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Hydrogeological Investigation, Terrain Analysis, and Groundwater Impact Assessment Zoning Amendment 6158 Rideau Valley Drive

Ottawa, Ontario

June 13, 2025 File: 100011.082

Millers Farm
6158 Rideau Valley Drive North
Manotick, Ontario
K4M 1B3

Attention: Jaime Mallory, Planner I, Development Review – Rural Services

Re: Hydrogeological Investigation, Terrain Analysis, and Groundwater Impact Assessment
Zoning Amendment
6158 Rideau Valley Drive, Ottawa, Ontario

This report presents the results of a hydrogeological investigation, terrain analysis, and groundwater impact assessment in support of a minor zoning by-law application with the City of Ottawa for the property located at 6158 Rideau Valley Drive, Ottawa, Ontario.

1.0 INTRODUCTION

The subject property covers an approximate area of 60.9 hectares (609,000 m^2), but for the purposes of the minor zoning by-law application investigations, the 'Site' referenced herein refers to the 5.4 hectare (54,400 m^2) portion of the subject property stretching from the frontage of the property along Rideau Valley Drive to a drainage ditch located west of the existing structures. The Site boundary is outlined in Figure 1 (Appendix A). It is understood that the current investigation is required to support a minor zoning by-law amendment in support of bringing existing home-based businesses on the Site into compliance with requirements of the Zoning By-law.

The work is being completed in accordance with MECP Procedure D-5-4 and D-5-5, and also with the City of Ottawa Hydrogeological and Terrain Analysis Guidelines (March, 2021). A technical consultation was also completed with relevant City Officials and NOVATECH on January 16th, 2024.

The objective of the hydrogeological investigation and terrain analysis presented herein is:

- To demonstrate that the construction of any new well on the property is in accordance with the requirements of the Ministry of the Environment, Conservation and Parks;
- To demonstrate that the quality of the well water meets the Ontario Drinking Water Quality Standards (ODWQS) and maximum treatable limits prescribed in Ontario Ministry of Environment, Conservation and Parks (MECP) Procedure D-5-5;

- To demonstrate that the quantity of water meets the MECP Procedure D-5-5 requirements; and
- To demonstrate that the results of the septic impact assessment meets the MECP Procedure D-5-4 requirements.

In addition to the hydrogeological investigation and terrain analysis, a groundwater impact assessment (GWA) was completed, which included the assessment of current on-site activities and their associated impacts and recommendations for applicable Best Management Practices (BMPs).

This report is subject to the Conditions and Limitations of This Report which follow the text of the report, and which are considered an integral part of the report.

2.0 TERRAIN ANALYSIS

2.1 Site Features, Topography and Drainage

The Site consists mainly of cleared and agricultural area, with unpaved access roadways, existing home-based business buildings, and agricultural structures (nine total structures). It is understood the Site consists of one domestic four-bedroom dwelling, and a workshop that is used by six employees. Two existing onsite domestic wells and two individual sewage systems are located on the Site, as displayed in the Detailed Site Plan (Figure 2, Appendix A). The Site is bounded to the east by Rideau Valley Dr N, with primarily agricultural crop and/or pasture land to the north, west, and south. Sections of provincially significant wetlands are present approximately 300 meters to the west and 90 meters to the east of the Site. The Rideau River is located approximately 300 meters to the east of the Site.

Topographic mapping data indicates that elevations across the Site range from approximately 88 metres above sea level (masl) in the west and eastern portions of the property to 93 masl in the central portion of the property. The elevation increases to a topographic ridge that strikes in an approximate north-south direction which is associated with a glacial drumlin feature that the Site is situated on. Drainage of the Site is expected to follow the topography and drain generally to the west and east down the associated banks of the drumlin.

Regional topography indicates decreasing elevations to the east, towards the Rideau River. Local overburden groundwater flow direction is expected to follow local topography and flow to the west for the western portion of the Site and east for the eastern portion for the Site, as the topographic ridge is expected to act as a local groundwater flow divide. Bedrock groundwater flow direction is expected to follow regional topography and flow generally to the east toward the Rideau River.

2.2 Potential Sources of Contamination

Potential sources of on-Site contamination to the water supply aquifer include ongoing agricultural activities, greenhouse farming, and existing commercial business activities (i.e., trucking business and landscaping supply business), and onsite sewage systems.

Potential off-Site sources of contamination include impacts from Rideau Valley Drive N bordering the Site to the east, agricultural activity on properties north, west, and south of the Site, and neighbouring sewage systems.

2.3 Surficial and Bedrock Geology

Surficial geology maps (Ontario Geologic Survey, 2010) indicate the Site is mainly underlain by fine-textured glaciolacustrine deposits of silt and clay, with minor sand and gravel. A portion of the eastern section of the Site is mapped as stone-poor sandy silt to silty sand-textured till on Paleozoic terrain. Available MECP water well records in the area indicate the overburden thickness ranges from approximately 15.9 to 24.5 meters below ground surface (10^{th} and 90^{th} percentile respectively).

Bedrock geology maps (Armstrong and Dodge, 2007) indicate the Site is underlain by limestone of the Oxford Formation. Available karst mapping (Brunton and Dodge, 2008) indicates that there are no documented karst formations within 10 kilometres of the Site.

2.4 Subsurface Conditions

Six boreholes (labelled BH24-01 through BH24-06) were advanced by Strata Drilling Group using a Geomachine GM100 to depths ranging between 3.65 m below ground surface (bgs) to 6.10 m bgs as part of the GETMEC Phase Two Environmental Site Assessment (ESA) investigation, conducted on July 18, 2024. The details and conclusions of this Phase Two ESA are provided under separate cover.

The macro core soil samples were obtained at regular depth intervals and logged in the field. The subsurface conditions and detailed soil stratigraphy were documented by GEMTEC staff during the drilling program. Four out of six locations were installed with groundwater monitoring wells (labelled BH/MW24-01, BH/MW24-03, BH/MW24-04, and BH/MW24-05) as part of the investigation.

The soil conditions encountered during the borehole drilling program are presented in the Record of Borehole Logs provided in Appendix B.

2.4.1 Geologic Conditions

The soil stratigraphy was visually observed and logged during the field investigation. The Record of Borehole Logs indicate the subsurface conditions encountered at the specific locations only. Boundaries between zones on the logs are often not distinct, but rather are transitional and have

been interpreted based on observations by trained GEMTEC field personnel. The precision with which subsurface conditions are indicated depends on the method of drilling, the frequency and recovery of samples, the method of sampling, and the uniformity of the subsurface conditions. Subsurface conditions at other than the test locations may vary from the conditions encountered in the boreholes. The following presents an overview of the subsurface conditions encountered in the boreholes advanced as part of this investigation.

The subsurface soil conditions encountered in the boreholes generally consists of brown silty sand with varying amounts of gravel from BH24-01 to BH24-04, whereas the subsurface soil conditions at BH24-05 and BH24-06 consisted of brown silty sand with varying amounts of gravel underlain by silty clay.

The overburden thickness is greater than 3 meters, and therefore, the Site does not display evidence of thin soils (i.e., less than 2 meters thick). The subsurface conditions are generally consistent with geologic mapping.

2.4.2 Groundwater - Elevations and Flow Direction

Groundwater elevations were calculated based on depth to groundwater measurements collected on August 2, 2024. Groundwater depths were measured directly from the top of each monitoring well riser using an electronic water level tape. Depth measurements were converted to groundwater elevations by subtracting the measured depth from the elevation of the top of each monitoring well riser.

All the monitoring wells were installed to straddle the anticipated water table based on conditions observed during drilling. The well screens were located within the overburden for all the monitoring wells.

The location of these monitoring wells is shown in Figure 2, Appendix A. The details of these monitoring wells are provided in Table 1.

Table 1: Monitoring Well Details

MW ID	Soil stratigraphy at Screen	Water Level (m Top of Casing)	Height of riser pipe (m)	Ground Elevation (m)	GW Elevation (m)
MW24-1	Overburden	3.36	0.10	93.43	89.97
MW24-3	Overburden	1.36	0.11	91.17	89.70
MW24-4	Overburden	1.46	0.12	91.41	89.83
MW24-5	Overburden	3.14	0.02	91.61	88.45

Groundwater elevations ranged from 88.45 and 89.97 masl on August 2, 2024. It is noted that each of the onsite monitoring wells were installed on the southwestern portion of the property, on the western side of the onsite drumlin. In the area of the Site that was investigated with monitoring wells, the inferred direction of shallow groundwater flow is generally to the southwest, based on measured groundwater elevations.

Seasonal fluctuation in water levels at the Site should be expected. Considering only one monitoring event was conducted, seasonal trends could not be identified. However, shallow groundwater level elevations are typically highest following the spring recharge and decline throughout the summer months.

2.5 MECP Water Well Records

A search of the Ministry of Environment, Conservation and Parks (MECP) water well records (https://www.ontario.ca/environment-and-energy/map-well-records) returned 32 water well records within 500 metres of the Site (Figure 1). Of the 32 wells, 21 were domestic supply wells, 2 were monitoring or test wells, and 9 were unidentified. A summary of the water well record data is provided in Appendix C.

Table 2 provides a summary of the well characteristics for the 32 water well records, including depth to water found, , depth to bedrock, and total well depth.

Table 2: Summary of Water Well Records Search Results

Parameter	10th Percentile	90th Percentile	Average / Geometric Mean
Depth Water Found (m)	22.8	84.4	53.9/46.1
Depth to Bedrock (m)	15.9	24.5	19.7/19.3
Total Well Depth (m)	28.4	76.0	53.3/48.0

The MECP Water Well Records for drinking water wells within 500 meters of the site indicate that the majority of existing private wells are completed in limestone bedrock. Bedrock geology maps (Ontario Geologic Survey, 2011) indicate the overburden at the Site is underlain by limestone of the Oxford Formation, with aligns with observations during drilling.

The well records indicate that soil thicknesses range from approximately 15.9 to 24.5 meters below ground surface (10th and 90th percentile respectively) with a geometric mean of 19.3 metres, and therefore, thin soils (i.e., less than 2 meters thick) are not expected on the Site.

3.0 WATER QUALITY AND QUANTITY ASSESSMENT

3.1 Test Well Construction

Two existing wells located on the Site were reviewed as part of the hydrogeological investigation, herein referred to as 'TW1' and 'PW1. The MECP water well record for TW1 is provided in Appendix D and the construction details are summarized in Table 3, below. The water well record was unavailable for PW1 at the time of this investigation. The approximate locations of the water wells are provided on the Detailed Site Plan, Figure 2.

Table 3: TW1 Water Well Construction Details

Well Construction Details – TW1 (Well Tag# A025676)	
Depth to Bedrock	27.70 metres
Length of Well Casing Above Ground Surface	0.69 metres (1)
Length of Well Casing Below Ground Surface	28.64 metres
Depth Water Found	20.71 metres
Total Well Depth	75.58 metres
Bedrock Description	Limestone

Notes: 1. Casing height measured by GEMTEC staff during Site work.

3.2 Groundwater Quantity

3.2.1 Assessment of Groundwater Quantity Requirements

The zoning amendment for the Site is being completed in support of bringing existing home-based businesses on the Site into compliance with requirements of the Zoning By-law. The client was consulted on their water uses, which were collaboratively estimated as:

- Six (6) seasonal workers (125 L/day as per Ontario Building Code OR conservatively estimated to be equivalent to residential 6 × 450 L/day = 2,700 L/day)
- One (1) 4-bedroom residence (5 persons × 450 L/day = 2,250 L/day)
- One (1) office worker (75 L/day)
- Vehicle washing station (approximately 400 litres per vehicle x 4 vehicles per week = 1,600 litres per week or conservatively assumed to be 1,600 litres per day)

- Based on information provided by the client, regular washing of all vehicles does not occur and washing consists of 3 to 4 vehicles and/or pieces of farm equipment per week. Information on water demand per wash is not specified but is conservatively estimated to be 450 litres per vehicle (i.e., approx. 100 gallons).

The total water demand for these proposed uses were conservatively estimated as 6,625 L/day. The available well yield is far greater than this estimated demand, as described in the following subsections.

3.2.2 Pumping Test

A pumping test was carried out on test well TW1 by a member of GEMTEC staff on June 19, 2024. Test well TW1 is an existing water supply well currently servicing a residential dwelling, with no groundwater quantity issues being reported. A licensed well technician (Air Rock Drilling Ltd.) removed the existing pump and installed a temporary submersible pump for the purposes of the pumping test. Following completion of the pumping test, the temporary submersible pump was removed and the existing pump re-installed following chlorination / disinfection.

The well was pumped at a constant rate of approximately 38 litres per minute for a period of eight hours. The test was started at a pumping rate of approximately 66 litres per minute for approximately 20 minutes, and then decreased to a flow rate of 38 litres per minute and pumped constantly at this rate for 8 hours (total test length 8 hours and 20 minutes). The water from the pumping test was discharged to the ground surface approximately 10 metres away from the test well such that the discharge flow was directed away from the well head.

Water level and flow rate measurements were taken at regular intervals throughout the pumping test. Water levels were also taken during the recovery phase of the pumping test (after the pump was turned off) for a total of 20 minutes. The pumping test drawdown and recovery graph is provided in Appendix E.

During the eight-hour pumping test, the water level decreased approximately 2.76 metres, from a static water level of 8.69 metres below ground surface. Frequent flow rate measurements confirmed that the pumping was maintained at a constant rate of approximately 38 litres per minute, excluding the first 20 minutes of the test. The pumping test withdrew a total volume of approximately 18,200 litres, and the well recovered 95 % after the pump was turned off within approximately 15 minutes.

3.2.3 Pumping Test Analyses

The transmissivity of the water supply aquifer was estimated from the pumping test drawdown data using Aqtesolv (Version 4.5), a commercially available software program from HydroSOLVE Inc. The Theis recovery method was employed to analyze the pumping test data. Insufficient drawdown was observed during the pumping test for analysis of aquifer properties. Analyses

performed using the Theis recovery method calculated the transmissivity of the water supply aquifer to be 3.8 m^2/day (Appendix E).

Based on these results, the test well is considered to be capable of repeat pumping at a constant rate of 38 litres per minute over an 8-hour period, equal to a total volume pumped of 18,200 litres. If the daily water requirement for the existing Site usage is in excess of 18,200 litres per day, or if the peak demand is greater than 38 litres per minute, additional investigations may be required.

3.3 Water Quality

3.3.1 Methodology

Preliminary water sampling was conducted at TW1 and PW1 on April 2, 2024, in which water samples were collected from untreated taps supplied by the wells. The samples were collected in laboratory supplied bottles after stabilization of field measured water quality parameters, and submitted to Paracel laboratories in Ottawa, Ontario for 'subdivision package' parameters.

Total chlorine tests were conducted in the field using a Hach DR 900 colorimeter to ensure that chlorine levels were at non-detectable concentrations prior to bacteriological testing. The temperature, conductivity, total dissolved solids, pH, turbidity, colour and free chlorine levels of the groundwater were measured at periodic intervals during the sampling events and are summarized in Appendix F. The field equipment used during the sampling is calibrated by GEMTEC and the details of field equipment are provided in Table 4.

Table 4: Field Equipment Overview

Field Parameters	Manufacturer	Model No.	Detection Limit
Total and Free Chlorine	Hach	DR 900	0.02 mg/L
pH, temperature, Conductivity	Hanna	HI 98130	-
Turbidity	Hanna	HI 98703	0.05 NTU
Colour	Hach	DR 900	5 TCU

Notes:
1. Hach DR900: colour and chlorine zeroed using distilled water prior to measuring field parameters.
2. Hanna HI 98130 calibration check using 4.0, 7.0 and 10.0 pH solutions (within +/- 0.02).
3. Hanna HI 98130 calibration check using 12.88 mS/cm solution (within +/- 0.05)
4. Hanna HI98703 calibration check using <0.10, 15.0, 100 NTU (within 2%).

Water samples were collected from TW1 following eight hours of pumping during the pumping test completed on June 19, 2024. The groundwater samples were collected directly from the discharge hose into laboratory supplied bottles. The groundwater samples were subsequently

submitted to Paracel laboratories in Ottawa, Ontario for analysis of 'subdivision package', volatile organic compounds (VOCs), petroleum hydrocarbons (PHCs), and 'trace metals' parameters.

Additional samples were collected from TW1 on August 1, 2024, from an untreated tap from the residential dwelling supplied by the test well. The samples were collected in laboratory supplied bottles after stabilization of field measured water quality parameters and submitted to Paracel laboratories in Ottawa, Ontario for bacteria and turbidity.

3.3.2 PW1 Water Quality

A summary of the chemical, physical and bacteriological analyses on the water samples from PW1 and the laboratory certificate of analyses are provided in Appendix F. The water quality discussed below includes the exceedances of the ODWQS.

Hardness

Per the laboratory results, the hardness from the April 2, 2024 was reported to be 307 mg/L. Water having a hardness above 100 milligrams per litre as $CaCO_3$ is often softened for domestic use, and thus is treatable. Water softeners are widely used throughout rural areas to treat hardness and there is no upper treatable limit for hardness. The ODWQS indicates that hardness levels exceeding 200 mg/L as $CaCO_3$ is considered poor but tolerable and hardness levels exceeding 500 mg/L as $CaCO_3$ is unacceptable for most domestic purposes, but a maximum treatable value is not available.

Turbidity

Per the laboratory results, turbidity from April 2, 2024 was reported to be 28.1 NTU, which exceeds the ODWQS aesthetic objective of 5 NTU. The field measured turbidity was less than 1 NTU at the time of sampling and is considered to be more representative of the raw groundwater quality. The elevated laboratory reported turbidity is likely associated with the high iron concentrations of 2.5 mg/L.

Iron

Per the laboratory results, iron from April 2, 2024, was reported to be 2.5 mg/L in PW1, which exceeds the ODWQS aesthetic objective of 0.3 mg/L, but is below the maximum concentration considered reasonably treatable of 10 mg/L listed in MECP Procedure D-5-5. Therefore, iron is considered to be acceptable based on the water sampling completed at PW1. Treatment may be desirable if the water well is used to supply drinking water.

Iron is often found in groundwater due to iron-rich mineral deposits under chemically reducing conditions. Excessive iron can discolour the water, stain laundry and fixtures, promote the growth of bacteria, and impart an undesirable taste to the water. As per MECP Procedure D-5-5, treatment options for iron concentrations up to 5.0 mg/L include water softeners or manganese greensand filters.

Organic Nitrogen

The organic nitrogen concentration (kjeldahl nitrogen – ammonia) for the sampling on April 2, 2024 was calculated to be 0.2 mg/L, which exceeds the ODWQS operational guidelines of 0.15 mg/L. The ODWQS indicates that levels of organic nitrogen in excess of 0.15 mg/L may be caused by septic tank or sewage contamination and is typically associated with elevated DOC concentrations. The organic nitrogen concentrations in slight exceedance of the operational guideline may be attributed to local wetlands and watercourse, on Site and off-Site septic systems.

Organic nitrogen can react with chlorine and severely reduce its disinfectant power; in addition, taste and odour problems may occur. It is not expected that ongoing chlorination will be utilized by the property owner on site, and, as such, no concerns with the operational exceedance for organic nitrogen were identified.

3.3.3 Test Well TW1 Water Quality

A summary of the chemical, physical and bacteriological analyses on the water samples from test well TW1 and the laboratory certificate of analyses are provided in Appendix F. The water quality discussed below includes the results of interest, i.e., exceedances, from all sampling events.

Bacteriological Parameters

Bacteriological laboratory results for TW1 for the initial sampling completed on April 2, 2024 reported non-detectable concentrations for E.coli and fecal coliforms and total coliform. After eight hours of pumping on June 19, 2024, the water quality sample reported elevated turbidity (turbidity attributed to install of external pump, discussed further in Section 3.3.3), and therefore the laboratory reported ‘no data: overgrown with nontarget’ for bacteriological parameters.

TW1 was resampled on August 1, 2024 for bacteria after resolving elevated turbidity levels, and reported non-detectable concentrations of E.Coli and Fecal Coliform. Total Coliform concentrations were reported to be 2 CFU/100 mL, which exceeds the Ontario Drinking Water Quality Standards (ODWQS) maximum acceptable concentration (MAC) of 0 CFU/100 mL. In accordance with MECP Procedure D-5-5, total coliform counts of less than 6 CFU/100 mL is considered indicative of acceptable water quality when E.Coli and Fecal Coliform are non-detectable in the sample. Therefore, the water sample meets the D-5-5 standard for acceptable water quality.

Based on the bacterial laboratory results reported for TW1, the water quality is acceptable.

Hardness

Per the laboratory results, the hardness from the April 2, 2024 and June 19, 2024 was reported to be 215 mg/L and 220 mg/L respectively. Water having a hardness above 100 milligrams per litre as $CaCO_3$ is often softened for domestic use, and thus is treatable. Water softeners are widely

used throughout rural areas to treat hardness and there is no upper treatable limit for hardness. The ODWQS indicates that hardness levels exceeding 200 mg/L as $CaCO_3$ is considered poor but tolerable and hardness levels exceeding 500 mg/L as $CaCO_3$ is unacceptable for most domestic purposes, but a maximum treatable value is not available.

Water softening by conventional sodium ion exchange water softeners that use sodium chloride may introduce relatively high concentrations of sodium into the drinking water, which may be of concern to persons on a sodium restricted diet. The use of potassium chloride in the water softener (which adds potassium to the water instead of sodium) could be considered as a means of keeping sodium concentrations in softened water at the background level. Alternatively, consideration could be given to providing a cold-water bypass water line for drinking water purposes that is not treated by a water softener.

Turbidity

Per the laboratory results, turbidity from April 2, 2024 and June 19, 2024 was reported to be 0.7 NTU and 10.1 NTU in TW1, respectively. The results from June 19, 2024 exceed the ODWQS aesthetic objective of 5 NTU.

The water quality results from the preliminary sampling on April 2, 2024 indicated acceptable turbidity levels well below the ODWQS aesthetic objective of 5 NTU. The elevated concentrations reported on June 19, 2024 are expected to be attributed to the removal of the existing pump, and installing an external pump in TW1 to perform the eight hour pumping test. During this process, loose sediment and/or material from the well casing may have been dislodged into the water column, increasing levels of total suspended solids and turbidity.

To confirm the in-situ groundwater does not display elevated levels of turbidity, TW1 was resampled after regular domestic use on August 1, 2024, and reported non-detectable levels of turbidity. Therefore, turbidity is considered to be acceptable based on the water sampling completed at TW1.

Iron

Per the laboratory results, iron from June 19, 2024 was reported to be 0.4 mg/L in TW1, which exceeds the ODWQS aesthetic objective of 0.3 mg/L, but is below the maximum concentration considered reasonably treatable of 10 mg/L listed in MECP Procedure D-5-5. Iron can be treated using water softeners or manganese greensand filtered at concentrations up to 5.0 mg/L.

It should be noted that iron during the first sampling event completed on April 2, 2024 reported concentrations of 0.1 mg/L, which is below the ODWQS aesthetic objective of 0.3 mg/L. It is expected that the elevated levels of iron on June 19th, 2024 are associated with elevated turbidity during the pumping test. Further, the filtered iron concentrations were reported to be non-detectable (less than 0.1 mg/L) on June 19th, which supports the theory that slightly elevated concentrations of iron are related to elevated turbidity levels.

4.0 SEPTIC IMPACT ASSESSMENT

The impact on groundwater resources due to wastewater treatment and disposal by the existing onsite sewage disposal system and development on the Site is assessed in the following sections.

4.1 Hydrogeological Sensitivity

Areas of thin soils cover, highly permeable soils, fractured bedrock exposed at ground surface and karst environments can contribute to hydrogeological sensitivity, which may not allow for sufficient attenuative processes for on-site septic systems and negatively impact the receiving aquifer. Areas of thin soil cover, generally taken to be less than two metres, or highly permeable soils, were not encountered at the Site. The overburden thickness on site was reported to be greater than 3.0 meters thick based on the borehole investigations, and karst mapping (Brunton and Dodge, 2008) does not indicate the presence of any inferred or potential karstic features on the Site. Based on this information, the Site is not considered to be hydrogeologically sensitive.

4.2 Overburden Groundwater Quality

Groundwater quality samples from two overburden monitoring wells, MW24-1 and MW24-3 were collected on August 2, 2024 for analysis of nitrate and nitrite. Table 5 outlines the monitoring well groundwater sampling results, and the laboratory result sheets are provided in Appendix G.

Table 5: Monitoring Well Sampling Summary

MW ID	Soil Stratigraphy at Screen	Nitrate (mg/L)	Nitrite (mg/L)
MW24-1	Overburden	1.03	0.05
MW24-3	Overburden	5.33	0.09

Sources of nitrate include on-site septic systems and agricultural land use, both on and off-site. Monitoring well MW24-3 was drilled within close proximity of an existing septic system (exact location unknown), which is expected to the source of the elevated concentrations of nitrates. Therefore, the elevated nitrate concentration of 5.33 mg/L is not considered to be representative of background nitrate levels in the receiving aquifer. Based on the inferred groundwater flow direction to the southwest (GEMTEC, 2024), MW24-1 is upgradient of the septic system and representative of background nitrate concentrations in the overburden, i.e., the septic receiving unit.

4.3 Hydrogeological Conceptual Site Model

A Hydrogeological Conceptual Site Model (CSM) was developed for the Site to outline the different hydrogeological units, including the septic receiving unit and the water supply aquifer, based on the following information:

- Surficial geology mapping indicate the Site is underlain by fine-textured glaciolacustrine deposits of silt and clay, with minor sand and gravel. A portion of the eastern section of the Site is mapped as stone-poor sandy silt to silty sand-textured till on Paleozoic terrain. Subsurface soil conditions encountered in the boreholes generally consists of brown silty sand with varying amounts of gravel (3 to 5+ metres in thickness) underlain by silty clay.
- Shallow groundwater flow is to the southwest, based on the results of the Phase 2 ESA (GEMTEC, 2024).
- Available MECP water well records in the area indicate the overburden thickness ranges from approximately 15.9 to 24.5 meters below ground surface (10^{th} and 90^{th} percentile respectively).
    - Two overburden wells were identified, which are completed in coarse grained sands and gravels at depths of greater than 12 metres below ground surface.
- The overburden on-site is approximately 27.7 metres in thickness based on the on-site well record (TW1, well record A025676).
- Bedrock geology maps (Armstrong and Dodge, 2007) indicate the Site is underlain by limestone of the Oxford Formation. Available karst mapping (Brunton and Dodge, 2008) indicates that there are no documented karst formations within 10 kilometres of the Site.

Based a review of relevant information mentioned, the CSM defines a shallow overburden unit generally consisting of silty sand and gravel, underlain by a generally low-permeability overburden unit consisting of silt and clay, which is underlain by a limestone bedrock aquifer at depths of approximately 15.9 to 24.5 meters below ground surface. The septic receiving aquifer is expected to be the shallow silty sand and gravel overburden logged during the borehole drilling program, but based on the water well record study, it is expected to be variable in thickness and extent. Water well records within 500 meters of the Site indicate the majority of well users utilize the bedrock supply aquifer, and overburden wells are completed in coarse grained sands and gravels at depths greater than 12 metres below ground surface, and therefore, septic effluent contamination to nearby well users in the septic receiving unit is not expected.

4.4 Septic Impact Assessment

The potential risk to groundwater resources on and off the Site was assessed in accordance with Ministry of Environment Procedure D-5-4: Technical Guideline for Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment. To evaluate the groundwater impacts, step three of the Three-Step Assessment Process outlining in MECP D-5-4 was followed for commercial properties.

4.4.1 Nitrate Dilution Calculations

The risk of individual Site septic systems will be assessed using nitrate-nitrogen contaminant loading for commercial properties. The maximum allowable concentration of nitrate in the groundwater at the boundaries of the subject property is 10 mg/L as per the Ministry of the Environment, Conservation and Parks guideline D-5-4, dated August 1996.

The nitrate concentration at the Site boundaries was calculated using the following information, and are summarized in Appendix H:

- Site area: 54,000 m^2.
- Assumed hard surface area: 20% of total Site area.
- Infiltration factors and water holding capacity of soils (WHC) based on information obtained from Table 3.1 of the Ministry of Environment Stormwater Management Planning and Design Manual, dated March 2003.
- Soil Factor: 0.2, which represents a medium combination of clay and loam.
- Cover Factor: 0.10 for cultivated land.
- Topography Factor: 0.2, representative of rolling land with an average slope of 2.8 to 3.8 m/km.
- Water holding capacity: 125 mm for urban lawns / shallow rooted crops, silt loam soil;
- An annual water surplus of 0.344 metres/year for soils with a water holding capacity of 125 mm.
    - Ottawa Airport Weather Station (1939-2020), Station ID: DC20492. Water surplus datasheet provided in Appendix H.
- Background nitrate concentration (MW24-01, sampled on August 2, 2024) of 1.03 mg/L in the septic receiving aquifer.

The maximum design flow for proposed conventional septic systems servicing on the Site is 6,790 liters per day assuming hard surface area of 20%, as outlined in Table 6, below.

Table 6: Calculated Maximum Septic Flows

Hard Surface Area	Background Nitrate Concentration (mg/L)	Maximum Septic Flow-Conventional[1] (litres per day)
20%	1.03	6,790

Notes:
1. MECP guideline D-5-4: (40 mg/L x Flow) / (Flow + Infiltration) = 10 mg/L - background nitrates.

For the purposes of zoning by-law amendment, the septic impact assessment indicates that the Site can support a residential septic (1,000 L/day) as per D-5-4 requirements, plus septic demands of 5,790 litres per day for commercial uses.

The Site is currently serviced by two septic systems, one of which is for the existing residential dwelling. Based on information provided by the owner, the sewage demands for the site was calculated to be 2,400 litres per day for the 4-bedroom residential dwelling and 825 litres per day for commercial uses, i.e., one office employee (1 x 75 L/day) and six seasonal workers that use shower and toilet (6 x 125 L/day), as per Ontario Building Code (OBC) Section 8.2.1.3 – Septic System Design Flows. The current septic demands are within the maximum calculated septic flows of 6,790 litres per day.

5.0 GROUNDWATER IMPACT STUDY

A groundwater impact assessment was completed for the Site to assess impacts to the groundwater based on the zoned usage(s). It is understood that under the zoning by-law amendment, two businesses will be in operation at the Site:

- A Trucking Business
  - Trucking of aggregates and soils, and snow removal in the winter months.
  - Trucks include various tractor trailers, dump trucks, straight trucks and backhoes.
- A Landscaping Supply Business
  - Sale of landscaping material such as soil, mulch and gravel, which is stockpiled on the Site.

The following sections outline the data sources reviewed as part of the groundwater impact assessment.

5.1 Rideau Valley Source Protection Area Review

The Assessment Report for the Mississippi-Rideau Source Protection Area (RVCA, 2011) and the MECP online resource: Source Protection Information Atlas (https://www.lioapplications.lrc.gov.on.ca/SourceWaterProtection/index.html?viewer=SourceWaterProtection.SWPViewer&locale=en-CA), was reviewed, and indicated the following points of interest for the Site:

- The Site is not located in an area designated as a highly vulnerable aquifer zone.
- The Site is not located in close proximity to a significant groundwater recharge area.
- The Site is not located in a surface water intake protection zone, or a wellhead protection area.

Nonetheless, the environmental risk posed by material storage (e.g., soils, fertiliser, road salt) or fuel on site, if present, should be mitigated where appropriate. Accordingly, it is recommended that storage mitigation strategies such as using spill-proof containers, secondary containment, overhead cover, and/or proper disposal procedures are applied as applicable. In addition, it is recommended that a spill response and prevention plan is prepared that at least includes suitable

spill kit(s) at refueling stations, fuel storage sites, and/or on board large machinery. Staff should be adequately trained on how to respond to and report spills.

5.2 Groundwater Vulnerability Analysis

Due to the proposed zoning amendment, a groundwater impact assessment is required to assess the risk of the water supply aquifer to impact from surficial activity. Based on a review of available background geologic and source water information, boreholes advanced on Site, septic impact assessment, and the water quality and quantity testing of existing domestic wells on the Site, the existing land use is not expected to negatively impact the groundwater aquifer. The determination is based on multiple lines of evidence, including:

- The Site is underlain by greater than three meters of soil, with no evidence of shallow/thin soils, highly permeable soils, or exposed bedrock.
    - Low permeability soils were encountered at depth in boreholes 24-05 and 24-06.
    - The Site is not considered to be hydrogeologically sensitive.
- Well records within 500 meters of the Site indicate that bedrock depths range from 15.7 to 24.5 meters below ground surface (10th and 90th percentile), with depths of logged water bearing zones ranging from 22.8 to 84.4 meters below ground surface (10th and 90th percentile).
- Geological mapping resources (Brunton and Dodge, 2008; OGS, 2010; OGS 2011) indicate that the Site is not underlain by inferred or potential karstic features. The Site is primarily underlain by limestone bedrock.
- Rideau Valley Source Protection Area indicates that the Site is not located in a highly vulnerable aquifer zone, a significant groundwater recharge zone, a surface water intake protection zone, or a wellhead protection zone.

The minor zoning by-law amendment is being completed in support of bringing existing home-based businesses on the Site into compliance with requirements of the Zoning By-law. As such, Site activity and/or Site usage remains unchanged. Based on the results of the Phase 2 ESA (GEMTEC, 2024), no impacts on the Site were identified. It is understood that equipment / vehicle (e.g., tractors) washing is completed in the most south-western building, which is equipped with an oil-water separator, acting as a mitigation measure for the washing station.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of this investigation, the following conclusions and professional opinions are provided:

6.1 Hydrogeological Conceptual Model

- The soil conditions encountered generally consisted of brown silty sand with varying amounts of gravel, underlain by silty clay.

- Based on boreholes advanced, the overburden thickness is greater than three meters on the Site. No thin soils, highly permeable soils or exposed bedrock were observed on the Site, and therefore is not considered to be hydrogeologically sensitive. A review of geologic mapping and MECP well records suggests that the silty sand is variable in thickness and extent in the vicinity of the site and underlain by relatively thick deposits of low permeability glaciomarine deposits.

- Shallow groundwater flow within the silty sand overburden is towards the southwest (GEMTEC, 2024).

- The water supply aquifer at the Site consists of limestone of the Oxford Formation. A review of MECP well records indicate two overburden well users, which are completed in coarse grained sands and gravels at depths of greater than 12 metres below ground surface.

6.2 Groundwater Quantity

- The quantity of groundwater available from the proposed water supply aquifer is sufficient for the Site and will sustain repeated pumping at the test rate and duration at 24-hour intervals over the long term.
    - For the purposes of assessing groundwater quantity, one of the three on-site water supply wells, TW1, was utilized, which was capable of repeat pumping at a constant rate of 38 litres per minute over an 8-hour period, equal to a total volume pumped of 18,200 litres.
    - It was estimated that the water demand for the present and proposed use of the property was 6,625 L/day. The results of the pumping test indicated that TW1 can supply 2.7 times the estimated water demand.
    - If the daily maximum water requirement for the proposed Site usage is above 18,200 litres per day, or if the peak demand is greater than 38 litres per minute, additional investigations are recommended.

- The well yields determined in the course of the investigation are representative of the yields in the long term.

6.3 Groundwater Quality

- For the purposes of the groundwater quality assessment to support re-zoning, TW1 was utilized. Test well TW1 is completed in the bedrock and currently services the existing residential dwelling. A second well is located on-site, PW1, for which no water well record is available, and the well construction details are unknown.

- The groundwater quality meets the ODWQS health-related and maximum acceptable concentrations for all parameters tested. The groundwater is safe for consumption based on the absence of health-related exceedances; however, groundwater treatment for operational and aesthetic parameters may be desired.
    - Bacteriological testing of TW1 initially reported non-detectable total coliform, E.coli and fecal coliform concentrations. At the time of the pumping test, elevated turbidity associated with pump removed resulted in laboratory reported 'no data, overgrown with non-target' and following re-sampling reported total coliform of 2 CFU/100mL. The groundwater quality is within acceptable limits for private wells, with total coliform counts less than 6 CFU/100mL and non-detectable E.coli.
    - The levels of hardness and iron are considered to be reasonably treatable using a conventional water softener and/or manganese greensand filters.
    - Sodium exceeds the 'warning level' for persons on sodium restricted diets and as per MECP Procedure D-5-5, the sodium concentration should be reported to the Local Medical Officer of Health.

6.4 Septic Impact Assessment

- The septic impact assessment indicates that the maximum allowable septic flows for the site 6,790 litres per day, for which the resultant nitrate concentration at the property boundary will be less than 10 mg/L in accordance with MECP Procedure D-5-4.
    - For the purposes of re-zoning, the Site is able to accommodate 'home-based' businesses, with maximum allowable septic flows of 5,790 litres per day for commercial use and 1,000 litres per day for residential use.
    - For purposes of the septic impact assessment, the Site use currently includes 1,000 litres per day for residential septic use and 825 litres per day for commercial use, consisting of 75 litres per day for 1 office employee and 125 litres per day for 6 seasonal workers. The current septic demand for the Site is within the calculated maximum allow septic flows.
- The site is underlain by a silty sand layer of variable thickness (3 to 5 metres) and extent, which is considered to be the 'receiving aquifer' for septic effluent. Nitrate concentrations of 5.33 mg/L were reported for MW24-03 and are likely associated with the existing septic located in close proximity to the monitoring point. Given the proximity to the existing septic system, the nitrate concentration in MW24-03 is not considered to be representative of the background nitrate concentration in the receiving aquifer. Monitoring well MW24-01, located upgradient, had a nitrate concentration of 1.03 mg/L and is considered to be more representative of the background nitrate concentration in the overburden aquifer. Nitrate sources at the site include the two on-site septic systems and agricultural site use (on-site and off-site).
    - No nitrate or nitrite was detected in the bedrock water supply aquifer.

6.5 Groundwater Impact Assessment

- The groundwater impact assessment did not identify risk of impacts to the groundwater based on the zoned usage(s), based on the following lines of evidence:

    - The Site is underlain by greater than three meters of soil, with no evidence of shallow/thin soils, highly permeable soils, or exposed bedrock. Low permeability soils were encountered at depth in boreholes 24-05 and 24-06.
    - The Site is not considered to be hydrogeologically sensitive.
    - Well records within 500 meters of the Site indicate that bedrock depths range from surface 15.7 to 24.5 meters below ground surface (10th and 90th percentile), with depths of logged water bearing zones ranging from 22.8 to 84.4 meters below ground surface (10th and 90th percentile).
    - Geological mapping resources (Brunton and Dodge, 2008; OGS, 2010; OGS 2011 indicate that the Site is not underlain by inferred or potential karstic features. The Site is primarily underlain by limestone bedrock.
    - Rideau Valley Source Protection Area indicates that the Site is not located in a highly vulnerable aquifer zone, a significant groundwater recharge zone, a surface water intake protection zone, or a wellhead protection zone.
    - Based on the Phase 2 ESA (GEMTEC, 2024), no impacts on the Site were identified.
    - It is understood that equipment / vehicle (e.g., tractors) washing is completed in the most south-western building, which is equipped with an oil-water separator, acting as a mitigation measure for the washing station.

It is our professional opinion that the water quality, quantity and septic impact assessment meets the requirements of MECP Procedure D-5-4 and D-5-5 for the purposes of re-zoning.

6.6 Recommendations

- If desired by owners, water softeners and manganese green sand filters may be used to treat operational guideline exceedances of hardness and iron.

    - Water softening by conventional sodium ion exchange water softeners that use sodium chloride may introduce relatively high concentrations of sodium into the drinking water, which may be of concern to persons on a sodium restricted diet. Alternatively, consideration could be given to providing a cold-water bypass water line for drinking water purposes that is not treated by a water softener or utilizing groundwater for plumbing systems only and providing potable water.

- Well construction details for PW1 are unknown. It is recommended that a licensed well technician carry out an inspection of PW1 to confirm the well is in acceptable condition.

- It is recommended that the property owners maintain and test their drinking water well in accordance with the Ministry of the Environment and Climate Change document “Water Supply Wells - Requirements and Best Management Practices, Revised April 2015”.

- It is recommended that the property owners maintain and check their Site septic system in accordance with the Ontario Building Code and best management practices.

7.0 CLOSURE

We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report, please do not hesitate to contact our office.

Andrius Paznekas, M.Sc., P.Geo
Hydrogeologist

BR/JKA/AP

8.0 REFERENCES

Armstrong, D.K. and Dodge, J.E.P. 2007. Paleozoic geology of southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 219

Brunton, F.R. and Dodge, J.E.P. 2008. Karst of southern Ontario and Manitoulin Island; Ontario Geological Survey, Groundwater Resources Study 5.

Ontario Geological Survey. 2010. Surficial geology of Southern Ontario. Ontario Geological Survey, Miscellaneous Release-Data 128-Revision 1.

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

Ontario Ministry of the Environment and Climate Change. 1996. Procedure D-5-5, Technical Guideline for Private Wells: Water Supply Assessment. August 1996.

Ontario Ministry of the Environment and Climate Change. 1996. Procedure D-5-4, Technical Guideline for Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment. August 1996.

CONDITIONS AND LIMITATIONS OF THIS REPORT

1. **Standard of Care:** GEMTEC has prepared this report in a manner consistent with generally accepted engineering or environmental consulting practice in the jurisdiction in which the services are provided at the time of the report. No other warranty, expressed or implied is made.
2. **Copyright:** The contents of this report are subject to copyright owned by GEMTEC, save to the extent that copyright has been legally assigned by us to another party or is used by GEMTEC under license. To the extent that GEMTEC owns the copyright in this report, it may not be copied without our prior written agreement for any purpose other than the purpose indicated in this report. The methodology (if any) contained in this report is provided to the Client in confidence and must not be disclosed or copied to third parties without the prior written agreement of GEMTEC. Disclosure of that information may constitute an actionable breach of confidence or may otherwise prejudice our commercial interests.
3. **Complete Report:** This report is of a summary nature and is not intended to stand alone without reference to the instructions given to GEMTEC by the Client, communications between GEMTEC and the Client and to any other reports prepared by GEMTEC for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. GEMTEC cannot be responsible for use of portions of the report without reference to the entire report.
4. **Basis of Report:** This Report has been prepared for the specific site, development, design objectives and purposes that were described to GEMTEC by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document, subject to the limitations provided herein, are only valid to the extent that this report expressly addresses the proposed development, design objectives and purposes. Any change of site conditions, purpose or development plans may alter the validity of the report and GEMTEC cannot be responsible for use of this report, or portions thereof, unless GEMTEC is requested to review any changes and, if necessary, revise the report.
5. **Time Dependence:** If the proposed project is not undertaken by the Client within 18 months following the issuance of this report, or within the timeframe understood by GEMTEC to be contemplated by the Client, the guidance and recommendations within the report should not be considered valid unless reviewed and amended or validated by GEMTEC in writing.
6. **Use of This Report:** The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without GEMTEC's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, GEMTEC may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process.

   Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.
7. **No Legal Representations:** GEMTEC makes no representations whatsoever concerning the legal significance of its findings, or as to other legal matters touched on in this report, including but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and change. Such interpretations and regulatory changes should be reviewed with legal counsel.
8. **Decrease in Property Value:** GEMTEC shall not be responsible for any decrease, real or perceived, of the property or site's value or failure to complete a transaction, as a consequence of the information contained in this report.
9. **Reliance on Provided Information:** The evaluation and conclusions contained in this report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations. information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in this report as a result of misstatements, omissions,

misrepresentations. or fraudulent acts of the Client or other persons providing information relied on by us. We are entitled to rely on such representations, information and instructions and are not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

10. **Investigation Limitations:** Site investigation programs are a professional estimate of the scope of investigation required to provide a general profile of subsurface conditions but even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions.

    The data derived from the site investigation program and subsequent laboratory testing are interpreted by trained personnel and extrapolated across the site to form an inferred geological representation and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. Conditions between and beyond the borehole/test hole locations may differ from those encountered at the borehole/test hole locations and the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies. Accordingly, GEMTEC does not warrant or guarantee the exactness of of the subsurface descriptions.

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

    In addition, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

11. **Sample Disposal:** GEMTEC will dispose of all uncontaminated soil and/or rock samples 60 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fill materials or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

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

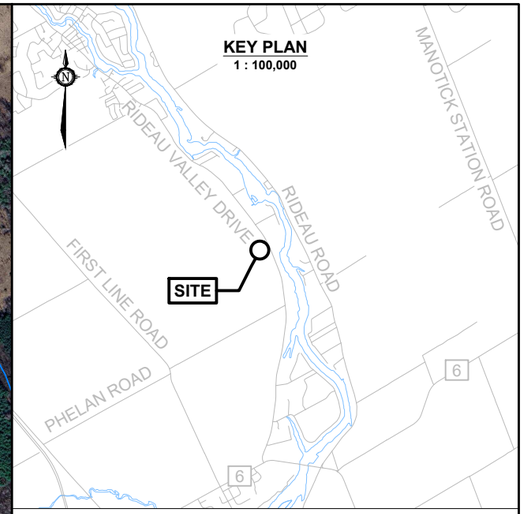
    During construction, GEMTEC should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of GEMTEC's report and to confirm and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

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

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

APPENDIX A

Figures



LEGEND

- APPROXIMATE SITE BOUNDARY
- STUDY AREA (500 RADIUS AROUND THE SITE BOUNDARY)
- WATERCOURSE
- WETLAND UNEVALUATED
- MECP PUBLIC WELL RECORDS

GENERAL NOTE(S)

1. Coordinate system: NAD83, UTM ZONE 18N, CGVD28
2. Distances, elevations, and coordinates are shown in metres unless denoted otherwise
3. This drawing is a schematic representation and should not be taken as a substitute for a legal survey.
4. Maps Data: Google, @2024 CNES / Airbus, First Base Solutions, Maxar Technologies
5. Contains information licensed under the Open Government Licence – Ontario
6. Geographic dataset source: Ontario GeoHub

SCALE 1:3,500

0 120 240m

DRAWING

SITE LOCATION PLAN

CLIENT

NOVATECH ENGINEERS, PLANNERS & LANDSCAPE ARCHITECTS

PROJECT

PHASE TWO
ENVIRONMENTAL SITE ASSESSMENT,
ZONING BY-LAW AMENDMENT APPLICATION
6158 RIDEAU VALLEY DRIVE
OTTAWA, ONTARIO

DRAWN BY	CHECKED BY
S.L.	A.P.
PROJECT NO.	REVISION NO.
100011.082	0
DATE	FIGURE NO.
SEPTEMBER 2024	**FIGURE A.1**

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LEGEND

- BH/ MW # — BOREHOLE/ MONITORING WELL ID
- XX.XX — GROUND SURFACE ELEVATION, IN METRES
- **BOREHOLE** (current investigation by GEMTEC)
- **BOREHOLE/ MONITORING WELL** (current investigation by GEMTEC)
- **TEST WELL** (current investigation by GEMTEC)
- **APPROXIMATE SITE BOUNDARY**
- **APPROXIMATE SEPTIC BED LOCATION**

GENERAL NOTE(S)

1. Coordinate system: NAD83, UTM ZONE 18N, CGVD28
2. Distances, elevations, and coordinates are shown in metres unless denoted otherwise
3. This drawing is a schematic representation and should not be taken as a substitute for a legal survey.
4. Maps Data: Google, @2024 CNES / Airbus, First Base Solutions, Maxar Technologies
5. Contains information licensed under the Open Government Licence – Ontario
6. Geographic dataset source: Ontario GeoHub

SCALE 1:1,500

0 30 60 90m

DRAWING
DETAILED SITE PLAN

CLIENT
NOVATECH ENGINEERS, PLANNERS & LANDSCAPE ARCHITECTS

PROJECT
PHASE TWO
ENVIRONMENTAL SITE ASSESSMENT,
ZONING BY-LAW AMENDMENT APPLICATION
6158 RIDEAU VALLEY DRIVE
OTTAWA, ONTARIO

DRAWN BY	CHECKED BY
S.L.	A.P.
PROJECT NO.	REVISION NO.
100011.082	0
DATE	FIGURE NO.
SEPTEMBER 2024	**FIGURE A.2**

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APPENDIX B

Borehole Logs

RECORD OF BOREHOLE 24-01

CLIENT: Novatech
PROJECT: Phase Two Environmental Site Assessment, 6158 Rideau Valley Drive, Ottawa, Ontario
JOB#: 100011.082
LOCATION: See Figure A.4, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 18 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY (mm)	BLOWS/0.3m	LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		93.43									
0	Direct Push Casing (155mm OD)	TOPSOIL		93.23	1	SS	200	NA		Hex: 5; IBL: 0	None		
		Loose to compact, brown SILTY SAND, trace gravel		0.20	2	SS	1200	NA	pH	Hex: 30; IBL: 0	None		Bentonite seal
1													
2					3	SS	600	NA		Hex: 25; IBL: 1	None		
					4	SS	550	NA		Hex: 35; IBL: 0	None		
3				90.38									
		Compact to dense, brown SILTY SAND, trace gravel		3.05	5	SS	750	NA	EC, SAR	Hex: 1100; IBL: 0	None		Filter sand 50 millimetre diameter well
4					6	SS	720	NA		Hex: 30; IBL: 1	None		
				88.86									
		Loose, brown SILTY SAND, trace gravel		4.57	7	SS	610	NA		Hex: 850; IBL: 0	None		
5				88.25									
		End of borehole Sampler refusal		5.18									

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEVATION (m)
Aug. 02/24	3.36 ▽	90.07

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LOGGED: MB
CHECKED: NS

ENV - BOREHOLE LOG 100011.082_BH LOGS_ 2024-08-21.GPJ GEMTEC 2018.GDT 8/22/24

RECORD OF BOREHOLE 24-02

CLIENT: Novatech
PROJECT: Phase Two Environmental Site Assessment, 6158 Rideau Valley Drive, Ottawa, Ontario
JOB#: 100011.082
LOCATION: See Figure A.4, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 18 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	TYPE	RECOVERY (mm)	BLOWS/0.3m	LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		93.85									
0	Direct Push Casing (155mm OD)	Brown sand and gravel, non-cohesive, dry (FILL MATERIAL)		92.35	1	SS	255	NA		Hex: 35; IBL: 0	None		Backfilled with auger cuttings
1		Brown SILTY SAND, some gravel, some clay		1.50	2	SS	255	NA		Hex: 30; IBL: 0	None		
2					3	SS	610	NA	EC, SAR	Hex: 640; IBL: 1	None		
3				90.20									
		End of borehole Sampler refusal		3.65									

GEMTEC
Consulting Engineers and Scientists

LOGGED: MB
CHECKED: NS

ENV - BOREHOLE LOG 100011.082_BH LOGS_ 2024-08-21.GPJ GEMTEC 2018.GDT 8/22/24

RECORD OF BOREHOLE 24-03

CLIENT: Novatech
PROJECT: Phase Two Environmental Site Assessment, 6158 Rideau Valley Drive, Ottawa, Ontario
JOB#: 100011.082
LOCATION: See Figure A.4, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 18 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	TYPE	RECOVERY (mm)	BLOWS/0.3m	LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		91.18									
0	Direct Push Casing (155mm OD)	TOPSOIL		90.93	1	SS	250	NA		Hex: 0; IBL: 0	None		Flush Mount
		Grey to brown, SILTY SAND, some gravel, some clay, non-cohesive		0.25									
1					2	SS	1300	NA		Hex: 55; IBL: 2	None		Bentonite seal
2					3	SS	650	NA		Hex: 65; IBL: 0	None		
					4	SS	500	NA		Hex: 80; IBL: 0	None		
3					5	SS	750	NA	PAHs, PHC F1-F4, BTEX	Hex: 400; IBL: 0	None		Filter sand 50 millimetre diameter well screen
				87.37									
4		Loose, grey SILTY SAND, some clay, some gravel, wet		3.81	6	SS	750	NA		Hex: 50; IBL: 0	None		
				86.61									
		End of borehole		4.57									

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEVATION (m)
Aug. 02/24	1.36 ▽	89.82

GEMTEC
Consulting Engineers and Scientists

LOGGED: MB
CHECKED: NS

ENV - BOREHOLE LOG 100011.082_BH LOGS_ 2024-08-21.GPJ GEMTEC 2018.GDT 8/22/24

RECORD OF BOREHOLE 24-04

CLIENT: Novatech
PROJECT: Phase Two Environmental Site Assessment, 6158 Rideau Valley Drive, Ottawa, Ontario
JOB#: 100011.082
LOCATION: See Figure A.4, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 18 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY (mm)	BLOWS/0.3m	LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		91.42									
0	Direct Push Casing (155mm OD)	Sandy GRAVEL		90.81	1	SS	350	NA		Hex: 0; IBL: 1	None		Flush Mount
1		Brown, SILTY SAND, some gravel, some clay, non-cohesive		0.61	2	SS	1200	NA		Hex: 5; IBL: 1	None		Bentonite seal
2					3	SS	600	NA		Hex: 0; IBL: 0	None		
					4	SS	550	NA	pH	Hex: 0; IBL: 0	None		
3					5	SS	750	NA	PAHs, PHC F1-F4, BTEX	Hex: 60; IBL: 0	None		Filter sand 50 millimetre diameter well screen
4					6	SS	610	NA		Hex: 35; IBL: 0	None		
				86.85									
		End of borehole		4.57									

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEVATION (m)
Aug. 02/24	1.46 ▽	89.96

GEMTEC
Consulting Engineers and Scientists

LOGGED: MB
CHECKED: NS

ENV - BOREHOLE LOG 100011.082_BH LOGS_ 2024-08-21.GPJ GEMTEC 2018.GDT 8/22/24

RECORD OF BOREHOLE 24-05

CLIENT: Novatech
PROJECT: Phase Two Environmental Site Assessment, 6158 Rideau Valley Drive, Ottawa, Ontario
JOB#: 100011.082
LOCATION: See Figure A.4, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 18 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY (mm)	BLOWS/0.3m	LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		91.61									
0	Direct Push Casing (155mm OD)	GRAVEL		91.36									Flush Mount
		Loose to compact, brown SILTY SAND, trace gravel		0.25	1	SS	457	NA		Hex: 0; IBL: 1	None		
1					2	SS	457	NA		Hex: 0; IBL: 0	None		
		Compact to dense, brown SILTY SAND, trace gravel with some clay		90.09 1.52	3	SS	432	NA		Hex: 0; IBL: 0	None		Bentonite seal
2					4	SS	432	NA		Hex: 0; IBL: 1	None		
3				88.56									
		Firm, brown SILTY SAND with some clay		3.05	5	SS	762	NA		Hex: 0; IBL: 0	None		
				87.80									
4		Firm to soft, grey SILTY CLAY with some gravel		3.81	6	SS	762	NA		Hex: 0; IBL: 0	None		Filter sand 50 millimetre diameter well screen
				87.04									
		Brown CLAY and SILT with some gravel		4.57	7	SS	635	NA	PAHs, PHC F1-F4, VOCs	Hex: 20; IBL: 0	None		
5				86.13									
		Grey CLAY and SILT with some gravel		5.48	8	SS	635	NA		Hex: 15; IBL: 0	None		
6				85.51									
		End of borehole		6.10									

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEVATION (m)
Aug. 02/24	3.14 ▽	88.47

GEMTEC
Consulting Engineers and Scientists

LOGGED: MB
CHECKED: NS

ENV - BOREHOLE LOG 100011.082_BH LOGS_ 2024-08-21.GPJ GEMTEC 2018.GDT 8/22/24

RECORD OF BOREHOLE 24-06

CLIENT: Novatech
PROJECT: Phase Two Environmental Site Assessment, 6158 Rideau Valley Drive, Ottawa, Ontario
JOB#: 100011.082
LOCATION: See Figure A.4, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 18 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	TYPE	RECOVERY (mm)	BLOWS/0.3m	LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		91.70									
0	Direct Push Casing (155mm OD)	SAND and GRAVEL		90.94	1	SS	381	NA		Hex: 15; IBL: 1	None		Backfilled with auger cuttings
1		Loose to compact, brown SILTY SAND, some clay and trace gravel		0.76	2	SS	381	NA		Hex: 0; IBL: 1	None		
2					3	SS	431	NA		Hex: 0; IBL: 0	None		
		Loose to compact, brown SILTY SAND and gravel. Asphalt layer noted at 9 feet (2.74 m bgs)		89.42 2.28	4	SS	431	NA		Hex: 10; IBL: 0	None		
3		Brown SILTY CLAY		88.65 3.05	5	SS	762	NA		Hex: 0; IBL: 0	None		
4					6	SS	762	NA		Hex: 0; IBL: 1	None		
5					7	SS	457	NA	PAHs, PHC F1-F4, VOCs	Hex: 45; IBL: 0	None		
		End of borehole		86.52 5.18									

GEMTEC
Consulting Engineers and Scientists

LOGGED: MB
CHECKED: NS

APPENDIX C

MECP Water Well Record Study

MECP Water Well Record Compilation
(6158 Rideau Valley- 500 m search radius)

Well ID	Completed	Depth (m)	Depth to Bedrock (m)	Static Water Level (m bgs)	Water Found (m bgs)	Water Detail	Well Use	Aquifer Type
1506567	09-08-61	20.7	-	3	19.8	FR	DO	OB
1506568	09-02-56	48.2	26.5	11.6	36.6, 43.6	FR	DO	BR
1507077	17-04-64	47.9	21.0	0.3	47.2	FR	DO	BR
1507079	23-09-64	29.9	16.5	7	29.9	FR	DO	BR
1507087	07-05-66	16.2	-	4.6	15.5	FR	DO	OB
1510256	27-09-69	45.1	24.7	6.7	44.8	FR	DO	BR
1512186	23-11-72	40.2	11.6	-	39.6	FR	DO	BR
1512195	05-12-72	86.3	21.0	7.9	24.7, 85.3	FR	DO	BR
1513228	11-05-73	75.6	17.7	9.1	57.9, 75.3	FR	DO	BR
1514125	10-06-74	39.6	21.3	0.9	39	FR	DO	BR
1515368	09-05-76	27.4	18.3	6.1	22.6, 26.2	FR	DO	BR
1516111	30-06-77	68.6	22.6	3	68.6	FR	DO	BR
1528576	18-07-95	54.9	17.1	5.8	54.6	UK	DO	BR
1531416	21-09-00	76.2	17.4	6.1	76.5	UK	DO	BR
1531913	22-05-01	134.7	14.3	2.1	131.1, 134.1	UK	DO	BR
1535187	22-10-04	48.8	17.7	7.8	43.6	-	DO	BR
1536170	20-11-05	-	-	-	-	-	-	-
1536171	20-11-05	75.6	27.7	9.1	-	-	DO	BR
7133639	29-10-09	31.1	-	-	-	UT	DO	-
7154279	26-10-10	-	-	-	-	-	-	-
7170966	24-08-11	71.6	18.0	5.3	70.1	UT	DO	BR
7189206	21-09-12	-	-	-	-	-	-	-
7234782	24-09-14	-	-	-	-	-	-	-
7234784	23-09-14	34.1	18.9	3.8	32	UT	DO	BR
7268607	16-06-16	-	-	-	-	-	MT	-
7268608	17-06-16	61	21.2	-	30.5	OT	TH	BR
7268609	15-06-16	-	-	-	-	-	-	-
7268610	18-07-16	40.8	22.9	3.7	37.8	UT	DO	BR
7313726	24-05-18	71	15.8	3.6	50.9, 59.1	-	-	BR
7344130	04-09-19	49.7	21.0	4.4	32, 39.6, 47.2	-	-	BR
7347909	28-10-19	37.5	20.1	3.6	24.4, 30.2, 34.7	-	-	BR
7451598	20-04-23	-	-	-	-	-	-	-

GEMTEC
Consulting Engineers and Scientists

Project: 10011.082
Date: August 2024

MECP Water Well Record Compilation
(6158 Rideau Valley- 500 m search radius)

https://www.ontario.ca/page/map-well-records

"Well Use"		"Water Detail"		"Aquifer Type"	
DO	Domestic	FR	Fresh	BR	Bedrock
ST	Livestock	SA	Salty	OB	Overburden
IR	Irrigation	SU	Sulphur		
IN	Industrial	MN	Mineral		
CO	Commercial	UK	Unknown		
MN	Municipal	GS	Gas		
PS	Public	IR	Iron		
AC	Cooling and A/C				
NU	Not Used				
OT	Other				
TH	Test Hole				
DE	Dewatering				
MO	Monitoring				
MT	Monitoring Test				

APPENDIX D

TW1 MECP Water Well Record

Ontario Ministry of the Environment

Well Tag Number (Place sticker and print number below)
A025676
A025676

Well Record
Regulation 903 Ontario Water Resources Act

page ___ of ___

Instructions for Completing Form

- For use in the **Province of Ontario** only. This document is a permanent **legal** document. Please retain for future reference.
- All Sections **must** be completed in full to avoid delays in processing. Further instructions and explanations are available on the back of this form.
- Questions regarding completing this application can be directed to the Water Well Management Coordinator at 416-235-6203.
- **All metre measurements shall be reported to 1/10th of a metre.**
- Please print clearly in blue or black ink only.

Ministry Use Only
MUN | CON | LOT

Well Owner's Information and Location of Well Information

First Name	Last Name	Mailing Address (Street Number/Name, RR,Lot,Concession)
Miller's Berrry Farm		6158 Rideau Valley Drive North

County/District/Municipality	Township/City/Town/Village	Province	Postal Code	Telephone Number (include area code)
Ottawa Carleton	Manotick	Ontario	K4M 1B3	613 692 2380

Address of Well Location (County/District/Municipality)	Township	Lot	Concession
Ottawa Carleton	Rideau	3	A

RR#/Street Number/Name	City/Town/Village	Site/Compartment/Block/Tract etc.
6158 Rideau Valley Dr.		

GPS Reading	NAD	Zone	Easting	Northing	Unit Make/Model	Mode of Operation
	83	18	449435	5004753	Garmin	☐ Undifferentiated ☒ Averaged ☐ Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth From	Depth To
brown	sandy soil	boulders		0	3.65
brown	hardpan			3.65	6.70
gray	sandy clay	boulders		6.70	27.7
gray	limestone			27.73	75.58

Hole Diameter

Depth From	Depth To	Diameter Centimetres
0	28.64	22.75
28.64	75.58	15.07

Water Record

Water found at ___ Metres	Kind of Water
20.71 m	☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:
NOT TESTED m	☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:
m	☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other:

After test of well yield, water was
☒ Clear and sediment free
☐ Other, specify

Chlorinated ☒ Yes ☐ No

Construction Record

Inside diam centimetres	Material	Wall thickness centimetres	Depth From	Depth To
Casing				
15.86	☒ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	0.48	+.45	28.64
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
Screen				
Outside diam	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	Slot No.		
No Casing or Screen				
	☒ Open hole		28.64	75.58

Test of Well Yield

Pumping test method: submersible

Pump intake set at - (metres) 45.93
Pumping rate - (litres/min) 45.5
Duration of pumping 1 hrs + ___ min
Final water level end of pumping 15.97 metres
Recommended pump type. ☐ Shallow ☒ Deep
Recommended pump depth 30.47 metres
Recommended pump rate. 45.5 (litres/min)
If flowing give rate - (litres/min)
If pumping discontinued, give reason.

	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Static Level		9.07		
1		10.79	1	13.44
2		11.50	2	11.62
3		12.13	3	10.42
4		13.03	4	9.85
5		13.03	5	9.56
10		14.14	10	9.19
15		14.79	15	9.16
20		15.16	20	9.14
25		15.37	25	9.14
30		15.54	30	9.13
40		15.72	40	9.13
50		15.86	50	9.12
60		15.97	60	9.12

Plugging and Sealing Record
☒ Annular space ☐ Abandonment

Depth set at - Metres From	Depth set at - Metres To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
28.64	0	Grouted Bentonite Slurry	.92m3

Method of Construction

☐ Cable Tool ☒ Rotary (air) mud ☐ Diamond ☐ Digging
☐ Rotary (conventional) ☒ Air percussion ☐ Jetting ☐ Other
☐ Rotary (reverse) ☐ Boring ☐ Driving

Water Use

☐ Domestic ☐ Industrial ☐ Public Supply ☐ Other Test well
☐ Stock ☐ Commercial ☐ Not used
☐ Irrigation ☐ Municipal ☐ Cooling & air conditioning

Final Status of Well

☒ Water Supply ☐ Recharge well ☐ Unfinished ☐ Abandoned, (Other)
☐ Observation well ☐ Abandoned, insufficient supply ☐ Dewatering
☐ Test Hole ☐ Abandoned, poor quality ☐ Replacement well

Well Contractor/Technician Information

Name of Well Contractor	Well Contractor's Licence No.
Capital Water SUpply LTd.	1558

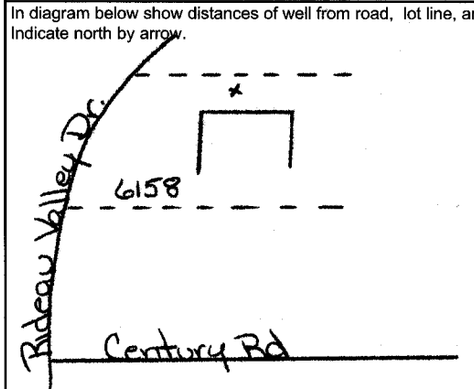
Business Address (street name, number, city etc.)
Box 490 Stittsville, Ontario K2S 1A6

Name of Well Technician (last name, first name)	Well Technician's Licence No.
Miller, STephen	T0097

Signature of Technician/Contractor: X
Date Submitted: 2005 11 22

Location of Well

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



Audit No. Z 39206
Was the well owner's information package delivered? ☒ Yes ☐ No
Date Well Completed: YYYY 2005 MM 11 DD 22
Date Delivered: YYYY 2005 MM 11 DD 22

Ministry Use Only

Data Source	Contractor 1558
Date Received JAN 13 2006	Date of Inspection YYYY MM DD
Remarks	Well Record Number

0506E (09/03) Contractor's Copy ☐ Ministry's Copy ☐ Well Owner's Copy ☐ *Cette formule est disponible en français*

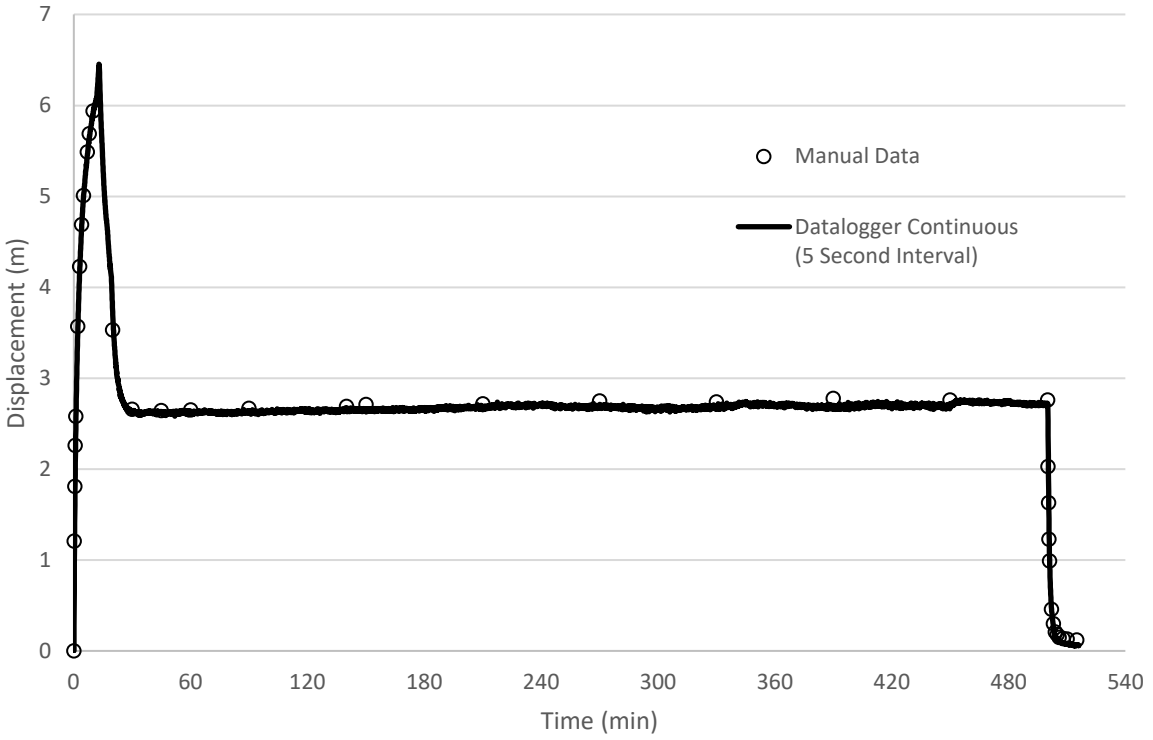
APPENDIX E

Pumping Test Analysis

GEMTEC Consulting Engineers and Scientists	Pumping Test Analysis Report
	Project: Scoped Hydrogeological Investigation
	Project Number: 100011.082
	Client: Novatech Engineers, Planners, & Architects

Location: 6158 Rideau Valley Drive, Ottawa, ON.		
Test Conducted by: JG	Pumping Well: TW1	P-Test Date: June 19, 2024
Analysis Performed by: BR	Method: Manual Measurements	Analysis Date: August 22, 2024
Aquifer Thickness: 46.9 m	Discharge: Constant 38 L/min *(1)*	Duration: 8 hours

Pumping Test Data (TW1): Drawdown and Recovery



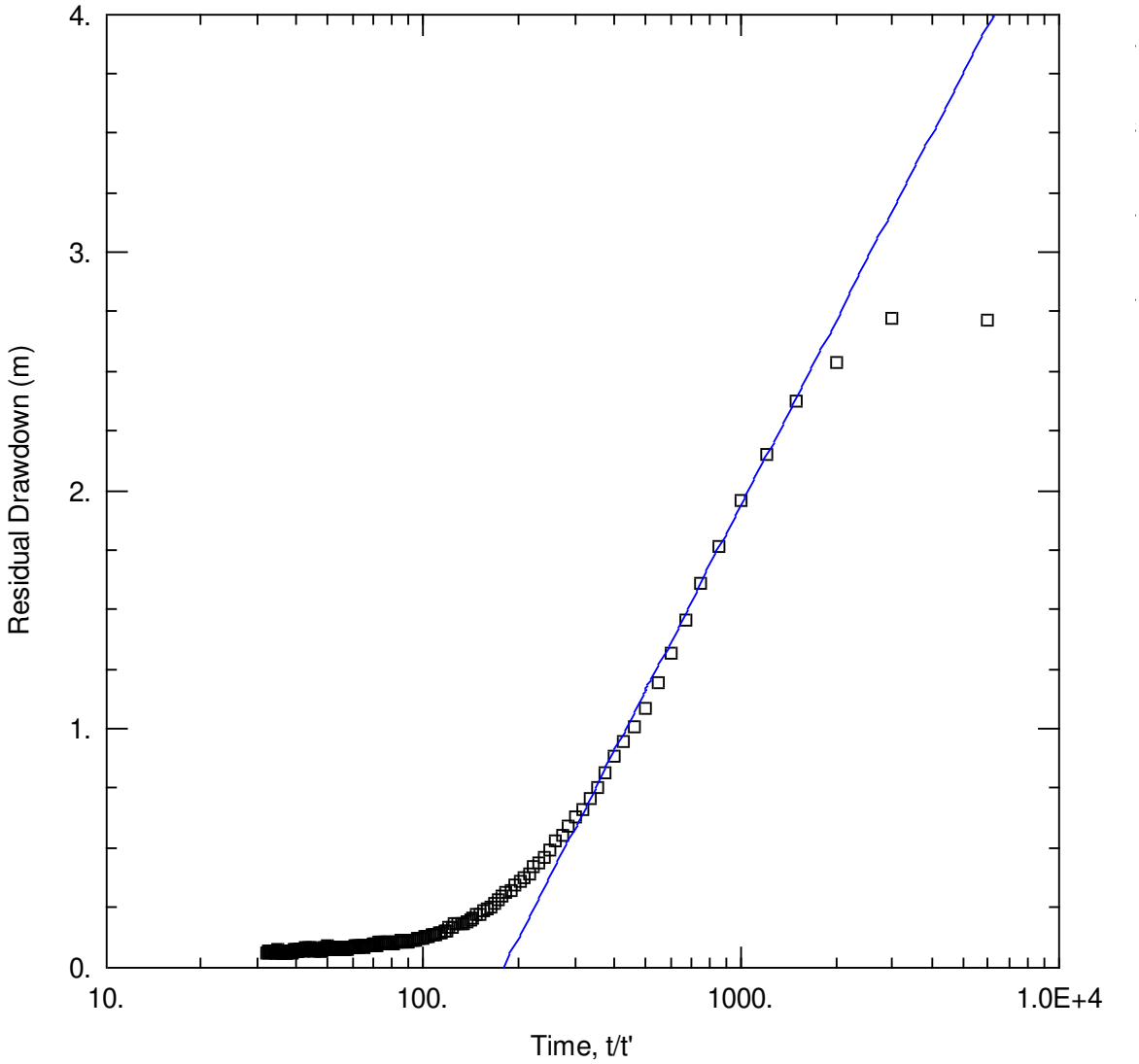
Water Levels TW23-1
Static : 9.38 m below top of casing
TOC = 0.69 m above ground surface
End of pump test (6-hours): 12.14 m below top of casing
Following recovery (15 minutes): 9.50 m below top of casing

Notes
1. Pumping rate of 66 litres per minute for first 20 minutes of pumping test, reduced to 38 litres pe minute for the remaining 8 hours of the test.

GEMTEC Consulting Engineers and Scientists	Pumping Test Analysis Report
	Project: Scoped Hydrogeological Investigation
	Project Number: 100011.082
	Client: Novatech Engineers, Planners, & Architects

Location: 6158 Rideau Valley Drive, Ottawa, ON.		
Test Conducted by: JG	Pumping Well: TW1	P-Test Date: June 19, 2024
Analysis Performed by: BR	Method: Manual Measurements	Analysis Date: August 22, 2024
Aquifer Thickness: 46.9 m	Discharge: Constant 38 L/min	Duration: 8 hours

Pumping Test Analysis (TW1): Theis-Recovery (Confined Aquifer)



Estimated Transmissivity: 3.8 m^2/day or 4 x 10^{-5} m^2/s

APPENDIX F

Domestic Well Water Quality and Laboratory Certificate Sheets

Summary of Field Water Quality Measurements

Well ID	Date	Time Since Initiaion of Pump	Temp (°C)	pH	Electrical Conductivity (µS/cm)	Total Dissolved Solids (ppm)	Turbidity (NTU)	Colour (ACU[1])	Colour (TCU[2,3])	Free Chlorine (mg/L)	Total Chlorine (mg/L)
PW1	2024-04-02	10 mins	14.3	7.67	593	296	0.64	-	-	-	-
		15 mins	13.2	7.66	590	290	0.53	<5	<5	<0.02	<0.02
TW1	2024-04-02	15 mins	10.4	7.88	563	279	1.2	-	-	-	-
		20 mins	11.1	7.63	535	268	0.93	<5	<5	<0.02	<0.02
TW1	2024-06-19	1 hour	12.5	7.76	572	293	13	-	-	-	-
		2 hours	13.0	7.77	582	294	24.8	-	-	-	-
		3 hours	12.9	7.67	579	281	16.3	-	-	-	-
		4 hours	13.3	7.58	560	294	11.8	20	3	<0.02	<0.02
		5 hours	13.9	7.53	582	296	12.1	-	-	-	-
		6 hours	13.2	7.51	571	285	8.97	-	-	-	-
		7 hours	13.5	7.53	558	284	7.82	-	-	-	-
		8 hours	13.5	7.50	571	286	10.3	55	4	<0.02	<0.02
TW1	2024-08-01	3 hours	10.5	7.84	540	269	0.79	-	-	<0.02	<0.02

NOTES:

1. ACU = Actual Colour Units
2. Field filtered using 0.45 micron filter
3. TCU = True Colour Units

Summary of Labratory Water Quality Measurements

Parameter	Units Date	PW1 04/02/2024	TW1 04/02/2024	TW1 8 hr 06/19/2024	TW1 8 hr (Filtered) 06/19/2024	TW1 08/01/2024	Ontario Drinking Water Standard	Type of Standard[1,2,3]
Microbiological Parameters								
E. Coli	CFU/100 mL	ND (1)	ND (1)	**NDOGN**	-	ND (1)	0	MAC
Fecal Coliforms	CFU/100 mL	ND (1)	ND (1)	ND (1)	-	ND (1)	0	MAC
Total Coliforms	CFU/100 mL	ND (1)	ND (1)	**NDOGN**	-	**2**	0	MAC
Heterotrophic Plate Count	CFU/mL	40	10	90	-	-	-	-
General Inorganics								
Alkalinity, total	mg/L	218	200	199	-	-	30-500	OG
Ammonia as N	mg/L	0.42	0.15	0.15	-	-	-	-
Dissolved Organic Carbon	mg/L	2.1	0.8	0.5	-	-	5	AO
Colour	TCU	ND (2)	ND (2)	ND (2)	-	-	5	AO
Colour, apparent	ACU	200	5	19	-	-	-	-
Conductivity	uS/cm	599	573	615	-	-	-	-
Hardness	mg/L	**307**	**215**	**220**	**-**	**-**	80-100	OG
pH	pH Units	8.0	8.0	8.1	-	-	6.5-8.5	OG
Phenolics	mg/L	ND (0.001)	ND (0.001)	ND (0.001)	-	-	-	-
Total Dissolved Solids	mg/L	336	290	336	**-**	**-**	500	AO
Sulphide	mg/L	0.04	ND (0.02)	ND (0.02)	-	-	0.05	AO
Tannin & Lignin	mg/L	0.2	ND (0.1)	ND (0.1)	-	-	-	-
Total Kjeldahl Nitrogen	mg/L	0.6	0.2	0.2	-	-	-	-
Total Organic Nitrogen[6]	mg/L	**0.18**	0.05	0.05	**-**	**-**	0.15	OG
Turbidity	NTU	**28.1**	0.7	**10.1**	-	ND (0.1)	5	AO
Anions								
Chloride	mg/L	35	36	44	-	-	250	AO
Fluoride	mg/L	0.7	0.8	0.9	-	-	1.5	MAC
Nitrate as N	mg/L	ND (0.1)	ND (0.1)	ND (0.1)	-	-	10[4]	MAC
Nitrite as N	mg/L	ND (0.05)	ND (0.05)	ND (0.05)	-	-	1.0[4]	MAC
Sulphate	mg/L	56	45	51	-	-	500	AO
Metals								
Aluminum	mg/L	-	-	0.006	ND (0.001)	-	0.1	OG
Antimony	mg/L	-	-	ND (0.0005)	ND (0.0005)	-	0.006	MAC
Arsenic	mg/L	-	-	ND (0.001)	ND (0.001)	-	0.025	MAC
Barium	mg/L	-	-	0.049	0.048	-	1	MAC
Beryllium	mg/L	-	-	ND (0.0005)	ND (0.0005)	-	-	-
Boron	mg/L	-	-	0.21	0.21	-	5	MAC
Cadmium	mg/L	-	-	ND (0.0001)	ND (0.0001)	-	0.005	MAC
Calcium	mg/L	42.1	42.6	43.1	40.6	-	-	-
Chromium	mg/L	-	-	ND (0.001)	ND (0.001)	-	0.05	MAC
Cobalt	mg/L	-	-	ND (0.0005)	ND (0.0005)	-	-	-
Copper	mg/L	-	-	ND (0.0005)	ND (0.0005)	-	1	AO
Iron	mg/L	**2.5**	0.1	**0.4**	ND (0.1)	-	0.3	AO
Lead	mg/L	-	-	0.0001	ND (0.0001)	-	0.01	MAC
Magnesium	mg/L	49.1	26.3	27.3	25.7	-	-	-
Manganese	mg/L	0.035	ND (0.005)	0.009	0.006	-	0.05/0.12[11]	AO
Mercury	mg/L	-	-	ND (0.0001)	ND (0.0001)	-	0.001	MAC
Molybdenum	mg/L	-	-	0.0037	0.0052	-	-	-
Nickel	mg/L	-	-	ND (0.001)	ND (0.001)	-	-	-
Potassium	mg/L	14.4	7.5	7.5	7.4	-	-	-

Summary of Labratory Water Quality Measurements

Parameter	Units Date	PW1 04/02/2024	TW1 04/02/2024	TW1 8 hr 06/19/2024	TW1 8 hr (Filtered) 06/19/2024	TW1 08/01/2024	Ontario Drinking Water Standard	Type of Standard[1,2,3]
Selenium	mg/L	-	-	ND (0.001)	ND (0.001)	-	0.01	MAC
Silver	mg/L	-	-	ND (0.0001)	ND (0.0001)	-	-	-
Sodium	mg/L	12.1	44.9	45.2	41.9	-	200(20)[5]	AO
Strontium	mg/L	-	-	1.53	1.46	-	7[10]	MAC
Thallium	mg/L	-	-	ND (0.001)	ND (0.001)	-	-	-
Uranium	mg/L	-	-	0.0003	0.0003	-	0.02	MAC
Vanadium	mg/L	-	-	ND (0.0005)	ND (0.0005)	-	-	-
Zinc	mg/L	-	-	ND (0.005)	ND (0.005)	-	5	AO
Volatiles								
Acetone	mg/L	-	-	ND (0.0050)	-	-	-	-
Benzene	mg/L	-	-	ND (0.0005)	-	-	0.001 mg/L	MAC
Bromodichloromethane	mg/L	-	-	ND (0.0005)	-	-	-	-
Bromoform	mg/L	-	-	ND (0.0005)	-	-	-	-
Bromomethane	mg/L	-	-	ND (0.0005)	-	-	-	-
Carbon Tetrachloride	mg/L	-	-	ND (0.0002)	-	-	0.002 mg/L	MAC
Chlorobenzene	mg/L	-	-	ND (0.0005)	-	-	0.08 mg/L	MAC
Chloroethane	mg/L	-	-	ND (0.0010)	-	-	-	-
Chloroform	mg/L	-	-	ND (0.0005)	-	-	-	-
Dibromochloromethane	mg/L	-	-	ND (0.0005)	-	-	-	-
Dichlorodifluoromethane	mg/L	-	-	ND (0.0010)	-	-	-	-
Ethylene dibromide (dibromoethane, 1	mg/L	-	-	ND (0.0002)	-	-	-	-
1,2-Dichlorobenzene	mg/L	-	-	ND (0.0005)	-	-	0.2 mg/L	MAC
1,3-Dichlorobenzene	mg/L	-	-	ND (0.0005)	-	-	-	-
1,4-Dichlorobenzene	mg/L	-	-	ND (0.0005)	-	-	0.005 mg/L	MAC
1,1-Dichloroethane	mg/L	-	-	ND (0.0005)	-	-	-	-
1,2-Dichloroethane	mg/L	-	-	ND (0.0005)	-	-	0.005 mg/L	MAC
1,1-Dichloroethylene	mg/L	-	-	ND (0.0005)	-	-	0.014 mg/L	MAC
cis-1,2-Dichloroethylene	mg/L	-	-	ND (0.0005)	-	-	-	-
trans-1,2-Dichloroethylene	mg/L	-	-	ND (0.0005)	-	-	-	-
1,2-Dichloroethylene, total	mg/L	-	-	ND (0.0005)	-	-	-	-
1,2-Dichloropropane	mg/L	-	-	ND (0.0005)	-	-	-	-
cis-1,3-Dichloropropylene	mg/L	-	-	ND (0.0005)	-	-	-	-
trans-1,3-Dichloropropylene	mg/L	-	-	ND (0.0005)	-	-	-	-
1,3-Dichloropropene, total	mg/L	-	-	ND (0.0005)	-	-	-	-
Ethylbenzene	mg/L	-	-	ND (0.0005)	-	-	0.14 mg/L	MAC
Hexane	mg/L	-	-	ND (0.0010)	-	-	-	-
Methyl Ethyl Ketone (2-Butanone)	mg/L	-	-	ND (0.0050)	-	-	-	-
Methyl Isobutyl Ketone	mg/L	-	-	ND (0.0050)	-	-	-	-
Methyl tert-butyl ether	mg/L	-	-	ND (0.0020)	-	-	-	-
Methylene Chloride	mg/L	-	-	ND (0.0050)	-	-	0.05 mg/L	MAC
Styrene	mg/L	-	-	ND (0.0005)	-	-	-	-
1,1,1,2-Tetrachloroethane	mg/L	-	-	ND (0.0005)	-	-	-	-
1,1,2,2-Tetrachloroethane	mg/L	-	-	ND (0.0005)	-	-	-	-
Tetrachloroethylene	mg/L	-	-	ND (0.0005)	-	-	0.01 mg/L	MAC
Toluene	mg/L	-	-	ND (0.0005)	-	-	0.06 mg/L	MAC
1,1,1-Trichloroethane	mg/L	-	-	ND (0.0005)	-	-	-	-
1,1,2-Trichloroethane	mg/L	-	-	ND (0.0005)	-	-	-	-

Summary of Labratory Water Quality Measurements

Parameter	Units Date	PW1 04/02/2024	TW1 04/02/2024	TW1 8 hr 06/19/2024	TW1 8 hr (Filtered) 06/19/2024	TW1 08/01/2024	Ontario Drinking Water Standard	Type of Standard[1,2,3]
Trichloroethylene	mg/L	-	-	ND (0.0005)	-	-	0.005 mg/L	MAC
Trichlorofluoromethane	mg/L	-	-	ND (0.0010)	-	-	-	-
Vinyl Chloride	mg/L	-	-	ND (0.0002)	-	-	0.001 mg/L	MAC
m/p-Xylene	mg/L	-	-	ND (0.0005)	-	-	-	-
o-Xylene	mg/L	-	-	ND (0.0005)	-	-	-	-
Xylenes, total	mg/L	-	-	ND (0.0005)	-	-	0.09 mg/L	MAC
Hydrocarbons					-	-	-	-
F1 PHCs (C6-C10)	mg/L	-	-	ND (0.0250)	-	-	-	-
F2 PHCs (C10-C16)	mg/L	-	-	ND (0.1)	-	-	-	-
F3 PHCs (C16-C34)	mg/L	-	-	ND (0.1)	-	-	-	-
F4 PHCs (C34-C50)	mg/L	-	-	ND (0.1)	-	-	-	-

NOTES:

1. MAC = Maximum Acceptable Concentration;
2. OG = Operational Guideline
3. AO = Aesthetic Objective
4. The total of Nitrate and Nitrite should not exceed 10 mg/litre.
5. The aesthetic objective for sodium is 200 mg/litre. The local medical officer of health should be notified when the sodium concentration exceeds 20 mg/litre for persons on sodium restricted diets.
6. Organic Nitrogen = Total Kjeldahl Nitrogen - $N\text{-}NH_3$ and should not exceed 0.15 mg/litre.
7. '-' signifies no value provided
8. Values listed in Table 3 in MOE Procedure D-5-5 Technical Guideline for Private Wells: Water Supply Assessment, August 1996
9. 'ND' = No concentration detected above method detection limit
10. Health Canada (2019) MAC for strontium
11. Health Canada (2019) MAC for manganese
12. Filtered metal concentrations are not directly comparable to Ontario Drinking Water Standards

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Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited
32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Brent Redmond

Client PO: Millers Farm
Project: 100011.082
Custody: 17657

Report Date: 8-Apr-2024
Order Date: 2-Apr-2024

Order #: 2414174

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

Paracel ID	Client ID
2414174-01	PW1
2414174-02	PW2

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	4-Apr-24	4-Apr-24
Ammonia, as N	EPA 351.2 - Auto Colour	4-Apr-24	4-Apr-24
Anions	EPA 300.1 - IC	3-Apr-24	3-Apr-24
Colour	SM2120 - Spectrophotometric	4-Apr-24	4-Apr-24
Colour, apparent	SM2120 - Spectrophotometric	4-Apr-24	4-Apr-24
Conductivity	EPA 9050A- probe @25 °C	4-Apr-24	4-Apr-24
Dissolved Organic Carbon	MOE 3247B - Combustion IR	5-Apr-24	8-Apr-24
E. coli	MOE E3407	3-Apr-24	3-Apr-24
Fecal Coliform	SM 9222D	3-Apr-24	3-Apr-24
Heterotrophic Plate Count	SM 9215C	3-Apr-24	3-Apr-24
Metals, ICP-MS	EPA 200.8 - ICP-MS	3-Apr-24	3-Apr-24
pH	EPA 150.1 - pH probe @25 °C	4-Apr-24	4-Apr-24
Phenolics	EPA 420.2 - Auto Colour, 4AAP	4-Apr-24	4-Apr-24
Hardness	Hardness as CaCO3	3-Apr-24	3-Apr-24
Sulphide	SM 4500SE - Colourimetric	8-Apr-24	8-Apr-24
Tannin/Lignin	SM 5550B - Colourimetric	3-Apr-24	3-Apr-24
Total Coliform	MOE E3407	3-Apr-24	3-Apr-24
Total Dissolved Solids	SM 2540C - gravimetric, filtration	4-Apr-24	5-Apr-24
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	3-Apr-24	3-Apr-24
Turbidity	SM 2130B - Turbidity meter	3-Apr-24	4-Apr-24

PARACEL LABORATORIES LTD.

Order #: 2414174

Certificate of Analysis

Report Date: 08-Apr-2024

Client: **GEMTEC Consulting Engineers and Scientists Limited**

Order Date: 2-Apr-2024

Client PO: **Millers Farm**

Project Description: 100011.082

	Client ID:	PW1	PW2	-	-	-	-
	Sample Date:	02-Apr-24 11:30	02-Apr-24 12:00	-	-		
	Sample ID:	2414174-01	2414174-02	-	-		
	Matrix:	Drinking Water	Drinking Water	-	-		
	MDL/Units						
Microbiological Parameters							
E. coli	1 CFU/100mL	ND	ND	-	-	-	-
Total Coliforms	1 CFU/100mL	ND	ND	-	-	-	-
Fecal Coliforms	1 CFU/100mL	ND	ND	-	-	-	-
Heterotrophic Plate Count	10 CFU/mL	40	10	-	-	-	-
General Inorganics							
Alkalinity, total	5 mg/L	218	200	-	-	-	-
Ammonia as N	0.01 mg/L	0.42	0.15	-	-	-	-
Dissolved Organic Carbon	0.5 mg/L	2.1	0.8	-	-	-	-
Colour, apparent	2 ACU	200	5	-	-	-	-
Colour	2 TCU	<2	<2	-	-	-	-
Conductivity	5 uS/cm	599	573	-	-	-	-
Hardness	1 mg/L	307	215	-	-	-	-
pH	0.1 pH Units	8.0	8.0	-	-	-	-
Phenolics	0.001 mg/L	<0.001	<0.001	-	-	-	-
Total Dissolved Solids	10 mg/L	336	290	-	-	-	-
Sulphide	0.02 mg/L	0.04	<0.02	-	-	-	-
Tannin & Lignin	0.1 mg/L	0.2	<0.1	-	-	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.6	0.2	-	-	-	-
Turbidity	0.1 NTU	28.1	0.7	-	-	-	-
Anions							
Chloride	1 mg/L	35	36	-	-	-	-
Fluoride	0.1 mg/L	0.7	0.8	-	-	-	-
Nitrate as N	0.1 mg/L	<0.1	<0.1	-	-	-	-
Nitrite as N	0.05 mg/L	<0.05	<0.05	-	-	-	-
Sulphate	1 mg/L	56	45	-	-	-	-

	Client ID:	PW1	PW2	-	-		
	Sample Date:	02-Apr-24 11:30	02-Apr-24 12:00	-	-	-	-
	Sample ID:	2414174-01	2414174-02	-	-		
	Matrix:	Drinking Water	Drinking Water	-	-		
	MDL/Units						
Metals							
Calcium	0.1 mg/L	42.1	42.6	-	-	-	-
Iron	0.1 mg/L	2.5	0.1	-	-	-	-
Magnesium	0.2 mg/L	49.1	26.3	-	-	-	-
Manganese	0.005 mg/L	0.035	<0.005	-	-	-	-
Potassium	0.1 mg/L	14.4	7.5	-	-	-	-
Sodium	0.2 mg/L	12.1	44.9	-	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions								
Chloride	ND	1	mg/L					
Fluoride	ND	0.1	mg/L					
Nitrate as N	ND	0.1	mg/L					
Nitrite as N	ND	0.05	mg/L					
Sulphate	ND	1	mg/L					
General Inorganics								
Alkalinity, total	ND	5	mg/L					
Ammonia as N	ND	0.01	mg/L					
Dissolved Organic Carbon	ND	0.5	mg/L					
Colour	ND	2	TCU					
Colour, apparent	ND	2	ACU					
Conductivity	ND	5	uS/cm					
Phenolics	ND	0.001	mg/L					
Total Dissolved Solids	ND	10	mg/L					
Sulphide	ND	0.02	mg/L					
Tannin & Lignin	ND	0.1	mg/L					
Total Kjeldahl Nitrogen	ND	0.1	mg/L					
Turbidity	ND	0.1	NTU					
Metals								
Calcium	ND	0.1	mg/L					
Iron	ND	0.1	mg/L					
Magnesium	ND	0.2	mg/L					
Manganese	ND	0.005	mg/L					
Potassium	ND	0.1	mg/L					
Sodium	ND	0.2	mg/L					
Microbiological Parameters								
E. coli	ND	1	CFU/100mL					
Total Coliforms	ND	1	CFU/100mL					
Fecal Coliforms	ND	1	CFU/100mL					
Heterotrophic Plate Count	ND	10	CFU/mL					

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	36.3	1	mg/L	36.3			0.0	20	
Fluoride	0.82	0.1	mg/L	0.79			4.4	20	
Nitrate as N	ND	0.1	mg/L	ND			NC	20	
Nitrite as N	ND	0.05	mg/L	ND			NC	20	
Sulphate	45.4	1	mg/L	45.2			0.4	10	
General Inorganics									
Alkalinity, total	217	5	mg/L	218			0.6	14	
Ammonia as N	0.148	0.01	mg/L	0.149			0.8	17.7	
Dissolved Organic Carbon	ND	0.5	mg/L	ND			NC	37	
Colour	ND	2	TCU	ND			NC	12	
Colour, apparent	200	2	ACU	200			0.0	12	
Conductivity	600	5	uS/cm	599			0.3	5	
pH	8.0	0.1	pH Units	8.0			0.1	3.3	
Phenolics	ND	0.001	mg/L	ND			NC	10	
Total Dissolved Solids	308	10	mg/L	290			6.0	10	
Sulphide	0.04	0.02	mg/L	0.04			2.5	10	
Tannin & Lignin	ND	0.1	mg/L	ND			NC	11	
Total Kjeldahl Nitrogen	0.54	0.1	mg/L	0.55			1.9	16	
Turbidity	28.1	0.1	NTU	28.1			0.0	10	
Metals									
Calcium	49.1	0.1	mg/L	48.4			1.4	20	
Iron	ND	0.1	mg/L	ND			NC	20	
Magnesium	17.5	0.2	mg/L	18.1			3.1	20	
Manganese	ND	0.005	mg/L	ND			NC	20	
Potassium	2.3	0.1	mg/L	2.3			0.9	20	
Sodium	15.8	0.2	mg/L	16.5			4.3	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100mL	ND			NC	30	
Total Coliforms	ND	1	CFU/100mL	ND			NC	30	
Fecal Coliforms	ND	1	CFU/100mL	ND			NC	30	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Heterotrophic Plate Count	ND	10	CFU/mL	ND			NC	30	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	45.5	1	mg/L	36.3	91.9	70-124			
Fluoride	1.83	0.1	mg/L	0.79	104	70-130			
Nitrate as N	1.04	0.1	mg/L	ND	104	77-126			
Nitrite as N	0.963	0.05	mg/L	ND	96.3	82-115			
Sulphate	53.5	1	mg/L	45.2	83.3	74-126			
General Inorganics									
Ammonia as N	1.10	0.01	mg/L	0.149	94.8	81-124			
Dissolved Organic Carbon	9.8	0.5	mg/L	ND	97.6	60-133			
Phenolics	0.026	0.001	mg/L	ND	104	67-133			
Total Dissolved Solids	90.0	10	mg/L	ND	90.0	75-125			
Sulphide	0.50	0.02	mg/L	0.04	92.4	79-115			
Tannin & Lignin	1.0	0.1	mg/L	ND	97.8	71-113			
Total Kjeldahl Nitrogen	1.51	0.1	mg/L	0.55	95.6	81-126			
Metals									
Calcium	55300	0.1	mg/L	48400	69.1	80-120			QM-07
Iron	2470	0.1	mg/L	11.5	98.5	80-120			
Magnesium	26800	0.2	mg/L	18100	87.9	80-120			
Manganese	53.3	0.005	mg/L	1.96	103	80-120			
Potassium	12900	0.1	mg/L	2320	106	80-120			
Sodium	25700	0.2	mg/L	16500	91.5	80-120			

Qualifier Notes:

Sample Qualifiers :

QC Qualifiers:

QM-07 The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.

Sample Data Revisions:

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

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

%REC: Percent recovery.

RPD: Relative percent difference.

NC: Not Calculated

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Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited
32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Brent Redmond

Client PO:
Project: 100011.082
Custody: 19923

Report Date: 26-Jun-2024
Order Date: 20-Jun-2024

Order #: 2425361

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

Paracel ID	Client ID
2425361-01	TW1 8hr
2425361-02	TW1 8hr (Filtered)

Approved By:

Dale Robertson, BSc
Laboratory Director

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	24-Jun-24	24-Jun-24
Ammonia, as N	EPA 351.2 - Auto Colour	24-Jun-24	24-Jun-24
Anions	EPA 300.1 - IC	20-Jun-24	20-Jun-24
Colour	SM2120 - Spectrophotometric	21-Jun-24	21-Jun-24
Colour, apparent	SM2120 - Spectrophotometric	20-Jun-24	20-Jun-24
Conductivity	EPA 9050A- probe @25 °C	24-Jun-24	24-Jun-24
Dissolved Organic Carbon	MOE 3247B - Combustion IR	24-Jun-24	24-Jun-24
E. coli	MOE E3407	20-Jun-24	20-Jun-24
Fecal Coliform	SM 9222D	20-Jun-24	20-Jun-24
Heterotrophic Plate Count	SM 9215C	20-Jun-24	20-Jun-24
Mercury by CVAA	EPA 245.2 - Cold Vapour AA	20-Jun-24	20-Jun-24
Metals, ICP-MS	EPA 200.8 - ICP-MS	20-Jun-24	21-Jun-24
pH	EPA 150.1 - pH probe @25 °C	24-Jun-24	24-Jun-24
PHC F1	CWS Tier 1 - P&T GC-FID	24-Jun-24	25-Jun-24
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	25-Jun-24	25-Jun-24
Phenolics	EPA 420.2 - Auto Colour, 4AAP	20-Jun-24	21-Jun-24
Hardness	Hardness as CaCO3	20-Jun-24	21-Jun-24
Sulphide	SM 4500SE - Colourimetric	24-Jun-24	24-Jun-24
Tannin/Lignin	SM 5550B - Colourimetric	24-Jun-24	24-Jun-24
Total Coliform	MOE E3407	20-Jun-24	20-Jun-24
Total Dissolved Solids	SM 2540C - gravimetric, filtration	21-Jun-24	21-Jun-24
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	21-Jun-24	25-Jun-24
Turbidity	SM 2130B - Turbidity meter	20-Jun-24	20-Jun-24
VOCs by P&T GC-MS	EPA 624 - P&T GC-MS	25-Jun-24	25-Jun-24

PARACEL LABORATORIES LTD.

Order #: 2425361

Certificate of Analysis

Report Date: 26-Jun-2024

Client: **GEMTEC Consulting Engineers and Scientists Limited**

Order Date: 20-Jun-2024

Client PO:

Project Description: 100011.082

	Client ID:	TW1 8hr	TW1 8hr (Filtered)	-	-		
	Sample Date:	19-Jun-24 16:30	19-Jun-24 16:30	-	-	-	-
	Sample ID:	2425361-01	2425361-02	-	-		
	Matrix:	Drinking Water	Drinking Water	-	-		
	MDL/Units						
Microbiological Parameters							
E. coli	1 CFU/100mL	NDOGN [1]	-	-	-	-	-
Total Coliforms	1 CFU/100mL	NDOGN [1]	-	-	-	-	-
Fecal Coliforms	1 CFU/100mL	ND	-	-	-	-	-
Heterotrophic Plate Count	10 CFU/mL	90	-	-	-	-	-
General Inorganics							
Alkalinity, total	5 mg/L	199	-	-	-	-	-
Ammonia as N	0.01 mg/L	0.15	-	-	-	-	-
Dissolved Organic Carbon	0.5 mg/L	0.5	-	-	-	-	-
Colour, apparent	2 ACU	19	-	-	-	-	-
Colour	2 TCU	<2	-	-	-	-	-
Conductivity	5 uS/cm	615	-	-	-	-	-
Hardness	1 mg/L	220	-	-	-	-	-
pH	0.1 pH Units	8.1	-	-	-	-	-
Phenolics	0.001 mg/L	<0.001	-	-	-	-	-
Total Dissolved Solids	10 mg/L	336	-	-	-	-	-
Sulphide	0.02 mg/L	<0.02	-	-	-	-	-
Tannin & Lignin	0.1 mg/L	<0.1	-	-	-	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.2	-	-	-	-	-
Turbidity	0.1 NTU	10.1	-	-	-	-	-
Anions							
Chloride	1 mg/L	44	-	-	-	-	-
Fluoride	0.1 mg/L	0.9	-	-	-	-	-
Nitrate as N	0.1 mg/L	<0.1	-	-	-	-	-
Nitrite as N	0.05 mg/L	<0.05	-	-	-	-	-
Sulphate	1 mg/L	51	-	-	-	-	-

	Client ID:	TW1 8hr	TW1 8hr (Filtered)	-	-	-	-
	Sample Date:	19-Jun-24 16:30	19-Jun-24 16:30	-	-		
	Sample ID:	2425361-01	2425361-02	-	-		
	Matrix:	Drinking Water	Drinking Water	-	-		
	MDL/Units						
Metals							
Mercury	0.0001 mg/L	<0.0001	<0.0001	-	-	-	-
Aluminum	0.001 mg/L	0.006	<0.001	-	-	-	-
Antimony	0.0005 mg/L	<0.0005	<0.0005	-	-	-	-
Arsenic	0.001 mg/L	<0.001	<0.001	-	-	-	-
Barium	0.001 mg/L	0.049	0.048	-	-	-	-
Beryllium	0.0005 mg/L	<0.0005	<0.0005	-	-	-	-
Boron	0.01 mg/L	0.21	0.21	-	-	-	-
Cadmium	0.0001 mg/L	<0.0001	<0.0001	-	-	-	-
Calcium	0.1 mg/L	43.1	40.6	-	-	-	-
Chromium	0.001 mg/L	<0.001	<0.001	-	-	-	-
Cobalt	0.0005 mg/L	<0.0005	<0.0005	-	-	-	-
Copper	0.0005 mg/L	<0.0005	<0.0005	-	-	-	-
Iron	0.1 mg/L	0.4	<0.1	-	-	-	-
Lead	0.0001 mg/L	0.0001	<0.0001	-	-	-	-
Magnesium	0.2 mg/L	27.3	25.7	-	-	-	-
Manganese	0.005 mg/L	0.009	0.006	-	-	-	-
Molybdenum	0.0005 mg/L	0.0037	0.0052	-	-	-	-
Nickel	0.001 mg/L	<0.001	<0.001	-	-	-	-
Potassium	0.1 mg/L	7.5	7.4	-	-	-	-
Selenium	0.001 mg/L	<0.001	<0.001	-	-	-	-
Silver	0.0001 mg/L	<0.0001	<0.0001	-	-	-	-
Sodium	0.2 mg/L	45.2	41.9	-	-	-	-
Strontium	0.01 mg/L	1.53	1.46	-	-	-	-
Thallium	0.001 mg/L	<0.001	<0.001	-	-	-	-
Uranium	0.0001 mg/L	0.0003	0.0003	-	-	-	-

	Client ID:	TW1 8hr	TW1 8hr (Filtered)	-	-	-	-
	Sample Date:	19-Jun-24 16:30	19-Jun-24 16:30	-	-		
	Sample ID:	2425361-01	2425361-02	-	-		
	Matrix:	Drinking Water	Drinking Water	-	-		
	MDL/Units						
Metals							
Vanadium	0.0005 mg/L	<0.0005	<0.0005	-	-	-	-
Zinc	0.005 mg/L	<0.005	<0.005	-	-	-	-
Volatiles							
Acetone	0.0050 mg/L	<0.0050	-	-	-	-	-
Benzene	0.0005 mg/L	<0.0005	-	-	-	-	-
Bromodichloromethane	0.0005 mg/L	<0.0005	-	-	-	-	-
Bromoform	0.0005 mg/L	<0.0005	-	-	-	-	-
Bromomethane	0.0005 mg/L	<0.0005	-	-	-	-	-
Carbon Tetrachloride	0.0002 mg/L	<0.0002	-	-	-	-	-
Chlorobenzene	0.0005 mg/L	<0.0005	-	-	-	-	-
Chloroethane	0.0010 mg/L	<0.0010	-	-	-	-	-
Chloroform	0.0005 mg/L	<0.0005	-	-	-	-	-
Dibromochloromethane	0.0005 mg/L	<0.0005	-	-	-	-	-
Dichlorodifluoromethane	0.0010 mg/L	<0.0010	-	-	-	-	-
1,2-Dibromoethane	0.0002 mg/L	<0.0002	-	-	-	-	-
1,2-Dichlorobenzene	0.0005 mg/L	<0.0005	-	-	-	-	-
1,3-Dichlorobenzene	0.0005 mg/L	<0.0005	-	-	-	-	-
1,4-Dichlorobenzene	0.0005 mg/L	<0.0005	-	-	-	-	-
1,1-Dichloroethane	0.0005 mg/L	<0.0005	-	-	-	-	-
1,2-Dichloroethane	0.0005 mg/L	<0.0005	-	-	-	-	-
1,1-Dichloroethylene	0.0005 mg/L	<0.0005	-	-	-	-	-
cis-1,2-Dichloroethylene	0.0005 mg/L	<0.0005	-	-	-	-	-
trans-1,2-Dichloroethylene	0.0005 mg/L	<0.0005	-	-	-	-	-
1,2-Dichloroethylene, total	0.0005 mg/L	<0.0005	-	-	-	-	-
1,2-Dichloropropane	0.0005 mg/L	<0.0005	-	-	-	-	-

	Client ID:	TW1 8hr	TW1 8hr (Filtered)	-	-		
	Sample Date:	19-Jun-24 16:30	19-Jun-24 16:30	-	-	-	-
	Sample ID:	2425361-01	2425361-02	-	-		
	Matrix:	Drinking Water	Drinking Water	-	-		
	MDL/Units						
Volatiles							
cis-1,3-Dichloropropylene	0.0005 mg/L	<0.0005	-	-	-	-	-
trans-1,3-Dichloropropylene	0.0005 mg/L	<0.0005	-	-	-	-	-
1,3-Dichloropropene, total	0.0005 mg/L	<0.0005	-	-	-	-	-
Ethylbenzene	0.0005 mg/L	<0.0005	-	-	-	-	-
Hexane	0.0010 mg/L	<0.0010	-	-	-	-	-
Methyl Ethyl Ketone (2-Butanone)	0.0050 mg/L	<0.0050	-	-	-	-	-
Methyl Isobutyl Ketone	0.0050 mg/L	<0.0050	-	-	-	-	-
Methyl tert-butyl ether	0.0020 mg/L	<0.0020	-	-	-	-	-
Methylene Chloride	0.0050 mg/L	<0.0050	-	-	-	-	-
Styrene	0.0005 mg/L	<0.0005	-	-	-	-	-
1,1,1,2-Tetrachloroethane	0.0005 mg/L	<0.0005	-	-	-	-	-
1,1,2,2-Tetrachloroethane	0.0005 mg/L	<0.0005	-	-	-	-	-
Tetrachloroethylene	0.0005 mg/L	<0.0005	-	-	-	-	-
Toluene	0.0005 mg/L	<0.0005	-	-	-	-	-
1,1,1-Trichloroethane	0.0005 mg/L	<0.0005	-	-	-	-	-
1,1,2-Trichloroethane	0.0005 mg/L	<0.0005	-	-	-	-	-
Trichloroethylene	0.0005 mg/L	<0.0005	-	-	-	-	-
Trichlorofluoromethane	0.0010 mg/L	<0.0010	-	-	-	-	-
Vinyl chloride	0.0002 mg/L	<0.0002	-	-	-	-	-
m,p-Xylenes	0.0005 mg/L	<0.0005	-	-	-	-	-
o-Xylene	0.0005 mg/L	<0.0005	-	-	-	-	-
Xylenes, total	0.0005 mg/L	<0.0005	-	-	-	-	-
Toluene-d8	Surrogate	114%	-	-	-	-	-
4-Bromofluorobenzene	Surrogate	113%	-	-	-	-	-
Dibromofluoromethane	Surrogate	102%	-	-	-	-	-

	Client ID:	TW1 8hr	TW1 8hr (Filtered)	-	-		
	Sample Date:	19-Jun-24 16:30	19-Jun-24 16:30	-	-	-	-
	Sample ID:	2425361-01	2425361-02	-	-		
	Matrix:	Drinking Water	Drinking Water	-	-		
	MDL/Units						
Hydrocarbons							
F1 PHCs (C6-C10)	0.0250 mg/L	<0.0250	-	-	-	-	-
F2 PHCs (C10-C16)	0.1 mg/L	<0.1	-	-	-	-	-
F3 PHCs (C16-C34)	0.1 mg/L	<0.1	-	-	-	-	-
F4 PHCs (C34-C50)	0.1 mg/L	<0.1	-	-	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions								
Chloride	ND	1	mg/L					
Fluoride	ND	0.1	mg/L					
Nitrate as N	ND	0.1	mg/L					
Nitrite as N	ND	0.05	mg/L					
Sulphate	ND	1	mg/L					
General Inorganics								
Alkalinity, total	ND	5	mg/L					
Ammonia as N	ND	0.01	mg/L					
Dissolved Organic Carbon	ND	0.5	mg/L					
Colour	ND	2	TCU					
Colour, apparent	ND	2	ACU					
Conductivity	ND	5	uS/cm					
Phenolics	ND	0.001	mg/L					
Total Dissolved Solids	ND	10	mg/L					
Sulphide	ND	0.02	mg/L					
Tannin & Lignin	ND	0.1	mg/L					
Total Kjeldahl Nitrogen	ND	0.1	mg/L					
Turbidity	ND	0.1	NTU					
Hydrocarbons								
F1 PHCs (C6-C10)	ND	0.0250	mg/L					
F2 PHCs (C10-C16)	ND	0.1	mg/L					
F3 PHCs (C16-C34)	ND	0.1	mg/L					
F4 PHCs (C34-C50)	ND	0.1	mg/L					
Metals								
Mercury	ND	0.0001	mg/L					
Aluminum	ND	0.001	mg/L					
Antimony	ND	0.0005	mg/L					
Arsenic	ND	0.001	mg/L					
Barium	ND	0.001	mg/L					
Beryllium	ND	0.0005	mg/L					
Boron	ND	0.01	mg/L					
Cadmium	ND	0.0001	mg/L					

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Calcium	ND	0.1	mg/L					
Chromium	ND	0.001	mg/L					
Cobalt	ND	0.0005	mg/L					
Copper	ND	0.0005	mg/L					
Iron	ND	0.1	mg/L					
Lead	ND	0.0001	mg/L					
Magnesium	ND	0.2	mg/L					
Manganese	ND	0.005	mg/L					
Molybdenum	ND	0.0005	mg/L					
Nickel	ND	0.001	mg/L					
Potassium	ND	0.1	mg/L					
Selenium	ND	0.001	mg/L					
Silver	ND	0.0001	mg/L					
Sodium	ND	0.2	mg/L					
Strontium	ND	0.01	mg/L					
Thallium	ND	0.001	mg/L					
Uranium	ND	0.0001	mg/L					
Vanadium	ND	0.0005	mg/L					
Zinc	ND	0.005	mg/L					
Microbiological Parameters								
E. coli	ND	1	CFU/100mL					
Total Coliforms	ND	1	CFU/100mL					
Fecal Coliforms	ND	1	CFU/100mL					
Heterotrophic Plate Count	ND	10	CFU/mL					
Volatiles								
Acetone	ND	0.0050	mg/L					
Benzene	ND	0.0005	mg/L					
Bromodichloromethane	ND	0.0005	mg/L					
Bromoform	ND	0.0005	mg/L					
Bromomethane	ND	0.0005	mg/L					
Carbon Tetrachloride	ND	0.0002	mg/L					
Chlorobenzene	ND	0.0005	mg/L					
Chloroethane	ND	0.0010	mg/L					

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Chloroform	ND	0.0005	mg/L					
Dibromochloromethane	ND	0.0005	mg/L					
Dichlorodifluoromethane	ND	0.0010	mg/L					
1,2-Dibromoethane	ND	0.0002	mg/L					
1,2-Dichlorobenzene	ND	0.0005	mg/L					
1,3-Dichlorobenzene	ND	0.0005	mg/L					
1,4-Dichlorobenzene	ND	0.0005	mg/L					
1,1-Dichloroethane	ND	0.0005	mg/L					
1,2-Dichloroethane	ND	0.0005	mg/L					
1,1-Dichloroethylene	ND	0.0005	mg/L					
cis-1,2-Dichloroethylene	ND	0.0005	mg/L					
trans-1,2-Dichloroethylene	ND	0.0005	mg/L					
1,2-Dichloroethylene, total	ND	0.0005	mg/L					
1,2-Dichloropropane	ND	0.0005	mg/L					
cis-1,3-Dichloropropylene	ND	0.0005	mg/L					
trans-1,3-Dichloropropylene	ND	0.0005	mg/L					
1,3-Dichloropropene, total	ND	0.0005	mg/L					
Ethylbenzene	ND	0.0005	mg/L					
Hexane	ND	0.0010	mg/L					
Methyl Ethyl Ketone (2-Butanone)	ND	0.0050	mg/L					
Methyl Isobutyl Ketone	ND	0.0050	mg/L					
Methyl tert-butyl ether	ND	0.0020	mg/L					
Methylene Chloride	ND	0.0050	mg/L					
Styrene	ND	0.0005	mg/L					
1,1,1,2-Tetrachloroethane	ND	0.0005	mg/L					
1,1,2,2-Tetrachloroethane	ND	0.0005	mg/L					
Tetrachloroethylene	ND	0.0005	mg/L					
Toluene	ND	0.0005	mg/L					
1,1,1-Trichloroethane	ND	0.0005	mg/L					
1,1,2-Trichloroethane	ND	0.0005	mg/L					
Trichloroethylene	ND	0.0005	mg/L					
Trichlorofluoromethane	ND	0.0010	mg/L					
Vinyl chloride	ND	0.0002	mg/L					

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
m,p-Xylenes	ND	0.0005	mg/L					
o-Xylene	ND	0.0005	mg/L					
Xylenes, total	ND	0.0005	mg/L					
Surrogate: 4-Bromofluorobenzene	*0.0916*		*%*	*114*	*50-140*			
Surrogate: Dibromofluoromethane	*0.0809*		*%*	*101*	*50-140*			
Surrogate: Toluene-d8	*0.0925*		*%*	*116*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	6.72	1	mg/L	6.66			0.9	20	
Fluoride	0.58	0.1	mg/L	0.63			8.4	20	
Nitrate as N	0.29	0.1	mg/L	0.28			4.3	20	
Nitrite as N	ND	0.05	mg/L	ND			NC	20	
Sulphate	29.5	1	mg/L	29.8			1.1	20	
General Inorganics									
Alkalinity, total	197	5	mg/L	199			1.0	14	
Ammonia as N	ND	0.01	mg/L	ND			NC	17.7	
Dissolved Organic Carbon	4.6	0.5	mg/L	4.7			0.3	37	
Colour	ND	2	TCU	ND			NC	12	
Colour, apparent	18	2	ACU	19			5.4	12	
Conductivity	607	5	uS/cm	615			1.3	5	
pH	8.1	0.1	pH Units	8.1			0.4	3.3	
Phenolics	ND	0.001	mg/L	ND			NC	10	
Total Dissolved Solids	90.0	10	mg/L	90.0			0.0	10	
Sulphide	ND	0.02	mg/L	ND			NC	10	
Tannin & Lignin	ND	0.1	mg/L	ND			NC	11	
Total Kjeldahl Nitrogen	0.30	0.1	mg/L	0.30			0.3	16	
Turbidity	0.2	0.1	NTU	0.2			5.4	10	
Hydrocarbons									
F1 PHCs (C6-C10)	ND	0.0250	mg/L	ND			NC	30	
Metals									
Mercury	ND	0.0001	mg/L	ND			NC	20	
Aluminum	0.041	0.001	mg/L	0.042			2.3	20	
Antimony	ND	0.0005	mg/L	ND			NC	20	
Arsenic	ND	0.001	mg/L	ND			NC	20	
Barium	0.009	0.001	mg/L	0.009			0.6	20	
Beryllium	ND	0.0005	mg/L	ND			NC	20	
Boron	ND	0.01	mg/L	ND			NC	20	
Cadmium	ND	0.0001	mg/L	ND			NC	20	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Calcium	9.5	0.1	mg/L	9.4			1.0	20	
Chromium	ND	0.001	mg/L	ND			NC	20	
Cobalt	ND	0.0005	mg/L	ND			NC	20	
Copper	0.0072	0.0005	mg/L	0.0072			0.7	20	
Iron	0.2	0.1	mg/L	0.2			0.1	20	
Lead	0.0002	0.0001	mg/L	0.0002			10.4	20	
Magnesium	1.9	0.2	mg/L	2.0			3.8	20	
Manganese	ND	0.005	mg/L	ND			NC	20	
Molybdenum	ND	0.0005	mg/L	ND			NC	20	
Nickel	ND	0.001	mg/L	ND			NC	20	
Potassium	0.7	0.1	mg/L	0.7			1.0	20	
Selenium	ND	0.001	mg/L	ND			NC	20	
Silver	ND	0.0001	mg/L	ND			NC	20	
Sodium	17.1	0.2	mg/L	18.1			5.6	20	
Thallium	ND	0.001	mg/L	ND			NC	20	
Uranium	ND	0.0001	mg/L	ND			NC	20	
Vanadium	ND	0.0005	mg/L	ND			NC	20	
Zinc	0.038	0.005	mg/L	0.039			1.4	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100mL	ND			NC	30	
Total Coliforms	ND	1	CFU/100mL	ND			NC	30	
Fecal Coliforms	ND	1	CFU/100mL	ND			NC	30	
Heterotrophic Plate Count	150	10	CFU/mL	170			12.0	30	
Volatiles									
Acetone	ND	0.0050	mg/L	ND			NC	30	
Benzene	ND	0.0005	mg/L	ND			NC	30	
Bromodichloromethane	ND	0.0005	mg/L	ND			NC	30	
Bromoform	ND	0.0005	mg/L	ND			NC	30	
Bromomethane	ND	0.0005	mg/L	ND			NC	30	
Carbon Tetrachloride	ND	0.0002	mg/L	ND			NC	30	
Chlorobenzene	ND	0.0005	mg/L	ND			NC	30	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Chloroethane	ND	0.0010	mg/L	ND			NC	30	
Chloroform	ND	0.0005	mg/L	ND			NC	30	
Dibromochloromethane	ND	0.0005	mg/L	ND			NC	30	
Dichlorodifluoromethane	ND	0.0010	mg/L	ND			NC	30	
1,2-Dibromoethane	ND	0.0002	mg/L	ND			NC	30	
1,2-Dichlorobenzene	ND	0.0005	mg/L	ND			NC	30	
1,3-Dichlorobenzene	ND	0.0005	mg/L	ND			NC	30	
1,4-Dichlorobenzene	ND	0.0005	mg/L	ND			NC	30	
1,1-Dichloroethane	ND	0.0005	mg/L	ND			NC	30	
1,2-Dichloroethane	ND	0.0005	mg/L	ND			NC	30	
1,1-Dichloroethylene	ND	0.0005	mg/L	ND			NC	30	
cis-1,2-Dichloroethylene	ND	0.0005	mg/L	ND			NC	30	
trans-1,2-Dichloroethylene	ND	0.0005	mg/L	ND			NC	30	
1,2-Dichloropropane	ND	0.0005	mg/L	ND			NC	30	
cis-1,3-Dichloropropylene	ND	0.0005	mg/L	ND			NC	30	
trans-1,3-Dichloropropylene	ND	0.0005	mg/L	ND			NC	30	
Ethylbenzene	ND	0.0005	mg/L	ND			NC	30	
Hexane	ND	0.0010	mg/L	ND			NC	30	
Methyl Ethyl Ketone (2-Butanone)	ND	0.0050	mg/L	ND			NC	30	
Methyl Isobutyl Ketone	ND	0.0050	mg/L	ND			NC	30	
Methyl tert-butyl ether	ND	0.0020	mg/L	ND			NC	30	
Methylene Chloride	ND	0.0050	mg/L	ND			NC	30	
Styrene	ND	0.0005	mg/L	ND			NC	30	
1,1,1,2-Tetrachloroethane	ND	0.0005	mg/L	ND			NC	30	
1,1,2,2-Tetrachloroethane	ND	0.0005	mg/L	ND			NC	30	
Tetrachloroethylene	ND	0.0005	mg/L	ND			NC	30	
Toluene	ND	0.0005	mg/L	ND			NC	30	
1,1,1-Trichloroethane	ND	0.0005	mg/L	ND			NC	30	
1,1,2-Trichloroethane	ND	0.0005	mg/L	ND			NC	30	
Trichloroethylene	ND	0.0005	mg/L	ND			NC	30	
Trichlorofluoromethane	ND	0.0010	mg/L	ND			NC	30	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Vinyl chloride	ND	0.0002	mg/L	ND			NC	30	
m,p-Xylenes	ND	0.0005	mg/L	ND			NC	30	
o-Xylene	ND	0.0005	mg/L	ND			NC	30	
Surrogate: 4-Bromofluorobenzene	*0.0913*		*%*		*114*	*50-140*			
Surrogate: Dibromofluoromethane	*0.0821*		*%*		*103*	*50-140*			
Surrogate: Toluene-d8	*0.0915*		*%*		*114*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	16.4	1	mg/L	6.66	97.7	70-124			
Fluoride	1.61	0.1	mg/L	0.63	98.2	70-130			
Nitrate as N	1.30	0.1	mg/L	0.28	102	77-126			
Nitrite as N	1.05	0.05	mg/L	ND	105	82-115			
Sulphate	38.3	1	mg/L	29.8	85.0	70-130			
General Inorganics									
Ammonia as N	0.983	0.01	mg/L	ND	98.3	81-124			
Dissolved Organic Carbon	13.9	0.5	mg/L	3.1	108	60-133			
Phenolics	0.025	0.001	mg/L	ND	98.4	74-126			
Total Dissolved Solids	102	10	mg/L	ND	102	75-125			
Sulphide	0.49	0.02	mg/L	ND	98.8	79-115			
Tannin & Lignin	1.0	0.1	mg/L	ND	104	71-113			
Total Kjeldahl Nitrogen	1.32	0.1	mg/L	0.30	102	81-126			
Hydrocarbons									
F1 PHCs (C6-C10)	1.98	0.0250	mg/L	ND	98.8	85-115			
F2 PHCs (C10-C16)	2.0	0.1	mg/L	ND	125	60-140			
F3 PHCs (C16-C34)	5.0	0.1	mg/L	ND	127	60-140			
F4 PHCs (C34-C50)	2.9	0.1	mg/L	ND	117	60-140			
Metals									
Mercury	0.0027	0.0001	mg/L	ND	90.2	70-130			
Aluminum	85.8	0.001	mg/L	41.5	88.5	80-120			
Arsenic	48.7	0.001	mg/L	0.219	97.0	80-120			
Barium	54.6	0.001	mg/L	8.63	91.9	80-120			
Beryllium	50.4	0.0005	mg/L	0.0173	101	80-120			
Boron	53.2	0.01	mg/L	5.64	95.1	80-120			
Cadmium	46.3	0.0001	mg/L	0.0066	92.6	80-120			
Calcium	18800	0.1	mg/L	9390	94.4	80-120			
Chromium	48.1	0.001	mg/L	0.155	95.8	80-120			
Cobalt	46.5	0.0005	mg/L	0.0217	92.9	80-120			
Copper	52.2	0.0005	mg/L	7.20	90.0	80-120			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Iron	2550	0.1	mg/L	202	94.0	80-120			
Lead	47.2	0.0001	mg/L	0.209	94.0	80-120			
Magnesium	11500	0.2	mg/L	2020	95.0	80-120			
Manganese	53.1	0.005	mg/L	3.99	98.2	80-120			
Molybdenum	44.4	0.0005	mg/L	0.415	87.9	80-120			
Nickel	46.5	0.001	mg/L	0.327	92.4	80-120			
Potassium	11100	0.1	mg/L	702	104	80-120			
Selenium	47.7	0.001	mg/L	0.083	95.3	80-120			
Silver	45.5	0.0001	mg/L	0.0036	90.9	80-120			
Sodium	26200	0.2	mg/L	18100	80.6	80-120			
Thallium	46.5	0.001	mg/L	0.018	92.9	80-120			
Uranium	49.5	0.0001	mg/L	0.0093	99.0	80-120			
Vanadium	48.7	0.0005	mg/L	0.121	97.1	80-120			
Zinc	80.8	0.005	mg/L	38.6	84.5	80-120			
Volatiles									
Acetone	0.103	0.0050	mg/L	ND	103	50-140			
Benzene	0.0426	0.0005	mg/L	ND	106	60-130			
Bromodichloromethane	0.0456	0.0005	mg/L	ND	114	60-130			
Bromoform	0.0485	0.0005	mg/L	ND	121	60-130			
Bromomethane	0.0420	0.0005	mg/L	ND	105	50-140			
Carbon Tetrachloride	0.0426	0.0002	mg/L	ND	106	60-130			
Chlorobenzene	0.0478	0.0005	mg/L	ND	119	60-130			
Chloroethane	0.0441	0.0010	mg/L	ND	110	50-140			
Chloroform	0.0435	0.0005	mg/L	ND	109	60-130			
Dibromochloromethane	0.0484	0.0005	mg/L	ND	121	60-130			
Dichlorodifluoromethane	0.0434	0.0010	mg/L	ND	108	50-140			
1,2-Dibromoethane	0.0484	0.0002	mg/L	ND	121	60-130			
1,2-Dichlorobenzene	0.0454	0.0005	mg/L	ND	114	60-130			
1,3-Dichlorobenzene	0.0442	0.0005	mg/L	ND	110	60-130			
1,4-Dichlorobenzene	0.0453	0.0005	mg/L	ND	113	60-130			
1,1-Dichloroethane	0.0445	0.0005	mg/L	ND	111	60-130			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
1,2-Dichloroethane	0.0440	0.0005	mg/L	ND	110	60-130			
1,1-Dichloroethylene	0.0459	0.0005	mg/L	ND	115	60-130			
cis-1,2-Dichloroethylene	0.0422	0.0005	mg/L	ND	106	60-130			
trans-1,2-Dichloroethylene	0.0492	0.0005	mg/L	ND	123	60-130			
1,2-Dichloropropane	0.0428	0.0005	mg/L	ND	107	60-130			
cis-1,3-Dichloropropylene	0.0401	0.0005	mg/L	ND	100	60-130			
trans-1,3-Dichloropropylene	0.0386	0.0005	mg/L	ND	96.4	60-130			
Ethylbenzene	0.0446	0.0005	mg/L	ND	112	60-130			
Hexane	0.0315	0.0010	mg/L	ND	78.8	60-130			
Methyl Ethyl Ketone (2-Butanone)	0.0992	0.0050	mg/L	ND	99.2	50-140			
Methyl Isobutyl Ketone	0.109	0.0050	mg/L	ND	109	50-140			
Methyl tert-butyl ether	0.111	0.0020	mg/L	ND	111	50-140			
Methylene Chloride	0.0404	0.0050	mg/L	ND	101	60-130			
Styrene	0.0424	0.0005	mg/L	ND	106	60-130			
1,1,1,2-Tetrachloroethane	0.0484	0.0005	mg/L	ND	121	60-130			
1,1,2,2-Tetrachloroethane	0.0331	0.0005	mg/L	ND	82.7	60-130			
Tetrachloroethylene	0.0485	0.0005	mg/L	ND	121	60-130			
Toluene	0.0462	0.0005	mg/L	ND	116	60-130			
1,1,1-Trichloroethane	0.0430	0.0005	mg/L	ND	108	60-130			
1,1,2-Trichloroethane	0.0448	0.0005	mg/L	ND	112	60-130			
Trichloroethylene	0.0469	0.0005	mg/L	ND	117	60-130			
Trichlorofluoromethane	0.0491	0.0010	mg/L	ND	123	60-130			
Vinyl chloride	0.0439	0.0002	mg/L	ND	110	50-140			
m,p-Xylenes	0.0878	0.0005	mg/L	ND	110	60-130			
o-Xylene	0.0444	0.0005	mg/L	ND	111	60-130			
Surrogate: 4-Bromofluorobenzene	*0.0767*		*%*		*95.9*	*50-140*			
Surrogate: Dibromofluoromethane	*0.0823*		*%*		*103*	*50-140*			
Surrogate: Toluene-d8	*0.0793*		*%*		*99.2*	*50-140*			

Qualifier Notes:

Sample Qualifiers :

1: NO DATA: Overgrown with nontarget.

Sample Data Revisions:

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

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

%REC: Percent recovery.

RPD: Relative percent difference.

NC: Not Calculated

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.

- F1 range corrected for BTEX.

- F2 to F3 ranges corrected for appropriate PAHs where available.

- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.

- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

- When reported, data for F4G has been processed using a silica gel cleanup.

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Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited
32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Brent Redmond

Client PO: Millers Farm
Project: 100011.082
Custody: 19582

Report Date: 6-Aug-2024
Order Date: 1-Aug-2024

Order #: 2431471

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

Paracel ID	Client ID
2431471-01	PW2

Approved By:

Dale Robertson, BSc
Laboratory Director

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
E. coli	MOE E3407	2-Aug-24	2-Aug-24
Fecal Coliform	SM 9222D	2-Aug-24	2-Aug-24
Total Coliform	MOE E3407	2-Aug-24	2-Aug-24
Turbidity	SM 2130B - Turbidity meter	3-Aug-24	3-Aug-24

Certificate of Analysis

Report Date: 06-Aug-2024

Client: **GEMTEC Consulting Engineers and Scientists Limited**

Order Date: 1-Aug-2024

Client PO: **Millers Farm**

Project Description: 100011.082

	Client ID:	PW2	-	-	-		
	Sample Date:	01-Aug-24 15:30	-	-	-	-	-
	Sample ID:	2431471-01	-	-	-		
	Matrix:	Drinking Water	-	-	-		
	MDL/Units						
Microbiological Parameters							
E. coli	1 CFU/100mL	ND	-	-	-	-	-
Total Coliforms	1 CFU/100mL	2	-	-	-	-	-
Fecal Coliforms	1 CFU/100mL	ND	-	-	-	-	-
General Inorganics							
Turbidity	0.1 NTU	<0.1	-	-	-	-	-

Certificate of Analysis

Report Date: 06-Aug-2024

Client: **GEMTEC Consulting Engineers and Scientists Limited**

Order Date: 1-Aug-2024

Client PO: **Millers Farm**

Project Description: 100011.082

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics								
Turbidity	ND	0.1	NTU					
Microbiological Parameters								
E. coli	ND	1	CFU/100mL					
Total Coliforms	ND	1	CFU/100mL					
Fecal Coliforms	ND	1	CFU/100mL					

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
Turbidity	ND	0.1	NTU	ND			NC	10	
Microbiological Parameters									
E. coli	ND	1	CFU/100mL	ND			NC	30	
Total Coliforms	1	1	CFU/100mL	2			66.7	30	BAC04
Fecal Coliforms	ND	1	CFU/100mL	ND			NC	30	

Qualifier Notes:

Sample Qualifiers :

QC Qualifiers:

BAC04	Duplicate QC data falls within method prescribed 95% confidence limits.

Sample Data Revisions:

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

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

%REC: Percent recovery.

RPD: Relative percent difference.

NC: Not Calculated

APPENDIX G

Monitoring Well Water Quality and Laboratory Certificate Sheets

AGAT Laboratories

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

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS
32 STEACIE DRIVE
OTTAWA, ON K2K 2A9
(613) 836-1422
ATTENTION TO: Mohit Bhargav
PROJECT: 100011.082
AGAT WORK ORDER: 24Z181360
WATER ANALYSIS REVIEWED BY: Yris Verastegui, Inorganic Team Lead
DATE REPORTED: Aug 09, 2024
PAGES (INCLUDING COVER): 5
VERSION*: 1

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

Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.*
- *AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.*
- *This Certificate shall not be reproduced except in full, without the written approval of the laboratory.*
- *The test results reported herewith relate only to the samples as received by the laboratory.*
- *Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.*
- *All reportable information is available on request from AGAT Laboratories, in accordance with ISO/IEC 17025:2017, ISO/IEC 17025:2005 (Quebec), DR-12-PALA and/or NELAP Standards.*
- *This document is signed by an authorized signatory who meets the requirements of the MELCCFP, CALA, CCN and NELAP.*
- *For environmental samples in the Province of Quebec: The analysis is performed on and results apply to samples as received. A temperature above 6°C upon receipt, as indicated in the Sample Reception Notification (SRN), could indicate the integrity of the samples has been compromised if the delay between sampling and submission to the laboratory could not be minimized.*

AGAT Laboratories

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

Certificate of Analysis

AGAT WORK ORDER: 24Z181360

PROJECT: 100011.082

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:RVD

SAMPLED BY:Chris Dionne

Nitrate and Nitrite in Water

DATE RECEIVED: 2024-08-02

DATE REPORTED: 2024-08-09

		SAMPLE DESCRIPTION:		MW-1	MW-3
		SAMPLE TYPE:		Water	Water
		DATE SAMPLED:		2024-08-02	2024-08-02
Parameter	Unit	G / S	RDL	6050317	6050318
Nitrate as N	mg/L		0.05	1.03	5.33
Nitrite as N	mg/L		0.05	0.05	0.09

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

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Iris Verástegui

AGAT Laboratories

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

Quality Assurance

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

AGAT WORK ORDER: 24Z181360

PROJECT: 100011.082

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:RVD

SAMPLED BY:Chris Dionne

Water Analysis

RPT Date: Aug 09, 2024			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Nitrate and Nitrite in Water															
Nitrate as N	6056692		9.62	9.76	1.4%	< 0.05	97%	70%	130%	102%	80%	120%	98%	70%	130%
Nitrite as N	6056692		<0.05	<0.05	NA	< 0.05	94%	70%	130%	100%	80%	120%	97%	70%	130%

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

Certified By: Iris Verástegui

AGAT Laboratories

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

Method Summary

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

AGAT WORK ORDER: 24Z181360

PROJECT: 100011.082

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:RVD

SAMPLED BY:Chris Dionne

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Nitrate as N	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH

APPENDIX H

Nitrate Dilution Calculations

Allowable Septic Systems Flow - 6158 Rideau Valley Drive, Ottawa, Ontario

Site	Area m^2	Topography Factor	Soil Factor	Cover Factor	Infiltration Factor	Annual Water Surplus (m^3/year)	Infiltration Volume (m^3/year)
6158 Rideau Valley Drive	54,400	0.20	0.20	0.10	0.50	0.394	21434

Hard Surface Area	Background Nitrate concentration (mg/L)	Available Infiltration [1] (litres per day)	Maximum Septic Flow-Conventional[2] (litres per day)
20%	1.03	23,489	6,790

Notes:

1. Available infiltration (litres per day) = Infiltration volume (m3/year) x (1000 litres/m3) / (365 days/year) x (1 - hard surface area) x Infiltration Factor
2. Calculated using the equation displayed in footnote 4. in MECP guideline D-5-4: (40 mg/L x Flow) / (Flow + Infiltration) 10 mg/L - background nitrates. Formula was rearranged to solve for Septic Flow: Flow = (10 mg/L - background nitrates) x Infiltation)/ (40 mg/L - (10 mg/L - background nitrates)).

Ottawa Intl A WATER BUDGET MEANS FOR THE PERIOD 1939-2020 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY...125 MM HEAT INDEX... 36.69
LONG... 75.67 LOWER ZONE..... 75 MM A..... 1.079

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.6	62	12	14	0	0	0	23	83	121	295
28- 2	-9.0	56	10	17	1	1	0	26	112	122	351
31- 3	-2.8	66	31	78	5	5	0	100	69	125	416
30- 4	5.7	73	68	74	31	31	0	111	0	125	490
31- 5	13.1	76	76	0	80	80	0	14	0	106	566
30- 6	18.3	85	85	0	116	115	-1	5	0	72	651
31- 7	20.9	88	88	0	136	121	-15	3	0	35	739
31- 8	19.6	84	84	0	118	93	-25	1	0	26	823
30- 9	14.8	82	82	0	75	66	-9	2	0	39	906
31-10	8.3	77	77	0	37	36	-1	7	0	73	77
30-11	1.3	76	59	8	10	10	0	24	9	106	154
31-12	-6.9	79	27	14	1	1	0	28	47	118	233
AVE	6.0 TTL	904	699	205	610	559	-51	344			

Ottawa Intl A STANDARD DEVIATIONS FOR THE PERIOD 1939-2020 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	2.9	26	15	17	1	1	0	29	44	13	59
28- 2	2.6	26	14	26	1	1	0	35	59	12	63
31- 3	2.6	28	22	49	5	5	0	54	87	3	71
30- 4	1.8	32	33	88	9	9	0	88	2	2	80
31- 5	1.8	34	34	2	12	12	0	24	0	22	94
30- 6	1.2	38	38	0	8	9	4	16	0	39	105
31- 7	1.2	45	45	0	8	23	25	16	0	38	117
31- 8	1.3	37	37	0	8	26	27	4	0	36	126
30- 9	1.5	39	39	0	8	15	14	12	0	42	132
31-10	1.5	37	37	1	7	7	2	18	0	41	37
30-11	1.8	27	27	8	4	4	0	30	13	27	45
31-12	3.0	30	22	14	1	1	0	28	34	16	55

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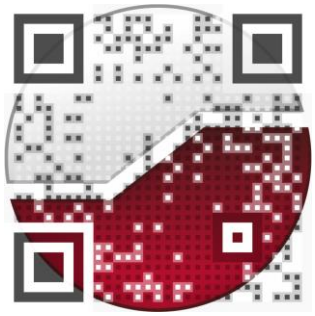

civil	civil
geotechnical	géotechnique
environmental	environnementale
field services	surveillance de chantier
materials testing	service de laboratoire des matériaux

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