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Hydrogeological Investigation & Terrain Analysis
Proposed Newill Subdivision
2727 Carp Road
Ottawa, Ontario

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Proposed Newill Subdivision
2727 Carp Road
Ottawa, Ontario

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1.0 INTRODUCTION

GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) was retained by 1384341 Ontario Ltd to conduct an updated hydrogeological investigation and terrain evaluation at the site of a proposed residential/commercial subdivision located at 2727 Carp Road, Ottawa, Ontario.

The proposed residential and commercial development (hereafter referred to as 'the subject site') will be comprised of a 69.76-hectare (172.4 acre) parcel of land located at 2727 Carp Road in Ottawa, Ontario (refer to Kay Plan, Figure 1). The proposed development will consist of 78 residential lot and 4 commercial lots along Carp Road.

The majority of the subject site is currently vacant and portions of it have been previously used for agricultural purposes. There is also one commercial property located along Carp Road (northeastern portion of the subject site) which is used for trailer storage. Residential properties with private services along Sentinel Pine Way, William Mooney Drive and Huntley Manor are situated on the southeast, south and west borders of the site. The majority of the site consists of open fields with the exception of the southern portion where mature trees exist and in the northern portion where a stream bisects the northern portion of the site, flowing from northwest to southeast.

The proposed development at the subject site will consist of 78 residential estate lots serviced with on-site septic disposal systems and water supply wells. The proposed lots will be accessed by an internal roadway system and will have an average lot size of 0.84 hectares, with a minimum lot size of 0.4 hectares. The proposed layout of the development is shown on the proposed Lot Development Plan, prepared by Novatech Engineering Consultants Ltd. located in Appendix A.

1.1 Background Information

This current report is a revision of our previous hydrogeological investigation entitled "Hydrogeological Investigation and Terrain Analysis, Proposed Residential Subdivision, Part Lots 7 and 8, Concession 3, Huntley, City of Ottawa, Ontario" prepared by Morey Houle Chevrier Engineering Ltd. (MHC) and dated March 27, 2003.

This current revised hydrogeological report was completed to address comments prepared by the Rideau Valley Conservation Authority (RVCA) entitled "Hydrogeological Impact Assessment, Newill (Rump) residential subdivision, part of lots 7 & 8, con. III, City of Ottawa (Huntley)" dated August 30, 2005. It should be noted that the previous hydrogeological report prepared by MHC, dated March 27, 2003 was recommended for approval by the RVCA for a limited number of lots only, i.e. phased approach, provided that certain conditions are applied/considered (refer to Appendix B). Our updated report is intended to address these conditions.

1.2 Objectives of Investigation

The objectives of this investigation are as follows:

- To review available background information to assist in characterization of subsurface conditions in the vicinity of the subject site and develop a hydrogeological conceptual model;
- To identify and characterize the shallow subsurface conditions on the subject site as they relate to the design of septic sewage disposal systems under the Ontario Building Code (OBC);
- To assess the potential for impact on the receiving aquifer(s) and any nearby surface water features from on-site septic disposal systems;
- To investigate the potential quantity and quality of groundwater available from drilled test wells on the subject site for potential domestic supply; and,
- To assess the long-term impacts on groundwater supply from existing developments on drilled water supply wells in the vicinity of the subject site.

Following a review of available background information and analysis of the results of the field investigation, conclusions and recommendations for the proposed residential development of the subject site are provided.

2.0 REVIEW OF BACKGROUND INFORMATION

2.1 Available Background Reports

A number of available background reports were reviewed as part of the revised investigation:

- “Carp Road Corridor, Community Design Plan” prepared by the City of Ottawa and dated June 2004 (Publication No. 3-08). This report is referred to herein as the “CDP Report”.
- “Carp Road Corridor, Groundwater Study” prepared by Dillon Consulting Limited and dated November 30, 2004 (ref: 04-3219). This report will herein be referred to as the “Groundwater Study Report”.
- “Mississippi-Rideau Source Protection Region, Assessment Report, Mississippi Valley Source Protection Area” prepared by Mississippi Valley Conservation and Rideau Valley Conservation Authority and dated August 4, 2011. This report will herein be referred to as the “MVSPR Report”.
- “Aggregate Resources Inventory of the City of Ottawa, Southern Ontario” prepared by the Ontario Geological Survey Aggregate Resources Inventory (Paper 191) and dated 2013. This report will herein be referred to as the “ARIP 191 Report”.

2.1.1 Community Design Plan Report (City of Ottawa, 2004)

The CDP report prepared by the City of Ottawa was reviewed for relevant information pertaining to the development of the subject site:

- Development of the site should preserve and add as many trees as possible and the use of landscaping, decorative fences, trees and/or shrubs in front of fencing to screen unsightly uses.
- The environmental features of the subject site (Schedule 2 CDP Report) shall be protected by implementing the policies in Section 4.7 of the Official Plan. In areas identified as groundwater recharge areas shown on Schedule 2, a groundwater impact assessment may be required to support development applications to determine the potential for impact on groundwater resources.
- A groundwater impact assessment may be required for development applications to support land uses that may pose a high risk to the groundwater resource, or uses that use large volumes of water or dispose of large volumes of liquid or solid waste, as per Section 4.7.5 of the Official Plan.
- Schedule 2 of the CDP Report indicates that the majority of the subject site is located in a high recharge area and a high-quality fishery discharge area.
- When reviewing development applications in areas identified as groundwater recharge areas, the City will consider the potential for impact on groundwater resources. A groundwater impact assessment may be required where the City has identified that the lands play a role in the management of the groundwater resource or the need is indicated in other available information such as subwatershed plans or local knowledge as per Section 4.7.5 of the Official Plan.

2.1.2 Groundwater Study Report (Dillon, 2004)

The Groundwater Study Report prepared by the Dillon Consulting Ltd. was reviewed for relevant information pertaining to the development of the subject site. The following recommendations were presented:

- Applicants of future high risk commercial and industrial development should demonstrate that the proposed development will not impact groundwater prior to receiving approval. Elements of the proponent's proposal may include: assessment of the hydrogeological characteristics, the design of protection engineering systems to reduce risk of chemical discharges, identification and abandonment of unused wells, the design of a groundwater monitoring system, establishment of a spill response plan, plans to encourage natural infiltration and possible posting of bonds to cover future environmental clean-up efforts.
- For existing land uses, it is recommended that mitigation actions be enacted primarily through voluntary mechanisms including: promotion of best management practices,

education of the public on the aquifer sensitivities, development of incentive programs to reduce contamination risk, and the review of road salting practices to reduce salt loading.

- For development of new subdivisions, a hydrogeological assessment following City of Ottawa protocols should be performed as a condition of approval. For development by consent, neighbouring wells should be sampled and favourable chemistry results obtained prior to approval being granted.

The following information from the report is considered relevant to this investigation:

- The Groundwater Study Report was completed using information from the following resources:
    - 1:50,000 scale overburden and bedrock geology maps by Geological Survey of Canada and 1:10,000 scale Ontario Base Maps from the Ministry of Natural Resources;
    - MECP Water Well Records;
    - Other previous studies (please refer to the Groundwater Study Report for specific sources); and,
    - Geographic Information System (GIS) Database sources from: City of Ottawa, Renfrew County, Ministry of Northern Development. In addition, GIS data from a Regional Groundwater Study (Golder et al, 2003) was modified to a scale suitable for analysis (1:25,000).
- The Surficial Geology & Aquifer Location map of the Groundwater Study Report indicates that:
    - The subject site has predominantly offshore marine sediments of the Champlain Sea consisting of clay and silt as well as Paleozoic bedrock and organic deposits of peat and muck to the west and till to the east.
    - The lands immediately adjacent to the southeastern boundary of the subject site have nearshore sediments of the Champlain Sea consisting of gravel and sand.
    - The closest glaciofluvial deposits of sand and gravel to the subject site are mapped to the south of Richardson Side Road (which is greater than 1.0 kilometre from the closest boundary of the subject site).
    - The map notes indicate that the information conveyed by this map is regional in nature and is not suitable for use in site specific evaluations.
- The Bedrock Geology & Aquifer Location map of the Groundwater Study Report indicates that:

  - The subject site is mapped as Paleozoic bedrock consisting of limestone and shale of the Verulam Formation (northern portion of the site) and limestone of the Bobcaygeon Formation (southern portion of the site).
  - The closest MOE Recorded Well Location and Aquifer Pumped symbols indicate an unconfined limestone aquifer.
  - The map notes indicate that the information conveyed by this map is regional in nature and is not suitable for use in site specific evaluations.

- The Groundwater Flow map of the Groundwater Study Report indicates that groundwater flow in the region of the site is expected to flow to the north (or to the northeast from the subject's site frame of reference). The map notes indicate that the information conveyed by this map is regional in nature and is not suitable for use in site specific evaluations.
- The Groundwater Infiltration map of the Groundwater Study Report indicates that groundwater infiltration is low for clay, silt, and organic deposits, moderate for bedrock and till and high for the sand and gravel deposits of the subject site. The map notes indicate that the information conveyed by this map is regional in nature and is not suitable for use in site specific evaluations.
- The Recharge/Discharge Areas map of the Groundwater Study Report indicates that the vertical groundwater gradient is subject site as being a recharge zone with the majority of the site identified as having a weak downward vertical groundwater gradient. A stream intersects the subject site and flows from west to east; the stream is identified as being a discharge area having a weak upward gradient. The map notes indicate that the information conveyed by this map is regional in nature and is not suitable for use in site specific evaluations.
- The Aquifer Vulnerability map of the Groundwater Study Report indicates that the subject site (as is much of the Carp Road Development Corridor) is located in a high vulnerability aquifer area. The map notes indicate that the information conveyed by this map is regional in nature and is not suitable for use in site specific evaluations.

2.1.3 Mississippi Valley Source Protection Region Report (MVSPR, 2011)

The MVSPR Report prepared by Mississippi Valley Conservation and Rideau Valley Conservation Authority was reviewed for relevant information pertaining to the development of the subject site:

- The Mississippi-Rideau Source Protection Region - Highly Vulnerable Aquifers (HVA's) map indicates that the subject site is located in a highly vulnerable aquifer zone. However, it should be noted that much of the Carp Road Development Corridor, the Waste Management West Carleton Environmental Centre and the Karson Quarry are also all located in the highly vulnerable aquifer zone.
- The Carp Wellhead Protection Area Map indicates that the closest corner of the subject site is located about 3.0 kilometres to the south of the outermost boundary of the Carp

Wellhead Protection Area (Zone D: 25 year travel time). In addition, the closest corner of the subject site to the Carp Communal well is approximately 6 kilometres.

2.1.4 ARIP 191 Report

The ARIP 191 Report prepared by Ontario Geological Survey was reviewed for relevant information to the development of the subject site:

- The subject site is shown as being located in a sand and gravel deposit of tertiary significance;
- A sand and gravel quarry is located to the southeast of the subject site (greater than 1.0 kilometres).

In addition to the sand and gravel deposits noted in the ARIP 191 Report, a small sand pit (<1.0 hectares) is located on the subject site, adjacent to the stream that bisects the subject site. The sand pit has been depleted.

2.1.5 Carp Road Corridor Zoning Study

In 2013, the City of Ottawa initiated a study of the zoning along the Carp Road Corridor to support economic development opportunities and to resolve issues with the previous zoning that were triggering amendments to permit development proposals to proceed along the Corridor.

The changes to Zoning By-law 2008-250 were intended to stimulate the local economy, to allow for more employment opportunities and to recognize that the Carp Road Corridor Rural Employment Area, as the largest rural employment area in the City, which plays an important role in the local economy. The study was also meant to influence and ensure that future planning decisions/approvals within the Corridor better reflect the evolution of the Corridor as a more diverse economic hub for the Western Rural area of Ottawa. Rather than requiring a performance-based zoning approach as recommended in past studies, the study of the zoning looked at each property along the Carp Road Corridor, which resulted in numerous changes including boundary changes, the addition of new uses and prohibition of other uses on some properties. Specific adjustments were also made to better separate the residential uses from the commercial and industrial uses given the conflicts with truck traffic and pollutants.

A report prepared by City staff (File Number: ACS2014-PAI-PGM-0071) was carried unanimously by City Council on May 14, 2014.

2.1.6 McGee Meadow Estates Subdivision

The McGee Meadow Estates is a 25-lot residential subdivision located adjacent to the subject site, on the southern border. The hydrogeological assessment and terrain evaluation were completed by Houle Chevrier Engineering Ltd. (herein referred to as HCEL), titled "Hydrogeological Assessment and Terrain Evaluation, Proposed Residential Subdivision, McGee

Subdivision, Ottawa, Ontario" and dated December 2009. The hydrogeological report, lot development plan and subdivision agreement were obtained from www.mcgeemeadow.ca/resources/.

A brief summary of the hydrogeological assessment and terrain evaluation conclusions and recommendations are provided below.

- The quality and quantity of groundwater is sufficient to service private residences based on the proposed development;
- Water supply recommendations include:
    - All wells should be drilled in accordance to local and MOE regulations and have well casings extend 10.0 metres below ground surface with a minimum casing length of 2.0 metres into sound, competent bedrock;
        - Rationale for 10.0 metre casings not provided.
    - Conventional water softeners and aeration (or activated charcoal filters, chlorination, manganese greensand filters, etc.) may be desired by homeowners to treat minor aesthetic objective and operational guidelines exceedances of hardness and hydrogen sulphide; and,
    - Drilled water wells may require hydro-fracturing to increase the well yield sufficiently to provide water at a rate of 13.7 litres per minute for a period greater than six hours.

Additional subdivision information including water quality results, pumping test results and terrain evaluation can be found in the hydrogeological report and subdivision agreement, i.e. Agreement of Purchase and Sale.

2.2 Land Use

The majority of the subject site is currently vacant undeveloped land and was previously used for agricultural purposes. Land use in the vicinity of the site consists of vacant undeveloped land and residential and commercial properties on private services. Residential properties, with private services, are located southeast and west of the subject site. Commercial properties are located to the north and northeast along Carp Road.

Specific land uses near the subject site boundaries are documented in Table 2.1.

Table 2.1 – Summary of Land Use in Study Area

Site Boundary	Existing Land Use
North / northeast (Carp Road)	• Commercial properties along Carp Road
East / southeast	• Combination of agricultural land, wooded areas, and residential properties (Huntley Manor Subdivision)
South / southwest (William Mooney Drive)	• Wooded areas and scattered residential properties (McGee Meadow Estates Subdivision)
West / southwest	• Residential properties (Arbourbrook Subdivision)

2.2.1 Technical Safety and Standards Authority (TSSA)

The Technical Standards and Safety Authority (TSSA) was contacted to conduct a search for the adjacent properties located at 2676, 2688, 2702, 2710, 2726, 2770, 2727, 2739, 2755, 2765, 2775, 2777, 2789, 2793, 2797, 2825, 2591 Carp Road, 80 Arbourbrook Boulevard, 120, 124, 128, 132, 136, 138, 140 Tansley Drive, 205, 215, 225 Maple Creek Crescent, 106, 122, 124, 128, 132, 136, 140, 144, 148, 152, 156, 160, 164, 168, 172 Reis Road and 158, 171, 189, 197, 217 Cardevco Road in Ottawa, Ontario. The TSSA indicated that they have no record of any fuel storage tanks at the above addresses.

It should be noted that the Fuels Safety Division of the TSSA did not register private fuel underground or aboveground storage tanks prior to January of 1990 or furnace oil tanks prior to May 1, 2002.

A copy of the search requests and the responses from the TSSA are provided in Appendix C.

2.2.2 Permit to Take Water and Environmental Compliance Approvals

No large scale water takings capable of causing adverse impacts to groundwater quantity were identified within 1000 metres of the subject site boundary (PTTW search completed July 25, 2019; https://www.ontario.ca/environment-and-energy/map-permits-take-water).

Several commercial properties are located along Carp Road, directly north of the subject site. Environmental Compliance Approvals (ECA's) are present for 15 of the commercial properties. The ECA's include industrial sewage works, air, waste management systems, and waste disposal sites. The waste disposal sites listed (ECA 2712-99VJ8R and 6469-ADXJVG) are for the processing and transfer of solid municipal and liquid waste as well as solid non-hazardous waste (limited to waste from the cleaning of water supply lines, storm sewers and sanitary sewers and all associated connections from municipal, industrial, commercial, institutional and domestic use). Potential impacts to groundwater quality from adjacent lands within 500 metres of the subject site boundary are not anticipated based on the present land uses identified in the ECA’s.

2.2.3 Former Carp Road Landfill (WESA 2014a & WESA 2014b)

A former 35-hectare landfill is owned and operated by Waste Management and located at the West Carleton Environmental Centre (WCEC), approximately 1.8 kilometres from the southern edge of the subject site. The former landfill is closed and has been capped with vegetated layers. An expansion of the landfill is proposed to the west, which would be located approximately 1.3 kilometres from the subject site.

Groundwater impact and hydrogeological assessment reports have been prepared for the proposed expansion of the landfill, including:

- “Groundwater Impact Assessment Report, West Carleton Environmental Centre, Ottawa, Ontario” prepared by WESA, a division of BluMetric Environmental Inc. and dated January 2014.
- “Hydrogeological Assessment Report, West Carleton Environmental Centre Landfill, Ottawa, Ontario” prepared by WESA, a division of BluMetric Environmental Inc. and dated January 2014.

The overburden and shallow bedrock groundwater flow direction is to the north on the western half of the landfill study area and becomes north-easterly across the eastern portion of the landfill. The regional groundwater flow direction of the deep bedrock aquifer is to the northeast towards the Carp River.

The groundwater impact assessment report discusses the effects on the hydrogeology (groundwater flow and groundwater quality) of the proposed landfill expansion. Groundwater monitoring data shows that leachate-impacted groundwater is moving in the direction of groundwater flow, to the north away from the landfill. Future groundwater flow is predicted to be consistent with current observed conditions, with groundwater flow being in a northeastern direction.

The western two-thirds of the existing landfill is unlined and leachate can enter the underlying groundwater system. The leachate is expected to move following the groundwater flow direction, to the northeast, where it will intersect the existing purge well system installed along Carp Road. The purge wells control the off-site impacts within the Contamination Attenuation Zone (CAZ). Transport modelling indicates that leachate-impacted groundwater will continue to migrate off-site in northeastern direction. Furthermore, groundwater impacts are expected from the proposed stormwater management ponds. The stormwater management ponds will have unlined portions to allow for groundwater infiltration. The maximum predicted extent of chloride concentrations from the stormwater management ponds is 130 mg/L, which could extend as far northwest as Richardson Side Road (located approximately 950 metres from the subject site).

Based on the hydrogeological and groundwater impact assessment reports, groundwater impacts at the subject site (located 1.3 kilometers northwest of the proposed landfill expansion) are not anticipated.

2.3 Topography

Topographic mapping data provided indicates that elevations range from about 112.5 to 120 metres above sea level. Overall, the property is relatively flat and slopes gently towards a stream that bisects the subject site.

2.4 Drainage

The drainage of the subject site is influenced by the natural topography and a stream which intersects the site. The stream flows from the west to east and controls the shallow groundwater flow from the northern and southern portion of the site.

2.5 Ontario Ministry of Environment and Climate Change Water Well Records

The Ministry of Environment, Conservation and Parks (MECP) Water Well Records for existing private wells in the surrounding development were obtained to determine the characteristics of existing private wells in the vicinity of the subject site (500 metre radius). A total of 146 well records were reviewed from the MECP online water well record mapping resource. Of the 146 well records, 124 wells were identified as domestic, public, or commercial wells (remaining 22 wells are monitoring, test, or not used).

Table 2.2 provides a summary of the well characteristics for the 124 water well records (using available data) for depth to water found, static water levels, depth to bedrock, depth into bedrock and total well depth.

Table 2.2 – Summary of Water Well Records Search Results

Parameter	10th Percentile	90th Percentile	Average / Geometric Mean
Depth Water Found (m)	8.0	68.6	29.2 / 20.3
Static Water Level (m)	1.1	5.5	3.4 / 2.3

Parameter	10th Percentile	90th Percentile	Average / Geometric Mean
Depth to Bedrock (m)	2.7	11.9	7.5 / 6.0
Depth into Bedrock (m)	6.2	81.0	38.0 / 23.7
Total Well Depth (m)	11.4	84.8	42.3 / 31.2

The MECP Water Well Records for drinking water wells surrounding the subject site (500 metre radius) indicate that water in existing private wells was encountered at shallower depths compared to that of the onsite test wells (i.e. geometric average of 20.9 metres below ground surface for the offsite private well records and geometric average of 27.9 metres below ground surface for the onsite test wells). The majority of wells are completed within the limestone bedrock, with the exception of 13 domestic overburden wells completed in sand and gravel at depths of 6.1 to 16.4 metres.

The MECP Water Well Records indicate that the total well depth in existing private wells have shallower well completion depths to the onsite test wells (i.e. geometric average of 31.2 metres below ground surface for the offsite private well records and geometric average of 38.6 metres below ground surface for the onsite test wells).

The depth to bedrock in existing private wells is similar to the depth to bedrock of the onsite test wells (i.e. geometric average of 6.0 metres below ground surface for the offsite well records and geometric average of 5.2 metres below ground surface for the onsite test wells).

3.0 TERRAIN EVALUATION

3.1 Regional Geology

Surficial geology maps of the Carp area indicate that the site is underlain by organic deposits, offshore marine sediments (clay and silt), glacial till, nearshore marine sediments (sand, reworked glaciofluvial) and bedrock. Bedrock geology maps of the Carp area indicate that the site is underlain by interbedded limestone and shale of the Simcoe Group Formation (approximately 150 to 180 metres thick). Paleozoic bedrock geology mapping further indicates that the site is underlain by the Bobcaygeon and Verulam Formations, which are separated by a vertical fault that runs parallel to the stream that bisects the subject site. The bedrock geology consists of limestone and shale bedrock of the Verulam Formation to the north and limestone bedrock of the Bobcaygeon Formation to the south. Surficial and bedrock geology maps, Figure C1 and C2 respectively, are provided in Appendix C.

3.2 Field Procedure

The initial field work for the terrain analysis was carried out in 2003 followed by subsequent investigations in 2017 and 2019. A summary of the field work completed as part of the terrain analysis are summarized below:

- 17 test pits (TP1 to TP17, inclusive) were advanced on March 25, 2003 using a track mounted backhoe supplied and operated by the owner. The test pits were advanced approximately 1.4 to 4.6 metres below ground surface.
    - Grain size distribution analyses submitted for two samples.
- Six boreholes were advanced at the site on September 9-14, 2004 using a track-mounted drill rig. Monitoring wells were installed in all boreholes, numbered MW1S, MW1D, MW2S, MW2D, M23S, MW3D, MW4S, MW4D, MW5S, MW6S, and MW6D. The monitoring wells were installed at depths of 1.5 to 3.0 metres (labelled "S") and 4.5 to 6.0 metres (labelled "D") below ground surface.
- Three boreholes were advanced at the site on July 12-13, 2017 using a track-mounted drill rig supplied and operated by George Downing Estates Drilling Ltd. The boreholes were continuously sampled until inferred bedrock was encountered.
    - Grain size distribution analyses submitted for five samples.
- Eight test pits (TP18 to TP25, inclusive) were advanced at the site on May 29, 2019 using a track mounted backhoe supplied and operated by the owner. The test pits were advanced approximately 1.8 to 3.0 metres below ground surface.
    - Grain size distribution analyses submitted for three samples.
- Two boreholes were advanced at the site on May 31, 2019 using a track-mounted drill rig in order to replace MW4S and MW4D, which were abandoned during the development of the trailer storage yard at the site. Monitoring wells were installed in the two boreholes, numbered MW4S-R and MW4D-R, where "R" refers to replacement. The monitoring wells were installed at depths of 1.5 to 3.0 metres (labelled "S") and 4.5 to 6.0 metres (labelled "D") below ground surface.

The locations of the boreholes and test pits are shown on the Detailed Site Plan, Figure 2. The ground surface elevations at the borehole locations were determined using our Trimble R10 GPS survey instrument. The elevations are referenced to geodetic datum. All field work was observed by a member of our engineering staff.

Following the completion of the borehole drilling work and test pit excavation, the soil samples were returned to our laboratory for examination by a geotechnical engineer and/or hydrogeologist. Descriptions of the subsurface conditions logged in the boreholes and test pits are provided on the Record of Borehole and Record of Test Pit sheets appended (Appendix D) and the results of the grain size distribution analyses are provided in Appendix E.

3.3 Soil Conditions

3.3.1 General

The soil descriptions in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification and identification of soil involves judgment and GEMTEC does not guarantee descriptions as exact, but infers accuracy to the extent that is common in current geotechnical practice.

The subsurface conditions are variable throughout the site, with the greatest distinction south of the creek that flows west to east through the subject site. An overview of the subsurface conditions, interpreted from the test pits and boreholes advanced during the investigation, are presented below, including geological cross sections. The results of grain size distribution analyses carried out on selected samples are shown in Appendix E.

3.3.2 Topsoil

A surficial layer of topsoil was encountered at all of the borehole and test pit locations. The topsoil is generally composed of brown silty sand and sand with varying amounts of organic material. The topsoil layer has a thickness ranging between about 0.1 to 0.4 metres.

3.3.3 Sand

A deposit of red brown to grey brown to grey, fine to medium sand to fine to coarse sand was encountered beneath the topsoil at all of the test pits, except borehole MW2 and test pits 11, 15, 16 and 17. The thickness of the sand deposit at the test pit and borehole locations is 0.2 to 4.4 metres. Test pits 1, 2, 3, and 9 were terminated in the sand material at depths of 4.2 to 4.3 metres below the existing ground surface.

3.3.4 Silty Sand

Beneath the topsoil at test pit 17, boreholes 17-1, 17-2, 17-3 and the fine to medium sand at test pit 6 and borehole MW4, a layer of yellow brown to grey brown to grey silty sand was encountered. The thickness of the silty sand layer at the test pit and borehole locations is 0.2 to 2.7 metres.

3.3.5 Silty Clay

Beneath the topsoil at test pits 11, 15, 16, 20, 21, 22, 24 and borehole 17-1, the sand deposit at test pits 6, 7, 8, 13, and 14 and beneath the silty sand layer at test pit 17, 23 and 25, a deposit of grey brown to grey silty clay was encountered. Where penetrated at the test pit locations the silty clay layer is 1.0 to 2.0 metres in thickness. Test pits 6, 7, 8, 11, 17, 23, 24 and 25 were terminated in the silty clay at depths of 3.05 to 4.6 metres below the existing ground surface.

3.3.6 Clayey Silt

Beneath the topsoil at borehole 17-1 and the upper and lower sand deposits at borehole 17-2 and 17-3 a deposit of grey brown to grey clayey silt was encountered. Where penetrated at the borehole locations, the clayey silt layer is 0.3 to 1.5 metres in thickness.

3.3.7 Clay

Beneath the topsoil at borehole MW2 and the sand deposit at borehole MW3 and MW6, a deposit of grey clay was encountered. Where penetrated at the borehole locations, the clay layer is 0.9 to 5.4 metres in thickness. It is noted that clay soils were only identified in the boreholes advanced using a track mounted auger in 2004. Grain size distribution curves collected from similar geologic units (i.e. silty clay layers identified in test pits 20, 23 and 25 advanced in May 2019) classify the soils as silt and clay with some sand / clay and silt with trace sand. The results of grain size distribution analyses carried out on selected samples are shown in Appendix E.

3.3.8 Sand and Gravel

Beneath the sand material at test pits 2 and 5, boreholes MW1, MW6, 17-1 and 17-2 a layer of grey brown sand and gravel was encountered. The thickness of the sand and gravel layer at the test pit and borehole locations is 1.8 to 3.5 metres. The test pits and boreholes MW1 and MW6 were terminated in the sand and gravel at depths of 3.5 to 6.0 metres below the existing ground surface. Boreholes 17-1 and 17-2 were terminated on inferred bedrock at depths of 12.2 to 12.9 metres below ground surface.

3.3.9 Glacial Till

Beneath the sand at test pits 12, 20, 23 and 25 and the silty clay at test pits 14, 15 and 16 a deposit of grey brown to grey silty sand glacial till was encountered. Where fully penetrated at the test pit locations the glacial till is 0.3 to 0.9 metres in thickness. Test pits 12, 14, 18, 19, 20, 21 and 22 were terminated in the glacial till at 1.4 to 3.3 metres below the existing ground surface. Large cobbles and boulders limited test pits 12 and 21 to practical refusal of 1.4 and 1.8 metres respectively; however, it is noted that test pits 22, 24 and 25 advanced in the vicinity of test pits 12 and 21 (refer to Figure 2) were completed to depths of 3.05 metres below ground surface.

3.3.10 Bedrock

Test pits 13, 15 and 16 were terminated on refusal to excavate on what is possibly the surface of the bedrock at depths of 2.3 to 3.3 metres below the existing ground surface.

Borehole MW2 encountered bedrock at 5.4 metres below ground surface and was cored to 6.0 metres below ground surface. Borehole MW5 was terminated on refusal at a depth of 3 metres below ground surface. Boreholes 17-1, 17-2, 17-3 were terminated on auger refusal at depths of 9.1 to 12.9 metres below ground surface.

The total overburden thickness at the site as indicated by the bedrock test well records provided by the well driller's ranges from 5 to 12 metres, with the exception of MW5 and TW5 which indicate an overburden thickness of approximately one metre.

Water was encountered in test pits 1, 3, 5, 6, 7, 13, 14, 16 at depths of about 1.3 to 4.2 metres below the existing ground surface on March 25, 2003. All of the remaining test pits were dry for the short time the test pits remained open.

3.4 Groundwater Conditions

3.4.1 Groundwater Levels

Groundwater levels in the onsite monitoring wells (MW1 to MW6, inclusive) and groundwater levels in the onsite test wells (TW1 to TW8, inclusive) are summarized in Tables 3.1 and 3.2 respectively. A summary table of groundwater levels is provided in Table F1, Appendix F.

Table 3.1 – Overburden Groundwater Conditions in Monitoring Wells

	Depth (m B.G.S[1])				
Monitoring Well	**2004**	**Jun 7, 2016**	**Jun 9, 2017**	**Jun 14, 2017**	**Jul 12, 2019**
MW1S	2.19	1.94	1.35	1.47	1.65
MW1D	2.19	2.03	1.38	1.49	1.66
MW2S	0.78	1.11	0.43	0.89	0.97
MW2D	0.74	1.07	0.39	0.89	0.96
MW3S	0.84	1.17	-0.10	0.85	0.98
MW3D	0.81	1.33	0.46	0.97	0.87
MW4S	2.00	1.63	Abandoned	Abandoned	1.78[2]
MW4D	2.11	1.69	Abandoned	Abandoned	1.83[2]
MW5S	2.80	3.27	1.85	2.21	2.66
MW6S	2.68	2.53	1.66	1.75	2.00
MW6D	2.76	2.69	1.82	1.95	2.10

1. BGS – below ground surface.
2. Water level taken from MW4S-R and MW4D-R, which are replacement monitoring wells.

Table 3.2 – Bedrock Groundwater Conditions in Test Wells

Test Well	Depth (m B.G.S[1])					
	2004	Jun 7, 2016	Jun 9, 2017	Jun 14, 2017	Oct 16, 2017	Jul 12, 2019
TW1	2.16	1.80	1.22	1.37	-	1.53
TW2	0.52	0.57	-0.22	0.23	0.50	0.16
TW3	0.60	0.72	0.01	0.26	1.23	0.42
TW4	1.91	1.47	In Use	In Use	In Use	1.41[2]
TW5	-	-	-	-	-	32.63
TW6	-	-	-	-	0.66	0.33
TW7	-	-	-	-	1.97	1.27
TW8	-	-	-	-	0.86	0.53

1. BGS – below ground surface.
2. Test Well TW4 currently in use as a water supply well.

3.4.2 Groundwater Flow Directions

Water level measurements for both overburden monitoring wells (< 6 metres bgs) and test wells (35.6 to 62.5 metres b.g.s) were used to estimate groundwater flow. The water levels in the test wells ranged from -0.22 (artesian conditions) to 2.16 metres b.g.s, shallow monitoring wells ranged from -0.10 (artesian conditions) to 3.27 metres b.g.s, and deep monitoring wells ranged from 0.39 to 2.76 metres b.g.s.

A stream bisects the site and flows from the northwest to the southeast (Figure 2). The stream is approximately 1.5 metres below the water table at nearby monitoring wells MW 1, MW 6, MW 3, and MW 4 as measured on June 7, 2016.

There are minimal downward/upward vertical hydraulic gradients at the site. Generally, the vertical hydraulic gradients are downward within the overburden and upwards between the overburden and bedrock (Table F1 in Appendix F). It is noted that bedrock test well TW2 displayed artesian conditions indicating confined aquifer conditions.

Based on the test wells, the regional groundwater flow direction is to the northeast. The local groundwater flow direction in the overburden is heavily influenced by the stream that intersects the site and results in eastward and westward groundwater flows toward the stream (Figure 3).

3.4.3 Long Term Groundwater Levels

Electronic water level data loggers were installed in MW2S, MW2D and TW2 from June 6, 2017 to July 27, 2017 and in MW1S, MW1D and TW1 from July 27, 2017 to August 29, 2017 to monitor long term groundwater levels. The water levels were corrected for changes in barometric pressure using a dedicated on-site electronic barometric logger. The water levels, corrected for barometric pressure, along with precipitation data are compiled in Appendix F and are summarized in Table 3.3 below.

Table 3.3 – Long Term Groundwater Level Measurements

Well ID	Geologic Material & Depth (m bgs[1])	Water Level (metres bgs)	Water Level (metres, elevation)
MW1S	Sand (1.5 – 3m)	2.00 - 2.31	114.55 – 114.86
MW1D	Sand / Gravel (4.5 – 6m)	1.95 - 2.25	114.53 – 114.83
TW1	Bedrock (14 – 62.5m)	2.05 - 2.36	114.57 – 114.87
MW2S[2]	Silty Clay and Glacial Till (1.5 – 3m)	1.05 – 1.73	115.90 – 116.58
MW2D	Gravel / Bedrock (4.5 – 6m)	1.04 – 1.77	115.88 – 116.61
TW2	Bedrock (6.1 – 36.6m)	-0.32 – 0.27	116.47 – 117.06

1. BGS = below ground surface
2. Borehole logs classify soils as clay; soil classification based on nearby test pits and grain size distribution curves.

The bedrock test wells displayed minimal groundwater fluctuations of 0.31 and 0.59 metres for TW1 and TW2 respectively during the time they were installed. The maximum daily fluctuations were 0.08 to 0.35 metres for TW1 and TW2 respectively.

The groundwater levels within the overburden monitoring wells (MW1S, MW1D, MW2S and MW2D) and test well TW1 are directly influenced by precipitation events (Appendix F). The observed water levels in test well TW2 do not respond to precipitation events as quickly as the other well; however, TW2 is influenced by periods of heavy rainfall (30+ mm) and displays artesian conditions (Appendix F).

The groundwater level monitoring indicates that there are upward vertical gradients between the overburden and bedrock. The artesian conditions observed in TW2 suggests that the bedrock aquifer is confined at that location.

3.5 Overburden Hydraulic Conductivity Testing

Hydraulic testing was carried out in the well screens installed in the overburden as part of this investigation. The hydraulic testing was carried out in order to estimate the hydraulic conductivity of the overburden. The hydraulic testing included falling/rising head testing by introducing a slug. A summary of the hydraulic testing carried out in this investigation is provided in Table 3.4.

Table 3.4 – Summary of Overburden Hydraulic Testing

Borehole	Geological Material Monitored	Test Methodology	
		Falling Head Test by Introducing a Slug[1]	Rising Head Test by Removing a Slug[2]
MW1D	Gravel	✓	✓
MW2S	Silty Clay and Glacial Till[3]	✓	✓
MW3D	Silty Clay[3]	✓	-
MW6D	Sand/Gravel	✓	✓

1. Falling head testing by introducing a slug involved introducing an instantaneous pressure increase to the water column within the well screen (equal to the volume of the slug) and monitoring the dissipation of the water level over time using a groundwater data logging pressure transducer together with an electric water level tape. Falling head testing was carried out on July 26, 2017.
2. Rising head testing by removing a slug involved introducing an instantaneous pressure decrease to the water column within the well screen (equal to the volume of the slug) and monitoring the recovery of the water level over time using a groundwater data logging pressure transducer together with an electric water level tape. Rising head testing was carried out on July 26, 2017.
3. Borehole logs classify soils as clay; soil classification based on nearby test pits and grain size distribution curves.

The well screens were installed within a surround of filter sand. Above the surround of filter sand, bentonite pellets were used to seal the monitoring well from the soil above. Details of the well screens are provided on the Record of Borehole sheets in Appendix D.

3.5.1 Hydraulic Testing Results

The results of the hydraulic testing carried out in the well screens are provided in Appendix G. A summary of the recovery measurements made during slug testing in boreholes MW1D, MW2S, MW3D and MW6D are provided in Table 3.5.

Table 3.5 – Summary of Results for Overburden Hydraulic Testing

Borehole	Geological Material Tested	Static Groundwater Depth (metres bgs[1])	Initial Groundwater Level Displacement (metres)	Recovery Time (seconds)	Recovery (percent)
MW1D (FH)	Gravel	1.29	0.61	20	99
MW1D (RH)	Gravel	1.29	0.89	20	99
MW2S (FH)	Silty Clay and Glacial Till[3]	0.53	0.45	30	95
MW2S (RH)	Silty Clay and Glacial Till[3]	0.53	0.42	30	93
MW3D	Silty Clay[2]	0.19	0.55	1800	64
MW6D (FH)	Sand/Gravel	1.76	0.26	15	99
MW6D (RH)	Sand/Gravel	1.76	0.47	15	99

1. Bgs = below ground surface
2. Water level within well screen (water losses to filter pack).
3. Borehole logs classify soils as clay; soil classification based on nearby test pits and grain size distribution curves.

Hydraulic conductivities calculated from the hydraulic test results carried out at boreholes MW1D, MW2S, MW3D and MW6D are provided in Table 3.6.

Table 3.6 – Calculated Overburden Hydraulic Conductivities

Borehole	Geological Material Monitored	Calculated Hydraulic Conductivity, k (m/s)	
		Falling Head Test by Introducing a Slug	Rising Head Test by Removing a Slug
MW1D	Gravel	6×10^{-4}	3×10^{-4}
MW2S	Silty Clay and Glacial Till[2]	8×10^{-5}	1×10^{-4}
MW3D	Silty Clay[2]	6×10^{-6}	-
MW6D	Sand/Gravel	2×10^{-4}	3×10^{-4}

1. The hydraulic conductivities were calculated using the Hvorslev Analysis.
2. Borehole logs classify soils as clay; soil classification based on nearby test pits and grain size distribution curves.

The hydraulic conductivity of the sand and sand/gravel units are within literature values for sands and gravels, which range from 10^{-6} to 1 m/s (Freeze and Cherry 1979). The hydraulic conductivity for clay units are higher than literature values, which range from 10^{-9} to 10^{-12} m/s. Although the soils are labelled as clay for MW2S and MW3D, subsequent test pit information with supporting grain size distribution curves indicates that soils previously identified as clay are likely to be silty clay. The closest test pit to MW2S (TP16) recorded silty clay and glacial till within the well screen depths. The overburden hydraulic conductivity is anticipated to be variable throughout the site, generally ranging from low permeability silty clay (6×10^{-6} m/s in MW3D) to high permeability sands and gravels (3×10^{-4} m/s in MW6D).

4.0 HYDROGEOLOGICAL CONCEPTUAL MODEL

4.1 Background Information

Based on the results of the review of MECP water well records, land use observations and available geology maps, the local hydrogeology on the subject site and adjacent lands are characterized by offshore marine sediments (clay and silt), nearshore marine sediments (fine to medium sands and sand/gravel), organic deposits (peat and muck) and Paleozoic bedrock. The bedrock geology consists of limestone and shale bedrock of the Simcoe Group. A mapped bedrock fault divides the site at the approximate location of the stream, where limestone and shale of the Verulam Formation is north of the fault and limestone with minor shales in the upper parts of the Bobcaygeon Formation is south of the fault (Figure C2, Appendix C).

4.2 Site Specific Geology

The subject site is primarily underlain by deposits of low permeability silty clay and silty sand till south of the stream that bisects the site and fine to coarse sands and gravels north of the stream, with occasional layers of clayey-silt ranging from 0.3 to 1.5 metres in thickness.

The site-specific geology findings are generally consistent with the findings of the available background information (surficial geology maps) with the exception of organic deposits and bedrock outcrops (refer to Figure C1 in Appendix C). No organic deposits (peat or muck) or exposed bedrock were identified in test pit, borehole, monitoring well, or available water well records. Also, bedrock was not identified during the site walk over. The reclassified surficial geology is presented in Figure C3 in Appendix C. The overburden thickness is presented in Figure C4 in Appendix C.

4.3 Hydrogeological Conceptual Model

The framework for the hydrogeological conceptual model for the subject site is summarized in Table 4.1 below.

Hydrogeological cross-sections for a north-south (Figure 4) and west-east alignment (Figure 5) across the subject site were prepared based information from available on-site monitoring and test wells. Please note that the boundaries between zones indicated on the cross-sections have been interpreted based on available information and may differ somewhat from that indicated. Ground surface elevations for each of the monitoring and test wells were measured using a Trimble R10 global positioning system. The elevations are referenced to geodetic datum.

Table 4.1 – Framework of Hydrogeological Conceptual Model

	Stratigraphic Unit	Generalized Composition	Thickness (m)
North of stream / fault	Overburden	• Topsoil; and, • Coarse-grained glaciomarine; o Relatively thick deposits of fine to medium sands; o Sand and gravel (< 2 metres) overlying the limestone bedrock; and, o Occasional, clayey-silt layers, increasing in thickness to the east (0.3 to 1.5 metres).	7 to 13 metres
	Bedrock	• Limestone and Shale (Simcoe Group – Bobcaygeon Formation)	Unknown
South of stream / fault	Overburden	• Topsoil; • Fine grained glaciomarine; o Silty clay and silt. • Coarse grained glaciomarine; o Fine to medium sands. • Till; and, o Silty to sandy glacial till underlain by coarse sands and gravels; • Thin (1 metre) at the south-western portion of the site (forested area to be preserved).	1 to 10 metres
	Bedrock	• Limestone and Shale (Simcoe Group – Verulam Formation)	Unknown

The bedrock surface elevation ranges from about 103.9 to 118.6 metres Above Mean Sea Level (AMSL) and the base of the well casings range from 101.4 to 112.9 metres AMSL. The elevation of the water bearing zones (depth water found) ranges from 63.4 to 108.5 metres AMSL and the elevation of the bottom of test wells ranged from 52.6 to 80.2 metres AMSL.

It is our assessment that the hydrogeological conceptual model is consistent with available background information and the results of the field investigation on the subject site. Hydrogeological cross sections (refer to Figures 4 and 5) were prepared based on our interpretation of the above noted hydrogeological conceptual model. The alignment of the cross section (Section A-A' and B-B') lines are provided on the Detailed Site Plan in Figure 2.

5.0 IMPACT ASSESSMENT

The impact on groundwater and surface water resources due to wastewater treatment and disposal by individual onsite sewage disposal systems on the subject site are assessed in the following sections.

5.1 Hydrogeological Sensitivity

In the absence of exposed bedrock, karstic features, areas of thin soils or areas of continuous highly permeable soils, the site is not considered to be hydrogeologically sensitive. As discussed in section 3.3 and 4.3, the overburden material generally consisted of deposits of low permeability silty clay and silty sand till south of the stream that bisects the site and fine to coarse sands and gravels north of the stream, with occasional layers of clayey-silt. The overburden thickness at the site is greater than 2.0 metres on all proposed residential and commercial lots (refer to Figure C4 in Appendix C). Some localized areas of thin soils were identified; however, they correspond to preserved forests areas that will not be developed. The coarse sands and gravels on the northern portion of the site are not continuous and contain clayey silt ranging from 0.3 to 1.5 metres in thickness.

5.2 Sewage Disposal Systems

This section discusses the results of the terrain evaluation as related to the installation of sewage disposal systems on the subject site for onsite wastewater treatment and disposal.

It should be noted that the following information is provided for general guidance purposes only and that all septic systems installed on the subject site should be designed on a lot by lot basis using a lot specific investigation involving test holes to determine the actual subsurface conditions at the location of the proposed septic system. In all cases, the septic system design must conform to the Ontario Building Code (OBC) requirements.

5.2.1 Class IV Septic Sewage Disposal Systems

This section discusses the results of the terrain evaluation as they relate to the feasibility of installing Class IV septic sewage disposal systems on the subject site.

The septic system envelope area (septic envelope) represents the area on a lot set aside for the construction of the leaching bed and is for the leaching bed only. It does not include that area required for the septic tank or the isolation/separation distances required by the Ontario Building Code (OBC). The size of the septic system envelope is a function of the percolation rate of the native soil in the vicinity of the septic envelope (or the fill used for the construction of a septic bed) and the daily effluent loading to the septic bed.

It is understood that the septic envelope sizes were estimated by Novatech for the purposes of preparing the Lot Development Plan in Appendix A. The conservative average septic system envelope required to service a single-family dwelling at this site; which was calculated using a conservative design flow of 3,500 litres/day and a conservative loading rate of 6 to 8 L/m^2/day for the silty sand, is 440 to 580 m^2. For those lots which are underlain by silt and clay, a loading rate of 4 litres/m^2/day is considered to be appropriate. The septic envelope area required under this scenario is 875 m^2 (0.088 hectares). This septic system envelope should be readily accommodated on the lot sizes that are proposed (minimum 0.6 hectares), as demonstrated in the Lot Development Plan.

Prior to establishing the actual septic envelope (leaching bed) location on any particular lot, test holes should be excavated to determine the actual subsurface conditions in the area of the proposed leaching bed.

The septic leaching bed design must ensure that the bottom of the absorption trenches is at least 0.9 metres above low permeability soils (such as silty clay), bedrock, and the seasonally high groundwater table. Based on the soil conditions which were observed in the test pits and boreholes, it is expected that some or all of the septic leaching beds at this site will be partially or fully raised.

A site-specific investigation should be carried out on each lot for septic system design purposes to determine the thickness and type of overburden present in any areas proposed for installation of leaching beds.

5.2.2 Tertiary Septic Systems

Approved septic disposal systems that meet the OBC requirements for tertiary treatment could also be considered for this development in place of conventional Class IV septic systems. The disposal beds for tertiary treatment systems require a smaller area than conventional Class IV septic systems. Furthermore, the required separation distance between the underside of the crushed stone layer in the disposal bed and low permeability soils, bedrock, or the seasonally high groundwater table is less than the required 0.9 metres for conventional septic systems. Some tertiary treatment systems are also effective in reducing contaminants, such as nitrate, prior to disposal to the leaching bed.

5.3 Groundwater Impacts

The potential risk to groundwater resources on and off the subject 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, the Three-Step Assessment Process outlining in MECP D-5-4 was followed.

5.3.1 Three-Step Assessment: Step 1 - Lot Size Considerations

Lot sizes of 1.0 hectares or larger are assumed to be sufficient for attenuative processes to reduce nitrate-nitrogen to acceptable concentrations in groundwater below adjacent properties. The proposed lot sizes of 0.4 hectares (minimum) fails this consideration.

5.3.2 Three-Step Assessment: Step 2 – Isolation

Where proposed lot sizes are less than 1.0 hectares, the risk of sewage effluent contamination must be assessed for the proposed subdivision. As per Procedure D-5-4, it is required to:

- Evaluate the most probable groundwater receiver for sewage effluent; and,
- Define the most probable lower hydraulic or physical boundary of the groundwater receiving the sewage effluent.

Based on the hydrogeological conceptual model and as per the isolation requirements of MECP Procedure D-5-4:

- The groundwater receiver for the septic effluent is the overburden groundwater within silty-clays, silty sands, fine to coarse grained sands and sands and gravels.
- The lower hydraulic boundary for the groundwater receiving the septic effluent is primarily low permeability soils (encountered south of the stream intersecting the subject site) and limestone bedrock north of the stream intersecting the subject site.

Further guidance for the determination of isolating conditions is provided in the MECP document entitled “MOEE Hydrogeological Technical Information Requirements for Land Development Applications” dated April 1995. The guidance information is found within Section 3.2.1: Located on Protective Surficial Deposits of Appendix C8: Guideline for Applying 15-08 to Large Subsurface Disposal Systems. The guidance information indicates that:

- Protective surficial deposits are unconsolidated earth materials whose saturated hydraulic conductivities are 10^{-5} cm/sec (or lower) and comprise the top 10 metres of the surficial materials at the site;
- These deposits are likely to be laterally continuous for at least 100 metres;
- These deposits do not contain significant lenses or beds of higher conductivity materials that would:
    - Exceed one metre in cumulative or total thickness;

- Serve as practical sources of groundwater flow to wells; or
- Impair the function of the earth materials as a barrier to contaminant migration.

The result of the hydrogeological conceptual model indicates that the surficial overburden deposits across the site do not meet the above requirements for isolation.

5.3.3 Three-Step Assessment: Step 3 - Nitrate Dilution Calculations

Where it cannot be demonstrated that the effluent is hydrogeologically isolated from the water supply aquifer and the proposed lot sizes are less than 1.0 hectares, the risk of individual on-site septic systems will be assessed using nitrate-nitrogen contaminant loading. The maximum allowable concentration of nitrate in the groundwater at the boundaries of the subject property is 10 milligrams per litre as per the Ministry of the Environment and Climate Change's guideline D-5-4, dated August 1996.

In order to assess the nitrate dilution, the commercial and residential lots were calculated separately. The septic flow for the commercial lots is based on information provided in Guideline D-5-4, Section 5.6.3 and the Carp Road Corridor Nitrate Impact Assessment Recommendations memo dated September 27, 2016, it was determined than an allowable daily design sanitary sewage flow for each of the four proposed commercial lots ranges from 3226 to 8525 litres per day. The details of this are provided on the following table.

Table 5.1 - Allowable Sewage Flow per Commercial Lot (assuming 40% hard surfaced area and tertiary treatment)

Block	Area (m^2)	Infiltration Factor	Precipitation Surplus (m^3/year)	Available Infiltration (litres per day)	Maximum Septic Flow (litres per day)
79	11,300	0.75	3887	4792	4792
80	7,600	0.75	2614	3226	3226
81	20,100	0.75	6914	8525	8525
82	11,800	0.75	4059	5004	5004

The nitrate concentration at the site boundaries was calculated using the following information:

- Subject site divided by residential and commercial lots;
    - Residential (Lots 1-78; refer to Lot Development Plan in Appendix A).
    - Commercial (Lots 79-82).
- Ministry of the Environment and Climate Change's guideline D-5-4, dated August 1996. In consideration of the proposal that the subject site will include both residential and commercial properties, information in both sections 5.6.2 and 5.6.3 of D-5-4 was implemented into our assessment;
- An annual water surplus ranging from 0.299 to 0.363 metres/year (average of Ottawa Airport and Carleton Place data, Environment Canada Water Surplus Datasets attached in Appendix H);
    - Ottawa International Airport (1939-2013) and Carleton Place (1984-2006);
        - 100 mm Sand, 150 mm Silty Sand, 200 mm Glacial Till and 280 mm Silty Clay.
- 78 residential lots are proposed;
    - A varying allowance for hard surface area on the residential lots, roadways, and pathways;
    - A total available area for infiltration of 697,600 square metres, net of hard surfaces (600,915 sq.m. residential/roadways/pathways, 30,635 sq.m. commercial, and 66,040 sq.m. open space);
    - An allowance of 1,000 litres per day of sewage flow per residential lot;
    - An allowance of 40 mg/L of nitrate-nitrogen in the effluent discharging from the proposed Class 4 septic systems;
    - An annual water surplus of 0.336 metres/year for the residential lots (1-78); and,
    - A combined infiltration factor of 0.60 for residential lots (1-78).
- 4 commercial lots are proposed;
    - An allowance for 40 percent hard surface area on the commercial lots;
    - An annual water surplus of 0.361 metres/year for the commercial lots (79-82);
    - A combined infiltration factor of 0.75 for the commercial lots (79-82);
    - An allowance for an average of 2,300 litres per day of sewage flow per commercial lot; (less than the maximum septic flow determined using information provided in Section 5.6.3 of D-5-4; see Table 5.1);
    - A septic flow of 2,300 litres per day per commercial lot corresponds to 30 employees as per the Ontario Building Code 2012.
    - The use of tertiary treatment systems in the construction of the septic systems at each commercial lot, capable of reducing the concentration of nitrate in the effluent exiting the treatment unit to a maximum of 20 mg/L (this concentration value was utilized when re-simplifying the formula provided in D-5-4 for the purpose of determining the factor used to determine the maximum allowable flow for each lot

from the determined available infiltration volume. The factor becomes 1 versus 3 as is the case without tertiary treatment).

The estimated nitrate concentration in the groundwater at the property boundary following development is 6.18 mg/L and 7.69 mg/L for the commercial and residential lots respectively. The calculations and assumptions used are provided in Appendix H. It has been determined that, through dilution of the nitrate stemming from the proposed septic systems, the proposed 4 commercial lots and 78 residential lots can be established while maintaining a nitrate concentration within the groundwater at the property boundary of less than 10 mg/L.

5.4 Background Nitrate Conditions

To further evaluate the potential risk of septic effluent on the water supply aquifer, the background water quality in the receiving overburden aquifer was assessed. Water samples were collected on June 9, 2016 and July 14, 2017 from all available overburden monitoring wells. In addition, a water quality sample was collected on June 28, 2019 from MW4-R, which serves as a replacement for the abandoned MW4. Nitrate concentrations varied throughout the site, with non-detectable concentrations on the southern portion of the site (<0.05 to <0.1 mg/L for MW2S, MW2D, MW3S, MW3D and MW5S) and nitrate concentrations on the northern portion of the site ranging from <0.1 to 7.86 mg/L in MW 1S, MW1D, MW4S, MW 4D, MW6S and MW 6D (Table 5.2).

The background nitrate concentrations are attributed to previous agricultural practices which occurred on the subject site. Compared to historical data (October 23, 2004), nitrate concentrations measured in 2016, 2017 and 2019 are consistent spatially and are generally decreasing over time. Some variability was observed in MW4D which reported an increase in the latest sampling event. The background nitrate sampling was completed over three seasons (fall 2004, spring 2016, summer 2017 and summer 2019) and the variability may in part be related to seasonal variations. It is anticipated that the nitrate concentrations will continue to decrease over time following the change of land use, from agricultural to fallow lands.

Table 5.2: Nitrate Concentrations in Overburden monitoring wells

Nitrate[1]	MW 1		MW 2		MW 3		MW 4		MW 5	MW 6	
mg/L	S[3]	D[4]	S	D	S	D	S	D	S	S	D
Oct 23, 2004	4.12	9.47	<0.05	<0.05	<0.05	<0.05	12.5	5.76	<0.05	-	-
Jun 9, 2016	2.56	7.86	<0.05	<0.05	<0.05	<0.05	5.75	3.02	<0.05	2.17	1.32
Jul 14, 2017	2.1	7.3	<0.1	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	0.5
Jun 28, 2019	-	-	-	-	-	-	4.3[2]	7.8[2]	-	-	-

1. Nitrite levels for all monitoring wells are at non-detectable levels (<0.05 mg/L)
2. Monitoring wells MW4S and MW4D were decommissioned in late 2016 (current commercial property). Monitoring wells MW4S-R and MW4D-R reinstalled to same specifications and within 30 metres of the decommissioned monitoring wells in May 2019.
3. S = Shallow wells (screened 1.5 to 3 metres b.g.s)
4. D = Deep wells (screened 4.5 to 6 metres b.g.s)

Based on the average nitrate concentrations in the shallow and deep monitoring wells on the northern portion of the site, the background nitrate concentration is estimated to be 3.4 mg/l (Table 5.3). As the northern portion of the subject site only occupies 20% of the proposed development, the weighted average background nitrate concentration in the receiving overburden aquifer at the subject site is estimated to be 0.8 mg/L.

Table 5.3: Nitrate Concentrations Summary (Northern Portion of Site)

Nitrate mg/L	MW 1		MW 4		MW 6		Arithmetic Average		Overburden Aquifer Average
	S[1]	D[2]	S	D	S	D	S	D	S + D
Oct 23, 2004	4.12	9.47	12.5	5.76	-	-	8.3	7.6	7.8
Jun 9, 2016	2.56	7.86	5.75	3.02	2.17	1.32	3.5	4.1	3.7
Jul 14, 2017	2.1	7.3	-	-	<0.1	0.5	2.43	4.43	3.4
Jun 28, 2019	-	-	4.3[4]	7.8[4]	-	-	-	-	-

1. S = Shallow wells (screened 1.5 to 3 metres b.g.s)
2. D = Deep wells (screened 4.5 to 6 metres b.g.s)
3. Arithmetic average for July 14, 2017 calculated using average of MW 4 June 9, 2016 and June 28, 2019 nitrate concentrations.

4. Monitoring wells MW4S and MW4D were decommissioned in late 2016 (current commercial property). Monitoring wells MW4S-R and MW4D-R reinstalled to same specifications and within 30 metres of the decommissioned monitoring wells in June 2019.

In addition, two water samples were collected from the stream on June 30, 2016, one upstream entering the site and the other downstream, leaving the site (Figure 2). Nitrate concentrations in the stream were <0.05 mg/L upstream and 0.34 mg/L downstream (Table 5.4).

Table 5.4: Nitrate Concentrations in Surface Water (refer to Figure 2 for sample locations)

Location	Date	Nitrate Concentrations (mg/L)
SW-1 (Upstream)	June 30, 2016	<0.05
SW-2 (Downstream)	June 30, 2016	0.34

Based on the results of the nitrate groundwater sampling and water level monitoring, the following conclusion are presented:

- Nitrate concentrations in the shallow and deep overburden monitoring wells have generally decreased from previously reported levels in 2004. Residual nitrate concentrations are attributed to past agricultural practices and levels are expected to continue to decrease over time;
- Nitrate concentrations in on-site bedrock test wells were non-detectable in all samples;
- Based on water level measurements across the subject site, groundwater flow in the overburden (shallow and deep overburden wells) is towards the stream that bisects the subject site; therefore, offsite impacts associated with nitrates are not anticipated.
- Nitrate concentrations over the northern portion of the site decrease in a northerly (up gradient) direction, from well MW 1 to MW 6, further supporting the notion that offsite impacts will not likely occur;
- Based on surface water samples at the upstream and downstream property boundaries, nitrate impacts to the stream appear to be negligible;
    - Sewage systems should be constructed at an appropriate setback from the surface water boundaries in accordance with the Ontario Building Code and any municipal requirements.
- Water levels in the bedrock are higher than the overburden water levels indicating upward gradients in the bedrock;
    - Artesian conditions observed in TW2 suggests a semi-confined to confined bedrock aquifer system at that location.
- The nitrate concentrations at the property boundary, based on nitrate dilution calculations, is estimated to be:
    - Commercial Lots (79-82) = 6.2 mg/L + background concentration of 3.4 mg/L;
    - Residential Lots (1-78) = 7.7 mg/L + background concentration of 0.8 mg/L.

It has been determined that, through dilution of the nitrate stemming from the proposed septic systems, the proposed 4 commercial lots and 78 residential lots can be established while maintaining a nitrate concentration within the groundwater at the property boundary of less than 10 mg/L. Therefore, the proposed subdivision meets the requirements of the Three-Step Assessment Process as outlined in MECP D-5-4.

5.5 Aquifer Vulnerability

The background documentation (see section 2.1) identifies the subject site to be located within a high recharge (City of Ottawa, 2004), highly vulnerable aquifer (MCSPR, 2011) with weak downward gradients (Dillon, 2004). The background reports indicate that the information conveyed by mapping is regional in nature and is not suitable for use in site specific evaluations.

The on-site investigation identified the overburden aquifer to have a weak downward gradient at the majority of the site (MW 1, MW3 and MW4) and a slightly upward gradient in the vicinity of MW2. The test wells, screened in the bedrock, have a higher hydraulic head, indicating upward vertical hydraulic gradients. In addition, artesian conditions at TW2 suggest the water supply aquifer is at least partially confined. This is supported by the non-detectable nitrate concentrations in the bedrock test wells, compared to the nitrate concentrations observed in the overburden aquifer. The proposed low impact development (78 lot residential and 4 lot commercial subdivision) does not pose a negative risk to groundwater quantity or quality based on the groundwater supply investigation (see section 6.0) and the three-step nitrate assessment (MECP D-5-4).

A review of the site uses in the vicinity of the subject site identified a landfill located 1.3 kilometres to the northwest. Based on the hydrogeological and groundwater impact assessment reports prepared for the landfill (see section 2.2.3), groundwater impacts at the subject site are not anticipated based on the groundwater flow directions, distance to the site and ongoing remediation of off-site water quality.

6.0 GROUNDWATER SUPPLY

A groundwater supply investigation was carried out in accordance with the MECP August 1996 document “Procedure D-5-5, Technical Guideline for Private Wells: Water Supply Assessment”, to determine the quantity and quality of groundwater available for domestic water supply. The results of the groundwater supply investigation are summarized in the following sections.

6.1 Test Well Construction

The MECP Procedure D-5-5 document indicates that a minimum of seven test wells are required for sites more than 60 hectares and up to 80 hectares, with the site under investigation being 70 hectares. Five test wells (TW 1 to TW 5) were drilled by Air Rock Drilling Co. Ltd. under Well Contractor License No. 1119 and were completed on March 14 to 18, 2003. Three additional wells (TW6 to TW8) were drilled by Air Rock Drilling Co. Ltd. and completed October 6-11, 2017; copies of the MECP Water Well Records and the Certificates of Well Compliance (Well Grouting Inspections) are provided in Appendix I.

The locations of the new test wells were chosen to provide maximum coverage of the site and with the intent for future use as water supply wells on individual lots (Figure 2). The geographical references for the test wells are provided in the respective MECP Water Well Records.

Well grouting inspections were carried out by GEMTEC staff during the sealing of the well casings in test wells TW 6, TW 7 and TW8. The test wells were constructed using a nominal 159 millimetre inside diameter steel casing. All of the test wells were completed with steel well casings installed a minimum of 6.1 metres (20 feet) below the ground surface. The construction details of the test wells are summarized in Table 6.1.

Table 6.1 – Summary of Test Well Construction Details

Test Well	Depth to Bedrock (m BGS)	Depth of Well Casing (m BGS)	Depth Water Found (m BGS)	Total Well Depth (m BGS)
TW 1	12.2	14.6	18.3 & 44.2	62.5
TW 2	4.6	6.7	15.2 & 34.4	36.6
TW 3	10.0	12.8	41.1 & 51.8	55.2
TW 4	7.6	10.0	45.1	61.0
TW 5	1.1	6.7	-	67.1
TW 6	6.4	8.2	9.1 & 32.3 & 41.7	43.6
TW 7	4.0	6.1	32.9	55.8
TW8	4.3	6.1	8.5 & 29.9 & 41.8	43.6

6.2 Pumping Tests Field Procedure

The pumping tests for the test wells used in this study were conducted March 17, 2003 to March 24, 2003 for TW 1 to TW 4. Due to initial low well yields, test wells TW 1 and TW4 were re-pumped on July 5, 2017 and May 16, 2016, respectively.

Six to eight-hour duration constant discharge rate pumping tests were conducted in each test well. The pump discharge was directed to the ground surface at a distance ranging from 5 to 10 metres from the test wells and in a manner such that the flow of water on the ground surface was directed away from the test wells. Based on the overburden geology, thickness and the duration of pumping, this is considered to be sufficient to ensure that artificial recharge does not occur.

6.2.1 Water Level Measurements

During the pumping tests, water level measurements were taken at regular intervals in the well being pumped using an electric water level tape and on a continuous basis using electronic data loggers. After the pump was shut off, water level data was collected until a minimum of 95 percent of the drawdown in water level had recovered in the test wells or two hours had passed. The water level measurements for the drawdown and recovery data for the pumping tests are provided in Appendix J. The drawdown data was measured with reference to the top of the well casings.

Water level measurements were also taken from other onsite test wells (observation wells) during the pumping of select test wells to determine potential interference effects between the test wells during pumping. Water level measurements taken in the observation wells are provided in Appendix J.

6.2.2 Flow Rate Measurements

The flow rate of the pump discharge hose was maintained at a constant flow rate. The discharge nozzle of the pump hose was outfitted with a critical flow nozzle which ensures that the flow rate of the pump is restricted to the critical flow nozzle calibration rate. A summary of the flow rate and duration from the pumping tests of the test wells is provided in Table 6.2:

Table 6.2 – Pump Test Flow Rates

Test Well	Date	Flow Rate (litres per minute)	Duration (Hours)	Discharge Volume (Litres)
TW 1	March 22, 2003	9	9	4,860
TW1	July 5, 2017	18.9	6	6,804
TW 2	March 24, 2003	23	6	8,280
TW 3	March 17, 2003	32	6	11,520
TW 4	March 19, 2003	14	6	5,040
TW4	May 16, 2016	26.5	8	12,720

Test Well	Date	Flow Rate (litres per minute)	Duration (Hours)	Discharge Volume (Litres)
TW 5	July 12, 2017	18.9	1	1,134
TW 6	October 19, 2017	22	6	7,920
TW 7	October 18, 2017	38	6	13,680
TW8	October 17, 2017	57	6	20,520

6.2.3 Groundwater Sampling

Total chlorine tests were conducted in the field to ensure that chlorine levels were at 0.0 mg/L prior to sampling for bacteriological testing. The temperature, conductivity, total dissolved solids, pH, turbidity and total chlorine levels of the groundwater were measured at periodic intervals during the pumping tests and are summarized in Appendix K. The field equipment used during the pumping test is calibrated monthly by GEMTEC and the details of field equipment are provided in Table 6.3:

Table 6.3 – Field Equipment Overview

Field Parameters	Manufacturer	Model No.
Total Chlorine	Hach	CN-60
pH, temperature, TDS and Conductivity	Hanna	HI 98129
Turbidity	Hanna	HI 98703

Groundwater samples for laboratory analysis were collected from the test wells half way through pumping and within the last hour of pumping (i.e. 6 hour test = 3 hour / 6 hour sampling and 8 hour test = 4 hour / 8 hour sampling).

The groundwater samples were collected in laboratory supplied bottles and prepared/preserved in the field in accordance with the industry standard sampling, handling and preservation procedures required by the laboratory. All water samples, including samples for metal analysis, were unfiltered. The groundwater samples were subsequently submitted to accredited laboratories in Ottawa, Ontario for chemical, physical and bacteriological analyses as listed in the MECP guideline titled “Technical Guideline for Private Wells: Water Supply Assessment”, dated August 1996.

6.3 Test Well Water Quality

The results of the chemical, physical and bacteriological analyses of the water samples from the test wells are summarized in Appendix K and the Laboratory Certificates of Analyses are provided in Appendix L.

6.3.1 Maximum Acceptable Concentration Exceedances

The proposed water supply aquifer, based on water samples collected from the onsite test wells, does not contain any maximum acceptable concentration exceedances of the Ontario Drinking Water Standards (ODWS). Based on the absence of health-related exceedances and the results of the bacteriological testing, the water from the proposed water supply aquifer is safe for consumption. It should be noted that total coliform exceedances were detected in multiple test wells, however following chlorination and re-sampling, all test wells reported non-detectable Total Coliform levels. A summary of the bacteriological exceedances is provided below.

- TW 1 (March 21, 2003) – Total Coliform reported as no data; overgrown with non-target;
    - Non-detectable Total Coliform following chlorination and re-sampling on August 21-22, 2003;
- TW 1 (July 5, 2017) – Total Coliform: 7 counts per 100 mL;
    - Non-detectable Total Coliform following chlorination and re-sampling on November 7-8, 2017;
- TW 2 (March 22, 2003) – Total Coliform reported as no data; overgrown with non-target;
    - Non-detectable Total Coliform following chlorination and re-sampling on August 20-21, 2003;
- TW 4 (May 10, 2016) – Total Coliform reported as no data; overgrown with non-target;
    - Non-detectable Total Coliform following chlorination and re-sampling on May 19-20, 2016.

6.3.2 Bacteriological Parameters

Total chlorine measurements made at regular intervals during the pumping test confirmed that total chlorine concentrations in the well water was non-detectable at the time of bacteriological sampling.

The results of the bacteriological analysis indicate that the water samples met all the standards of the ODWS for bacteriological parameters (following chlorination and re-pumping in test wells TW1, TW2 and TW4). Based on the bacteriological testing, the water is suitable for consumption.

6.3.3 Other Health Related Parameters

No maximum acceptable concentration limits of the ODWS were exceeded in the water samples collected from the onsite test wells.

6.3.4 Operational Guideline Exceedances

Operational related exceedances of the Ontario Drinking Water Standards (ODWS) were detected for hardness (in all test wells sampled) and for organic nitrogen (TW 8). The operational guideline exceedances are discussed in the following section:

Hardness

The concentration of hardness in water samples obtained from all seven (7) test wells ranged from 201 to 395 mg/L as $CaCO_3$ and was higher than the operational guideline of 80 to 100 mg/L of $CaCO_3$ as specified in the ODWS.

Water having a hardness level above 80 to 100 mg/L as CaCO3 is often softened for domestic use. The MECP Procedure D-5-5 document states that water having a hardness value more than 300 mg/L is considered "very hard". The Ontario Ministry of the Environment publication entitled "Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines", states that water with hardness in excess of 500 mg/L is considered to be unacceptable for most domestic purposes. There is no upper treatable limit for hardness specified in MECP Procedure D-5-5.

The concentrations of hardness in all the test wells are below the reported threshold of 500 mg/L as CaCO3 as specified in the Technical Support Document for the ODWS. The concentration of hardness observed in the test wells is considered to be reasonably treatable using a conventional water softener. Most water supply wells within rural eastern Ontario are equipped with water softeners.

Water softening by conventional sodium ion exchange may introduce relatively high concentrations of sodium into the drinking water that 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 the water at background levels. Consideration could also be given to providing a bypass of the water softener for drinking water purposes (for example, a bypass of the softener to the cold-water kitchen tap).

Organic Nitrogen

The organic nitrogen concentration (total kjeldahl nitrogen – ammonia) exceeded the operational guideline of 0.15 mg/L for Ontario Drinking Water Standards (ODWS) in samples from test well

TW 8. Of the seven test wells sampled, only TW 8 slightly exceeded the ODWS with a concentration of 0.2 mg/l.

The ODWS indicates that levels of organic nitrogen in excess of 0.15 mg/L may be caused by septic tank or sewage effluent contamination and is typically associated with Dissolved Organic Carbon (DOC) contribution of 0.6 mg/L. The DOC in TW 8 was reported to be 2.5 and 2.3 mg/L in the 3-hr and 6-hr sample respectively. Organic nitrogen can react with chlorine and severely reduce its disinfectant power; in addition, taste and odour problems may also occur.

The observed organic nitrogen concentration in TW 8 does not appear to be representative of the background groundwater quality at the subject site. In addition, it is not expected that chlorination will be utilized by homeowners in the residential subdivision and, as such, no concerns with the operational objective exceedance for organic nitrogen were identified.

6.3.5 Aesthetic Objective Exceedances

Aesthetic objective exceedances of the Ontario Drinking Water Standards (ODWS) were detected for manganese (TW1, TW6 and TW8), iron (all test wells except TW7), turbidity (TW1, TW4 and TW7 lab only), sulphide (TW2, TW3, TW6 and TW7) and total dissolved solids (TW1, TW4, TW6). These exceedances are discussed in the following sections:

Manganese

The manganese concentration in all test wells ranged from 0.006 to 0.191 mg/L. The manganese concentration in TW 1, TW6 and TW8 is above the aesthetic objective of 0.05 mg/L listed by the ODWS. Manganese can naturally occur in groundwater and elevated levels of manganese may cause staining to plumbing fixtures and laundry, and effect the taste of the water. However, the manganese level is well within the maximum reasonably treatable limits (1.0 mg/l) provided in Table 3 of the Appendix in the MECP Guideline D-5-5.

Iron

The iron levels within the on-site test wells ranged from <0.1 to 1.0 milligrams per litre. With the exception of TW7, all remaining test wells exceeded the aesthetic objective of 0.3 milligrams per litre listed by the ODWS. Elevated levels of iron may cause staining to plumbing fixtures and laundry. However, the iron level is well within the maximum reasonably treatable limits (5.0 mg/l) provided in Table 3 of the Appendix in the MECP Guideline D-5-5.

Turbidity

The laboratory Certificates of Analysis indicates that the level of turbidity in test wells TW 1 (2003 and 2017), TW3 (2003), TW4 (2003) and TW7 (2017) exceeded the ODWS aesthetic objective. However, it should be noted that turbidity may be affected by various factors to which the water sample would have been subjected from the time of sampling to the time of analysis. As such, field measurements of turbidity are considered to be more representative of the water being sampled. The turbidity levels during the pumping tests for all test wells, with the exception of TW3, indicated that the turbidity level continuously decreased throughout the pumping test and was less than 5 NTU at the time of sampling. Test well TW3 was further developed and pumped for a period of approximately seven hours on August 25, 2003. Field measurements of turbidity following the additional pumping was measured to be <1.0 NTU.

Based on the field measurements the level of turbidity in all of the test wells meets the ODWS aesthetic objective.

Hydrogen Sulphide

Hydrogen sulphide levels of 0.16, 3.70, 0.39 and 0.30 were measured at the end of the pumping tests at TW2, TW3, TW6 and TW7 respectively. The hydrogen sulphide in the test wells is likely naturally occurring. The Ministry of Environment (MOE) indicates that hydrogen sulphide levels of up to 2.5 mg/l can be reasonably treatable using a manganese greensand filter. Based on past discussion with MOE personnel who set the MOE treatability limits, it is understood that the treatability limits are a conservative estimate of treatability. Valley Plumbing and Treatment of Perth, Ontario, water treatment specialists, were contacted to provide information on current capabilities of hydrogen sulphide treatment systems. Valley Plumbing indicated that hydrogen sulphide levels in drinking water of up to 20 mg/l can be treated using an air injection system such as Odour Oxidizer by Amitrol or equivalent. Accordingly, the hydrogen sulphide levels measured at the site are indicated to be readily treatable.

Total Dissolved Solids

The Total Dissolved Solids (TDS) levels in test wells TW1, TW4 and TW6 were reported to be 660, 512 and 502 mg/l respectively, which exceeds the ODWS aesthetic objective of 500 milligrams per litre. Elevated levels of TDS can lead to problems associated with encrustation and corrosion.

To determine the corrosive nature of the groundwater, the Langelier Saturation Index (LSI) was calculated for the samples obtained from the test wells. These values are based on the TDS, temperature, pH, alkalinity, and calcium observed in the sample. A copy of the calculation to determine the LSI value is provided in Appendix M. The LSI was calculated to be 0.77, 0.94 and 0.76 for TW1, TW4 and TW6 respectively. This indicates that the water is scale forming but non corrosive. In our experience, the palatability of water with a TDS concentration of that measured should not be an issue.

6.3.6 Testing for Pesticides

A sample of water was obtained from TW3 on October 23, 2004 and delivered to Accutest Laboratories Ltd. for pesticides testing. The results of the testing are provided in Appendix L and indicate no detectable levels of pesticides in the sample.

6.3.7 Comparison Between 2003 and 2016/2017 Water Quality

Tests wells TW1 and TW4 were originally pumped and sampled in 2003 and then re-pumped in July 2017 and May 2016 respectively. The ODWS exceedances are summarized in Table 6.5 below.

Table 6.5 –2003 and 2016/2017 ODWS Exceedances Test Wells TW 1 and TW 4

TW 1 March 21, 2003	TW 1 July 5, 2017	TW 4 March 19, 2003	TW 4 May 10, 2016
Hardness	Hardness	Hardness	Hardness
Turbidity	Turbidity	Turbidity	-
-	Iron	Iron	Iron
-	Total Dissolved Solids	-	-
-	Manganese	-	-

The water quality in TW1 and TW4 has not significantly changed between the earlier and more recent sampling rounds, with a few exceptions described below. Notable changes in water quality in TW1 include increases in chloride (66 to 86 mg/l) and decreases in sodium (47 to 38.8 mg/l) and fluoride (0.23 to <0.1 mg/l). Notable changes in water quality in TW4 include increases in chloride (49 to 133 mg/l) and sodium (32 to 56.7 mg/l) and decreases in fluoride (0.7 to 0.23 mg/l). The variability in water quality observed from 2003 to 2016 and 2017 may be attributed to the further development of the test wells, both of which had increased well yields (discussed in section 6.5 below).

All water quality parameters continue to meet the ODWS and/or aesthetic objective treatability limit; no health-related parameters were exceeded. To note, TW1 had an initial total coliform exceedance (7 CFU/100mL) and TW4 had non-reportable values (overgrown) upon resampling. These exceedances can be attributed to the test wells not being used for 10+ years; following chlorination and additional pumping, both TW1 and TW4 reported non-detectable total coliform.

6.3.8 Water Quality Spatial Variability

The spatial variability of groundwater at the subject site was assessed using piper diagrams created in GW_Chart (Winston, R.B., 2000, Graphical User Interface for MODFLOW, Version 4: U.S. Geological Survey Open-File Report 00-315, 27 p.). Piper diagrams are used to understand the sources of dissolved constituents in groundwater using analytical data. The water quality information from all bedrock test wells were used. The following parameters were obtained from the ‘subdivision package’ and used as inputs: calcium, magnesium, sodium, potassium, chloride, sulphate and total dissolved solids. Carbonate and bicarbonate were converted from alkalinity. The piper diagram for the bedrock water quality is provided in Appendix K. The seven test wells are clustered together, with no dominant or calcium dominant cation. The dominant anion is bicarbonate and the groundwater can generally be classified as a calcium bicarbonate type.

Based on geologic mapping of the area, the test wells are completed in limestone and shale bedrock of the Bobcaygeon and/or Verulam Formation of the Simcoe Group. With the exception of TW3, which indicated shale bedrock on the Water Well Record, the remaining bedrock test wells were completed in limestone bedrock. Based on the water quality results and piper diagrams, no significant water quality variability was observed across the subject site.

6.4 Off-Site Water Quality

6.4.1 Well Survey 2005

A survey of six existing wells at the Arbourbrook Subdivision on the north side of the subject site and seven existing wells in the Huntley Manor subdivision on the south side of the side were carried out in the fall of 2003. As part of the well survey, well owners were questioned as to any problems experienced with the quantity of water obtained from their wells. The well owners interviewed indicated that the wells in question have been supplying water for domestic family dwelling for some 1 to 17 years. Only one of the 13 well owners indicated any problem with water quantity. That well owner (on Huntley Manor Drive) indicated that about five years ago (1998) their well had to be deepened for quantity purposes to some 107 metres but since that time, with the use of a storage tank, no water quantity problems have been experienced. All of the well owners indicated that conventional water softeners are utilized for their well water to treat hardness, iron and/or manganese.

Water samples were collected from two nearby private wells located on private lots to characterize groundwater quality at established wells in the vicinity of the subject site. The water samples were collected April 8, 2005 from two residences located on Huntley Manor Drive (samples labelled “Turcotte” and “KHOL1”), directly adjacent to the subject site. The exact locations are not provided in this report to respect participant’s privacy. The addresses of the private lots are maintained on file at GEMTEC’s office. The results of the private well sampling were provided to each of the well owners separately by means of a letter and the Laboratory Certificates of Analysis are provided in Appendix N.

The private well samples were collected in laboratory supplied bottles and prepared/preserved in the field in accordance with the industry standard sampling, handling and preservation procedures required by the laboratory. The private well samples were subsequently submitted to Accutest laboratories Ltd. in Ottawa, Ontario for analysis chemical, physical and bacteriological analyses as listed in the MECP guideline titled “Technical Guideline for Private Wells: Water Supply Assessment”, dated August 1996.

Water samples were collected directly from the pressure tank or an untreated sample point (as determined by the well owner) after purging the water system at full flow for a period of about 10 to 15 minutes. When contacting well owners for collection of a water sample, it was requested that we be provided access to an untreated sample point.

Based on the results of the water sampling for offsite private wells, the water quality in the vicinity of the subject site is considered to be good and no significant exceedances of the ODWS were identified. Furthermore, no health-related parameters were exceeded.

6.4.2 Well Survey 2019

Given the background water quality sampling was completed in 2005, additional water quality samples were collected from the Huntley Manor and Arbourbrook Subdivisions. A door-to-door survey was initiated along Huntley Manor Drive (Huntley Manor Subdivision) and Sentinel Pine Way (Arbourbrook Subdivision) on May 30, 2019 until one homeowner in each subdivision agreed to participate in the voluntary water quality sampling. One homeowner along Huntley Manor Drive ("PW1") and the second ("PW2") along Sentinel Pine Way were interviewed and they allowed water quality samples to be collected from untreated taps, following the same procedure outlined in the 2005 well survey above. The Laboratory Certificates of Analysis and associated MECP Water Well Records are provided in Appendix N. The well owners interviewed indicated that their well water quality was good and they have not had any water quantity concerns. The homeowner on Huntley Manor Drive (PW1) indicated the groundwater to have high iron concentrations.

6.4.3 Comparison between Onsite Test Wells and Offsite Private Wells

Table 6.4 provides a list of all Ontario Drinking Water Standards (ODWS) aesthetic objective (AO) and operational guideline (OG) exceedances for both the onsite test wells, offsite private wells sampled during the course of this investigation and water quality results from four test wells within the McGee Subdivision (refer to section 2.1.6).

Table 6.4 - Comparison of Test Well and Private Well Exceedances

Onsite Test Wells (2004, 2016, 2017)	Huntley Manor (April 5, 2005)	Huntley & Arbourbrook (May 30, 2019)	McGee Estates Test Wells (Aug 2009)
Hardness (7/7)	Hardness (2/2)	Hardness (2/2)	Hardness (4/4)
-	Turbidity (1/2)	-	Turbidity (3/4)
Hydrogen Sulphide (4/7)	-	-	Hydrogen Sulphide (4/4)
Iron (6/7)	Iron (2/2)	Iron (1/2)	-
Manganese (3/7)	Manganese (1/2)	-	-

Onsite Test Wells (2004, 2016, 2017)	Huntley Manor (April 5, 2005)	Huntley & Arbourbrook (May 30, 2019)	McGee Estates Test Wells (Aug 2009)
Organic Nitrogen (1/7)	Organic Nitrogen (1/2)	-	Organic Nitrogen (1/4)
Total Dissolved Solids (3/7)	Total Dissolved Solids (1/2)	-	Total Dissolved Solids (1/4)
-	Colour (1/2)	-	-

1. Refer to Detailed Site Plan, Figure 2, for well locations.

Generally, both on-site and off-site private wells have similar ODWS exceedances. Notable differences include iron and manganese exceedances in the on-site test wells and Huntley Manor Subdivision private wells. One of the four private wells sampled had ODWS exceedances of colour, turbidity, total dissolved solids, iron and manganese. The elevated iron concentrations, measured to be 1.0 mg/L is likely the cause of the elevated turbidity and colour concentrations, as the iron may precipitate out of solution between the time the sample is collected and tested in the laboratory.

Based on the laboratory results of the onsite test wells and offsite private wells, the onsite test wells are likely utilizing the same aquifer as the offsite private wells.

6.5 Pumping Test Analysis

6.5.1 Pump Test Analysis Overview

The drawdown and recovery water level data from the eight test wells are provided in Appendix J. Test wells TW1 and TW4 were re-pumped in order to confirm aquifer transmissivity and water quality parameters. The details of the pumping tests carried out on the test wells are provided in Table 6.6 and 6.7 below. All depths provided are in metres below ground surface (m BGS).

Table 6.6 – Pumping Tests Details (2003)

Parameter	TW 1 Mar 22/03	TW 2 Mar 24/03	TW 3 Mar 17/03	TW 4 Mar 19/03
Duration (minutes)	540	360	360	360
Flow Rate (litres per minute)	9	23	32	14
Static Water Level (m BGS)	3.43	0.93	1.19	3.45

Parameter	TW 1 Mar 22/03	TW 2 Mar 24/03	TW 3 Mar 17/03	TW 4 Mar 19/03
Well Depth (m BGS)	62.5	36.6	55.2	61.0
Available Drawdown (m)	58	34	53	56
Water Level at End of Pumping (m BGS)	44.19	20.78	11.80	21.06
Observed Drawdown at End of Pumping (m)	40.76	19.85	10.61	17.61
Percent Drawdown Utilized (%)	70.3	58.4	20.0	31.4
Specific Capacity (Litres/min/m)	0.2	1.2	3.0	0.8

Table 6.7 – Pumping Tests Details (2016-2017)

Parameter	TW 1 Jul 5/17	TW 4 May 16/16	TW 5[1] Jul 12/17	TW 6 Oct 19/17	TW 7 Oct 18/17	TW 8 Oct 17/17
Duration (minutes)	374	480	-	360	360	360
Flow Rate (litres per minute)	18.9	26.5	-	22	38	57
Static Water Level (m BGS)	1.89	1.75	-	0.27	1.42	0.49
Well Depth (m BGS)	62.5	61.0	-	43.6	55.8	43.6
Available Drawdown (m)	60.6	59.2	-	43.3	54.4	43.1
Water Level at End of Pumping (m BGS)	2.29	18.4	-	1.82	3.1	0.78

Parameter	TW 1 Jul 5/17	TW 4 May 16/16	TW 5[1] Jul 12/17	TW 6 Oct 19/17	TW 7 Oct 18/17	TW 8 Oct 17/17
Observed Drawdown at End of Pumping (m)	0.40	16.7	-	1.56	1.69	0.28
Percent Drawdown Utilized (%)	0.66	28.2	-	4.2	3.1	0.65
Specific Capacity (Litres/min/m)	47.2	1.6	-	14.1	22.5	203.6

1. Test well 5 did not yield sufficient water, not used as a test well.

As per MECP Procedure D-5-5, each of the test wells was pumped at a flow rate greater than 18.8 litres per minute for 6 hours. The largest percent drawdown utilized at the end of pumping was 70.3% in test well TW 1 (with the exception of TW5 which did not have sufficient water), which corresponds to a 40.76 metre drawdown. The drawdown utilized in the remaining test wells ranged from 0.65 to 70.3 percent. Test wells TW1 and TW4 were re-pumped on July 5, 2017 and May 16, 2016 respectively to confirm aquifer transmissivity. Both wells were capable of pumping at rates greater than 18.8 litres per minute for greater than six hours. The increase in aquifer transmissivity may be attributed to further well development (additional pumping) or development in the vicinity of the subject site (drilling and hydrofracturing).

Based on these results, all of the onsite test wells are capable of supplying water at a rate greater than 18.8 litres per minute for a period greater than six hours. This is considered more than sufficient for typical domestic use. The only exception was test well TW5 which is now situated in a tree conservation area outside of the proposed lot development plan (refer to Appendix A).

6.5.2 Transmissivity Analysis

The transmissivity of the water supply aquifer was estimated from the pumping test drawdown and recovery data using Aqtesolv version 4.5, a commercially available software program from HydroSOLVE Inc. The water supply aquifer is modelled as a confined to leaky-confined aquifer based on pumping test and water level observation data. As such, the pumping tests results were analyzed for both, confined and leaky-confined conditions. The results of the Aqtesolv 4.5 analyses are provided in Appendix J.

6.5.2.1 Pumping Test TW 1

March 22, 2003

Test well TW 1 was pumped at a constant rate of 9 L/min for 540 minutes. The drawdown in the pumped well gradually increased to 40.76 metres throughout the 540 minutes of pumping. The water level in the test well recovered 95% in 120 minutes after the pump was shut off.

Aquifer parameters were evaluated using drawdown and recovery data from the pumping well. The specific capacity of the well at the time of maximum drawdown was 0.2 L/min/m. The aquifer transmissivity estimates are summarized below:

- Confined aquifer, Cooper-Jacob Analysis, 1 x 10^{-6} m^2/s
- Confined aquifer, Theis Recovery Analysis, 7 x 10^{-7} m^2/s
- Leaky Confined Aquifer, Hantush-Jacob, 7 x 10^{-7} m^2/s
- Leaky Confined Aquifer, Hantush-Jacob Recovery, 5 x 10^{-7} m^2/s

The average transmissivity of the bedrock aquifer in the area of the test well is calculated to be 9 x 10^{-7} m^2/sec assuming a confined aquifer and 6 x 10^{-7} m^2/s assuming a leaky confined aquifer.

July 5, 2017

Test well TW1 was re-pumped July 5, 2017 to confirm aquifer transmissivity and water quality. Test well TW 1 was pumped at a constant rate of 18.9 L/min for 374 minutes. The drawdown in the pumped well increased to 0.40 m after 30 minutes of pumping and remained at that level for the remaining 344 minutes of pumping. The water level in the test well recovered 100% in 60 minutes after the pump was shut off.

Aquifer parameters were evaluated using drawdown and recovery data from the pumping well. The specific capacity of the well at the time of maximum drawdown was 47.25 L/min/m. The aquifer transmissivity estimates are summarized below:

- Confined aquifer, Cooper-Jacob Analysis, 2 x 10^{-4} m^2/s
- Leaky Confined Aquifer, Hantush-Jacob, 1 x 10^{-4} m^2/s

The average transmissivity of the bedrock aquifer in the area of the test well is calculated to be 2 x 10^{-4} m^2/sec assuming a confined aquifer and 1 x 10^{-4} m^2/s assuming a leaky confined aquifer.

6.5.2.2 Pumping Test TW 2

Test well TW 2 was pumped at a constant rate of 23 L/min for 360 minutes. The drawdown in the pumped well gradually increased to 14 metres throughout the first 200 minutes of pumping and then increased to approximately 20 metres in the following 160 minutes. The water level in the test well recovered 99% in 35 minutes after the pump was shut off.

Aquifer parameters were evaluated using drawdown and recovery data from the pumping well. The specific capacity of the well at the time of maximum drawdown was 1.2 L/min/m. The aquifer transmissivity estimates are summarized below:

- Confined aquifer, Cooper-Jacob Analysis, 1 x 10^{-5} m^2/s
- Confined aquifer, Theis Recovery Analysis, 5 x 10^{-6} m^2/s
- Leaky Confined Aquifer, Hantush-Jacob, 6 x 10^{-6} m^2/s
- Leaky Confined Aquifer, Hantush-Jacob Recovery, 3 x 10^{-6} m^2/s

The average transmissivity of the bedrock aquifer in the area of the test well is calculated to be 7 x 10^{-6} m^2/sec assuming a confined aquifer and 4 x 10^{-6} m^2/s assuming a leaky confined aquifer.

6.5.2.3 Pumping Test TW 3

Test well TW 3 was pumped at a constant rate of 32 L/min for 360 minutes. The drawdown in the pumped well gradually increased to 10.6 metres throughout the pumping test. The water level in the test well recovered 99% in 120 minutes after the pump was shut off.

Aquifer parameters were evaluated using drawdown and recovery data from the pumping well. The specific capacity of the well at the time of maximum drawdown was 2.9 L/min/m. The aquifer transmissivity estimates are summarized below:

- Confined aquifer, Cooper-Jacob Analysis, 6 x 10^{-5} m^2/s
- Confined aquifer, Theis Recovery Analysis, 2 x 10^{-5} m^2/s
- Leaky Confined Aquifer, Hantush-Jacob, 9 x 10^{-6} m^2/s
- Leaky Confined Aquifer, Hantush-Jacob Recovery, 1 x 10^{-5} m^2/s

The average transmissivity of the bedrock aquifer in the area of the test well is calculated to be 4 x 10^{-5} m^2/sec assuming a confined aquifer and 9 x 10^{-6} m^2/s assuming a leaky confined aquifer.

6.5.2.4 Pumping Test TW 4

March 19, 2003

Test well TW 4 was pumped at a constant rate of 14 L/min for 374 minutes. The drawdown in the pumped well gradually increased to approximately 21.5 metres throughout the first 220 minutes and then began to decrease during the remaining 154 minutes. The water level in the test well recovered 97% in 55 minutes after the pump was shut off.

Aquifer parameters were evaluated using drawdown and recovery data from the pumping well. The specific capacity of the well at the time of maximum drawdown was 0.6 L/min/m. The aquifer transmissivity estimates are summarized below:

- Confined aquifer, Cooper-Jacob Analysis, 3 x 10^{-6} m^2/s
- Confined aquifer, Theis Recovery Analysis, 3 x 10^{-6} m^2/s
- Leaky Confined Aquifer, Hantush-Jacob, 1 x 10^{-6} m^2/s
- Leaky Confined Aquifer, Hantush-Jacob Recovery, 6 x 10^{-7} m^2/s

The average transmissivity of the bedrock aquifer in the area of the test well is calculated to be 3 x 10^{-6} m^2/sec assuming a confined aquifer and 8 x 10^{-7} m^2/s assuming a leaky confined aquifer.

May 16, 2016

Test well TW4 was re-pumped May 16, 2016 to confirm aquifer transmissivity and water quality. Test well TW 4 was pumped at a constant rate of 26.5 L/min for 480 minutes. The drawdown in the pumped well gradually increased to 16.7 metres after 480 minutes of pumping. The water level in the test well recovered 97% in 45 minutes after the pump was shut off.

Aquifer parameters were evaluated using drawdown and recovery data from the pumping well. The specific capacity of the well at the time of maximum drawdown was 1.6 L/min/m. The aquifer transmissivity estimates are summarized below:

- Confined aquifer, Cooper-Jacob Analysis, 1 x 10^{-5} m^2/s
- Confined aquifer, Theis Recovery Analysis, 7 x 10^{-6} m^2/s
- Leaky Confined Aquifer, Hantush-Jacob, 7 x 10^{-6} m^2/s

The average transmissivity of the bedrock aquifer in the area of the test well is calculated to be 8 x 10^{-6} m^2/sec assuming a confined aquifer and 7 x 10^{-6} m^2/s assuming a leaky confined aquifer.

6.5.2.5 Pumping Test TW 5

The water well record for test well TW5 reported no water found and no pump test was conducted following drilling on March 18, 2003. The test well was pumped on July 12, 2017 at a rate of 18.9 litres per minute and following one hour of pumping was dry. No aquifer transmissivity analysis was conducted.

6.5.2.6 Pumping Test TW 6

Test well TW 6 was pumped at a constant rate of 22 L/min for 360 minutes. The drawdown in the pumped well increased to 1.56 metres after 30 minutes of pumping and remained at that level for the remaining 330 minutes of pumping. The water level in the test well recovered 95% in 15 minutes after the pump was shut off.

Aquifer parameters were evaluated using drawdown and recovery data from the pumping well. The specific capacity of the well at the time of maximum drawdown was 14.1 L/min/m. The aquifer transmissivity estimates are summarized below:

- Confined aquifer, Cooper-Jacob Analysis, 7 x 10^{-5} m^2/s
- Confined aquifer, Theis Recovery Analysis, 8 x 10^{-5} m^2/s
- Leaky Confined Aquifer, Hantush-Jacob, 4 x 10^{-5} m^2/s
- Leaky Confined Aquifer, Hantush-Jacob Recovery, 8 x 10^{-5} m^2/s

The average transmissivity of the bedrock aquifer in the area of the test well is calculated to be 7 x 10^{-5} m^2/sec assuming a confined aquifer and 6 x 10^{-5} m^2/s assuming a leaky confined aquifer.

6.5.2.7 Pumping Test TW 7

Test well TW 7 was pumped at a constant rate of 38 L/min for 360 minutes. The drawdown in the pumped well gradually increased to 1.69 metres throughout the 360 minutes of pumping. The water level in the test well recovered 95% in 85 minutes after the pump was shut off.

Aquifer parameters were evaluated using drawdown and recovery data from the pumping well. The specific capacity of the well at the time of maximum drawdown was 22.5 L/min/m. The aquifer transmissivity estimates are summarized below:

- Confined aquifer, Cooper-Jacob Analysis, 4 x 10^{-4} m^2/s
- Confined aquifer, Theis Recovery Analysis, 3 x 10^{-4} m^2/s
- Leaky Confined Aquifer, Hantush-Jacob, 7 x 10^{-5} m^2/s
- Leaky Confined Aquifer, Hantush-Jacob Recovery, 2 x 10^{-4} m^2/s

The average transmissivity of the bedrock aquifer in the area of the test well is calculated to be 3 x 10^{-4} m^2/sec assuming a confined aquifer and 9 x 10^{-5} m^2/s assuming a leaky confined aquifer.

6.5.2.8 Pumping Test TW 8

Test well TW 8 was pumped at a constant rate of 57 L/min for 360 minutes. The drawdown in the pumped well increased to 0.28 m after 40 minutes of pumping and remained at that level for the remaining 320 minutes of pumping. The water level in the test well recovered 99% in 15 minutes after the pump was shut off.

Aquifer parameters were evaluated using drawdown and recovery data from the pumping well. The specific capacity of the well at the time of maximum drawdown was 203.6 L/min/m. An aquifer transmissivity of 2 x 10^{-3} m^2/sec was estimated using the Cooper-Jacob method for the water level drawdown data and pumping rates. The aquifer transmissivity estimates are summarized below:

- Confined aquifer, Cooper-Jacob Analysis, 2 x 10^{-3} m^2/s

- Confined aquifer, Theis Recovery Analysis, 2 x 10^{-3} m^2/s
- Leaky Confined Aquifer, Hantush-Jacob, 1 x 10^{-3} m^2/s

The average transmissivity of the bedrock aquifer in the area of the test well is calculated to be 2 x 10^{-3} m^2/sec assuming a confined aquifer and 1 x 10^{-3} m^2/s assuming a leaky confined aquifer.

6.5.3 Unified Aquifer Parameters

The unified parameter values were calculated the geometric mean from the specific capacity and transmissivity values of the current investigation (Table 6.8).

Table 6.8 – Summary of Aquifer Parameters

Unified Aquifer Parameters	Minimum	Maximum	Arithmetic Average	Geometric Mean
Specific Capacity (Litres/min/m)	1.2	203.6	10.8	41.9
Transmissivity – Confined (m^2/sec)	5 x 10^{-6}	2 x 10^{-3}	4 x 10^{-4}	8 x 10^{-5}
Transmissivity – Leaky Confined (m^2/sec)	3 x 10^{-6}	1 x 10^{-3}	1 x 10^{-4}	3 x 10^{-5}

Notes: The specific capacity and transmissivity of TW 1 and TW4 from the most recent pumping test data was used in the calculations.

The geometric mean was computed in addition to the arithmetic average. The geometric average is a more representative "average" of a natural population (Gaussian distribution). Based on the unified parameter calculations, the specific yield of the bedrock water supply aquifer at the subject site is 41.9 litres per minute per metre and the transmissivity is estimated to be 8 x 10^{-5} m^2/s assuming a confined aquifer and 3 x 10^{-5} m^2/s assuming a leaky confined aquifer.

6.6 Hydraulic Interference Effects

During the pumping of the onsite test wells TW 6, TW7 and TW 8 on October 17 to October 19, 2017, water level measurements were taken every 15 minutes at test wells TW2, TW3, TW6, TW7 and TW8 using electronic dataloggers. During the pumping of test well TW1 on July 5, 2017, water level measurements were taken every 15 minutes at test wells TW2 and monitoring wells MW1D. The water level measurements in the observation wells are reported in Appendix J and discussed below.

6.6.1 Bedrock Observation Wells

The change in water level measurements in bedrock monitoring wells (test wells not being pumped) during the pumping tests for test wells TW 1, TW 6, TW 7 and TW 8 ranged from 0.03 to 0.20 metres (decrease in water level). The measured drawdown in each of the observation wells is provided in Appendix J. Based on the observed water levels during pumping, hydraulic interference between wells is expected to be minimal. The well interference effects are further discussed in section 6.6.3 below.

6.6.2 Overburden Observation Wells

The change in water level measurements overburden monitoring well MW1D (screened 4.5 to 6.0 metres below ground surface in sand and gravel) during the pumping tests for test well TW 1 decreased approximately 0.03 metres. The 0.03 metre decrease in water level is within the daily water level fluctuations for MW1D and does not appear to be the result of pumping from test well TW1. Based on the water level observations in the overburden monitoring well (MW1D), the overburden does not appear to be hydraulically connected to the bedrock aquifer in the vicinity of the test well.

6.6.3 Interference Effects from Neighbouring Subdivisions

As discussed in section 3.4.3., electronic dataloggers were installed in two bedrock test wells, TW1 and TW2, for approximately four to six weeks. Both TW1 and TW2 are located on proposed residential lots directly adjacent to the neighbouring Arbourbrook Estates Subdivision, which has 67 residential and 2 commercial lots. The bedrock test wells displayed minimal groundwater fluctuations of 0.31 and 0.59 metres for TW1 and TW2 respectively, during the time they were installed. The maximum daily fluctuations were 0.08 to 0.35 metres for TW1 and TW2 respectively.

The long-term groundwater level monitoring in the two on-site bedrock test wells act as observation wells to the 69-lot subdivision. The data suggests that there is minimal interference between the on-site test wells and the neighbouring residential subdivision; therefore, no significant interreference effects are anticipated.

6.6.4 Computer Model Simulations

A well interference simulation was developed using Aqtesolv version 4.5. A scenario was developed and the well simulation output is provided on Figure O1 in Appendix O for discussion purposes. A discussion of the simulation and the parameters used in its development are provided in the following sections. No estimates of the storativity are available; however, typical values for confined aquifers range from 5 x 10^{-5} to 5 x 10^{-3} (Todd, 1980).

6.6.4.1 Scenario 1 (Figure O1 - Appendix O)

Scenario 1 is provided to illustrate the maximum drawdown using the unified aquifer parameters identified in Table 6.8. The average storativity for confined aquifers was used (Todd, 1980).

Furthermore, the individual pumping rate of 18.9 litres per minute is used for both residential and commercial properties. The peak demand for commercial properties is expected to occur over a larger time period (i.e. 8 hour day) and therefore a peak demand of 18.9 litres per minute should be sufficient to represent commercial well usage.

The following parameter values were utilized in the model:

- Number of pumping wells = 82 wells (78 residential and 4 commercial);
- Individual well pumping rate = 18.9 litres per minute;
- Duration of pumping = 120 minutes;
- Analysis model = Theis
- Aquifer thickness = Confined aquifer, 60 metres;
- Aquifer transmissivity = 8 x 10^{-5} m^2/s (geomean; current investigation); and,
- Storativity coefficient = 5 x 10^{-4}.

The results of Scenario 1 simulation indicate that the maximum drawdown within the site is about 4.0 to 4.5 metres and the maximum interference between wells is approximately 0.5 to 1.0 metres. The drawdown decreases to less than 0.1 metres a distance of approximately 100 metres from the pumping wells and is a maximum of approximately 0.5 metres at the property boundary. The computer simulation results are consistent with the observed long-term water level fluctuations in TW1 and TW2. Therefore, based on the results of the well interference simulation and long-term water level monitoring of TW1 and TW2, the interference between drinking water wells is deemed negligible.

6.6.4.2 Scenario 2 (Figure O2 - Appendix O)

Scenario 2 is provided to illustrate the maximum drawdown assuming a leaky-confined aquifer. The average storativity for confined aquifers was used (Todd, 1980). Furthermore, the individual pumping rate of 18.9 litres per minute is used for both residential and commercial properties. The peak demand for commercial properties is expected to occur over a larger time period (i.e. 8 hour day) and therefore a peak demand of 18.9 litres per minute should be sufficient to represent commercial well usage.

The following parameter values were utilized in the model:

- Number of pumping wells = 82 wells (78 residential and 4 commercial);
- Individual well pumping rate = 18.9 litres per minute;
- Duration of pumping = 120 minutes;
- Analysis model = Theis
- Aquifer thickness = Leaky-confined aquifer, 60 metres;
- Leakage Factor (1/B) = 0.4 (average leakage factor from pumping test data);
- Aquifer transmissivity = 3 x 10^{-5} m^2/s (geomean; current investigation); and,

- Storativity coefficient = 5 x 10^{-4}.

The results of Scenario 2 simulation indicate that the maximum drawdown within the site is approximately 5.5 metres and the maximum interference between wells is negligible. The drawdown is localized to the individual water wells and no drawdown is observed at the property boundaries. The computer simulation results are consistent with the observed long-term water level fluctuations in TW1 and TW2. Therefore, based on the results of the well interference simulation and long-term water level monitoring of TW1 and TW2, the interference between drinking water wells is deemed negligible.

6.7 Long Term Well Yields

The British Columbia Ministry of the Environment (2012) estimates the long-term well yield by first determining the well's specific capacity after 100 days of pumping (theoretical drawdown without recharge). The assessment was carried out using the following data:

- Time (t) - 100 days;
- Pumping Rate (Q) – 27.2 m3/day (based on peak flow of 18.9 litres per minute);
- Transmissivity (T) – 3 x 10-5 m2/s (assumes a leaky confined aquifer as a conservative approach; refer to Table 6.8);
- Distance (r) - 0.078 metres (based on radius of open hole test well);
- Storativity (S) – 5 x 10-4 (based on an estimate of storativity from Todd, 1980); and,
- Maximum Available Drawdown (D) – 34 metres (conservative maximum available drawdown from TW2; refer to Tale 6.6).

First, the drawdown in the aquifer after 100 days of pumping is calculated using the Modified Nonequilibrium Equation (Groundwater and Wells 2nd Ed., Driscoll, 1986):

$$\mathrm{s} = \frac{0.183 \cdot Q}{T} \cdot Log\, \frac{2.25 \cdot T \cdot t}{r^2 \cdot S}$$

The specific capacity after 100 days (SC) is calculated using the pumping flow rate (Q) and estimated drawdown after 100 days (S):

$$\mathrm{SC} = \frac{\mathrm{Q}}{\mathrm{s}}$$

The safe well yield (Q_{safe}) can then be estimated by multiplying the specific capacity after 100 days of pumping (SC) by the maximum available drawdown (D) by a safety factor of 0.7:

$$\mathrm{Q}_{\mathrm{safe}} = 0.7 \times \mathrm{SC}_{100} \times \mathrm{D}_{\mathrm{available}}$$

Using this approach, the safe well yield was calculated for the average scenario based on unified transmissivity values. The safe well yield was calculated to be approximately 41 litres per minute of continuous pumping for 100 days. This is two times greater than the peak pumping rates of 18.9 litres per minute for a period of 2 hours, as outlined in MECP Procedure D-5-5.

7.0 CONCLUSIONS

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

- The site geology consists of glaciomarine deposits (clayey silts to fine to medium sands), glacial till, and sand and gravel overlying the proposed bedrock water supply aquifer.
- The overburden of the subject site is characterized by shallow bedrock conditions on the southwestern portion of the subject site (1.0 to 2.2 metres) with the overburden depth increasing in a north-easterly direction. Overburden thickness on the proposed residential and commercial lots is greater than 2.0 metres.
- Water levels measured in on-site wells indicate downward vertical gradients within the overburden and upward vertical gradients between the overburden and bedrock. Based on the artesian conditions observed in TW2, the water supply aquifer is at least partially confined.
- The test well construction is typical of wells which will be used in the development in the future.
- Interference between drinking water wells is expected to be negligible under typical usage for residential developments. This is based on observations made during groundwater pumping tests, long-term groundwater level monitoring and groundwater model simulations.
- The water quality determined in the course of this investigation is representative of the long-term water quality which future lot owners are likely to obtain from their wells constructed in accordance with the well construction recommendations.
- The water quality available from drilled wells on the subject site is safe for consumption based on the absence of health-related exceedances of the ODWS.
- The quality of the groundwater meets the Ministry of the Environment and Climate Change Regulations, Standards, Guidelines and Objectives with the exception of hardness (all wells), organic nitrogen (1 of 7 wells), iron (6 of 7 wells), manganese (3 of 7 wells), total dissolved solids (3 of 7 wells) and hydrogen sulphide (4 of 7 wells). Following well chlorination, no health-related parameters have been exceeded.
    - The levels of hardness and iron are considered to be reasonably treatable using a conventional water softener (Table 3 of the Appendix of MOE Guideline D-5-5).
    - The level of organic nitrogen is an operational parameter intended for use in waters requiring chlorination for disinfection purposes. As there are no disinfection requirements for the subject site, this operational exceedance is not of concern.
    - An unofficial addendum to Procedure D-5-5 (July 6, 1995) indicates that sulphide concentrations of up to 2.5 mg/L can be reasonably treated with manganese

greensand filters. Based on past discussions with the MOE personnel who set the MOE treatability limits, it is understood that the treatability limits are a conservative estimate. Valley Plumbing and Treatment of Perth, Ontario, water treatment specialists, indicated that hydrogen sulphide levels in drinking water of up to 20 mg/L can be treated using air injection systems such as Odour Oxidizer or equivalent.

- The quantity of groundwater available from the proposed water supply aquifer is more than sufficient for the proposed development and will sustain repeated pumping at the test rate and duration at 24-hour intervals over the long term. The well yields determined in the course of this investigation are representative of the long-term yields which future lot owners are likely to obtain from their wells constructed in accordance with the well construction recommendations.
    - It is noted that the water supply recommendations from the neighbouring McGee Meadow Estates Subdivision states that drilled wells may require hydrofracking to increase well yields.
- The proposed subdivision (low impact development) meets the MECP D-5-4 Groundwater Impact Assessment (Three-Step Process).
    - Individual on-site septic systems will not cause concentrations of nitrate-nitrogen in groundwater to exceed 10 mg/L at the downgradient property boundary based on contaminant attenuation concentrations.

8.0 RECOMMENDATIONS

The following provides recommendations regarding well construction specifications, water quality and septic system design:

8.1 Well Construction Recommendations

- Any original test wells which are not located in suitable locations for future development use and any other existing wells located on the property should be abandoned by a licensed well driller in accordance with MECP regulations following draft plan approval of the subdivision;
- All wells that are drilled in the subdivision should be constructed in accordance with local and MECP regulations, including but not limited to Ontario Reg. 903. In addition, it is recommended that all new wells be installed in the bedrock aquifer;
- Drinking water wells should be located so that they meet and preferably exceed the minimum setback distances from septic systems, property lines and any other sources of contamination, as required in the Ontario Building Code and/or Ontario Reg. 903;
- Well casings should be extended at least 6.0 metres below ground surface. The entire annular space between the steel casing and the overburden/bedrock should be filled with a suitable cement or bentonite grout;

    - In addition to the minimum recommended well casing lengths specified in the preceding recommendation, all well casings should be completed a minimum of 1.5 metres into sound, competent bedrock;
- A well grouting certification inspection should be conducted during the installation and grouting of the well casing for future wells installed on the subject site. The well grouting certification inspection should be conducted under the supervision of a professional engineer or professional geoscientist;
- It is recommended that newly drilled water wells be developed by the well driller for a minimum of one hour of pumping following completion of the well drilling. This well development can be carried out in conjunction with the one-hour pumping test that is required for the MECP Water Well Record;
- It is recommended that newly drilled water wells be chlorinated by the well driller following completion of the well drilling and pumping.
- The test wells completed for this study were completed at depths ranging from 36.6 to 62.5 metres below ground surface. Future drinking water wells completed on the subject site at depths outside of this range may encounter different hydrogeological conditions and the quality and quantity of water available from drilled wells may differ than that presented in this study; and,
- A statement should be added to the subdivision agreement to inform residents that drilled wells located adjacent to William Mooney Road may require hydro-fracturing to increase the well yield sufficiently to provide water at a rate of 18.9 litres per minute for a period greater than six hours. This recommendation is based on the results of the McGee Meadow Estates Subdivision and on-site test well TW5.

8.2 Well Ownership Recommendations

- It is recommended that the property owners construct, 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”.
- The use of earth energy systems shall not be permitted within the subdivision.
- For all newly drilled wells, it is recommended that a raw water sample be collected and analyzed for potability requirements (E. Coli. and total coliform bacteria).
    - If any bacteriological exceedances of the Ontario Drinking Water Standards (ODWS) are noted in the sampling, then it is recommended that the homeowner take remedial actions (such as chlorination of the well to eliminate bacteria) and retest a raw water sample to confirm that the remedial actions were effective.
- It is recommended that homeowners be informed that hardness levels may exceed the ODWS operational guidelines. Conventional water softeners may be desired by homeowners to treat minor aesthetic objective and operational guideline exceedances of the ODWS such as hardness. On heating, hard water has a tendency to form scale

deposits and can form excessive scum with regular soaps. Conversely, soft water may result in accelerated corrosion of water pipes.

- Aeration of well water (or other treatment such as activated charcoal filters, chlorination, manganese greensand filters and other forms of oxidizing treatment) may be desired by homeowners to treat aesthetic objective exceedances of the ODWS for hydrogen sulphide;
- It is recommended that homeowners be informed that water softening by conventional sodium ion exchange 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 the water at background levels. Consideration could also be given to providing a bypass of the water softener for drinking water purposes.
- Potential residents should be informed of the following information:
  - Background sodium levels in the drinking water wells at the site may exceed the warning level for persons on sodium restricted diets;
  - The following water quality parameters may not meet the ODWS operational guidelines in drinking water wells completed at the subject site:
    - Hardness – Hardness levels in the onsite test wells were greater than the operational guideline for hardness and can be expected in future wells drilled at the property.
    - Organic nitrogen – Organic nitrogen levels in onsite test wells encountered a single exceedance of the operational guideline for organic nitrogen; this result may occur in future wells drilled at the property. Taste and odour problems are common with organic nitrogen levels greater than the operational guideline. In addition, organic nitrogen levels in exceedance of the operational guideline can react with chlorine disinfection systems and severely reduce its disinfection power.
  - The following water quality parameters may not meet the ODWS aesthetic objectives in drinking water wells completed at the subject site:
    - Iron – Iron concentrations in some of the water samples from onsite test wells exceeded the ODWS aesthetic objective for iron and a similar condition may be encountered in future wells drilled at the property. Excessive levels of iron may impart a brownish colour to laundered goods, plumbing fixtures and the water itself; it may also produce a bitter, astringent taste in water and beverages; and the precipitation of iron can promote the growth of iron bacteria in water distribution systems. Any iron exceedances can be effectively treated with the use of conventional water softener (up to 5 mg/L), oxidation with filtration through proprietary media (up to 10 mg/L) or chlorination followed by sand or multimedia filtration (up to 10 mg/L).

    - Sulphide – Sulphide levels in four of the onsite test wells exceeded the ODWS aesthetic objective for sulphide and a similar condition may be encountered in future wells drilled on the subject site. Although ingestion of large quantities of sulphide can produce toxic effects on humans, it is unlikely that an individual would consume a harmful dose in drinking water because of the associated unpleasant taste and odour. Sulfide, in association with iron, produces black stains on laundered items and black deposits on pipes and fixtures. Hydrogen sulphide can be effectively treated through the use of activated charcoal filters, chlorination, manganese greensand filters and other forms of oxidizing treatment.

8.3 Septic System Construction Recommendations

- Septic systems should be located in general accordance with the Lot Development Plan prepared by Novatech.
- The proposed residential lots will be serviced by conventional septic sewage disposal systems designed according to the Ontario Building Code. A site-specific investigation should be conducted on each lot for the design of the septic system;
    - Tertiary septic systems could be considered for the proposed residential lot development and/or individual property owners. Any tertiary systems should be designed according to the Ontario Building Code. A site-specific investigation should be conducted on each lot for the design of the septic system.
    - It is recommended that if property owners choose to install tertiary treatment septic systems, then it will be required to enter a maintenance agreement with authorized agents of the system manufacturer for the service life of the system.
    - In view of the percolation time of the native silty clay on the southern portion of the site, a sand mantle should be allowed for on some of the proposed lots.
- The proposed commercial lots will be serviced by tertiary treatment septic sewage disposal systems that achieve a minimum of 50% reduction in nitrogen, approved under the Ontario Building Code, prior to the effluent being disposed to a Class IV leaching bed (Type A or Type B). A site-specific investigation should be conducted on each lot for the design of the septic system;
    - It is required that the property owners enter a maintenance agreement with authorized agents of the tertiary treatment septic system manufacturer for the service life of the system;
    - The proposed commercial lots (lots 79-82) shall have sewage flows limited to those outlined in Table 5.1 – Allowable Sewage Flow Per Commercial Lot and the average sewage flow for the four commercial lots shall be 2,300 litres per day.
    - If during the site plan approval process, the proposed commercial septic system design flow exceeds the preliminary septic flow recommendation for a specific lot, then it is recommended that a detailed groundwater impact assessment be conducted. If the detailed groundwater impact assessment demonstrates that

additional septic flow can be accommodated on the lot, then the preliminary septic flow recommendation for that lot should be amended accordingly.

8.4 Septic Ownership Recommendations

- It is recommended that the property owners construct, maintain and check their onsite septic system in accordance with the Ontario Building Code.

8.5 Site Phasing and Performance Reviews

- The proposed 78 residential lots should be completed in two phases, with no more than 40 lots in any phase (refer to the Lot Development Plan in Appendix A for lot and phasing locations).
- Performance reviews will be conducted in accordance with MECP Procedure D-5-5 Private Wells: Water Supply Assessment, section 4.7 Phased Developments.
- To provide information on the groundwater quality and septic system performance for each phase of the development, groundwater samples will be obtained from a representative number of wells on nearby lots within the previous phases. The wells will be sampled prior to the registration of the next phase for chemical, physical and bacteriological analyses listed in the Ontario Ministry of the Environment (MOE) guideline titled “Technical Guideline for Private Wells: Water Supply Assessment”, dated August 1996. The wells would be chosen based on groundwater flow directions and the locations of septic systems, such that the results are representative of the groundwater available from drilled wells in the subsequent phases.
- Carry out interviews with the homeowners at the sampling locations to identify any problems with the existing septic system or the water quality and quantity.
- Maintain the results of all sampling/testing and resident interviews in a spreadsheet to easily track any potential groundwater quality or quantity issues. The spreadsheet would also include Global Positioning Systems (GPS) data for each well used in the study.
- The results of the proposed performance evaluation would be reported prior to the registration of the subsequent phases. The report would include the MECP Water Well Records for the private wells sampled and a site plan showing the sampled well locations as well as any other wells drilled in the subdivision.
- In accordance with the MOE guideline D-5-5, the recommendations and requirements provided in the hydrogeological report and terrain evaluation will be assessed and updated, if required, based on the findings of the investigations for the performance reports and/or a change in the surrounding land use.

9.0 LIMITATIONS OF REPORT

This report was prepared for 1384341 Ontario Ltd and is intended for the exclusive use of 1384341 Ontario Ltd. This report may not be relied upon by any other person or entity without the express written consent of GEMTEC and 1384341 Ontario Ltd. Nothing in this report is intended to provide a legal opinion.

The investigation undertaken by GEMTEC with respect to this report and any conclusions or recommendations made in this report reflect the best judgments of GEMTEC based on the site conditions observed during the investigations undertaken at the date(s) identified in the report and on the information available at the time the report was prepared. This report has been prepared for the application noted and it is based, in part, on visual observations made at the site, subsurface investigations at discrete locations and depths and laboratory analyses of specific chemical parameters and material during a specific time interval, all as described in the report. Unless otherwise stated, the findings contained in this report cannot be extrapolated or extended to previous or future site conditions, portions of the site that were unavailable for direct investigation, subsurface locations on the site that were not investigated directly, or chemical parameters, materials or analysis which were not addressed.

Should new information become available during future work, including excavations, borings or other studies, GEMTEC should be requested to review the information and, if necessary, re-assess the conclusions presented herein.

We trust that this report is sufficient for your requirements. If you have any questions concerning this information or if we can be of further assistance to you on this project, please call.

Andrius Paznekas, M.Sc.
Environmental Scientist

LICENSED PROFESSIONAL ENGINEER
S. G. PELKEY
100220192
21 Aug 2019
PROVINCE OF ONTARIO

Shaun Pelkey, M.Sc.E., P.Eng.
Principal, Environmental Engineer

10.0 REFERENCES

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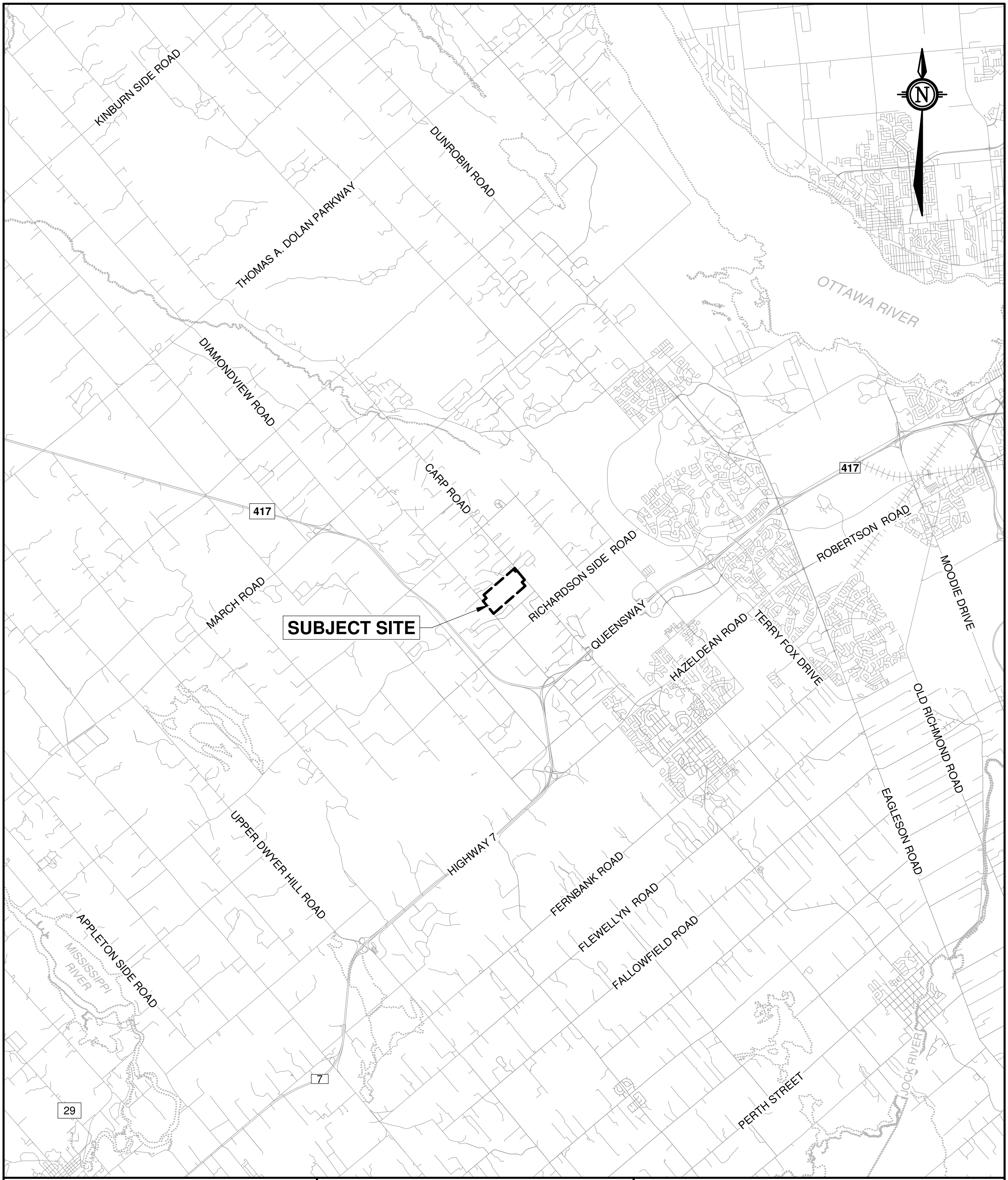

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Project
HYDROGEOLOGICAL INVESTIGATION
2727 CARP ROAD
OTTAWA, ONTARIO

Drawing
KEY PLAN

Drwn By	Chkd By	Date	Project No.	Revision No.	
P.C.	A.P.	AUGUST 2019	61813.15	0	**FIGURE 1**

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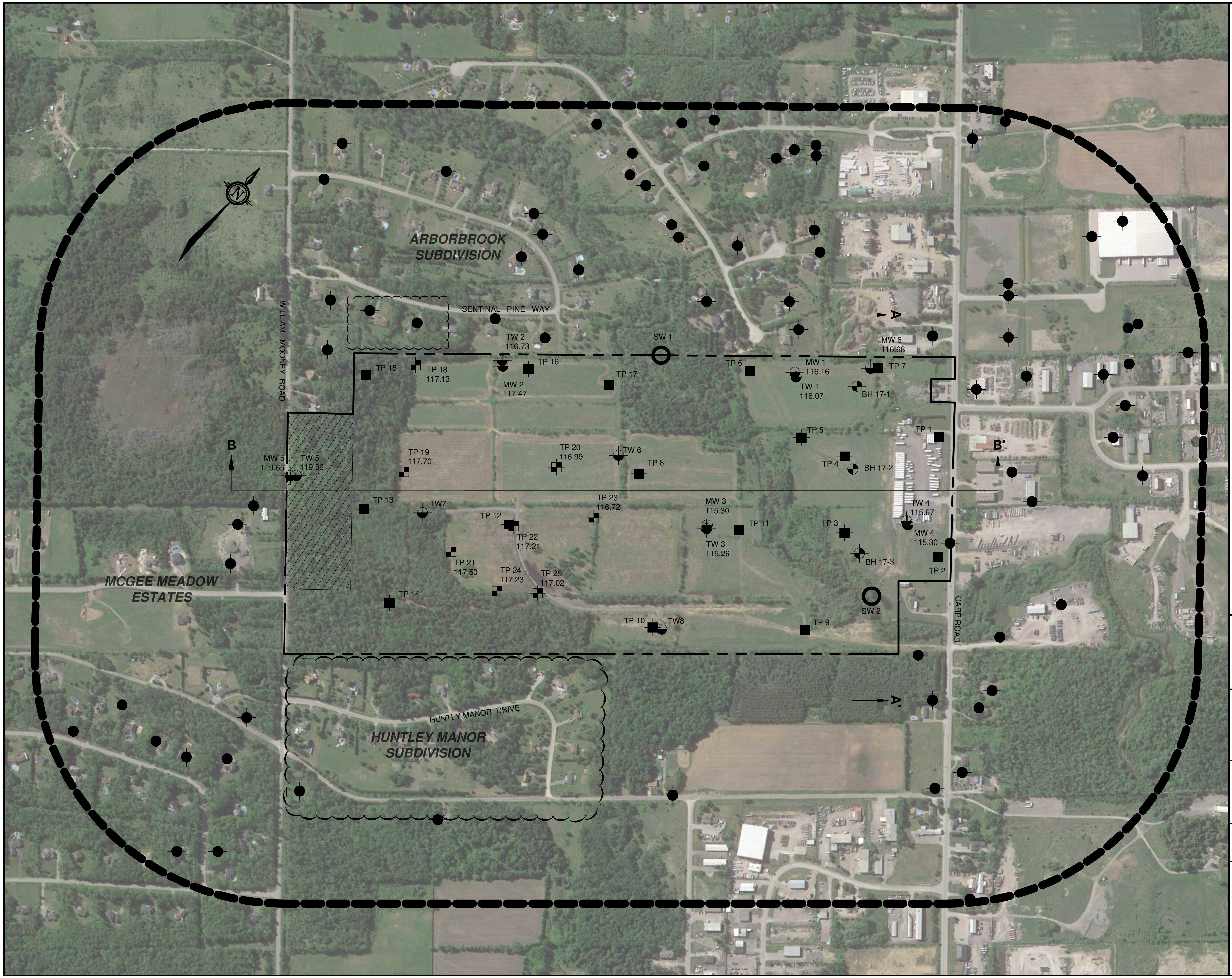

LEGEND

TP 1 ▚	TEST PIT LOCATION (current investigation by GEMTEC)
BH 17-1 ◐	BOREHOLE (current investigation by GEMTEC)
TW 1 ◐	TEST WELL (current investigation by GEMTEC)
MW 1 ◒	MONITORING WELL LOCATION (current investigation by GEMTEC)
TP 1 ■	TEST PIT - APPROXIMATE LOCATION (previous investigation by GEMTEC, 2017)
SW 1 ●	AVAILABLE MECP WATER WELL RECORDS
SW 1 ○	SURFACE WATER SAMPLING (approximate location)
BH/TP/MW #	BOREHOLE/TEST PIT/MONITORING WELL ID
XX.XX	GROUND SURFACE ELEVATION, IN METRES GEODETIC DATUM
— - - —	SUBJECT SITE
▬ ▬ ▬ ▬	500 METRE BUFFER SHOWING EXTENT OF STUDY AREA
A A'	CROSS SECTION (current investigation by GEMTEC)
▨	FORESTED AREA TO BE PRESERVED (Refer to lot development plan by Novatech)
○	APPROXIMATE LOCATION OF PRIVATE WELLS SAMPLED

Scale

1:7500

0 150 300 450m

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Drawing

DETAILED SITE PLAN

Client

1384341 ONTARIO LTD.

Project
61318.15

Drwn by
P.C.

Chkd by
A.P.

HYDROGEOLOGICAL
INVESTIGATION
2727 CARP ROAD
OTTAWA, ONTARIO

Date
AUGUST 2019

Rev.
0

FIGURE 2

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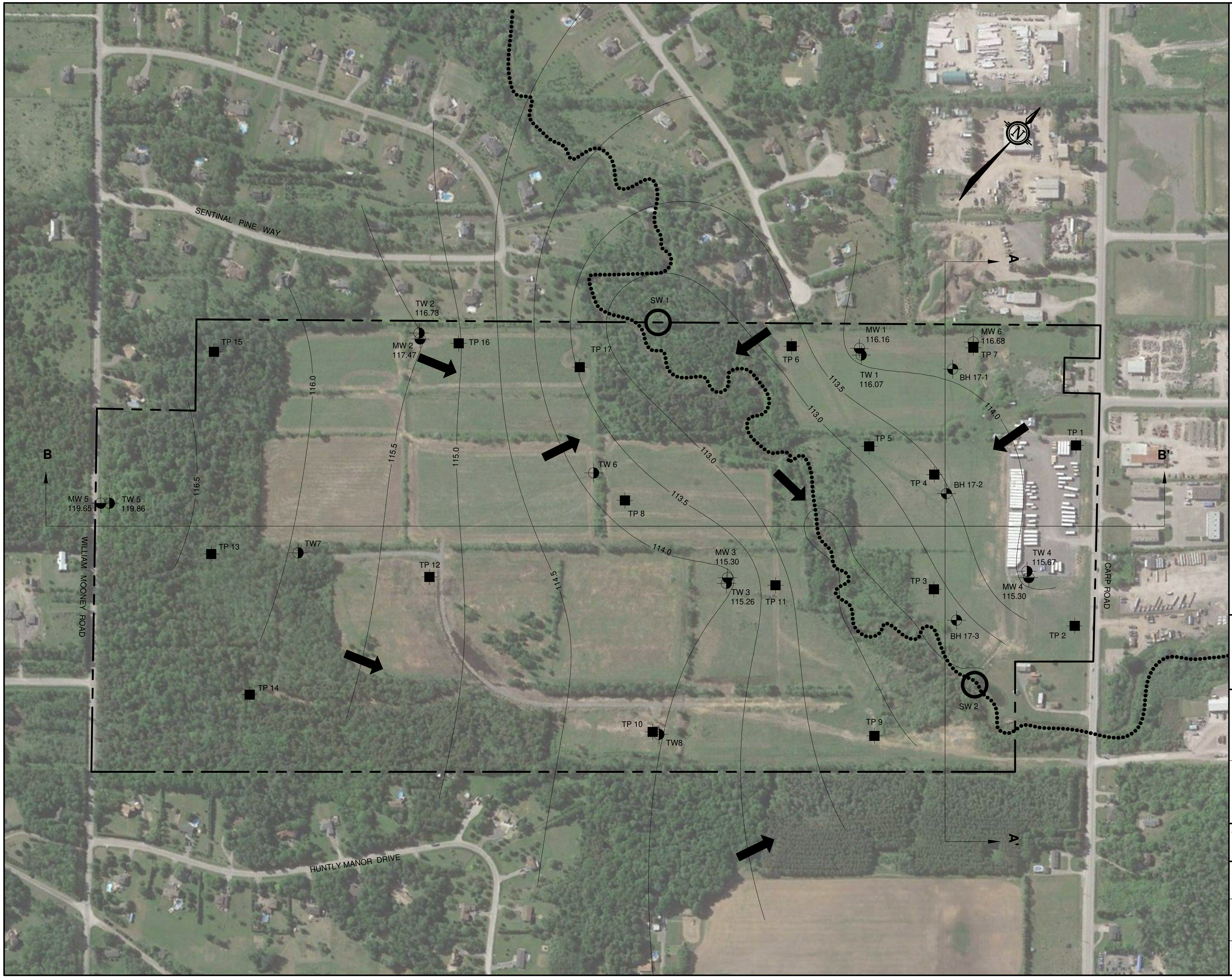

LEGEND

BH 17-1
115.97
BOREHOLE
(current investigation by GEMTEC)
GROUND SURFACE ELEVATION IN METRES
GEODETIC DATUM

TW 1
116.16
TEST WELL
(current investigation by GEMTEC)

MW 1
116.16
MONITORING WELL LOCATION
(current investigation by GEMTEC)

TP 1
TEST PIT
(approximate location)

SW 1
SURFACE WATER SAMPLING
(approximate location)

SUBJECT SITE

A A'
CROSS SECTION
(current investigation by GEMTEC)

116
GROUNDWATER ELEVATION CONTOURS,
SHALLOW OVERBURDEN (June 9, 2016)

STREAM

DIRECTION OF SHALLOW GROUNDWATER
FLOW (June 9, 2016)

Scale
1:5000
0 100 200 300m

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Drawing
OVERBURDEN GROUNDWATER
FLOW DIRECTION

Client
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Project
61318.15

HYDROGEOLOGICAL
INVESTIGATION
2727 CARP ROAD
OTTAWA, ONTARIO

Drwn by	Chkd by
P.C.	A.P.

Date	Rev.	
AUGUST 2018	0	**FIGURE 3**

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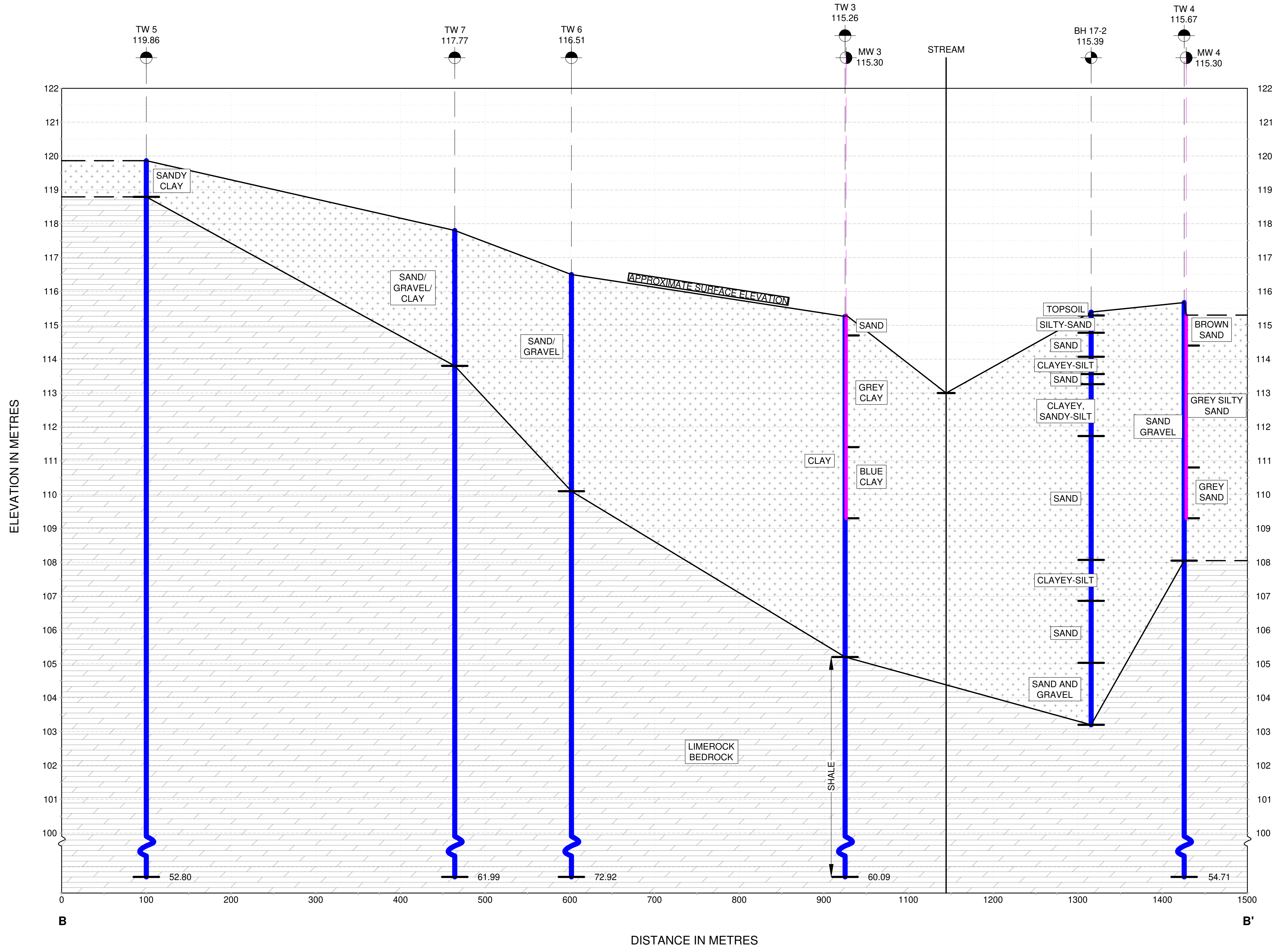
PROFILE B - B` (OVERBURDEN)

2727 CARP ROAD



LEGEND

⊕ BH 17-2 115.39 — BOREHOLE (current investigation by GEMTEC)

GROUND SURFACE ELEVATION IN METRES GEODETIC DATUM

◑ TW 3 115.26 — TEST WELL (current investigation by GEMTEC)

◐ MW 3 115.30 — MONITORING WELL (current investigation by GEMTEC)

— — — INTERPRETTED

▨ INTERBEDDED SILTY CLAY, CLAYEY-SILT, AND FINE SAND

▤ LIMESTONE BEDROCK

Vertical Scale

1:125

0 2.5 5 7.5m

Horizontal Scale

1:5000

0 100 200 300m

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Drawing
HYDROGEOLOGICAL
CROSS SECTION B-B`
(OVERBURDEN)

Client
1384341 ONTARIO LTD.

Project
61318.15

HYDOGEOLOGICAL INVESTIGATION
2727 CARP ROAD
OTTAWA, ONTARIO

Drwn by	Chkd by
P.C.	A.P.

Date
AUGUST 2019

Rev.
0

FIGURE 4

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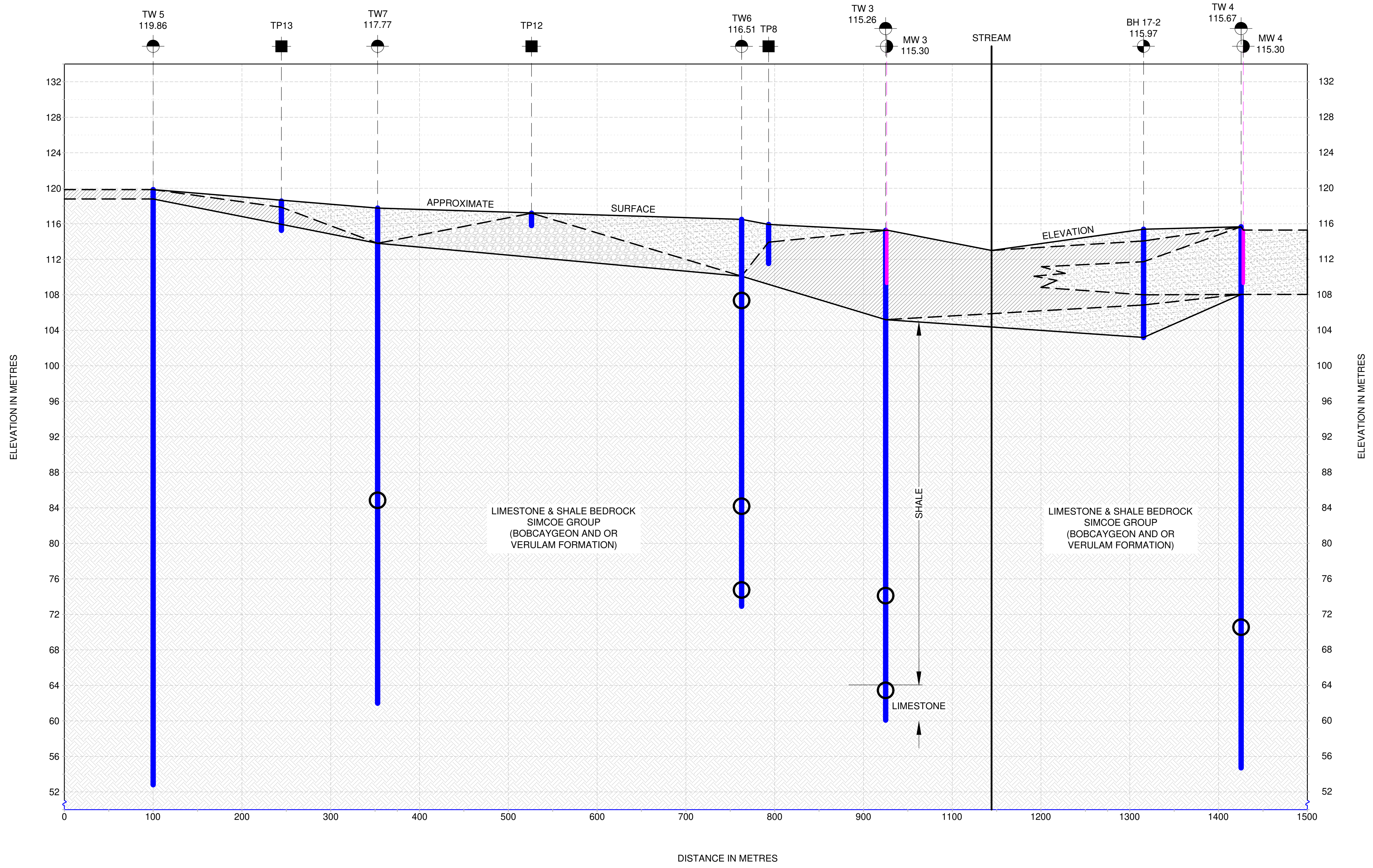
PROFILE B - B` (BEDROCK)

2727 CARP ROAD



LEGEND

◓ TW 3 115.26	TEST WELL (current investigation by GEMTEC) GROUND SURFACE ELEVATION IN METRES GEODETIC DATUM
◑ MW 3 115.30	MONITOR WELL (current investigation by GEMTEC)
◕ BH 17-2 115.39	BOREHOLE (current investigation by GEMTEC)
■ TP1	TEST PIT - APPROXIMATE LOCATION AND INFERRED GROUND SURFACE ELEVATION (current investigation by GEMTEC)
○	WATER FOUND (current investigation by GEMTEC)
— — — —	INTERPRETTED
▨	CLAY, SILTY CLAY AND SILT (FINE GRAINED GLACIOMARINE)
▨	LIMESTONE & SHALE BEDROCK
▨	SILTY TO SANDY CLAY, WITH GRAVELS/ COBBLES (GLACIAL TILL)
▨	SAND/ SAND AND GRAVEL (COURSE GRAINED GLACIOMARINE)

Vertical Scale

1:500

0 10 20 30m

Horizontal Scale

1:5000

0 100 200 300m

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Drawing
HYDROGEOLOGICAL
CROSS SECTION B-B`
(BEDROCK)

Client
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Project
61318.15

HYDOGEOLOGICAL INVESTIGATION
2727 CARP ROAD
OTTAWA, ONTARIO

Drwn by
P.C.

Chkd by
A.P.

Date
AUGUST 2019

Rev.
0

FIGURE 5

APPENDIX A

Lot Development Plan
Prepared by Novatech Engineering Consultants Ltd.

LEGEND

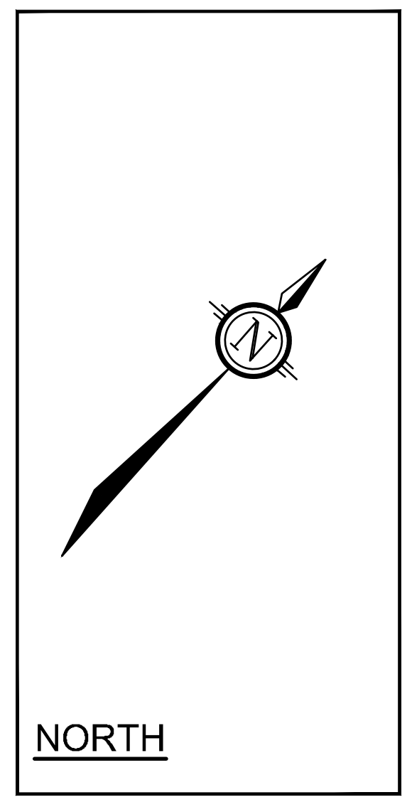
- 30m SETBACK LINE (FROM NHWM)
- MEANDER BELT (PROVIDED BY MVCA)
- 1:100 YR FLOODPLAIN (PROVIDED BY MVCA)
- REGULATORY LIMIT (PROVIDED BY MVCA)
- PROPOSED PHASE LIMITS
- PROPOSED REALIGNED HEADWATER FEATURE
- PROPOSED 30m CORRIDOR WIDTH
- PROPOSED SPLIT RAIL FENCE
- PROPOSED RAISED SEPTIC SYSTEM
- ▭ PROPOSED BUILDING ENEVELOPE (2500ft²)
- Ⓦ PROPOSED WELL LOCATION
- Ⓦ EXISTING TEST WELL LOCATION
- MW EXISTING MONITORING WELL LOCATION
- BN EXISTING BUTTERNUT TREE LOCATION WITH 25m SETBACK

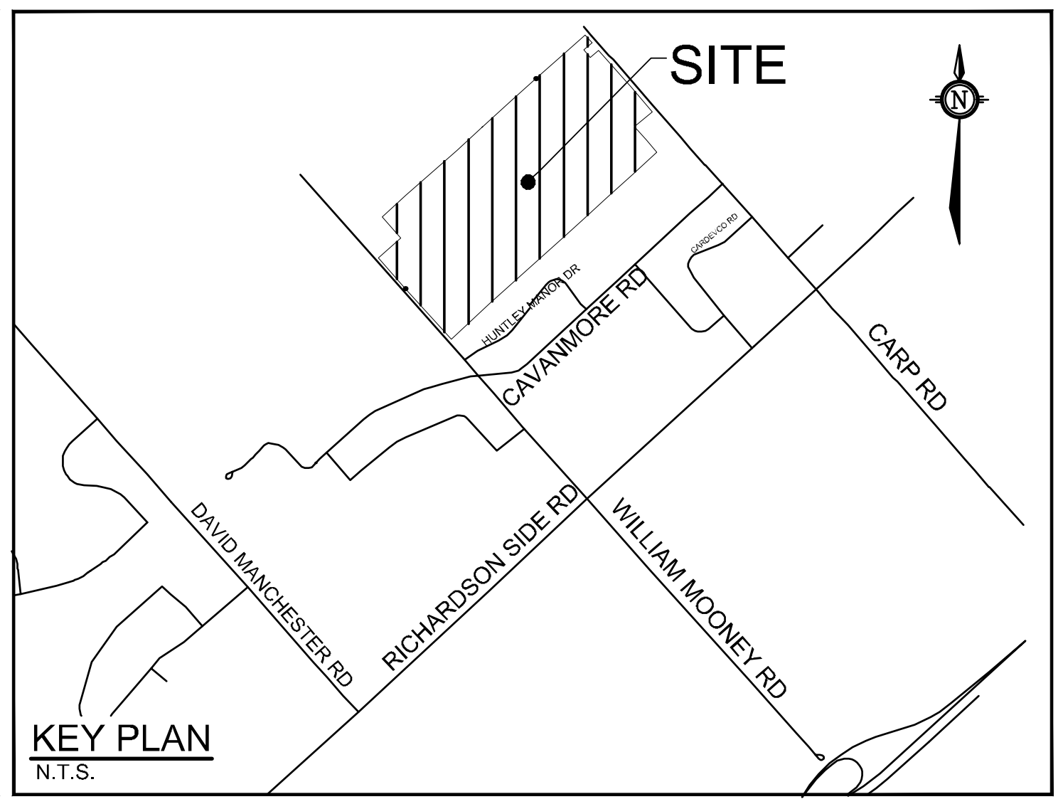
PROPOSED SEPTIC SYSTEM DETAILS:

LOCATION	DESIGN FLOW (L/day)	# OF RUNS	LENGTH OF RUNS	IMPORTED SAND (min/cm)	SIDE SLOPES	LOADING RATE (L/m2/day)	LOADING AREA REQUIRED (m2)	LOADING AREA PROVIDED (m2)
LOTS 1-78	3500	8	17.5	8	3:1	4	875	877
BLOCK 79 AND 82	1635	6	12	8	3:1	4	408	618
BLOCK 80	1050	6	8	8	3:1	4	262	542
BLOCK 81	2785	8	15	8	3:1	4	696	877

RR4 and RC9 Zoning Provisions

I	II	III	IV	V	VI		VII	VIII	IX	X	XI
ZONING MECHANISMS	**Minimum Lot Area (m2)**	**Minimum Lot Width (m)**	**Minimum Front Yard Setback (m)**	**Minimum Rear Yard Setback (m)**	**Minimum Interior Side Yard Setback (m)**		**Minimum Corner Side Yard Setback (m)**	**Maximum Height (m) -Principal Building**	**Maximum Lot Coverage (%)**	**Landscaping of Yards**	**Outdoor Storage**
					Abutting a residential zone	All other zones					
RC9	4000	30	10	10	4.5	3	6	11	25	required front and corner side yards to be landscaped, except for driveways crossing the front or corner side yard leading to a parking area	outdoor storage permitted in interior side and rear yard only; must be screened and concealed from view from abutting streets and from abutting non-commercial or non-industrial zones
RR4	4000	30	7.5	15	4.5		3	4.5	11	N/A	N/A





M:\2000\100149\CAD\design\NEW DESIGN CP4\100149-BP.dwg, LDC, Jun 26, 2019 - 11:35am, lseely

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
8	REVISED PER COMMENTS	JUN 27/19	LAB
7	ISSUED FOR COORDINATION	MAY 28/19	LAB
6	ISSUED FOR COORDINATION	MAY 9/19	LAB
5	REVISED FOR COORDINATION	JUL 11/18	LAB
4	REVISED FOR COORDINATION	APR 06/18	LSC
3	ISSUED FOR COORDINATION - REVISED NTW LOCATIONS	JUL 21/17	SM
2	ISSUED FOR COORDINATION	MAY 12/17	DJC
1	ISSUED FOR COORDINATION	MAY 10/17	DJC

SCALE
1:1500

1:1500
0 15 30 45 60

DESIGN	DJC
CHECKED	SMG
DRAWN	DJC
CHECKED	SMG
APPROVED	SMG

FOR REVIEW ONLY

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

CITY OF OTTAWA
2727 CARP ROAD

LOT DEVELOPMENT AND CONSTRAINTS PLAN

PROJECT No. 100149-00
REV REV # 8
DRAWING No. 100149-LDC

PLANB1.DWG - 1000mmx707mm

APPENDIX B

Mississippi Valley Conservation Authority (MVCA) Comments

100149

RECEIVED OCT - 7 2005

Mississippi Valley Conservation

File: P08-T15-OLV2002-0025

October 4, 2005

Mr. Greg Winters
Novatech Engineering Consultants Ltd.
Suite 200
240 Michael Cowpland Drive
Ottawa, ON K2M 1P6

Dear Mr. Winters:

Re: Plan of Subdivision and Zoning By-law Amendment Proposal
Newill Corporation
Part of Lots 7 and 8, Concession 3
2727 Carp Road
City of Ottawa (Huntley)
City File Nos. OLV2002-0025 and OZP2002-0132

Please find enclosed our letter dated September 28, 2005 containing our recommended draft plan conditions for the above noted subdivision application. As detailed in the letter, one of the key aspects of the recommendations is the performance report to be completed between phases of the subdivision. The following are to expand on the items listed in our letter of September 28, 2005 that will be addressed in the performance report:

- An update on the neighboring land use with an assessment of any new threats to the water supply aquifer.
- Water quality analysis including volatile organic carbons of untreated water supply from wells identified in the original hydrogeological report in the phase already developed and the representative samples from the newer wells.
- A study addressing the interference and drawdown impacts for existing wells. The study will be conducted on selected wells. The wells must be located in similar hydrogeology and down gradient of the groundwater and septic flow direction. Water levels in the new wells will be monitored for a sufficiently long period of time accounting for water levels during peak hours of use and to account for slow response of the aquifer. More than one set of observations must be obtained over a sufficiently long time to account for seasonal changes.

.../2

- Water quality analysis from east side (between Carp Road and Huntley Creek) from monitors installed in the aquifer receiving the septic effluent and in the test wells to demonstrate that nitrates, due to agricultural sources, are dissipating as implied by the original report. Placement of monitors should account for groundwater and nitrate plume flow directions.
- Interviews with the property owners to determine if there have been any occurrences of well water quality or quantity problems or malfunctioning septic systems.
- A visual inspection of septic systems, together with information from the property owners on septic tank pump out intervals and any other required maintenance.
- Re-evaluation of well construction and other recommendations contained in the original hydrogeological report within the context of the updated information.
- Re-assessment of the original recommendations and conclusions within the context of any new criteria or guidelines.
- Well records, GPS coordinates and a map showing well sampling locations and water level elevations must be provided. Original lab analysis reports must also be made available. The wells must be located in similar hydrogeology. Borehole logs and site cross-sections are useful tools to clarify site conceptual hydrogeology. The rationale for determining the size of the representative sample must be provided. The placement and number of monitors must be sufficient to provide confidence in the conclusions and recommendations. Methodologies, investigations and analysis, including assumptions, must be documented in detail.

If you have any questions please contact the undersigned.

Yours truly,

John Price

John Price, P. Eng.
Watershed Management Coordinator

cc Asher Rizvi, Conservation Partners Site

OLV2002-0025a.wpd

Mississippi Valley Conservation

File: P08-T15-OLV2002-0025

September 28, 2005

Mr. Kathy Rygus
City of Ottawa
Planning and Growth Management
110 Laurier Avenue West
Ottawa, ON K1P 1J1

Dear Ms. Rygus:

Re: Plan of Subdivision and Zoning By-law Amendment Proposal
Newill Corporation
Part of Lots 7 and 8, Concession 3
2727 Carp Road
City of Ottawa (Huntley)
City File Nos. OLV2002-0025 and OZP2002-0132

Staff of Mississippi Valley Conservation (MVC) have reviewed the above noted plan of subdivision and zoning by-law proposal with respect to the potential impact on natural hazards, natural heritage features and private servicing. As indicated in the proposal summary, a tributary of the Carp River (Huntley Creek) conveys flow through the proposed subdivision. The number and layout of the lots have changed since the original application. There are now proposed to be 80 residential lots and 3 commercial blocks along Carp Road. Considering the total gross area of the property, the average lot size is of 0.8 hectares. Also the originally proposed crossing of the tributary has been eliminated.

The supporting documentation that was part of our review included:

- "Newill Corporation Subdivision - Conceptual Stormwater Management Report" (March 2003) prepared by Novatech Engineering Consultants Ltd.
- "Preliminary Tree Study and Conservation Plan" (April 2003) prepared by Muncaster Environmental Planning.
- "Hydrogeological Investigation and Terrain Evaluation" (March 2003) prepared by Morey Houle Chevrier Engineering Ltd. and subsequent submissions dated October 2003, December 2004, January 2005, February 2005, May 2005 and June 2005.

.../2

Member of
Conservation ONTARIO
Natural Champions

[redacted] 4175 Hwy. 511, RR#2, Lanark, ON K0G 1K0 • Tel. (613) 259-2421 • Fax (613) 259-3468 • info@mvc.on.ca

Stormwater Management

Due to the low increase in imperviousness with estate residential subdivisions, it is proposed to address change in runoff with development by implementing Best Management Practices (BMPs) such as minimum grade ditches, vegetated swales, vegetative buffers around watercourses and promoting infiltration and filtering of runoff through sheet drainage.

Tree Conservation Plan

The key features have been highlighted and flagged for retention. Best Management Practices will be help retain trees on the lots that have significant woody vegetation. Key general recommendations from the plan are:

- Protect breeding birds by not removing trees between May 15th and July 10th.
- Grubbing and grading should be kept to a minimum and the limits of vegetation removal should be clearly marked and maintained with flagging tape and/or fencing for the duration of construction.
- A minimum setback of the drip line around tree trunks should be marked with fencing or flagging tape before the start of construction and maintained to protect the root system. No grading or heavy machine traffic should be permitted in the setback area due to possible soil compaction.
- Close cutting of vegetation will reduce the need for grubbing where vegetation removal is normally required for access or in work areas where re-grading is not necessary.
- To reduce major changes to micro-habitats, gradual removal or thinning is recommended.
- Transplanting of regenerating stems is recommended for the agricultural fields and open areas in the riparian zone along the watercourse.

Hydrogeological Investigation and Terrain Evaluation

The hydrogeological and terrain assessment report and the subsequent submissions for the proposed subdivision were reviewed to evaluate availability of water for 80 lots, suitability of septic systems and risk to water quality from proposed and existing land uses as considering the Official Plan policy of the City of Ottawa, the Ministry of the Environment Hydrological Technical Information Requirements for Land Development Applications (April, 1995) and Provincial Policy Statement (2005). Reports have concluded that:

.../3

- Sufficient water quantity is available on-site based on the 4 test wells. The report has concluded that it may be necessary to drill to depths greater than 61m on some lots to produce a sufficient water supply. Site water storage may also be required to meet peak daily domestic demands. Mutual well interference is calculated to range from 3.7 to 68 metres depending on the assumptions made during calculations (see Kollaard Associates June 15, 2005 response).
- On-site water quality from test wells was found to be acceptable as per the Safe Drinking water guidelines (with the exception of background Nitrate levels on the east side of the property as described below) with elevated parameters of Phenols, Hydrogen Sulphide, organic Nitrogen, Iron, Sodium, Manganese, TDS and turbidity. Pesticide analysis was conducted on well water to further assess the potential health risk. No pesticide presence was found. For Hydrogen Sulphide, the report has concluded that it is treatable with commercially available treatment systems. The reports have indicated that all the neighboring well owners surveyed are using treatment systems.
- Background Nitrate levels ranging from 4.1 to 12.5 mg/l were found east of Huntley Creek and less than 0.1 mg/l on west side of the creek. The report indicates the source of the Nitrate on the east side to be agricultural. Subsequent analysis (Kollaard Associates June 15, 2005) showed that nitrates are decreasing with current levels at 2.54-7.98 mg/l on the east side at the same locations sampled previously.
- A solid waste disposal site, located about 2km south east of the property, is not seen as posing any danger. The plume from the waste site is migrating to the east and the waste site is fitted with an intercept system. Accordingly , it is considered that the private wells at the subject site should not be impacted by the presence of the waste disposal site.
- The report has concluded that no impacts from neighboring developments are expected.

Based on the information contained in the reports, it can be confirmed that the bedrock aquifer could supply groundwater of reasonable quality for the proposed subdivision. Considering the proposed lot density, however, there could be some issues regarding well drawdown and interference effects. The existing nitrate contamination on the east side of Huntley Creek will have to be addressed before development can proceed in that area.

Therefore, MVC recommends draft plan approval of this proposed plan of subdivision application subject to the following conditions:

1) Prior to registration, or prior to an application for a Certificate of Approval for any stormwater works (whichever comes first), the owner shall prepare a Stormwater Site

Management Plan in accordance with the approved "Newill Corporation Subdivision - Conceptual Stormwater Site Management Plan" (March 2003) prepared by Novatech Engineering Consultants Inc. and "Preliminary Tree Study and Conservation Plan" (April 2003) prepared by Muncaster Environmental Planning. The Stormwater Site Management Plan shall identify the sequence of its implementation in relation to the construction of the subdivision and shall be to the satisfaction of the City of Ottawa and Mississippi Valley Conservation.

2) The design of the subdivision and development on individual lots will implement the conclusions and recommendations of the Site Stormwater Management Plan, Tree Study and Conservation Plan and Hydrogeological and Terrain Assessment and any subsequent addendums.

3) A consolidated report will be prepared incorporating and appending all the hydrogeological and terrain analysis information submitted to date.

4) The development of the subdivision shall proceed starting with the lots between William Mooney Road and Huntley Creek. Prior to any development occurring on lots between Huntley Creek and Carp Road, it shall be demonstrated that the Nitrate levels in the near surface and deep aquifers in this area are substantially reduced from current levels and it can be demonstrated that reasonable use criteria can be met.

5) The development of this subdivision will be phased. Each phase is to contain not more than 35 lots. Prior to the registration of each phase, subsequent to the first phase, the owner shall prepare a performance report demonstrating the operation of wells and private sewage disposal systems in the previous phases of the development to be satisfactory.

A report prepared by a qualified professional shall be submitted to the City of Ottawa and Mississippi Valley Conservation to demonstrate that the existing wells and private sewage disposal systems in previous phases are functioning in a satisfactory manner. The assessment shall be based on a representative sample of sewage disposal systems and wells from the previous phases and shall include:

- interviews with the property owners to determine any occurrences of well water quality or quantity issues or malfunctioning sewage disposal systems
- a general chemistry analysis (including volatile organic carbons) of the water supply (untreated)
- a visual investigation of sewage disposal systems together with records from property owners on septic tank pump out intervals and any other required maintenance

.../5

- Re-evaluation of conclusions and recommendations contained in the original hydrogeological analysis with respect to well construction, interference and draw down impacts, Nitrate plume levels and within the context of new criteria or guidelines.

The performance report will not be completed for any phase until 80% of the lots for that phase have been built upon and occupied.

6) Any operation involving groundwater extraction (e.g. groundwater source open loop heat pumps) within the development should not be permitted unless a detailed assessment of the water demand on the overall aquifer is completed.

7) The subdivision agreement and the agreements of purchase and sale will contain a clause whereby the purchaser is advised and acknowledges that, to prevent mutual interference of future wells on site, all wells must be drilled to a minimum depth of 35 metres. Additionally, any well with a yield of less than 13.7 L/min must be drilled to at least 70 metres below the existing ground surface.

8) All water wells will be constructed in compliance with amended Regulation 903 and the recommendations contained in the hydrogeological report. Wells should be drilled with casings set well into bedrock, with the entire annular space filled with a suitable grout and supervised by a certified professional

9) Wells that will not be utilized for potable water or future monitoring and/or not meeting minimum specifications shall be abandoned in accordance with *Ontario Water Resources Act, R.R.O. Regulation 903.*

10) The agreements of purchase and sale will also contain the following causes:
    - Homeowners should regularly inspect their sewage disposal systems and follow a sewage management program to minimize the impact to the groundwater aquifer and the risk of system failure
    - Prior to connection to the plumbing system, each well should be properly developed and re-tested to verify that bacteria Nitrates, Fluoride and other health related parameters are within the Ontario Safe Drinking Water Standards.
    - Homeowners are advised to complete regular water quality analysis for bacteria and other health related parameters. In case of any exceedances of health related parameter criteria contained in the Ontario Safe Drinking Water Standards, the Medical Officer of Health should be consulted for further evaluation and measures.
    - Homeowners are advised that water quality is not guaranteed over time and treatment/filtration may become necessary.

.../6

- Depending on the individual wells, the water may be subject to elevated aesthetic parameters (Hydrogen, Sulphide, hardness, Iron, Manganese, total dissolved solids, Sodium, Organic Nitrogen, etc.). Incrustation, taste, odor and colour problems may occur and treatment units may be required to improve water quality.
- Treating water using softeners may further increase the sodium content. People on sodium restricted diets should use a separate water supply and should consult their physician for advice on the use of well water.
- Low yield wells may be encountered on individual lots and supplemental storage may also be required to meet peak daily domestic demands.

If you have any questions please contact the undersigned.

Yours truly,

John Price

John Price, P. Eng.
Watershed Management Coordinator

cc Asher Rizvi, Conservation Partners Site

OLV2002-0025.wpd

Internal Memo
Date: Aug. 30, 2005
File No:OLV2002-0020 &
OZP2002-0132

L'OFFICE DE PROTECTION DE LA NATURE DE LA VALLÉE RIDEAU
RIDEAU VALLEY CONSERVATION AUTHORITY

To: John Price, Water Resources Coordinator, MVC
From: Asher Rizvi, Hydrogeologist, Conservation Partners

Subject: **Hydrogeological Impact Assessment, Newill (Rump) residential sub-division, part of lots 7 & 8, con. III, City of Ottawa (Huntley)**

Hydrogeological Assessment (MHC March 2003) and subsequent submissions (Oct. 2003, Dec. 2004, Jan. 2005, Feb. 2005, May. 2005, Jun. 2005) for the Newill sub-division were reviewed to evaluate availability of water for 80 lots, suitability of septic systems and risk to water quality from proposed and existing landuses as per official plan policy of the City of Ottawa, document MOEE Hydrological Technical Information Requirements for Land Development Applications (April, 1995) and Provincial Policy Statement (2005). Reports have concluded that:

1 Sufficient water quantity is available on-site based on 4 test wells. Report has concluded that it may be necessary to drill to depths greater then 61m on some lots to produce a sufficient water supply. Site water storage may be required to meet peak daily domestic demands. Mutual well interference is calculated to be ranging from 3.68-68m depending on the assumptions made during calculations as per Kollaard Associates June 15, 2005 response.

2 On-site water quality from test wells was found to be acceptable as per Safe Drinking water guidelines with elevated parameters of Phenols, hydrogen sulphide, organic nitrogen, Iron, sodium, Manganese, TDS and turbidity. Pesticide analysis was conducted on well water to further confirm the health risk. No pesticide presence was found. For hydrogen sulphide report has concluded that it is treatable with commercially available treatment systems. MHC reports have indicated that all the neighboring well owners surveyed are using treatment systems.

3 Background Nitrate levels ranging from 4.1 to 12.5 mg/l were found east of the Huntley Creek and 1.56 to 3.75 mg/l on west side of the Creek . Report indicates the source to be agricultural. Subsequent analysis (Kollaard Associates June 15, 2005) showed that nitrates are decreasing with current levels at 2.54-7.98 mg/l on the east side at the same locations sampled previously.

4 A solid waste disposal site, located about 2km south east , is not seen as posing any danger as the plume for the waste site is directed to the east and waste site is fitted with an intercept system. Accordingly , it is considered that the private wells at the subject site should not be impacted by presence of the waste disposal site. (MHC Oct.10, 2003).

5 Report has concluded that no impacts from neighboring developments are expected.

Based on the information contained in MHC and Kollard reports, it can be confirmed that the bedrock aquifer could supply groundwater of reasonable quality for the Proposed Subdivision. Considering the proposed lot density, however, there is some concern about drawdown, interference effects and existing nitrate contamination. In order to overcome these problems, alternative solutions are considered. These are:

a) decreasing the lot density to optimum interference and to optimum nitrate levels

b) using groundwater from communal wells located in well head protected areas.

c) A study addressing the interference and drawdown impacts including all the wells using the aquifer and suggesting optimum number of wells and septic systems

d) a draft approval can be granted for the development of a limited number of lots, subject to the following conditions:

  i) A limited number (about 40 lots accounting for background nitrate levels) be allowed to develop. After the total completion of the development of the 40 lots, a study shall be undertaken of sufficient detail to review the operation of existing wells, including quantity/ quality, more specifically, drawdown and interference effects of wells. The study will also evaluate the nitrate plume.

  ii) If the above mentioned study concludes that nitrate levels, drawdown and interference of wells are not being affected by the proposed lot sizes, then the registration of the second phase shall resume, without further study.

  iii) If on the contrary, the study indicates the possibility that drawdown and interference of wells are being affected by lot density, then the whole proposed subdivision should be serviced by an alternative communal well water supply or not allowed to proceed at all.

Based on the above and hydrogeological assessment reports , MVC recommends allowing the subdivision application to proceed for limited number of lots only, provided that following conditions are applied/considered to require that:

General

1 A consolidated report must be provided appending all the information submitted to date in the relevant sections.

2 Recommendations of the Hydrogeological Assessment must be implemented to ensure safe drinking water and minimize the impacts to environment.

3 Development should proceed in phases. Minimum lot size in each phase will be 0.8 ha. First phase should not contain more than 40 lots.

4 Development is only to proceed in up-gradient side (west side of the creek) as determined through site investigations.

5 Recommendation of the subsequent phases and development in east side of the Huntley Creek will be based on the satisfactory performance of water quality, wells and septic system in earlier phase. Report will also evaluate the nitrate plume levels. Atleast 100% of the lots must have been built and occupied in the earlier phase before the performance evaluation. The performance report must include:

  e) An up-date on the neighboring landuse with an assessment of any new threats to water supply aquifer.

  b) Water quality analysis including volatile organic carbons of untreated water supply from wells identified in the original hydro-g report in the phase already developed, original wells in the subsequent phase and the representative sample from the newer wells.

  c) A study addressing the interference and drawdown impacts for existing wells. Study will be conducted on selected wells. The wells must be located in similar hydrogeology and down gradient of the groundwater and septic flow direction. Water levels in the new well will be monitored for sufficiently long period of time accounting for water levels during peak hours of use and to account for slow response of the aquifer. More then one set of observations must be obtained over sufficient long time to account for seasonal changes.

d) Water quality analysis from east side (between carp road and huntley creek) from monitors installed in the aquifer receiving the septic effluent and in the test wells to demonstrate that nitrates due to agricultural source are dissipating as implied by the report. Placement of monitors should account for groundwater and nitrate plume flow directions.

e) Interviews with the property owners to determine if there have been any occurrences of well water quality or quantity problems or malfunctioning septic systems.

f) A visual inspection of septic systems, together with information from the property owners on septic tank pump out intervals and any other required maintenance.

g) Re-evaluation of well construction and other recommendations contained in the original hydrogeological report within the context of the updated information,

h) Re-assessment of original hydro-G within the context of any new criteria or guidelines.

i) Well records, GPS coordinates and a map showing well and sampling locations. Waterlevel elevations must be provided. Original lab analysis reports must also be made available. The wells must be located in similar hydrogeology. Borehole logs and site cross-sections are useful tools to clarify site conceptual hydrogeology. The rationale for determining the size of the representative sample must be provided. The placement and number of monitors must be sufficient to provide confidence in the conclusions and recommendations. Methodologies, investigations and analysis including assumptions must be documented in detail.

4 Any operation involving groundwater extraction (groundwater source open loop heat pumps etc.) within the development should not be permitted unless a detailed assessment of the water demand on the overall aquifer is completed.

5 Nitrate dilution calculations based on MOE 1995 methodology (exclusion of impervious areas, no storm water management contribution towards dilution etc.) are being accepted as basis for recommending the development. If in the future, the total lot coverage area in the development used in the nitrate dilution calculations changes due to some reasons, then applicant shall demonstrate by providing updated calculations as per MOE methodology that the nitrate impacts still meet the provincial criteria of 10 mg/l.

Septic system

1 Sewage system designs shall be based on specific investigations to evaluate the suitability of local conditions on each lot. All sewage systems shall be constructed according to the Ontario Building Code and in accordance with the recommendations of the hydrogeological report.

2 Where applicable, the sewage systems along the surface water features have to be examined individually to assess their impact on the feature. Proper separation between sewage source and sensitive features should be maintained. This may be problem for lands with boundaries extending all the way to surface water features. In this case,

additional buffers should be included for protection as agreed. Sensitive features are not to be utilized for nitrate reductions for the sewage effluent being generated within the site boundaries.

3 Homeowners are advised that the Ontario Building Code allows the installation of selected Treatment Units capable of producing secondary and tertiary effluent quality. Treatment Units may benefit the homeowner, depending on site-specific conditions, as the associated leaching bed area will be smaller. As an added benefit, Treatment Units will reduce the nutrient and contaminant impact on the groundwater.

4 A clause shall be registered on title stating that the homeowners shall regularly inspect their sewage systems and follow a sewage system management program to minimize the impact to the groundwater and the risk of system failure. Septic Systems Do's and Don'ts Guides and Septic Smart Guides should be consulted in this regard and are available from regulatory agencies.

Water Quantity

1 Wells should be drilled with casing set well into the bedrock and entire annular space filled with a suitable grout.

2 Low yielding wells are a possibility. Well driller or hydrogeological professional must ensure that wells have a min. of 13.7 l/min well yield sustainable for 6 hours as per MOE requirements. If this requirement is not met then supplementary storage must be installed to prevent extreme well interference problems during peak hours of well use. Repots has indicated that it may be necessary to drill deeper then 61 on some lots to produce sufficient water supply.

3 All water wells should be constructed in compliance with the MOE amended Well Regulations 903 and in accordance with the recommendations contained in the hydrogeological report for ensuring well and water quality safety. The construction and grouting of the wells should be supervised by a certified professional and a well compliance certificate provided to the satisfaction of the City of Ottawa.

4 The subdivision agreement contain a clause whereby the owner agrees that any existing wells or other monitors on the site including test wells which do not meet minimum specifications (13.7 l/min yield etc.) of the MOE requirements and hydrogeological assessment (minimum well casing etc.) will be abandoned. Wells that will not be utilized for potable water supply or future monitoring or are at risk due to improper well construction and under surficial or septic impacts, shall also be abandoned in accordance with well regulations (Ontario Water Resources Act, R.R.O. 1990, Regulation 903, and any subsequent amendments). A certificate of compliance shall be provided in this regard.

Water Quality

1 Prior to connection to the plumbing system each well shall be retested to verify that bacteria, nitrates, flouride and other health related parameters are within the Ontario Safe Drinking Water Standards. Newly developed wells may encounter turbidity, which can interfere with the effectiveness of some treatment systems. Therefore, wells must be properly developed before connection to the house plumbing system.

2 The well owner is advised to do a regular water quality analysis for bacteria, septic indicators and other health related parameters in accordance with the Ontario Safe Drinking Water Act (2003). In case of any exceedances, medical officer of health should

be consulted for further evaluation and necessary measures. Safe Drinking water Act criteria must be followed to avoid any future serious health issues.

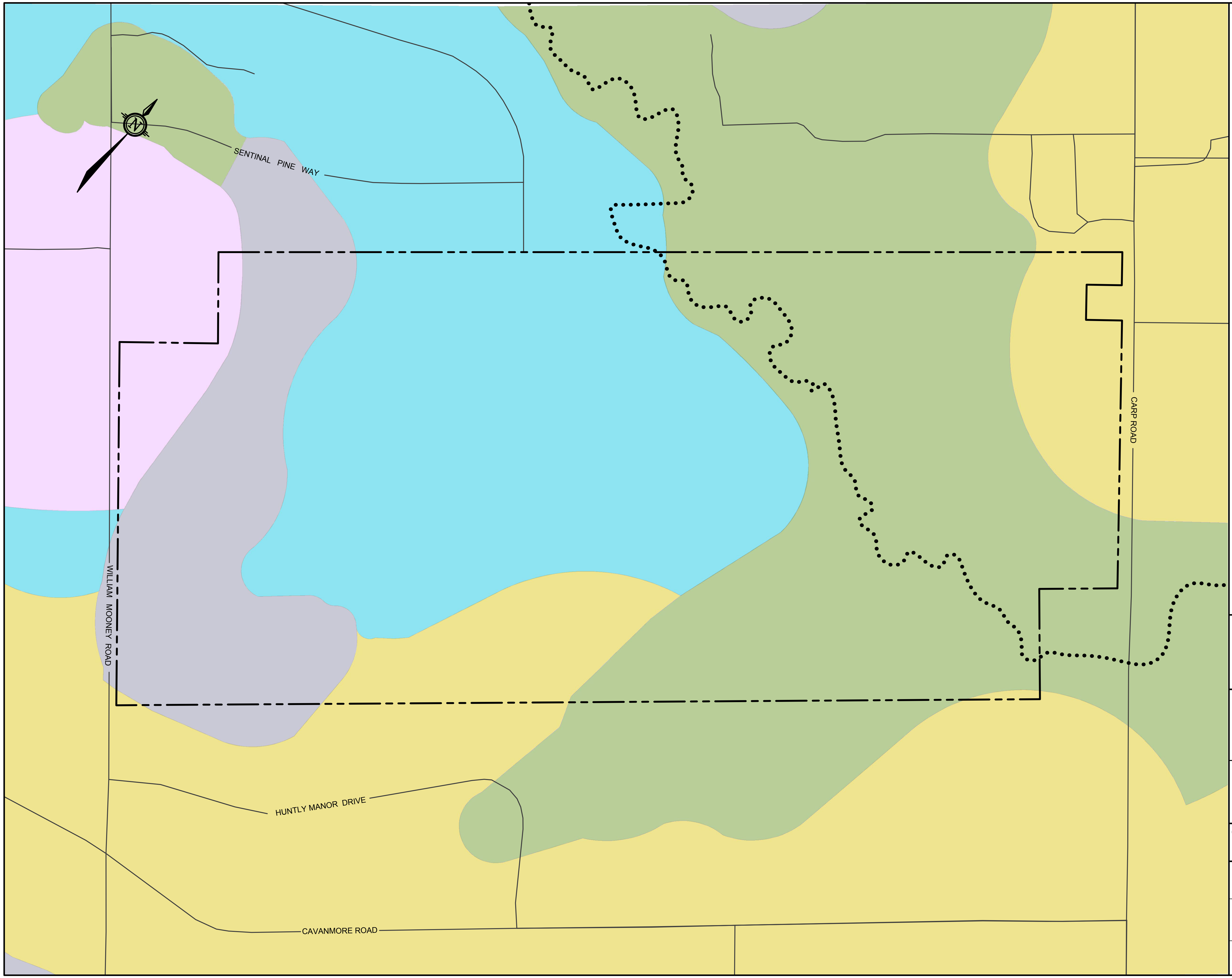
3 The homeowner is advised that water quality is not guaranteed over time and treatment/filtration may become necessary. Depending on the well, the water may be subject to elevated aesthetic parameters (hydrogen sulphide, hardness, iron, manganese, TDS, sodium, Organic Nitrogen etc.). Incrustation, taste, odor and color problems are expected. Therefore, well owners should be aware that treatment systems may be required to improve the water quality. Treating the water by softeners may further increase the sodium content. People on sodium restricted diets should use a separate water supply and should consult their physician for advice on the use of the well water.

4 Homeowners shall follow a well management program to minimize the potential for contamination of the groundwater from various pollutants. The guides "How Well is Your Well" and "Water Well Best Management Practices" should be consulted in this regard. These guides are available from regulatory agencies.

We would like to take this opportunity to point out that a comprehensive hydrogeological review is conducted based on the MOEE Hydrological Technical Information Requirements for Land Development Applications (April, 1995) including appendices D-5-4/D-5-5 last revised in 1996. The procedures documented in the guidelines are a minimum requirement for risk assessment and must be followed for evaluating the drinking water supplies. The hydrogeological assessments submitted in support of this development lack the reporting and investigative protocols as specified in these guidelines. Such deviations from the guidelines without any rationalization or substantiation and the absence of complete information in one comprehensive report delays the review process.

APPENDIX C

Land Use Maps and Background Documents



LEGEND

— — — SUBJECT SITE

⋯ STREAM

🟨 COURSE-TEXTURED GLACIOMARINE DEPOSITS

🟩 TILL

▨ FINE-TEXTURED GLACIOMARINE DEPOSITS

▨ ORGANIC DEPOSITS

🟪 PALEOZOIC BEDROCKS

SOURCE:
ARMSTRONG, D.K. AND DODGE, J.E.P. 2007.
PALEOZOIC GEOLOGY OF SOUTHERN ONTARIO;
ONATRIO GEOLOGICAL SURVYE, MISCELLANEOUS
RELEASE - DATA 219.

Scale
1:7500
0 150 300 450m

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

32 Steacie Drive
Ottawa, ON
Tel: (613) 836-1422
www.gemtec.ca
ottawa@gemtec.ca

Drawing
OGS SURFICIAL GEOLOGY

Client
1384341 ONTARIO LTD.

Project
61318.15

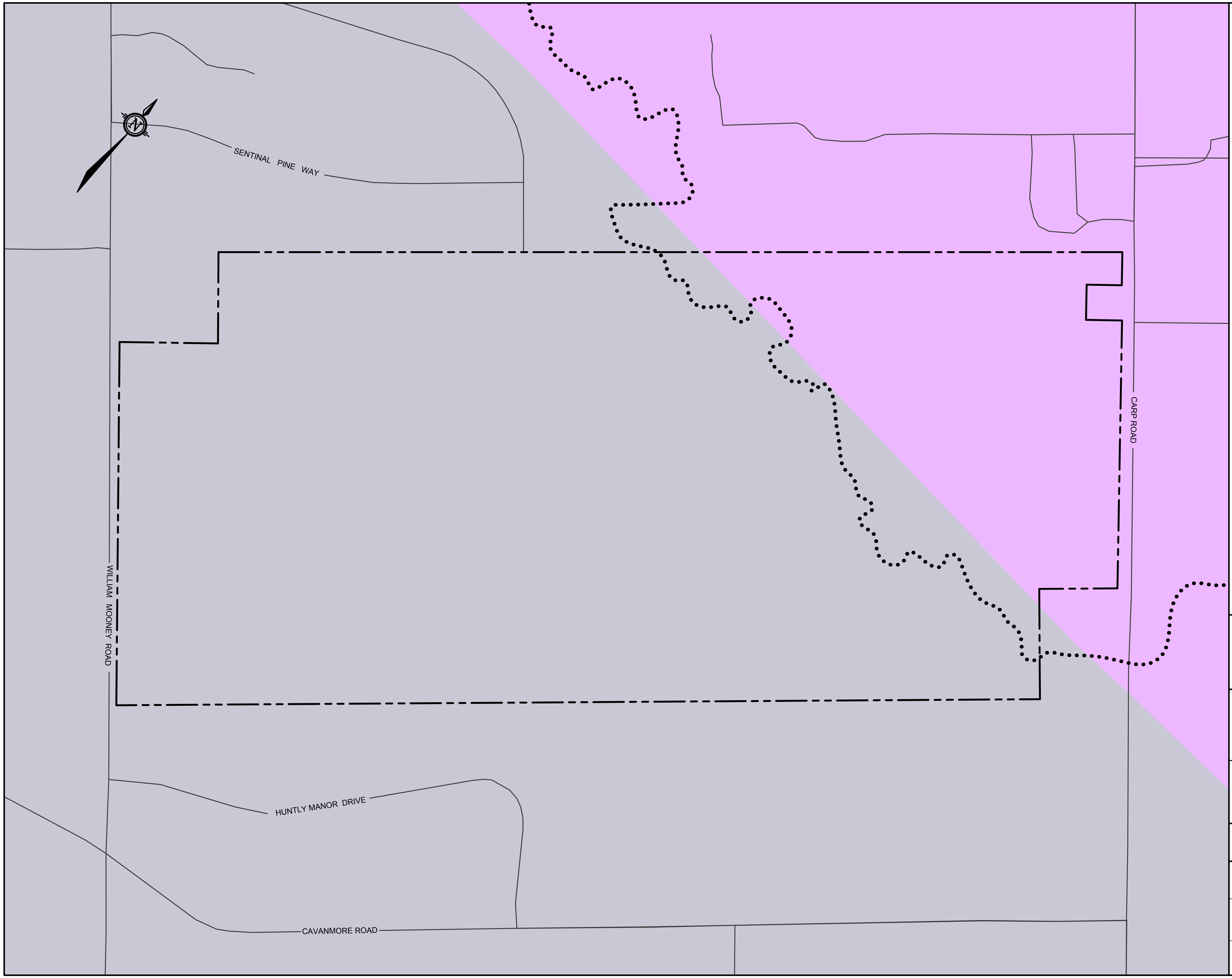
HYDROGEOLOGICAL
INVESTIGATION
2727 CARP ROAD
OTTAWA, ONTARIO

Drwn by	Chkd by
P.C.	A.P.

Date
AUGUST 2019

Rev.
0

FIGURE C1



LEGEND

- - - SUBJECT SITE

⋯ STREAM

▨ VERULAM FORMATION: LIMESTONE AND SHALE

🟪 BOBCAYGEON FORMATION: LIMESTONE

SOURCE:
ARMSTRONG, D.K. AND DODGE, J.E.P. 2007.
PALEOZOIC GEOLOGY OF SOUTHERN ONTARIO;
ONATRIO GEOLOGICAL SURVYE, MISCELLANEOUS
RELEASE - DATA 219.

Scale
1:7500
0 150 300 450m

GEMTEC
CONSULTING ENGINEERS
AND SCIENTISTS

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Ottawa, ON
Tel: (613) 836-1422
www.gemtec.ca
ottawa@gemtec.ca

Drawing
OGS BEDROCK GEOLOGY

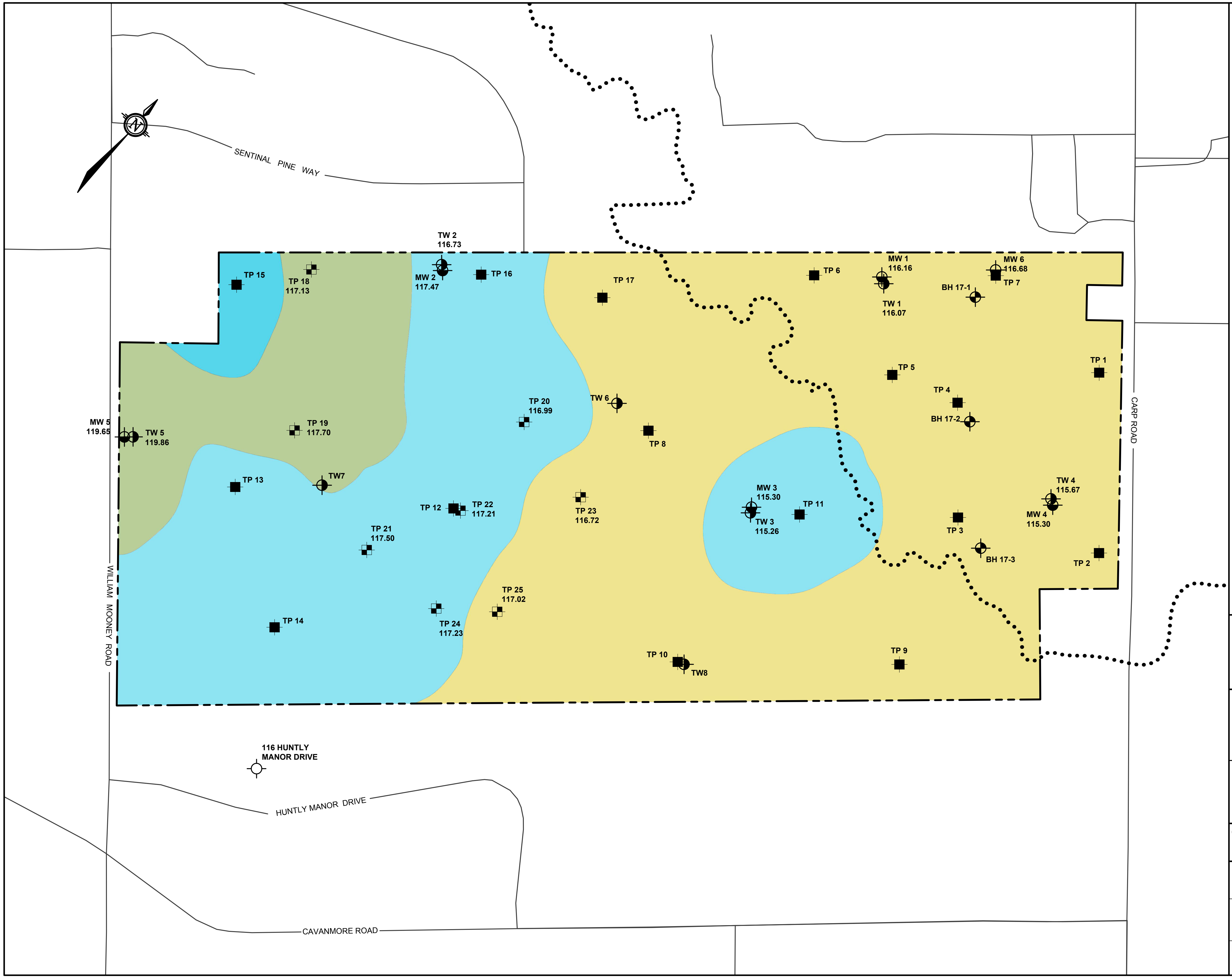
Client
1384341 ONTARIO LTD.

Project
61318.15

HYDROGEOLOGICAL
INVESTIGATION
2727 CARP ROAD
OTTAWA, ONTARIO

Drwn by	Chkd by
P.C.	A.P.

Date	Rev.	
AUGUST 2019	0	**FIGURE C2**



LEGEND

BH 17-1	BOREHOLE (current investigation by GEMTEC)
TP 18	TEST PIT (current investigation by GEMTEC)
TW 1	TEST WELL (current investigation by GEMTEC)
MW 1	MONITORING WELL LOCATION (current investigation by GEMTEC)
	PRIVATE WELL LOCATION MECP WATER WELL RECORD
TP 1	TEST PIT (approximate location)
BH/TP/MW ←	ID
XX.XX ←	GROUND SURFACE ELEVATION, IN METRES GEODETIC DATUM
	SUBJECT SITE
	STREAM
0.5	OVERBURDEN THICKNESS, IN METRES (0.5 metre interval)
🟨	COURSE-TEXTURED GLACIOMARINE DEPOSITS (SILTY SAND TO SAND)
🟦	FINE-TEXTURED GLACIOMARINE DEPOSITS (SILTY CLAY)
🟩	TILL (SILTY SAND , TRACE GRAVEL, TRACE CLAY)

* UPPER MOST SOIL UNIT, BELOW TOPSOIL, THAT IS A MINIMUM OF 0.5m THICK.

* BASED ON TEST PIT INFORMATION AND DETAILED BOREHOLE LOGGING (TP1-25) & (BH17-1, 17-2, 17-3)

Scale
1:5000
0 100 200 300m

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

32 Steacie Drive
Ottawa, ON
Tel: (613) 836-1422
www.gemtec.ca
ottawa@gemtec.ca

Drawing
RECLASSIFIED SURFICIAL GEOLOGY
(0-2m)

Client
1384341 ONTARIO LTD.

Project
61318.15

Drwn by
P.C.

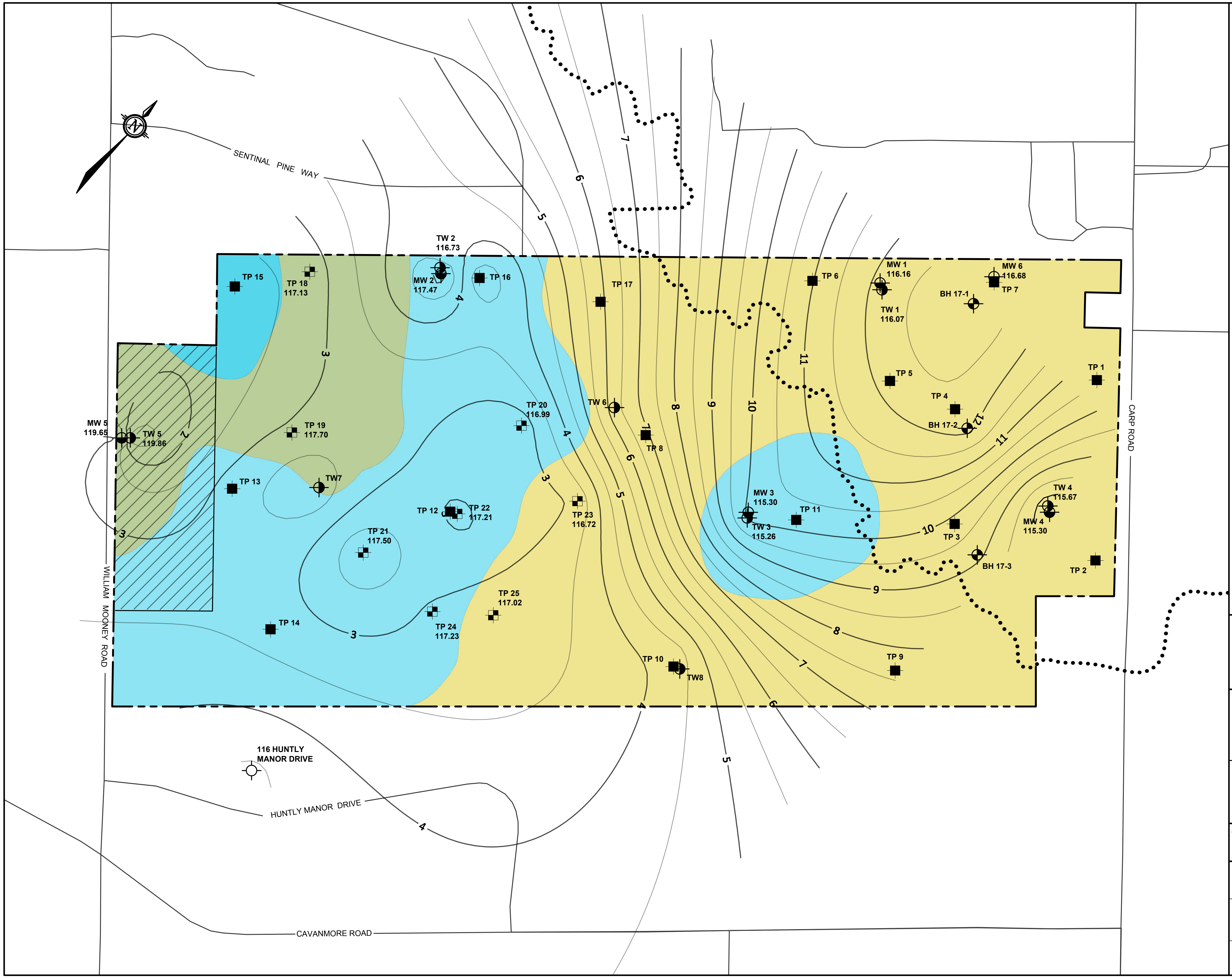
Chkd by
A.P.

HYDROGEOLOGICAL
INVESTIGATION
2727 CARP ROAD
OTTAWA, ONTARIO

Date
AUGUST 2019

Rev.
0

FIGURE C3



LEGEND

BH 17-1	⊕	BOREHOLE (current investigation by GEMTEC)
TP 18	▚	TEST PIT (current investigation by GEMTEC)
TW 1	⊕	TEST WELL (current investigation by GEMTEC)
MW 1	⊕	MONITORING WELL LOCATION (current investigation by GEMTEC)
	○	PRIVATE WELL LOCATION MECP WATER WELL RECORD
TP 1	■	TEST PIT (approximate location)

BH/TP/MW ← ID
XX.XX ← GROUND SURFACE ELEVATION, IN METRES GEODETIC DATUM

- - -	SUBJECT SITE
•••	STREAM
0.5	OVERBURDEN THICKNESS, IN METRES (0.5 metre interval)
🟨	COURSE-TEXTURED GLACIOMARINE DEPOSITS (SILTY SAND TO SAND)
🟦	FINE-TEXTURED GLACIOMARINE DEPOSITS (SILTY CLAY)
🟩	TILL (SILTY SAND , TRACE GRAVEL, TRACE CLAY)

* UPPER MOST SOIL UNIT, BELOW TOPSOIL, THAT IS A MINIMUM OF 0.5m THICK.

* BASED ON TEST PIT INFORMATION AND DETAILED BOREHOLE LOGGING (TP1-25) & (BH17-1, 17-2, 17-3)

▨ FORESTED AREA TO BE PRESERVED

Scale
1:5000
0 100 200 300m

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

32 Steacie Drive
Ottawa, ON
Tel: (613) 836-1422
www.gemtec.ca
ottawa@gemtec.ca

Drawing
OVERBURDEN THICKNESS

Client
1384341 ONTARIO LTD.

Project
61318.15

Drwn by
P.C.

Chkd by
A.P.

HYDROGEOLOGICAL INVESTIGATION
2727 CARP ROAD
OTTAWA, ONTARIO

Date
AUGUST 2019

Rev.
0

FIGURE C4

RE: 61318.15 - Storage tank / incident report

Public Information Services <publicinformationservices@tssa.org>

Wed 7/26/2017 10:15 AM

To: Andrius Paznekas <apaznekas@hceng.ca>;

Hello Andrius,

Thank you for your inquiry.

We have no record in our database of any fuel storage tanks at the subject address (addresses).

For a further search in our archives please submit your request in writing to Public Information Services via e-mail (publicinformationservices@tssa.org) or through mail along with a fee of $56.50 (including HST) per location. The fee is payable with credit card (Visa or MasterCard) or with a Cheque made payable to TSSA.

Although TSSA believes the information provided pursuant to your request is accurate, please note that TSSA does not warrant this information in any way whatsoever.

Thank you and have a great day,
Sherees

Sherees Thompson | Public Information Agent
Facilities
345 Carlingview Drive
Toronto, Ontario M9W 6N9
Tel: +1-416-734-3363 | Fax: +1-416-231-6183 | E-Mail: sthompson@tssa.org
www.tssa.org

From: Andrius Paznekas [mailto:apaznekas@hceng.ca]
Sent: Thursday, July 20, 2017 1:37 PM
To: Public Information Services
Subject: 61318.15 - Storage tank / incident report

Good afternoon,

Please conduct a search for storage tanks and/or incidents at the following addresses located in Ottawa (Carp), Ontario.

I'm interested in commercial/industrial properties within 500 metres of 2727 Carp Road. I'm not sure if there's a better way to request the information (e.g. if you're able to search a radius or have to enter addresses manually), but I've compiled the addresses below. Let me know if I'm able to provide any other information that may aid in your search.

2676, 2688, 2702, 2710, 2726, 2770, 2727, 2739, 2755, 2765, 2775, 2777, 2789, 2793, 2797, 2825, 2591 Carp Road

80 Arbourbrook Boulevard

120, 124, 128, 132, 136, 138, 140 Tansley Drive

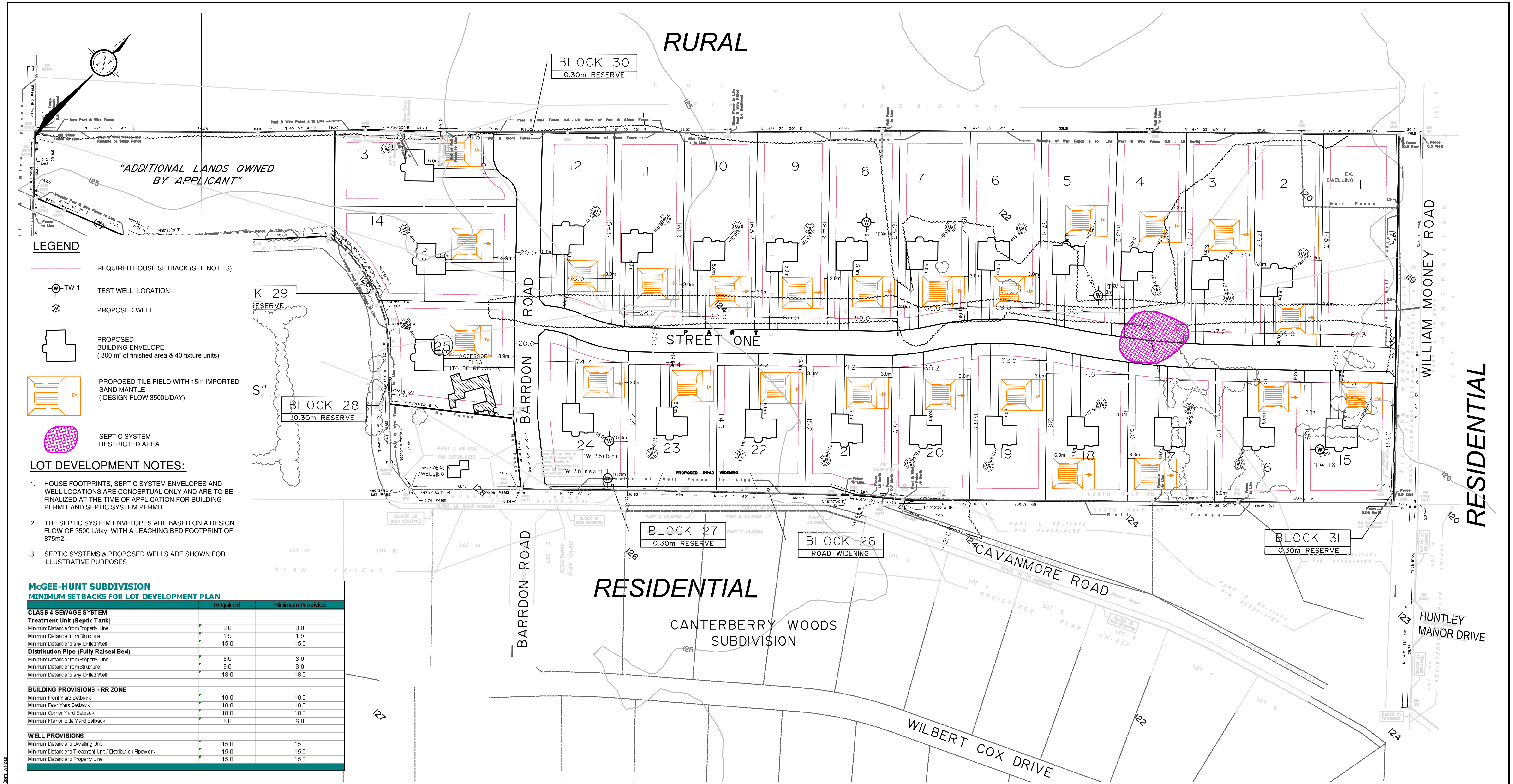
205, 215, 225 Maple Creek Crescent

106, 122, 124, 128, 132, 136, 140, 144, 148, 152, 156, 160, 164, 168, 172 Reis Road

158, 171, 189, 197, 217 Cardevco Road

Thank you!

Andrius Paznekas, B.Sc., M.Sc.
tel: 613.836.1422
cell: 613.295.8425
fax: 613.836.9731
Houle Chevrier Engineering Ltd.
32 Steacie Drive • Ottawa, Ontario • K2K 2A9
www.hceng.ca



LEGEND

----	REQUIRED HOUSE SETBACK (SEE NOTE 3)
Ⓦ TW-1	TEST WELL LOCATION
Ⓦ	PROPOSED WELL
	PROPOSED BUILDING ENVELOPE (300 m² of finished area & 40 fixture units)
	PROPOSED TILE FIELD WITH 15m IMPORTED SAND MANTLE (DESIGN FLOW 3500L/DAY)
▨	SEPTIC SYSTEM RESTRICTED AREA

LOT DEVELOPMENT NOTES:

1. HOUSE FOOTPRINTS, SEPTIC SYSTEM ENVELOPES AND WELL LOCATIONS ARE CONCEPTUAL ONLY AND ARE TO BE FINALIZED AT THE TIME OF APPLICATION FOR BUILDING PERMIT AND SEPTIC SYSTEM PERMIT.
2. THE SEPTIC SYSTEM ENVELOPES ARE BASED ON A DESIGN FLOW OF 3500 L/day WITH A LEACHING BED FOOTPRINT OF 875m2.
3. SEPTIC SYSTEMS & PROPOSED WELLS ARE SHOWN FOR ILLUSTRATIVE PURPOSES

McGEE-HUNT SUBDIVISION
MINIMUM SETBACKS FOR LOT DEVELOPMENT PLAN

	Required	Minimum Provided
CLASS 4 SEWAGE SYSTEM		
Treatment Unit (Septic Tank)		
Minimum Distance from Property Line	3.0	3.0
Minimum Distance from Structure	1.5	1.5
Minimum Distance to any Drilled Well	15.0	15.0
Distribution Pipe (Fully Raised Bed)		
Minimum Distance from Property Line	6.0	6.0
Minimum Distance from Structure	8.0	8.0
Minimum Distance to any Drilled Well	18.0	18.0
BUILDING PROVISIONS - RR ZONE		
Minimum Front Yard Setback	10.0	10.0
Minimum Rear Yard Setback	10.0	10.0
Minimum Corner Yard Setback	10.0	10.0
Minimum Interior Side Yard Setback	6.0	6.0
WELL PROVISIONS		
Minimum Distance to Dwelling Unit	15.0	15.0
Minimum Distance to Treatment Unit / Distribution Pipework	15.0	15.0
Minimum Distance to Property Line	15.0	15.0

PLAN OF
PART OF LOT 7
CONCESSION 4
GEOGRAPHIC TOWNSHIP OF HUNTLEY
NOW THE CITY OF OTTAWA
SCALE 1 : 3000

0 40 80 120 160 200 metres

MARCH, 2012

LOT DEVELOPMENT PLAN

AVERAGE MINIMUM LOT AREA 8000 sq.m.
MINIMUM LOT FRONTAGE 60 metres

107176

NOVATECH
ENGINEERING
CONSULTANTS LTD.
ENGINEERS & PLANNERS
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada
K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Email: novainfo@novatech-eng.com

APPENDIX D

Borehole and Test Pit Logs

RECORD OF BOREHOLE 17-1

CLIENT: 1384341 Ontario Ltd.
PROJECT: Hydrogeological Investigation
JOB#: 61318.15
LOCATION: See Detailed Site Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD2013
BORING DATE: 12/07/2017

BORING METHOD: Power Auger 200 mm Diameter Hollow Stem; N Diamond Bit

● PENETRATION RESISTANCE (N), BLOWS/0.3m
▲ DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED
WATER CONTENT, % W_P ⊢ W ⊖ ⊣ W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)
Ground Surface	115.97
Brown sandy-silt, roots (TOPSOIL)	115.87 0.10
Brown CLAYEY-SILT, some sand, roots	
Brown/grey SILTY-CLAY, some sand, stiff	114.97 1.00
Brown fine to medium SAND	114.50 1.47
Brown/grey fine SAND, some silt and clay	111.70 4.27
Brown/grey fine SAND with occasional stiff to very stiff grey clayey-silt lenses (6.6m, 7.7m and 7.8m)	109.26 6.71
Brown/grey fine to coarse SAND	107.44 8.53
Brown medium-coarse SAND with gravels	105.92 10.05
Grey/black layered fine to medium SAND	105.61 10.36
Brown/grey coarse SAND and GRAVEL	105.00 10.97
Inferred BEDROCK (spoon refusal)	103.02 12.95

SAMPLES NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
1	50 D.O. SS		4
2	50 D.O. SS		5
3	50 D.O. SS		14
4	50 D.O. SS		22
5	50 D.O. SS		12
6	50 D.O. SS		14
7	75 D.O. SS		27
8	75 D.O. SS		6
9	75 D.O. SS		4
10	75 D.O. SS		4
11	75 D.O. SS		4
12	75 D.O. SS		9
13	75 D.O. SS		7
14	62.5 D.O. SS		10
15	62.5 D.O. SS		24
16	62.5 D.O. SS		95
17	62.5 D.O. SS		67
18	62.5 D.O. SS		122
19	62.5 D.O. SS		35
20	62.5 D.O. SS		35

>99 for 50mm

>>

DEPTH SCALE METRES: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

GEMTEC
Consulting Engineers and Scientists

LOGGED: A.P.
CHECKED: K.H.

RECORD OF BOREHOLE 17-2

CLIENT: 1384341 Ontario Ltd.
PROJECT: Hydrogeological Investigation
JOB#: 61318.15
LOCATION: See Detailed Site Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD2013
BORING DATE: 12/07/2017

BORING METHOD: Power Auger, 200 mm Diameter Hollow Stem (0 to approx. 6.7 m); N, Diamond Bit (approx. 6.7 to 15 m)

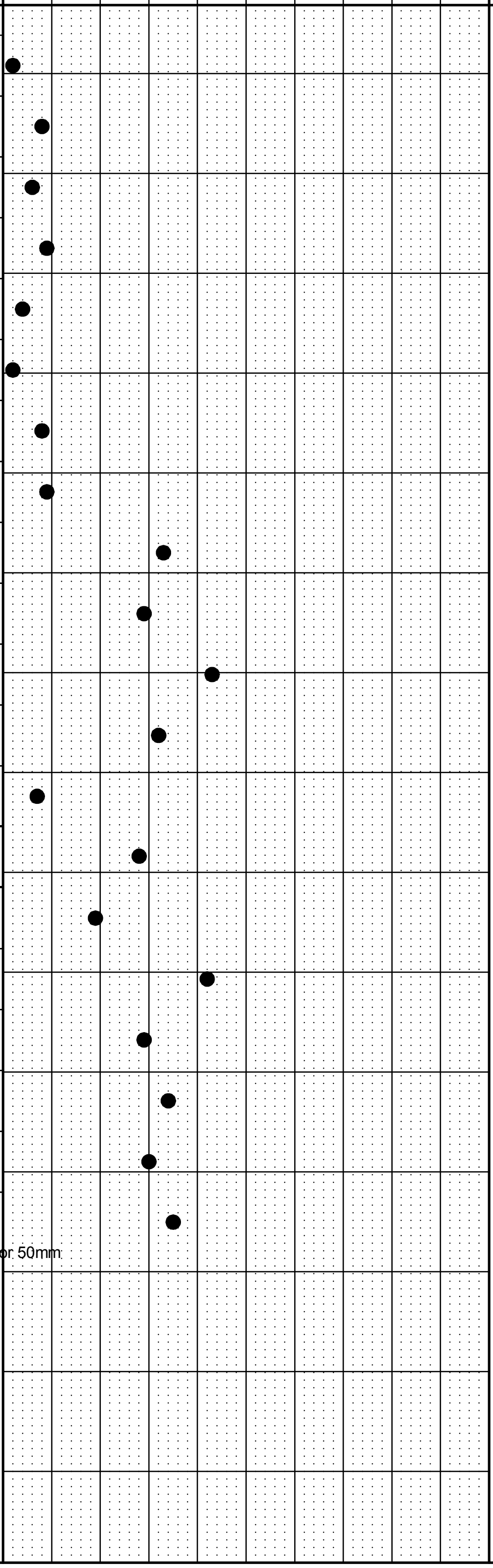
SOIL PROFILE

DESCRIPTION	ELEV. / DEPTH (m)
Ground Surface	115.39
Brown TOPSOIL	115.29 0.10
Brown/grey SILTY-SAND	114.78 0.61
Brown fine SAND	114.07 1.32
Brown/grey CLAYEY-SILT, trace sand, stiff	113.56 1.83
Brown/grey fine to medium SAND	113.26 2.13
Brown/grey CLAYEY, SANDY-SILT, stiff	112.34 3.05
Brown/grey CLAYEY-SILT, some sand, loose	111.73 3.66
Brown/grey fine SAND	110.51 4.88
Brown/grey fine to medium SAND, trace gravel	108.07 7.32
Grey CLAYEY-SILT some sand	106.86 8.53
Brown/grey fine-coarse SAND, some gravel	105.03 10.36
Coarse SANDS and GRAVELS	103.20 12.19
Inferred BEDROCK (spoon and auger refusal)	

SAMPLES

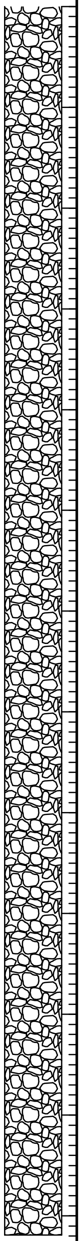
NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
1	50 D.O.		2
2	50 D.O.		8
3	50 D.O.		6
4	50 D.O.		9
5	50 D.O.		4
6	50 D.O.		2
7	50 D.O.		8
8	50 D.O.		9
9	75 D.O.		33
10	75 D.O.		29
11	75 D.O.		43
12	62.5 D.O.		32
13	62.5 D.O.		7
14	62.5 D.O.		28
15	62.5 D.O.		19
16	62.5 D.O.		42
17	62.5 D.O.		29
18	62.5 D.O.		34
19	62.5 D.O.		30
20	62.5 D.O.		35
			>99 for 50mm

● PENETRATION RESISTANCE (N), BLOWS/0.3m
▲ DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED
WATER CONTENT, % W_P — W — W_L



ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GEMTEC
Consulting Engineers and Scientists

LOGGED: A.P.
CHECKED: K.H.

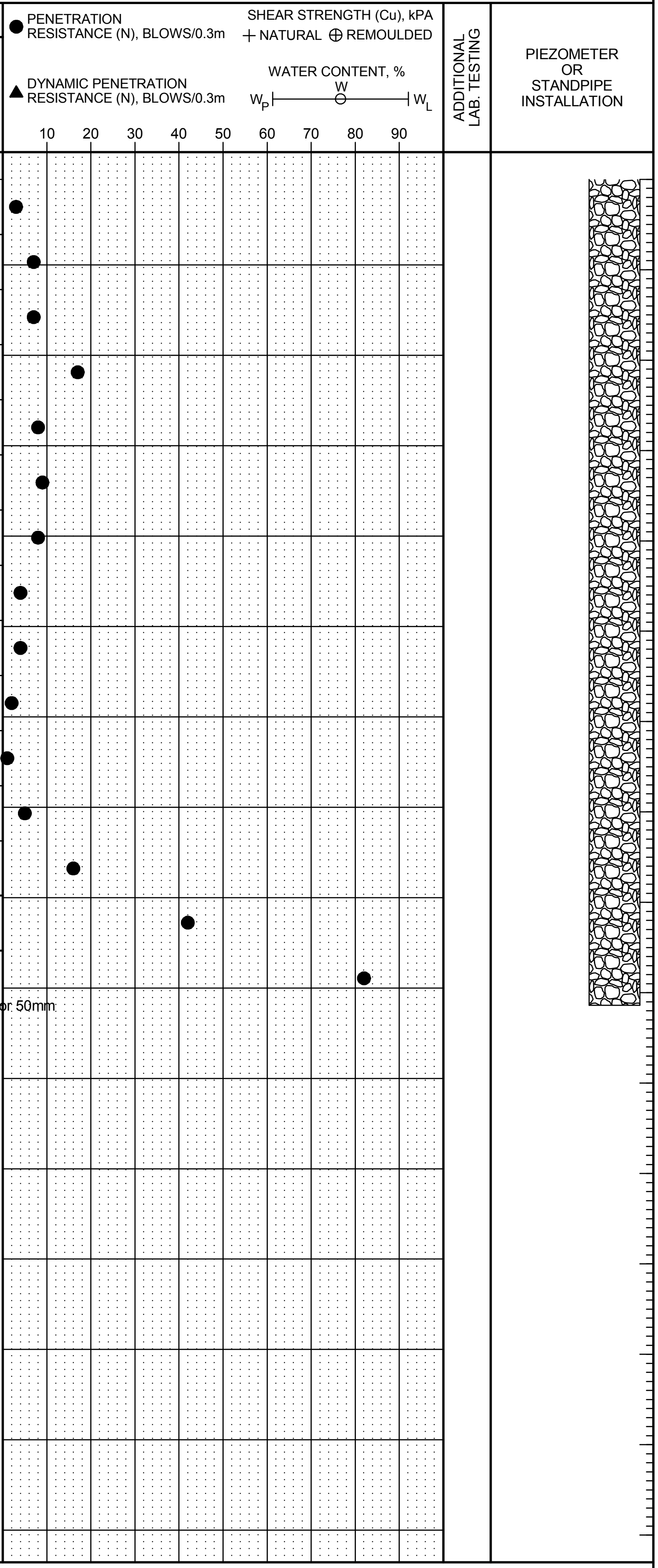
RECORD OF BOREHOLE 17-3

CLIENT: 1384341 Ontario Ltd.
PROJECT: Hydrogeological Investigation
JOB#: 61318.15
LOCATION: See Detailed Site Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD2013
BORING DATE: 13/07/2017

BORING METHOD: Power Auger 200 mm Diameter Hollow Stem

SOIL PROFILE		SAMPLES			
DESCRIPTION	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
Ground Surface	114.95				
Brown TOPSOIL	114.75 0.20				
Brown SILTY-SAND, roots		1	75 D.O.		3
Brown fine SAND	114.34 0.61	2	75 D.O.		7
		3	75 D.O.		7
Brown/grey CLAYEY-SILT, trace sand, stiff to very stiff	113.43 1.52				
Brown/grey silty fine SAND Occasional layers of stiff CLAYEY-SILT, some sand (2.7m and 4.8m)	113.12 1.83	4	75 D.O.		17
		5	75 D.O.		8
		6	75 D.O.		9
		7	75 D.O.		8
		8	75 D.O.		4
		9	75 D.O.		4
Brown/grey CLAYEY-SILT, some sand, stiff	109.16 5.79	10	75 D.O.		2
		11	75 D.O.		1
Brown/grey fine SAND	108.09 6.86	12	75 D.O.		5
		13	75 D.O.		16
Brown/greymedium to coarse SAND, trace gravel	106.73 8.22	14	75 D.O.		42
		15	75 D.O.		82
Inferred BEDROCK (spoon and auger refusal)	105.81 9.14				>99 for 50mm



LOGGED: A.P.

CHECKED: K.H.

GEMTEC
Consulting Engineers and Scientists

Ontario Ministry of the Environment

Well Tag A 003478

MW1

Well Recorc

Regulation 903 Ontario Water Resources Ac

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Instructions for Completing Form

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- 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: NEWILL
Last Name: CORPORATION
Mailing Address (Street Number/Name, RR,Lot,Concession): 2591 CARP ROAD
County/District/Municipality: WEST CARLETON
Township/City/Town/Village: OTTAWA
Province: Ontario
Postal Code: K0A 1L0
Telephone Number (include area code): 831 8968
Address of Well Location (County/District/Municipality): WEST CARLETON
Township: HUNTLEY
Lot: 3
Concession: 3
RR#/Street Number/Name: 2727 CARP ROAD
City/Town/Village: OTTAWA
Site/Compartment/Block/Tract etc.: 4 R 8028
GPS Reading: NAD 83 Zone 18 Easting E422533 Northing N5016669
Unit Make/Model: MAGELLAN
Mode of Operation: UTM ☐ Undifferentiated ☐ Averaged ☐ Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth Metres From	To
BROWN	TOPSOIL		FINE	0	1.5
GREY	SAND		MED	1.5	3.6
GRAY	GRAVEL	BOULDERS	COARSE	3.6	6
			WELL #3		

Hole Diameter

Depth Metres From	To	Diameter Centimetres
0	6	25

Water Record

Water found at Metres	Kind of Water	
___ m ☐ Gas ☐ Other	☐ Fresh ☐ Salty	☐ Sulphur ☐ Minerals
___ m ☐ Gas ☐ Other	☐ Fresh ☐ Salty	☐ Sulphur ☐ Minerals
___ m ☐ Gas ☐ Other	☐ Fresh ☐ Salty	☐ Sulphur ☐ Minerals

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 Metres From	To
Casing				
05	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	.4mm	0	3
05	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	.4mm	0	6
15	☒ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	.188	+.9	.9
Screen				
Outside diam 5.7	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	Slot No. 4	1.5 4.5	3 6
No Casing or Screen				
	☐ Open hole			

Test of Well Yield

Pumping test method	Draw Down Time min	Water Level Metres	Recovery Time min	Water Level Metres
Pump intake set at - (metres)	Static Level			
Pumping rate - (litres/min)	1		1	
Duration of pumping ___hrs + ___ min	2		2	
Final water level end of pumping ___ metres	3		3	
Recommended pump type. ☐ Shallow ☐ Deep	4		4	
Recommended pump depth. ___ metres	5		5	
Recommended pump rate. (litres/min)	10		10	
If flowing give rate - (litres/min)	15		15	
	20		20	
	25		25	
If pumping discontinued, give reason.	30		30	
	40		40	
	50		50	
	60		60	

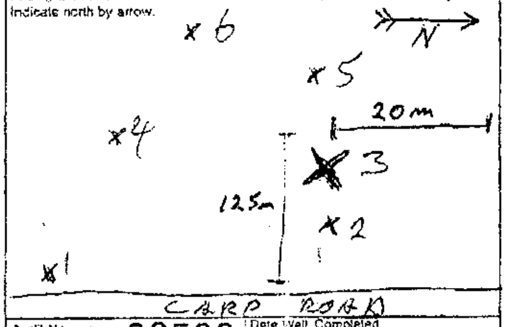
Plugging and Sealing Record

☐ Annular space ☐ Abandonment

Depth set at - Metres From	To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
0	1.5	BENTONITE	7 bags
1.5	3	#80 SAND	5 bags
3	4.5	BENTONITE	6 bags
4.5	6	#8 SAND	5 bags.

Location of Well

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



Method of Construction

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

Water Use

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

Final Status of Well

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

Audit No. Z 03582

Date Well Completed YYYY MM DD

Was the well owner's information package delivered? ☐ Yes ☒ No

Date Delivered YYYY MM DD

Well Contractor/Technician Information

Name of Well Contractor: PLUMBING VILLAGE
Well Contractor's Licence No.: 6574
Business Address (street name, number, city etc.): BOX 429 CARP ONT K0A 1L0
Name of Well Technician (last name, first name): S. GRUSE
Well Technician's Licence No: 310
Signature of Technician/Contractor: x
Date Submitted YYYY MM DD

Ministry Use Only

Data Source
Contractor
Date Received YYYY MM DD
Date of Inspection YYYY MM DD
Remarks
Well Record Number

0506E (09/03)

Contractor's Copy ☐ Ministry's Copy ☐ Well Owner's Copy ☐

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Ontario Ministry of the Environment

Well Tag Number: A003480

MW2

Well Record

Regulation 903 Ontario Water Resources Act

page ___ of ___

Instructions for Completing Form

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- **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: NEWILL	Last Name: CORPORATION	Mailing Address (Street Number/Name, RR, Lot Concession): 2591 CARP ROAD	
County/District/Municipality: WEST CARLETON	Township/City/Town/Village: OTTAWA	Province: Ontario	Postal Code: K0A1L0
Telephone Number (include area code): 831 8968			
Address of Well Location (County/District/Municipality): 2727 CARP ROAD	Township: WEST CARLETON	Lot: 8	Concession: 3
RR#/Street Number/Name: ~~OTTAWA~~ WEST CARLETON	City/Town/Village: OTTAWA	Site/Compartment/Block/Tract etc.: 4R 8028	
GPS Reading NAD 83, Zone 18, Easting E 422093, Northing N 5016301	Unit Make/Model: MAGELLAN	Mode of Operation: ☐ Undifferentiated ☑ Averaged ☐ Differentiated, specify ___	UTM

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth Metres From	To
BROWN	TOPSOIL		PACKED	0	.9
GREY	CLAY		HARD	.9	4.8
GREY	GRAVEL	STONES	LOOSE	4.8	5.4
GREY	LIMESTONE		MED	5.4	6.0

WELL #5

Hole Diameter

Depth Metres From	To	Diameter Centimetres
0	6	25

Water Record

Water found at Metres	Kind of Water	
___ m	☐ Fresh ☐ Salty	☐ Sulphur ☐ Minerals
☐ Gas ☐ Other		
___ m	☐ Fresh ☐ Salty	☐ Sulphur ☐ Minerals
☐ Gas ☐ Other		
___ m	☐ Fresh ☐ Salty	☐ Sulphur ☐ Minerals
☐ Gas ☐ 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 Metres From	To
Casing				
5	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	4 m	0	3
5	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	4 m	0	6
15	☒ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	.188	+.9	.9
Screen				
Outside diam	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	Slot No. #1	1.5	3
5.7		#4 #2	4.5	6
No Casing or Screen				
	☐ Open hole			

Test of Well Yield

Pumping test method	Draw Down Time min	Water Level Metres	Recovery Time min	Water Level Metres
Pump intake set at - (metres)	Static level			
Pumping rate - (litres/min)	1		1	
Duration of pumping ___ hrs + ___ min	2		2	
Final water level end of pumping ___ metres	3		3	
Recommended pump type. ☐ Shallow ☐ Deep	4		4	
Recommended pump depth. ___ metres	5		5	
Recommended pump rate. (litres/min)	10		10	
If flowing give rate - (litres/min)	15		15	
If pumping discontinued, give reason.	20		20	
	25		25	
	30		30	
	40		40	
	50		50	
	60		60	

Plugging and Sealing Record ☒ Annular space ☐ Abandonment

Depth set at - Metres From	To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
0	1.5	BENTONITE	4 bags
1.5	3	#80 SAND	5 bags.
3	4.5	BENTONITE	4 bags
4.5	6	#80 SAND	5 bags

Method of Construction

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

Water Use

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

Final Status of Well

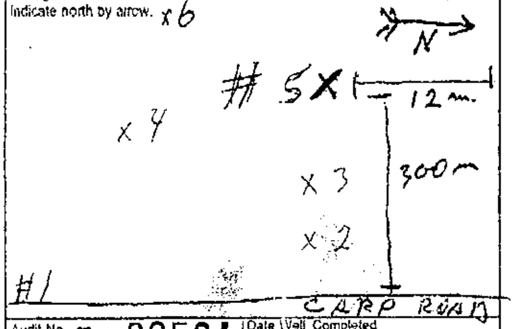
☐ Water Supply ☐ Recharge well ☐ Unfinished ☐ Abandoned, (Other)
☐ Observation well ☐ Abandoned, insufficient supply ☐ Dewatering
☒ Test Hole ☐ Abandoned, poor quality ☐ Replacement well

Well Contractor/Technician Information

Name of Well Contractor: PLUMBING VILLAGE
Well Contractor's Licence No.: 6574
Business Address (street name, number, city etc.): BOX 429 CARP ONT. K0A-1L0
Name of Well Technician (last name, first name): S. SLUSE
Well Technician's Licence No.: 310
Signature of Technician/Contractor: x D -
Date Submitted YYYY MM DD

Location of Well

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



Audit No. Z 03584
Date Well Completed YYYY MM DD
Was the well owner's information package delivered? ☐ Yes ☒ No
Date Delivered YYYY MM DD

Ministry Use Only

Data Source
Contractor
Date Received YYYY MM DD
Date of Inspection YYYY MM DD
Remarks
Well Record Number

0506E (09/03)

Contractor's Copy ☐ Ministry's Copy ☐ Well Owner's Copy ☐

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Ontario Ministry of the Environment

Well Tag Number A 003479

MW3

Well Record

Regulation 903 Ontario Water Resources Act

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Instructions for Completing Form

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- **All metre measurements shall be reported to 1/10th of a metre.**
- Please print clearly in blue or black ink only

Well Owner's Information and Location of Well Information

Ministry Use Only: MUN ___ CON ___ LOT ___

First Name: NIEWILL
Last Name: CORPORATION
Mailing Address (Street Number/Name, RR,Lot,Concession): 2591 CARP ROAD
County/District/Municipality: WEST CARLETON
Township/City/Town/Village: OTTAWA
Province: Ontario
Postal Code: K0A 1L0
Telephone Number (include area code): 831 8968
Address of Well Location (County/District/Municipality): WEST CARLETON
Township: HUNTLEY
Lot: 7
Concession: E 3
RR#/Street Number/Name: 2727 CARP ROAD
City/Town/Village: OTTAWA
Site/Compartment/Block/Tract etc.: 4R 8028
GPS Reading: NAD 83 Zone 18 Easting E422610 N Northing 5016328
Unit Make/Model: MAGELLAN
Mode of Operation: UTM ☐ Undifferentiated ☒ Averaged ☐ Differentiated, specify ___

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth Metres From	Depth Metres To
BROWN	SAND		FINE	0	.6
GREY	CLAY		HARD	.6	3.9
BLUE	CLAY		WET	3.9	6

WELL #4

Hole Diameter

Depth Metres From	Depth Metres To	Diameter Centimetres
0	6	25

Water Record

Water found at ___ Metres / Kind of Water

☐ ___ m ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other ___

☐ ___ 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 Metres From	Depth Metres To
Casing				
5	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	4m	0	3
5	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	4m	0	6
15	☒ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	188	+.9	.9
Screen				
Outside diam 5.7	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	Slot No 4	1.5	3
			4.5	6
No Casing or Screen				
	☐ Open hole			

Test of Well Yield

Pumping test method ___
Pump intake set at - (metres) ___
Pumping rate - (litres/min) ___
Duration of pumping ___ hrs + ___ min
Final water level end of pumping ___ metres
Recommended pump type. ☐ Shallow ☐ Deep
Recommended pump depth. ___ metres
Recommended pump rate. ___ (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			
1		1	
2		2	
3		3	
4		4	
5		5	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	

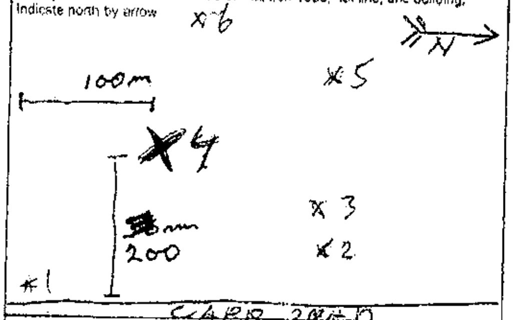
Plugging and Sealing Record

☐ 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)
0	1.5	BENTONITE	4 bags
1.5	3	#80 SAND	5 bags
3	4.5	BENTONITE	4 bags
4.5	6	#80 SAND	5 bags.

Location of Well

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



Method of Construction

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

Water Use

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

Final Status of Well

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

Well Contractor/Technician Information

Name of Well Contractor: PLUMBING VILLAGE
Well Contractor's Licence No: 6574
Business Address (street name, number, city etc.): BOX 479 CARP ONT K0A 1L0
Name of Well Technician (last name, first name): G. GRUSE
Well Technician's Licence No.: 310
Signature of Technician/Contractor: X
Date Submitted YYYY MM DD

Audit No. Z 03583

Date Well Completed YYYY MM DD

Was the well owner's information package delivered? ☐ Yes ☒ No

Date Delivered YYYY MM DD

Ministry Use Only

Data Source
Contractor
Date Received YYYY MM DD
Date of Inspection YYYY MM DD
Remarks
Well Record Number

0506E (09/03)

Contractor's Copy ☐ Ministry's Copy ☐ Well Owner's Copy ☐

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Ontario Ministry of the Environment

Well Tag No. A 003476
00 3476

MW4

Well Record

Regulation 903 : Ontario Water Resources Act

page ___ of ___

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- 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: NEWILL Last Name: CORPORATION
Mailing Address (Street Number/Name, RR, Lot, Concession): 2591 CARP ROAD
County/District/Municipality: WEST CARLETON
Township/City/Town/Village: OTTAWA
Province: Ontario
Postal Code: KOA1LO
Telephone Number (include area code): 831 8968
Address of Well Location (County/District/Municipality): WEST CARLETON
Township: HUNTLEY
Lot: 7
Concession: 3
RR#/Street Number/Name: 2727 CARP ROAD
City/Town/Village: OTTAWA
Site/Compartment/Block/Tract etc: 4R 8028
GPS Reading: NAD 83 Zone 18 Easting 422914E Northing 5016559N
Unit Make/Model: MAGELLIN
Mode of Operation: ☐ Undifferentiated ☒ Averaged ☐ Differentiated, specify ___ UTM

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth Metres From	Depth Metres To
BROWN	SAND		FINE	0	.9
GREY	SAND	SILTY	MEDIUM	.9	4.5
GREY	SAND		FINE	4.5	6
			WELL #1		

Hole Diameter

Depth Metres From	Depth Metres To	Diameter Centimetres
0	6	25

Water Record

Water found at ___ Metres / Kind of Water

___ m ☐ Gas ☐ Other: ☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals

___ m ☐ Gas ☐ Other ☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals

___ m ☐ Gas ☐ Other ☑ Fresh ☐ Salty ☐ Sulphur ☐ Minerals

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 Metres From	Depth Metres To
Casing				
5	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	.4	0	3
5	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	.4	0	6
15	☒ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	188	+.9	.9
Screen				
Outside diam	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	Slot No.	1.5	3
5.7		4	4.5	6
No Casing or Screen				
	☐ Open hole			

Test of Well Yield

Pumping test method ___
Pump intake set at - (metres) ___
Pumping rate - (litres/min) ___
Duration of pumping ___ hrs + ___ min
Final water level end of pumping ___ metres
Recommended pump type. ☐ Shallow ☐ Deep
Recommended pump depth. ___ metres
Recommended pump rate. (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			
1		1	
2		2	
3		3	
4		4	
5		5	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	

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)
0	1.5	BENTONITE	4 bags
1.5	3	#80 SAND	5 bags
3	4.5	BENTONITE	4 bags
4.5	6	#80 SAND	5 bags

Method of Construction

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

Water Use

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

Final Status of Well

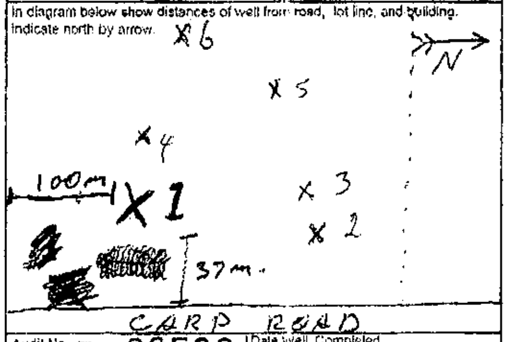
☐ Water Supply ☐ Observation well ☒ Test Hole ☐ Recharge well ☐ Abandoned, insufficient supply ☐ Abandoned, poor quality ☐ Unfinished ☐ Dewatering ☐ Replacement well ☐ Abandoned, (Other) ___

Well Contractor/Technician Information

Name of Well Contractor: PLUMBING VILLAGE
Well Contractor's Licence No.: 6574
Business Address (street name, number, city etc.): BOX 429 CARP ONT K0A1L0
Name of Well Technician (last name, first name): S SCUSE
Well Technician's Licence No.: 310
Signature of Technician/Contractor ___
Date Submitted YYYY MM DD

Location of Well

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



Audit No. Z 03580
Date Well Completed YYYY MM DD
Was the well owner's information package delivered? ☐ Yes ☒ No
Date Delivered YYYY MM DD

Ministry Use Only

Data Source ___ Contractor ___
Date Received YYYY MM DD
Date of Inspection YYYY MM DD
Remarks ___
Well Record Number ___

Ontario Ministry of the Environment

Well Tag Number A006488

MW5

Well Record

Regulation 903 Ontario Water Resources Act

page ___ of ___

Instructions for Completing Form

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- 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: NEWILL
Last Name: CORPORATION
Mailing Address (Street Number/Name, RR,Lot,Concession): 1591 CARP ROAD
County/District/Municipality: WEST CARLETON
Township/City/Town/Village: OTTAWA
Province: Ontario
Postal Code: K0A 1L0
Telephone Number (include area code): 613 831 8968
Address of Well Location (County/District/Municipality): WEST CARLETON
Township: HUNTLEY
Lot: 7
Concession: 3
RR#/Street Number/Name: 2727 CARP ROAD
City/Town/Village: OTTAWA
Site/Compartment/Block/Tract etc.: 4R 8028
GPS Reading: NAD 83 Zone ___ Easting ___ Northing ___
Unit Make/Model: ___
Mode of Operation: ☐ Undifferentiated ☐ Averaged ☐ Differentiated, specify ___

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth Metres From	Depth Metres To
GREY	HARDPAN	STONES	PACKED	0	3
			WELL #6		

Hole Diameter

Depth Metres From	Depth Metres To	Diameter Centimetres
0	3	25

Construction Record

Inside diam centimetres	Material	Wall thickness centimetres	Depth From	Metres To
Casing				
5	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	.4	0	3
15	☒ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	188	+.9	.9
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
Screen				
Outside diam 5.7	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	Slot No. 4	1.5	3
No Casing or Screen				
	☐ Open hole			

Water Record

Water found at ___ Metres / Kind of Water

___ m ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other: ___

___ 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

Test of Well Yield

Pumping test method	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Pump intake set at - (metres)	Static Level			
Pumping rate - (litres/min)	1		1	
Duration of pumping ___ hrs + ___ min	2		2	
Final water level end of pumping ___ metres	3		3	
Recommended pump type. ☐ Shallow ☐ Deep	4		4	
Recommended pump depth. ___ metres	5		5	
Recommended pump rate. (litres/min)	10		10	
	15		15	
If flowing give rate - (litres/min)	20		20	
	25		25	
If pumping discontinued, give reason.	30		30	
	40		40	
	50		50	
	60		60	

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)
0	1.5	BENTONITE	4
1.5	3	#30 SAND	5

Method of Construction

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

Water Use

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

Final Status of Well

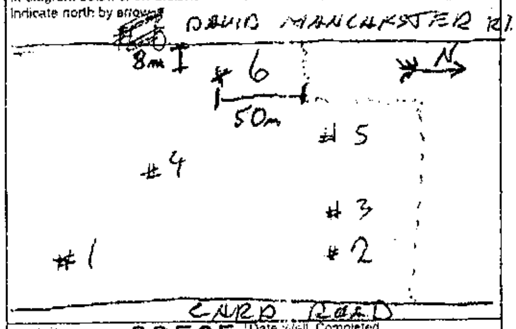
☐ Water Supply ☐ Recharge well ☐ Unfinished ☐ Abandoned, (Other)
☐ Observation well ☐ Abandoned, insufficient supply ☐ Dewatering
☑ Test Hole ☐ Abandoned, poor quality ☐ Replacement well

Well Contractor/Technician Information

Name of Well Contractor: FLUMBING VILLAGE
Well Contractor's Licence No.: 6574
Business Address (street name, number, city etc.): BOX 429 CARP ONT K0A 1L0
Name of Well Technician (last name, first name): S. STRUSS
Well Technician's Licence No.: 310
Signature of Technician/Contractor: B. W. Stuce
Date Submitted YYYY MM DD

Location of Well

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



Audit No. Z 03585
Date Well Completed YYYY MM DD
Was the well owner's information package delivered? ☐ Yes ☒ No
Date Delivered YYYY MM DD

Ministry Use Only

Data Source
Contractor
Date Received YYYY MM DD
Date of Inspection YYYY MM DD
Remarks
Well Record Number

Ontario Ministry of the Environment

Well Tag (place sticker below) A 003477

003477

MW 6

Well Record

Regulation 903 Ontario Water Resources Act

page ___ of ___

Instructions for Completing Form

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- **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: AIEWILL
Last Name: CORPORATION
Mailing Address (Street Number/Name, RR, Lot, Concession): 2591 CARP ROAD
County/District/Municipality: WEST CARLETON
Township/City/Town/Village: OTTAWA
Province: Ontario
Postal Code: K0A 1L0
Telephone Number (include area code): 613 831 8968
Address of Well Location (County/District/Municipality): WEST CARLETON
Township: HUNTLEY
Lot: 3
Concession: 3
RR#/Street Number/Name: 2727 CARP ROAD
City/Town/Village: OTTAWA
Site/Compartment/Block/Tract etc.: 4R 8028
GPS Reading: NAD 83 Zone 18E Easting 422653N Northing 5016778
Unit Make/Model: MAGELLAN
Mode of Operation: UTM ☐ Undifferentiated ☐ Averaged ☐ Differentiated, specify ___

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth Metres From	To
BROWN	SAND		FINE	0	1.2
GREY	CLAY		HARD	1.2	2.1
BROWN	SAND		FINE	2.1	4.2
GREY	SAND	GRAVEL	COARSE	4.2	6
			WELL #1		

Hole Diameter

Depth Metres From	To	Diameter Centimetres
0	6	25

Water Record

Water found at Metres / Kind of Water

☐ ___ m ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other

☐ ___ 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 Metres From	To
Casing				
5	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	.4	0	3
5	☐ Steel ☐ Fibreglass ☒ Plastic ☐ Concrete ☐ Galvanized	.4	0	6
15	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	188	+9	.9
Screen				
Outside diam	☐ Steel ☐ Fibreglass	Slot No	1.5	3
5.7	☒ Plastic ☐ Concrete ☐ Galvanized	4	4.5	6
No Casing or Screen				
	☐ Open hole			

Test of Well Yield

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

Draw Down Time min	Water Level Metres	Recovery Time min	Water Level Metres
Static level			
1		1	
2		2	
3		3	
4		4	
5		5	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	

Plugging and Sealing Record

☐ Annular space ☐ Abandonment

Depth set at - Metres From	To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
0	1.5	BENTONITE	4
1.5	3	#80 SAND	5
3	4.5	BENTONITE	6
4.5	6	#8 SAND	5 kg

Method of Construction

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

Water Use

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

Final Status of Well

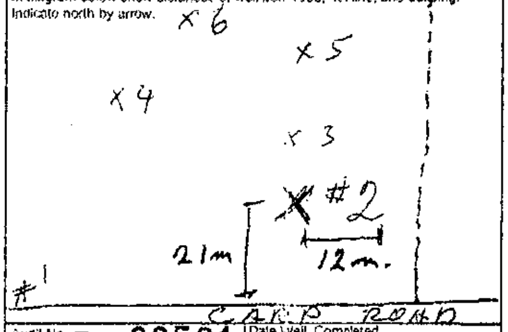
☐ Water Supply ☐ Recharge well ☐ Unfinished ☐ Abandoned, (Other)
☐ Observation well ☐ Abandoned, insufficient supply ☐ Dewatering
☒ Test Hole ☐ Abandoned, poor quality ☐ Replacement well

Well Contractor/Technician Information

Name of Well Contractor: PLUMBING VILLAGE
Well Contractor's Licence No.: 6574
Business Address (street name, number, city etc.): BOX 429 CARP ONT K0A 1L0
Name of Well Technician (last name, first name): S. SILUSE?
Well Technician's Licence No.: 310
Signature of Technician/Contractor: x
Date Submitted YYYY MM DD

Location of Well

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



Audit No. Z 03581
Date Well Completed YYYY MM DD
Was the well owner's information package delivered? ☐ Yes ☒ No
Date Delivered YYYY MM DD

Ministry Use Only

Data Source
Contractor
Date Received YYYY MM DD
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

RECORD OF BOREHOLE MW4D-R

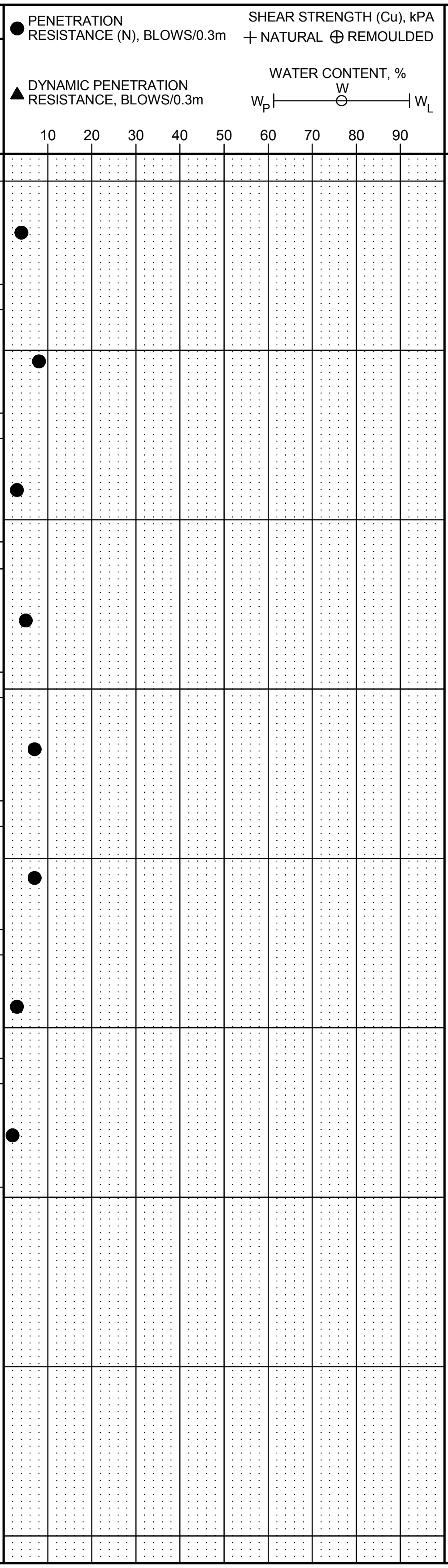
CLIENT: Cavanagh Construction Ltd.
PROJECT: Hydrogeological Consultations
JOB#: 61318.15
LOCATION: See Site Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: May 31 2019

BORING METHOD: Power Auger, Hollow Stem Auger (210mm OD)

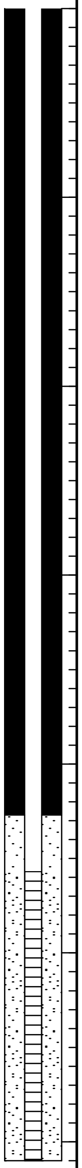
SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)
Ground Surface	116.35
Dark brown silty sand, with organic material (TOPSOIL)	116.17 0.18
Brown SILTY SAND, trace gravel and cobbles	114.98 1.37
Brown SILTY SAND	112.44 3.91
Grey SILTY SAND	110.25 6.10
End of borehole	

NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
1	SS	229	4
2	SS	310	8
3	SS	559	3
4	SS	508	5
5	SS	483	7
6	SS	508	7
7	SS	508	3
8	SS	610	2



ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



Bentonite
Above ground protector

Filter Sand

50 mm diameter, 1.52 m length slotted PVC pipe

Groundwater seepage observed at 1.52 m below ground surface

GEMTEC Consulting Engineers and Scientists

LOGGED: A.N.

CHECKED: A.P.

RECORD OF BOREHOLE MW4S-R

CLIENT: Cavanagh Construction Ltd.
PROJECT: Hydrogeological Consultations
JOB#: 61318.15
LOCATION: See Site Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: May 31 2019

BORING METHOD: Power Auger, Hollow Stem Auger (210mm OD)

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0	Ground Surface	116.33				
	Dark brown silty sand, with organic material (TOPSOIL)	116.15 0.18				
	Brown SILTY SAND, trace gravel and cobbles		1	SS	432	2
1			2	SS	457	3
	Brown SILTY SAND	114.70 1.63	3	SS	508	3
2	Grey brown SILTY SAND	113.99 2.34	4	SS	559	7
3	End of borehole	113.28 3.05				

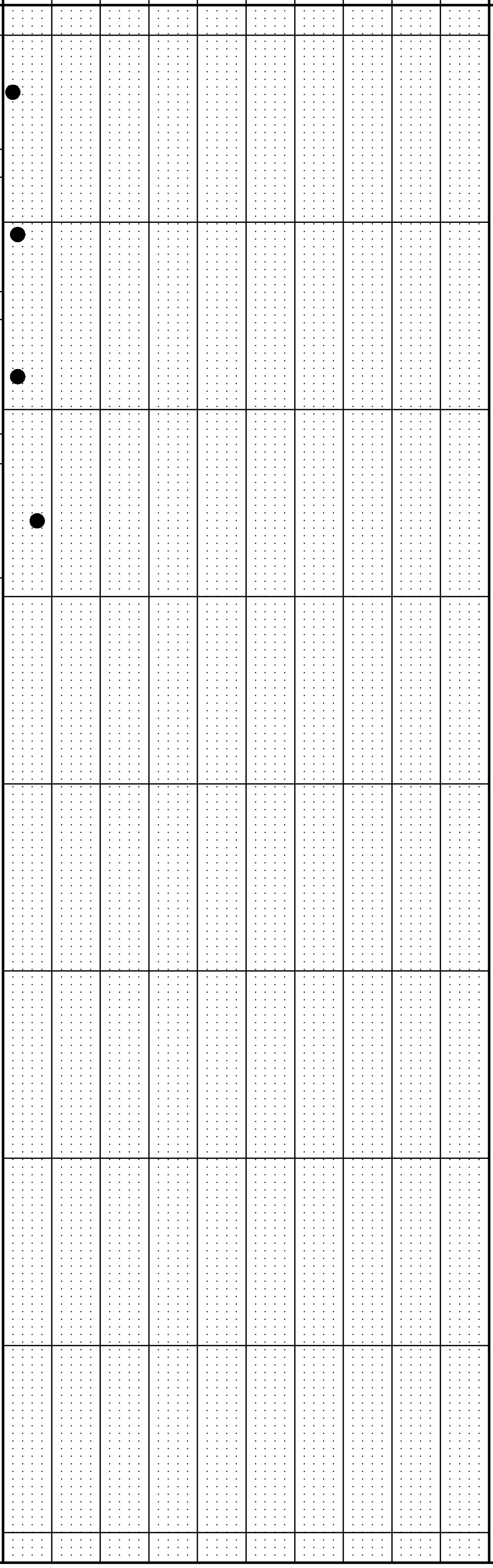
● PENETRATION RESISTANCE (N), BLOWS/0.3m

▲ DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m

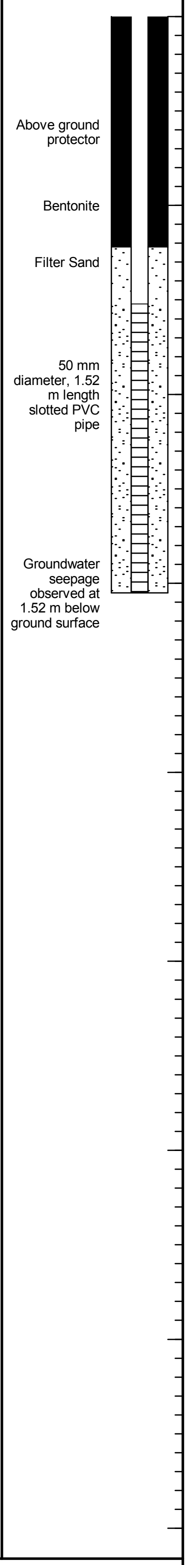
SHEAR STRENGTH (Cu), kPA
+ NATURAL ⊕ REMOULDED

WATER CONTENT, %
W_P ⊢—○—⊣ W_L

ADDITIONAL LAB. TESTING



PIEZOMETER OR STANDPIPE INSTALLATION



GEMTEC
Consulting Engineers and Scientists

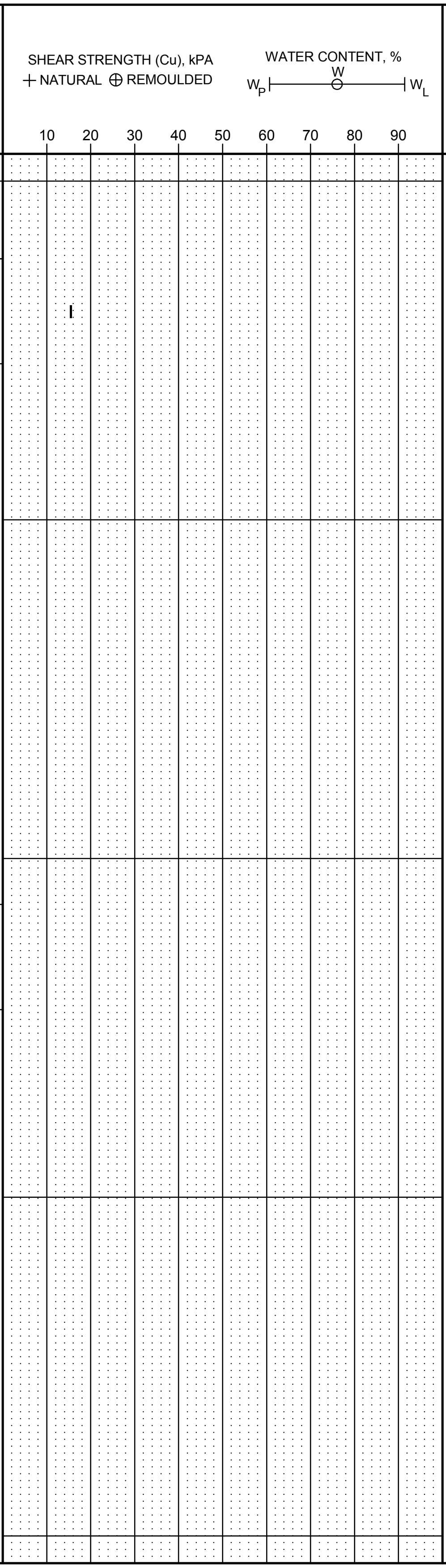
LOGGED: A.N.
CHECKED: A.P.

RECORD OF TEST PIT 18

CLIENT: Cavanagh Construction Limited
PROJECT: Hydrogeological Consultations - Rump Lands
JOB#: 61318.15
LOCATION: See Test Pit Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: May 29 2019

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface	117.1				
	Dark brown sandy silt, with organic material (TOPSOIL)	116.9 0.2	1	GS		Test pit backfilled with excavated material
	Grey brown silty sand, some gravel, some clay, cobbles, boulders (GLACIAL TILL)	115.0 2.1	2	GS	MH	
1						
2						
	Grey sandy clayey silt, some gravel, cobbles and boulders (GLACIAL TILL)	114.4 2.7	3	GS		
	Practical refusal in glacial till End of test pit					Minor groundwater inflow at 2.13 m below ground surface. Significant groundwater inflow at 2.74 m below ground surface
3						
4						



GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

LOGGED: A.N.
CHECKED: A.P.

RECORD OF TEST PIT 19

CLIENT: Cavanagh Construction Limited
PROJECT: Hydrogeological Consultations - Rump Lands
JOB#: 61318.15
LOCATION: See Test Pit Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: May 29 2019

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED / WATER CONTENT, % W_P W W_L	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
	Ground Surface	117.7					
0	Dark brown sandy silt, with organic material (TOPSOIL)						Test pit backfilled with excavated material
	Grey brown silty sand, some gravel, some clay, cobbles, boulders (GLACIAL TILL)	117.5 0.3					
1							
2	Grey sandy clayey silt, some gravel, cobbles and boulders (GLACIAL TILL)	115.7 2.0					
3	End of test pit	114.7 3.1					Minor groundwater inflow at 1.98 m below ground surface
4							

Chart scale: 10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

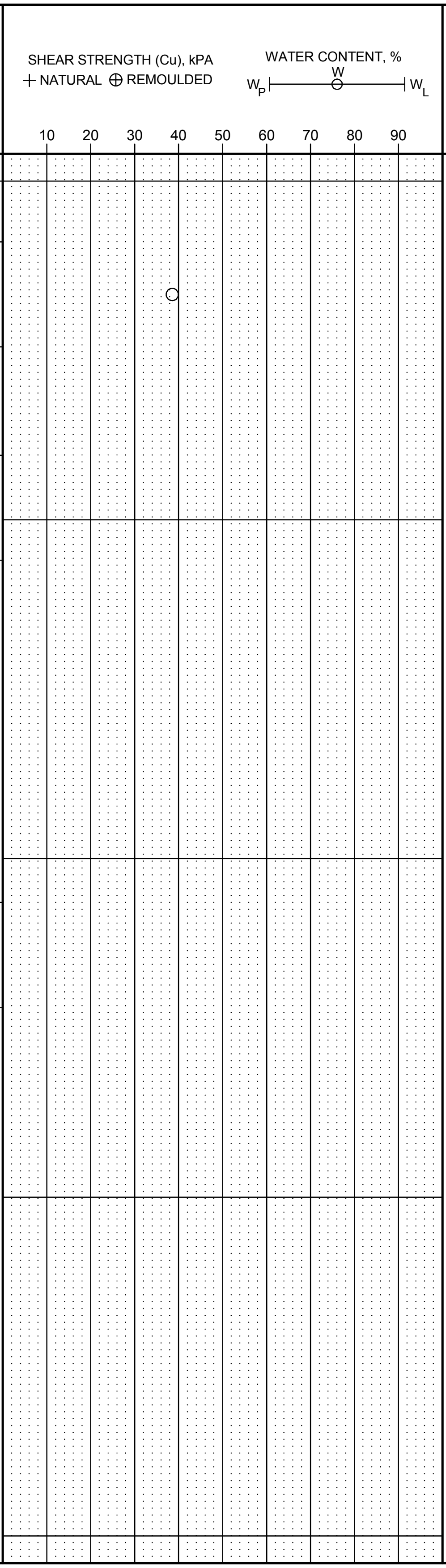
LOGGED: A.N.
CHECKED: A.P.

RECORD OF TEST PIT 20

CLIENT: Cavanagh Construction Limited
PROJECT: Hydrogeological Consultations - Rump Lands
JOB#: 61318.15
LOCATION: See Test Pit Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: May 29 2019

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface	117.0				
	Dark brown silty sand / sandy silt, with organic material (TOPSOIL)	116.8 0.2	1	GS		Test pit backfilled with excavated material
	Very stiff to stiff, grey brown SILT and CLAY, some sand (WEATHERED CRUST)	116.2 0.8	2	GS	MH	
1	Grey brown SILTY SAND	115.3 1.7	3	GS		
2	Grey brown silty sand, some gravel, some clay, cobbles, boulders (GLACIAL TILL)	114.9 2.1				
	Grey sandy clayey silt, some gravel, cobbles and boulders (GLACIAL TILL)	114.3 2.7	4	GS		
3	End of test pit					Minor to moderate groundwater inflow at 1.02 m below ground surface
4						



LOGGED: A.N.

CHECKED: A.P.

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

RECORD OF TEST PIT 21

CLIENT: Cavanagh Construction Limited
PROJECT: Hydrogeological Consultations - Rump Lands
JOB#: 61318.15
LOCATION: See Test Pit Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: May 29 2019

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED / WATER CONTENT, % W_P W W_L	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface	117.5					
	Dark brown silty sand / sandy silt, with organic material (TOPSOIL)	117.2 0.3					Test pit backfilled with excavated material
	Very stiff to stiff, grey brown SILT and CLAY, trace sand (WEATHERED CRUST)	116.6 0.9					
1	Grey brown silty sand, some gravel, some clay, cobbles, boulders (GLACIAL TILL)	115.7 1.8					
2	Practical refusal in glacial till (boulders) End of test pit						Significant groundwater inflow at 1.25 m below ground surface
3							
4							

Shear strength / water content scale: 10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: A.N.

CHECKED: A.P.

RECORD OF TEST PIT 22

CLIENT: Cavanagh Construction Limited
PROJECT: Hydrogeological Consultations - Rump Lands
JOB#: 61318.15
LOCATION: See Test Pit Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: May 29 2019

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED / WATER CONTENT, % W_P W W_L (10 20 30 40 50 60 70 80 90)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface	117.2					
	Dark brown to black, sandy silt, with organics (TOPSOIL)	117.0 0.3					Test pit backfilled with excavated material
	Brown SILTY SAND	116.7 0.5					
1	Very stiff to stiff, grey brown SILT and CLAY, trace sand (WEATHERED CRUST)	115.7 1.5					
2	Grey brown silty sand, some gravel, some clay, cobbles, boulders (GLACIAL TILL)	115.1 2.1					
	Grey sandy clayey silt, some gravel, cobbles and boulders (GLACIAL TILL)	114.2 3.1					
3	End of test pit						No groundwater observed entering test pit during time of excavation
4							

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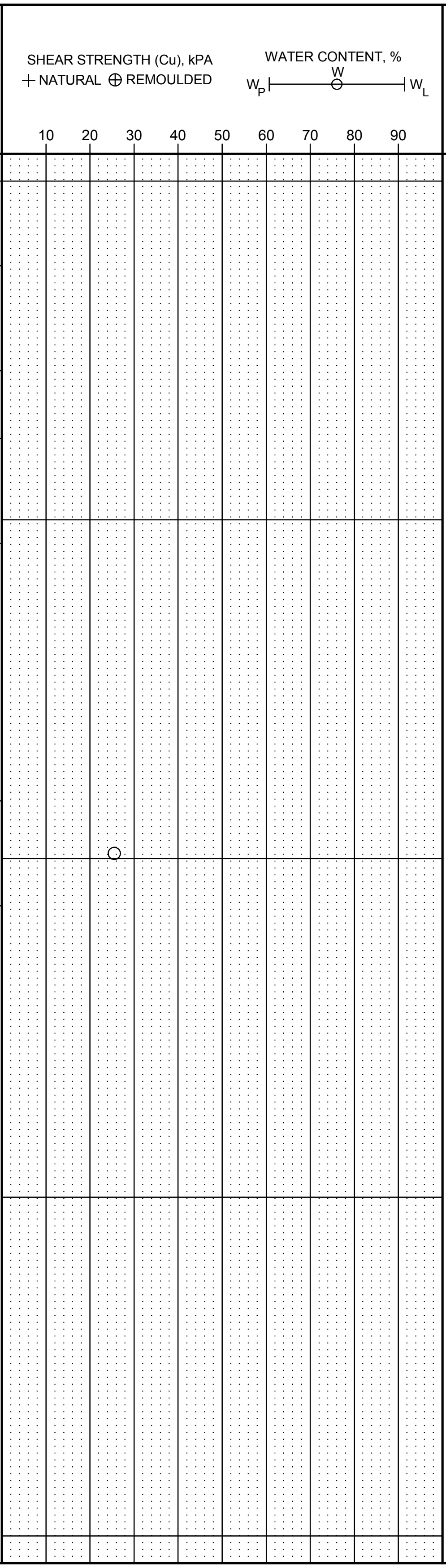
LOGGED: A.N.
CHECKED: A.P.

RECORD OF TEST PIT 23

CLIENT: Cavanagh Construction Limited
PROJECT: Hydrogeological Consultations - Rump Lands
JOB#: 61318.15
LOCATION: See Test Pit Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: May 29 2019

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface	116.7				
	Dark brown to black, sandy silt, with organics (TOPSOIL)	116.5 0.3	1	GS		Test pit backfilled with excavated material
	Grey brown SILTY SAND	116.0 0.8	2	GS		
1	Grey SILTY SAND / SANDY SILT	114.9 1.8	3	GS		
2	Stiff, grey SILT and CLAY, trace sand	113.7 3.1	4	GS	MH	
3	End of test pit					Minor groundwater inflow at 0.71 m below ground surface
4						



LOGGED: A.N.

CHECKED: A.P.

RECORD OF TEST PIT 24

CLIENT: Cavanagh Construction Limited
PROJECT: Hydrogeological Consultations - Rump Lands
JOB#: 61318.15
LOCATION: See Test Pit Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: May 29 2019

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED / WATER CONTENT, % W_P ⊢ W ○ ⊣ W_L 10 20 30 40 50 60 70 80 90	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		117.2					
	Dark brown silty sand / sandy silt, with organic material (TOPSOIL)		116.9 0.3					Test pit backfilled with excavated material
1	Very stiff to stiff, grey brown SILT and CLAY (WEATHERED CRUST)		115.6 1.7					
2	Stiff, grey SILT and CLAY, trace sand		114.2 3.1					
3	End of test pit							No groundwater observed entering test pit during time of excavation
4								

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LOGGED: A.N.
CHECKED: A.P.

GEO - TESTPIT LOG 61318.15_TEST PIT LOGS_GNT_V02_2019-07-29.GPJ GEMTEC 2018.GDT 31/7/19

RECORD OF TEST PIT 25

CLIENT: Cavanagh Construction Limited
PROJECT: Hydrogeological Consultations - Rump Lands
JOB#: 61318.15
LOCATION: See Test Pit Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: May 29 2019

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED / WATER CONTENT, % W_P ⊢—○ W—⊣ W_L (10 20 30 40 50 60 70 80 90)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		117.0					
	Dark brown to black, sandy silt, with organics (TOPSOIL)		116.8 0.3	1	GS			Test pit backfilled with excavated material
	Brown SILTY SAND		115.9 1.1	2	GS			
1								
	Stiff, grey SILT and CLAY, trace sand		114.0 3.1	3	GS	○	MH	
2								
3	End of test pit							Groundwater seepage observed at about 0.76 m below ground surface
4								

GEO - TESTPIT LOG 61318.15_TEST PIT LOGS_GNT_V02_2019-07-29.GPJ GEMTEC 2018.GDT 31/7/19

GEMTEC
Consulting Engineers and Scientists

LOGGED: A.N.
CHECKED: A.P.

TABLE I

RECORD OF TEST PITS
PROPOSED RESIDENTIAL SUBDIVISION
PART LOTS 7 AND 8, CONCESSION 3
HUNTLEY WARD, CITY OF OTTAWA, ONTARIO

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP1	0.00 – 0.30	TOPSOIL
	0.30 – 1.00	Red brown fine to medium SAND
	1.00 – 4.20	Grey brown fine to coarse SAND
	4.20	End of test pit

Water observed in test pit at about 2.0 metres below existing ground surface, March 25, 2003.

TP2	0.00 – 0.30	TOPSOIL
	0.30 – 0.75	Red brown fine to medium SAND, trace to some coarse sand, gravel and cobbles
	0.75 – 4.20	Grey brown SAND and GRAVEL, some cobbles, trace silt and clay
	4.20	End of test pit

Test pit dry, March 25, 2003.

TP3	0.00 – 0.30	TOPSOIL
	0.30 – 3.76	Yellow brown to grey brown fine to medium SAND, trace silt
	3.76 – 4.30	Grey fine to medium SAND, some silt, trace clay
	4.30	End of test pit

Water observed in test pit at about 3.8 metres below existing ground surface, March 25, 2003.

TABLE I (CONTINUED)

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP4	0.00 – 0.20	TOPSOIL
	0.20 – 1.27	Red brown fine to medium SAND
	1.27 – 3.75	Grey brown fine to medium SAND
	3.75 – 4.60	Grey fine to medium SAND, some boulders
	4.60	End of test pit

Test pit dry, March 25, 2003.

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP5	0.00 – 0.25	TOPSOIL
	0.25 – 0.80	Red brown to grey brown fine to coarse SAND, some gravel and cobbles
	0.80 – 3.50	Grey brown SAND and GRAVEL
	3.50	End of test pit

Water observed in test pit at about 3.1 metres below existing ground surface, March 25, 2003.

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP6	0.00 – 0.22	TOPSOIL
	0.22 – 1.34	Red brown fine to medium SAND
	1.34 – 3.20	Grey brown fine to medium SAND
	3.20 – 3.36	Grey SILTY SAND, trace to some clay
	3.36 – 4.20	Grey SILTY CLAY
	4.20	End of test pit

Water observed in test pit at about 1.3 metres below existing ground surface, March 25, 2003.

TABLE I (CONTINUED)

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP7	0.00 – 0.28	TOPSOIL
	0.28 – 0.58	Red brown fine to medium SAND
	0.58 – 4.20	Grey brown fine to coarse SAND
	4.20 – 4.30	Grey brown SILTY CLAY, some silt
	4.30	End of test pit

Water observed in test pit at about 4.2 metres below existing ground surface, March 25, 2003.

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP8	0.00 – 0.30	TOPSOIL
	0.30 – 1.57	Yellow brown fine to medium SAND
	1.57 – 2.00	Grey brown fine to medium SAND
	2.00 – 4.40	Grey SILTY CLAY
	4.40	End of test pit

Test pit dry, March 25, 2003.

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP9	0.00 – 0.28	TOPSOIL
	0.28 – 4.20	Grey brown fine to medium SAND
	4.20	End of test pit

Test pit dry, March 25, 2003.

TABLE I (CONTINUED)

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP10	0.00 – 0.30	TOPSOIL
	0.30 – 1.50	Yellow brown to grey brown fine to medium SAND, trace silt
	1.50 – 2.45	Grey fine to medium SAND
	2.45	End of test pit in grey SILTY CLAY

Test pit dry, March 25, 2003.

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP11	0.00 – 0.25	TOPSOIL
	0.25 – 2.30	Grey brown SILTY CLAY
	2.30 – 4.26	Grey SILTY CLAY
	4.26	End of test pit

Test pit dry, March 25, 2003.

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP12	0.00 – 0.25	TOPSOIL
	0.25 – 0.56	Yellow brown fine to medium SAND
	0.56 – 1.40	Grey brown silty clay, some gravel, cobbles and boulders (GLACIAL TILL)
	1.40	End of test pit

Test pit dry, March 25, 2003.

TABLE I (CONTINUED)

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP13	0.00 – 0.35	TOPSOIL
	0.35 – 0.70	Red brown fine to medium SAND
	0.70 – 3.30	Grey brown to grey SILTY CLAY, some cobbles
	3.30	End of test pit, refusal BEDROCK

Water observed in test pit at about 1.8 metres below existing ground surface, March 25, 2003.

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP14	0.00 – 0.23	TOPSOIL
	0.23 – 0.43	Red brown fine to medium SAND
	0.43 – 1.42	Grey brown SILTY CLAY, some cobbles
	1.42 – 3.30	Grey clayey silt, some sand gravel and cobbles (GLACIAL TILL)
	3.30	End of test pit, refusal

Water observed in test pit at about 3.2 metres below existing ground surface, March 25, 2003.

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP15	0.00 – 0.17	TOPSOIL
	0.17 – 2.00	Grey brown SILTY CLAY
	2.00 – 2.25	Grey brown clayey silt clay, some sand gravel and cobbles (GLACIAL TILL)
	2.25	End of test pit, refusal BEDROCK

Test pit dry, March 25, 2003.

TABLE I (CONTINUED)

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP16	0.00 – 0.25	TOPSOIL
	0.25 – 2.20	Grey brown SILTY CLAY
	2.20 – 3.10	Grey clayey silt, some sand gravel and cobbles (GLACIAL TILL)
	3.10	End of test pit, refusal BEDROCK

Water observed in test pit at about 3.0 metres below existing ground surface, March 25, 2003.

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP17	0.00 – 0.30	TOPSOIL
	0.30 – 2.00	Yellow brown SILTY SAND
	2.00 – 3.00	Grey brown SILTY SAND, trace clay
	3.00 – 4.60	Grey SILTY CLAY
	4.60	End of test pit

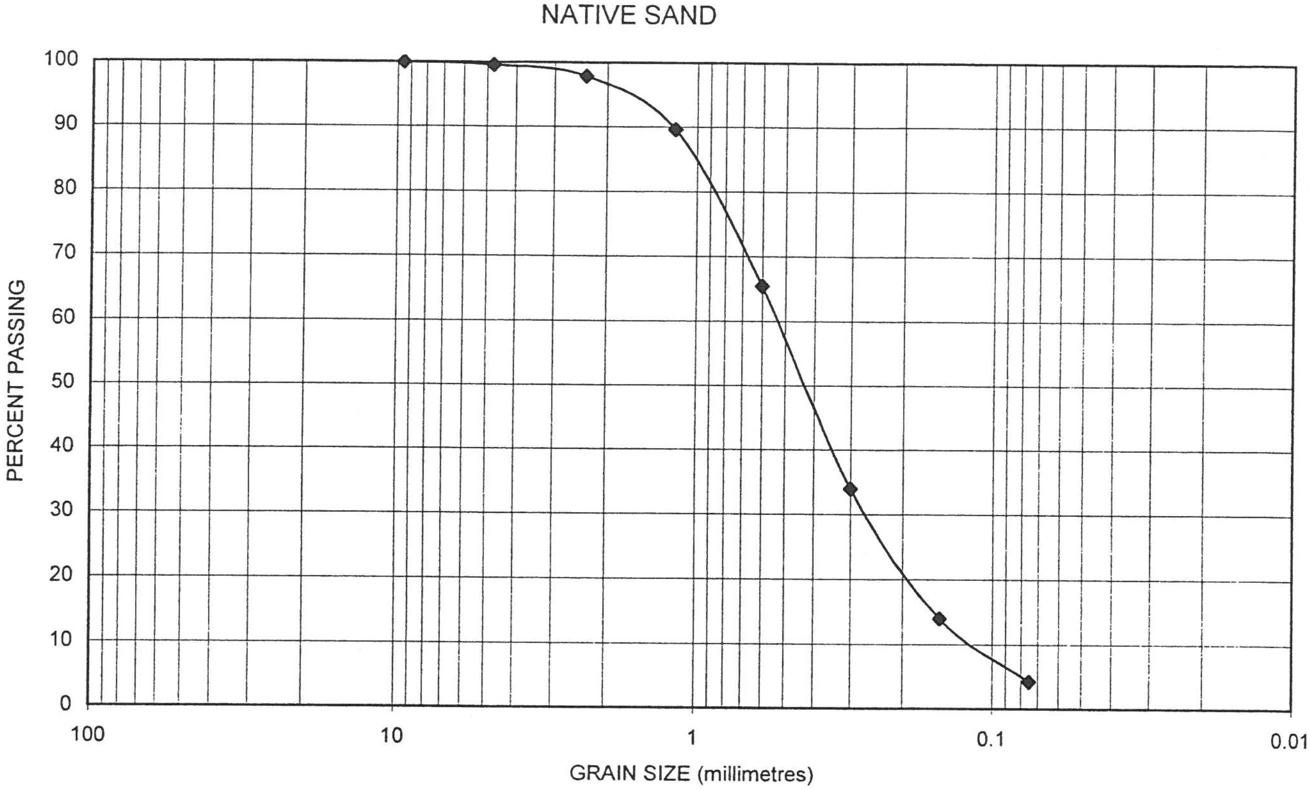
Test pit dry, March 25, 2003.

APPENDIX E

Grain Size Analyses

GRAIN SIZE DISTRIBUTION ANALYSIS

FIGURE 3



SIEVE SIZE (mm)	150	75	37.5	26.5	19.0	13.2	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075
SAMPLE							100.0	99.6	97.9	89.6	65.4	34.0	14.0	4.3

CLIENT: Novatech Engineering Consultants Ltd.

PROJECT: Newill Subdivision

OUR REF.: 031-040

TYPE OF MATERIAL: Sand

INTENDED USE: unknown

DATE SAMPLED: March 25, 2003

DATE TESTED: March 28, 2003

SOURCE: TP1

SAMPLE NO: 1

REMARKS:

MOREY HOULE CHEVRIER
ENGINEERING LTD
2204 Abbott Road, RR 5, Kemptville, Ontario, K0G 1J0
ph: 258-3742 fax: 258-4541

Issued by:

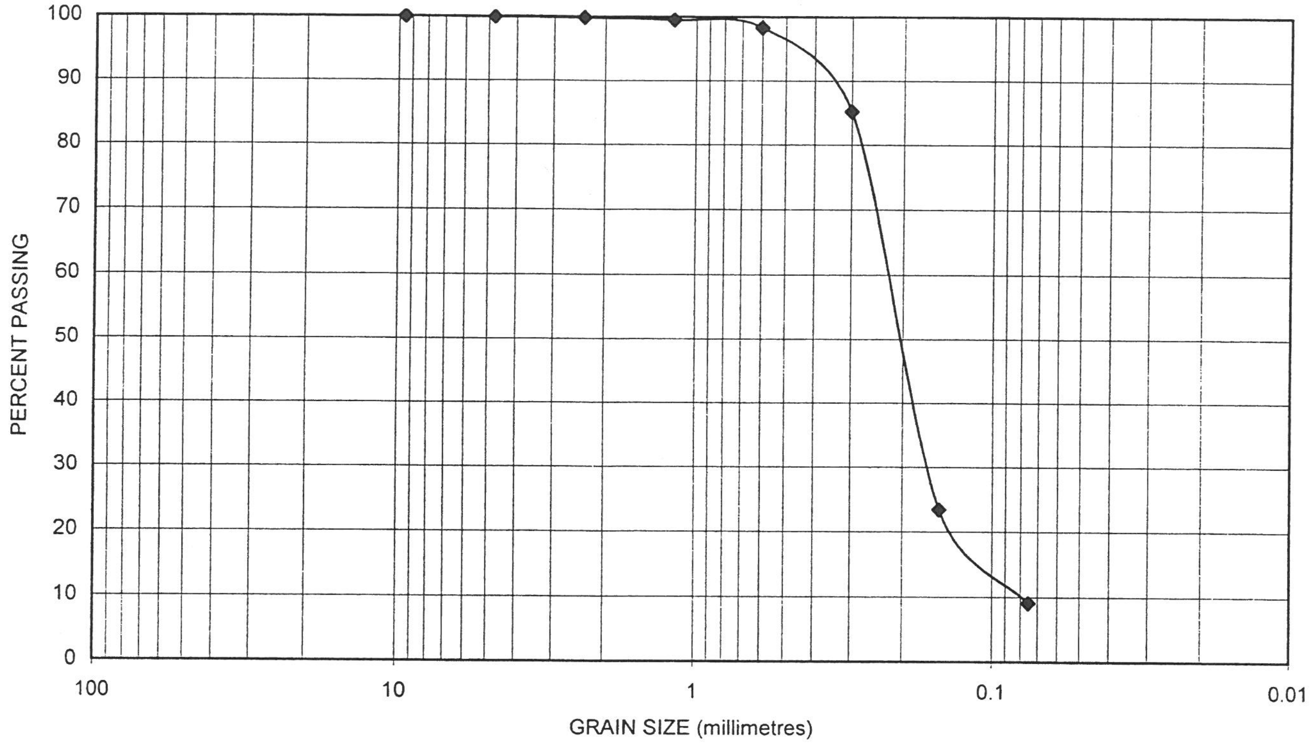
C.R. Morey, P.Eng.

Date:

GRAIN SIZE DISTRIBUTION ANALYSIS

FIGURE 4

NATIVE SAND



SIEVE SIZE (mm)	150	75	37.5	26.5	19.0	13.2	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075
SAMPLE							100.0	99.9	99.8	99.5	98.3	85.2	23.4	9.1

CLIENT: Novatech Enginerring Consultants Ltd.

PROJECT: Newill Subdivision

OUR REF.: 031-040

TYPE OF MATERIAL: Sand

INTENDED USE: unknown

DATE SAMPLED: March 25, 2003

DATE TESTED: March 28, 2003

SOURCE: TP13

SAMPLE NO: 1

REMARKS:

MOREY HOULE CHEVRIER
ENGINEERING LTD
2204 Abbott Road, RR 5, Kemptville, Ontario, K0G 1J0
ph: 258-3742 fax: 258-4541

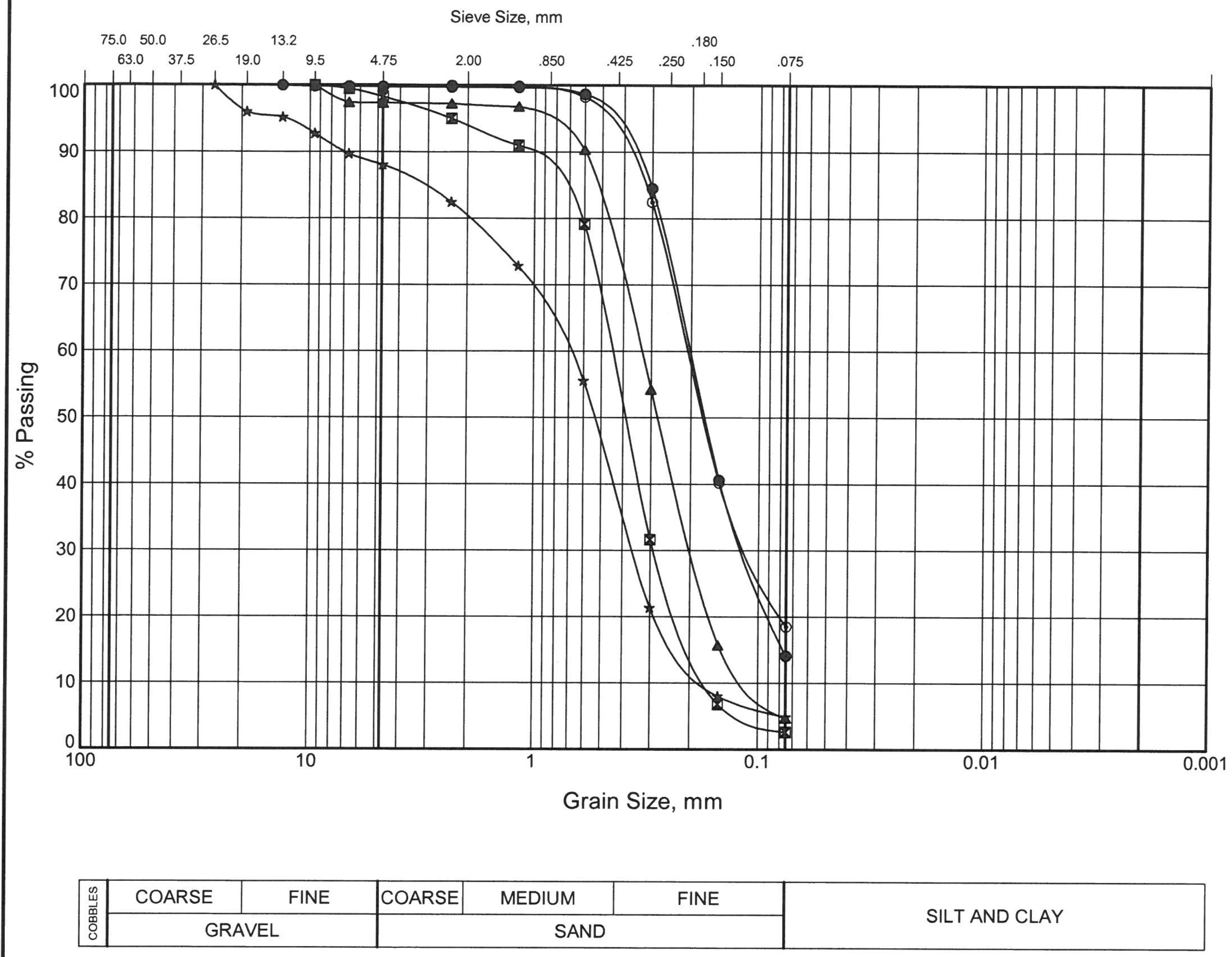
Issued by:

C.R. Morey, P.Eng.

Date:

GRAIN SIZE DISTRIBUTION

FIGURE A1



Legend	Borehole	Sample	Depth (m)	% Gravel	% Sand	% Silt & Clay
●	17-1	9	4.9 - 5.5	0	86	14
⊠	17-1	14	11.6 - 9.1	2	96	3
▲	17-2	10	5.5 - 6.1	3	93	5
★	17-2	16	9.1 - 9..75	12	83	5
⊙	17-3	6	3.0 - 3.7	0	81	19

Houle Chevrier Engineering

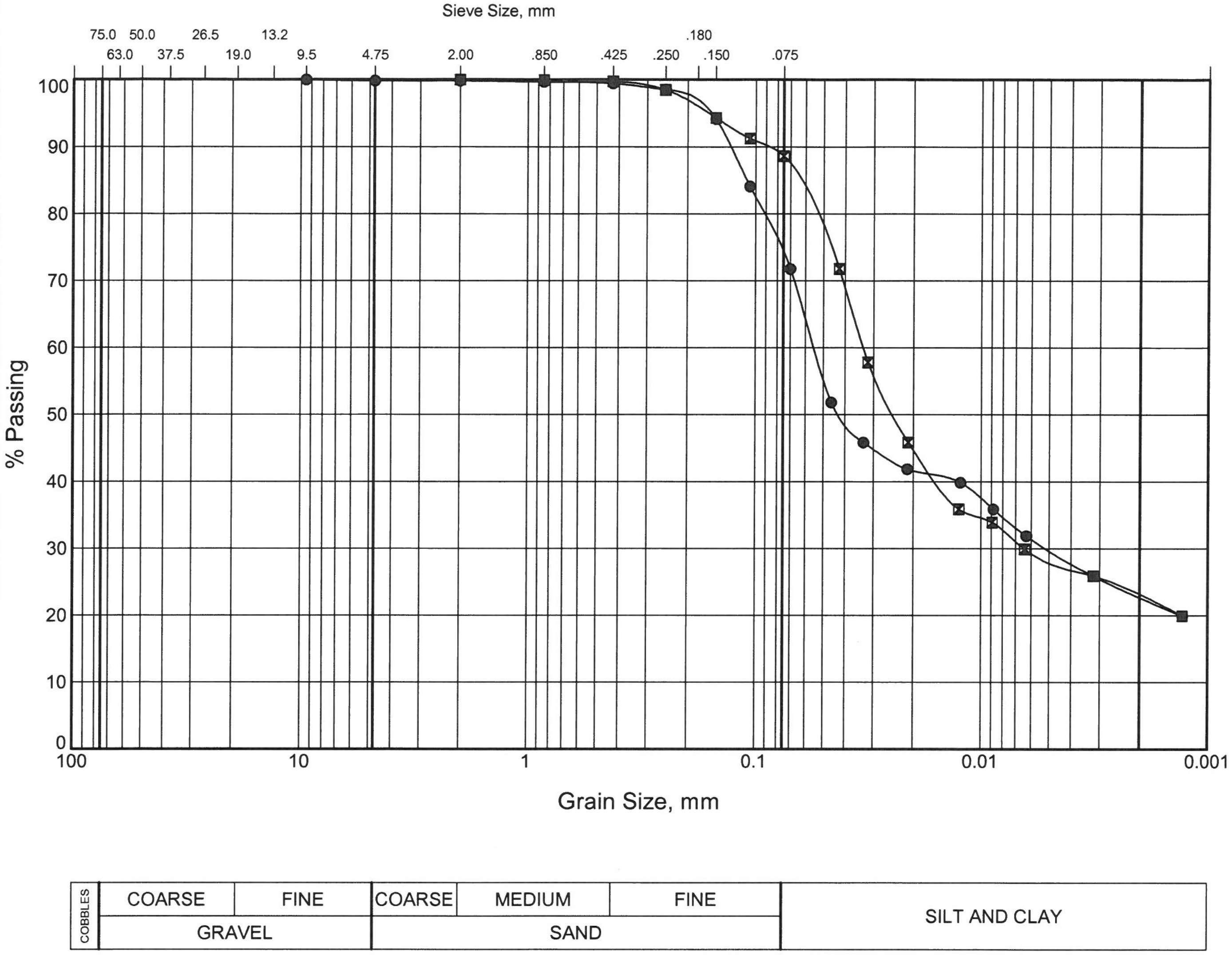
Date: August 2017

Project: 61318.15

SOILS GRAIN SIZE GRAPH UNIFIED % (SIEVE) 61318.15_GNT_2017-07-17.GPJ HOULE CHEVRIER FEB 9 2011.GDT 17/8/1

GRAIN SIZE DISTRIBUTION

FIGURE A2



Legend	Borehole	Sample	Depth (m)	% Gravel	% Sand	% Silt	% Clay
●	17-2	5	2.4 - 3.0	0	26	51	23
☒	17-3	11	6.1 - 6.7	0	11	66	23

Houle Chevrier Engineering

Date: August 2017

Project: 61318.15

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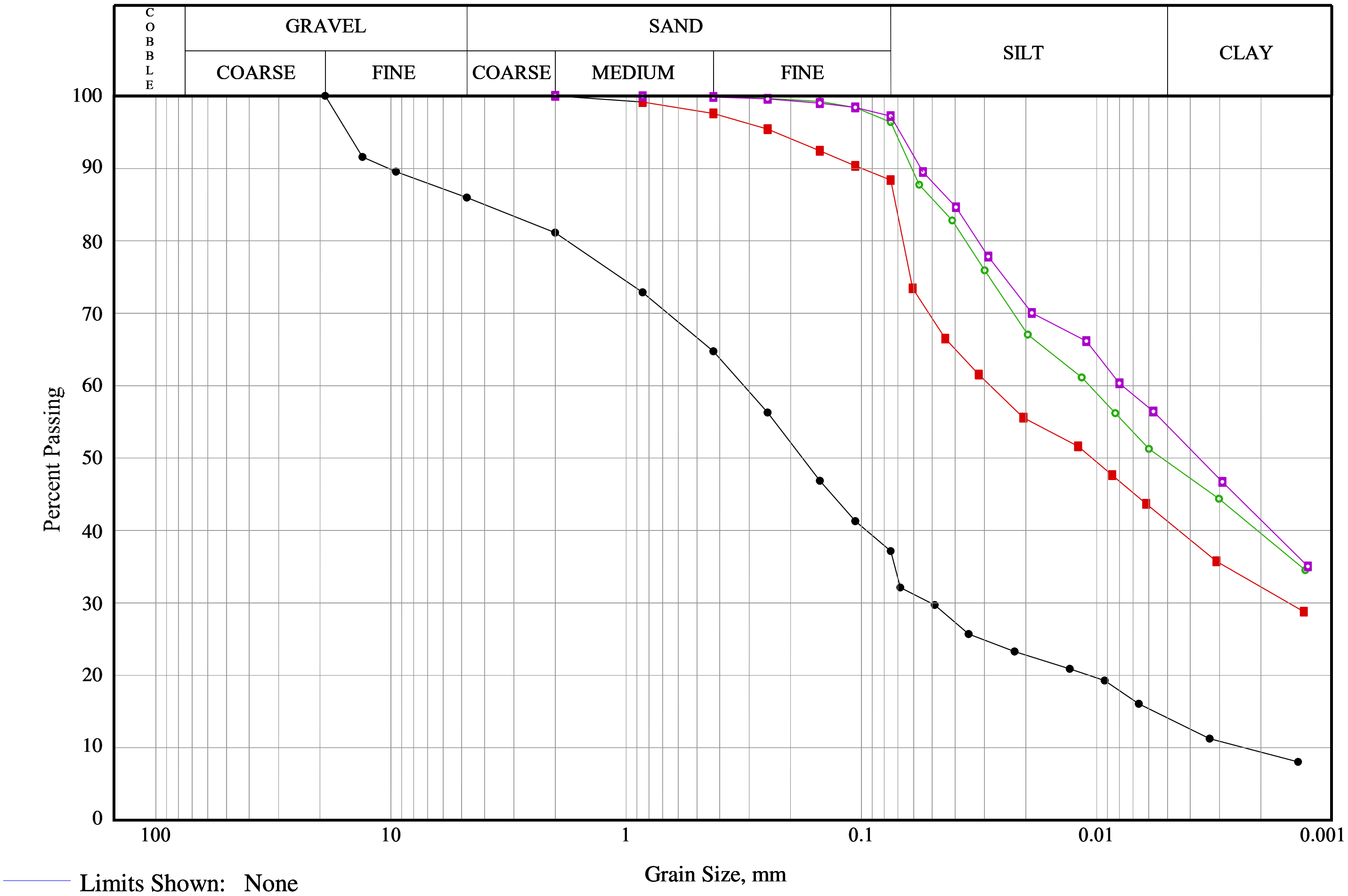
Client: 1384341 Ontario Ltd (Cavanagh Developments)
Project: 13-423 Cavanagh / HydroG / Rump Lands Carp Rd
Project #: 6131815

Soils Grading Chart



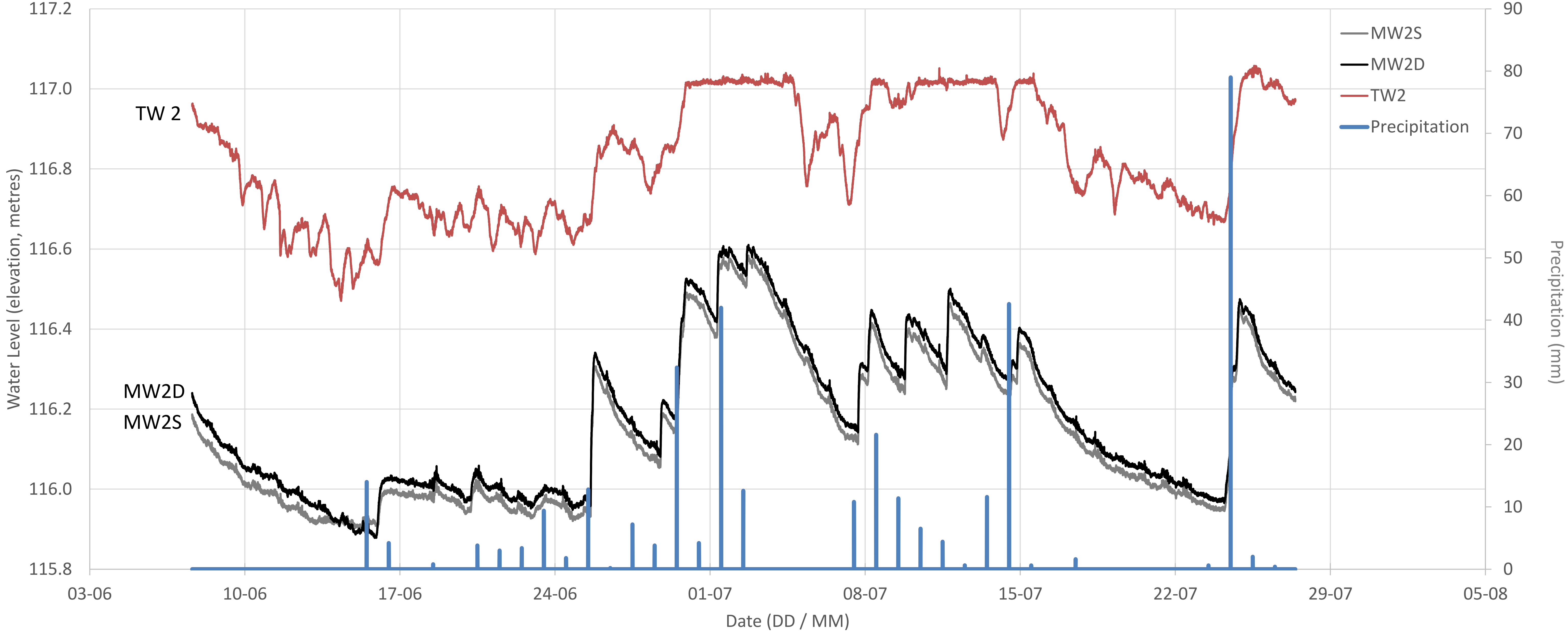
Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
●		18	02	0.23-0.50	14.0	48.8	23.0	14.1
■		20	02	0.2-0.5	0.0	11.6	47.1	41.3
○		23	04	1.83-2.0	0.0	3.6	46.9	49.4
▣		25	03	1.12-1.4	0.0	2.8	42.8	54.4

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
●	Silty sand , some gravel, some clay	N/A	0.00	0.01	0.05	0.18	0.32	4.00	23.0
■	Silt and clay , some sand	N/A	---	---	0.00	0.01	0.03	0.07	47.1
○	Clay and silt , trace sand	N/A	---	---	---	0.01	0.01	0.05	46.9
▣	Clay and silt , trace sand	N/A	---	---	---	0.00	0.01	0.04	42.8

APPENDIX F

Water Level Data

Figure F1: MW2S, MW2D, TW2 Long Term Water Level Data (2017)



Notes:

1. Precipitation data input as single daily entry (12 pm)
2. Water level data corrected for barometric pressure changes.

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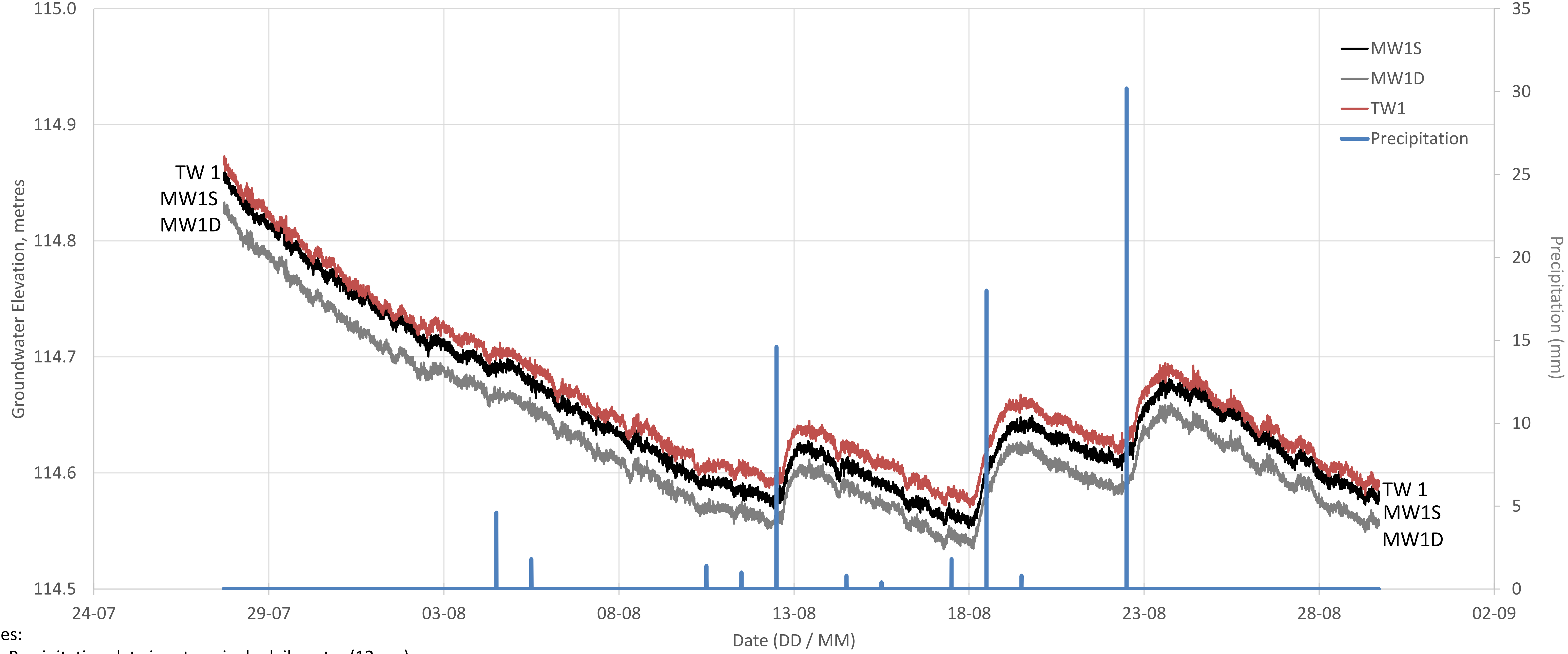
Date: November 2017

Figure F2: MW1S, MW1D, TW1 Long Term Water Level Data (2017)



Notes:

1. Precipitation data input as single daily entry (12 pm)
2. Water level data corrected for barometric pressure changes.

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Project: 61318.15

Date: November 2017

TABLE F1
GROUNDWATER LEVELS - MONITORING WELLS

Well ID	Formation Screened	Easting[1]	Northing	Ground Elevation (m)	Top of Casing Elevation (m)	Top of PVC Elevation (m)	Groundwater Depth (mbgs)[3]				Groundwater Elevation				Vertical Gradient				
							Oct-04	07-Jun-16	09-Jun-17	12-Jul-19	Oct-04	07-Jun-16	09-Jun-17	12-Jul-19	Gradient	23-Oct-04	07-Jun-16	09-Jun-17	12-Jul-19
MW1S	Sand	422570.832	5016885.222	116.158	116.897	116.864	2.19	1.94	1.35	1.65	113.97	114.21	114.81	114.51	-	-	-	-	-
MW1D	Sand & Gravel	422570.832	5016885.222	116.158	116.897	116.782	2.19	2.03	1.38	1.66	113.97	114.13	114.78	114.50	OB[4]	neutral	downward	downward	neutral
TW1	Bedrock	422578.505	5016880.182	116.070	116.928	-	2.16	1.80	1.22	1.53	114.77	115.13	115.71	115.40	OB/BR[4]	upward	upward	upward	upward
MW2S	Silty Clay & Glacial Till	422121.607	5016509.428	116.653	117.4745	117.632	0.78	1.11	0.43	0.97	115.87	115.54	116.23	115.68	-	-	-	-	-
MW2D	Gravel & Bedrock	422121.607	5016509.428	116.653	117.475	117.649	0.74	1.07	0.39	0.96	115.91	115.58	116.26	115.69	OB	upward	upward	upward	neutral
TW2	Bedrock	422115.269	5016514.614	116.733	117.05	-	0.52	0.57	-0.22	0.16	116.53	116.48	117.27	116.89	OB/BR	upward	upward	upward	upward
MW3S	Silty Clay	422639.195	5016539.371	115.296	116.3405	116.441	0.84	1.17	-0.10	0.98	114.46	114.13	115.40	114.32	-	-	-	-	-
MW3D	Silty Clay	422639.195	5016539.371	115.296	116.3405	116.165	0.81	1.33	0.46	0.87	114.49	113.96	114.84	114.43	OB	upward	downward	downward	upward
TW3	Bedrock	422643.526	5016533.014	115.264	115.9985	-	0.60	0.72	0.01	0.42	115.39	115.27	115.99	115.57	OB/BR	upward	upward	upward	upward
MW4S	Silty Sand	422941.937	5016803.806	115.785	116.795	116.783	2.00	1.63	Decom	1.78	113.79	114.16	-	114.01	-	-	-	-	-
MW4D	Sand	422941.937	5016803.806	115.785	116.795	116.790	2.11	1.69	Decom	1.83	113.68	114.09	-	113.96	OB	downward	downward	-	downward
TW4	Bedrock	422934.705	5016808.513	115.670	116.86	-	1.91	1.47	In Use	1.41	114.96	115.40	-	115.46	OB/BR	upward	upward	-	upward
MW5S	Glacial Till	421944.923	5016064.413	119.647	120.598	120.060	2.80	3.27	1.85	2.66	116.85	116.38	117.80	116.99	-	-	-	-	-
TW5	Bedrock	421953.482	5016071.737	119.861	120.24	-	2.80	3.27	1.85	32.85	117.44	116.97	118.39	87.39	OB/BR	upward	upward	upward	N/A
MW6S	Silty Clay & Sand	422679.699	5016991.465	116.681	117.3715	117.110	2.68	2.53	1.66	2.00	114.00	114.15	115.02	114.68	-	-	-	-	-
MW6D	Sand & Gravel	422679.699	5016991.465	116.681	117.37	117.086	2.76	2.69	1.82	2.10	113.92	114.00	114.86	114.58	-	-	-	-	-
TW6	Bedrock	422419.699	5016525.753	116.505	116.954	-	-	-	-	0.33	-	-	-	116.62	-	-	-	-	-
TW7	Bedrock	422179.235	5016179.764	117.768	118.46	-	-	-	-	1.27	-	-	-	117.19	-	-	-	-	-
TW8	Bedrock	422694.375	5016335.988	117.010	117.426	-	-	-	-	0.53	-	-	-	116.90	-	-	-	-	-

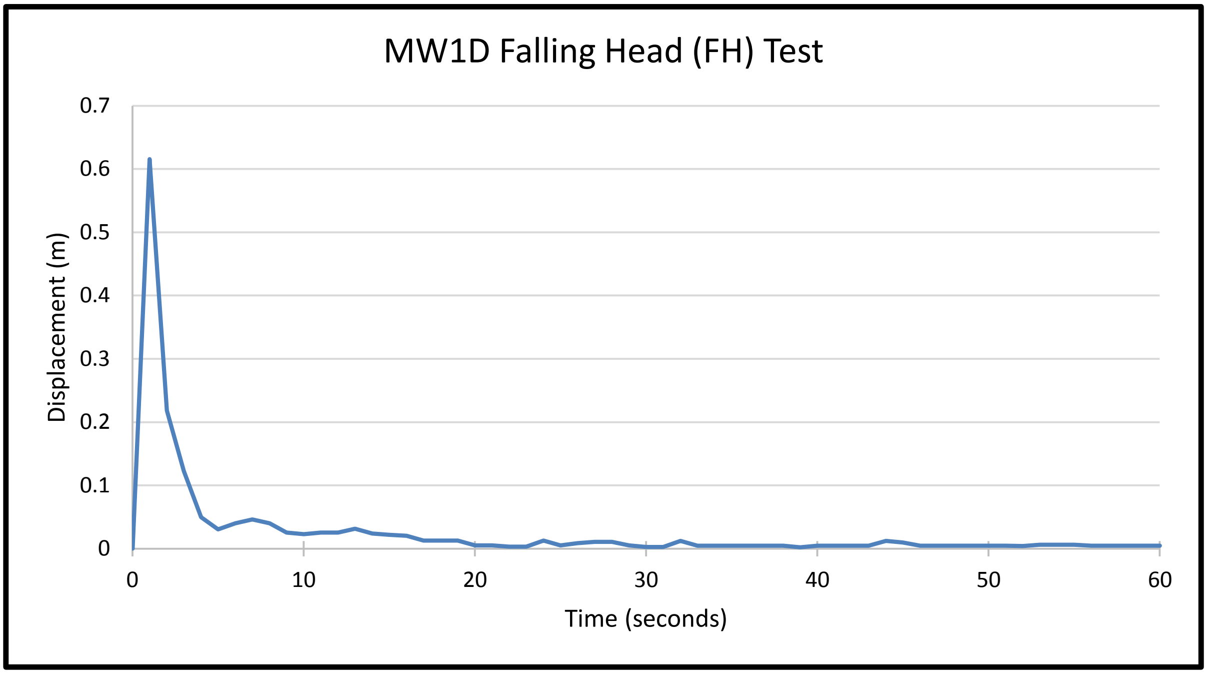
Notes:
1) UTM Zone 18N NAD83
2) metres below top of casing (PVC or Steel)
3) metres below ground surface
4) Gradients determined at each well nest location, within the overburden (OB) and between the overburden and bedrock (OB/BR)
5) N/A - Not applicable (well did not fully recover)

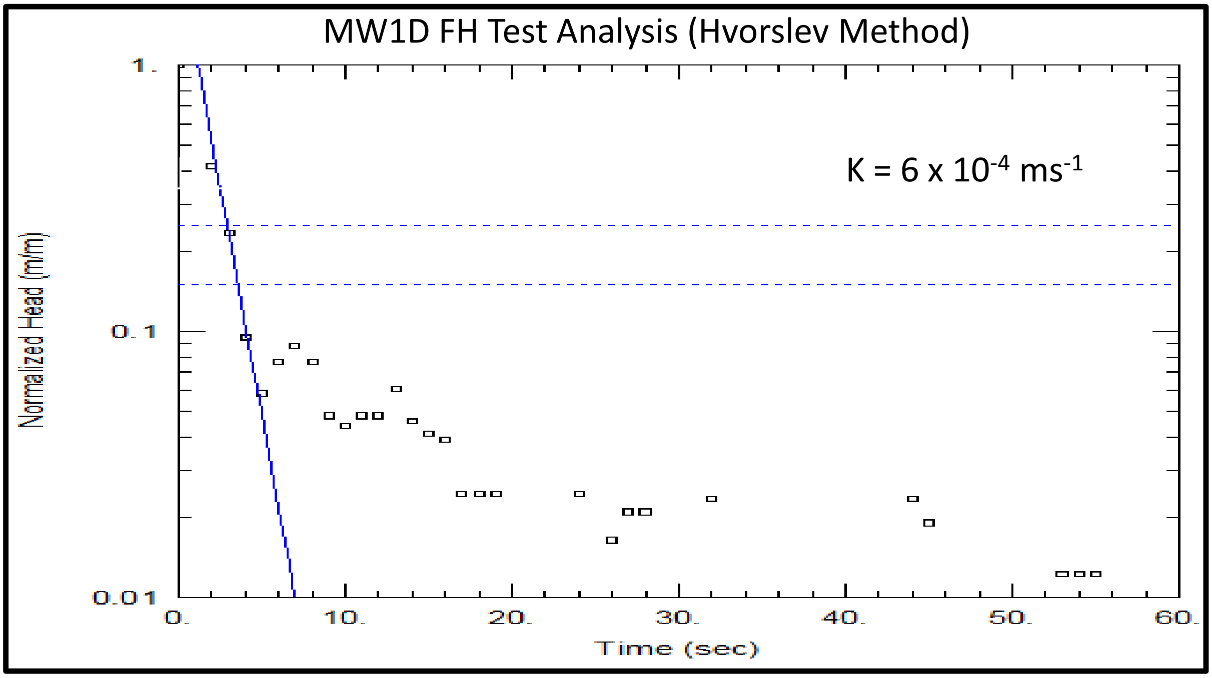
APPENDIX G

Hydraulic Testing – Monitoring Wells

Slug Test Data

FIGURE G1





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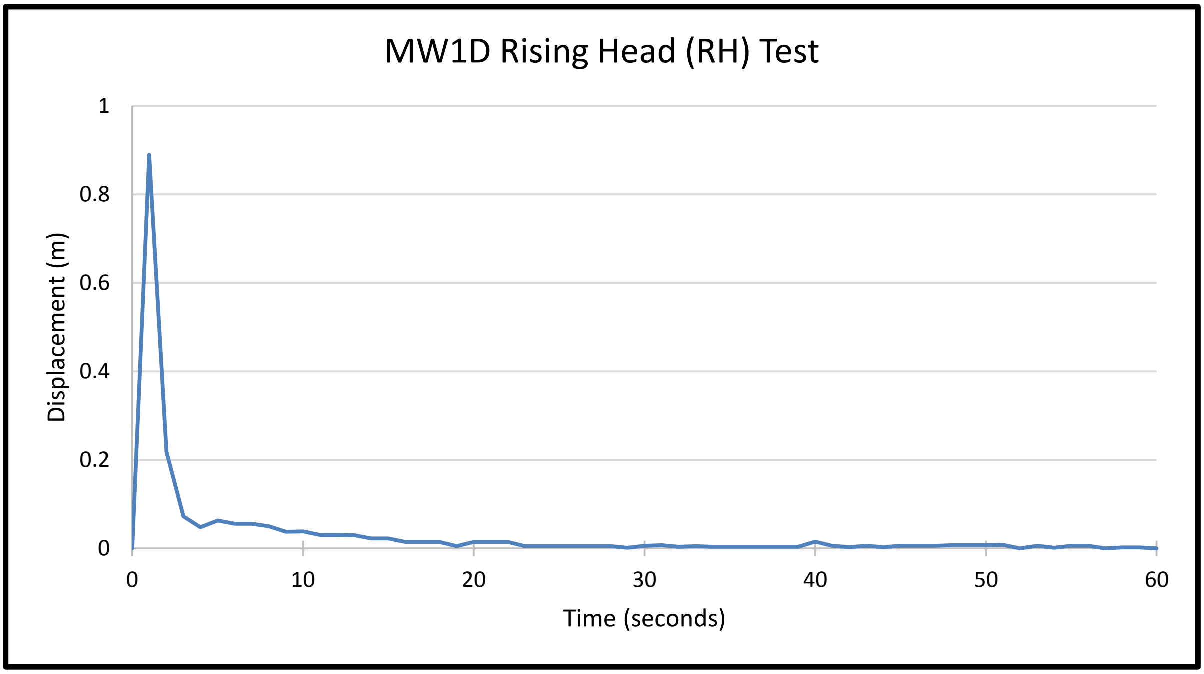
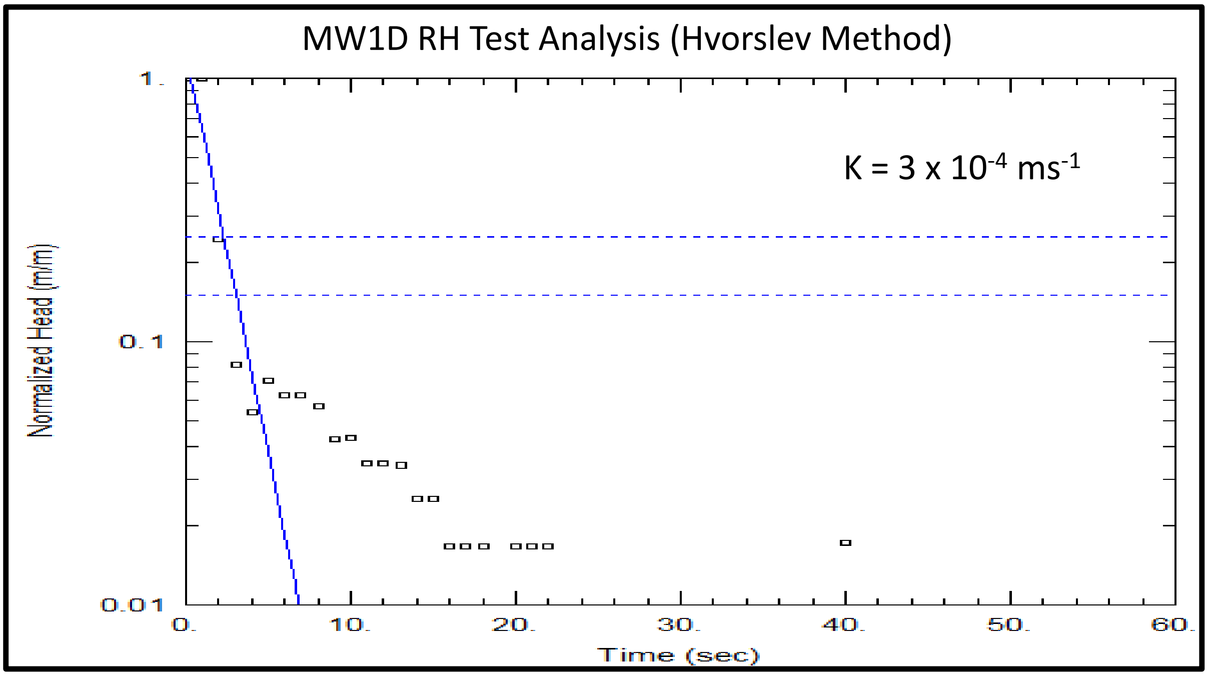
Slug Test Data

FIGURE G2





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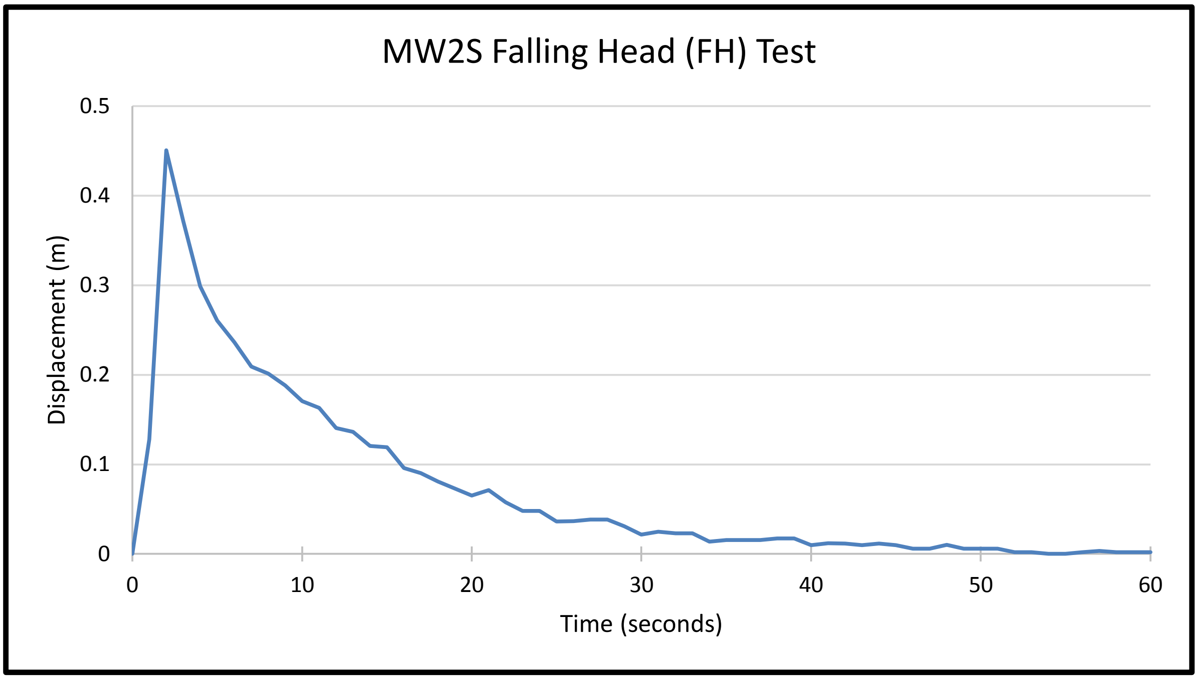
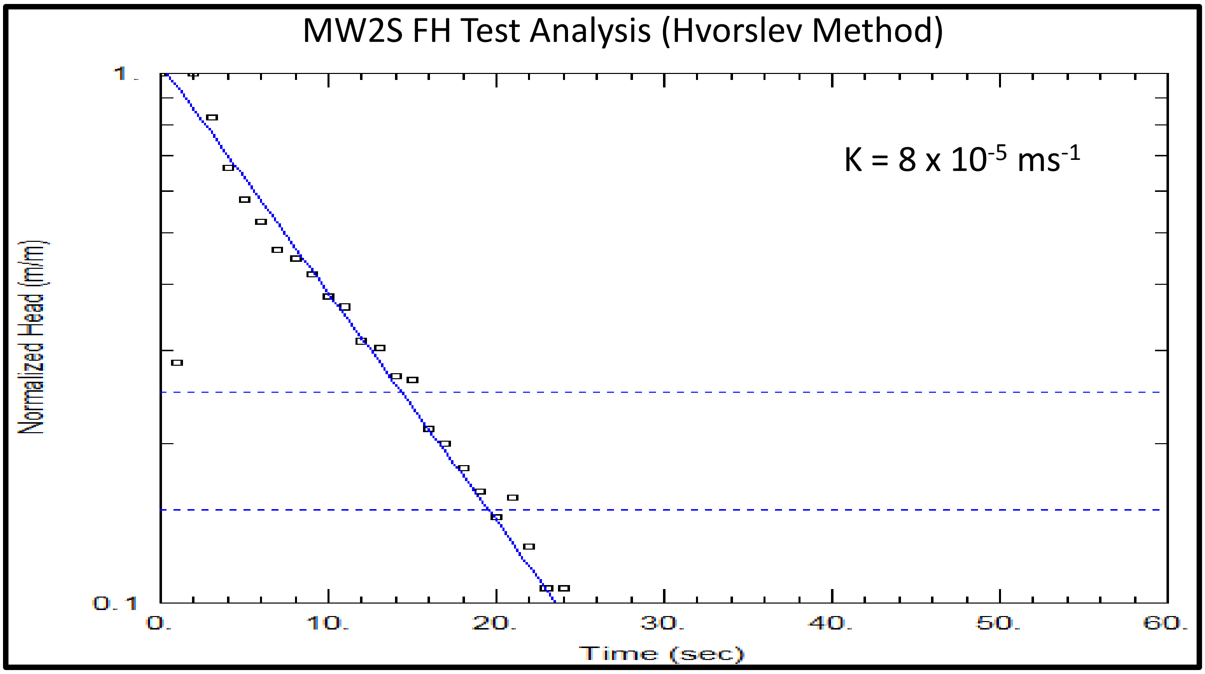
Slug Test Data

FIGURE G3





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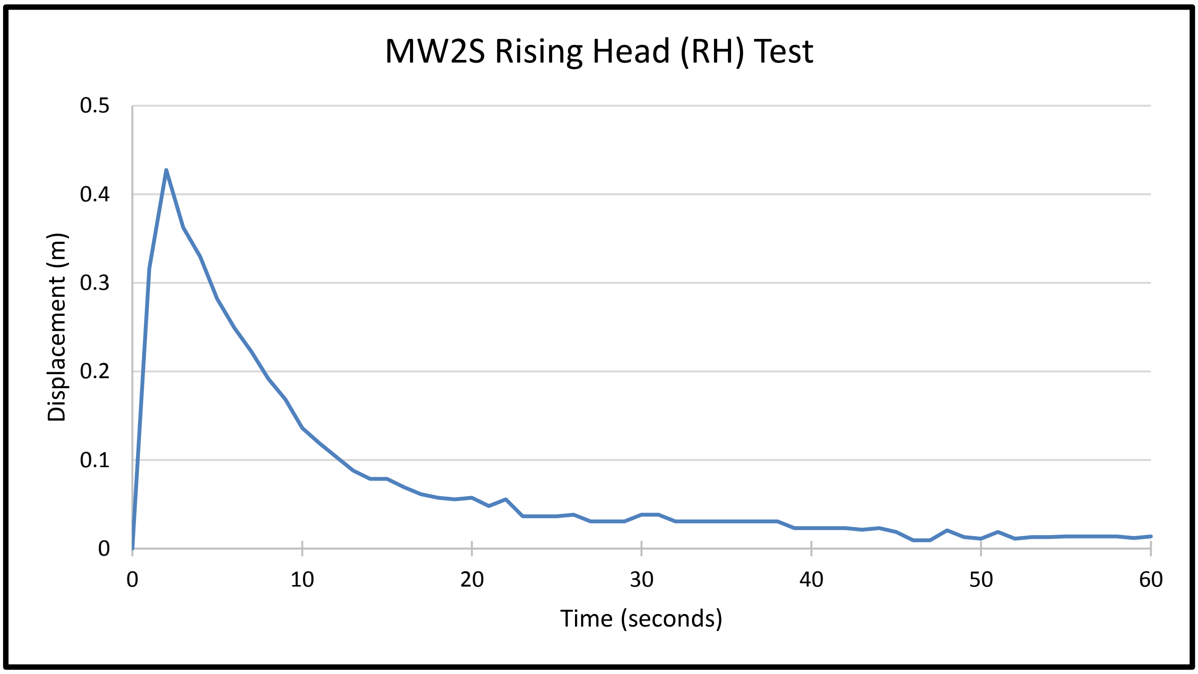
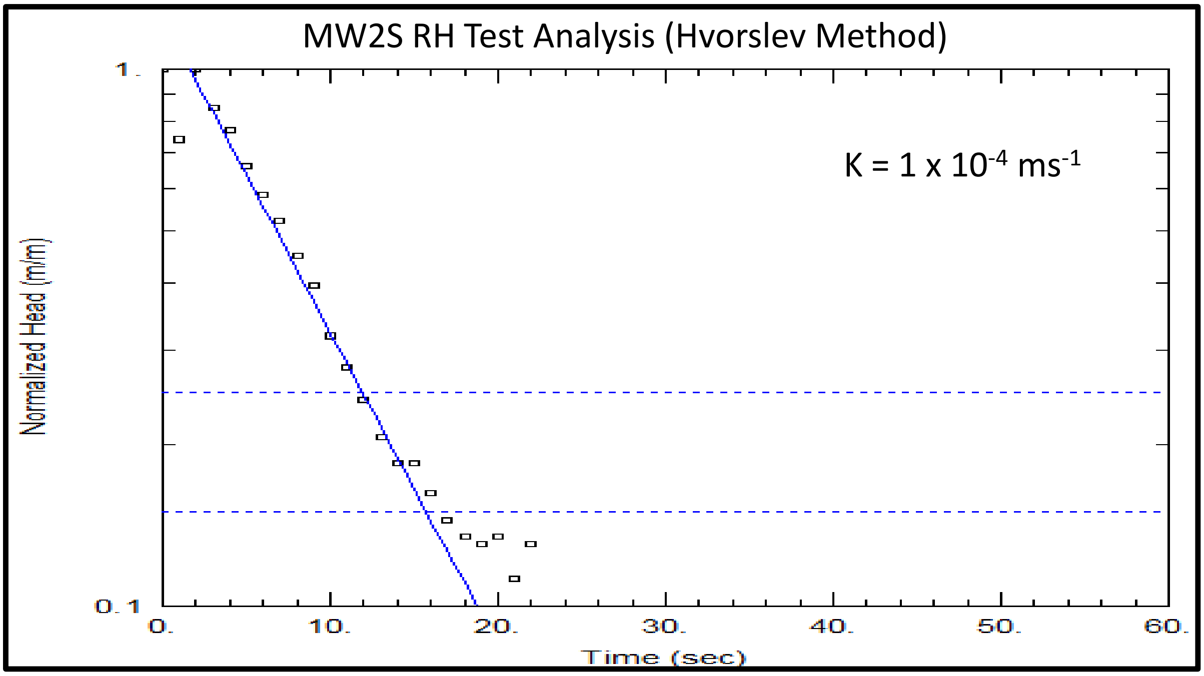
Date: August 2017

Project: 61318.15

Slug Test Data

FIGURE G4





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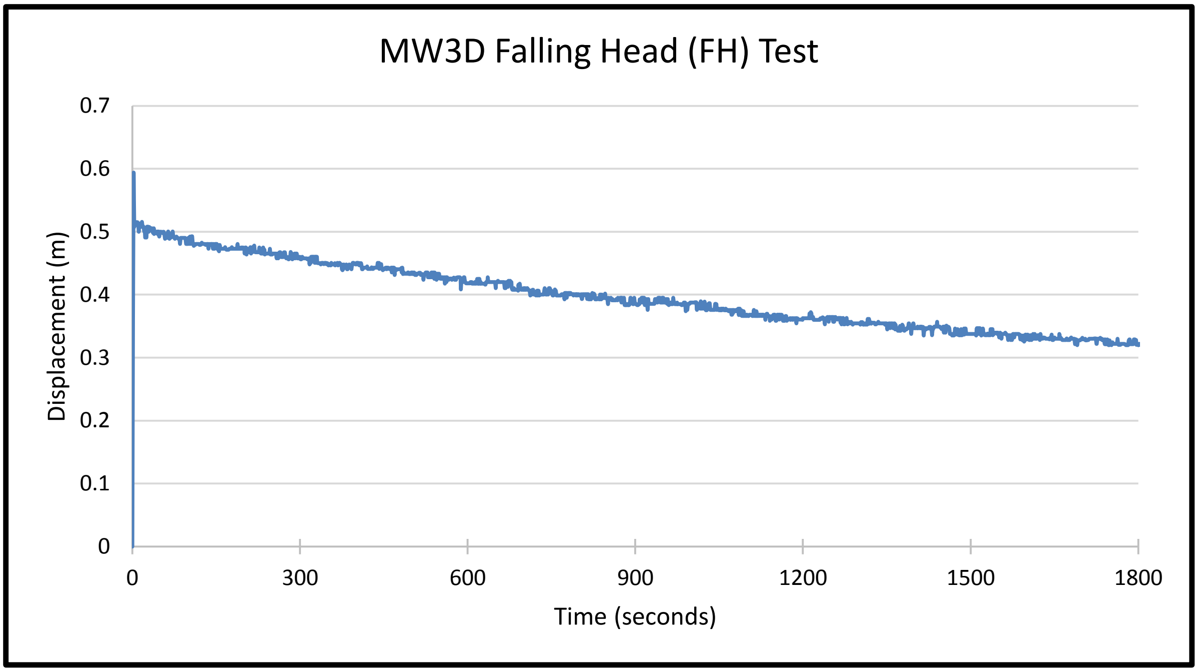
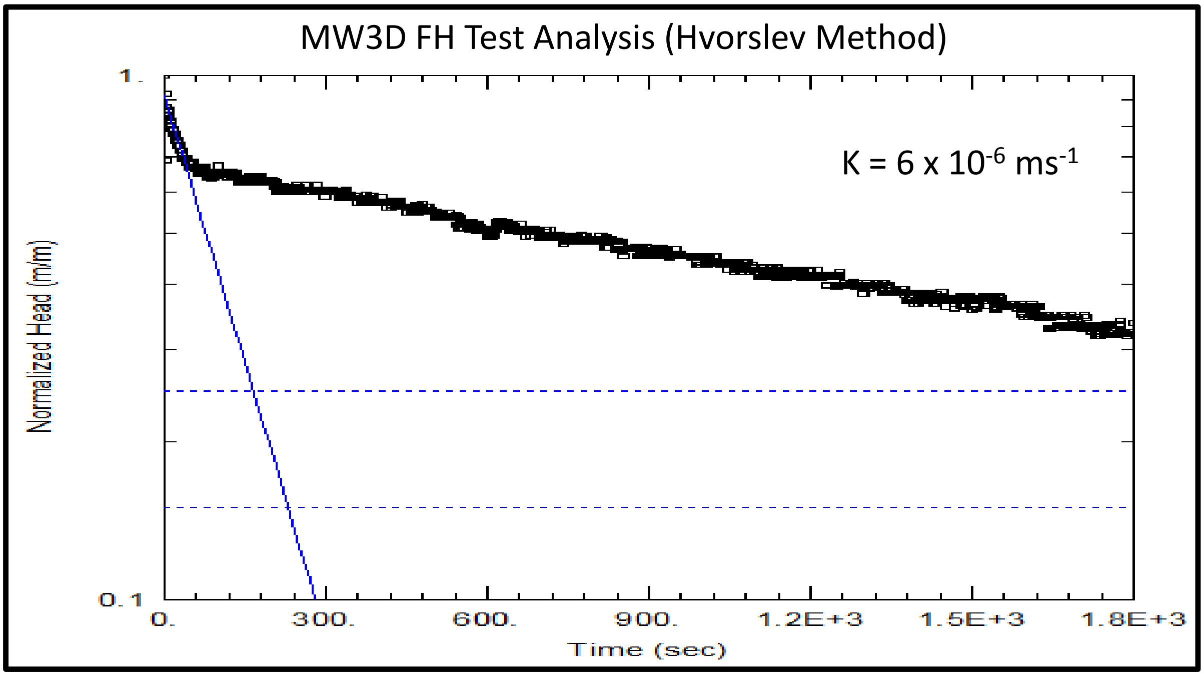
Date: August 2017

Project: 61318.15

Slug Test Data

FIGURE G5





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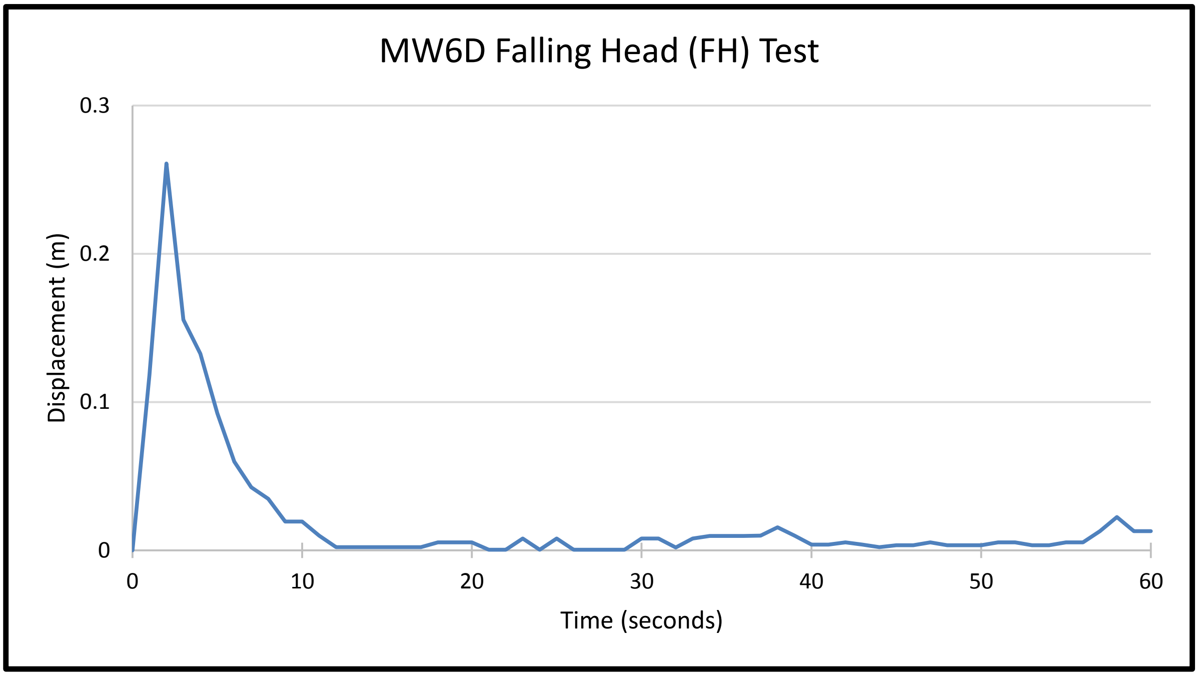
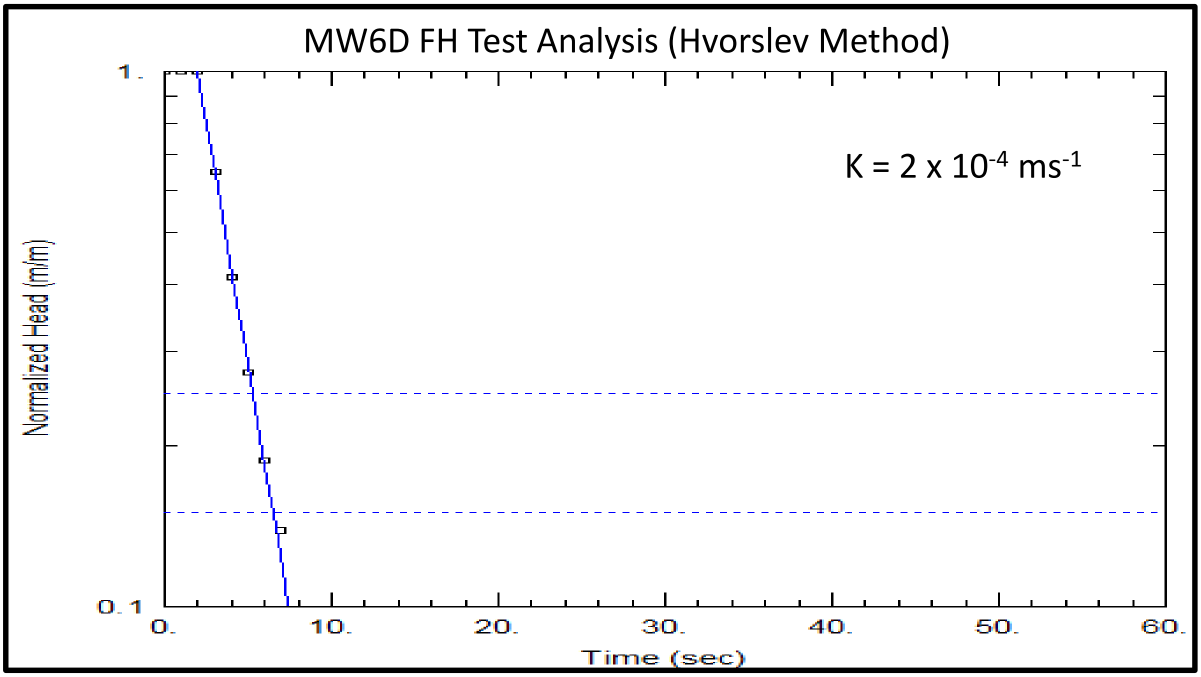
Date: August 2017

Project: 61318.15

Slug Test Data

FIGURE G6





K = 2 x 10^{-4} ms^{-1}

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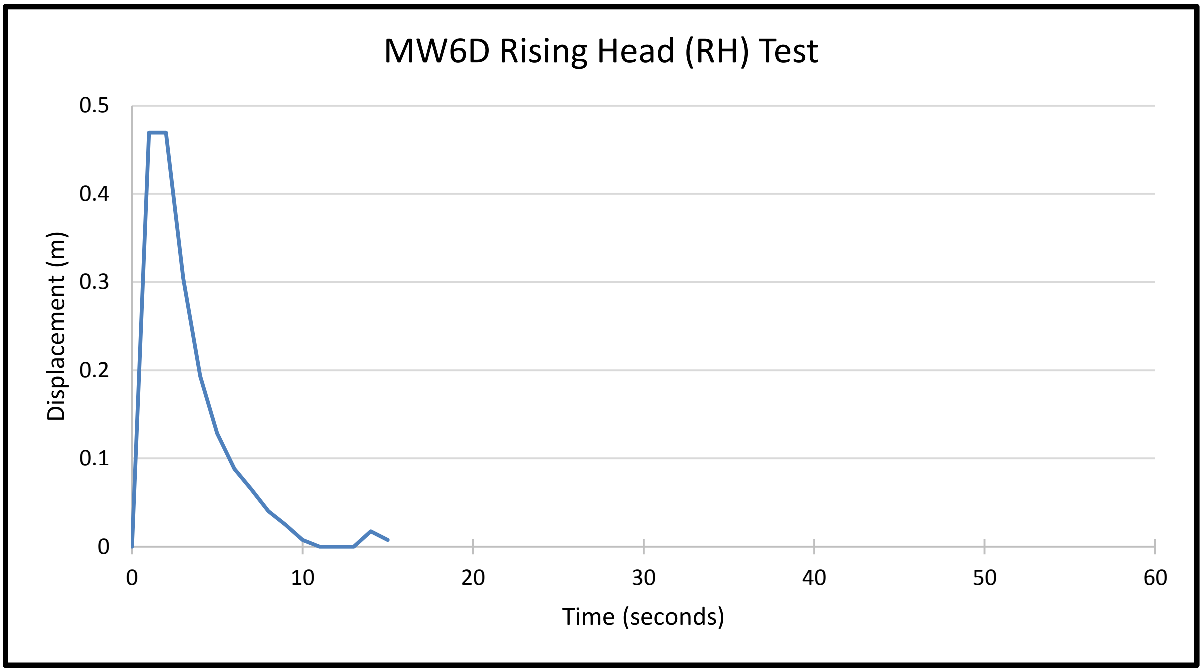
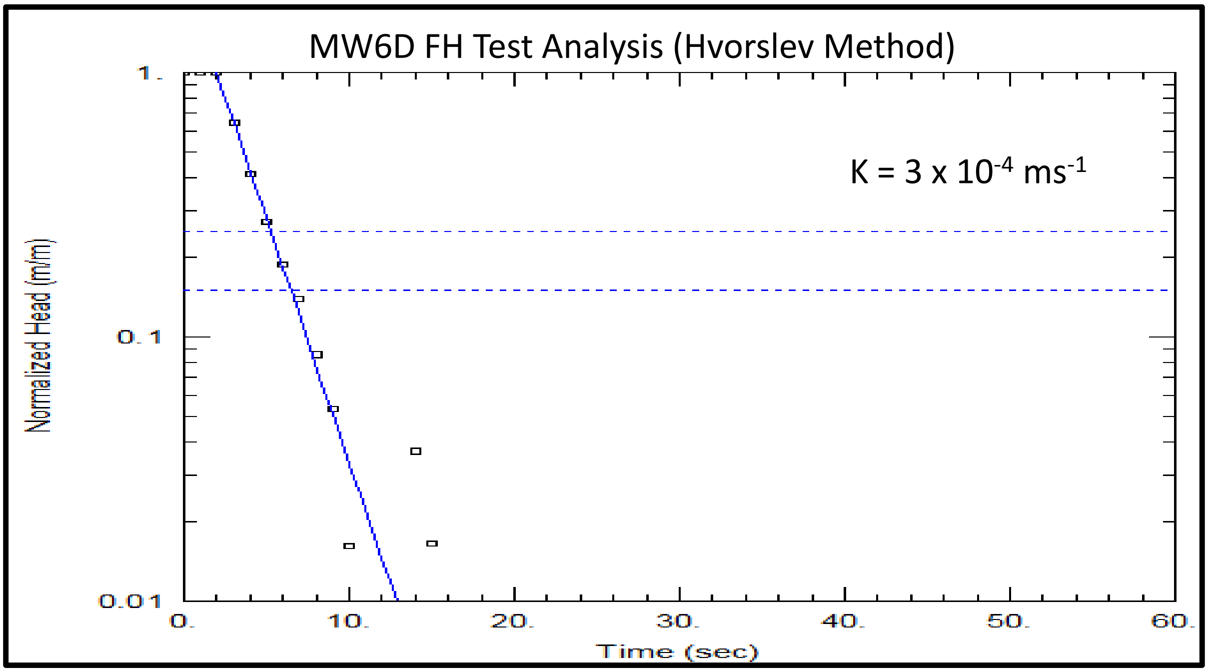
Date: August 2017

Project: 61318.15

Slug Test Data

FIGURE G7





Date: August 2017

Project: 61318.15

APPENDIX H

Nitrate Dilution Calculations

Nitrate Dilution Calculation Worksheet - Commercial

Nitrate Loading

Untreated Commercial Septic Systems

Number of lots with untreated septic systems =	0	lots
Nitrate loading from untreated septic system =	0	grams/lot/day
Total annual nitrate loading from untreated systems =	0	grams/year

Treated Commercial Septic Systems (average of 1,760 litres/lot/day)

Number of lots with treated septic systems =	4	lots
Nitrate loading from treated septic system =	46	grams/lot/day
Total annual nitrate loading from treated systems =	67160	grams/year
Total annual nitrate loading from 4 treated commercial systems =	**67160**	**grams/year**

Dilution Volumes

Infiltration Factors

Topography factor =	0.2
Soil factor =	0.4
Cover factor =	0.15
Combined infiltration factor =	0.75

Precipitation Infiltration

Annual water surplus =	0.361	metres/year
Annual infiltration (Water Surplus x Infiltration Factor) =	0.2708	metres/year

Infiltration Area and Infiltration Volumes

Total commercial site area	51056	square metres
Area available for infiltration (Site Area - Hard Surface Area) = *(assumes 40% HS in commercial lots)*	30633	square metres
Total Annual Volume of Infiltration (Infiltration x Area) =	8294	cubic metres/year
Annual Flow from Commercial Lots (assuming avg. 1760 L/day/lot	2570	cubic metres/year
Total Annual Volume of Septic Effluent =	2570	cubic metres/year
Total Annual Volume Available for Dilution =	**10863**	**cubic metres/year**

Dilution Calculation

$$C_{Nitrate} = \frac{Mass}{Volume} = \frac{Annual\ Nitrate\ Loading(grams/year)}{Annual\ Dilution\ Volume(cubic\ metres/year)} = \frac{grams}{cubic\ metre} = \frac{mg}{L}$$

$$\mathbf{C_{Nitrate} = \frac{67160\ grams/year}{10863\ cubic\ metres/year} = 6.18\ mg/L}$$

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Date: July 2019

Nitrate Dilution Calculation Worksheet - Residential

Nitrate Loading

Residential Septic Systems (assumes 1,000 L/day/lot)

Number of lots with untreated septic systems = 78 lots
Nitrate loading from untreated septic system = 40 grams/lot/day
Total annual nitrate loading from untreated systems = 1138800 grams/year

Total Annual Nitrate Loading from all Systems = 1138800 grams/year

Dilution Volumes

Infiltration Factors

Topography factor = 0.2
Soil factor = (Weighted Avg) 0.3
Cover factor = 0.1
Combined infiltration factor = 0.6

Precipitation Infiltration

Annual water surplus = 0.336 metres/year
Annual infiltration (Water Surplus x Infiltration Factor) = 0.2014 metres/year

Infiltration Area and Infiltration Volumes

Area available for infiltration (Site Area - Hard Surface Area) = 593716 square metres
(assumes varying % HS in residential lots/roadways/walkways, 0% HS in Open Space)

Total Annual Volume of Infiltration (Infiltration x Area) = 119586 cubic metres/year

Annual Flow from Commercial Lots (assuming avg. 2,300 L/day/lo 0 cubic metres/year
Annual Flow from Residential Lots (assuming 1000 L/day/lot) = 28470 cubic metres/year
Total Annual Volume of Septic Effluent = 28470 cubic metres/year

Total Annual Volume Available for Dilution = 148056 cubic metres/year

Dilution Calculation

$$C_{Nitrate} = \frac{Mass}{Volume} = \frac{Annual\ Nitrate\ Loading(grams/year)}{Annual\ Dilution\ Volume(cubic\ metres/year)} = \frac{grams}{cubic\ metre} = \frac{mg}{L}$$

$$\mathbf{C_{Nitrate} = \frac{1138800\ grams/year}{148056\ cubic\ metres/year} = 7.69\quad mg/L}$$

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Date: July 2019

Nitrate Dilution Infiltration Factors

Infiltration Factors

Topography Factors

Flat Land (not to exceed 0.6 m per km	0.3
Rolling Land (2.8 to 3.8 m per km)	0.2
Hilly Land (28 to 47 m per km)	0.1

Soil Factors

Tight Impervious Clay	0.1
Medium combo of Clay and Loam	0.2
Open Sandy Loam	0.4

Cover

Cultivated Land	0.1
Woodland	0.2

Soil Type	Carleton Place Water Surplus (mm)	Ottawa Airport Water Suplus (mm)	Average Surplus (mm)
Sand	363.0	359	361.0
Silty Sand	338	328	333.0
Glacial Till	325	311	318.0
Silty Clay	314.0	299	306.5

Weighted Water Suplus for 2727 Carp Road Site Based on Soil Types

$$\underline{Weighted\ Average\ Water\ Surplus\ (COMMERCIAL\ LOTS\ 79-82) =}$$

$$[100\% * 361.0] + [0\% * 333.0] + [0\% * 318.0] + [0\% * 306.5] = 361\ mm$$

$$\underline{Weighted\ Average\ Water\ Surplus\ (RESIDENTIAL\ LOTS\ 1-78) =}$$

$$[51\% * 361.0] + [0\% * 333.0] + [12\% * 318.0] + [37\% * 306.5] = 335.7\ mm$$

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TABLE 1: Allowable Flows - Commercial Septic Systems

					Scenario No. 1 (40% hard surface and no treatment)		Scenario No. 2 (40% hard surface and use of tertiary treatment)	
Block	**Area m2**	**Infiltration Factor**	**Annual Water Surplus (m3/year)**	**Precipitation Surplus (m3/year)**	**available infiltration (litres per day)**	**maximum septic flow (litres per day)**	**available infiltration (litres per day)**	**maximum septic flow (litres per day)**
79	11300.0	0.75	0.361	4079	5029	1676	5029	5029
80	7600.0	0.75	0.361	2744	3383	1128	3383	3383
81	20100.0	0.75	0.361	7256	8946	2982	8946	8946
82	11800.0	0.75	0.361	4260	5252	1751	5252	5252

Notes:

1. Scenario No. 1 values are calculated assuming:
    a) A total of 40% hard surface from which runoff is not available for infiltration
    b) No use of tertiary treatment systems (nitrate reduction technology)

2. Scenario No. 2 values are calculated under the following:
    a) Carried out in accordance with Section 5.6.3 of the MOECC Procedure D-5-4
    b) Incorporates a value of 20 mg/L nitrate in the discharged effluent from the tertiary treatment system
    c) The calculated maximum allowable flow is based on a simplification of the formula provided in Section 5.6.3, utilizing a concentration of 20 mg/L of Nitrate in the effluent discharging from the tertiary treatment unit
    d) A total of 40% hard surface from which runoff is not available for infiltration

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Project: 61318.15
Date: July 2019

```
                       Sand 100mm_WBNRMSD_comp
CarletonPlace-Appleton   WATER BUDGET MEANS FOR THE PERIOD 1984-2006   DC20492

   LAT.... 45.15     WATER HOLDING CAPACITY...100 MM     HEAT INDEX... 35.93
   LONG... 76.20     LOWER ZONE.............. 60 MM     A............ 1.068

 DATE   TEMP (C)  PCPN  RAIN  MELT   PE    AE   DEF   SURP  SNOW  SOIL  ACC P

31- 1   -9.9       68    18    20     1     1     0    36    63    98    303
28- 2   -8.1       51    16    28     1     1     0    41    71   100    354
31- 3   -2.4       60    28    81     7     7     0   102    21   100    414
30- 4    6.1       71    67    25    34    34     0    59     0    98    485
31- 5   12.9       83    83     0    80    80     0    16     0    86    566
30- 6   18.0       88    88     0   115   111    -4     7     0    56    657
31- 7   20.4       96    96     0   133   116   -17     2     0    34    753
31- 8   19.3       81    81     0   116    90   -26     1     0    24    833
30- 9   14.7       88    88     0    75    68    -7     3     0    40    923
31-10    8.1       84    83     1    36    36     0    17     0    71     86
30-11    1.5       85    65    12    10    10     0    43     8    94    172
31-12   -5.9       67    26    16     2     2     0    36    33    98    238
AVE      6.2 TTL  921   739   183   610   556   -54   363


CarletonPlace-Appleton   STANDARD DEVIATIONS FOR THE PERIOD 1984-2006  DC20492

 DATE   TEMP (C)  PCPN  RAIN  MELT   PE    AE   DEF   SURP  SNOW  SOIL  ACC P

31- 1    3.4       33    23    20     1     1     0    41    40     9     64
28- 2    2.4       23    18    27     1     1     0    35    45     0     71
31- 3    2.2       28    19    36     4     4     0    39    42     0     74
30- 4    1.6       40    38    43     8     8     0    47     0     6     96
31- 5    1.6       35    35     0    11    11     0    20     0    23    100
30- 6    1.4       38    38     0     9    12    11    14     0    34    106
31- 7    1.1       42    42     0     8    25    25     7     0    37    127
31- 8    1.2       38    38     0     8    27    29     2     0    39    135
30- 9    1.5       34    34     0     8    15    13    14     0    39    139
31-10    1.3       35    37     5     6     6     0    31     2    31     35
30-11    1.8       26    24    10     4     4     0    37    17    13     50
31-12    3.4       28    24    17     2     2     0    32    31     6     60
```

```
                         Silty Sand 150mm_WBNRMSD_comp
CarletonPlace-Appleton   WATER BUDGET MEANS FOR THE PERIOD 1984-2006   DC20492

   LAT.... 45.15     WATER HOLDING CAPACITY...150 MM     HEAT INDEX... 35.93
   LONG... 76.20     LOWER ZONE............... 90 MM     A............ 1.068

 DATE   TEMP (C)  PCPN  RAIN  MELT   PE    AE   DEF   SURP  SNOW  SOIL  ACC P

31- 1   -9.9       68    18    20     1     1     0    33    63   144    303
28- 2   -8.1       51    16    28     1     1     0    38    71   148    354
31- 3   -2.4       60    28    81     7     7     0   100    21   150    414
30- 4    6.1       71    67    25    34    34     0    59     0   148    485
31- 5   12.9       83    83     0    80    80     0    16     0   136    566
30- 6   18.0       88    88     0   115   114     0     7     0   103    657
31- 7   20.4       96    96     0   133   127    -6     2     0    70    753
31- 8   19.3       81    81     0   116    98   -17     1     0    51    833
30- 9   14.7       88    88     0    75    69    -6     3     0    67    923
31-10    8.1       84    83     1    36    36     0    13     0   101     86
30-11    1.5       85    65    12    10    10     0    35     8   133    172
31-12   -5.9       67    26    16     2     2     0    31    33   142    238
AVE      6.2 TTL  921   739   183   610   579   -29   338


CarletonPlace-Appleton   STANDARD DEVIATIONS FOR THE PERIOD 1984-2006  DC20492

 DATE   TEMP (C)  PCPN  RAIN  MELT   PE    AE   DEF   SURP  SNOW  SOIL  ACC P

31- 1    3.4       33    23    20     1     1     0    40    40    16     64
28- 2    2.4       23    18    27     1     1     0    35    45     8     71
31- 3    2.2       28    19    36     4     4     0    38    42     0     74
30- 4    1.6       40    38    43     8     8     0    47     0     6     96
31- 5    1.6       35    35     0    11    11     0    20     0    23    100
30- 6    1.4       38    38     0     9     9     1    14     0    40    106
31- 7    1.1       42    42     0     8    15    13     7     0    52    127
31- 8    1.2       38    38     0     8    23    25     2     0    55    135
30- 9    1.5       34    34     0     8    13    11    14     0    54    139
31-10    1.3       35    37     5     6     6     0    29     2    46     35
30-11    1.8       26    24    10     4     4     0    39    17    26     50
31-12    3.4       28    24    17     2     2     0    33    31    15     60
```

```
                        Glacial Till 200mm_WBNRMSD_comp
CarletonPlace-Appleton   WATER BUDGET MEANS FOR THE PERIOD 1984-2006   DC20492

   LAT.... 45.15     WATER HOLDING CAPACITY...200 MM     HEAT INDEX... 35.93
   LONG... 76.20     LOWER ZONE...............120 MM     A............ 1.068

 DATE   TEMP (C)  PCPN  RAIN  MELT   PE    AE   DEF   SURP  SNOW  SOIL  ACC P

31- 1   -9.9       68    18    20     1     1     0    28    63   190    303
28- 2   -8.1       51    16    28     1     1     0    37    71   196    354
31- 3   -2.4       60    28    81     7     7     0    98    21   200    414
30- 4    6.1       71    67    25    34    34     0    59     0   198    485
31- 5   12.9       83    83     0    80    80     0    16     0   186    566
30- 6   18.0       88    88     0   115   115     0     7     0   153    657
31- 7   20.4       96    96     0   133   131    -2     2     0   116    753
31- 8   19.3       81    81     0   116   105   -10     1     0    90    833
30- 9   14.7       88    88     0    75    71    -4     3     0   104    923
31-10    8.1       84    83     1    36    36     0    13     0   138     86
30-11    1.5       85    65    12    10    10     0    34     8   171    172
31-12   -5.9       67    26    16     2     2     0    27    33   185    238
AVE      6.2 TTL  921   739   183   610   593   -16   325


CarletonPlace-Appleton   STANDARD DEVIATIONS FOR THE PERIOD 1984-2006  DC20492

 DATE   TEMP (C)  PCPN  RAIN  MELT   PE    AE   DEF   SURP  SNOW  SOIL  ACC P

31- 1    3.4       33    23    20     1     1     0    39    40    24     64
28- 2    2.4       23    18    27     1     1     0    36    45    14     71
31- 3    2.2       28    19    36     4     4     0    40    42     0     74
30- 4    1.6       40    38    43     8     8     0    47     0     6     96
31- 5    1.6       35    35     0    11    11     0    20     0    23    100
30- 6    1.4       38    38     0     9     9     0    14     0    41    106
31- 7    1.1       42    42     0     8     8     5     7     0    58    127
31- 8    1.2       38    38     0     8    17    17     2     0    65    135
30- 9    1.5       34    34     0     8    10     8    14     0    66    139
31-10    1.3       35    37     5     6     6     0    29     2    58     35
30-11    1.8       26    24    10     4     4     0    38    17    38     50
31-12    3.4       28    24    17     2     2     0    35    31    24     60
```

```
                         Silty Clay 280mm_WBNRMSD_comp
CarletonPlace-Appleton   WATER BUDGET MEANS FOR THE PERIOD 1984-2006   DC20492

   LAT.... 45.15     WATER HOLDING CAPACITY...280 MM     HEAT INDEX... 35.93
   LONG... 76.20     LOWER ZONE...............168 MM     A............ 1.068

 DATE   TEMP (C)  PCPN  RAIN  MELT   PE    AE   DEF   SURP  SNOW  SOIL  ACC P

31- 1   -9.9       68    18    20     1     1     0    24    63   264    303
28- 2   -8.1       51    16    28     1     1     0    33    71   274    354
31- 3   -2.4       60    28    81     7     7     0    96    21   280    414
30- 4    6.1       71    67    25    34    34     0    59     0   278    485
31- 5   12.9       83    83     0    80    80     0    16     0   266    566
30- 6   18.0       88    88     0   115   115     0     7     0   233    657
31- 7   20.4       96    96     0   133   132     0     2     0   194    753
31- 8   19.3       81    81     0   116   111    -4     1     0   162    833
30- 9   14.7       88    88     0    75    73    -2     3     0   174    923
31-10    8.1       84    83     1    36    36     0    13     0   208     86
30-11    1.5       85    65    12    10    10     0    33     8   242    172
31-12   -5.9       67    26    16     2     2     0    27    33   256    238
AVE      6.2 TTL  921   739   183   610   602    -6   314


CarletonPlace-Appleton   STANDARD DEVIATIONS FOR THE PERIOD 1984-2006  DC20492

 DATE   TEMP (C)  PCPN  RAIN  MELT   PE    AE   DEF   SURP  SNOW  SOIL  ACC P

31- 1    3.4       33    23    20     1     1     0    39    40    31     64
28- 2    2.4       23    18    27     1     1     0    36    45    20     71
31- 3    2.2       28    19    36     4     4     0    43    42     0     74
30- 4    1.6       40    38    43     8     8     0    47     0     6     96
31- 5    1.6       35    35     0    11    11     0    20     0    23    100
30- 6    1.4       38    38     0     9     9     0    14     0    41    106
31- 7    1.1       42    42     0     8     7     1     7     0    60    127
31- 8    1.2       38    38     0     8    10     9     2     0    74    135
30- 9    1.5       34    34     0     8     8     3    14     0    76    139
31-10    1.3       35    37     5     6     6     0    29     2    69     35
30-11    1.8       26    24    10     4     4     0    38    17    49     50
31-12    3.4       28    24    17     2     2     0    35    31    33     60
```

```
                      OttawaIntlA_100mm_WBNRMSDdasdasdasd
Ottawa Intl A            WATER BUDGET MEANS FOR THE PERIOD 1939-2013   DC20492

   LAT.... 45.32     WATER HOLDING CAPACITY...100 MM     HEAT INDEX... 36.57
   LONG... 75.67     LOWER ZONE............... 60 MM     A............ 1.078

 DATE   TEMP (C)  PCPN  RAIN  MELT   PE    AE   DEF   SURP  SNOW  SOIL  ACC P

31- 1  -10.7       62    11    14     0     0     0    23    85    98    296
28- 2   -9.0       55    10    16     1     1     0    25   115    98    352
31- 3   -2.7       66    31    79     6     6     0   102    71   100    418
30- 4    5.7       71    67    76    32    32     0   111     0   100    489
31- 5   13.0       76    76     0    80    80     0    14     0    82    566
30- 6   18.3       84    84     0   116   113    -4     5     0    48    649
31- 7   20.9       86    86     0   136   114   -22     2     0    19    735
31- 8   19.6       83    83     0   117    86   -32     1     0    15    818
30- 9   14.7       84    84     0    75    65   -10     3     0    31    902
31-10    8.2       75    75     0    37    36    -1     9     0    62     76
30-11    1.3       78    60     8    10    10     0    31    10    89    154
31-12   -7.1       81    27    15     1     1     0    33    49    97    234
AVE      6.0 TTL  901   694   208   611   544   -69   359


Ottawa Intl A            STANDARD DEVIATIONS FOR THE PERIOD 1939-2013  DC20492

 DATE   TEMP (C)  PCPN  RAIN  MELT   PE    AE   DEF   SURP  SNOW  SOIL  ACC P

31- 1    2.9       26    15    18     1     1     0    29    45     8     59
28- 2    2.5       27    14    25     1     1     0    35    60     7     63
31- 3    2.6       28    22    50     5     5     0    56    90     0     70
30- 4    1.8       31    32    91     9     9     0    90     3     2     78
31- 5    1.9       32    32     3    12    12     0    23     0    22     90
30- 6    1.2       39    39     0     8    12    10    17     0    35    101
31- 7    1.1       40    40     0     8    27    29    10     0    29    104
31- 8    1.3       38    38     0     8    28    30     4     0    28    117
30- 9    1.4       40    40     0     8    16    16    14     0    35    124
31-10    1.5       36    36     1     7     6     2    19     0    36     36
30-11    1.7       27    27     8     4     4     0    33    13    20     45
31-12    2.9       30    23    14     1     1     0    30    35     9     56
```

```
                     OttawaIntlA_150mm_WBNRMSDasdasdasdasd
Ottawa Intl Airport      WATER BUDGET MEANS FOR THE PERIOD 1939-2013   DC20492

   LAT.... 45.32     WATER HOLDING CAPACITY...150 MM     HEAT INDEX... 36.57
   LONG... 75.67     LOWER ZONE............... 90 MM     A............ 1.078

 DATE   TEMP (C)  PCPN  RAIN  MELT   PE    AE   DEF   SURP  SNOW  SOIL  ACC P

31- 1  -10.7       62    11    14     0     0     0    21    85   142    296
28- 2   -9.0       55    10    16     1     1     0    23   115   144    352
31- 3   -2.7       66    31    79     6     6     0    99    71   149    418
30- 4    5.7       71    67    76    32    32     0   110     0   150    489
31- 5   13.0       76    76     0    80    80     0    14     0   132    566
30- 6   18.3       84    84     0   116   116     0     5     0    95    649
31- 7   20.9       86    86     0   136   126    -9     2     0    52    735
31- 8   19.6       83    83     0   117    97   -21     1     0    38    818
30- 9   14.7       84    84     0    75    67    -8     2     0    52    902
31-10    8.2       75    75     0    37    36    -1     7     0    85     76
30-11    1.3       78    60     8    10    10     0    20    10   123    154
31-12   -7.1       81    27    15     1     1     0    24    49   139    234
AVE      6.0 TTL  901   694   208   611   572   -39   328


Ottawa Intl Airport      STANDARD DEVIATIONS FOR THE PERIOD 1939-2013  DC20492

 DATE   TEMP (C)  PCPN  RAIN  MELT   PE    AE   DEF   SURP  SNOW  SOIL  ACC P

31- 1    2.9       26    15    18     1     1     0    29    45    19     59
28- 2    2.5       27    14    25     1     1     0    34    60    17     63
31- 3    2.6       28    22    50     5     5     0    55    90     5     70
30- 4    1.8       31    32    91     9     9     0    90     3     2     78
31- 5    1.9       32    32     3    12    12     0    23     0    22     90
30- 6    1.2       39    39     0     8     8     1    17     0    41    101
31- 7    1.1       40    40     0     8    19    20    10     0    42    104
31- 8    1.3       38    38     0     8    23    24     4     0    42    117
30- 9    1.4       40    40     0     8    13    13    13     0    48    124
31-10    1.5       36    36     1     7     7     2    18     0    47     36
30-11    1.7       27    27     8     4     4     0    29    13    34     45
31-12    2.9       30    23    14     1     1     0    29    35    22     56
```

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                         OttawaIntlA_200mm_WBNRMSDasdasdasdasd
Ottawa Intl Airport      WATER BUDGET MEANS FOR THE PERIOD 1939-2013   DC20492

   LAT.... 45.32     WATER HOLDING CAPACITY...200 MM     HEAT INDEX... 36.57
   LONG... 75.67     LOWER ZONE...............120 MM     A............ 1.078

 DATE   TEMP (C)  PCPN  RAIN  MELT   PE    AE   DEF   SURP  SNOW  SOIL  ACC P

31- 1  -10.7       62    11    14     0     0     0    19    85   184    296
28- 2   -9.0       55    10    16     1     1     0    21   115   188    352
31- 3   -2.7       66    31    79     6     6     0    95    71   198    418
30- 4    5.7       71    67    76    32    32     0   109     0   200    489
31- 5   13.0       76    76     0    80    80     0    14     0   182    566
30- 6   18.3       84    84     0   116   116     0     5     0   144    649
31- 7   20.9       86    86     0   136   132    -4     2     0    96    735
31- 8   19.6       83    83     0   117   105   -12     1     0    74    818
30- 9   14.7       84    84     0    75    69    -5     2     0    86    902
31-10    8.2       75    75     0    37    36     0     6     0   118     76
30-11    1.3       78    60     8    10    10     0    17    10   160    154
31-12   -7.1       81    27    15     1     1     0    20    49   180    234
AVE      6.0 TTL  901   694   208   611   588   -21   311


Ottawa Intl Airport      STANDARD DEVIATIONS FOR THE PERIOD 1939-2013  DC20492

 DATE   TEMP (C)  PCPN  RAIN  MELT   PE    AE   DEF   SURP  SNOW  SOIL  ACC P

31- 1    2.9       26    15    18     1     1     0    28    45    28     59
28- 2    2.5       27    14    25     1     1     0    34    60    26     63
31- 3    2.6       28    22    50     5     5     0    55    90     8     70
30- 4    1.8       31    32    91     9     9     0    89     3     2     78
31- 5    1.9       32    32     3    12    12     0    23     0    22     90
30- 6    1.2       39    39     0     8     8     0    17     0    41    101
31- 7    1.1       40    40     0     8    11    11    10     0    49    104
31- 8    1.3       38    38     0     8    18    19     4     0    52    117
30- 9    1.4       40    40     0     8    11    10    13     0    58    124
31-10    1.5       36    36     1     7     7     1    17     0    56     36
30-11    1.7       27    27     8     4     4     0    27    13    44     45
31-12    2.9       30    23    14     1     1     0    28    35    31     56
```

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                     OttawaIntlA_280mm_WBNRMSDsadasdasdasd
Ottawa Intl Airport      WATER BUDGET MEANS FOR THE PERIOD 1939-2013   DC20492

   LAT.... 45.32     WATER HOLDING CAPACITY...280 MM     HEAT INDEX... 36.57
   LONG... 75.67     LOWER ZONE...............168 MM     A............ 1.078

 DATE   TEMP (C)  PCPN  RAIN  MELT   PE    AE   DEF   SURP  SNOW  SOIL  ACC P

31- 1  -10.7        62    11    14     0     0     0    17    85   257    296
28- 2   -9.0        55    10    16     1     1     0    20   115   262    352
31- 3   -2.7        66    31    79     6     6     0    91    71   276    418
30- 4    5.7        71    67    76    32    32     0   107     0   280    489
31- 5   13.0        76    76     0    80    80     0    14     0   262    566
30- 6   18.3        84    84     0   116   116     0     5     0   224    649
31- 7   20.9        86    86     0   136   135    -1     2     0   173    735
31- 8   19.6        83    83     0   117   112    -5     1     0   143    818
30- 9   14.7        84    84     0    75    72    -3     2     0   153    902
31-10    8.2        75    75     0    37    36     0     6     0   185     76
30-11    1.3        78    60     8    10    10     0    16    10   228    154
31-12   -7.1        81    27    15     1     1     0    18    49   250    234
AVE      6.0 TTL  901   694   208   611   601    -9   299


Ottawa Intl Airport      STANDARD DEVIATIONS FOR THE PERIOD 1939-2013  DC20492

 DATE   TEMP (C)  PCPN  RAIN  MELT   PE    AE   DEF   SURP  SNOW  SOIL  ACC P

31- 1    2.9        26    15    18     1     1     0    27    45    40     59
28- 2    2.5        27    14    25     1     1     0    34    60    37     63
31- 3    2.6        28    22    50     5     5     0    56    90    16     70
30- 4    1.8        31    32    91     9     9     0    87     3     2     78
31- 5    1.9        32    32     3    12    12     0    23     0    22     90
30- 6    1.2        39    39     0     8     8     0    17     0    41    101
31- 7    1.1        40    40     0     8     8     3    10     0    53    104
31- 8    1.3        38    38     0     8    12    12     4     0    62    117
30- 9    1.4        40    40     0     8     9     6    13     0    69    124
31-10    1.5        36    36     1     7     7     1    17     0    66     36
30-11    1.7        27    27     8     4     4     0    27    13    55     45
31-12    2.9        30    23    14     1     1     0    28    35    42     56
```

APPENDIX I

Water Well Records and Certificates of Well Compliance

Ontario Ministry of the Environment

The Ontario Water Resources Act
WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

11 1533700 Municipality 15005 Con. CON 03

County or District	Township/Borough/City/Town/Village	Con block tract survey, etc.	Lot
Ottawa-Carleton	West Carleton	3	8

[redacted]

Address: Carp, Ont

Date completed: 17 day 03 month 03 year

21 Northing RC Elevation RC Basin Code ii iii iv

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth - feet From	Depth - feet To
Brown	Sand	Gravel		0	40
Grey	limestone			40	205

31
32

41 WATER RECORD

Water found at - feet	Kind of water
60	1 ☑ Fresh Hf 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
145	1 ☑ Fresh Tested 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas

51 CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth - feet From	Depth - feet To
6¼	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic	188	0	48
8¾	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic		0	46
6	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic		46	205

SCREEN

Sizes of opening (Slot No.)	Diameter inches	Length feet

Material and type	Depth at top of screen feet

61 PLUGGING & SEALING RECORD

☑ Annular space ☐ Abandonment

Depth set at - feet From	To	Material and type (Cement grout, bentonite, etc.)
2	48	Bentonite

71 PUMPING TEST

Pumping test method: 1 ☑ Pump 2 ☐ Bailer

Pumping rate: 1½ GPM

Duration of pumping: 1 Hours Mins

Static level	Water level end of pumping	Water levels during: 1 ☐ Pumping 2 ☑ Recovery			
		15 minutes	30 minutes	45 minutes	60 minutes
11 feet	200 feet	182 feet	164 feet	146 feet	128 feet

If flowing give rate: GPM

Pump intake set at: feet

Water at end of test: ☐ Clear ☑ Cloudy

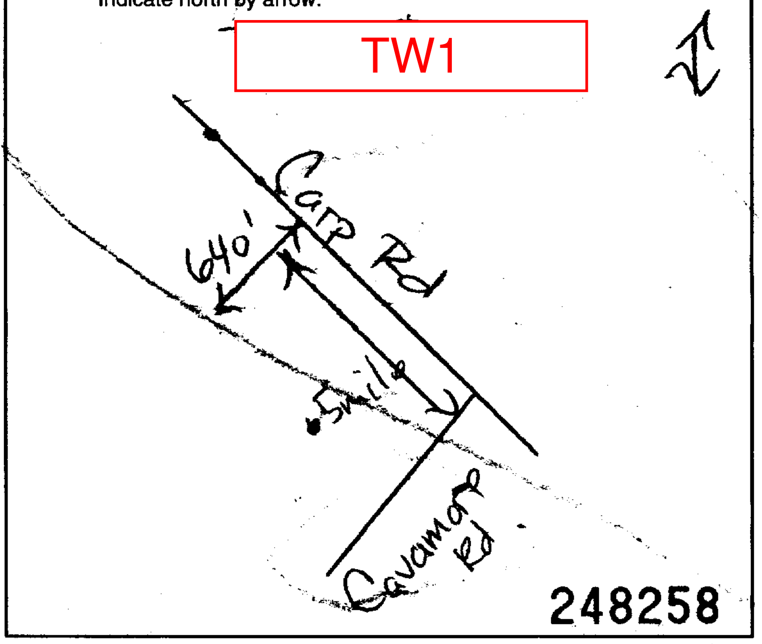
Recommended pump type: ☐ Shallow ☑ Deep

Recommended pump setting: 200 feet

Recommended pump rate: 1½ GPM

LOCATION OF WELL

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



248258

FINAL STATUS OF WELL

- 1 ☑ Water supply
- 2 ☐ Observation well
- 3 ☑ Test hole
- 4 ☐ Recharge well
- 5 ☐ Abandoned, insufficient supply
- 6 ☐ Abandoned, poor quality
- 7 ☐ Abandoned (Other)
- 8 ☐ Dewatering
- 9 ☐ Unfinished
- 10 ☐ Replacement well

WATER USE

- 1 ☐ Domestic
- 2 ☐ Stock
- 3 ☐ Irrigation
- 4 ☐ Industrial
- 5 ☐ Commercial
- 6 ☐ Municipal
- 7 ☐ Public supply
- 8 ☐ Cooling & air conditioning
- 9 ☑ Not use
- 10 ☐ Other

METHOD OF CONSTRUCTION

- 1 ☐ Cable tool
- 2 ☐ Rotary (conventional)
- 3 ☐ Rotary (reverse)
- 4 ☐ Rotary (air)
- 5 ☑ Air percussion
- 6 ☐ Boring
- 7 ☐ Diamond
- 8 ☐ Jetting
- 9 ☐ Driving
- 10 ☐ Digging
- 11 ☐ Other

Name of Well Contractor: Air-Rock Drilling Co Ltd

Well Contractor's Licence No.: 1119

Address: RR #1 Richmond, Ont

Name of Well Technician: Ken Desaulniers

Well Technician's Licence No.: T4

Signature of Technician/Contractor:

Submission date: 11 day 04 mo 03 yr

MINISTRY USE ONLY

Data source

Contractor: 1119

Date received: MAY 08 2003

Date of inspection

Inspector

Remarks

CSS.ES3

2 - MINISTRY OF THE ENVIRONMENT COPY

0506 (07/00) Front Form 9

Ontario Ministry of the Environment

The Ontario Water Resources Act

WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

11

1533701

Municipality 15005 Con. CON 03

County or District	Township/Borough/City/Town/Village	Con block tract survey, etc.	Lot
Ottawa Carleton	West Carleton (Huntley)	3	8

[redacted]

Address: Carp, Ont

Date completed: 17 day 03 month 03 year

21

Northing | RC | Elevation | RC | Basin Code | ii | iii | iv

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth - feet From	Depth - feet To
	clay	gravel, sand		0	15
grey	limestone			15	120

31

32

WATER RECORD

Water found at - feet	Kind of water
51	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas — not
113	1 ☐ ~~Fresh~~ 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas — est 50
	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas

CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth - feet From	Depth - feet To
6 1/4	1 ☑ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic	188	0	22
8 3/4	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☑ Open hole 5 ☐ Plastic		0	20
6	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☑ Open hole 5 ☐ Plastic		20	120

SCREEN

Sizes of opening (Slot No.)	Diameter inches	Length feet

Material and type	Depth at top of screen feet

PLUGGING & SEALING RECORD

☑ Annular space ☐ Abandonment

Depth set at - feet From	To	Material and type (Cement grout, bentonite, etc.)
2	22	bentonite

PUMPING TEST

71

Pumping test method: 1 ☑ Pump 2 ☐ Bailer	Pumping rate 4 GPM	Duration of pumping 1 Hours Mins

Water levels during 1 ☐ Pumping 2 ☑ Recovery

Static level	Water level end of pumping	15 minutes	30 minutes	45 minutes	60 minutes
16 feet	115 feet	67 feet	19 feet	16 feet	16 feet

If flowing give rate: GPM

Pump intake set at: feet

Water at end of test: ☐ Clear ☑ Cloudy

Recommended pump type: ☐ Shallow ☑ Deep

Recommended pump setting: 115 feet

Recommended pump rate: 4 GPM

FINAL STATUS OF WELL

- 1 ☐ Water supply
- 2 ☐ Observation well
- 3 ☑ Test hole
- 4 ☐ Recharge well
- 5 ☐ Abandoned, insufficient supply
- 6 ☐ Abandoned, poor quality
- 7 ☐ Abandoned (Other)
- 8 ☐ Dewatering
- 9 ☐ Unfinished
- 10 ☐ Replacement well

WATER USE

- 1 ☐ Domestic
- 2 ☐ Stock
- 3 ☐ Irrigation
- 4 ☐ Industrial
- 5 ☐ Commercial
- 6 ☐ Municipal
- 7 ☐ Public supply
- 8 ☐ Cooling & air conditioning
- 9 ☑ Not use
- 10 ☐ Other

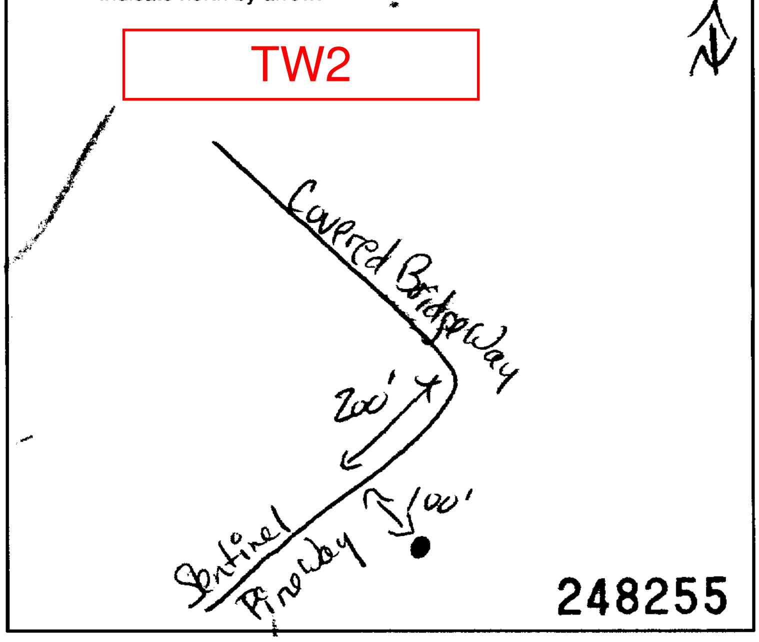
METHOD OF CONSTRUCTION

- 1 ☐ Cable tool
- 2 ☐ Rotary (conventional)
- 3 ☐ Rotary (reverse)
- 4 ☐ Rotary (air)
- 5 ☑ Air percussion
- 6 ☐ Boring
- 7 ☐ Diamond
- 8 ☐ Jetting
- 9 ☐ Driving
- 10 ☐ Digging
- 11 ☐ Other

LOCATION OF WELL

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

TW2



248255

Name of Well Contractor: Air Rock Drilling Co Ltd

Well Contractor's Licence No.: 1119

Address: RR#1 Richmond, Ont

Name of Well Technician: Shannon Purcell

Well Technician's Licence No.: T2122

Signature of Technician/Contractor:

Submission date: 11 day 04 mo 03 yr

MINISTRY USE ONLY

Data source | Contractor 1119 | Date received MAY 08 2003

Date of inspection | Inspector

Remarks: CSS.ES3

2 - MINISTRY OF THE ENVIRONMENT COPY

0506 (07/00) Front Form 9

Ontario Ministry of the Environment

The Ontario Water Resources Act
WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

11 **1533704** Municipality 15005 Con CON 03

County or District [redacted]
Township/Borough/City/Town/Village: West Carleton (Huntley)
Con block tract survey, etc.: 3
Lot: 8
Address: Carp, Ont
Date completed: 14 day 03 month 03 year

21 [redacted]

Northing RC Elevation RC Basin Code

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth - feet From	To
grey	Clay			0	33
Brown	Shale			33	168
grey	Limestone			168	181

31

32

41 WATER RECORD

Water found at - feet	Kind of water
135	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas NOT
170	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas TESTD
	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas

51 CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth - feet From	To
6 1/4	1 ☑ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic	188	0	42
8 3/4	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic		0	40
6	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☑ Open hole 5 ☐ Plastic		40	181

SCREEN

Sizes of opening (Slot No.) | Diameter inches | Length feet
Material and type | Depth at top of screen feet

61 PLUGGING & SEALING RECORD

☑ Annular space ☐ Abandonment

Depth set at - feet From	To	Material and type (Cement grout, bentonite, etc.)
2	42	bentonite

PUMPING TEST

71 Pumping test method: 1 ☑ Pump 2 ☐ Bailer
Pumping rate: 7 GPM
Duration of pumping: 1 Hours Mins
Static level: 20 feet
Water level end of pumping: 170 feet
Water levels during: 1 ☐ Pumping 2 ☑ Recovery
15 minutes: 85 feet
30 minutes: 20 feet
45 minutes: 20 feet
60 minutes: 20 feet
If flowing give rate: GPM
Pump intake set at: feet
Water at end of test: ☐ Clear ☑ Cloudy
Recommended pump type: ☐ Shallow ☑ Deep
Recommended pump setting: 170 feet
Recommended pump rate: 7 GPM

FINAL STATUS OF WELL

1 ☐ Water supply
2 ☐ Observation well
3 ☑ Test hole
4 ☐ Recharge well
5 ☐ Abandoned, insufficient supply
6 ☐ Abandoned, poor quality
7 ☐ Abandoned (Other)
8 ☐ Dewatering
9 ☐ Unfinished
10 ☐ Replacement well

WATER USE

1 ☐ Domestic
2 ☐ Stock
3 ☐ Irrigation
4 ☐ Industrial
5 ☐ Commercial
6 ☐ Municipal
7 ☐ Public supply
8 ☐ Cooling & air conditioning
9 ☑ Not use
10 ☐ Other

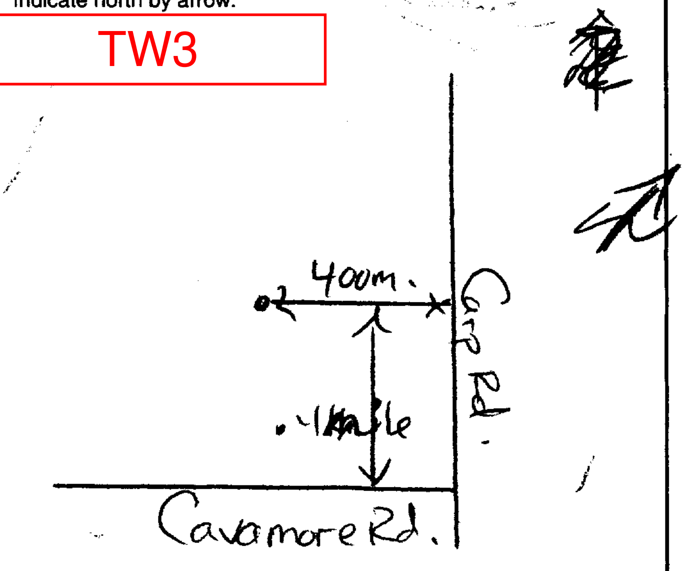
METHOD OF CONSTRUCTION

1 ☐ Cable tool
2 ☐ Rotary (conventional)
3 ☐ Rotary (reverse)
4 ☐ Rotary (air)
5 ☑ Air percussion
6 ☐ Boring
7 ☐ Diamond
8 ☐ Jetting
9 ☐ Driving
10 ☐ Digging
11 ☐ Other

LOCATION OF WELL

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

TW3



248252

Name of Well Contractor: Air Rock Drilling Co Ltd
Well Contractor's Licence No.: 1119
Address: RR#1 Richmond, Ont
Name of Well Technician: Ken Desaulniers
Well Technician's Licence No.: T4
Signature of Technician/Contractor: KDes
Submission date: 11 day 04 mo 03 yr

MINISTRY USE ONLY
Data source | Contractor 1119 | Date received MAY 08 2003
Date of inspection | Inspector
Remarks CSS.ES3

2 - MINISTRY OF THE ENVIRONMENT COPY

0506 (07/00) Front Form 9

Ontario Ministry of the Environment

The Ontario Water Resources Act
WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

11 1533703

Municipality 15005 Con. CON 03

County or District	Township/Borough/City/Town/Village	Con block tract survey, etc.	Lot 25-27
Ottawa Carleton	West Carleton (Huntley)	3	7

[redacted]

Address: Carp, Ont

Date completed 17 day 03 month 03 year

21 UTM 10 12 17 | Northing 18 24 | RC 25 | Elevation 26 | RC 30 | Basin Code 31 ii iii iv 47

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth - feet From	Depth - feet To
	Sand	gravel		0	25
grey	Limestone			25	200

31
32

41 WATER RECORD

Water found at - feet	Kind of water
10-13 148	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas 14 NOT
15-18	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas 19 TESTED
20-23	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas 24
25-28	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas 29
30-33	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas 34

51 CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth - feet From	Depth - feet To
10-11 6¼	12 1 ☑ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic	188	0	13-16 33
17-18 8¾	19 1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☑ Open hole 5 ☐ Plastic		0	20-23 31
24-25 6	26 1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☑ Open hole 5 ☐ Plastic		31	27-30 200

60

SCREEN

Sizes of opening (Slot No.) 31-33
Diameter 34-38 inches
Length 39-40 feet
Material and type
Depth at top of screen 41-44 feet 30

61 PLUGGING & SEALING RECORD

☑ Annular space ☐ Abandonment

Depth set at - feet From	Depth set at - feet To	Material and type (Cement grout, bentonite, etc.)
10-13 2	14-17 33	bentonite
18-21	22-25	
26-29	30-33	80

71 PUMPING TEST

Pumping test method 10: 1 ☑ Pump 2 ☐ Bailer
Pumping rate 4 GPM 11-14
Duration of pumping 1 Hours 15-16 ..... Mins 17-18

Static level 19-21	Water level end of pumping 22-24	15 minutes 26-28	30 minutes 29-31	45 minutes 32-34	60 minutes 35-37
12 feet	180 feet	132 feet	84 feet	36 feet	12 feet

25 Water levels during 1 ☐ Pumping 2 ☑ Recovery

If flowing give rate 38-41 GPM
Pump intake set at feet
Water at end of test 42: ☐ Clear ☑ Cloudy
Recommended pump type: ☐ Shallow ☑ Deep
Recommended pump setting 43-45 180 feet
Recommended pump rate 46-49 4 GPM
50-53

FINAL STATUS OF WELL 54

- 1 ☐ Water supply
- 2 ☐ Observation well
- 3 ☑ Test hole
- 4 ☐ Recharge well
- 5 ☐ Abandoned, insufficient supply
- 6 ☐ Abandoned, poor quality
- 7 ☐ Abandoned (Other)
- 8 ☐ Dewatering
- 9 ☐ Unfinished
- 10 ☐ Replacement well

WATER USE 55-56

- 1 ☐ Domestic
- 2 ☐ Stock
- 3 ☐ Irrigation
- 4 ☐ Industrial
- 5 ☐ Commercial
- 6 ☐ Municipal
- 7 ☐ Public supply
- 8 ☐ Cooling & air conditioning
- 9 ☑ Not use
- 10 ☐ Other

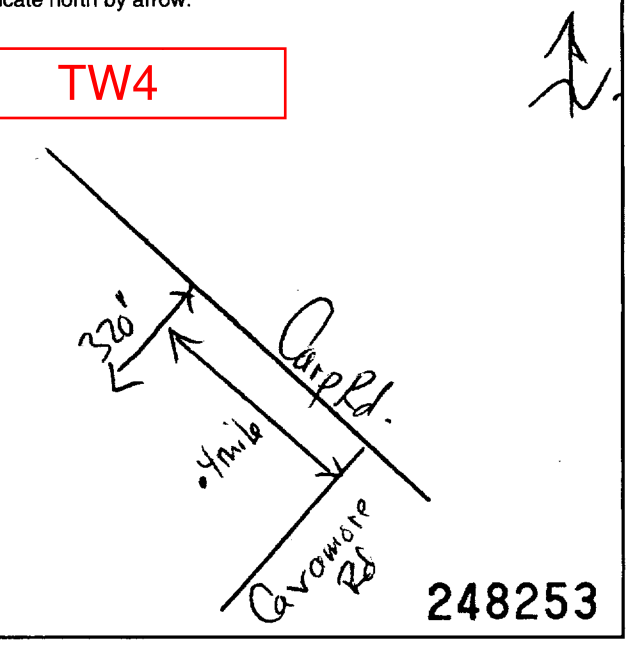
METHOD OF CONSTRUCTION 57

- 1 ☐ Cable tool
- 2 ☐ Rotary (conventional)
- 3 ☐ Rotary (reverse)
- 4 ☐ Rotary (air)
- 5 ☑ Air percussion
- 6 ☐ Boring
- 7 ☐ Diamond
- 8 ☐ Jetting
- 9 ☐ Driving
- 10 ☐ Digging
- 11 ☐ Other

LOCATION OF WELL

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

TW4



248253

Name of Well Contractor: Air Rock Drilling Ltd
Well Contractor's Licence No.: 1119
Address: RR#1 Richmond, Ont
Name of Well Technician: Shannon Purcell
Well Technician's Licence No.: T2122
Signature of Technician/Contractor:
Submission date: 11 day 04 mo 03 yr

MINISTRY USE ONLY
Data source 58
Contractor 59-62 1119
Date received 63-68 MAY 0 8 2003 80
Date of inspection
Inspector
Remarks CSS.ES3

2 - MINISTRY OF THE ENVIRONMENT COPY

0506 (07/00) Front Form 9

Ontario Ministry of the Environment

The Ontario Water Resources Act

WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

11 **1533702**

Municipality 15005 Con. CON 03

County or District	Township/Borough/City/Town/Village	Con block tract survey, etc.	Lot
Ottawa Carleton	West Carleton (Huntley)	3	8

[redacted]

Address: Carp, Ont

Date completed: 18 (day) 03 (month) 03 (year)

21 UTM · Northing · RC · Elevation · RC · Basin Code · ii · iii · iv

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth - feet From	Depth - feet To
	sandy clay			0	3.5
grey	limestone			3.5	220

31

32

41 WATER RECORD

Water found at - feet	Kind of water
10-13	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
15-18	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
20-23	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
25-28	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
30-33	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas

51 CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth - feet From	Depth - feet To
6 1/4	1 ☑ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic	188	0	22
8 3/4	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☑ Open hole 5 ☐ Plastic		0	20
6	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☑ Open hole 5 ☐ Plastic		20	220

SCREEN

Sizes of opening (Slot No.):
Diameter: inches
Length: feet
Material and type:
Depth at top of screen: feet

61 PLUGGING & SEALING RECORD

☑ Annular space ☐ Abandonment

Depth set at - feet From	Depth set at - feet To	Material and type (Cement grout, bentonite, etc.)
2	22	cement grout

71 PUMPING TEST

Pumping test method: 1 ☐ Pump 2 ☐ Bailer
Pumping rate: GPM
Duration of pumping: Hours Mins
Static level: feet
Water level end of pumping: feet
Water levels during 1 ☐ Pumping 2 ☐ Recovery
15 minutes: feet
30 minutes: feet
45 minutes: feet
60 minutes: feet
If flowing give rate: GPM
Pump intake set at: feet
Water at end of test: ☐ Clear ☐ Cloudy
Recommended pump type: ☐ Shallow ☐ Deep
Recommended pump setting: feet
Recommended pump rate: GPM

FINAL STATUS OF WELL

- 1 ☐ Water supply
- 2 ☐ Observation well
- 3 ☑ Test hole
- 4 ☐ Recharge well
- 5 ☐ Abandoned, insufficient supply
- 6 ☐ Abandoned, poor quality
- 7 ☐ Abandoned (Other)
- 8 ☐ Dewatering
- 9 ☐ Unfinished
- 10 ☐ Replacement well

WATER USE

- 1 ☐ Domestic
- 2 ☐ Stock
- 3 ☐ Irrigation
- 4 ☐ Industrial
- 5 ☐ Commercial
- 6 ☐ Municipal
- 7 ☐ Public supply
- 8 ☐ Cooling & air conditioning
- 9 ☑ Not use
- 10 ☐ Other

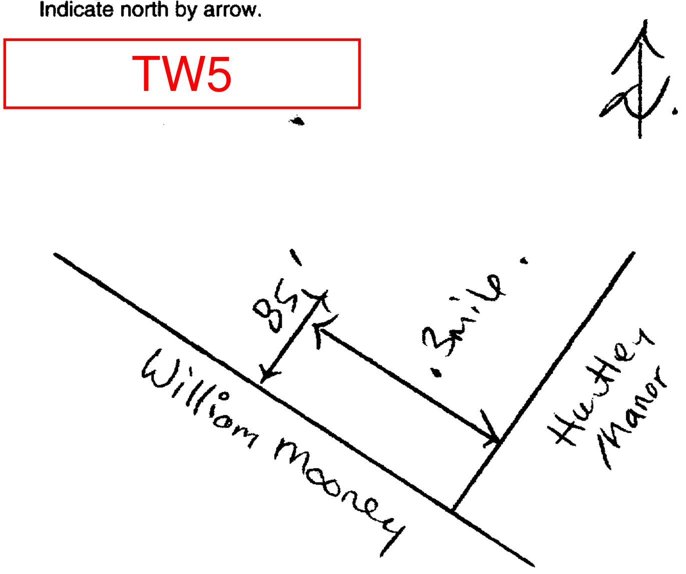
METHOD OF CONSTRUCTION

- 1 ☐ Cable tool
- 2 ☐ Rotary (conventional)
- 3 ☐ Rotary (reverse)
- 4 ☐ Rotary (air)
- 5 ☑ Air percussion
- 6 ☐ Boring
- 7 ☐ Diamond
- 8 ☐ Jetting
- 9 ☐ Driving
- 10 ☐ Digging
- 11 ☐ Other

LOCATION OF WELL

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

TW5



248254

Name of Well Contractor: Air Rock Drilling Co Ltd
Well Contractor's Licence No.: 1119
Address: RR#1 Richmond, Ont
Name of Well Technician: Shannon Purcell
Well Technician's Licence No.: T2122
Signature of Technician/Contractor:
Submission date: 11 (day) 04 (mo) 03 (yr)

MINISTRY USE ONLY
Data source:
Contractor: 1119
Date received: MAY 08 2003
Date of inspection:
Inspector:
Remarks: CSS.ES3

2 - MINISTRY OF THE ENVIRONMENT COPY

0506 (07/00) Front Form 9

Ontario

Ministry of the Environment
and Climate Change

Measurements recorded in: ☐ Metric ☒ Imperial

Tag#:A229072

A229072

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	1384341 Ontario Limited (c/o Cavanagh Const)		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
9094 Cavanagh Road	Ashton	On	K0A 1B0	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
2727 Carp Road	Huntley	P/L 7&8	3

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottwa-Carleton	Carp	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	422416	5016516		TEST WELL # 1 OF 3

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	To
	Sand	& Gravel		0'	21'
Black & Grey	Limestone			21'	30'
Black & Grey	Limestone			30'	106'
Black & Grey	Limestone			106'	137'
Black & Grey	Limestone			137'	143'

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
27'	17'	Neat cement	9.36
17'	0'	Bentonite slurry	8.4

Method of Construction

☐ Cable Tool
☐ Rotary (Conventional)
☐ Rotary (Reverse)
☐ Boring
☒ Air percussion
☐ Other, *specify* ____
☐ Diamond
☐ Jetting
☐ Driving
☐ Digging

Well Use

☐ Public
☒ Domestic
☐ Livestock
☐ Irrigation
☐ Industrial
☐ Other, *specify* ____
☐ Commercial
☐ Municipal
☒ Test Hole
☐ Cooling & Air Conditioning
☐ Not used
☐ Dewatering
☐ Monitoring

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	To
6 1/4"	Steel	.188"	+2'	27'
6"	Open Hole		27'	143'

Status of Well

☒ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, *specify* ____
☐ Other, *specify* ____

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	To

Water Details

Water found at Depth	Kind of Water
30 (m/ft) ☐ Gas	☐ Fresh ☒ Untested ☐ Other, *specify*
106 (m/ft) ☐ Gas	☐ Fresh ☒ Untested ☐ Other, *specify*
137 (m/ft) ☐ Gas	☐ Fresh ☒ Untested ☐ Other, *specify*

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0'	27'	9 3/4"
27'	143'	6"

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, *specify* Not tested

If pumping discontinued, give reason: X

Pump intake set at (m/ft) 120

Pumping rate (l/min / GPM) 20

Duration of pumping 1 hrs + 0 min

Final water level end of pumping (m/ft) 96'7"

If flowing give rate (l/min / GPM) X

Recommended pump depth (m/ft) 100'

Recommended pump rate (l/min / GPM) 20

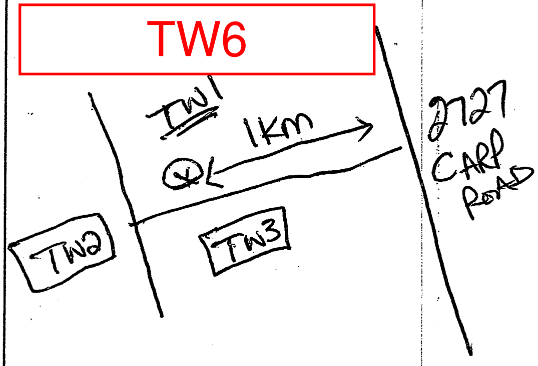
Well production (l/min / GPM) 20

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Water Level (m/ft)	Recovery Time (min)	Water Level (m/ft)
Static Level	2'9"		96'7"
1	13.3	1	81'3"
2	20.4	2	69.3
3	25.9	3	57.1
4	30.4	4	45.7
5	36.1	5	35.9
10	53.2	10	23.6
15	61.2	15	12.7
20	74.6	20	5.6
25	80.5	25	2.9
30	89.8	30	2.9
40	93.6	40	2.9
50	95.4	50	2.9
60	96'7"	60	2'9"

Map of Well Location

Please provide a map below following instructions on the back.



Comments: 3/4 HP - 15 GPM SET @ 100 FT

TEST WELL #1 of 3

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Air Rock Drilling Co. Ltd.	1119

Business Address (Street Number/Name)	Municipality
6659 Franktown Road, RR#1	Richmond

Province	Postal Code	Business E-mail Address
ON	K0A 2Z0	air-rock@sympatico.ca

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
6138382170	Hogan, Dan

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted (YYYYMMDD)
T3058		2017 10 31

Well owner's information package delivered ☒ Yes ☐ No

Date Package Delivered (YYYYMMDD) 2017 10 13

Date Work Completed (YYYYMMDD) 2017 10 11

Ministry Use Only
Audit No. Z262255
Received

0506E (2014/11)

Ministry's Copy

Ottawa

CERTIFICATE OF WELL COMPLIANCE

I, Ken Desaulniers DO HEREBY CERTIFY that I am licensed to drill wells in the Province of Ontario, and that I have supervised the drilling of a well on the

property of 1384341 ONTARIO LIMITED (c/o Cavanagh Construction)

located at #2727 CARP ROAD Carp

Lot/Plan No.) in the City of Ottawa (Geographical Township of [redacted] Huntley

Lot Part 7 & 8 Conc 3 Plan# X S/L# X

CERTIFY FURTHER that, I am aware of the well drilling requirements, the guidelines, recommendations and regulations of the Ministry of the Environment governing well installations in the Province of Ontario, and the standards specified in any subdivision agreement and hydrogeological report applicable to this site and City Standards.

AND DO HEREBY CERTIFY THAT the said well has been drilled, cased, grouted (cement or bentonite) as applicable and constructed in strict conformity with the standards required.

Signed this 11TH day of OCTOBER 2017

Air Rock Drilling Co. Ltd.

Well Driller/Company

The Engineer on behalf of the landowner set out above Certifies that he/she has inspected the well and it was constructed in accordance with the specifications in O.Reg.903, this report and the Hydrogeological Report with regards to casing length and grouting requirements.

SIGNED this 2 day of Nov. 2017

A.C. Houle, P.Eng.

Engineer

Gemtec Limited

Nov.2/17

A. C. HOULE

A.C. Houle

TW# 1 OF 3
2017579
TAG A229072

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City of Ottawa
Client Service Centre
8243 Victoria Street
Ottawa, ON K0A 2P0

Ville d'Ottawa
Centre de service
8243, rue Victoria
Ottawa, ON K0A 2P0

2001
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Année internationale

Ontario

Ministry of the Environment and Climate Change

Measurements recorded in: ☐ Metric ☒ Imperial

Tag#:A229073 ...t Below)

A229073

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name	Last Name / Organization 1384341 Ontario Limited (c/o Cavanagh Const)	E-mail Address	☐ Well Constructed by Well Owner

Mailing Address (Street Number/Name) 9094 Cavanagh Road	Municipality Ashton	Province On	Postal Code K0A 1B0	Telephone No. *(inc. area code)*

Well Location

Address of Well Location (Street Number/Name) 2727 Carp Road	Township Huntley	Lot P/L 7&	Concession 3
County/District/Municipality Ottawa-Carleton	City/Town/Village Carp	Province Ontario	Postal Code

UTM Coordinates NAD 83	Zone 18	Easting 422183	Northing 5016181	Municipal Plan and Sublot Number

Other: TEST WELL # 2 OF 3

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	To
	Sand	& Gravel & Clay		0'	13'
Black & Gray	Limestone			13'	108'
Black & Gray	Limestone			108'	183'

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used *(Material and Type)*	Volume Placed *(m³/ft³)*
20'	10'	Neat cement	10.9
10'	0'	Bentonite slurry	8.4

Method of Construction

☐ Cable Tool
☐ Rotary (Conventional)
☐ Rotary (Reverse)
☐ Boring
☒ Air percussion
☐ Other, *specify* SURGED
☐ Diamond
☐ Jetting
☐ Driving
☐ Digging

Well Use

☐ Public
☒ Domestic
☐ Livestock
☐ Irrigation
☐ Industrial
☐ Other, *specify*
☐ Commercial
☐ Municipal
☒ Test Hole
☐ Cooling & Air Conditioning
☐ Not used
☐ Dewatering
☐ Monitoring

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	To
6¼"	Steel	.188"	+2'	20'
6"	Open Hole		20'	183'

Status of Well

☒ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, *specify*
☐ Other, *specify*

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	To

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, *specify* Not tested

If pumping discontinued, give reason: X

Pump intake set at (m/ft): 160

Pumping rate (l/min / GPM): 20

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 21'4"

If flowing give rate (l/min / GPM): X

Recommended pump depth (m/ft): 100'

Recommended pump rate (l/min / GPM): 20

Well production (l/min / GPM): 20

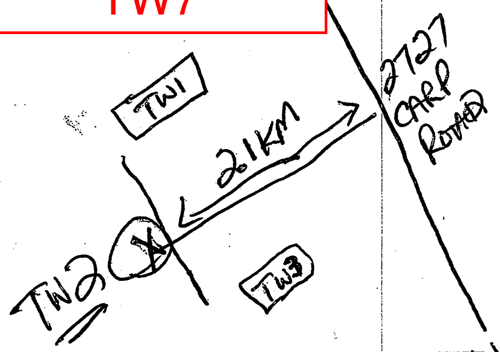
Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Water Level (m/ft)	Recovery Time (min)	Water Level (m/ft)
Static Level	7'7"		21.4"
1	12.9	1	14.6
2	15.1	2	10.1
3	16.3	3	8.7
4	17.1	4	7.7
5	17.8	5	7.7
10	19.9	10	7.7
15	20.3	15	7.7
20	20.7	20	7.7
25	21.4	25	7.7
30	21.4	30	7.7
40	21.4	40	7.7
50	21.4	50	7.7
60	21'4"	60	7'7"

Map of Well Location

n the back.

TW7



Comments: 3/4 HP - 15 GPM SET @ 100 FT (TEST WELL # 2 OF 3

Water Details

Water found at Depth	Kind of Water
108 (m/ft) ☐ Gas	☐ Fresh ☒ Untested ☐ Other, *specify*
(m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, *specify*
(m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, *specify*

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0'	20'	9¾"
20'	183'	6"

Well Contractor and Well Technician Information

Business Name of Well Contractor Air Rock Drilling Co. Ltd.	Well Contractor's Licence No. 1119
Business Address (Street Number/Name) 6659 Franktown Road, RR#1	Municipality Richmond

Province ON	Postal Code K0A 2Z0	Business E-mail Address air-rock@sympatico.ca

Bus.Telephone No. *(inc. area code)* 6138382170	Name of Well Technician (Last Name, First Name) Hogan, Dan

Well Technician's Licence No. T3058	Signature of Technician and/or Contractor	Date Submitted 2017 10 31

Well owner's information package delivered ☒ Yes ☐ No

Date Package Delivered: 2017 10 13

Date Work Completed: 2017 10 10

Ministry Use Only

Audit No. Z262257

Received

0506E (2014/11)

Ministry's Copy

Ottawa

CERTIFICATE OF WELL COMPLIANCE

I, Ken Desaulniers DO HEREBY CERTIFY that I am licensed to drill wells in the Province of Ontario, and that I have supervised the drilling of a well on the

property of 1384341 ONTARIO LIMITED (c/o Cavanagh Construction)

located at #2727 CARP ROAD Carp

Lot/Plan No.) in the City of Ottawa (Geographical Township of [redacted] Huntley

Part 7 Lot 8 Conc 3 PLAN# X S/L# X

CERTIFY FURTHER that, I am aware of the well drilling requirements, the guidelines, recommendations and regulations of the Ministry of the Environment governing well installations in the Province of Ontario, and the standards specified in any subdivision agreement and hydrogeological report applicable to this site and City Standards.

AND DO HEREBY CERTIFY THAT the said well has been drilled, cased, grouted (cement or bentonite) as applicable and constructed in strict conformity with the standards required.

Signed this 10TH day of OCTOBER 2017

Air Rock Drilling Co. Ltd.

Well Driller/Company

The Engineer on behalf of the landowner set out above Certifies that he/she has inspected the well and it was constructed in accordance with the specifications in O.Reg.903, this report and the Hydrogeological Report with regards to casing length and grouting requirements.

SIGNED this 2 day of Nov., 2017

A.C. Houle, P. Eng.

Engineer

Gemtec Limited

Nov. 2/17

A. C. HOULE

TW#2 OF 3
2017578
TAG A229073

Shaping our future together
Ensemble, formons notre avenir

Ontario
Ministry of the Environment and Climate Change

Measurements recorded in: ☐ Metric ☒ Imperial

W Tag#:A229074 Below)
A229074

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Well Owner's Information

First Name:
Last Name / Organization: 1384341 Ontario Limited (c/o Cavanagh Const)
E-mail Address:
☐ Well Constructed by Well Owner
Mailing Address (Street Number/Name): 9094 Cavanagh Road
Municipality: Ashton
Province: On
Postal Code: K0A 1B0
Telephone No. *(inc. area code)*:

Well Location

Address of Well Location (Street Number/Name): 2727 Carp Road
Township: Huntley
Lot: P/L 7&
Concession: 3
County/District/Municipality: Ottawa-Carleton
City/Town/Village: Carp
Province: Ontario
Postal Code:
UTM Coordinates: NAD 83 Zone 18 Easting 442692 Northing 5016337
Municipal Plan and Sublot Number:
Other: TEST WELL # 3 OF 3

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/[✓ ft]) From	To
	Sand	& Grey Clay		0'	14'
Black & Grey	Limestone			14'	28'
Black & Grey	Limestone			28'	98'
Black & Grey	Limestone			98'	133'
Black & Grey	Limestone			133'	143'

Annular Space

Depth Set at (m/[✓ ft]) From	To	Type of Sealant Used *(Material and Type)*	Volume Placed (m³/[✓ ft³])
20'	0'	Neat cement	10.9

Method of Construction

☐ Cable Tool
☐ Rotary (Conventional)
☐ Rotary (Reverse)
☐ Boring
☒ Air percussion
☐ Other, *specify*
☐ Diamond
☐ Jetting
☐ Driving
☐ Digging

Well Use

☐ Public
☒ Domestic
☐ Livestock
☐ Irrigation
☐ Industrial
☐ Other, *specify*
☐ Commercial
☐ Municipal
☒ Test Hole
☐ Cooling & Air Conditioning
☐ Not used
☐ Dewatering
☐ Monitoring

Construction Record - Casing

Inside Diameter (cm/[✓ in])	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/[✓ ft]) From	To
6 1/4"	Steel	.188"	+2'	20'
6"	Open Hole		20'	143'

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	To

Status of Well

☒ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, *specify*
☐ Other, *specify*

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, *specify* Not tested
If pumping discontinued, give reason: X
Pump intake set at (m/[✓ ft]): 120
Pumping rate (l/min / [✓ GPM]): 20
Duration of pumping: 1 hrs + 0 min
Final water level end of pumping (m/ft): 5.1'
If flowing give rate (l/min / GPM): X
Recommended pump depth (m/[✓ ft]): 100'
Recommended pump rate (l/min / [✓ GPM]): 20
Well production (l/min / [✓ GPM]): 20
Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Water Level (m/ft)	Recovery Time (min)	Water Level (m/ft)
Static Level	3'8"		5.1'
1	4.3	1	3.8
2	4.4	2	3.8
3	4.5	3	3.8
4	4.6	4	3.8
5	4.6	5	3.8
10	4.8	10	3.8
15	4.9	15	3.8
20	5	20	3.8
25	5.1	25	3.8
30	5.1	30	3.8
40	5.1	40	3.8
50	5.1	50	3.8
60	5.1'	60	3'8"

Water Details

Water found at Depth 28 (m/[✓ ft]) ☐ Gas — Kind of Water: ☐ Fresh ☒ Untested ☐ Other, *specify*
Water found at Depth 98 (m/[✓ ft]) ☐ Gas — Kind of Water: ☐ Fresh ☒ Untested ☐ Other, *specify*
Water found at Depth 133 (m/[✓ ft]) ☐ Gas — Kind of Water: ☐ Fresh ☒ Untested ☐ Other, *specify*

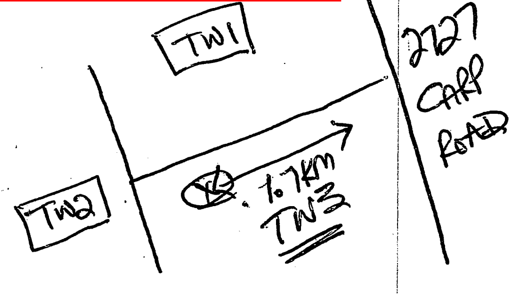
Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0'	20	9 3/4"
20'	143'	6"

Map of Well Location

TW8

on the back.



Comments: 3/4 HP - 15 GPM SET @ 100 FT (TEST WELL #3 OF 3

Well Contractor and Well Technician Information

Business Name of Well Contractor: Air Rock Drilling Co. Ltd.
Well Contractor's Licence No.: 1119
Business Address (Street Number/Name): 6659 Franktown Road, RR#1
Municipality: Richmond
Province: ON
Postal Code: K0A 2Z0
Business E-mail Address: air-rock@sympatico.ca
Bus. Telephone No. *(inc. area code)*: 6138382170
Name of Well Technician (Last Name, First Name): Hogan, Dan
Well Technician's Licence No.: T3058
Signature of Technician and/or Contractor: Kenney D
Date Submitted: 2017 10 31 (YYYY MM DD)

Well owner's information package delivered: ☒ Yes ☐ No
Date Package Delivered: 2017 10 13 (YYYY MM DD)
Date Work Completed: 2017 10 06 (YYYY MM DD)

Ministry Use Only
Audit No. Z262256
Received

0506E (2014/11)

Ministry's Copy

CERTIFICATE OF WELL COMPLIANCE

I, Ken Desaulniers DO HEREBY CERTIFY that I am licensed to drill wells in the Province of Ontario, and that I have supervised the drilling of a well on the

property of 1384341 ONTARIO LIMITED (c/o Cavanagh Construction)

located at #2727 CARP ROAD Carp

Lot/Plan No.) in the City of Ottawa (Geographical Township of [redacted] Huntley

Lot Part 7 & 8 CONC 3 PLAN# X S/L# X

CERTIFY FURTHER that, I am aware of the well drilling requirements, the guidelines, recommendations and regulations of the Ministry of the Environment governing well installations in the Province of Ontario, and the standards specified in any subdivision agreement and hydrogeological report applicable to this site and City Standards.

AND DO HEREBY CERTIFY THAT the said well has been drilled, cased, grouted (cement or bentonite) as applicable and constructed in strict conformity with the standards required.

Signed this 6TH day of OCTOBER 2017

AirRock Drilling Co. Ltd.

Well Driller/Company

The Engineer on behalf of the landowner set out above Certifies that he/she has inspected the well and it was constructed in accordance with the specifications in O.Reg.903, this report and the Hydrogeological Report with regards to casing length and grouting requirements.

SIGNED this 2 day of NOV. 2017

A.C. Houle, P.Eng.

Engineer

Gemtec Limited

Nov. 2/17

A. C. HOULE

A.C. Houle

TW# 3 OF 3
201577
TAG A229074

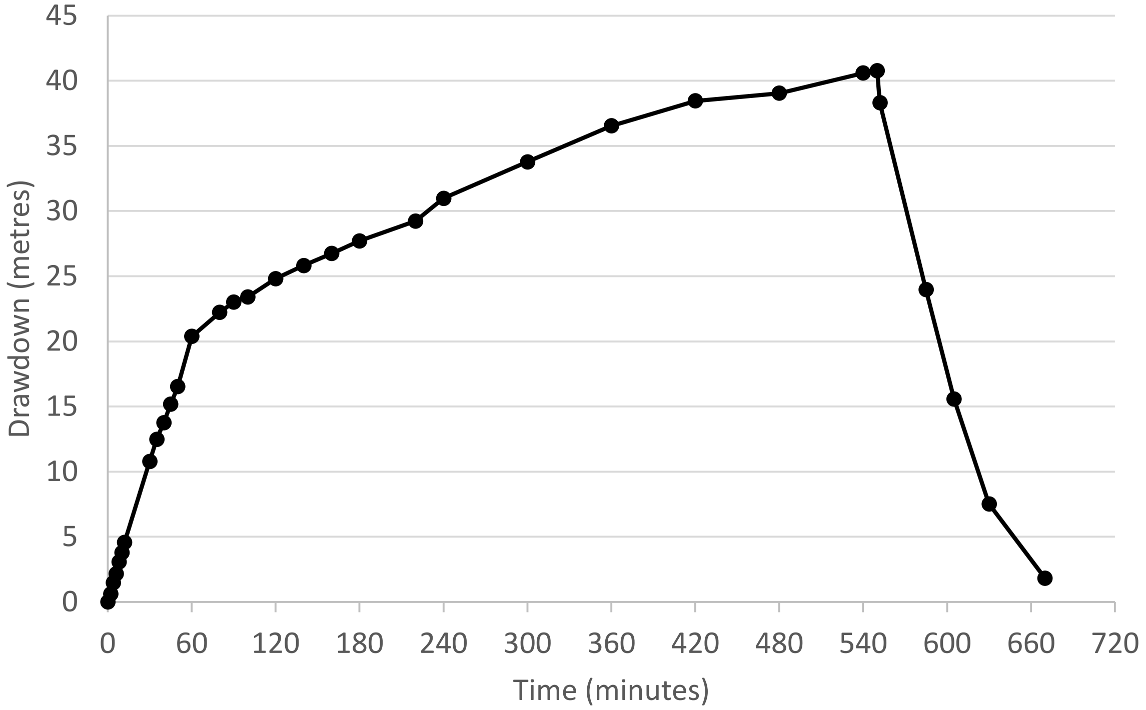
APPENDIX J

Drawdown and Transmissivity Estimates

GEMTEC CONSULTING ENGINEERS AND SCIENTISTS	Pumping Test Analysis Report Project: Hydrogeological Investigation Project Number: 61318.15 Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario		
Test Conducted by: AP	Pumping Well: TW1	P-Test Date: **March 22, 2003**
Analysis Performed by: AP	Method: Water Level Tape	Re-Analysis Date: July 7, 2017
Aquifer Thickness: 58 m	Discharge: Constant 9.0 L/min	Duration: 9 hours

Pumping Test Data (TW1): Drawdown and Recovery



<u>Water Levels (metres below ground surface)</u>

Static : 2.57 m

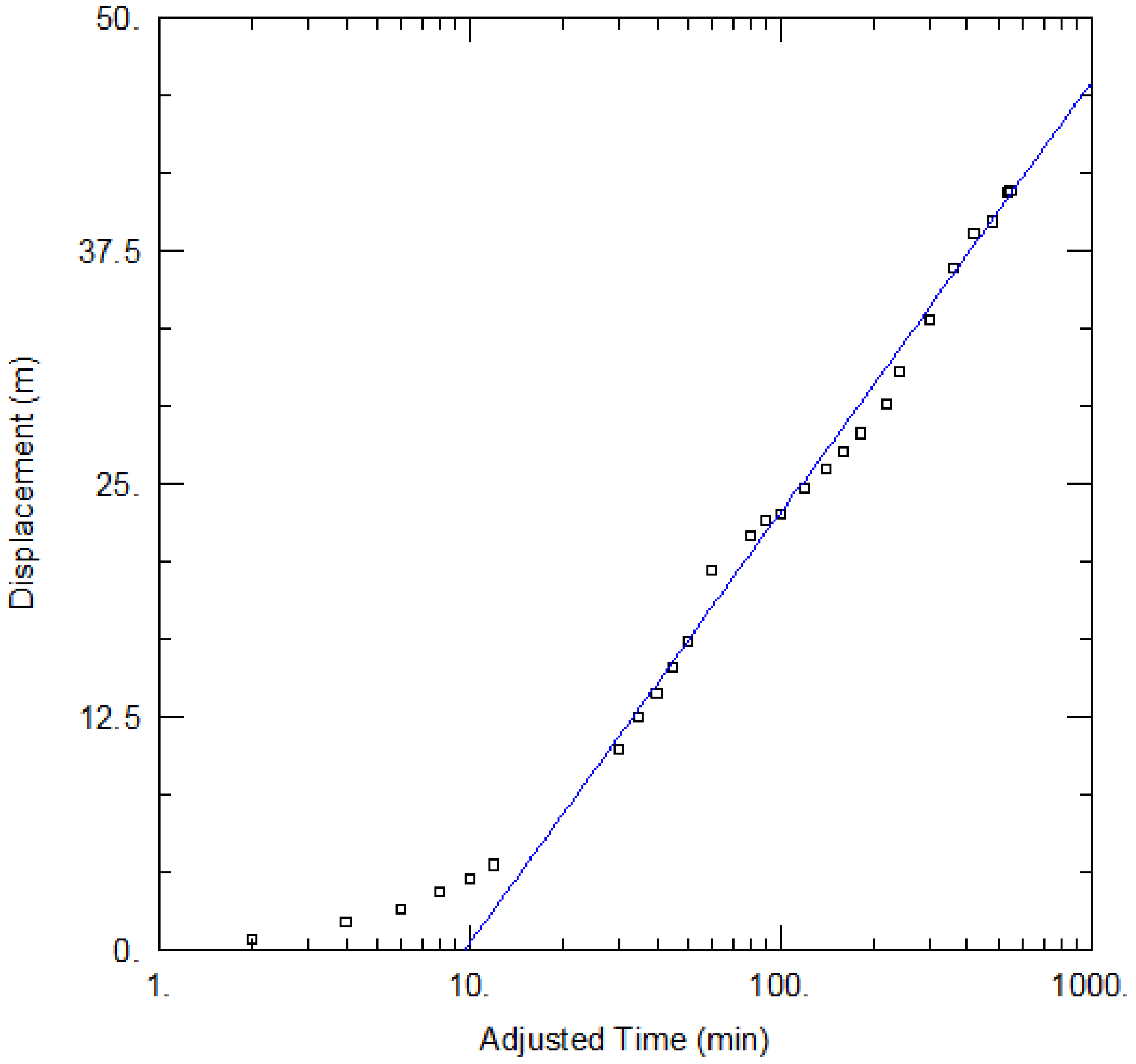
End of pump test (9-hours): 40.89 m

Final water level following recovery: 4.39 m

GEMTEC CONSULTING ENGINEERS AND SCIENTISTS	Pumping Test Analysis Report Project: Hydrogeological Investigation Project Number: 61318.15 Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario		
Test Conducted by: AP	Pumping Well: TW1	P-Test Date: **March 22, 2003**
Analysis Performed by: AP	Method: Cooper-Jacob Analysis	Re-Analysis Date: July 7, 2017
Aquifer Thickness: 58 m	Discharge: Constant 9.0 L/min	Duration: 9 hours

Pumping Test Analysis - Confined (TW1)

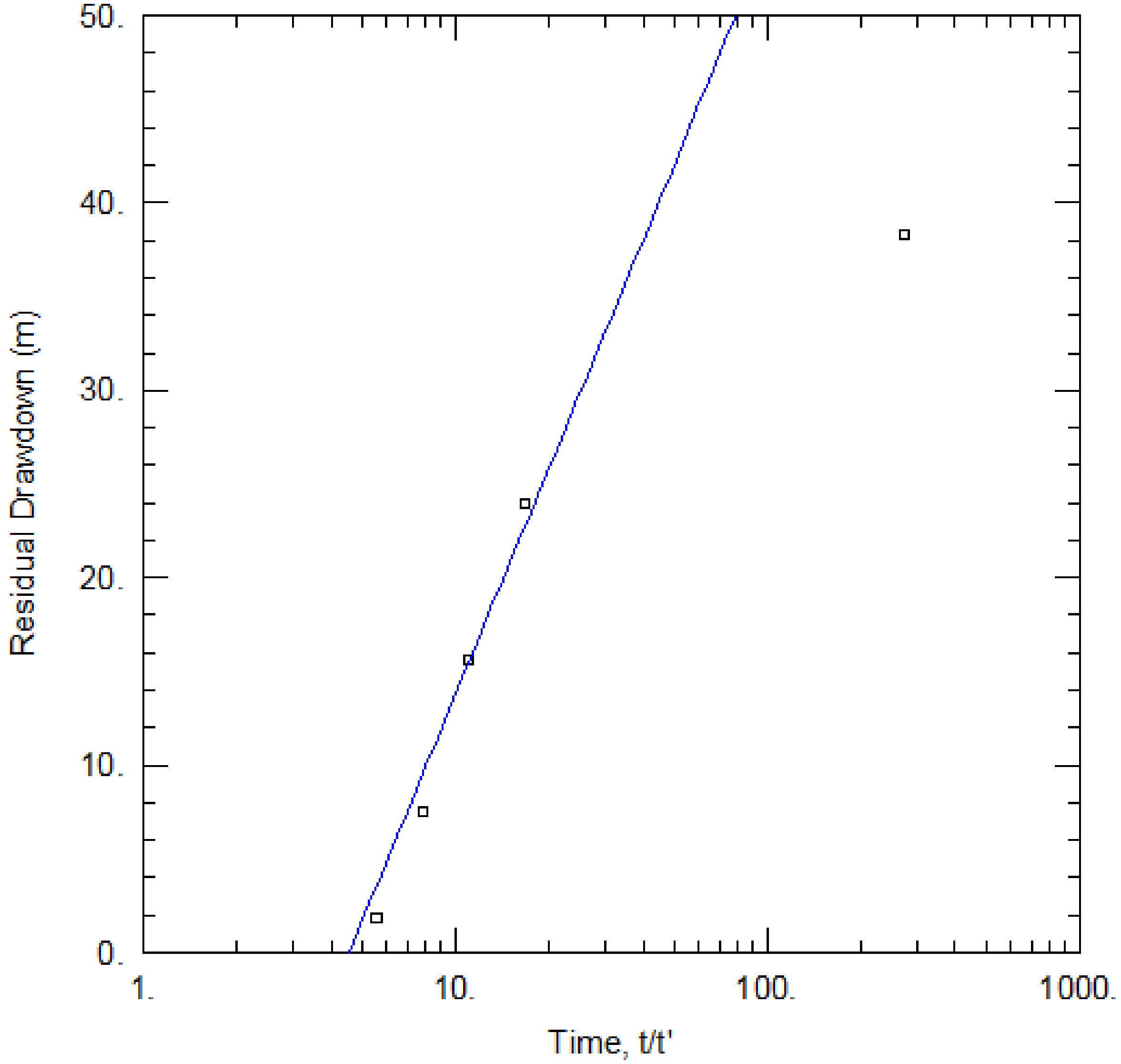


Estimated Transmissivity: 0.10 m^2/day or 1 x 10^{-6} m^2/s

GEMTEC
CONSULTING ENGINEERS
AND SCIENTISTS

Pumping Test Analysis Report		
Project: Hydrogeological Investigation		
Project Number: 61318.15		
Client: 1384341 Ontario Ltd.		
Location: 2727 Carp Road, Ottawa, Ontario		
Test Conducted by: AP	Pumping Well: TW1	P-Test Date: **March 22, 2003**
Analysis Performed by: AP	Method: Theis Analysis	Re-Analysis Date: July 7, 2017
Aquifer Thickness: 58 m	Discharge: Constant 9.0 L/min	Duration: 9 hours

Pumping Test Analysis – Confined Recovery (TW1)



Estimated Transmissivity: 0.06 m^2/day or 7 x 10^{-7} m^2/s

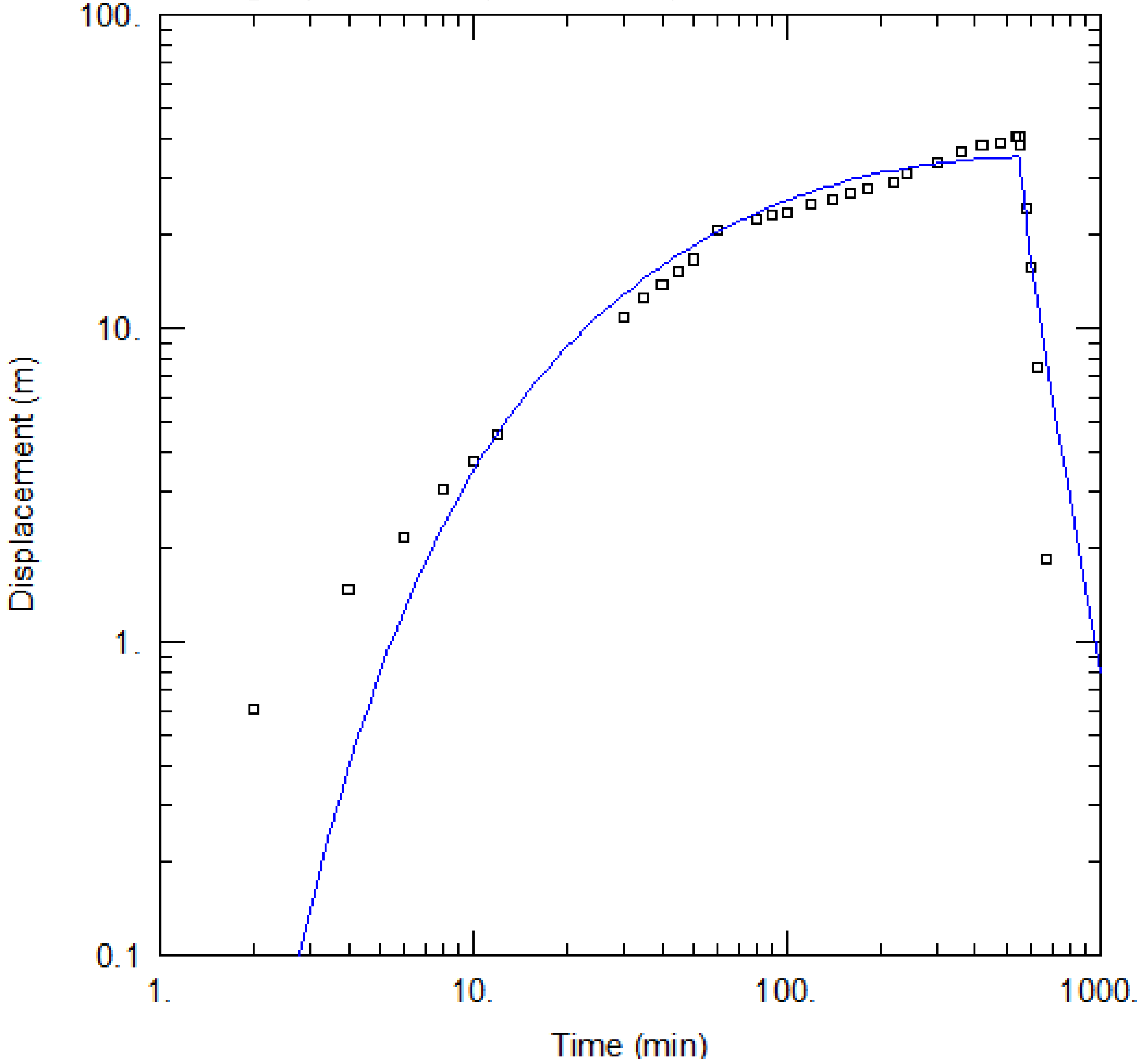
GEMTEC
CONSULTING ENGINEERS
AND SCIENTISTS

Pumping Test Analysis Report
Project: Hydrogeological Investigation
Project Number: 61318.15
Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario

Test Conducted by: AP	Pumping Well: TW1	P-Test Date: **March 22, 2003**
Analysis Performed by: AP	Method: Hantush-Jacob Analysis	Re-Analysis Date: July 7, 2017
Aquifer Thickness: 58 m	Discharge: Constant 9.0 L/min	Duration: 9 hours

Pumping Test Analysis – Leaky Confined (TW1)

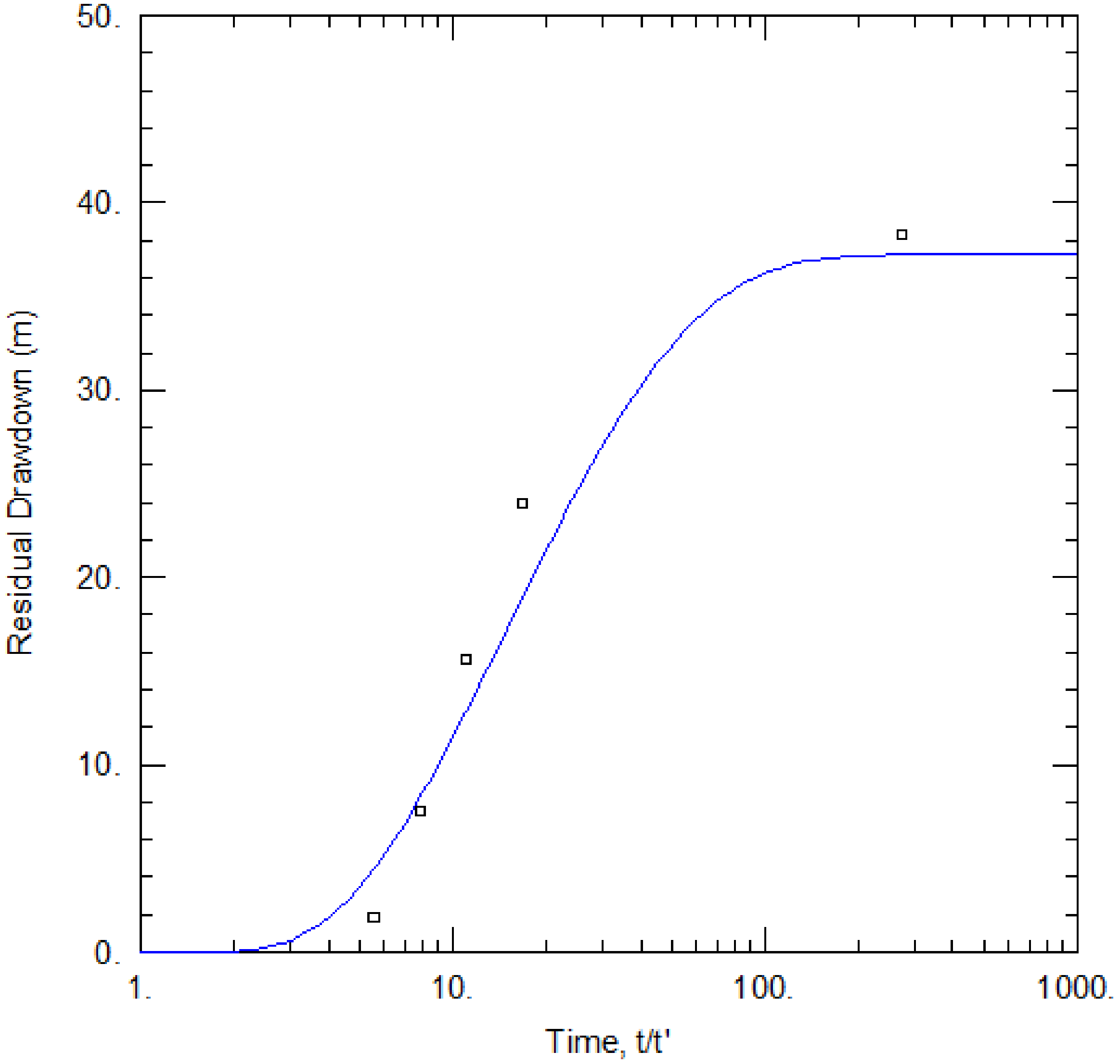


Estimated Transmissivity: 0.06 m²/day or 7 x 10⁻⁷ m²/s
r/B: 0.6

GEMTEC Consulting Engineers and Scientists	Pumping Test Analysis Report
	Project: Hydrogeological Investigation
	Project Number: 61318.15
	Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario		
Test Conducted by: AP	Pumping Well: TW1	P-Test Date: **March 22, 2003**
Analysis Performed by: AP	Method: Hantush-Jacob Analysis	Re-Analysis Date: July 7, 2017
Aquifer Thickness: 58 m	Discharge: Constant 9.0 L/min	Duration: 9 hours

Pumping Test Analysis – Leaky Confined Recovery (TW1)



Estimated Transmissivity: 0.04 m^2/day or 5 x 10^{-7} m^2/s
r/B: 0.7

Pumping Test Analysis Report

Project: Hydrogeological Investigation

Project Number: 61318.15

Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario

Test Conducted by: AP

Pumping Well: TW1

P-Test Date: **July 5, 2017**

Analysis Performed by: AP

Method: Continuous Datalogger

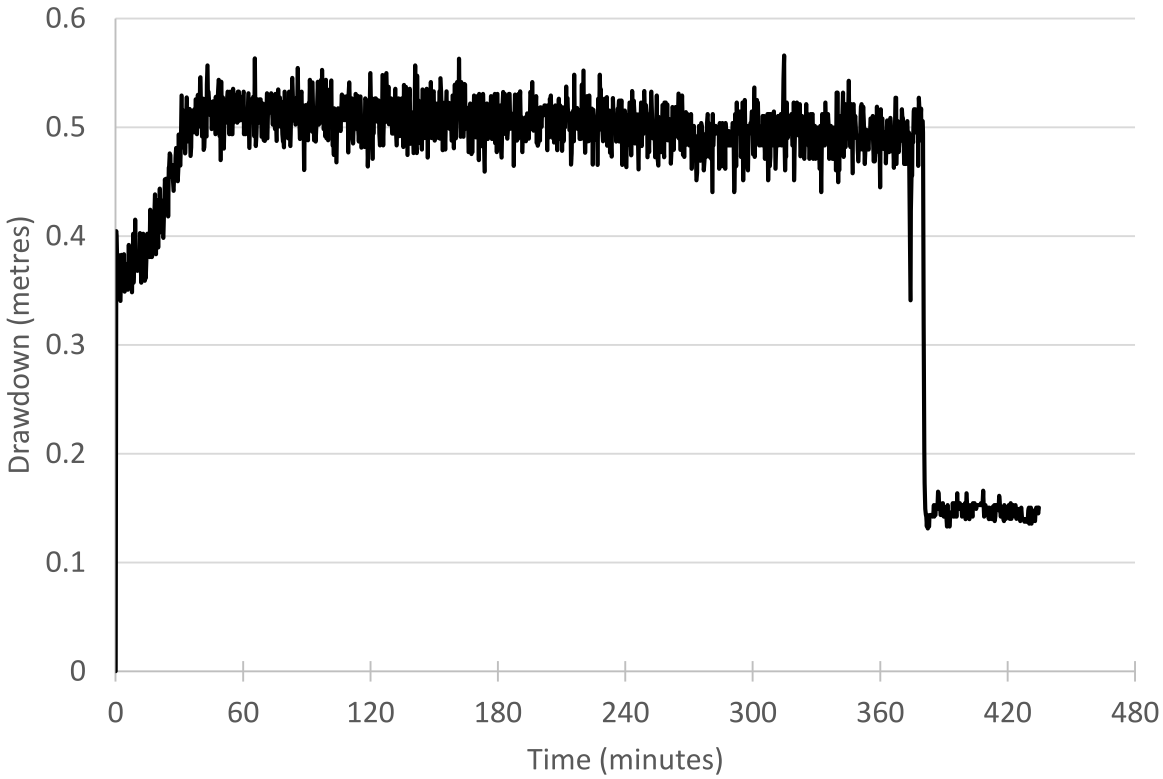
Analysis Date: July 7, 2017

Aquifer Thickness: 58 m

Discharge: Constant 18.9 L/min

Duration: 6 hours

Pumping Test Data (TW1): Drawdown and Recovery



<u>Water Levels (metres below ground surface)</u>

Static : 1.85 m

End of pump test (6-hours): 2.25 m

Final water level following recovery: 1.89 m

Note: Sediment in well clogged pump upon start up, pumping test had to be re-started.

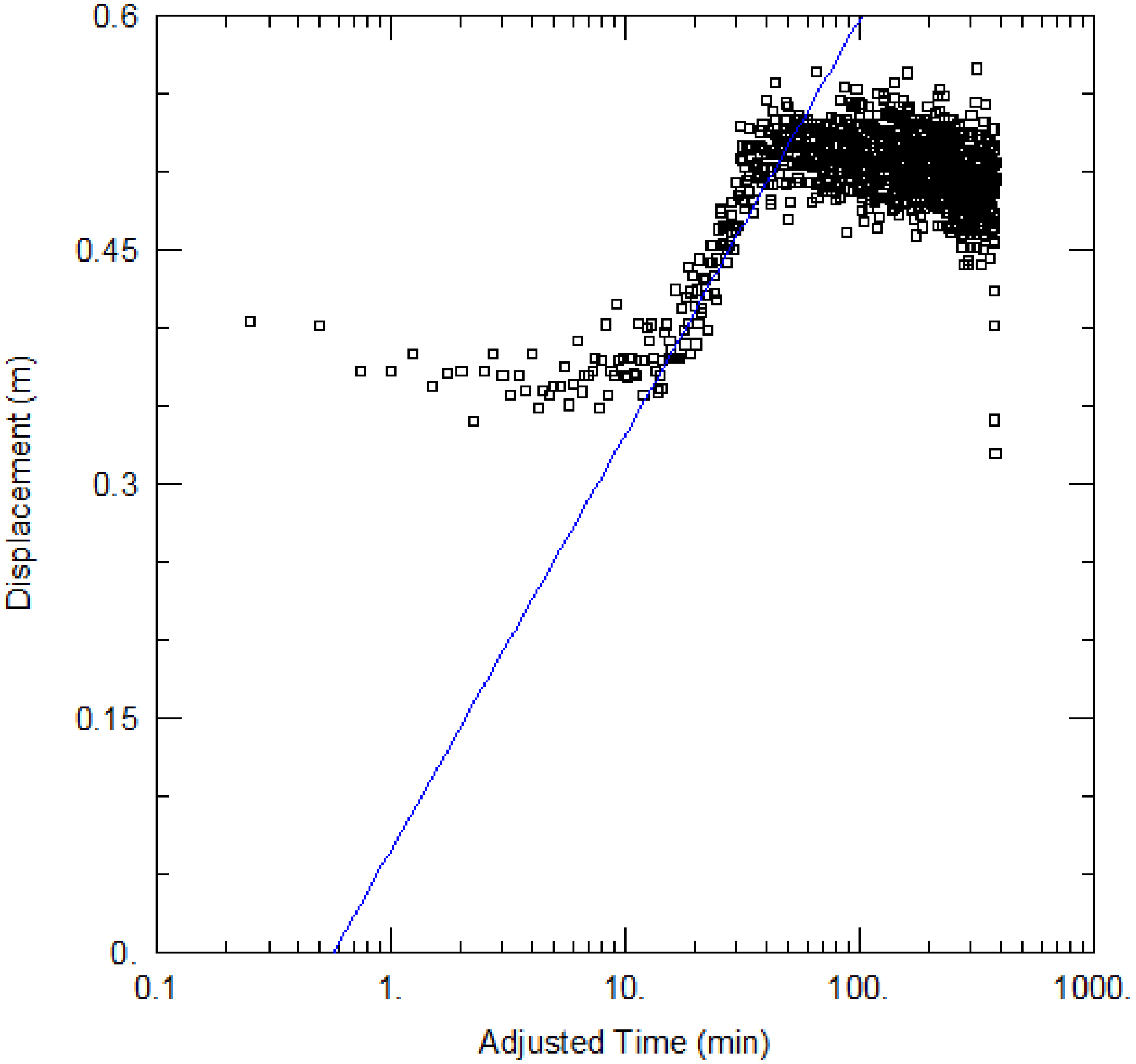
GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

Pumping Test Analysis Report
Project: Hydrogeological Investigation
Project Number: 61318.15
Client: Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario

Test Conducted by: AP	Pumping Well: TW1	P-Test Date: **July 5, 2017**
Analysis Performed by: AP	Method: Cooper-Jacob Analysis	Analysis Date: July 7, 2017
Aquifer Thickness: 58 m	Discharge: Constant 18.9 L/min	Duration: 6 hours

Pumping Test Analysis – Confined (TW1)



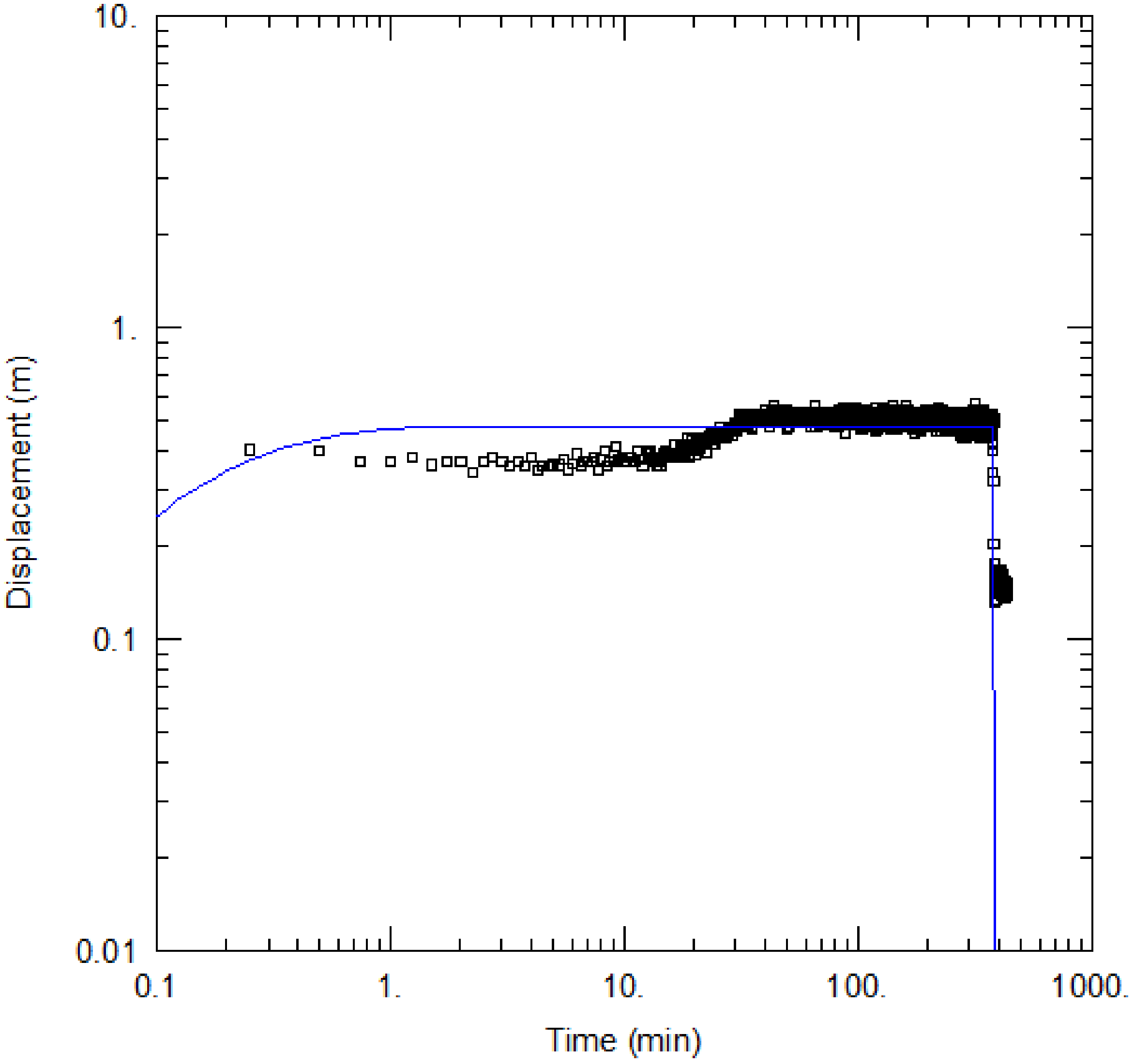
Estimated Transmissivity: 19 m^2/day or 2 x 10^{-4} m^2/s

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

Pumping Test Analysis Report	
Project: Hydrogeological Investigation	
Project Number: 61318.15	
Client: Client: 1384341 Ontario Ltd.	

Location: 2727 Carp Road, Ottawa, Ontario		
Test Conducted by: AP	Pumping Well: TW1	P-Test Date: **July 5, 2017**
Analysis Performed by: AP	Method: Hantush Jacob Analysis	Analysis Date: July 2019
Aquifer Thickness: 58 m	Discharge: Constant 18.9 L/min	Duration: 6 hours

Pumping Test Analysis – Leaky Confined (TW1)

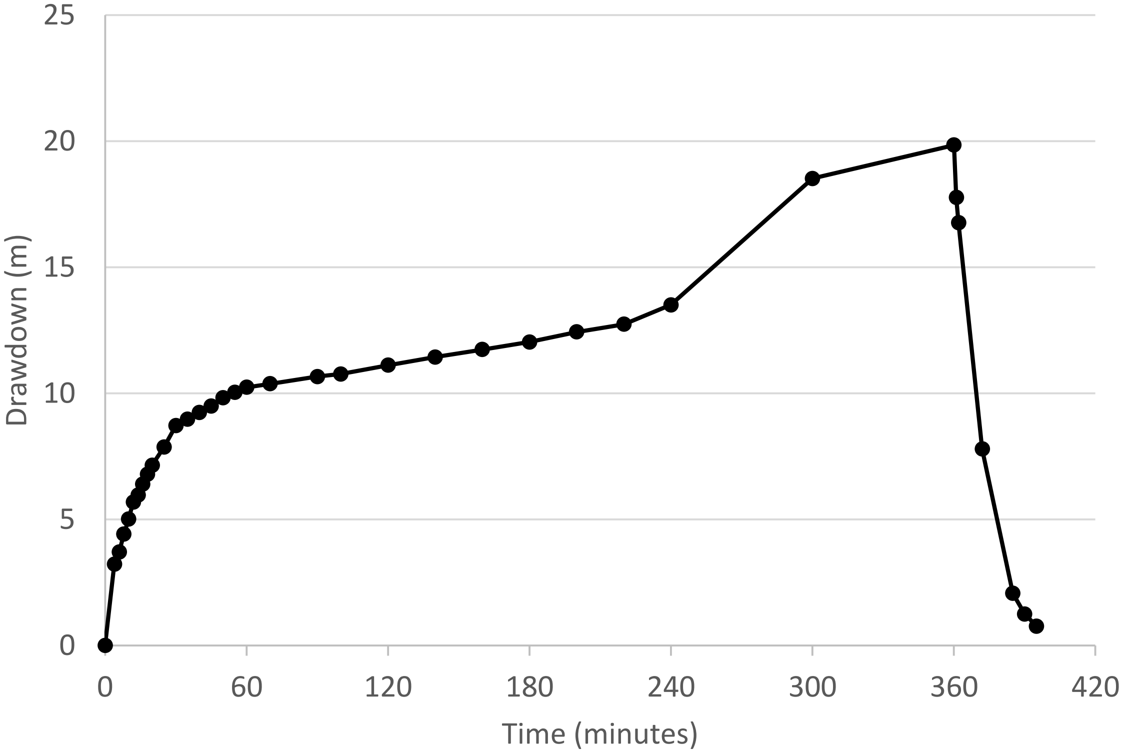


Estimated Transmissivity: 10 m^2/day or 1 x 10^{-4} m^2/s
r/B: 0.5

GEMTEC CONSULTING ENGINEERS AND SCIENTISTS	Pumping Test Analysis Report Project: Hydrogeological Investigation Project Number: 61318.15 Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario		
Test Conducted by: AP	Pumping Well: TW2	P-Test Date: **March 24, 2003**
Analysis Performed by: AP	Method: Water Level Tape	Re-Analysis Date: Nov 7, 2017
Aquifer Thickness: 34 m	Discharge: Constant 23 L/min	Duration: 6 hours

Pumping Test Data (TW2): Drawdown and Recovery



Water Levels (metres below ground surface)
Static : 0.61 m
End of pump test (6-hours): 20.46 m
Final water level following recovery (35 minutes): 1.38 m

GEMTEC
CONSULTING ENGINEERS
AND SCIENTISTS

Pumping Test Analysis Report

Project: Hydrogeological Investigation

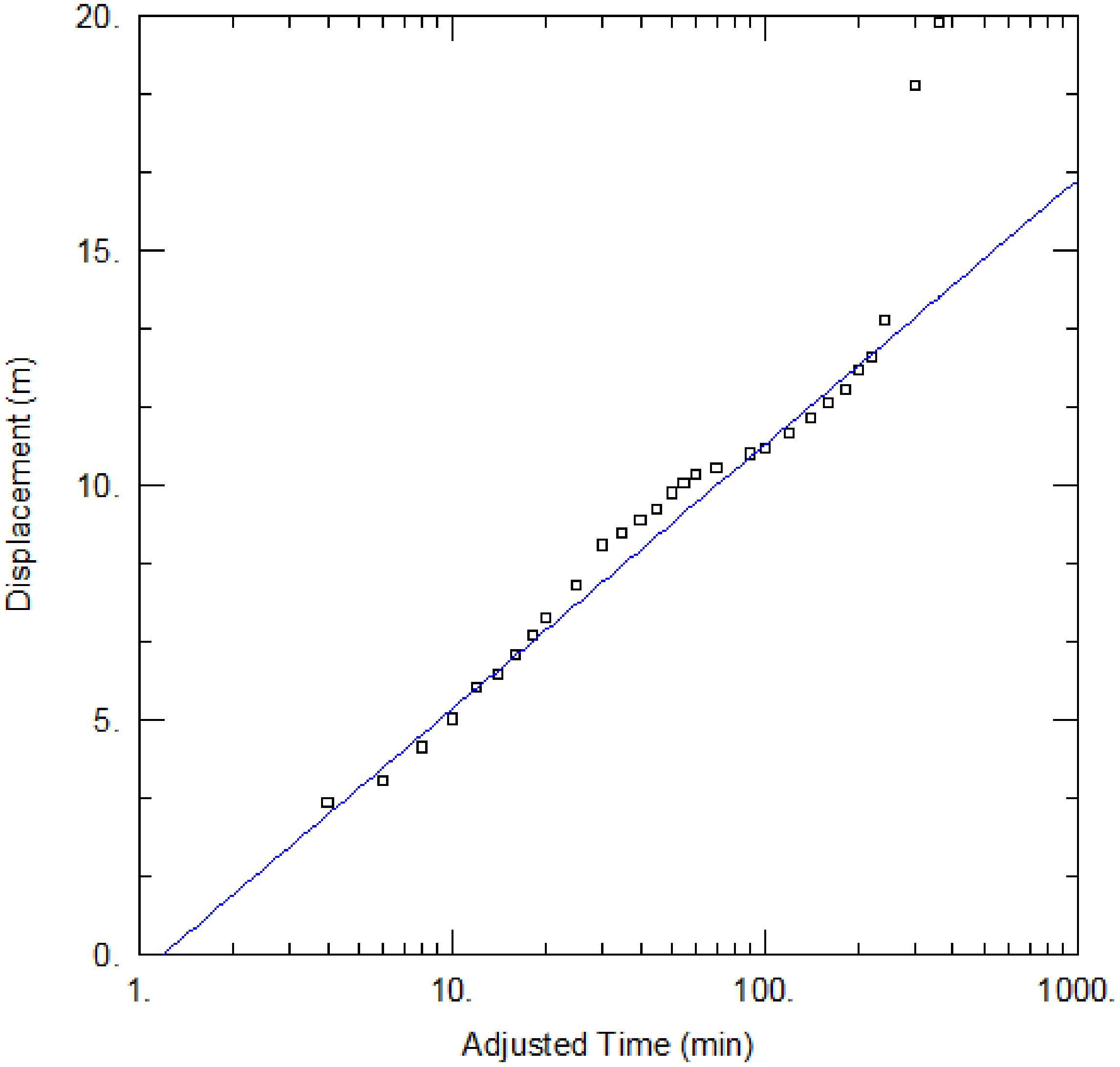
Project Number: 61318.15

Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario

Test Conducted by: AP	Pumping Well: TW2	P-Test Date: **March 24, 2003**
Analysis Performed by: AP	Method: Cooper-Jacob Analysis	Re-Analysis Date: Nov 7, 2017
Aquifer Thickness: 34 m	Discharge: Constant 23 L/min	Duration: 6 hours

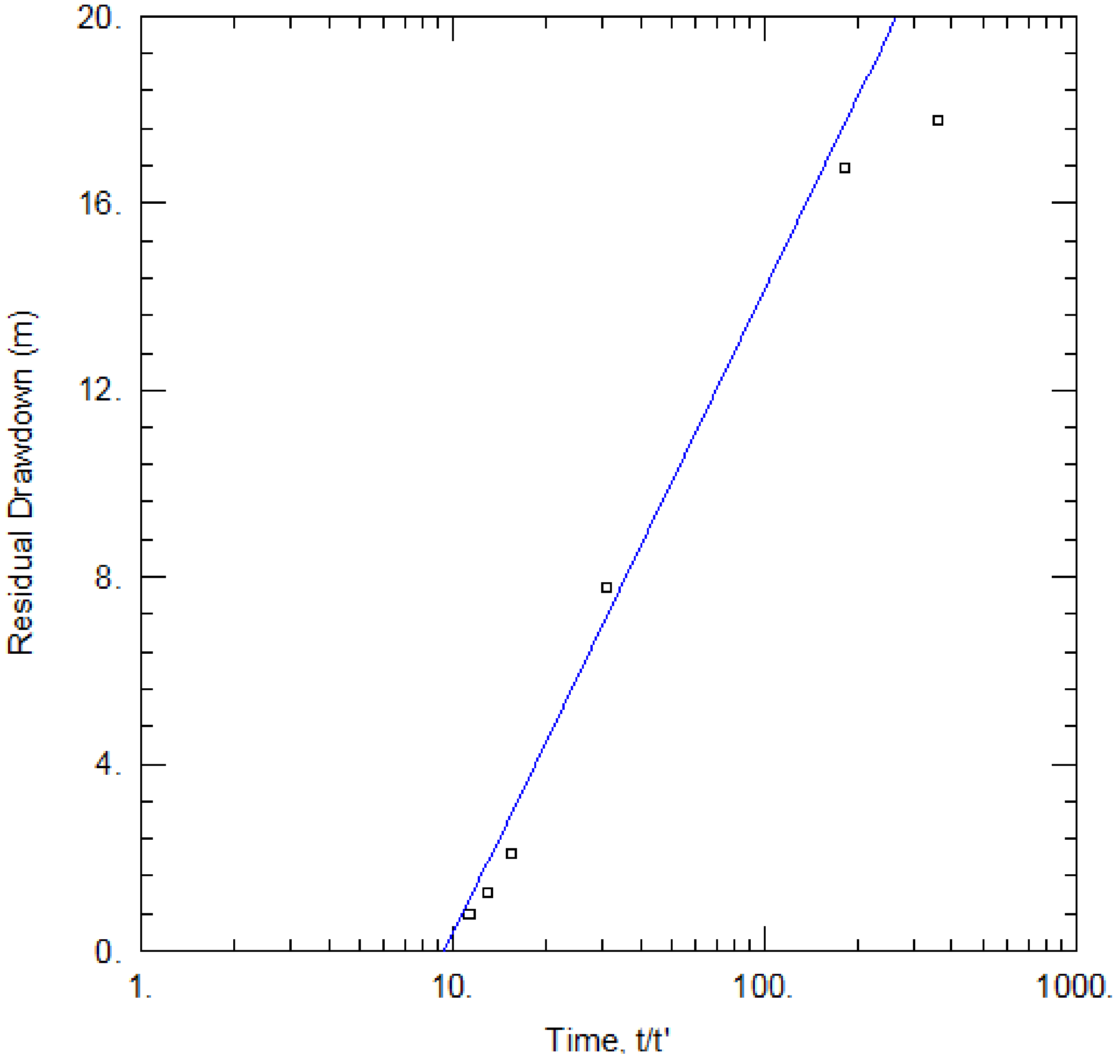
Pumping Test Analysis – Confined (TW2)



Estimated Transmissivity: 1.1 m^2/day or 1 x 10^{-5} m^2/s

GEMTEC Consulting Engineers and Scientists	Pumping Test Analysis Report Project: Hydrogeological Investigation Project Number: 61318.15 Client: 1384341 Ontario Ltd.	
Location: 2727 Carp Road, Ottawa, Ontario		
Test Conducted by: AP	Pumping Well: TW2	P-Test Date: **March 24, 2003**
Analysis Performed by: AP	Method: Cooper-Jacob Analysis	Re-Analysis Date: Nov 7, 2017
Aquifer Thickness: 34 m	Discharge: Constant 23 L/min	Duration: 6 hours

Pumping Test Analysis – Confined Recovery (TW2)



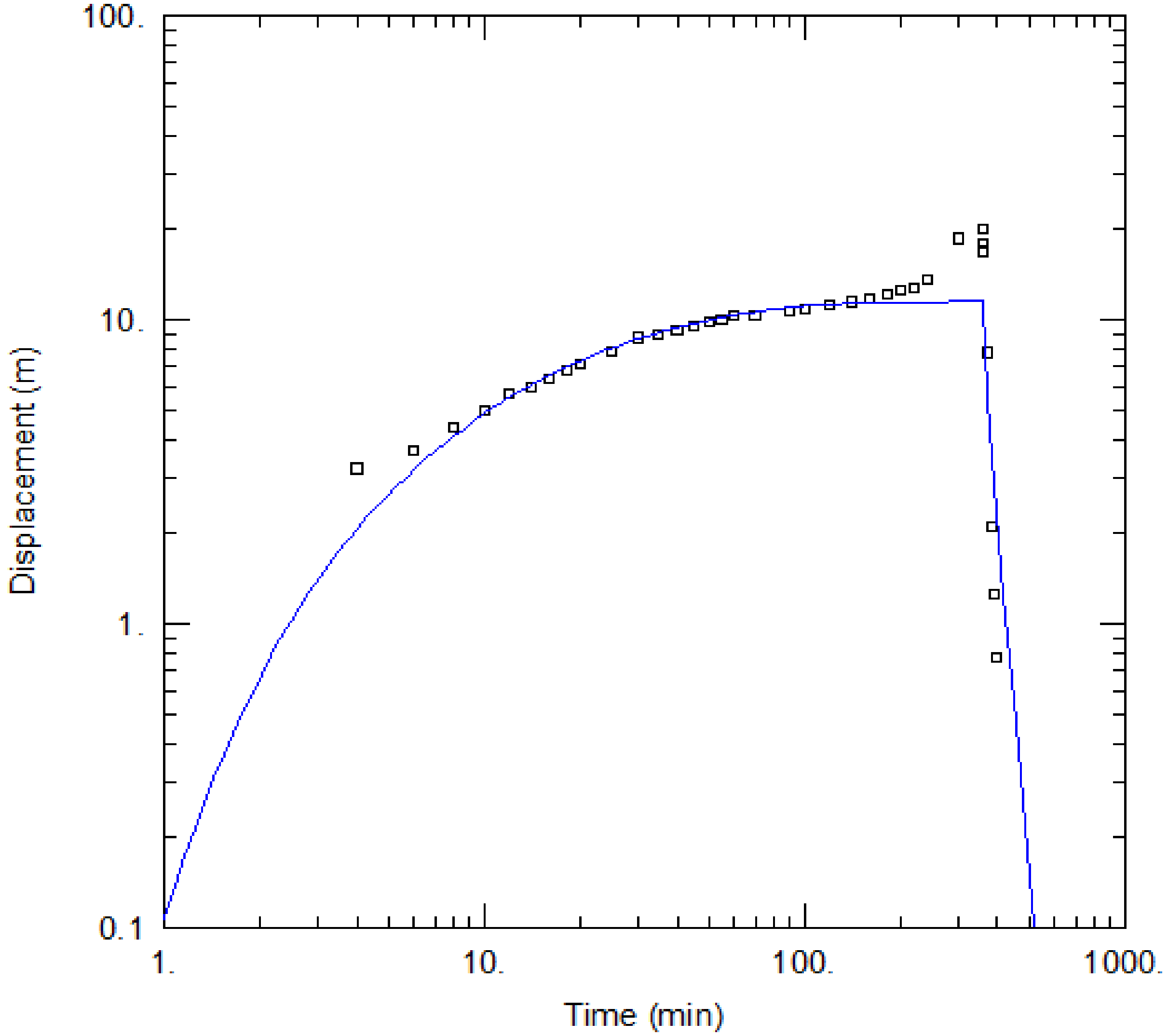
Estimated Transmissivity: 0.4 m^2/day or 5 x 10^{-6} m^2/s

GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

Pumping Test Analysis Report	
Project: Hydrogeological Investigation	
Project Number: 61318.15	
Client: 1384341 Ontario Ltd.	

Location: 2727 Carp Road, Ottawa, Ontario		
Test Conducted by: AP	Pumping Well: TW2	P-Test Date: **March 24, 2003**
Analysis Performed by: AP	Method: Hantush-Jacob Analysis	Re-Analysis Date: July 2019
Aquifer Thickness: 34 m	Discharge: Constant 23 L/min	Duration: 6 hours

Pumping Test Analysis – Leaky Confined (TW2)

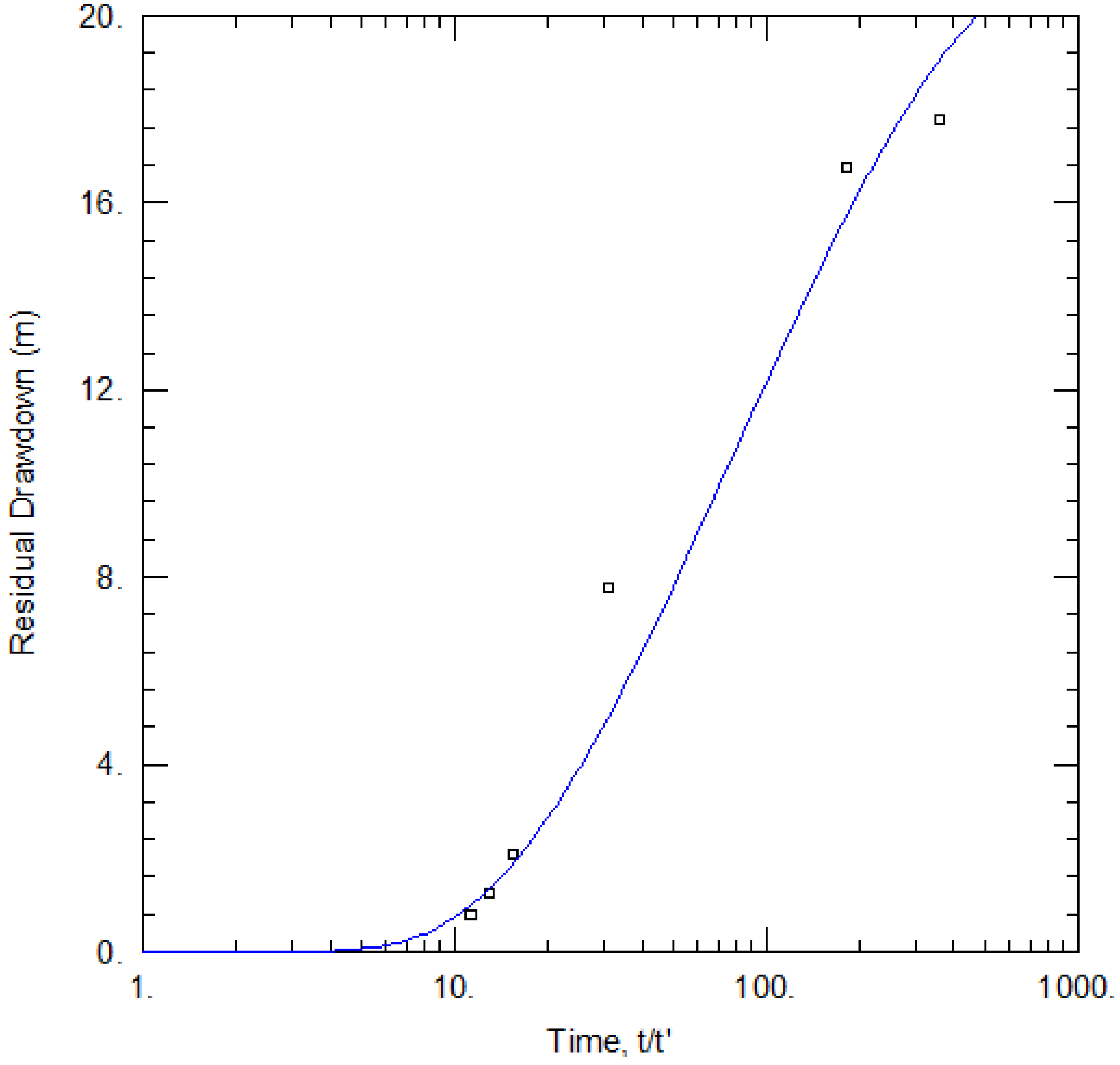


Estimated Transmissivity: 0.5 m^2/day or 6 x 10^{-6} m^2/s
r/B: 0.4

GEMTEC
CONSULTING ENGINEERS
AND SCIENTISTS

Pumping Test Analysis Report		
Project: Hydrogeological Investigation		
Project Number: 61318.15		
Client: 1384341 Ontario Ltd.		
Location: 2727 Carp Road, Ottawa, Ontario		
Test Conducted by: AP	Pumping Well: TW2	P-Test Date: **March 24, 2003**
Analysis Performed by: AP	Method: Hantush-Jacob Analysis	Re-Analysis Date: July 2019
Aquifer Thickness: 34 m	Discharge: Constant 23 L/min	Duration: 6 hours

Pumping Test Analysis – Leaky Confined Recovery (TW2)



Estimated Transmissivity: 0.3 m^2/day or 3 x 10^{-6} m^2/s
r/B: 0.4

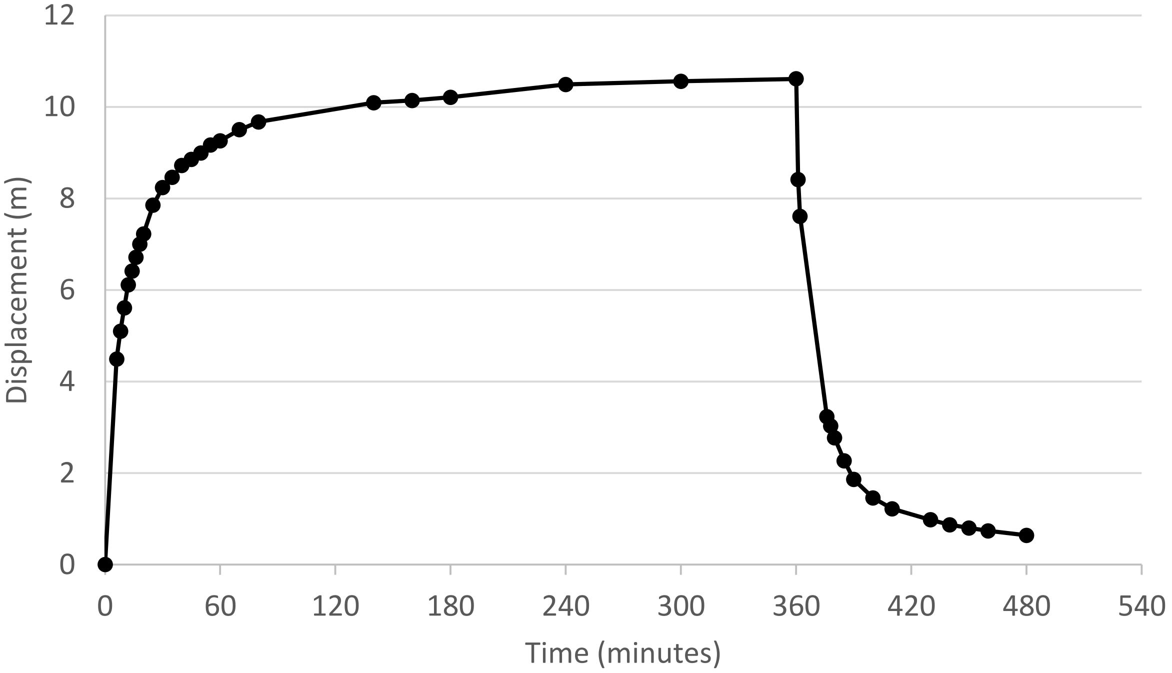
GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

Pumping Test Analysis Report
Project: Hydrogeological Investigation
Project Number: 61318.15
Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario

Test Conducted by: AP
Pumping Well: TW3
P-Test Date: **March 17, 2003**
Analysis Performed by: AP
Method: Water Level Tape
Re-Analysis Date: Nov 7, 2017
Aquifer Thickness:53 m
Discharge: Constant 32 L/min
Duration: 6 hours

Pumping Test Data (TW3): Drawdown and Recovery



<u>Water Levels (metres below ground surface)</u>
Static : 0.46 m
End of pump test (6-hours): 11.07 m
Final water level following recovery: 1.10 m

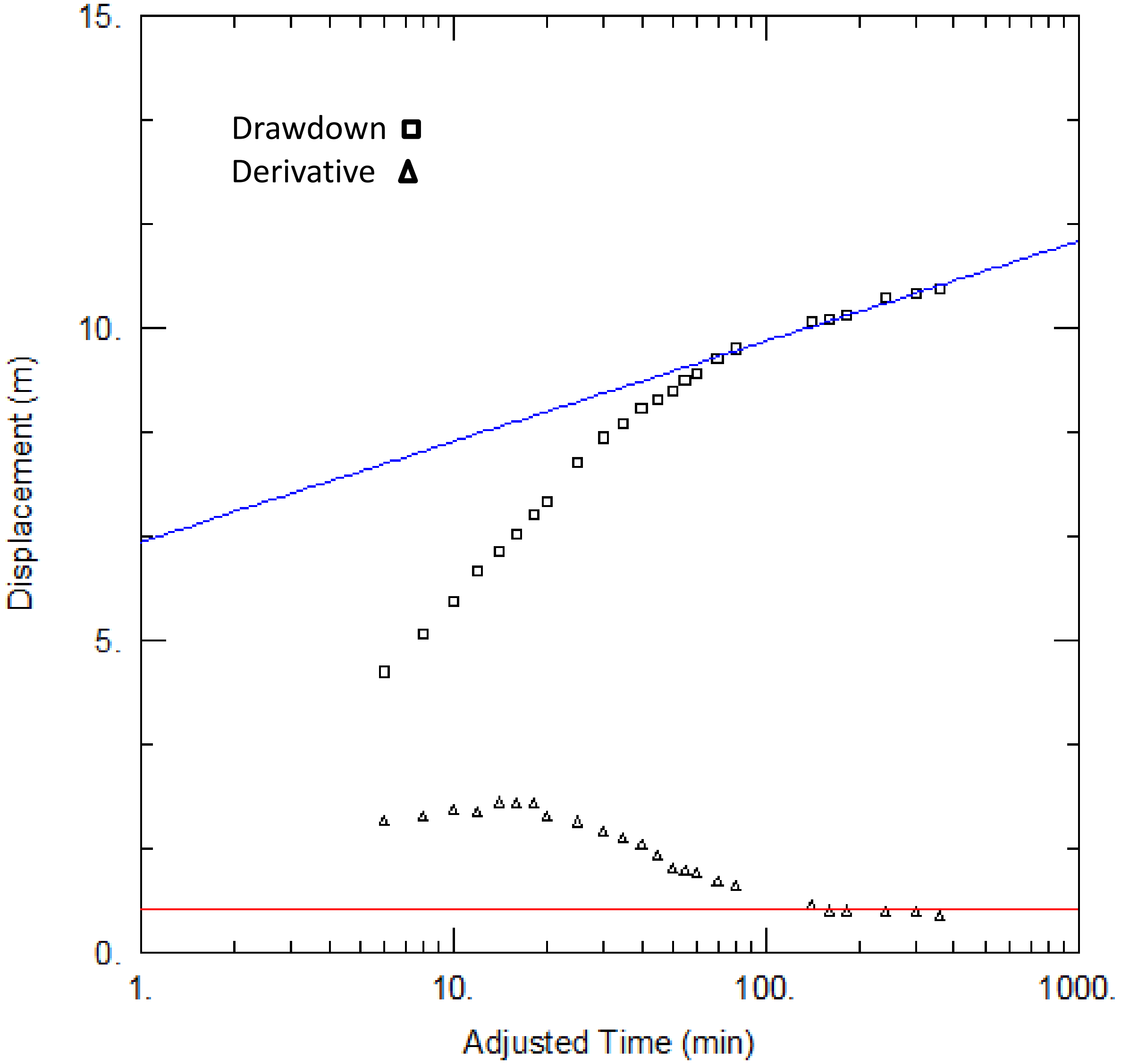
GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

Pumping Test Analysis Report
Project: Hydrogeological Investigation
Project Number: 61318.15
Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario

Test Conducted by: AP	Pumping Well: TW3	P-Test Date: **March 17, 2003**
Analysis Performed by: AP	Method: Cooper-Jacob Analysis	Re-Analysis Date: Nov 7, 2017
Aquifer Thickness:53 m	Discharge: Constant 32 L/min	Duration: 6 hours

Pumping Test Analysis – Confined (TW3)



Estimated Transmissivity: 5.3 m²/day or 6 x 10^{-5} m²/s

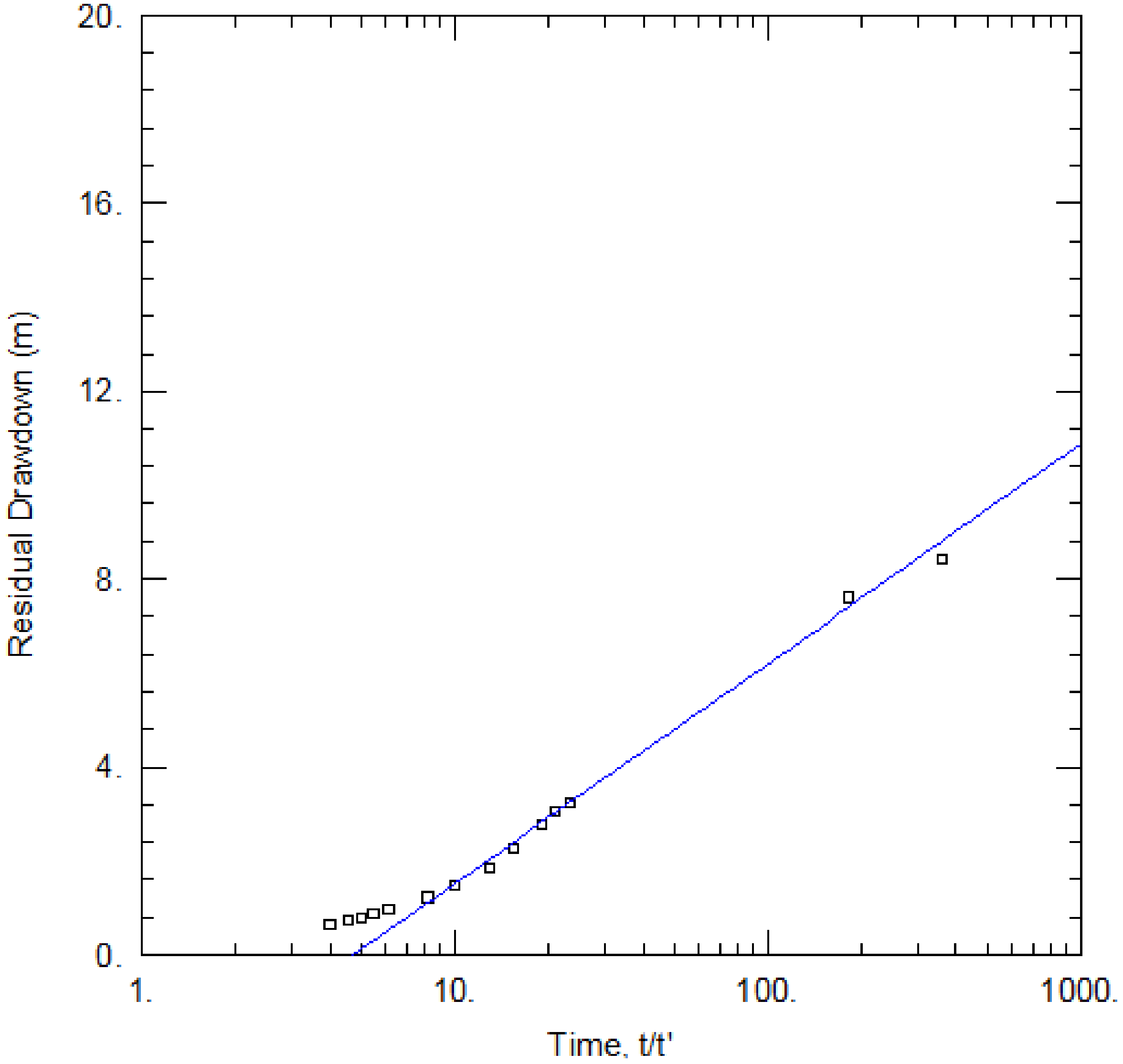
GEMTEC
CONSULTING ENGINEERS
AND SCIENTISTS

Pumping Test Analysis Report
Project: Hydrogeological Investigation
Project Number: 61318.15
Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario

Test Conducted by: AP	Pumping Well: TW3	P-Test Date: **March 17, 2003**
Analysis Performed by: AP	Method: Theis Analysis	Re-Analysis Date: Nov 7, 2017
Aquifer Thickness:53 m	Discharge: Constant 32 L/min	Duration: 6 hours

Pumping Test Analysis – Confined Recovery (TW3)



Estimated Transmissivity: 1.8 m^2/day or 2 x 10^{-5} m^2/s

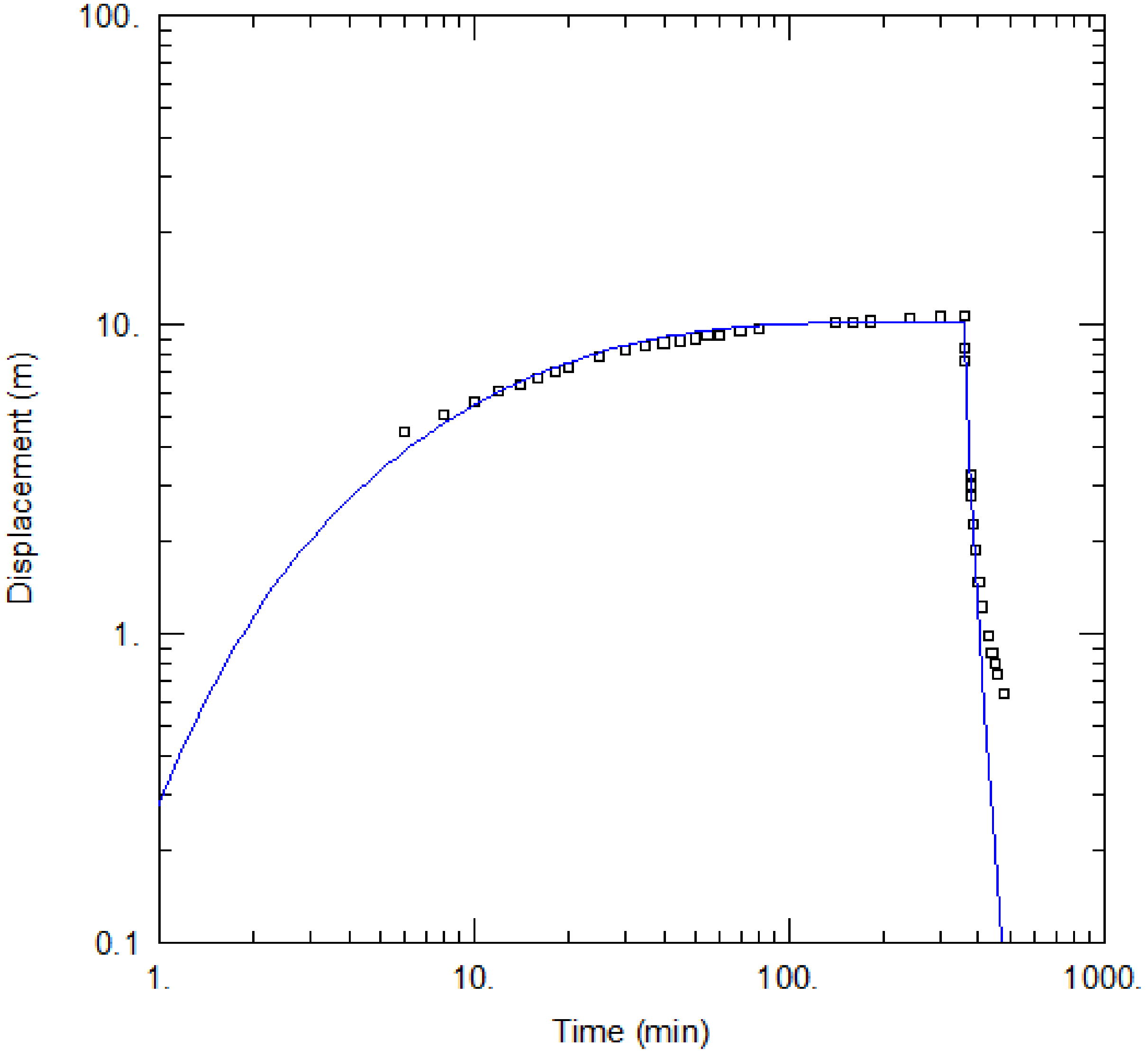
GEMTEC
CONSULTING ENGINEERS
AND SCIENTISTS

Pumping Test Analysis Report
Project: Hydrogeological Investigation
Project Number: 61318.15
Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario

Test Conducted by: AP	Pumping Well: TW3	P-Test Date: **March 17, 2003**
Analysis Performed by: AP	Method: Hantush-Jacob Analysis	Re-Analysis Date: July 2019
Aquifer Thickness:53 m	Discharge: Constant 32 L/min	Duration: 6 hours

Pumping Test Analysis – Leaky Confined (TW3)

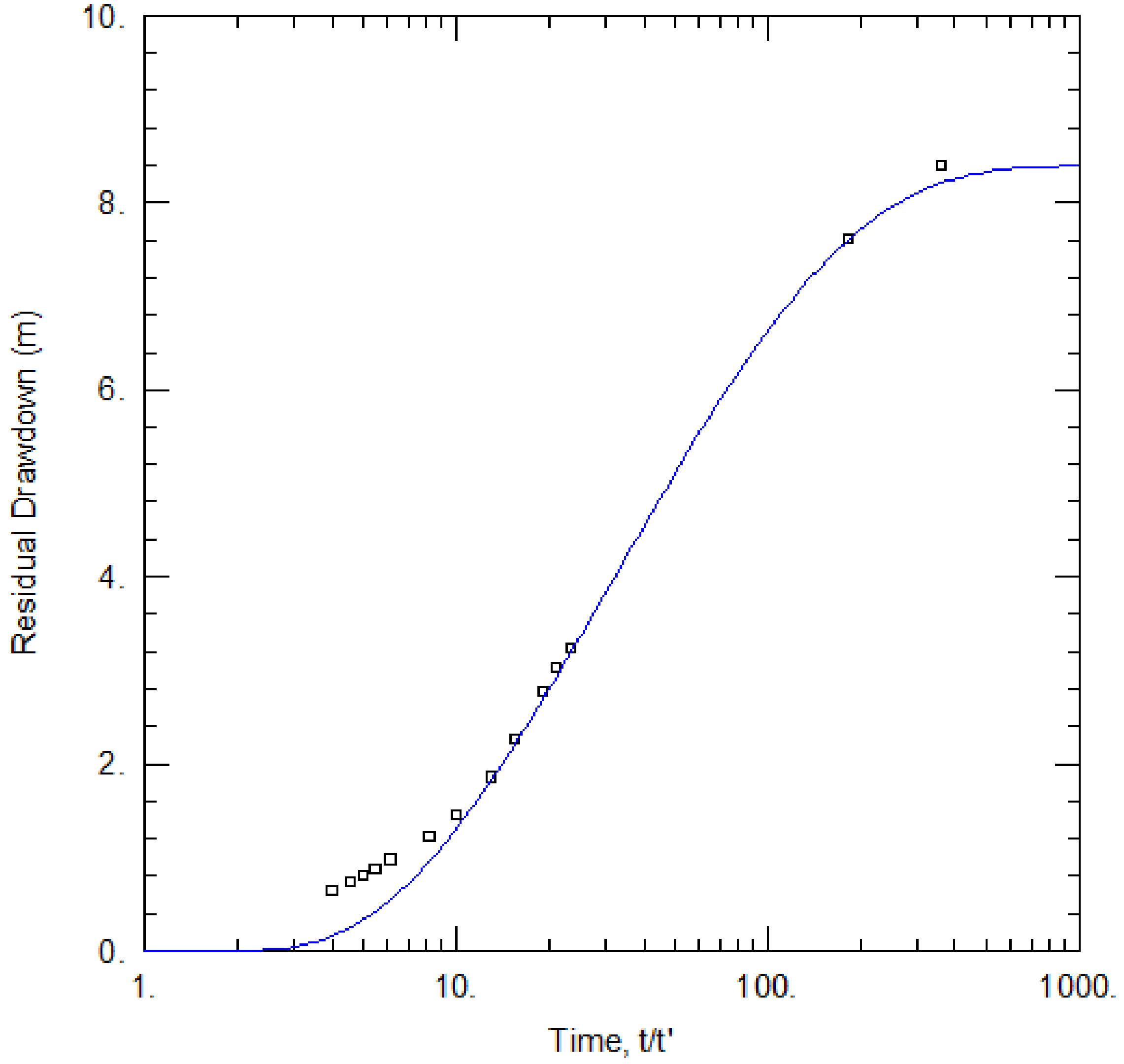


Estimated Transmissivity: 0.8 m^2/day or 9 x 10^{-6} m^2/s
r/B: 0.4

GEMTEC Consulting Engineers and Scientists	Pumping Test Analysis Report Project: Hydrogeological Investigation Project Number: 61318.15 Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario		
Test Conducted by: AP	Pumping Well: TW3	P-Test Date: **March 17, 2003**
Analysis Performed by: AP	Method: Hantush-Jacob Analysis	Re-Analysis Date: July 2019
Aquifer Thickness:53 m	Discharge: Constant 32 L/min	Duration: 6 hours

Pumping Test Analysis – Leaky Confined Recovery (TW3)



Estimated Transmissivity: 1.0 m^2/day or 1 x 10^{-5} m^2/s
r/B: 0.4

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

Pumping Test Analysis Report

Project: Hydrogeological Investigation

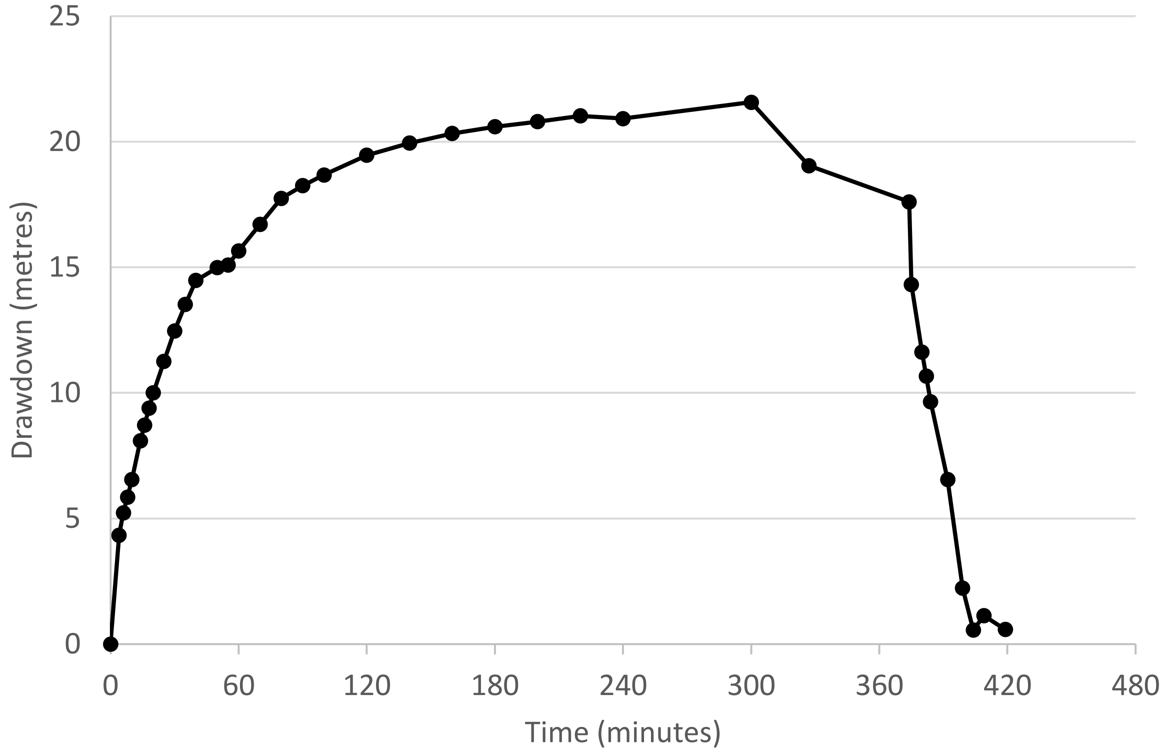
Project Number: 61318.15

Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario

Test Conducted by: AP	Pumping Well: TW4	P-Test Date: **March 19, 2003**
Analysis Performed by: AP	Method: Water Level Tape	Re-Analysis Date: Nov 7, 2017
Aquifer Thickness:56 m	Discharge: Constant 14 L/min	Duration: 6 hours

Pumping Test Data (TW4): Drawdown and Recovery



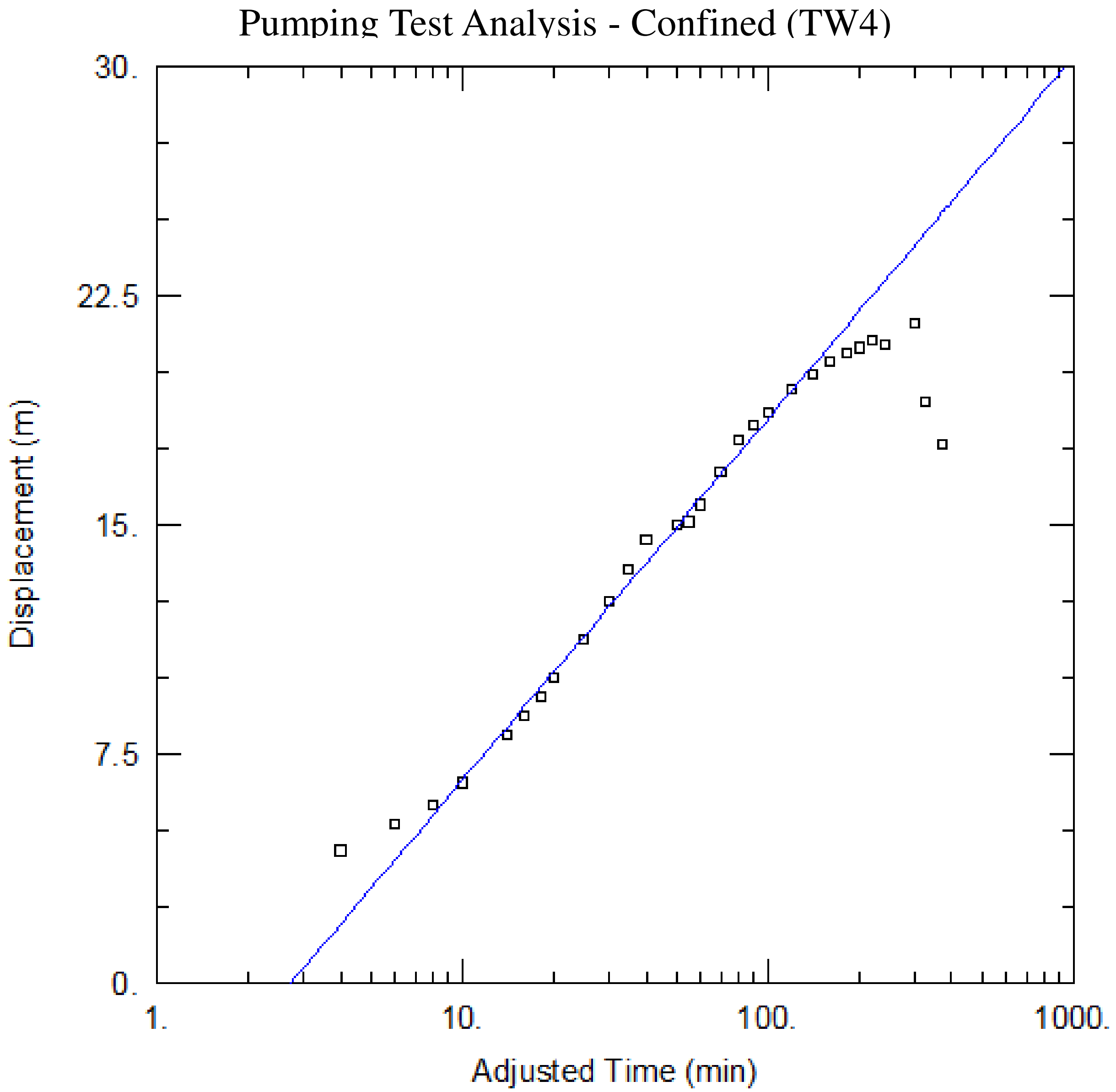
Water Levels (metres below ground surface)
Static : 2.26 m
End of pump test (6-hours): 19.87 m
Final water level following recovery: 2.84 m

GEMTEC
Consulting Engineers and Scientists

Pumping Test Analysis Report
Project: Hydrogeological Investigation
Project Number: 61318.15
Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario

Test Conducted by: AP	Pumping Well: TW4	P-Test Date: **March 19, 2003**
Analysis Performed by: AP	Method: Cooper-Jacob Analysis	Re-Analysis Date: Nov 7, 2017
Aquifer Thickness:56 m	Discharge: Constant 14 L/min	Duration: 6 hours



Estimated Transmissivity: 0.3 m^2/day or 3 x 10^{-6} m^2/s

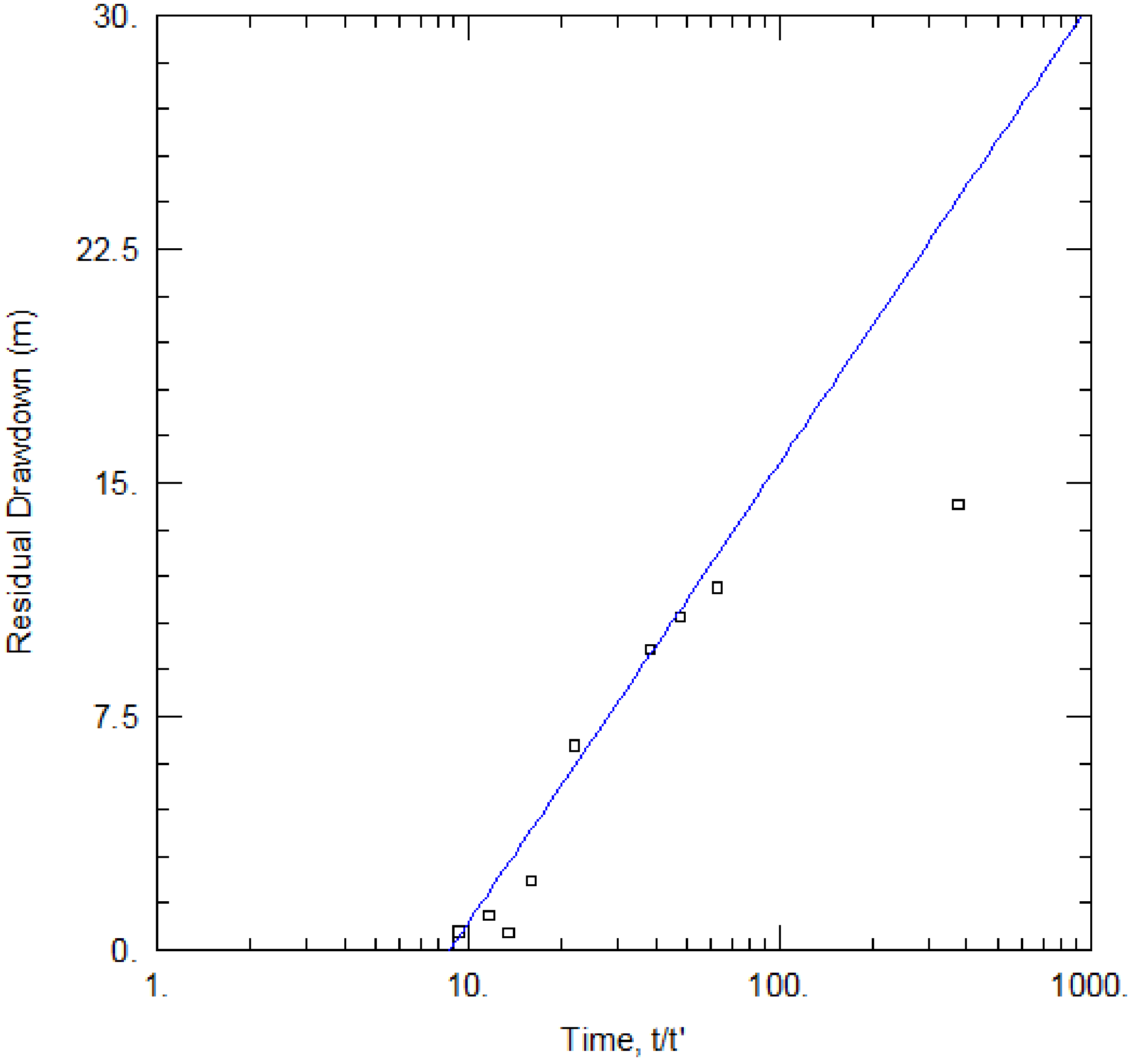
GEMTEC
CONSULTING ENGINEERS
AND SCIENTISTS

Pumping Test Analysis Report
Project: Hydrogeological Investigation
Project Number: 61318.15
Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario

Test Conducted by: AP	Pumping Well: TW4	P-Test Date: **March 19, 2003**
Analysis Performed by: AP	Method: Cooper-Jacob Analysis	Re-Analysis Date: Nov 7, 2017
Aquifer Thickness:56 m	Discharge: Constant 14 L/min	Duration: 6 hours

Pumping Test Analysis – Confined Recovery (TW4)

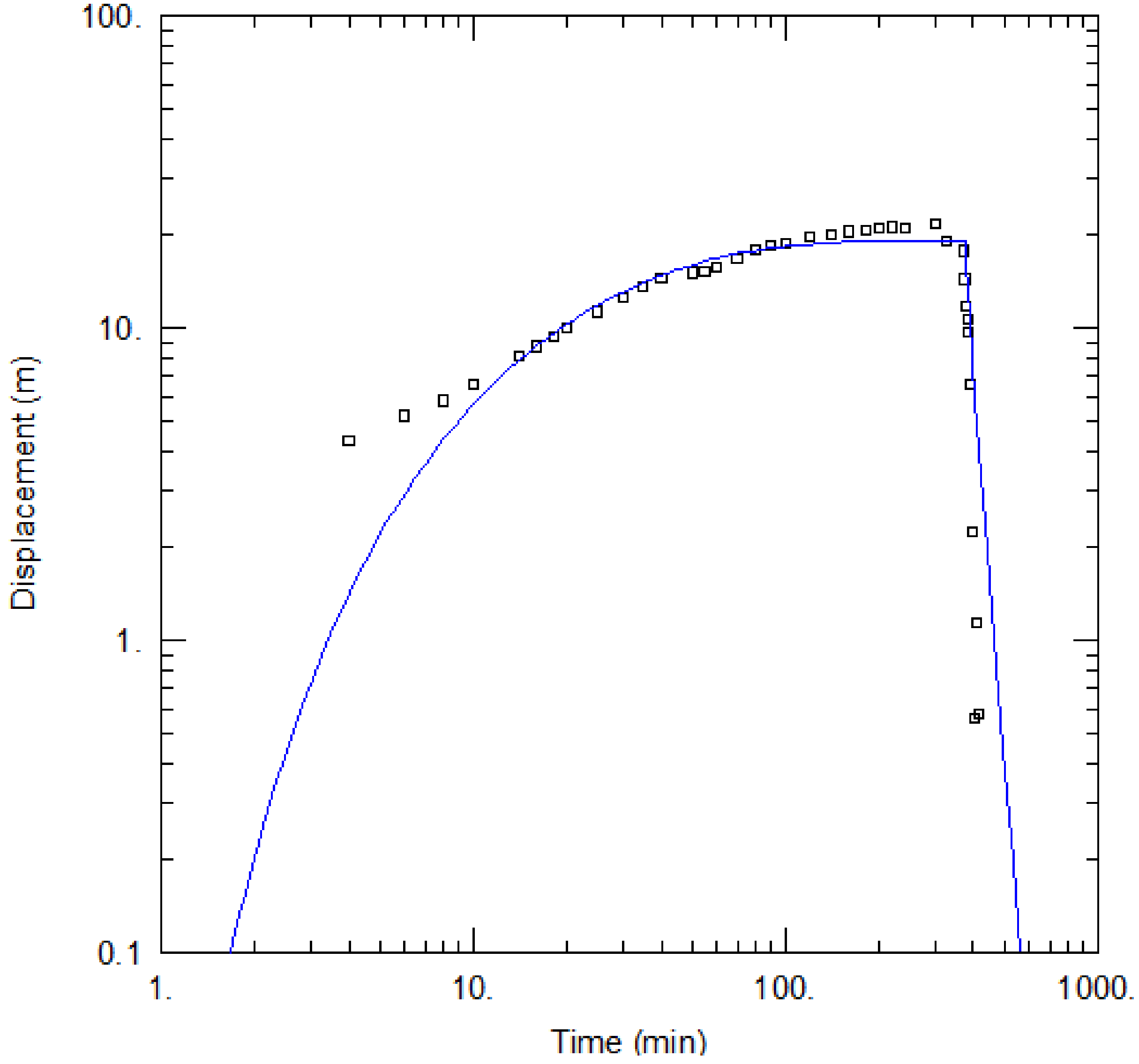


Estimated Transmissivity: 0.3 m^2/day or 3 x 10^{-6} m^2/s

GEMTEC Consulting Engineers and Scientists	Pumping Test Analysis Report Project: Hydrogeological Investigation Project Number: 61318.15 Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario		
Test Conducted by: AP	Pumping Well: TW4	P-Test Date: **March 19, 2003**
Analysis Performed by: AP	Method: Hantush-Jacob Analysis	Re-Analysis Date: July 2019
Aquifer Thickness:56 m	Discharge: Constant 14 L/min	Duration: 6 hours

Pumping Test Analysis – Leaky Confined (TW4)



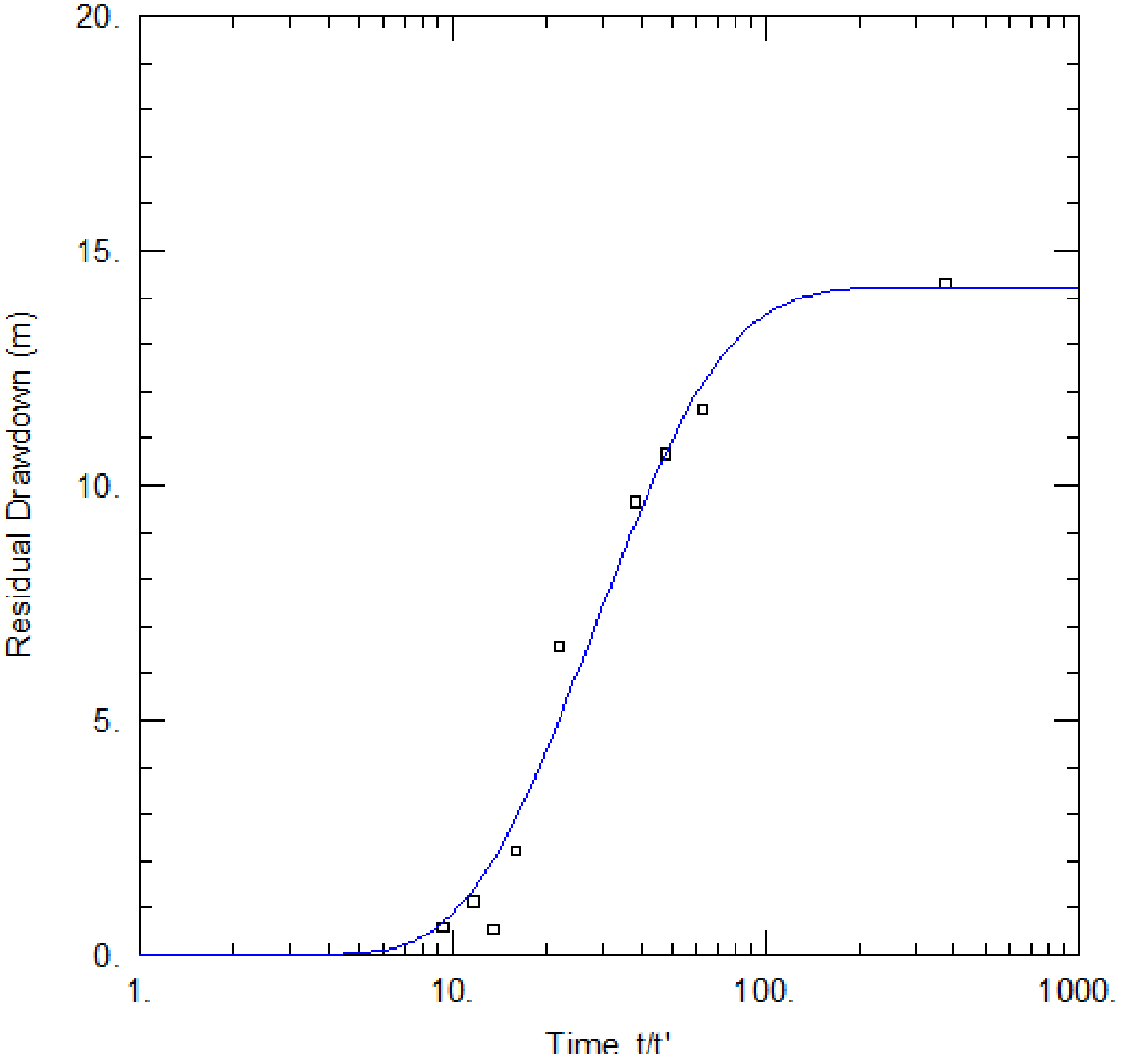
Estimated Transmissivity: 0.1 m^2/day or 1 x 10^{-6} m^2/s
r/B: 0.6

GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

	Pumping Test Analysis Report
	Project: Hydrogeological Investigation
	Project Number: 61318.15
	Client: 1384341 Ontario Ltd.
Location: 2727 Carp Road, Ottawa, Ontario	

Test Conducted by: AP	Pumping Well: TW4	P-Test Date: **March 19, 2003**
Analysis Performed by: AP	Method: Hantush-Jacob Analysis	Re-Analysis Date: July 2019
Aquifer Thickness:56 m	Discharge: Constant 14 L/min	Duration: 6 hours

Pumping Test Analysis – Leaky Confined Recovery (TW4)

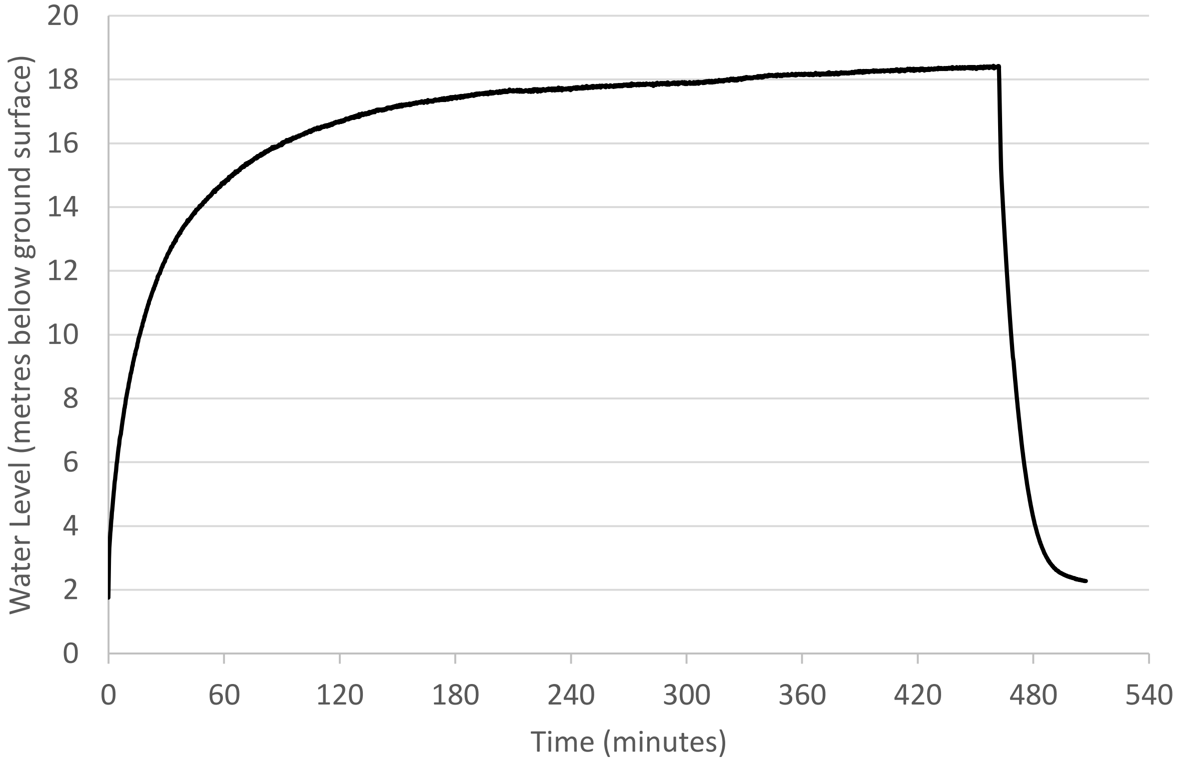


Estimated Transmissivity: 0.05 m²/day or 6 x 10^{-7} m²/s
r/B: 1.5

GEMTEC
CONSULTING ENGINEERS
AND SCIENTISTS

Pumping Test Analysis Report
Project: Hydrogeological Investigation
Project Number: 61318.15
Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario		
Test Conducted by: GD	Pumping Well: TW 4	P-Test Date: May 16, 2016
Analysis Performed by: AP	Method: Continuous Datalogger	Analysis Date: June 13, 2016
Aquifer Thickness: 53 m	Discharge: Constant 26.5 L/min	Duration: 8 hours



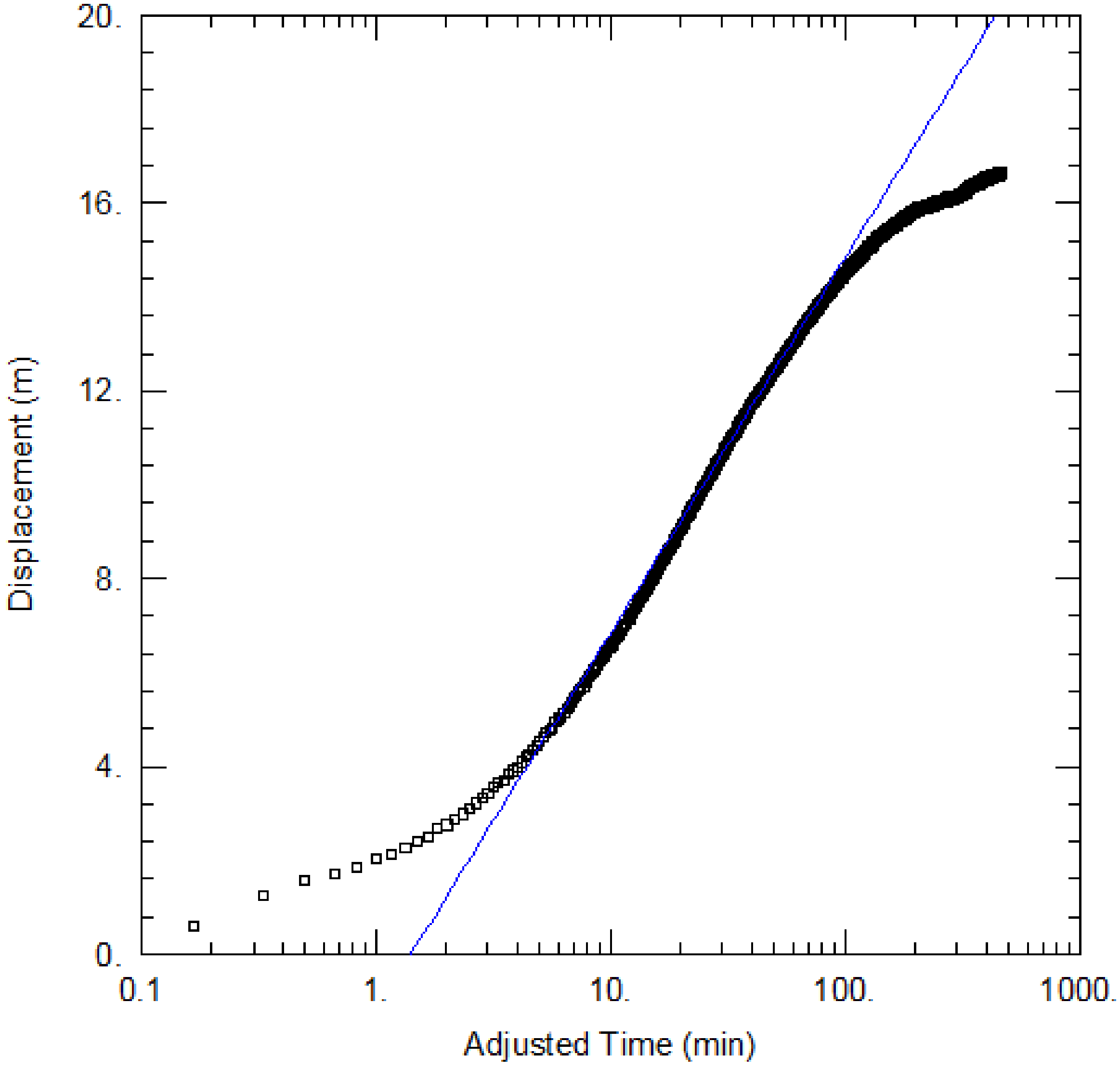
Pumping Test Data (TW4): Drawdown and Recovery

<u>Water Levels (metres below ground surface)</u>
Static : 1.75 m
End of pump test (8-hours): 18.4 m
Final water level following recovery: 2.27 m

GEMTEC CONSULTING ENGINEERS AND SCIENTISTS	Pumping Test Analysis Report Project: Hydrogeological Investigation Project Number: 61318.15 Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario		
Test Conducted by: GD	Pumping Well: TW 4	P-Test Date: May 16, 2016
Analysis Performed by: AP	Method: Cooper-Jacob Analysis	Analysis Date: June 13, 2016
Aquifer Thickness: 53 m	Discharge: Constant 26.5 L/min	Duration: 8 hours

Pumping Test Analysis - Confined (TW4)



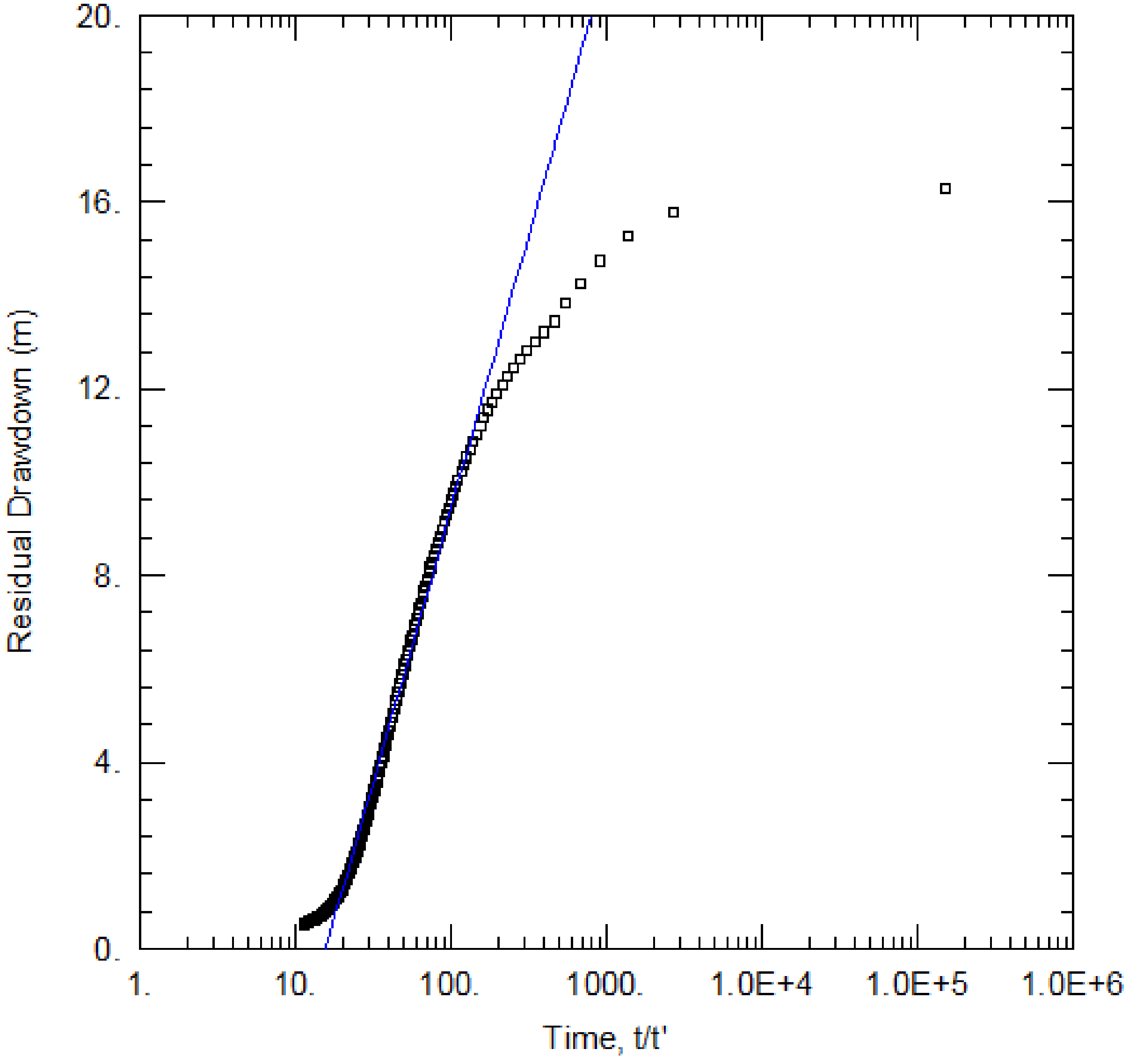
Estimated Transmissivity: 0.9 m^2/day or 1 x 10^{-5} m^2/s

GEMTEC
CONSULTING ENGINEERS
AND SCIENTISTS

Pumping Test Analysis Report	
Project: Hydrogeological Investigation	
Project Number: 61318.15	
Client: 1384341 Ontario Ltd.	
Location: 2727 Carp Road, Ottawa, Ontario	

Test Conducted by: GD	Pumping Well: TW 4	P-Test Date: May 16, 2016
Analysis Performed by: AP	Method: Theis Analysis	Analysis Date: June 13, 2016
Aquifer Thickness: 53 m	Discharge: Constant 26.5 L/min	Duration: 8 hours

Pumping Test Analysis – Confined Recovery (TW4)



Estimated Transmissivity: 0.6 m^2/day or 7 x 10^{-6} m^2/s

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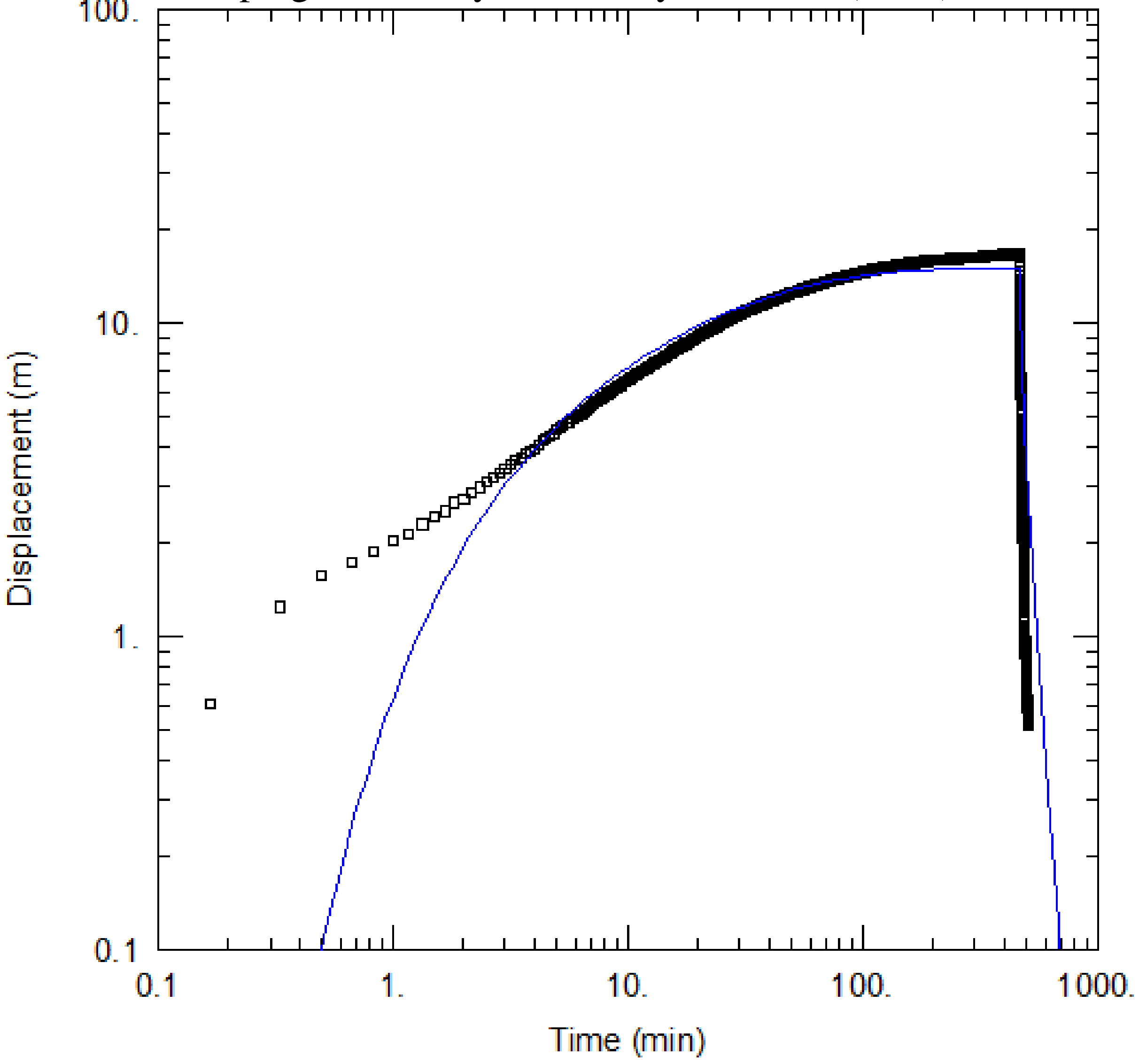
Pumping Test Analysis Report		
Project: Hydrogeological Investigation		
Project Number: 61318.15		
Client: 1384341 Ontario Ltd.		
Location: 2727 Carp Road, Ottawa, Ontario		
Test Conducted by: GD	Pumping Well: TW 4	P-Test Date: May 16, 2016
Analysis Performed by: AP	Method: Hantush-Jacob Analysis	Analysis Date: July 2019
Aquifer Thickness: 53 m	Discharge: Constant 26.5 L/min	Duration: 8 hours

Pumping Test Analysis – Leaky Confined (TW4)

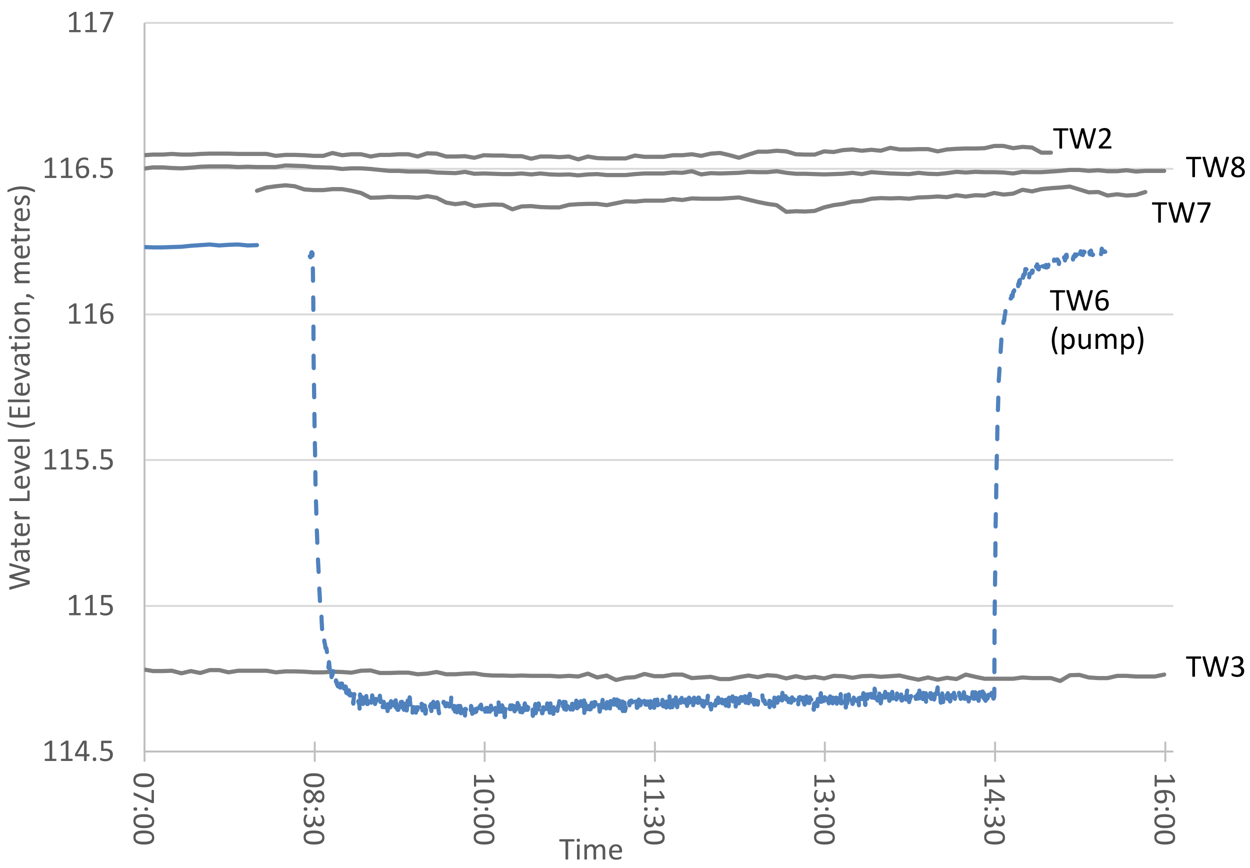


Estimated Transmissivity: 0.6 m^2/day or 7 x 10^{-6} m^2/s
r/B: 0.2

GEMTEC Consulting Engineers and Scientists	Pumping Test Analysis Report Project: Hydrogeological Investigation Project Number: 61318.15 Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario		
Test Conducted by: AP	Pumping Well: TW 6	P-Test Date: Oct 19, 2017
Analysis Performed by: AP	Method: Continuous Datalogger	Analysis Date: Nov 7, 2017
Aquifer Thickness: 37 m	Discharge: Constant 22 L/min	Duration: 6 hours

Pumping Test Data (TW6): Drawdown and Recovery



Water Levels (metres below ground surface)

Static : 0.27 m

End of pump test (6-hours): 1.82 m

Final water level following recovery: 0.31 m

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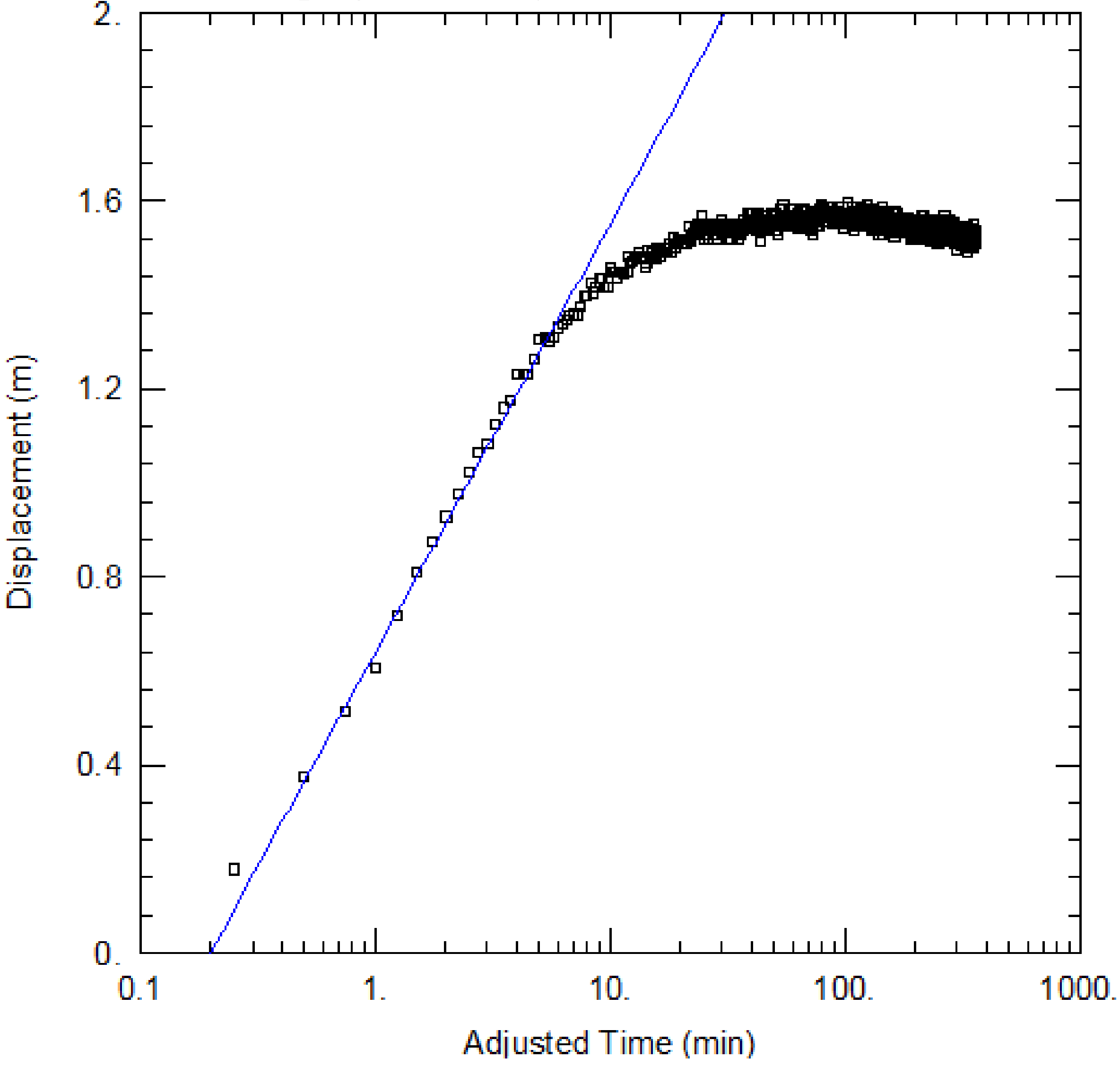
Pumping Test Analysis Report
Project: Hydrogeological Investigation
Project Number: 61318.15
Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario

Test Conducted by: AP
Pumping Well: TW 6
P-Test Date: Oct 19, 2017
Analysis Performed by: AP
Method: Cooper-Jacob Analysis
Analysis Date: Nov 7, 2017
Aquifer Thickness: 37 m
Discharge: Constant 22 L/min
Duration: 6 hours

Pumping Test Analysis - Confined (TW6)



Estimated Transmissivity: 6 m^2/day or 7 x 10^{-5} m^2/s

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Pumping Test Analysis Report
Project: Hydrogeological Investigation
Project Number: 61318.15
Client: 1384341 Ontario Ltd.

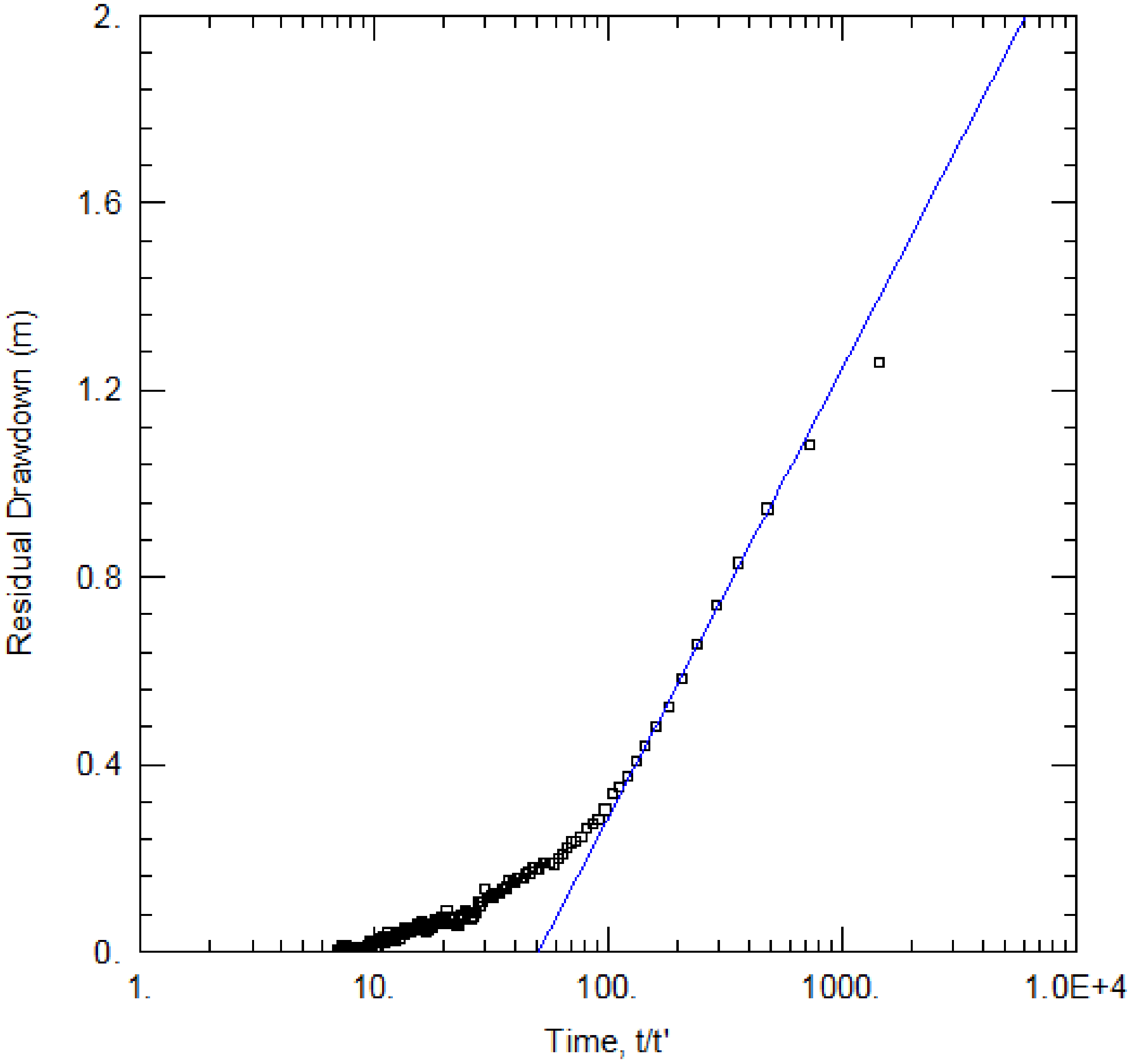
Location: 2727 Carp Road, Ottawa, Ontario

Test Conducted by: AP
Pumping Well: TW 6
P-Test Date: Oct 19, 2017

Analysis Performed by: AP
Method: Theis Analysis
Analysis Date: Nov 7, 2017

Aquifer Thickness: 37 m
Discharge: Constant 22 L/min
Duration: 6 hours

Pumping Test Analysis – Confined Recovery (TW6)

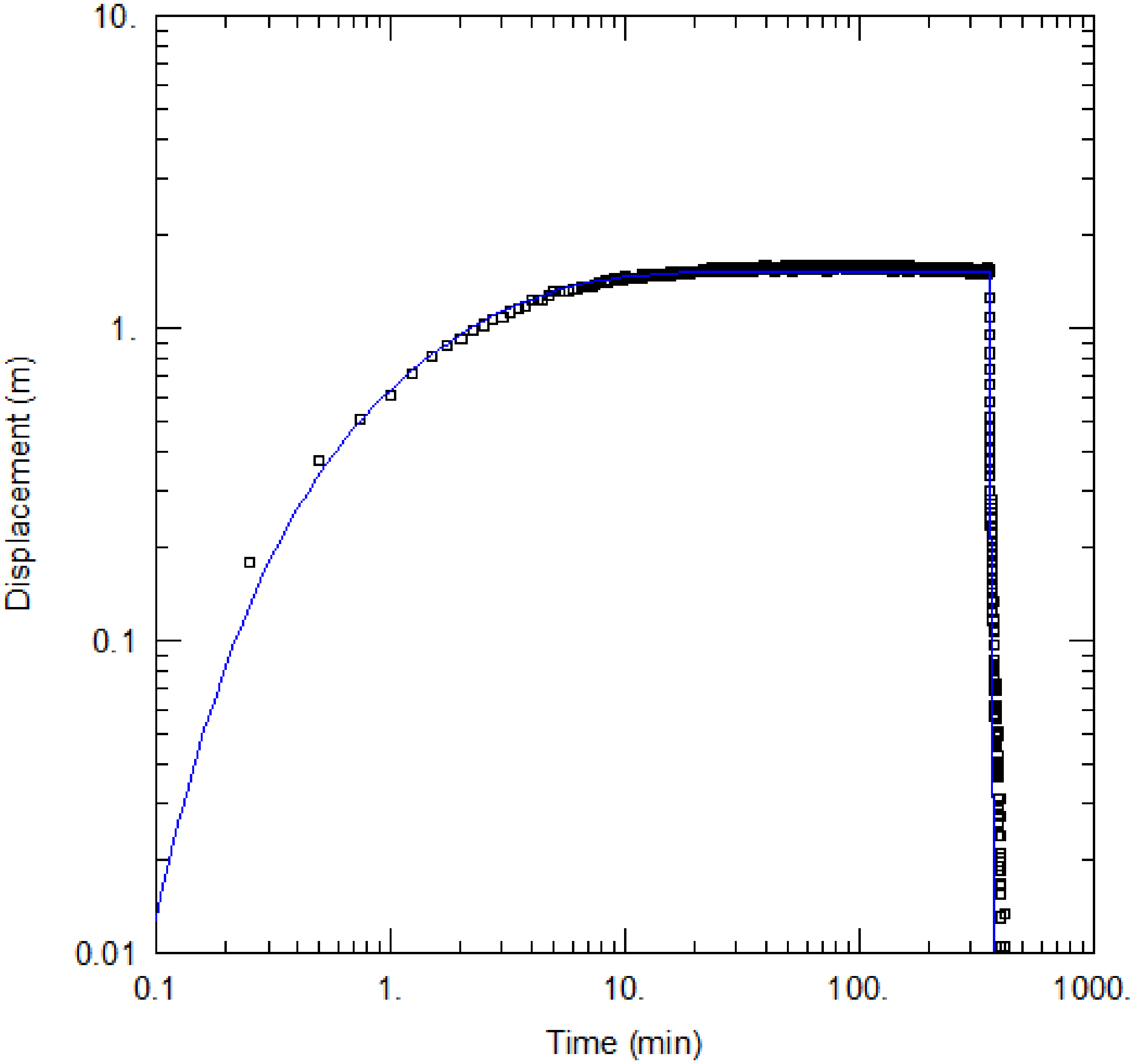


Estimated Transmissivity: 7 m^2/day or 8 x 10^{-5} m^2/s

GEMTEC Consulting Engineers and Scientists	Pumping Test Analysis Report Project: Hydrogeological Investigation Project Number: 61318.15 Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario		
Test Conducted by: AP	Pumping Well: TW 6	P-Test Date: Oct 19, 2017
Analysis Performed by: AP	Method: Hantush-Jacob Analysis	Analysis Date: July 2019
Aquifer Thickness: 37 m	Discharge: Constant 22 L/min	Duration: 6 hours

Pumping Test Analysis – Leaky Confined (TW6)

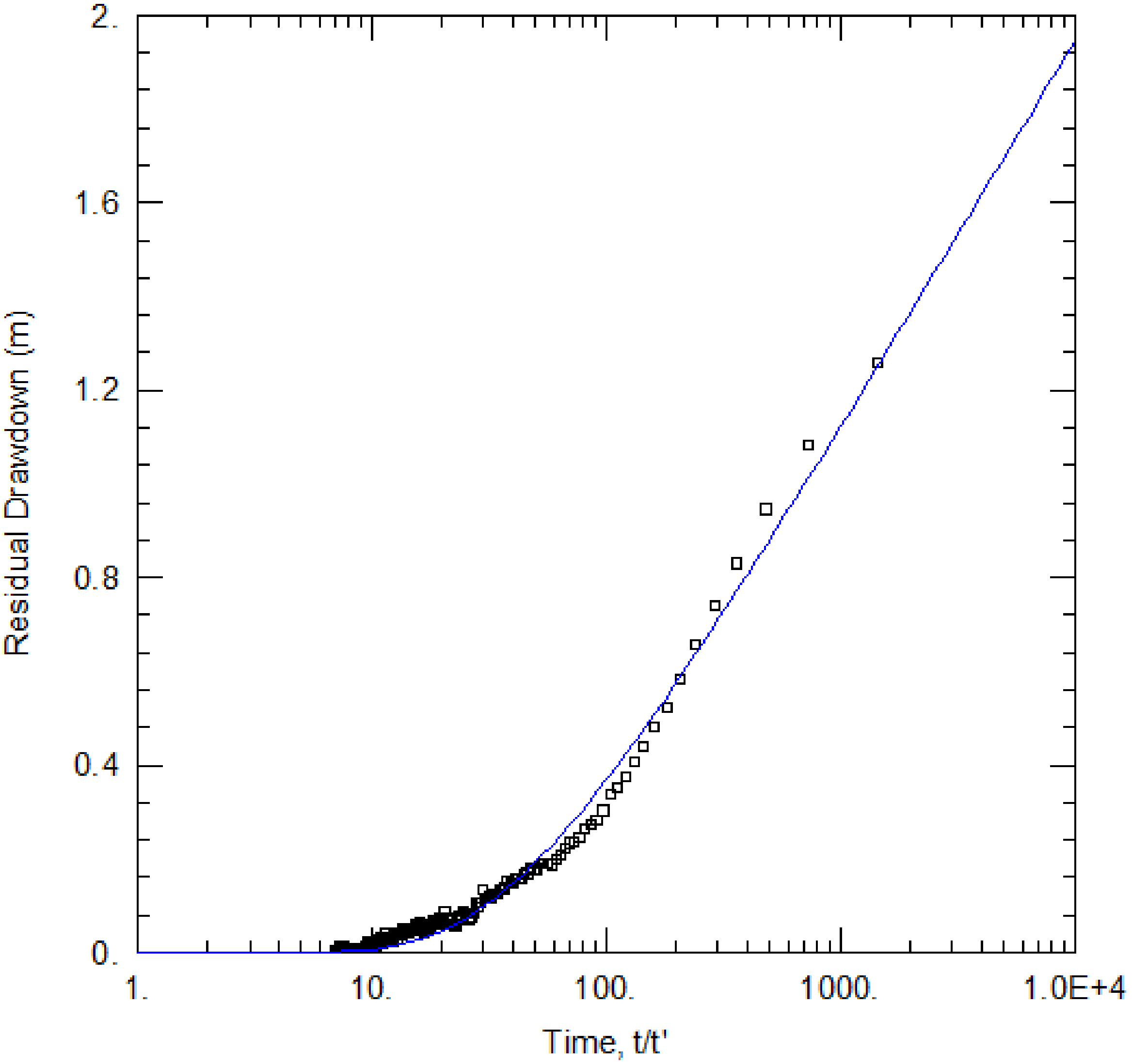


Estimated Transmissivity: 3.5 m^2/day or 4 x 10^{-5} m^2/s
r/B: 0.4

GEMTEC Consulting Engineers and Scientists	Pumping Test Analysis Report Project: Hydrogeological Investigation Project Number: 61318.15 Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario		
Test Conducted by: AP	Pumping Well: TW 6	P-Test Date: Oct 19, 2017
Analysis Performed by: AP	Method: Hantush-Jacob Analysis	Analysis Date: July 2019
Aquifer Thickness: 37 m	Discharge: Constant 22 L/min	Duration: 6 hours

Pumping Test Analysis – Leaky Confined Recovery (TW6)



Estimated Transmissivity: 7 m^2/day or 8 x 10^{-5} m^2/s
r/B: 0.002

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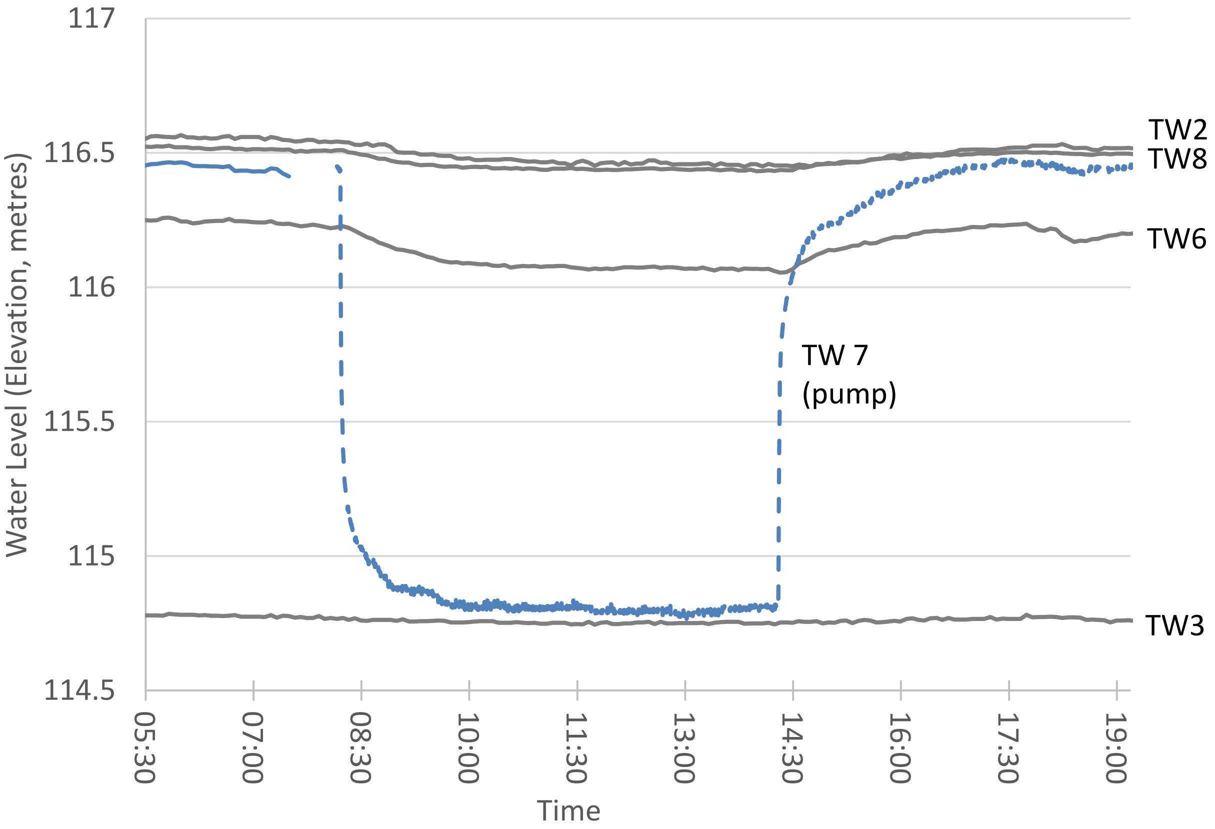
Consulting Engineers and Scientists

Pumping Test Analysis Report
Project: Hydrogeological Investigation
Project Number: 61318.15
Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario

Test Conducted by: AP	Pumping Well: TW 7	P-Test Date: Oct 18, 2017
Analysis Performed by: AP	Method: Continuous Datalogger	Analysis Date: Nov 7, 2017
Aquifer Thickness: 52 m	Discharge: Constant 38 L/min	Duration: 6 hours


Pumping Test Data (TW7): Drawdown and Recovery

Water Levels (metres below ground surface)
Static : 1.42 m
End of pump test (6-hours): 3.07 m
Final water level following recovery: 1.53 m

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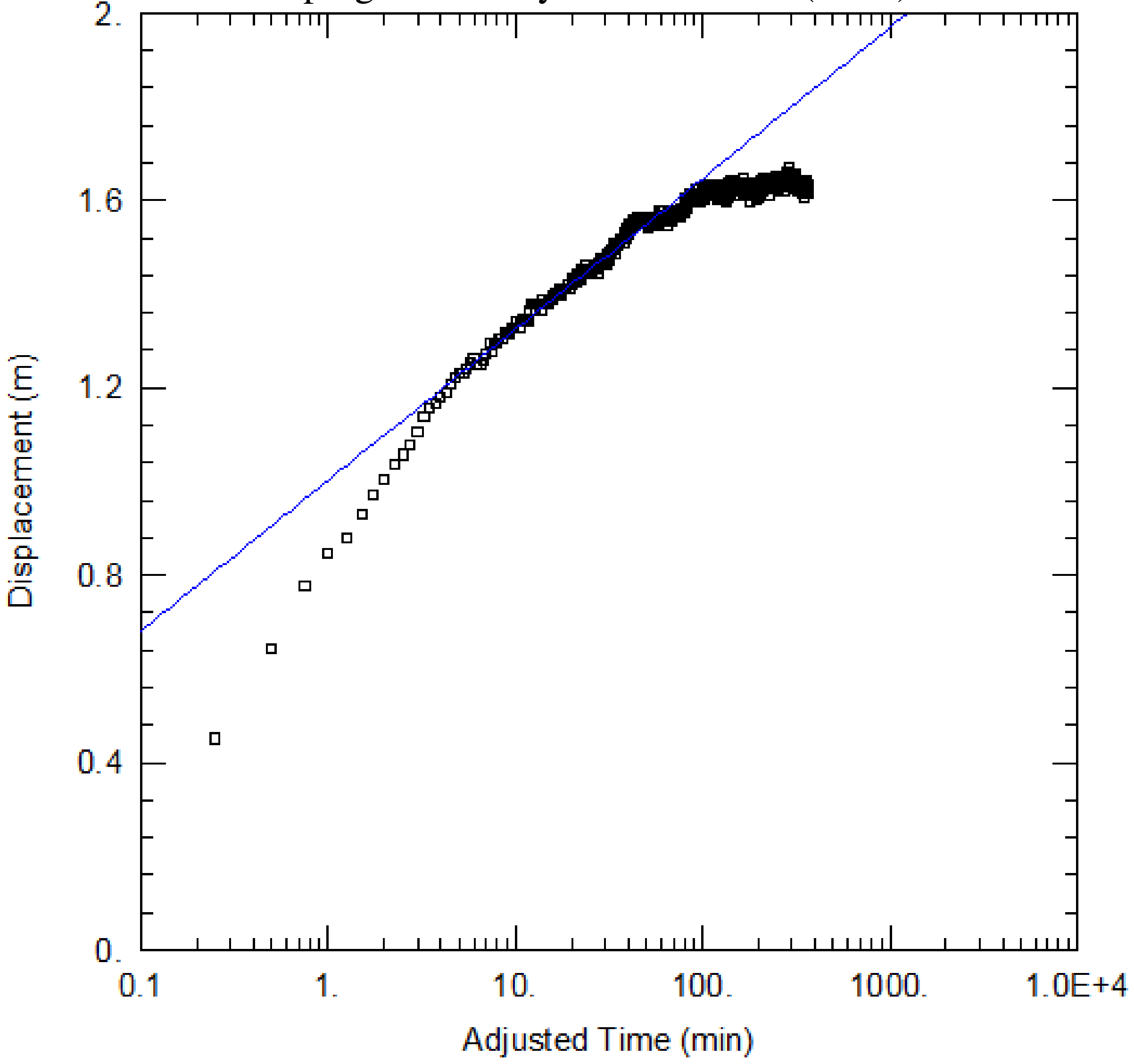
Pumping Test Analysis Report
Project: Hydrogeological Investigation
Project Number: 61318.15
Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario

Test Conducted by: AP	Pumping Well: TW 7	P-Test Date: Oct 18, 2017
Analysis Performed by: AP	Method: Cooper-Jacob Analysis	Analysis Date: Nov 7, 2017
Aquifer Thickness: 52 m	Discharge: Constant 38 L/min	Duration: 6 hours

Pumping Test Analysis – Confined (TW7)



Estimated Transmissivity: 31 m^2/day or 4 x 10^{-4} m^2/s

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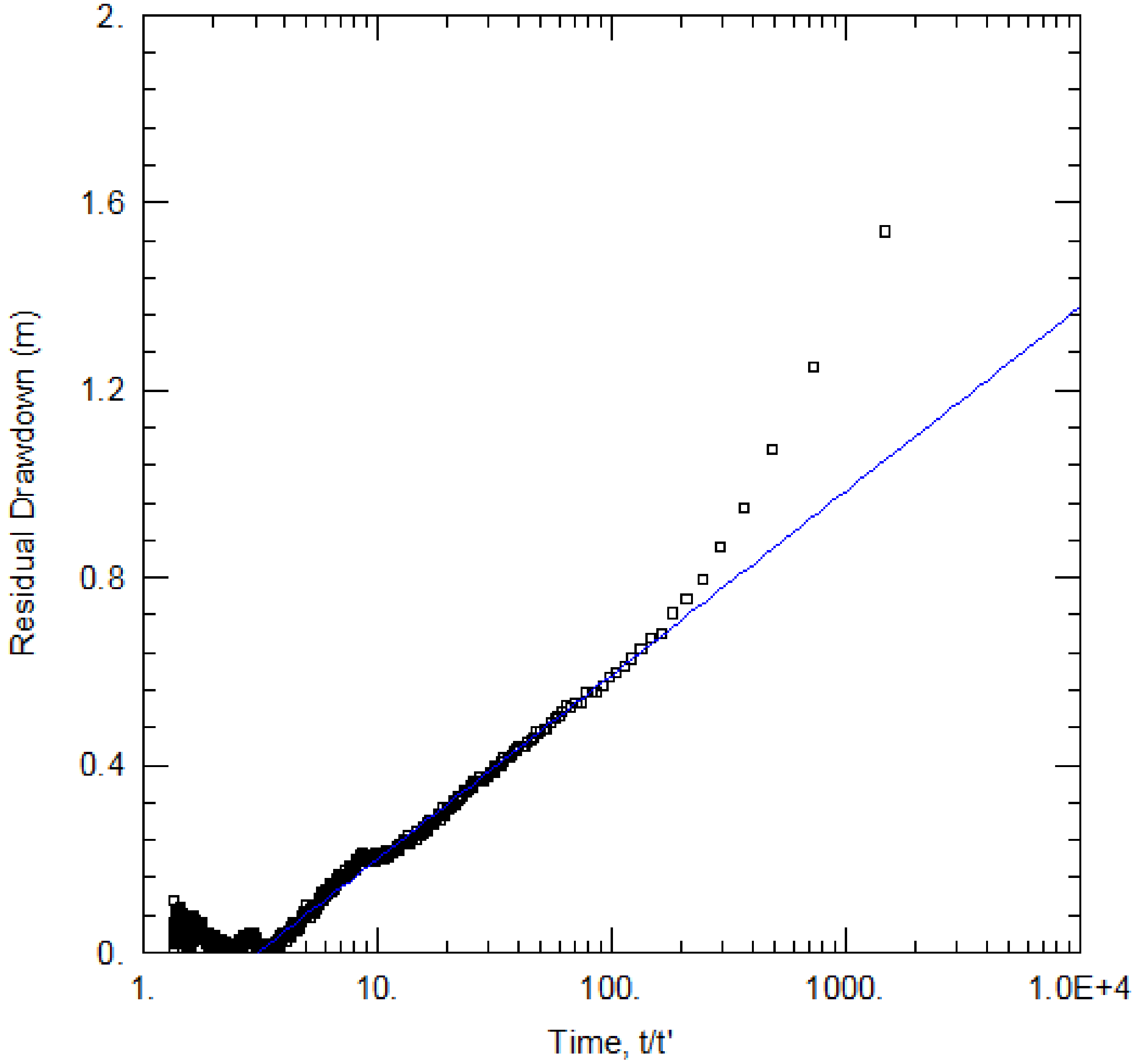
Pumping Test Analysis Report		
Project: Hydrogeological Investigation		
Project Number: 61318.15		
Client: 1384341 Ontario Ltd.		
Location: 2727 Carp Road, Ottawa, Ontario		
Test Conducted by: AP	Pumping Well: TW 7	P-Test Date: Oct 18, 2017
Analysis Performed by: AP	Method: Theis Analysis	Analysis Date: Nov 7, 2017
Aquifer Thickness: 52 m	Discharge: Constant 38 L/min	Duration: 6 hours

Pumping Test Analysis – Confined Recovery (TW7)



Estimated Transmissivity: 25 m^2/day or 3 x 10^{-4} m^2/s

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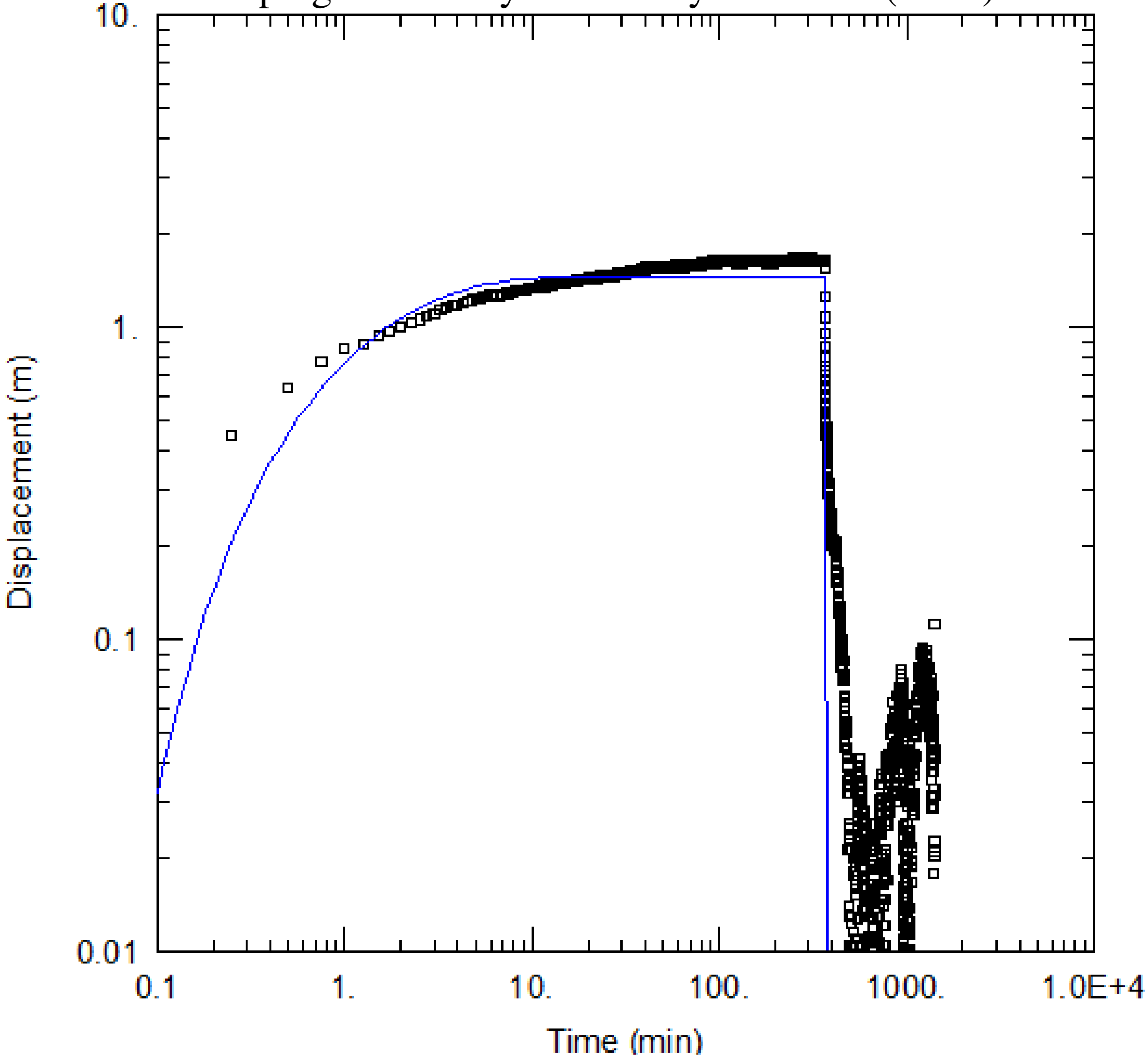
Pumping Test Analysis Report
Project: Hydrogeological Investigation
Project Number: 61318.15
Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario		
Test Conducted by: AP	Pumping Well: TW 7	P-Test Date: Oct 18, 2017
Analysis Performed by: AP	Method: Hantush-Jacob Analysis	Analysis Date: July 2019
Aquifer Thickness: 52 m	Discharge: Constant 38 L/min	Duration: 6 hours

Pumping Test Analysis – Leaky Confined (TW7)



Estimated Transmissivity: 6 m^2/day or 7 x 10^{-5} m^2/s
r/B: 0.5

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AND SCIENTISTS

Pumping Test Analysis Report
Project: Hydrogeological Investigation
Project Number: 61318.15
Client: 1384341 Ontario Ltd.

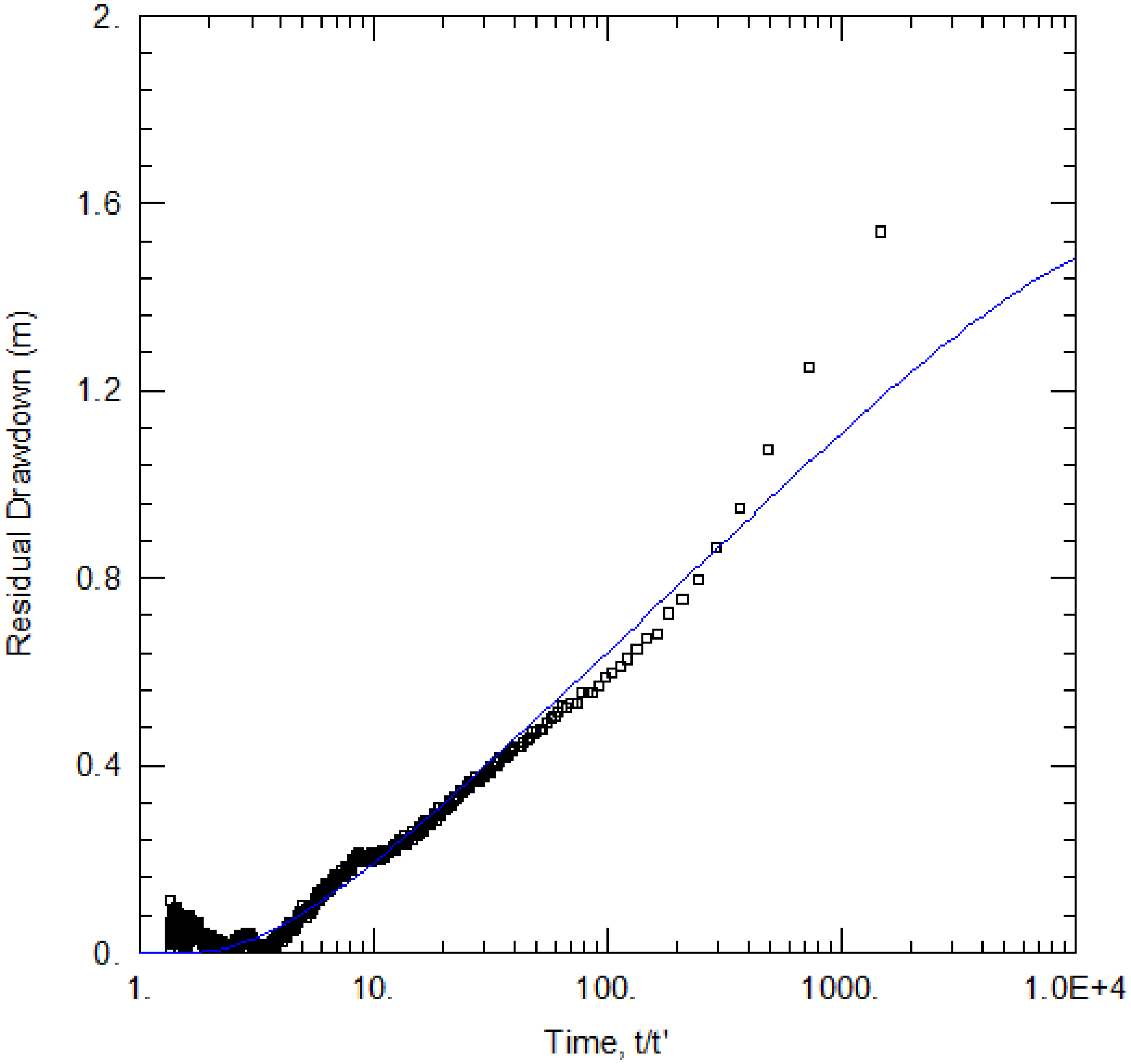
Location: 2727 Carp Road, Ottawa, Ontario

Test Conducted by: AP
Pumping Well: TW 7
P-Test Date: Oct 18, 2017

Analysis Performed by: AP
Method: Hantush-Jacob Analysis
Analysis Date: July 2019

Aquifer Thickness: 52 m
Discharge: Constant 38 L/min
Duration: 6 hours

Pumping Test Analysis – Leaky Confined Recovery (TW7)



Estimated Transmissibility: 21 m^2/day or 2 x 10^{-4} m^2/s
r/B: 0.03

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Pumping Test Analysis Report

Project: Hydrogeological Investigation

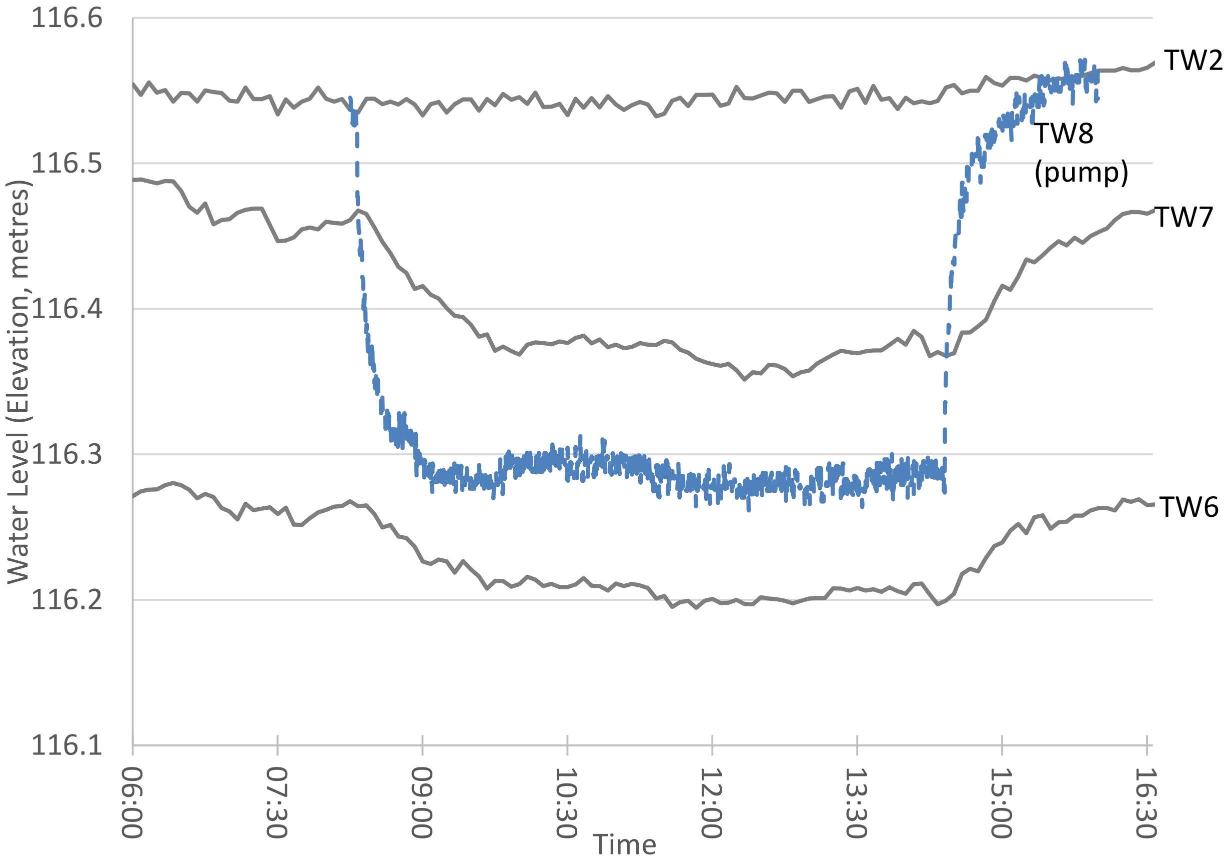
Project Number: 61318.15

Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario

Test Conducted by: AP	Pumping Well: TW 8	P-Test Date: Oct 17, 2017
Analysis Performed by: AP	Method: Continuous Datalogger	Analysis Date: Nov 7, 2017
Aquifer Thickness: 39 m	Discharge: Constant 57 L/min	Duration: 6 hours

Pumping Test Data (TW8): Drawdown and Recovery



<u>Water Levels (metres below ground surface)</u>

Static : 0.49 m

End of pump test (6-hours): 0.78 m

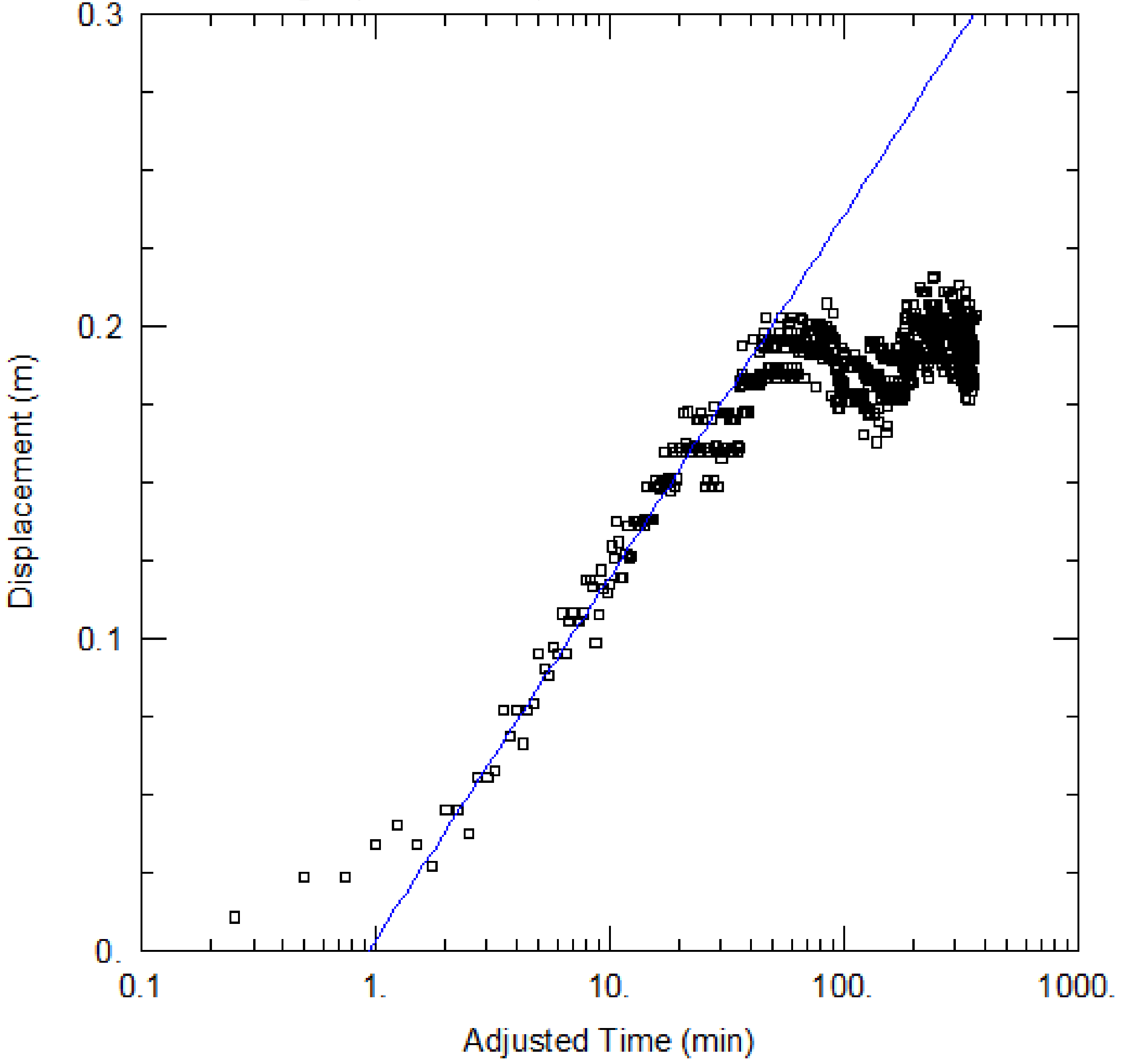
Final water level following recovery: 0.51 m

Pumping Test Analysis Report
Project: Hydrogeological Investigation
Project Number: 61318.15
Client: 1384341 Ontario Ltd.

Location: 2727 Carp Road, Ottawa, Ontario

Test Conducted by: AP	Pumping Well: TW 8	P-Test Date: Oct 17, 2017
Analysis Performed by: AP	Method: Cooper-Jacob Analysis	Analysis Date: Nov 7, 2017
Aquifer Thickness: 39 m	Discharge: Constant 57 L/min	Duration: 6 hours

Pumping Test Analysis - Confined (TW8)



Estimated Transmissivity: 170 m^2/day or 2 x 10^{-3} m^2/s

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Pumping Test Analysis Report
Project: Hydrogeological Investigation
Project Number: 61318.15
Client: 1384341 Ontario Ltd.

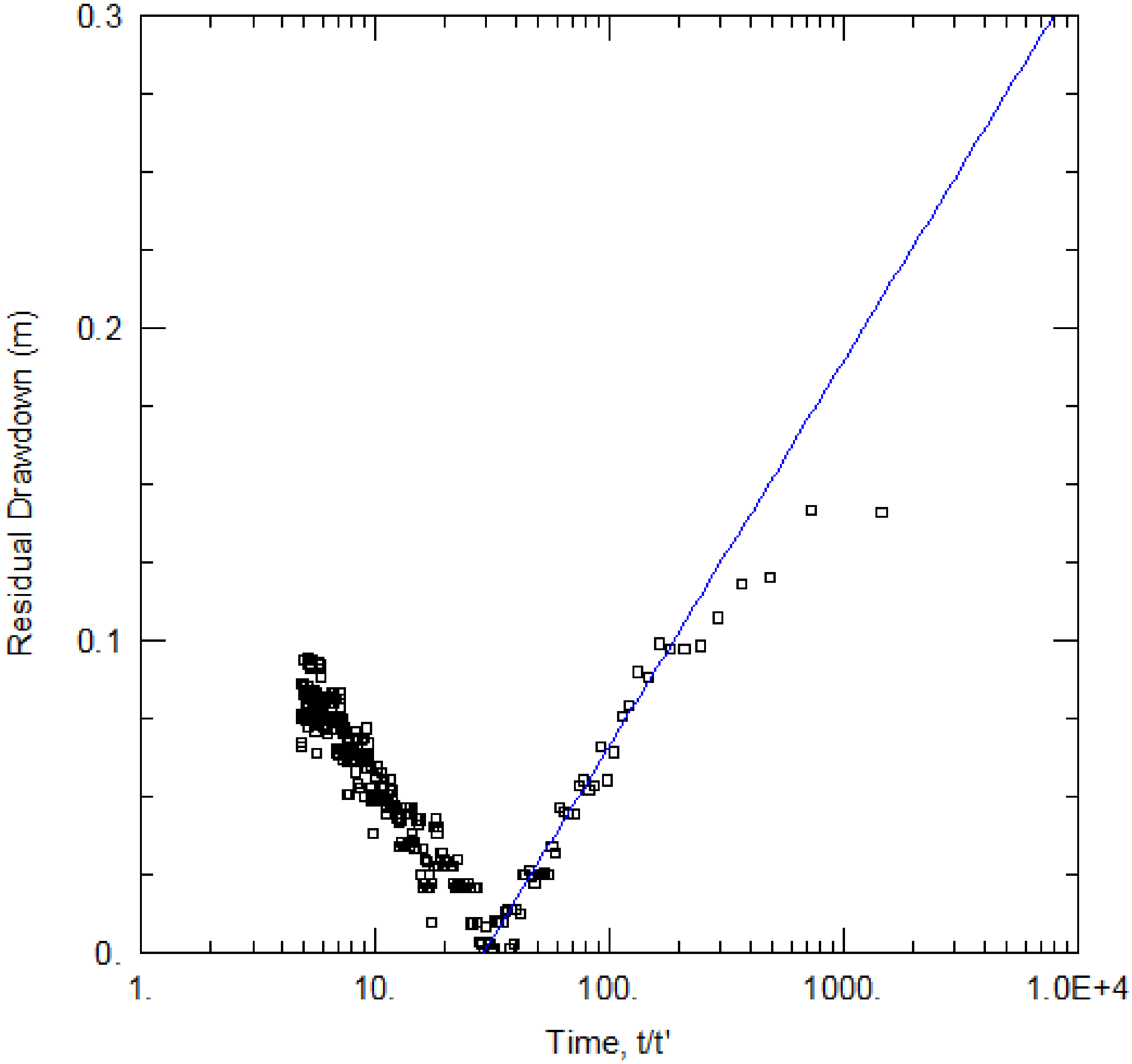
Location: 2727 Carp Road, Ottawa, Ontario

Test Conducted by: AP
Pumping Well: TW 8
P-Test Date: Oct 17, 2017

Analysis Performed by: AP
Method: Theis Analysis
Analysis Date: Nov 7, 2017

Aquifer Thickness: 39 m
Discharge: Constant 57 L/min
Duration: 6 hours

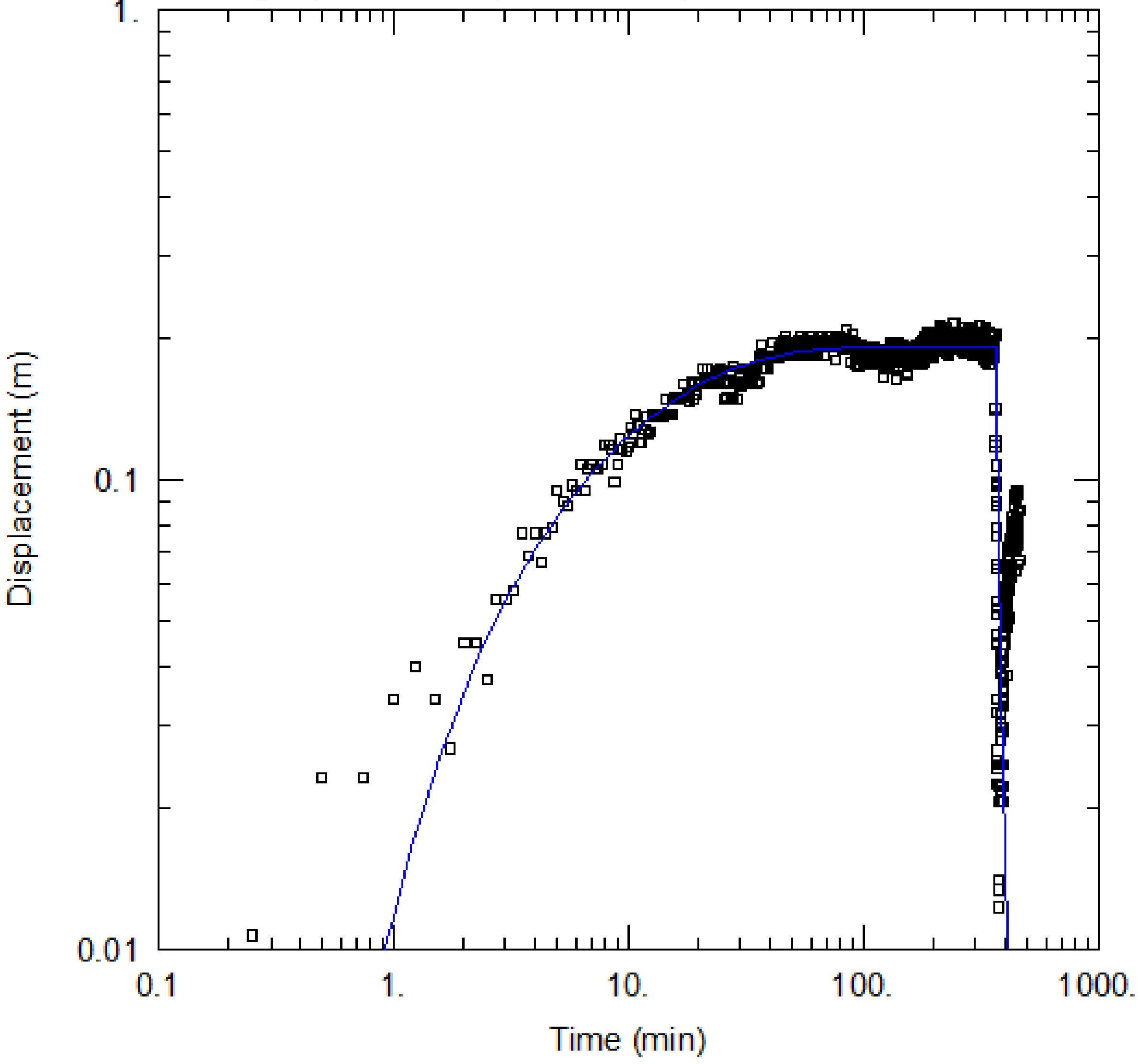
Pumping Test Analysis – Confined Recovery (TW8)



Estimated Transmissivity: 170 m^2/day or 2 x 10^{-3} m^2/s

GEMTEC CONSULTING ENGINEERS AND SCIENTISTS	Pumping Test Analysis Report Project: Hydrogeological Investigation Project Number: 61318.15 Client: 1384341 Ontario Ltd.	
Location: 2727 Carp Road, Ottawa, Ontario		
Test Conducted by: AP	Pumping Well: TW 8	P-Test Date: Oct 17, 2017
Analysis Performed by: AP	Method: Hantush-Jacob Analysis	Analysis Date: July 2019
Aquifer Thickness: 39 m	Discharge: Constant 57 L/min	Duration: 6 hours

Pumping Test Analysis – Leaky Confined (TW8)



Estimated Transmissivity: 96 m^2/day or 1 x 10^{-3} m^2/s
r/B: 0.4

APPENDIX K

Pumping Test Water Quality Summary (Field and Lab)

Table 1 (1/2)

Summary Field Parameters – Pumping Tests

Test Well	Date	Hours Since Pumping Started (h)	Temp (°C)	Conductivity (us/cm)	Total Dissolved Solids (ppm)	pH (pH Units)	Turbidity (NTU)	Free Chlorine (ppm)	Sulphide (mg/L)
TW 1	22-Mar-03	2	8.8	377	188	7.8	3.5	0	0
		4	9.1	266	133	6.2	3.9	3	0
		5	9.2	432	216	5.7	-	2.3	0
		6	9.3	460	230	-	0.6	2	0
		7	9.2	465	232	-	0.7	2.2	0
		8	-	407	203	3.6	-	0.6	0
TW 1	05-Jul-17	1	8.9[1]	3363	1681	7.34	127.0	-	-
		2	8.9	1781	890	7.61	35.0	0	-
		3	8.9	1687	843	8.15	24.0	0	-
		4	8.9	1200	600	8.18	9.7	0	-
		5	8.9	1019	509	7.73	3.9	0	-
		6	8.9	1020	510	7.79	4.0	0	-
TW 2	24-Mar-03	1	-	-	-	-	7.1	0	0.2
		2	-	-	-	-	0.3	0	0.2
		3	-	-	-	-	0.4	0	0.2
		4	-	-	-	-	0.9	0	0.2
		5	-	-	-	-	0.7	0	0.2
		6	-	-	-	-	0.4	0	0.3
TW 3	17-Mar-03	1	10.1	416	208	-	194.0	0	5
		3	9.8	406	203	-	121.0	0	5
		5	10	404	202	-	51.0	0	5
		6	9.8	411	205	-	42.0	0	-
TW 3	25-Aug-03	7	-	-	-	-	<1.0	-	-
TW 4	19-Mar-03	1	10.3	482	241	7.9	5.9	0	0
		2	10.6	449	224	7.1	0.8	0	0
		3	10.5	328	164	7.2	0.5	0	0
		4	10.5	230	115	7.7	1.5	0	0
		5	10.7	441	220	7.4	0.8	0	0
		6	9.2	441	220	7	0.4	0	0

Notes: 1. Temperature data recorded from datalogger, field measured temperature erroneous.

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Date: November 2017

Project: 61318.15

Table 1 (2/2)

Summary Field Parameters – Pumping Tests

Test Well	Date	Hours Since Pumping Started (h)	Temp (°C)	Conductivity (us/cm)	Total Dissolved Solids (ppm)	pH (pH Units)	Turbidity (NTU)	Free Chlorine (ppm)	Sulphide (mg/L)
TW 4	10-May-16	1	10.7	909	454	8.35	22.4	0	-
		2	11.4	903	451	8.13	17.6	0	-
		3	11.4	910	455	8.23	3.0	0	-
		4	12.3	877	438	8.13	1.1	0	-
		5	12.8	864	432	8.07	1.0	0	-
		6	12.9	900	450	8.06	0.9	0	-
		7	13.3	871	435	8.1	0.7	0	-
		8	12.7	845	422	8.15	0.6	0	-
TW 5	12-Jul-17	1	-	-	-	-	-	-	-
TW 6	19-Oct-17	1	10.3	731	365	7.71	36.4	0	-
		2	10.6	722	361	7.47	27.5	0	-
		3	10.7	720	360	7.48	15.0	0	-
		4	10.9	725	362	7.47	5.0	0	-
		5	11.3	720	360	7.41	3.4	0	-
		6	11.2	715	357	7.59	2.7	0	-
TW 7	18-Oct-17	1	8.8	716	358	8.23	16.6	0	-
		2	9.2	720	360	8.04	9.7	0	-
		3	9.6	724	362	8.08	4.7	0	-
		4	9.9	727	363	8.01	4.0	0	-
		5	10	730	365	7.83	2.5	0	-
		6	10.2	734	367	7.9	1.0	0	-
TW 8	17-Oct-17	1	8.6	800	400	7.75	1.0	0	-
		2	9.1	800	400	6.68	0.7	0	-
		3	9.4	799	399	6.68	0.8	0	-
		4	9.3	800	400	6.67	2.2	0	-
		5	9.3	800	400	7.66	0.7	0	-
		6	9.4	799	399	7.68	0.4	0	-

Table 2

Summary of Laboratory Parameters Analyzed (TW 1; Mar 21, 2003)

	Parameter	Units	9Hr	Ontario Drinking Water Standard	Type of Standard
Microbiological Parameters	Escherichia coli	CFU/100mL	NDOGN / 0*	0	MAC
	Fecal Coliform	CFU/100mL	0 / 0*	0	MAC
	Total coliforms	CFU/100mL	0 / 0*	0	MAC
	Heterotrophic Plate Count	CFU/1mL	- / 5*	-	-
General Inorganics	Alkalinity (as $CaC0_3$)	mg/L	251	30-500	OG
	Ammonia as N (NH_3)	mg/L	0.25	-	-
	Dissolved Organic Carbon (DOC)	mg/L	1.7	5	AO
	Colour	TCU	3	5	AO
	Electrical Conductivity	uS/cm	700	-	-
	Total Hardness (as $CaC0_3$)	mg/L	248	80-100	OG
	pH	pH units	7.99	6.5-8.5	OG
	Phenols	mg/L	<0.001	-	-
	Total Dissolved Solids (TDS)	mg/L	455	500	AO
	Sulphide (S_2)	mg/L	0.01	0.05	AO
	Tannins and Lignins	mg phenol/L	<0.1	-	-
	Total Kjeldahl Nitrogen (TKN)	mg/L	0.35	-	-
	Organic Nitrogen (TKN - NH3)	mg/L	0.10	0.15	OG
	Turbidity	NTU	6.3	5	AO
Anions	Chloride (Cl)	mg/L	66	250	AO
	Fluoride (F)	mg/L	0.23	1.5	MAC
	Nitrate as N (NO_3)	mg/L	<0.10	10	MAC
	Nitrite as N (NO_2)	mg/L	<0.10	0.1	MAC
	Sulphate (SO_4)	mg/L	19	500	AO
Metals	Calcium (Ca)	mg/L	53	-	-
	Iron (Fe)	mg/L	0.18	0.3	AO
	Magnesium (Mg)	mg/L	28	-	-
	Manganese (Mn)	mg/L	0.016	0.05	AO
	Potassium (K)	mg/L	8	-	-
	Sodium (Na)	mg/L	47	200	AO

NOTES:

MAC = Maximum acceptable concentration
NR = Not Reportable
OG = Operational guideline
AO = Aesthetic objective
ND = Not Detectable
NDOGN = No Data; Overgrown with Nontarget

* Sample retaken August 22, 2003 (well chlorinated August 21, 2003)

GEMTEC
Consulting Engineers and Scientists

Date: November 2017

Project: 61318.15

Table 3

Summary of Laboratory Parameters Analyzed (TW 1; Jul 5, 2017)

	Parameter	Units	6Hr	Ontario Drinking Water Standard	Type of Standard
Microbiological Parameters	Escherichia coli	CFU/100mL	ND / ND*	0	MAC
	Fecal Coliform	CFU/100mL	ND / ND*	0	MAC
	Total coliforms	CFU/100mL	7 / ND*	0	MAC
	Heterotrophic Plate Count	CFU/1mL	30 / <10*	-	-
General Inorganics	Alkalinity (as $CaC0_3$)	mg/L	347	30-500	OG
	Ammonia as N (NH_3)	mg/L	0.16	-	-
	Dissolved Organic Carbon (DOC)	mg/L	2.1	5	AO
	Colour	TCU	3	5	AO
	Electrical Conductivity	uS/cm	962	-	-
	Total Hardness (as $CaC0_3$)	mg/L	395	80-100	OG
	pH	pH units	7.8	6.5-8.5	OG
	Phenols	mg/L	<0.001	-	-
	Total Dissolved Solids (TDS)	mg/L	660	500	AO
	Sulphide (S_2)	mg/L	<0.02	0.05	AO
	Tannins and Lignins	mg phenol/L	0.1	-	-
	Total Kjeldahl Nitrogen (TKN)	mg/L	0.2	-	-
	Organic Nitrogen (TKN - NH3)	mg/L	-	0.15	OG
	Turbidity	NTU	12.8	5	AO
Anions	Chloride (Cl)	mg/L	86	250	AO
	Fluoride (F)	mg/L	<0.1	1.5	MAC
	Nitrate as N (NO_3)	mg/L	<0.1	10	MAC
	Nitrite as N (NO_2)	mg/L	<0.05	0.1	MAC
	Sulphate (SO_4)	mg/L	74	500	AO
Metals	Calcium (Ca)	mg/L	111	-	-
	Iron (Fe)	mg/L	1	0.3	AO
	Magnesium (Mg)	mg/L	28.3	-	-
	Manganese (Mn)	mg/L	0.096	0.05	AO
	Potassium (K)	mg/L	3.1	-	-
	Sodium (Na)	mg/L	38.8	200	AO

NOTES:

MAC = Maximum acceptable concentration
NR = Not Reportable
OG = Operational guideline
AO = Aesthetic objective
ND = Not Detectable
NDOGN = No Data; Overgrown with Nontarget
* Sample retaken November 8, 2017 (well chlorinated November 7, 2017)

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

Date: November 2017

Project: 61318.15

Table 4

Summary of Laboratory Parameters Analyzed (TW 2; Mar 22, 2003)

	Parameter	Units	6Hr	Ontario Drinking Water Standard	Type of Standard
Microbiological Parameters	Escherichia coli	CFU/100mL	0 / 0*	0	MAC
	Fecal Coliform	CFU/100mL	0 / 0*	0	MAC
	Total coliforms	CFU/100mL	NDOGN / 0*	0	MAC
	Heterotrophic Plate Count	CFU/1mL	- / 5*	-	-
General Inorganics	Alkalinity (as $CaC0_3$)	mg/L	238	30-500	OG
	Ammonia as N (NH_3)	mg/L	0.02	-	-
	Dissolved Organic Carbon (DOC)	mg/L	2.5	5	AO
	Colour	TCU	<2	5	AO
	Electrical Conductivity	uS/cm	593	-	-
	Total Hardness (as $CaC0_3$)	mg/L	253	80-100	OG
	pH	pH units	7.72	6.5-8.5	OG
	Phenols	mg/L	<0.001	-	-
	Total Dissolved Solids (TDS)	mg/L	385	500	AO
	Sulphide (S_2)	mg/L	0.16	0.05	AO
	Tannins and Lignins	mg phenol/L	<0.1	-	-
	Total Kjeldahl Nitrogen (TKN)	mg/L	0.12	-	-
	Organic Nitrogen (TKN - NH3)	mg/L	0.10	0.15	OG
	Turbidity	NTU	4.7	5	AO
Anions	Chloride (Cl)	mg/L	43	250	AO
	Fluoride (F)	mg/L	0.43	1.5	MAC
	Nitrate as N (NO_3)	mg/L	<0.10	10	MAC
	Nitrite as N (NO_2)	mg/L	<0.10	0.1	MAC
	Sulphate (SO_4)	mg/L	17	500	AO
Metals	Calcium (Ca)	mg/L	83	-	-
	Iron (Fe)	mg/L	0.39	0.3	AO
	Magnesium (Mg)	mg/L	11	-	-
	Manganese (Mn)	mg/L	0.014	0.05	AO
	Potassium (K)	mg/L	1	-	-
	Sodium (Na)	mg/L	33	200	AO

NOTES:

MAC = Maximum acceptable concentration

AO = Aesthetic objective

NR = Not Reportable

ND = Not Detectable

OG = Operational guideline

NDOGN = No Data; Overgrown with Nontarget

* Sample retaken August 21, 2003 (well chlorinated August 20, 2003)

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Table 5

Summary of Laboratory Parameters Analyzed (TW 3; Mar 17, 2003)

	Parameter	Units	6Hr	Ontario Drinking Water Standard	Type of Standard
Microbiological Parameters	Escherichia coli	CFU/100mL	0	0	MAC
	Fecal Coliform	CFU/100mL	0	0	MAC
	Total coliforms	CFU/100mL	0	0	MAC
	Heterotrophic Plate Count	CFU/1mL	-	-	-
General Inorganics	Alkalinity (as $CaC0_3$)	mg/L	260	30-500	OG
	Ammonia as N (NH_3)	mg/L	0.21	-	-
	Dissolved Organic Carbon (DOC)	mg/L	2.4	5	AO
	Colour	TCU	5	5	AO
	Electrical Conductivity	uS/cm	564	-	-
	Total Hardness (as $CaC0_3$)	mg/L	201	80-100	OG
	pH	pH units	7.80	6.5-8.5	OG
	Phenols	mg/L	0.003	-	-
	Total Dissolved Solids (TDS)	mg/L	367	500	AO
	Sulphide (S_2)	mg/L	3.70	0.05	AO
	Tannins and Lignins	mg phenol/L	0.2	-	-
	Total Kjeldahl Nitrogen (TKN)	mg/L	0.35	-	-
	Organic Nitrogen (TKN - NH3)	mg/L	0.14	0.15	OG
	Turbidity	NTU	50.2 / < 1.0*	5	AO
Anions	Chloride (Cl)	mg/L	30	250	AO
	Fluoride (F)	mg/L	0.83	1.5	MAC
	Nitrate as N (NO_3)	mg/L	<0.10	10	MAC
	Nitrite as N (NO_2)	mg/L	<0.10	0.1	MAC
	Sulphate (SO_4)	mg/L	11	500	AO
Metals	Calcium (Ca)	mg/L	41	-	-
	Iron (Fe)	mg/L	0.63	0.3	AO
	Magnesium (Mg)	mg/L	24	-	-
	Manganese (Mn)	mg/L	0.018	0.05	AO
	Potassium (K)	mg/L	9	-	-
	Sodium (Na)	mg/L	42	200	AO

NOTES:

MAC = Maximum acceptable concentration

AO = Aesthetic objective

NR = Not Reportable

ND = Not Detectable

OG = Operational guideline

NDOGN = No Data; Overgrown with Nontarget

* Field measurement on August 25, 2003 following 7 hours of pumping

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Table 6

Summary of Laboratory Parameters Analyzed (TW 4; Mar 19, 2003)

	Parameter	Units	6Hr	Ontario Drinking Water Standard	Type of Standard
Microbiological Parameters	Escherichia coli	CFU/100mL	0	0	MAC
	Fecal Coliform	CFU/100mL	0	0	MAC
	Total coliforms	CFU/100mL	0	0	MAC
	Heterotrophic Plate Count	CFU/1mL	0	-	-
General Inorganics	Alkalinity (as $CaC0_3$)	mg/L	237	30-500	OG
	Ammonia as N (NH_3)	mg/L	0.16	-	-
	Dissolved Organic Carbon (DOC)	mg/L	2.2	5	AO
	Colour	TCU	4	5	AO
	Electrical Conductivity	uS/cm	651	-	-
	Total Hardness (as $CaC0_3$)	mg/L	275	80-100	OG
	pH	pH units	7.98	6.5-8.5	OG
	Phenols	mg/L	<0.001	-	-
	Total Dissolved Solids (TDS)	mg/L	423	500	AO
	Sulphide (S_2)	mg/L	0.01	0.05	AO
	Tannins and Lignins	mg phenol/L	<0.1	-	-
	Total Kjeldahl Nitrogen (TKN)	mg/L	0.24	-	-
	Organic Nitrogen (TKN - NH3)	mg/L	0.08	0.15	OG
	Turbidity	NTU	6.6	5	AO
Anions	Chloride (Cl)	mg/L	49	250	AO
	Fluoride (F)	mg/L	0.70	1.5	MAC
	Nitrate as N (NO_3)	mg/L	<0.10	10	MAC
	Nitrite as N (NO_2)	mg/L	<0.10	0.1	MAC
	Sulphate (SO_4)	mg/L	32	500	AO
Metals	Calcium (Ca)	mg/L	74	-	-
	Iron (Fe)	mg/L	0.47	0.3	AO
	Magnesium (Mg)	mg/L	22	-	-
	Manganese (Mn)	mg/L	0.040	0.05	AO
	Potassium (K)	mg/L	3	-	-
	Sodium (Na)	mg/L	32	200	AO

NOTES:

MAC = Maximum acceptable concentration
AO = Aesthetic objective
NR = Not Reportable
ND = Not Detectable
OG = Operational guideline
NDOGN = No Data; Overgrown with Nontarget

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Table 7

Summary of Laboratory Parameters Analyzed (TW 4; May 10, 2016)

	Parameter	Units	4 Hr	8 Hr	Ontario Drinking Water Standard	Type of Standard
Microbiological Parameters	Escherichia coli	CFU/100mL	NDOGN	NDOGN / ND* & ND**	0	MAC
	Fecal Coliform	CFU/100mL	ND	ND / ND* & ND**	0	MAC
	Total coliforms	CFU/100mL	NDOGN	NDOGN / ND* & ND**	0	MAC
	Heterotrophic Plate Count	CFU/1mL	600	NDOGN / 20* & 55**	-	-
General Inorganics	Alkalinity (as $CaC0_3$)	mg/L	246	247	30-500	OG
	Ammonia as N (NH_3)	mg/L	0.10	0.10	-	-
	Dissolved Organic Carbon (DOC)	mg/L	2.0	2.1	5	AO
	Colour	TCU	<5	<5	5	AO
	Electrical Conductivity	uS/cm	936	929	-	-
	Total Hardness (as $CaC0_3$)	mg/L	342	336	80-100	OG
	pH	pH units	8.10	8.22	6.5-8.5	OG
	Phenols	mg/L	<0.001	<0.001	-	-
	Total Dissolved Solids (TDS)	mg/L	516	512	500	AO
	Sulphide (S_2)	mg/L	<0.05	<0.05	0.05	AO
	Tannins and Lignins	mg phenol/L	<0.1	<0.1	-	-
	Total Kjeldahl Nitrogen (TKN)	mg/L	0.11	0.14	-	-
	Organic Nitrogen (TKN - NH3)	mg/L	0.01	0.04	0.15	OG
	Turbidity	NTU	3.7	5.0	5	AO
Anions	Chloride (Cl)	mg/L	137	133	250	AO
	Fluoride (F)	mg/L	0.26	0.23	1.5	MAC
	Nitrate as N (NO_3)	mg/L	<0.05	<0.05	10	MAC
	Nitrite as N (NO_2)	mg/L	<0.05	<0.05	0.1	MAC
	Sulphate (SO_4)	mg/L	48.6	50.6	500	AO
Metals	Calcium (Ca)	mg/L	92.8	91.5	-	-
	Iron (Fe)	mg/L	0.515	0.458	0.3	AO
	Magnesium (Mg)	mg/L	26.7	26.2	-	-
	Manganese (Mn)	mg/L	0.047	0.045	0.05	AO
	Potassium (K)	mg/L	3.75	3.74	-	-
	Sodium (Na)	mg/L	58.0	56.7	200	AO

NOTES:

MAC = Maximum acceptable concentration
NR = Not Reportable
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AO = Aesthetic objective
ND = Not Detectable
NDOGN = No Data; Overgrown with Nontarget

* / ** Samples retaken on May 20, 2016 after 8 hours of pumping (well chlorinated May 19, 2016)

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Table 8

Summary of Laboratory Parameters Analyzed (TW 4; May 16, 2016) - Metals

Parameter	Units	8 Hr	Ontario Drinking Water Standard	Type of Standard
Antimony	ug/L	<1.0	6	MAC
Arsenic	ug/L	<1.0	25	MAC
Barium	ug/L	283	1000	MAC
Beryllium	ug/L	<0.5	-	-
Boron	ug/L	44.1	5000	MAC
Cadmium	ug/L	<0.2	5	MAC
Chromium	ug/L	4.8	50	MAC
Cobalt	ug/L	<0.5	-	-
Copper	ug/L	<1.0	1000	AO
Lead	ug/L	<0.5	10	MAC
Molybdenum	ug/L	<0.5	-	-
Nickel	ug/L	<1.0	-	-
Selenium	ug/L	<1.0	10	MAC
Silver	ug/L	<0.2	-	-
Thallium	ug/L	<0.3	-	-
Uranium	ug/L	<0.5	20	MAC
Vanadium	ug/L	0.4	-	-
Zinc	ug/L	<5.0	5000	AO

NOTES:
MAC = Maximum acceptable concentration
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Table 9

Summary of Laboratory Parameters Analyzed (TW 6; October 19, 2017)

	Parameter	Units	3 Hr	6 Hr	Ontario Drinking Water Standard	Type of Standard
Microbiological Parameters	Escherichia coli	CFU/100mL	ND	ND	0	MAC
	Fecal Coliform	CFU/100mL	ND	ND	0	MAC
	Total coliforms	CFU/100mL	ND	ND	0	MAC
	Heterotrophic Plate Count	CFU/1mL	<10	<10	-	-
General Inorganics	Alkalinity (as $CaC0_3$)	mg/L	294	292	30-500	OG
	Ammonia as N (NH_3)	mg/L	0.11	0.10	-	-
	Dissolved Organic Carbon (DOC)	mg/L	2.8	2.4	5	AO
	Colour	TCU	9	5	5	AO
	Electrical Conductivity	uS/cm	733	710	-	-
	Total Hardness (as $CaC0_3$)	mg/L	332	332	80-100	OG
	pH	pH units	8.0	8.0	6.5-8.5	OG
	Phenols	mg/L	<0.001	<0.001	-	-
	Total Dissolved Solids (TDS)	mg/L	480	502	500	AO
	Sulphide (S_2)	mg/L	0.25	0.39	0.05	AO
	Tannins and Lignins	mg phenol/L	<0.1	<0.1	-	-
	Total Kjeldahl Nitrogen (TKN)	mg/L	0.2	0.2	-	-
	Organic Nitrogen (TKN - NH3)	mg/L	0.09	0.1	0.15	OG
	Turbidity	NTU	14.2	3.9	5	AO
Anions	Chloride (Cl)	mg/L	56	57	250	AO
	Fluoride (F)	mg/L	0.5	0.5	1.5	MAC
	Nitrate as N (NO_3)	mg/L	<0.1	<0.1	10	MAC
	Nitrite as N (NO_2)	mg/L	<0.05	<0.05	0.1	MAC
	Sulphate (SO_4)	mg/L	44	44	500	AO
Metals	Calcium (Ca)	mg/L	93.8	93.6	-	-
	Iron (Fe)	mg/L	1	0.3	0.3	AO
	Magnesium (Mg)	mg/L	23.7	23.8	-	-
	Manganese (Mn)	mg/L	0.057	0.057	0.05	AO
	Potassium (K)	mg/L	3.0	3.0	-	-
	Sodium (Na)	mg/L	19.2	19.9	200	AO

NOTES:

MAC = Maximum acceptable concentration
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NR = Not Reportable
ND = Not Detectable
OG = Operational guideline
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Table 10

Summary of Laboratory Parameters Analyzed (TW 6; October 19, 2017) - Metals

Parameter	Units	6 Hr	Ontario Drinking Water Standard	Type of Standard
Mercury	mg/L	ND (0.0001)	0.001	MAC
Aluminum	mg/L	0.030	0.1	MAC
Antimony	mg/L	ND (0.0005)	0.006	MAC
Arsenic	mg/L	ND (0.001)	0.025	MAC
Barium	mg/L	0.332	1	MAC
Beryllium	mg/L	ND (0.0005)	-	-
Boron	mg/L	0.03	5	MAC
Cadmium	mg/L	ND (0.0001)	0.005	MAC
Chromium	mg/L	ND (0.001)	0.05	MAC
Chromium (VI)	mg/L	ND (0.010)	-	-
Cobalt	mg/L	ND (0.0005)	-	-
Copper	mg/L	ND (0.0005)	1	AO
Lead	mg/L	ND (0.0001)	0.01	MAC
Molybdenum	mg/L	ND (0.0005)	-	-
Nickel	mg/L	ND (0.001)	-	-
Selenium	mg/L	ND (0.001)	0.05	MAC
Silicon	mg/L	10.0	-	-
Silver	mg/L	ND (0.0001)	-	-
Strontium	mg/L	0.73	-	-
Thallium	mg/L	ND (0.001)	-	-
Tin	mg/L	ND (0.01)	-	-
Titanium	mg/L	ND (0.005)	-	-
Tungsten	mg/L	ND (0.01)	-	-
Uranium	mg/L	0.0001	0.02	MAC
Vanadium	mg/L	ND (0.0005)	-	-
Zinc	mg/L	ND (0.005)	5	AO

NOTES:

MAC = Maximum acceptable concentration

AO = Aesthetic objective

NR = Not Reportable

ND = Not Detectable

OG = Operational guideline

NDOGN = No Data; Overgrown with Nontarget

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Table 11

Summary of Laboratory Parameters Analyzed (TW 7; October 18, 2017)

	Parameter	Units	3 Hr	6 Hr	Ontario Drinking Water Standard	Type of Standard
Microbiological Parameters	Escherichia coli	CFU/100mL	ND	ND	0	MAC
	Fecal Coliform	CFU/100mL	ND	ND	0	MAC
	Total coliforms	CFU/100mL	ND	ND	0	MAC
	Heterotrophic Plate Count	CFU/1mL	<10	<10	-	-
General Inorganics	Alkalinity (as $CaC0_3$)	mg/L	293	294	30-500	OG
	Ammonia as N (NH_3)	mg/L	0.42	0.42	-	-
	Dissolved Organic Carbon (DOC)	mg/L	2.0	2.1	5	AO
	Colour	TCU	4	3	5	AO
	Electrical Conductivity	uS/cm	722	724	-	-
	Total Hardness (as $CaC0_3$)	mg/L	228	233	80-100	OG
	pH	pH units	7.9	8.0	6.5-8.5	OG
	Phenols	mg/L	<0.001	<0.001	-	-
	Total Dissolved Solids (TDS)	mg/L	434	426	500	AO
	Sulphide (S_2)	mg/L	7.00	0.30	0.05	AO
	Tannins and Lignins	mg phenol/L	0.8	0.2	-	-
	Total Kjeldahl Nitrogen (TKN)	mg/L	0.5	0.5	-	-
	Organic Nitrogen (TKN - NH3)	mg/L	0.08	0.1	0.15	OG
	Turbidity	NTU	4.1	12.9	5	AO
Anions	Chloride (Cl)	mg/L	65	69	250	AO
	Fluoride (F)	mg/L	0.7	0.7	1.5	MAC
	Nitrate as N (NO_3)	mg/L	<0.1	<0.1	10	MAC
	Nitrite as N (NO_2)	mg/L	<0.05	<0.05	0.1	MAC
	Sulphate (SO_4)	mg/L	21	20	500	AO
Metals	Calcium (Ca)	mg/L	46.1	48.7	-	-
	Iron (Fe)	mg/L	<0.1	<0.1	0.3	AO
	Magnesium (Mg)	mg/L	27.4	27.0	-	-
	Manganese (Mn)	mg/L	0.006	0.006	0.05	AO
	Potassium (K)	mg/L	8.5	8.0	-	-
	Sodium (Na)	mg/L	57.0	54.0	200	AO

NOTES:

MAC = Maximum acceptable concentration
AO = Aesthetic objective
NR = Not Reportable
ND = Not Detectable
OG = Operational guideline
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Table 12
Summary of Laboratory Parameters Analyzed (TW 7; October 18, 2017) - Metals

Parameter	Units	6 Hr	Ontario Drinking Water Standard	Type of Standard
Mercury	mg/L	ND (0.0001)	0.001	MAC
Aluminum	mg/L	0.036	0.1	MAC
Antimony	mg/L	ND (0.0005)	0.006	MAC
Arsenic	mg/L	ND (0.001)	0.025	MAC
Barium	mg/L	0.136	1	MAC
Beryllium	mg/L	ND (0.0005)	-	-
Boron	mg/L	0.14	5	MAC
Cadmium	mg/L	ND (0.0001)	0.005	MAC
Chromium	mg/L	ND (0.001)	0.05	MAC
Chromium (VI)	mg/L	ND (0.010)	-	-
Cobalt	mg/L	ND (0.0005)	-	-
Copper	mg/L	0.0007	1	AO
Lead	mg/L	ND (0.0001)	0.01	MAC
Molybdenum	mg/L	ND (0.0005)	-	-
Nickel	mg/L	ND (0.001)	-	-
Selenium	mg/L	0.006	0.05	MAC
Silicon	mg/L	6.87	-	-
Silver	mg/L	ND (0.0001)	-	-
Strontium	mg/L	2.59	-	-
Thallium	mg/L	ND (0.001)	-	-
Tin	mg/L	ND (0.01)	-	-
Titanium	mg/L	ND (0.005)	-	-
Tungsten	mg/L	ND (0.01)	-	-
Uranium	mg/L	ND (0.0001)	0.02	MAC
Vanadium	mg/L	ND (0.0005)	-	-
Zinc	mg/L	0.006	5	AO

NOTES:

MAC = Maximum acceptable concentration
AO = Aesthetic objective
NR = Not Reportable
ND = Not Detectable
OG = Operational guideline
NDOGN = No Data; Overgrown with Nontarget

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Table 13

Summary of Laboratory Parameters Analyzed (TW 8; October 17, 2017)

	Parameter	Units	3 Hr	6 Hr	Ontario Drinking Water Standard	Type of Standard
Microbiological Parameters	Escherichia coli	CFU/100mL	ND	ND	0	MAC
	Fecal Coliform	CFU/100mL	ND	ND	0	MAC
	Total coliforms	CFU/100mL	ND	ND	0	MAC
	Heterotrophic Plate Count	CFU/1mL	<10	<10	-	-
General Inorganics	Alkalinity (as $CaC0_3$)	mg/L	278	278	30-500	OG
	Ammonia as N (NH_3)	mg/L	0.11	0.11	-	-
	Dissolved Organic Carbon (DOC)	mg/L	2.5	2.3	5	AO
	Colour	TCU	<2	<2	5	AO
	Electrical Conductivity	uS/cm	794	799	-	-
	Total Hardness (as $CaC0_3$)	mg/L	322	324	80-100	OG
	pH	pH units	7.7	7.7	6.5-8.5	OG
	Phenols	mg/L	<0.001	<0.001	-	-
	Total Dissolved Solids (TDS)	mg/L	416	452	500	AO
	Sulphide (S_2)	mg/L	<0.02	<0.02	0.05	AO
	Tannins and Lignins	mg phenol/L	<0.1	<0.1	-	-
	Total Kjeldahl Nitrogen (TKN)	mg/L	0.3	0.3	-	-
	Organic Nitrogen (TKN - NH3)	mg/L	0.2	0.2	0.15	OG
	Turbidity	NTU	3.3	3.0	5	AO
Anions	Chloride (Cl)	mg/L	79	79	250	AO
	Fluoride (F)	mg/L	0.2	0.2	1.5	MAC
	Nitrate as N (NO_3)	mg/L	<0.1	<0.1	10	MAC
	Nitrite as N (NO_2)	mg/L	<0.05	<0.05	0.1	MAC
	Sulphate (SO_4)	mg/L	57	57	500	AO
Metals	Calcium (Ca)	mg/L	92.5	93.1	-	-
	Iron (Fe)	mg/L	0.9	0.9	0.3	AO
	Magnesium (Mg)	mg/L	22.0	22.2	-	-
	Manganese (Mn)	mg/L	0.191	0.191	0.05	AO
	Potassium (K)	mg/L	1.5	1.5	-	-
	Sodium (Na)	mg/L	31.7	32.1	200	AO

NOTES:

MAC = Maximum acceptable concentration
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AO = Aesthetic objective
ND = Not Detectable
NDOGN = No Data; Overgrown with Nontarget

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Table 14

Summary of Laboratory Parameters Analyzed (TW 8; October 17, 2017) - Metals

Parameter	Units	6 Hr	Ontario Drinking Water Standard	Type of Standard
Mercury	mg/L	ND (0.0001)	0.001	MAC
Aluminum	mg/L	ND (0.001)	0.1	MAC
Antimony	mg/L	ND (0.0005)	0.006	MAC
Arsenic	mg/L	ND (0.001)	0.025	MAC
Barium	mg/L	0.109	1	MAC
Beryllium	mg/L	ND (0.0005)	-	-
Boron	mg/L	0.01	5	MAC
Cadmium	mg/L	ND (0.0001)	0.005	MAC
Chromium	mg/L	ND (0.001)	0.05	MAC
Chromium (VI)	mg/L	ND (0.010)	-	-
Cobalt	mg/L	ND (0.0005)	-	-
Copper	mg/L	ND (0.0005)	1	AO
Lead	mg/L	ND (0.0001)	0.01	MAC
Molybdenum	mg/L	0.0023	-	-
Nickel	mg/L	ND (0.001)	-	-
Selenium	mg/L	ND (0.001)	0.05	MAC
Silicon	mg/L	8.00	-	-
Silver	mg/L	ND (0.0001)	-	-
Strontium	mg/L	0.24	-	-
Thallium	mg/L	ND (0.001)	-	-
Tin	mg/L	ND (0.01)	-	-
Titanium	mg/L	ND (0.005)	-	-
Tungsten	mg/L	ND (0.01)	-	-
Uranium	mg/L	0.0009	0.02	MAC
Vanadium	mg/L	ND (0.0005)	-	-
Zinc	mg/L	ND (0.005)	5	AO

NOTES:

MAC = Maximum acceptable concentration
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NR = Not Reportable
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OG = Operational guideline
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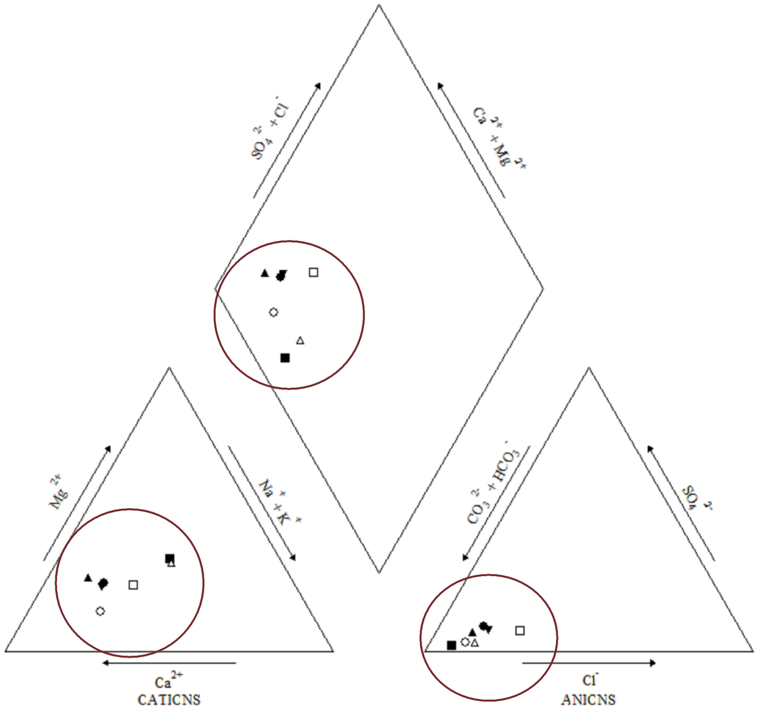
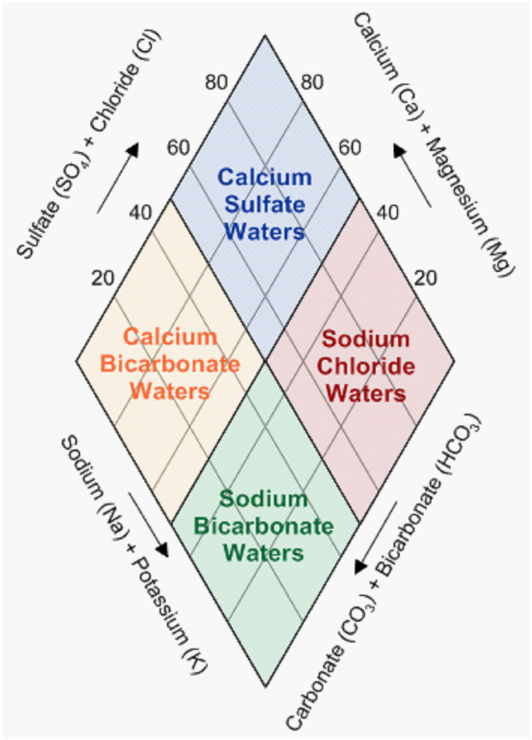


Piper Plot created using GW_Chart



	TW1	TW2	TW3	TW4	TW6	TW7	TW8
Ca	111	83	41	91.5	93.6	48.7	93.1
Mg	28.3	11	24	26.2	23.8	27	22.2
Na	38.8	33	42	56.7	19.9	54	32.1
K	3.1	1	9	3.74	3	8	1.5
CO_3	208.2	142.8	156	148.2	175.2	176.4	166.8
HCO_3	423.3	290.4	317.2	301.3	356.2	358.7	339.2
Cl	86	43	30	133	57	69	79
SO_4	74	17	11	50.6	44	20	57
TDS	660	385	367	512	502	426	452
Symbol	Circle	Open Circle	Square	Open Square	Triangle	Open Triangle	Inverted Triangle

Note: CO_3 = alkalinity * 0.6 and HCO_3 = alkalinity * 1.22

GEMTEC
CONSULTING ENGINEERS
AND SCIENTISTS

32 Steacie Drive, Ottawa, ON K2K 2A9
T: (613) 836-1422 | www.gemtec.ca | ottawa@gemtec.ca

PIPE DIAGRAM - BEDROCK TEST WELLS

Project HYDROGEOLOGICAL INVESTIGATION
2727 CARP ROAD, OTTAWA, ONTARIO

Project No.
61318.15

FIGURE K1

APPENDIX L

Laboratory Certificates of Analysis – Onsite Test and Monitoring Wells

ACCUTEST LABORATORIES LTD

REPORT OF ANALYSIS

Client: **Morey Houle Chevrier Engineering**
28 Clothier St E., Unit B, Box 910
Kemptville, ON
K0G 1J0
Attention: **Mr. Randy Morey**

Report Number: 2313096
Date: 2003-08-25
Date Submitted: 2003-08-22

Project: 031-040

P.O. Number:
Matrix: Water

								GUIDELINE		
		LAB ID:	267773					MOE REG 170/03		
		Sample Date:	2003-08-22							
		Sample ID:	TW1							
PARAMETER	**UNITS**	**MDL**						**TYPE**	**LIMIT**	**UNITS**
Total Coliforms	ct/100mL		0					MAC	0	ct/100mL
Escherichia Coli	ct/100mL		0					MAC	0	ct/100mL
Heterotrophic Plate Count	ct/1mL		5					MAC	500	ct/1mL
Faecal Coliforms	ct/100mL		0					MAC	0	ct/100mL
Faecal Streptococcus	ct/100mL		0							

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

APPROVAL: ____________________
Krista Johns
Microbiology Analyst

ACCUTEST LABORATORIES LTD

REPORT OF ANALYSIS

Client: **Morey Houle Chevrier Engineering**
28 Clothier St E., Unit B, Box 910
Kemptville, ON
K0G 1J0
Attention: **Mr. Randy Morey**

Report Number: 2312997
Date: 2003-08-25
Date Submitted: 2003-08-21

Project: 031-040

P.O. Number:
Matrix: Water

		LAB ID:	267397					**GUIDELINE**		
		Sample Date:	2003-08-21					MOE REG 170/03		
		Sample ID:	TW2 031-040							
PARAMETER	**UNITS**	**MDL**						**TYPE**	**LIMIT**	**UNITS**
Total Coliforms	ct/100mL		0					MAC	0	ct/100mL
Escherichia Coli	ct/100mL		0					MAC	0	ct/100mL
Heterotrophic Plate Count	ct/1mL		5					MAC	500	ct/1mL
Faecal Coliforms	ct/100mL		0					MAC	0	ct/100mL
Faecal Streptococcus	ct/100mL		0							

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

APPROVAL: ____________
Peter Haulena
Analytical Services Manager

ACCUTEST LABORATORIES LTD.

REPORT OF ANALYSIS

Client: Morey Houle Chevrier Engineering

ATT: Dean Tataryn

Report Number: 2303909
Date: 2003-04-01
Date Submitted: 2003-03-22

Project: 031-040

P.O. Number:
Matrix: Water

LAB ID:			239667				
Sample Date:			2003-03-21				
Sample ID:			TW#1				
PARAMETER	UNITS	MDL					
Alkalinity as CaCO3	mg/L	5	251				
Ca	mg/L	1	53				
Cl	mg/L	1	66				
Conductivity	uS/cm	5	700				
Colour	TCU	2	3				
DOC	mg/L	0.5	1.7				
F	mg/L	0.10	0.23				
Fe	mg/L	0.01	0.18				
H2S	mg/L	0.01	0.01				
Hardness as CaCO3	mg/L	1	248				
Ion Balance		0.01	0.99				
Mg	mg/L	1	28				
Mn	mg/L	0.005	0.016				
N-NH3	mg/L	0.02	0.25				
N-NO2	mg/L	0.10	<0.10				
N-NO3	mg/L	0.10	<0.10				
pH			7.99				
Phenols	mg/L	0.001	<0.001				
K	mg/L	1	8				
Na	mg/L	2	47				
SO4	mg/L	1	19				
Tannin & Lignin	mg/L	0.1	<0.1				
Total Kjeldahl Nitrogen	mg/L	0.05	0.35				
Turbidity	NTU	0.1	6.3				
TDS (COND - CALC)	mg/L	5	455				

MDL = Method Detection Limit   INC = Incomplete   Method references available upon request.

Comment:

APPROVAL:

Ewan McRobbie
Inorganic Lab Supervisor

ACCUTEST LABORATORIES LTD.

REPORT OF ANALYSIS

Client: Morey Houle Chevrier Engineering

ATT: Dean Tataryn

Report Number: 2303940
Date: 2003-04-01
Date Submitted: 2003-03-24

Project: 031-040

P.O. Number:
Matrix: Water

		LAB ID:	239708				
		Sample Date:	2003-03-22				
		Sample ID:	TW 2				
PARAMETER	**UNITS**	**MDL**					
Alkalinity as CaCO3	mg/L	5	238				
Background Colonies	ct/100mL		>200				
Ca	mg/L	1	83				
Cl	mg/L	1	43				
Conductivity	uS/cm	5	593				
Colour	TCU	2	<2				
DOC	mg/L	0.5	2.5				
Escherichia Coli	ct/100mL		0				
F	mg/L	0.10	0.43				
Faecal Coliforms	ct/100mL		0				
Faecal Streptococcus	ct/100mL		0				
Fe	mg/L	0.01	0.39				
H2S	mg/L	0.01	0.16				
Hardness as CaCO3	mg/L	1	253				
Ion Balance		0.01	1.03				
Mg	mg/L	1	11				
Mn	mg/L	0.005	0.014				
N-NH3	mg/L	0.02	0.02				
N-NO2	mg/L	0.10	<0.10				
N-NO3	mg/L	0.10	<0.10				
pH			7.72				
Phenols	mg/L	0.001	<0.001				
K	mg/L	1	1				
Na	mg/L	1	33				
Heterotrophic Plate Count	ct/1mL		14				
SO4	mg/L	1	17				
Tannin & Lignin	mg/L	0.1	<0.1				
Total Coliforms	ct/100mL		OG				
Total Kjeldahl Nitrogen	mg/L	0.05	0.12				
Turbidity	NTU	0.1	4.7				

MDL = Method Detection Limit INC = Incomplete Method references available upon request.

Comment:

APPROVAL:

Ewan McRobbie
Inorganic Lab Supervisor

ACCUTEST LABORATORIES LTD.

REPORT OF ANALYSIS

Client: Morey Houle Chevrier Engineering

ATT: Dean Tataryn

Report Number: 2303940
Date: 2003-04-01
Date Submitted: 2003-03-24

Project: 031-040

P.O. Number:
Matrix: Water

		LAB ID:	239708				
		Sample Date:	2003-03-22				
		Sample ID:	TW 2				
PARAMETER	UNITS	MDL					
TDS (COND - CALC)	mg/L	5	385				

MDL = Method Detection Limit INC = Incomplete Method references available upon request.
Comment:

APPROVAL:
Ewan McRobbie
Inorganic Lab Supervisor

ACCUTEST LABORATORIES LTD.

REPORT OF ANALYSIS

Client: **Morey Houle Chevrier Engineering**

ATT: Dean Tataryn

Report Number:	2303535
Date:	2003-03-19
Date Submitted:	2003-03-17
Project:	031-040
P.O. Number:	
Matrix:	Water

		LAB ID:	238148				
		Sample Date:	2003-03-15				
		Sample ID:	TW3				
PARAMETER	**UNITS**	**MDL**					
Alkalinity as CaCO3	mg/L	5	260				
Ca	mg/L	1	41				
Cl	mg/L	1	30				
Conductivity	uS/cm	5	564				
Colour	TCU	2	5				
DOC	mg/L	0.5	2.4				
Escherichia Coli	ct/100mL		0				
F	mg/L	0.10	0.83				
Faecal Coliforms	ct/100mL		0				
Faecal Streptococcus	ct/100mL		0				
Fe	mg/L	0.01	0.63				
H2S	mg/L	0.01	3.70				
Hardness as CaCO3	mg/L	1	201				
Ion Balance		0.01	0.96				
Mg	mg/L	1	24				
Mn	mg/L	0.005	0.018				
N-NH3	mg/L	0.02	0.21				
N-NO2	mg/L	0.10	<0.10				
N-NO3	mg/L	0.10	<0.10				
pH			7.80				
Phenols	mg/L	0.001	0.003				
K	mg/L	1	9				
Na	mg/L	2	42				
Heterotrophic Plate Count	ct/1mL		0				
SO4	mg/L	1	11				
Tannin & Lignin	mg/L	0.1	0.2				
Total Coliforms	ct/100mL		0				
Total Kjeldahl Nitrogen	mg/L	0.05	0.35				
Turbidity	NTU	0.1	50.2				
TDS (COND - CALC)	mg/L	5	367				

MDL = Method Detection Limit INC = Incomplete Method references available upon request.

Comment:

APPROVAL:

Ewan McRobbie
Inorganic Lab Supervisor

ACCUTEST LABORATORIES LTD.

REPORT OF ANALYSIS

Client: Morey Houle Chevrier Engineering

ATT: Dean Tataryn

Report Number:	2303813
Date:	2003-03-31
Date Submitted:	2003-03-19
Project:	031-040
P.O. Number:	
Matrix:	Water

		LAB ID:	239407				
		Sample Date:	2003-03-19				
		Sample ID:	TW#4				
PARAMETER	**UNITS**	**MDL**					
Alkalinity as CaCO3	mg/L	5	237				
Ca	mg/L	1	74				
Cl	mg/L	1	49				
Conductivity	uS/cm	5	651				
Colour	TCU	2	4				
DOC	mg/L	0.5	2.2				
Escherichia Coli	ct/100mL		0				
F	mg/L	0.10	0.70				
Faecal Coliforms	ct/100mL		0				
Faecal Streptococcus	ct/100mL		0				
Fe	mg/L	0.01	0.47				
H2S	mg/L	0.01	0.01				
Hardness as CaCO3	mg/L	1	275				
Ion Balance		0.01	1.02				
Mg	mg/L	1	22				
Mn	mg/L	0.005	0.040				
N-NH3	mg/L	0.02	0.16				
N-NO2	mg/L	0.10	<0.10				
N-NO3	mg/L	0.10	<0.10				
pH			7.98				
Phenols	mg/L	0.001	<0.001				
K	mg/L	1	3				
Na	mg/L	2	32				
Heterotrophic Plate Count	ct/1mL		0				
SO4	mg/L	1	32				
Tannin & Lignin	mg/L	0.1	<0.1				
Total Coliforms	ct/100mL		0				
Total Kjeldahl Nitrogen	mg/L	0.05	0.24				
Turbidity	NTU	0.1	6.6				
TDS (COND - CALC)	mg/L	5	423				

MDL = Method Detection Limit INC = Incomplete Method references available upon request.

Comment:

APPROVAL:

Ewan McRobbie
Inorganic Lab Supervisor

LABORATORIES LTD

REPORT OF ANALYSIS

Client: **Morey Houle Chevrier Engineering**
28 Clothier St E., Unit B, Box 910
Kemptville, ON
K0G 1J0
Attention: Mr. Randy Morey

Report Number: 2420554
Date: 2004-11-11
Date Submitted: 2004-10-26

Project: 031-040

P.O. Number:
Matrix: Water

			350540 2004-10-23 TW #3					GUIDELINE		
PARAMETER	UNITS	MDL						TYPE	LIMIT	UNITS
Picloram	ug/L	5	<5							
CARBAMATES										
Aldicarb	ug/L	9	<9							
Bendiocarb	ug/L	2	<2							
Carbaryl	ug/L	5	<5							
Carbofuran	ug/L	5	<5							
TRIAZINE & RELATED HERBICIDES										
Alachlor	ug/L	0.5	<0.5							
Atrazine	ug/L	0.2	<0.2							
De-ethylated atrazine	ug/L	0.5	<0.5							
Atrazine + *N*-dealkylated metabolites	ug/L	0.2	<0.2							
Cyanazine	ug/L	1	<1							
Metolachlor	ug/L	0.5	<0.5							
Metribuzin	ug/L	5	<5							
Prometryne	ug/L	0.25	<0.25							
Simazine	ug/L	1	<1							
ORGANOPHOSPHOROUS PESTICIDES										
Azinphos-methyl	ug/L	2	<2							
Chlorpyrifos	ug/L	1	<1							
Diazinon	ug/L	1	<1							
Diclofop-methyl	ug/L	0.9	<0.9							
Dimethoate	ug/L	2.5	<2.5							
Malathion	ug/L	5	<5							
Parathion	ug/L	1	<1							
Phorate	ug/L	0.5	<0.5							
Temephos	ug/L	10	<10							
Terbufos	ug/L	0.4	<0.4							
Triallate	ug/L	1	<1							
Trifluralin	ug/L	1	<1							

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

APPROVAL:
Mina Nasrai

LABORATORIES LTD

REPORT OF ANALYSIS

Client: **Morey Houle Chevrier Engineering**
28 Clothier St E., Unit B, Box 910
Kemptville, ON
K0G 1J0
Attention: **Mr. Randy Morey**

Report Number: 2420554
Date: 2004-11-11
Date Submitted: 2004-10-25

Project: 031-040

P.O. Number:
Matrix: Water

		LAB ID:	350540				GUIDELINE		
		Sample Date:	2004-10-23						
		Sample ID:	TW #3						
PARAMETER	UNITS	MDL					TYPE	LIMIT	UNITS
Organochlorine Pesticides (OCPs) & PCBs									
Aldrin	ug/L	0.006	<0.006						
Dieldrin	ug/L	0.006	<0.006						
Aldrin + Dieldrin	ug/L	0.012	<0.012						
a-chlordane	ug/L	0.006	<0.006						
g-chlordane	ug/L	0.006	<0.006						
Oxychlordane	ug/L	0.006	<0.006						
Chlordane (Total)	ug/L	0.018	<0.018						
op-DDT	ug/L	0.006	<0.006						
pp-DDD	ug/L	0.006	<0.006						
pp-DDE	ug/L	0.006	<0.005						
pp-DDT	ug/L	0.006	<0.006						
(DDT) + Metabolites	ug/L	0.024	<0.024						
Heptachlor	ug/L	0.006	<0.006						
Heptachlor epoxide	ug/L	0.006	<0.006						
Heptachlor + Heptachlor Epoxide	ug/L	0.012	<0.012						
Lindane	ug/L	0.006	<0.006						
Methoxychlor	ug/L	0.024	<0.024						
Polychlorinated Biphenyls (PCBs)	ug/L	0.1	<0.1						
CHLOROPHENOLS									
2,3,4,6-tetrachlorophenol	ug/L	0.5	<0.5						
2,4,6-trichlorophenol	ug/L	0.5	<0.5						
2,4-dichlorophenol	ug/L	0.5	<0.5						
Pentachlorophenol	ug/L	0.5	<0.5						
PHENOXYACID HERBICIDES									
2,4,5-trichlorophenoxyacetic acid (2,4,5-T)	ug/L	1	<1						
2,4-dichlorophenoxyacetic acid (2,4-D)	ug/L	1	<1						
Bromoxynil	ug/L	0.5	<0.5						
Dicamba	ug/L	1	<1						
Dinoseb	ug/L	1	<1						

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

APPROVAL:
Mina Nasrai

LABORATORIES LTD

REPORT OF ANALYSIS

Client. Morey Houle Chevrier Engineering
28 Clothier St E., Unit B, Box 910
Kemptville, ON
K0G 1J0
Attention: **Mr. Randy Morey**

Report Number: 2420554
Date: 2004-11-11
Date Submitted: 2004-10-26

Project: 031-040

P.O. Number:
Matrix: Water

		LAB ID:	350540					GUIDELINE		
		Sample Date:	2004-10-23							
		Sample ID:	TW #3							
PARAMETER	UNITS	MDL						TYPE	LIMIT	UNITS
DIURON & GLYPHOSATE										
Diuron	ug/L	10	<10							
Glyphosate	ug/L	10	<10							
DIQUAT & PARAQUAT										
Diquat	ug/L	7	<7							
Paraquat	ug/L	1	<1							
BENZO (a) PYRENE										
Benzo(a)pyrene	ug/L	0.01	<0.01							

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration
Comment:

APPROVAL:

ACCUTEST LABORATORIES LTD

REPORT OF ANALYSIS

lient: **Morey Houle Chevrier Engineering**
28 Clothier St E., Unit B, Box 910
Kemptville, ON
K0G 1J0
ttention: Mr. Randy Morey

Report Number: 2420554
Date: 2004-11-11
Date Submitted: 2004-10-26

Project: 031-040

P.O. Number:
Matrix: Water

		LAB ID:	350534	350535	350536	350537	350538	**GUIDELINE**		
		Sample Date:	2004-10-23	2004-10-23	2004-10-23	2004-10-23	2004-10-23			
		Sample ID:	TW #1 Deep	TW #1 Shallow	TW#2 Deep	TW #2 Shallow	TW #3 Deep			
PARAMETER	**UNITS**	**MDL**						**TYPE**	**LIMIT**	**UNITS**
NO3 (Nitrate)	mg/L	0.10	9.47	4.12	<0.10	<0.10	<0.10			

L = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration
mment:

APPROVAL
Ewan McRobbie

ACCUTEST LABORATORIES LTD

REPORT OF ANALYSIS

Client: Morey Houle Chevrier Engineering
28 Clothier St E., Unit B, Box 910
Kemptville, ON
K0G 1J0
Attention: Mr. Randy Morey

Report Number: 2420554
Date: 2004-11-11
Date Submitted: 2004-10-26

Project: 031-040

P.O. Number:
Matrix: Water

			350539	350541	350542	350543		GUIDELINE		
			2004-10-23	2004-10-23	2004-10-23	2004-10-23				
			TW #3 Shallow	TW #4 Deep	TW #4 Shallow	TW #5 Shallow				
PARAMETER	UNITS	MDL						TYPE	LIMIT	UNITS
N-NO3 (Nitrate)	mg/L	0.10	<0.10	5.76	12.5	<0.10				

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

APPROVAL:

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

CLIENT NAME: **HOULE CHEVRIER**
32 STEACIE DRIVE
OTTAWA, ON K2K2A9
(613) 836-1422

ATTENTION TO: **James Mcewen**

PROJECT: **63978.96**

AGAT WORK ORDER: **16Z093547**

MICROBIOLOGY ANALYSIS REVIEWED BY: **Inesa Alizarchyk, Inorganic Lab Supervisor**

WATER ANALYSIS REVIEWED BY: **Inesa Alizarchyk, Inorganic Lab Supervisor**

DATE REPORTED: **May 18, 2016**

PAGES (INCLUDING COVER): **12**

VERSION*: **1**

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

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

Certificate of Analysis

CLIENT NAME: HOULE CHEVRIER
PROJECT: 63978.96
SAMPLING SITE:

AGAT WORK ORDER: 16Z093547
ATTENTION TO: James Mcewen
SAMPLED BY:

Microbiological Analysis (water)

SAMPLE TYPE: Water
SAMPLE ID: 7549793
DATE RECEIVED: May 11, 2016
DATE SAMPLED: May 10, 2016
DATE REPORTED: May 18, 2016
SAMPLE DESCRIPTION: Set 1 - 4 hr

PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
Escherichia coli	CFU/100mL	NDOGN	0	1	May 13, 2016	CT	May 12, 2016
Total Coliforms	CFU/100mL	NDOGN	0	1	May 13, 2016	CT	May 12, 2016
Fecal Coliform	CFU/100mL	ND		1	May 13, 2016	CT	May 12, 2016
Heterotrophic Plate Count	CFU/1mL	600		10	May 14, 2016	NB	May 12, 2016

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to SDWA - Microbiology
NDOGN – No Data; Overgrown with nontarget, refers to over-crowding microbial growth;
ND - Not Detected
NDOGHPC- No Data; HPC Plate Overgrown with Target.

Certified By:

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

Certificate of Analysis

CLIENT NAME: HOULE CHEVRIER **AGAT WORK ORDER: 16Z093547**
PROJECT: 63978.96 **ATTENTION TO: James Mcewen**
SAMPLING SITE: **SAMPLED BY:**

Subdiv. Well Water Supply

SAMPLE TYPE: Water **SAMPLE ID: 7549793** **DATE RECEIVED: May 11, 2016**
DATE SAMPLED: May 10, 2016 **DATE REPORTED: May 18, 2016**
SAMPLE DESCRIPTION: Set 1 - 4 hr

PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
Electrical Conductivity	uS/cm	936		2	May 13, 2016	PB	May 13, 2016
pH	pH Units	8.10		NA	May 13, 2016	PB	May 13, 2016
Total Hardness (as CaCO3)	mg/L	342		0.5	May 16, 2016	SYS	May 16, 2016
Total Dissolved Solids	mg/L	516		20	May 17, 2016	PB	May 16, 2016
Alkalinity (as CaCO3)	mg/L	246		5	May 13, 2016	PB	May 13, 2016
Fluoride	mg/L	0.26		0.05	May 16, 2016	MM	May 16, 2016
Chloride	mg/L	137		0.50	May 16, 2016	MM	May 16, 2016
Nitrate as N	mg/L	<0.05		0.05	May 16, 2016	MM	May 16, 2016
Nitrite as N	mg/L	<0.05		0.05	May 16, 2016	MM	May 16, 2016
Sulphate	mg/L	48.6		0.10	May 16, 2016	MM	May 16, 2016
Tannins and Lignins	mg phenol/L	<0.1		0.1	May 17, 2016	ME	May 17, 2016
Ammonia as N	mg/L	0.10		0.02	May 16, 2016	SS	May 16, 2016
Total Kjeldahl Nitrogen	mg/L	0.11		0.10	May 16, 2016	OD	May 16, 2016
Dissolved Organic Carbon	mg/L	2.0		0.5	May 13, 2016	ND	May 13, 2016
Phenols	mg/L	<0.001		0.001	May 13, 2016	SN	May 13, 2016
Hydrogen Sulphide	mg/L	<0.05		0.05	May 13, 2016	SN	May 13, 2016
Colour	TCU	<5		5	May 12, 2016	ME	May 12, 2016
Turbidity	NTU	3.7		0.5	May 12, 2016	ME	May 12, 2016
Calcium	mg/L	92.8		0.05	May 16, 2016	AA	May 16, 2016
Magnesium	mg/L	26.7		0.05	May 16, 2016	AA	May 16, 2016
Sodium	mg/L	58.0		0.05	May 16, 2016	AA	May 16, 2016
Potassium	mg/L	3.75		0.05	May 16, 2016	AA	May 16, 2016
Iron	mg/L	0.515		0.010	May 13, 2016	CR	May 13, 2016
Manganese	mg/L	0.047		0.002	May 13, 2016	CR	May 13, 2016
% Difference/ Ion Balance	%	1.85		NA	May 16, 2016	SYS	May 16, 2016

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard
Sodium:Please note that the analytical results have been confirmed by re-analysis.

Certified By:

AGAT Laboratories

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Certificate of Analysis

CLIENT NAME: HOULE CHEVRIER
AGAT WORK ORDER: 16Z093547
PROJECT: 63978.96
ATTENTION TO: James Mcewen
SAMPLING SITE:
SAMPLED BY:

Microbiological Analysis (water)

SAMPLE TYPE: Water
SAMPLE ID: 7549796
DATE RECEIVED: May 11, 2016
DATE SAMPLED: May 10, 2016
DATE REPORTED: May 18, 2016
SAMPLE DESCRIPTION: Set 2 - 8 hr

PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
Escherichia coli	CFU/100mL	NDOGN	0	1	May 13, 2016	CT	May 12, 2016
Total Coliforms	CFU/100mL	NDOGN	0	1	May 13, 2016	CT	May 12, 2016
Fecal Coliform	CFU/100mL	ND		1	May 13, 2016	CT	May 12, 2016
Heterotrophic Plate Count	CFU/1mL	NDOGHPC		10	May 14, 2016	NB	May 12, 2016

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to SDWA - Microbiology
NDOGN – No Data; Overgrown with nontarget, refers to over-crowding microbial growth;
ND - Not Detected
NDOGHPC- No Data; HPC Plate Overgrown with Target.

Certified By:

Certificate of Analysis

CLIENT NAME: HOULE CHEVRIER
PROJECT: 63978.96
SAMPLING SITE:

AGAT WORK ORDER: 16Z093547
ATTENTION TO: James Mcewen
SAMPLED BY:

O. Reg. 153(511) - Metals (Comprehensive) (Water)

SAMPLE TYPE: Water **SAMPLE ID: 7549796** **DATE RECEIVED: May 11, 2016**

DATE SAMPLED: May 10, 2016 **DATE REPORTED: May 18, 2016**

SAMPLE DESCRIPTION: Set 2 - 8 hr

PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
Antimony	µg/L	<1.0		1.0	May 13, 2016	CR	May 13, 2016
Arsenic	µg/L	<1.0		1.0	May 13, 2016	CR	May 13, 2016
Barium	µg/L	283		2.0	May 13, 2016	CR	May 13, 2016
Beryllium	µg/L	<0.5		0.5	May 13, 2016	CR	May 13, 2016
Boron	µg/L	44.1		10.0	May 13, 2016	CR	May 13, 2016
Cadmium	µg/L	<0.2		0.2	May 13, 2016	CR	May 13, 2016
Chromium	µg/L	4.8		2.0	May 13, 2016	CR	May 13, 2016
Cobalt	µg/L	<0.5		0.5	May 13, 2016	CR	May 13, 2016
Copper	µg/L	<1.0		1.0	May 13, 2016	CR	May 13, 2016
Lead	µg/L	<0.5		0.5	May 13, 2016	CR	May 13, 2016
Molybdenum	µg/L	<0.5		0.5	May 13, 2016	CR	May 13, 2016
Nickel	µg/L	<1.0		1.0	May 13, 2016	CR	May 13, 2016
Selenium	µg/L	<1.0		1.0	May 13, 2016	CR	May 13, 2016
Silver	µg/L	<0.2		0.2	May 13, 2016	CR	May 13, 2016
Thallium	µg/L	<0.3		0.3	May 13, 2016	CR	May 13, 2016
Uranium	µg/L	<0.5		0.5	May 13, 2016	CR	May 13, 2016
Vanadium	µg/L	0.4		0.4	May 13, 2016	CR	May 13, 2016
Zinc	µg/L	<5.0		5.0	May 13, 2016	CR	May 13, 2016

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to T1(All-GW)

Certified By:

Certificate of Analysis

CLIENT NAME: HOULE CHEVRIER | **AGAT WORK ORDER: 16Z093547**
PROJECT: 63978.96 | **ATTENTION TO: James Mcewen**
SAMPLING SITE: | **SAMPLED BY:**

Subdiv. Well Water Supply

SAMPLE TYPE: Water **SAMPLE ID: 7549796** **DATE RECEIVED: May 11, 2016**
DATE SAMPLED: May 10, 2016 **DATE REPORTED: May 18, 2016**
SAMPLE DESCRIPTION: Set 2 - 8 hr

PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
Electrical Conductivity	uS/cm	929		2	May 13, 2016	PB	May 13, 2016
pH	pH Units	8.22		NA	May 13, 2016	PB	May 13, 2016
Total Hardness (as CaCO3)	mg/L	336		0.5	May 16, 2016	SYS	May 16, 2016
Total Dissolved Solids	mg/L	512		20	May 17, 2016	PB	May 16, 2016
Alkalinity (as CaCO3)	mg/L	247		5	May 13, 2016	PB	May 13, 2016
Fluoride	mg/L	0.23		0.05	May 16, 2016	MM	May 16, 2016
Chloride	mg/L	133		0.50	May 16, 2016	MM	May 16, 2016
Nitrate as N	mg/L	<0.05		0.05	May 16, 2016	MM	May 16, 2016
Nitrite as N	mg/L	<0.05		0.05	May 16, 2016	MM	May 16, 2016
Sulphate	mg/L	50.6		0.10	May 16, 2016	MM	May 16, 2016
Tannins and Lignins	mg phenol/L	<0.1		0.1	May 17, 2016	ME	May 17, 2016
Ammonia as N	mg/L	0.10		0.02	May 16, 2016	SS	May 16, 2016
Total Kjeldahl Nitrogen	mg/L	0.14		0.10	May 16, 2016	OD	May 16, 2016
Dissolved Organic Carbon	mg/L	2.1		0.5	May 13, 2016	ND	May 13, 2016
Phenols	mg/L	<0.001		0.001	May 13, 2016	SN	May 13, 2016
Hydrogen Sulphide	mg/L	<0.05		0.05	May 13, 2016	SN	May 13, 2016
Colour	TCU	<5		5	May 12, 2016	ME	May 12, 2016
Turbidity	NTU	5.0		0.5	May 12, 2016	ME	May 12, 2016
Calcium	mg/L	91.5		0.05	May 16, 2016	AA	May 16, 2016
Magnesium	mg/L	26.2		0.05	May 16, 2016	AA	May 16, 2016
Sodium	mg/L	56.7		0.05	May 16, 2016	AA	May 16, 2016
Potassium	mg/L	3.74		0.05	May 16, 2016	AA	May 16, 2016
Iron	mg/L	0.458		0.010	May 13, 2016	CR	May 13, 2016
Manganese	mg/L	0.045		0.002	May 13, 2016	CR	May 13, 2016
% Difference/ Ion Balance	%	2.45		NA	May 16, 2016	SYS	May 16, 2016

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard
Sodium:Please note that the analytical results have been confirmed by re-analysis.

Certified By:

Quality Assurance

CLIENT NAME: HOULE CHEVRIER

PROJECT: 63978.96

SAMPLING SITE:

AGAT WORK ORDER: 16Z093547

ATTENTION TO: James Mcewen

SAMPLED BY:

Microbiology Analysis

RPT Date: May 18, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Microbiological Analysis (water)															
Escherichia coli	7549793	7549793	NDOGN	NDOGN	NA	< 1									
Total Coliforms	7549793	7549793	NDOGN	NDOGN	NA	< 1									
Fecal Coliform	7549796	7549796	ND	ND	NA	< 1									
Heterotrophic Plate Count	7549793	7549793	600	595	0.8%	< 10									

Comments: NDOGN – No Data; Overgrown with nontarget, refers to over-crowding microbial growth;
ND - Not Detected
NA - % RPD Not Applicable

Certified By:

AGAT Laboratories

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Quality Assurance

CLIENT NAME: HOULE CHEVRIER **AGAT WORK ORDER: 16Z093547**
PROJECT: 63978.96 **ATTENTION TO: James Mcewen**
SAMPLING SITE: **SAMPLED BY:**

Water Analysis

RPT Date: May 18, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Subdiv. Well Water Supply															
Electrical Conductivity	7548296		2210	2210	0.0%	< 2	103%	80%	120%	NA			NA		
pH	7548296		8.28	8.26	0.2%	NA	100%	90%	110%	NA			NA		
Total Dissolved Solids	7548281		1010	1020	1.0%	< 20	98%	80%	120%	NA			NA		
Alkalinity (as CaCO3)	7548296		855	849	0.7%	< 5	99%	80%	120%	NA			NA		
Fluoride	7551821		<0.25	<0.25	NA	< 0.05	101%	90%	110%	103%	90%	110%	92%	80%	120%
Chloride	7551821		12.9	13.3	3.1%	< 0.10	99%	90%	110%	109%	90%	110%	110%	80%	120%
Nitrate as N	7551821		<0.25	<0.25	NA	< 0.05	91%	90%	110%	108%	90%	110%	108%	80%	120%
Nitrite as N	7551821		<0.25	<0.25	NA	< 0.05	NA	90%	110%	104%	90%	110%	107%	80%	120%
Sulphate	7551821		17.5	17.8	1.7%	< 0.10	97%	90%	110%	108%	90%	110%	109%	80%	120%
Tannins and Lignins	7549793	7549793	<0.1	<0.1	NA	< 0.1	89%	80%	120%	95%	85%	115%	85%	70%	130%
Ammonia as N	7547451		<0.02	<0.02	NA	< 0.02	90%	90%	110%	93%	90%	110%	105%	80%	120%
Total Kjeldahl Nitrogen	7547464		0.44	0.52	NA	< 0.10	100%	80%	120%	104%	80%	120%	99%	70%	130%
Dissolved Organic Carbon	7549793	7549793	2.0	2.0	NA	< 0.5	102%	90%	110%	100%	90%	110%	97%	80%	120%
Phenols	7547622		<0.001	<0.001	NA	< 0.001	98%	90%	110%	97%	90%	110%	93%	80%	120%
Sulphide	7552576		<0.05	<0.05	NA	< 0.05	99%	80%	120%	101%	85%	115%	102%	70%	130%
Hydrogen Sulphide	7552576		<0.05	<0.05	NA	< 0.05	99%	90%	110%	101%	90%	110%	102%	80%	120%
Colour	7546818		39	40	2.5%	< 5	100%	90%	110%	NA			NA		
Turbidity	7549020		<0.5	<0.5	NA	< 0.5	103%	90%	110%	NA			NA		
Calcium	7550688		98.6	100	1.4%	< 0.05	101%	90%	110%	102%	90%	110%	101%	70%	130%
Magnesium	7550688		41.8	42.0	0.5%	< 0.05	102%	90%	110%	102%	90%	110%	105%	70%	130%
Sodium	7550688		23.6	23.0	2.6%	< 0.05	94%	90%	110%	94%	90%	110%	98%	70%	130%
Potassium	7550688		2.03	2.04	0.5%	< 0.05	95%	90%	110%	94%	90%	110%	97%	70%	130%
Iron	7550206		0.390	0.415	6.2%	< 0.010	100%	90%	110%	100%	90%	110%	100%	70%	130%
Manganese	7550206		0.004	0.005	NA	< 0.002	101%	90%	110%	100%	90%	110%	103%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

O. Reg. 153(511) - Metals (Comprehensive) (Water)															
Antimony	7550206		<1.0	<1.0	NA	< 1.0	99%	70%	130%	101%	80%	120%	104%	70%	130%
Arsenic	7550206		<1.0	<1.0	NA	< 1.0	100%	70%	130%	96%	80%	120%	104%	70%	130%
Barium	7550206		10.5	10.9	3.7%	< 2.0	99%	70%	130%	99%	80%	120%	97%	70%	130%
Beryllium	7550206		<0.5	<0.5	NA	< 0.5	109%	70%	130%	106%	80%	120%	112%	70%	130%
Boron	7550206		<10.0	<10.0	NA	< 10.0	97%	70%	130%	99%	80%	120%	100%	70%	130%
Cadmium	7550206		<0.2	<0.2	NA	< 0.2	100%	70%	130%	100%	80%	120%	104%	70%	130%
Chromium	7550206		<2.0	<2.0	NA	< 2.0	100%	70%	130%	100%	80%	120%	97%	70%	130%
Cobalt	7550206		<0.5	<0.5	NA	< 0.5	103%	70%	130%	101%	80%	120%	102%	70%	130%
Copper	7550206		24.5	26.3	7.1%	< 1.0	101%	70%	130%	101%	80%	120%	96%	70%	130%
Lead	7550206		<0.5	<0.5	NA	< 0.5	103%	70%	130%	101%	80%	120%	102%	70%	130%

Quality Assurance

CLIENT NAME: HOULE CHEVRIER

PROJECT: 63978.96

SAMPLING SITE:

AGAT WORK ORDER: 16Z093547

ATTENTION TO: James Mcewen

SAMPLED BY:

Water Analysis (Continued)

RPT Date: May 18, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Molybdenum	7550206		<0.5	<0.5	NA	< 0.5	99%	70%	130%	96%	80%	120%	99%	70%	130%
Nickel	7550206		<1.0	<1.0	NA	< 1.0	102%	70%	130%	100%	80%	120%	99%	70%	130%
Selenium	7550206		<1.0	<1.0	NA	< 1.0	99%	70%	130%	96%	80%	120%	113%	70%	130%
Silver	7550206		<0.2	<0.2	NA	< 0.2	95%	70%	130%	104%	80%	120%	106%	70%	130%
Thallium	7550206		<0.3	<0.3	NA	< 0.3	104%	70%	130%	101%	80%	120%	103%	70%	130%
Uranium	7550206		<0.5	<0.5	NA	< 0.5	100%	70%	130%	101%	80%	120%	100%	70%	130%
Vanadium	7550206		<0.4	<0.4	NA	< 0.4	98%	70%	130%	98%	80%	120%	101%	70%	130%
Zinc	7550206		<5.0	<5.0	NA	< 5.0	100%	70%	130%	101%	80%	120%	113%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By:

Method Summary

CLIENT NAME: HOULE CHEVRIER **AGAT WORK ORDER: 16Z093547**

PROJECT: 63978.96 **ATTENTION TO: James Mcewen**

SAMPLING SITE: **SAMPLED BY:**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Microbiology Analysis			
Escherichia coli	MIC-93-7010	EPA 1604	Membrane Filtration
Total Coliforms	MIC-93-7010	EPA 1604	Membrane Filtration
Fecal Coliform	MIC-93-7000	SM 9222 D	MF/INCUBATOR
Heterotrophic Plate Count	MIC-93-7020	SM 9215C	MF/INCUBATOR

Method Summary

CLIENT NAME: HOULE CHEVRIER
AGAT WORK ORDER: 16Z093547
PROJECT: 63978.96
ATTENTION TO: James Mcewen
SAMPLING SITE:
SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Antimony	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Barium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Boron	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Chromium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Copper	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Lead	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Nickel	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Selenium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Silver	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Thallium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Uranium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Zinc	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Electrical Conductivity	INOR-93-6000	SM 2510 B	PC TITRATE
pH	INOR-93-6000	SM 4500-H+ B	PC TITRATE
Total Hardness (as CaCO3)	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Total Dissolved Solids	INOR-93-6028	SM 2540 C	BALANCE
Alkalinity (as CaCO3)	INOR-93-6000	SM 2320 B	PC TITRATE
Fluoride	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Chloride	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Nitrate as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Tannins and Lignins	INOR-93-6058	SM 550B, 21st Edition	SPECTROPHOTOMETER
Ammonia as N	INOR-93-6059	QuikChem 10-107-06-1-J & SM 4500 NH3-F	LACHAT FIA
Total Kjeldahl Nitrogen	INOR-93-6048	QuikChem 10-107-06-2-I & SM 4500-Norg D	LACHAT FIA
Dissolved Organic Carbon	INOR-93-6049	EPA 415.1 & SM 5310 B	SHIMADZU CARBON ANALYZER
Phenols	INOR-93-6050	MOE ROPHEN-E 3179 & SM 5530 D	TECHNICON AUTO ANALYZER
Hydrogen Sulphide	INOR-93-6054	SM 4500 S2- D	SPECTROPHOTOMETER
Colour	INOR-93-6046	SM 2120 B	SPECTROPHOTOMETER
Turbidity	INOR-93-6044	SM 2130 B	NEPHELOMETER
Calcium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Magnesium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Sodium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Potassium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Iron	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Manganese	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
% Difference/ Ion Balance		SM 1030 E	CALCULATION

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CLIENT NAME: HOULE CHEVRIER
32 STEACIE DRIVE
OTTAWA, ON K2K2A9
(613) 836-1422

ATTENTION TO: James Mcewen

PROJECT: 63978.96

AGAT WORK ORDER: 16Z097017

MICROBIOLOGY ANALYSIS REVIEWED BY: Inesa Alizarchyk, Inorganic Lab Supervisor

DATE REPORTED: May 31, 2016

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

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

Certificate of Analysis

AGAT WORK ORDER: 16Z097017
PROJECT: 63978.96

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http://www.agatlabs.com

CLIENT NAME: HOULE CHEVRIER
SAMPLING SITE:

ATTENTION TO: James Mcewen
SAMPLED BY:

Microbiological Analysis (water)

DATE RECEIVED: 2016-05-20

DATE REPORTED: 2016-05-31

			SAMPLE DESCRIPTION:	**R-1(1-2)**	**R-2(1-2)**
			SAMPLE TYPE:	**Water**	**Water**
			DATE SAMPLED:	**5/20/2016**	**5/20/2016**
Parameter	**Unit**	**G / S**	**RDL**	**7573859**	**7573866**
Escherichia coli	CFU/100mL	0	**1**	ND	ND
Total Coliforms	CFU/100mL	0	**1**	ND	ND
Fecal Coliform	CFU/100mL		1	ND	ND
Heterotrophic Plate Count	CFU/1mL		10	20	55

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to SDWA - Microbiology
7573859-7573866 ND - Not Detected.

Certified By:

Quality Assurance

CLIENT NAME: HOULE CHEVRIER
PROJECT: 63978.96
SAMPLING SITE:

AGAT WORK ORDER: 16Z097017
ATTENTION TO: James Mcewen
SAMPLED BY:

Microbiology Analysis

RPT Date: May 31, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Microbiological Analysis (water)															
Escherichia coli	7572225		ND	ND	NA	< 1									
Total Coliforms	7572225		ND	ND	NA	< 1									
Fecal Coliform	7573859	7573859	ND	ND	NA	< 1									
Heterotrophic Plate Count	7573859	7573859	ND	ND	NA	< 10									

Comments: ND - Not Detected, NA - % RPD Not Applicable

Certified By:

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

Method Summary

CLIENT NAME: HOULE CHEVRIER

AGAT WORK ORDER: 16Z097017

PROJECT: 63978.96

ATTENTION TO: James Mcewen

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Microbiology Analysis			
Escherichia coli	MIC-93-7010	EPA 1604	Membrane Filtration
Total Coliforms	MIC-93-7010	EPA 1604	Membrane Filtration
Fecal Coliform	MIC-93-7000	SM 9222 D	MF/INCUBATOR
Heterotrophic Plate Count	MIC-93-7020	SM 9215C	MF/INCUBATOR

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Certificate of Analysis

Houle Chevrier

32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Andrius Paznekas

Client PO:
Project: 61318.15
Custody: 6642

Report Date: 12-Jul-2017
Order Date: 6-Jul-2017

Order #: 1727266

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

Paracel ID	**Client ID**
1727266-01	TW1-6

Approved By:

Dale Robertson, BSc
Laboratory Director

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Alkalinity, total to pH 4.5	EPA 310.1 - Titration to pH 4.5	6-Jul-17	6-Jul-17
Ammonia, as N	EPA 351.2 - Auto Colour	11-Jul-17	11-Jul-17
Anions	EPA 300.1 - IC	7-Jul-17	7-Jul-17
Colour	SM2120 - Spectrophotometric	6-Jul-17	6-Jul-17
Conductivity	EPA 9050A- probe @25 °C	6-Jul-17	6-Jul-17
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	12-Jul-17	12-Jul-17
E. coli	MOE E3407	6-Jul-17	6-Jul-17
Fecal Coliform	SM 9222D	6-Jul-17	6-Jul-17
Heterotrophic Plate Count	SM 9215C	6-Jul-17	6-Jul-17
Metals, ICP-MS	EPA 200.8 - ICP-MS	7-Jul-17	7-Jul-17
pH	EPA 150.1 - pH probe @25 °C	6-Jul-17	6-Jul-17
Phenolics	EPA 420.2 - Auto Colour, 4AAP	7-Jul-17	11-Jul-17
Subdivision Package	Hardness as CaCO3	7-Jul-17	7-Jul-17
Sulphide	SM 4500SE - Colourimetric	11-Jul-17	11-Jul-17
Tannin/Lignin	SM 5550B - Colourimetric	7-Jul-17	7-Jul-17
Total Coliform	MOE E3407	6-Jul-17	6-Jul-17
Total Dissolved Solids	SM 2540C - gravimetric, filtration	6-Jul-17	7-Jul-17
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	11-Jul-17	12-Jul-17
Turbidity	SM 2130B - Turbidity meter	6-Jul-17	7-Jul-17

Certificate of Analysis
Client: Houle Chevrier
Client PO:

Report Date: 12-Jul-2017
Order Date: 6-Jul-2017
Project Description: 61318.15

	Client ID:	TW1-6	-	-	-
	Sample Date:	05-Jul-17	-	-	-
	Sample ID:	1727266-01	-	-	-
	MDL/Units	Drinking Water	-	-	-
Microbiological Parameters					
E. coli	1 CFU/100 mL	ND	-	-	-
Fecal Coliforms	1 CFU/100 mL	ND	-	-	-
Total Coliforms	1 CFU/100 mL	7	-	-	-
Heterotrophic Plate Count	10 CFU/mL	30	-	-	-
General Inorganics					
Alkalinity, total	5 mg/L	347	-	-	-
Ammonia as N	0.01 mg/L	0.16	-	-	-
Dissolved Organic Carbon	0.5 mg/L	2.1	-	-	-
Colour	2 TCU	3	-	-	-
Conductivity	5 uS/cm	962	-	-	-
Hardness	mg/L	395	-	-	-
pH	0.1 pH Units	7.8	-	-	-
Phenolics	0.001 mg/L	<0.001	-	-	-
Total Dissolved Solids	10 mg/L	660	-	-	-
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	12.8	-	-	-
Anions					
Chloride	1 mg/L	86	-	-	-
Fluoride	0.1 mg/L	<0.1	-	-	-
Nitrate as N	0.1 mg/L	<0.1	-	-	-
Nitrite as N	0.05 mg/L	<0.05	-	-	-
Sulphate	1 mg/L	74	-	-	-
Metals					
Calcium	0.1 mg/L	111	-	-	-
Iron	0.1 mg/L	1	-	-	-
Magnesium	0.2 mg/L	28.3	-	-	-
Manganese	0.005 mg/L	0.096	-	-	-
Potassium	0.1 mg/L	3.1	-	-	-
Sodium	0.2 mg/L	38.8	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%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						
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/100 mL						
Fecal Coliforms	ND	1	CFU/100 mL						
Total Coliforms	ND	1	CFU/100 mL						
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	86.1	1	mg/L	86.1			0.1	10	
Fluoride	ND	0.1	mg/L	ND				10	
Nitrate as N	ND	0.1	mg/L	ND				20	
Nitrite as N	ND	0.05	mg/L	ND				20	
Sulphate	72.5	1	mg/L	73.7			1.6	10	
General Inorganics									
Alkalinity, total	240	5	mg/L	243			1.2	14	
Ammonia as N	0.141	0.01	mg/L	0.155			9.6	8	QR-05
Dissolved Organic Carbon	2.9	0.5	mg/L	3.3			11.6	37	
Colour	3	2	TCU	3			0.0	12	
Conductivity	566	5	uS/cm	582			2.8	11	
pH	7.5	0.1	pH Units	7.5			0.1	10	
Phenolics	ND	0.001	mg/L	ND				10	
Total Dissolved Solids	628	10	mg/L	660			5.0	10	
Sulphide	ND	0.02	mg/L	ND				10	
Tannin & Lignin	ND	0.1	mg/L	ND			0.0	11	
Total Kjeldahl Nitrogen	ND	0.1	mg/L	0.23			0.0	10	
Turbidity	0.2	0.1	NTU	0.2			0.0	10	
Metals									
Calcium	10.4	0.1	mg/L	10.4			0.2	20	
Iron	ND	0.1	mg/L	ND			0.0	20	
Magnesium	2.7	0.2	mg/L	2.7			2.0	20	
Manganese	ND	0.005	mg/L	ND			0.0	20	
Potassium	0.7	0.1	mg/L	0.7			0.7	20	
Sodium	21.0	0.2	mg/L	20.6			1.8	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL	ND				30	
Fecal Coliforms	ND	1	CFU/100 mL	ND				30	
Total Coliforms	7	1	CFU/100 mL	7			0.0	30	
Heterotrophic Plate Count	ND	10	CFU/mL	30			0.0	30	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	96.1	1	mg/L	86.1	101	78-112			
Fluoride	0.95	0.1	mg/L	ND	95.5	73-113			
Nitrate as N	0.88	0.1	mg/L	ND	88.2	81-112			
Nitrite as N	1.02	0.05	mg/L	ND	102	76-107			
Sulphate	82.7	1	mg/L	73.7	89.9	75-111			
General Inorganics									
Ammonia as N	0.413	0.01	mg/L	0.155	103	81-124			
Dissolved Organic Carbon	11.7	0.5	mg/L	3.3	84.0	60-133			
Phenolics	0.028	0.001	mg/L	ND	112	69-132			
Total Dissolved Solids	102	10	mg/L		102	75-125			
Sulphide	0.48	0.02	mg/L	ND	85.5	79-115			
Tannin & Lignin	0.9	0.1	mg/L	ND	88.3	71-113			
Total Kjeldahl Nitrogen	2.12	0.1	mg/L		106	81-126			
Metals									
Calcium	958		ug/L		95.8	80-120			
Iron	948		ug/L	6	94.2	80-120			
Magnesium	3420		ug/L	2690	73.5	80-120			QM-07
Manganese	53.1		ug/L	2.83	101	80-120			
Potassium	1550		ug/L	721	82.5	80-120			
Sodium	1190		ug/L		119	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.

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

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

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Certificate of Analysis

Houle Chevrier
32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Andrius Paznekas

Client PO:
Project: 61318.15
Custody: 6676

Report Date: 23-Oct-2017
Order Date: 17-Oct-2017

Order #: 1742284

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

Paracel ID	**Client ID**
1742284-01	NTW3-3hr
1742284-02	NTW3-6hr

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: Houle Chevrier
Client PO:

Report Date: 23-Oct-2017
Order Date: 17-Oct-2017
Project Description: 61318.15

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	18-Oct-17	18-Oct-17
Ammonia, as N	EPA 351.2 - Auto Colour	19-Oct-17	19-Oct-17
Anions	EPA 300.1 - IC	19-Oct-17	19-Oct-17
Chromium, hexavalent - water	MOE E3056 - colourimetric	18-Oct-17	18-Oct-17
Colour	SM2120 - Spectrophotometric	19-Oct-17	19-Oct-17
Conductivity	EPA 9050A- probe @25 °C	18-Oct-17	18-Oct-17
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	19-Oct-17	19-Oct-17
E. coli	MOE E3407	18-Oct-17	18-Oct-17
Fecal Coliform	SM 9222D	18-Oct-17	18-Oct-17
Heterotrophic Plate Count	SM 9215C	18-Oct-17	18-Oct-17
Mercury by CVAA	EPA 245.2 - Cold Vapour AA	23-Oct-17	23-Oct-17
Metals, ICP-MS	EPA 200.8 - ICP-MS	18-Oct-17	18-Oct-17
pH	EPA 150.1 - pH probe @25 °C	18-Oct-17	18-Oct-17
Phenolics	EPA 420.2 - Auto Colour, 4AAP	18-Oct-17	18-Oct-17
Subdivision Package	Hardness as CaCO3	18-Oct-17	18-Oct-17
Sulphide	SM 4500SE - Colourimetric	18-Oct-17	18-Oct-17
Tannin/Lignin	SM 5550B - Colourimetric	20-Oct-17	23-Oct-17
Total Coliform	MOE E3407	18-Oct-17	18-Oct-17
Total Dissolved Solids	SM 2540C - gravimetric, filtration	19-Oct-17	20-Oct-17
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	18-Oct-17	23-Oct-17
Turbidity	SM 2130B - Turbidity meter	19-Oct-17	19-Oct-17

Order #: 1742284

Certificate of Analysis
Client: Houle Chevrier
Client PO:

Report Date: 23-Oct-2017
Order Date: 17-Oct-2017
Project Description: 61318.15

Client ID:		NTW3-3hr	NTW3-6hr	-	-
Sample Date:		17-Oct-17	17-Oct-17	-	-
Sample ID:		1742284-01	1742284-02	-	-
	MDL/Units	Drinking Water	Drinking Water	-	-
Microbiological Parameters					
E. coli	1 CFU/100 mL	ND	ND	-	-
Fecal Coliforms	1 CFU/100 mL	ND	ND	-	-
Total Coliforms	1 CFU/100 mL	ND	ND	-	-
Heterotrophic Plate Count	10 CFU/mL	<10	<10	-	-
General Inorganics					
Alkalinity, total	5 mg/L	278	278	-	-
Ammonia as N	0.01 mg/L	0.11	0.11	-	-
Dissolved Organic Carbon	0.5 mg/L	2.5	2.3	-	-
Colour	2 TCU	<2	<2	-	-
Conductivity	5 uS/cm	794	799	-	-
Hardness	mg/L	322	324	-	-
pH	0.1 pH Units	7.7	7.7	-	-
Phenolics	0.001 mg/L	<0.001	<0.001	-	-
Total Dissolved Solids	10 mg/L	416	452	-	-
Sulphide	0.02 mg/L	<0.02	<0.02	-	-
Tannin & Lignin	0.1 mg/L	<0.1	<0.1	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.3	0.3	-	-
Turbidity	0.1 NTU	3.3	3.0	-	-
Anions					
Chloride	1 mg/L	79	79	-	-
Fluoride	0.1 mg/L	0.2	0.2	-	-
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	57	57	-	-
Metals					
Mercury	0.0001 mg/L	-	<0.0001	-	-
Aluminum	0.001 mg/L	-	<0.001	-	-
Antimony	0.0005 mg/L	-	<0.0005	-	-
Arsenic	0.001 mg/L	-	<0.001	-	-
Barium	0.001 mg/L	-	0.109	-	-
Beryllium	0.0005 mg/L	-	<0.0005	-	-
Boron	0.01 mg/L	-	0.01	-	-
Cadmium	0.0001 mg/L	-	<0.0001	-	-
Calcium	0.1 mg/L	92.5	93.1	-	-
Chromium	0.001 mg/L	-	<0.001	-	-

Client ID: **Sample Date:** **Sample ID:**	**MDL/Units**	NTW3-3hr 17-Oct-17 1742284-01 Drinking Water	NTW3-6hr 17-Oct-17 1742284-02 Drinking Water	- - - -	- - - -
Chromium (VI)	0.010 mg/L	-	<0.010	-	-
Cobalt	0.0005 mg/L	-	<0.0005	-	-
Copper	0.0005 mg/L	-	<0.0005	-	-
Iron	0.1 mg/L	0.9	0.9	-	-
Lead	0.0001 mg/L	-	<0.0001	-	-
Magnesium	0.2 mg/L	22.0	22.2	-	-
Manganese	0.005 mg/L	0.191	0.191	-	-
Molybdenum	0.0005 mg/L	-	0.0023	-	-
Nickel	0.001 mg/L	-	<0.001	-	-
Potassium	0.1 mg/L	1.5	1.5	-	-
Selenium	0.001 mg/L	-	<0.001	-	-
Silicon	0.01 mg/L	-	8.00	-	-
Silver	0.0001 mg/L	-	<0.0001	-	-
Sodium	0.2 mg/L	31.7	32.1	-	-
Strontium	0.01 mg/L	-	0.24	-	-
Thallium	0.001 mg/L	-	<0.001	-	-
Tin	0.01 mg/L	-	<0.01	-	-
Titanium	0.005 mg/L	-	<0.005	-	-
Tungsten	0.01 mg/L	-	<0.01	-	-
Uranium	0.0001 mg/L	-	0.0009	-	-
Vanadium	0.0005 mg/L	-	<0.0005	-	-
Zinc	0.005 mg/L	-	<0.005	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%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						
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									
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						
Calcium	ND	0.1	mg/L						
Chromium (VI)	ND	0.010	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						
Silicon	ND	0.01	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						
Tin	ND	0.01	mg/L						
Titanium	ND	0.005	mg/L						
Tungsten	ND	0.01	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/100 mL						
Fecal Coliforms	ND	1	CFU/100 mL						
Total Coliforms	ND	1	CFU/100 mL						
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	237	1	mg/L	237			0.1	10	
Fluoride	0.23	0.1	mg/L	0.23			0.3	10	
Nitrate as N	0.81	0.1	mg/L	0.81			0.0	20	
Nitrite as N	ND	0.05	mg/L	ND				20	
Sulphate	99.4	1	mg/L	99.3			0.1	10	
General Inorganics									
Alkalinity, total	276	5	mg/L	278			0.8	14	
Ammonia as N	0.535	0.01	mg/L	0.545			1.8	17.7	
Dissolved Organic Carbon	1.1	0.5	mg/L	1.0			6.9	37	
Colour	ND	2	TCU	ND				12	
Conductivity	774	5	uS/cm	794			2.5	11	
pH	7.8	0.1	pH Units	7.7			0.6	10	
Phenolics	ND	0.004	mg/L	ND				10	GEN02
Total Dissolved Solids	436	10	mg/L	416			4.7	10	
Sulphide	ND	0.02	mg/L	ND				10	
Tannin & Lignin	ND	0.1	mg/L	ND			0.0	11	
Total Kjeldahl Nitrogen	0.33	0.1	mg/L	0.38			14.2	10	QR-01
Turbidity	3.2	0.1	NTU	3.3			0.6	10	
Metals									
Mercury	ND	0.0001	mg/L	ND			0.0	20	
Aluminum	ND	0.001	mg/L	ND				20	
Antimony	0.0006	0.0005	mg/L	ND			0.0	20	
Arsenic	ND	0.001	mg/L	ND			0.0	20	
Barium	0.054	0.001	mg/L	0.057			4.1	20	
Beryllium	ND	0.0005	mg/L	ND			0.0	20	
Boron	0.08	0.01	mg/L	0.08			6.1	20	
Cadmium	ND	0.0001	mg/L	ND			0.0	20	
Calcium	110	0.1	mg/L	108			2.6	20	
Chromium (VI)	ND	0.010	mg/L	ND				20	
Chromium	ND	0.001	mg/L	ND			0.0	20	
Cobalt	ND	0.0005	mg/L	ND			0.0	20	
Copper	0.0008	0.0005	mg/L	0.0007			4.5	20	
Iron	ND	0.1	mg/L	ND			0.0	20	
Lead	0.0001	0.0001	mg/L	ND			0.0	20	
Magnesium	89.0	0.2	mg/L	88.5			0.6	20	
Manganese	ND	0.005	mg/L	ND			0.0	20	
Molybdenum	0.0014	0.0005	mg/L	0.0012			15.7	20	
Nickel	ND	0.001	mg/L	ND			0.0	20	
Potassium	4.2	0.1	mg/L	4.3			1.3	20	
Selenium	0.001	0.001	mg/L	0.001			1.0	20	
Silicon	6.52	0.01	mg/L	5.86			10.6	20	
Silver	ND	0.0001	mg/L	ND			0.0	20	
Sodium	56.4	0.2	mg/L	56.2			0.4	20	
Thallium	ND	0.001	mg/L	ND			0.0	20	
Tin	ND	0.01	mg/L	ND			0.0	20	
Titanium	ND	0.005	mg/L	ND			0.0	50	
Tungsten	ND	0.01	mg/L	ND			0.0	20	
Uranium	0.0055	0.0001	mg/L	0.0051			7.0	20	
Vanadium	ND	0.0005	mg/L	ND			0.0	20	
Zinc	0.012	0.005	mg/L	0.013			3.8	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL	ND				30	
Fecal Coliforms	ND	1	CFU/100 mL	ND				30	
Total Coliforms	ND	1	CFU/100 mL	ND				30	
Heterotrophic Plate Count	10	10	CFU/mL	10			0.0	30	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	9.84	1	mg/L		98.4	78-112			
Fluoride	1.25	0.1	mg/L	0.23	102	73-113			
Nitrate as N	1.81	0.1	mg/L	0.81	101	81-112			
Nitrite as N	0.964	0.05	mg/L	ND	96.4	76-107			
Sulphate	108	1	mg/L	99.3	89.9	75-111			
General Inorganics									
Ammonia as N	0.804	0.01	mg/L	0.545	104	81-124			
Dissolved Organic Carbon	11.7	0.5	mg/L	1.0	107	60-133			
Phenolics	0.024	0.001	mg/L		97.0	69-132			
Total Dissolved Solids	92.0	10	mg/L		92.0	75-125			
Sulphide	0.53	0.02	mg/L	ND	106	79-115			
Tannin & Lignin	1.0	0.1	mg/L	ND	97.8	71-113			
Total Kjeldahl Nitrogen	2.32	0.1	mg/L	0.38	97.2	81-126			
Metals									
Mercury	0.0030	0.0001	mg/L	ND	99.0	70-130			
Aluminum	65.9		ug/L	ND	132	80-120			QM-07
Antimony	58.9		ug/L	0.0294	118	80-120			
Arsenic	68.1		ug/L	0.278	136	80-120			QM-07
Barium	102		ug/L	56.6	90.3	80-120			
Beryllium	52.5		ug/L	0.0022	105	80-120			
Boron	122		ug/L	80.7	83.2	80-120			
Cadmium	53.2		ug/L		106	80-120			
Calcium	924		ug/L		92.4	80-120			
Chromium (VI)	0.185	0.010	mg/L	ND	92.5	70-130			
Chromium	52.6		ug/L		105	80-120			
Cobalt	57.4		ug/L	0.0186	115	80-120			
Copper	56.6		ug/L	0.738	112	80-120			
Iron	1100		ug/L		110	80-120			
Lead	50.2		ug/L	0.0376	100	80-120			
Magnesium	1010		ug/L		101	80-120			
Manganese	53.3		ug/L		107	80-120			
Molybdenum	60.8		ug/L	1.22	119	80-120			
Nickel	56.0		ug/L	0.109	112	80-120			
Potassium	5160		ug/L	4250	90.8	80-120			
Selenium	52.6		ug/L		105	80-120			
Silicon	45.1		ug/L		90.2	80-120			
Silver	48.0		ug/L	ND	96.0	80-120			
Sodium	1040		ug/L		104	80-120			
Thallium	51.9		ug/L	0.011	104	80-120			
Tin	53.3		ug/L		107	80-120			
Titanium	52.5		ug/L		105	70-130			
Tungsten	58.7		ug/L	0.20	117	80-120			
Uranium	50.8		ug/L		102	80-120			
Vanadium	52.8		ug/L		106	80-120			
Zinc	69.5		ug/L	12.6	114	80-120			

Qualifier Notes:

Sample Qualifiers :

QC Qualifiers :

GEN02 : Elevated Reporting Limit due to matrix interference.

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

QR-01 : Duplicate RPD is high, however, the sample result is less than 10x the MDL.

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.

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Certificate of Analysis

Houle Chevrier

32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Andrius Paznekas

Client PO:
Project: 61318.15
Custody: 6677

Report Date: 24-Oct-2017
Order Date: 18-Oct-2017

Order #: 1742435

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

Paracel ID	Client ID
1742435-01	NTW2- 3hr
1742435-02	NTW2- 6hr

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	20-Oct-17	20-Oct-17
Ammonia, as N	EPA 351.2 - Auto Colour	24-Oct-17	24-Oct-17
Anions	EPA 300.1 - IC	23-Oct-17	23-Oct-17
Chromium, hexavalent - water	MOE E3056 - colourimetric	20-Oct-17	20-Oct-17
Colour	SM2120 - Spectrophotometric	20-Oct-17	20-Oct-17
Conductivity	EPA 9050A- probe @25 °C	20-Oct-17	20-Oct-17
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	23-Oct-17	24-Oct-17
E. coli	MOE E3407	19-Oct-17	19-Oct-17
Fecal Coliform	SM 9222D	19-Oct-17	19-Oct-17
Heterotrophic Plate Count	SM 9215C	20-Oct-17	20-Oct-17
Mercury by CVAA	EPA 245.2 - Cold Vapour AA	23-Oct-17	23-Oct-17
Metals, ICP-MS	EPA 200.8 - ICP-MS	19-Oct-17	19-Oct-17
pH	EPA 150.1 - pH probe @25 °C	20-Oct-17	20-Oct-17
Phenolics	EPA 420.2 - Auto Colour, 4AAP	20-Oct-17	23-Oct-17
Subdivision Package	Hardness as CaCO3	19-Oct-17	19-Oct-17
Sulphide	SM 4500SE - Colourimetric	24-Oct-17	24-Oct-17
Tannin/Lignin	SM 5550B - Colourimetric	20-Oct-17	23-Oct-17
Total Coliform	MOE E3407	19-Oct-17	19-Oct-17
Total Dissolved Solids	SM 2540C - gravimetric, filtration	21-Oct-17	24-Oct-17
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	19-Oct-17	23-Oct-17
Turbidity	SM 2130B - Turbidity meter	19-Oct-17	19-Oct-17

Order #: 1742435

Certificate of Analysis
Client: Houle Chevrier
Client PO:

Report Date: 24-Oct-2017
Order Date: 18-Oct-2017
Project Description: 61318.15

	Client ID:	NTW2- 3hr	NTW2- 6hr	-	-
	Sample Date:	18-Oct-17	18-Oct-17	-	-
	Sample ID:	1742435-01	1742435-02	-	-
	MDL/Units	Drinking Water	Drinking Water	-	-
Microbiological Parameters					
E. coli	1 CFU/100 mL	ND	ND	-	-
Fecal Coliforms	1 CFU/100 mL	ND	ND	-	-
Total Coliforms	1 CFU/100 mL	ND	ND	-	-
Heterotrophic Plate Count	10 CFU/mL	<10	<10	-	-
General Inorganics					
Alkalinity, total	5 mg/L	293	294	-	-
Ammonia as N	0.01 mg/L	0.42	0.42	-	-
Dissolved Organic Carbon	0.5 mg/L	2.0	2.1	-	-
Colour	2 TCU	4	3	-	-
Conductivity	5 uS/cm	722	724	-	-
Hardness	mg/L	228	233	-	-
pH	0.1 pH Units	7.9	8.0	-	-
Phenolics	0.001 mg/L	<0.001	<0.001	-	-
Total Dissolved Solids	10 mg/L	434	426	-	-
Sulphide	0.02 mg/L	7.00	0.30	-	-
Tannin & Lignin	0.1 mg/L	0.8	0.2	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.5	0.5	-	-
Turbidity	0.1 NTU	4.1	12.9	-	-
Anions					
Chloride	1 mg/L	65	69	-	-
Fluoride	0.1 mg/L	0.7	0.7	-	-
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	21	20	-	-
Metals					
Mercury	0.0001 mg/L	-	<0.0001	-	-
Aluminum	0.001 mg/L	-	0.036	-	-
Antimony	0.0005 mg/L	-	<0.0005	-	-
Arsenic	0.001 mg/L	-	<0.001	-	-
Barium	0.001 mg/L	-	0.136	-	-
Beryllium	0.0005 mg/L	-	<0.0005	-	-
Boron	0.01 mg/L	-	0.14	-	-
Cadmium	0.0001 mg/L	-	<0.0001	-	-
Calcium	0.1 mg/L	46.1	48.7	-	-
Chromium	0.001 mg/L	-	<0.001	-	-

Certificate of Analysis
Client: Houle Chevrier
Client PO:

Report Date: 24-Oct-2017
Order Date: 18-Oct-2017
Project Description: 61318.15

Client ID: **Sample Date:** **Sample ID:**	**MDL/Units**	NTW2- 3hr 18-Oct-17 1742435-01 Drinking Water	NTW2- 6hr 18-Oct-17 1742435-02 Drinking Water	- - - -	- - - -
Chromium (VI)	0.010 mg/L	-	<0.010	-	-
Cobalt	0.0005 mg/L	-	<0.0005	-	-
Copper	0.0005 mg/L	-	0.0007	-	-
Iron	0.1 mg/L	<0.1	<0.1	-	-
Lead	0.0001 mg/L	-	<0.0001	-	-
Magnesium	0.2 mg/L	27.4	27.0	-	-
Manganese	0.005 mg/L	0.006	0.006	-	-
Molybdenum	0.0005 mg/L	-	<0.0005	-	-
Nickel	0.001 mg/L	-	<0.001	-	-
Potassium	0.1 mg/L	8.5	8.0	-	-
Selenium	0.001 mg/L	-	0.006	-	-
Silicon	0.01 mg/L	-	6.87	-	-
Silver	0.0001 mg/L	-	<0.0001	-	-
Sodium	0.2 mg/L	57.0	54.0	-	-
Strontium	0.01 mg/L	-	2.59	-	-
Thallium	0.001 mg/L	-	<0.001	-	-
Tin	0.01 mg/L	-	<0.01	-	-
Titanium	0.005 mg/L	-	<0.005	-	-
Tungsten	0.01 mg/L	-	<0.01	-	-
Uranium	0.0001 mg/L	-	<0.0001	-	-
Vanadium	0.0005 mg/L	-	<0.0005	-	-
Zinc	0.005 mg/L	-	0.006	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%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						
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									
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						
Calcium	ND	0.1	mg/L						
Chromium (VI)	ND	0.010	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						
Silicon	ND	0.01	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						
Tin	ND	0.01	mg/L						
Titanium	ND	0.005	mg/L						
Tungsten	ND	0.01	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/100 mL						
Fecal Coliforms	ND	1	CFU/100 mL						
Total Coliforms	ND	1	CFU/100 mL						
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	50.8	1	mg/L	50.7			0.2	10	
Fluoride	3.50	0.1	mg/L	3.54			1.1	10	
Nitrate as N	ND	0.1	mg/L	ND			0.0	20	
Nitrite as N	ND	0.05	mg/L	ND				20	
Sulphate	50.5	1	mg/L	50.5			0.0	10	
General Inorganics									
Alkalinity, total	287	5	mg/L	293			2.2	14	
Ammonia as N	0.078	0.01	mg/L	0.072			7.5	17.7	
Dissolved Organic Carbon	2.9	0.5	mg/L	3.1			4.8	37	
Colour	4	2	TCU	4			0.0	12	
Conductivity	709	5	uS/cm	722			1.9	11	
pH	7.9	0.1	pH Units	7.9			0.1	10	
Phenolics	ND	0.001	mg/L	ND				10	
Total Dissolved Solids	104	10	mg/L	100			3.9	10	
Sulphide	0.29	0.02	mg/L	0.30			2.7	10	
Tannin & Lignin	ND	0.1	mg/L	ND			0.0	11	
Total Kjeldahl Nitrogen	0.51	0.1	mg/L	0.54			4.3	10	
Turbidity	4.1	0.1	NTU	4.1			0.5	10	
Metals									
Mercury	ND	0.0001	mg/L	ND			0.0	20	
Aluminum	ND	0.001	mg/L	ND			0.0	20	
Antimony	0.0007	0.0005	mg/L	ND			0.0	20	
Arsenic	ND	0.001	mg/L	ND			0.0	20	
Barium	0.083	0.001	mg/L	0.084			0.7	20	
Beryllium	ND	0.0005	mg/L	ND			0.0	20	
Boron	0.05	0.01	mg/L	0.05			1.2	20	
Cadmium	ND	0.0001	mg/L	ND			0.0	20	
Calcium	84.3	0.1	mg/L	84.6			0.3	20	
Chromium (VI)	ND	0.010	mg/L	ND				20	
Chromium	ND	0.001	mg/L	ND			0.0	20	
Cobalt	ND	0.0005	mg/L	ND			0.0	20	
Copper	0.0363	0.0005	mg/L	0.0362			0.1	20	
Iron	0.2	0.1	mg/L	0.2			1.0	20	
Lead	0.0001	0.0001	mg/L	ND			0.0	20	
Magnesium	11.3	0.2	mg/L	11.3			0.1	20	
Manganese	0.068	0.005	mg/L	0.068			0.2	20	
Molybdenum	0.0014	0.0005	mg/L	0.0013			9.0	20	
Nickel	ND	0.001	mg/L	ND			0.0	20	
Potassium	9.0	0.1	mg/L	9.1			0.5	20	
Selenium	0.002	0.001	mg/L	0.002			4.3	20	
Silicon	3.37	1.00	mg/L	3.23			4.5	20	
Silver	ND	0.0001	mg/L	ND				20	
Sodium	10.8	0.2	mg/L	10.7			0.4	20	
Thallium	ND	0.001	mg/L	ND			0.0	20	
Tin	ND	0.01	mg/L	ND			0.0	20	
Titanium	ND	0.005	mg/L	ND			0.0	50	
Tungsten	ND	0.01	mg/L	ND			0.0	20	
Uranium	0.0051	0.0001	mg/L	0.0048			6.1	20	
Vanadium	ND	0.0005	mg/L	ND			0.0	20	
Zinc	0.014	0.005	mg/L	0.015			9.3	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL	ND				30	
Fecal Coliforms	ND	1	CFU/100 mL	ND				30	
Total Coliforms	ND	1	CFU/100 mL	ND				30	
Heterotrophic Plate Count	ND	10	CFU/mL	ND				30	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	60.2	1	mg/L	50.7	94.9	78-112			
Fluoride	4.52	0.1	mg/L	3.54	97.3	73-113			
Nitrate as N	1.03	0.1	mg/L	ND	103	81-112			
Nitrite as N	0.975	0.05	mg/L	ND	97.5	76-107			
Sulphate	59.6	1	mg/L	50.5	91.8	75-111			
General Inorganics									
Ammonia as N	0.348	0.01	mg/L	0.072	110	81-124			
Dissolved Organic Carbon	13.5	0.5	mg/L	2.9	106	60-133			
Phenolics	0.024	0.001	mg/L	ND	97.3	69-132			
Total Dissolved Solids	106	10	mg/L		106	75-125			
Sulphide	0.73	0.02	mg/L	0.30	85.6	79-115			
Tannin & Lignin	1.0	0.1	mg/L	ND	97.8	71-113			
Total Kjeldahl Nitrogen	2.57	0.1	mg/L	0.54	102	81-126			
Metals									
Mercury	0.0030	0.0001	mg/L	ND	99.0	70-130			
Aluminum	61.2		ug/L	0.042	122	80-120			QM-07
Antimony	56.0		ug/L	0.491	111	80-120			
Arsenic	65.8		ug/L	0.665	130	80-120			QM-07
Barium	134		ug/L	83.6	102	80-120			
Beryllium	57.3		ug/L	0.0167	115	80-120			
Boron	105		ug/L	54.5	101	80-120			
Cadmium	58.9		ug/L	0.0024	118	80-120			
Calcium	942		ug/L		94.2	80-120			
Chromium (VI)	0.175	0.010	mg/L	ND	87.5	70-130			
Chromium	60.2		ug/L	0.294	120	80-120			
Cobalt	57.1		ug/L	0.0967	114	80-120			
Copper	90.4		ug/L	36.2	108	80-120			
Iron	1450		ug/L	223	122	80-120			QM-07
Lead	54.3		ug/L	0.0871	108	80-120			
Magnesium	964		ug/L		96.4	80-120			
Manganese	124		ug/L	68.0	111	80-120			
Molybdenum	57.6		ug/L	1.28	113	80-120			
Nickel	57.1		ug/L	0.664	113	80-120			
Potassium	9730		ug/L	9060	67.0	80-120			QM-07
Selenium	47.9		ug/L		95.7	80-120			
Silicon	47.1		ug/L		94.1	80-120			
Silver	56.3		ug/L	ND	113	80-120			
Sodium	942		ug/L		94.2	80-120			
Thallium	57.2		ug/L	0.009	114	80-120			
Tin	58.4		ug/L	ND	117	80-120			
Titanium	48.5		ug/L		97.0	70-130			
Tungsten	57.3		ug/L	0.03	115	80-120			
Uranium	48.4		ug/L		96.8	80-120			
Vanadium	61.4		ug/L	0.324	122	80-120			QM-07
Zinc	73.7		ug/L	15.3	117	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.

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Certificate of Analysis

Houle Chevrier

32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Andrius Paznekas

Client PO:
Project: 61318.15
Custody: 6678

Report Date: 26-Oct-2017
Order Date: 19-Oct-2017

Order #: 1742503

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

Paracel ID	Client ID
1742503-01	NTW1-3 hr
1742503-02	NTW1-6 hr

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	20-Oct-17	20-Oct-17
Ammonia, as N	EPA 351.2 - Auto Colour	24-Oct-17	24-Oct-17
Anions	EPA 300.1 - IC	23-Oct-17	23-Oct-17
Chromium, hexavalent - water	MOE E3056 - colourimetric	20-Oct-17	20-Oct-17
Colour	SM2120 - Spectrophotometric	20-Oct-17	20-Oct-17
Conductivity	EPA 9050A- probe @25 ℃	20-Oct-17	20-Oct-17
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	23-Oct-17	24-Oct-17
E. coli	MOE E3407	19-Oct-17	19-Oct-17
Fecal Coliform	SM 9222D	19-Oct-17	19-Oct-17
Heterotrophic Plate Count	SM 9215C	20-Oct-17	20-Oct-17
Mercury by CVAA	EPA 245.2 - Cold Vapour AA	23-Oct-17	23-Oct-17
Metals, ICP-MS	EPA 200.8 - ICP-MS	24-Oct-17	24-Oct-17
pH	EPA 150.1 - pH probe @25 ℃	20-Oct-17	20-Oct-17
Phenolics	EPA 420.2 - Auto Colour, 4AAP	20-Oct-17	23-Oct-17
Subdivision Package	Hardness as CaCO3	24-Oct-17	24-Oct-17
Sulphide	SM 4500SE - Colourimetric	24-Oct-17	24-Oct-17
Tannin/Lignin	SM 5550B - Colourimetric	20-Oct-17	23-Oct-17
Total Coliform	MOE E3407	19-Oct-17	19-Oct-17
Total Dissolved Solids	SM 2540C - gravimetric, filtration	21-Oct-17	24-Oct-17
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	19-Oct-17	23-Oct-17
Turbidity	SM 2130B - Turbidity meter	19-Oct-17	19-Oct-17

Order #: 1742503

Certificate of Analysis

Client: Houle Chevrier

Client PO:

Report Date: 26-Oct-2017

Order Date: 19-Oct-2017

Project Description: 61318.15

Client ID:		NTW1-3 hr	NTW1-6 hr	-	-
Sample Date:		19-Oct-17	19-Oct-17	-	-
Sample ID:		1742503-01	1742503-02	-	-
	MDL/Units	Drinking Water	Drinking Water	-	-
Microbiological Parameters					
E. coli	1 CFU/100 mL	ND	ND	-	-
Fecal Coliforms	1 CFU/100 mL	ND	ND	-	-
Total Coliforms	1 CFU/100 mL	ND	ND	-	-
Heterotrophic Plate Count	10 CFU/mL	<10	10	-	-
General Inorganics					
Alkalinity, total	5 mg/L	294	292	-	-
Ammonia as N	0.01 mg/L	0.11	0.10	-	-
Dissolved Organic Carbon	0.5 mg/L	2.8	2.4	-	-
Colour	2 TCU	9	5	-	-
Conductivity	5 uS/cm	733	710	-	-
Hardness	mg/L	332	332	-	-
pH	0.1 pH Units	8.0	8.0	-	-
Phenolics	0.001 mg/L	<0.001	<0.001	-	-
Total Dissolved Solids	10 mg/L	480	502	-	-
Sulphide	0.02 mg/L	0.25	0.39	-	-
Tannin & Lignin	0.1 mg/L	<0.1	<0.1	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.2	0.2	-	-
Turbidity	0.1 NTU	14.2	3.9	-	-
Anions					
Chloride	1 mg/L	56	57	-	-
Fluoride	0.1 mg/L	0.5	0.5	-	-
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	44	44	-	-
Metals					
Mercury	0.0001 mg/L	-	<0.0001	-	-
Aluminum	0.001 mg/L	-	0.030	-	-
Antimony	0.0005 mg/L	-	<0.0005	-	-
Arsenic	0.001 mg/L	-	<0.001	-	-
Barium	0.001 mg/L	-	0.332	-	-
Beryllium	0.0005 mg/L	-	<0.0005	-	-
Boron	0.01 mg/L	-	0.03	-	-
Cadmium	0.0001 mg/L	-	<0.0001	-	-
Calcium	0.1 mg/L	93.8	93.6	-	-
Chromium	0.001 mg/L	-	<0.001	-	-

Certificate of Analysis

Client: Houle Chevrier

Client PO:

Report Date: 26-Oct-2017

Order Date: 19-Oct-2017

Project Description: 61318.15

Client ID:		NTW1-3 hr	NTW1-6 hr	-	-
Sample Date:		19-Oct-17	19-Oct-17	-	-
Sample ID:		1742503-01	1742503-02	-	-
	MDL/Units	Drinking Water	Drinking Water	-	-
Chromium (VI)	0.010 mg/L	-	<0.010	-	-
Cobalt	0.0005 mg/L	-	<0.0005	-	-
Copper	0.0005 mg/L	-	<0.0005	-	-
Iron	0.1 mg/L	1	0.3	-	-
Lead	0.0001 mg/L	-	<0.0001	-	-
Magnesium	0.2 mg/L	23.7	23.8	-	-
Manganese	0.005 mg/L	0.057	0.057	-	-
Molybdenum	0.0005 mg/L	-	<0.0005	-	-
Nickel	0.001 mg/L	-	<0.001	-	-
Potassium	0.1 mg/L	3.0	3.0	-	-
Selenium	0.001 mg/L	-	<0.001	-	-
Silicon	0.01 mg/L	-	10.0	-	-
Silver	0.0001 mg/L	-	<0.0001	-	-
Sodium	0.2 mg/L	19.2	19.9	-	-
Strontium	0.01 mg/L	-	0.73	-	-
Thallium	0.001 mg/L	-	<0.001	-	-
Tin	0.01 mg/L	-	<0.01	-	-
Titanium	0.005 mg/L	-	<0.005	-	-
Tungsten	0.01 mg/L	-	<0.01	-	-
Uranium	0.0001 mg/L	-	0.0001	-	-
Vanadium	0.0005 mg/L	-	<0.0005	-	-
Zinc	0.005 mg/L	-	<0.005	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%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						
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									
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						
Calcium	ND	0.1	mg/L						
Chromium (VI)	ND	0.010	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						
Silicon	ND	0.01	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						
Tin	ND	0.01	mg/L						
Titanium	ND	0.005	mg/L						
Tungsten	ND	0.01	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/100 mL						
Fecal Coliforms	ND	1	CFU/100 mL						
Total Coliforms	ND	1	CFU/100 mL						
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	50.8	1	mg/L	50.7			0.2	10	
Fluoride	3.50	0.1	mg/L	3.54			1.1	10	
Nitrate as N	ND	0.1	mg/L	ND			0.0	20	
Nitrite as N	ND	0.05	mg/L	ND				20	
Sulphate	50.5	1	mg/L	50.5			0.0	10	
General Inorganics									
Alkalinity, total	287	5	mg/L	293			2.2	14	
Ammonia as N	0.078	0.01	mg/L	0.072			7.5	17.7	
Dissolved Organic Carbon	2.9	0.5	mg/L	3.1			4.8	37	
Colour	4	2	TCU	4			0.0	12	
Conductivity	709	5	uS/cm	722			1.9	11	
pH	7.9	0.1	pH Units	7.9			0.1	10	
Phenolics	ND	0.001	mg/L	ND				10	
Total Dissolved Solids	104	10	mg/L	100			3.9	10	
Sulphide	0.29	0.02	mg/L	0.30			2.7	10	
Tannin & Lignin	ND	0.1	mg/L	ND			0.0	11	
Total Kjeldahl Nitrogen	0.51	0.1	mg/L	0.54			4.3	10	
Turbidity	0.3	0.1	NTU	0.3			3.8	10	
Metals									
Mercury	ND	0.0001	mg/L	ND			0.0	20	
Aluminum	0.023	0.001	mg/L	0.024			2.1	20	
Antimony	ND	0.0005	mg/L	ND			0.0	20	
Arsenic	ND	0.001	mg/L	ND			0.0	20	
Barium	0.015	0.001	mg/L	0.015			1.7	20	
Beryllium	ND	0.0005	mg/L	ND			0.0	20	
Boron	ND	0.01	mg/L	ND			0.0	20	
Cadmium	ND	0.0001	mg/L	ND			0.0	20	
Calcium	9.0	0.1	mg/L	9.4			4.1	20	
Chromium (VI)	ND	0.010	mg/L	ND				20	
Chromium	ND	0.001	mg/L	ND			0.0	20	
Cobalt	ND	0.0005	mg/L	ND			0.0	20	
Copper	0.0429	0.0005	mg/L	0.0425			0.8	20	
Iron	ND	0.1	mg/L	ND			0.0	20	
Lead	0.0100	0.0001	mg/L	0.0104			3.4	20	
Magnesium	2.2	0.2	mg/L	2.1			1.3	20	
Manganese	ND	0.005	mg/L	ND			0.0	20	
Molybdenum	0.0007	0.0005	mg/L	0.0011			48.7	20	QR-01
Nickel	ND	0.001	mg/L	ND			0.0	20	
Potassium	0.7	0.1	mg/L	0.7			0.5	20	
Selenium	ND	0.001	mg/L	ND			0.0	20	
Silicon	2.11	0.01	mg/L	2.28			7.8	20	
Silver	0.0001	0.0001	mg/L	ND			0.0	20	
Sodium	10.4	0.2	mg/L	10.3			1.6	20	
Thallium	ND	0.001	mg/L	ND			0.0	20	
Tin	ND	0.01	mg/L	ND			0.0	20	
Titanium	ND	0.005	mg/L	ND			0.0	50	
Tungsten	ND	0.01	mg/L	ND			0.0	20	
Uranium	ND	0.0001	mg/L	ND			0.0	20	
Vanadium	ND	0.0005	mg/L	ND			0.0	20	
Zinc	0.022	0.005	mg/L	0.023			1.0	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL	ND				30	
Fecal Coliforms	ND	1	CFU/100 mL	ND				30	
Total Coliforms	ND	1	CFU/100 mL	ND				30	
Heterotrophic Plate Count	ND	10	CFU/mL	ND				30	

Certificate of Analysis
Client: Houle Chevrier
Client PO:

Report Date: 26-Oct-2017
Order Date: 19-Oct-2017
Project Description: 61318.15

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	60.2	1	mg/L	50.7	94.9	78-112			
Fluoride	4.52	0.1	mg/L	3.54	97.3	73-113			
Nitrate as N	1.03	0.1	mg/L	ND	103	81-112			
Nitrite as N	0.975	0.05	mg/L	ND	97.5	76-107			
Sulphate	59.6	1	mg/L	50.5	91.8	75-111			
General Inorganics									
Ammonia as N	0.348	0.01	mg/L	0.072	110	81-124			
Dissolved Organic Carbon	13.5	0.5	mg/L	2.9	106	60-133			
Phenolics	0.024	0.001	mg/L	ND	97.3	69-132			
Total Dissolved Solids	106	10	mg/L		106	75-125			
Sulphide	0.73	0.02	mg/L	0.30	85.6	79-115			
Tannin & Lignin	1.0	0.1	mg/L	ND	97.8	71-113			
Total Kjeldahl Nitrogen	2.57	0.1	mg/L	0.54	102	81-126			
Metals									
Mercury	0.0030	0.0001	mg/L	ND	99.0	70-130			
Aluminum	80.4		ug/L	23.9	113	80-120			
Antimony	56.7		ug/L	0.119	113	80-120			
Arsenic	58.3		ug/L	0.269	116	80-120			
Barium	67.4		ug/L	15.0	105	80-120			
Beryllium	57.0		ug/L	0.0455	114	80-120			
Boron	61.7		ug/L	5.27	113	80-120			
Cadmium	53.8		ug/L	0.0281	108	80-120			
Calcium	1820		ug/L	663	116	80-120			
Chromium (VI)	0.175	0.010	mg/L	ND	87.5	70-130			
Chromium	55.0		ug/L	0.241	110	80-120			
Cobalt	53.3		ug/L	0.0433	106	80-120			
Copper	92.2		ug/L	42.5	99.4	80-120			
Iron	1100		ug/L	34	107	80-120			
Lead	62.5		ug/L	10.4	104	80-120			
Magnesium	3130		ug/L	2150	97.8	80-120			
Manganese	58.9		ug/L	3.12	112	80-120			
Molybdenum	50.0		ug/L	1.10	97.7	80-120			
Nickel	52.5		ug/L	0.247	105	80-120			
Potassium	1800		ug/L	747	105	80-120			
Selenium	58.0		ug/L	0.235	116	80-120			
Silicon	47.2		ug/L		94.4	80-120			
Silver	51.1		ug/L	0.0499	102	80-120			
Sodium	11100		ug/L	10300	88.2	80-120			
Thallium	53.7		ug/L	0.063	107	80-120			
Tin	52.6		ug/L	0.74	104	80-120			
Titanium	45.5		ug/L		91.0	70-130			
Tungsten	52.8		ug/L	0.49	105	80-120			
Uranium	55.4		ug/L	ND	111	80-120			
Vanadium	55.8		ug/L	0.105	111	80-120			
Zinc	77.7		ug/L	22.7	110	80-120			

Qualifier Notes:

Login Qualifiers :

Container(s) - Bottle and COC sample ID don't match - Bottle reads as NTW1- 6 hr instead of NTW2- 6 hr.

Applies to samples: NTW1-6 hr

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.

QR-01 : Duplicate RPD is high, however, the sample result is less than 10x the MDL.

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.

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Certificate of Analysis

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

Client PO:
Project: 61318.15
Custody: 7612

Report Date: 10-Nov-2017
Order Date: 8-Nov-2017

Order #: 1745366

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

Paracel ID	Client ID
1745366-01	TW1-R1

Approved By:

Dale Robertson, BSc
Laboratory Director

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
E. coli	MOE E3407	9-Nov-17	9-Nov-17
Fecal Coliform	SM 9222D	9-Nov-17	9-Nov-17
Heterotrophic Plate Count	SM 9215C	8-Nov-17	8-Nov-17
Total Coliform	MOE E3407	9-Nov-17	9-Nov-17

Certificate of Analysis
Client: GEMTEC Consulting Engineers and Scientists Limited
Client PO:

Report Date: 10-Nov-2017
Order Date: 8-Nov-2017
Project Description: 61318.15

	Client ID:	TW1-R1	-	-	-
	Sample Date:	08-Nov-17	-	-	-
	Sample ID:	1745366-01	-	-	-
	MDL/Units	Drinking Water	-	-	-
Microbiological Parameters					
E. coli	1 CFU/100 mL	ND	-	-	-
Fecal Coliforms	1 CFU/100 mL	ND	-	-	-
Total Coliforms	1 CFU/100 mL	ND	-	-	-
Heterotrophic Plate Count	10 CFU/mL	<10	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL						
Fecal Coliforms	ND	1	CFU/100 mL						
Total Coliforms	ND	1	CFU/100 mL						
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
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL	ND				30	
Fecal Coliforms	ND	1	CFU/100 mL	ND				30	
Total Coliforms	ND	1	CFU/100 mL	ND				30	
Heterotrophic Plate Count	ND	10	CFU/mL	ND				30	

Qualifier Notes:

Sample Qualifiers :

QC Qualifiers :

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.

LABORATORIES LTD

REPORT OF ANALYSIS

Client: **Morey Houle Chevrier Engineering**
28 Clothier St E., Unit B, Box 910
Kemptville, ON
K0G 1J0
Attention: Mr. Randy Morey

Report Number: 2420554
Date: 2004-11-11
Date Submitted: 2004-10-26

Project: 031-040

P.O. Number:
Matrix: Water

			350540					GUIDELINE		
			2004-10-23							
			TW #3							
PARAMETER	UNITS	MDL						TYPE	LIMIT	UNITS
Picloram	ug/L	5	<5							
CARBAMATES										
Aldicarb	ug/L	9	<9							
Bendiocarb	ug/L	2	<2							
Carbaryl	ug/L	5	<5							
Carbofuran	ug/L	5	<5							
TRIAZINE & RELATED HERBICIDES										
Alachlor	ug/L	0.5	<0.5							
Atrazine	ug/L	0.2	<0.2							
De-ethylated atrazine	ug/L	0.5	<0.5							
Atrazine + *N*-dealkylated metabolites	ug/L	0.2	<0.2							
Cyanazine	ug/L	1	<1							
Metolachlor	ug/L	0.5	<0.5							
Metribuzin	ug/L	5	<5							
Prometryne	ug/L	0.25	<0.25							
Simazine	ug/L	1	<1							
ORGANOPHOSPHOROUS PESTICIDES										
Azinphos-methyl	ug/L	2	<2							
Chlorpyrifos	ug/L	1	<1							
Diazinon	ug/L	1	<1							
Diclofop-methyl	ug/L	0.9	<0.9							
Dimethoate	ug/L	2.5	<2.5							
Malathion	ug/L	5	<5							
Parathion	ug/L	1	<1							
Phorate	ug/L	0.5	<0.5							
Temephos	ug/L	10	<10							
Terbufos	ug/L	0.4	<0.4							
Triallate	ug/L	1	<1							
Trifluralin	ug/L	1	<1							

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

APPROVAL:
Mina Nasrai

REPORT OF ANALYSIS

Client: **Morey Houle Chevrier Engineering**
28 Clothier St E., Unit B, Box 910
Kemptville, ON
K0G 1J0
Attention: **Mr. Randy Morey**

Report Number: 2420554
Date: 2004-11-11
Date Submitted: 2004-10-26

Project: 031-040

P.O. Number:
Matrix: Water

		LAB ID:	350540					GUIDELINE		
		Sample Date:	2004-10-23							
		Sample ID:	TW #3							
PARAMETER	UNITS	MDL						TYPE	LIMIT	UNITS
Organochlorine Pesticides (OCPs) & PCBs										
Aldrin	ug/L	0.006	<0.006							
Dieldrin	ug/L	0.006	<0.006							
Aldrin + Dieldrin	ug/L	0.012	<0.012							
a-chlordane	ug/L	0.006	<0.006							
g-chlordane	ug/L	0.006	<0.006							
Oxychlordane	ug/L	0.006	<0.006							
Chlordane (Total)	ug/L	0.018	<0.018							
op-DDT	ug/L	0.006	<0.006							
pp-DDD	ug/L	0.006	<0.006							
pp-DDE	ug/L	0.006	<0.005							
pp-DDT	ug/L	0.006	<0.006							
(DDT) + Metabolites	ug/L	0.024	<0.024							
Heptachlor	ug/L	0.006	<0.006							
Heptachlor epoxide	ug/L	0.006	<0.006							
Heptachlor + Heptachlor Epoxide	ug/L	0.012	<0.012							
Lindane	ug/L	0.006	<0.006							
Methoxychlor	ug/L	0.024	<0.024							
Polychlorinated Biphenyls (PCBs)	ug/L	0.1	<0.1							
CHLOROPHENOLS										
2,3,4,6-tetrachlorophenol	ug/L	0.5	<0.5							
2,4,6-trichlorophenol	ug/L	0.5	<0.5							
2,4-dichlorophenol	ug/L	0.5	<0.5							
Pentachlorophenol	ug/L	0.5	<0.5							
PHENOXYACID HERBICIDES										
2,4,5-trichlorophenoxyacetic acid (2,4,5-T)	ug/L	1	<1							
2,4-dichlorophenoxyacetic acid (2,4-D)	ug/L	1	<1							
Bromoxynil	ug/L	0.5	<0.5							
Dicamba	ug/L	1	<1							
Dinoseb	ug/L	1	<1							

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

APPROVAL:
Mina Nasrai

LABORATORIES LTD

REPORT OF ANALYSIS

Client. Morey Houle Chevrier Engineering
28 Clothier St E., Unit B, Box 910
Kemptville, ON
K0G 1J0
Attention: **Mr. Randy Morey**

Report Number: 2420554
Date: 2004-11-11
Date Submitted: 2004-10-26

Project: 031-040

P.O. Number:
Matrix: Water

		LAB ID:	350540					GUIDELINE		
		Sample Date:	2004-10-23							
		Sample ID:	TW #3							
PARAMETER	UNITS	MDL						TYPE	LIMIT	UNITS
DIURON & GLYPHOSATE										
Diuron	ug/L	10	<10							
Glyphosate	ug/L	10	<10							
DIQUAT & PARAQUAT										
Diquat	ug/L	7	<7							
Paraquat	ug/L	1	<1							
BENZO (a) PYRENE										
Benzo(a)pyrene	ug/L	0.01	<0.01							

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration
Comment:

APPROVAL:

ACCUTEST LABORATORIES LTD

REPORT OF ANALYSIS

lient: Morey Houle Chevrier Engineering
28 Clothier St E., Unit B, Box 910
Kemptville, ON
K0G 1J0
ttention: Mr. Randy Morey

Report Number: 2420554
Date: 2004-11-11
Date Submitted: 2004-10-26

Project: 031-040

P.O. Number:
Matrix: Water

		LAB ID:	350534	350535	350536	350537	350538	GUIDELINE		
		Sample Date:	2004-10-23	2004-10-23	2004-10-23	2004-10-23	2004-10-23			
		Sample ID:	TW #1 Deep	TW #1 Shallow	TW#2 Deep	TW #2 Shallow	TW #3 Deep			
PARAMETER	UNITS	MDL						TYPE	LIMIT	UNITS
NO3 (Nitrate)	mg/L	0.10	9.47	4.12	<0.10	<0.10	<0.10			

IL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration
mment:

APPROVAL
Ewan McRobbie

ACCUTEST LABORATORIES LTD

REPORT OF ANALYSIS

Client: Morey Houle Chevrier Engineering
28 Clothier St E., Unit B, Box 910
Kemptville, ON
K0G 1J0
Attention: Mr. Randy Morey

Report Number: 2420554
Date: 2004-11-11
Date Submitted: 2004-10-26

Project: 031-040

P.O. Number:
Matrix: Water

			350539	350541	350542	350543		GUIDELINE		
			2004-10-23	2004-10-23	2004-10-23	2004-10-23				
			TW #3 Shallow	TW #4 Deep	TW #4 Shallow	TW #5 Shallow				
PARAMETER	UNITS	MDL						TYPE	LIMIT	UNITS
N-NO3 (Nitrate)	mg/L	0.10	<0.10	5.76	12.5	<0.10				

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration
Comment:

APPROVAL:

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

CLIENT NAME: HOULE CHEVRIER
32 STEACIE DRIVE
OTTAWA, ON K2K2A9
(613) 836-1422

ATTENTION TO: James Mcewen

PROJECT: 61318.13

AGAT WORK ORDER: 16Z104077

WATER ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

DATE REPORTED: Jun 15, 2016

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

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

Certificate of Analysis

AGAT WORK ORDER: 16Z104077

PROJECT: 61318.13

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

CLIENT NAME: HOULE CHEVRIER

SAMPLING SITE:

ATTENTION TO: James Mcewen

SAMPLED BY:

Inorganic Chemistry (Water)

DATE RECEIVED: 2016-06-10

DATE REPORTED: 2016-06-15

			SAMPLE DESCRIPTION:	MW1S	MW1D	MW2S	MW2D	MW3S	MW3D	MW4S	MW4D
			SAMPLE TYPE:	Water	Water	Water	Water	Water	Water	Water	Water
			DATE SAMPLED:	6/9/2016	6/9/2016	6/9/2016	6/9/2016	6/9/2016	6/9/2016	6/9/2016	6/9/2016
Parameter	**Unit**	**G / S**	**RDL**	**7622716**	**7622747**	**7622759**	**7622761**	**7622763**	**7622765**	**7622766**	**7622767**
Nitrate as N	mg/L		0.05	2.56	7.86	<0.05	<0.05	<0.05	<0.05	5.75	3.02
Nitrite as N	mg/L		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ammonia as N	mg/L		0.02	<0.02	<0.02	0.07	0.04	<0.02	0.07	<0.02	<0.02
Total Kjeldahl Nitrogen	mg/L		0.10	0.14	0.18	0.16	0.18	0.46	0.16	0.23	<0.10

			SAMPLE DESCRIPTION:	MW5S	MW6D	MW6S
			SAMPLE TYPE:	Water	Water	Water
			DATE SAMPLED:	6/9/2016	6/9/2016	6/9/2016
Parameter	**Unit**	**G / S**	**RDL**	**7622769**	**7622770**	**7622771**
Nitrate as N	mg/L		0.05	<0.05	2.17	1.32
Nitrite as N	mg/L		0.05	<0.05	<0.05	<0.05
Ammonia as N	mg/L		0.02	<0.02	<0.02	<0.02
Total Kjeldahl Nitrogen	mg/L		0.10	<0.10	0.18	0.18

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

Certified By: Amanjot Bhela

Quality Assurance

CLIENT NAME: HOULE CHEVRIER
PROJECT: 61318.13
SAMPLING SITE:

AGAT WORK ORDER: 16Z104077
ATTENTION TO: James Mcewen
SAMPLED BY:

Water Analysis

RPT Date: Jun 15, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Inorganic Chemistry (Water)															
Nitrate as N	7624586		<0.5	<0.5	NA	< 0.05	95%	90%	110%	102%	90%	110%	109%	80%	120%
Nitrite as N	7624586		<0.5	<0.5	NA	< 0.05	NA	90%	110%	98%	90%	110%	96%	80%	120%
Ammonia as N	7622761	7622761	0.04	0.03	NA	< 0.02	97%	90%	110%	97%	90%	110%	98%	80%	120%
Total Kjeldahl Nitrogen	7618516		2.86	3.04	6.1%	< 0.10	100%	80%	120%	104%	80%	120%	99%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Amanjot Bhela

Method Summary

CLIENT NAME: HOULE CHEVRIER
PROJECT: 61318.13
SAMPLING SITE:

AGAT WORK ORDER: 16Z104077
ATTENTION TO: James Mcewen
SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Nitrate as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Ammonia as N	INOR-93-6059	QuikChem 10-107-06-1-J & SM 4500 NH3-F	LACHAT FIA
Total Kjeldahl Nitrogen	INOR-93-6048	QuikChem 10-107-06-2-I & SM 4500-Norg D	LACHAT FIA

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FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: HOULE CHEVRIER
32 STEACIE DRIVE
OTTAWA, ON K2K2A9
(613) 836-1422

ATTENTION TO: Shaun Pelkey

PROJECT: 63978.96

AGAT WORK ORDER: 16Z111851

WATER ANALYSIS REVIEWED BY: Sofka Pehlyova, Senior Analyst

DATE REPORTED: Jul 07, 2016

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

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 16Z111851
PROJECT: 63978.96

CLIENT NAME: HOULE CHEVRIER
SAMPLING SITE:

ATTENTION TO: Shaun Pelkey
SAMPLED BY:Andrius Paznekas

Inorganic Chemistry (Water)

DATE RECEIVED: 2016-07-04

DATE REPORTED: 2016-07-07

			SAMPLE DESCRIPTION:	SW-1	SW-2
			SAMPLE TYPE:	Water	Water
			DATE SAMPLED:	6/30/2016	6/30/2016
Parameter	**Unit**	**G / S**	**RDL**	**7679403**	**7679416**
Nitrate as N	mg/L		0.05	<0.05	0.34
Nitrite as N	mg/L		0.05	<0.05	<0.05
(Nitrate + Nitrite) as N	mg/L		0.07	<0.07	0.34
Ammonia as N	mg/L		0.02	0.02	<0.02
Total Kjeldahl Nitrogen	mg/L		0.10	1.23	0.38

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

Certified By: Sofia Pehlyova

Quality Assurance

CLIENT NAME: HOULE CHEVRIER
PROJECT: 63978.96
SAMPLING SITE:

AGAT WORK ORDER: 16Z111851
ATTENTION TO: Shaun Pelkey
SAMPLED BY:Andrius Paznekas

Water Analysis

RPT Date: Jul 07, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Inorganic Chemistry (Water)															
Nitrate as N	7674259		<0.25	<0.25	NA	< 0.05	101%	90%	110%	108%	90%	110%	103%	80%	120%
Nitrite as N	7674259		<0.25	<0.25	NA	< 0.05	NA	90%	110%	96%	90%	110%	97%	80%	120%
Ammonia as N	7681819		18.1	19.0	4.9%	< 0.02	103%	90%	110%	105%	90%	110%	99%	80%	120%
Total Kjeldahl Nitrogen	7679403	7679403	1.23	1.15	6.7%	< 0.10	101%	80%	120%	94%	80%	120%	95%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Sofia Pehlyova

Method Summary

CLIENT NAME: HOULE CHEVRIER

PROJECT: 63978.96

SAMPLING SITE:

AGAT WORK ORDER: 16Z111851

ATTENTION TO: Shaun Pelkey

SAMPLED BY:Andrius Paznekas

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Nitrate as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
(Nitrate + Nitrite) as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Ammonia as N	INOR-93-6059	QuikChem 10-107-06-1-J & SM 4500 NH3-F	LACHAT FIA
Total Kjeldahl Nitrogen	INOR-93-6048	QuikChem 10-107-06-2-I & SM 4500-Norg D	LACHAT FIA

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Certificate of Analysis

Houle Chevrier

32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Nicole Soucy

Client PO:
Project: 61318.15
Custody: 37861

Report Date: 26-Jul-2017
Order Date: 21-Jul-2017

Order #: 1729552

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

Paracel ID	Client ID
1729552-01	MW1-S
1729552-02	MW1-D
1729552-03	MW2-S
1729552-04	MW2-D
1729552-05	MW3-S
1729552-06	MW3-D
1729552-07	MW5-S
1729552-08	MW6-S
1729552-09	MW6-D

MW 3S and 3D MISLABELLED! Switch

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: Houle Chevrier
Client PO:

Report Date: 26-Jul-2017
Order Date: 21-Jul-2017
Project Description: 61318.15

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC	24-Jul-17	24-Jul-17
Metals, ICP-MS	EPA 200.8 - ICP-MS	25-Jul-17	25-Jul-17

Certificate of Analysis
Client: Houle Chevrier
Client PO:

Report Date: 26-Jul-2017
Order Date: 21-Jul-2017
Project Description: 61318.15

	Client ID: **Sample Date:** **Sample ID:** **MDL/Units**	MW1-S 21-Jul-17 1729552-01 Water	MW1-D 21-Jul-17 1729552-02 Water	MW2-S 21-Jul-17 1729552-03 Water	MW2-D 21-Jul-17 1729552-04 Water
Anions					
Chloride	1 mg/L	<1	36	-	-
Fluoride	0.1 mg/L	<0.1	<0.1	-	-
Nitrate as N	0.1 mg/L	2.1	7.3	<0.1	<0.1
Nitrite as N	0.05 mg/L	<0.05	<0.05	<0.05	<0.05
Sulphate	1 mg/L	4	38	-	-
Metals					
Calcium	100 ug/L	40600	93600	-	-
Magnesium	200 ug/L	6980	17800	-	-
Sodium	200 ug/L	11400	28800	-	-

	Client ID: **Sample Date:** **Sample ID:** **MDL/Units**	MW3-S 21-Jul-17 1729552-05 Water	MW3-D 21-Jul-17 1729552-06 Water	MW5-S 21-Jul-17 1729552-07 Water	MW6-S 21-Jul-17 1729552-08 Water
Anions					
Nitrate as N	0.1 mg/L	<0.1	<0.1	<0.1	<0.1
Nitrite as N	0.05 mg/L	<0.05	<0.05	<0.05	<0.05

	Client ID: **Sample Date:** **Sample ID:** **MDL/Units**	MW6-D 21-Jul-17 1729552-09 Water	- - - -	- - - -	- - - -
Anions					
Nitrate as N	0.1 mg/L	0.5	-	-	-
Nitrite as N	0.05 mg/L	<0.05	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%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						
Metals									
Calcium	ND	100	ug/L						
Magnesium	ND	200	ug/L						
Sodium	ND	200	ug/L						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	328	5	mg/L	323			1.7	10	
Fluoride	ND	0.1	mg/L	ND				10	
Nitrate as N	ND	0.1	mg/L	ND				20	
Nitrite as N	ND	0.05	mg/L	ND				20	
Sulphate	62.3	1	mg/L	64.1			2.9	10	
Metals									
Calcium	ND	100	ug/L	ND				20	
Magnesium	ND	200	ug/L	ND				20	
Sodium	ND	200	ug/L	203			0.0	20	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	8.78	1	mg/L		87.8	78-112			
Fluoride	0.96	0.1	mg/L	ND	96.1	73-113			
Nitrate as N	0.92	0.1	mg/L	ND	91.8	81-112			
Nitrite as N	1.03	0.05	mg/L		103	76-117			
Sulphate	73.6	1	mg/L	64.1	94.4	75-111			
Metals									
Calcium	925		ug/L	ND	92.5	80-120			
Magnesium	1050		ug/L	ND	105	80-120			
Sodium	1290		ug/L	203	109	80-120			

Certificate of Analysis

Client: Houle Chevrier

Client PO:

Report Date: 26-Jul-2017

Order Date: 21-Jul-2017

Project Description: 61318.15

Qualifier Notes:

None

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.

Certificate of Analysis

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

Client PO:
Project: 61318.15
Custody: 36351

Report Date: 3-Jul-2019
Order Date: 28-Jun-2019

Order #: 1926694

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

Paracel ID	Client ID
1926694-01	MW4S
1926694-02	MW4D

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Client: GEMTEC Consulting Engineers and Scientists Limited

Client PO:

Report Date: 03-Jul-2019

Order Date: 28-Jun-2019

Project Description: 61318.15

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC	29-Jun-19	29-Jun-19

Certificate of Analysis

Client: GEMTEC Consulting Engineers and Scientists Limited

Client PO:

Report Date: 03-Jul-2019

Order Date: 28-Jun-2019

Project Description: 61318.15

Client ID:		MW4S	MW4D	-	-
Sample Date:		28-Jun-19 10:30	28-Jun-19 11:10	-	-
Sample ID:		1926694-01	1926694-02	-	-
	MDL/Units	Water	Water	-	-
Anions					
Nitrate as N	0.1 mg/L	4.3	7.8	-	-
Nitrite as N	0.05 mg/L	<0.05	<0.05	-	-

Certificate of Analysis

Client: GEMTEC Consulting Engineers and Scientists Limited

Client PO:

Report Date: 03-Jul-2019

Order Date: 28-Jun-2019

Project Description: 61318.15

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Nitrate as N	ND	0.1	mg/L						
Nitrite as N	ND	0.05	mg/L						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Nitrate as N	7.89	0.1	mg/L	7.80			1.2	10	
Nitrite as N	ND	0.05	mg/L	ND			0.0	10	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Nitrate as N	8.71	0.1	mg/L	7.80	91.1	79-120			
Nitrite as N	0.981	0.05	mg/L	ND	98.1	84-117			

Qualifier Notes:

None

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.

APPENDIX M

Langelier Saturation Index (LSI) Calculations

Langelier Saturation Index Calculation

Project 61318.15
Test Well: TW1 - 6hr
Date: July 5, 2017

Inputs

pH =	7.8	
Total Dissolved Solids =	660	
Calcium (as $CaCO_3$) =	395	Note: Ca (as CaCO3) = 2.5 x Ca
Alkalinity (as $CaCO_3$) =	347	
Temperature (^oC) =	8.9	(field measured)

Where Langelier Saturation Index (LSI) is defined as: $LSI = pH - pH_s$

Where: $pH_s = (9.3 + A + B) - (C + D)$

And:

$$A = \frac{(\log_{10}[TDS] - 1)}{10}$$

$$B = -13.12 \cdot \log_{10}[Temp + 273] + 34.55$$

$$C = \log_{10}[Calcium] - 0.4$$

$$D = \log_{10}[Alkalinity]$$

Output:

A =	0.18
B =	2.40
C =	2.20
D =	2.54
pH_s =	7.15
LSI =	**0.65**

LSI Value	Indication
-2.0 to -0.5	Serious corrosion
-0.5 to 0.0	Slight corrosion but non-scale forming
LSI = 0	Balanced but corrosion possible
0.0 to 0.5	Slightly scale forming and corrosive
0.5 to 2	Scale forming but non corrosive

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Langelier Saturation Index Calculation

Project 61318.15
Test Well: TW4 - 8hr
Date: May 10, 2016

Inputs

pH = 8.22
Total Dissolved Solids = 512
Calcium (as $CaCO_3$) = 336 Note: Ca (as CaCO3) = 2.5 x Ca
Alkalinity (as $CaCO_3$) = 247
Temperature (^oC) = 12.7 (field measured)

Where Langelier Saturation Index (LSI) is defined as: $LSI = pH - pH_s$

Where: $pH_s = (9.3 + A + B) - (C + D)$

And:

$$A = \frac{(\log_{10}[TDS] - 1)}{10}$$

$$B = -13.12 \cdot \log_{10}[Temp + 273] + 34.55$$

$$C = \log_{10}[Calcium] - 0.4$$

$$D = \log_{10}[Alkalinity]$$

Output:

A = 0.17
B = 2.33
C = 2.13
D = 2.39
pH_s = 7.28

LSI = 0.94

LSI Value	**Indication**
-2.0 to -0.5	Serious corrosion
-0.5 to 0.0	Slight corrosion but non-scale forming
LSI = 0	Balanced but corrosion possible
0.0 to 0.5	Slightly scale forming and corrosive
0.5 to 2	Scale forming but non corrosive

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Langelier Saturation Index Calculation

Test Well: TW6 - 6hr

Inputs

pH = 8

Total Dissolved Solids = 502

Calcium (as $CaCO_3$) = 332 Note: Ca (as CaCO3) = 2.5 x Ca

Alkalinity (as $CaCO_3$) = 294

Temperature (^oC) = 11.2 (field measured)

Where Langelier Saturation Index (LSI) is defined as: $LSI = pH - pH_s$

Where: $pH_s = (9.3 + A + B) - (C + D)$

And:

$$A = \frac{(\log_{10}[TDS] - 1)}{10}$$

$$B = -13.12 \cdot \log_{10}[Temp + 273] + 34.55$$

$$C = \log_{10}[Calcium] - 0.4$$

$$D = \log_{10}[Alkalinity]$$

Output:

A = 0.17

B = 2.36

C = 2.12

D = 2.47

pH_s = 7.24

LSI = 0.76

LSI Value	Indication
-2.0 to -0.5	Serious corrosion
-0.5 to 0.0	Slight corrosion but non-scale forming
LSI = 0	Balanced but corrosion possible
0.0 to 0.5	Slightly scale forming and corrosive
0.5 to 2	Scale forming but non corrosive

APPENDIX N

Laboratory Certificates of Analysis – Private Wells

Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited

32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Andrius Paznekas

Client PO:
Project: 61318.15
Custody: 10164

Report Date: 5-Jun-2019
Order Date: 30-May-2019

Order #: 1922529

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

Paracel ID	Client ID
1922529-01	PW1
1922529-02	PW2

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: GEMTEC Consulting Engineers and Scientists Limited
Client PO:

Report Date: 05-Jun-2019
Order Date: 30-May-2019
Project Description: 61318.15

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	31-May-19	31-May-19
Ammonia, as N	EPA 351.2 - Auto Colour	3-Jun-19	3-Jun-19
Anions	EPA 300.1 - IC	1-Jun-19	1-Jun-19
Colour	SM2120 - Spectrophotometric	31-May-19	31-May-19
Conductivity	EPA 9050A- probe @25 °C	31-May-19	31-May-19
Dissolved Organic Carbon	MOE E3247B - Combustion IR, filtration	5-Jun-19	5-Jun-19
E. coli	MOE E3407	31-May-19	31-May-19
Fecal Coliform	SM 9222D	31-May-19	1-Jun-19
Heterotrophic Plate Count	SM 9215C	31-May-19	31-May-19
Metals, ICP-MS	EPA 200.8 - ICP-MS	31-May-19	31-May-19
pH	EPA 150.1 - pH probe @25 °C	31-May-19	31-May-19
Phenolics	EPA 420.2 - Auto Colour, 4AAP	4-Jun-19	4-Jun-19
Subdivision Package	Hardness as CaCO3	31-May-19	31-May-19
Sulphide	SM 4500SE - Colourimetric	5-Jun-19	5-Jun-19
Tannin/Lignin	SM 5550B - Colourimetric	31-May-19	31-May-19
Total Coliform	MOE E3407	31-May-19	31-May-19
Total Dissolved Solids	SM 2540C - gravimetric, filtration	3-Jun-19	4-Jun-19
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	4-Jun-19	5-Jun-19
Turbidity	SM 2130B - Turbidity meter	31-May-19	31-May-19

Order #: 1922529

Certificate of Analysis

Client: GEMTEC Consulting Engineers and Scientists Limited

Client PO:

Report Date: 05-Jun-2019

Order Date: 30-May-2019

Project Description: 61318.15

Client ID:		PW1	PW2	-	-
Sample Date:		30-May-19 12:00	30-May-19 12:00	-	-
Sample ID:		1922529-01	1922529-02	-	-
	MDL/Units	Drinking Water	Drinking Water	-	-
Microbiological Parameters					
E. coli	1 CFU/100 mL	ND	ND	-	-
Fecal Coliforms	1 CFU/100 mL	ND	ND	-	-
Total Coliforms	1 CFU/100 mL	ND	ND	-	-
Heterotrophic Plate Count	10 CFU/mL	<10 [2]	<10 [2]	-	-
General Inorganics					
Alkalinity, total	5 mg/L	235	253	-	-
Ammonia as N	0.01 mg/L	0.03	0.03	-	-
Dissolved Organic Carbon	0.5 mg/L	0.6	1.5	-	-
Colour	2 TCU	3	<2	-	-
Conductivity	5 uS/cm	481	712	-	-
Hardness	mg/L	258	285	-	-
pH	0.1 pH Units	7.7	7.7	-	-
Phenolics	0.001 mg/L	<0.001	<0.001	-	-
Total Dissolved Solids	10 mg/L	288	426	-	-
Sulphide	0.02 mg/L	<0.02	<0.02	-	-
Tannin & Lignin	0.1 mg/L	<0.1	<0.1	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	<0.1	<0.1	-	-
Turbidity	0.1 NTU	4.0	0.2	-	-
Anions					
Chloride	1 mg/L	8	74	-	-
Fluoride	0.1 mg/L	<0.1	<0.1	-	-
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	26	19	-	-
Metals					
Calcium	0.1 mg/L	72.3	99.6	-	-
Iron	0.1 mg/L	0.6	<0.1	-	-
Magnesium	0.2 mg/L	18.9	8.9	-	-
Manganese	0.005 mg/L	0.022	0.009	-	-
Potassium	0.1 mg/L	1.5	1.0	-	-
Sodium	0.2 mg/L	8.1	44.6	-	-

Certificate of Analysis
Client: GEMTEC Consulting Engineers and Scientists Limited
Client PO:

Report Date: 05-Jun-2019
Order Date: 30-May-2019
Project Description: 61318.15

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%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						
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/100 mL						
Fecal Coliforms	ND	1	CFU/100 mL						
Total Coliforms	ND	1	CFU/100 mL						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	7.14	1	mg/L	7.52			5.1	10	
Fluoride	ND	0.1	mg/L	ND				10	
Nitrate as N	ND	0.1	mg/L	ND				10	
Nitrite as N	ND	0.05	mg/L	ND				10	
Sulphate	26.2	1	mg/L	26.3			0.4	10	
General Inorganics									
Alkalinity, total	235	5	mg/L	235			0.1	14	
Ammonia as N	0.012	0.01	mg/L	0.025			71.6	17.7	QR-01
Dissolved Organic Carbon	ND	0.5	mg/L	ND			0.0	37	
Colour	3	2	TCU	3			0.0	12	
Conductivity	473	5	uS/cm	481			1.7	5	
pH	7.7	0.1	pH Units	7.7			0.0	10	
Phenolics	ND	0.001	mg/L	ND				10	
Total Dissolved Solids	400	10	mg/L	426			6.3	10	
Sulphide	ND	0.02	mg/L	ND				10	
Tannin & Lignin	ND	0.1	mg/L	ND			0.0	11	
Total Kjeldahl Nitrogen	ND	0.1	mg/L	ND				16	
Turbidity	1.4	0.1	NTU	1.3			7.4	10	
Metals									
Calcium	22.6	0.1	mg/L	22.5			0.6	20	
Iron	0.6	0.1	mg/L	0.6			1.1	20	
Magnesium	22.5	0.2	mg/L	22.7			0.7	20	
Manganese	0.022	0.005	mg/L	0.021			2.5	20	
Potassium	3.8	0.1	mg/L	3.9			2.3	20	
Sodium	207	0.2	mg/L	209			1.0	20	
Microbiological Parameters									
E. coli	ND	1	CFU/100 mL	ND				30	
Fecal Coliforms	ND	1	CFU/100 mL	ND				30	
Total Coliforms	ND	1	CFU/100 mL	2			0.0	30	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	17.6	1	mg/L	7.52	101	77-123			
Fluoride	0.93	0.1	mg/L	ND	93.3	79-121			
Nitrate as N	1.06	0.1	mg/L		106	86-114			
Nitrite as N	0.947	0.05	mg/L	ND	94.7	84-117			
Sulphate	36.9	1	mg/L	26.3	106	74-126			
General Inorganics									
Ammonia as N	0.307	0.01	mg/L	0.025	113	81-124			
Dissolved Organic Carbon	9.4	0.5	mg/L	ND	94.0	60-133			
Phenolics	0.024	0.001	mg/L	ND	96.4	69-132			
Total Dissolved Solids	104	10	mg/L		104	75-125			
Sulphide	0.50	0.02	mg/L	ND	101	79-115			
Tannin & Lignin	0.8	0.1	mg/L	ND	84.1	71-113			
Total Kjeldahl Nitrogen	2.01	0.1	mg/L	ND	100	81-126			
Metals									
Calcium	34100		ug/L	22500	116	80-120			
Iron	3530		ug/L	635	116	80-120			
Magnesium	9700		ug/L		97.0	80-120			
Manganese	77.0		ug/L	21.3	112	80-120			
Potassium	15600		ug/L	3860	118	80-120			
Sodium	9800		ug/L		98.0	80-120			

Qualifier Notes:

Sample Qualifiers :

2 : Subcontracted analysis - Caduceon

QC Qualifiers :

QR-01 : Duplicate RPD is high, however, the sample result is less than 10x the MDL.

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.

ACCUTEST LABORATORIES LTD

REPORT OF ANALYSIS

Client: Morey Houle Chevrier Engineering
28 Clothier St E., Unit B, Box 910
Kemptville, ON
KCG 1J0

Attention: Mr. Randy Morey

Report Number:	2505851
Date:	2005-04-12
Date Submitted:	2005-04-08
Project:	
P.O. Number:	
Matrix:	Water

		LAB ID:	378025	378026				GUIDELINE	
		Sample Date:	2005-04-07	2005-04-07				MOE REG. 170/03	
		Sample ID:	Turcotte	KOHL1					
PARAMETER	**UNITS**	**MDL**					**TYPE**	**LIMIT**	**UNITS**
Alkalinity as CaCO3	mg/L	5	282	235			OG	500	mg/L
Chloride	mg/L	1	70	7			AO	250	mg/L
Colour	TCU	2	6	<2			AO	5	TCU
Conductivity	uS/cm	5	839	500					TCU
Dissolved Organic Carbon	mg/L	0.5	2.9	1.3			AO	5	mg/L
Fluoride	mg/L	0.10	0.27	0.27			MAC	1.5	mg/L
Hydrogen Sulphide	mg/L	0.01	<0.01	<0.01			AO	0.05	mg/L
N-NH3 (Ammonia)	mg/L	0.02	0.05	0.04					mg/L
N-NO2 (Nitrite)	mg/L	0.10	<0.10	<0.10			MAC	1.0	mg/L
N-NO3 (Nitrate)	mg/L	0.10	<0.10	<0.10			MAC	10.0	mg/L
pH			7.64	7.82			AO	6.5-8.5	
Phenols	mg/L	0.001	<0.001	<0.001					
Sulphate	mg/L	1	65	30			AO	500	mg/L
Tannin & Lignin	mg/L	0.1	0.1	<0.1					mg/L
TDS (COND - CALC)	mg/L	5	545	325			AO	500	mg/L
Total Kjeldahl Nitrogen	mg/L	0.05	0.30	<0.05					mg/L
Turbidity	NTU	0.1	17.8	4.1			AO	1.0	NTU
Hardness as CaCO3	mg/L	1	398	264			OG	100	mg/L
Ion Balance		0.01	0.98	1.00					mg/L
Calcium	mg/L	1	115	76					mg/L
Magnesium	mg/L	1	27	18					mg/L
Potassium	mg/L	1	2	1					mg/L
Sodium	mg/L	2	17	6			AO	20	mg/L
Iron	mg/L	0.01	1.00	0.40			AO	0.3	mg/L
Manganese	mg/L	0.01	0.09	0.02			AO	0.05	mg/L

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

APPROVAL:

Ewan McRobbie
Inorganic Lab Supervisor

ACCUTEST LABORATORIES LTD

REPORT OF ANALYSIS

Client: Morey Houle Chevrier Engineering
28 Clothier St E., Unit B. Box 910
Kemptville, ON
K0G 1J0
Attention: Mr. Randy Morey

Report Number: 2505841
Date: 2005-04-11
Date Submitted: 2005-04-08

Project:

P.O. Number:
Matrix: Water

		LAB ID:	377993	377994				**GUIDELINE**		
		Sample Date:	2005-04-07	2005-04-07				MOE REG. 170/03		
		Sample ID:	Turcotte	KOHL1						
PARAMETER	**UNITS**	**MDL**						**TYPE**	**LIMIT**	**UNITS**
Total Coliforms	ct/100mL		0	0				MAC	0	ct/100mL
Escherichia Coli	ct/100mL		0	0				MAC	0	ct/100mL
Heterotrophic Plate Count	ct/1mL		0	0				MAC	500	ct/1mL
Faecal Coliforms	ct/100mL		0	0				MAC	0	ct/100mL
Faecal Streptococcus	ct/100mL		2	0						ct/100mL

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

APPROVAL:
Tim McCooeye
QC Manager

Ministry
of the
Environment

The Ontario Water Resources Act

WATER WELL RECORD

[redacted]

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	TO
Brown	Loom			0	8
Gray	Clay		Sticky	8	20
Gray	Limestone		Broken	20	35

WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
23	☐ FRESH ☐ SALTY ☐ SULPHUR ☐ MINERALS ☐ GAS
	☐ FRESH ☐ SALTY ☐ SULPHUR ☐ MINERALS ☐ GAS
	☐ FRESH ☐ SALTY ☐ SULPHUR ☐ MINERALS ☐ GAS
	☐ FRESH ☐ SALTY ☐ SULPHUR ☐ MINERALS ☐ GAS
	☐ FRESH ☐ SALTY ☐ SULPHUR ☐ MINERALS ☐ GAS

CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	TO
6 1/4	☒ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE ☐ PLASTIC	.188	0	22
6 1/8	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☒ OPEN HOLE ☐ PLASTIC		22	35
	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE ☐ PLASTIC			

SCREEN

SLOT NO.	DIAMETER	LENGTH
	INCHES	FEET

MATERIAL AND TYPE	DEPTH TO TOP OF SCREEN
	FEET

PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)
Grouted		Cement (2)

PUMPING TEST

PUMPING TEST METHOD: ☒ PUMP ☐ BAILER		PUMPING RATE: 15-20 GPM		DURATION OF PUMPING: 1 HOURS ___ MINS	
STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING ☒ PUMPING ☐ RECOVERY			
		15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
4 FEET	10 FEET	10 FEET	10 FEET	10 FEET	10 FEET
IF FLOWING, GIVE RATE: GPM		PUMP INTAKE SET AT: 10 FEET		WATER AT END OF TEST: ☒ CLEAR ☐ CLOUDY	
RECOMMENDED PUMP TYPE: ☐ SHALLOW ☒ DEEP		RECOMMENDED PUMP SETTING: 15 FEET		RECOMMENDED PUMPING RATE: 5 GPM	

FINAL STATUS OF WELL

☒ WATER SUPPLY
☐ OBSERVATION WELL
☐ TEST HOLE
☐ RECHARGE WELL
☐ ABANDONED, INSUFFICIENT SUPPLY
☐ ABANDONED, POOR QUALITY
☐ UNFINISHED
☐ DEWATERING

WATER USE

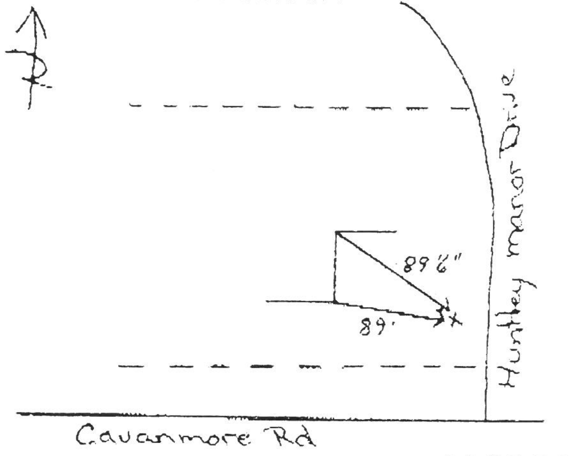
☒ DOMESTIC
☐ STOCK
☐ IRRIGATION
☐ INDUSTRIAL
☐ OTHER
☐ COMMERCIAL
☐ MUNICIPAL
☐ PUBLIC SUPPLY
☐ COOLING OR AIR CONDITIONING
☐ NOT USED

METHOD OF CONSTRUCTION

☐ CABLE TOOL
☐ ROTARY (CONVENTIONAL)
☐ ROTARY (REVERSE)
☐ ROTARY (AIR)
☒ AIR PERCUSSION
☐ BORING
☐ DIAMOND
☐ JETTING
☐ DRIVING
☐ DIGGING
☐ OTHER

LOCATION OF WELL

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



DRILLERS REMARKS

113322

CONTRACTOR

NAME OF WELL CONTRACTOR: Capital Water Supply Ltd.
WELL CONTRACTOR'S LICENCE NUMBER: 1558
ADDRESS: Box 490 Stittsville, Ontario K2S 1A6
NAME OF WELL TECHNICIAN: S. Miller
WELL TECHNICIAN'S LICENCE NUMBER: T0097
SIGNATURE OF TECHNICIAN/CONTRACTOR
SUBMISSION DATE: DAY 20 MO 12 YR 91

OFFICE USE ONLY

Ontario Ministry of the Environment

Measurements recorded in: ☒ Metric ☐ Imperial

Well Tag No. *(Place Sticker and/or Print Below)*
A082930 A 082930

Well Record

Regulation 903 Ontario Water Resources Act

Page ___ of ___

[redacted]

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa Carleton	Carp	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	18	421847	5016418		

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth *(m/ft)* From	To
Brown	Soil	Stones	Loose & Wet	0	.91
Brown	Clay			.91	2.43
Gray	Gravel			2.43	3.04
Gray	Limestone			3.04	37.48

Annular Space

Depth Set at *(m/ft)* From	To	Type of Sealant Used *(Material and Type)*	Volume Placed *(m³/ft³)*
6.4	0	Grouted Bentonite Slurry	.986m^3

Method of Construction

- ☐ Cable Tool
- ☐ Rotary (Conventional)
- ☒ Rotary (Reverse) Air
- ☐ Boring
- ☒ Air percussion
- ☐ Other, *specify* ______
- ☐ Diamond
- ☐ Jetting
- ☐ Driving
- ☐ Digging

Well Use

- ☐ Public
- ☒ Domestic
- ☐ Livestock
- ☐ Irrigation
- ☐ Industrial
- ☐ Other, *specify* ______
- ☐ Commercial
- ☐ Municipal
- ☐ Test Hole
- ☐ Cooling & Air Conditioning
- ☐ Not used
- ☐ Dewatering
- ☐ Monitoring

Construction Record - Casing

Inside Diameter *(cm/in)*	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness *(cm/in)*	Depth *(m/ft)* From	To
15.86	Steel	.48	+.45	6.40

Status of Well

- ☒ Water Supply
- ☐ Replacement Well
- ☐ Test Hole
- ☐ Recharge Well
- ☐ Dewatering Well
- ☐ Observation and/or Monitoring Hole
- ☐ Alteration (Construction)
- ☐ Abandoned, Insufficient Supply
- ☐ Abandoned, Poor Water Quality
- ☐ Abandoned, other, *specify* ______
- ☐ Other, *specify* ______

Construction Record - Screen

Outside Diameter *(cm/in)*	Material (Plastic, Galvanized, Steel)	Slot No.	Depth *(m/ft)* From	To

Water Details

Water found at Depth 31.08 *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☒ Untested ☐ Other, *specify* ______

Water found at Depth 33.52 *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☒ Untested ☐ Other, *specify* ______

Water found at Depth ______ *(m/ft)* ☐ Gas | Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify* ______

Hole Diameter

Depth *(m/ft)* From	To	Diameter *(cm/in)*
0	6.40	15.86
6.40	37.48	15.23

Results of Well Yield Testing

After test of well yield, water was:
☒ Clear and sand free
☐ Other, *specify* ______

If pumping discontinued, give reason:

Pump intake set at *(m/ft)* 9.14

Pumping rate *(l/min / GPM)* 54.6

Duration of pumping 1 hrs + ______ min

Final water level end of pumping *(m/ft)* 2.48

If flowing give rate *(l/min / GPM)*

Recommended pump depth *(m/ft)* 9.14

Recommended pump rate *(l/min / GPM)* 45.5

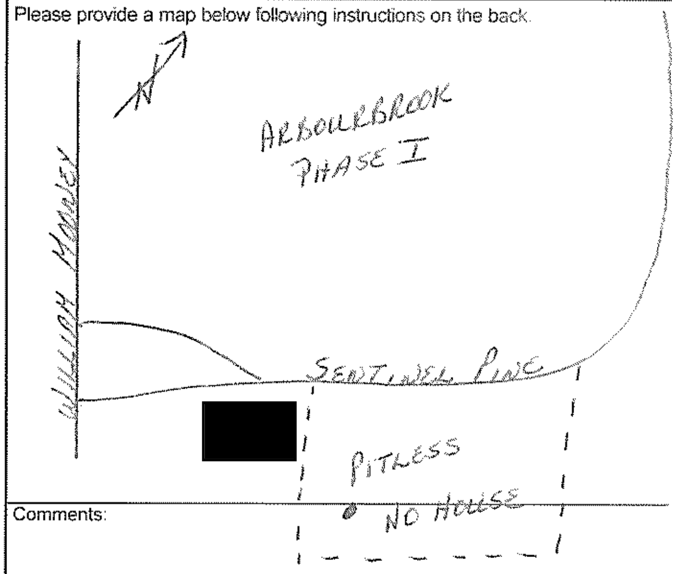
Well production *(l/min / GPM)*

Disinfected? ☒ Yes ☐ No

Draw Down Time *(min)*	Draw Down Water Level *(m/ft)*	Recovery Time *(min)*	Recovery Water Level *(m/ft)*
Static Level	1.78		
1	2.09	1	2.15
2	2.14	2	2.09
3	2.18	3	2.06
4	2.21	4	2.04
5	2.23	5	2.02
10	2.30	10	1.95
15	2.36	15	1.91
20	2.39	20	1.89
25	2.42	25	1.88
30	2.43	30	1.87
40	2.44	40	1.86
50	2.46	50	1.86
60	2.48	60	1.85

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Capital Water Supply Ltd.	1558

Business Address (Street Number/Name)	Municipality
Box 490	Stittsville

Province	Postal Code	Business E-mail Address
Ontario	K2S 1A6	office@ capitalwater.ca

Bus.Telephone No. *(inc. area code)*	Name of Well Technician (Last Name, First Name)
613 836 1766	Miller, Stephen

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
0097		20090911

Well owner's information package delivered ☒ Yes ☐ No

Date Package Delivered 20090909

Date Work Completed 20090908

Ministry Use Only

Audit No. Z 101719

Received OCT 06 2009

0506E (12/2007)

APPENDIX O

Well Interference Modelling

LEGEND

— — — SUBJECT SITE

CONTOUR INTERVAL, 0.5m

Scale

1:5000

0 100 200 300m

GEMTEC
CONSULTING ENGINEERS
AND SCIENTISTS

32 Steacie Drive
Ottawa, ON
Tel: (613) 836-1422
www.gemtec.ca
ottawa@gemtec.ca

Drawing

INTERFERENCE MODELLING SCENARIO 1

Client

1384341 ONTARIO LTD.

Project
61318.15

HYDROGEOLOGICAL INVESTIGATION

2727 CARP ROAD
OTTAWA, ONTARIO

Drwn by	Chkd by
S.L.	A.P.

Date
DECEMBER 2017

Rev.
0

FIGURE O1

P:\0. Files\61300\61318.15\HydroG Update 2017\Hydraulic Testing\Well Interference Modelling\61318.15_(04)_FG2_V01_2017-12-14.dwg

LEGEND

— — —	SUBJECT SITE
∼	CONTOUR INTERVAL, 0.2m

Scale
1:5000
0 100 200 300m

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

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Ottawa, ON
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Drawing
INTERFERENCE MODELLING SCENERIO 2

Client
1384341 ONTARIO LTD.

Project
61318.15

HYDROGEOLOGICAL
INVESTIGATION
2727 CARP ROAD
OTTAWA, ONTARIO

Drwn by P.C.
Chkd by A.P.

Date AUGUST 2019
Rev. 0
FIGURE O2

P:\0. Files\61300\61318.15\HydroG Update 2019\Drafting\Drawings\61318.15_HydroG_FG O1-O2_V01_2019-08-14.dwg, FIGURE O2, 19/08/15 11:50:23 AM experience • knowledge • integrity

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

expérience • connaissance • intégrité