Hydrogeological Assessment

Large Sewage Disposal System, Rideau Road and Somme Street, Ottawa, Ontario

Consolidated Fastfrate (Ottawa) Holdings Inc.

2 November 2021

→ **The Power of Commitment**

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1. Introduction

This report presents the results of a hydrogeologic assessment that was completed by GHD Limited (GHD) in support of a large sewage disposal system (the System) for Consolidated Fastfrate (Ottawa) Holdings Inc. The System is to be constructed on lands located southeast of the intersection of Rideau Road and Somme Street, Ottawa, ON (herein referred to as "the Site"). The location of the Site is depicted on the **Site Plan Location, Figure 1**.

The Site consists of a vacant parcel and has an overall area of 7.02 hectares (17.35 acres). The proposed development is to consist of a warehouse, cross-docks and office building that will be privately serviced for water and septic. The Site will also consist of asphalt parking and a storm water pond. The proposed layout of the Site is illustrated on the **Concept Plan, Figure 2**.

Based upon design flow values provided to GHD, the sewage effluent discharged to the septic bed will be greater than 10,000 L/day. This assessment will be used to support an application for an Environmental Compliance Approval (ECA) with the Ministry of the Environment, Conservation and Parks (MECP) for a Chapter 22 Large Subsurface Sewage Disposal System.

This hydrogeological assessment was completed to evaluate the ability of the Site to support the sewage disposal system proposed for the development as the assessment is required by the MECP to review prior to a pre-consultation meeting.

1.1 Terms of Reference

GHD was retained by Consolidated Fastfrate (Ottawa) Holdings Inc. (the Client) to complete this hydrogeological assessment in accordance with our proposal reference no. PG-5306, dated October 14, 2021.

GHD (formerly Inspec Sol and Conestoga-Rovers & Associates) completed a Geotechnical Investigation and Phase II Environmental Site Assessment for the Site in 2008 and 2009, respectively; a Geotechnical Investigation in 2020; a Hydrogeological Assessment related to pumping test of a water well in 2020 (report dated 2021); and a Septic Assessment and Percolation Rate Evaluation in 2021.

GHD has reviewed the following documents made available to us as part of this assessment:

- Phase II Environmental Site Assessment and Hydrogeological Assessment, Report Ref. No. 045804 (12), by Conestoga-Rovers & Associates, dated September 2008;
- Hydrogeological Investigation, Terrain Analysis and Impact Assessment, Proposed Industrial Subdivision, Report Ref. No. 08-1122-0215, by Golder Associates, dated December 2008;
- Geotechnical Study Subdivision Plan, Hawthorne Industrial Park, Report Ref. No. T020556-A1, by Inpec-Sol, dated May 4, 2009;
- Geotechnical Investigation Report, Report Ref. No. 11215612-A1 by GHD Limited, dated September 10, 2020;
- Hydrogeological Assessment Report, Report Ref. No. 11220832, by GHD Limited, dated January 19, 2021; and,
- Septic Assessment and Percolation Rate Evaluation, Report Ref. No. 11220832-01, by GHD Limited, dated April 12, 2021.

1.2 Purpose and Scope

The purpose of the hydrogeologic assessment was to define the prevailing hydrogeological conditions and demonstrate the ability of the Site to support a sewage disposal system. To accomplish the foregoing purposes, the following scope of work was conducted:

- A desktop review of groundwater information from existing monitoring wells and reports to assess the direction of groundwater flow. Reviewed soil stratigraphy from reports completed for the Site and local area;

– Reviewed available background information relevant to the Site such as geologic, physiographic and water resources reports and maps;
– Completed a Reasonable Use Concept (RUC) assessment for nitrate and assessed the potential for phosphorus impacts;
– Summarized our findings within this hydrogeological report to meet the general requirements of the MECP's Chapter 22 for Large Subsurface Sewage Disposal Systems.

1.3 Limitations

This report has been prepared by GHD for Consolidated Fastfrate (Ottawa) Holdings Inc., and may only be used and relied on by Consolidated Fastfrate (Ottawa) Holdings Inc., for the purpose agreed between GHD and Consolidated Fastfrate (Ottawa) Holdings Inc., as set out in Section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Consolidated Fastfrate (Ottawa) Holdings Inc., arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on information and assumptions made by GHD and described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

2. Site Conditions

The Site consists of vacant lands. The areas to the north, east and south are currently privately serviced. To the west is a quarry development and additional industrial / commercial properties that are municipally serviced. Surrounding land use within 500 m of the Site at the time of this report were observed to consist of:

- East – undeveloped lands;
- West – undeveloped lands; Hawthorne Road then industrial properties (Tomlinson Rideau Quarry and Plant; LaFarge);
- North – Rideau Road, forested area then residential lots; and
- South – Somme Street; undeveloped lands then industrial / commercial lots (gated equipment lay-down yard and stormwater ponds; then Renewi Canada Ltd.).

Within 500 m of the proposed development, one residential lot was observed at 4885 Hawthorne Road (north of the Site).

2.1 Topography

The regional topography is presented on **Figure 3**. The Site is relatively flat with the regional topography sloping from southwest to northeast. Based upon a survey plan reviewed by GHD, the topographic relief is on the order of 1 to 2 metres across the Site.

2.2 Physiography

The Site is situated within the physiographic region known as the Russell and Prescott Sand Plains. In the United Counties of Prescott and Russell, and the Regional Municipality of Ottawa-Carleton, there is a group of large sand plains separated by the clays of the lower Ottawa Valley. The plains cover an area of nearly 1,500 square

kilometres and a level surface of about 85 metres above sea level. The plains were originally a continuous delta that was built by the Ottawa River into the Champlain Sea. The plains are as thick as 6 to 10 m in some areas (Chapman and Putnam, 1984). The physiography of the area is illustrated on **Figure 4** showing the Site is within a sand plains with Peat and Muck to the north and Limestone Plains to the west.

2.3 Regional Geology

Surficial geology mapping presented on **Figure 5** indicates the Site is a mix of organic deposits, Paleozoic bedrock and coarse textured glaciolacustrine deposits.

The Quaternary geology is presented on **Figure 6** and suggests undifferentiated carbonate and clastic sedimentary rock exposed at surface or covered by a discontinuous thin layer of drift. Bedrock outcrops are common in the area.

The bedrock of this area, as presented on **Figure 7**, is comprised of shale, limestone, dolostone, and siltstone.

2.4 Local Geology

An investigation was previously conducted by GHD as part of an assessment of the soils and subsurface conditions in the area of the proposed septic system. The report is provided for reference in **Appendix A** of this document. An overview of our observations made during the subsurface exploration are presented in the following sub-sections.

2.4.1 Overburden Soil

On March 31, 2021, five (5) test pits were advanced under the supervision of GHD to depths ranging from 2.4 to 3.4 metres below ground surface (mbgs). The locations of the test pits are presented on Figure 2 of the report provided in Appendix A. Field logs were maintained of the underlying soil conditions throughout the test pit activities.

The soil stratigraphy consisted of fill at each location described as gravelly sand with silt trace clay to a silty sand with gravel and clay. Fill was observed to the bottom of each test pit. The fill also included a mix of asphalt, bricks and concrete at each location. Refusal was encountered at 2.4 m at TP-1 due to asphalt. Hydrometer testing of the fill material indicated 18 to 41% gravel, 36 to 47% sand, 12 to 23% silt, and 4 to 12% clay sized particles by weight. The percolation rate of the fill was estimated to have an average value of 12 to 20 min/cm with a medium permeability.

Based upon GHD's previous geotechnical work at the Site, the upper soils are comprised of fill to depths on the order of 6 mbgs (GHD, 2020). Underlying the fill at BH-1 documented in the geotechnical report was native silty sand to a depth of 8.2 mbgs where limestone bedrock was encountered (GHD, 2020).

Prior to GHD's investigations at the Site, drilling and test pits were advanced across the Site and a larger industrial park area as documented in Golder (2008). At the Site, monitoring well MW7-08 was drilled to a depth of 6.1 mbgs encountering fill to a depth of 5.4 mbgs then underlain by glacial till. The well is screened bridging the fill and till layers. Bedrock was not encountered. The borehole was terminated at 7 mbgs (Golder 2008).

In general, soils encountered in previous subsurface test holes at the Site and in this general area consisted of a layer of fill material described as gravelly sand with silt trace clay to a silty sand with gravel and clay overlying a native silty sand / sandy silt deposit followed by glacial till or limestone bedrock. The location of the test holes located on the Site are shown on Figure 8.

2.4.2 Bedrock

Bedrock was found at 8.5 mbgs based upon the well record for test well TW-2 and at a depth of 8.2 mbgs at BH-1. Bedrock was not encountered at MW7-08 to a depth of 7 mbgs and was not encountered in the test pits excavated in the area of the proposed septic bed area.

2.5 Description of Surface Water Features

No surface water features are present on the Site. There are no permanent water features (i.e. creeks, lakes, rivers etc) within 300 m of the Site.

3. Hydrogeology

The following section describes the regional and local hydrogeology including groundwater flow direction and hydrochemistry.

3.1 Regional Hydrogeology

Information regarding the groundwater characteristics of the area within 500 m of the Site was obtained from an inventory of existing MECP well records. A total of seventeen (17) water well records were identified for statistical breakdown. The data has been summarized in Table 1. The MECP well records and the approximate locations are provided in **Appendix B**.

3.2 Water Well Records

The information from the MECP data indicates a mix of overburden materials (fill, sand, clay, gravel etc.) overlying bedrock including shale, sandstone, limestone and quartz. Based upon the well records, there is one (1) primary bedrock aquifer in this immediate area that is tapped by drilled wells. Of the seventeen (17) records, seven (7) are monitoring wells and will not be considered further within this discussion.

The groundwater was generally described as “fresh” in the well records reviewed. The information from the MECP data indicates that all ten (10) wells were drilled bedrock wells averaging a depth of about 41 m. The bedrock wells encountered water at an average depth of 31 m with pumping rates averaging nearly 100 L/min. No flowing artesian wells were reported. A summary of the MECP well record data is presented in Table 1 below.

Table 1 Summary of Water Well Records

Total Number of Wells Inventoried: 17
Dug/Bored Wells: 0 (0%)
Drilled Wells (Overburden): 0 (0%)
Drilled Wells (Bedrock): 10 (59%)
Monitoring Wells*: 7 (41%)

Parameters	Statistical Summary Dug / Bored Wells		Statistical Summary Drilled – Overburden		Statistical Summary Drilled – Bedrock	
WELL YIELDS						
Range	-- L/min	-- USgpm	-- L/min	-- USgpm	19 to 680 L/min	5 to 180 USgpm
Average	-- L/min	-- USgpm	-- L/min	-- USgpm	99.1 L/min	26.2 USgpm
REPORTED YIELDS	**Frequency**					
Not Reported	0	0%	0	0%	0	0%
Dry	0	0%	0	0%	0	0%
0 to 1 USgpm	0	0%	0	0%	0	0%
2 to 4 USgpm	0	0%	0	0%	0	0%
5 to 9 USgpm	0	0%	0	0%	6	60%
≥10 USgpm	0	0%	0	0%	4	40%
STATIC WATER LEVELS						
Range	N/A	N/A	N/A	N/A	2.3 to 14.2 m	7.5 to 46.6 ft
Average	N/A	N/A	N/A	N/A	8.4 m	27.6 ft
WATER ENCOUNTERED						
Range	N/A	N/A	N/A	N/A	9.1 to 75.0 m	30 to 246 ft
Average	N/A	N/A	N/A	N/A	31.2 m	103.5 ft
WELL DEPTH						
Range	N/A	N/A	N/A	N/A	17.4 to 75.6 m	57 to 248 ft
Average	N/A	N/A	N/A	N/A	40.8 m	133.9 ft

Notes: Data based on MECP well record information (see Appendix B). L/m represents litres per minute, USgpm indicates US gallons per minute and m is metres. *Monitoring wells are not included in the statistical data summarized.

3.3 Groundwater

Based upon information reviewed, there are two hydrogeological units identified at the Site and in this general area. The first is a shallow zone of water within either the fill, the shallow native overburden or upper bedrock. Previous reports indicate that the groundwater flow in the shallow zone is to the northeast at a gradient of approximately 0.015 m/m (Golder, 2008). Groundwater was encountered within the overburden in each of the five (5) test pits advanced by GHD in 2021 at depths observed between 1.8 and 2.4 mbgs. At MW7-08, water was encountered at a depth of 3.65 mbgs. Water levels measured at MW7-08 in November 2020 indicated a water level at 3.00 mbgs. The shallow groundwater flow direction of northeast across the Site will be utilized during the RUC impact assessment for the proposed septic system.

A deeper confined aquifer found within the bedrock, generally at depths of 25 to 35 metres below ground surface. This aquifer is proposed for water supply for the development. Based upon the water levels collected by GHD in November 2020, the regional groundwater flow within the bedrock is also in a northeasterly direction. Previous studies have indicated the groundwater flow in the bedrock to be in a west to east direction at a gradient of approximately 0.005 m/m (Golder, 2008). Test well TW-2 is constructed within the deeper confined aquifer. During pumping tests conducted by others and by GHD in 2020, the testing indicated that there was no hydraulic connectivity between the shallow water zone and deeper confined aquifer.

3.3.1 Background Groundwater Chemistry

Background groundwater chemistry is provided in **Table 2**. Water samples were collected previously by CRA at MW7-08 on July 17, 2008 (CRA, 2008) and at TW-2 on November 19, 2020 during a pumping test conducted at this location (GHD, 2021).

The results of the chemical analysis from the original reports are summarized in **Table 2**. The analytical data is relatively low for nitrogen-based compounds within the shallow water zone and very low to non-detect within the drinking water aquifer. There were detections of bacteria within the shallow water zone; however, the deeper confined unit was non-detect for bacteria confirming there is a lack of connectivity hydraulically between the shallow and deeper units.

Table 2 Analytical Groundwater Data

Parameter	Well Identifier			ODWS	
	MW7-08	TW-2*		MAC	AO/OG
	July 17, 2008	November 19, 2020*			
Alkalinity (as $CaCO_3$)	**840**	269	267	--	30 to 500
Ammonia	2.24	0.25	0.25	--	--
Chemical Oxygen Demand	110	--	--	--	--
Chloride	**297**	91	94	--	250
Conductivity (µmho/cm)	2620	1390	1380	--	--
Dissolved Organic Carbon	25	2.4	2.2	--	--
Nitrate (N)	< 0.3	<0.01	<0.01	1.0	--
Nitrite (N)	< 0.3	<0.05	<0.05	10	--
pH	7.51	7.8	7.7	--	
Phenol	0.008	--	--		
Phosphorus	2.50	--	--	--	--
Sulfate	271	378	389	--	500
Total Dissolved Solids	**1710**	**930**	**940**	--	500
Total Kjeldahl Nitrogen	4.20	0.3	0.4	--	--
E.coli	5	--	Non-detect		
Total Coliform	3800	--	Non-detect		
Fecal Coliform	6	--	Non-detect		

Parameter	Well Identifier			ODWS	
	MW7-08	TW-2*		MAC	AO/OG
	July 17, 2008	November 19, 2020*			
Heterotrophic Plate Count	<500	--	<10		

Notes:
(<) indicates below laboratory detection limit, **bolded** values exceed ODWS
Units are in mg/L unless otherwise stated.
MAC – Maximum Acceptable Concentration; AO – Aesthetic Objective; OG – Operational Guideline
*TW-2 sampled during a pumping test after 1 hour of pumping and at the end of the test (6 hours)

4. Septic Design

The septic design is being completed by others. It is GHD's understanding that the daily design flow will be 12,800 L/day based upon the building size and warehouse loading bays. The daily design flow provided to GHD will be used to conduct the impact assessment.

As indicated within our Septic Assessment letter (Appendix A), the underlying soils was a mix of fill materials. It was recommended that the tile bed be a fully raised adsorption trench leaching bed due to the inconsistency of the fill materials observed and shallow groundwater seepage observed. The existing fill material is recommended to be compacted to ensure uneven settlement of the tiles does not occur.

The proposed tile bed area and the existing water well (i.e. TW-2) are a distance of about 50 m apart from each other. The minimum setback from a tile bed and drilled well is 15 m. It is our opinion that there is minimal potential for groundwater impact as a result of the planned development from a quality perspective provided that the septic system is constructed properly.

No further discussion of septic design is provided in this report.

5. Impact Assessment

5.1 Site Specific Considerations

Based upon our assessment, it is our opinion that the Site can be serviced with a fully raised adsorption trench leaching bed. The location of the proposed leaching bed and the dilution area, based on the groundwater flow direction is presented on **Figure 9**.

The potential impacts from the leaching bed are discussed in the following sections.

5.2 Nitrate Assessment

5.2.1 Nitrate Loading

Primarily, nitrate impact is of particular concern from a groundwater perspective. A conventional treatment system is proposed for the septic system. Nitrate dilution was calculated in order to assess the potential impact on the downgradient receptors. Section 22.5.7 of the MECP's Chapter 22 indicates that existing and background concentrations of critical contaminants should generally be used only for reference, not for calculation of allowable water quality limits. The following assumptions were used in the nitrate impact calculations:

– Nitrate in the untreated sewage is estimated to be on the order 40 mg/L;
– The dilution area for the leaching bed is assumed to be approximately 17,035 m^2 based on the proposed configuration of the leaching bed and general groundwater flow direction;
– The estimated recharge rate of 250 mm/year was used as specified in Chapter 22; and
– Design flow of 12,800 L/day.

The following equations were used to predict the potential impact of nitrate to the shallow groundwater:

Equations: Eq'n #

$V_A = A_D \times k$ (1)

$V_T = V_A + V_S$ (2)

$C_{PB} = (C_S \times V_S) / V_T$ (3)

Where:

V_A = annual dilution volume [m^3]

A_D = dilution area [m^2]

V_T = total volume of water [m^3]

V_S = annual sewage volume [m^3]

C_{PB} = concentration at property boundary [mg/L]

C_S = concentration in sewage [mg/L]

k = 0.25 m Annual Dilution Precipitation Rate as per the MECP.

Based on our understanding of the groundwater flow direction and the daily design effluent loading, the following is presented:

A_D = 17,035 m^2 Infiltration area from **Figure 9**

V_A = 4,259 m^3 Annual dilution volume

V_S = 4,672 m^3 Loading of an average of 12,800 L/day

V_T = 8,931 m^3 Total water volume

C_S = 40 mg/L Effluent Nitrate Concentration

C_{PB} = 20.9 mg/L Nitrate concentration expected at site boundary

Using dilution only, the nitrate concentration generated from sewage at the Site is calculated to be 20.9 mg/L. The calculations are provided in **Appendix C**.

It is understood that the MECP generally targets a RUC value of 2.5 mg/L at the property boundary (25% of the Ontario Drinking Water Standard for nitrate which is 10 mg/L). Based upon the calculations to meet a nitrate concentration of 2.5 mg/L, treatment is required to reduce nitrate to 4.8 mg/L as it is discharged into the tile bed in order for dilution to reduce the nitrate concentration to meet the RUC value. The nitrate dilution calculations do not consider other factors such as denitrification or dilution within existing groundwater.

5.3 Phosphorus Impact Assessment

The main source of additional phosphorus loading from the Site would be associated with the treated wastewater effluent. The distance between the Site and the nearest water body is about 12 kilometres to the Rideau River (inferred to be upgradient of the Site). The nearest downgradient surface water receiver is greater than 12 kilometres. As per Chapter 22 for Large Subsurface Sewage Disposal Systems, a separation distance of 300 m between the area of sewage infiltration and a surface water body should be sufficient to ensure that there are no appreciable effects to surface water quality due to phosphorous.

6. Conclusions and Recommendations

The supporting data upon which our recommendations are based, have been presented in the foregoing sections of this report. Based on the results of this assessment, it is the opinion of GHD that the Site is suitable for a fully raised bed to service the facility provided tertiary treatment is utilized to reduce the expected nitrate concentrations. Based upon the information reviewed and assumptions made by GHD, the effluent of the sewage system will flow laterally toward the northeast with minimal vertically migration into the deeper underlying bedrock aquifer accessed by the Site's groundwater well. To the northeast beyond the Site, there are no downgradient wells in close proximity.

6.1 Groundwater

Shallow water was encountered within the fill in the area of the proposed fully raised bed. The shallow groundwater flow direction was indicated to be toward the northeast. Based on the information assessed, it is our opinion that good construction and mitigation techniques must be used to minimize the potential for impact.

It is our opinion that there is minimal potential for groundwater impact as a result of the planned development from a quality perspective provided that the septic system is constructed properly.

6.2 Impact Assessment

Based on the impact assessment, tertiary treatment will be required. Following treatment, there is minimal potential impact from the proposed septic system. This is based on the distance to downgradient wells (i.e. there are no groundwater receivers of the effluent in close proximity of the Site), the presence of relatively low permeable soils above the underlying bedrock aquifer, and no surface water within 300 m that would be adversely affected by phosphorous.

It is the professional opinion of GHD that the proposed sewage system will have no significant impact on the groundwater aquifer, shallow water or any downgradient receptors that utilize groundwater.

6.3 Signatures

The following signatures are provided of GHD staff that prepared and conducted the hydrogeological assessment. Should questions arise regarding any aspect of our report, please contact the undersigned or our office.

Sincerely,

GHD

Steven Gagné, H.B.Sc.
Associate, Project Director

Robert Neck, P. Geo. (Limited)
Associate Project Director

PROFESSIONAL GEOSCIENTIST
LIMITED MEMBER
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Figures

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 18N

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301 SOMME STREET, OTTAWA, ON
PT LOT 26, CON 6 FROM RIDEAU RIVER
GEOGRAPHIC TOWNSHIP OF GLOUCESTER
CITY OF OTTAWA

HYDROGEOLOGICAL ASSESSMENT-
ON-SITE SEWAGE SYSTEM

SITE LOCATION PLAN

Project No. 12565773
Revision No.
Date Oct 29, 2021

FIGURE 1

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HYDROGEOLOGICAL ASSESSMENT-
ON-SITE SEWAGE SYSTEM

CONCEPT PLAN

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FIGURE 2

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PT LOT 26, CON 6 FROM RIDEAU RIVER
GEOGRAPHIC TOWNSHIP OF GLOUCESTER
CITY OF OTTAWA

HYDROGEOLOGICAL ASSESSMENT-
ON-SITE SEWAGE SYSTEM

REGIONAL TOPOGRAPHY

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FIGURE 3

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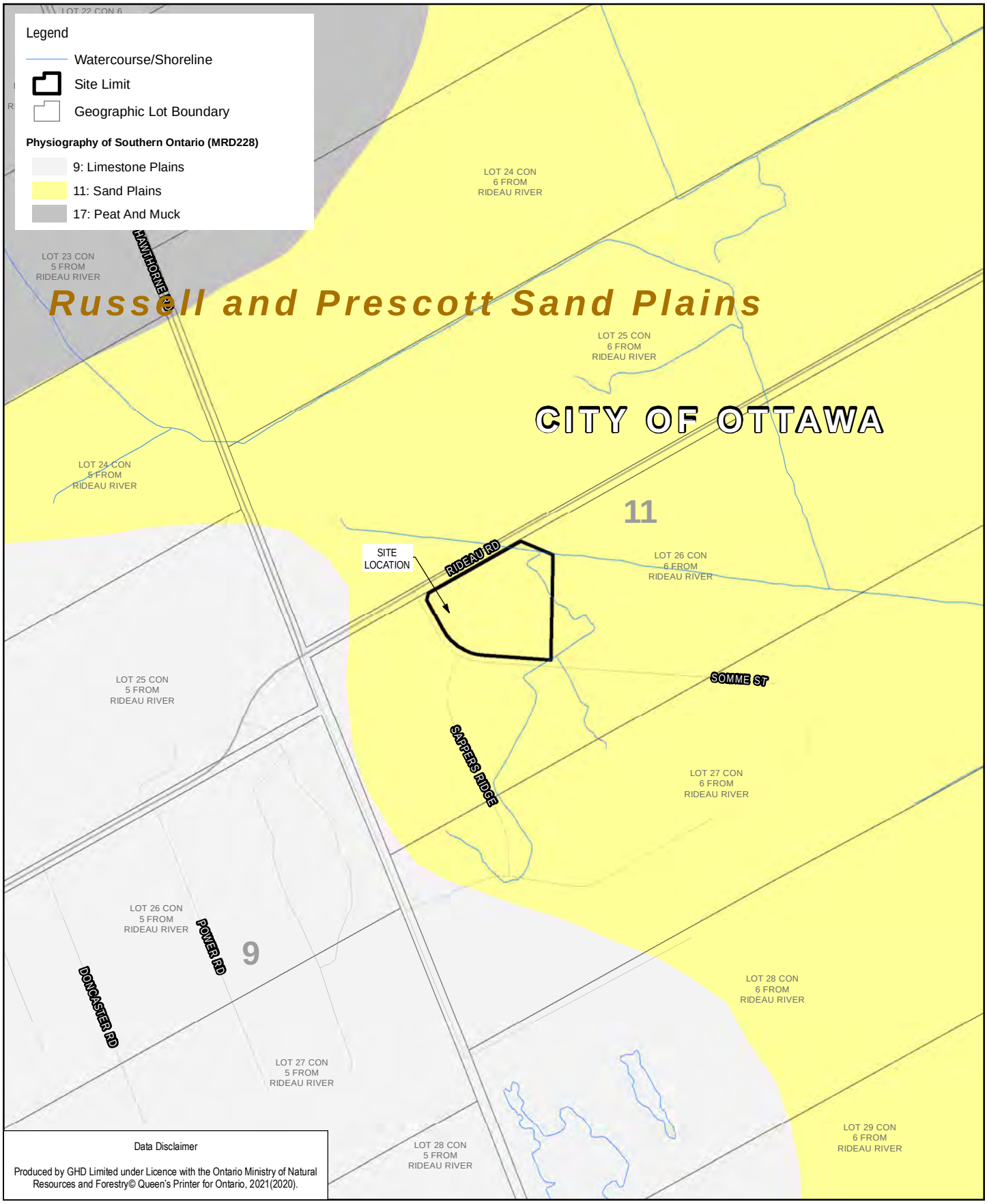

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GEOGRAPHIC TOWNSHIP OF GLOUCESTER
CITY OF OTTAWA

HYDROGEOLOGICAL ASSESSMENT-
ON-SITE SEWAGE SYSTEM
PHYSIOGRAPHY

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Date Oct. 2021

FIGURE 4

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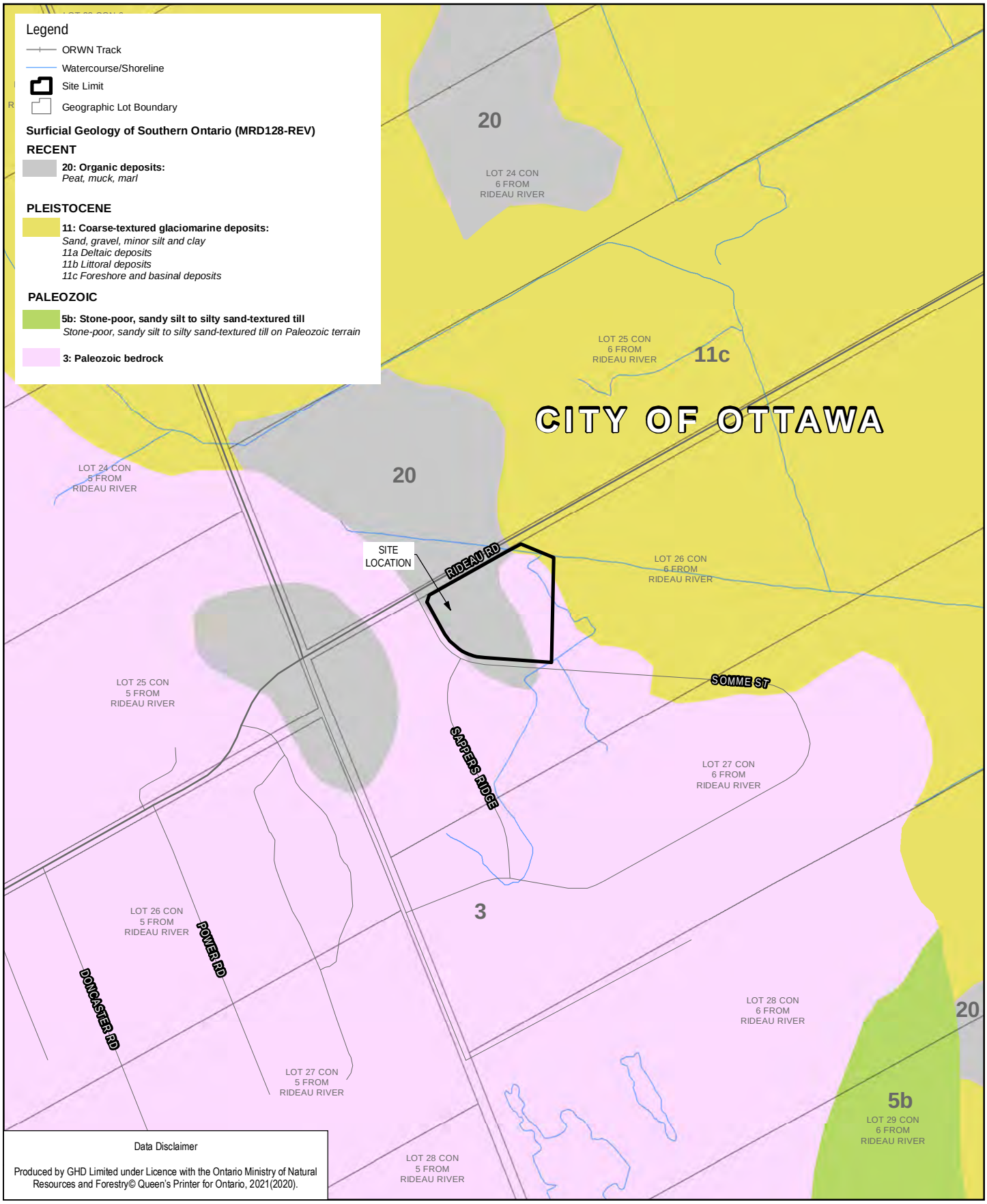

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HYDROGEOLOGICAL ASSESSMENT-
ON-SITE SEWAGE SYSTEM

SURFICIAL GEOLOGY

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FIGURE 5

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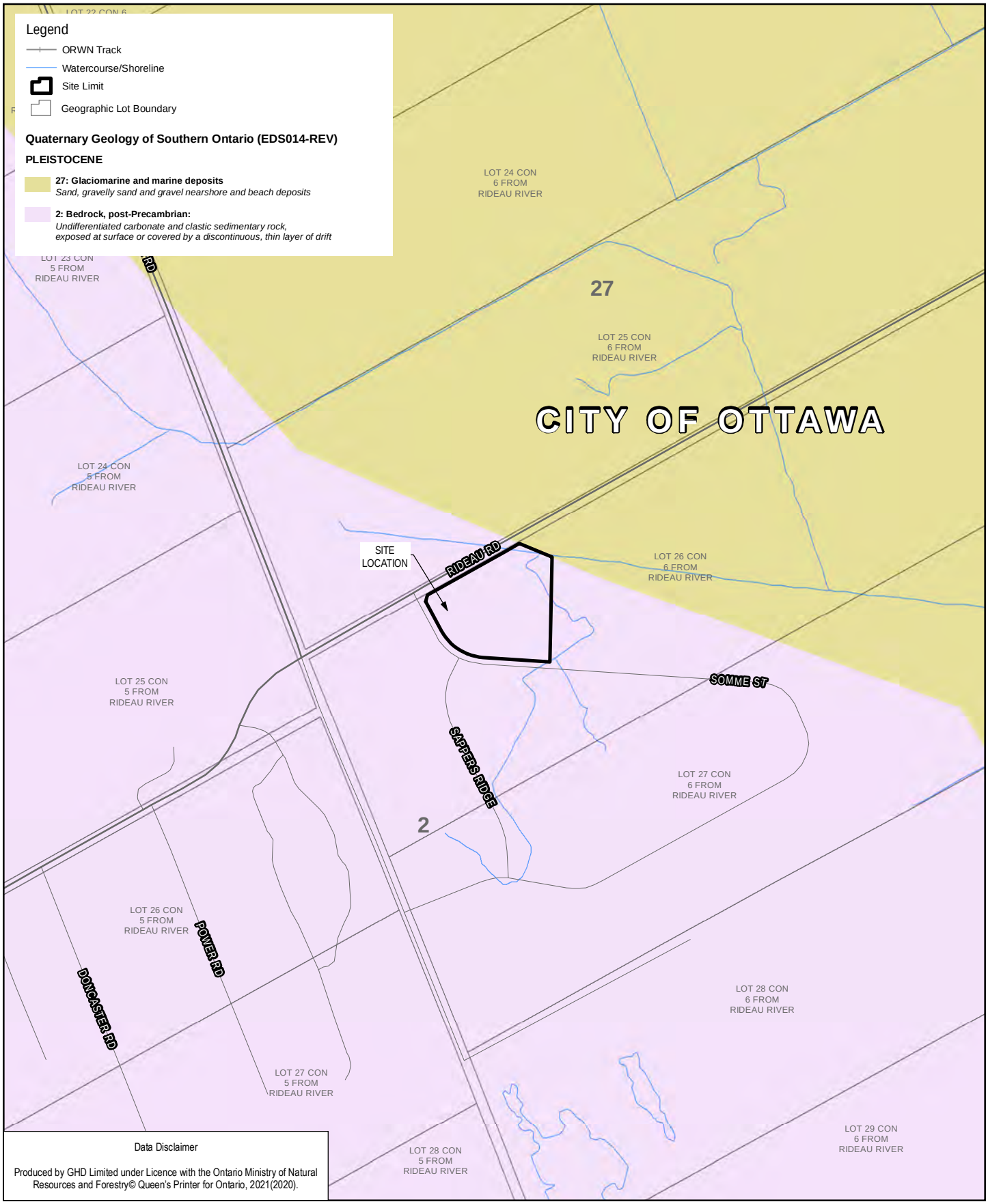

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301 SOMME STREET, OTTAWA, ON
PT LOT 26, CON 6 FROM RIDEAU RIVER
GEOGRAPHIC TOWNSHIP OF GLOUCESTER
CITY OF OTTAWA

HYDROGEOLOGICAL ASSESSMENT-
ON-SITE SEWAGE SYSTEM

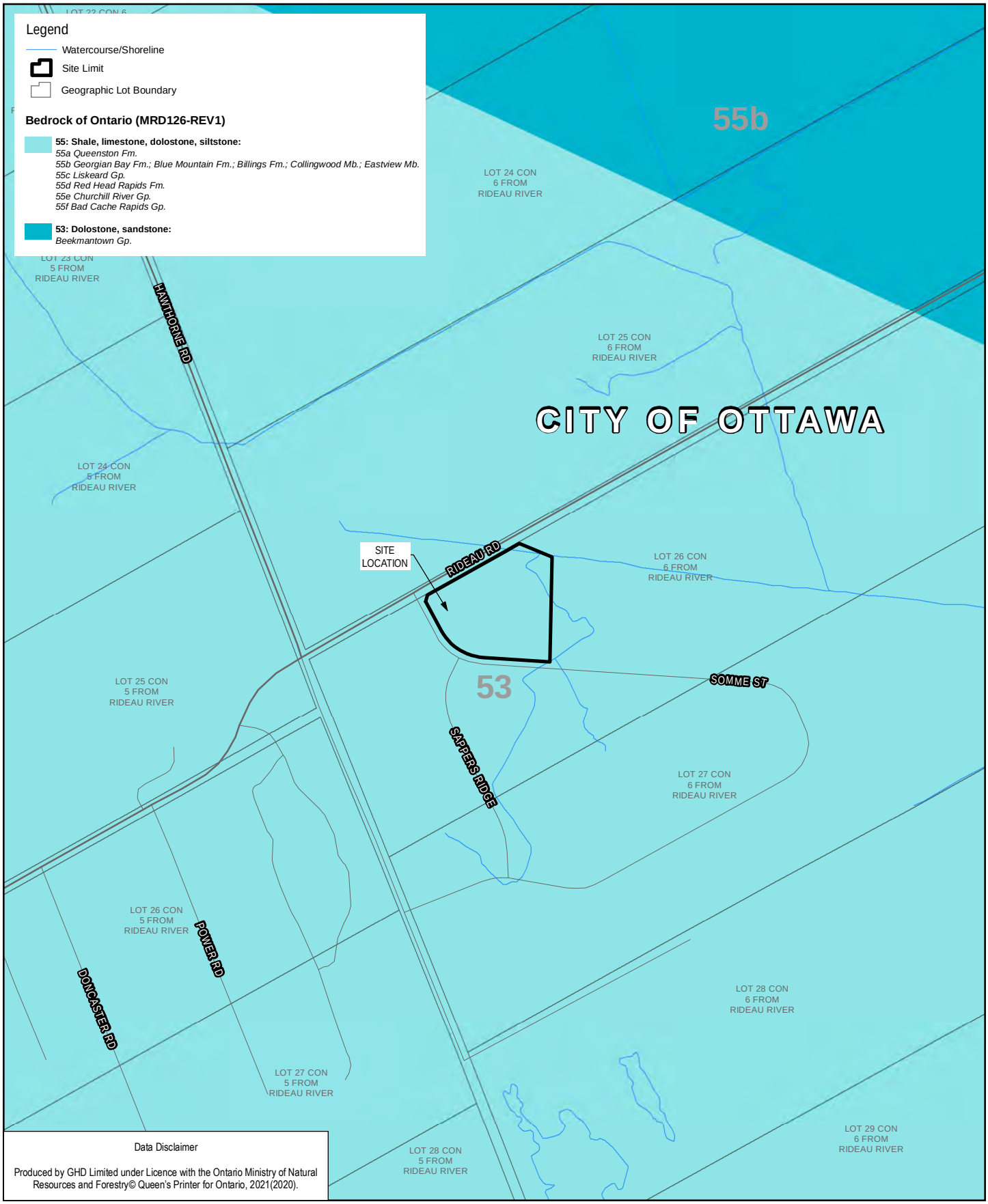
QUATERNARY GEOLOGY

Project No. 12565773
Revision No.
Date Oct. 2021

FIGURE 6

O:\GIS\PROJECTS\12565000s\12565773\Layouts\202110_RPT001\12565773_202110_RPT001_GIS006 - Quaternary Geology.mxd
Print date: 29 Oct 2021 - 11:10

EDS014-REV. Ontario Geological Survey, 1997. Quaternary geology, seamless coverage of the province of Ontario: Ontario Geological Survey, Data Set 14.



Paper Size ANSI A

0 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 18N

N

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CONSOLIDATED FASTFRATE (OTTAWA) HOLDINGS LTD.
301 SOMME STREET, OTTAWA, ON
PT LOT 26, CON 6 FROM RIDEAU RIVER
GEOGRAPHIC TOWNSHIP OF GLOUCESTER
CITY OF OTTAWA

ON-SITE SEWAGE & SEPTIC ASSESSMENT
BEDROCK GEOLOGY

Project No. 12565773
Revision No.
Date Oct. 2021

FIGURE 7

O:\GIS\PROJECTS\12565000s\12565773\Layouts\202110_RPT001\12565773_202110_RPT001_GIS007 - Bedrock Geology.mxd
Print date: 29 Oct 2021 - 11:15

MRD126-REV. Ontario Geological Survey 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release---Data 126-Revision 1.

Data Disclaimer

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Paper Size ANSI A

0 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 18N

N

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CONSOLIDATED FASTFRATE (OTTAWA) HOLDINGS LTD.
301 SOMME STREET, OTTAWA, ON
PT LOT 26, CON 6 FROM RIDEAU RIVER
GEOGRAPHIC TOWNSHIP OF GLOUCESTER
CITY OF OTTAWA

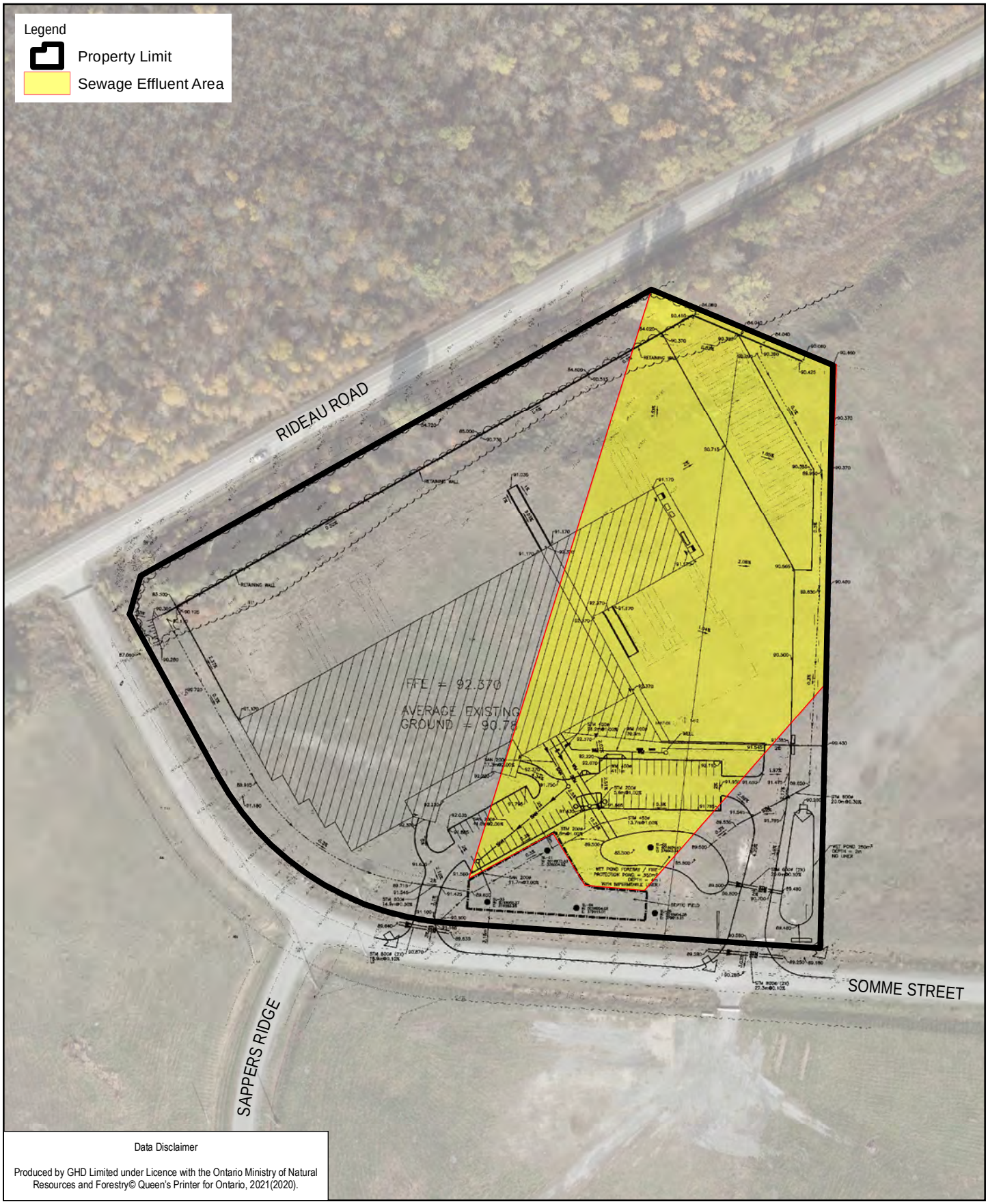
ON-SITE SEWAGE & SEPTIC ASSESSMENT
TEST HOLE PLAN

Project No. 12565773
Revision No.
Date Oct. 2021

FIGURE 8

O:\GIS\PROJECTS\12565000s\12565773\Layouts\202110_RPT001\12565773_202110_RPT001_GIS003 - Test Hole Plan.mxd
Print date: 29 Oct 2021 - 10:39

Data source: © City of Ottawa, 2019.



Data Disclaimer

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Paper Size ANSI A

0 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 18N

N

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CONSOLIDATED FASTFRATE (OTTAWA) HOLDINGS LTD.
301 SOMME STREET, OTTAWA, ON
PT LOT 26, CON 6 FROM RIDEAU RIVER
GEOGRAPHIC TOWNSHIP OF GLOUCESTER
CITY OF OTTAWA

HYDROGEOLOGICAL ASSESSMENT-
ON-SITE SEWAGE SYSTEM

SEPTIC EFFLUENT AREA

Project No. 12565773
Revision No.
Date Oct. 2021

FIGURE 9

O:\GIS\PROJECTS\12565000s\12565773\Layouts\202110_RPT001\12565773_202110_RPT001_GIS008 - Septic Effluent Area.mxd
Print date: 29 Oct 2021 - 12:18

Data source: © City of Ottawa, 2019.

Appendices

Appendix A

Septic Assessment and Percolation Rate Evaluation Letter

347 Pido Road
Peterborough, Ontario K9J 6X7
Canada
www.ghd.com

Our ref: 11220832-01

12 April 2021

Consolidated Fastfrate (Ottawa) Holdings Inc.
c/o Pierre Courteau
CBRE Limited
333 Preston Street, 7th Floor
Ottawa, Ontario K1S 5N4

Re: Septic Assessment and Percolation Rate Evaluation
Proposed Commercial Development
Rideau Road and Somme Street
Gloucester Con 6 from Rideau River, Lot 26
Ottawa, Ontario

Dear Mr. Courteau:

1. Introduction

GHD Limited (GHD) is pleased to provide you (the Client) with the following letter documenting excavation activities completed in the general locations of a proposed septic tile bed and stormwater pond. The locations were requested by CIMA. This letter also provides a summary of approximate percolation rate (T-time) values based upon soil collected from the test pit locations.

The general location is illustrated on the Site Location Plan, Figure 1. The test pit locations are illustrated on the Test Pit Location Plan, Figure 2.

2. Field Activities

Test pits were advanced under the supervision of GHD on March 31, 2021. The test pits were excavated at five (5) locations to depths ranging from 2.4 to 3.4 m. The soil stratigraphy consisted of fill at each location described as gravelly sand with silt trace clay to a silty sand with gravel and clay. Fill was observed to the bottom of each test pit. The fill also included a mix of asphalt, bricks and concrete at each location. Refusal was encountered at 2.4 m at TP-1 due to asphalt. Test pit logs are provided in Appendix A.

Soil samples were collected from each test pit. Hydrometer testing was conducted at GHD's laboratory. The grain size data, included in Appendix A, indicated:

– 18 – 41% gravel; 36 – 47% sand; 12 – 23% silt; and, 4 – 12% clay size particles by weight.

Groundwater seepage was encountered at each test pit. The shallow groundwater was observed between 1.8 and 2.4 metres below ground surface (mbgs). Test pits TP-2, TP-3, TP-4 and TP-5 encountered groundwater at 1.8 mbgs.

Based upon the Supplementary Guidelines to the Ontario Building Code 1997, the percolation rate is estimated (based upon the gradation test results only) to have an average value of 12 to 20 min/cm with a medium permeability.

3. Conclusions and Recommendations

Due to the inconsistency of the fill materials observed and shallow groundwater seepage encountered it is recommended the septic disposal system be a fully raised bed absorption trench leaching bed. It is recommended prior to placement if the imported fill that any surficial organics be removed from the tile bed and mantle area. It is also suggested that that the existing fill material be compacted to ensure uneven settlement of the tiles does not occur.

The waste disposal system should meet Ontario Regulation 350/06 made under the Building Code Act, 1992 and incorporate the following design features:

1. Organics should be stripped from the area of the leaching bed and downgradient mantle.
2. The exposed subgrade below the tile bed should be trimmed and scarified, and provided with a gentle slope of 0.5% in the direction of the mantle.
3. The tile bed should be constructed as a fully raised leaching type bed up to the full height of at least 1 m above existing grade. The raised bed should consist of clean, granular fill capable of providing an in-place T-time of 4 to 8 min/cm.
4. The mantle should be constructed along the downgradient margin of the raised bed. Each mantle should extend along the full width of the bed and for a minimum of 15 m downgradient from the bed. The mantle should consist of similar granular fill raised to a minimum of 250 mm above the surrounding grade. Surface runoff should be diverted away from the leaching bed by means of proper site drainage.
5. The waste disposal system should be kept clear of surface drainage swales, roof leader drains, and other sources of surface water.
6. The tile bed should be kept away from shade trees and a healthy cover of vegetation should be developed and maintained over the bed to promote evapotranspiration.
7. When sighting a tile bed on sloping ground, it is recommended that procedures outlined in the Building Code be followed closely.
8. Minimum set back distances from septic tank (plus 2 times height raised):
    - Building – 1.5 m
    - Drilled well – 15 m
    - Property line – 3 m
    - Open water course – 15 m
9. Minimum set back distances from septic tile bed (plus 2 times height raised):
    - Building – 5 m
    - Drilled well, properly sealed – 15 m
    - Open water course – 15 m
    - Property line – 3 m
    - Shallow well – 30 m
10. The layout, design and construction of the waste disposal bed should be subject to inspection by experienced hydrogeologic personnel.

We trust that this report meets your immediate requirements. Should you have any questions, please contact our office.

Regards

GHD

PROFESSIONAL GEOSCIENTIST
LIMITED MEMBER
ROBERT W. NECK
2262
ONTARIO

Robert Neck, M.Eng., P.Geo. (Limited)
Project Manager

Nyle McIlveen, P. Eng
Senior Engineer

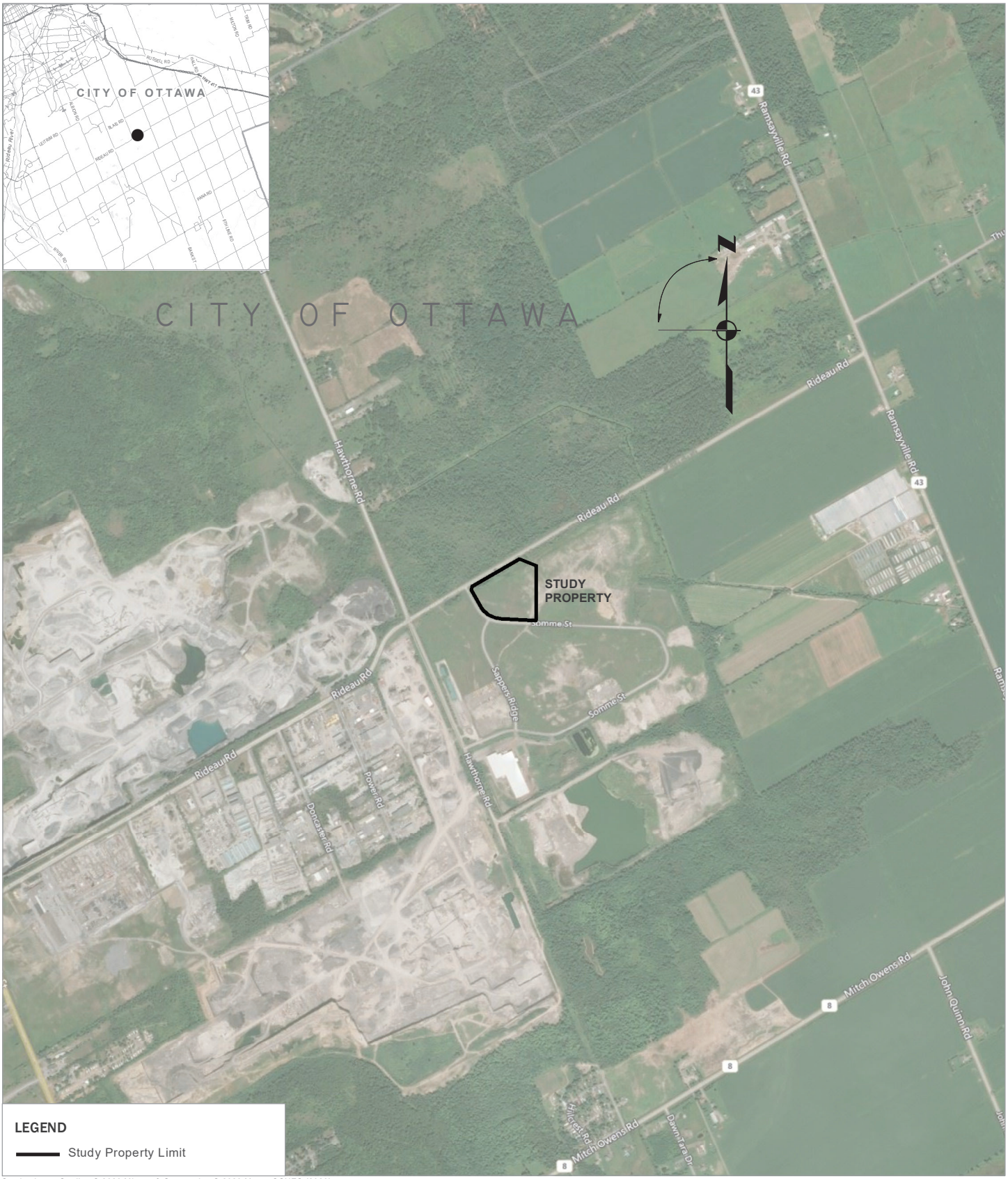
LICENSED PROFESSIONAL ENGINEER
N. C. McILVEEN
PROVINCE OF ONTARIO

Encl.: Appendix A (Test Pit Logs and Gradation Results)

Email to Pierre Courteau
Cc: Christian Lavoie-Lebel (Christian.Lavoie-Lebel@cima.ca)

Attachment 1

Figures



NAD83, MTM Zone 9
1 cm : 200 meters

Meters
0 220 440 880

ATTRIBUTION STATEMENTS

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K:\GIS_PROJECTS\GHD\CA-

Consolidated Fastfrate (Ottawa) Holdings Inc.

RIDEAU ROAD & SOMME STREET
CITY OF OTTAWA
ONTARIO

SEPTIC ASSESSMENT
SITE LOCATION PLAN

Project No. 11220832-01
Revision No. 1
Date Apr 2021

FIGURE 1

NAD83, MTM Zone 9
1 cm : 16 meters

Meters
0 15 30 60

ATTRIBUTION STATEMENTS

K:\GIS_PROJECTS\GHD\CA-

Consolidated Fastfrate (Ottawa) Holdings Inc.

RIDEAU ROAD & SOMME STREET
CITY OF OTTAWA
ONTARIO

SEPTIC ASSESSMENT
TEST HOLE LOCATION PLAN

Project No.	11220832-01
Revision No.	1
Date	Apr 2021

FIGURE 2

Appendix A

Test Pit Logs and Gradation Results

REFERENCE No.: 11220832 ENCLOSURE No.: A-1

TEST HOLE No.: TP-1
ELEVATION: Existing grade

TEST HOLE REPORT

Page: 1 of 1

CLIENT: Consolidated Fastfrate
PROJECT: Septic Assessment
LOGGED BY: J. Scott DATE: 31 March 2021
EXCAVATION COMPANY: Goldie Mohr Ltd. METHOD: Backhoe
NOTES: 18T E: 456548 N: 5017167

LEGEND
GS - GRAB SAMPLE
▼ - WATER LEVEL

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) — △ Field □ Lab	COMMENTS
		0.0		GROUND SURFACE			10 20 30 40 50 60 70 80 90	
				TOPSOIL (178mm)				
		0.2		**SM** - Gravelly sand (fill), with silt, trace clay, concrete, brick, asphalt, compact, brown, moist				- Test pit open upon completion
1	0.5							
2					GS-1	--		- GS-1 37% Gravel 47% Sand 12% Silt 4% Clay
3	1.0							
4								
5	1.5							
6		1.8		With clay, loose	GS-2	--		- GS-2 41% Gravel 36% Sand 16% Silt 7% Clay
7	2.0	2.1		Wet				- Groundwater infiltration observed at approximately 2.1 mbgs
8	2.5	2.4		END OF TEST HOLE				- Refusal at 2.4m (asphalt)
9								
10	3.0							
11								
12	3.5							
13	4.0							
14								
	4.5							

TEST HOLE LOG GEOTECH 11220832 TEST PIT GINT LOGS.GPJ GEOLOGIC.GDT 12/4/21

REFERENCE No.: 11220832 ENCLOSURE No.: A-2

TEST HOLE No.: TP-2
ELEVATION: Existing grade

TEST HOLE REPORT

Page: 1 of 1

CLIENT: Consolidated Fastfrate
PROJECT: Septic Assessment
LOGGED BY: J. Scott DATE: 31 March 2021
EXCAVATION COMPANY: Goldie Mohr Ltd. METHOD: Backhoe
NOTES: 18T E: 456572 N: 5017175

LEGEND
GS - GRAB SAMPLE
▼ - WATER LEVEL

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) (△ Field, □ Lab)	COMMENTS
		0.0		GROUND SURFACE			10 20 30 40 50 60 70 80 90	
				TOPSOIL (102mm)				
		0.1		**SM** - Gravelly sand (fill), with silt, concrete, brick, asphalt, brown, moist				
1								
	0.5							
2								
3					GS-1	--		
	1.0							
4								
5								
	1.5							
6		1.8		Wet				- Groundwater infiltration observed at approximately 1.8 mbgs
7								
	2.0							
8								
	2.5							
9		2.7		END OF TEST HOLE				
10	3.0							
11								
	3.5							
12								
13	4.0							
14								
	4.5							

- Test pit open upon completion

TEST HOLE LOG GEOTECH 11220832 TEST PIT GINT LOGS.GPJ GEOLOGIC.GDT 12/4/21

REFERENCE No.: 11220832 ENCLOSURE No.: A-3

TEST HOLE No.: TP-3
ELEVATION: Existing grade

TEST HOLE REPORT

Page: 1 of 1

CLIENT: Consolidated Fastfrate
PROJECT: Septic Assessment
LOGGED BY: J. Scott DATE: 31 March 2021
EXCAVATION COMPANY: Goldie Mohr Ltd. METHOD: Backhoe
NOTES: 18T E: 456599 N: 5017156

LEGEND
GS - GRAB SAMPLE
▼ - WATER LEVEL

Depth (ft / m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) (△ Field, □ Lab)	COMMENTS
0.0	0.0		GROUND SURFACE				— 0.2 m
	0.2		**TOPSOIL** (152 mm)				
1 / 0.5			**SM** - Gravelly sand (fill), with silt, concrete, asphalt, brown, moist				
2							
3 / 1.0							
4	1.2		Grey, cobbles	GS-1	--		
5 / 1.5							
6	1.8		Wet				- Groundwater infiltration observed at approximately 1.8 mbgs
7 / 2.0							
8 / 2.5							
9				GS-2	--		- 50 mm diameter monitoring well installed to 2.7 mbgs
10 / 3.0	3.0		END OF TEST HOLE				
11 / 3.5							
12							
13 / 4.0							
14							
4.5							

Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (w_p, w_l): 10 20 30 40 50 60 70 80 90 %

- Test pit open upon completion

TEST HOLE LOG GEOTECH 11220832 TEST PIT GINT LOGS.GPJ GEOLOGIC.GDT 12/4/21

REFERENCE No.: 11220832 ENCLOSURE No.: A-4

TEST HOLE REPORT

TEST HOLE No.: TP-4
ELEVATION: Existing grade

Page: 1 of 1

CLIENT: Consolidated Fastfrate
PROJECT: Septic Assessment
LOGGED BY: J. Scott DATE: 31 March 2021
EXCAVATION COMPANY: Goldie Mohr Ltd. METHOD: Backhoe
NOTES: 18T E: 456656 N: 5017172

LEGEND
GS - GRAB SAMPLE
▼ - WATER LEVEL

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) — △ Field □ Lab	COMMENTS
		0.0		GROUND SURFACE			10 20 30 40 50 60 70 80 90	
		0.1		**TOPSOIL** (102mm)				
1	0.5			**SM** - Gravelly sand (fill), with silt, with clay, concrete, asphalt, brown, moist				- Test pit open upon completion
2								
3	1.0				GS-1	--		- GS-1 32% Gravel 44% Sand 17% Silt 7% Clay
4								
5	1.5							
6		1.8		Wet				- Groundwater infiltration observed at approximately 1.8 mbgs
7	2.0							
8								
9	2.5							
10					GS-2	--		
11	3.0	3.4		END OF TEST HOLE				
12	3.5							
13								
14	4.0							
	4.5							

REFERENCE No.: 11220832 ENCLOSURE No.: A-5

TEST HOLE REPORT

TEST HOLE No.: TP-5
ELEVATION: Existing grade

Page: 1 of 1

CLIENT: Consolidated Fastfrate
PROJECT: Septic Assessment
LOGGED BY: J. Scott DATE: 31 March 2021
EXCAVATION COMPANY: Goldie Mohr Ltd. METHOD: Backhoe
NOTES: 18T E: 456601 N: 5017160

LEGEND
GS - GRAB SAMPLE
▼ - WATER LEVEL

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	COMMENTS
		0.0		GROUND SURFACE			
		0.1		**TOPSOIL** (102mm)			
1	0.5			**SM** - Silty sand (fill), with gravel, with clay, with asphalt, concrete, brown, moist			- Test pit open upon completion
3	1.0				GS-1	--	
4		1.2		Grey			
5	1.5						
6		1.8		Wet			- Groundwater infiltration observed at approximately 1.8 mbgs
7	2.0						
8	2.5						
9					GS-2	--	- GS2 18% Gravel 47% Sand 23% Silt 12% Clay
10	3.0	3.0		END OF TEST HOLE			
11	3.5						
12							
13	4.0						
14	4.5						

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)

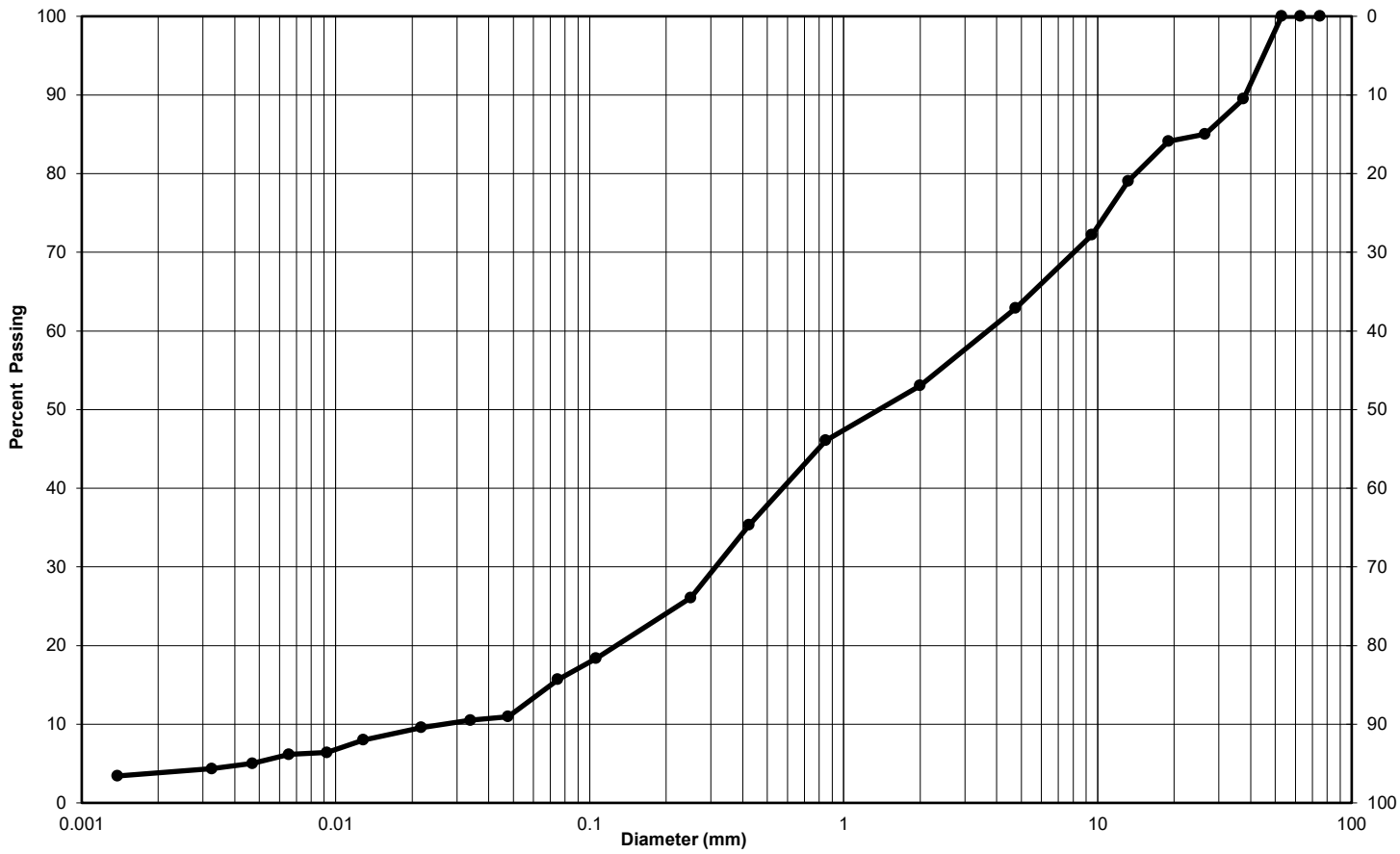
10 20 30 40 50 60 70 80 90

TEST HOLE LOG GEOTECH 11220832 TEST PIT GINT LOGS.GPJ GEOLOGIC.GDT 12/4/21

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	Consolidated Fastfrate	**Lab No.:**	SS-21-25
Project/Site:	Rideau Street & Somme Street, Ottawa, ON	**Project No.:**	11220832

Borehole no.:	TP1	Sample no.:	GS1
Depth:	0.6 - 0.9 m	Enclosure:	A-6



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
	37	47	16
Silt-size particles (%):	12		
Clay-size particles (%) (<0.002mm):	4		

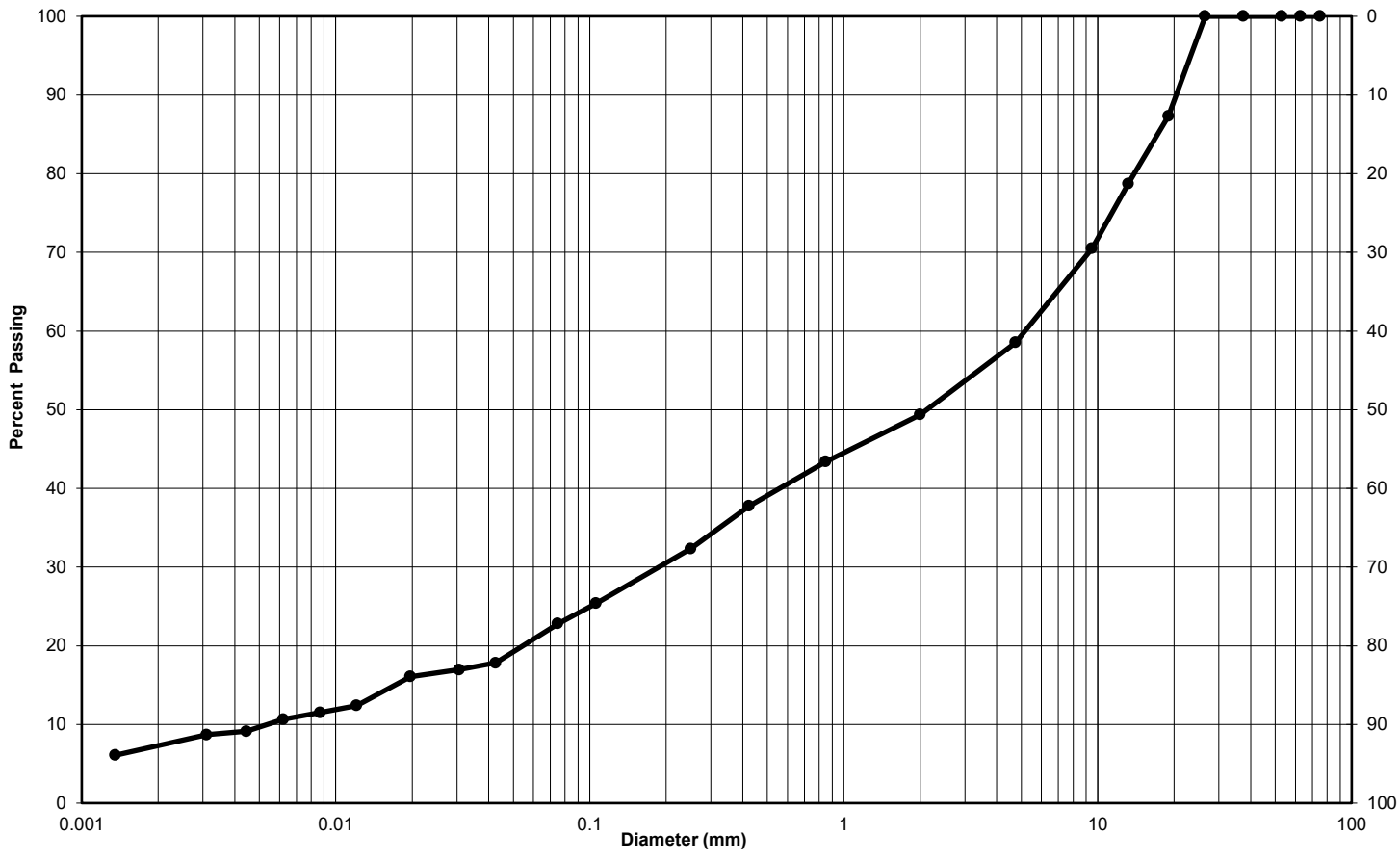
Remarks: Moisture Content = 7.1% as per, ASTM D2216.

Performed by:	Josh Sullivan	**Date:**	April 7, 2021
Verified by:	Joe Sullivan	**Date:**	April 7, 2021

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	Consolidated Fastfrate	**Lab No.:**	SS-21-25
Project/Site:	Rideau Street & Somme Street, Ottawa, ON	**Project No.:**	11220832

Borehole no.:	TP1	Sample no.:	GS2
Depth:	1.8 - 2.1 m	Enclosure:	A-7



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
	41	36	23
Silt-size particles (%):	16		
Clay-size particles (%) (<0.002mm):	7		

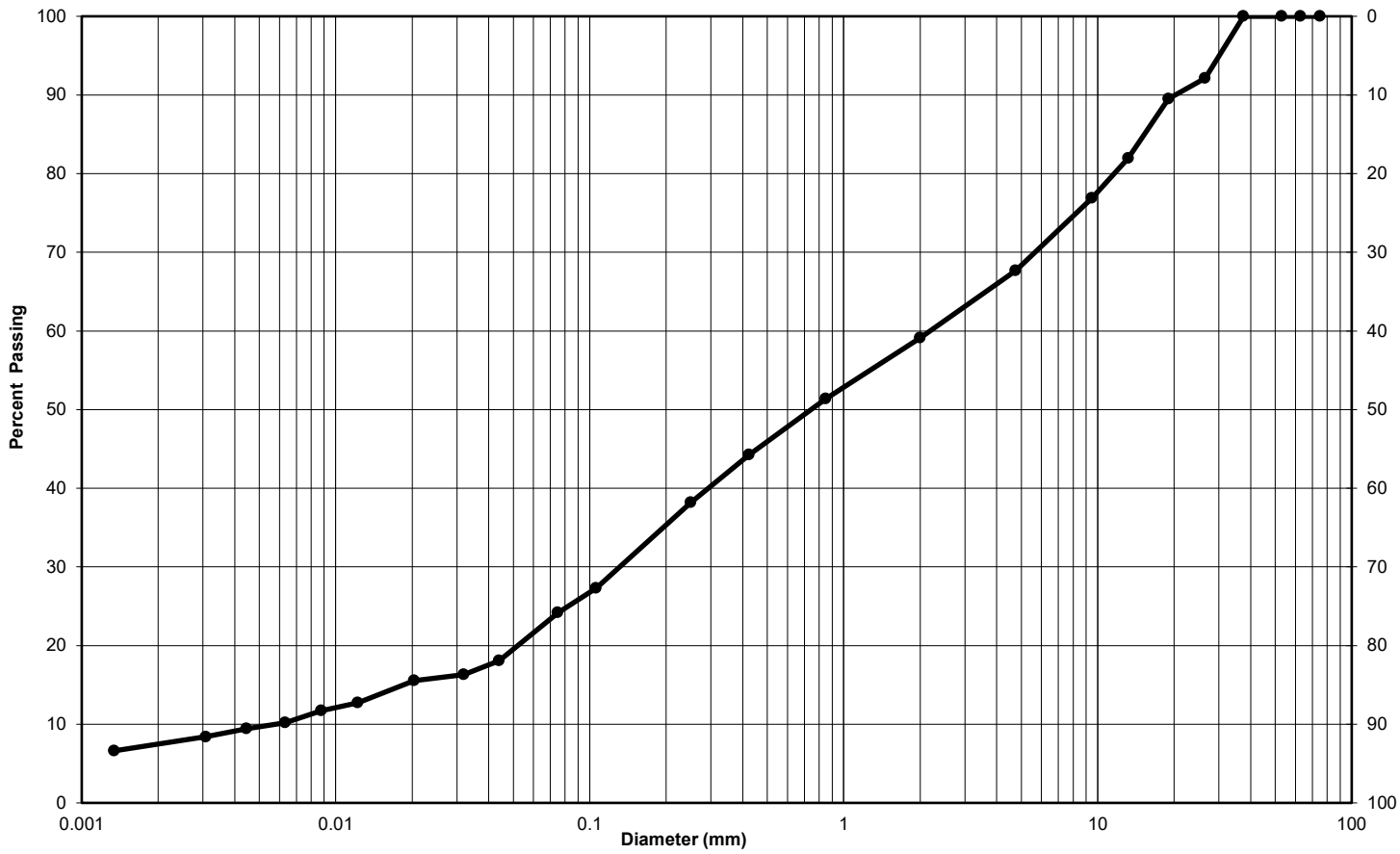
Remarks: Moisture Content = 8.7% as per, ASTM D2216.

Performed by:	Josh Sullivan	**Date:**	April 7, 2021
Verified by:	Joe Sullivan	**Date:**	April 7, 2021

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	Consolidated Fastfrate	**Lab No.:**	SS-21-25
Project/Site:	Rideau Street & Somme Street, Ottawa, ON	**Project No.:**	11220832

Borehole no.:	TP4	Sample no.:	GS1
Depth:	0.9 - 1.2 m	Enclosure:	A-8



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
	32	44	24
Silt-size particles (%):	17		
Clay-size particles (%) (<0.002mm):	7		

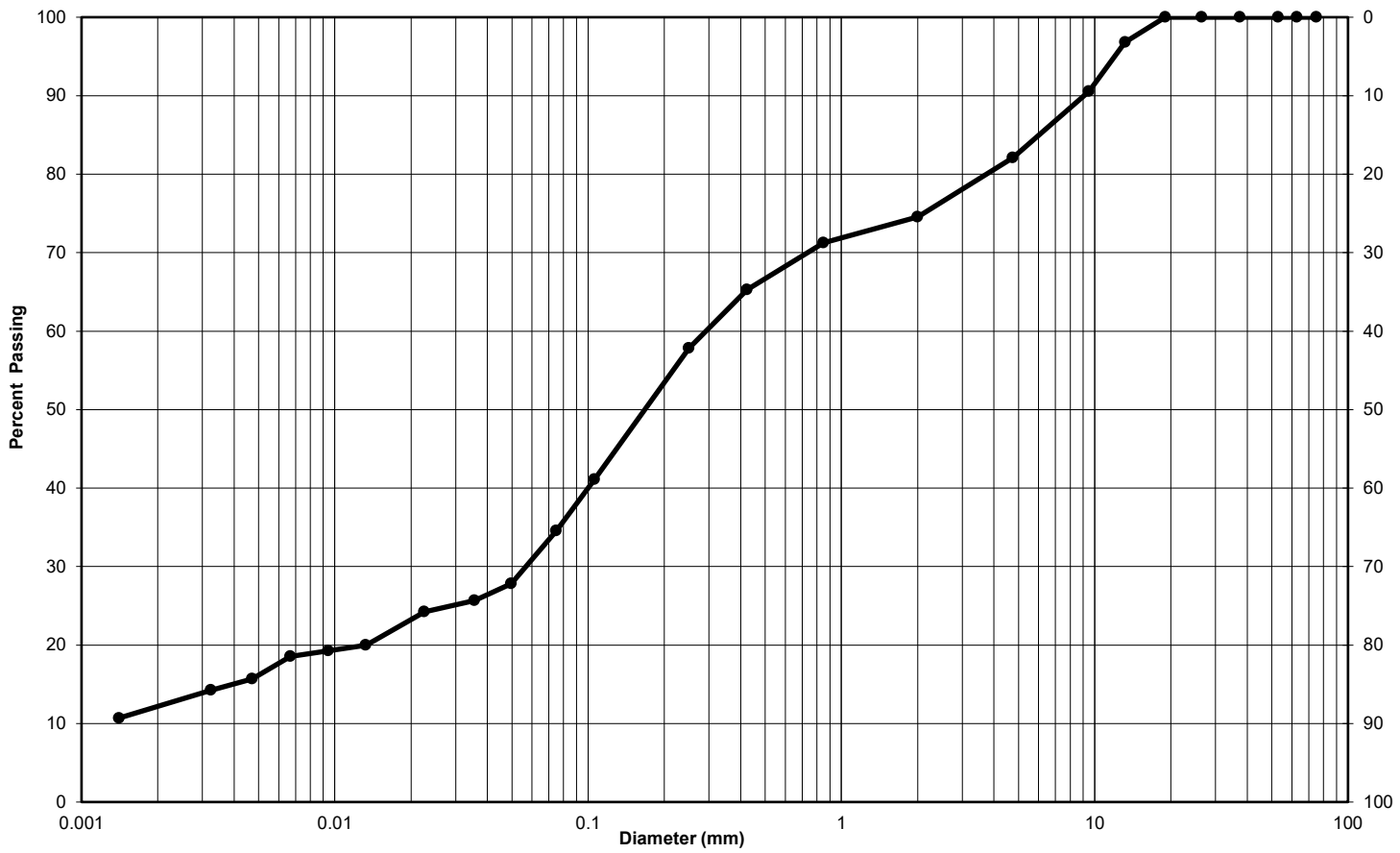
Remarks: Moisture Content = 10.6% as per, ASTM D2216.

Performed by:	Josh Sullivan	**Date:**	April 7, 2021
Verified by:	Joe Sullivan	**Date:**	April 7, 2021

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	Consolidated Fastfrate	**Lab No.:**	SS-21-25
Project/Site:	Rideau Street & Somme Street, Ottawa, ON	**Project No.:**	11220832

Borehole no.:	TP5	Sample no.:	GS2
Depth:	2.75 - 3.05 m	Enclosure:	A-9



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
	18	47	35
Silt-size particles (%):	23		
Clay-size particles (%) (<0.002mm):	12		

Remarks: Moisture Content = 22.4% as per, ASTM D2216.

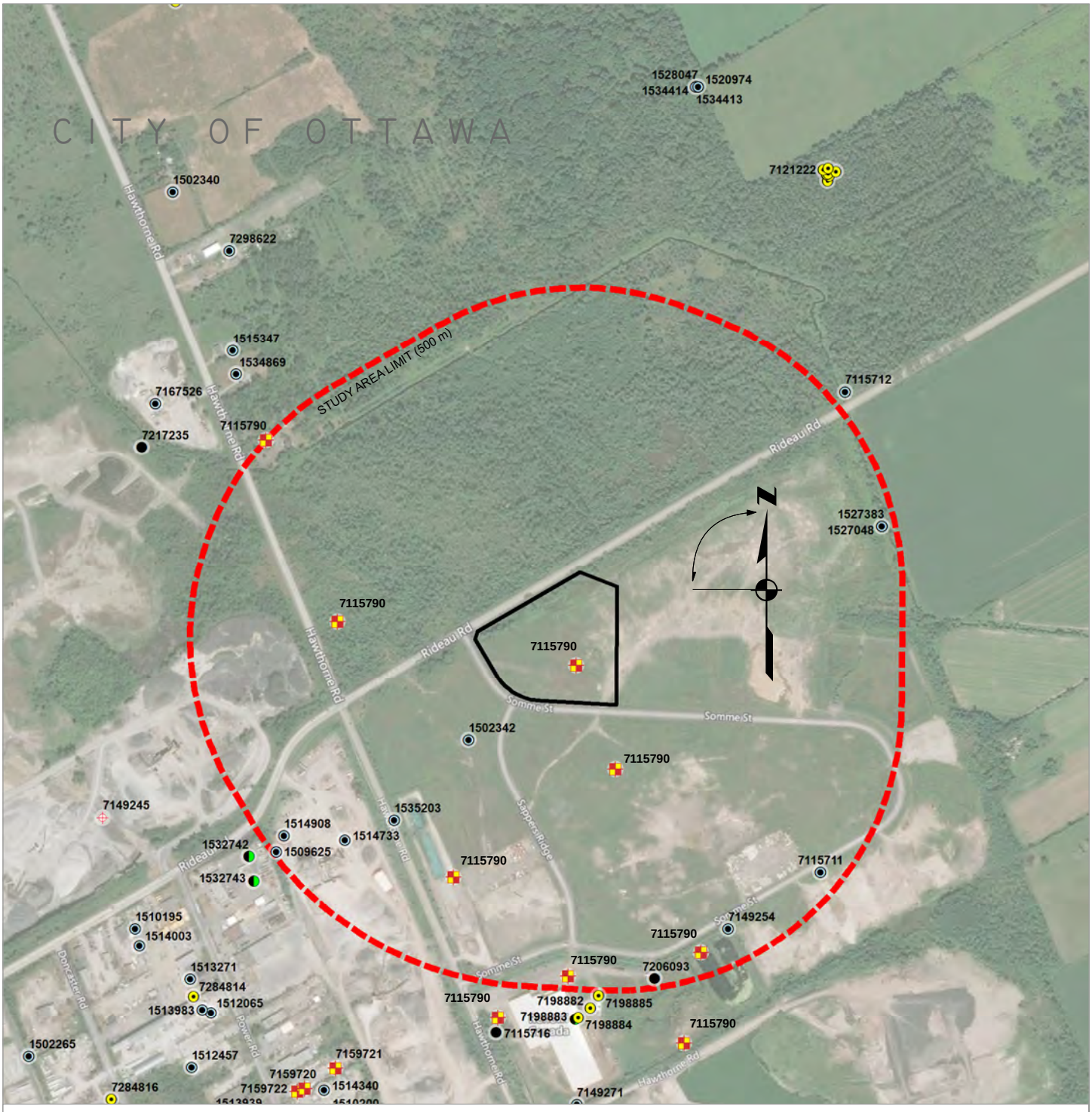
Performed by:	Josh Sullivan	**Date:**	April 7, 2021
Verified by:	Joe Sullivan	**Date:**	April 7, 2021

ghd.com

→ The Power of Commitment

Appendix B

MECP Water Well Records



LEGEND

- Study Property Limit
- 500 m Radius

MECP Well, Final Status

- Abandoned Monitoring and Test Hole
- Abandoned-Other
- Abandoned-Quality
- Abandoned-Supply
- Alteration
- Dewatering
- Monitoring and Test Hole
- Observation Wells
- Recharge Well
- Replacement Well
- Test Hole
- Unfinished
- Water Supply
- Other Status
- No Data
- Not A Well

NAD83, MTM Zone 9
1 cm : 100 meters

Meters: 0 | 110 | 220 | 440

ATTRIBUTION STATEMENTS

K:\GIS_PROJECTS\GHD\CA-

Consolidated Fastfrate (Ottawa) Holdings Inc.
RIDEAU ROAD & SOMME STREET
CITY OF OTTAWA
ONTARIO

HYDROGEOLOGY ASSESSMENT
MECP WATER WELLS

Project No. 12565773
Revision No. -
Date Jan 21

APPENDIX B

Created by: Will Pridham

WELL RECORD LISTINGS

Ministry of the Environment Conservation & Parks (MECP)

Database Currency: 2020-04-30

Date Accessed: 2020-11-13

Project ID: 11220832 **Office:** Peterborough, ON

Lot: LOT 27
Con: CON 6 FROM RIDEAU RIVER
Township: GLOUCESTER
County: OTTAWA-CARLETON
Street: 35 SAPPERS RIDGE
City: Ottawa
Site:
Elevation: 89.57 *masl.*
UTM: 18 E 456749 N 5016668 **Long/Lat:** -75.552 , 45.302

Well ID: 7206093
Borehole ID: 1004500104
Completion Date: 7/18/2013
Received Date: 8/12/2013
Tag: A089801
Audit No: Z103282
Contractor License: 3749

DETAILS

Primary Use: Public **Secondary Use:** Public **Final Status:**

Well Depth: 47.2 m **Depth to Bedrock:** 0 m **Static Level:** 7.6 m **Well Type:**

Pump Rate: 10 GPM **Boring Method:** Rotary (Convent.)

CASING DETAILS		DEPTH IN METERS	
Material	**Diameter (cm)**	**Top**	**Bottom**
STEEL	14.29	12.19	-0.61

FORMATION DETAILS		DEPTH IN METERS	
Colour	**Material**	**Top**	**Bottom**
	LIMESTONE	7.32	47.24
	FILL	0.00	2.44
GREY	CLAY	2.44	7.32

Lot: LOT 27
Con: CON 6 FROM RIDEAU RIVER
Township: GLOUCESTER
County: OTTAWA-CARLETON
Street: HAWTHORNE ROAD AT RIDEAU ROAD
City: Ottawa
Site:
Elevation: 90.95 *masl.*

Well ID: 7115790
Borehole ID: 1002782554
Completion Date: 7/7/2008
Received Date: 11/26/2008
Tag: A074584
Audit No: M02897
Contractor License: 1844

UTM: 18 E 456598 N 5016675 **Long/Lat:** -75.554 , 45.302

DETAILS

Primary Use: Monitoring **Secondary Use:** Monitoring **Final Status:** Test Hole

Well Depth: 0 m **Depth to Bedrock:** 0 m **Static Level:** 1 m **Well Type:**

Pump Rate: **Boring Method:** H.S.A.

CASING DETAILS DEPTH IN METERS

Material	Diameter (cm)	Top	-	Bottom

FORMATION DETAILS DEPTH IN METERS

Colour	Material	Top	-	Bottom
BROWN	FILL	0.27		1.43
GREY	SAND	1.43		1.83
BROWN	TILL	1.83		2.32
GREY	FINE SAND	0.00		0.27

Lot: LOT 27
Con: CON 6 FROM RIDEAU RIVER
Township: GLOUCESTER
County: OTTAWA-CARLETON
Street: HAWTHORNE ROAD AT RIDEAU ROAD
City: Ottawa
Site:
Elevation: 94.41 *masl.*
UTM: 18 E 456831 N 5016712 **Long/Lat:** -75.551 , 45.303

Well ID: 7115790
Borehole ID: 1002782518
Completion Date: 7/7/2008
Received Date: 11/26/2008
Tag: A074584
Audit No: M02897
Contractor License: 1844

DETAILS

Primary Use: Monitoring **Secondary Use:** Monitoring **Final Status:** Test Hole

Well Depth: 0 m **Depth to Bedrock:** 0 m **Static Level:** 1.3 m **Well Type:**

Pump Rate: **Boring Method:** H.S.A.

CASING DETAILS		DEPTH IN METERS	
Material	**Diameter (cm)**	**Top** -	**Bottom**
STEEL	15.86	-0.45	6.40

FORMATION DETAILS		DEPTH IN METERS	
Colour	**Material**	**Top** -	**Bottom**
GREY	SANDSTONE	1.30	9.10
BROWN	TOPSOIL	0.00	1.30

Lot: LOT 27
Con: CON 6 FROM RIDEAU RIVER
Township: GLOUCESTER
County: OTTAWA-CARLETON
Street: TW#7 HOAWTHORNE RD.
City: GLOUCESTER
Site:
Elevation: 88.61 *masl.*
UTM: 18 E 456879 N 5016752 **Long/Lat:** -75.550 , 45.303

Well ID: 7149254
Borehole ID: 1003262503
Completion Date: 5/25/2010
Received Date: 8/4/2010
Tag: A082844
Audit No: Z101832
Contractor License: 1558

DETAILS

Primary Use: Monitoring **Secondary Use:** Monitoring **Final Status:** Water Supply

Well Depth: 29.9 m **Depth to Bedrock:** 0 m **Static Level:** 4.4 m **Well Type:**

Pump Rate: 27.3 LPM **Boring Method:** Rotary (Reverse)

CASING DETAILS		DEPTH IN METERS	
Material	**Diameter (cm)**	**Top** -	**Bottom**
STEEL	15.86	-0.45	6.40

FORMATION DETAILS		DEPTH IN METERS	
Colour	**Material**	**Top** -	**Bottom**
GREY	SANDSTONE	1.30	9.10
BROWN	TOPSOIL	0.00	1.30

Lot:	LOT 26	**Well ID:**	7115790
Con:	CON 6 FROM RIDEAU RIVER	**Borehole ID:**	1001905211
Township:	GLOUCESTER	**Completion Date:**	7/14/2008
County:	OTTAWA-CARLETON	**Received Date:**	11/26/2008
Street:	HAWTHORNE ROAD AT RIDEAU ROAD	**Tag:**	A074584
City:	Ottawa	**Audit No:**	M02897
Site:		**Contractor License:**	1844
Elevation:	89.13 *masl.*		
UTM:	18 E 456400 N 5016852 **Long/Lat:** -75.556 , 45.304		

DETAILS

Primary Use: Monitoring **Secondary Use:** Monitoring **Final Status:** Test Hole

Well Depth: 7.6 m **Depth to Bedrock:** 0 m **Static Level:** 1.7 m **Well Type:**

Pump Rate: **Boring Method:** H.S.A.

CASING DETAILS DEPTH IN METERS

Material	Diameter (cm)	Top	-	Bottom

FORMATION DETAILS DEPTH IN METERS

Colour	Material	Top	-	Bottom
GREY	FINE SAND	0.00		0.27
BROWN	FILL	0.27		1.43
BROWN	TILL	1.83		2.32
GREY	SAND	1.43		1.83

Lot:	LOT 27	**Well ID:**	7115711
Con:	CON 6 FROM RIDEAU RIVER	**Borehole ID:**	1001904894
Township:	GLOUCESTER	**Completion Date:**	9/26/2008
County:	OTTAWA-CARLETON	**Received Date:**	12/2/2008
Street:	TW #5	**Tag:**	A068335
City:	GLOUCESTER	**Audit No:**	Z84410
Site:		**Contractor License:**	1558

Elevation: 87.38 *masl.*

UTM: 18 E 457043 N 5016848 **Long/Lat:** -75.548 , 45.304

DETAILS

Primary Use: Domestic **Secondary Use:** Domestic **Final Status:** Water Supply

Well Depth: 29.9 m **Depth to Bedrock:** 0 m **Static Level:** 6.8 m **Well Type:** Bedrock

Pump Rate: 180 GPM **Boring Method:** Cable Tool

CASING DETAILS		DEPTH IN METERS	
Material	**Diameter (cm)**	**Top** -	**Bottom**
STEEL	25.40		5.49
OPEN HOLE	22.86		58.52

FORMATION DETAILS		DEPTH IN METERS	
Colour	**Material**	**Top** -	**Bottom**
BROWN	SANDSTONE	0.00	15.85
GREY	QUARTZITE	15.85	21.95
WHITE	SANDSTONE	21.95	48.77
GREY	SANDSTONE	48.77	58.52

Lot: LOT 26 **Well ID:** 1509625

Con: CON 5 FROM RIDEAU RIVER **Borehole ID:** 10031657

Township: GLOUCESTER **Completion Date:** 5/4/1968

County: OTTAWA-CARLETON **Received Date:** 6/12/1968

Street: **Tag:**

City: **Audit No:**

Site: **Contractor License:** 3002

Elevation: 103.27 *masl.*

UTM: 18 E 456091 N 5016902 **Long/Lat:** -75.560 , 45.304

DETAILS

Primary Use: Domestic **Secondary Use:** Domestic **Final Status:** Water Supply

Well Depth: 58.5 m **Depth to Bedrock:** 0 m **Static Level:** 11 m **Well Type:** Bedrock

Pump Rate: 180 GPM **Boring Method:** Cable Tool

CASING DETAILS		DEPTH IN METERS	
Material	**Diameter (cm)**	**Top** -	**Bottom**
OPEN HOLE	22.86		58.52

STEEL	25.40	5.49

FORMATION DETAILS		DEPTH IN METERS	
Colour	**Material**	**Top** -	**Bottom**
BROWN	SHALE	0.61	3.05
BROWN	TOPSOIL	0.00	0.61
GREY	LIMESTONE	3.05	35.36

Lot: LOT 26
Con: CON 5 FROM RIDEAU RIVER
Township: GLOUCESTER
County: OTTAWA-CARLETON
Street:
City:
Site:
Elevation: 99.42 *masl.*
UTM: 18 E 456211 N 5016920 **Long/Lat:** -75.559 , 45.304

Well ID: 1514733
Borehole ID: 10036703
Completion Date: 4/15/1975
Received Date: 7/8/1975
Tag:
Audit No:
Contractor License: 1517

DETAILS

Primary Use: Commerical **Secondary Use:** Commerical **Final Status:** Water Supply

Well Depth: 35.4 m **Depth to Bedrock:** 0.6 m **Static Level:** 12. m **Well Type:** Bedrock

Pump Rate: 10 GPM **Boring Method:** Cable Tool

CASING DETAILS		DEPTH IN METERS	
Material	**Diameter (cm)**	**Top** -	**Bottom**
OPEN HOLE	12.70		35.36
STEEL	12.70		5.49

FORMATION DETAILS		DEPTH IN METERS	
Colour	**Material**	**Top** -	**Bottom**
BROWN	TOPSOIL	0.00	0.61
BROWN	SHALE	0.61	3.05
GREY	LIMESTONE	3.05	35.36

Lot: LOT 26
Con: CON 5 FROM RIDEAU RIVER
Township: GLOUCESTER
County: OTTAWA-CARLETON

Well ID: 1514908
Borehole ID: 10036875
Completion Date: 8/15/1975
Received Date: 9/11/1975

Street: 3500 RIDEAU ROAD **Tag:** A018916
City: GLOUCESTER **Audit No:** Z19099
Site: **Contractor License:** 1119
Elevation: 90.37 *masl.*
UTM: 18 E 456105 N 5016929 **Long/Lat:** -75.560 , 45.304

DETAILS

Primary Use: Domestic **Secondary Use:** Domestic **Final Status:** Water Supply

Well Depth: 75.6 m **Depth to Bedrock:** 0 m **Static Level:** 12. m **Well Type:** Bedrock

Pump Rate: 75.71 LPM **Boring Method:** Air Percussion

CASING DETAILS		DEPTH IN METERS	
Material	**Diameter (cm)**	**Top** -	**Bottom**
OPEN HOLE		6.09	42.67
STEEL	15.88	0.00	6.70

FORMATION DETAILS		DEPTH IN METERS	
Colour	**Material**	**Top** -	**Bottom**
GREY	LIMESTONE	10.68	13.01
GREY	SANDSTONE	0.37	10.68
	GRAVEL	0.00	0.37

Lot: <null> **Well ID:** 1535203
Con: **Borehole ID:** 11172955
Township: GLOUCESTER **Completion Date:** 10/27/2004
County: OTTAWA-CARLETON **Received Date:** 11/26/2004
Street: 3500 RIDEAU ROAD **Tag:** A018916
City: GLOUCESTER **Audit No:** Z19099
Site: **Contractor License:** 1119
Elevation: 90.37 *masl.*
UTM: 18 E 456298 N 5016953 **Long/Lat:** -75.557 , 45.305

DETAILS

Primary Use: Domestic **Secondary Use:** Domestic **Final Status:** Water Supply

Well Depth: 42.7 m **Depth to Bedrock:** 1.2 m **Static Level:** 14. m **Well Type:** Bedrock

Pump Rate: 75.71 LPM **Boring Method:** Air Percussion

CASING DETAILS DEPTH IN METERS

Material	Diameter (cm)	Top	-	Bottom

FORMATION DETAILS		DEPTH IN METERS		
Colour	Material	Top	-	Bottom
GREY	FINE SAND	0.00		0.27
GREY	SAND	1.43		1.83
BROWN	TILL	1.83		2.32
BROWN	FILL	0.27		1.43

Lot: LOT 26
Con: CON 6 FROM RIDEAU RIVER
Township: GLOUCESTER
County: OTTAWA-CARLETON
Street: HAWTHORNE ROAD AT RIDEAU ROAD
City: Ottawa
Site:
Elevation: 85.10 *masl.*
UTM: 18 E 456687 N 5017036 **Long/Lat:** -75.552 , 45.305

Well ID: 7115790
Borehole ID: 1002782572
Completion Date: 7/15/2008
Received Date: 11/26/2008
Tag: A074584
Audit No: M02897
Contractor License: 1844

DETAILS

Primary Use: Monitoring **Secondary Use:** Monitoring **Final Status:** Test Hole

Well Depth: 0 m **Depth to Bedrock:** 0 m **Static Level:** 3 m **Well Type:**

Pump Rate: **Boring Method:**

CASING DETAILS DEPTH IN METERS

H.S.A.

Material	Diameter (cm)	Top	-	Bottom

FORMATION DETAILS		DEPTH IN METERS		
Colour	Material	Top	-	Bottom
BROWN	TILL	1.83		2.32
BROWN	FILL	0.27		1.43
GREY	SAND	1.43		1.83

GREY	FINE SAND	0.00	0.27

Lot: LOT 26
Con: CON 6 FROM RIDEAU RIVER
Township: GLOUCESTER
County: OTTAWA-CARLETON
Street:
City:
Site:
Elevation: 87.74 *masl.*
UTM: 18 E 456431 N 5017092 **Long/Lat:** -75.556 , 45.306

Well ID: 1502342
Borehole ID: 10024385
Completion Date: 11/30/1950
Received Date: 12/6/1951
Tag:
Audit No:
Contractor License: 3504

DETAILS

Primary Use: Livestock **Secondary Use:** Livestock **Final Status:** Water Supply

Well Depth: 17.4 m **Depth to Bedrock:** 8.2 m **Static Level:** 4 m **Well Type:** Bedrock

Pump Rate: 1 GPM **Boring Method:** Cable Tool

CASING DETAILS / DEPTH IN METERS

Material	Diameter (cm)	Top	-	Bottom
STEEL	12.70			8.23
OPEN HOLE	12.70			17.37

FORMATION DETAILS / DEPTH IN METERS

Colour	Material	Top	-	Bottom
	PREV. DRILLED	0.00		8.23
	SANDSTONE	8.23		17.37

Lot: LOT 26
Con: CON 6 FROM RIDEAU RIVER
Township: GLOUCESTER
County: OTTAWA-CARLETON
Street: HAWTHORNE ROAD AT RIDEAU ROAD
City: Ottawa
Site:
Elevation: 84.01 *masl.*
UTM: 18 E 456622 N 5017219 **Long/Lat:** -75.553 , 45.307

Well ID: 7115790
Borehole ID: 1002782563
Completion Date: 7/14/2008
Received Date: 11/26/2008
Tag: A074584
Audit No: M02897
Contractor License: 1844

DETAILS

Primary Use: Monitoring **Secondary Use:** Monitoring **Final Status:** Test Hole

Well Depth: 0 m **Depth to Bedrock:** 0 m **Static Level:** 3.6 m **Well Type:**

Pump Rate: **Boring Method:** H.S.A.

CASING DETAILS DEPTH IN METERS

Material	Diameter (cm)	Top	-	Bottom

FORMATION DETAILS DEPTH IN METERS

Colour	Material	Top	-	Bottom
GREY	FINE SAND	0.00		0.27
BROWN	TILL	1.83		2.32
BROWN	FILL	0.27		1.43
GREY	SAND	1.43		1.83

Lot: LOT 25
Con: CON 6 FROM RIDEAU RIVER
Township: GLOUCESTER
County: OTTAWA-CARLETON
Street: HAWTHORNE ROAD AT RIDEAU ROAD
City: Ottawa
Site:
Elevation: 84.01 *masl.*
UTM: 18 E 456206 N 5017303 **Long/Lat:** -75.559 , 45.308

Well ID: 7115790
Borehole ID: 1002782590
Completion Date: 7/15/2008
Received Date: 11/26/2008
Tag: A074584
Audit No: M02897
Contractor License: 1844

DETAILS

Primary Use: Monitoring **Secondary Use:** Monitoring **Final Status:** Test Hole

Well Depth: 0 m **Depth to Bedrock:** 0 m **Static Level:** 1.6 m **Well Type:**

Pump Rate: **Boring Method:**

CASING DETAILS DEPTH IN METERS

H.S.A.

Material	Diameter (cm)	Top	-	Bottom
OPEN HOLE	15.24			30.48
STEEL	15.24			11.89

FORMATION DETAILS — DEPTH IN METERS

Colour	Material	Top	-	Bottom
GREY	SANDSTONE	8.53		30.48
GREY	HARDPAN	1.52		8.53
BROWN	SAND	0.00		1.52

Lot: LOT 26
Con: CON 6 FROM RIDEAU RIVER
Township: GLOUCESTER
County: OTTAWA-CARLETON
Street:
City:
Site:
Elevation: 82.18 *masl.*
UTM: 18 E 457162 N 5017453 **Long/Lat:** -75.546 , 45.309

Well ID: 1527383
Borehole ID: 10049033
Completion Date: 8/16/1993
Received Date: 9/21/1993
Tag:
Audit No: 135946
Contractor License: 1558

DETAILS

Primary Use: Domestic **Secondary Use:** Domestic **Final Status:** Water Supply

Well Depth: 30.5 m **Depth to Bedrock:** 8.5 m **Static Level:** 2.1 m **Well Type:** Bedrock

Pump Rate: 20 GPM **Boring Method:** Air Percussion

CASING DETAILS — DEPTH IN METERS

Material	Diameter (cm)	Top	-	Bottom
STEEL	15.24			11.89
OPEN HOLE	15.24			30.48

FORMATION DETAILS — DEPTH IN METERS

Colour	Material	Top	-	Bottom
BROWN	SAND	0.00		1.52

GREY	HARDPAN	1.52	8.53
GREY	SANDSTONE	8.53	30.48

Lot: LOT 26
Con: CON 6 FROM RIDEAU RIVER
Township: GLOUCESTER
County: OTTAWA-CARLETON
Street:
City:
Site:
Elevation: 82.18 *masl.*
UTM: 18 E 457162 N 5017453 **Long/Lat:** -75.546 , 45.309

Well ID: 1527048
Borehole ID: 10048727
Completion Date: 4/19/1993
Received Date: 5/6/1993
Tag:
Audit No: 130025
Contractor License: 1558

DETAILS

Primary Use: Domestic **Secondary Use:** Domestic **Final Status:** Water Supply

Well Depth: 41.1 m **Depth to Bedrock:** 0 m **Static Level:** 9.4 m **Well Type:** Bedrock

Pump Rate: 15 GPM **Boring Method:** Air Percussion

CASING DETAILS / DEPTH IN METERS

Material	Diameter (cm)	Top	-	Bottom
OPEN HOLE	15.24			22.86
STEEL	15.24			9.45
OPEN HOLE	15.24			41.15

FORMATION DETAILS / DEPTH IN METERS

Colour	Material	Top	-	Bottom
WHITE	SANDSTONE	10.06		41.15
GREY	HARDPAN	2.74		4.57
BROWN	CLAY	0.00		2.74
GREY	LIMESTONE	4.57		10.06

Lot: LOT 26
Con: CON 6 FROM RIDEAU RIVER
Township: GLOUCESTER
County: OTTAWA-CARLETON
Street:
City:
Site:

Well ID: 1527384
Borehole ID: 10049034
Completion Date: 8/16/1993
Received Date: 9/21/1993
Tag:
Audit No: 135944
Contractor License: 1558

Elevation: 82.18 *masl.*

UTM: 18 E 457162 N 5017453 **Long/Lat:** -75.546 , 45.309

DETAILS

Primary Use: Domestic **Secondary Use:** Domestic **Final Status:** Water Supply

Well Depth: 30.5 m **Depth to Bedrock:** 0 m **Static Level:** 6.7 m **Well Type:** Bedrock

Pump Rate: 15 GPM **Boring Method:** Air Percussion

CASING DETAILS		DEPTH IN METERS		
Material	**Diameter (cm)**	**Top**	-	**Bottom**
STEEL	15.24			6.71
OPEN HOLE	15.24			30.48

FORMATION DETAILS		DEPTH IN METERS		
Colour	**Material**	**Top**	-	**Bottom**
GREY	SANDSTONE	0.00		30.48

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 — 1527383 — MUNICIP 15002 — CON. CON. K6

COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	CON., BLOCK, TRACT, SURVEY, ETC.	LOT
[redacted]	[redacted]ucester	6	26

[redacted] Box 4208 stn. "E" Ottawa, Ontario K1S 5B2 — DATE COMPLETED: DAY 16 MO 8 YR 93

RC — ELEVATION — RC — BASIN CODE

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
Brown	Sand	Stone		0	5
Gray	Hardpan	Boulders		5	28
Gray	Sandstone		Hard	28	100

31
32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
58	1 ☐ FRESH 2 ☐ SALTY — 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
88	1 ☐ FRESH 2 ☐ SALTY — 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
NOT TESTED	1 ☐ FRESH 2 ☐ SALTY — 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY — 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY — 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
6 1/4	1 ☐ STEEL 2 ☒ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC	.188	0	39
5 15/16	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☒ OPEN HOLE 5 ☐ PLASTIC		39	100
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC			

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER INCHES	LENGTH FEET

MATERIAL AND TYPE	DEPTH TO TOP OF SCREEN FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	DEPTH SET AT - FEET TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)
37.5	0	Cement - Grouted

71 PUMPING TEST

PUMPING TEST METHOD	PUMPING RATE	DURATION OF PUMPING
1 ☒ PUMP 2 ☐ BAILER	20 GPM	1 HOURS ____ MINS

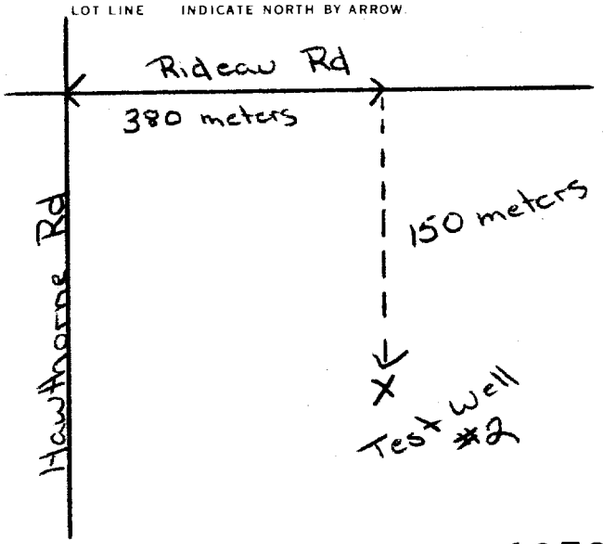
STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING: 1 ☒ PUMPING 2 ☐ RECOVERY	15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
7'6" FEET	14'6" FEET		13'11" FEET	14 FEET	14'4" FEET	14'6" FEET

IF FLOWING, GIVE RATE	PUMP INTAKE SET AT	WATER AT END OF TEST
GPM	FEET	1 ☐ CLEAR 2 ☒ CLOUDY

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
☐ SHALLOW ☒ DEEP	50 FEET	5 GPM

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS: 135946

FINAL STATUS OF WELL	WATER USE	METHOD OF CONSTRUCTION
1 ☒ WATER SUPPLY	1 ☒ DOMESTIC	1 ☐ CABLE TOOL
2 ☐ OBSERVATION WELL	2 ☐ STOCK	2 ☐ ROTARY (CONVENTIONAL)
3 ☐ TEST HOLE	3 ☐ IRRIGATION	3 ☐ ROTARY (REVERSE)
4 ☐ RECHARGE WELL	4 ☐ INDUSTRIAL	4 ☐ ROTARY (AIR)
5 ☐ ABANDONED, INSUFFICIENT SUPPLY	5 ☐ COMMERCIAL	5 ☒ AIR PERCUSSION
6 ☐ ABANDONED, POOR QUALITY	6 ☐ MUNICIPAL	6 ☐ BORING
7 ☐ UNFINISHED	7 ☐ PUBLIC SUPPLY	7 ☐ DIAMOND
☐ DEWATERING	8 ☐ COOLING OR AIR CONDITIONING	8 ☐ JETTING
	9 ☐ NOT USED	9 ☐ DRIVING
	☐ OTHER	☐ DIGGING ☐ OTHER

CONTRACTOR

NAME OF WELL CONTRACTOR	WELL CONTRACTOR'S LICENCE NUMBER
Capital Water Supply Ltd.	1558

ADDRESS: Box 490 Stittsville, Ontario K2S 1A6

NAME OF WELL TECHNICIAN	WELL TECHNICIAN'S LICENCE NUMBER
S.Miller/T. Harrison	T0097/T2251

SIGNATURE OF TECHNICIAN/CONTRACTOR: [signature] — SUBMISSION DATE: DAY 18 MO 8 YR 93

OFFICE USE ONLY

DATA SOURCE	CONTRACTOR	DATE RECEIVED
	1558	SEP 21 1993

DATE OF INSPECTION: — INSPECTOR: — REMARKS:

MINISTRY OF THE ENVIRONMENT COPY

FORM NO. 0506 (11/86) FORM 9

Appendix C

Nitrate Loading Calculations

Appendix C

Mass Balance Calculation - Nitrate Loading using Average Flows

Calculations based upon Septic Effluent Area, Figure 9.

Equations	**Eq'n #**
$V_A = A_D \times k$	(1)
$V_T = V_A + V_S$	(2)
$C_{PB} = (C_S \times V_S) / V_T$	(3)

Where:

V_A = annual dilution volume [m^3]
A_D = dilution area [m^2]
V_T = total volume of water [m^3]
V_S = annual sewage volume [m^3]
C_{PB} = concentration at property boundary [mg/L]
C_S = concentration in sewage [mg/L]
k = 0.25 m (Precipitation rate - can be adjusted. Assumed rate from MECP document)

A_D =	17035	m^2	Infiltration area based upon Figure 9
V_A =	4258.8	m^3	
V_S =	4672	m^3	Loading of 12,800 L/day provided (1 m^3 = 1000 L)
V_T =	8930.8	m^3	
C_S =	40	mg/L	Assumed value
C_{PB} =	20.9	mg/L	Nitrate concentration expected at property boundary

Therefore, if 40 mg/L of nitrate is in the effluent, 20.9 mg/L will be at the property boundary.

$C_S = (C_{PB} \times V_T) / V_S$ (4)

C_{PB} =	2.5	mg/L	As per MECP guidance manual Chapter 22
C_S =	4.8	mg/L	Nitrate concentration into leaching bed to meet 2.5 mg/L downgradient at property boundary

Tertiary treatment would be required to reduce Nitrate to 4.8 mg/L or lower in order to meet 2.5 mg/L at the property boundary.

Note: MECP Design Guidelines for Sewage Works (2008) used in above calculations (Chapter 22)

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→ The Power of Commitment