



HYDROGEOLOGICAL REVIEW MABERLY PINES SUBDIVISION CONTRACT #2021-PD-002

Submitted to:

The Corporation of Tay Valley Township

217 Harper Road Perth, ON K7H 3C6

Submitted by:

BluMetric Environmental Inc.

The Tower – The Woolen Mill 4 Cataraqui Street Kingston, ON K7K 1Z7

BluMetric Project Number: 220037

November 30, 2021

www.blumetric.ca

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The Corporation of Tay Valley Township 217 Harper Road Perth, ON K7H 3C6 Attention: Amanda Mabo, Clerk <u>clerk@tayvalleytwp.ca</u>

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1. INRODUCTION

BluMetric Environmental Inc. (BluMetric[™]) was retained by Tay Valley Township (TVT) to conduct a review of hydrogeological conditions at the Maberly Pines Subdivision located approximately three kilometres south of the Village of Maberly, Ontario, on the northeast side of Bolingbrook Road (see Figure 1).

The Maberly Pines Subdivision was investigated by Water and Earth Science Associates Limited (WESA) in 1979 (report titled Maberly Pines Subdivision, Terrain, Hydrogeological and Ecological Analysis). The development was subsequently approved, and all 56 lots were sold to individual owners. Since that time, five of the lots have been developed and two have been issued building permits. There are currently 49 vacant lots issued through By-Law NO. 2021-033 to Amend By-Law No. 2002-121, as amended Plan 21 Lakeside Living (Maberly Pines) (Geographic Township of South Sherbrooke).

Recent concerns regarding development lead TVT to consult with the Mississippi Valley Conservation Authority (MVCA) and the Rideau Valley Conservation Authority (RVCA) regarding approval based on current guidelines. It was noted that the WESA, 1979 report does not fully address the current guidelines regarding the assessment of water quality, quantity, and nitrate impact assessment for the development. The Ministry of the Environment, Conservation and Parks (MECP) has developed additional requirements for assessment since the late 1970's including Procedure D-5-4: Technical Guideline for Individual On-site Sewage Systems: Water Quality Impact Risk Assessment (1996), and Procedure D-5-5: Technical Guideline for Private Wells: Water Supply Assessment (1996). These are the current guidelines used by MVCA and RVCA for the review of Hydrogeological Reports submitted in support of Subdivision Plan Application Approval within the County of Lanark, Ontario.

The Township's request for a hydrogeological review of the Maberly Pines Subdivision was implemented by BluMetric to meet the following objectives.

1.1 OBJECTIVES

The objectives of this study as defined in the Request for Proposal (2021-PD-002) from TVT are as follows:

- Determine if there is sufficient groundwater available at the subdivision for development as residential lots.
- Determine if the groundwater at the subdivision is potable and of acceptable water quality.
- Determine if the hydrogeological features at the subdivision will allow development on all of the lots with sufficient capacity to support the installation of septic systems.



- Produce two conceptual lot layout plans identifying the recommended locations of wells, septic systems and dwellings based inferred groundwater flow direction and site constraints:
 - Conventional lot layout plan (Figure 3) is intended to meet "as closely as possible" the current Ministry of the Environment Conservation and Parks (MECP) regulations (i.e., Procedures D-5-4 and D-5-5) that would be required if the subdivision was developed using conventional Class 4 sewage systems.
 - Restricted lot layout plan (Figure 4) introduces measures to address the lot constraints on the private servicing, to mitigate potential impacts to well water quality.

1.2 SITE DESCRIPTION

The Maberly Pines Estate (referred to herein as "the site") encompasses a total area of approximately 76.8 hectares and is comprised of undulating terrain (see Figures 2 and 3 for topographic contours at the site and surrounding lands) that includes bedrock ridges with interspersed lowland areas, and ponds. Existing development at the subdivision includes several access roads and residences on some of the lots. Most of the subdivision is forested land. Surrounding land uses within 500 m of the site include forested areas, cottages and some rural residences, lakes, and Bolingbroke Road. All existing development in the area utilizes private individual water supply and individual septic sewer systems as municipal servicing is not available.

1.3 SUBDIVISION

The Maberly Pines subdivision was created by a developer identified as 'Lakeside Living' (no longer operating) and was approved by the Provincial Government in 1980. The subdivision includes 56 lots as indicated on Figures 3 and 4 (Conceptual Lot Development Plans) and the topographic survey dated 1980 (Appendix B). The status of development of the lots is as follows:

- Five developed lots
 - One permanent residence (Lot 20)
 - Four seasonal residences (Lots 6, 24, 47, and 55)
- Two permitted lots (Lots 23 and 35)
- Vacant lots as per By-Law NO. 2021-033, Plan 21
 - Lots 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 48, 49, 50, 51, 52, 53, 54, 56

The minimum lot size at the subdivision is 4700 m² (0.5 hectares). The maximum lot size is 3.2 hectares and the average lot size is 1.1 hectares.



Currently, developed lots of the site are serviced by individual on-site wells and individual on-site wastewater treatment systems (OWTS). This form of servicing is consistent with the established hierarchy prescribed in the Ontario Provincial Policy Statement and is consistent with the established neighbouring rural estate lot developments.

2. METHODOLOGY

2.1 BACKGROUND INFORMATION REVIEW

A review of information pertaining to the site was conducted, including the following elements:

- Water well records from the Ontario water well information system (WWIS) database.
- Geological information from the Ontario Geological Survey online databases.
- A report titled 'Maberly Pines Subdivision, Terrain, Hydrogeological and Ecological Analysis' (WESA, 1979), including:
 - Topographic survey of the site conducted by Geo. W. Bracken Ltd. of Smiths Falls Ontario in 1980.
 - Terrain analysis data and grain size analysis.

2.2 GROUNDWATER SAMPLING AND ANALYSIS

BluMetric contacted TVT to help identify existing well owners at the Maberly Pines Development to determine viable groundwater sampling locations and to identify recently installed wells on and within 500 m of the subdivision boundaries.

Groundwater sampling took place on November 23, 2021, and consisted of sampling one previously established location. Attempts were made to sample other locations but since they are seasonal cottages, they had already been winterized, and were vacant at the time of the site visit. In some cases, there does not appear to be an established well on the property for example, lot 47 is developed; however, there was no identification of a well in Ontario Well Records and in speaking with neighbors it was mentioned that there is no well at lot 47.

All groundwater samples were submitted for comprehensive testing of bacteriological, chemical and physical water quality parameters consistent with standard 'Subdivision Water Supply' suite of parameters in accordance with Ministry of the Environment (MOE) Regulation D-5-5. The groundwater samples were also submitted for analysis of 'RVCA recommended' Ontario Regulation 153/4 Table 8 standards for metals' including uranium, strontium, and barium, and for volatile organic compounds (VOCs).



All samples were collected unfiltered and unchlorinated and were placed directly into clean bottles supplied by the analytical laboratory. Samples were placed immediately into a cooler with ice and were transported directly to the Caduceon laboratory in Kingston. All samples were received by the laboratory within six hours of collection. Caduceon is fully accredited by the Canadian Association for Laboratory Accreditation (CALA).

2.3 OFFSITE WELL OWNER INTERVIEWS

An effort was made to interview well owners about their well and septic systems. A standard form was used to conduct each brief interview. The form includes standard questions about the well location, water quality, water quantity and potential environmental concerns. Well owner interview log sheets are included in Appendix 4.

2.4 DEVELOPMENT OF CONCEPTUAL SITE PLANS

An assessment of the suitability for development of each lot was conducted. Two development scenarios were considered, including:

- Lot layout and servicing using conventional septic systems.
- Lot layout and servicing using a combination of conventional and alternative septic systems.

3. GEOLOGY AND HYDROGEOLOGY

3.1 GEOLOGY

Surficial geological mapping information from the Ontario Geological Survey (OGS) indicates the site has "bedrock drift over Precambrian terrain". The Soil Survey of Lanark classifies surficial soils at the site as sandy loam coded MSL-R B5-S4. Site reconnaissance by WESA in 1979 identified surficial soils as a glacial till ground moraine covering much of the area, that ranged in thickness from 0.3 metres to greater than 1 metre. The till is characterized as a non-homogeneous veneer of angular granitic pebbles and cobbles in a silty sand matrix that is discontinuous across the site (WESA, 1979). WESA further described areas of poorly stratified pebbly sand up to 5 metres in thickness. Much of the site is comprised of exposed bedrock escarpments, ridges, and knobs. A terrain map was included with the WESA (1979) report and is provided in Appendix C of this report (this information is included in Figure 3, Conceptual Lot Development Plan A – Conventional Private Services).

WESA (1979) submitted one soil sample thought to be characteristic of the site to JD Paterson of Ottawa for grain size analysis. The grain size analysis is included in the WESA (1979) report. The



soil is described by WESA as 'glacial till ground moraine'. The permeability of the soil sample was determined using the Falling Head Permeameter method to be 2.42×10^{-4} cm/sec = 68.87 min/cm.

Bedrock geology mapping information from the OGS shows that the site is in the Central Grenville Metasedimentary belt of the Precambrian Canadian Shield. The bedrock units are Neo-Mesoproterozoic (0.542 Ga to 1.6 Ga) mafic to ultramafic plutonic rocks that have undergone amphibolite prograde metamorphism (Markley et al., 2018). The metamorphic protoliths within this unit include diorite, gabbro, peridotite, pyroxenite, and anorthosite. This unit is bound to the north and south by Neo-Mesoproterozoic late felsic plutonic rocks.

3.2 HYDROGEOLOGY

In the Tay Valley Township area, the most important water supply 'aquifers' typically occur within the Precambrian bedrock. Permeability within these strata is controlled by fractures (i.e. flow is not considered to be within a 'porous media') and aquifer conditions are heterogenous.

The site is geographically situated between the highest point of the Rideau Watershed (Carnahan Lake) and the Ottawa River where an elevation change of 204 metres distinguishes the modal groundwater flow direction to be to the north/northeast (RVCA, 2021). The direction of groundwater flow in the bedrock aquifer beneath the site is interpreted to be to the northeast. Topography fluctuates in the area thereby causing groundwater recharge pathways to flow in directions dictated by slope orientations and topographic lowlands as depicted in WESA 1979. To further this interpretation, the Site is situated along the central and northern aspect of a peninsular topographic high with lowlands to the north, east, and south leading to the likelihood that locally, radial groundwater recharge flow directions occur.

3.3 WATER WELL RECORDS

A review of available MECP Water Well Records in the vicinity of the site was undertaken as part this study. This information was compared to water well records collected and reviewed by WESA in 1979.

A total of 17 MECP water well records were identified within 500 m of the subdivision, as indicated on Figure 2. Overburden thickness, depth of casing, aquifer interception points and well yield related information were reviewed in detail and included in a summary table (Table 1).



Well ID	Well Depth (mbgs)	Overburden Depth (m)	Casing Depth (mbgs)	Depth to Groundwater (mbgs)	Static Water Level (mbgs)	1hr Test Pump Rate (L/min)	Drawdown (m)	Specific Capacity ((L/min)/m)	Date Drilled
3503579	24.38	2.4	6.7	22.50	5.48	91.0	0.0	high	10-Sep-1973
3506287	45.72	5.5	7.0	43.28	2.74	9.0	15.5	0.6	8-Jun-1981
3506755	68.58	2.7	6.7	64.00	4.88	9.0	36.6	0.2	28-Jun-1983
3506756	19.51	0.9	6.7	18.28	5.48	18.0	0.0	high	27-Jun-1983
3506757	68.58	0.6	7.0	64.00	6.70	4.5	43.3	0.1	24-Jun-1983
3507365	56.39	1.2	6.7	44.80, 55.47	9.75	18.0	37.5	0.5	9-Sep-1985
3507887	26.52	1.8	6.7	N/A	4.57	31.8	0.0	high	14-May-1987
3509525	60.96	4.6	6.7	59.44	5.49	13.6	16.5	0.8	28-Aug-1990
3510061	49.68	1.8	6.7	48.16	18.28	36.4	27.4	1.3	29-Oct-1991
3510138	48.16	1.2	6.7	38.40, 46.33	6.10	36.4	33.5	1.1	13-Nov-1991
3513257	60.96	0.5	6.7	21.34	9.45	18.2	0.0	high	1-Mar-2001
3513786	67.06	1.8	6.7	28.04, 71.63	4.88	13.6	8.8	1.5	18-Jul-2002
3514498	42.67	2.1	6.7	15.24	7.92	18.2	3.0	6.1	23-Mar-2004
7046732	67.06	1.5	6.7	64.62	10.15	30.0	8.8	3.4	28-Jun-2007
7048408	35.05	0.9	6.7	32.92	10.60	45.0	15.2	3.0	4-Jul-2007
7158460	42.70	0.6	6.1	12.00, 36.00	7.30	27.0	4.1	6.6	25-Nov-2010
7189149	121.92	1.2	6.7	N/A	6.40	13.6	36.9	0.4	24-Sep-2012

 Table 1:
 MECP Water Well Records Summary

The suitability of the aquifer to supply the proposed development was assessed using the methodology provided in MECP Procedure D-5-5 (MOEE, 1996), which indicates the number of people per house is the number of bedrooms plus one. For the purpose of this study, it is assumed that new houses in the subdivision will be four-bedroom single family homes, so the number of persons per house will be five (5). Procedure D-5-5 indicates the minimum 'per-person water requirement' is 450 L/day, which is 2,250 L/day per house (or per well). Procedure D-5-5 indicates that 'peak demand' is assumed to occur over a 120-minute period and is to be based on a per person usage rate of 3.75 L/min during that period. Using this information, the 'peak demand rate' per house is $3.75 \times 5 = 18.75$ L/min.

The Canadian Mortgage and Housing Corporation's Household Guide to Water Efficiency (CMHC, 2000, revised 2014) indicates that the average daily residential water use in Ontario is 225 L per person per day (1,125 L/day for a four-bedroom house). Current Ontario Building Code requirements (OBC, 2012) for water conservation specify that toilet and shower consumption must now comply with lower use requirements (OBC Table 7.6.4.2.A & B and Table 7.6.4.1). Based on the new requirements, toilet water demand is assumed to be 4.8 L/flush. Shower consumption is assumed to be 7.6 L/min. Toilet use accounts for approximately 25% of total domestic water use, and shower use accounts for approximately 20% (CMHC, 2014). The OBC efficiencies will result in an average per person domestic water usage of 163 L/day. This suggests that the daily household water demand could often be less than 1,000 L/day.



The review of water well records within 500 m of the subdivision provided the following information regarding water quantity:

- Four wells did not show any appreciable drawdown in response to pumping and are considered high yield.
- 10 wells were pumped at a rate that was at or near the 'peak demand rate' as indicated above with varying amounts of drawdown.
- 12 of the 17 wells appear to have sufficient yield to meet peak demand and average daily residential use requirements.

Due to the nature of the fractured bedrock aquifer at the site, a small percentage of future wells may not intersect fracture networks that will provide sufficient yield for normal residential use. For lots with low yielding wells additional water storage at surface may be required to meet peak demand requirements.

3.5 WATER QUALITY

Local groundwater quality was evaluated through the collection of samples from the water supply wells located at the site, specifically from 2003 Pond Lane (see Figure 2).

The selected parameters for analysis followed the groundwater quality parameters table listed in the Appendix C of Procedure D-5-5 and 'RVCA recommended Ontario Regulation 153/04 metals, strontium, and volatile organic compounds (VOCs). The groundwater quality analytical results are summarized in Table 2 in comparison to the available standards and objectives listed in the Ontario Drinking Water Standards, Objectives, and Guidelines (ODWSOG), Ontario Regulation 169/03, as amended, Ontario Regulation 373/15, Ontario Regulation 457/16, and Ontario Regulation 153/04 Table 8 standards.

All results for VOC parameters were below the method detection limits for each parameter (i.e. all results were non detectible). A review of the analytical data summarized in Table 2 indicates that all tested water quality parameters were below the health and aesthetic related ODWSOG except for the following:

• Hardness

The operational guideline (OG) for hardness and the aesthetic objective (AO) for total dissolved solids were exceeded for the well water sample. Sodium was detected below the AO of 200 mg/L and above the recommended notification limit of 20 mg/L for persons on a sodium reduced diet. Each of these water quality parameters are discussed further below:



<u>Hardness</u> - Hardness was reported at 213 mg/L, exceeding the OG of 80-100 mg/L. Hardness is caused by dissolved calcium and magnesium, and is expressed as the equivalent quantity of calcium carbonate. On heating, hard water tends to form scale deposits and can form excessive scum with regular soaps. However, certain detergents are largely unaffected by hardness. Hardness levels below 500 mg/L in drinking water are considered generally acceptable for most domestic purposes and can be treated using a conventional water softener system. Softening using a domestic water softener increases the sodium level in drinking water. Sodium concentrations are reported at 28.7 whereby a concentration exceeding 20 mg/L is to be reported to the local Medical Officer of health so that this information can be communicated to local physicians for their use with patients on sodium restricted diets.

Overall, it is BluMetric's professional opinion based on the water sampling completed that a water supply of adequate water quality is available from the local bedrock aquifer.

Regional groundwater quality was also assessed for supply wells sampled as part of the Ontario Geological Survey study, 'Ambient Groundwater Geochemistry Data for Southern Ontario, 2007–2014; Ontario Geological Survey, Miscellaneous Release—Data 283–Revised.' One well location was identified in this study within 10 km from the subject properties. 13-AG-002 is located 5.2 km east of the site. The water quality results for these locations are summarized in Table 3 in comparison to the ODWSOG. No parameters reported for the Ambient Groundwater Quality Summary samples included in Table 3 were reported in exceedance of the ODWSOG objectives.

The results from the regional well water quality assessment indicate that a well water supply of acceptable water quality is available. No concern regarding regional groundwater quality within the area of the proposed severance properties were identified.

3.6 HYDROGEOLOGICAL SENSITIVITY

The terrain analysis plan (Appendix C) shows that surficial soil thickness varies significantly across the site and includes areas of exposed bedrock. Low permeability rates of surficial soils were determined by WESA in 1979 with T-times of 68.87 min/cm, a result that comes from one amalgamated sample thought to be characteristic of the till at the site. A low percolation rate reduces the likelihood of filtration but rather promotes the transport of contaminants along surficial water flow pathways into surface water bodies.

The site is considered potentially hydrogeologically sensitive due to the generally thin layer of soil cover over bedrock in some areas. Discontinuous thin soil coverage reduces the potential for filtration of contaminants. Measures for well construction and septic system design are provided herein to mitigate potential well water quality impacts.



The subdivision does not occur within a zone that has been identified by OGS as "potentially karstic", and no karst related features have been identified at the site.

Some degree of isolation can be inferred, based on water well record information. The aquifer at the site, which can be said to occur as a 'hydro-stratigraphic fracture zone' within the Precambrian bedrock unit, is encountered at depths of greater than 10 m below ground surface (i.e. water bearing fractures within the bedrock unit were identified during drilling and occur at depth >10 m. This suggests that the upper bedrock zone provides a measure of protection of the deeper water bearing fracture zones, and potentially impedes the infiltration of potentially contaminated water from the surface and in the overburden unit.

3.7 FUTURE WELL CONSTRUCTION

New lots in the subdivision will be serviced by individual drilled water supply wells completed in the Precambrian bedrock. The wells must be installed by a licensed well contractor in accordance with Ontario Regulation 903. As indicated on Figure 3 and Figure 4, water supply wells must be constructed up gradient of the septic system location(s). A minimum of 50 m separation distance between water supply wells and septic systems is prescribed as best practice by RVCA, though a 30 m separation may be acceptable to address potential hydrogeologically sensitive conditions. Furthermore, the water supply well should be located with a minimum 30 m separation distance from all water courses, as indicated as best practice by the RVCA.

Based on the review of the MECP water well records, it is apparent that well yields of 18.75 L/min or greater are available from the granite bedrock aquifer (sufficient for a 4-bedroom home) situated at depths between 40 and 100 m. As a measure to address potentially sensitive hydrogeological conditions due to shallow bedrock it is recommended that the steel water well casing be installed and grouted into place to a depth of 4 m (12 feet) into competent bedrock or to a minimum depth of 12 m, whichever depth is greatest.

The annular space between the well casing and the drilled hole should be sealed with high early strength cement grout, prepared with 4% bentonite. The objective of the procedure is to prevent contamination of the bedrock aquifer via infiltration through the well annular space. Further to this, O. Reg. 903 requires the well contractor to install a suitable sealant around the base

of the well casing where it intersects the bedrock. The following recommendations provide additional measures to ensure water supply wells are protected from surface derived contaminants:

a. A 25.4 cm (10 in.) diameter hole should be drilled through the overburden and at least 4m (12 ft.) into competent (i.e. un-weathered) bedrock or to a minimum depth of 12 m, whichever depth is greatest.



- b. New steel casing, 15.3 cm (6 in.) in diameter, should be installed in the drilled hole. Steel casing must extend 4 m (12 feet) into competent bedrock or to a minimum depth of 12 m, whichever depth is greatest.
- c. Ontario Reg. 903 well placement requirements and grouting procedures should be followed to ensure that surface derived contaminants cannot enter the well.
- d. When the grout has set (24 hours for quick set cement, 72 hours for a regular cement), drilling can continue until a suitable water supply is obtained. The cement must be dry before drilling is continued. Disturbance of partially set grout can either cause fractures to form in the grout, or separation between the grout and the bounding materials. This could create a pathway for contamination between the overburden and the bedrock aquifer.
- e. The well must be completed with a vented and vermin proof well cap and the well casing must extend at least 40 cm (16 inches) above ground surface. The ground surface must be graded away from the well.

It is recommended that the newly constructed wells be pumped for a minimum of 6 hours after construction to ensure adequate well development and to reduce groundwater turbidity to acceptable levels before connection to the residences plumbing system.

Chlorine should be introduced at the completion of well development in sufficient quantity to produce a free chlorine residual of at least 50 mg/L (ppm). The chlorine should be mixed with the standing water in the casing using a procedure that will result in the thorough vertical mixing of the chlorine over the entire depth of the well.

The well should be completed with a submersible pump, pitless adaptor and vermin proof well cap. All such mechanical work connected to the well is to be completed by a licensed well contractor possessing a valid Class 4 pump installer's license. After completion of the mechanical work in the well, the well should be disinfected as described above.

The grading around the well casing should be slightly elevated to direct surface runoff away from the well. The casing should project approximately 400 mm above the mounded soil within 3 m in all directions from the casing.

Further to above, the installed water well must be maintained by the well owner as per the requirements under Ontario Reg. 903 (and subsequent amendments). Well maintenance requirements are provided in Chapter 11 of the MECP document, 'Water Supply Wells – Requirements and Best Management Practices' (Revised April 2015) available at:

https://www.ontario.ca/document/water-supply-wells-requirements-and-best-practices



3.8 SURFACE STORAGE FOR LOW YIELD WELLS

The daily water usage according to Procedure D-5-5 is 2,250 L/day. The peak demand water usage is (18.75 L x 120 mins) 2,250 L in 120 minutes.

The volume of water that can be stored in each new well (based on 6" diameter well that is 70 m deep) is approximately 1,270 L. However, the pumping rate in the well may be relatively low (to ensure the water level does not draw down past the pump), so the water stored in the well will not be delivered at a fast enough rate for use during peak demand periods. For example, if the maximum sustainable flow rate from a well is 3 L/min, it can only deliver 360 L during the 120 minute long peak demand period, so an additional 1,890 L of surface storage would be required. In cases where surface storage is deemed to be necessary, the amount of surface storage should be determined based on the actual sustainable yield of the well (as determined by a suitable pumping test).

As discussed in the WESA (1979) report, development planning should preclude any high volume water usages.

3.9 POTABLE WATER TREATMENT

The water within the bedrock aquifer has elevated hardness. A standard residential grade water softener can be installed to remove hardness in the raw water. Conventional water softeners will introduce sodium into the water supply, and it may be appropriate to bypass the water softener with a separate tap for drinking water.

3.10 WASTEWATER TREATMENT AND DISPOSAL

MECP Procedure D-5-4 (Technical Guidelines for Individual On-site Sewage Systems: Water Quality Impact Risk Assessment, MOEE, 1996) provides a methodology for assessing the risks associated with individual onsite sewage systems. Procedure D-5-4 indicates that developments consisting of lots which average 1 hectare (with no lot being smaller than 0.8 hectares) may not require a detailed hydrogeological assessment if it can be demonstrated that the area is not hydrogeologically sensitive. Although the average lot size in the subdivision is 1.1 hectares, 16 of the lots are less than 0.8 hectares (see Table 5 for lot size details), so a nitrate impact assessment has been provided.

3.11 PREDICTIVE NITRATE IMPACT ASSESSMENT

In assessing the impact of the subdivision, the estimate of groundwater recharge, by infiltration from precipitation, is the primary site-specific input parameter. In this regard, assumptions are required to be made with respect to evaporation and evapotranspiration, as well as infiltration



and runoff rates. The rate of infiltration will be dependent upon surficial soil types, vegetative ground covers and their distribution, and site topography.

In conducting our assessment, a mean annual precipitation value of 939.8 mm/year was used (Environment Canada, 2021). An estimation of infiltration was calculated based on site specific information and the infiltration factors provided in the document MOEE Hydrogeological Technical Information Requirements for Land Development Applications (MOEE, 1995). A calculation is provided in Appendix 4.

The cumulative nitrate impact for this subdivision has been calculated to be 4.98 mg/L with parameters detailed in Table 4a. Nitrate concentrations in onsite and offsite wells is assumed to be typically non-detectible (see onsite groundwater analytical results in Table 2) so the additional loading will be well below the provincially mandated limit of 10 mg/L. As such the subdivision as a whole should have an acceptable impact.

3.12 SEWAGE SYSTEM DESIGN

Assuming a four bedroom residence, the septic system would have to be sized to accommodate a daily sewage flow rate (Q) of 1600 L/d (OBC Table 8.2.1.3.A). Given that the lots have soils with a percolation time (T-time) >50 min/cm or bedrock, whereby the OBC specified loading rate would be 4 L/m²/d (Table 8.7.4.1.A) the mantle loading area can thereby be calculated. The OBC further specifies that the mantle is to be constructed of suitable leaching bed fill to a depth of at least 250 mm of the loading area and extend at least 15 m beyond the outer distribution pipes in any direction in which the effluent entering the soil will be moving horizontally.

Sewage systems must be designed in accordance with Part 8 of the Ontario Building Code (OBC). The OBC sets out minimum design and construction standards for all approved classes of sewage systems. It is proposed that private services be carefully assessed based on lot size, proximity to surface water bodies, and the slope of the land.

An assessment of the suitability for development of each lot was conducted. Two development scenarios have been considered: lot servicing using conventional septic systems (see Figure 3, Conceptual Lot Development Plan A – Conventional Private Services), and lot servicing incorporating alternative septic systems (see Figure 4, Conceptual Lot Development Plan A – Restricted Private Services). Table 5 (below) provides a summary of our analysis and a breakdown of the lots in terms of development status, lot size, suitability for conventional septic system, and constraints (water bodies, steep slopes). Table 5 also provides a list of concerns where conventional systems are not deemed suitable, along with suggested solutions/recommendations for the lots that will require alternatives to conventional systems. Figure 4 reflects the following tabulated breakdown of sites according to the rationale described above.



lable	5.			y summary							
Lot #	Area (m²)	Status	Conventional / Restricted	Restrictions / Considerations	Solutions / Recommendations						
1	8737	Vacant	Conventional	Observatory	Raised Bed						
2	13952	Vacant	Conventional	N/A	Raised Bed						
3	8693	Vacant	Conventional	Gradient	Max. 4:1 slope for septic / Raised Bed						
4	6824	Vacant	Conventional	N/A	Raised Bed						
5	8066	Vacant	Conventional	N/A	Raised Bed						
6	7712	Developed	-	-							
7	14003	Vacant	Conventional	N/A	Raised Bed						
8	12012	Vacant	Conventional	Surface water body	OBC clearances 15 metres / WESA 1979 = 30 m / Raised Bed						
9	17486	Vacant	Conventional	N/A	Raised Bed						
10	11369	Vacant	Conventional	N/A	Raised Bed						
11	11596	Vacant	Conventional	N/A	Raised Bed						
12	9687	Vacant	Conventional	N/A	Raised Bed						
13	8030	Vacant	Conventional	N/A	Raised Bed						
13	8075	Vacant	Conventional	Gradient							
					Max. 4:1 slope for septic // Raised Bed						
15	9771	Vacant	Conventional	Gradient	Max. 4:1 slope for septic / Raised Bed						
16	9118	Vacant	Conventional	Gradient, Exposed Bedrock	Max. 4:1 slope for septic, Raised Bed						
17	10604	Vacant	Conventional	Gradient, Exposed Bedrock Gradient, Exposed Bedrock, Weil	Max. 4:1 slope for septic, Raised Bed						
18	9068	Vacant	Restricted	Gradient, Exposed Bedrock, Weil	Max. 4:1 slope for septic, Alternative Sewage Treatment System						
19	7966	Vacant	Restricted	provimity to psighboring wells	Max. 4:1 slope for septic, Alternative Sewage Treatment System						
20	12424	Developed	-	-							
21	8488	Vacant	Conventional	N/A	Raised Bed						
22	7789	Vacant	Conventional	N/A	Raised Bed						
23	11079	Permitted	-	-							
24	10840	Developed	-	•							
25	12592	Vacant	Restricted	Gradient, Exposed Bedrock	Max. 4:1 slope for septic, Raised bed						
26	11831	Vacant	Conventional	N/A	Raised Bed						
27	4700	Vacant	Restricted	Lot size	Alternative Sewage Treatment System						
28	6974	Vacant	Conventional	Gradient	Max 4:1 slope for septic / Raised Bed						
20	10770	Vacant	Conventional	N/A	Raised Bed						
30	6233	Vacant	Conventional	N/A N/A	Raised Bed						
31	32459	Vacant	Conventional	N/A	Raised Bed						
32	20926	Vacant	Conventional	N/A	Raised Bed						
33	15389	Vacant	Conventional	Exposed Bedrock	Raised Bed						
34	9840	Vacant	Conventional	Gradient	Max 4:1 slope for septic / Raised Bed						
35	6145	Permitted	-	-	•						
36	7609	Vacant	Conventional	Surface Water Body	OBC clearances 15 metres from surface waters / WESA 1979 = 30 m / Raised Bed						
37	6791	Vacant	Restricted	Lot size, Surface Water Body, well proximity to septic treatment system, well proximity to neighboring wells	OBC clearances 15 metres from surface waters / WESA 1979 = 30 m / Recommended > 30 metres between well and septic / <u>Alternative</u> Sewage Treatment System						
38	6442	Vacant	Restricted	Lot size, Surface Water Body, well proximity to septic treatment system, well proximity to neighboring wells	OBC clearances 15 metres from surface waters / WESA 1979 = 30 m / Recommended > 30 metres between well and septic / <u>Alternative</u> Sewage Treatment System						
39	8473	Vacant	Conventional	Gradient, Surface Water Body	Max. 4:1 slope for septic, OBC clearances 15 metres						
40	8287	Vacant	Conventional	N/A	Raised Bed						
41	13254	Vacant	Conventional	Gradient	Max. 4:1 slope for septic						
42	6413	Vacant	Conventional	N/A	Raised Bed						
43	6901	Vacant	Conventional	N/A	Raised Bed						
44	6522	Vacant	Restricted	Lot size, Surface Water Body	Max. 4:1 slope for septic, OBC clearances 15 metres / WESA 1979 = 30m not possible						
45	9520	Vacant	Restricted	Lot size, Surface Water Body	Max. 4:1 slope for septic, OBC clearances 15 metres / WESA 1979 = 30m not possible						
46	10298	Vacant	Conventional	N/A	Raised Bed						
40	7389	Developed	Conventional	-							
			- Conventional		Daired Red						
48	7120	Vacant		N/A	Raised Bed						
49	12097	Vacant	Conventional	N/A	Raised Bed						
50	11534	Vacant	Conventional	Exposed Bedrock	Raised Bed						
51	12634	Vacant	Conventional	Exposed Bedrock	Raised Bed						
52	10099	Vacant	Conventional	Gradient, Exposed Bedrock	Max. 4:1 slope for septic, Raised Bed						
53	15447	Vacant	Conventional	N/A	Raised Bed						
54	16997	Vacant	Conventional	Surface Water Body	OBC clearances 15 metres from surface waters / WESA 1979 = 30m / Raised Bed						
55	23678	Developed	-	-	-						
56	18025	Vacant	Conventional	N/A	Raised Bed						

Table 5:Lot Serviceability Summary



For lots that meet clearances and requirements in accordance with sections 8.2.1.6, 8.7.4.2, 8.7.5.3 of the OBC, it is suggested that traditional Class 4 sewage systems consisting of a septic tank and leaching bed be implemented (see Figure 4). For lots that exceed clearances and requirements outlined in sections 8.2.1.6, 8.7.4.2, and 8.7.5.3 of the OBC it is suggested that alternative sewage treatment systems be implemented (see Figure 4).

Section 8.7.4.2 and 8.7.5.3 of the OBC requirements state that there must be a minimum of 900 mm of suitable soil or leaching bed fill present between the base of the filter bed or absorption trenches and native soil with a T-time >50 min/cm, bedrock, or high groundwater table. All lots at the site consist of either bedrock or a varying thickness of surficial soil with a T-time of >50 min/cm thereby requiring, at a minimum, fully raised Class 4 filter beds and/or absorption trench style leaching beds for all vacant lots. For lots that have sloping topography, a 4:1 gradient (25% slope) is the maximum allowable for septic bed application.

The conventional Lot Development Plan (Figures 1) shows the size of the leaching beds required for a 4-bedroom household. The leaching beds have been located as close as possible to be in accordance with section 8.2.1.6 of the OBC. The sewage system layouts on Figure 2 are fully raised leaching beds with an imported sand mantle that covers an area of 500 sq. metres. This area was determined using an equation to determine the loading rate area required (LRAR) and is as follows:

LRAR = Q / TWhere: Q = The total daily design sewage flow in litres T = The percolation time of the native soil in min/cm

In accordance with OBC, a minimum separation of 18 m for fully raised systems is required between a well and a Class 4 sewage system, however, it has been recommended that this distance be increased to \geq 30 metres. Clearance distances also apply to wells and sewage systems located on neighbouring lots.

In all instances, careful, site-specific analysis of the soil morphology in the area of each proposed leaching bed is required during the design stages of the leaching bed in order to determine if sufficient soil exists to facilitate the use of native soil for subgrade preparation.

It is not the intent of Figure 2 (Lot Development Plan) to restrict placement of a dwelling on each lot. While the actual configuration and position of the home may change, the relative position of the home, sewage system and well should be maintained. In all cases, the separation criteria for the immediate and neighbouring lots should be followed.



Alternative Sewage System Design Considerations

Alternative sewage treatment systems can be implemented on lots that are steeply sloping, have less than 0.5 hectares of useable land, or have surface water bodies that cover more than 30% of the lot. This practice would reduce the likelihood of excess nitrates entering surface water/groundwaters. The highly variable sloping terrain and bedrock escarpments at the site bring about an added level of complexity in septic system placement on some of the lots. Surface water runoff will need to be controlled upgradient of these systems to avoid untimely erosion of septic systems and reduce the potential of an unnecessary influx of partially treated wastewater into the surrounding environment.

Oakley et al., 2010 distinguished that conventional onsite wastewater treatment systems comprised of sand filters and denitrifying bioreactors (septic tanks) are the most robust and reliable wastewater treatment methods however, their implementation is constricted to larger lot size.

As a substitute to the use of a traditional septic tank and filter beds or absorption trench style leaching beds, alternative treatment of sewage may be utilized in accordance with OBC. As depicted in Figure 3, the area required for alternative sewage treatment units greatly reduces the sewage treatment footprint allowing for lots with tight clearances to be developed. These alternative sewage treatment systems vary in technologies from porous bacterial enriched foam and denitrifying lignocellulose mediums to microbial electrochemical septic tanks (MESTs). They are classified as Class 4 sewage systems and are therefore held to the same building code in the OBC.

Alternative sewage treatment systems that are suggested for the site include but are not limited to:

- Waterloo Biofilter Designed to perform on difficult sites including small remote lots, areas of exposed bedrock, in soils with low permeability, areas with high water tables, and environmentally sensitive areas. There are many applications to suit the needs of the site-specific conditions. Third party tested. Canadian manufactured.
- Ecoflo biofilter by Premier Tech Designed to perform on difficult sites including small remote lots, areas of exposed bedrock, in soils with low permeability, areas with high water tables, and environmentally sensitive areas. United States manufactured.

4. CONCLUSIONS

The following statements and conclusions are based on the investigation and analysis contained within this report:



- Existing water well records within 500 m of the subdivision show that well yields are acceptable in most cases. Some wells have relatively low yields. This may be due to the nature of the fractured bedrock aquifer at the site. A small percentage of future wells may not intersect fracture networks that will provide sufficient yield for normal residential use.
- If the yield of any future well is insufficient to provide an adequate quantity of water to meet 'peak demand 'requirements, surface storage may be required. In these cases, the amount of surface storage should be determined based on the actual sustainable yield of the well, as determined by a six-hour pumping test.
- Analytical results from a water quality sample obtained from the well at 2003 Pond Lane (within the subdivision) are all below the limits specified in the ODWSOG, except for the result for hardness. Hardness levels below 500 mg/L in drinking water are considered generally acceptable for most domestic purposes and can be treated using a conventional water softener system.
- The concentration of sodium (28.7 mg/L) in the sample from the well at 2003 Pond Lane exceeds 20 mg/L. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L.
- The site is potentially hydrogeologically sensitive. Discontinuous thin soil coverage reduces the potential for filtration of contaminants. Measures for well construction and septic system design are provided herein to mitigate potential water quality impacts. The results of a site wide predictive nitrate impact assessment show that additional nitrate loading from individual septic systems should be well below the provincially mandated limit of 10 mg/L so the subdivision should have an acceptable impact.
- The subject property is suitable for development as a residential subdivision at the proposed density, if future development incorporates appropriate alternatives for wastewater treatment at lots that are not suitable for conventional systems. Any potential impacts to neighbouring well users are expected to be minimal.

5. **RECOMMENDATIONS**

5.1 WATER SUPPLY

- All future water wells in the subdivisions should be constructed so that the steel water well casing is installed and grouted into place to a depth of 4 m (12 feet) into competent bedrock or to a minimum depth of 12 m, whichever depth is greatest. This will reduce the potential of contamination. If any new well is deemed to be incapable of providing an adequate supply or use with supplemental storage (i.e. extremely low yield), it should be decommissioned according to the requirements of O.Reg. 903.
- At the time of new well installation, the drilling of the casing hole, installation of casing, and grouting of the annular space should be inspected by a licensed Professional Engineer



or Professional Geoscientist of Ontario. All well construction must be carried out by a licensed well technician.

- Wells should be developed to a sand free state in order to ensure that the residual turbidity created by the well drilling activities is completely purged from the well. Additional well development, prior to placing the well into use, is strongly recommended in order to provide adequate development of the formation and remove extraneous rock debris from the aquifer pathways.
- All future water wells should be constructed so that the top of well casing is a minimum of 400 mm above the finished grade within a 3 m radius of the wellhead. The grade should slope away from the wellhead in all directions for a distance of at least 3 m.
- Well owners should ensure that the wellhead and surrounding area are maintained in accordance with the requirements of O.Reg. 903. Future well owners should refer to the MECP Water Supply Wells Requirements and Best Management Practices, (Revised April 2015) website at: https://dr6j45jk9xcmk.cloudfront.net/documents/4410/a-wwbmptitle-master-table-of-contents-chapter-1.pdf
- The raw water found in the water supply aquifer system is considered to be hard. Residential grade water softeners are recommended where water hardness is deemed unsuitable. A warning clause addressed to people on low sodium diets should be registered on title regarding the elevated concentration of sodium (> 20 mg/L) associated with water softeners.

5.2 WASTEWATER TREATMENT

- For lots that meet clearances and requirements in accordance with the OBC, it is suggested that fully raised Class 4 sewage systems consisting of a septic tank and leaching beds be implemented (i.e. conventional systems with raised beds). Imported fill should be used to raise septic beds no less than 900 mm above native ground surface. These lots are listed in Table 5 and indicated on Figure 4.
- Special attention should be taken with the placement of fully raised Class 4 sewage systems on steeply sloping lots that meet clearances and requirements in accordance with the OBC, including as indicated in Table 5 and on Figure 4 (i.e. conventional systems with raised beds on sloping lots).
- For lots that exceed clearances and requirements outlined in the OBC it is suggested that alternative sewage treatment systems be implemented. These lots are identified in Table 5 and on Figure 4 and include Lots 18, 19, 27, 37, and 38.
- Special attention should be taken with the placement of septic beds on sites with water bodies. Ideally a minimum distance of 30 m should be maintained between the water body high water line and septic bed as recommended by WESA (1979). In some cases (Lots 44 and 45) this will not be possible, so the OBC minimum distance of 15 m must be maintained. These lots are indicated in Table 5.



- A lot-specific investigation should be carried out for the detailed sewage system design and site grading plan at each lot as part of the building permit application process.
- Proposed well, septic, and building locations are noted on Figure 4 (Conceptual Lot Development Plan B Restricted Private Services).
- Future owners of individual onsite wastewater treatment systems should familiarize themselves with basic safety and maintenance information which is available at: http://www.omafra.gov.on.ca/english/environment/facts/sep_smart.htm

The conclusions presented in this report represent our professional opinion and are based on the conditions observed on the dates set out in the report for the specific locations where samples were collected, the information available at the time this report was prepared, the scope of work, and any limiting conditions noted herein. BluMetric provides no assurances regarding changes to conditions after the time of the assessment. BluMetric makes no warranty as to the accuracy or completeness of the information provided by others or of the conclusions and recommendations predicated on the accuracy of that information.

This report has been prepared for Tay Valley Township. Any use a third party makes of this report, any reliance on the report, or decisions based upon the report, are the responsibility of those third parties unless authorization is received from BluMetric in writing. BluMetric accepts no responsibility for any loss or damages suffered by any unauthorized third party as a result of decisions made or actions taken based on this report.

This report was written by Matthew DeGeer and Russell Chown of BluMetric and reviewed by Robert Hillier of BluMetric. We trust that this assessment satisfies local requirements. If you have any questions, please do not hesitate to contact the undersigned.

Respectfully submitted, BluMetric Environmental Inc.

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- Ontario Building Code (O. Reg. 332/12: BUILDING CODE, under Building Code Act, 1992, S.O. 1992, c. 23)







Table 2: Well Water Quality Summary Tay Valley Township - Maberly Pines Subdivision - 56 lot development

Parameter				Sample ID: 2003-01				
	Units	MDL	ODWS	OG ^{1, 2}		O. Reg. 153/04 ⁶		
Sample Date			Objective	Type of Objective	LG&LDHU ³	Table 8	23-11-2021	
Field Measurements								
Conductivity	u\$/cm	1	-	-	-	-	488.5	
pH	pH units	0.01	-	-	-	-	6.99	
Hydrogen Sulphide	-	-	-	-	-	-	No odour	
Temperature	°c	0.1	-	-	-	-	8.9	
Visual Clarity	-	-	-	-	-	-	Clear & Colourless	
Microbiological Parameters	6511/000		0.0511.400		0.0511/000			
E. Coli Fecal Coliforms	CFU/100 mL	1	0 CFU/100 mL	MAC	0 CFU/100 mL	-	0	
	CFU/100 mL	1	- 0 CFU/100 mL	- MAC	- 5 (511/100 ml	-	0	
Total Coliforms General Inorganics	CFU/100 mL	1	0 CF0/100 mL	MAC	5 CFU/100 mL	-	U	
Alkalinity, total	mg/L	5	500 mg/L	OG	-	-	234	
Ammonia as N	mg/L	0.01	500 mg/L	00	-		0.02	
Dissolved Organic Carbon	mg/L	0.01	5 mg/L	AO	-		Hold for results	
Colour	TCU	2	5 TCU	AO	-		<2	
Conductivity	u\$/cm	5	-	-	-	-	476	
Hardness	mg/L	1	80-100	OG	· ·	-	213	
pH	pH Units	0.1	-	-	-	-	8.12	
Phenolics	mg/L	0.001	-	-	-	-		
Total Dissolved Solids	mg/L	1	500 mg/L	AO	-	-	246	
Sulphide	mg/L	0.01	0.05 mg/L	AO		-		
Tannin & Lignin	mg/L	0.1		-		-	1	
Total Kjeldahl Nitrogen	mg/L	0.1	-	-	-	-		
Turbidity	NTU	0.1	5 NTU	AO		-	0.2	
Anions								
Chloride	mg/L	1	250 mg/L	AO	-	-	7.2	
Fluoride	mg/L	0.1	1.5 mg/L	MAC	-	-	0.2	
Nitrate as N	mg/L	0.1	10 mg/L	MAC	-	-	<0.10	
Nitrite as N	mg/L	0.1	1 mg/L	MAC	-	-	<0.10	
Sulphate	mg/L	1	500 mg/L	AO	-	-	18	
Metals					r			
Antimony (Sb)	mg/L	0.0005	0.006 mg/L	IMAC	-	0.006	< 0.0001	
Arsenic (As)	mg/L	0.001	0.01 mg/L	IMAC	-	0.025	<0.0001	
Barium (Ba)	mg/L	0.001	1 mg/L	MAC	-	1	0.086	
Beryllium (Be)	mg/L	0.0005	-	-	-	0.004	<0.0001	
Boron (B)	mg/L 🖉	0.01	5 mg/L	IMAC	-	5	0.153	
Cadmium (Cd)	mg/L	0.0001	0.005 mg/L	MAC	-	0.0021	<0.000015	
Calcium (Ca)	mg/L	0.1		-	-	-	55.8	
Chromium (Cr)	mg/L	0.001	0.05 mg/L	MAC	-	0.05	<0.002	
Cobalt (Co)	mg/L	0.0002		-	-	0.0038	0.0001	
Copper (Cu)	mg/L	0.001	1 mg/L	AO	-	0.069	0.019	
Iron (Fe)	mg/L	0.1	0.3 mg/L	AO	-	-	< 0.005	
Lead (Pb)	mg/L	0.0001	0.01 mg/L	MAC	-	0.01	0.00018	
Magnesium (Mg) Manganese (Mn)	mg/L	0.2	-	-	-		18	
	mg/L	0.005	0.05 mg/L	AO -	-	-	0.018	
Molybdenum (Mo) Nickel (Ni)	mg/L	0.005	-	-	-	0.1	< 0.0008	
	mg/L	0.005	-			-	2.8	
Potassium (K) Selenium (Se)	mg/L mg/L	0.001	- 0.05 mg/L	-	-	0.01	<0.001	
Silver (Ag)	mg/L	0.0001	0.05 mg/L	-	-	0.0012	<0.001	
Sodium (Na)	mg/L	0.0001	- 200 mg/L ⁴	-	-	-	28.7	
Strontium (Sr)						-		
	mg/L	0.001	7.05	MAC	-		0.557	
Thallium (TI)	mg/L	0.0001	- 0.02 mg/l	-	-	0.002	< 0.00005	
Uranium (U)	mg/L	0.0001	0.02 mg/L	-	-	0.02	0.00198	
Vanadium (V) Zinc (Zn)	mg/L	0.001	- 5 mg/L	-	-	0.0062	0.0002	
Volatile Organic Compounds	mg/L	0.01	J INg/L	-	-	0.89	0.006	
Acetone	μg/L	30	-	-		2700	<30	
Benzene	μg/L	0.5	- 1.0 μg/L	MAC		5	<0.5	
Bromodichloromethane	μg/L μg/L	2	1.0 μg/L	-		16	<0.5	
Bromodichioromethane	μg/L μg/L	5	-	-		25	<5	
Bromomethane	μg/L μg/L	0.5	-	-		0.89	<0.5	
Carbon Tetrachloride	μg/L μg/L	0.2	-	-		0.79	<0.2	
Monochlorobenzene	μg/L μg/L	0.2	-	-		-	<0.2	
Chloroform	μg/L μg/L	1	-	-		2.4	<1	
Dibromochloromethane	μg/L μg/L	2	-	-		2.4	<2	
Dichlorobenzene, 1, 2-	μg/L μg/L	0.5	- 200 μg/L	MAC		3	<0.5	
Dichlorobenzene, 1, 3-	μg/L μg/L	0.5	200 µg/L -			59	<0.5	
Dichlorobenzene, 1, 4-	μg/L μg/L	0.5	- 5.0 μg/L	MAC		1	<0.5	
Dichlorodifluoromethane	μg/L μg/L	2	- 5.0 μg/L	MAC -		590	<0.5	
Dichloroethane, 1, 1-	μg/L μg/L	0.5	-	-		590	<0.5	
Dichloroethane, 1, 2-		0.5	- 5.0 μg/L	MAC		1.6	<0.5	
Dichloroethylene, 1, 2-	μg/L μg/L	0.5	5.0 μg/L 14.0 μg/L	MAC		1.6	<0.5	



Table 2: Well Water Quality Summary Tay Valley Township - Maberly Pines Subdivision - 56 lot development

Parameter				Sample ID: 2003-01			
	Units	MDL	ODWS	OG ^{1, 2}		O. Reg. 153/04 ⁶	
Sample Date			Objective	Type of Objective	LG&LDHU ³	Table 8	23-11-2021
Dichloroethene, cis-1, 2-	μg/L	0.5	-	-		-	< 0.5
Dichloroethene, trans-1, 2-	μg/L	0.5	-	-		-	< 0.5
Dichloropropane, 1, 2-	µg/L	0.5	-	-		5	< 0.5
Dichloropropene, cis-1,3-	µg/L	0.5	-	-		-	< 0.5
Dichloropropene, trans-1,3-	μg/L	0.5	-	-		-	< 0.5
Dichloropropene, trans-1,3-	μg/L	0.5	-	-		-	< 0.5
Dichloropropene 1,3- cis+trans	μg/L	0.5	-	-		-	< 0.5
Ethylbenzene	μg/L	0.5	140 µg/L	MAC		2.4	<0.5
Dibromoethane, 1,2- (Ethylene Dibromide)	μg/L	0.2	-	-		-	<0.2
Hexane	μg/L	5	-	-		51	<5
Methyl Ethyl Ketone	μg/L	20	-	-		1800	<20
Methyl Isobutyl Ketone	μg/L	20	-	-		640	<20
Methyl-t-butyl Ether	μg/L	2	-	-		15	<2
Dichloromethane (Methylene Chloride)	μg/L	5	-	-		50	<5
Styrene	μg/L	0.5	-	-		5.4	< 0.5
Tetrachloroethane, 1, 1, 1, 2-	μg/L	0.5	-	-		1.1	< 0.5
Tetrachloroethane, 1, 1, 2, 2-	μg/L	0.5	-	-		1	< 0.5
Tetrachloroethylene	μg/L	0.5	10 µg/L	MAC		1.6	<0.5
Toluene	μg/L	0.5	60 µg/L	MAC		22	< 0.5
Trichloroethane, 1, 1, 1-	μg/L	0.5	-	-		200	<0.5
Trichloroethane, 1, 1, 2-	μg/L	0.5	-	-		4.7	< 0.5
Trichloroethylene	μg/L	0.5	5.0 μg/L	MAC		1.6	< 0.5
Trichlorofluoromethane	μg/L	5	-	-		150	<5
Vinyl Chloride	μg/L	0.2	1.0 µg/L	MAC		0.5	<0.2
Xylene, m, p-	µg/L	1	-			-	<1
Xylene, o-	μg/L	0.5				-	<.5
Xylene, m, p, o-	μg/L	1.1	-			-	<1.1

Notes:

1 - Denotes Ontario Drinking-Water Standards Objectives and

Denotes Orinking-Water Standards Objectives and Guidelines, June 2006 (O. Reg. 169/03, as amended)
 Denotes Ontario Drinking-Water Standards Objectives and Guidelines, June 2006 (O. Reg. 373/15, s. 1; O. Reg. 457/16, s. 1.)
 Denotes Leeds, Grenville, and Lanark District Health Unit Safe Drinking Water Interpretation
 Potential elevated socium intake should should be communicated to your physician when

4 - Potential elevated sodium intake should should be communicated to your physician w concentration exceeds 20 mg/L,
5 - Health Canada Proposed Standard
6 - O. Reg. 153/04 - Table 8: Generic Site Condition Standards for Use within 30 m of a Water Body in a Potable Groundwater Condition
MAC - Maximum Acceptable Concentration
IMAC - Interim Maximum Acceptable Concentration
A - Asthetic Objective

OG - Operational Guideline (for water treatment)

- Denotes exceeds OD/WSOG
 Denotes exceeds OD/WSOG
 Denotes exceeds O, Reg. 153/04
 No standard value or parameter not tested



Table 3: Well Water Quality (Ambient Groundwater Study) Ontario Geological Survey Ambient Groundwater Quality Summary Tay Valley Township - Maberly Pines Subdivision - 56 lot development

Parameter		Regu	13-AG-002	
raiainetei	Units		ubject property	5.02 km east
			epth (m)	50.29
		ODW	/SOG ¹	
Sample Date		Objective	Type of Objective	25-May-13
General Inorganics				
Alkalinity, total	mg/L	500 mg/L	OG	-
Ammonia as N	mg/L	-	-	-
Colour	TCU	5 TCU	AO	-
Conductivity	u\$/cm	-	-	582
DOC	mg/L	5	AO	2.2
pН	pH Units	6.5 - 8.5	-	6.27
TDS	mg/L	500	AO	387.4
Organic Nitrogen	mg/L	-	-	0.07
TKN	mg/L	-		0.07
Anions				
Chloride	mg/L	250 mg/L	AO	54.28
Fluoride	mg/L	1.5 mg/L	MAC	0.107
Nitrate as N	mg/L	10 mg/L	MAC	1.34
Nitrite as N	mg/L	1 mg/L	MAC	<0.005
Sulphide	mg/L	0.05	AO	NA
Sulphate	mg/L	500 mg/L	AO	50.06
Metals				
Calcium	mg/L		-	71.31
Iron	mg/L	0.30 mg/L	AO	<0.015
Magnesium	mg/L	-	-	12.457
Manganese	mg/L	0.05 mg/L	AO	0.002
Potassium	mg/L	-	-	3.29
Sodium	mg/L	200 mg/L	AO	13.184
Antimony (Sb)	μg/L	6	IMAC	0.015
Arsenic (As)	μg/L	25	IMAC	0.088
Barium (Ba)	μg/L	1000	MAC	84.5
Boron (B)	μg/L	5000	IMAC	74
Cadmium (Cd)	μg/L	5	MAC	<0.01
Chromium (Cr)	μg/L	50	MAC	<0.02
Copper (Cu)	μg/L	1000	AO	5.91
Lead (Pb)	μg/L	10	MAC	0.1102
Mercury (Hg)	μg/L	1	MAC	<0.0015
Selenium	μg/L	10	MAC	<0.2
Zinc	μg/L	5000	AO	1.3
Uranium	μg/L	20	MAC	1.09

Notes:

1 - Denotes Ontario Drinking-Water Standards Objectives and

Guidelines, June 2006 (O. Reg. 169/03, as amended)

MAC - Maximum Acceptable Concentration

 $\mathsf{IMAC}\,$ - Interim Maximum Acceptable Concentration

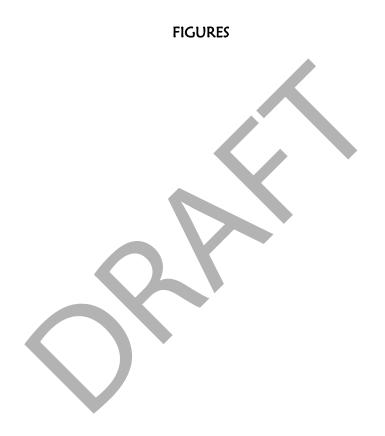
AO - Aesthetic Objective

OG - Operational Guideline (for water treatment)

- Denotes exceeds respective Ontario Drinking Water Standard

- - No standard value or parameter not tested

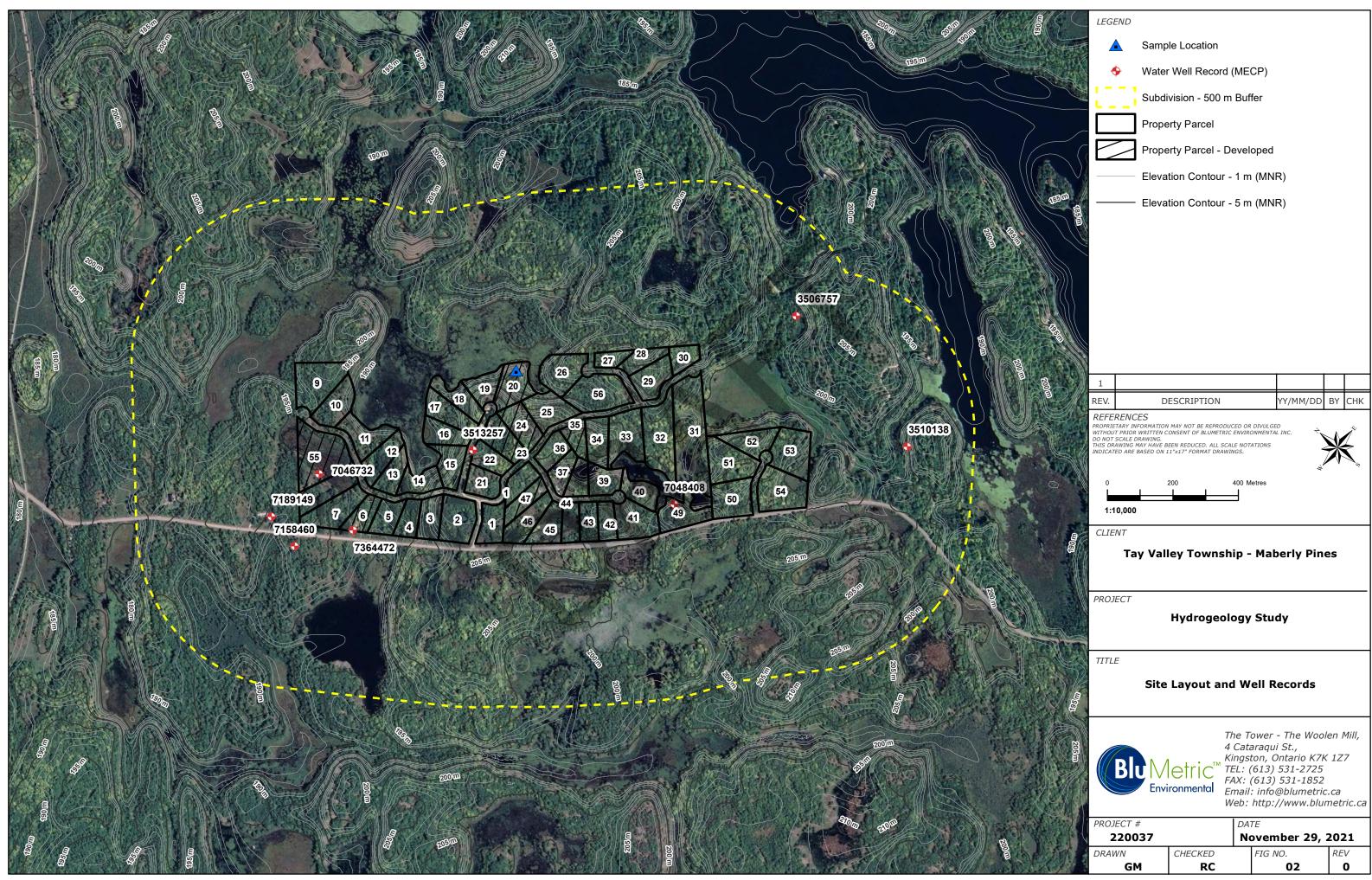
Parameters		Units	Information Source/Calculation
Annual Precipitation (P) =	0.9398	m/year	Canadian Climate Normals 1981-2010 Station Data, Godfrey Station.
Runoff (Q) =	16.5	%	
Evapotranspiration(E) =	58.6	%	Silty Loam Table 3.1: Hydrologic Cycle Component Values, (MOE Stormwater Mangement Planning and Design Manual, March 2003)
Infiltration/groundwater recharge (R) =	24.9	%	
Concentration of Nitrate =	40	mg/L	Values as specified in Section 5.6.2 of Procedure D-5-4 Technical Guideline For
Concentration of Nitrate =	40000	mg/m3	Individual On-Site Sewage Sytems: Water Quality Impact Risk Assessment, Last
Daily Flow rate of Sewage =	1000	L /day	Revision August 1996
Number of units =	56		
Yearly Sewage Volume (S_y) =	20440	m³/year	
Total Property Surface Area =	767579	m ²	Total Development Area
% Pervious Area =	80%		Stormwater Management Report prepared by Forefront Engineering Inc.
Infiltration Surface Area $(A_d) =$	614063.2	m ²	
Infiltration Flux, R	143697.05	m³/year	R=P-Q-E
Yearly Volume of Sewage (Sy) =	20440	m ³ /year	
Yearly Volume of Infiltration (R) =	143697	m³/year	
Yearly Mass Loading of Nitrate $(M_y) =$	817600000	mg/year	
Nitrate Conc.at Downgradient Prop.Boundary =	4981.20	U	My/(Sy + R)
" =	4.98	mg/L	
Background Nitrate Concentration =	0.00	mg/L	Max. concentration measured at test wells (2003-01)
Nitrate Total =	4.98	mg/L	

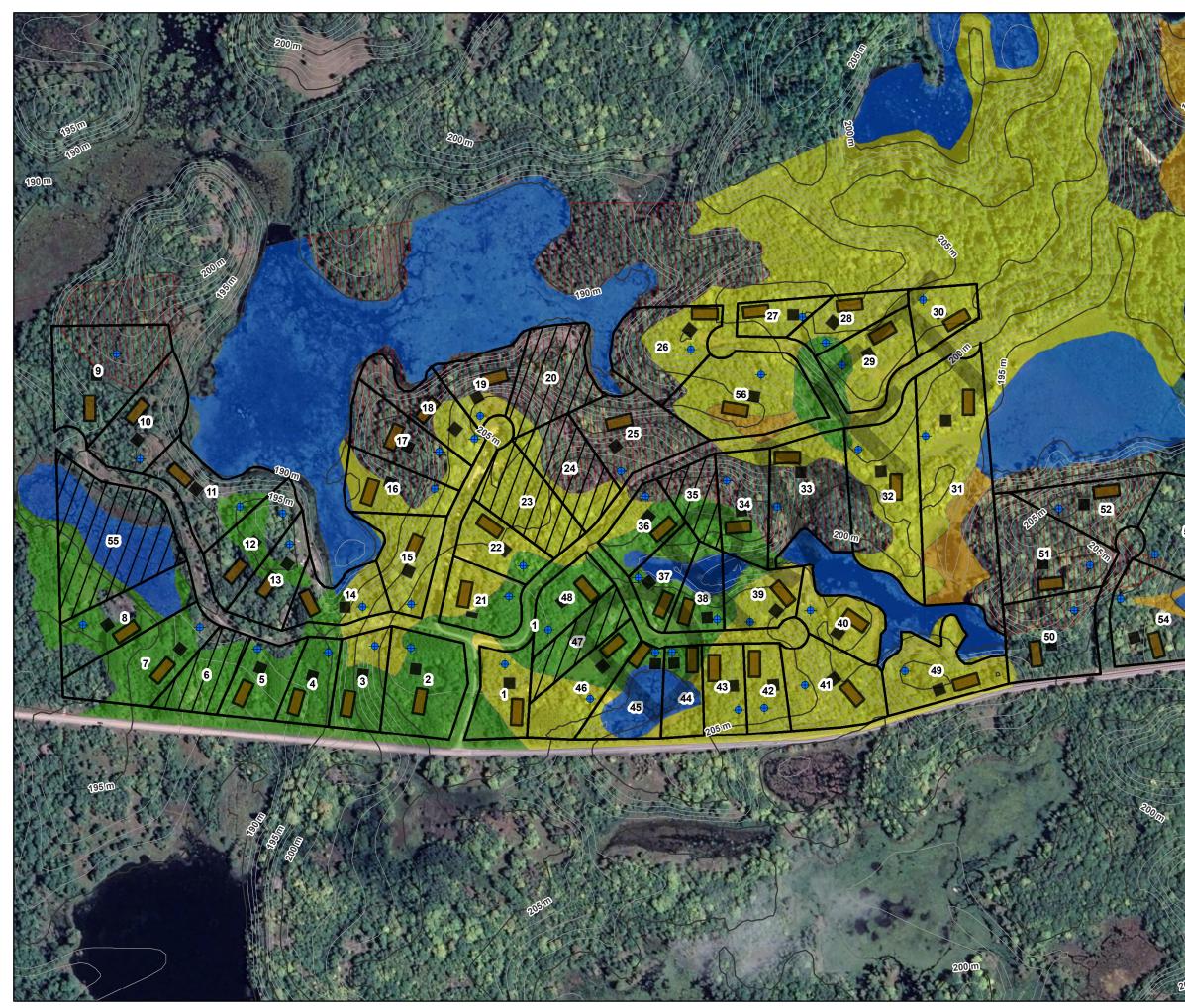


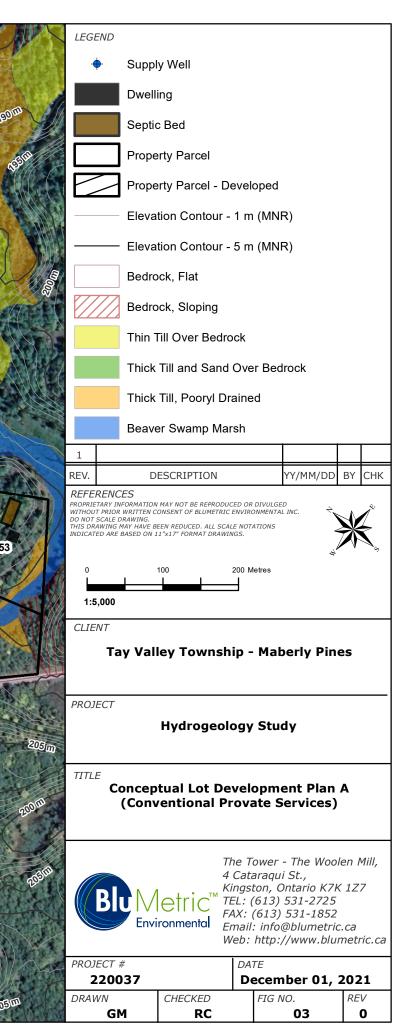




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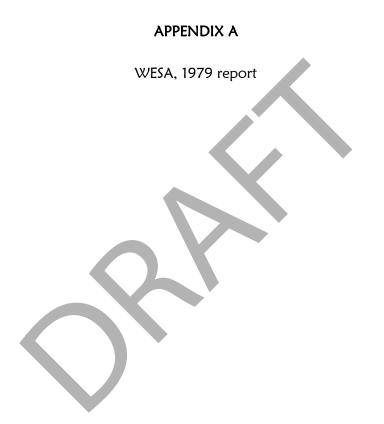








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MABERLY PINES DEVELOPMENT

Terrain: Hydrogeological and Ecological Analysis

Concession V Parts of Lots 12, 13, 19, 15,

Concession VI Part of Lot 13

South Sherbrooke Township



WATER AND EARTH SCIENCE ASSOCIATES LTD.

124 O'CONNOR ST., SUITE 303, OTTAWA, ONTARIO KIP 5 M9

MABERLY PINES DEVELOPMENT

Terrain, Hydrogeological and Ecological Analysis

Concession V Parts of Lots 12, 13, 14, 15

Concession VI Part of Lot I3

South Sherbrooke Township

Derek P. Smith M.Sc. FGAC

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Water and Earth Science Associates Ltd.

Harold J. Parsons, Director

Al Macdonald B.Sc.

Bufo Inc.

1.0 Introduction

Water and Earth Science Associates were commissioned by Mr. Jacques Noel, President of Lakeside Living Limited to conduct an analysis of the hydrogeological, terrain and ecological conditions of a proposed seasonal residental subdivision located on Concession V (parts of Lots 12, 13, 14, 15) and Concession VI (part of Lot 13), Township of South Sherbrooke. (Figure 1)

In order to establish the suitability of the property for development on wells and septic tank systems and provide planning and environmental guidelines as dictated by terrain conditions, the following site factors were studied:

- the distribution and lithology of bedrock and surficial materials
- 2. topography and drainage
- 3. the hydrogeological characteristics of the bedrock aquifer
 - the characteristics of terrain units and their potential to disperse and attenuate septic tank effluent, and
- 5. the most suitable design of well and septic tank systems.

The results of our investigations are presented in the following report.

1.1 Study Methods

First, a site reconnaissance of the property was made and pertinent published literature about the physiography, geology, ecology and hydrogeology of the Little Silver Lake area was reviewed.

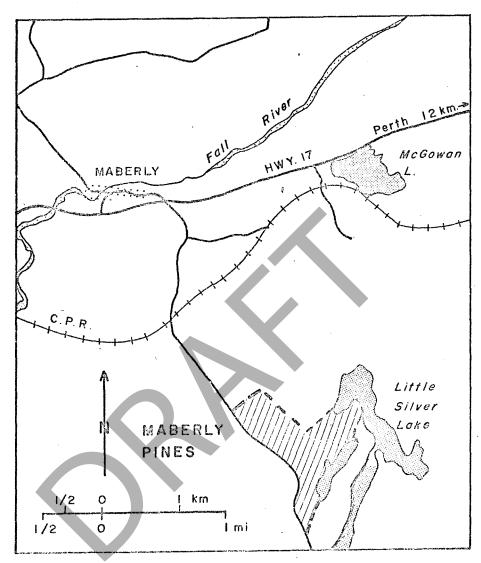


FIGURE I MABERLY PINES LOCATION MAP

Then five days of field work were conducted at the site during which time the geology and ecology of the land parcel was mapped at a scale of 1:2400. Large and small scale air photographs were used during this investigation. Field mapping was conducted by geological traversing and hand digging shallow test pits into the surficial sediments.

All published well logs from Concessions 3 - 9 and Lots 11 - 16 of South Sherbrooke Township were collected and analyzed to establish the potential of aquifers within the property. The grain size distribution and hydraulic conductivity of a typical soil sample were measured in the laboratory to determine the suitability of surficial materials for the in-ground disposal of domestic sewage.

Finally, planning documents and government regulations were reviewed as a basis for the recommendations included in this report.

1.2 Physiography

Physiographically, the Maberly Pines area is made up of a series of bedrock knobs and ridges interspersed with lowland areas. The terrain has a northwest-southeast orientation which is particularly pronounced immediately south of Little Silver Lake (Figure 2). Site topography reflects the peneplanation of this region which was caused by four major glacial advances and retreats. A maximum elevation of 212 metres above sea level occurs near Little Silver Lake, although most bedrock ridges lie at 202 - 210 metres above sea level. Lowland areas occur at elevations which range from 192 to 200 metres above sea level. Some variation in the elevation of swamps occurs across the site. For example, the large pond in the northwest corner of the site has a 192 metre water level while a small waterbody near the highway to the south of the property lies at a 200 metre elevation.

2.0 Site Geology

The Little Silver Lake area is a good example of the Precambrian Terrain which characterizes much of the Canadian Shield of Ontario and Quebec. Ancient Precambrian rocks, last deformed by the Grenville Mountain Building episode which occurred about 950 million years ago, are overlain by a thin veneer of much younger glacial and non-glacial sediments. An irregular glaciated topography with an immature drainage pattern and numerous beaver ponds in lowland areas typify this torrain type.

The geology of the Little Silver Lake site is summarized in chart form as Table 1 of this text. A brief discussion of bedrock and surficial deposits is included below. The reader is referred to the geological references cited in the bibliography of this text if more details of the geological history of the Perth-Maberly region are of interest.

2.1 Bedrock Geology

The site is underlain by a Precambrian crystalline basement complex which includes biotite gneiss, diorite, migmatite, marble, quartzite, pegmatite and related paragneissic rocks. Bedrock is foliated with a northeast - southwest trend and near vertical dips.

The upper rock surface is striated, plucked and grooved and indicates that the last movement of glacial ice across this region was

	GEOLOGICAL AGE		LITHOLOGY	THICKNESS	SLOPE	GEOLOGICAL HISTORY		
SURFICIAL DEPOSITS	QUATERNARY		Soils; podzols, acidic and immature. Bog deposits, muck and peat, areas of fen vegetation, marsh. Glacial till, angular pebbles and boulders with a silty sandy brown matrix; pebbly sand facies overlies till.	5 to 10 cm .3 m to greater than 1 metre	flat deposited as thin veneer on sloping bedrock	Formed by interaction of biological, climatic and geological elements. Controlled by beaver population or formed in poorly drained lowlands, produced by high organic deposition in wet areas. Direct deposit from glacial ice; glacial till ground moraine. Sandy facies restricted to poorly developed small drumlin		
BEDROCK	PRECAMBRIAN		Migmatite, biotite gneiss, diorite, marble, pegmatite and other granitized paragneisses	unknown	5 - 40% slopes, steep escarp- ment in places	Eroded roots of the Grenville Mountains (950 million years old).		

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Table 1: Summary of Geological History

in a northeast to southwest direction. Bedrock outcrops at the ground surface throughout the property and forms abrupt bedrock escarpments in many places.

Small outcrops and escarpments are present throughout parts of the land parcel forming a rugged microrelief.

Some evidence of minor open pit feldspar mining activity is present on the property, although excavations are too small to comprise a constraint to site planning.

2.1 Surficial Geology

Bedrock is covered by a veneer of glacial till ground moraine over most of the property. The distribution of the till material and bedrock outcrop areas is shown on Figure 2 of this report.

The till ground moraine material is composed of angular granitic pebbles and cobbles with a fine sand and silt matrix. In several areas of the property, poorly stratified pebbly sand deposits are found associated with the till ground moraine. These deposits apparently range up to 5 metres in thickness, lie stratigraphically above the till material and are oriented parallel to the direction of the last ice movement. They are interpreted as being very poorly developed small drumlin structures based on this evidence. The major drumlin is located just south of the property boundary near Little Silver Lake (just outside area of Figure 2) and has been partially quarried for borrow material. Similar deposits were noticed in several areas of the site but were mapped as a sand facies of the till ground moraine material due to their diffuse form and thinness. The composition of a typical sample of the till ground moraine material was analyzed in the laboratory with the following results:

Grain	Size	Distribution	Clay	2.%
			Silt	18%
		Fine	Sand	36%
		Medium	Sand	12%
		Coarse	Sand	8%
		G	rave 1	24%

Permeability (using Falling Head Permeameter) = 2.42 x 10⁻⁴ cm/sec.

Where present, the till unit is usually only a few centimetres to half a metre in thickness on ridge tops. However, in valley areas, a till thickness of 1 metre or greater was found during field investigations.

Swamp deposits include poorly drained black organic soils, muck and peat deposits. Their distribution is restricted to lowland areas and have been greatly extended in recent years by the activities of the beaver population in the area.

In general, soils formed on the sandy till ground moraine are poorly developed, are from 10 to 20 centimetres thick and have a poor potential for agricultural crop production.

3.0 Hydrogeology

In order to provide information on potential well yields and groundwater quality within the Maberly Pines subdivision, existing

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well logs recorded with the Ministry of the Environment from Concessions 7, 8, 9, Lots 11 to 16 have been assembled and analyzed.

The Precambrian bedrock is the only geological unit in the study region with the potential to provide adequate quantities of groundwater for domestic water supplies. Surficial materials are too thin and discontinuous in nature to furnish reliable water sources. Therefore, dug or driven wells are considered unsuitable for use on this property.

Knowledge of the recharge characteristics, water supply potential and grou dwater quality of the Precambrian aquifer is an important factor in the planning of any development of this site. A brief discussion of these points is included in the following sections. 3.1 Recharge Characteristics

Groundwater movement in the Precambrian basement rock is controlled by variations in topography between highlands and lowland areas and the pattern and extent of the fracture system present. Figure 3 illustrates in a theoretical manner how the precipitation which falls on upland recharge areas will flow downwards into the saturated groundwater zone below the water table and hence, in a lateral direction towards lowland swamp and stream discharge zones.

Saturated hydraulic gradients in Precambrian terrain are impossible to measure without detailed drilling data. Gradients in the unsaturated near-surface fracture system, however, should reflect surface topography variations and the orientation of fracture patterns closely and are typically quite high (0.2 to 0.7). Infiltration rates

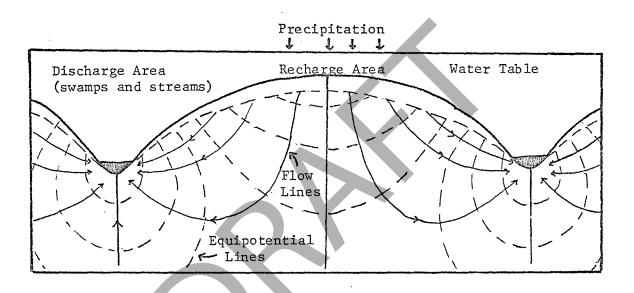


Figure 3: Idealized Model illustrating Groundwater Flow from Recharge on the Topographic Highs to Discharge in the Valleys (Hubbert, 1940)

and groundwater flow velocities should be high in this terrain but cannot be calculated because measurements of the bedrock fracture permeability have not been made. However, groundwater movement in the order of 25 - 50 metres per year is considered a reasonable estimate based on theoretical calculations.

Based on this information, wells should be located on highland areas, for two reasons:

a) septic tile weeping beds can then be located at lower elevations and will flow away from, not towards water wells

b) wells will be recharged by precipitation and will be located at a sufficient distance from lowland marsh areas to avoid drawing water from these sources. Marsh water is often of poor quality due to high organic acid concentrations, low pH or colour and odour problems.

3.2 Aquifer Potential

The water wells for all domestic wells utilizing the Precambrian bedrock aquifer in Concessions 7, 8 and 9, Lots 10 to 16 have been analyzed to provide an assessment of the groundwater supply potential in the Maberly Pines Subdivision. The 17 logs recorded with the Ministry of the Environment are included as Appendix B in this report. There is no well log information from the proposed subdivision with existing cottages along Silver Lake using lake water as a water source.

Well yields in Precambrian terrain vary as a function of the degree of fracture (i.e. fracture permeability) of the bedrock.

Well yields can vary significantly within short distances (i.e. 100 metres or less) in this rock type. It should be noted that fractures usually decrease in density with depth along the metamorphic foliation and the joint pattern in granitic rocks. Well yields are usually not significantly increased if wells are drilled beyond 50 metres as a consequence.

Water was found from 10.0 to 38.4 metres below the ground surface (mean = 21.3 metres) in these wells with a static level variation of 1.21 to 10.0 metres (mean 16.5). Well data are too sparse to permit an analysis of fracture system patterns using depth histograms. However, well depths vary from 8.2 to 35.0 metres which indicate that near surface fracture systems are supplying adequate water supplies from existing residences.

To evaluate well yields, each log was examined and classified as follows:

Poor yields (drawdowns were high, 25 - 75' after short term (1-2 hr) pump tests at 5 gpm or less)	12
Moderate yields (drawdowns were fairly low, less than 50' after short term pump tests at 5 - 10 gpm)	3
Good yields (drawdowns were low after short term pump tests at greater than 10 gpm)	. 2

TOTAL 17 wells

Number of Wells

The following conclusions can be drawn from this analysis: a) twelve of the existing wells in this area have yields close to the minimum required to service a domestic residence (4 igpm or 18 litres per minute). Wells should be drilled and constructed as per the recommendations oulined in Section 4.1 to maximize the well yields and eliminate potential contamination problems.

b) it is unlikely that high volume wells of 200 litres per minute or greater could be drilled on this site. Development planning should preclude high volume water usages as a consequence.

3.3 Water Quality

The water quality of groundwater from existing wells in the Little Silver Lake area is reported to be fresh, colourless and odourless. This is most likely the case on the study property.

4.0 Type of Development

It is understood that the Little Silver Lake subdivision will be a seasonal recreational development. As a consequence, septic tanks will be used primarily during summer months and water requirements will be lower than in permanent subdivisions. The recommendations proposed in this report however, are based on the assumption that some winter utilization may also occur and that coversion of dwellings to yearly use is a possibility i.e. that the development is a year-round backlot subdivision. A restriction of the subdivision to seasonal use however, should provide a large safety factor to guarantee the integrity of groundwater supplies.

4.1 Suitability for Development

Six terrain units, or land types having a unique association

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of lithological, ecological and topographic characteristics have been identified on this property from our field work. These are:

1. bedrock, highly sloping

2. bedrock, flat

3. thin till over bedrock

4. thick till and sand over bedrock

5. thick till, poorly drained

6. beaver swamp

The distribution of each terrain unit is mapped on Figure 2 of this report while their characteristics are summarized as Table 2.

Terrain Unit 1 (bedrock, sloping) has little or not capability to attenuate septic tank effluent in its natural state due to the thin nature of the soil cover in these areas. High slopes, abundant outcrops and rock escarpments are major planning constraints throughout this unit. Terrain Unit 1 is not recommended for the installation of septic tank systems.

<u>Terrain Unit 2</u> (bedrock, flat) has the same constraints as Unit 1 but slopes are usually less than 10% and till material is thicker in isolated pockets. Development on large lots (2 - 3 acres) is considered feasible on this unit provided tile beds are fully raised and well to septic tank spacings of 30 - 50 metres are instituted. Lot planning will require locating suitable tile bed locations first and locating dwellings second in respect to these areas.

Terrain Unit 3 and 4 are distinguised on the basis of till depth. A typical sample of the silty sand till ground moraine gave a falling

TERRA IN UNIT	LITHOLOGY OF UNIT	THICKNESS OF SURFICIAL MATERIALS	HYDRAULIC CONDUCTIVITY	WATER TABLE DEPTH	SLOPE	SUITABILITY FOR CONVENTIONAL SEPTIC TANKS	WELL TO SEPTIC TANK SPACINGS	RECOMMENDED SEPTIC SYSTEM DESIGN
1	Bedrock, sloping, very thin veneer of till	03 m	greater than 2.43 x 10 ⁻⁴ cm/sec where coarse grained and thin	below bedrock surface	5 - 40% with rock escarpments	very poor, not recommended for development	-	-
2	Bedrock, flat out- crop with pockets of till	0 - 1.0 m in pockets	as below	below bedrock surface	0 - 20% rolling, rugged microrelief	poor	30 - 50 metre wells to be "upstream" from tile beds	fully raised 1 m tile beds with soil mantles
3	Thin till over bedrock	.5 - 1.5 m blanket	tested at 2.43 x 10 ⁻⁴ cm/sec	below bedrock surface	5 - 10%	fair to good	30 m	partially raised (.5 - 1.0 m) tile beds with soil mantles
4	Thick till and sand over bedrock	1.0 m blanket	as above	well drained, below bedrock surface	5 - 10%	excellent	30 m	septic tanks as per Ministry of Environ ment standards
5	Thick till poorly drained	as above.	as above	within .5 m of surface	0 - 40%	poor no development	. 	-
6	Beaver swamp	unknown	low	at surface	0%	nil no development	-	-

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Table 2: Maberly Pines Development Potential of Terrain Units

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head permeameter reading of 2.43×10^{-4} cm/second. Table 3 summarizes published literature comparing both permeability (hydraulic conductivity) and percolation test data for different types of surficial geological materials.

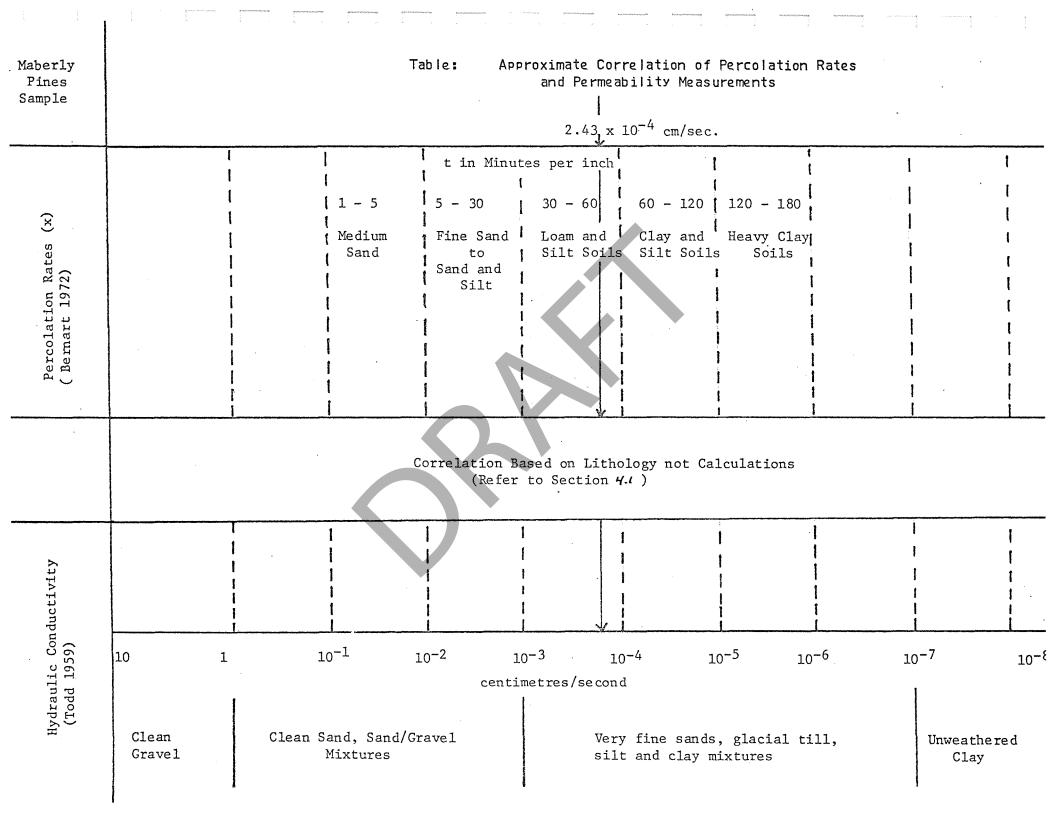
Permeability is expressed as both cm/second and minutes per inch in this Table. It is impossible, however, to relate percolation times and permeability measurements directly because permeameter readings are accurate saturated flow velocity measurements done in the laboratory while percolation readings are simple field tests. Percolation tests are often highly inaccurate due to problems of stratigraphic variation, compaction and partially saturated test holes. Also, percolation tests usually give higher (i.e. more permeable) results due to the presence of temporary structures in the soil horizon (rootlets, worm burrows, fissures, cracks, thin pervious soil lenses, etc.)

The Maberly Pines till sample has a permeability of 2.43×10^{-4} cm/second (or 175 minutes per inch if percolation could be calculated directly). According to Bernhart (1972) however, this permeability would yield a field percolation test near 60 minutes/inch and would be an excellent, although slightly impervious porous media for the attenuation of septic tank effluent.

In Terrain Unit 3 and 4 where till thickness is less than 1 metre, partially raised tile beds should be required. Minimum lot sizes of 1 acre are suggested for these units.

Poorly drained till areas have been mapped as <u>Terrain Unit 5</u> (Figure 2). These areas would require fill and drainage work during development and should be avoided whenever possible.

<u>Terrain Unit 6</u> is swampland with no potential for development. These areas are highly sensitive ecological zones and should not be filled or altered in any manner.



Well and septic tank design and site investigation recommendations are included in the following sections for each terrain unit.

4.1 Recommended Well Design

To minimize the risk of well water contamination and maximize well yields:

1. All wells should be drilled with a cable tool rig or an air rotary rig. Wells should be drilled slowly to minimize blockage and sealing of the fine joints and fractures in the bedrock which are the source of water in the Precambrian bedrock. In addition, wells should be surged every 5 metres during construction. Rotary drilling using "down-the-hole Hammer" technique (i.e. air percussion) seals fractures and result in low yields, over-deepened wells and high well construction costs.

2. All wells should be properly cement-grouted one casing length(about 7.5 metres) into bedrock to seal off near surface fractures close to the well which have a high potential to permit contaminated surface water from recharging the well.

3. Wells should be drilled at least 50 metres from swamps and marshes to avoid the possibility of recharging wells with poor quality water. Swamp water is often enriched in organic acids and may have an objectionable colour and odour.

4.2 Tile Field Design Recommendations

1. It is recommended that the capacity of septic tanks and the lengths of weeping tile used by increased be increased by a factor of 1.5 over Ministry of Environment guidelines. It is felt that most septic tank systems are underdesigned for the capacity loadings placed on them by modern household appliances (e.g. dishwashers).

2. It is recommended that tile bed or well spacings within individual lots be increased to between 30 and 50 metres as a safety factor in order to minimize any risk of contamination of potable well water. Tile beds should be located blow wells to permit effluent to flow away from and not towards water supplies.

3. Septic tanks on Terrain Units 2 and 3 will require raised tile bed installations. A diagram of this design is included as Figure 4 of this report.

4. Where slopes are high (5 - 10%), tile bed construction will require:

that a 40 x 50' minimum area be infilled with semipermeable material to reduce the slope to less than 1%

and

that a mantle of fill (20' minimum width by 2' depth) be constructed around the tile bed.

A generalized sketch of these conditions is included as Figure 5.

Tile bed construction on slopes of 10 - 25% is difficult and might require extensive remedial work with heavy construction machinery. These cases should be designed and approved on an individual basis.

5. Precambrian terrain (especially Terrain Units 1, 2 and 3) which are to be developed for seasonal and recreational uses, have a

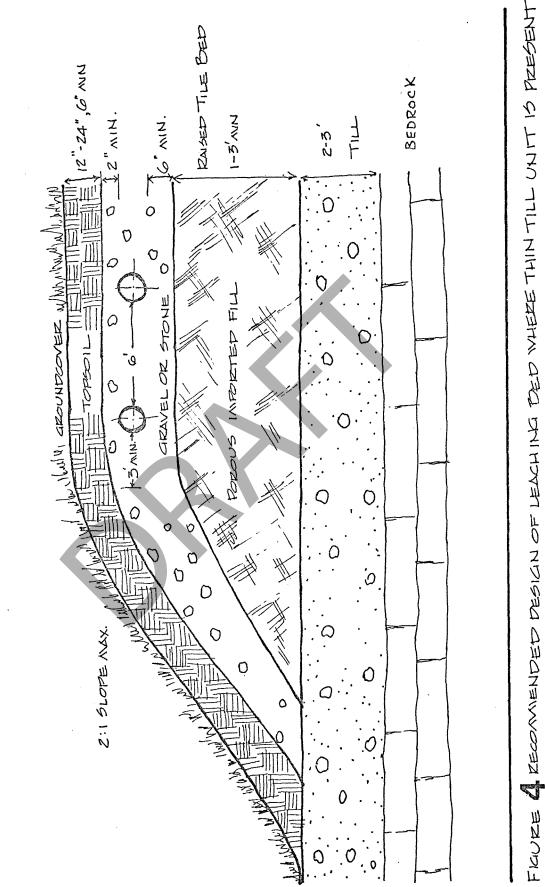
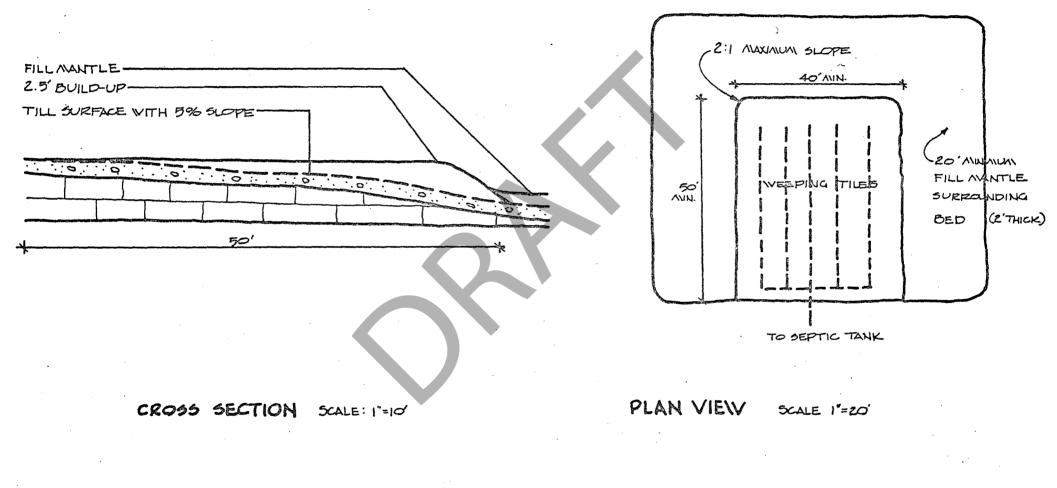


FIGURE 5: RECOMMENDED SEPTIC TANK TILE BED DESIGN ON SLOPING TERRAIN (10% MAX. SLOPE)



high potential to be serviced with Humus toilets (or some other alternative sewage system brand which does not utilize in-ground disposal methods). These toilets are functional, economical and eliminate all risk of groundwater pollution.

4.3 Site Inspections

It is recommended that a lot by lot field survey of potential tile field locations be made upon completion of the concept plan with officials of the Public Health Unit, Perth Ontario.

Any possible problems with tile bed sitings due to localized drainage channels, minor escarpments or soil thickness variations, would be identified at this time. In addition, any inaccuracies in the base map or contours which might effect site layouts would be verified at this time.

Please note that this is not a lengthy procedure but has recently become a general requirement of the Ministry of the Environment for this type of terrain.

5.0 Vegetation and Wildlife

Methodology and Fromat of Ecosystem Analysis

To assess the vegetation and wildlife components for ecological constraints to development, the site was divided into natural ecosystems. An ecosystem can be defined as the interaction and interdependence of all physical and biological components of any area. The physical and vegetation parameters of an individual ecosystem constitute a <u>biotope</u>. For this discussion, the study site has been categorized into upland biotope, lowland biotope, open field biotope marsh and swamp biotope and lake and shoreline biotope. Each biotope is described under the following headings:

- description and distribution

- threatened species or unique associations
- species of economic importance

- constraints to development

The vegetation component of each biotope is described with regards to species composition and distribution. The discussion of unique associations at particular sites includes consideration of abundance of species and significance of the association of plants and animals to the biotope. Decisions concerning the presence of rare and endangered species are based upon each species' range, the occurrence of suitable habitat, and records in the scientific litera-Species of economic importance include game species of birds ture. and animals, sport fishes, fur-bearers and commercial forest tree speices. Canada Land Inventory capability maps for ungulate, waterfowl and forestry production are referred to where applicable. Constraints to development were derived after evaluating sensitivities of the ecosystems to the types of disturbance generated by an estate lot housing project. Areas of high and moderate sensitivity have been mapped on Figure 2 of this report as a guideline for subdivision planning.

5.1 Upland Biotope (Terrain Units 1 and 2)

A. Description and Distribution

The upland biotope is composed of high, well-drained areas that may be forested or shrub covered and partially bare. The forested portions of upland sites are covered by stands of red oak but varied micro-relief promotes some growth of sugar maple and white birch in more moist situations. Thin soils on high ground are dominated by juniper shrubs that may be associated with small oaks. Small bare rocky sites are scattered intermittently throughout the juniper shrub areas.

B. Unique Associations

No rare or endangered species or unique associations were observed in the upland biotope on the Little Silver Lake property.

C. Species of Economic Importance

During the site reconnaissance on November 16, 1978, three ruffed grouse were flushed from juniper shrubs in the upland areas. These birds are an important upland game species that are hunted during the autumn months. Another game species, snowshoe hare, inhabit areas of scrub vegetation and secondary growth as well. Although the property has moderately severe limitations to the production of ungulates (Canada Land Inventory 1970), a deer was observed on the site in November. Deer may inhabit or wander through the property where there is suitable browse and cover.

The land has severe limitations to the growth of commercial forests of red pine and red oak because of either soil moisture excesses or thin soil layers (Canada Land Inventory 1971).

D. Constraints to Development

Upland clearings have a low degree of ecolocial sensitivity and are suitable for development. 5.2 Lowland Biotope (corresponds to parts of Terrain Unit 3, 4, 5)

A. Description and Distribution

The lowland biotope includes the low-lying, well-drained areas where there are deeper soil deposits and also areas associated with the swamps. The forest stand is composed largely of poplars and sugar maples with white birch and some eastern white cedar. The understory consists of red osier dogwood, willows and ash shrubs. There is a stand of white pine along ridges and low-lying areas between the north end of the small lake and Little Silver Lake. The stand composition changes to a predominance of oak on the ridge hillsides as the soil moisture conditions become drier. Oak stands are not mature but consist of scattered mature individuals among younger trees.

B. Unique Associations

No rare or endangered species or unique associations were observed in the lowland biotope.

C. Species of Economic Importance

The low-lying areas of the Little Silver Lake property have severe limitations to the growth of hard maple commercial forests because of moisture excesses and shallow soil conditions. Ruffed grouse and snowshoe hare are found in virtually all areas of the acreage including the lowland biotope.

D. Constraints to Development

The tree growth in the low areas prevents surficial erosion and is an important input of organic matter (via leaf litter) into the soil. Existing vegetation on the hillsides helps to stabilize the thin soil that has been deposited on these slopes. Tree cutting should be minimized therefore, during construction activities in this terrain unit.

5.3 Open Field Biotope (corresponds to parts of Terrain Units 3 & 4)

A. Description and Distribution

The rugged and shallow and stony soils place severe limitations on agricultural practices in these terrain units. While some open field areas were once cleared for agriculture, they are currently either being used for grazing purposes while other clearings have been left fallow for several years. Unused fields have early successional growths of golden rod, milkweed, staghorn sumac, hawthorn and some poplar saplings. Areas with scrub vegetation provide habitat for ruffed grouse, eastern cottontails, snowshoe hare, raccoon and fox.

B. Unique Associations

No rare or endangered species or unique associations are present in the open field biotope.

C. Species of Economic Importance

Upland game associated with fields, clearings and the vegetation on the edge of these openings include ruffed grouse and snowshoe hare. As previously stated, deer may wander through the property where there is suitable browse and cover.

D. Constraints to Development

The fields and clearings are the most suitable areas for development. These sites, some originally chosen for use as pastures, are the best drained and deepest soiled areas on the property. They do not have a high degree of ecological sensitivity as they have been disturbed by human activity in the recent past.

5.4 Marsh and Swamp Biotope (corresponds to Terrain Unit 6)

A. Description and Distribution

At the south end of the small lake, along the shallow margins and extending to the Westport-Maberly Road, marsh vegetation consisting of cattails, bulrushes and grasses grow in submerged and water-logged soils. Ash, dogwood and willow shrubs are proliferant in the poorly drained conditions that exist around the perimeter of the lake.

Throughout the rest of the property, there are extensive permanently floodec low-lying areas. These swamps, created by beavers disturbing the natural drainage, are filled with dead and rotting trees, notably poplar. Shrubs, including willow and ash, grow on wet sites at the swamp edges.

B. Unique Associations

The presence of wetlands in a relatively undisturbed tract of land is conducive to a diverse group of wildlife. There is evidence of beaver activity at all the swamp sites and muskrats are almost always associated with them. Although this land is classed as having severe limitations to the production of waterfowl according to Land Capability for Wildlife - Waterfowl, Canada Land Inventory 1971, the extensive swampy sites and the marsh area of the small lake serve as important resting and feeding locations for migrants. They may also support a small resident breeding population for some species of ducks. Marshes and swamps are also excellent habitats and important production centres for aquatic invertebrates, amphibians and reptiles.

C. Species of Economic Importance

Waterfowl such as mallards, black ducks and bluewinged teal are important game species despite the severe limitations to waterfowl production classification by the Canada Land Inventory 1971. Beaver and muskrat are fur-bearers that inhabit most of the existing wetland areas but their economic potential is unknown.

D. Constraints to Development

Marshes and swamps are vulnerable to pollution by increased inputs of natural and unnatural substances from development. Road and building constructionnear marshes and swamps may cause some siltation, particularly in the shallow waters. Inputs of nutrients from sewage effluents change the chemical conditions of the water. Eutrophication destroys the floating and emergent vegetation and is extremely detrimental to populations of waterfowl and other wetland wildlife. No development activities such as dredging or infilling should be permitted in this terrain unit.

5.5 Lake and Shoreline Biotope (Mapped on Figure 2)

A. Description and Distribution

Included in the property is approximately 4.0 km of Little Silver Lake shoreline and 1.5 km of shoreline of the small läke. There is little emergent aquatic vegetation on Little Silver Lake as shore is rocky, steep-sloped and in most locations forested. The depth of water increases rapidly from the lake edge. This lake is a warm water fishery with such species as smallmouth bass and yellow perch. The small, shallow lake has a rocky shoreline except at the south end where emergent aquatic vegetation is proliferant. Yellow perch and introduced rainbow trout inhabit the lake at the present time. Beaver activity was observed and the lake probably serves as an important resting and feeding site for some migrants and may support a small resident duck population.

B. Unique Associations

No rare or endangered species or unique associations were observed in the lake and shoreline biotope.

C. Species of Economic Importance

Surface-feeding ducks such as mall rds, blacks and blue-winged teal as well as diving ducks like ring-necked ducks, scaup, goldeneye and bufflehead are common game species of waterfowl. Sport fishes from a warm water fishery like Little Silver Lake include large and/or smallmouth bass, yellow perch, walleye and northern pike. Approximately 2,000 rainbow trout have been planted in the small lake. Successful over wintering of the trout will not be known until the spring of 1979, and breeding is unlikely.

D. Constraints to Development

As settling basins, the lakes are sensitive to inputs of sewage and silt. Little Silver Lake and the adjacent small lake are relatively small and not tolerant to inputs of effluents from residential developments. In comparison, other much larger lakes are not eutrophied because of unnatural nutrient enrichment from cottage disposal systems. The fisheries may be affected as a result of damage to spawning areas. The trout in the small lake will tend to move upstream (in this case into Little Silver Lake) if the conditions become too severe.

Accordingly, we endorse the development recommendations made for these lakes by the Ministry of Natural Resources (Little Silver Lake Study Report, M.N.R., Lanark District, December 1978);

1. All development, including septic tanks and tilefields should be set back at least 100 feet from the highwater mark. If the physical limitations of a particular lot indicate a greater setback is required, the Ministry will recommend this when reviewing the specific proposal.

2. The disturbance of the natural vegetation within 100 feet of the highwater mark should be discouraged. This will help to stabilize soils, hold back nutrients, and protect the scenic quality of the shoreline.

3. No development, including dredging and/or filling should be permitted within the wetland areas shown on the accompanying map.

4. Future development should be compatible with existing uses on the lake, and should be consistent with the lake's ability to support the proposed area.

Respectfully submitted

Gerek & Smith

Derek P. Smith M.Sc. FGAC

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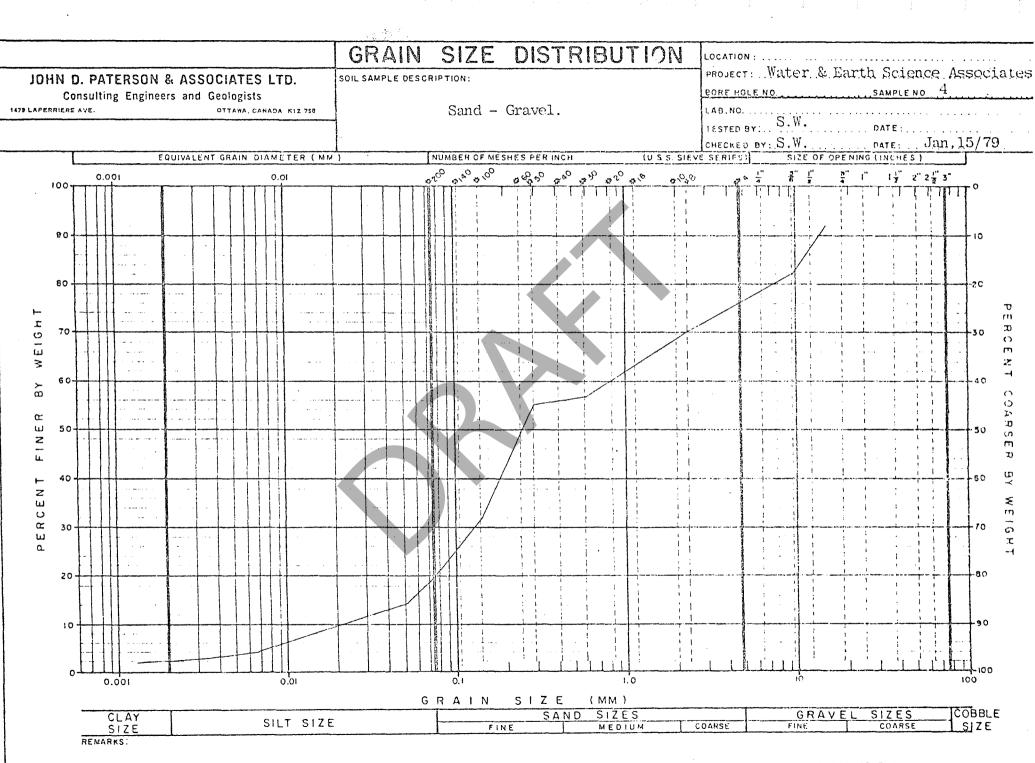
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Grain Size Analysis Matrix of

Glacial Till Ground Moraine



APPENDIX B

Water Well Logs

Concessions 7, 8, 9

Lots 10 - 16

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7	10	377220 4963650	600	6	FR	58	11	76	5	1/00	DO	VILLENEUVE F Tpsl Msnd 0005 Shle 0015 Grey Grnt 0076
7	15	379350 4965130	575	2	FR	78	10	50	1	2/00	DO	SMITH L Msnd 0014 Red Grnt 0115
7	16	380160 4965295	585	6	FR	40		48	4	2/00	DO	CONROY J Brwn Tpsl 0001 Whit Lmsn 0036 Blck Grnt 0048
8	11	377220 4964780 .	610	6	FR	52	10	25	2	1/00	DO	MUNRO S Tps1 0001 Fill Bldr 0012 Red Grnt 0062
8	13	378040 4965430	609	6	FR	32 64	8	65	2	1/00	ST DO	BRIGGS A Msnd 0007 Blck Grnt 0065
· 8	14	378100 4965640	600	6	FR	40	10	45	5	3/30	DO	FLEMING Cecil Brwn Msnd 0007 Blck Grnt 0050
8	14	378140 4965800	575	б	FR	35 55	20	63	-1	3/00	DO	FLEMING V Brwn Tpsl 0004 Rock 0018 Blck Grnt 0063
8	14	378300 4965870	565	6	FR	40	25	45	5	/30	DO	MARSHALE H Fill 0012 Shle 0016 Grnt 0054
8	14	378500 4965620	625	6	FR	27	11	15	45	/30	DO	MCFARLAND CONSTRUCT Msnd 0004 Red Grnt 0033

CON	LOT	UTM EASTING NORTHING	ELEV FEET	CSG DIA INS	KIND OF WATER	WATER FOUND FEET	STAT LVL FEET	PUMP LVL FEET	TEST RATE GPM	TEST TIME HR/MN	WATER USE	OWNER/LOG
9	11	376550 4965345	585	6	FR	50	15	63	1	1/00	DO	GRAY A Msnd 0004 Blck Grnt 0063
9	13	377400 4965620	590	6	FR	68	4	70	1	3/15	DO	MACDONNEL B Tps1 Msnd 0008 Grey Grnt 0068 Grn Grnt Shle 0069 Blck Grnt 0070
9	13	377450 4966277	650	6	FR	115	22	126	5	1/00	ST DO	CONBOY R Shle 0003 Blck Grnt 0126
9	14	377615 4966220	650	6	FR	40	12	16	30	1/00	PS	MABERLY SCHOOL Msnd 0001 Grey Grnt 0048
9	14	377670 4966690	550	6	FR	80	18	100	7	1/30	DO	VANALSTINE K Brwn Tpsl 0001 Grey Grnt 0018 Red Grnt 0040 Grey Grnt 0100
9	14	378020 4965820	595	6	FR	35 80	10.	75	2	1/00	DO	ORSER W Clay 0001 Bldr 0011 Grnt 0085
9	16	378400 4967791	607	6	FR	65	33	72	4	1/30	ST	VANALSTINE D Whit Lmsn 0072
9	16	378740 4967676	620	7	FR	30	18	56	5	1/30	DO	VANALSTINE D Brwn Tpsl 0015 Grvl 0018 Whit Lmsn 0056

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APPENDIX B

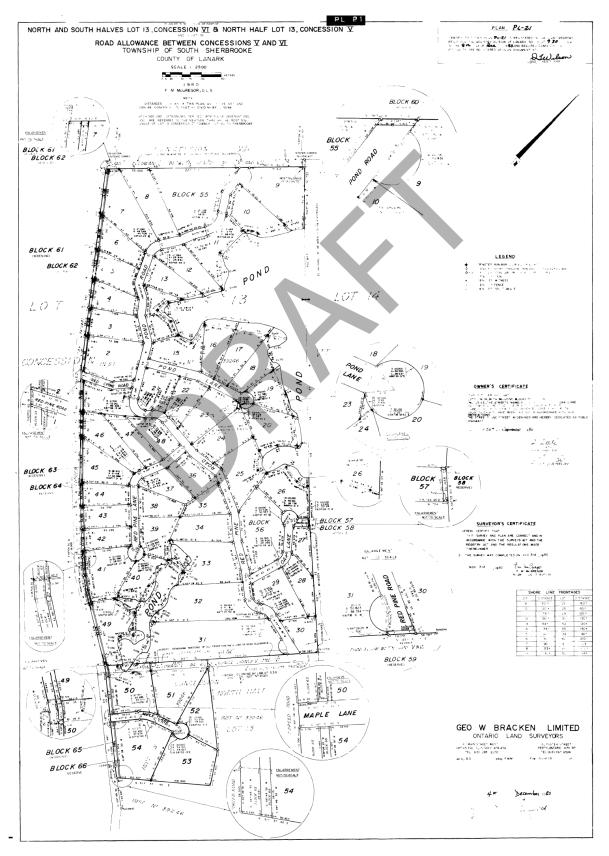
Topographic Survey (1980)



THE CORPORATION OF TAY VALLEY TOWNSHIP HYDROGEOLOGICAL REVIEW MABERLY PINES SUBDIVISION

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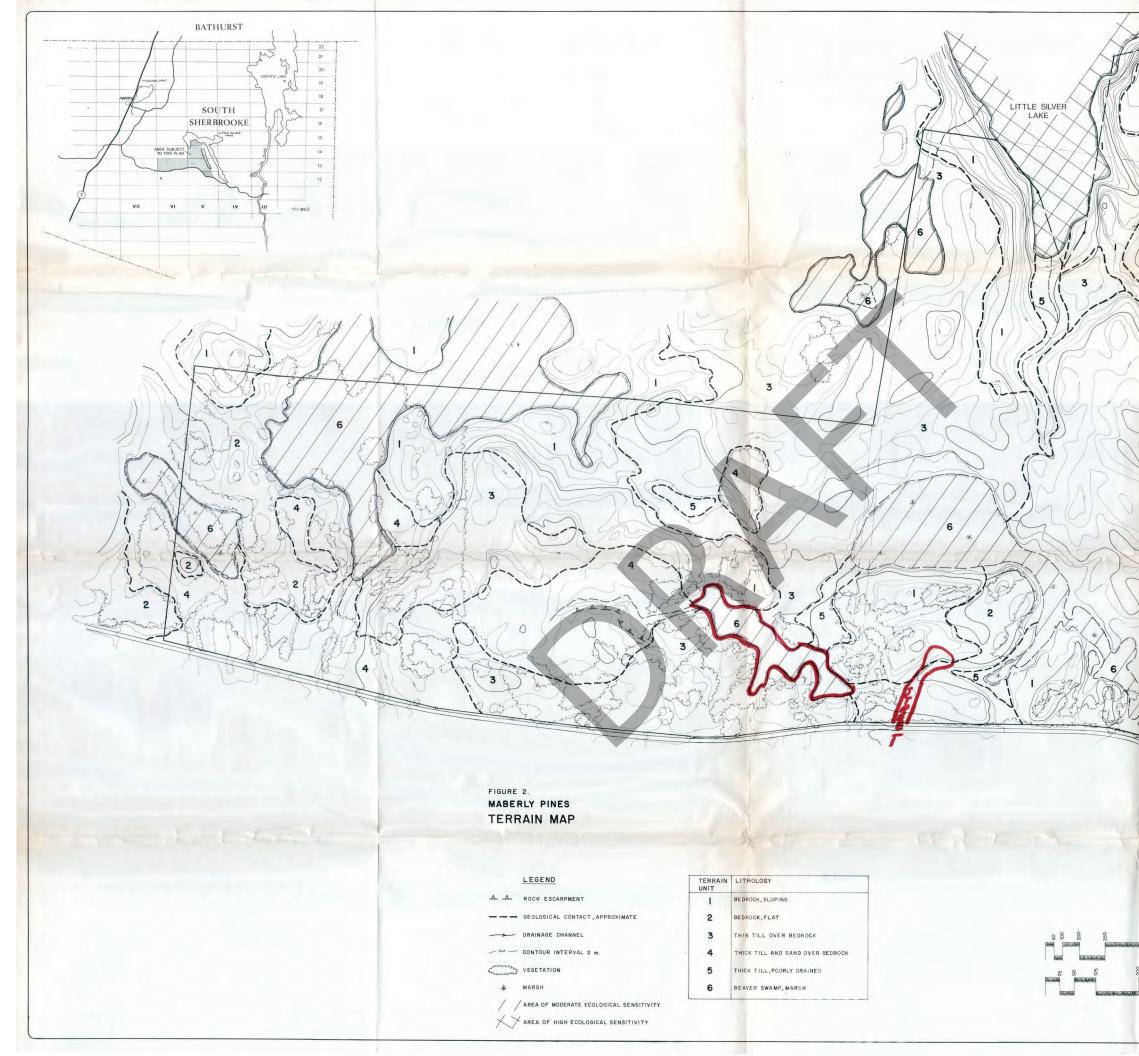
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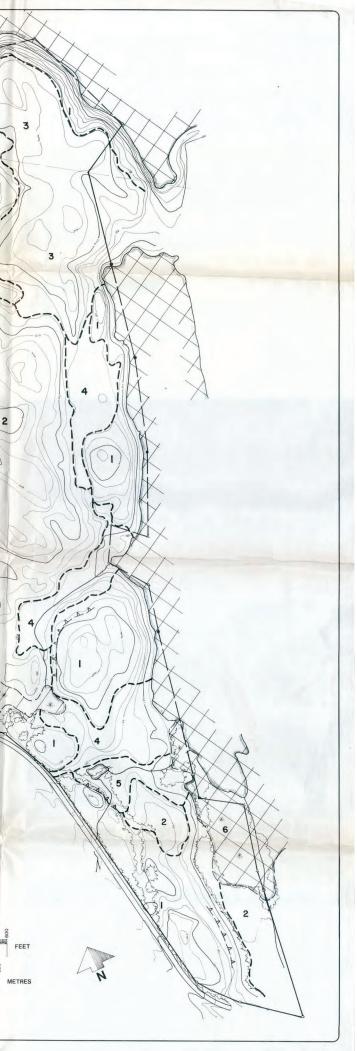


APPENDIX C

Terrain Analysis Map (WESA, 1979)







APPENDIX D

MECP Water Well Records



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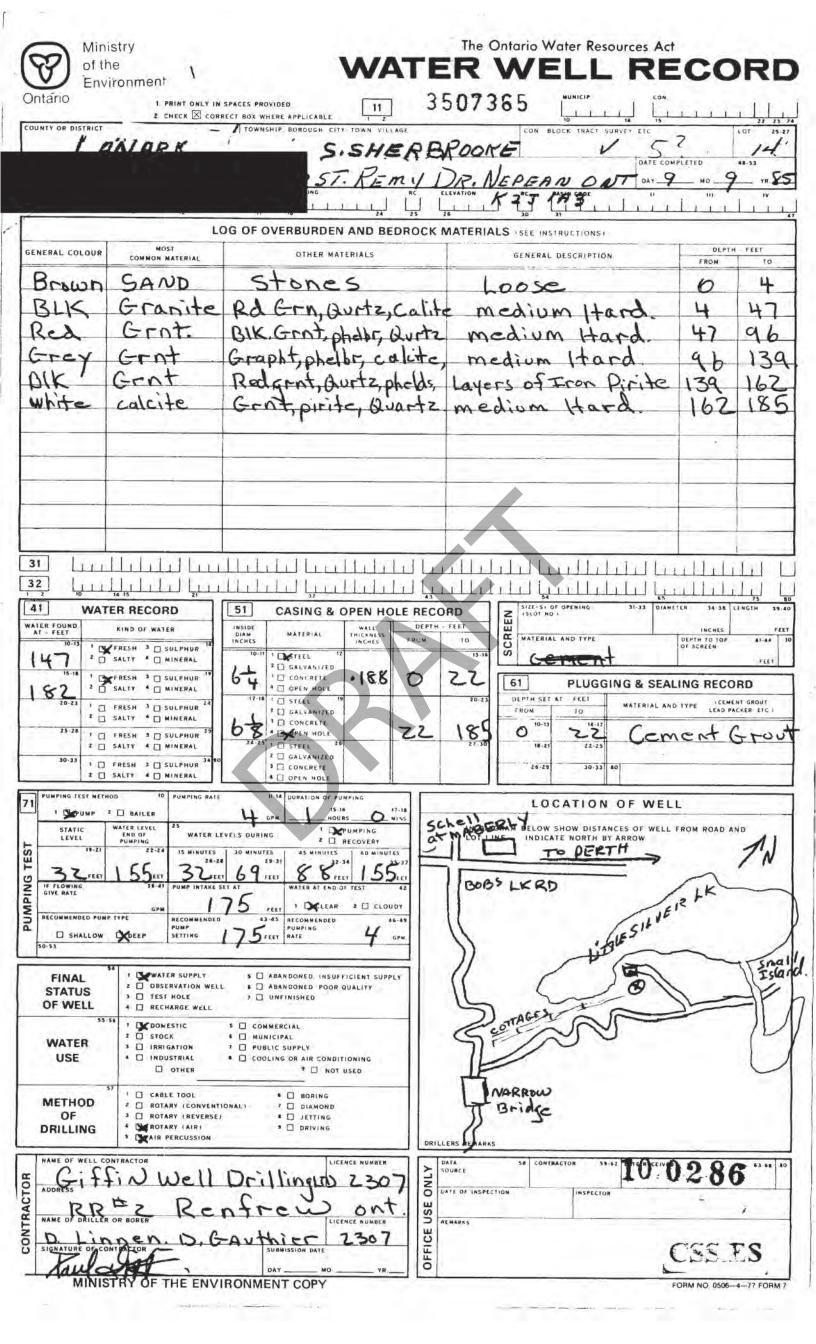
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WATER FOUND AT - FEET 10-13 1	and a second	145/DE DIAM MAT INCHES 10-11 1 STE	FRIAL (A1.1) (A1	LIPTH FIN	WATERIAL AND TYPE	INCHES DEPTH TO TOP OL SCHEEN	41-44 TEFT
WATER FOUND AT - FEET 0/42 15-18	KIND OF WATER	195/06 UAN 947 195/07 10 511 06 51/1 641 175 510 175 5	ERIAL JANE 44 1 E. 12 AN 12 LAR 14 14 14 14 14 14 14 14 14 14 14 14 14 14 1	LEPTH (FEN) La W 10 D 00,73	61 PLUGGIN	G & SEALING REC	ILAA TEPT
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HERAL COLOUR COMMAND ALLERS FOR CRUTCHALS CENTRAL DISCRIPTION WICH PCC Schuller Sc		10 12		HC. ELEVATION		n m w
Solly S				DROCK MATER	IALS (SEE INSTRUCTIONS)	
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1 2 0 10	-	TER RECORD	51 CASING & OPEN HO	LE RECORD	Z 5126+5+ OF OPENING 31-	33 DIAMETER 34-38 LENGTH
1 1 0 1 1 0 1	- FEET		DIAM MATERIAL THICANESS		W MATERIAL AND TYPE	DEFTH TO TOP
	156	6 LIGAS		13-10		FEE
12.0 10 PARTY 0 Contraction 10 PARTY 0 PARTY 0 Contraction PARTY 0 PARTY	152.0	SALTY & MINERALS	64 S DPLASTIC 188	0 22	DEPTH SET AT FEET	CENTRE COONT
1 1 1 Contraction 1 Contraction <td< td=""><td>10</td><td>SALTY 6 GAS</td><td>2 GALVANIZED 3 CONCRETE 4 DOPEN HOLE</td><td></td><td>10 ID</td><td>LEAD PACKER ETC</td></td<>	10	SALTY 6 GAS	2 GALVANIZED 3 CONCRETE 4 DOPEN HOLE		10 ID	LEAD PACKER ETC
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LOCATION OF WELL STATUE WALE VALUES WATER LEVELS DURING STATUS S	2 0	SALTY 6 GAS	4 DOPEN HOLE		26-29 30-33 40	
static ************************************			F / 15-18 1		LOCATION OF	WELL
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FINAL ** : © WATER SUPPLY : OBSERVATION WELL : OBSERVATION WELL : ABANDONED : INSUFFICIENT SUPPLY STATUS : OBSERVATION WELL : OBSERVATION : OBSE		P TYPE RECOMMENDED PUMP	43-45 RECOMMENDED 45	-45	11	
WATER USE 1 IRBIGATION 7 PUBLIC SUPPLY 1 INDUSTRIAL 0 COOLING OR AIR CONDITIONING 0 OTHER 9 NOT USED 57 METHOD 0F 1 CABLE TOOL 0 BORING 2 ROTARY (CONVENTIONAL) 7 DIAMOND 0F 1 ROTARY (AIR) 1 DIAMOND 1 ROTARY (AIR) 1 DIAMOND 1 ROTARY (AIR) 1 DIGGING 0 OTHER NAME OF WELL CONTRACTOR ADDRESS NAME OF WELL CONTRACTOR ADDRESS NAME OF WELL CONTRACTOR ADDRESS NAME OF WELL TECHNICIAN NAME OF WELL TECHNICIAN NAME OF WELL TECHNICIAN NAME OF WELL TECHNICIAN		DE DEEP SETTING	40reer RATE	.Рм		1/25 -
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OF ISTRUCTION ISTRUCTION ADDRESS ADDRESS ADDRESS ISTRUCTION I A ROTARY (REVERSE) I DETTING I DETTING		I CABLE TOOL	BORING		5	<i>Km</i>
ADDRESS AND CONTRACTOR DE DIGGING OTHER DIGG	OF	3 C ROTARY (REVERSE)	. D JETTING		//	
ADDRESS ADDRESS DATE ADDRESS DA		S AIR PERCUSSION	D DIGGING DOTHER			
NAME OF WELL TECHNICIAN ASPECTON INSPECTOR	Air.	- Rock Dri	ling GAD. 1119		SE CONTRACTOR 195-52 DATE	"DEC 0 6 1991 ""
WELL TECHNICIAN WELL TECHNICIAN'S PREMARKS	RAN	× 2 sta	ever On?			21
	NAME OF WELL	TECHNICIAN	Tweel Treestories			

Onta	Environment		,	he Ontario Wat WATER W		
int only in space ark correct box v	with a checkmark, where applicable	r [1]	3513257	B5014		1 22 23 2
County or District	k.	Township/Borough/City/	TownVillage	Con block tract s		13
		596 north K	Pussell Rd. , Rus	gell Date comple	BIGC PBIG	3 OT
1	Т М 10 12	(Northing	RC Elevation K 4		, w	
General colour	LOG OF (Most common material	OVERBURDEN AND BEDR Other materials	OCK MATERIALS (see instru-	uctions) neral description		h - feet
					From	То
red	sand				0'	112
black	granite				12	23'
rey/otan	ge preen granite				23'	130
lack/gre	y granite				130	156
Ley locan	and granile				156	190'
Jack	grance				110	
	لبلبللبيبالبلبل	بلبطلسبال			Lillin	LL
	1 1	CASING & OPEN HOLE I	RECORD	as of opening 31-33 Dia	es meter 34-38 Leng	1 1 75
ater found - leet	Kind of water diam inches	Material Wall thickness inches	Depth - feet	ot No.)	Inches	teet
	Fresh 3 Sulphur 14	1 2-Steel 12 /88	From To 22 ^{13/6} Ma	terial and type	Depth at top	of screen
	Fresh ³ Sulphur 19 4 Minerals	Concrete Open hole Plastic	61	PLUGGING & SEA	LING RECORD	
20-23 1 🔲	Fresh 3 Sulphur 24	1 Steel 19 2 Galvanized 3 Concrete	20-23	Annular space	Abandonn	nent
00.00	Salty 6 Gas	4 Open hole 5 Plastic	From	0	pe (Cement grout, b	entonita, etc.)
20.22	Salty 6 Gas	1 Steel 26 2 Galvanized 3 Concrate	18-2	22-25	4	
	Salty 6 Gas	4 🖸 Open hole 5 🗇 Plastic	26-3	30-33 80	~	-
1 Pumping test me	athod 10 Pumping rate + 11-14 Bailer GRM	Duration of pumping	Townson and	LOCATION OF WELL	5	1
Static leval W	dater level 25 Water levels during	Pumping 2 🗌 Recovery	In diagram below a Indicate north by a	show distances of well fr prow.	om road and lo	t line.
If flowing give rat	15 minutes 30 minutes 30 minutes 31 7 0 31	45 minutes 41 2 34 31 35-37				
feet If flowing give rat	6 00	Vater at end of test 42	1.			
Recommended pu		Clear Cloudy Recommended 48-49 pump rate				
Shallow	Proceep pump setting 75 feet	POINT IS 4 GPM				
		pply ⁹ 🖂 Unfinished	4			
2 Observation 3 Test hole	n well 6 🖸 Abandoned, poor quality 7 🗇 Abandoned (Other)	¹⁰ Replacement well	A A			
* C Recharge v	ss-se		9			
Domestic	5 🔲 Commercial 5 🛄 Municipal	9 🗋 Not use 10 🗌 Other	00			
 Irrigation Industrial 	 7 Delic supply 8 Cooling & air conditioning 					
	SONSTRUCTION 57	🤋 🗋 Driiving				
 Cable tool Rotary (cor Rotary (rev Rotary (air) 	nventional) ⁶ Boring verse) ⁷ Diamond	10 Digging 11 Digging		eta:	225	789
lame of Well Contra		Well Contractor's Licence No.	Data se Contrae	ctor \$9.62 (Da	22J	63-68 8
Huf A	allita	2558	No Solurce 2	558 A	에 걸 날 것 같아. 다.	001
diama II	1 0 0	Decima	Date of inspection	Inspector		
Ri mal	Jonalds Corners Ont	KOGIMO	S			
AN MCL	Jonalds Corners Ont Wall	Well Technician's Licence No. T2228	Remarks			

Township/Borough/City/Tow	wn/Village			
souce starte	1. A.	Con block tract :	survey, etc. L	ot 4
Address	tion it in	1 L Date compl	eled	1 0
Easting Northing	RC Elevation	BC Basin Code		month
3 OF OVERBURDEN AND BEDRO		and there are a rearry	Den	th - fee
Other materials	Gen	eral description	From	
			0	3
			1	32
			1	75
			/	11
			114	23
			-	
			-	
3 Galvanized 3 Concrete 4 Open hole 5 Plastic 24/25 1 Steel 4 Galvanized 3 Concrete 4 Galvanized 3 Concrete 4 Galvanized 3 Concrete 4 Galvanized 3 Concrete 4 Open hole 5 Plastic 11 14 Open hole 5 Plastic 11 14 Open hole 5 Plastic 11 14 Duration of pumping 15 15 16 15 17 16 17 18 18 16 19 16 10 16 10 16 11 16 12 16 14 16 143-45 16 <t< th=""><th>27-30 27-30 18-21 26-29 In diagram below si Indicate north by ar</th><th>A control of well for the former of the form</th><th>rpe (Cement grout, b</th><th>oentonit</th></t<>	27-30 27-30 18-21 26-29 In diagram below si Indicate north by ar	A control of well for the former of the form	rpe (Cement grout, b	oentonit
icient supply ⁹ Unfinished quality ¹⁰ Replacement well r)		\square	i.	
9 🗆 Not use 10 🗇 Other				_
⁹ Driving ¹⁰ Digging ¹¹ Other	L	ittle Silver		24
Well Contractor's Licence No. 2558	Date of inspection	Inspector	AUG 1 3 2	2002
Well Technician's Licence No.	Remarks	,r.,		~
Submission date 02	S	Ϋ́,		*
	Other materials Other material Other material	Other materials Gen Other materials Gen Image: State of the st	SOF OVERBURDEN AND BEDROCK MATERIALS (see instructions) Other materials General description Other materials From To Material Weat Material Weat Open fold From To O	2 OF OVERBURDEN AND BEDROCK MATERIALS (see instructions) Depth description Depth description Other materials Genoral description 0 Other materials Genoral description 0 3 5 /

A	Ministry of We	Il Tao Number	a ai number below)	-	14/-11	Deces
	he Environment	a 0065	21 - A	Regulation 90	3 Ontario Water F	
Instructions for Completin	g Form	A006	544		pa	ge <u>1</u> of <u>1</u>
 For use in the Province of All Sections must be com Questions regarding com 	pleted in full to avoid de pleting this application of	elays in processing. F can be directed to the	urther instructions a	nd explanations are available	ailable on the bac	k of this form.
 All metre measurement Please print clearly in blu 		1/10 [™] of a metre.	1	Ministry Us	e Only	
Address of Well Location (County, 133 Kainbow Ane RR#/Street Number/Name Soluth Sherbrooke 3PS Reading NAD Zon 83 /8	, Lanork Ct. Twp.	Vity/	Sherbrooke Town/Village Make/Model Mo	de of Operation: Und	artment/Block/Trac	6. T
og of Overburden and Be	drock Materials (see	instructions)	5			Materia
Seneral Colour Most common		er Materials	Gene	ral Description	Depth From	, To
Sand/grove) black/pink granite lock/grey/green (mic	Istones				2.13	2.13
lack lare sloreen (mic	a) granite				14.33	
Jack granite	J-240.2			s (es) (e	15.85	21.95
hitelarey granite					21.95	27.43
block Jpink granite					27.43	41.15
Jack granite		1			41.15	42.67
2		Horm @ 14	Part	4		
Hole Diameter	[(4 gpm @ 14p Construction Record	frei.	Tes	t of Well Yield	144) T
Depth Metres Diameter	Inside	Wall D	Depth Metres	Pumping test method	Draw Down	Recovery
From To Centimetres	diam Material centimetres	thickness centimetres	From To	Pump.	Time Water Level T min Metres r	ime Water Leve min Metres
0, 6.70 25.4		Casing		Pump intake set at - (metres) 24.38	Static Level	
	1524 Steel Fibre		61 6.70	Pumping rate - (litres/min)	1 4. 00	1 10.06
Water Record	Plastic Conc Galvanized	rete		Duration of pumping	2 8.19	2 9.75
Ater found Kind of Water	Steel Fibre	glass		hrs + min		
Gas Salty Minerals	Plastic Conc	rrete		Final water level end of pumping B.90 metres	3 8.32	3 9.53
Gas Not Salty Minerals	Galvanized	diast	_	Recommended pump type.	4 8.43	4 937
m Fresh Sulphur Gas Salty Minerals	Plastic Conc			Shallow Deep Recommended pump		5 9.25
Other:	Galvanized			depth. 35 metres		
m Fresh Sulphur Gas Salty Minerals	Outside Steel Fibre	Screen		rate. (litres/min)		10 8.88 15 8.63
Other: After test of well yield, water was	diam Plastic Conc			If flowing give rate -	20 9.56 :	20 8 50
Clear and sediment free	Galvanized			(litres/min)	1.0.2	25 8.37 30 8.35
VOther, specify Cloudy		No Casing or Screen	1	ued, give reason.	40 10.43 .	40 8.08
hlorinated YYesNo	Open hole			1.1.		50 <u>1.90</u> 60 <u>1.74</u>
Plugging and Sea	aling Record 🗌 A	nnular space 🔲 Abando	nment	Location of		
Depth set at - Metres Material and type From To	e (bentonite slurry, neat cement	slurry) etc. Volume Plac (cubic metri		ow show distances of well fr	om road, lot line, and	d building.
5.70 D. Quick qu	out	0.22		2)		
				133		
				4)		
				30		
M	ethod of Construction					
Cable Tool Rotary (a Rotary (conventional)			ing	Suppose		
Rotary (reverse)	Driving			¥ 5 C hoo	1	
Domestic Industria	Water Use	Supply Dotte	_	Fro		
Stock	cial 🗌 Not us	ed	r			
Irrigation Municipa	Final Status of Well	g & air conditioning	Audit No. Z	06648 Dat	e Well Completed	1 103 23
Water Supply Recharge we	II Unfinis		(Other) Was the well of	inter o anoni boon	e Delivered YYY	MM, DD
Observation well Abandoned. i Test Hole Abandoned, p	nsufficient supply Dewate	ering cement well	package delive	red? Wyes No	3004	1 03
Well Cont	ractor/Technician Inform	nation	Data David	Ministry Use		0
WINF HALL Ltd		Well Contractor's Licence	e No. Data Source	Cor	ntractor 255	0
usiness Address (street name, number		A (Date Received	6 2004 MM , DD Dat	e of Inspection YYY	Y MM DO
KR1, 260 Hall Shore Rd Jame of Well Technician (last name, fi	st name)	Well Technician's Licenc			I Record Number	- I I
Mark Hall Ignature of Technician/Contractor		2558 Date Submitted		CSS.ES5	35144	9.0
Austal		2004 03	23		00111	50
506E (09/03)	Contractor's Conv E	1 Ministry's Conv Pr W	All Owner's Conv II	Cette fr	mule est disconit	le en français

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Ontario		ment		411 51411	it number bel	Regul			ario Water P	Reso	ecord
 For use in the Provin All Sections must be 	completed in fi	only. This document of the second s	ent is a per in process	manent lega sing. Further	al docume instruction	nt. Please retain is and explanation	for futur s are ava	e refe ulable	erence. e on the ba	ack of	this form.
 Questions regarding All metre measurem 	completing this	s application can	be directed	d to the Wat							
 Please print clearly in 			oramen			Min	istry Use	Only	У	- 1	1
Address of Well Location (Con		licipality)		ownship	Jack.	lea	Lot	2	Conce	ssion	-
County Road RR#/Street Number/Name	3b			Sorth S City/Town/V	ner pro Village	Si			nt/Block/Tr	act et	9,
Con 6 Lot 13 GPS Reading NAD	Zone Easting	North	hina	Unit Make/N	Model	Mode of Operation	: Dund	ifferent	iated i	Aver	aned
8 3	18 379	16211 49	636218	Mage Ile		Waas			ed, specify_		ageu
Log of Overburden and General Colour Most comr	Bedrock Ma	terials (see inst Other Ma			G	eneral Description			Dep	th	Metres
		Stries Wid							Fro	om 	To 1,52
black larey ara	boulders nite							_	0.	52	67.06
pinch grey gra	0/10							-	11-		01.00
									1		
		7	1	11	0	7 11-	1	-			
		3gpm 1	13.64	litres)	220	Deep (67.0	6m)	_		_	
Hole Diameter	1	Cone	truction Re	cord		N	Tes	tofV	Vell Yield		
Depth Metres Diame	er Inside	Colls	Wall	Depth	Metre	Pumping tes		_	aw Down	R	ecovery
From To Centime	es diam	Material	thickness		То	Pum	~	Time min	Water Level Metres	Time	Water Level Metres
0. 6,70 25.4	centimetres		centimetres Casing		10	Pump intake (metres)	set at -	Static			
	15.24	Steel Fibreglass	, 49	0.61	6.70	Pumping rat	e -	Level 1	10.15	1	15.44
	- 10304	Plastic Concrete			0110	(litres/min)		2	(1 2 0	2	14.22
Water Record Water found at Metres Kind of Wate		Galvanized				hrs +_		6	10.20	2	
64.62m Fresh Sulph		Plastic Concrete				Final water	evel end	3	10.30	3	13.25
Gas Salty Mine Wother: NOT TESTER	als	Galvanized			-	Recommend type.	ed pump	4	10.57	4	12.45
m Fresh Sulpi		Steel Fibreglass				Recommend	w Deep	5	10.30	E	11.70
Gas Salty Mine	als [Galvanized				depth. 42		5	10.30	5	11.78
m Fresh Sulph			Screen	1	P	rate. (litres)		10	11.43	10	10.08
Gas Salty Mine	als Outside diam	Steel Fibreglass	Slot No.			(litres/ If flowing give	nin) e rate -	15 20	12.95 13.82	15 20	9.69
After test of well yield, water wa	3	Galvanized				(litres/		25	15.02	25	9.50
Bother, specify <u>Cloudy</u>		No C	asing or Se	creen	1.	ued, give rea	son.	30 40	15.82	30 40	9.15 9.36
Chlorinated Types INo		Den hole		6.70	67.0	56		50	17.39	50	9.29
	Sealing Recor	rd (PAnnula	r snace	Abandonment			ocation of	60	18.99	60	9,23
Depth set at - Metres Material an		urry, neat cement slurry) etc Vol	ume Placed		n below show distance				and bu	ilding.
From 10	ggs Cem	1	(00	bic metres)	Indicate n	orth by arrow.	not.	Ro	ad 3	6	
stor u. d. S. F	has ani	ck grout		044		0	- A	110	1		
	g gui	Just	0	- 4 - A - A							
Cable Tool	Method of C ary (air)	Construction		Digging			-	7			
Rotary (conventional)	percussion	Jetting		Other			1	1		1	from
Rotary (reverse)	ng Water	Use						1	5'(4.5	10,) from ed
	istrial	Public Supp	ly	Other					pro	site	2
Stock Col Irrigation Mu	nmercial licipal	Not used	ir conditioning	n and the	Audit No.	- FOFA	Dat	_	Completed	-	
	Final State	us of Well				z 5852		e Deliv	ared m	07	6 28
Water Supply Recharg	e well ied, insufficient su	Dewatering	L] Abar	doned, (Other)	Was the v package c	well owner's informatic lelivered?	0	S Dell		207	6 128

Observation well Abandoned, insufficient supply Test Hole Abandoned, poor quality	Dewatering Replacement well
Well Contractor/Technic	
Name of Well Contractor WILF Hall & Sons Well Drillin	Well Contractor's Licence No. 2558
Business Address (street name, number, city etc.) 260 Hall Shore Rd. M. Donald 5	Corners Ont KOGIMO
Mark Hall	Well Technician's Licence No.
Signature of Technician/Contractor X Stud Hall	Date Submitted YYYY MM DD
0506E (08/2006)	Ministry's Cop

		Min	istry	Use Only			
Data Source		5		Contractor	58		
Date Received	YYYY IUII	мм 17	2007	Date of Inspection	YYYY	MM	DD
Remarks				Well Record Numb	ber		

Cette formule est disponible en français

S Ontario	Ministry of the Environment	Δ	51413	umber		lation 90	03 Or	ntario Wate	er Re	
 For use in the Province All Sections must be co Questions regarding con All metre measuremen 	of Ontario only. The mpleted in full to average application of the mpleting this application of the mpleting	his document is a roid delays in proc ation can be dire	permanent le cessing. Furth	or instruct	one and avalanatia	no oro oi	milak	eference.		
 Please print clearly in blue 	ue or black ink only		letre.		Mi	nistry Us	se Or	nly		
Address of Well Location (County			Township	. S. mais	<u>1 1</u>	Lot	, ,	Conc	6 ASSIO	
# 4/93 Hwy RR#/Street Number/Name Con b Lof 13 GPS Reading NAD Zoi		Northing	City/Town	1/Village	S	ite/Comp	÷	ent/Block/T	ract e	tc.
8 3) Log of Overburden and B	5 318113149	49127	316 Ma.	gellan	Mode of Operation	- Canada - C	- north	ntiated	Ave	raged
aeneral Colour Most common red Sand black-Ired araniti	material	Other Materials			General Description			0.0	om	Metres To 0.9 32,9
black brown gra black granite	nite							32		33.
Hole Diameter	100	pm (45.46		115	"Deep (35.	05m)	<u>h</u>			
Depth Metres Diameter From To Centimetres	Inside	Construction Wall	Depth	Met	res Pumping tes		D	Well Yield		lecovery
0. 6:70 25.4	diam Mate	Casing	- 7	Tr	Pump intake (metres)	set at -	Time min Static Level		min	Water Le Metres
Water Record		Concrete	5 0.67	35	05 (litres/min)4 Duration of p	5	2	11.75	1	21.2
Ater found Metres Kind of Water Kind Metres Sulphur Gas Salty, Minerals Other: hot Tested	Steel	Concrete			Final water lo of pumping	evel end 3 metres	0	12.70	3	17.8
m Fresh Sulphur Gas Salty Minerals	Steel Plastic	Concrete			Recommend		4	13.28	4	16.70
Other: m Fresh Sulphur Gas Salty Minerals	Outside Outside	Screen			Recommend	metres	10	16.37	10	13.33
Other: er test of well yield, water was Clear and sediment free	diam Steel				(litres/r If flowing give (litres/r	e rate - nin) scontin-	15 20 25 30	17.94 19.30 20.09 21.90	15 20 25 30	11.92 11.10 10.42 10.04
Potiner, specify <u>Cloudy</u> lorinated Ves No	Depen hole	No Casing or	Screen 6.70	35,	05	son.	40 50 60	23.91 25.08 25.75	40 50 60	9.28 8.74 8.33
Plugging and Sea	aling Record (bentonite slurry, neat ce	P Annular space	Abandonment olume Placed cubic metres)	In diagram	m below show distances	cation o			nd bui	
	cement quick gro		0.044	_ Indicate r	horth by arrow. Hw y	#36				
<i>a Dags</i>	ynick gro	<u>ul</u> (0	044			1	#4	R3		-
						(
Cable Tool Dratary (a Rotary (conventional) Air percu Rotary (reverse) Boring	ssion Ju	on lamond etting riving	Digging				s U	Vell		
Domestic Industrial Stock Commerce rrigation Municipal	ial 🗌 N	ublic Supply ot used ooling & air conditionin	C Other	Audit No.		Por	nd	Completed		_
Nater Supply Recharge well	Final Status of Well		andoned, (Other)	the second second	Z 58533 well owner's information lelivered?	Date	Delive	500	YY	MM 00 MM 00 7 4
Well Contractor ILF Hall & Sons We ness Address (street name, number O Hall Shore Rd M g of Well Technician (last name, firs	actor/Technician In II Drilling city etc.)	formation RRI Well Contractor 25	58 KOGIMO	Data Sour	rce	DD Date	of Ins	558 pection yy	rr I	MM DD
Mark Hall hature of Technician/Contractor Studyoff BE (08/2006)		Date Submitted v	18 VYY MM DD	Remarks		weit	-	rd Number	26.1 -	francis (

Minietru'e Const



Ministry of the Environment orded in: Metric Imperial Well Tag No. (Place Sticker and/or Print Below)



Regulation 903 Ontario Water Resources Act Page of

	on (Street Number/Name)		ownship	had	Lot	Concess	ion	
<u>4417</u> (County/District/Munici	ounty Kd 31		South Sher	prooke.	13	Province 7	Postal	Code
	mork Court	4	Maberly			Ontario		
UTM Coordinates Zone	Easting Nort		lunicipal Plan and Suble	ot Number		Other		
NAD 8 3 1 8	5 3 7 7 7 9 7 9 drock Materials/Abandon	7 <u>63543</u>	rd (see instructions on the	back of this form)				
General Colour	Most Common Material	1	er Materials		al Description	1	Dept From	h (<i>m/ft</i>)
black	earth						\mathcal{O}	16
sed + black	araqute						,6	19.8
green	granite granite			,,,,,,,,,			19.8	427
green c	Junic						//.0	101
				· · · · · · · · · · · · · · · · · · ·				
								1
	Annular S	pace		R	esults of W	ell Yield Testin	IC	
Depth Set at (m/ft)	Type of Seala	nt Used	Volume Placed	After test of well yield, w	rater was;	Draw Down	Re	ecovery
From To	(Material and	i ype)	(m³/ft³)	Clear and sand fre		Time Water Le (min) (m/it)	vel Time ((<i>min</i>)	Water Level (m/ft)
0 6.1	Cement		120kg	If pumping discontinued	, give reason:	Static 7.3	,	
						1 8.5	1	10.2
				Pump intake set at (m/	(ft)	2 .8.7	2	9.4
				40		3 9,0	3	92
Method of Co				Pumping rate (I/min / G	(* WI)	4 9.2		90
Cable Tool	Diamond Diamond Dubli			Duration of pumping				
Rotary (Reverse)	Dríving Lives		e D Monitoring & Air Conditioning	Final water level end of		5 9,4	5	8.8
Air percussion		strial	a Air conditioning	1/.4	pariping (mary	10 7.0	10	8.3
Other, specify		r, specify		If flowing give rate (I/mi	in / GPM)	15 10.2	? 15	7.9
Inside Open Hole	e OR Material Wall	Depth (<i>m/ft</i>)	Status of Well	Recommended pump	depth <i>(m/ft)</i>	20 10.6	, 20	7.6
Diameter (Galvanize (cm/in) Concrete,	ed, Fibreglass, Thickness Plastic, Steel) (<i>cm/in</i>)	From To	Replacement Well	39		25 10.9	25	7.3
15.85 Ste	od ,88	0 6.1	Recharge Well	Recommended pump : (I/min / GPM)	rate	30 11.0	30	73
		<u> </u>	Dewatering Well	Well production (I/min /	(GPM)	40 11.2	40	7.3
			Monitoring Hole	26	Gr Ing	50 11.3	50	7.3
			(Construction)	Disinfected?		60 11.4	60	7.3
 Cr	onstruction Record - Scree		Insufficient Supply		Map of W	ell Location	<u> </u>	<u></u>
Ordeide	aterial Slot No.	Depth (<i>m/ft</i>)	Abandoned, Poor Water Quality	Please provide a map b			e back.	
(cm/in) (Plastic, Ga	Ivanized, Steel)	From To	Abandoned, other, specify		Maber	44		
					1 Taber		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	
			Other, specify			174	197	
	Water Details		ole Diameter					
10	Kind of Water: Fresh	Untested Depu From	h (<i>m/it</i>) Diameter To (<i>cm/in</i>)					
Water found at Depth	Kind of Water: Fresh	Untested	42.7 15.24			1 Di		
<i>36 (m/ft)</i> ⊡Gas	Other, specify	¥			Kov	JAN1		
	Kind of Water: Fresh	Untested			Cor	30		
	ell Contractor and Well T	echnician Informat	ion			117		
Business Name of Well	l Contractor		Il Contractor's Licence No.			•		
Business Address (Stre	Mp.50~ per/Number/Name);		1 9 0 5 nicipality i	Comments:				
2076 0	Id Brook Rd		Taberly					
	ostal Code Business E	-mail Address	/	Well owner's Date Pa	ckage Delivere	ad Bair	nistry Use	
Bus.Telephone No. (inc.	area code) Name of Well Te	ک بند ک	· · ·	information package	1.0.11	2 5 Audit No		10/14/01/05/1651
6132674	1800 Darre	11 Steve	<u>150 n</u>	delivered	ork Completed		1242	218 218
	No. Signature of Technician 9 Drien B	and/or Contractor Data	e Submitted	No 201	10/1/1	25 Received	1AN 2	4 2011
0506E (2007/12) © Quee	n's Printer for Ontario, 2007	··· / 100	Ministry's Copy	<u> </u>	1 3 T M-1 T	I I Land and a fille po	1 1 X	

\$ Doutering	Ontario Ministry of		Well Tag No. (Pl	ace Sticker and/or Print Below)	Well Record
Unitario	the Environm	nent	1	Tag#: A134690	Regulation 903 Ontario Water Resources Act
Measurements recorded i	n: 🗌 Metric	1 Imperial	A134690	•	Page / of /

Address of Well Location (Street Number/Name)	Township	Lot	Conces	sion	
4452 Bolingbrooke Road	South Sher	rbrooke 13	Province	/ Posta	al Çode
County/District/Municipality/	Maberly		Ontario		Habo
UTM Coordinates Zone Easting Northing	Municipal Plan and Sub	lot Number	Other		-
NAD 8 3 1 8 3 7 9 4 3 8 4 9 6 3 6 5 1		heads of this formal			
Overburden and Bedrock Materials/Abandonment Sealing F General Colour Most Common Material	Other Materials	General Description	ľ	Dep	pth (<i>m/ft</i>) To
Red Sand/stones				0	4
black larey fred granite				4'	32'
				32'	198'
Grey granite				198'	205
di la ta				205	280
Red granite				280'	284
Black/grey granite				284	310
Black/grey/pink granite				310	400'
DIUCK/grey/pink grainse					
Annular Space		Results of W	ell Yield Testi		
Depth Set at (<i>m/ft</i>) Type of Sealant Used From To (<i>Material and Type</i>)	Volume Placed (m³/ft³)	After test of well yield, water was:	Draw Down		Recovery Water Level
0 22' 2 Bags cement	0.044	DOther, specify 2/04dy	(min) (m/ft Static		(m/ft)
		If pumping discontinued, give reason:	Level	/	
2 Bags quick grout	0.077		1 21.0	2 1	141.2
		Pump intake set at (m/ft)	2 23.1	f'^{2}	139.8
	II Use	Pumping rate (1/min / GPM)	3 26.0	3	137.10
mentod et ettertet	mmercial 🗌 Not used	3gpm	4 28.8	1	136.3'
	inicipal Dewatering st Hole Monitoring	Duration of pumping hrs + min	5 3/3	1	135.4'
Boring Digging Irrigation Co	ooling & Air Conditioning	Final water level end of pumping (m/ft)		1	129.35'
Air percussion Industrial Other, specify Other, specify		If flowing give rate (1/min / GPM)	15 55.0	1 15	124.0
Construction Record - Casing	Status of Well		50.0	1 00	1
Inside Open Hole OR Material Wall Depth (m/ft) Diameter (Galvanized, Fibreglass, Thickness	Replacement Well	Recommended pump depth (m/ft)	0.0.0	,	119.75
(cm/in) Concrete, Plastic, Steel) (cm/in) From To	Test Hole	350 Recommended pump rate	16.0		116.2
6" Steel , 48cm 0 22	2 Recharge Well	(Vmin/GPM) 2,9pm.	00.4	1 10	12.95
A STREET ST	Observation and/or Monitoring Hole	Well production (I/min / GPM)	40 104.0		106.75 ,
A	Alteration (Construction)	Disinfected?	50 124.6	50	100.115
	Abandoned, Insufficient Supply	Yes No	60 142.	5 60	95.8
Construction Record - Screen Outside Depth (m/ft)	Abandoned, Poor Water Quality	Map of W Please provide a map below following	ell Location	ne back.	
Outside Material Depth (m/ft) Diameter (Plastic, Galvanized, Steel) Slot No. From To	Abandoned, other,				
- Internet and the second seco	specify	Balinab	conker	Roa	d
	Other, specify	- Sound's	44	52	
Water Details	Hole Diameter	Bolingb 16' From house		/	
Water found at Depth Kind of Water: Fresh @Untested	Depth (m/ft) Diameter	house •		/	
Image: Contract of the second seco	22' 25.Her		/		
(m/ft) Gas Other, specify	- dd 0.5.101		/		
Water found at Depth Kind of Water: Fresh Untested		-			
(m/fit) Gas Other, specify	rmation				
Business Name of Well Contractor	Well Contractor's Licence No.				
WILF HALL & JONS WELL DRILLING Business Address (Street Number/Name)	F 3 5 5 8 Municipality	Comments:			
25h HallShore Rd RRI McDond	Id's Corners	sammana.			
Province Postal Code Business E-mail Address	1	Wall augoria Data Bastiana Daliura	d I and	nieter 11-	o Only
DN KOGIMO with falled Bus. Telephone No. (inc. area code) Name of Well Technician (Last Na	@ bell net.ca ame, First Name)	Well owner's Date Package Delivered	Audit No		
611312178121933 Hall Mork		delivered Date Work Completed	24	z 15.	3980
Well-Technician's Licence No. Signature of Technician and/or Contracto	Date Submitted	Ves 2012 09	24 Received		15 9949
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APPENDIX E

Well Owner Interview Forms





4

WELL INSPECTION SURVEY FORM

WELL ID (SAMPLE ID): 70- Blind Duplicate ID:	16732_Sample Date/	Time:
OWNER/ADDRESS OF WELL:	Sample Loo Sampler I	
Name: Karen Pr. ful	Person Intervie	ewed: Marth Debeer
Address: County Rol 36	AND A REAL PROPERTY OF A	1015
Telephone (Home):	(Busin	ess):
How Long as Owner:	Heating: Oil	Gas Electric Other (circle one)
Sampling Results Requested? Yes Field Readings: TurbidityTer		s:
TENANT (if different from owner):		
Name:	Person Interview	wed:
Telephone (Home):	(Busin	ess):
How Long as Tenant:		
PART I: PREVIOUS WELL ISSUES		
Type of Water Quality Issue:		
Type of Water Quantity Issue:		
Outcome(s):		
Available Documentation:		
Available Sampling Results?:		
PART II: WELL CONSTRUCTION E	DETAILS	
No. of Wells/Type (dug/drilled):	Drilled	
Does well draw water from overburde	n obedrock? (circle correct of	ne)
Location of Well in Relation to Reside	ence/Buildings: 1	
Well 1 GPS coordinates: (N)	4963628	(E) 379621
Well 2 GPS coordinates: (N)		(E)
Water Well Record Available?: Y	(Y/N; attach copy) Cor	nstruction Date: 2007/06/28
Well Type (dug, drilled):	Drilled	
Well Depth (m): 67.0	7 Diameter (c	:m): 25.4
Casing Length (m): 6-70	Diameter (c	m): 15.24
Screen Installed?	(Y/N) Water Quality	
Test Pumping Rate: 13.64	L/min Test Max. Dra	wdown/Time:
Depth to Bedrock (1.52	and an one particular state of the state of the state of the	slack/gren granite
Depth Water found @ft): 64.62	Recommended Pumping R	1 7 2 2

PART III: PUMP INSTALLATION DETAILS

Pump Type / HP (sub	omersible, centifugal, jet, etc):sible
Date of Installation:	
Pump Intake Depth (r	m):
Storage Tank Type (b	oladder, contact, etc.):
Tank capacity (specif	y units):
Have you had any pro	oblems with your pump? (If so, what?)
PART IV: WATER T	REATMENT SYSTEM(S)
Do you have a water	treatment system(s)? Yes (No) (circle one)
Type(s): (pls circle)	Water softener / Reverse Osmosis / Distillation / Filtration / UV
Date of Installation:	
Services:	Entire system / Kitchen Faucet (circle one or write other)
Water Softener:	Salt Type: (pls circle) NaCl / KCl
Discharge location:	
Reverse Osmosis:	
Discharge location:	
Filtration: (pls circle	e) Cartridge / Greensand / Other (specify):
Cartridge size (um):	
How often is cartridge	e replaced?
Disinfection:	Make/model:
	Location:
PART V: WATER U	SAGE
What is well water us	and for (annality for analy wall)?

What is well water used for (specify for each well)?

(eg., domestic supply, agricultural, commercial/industrial usage - see below; give specifics)

Domestic suppli 1

If domestic usage, spe	cify number of pe	ersons using v	vell:	1-2	1		
Lawn watering?	N	(Y/N)					
Type & number of Live	estock watered fro	om well:					
Other uses for water r	not specified abov	e:	Bottling	for 1	personal	use	at
permonent	residerc	e.	7	0	1.000		

Owner Permission to Take Well Water Level	
	print name signature
Well Water Level (m TOC):	Date/Time:
PART VI: SEPTIC SYSTEM	
Location: Any problem with system?	Age:
When was tank last pumped?	
Interviewed By: Matt Debeer	Date: Nov 3 2021
Ref: BluMetric Well Inspection Survey Form-V2.xls	
Site Plan /Well Insp indicate well vs Septic locat	tion, site drainage, adjacent land use, N arrow, scale
Is surface drainage away from well? Yes / No	Well Casing Height (m)
Well location photo taken? Yes / No Please see well Re	cord
	Lord

APPENDIX F

Laboratory Report of Analyses





C.O.C.: DW116170

Report To:

Blumetric Environmental 1682 Woodward Drive, Ottawa ON K2C 3R8 Canada Attention: Matt DeGeer

DATE RECEIVED: 23-Nov-21 DATE REPORTED: 29-Nov-21

SAMPLE MATRIX: Drinking Water

Preliminary Report

REPORT No. B21-38554 (i)

Caduceon Environmental Laboratories 285 Dalton Ave Kingston Ontario K7K 6Z1

Tel: 613-544-2001 Fax: 613-544-2770

JOB/PROJECT NO.: 220037

P.O. NUMBER:

WATERWORKS NO.

		ĺ	Client I.D.		2003-01		
			Sample I.D.		B21-38554-1		
			Date Collect	ed	23-Nov-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
Fluoride	mg/L	0.1	SM4110C	26-Nov-21/O	0.2		
Chloride	mg/L	0.5	SM4110C	26-Nov-21/O	7.2		
Nitrite (N)	mg/L	0.1	SM4110C	26-Nov-21/O	< 0.1		
Nitrate (N)	mg/L	0.1	SM4110C	26-Nov-21/O	< 0.1		
Nitrate + Nitrite (N)	mg/L	0.1	SM4110C	26-Nov-21/O	< 0.1		
Sulphate	mg/L	1	SM4110C	26-Nov-21/O	18		
Hardness (as CaCO3)	mg/L	1	SM 3120	29-Nov-21/O	213		
Barium	mg/L	0.001	SM 3120	29-Nov-21/O	0.086		
Boron	mg/L	0.005	SM 3120	29-Nov-21/O	0.153		
Chromium	µg/L	2	SM 3120	29-Nov-21/O	< 2		
Copper	mg/L	0.002	SM 3120	29-Nov-21/O	0.019		
Zinc	mg/L	0.005	SM 3120	29-Nov-21/O	0.006		
Sodium	mg/L	0.2	SM 3120	29-Nov-21/O	28.7		
Calcium	mg/L	0.02	SM 3120	29-Nov-21/O	55.8		
Iron	mg/L	0.005	SM 3120	29-Nov-21/O	< 0.005		
Potassium	mg/L	0.1	SM 3120	29-Nov-21/O	2.8		
Magnesium	mg/L	0.02	SM 3120	29-Nov-21/O	18.0		
Manganese	mg/L	0.001	SM 3120	29-Nov-21/O	0.018		
Strontium	mg/L	0.001	SM 3120	29-Nov-21/O	0.557		
Fecal Coliform	cfu/100mL	1	SM9222D	24-Nov-21/K	0		
Dissolved Organic Carbon	mg/L		EPA 415.2	/			
Antimony	mg/L	0.0001	EPA 200.8	26-Nov-21/O	< 0.0001		
Arsenic	mg/L	0.0001	EPA 200.8	26-Nov-21/O	< 0.0001		
Beryllium	mg/L	0.0001	EPA 200.8	26-Nov-21/O	< 0.0001		
Cadmium	mg/L).000015	EPA 200.8	26-Nov-21/O	< 0.000015		
Cobalt	mg/L	0.0001	EPA 200.8	26-Nov-21/O	0.0001		
Lead	mg/L	0.00002	EPA 200.8	26-Nov-21/O	0.00018		

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Michelle Dubien Lab Manager



NTAL LABORATORIES

C.O.C.: DW116170

Report To:

Blumetric Environmental 1682 Woodward Drive, Ottawa ON K2C 3R8 Canada Attention: Matt DeGeer

DATE RECEIVED: 23-Nov-21 DATE REPORTED: 29-Nov-21

SAMPLE MATRIX: Drinking Water

Preliminary Report

REPORT No. B21-38554 (i)

Caduceon Environmental Laboratories 285 Dalton Ave Kingston Ontario K7K 6Z1

Tel: 613-544-2001 Fax: 613-544-2770

JOB/PROJECT NO.: 220037

P.O. NUMBER:

WATERWORKS NO.

		1	Client I.D.		2003-01		1
			Sample I.D.		B21-38554-1		
			Date Collect	ed	23-Nov-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed	\wedge		
Molybdenum	mg/L	0.0001	EPA 200.8	26-Nov-21/O	0.0008		
Nickel	mg/L	0.0002	EPA 200.8	26-Nov-21/O	< 0.0002		
Selenium	mg/L	0.001	EPA 200.8	26-Nov-21/O	< 0.001		
Silver	mg/L	0.0001	EPA 200.8	26-Nov-21/O	< 0.0001		
Thallium	mg/L	0.00005	EPA 200.8	26-Nov-21/O	< 0.00005		
Uranium	mg/L	0.00005	EPA 200.8	26-Nov-21/O	0.00198		
Vanadium	mg/L	0.0001	EPA 200.8	26-Nov-21/O	0.0002		
Mercury	mg/L	0.00002	SM 3112 B	25-Nov-21/O	< 0.00002		
Total Coliform	cfu/100mL	1	MOE E3407	24-Nov-21/K	0		
E coli	cfu/100mL	1	MOE E3407	24-Nov-21/K	0		
Background	cfu/100mL	1	MOE E3407	24-Nov-21/K	0		
Conductivity @25°C	µmho/cm	1	SM 2510B	25-Nov-21/O	476		
Alkalinity(CaCO3) to pH4.5	mg/L	5	SM 2320B	25-Nov-21/O	234		
pH @25°C	pH Units		SM 4500H	25-Nov-21/O	8.12		
TDS (Calc. from Cond.)	mg/L	1	Calc.	26-Nov-21	246		
Ammonia (N)-Total	mg/L	0.01	SM4500- NH3-H	25-Nov-21/K	0.02		
Colour	TCU	2	SM 2120C	26-Nov-21/O	< 2		
Turbidity	NTU	0.1	SM 2130	25-Nov-21/O	0.2		

M. Duli

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Michelle Dubien Lab Manager



IVIRONMENTAL LABORATORIES Client committed. Quality assured.

C.O.C.: DW116170

Report To:

Blumetric Environmental 1682 Woodward Drive, Ottawa ON K2C 3R8 Canada Attention: Matt DeGeer

DATE RECEIVED: 23-Nov-21 DATE REPORTED: 29-Nov-21

SAMPLE MATRIX: Drinking Water

Preliminary Report

REPORT No. B21-38554 (ii)

Caduceon Environmental Laboratories 285 Dalton Ave

Kingston Ontario K7K 6Z1 Tel: 613-544-2001 Fax: 613-544-2770

JOB/PROJECT NO.: 220037

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		2003-01		
			Sample I.D.		B21-38554-1		
			Date Collect	ed	23-Nov-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed		- -	
Acetone	µg/L	30	EPA 8260	26-Nov-21/R	< 30		
Benzene	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Bromodichloromethane	µg/L	2	EPA 8260	26-Nov-21/R	< 2		
Bromoform	µg/L	5	EPA 8260	26-Nov-21/R	< 5		
Bromomethane	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Carbon Tetrachloride	µg/L	0.2	EPA 8260	26-Nov-21/R	< 0.2		
Monochlorobenzene (Chlorobenzene)	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Chloroform	µg/L	1	EPA 8260	26-Nov-21/R	< 1		
Dibromochloromethane	µg/L	2	EPA 8260	26-Nov-21/R	< 2		
Dichlorobenzene,1,2-	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Dichlorobenzene,1,3-	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Dichlorobenzene,1,4-	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Dichlorodifluoromethane	µg/L	2	EPA 8260	26-Nov-21/R	< 2		
Dichloroethane,1,1-	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Dichloroethane,1,2-	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Dichloroethylene,1,1-	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Dichloroethene, cis-1,2-	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Dichloroethene, trans-1,2-	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Dichloropropane,1,2-	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Dichloropropene, cis-1,3-	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Dichloropropene, trans-1,3-	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Dichloropropene 1,3- cis+trans	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Ethylbenzene	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Dibromoethane,1,2- (Ethylene Dibromide)	µg/L	0.2	EPA 8260	26-Nov-21/R	< 0.2		
Hexane	µg/L	5	EPA 8260	26-Nov-21/R	< 5		

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Michelle Dubien Lab Manager



IRONMENTAL LABORATORIES Client committed. Quality assured.

C.O.C.: DW116170

Report To:

Blumetric Environmental 1682 Woodward Drive, Ottawa ON K2C 3R8 Canada <u>Attention:</u> Matt DeGeer

DATE RECEIVED: 23-Nov-21 DATE REPORTED: 29-Nov-21

SAMPLE MATRIX: Drinking Water

Preliminary Report

REPORT No. B21-38554 (ii)

Caduceon Environmental Laboratories 285 Dalton Ave

Kingston Ontario K7K 6Z1 Tel: 613-544-2001 Fax: 613-544-2770

JOB/PROJECT NO.: 220037

P.O. NUMBER:

WATERWORKS NO.

			Client I.D.		2003-01		
			Sample I.D.		B21-38554-1		
			Date Collect	ed	23-Nov-21		
Parameter	Units	R.L.	Reference Method	Date/Site Analyzed			
Methyl Ethyl Ketone	µg/L	20	EPA 8260	26-Nov-21/R	< 20		
Methyl Isobutyl Ketone	µg/L	20	EPA 8260	26-Nov-21/R	< 20		
Methyl-t-butyl Ether	µg/L	2	EPA 8260	26-Nov-21/R	< 2		
Dichloromethane (Methylene Chloride)	µg/L	5	EPA 8260	26-Nov-21/R	< 5		
Styrene	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Tetrachloroethane,1,1,1,2-	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Tetrachloroethane,1,1,2,2-	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Tetrachloroethylene	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Toluene	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Trichloroethane,1,1,1-	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Trichloroethane,1,1,2-	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Trichloroethylene	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Trichlorofluoromethane	µg/L	5	EPA 8260	26-Nov-21/R	< 5		
Vinyl Chloride	µg/L	0.2	EPA 8260	26-Nov-21/R	< 0.2		
Xylene, m,p-	µg/L	1.0	EPA 8260	26-Nov-21/R	< 1.0		
Xylene, o-	µg/L	0.5	EPA 8260	26-Nov-21/R	< 0.5		
Xylene, m,p,o-	µg/L	1.1	EPA 8260	26-Nov-21/R	< 1.1		

M. Duli

R.L. = Reporting Limit

Test methods may be modified from specified reference method unless indicated by an * Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

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