SEPTIC IMPACT ASSESSMENT (REV.1)
5646-5650 MANOTICK MAIN STREET

Project No.: CCO-22-2383

Prepared for:

Hawkins Properties
650a Eagleson Road
Ottawa, ON

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McINTOSH PERRY

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1.0 INTRODUCTION

McIntosh Perry (MP) was retained by Hawkins Properties to conduct a Sewage System Impact Assessment Report for the Site located at 5646-5650 Manotick Main Street, Ottawa, Ontario (the Site, Figure 1). It is our understanding that the Client wishes to construct sewage systems to service the proposed 1-storey drive-through restaurant and the existing 2-bay carwash scheduled to remain, complete with new drive aisles and parking areas at the Site, which has triggered the need for a Site Plan Control Application. As part of pre-consultation with the City of Ottawa, it was identified that a Septic Impact Assessment was required to ensure that the proposed septic systems do not impact the groundwater should it be used as a source of drinking water in the surrounding area.

This work was conducted in general accordance with the City of Ottawa's guidance document; City of Ottawa - Hydrogeological and Terrain Analysis Guidelines (March 2021).

The following report describes the Terrain Analysis and associated Sewage System Impact Assessment that was undertaken. This Hydrogeological Assessment and Septic Impact Assessment addresses the following:

- General Site setting information;
- Geological and hydrogeological background;
- Site-specific conditions; and
- Existing and proposed water and wastewater infrastructure (on-site and off-site).

1.1 Site Description

The property is located at 5646-5650 Manotick Main Street within the Rideau-Jock Ward. The property is legally described as:

PART OF LOT 4, CONCESSION A, NORTH GOWER, (A.K.A. CONCESSION A, BROKEN FRONT) AS IN NS268982 EXCEPT PART 1 ON 5R-10077. OTTAWA.

PIN 039020885

PART OF LOT 4, CONCESSION A, NORTH GOWER, (A.K.A. CONCESSION A, BROKEN FRONT) AS IN N334886. OTTAWA. TOGETHER WITH AS IN N334886

PIN 039020886

The Site covers approximately 0.41 ha and is located at the intersection of Manotick Main Street and Mahogany Harbour Lane. The Site is currently zoned as Rural Commercial (RC1). See Figure 1 for the Site Location Plan for more details.

1.2 Existing Conditions and Infrastructure

The existing Site is currently developed with a 2-storey commercial building and attached carwash with associated road/parking area and landscaped areas at 5646 Manotick Main Street, and with a single-storey

detached residential dwelling at 5650 Manotick Main Street with paved driveway and landscaped areas. The Site is serviced by an on-site well and septic system. There are no storm services currently on site. Storm water currently sheet flows to the northeast section of the site where it is collected by a ditch system along Manotick Main Street which promotes infiltration.

Sewer and watermain mapping collected from the City of Ottawa indicate that the following services exist across the property frontages within the adjacent municipal rights-of-way(s):

- Manotick Main Street
  - 305 mm diameter PVC watermain.

1.3 Proposed Development and Statistics

The proposal is to develop a 1-storey drive-through restaurant while retaining the existing 2-bay carwash currently on-site, complete with new drive aisles and parking areas with access from Manotick Main Street.

2.0 INVESTIGATION

2.1 Site Setting

At the present time, the existing lots are developed with a two-storey commercial building with attached carwash and a residential dwelling with a shared entrance road from Manotick Main Street. On-site vegetation consists primarily of trees and landscaped areas. Based on a review of historical aerial photographs available on GeoOttawa, it appears that the subject property was developed prior to 1976 (earliest photo is 1976) with a similar Site configuration. Previous use at the Site could not be confirmed.

The climate is continental with cool winters and warm summers. The 1981-2010 mean annual precipitation is approximately 943.4 mm with 223.5 cm as snow, and the mean daily temperature is 6.4 °C (Environment Canada Climate Normals for Ottawa MacDonald-Cartier Int'l Airport, ON).

2.2 Neighbouring Properties and Land Uses

The Site is bounded to the northwest by mixed use/commercial, residential use to the north/northeast and to the south.

Based on a review of MECP well records, McIntosh Perry's local knowledge of the area, as well as publicly available data from the City of Ottawa's GeoOttawa GIS database, the municipal water supply network does not service the subject Site and all immediately surrounding properties. It is understood that even though there is a municipal water supply line that runs along Manotick Main Street, the immediately surrounding properties fronting on Manotick Main Street from Bridgeport Avenue to approximately 400 m northwest from the Bridgeport Avenue and Manotick intersection, are serviced by individual drinking water wells. Additionally, there are no available municipal sanitary sewers in the vicinity of the Site along Manotick Main Street and therefore all neighbouring properties along Manotick Main Street are expected to be serviced with private

sewage systems. Figures 2 presents the land usage for the surrounding areas, while Figure 3 presents the local topographical and hydrological information.

2.3 Hydrology and Hydrogeology

Ground surface at the Site is generally relatively flat. Regional relief appears to slope to the north. Ground surface elevation at the Site varies from 88.5-90.0 m (geodetic).

The Site occurs within the Rideau Falls – Rideau River watershed. The closest water body to the Site is the Mahogany Harbour, part of the West Branch Rideau River, located approximately 40 metres (m) north, at its closest point. On-site infiltration of water is interpreted to occur in areas of permeable ground surface. Surface drainage at the Site appears to be largely controlled by sheet flow runoff to the northeast ditches along Manotick Main Street with a small part of the southwestern edge of the Site currently draining to the southwest along the tree line.

On a local scale, groundwater is interpreted to reflect local topography. Groundwater flow at the Site is expected to flow to the north. As part of a Geotechnical Investigation completed by Terrapex Environmental Ltd., 13 boreholes were advanced in the overburden at the Site with four (4) of the boreholes being instrumented with monitoring wells. Static water levels monitoring conducted in the piezometers confirms that local shallow groundwater flow within the overburden is to the north-east.

2.4 Water Well Record Review

MP conducted a review of MECP WWIS records within 500 m of the Site. Out the of the 131 wells found within the study area, one (1) was listed as commercial, two (2) were listed as livestock, two (2) were listed as test holes/monitoring, 11 were undefined, and 115 were listed for domestic water supply usage and shown in Figure 4. The MECP Water Well Information System Records are summarized in Table 2-1 below.

Table 2-1: MECP WWIS Summary (MECP 2021)

Well ID	Depth (m)	Overburden Material	Depth to Bedrock (m)	Completion Material	Static Water Level (mBGS)	Well Type	Year Completed
1500540	22.6	FILL, HARDPAN, BOULDERS	10.4	LIMESTONE	7	Domestic	23-Jul-63
1500543	15.2	GRAVEL, BOULDERS	10.4	LIMESTONE	6.1	Domestic	10-Jan-64
1500548	16.2	BOULDERS, CLAY, GRAVEL	7.3	LIMESTONE	6.1	Domestic	06-Apr-64
1500562	30.5	CLAY, GRAVEL	7	LIMESTONE	6.1	Domestic	31-May-66
1500567	25.3	MEDIUM SAND, HARDPAN, BOULDERS	5.5	LIMESTONE	5.5	Domestic	30-Nov-66

1506485	18	TOPSOIL, CLAY, GRAVEL	9.1	LIMESTONE	4.9	Domestic	03-Dec-48
1506486	8.5	CLAY, GRAVEL	-	GRAVEL	0.6	Domestic	24-Oct-49
1506487	12.8	CLAY	9.1	LIMESTONE	0.9	Domestic	13-Dec-52
1506488	11.9	CLAY, GRAVEL	-	GRAVEL	1.2	Domestic	20-Oct-54
1506489	29.6	MEDIUM SAND, BOULDERS	13.4	LIMESTONE	8.5	Domestic	22-Nov-54
1506490	31.7	GRAVEL, BOULDERS	16.5	LIMESTONE	9.8	Domestic	05-Feb-57
1506491	12.8	CLAY	11	LIMESTONE	2.4	Domestic	02-Nov-57
1506492	13.7	CLAY, GRAVEL	-	GRAVEL	3.7	Domestic	10-May-60
1506493	45.7	GRAVEL, BOULDERS, CLAY	17.7	SANDSTONE	10.4	Domestic	11-Aug-60
1506494	8.5	CLAY, GRAVEL	-	GRAVEL	0.6	Domestic	04-Oct-49
1506495	19.5	CLAY	9.1	LIMESTONE	3	Domestic	20-Nov-51
1506496	20.4	CLAY, GRAVEL, HARDPAN	9.1	LIMESTONE	4.9	Domestic	16-Jan-53
1506497	21	CLAY	9.8	LIMESTONE	4.9	Domestic	08-Apr-53
1506498	18.3	CLAY, GRAVEL	9.8	LIMESTONE	5.5	Domestic	18-Nov-55
1506499	16.2	BOULDERS, CLAY, GRAVEL	8.5	LIMESTONE	4	Domestic	18-Jul-56
1506500	20.7	STONES, GRAVEL, MEDIUM SAND	11.9	LIMESTONE	8.5	Domestic	14-Sep-56
1506501	21.3	CLAY	6.7	LIMESTONE	1.8	Domestic	01-Oct-56
1506502	13.4	CLAY, GRAVEL	-	GRAVEL	1.8	Domestic	04-Nov-56
1506503	21.3	CLAY	7.3	LIMESTONE	5.5	Domestic	16-Nov-56
1506504	18.3	CLAY	9.4	LIMESTONE	3.7	Domestic	14-Jul-58
1506505	34.1	PREVIOUSLY DUG, LIMESTONE	19.2	SANDSTONE	5.5	Commerical	19-May-60
1506506	31.4	CLAY, BOULDERS, GRAVEL	12.2	LIMESTONE	6.1	Domestic	02-Jun-60
1506507	21.9	TOPSOIL, CLAY	13.7	LIMESTONE	9.1	Domestic	05-Mar-63
1506508	32.9	TOPSOIL, CLAY, GRAVEL	9.1	LIMESTONE	11.6	Livestock	12-Oct-65
1506509	31.1	CLAY,MEDIUM SAND,STONES	9.1	LIMESTONE	10.7	Domestic	04-Jul-53
1506512	19.2	CLAY	8.5	LIMESTONE	4	Domestic	03-Aug-56

1506513	14.3	BOULDERS, CLAY, GRAVEL	11.3	LIMESTONE	5.2	Domestic	18-Jun-57
1506518	27.4	CLAY,BOULDERS	9.1	LIMESTONE	2.1	Domestic	27-May-60
1506521	19.8	TOPSOIL, CLAY	10.4	LIMESTONE	7.9	Domestic	20-Jun-62
1506522	21.3	CLAY	10.4	LIMESTONE	6.1	Domestic	24-Oct-64
1506525	16.5	CLAY, BOULDERS	8.5	LIMESTONE	5.2	Domestic	29-Aug-67
1506526	21.3	CLAY, MEDIUM SAND, BOULDERS, HARDPAN	7.6	LIMESTONE	3.7	Domestic	21-Oct-67
1506527	19.2	CLAY,BOULDERS, HARDPAN	9.1	LIMESTONE	5.2	Domestic	29-Apr-68
1506600	46.6	CLAY, TOPSOIL,MEDIUM SAND, GRAVEL, SILT	27.4	LIMESTONE	11.9	Domestic	16-Jul-51
1506602	21.3	CLAY, BOULDERS	11.6	LIMESTONE	7.9	Domestic	19-Sep-59
1506605	40.2	PREVIOUSLY DUG, PREV. DRILLED, LIMESTONE	26.5	SANDSTONE	10.7	Livestock	08-Feb-64
1507754	22.9	CLAY, HARDPAN	7.3	LIMESTONE	1.8	Domestic	02-Oct-67
1510418	21.9	CLAY, BOULDERS	5.5	LIMESTONE	6.1	Domestic	24-Oct-69
1511017	29	HARDPAN, BOULDERS	14	LIMESTONE	6.1	Domestic	08-Dec-70
1509854	16.8	MEDIUM SAND,BOULDERS	7.6	LIMESTONE	4.6	Domestic	12-Nov-68
1509855	21.9	MEDIUM SAND,BOULDERS	11.3	LIMESTONE	5.2	Domestic	14-Nov-68
1510363	25.9	HARDPAN	5.2	LIMESTONE	2.4	Domestic	23-Sep-69
1511726	18.9	SAND,CLAY,	7	LIMESTONE	3.4	Domestic	30-Mar-72
1511727	14.6	SAND,CLAY	5.2	LIMESTONE	2.7	Domestic	29-Mar-72
1511728	22.3	SAND, CLAY, GRAVEL	12.2	LIMESTONE	6.7	Domestic	25-Mar-72
1509973	15.5	CLAY, BOULDERS	7.6	LIMESTONE	3	Domestic	04-Jan-69
1510132	29.9	GRAVEL, BOULDERS	18.9	LIMESTONE	2.1	Domestic	24-Jun-69
1510422	22.6	CLAY, BOULDERS	7	LIMESTONE	5.5	Domestic	29-Oct-69
1510424	22.3	CLAY,BOULDERS, MEDIUM SAND, GRAVEL	6.4	LIMESTONE	4.6	Domestic	31-Oct-69

1510434	13.1	TOPSOIL, CLAY,MEDIUM SAND, HARDPAN, STONE, GRAVEL, FINE SAND	11.6	LIMESTONE	4.6	Domestic	02-Dec-69
1510472	20.4	CLAY,MEDIUM SAND,GRAVEL, BOULDERS	7.9	LIMESTONE/ SHALE	4.6	Domestic	18-Dec-69
1510655	29.3	HARDPAN,BOULDERS	11.6	LIMESTONE	18.3	Domestic	26-Jun-70
1510858	19.5	CLAY,SILT, GRAVEL, BOULDERS	7	LIMESTONE	6.1	Domestic	07-Aug-70
1510874	20.7	HARDPAN,BOULDERS	11.6	LIMESTONE	6.7	Domestic	28-Aug-70
1511047	19.2	HARDPAN,BOULDERS	10.7	LIMESTONE	6.1	Domestic	30-Nov-70
1511053	20.7	CLAY, SAND,BOULDERS	6.7	LIMESTONE	4.6	Domestic	18-Jan-71
1511189	27.7	CLAY,SAND,BOULDERS	11.9	LIMESTONE	5.5	Domestic	27-May-71
1511202	22.3	HARDPAN, BOULDERS, SAND, GRAVEL	12.8	LIMESTONE	6.1	Domestic	07-Jun-71
1511203	26.2	HARDPAN, BOULDERS	11	LIMESTONE	4.6	Domestic	07-Jun-71
1511230	36.9	CLAY, SAND, BOULDERS	6.4	LIMESTONE	2.4	Domestic	29-Jun-71
1511311	15.8	CLAY, GRAVEL, HARDPAN	11	LIMESTONE	3	Domestic	15-Jul-71
1511722	14.6	SAND,CLAY,BOULDERS	7.3	LIMESTONE	5.5	Domestic	10-Feb-72
1511518	19.8	CLAY	0.3	LIMESTONE	2.4	Domestic	05-Oct-71
1511537	41.5	HARDPAN, BOULDERS, SAND, GRAVEL, CLAY	13.1	LIMESTONE	9.1	Domestic	28-Oct-71
1511545	29.9	SAND,CLAY,GRAVEL, BOULDERS, HARDPAN	17.4	LIMESTONE	14	Domestic	28-Oct-71
1511638	21.3	SAND,CLAY,BOULDERS	4.3	LIMESTONE	2.4	Domestic	22-Nov-71
1511640	30.5	SAND,CLAY,BOULDERS	6.1	LIMESTONE	5.2	Domestic	24-Nov-71
1511647	30.2	CLAY,SAND,BOULDERS, HARDPAN	12.5	LIMESTONE	8.5	Domestic	13-Dec-71

1512140	41.1	CLAY,BOULDERS, SAND, LIMESTONE	10.4	SANDSTONE	7.3	Domestic	19-Oct-72
1512169	45.7	CLAY,BOULDERS, SAND, LIMESTONE	7.3	SANDSTONE	5.5	Domestic	14-Sep-72
1512171	32	FILL, SAND, BOULDERS	9.1	LIMESTONE	6.1	Domestic	14-Sep-72
1512310	39.6	SAND,CLAY,BOULDERS, HARDPAN, LIMESTONE	17.4	SANDSTONE	9.4	Domestic	24-Jan-73
1513374	11.9	SAND, CLAY, GRAVEL	-	GRAVEL	1.5	Domestic	05-Jun-73
1513556	14.6	CLAY,STONES	11.9	LIMESTONE	2.4	Domestic	12-Sep-73
1513558	45.1	SAND,BOULDERS, HARDPAN, LIMESTONE	11.3	SANDSTONE	7.6	Domestic	12-Sep-73
1514288	22.3	SAND, CLAY, STONES	6.7	LIMESTONE	1.5	Domestic	06-Aug-74
1514569	28.7	SAND, CLAY	28	LIMESTONE	0	Domestic	17-May-74
1514616	42.7	CLAY,BOULDERS,HARDPAN, LIMESTONE	8.8	SANDSTONE	4.6	Domestic	22-Apr-75
1515615	35.1	SAND,BOULDERS, HARDPAN, LIMESTONE	19.5	SANDSTONE	15.2	Domestic	24-Sep-76
1516106	25.3	CLAY,STONES	14.3	LIMESTONE	3.7	Domestic	23-Jun-77
1516114	9.1	CLAY	4.6	LIMESTONE	2.4	Domestic	11-Jul-77
1516271	22.3	CLAY,SAND,BOULDERS, HARDPAN	14.6	LIMESTONE	9.1	Domestic	20-Oct-77
1516334	13.4	SAND, STONES	6.4	LIMESTONE	1.5	Domestic	29-Sep-77
1516567	47.2	CLAY, BOULDERS, LIMESTONE	17.7	SANDSTONE	9.1	Domestic	06-Jun-78
1516571	38.1	CLAY,BOULDERS,HARDPAN,GRAVEL, LIMESTONE	17.7	SANDSTONE	7.6	Domestic	14-Jun-78
1517564	19.2	CLAY,BOULDERS, HARDPAN, GRAVEL	14	LIMESTONE	4.6	Domestic	23-Apr-81
1517651	14.6	CLAY, SAND, GRAVEL	7.6	LIMESTONE	1.5	Domestic	29-Jun-81
1517652	18.3	CLAY,BOULDERS,SAND	7.9	LIMESTONE	4.6	Domestic	29-Jun-81
1518656	13.1	CLAY,HARDPAN,STONES	9.8	LIMESTONE	3.4	Domestic	19-Oct-83

1518957	33.5	SAND,HARDPAN,BOULDERS	18.6	LIMESTONE	3.4	Domestic	11-May-84
1519037	48.8	CLAY, HARDPAN, STONES, LIMESTONE	13.4	SANDSTONE	7.6	Domestic	17-Jan-84
1533319	24.4	CLAY,GRAVEL	5.8	LIMESTONE	3	Domestic	01-Nov-02
7049988	0	-	-	-	-	-	10-Sep-07
7052064	27.4	CLAY	-	LIMESTONE	1.9	Domestic	18-Oct-07
7053560	53.3	HARDPAN,BOULDERS, LIMESTONE	-	SANDSTONE	10.3	Domestic	12-Nov-07
7108186	43	SAND,GRAVEL	-	LIMESTONE	3.2	Domestic	14-May-08
7108187	42.7	SAND,GRAVEL, LIMESTONE	-	SANDSTONE	3.2	Domestic	14-May-08
7109789	7.6	-	-	-	0		24-Jun-08
7111921	29.6	-	-	-	3.7	-	09-Sep-08
7112930	22.9	CLAY,STONES, SAND	-	LIMESTONE	2.9	Domestic	12-Aug-08
7130171	0	-	-	-	0	Domestic	11-Sep-09
7154903	0	-	-	-	0	Domestic	01-Nov-10
7161173	0	-	-	-	0	Domestic	23-Mar-11
7166914	0	-	-	-	0	Domestic	28-Jul-11
7167126	39.6	CLAY,SAND,STONES, LIMESTONE	-	SANDSTONE	0	Domestic	06-Jul-11
7173519	0	-	-	-	0	Domestic	28-Nov-11
7173907	0	-	-	-	0		07-Nov-11
7174725	0	-	-	-	0	Domestic	05-Jan-12
7181759	38	CLAY, TILL, SAND, GRAVEL	-	DOLOMITE	2.9	Test Hole	23-Mar-12
7181760	14.5	CLAY, TILL, SAND, GRAVEL	-	DOLOMITE	2.9	Monitoring and Test Hole	23-Mar-12
7210675	24.4	CLAY,SAND, GRAVEL, BOULDERS	-	LIMESTONE	1.8	Domestic	23-Sep-13
7211084	0	-	-	-	0	Domestic	30-Oct-13
7242995	0	-	-	-	0		22-Apr-15
7243008	42.7	CLAY,SAND, BOULDERS	-	LIMESTONE	3.7	Domestic	21-Apr-15
7243009	42.7	CLAY,SAND,BOULDERS	-	LIMESTONE	3.8	Domestic	15-Apr-15

7287863	47.5	GRAVEL,BOULDERS, CLAY, LIMESTONE	-	SANDSTONE	7.7	Domestic	10-May-17
7298148	0	-	-	-	0	-	03-Oct-17
7299183	0	-	-	-	0	-	06-Oct-17
7321066	0	-	-	-	0	-	20-Aug-18
7321150	36.6	GRAVEL, FILL	-	LIMESTONE	7	Domestic	22-Aug-18
7324268	0	-	-	-	0	-	11-Oct-18
7324272	41.1	CLAY,GRAVEL,SANDY , LIMESTONE	-	SANDSTONE	4.1	Domestic	03-Oct-18
7345394	0	-	-	-	0	-	17-Oct-19
7370182	0	-	-	-	0	-	02-Sep-20
7371700	0	-	-	-	0	-	18-Aug-20
7377751	0	-	-	-	0	-	13-Nov-20

Geological information provided by the well drillers in the WWIS records was generally consistent with Ontario Geological Survey (OGS) data published for the area. Well records described the overburden as clay, sand, and gravel and limestone and sandstone as the bedrock. Bedrock was found between 0.3 – 28 m below ground surface (bgs), with the average of 10.7m bgs (MECP, 2021).

2.5 Background Geology and Hydrology

2.5.1 Ontario Geological Survey (OGS) – Surficial Geology

Surficial geology maps of southern Ontario classify the overburden as silt and clay, minor sand and gravel for the majority of the Site, except the most eastern corner of the Site which is classified as stone-poor, sandy silt to silt sand textured till on Paleozoic terrain (OGS, 2021).

2.5.2 Ontario Geological Survey (OGS) – Bedrock Geology

Geological maps of the area classify the bedrock under the Site as limestone, dolostone, shale, and sandstone of the Ottawa and Beekmantown Group (OGS, 2021).

3.0 TERRAIN ANALYSIS

3.1 On-Site Investigation

As part of a geotechnical investigation conducted by Terrapex, boreholes were advanced via drilling at various locations throughout the Site to assess its geology and subsurface conditions, including properties of the on-site overburden. In total, 13 boreholes were advanced.

The boreholes were advanced using direct push technology at MW111 and MW112, while the remaining were advanced using hollow stem augers aided by 7822 DT Geoprobe drill rig. Boreholes were advanced to a

maximum depth of 9.3 m below the ground surface. Boreholes MW101, BH102, BH103, BH106, and MW109 were advanced to refusal on inferred bedrock, while the remaining boreholes terminated in the overburden.

The samples were collected using a 51 mm outside diameter split spoon sampler following the Standard Penetration Test (SPT) procedure, except for MW111 and MW112. Refer to Appendix A for draft geotechnical report, including the borehole locations and borehole logs.

All samples were logged as retrieved, and visual description and soil type identification were added to the logs. Subsequently, three (3) soil samples were submitted for Grain-Size analyses and Atterberg Limits tests to Terrapex's laboratory.

3.2 Site Evaluation

3.2.1 Overburden Depth

Where boreholes were advanced to refusal, overburden across the site was found to be between 8.2m to 9.3m bgs, with an inferred bedrock elevation between 91.20 m and 92.43 m.

3.2.2 Overburden Characterization

In general, the site stratigraphy consists of four layers, shallow topsoil or asphaltic concrete and granular material in parking lot areas, followed by fill material composed of clayey silt with traces of sand and gravel below the asphaltic concrete areas and below the topsoil layer at BH103, BH103, and BH104. Sandy silt fill followed by sand fill is present at the surface of the ground at BH106. Sandy silt fill is also present below the topsoil layer in BH110. The fill materials extend the entire depth of BH104, to a depth of 3.4 m at BH106, and to depths ranging between 0.6 to 1.5 m bgs at the remaining boreholes. The sand fill present at BH106 was inferred to be placed to backfill the excavation associated with the decommissioning of the former underground storage tank. Below the fill material is the native soil consisting of clayey silt which is underlain by layer of silty clay.

For classification purposes, the soils encountered at this site can be divided into three major zones.

a) Topsoil and granular fill
b) Fill
c) Clayey Silt
d) Silty Clay
e) Inferred Bedrock

The soils encountered during the investigation, together with the field and laboratory test results, are shown on the Record of Borehole sheets included in the Appendix A. Laboratory test results for Particle Size Distribution are also included in Appendix A. Description of the strata encountered are given below.

3.2.2.1 Topsoil

A layer of topsoil was encountered in at the existing surface that extend to an approximate depth of 600 mm.

Crushed limestone granular material is present below the asphaltic surfaces at MW101, BH105, BH113, and at the surface at BH106, BH107, and MW111. The granular material later ranges from 0.2 to 1.5 m bgs.

3.2.2.2 Fill

Underlying the topsoil and below the asphaltic surfaces as a lay or clayey silt fill with traces of sand and gravel. The layers was found in BH102 to BH105 and BH113 and ranged from 0.2 to 1.81 m bgs. Additionally, sandy silt fill followed by sand fill is present at the surface of BH106 and BH110. The sandy silt fill material extends to a depth of between 0.6 to 3.4 m bgs at the remaining boreholes (Terrapex, 2022).

The fill material had a dark to brown colour and was moist. Water content of the fill samples collected at MW101, BH102, BH106, MW109, and BH113, ranged from 4 - 32% by weight. The SPT 'N' value ranges from 0 to 17 blows/300mm (Terrapex, 2022).

3.2.2.3 Clayey Silt

A clayey silt layer was found below the topsoil layer at BH103, below the clayey silt fill in BH105 and BH113, below the granular fill in BH 107 and MW111, below the surface topsoil at BH108, MW109, and MW112, below the sandy silt fill at BH110, and below the paved surface at MW101. The clayey silt layer ranges between 1.3 and 4.5 m bgs. The clayey silt was observed to be brown in colour with water content ranging between 14-40% by weight and with SPT 'N' values ranging from 1 to 8 blows/300mm. One representative sample underwent grain size analysis testing, and the layer was observed to contain 0% gravel, 35.1% sand, 40.2% silt, and 24.1% clay. A summary of the grain size distribution for this layer is shown in Table 3-1.

Table 3-1: Grain Size Distribution of the clayey silt Layer in BH101

Grain Size	(%)
Gravel	0
Sand	35.1
Silt	40.2
Clay	24.1

3.2.2.4 Silty Clay

A silty clay layer was found below clayey silt layer ranging from 1.5 to 9.1 m bgs. The silty clay was observed to be grey in colour with water content ranging between 30-59% by weight and with SPT 'N' values ranging from 0 to 5 blows/300mm. Two (2) representative samples underwent grain size analysis testing, and the layer was observed to contain 0% gravel, 1.4-2.1% sand, 46.3-52.6% silt, and 46-51.1% clay (Terrapex, 2022). A summary of the grain size distribution for this layer is shown in Table 3-2.

Table 3-2: Grain Size Distribution of the silty clay Layer in BH101 and BH109

Grain Size	(%)
Gravel	0
Sand	1.4 – 2.1
Silt	46.3 – 52.6
Clay	46 – 51.1

3.2.3 Soil Classification for Private Sanitary Servicing

Comparison of the soil classification for the Unified Soil Classification as provided in the Ministry of Municipal Affairs and Housing (MMAH) Supplementary Standard SB-6: Time and Soil Descriptions, reveals that the main shallow horizon native soil assessed on-site into which any private sewage system would discharge consists of the following:

- ML to CL: Clayey silts and silty clays
    - According to Table 2 of SB-6, the ML and CL group of soils have a coefficient of permeability (K) of 10^{-5} to 10^{-6} cm/sec and a percolation time (T) of 20 to 50 min/cm. This soil type has a medium to low permeability and is deemed acceptable as the native receiving soil for a proposed Class 4 sewage system.

Based on the above-noted soil classifications, it is proposed the development be serviced with a Class 4 sewage system with a leaching bed(s) constructed to discharge onto the native clayey silt deposits present throughout to the Site. Further, the leaching bed will have to be constructed as fully-raised bed using clean imported sand fill overlaying the clayey silt deposit present at the Site.

3.2.4 Groundwater

Groundwater was observed in four (4) monitoring wells instrumented at the Site during the geotechnical investigation completed by Terrapex. At the time of investigation on October 27, 2022, the depth of the groundwater ranged between El. 97.01 m to El. 98.57m. The depth and level of groundwater in five boreholes are summarized in Table 3-3. The groundwater level may be expected to fluctuate due to seasonal changes.

Table 3-3: Groundwater Level Readings in installed monitoring wells

Borehole	Measuring Date	Surface El. (m)	Groundwater Depth (m bgs)	Water Table El. (m)
MW101	2022-10-27	123.6	2.56	98.07
MW109	2022-10-27	124.1	2.90	97.01
MW113	2022-10-27	123.4	2.00	98.36
MW112	2022-10-27	123.5	2.02	98.57

3.2.5 Bedrock

As previously discussed, on-site bedrock is generally characterized as limestone, dolostone, shale, and sandstone of the Ottawa and Beekmantown Group (OGS, 2021), which is supported by well records that list the bedrock as either "limestone" or "sandstone". Based on OGS karst mapping (OGS 2021), the subject site is not located within a karst area. No observations of the bedrock were made during the site investigation given the depth of overburden on the subject site.

3.2.6 Recharge and Discharge Areas

Based on a review of topographic data, and geological maps, and the local Source Water Protection mapping (Mississippi-Rideau, 2013), it is our interpretation that the Site is not located in a groundwater recharge zone.

3.2.7 Hydrogeologically Sensitive Areas

Based on information reviewed from Terrapex's geotechnical investigation and available well records in the vicinity, the Site has soil thicknesses generally exceeding 8.2 m and there were no observed areas of bedrock outcrop or karst conditions on or near the site. The proposed development area appears to be well drained and there were no areas of groundwater upwelling or significant discharge noted. The Site is therefore not considered to be in hydrogeologically sensitive area and is not located within a highly vulnerable aquifer as per the local Source Water Protection mapping (Mississippi-Rideau, 2013).

4.0 SEPTIC IMPACT ASSESSMENT

As part of the development application process, the City of Ottawa requires that a septic impact assessment be completed as per the City's Hydrogeological and Terrain Analysis Guidelines. The City's guidelines generally follow the MECP's Procedure D-5-4 (Technical Guideline for Individual On-site Sewage Systems: Water Quality Impact Risk Assessment), which outlines the following steps to be completed as part of a septic impact assessment for residential developments:

- Step 1 – Lot Size Consideration
- Step 2 – System Isolation Consideration
- Step 3 – Contaminant Attenuation Considerations

For this commercial development, it was estimated that lot size consideration would not be a consideration given the proposed density of the development, therefore system isolation and contamination attenuation consideration were reviewed. Per the City of Ottawa guidelines for commercial development, the evaluation require that a maximum allowable flow for each lot or block in the commercial development be established. Section 5.6.3 of the Procedure D-5-4 outlines a simplified approach for determining the maximum allowable flow calculated by dividing the site-specific amount of available infiltration by a factor of three. Given the specific characteristics of the proposed project are known, MP has elected to proceed with a site-specific predictive assessment that does not rely on the simplified approach, but instead takes into consideration the available project-specific information.

4.1.1 System Isolation Consideration

A review of available information was undertaken to establish if the proposed development site can be considered low risk for groundwater impacts from sewage effluent per the City of Ottawa's Hydrogeological and Terrain Analysis Guidelines. As part of this process, site and project-specific data was reviewed, along with available Hydrogeological regional studies which include the subject site that were made available for review by the City of Ottawa's Hydrogeology staff.

Based on the site-specific Geotechnical Investigation Report (Terrapex, Dec. 2022), bedrock consisting of limestone/sandstone is expected to be situated at depths ranging from 7.6 to 12 mbg in the general area of the site, which is overlain with native overburden consisting of clayey silt and silty clay. Per the geotechnical report, the clayey silt layer which extends to depths ranging from 1.3 to 4.5 mbg is expected to have a coefficient of permeability (K) of less than 10^{-7} cm/sec, which corresponds to a low permeability, while the silty clay which extends below the clayey silt layer to the assumed bedrock is expected to have a coefficient of permeability (K) of less than 10^{-9} cm/sec, which corresponds to a very low permeability. A review of available regional hydrogeology report titled "Hydrogeological Suitability, Extension of Manotick Development Area" (Geo-Analysis Inc., 1989) corroborates the findings of the geotechnical investigation by suggesting that the subject site is situated in an area with an overburden thickness ranging from 10 to 15 metres, with the overburden material consisting of marine silt or clay.

Following City of Ottawa review comments for the original report, efforts were made to confirm via groundwater sampling if the local aquifer appeared to be hydrogeological isolated from discharge from existing on-site and offsite sewage systems surrounding the site. To this end, McIntosh Perry arranged with the nearest downgradient well Owner at 5640 Manotick Main Street located due north of the subject site to collect a well water sample for laboratory analysis for the full suite of standard "Subdivision Supply" parameters, which includes indicator parameters for possible existing sewage system impacts. The well head was observed to extend above-grade but was protected from vehicular damage in the nearby parking area via the use of a precast concrete collar that prevented the observation of any well tag and was located along the northern edge of the property at 5640 Manotick Main, approximately 23.9m due north from the north-west corner of the subject property corner. The sample was collected by McIntosh Perry staff from an untreated tap that was disinfected using bleach located in the building's basement. After flushing of the tap for approximately 5 minutes, chlorine test strips were used to ensure no chloring residual were present before collecting the water sample in laboratory supplied bottles and promptly submitting the samples for analysis at an accredited laboratory.

A review of laboratory results did not suggest current sewage system impacts to the local groundwater aquifer based on key indicator parameters such as nitrate, nitrate, organic nitrogen, E. Coli, Fecal Coliforms and Fecal Coliforms, which were all not detected in the water sample (refer to Appendix C). Given that the proposed leaching beds for the sewage systems are to be located generally in the area where existing leaching beds currently in operation exists, this suggests that the local groundwater aquifer is sufficiently isolated from shallow subsurface discharge from properly designed and constructed private sewage systems. It should be noted that as part of "Manotick Groundwater Study Interim Report – Draft" *(Dillon Consulting, 2017)*, it was

identified that only 1% of 187 sample analyzed for nitrates were in excess of the maximum acceptable concentration (MAC) of 10 mgl/L in that study's project limits, indicating that sewage system impact the local groundwater are not a considered common in the area.

It is therefore McIntosh Perry's opinion that the sewage system effluent is generally hydrogeologically isolated from the existing groundwater supply aquifers although the site's low permeability overburden does not strictly achieve the 10m depth typically considered to be sufficiently hydrogeologically isolating per the City's Hydrogeological and Terrain Analysis Guidelines, given the presence 8 m depth (+/-) of low or very low permeability overburden materials, along with negative results for key sewage system impact indicators in an immediately downgradient well and supporting evidence for local background reports which do not suggest local issues of private sewage system impacts to the local groundwater aquifer.

In addition to this, McIntosh Perry also conducted to a predictive assessment as presented in Section 4.1.2 as part of a multi-barrier approach to safeguarding the local water supply aquifer.

4.1.2 Predictive Assessment – Commercial Development

The Thorthwaite Water Balance method, in conjunction with local climatic data available from Environment Canada for Ottawa's MacDonald-Cartier International Airport YOW (Site Climate ID: 6106000), was used to estimate the net potential infiltration for the subject site.

The maximum allowable effluent flows for the site without exceeding the ODWO of 10 mg/L at the property boundaries was calculated using the following information:

- A water surplus (Ws) value of **333.88 mm/yr** was calculated based on 1981-2010 Climate Normal data for Ottawa's MacDonald-Cartier International Airport (YOW) (Site Climate ID: 6106000);
- An infiltration factor (I_f) of **0.325** was calculated as per Table 2 of MECP's document titled "MOEE Hydrogeological Technical Requirements for Land Development Applications," dated April 1995. The factors used to calculate the Infiltration Factor (If) and the associated rationale for selection are presented below:
    - A topographic factor of 0.125 was used as the average land slope on-site can be considered an interpolation between 'rolling land' and 'hilly land'.
    - A soil factor of 0.10 was used due to the native clayey silt underlain by silty encountered in the overburden throughout the site (Terrapex, 2022).
    - A cover factor of 0.10 was used for Cultivated Land (0.1) as the majority of the infiltrating area on-site are expected to remain as cultivated land/mowed grass.
- Available infiltration (I) was calculated by multiplying the water surplus (Ws) by the infiltration factor (If). This yielded an infiltration value of **0.108510 m/yr**.
- The infiltration area (A) was determined to be 0.163135 ha (1631.35 m^2) or 40% of the site, once adjustments were made for the approximately 2,447.03 m^2 of hard-surfaced areas proposed on-site (i.e., parking/driving surfaces, roofs).

- The dilution water (D_w) available was calculated as 177.02 m^3/yr (484.98 L/day) by multiplying the infiltration area (A) with the available infiltration (I).
- Background nitrate concentration (C_b) of 0 mg/L was used as the site is located in a local highpoint along a natural ridge that sits between the Rideau River to the north-east and a local creek to the west/south-west and is therefore not expected to be impacted by other nearby development from a groundwater flow perspective. This is supported by a non-detect laboratory result from groundwater sample collected from an immediately downgradient drilled well located at the neighbouring property at 5640 Manotick Main Street.
- Car Wash Discharge was assumed to have negligeable nitrate loading and contribute to available dilution water available on-site based on published numbers for both in-bay automatic and self-service carwash wastewater quality in the USA (AE Ghaly et al., (2021)).
- Minimum daily discharge to subsurface from the Car Wash Facility was set to approximately 2140 L/day based on a review of water consumption data from another similar Car Wash Facility operated within the City of Ottawa, and an estimated water recirculation ratio of 2. Note that recirculation ratio could be adjusted higher or lower to account for seasonal variations in Car Wash flows to maintain sufficient dilution water from the car wash's sanitary discharge. Additionally, on-site facility usage data for the existing 2-bay car wash suggested that the average flow is in the order of 913 L/day based on a review of available data from June 2019 to December 2023. It is expected that facility usage after facility re-development may increase, therefore the 2140 L/day value remains reasonable. The new car wash private sewage system is expected to be rated to a daily peak of 4,750 L/day.
- Target nitrate concentration at the property boundaries of 10 mg/L (as per ODWO).
- Raw restaurant effluent nitrate concentration was set at 40 mg/L, since the effluent is generally expected to be from domestic origins based on the type of facility being serviced. The site-specific sewage system design proposed to service the restaurant facility will employ the use of a Level 4 treatment unit consisting of a Waterloo Biofilter™ unit, which will include a 50% recirculation loop capable of 60% total nitrogen removal (refer to Independent NSF International Testing data, Appendix B).

Based on the above-noted information, the maximum effluent flow from the proposed restaurant facility (Q_e) without exceeding the maximum boundary nitrate concentration of 10 mg/L would of be 4375 L/day. Based on Table 8.2.1.3.B of Part 8 of the Ontario Building Code (OBC), for a Food Service Operation, this is equivalent to a 35 seat restaurant (not 24 hour) at 125 L/day/seat.

Calculations for the predictive nitrate attenuation are presented in Appendix D.

4.1.3 Other Discussions

In addition to the above-noted analysis, it is important to note that the subject-site is underlain by a relatively thick (~8m to 10m thick) and uniform clayey silt to silty clay deposit, which is expected to extend across the neighbouring down-gradient sites from a shallow groundwater flow perspective all the way to Rideau River to

the north-east. This helps to hydrogeologically isolate the local bedrock aquifer from the proposed shallow subsurface sewage system discharge associated with the proposed development as outlined in Section 4.1.1.

5.0 RECOMMENDATIONS

5.1 Wastewater Servicing

Private Sewage Systems

- Approval for on-site septic treatment will be governed by the OBC as it is understood that the Daily Design Flow proposed commercial restaurant will be approximately 4,375 litres per day, and for the car wash facility will be a peak of 4,750 L/day based on available space on-site and proposed sewage system design, and therefore will be less than 10,000 litres per day.
- It is recommended that the proposed commercial development be serviced with Class 4 sewage systems with leaching beds constructed to discharge onto the native clayey silt as is present throughout the Site.
- Any septic systems must be constructed with all appropriate setbacks, treatment units and stipulations as per applicable Ontario Regulations, including with advanced treatment units where required as outlined in this report.

Servicing Layout

- The proposed development and associated new Class 4 sewage systems should follow the layout included in the Site Plan application.

6.0 LIMITATIONS

This report has been prepared and the work referred to in this report has been undertaken by McIntosh Perry Consulting Engineers Ltd. for Hawkins Properties It is intended for the sole and exclusive use of Hawkins Properties, their affiliated companies and partners and their respective insurers, agents, employees, advisors, and reviewers. The report may not be relied upon by any other person or entity without the express written consent (Reliance Letter) of McIntosh Perry Consulting Engineers Ltd.

Any use which a third party makes of this report, or any reliance on decisions made based on it, without a reliance letter are the responsibility of such third parties. McIntosh Perry Consulting Engineers Ltd. accept no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The investigation undertaken by McIntosh Perry Consulting Engineers Ltd. with respect to this report and any conclusions or recommendations made in this report reflect McIntosh Perry Consulting Engineers Ltd. judgment based on the Site conditions observed at the time of the site inspection on the date(s) set out in this report and on information available at the time of the preparation of this report.

This report has been prepared for specific application to this site and it is based, in part, upon visual observation of the Site, subsurface investigation at discrete locations and depths, and specific analysis of specific chemical parameters and materials during a specific time interval, all as described in this report. Unless otherwise stated, the findings cannot be extended to previous or future Site conditions, portions of the Site which were unavailable for direct investigation, subsurface locations which were not investigated directly, or chemical parameters, materials or analysis which were not addressed. Substances other than those addressed by the investigation described in this report may exist within the Site, substances addressed by the investigation may exist in areas of the Site not investigated and concentrations of substances addressed which are different than those reported may exist in areas other than the locations from which samples were taken.

If site conditions or applicable standards change or if any additional information becomes available at a future date, modifications to the findings, conclusions and recommendations in this report may be necessary.

We trust that this information is satisfactory for your present requirements. Should you have any questions or require additional information, please do not hesitate to contact the undersigned.

Respectfully submitted,

McIntosh Perry Consulting Engineers Ltd.

Patrick Leblanc, P.Eng.
Practice Area Lead (Environmental Engineer)
(613) 714-4586
p.leblanc@mcintoshperry.com

Ref.: U:\Ottawa\01 Project - Proposals\2022 Jobs\CCO\CCO-22-2383 Hawkins Properties_ZBLA_5646 Manotick Main St\Env. Eng\Sewage System Impact Assessment\Report\CCO-22-2383 - Septic Impact Assessment - 5646 Manotick Main St.22.Mar.04.2024.Rev.1.docx

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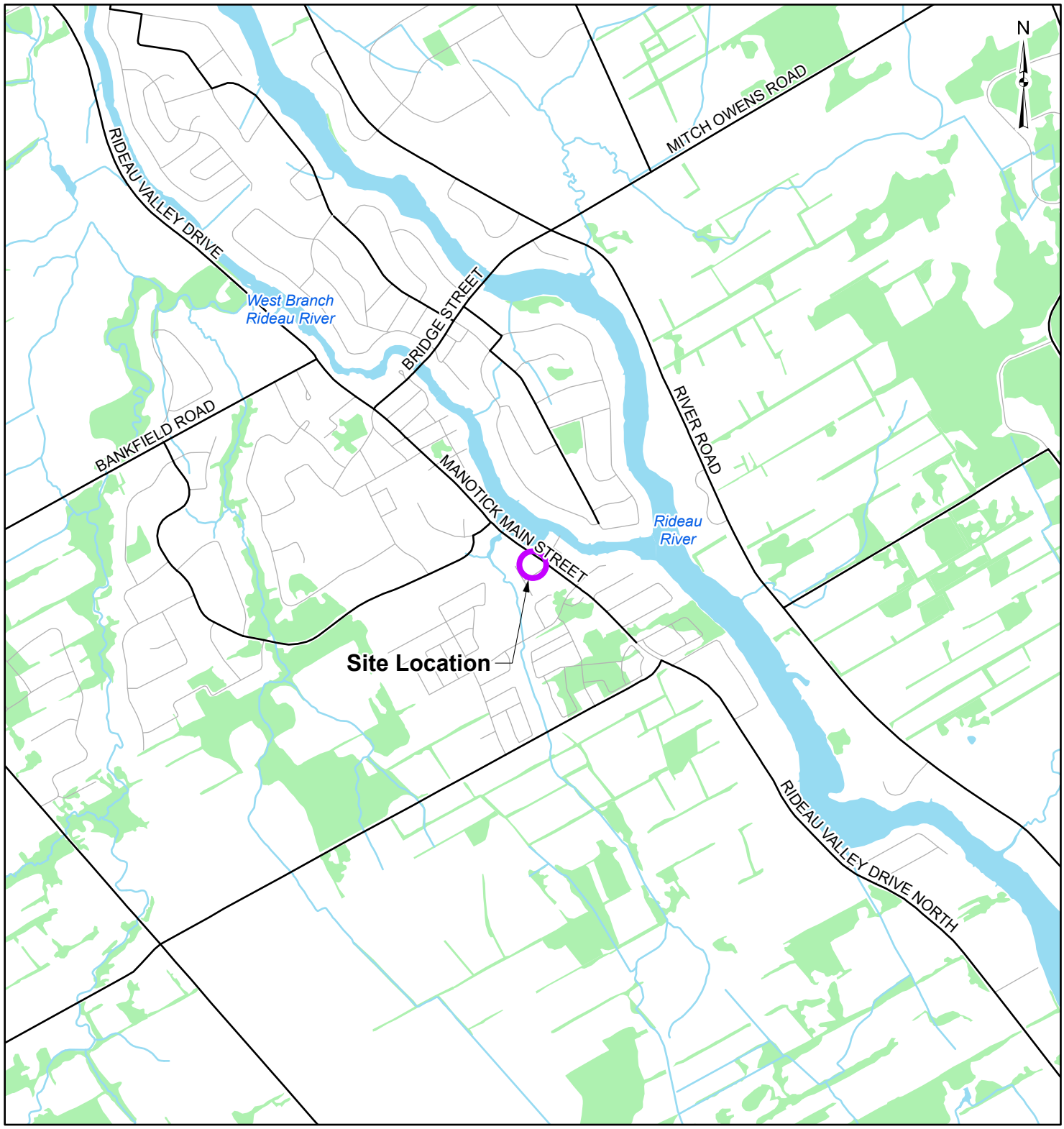
FIGURES



LEGEND

- Site Location
- Local Road
- Major Road
- Waterbody
- Watercourse
- Wooded Area

600 300 0 600

Scale 1:25,000 Metres

REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2023.

CLIENT: HAWKINS PROPERTIES

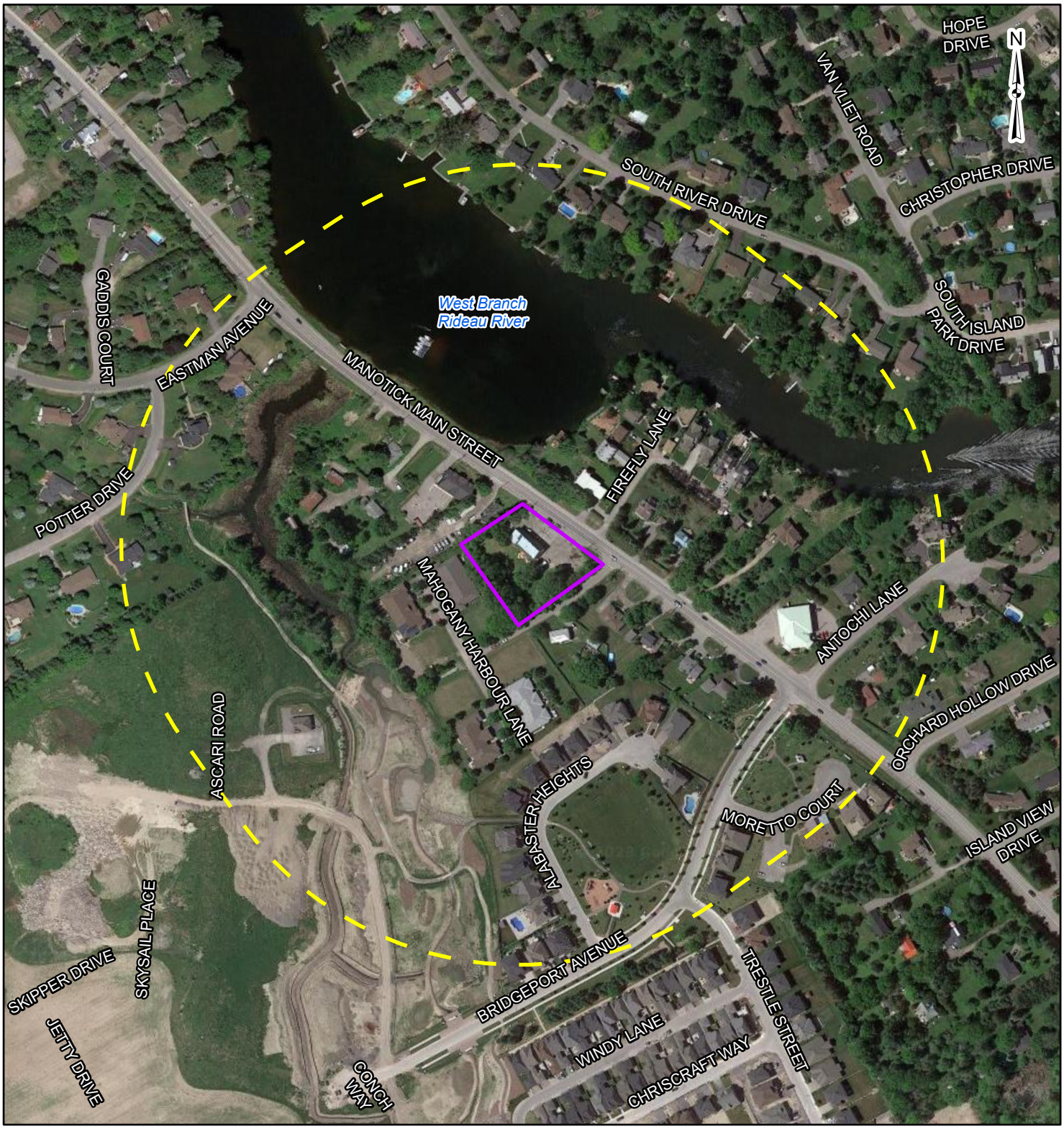
PROJECT: SEPTIC IMPACT ASSESSMENT
5646-5650 MANOTICK MAIN STREET

TITLE: SITE LOCATION PLAN

McINTOSH PERRY
115 Walgreen Road, RR3, Carp, ON K0A1L0
Tel: 613-836-2184 Fax: 613-836-3742
www.mcintoshperry.com

PROJECT NO:	CCO-22-2383
Date	Jun., 14, 2023
GIS	AH
Checked By	KC

FIGURE: 1



LEGEND

- Site Boundary
- 250m Buffer

100 50 0 100

Scale 1:4,000 Metres

REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2023.

CLIENT: HAWKINS PROPERTIES

PROJECT: SEPTIC IMPACT ASSESSMENT
5646-5650 MANOTICK MAIN STREET

TITLE: STUDY AREA AND SURROUNDING LAND USE

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PROJECT NO: CCO-22-2383	
Date	Jun., 14, 2023
GIS	AH
Checked By	KC

FIGURE: 2

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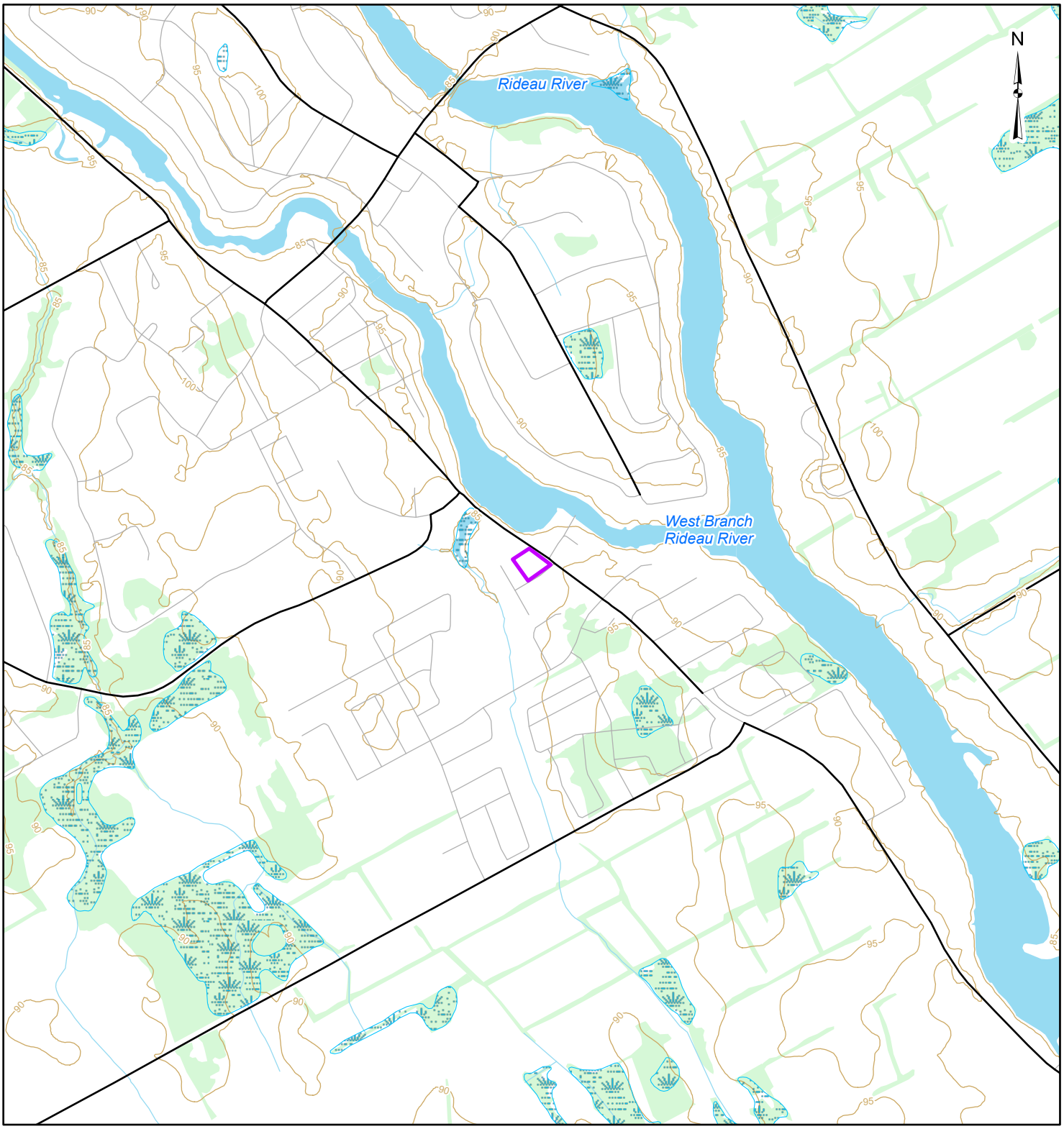

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Scale 1:15,000 Metres

LEGEND

- Site Boundary
- Contour (masl)
- Local Road
- Major Road
- Watercourse
- Waterbody
- Unevaluated Wetland
- Wooded Area

REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2023.

CLIENT: HAWKINS PROPERTIES

PROJECT: SEPTIC IMPACT ASSESSMENT
5646-5650 MANOTICK MAIN STREET

TITLE: DRAINAGE AND TOPOGRAPHY

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PROJECT NO:	CCO-22-2383
Date	Jun., 14, 2023
GIS	AH
Checked By	KC

FIGURE: 3

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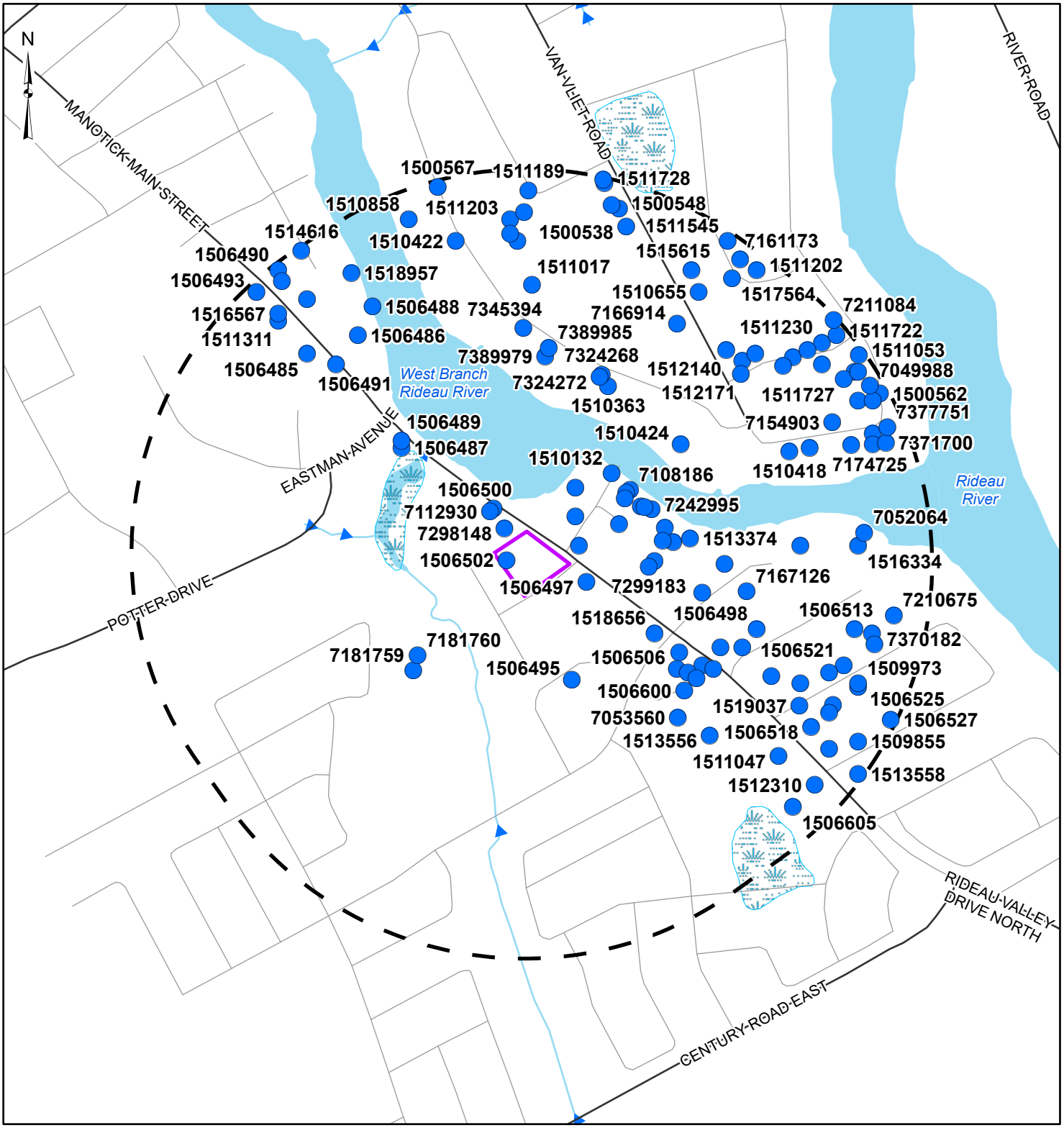

LEGEND

- MECP Well Location \
- Site Boundary
- 500m Buffer
- Local Road
- Major Road
- Watercourse
- Waterbody
- Unevaluated Wetland

REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2023.

CLIENT: HAWKINS PROPERTIES

PROJECT: SEPTIC IMPACT ASSESSMENT
5646-5650 MANOTICK MAIN STREET

TITLE: MECP WELL RECORD SUMMARY

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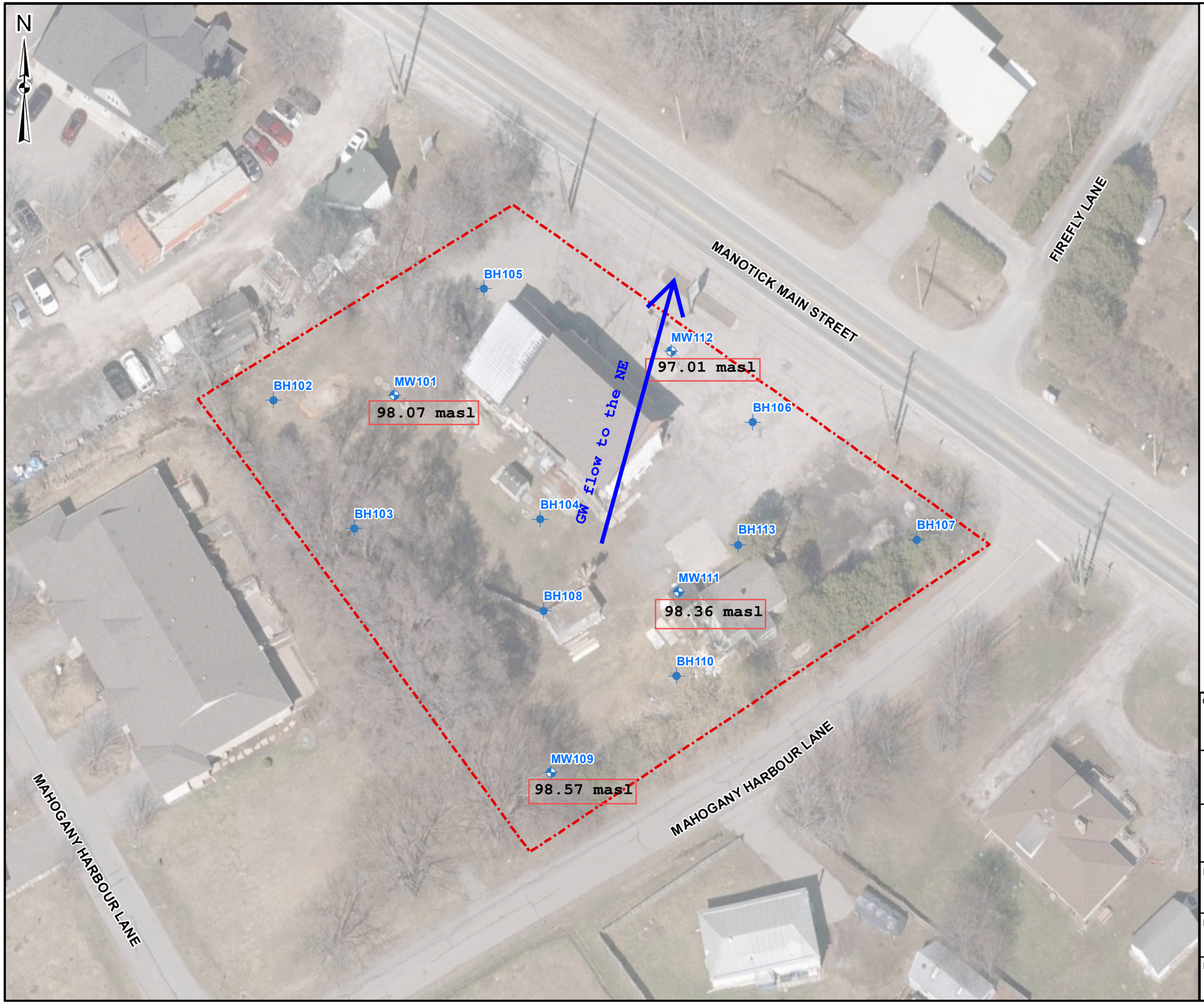
PROJECT NO:	CCO-22-2383
Date	Jun., 14, 2023
GIS	AH
Checked By	KC

FIGURE: 4



LEGEND

- PROPERTY BOUNDARY
- BOREHOLE
- MONITORING WELL

NOTE: Figure edited from Geotechnical Investigation Report completed by Terrapex Environmental Ltd., December 2022

0 10 20 30
Metres

DATA SOURCE: CITY OF OTTAWA
MAP PROJECTION: NAD 1983 UTM ZONE 18N

CLIENT:
HAWKINS PROPERTIES
650a EAGLESON ROAD,
OTTAWA, ONTARIO, K2M 1H4

SITE LOCATION:
5646-5650 MANOTICK MAIN STREET, MANOTICK, ONTARIO

McINTOSH PERRY

DRAWING TITLE:
BOREHOLE/MONITORING WELL LOCATIONS AND SHALLOW GROUNDWATER FLOW DIRECTION

DRAWN BY:	PROJECT NO.:	CHECKED BY:
KC	CCO-22-2383	PL
REVISION: 0	DATE: JUNE 15 2023	FIGURE: **5**

APPENDIX A – GEOTECHNICAL REPORT

DRAFT
GEOTECHNICAL INVESTIGATION REPORT

Proposed Commercial Development
5650 Manotick Main Street
Manotick, Ontario

December 16, 2022

Terrapex Environmental Ltd.
20 Gurdwara Road, Unit 1
Ottawa, ON, K2E 8B3
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Website: www.terrapex.com

DISTRIBUTION: **Hawkins Properties**

PROJECT # CO884.01

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APPENDICES

1 INTRODUCTION

Terrapex Environmental Ltd. (Terrapex) was retained by Hawkins Properties to carry out a geotechnical investigation for the proposed commercial development at the properties located at 5646 and 5650 Manotick Main Street, Manotick, Ontario (hereafter referred to as the "Site"). Authorization to proceed with this study was given by Mr. Jade Hawkins.

The Site is located on the west side of Manotick Main Street, approximately 250 m south of Eastman Avenue and approximately 30 m north of Mahogany Harbour Lane in Manotick, Ontario. The north section of the Site (5646 Manotick Main Street) is developed by a two-storey building that consist of a storefront on the main floor, two apartment units on the second floor, and a two-bay car wash. The south section of the Site is developed with a single storey detached home.

Based on the findings of the Phase One Environmental Site Assessment undertaken previously at the site by Terrapex, the Site previously contained a fueling station.

It was originally planned to demolish the existing buildings at the Site and redevelop the Site with a 5-bay car wash building and a Starbucks restaurant building. The carwash building was to be situated in the northwest corner of the site, and the Starbucks building near the southeast corner. Terrapex was subsequently advised that the proposed development scheme has changed, and the Site will be developed with two single storey drive through restaurant buildings located at the northwest and southwest corners of the Site with the remainder of the Site being developed with driveways, parking lots and some other soft and hard landscaping features.

The locations of the proposed buildings are shown on Figure 2, "General Site Layout" attached in Appendix B of this report.

The recommendations provided in this report are preliminary in nature, subject to review and revision upon completion of the grading and architectural plans.

The purpose of this investigation was to characterize the underlying soil and groundwater conditions, to determine the relevant geotechnical properties of encountered soils and to provide geotechnical engineering recommendations for the proposed development.

This report presents the results of the investigation performed in accordance with the general terms of reference outlined above and is intended for the guidance of the owner and the design architects or engineers only. It is assumed that the design will be in accordance with the applicable building codes and standards.

2 FIELD WORK

The field work for this study was carried out during the period October 11 to 13, 2022. It consisted of 13 boreholes advanced by a drilling contractor commissioned and supervised by Terrapex. The boreholes are designated as MW101, BH102 through BH108, MW109, BH110, MW111, MW112 and BH113, advanced to depths ranging from of 1.2 m to 9.3 m below ground surface (mbg). Boreholes MW111 and MW112 were advanced by direct push technology. The remaining boreholes were advanced by conventional drilling techniques.

The locations of the boreholes are shown on Figure 2 in Appendix B. The borehole log sheets are enclosed in Appendix C of this report.

Standard penetration tests were carried out while advancing all the boreholes, except for MW111 and MW112, to take representative soil samples and to measure penetration index values (N-values) to characterize the condition of the various soil materials. The number of blows of the striking hammer required to drive the split spoon sampler through 300 mm depth increments was recorded and these are presented on the logs as penetration index values.

In situ vane tests were carried out in several of the boreholes, and a pocket penetrometer was used on samples retained from the boreholes to estimate the undrained shear strength of the clayey soils.

Groundwater level observations were made in all boreholes during their advancement. Monitoring wells were installed in Boreholes MW101, MW109, MW111, and MW112.

The ground surface elevations at the locations of the boreholes were established on site by **Terrapex** using a rod and survey level. The elevations of the boreholes were referenced to the top of the bolt collar of fire hydrant HO11559, located northeast of the site on the east side of Manotick Main Street. The reference elevation was assumed as 100 m.

The fieldwork for this project was carried out under the full-time supervision of an experienced geotechnical technician from this office who laid out the positions of the boreholes in the field, arranged locates of buried services, effected the drilling, sampling and in situ testing, observed groundwater conditions, and prepared field borehole log sheets.

3 LABORATORY TESTS

The soil samples recovered from the split spoon sampler were properly sealed, labelled and delivered to our laboratory. They were visually classified and water content tests were conducted on all samples retained from Boreholes MW101, BH102, BH104, BH106, MW109, and BH113. The results of the classification, water contents, and Standard Penetration tests are presented on the borehole log sheets in Appendix C.

Grain-size analyses and Atterberg Limits tests were carried out on three (3) soil samples (MW101

Samples 3 and 6, and MW109 Sample 2). The results of these tests are enclosed in Appendix D.

In addition, BH106 Sample 5, was submitted to AGAT Laboratories for determination of pH and sulphate content and its potential for sulphate attack on buried concrete. The results of these tests are enclosed in Appendix E; discussed in Section 5.12 of this report.

4 SITE AND SUBSURFACE CONDITONS

Full details of the subsurface soil and groundwater conditions at the site are given on the Borehole Log Sheets attached in Appendix C of this report.

The following paragraphs present a description of the site and a commentary on the engineering properties of the various soil materials contacted in the boreholes.

It should be noted that the boundaries of soil types indicated on the borehole logs are inferred from non-continuous soil sampling and observations made during drilling. These boundaries are intended to reflect transition zones for the purpose of geotechnical design, and therefore, should not be construed as exact planes of geological change.

4.1. SITE DESCRIPTION

The Site is located on the west side of Manotick Main Street, approximately 250 m south of Eastman Avenue and approximately 30 m north of Mahogany Harbour Lane in Manotick, Ontario. It has a trapezoidal shape with an approximate width of 70 m and depths ranging from 48 to 68 m.

The north section of the Site (5646 Manotick Main Street) is developed with a two-storey building that consists of a storefront on the main floor, two apartment units on the second floor, and a two-bay car wash. The south section of the Site is developed with a single storey detached home.

Based on the findings of the Phase One Environmental Site Assessment undertaken previously at the site by Terrapex, a fueling station existed at the Site.

The Site is bounded by residential properties to the north, east and west.

The ground surface topography of the site is relatively flat. The ground surface elevations at the borehole locations range between 99.91 m at Borehole MW109, and 100.86 m at BH113.

4.2. TOPSOIL, ASPHALTIC CONCRETE AND GRANULAR MATERIAL

Topsoil is present at the ground surface in Boreholes BH102, BH103, BH104, BH108, MW109, BH110, and MW112. The thickness of the topsoil ranges from 200 to 600 mm. A 200 mm thick

layer of topsoil is also present below fill soil in Borehole BH103.

The ground at the locations of Boreholes MW101, BH105 and BH113 is covered with a thin layer of asphaltic concrete.

Crusher run limestone granular material is present below the asphaltic concrete at Boreholes MW101, BH105, and BH113, and at the ground surface at Boreholes BH106, BH107 and MW111. The crusher-run limestone extends to depths ranging from 0.2 to 1.5 m.

4.3. FILL MATERIAL

Clayey silt fill with traces of sand and gravel is present below the topsoil in Boreholes BH102, BH103, and BH104, and below the asphaltic concrete pavement at Boreholes BH105 and BH113. Sandy silt fill followed by sand fill is present at the surface of the ground at Borehole BH106. Sandy silt fill is also present below the topsoil in BH110. The fill materials extend to the termination depth of Borehole BH104, to a depth of 3.4 m at Borehole BH106, and to depths ranging from 0.6 to 1.5 mbg at the remaining boreholes. The indications are that the sand fill present at Borehole BH106 was placed to backfill the excavation resulting from decommissioning of an underground storage tank associated with the former fueling station.

The fill is dark brown and brown in colour and moist in appearance. The water content of the samples of the fill obtained from Boreholes MW101, BH102, BH106, MW109, and BH113 range from 4 to 32% by weight. SPT in the fill provided N-values ranging from 0 to 17, indicating a very loose to compact condition or very soft to stiff consistency.

4.4. NATIVE SOIL

The native overburden soils below the fill material consist of clayey silt followed by silty clay.

4.4.1. CLAYEY SILT

Clayey silt is present below the asphaltic concrete pavement in Borehole MW101, below the buried topsoil layer in Borehole BH103, below the clayey silt fill in Boreholes BH105 and BH113, below the crusher-run limestone fill in Boreholes BH107 and MW111, below the surface topsoil in Boreholes BH108, MW109, and MW112, and below the sandy silt fill in Borehole BH110. The layer extends to depths ranging from 1.3 to 4.5 mbg.

The clayey silt is brown in colour with the water content of samples ranging from 14% to 40% by weight; moist to wet in appearance.

SPT carried out in the clayey silt layer provided N-values ranging from 1 to 8 indicating a very soft to stiff consistency, more typically being firm.

Grain size analysis and Atterberg Limits test was carried out on a representative sample of the clayey silt. The test result is enclosed in Appendix D and summarized in the following table.

Sample No. and Depth	Sample Description	Gravel %	Sand %	Silt %	Clay %
BH101 Sample 3; 1.8 m	Clayey sandy silt	0	35.1	40.2	24.1

Based on the results of the grain size analyses, the Coefficient of Permeability (k) of the clayey silt is estimated to be less than 10^{-7} cm/sec, corresponding to low relative permeability.

Atterberg Limits test conducted on MW101, Sample 3 revealed that the clayey silt has a Liquid Limit of 51 and a Plasticity Index of 32. The test results are enclosed in Appendix D.

4.4.2. SILTY CLAY

Silty clay underlies the clayey silt extending to the explored depths of the deep boreholes. The layer is grey in color with its water content ranging from 30 to 59% by weight, wet to very wet in appearance.

SPT carried out in the layer provided N-values ranging from 0 to 5, indicating a soft to firm consistency. In situ vain shear tests performed in the silty clay provided shear strengths ranging from 50 to 100 kPa with remoulded strengths of 50 to 80 kPa.

Penetrometer measurements performed on samples of the silty clay provided shear strength estimates of 100 kPa at shallow depths reducing with depth to 25 kPa.

Grain size analyses and Atterberg Limits tests were carried out on two (2) representative samples of the silty clay. The test results are enclosed in Appendix D and summarized in the following table.

Sample No. and Depth	Sample Description	Gravel %	Sand %	Silt %	Clay %
BH101 Sample 6; 6 m	Grey Silty Clay	0	1.4	52.6	46
BH109 Sample 2; 1 m	Grey Silty clay	0	2.1	46.3	51.1

Based on the results of the grain size analysis, the Coefficient of Permeability (k) of the silty clay is estimated to be less than 10^{-9} cm/sec, corresponding to a very low relative permeability.

Atterberg Limits test conducted on Sample MW101, Sample 6 revealed that the sample has a Liquid Limit of 39 and a Plasticity Index of 21. Atterberg Limits test conducted on sample MW109, Sample 2 revealed that the sample has a Liquid Limit of 31 and a Plasticity Index of 20. The test

results are enclosed in Appendix D.

4.5. BEDROCK

According to available surficial geology maps, the bedrock at the site is expected to be comprised of limestone, dolostone, shale, arkose, sandstone of Ottawa Group, Simcoe Group, Shadow Lake Formation.

Rock coring was not carried out in the drilled boreholes. According to available well records and historic borehole data, bedrock of limestone/sandstone is expected to be situated at depths ranging from 7.6 to 12 mbg in the general area of the site.

The depths at which auger refusal was encountered in the drilled boreholes are presented in the Table below.

Borehole No.	Auger Refusal Depth (mbgs)	Auger Refusal Elevation (m)
MW101	8.2	92.43
BH102	9.0	91.69
BH103	9.3	91.20
BH106	8.4	92.23
MW109	8.5	91.41

4.6. GROUNDWATER

Groundwater levels were measured in the boreholes during their advancement and subsequently in the monitoring wells on October 27, 2022. The groundwater levels measured in the monitoring wells are tabulated below.

Borehole No.	Date	Groundwater Depth (mbg)	Groundwater Elevation (m)
MW101	October 27, 2022	2.56	98.07
MW109	October 27, 2022	2.90	97.01
MW1113	October 27, 2022	2.00	98.36
MW112	October 27, 2022	2.02	98.57

It should be noted that groundwater levels are subject to seasonal fluctuations. A higher groundwater level condition may also develop following significant rainfall events.

5 DISCUSSION AND RECOMMENDATIONS

The following discussions and recommendations are based on the factual data obtained from the boreholes advanced at the site and are intended for use by the client and design architects and engineers only.

We understand that it is proposed to demolish the existing buildings at the Site and redevelop the Site with two single storey drive through restaurant buildings located at the northwest and southwest corners of the Site with the remainder of the Site being developed with driveways, parking lots and other soft and hard landscaping features. The locations of the proposed buildings are shown on Figure 2, in Appendix B of this report.

The construction methods described in this report are not specifications or recommendations to the contractors or as the only suitable methods. The collected data and the interpretation presented in this report may not be sufficient to assess all the factors that may influence the construction. Contractors bidding on this project or conducting work associated with this project should make their own interpretation of the factual data and/or carry out their own investigations as they might deem necessary. The contractor should also select the method of construction, equipment and sequence based on their previous experience on similar projects.

5.1. EXCAVATION

Based on the field results, excavations for foundations and utility trenches are not expected to pose any unusual difficulty. Excavation of the soils at this site can be carried out with hydraulic excavators.

All excavations must be carried out in accordance with the Occupational Health and Safety Act (OHSA). With respect to the OHSA, the fill materials and the underlying native soils above the groundwater table are expected to conform to Type 3 soils. Soils situated below the water table are considered Type 4 soils.

Temporary excavation sidewalls in Type 3 soils should not exceed 1.0 horizontal to 1.0 vertical. Excavations extended below the water table must be sloped at a maximum inclination of 3.0 horizontal to 1.0 vertical.

In the event very loose and/or soft soils are encountered at shallow depths or within zones of persistent seepage, it will be necessary to flatten the side slopes to achieve stable conditions.

For excavations through multiple soil types, the side slope geometry is governed by the soil with the highest number designation. Excavation side-slopes should not be unduly left exposed to inclement weather.

Where workers must enter excavations extending deeper than 1.2 m below grade, the excavation

sidewalls must be suitably sloped and/or braced in accordance with the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavations resulting from removal of remnants of the former buildings in the form of buried foundations and slabs and old utilities would need to be backfilled with an engineered fill material if the fill is to support underground services and the pavement structure.

5.2. GROUNDWATER CONTROL

Based on observations made during drilling of the boreholes, and close examination of the soil samples extracted from the boreholes, significant groundwater seepage is not expected to occur from the cohesive (clayey) fill and native soils. It is anticipated that adequate control of groundwater seepage can be achieved with a series of filter sump pumps in the bases of the excavations.

Excavations extending below the groundwater table into the wet sand fill deposits encountered in Borehole BH106 will require active dewatering.

Surface water should be directed away from open excavations.

It will be necessary to determine the construction dewatering requirements and to collect the information required for the application for Permit to Take Water (PTTW), should this be deemed necessary.

5.3. SITE GRADING

Grading and architectural plans were not available at the time of preparation of this report. It is assumed that only minor modifications to site grading will be required. The existing services will have to be decommissioned, and the excavations left behind will need to be engineered.

The site is underlain by a soft to firm silty clay layer that is prone to settlement when subjected to additional loads. It is recommended that the site grade be kept at approximately the current elevations to avoid long-term settlement of the roads and any other rigid landscape areas. The proposed grading plan must be reviewed by Terrapex when it becomes available.

5.4. ENGINEERED FILL

The following recommendations regarding construction of engineered fill should be adhered to during the construction stage:

- All surface vegetation, organic materials, loose or soft fill soils, and softened and/or disturbed soils must be removed, and the exposed subgrade soils proof-rolled under the supervision of the Geotechnical Engineer prior to placement of new fill.
- If the fill will be used to support structures, the existing fill must be removed in its entirety prior to placement of new fill.

- Soils used as engineered fill should be free of organics and/or other unsuitable material. The engineered fill must be placed in lifts not exceeding 200 mm in thickness and compacted to at least 98% Standard Proctor maximum Dry Density (SPMDD).
- Engineered fill operations should be monitored and compaction tests should be performed on a full-time basis by a qualified engineering technician supervised by the project engineer.
- The boundaries of the engineered fill must be clearly and accurately laid out in the field by qualified surveyors prior to the commencement of engineered fill construction. The top of the engineered fill should extend a minimum of 2.5 m beyond the envelope of the proposed structures. Where the depth of engineered fill exceeds 1.5 m, this horizontal distance of 2.5 m beyond the perimeter of the structure should be increased by at least 1 m for each 1.5 m depth of fill.
- The engineered fill operation should take place in favorable climatic conditions. If the work is carried out in months where freezing temperatures may occur, all frost affected material must be removed prior to the placement of frost-free fill.
- If unusual soil conditions become apparent during construction, due to subsurface groundwater influences, our office should be contacted in order to assess the conditions and recommend appropriate remedial measures.

5.5. REUSE OF ON-SITE EXCAVATED SOIL

On-site excavated inorganic soils, and soils free of construction debris and other deleterious materials are considered suitable for reuse as backfill provided their water content is within 2% of their optimum water contents (OWC) as determined by Standard Proctor test, and the materials are effectively compacted with a heavy sheepsfoot compactor.

While the quality of the on-site soils is considered suitable for backfilling; the moisture content of the soils and the lift thickness for compaction must be properly controlled during backfilling. Measured water content within the fill and native soils within the presumed excavation depth generally range from approximately 14 to 59%. The native soils are very wet, unsuitable for use as engineered fill.

5.6. SERVICE TRENCHES

Based on the assumed site grades, sewer pipes and water mains are anticipated to be supported on undisturbed native deposits which are considered suitable for supporting water mains, sewer pipes, manholes, catch basins and other related structures.

The type of bedding depends mainly on the strength of the subgrade immediately below the invert levels.

Normal Class ‘B’ bedding is recommended for underground utilities. Granular ‘A’ or 19 mm crusher-run limestone can be used as bedding material; all granular materials should meet OPS 1010 specifications. The bedding material should be compacted to a minimum of 95% SPMDD.

Bedding details should follow the applicable governing design detail. Trenches dug for these purposes should not be unduly left exposed to inclement weather.

Pipe bedding and backfill for flexible pipes should be undertaken in accordance with OPSD 802.010. Pipe embedment and cover for rigid pipes should be undertaken in accordance with OPSD 802.030.

If unsuitable bedding conditions occur, careful preparation and strengthening of the trench bases prior to sewer installation will be required. The subgrade may be strengthened by placing a thick mat consisting of 50 mm crusher-run limestone. Field conditions will determine the depth of stone required. Geotextiles and/or geogrids may be helpful, and these options should be reviewed by Terrapex on a case-by-case basis.

Sand cover material should be placed as backfill to at least 300 mm above the top of pipes. Placement of additional granular material (thickness dictated by the type of compaction equipment) as required or use of smaller compaction equipment for the first few lifts of native material above the pipe will probably be necessary to prevent damage to the pipe during the trench backfill compaction.

It is recommended that service trenches be backfilled with on-site native materials such that at least 95% of SPMDD is obtained in the lower zone of the trench and 98% of SPMDD for the upper 1 m.

In areas of narrow trenches or confined spaces such as around manholes, catch basins, etc., the use of aggregate fill such as Granular ‘B’ Type I (OPSS 1010) is required if there is to be post-construction grade integrity.

5.7. FOUNDATION DESIGN

We understand that the proposed buildings will be lightly loaded single storey structures. It is anticipated that only minor modifications to site grading will be required.

5.7.1. SHALLOW FOOTINGS

Based on the soil stratigraphy observed in MW101, BH102, BH103 and MW109, situated within the footprints or close proximity of the proposed buildings, conventional spread or strip footings may be used to support the proposed buildings.

Foundations founded on the undisturbed native silty clay soil above elevation 98.0 m with maximum dimensions of 2 m for pad footings and 1 m for strip footing may be designed based on a bearing resistance of 50 kPa at Serviceability Limit States (SLS) and factored geotechnical bearing resistance at Ultimate Limit States (ULS) of 75 kPa.

The total and differential settlements of spread footings designed in accordance with the recommendations provided above should not exceed the conventional limits of 25 mm and 19 mm respectively.

Due to variations in the consistency of the founding soils and/or loosening caused by excavating disturbance and/or seasonal frost effects, all footing subgrades must be evaluated by the Geotechnical Engineer prior to placing formwork and foundation concrete to ensure that the soil exposed at the excavation base is consistent with the design geotechnical bearing resistance.

In the event necessary, the stepping of the footings at different elevations should be carried out at an angle no steeper than 2 horizontal (clear horizontal distance between footings) to 1 vertical (difference in elevation) and no individual footing step should be greater than 0.60 m.

Rainwater or groundwater seepage entering the foundation excavations must be pumped away (not allowed to pond). The foundation subgrade soils should be protected from freezing, inundation, and equipment traffic. If unstable subgrade conditions develop, Terrapex should be contacted to assess the conditions and make appropriate recommendations.

All exterior footings and footings in unheated areas should be provided by at least 1.8 m of soil cover or equivalent artificial thermal insulation for frost protection purposes. If construction proceeds during freezing weather conditions, adequate temporary frost protection for the footing bases and concrete must be provided.

5.7.2. GROUND IMPROVEMENT

Ground improvement techniques, such as Controlled Modulus Columns (CMC) or Geopiers extended to an approximate depth of 8 mbg could be used to improve the condition of the native soils. CMCs consist of thin concrete columns, and Geopiers consist of rammed aggregate piers installed throughout the footprints of the buildings. The composite of the native silty clay and ground improvement system could provide bearing resistances ranging to 250 kPa at SLS. The spread and strip footings for the building would be constructed using conventional methods, supported on a granular load transfer platform overlying the ground improvement system.

The ground improvement system should be designed, installed, and certified by a specialist ground improvement contractor.

5.7.3. DEEP FOUNDATION

Caissons may also be considered to support the building. Caissons founded on the bedrock, at depths ranging from 8 to 9 mbg may be designed based on end bearing resistance of 1 MPa at ULS.

Temporary liners will be required at the site due to the presence of soft clay and wet sands to

prevent caving of the sides of the drilled holes. The installation of the caissons must be inspected by a qualified geotechnical engineer to ensure that the caissons are constructed on bedrock in accordance with the design intent. The contractor must take into consideration the excavation method to be used through the loose and water bearing soils (continuous liners, mud drilling, etc.) and the concreting technique for installing caissons in accordance with good construction practice.

The hole base should be cleaned using the auger and observed and approved by the Geotechnical Engineer.

Concrete should be placed to a minimum thickness of 600 mm in the caisson hole and mixed with the auger. The concrete should then be extracted from the caisson hole and disposed. Concrete placement for the caisson foundation may then proceed.

In the event that more than 150 mm of water is present in the base of the hole, it will be necessary to place concrete using the tremie method to ensure proper placement of the concrete in water.

5.8. FLOOR SLAB

It is expected that the subgrade below the floor slabs of the buildings will consist of engineered fill.

Subgrade preparation should include the removal of all organic soil, loose or soft fill materials and any wet, and disturbed native soils. After removal of all unsuitable materials, the subgrade should be inspected and adjudged as satisfactory before placement and compaction of new fill. The excavation must be backfilled with suitable approved fill; placed in maximum lifts of 200 mm thickness and compacted to at least 98% of SPMDD.

It is recommended that a combined moisture barrier and a levelling course, having a minimum thickness of 200 mm and comprised of free draining material such as Granular A compacted to minimum 100 % of its SPMDD or 19 mm clear stone compacted to a dense condition be provided as a base for the slab-on-grade.

Perimeter drainage at the foundation level is not required provided the finished floor surface is at least 150 mm above the prevailing grade and the surrounding surfaces slope away from the buildings.

5.9. LATERAL EARTH PRESSURE

Parameters used in the determination of earth pressure acting on structures subject to unbalanced pressures are defined below.

SOIL PARAMETERS

Parameter	Definition	Units
Φ'	angle of internal friction	degrees
γ	bulk unit weight of soil	kN/m^3
Ka	active earth pressure coefficient (Rankine)	dimensionless
Ko	at-rest earth pressure coefficient (Rankine)	dimensionless
Kp	passive earth pressure coefficient (Rankine)	dimensionless

The appropriate un-factored values for use in the design of structures subject to unbalanced earth pressures at this site are tabulated as follows:

SOIL PARAMETER VALUES

SOIL	Parameters				
	Φ'	γ	Ka	Kp	Ko
Fill Material	28°	20.0	0.36	2.77	0.53
Clayey Silt	29°	19.0	0.35	2.88	0.52
Silty Clay	27°	18.0	0.39	2.66	0.54

1. Passive and sliding resistance within the zone subject to frost action (i.e. within 1.8 m below finished grade) should be disregarded in the lateral resistance computations.
2. Temporary and/or permanent surcharges at the ground surface should be considered in accordance with the applicable Soil Mechanics methods.

The design earth pressures in compacted backfill should be augmented with the dynamic effects of the compaction efforts, which typically are taken as a uniform 12 kPa pressure over the entire depth below grade where the calculated earth pressure based on the above earth pressure factors is less than 12 kPa.

Walls or bracings subject to unbalanced earth pressures must be designed to resist a pressure that can be calculated based on the following formula:

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

where **P** = lateral pressure in kPa acting at a depth h (m) below ground surface

K = applicable lateral earth pressure coefficient

γ = bulk unit weight of backfill (kN/m^3)

h = height at any point along the interface (m)

q = the complete surcharge loading (kPa)

This equation assumes that free-draining backfill and positive drainage is provided behind the foundation walls to ensure that there is no hydrostatic pressure acting in conjunction with the earth pressure.

Resistance to sliding of earth retaining structures is developed by friction between the base of the footing and the soil. This friction (R) depends on the normal load on the soil contact (N) and the frictional resistance of the soil (tan Φ') expressed as: R = N tan Φ'. This is an ultimate resistance value and does not contain a factor of safety.

5.10. PAVEMENT DESIGN

Based on the existing topography of the site and the presumption that there will be minor re-grading, it is anticipated that the sub-grade material for the pavement will generally comprise of native clayey silt or fill soil.

The subgrade should be thoroughly proof-rolled and re-compacted to ensure uniformity in subgrade strength and support. Lift thicknesses should not exceed 200 mm in loose state and the excavated site material should be compacted using heavy vibratory rollers. As an alternative, if suitable on-site native material is not available, the upper part of the subgrade could be improved by placing imported granular material.

Given the frost susceptibility and drainage characteristics of the subgrade soils, the pavement design presented below is recommended.

RECOMMENDED ASPHALTIC CONCRETE PAVEMENT STRUCTURE DESIGN (MINIMUM COMPONENT THICKNESSES)

Pavement Layer	Compaction Requirements	Light Duty Pavement	Heavy Duty Pavement
Surface Course Asphaltic Concrete	97% Marshall Density	40 mm Hot-Laid HL3	50 mm Hot-Laid HL3
Binder Course Asphaltic Concrete	97% Marshall Density	50 mm Hot-Laid HL8	70 mm Hot-Laid HL8
Granular Base	100% SPMDD	150 mm compacted depth OPSS Granular A	150 mm compacted depth Granular A
Granular Sub-Base	100% SPMDD	300 mm compacted depth Granular B	450 mm compacted depth Granular B

* Standard Proctor maximum dry density (ASTM-D698)

The subgrade must be compacted to at least 98% of SPMDD for at least the upper 1.0 m and 95% below this level. The granular base and sub-base materials should be compacted to a minimum of 100% SPMDD.

The long-term performance of the proposed pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure that uniform subgrade moisture and density conditions are achieved as much as practically possible when fill is placed and that the subgrade is not disturbed and weakened after it is exposed.

Control of surface water is a significant factor in achieving good pavement life. Grading adjacent

to the pavement areas must be designed so that water is not allowed to pond adjacent to the outside edges of the pavement or curb. In addition, the need for adequate drainage cannot be over-emphasized. The subgrade must be free of depressions and sloped (preferably at a minimum gradient of three percent) to provide effective drainage toward subgrade drains. Sub-drains are recommended to intercept excess subsurface moisture at the curb lines and catch basins. The invert of sub-drains should be maintained at least 0.3 m below subgrade level.

Additional comments on the construction of pavement areas are as follows:

- As part of the subgrade preparation, the proposed pavement areas should be stripped of vegetation, topsoil, unsuitable earth fill and other obvious objectionable material. The subgrade should be properly shaped and sloped as required, and then proof-rolled. Loose/soft or spongy subgrade areas should be sub-excavated and replaced with suitable approved material compacted to at least 98% of SPMDD.

- Where new fill is needed to increase the grade or replace disturbed portions of the subgrade, excavated inorganic soils or similar clean imported fill materials may be used, provided their moisture content is maintained within 2 % of the soil's optimum moisture content. All fill must be placed and compacted to not less than 98% of SPMDD.

- For fine-grained soils, as encountered at the site, the degree of compaction specification alone cannot ensure distress free subgrade. Proof-rolling must be carried out and witnessed by Terrapex personnel for final recommendations of sub-base thicknesses.

- In the event that pavement construction takes place in the spring thaw, the late fall, or following periods of significant rainfall, it should be anticipated that an increase in thickness of the granular sub-base layer will be required to compensate for reduced subgrade strength.

5.11. EARTHQUAKE DESIGN PARAMETERS

The Ontario Building Code (2012) stipulates the methodology for earthquake design analysis, as set out in Subsection 4.18.7. The determination of the type of analysis is predicated on the importance of the structure, the spectral response acceleration, and the site classification.

The parameters for determination of the Site Classification for Seismic Site Response are set out in Table 4.1.8.4.A of the Ontario Building Code (2012). The classification is based on the determination of the average shear wave velocity in the top 30 metres of the site stratigraphy, where shear wave velocity (vs) measurements have been taken. In the absence of such measurements, the classification is estimated on the basis of empirical analysis of undrained shear strength or penetration resistance. The applicable penetration resistance is that which has been corrected to a rod energy efficiency of 60% of the theoretical maximum or the (N60) value.

Based on the borehole information, the subsurface stratigraphy generally consists of fill material, followed by firm to soft clayey silt and silty clay underlain by bedrock at an approximate depth of 8 m below grade. Accordingly, the site designation for seismic analysis is Class D.

The site specific 5% damped spectral acceleration coefficients, and the peak ground acceleration factors are provided in the 2012 Ontario Building Code - Supplementary Standard SB-1 (August 15, 2006), Table 1.2, location Ottawa, Ontario.

5.12. CHEMICAL CHARACTERIZATION OF SUBSURFACE SOIL

A native soil sample obtained from Borehole BH106 Sample 6 from an approximate depth of 4 mbg was submitted to AGAT Laboratories for pH index test and water-soluble sulphate content to determine the potential of attacking the subsurface concrete. The Certificate of Analysis provided by the analytical chemical testing laboratory is contained in Appendix E of this report.

The test result reveals that the pH index of the soil sample is 7.19. The water-soluble sulphate content of the tested sample is 0.0178%. The concentration of water-soluble sulphate content of the tested sample is below the CSA Standard of 0.1% water-soluble sulphate (Table 12 of CSA A23.1, Requirements for Concrete Subjected to Sulphate Attack). Special concrete mixes against sulphate attack are therefore not required for the sub-surface concrete of the proposed buildings.

6. LIMITATIONS OF REPORT

The Limitations of Report, as quoted in Appendix ‘A’, are an integral part of this report.

Yours respectfully,
Terrapex Environmental Ltd.

Meysam Najari, Ph.D.
Geotechnical designer

Vic Nersesian, P.Eng.
Senior Geotechnical Engineer

APPENDIX A

LIMITATIONS OF REPORT

LIMITATIONS OF REPORT

This report has been completed in accordance with the terms of reference for this project as agreed upon by Tara Developments (the Client) and Terrapex Environmental Ltd. (Terrapex) and generally accepted engineering consulting practices in this area.

The conclusion and recommendations in this report are based on information determined at the inspection locations. Soil and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction which could not be detected or anticipated at the time of the soil investigation. If new or different information is identified, Terrapex should be requested to re-evaluate its conclusions and recommendations and amend the report as appropriate.

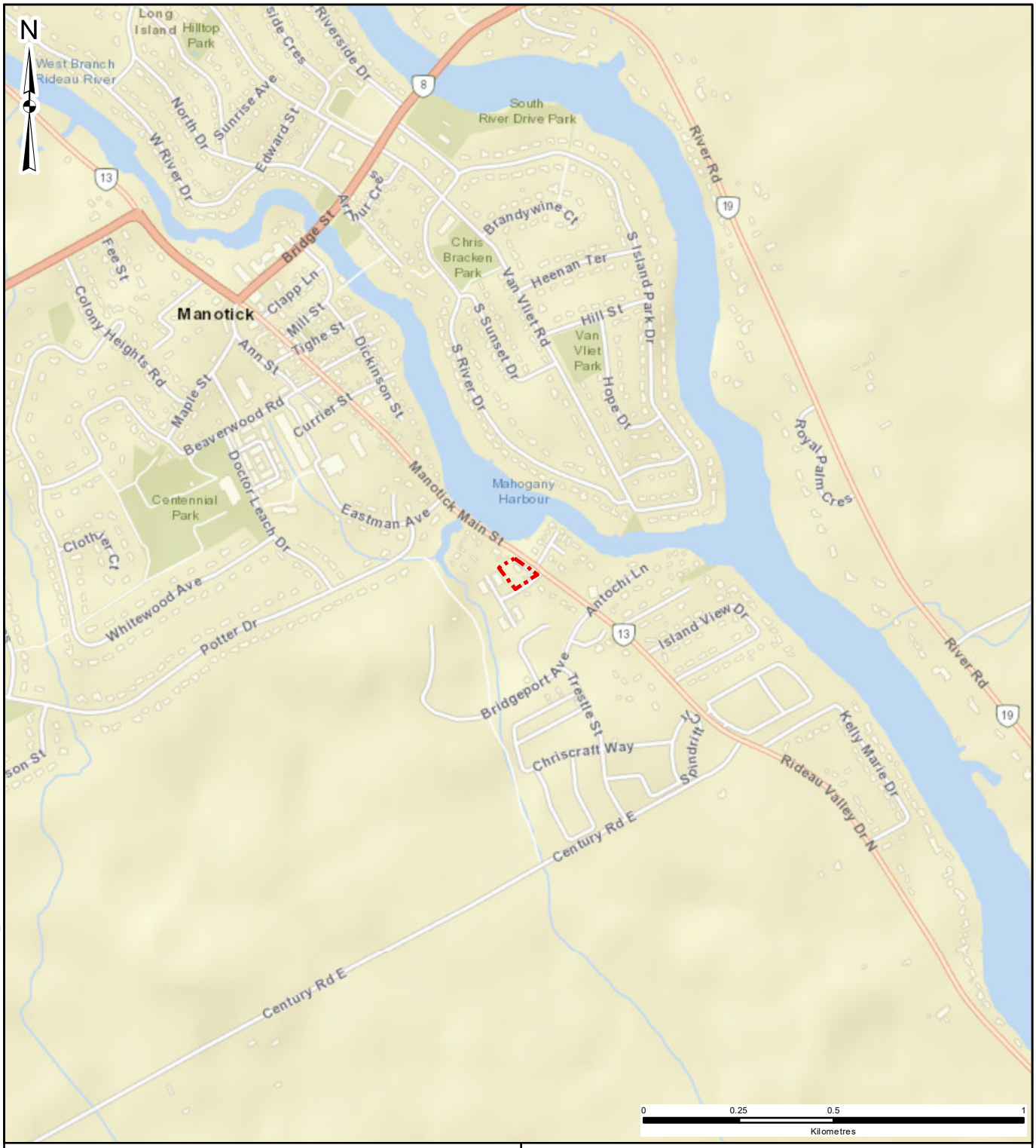
The design recommendations given in this report are applicable only to the project described in the text, and then only if constructed substantially in accordance with details of alignment and elevations stated in the report. Since all details of the design may not be known to us, in our analysis certain assumptions had to be made as set out in this report. The actual conditions may, however, vary from those assumed, in which case changes and modifications may be required to our recommendations.

This report was prepared for the sole use of Hawkins Properties. Terrapex accepts no liability for claims arising from the use of this report, or from actions taken or decisions made as a result of this report, by parties other than Tara Developments. The material herein reflects Terrapex's judgement in light of the information available to it at the time of preparation. We recommend, therefore, that we be retained during the final design stage to review the design drawings and to verify that they are consistent with our recommendations, or the assumptions made in our analysis. We also recommend that we be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the test holes. In cases where these recommendations are not followed, Terrapex's responsibility is limited to accurately interpreting the conditions encountered at the test holes, only.

The comments given in this report on potential construction problems and possible methods are intended for the guidance of the design engineer, only. The number of inspection locations may not be sufficient to determine all the factors that may affect construction methods and costs. Contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work.

APPENDIX B

BOREHOLE LOCATION PLAN



LEGEND

PROPERTY BOUNDARY

DATA SOURCE: ESRI
MAP PROJECTION: NAD 1983 UTM Zone 18N

CLIENT: 595831 ONTARIO INC.

SITE LOCATION: 5646 AND 5650 MANOTICK MAIN STREET, MANOTICK, ONTARIO

TERRAPEX

TITLE: **SITE LOCATION**

DRAWN BY: JS	PROJECT NO.: CO884.01	CHECKED BY: MG
REVISION: 00	DATE: DECEMBER 2022	**FIGURE: 1**

jserroul C:\Users\JSerroul\OneDrive - Terrapex Environmental Ltd\PROJECTS\Ottawa\CO800\CO884.01 5646_5650 Manotick Main St, Manotick\MXD\FIG 1 SITE LOCATION.mxd

LEGEND

- PROPERTY BOUNDARY
- BOREHOLE
- MONITORING WELL

0 10 20 30
Metres

DATA SOURCE: CITY OF OTTAWA
MAP PROJECTION: NAD 1983 UTM ZONE 18N

CLIENT:
595831 ONTARIO INC.

SITE LOCATION:
5646 AND 5650 MANOTICK MAIN STREET, MANOTICK, ONTARIO

TERRAPEX

TITLE:
GENERAL SITE LAYOUT

DRAWN BY:	PROJECT NO.:	CHECKED BY:
JS	CO884.01	MG
REVISION: 00	DATE: DECEMBER 2022	FIGURE: **2**

C:\Users\JSerroul\OneDrive - Terrapex Environmental Ltd\PROJECTS\Ottawa\CO800\CO884.01 5646_5650 Manotick Main St, Manotick\MXD\FIG 2 GENERAL SITE LAYOUT.mxd

APPENDIX C

BOREHOLE LOG SHEETS

CLIENT: Hawkins Properties	PROJECT NO.: CO884.01	**RECORD OF: MW101**
ADDRESS: 5646/5650 Manotick Main Street.		
CITY/PROVINCE: Ottawa,ON	NORTHING (m):	EASTING (m): ELEV. (m) 100.63
CONTRACTOR: Strata Drilling Group	METHOD: 7822 DT Geoprobe equipped with hollow stem augers	
BOREHOLE DIAMETER (cm): 9.5	WELL DIAMETER (cm): 5.08	SCREEN SLOT #: 10 SAND TYPE: No-2 SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) ● / N-VALUE (Blows/300mm) ▲	WATER CONTENT (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL) (new title)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		asphaltic concrete and crusher run limestone FILL	0	100.5	12	20.1	1		55	<10			
		firm, moist, brown CLAYEY SILT trace sand some rootlets	0.5	100									
			1	99.5	4	25.1	2		56	<10			
		firm to soft SILTY CLAY	1.5	99	5 100	34.6	3		100	<10	BTEX F1-F4 pH		
		moist brown ---- grey	2	98.5									
			2.5	98									
			3	97.5	2 50	43.6	4		100	<10			
			3.5	97	50+								
			4	96.5									
			4.5	96	50+								
			5	95.5	3	56.4	5		100	<10			
		wet ----- very wet	5.5	95									
			6	94.5	0	36.9	6		100	<10			
			6.5	94									
			7	93.5									
			7.5	93	100	32.2	7			<10			
			8	92.5									
		END OF BOREHOLE BOREHOLE TERMINATED ON ASSUMED BEDROCK											

TERRAPEX

LOGGED BY: JM	DRILLING DATE: 11-Oct-2022
INPUT BY: UB	MONITORING DATE: 27-10-22
REVIEWED BY: JM	PAGE 1 OF 1

CLIENT: Hawkins Properties	PROJECT NO.: CO884.01	**RECORD OF: BH102**
ADDRESS: 5646/5650 Manotick Main Street.		
CITY/PROVINCE: Ottawa,ON	NORTHING (m):	EASTING (m): ELEV. (m) 100.49
CONTRACTOR: Strata Drilling Group	METHOD: 7822 DT Geoprobe equipped with hollow stem augers	
BOREHOLE DIAMETER (cm): 9.5	WELL DIAMETER (cm): 5.08	SCREEN SLOT #: 10 SAND TYPE: No-2 SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) / N-VALUE (Blows/300mm)	WATER CONTENT (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL) (new title)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		Topsoil	0										
		moist, dark brown clayey silt trace sand with organics FILL	0.5	100	2	32.3	1		100	<10			
			1	99.5	1	24.4	2		100	<10			
		firm to soft SILTY CLAY	1.5	99	4 / 100	37.3	3		100	<10	pH		
			2	98.5									
			2.5	98	50+								
			3	97.5									
			3.5	97	5 / 75	38.2	4		100	<10	BTEX F1-F4		
		olive brown ---- grey	4	96.5	50+								
			4.5	96									
			5	95.5	50+								
			5.5	95									
			6	94.5									
			6.5	94	1	37.8	5		100	<10			
			7	93.5									
		wet ----- very wet	7.5	93									
			8	92.5	0	30.3	6			<10			
			8.5	92									
			9	91.5									
		END OF BOREHOLE											

TERRAPEX

LOGGED BY: JM	DRILLING DATE: 11-Oct-2022
INPUT BY: UB	MONITORING DATE:
REVIEWED BY: JM	PAGE 1 OF 2

CLIENT: Hawkins Properties	PROJECT NO.: CO884.01	**RECORD OF: BH102**
ADDRESS: 5646/5650 Manotick Main Street.		
CITY/PROVINCE: Ottawa,ON	NORTHING (m):	EASTING (m): ELEV. (m) 100.49
CONTRACTOR: Strata Drilling Group	METHOD: 7822 DT Geoprobe equipped with hollow stem augers	
BOREHOLE DIAMETER (cm): 9.5	WELL DIAMETER (cm): 5.08	SCREEN SLOT #: 10 SAND TYPE: No-2 SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) 40 80 120 160 N-VALUE (Blows/300mm) 20 40 60 80	WATER CONTENT (%) ▲ PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL) (new title)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		BOREHOLE TERMINATED ON ASSUMED BEDROCK											

TERRAPEX

LOGGED BY: JM	DRILLING DATE: 11-Oct-2022
INPUT BY: UB	MONITORING DATE:
REVIEWED BY: JM	PAGE 2 OF 2

CLIENT: Hawkins Properties	PROJECT NO.: CO884.01	**RECORD OF: BH103**
ADDRESS: 5646/5650 Manotick Main Street.		
CITY/PROVINCE: Ottawa,ON	NORTHING (m):	EASTING (m): ELEV. (m) 100.5
CONTRACTOR: Strata Drilling Group	METHOD: 7822 DT Geoprobe equipped with hollow stem augers	
BOREHOLE DIAMETER (cm): 9.5	WELL DIAMETER (cm): 5.08	SCREEN SLOT #: 10 SAND TYPE: No-2 SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) / N-VALUE (Blows/300mm)	WATER CONTENT (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL) (new title)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		Topsoil	0	100.5									
		dark brown clayey silt trace sand trace organics FILL	0.5	100	2		1		100	<10			
		saturated grey silty clay FILL											
		Topsoil	1	99.5	4		2		100	<10			
		firm, brown, CLAYEY SILT trace rootlets sand and gravel	1.5	99	38 / 2		3		100	<10			
		firm to soft, grey SILTY CLAY	2	98.5	50+								
			2.5	98									
			3	97.5									
			3.5	97	4		4		100	<10	BTEX F1-F4		
			4	96.5	50+								
			4.5	96									
			5	95.5	50+								
			5.5	95	5		5		100	<10			
		moist ----- very wet	6	94.5									
			6.5	94	1		6		100	<10			
			7	93.5									
			7.5	93									
			8	92.5	0		7		100	<10			
			8.5	92									
			9	91.5									

TERRAPEX

LOGGED BY: JM	DRILLING DATE: 12-Oct-2022
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REVIEWED BY: JM	PAGE 1 OF 2

CLIENT: Hawkins Properties	PROJECT NO.: CO884.01	**RECORD OF: BH103**
ADDRESS: 5646/5650 Manotick Main Street.		
CITY/PROVINCE: Ottawa,ON	NORTHING (m):	EASTING (m): ELEV. (m) 100.5
CONTRACTOR: Strata Drilling Group	METHOD: 7822 DT Geoprobe equipped with hollow stem augers	
BOREHOLE DIAMETER (cm): 9.5	WELL DIAMETER (cm): 5.08	SCREEN SLOT #: 10 SAND TYPE: No-2 SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) 40 80 120 160 N-VALUE (Blows/300mm) 20 40 60 80	WATER CONTENT (%) ▲ PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL) (new title)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		pieces of limestone					8			<10			
		END OF BOREHOLE BOREHOLE TERMINATED ON ASSUMED BEDROCK											

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LOGGED BY: JM	DRILLING DATE: 12-Oct-2022
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CLIENT: Hawkins Properties	PROJECT NO.: CO884.01	**RECORD OF: BH104**
ADDRESS: 5646/5650 Manotick Main Street.		
CITY/PROVINCE: Ottawa,ON	NORTHING (m):	EASTING (m): ELEV. (m) 100.6
CONTRACTOR: Strata Drilling Group	METHOD: 7822 DT Geoprobe equipped with hollow stem augers	
BOREHOLE DIAMETER (cm): 9.5	WELL DIAMETER (cm): 5.08	SCREEN SLOT #: 10 SAND TYPE: No-2 SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) ● 40 80 120 160 / N-VALUE (Blows/300mm) ▲ 20 40 60 80	WATER CONTENT (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL) (new title)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		TopSoil	0	100.5	4	16.7	1		83	<10			
		moist, dark brown clayey silt traces of sand and gravel some rootlets FILL	0.5	100									
			1	99.5	3	27.3	2		83	<10			
					2	18	3		100	<10			
		END OF BOREHOLE	1.5										

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CLIENT: Hawkins Properties	PROJECT NO.: CO884.01	**RECORD OF: BH105**
ADDRESS: 5646/5650 Manotick Main Street.		
CITY/PROVINCE: Ottawa,ON	NORTHING (m):	EASTING (m): ELEV. (m) 100.61
CONTRACTOR: Strata Drilling Group	METHOD: 7822 DT Geoprobe equipped with hollow stem augers	
BOREHOLE DIAMETER (cm): 9.5	WELL DIAMETER (cm): 5.08	SCREEN SLOT #: 10 SAND TYPE: No-2 SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) 40 80 120 160 / N-VALUE (Blows/300mm) 20 40 60 80	WATER CONTENT (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL) (new title)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		ASPHALTIC CONCRETE	0	100.5	17				66	<10			
		moist, grey, crusher run limestone					1						
		dark brown clayey silt trace sand and gravel FILL	0.5	100									
		brown, clayey silt FILL	1	99.5	4		2		50	<10	M+1 BTEX F1-F4		
		grey crusher run limestone	1.5		3		3		100	<10			
		END OF BOREHOLE											

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CLIENT: Hawkins Properties	PROJECT NO.: CO884.01	**RECORD OF: BH106**
ADDRESS: 5646/5650 Manotick Main Street.		
CITY/PROVINCE: Ottawa,ON	NORTHING (m):	EASTING (m): ELEV. (m) 100.63
CONTRACTOR: Strata Drilling Group	METHOD: 7822 DT Geoprobe equipped with hollow stem augers	
BOREHOLE DIAMETER (cm): 9.5	WELL DIAMETER (cm): 5.08	SCREEN SLOT #: 10 SAND TYPE: No-2 SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) ● / N-VALUE (Blows/300mm) ▲	WATER CONTENT (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL) (new title)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		grey crusher run limestone	0	100.5	17	5.8	1		66	<10			
		moist, brown silty sand FILL	0.5	100									
			1	99.5	5	17.8	2		41	<10			
			1.5	99	5								
		wet, brown sand traces of silt and gravel FILL	2		0	16	3		83	<10	pH		
				98.5	0								
			2.5	98	0	17	4		83	<10			
		firm to soft SILTY CLAY	3	97.5	3	50.2	5		75	<10	BTEX F1-F4		
			3.5	97									
			4	96.5	2	58.7	6		100	<10			
		olive brown ---- grey	4.5	96									
			5	95.5	90/70								
			5.5	95									
		brown ---- grey	6	94.5		32	7		100	<10			
			6.5	94	2								
			7	93.5									
			7.5	93		11.4	8		100	<10			
		limetone pieces	8	92.5	20								
		END OF BOREHOLE BOREHOLE TERMINATED ON ASSUMED BEDROCK											

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CLIENT: Hawkins Properties	PROJECT NO.: CO884.01	**RECORD OF: BH107**
ADDRESS: 5646/5650 Manotick Main Street.		
CITY/PROVINCE: Ottawa,ON	NORTHING (m):	EASTING (m): ELEV. (m) 100.82
CONTRACTOR: Strata Drilling Group	METHOD: 7822 DT Geoprobe equipped with hollow stem augers	
BOREHOLE DIAMETER (cm): 9.5	WELL DIAMETER (cm): 5.08	SCREEN SLOT #: 10 SAND TYPE: No-2 SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) / N-VALUE (Blows/300mm)	WATER CONTENT (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL) (new title)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		moist grey crusher run limestone	0	100.5	13		1		50	<10			
		moist brown CLAYEY SILT	0.5								M+I dup BH107-12 BTEX F1-F4		
			1	100	4		2		42	<10			
			1.5	99.5	8		3		42	<10			
		END OF BOREHOLE		99									

SHEAR STRENGTH (kPa): 40 80 120 160
N-VALUE (Blows/300mm): 20 40 60 80
WATER CONTENT (%): 20 40 60 80

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REVIEWED BY: JM	PAGE 1 OF 1

CLIENT: Hawkins Properties	PROJECT NO.: CO884.01	**RECORD OF: BH108**
ADDRESS: 5646/5650 Manotick Main Street.		
CITY/PROVINCE: Ottawa,ON	NORTHING (m):	EASTING (m): ELEV. (m) 100.16
CONTRACTOR: Strata Drilling Group	METHOD: 7822 DT Geoprobe equipped with hollow stem augers	
BOREHOLE DIAMETER (cm): 9.5	WELL DIAMETER (cm): 5.08	SCREEN SLOT #: 10 SAND TYPE: No-2 SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) ● 40 80 120 160 N-VALUE (Blows/300mm) ▲ 20 40 60 80	WATER CONTENT (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL) (new title)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		Topsoil	0	100	4 ▲		1		66	<10			
			0.5	99.5									
		firm, brown CLAYEY SILT trace sand and gravel	1		4 ▲		2		92	<10	pH BTEX F1-F4		
		END OF BOREHOLE		99									

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LOGGED BY: JM	DRILLING DATE: 12-Oct-22
INPUT BY: UB	MONITORING DATE:
REVIEWED BY: JM	PAGE 1 OF 1

CLIENT: Hawkins Properties	PROJECT NO.: CO884.01	**RECORD OF: MW109**
ADDRESS: 5646/5650 Manotick Main Street.		
CITY/PROVINCE: Ottawa,ON	NORTHING (m):	EASTING (m): ELEV. (m) 99.91
CONTRACTOR: Strata Drilling Group	METHOD: 7822 DT Geoprobe equipped with hollow stem augers	
BOREHOLE DIAMETER (cm): 9.5	WELL DIAMETER (cm): 5.08	SCREEN SLOT #: 10 SAND TYPE: No-2 SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) / N-VALUE (Blows/300mm)	WATER CONTENT (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL) (new title)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		Topsoil	0	99.5	6	24.2	1		100	<10	M+I		
		firm, moist, brown CLAYEY SILT trace sand	0.5										
			1	99	2	24.6	2		100	<10			
			1.5	98.5									
			2	98	2 60 70/50	40.3	3		100	<10			
			2.5	97.5									
		firm to soft, moist SILTY CLAY	3	97									
			3.5	96.5	2 60	46.4	4		2	<10	BTEX F1-F4		
			4	96	100/80								
			4.5	95.5	80/50								
			5	95									
			5.5	94.5	4 50	42	5		100	<10			
		olive brown ---- grey	6	94									
			6.5	93.5	25	38	6		100	<10			
			7	93									
			7.5	92.5									
			8	92	0	43	7		100	<10			
			8.5	91.5									
		END OF BOREHOLE BOREHOLE TERMINATED ON ASSUMED BEDROCK											

TERRAPEX

LOGGED BY: JM	DRILLING DATE: 12-Oct-22
INPUT BY: UB	MONITORING DATE: 27-10-2022
REVIEWED BY: JM	PAGE 1 OF 1

CLIENT: Hawkins Properties	PROJECT NO.: CO884.01	**RECORD OF: BH110**
ADDRESS: 5646/5650 Manotick Main Street.		
CITY/PROVINCE: Ottawa,ON	NORTHING (m):	EASTING (m): ELEV. (m) 100.23
CONTRACTOR: Strata Drilling Group	METHOD: 7822 DT Geoprobe equipped with hollow stem augers	
BOREHOLE DIAMETER (cm): 9.5	WELL DIAMETER (cm): 5.08	SCREEN SLOT #: 10 SAND TYPE: No-2 SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) / N-VALUE (Blows/300mm)	WATER CONTENT (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL) (new title)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		Topsoil	0	100	4								
		moist dark brown sandy silt trace clay organics FILL	0.5				1		100	<10			
		firm moist brown CLAYEY SILT trace sand some rootlets		99.5	5		2		100	<10			
			1	99									
			1.5		5		3		100	<10	BTEX F1-F4		
				98.5									
		END OF BOREHOLE											

TERRAPEX

LOGGED BY: JM	DRILLING DATE: 12-Oct-22
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REVIEWED BY: JM	PAGE 1 OF 1

CLIENT: Hawkins Properties	PROJECT NO.: CO884.01	**RECORD OF: MW111**
ADDRESS: 5646/5650 Manotick Main Street.		
CITY/PROVINCE: Ottawa,ON	NORTHING (m):	EASTING (m): ELEV. (m) 100.41
CONTRACTOR: Strata Drilling Group	METHOD: 7822 DT Geoprobe equipped with hollow stem augers	
BOREHOLE DIAMETER (cm): 9.5	WELL DIAMETER (cm): 5.08	SCREEN SLOT #: 10 SAND TYPE: No-2 SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) ● 40 80 120 160 N-VALUE (Blows/300mm) ▲ 20 40 60 80	WATER CONTENT (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL) (new title)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		crusher run limestone	0	100									
			0.5				1		13	<10			
			1	99.5									
		brown CLAYEY SILT trace sand	1.5	99									
			2	98.5			2		100	<10			
			2.5	98									
		moist olive brown SILTY CLAY	3	97.5									
			3.5	97									
			4	96.5			3		100	<10	BTEX F1-F4		
			4.5	96									
			5	95.5									
			5.5	95			4		100	<10			
			6	94.5									
		END OF BOREHOLE BOREHOLE TERMINATED ON ASSUMED BEDROCK											

TERRAPEX

LOGGED BY: JM	DRILLING DATE: 12-Oct-22
INPUT BY: UB	MONITORING DATE: 27-10-22
REVIEWED BY: JM	PAGE 1 OF 1

CLIENT: Hawkins Properties | PROJECT NO.: CO884.01 | **RECORD OF: MW112**

ADDRESS: 5646/5650 Manotick Main Street.

CITY/PROVINCE: Ottawa,ON | NORTHING (m): | EASTING (m): | ELEV. (m) 100.58

CONTRACTOR: Strata Drilling Group | METHOD: 7822 DT Geoprobe equipped with hollow stem augers

BOREHOLE DIAMETER (cm): 9.5 | WELL DIAMETER (cm): 5.08 | SCREEN SLOT #: 10 | SAND TYPE: No-2 | SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) ● 40 80 120 160 / N-VALUE (Blows/300mm) ▲ 20 40 60 80	WATER CONTENT (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL) (new title)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		Topsoil	0	100.5					100	<10			
		moist grey CLAYEY SILT	0.5	100									
			1	99.5			1		100	<10			
			1.5	99									
			2	98.5			2		100	8% LEL	BTEX F1-F4 dup MW112-12		
			2.5	98									
			3	97.5									
			3.5	97			3		100	10 ppm	BTEX F1-F4		
			4	96.5									
		olive brown SILTY CLAY	4.5	96									
			5	95.5			4		100	<10			
			5.5	95									
			6	94.5									
		END OF BOREHOLE BOREHOLE TERMINATED ON ASSUMED BEDROCK											

TERRAPEX

LOGGED BY: JM | DRILLING DATE: 12-Oct-22

INPUT BY: UB | MONITORING DATE: 27-10-22

REVIEWED BY: JM | PAGE 1 OF 1

CLIENT: Hawkins Properties	PROJECT NO.: CO884.01	**RECORD OF: BH113**
ADDRESS: 5646/5650 Manotick Main Street.		
CITY/PROVINCE: Ottawa,ON	NORTHING (m):	EASTING (m): ELEV. (m) 100.86
CONTRACTOR: Strata Drilling Group	METHOD: 7822 DT Geoprobe equipped with hollow stem augers	
BOREHOLE DIAMETER (cm): 9.5	WELL DIAMETER (cm): 5.08	SCREEN SLOT #: 10 SAND TYPE: No-2 SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) / N-VALUE (Blows/300mm)	WATER CONTENT (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	SV/TOV (ppm or %LEL) (new title)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		asphaltic concrete and crusher run limestone	0										
		dark brown clayey silt FILL	0.5	100.5	6	20.9	1		46	<10			
		firm brown CLAYEY SILT trace sand	1	100	5	34.2	2		66	<10			
			1.5	99.5	3	36.8	3		100	<10			
		END OF BOREHOLE											

TERRAPEX

LOGGED BY: JM	DRILLING DATE: 12-Oct-22
INPUT BY: UB	MONITORING DATE:
REVIEWED BY: JM	PAGE 1 OF 1

KEY TO SYMBOLS

Symbol Description

Strata symbols


Fill


Description not given for:
"OZ"


Description not given for:
"0T"


Low plasticity
clay


Silty sand


Description not given for:
"ST"


Description not given for:
"OZS8"


Limestone


Topsoil


Paving


Description not given for:
"8SZ"


Description not given for:
"ZOS"

Symbol Description


Description not given for:
"SZOJ"


Description not given for:
"S8"


Silty low plasticity
clay

Misc. Symbols


Description not given for:
"GWATER2"


Description not given for:
"FTRANGLE"


Description not given for:
"FSQUARE"

Soil Samplers


Split Spoon

Monitor Well Details


top of well,
recessed pipe


bentonite pellets


silica sand, blank PVC


slotted pipe w/ sand

Notes:

1. Exploratory borings were drilled on 12-Oct-22 using a 4-inch diameter continuous flight power auger.

2. No free water was encountered at the time of drilling or when re-checked the following day.

3. Boring locations were taped from existing features and elevations extrapolated from the final design schematic plan.

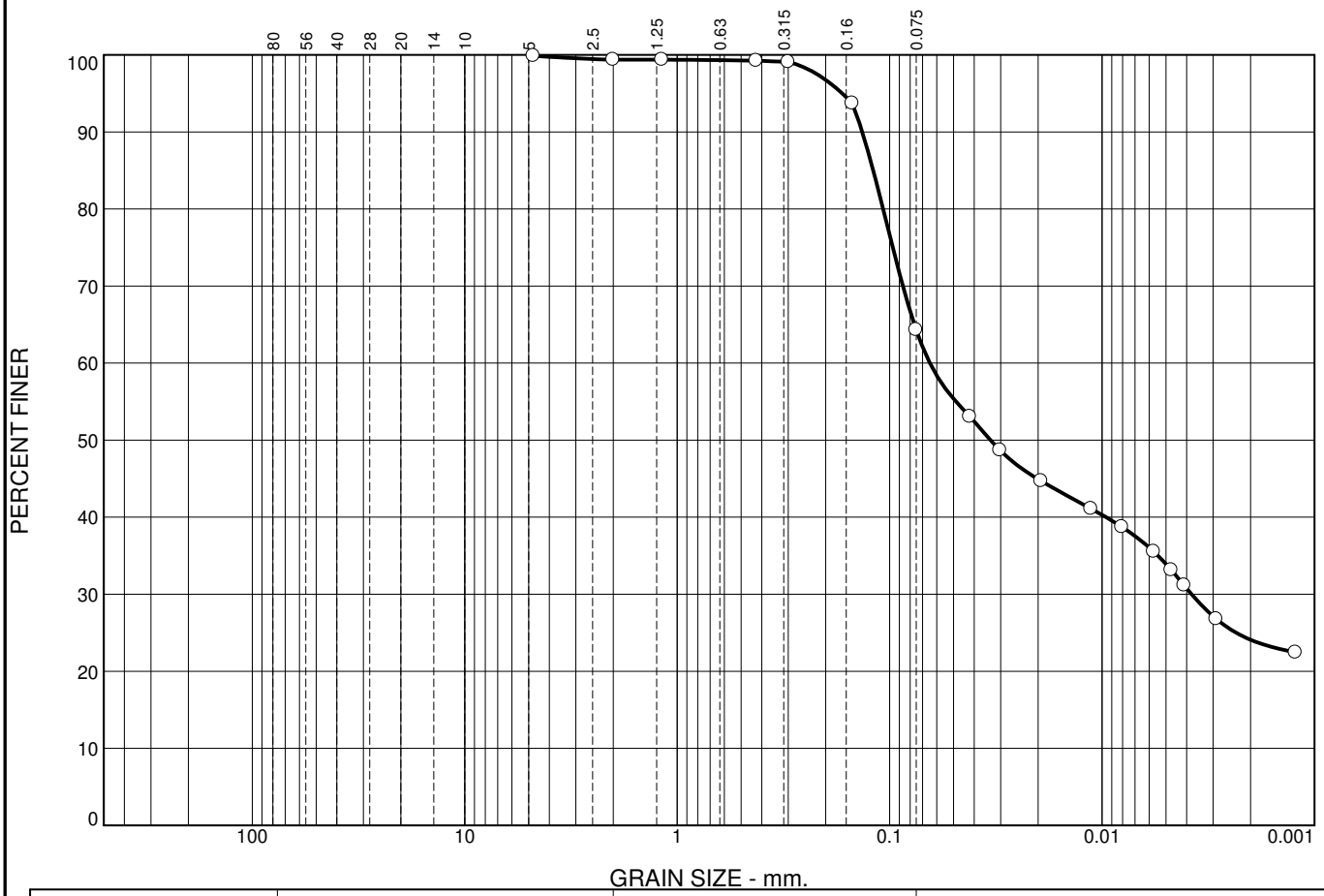
4. These logs are subject to the limitations, conclusions, and recommendations in this report.

5. Results of tests conducted on samples recovered are reported on the logs.

APPENDIX D

GEOTECHNICAL LABORATORY TEST RESULTS

Particle Size Distribution Report



	% +75mm	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○			0.2	34.9	40.2	24.1

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	51	19	0.1194	0.0646	0.0335	0.0038				

Material Description	USCS	AASHTO
○ sandy, SILT AND CLAY	CH	A-7-6(18)

Project No. CO884.01 **Client:** Hawkins Properties
Project:

○ **Location:** Hawkins Properties **Sample Number:** BH 101-SS3

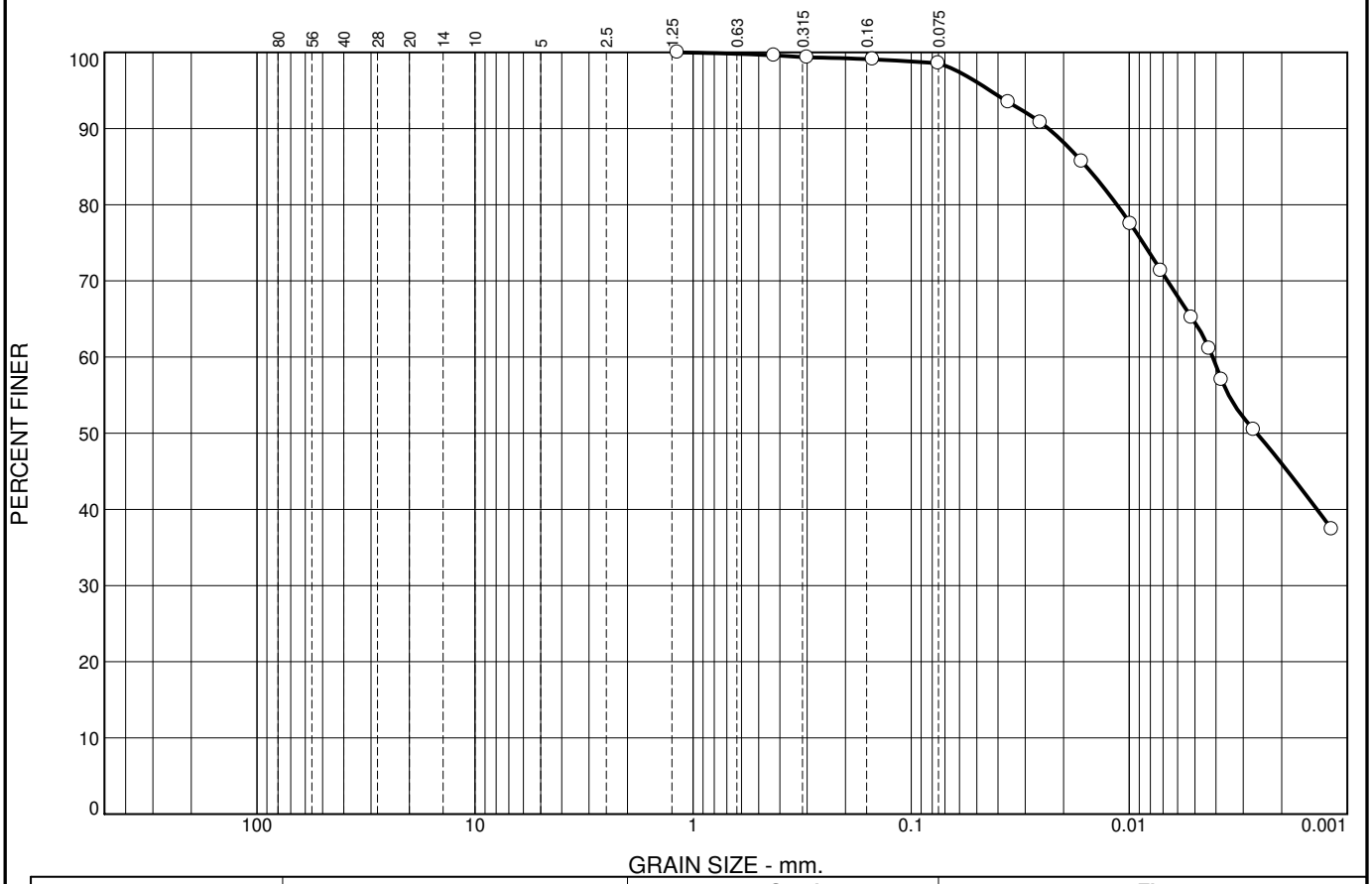
Remarks:

Terrapex

Ottawa, ON

Figure 1

Particle Size Distribution Report



	% +75mm	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○	0.0	0.0	0.4	1.0	52.6	46.0

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	39	18	0.0157	0.0041	0.0026					

Material Description	USCS	AASHTO
○ SILT AND CLAY, trace sand	CL	A-6(22)

Project No. CO884.01 **Client:** Hawkins Properties

Project:

○ **Location:** Hawkins Properties **Sample Number:** BH 101-SS6

Remarks:

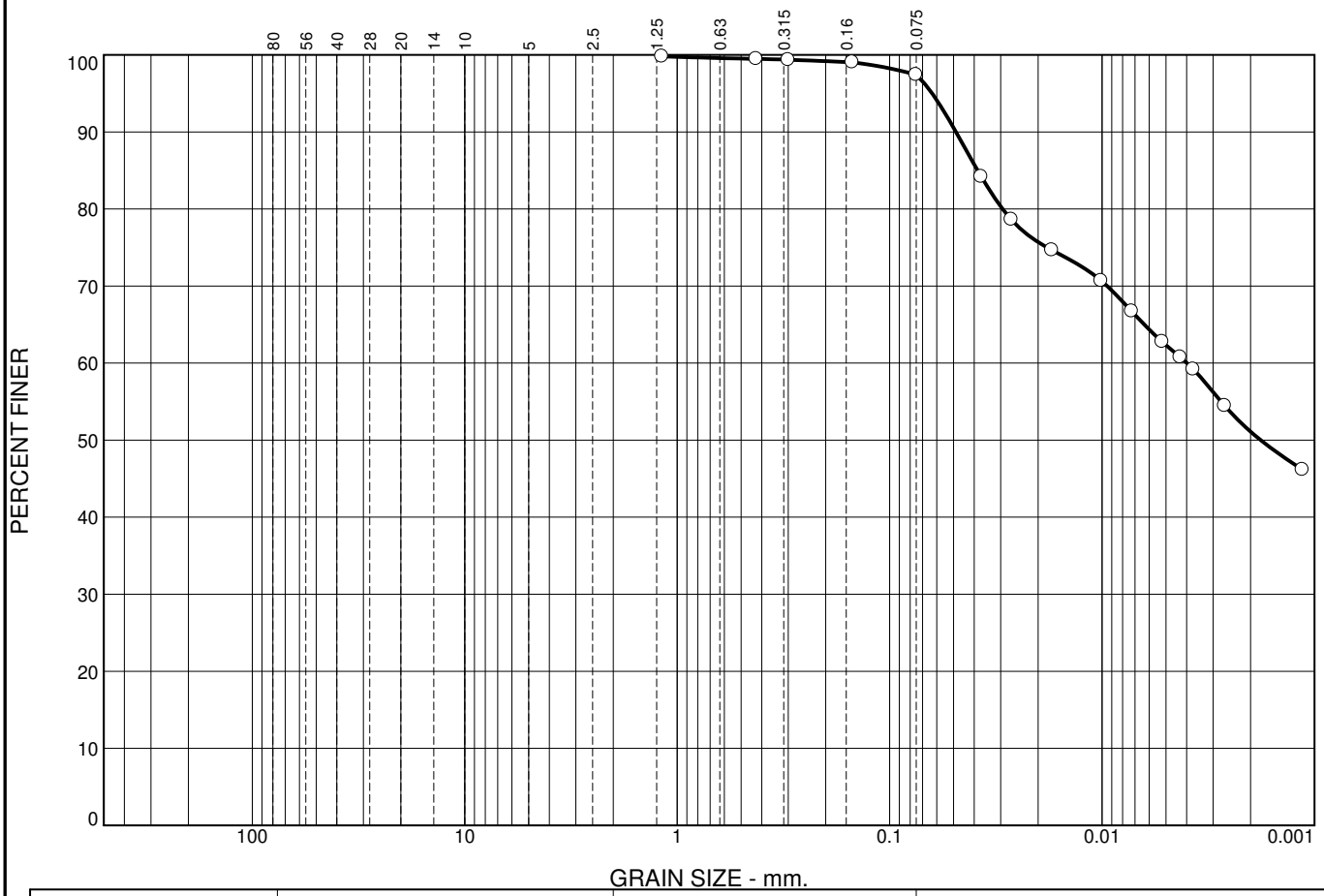
Terrapex

Ottawa, ON

Figure 2

Tested By: UB

Particle Size Distribution Report



	% +75mm	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
○				2.1	46.3	51.1

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	31	11	0.0385	0.0040	0.0018					

Material Description	USCS	AASHTO
○ CLAY AND SILT, trace sand		

Project No. CO884.01 **Client:** Hawkins Properties
Project:

○ **Location:** Hawkins Properties **Sample Number:** BH 109-SS2

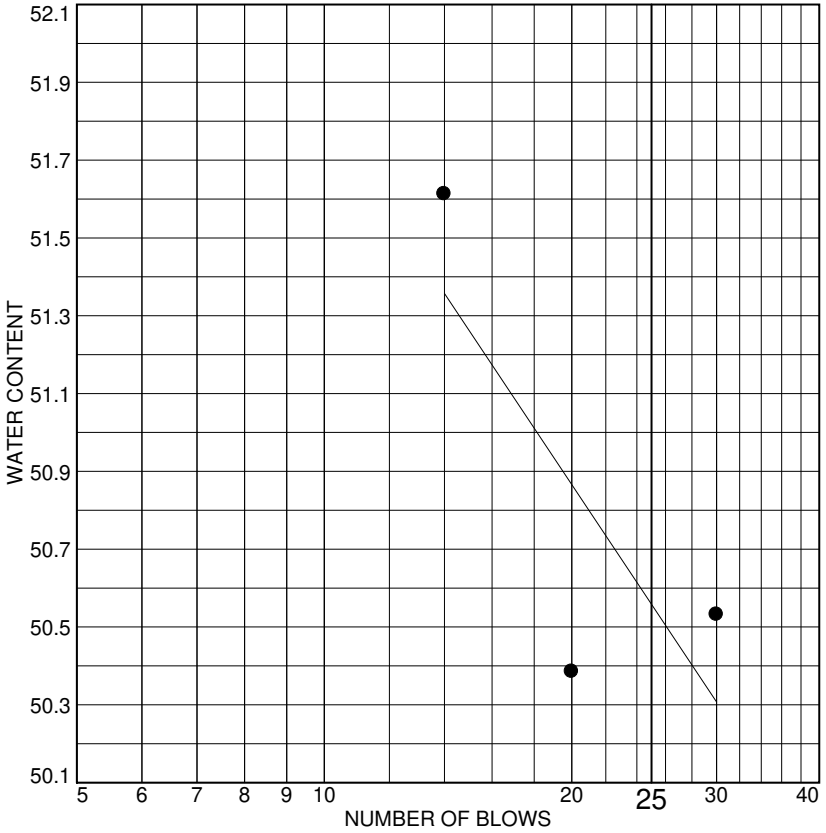
Remarks:

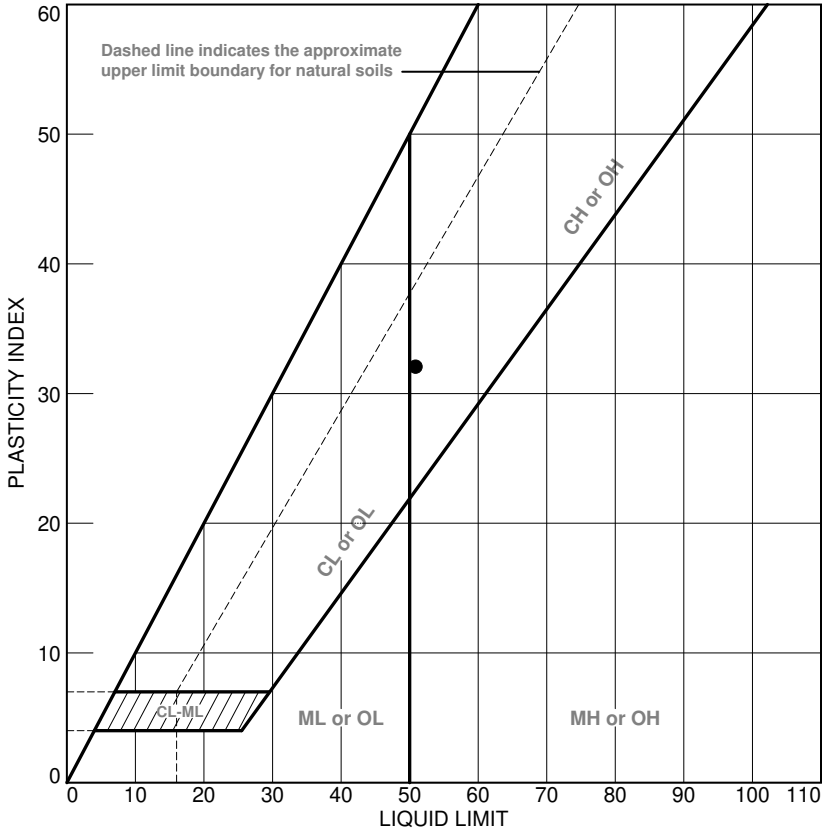
Terrapex

Ottawa, ON

Figure 3

LIQUID AND PLASTIC LIMITS TEST REPORT





	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PI
●		BH 101-SS3			CH	sandy, SILT AND CLAY		51	32

Client Hawkins Properties

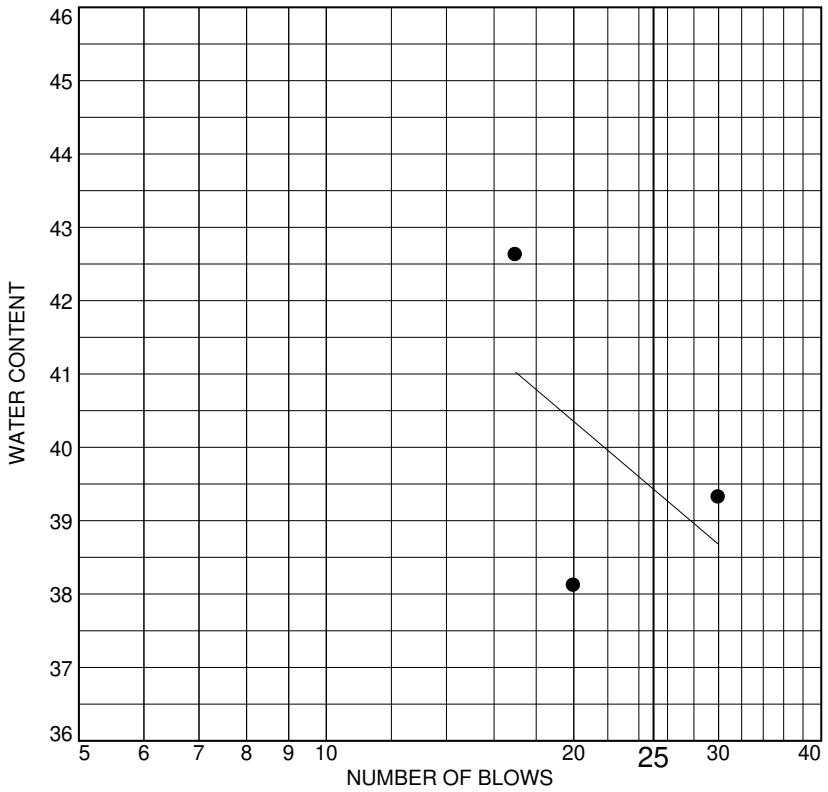
Project

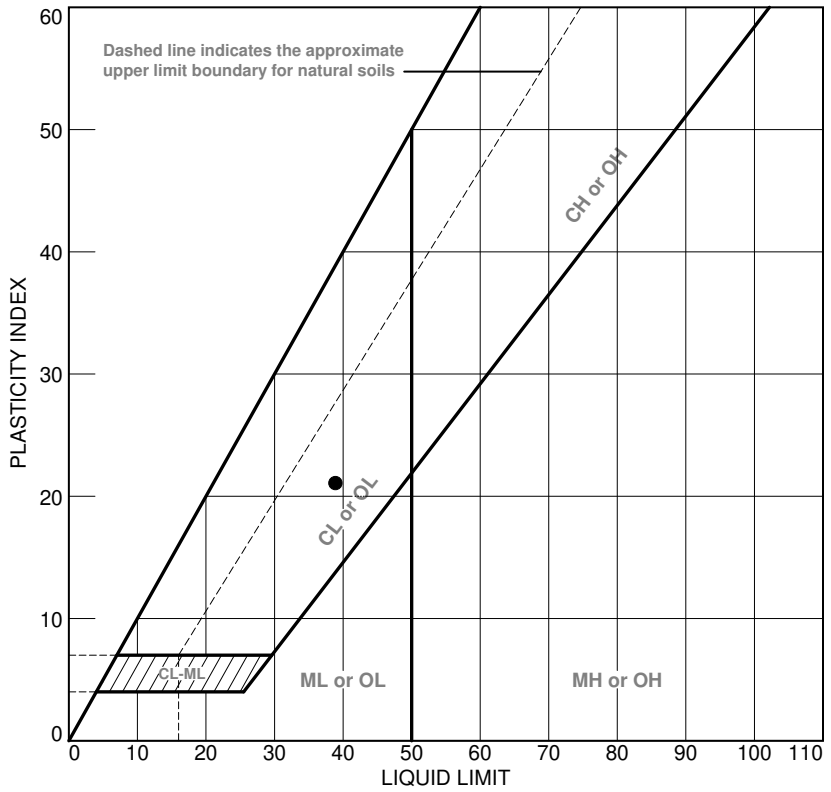
Project No. CO884.01 Figure 4

Terrapex

Ottawa, ON

LIQUID AND PLASTIC LIMITS TEST REPORT





	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PI
●		BH 101-SS6			CL	SILT AND CLAY, trace sand		39	21

Client Hawkins Properties	**Terrapex**	
Project		
Project No. CO884.01 Figure 5	**Ottawa, ON**	

Tested By: UB

APPENDIX E

CERTIFICATE OF CHEMICAL ANALYSES

AGAT Laboratories

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

CLIENT NAME: TERRAPEX ENVIRONMENTAL LIMITED
20 GURDWARA ROAD, UNIT 1
OTTAWA, ON K2E 8B3
613-745-6471
ATTENTION TO: Ottawa Location
PROJECT: CO884.01
AGAT WORK ORDER: 22Z964139
SOIL ANALYSIS REVIEWED BY: Nivine Basily, Inorganics Report Writer
DATE REPORTED: Nov 02, 2022
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

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: 22Z964139
PROJECT: CO884.01

CLIENT NAME: TERRAPEX ENVIRONMENTAL LIMITED
SAMPLING SITE:Hawkin Properties

ATTENTION TO: Ottawa Location
SAMPLED BY:

Inorganic Chemsitry (Soil)

DATE RECEIVED: 2022-10-31 DATE REPORTED: 2022-11-02

		SAMPLE DESCRIPTION:		BH-106-SS-6
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2022-10-12
Parameter	Unit	G / S	RDL	4477265
Sulphate (2:1)	µg/g		2	178
pH (2:1)	pH Units		NA	7.19

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
4477265 pH and Sulphate were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).
Analysis performed 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

Quality Assurance

CLIENT NAME: TERRAPEX ENVIRONMENTAL LIMITED

AGAT WORK ORDER: 22Z964139

PROJECT: CO884.01

ATTENTION TO: Ottawa Location

SAMPLING SITE:Hawkin Properties

SAMPLED BY:

Soil Analysis

RPT Date: Nov 02, 2022			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 Chemsitry (Soil)															
Sulphate (2:1)	4474463		15	15	0.0%	< 2	94%	70%	130%	93%	80%	120%	96%	70%	130%
pH (2:1)	4345153		6.96	7.39	6.0%	NA	99%	80%	120%						

Comments: NA signifies Not Applicable.
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.

Certified By:

AGAT Laboratories

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

Time Markers

AGAT WORK ORDER: 22Z964139

PROJECT: CO884.01

CLIENT NAME: TERRAPEX ENVIRONMENTAL LIMITED

ATTENTION TO: Ottawa Location

Sample ID	Sample Description	Sample Type	Date Sampled	Date Received
4477265	BH-106-SS-6	Soil	12-OCT-2022	31-OCT-2022

Inorganic Chemsitry (Soil)

Parameter	Date Prepared	Date Analyzed	Initials
Sulphate (2:1)	02-NOV-2022	02-NOV-2022	LC
pH (2:1)	02-NOV-2022	02-NOV-2022	SR

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

Method Summary

CLIENT NAME: TERRAPEX ENVIRONMENTAL LIMITED

AGAT WORK ORDER: 22Z964139

PROJECT: CO884.01

ATTENTION TO: Ottawa Location

SAMPLING SITE:Hawkin Properties

SAMPLED BY:

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

AGAT Laboratories

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 #: 22Z964139

Cooler Quantity: One - ice

Arrival Temperatures: 6.0 16.2 15.9
1.3 12.0 11.5

Custody Seal Intact: ☐Yes ☐No ☐N/A

Notes:

Report Information:

Company: Rosaplex
Contact: 613-745-6471
Address: 20 Gwendowdale Rd

Phone: Fax:

Reports to be sent to:
1. Email:
2. Email:

Regulatory Requirements: ☐ No Regulatory Requirement

(Please check all applicable boxes)

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

☐ Sewer Use
☐ Sanitary ☐ Storm
Region (Indicate One) ☐ MISA

☐ Regulation 558
☐ CCME
☐ 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: 08544-01
Site Location: Hawkin properties
Sampled By:
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 Y/N	O. Reg 153 Metals and Inorganics	All Metals ☐ 153 Metals (excl. Hydrides)	Hydride Metals ☐ 153 Metals (incl. Hydrides)	ORPs: ☐ B-HWS ☐ Cl⁻ ☐ CN⁻	☐ Cr⁶⁺ ☐ EC ☐ FOC ☐ Hg	☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ N-1, ☐ TKN	☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use	PH and Sulphides
BH-106-SS-6	12-Oct-2022		1																						X

Samples Relinquished By (Print Name and Sign): Urraig	Date 31-10-2022	Time 12:15pm	Samples Received By (Print Name and Sign): Berthelet	Date 22-10-31	Time 12h20
Samples Relinquished By (Print Name and Sign):	Date 22-10-31	Time	Samples Received By (Print Name and Sign): M. GRASIC	Date	Time
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time

'22 NOV 1 9:41 am

Page ____ of ____

N°: T 085438

APPENDIX B – WATERLOO BIOFILTER NUTRIENT REDUCTION - NSF TESTING RESULTS SUMMARY

NSF International
Ann Arbor, MI • Sacramento, CA • Washington, D.C. • Brussels, Belgium

Data Summary for Waterloo Biofilter® Model 4 Bedroom Under the EPA ETV Water Quality Protection Center

The following is a preliminary summary of the test results obtained for the Waterloo Biofilter® Model 4 Bedroom for nutrient reduction under the ETV Water Quality Protection Center. These results have been QA reviewed, but will not be considered final until all EPA reviews have been completed. The testing was completed at the Massachusetts Septic Systems Test Center during the period of March 2001 through April 2002. A full report for this testing will be completed soon and posted on the EPA (www.epa.gov/etv) and NSF (www.nsf.org/etv) web sites.

Table 1. BOD_5/$CBOD_5$ and TSS Data Summary

	BOD_5	$CBOD_5$		TSS		
	Influent (mg/L)	Effluent (mg/L)	Removal Percent	Influent (mg/L)	Effluent (mg/L)	Removal Percent
Samples	53	53	53	53	53	52
Average	210	10	95	150	7	95
Median	200	7.4	96	130	5	97
Max	370	43	99	340	55	>99
Min	67	1.0	71	61	<1	51
Std. Dev.	73	9.0	6.0	66	8	8

Table 2. Nitrogen Data Summary

	TKN (mg/L)		NH4 (mg/L)		Total Nitrogen (mg/L)		Nitrate (mg/L)	Nitrite (mg/L)	Temperature (C)
	Influent	Effluent	Influent	Effluent	Influent	Effluent	Effluent	Effluent	Effluent
Samples	53	53	53	53	53	53	53	53	51
Average	37	3.7	23	2.4	37	14	10	0.19	15
Median	37	1.6	23	0.7	37	13	10	0.14	14
Maximum	45	31	29	24	45	45	33	0.84	24
Minimum	24	<0.5	18	<0.2	24	6.8	0.6	<0.05	5.2
Std. Dev.	4.2	5.5	2.4	4.0	4.2	6.0	5.0	0.20	5.9

NSF Contact: Thomas Stevens
(734) 769-5347
stevenst@nsf.org

ETI Independent Testing

Buzzard's Bay Test Facility, MA

24-Month Waterloo Biofilter Testing with 50% Recirculation in Triplicate for the Period of June 1999-June 2001

Results

- The Waterloo Biofilter can be loaded at very high rates
- Tertiary quality effluent
- ~60% total nitrogen removal
- Fecal coliforms are reduced by 99% in the Waterloo Biofilter and 99.99% with an additional foot of coarse sand or >99.999% with 10" of fine sand
- 10" of soil or fine sand after the Biofilter is equivalent to an under-drained 60" thick Title 5 sand filter system, but with much better nitrogen removal
- Very low power consumption; less than a re-circulating sand filter and 1/3 of a standard ATU producing secondary effluent (www.buzzardsbay.org/etiresults.htm)

Biofilter organic results including start-up period (124-133 samples)

	$_{c+n}BOD_5$ mg/L	TSS mg/L	Fecals cfu/100 mL	NH_4-N mg/L	TN mg/L
Influent Median	162	161	3100K	24.2	34.6
Effluent Median	9	6	32K	0.5	13.9
% Removal	94.4	96.3	99.0	97.9	59.8

Fecal coliform results for 12" and 10" lysimeter testing (25-31 samples)

	Lysimeter A1 May '00 — Jul '01 cfu/100 mL	Lysimeter A2 June '00 — July '01 cfu/100 mL	Lysimeter A3 June '00 — July '01 cfu/100 mL
Influent Sewage	3 700 000	3 800 000	3 700 000
Effluent After Waterloo + 12" of T= 0.8 min/cm Sand	400	295	100
% Removal	99.989	99.992	99.997
Effluent After Waterloo + 10" of T= 5 min/cm Sand	-	-	<1
% Removal	-	-	>99.999

21-Month Single-Pass Waterloo Biofilter Testing (No Recirculation)

Results

- A single pass through the Waterloo Biofilter is very effective at removing dissolved organics and solids
- ~40% total nitrogen removal
- Very low power consumption; about half that of a re-circulating sand filter and 1/6 of a standard ATU producing secondary effluent

Biofilter single pass organic results from September 2001 - June 2002

	# of Samples	$_cBOD$ mg/L	TSS mg/L	DO mg/L	TN mg/L
Influent Median	37	214	130	0	37
Effluent Median	19	6.4	3.0	5.6	23.1
% Removal	-	97.0	97.7	-	42.4

Buzzard's Bay Site Manager
George Heufelder
Buzzard's Bay Project
2870 Cranberry Highway
East Wareham, MA
02538
Phone: 508-291-3625
Site: 508-563-6757

Project Overseers
USEPA
MDEP
USDOD
BCDHE
NEIWPCC

Waterloo Biofilter Systems Inc.
143 Dennis Street
P.O. Box 400
Rockwood, ON
Canada N0B 2K0
Phone: 519-856-0757
www.waterloo-biofilter.com

APPENDIX C – LABORATORY RESULTS

PARACEL LABORATORIES LTD. | TRUSTED. RESPONSIVE. RELIABLE.

1-800-749-1947
www.paracellabs.com

Certificate of Analysis

McIntosh Perry Consulting Eng. (Carp)
115 Walgreen Rd.
RR#3 Carp, ON K0A 1L0
Attn: Patrick Leblanc

Report Date: 9-Nov-2023
Order Date: 2-Nov-2023

Client PO:
Project: CCO-22-2383
Custody: 143505

Order #: 2344385

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

Paracel ID	Client ID
2344385-01	5640 Manotick Main

Approved By:

Dale Robertson, BSc
Laboratory Director

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	6-Nov-23	6-Nov-23
Ammonia, as N	EPA 351.2 - Auto Colour	6-Nov-23	6-Nov-23
Anions	EPA 300.1 - IC	6-Nov-23	6-Nov-23
Colour	SM2120 - Spectrophotometric	3-Nov-23	3-Nov-23
Conductivity	EPA 9050A- probe @25 °C	6-Nov-23	6-Nov-23
Dissolved Organic Carbon	MOE 3247B - Combustion IR	3-Nov-23	6-Nov-23
E. coli	MOE E3407	3-Nov-23	3-Nov-23
Fecal Coliform	SM 9222D	3-Nov-23	3-Nov-23
Metals, ICP-MS	EPA 200.8 - ICP-MS	3-Nov-23	6-Nov-23
pH	EPA 150.1 - pH probe @25 °C	6-Nov-23	6-Nov-23
Phenolics	EPA 420.2 - Auto Colour, 4AAP	6-Nov-23	6-Nov-23
Hardness	Hardness as CaCO3	3-Nov-23	6-Nov-23
Sulphide	SM 4500SE - Colourimetric	3-Nov-23	6-Nov-23
Tannin/Lignin	SM 5550B - Colourimetric	6-Nov-23	6-Nov-23
Total Coliform	MOE E3407	3-Nov-23	3-Nov-23
Total Dissolved Solids	SM 2540C - gravimetric, filtration	4-Nov-23	6-Nov-23
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	3-Nov-23	3-Nov-23
Turbidity	SM 2130B - Turbidity meter	3-Nov-23	3-Nov-23

PARACEL LABORATORIES LTD.

Order #: 2344385

Certificate of Analysis

Report Date: 09-Nov-2023

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 2-Nov-2023

Client PO:

Project Description: CCO-22-2383

	Client ID:	5640 Manotick Main	-	-	-	-	-
	Sample Date:	02-Nov-23 12:55	-	-	-		
	Sample ID:	2344385-01	-	-	-		
	Matrix:	Drinking Water	-	-	-		
	MDL/Units						
Microbiological Parameters							
E. coli	1 CFU/100mL	ND	-	-	-	-	-
Total Coliforms	1 CFU/100mL	ND	-	-	-	-	-
Fecal Coliforms	1 CFU/100mL	ND	-	-	-	-	-
General Inorganics							
Alkalinity, total	5 mg/L	279	-	-	-	-	-
Ammonia as N	0.01 mg/L	0.06	-	-	-	-	-
Dissolved Organic Carbon	0.5 mg/L	1.3	-	-	-	-	-
Colour	2 TCU	<2	-	-	-	-	-
Conductivity	5 uS/cm	997	-	-	-	-	-
Hardness	mg/L	428	-	-	-	-	-
pH	0.1 pH Units	8.0	-	-	-	-	-
Phenolics	0.001 mg/L	<0.001	-	-	-	-	-
Total Dissolved Solids	10 mg/L	610	-	-	-	-	-
Sulphide	0.02 mg/L	<0.02	-	-	-	-	-
Tannin & Lignin	0.1 mg/L	<0.1	-	-	-	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	<0.1	-	-	-	-	-
Turbidity	0.1 NTU	3.8	-	-	-	-	-
Anions							
Chloride	1 mg/L	79	-	-	-	-	-
Fluoride	0.1 mg/L	<0.1	-	-	-	-	-
Nitrate as N	0.1 mg/L	<0.1	-	-	-	-	-
Nitrite as N	0.05 mg/L	<0.05	-	-	-	-	-
Phosphate as P	0.5 mg/L	<0.5	-	-	-	-	-
Sulphate	1 mg/L	155	-	-	-	-	-
Metals							

Certificate of Analysis

Report Date: 09-Nov-2023

Client: **McIntosh Perry Consulting Eng. (Carp)**

Order Date: 2-Nov-2023

Client PO:

Project Description: CCO-22-2383

	Client ID:	5640 Manotick Main	-	-	-	-	-
	Sample Date:	02-Nov-23 12:55	-	-	-		
	Sample ID:	2344385-01	-	-	-		
	Matrix:	Drinking Water	-	-	-		
	MDL/Units						
Metals							
Aluminum	0.001 mg/L	<0.001	-	-	-	-	-
Antimony	0.0005 mg/L	<0.0005	-	-	-	-	-
Arsenic	0.001 mg/L	<0.001	-	-	-	-	-
Barium	0.001 mg/L	0.128	-	-	-	-	-
Boron	0.01 mg/L	0.05	-	-	-	-	-
Cadmium	0.0001 mg/L	<0.0001	-	-	-	-	-
Calcium	0.1 mg/L	93.0	-	-	-	-	-
Chromium	0.001 mg/L	<0.001	-	-	-	-	-
Copper	0.0005 mg/L	0.0008	-	-	-	-	-
Iron	0.1 mg/L	0.4	-	-	-	-	-
Lead	0.0001 mg/L	<0.0001	-	-	-	-	-
Magnesium	0.2 mg/L	47.6	-	-	-	-	-
Manganese	0.005 mg/L	0.050	-	-	-	-	-
Potassium	0.1 mg/L	5.1	-	-	-	-	-
Selenium	0.001 mg/L	<0.001	-	-	-	-	-
Sodium	0.2 mg/L	36.2	-	-	-	-	-
Strontium	0.01 mg/L	1.15	-	-	-	-	-
Uranium	0.0001 mg/L	0.0007	-	-	-	-	-
Zinc	0.005 mg/L	<0.005	-	-	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions								
Chloride	ND	1	mg/L					
Fluoride	ND	0.1	mg/L					
Nitrate as N	ND	0.1	mg/L					
Nitrite as N	ND	0.05	mg/L					
Phosphate as P	ND	0.5	mg/L					
Sulphate	ND	1	mg/L					
General Inorganics								
Alkalinity, total	ND	5	mg/L					
Ammonia as N	ND	0.01	mg/L					
Dissolved Organic Carbon	ND	0.5	mg/L					
Colour	ND	2	TCU					
Conductivity	ND	5	uS/cm					
Phenolics	ND	0.001	mg/L					
Total Dissolved Solids	ND	10	mg/L					
Sulphide	ND	0.02	mg/L					
Tannin & Lignin	ND	0.1	mg/L					
Total Kjeldahl Nitrogen	ND	0.1	mg/L					
Turbidity	ND	0.1	NTU					
Metals								
Aluminum	ND	0.001	mg/L					
Antimony	ND	0.0005	mg/L					
Arsenic	ND	0.001	mg/L					
Barium	ND	0.001	mg/L					
Boron	ND	0.01	mg/L					
Cadmium	ND	0.0001	mg/L					
Calcium	ND	0.1	mg/L					
Chromium	ND	0.001	mg/L					
Copper	ND	0.0005	mg/L					
Iron	ND	0.1	mg/L					
Lead	ND	0.0001	mg/L					
Magnesium	ND	0.2	mg/L					
Manganese	ND	0.005	mg/L					

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Potassium	ND	0.1	mg/L					
Selenium	ND	0.001	mg/L					
Sodium	ND	0.2	mg/L					
Strontium	ND	0.01	mg/L					
Uranium	ND	0.0001	mg/L					
Zinc	ND	0.005	mg/L					
Microbiological Parameters								
E. coli	ND	1	CFU/100mL					
Total Coliforms	ND	1	CFU/100mL					
Fecal Coliforms	ND	1	CFU/100mL					

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	79.4	1	mg/L	79.0			0.5	20	
Fluoride	ND	0.1	mg/L	ND			NC	20	
Nitrate as N	ND	0.1	mg/L	ND			NC	20	
Nitrite as N	ND	0.05	mg/L	ND			NC	20	
Phosphate as P	ND	0.5	mg/L	ND			NC	20	
Sulphate	155	1	mg/L	155			0.0	20	
General Inorganics									
Alkalinity, total	349	5	mg/L	353			1.2	14	
Ammonia as N	0.018	0.01	mg/L	0.020			7.8	17.7	
Dissolved Organic Carbon	1.2	0.5	mg/L	1.3			13.2	37	
Colour	ND	2	TCU	ND			NC	12	
Conductivity	1540	5	uS/cm	1460			5.2	5	QR-05
pH	7.9	0.1	pH Units	7.9			0.0	3.3	
Phenolics	ND	0.001	mg/L	ND			NC	10	
Total Dissolved Solids	260	10	mg/L	264			1.5	10	
Sulphide	ND	0.02	mg/L	ND			NC	10	
Tannin & Lignin	ND	0.1	mg/L	ND			NC	11	
Total Kjeldahl Nitrogen	ND	0.1	mg/L	0.10			NC	16	
Turbidity	0.2	0.1	NTU	0.2			0.0	10	
Metals									
Aluminum	0.002	0.001	mg/L	0.002			3.1	20	
Antimony	ND	0.0005	mg/L	ND			NC	20	
Arsenic	ND	0.001	mg/L	ND			NC	20	
Barium	0.079	0.001	mg/L	0.082			3.2	20	
Boron	ND	0.01	mg/L	ND			NC	20	
Cadmium	ND	0.0001	mg/L	ND			NC	20	
Calcium	101	0.1	mg/L	101			0.7	20	
Chromium	ND	0.001	mg/L	ND			NC	20	
Copper	0.0085	0.0005	mg/L	0.0086			1.4	20	
Iron	ND	0.1	mg/L	ND			NC	20	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Lead	0.0003	0.0001	mg/L	0.0003			9.9	20	
Magnesium	27.9	0.2	mg/L	27.8			0.0	20	
Manganese	0.482	0.005	mg/L	0.481			0.1	20	
Potassium	2.7	0.1	mg/L	2.7			0.3	20	
Selenium	ND	0.001	mg/L	ND			NC	20	
Sodium	5.3	0.2	mg/L	5.6			7.2	20	
Uranium	0.0014	0.0001	mg/L	0.0014			3.8	20	
Zinc	0.006	0.005	mg/L	0.006			3.8	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100mL	ND			NC	30	
Total Coliforms	ND	1	CFU/100mL	ND			NC	30	
Fecal Coliforms	ND	1	CFU/100mL	ND			NC	30	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	88.9	1	mg/L	79.0	99.0	70-124			
Fluoride	1.02	0.1	mg/L	ND	102	70-130			
Nitrate as N	1.02	0.1	mg/L	ND	102	77-126			
Nitrite as N	0.904	0.05	mg/L	ND	90.4	82-115			
Phosphate as P	5.49	0.5	mg/L	ND	110	76-130			
Sulphate	164	1	mg/L	155	91.9	70-130			
General Inorganics									
Ammonia as N	1.08	0.01	mg/L	0.020	106	81-124			
Dissolved Organic Carbon	11.0	0.5	mg/L	1.4	95.9	60-133			
Phenolics	0.026	0.001	mg/L	ND	102	67-133			
Total Dissolved Solids	108	10	mg/L	ND	108	75-125			
Sulphide	0.47	0.02	mg/L	ND	94.6	79-115			
Tannin & Lignin	1.0	0.1	mg/L	ND	99.9	71-113			
Total Kjeldahl Nitrogen	1.00	0.1	mg/L	0.10	89.4	81-126			
Metals									
Aluminum	44.4	0.001	mg/L	2.05	84.6	80-120			
Arsenic	53.9	0.001	mg/L	0.261	107	80-120			
Barium	52.2	0.001	mg/L	ND	104	80-120			
Boron	51.4	0.01	mg/L	8.67	85.5	80-120			
Cadmium	45.2	0.0001	mg/L	0.0470	90.3	80-120			
Calcium	10700	0.1	mg/L	ND	107	80-120			
Chromium	52.4	0.001	mg/L	0.459	104	80-120			
Copper	52.9	0.0005	mg/L	8.61	88.5	80-120			
Iron	2230	0.1	mg/L	2.8	89.0	80-120			
Lead	42.2	0.0001	mg/L	0.312	83.7	80-120			
Magnesium	10800	0.2	mg/L	ND	108	80-120			
Manganese	96.7	0.005	mg/L	49.6	94.1	80-120			
Potassium	12600	0.1	mg/L	2730	98.4	80-120			
Selenium	49.8	0.001	mg/L	0.158	99.2	80-120			
Sodium	14300	0.2	mg/L	5640	86.2	80-120			

Certificate of Analysis

Report Date: 09-Nov-2023

Client: McIntosh Perry Consulting Eng. (Carp)

Order Date: 2-Nov-2023

Client PO:

Project Description: CCO-22-2383

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Uranium	45.7	0.0001	mg/L	1.41	88.5	80-120			
Zinc	48.3	0.005	mg/L	6.10	84.3	80-120			

Certificate of Analysis

Report Date: 09-Nov-2023

Client: **McIntosh Perry Consulting Eng. (Carp)**

Order Date: 2-Nov-2023

Client PO:

Project Description: CCO-22-2383

Qualifier Notes:

Sample Qualifiers :

QC Qualifiers:

QR-05 Duplicate RPDs higher than normally accepted. Remaining batch QA\QC was acceptable. May be sample effect.

Sample Data Revisions:

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

NC: Not Calculated

PARACE LABORATORIES LTD

Paracel ID: 2344385

vd.
J8
com

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2344385	№ 143505

Client Name: McIntosh Perry Consulting Engineers Ltd.
Contact Name: Patrick Leblanc
Address: 115 Walgreen Rd., RR#3 Carp, ON K0A 1L0
Telephone: 613-714-4586

Project Ref: CCO-22-2383
Quote #: 23-178
PO #:
E-mail: ap@mcintoshperry.com p.leblanc@mcintoshperry.com

Page 1 of 1

Turnaround Time
☐ 1 day ☐ 3 day
☐ 2 day ☒ Regular
Date Required:

☐ REG 153/04 ☐ REG 406/19

Other Regulation
☐ Table 1 ☐ Res/Park ☐ Med/Fine
☐ Table 2 ☐ Ind/Comm ☐ Coarse
☐ Table 3 ☐ Agri/Other
☐ Table
For RSC: ☐ Yes ☐ No
☐ REG 558 ☐ PWQO
☐ CCME ☐ MISA
☐ SU - Sani ☐ SU - Storm
Mun:
☐ Other:

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	Subdivision Sugrty per Quote #23-178				
1	5640 Manotick Main	GW		9	Nov. 2, 2023	12:55 PM								X				
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		

Required Analysis

Comments:

Method of Delivery: Walk

Relinquished By (Sign):	Received By Driver/Depot:	Received at Lab: HP	Verified By: Hisal
Relinquished By (Print): Patrick Leblanc	Date/Time: NOV 2/23 2:00 pm	Date/Time: Nov 2, 23 16:15	Date/Time: Nov 2, 23 16:48
Date/Time: Nov. 2, 2023 1:55 PM	Temperature: 10.3 °C	Temperature: 6.4 °C	pH Verified: ☐ By: HP

PARACEL LABORATORIES LTD.

Paracel ID: 2344385

Paracel Order Number	**Chain Of Custody** Ontario Drinking Water Samples

Client Name:	McIntosh Perry Consulting	Project Ref:	CCO-22-2383	Waterworks Name: private well	Samples Taken By:		
Contact Name:	Patrick Leblanc	Quote #:	23-178	Waterworks Number: n/a	Name:	Patrick Leblanc	
Address:	115 Walgreen Rd, RR3, Carp, ON	PO #:		Address: 5640 Manotick Main St.	Signature:		
After Hours Contact:		E-mail:	p.leblanc@mcintoshperry.com	Manotick, ON	Page 1 of 1		
Telephone:	613-714-4586	Fax:		Public Health Unit: n/a	Turn Around Time Required: ☐1 day ☐2 day ☐3 day ☒4 day		

Samples Submitted Under: (Indicate **ONLY one**)
☐ ON REG 170/03 ☐ ON REG 319/08 ☒ Private Well
☐ ON REG 243/07 ☐ Other:

Have LSN forms been submitted to MOE/MOHLTC?: ☐ Yes ☐ No ☒ N/A

Are these samples for human consumption?: ☐ Yes ☒ No

All information must be completed before samples will be processed.

Sample Type: R = Raw ; T = Treated ; D = Distribution; P = Plumbing
Source Type: G = Ground Water; S = Surface Water
Reportable: Requires AWQI reporting as per Regulation - Y = Yes; N = No

	LOCATION NAME	SAMPLE ID	Sample Type: R/T/D/P	Source Type: G / S	Reportable: Y / N	Resample	SAMPLE COLLECTED DATE	SAMPLE COLLECTED TIME	# of Containers	Free/Combined Chlorine Residual mg/L	Standing / Flushed: S / F (REG 243)	Required Analyses: Total Coliform/E. Coli	HPC	Lead	THM	Subdiv. Supply			
1	5640 Manotick Main	5640 Manotick Main	R	G	N	N	Nov. 2, 2023	12:55PM	9	0	F	☐	☐	☐	☐	✓	☐	☐	☐
2												☐	☐	☐	☐	☐	☐	☐	☐
3												☐	☐	☐	☐	☐	☐	☐	☐
4												☐	☐	☐	☐	☐	☐	☐	☐
5												☐	☐	☐	☐	☐	☐	☐	☐
6												☐	☐	☐	☐	☐	☐	☐	☐
7												☐	☐	☐	☐	☐	☐	☐	☐
8												☐	☐	☐	☐	☐	☐	☐	☐
9												☐	☐	☐	☐	☐	☐	☐	☐
10												☐	☐	☐	☐	☐	☐	☐	☐

Comments: please send invoice to ap@mcintoshperry.com Revised CoC

Method of Delivery:

Relinquished By (Sign): Patrick Leblanc (Digitally signed by Patrick Leblanc DN: cn=Patrick Leblanc, c=CA, o=McIntosh Perry, email=p.leblanc@mcintoshperry.com Date: 2023.11.02 17:07:03 -04'00')	Received By Driver/Depot:	Received at Lab:	Verified By: DC
Relinquished By (Print):	Date/Time:	Date/Time:	Date/Time: Nov 3 2023 8:00
Date/Time:	Temperature: °C	Temperature: °C	pH Verified: ☐ By:

APPENDIX D – NITRATE ATTENUATION CALCULATIONS

CCO-22-2383
Proposed Development - 5646 - 5650 Manotick Main (Restaurant + Car Wash)
Nitrate Loading Calculations (June 14, 2023)

Land Area		0.407838	ha	
	A_{total}	4078.38	m2	2447.03
	Infiltrating Area	40%		
	A_{perv}	1631.35	m2	0.16313536
Water Surplus (W_s)				
Precipitation		943.4	mm/yr	Verified
Evapotranspiration		609.52	mm/yr	
W_s = Precipitation - Evapotranspiration	W_s	333.88	mm/yr	
	W_s	0.33388	m/yr	
Infiltration Factor (I_f) per MOEE 1995				
Topo Hilly Land		0.12500		
Soil silty clay/clayey silt		0.1		
Cover Cultivated lands		0.1		
	I_f =	0.325		
Infiltration (I)				
$I=W_s * I_f$	I =	0.108510	m/yr	
Runoff = W_s - I	Runoff =	0.225366	m/yr	
Dilution Water Available (D_w)				
$D_{w,perv} = A_{perv} * I$	D_w =	177.02	m3/yr	
		484.98	L/day	
$Runoff_{perv} = A_{perv} * W_s * (1-I_f)$	$Runoff_{perv}$ =	367.65	m3/yr	
$Runoff_{imperv} = A_{imper} * Ws$	$Runoff_{imperv}$ =	817.01	m3/yr	
$Runoff_{total} = Runoff_{perv} + Runoff_{imper}$	$Runoff_{total}$ =	1184.66	m3/yr	
	Runoff Reduction % =	0%	(if using LID for stormwater management)	
	Car Wash Discharge =	2140	L/day (assumes negligeable nitrate in car wash effluent)	
	Car Wash Discharge =	781.10	m3/yr	
$D_{w\ (final)} = D_{w,perv}$ + Runoff Reduction + Car Wash	$D_{w\ (final)}$ =	958.12	m3/yr	
	$D_{w\ (final)}$ =	2624.98	L/day	
Nitrate Concentrations				
Background Nitrate Concentration (C_b)	C_b =	0	mg/L	
Max Boundary Nitrate Concentration (C_{boun})	C_{boun} =	10	mg/L	
Effluent Nitrate Concentration (C_e)	C_e =	40	mg/L	
	Nitrate Reduction	60%	(Waterloo Biofilter Level 4 treatment w/ 50% recirculation)	
	$C_{e\ (final)}$ =	16	mg/L	
Maximum Allowable Number of Lots (N)	or	Target Nitrate Concentration (C_w)		
$N = [D_w * (C_b - C_{boun})] / [Q_e * (C_{boun} - C_b - C_e)]$		N=	1.000	lots
N = N/A		$C_w = [(C_e * Q_e * N) / ((Q_e * N) + D_w)] + C_b$		
		C_w =	10	mg/L
		$C_w <= C_{boun}$	Therefore proposed development will not exceed ODWO at property limit	
Max Restaurant Effluent Flow (Q_e)	Q_e =	4375	L/day/Lot	

Potential Evapotranspiration

Thornthwaite Method, "Hydrology & Hydraulic Systems", Gupta

Etmonth = 1.62 (10* Tm)/ I)^a
where:
a = 675* 10^-9* I^3 - 771 * 10^-7* I^2 +179* 10^-4 * I + 492* 10^-3

I = sum (Tm/5)^1.514

Stn: **OTTAWA MACDONALD-CARTIER INT'L A* ONTARIO**
Site Climate ID: 6106000

Month	Temp C	I	ET (cm) unadjusted	Daylight Factor	ET (cm) adjusted
January	-10.3				
Feb	-8.1				
March	-2.3				
April	6.3	1.4189	2.8610	1.13	3.2330
May	13.3	4.3982	6.4518	1.28	8.2583
June	18.5	7.2487	9.2396	1.29	11.9191
July	21	8.7821	10.6062	1.31	13.8942
Aug	19.8	8.0336	9.9484	1.21	12.0375
Sept	15	5.2767	7.3542	1.04	7.6483
Oct	8	2.0372	3.7105	0.94	3.4879
Nov	1.5	0.1616	0.6001	0.79	0.4741
Dec	-6.2				
I		37.356948	50.7719		60.9524
thus a =		1.0883			

Notes:
-Daylight Factor is an adjustment Factor for possible hours of sunshine based on latitude for Ottawa.
-Monthly temperatures from Environment Canada Climate Normals (1981-2010)

Input data from user
Set value
Site Constant (adjustment for latitude)
Calculated by worksheet