REPORT

Geotechnical Investigation

Commercial Development, Cowan's Grove, 4791 Bank Street, Ottawa, Ontario

Submitted to:

Urbandale Corporation
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Submitted by:

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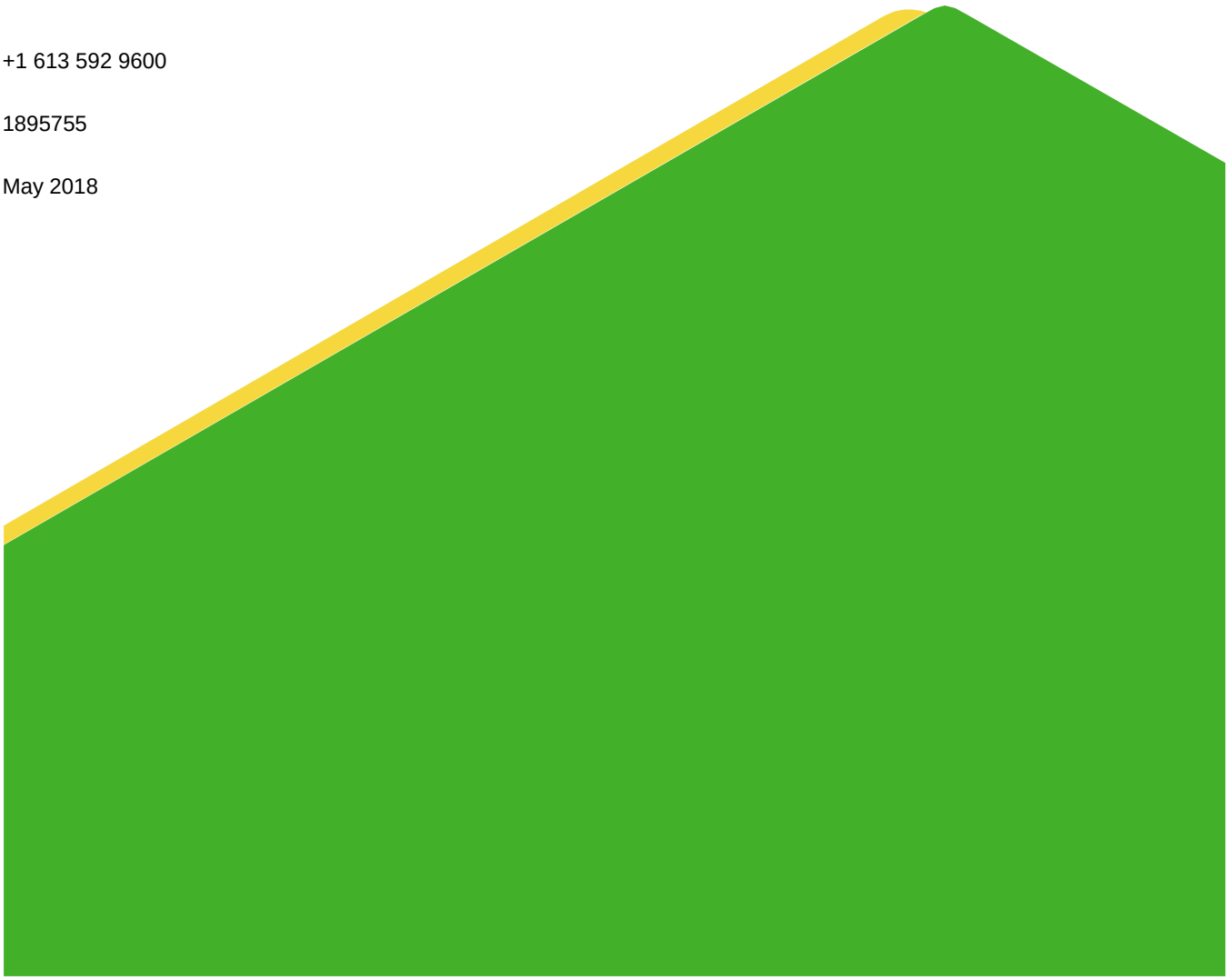

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for the proposed Cowan's Grove commercial development to be located at 4791 Bank Street in Ottawa, Ontario.

The purpose of this geotechnical investigation was to assess the subsurface conditions in the area of the proposed commercial development by means of nine test pits. Based on an interpretation of the factual information obtained, and a review of the existing information available for the site, a general description of the subsurface conditions is presented. These interpreted subsurface conditions and available project details were used to prepare engineering guidelines on the geotechnical design aspects of the project, including construction considerations which could influence design decisions.

The reader is also referred to the "Important Information and Limitations of This Report" which follows the text but forms an integral part of this document.

2.0 DESCRIPTION OF PROJECT AND SITE

Plans are being prepared for the construction of a commercial development to be located at 4791 Bank Street in Ottawa, Ontario (see Key Map inset, Figure 1).

The following is known about the project and site:

- The site is located along the west side of the Kellam Lands development and is bounded to the north, east, and south by undeveloped lands, and to the west by Bank Street.
- The site is approximately trapezoidal in shape measuring about 185 metres by 95 metres in plan area.
- The commercial development will consist of five buildings with areas ranging from about 325 to 990 square metres in size. It is assumed that all of the buildings will be one storey in height and be of slab on grade construction (i.e., no basement level).
- At-grade parking and drive lanes will be provided around the site.

A previous geotechnical investigation has been completed at this site and the results of that investigation were presented in the following report

- Report to Urbandale Corporation titled "*Geotechnical Investigation, Proposed Residential Development, Kellam Lands, Ottawa, Ontario*" dated December 2013 (Report Number 12-1121-0286).

Based on a review of the published geological mapping, and a previous investigation carried out at the site, the subsurface conditions at this site are expected to consist of about 2 to 4 metres of silt, sand, and glacial till overlying bedrock. The bedrock is mapped to be dolomitic limestone of the Oxford Formation.

3.0 PROCEDURE

The fieldwork for this investigation was carried out on April 4, 2018. During that time, nine test pits (numbered 18-01 to 18-09, inclusive) were put down at the approximate locations shown on the Site Plan, Figure 1.

The test pits were advanced using a track mounted excavator supplied and operated by Glenn Wright Excavating of Ottawa, Ontario. The test pits were advanced to depths ranging from about 2.3 to 4.7 metres below the existing ground surface.

The soil exposed on the sides of the test pits were classified by visual and tactile examination. The groundwater seepage conditions were observed in the open test pits and the test pits were loosely backfilled upon completion of excavating and sampling.

The fieldwork was supervised by experienced personnel from our staff who located the boreholes, directed the excavating operations, logged the test pits and samples, and took custody of the samples retrieved. On completion of the excavating operations, samples of the soils obtained from the test pits were transported to our laboratory for examination by the project engineer and laboratory testing. Geotechnical index and classification tests, such as water content determinations and grain size distribution tests, were carried out on select soil samples.

One sample of soil from test pit 18-05 was submitted to Eurofins Environment Ontario for basic chemical analysis related to potential corrosion of buried steel elements and potential sulphate attack on buried concrete elements.

The test pit locations were selected, marked in the field, and subsequently surveyed by Golder Associates personnel. The position and ground surface elevation at the borehole locations were determined using a Trimble R8 GPS survey unit. The elevations are referenced to Geodetic datum.

4.0 SUBSURFACE CONDITIONS

4.1 General

Information on the subsurface conditions is provided as follows:

- Record of Test Pits from the current investigation are provided in Table 1.
- Record of Test Pit from the previous investigation is provided in Appendix A.
- Results of the basic chemical analysis are provided in Appendix B.

In general, the subsurface conditions at the site consist of a surficial layer of topsoil and fill, over silts and sands, over glacial till and bedrock. Based on the Geological Survey of Canada published bedrock geology maps, the bedrock in this area is indicated to be dolomitic limestone of the Oxford Formation.

The following sections present a more detailed overview of the subsurface conditions encountered in the test pits advanced during the current and previous investigation.

4.2 Topsoil and Fill

A layer of topsoil, which ranges in thickness from about 150 to 400 millimetres, exists at the ground surface at all the test pit locations.

A layer of fill exists below the topsoil in test pit 18-01. The fill generally consists of gravelly silty sand and extends to a depth of about 250 millimetres below the existing ground surface. The fill contains concrete, wood, and cobbles.

A granular pad has also been constructed on the northwest corner of the site as a parking lot for the service and display centres at the site.

4.3 Silty Sand to Sandy Silt, Silt, and Clayey Silt

A deposit of silty sand to sandy silt, silt, and clayey silt with varying amounts of gravel exists below the fill in test pit 18-01, and below the topsoil in tespits 18-03 and 18-06 to 18-09. These deposits extend to depths ranging from about 0.3 to 2.1 metres below the existing ground surface.

The results of grain size distribution testing carried out on two samples of the silt and clayey silt are provided in Figure 2.

The measured natural water content on two samples of the silt and clayey silt deposits are about 21 and 29 percent.

4.4 Glacial Till

A deposit of glacial till exists beneath the topsoil, fill, and silty sand to sandy silt, where encountered. The glacial till generally consists of a heterogeneous mixture of gravel, cobbles, and boulders in a matrix of silty sand. The glacial till was not fully penetrated by all the test pits, but was proven to depths ranging from about 2.3 to 4.7 metres below the existing ground surface.

4.5 Refusal and Bedrock

The bedrock surface was encountered in test pits 18-02, 18-05, 18-06, 18-07, 18-09, and 13-2 at depths ranging from about 2.3 to 3.6 metres below the existing ground surface. Refusal to excavating within the glacial till was encountered in test pits 18-01, 18-03, 18-04, and 18-08 at depths ranging from about 2.7 to 4.7 metres below the existing ground surface.

A summary of the depths and elevations of the bedrock surface, as well as the ground surface elevations at the test pit locations, is provided in the following table.

Test Pit Number	Ground Surface Elevation (metres)	Bedrock Surface / Refusal Depth (metres)	Bedrock Surface / Refusal Elevation (metres)
18-01	94.0	4.7^{R}	89.3
18-02	93.5	3.6	89.9
18-03	94.0	4.0^{R}	90.0
18-04	93.9	4.3^{R}	89.6
18-05	92.9	3.2	89.7
18-06	92.4	2.3	90.1
18-07	93.4	3.5	89.9
18-08	92.2	2.7^{R}	89.5
18-09	91.9	3.6	88.3
13-2	93.2	3.4	89.8

Note – ^{R} denotes refusal within the glacial till deposit

4.6 Groundwater

The groundwater seepage conditions were observed in the test pits during the short time that they remained open. Groundwater seepage occurred at depths ranging from about 0.4 to 4.3 metres below the existing ground surface.

Groundwater levels are however expected to fluctuate seasonally. Higher groundwater levels are expected during wet periods of the year, such as spring.

4.7 Corrosion

One soil sample from test pit 18-05 was submitted to Eurofins Environment Ontario for basic chemical analysis related to potential sulphate attack on buried concrete elements and corrosion of buried ferrous elements. The results of this testing are provided in Appendix B, and are summarized below.

Test Pit Number / Sample Number	Sample Depth (m)	Chloride (%)	SO_4 (%)	pH	Resistivity (Ohm-cm)
TP 18-05 / Sa 2	2.3 – 2.5	0.004	0.03	8.04	3450

5.0 DISCUSSION

5.1 General

This section of the report provides engineering guidelines on the geotechnical design aspects of this project based on our interpretation of the borehole information and project requirements. Reference should be made to the "Important Information and Limitations of This Report" which follows the text of this report but forms an integral part of this document.

The foundation engineering guidelines presented in this section have been developed in a manner consistent with the procedures outlined in Part 4 of the 2012 Ontario Building Code (OBC) for Limit States Design.

5.2 Foundation Excavations

Excavations for the construction of the foundations will be through the topsoil, fill, silty sand to sandy silt, where encountered, and into the underlying glacial till. No unusual problems are anticipated in excavating in the overburden soil using conventional hydraulic excavating equipment recognizing that cobbles and boulders will be encountered within the glacial till. The Occupational Health and Safety Act (OHSA) of Ontario indicates that side slopes in the overburden above the water table could be sloped no steeper than 1 horizontal to 1 vertical (i.e., Type 3 soil). Excavations below the water table should be sloped as flat as 3 horizontal to 1 vertical (i.e., Type 4 soil). Boulders larger than 0.3 metres in diameter should be removed from the excavation side slopes for worker safety.

Based on present groundwater levels, excavations deeper than about 0.4 metres will extend below the groundwater level. Groundwater inflow into the excavations should feasibly be handled by pumping from sumps within the excavations. Groundwater inflow is expected to be low to moderate; however, the actual rate of groundwater inflow will depend on many factors including the contractor's schedule and rate of excavation, the size of the excavation, the number of working areas being excavated at one time, and the time of year at which the excavation is made. Also, there may be instances where significant volumes of precipitation, surface runoff and/or groundwater collects in an open excavation, and must be pumped out.

Under the new regulations, a Permit-To-Take-Water (PTTW) is required from the Ministry of the Environment and Climate Change (MOECC) if a volume of water greater than 400,000 litres per day is pumped from the excavations. If the volume of water to be pumped will be less than 400,000 litres per day, but more than 50,000 litres per day, the water taking will not require a PTTW, but will need to be registered in the Environmental Activity and Sector Registry (EASR) as a prescribed activity. Based on the groundwater information collected during the current and previous investigation, it is considered unlikely that a PTTW would be required during construction for this project. However, registration in the EASR may be required. The requirement for registration (i.e., if more than 50,000 litres per day is being pumped) can be assessed at the time of construction. Registration is a quick process that will not significantly disrupt the construction schedule.

5.3 Foundations

In general, the subsurface conditions in the area of the proposed commercial development consist of up to 0.4 metres of topsoil and/or fill over silty sand to sandy silt, silty, and/or clayey silt over glacial till.

It is considered that the proposed commercial development can be supported on conventional spread footings founded on or within the native, undisturbed silty sand to sandy silt and glacial till. The fill is not suitable to support the foundation loads.

For footings placed on native, undisturbed silty sand to sandy silt or glacial till, the Serviceability Limit States (SLS) net bearing resistance for pad and strip footings can be taken as 200 kilopascals. The factored bearing resistance at Ultimate Limit States (ULS) for spread footing foundations may be taken as 250 kilopascals. The ULS bearing resistance value includes a resistance factor of 0.5.

The glacial till at this site contains cobbles and boulders. Any cobbles and boulders in the area of the footings which have been loosened during the foundation excavation should be removed (and not pushed back into place) and the cavity filled with lean concrete. Otherwise, recompression of the disturbed soils could lead to larger than expected post-construction settlements.

The post construction total and differential settlements of footings sized using the above SLS net bearing resistance value should be less than about 25 and 15 millimetres, respectively, provided that the soil at or below founding level is not disturbed during construction.

If the subgrade elevation will be lower than the underside of footing elevation, the subgrade will need to be raised to the footing elevation using compacted engineered fill. The engineered fill should consist of Ontario Provincial Standard Specification (OPSS) Granular B Type II placed in maximum 300 millimetre thick lifts, and compacted to 95 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment.

The engineered fill should be placed to occupy the full zone of influence/support of the building foundations, which is considered to extend out and down from the edge of the perimeter footings at a slope of 1 horizontal to 1 vertical. The topsoil layer as well as any random (i.e., non-select) fill material should also be removed from within these limits.

5.4 Seismic Design

The seismic design provisions of the 2012 Ontario Building Code depend, in part, on the shear wave velocity of the upper 30 metres of soil and/or rock below founding level. However, the OBC also permits the Site Class to be specified based solely on the stratigraphy and in situ testing data (i.e., standard penetration test results), rather than from direct measurements of the shear wave velocity. Using that methodology, a Site Class of C can be used for design of the proposed building.

5.5 Slab on Grade

Conventional slab on grade construction can be used for the proposed commercial development.

For predictable performance of the floor slab, the existing topsoil, fill, as well as any wet or disturbed material should be removed from within the proposed building areas. Provision should be made for at least 150 millimetres of OPSS Granular A to form the base for the floor slab. Any bulk fill required to raise the grade to the underside of the Granular A should consist of OPSS Granular B Type II. The underslab fill should be placed in maximum 300 millimetre thick lifts and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment.

5.6 Frost Protection

The soils at this site are considered to be frost susceptible. Therefore, all exterior foundation elements should be provided with a minimum of 1.5 metres of earth cover for frost protection purposes. Isolated, unheated footings adjacent to surfaces which are cleared of snow cover during winter months should be provided with a minimum of 1.8 metres of earth cover.

Consideration could be given to insulating the bearing surface with high density insulation as an alternative to earth cover. Further geotechnical input can be provided in this regard, if required.

5.7 Foundation Wall Backfill

The soils at this site are frost susceptible and should not be used as backfill against exterior or unheated foundation elements. To avoid problems with frost adhesion and heaving, these foundation elements should be backfilled with non-frost susceptible sand or sand and gravel conforming to the requirements of OPSS Granular B Type I.

In areas where pavement or other hard surfacing will abut the proposed building, differential frost heaving could occur between the granular fill and the adjacent areas. To reduce this differential heaving, the backfill adjacent to the wall should be placed to form a frost taper. The frost taper should be brought up to pavement subgrade level from 1.5 metres below finished exterior grade at a slope of 3 horizontal to 1 vertical, or flatter, away from the wall. The granular fill should be placed in maximum 300 millimetre thick lifts and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment.

The pavement or hard surfacing could be expected to perform better in the long term if the granular backfill against the foundation walls is drained by means of a perforated pipe subdrain in a surround of 19 millimetre clear stone, fully wrapped in a geotextile, which leads by gravity drainage to a positive outlet.

5.8 Site Servicing

Excavations for the installation of site services will be through the topsoil, fill and into the native silty sand to sandy silt and glacial till.

No unusual problems are anticipated in excavating in the overburden using conventional hydraulic excavating equipment, recognizing that large boulders may be encountered. Boulders larger than 0.3 metres in size should be removed from the excavation side slopes.

Excavation side slopes above the water table should be stable in the short term at 1 horizontal to 1 vertical. Side slopes below the water table should be sloped at 3 horizontal to 1 vertical. Alternatively, the excavations could be carried out using steeper side slopes with all manual labour carried out within a fully braced steel trench box for worker safety.

Some groundwater inflow into the excavations could be expected. However, it should be possible to handle the groundwater inflow by pumping from well filtered sumps in the excavations provided suitably sized pumps are used.

At least 150 millimetres of OPSS Granular A should be used as pipe bedding for sewer and water pipes. Where unavoidable disturbance to the subgrade surface occurs, it will be necessary to remove the disturbed material, and place a sub-bedding layer consisting of compacted OPSS Granular B Type II beneath the Granular A. The bedding material should in all cases extend to the spring line of the pipe and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density. The use of clear crushed stone as a bedding layer should not be permitted anywhere on this project since fine particles from the sandy backfill materials or surrounding soil could potentially migrate into the voids in the clear crushed stone and cause loss of lateral pipe support.

Cover material, from spring line of the pipe to at least 300 millimetres above the top of pipe, should consist of OPSS Granular A or Granular B Type I with a maximum particle size of 25 millimetres. The cover material should be compacted to at least 95 percent of the standard Proctor maximum dry density.

It is should be generally acceptable to re-use the excavated overburden soils as trench backfill. However, some of the overburden materials may be too wet to compact. Where that is the case, the wet materials should be wasted (and drier materials imported) or these materials should be placed only in the lower portions of the trench, recognizing that some future settlement of the ground surface or roadway may occur.

In areas where the trench will be covered with hard surfaced materials, the type of material placed within the frost zone (between finished grade and about 1.8 metres depth) should match the soil exposed on the trench walls for frost heave compatibility. Trench backfill should be placed in maximum 300 millimetre thick lifts and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density.

5.9 Pavement Design

In preparation for pavement construction, all topsoil, fill, and deleterious material (i.e., material containing organic material) should be removed from all pavement areas.

Those portions of the fill not containing organic matter may be left in place provided that some limited long term settlement of the pavement surface can be tolerated. However, the surface of the fill material at subgrade level should be proof rolled with a heavy smooth drum roller under the supervision of qualified geotechnical personnel to compact the existing fill and to identify soft areas requiring sub-excavation and replacement with more suitable fill.

Sections requiring grade raising to the proposed subgrade level should be filled using acceptable (compactable and inorganic) earth borrow or OPSS Select Subgrade Material meeting the requirements of OPSS 212 and 1010, respectively. These materials should be placed in maximum 300 millimetre thick lifts and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment.

The surface of the subgrade or fill should be crowned to promote drainage of the pavement granular structure. Perforated pipe subdrains should be provided at subgrade level extending from the catch basins for a distance of at least 3 metres in four orthogonal directions or longitudinally where parallel to a curb.

The pavement structure for car parking areas should consist of:

Pavement Component	Thickness (millimetres)
Asphaltic Concrete	50
OPSS Granular A Base	150
OPSS Granular B Type II Subbase	300

The pavement structure for access roadways and truck traffic areas should consist of:

Pavement Component	Thickness (millimetres)
Asphaltic Concrete	90
OPSS Granular A Base	150
OPSS Granular B Type II Subbase	450

The granular base and subbase materials should be uniformly compacted to at least 100 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment. The asphaltic concrete should be compacted in accordance with Table 10 of OPSS 310.

The composition of the asphaltic concrete pavement in car parking areas should be as follows:

- Superpave 12.5 Surface Course – 50 millimetres.

The composition of the asphaltic concrete pavement in access roadways and truck traffic areas should be as follows:

- Superpave 12.5 Surface Course – 40 millimetres.
- Superpave 19.0 Binder Course – 50 millimetres.

The asphalt cement should consist of PG 58-34.

The above pavement designs are based on the assumption that the pavement subgrade has been acceptably prepared (i.e., where the trench backfill and grade raise fill have been adequately compacted to the required density and the subgrade surface not disturbed by construction operations or precipitation). Depending on the actual conditions of the pavement subgrade at the time of construction, it could be necessary to increase the thickness of the subbase and/or to place a woven geotextile beneath the granular materials.

5.10 Corrosion and Cement Type

One sample of soil from test pit 18-05 was submitted to Eurofins Environmental Ontario for basic chemical analysis related to potential corrosion of exposed buried steel and concrete elements (corrosion and sulphate attack). The results of this testing are provided in Appendix B.

The results indicate that concrete made with Type GU Portland cement should be acceptable for substructures. The results also indicate an elevated potential for corrosion of exposed ferrous metal.

6.0 ADDITIONAL CONSIDERATIONS

The soils at this site are sensitive to disturbance from ponded water, construction traffic, and frost.

All footing and subgrade areas should be inspected by experienced geotechnical personnel prior to filling or concreting to ensure that soil having adequate bearing capacity has been reached and that the bearing surfaces have been properly prepared. The placing and compaction of any engineered fill should be inspected to ensure that the materials used conform to the specifications from both a grading and compaction view point.

The test pits excavated on the site constitute zones of disturbance. The locations of the test pits will need to be repaired at the time of construction.

At the time of the writing of this report, only preliminary details for the proposed commercial development were available. Golder Associates should be retained to review the final drawings and specifications for this project prior to tendering to ensure that the guidelines in this report have been adequately interpreted.

Signature Page

Golder Associates Ltd.

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WAM/WC/mvrd
https://golderassociates.sharepoint.com/sites/1895755/deliverables/geotechnical report/final/1895755-001-r-rev0-cowan's grove-may 2018.docx

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Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client, **Urbandale Corporation.** The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder cannot be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

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The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder cannot be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Groundwater Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. **The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report.** The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

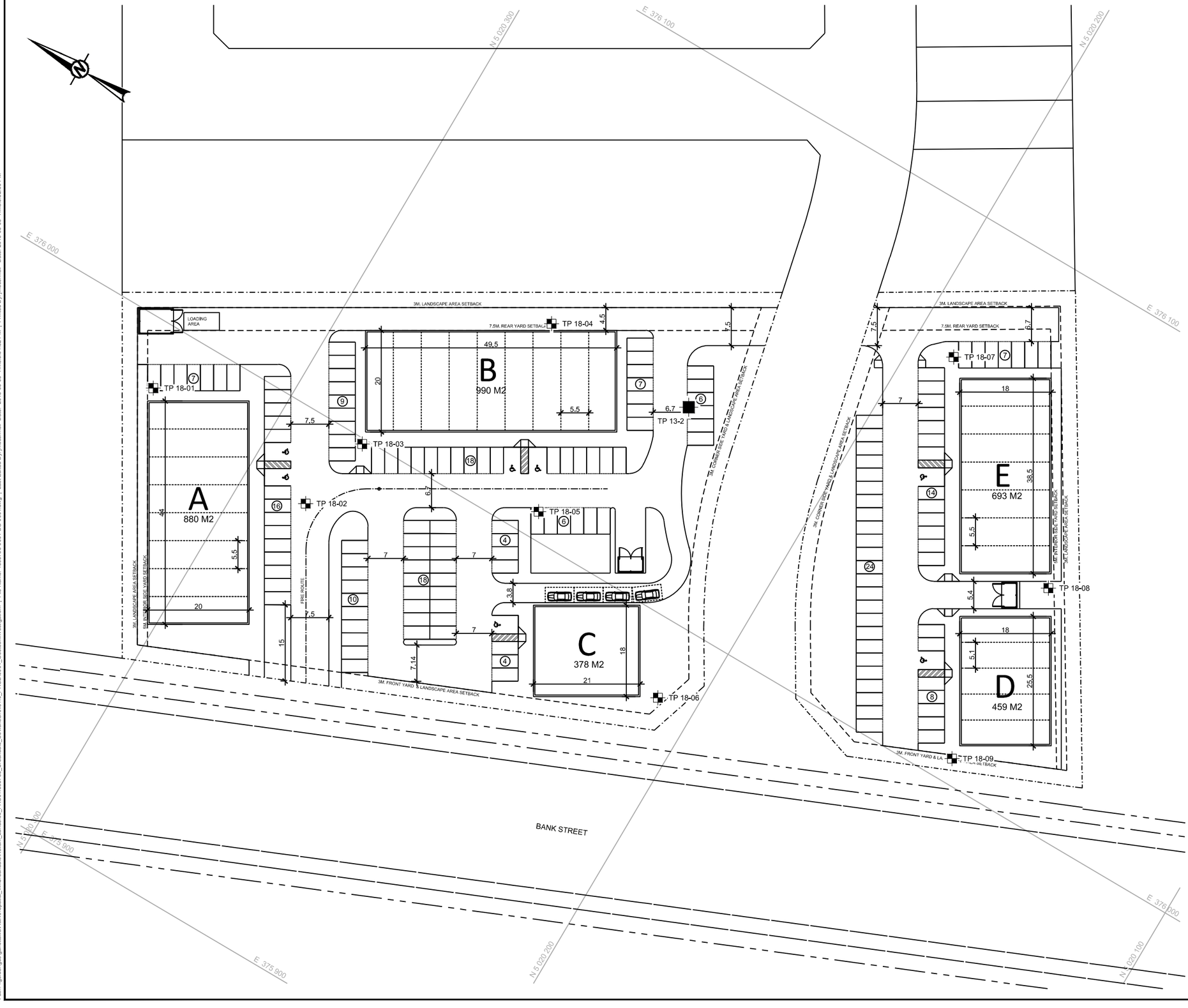
Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

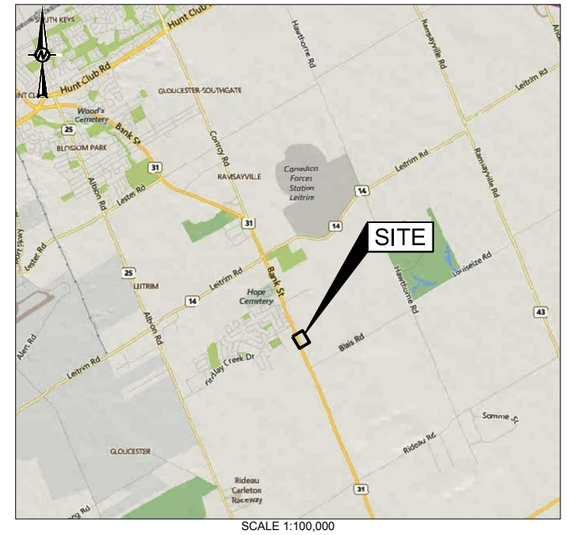
During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.



KEY MAP



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LEGEND

- APPROXIMATE TEST PIT LOCATION
- APPROXIMATE TEST PIT LOCATION, PREVIOUS INVESTIGATION BY GOLDER ASSOCIATES LTD., REPORT NO. 12-1121-0286, DATED NOVEMBER 2013

REFERENCE(S)

1. BASE PLAN SUPPLIED BY URBANDALE ON MARCH 20, 2018, DRAWING NO. 1420 COWAN'S GROVE SITE PLAN 2018-03-15.dwg
2. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

0 12.5 25
1:750 METRES

CLIENT
URBANDALE CORPORATION

PROJECT
GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT - COWAN'S GROVE
4791 BANK STREET, OTTAWA, ONTARIO

TITLE
SITE PLAN

CONSULTANT
GOLDER

YYYY-MM-DD	2018-03-21
DESIGNED	----
PREPARED	JM
REVIEWED	WAM
APPROVED	WC

PROJECT NO.	CONTROL	REV.	FIGURE
1895755	0001	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

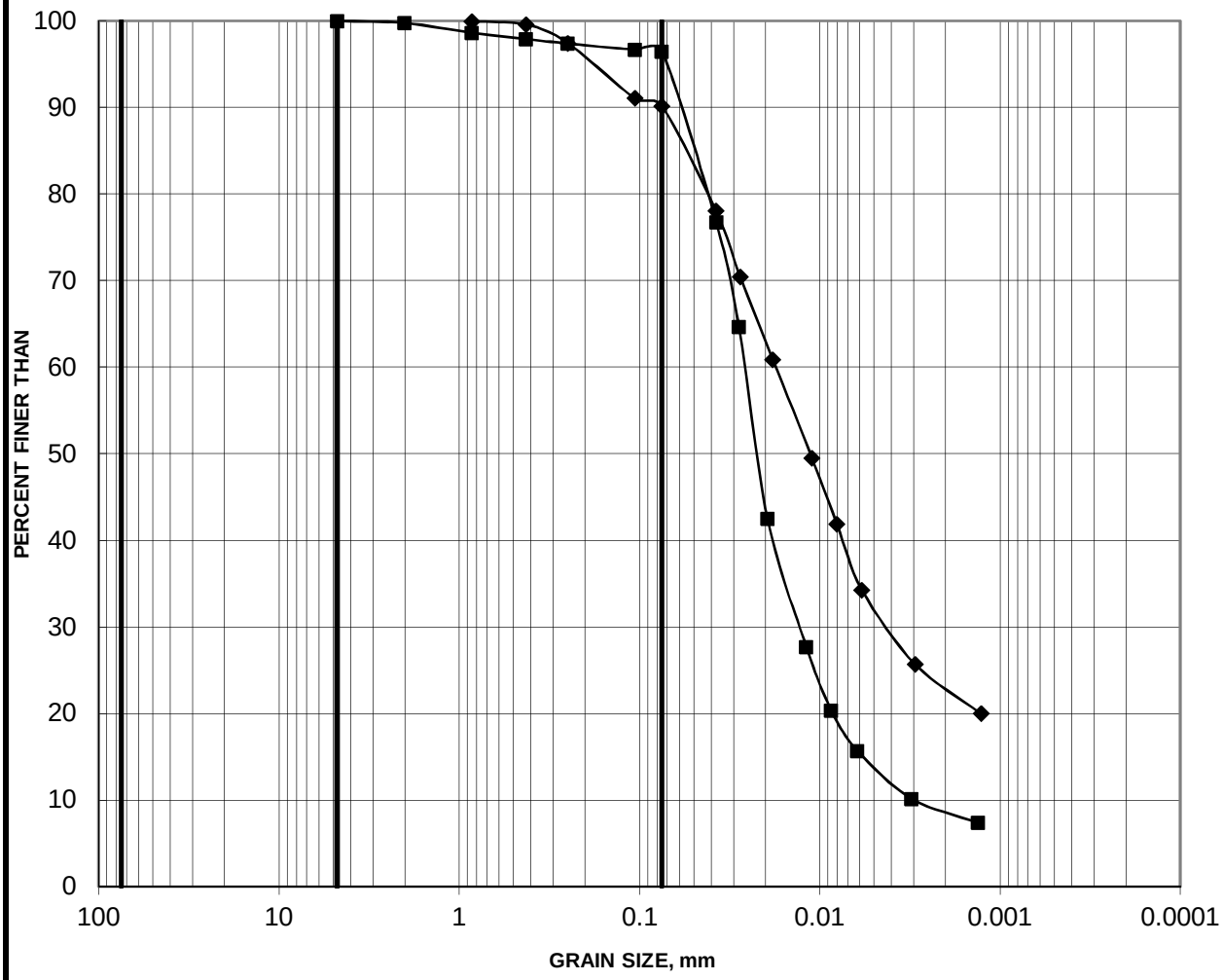
25 mm

Path: \\golder.gds\gal\ottawa\Active\Spatial_IM\Urbandale\Kellam_Lands\99_PROJ\1895755_Urbandale_CowansGrove\40_PROD\0001_GeotechInvestigation\ | File Name: 1895755-0001-BG-0001.dwg | Last Edited By: jmconnell Date: 2018-05-08 Time:3:31:32 PM | Printed By: jmconnell Date: 2018-05-08 Time:3:32:00 PM

GRAIN SIZE DISTRIBUTION

FIGURE 2

(ML) SILT and CLAYEY SILT



Cobble	coarse	fine	coarse	medium	fine	SILT AND CLAY
Size	GRAVEL SIZE		SAND SIZE			

Test Pit	Sample	Depth (m)
18-03	2	0.80-1.00
18-06	2	0.22-0.80

Project: 1895755 /1000

Golder Associates

Created by: MI
Checked by: CNM

APPENDIX A

Record of Test Pit from Previous Investigation

TABLE 1

RECORD OF TEST PITS

TEST PIT NUMBER (ELEVATION)	DEPTH (METRES)	DESCRIPTION
TP 13-1	0.0 – 0.4	Black TOPSOIL
(91.50 m)	0.4 – 1.5	Grey brown SANDY SILT
	1.5 – 3.0	Grey SILTY SAND, trace gravel, trace clay, with cobbles and boulders (GLACIAL TILL)
	3.0	Refusal on BEDROCK
		Test Pit dry upon completion
		Sample 1 — Depth (m) 0.4 – 1.50
TP 13-2	0.0 – 0.2	Black TOPSOIL with roots
(93.21 m)	0.2 – 1.15	Brown SILTY SAND trace gravel, trace clay, with cobbles and boulders (GLACIAL TILL)
	1.15 – 3.4	Grey SILTY SAND, trace gravel, trace clay, with cobbles and boulders (GLACIAL TILL)
	3.4	Refusal on BEDROCK
		Water Seepage at 3.4 metres
		Sample 1 — Depth (m) 0.2 – 1.15
TP 13-3	0.0 – 0.15	Black TOPSOIL with roots
(91.04 m)	0.15 – 1.40	Brown SILTY SAND trace gravel, trace clay, with cobbles and boulders (GLACIAL TILL)
	1.1 – 1.5	Grey SILTY SAND, trace gravel, trace clay, with cobbles and boulders (GLACIAL TILL)
	1.5	Refusal on BEDROCK
		Water Seepage at 1.4 metres
		Sample 1 — Depth (m) 0.15 – 1.4

APPENDIX B

Results of Chemical Analysis

Certificate of Analysis

eurofins | Environment Testing

Client: Golder Associates Ltd. (Ottawa)
1931 Robertson Road
Ottawa, ON
K2H 5B7
Attention: Mr. Alex Meacoe
PO#:
Invoice to: Golder Associates Ltd. (Ottawa)

Report Number: 1805058
Date Submitted: 2018-04-09
Date Reported: 2018-04-17
Project: 1895755
COC #: 188731

				Lab I.D.	1352745
				Sample Matrix	Soil
				Sample Type	
				Sampling Date	2018-04-04
				Sample I.D.	18-05 SA2/2.3-2.5m
Group	**Analyte**	**MRL**	**Units**	**Guideline**	
Agri. - Soil	pH	2.00			8.04
	SO4	0.01	%		0.03
General Chemistry	Cl	0.002	%		0.004
	Electrical Conductivity	0.05	mS/cm		0.29
	Resistivity	1	ohm-cm		3450

Guideline = *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

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