



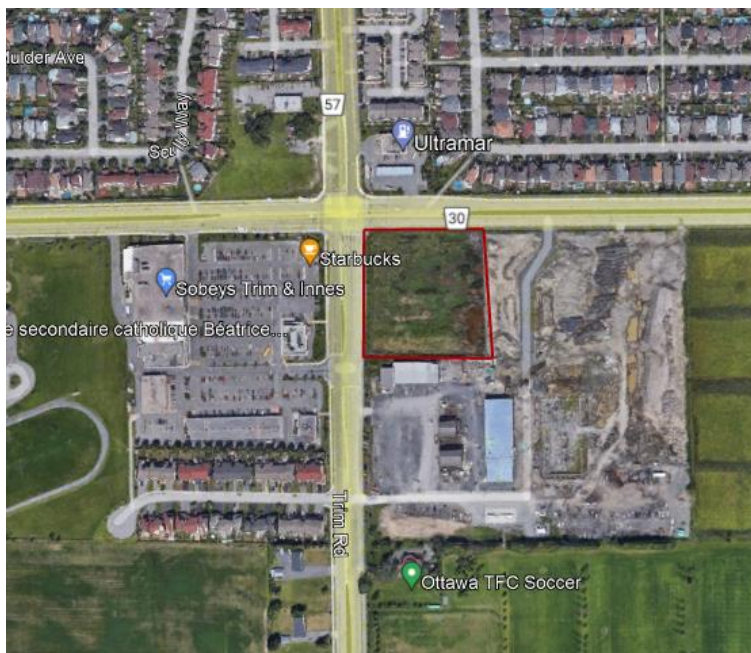
ENGINEERING



LABORATORY



HYDROGEOLOGICAL INVESTIGATION



400 Esna Park Drive, Unit 15
Markham, ON
L3R 3K2

Tel: (905) 475-7755
Fax: (905) 475-7718
www.fisherenvironmental.com

5210 INNES ROAD, OTTAWA, ONTARIO,

Prepared for:
Dymon Group of Companies

Project No. FE-P 22-12470H

November 30, 2022

Issued to: Dymon Group of Companies
2-1830 Walkley Road,
Ottawa, Ontario K1H, 8K3

Contact: James Byck, B.Arch., C.E.T
jbyck@dymon.ca

Project Name: Hydrogeological Investigation for Proposed Development

Project Address: 5210 Innes Road, Ottawa, Ontario

Project Number: FE-P 22-12470H

Issued on: November 30, 2022

**Project Manager:
(Primary Contact)**



Sean Fisher, M.Sc. Eng.,
Project Manager,
sean@fishereng.com

Report Prepared By:



Clive Wiggan, PhD., PMP.,
Project Manager
clive@fishereng.com

Report Reviewed By:



The seal is a circular professional engineer's stamp for the Province of Ontario. It contains the text "LICENSED PROFESSIONAL ENGINEER", "M. FAN", "100154673", and "PROVINCE OF ONTARIO".

Frank Fan, PEng.,
Geotechnical Engineer
frank@fishereng.com

TABLE OF CONTENTS

1. INTRODUCTION.....	1
2. SITE AND PROJECT DESCRIPTIONS	1
3. SCOPE OF HYDROGEOLOGICAL INVESTIGATION	2
4. FIELD AND LABORATORY WORKS	3
5. SUBSOIL CONDITIONS.....	4
6. HYDROGEOLOGICAL STUDY	5
6.1 HYDROGEOLOGICAL CONDITIONS	5
6.2 HYDRAULIC CONDUCTIVITY K MODELING RESULTS	7
6.3 GRAIN SIZE ANALYSIS FOR HYDRAULIC CONDUCTIVITY K.....	8
7. CONSTRUCTION DEWATERING & PERMANENT DRAINAGE.....	8
7.1 CONSTRUCTION DEWATERING	8
7.2 PERMANENT DRAINAGE	9
7.3 PERMIT TO TAKE WATER (PTTW).....	10
7.4 GROUNDWATER QUALITY.....	10
7.5 DEWATERING INFLUENCE ZONE	11
7.6 HYDROGEOLOGICAL IMPACT	11
8. INFILTRATION TESTS	12
9. DISCUSSION/RECOMMENDATIONS	13
10. LIMITATIONS.....	14
APPENDIX A – SITE AND LOCATION MAPS AND PLANS	A
APPENDIX B – LOG OF BOREHOLES.....	B
APPENDIX C – MOISTURE CONTENT AND GRAIN SIZE DISTRIBUTION ANALYSES.....	C
APPENDIX D – SEWER BYLAW RESULTS	D
APPENDIX E – HYDRAULIC CONDUCTIVITY ANALYSES	E
APPENDIX F – CONSTRUCTION DEWATERING AND PERMANENT DRAINAGE.....	F
APPENDIX G – BACKFILL AND DRAINAGE DESIGN.....	G
APPENDIX H – WELL SURVEY.....	H



1. INTRODUCTION

Fisher Engineering Limited was retained by Dymon Group of Companies to carry out a hydrogeological investigation for the proposed redevelopment at the property located at 5210 Innes Road, Ottawa, Ontario, hereinafter referred to as the 'Site'.

The purpose of the Hydrogeological Investigation was to evaluate groundwater conditions with respect to the redevelopment of the site.

The Hydrogeological Review has been prepared in accordance with the Ontario Water Resources Act, Ontario Regulation 387/04 and Ontario Ottawa Sanitary and Storm Sewer By-Law No.2003-514 (2003).

The report has been prepared specifically and solely for the proposed development regarding hydrogeological aspects for design and construction.

2. SITE AND PROJECT DESCRIPTIONS

Site Settings

The site is located at the southeast corner of the intersection of Innes Road and Trim Road in Ottawa, and is bounded by Innes Road to the north, industrial properties to the east & south and Trim Road to the west, beyond which are commercial properties.

The subject property was vacant and covered with grass during the investigation and an approximate area of 12,986m².

Topography

The site is fairly flat and is approximately 0.6 to 1.0m below the adjacent roadways (Innes Road and Trim Road). Ground surface elevations vary from approximately 87.67m to 88.01m asl based on the topographic survey plan provided to Fisher.

Proposed Development

Site Plans, prepared by DCA- A Group of Architect, dated July 13, 2022, provided to Fisher during the current investigation show the proposed development consisting of a 3-storey, 18m high self- storage building with no underground levels. The proposed building will be located in the centre of the property with a footprint of 5,666m². Finished Floor Elevation (FFE) was given as 87.75m asl.



3. SCOPE OF HYDROGEOLOGICAL INVESTIGATION

The Hydrogeological Investigation works were required to:

- 1) Establish groundwater conditions for the design of dewatering works, if required, prior to construction of the proposed building.
- 2) Determine the need for permanent drainage and
- 3) Conduct calculations/analyses of the groundwater quantity and quality to be used for the necessary applications for permits prior to proceeding with construction dewatering and design of permanent drainage, if necessary.

The scope of this work generally consisted of the following:

- **Drilling/locating Monitoring Wells.** Drilling of monitoring wells and reviewing / compiling the borehole logs and onsite / laboratory testing.
- **Data Evaluation.** Evaluating the results of soil types, groundwater static levels, ground surface elevation, groundwater quality, flow direction and other available hydrogeological data for the site and their potential impact on the proposed development.
- **Private Well Survey.** Carry out a search of the MECP records to ascertain the number of private water wells within 500m of the site and determine the impact of construction on these wells.
- **Hydraulic Conductivity Tests.** Conduct single well response tests and record groundwater level drawdown and recovery to model/calculate hydraulic conductivity.
- **Groundwater Quality Analysis.** Carry out laboratory analyses on soil and groundwater to determine compliance with the Ontario Ottawa Sanitary and Storm Sewer, By-Law No. 2003-514 (2003).
- **Hydrogeological Report.** Prepare and submit a report detailing the findings and recommendations of the Hydrogeological Investigation.



4. FIELD AND LABORATORY WORKS

Subsurface exploration for the hydrogeological Investigation was conducted concurrent with drilling for a Geotechnical investigation on September 20 - 23, 2022, and consisted of six (6) boreholes, BH101 to BH106, advanced to depths of 6.55m to 32.33m (corresponding elevations from 81.12m to 55.45m asl). Monitoring wells were installed in five (5) of the boreholes for groundwater level monitoring, sampling and testing purposes. The wells were constructed with 3.05m (10') long, 51mm diameter PVC slotted screen pipes, with the base at approximate depths as shown in the logs of boreholes at Appendix B. A clean silica sand pack was placed around each well screen which was isolated with bentonite extending to slightly below existing grade. Two (2) shallow test wells were installed for infiltration testing.

Boreholes were advanced using solid stem augurs or mud rotary and the subsurface strata sampled at regular intervals using a split-spoon sampler following the procedure as detailed in ASTM Standard specification D1586 for Standard Penetration Test. Field tests to determine the engineering parameters of the soil were carried out during drilling, which included Standard Penetration Tests (SPT). Approximate locations of the boreholes are shown on the Borehole Location Plan in Appendix A.

Laboratory Analyses

Seven (7) representative soil samples from BH1, BH2 and BH3 were selected and submitted to Fisher Environmental laboratory for moisture content analyses during the initial geotechnical investigation. Six (6) samples from BH102, BH103 and BH104 were submitted for grain size, moisture and hydrometer analyses. The laboratory samples were tested and classified in general accordance with the Unified Soil Classification System, ASTM D 2487, and Standard Practice for Classification of Soil for Engineering Purposes. Laboratory test results are presented in Appendix C.

The soil samples recovered during the investigation will be stored in the Fisher Engineering laboratory for 30 days after submitting the report and will be discarded thereafter unless instructed otherwise.

Site Survey

Elevations at borehole/monitoring well locations were established by interpolating from a topographic survey plan, by Annis, O'Sullivan, Vollebakk Ltd, dated November 10, 2021, which was provided to Fisher during the investigation.



5. SUBSOIL CONDITIONS

Surface and subsurface conditions encountered at borehole locations are shown in Appendix B - Log of Boreholes and are summarized in the following sections. The logs include stratification at borehole locations along with detailed soil descriptions. Variations in soil stratification may occur and should be expected between borehole locations and elsewhere on the site.

Fill/Topsoil – A layer of dark brown clayey silt / topsoil was encountered in BH1 and BH3 to depth of 0.61m and was underlain by brown to greyish brown silty clay fill to maximum depth of 1.22m bgs. The encountered fill layers were moist, except in BH2, where the upper 0.60m was wet. SPT 'N' values were generally from 1 to 4 blows per 300mm penetration in the upper section of organic fill/topsoil changing to 9 to 11 blows per 300mm penetration in the lower section consisting of clayey silt. Moisture content in the lower section ranged from 34 to 37%. Fill depths/elevations are presented in Table 1.

Silty Clay to Clay – Brown to grey silty clay to clay deposits were encountered in all boreholes below the fill / organic topsoil. Standard penetration test (SPT) was advanced to 6.55m bgs in these layers with SPT 'N' values ranging from 14 to 0 blows per 300mm penetration and generally 0 to 4 blows at 2.5m indicating a very soft to stiff consistency. Moisture content ranged from 43 to 73% from the samples obtained in the section.

Clay with Gravel – Grey, wet, soft clay with, layers of gravelly sand and pieces of rock, was encountered in BH101 below the soft clay, extending to approximate depth of 22.86m bgs.

Gravelly Sand – Grey, wet, very dense gravelly sand, with pieces of crushed rock, was encountered below the soft clay/depth of 27.43m in BH106 extending to approximate depth of 31.39m bg.

Crushed Rock Material – Grey, dry, crushed rock material with some clay/silt was encountered in BH101 and BH106 below the clayey gravelly sand extending to respective termination depths of 24.41m and 32.33m bgs. SPT 'N' values ranged from 26 to auger refusal at over 100 blows per 300mm indicating a very stiff to hard/very dense condition.

Bedrock – Refusal to auguring was encountered at depths of 24.41m and 32.33m in BH101 and BH106 respectively. Based on information available on the geological data for BH (ID 616330, drilled on the property across Trim Road) bedrock was encountered at depth of 39m.



Table 1: Fill depths and Elevations

Borehole No.	BH101	BH102	BH103	BH104	BH105	BH106	BH1	BH2	BH3
Surface Elevation (m asl)	87.84	87.67	87.94	87.96	87.90	87.78	87.90	88.00	87.85
Depth of Borehole (m)	8.08	8.08	8.08	14.18	13.72	8.08	18.29	25.30	24.99
Elevation at Bottom of Borehole (m asl)	79.76	79.59	79.86	73.78	74.18	79.70	69.61	62.70	62.86
Depth of Fill/topsoil (m)	n/a	1.07	0.91	0.91	0.69	n/a	1.22	1.07	1.22
Elevation at Bottom of Fill (m asl)		86.60	87.03	87.05	87.21		86.68	86.93	86.63

6. HYDROGEOLOGICAL STUDY

A hydrogeological study for the subject site was conducted based on the boreholes/wells' exploration, observation and site/laboratory testing. Groundwater details from the five (5) newly installed monitoring wells were used in the Hydrogeological Study. The wells were constructed generally with 3.05m (10') long, 51mm diameter PVC slotted screen pipes, with the bases at approximate depths below existing grade as shown in Appendix B. Clean silica sand packs were placed around each well screen which was isolated with bentonite extending to slightly below existing grade.

Boreholes were advanced using dry auguring with mud rotary used for deeper boreholes. Subsoils and groundwater conditions were observed and recorded during the field investigation. Standing water was observed at depths of 0.61m to 4.88m below prevailing grade in five of the open boreholes while two were dry on completion of drilling.

6.1 Hydrogeological Conditions

Review of the available surficial geological and hydrogeological information for the area shows that the soils comprise generally of Fine-textured glaciomarine deposits of silt and clay, minor sand and gravel: massive to well laminated (Ontario Geological Survey Map). Underlying bedrock is represented by limestone, dolostone, shale, arkose and sandstone of the Ottawa Group: Simcoe Group: and Shadow Lake Formation. Depth to bedrock in the area is generally more than 40m below grade. Surficial geology maps are presented in Appendix A.



The site subsoils and hydrogeological conditions were observed and recorded during both the geotechnical and hydrogeological investigations. Based on the boreholes/wells' exploration, the subsurface soils on the site were dominated by grey/brown silty clay underlain by clay with coarse sand/gravel and possibly rock at further depths.

All monitoring wells were purged/developed and allowed to fully recover prior to carrying out groundwater level measurements and sampling. Measured groundwater depths and elevations are summarized in Table 2.

Table 2: Groundwater Depths and Elevations

Monitoring Well No.		BH(MW)101	BH(MW)102	BH103	BH(MW)104	BH(MW)105	BH(MW)106	BH1	BH2	BH3
Surface Elevation (m asl)		87.84	87.67	87.94	87.96	87.90	87.78	87.90	88.00	87.85
Depth of Well, m bgs		6.10	6.10	n/a	6.10	6.10	6.10	n/a	n/a	n/a
Elevation at well base, m asl		81.74	81.57		81.86	81.80	81.68			
Depth of BH, m bgs		24.41	6.55	6.55	6.55	6.55	32.33	18.29	25.30	24.99
Elevation at borehole base, m asl		63.43	81.12	81.39	81.41	81.35	55.45	69.61	62.70	62.86
In open borehole on Completion	GW level, m bgs	n/a - mud rotary	Dry	3.55	4.88	Dry	n/a - mud rotary	5.49	1.52	0.61
	GW Ele, m asl			84.39	83.08			82.41	86.48	87.24
6-Oct-22	GW level, m bgs	1.92	1.74	n/a	2.07	2.09	2.36	n/a	n/a	n/a
	GW Ele, m asl	85.92	85.93		85.89	85.81	85.42			

Comments on Table 2:

The following general comments regarding groundwater conditions at the site are based on the groundwater level data and the geotechnical investigation:

- Standing water was observed at depths of 0.61m to 4.88m below prevailing grade in open boreholes BH1 to BH3, BH103 and BH104. Boreholes BH102 and BH105 were dry on completion of drilling. Boreholes BH101 and BH106 were drilled using mud rotary and consequently groundwater conditions on completion of drilling could not be ascertained.



- Static groundwater levels were measured at 1.74m to 2.36m bgs (elevation from 85.42m to 85.93m asl) in the shallow monitoring wells (well base from 81.57m to 84.91m asl).
- Groundwater flow is towards southeast with an approximate gradient of 1.95%.
- The nearest body of surface water is the Cardinal Creek located approximately 1.1km east of the site.
- The site is located in a developed residential neighborhood, with water supply via municipal water system. Some older supply wells are shown on the Ministry's well records portal, but these may have been decommissioned and not reported.

6.2 Hydraulic Conductivity K Modeling Results

Rising Head Slug Tests

Rising head slug tests (SWRT) were carried out in monitoring wells, MW101, MW104 and MW106, on October 6, 2022. The water bearing media consisted mainly of clayey silt/silty clay to clay at various depths, and were assumed to be unconfined, homogenous, isotropic and of uniform thickness. It was also assumed that the wells fully penetrated the water bearing soils. Data from the rising head tests were used to calculate the hydraulic conductivity values using Luthin's method.

Calculated values for hydraulic conductivity (k) are summarized in Table 3 and are generally representative of the water bearing soils consisting of clayey/silty soils within the screened depths and also varied with occasional interbedded wet seams. Details of the hydraulic conductivity analyses are presented in Appendix C.

Table 3: Summary of Single Well Response Tests and Hydraulic Conductivity Results

Test Wells	Well Surface Elevation (m asl)	Groundwater Depth (m)	Screen Elevation (m asl)	Variance of water head created (m)	30 Minutes/ Recovery Percentage	Hydraulic Conductivity, K (Luthin's Method)	
						m/s	m/day
MW101	87.84	2.68	81.74 – 84.79	2.430	31 min / 16%	6.5×10^{-7}	0.052
MW104	87.96	2.82	81.86 – 84.91	2.763	31 min / 15%	4.54×10^{-7}	0.039
MW106	87.78	2.59	81.68 – 84.73	3.141	31 min / 2%	4.54×10^{-8}	0.004



6.3 Grain Size Analysis for Hydraulic Conductivity K

Representative soil samples from BH1, BH4, BH5 and BH8 were selected from depths associated with typical conventional footing locations or change in soil stratigraphy and submitted to the laboratory for grain size distribution and hydrometer analyses. Coefficient of permeability, k in cm/sec and corresponding percolation T , in mins/cm were estimated from Table 3 of the Supplementary Guidelines to the Ontario Building Code 1997. The results of the grain size distribution and hydrometer analyses are presented in Appendix C and summarized in Table 4.

Table 4: Hydraulic Conductivity Estimated from Grain Size Analysis

Location	Depth of soil sample (m)	Soil Classification	Estimated Coefficient of Permeability cm/sec	Percolation Rate, T – mins/cm
BH2	1.53 – 1.98	Silty Clay (CL)	10^{-6} or less	Over 50
BH3	1.53 – 1.98	Silty Clay, trace Sand (ML)	$10^{-5} - 10^{-6}$	20 - 50
BH4	0.76 – 1.22	Silty Clay, trace Sand (ML)	$10^{-5} - 10^{-6}$	20 - 50
TH1	1.53 – 1.98	Silty Clay (CL)	10^{-6} or less	Over 50
TH2	1.53 – 1.98	Silty Clay (CL)	10^{-6} or less	Over 50

7. CONSTRUCTION DEWATERING & PERMANENT DRAINAGE

7.1 Construction Dewatering

The proposed development will consist of a three-storey self-storage building with no underground level. Finished floor elevation is 87.75m asl. Deep foundations are proposed however conventional footings for slab on grade, or grade beam typically used with deep foundations, would be expected at approximately 1.5m below prevailing grade for frost protection. Gross floor area for the ground floor level is approximately 5,666m².

Based on the geotechnical investigation, conventional spread/strip footings or grade beams for deep foundations, if used, would generally be 1.5m below ground floor at an average elevation of 86.25m asl. Groundwater elevations vary between 85.42m and 85.93m asl. This means that the footings/grade beams would be slightly above the groundwater levels observed in the monitoring wells. Groundwater levels should therefore be lowered generally to 1m below the designed footing depths to protect footing



subgrade from hydraulic pressure disturbance during construction. The highest observed groundwater elevation (85.93m asl) was used to estimate construction groundwater dewatering rate. An average hydraulic conductivity value of $3.68 \times 10^{-7} \text{m/s}$, obtained from rising head slug tests in three shallow monitoring wells (MW101, MW104 & MW106) was used to estimate groundwater discharge rates.

Based on the calculations, shown in Appendix F, a construction groundwater dewatering flowrate of **4.52 m³/day (4,520 L/day)** was obtained for an average conventional footing/grade beam elevation of 86.25m asl with an excavation area of 5,666m². Factored construction groundwater dewatering flowrate of **6.78 m³/day (6,780 L/day)** is applicable with the given footing elevation (**FS of 1.5**).

Seasonal High Groundwater Levels

Groundwater levels were measured during the month of October. The highest groundwater level observed in the shallow monitoring wells was used to estimate construction dewatering. The highest groundwater level was increased by 0.5m and used to estimate permanent drainage rate.

Accounting for Accumulated Precipitation

Provisions should be made to pump accumulated water from the excavation areas during construction, particularly following a period of heavy rainfall. For example, 25mm rainfall in 24 hrs may result in accumulation of up to 141.65m³ in the excavated area. Subsurface soils at the expected excavation depth are dominated by silty clay to clay. Consequently, some ponding of rainwater may be expected. A conservative accumulated volume of **50 m³/day** may therefore be assumed for planning purposes. Accumulated precipitation may be stored on site for subsequent disposal to an MECP-licensed facility. If the water is to be discharged into the public sewer system, then an application for the discharge of private water will have to be made to City of Ottawa. The water quality, at the time of the application, will need to be ascertained to ensure compliance with the Ontario Ottawa Sanitary and Storm Sewer By-Law No. 2003-514 (2003).

*Maximum construction discharge rates, taking into consideration accumulated precipitation volumes, are **54,520 L/day (unfactored)** and **56,780 L/day (factored)**.*

7.2 Permanent Drainage

For the building with no underground level, FFE is 87.75m asl. The highest observed groundwater elevation is 85.93m observed during October. In the absence of long-term groundwater level monitoring the highest observed groundwater level was increased by 1.0m to 86.93m in order to estimate the



requirements for permanent drainage. Under these conditions, permanent drainage will still not be required for the building with no underground level.

It should be noted however perimeter and under-slab drainage should be provided for any subsurface portion of the building, such as below grade loading docks and elevator shafts, which are within 1m of the highest observed groundwater level. A nominal groundwater discharge rate of $2\text{m}^3/\text{day}$ should be used for planning purposes.

An application for permission to discharge to the municipal sewer system may be required unless any subsurface structure of the building is designed as watertight or onsite disposal facilities are utilized.

7.3 Permit to Take Water (PTTW)

As the calculated total construction dewatering flowrate for the building, including accumulated precipitation, is less than $50\text{m}^3/\text{day}$, registration on the MECP Environmental Activity and Sector Registry (EASR) for Water Taking will not be required for construction. An application for permission to take water (PTTW) will not be required for neither construction dewatering nor permanent drainage as the daily flowrates are less than 400,000 L/day and 50,000 L/day respectively.

7.4 Groundwater Quality

One groundwater sample was collected from monitoring well MW5 and submitted to ALS laboratory for analyses of parameters under the Ontario Ottawa Sanitary and Storm Sewer By-Law No. 2003-514 (2003). The results of analyses for groundwater quality under the Ontario Ottawa Sanitary Sewer Bylaw and Storm Sewer By-Law No. 2003-514 (2003) show compliance with all parameters except as listed in Table 5.

Table 5: Results from Sewer Use Bylaw tests

Parameters	Guide Limits		Results
	Table 1 (Sanitary Sewer)	Table 2 (Storm Sewer)	MW4
Manganese (Mn)- Total mg/L	5	0.05	0.0959

Based on the results, presented in Table 5, pre-treatment of the groundwater will be required prior to discharging to the storm sewer system. The groundwater, in its present form, may be discharged to the sanitary sewer system without treatment.



It should be noted however that testing of groundwater at the depths observed during the investigation would not be representative of the water that might accumulate during a high rainfall event. Any accumulation of precipitation occurring in the excavation during construction, that may require offsite discharge, will have to be tested at the time of the event to determine the quality of water for discharge.

7.5 Dewatering Influence Zone

The soils to the proposed excavation depths are dominated by clayey silt to silty clay. The estimated construction groundwater dewatering rate is based on worst-case groundwater conditions that might occur during the construction period. Estimated dewatering influence zones are less than 0.83m from the edge of the excavation area. As the dewatering quantity is relatively small and, based on the type of soils, construction dewatering may be handled by pumping from sump pits. Consequently, the dewatering influence zone will be negligible.

7.6 Hydrogeological Impact

Based on the estimated dewatering influence zone of less than 1m it was determined that there will not be any negative impact to the natural environment, City of Ottawa Sewer works nor surrounding properties due to construction dewatering because of the relatively small quantity of water, type of soils and depths at which groundwater was encountered. No groundwater induced depression at surface level is expected. Consequently, it is not expected that construction dewatering will impact public infrastructure, the natural environment nor will there be any settlement issues.

7.7 Private Well Survey

A query of the MECC water well records showed that there are approximately 33 well records within an approximate radius of 500m of the site as shown in Appendix H. Three (3) of these were listed as supply wells. The wells were installed mainly during the 1960's. Well depths vary from approximately 20.7m to 43.3m below prevailing grade. Static water levels were observed at depths of 5.8m to 20.7m with pump intake set at 7.6 to 12.2m bgs.

It is expected that newer developments in the area would be serviced by municipal water supply and that domestic water supply wells will not be widely used.

The type of material encountered at the expected excavation depths, below the surficial soils, are mainly clayey silt to clay/silty clay. Conventional pumping methods, pumping from sump pits is recommended



for the building with no underground levels. It is therefore not expected that construction dewatering will impact the quality and quantity of supply wells, if any, in proximity to the site.

8. INFILTRATION TESTS

Based on the field observation, the soils at the infiltration depth may be described as C.L (Inorganic clays of low to medium plasticity, silty clayey). For TH1 and TH2, grey, moist, soft silty clay was observed to depths of 1.98m below prevailing grade. This is consistent across the site, based on the subsurface investigation, and is underlain generally by grey, moist to wet, very soft clay. Coefficient of Permeability K values for C.L soils, based on the 'Supplementary Guidelines to the Ontario Building Code 1997, SB-6 Percolation Time and Soil Description', are approximately 10^{-6} cm/s and less with Percolation Time T of over 50 mins/cm.

Field percolation tests were conducted on the site on October 6, 2022. Two test boreholes were drilled to approximate depth of 1.98m bgs and 100mm diameter pipes installed with slotted screen from the base of the test holes to five feet from the bottom. Well sand was placed at the bottom of the test holes to prevent scouring when water was poured.

Initial tests showed that an average of 1.1cm and 1.25cm of water seeped away in TH1 and TH2 respectively in 25 minutes. Pre-soaking of the soil was therefore carried out overnight (approximately 19 hours) and falling-head tests conducted on October 7, 2022. During pre-soaking, water levels fell approximately 34mm and 37mm over the 19-hour period in TH1 and TH2 respectively. Fresh potable water was added to the test holes and the fall in water levels monitored until the water level drop rates appeared to have stabilized.

Using the last three observed stable successive intervals, the percolation rate (Time T) was calculated as 50 min/cm and 33.33 min/cm in TH1 and TH2 respectively with corresponding infiltration rates, calculated as $1/T$, of 1.2 cm/h and 1.8 cm/h. Factored infiltration rate of 8 and 12 mm/h (FS of 1.5) should be used for planning purposes.

Based on a minimum percolation design criterion of 4.17×10^{-4} cm/sec (15 mm/h) as recommended by the Ontario MOE Stormwater Management Planning and Design Manual 2003 for infiltration trenches, it is not expected that the subject site would be suitable for the construction of infiltration facilities in the area of TH1 within the tested depth.



9. DISCUSSION/RECOMMENDATIONS

1. Hydraulic conductivity values (k) calculated from on-site single well response tests are in the range 4.54×10^{-8} to 6.05×10^{-7} m/s (0.004 to 0.052m/day) in the shallow monitoring wells. These are representative of the saturated subsoils dominated by silty clay to clay within the screened interval.
2. An average construction dewatering flowrate of 4.52 m³/day was estimated for approximate conventional footing elevation of 86.25m asl. A factor of safety of 1.5 should be applied to the construction dewatering rate.
3. Permanent drainage will not generally be required for the building with no underground level. It should be noted however that any below grade structure within 1m of the highwater level should be constructed with perimeter and under slab drainage unless designed as watertight.
4. Neither registration on the MECP's EASR Website for water taking nor an application for PTTW will be required under conditions observed on the site.
5. Based on the subsurface investigation, rising head slug tests and analyses and types of soils at the expected excavation depth, the groundwater discharge rate is not considered to be significant and may be handled by conventional pumping method via sump pits during construction.
6. The groundwater quality determined by laboratory analyses revealed exceedance(s) of storm guide limits and consequently pre-treatment of the water will be required before it can be discharged to the public storm sewer system.
7. It should be noted that if it is intended that any accumulated water, following periods of heavy rainfall, be discharged into the public sewer, then a permit to discharge would be required along with laboratory analyses to ensure compliance with the City of Ottawa Sewer Use Bylaws.
8. It is not expected that construction will impact the quality or quantity of supply wells, if any, in proximity to the site.
9. Based on field infiltration tests, infiltration-based LID measures may not be suitable for the site.
10. Dewatering rates for construction dewatering and permanent drainage presented in the preceding are based on common practice and reasonable assumptions for the underground level grade and are subject to revision should the subsurface portion of the building design changes.



10.LIMITATIONS

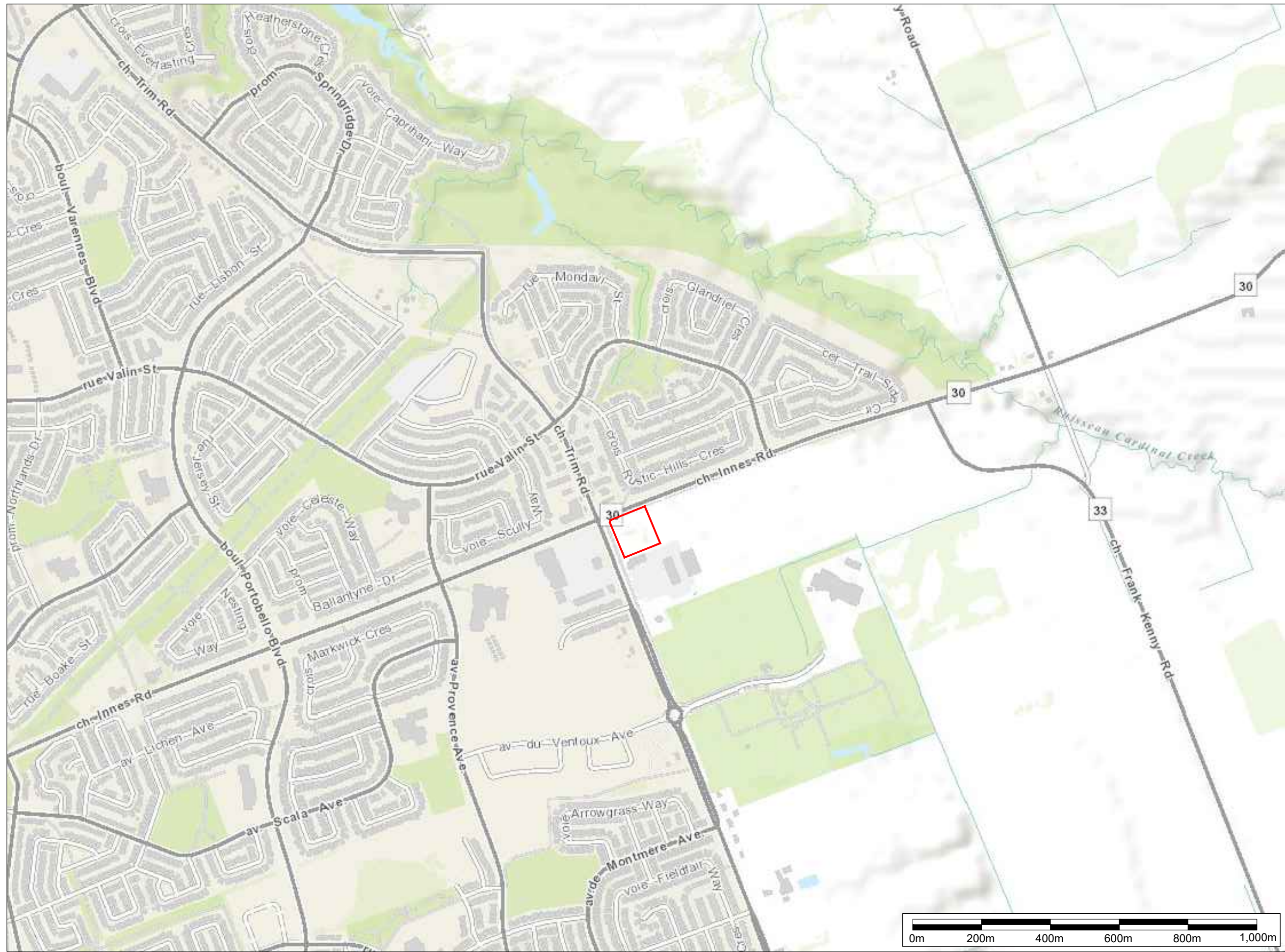
This report is limited in scope to those items specifically referenced in the text. The discussions and recommendations presented in this report are intended only as guidance for the named client, design engineers and those directly associated with implementing, regulating and monitoring of the project. The information on which these recommendations are based is subject to confirmation by engineering personnel at the time of construction. Localized variations in the subsoil conditions may be present between and beyond the boreholes and should be verified during construction.

As more specific subsurface information becomes available during excavations on the Site, this report should be updated. Contractors bidding on or undertaking the work should decide on their own investigations, as well as their own interpretations of the factual borehole results. This concern specifically applies to the classification of the subsurface soil and the potential reuse of these soils on/off Site. Contractors should draw their own conclusions as to how the near surface and subsurface conditions may affect them.



APPENDIX A – SITE AND LOCATION MAPS AND PLANS

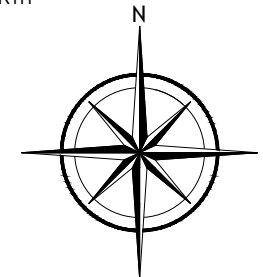




400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718

NORTH



LEGEND

— SITE BOUNDARY

PROJECT NAME AND ADDRESS

**GEOTECHNICAL &
HYDROGEOLOGICAL
INVESTIGATIONS**

5210 Innes Road,
Ottawa, ON

FIGURE A1:

SITE LOCATION PLAN

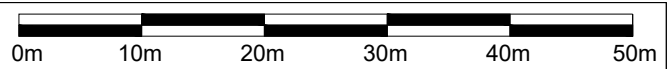
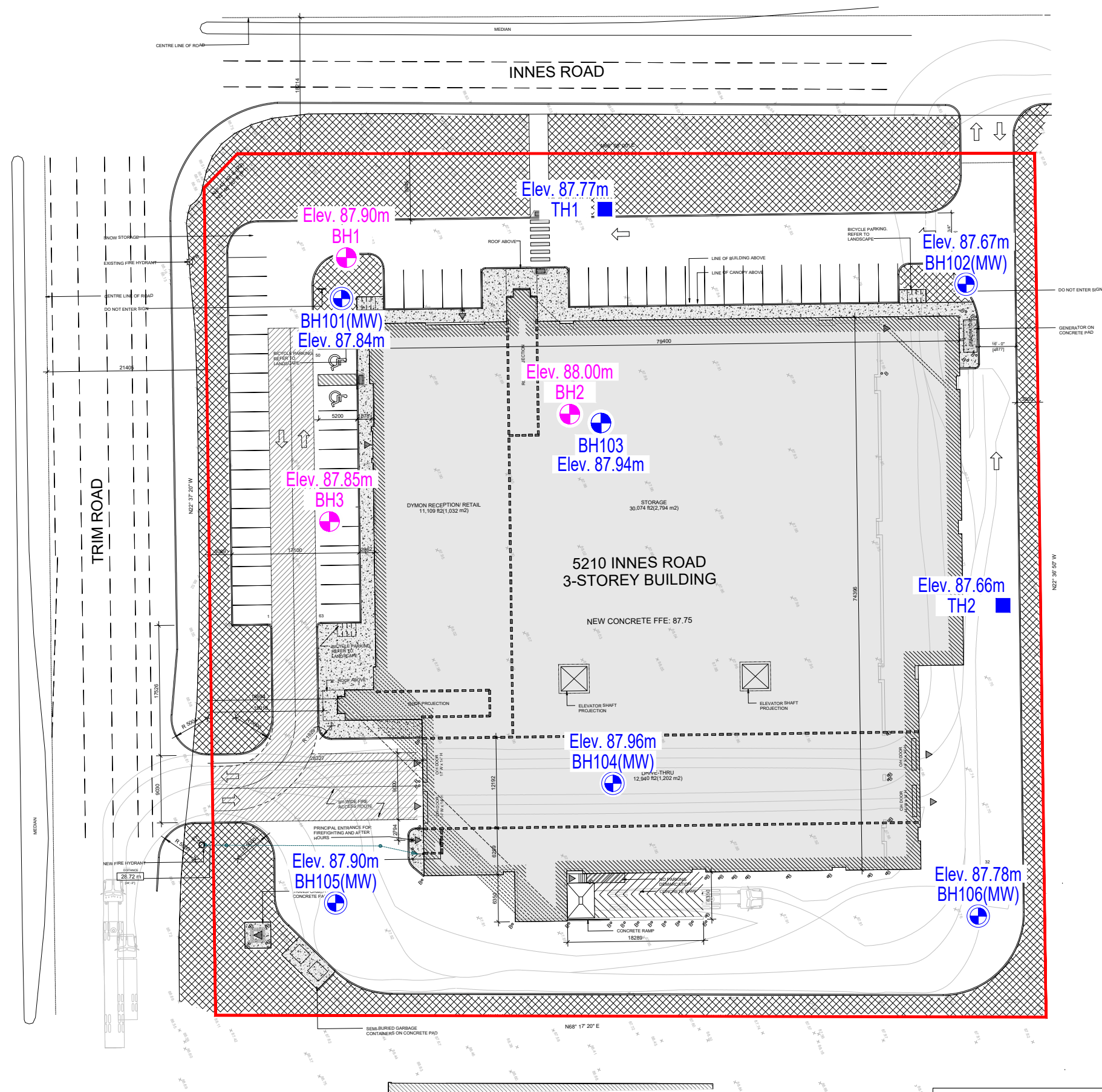
PROJECT NO.
FE-P 22-12469/70

DATE
6 October 2022

SCALE
AS SHOWN

SHEET NO.

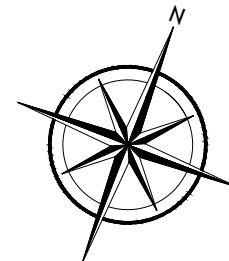
A1



400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718

NORTH



LEGEND

- SITE BOUNDARY
- EXISTING BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION
- TEST HOLE LOCATION

PROJECT NAME AND ADDRESS

GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

5210 Innes Road,
Ottawa, ON

FIGURE A2:

SITE PLAN WITH BOREHOLES / MONITORING WELL AND TEST HOLE LOCATIONS

PROJECT NO.

FE-P 22-12469/70

DATE

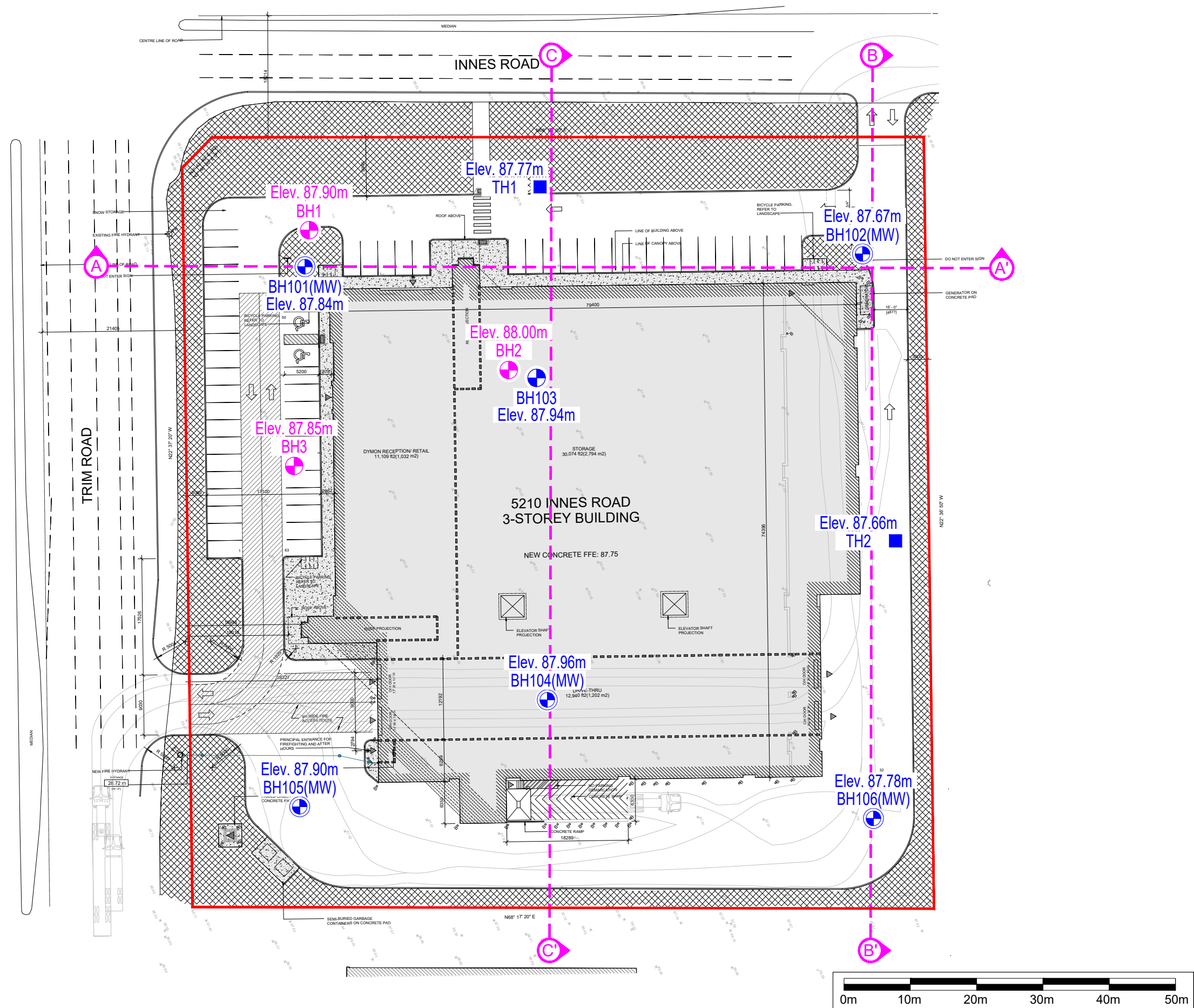
6 October 2022

SCALE

AS SHOWN

SHEET NO.

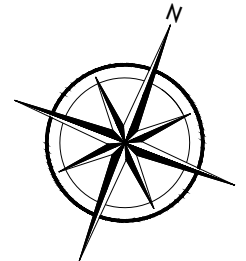
A2



400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718

NORTH



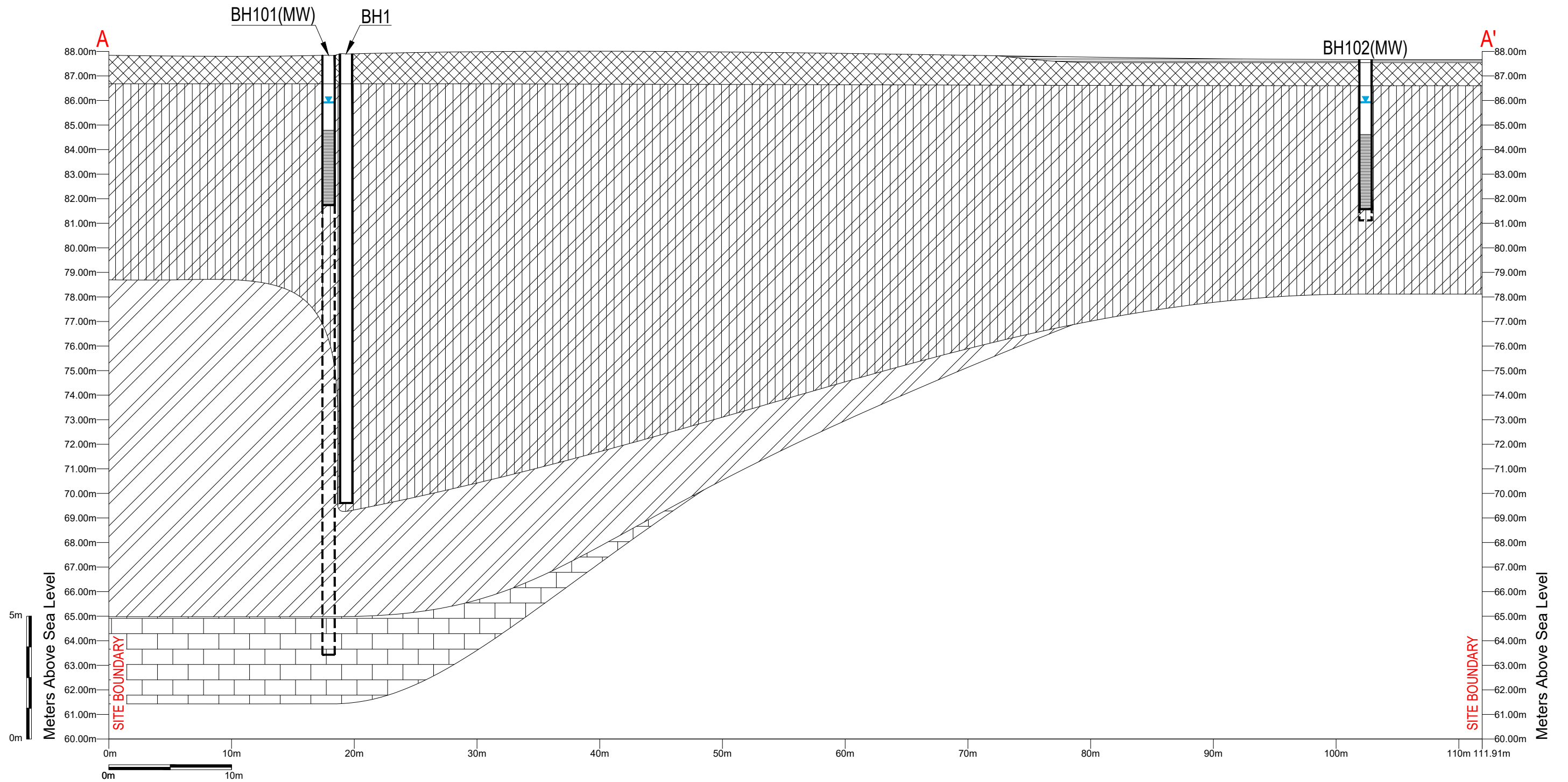
LEGEND

- SITE BOUNDARY
- EXISTING BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION
- TEST HOLE LOCATION
- A-A CROSS SECTION MARK

PROJECT NAME AND ADDRESS
**GEOTECHNICAL &
HYDROGEOLOGICAL
INVESTIGATIONS**
5210 Innes Road,
Ottawa, ON

FIGURE A3:
**SITE PLAN WITH BOREHOLES /
MONITORING WELL AND
TEST HOLE LOCATIONS**

PROJECT NO. FE-P 22-12469/70	SHEET NO. A3
DATE 6 October 2022	
SCALE AS SHOWN	





400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718

NORTH



LEGEND

	TOPSOIL		GROUNDWATER POTENTIOMETRIC LEVEL
	FILL		
	SILT		
	CLAY		
	CRUSHED ROCK		

PROJECT NAME AND ADDRESS

GEOTECHNICAL &
HYDROGEOLOGICAL
INVESTIGATIONS

5210 Innes Road,
Ottawa, ON

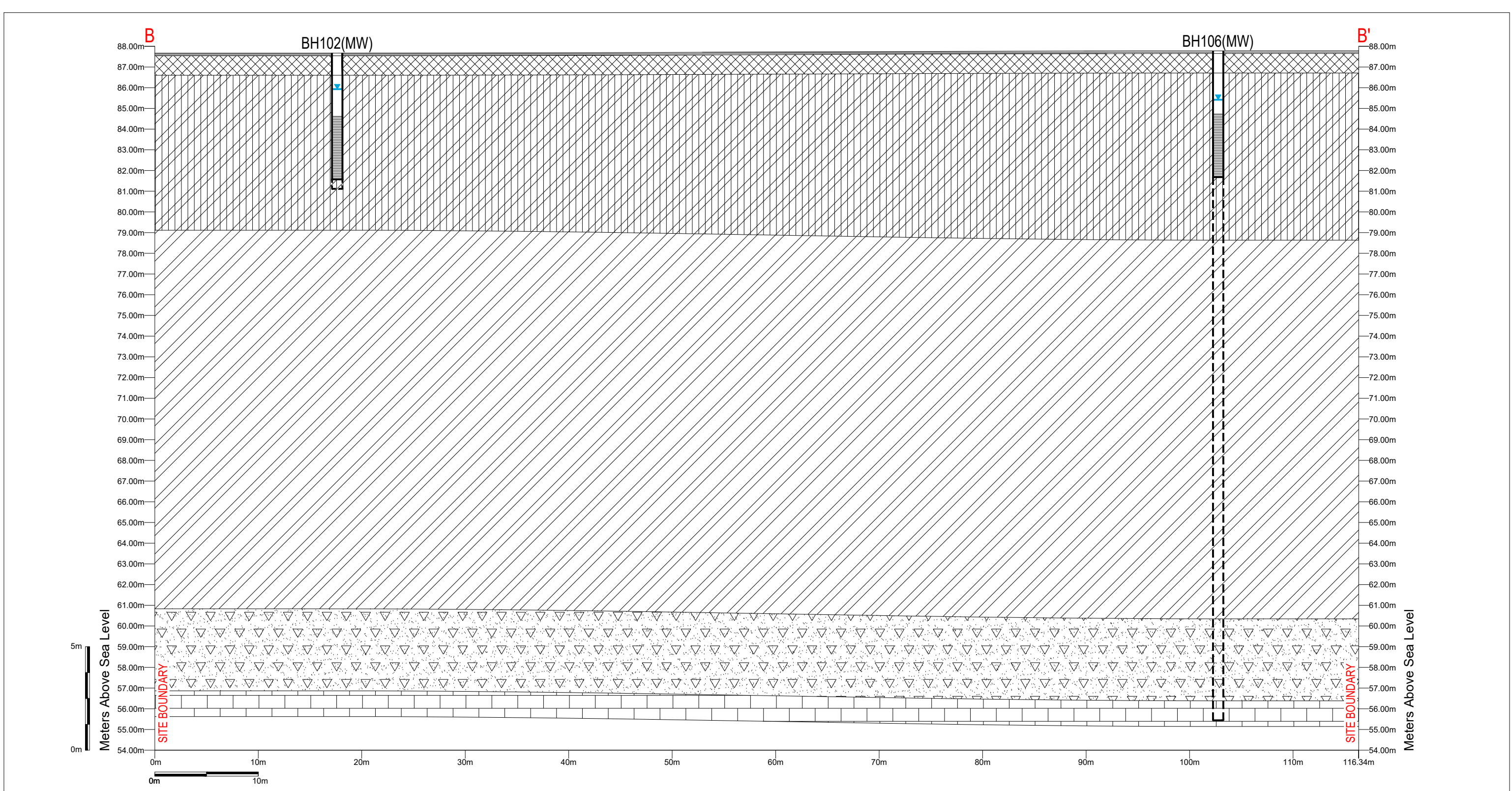
PROJECT NO. FE-P 22-12469/70
DATE. 6 October 2022
SCALE. AS SHOWN

FIGURE A4.1:

CROSS-SECTION A - A';

SHEET NO.

A4.1





400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718

NORTH

LEGEND



TOPSOIL



SAND



CLAY



CRUSHED ROCK



GROUNDWATER POTENTIOMETRIC LEVEL



TOPSOIL



SILT



GRAVEL

PROJECT NAME AND ADDRESS

GEOTECHNICAL &
HYDROGEOLOGICAL
INVESTIGATIONS

5210 Innes Road,
Ottawa, ON

PROJECT NO.
FE-P 22-12469/70

DATE.
6 October 2022

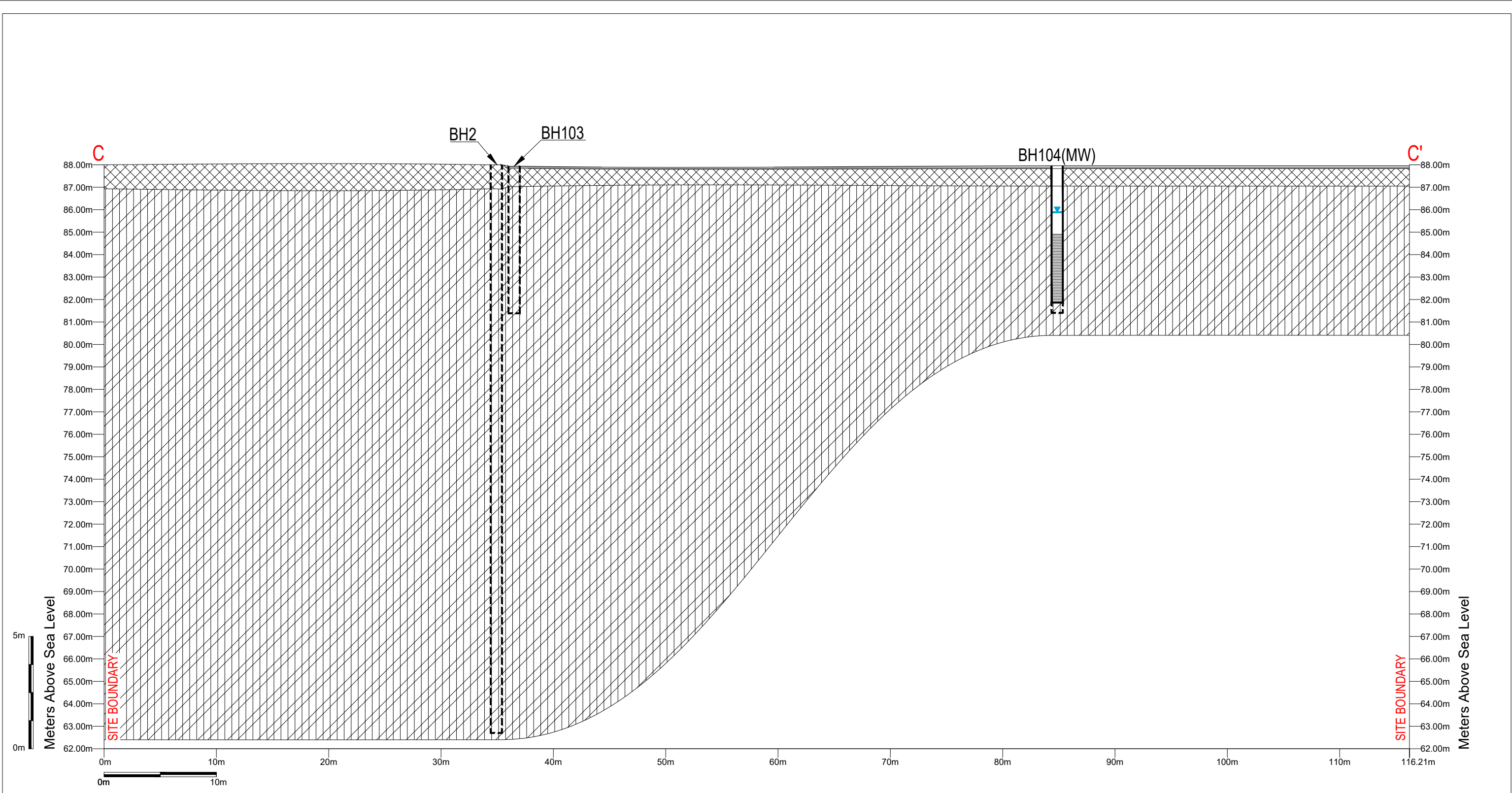
SCALE.
AS SHOWN

FIGURE A4.2:

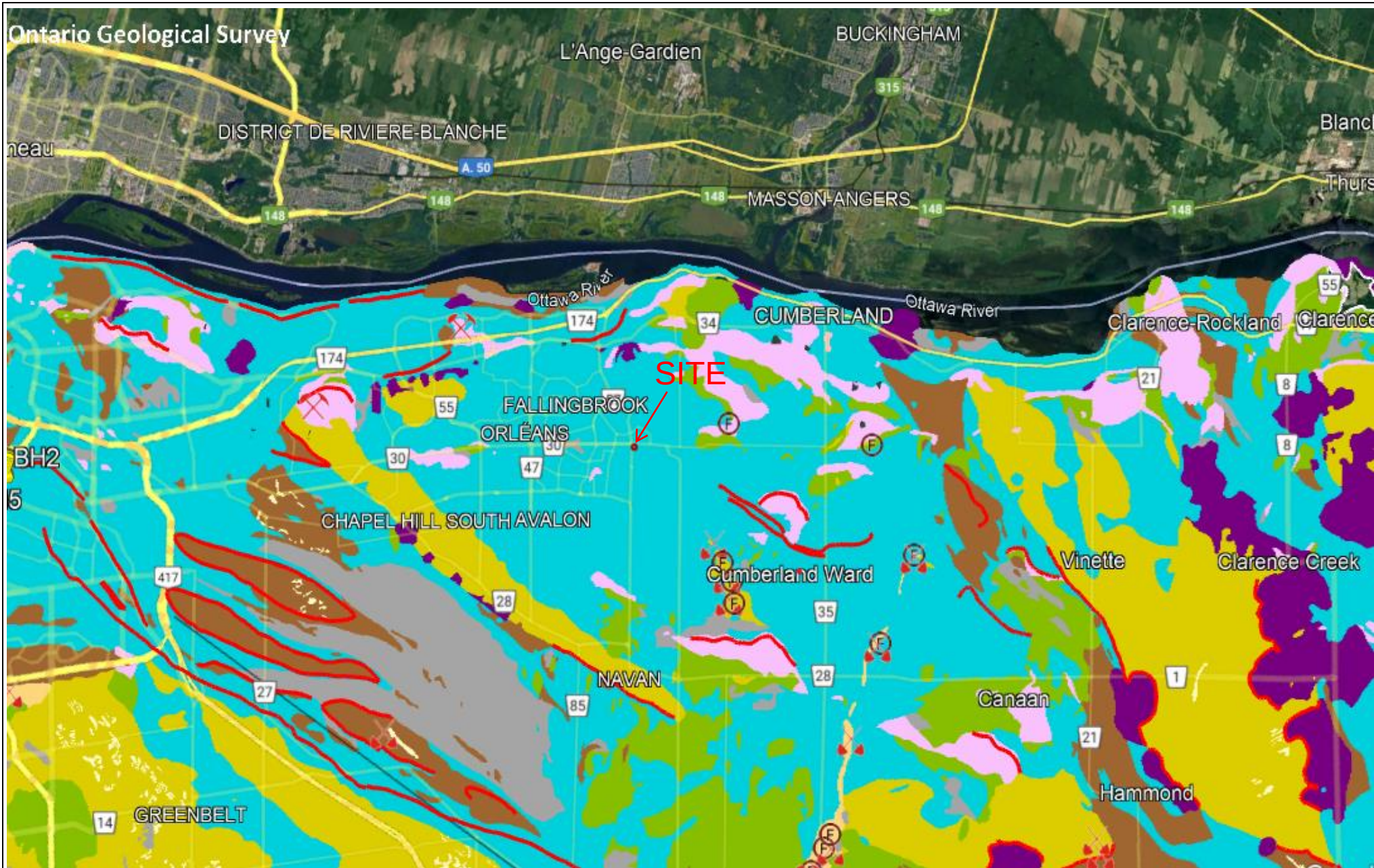
CROSS-SECTION B - B';

SHEET NO.

A4.2



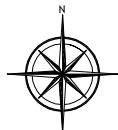
 400 Esna Park Dr., #15 Markham, Ontario L3R 3K2 Tel: 905 475-7755 Fax: 905 475-7718	NORTH	LEGEND <table><tr><td></td><td>TOPSOIL</td></tr><tr><td></td><td>FILL</td></tr><tr><td></td><td>SILT</td></tr><tr><td></td><td>CLAY</td></tr></table>  GROUNDWATER POTENTIOMETRIC LEVEL		TOPSOIL		FILL		SILT		CLAY	PROJECT NAME AND ADDRESS GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS 5210 Innes Road, Ottawa, ON	<table><tr><td>PROJECT NO. FE-P 22-12469/70</td></tr><tr><td>DATE. 6 October 2022</td></tr><tr><td>SCALE. AS SHOWN</td></tr></table>	PROJECT NO. FE-P 22-12469/70	DATE. 6 October 2022	SCALE. AS SHOWN	FIGURE A4.3: CROSS-SECTION C - C';	SHEET NO. A4.3
	TOPSOIL																
	FILL																
	SILT																
	CLAY																
PROJECT NO. FE-P 22-12469/70																	
DATE. 6 October 2022																	
SCALE. AS SHOWN																	



400 Esna Park Dr., #15
Markham, Ontario
L3R 3K2

Tel: 905 475-7755
Fax: 905 475-7718

KEY PLAN



LEGEND Fine-texture glaciomarine deposits of silt and clay,
minor sand and gravel: Massive to well laminated.



PROJECT NAME AND ADDRESS
HYDROGEOLOGICAL
INVESTIGATION
743 Warden Avenue,
TORONTO, ON

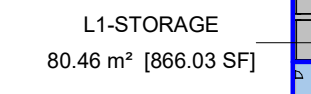
FE-P22-12484
PROJECT NO.

DATE
OCTOBER 2022

SCALE
As shown

FIGURE: A5

Surficial
Geology Map.



GROSS AREA	
SM	SF
17003.09 m ²	183019.71 ft ²

DCA

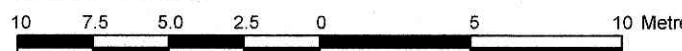
A GROUP OF ARCHITECTS
201-1339 WELLINGTON ST. W OTTAWA ON K1Y 3B8
WWW.ARCHITECTSDCA.COM 613.725.2294

TOPOGRAPHICAL PLAN OF

**PART OF LOT 1
CONCESSION 8
GEOGRAPHIC TOWNSHIP OF CUMBERLAND
CITY OF OTTAWA**

Surveyed by Annis, O'Sullivan, Vollebakk Ltd.

Scale 1 : 250



Metric

DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND
CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

Nov. 10, 2021
Date

E.H. Herweyer O.L.S.

SITE AREA = 12992 m²

Bearings are grid, derived from Can-Net 2018 Real Time Network GPS and
are referenced to Specified Control Points 01919880184 and
019198434761, MTM Zone 9 (76°30' West Longitude) NAD-83 (original).

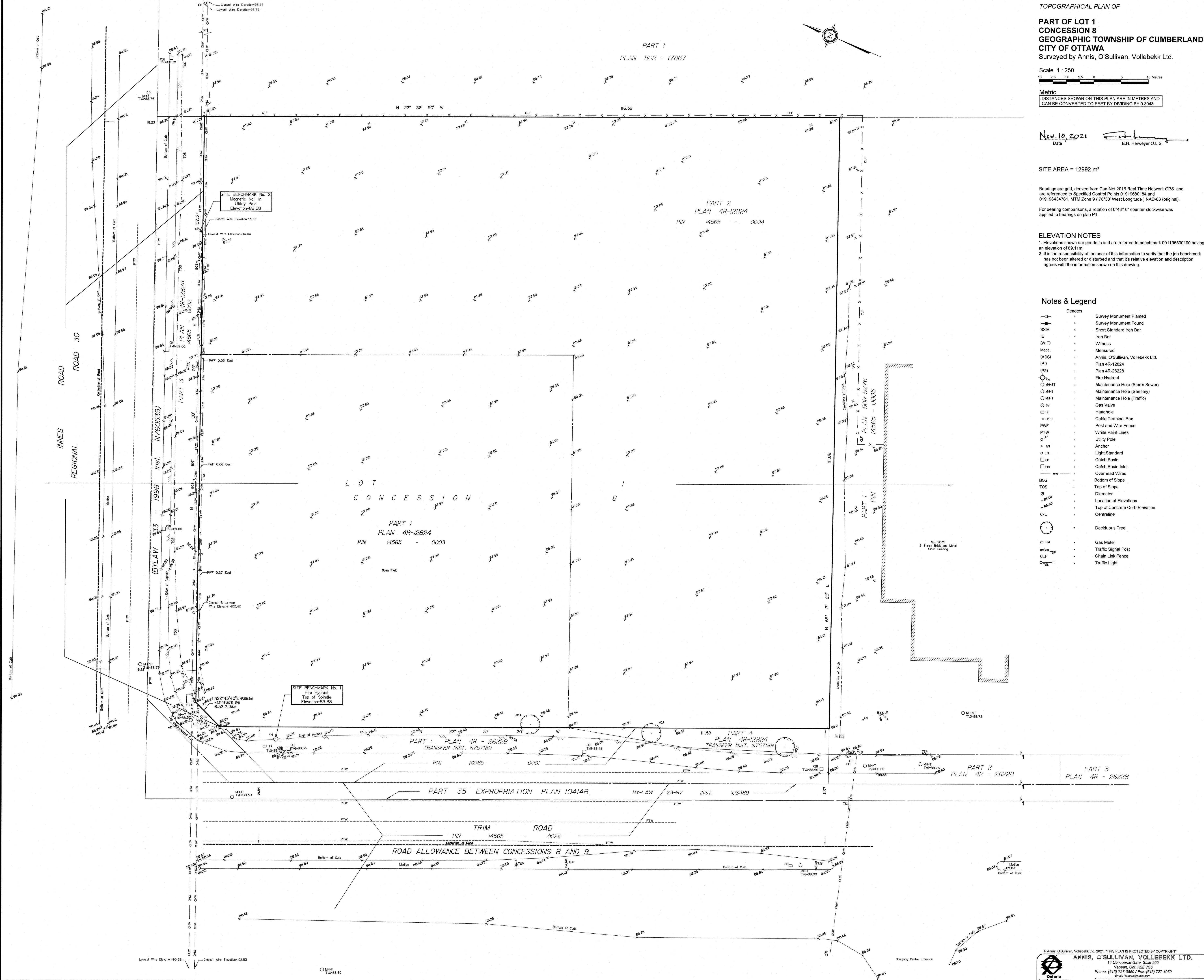
For bearing comparisons, a rotation of 0°43'10" counter-clockwise was
applied to bearings on plan P1.

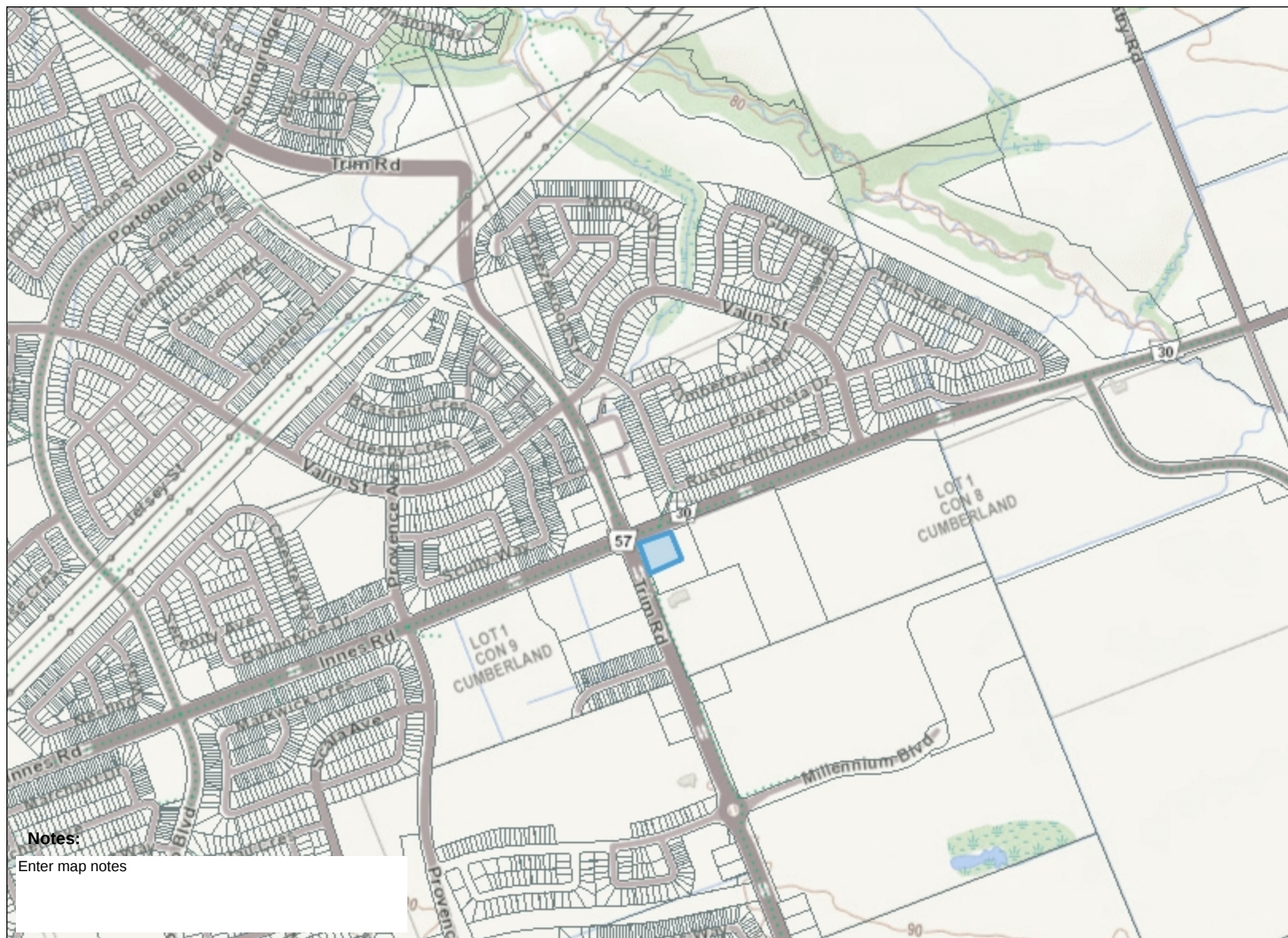
ELEVATION NOTES

- Elevations shown are geodetic and are referred to benchmark 001196530180 having
an elevation of 89.11m.
- It is the responsibility of the user of this information to verify that the job benchmark
has not been altered or disturbed and that it's relative elevation and description
agrees with the information shown on this drawing.

Notes & Legend

Denotes	
—□—	Survey Monument Planted
—■—	Survey Monument Found
SSIB	Short Standard Iron Bar
IB	Iron Bar
(WIT)	Witness
Meos.	Measured
(AOG)	Annis, O'Sullivan, Vollebakk Ltd.
(P1)	Plan 4R-12824
(P2)	Plan 4R-26228
○ FH	Fire Hydrant
○ MH-ST	Maintenance Hole (Storm Sewer)
○ MH-S	Maintenance Hole (Sanitary)
○ MH-T	Maintenance Hole (Traffic)
○ GV	Gas Valve
□ H	Handhole
□ TB-C	Cable Terminal Box
PWF	Post and Wire Fence
PTW	White Paint Lines
○ UP	Utility Pole
• AN	Anchor
○ LS	Light Standard
□ CB	Catch Basin
□ CBI	Catch Basin Inlet
— OW —	Overhead Wires
BOS	Bottom of Slope
TOS	Top of Slope
○ 45.00	Diameter
• 85.00	Location of Elevations
• 85.00	Top of Concrete Curb Elevation
C/L	Centreline
○	Deciduous Tree
□ GM	Gas Meter
○ TSP	Traffic Signal Post
CLF	Chain Link Fence
○ TSL	Traffic Light





Notes:

Enter map notes

0.6 0 0.32 0.6 Kilometres

Absence of a feature in the map does not mean they do not exist in this area.

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Natural Resources and Forestry (OMNRF) shall not be liable in any way for the use of, or reliance upon, this map or any information on this map.

© Copyright for Ontario Parcel data is held by King's Printer for Ontario and its licensors and may not be reproduced without permission. THIS IS NOT A PLAN OF SURVEY.



Imagery Copyright Notices: DRAPE © Aéro-Photo (1961) Inc., 2008 - 2009
GTA 2005 / SWOOP 2006 / Simcoe-Muskoka-Dufferin © FirstBase Solutions, 2005 / 2006 / 2008
© King's Printer for Ontario, 2022

Legend

- Assessment Parcel
- ANSI
- Earth Science Provincially Significant/sciences de la terre d'importance provinciale
- Earth Science Regionally Significant/sciences de la terre d'importance régionale
- Life Science Provincially Significant/sciences de la vie d'importance provinciale
- Life Science Regionally Significant/sciences de la vie d'importance régionale
- Conservation Reserve
- Provincial Park
- Natural Heritage System



APPENDIX B – LOG OF BOREHOLES



PROJECT NAME: GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

LOCATION: 5210 Innes Road, Ottawa, ON

DRILLING METHOD: Truck, Mud Rotary

DRILLING DATE: 21 September, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	SHEAR STRENGTH (Kpa) ➡				MOISTURE CONTENT (%) ●					
							20	40	60	80	10	20	30	40		
0	Augered to 9.14m		87.84												2" blank PVC 2" Slotted Pipe 6.10m bgs 1.92m Concrete Bentonite Pellets Silica Sand	
2																
4																
6																
8																
10																
12																
14																
16																
18																
20																
22																
24																
26																
28																
30																
32																
34																
9	CLAY: Grey, wet, very soft		9.14 78.70													
				SS-1	0											

Groundwater Depth (m): on completion: N/A, Mud Rotary, on 6 October 2022: 1.92m

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

LOCATION: 5210 Innes Road, Ottawa, ON

DRILLING METHOD: Truck, Mud Rotary

DRILLING DATE: 21 September, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION		
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80						
							SHEAR STRENGTH (Kpa) ➤				MOISTURE CONTENT (%) ●						
36 11	CLAY: Grey, wet, very soft																
38																	
40 12																	
42																	
44	CLAY: Grey, layers of gravelly sand, pieces of crushed rock, very moist to wet, very stiff/compact		18.29/ 69.55														
46 14																	
48																	
50 15																	
52																	
54 16																	
56																	
58 17																	
60																	
62 19																	
64																	
66 20																	
68																	
70 21																	

Groundwater Depth (m): on completion: N/A, Mud Rotary, on 6 October 2022: 1.92m

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

LOCATION: 5210 Innes Road, Ottawa, ON

DRILLING METHOD: Truck, Mud Rotary

DRILLING DATE: 21 September, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲	VAPOUR READING (ppm) □	PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80	20 40 60 80	
							SHEAR STRENGTH (Kpa) ➕	MOISTURE CONTENT (%) ●	
70					SS-5	26			
72									
74									
76	CRUSHED ROCK: Grey, some silt/clay, wet, very dense		22.86/ 64.98						
78									
80	Auger refusal @ 24.41m probably due to chunk/piece of rock End of borehole at 24.41m		24.41/ 63.43		SS-6	100+			
82									
84									
86									
88									
90									
92									
94									
96									
98									
100									
102									
104									

Groundwater Depth (m): on completion: N/A, Mud Rotary, on 6 October 2022: 1.92m

DRAWN: D.C.

LOGGED: J.Y.

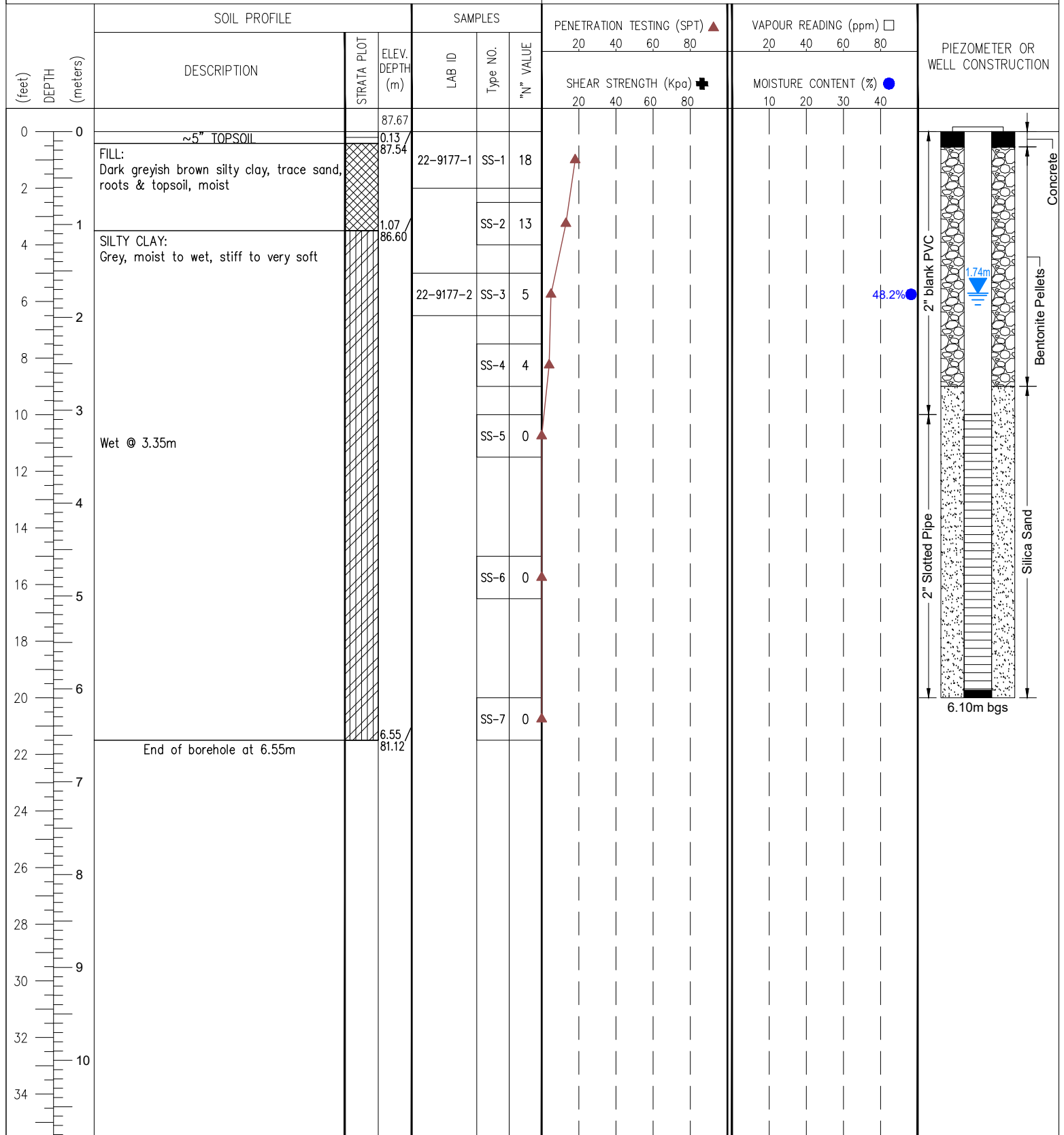
CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

LOCATION: 5210 Innes Road, Ottawa, ON

DRILLING METHOD: Truck, Solid Stem

DRILLING DATE: 22 September, 2022



PROJECT NAME: GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

LOCATION: 5210 Innes Road, Ottawa, ON

DRILLING METHOD: Truck, Solid Stem

DRILLING DATE: 20 September, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➡				MOISTURE CONTENT (%) ●				
0			87.94												
	~4" TOPSOIL														
2	FILL: Dark grey silty clay, trace sand, roots, topsoil & topsoil mixed soils, moist			22-9177-3	SS-1	8									
1			0.91 / 87.03												
4	SILTY CLAY: Greenish grey, moist, stiff to very soft				SS-2	13									
6				22-9177-4	SS-3	6								45.8%	
2															
8					SS-4	2									
10															
12	SILTY CLAY: Grey, moist to wet, very soft		3.35 / 84.59			SS-5	2								
4															
14															
16	Wet @ 4.57m					SS-6	0								
5															
18															
20															
22	End of borehole at 6.55m		6.55 / 81.39			SS-7	0								
7															
24															
26															
28															
30															
32															
34															

Groundwater Depth (m): on completion: 3.55m

DRAWN: D.C.

LOGGED: J.Y.

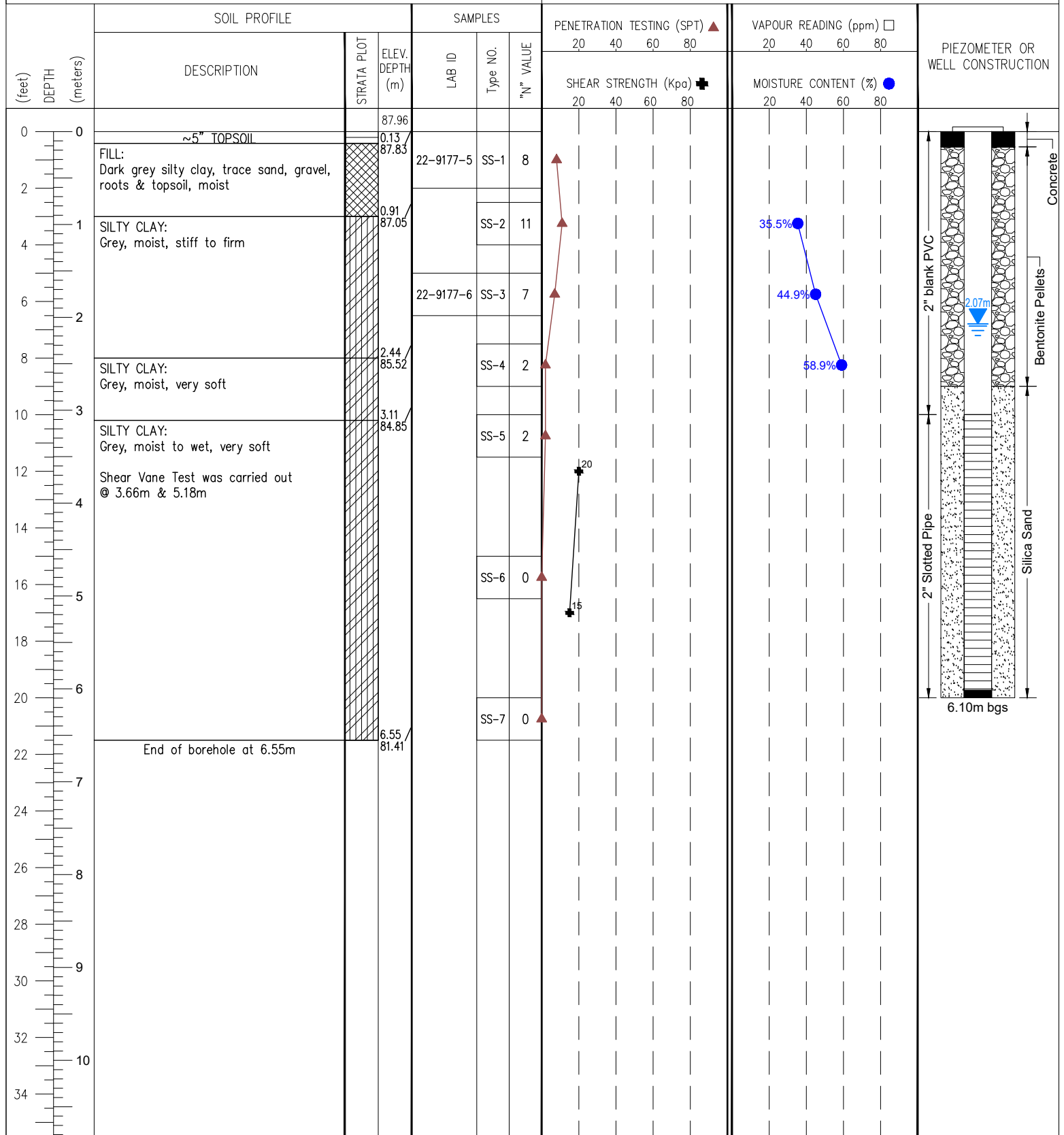
CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

LOCATION: 5210 Innes Road, Ottawa, ON

DRILLING METHOD: Truck, Solid Stem

DRILLING DATE: 20 September, 2022



Groundwater Depth (m): on completion: 4.88m; on 6 October 2022: 2.07m

DRAWN: D.C.

LOGGED: J.Y.

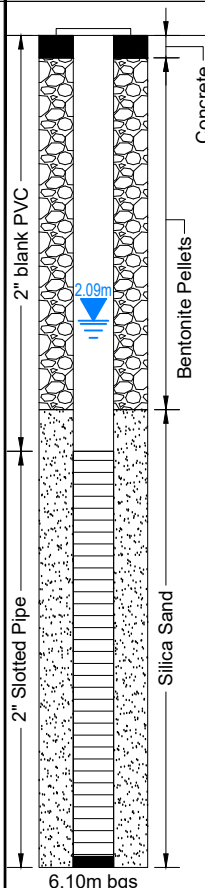
CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

LOCATION: 5210 Innes Road, Ottawa, ON

DRILLING METHOD: Truck, Solid Stem

DRILLING DATE: 20 September, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE										
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●					
0	0		87.90				20	40	60	80		20	40	60	80	
	~4" TOPSOIL		0.10 87.80	22-9177-7	SS-1	11										
2	FILL: Dark grey to reddish brown silty clay, trace sand & roots, moist		0.69 87.21		SS-2	14										
4	SILTY CLAY: Grey, moist, stiff			22-9177-8	SS-3	10										
6																
8	SILTY CLAY: Grey, moist, firm		2.44 85.46		SS-4	6										
10	CLAY: Grey, moist, very soft		3.14 84.76		SS-5	0										
12																
14																
16					SS-6	0										
18																
20																
22	End of borehole at 6.55m		6.55 81.35		SS-7	0										
24																
26																
28																
30																
32																
34																

Groundwater Depth (m): on completion: Dry, on 6 October 2022: 2.09m

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

LOCATION: 5210 Innes Road, Ottawa, ON

DRILLING METHOD: Truck, Mud Rotary

DRILLING DATE: 22 September, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	SHEAR STRENGTH (Kpa) ➡				MOISTURE CONTENT (%) ●					
							20	40	60	80	10	20	30	40		
0	Augered to 9.14m		87.78												2" blank PVC 2.36m 2" Slotted Pipe 6.10m bgs Concrete Bentonite Pellets Silica Sand	
2																
4																
6																
8																
10																
12																
14																
16																
18																
20																
22																
24																
26																
28																
30																
32																
34																
		CLAY: Grey, wet, very soft		9.14 78.64		SS-1	0									

Groundwater Depth (m): on completion: N/A, Mud Rotary, on 6 October 2022: 2.36m

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.



LOG OF BOREHOLE

NO. BH106(MW) SHEET. 2 of 4

PROJECT NO.: FE-P# 22-12469/70

PROJECT NAME: GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

LOCATION: 5210 Innes Road, Ottawa, ON

DRILLING METHOD: Truck, Mud Rotary

DRILLING DATE: 22 September, 2022

(feet) DEPTH (meters)	SOIL PROFILE		SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➤				MOISTURE CONTENT (%) ●				
36 11	CLAY: Grey, wet, very soft														
38															
40 12															
42															
44															
46 14															
48															
50 15															
52															
54															
56 17															
58															
60 18															
62															
64															
66 20															
68															
70 21															

Groundwater Depth (m): on completion: N/A, Mud Rotary, on 6 October 2022: 2.36m

DRAWN: D.C.

LOGGED: J.Y.

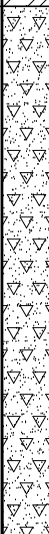
CHECKED: C.W.

PROJECT NAME: GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

LOCATION: 5210 Innes Road, Ottawa, ON

DRILLING METHOD: Truck, Mud Rotary

DRILLING DATE: 22 September, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION		
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE											
							SHEAR STRENGTH (Kpa) ➕				MOISTURE CONTENT (%) ●						
							20	40	60	80	20	40	60	80			
							20	40	60	80	10	20	30	40			
70	CLAY: Grey, wet, very soft			SS-5	0	▲											
72																	
74																	
76																	
78																	
80																	
82																	
84																	
86																	
88																	
90																	
92																	
94	GRAVELLY SAND: Grey, some clay/silt, pieces of crushed rock, wet, very dense		27.43/ 60.35	SS-7	100+	▲											
96																	
98																	
100																	
102																	
104																	
106																	
108																	
110	CRUSHED ROCK: Grey, wet, very dense Auger refusal @ 32.33m probably due to chunk/piece of rock		31.39/ 56.39	SS-8	76	▲											
112																	
114																	
116																	

Groundwater Depth (m): on completion: N/A, Mud Rotary, on 6 October 2022: 2.36m

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.



LOG OF BOREHOLE

NO. BH106(MW) SHEET. 4 of 4

PROJECT NO.: FE-P# 22-12469/70

PROJECT NAME: GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

LOCATION: 5210 Innes Road, Ottawa, ON

DRILLING METHOD: Truck, Mud Rotary

DRILLING DATE: 22 September, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) +				MOISTURE CONTENT (%) ●				
32	CRUSHED ROCK: Grey, wet, very dense Auger refusal @ 32.33m probably due to chunk/piece of rock End of borehole at 32.33m		32.33 55.45		SS-9	100+									
33															
34															
35															
36															
37															
38															
39															
40															
41															
42															

Groundwater Depth (m): on completion: N/A, Mud Rotary, on 6 October 2022: 2.36m

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.



LOG OF BOREHOLE NO. BH1 SHEET 1 of 1

PROJECT NO.: FE-P 21-10991

PROJECT NAME: GEOTECHNICAL INVESTIGATION

LOCATION: 5210 Innes Road, Ottawa

DRILLING METHOD: Geo-probe Solid Steam

DRILLING DATE: 8 March 2021

SOIL PROFILE			SAMPLES		PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION	
DEPTH (m) (feet)	DESCRIPTION	STRATA PLAT ELEV. DEPTH (m)	TYPE	NUMBER	3" VALUE	20 40 60 80				20 40 60 80				
						SHEAR STRENGTH (kPa) ◆				MOISTURE CONTENT (%) ○				
0	GROUND SURFACE (m asl)	87.80												
1	FILL: organic silty clay, dark, brown, moist	88.1/87.5	SS	1	2									
2														
3	FILL: silty clay, trace of rootlets, clayey particles, greyish brown, moist, silt	88.2/88.0	SS	2	10									
4														
5			SS	3	7									
6	SILTY CLAY: greyish brown, moist, firm to soft													
7			SS	4	4									
8														
9			SS	5	3									
10														
11														
12														
13														
14														
15														
16	Grey clay below 4.57m wet		SS	6	1									
17														
18	DCPT from 5.33m													
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														
35														
36														
37														
38														
39														
40														
41														
42														
43														
44														
45														
46														
47														
48														
49														
50														
51														
52														
53														
54														
55														
56														
57														
58														
59														
60	become harder at 17.69m													
61														
62	End of BH at 18.29m													
63														
64														
65														
66														
67														
68														
69														
70														
71														
72														
73														
74														
75														
76														
77														
78														
79														
80														
81														
82														
83														
84														
Groundwater Depth (m): On Completion: 5.49m														
PEUW: Drop Under Hammer Weight														
LOGGED: ZA														
CHECKED: FF														

Groundwater Depth (m): On Completion: 5.49m

PEUW: Drop Under Hammer Weight

LOGGED: ZA

CHECKED: FF

PROJECT NAME: GEOTECHNICAL INVESTIGATION

LOCATION: 5210 Innes Road, Ottawa

DRILLING METHOD: Geo-probe Solid Steam

DRILLING DATE: 9 March 2021

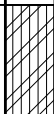
SOIL PROFILE					SAMPLES		PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
DEPTH (m)	DESCRIPTION	STAIN PLOT ELEV. DEPTH (m)	NUMBER	WATER	% VALUE	SHEAR STRENGTH (kPa) ◆				MOISTURE CONTENT (%) ○					
						20	40	60	80	20	40	60	80		
0	GROUND SURFACE (m aal)	00.00													
0.5	FILL: silty clay, some rootlets, brown, wet	00.00	SS	1	1										
1	FILL: silty clay, greyish brown, trace of rootlets	00.00	SS	2	11										
2			SS	3	4										
3	SILTY CLAY: grey, moist, firm to soft		SS	4	5										
4			SS	5	1										
5	clay below 3.05m very soft below 3.05m														
6	DCPT from 3.66m														
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															
31															
32															
33															
34															
35															
36															
37															
38															
39															
40															
41															
42															
43															
44															
45															
46															
47															
48															
49															
50															
51															
52															
53															
54															
55															
56															
57															
58															
59															
60															
61															
62															
63															
64															
65															
66															
67															
68															
69															
70															
71															
72															
73															
74															
75															
76															
77															
78															
79															
80															
81															
82															
83															
84															
85															
86															
87															
88															
89															
90															
91															
92															
93															
94															
95															
96															
97															
98															
99															
100															
101															
102															
103															
104															
105															
106															
107															
108															
109															
110															
111															
112															
113															
114															
115															
116															
117															
118															
119															
120															
121															
122															
123															
124															
125															
126															
127															
128															
129															
130															
131															
132															
133															
134															
135															
136															
137															
138															
139															
140															
141															
142															
143															
144															
145															
146															
147															
148															
149															
150															
151															
152															
153															
154															
155															

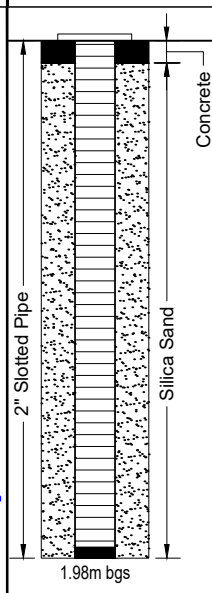
PROJECT NAME: GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

LOCATION: 5210 Innes Road, Ottawa, ON

DRILLING METHOD: Truck, Solid Stem

DRILLING DATE: 23 September, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ✚				MOISTURE CONTENT (%) ●				
0	0	Augered to 1.52m		87.77											
2															
1															
4															
6		SILTY CLAY: Grey, moist, soft		1.52 / 86.25		SS-1	7	▲						47.3% ●	
2		End of test hole at 1.98m		1.98 / 85.79											
8															
10	3														
12															
4															
14															
16															
5															
18															



Groundwater Depth (m): on completion: Dry

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.

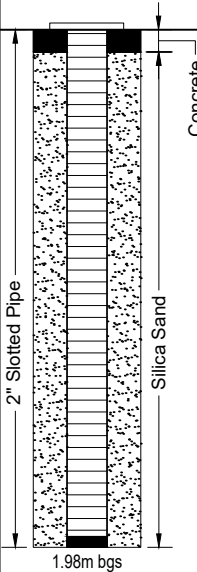
PROJECT NAME: GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

LOCATION: 5210 Innes Road, Ottawa, ON

DRILLING METHOD: Truck, Solid Stem

DRILLING DATE: 23 September, 2022

(feet) DEPTH (meters)	SOIL PROFILE			SAMPLES			PENETRATION TESTING (SPT) ▲				VAPOUR READING (ppm) □				PIEZOMETER OR WELL CONSTRUCTION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	LAB ID	Type NO.	"N" VALUE	20 40 60 80				20 40 60 80				
							SHEAR STRENGTH (Kpa) ➤				MOISTURE CONTENT (%) ●				
0	0	Augered to 1.52m		87.66											
2															
1															
4															
6		SILTY CLAY: Grey, moist, soft		1.52 / 86.14		SS-1	6	▲						42.8% ●	
2		End of test hole at 1.98m		1.98 / 85.68											
8															
10	3														
12															
4															
14															
16															
5															
18															



Groundwater Depth (m): on completion: Dry

DRAWN: D.C.

LOGGED: J.Y.

CHECKED: C.W.

APPENDIX C – MOISTURE CONTENT AND GRAIN SIZE DISTRIBUTION ANALYSES



Project Name: Geotechnical Investigation

F.E. Lab #: 22-495

Client: Dymon Group of Companies

Date Sampled: 20-Sep-2022

Project ID: 22-12470

Date Received: 26-Sep-2022

Location: 5210 Innes Road

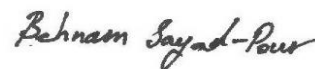
Date Reported: 18-Oct-2022

Ottawa, Ontario

Certificate of Analysis

Analyses	Matrix	Quantity	Testing Date	Method Reference
Moisture Content	Soil	6	26-Sep-22	ASTM D2216
Grain Size (Sieve Analysis)	Soil	0	N.A.	LS-602
Grain Size (Hydrometer)	Soil	5	12-Oct-22	LS-702
Atterberg test	Soil	0	N.A.	LS-703/704

Authorized by:



Behnam Sayad Pour Zanjani

Geo-Lab Supervisor

Certificate of Analysis

Analysis Requested:	Moisture Content	Sample Description:	6 Soil Sample(s)
----------------------------	------------------	----------------------------	------------------

Sample Info	BH2 SS3	BH3 SS3	BH4 SS2	BH4 SS3	BH4 SS4	TH1
Sample Depth (m)	1.53-1.98	1.53-1.98	0.76-1.22	1.53-1.98	2.29-2.75	1.53-1.98
Moisture Content (%)	48.2	45.8	35.5	44.9	58.9	47.3

Sample Info	TH2					
Sample Depth (m)	1.53-1.98					
Moisture Content (%)	42.8					

Certificate of Analysis

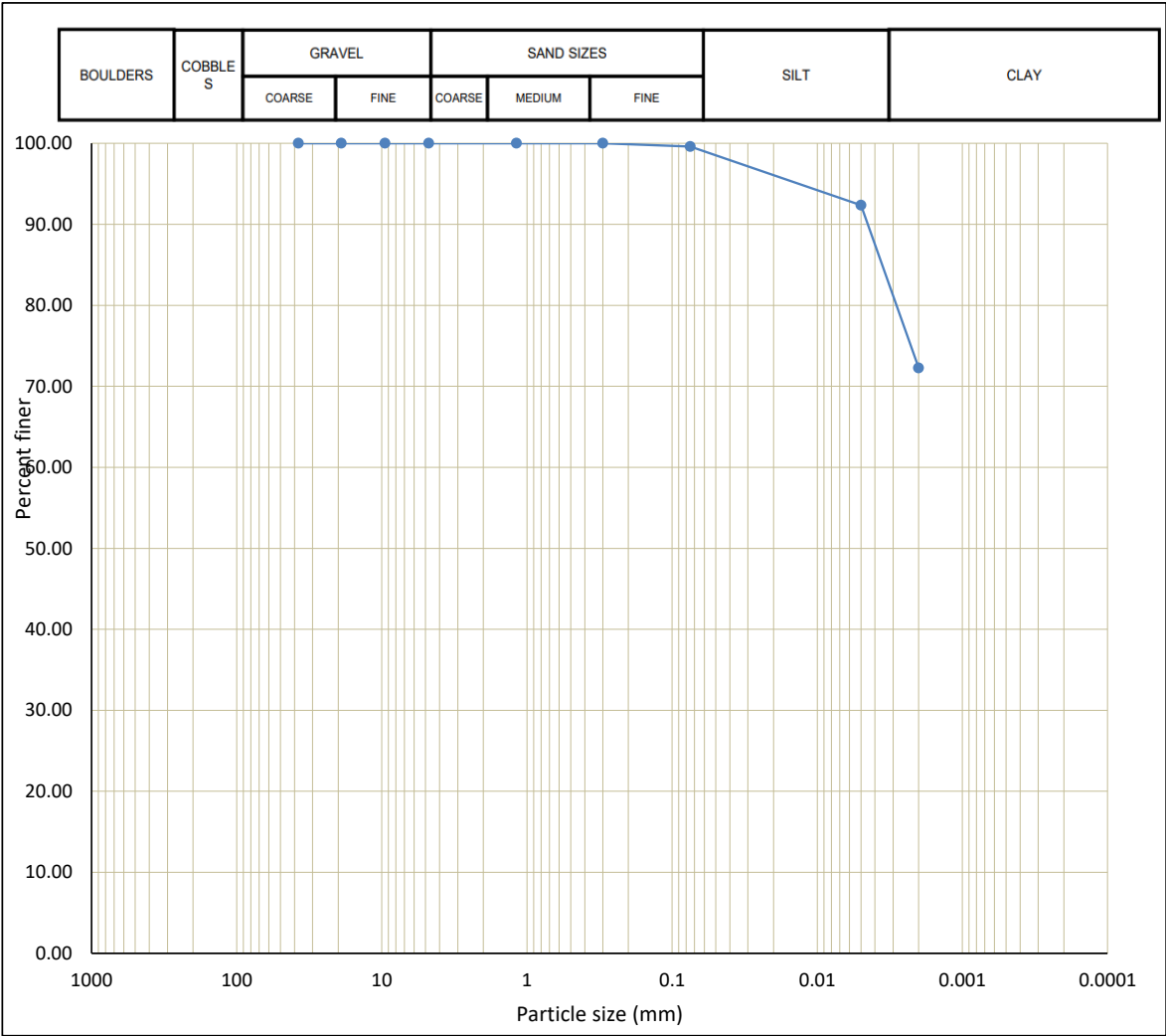
Analysis Requested:	Grain Size (Hydrometer)
Sample Description:	5 Soil Sample(s)

Sample Info	22-508 BH2 SS3	22-509 BH3 SS3	22-510 BH4 SS2	22-511 TH1	22-512 TH2	
Sample Depth (m)	1.53-1.98	1.53-1.98	0.76-1.22	1.53-1.98	1.53-1.98	
Grain Size (%)						
>19mm	0.0	0.0	0.0	0.0	0.0	
9.5mm-19mm	0.0	0.0	0.0	0.0	0.0	
4.75mm-9.5mm	0.0	0.0	0.0	0.0	0.0	
1.18mm-4.75mm	0.0	0.0	0.0	0.0	0.0	
300um-1.18mm	0.0	0.2	0.0	0.0	0.0	
75um-300um	0.4	0.6	0.6	0.4	0.2	
5um-75um	7.2	9.7	15.1	10.8	11.9	
2um-5um	20.1	15.9	14.2	14.8	15.4	
<2um	72.3	73.6	70.1	74.0	72.5	
Clay	72	74	70	74	72	
Silt	27	26	29	26	27	
Sand	0	1	1	0	0	
Gravel	0	0	0	0	0	

Grain Size Distribution

Sample ID: 22-508 BH2 SS3 1.53-1.98

Gravel: 0% Sand: 0% Silt: 27% Clay: 72%

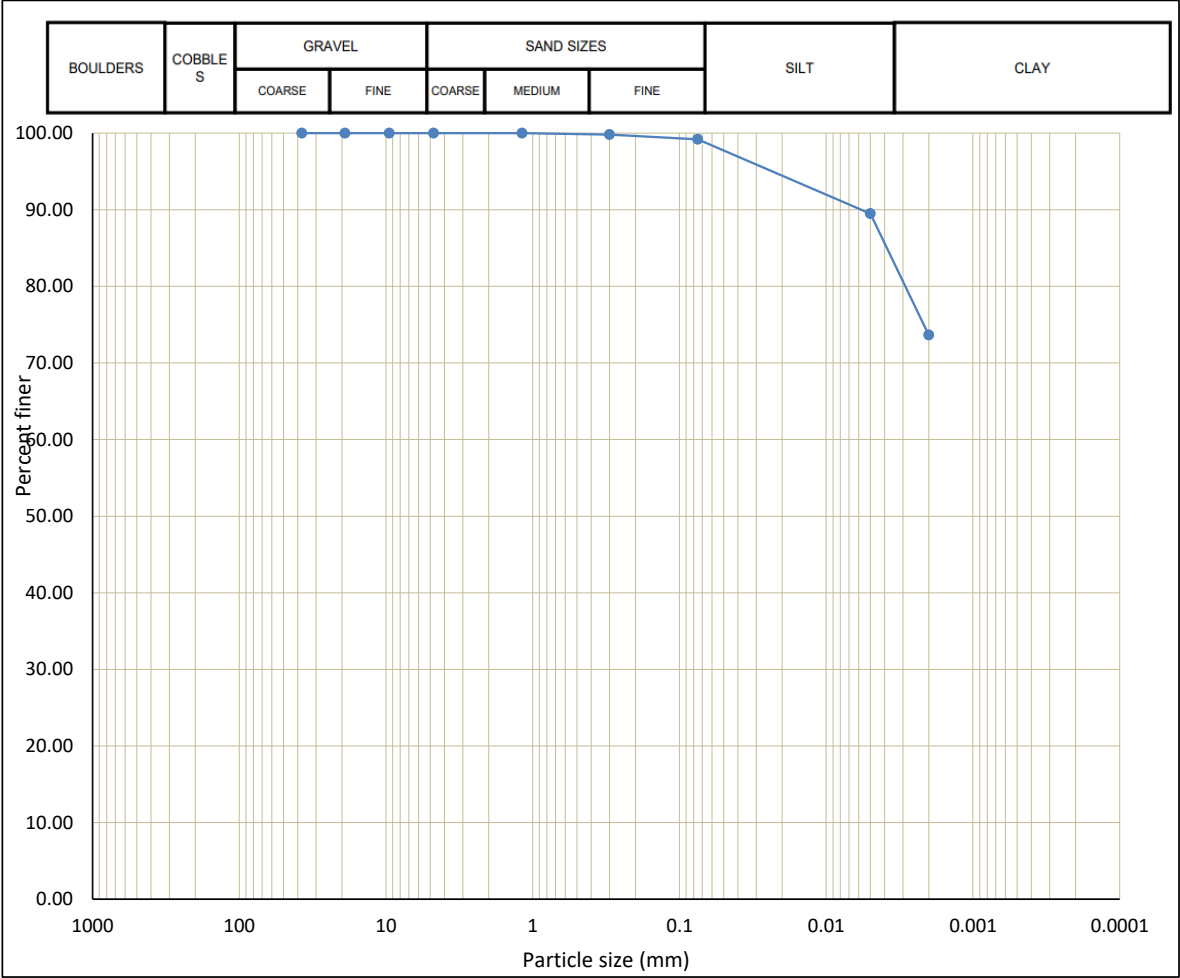


Sample ID: 22-508 BH2 SS3 1.53-1.98		
Diameter	Weight (%)	Grain Size
>4.75mm	0.0	Gravel
1.18mm-4.75mm	0.0	Coarse Sand
300um-1.18mm	0.0	Medium Sand
75um-300um	0.4	Fine Sand
5um-75um	7	Silt
2um-5um	20	
<2um	72	Clay

Grain Size Distribution

Sample ID: 22-509 BH3 SS3 1.53-1.98

Gravel: 0% Sand: 1% Silt: 26% Clay: 74%

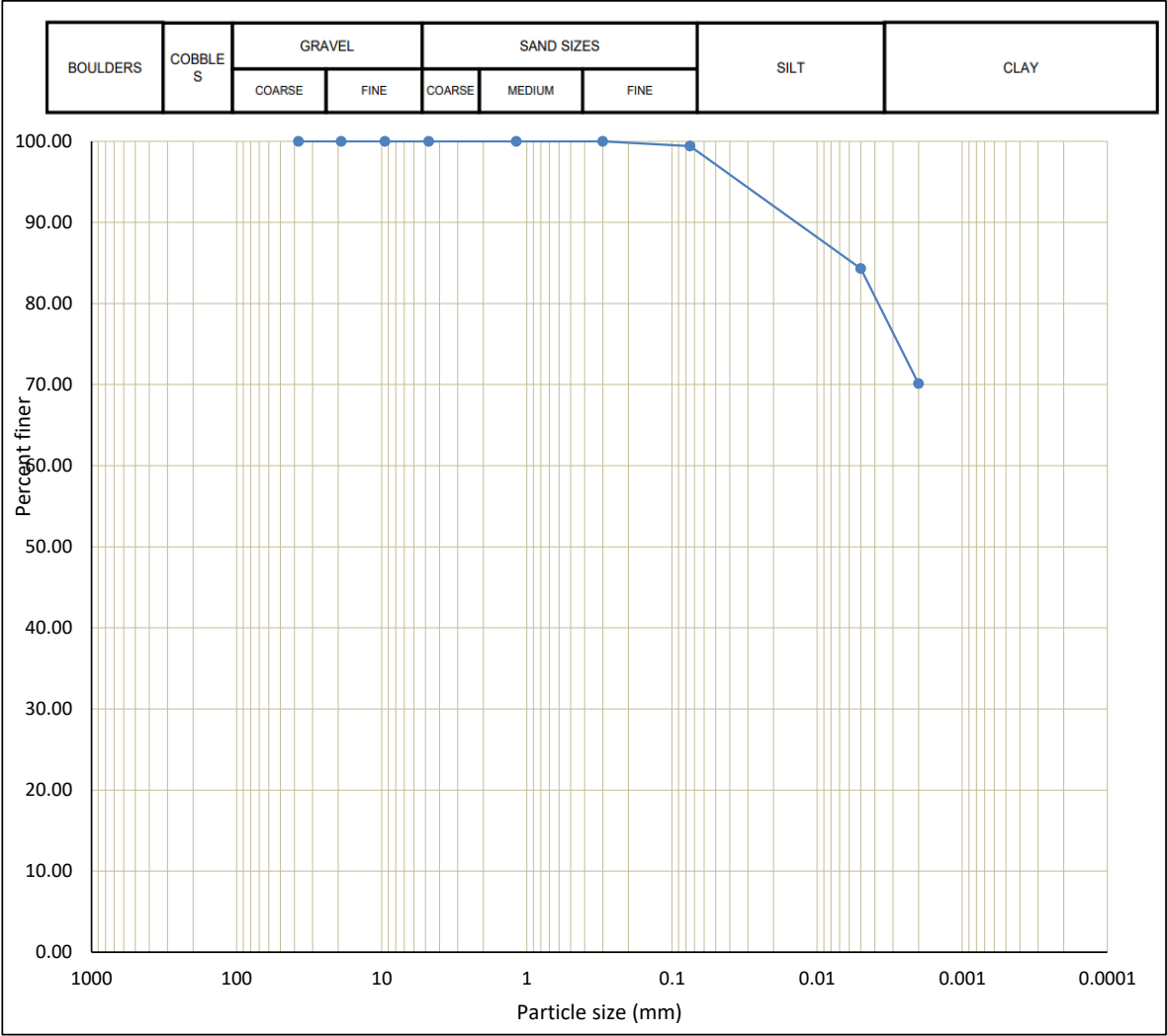


Sample ID: 22-509 BH3 SS3 1.53-1.98		
Diameter	Weight (%)	Grain Size
>4.75mm	0.0	Gravel
1.18mm-4.75mm	0.0	Coarse Sand
300um-1.18mm	0.2	Medium Sand
75um-300um	0.6	Fine Sand
5um-75um	10	Silt
2um-5um	16	
<2um	74	Clay

Grain Size Distribution

Sample ID: 22-510 BH4 SS2 0.76-1.22

Gravel: 0% Sand: 1% Silt: 29% Clay: 70%



Sample ID: 22-510 BH4 SS2 0.76-1.22		
Diameter	Weight (%)	Grain Size
>4.75mm	0.0	Gravel
1.18mm-4.75mm	0.0	Coarse Sand
300um-1.18mm	0.0	Medium Sand
75um-300um	0.6	Fine Sand
5um-75um	15	Silt
2um-5um	14	
<2um	70	Clay

Grain Size Distribution

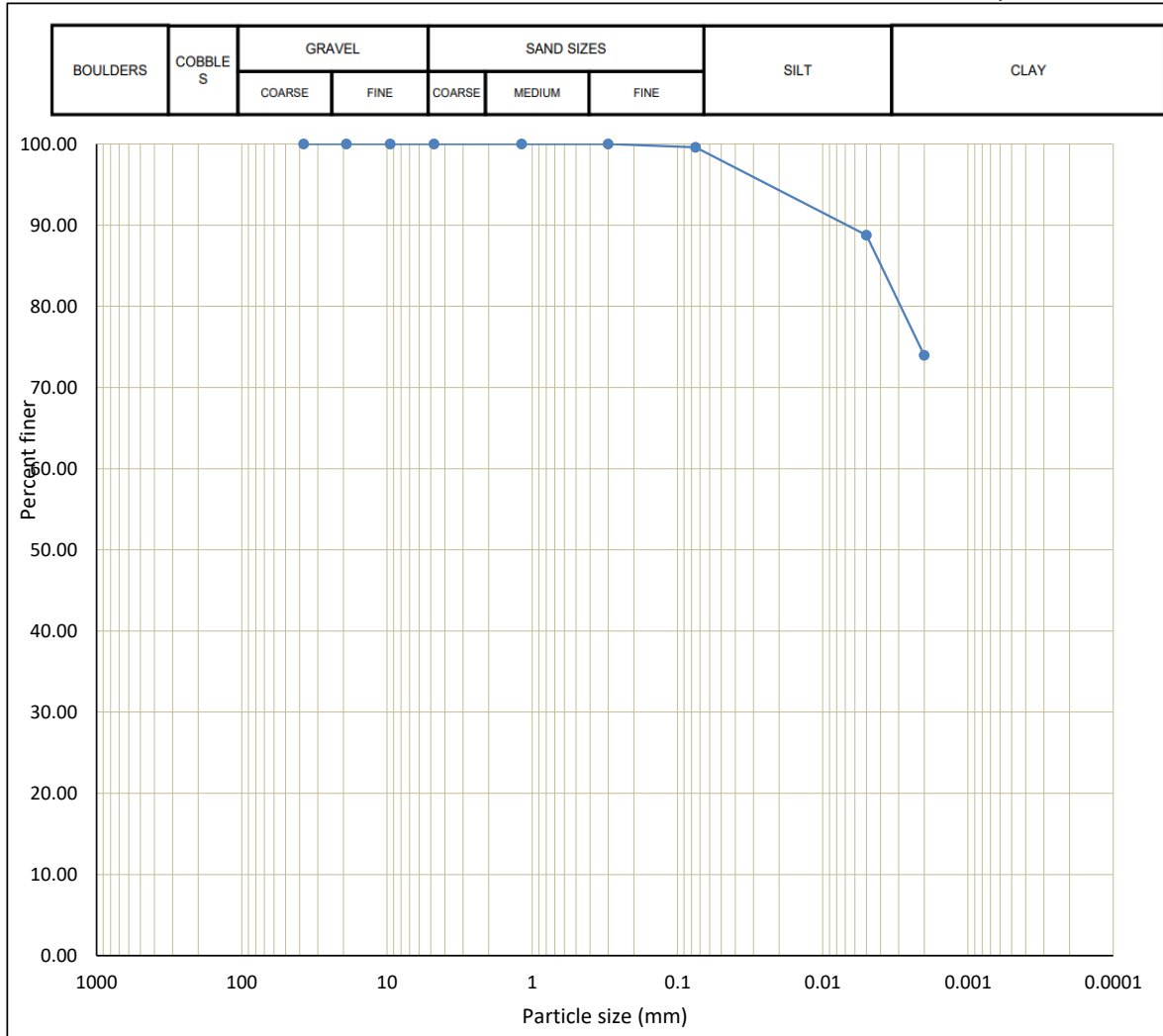
Sample ID: 22-511 TH1 1.53-1.98

Gravel: 0%

Sand: 0%

Silt: 26%

Clay: 74%



Sample ID: 22-511 TH1 1.53-1.98		
Diameter	Weight (%)	Grain Size
>4.75mm	0.0	Gravel
1.18mm-4.75mm	0.0	Coarse Sand
300um-1.18mm	0.0	Medium Sand
75um-300um	0.4	Fine Sand
5um-75um	11	Silt
2um-5um	15	
<2um	74	Clay

Grain Size Distribution

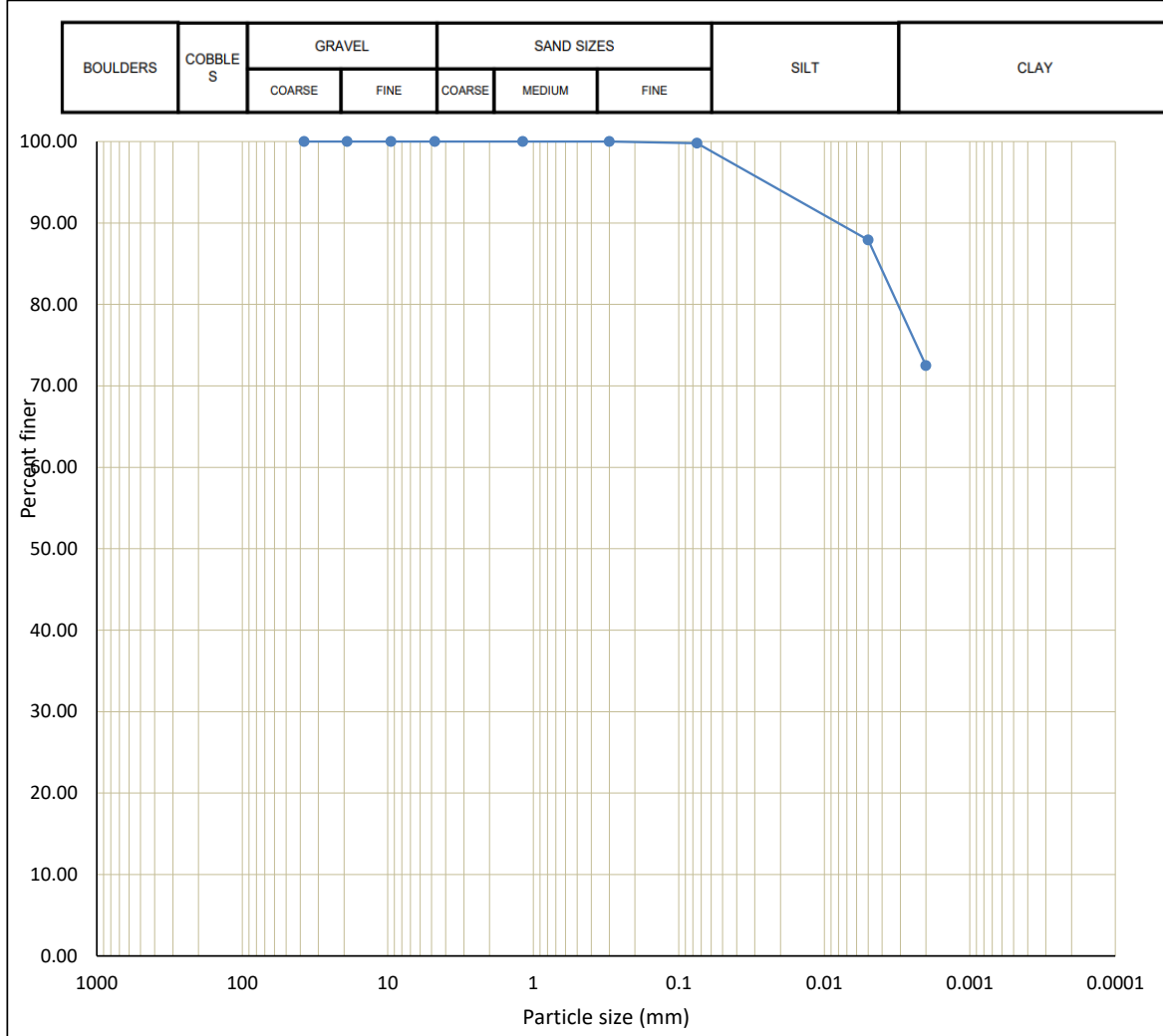
Sample ID: 22-512 TH2 1.53-1.98

Gravel: 0%

Sand: 0%

Silt: 27%

Clay: 72%



Sample ID: 22-512 TH2 1.53-1.98		
Diameter	Weight (%)	Grain Size
>4.75mm	0.0	Gravel
1.18mm-4.75mm	0.0	Coarse Sand
300um-1.18mm	0.0	Medium Sand
75um-300um	0.2	Fine Sand
5um-75um	12	Silt
2um-5um	15	Clay
<2um	72	

LAB JOB No:		Standard Laboratory Request Form: Chain of Custody										Page <u>1</u> of <u>1</u>																																																																																																																																																																																																															
CLIENT INFORMATION Name: Contact: Address: 5210 INNES Email: Fax: Fax results ☐ Phone: Email results ☒						PROJECT INFORMATION Project Name: 5210 INNES Project ID: 27-12470 Sampled By: TURNAROUND TIME (TAT): Check ONE if all samples are the same/or see below. <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">STD - Standard (5-7 bus. days)</td> <td style="width: 33%;"></td> <td style="width: 33%;">Standard Charge</td> </tr> <tr> <td>3D - Three-Day (72 hrs.)</td> <td></td> <td> +25% SURCHARGES MAY APPLY Custom quotations (if applicable) will be reflected on final billing. CALL for: Emergencies, Bulk Quotes, or other Questions. </td> </tr> </table>						STD - Standard (5-7 bus. days)		Standard Charge	3D - Three-Day (72 hrs.)		+25% SURCHARGES MAY APPLY Custom quotations (if applicable) will be reflected on final billing. CALL for: Emergencies, Bulk Quotes, or other Questions.	BILLING INFORMATION Purchase Order No: Verbal Authorization: Credit Card Type (e.g. MC/Visa/AMEX...): Credit Card #: Expiry Date:																																																																																																																																																																																																									
STD - Standard (5-7 bus. days)		Standard Charge																																																																																																																																																																																																																									
3D - Three-Day (72 hrs.)		+25% SURCHARGES MAY APPLY Custom quotations (if applicable) will be reflected on final billing. CALL for: Emergencies, Bulk Quotes, or other Questions.																																																																																																																																																																																																																									
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">LAB SAMPLE ID</th> <th rowspan="2">CLIENT'S SAMPLE ID AND DESCRIPTION</th> <th rowspan="2">SAMPLING DATE/TIME</th> <th rowspan="2">SAMPLE MATRIX</th> <th rowspan="2">CONTAINER NO. and TYPE</th> <th rowspan="2">TAT (Above)</th> <th colspan="10">ANALYSIS REQUESTED (Check or Specify)</th> <th rowspan="2">NOTES</th> </tr> <tr> <th>Moisture Content</th> <th>Sieve Analysis</th> <th>Hydrometer</th> <th>Atterberg Limits</th> <th>Proctor</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>BH2 5'-6.5'</td> <td>Sep 20</td> <td>Soil</td> <td>bag</td> <td>STD</td> <td>✓</td> <td>✗</td> <td>✓</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>BH4 2.5'-4'</td> <td rowspan="4" style="text-align: center;">↓</td> <td>Soil</td> <td>bag</td> <td rowspan="4" style="text-align: center;">↓</td> <td rowspan="4" style="text-align: center;">↓</td> <td>✗</td> <td>✓</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>5'-6.5'</td> <td>Soil</td> <td>bag</td> <td>✗</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>10'-11.5'</td> <td>Soil</td> <td>bag</td> <td>✗</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>3</td> <td>BH3 5'-6.5'</td> <td>Soil</td> <td>bag</td> <td></td> <td></td> <td>✓</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>4</td> <td>TH1 5'-6.5'</td> <td rowspan="2" style="text-align: center;">↓</td> <td>Soil</td> <td>bag</td> <td rowspan="2" style="text-align: center;">↓</td> <td rowspan="2" style="text-align: center;">↓</td> <td></td> <td></td> <td>✓</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>5</td> <td>TH2 5'-6.5'</td> <td>Soil</td> <td>bag</td> <td></td> <td></td> <td>✓</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>														LAB SAMPLE ID	CLIENT'S SAMPLE ID AND DESCRIPTION	SAMPLING DATE/TIME	SAMPLE MATRIX	CONTAINER NO. and TYPE	TAT (Above)	ANALYSIS REQUESTED (Check or Specify)										NOTES	Moisture Content	Sieve Analysis	Hydrometer	Atterberg Limits	Proctor							1	BH2 5'-6.5'	Sep 20	Soil	bag	STD	✓	✗	✓										2	BH4 2.5'-4'	↓	Soil	bag	↓	↓	✗	✓											5'-6.5'	Soil	bag	✗										10'-11.5'	Soil	bag	✗									3	BH3 5'-6.5'	Soil	bag			✓							4	TH1 5'-6.5'	↓	Soil	bag	↓	↓			✓									5	TH2 5'-6.5'	Soil	bag			✓																																																																														
LAB SAMPLE ID	CLIENT'S SAMPLE ID AND DESCRIPTION	SAMPLING DATE/TIME	SAMPLE MATRIX	CONTAINER NO. and TYPE	TAT (Above)	ANALYSIS REQUESTED (Check or Specify)														NOTES																																																																																																																																																																																																							
						Moisture Content	Sieve Analysis	Hydrometer	Atterberg Limits	Proctor																																																																																																																																																																																																																	
1	BH2 5'-6.5'	Sep 20	Soil	bag	STD	✓	✗	✓																																																																																																																																																																																																																			
2	BH4 2.5'-4'	↓	Soil	bag	↓	↓	✗	✓																																																																																																																																																																																																																			
	5'-6.5'		Soil	bag			✗																																																																																																																																																																																																																				
	10'-11.5'		Soil	bag			✗																																																																																																																																																																																																																				
3	BH3 5'-6.5'		Soil	bag					✓																																																																																																																																																																																																																		
4	TH1 5'-6.5'	↓	Soil	bag	↓	↓			✓																																																																																																																																																																																																																		
5	TH2 5'-6.5'		Soil	bag					✓																																																																																																																																																																																																																		
Relinquished by: Name: (print) JAMAL, Clive Signature: Date & Time: Sep 26 Method of Shipment: by hand			Client's Comments: 					Regulatory Requirements: OPSS Reg. Purpose for sampling: <table style="width: 100%;"> <tr> <td>Road Base</td> <td>Engineering Fill</td> </tr> <tr> <td>Road Subbase</td> <td>Soil Classification</td> </tr> <tr> <td>Subgrade</td> <td>Other</td> </tr> <tr> <td>Backfill</td> <td></td> </tr> </table>						Road Base	Engineering Fill	Road Subbase	Soil Classification	Subgrade	Other	Backfill																																																																																																																																																																																																							
Road Base	Engineering Fill																																																																																																																																																																																																																										
Road Subbase	Soil Classification																																																																																																																																																																																																																										
Subgrade	Other																																																																																																																																																																																																																										
Backfill																																																																																																																																																																																																																											
Received by (Internal): Name: Date & Time:			Arrival Temperature °C: Laboratory Remarks:																																																																																																																																																																																																																								



FISHER ENVIRONMENTAL LABORATORIES

FULL RANGE ANALYTICAL SERVICES • SOIL/WATER/AIR TESTING • ENVIRONMENTAL
COMPLIANCE PACKAGES • 24 HOUR EMERGENCY RESPONSE • CALA ACCREDITED

400 ESNA PARK DRIVE #15
MARKHAM, ONT. L3R 3K2
TEL: 905 475-7755
FAX: 905 475-7718
www.fisherenvironmental.com

Client: Dymon Group of Companies

Address:

Tel.:

Email:

Attn.:

F.E. Job #: 21-6138

Project Name: Geotechnical

Project ID: FE-P 21-10991

Date Sampled: 8, 9-Mar-2021

Date Received: 10-Mar-2021

Date Reported: 17-Mar-2021

Location: 5210 Innes Road

Ottawa, ON

Certificate of Analysis

Analyses	Matrix	Quantity	Date Extracted	Date Analyzed	Lab SOP	Method Reference
Moisture Content	Soil	7	N/A	12-Mar-21	Support Procedures F-99	Carter (1993)

Fisher Environmental Laboratories is accredited by CALA (the Canadian Association for Laboratory Accreditation Inc.) for specific parameters as required by Ontario Regulation 153/04. All analytical testing has been performed in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act published by Ontario Ministry of the Environment.

Authorized by:


Roger Lin, Ph. D., C. Chem.
Laboratory Manager



Certificate of Analysis

Analysis Requested:	Moisture Content
Sample Description:	7 Soil Sample(s)

Parameter	21-6138-1 BH1 0.75-1.35m	21-6138-2 BH1 2.25-2.85m	21-6138-3 BH1 4.55-5.15m	21-6138-4 BH2 1.50-2.10m	21-6138-5 BH2 3.00-3.60m	21-6138-6 BH3 0.75-1.35m
Moisture Content (%)	37	44	73	48	68	34

Parameter	21-6138-7 BH3 2.25-2.85m					
Moisture Content (%)	43					

QA/QC Report

Parameter	Blank	RL	LCS	AR	Duplicate	AR
			Recovery (%)		RPD (%)	
Moisture Content (%)	<0.1	0.1	100	70-130	4.0	0-20

LEGEND:

RL - Reporting Limit

LCS - Laboratory Control Sample

AR - Acceptable Range

RPD - Relative Percent Difference

APPENDIX D – SEWER BYLAW RESULTS



CERTIFICATE OF ANALYSIS (GUIDELINE EVALUATION)

Work Order	: WT2217418	Page	: 1 of 7
Client	: Fisher Environmental Ltd.	Laboratory	: Waterloo - Environmental
Contact	: Clive Wiggan	Account Manager	: Emily Hansen
Address	: 15-400 Esna Park Drive Markham ON Canada L3R 3K2	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: 905 475 7755, Ext. 29	Telephone	: +1 519 886 6910
Project	: ----	Date Samples Received	: 11-Oct-2022 15:52
PO	: ----	Date Analysis Commenced	: 12-Oct-2022
C-O-C number	: 20-1004260	Issue Date	: 25-Oct-2022 13:48
Sampler	: CLIENT		
Site	: ----		
Quote number	: FISHER ENVIRONMENTAL - ALS 2022 STANDING OFFER		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Guideline Comparison

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Laboratory Department</i>
Adam Boettger	Team Leader - LCMS	LCMS, Waterloo, Ontario
Amanda Ganouri-Lumsden	Department Manager - Microbiology and Prep	Microbiology, Waterloo, Ontario
Caitlin Macey	Team Leader - Inorganics	Inorganics, Burnaby, British Columbia
Danielle Gravel	Team Leader - Semi-Volatile Instrumentation	Organics, Waterloo, Ontario
David Tremblett	Team Leader - Volatiles	Air Quality, Waterloo, Ontario
Greg Pokocky	Supervisor - Inorganic	Inorganics, Waterloo, Ontario
Greg Pokocky	Supervisor - Inorganic	Metals, Waterloo, Ontario
Jocelyn Kennedy	Department Manager - Semi-Volatile Organics	Organics, Waterloo, Ontario
Rachel Cameron	Team Leader - Semi-Volatile Organics	Organics, Waterloo, Ontario
Sarah Birch	Team Leader - Volatiles	Organics, Waterloo, Ontario

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guidelines are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

Key : LOR: Limit of Reporting (detection limit).

Unit	Description
µg/L	micrograms per litre
CFU/100mL	colony forming units per 100 mL
mg/L	milligrams per litre
pH units	pH units

>: greater than.

<: less than.

Red shading is applied where the result is greater than the Guideline Upper Limit or the result is lower than the Guideline Lower Limit.

For drinking water samples, Red shading is applied where the result for E.coli, fecal or total coliforms is greater than or equal to the Guideline Upper Limit .

Qualifiers

Qualifier	Description
BODL	Limit of Reporting for BOD was increased to account for the largest volume of sample tested.



Analytical Results

				Client sample ID	5210 INNES RD OTTAWA-MW5					
Sub-Matrix: Water (Matrix: Water)				Sampling date/time	11-Oct-2022 17:06					
Analyte	Method	LOR	Unit	WT2217418-001	COOSUB SAN	COOSUB STM				
Physical Tests										
pH	E108	0.10	pH units	8.30	5.5 - 11 pH units	6 - 9 pH units	--	--	--	--
solids, total suspended [TSS]	E160	3.0	mg/L	4.6	350 mg/L	15 mg/L	--	--	--	--
Anions and Nutrients										
fluoride	E235.F	0.020	mg/L	0.545	10 mg/L	--	--	--	--	--
Kjeldahl nitrogen, total [TKN]	E318	0.050	mg/L	0.452	100 mg/L	--	--	--	--	--
phosphorus, total	E372-U	0.0020	mg/L	0.0430	10 mg/L	0.4 mg/L	--	--	--	--
sulfate (as SO4)	E235.SO4	0.30	mg/L	13.8	--	--	--	--	--	--
Cyanides										
cyanide, strong acid dissociable (total)	E333	0.0020	mg/L	<0.0020	2 mg/L	0.02 mg/L	--	--	--	--
Total Sulfides										
sulfide, total (as H2S)	E395-H	0.011	mg/L	0.015	2 mg/L	--	--	--	--	--
sulfide, total (as S)	E395-H	0.010	mg/L	0.014	2 mg/L	--	--	--	--	--
Microbiological Tests										
coliforms, Escherichia coli [E. coli]	E012A.EC	1	CFU/100mL	<1	--	200 CFU/100mL	--	--	--	--
Total Metals										
aluminum, total	E420	0.0030	mg/L	0.104	50 mg/L	--	--	--	--	--
antimony, total	E420	0.00010	mg/L	0.00054	5 mg/L	--	--	--	--	--
arsenic, total	E420	0.00010	mg/L	0.00141	1 mg/L	0.02 mg/L	--	--	--	--
bismuth, total	E420	0.000050	mg/L	<0.000050	5 mg/L	--	--	--	--	--
boron, total	E420	0.010	mg/L	0.049	25 mg/L	--	--	--	--	--
cadmium, total	E420	0.0000050	mg/L	0.0000583	0.02 mg/L	0.008 mg/L	--	--	--	--
chromium, total	E420	0.00050	mg/L	<0.00050	5 mg/L	0.08 mg/L	--	--	--	--
cobalt, total	E420	0.00010	mg/L	0.00036	5 mg/L	--	--	--	--	--
copper, total	E420	0.00050	mg/L	0.00244	3 mg/L	0.04 mg/L	--	--	--	--
lead, total	E420	0.000050	mg/L	0.000400	5 mg/L	0.12 mg/L	--	--	--	--
manganese, total	E420	0.00010	mg/L	0.0959	5 mg/L	0.05 mg/L	--	--	--	--
mercury, total	E508	0.0000050	mg/L	<0.0000050	0.001 mg/L	0.0004 mg/L	--	--	--	--
molybdenum, total	E420	0.000050	mg/L	0.0182	5 mg/L	--	--	--	--	--



Analyte	Method	LOR	Unit	WT2217418-001 (Continued)	COOSUB SAN	COOSUB STM				
Total Metals - Continued										
nickel, total	E420	0.00050	mg/L	0.00127	3 mg/L	0.08 mg/L	--	--	--	--
selenium, total	E420	0.000050	mg/L	0.000101	5 mg/L	0.02 mg/L	--	--	--	--
silver, total	E420	0.000010	mg/L	<0.000010	5 mg/L	0.12 mg/L	--	--	--	--
tin, total	E420	0.00010	mg/L	0.0141	5 mg/L	--	--	--	--	--
titanium, total	E420	0.00030	mg/L	0.00414	5 mg/L	--	--	--	--	--
vanadium, total	E420	0.00050	mg/L	0.00212	5 mg/L	--	--	--	--	--
zinc, total	E420	0.0030	mg/L	0.0034	3 mg/L	0.04 mg/L	--	--	--	--
Aggregate Organics										
carbonaceous biochemical oxygen demand [CBOD]	E555	2.0	mg/L	<3.0 BODL	300 mg/L	25 mg/L	--	--	--	--
oil & grease (gravimetric)	E567	5.0	mg/L	<5.0	--	--	--	--	--	--
oil & grease, animal/vegetable (gravimetric)	EC567A.SG	5.0	mg/L	<5.0	150 mg/L	--	--	--	--	--
oil & grease, mineral (gravimetric)	E567SG	5.0	mg/L	<5.0	15 mg/L	--	--	--	--	--
phenols, total (4AAP)	E562	0.0010	mg/L	0.0040	1 mg/L	0.008 mg/L	--	--	--	--
Volatile Organic Compounds [Fuels]										
trimethylbenzene, 1,3,5-	E611F	0.50	µg/L	<0.50	3 µg/L	--	--	--	--	--
benzene	E611D	0.50	µg/L	<0.50	10 µg/L	2 µg/L	--	--	--	--
bromodichloromethane	E611D	0.50	µg/L	<0.50	350 µg/L	--	--	--	--	--
bromoform	E611D	0.50	µg/L	<0.50	630 µg/L	--	--	--	--	--
bromomethane	E611D	0.50	µg/L	<0.50	110 µg/L	--	--	--	--	--
carbon tetrachloride	E611D	0.20	µg/L	<0.20	57 µg/L	--	--	--	--	--
chlorobenzene	E611D	0.50	µg/L	<0.50	57 µg/L	--	--	--	--	--
chloroethane	E611D	0.50	µg/L	<0.50	270 µg/L	--	--	--	--	--
chloroform	E611D	0.50	µg/L	<0.50	80 µg/L	2 µg/L	--	--	--	--
chloromethane	E611D	2.0	µg/L	<2.0	190 µg/L	--	--	--	--	--
dibromochloromethane	E611D	0.50	µg/L	<0.50	57 µg/L	--	--	--	--	--
dibromoethane, 1,2-	E611D	0.20	µg/L	<0.20	28 µg/L	--	--	--	--	--
dichlorobenzene, 1,2-	E611D	0.50	µg/L	<0.50	88 µg/L	5.6 µg/L	--	--	--	--
dichlorobenzene, 1,3-	E611D	0.50	µg/L	<0.50	36 µg/L	--	--	--	--	--
dichlorobenzene, 1,4-	E611D	0.50	µg/L	<0.50	17 µg/L	6.8 µg/L	--	--	--	--
dichloroethylene, cis-1,2-	E611D	0.50	µg/L	<0.50	200 µg/L	5.6 µg/L	--	--	--	--
dichloromethane	E611D	1.0	µg/L	<1.0	211 µg/L	5.2 µg/L	--	--	--	--
dichloropropylene, trans-1,3-	E611D	0.30	µg/L	<0.30	70 µg/L	5.6 µg/L	--	--	--	--
ethylbenzene	E611D	0.50	µg/L	<0.50	57 µg/L	2 µg/L	--	--	--	--



Analyte	Method	LOR	Unit	WT2217418-001 (Continued)	COOSUB SAN	COOSUB STM				
Volatile Organic Compounds - Continued										
tetrachloroethane, 1,1,2,2-	E611D	0.50	µg/L	<0.50	40 µg/L	17 µg/L	--	--	--	--
tetrachloroethylene	E611D	0.50	µg/L	<0.50	50 µg/L	4.4 µg/L	--	--	--	--
toluene	E611D	0.50	µg/L	<0.50	80 µg/L	2 µg/L	--	--	--	--
trichloroethylene	E611D	0.50	µg/L	<0.50	54 µg/L	7.6 µg/L	--	--	--	--
trichlorofluoromethane	E611D	0.50	µg/L	<0.50	20 µg/L	--	--	--	--	--
vinyl chloride	E611D	0.50	µg/L	<0.50	400 µg/L	--	--	--	--	--
xylene, m+p-	E611D	0.40	µg/L	<0.40	--	--	--	--	--	--
xylene, o-	E611D	0.30	µg/L	<0.30	--	--	--	--	--	--
xylenes, total	E611D	0.50	µg/L	<0.50	320 µg/L	4.4 µg/L	--	--	--	--
Volatile Organic Compounds Surrogates										
bromofluorobenzene, 4-	E611D	1.0	%	97.8	--	--	--	--	--	--
difluorobenzene, 1,4-	E611D	1.0	%	98.9	--	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons										
anthracene	E641A-L	0.000010	mg/L	<0.000010	--	--	--	--	--	--
benz(a)anthracene	E641A-L	0.000010	mg/L	<0.000010	--	--	--	--	--	--
benzo(a)pyrene	E641A-L	0.0000050	mg/L	<0.0000050	--	--	--	--	--	--
benzo(b+j)fluoranthene	E641A-L	0.000010	mg/L	<0.000010	--	--	--	--	--	--
benzo(e)pyrene	E641A-L	0.000010	mg/L	<0.000010	--	--	--	--	--	--
benzo(g,h,i)perylene	E641A-L	0.000010	mg/L	<0.000010	--	--	--	--	--	--
benzo(k)fluoranthene	E641A-L	0.000010	mg/L	<0.000010	--	--	--	--	--	--
chrysene	E641A-L	0.000010	mg/L	<0.000010	--	--	--	--	--	--
dibenz(a,h)acridine	E642D	0.000050	mg/L	<0.000056	--	--	--	--	--	--
dibenz(a,h)anthracene	E641A-L	0.0000050	mg/L	<0.0000050	--	--	--	--	--	--
dibenz(a,j)acridine	E642D	0.000050	mg/L	<0.000056	--	--	--	--	--	--
dibenzo(a,i)pyrene	E642D	0.000050	mg/L	<0.000056	--	--	--	--	--	--
dibenzo(c,g)carbazole, 7H-	E642D	0.000050	mg/L	<0.000056	--	--	--	--	--	--
dinitropyrene, 1,3-	E642D	0.0010	mg/L	<0.0010	--	--	--	--	--	--
dinitropyrene, 1,6-	E642D	0.0010	mg/L	<0.0010	--	--	--	--	--	--
dinitropyrene, 1,8-	E642D	0.0010	mg/L	<0.0010	--	--	--	--	--	--
fluoranthene	E641A-L	0.000010	mg/L	<0.000010	--	--	--	--	--	--
fluorene	E655B	0.20	µg/L	<0.20	59 µg/L	--	--	--	--	--
indeno(1,2,3-c,d)pyrene	E641A-L	0.000010	mg/L	<0.000010	--	--	--	--	--	--
methylcholanthrene, 3-	E642D	0.000050	mg/L	<0.000056	--	--	--	--	--	--
methylnaphthalene, 1-	E655B	0.40	µg/L	<0.40	32 µg/L	--	--	--	--	--
methylnaphthalene, 2-	E655B	0.40	µg/L	<0.40	22 µg/L	--	--	--	--	--
naphthalene	E655B	0.20	µg/L	<0.20	59 µg/L	6.4 µg/L	--	--	--	--



Analyte	Method	LOR	Unit	WT2217418-001 (Continued)	COOSUB SAN	COOSUB STM				
Polycyclic Aromatic Hydrocarbons - Continued										
perylene	E641A-L	0.000010	mg/L	<0.000010	--	--	--	--	--	--
phenanthrene	E641A-L	0.000010	mg/L	0.000073	--	--	--	--	--	--
pyrene	E641A-L	0.000010	mg/L	0.000015	--	--	--	--	--	--
PAHs, total (ON Sewer Use)	EC640A	0.00175	mg/L	<0.00175	--	--	--	--	--	--
chrysene-d12	E641A-L	0.1	%	89.7	--	--	--	--	--	--
naphthalene-d8	E641A-L	0.1	%	84.6	--	--	--	--	--	--
phenanthrene-d10	E641A-L	0.1	%	106	--	--	--	--	--	--
terphenyl-d14, p-	E642D	0.1	%	105	--	--	--	--	--	--
Aldehydes										
Formaldehyde	E693A	2.0	µg/L	7.0	300 µg/L	--	--	--	--	--
Phthalate Esters										
bis(2-ethylhexyl) phthalate [DEHP]	E655B	1.0	µg/L	<1.0	280 µg/L	--	--	--	--	--
butyl benzyl phthalate	E655B	0.40	µg/L	<0.40	17 µg/L	--	--	--	--	--
diethyl phthalate	E655B	0.20	µg/L	<0.20	200 µg/L	--	--	--	--	--
di-n-butyl phthalate	E655B	1.0	µg/L	<1.0	57 µg/L	--	--	--	--	--
di-n-octyl phthalate [DNOP]	E655B	0.40	µg/L	<0.40	30 µg/L	--	--	--	--	--
Semi-Volatile Organics										
bis(2-chloroethoxy)methane	E655B	0.40	µg/L	<0.40	36 µg/L	--	--	--	--	--
indole	E655B	0.40	µg/L	<0.40	50 µg/L	--	--	--	--	--
Semi-Volatile Organics Surrogates										
fluorobiphenyl, 2-	E655B	1.0	%	83.2	--	--	--	--	--	--
nitrobenzene-d5	E655B	1.0	%	117	--	--	--	--	--	--
terphenyl-d14, p-	E655B	1.0	%	81.7	--	--	--	--	--	--
Chlorinated Phenolics										
dichlorophenol, 2,4-	E655B	0.30	µg/L	<0.30	44 µg/L	--	--	--	--	--
tribromophenol, 2,4,6-	E655B	0.50	%	137	--	--	--	--	--	--
Nonylphenols										
nonylphenol diethoxylates [NP2EO]	E749B	0.10	µg/L	<0.10	--	--	--	--	--	--
nonylphenol ethoxylates, total	E749B	2.0	µg/L	<2.0	25 µg/L	10 µg/L	--	--	--	--
nonylphenol monoethoxylates [NP1EO]	E749B	2.0	µg/L	<2.0	--	--	--	--	--	--
nonylphenols [NP]	E749A	1.0	µg/L	<1.0	2.5 µg/L	1 µg/L	--	--	--	--
Polychlorinated Biphenyls										
Aroclor 1016	E687	0.020	µg/L	<0.020	--	--	--	--	--	--



Analyte	Method	LOR	Unit	WT2217418-001 (Continued)	COOSUB SAN	COOSUB STM				
Polychlorinated Biphenyls - Continued										
Aroclor 1221	E687	0.020	µg/L	<0.020	--	--	--	--	--	--
Aroclor 1232	E687	0.020	µg/L	<0.020	--	--	--	--	--	--
Aroclor 1242	E687	0.020	µg/L	<0.020	--	--	--	--	--	--
Aroclor 1248	E687	0.020	µg/L	<0.020	--	--	--	--	--	--
Aroclor 1254	E687	0.020	µg/L	<0.020	--	--	--	--	--	--
Aroclor 1260	E687	0.020	µg/L	<0.020	--	--	--	--	--	--
Aroclor 1262	E687	0.020	µg/L	<0.020	--	--	--	--	--	--
Aroclor 1268	E687	0.020	µg/L	<0.020	--	--	--	--	--	--
polychlorinated biphenyls [PCBs], total	E687	0.060	µg/L	<0.060	--	0.4 µg/L	--	--	--	--
decachlorobiphenyl	E687	0.1	%	105	--	--	--	--	--	--
tetrachloro-m-xylene	E687	0.1	%	104	--	--	--	--	--	--
Organochlorine Pesticides										
hexachlorobenzene	E660F	0.0080	µg/L	<0.0080	0.1 µg/L	0.04 µg/L	--	--	--	--
decachlorobiphenyl	E660F	0.10	%	128	--	--	--	--	--	--
tetrachloro-m-xylene	E660F	0.10	%	104	--	--	--	--	--	--
Nitrosamines										
nitrosodimethylamine, n- [NDMA]	E725A	0.030	µg/L	<0.030	400 µg/L	--	--	--	--	--
nitrosodimethylamine-d6, n-	E725A	0.10	%	104	--	--	--	--	--	--

Please refer to the General Comments section for an explanation of any qualifiers detected.

Summary of Guideline Breaches by Sample

SampleID/Client ID	Matrix	Analyte	Analyte Summary	Guideline	Category	Result	Limit
5210 INNES RD OTTAWA-MW5	Water	manganese, total		COOSUB	STM	0.0959 mg/L	0.05 mg/L

Key:
 COOSUB Ontario Ottawa Sanitary and Storm Sewer By-Law No. 2003-514 (2003)
 City of Ottawa Sanitary Sewer Use By-Law 2003-514
 SAN City of Ottawa Storm Sewer By-Law 2003-514
 STM

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: WT2217418	Page	: 1 of 14
Client	: Fisher Environmental Ltd.	Laboratory	: Waterloo - Environmental
Contact	: Clive Wiggan	Account Manager	: Emily Hansen
Address	: 15-400 Esna Park Drive Markham ON Canada L3R 3K2	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: 905 475 7755, Ext. 29	Telephone	: +1 519 886 6910
Project	: ----	Date Samples Received	: 11-Oct-2022 15:52
PO	: ----	Issue Date	: 25-Oct-2022 13:48
C-O-C number	: 20-1004260		
Sampler	: CLIENT		
Site	: ----		
Quote number	: FISHER ENVIRONMENTAL - ALS 2022 STANDING OFFER		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "----" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Matrix Spike outliers occur.
- Laboratory Control Sample (LCS) outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers occur - please see following pages for full details.



Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Water**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Laboratory Control Sample (LCS) Recoveries								
Polycyclic Aromatic Hydrocarbons	QC-701488-002	----	dibenzo(a,i)pyrene	189-55-9	E642D	59.0 % LCS-ND	60.0-130%	Recovery less than lower control limit
Phthalate Esters	QC-MRG2-7014890 02	----	di-n-octyl phthalate [DNOP]	117-84-0	E655B	152 % LCS-H	50.0-140%	Recovery greater than upper control limit

Result Qualifiers

Qualifier	Description
LCS-H	Lab Control Sample recovery was above ALS DQO. Non-detected sample results are considered reliable. Other results, if reported, have been qualified.
LCS-ND	Lab Control Sample recovery was slightly outside ALS DQO. Reported non-detect results for associated samples were unaffected.



Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water** Evaluation: * = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Aggregate Organics : Biochemical Oxygen Demand (Carbonaceous) - 5 day										
HDPE [BOD HT-4d] 5210 INNES RD OTTAWA- MW5	E555	11-Oct-2022	----	----	----		12-Oct-2022	4 days	1 days	✓
Aggregate Organics : Mineral Oil & Grease by Gravimetry										
Amber glass (hydrochloric acid) 5210 INNES RD OTTAWA- MW5	E567SG	11-Oct-2022	14-Oct-2022	29 days	3 days	✓	17-Oct-2022	40 days	3 days	✓
Aggregate Organics : Oil & Grease by Gravimetry										
Amber glass (hydrochloric acid) 5210 INNES RD OTTAWA- MW5	E567	11-Oct-2022	14-Oct-2022	29 days	3 days	✓	17-Oct-2022	40 days	3 days	✓
Aggregate Organics : Phenols (4AAP) in Water by Colorimetry										
Amber glass total (sulfuric acid) [ON MECP] 5210 INNES RD OTTAWA- MW5	E562	11-Oct-2022	17-Oct-2022	29 days	7 days	✓	20-Oct-2022	22 days	3 days	✓
Aldehydes : Aldehydes by GC-ECD										
Glass vial (ammonium chloride+copper sulfate) 5210 INNES RD OTTAWA- MW5	E693A	11-Oct-2022	----	----	----		12-Oct-2022	8 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE [ON MECP] 5210 INNES RD OTTAWA- MW5	E235.F	11-Oct-2022	14-Oct-2022	----	----		17-Oct-2022	28 days	7 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE [ON MECP] 5210 INNES RD OTTAWA- MW5	E235.SO4	11-Oct-2022	14-Oct-2022	----	----		17-Oct-2022	28 days	7 days	✓



Matrix: **Water** Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) [ON MECP] 5210 INNES RD OTTAWA- MW5	E318	11-Oct-2022	17-Oct-2022	----	----		18-Oct-2022	28 days	8 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) [ON MECP] 5210 INNES RD OTTAWA- MW5	E372-U	11-Oct-2022	17-Oct-2022	----	----		18-Oct-2022	28 days	8 days	✓
Chlorinated Phenolics : BNA (ON 625 list) by GC-MS										
Amber glass/Teflon lined cap [ON MECP] 5210 INNES RD OTTAWA- MW5	E655B	11-Oct-2022	18-Oct-2022	----	----		19-Oct-2022	----	----	
Cyanides : Total Cyanide										
UV-inhibited HDPE - total (sodium hydroxide) 5210 INNES RD OTTAWA- MW5	E333	11-Oct-2022	13-Oct-2022	----	----		13-Oct-2022	14 days	3 days	✓
Microbiological Tests : E. coli (MF-mFC-BCIG)										
Sterile HDPE (Sodium thiosulphate) [ON MECP] 5210 INNES RD OTTAWA- MW5	E012A.EC	11-Oct-2022	----	----	----		12-Oct-2022	48 hrs	33 hrs	✓
Nitrosamines : Nitrosamines by LC-MS-MS by Direct Injection (Routine Levels)										
Amber glass/Teflon lined cap - LCMS 5210 INNES RD OTTAWA- MW5	E725A	11-Oct-2022	13-Oct-2022	29 days	2 days	✓	24-Oct-2022	28 days	11 days	✓
Nonylphenols : Nonylphenol Ethoxylates in Water by LC-MS-MS Positive Mode										
Amber glass/Teflon lined cap - LCMS 5210 INNES RD OTTAWA- MW5	E749B	11-Oct-2022	13-Oct-2022	8 days	3 days	✓	13-Oct-2022	7 days	0 days	✓
Nonylphenols : Nonylphenol, Octylphenol and BPA in Water by LC-MS-MS Negative Mode										
Amber glass/Teflon lined cap - LCMS 5210 INNES RD OTTAWA- MW5	E749A	11-Oct-2022	13-Oct-2022	8 days	3 days	✓	13-Oct-2022	7 days	0 days	✓
Organochlorine Pesticides : OCP Analysis by GC-MS-MS										
Amber glass/Teflon lined cap [ON MECP] 5210 INNES RD OTTAWA- MW5	E660F	11-Oct-2022	12-Oct-2022	15 days	1 days	✓	13-Oct-2022	40 days	2 days	✓



Matrix: **Water** Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Phthalate Esters : BNA (ON 625 list) by GC-MS										
Amber glass/Teflon lined cap [ON MECP] 5210 INNES RD OTTAWA- MW5	E655B	11-Oct-2022	18-Oct-2022	----	----		19-Oct-2022	----	----	
Physical Tests : pH by Meter										
HDPE [ON MECP] 5210 INNES RD OTTAWA- MW5	E108	11-Oct-2022	14-Oct-2022	----	----		15-Oct-2022	14 days	4 days	✓
Physical Tests : TSS by Gravimetry										
HDPE [ON MECP] 5210 INNES RD OTTAWA- MW5	E160	11-Oct-2022	----	----	----		12-Oct-2022	7 days	1 days	✓
Polychlorinated Biphenyls : PCB Aroclors by GC-MS										
Amber glass/Teflon lined cap [ON MECP] 5210 INNES RD OTTAWA- MW5	E687	11-Oct-2022	12-Oct-2022	21 days	1 days	✓	13-Oct-2022	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : BNA (ON 625 list) by GC-MS										
Amber glass/Teflon lined cap [ON MECP] 5210 INNES RD OTTAWA- MW5	E655B	11-Oct-2022	18-Oct-2022	----	----		19-Oct-2022	----	----	
Polycyclic Aromatic Hydrocarbons : PAHs (ON Special List) by GC-MS										
Amber glass/Teflon lined cap 5210 INNES RD OTTAWA- MW5	E642D	11-Oct-2022	18-Oct-2022	15 days	8 days	✓	19-Oct-2022	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS (Low Level)										
Amber glass/Teflon lined cap (sodium bisulfate) 5210 INNES RD OTTAWA- MW5	E641A-L	11-Oct-2022	17-Oct-2022	15 days	6 days	✓	18-Oct-2022	40 days	1 days	✓
Semi-Volatile Organics : BNA (ON 625 list) by GC-MS										
Amber glass/Teflon lined cap [ON MECP] 5210 INNES RD OTTAWA- MW5	E655B	11-Oct-2022	18-Oct-2022	15 days	8 days	✓	19-Oct-2022	40 days	1 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) 5210 INNES RD OTTAWA- MW5	E508	11-Oct-2022	12-Oct-2022	----	----		12-Oct-2022	28 days	2 days	✓



Matrix: **Water** Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Total Metals : Total metals in Water by CRC ICPMS										
HDPE total (nitric acid) 5210 INNES RD OTTAWA- MW5	E420	11-Oct-2022	13-Oct-2022	----	----		13-Oct-2022	180 days	3 days	✓
Total Sulfides : Total Sulfide by Colourimetry (Automated Flow)										
HDPE total (zinc acetate+sodium hydroxide) 5210 INNES RD OTTAWA- MW5	E395-H	11-Oct-2022	----	----	----		14-Oct-2022	7 days	4 days	✓
Volatile Organic Compounds : VOCs (Eastern Canada List) by Headspace GC-MS										
Glass vial (sodium bisulfate) 5210 INNES RD OTTAWA- MW5	E611D	11-Oct-2022	16-Oct-2022	----	----		16-Oct-2022	14 days	6 days	✓
Volatile Organic Compounds [Fuels] : VOCs (Full List) by Headspace GC-MS										
Glass vial (sodium bisulfate) 5210 INNES RD OTTAWA- MW5	E611F	11-Oct-2022	16-Oct-2022	----	----		16-Oct-2022	14 days	6 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).



Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water** Evaluation: ✖ = QC frequency outside specification; ✔ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Laboratory Duplicates (DUP)							
Aldehydes by GC-ECD	E693A	691490	1	4	25.0	5.0	✔
Biochemical Oxygen Demand (Carbonaceous) - 5 day	E555	691814	1	4	25.0	5.0	✔
E. coli (MF-mFC-BCIG)	E012A.EC	691540	0	17	0.0	5.0	✖
Fluoride in Water by IC	E235.F	697107	1	4	25.0	5.0	✔
Nitrosamines by LC-MS-MS by Direct Injection (Routine Levels)	E725A	691888	1	20	5.0	5.0	✔
Nonylphenol Ethoxylates in Water by LC-MS-MS Positive Mode	E749B	694391	1	8	12.5	5.0	✔
Nonylphenol, Octylphenol and BPA in Water by LC-MS-MS Negative Mode	E749A	694390	1	8	12.5	5.0	✔
pH by Meter	E108	697112	1	19	5.2	5.0	✔
Phenols (4AAP) in Water by Colorimetry	E562	698968	1	20	5.0	5.0	✔
Sulfate in Water by IC	E235.SO4	697105	1	9	11.1	5.0	✔
Total Cyanide	E333	694685	1	14	7.1	5.0	✔
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	698966	1	18	5.5	5.0	✔
Total Mercury in Water by CVAAS	E508	691389	1	20	5.0	5.0	✔
Total metals in Water by CRC ICPMS	E420	693441	1	20	5.0	5.0	✔
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	698969	1	20	5.0	5.0	✔
Total Sulfide by Colourimetry (Automated Flow)	E395-H	696107	1	14	7.1	5.0	✔
TSS by Gravimetry	E160	691026	1	19	5.2	4.7	✔
VOCs (Eastern Canada List) by Headspace GC-MS	E611D	698633	1	2	50.0	5.0	✔
VOCs (Full List) by Headspace GC-MS	E611F	698632	1	3	33.3	5.0	✔
Laboratory Control Samples (LCS)							
Aldehydes by GC-ECD	E693A	691490	1	4	25.0	5.0	✔
Biochemical Oxygen Demand (Carbonaceous) - 5 day	E555	691814	1	4	25.0	5.0	✔
BNA (ON 625 list) by GC-MS	E655B	701490	1	2	50.0	5.0	✔
Fluoride in Water by IC	E235.F	697107	1	4	25.0	5.0	✔
Mineral Oil & Grease by Gravimetry	E567SG	695645	1	9	11.1	5.0	✔
Nitrosamines by LC-MS-MS by Direct Injection (Routine Levels)	E725A	691888	1	20	5.0	5.0	✔
Nonylphenol Ethoxylates in Water by LC-MS-MS Positive Mode	E749B	694391	1	8	12.5	5.0	✔
Nonylphenol, Octylphenol and BPA in Water by LC-MS-MS Negative Mode	E749A	694390	1	8	12.5	5.0	✔
OCP Analysis by GC-MS-MS	E660F	691066	1	2	50.0	5.0	✔
Oil & Grease by Gravimetry	E567	695644	1	13	7.6	5.0	✔
PAHs (ON Special List) by GC-MS	E642D	701488	1	2	50.0	5.0	✔
PAHs by Hexane LVI GC-MS (Low Level)	E641A-L	698948	1	4	25.0	5.0	✔
PCB Aroclors by GC-MS	E687	691065	1	19	5.2	4.7	✔
pH by Meter	E108	697112	1	19	5.2	5.0	✔
Phenols (4AAP) in Water by Colorimetry	E562	698968	1	20	5.0	5.0	✔
Sulfate in Water by IC	E235.SO4	697105	1	9	11.1	5.0	✔



Matrix: **Water**

Evaluation: ✖ = QC frequency outside specification; ✔ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Laboratory Control Samples (LCS) - Continued							
Total Cyanide	E333	694685	1	14	7.1	5.0	✔
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	698966	1	18	5.5	5.0	✔
Total Mercury in Water by CVAAS	E508	691389	1	20	5.0	5.0	✔
Total metals in Water by CRC ICPMS	E420	693441	1	20	5.0	5.0	✔
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	698969	1	20	5.0	5.0	✔
Total Sulfide by Colourimetry (Automated Flow)	E395-H	696107	1	14	7.1	5.0	✔
TSS by Gravimetry	E160	691026	1	19	5.2	4.7	✔
VOCs (Eastern Canada List) by Headspace GC-MS	E611D	698633	1	2	50.0	5.0	✔
VOCs (Full List) by Headspace GC-MS	E611F	698632	1	3	33.3	5.0	✔
Method Blanks (MB)							
Aldehydes by GC-ECD	E693A	691490	1	4	25.0	5.0	✔
Biochemical Oxygen Demand (Carbonaceous) - 5 day	E555	691814	1	4	25.0	5.0	✔
BNA (ON 625 list) by GC-MS	E655B	701490	1	2	50.0	5.0	✔
E. coli (MF-mFC-BCIG)	E012A.EC	691540	1	17	5.8	5.0	✔
Fluoride in Water by IC	E235.F	697107	1	4	25.0	5.0	✔
Mineral Oil & Grease by Gravimetry	E567SG	695645	1	9	11.1	5.0	✔
Nitrosamines by LC-MS-MS by Direct Injection (Routine Levels)	E725A	691888	1	20	5.0	5.0	✔
Nonylphenol Ethoxylates in Water by LC-MS-MS Positive Mode	E749B	694391	1	8	12.5	5.0	✔
Nonylphenol, Octylphenol and BPA in Water by LC-MS-MS Negative Mode	E749A	694390	1	8	12.5	5.0	✔
OCP Analysis by GC-MS-MS	E660F	691066	1	2	50.0	5.0	✔
Oil & Grease by Gravimetry	E567	695644	1	13	7.6	5.0	✔
PAHs (ON Special List) by GC-MS	E642D	701488	1	2	50.0	5.0	✔
PAHs by Hexane LVI GC-MS (Low Level)	E641A-L	698948	1	4	25.0	5.0	✔
PCB Aroclors by GC-MS	E687	691065	1	19	5.2	4.7	✔
Phenols (4AAP) in Water by Colorimetry	E562	698968	1	20	5.0	5.0	✔
Sulfate in Water by IC	E235.SO4	697105	1	9	11.1	5.0	✔
Total Cyanide	E333	694685	1	14	7.1	5.0	✔
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	698966	1	18	5.5	5.0	✔
Total Mercury in Water by CVAAS	E508	691389	1	20	5.0	5.0	✔
Total metals in Water by CRC ICPMS	E420	693441	1	20	5.0	5.0	✔
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	698969	1	20	5.0	5.0	✔
Total Sulfide by Colourimetry (Automated Flow)	E395-H	696107	1	14	7.1	5.0	✔
TSS by Gravimetry	E160	691026	1	19	5.2	4.7	✔
VOCs (Eastern Canada List) by Headspace GC-MS	E611D	698633	1	2	50.0	5.0	✔
VOCs (Full List) by Headspace GC-MS	E611F	698632	1	3	33.3	5.0	✔
Matrix Spikes (MS)							
Aldehydes by GC-ECD	E693A	691490	1	4	25.0	5.0	✔
Fluoride in Water by IC	E235.F	697107	1	4	25.0	5.0	✔
Nitrosamines by LC-MS-MS by Direct Injection (Routine Levels)	E725A	691888	1	20	5.0	5.0	✔



Matrix: **Water**

Evaluation: ✖ = QC frequency outside specification; ✔ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Matrix Spikes (MS) - Continued							
Nonylphenol Ethoxylates in Water by LC-MS-MS Positive Mode	E749B	694391	1	8	12.5	5.0	✔
Nonylphenol, Octylphenol and BPA in Water by LC-MS-MS Negative Mode	E749A	694390	1	8	12.5	5.0	✔
Phenols (4AAP) in Water by Colorimetry	E562	698968	1	20	5.0	5.0	✔
Sulfate in Water by IC	E235.SO4	697105	1	9	11.1	5.0	✔
Total Cyanide	E333	694685	1	14	7.1	5.0	✔
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	698966	1	18	5.5	5.0	✔
Total Mercury in Water by CVAAS	E508	691389	1	20	5.0	5.0	✔
Total metals in Water by CRC ICPMS	E420	693441	1	20	5.0	5.0	✔
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	698969	1	20	5.0	5.0	✔
Total Sulfide by Colourimetry (Automated Flow)	E395-H	696107	1	14	7.1	5.0	✔
VOCs (Eastern Canada List) by Headspace GC-MS	E611D	698633	1	2	50.0	5.0	✔
VOCs (Full List) by Headspace GC-MS	E611F	698632	1	3	33.3	5.0	✔



Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
E. coli (MF-mFC-BCIG)	E012A.EC Waterloo - Environmental	Water	ON E3433 (mod)	Following filtration (0.45 µm), and incubation at 44.5±0.2°C for 24 hours, colonies exhibiting characteristic morphology of the target organism are enumerated.
pH by Meter	E108 Waterloo - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
TSS by Gravimetry	E160 Waterloo - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
Fluoride in Water by IC	E235.F Waterloo - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Waterloo - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318 Waterloo - Environmental	Water	Method Fialab 100, 2018	TKN in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021).
Total Cyanide	E333 Waterloo - Environmental	Water	ISO 14403 (mod)	Total or Strong Acid Dissociable (SAD) Cyanide is determined by Continuous Flow Analyzer (CFA) with in-line UV digestion followed by colourimetric analysis. Method Limitation: High levels of thiocyanate (SCN) may cause positive interference (up to 0.5% of SCN concentration).
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Waterloo - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Total Sulfide by Colourimetry (Automated Flow)	E395-H Vancouver - Environmental	Water	APHA 4500 -S E-Auto-Colorimetry	Sulfide is determined using the gas dialysis automated methylene blue colourimetric method. Results expressed "as H2S" if reported represent the maximum possible H2S concentration based on the total sulfide concentration in the sample. The H2S calculation converts Total Sulphide as (S2-) and reports it as Total Sulphide as (H2S)



Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Total metals in Water by CRC ICPMS	E420 Waterloo - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Total Mercury in Water by CVAAS	E508 Waterloo - Environmental	Water	EPA 1631E (mod)	Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS
Biochemical Oxygen Demand (Carbonaceous) - 5 day	E555 Waterloo - Environmental	Water	APHA 5210 B (mod)	Samples are diluted and incubated for a specified time period, after which the oxygen depletion is measured using a dissolved oxygen meter. Nitrification inhibitor is added to samples to prevent nitrogenous compounds from consuming oxygen resulting in only carbonaceous oxygen demand being reported by this method. Free chlorine is a negative interference in the BOD method; please advise ALS when free chlorine is present in samples.
Phenols (4AAP) in Water by Colorimetry	E562 Waterloo - Environmental	Water	EPA 9066	This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide (K ₃ Fe(CN) ₆) and 4-amino-antipyrine (4-AAP) to form a red complex which is measured colorimetrically.
Oil & Grease by Gravimetry	E567 Waterloo - Environmental	Water	BC MOE Lab Manual (Oil & Grease) (mod)	The entire water sample is extracted with hexane and the extract is evaporated to dryness. The residue is then weighed to determine Oil and Grease.
Mineral Oil & Grease by Gravimetry	E567SG Waterloo - Environmental	Water	BC MOE Lab Manual (Oil & Grease) (mod)	The entire water sample is extracted with hexane, followed by silica gel treatment after which the extract is evaporated to dryness. The residue is then weighed to determine Mineral Oil and Grease.
VOCs (Eastern Canada List) by Headspace GC-MS	E611D Waterloo - Environmental	Water	EPA 8260D (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
VOCs (Full List) by Headspace GC-MS	E611F Waterloo - Environmental	Water	EPA 8260D (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
PAHs by Hexane LVI GC-MS (Low Level)	E641A-L Waterloo - Environmental	Water	EPA 8270E (mod)	Polycyclic Aromatic Hydrocarbons (PAHs) are analyzed by large volume injection (LVI) GC-MS.
PAHs (ON Special List) by GC-MS	E642D Waterloo - Environmental	Water	EPA 8270E (mod)	Polycyclic Aromatic Hydrocarbons (PAHs) are analyzed by GC-MS.



Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
BNA (ON 625 list) by GC-MS	E655B Waterloo - Environmental	Water	EPA 8270E (mod)	BNA are analyzed by GC-MS.
OCP Analysis by GC-MS-MS	E660F Waterloo - Environmental	Water	EPA 8270E (mod)	Pesticides are analyzed by GC-MS-MS
PCB Aroclors by GC-MS	E687 Waterloo - Environmental	Water	EPA 8270E (mod)	PCB Aroclors are analyzed by GC-MS
Aldehydes by GC-ECD	E693A Waterloo - Environmental	Water	EPA METHOD 556.1	This is a gas chromatography method optimized for the determination of aldehydes in water and solid samples. Aldehydes are derivatized with o-(2,3,4,5,6-pentafluorobenzyl) hydroxylamine (PFBHA) to obtain their corresponding pentafluorobenzyl oximes. The oxime derivatives are then extracted from the water with hexane containing pentachloronitrobenzene as internal standard. The hexane extracts are analyzed by gas chromatography with electron capture detection (GC-ECD).
Nitrosamines by LC-MS-MS by Direct Injection (Routine Levels)	E725A Waterloo - Environmental	Water	QWI-ORG/WP239	An aliquot of sample is injected directly using liquid chromatography tandem mass spectrometry.
Nonylphenol, Octylphenol and BPA in Water by LC-MS-MS Negative Mode	E749A Waterloo - Environmental	Water	J. Chrom A849 (1999) p.467-482	An aliquot of 5.0 ± 0.10 mL of filtered sample is spiked with Nonylphenol-D4, Nonylphenol Diethoxylate 13C6, and Bisphenol A 13C12 internal standards and analyzed by LC-MS/MS.
Nonylphenol Ethoxylates in Water by LC-MS-MS Positive Mode	E749B Waterloo - Environmental	Water	J. Chrom A849 (1999) p.467-482	Water samples are filtered and analyzed on LCMS/MS by direct injection.
Animal & Vegetable Oil & Grease by Gravimetry	EC567A.SG Waterloo - Environmental	Water	APHA 5520 (mod)	Animal & vegetable oil and grease is calculated as follows: Oil & Grease (gravimetric) minus Mineral Oil & Grease (gravimetric)
Total PAH (Ontario Sewer Use Extended List)	EC640A Waterloo - Environmental	Water	Calculation (Sum of the Squares)	Total PAH (Ontario Sewer Use) is the sum of the following PAHs: anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b+j)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, phenanthrene, pyrene, benzo(e)pyrene, perylene, 3-methylcholanthrene, 1,3-dinitropyrene, 1,6-dinitropyrene, 1,8-dinitropyrene, 7H-dibenzo(c,g)carbazole, dibenzo(a,i)pyrene, dibenz(a,j)acridine, and dibenz(a,h)acridine. When the PAH is less than LOR, zero is used for calculation.
Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions



Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Digestion for TKN in water	EP318 Waterloo - Environmental	Water	APHA 4500-Norg D (mod)	Samples are digested at high temperature using Sulfuric Acid with Copper catalyst, which converts organic nitrogen sources to Ammonia, which is then quantified by the analytical method as TKN. This method is unsuitable for samples containing high levels of nitrate. If nitrate exceeds TKN concentration by ten times or more, results may be biased low.
Digestion for Total Phosphorus in water	EP372 Waterloo - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Oil & Grease Extraction for Gravimetry	EP567 Waterloo - Environmental	Water	BC MOE Lab Manual (Oil & Grease) (mod)	The entire water sample is extracted with hexane by liquid-liquid extraction.
VOCs Preparation for Headspace Analysis	EP581 Waterloo - Environmental	Water	EPA 5021A (mod)	Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler. An aliquot of the headspace is then injected into the GC/MS-FID system.
PHCs and PAHs Hexane Extraction	EP601 Waterloo - Environmental	Water	EPA 3511 (mod)	Petroleum Hydrocarbons (PHCs) and Polycyclic Aromatic Hydrocarbons (PAHs) are extracted using a hexane liquid-liquid extraction.
PAHs DCM Extraction	EP642 Waterloo - Environmental	Water	EPA 3510C (mod)	PAH are extracted from aqueous sample using DCM liquid-liquid extraction.
BNA Extraction	EP655 Waterloo - Environmental	Water	EPA 3510C (mod)	SVOCs are extracted from aqueous sample using DCM liquid-liquid extraction.
Pesticides, PCB, and Neutral Extractable Chlorinated Hydrocarbons Extraction	EP660 Waterloo - Environmental	Water	EPA 3511 (mod)	Samples are extracted from aqueous sample using an organic solvent liquid-liquid extraction.
Preparation of Nitrosamines for Direct Injection LC-MS-MS	EP725A Waterloo - Environmental	Water	QWI-ORG/WP239	Preparation of Nitrosamines in Water for Direct Injection LC-MS-MS
Preparation of Nonylphenol and Nonylphenol Ethoxylates	EP749 Waterloo - Environmental	Water	J. Chrom A849 (1999) p.467-482	An aliquot of 5.0 ± 0.10 mL of filtered sample is spiked with Nonylphenol-D4, Nonylphenol Diethoxylate 13C6, and Bisphenol A 13C12 internal standards and analyzed by LC-MS/MS.

QUALITY CONTROL REPORT

Work Order	: WT2217418	Page	: 1 of 18
Client	: Fisher Environmental Ltd.	Laboratory	: Waterloo - Environmental
Contact	: Clive Wiggan	Account Manager	: Emily Hansen
Address	: 15-400 Esna Park Drive Markham ON Canada L3R 3K2	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	:	Telephone	: +1 519 886 6910
Project	: ----	Date Samples Received	: 11-Oct-2022 15:52
PO	: ----	Date Analysis Commenced	: 12-Oct-2022
C-O-C number	: 20-1004260	Issue Date	: 25-Oct-2022 13:50
Sampler	: CLIENT 905 475 7755, Ext. 29		
Site	: ----		
Quote number	: FISHER ENVIRONMENTAL - ALS 2022 STANDING OFFER		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	Position	Laboratory Department
Adam Boettger	Team Leader - LCMS	Waterloo LCMS, Waterloo, Ontario
Amanda Ganouri-Lumsden	Department Manager - Microbiology and Prep	Waterloo Microbiology, Waterloo, Ontario
Caitlin Macey	Team Leader - Inorganics	Vancouver Inorganics, Burnaby, British Columbia
Danielle Gravel	Team Leader - Semi-Volatile Instrumentation	Waterloo Organics, Waterloo, Ontario
David Tremblett	Team Leader - Volatiles	Waterloo Air Quality, Waterloo, Ontario
Greg Pokocky	Supervisor - Inorganic	Waterloo Inorganics, Waterloo, Ontario
Greg Pokocky	Supervisor - Inorganic	Waterloo Metals, Waterloo, Ontario
Jocelyn Kennedy	Department Manager - Semi-Volatile Organics	Waterloo Organics, Waterloo, Ontario
Rachel Cameron	Team Leader - Semi-Volatile Organics	Waterloo Organics, Waterloo, Ontario
Sarah Birch	Team Leader - Volatiles	Waterloo Organics, Waterloo, Ontario

Page : 2 of 18
Work Order : WT2217418
Client : Fisher Environmental Ltd.
Project : ----



General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO = Data Quality Objective.

LOR = Limit of Reporting (detection limit).

RPD = Relative Percent Difference

= Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.



Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: Water					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 691026)											
WT2217165-001	Anonymous	solids, total suspended [TSS]	----	E160	3.0	mg/L	89.6	85.4	4.80%	20%	----
Physical Tests (QC Lot: 697112)											
WT2217293-001	Anonymous	pH	----	E108	0.10	pH units	8.73	8.75	0.229%	4%	----
Anions and Nutrients (QC Lot: 697105)											
WT2217203-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	78.5	77.8	0.892%	20%	----
Anions and Nutrients (QC Lot: 697107)											
WT2217203-001	Anonymous	fluoride	16984-48-8	E235.F	0.020	mg/L	0.658	0.639	2.92%	20%	----
Anions and Nutrients (QC Lot: 698966)											
WT2217371-001	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	0.500	mg/L	<0.500	<0.500	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 698969)											
WT2217206-001	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.286	0.282	1.26%	20%	----
Cyanides (QC Lot: 694685)											
TY2202609-001	Anonymous	cyanide, strong acid dissociable (total)	----	E333	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Total Sulfides (QC Lot: 696107)											
VA22C4619-001	Anonymous	sulfide, total (as S)	18496-25-8	E395-H	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
Total Metals (QC Lot: 691389)											
TY2202462-007	Anonymous	mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Total Metals (QC Lot: 693441)											
WT2217303-001	Anonymous	aluminum, total	7429-90-5	E420	0.0300	mg/L	<0.0300	<0.0300	0	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00100	mg/L	<0.00100	<0.00100	0	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00100	mg/L	<0.00100	<0.00100	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000500	mg/L	<0.000500	<0.000500	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.100	mg/L	<0.100	<0.100	0	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000500	mg/L	<0.0000500	<0.0000500	0	Diff <2x LOR	----
		chromium, total	7440-47-3	E420	0.00500	mg/L	<0.00500	<0.00500	0	Diff <2x LOR	----
		cobalt, total	7440-48-4	E420	0.00100	mg/L	<0.00090	<0.00100	0.00010	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00500	mg/L	<0.00100	<0.00500	0.00400	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000500	mg/L	<0.000500	<0.000500	0	Diff <2x LOR	----
		manganese, total	7439-96-5	E420	0.00100	mg/L	0.0197	0.0182	7.82%	20%	----



Sub-Matrix: Water					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Total Metals (QC Lot: 693441) - continued											
WT2217303-001	Anonymous	molybdenum, total	7439-98-7	E420	0.000500	mg/L	<0.000500	<0.000500	0	Diff <2x LOR	----
		nickel, total	7440-02-0	E420	0.00500	mg/L	<0.00500	<0.00500	0	Diff <2x LOR	----
		selenium, total	7782-49-2	E420	0.000500	mg/L	<0.000500	<0.000500	0	Diff <2x LOR	----
		silver, total	7440-22-4	E420	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00100	mg/L	<0.00100	<0.00100	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00300	mg/L	<0.00300	<0.00300	0	Diff <2x LOR	----
		vanadium, total	7440-62-2	E420	0.00500	mg/L	<0.00500	<0.00500	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0300	mg/L	<0.0300	<0.0300	0	Diff <2x LOR	----
Aggregate Organics (QC Lot: 691814)											
WT2217468-001	Anonymous	carbonaceous biochemical oxygen demand [CBOD]	----	E555	2.0	mg/L	5.4	5.4	0.0%	30%	----
Aggregate Organics (QC Lot: 698968)											
WT2217206-001	Anonymous	phenols, total (4AAP)	----	E562	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Volatile Organic Compounds (QC Lot: 698632)											
WT2217371-001	Anonymous	trimethylbenzene, 1,3,5-	108-67-8	E611F	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
Volatile Organic Compounds (QC Lot: 698633)											
WT2217371-001	Anonymous	benzene	71-43-2	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		bromodichloromethane	75-27-4	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		bromoform	75-25-2	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		bromomethane	74-83-9	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		carbon tetrachloride	56-23-5	E611D	0.20	µg/L	<0.20	<0.20	0	Diff <2x LOR	----
		chlorobenzene	108-90-7	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		chloroethane	75-00-3	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		chloroform	67-66-3	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		chloromethane	74-87-3	E611D	2.0	µg/L	<2.0	<2.0	0	Diff <2x LOR	----
		dibromochloromethane	124-48-1	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dibromoethane, 1,2-	106-93-4	E611D	0.20	µg/L	<0.20	<0.20	0	Diff <2x LOR	----
		dichlorobenzene, 1,2-	95-50-1	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dichlorobenzene, 1,3-	541-73-1	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dichlorobenzene, 1,4-	106-46-7	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dichloroethylene, cis-1,2-	156-59-2	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dichloromethane	75-09-2	E611D	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		dichloropropylene, trans-1,3-	10061-02-6	E611D	0.30	µg/L	<0.30	<0.30	0	Diff <2x LOR	----
		ethylbenzene	100-41-4	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----



Sub-Matrix: Water					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Volatile Organic Compounds (QC Lot: 698633) - continued											
WT2217371-001	Anonymous	tetrachloroethane, 1,1,2,2-	79-34-5	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		tetrachloroethylene	127-18-4	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		toluene	108-88-3	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		trichloroethylene	79-01-6	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		trichlorofluoromethane	75-69-4	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		vinyl chloride	75-01-4	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		xylene, m+p-	179601-23-1	E611D	0.40	µg/L	<0.40	<0.40	0	Diff <2x LOR	----
		xylene, o-	95-47-6	E611D	0.30	µg/L	<0.30	<0.30	0	Diff <2x LOR	----
Aldehydes (QC Lot: 691490)											
WT2217371-001	Anonymous	Formaldehyde	50-00-0	E693A	2.0	µg/L	<2.0	<2.0	0	Diff <2x LOR	----
Nonylphenols (QC Lot: 694390)											
WT2217371-001	Anonymous	nonylphenols [NP]	84852-15-3	E749A	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
Nonylphenols (QC Lot: 694391)											
WT2217371-001	Anonymous	nonylphenol diethoxylates [NP2EO]	n/a	E749B	0.10	µg/L	<0.10	<0.10	0	Diff <2x LOR	----
		nonylphenol monoethoxylates [NP1EO]	n/a	E749B	2.0	µg/L	<2.0	<2.0	0	Diff <2x LOR	----
Nitrosamines (QC Lot: 691888)											
WT2216975-001	Anonymous	nitrosodimethylamine, n- [NDMA]	62-75-9	E725A	0.030	µg/L	0.043	0.046	0.002	Diff <2x LOR	----



Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: Water

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 691026)						
solids, total suspended [TSS]	----	E160	3	mg/L	<3.0	----
Anions and Nutrients (QCLot: 697105)						
sulfate (as SO ₄)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 697107)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 698966)						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 698969)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Cyanides (QCLot: 694685)						
cyanide, strong acid dissociable (total)	----	E333	0.002	mg/L	<0.0020	----
Total Sulfides (QCLot: 696107)						
sulfide, total (as S)	18496-25-8	E395-H	0.01	mg/L	<0.010	----
Microbiological Tests (QCLot: 691540)						
coliforms, Escherichia coli [E. coli]	----	E012A.EC	1	CFU/100mL	<1	----
Total Metals (QCLot: 691389)						
mercury, total	7439-97-6	E508	0.000005	mg/L	<0.0000050	----
Total Metals (QCLot: 693441)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
chromium, total	7440-47-3	E420	0.0005	mg/L	<0.00050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----



Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 693441) - continued						
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Aggregate Organics (QCLot: 691814)						
carbonaceous biochemical oxygen demand [CBOD]	----	E555	2	mg/L	<2.0	----
Aggregate Organics (QCLot: 695644)						
oil & grease (gravimetric)	----	E567	5	mg/L	<5.0	----
Aggregate Organics (QCLot: 695645)						
oil & grease, mineral (gravimetric)	----	E567SG	5	mg/L	<5.0	----
Aggregate Organics (QCLot: 698968)						
phenols, total (4AAP)	----	E562	0.001	mg/L	<0.0010	----
Volatile Organic Compounds (QCLot: 698632)						
trimethylbenzene, 1,3,5-	108-67-8	E611F	0.5	µg/L	<0.50	----
Volatile Organic Compounds (QCLot: 698633)						
benzene	71-43-2	E611D	0.5	µg/L	<0.50	----
bromodichloromethane	75-27-4	E611D	0.5	µg/L	<0.50	----
bromoform	75-25-2	E611D	0.5	µg/L	<0.50	----
bromomethane	74-83-9	E611D	0.5	µg/L	<0.50	----
carbon tetrachloride	56-23-5	E611D	0.2	µg/L	<0.20	----
chlorobenzene	108-90-7	E611D	0.5	µg/L	<0.50	----
chloroethane	75-00-3	E611D	0.5	µg/L	<0.50	----
chloroform	67-66-3	E611D	0.5	µg/L	<0.50	----
chloromethane	74-87-3	E611D	2	µg/L	<2.0	----
dibromochloromethane	124-48-1	E611D	0.5	µg/L	<0.50	----
dibromoethane, 1,2-	106-93-4	E611D	0.2	µg/L	<0.20	----
dichlorobenzene, 1,2-	95-50-1	E611D	0.5	µg/L	<0.50	----
dichlorobenzene, 1,3-	541-73-1	E611D	0.5	µg/L	<0.50	----
dichlorobenzene, 1,4-	106-46-7	E611D	0.5	µg/L	<0.50	----
dichloroethylene, cis-1,2-	156-59-2	E611D	0.5	µg/L	<0.50	----
dichloromethane	75-09-2	E611D	1	µg/L	<1.0	----
dichloropropylene, trans-1,3-	10061-02-6	E611D	0.3	µg/L	<0.30	----
ethylbenzene	100-41-4	E611D	0.5	µg/L	<0.50	----
tetrachloroethane, 1,1,2,2-	79-34-5	E611D	0.5	µg/L	<0.50	----



Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Volatile Organic Compounds (QCLot: 698633) - continued						
tetrachloroethylene	127-18-4	E611D	0.5	µg/L	<0.50	----
toluene	108-88-3	E611D	0.5	µg/L	<0.50	----
trichloroethylene	79-01-6	E611D	0.5	µg/L	<0.50	----
trichlorofluoromethane	75-69-4	E611D	0.5	µg/L	<0.50	----
vinyl chloride	75-01-4	E611D	0.5	µg/L	<0.50	----
xylene, m+p-	179601-23-1	E611D	0.4	µg/L	<0.40	----
xylene, o-	95-47-6	E611D	0.3	µg/L	<0.30	----
Polycyclic Aromatic Hydrocarbons (QCLot: 698948)						
anthracene	120-12-7	E641A-L	0.01	µg/L	<0.010	----
benz(a)anthracene	56-55-3	E641A-L	0.01	µg/L	<0.010	----
benzo(a)pyrene	50-32-8	E641A-L	0.005	µg/L	<0.0050	----
benzo(b+j)fluoranthene	n/a	E641A-L	0.01	µg/L	<0.010	----
benzo(e)pyrene	192-97-2	E641A-L	0.01	µg/L	<0.010	----
benzo(g,h,i)perylene	191-24-2	E641A-L	0.01	µg/L	<0.010	----
benzo(k)fluoranthene	207-08-9	E641A-L	0.01	µg/L	<0.010	----
chrysene	218-01-9	E641A-L	0.01	µg/L	<0.010	----
dibenz(a,h)anthracene	53-70-3	E641A-L	0.005	µg/L	<0.0050	----
fluoranthene	206-44-0	E641A-L	0.01	µg/L	<0.010	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.01	µg/L	<0.010	----
perylene	198-55-0	E641A-L	0.01	µg/L	<0.010	----
phenanthrene	85-01-8	E641A-L	0.01	µg/L	<0.010	----
pyrene	129-00-0	E641A-L	0.01	µg/L	<0.010	----
Polycyclic Aromatic Hydrocarbons (QCLot: 701488)						
dibenz(a,h)acridine	226-36-8	E642D	0.05	µg/L	<0.050	----
dibenz(a,j)acridine	224-42-0	E642D	0.05	µg/L	<0.050	----
dibenzo(a,i)pyrene	189-55-9	E642D	0.05	µg/L	<0.050	----
dibenzo(c,g)carbazole, 7H-	194-59-2	E642D	0.05	µg/L	<0.050	----
dinitropyrene, 1,3-	75321-20-9	E642D	1	µg/L	<1.0	----
dinitropyrene, 1,6-	42397-64-8	E642D	1	µg/L	<1.0	----
dinitropyrene, 1,8-	42397-65-9	E642D	1	µg/L	<1.0	----
methylcholanthrene, 3-	56-49-5	E642D	0.05	µg/L	<0.050	----
Polycyclic Aromatic Hydrocarbons (QCLot: 701490)						
fluorene	86-73-7	E655B	0.2	µg/L	<0.20	----
methylnaphthalene, 1-	90-12-0	E655B	0.4	µg/L	<0.40	----
methylnaphthalene, 2-	91-57-6	E655B	0.4	µg/L	<0.40	----



Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Polycyclic Aromatic Hydrocarbons (QCLot: 701490) - continued						
naphthalene	91-20-3	E655B	0.2	µg/L	<0.20	----
Aldehydes (QCLot: 691490)						
Formaldehyde	50-00-0	E693A	2	µg/L	<2.0	----
Phthalate Esters (QCLot: 701490)						
bis(2-ethylhexyl) phthalate [DEHP]	117-81-7	E655B	1	µg/L	<1.0	----
butyl benzyl phthalate	85-68-7	E655B	0.4	µg/L	<0.40	----
diethyl phthalate	84-66-2	E655B	0.2	µg/L	<0.20	----
di-n-butyl phthalate	84-74-2	E655B	1	µg/L	<1.0	----
di-n-octyl phthalate [DNOP]	117-84-0	E655B	0.4	µg/L	<0.40	----
Semi-Volatile Organics (QCLot: 701490)						
bis(2-chloroethoxy)methane	111-91-1	E655B	0.4	µg/L	<0.40	----
indole	120-72-9	E655B	0.4	µg/L	<0.40	----
Chlorinated Phenolics (QCLot: 701490)						
dichlorophenol, 2,4-	120-83-2	E655B	0.3	µg/L	<0.30	----
Nonylphenols (QCLot: 694390)						
nonylphenols [NP]	84852-15-3	E749A	1	µg/L	<1.0	----
Nonylphenols (QCLot: 694391)						
nonylphenol diethoxylates [NP2EO]	n/a	E749B	0.1	µg/L	<0.10	----
nonylphenol monoethoxylates [NP1EO]	n/a	E749B	2	µg/L	<2.0	----
Polychlorinated Biphenyls (QCLot: 691065)						
Aroclor 1016	12674-11-2	E687	0.02	µg/L	<0.020	----
Aroclor 1221	11104-28-2	E687	0.02	µg/L	<0.020	----
Aroclor 1232	11141-16-5	E687	0.02	µg/L	<0.020	----
Aroclor 1242	53469-21-9	E687	0.02	µg/L	<0.020	----
Aroclor 1248	12672-29-6	E687	0.02	µg/L	<0.020	----
Aroclor 1254	11097-69-1	E687	0.02	µg/L	<0.020	----
Aroclor 1260	11096-82-5	E687	0.02	µg/L	<0.020	----
Aroclor 1262	37324-23-5	E687	0.02	µg/L	<0.020	----
Aroclor 1268	11100-14-4	E687	0.02	µg/L	<0.020	----
Organochlorine Pesticides (QCLot: 691066)						
hexachlorobenzene	118-74-1	E660F	0.008	µg/L	<0.0080	----
Nitrosamines (QCLot: 691888)						
nitrosodimethylamine, n- [NDMA]	62-75-9	E725A	0.03	µg/L	<0.030	----





Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: Water

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 691026)									
solids, total suspended [TSS]	----	E160	3	mg/L	150 mg/L	89.0	85.0	115	----
Physical Tests (QCLot: 697112)									
pH	----	E108	----	pH units	7 pH units	101	98.0	102	----
Anions and Nutrients (QCLot: 697105)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 697107)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	100	90.0	110	----
Anions and Nutrients (QCLot: 698966)									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	104	75.0	125	----
Anions and Nutrients (QCLot: 698969)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.53 mg/L	97.5	80.0	120	----
Cyanides (QCLot: 694685)									
cyanide, strong acid dissociable (total)	----	E333	0.002	mg/L	0.25 mg/L	89.4	80.0	120	----
Total Sulfides (QCLot: 696107)									
sulfide, total (as H2S)	7783-06-4	E395-H	----	mg/L	0.085 mg/L	80.1	80.0	120	----
sulfide, total (as S)	18496-25-8	E395-H	0.01	mg/L	0.08 mg/L	80.0	80.0	120	----
Total Metals (QCLot: 691389)									
mercury, total	7439-97-6	E508	0.000005	mg/L	0.0001 mg/L	101	80.0	120	----
Total Metals (QCLot: 693441)									
aluminum, total	7429-90-5	E420	0.003	mg/L	0.1 mg/L	99.1	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	0.05 mg/L	108	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	0.05 mg/L	104	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	0.05 mg/L	104	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	0.05 mg/L	87.8	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.005 mg/L	108	80.0	120	----
chromium, total	7440-47-3	E420	0.0005	mg/L	0.0125 mg/L	101	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.0125 mg/L	101	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.0125 mg/L	99.2	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.025 mg/L	106	80.0	120	----



Sub-Matrix: Water					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		Qualifier
					Concentration	LCS	Low	High	
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 693441) - continued									
manganese, total	7439-96-5	E420	0.0001	mg/L	0.0125 mg/L	103	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.0125 mg/L	100	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.025 mg/L	101	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	0.05 mg/L	104	80.0	120	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.005 mg/L	106	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.025 mg/L	106	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.0125 mg/L	99.2	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.025 mg/L	102	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.025 mg/L	101	80.0	120	----
Aggregate Organics (QCLot: 691814)									
carbonaceous biochemical oxygen demand [CBOD]	----	E555	2	mg/L	198 mg/L	103	85.0	115	----
Aggregate Organics (QCLot: 695644)									
oil & grease (gravimetric)	----	E567	5	mg/L	200 mg/L	91.4	70.0	130	----
Aggregate Organics (QCLot: 695645)									
oil & grease, mineral (gravimetric)	----	E567SG	5	mg/L	100 mg/L	88.2	70.0	130	----
Aggregate Organics (QCLot: 698968)									
phenols, total (4AAP)	----	E562	0.001	mg/L	0.02 mg/L	106	85.0	115	----
Volatile Organic Compounds (QCLot: 698632)									
trimethylbenzene, 1,3,5-	108-67-8	E611F	0.5	µg/L	100 µg/L	114	70.0	130	----
Volatile Organic Compounds (QCLot: 698633)									
benzene	71-43-2	E611D	0.5	µg/L	100 µg/L	113	70.0	130	----
bromodichloromethane	75-27-4	E611D	0.5	µg/L	100 µg/L	116	70.0	130	----
bromoform	75-25-2	E611D	0.5	µg/L	100 µg/L	100	70.0	130	----
bromomethane	74-83-9	E611D	0.5	µg/L	100 µg/L	103	60.0	140	----
carbon tetrachloride	56-23-5	E611D	0.2	µg/L	100 µg/L	115	70.0	130	----
chlorobenzene	108-90-7	E611D	0.5	µg/L	100 µg/L	111	70.0	130	----
chloroethane	75-00-3	E611D	0.5	µg/L	100 µg/L	108	60.0	140	----
chloroform	67-66-3	E611D	0.5	µg/L	100 µg/L	111	70.0	130	----
chloromethane	74-87-3	E611D	2	µg/L	100 µg/L	92.6	60.0	140	----
dibromochloromethane	124-48-1	E611D	0.5	µg/L	100 µg/L	100	70.0	130	----
dibromoethane, 1,2-	106-93-4	E611D	0.2	µg/L	100 µg/L	91.3	70.0	130	----
dichlorobenzene, 1,2-	95-50-1	E611D	0.5	µg/L	100 µg/L	110	70.0	130	----
dichlorobenzene, 1,3-	541-73-1	E611D	0.5	µg/L	100 µg/L	111	70.0	130	----
dichlorobenzene, 1,4-	106-46-7	E611D	0.5	µg/L	100 µg/L	110	70.0	130	----



Sub-Matrix: Water					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		Qualifier
					Concentration	LCS	Low	High	
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 698633) - continued									
dichloroethylene, cis-1,2-	156-59-2	E611D	0.5	µg/L	100 µg/L	95.9	70.0	130	----
dichloromethane	75-09-2	E611D	1	µg/L	100 µg/L	118	70.0	130	----
dichloropropylene, trans-1,3-	10061-02-6	E611D	0.3	µg/L	100 µg/L	90.1	70.0	130	----
ethylbenzene	100-41-4	E611D	0.5	µg/L	100 µg/L	106	70.0	130	----
tetrachloroethane, 1,1,2,2-	79-34-5	E611D	0.5	µg/L	100 µg/L	103	70.0	130	----
tetrachloroethylene	127-18-4	E611D	0.5	µg/L	100 µg/L	106	70.0	130	----
toluene	108-88-3	E611D	0.5	µg/L	100 µg/L	106	70.0	130	----
trichloroethylene	79-01-6	E611D	0.5	µg/L	100 µg/L	114	70.0	130	----
trichlorofluoromethane	75-69-4	E611D	0.5	µg/L	100 µg/L	109	60.0	140	----
vinyl chloride	75-01-4	E611D	0.5	µg/L	100 µg/L	94.4	60.0	140	----
xylene, m+p-	179601-23-1	E611D	0.4	µg/L	200 µg/L	110	70.0	130	----
xylene, o-	95-47-6	E611D	0.3	µg/L	100 µg/L	108	70.0	130	----
Polycyclic Aromatic Hydrocarbons (QCLot: 698948)									
anthracene	120-12-7	E641A-L	0.01	µg/L	0.5263 µg/L	114	50.0	140	----
benz(a)anthracene	56-55-3	E641A-L	0.01	µg/L	0.5263 µg/L	115	50.0	140	----
benzo(a)pyrene	50-32-8	E641A-L	0.005	µg/L	0.5263 µg/L	92.8	50.0	140	----
benzo(b+j)fluoranthene	n/a	E641A-L	0.01	µg/L	0.5263 µg/L	93.7	50.0	140	----
benzo(e)pyrene	192-97-2	E641A-L	0.01	µg/L	0.5263 µg/L	101	50.0	140	----
benzo(g,h,i)perylene	191-24-2	E641A-L	0.01	µg/L	0.5263 µg/L	110	50.0	140	----
benzo(k)fluoranthene	207-08-9	E641A-L	0.01	µg/L	0.5263 µg/L	111	50.0	140	----
chrysene	218-01-9	E641A-L	0.01	µg/L	0.5263 µg/L	110	50.0	140	----
dibenz(a,h)anthracene	53-70-3	E641A-L	0.005	µg/L	0.5263 µg/L	89.3	50.0	140	----
fluoranthene	206-44-0	E641A-L	0.01	µg/L	0.5263 µg/L	116	50.0	140	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.01	µg/L	0.5263 µg/L	89.5	50.0	140	----
perylene	198-55-0	E641A-L	0.01	µg/L	0.5263 µg/L	110	50.0	140	----
phenanthrene	85-01-8	E641A-L	0.01	µg/L	0.5263 µg/L	123	50.0	140	----
pyrene	129-00-0	E641A-L	0.01	µg/L	0.5263 µg/L	115	50.0	140	----
Polycyclic Aromatic Hydrocarbons (QCLot: 701488)									
dibenz(a,h)acridine	226-36-8	E642D	0.05	µg/L	1.6 µg/L	88.2	60.0	130	----
dibenz(a,j)acridine	224-42-0	E642D	0.05	µg/L	1.6 µg/L	87.2	60.0	130	----
dibenzo(a,i)pyrene	189-55-9	E642D	0.05	µg/L	1.6 µg/L	# 59.0	60.0	130	LCS-ND
dibenzo(c,g)carbazole, 7H-	194-59-2	E642D	0.05	µg/L	1.6 µg/L	88.9	60.0	130	----
dinitropyrene, 1,3-	75321-20-9	E642D	1	µg/L	1.6 µg/L	96.7	60.0	130	----
dinitropyrene, 1,6-	42397-64-8	E642D	1	µg/L	1.6 µg/L	106	60.0	130	----
dinitropyrene, 1,8-	42397-65-9	E642D	1	µg/L	1.6 µg/L	119	60.0	130	----



Sub-Matrix: Water					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		Qualifier
					Concentration	LCS	Low	High	
Analyte	CAS Number	Method	LOR	Unit					
Polycyclic Aromatic Hydrocarbons (QCLot: 701488) - continued									
methylcholanthrene, 3-	56-49-5	E642D	0.05	µg/L	1.6 µg/L	109	60.0	130	----
Polycyclic Aromatic Hydrocarbons (QCLot: 701490)									
fluorene	86-73-7	E655B	0.2	µg/L	1.6 µg/L	97.4	50.0	140	----
methylnaphthalene, 1-	90-12-0	E655B	0.4	µg/L	1.6 µg/L	84.9	50.0	140	----
methylnaphthalene, 2-	91-57-6	E655B	0.4	µg/L	1.6 µg/L	88.5	50.0	140	----
naphthalene	91-20-3	E655B	0.2	µg/L	1.6 µg/L	99.0	50.0	140	----
Aldehydes (QCLot: 691490)									
Formaldehyde	50-00-0	E693A	2	µg/L	25.75 µg/L	103	70.0	130	----
Phthalate Esters (QCLot: 701490)									
bis(2-ethylhexyl) phthalate [DEHP]	117-81-7	E655B	1	µg/L	6.4 µg/L	130	50.0	140	----
butyl benzyl phthalate	85-68-7	E655B	0.4	µg/L	6.4 µg/L	131	50.0	140	----
diethyl phthalate	84-66-2	E655B	0.2	µg/L	6.4 µg/L	105	50.0	140	----
di-n-butyl phthalate	84-74-2	E655B	1	µg/L	6.4 µg/L	117	50.0	140	----
di-n-octyl phthalate [DNOP]	117-84-0	E655B	0.4	µg/L	6.4 µg/L	# 152	50.0	140	LCS-H
Semi-Volatile Organics (QCLot: 701490)									
bis(2-chloroethoxy)methane	111-91-1	E655B	0.4	µg/L	1.6 µg/L	92.2	50.0	140	----
indole	120-72-9	E655B	0.4	µg/L	1.6 µg/L	105	50.0	140	----
Chlorinated Phenolics (QCLot: 701490)									
dichlorophenol, 2,4-	120-83-2	E655B	0.3	µg/L	4.8 µg/L	92.6	65.0	130	----
Nonylphenols (QCLot: 694390)									
nonylphenols [NP]	84852-15-3	E749A	1	µg/L	10 µg/L	96.6	75.0	125	----
Nonylphenols (QCLot: 694391)									
nonylphenol diethoxylates [NP2EO]	n/a	E749B	0.1	µg/L	1 µg/L	102	75.0	125	----
nonylphenol monoethoxylates [NP1EO]	n/a	E749B	2	µg/L	20 µg/L	103	75.0	125	----
Polychlorinated Biphenyls (QCLot: 691065)									
Aroclor 1016	12674-11-2	E687	0.02	µg/L	0.2 µg/L	99.4	60.0	140	----
Aroclor 1221	11104-28-2	E687	0.02	µg/L	0.2 µg/L	99.4	60.0	140	----
Aroclor 1232	11141-16-5	E687	0.02	µg/L	0.2 µg/L	99.4	60.0	140	----
Aroclor 1242	53469-21-9	E687	0.02	µg/L	0.2 µg/L	99.4	60.0	140	----
Aroclor 1248	12672-29-6	E687	0.02	µg/L	0.2 µg/L	97.3	60.0	140	----



Sub-Matrix: Water					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		Qualifier
					Concentration	LCS	Low	High	
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Polychlorinated Biphenyls (QCLot: 691065) - continued									
Aroclor 1254	11097-69-1	E687	0.02	µg/L	0.2 µg/L	93.2	60.0	140	----
Aroclor 1260	11096-82-5	E687	0.02	µg/L	0.2 µg/L	94.6	60.0	140	----
Aroclor 1262	37324-23-5	E687	0.02	µg/L	0.2 µg/L	94.6	60.0	140	----
Aroclor 1268	11100-14-4	E687	0.02	µg/L	0.2 µg/L	94.6	60.0	140	----
Organochlorine Pesticides (QCLot: 691066)									
hexachlorobenzene	118-74-1	E660F	0.008	µg/L	0.2 µg/L	106	50.0	150	----
Nitrosamines (QCLot: 691888)									
nitrosodimethylamine, n- [NDMA]	62-75-9	E725A	0.03	µg/L	0.25 µg/L	104	50.0	150	----

Qualifiers

Qualifier	Description
LCS-H	Lab Control Sample recovery was above ALS DQO. Non-detected sample results are considered reliable. Other results, if reported, have been qualified.
LCS-ND	Lab Control Sample recovery was slightly outside ALS DQO. Reported non-detect results for associated samples were unaffected.



Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: Water					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 697105)										
WT2217203-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	98.7 mg/L	100 mg/L	98.7	75.0	125	----
Anions and Nutrients (QCLot: 697107)										
WT2217203-001	Anonymous	fluoride	16984-48-8	E235.F	0.990 mg/L	1 mg/L	99.0	75.0	125	----
Anions and Nutrients (QCLot: 698966)										
WT2217371-001	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	26.9 mg/L	2.5 mg/L	108	70.0	130	----
Anions and Nutrients (QCLot: 698969)										
WT2217206-001	Anonymous	phosphorus, total	7723-14-0	E372-U	ND mg/L	0.1 mg/L	ND	70.0	130	----
Cyanides (QCLot: 694685)										
TY2202609-001	Anonymous	cyanide, strong acid dissociable (total)	----	E333	0.216 mg/L	0.25 mg/L	86.5	75.0	125	----
Total Sulfides (QCLot: 696107)										
VA22C4657-004	Anonymous	sulfide, total (as S)	18496-25-8	E395-H	0.089 mg/L	0.1 mg/L	88.7	75.0	125	----
Total Metals (QCLot: 691389)										
TY2202462-008	Anonymous	mercury, total	7439-97-6	E508	0.0000994 mg/L	0.0001 mg/L	99.4	70.0	130	----
Total Metals (QCLot: 693441)										
WT2217319-001	Anonymous	aluminum, total	7429-90-5	E420	ND mg/L	0.1 mg/L	ND	70.0	130	----
		antimony, total	7440-36-0	E420	0.0514 mg/L	0.05 mg/L	103	70.0	130	----
		arsenic, total	7440-38-2	E420	0.0509 mg/L	0.05 mg/L	102	70.0	130	----
		bismuth, total	7440-69-9	E420	0.0493 mg/L	0.05 mg/L	98.6	70.0	130	----
		boron, total	7440-42-8	E420	0.048 mg/L	0.05 mg/L	95.1	70.0	130	----
		cadmium, total	7440-43-9	E420	0.00507 mg/L	0.005 mg/L	101	70.0	130	----
		chromium, total	7440-47-3	E420	0.0123 mg/L	0.0125 mg/L	98.7	70.0	130	----
		cobalt, total	7440-48-4	E420	0.0125 mg/L	0.0125 mg/L	100	70.0	130	----
		copper, total	7440-50-8	E420	ND mg/L	0.0125 mg/L	ND	70.0	130	----
		lead, total	7439-92-1	E420	0.0250 mg/L	0.025 mg/L	99.9	70.0	130	----
		manganese, total	7439-96-5	E420	ND mg/L	0.0125 mg/L	ND	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.0123 mg/L	0.0125 mg/L	98.7	70.0	130	----
		nickel, total	7440-02-0	E420	0.0246 mg/L	0.025 mg/L	98.3	70.0	130	----
		selenium, total	7782-49-2	E420	0.0514 mg/L	0.05 mg/L	103	70.0	130	----
		silver, total	7440-22-4	E420	0.00520 mg/L	0.005 mg/L	104	70.0	130	----



Sub-Matrix: Water					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 693441) - continued										
WT2217319-001	Anonymous	tin, total	7440-31-5	E420	0.0249 mg/L	0.025 mg/L	99.6	70.0	130	----
		titanium, total	7440-32-6	E420	ND mg/L	0.0125 mg/L	ND	70.0	130	----
		vanadium, total	7440-62-2	E420	0.0253 mg/L	0.025 mg/L	101	70.0	130	----
		zinc, total	7440-66-6	E420	ND mg/L	0.025 mg/L	ND	70.0	130	----
Aggregate Organics (QCLot: 698968)										
WT2217206-001	Anonymous	phenols, total (4AAP)	----	E562	0.0205 mg/L	0.02 mg/L	102	75.0	125	----
Volatile Organic Compounds (QCLot: 698632)										
WT2217371-001	Anonymous	trimethylbenzene, 1,3,5-	108-67-8	E611F	97.7 µg/L	100 µg/L	97.7	60.0	140	----
Volatile Organic Compounds (QCLot: 698633)										
WT2217371-001	Anonymous	benzene	71-43-2	E611D	100 µg/L	100 µg/L	100	60.0	140	----
		bromodichloromethane	75-27-4	E611D	103 µg/L	100 µg/L	103	60.0	140	----
		bromoform	75-25-2	E611D	88.4 µg/L	100 µg/L	88.4	60.0	140	----
		bromomethane	74-83-9	E611D	84.6 µg/L	100 µg/L	84.6	60.0	140	----
		carbon tetrachloride	56-23-5	E611D	99.0 µg/L	100 µg/L	99.0	60.0	140	----
		chlorobenzene	108-90-7	E611D	97.6 µg/L	100 µg/L	97.6	60.0	140	----
		chloroethane	75-00-3	E611D	93.9 µg/L	100 µg/L	93.9	60.0	140	----
		chloroform	67-66-3	E611D	97.9 µg/L	100 µg/L	97.9	60.0	140	----
		chloromethane	74-87-3	E611D	81.5 µg/L	100 µg/L	81.5	60.0	140	----
		dibromochloromethane	124-48-1	E611D	88.7 µg/L	100 µg/L	88.7	60.0	140	----
		dibromoethane, 1,2-	106-93-4	E611D	80.2 µg/L	100 µg/L	80.2	60.0	140	----
		dichlorobenzene, 1,2-	95-50-1	E611D	99.3 µg/L	100 µg/L	99.3	60.0	140	----
		dichlorobenzene, 1,3-	541-73-1	E611D	101 µg/L	100 µg/L	101	60.0	140	----
		dichlorobenzene, 1,4-	106-46-7	E611D	103 µg/L	100 µg/L	103	60.0	140	----
		dichloroethylene, cis-1,2-	156-59-2	E611D	83.7 µg/L	100 µg/L	83.7	60.0	140	----
		dichloromethane	75-09-2	E611D	106 µg/L	100 µg/L	106	60.0	140	----
		dichloropropylene, trans-1,3-	10061-02-6	E611D	75.2 µg/L	100 µg/L	75.2	60.0	140	----
		ethylbenzene	100-41-4	E611D	92.1 µg/L	100 µg/L	92.1	60.0	140	----
		tetrachloroethane, 1,1,2,2-	79-34-5	E611D	93.4 µg/L	100 µg/L	93.4	60.0	140	----
		tetrachloroethylene	127-18-4	E611D	90.6 µg/L	100 µg/L	90.6	60.0	140	----
		toluene	108-88-3	E611D	92.2 µg/L	100 µg/L	92.2	60.0	140	----
		trichloroethylene	79-01-6	E611D	97.2 µg/L	100 µg/L	97.2	60.0	140	----
		trichlorofluoromethane	75-69-4	E611D	92.1 µg/L	100 µg/L	92.1	60.0	140	----
		vinyl chloride	75-01-4	E611D	80.4 µg/L	100 µg/L	80.4	60.0	140	----
		xylene, m+p-	179601-23-1	E611D	191 µg/L	200 µg/L	95.7	60.0	140	----



Sub-Matrix: Water					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 698633) - continued										
WT2217371-001	Anonymous	xylene, o-	95-47-6	E611D	95.0 µg/L	100 µg/L	95.0	60.0	140	----
Aldehydes (QCLot: 691490)										
WT2217418-001	5210 INNES RD OTTAWA-MW5	Formaldehyde	50-00-0	E693A	27.4 µg/L	25.75 µg/L	107	50.0	150	----
Nonylphenols (QCLot: 694390)										
WT2217371-001	Anonymous	nonylphenols [NP]	84852-15-3	E749A	11.0 µg/L	10 µg/L	110	60.0	140	----
Nonylphenols (QCLot: 694391)										
WT2217371-001	Anonymous	nonylphenol diethoxylates [NP2EO]	n/a	E749B	0.97 µg/L	1 µg/L	96.9	60.0	140	----
		nonylphenol monoethoxylates [NP1EO]	n/a	E749B	12.2 µg/L	20 µg/L	60.8	60.0	140	----
Nitrosamines (QCLot: 691888)										
WT2216975-001	Anonymous	nitrosodimethylamine, n- [NDMA]	62-75-9	E725A	0.272 µg/L	0.25 µg/L	109	50.0	150	----



COC Number: 2

Canada Toll Free: 1 800 668 9878

Page

Environmental Division
Waterloo
Work Order Reference
WT2217418



Telephone : +1 519 886 6910

Report To Company: Fisher Engineering Contact: Clwe Phone: 416-605-9722 Company address below will appear on the final report		Turnaround Time (TAT) Requested ☒ Routine [R] if received by 3pm M-F - no surcharges apply ☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum ☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum ☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum ☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum ☐ Same day [E2] if received by 10am M-S - 200% rush surcharge. A may apply to rush requests on weekends, statutory holidays and no	
Street: 15-400 Esna Park Dr City/Province: Maryborough, ON Postal Code: L3R 3K2		Select Report Format: ☒ PDF ☐ EXCEL ☐ EDD (DIGITAL) Merge QC/QCI Reports with COA ☒ YES ☐ NO ☐ N/A ☐ Compare Results to Criteria on Report - provide details below if box checked Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX Email 1 or Fax: Clwe@Fisher Eng Email 2: Email 3:	
Invoice To Same as Report To ☐ YES ☐ NO Copy of Invoice with Report ☐ YES ☐ NO		Invoice Recipients Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX Email 1 or Fax: Email 2: Email 3:	
Company: Fisher Engineering Contact: Clwe		Project Information Account # / Quote #: Job #: PCAFE: LS:	
ALS Lab Work Order # (ALS use only):		ALS Contact: Sampler:	
Sample # (S use only):		Sample Identification and/or Coordinates (This description will appear on the report)	
		Date (dd-mmm-yy):	
		Time (hh:mm)	
		Sample Type	
		5210 Innes Rd Ottawa Ottawa sewer discharge by laws (Storm and Sanitary) MW 5 (Unfiltered)	
		11-10-22	
		Water	
Drinking Water (DW) Samples ¹ (client use) samples taken from a Regulated DW System? ☐ YES ☒ NO samples for human consumption/ use? ☐ YES ☒ NO		Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)	
SHIPMENT RELEASE (client use) Released by: N. N. N. Date: 11/10/22 Time:		INITIAL SHIPMENT RECEPTION (ALS use only) Received by: Date: Time:	
SAMPLE RECEIPT DETAILS (ALS use only) Cooling Method: ☐ NONE ☐ ICE ☐ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A INITIAL COOLER TEMPERATURES °C: 6.9 FINAL COOLER TEMPERATURES °C:		FINAL SHIPMENT RECEPTION (ALS use only) Received by: FH Date: 2022-20-11 Time: 5:30PM	

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

are to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OR-321/NW-158 OGCN-202

MAOS 382, MM-274, L-164, GC-522, B-187

AUG 2020 FROM

APPENDIX E – HYDRAULIC CONDUCTIVITY ANALYSES



Location: 5210 Innes Road, Ottawa

Project: FE-P-22-12470H

Test Date: 10/6/2022

Tested by: CAW

Well No. MW101

Equilibrium Water level (from top of pipe) HE 268 cm
 Initial Water level (from top of pipe) Ho 511 cm
 Monitoring well inner Dia D 0.05 m
 Initial Time offset To 1 second
 Reverse of Luthin's reference system $Ru = Ho - HE$ 243.00 cm
 Slope of $\text{Log}((ho-he)/(ht-he)) / T$ 4.00E-05
 $G = Ru / (HT - HE)$

Hydraulic conductivity computed k = 0.0000605 cm/s
 6.05E-07 m/s
 0.052 m/day

Time	HT (Water Drop)			G	LOG (G)
(Interval s)	(Elapsed s)	(m)	(cm)		
	0	5.11			
10	10	5.090	509.0	1.00830	0.00359
10	20	5.080	508.0	1.01250	0.00540
10	30	5.075	507.5	1.01461	0.00630
10	40	5.065	506.5	1.01887	0.00812
10	50	5.060	506.0	1.02101	0.00903
10	60	5.060	506.0	1.02101	0.00903
30	90	5.060	506.0	1.02101	0.00903
30	120	5.060	506.0	1.02101	0.00903
30	150	5.060	506.0	1.02101	0.00903
30	180	5.055	505.5	1.02316	0.00994
30	210	5.045	504.5	1.02748	0.01178
30	240	5.035	503.5	1.03185	0.01362
30	270	5.030	503.0	1.03404	0.01454
30	300	5.025	502.5	1.03625	0.01546
30	330	5.020	502.0	1.03846	0.01639
30	360	5.000	500.0	1.04741	0.02012
300	660	4.955	495.5	1.06813	0.02862
300	960	4.900	490.0	1.09459	0.03925
300	1260	4.830	483.0	1.13023	0.05317
300	1560	4.770	477.0	1.16268	0.06546
300	1860	4.720	472.0	1.19118	0.07598
1800	3660	4.670	467.0	1.22111	0.08675
1800	5460	4.340	434.0	1.46386	0.16550

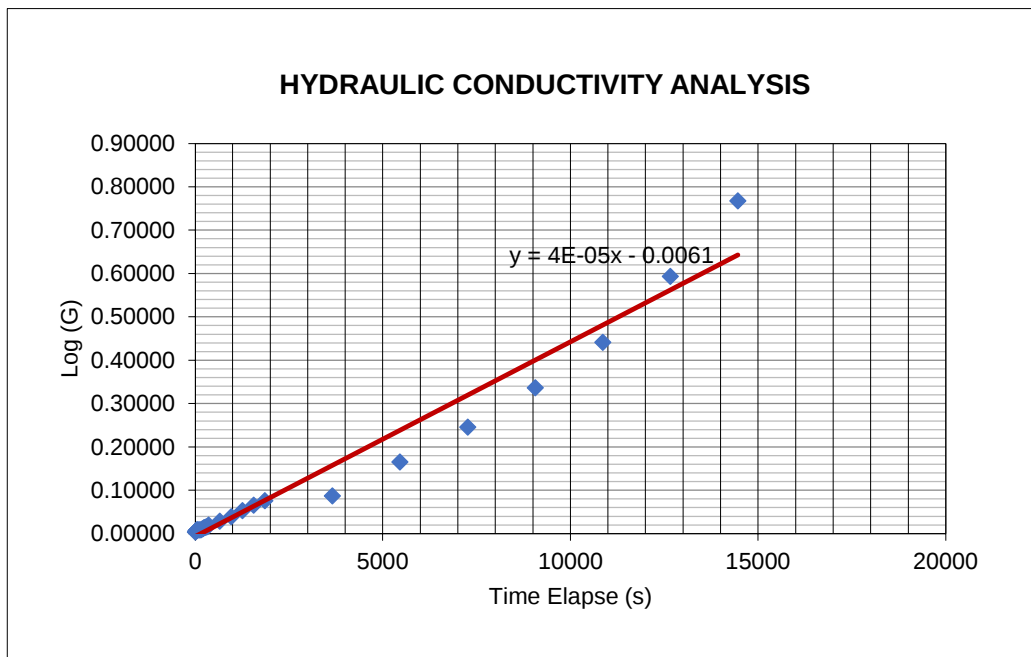
Location: 5210 Innes Road, Ottawa

Project: FE-P-22-12470H

Test Date: 10/6/2022

Tested by: CAW

Well No. MW101



Location: 5210 Innes Road, Ottawa

Project: FE-P-22-12470H

Test Date: 10/6/2022

Tested by: CAW

Well No. MW104

Equilibrium Water level (from top of pipe) HE 282 cm
Initial Water level (from top of pipe) Ho 558.3 cm
Monitoring well inner Dia D 0.05 m
Initial Time offset To 1 second
Reverse of Luthin's reference system Ru = Ho - HE 276.30 cm
Slope of Log((ho-he)/(ht-he)) / T 3.00E-05
G = Ru / (HT - HE)

Hydraulic conductivity computed k = 0.0000454 cm/s
4.54E-07 m/s
0.039 m/day

Time (Interval s)	HT (Water Drop)			G	LOG (G)
	(Elapsed s)	(m)	(cm)		
	0	5.583			
10	10	5.550	555.0	1.01209	0.00522
10	20	5.530	553.0	1.01956	0.00841
10	30	5.520	552.0	1.02333	0.01002
10	40	5.510	551.0	1.02714	0.01163
10	50	5.500	550.0	1.03097	0.01325
10	60	5.500	550.0	1.03097	0.01325
30	90	5.490	549.0	1.03483	0.01487
30	120	5.480	548.0	1.03872	0.01650
30	150	5.470	547.0	1.04264	0.01814
30	180	5.460	546.0	1.04659	0.01978
30	210	5.450	545.0	1.05057	0.02143
30	240	5.440	544.0	1.05458	0.02308
30	270	5.430	543.0	1.05862	0.02474
30	300	5.425	542.5	1.06065	0.02557
30	330	5.420	542.0	1.06269	0.02641
30	360	5.415	541.5	1.06474	0.02724
300	660	5.360	536.0	1.08780	0.03655
300	960	5.310	531.0	1.10964	0.04518
300	1260	5.270	527.0	1.12776	0.05221
300	1560	5.225	522.5	1.14886	0.06027
300	1860	5.180	518.0	1.17076	0.06847
1800	3660	5.140	514.0	1.19095	0.07589
1800	5460	4.890	489.0	1.33478	0.12541

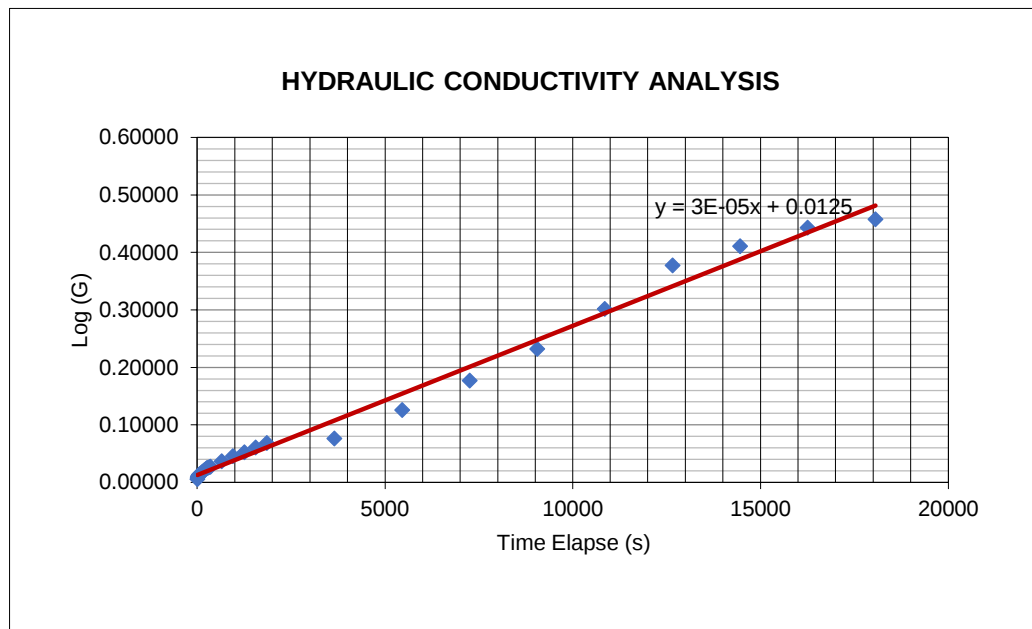
Location: 5210 Innes Road, Ottawa

Project: FE-P-22-12470H

Test Date: 10/6/2022

Tested by: CAW

Well No. MW104



Location: 5210 Innes Road, Ottawa

Project: FE-P-22-12470H

Test Date: 10/6/2022

Tested by: CAW

Well No. MW106

Equilibrium Water level (from top of pipe) H_E

259 cm

Initial Water level (from top of pipe) H_o

573.1 cm

Monitoring well inner Dia D

0.05 m

Initial Time offset T_o

1 second

Reverse of Luthin's reference system $R_u = H_o - H_E$

314.10 cm

Slope of $\text{Log}((H_o - H_E)/(H_T - H_E)) / T$

3.00E-06

$G = R_u / (H_T - H_E)$

Hydraulic conductivity computed $k =$ 0.0000045 cm/s

4.54E-08 m/s

0.004 m/day

Time (Interval s)	HT (Water Drop)			G	LOG (G)
	(Elapsed s)	(m)	(cm)		
	0	5.731			
10	10	5.730	573.0	1.00032	0.00014
10	20	5.729	572.9	1.00064	0.00028
10	30	5.728	572.8	1.00096	0.00041
10	40	5.727	572.7	1.00128	0.00055
10	50	5.726	572.6	1.00159	0.00069
10	60	5.725	572.5	1.00191	0.00083
30	90	5.724	572.4	1.00223	0.00097
30	120	5.723	572.3	1.00255	0.00111
30	150	5.722	572.2	1.00287	0.00125
30	180	5.721	572.1	1.00319	0.00138
30	210	5.720	572.0	1.00351	0.00152
30	240	5.719	571.9	1.00384	0.00166
30	270	5.718	571.8	1.00416	0.00180
30	300	5.717	571.7	1.00448	0.00194
30	330	5.716	571.6	1.00480	0.00208
30	360	5.715	571.5	1.00512	0.00222
300	660	5.700	570.0	1.00997	0.00431
300	960	5.690	569.0	1.01323	0.00571
300	1260	5.680	568.0	1.01650	0.00711
300	1560	5.670	567.0	1.01981	0.00852
300	1860	5.660	566.0	1.02313	0.00993
1800	3660	5.650	565.0	1.02647	0.01135
1800	5460	5.610	561.0	1.04007	0.01706
1800	7260	5.560	556.0	1.05758	0.02431
1800	9060	5.520	552.0	1.07201	0.03020
1800	10860	5.470	547.0	1.09063	0.03768
1800	12660	5.430	543.0	1.10599	0.04375
1800	14460	5.390	539.0	1.12179	0.04991
1800	16260	5.340	534.0	1.14218	0.05774
1800	18060	5.300	530.0	1.15904	0.06410

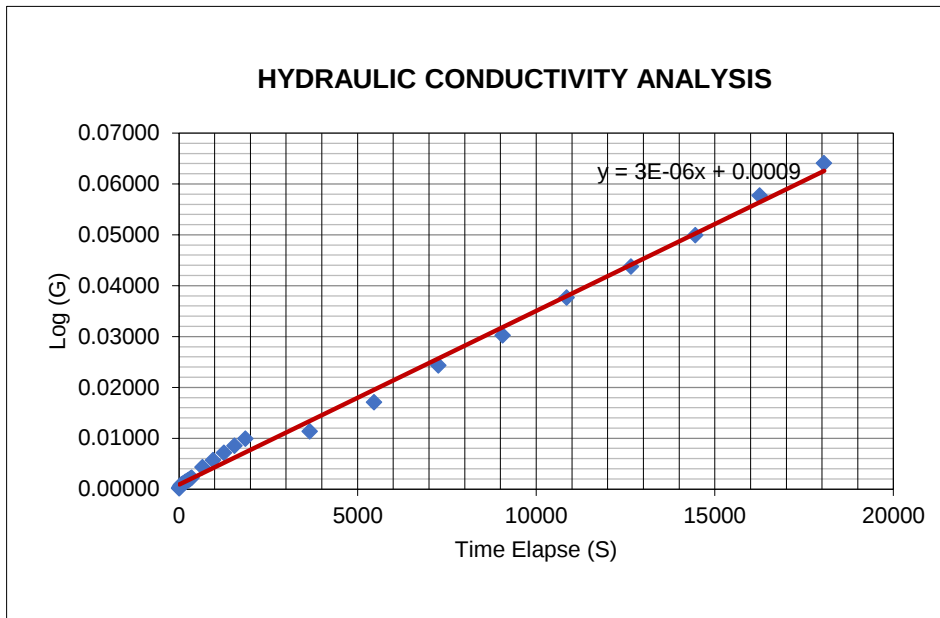
Location: 5210 Innes Road, Ottawa

Project: FE-P-22-12470H

Test Date: 10/6/2022

Tested by: CAW

Well No. MW106



APPENDIX F – CONSTRUCTION DEWATERING AND PERMANENT DRAINAGE





Construction Dewatering Calculation

Location: 5210 Innes Road, Ottawa
 Project: FE-P-22-12470H
 Date: 11/25/2022

Dupuit Forcheimer for Radial Flow to a Closely Welled System or Excavation

Construction Units	Finished lowest floor elevation (m asl)	Average grade (m asl)	Lowest Conventional Footing Elevation (m asl)	Required Dewatering Elevation (m asl)	Static water level		Well base elevation (m)	H (m)	h _w (m)	H-h _w (m)	R ₀ (m)		r _w	ab (m ²)	K (m/s)	H ² -h _w ²	lnR ₀	lnr _w	Q _c (m ³ /s)	Q _c (m ³ /day)
					BGS (m)	Elevation (m asl)					Model	Adjusted								
Building with no UG level	87.75	87.85	86.25	85.25	1.74	85.93	84.95	0.98	0.3	0.68	0.83	43.29	42.47	5666	3.68E-07	0.87	3.77	3.75	5.23E-05	4.52

Dupuit Forcheimer Equation

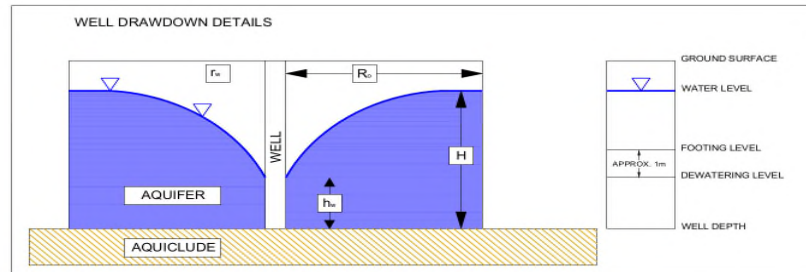
$$Q = \frac{\pi K (H^2 - h_w^2)}{\ln R_0 - \ln r_w}$$

Equivalent radius of well, r_w

$$r_w = \sqrt{\frac{ab}{\pi}}$$

Radius of influence in m, calculated from Sichardt's equation

$$R_0 = 2000 (H - h_w) \sqrt{k}$$

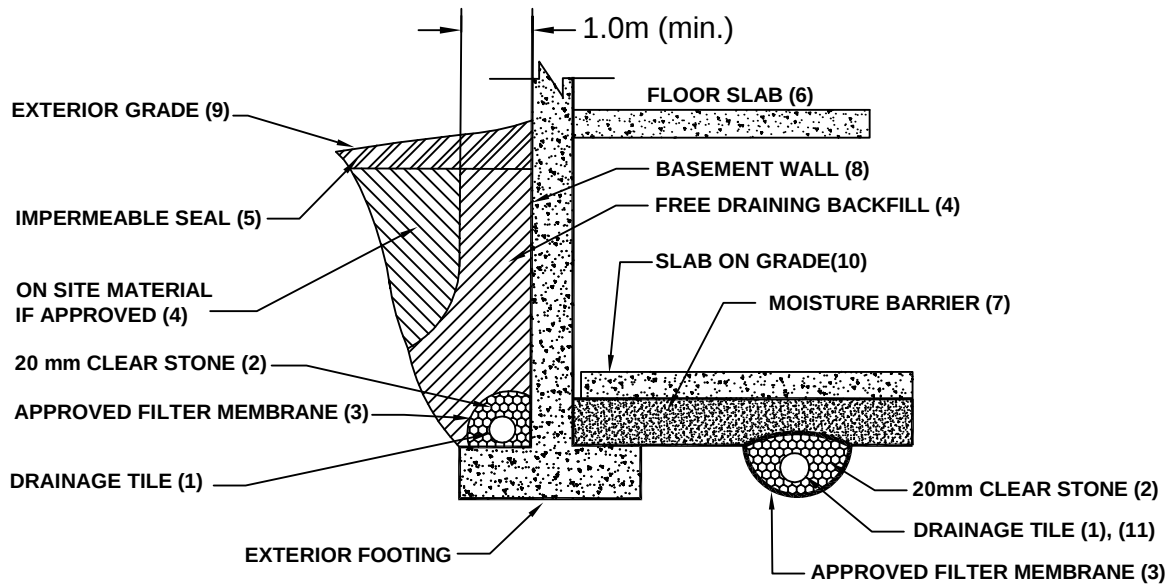


Where:

r_w = equivalent radius of the well in m,
 H = hydraulic head of the original water table (total saturated aquifer thickness) in m,
 h_w = hydraulic head at maximum dewatering (proposed drawdown) in m,
 R₀ = radius of influence in m, calculated from Sichardt's equation, and
 K = hydraulic conductivity, in m/s
 a = length of excavation area in m
 b = width of excavation area in m

APPENDIX G – BACKFILL AND DRAINAGE DESIGN

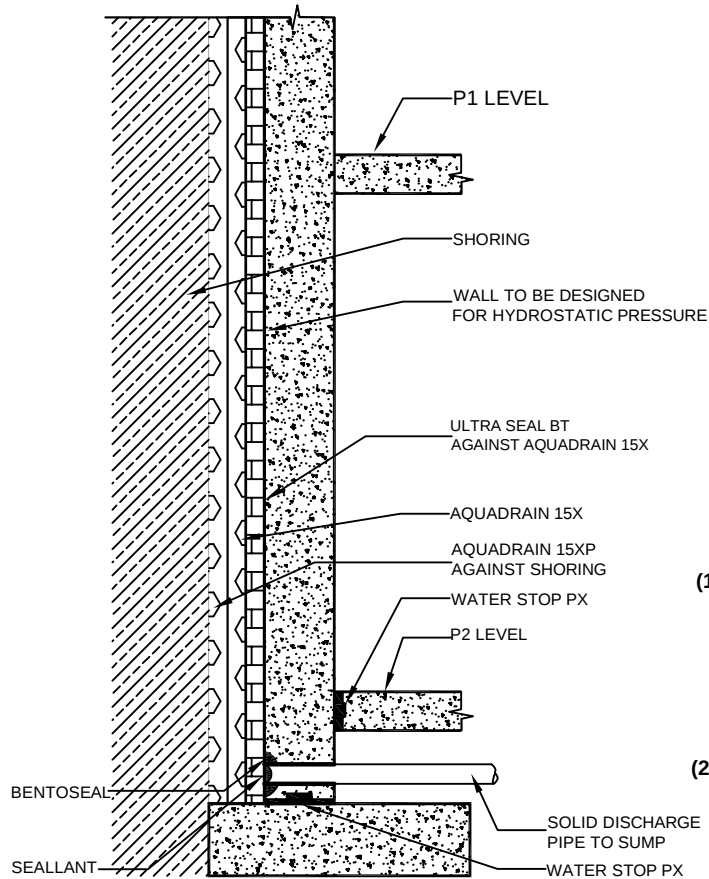




NOTES:

- (1) DRAINAGE TILE TO CONSIST OF 100mm (4") DIAMETER WEEPING TILE OR EQUIVALENT PERFORATED PIPE LEADING TO A POSITIVE SUMP OR OUTLET.
- (2) 20mm (3/4") CLEAR STONE - 150mm (6") TOP AND SIDE OF DRAIN. IF DRAIN IS NOT ON FOOTING, PLACE 100mm (4") OF STONE BELOW DRAIN.
- (3) WRAP THE CLEAR STONE WITH AN APPROVED FILTER MEMBRANE (TERRAFIX 279R OR EQUIVALENT).
- (4) FREE DRAINING BACKFILL - OPSS GRANULAR B OR EQUIVALENT COMPACTED TO THE SPECIFIED DENSITY. DO NOT USE HEAVY COMPACTION EQUIPMENT WITHIN 1.8m (6') OF WALL.
- (5) IMPERMEABLE BACKFILL SEAL - COMPACTED CLAY, CLAYEY SILT OR EQUIVALENT. IF ORIGINAL SOIL IS FREE-DRAINING, SEAL MAY BE OMITTED. MAXIMUM THICKNESS OF SEAL TO BE 0.5m.
- (6) DO NOT BACKFILL UNTIL WALL IS SUPPORTED BY BASEMENT AND FLOOR SLABS OR ADEQUATE BRACING.
- (7) MOISTURE BARRIER TO BE AT LEAST 200mm (8") OF COMPACTED CLEAR 20mm (3/4") STONE OR EQUIVALENT FREE DRAINING MATERIAL. A VAPOUR BARRIER MAY BE REQUIRED FOR SPECIALTY FLOORS.
- (8) BASEMENT WALL TO BE DAMP PROOFED.
- (9) EXTERIOR GRADE TO SLOPE AWAY FROM BUILDING.
- (10) SLAB ON GRADE SHOULD NOT BE STRUCTURALLY CONNECTED TO THE WALL OR FOOTING
- (11) UNDERFLOOR DRAIN INVERT TO BE AT LEAST 300mm (12") BELOW UNDERSIDE OF FLOOR SLAB. DRAINAGE TILE PLACED IN PARALLEL ROWS 6 TO 8m (20-25') CENTERS ONE WAY. PLACE DRAIN ON 100mm (4") CLEAR STONE WITH 150mm (6") OF CLEAR STONE ON TOP AND SIDES. ENCLOSE STONE WITH FILTER FABRIC AS NOTED IN (3)
- (12) THE ENTIRE SUBGRADE TO BE SEALED WITH APPROVED FILER FABRIC (TERRAFIX 270R OR EQUIVALENT) IF NON-COHESIVE(SANDY) SOILS BELOW GROUND WATER TABLE ENCOUNTERED.
- (13) DO NOT CONNECT THE UNDERFLOOR DRAINS TO PERIMETER DRAINS.
- (14) REVIEW THE GEOTECHNICAL REPORT FOR SPECIFIC DETAILS.

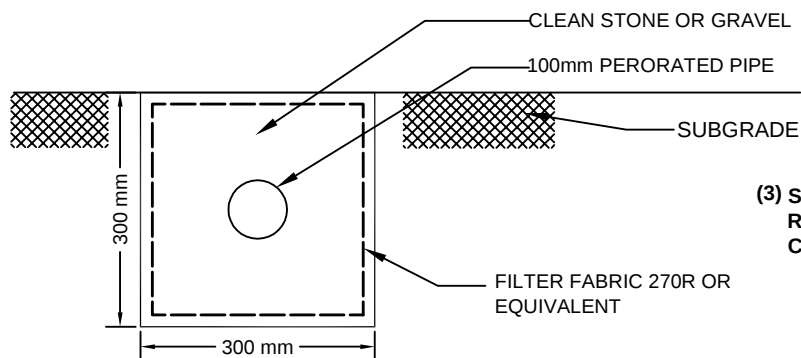
DRAINAGE AND BACKFILL RECOMMENDATIONS
BASEMENT WITH UNDERFLOOR DRAINAGE
 (NOT TO SCALE)



NOTES:

- (1) ALL PERMANENT DRAINAGE PIPES MUST HAVE GEOTEXTILE FILTER SLEEVE TO PREVENT LONG TERM SILTING. TO FURTHER MINIMIZE SILTATION OF THE DRAINAGE SYSTEM, ALL DRAINAGE PIPE CONNECTION MUST BE SOLID PVC ELBOWS AND TS. NO "BUTT" END CONNECTIONS SHOULD BE PERMITTED.
- (2) PERIMETER COLLECTION PIPE TO BE SOLID PIPE,

**SUGGESTED EXTERIOR DRAINAGE AGAINST SHORING
(NOT TO SCALE)**

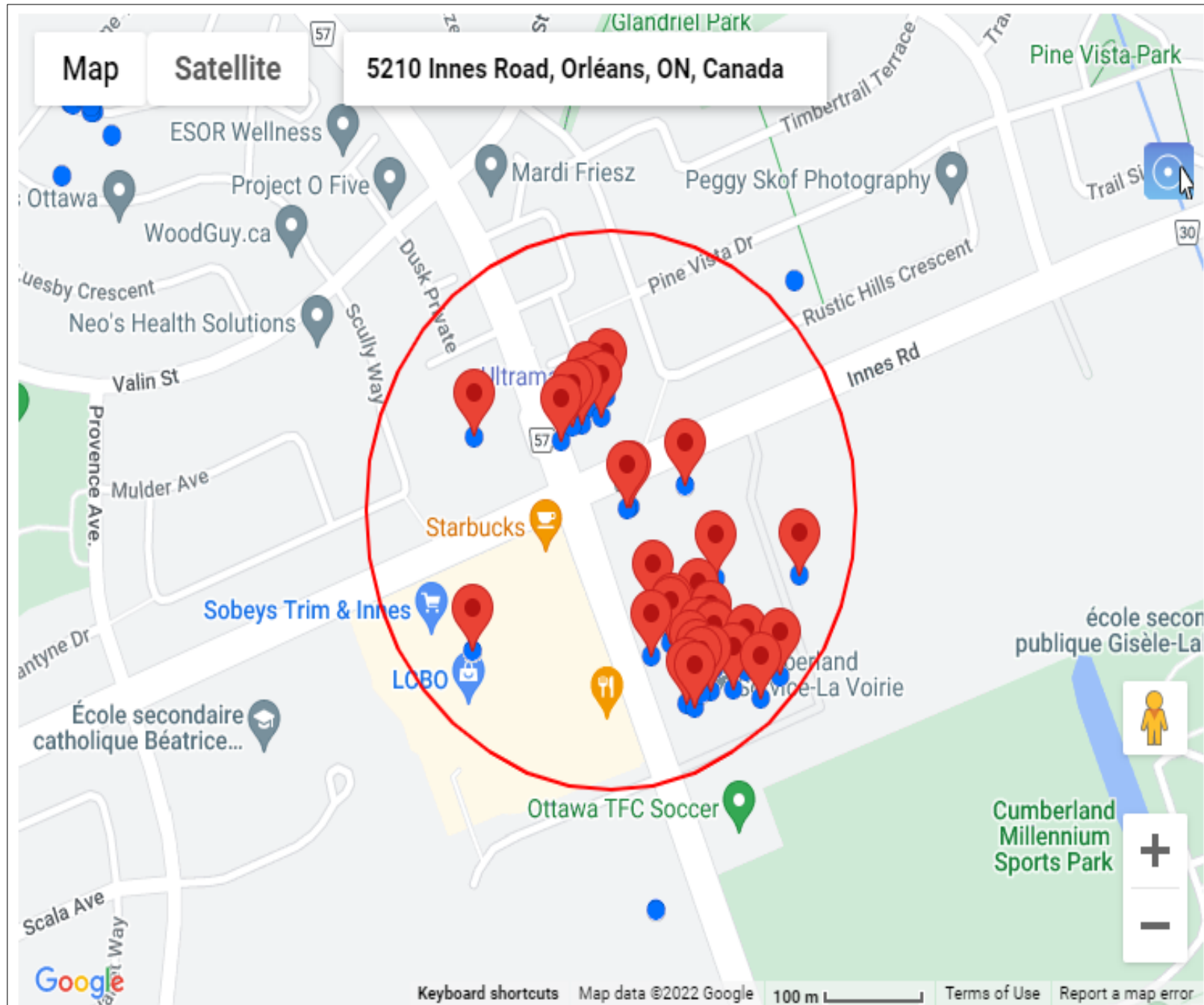


- (3) SUBGRADE DRAIN TO BE PLACED IN PARALLEL ROWS 6-8 m (20'-25'), FROM CENTERLINE TO CENTERLINE.

**DETAIL OF SUBGRADE DRAIN
(NOT TO SCALE)**

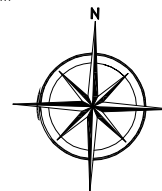
APPENDIX H – WELL SURVEY





400 Esna Park Dr., #15 Tel: 905 475-7755
Markham, Ontario Fax: 905 475-7718
L3R 3K2

NORTH



LEGEND

SITE BOUNDARY

PROJECT NAME AND ADDRESS

HYDROGEOLOGICAL INVESTIGATION

5210 Innes Road,
OTTAWA, ONTARIO

FIGURE 1:

WELLS WITHIN 500M RADIUS

SHEET NO.

PROJECT NO.

FE-P22-12470H

DATE

NOVEMBER 2022

SCALE

AS SHOWN

H1

31 G/62

UTM 118 464359



1512782

GROUND WATER BRANCH

56 No

538

5R 5034968N

The Ontario Water Resources Commission Act

Elev. 98R 102911

Basin 1025

County or District

Russell

Township, Village, Town or City Cumberland

Con. 9

Lot 1

Date completed August 7, 1963

(day

month

year)

Address R.R. # 1, Navan, Ont.

Casing and Screen Record

Inside diameter of casing 2"

Total length of casing 130'

Type of screen

Length of screen

Depth to top of screen

Diameter of finished hole 2"

Pumping Test

Static level 25'

Test-pumping rate 10 G.P.M.

Pumping level 40'

Duration of test pumping 2 hrs.

Water clear or cloudy at end of test clear

Recommended pumping rate 10 G.P.M.

with pump setting of 40 feet below ground surface

Well Log

Water Record

Overburden and Bedrock Record

blue clay

sand & fine gravel

grey limestone

From
ft.To
ft.Depth(s) at
which water(s)
foundKind of water
(fresh, salty,
sulphur)

0

120

120

128

142

128

142

fresh

For what purpose(s) is the water to be used? farm use

Is well on upland, in valley, or on hillside? upland

Drilling or Boring Firm

G. Charbonneau, Diamond & Cable Drilling

Address R.R. # 1, Box 194, Orleans, Ont.

Licence Number 1025

Name of Driller or Borer G. Charbonneau

Address R.R. # 1, Orleans, Ont.

Date August 7, 1963

Gerard Charbonneau

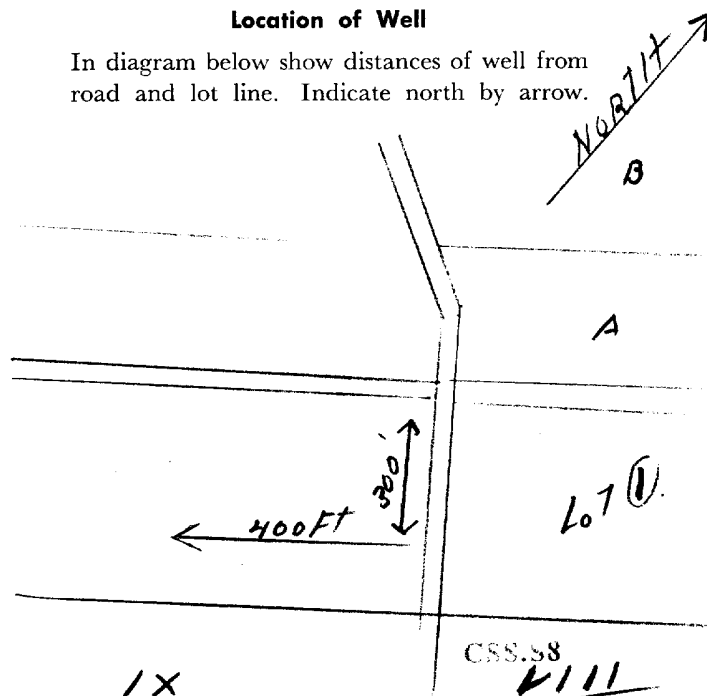
(Signature of Licensed Drilling or Boring Contractor)

Form 7 10M-62-1152

OWRC COPY

Location of Well

In diagram below show distances of well from
road and lot line. Indicate north by arrow.



CSS.S8

4111



Ontario

316 6E ✓

1518164

MUNICIP.
15011

CON.
|CON

b8

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

11

COUNTY OR DISTRICT OTT CHARLETON
Dunsmuir Russell

TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE
Cumberland

CON. BLOCK. TRACT. SURVEY ET
8

LOT **A** 25-27

2 Pintail Terrace, Cumberland, Ont.

DATE COMPLETED 26 04 82

NG	RC	ELEVATION	RC	BASIN CODE	II	III	IV
35199	4	0290	4	26			

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

[illegible][illegible]

41 WATER RECORD		10 14 15 21		
WATER FOUND AT - FEET	KIND OF WATER			
10-13 0068	1 ☒ FRESH 2 ☐ SALTY	3 ☐ SULPHUR 4 ☐ MINERAL	14	
15-18	1 ☐ FRESH 2 ☐ SALTY	3 ☐ SULPHUR 4 ☐ MINERAL	19	
20-23	1 ☐ FRESH 2 ☐ SALTY	3 ☐ SULPHUR 4 ☐ MINERAL	24	
25-28	1 ☐ FRESH 2 ☐ SALTY	3 ☐ SULPHUR 4 ☐ MINERAL	29	
30-33	1 ☐ FRESH 2 ☐ SALTY	3 ☐ SULPHUR 4 ☐ MINERAL	34	

INSIDE DIA. INCHES		MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET	
				FROM	TO
10-11 6 1/4 06	☒ 1 STEEL ☐ 2 GALVANIZED ☐ 3 CONCRETE ☐ 4 OPEN HOLE	12 188	0	51 0051	
17-18	☐ 1 STEEL ☐ 2 GALVANIZED ☐ 3 CONCRETE ☐ 4 OPEN HOLE	19		20-21	
24-25	☐ 1 STEEL ☐ 2 GALVANIZED ☐ 3 CONCRETE ☐ 4 OPEN HOLE	26		27-30	

*SCREEN	SIZE(S) OF OPENING (SLOT NO 1)		31-33	DIAMETER	34-38	LENGTH	39-40
					INCHES	FEET	
	MATERIAL AND TYPE				DEPTH TO TOP OF SCREEN		41-44 30
						FEET	

61		PLUGGING & SEALING RECORD	
DEPTH SET AT		FEET	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)
FROM	TO		
10-13	14-17		
18-21	22-25		
26-29	30-33	80	

PUMPING TEST	PUMPING TEST METHOD		PUMPING RATE		DURATION OF PUMPING	
	1 ☒ PUMP	2 ☐ BAILER	0080	15-16 HOURS	00	17-18 MINS
	STATIC LEVEL		WATER LEVELS DURING		1 ☐ PUMPING	
	WATER LEVEL END OF PUMPING				2 ☒ RECOVERY	
	19-21 FEET	22-24 FEET	15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
017	030	017	017	017	017	
IF FLOWING, GIVE RATE		PUMP INTAKE SET AT		WATER AT END OF TEST		
38-41		30		42		
RECOMMENDED PUMP TYPE		RECOMMENDED PUMP SETTING		RECOMMENDED PUMP RATE		
1 ☒ SHALLOW ☐ DEEP		030		0030		
30-53						

LOCATION OF WELL

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

Rd 30

Lot 8

25

North

DRIILLER'S REMARKS

FINAL STATUS OF WELL	1 ☒ WATER SUPPLY	5 ☐ ABANDONED. INSUFFICIENT SUPPLY
	2 ☐ OBSERVATION WELL	6 ☐ ABANDONED. POOR QUALITY
	3 ☐ TEST HOLE	7 ☐ UNFINISHED
	4 ☐ RECHARGE WELL	
WATER USE 01	1 ☒ DOMESTIC	5 ☐ COMMERCIAL
	2 ☐ STOCK	6 ☐ MUNICIPAL
	3 ☐ IRRIGATION	7 ☐ PUBLIC SUPPLY
	4 ☐ INDUSTRIAL	8 ☐ COOLING OR AIR CONDITIONING
	☐ OTHER _____	9 ☐ NOT USED
METHOD OF DRILLING 4	1 ☐ CABLE TOOL	6 ☐ BORING
	2 ☐ ROTARY (CONVENTIONAL)	7 ☐ DIAMOND
	3 ☐ ROTARY (REVERSE)	8 ☐ JETTING
	4 ☒ ROTARY (AIR)	9 ☐ DRIVING
	5 ☐ AIR PERCUSSION	

CONTRACTOR	NAME OF WELL CONTRACTOR		LICENCE NUMBER	
	G. Charbonneau + Son Drilling Ltd 1504			
	ADDRESS			
	R.R. 2, Box 194, Orleans, Ont. K1C 1T1			
	NAME OF DRILLER OR BORER		LICENCE NUMBER	
CONTRACTOR	R. Charbonneau			
	SIGNATURE OF CONTRACTOR		SUBMISSION DATE	
			26 04 82	
		DAY MO YR		

OFFICE USE ONLY	DATA SOURCE		58	CONTRACTOR	59-62	DATE RECEIVED	63-66	67
	1			1504		05 04 83		
	DATE OF INSPECTION			INSPECTOR				
	REMARKS							

GROUND WATER BRANCH
JAN 19 1961
ONTARIO WATER
RESOURCES COMMISSION

The Ontario Water Resources Commission Act, 1957

WATER WELL RECORD

County or District.....Russell.....Township, Village, Town or City.....Cumberland
 Date completed.....17.....Dec.....60
 (day) (month) (year)
 Address.....Navan R.R. No. 1.....

Casing and Screen Record

Inside diameter of casing.....2"

Total length of casing.....100'

Type of screen.....

Length of screen.....

Depth to top of screen.....

Diameter of finished hole.....2"

Pumping Test

Static level.....19'

Test-pumping rate.....7.....G.P.M.

Pumping level.....25'

Duration of test pumping.....2 Hrs

Water clear or cloudy at end of test.....clear

Recommended pumping rate.....7.....G.P.M.

~~XXXXXXXXXXXX~~ Pump Set 25'

Well Log

Water Record

[illegible]

For what purpose(s) is the water to be used?

Domestic

Is well on upland, in valley, or on hillside?..... **HP**.....

Drilling Firm

Address

Licence Number.....454.

Name of Driller.....Gerard Charbonneau

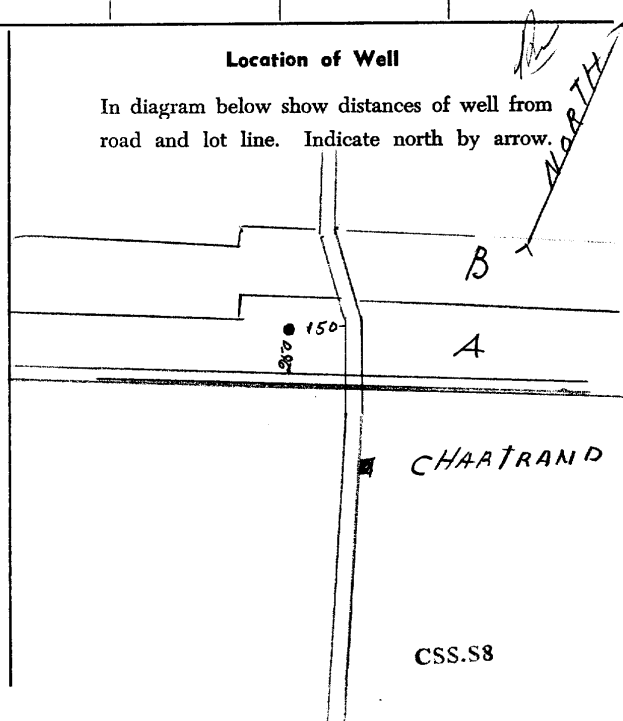
Address Orleans

Date Dec 17/60

Gerard Charbonneau
(Signature of Licensed Drilling Contractor)

Location of Well

In diagram below show distances of well from road and lot line. Indicate north by arrow.



APPENDIX I: INFILTRATION TESTS



Percolation Test Data Sheet

Project:	5210 Innes Rd, Ottawa	Project No	22-12470	Date:	10/6/2022		
Test Hole No:	TP1	Tested By:	CAW				
Depth of Test Hole, D_T :	1.98	USCS Soil Classification:	CL				
Test Hole Dimensions (cm)			Length	Width			
Radius (if round)=	4"	Sides (if rectangular)=					
Sandy Soil Criteria Tests							
Trial No.	StartTime	Stop Time	Time Interval (min)	Initial Depth to Water (cm)	Final Depth to Water (cm)	Change in Water Level (cm)	Greater than or Equal to 6"
1	13:30	13:55	0:25	80	81.12	1.12	Less
2	14:00	14:25	0:25	75	76.1	1.1	Less
If two consecutive measurements show that six inches of water seeps away in less than 25 minutes (150mm), the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".							
Test No.	Start Time	Stop Time	Δt Time Interval (min)	D_0 Initial Depth to Water (cm)	D_f Final Depth to Water (cm)	ΔD Change in Water Level (cm)	Percolation Rate (min/cm)
1	9:31	10:01	30.00	96.50	96.90	0.40	25.00
2	10:01	10:31	30.00	96.90	97.40	0.50	20.00
3	10:31	11:01	30.00	97.40	97.80	0.40	25.00
4	11:01	11:31	30.00	97.80	98.30	0.50	20.00
5	11:31	12:01	30.00	98.30	98.70	0.40	25.00
6	12:01	12:31	30.00	98.70	99.10	0.40	25.00
7	12:31	13:01	30.00	99.10	99.60	0.50	20.00
8	13:01	13:31	30.00	99.60	99.80	0.20	50.00
9	13:31	14:01	30.00	99.80	100.00	0.20	50.00
10	14:01	14:31	30.00	100.00	100.20	0.20	50.00
11	14:31	15:01	30.00	100.20	100.40	0.20	50.00
COMMENTS: Sunny (11 °C), Pre soak overnight: water fell 34mm in 19 hours							

Percolation Test Data Sheet

Project:	5210 Innes Rd, Ottawa	Project No	22-12470	Date:	10/6/2022		
Test Hole No:	TP2	Tested By:	CAW				
Depth of Test Hole, D_T :	1.98	USCS Soil Classification:	C.L				
Test Hole Dimensions (cm)			Length	Width			
Radius (if round)=	4"	Sides (if rectangular)=					
Sandy Soil Criteria Tests							
Trial No.	Start Time	Stop Time	Time Interval (min)	Initial Depth to Water (cm)	Final Depth to Water (cm)	Change in Water Level (cm)	Greater than or Equal to 6"
1	13:40	14:05	0:25	61	62.2	1.2	Less
2	14:10	14:35	0:25	63	64.3	1.3	Less
If two consecutive measurements show that six inches of water seeps away in less than 25 minutes (150mm), the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".							
Test No.	Start Time	Stop Time	Δt Time Interval (min)	D_0 Initial Depth to Water (cm)	D_f Final Depth to Water (cm)	ΔD Change in Water Level (cm)	Percolation Rate (min/cm)
1	9:21	9:51	30.00	103.00	103.60	0.60	16.67
2	9:51	10:21	30.00	103.60	104.10	0.50	20.00
3	10:21	10:51	30.00	104.10	104.60	0.50	20.00
4	10:51	11:21	30.00	104.60	104.90	0.30	33.33
5	11:21	11:51	30.00	104.90	105.50	0.60	16.67
6	11:51	12:21	30.00	105.50	105.80	0.30	33.33
7	12:21	12:51	30.00	105.80	106.10	0.30	33.33
8	12:51	13:21	30.00	106.10	106.40	0.30	33.33
9	13:21	13:51	30.00	106.40	106.70	0.30	33.33
10	13:51	14:21	30.00	106.70	107.00	0.30	33.33
COMMENTS: Sunny (11 °C), Pre soak overnight: water fell 37mm in 19 hours							