Geotechnical Investigation
Proposed Building Addition
280 Laurier Avenue East
Ottawa, Ontario

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Executive Summary

EXP Services Inc. (EXP) is completed the geotechnical investigation for the proposed addition to the building located at 280 Laurier Avenue East, Ottawa, Ontario (Figure 1). Terms and conditions of this assignment were outlined in EXP's proposal number: OTT-21013283-A0 dated June 22, 2021 and authorized by Smart Living Properties (the client) via EXP work authorization form on June 22, 2021.

The proposed addition will comprise of three storey structure with one basement level to be constructed on the east side of the existing six storey building. The ground floor slab and basement elevations of the proposed addition are expected to match the elevation of the existing building.

The fieldwork for the geotechnical investigation was completed on July 8 to 9, 2021 and consists of four (4) boreholes (Borehole Nos. 1A and 1 to 3) advanced to termination/cone refusal depths ranging between 4.6 m to 16.3 m. The fieldwork was supervised on a full-time basis by a representative from EXP.

The geotechnical investigation revealed the subsurface conditions to comprise of asphaltic concrete pavement underlain by sand with gravel to silty sand with gravel fill which extends to depths of 0.3 m to 1.7 m below existing grade (Elevation 69.6 m to Elevation 68.5 m). The fill is underlain by native clay which extends to 12.4 m depth (Elevation 57.8 m) in Borehole No. 2 and to the termination depths of 4.6 m to 8.2 m (Elevation 65.4 m to Elevation 61.8 m) in Borehole Nos. 1A, 1, and 3. The clay in Borehole No. 2 is underlain by silty gravel with sand to silty sand with gravel glacial till which extends to the sampling termination depth of 15.8 m below ground surface (Elevation 54.4 m). The groundwater level measurements indicate the groundwater level is at 4.1 m and 7.2 m depth below the existing ground surface (Elevation 65.9m and Elevation 62.7 m).

Based on the borehole information and Table 4.1.8.4.A in the 2012 Ontario Building Code (as amended May 2, 2019), the site classification for seismic site response is **Class D** and the subsurface soils are not susceptible to liquefaction during a seismic event.

The site is underlain by a sensitive marine clay deposit that is prone to consolidation settlement if overstressed by loads imposed on it by site grade raise, foundations and by the permanent lowering of the groundwater level following construction. Since the site is located in a well-established developed area of the city of Ottawa, raising the grades at the site or lowering of the groundwater are not anticipated as part of the proposed development.

Based on a review of the borehole information, the proposed new building addition may be supported by strip and square pad footings designed to bear on the native clay. Strip footings having a maximum width of 1.0 m founded on the surface of the native clay contacted in the boreholes at a maximum 2.5 m depth (Elevation 68.2) may be designed for a bearing pressure at SLS of 90 kPa and factored geotechnical resistance at ULS of 140 kPa. Square pad footings having a width and length of 2.0 m founded on the surface of the native clay may be designed for a bearing pressure at SLS of 110 kPa and factored geotechnical resistance at ULS of 160 kPa. Footings of the proposed addition must be founded at the same depth as the existing footings.

Footings at different elevations should be located such that the higher footings are set below a line drawn up at 10 horizontal to 7 vertical (10H:7V) from the near edge of the lower footing. This concept should also be applied to service excavation, etc. to ensure that undermining is not a problem.

It should be noted that the exposed clay subgrade surface is susceptible to disturbance due to movement of workers and prevailing weather conditions during construction. Therefore, it is recommended the approved footing beds should be protected with a 50 mm thick concrete mud slab.

A minimum of 1.5 m of earth cover should be provided to the exterior foundations of heated structures to protect them from damage due to frost penetration. The frost cover should be increased to 2.1 m for unheated structures if snow will not be removed from their vicinity and to 2.4 m if snow will be removed from the vicinity of the structure. When earth cover is less than the minimum required, an equivalent thermal combination of earth cover and rigid insulation or rigid insulation alone should be provided.

The basement floor for the proposed new building addition may be designed as a slab-on-grade set on the native undisturbed clay or on a minimum 300 mm thick engineered fill pad consisting of Ontario Provincial Standard Specification (OPSS) Granular B Type II compacted to 98 percent standard Proctor maximum dry density (SPMDD). The floor slab should be set on a bed of well-packed 19 mm clear stone at least 200 mm thick placed on the engineered fill pad or on native clay.

A perimeter drainage system should be installed around the proposed new building addition. The need for an underfloor drainage system will have to be determined once the design elevation of the lowest floor of the new building addition (basement floor) has been established and compared with the groundwater elevation and likely will be required.

The subsurface basement walls of the proposed building will be subjected to lateral static and dynamic (seismic) earth forces. The lateral static earth thrust against the subsurface walls may be computed using the expressions provided in the body of the report.

It is anticipated that excavations may be undertaken using conventional equipment capable of removing construction debris within the fill (such as brick fragments). All excavation work should be completed in accordance with the Occupational Health and Safety Act (OHSA), Ontario, Reg. 213/91. Based on the definitions provided in OHSA, the subsurface soils at the site are considered to be Type 3 soil. As per OHSA, the sidewalls of open cut excavations undertaken within Type 3 soil, must be sloped back at 1H:1V from the bottom of the excavation. Within zones of persistent seepage, the excavation side slopes are expected to slough and eventually stabilize at 2H:1V to 3H:1V from the bottom of the excavation. Pre-condition survey of the surrounding buildings as well vibration monitoring are recommended to be completed as part of the proposed construction.

If side slopes cannot be achieved due to space restrictions, such as the proximity of the excavation to neighboring structures (existing buildings) and infrastructure and streets, the excavation for the proposed new building addition would have to be undertaken within the confines of an engineered support system (shoring system).

Seepage of the surface and subsurface water into these excavations is anticipated. However, it should be possible to collect water entering the excavations at low points and to remove it by conventional pumping techniques. In areas of high infiltration or in areas where more permeable soil layers may exist, a higher seepage rate should be anticipated and may require high capacity pumps to keep the excavation dry.

The excavations for foundations are anticipated to be above the groundwater level and as such the removal of groundwater from the excavation is anticipated to be minimal. In this case, groundwater removal during the short-term construction activities is not anticipated to impact existing neighboring structures (buildings) and infrastructure.

It is anticipated that the majority of the material required for underfloor fill and backfilling purposes would have to be imported and should preferably conform to the specifications provided in the body of the report.

The above and other related considerations are discussed in greater detail in the attached report.

1. Introduction

EXP Services Inc. (EXP) is pleased to present the results of the geotechnical investigation completed for the proposed addition to the building located at 280 Laurier Avenue East, Ottawa, Ontario (Figure 1). Terms and conditions of this assignment were outlined in EXP's proposal number: OTT-21013283-A0 dated June 22, 2021 and authorized by Smart Living Properties (the client) via the EXP work authorization form on June 22, 2021.

It is our understanding that plans call for the construction of a three (3) storey addition with a basement to be constructed on the east side of the existing six (6) storey building currently situated at the site. It is assumed the footings of the existing building are approximately at a depth of 2.5 m below the existing grade.. It is further assumed that the new building addition footings and basement floor slab elevations will match those of the existing building. Since the site is located in a well-established developed area of the city of Ottawa, minimal to no raise in the site grades are anticipated for this project.

Information regarding the design elevation of the lowest finished floor (basement floor) of the proposed building addition and final site grades were not available at the time of preparation of this report. This report should be updated when this information becomes available.

The geotechnical investigation was undertaken to:

a) Establish the subsurface soil and groundwater conditions at the four (4) boreholes located on the site;

b) Provide classification of the site for seismic design in accordance with requirements of the 2012 Ontario Building Code (OBC) as amended May 2, 2019 and assess the liquefication potential of the subsurface soils in a seismic event;

c) Discuss grade raise restrictions;

d) Provide the bearing pressure at Serviceability Limit State (SLS) and factored geotechnical resistance at Ultimate Limit State (ULS) of the most suitable type of foundation for the proposed building addition, as well as anticipated total and differential settlements;

e) Discuss lateral earth pressure against subsurface walls;

f) Comment on slab-on-grade construction and permanent drainage requirements;

g) Discuss excavation conditions and dewatering requirements during construction of the foundations for the proposed building addition;

h) Comment on backfilling requirements and suitability of the on-site soils for backfilling purposes; and,

i) Comment on subsurface concrete requirements and the corrosion potential of subsurface soils to buried metal structures/members.

The comments and recommendations given in this report assume that the above-described design concept will proceed into construction. If changes are made either in the design phase or during construction, this office must be retained to review these modifications. The result of this review may be a modification of our recommendations or

it may require additional field or laboratory work to check whether the changes are acceptable from a geotechnical viewpoint.

2. Site Description

The property is located in a well-established developed area of the city of Ottawa on the south side of Laurier Avenue East between Sweetland Avenue and Russell Avenue. The site for the proposed building addition is currently occupied by an asphalt paved parking lot.

The neighboring property east and south sides of the sites are occupied by two (2) story residential buildings likely containing one basement level.

The ground surface of the site is generally flat with approximate ground surface elevations of Elevation 70.20 m to Elevation 69.87 m at the borehole locations.

3. Procedure

The fieldwork for the geotechnical investigation was completed on July 8 to 9, 2021 and consists of four (4) boreholes (Borehole Nos. 1A and 1 to 3) advanced to termination/cone refusal depths of 4.6 m to 16.3 m. The fieldwork was supervised on a full-time basis by a representative from EXP.

The geodetic elevations and locations of the boreholes were established on site by EXP and are shown in Figure 2.

Prior to the fieldwork, the locations of the boreholes were cleared of any public and private underground services. The boreholes were drilled using a truck-mounted drill rig operated by a drilling specialist subcontracted to EXP. Standard penetration tests (SPTs) were performed in both boreholes at 0.8 m to 1.6 m depth intervals and the soil samples were retrieved by the split-barrel sampler. Field vanes and pocket penetrometer testing were conducted in the cohesive soils. A dynamic cone penetration test (DCPT) was conducted in Borehole No. 2 from a 15.8 m depth to a cone refusal depth of 16.3 m below existing grade.

A 19 mm diameter standpipe with slotted section was installed in Borehole Nos. 1 and 3 whereas a 51 mm diameter monitoring well with screened section was installed in Borehole No. 1A for long-term monitoring/sampling of the groundwater level. The standpipes and monitoring well were installed in accordance with EXP standard practice and the installation configuration is documented on the respective borehole log. The boreholes were backfilled upon completion of drilling and the installation of the standpipes and monitoring well.

All soil samples were visually examined in the field for textural classification, logged, preserved in plastic bags and identified. On completion of the fieldwork, all the soil samples were transported to the EXP laboratory in Ottawa where they were visually examined by a geotechnical engineer and the borehole logs were prepared. The engineer also assigned the laboratory testing which consisted of performing the following tests on the soil samples:

Natural Moisture Content .....30 Tests
Natural Unit Weight.....4 Tests
Grain Size Analysis.....3 Tests
Atterberg Limits.....3 Tests
Chemical Analysis (pH, sulphate, chloride) ..... 2 Tests

4. Subsurface Soil and Groundwater Conditions

A detailed description of the geotechnical conditions encountered in the boreholes is given on the borehole logs, Figures 3 to 6. The borehole logs and related information depict subsurface conditions only at the specific locations and times indicated. Subsurface conditions and water levels at other locations may differ from conditions at the locations where sampling was conducted. The passage of time may also result in changes in the conditions interpreted to exist at the locations where sampling was conducted.

The boreholes were drilled to provide representation of subsurface conditions as part of a geotechnical exploration program and are not intended to provide evidence of environmental conditions.

It should be noted that the soil boundaries indicated on the borehole logs are intended to reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. The "Notes on Sample Descriptions" preceding the borehole logs forms an integral part of this report and should be read in conjunction with this report.

A review of the borehole logs indicates the following subsurface soil conditions with depth and groundwater level measurements.

4.1 Asphalt Pavement

A 50 mm thick asphalt pavement was encountered at ground surface in Borehole Nos. 1 to 3.

4.2 Fill

Fill was contacted underneath the asphalt pavement in Borehole Nos. 1 to 3 and extends to depths of 0.3 m to 1.7 m below existing grade (Elevation 69.6 m to Elevation 68.5 m). The fill material comprises of sand with gravel to silty sand with gravel and contains brick fragments in Borehole No. 2. The fill material is in a loose to very dense state as indicated by the SPT N-values of 7 to 63 per 250 mm of sampler length and has a natural moisture content ranging from 3 percent to 13 percent.

4.3 Clay (CH to CL)

The fill in Borehole Nos. 1 to 3 is underlain by native clay which extends to 12.4 m depth (Elevation 57.8 m) in Borehole No. 2 and to the termination depths of 4.6 m to 8.2 m (Elevation 65.4 m to Elevation 61.8 m) in Borehole Nos. 1A, 1, and 3. The clay has a firm to very stiff consistency as indicated by the undrained shear strength measurements of 43 kPa to higher than 120 kPa as indicated by the in-situ vane test results. The clay has a natural moisture content ranging from 26 percent to 78 percent. The natural unit weight of the clay is 16.4 kN/m^3 to 17.6 kN/m^3. It should be noted that hydrocarbon odour was detected in the spoil samples retrieved from 3.0 m and 3.8 m depths from Borehole Nos. 1 and 1A respectively. results of environmental testing on soil and groundwater collected from the boreholes will be reported under separate letter.

Grain size analysis and Atterberg Limits were conducted on three (3) samples of the clay and the grain size distribution curve is shown in Figures 7 to 9. The test results are summarized in Table I.

Table I: Summary of Results from Grain-Size Analysis and Atterberg Limits - Clay Samples								
Borehole (BH) No.: Sample (SS) No.	Depth (m)	Grain-Size Analysis (%)			Atterberg Limits (%)			
		Gravel	Sand	Silt Clay	Liquid Limit	Plastic Limit	Plasticity Index	Soil Classification (USCS)
MW-2: SS4	2.3 – 2.9	0	0	100	69	29	40	Clay of High Plasticity (CH)
MW-2: SS8	6.1 – 6.7	0	0	100	58	28	30	Clay of High Plasticity (CH)
MW-2: SS11	10.7 – 11.3	0	3	97	27	18	9	Clay of low Plasticity (CL)

Based on the results of the grain size analysis and Atterberg Limits, the soil may be classified as a clay (CL to CH) of low to high plasticity in accordance with the Unified Soil Classification System (USCS).

4.4 Glacial Till

The clay in Borehole No. 2 is underlain by glacial till which extends to the sampling termination depth of 15.8 m below ground surface (Elevation 54.4 m). The glacial till comprises of silty gravel with sand to silty sand with gravel and contains shale fragments. The glacial till is in a loose to very dense state as indicated by the SPT N-values of 4 to 62 and has a natural moisture content ranging from 8 percent to 12 percent.

4.5 Inferred Boulders or Bedrock

Based on the dynamic cone penetration test (DCPT) results from Borehole No. 2, cone refusal was met on inferred boulders or bedrock at a 16.3 m depth (Elevation 53.9 m).

4.6 Groundwater Level

Groundwater level measurements taken on July 19, 2021 in the standpipe and monitoring well installed in Borehole Nos. 1A and 3 indicate the groundwater level is at 4.1 m and 7.2 m depth below the existing ground surface (Elevation 65.9 m and Elevation 62.7 m) respectively while the standpipe installed in Borehole No. 1 was dry.

Groundwater levels were determined in the boreholes at the times and under the conditions stated in the scope of services. Note that fluctuations in the level of groundwater may occur due to a seasonal variation such as precipitation, snowmelt, rainfall activities, and other factors not evident at the time of measurement and therefore may be at a higher level during wet weather periods.

5. Seismic Site Classification and Liquefaction Potential of Soils

5.1 Site Classification for Seismic Site Response

Based on the borehole information and Table 4.1.8.4.A in the 2012 Ontario Building Code (as amended May 2, 2019), the site classification for seismic site response is **Class D**.

5.2 Liquefaction Potential of Soils

The subsurface soils are not susceptible to liquefaction during a seismic event.

6. Grade Raise Restrictions

The site is underlain by a sensitive marine clay deposit that is prone to consolidation settlement if overstressed by loads imposed on it by site grade raise, foundations and by the permanent lowering of the groundwater level following construction. Overstressing of the clay will result in its consolidation and subsequent settlement of foundations, which may exceed tolerable limits of the structure resulting in cracking of the structure.

Since the site is located in a well-established developed area of the city of Ottawa, raising the grades at the site is not anticipated as part of the proposed development. Therefore, the geotechnical engineering comments and recommendations provided in this report are based on the assumption that there will be minimal to no raise in the site grades for this project. If the above assumption is incorrect, EXP should be contacted to review the acceptability of the proposed grade raise from a geotechnical point of view and provide updated bearing pressure value at serviceability limit state (SLS) and factored geotechnical resistance value at ultimate limit state (ULS) for the footings of the proposed new building addition, in view of the proposed site grade raise.

7. Foundation Considerations

The borehole information indicates the subsurface condition consists of fill underlain by firm to very stiff clay contacted at 0.3 m to 1.7 m depths below existing grade (Elevation 69.6 m to Elevation 68.5 m). The groundwater level was measured between 4.1 m and 7.2 m depth below existing grade (Elevation 65.9 and Elevation 62.7 m).

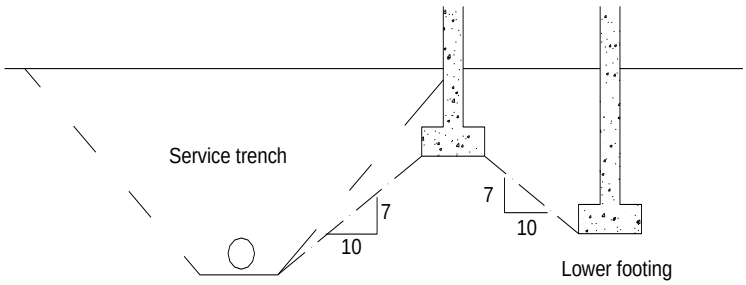
Based on a review of the borehole information, it is considered feasible to support the proposed building addition on strip and square pad footings designed to bear on the native clay. Strip footings having a maximum width of 1.0 m founded on the surface of the native clay contacted in the boreholes at a maximum depth of 2.5 m below existing grade may be designed for a bearing pressure at SLS of 90 kPa and factored geotechnical resistance at ULS of 140 kPa. Square pad footings having a width and length of 2.0 m founded on the silty clay at a maximum depth of 2.5 m depth below existing grade may be designed for a bearing pressure at SLS of 110 kPa and factored geotechnical resistance at ULS of 160 kPa.

To prevent the need to underpin the existing footings along the east wall of the existing building where the proposed new building addition will be located, it is recommended that the basement floor slab and footings for the new building addition be placed at the same depth as the existing basement floor slab and existing footings. This is valid for the footings, provided the native clay at the same level as the bottom of the existing footings is capable of supporting the bearing pressure at serviceability limit state (SLS) and factored geotechnical resistance at ultimate limit state (ULS) recommended above for the footings.

The total and differential settlements of footings designed in accordance with the recommendations of this report and with careful attention to construction detail are expected to be less than 25 mm and 19 mm respectively.

As previously mentioned, the footings for the proposed new addition located adjacent to the footings of the existing building should be located at the same elevation as the bottom of the existing footing to eliminate the need for underpinning of the existing footing. This is subject to confirmation that the founding soil at the same level as the bottom of the existing footing is capable of supporting the design SLS and factored ULS values noted above. If deeper excavation is required for the new footings located adjacent to existing footings, underpinning of the existing footings may be required. EXP can provide additional recommendations regarding the underpinning of the existing footings.

Footings at different elevations should be located such that the higher footings are set below a line drawn up at 10 horizontal to 7 vertical (10H:7V) from the near edge of the lower footing. This concept should also be applied to service excavation, etc. to ensure that undermining is not a problem.



FOOTINGS NEAR SERVICE TRENCHES OR AT DIFFERENT ELEVATIONS

All footing beds should be examined by a geotechnical engineer to ensure that the founding soil is capable of supporting the bearing pressure at SLS and that the footings have been properly prepared.

It should be noted that the exposed clay subgrade surface is susceptible to disturbance due to movement of workers and construction traffic and the prevailing weather conditions during construction and therefore, the approved footing beds should be covered or protected with a 50 mm thick concrete mud slab.

A minimum of 1.5 m of earth cover should be provided to the exterior foundations of heated structures to protect them from damage due to frost penetration. The frost cover should be increased to 2.1 m for unheated structures if snow will not be removed from their vicinity and to 2.4 m if snow will be removed from the vicinity of the structure. When earth cover is less than the minimum required, an equivalent thermal combination of earth cover and rigid insulation or rigid insulation alone should be provided. EXP can provide additional comments in this regard, if required.

The recommended bearing pressure at SLS and factored geotechnical resistances at ULS have been calculated by EXP from the borehole information for the design stage only. The investigation and comments are necessarily on-going as new information of underground conditions becomes available. For example, more specific information is available with respect to conditions between boreholes when foundation construction is underway. The interpretation between boreholes and the recommendations of this report must therefore be checked through field monitoring provided by an experienced geotechnical engineer to validate the information for use during the construction stage.

8. Slab-on-Grade Construction and Permanent Drainage Systems

The basement floor for the proposed new building addition may be designed as a slab-on-grade set on the native undisturbed clay or on a minimum 300 mm thick engineered fill pad consisting of Ontario Provincial Standard Specification (OPSS) Granular B Type II compacted to 98 percent standard Proctor maximum dry density (SPMDD). The floor slab should be set on a bed of well-packed 19 mm clear stone at least 200 mm thick placed on the engineered fill pad or on native clay. The clear stone would prevent the capillary rise of moisture from the sub-soil to the floor slab. Adequate saw cuts should be provided in the floor slab to control cracking.

A perimeter drainage system should be installed around the proposed new building addition. If the perimeter drainage system of the existing building is encountered during the construction of the new building addition, it should be reinstated following construction of the new building addition.

The need for an underfloor drainage system will have to be determined once the design elevation of the lowest floor of the new building addition (basement floor) has been established and compared with the groundwater elevation. Once the design elevation of the basement floor is known, EXP should be contacted to review and provide comment regarding whether or not an underfloor drainage system is required for the proposed new building addition.

The finished floor slab should be set at least 150 mm higher than the finished exterior grade. The finished exterior grade should be sloped away from the building to prevent ponding of surface water close to the exterior walls of the proposed building addition.

9. Lateral Earth Pressure to Subsurface Walls

The subsurface basement walls of the proposed building addition should be backfilled with free draining material, such as OPSS 1010 Granular B Type II and equipped with a perimeter drainage system to prevent the buildup of hydrostatic pressure behind the walls. The walls will be subjected to lateral static and dynamic (seismic) earth forces. The expressions below assume free draining backfill material, a perimeter drainage system, level backfill surface behind the wall and vertical face on the back side of the wall.

For design purposes, the lateral static earth thrust against the subsurface walls may be computed from the following equation:

$$P = K_0 h (½ \gamma h + q)$$

where P = lateral earth thrust acting on the subsurface wall; kN/m

K_0 = lateral earth pressure coefficient for 'at rest' condition for Granular B Type II backfill material = 0.50

γ = unit weight of free draining granular backfill; Granular B Type II = 22 kN/m^3

h = depth of point of interest below top of backfill, m

q = surcharge load stress, kPa

The lateral dynamic (seismic) thrust may be computed from the equation given below:

$$\Delta_{Pe} = \gamma H^2 \frac{a_h}{g} F_b$$

where Δ_{Pe} = dynamic thrust in kN/m of wall

H = height of wall, m

γ = unit weight of backfill material = 22 kN/m^3

$\frac{a_h}{g}$ = seismic coefficient = 0.32

F_b = thrust factor = 1.0

The dynamic (seismic) thrust does not take into account the surcharge load. The resultant force acts approximately at 0.63H above the base of the wall.

All subsurface walls of the proposed new building addition should be properly dampproofed.

10. Excavation and De-Watering Requirements

10.1 Excess Soil Management

Ontario Regulation 406/19 made under the Environmental Protection Act (November 28, 2019) has been enacted as of January 1, 2021. The new regulation dictates the testing protocol required for the management and disposal of excess soils. As set forth in the regulation, specific analytical testing protocols need to be implemented and followed based on the volume of soil to be managed. The testing protocols are specific as to whether the soils are stockpiled or in situ. In either scenario, the testing protocols are far more onerous than have been historically carried out as part of standard industry practices. These decisions should be factored in and accounted for prior to the initiation of the project-defined scope of work. EXP would be pleased to assist with the implementation of a soil management and testing program that would satisfy the requirements of Ontario Regulation 406/19.

10.2 Excavations

The excavations for the building addition foundations are expected to extend to a maximum depth of 2.0 m below the existing ground surface (Elevation 68.2 m. These excavations will extend through the fill and to the native clay. The excavations are anticipated to be above the groundwater level.

It is anticipated that excavations may be undertaken using conventional equipment capable of removing construction debris within the fill (such as brick fragments). All excavation work should be completed in accordance with the Occupational Health and Safety Act (OHSA), Ontario, Reg. 213/91. Based on the definitions provided in OHSA, the subsurface soils at the site are considered to be Type 3 soil. As per OHSA, the sidewalls of open cut excavations undertaken within Type 3 soil, must be sloped back at 1H:1V from the bottom of the excavation. Within zones of persistent seepage, the excavation side slopes are expected to slough and eventually stabilize at 2H:1V to 3H:1V from the bottom of the excavation.

If side slopes cannot be achieved due to space restrictions, such as the proximity of the excavation to neighboring structures (existing buildings) and infrastructure, the excavation for the proposed new building addition would have to be undertaken within the confines of an engineered support system (shoring system).

The type of foundation and horizontal distance of the foundations of the neighboring buildings and the infrastructure to the excavation for the proposed new building addition and the founding depths of the foundations of the neighboring buildings and the invert depths of the neighboring infrastructure would have to be determined to assess the need for a shoring system for the excavation of the proposed new building addition. This information would be required for the design of the shoring system, should it be determined that a shoring system will be required for the excavation of the new building addition.

The need for a shoring system, the most appropriate type of shoring system and the design and installation of the shoring system should be determined by the contractors bidding on this project. The design of the shoring system should be undertaken by a professional engineer experienced in shoring design and the installation of the shoring system should be undertaken by a contractor experienced in the installation of shoring systems. The shoring system should be designed and installed in accordance with latest edition of Ontario Regulation 213/91 under the OHSA and the 2006 Fourth Edition of the Canadian Foundation Engineering Manual (CFEM).

The shoring system as well as the existing building on site, the adjacent neighboring settlement sensitive structures (such as the neighboring buildings) and neighboring infrastructure should be monitored for movement (deflection) on a periodic basis during construction operations.

A pre-construction condition survey of the existing building, adjacent neighboring structures and infrastructure should be undertaken prior to the start of any construction activities.

It is recommended that vibration monitoring be conducted at the site and at adjacent neighboring structures (such as the existing buildings) and infrastructure during the installation of the shoring system and during construction of the new building addition. This is to ensure the existing neighboring structures and infrastructure are not damaged as a result of the construction activities and the installation of the shoring system for the proposed new building addition.

Base heave type failure is not expected in excavations that extend into the native clay at a maximum 2.0 m depth below existing grade.

The clay stratum at the site is susceptible to disturbance due to the movement of construction equipment and personnel on its surface. It is therefore recommended that the excavation at the site should be undertaken by equipment that does not need to travel on the excavated surface, such as a gradall or mechanical shovel.

Extra care should be exercised during the excavation close to the existing building to prevent the undermining of the existing footings. Reference is made to Section 7 of this report regarding measures to prevent the undermining of existing footings.

Many geologic materials deteriorate rapidly upon exposure to meteorological elements. Unless otherwise specifically indicated in this report, walls and floors of excavations must be protected from moisture, desiccation, and frost action throughout the course of construction.

10.3 De-Watering Requirements and Impact on Neighboring Structures and Infrastructure

Seepage of the surface and subsurface water into these excavations is anticipated to be minimal. However, and if required, it should be possible to collect water entering the excavations at low points and to remove it by conventional pumping techniques. In areas of high infiltration or in areas where more permeable soil layers may exist, a higher seepage rate should be anticipated and may require high capacity pumps to keep the excavation dry.

The excavations for foundations are anticipated to be above the groundwater level and as such the removal of groundwater from the excavation is anticipated to be minimal or not at all. In this case, groundwater removal during the short-term construction activities is not anticipated to impact existing neighboring structures (buildings) and infrastructure.

It has been assumed that the maximum excavation depth at the site for foundations of the new building addition will be approximately 2.0 m below existing grade and minimal or no groundwater removal is anticipated. However, it is noteworthy to mention that new legislation came into force in Ontario on March 29, 2016 to regulate groundwater takings for construction dewatering purposes. Prior to March 29, 2016, a Category 2 Permit to Take Water (PTTW) was required from the Ontario Ministry of the Environment and Climate Change (MOECC) for groundwater takings related to construction dewatering, where taking volumes in excess of 50 m3/day, but less than 400 m3/day, and the taking duration was no more than 30 consecutive days. The new legislation replaces the Category 2 PTTW for construction dewatering with a new process under the Environmental Activity and Sector Registry (EASR). The EASR is an on-line registry, which allows persons engaged in prescribed activities, such as water takings, to register with the MOECC instead of applying for a PTTW.

To be eligible for the new EASR process, the construction dewatering taking must be less than 400 m3/day under normal conditions. The water taking can be groundwater, storm water, or a combination of both. It should be noted that the 30-consecutive day limit on the water taking under the old Category 2 PTTW process has been removed in the new EASR process. Also, it should be noted that the EASR process requires two technical studies be prepared by a Qualified Person, prior to any water taking. These studies include a Water Taking Report, which provides assurance that the taking will not cause any unacceptable impacts, and a Discharge Plan, which provides assurance that the discharge will not result in any adverse impacts to the environment. EXP has qualified persons who can prepare these types of reports, if required. A significant advantage of the new EASR process over the former Category 2 PTTW process, is that the groundwater taking may begin immediately after completing the on-line registration of the taking and paying the applicable fee, assuming the accompanying technical studies have been completed. The former PTTW process typically took more than 90 days, which had the potential to impact construction schedules.

Although this investigation has estimated the groundwater levels at the time of the fieldwork, and commented on dewatering and general construction problems, conditions may be present which are difficult to establish from standard boring and excavating techniques and which may affect the type and nature of dewatering procedures used by the contractor in practice. These conditions include local and seasonal fluctuations in the groundwater table, erratic changes in the soil profile, thin layers of soil with large or small permeabilities compared with the soil mass, etc. Only carefully controlled tests using pumped wells and observation wells will yield the quantitative data on groundwater volumes and pressures that are necessary to adequately engineer construction dewatering systems.

11. Backfilling Requirements and Suitability of On-Site Soils for Backfilling Purposes

The materials to be excavated from the site will consist of small amount of fill and native clay. The excavated soils are not considered suitable for use as backfill and therefore must be disposed off-site or used in landscaped areas.

It is anticipated that the majority of the material required for underfloor fill and backfilling purposes would have to be imported and should preferably conform to the following specification:

- Engineered fill under the slab-on-grade area - OPSS 1010 Granular B Type II placed in 300 mm thick lifts and each lift compacted to 98 percent SPMDD.
- Backfill in footing trenches and against foundation walls – OPSS 1010 Granular B Type II placed in 300 mm thick lifts and each lift compacted to 98 percent of the SPMDD inside the building and 95 percent SPMDD outside the building respectively.
- Backfill in services trenches inside building – OPSS 1010 Granular B Type II placed in 300 mm thick lifts and each lift compacted to 98 percent of the SPMDD.

12. Subsurface Concrete and Steel Requirements

Chemical tests limited to pH and sulphate were performed on two (2) soil samples. The certificate of the laboratory analysis is attached in Appendix A and the results are summarized in Table II.

Table II: Chemical Test Results on Soil Sample

Borehole No. (Sample No.)	Soil Type	Depth (m)	pH	Sulphate (%)
BH-2 SS2	Clay	0.75-1.0	8.13	0.0209
BH 3- SS3	Clay	1.5-2.1	7.23	0.0576

The sulphate content in the clay is less than 0.1 percent. This concentration would have a negligible potential of sulphate attack on subsurface concrete. The concrete should be designed in accordance with Table Nos. 3 and 6 of CSA A.23.1-14. However, the concrete should be dense, well compacted and cured.

13. General Comments

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

The information contained in this report is not intended to reflect on environmental aspects of the soils and groundwater. Should specific information be required, including for example the presence of pollutants, contaminants or other hazards in the soil, additional testing may be required.

We trust that the information contained in this report is satisfactory for your purposes. Should you have any questions, please contact this office.

Sincerely.

Athir Nader, M.A.Sc., P.Eng.
Senior Project Manager, Geotechnical Services
Earth and Environment

Ismail Taki, M.Eng, P.Eng.
Senior Manager, Eastern Region
Earth and Environment

13. General Comments

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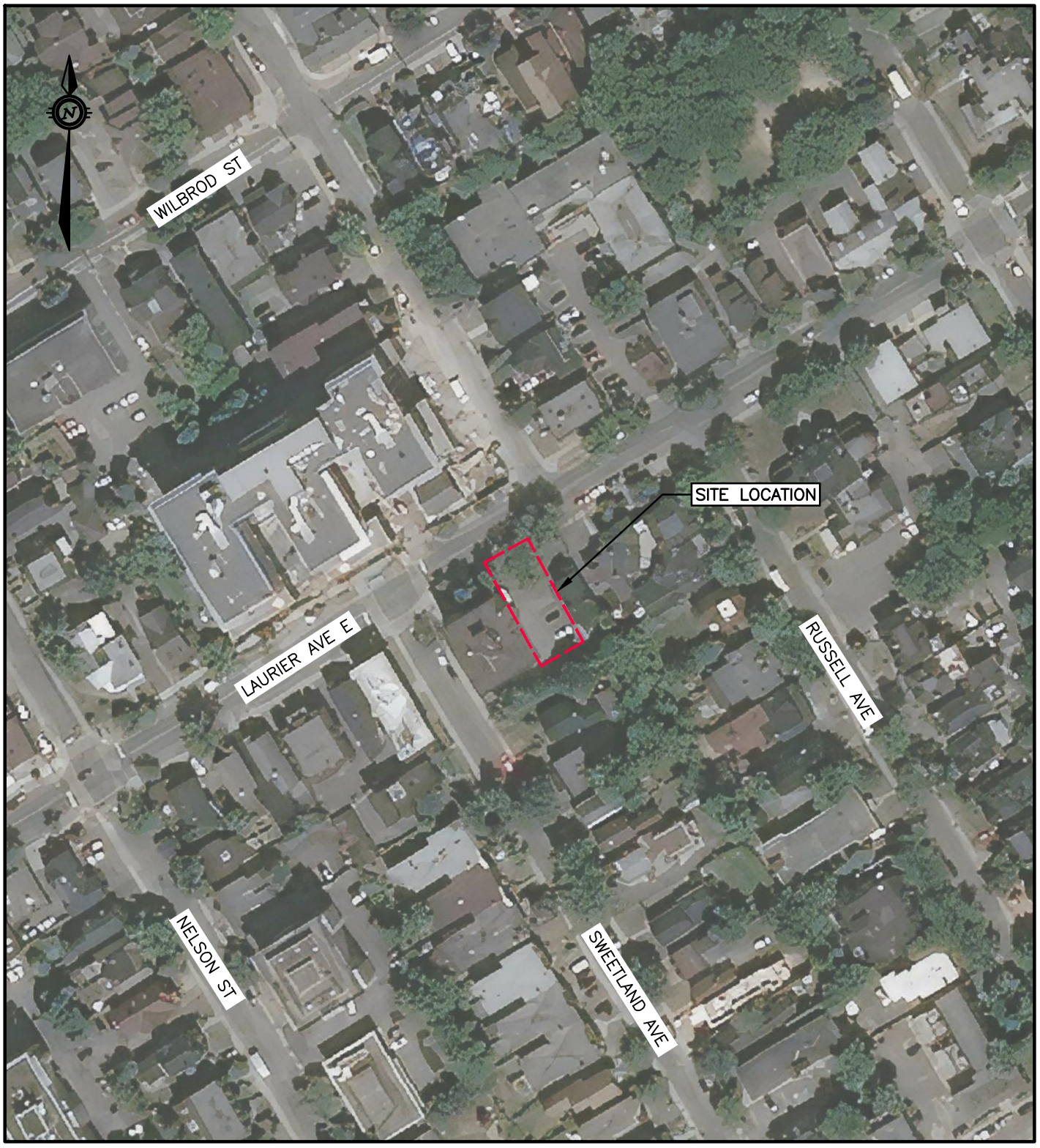
Sincerely.

for

Athir Nader, M.A.Sc., P.Eng.
Senior Project Manager, Geotechnical Services
Earth and Environment

Ismail Taki, M.Eng, P.Eng.
Senior Manager, Eastern Region
Earth and Environment

Figures



0 15m 30m 60m

HORIZONTAL 1:1500

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Ottawa, ON K2B 8H6

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DESIGN	A.N.
DRAWN	G.C.
DATE	JULY 2021
FILE NO	OTT-21013283-A0

GEOTECHNICAL INVESTIGATION
PROPOSED BUILDING ADDITION
280 LAURIER AVENUE EAST, OTTAWA, ONTARIO

SITE LOCATION PLAN

SCALE	1:1500
SKETCH NO	FIG 1

Filename: E:\OTT\OTT-21013283-A0\60 Execution\65 Drawings\21013283-A0 Figures.dwg
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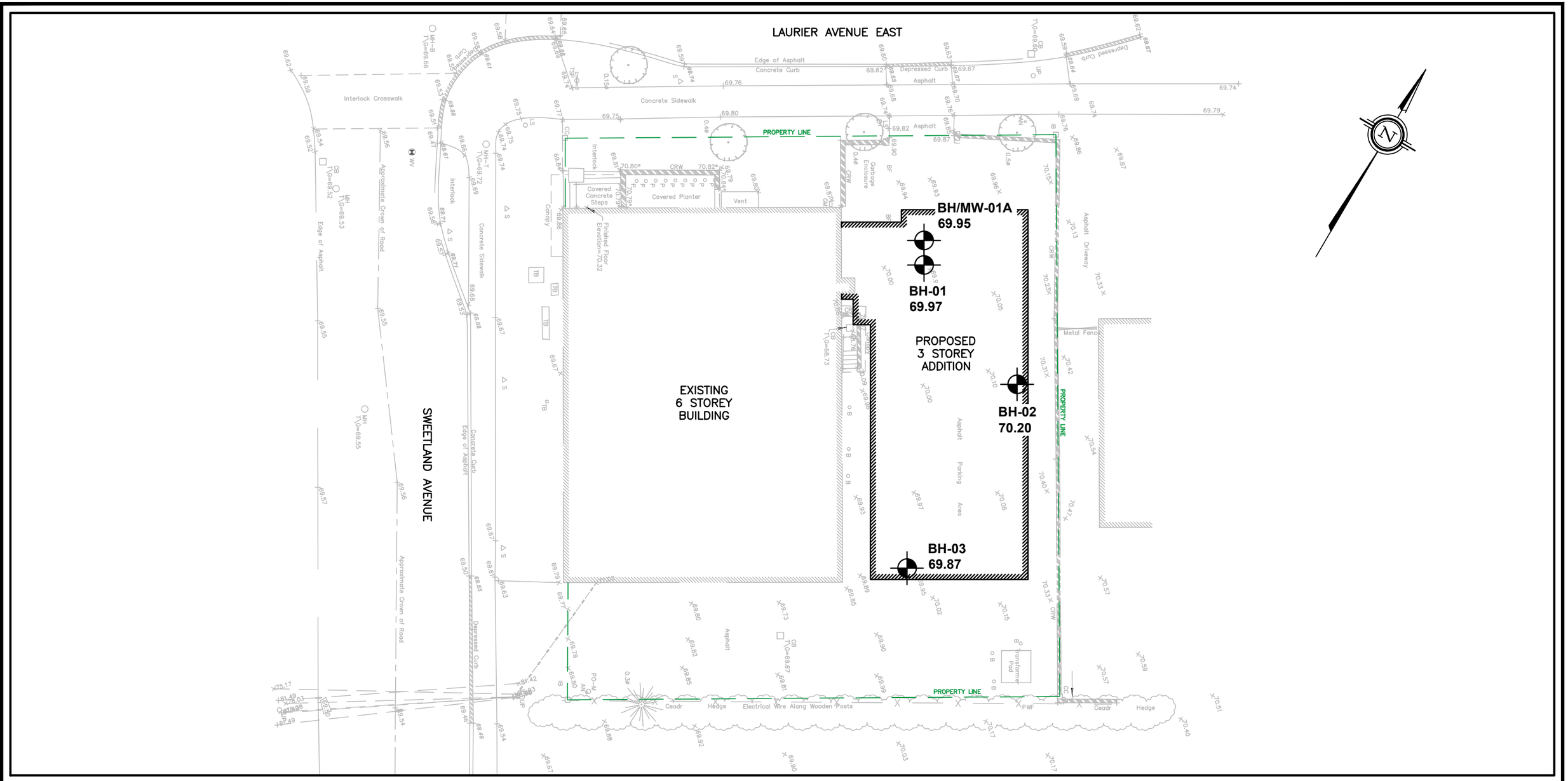

LEGEND

BH-01 BOREHOLE LOCATION
69.97 GROUND SURFACE ELEVATION IN METERS

0 2m 4m 8m
HORIZONTAL 1:200

NOTES:

1. THE BOUNDARIES AND SOIL TYPES HAVE BEEN ESTABLISHED ONLY AT BOREHOLE LOCATIONS. BETWEEN BOREHOLE LOCATIONS THEY ARE ASSUMED AND MAY BE SUBJECT TO CONSIDERABLE ERROR.
2. SOIL SAMPLES WILL BE RETAINED IN STORAGE FOR THREE MONTHS AND THEN DESTROYED UNLESS THE CLIENT ADVISES THAT AN EXTENDED TIME PERIOD IS REQUIRED.
3. ASPHALT QUANTITIES SHOULD NOT BE ESTABLISHED FROM THE INFORMATION PROVIDED AT BOREHOLE LOCATIONS.
4. BOREHOLE ELEVATIONS SHOULD NOT BE USED TO DESIGN BUILDING(S) OR FLOOR SLABS OR PARKING LOT(S) GRADES.
5. THIS DRAWING FORMS PART OF THE REPORT PROJECT NUMBER AS REFERENCED AND SHOULD BE USED ONLY IN CONJUNCTION WITH THIS REPORT.
6. BASE DRAWING OBTAINED FROM EXP DRAWING "21012649 EXISTING TOPO-2021-06-21" DATED JUNE 21, 2021

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Ottawa, ON K2B 8H6
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DESIGN	A.N.
DRAWN	G.C.
DATE	JULY 2021
FILE NO	OTT-21013283-A0

GEOTECHNICAL INVESTIGATION
PROPOSED BUILDING ADDITION
280 LAURIER AVENUE EAST, OTTAWA, ONTARIO

BOREHOLE LOCATION PLAN

SCALE 1:200
SKETCH NO FIG 2

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Notes On Sample Descriptions

1. All sample descriptions included in this report follow the Canadian Foundations Engineering Manual soil classification system. This system follows the standard proposed by the International Societv for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by **exp** Services Inc. also follow the same system. Different classification systems may be used by others; one such system is the Unified Soil Classification. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

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

0.002 0.006 0.02 0.06 0.2 0.6 2.0 6.0 20 60 200

EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

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

UNIFIED SOIL CLASSIFICATION

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

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Log of Borehole BH-1

Project No: OTT-21013283-A0

Project: Proposed three Storey Building Addition

Location: 280 Laurier Avenue East, Ottawa, Ontario

Figure No. 3

Page. 1 of 1

Date Drilled: 'July 8, 2021

Drill Type:

Datum: Geodetic Elevation

Logged by: JE Checked by: AN

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)
Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		ASPHALT PAVEMENT ~50 mm thick	69.97	0				
		FILL	69.9					
		Silty sand with gravel, brown, moist, (compact)	69.6		12		SS1	
		CLAY (CH)		1	14	>250	SS2	
		High Plasticity, grey, moist to wet, (stiff to very stiff)			11	>250	SS3	17.6
				2		>250		
		-Hydrocarbon odour detected in the soil samples retreived from 3.0 m depth		3	2		SS4	16.4
				4	101 s=20.2			
					91 s=9.1			
				5	Hammer Weight		SS5	
					96 s=8.0			
				6	72 s=5.1			
					Hammer Weight		SS6	
				7	58 s=5.8			
					82 s=5.9			
			61.8	8	2		SS7	
		Borehole Terminated at 8.2 m Depth						

LOG OF BOREHOLE BH LOGS_21013283-A0_PROPOSED BUILDING ADDITION.GPJ TROW OTTAWA.GDT 8/4/21

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. A 19 mm diameter standpipe with slotted section installed as shown.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-21013283-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
On Completion	Dry	7.5
'July 19, 2021	Dry	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH-1A

Project No: OTT-21013283-A0

Project: Proposed three Storey Building Addition

Location: 280 Laurier Avenue East, Ottawa, Ontario

Figure No. 4

Page. 1 of 1

Date Drilled: 'July 9, 2021

Drill Type:

Datum: Geodetic Elevation

Logged by: GC Checked by: AN

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)

Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		Straight drilling with no sampling from ground surface to 2.3 m depth.	69.95	0	20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60		
		CLAY (CH) High Plasticity, grey, moist	67.7	2	4		SS1	
		-Hydrocarbon odour detected in the soil samples retreived from 3.0 m depth	65.85	4	1		SS2	
		Borehole Terminated at 4.6 m Depth	65.4					

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. A 51 mm diameter monitoring well with screened section installed as shown.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-21013283-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
'July 19, 2021	4.1	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE BH LOGS_21013283-A0_PROPOSED BUILDING ADDITION.GPJ TROW OTTAWA.GDT 8/4/21

Log of Borehole BH-2

Project No: OTT-21013283-A0

Project: Proposed three Storey Building Addition

Location: 280 Laurier Avenue East, Ottawa, Ontario

Figure No. 5

Page. 1 of 2

Date Drilled: 'July 9, 2021

Drill Type:

Datum: Geodetic Elevation

Logged by: GC Checked by: AN

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test

Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		ASPHALT PAVEMENT ~50 mm thick	70.2	0	9		SS1	
		FILL Sand with gravel, brick fragments, brown, moist, oxidized stains, no odours, (loose to very dense)	70.2	1	63 for 250 mm		SS2	
			68.5	2	13		SS3	
		CLAY (CH) High plasticity, grey, moist to wet, no stains, no odours, (firm to very stiff)		3	6 77 s=11.0		SS4	
				4	3 77 s=7.7		SS5	
				5	1 101 s=10.1 Hammer Weight		SS6	
				6	72 s=14.4		SS7	
				7	Hammer Weight 77 s=11.0		SS8	
				8	Hammer Weight 43 s=8.6		SS9	
				9	Hammer Weight		SS10	
				10	101 s=20.2			

Continued Next Page

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-21013283-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE BH LOGS_21013283-A0_PROPOSED BUILDING ADDITION.GPJ TROW OTTAWA.GDT 8/4/21

Log of Borehole BH-2

Project No: OTT-21013283-A0

Project: Proposed three Storey Building Addition

Figure No. 5

Page. 2 of 2

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		CLAY (CH) High plasticity, grey, moist to wet, no stains, no odours, (firm to very stiff) *(continued)*	60.2	10	Shear Strength 20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60		
		CLAY (CL) Sand seams, low plasticity, grey, wet, no stains, no odours, (very stiff)	59.5	11	Hammer Weight		SS11	
				12	>120		SS12	
		GLACIAL TILL Silty sand with gravel, some clay, slightly cohesive in the upper 3.0 m, shale fragments, grey, wet, very slight hydrocarbon odour, (compact to very dense)	57.8	13	4		SS13	
				14	23		SS14	
				15	62			
		Dynamic Cone Penetration Test (DCPT) conducted from 15.8 m depth to refusal at 16.3 m depth.	54.4	16				
		Cone Refusal at 16.3 m Depth	53.9					

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. Borehole backfilled upon completion of drilling.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-21013283-A0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE BH LOGS_21013283-A0_PROPOSED BUILDING ADDITION.GPJ TROW OTTAWA.GDT 8/4/21

Log of Borehole BH-3

Project No: OTT-21013283-A0

Project: Proposed three Storey Building Addition

Location: 280 Laurier Avenue East, Ottawa, Ontario

Figure No. 6

Page. 1 of 1

Date Drilled: 'July 8, 2021

Drill Type:

Datum: Geodetic Elevation

Logged by: JE Checked by: AN

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)

Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		ASPHALT PAVEMENT ~50 mm thick	69.87	0				
		FILL Sand with gravel, brown to grey, damp to moist, (loose)	69.8					
		CLAY (CH) High plasticity, mottling and organics in the upper 2.0 m, grey, moist to wet, (firm to stiff)	69.6		7		SS1	
				1	9		SS2	
				2	10		SS3	17.6
					6		SS4	17.3
				3	2		SS5	
					29 s=2.9			
				4	82 s=6.8			
				5	1		SS6	
					77 s=7.0			
				6	86 s=6.6			
					1		SS7	
				7	43 s=6.1			
			62.6		82 s=8.2			
		Borehole Terminated at 7.3 m Depth	62.67					

NOTES:
1. Borehole/Test Pit data requires Interpretation by exp. before use by others
2. A 19 mm diameter standpipe with slotted section installed as shown.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-21013283-A0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
'July 19, 2021	7.2	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	4.5 - 5.1	100	18
2	5.1 - 6.6	100	25

LOG OF BOREHOLE BH LOGS_21013283-A0_PROPOSED BUILDING ADDITION.GPJ TROW OTTAWA.GDT 8/4/21

EXP Services Inc.
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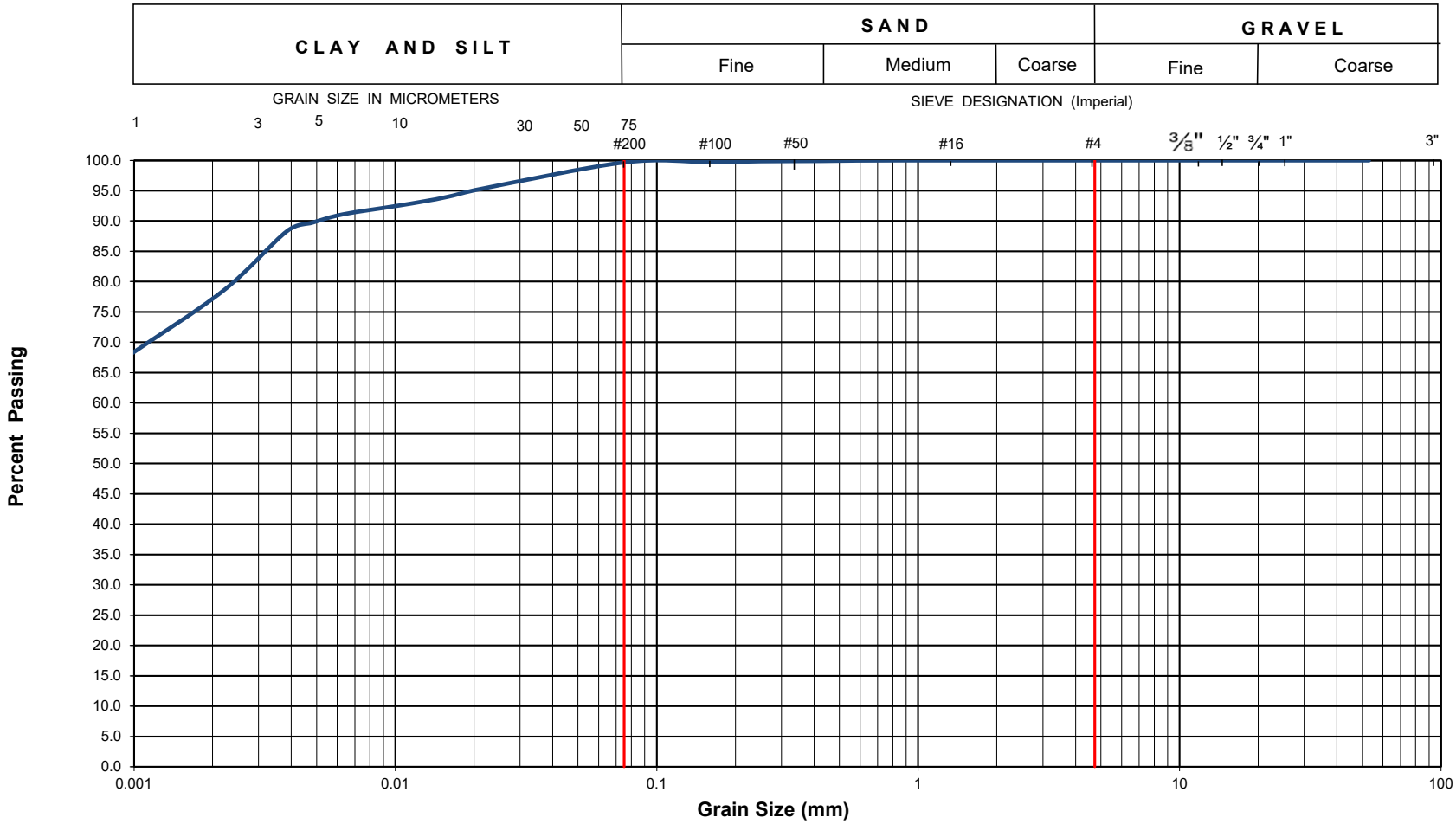
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422

Unified Soil Classification System



EXP Project No.:	**OTT-21013283-A0**	**Project Name :**	**Proposed Building Addition**						
Client :	**Smart Living Properties**	**Project Location :**	**280 Laurier Avenue East, Ottawa, Ontario**						
Date Sampled :	**July 9, 2021**	**Borehole No:**	**BH-2**		**Sample No.:**	**SS4**		**Depth (m) :**	**2.3-2.9**
Sample Description :		**% Silt and Clay**	**100**	**% Sand**	**0**	**% Gravel**	**0**	**Figure :**	**7**
Sample Description :		**CLAY of High Plasticity (CH)**							

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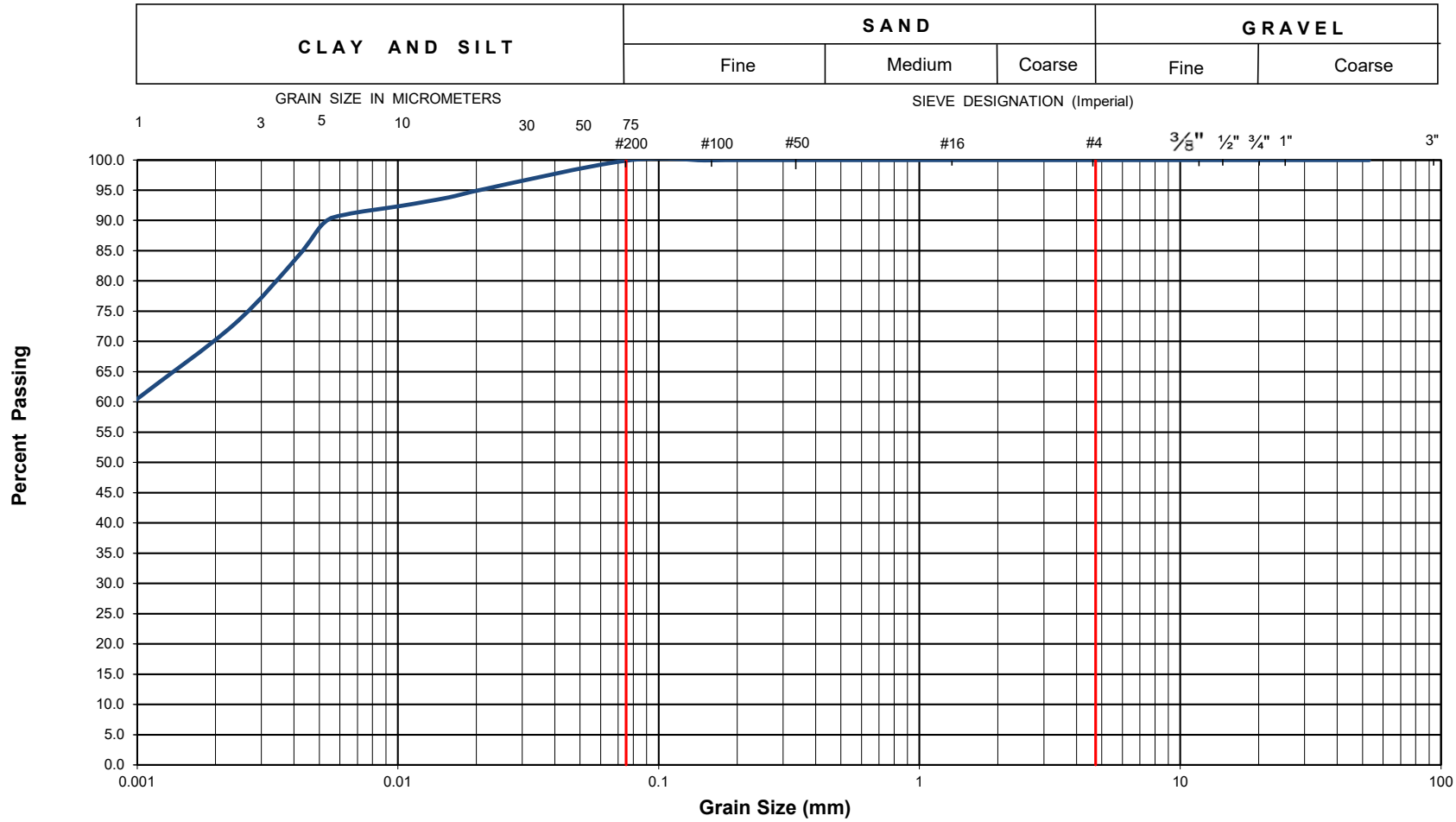
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422

Unified Soil Classification System



EXP Project No.:	**OTT-21013283-A0**	**Project Name :**	**Proposed Building Addition**						
Client :	**Smart Living Properties**	**Project Location :**	**280 Laurier Avenue East, Ottawa, Ontario**						
Date Sampled :	**July 9, 2021**	**Borehole No:**	**BH-2**	**Sample No.:**	**SS8**	**Depth (m) :**	**6.1-6.7**		
Sample Description :		**% Silt and Clay**	**100**	**% Sand**	**0**	**% Gravel**	**0**	**Figure :**	**8**
Sample Description :		**CLAY of High Plasticity (CH)**							

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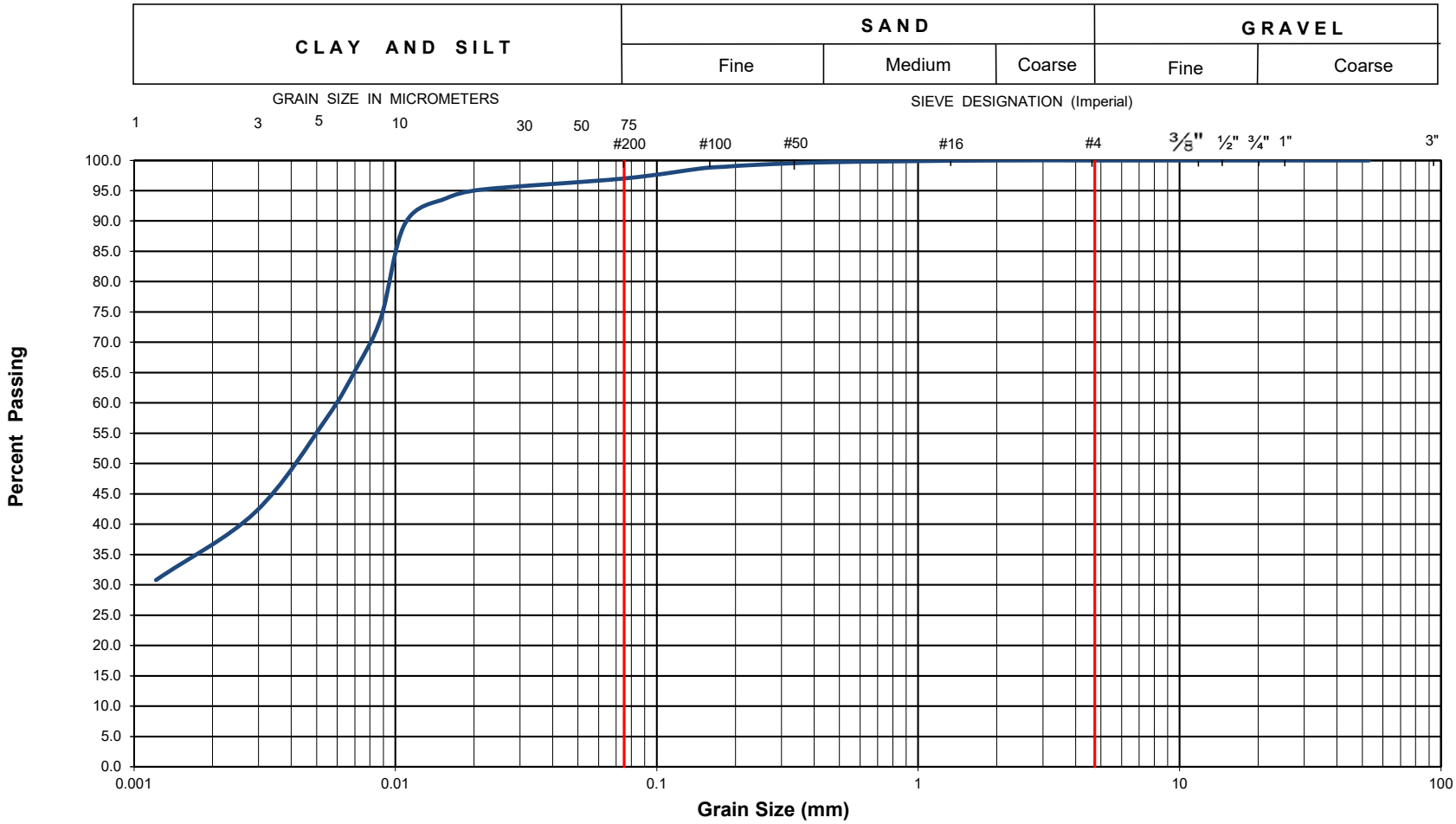
Grain-Size Distribution Curve
Method of Test For Particle Size Analysis of Soil
ASTM C-136/ASTM D422

Unified Soil Classification System



EXP Project No.:	**OTT-21013283-A0**	**Project Name :**	**Proposed Building Addition**						
Client :	**Smart Living Properties**	**Project Location :**	**280 Laurier Avenue East, Ottawa, Ontario**						
Date Sampled :	**July 9, 2021**	**Borehole No:**	**BH-2**		**Sample No.:**	**SS11**		**Depth (m) :**	**10.7-11.3**
Sample Description :		**% Silt and Clay**	**97**	**% Sand**	**3**	**% Gravel**	**0**	**Figure :**	**9**
Sample Description :		**CLAY of Low Plasticity (CL)**							

Appendix A:
Laboratory Certificate of Analysis

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: EXP SERVICES INC
2650 QUEENSVIEW DRIVE, UNIT 100
OTTAWA, ON K2B8H6
(613) 688-1899
ATTENTION TO: Gary Cui
PROJECT: OTT-21013283-A0
AGAT WORK ORDER: 21Z774692
SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Lab Manager
DATE REPORTED: Jul 20, 2021
PAGES (INCLUDING COVER): 6
VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.*
- *AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.*
- *This Certificate shall not be reproduced except in full, without the written approval of the laboratory.*
- *The test results reported herewith relate only to the samples as received by the laboratory.*
- *Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.*
- *All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.*

AGAT Laboratories

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MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 21Z774692

PROJECT: OTT-21013283-A0

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: Gary Cui

SAMPLING SITE:

SAMPLED BY:

Inorganic Chemistry (Soil)

DATE RECEIVED: 2021-07-13

DATE REPORTED: 2021-07-20

				BH2 SS2	
			SAMPLE DESCRIPTION:	2'6"-3'4"	BH2 SS3 5'-7'
			SAMPLE TYPE:	Soil	Soil
			DATE SAMPLED:	2021-07-09	2021-07-09
Parameter	Unit	G / S	RDL	2735668	2735679
pH, 2:1 CaCl2 Extraction	pH Units		NA	8.13	7.23
Sulphate (2:1)	µg/g		2	209	576

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

2735668-2735679 pH was determined on the 0.01M CaCl2 extract obtained from 2:1 leaching procedure (2 parts extraction fluid:1 part wet soil).

Analysis perfomed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 21Z774692

PROJECT: OTT-21013283-A0

CLIENT NAME: EXP SERVICES INC

ATTENTION TO: Gary Cui

SAMPLING SITE:

SAMPLED BY:

Sulphate%

DATE RECEIVED: 2021-07-13

DATE REPORTED: 2021-07-20

				BH2 SS2	
			SAMPLE DESCRIPTION:	2'6"-3'4"	BH2 SS3 5'-7'
			SAMPLE TYPE:	Soil	Soil
			DATE SAMPLED:	2021-07-09	2021-07-09
Parameter	Unit	G / S	RDL	2735668	2735679
Sulphate (2:1)	%		0.0002	0.0209	0.0576

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

2735668-2735679 Sulphate was determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

Analysis perfomed at AGAT Toronto (unless marked by *)

Certified By:

Amanjot Bhela

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
AMANJOT BHELA
CHEMIST

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 21Z774692

PROJECT: OTT-21013283-A0

ATTENTION TO: Gary Cui

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Jul 20, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Inorganic Chemistry (Soil)															
pH, 2:1 CaCl2 Extraction	2735668	2735668	8.13	8.08	0.6%	NA	100%	80%	120%						
Sulphate (2:1)	2732333		240	239	0.4%	< 2	96%	70%	130%	100%	80%	120%	100%	70%	130%

Comments: NA Signifies Not Applicable.
Duplicate NA: results are under 5X the RDL and RPD will not be calculated.

Sulphate%															
Sulphate (2:1)	2732333		0.0240	0.0239	0.4%	< 0.0002	96%	70%	130%	100%	80%	120%	100%	70%	130%

Certified By:

AGAT Laboratories

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MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: EXP SERVICES INC

AGAT WORK ORDER: 21Z774692

PROJECT: OTT-21013283-A0

ATTENTION TO: Gary Cui

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
pH, 2:1 CaCl2 Extraction	INOR-93-6031	modified from EPA 9045D and MCKEAGUE 3.11	PH METER
Sulphate (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH

AGAT Laboratories

2 Lg

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 21 2774 692

Cooler Quantity: 1

Arrival Temperatures: 8.45 / 24.6 / 24.9

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes: ice pac 11.6 12' 11.4

Report Information:

Company: EXP Services Inc. Ottawa
Contact: Gary Cui
Address: 2650 Queensview dr. Unit 100
Ottawa, ON, K2B 8H6
Phone: 613-688-1899 Fax:
Reports to be sent to:
1. Email: gary.cui@exp.com
2. Email: ismail.taki@exp.com

Regulatory Requirements:

(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One) ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One) ☐ Coarse ☐ Fine

☐ Excess Soils R406
Table (Indicate One)
☐ Regulation 558
☐ CCME

☐ Sewer Use ☐ Sanitary ☐ Storm
(Region)
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
(Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☐ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: OTT-21013283-A0
Site Location: 280 Laurier E
Sampled By: EXP
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC (Y/N)	O. Reg 153: Metals & Inorganics	O. Reg 153: Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	O. Reg 153: BTEX, F1-F4 PHCs Analyze F4G if required ☐ Yes ☐ No	O. Reg 153: PAHs	O. Reg 153: PCBs	O. Reg 153: VOC	O. Reg 558: Landfill Disposal Characterization TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	O. Reg 406: Excess Soils SPLP Rainwater Leach SPLP: ☐ Metals ☐ VOCs ☐ SVOCs	O. Reg 406: Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Salt - EC/SAR	pH	Sulphate						Potentially Hazardous or High Concentration (Y/N)
BH2 SS2 2'6" - 3'4"	July 9	AM PM	1	S													✓	✓						
BH2 SS3 5'-7'	July 9	AM PM	1	S																				
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Jeff MacMillan	July 17/21	3:45 PM		15 Jul/21	1550
Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Peter Penn	2017/14	16:00	Simon Z	21/7/15	8:36
Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time

Page 1 of 1

No: 111859

Appendix B:
Legal Notification

Legal Notification

This report was prepared by EXP Services Inc. (EXP) for the account of Smart Living Properties.

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

Report Distribution

Jeremy Silburt, Smart Living Properties; Jeremy@smartlivingproperties.ca