L/Day - 2.0 SF	Storm Event Flow Rate L/Day	Total Construction Dewatering Flow Rate (L/Day) - 2.0 SF
88.3	80.85	80.35	86.7	21,000.0	5,100.0	26,100.0



Soil Engineers Ltd.

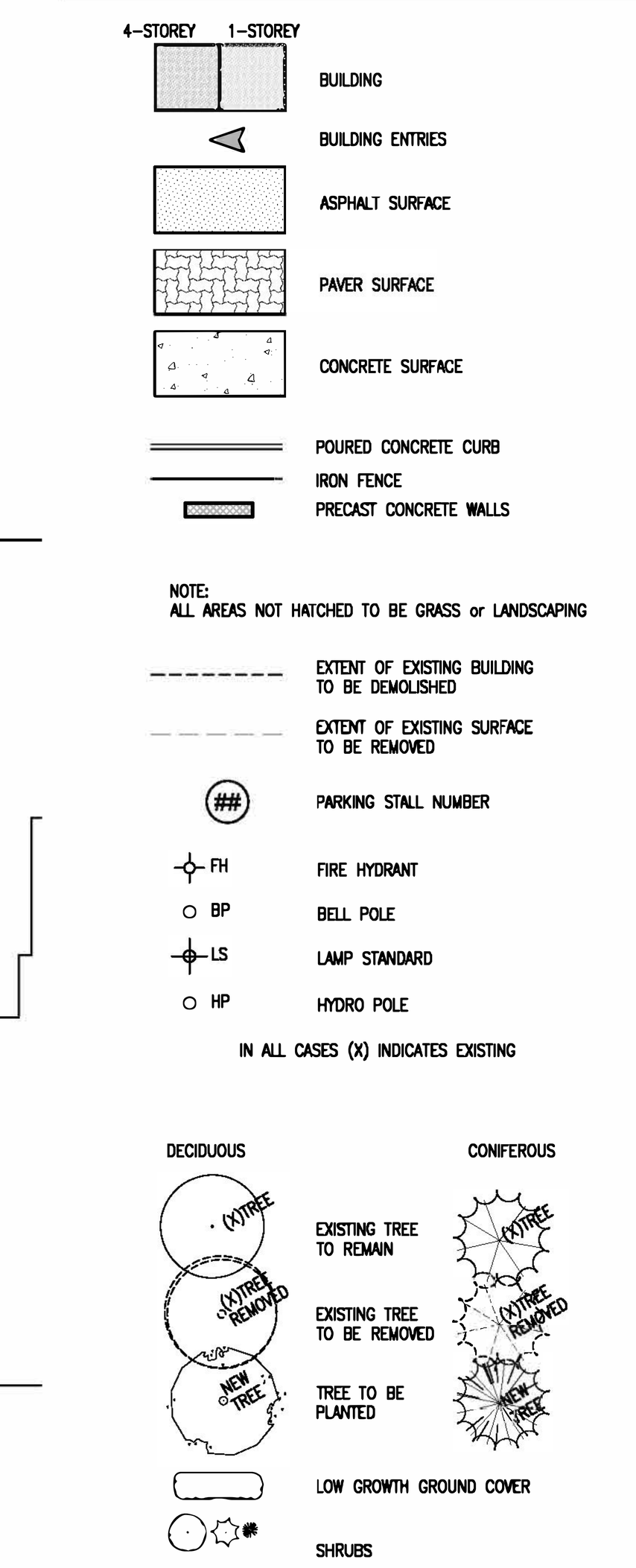
Project Title	HG Assessment		Load Case: Long-Term Foundation Drainage
Location	325 King Street, NOTL		
Drawn By: TA	Checked By: NA	Scale: 1:194	
Date: 2024-07-29, 11:38:14 AM		Reference No.: 2405-W131	Drawing No.: 2



SITE PLAN

SCALE : 1:200

LEGEND



FOR LANDSCAPING REFER TO DRAWINGS PRODUCED BY:
STRYBOS BARRON KING LANDSCAPE ARCHITECTURE
5770 HURONTARIO STREET, SUITE 320,
MISSISSAUGA, ONTARIO
L5R 3G5

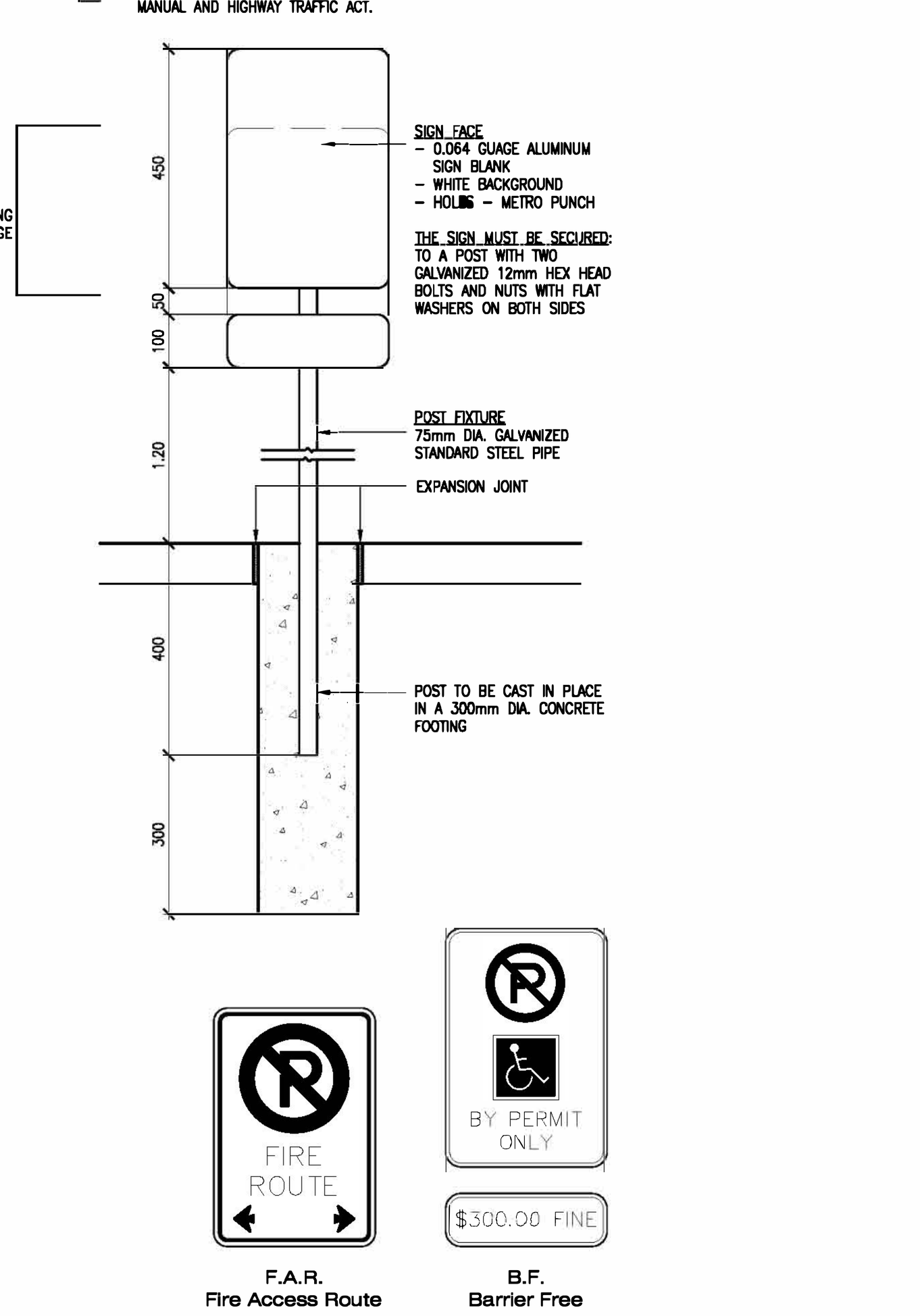
TYPICAL SIGNAGE

SIGNAGE NOTES:

ALL PARKING SPACES FOR BARRIER-FREE SHALL BE INDICATED WITH TYPICAL BARRIER FREE SIGNAGE CENTERED AT EACH PARKING SPACE – THESE SIGNS SHALL BE SUPPLIED & INSTALLED BY THE GENERAL CONTRACTOR
THE SIGN SHALL BE MOUNTED AT A HEIGHT OF 1.0–1.5 METERS FROM TOP OF CURB TO BOTTOM OF SIGN & CENTERED WITHIN THE PARKING SPACE.

THE GENERAL CONTRACTOR SHALL SUPPLY ALL REQUIRED FIRE ROUTE SIGNS. THESE SIGNS SHALL BE POSTED IN COMPLIANCE WITH THE HIGHWAY TRAFFIC ACT AND OR THE ONTARIO TRAFFIC MANUAL; WITH A MAX. SPACING OF 30M

ALL STOP, BARRIER FREE, STAFF PARKING, NO OVERNIGHT PARKING AND ONE WAY SIGNS SHALL BE SUPPLIED & INSTALLED BY THE GENERAL CONTRACTOR, – ALL SIGNS SHALL CONFORM TO THE ONTARIO TRAFFIC MANUAL AND HIGHWAY TRAFFIC ACT.



NOTE

VEHICULAR MOVEMENT LIMITS FOR GARBAGE AND DELIVERY TRUCKS AS PROVIDED BY:
R.V. ANDERSON ASSOCIATES LIMITED
43 CHURCH STREET, SUITE 104,
ST. CATHARINES, ON,
L2R 7E1

KEY PLAN

SCALE : NOT TO SCALE

SURVEY NOTE:

LOTS 149, 150, 191 & 192, TP PLAN 86 (BEING PART 1 ON PLAN 30R-15804,
325 KING STREET, TOWN OF NIAGARA-ON-THE-LAKE, REGIONAL MUNICIPALITY OF NIAGARA

BOUNDARIES, SURVEY, TOPOGRAPHIC, EXISTING SITE FEATURES:
J.D. BARNES LIMITED, 4318 PORTAGE ROAD – UNIT 2, NIAGARA FALLS, ON, L2E 6A4

SITE STATISTICS

LOT AREA	16,456.58 m²
BUILDING GROUND COVER	
Parliament Oak Hotel	3,364.77 m²
Pavilion	129.36 m²
Gazebo	46.57 m²
Total Building Coverage	3,540.70 m²
21.5% of Lot Area (25% Permitted)	
DRIVEWAY/ ASPHALT AREA	
12.0% of Lot Area	1,970.52 m²
LANDSCAPED AREA	
66.5% of Lot Area	10,945.36 m²

PARKING REQUIREMENTS

Hotel, Motel	= 1 per quest room in addition to other uses	129	Rooms	129 Spaces
Restaurant	= 1 per 18.5 m² GFLA	775 m²	Restaurant, Bar/ Lounge, Private Bar/ Lounge & Breakfast Room	42 Spaces
Restaurant Outdoor Patio	= 1 per 30 m² GFLA of outdoor patio area in addition to the requirements for a restaurant or take-out restaurant	195 m²	Patio	7 Spaces
Conference Rooms or Areas Used in Conjunction with Other Uses	= 1 per 18.5 m²	551.9 m²	Upper Canada Banquet Room, Lower Canada Banquet Room, Simcoe Meeting Room	30 Spaces
Spa	= 1 per 15.0 m²	313.3 m²		21 Spaces
Office	= 1 per 28.0 m²	84.4 m²		4 spaces
TOTAL PARKING REQUIRED				233 Spaces
REQUIRED DESIGNATED ACCESSIBLE PARKING SPACES				7 Designated Spaces

PARKING PROVIDED

STANDARD PARKING SPACE (2.75m x 6.00m TYPICAL)	
AT GRADE	7 Spaces
BELOW GRADE	234 Spaces
DESIGNATED ACCESSIBLE PARKING	
AT GRADE	1 Spaces
BELOW GRADE	6 Spaces
TOTAL PARKING PROVIDED	248 Spaces

Peter J. Lesdow
architect
4465 Drummond Road, Unit 11, Niagara Falls, Ontario L2E 6C5
telephone: 905-357-1112
e-mail: plesdow@cogeco.net

SITE PLAN & STATISTICS

DATE	REVISIONS	DATE	REVISIONS
Jan. 04/ 23	REDESIGN FOR PRE-CONSULTATION	Oct. 26/ 23	O.P.A./Z.B.A. ADDED INFORMATION
Jan. 31/ 23	SHADOW STUDY	Nov. 16/ 23	ENLARGED COVERED TERRACE
Feb. 01/ 23	FOR O.P.A./Z.B.A SUBMISSIONS	Apr. 08/ 24	REVISED PARKING GARAGE
May 29/ 23	FOR CONSULTANT COORDINATION	May 22/ 24	COORDINATION CIRCULATION
Jun. 07/ 23	FENCE REVISION	July 06/ 24	COORDINATION CIRCULATION
Sep. 21/ 23	ADDED INFORMATION		

PARLIAMENT OAK HOTEL

325 King Street
Niagara-on-the-Lake

DATE:	Nov. 18/ 22
SCALE:	1:100
DRAWN BY:	MRW
CHECK BY:	PJL

22 – 13

A101

BASEMENT 2 FLOOR PLAN

SCALE: 1:100

Peter J. Lesdow
architect

BASEMENT 2 FLOOR PLAN

PARLIAMENT OAK HOTEL
325 King Street
Niagara-on-the-Lake

DATE: Nov. 18/22
SCALE: 1:100
DRAWN BY: MRW
CHECK BY: PJL

22 – 13

A104

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BASEMENT 1 FLOOR PLAN

DATE	REVISIONS	DATE	REVISIONS
Dec. 07/ 22	FOR PRE-CONSULTATION	May 22/ 24	COORDINATION CIRCULATION
Jan. 04/ 23	REDESIGN FOR PRE-CONSULTATION	July 06/ 24	COORDINATION CIRCULATION
Feb. 01/ 23	FOR O.P.A/Z.B.A SUBMISSIONS		
May 29/ 23	FOR CONSULTANT COORDINATION		
Jun. 16/ 23	FOR HOTEL CONSULTANT		
Oct. 26/ 23	O.P.A/Z.B.A ADDED INFORMATION		

PARLIAMENT OAK HOTEL

325 King Street
Niagara-on-the-Lake

DATE: Nov. 18/ 22
SCALE: 1:100
DRAWN BY: MRW
CHECK BY: PJL

22 – 13

A106

SECTION A-A
SCALE: 1:100

SECTION B-B
SCALE: 1:100

SECTION C-C
SCALE: 1:100

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BUILDING SECTIONS
A-A, B-B, C-C

DATE	REVISIONS	DATE	REVISIONS
Dec. 07/ 22	FOR PRE-CONSULTATION	May 22/ 24	COORDINATION CIRCULATION
Jan. 04/ 23	REDESIGN FOR PRE-CONSULTATION	July 06/ 24	COORDINATION CIRCULATION
Feb. 01/ 23	FOR O.P.A/Z.B.A SUBMISSIONS		
May 29/ 23	FOR CONSULTANT COORDINATION		
Jun. 16/ 23	FOR HOTEL CONSULTANT		
Oct. 26/ 23	O.P.A./Z.B.A. ADDED INFORMATION		

PARLIAMENT OAK HOTEL
325 King Street
Niagara-on-the-Lake

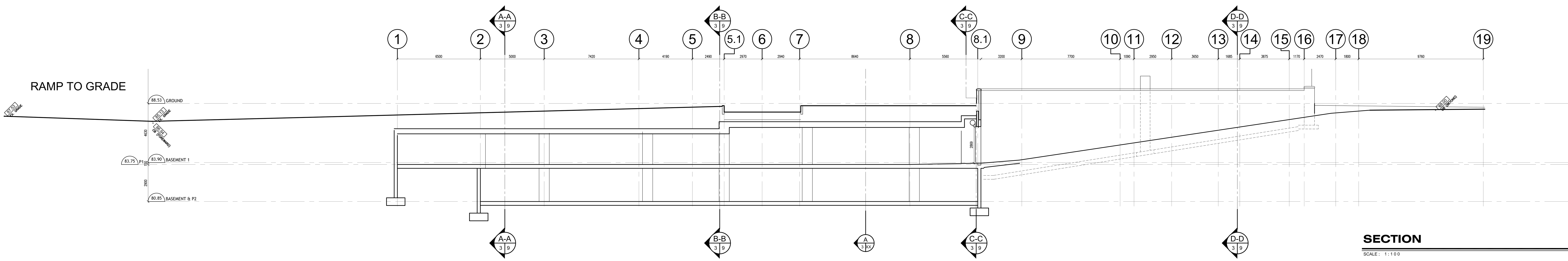
DATE:	Nov. 18/ 22
SCALE:	1:100
DRAWN BY:	MRW
CHECK BY:	PJL

22 – 13

A301

SECTION D-D

SCALE: 1:100



SECTION E-E

SCALE: 1:100

Peter J. Lesdow
architect

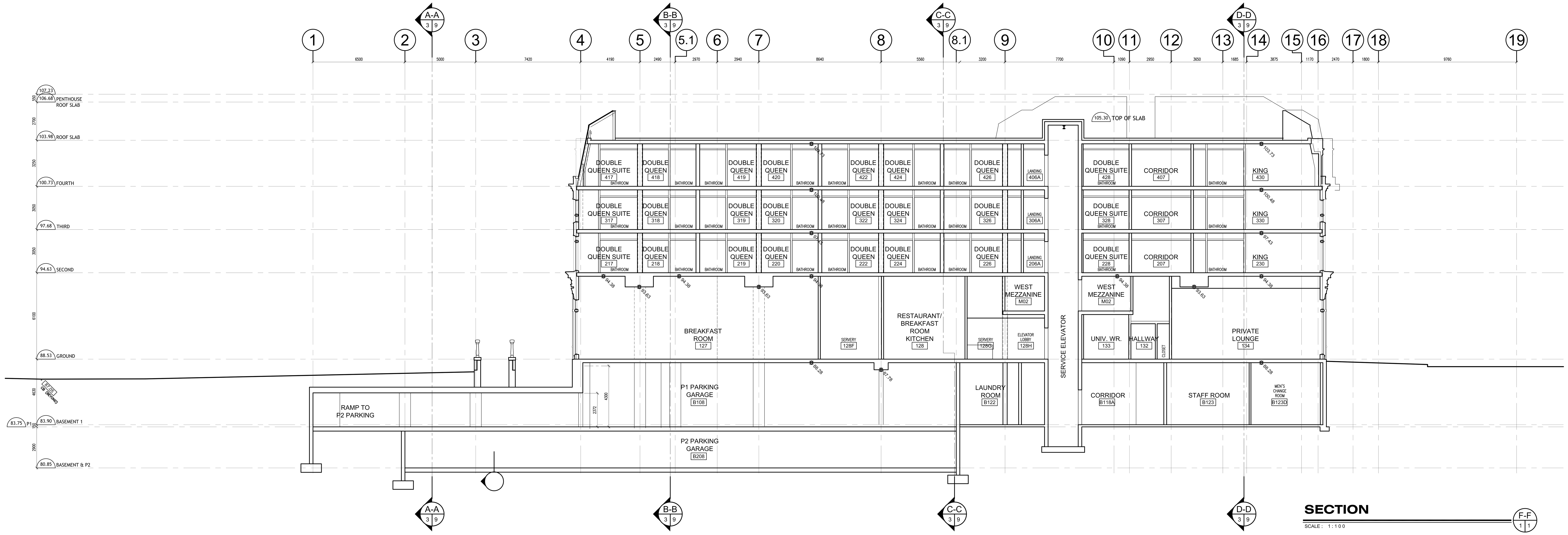
BUILDING SECTIONS D-D, E-E

PARLIAMENT OAK HOTEL
325 King Street
Niagara-on-the-Lake

DATE: Nov. 18/ 22
SCALE: 1:100
DRAWN BY: MRW
CHECK BY: PJL

22 - 13

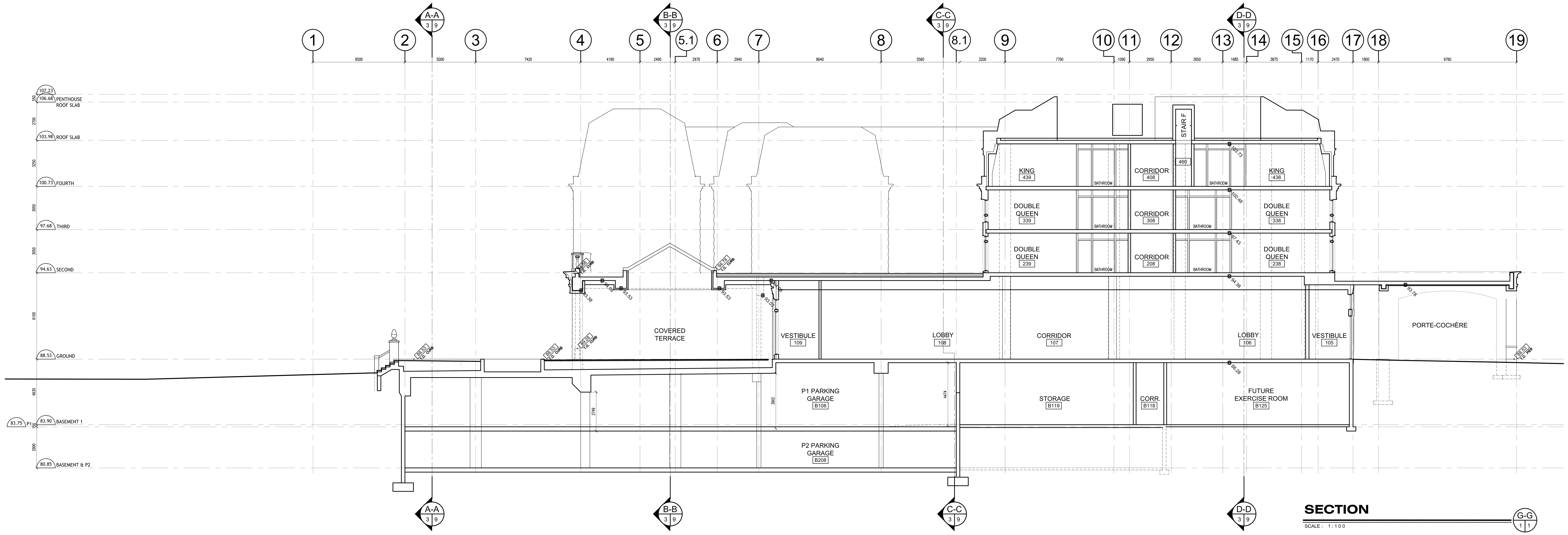
A302



SECTION

SCALE: 1:100

F-F



SECTION

SCALE: 1:100

G-G

Peter J. Lesdow
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BUILDING SECTIONS F-F, G-G

DATE	REVISIONS	DATE	REVISIONS
Dec. 07/ 22	FOR PRE-CONSULTATION	May 22/ 24	COORDINATION CIRCULATION
Jan. 04/ 23	REDESIGN FOR PRE-CONSULTATION	July 06/ 24	COORDINATION CIRCULATION
Feb. 01/ 23	FOR O.P.A/Z.B.A SUBMISSIONS		
May 29/ 23	FOR CONSULTANT COORDINATION		
Jun. 16/ 23	FOR HOTEL CONSULTANT		
Oct. 26/ 23	O.P.A./Z.B.A. ADDED INFORMATION		

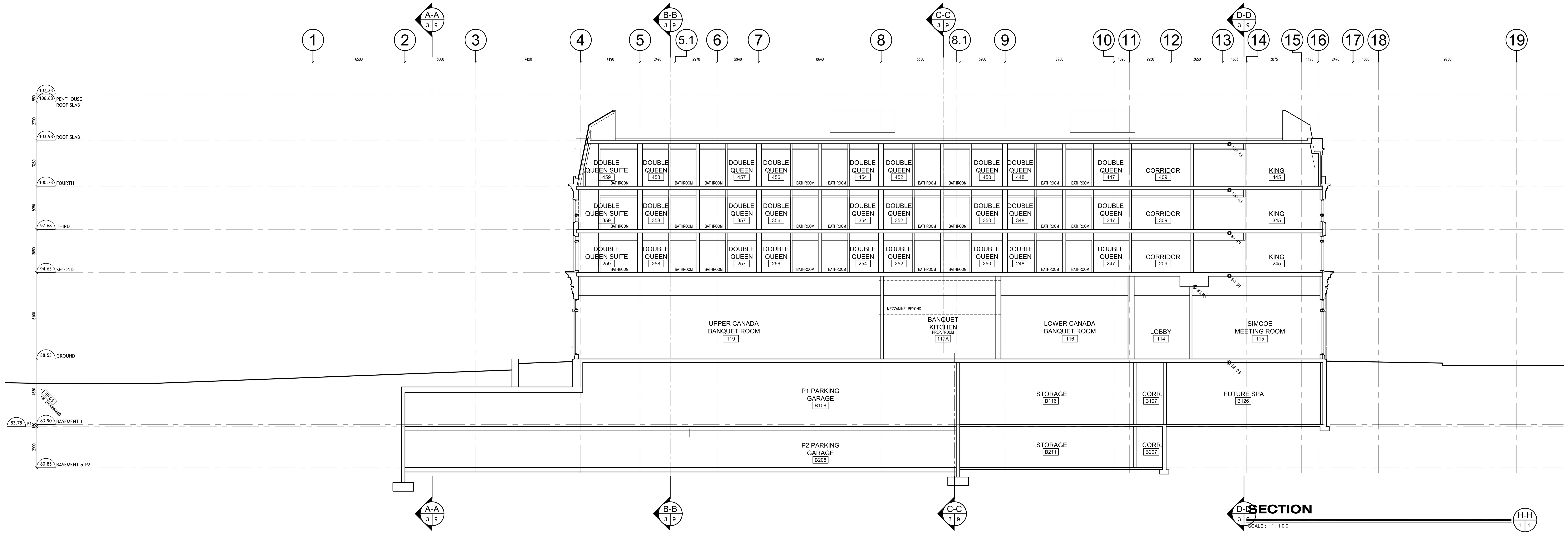
PARLIAMENT OAK HOTEL

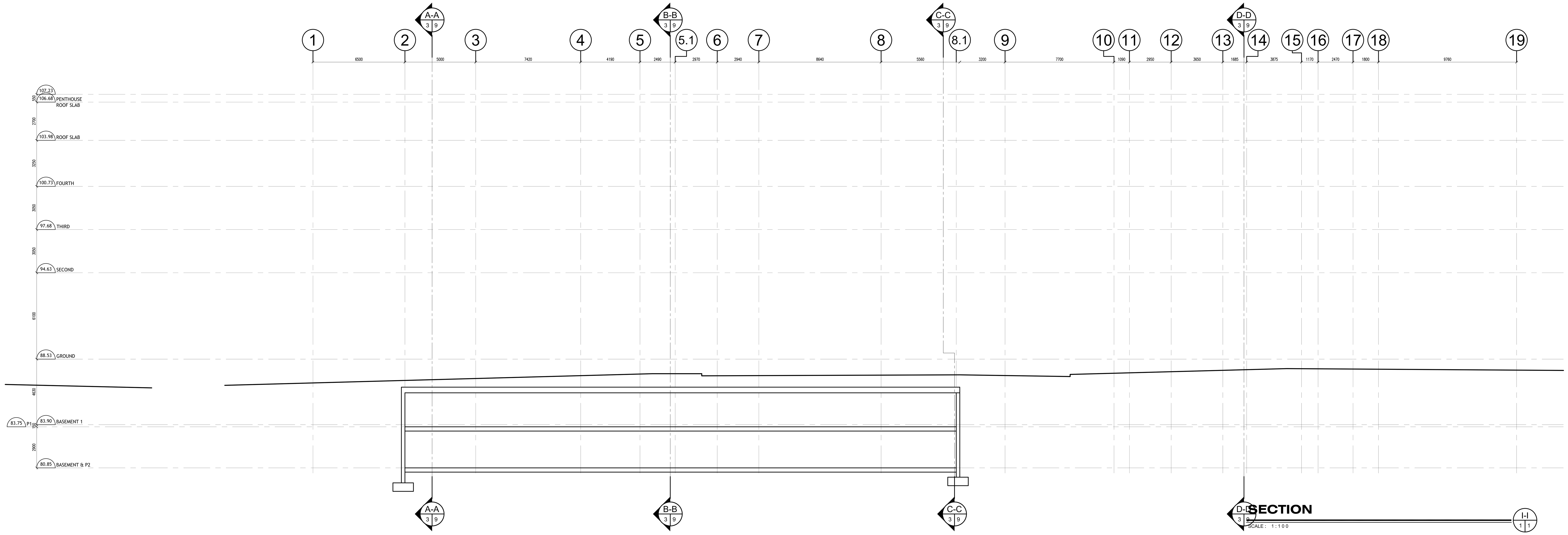
325 King Street
Niagara-on-the-Lake

DATE: Nov. 18/ 22
SCALE: 1:100
DRAWN BY: MRW
CHECK BY: PJL

22 – 13

A303





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telephone: 905-357-1112 e-mail: plesdow@cogeco.net

BUILDING SECTIONS
H-H, I-I

DATE	REVISIONS	DATE	REVISIONS
Dec. 07/ 22	FOR PRE-CONSULTATION	May 22/ 24	COORDINATION CIRCULATION
Jan. 04/ 23	REDESIGN FOR PRE-CONSULTATION	July 06/ 24	COORDINATION CIRCULATION
Feb. 01/ 23	FOR O.P.A/Z.B.A SUBMISSIONS		
May 29/ 23	FOR CONSULTANT COORDINATION		
Jun. 16/ 23	FOR HOTEL CONSULTANT		
Oct. 26/ 23	O.P.A/Z.B.A. ADDED INFORMATION		

PARLIAMENT OAK HOTEL
325 King Street
Niagara-on-the-Lake

DATE: Nov. 18/ 22
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DRAWN BY: MRW
CHECK BY: PJL

22 – 13

A304