HARDEN ENVIRONMENTAL SERVICES LIMITED

Level 1 and Level 2 Hydrogeological Evaluation for Above Water Table Aggregate Extraction

Hallman Pit

Township of Wilmot
Regional Municipality of Waterloo

Prepared For:

Jackson Harvest Farms Ltd.

September 3, 2019
REF. No. 1728

Executive Summary

Jackson Harvest Farms Ltd. is applying to the Ministry of Natural Resources and Forestry for a Category 3 license to extract aggregate from their property located in the Township of Wilmot, Regional Municipality of Waterloo. A Category 3 license permits aggregate extraction only from above the water table.

A permit to take water will be required for water used in the aggregate processing plant. The discharge water will be recirculated on-site. Any loss of water from evaporation or entrainment in exported aggregate is compensated by decreased evapotranspiration in the working area. There will be no decrease in the quantity of groundwater at the site.

A wetland is located along the eastern site boundary. A feature-specific water balance was prepared for the wetland. There will be no reduction in water available to the wetland and there will be no significant change in hydroperiod of the wetland.

Groundwater beneath the site does not flow toward the Region of Waterloo production wells. There will be no water quality or water quantity impact to any private well or municipal well arising from the proposed aggregate extraction.

The aggregate extractive activity will temporarily replace agricultural activities resulting in an improvement to groundwater quality beneath the site. Neither the disturbance of the sand and gravel through extractive activities nor the processing of the aggregate will result in the release of nutrients to the ground water system. In the long-term, improvements will be made in regard to nutrient applications resulting in a reduction of nitrate concentrations within the Issue Contributing Area identified in the local Source Water Protection Plan.

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this report is to provide a hydrogeological assessment as part of a Licence application under the *Aggregate Resources Act (ARA)* being made by Jackson Harvest Farms Ltd. (JHFL). JHFL is applying for a Category 3 licence for the property located on the south side of Bleams Road approximately 1200 metres east of Sandhills Road. The civic address is 1894 and 1922 Witmer Road. The Category 3 licence will only permit the extraction of aggregate from above the water table. One pond will be created in the water table as a water source for the aggregate processing plant. The proposed license tonnage is 750,000 tonnes per year. A permit to take water will be required to supply the aggregate processing plant.

1.2 STUDY SCOPE

The 65.3 hectare (161 acre) property ("the Site") is located in Part Lot 10 Concession South of Bleams Road in the Township of Wilmot, Regional Municipality of Waterloo (Figures 1.1 and 1.2). The Site is located at the subwatershed boundary of Alder Creek and the Nith River within the Grand River watershed (Figures 1.3). Potential impacts to these waterways have been considered. Local well water supply is obtained from both the sand and gravel and bedrock aquifers. Potential impacts to private water wells have been considered in Section 7.1. A wetland is found along the eastern property boundary. A feature specific water balance has been prepared and is presented in Section 4.6.

The objectives of this study are to:

i. define the local hydrogeological setting,
ii. determine the local water table elevation,
iii. assess the extent of local groundwater / surface water interaction,
iv. determine the potential for adverse effects to water wells, springs, wetlands, ponds, and
v. recommend measures to minimize any significant impacts identified.

This study meets the requirements of the Level I and Level II Hydrogeological Assessments as required under the *Aggregate Resources Act*.

The scope of work was presented to the Grand River Conservation Authority and the Region of Waterloo (ROW). The GRCA comments on the scope of work are included in Appendix A and the ROW provided the *Draft Regional Municipality of Waterloo Guidelines for Hydrogeological*

Assessments for Proposed Mineral Aggregate Resource Extraction Projects. The recommended scope of work was adopted into this study with minor variations.

1.3 METHODOLOGY

The undertaking of this study included but was not limited to the following activities:

i. review of background information including quaternary geology, bedrock geology, physiography, areas of natural and scientific interest, natural heritage features, Grand River Conservation Authority documents, Source Water Protection documents, existing aggregate operation reports and monitoring data and water well records,
ii. review of the 2019 Stantec Report Operational Testing Program, Wilmot Centre Well Field Report and ROW Monitoring Reports,
iii. installation of five dedicated groundwater monitors and one surface water monitor,
iv. measuring water levels of monitors and continuous monitoring with data loggers,
v. level survey of monitoring stations,
vi. obtaining water quality samples from on-site wells on two occasions,
vii. water well survey of private wells within 500 metres of the site,
viii. determining the surface water and groundwater catchment area of the wetland,
ix. preparing feature specific and site water balances,
x. determination of existing groundwater flow directions and
xi. assessment of cumulative impact on the Nith River.

1.3.1 GEOLOGICAL INVESTIGATION

In April of 2017, four boreholes were drilled by Aardvark Drilling Inc. Soil samples were obtained in the overburden with a split-spoon sampler. Groundwater monitors were installed and are designated MW1 through MW4. All monitors were completed in the overburden. MW5 was drilled July 4, 2017 and a monitor installed as part of a Phase 2 Environmental investigation.

All boreholes and groundwater monitors are shown on Figure 1.4. Borehole records are found in Appendix B.

1.3.2 GROUNDWATER MONITOR INSTALLATION AND WATER LEVEL MEASUREMENTS

51 mm inside diameter PVC piezometers were installed in all boreholes.

Details of groundwater monitor installations are found in Table 1.

Water level measurements at the Site commenced in May 2017. Manual water level measurements are summarized in Table 2. Water levels were obtained with an electric measuring tape.

Data loggers were installed in all onsite monitors and the hydrographs of manual measurements and data obtained on an hourly interval are shown on Figures 1.5 through to 1.11.

The monitoring wells were surveyed to a geodetic datum.

1.3.3 HYDRAULIC TESTING

Hydraulic testing was conducted in monitors MW1, MW2 and MW5 on November 14, 2018. This testing was conducted using the Falling Head Method. The Falling Head method involves adding a known volume of water into the monitoring well and measuring the water level as it returns to pre-test or static level. The observed change in the water level with time was converted to a hydraulic conductivity using the Hvorslev method as described by Freeze and Cherry (1979). The data and analyses of these tests are included in Appendix C and results are summarized in Table 3.

Table 3: Summary of Hydraulic Testing

Monitor	k (m/sec)
MW1	1.17E-04
MW2	2.56E-05
MW5	6.05E-05

1.3.4 WATER QUALITY SAMPLING

Groundwater samples were obtained from on-site groundwater monitors to characterize the existing groundwater quality beneath the Site. The sampling locations are MW1, MW2, MW3, MW4 and MW5. The samples were obtained on March 26, 2019 and on July 8, 2019. The samples were obtained after the removal of three well volumes. During the July 8 sampling event, a sample was also obtained from the on-site wetland/pond near monitor SG1. The samples were analyzed for general chemistry, nutrients, anions, DOC and dissolved metals. The results of the testing are found in Appendix D and summarized in Table 4.

All analyses were conducted by Maxxam Laboratories in Mississauga. Maxxam is a Ministry of the Environment, Conservation and Parks (MECP) certified laboratory.

1.3.5 PRIVATE WELL SURVEY

There are 16 civic addresses not connected to the municipal water supply within five hundred metres of the Site as shown on Figure 1.12 and discussed in Section 4.5. These residents were contacted as part of the well survey. The remaining residences obtain water from the municipal water supply system. The details of the private well survey are found in Table 5 and Appendix E.

1.3.6 COMPLEMENTARY STUDIES

The natural heritage study for this Site has been conducted by Dance Environmental.

Planning documents and Site plans have been prepared by IBI Group (IBI).

2.0 PHYSICAL SETTING

2.1 SITE DESCRIPTION AND SURROUNDING LAND USE

The Site is located on the north side of Witmer Road in the Township of Wilmot, Regional Municipality of Waterloo. The road network is oriented approximately east to west and north to south. The surrounding area is agriculture to the south, east and west. The hamlet of Shingletown is located along the northern site boundary.

There are 52 residences within 500 metres of the Site as shown on Figure 1.2.

The Site has been part of an active cash crop and beef farm for decades. A farm house and numerous farm buildings including manure storage facilities were present at the Site until 2017. Liquid manure was historically stored at the site and spread on the farm fields.

Several existing aggregate sites are found in the general area of the Site as shown on Figure 2.1.

Wetlands and water bodies in the area are shown on Figure 2.2. The nearest environmental features considered in this study are the Schindelsteddle South Wetland Complex and the Silver Spring Creek and Hunsberger Creek Wetland Complex.

There are lands regulated by the Grand River Conservation Authority within the proposed aggregate license boundaries. Figure 2.3 shows regulation limits around wetlands and floodplain associated with the wetlands.

2.2 AREAS OF NATURAL AND SCIENTIFIC INTEREST

The are no nearby Areas of Natural and Scientific Interest (Figure 2.4).

2.3 PHYSIOGRAPHY

According to Chapman and Putnam (1986) the Site is located within the Waterloo Hills physiographic region (Figure 2.5).

2.4 TOPOGRAPHY, DRAINAGE AND SOILS

The ground surface elevation of the Site ranges from 375 m AMSL to 355 m AMSL. The higher ground surface elevations occur in the northern and western areas of the site. The lower ground surface elevations occur adjacent to the wetland located centrally along the eastern site boundary. Approximately 36% of the site drains to this wetland. The wetland is permanently water filled. A small portion of the northwest corner of the site drains northerly onto adjacent lands.

Three soil types are identified beneath the Site as the Lisbon Sandy Loam, Fox Sandy Loam and the Burford Gravel Loam (Figure 2.6). All soil types are well drained. Overland drainage will only occur during frozen ground conditions and winter-time thaws.

2.5 SURFACE WATER FEATURES

The Site is located along the sub watershed boundary between Alder Creek and the Nith River (Figure 1.3). Alder Creek subwatershed has a total area of 82 km^2.

Two surface water features are identified on various mapping systems. A 2.2 hectare wetland is located along the eastern site boundary. The majority of the wetland and its catchment area is located on the adjacent property. Historical aerial photos show that the wetland is perennially wet. There is no surface water outlet for the wetland. The wetland potentially has a total catchment area of 182 ha as shown on Figure 2.7. However, overland drainage to the wetland will only occur from a smaller area and even then, only under spring thaw or winter thaw conditions.

A second surface water feature located southwest of the wetland is identified on various maps and is designated as a wetland feature on the GRCA mapping system. A review of historical photographs suggests that this is a man-made feature associated with the former intensive cattle farming operation. There is presently no water present in the feature and according to the Dance natural heritage report, is not a wetland feature. The Grand River Conservation Authority concurs with this finding.

2.6 WETLANDS

A 2.2 hectare wetland is located along the eastern property boundary. The wetland is identified as unevaluated and part of the Schindelsteddle South wetland complex. Detailed information about this wetland can be found in the Dance, 2019 natural heritage report.

2.7 CLIMATE

According to the climate data obtained by Environment Canada between 1973 and 2015, the normal annual precipitation in nearby Kitchener/Waterloo is 889 mm. Of this, a significant quantity is returned to the atmosphere by evaporative and evapotranspiration processes. The evapotranspiration is estimated to be 55% of precipitation. The remaining 'surplus water' available for runoff or infiltration is approximately 400 mm/year. Approximately 650 mm per year of evaporation from open bodies of water occurs in this area as determined from pan evaporation measurements at the Elora climate station.

3.0 REGIONAL AND SITE GEOLOGY

3.1 BEDROCK

The site is underlain by the Upper Silurian aged Salina Formation. The Salina Formation comprises shale and dolostone rock types. Water well record 6503292 (Figure 3.1) drilled to a depth of 102 metres identifies the shale and limestone beginning at 87 metres below ground surface. The ground surface at this well is approximately 360 m AMSL; therefore, the top of bedrock in this area is at approximately 273 m AMSL. Given the Site elevation range of 375 to 355 m AMSL and the above-water-table designation of the pit, the bedrock does not influence any decision making for this ARA application.

3.2 QUATERNARY GEOLOGY

Kame sand is identified as the main surficial geological unit beneath this site (Figure 3.2). However, the Waterloo moraine is a complex sequence of various glacial deposits resulting from the advance and retreat of the Lake Huron, Georgian Bay, Lake Erie and Lake Ontario ice lobes. The more than 80 metres of glacial material includes both relatively permeable (aquifers) and relatively impermeable (aquitards) stratigraphic layers. The youngest deposits occur near to the ground surface and although glacial tills have been identified elsewhere at the surface on the Waterloo Moraine, this does not occur at this site.

A well drilled on an adjacent property west of the site (water well record 6503292) shows that the overburden is 87 metres thick. The sequence of geological materials is shown in Table 6.

Table 6: Geological Materials at Well Record 6503292

Depth Below Ground (metres)		Geological Materials
From	To	
0	24	Sand
24	36.5	Clay

Depth Below Ground (metres)		Geological Materials
From	To	
36.5	42	Gravel and Clay
42	87	Clay
87		Shale

The onsite drilling found that kame sand and gravel deposits extend at least to a depth of 23 metres.

4.0 HYDROGEOLOGY

The site is located in an upland area of the Nith River and Alder Creek Subwatersheds. This is an area of significant groundwater recharge. This function will not change as a result of the proposed development. The underlying kame sand deposits facilitate the infiltration of precipitation and snowmelt.

The regional groundwater flow direction is shown in the Alder Creek Subwatershed Study to be southerly to southeasterly. Groundwater flowing through this site ultimately discharges to Alder Creek near to its confluence with the Nith River. On-site monitoring confirms this overall groundwater flow direction.

Hydrographs of water levels obtained from each of the monitors are shown on Figures 1.5 to 1.11.

The highest groundwater elevations occur along the northern property boundary as measured in MW3. The highest groundwater elevation was measured here in July of 2019 at 355.7 m AMSL. The lowest groundwater elevation occurs along the southern property boundary at MW5 with an elevation of 352.9 m AMSL. There is a 2.8 m water level difference across the entire site. The distance across the site is 1200 metres resulting in an average hydraulic gradient of 0.002 m/m.

The equipotentials of the high-water table are shown on Figure 3.3A. Groundwater flow is perpendicular to the equipotentials and is thus shown to be flowing in a southeasterly direction in the northern portion of the site. It is also interpreted that under high water conditions, the on-site wetland influences groundwater levels as shown by the deflection of groundwater contours around the wetland. As seen in the hydrographs for MW1 and SG1, this effect lasts for several months. In late summer and fall, the influence of the wetland no longer occurs as interpreted in Figure 3.3A.

The seasonal water level fluctuation is found to be between 0.6 and 0.7 metres with the exception of MW1 located adjacent to the wetland. Here the seasonal water level difference is one metre as influenced by accumulating surface water in the wetland. Groundwater elevations are found to

be their highest in August and their lowest in February as shown on the hydrographs. The water level in the wetland fluctuates by 1.3 metres on a seasonal basis.

The wetland is found to be situated within the local water table. The water table supports the wetland for most of the year, but as seen on Figure 1.10, the spring freshet or a significant snow melt results in a rapid rise in surface water level resulting in a phenomenon known as bank storage. In this time pond water recharges the groundwater system. In 2018 and 2019 the water level in the pond was higher than the surrounding groundwater for several months (mid February to mid May). Following this period, groundwater levels at MW1 are found at a higher elevation than the wetland surface water level.

4.1 LOCAL GROUNDWATER USE

There are fifty-two residential addresses located within five hundred metres of the subject property. The depth of wells range from 12.79 to 103.02 metres. This shows that both the bedrock and overburden as used for a water supply. There are several wells which obtain water from the upper sand and gravel unit. The proposed above-water-table extraction will not interfere with the quality or quantity of water available to these wells.

Figures 4.1 and 4.2 are cross sections along Bleams and Witmer Road showing the pit location relative to the geological conditions at private wells from the water well record data base. Water level elevations shown on Figures 4.1 and 4.2 are taken from water well records, and if available the Harden measured water level is used.

There are residences north of the site, along Bleams Road, that are connected to the municipal water system. The residences on Bleams Road within 500 m of the Site that are not connected are 2078B, 2118, 2143, 2175, 2229 and 2295 Bleams Road.

4.2 AQUIFER CONNECTION TO RMOW WELLS K50/K51/K52

The RMOW operates three municipal wells designated K50/K51 and K52 as shown on Figure 4.3. The municipal wells obtain water from a deeper sand and gravel unit.

We have reviewed the draft Stantec 2018 Operational Testing Program, Wilmot Centre Well Field Report dated April 2019. We reviewed this report as it provides a local perspective to groundwater flow related to the water taking by RMOW from wells K50/K51/K52.

The RMOW has designated aquifers as AFxx and aquitards as ATxx. An aquifer is defined as a saturated geological layer that can be used as a water source using wells. Aquifers are often sand and gravel layers in unconsolidated deposits. An aquitard is a geological unit that cannot supply enough water for a water supply and is often mainly silt or clay in unconsolidated deposits.

The cross sections provided in the Stantec report show that the Site is found to be mainly within the unsaturated zone of aquifer AFB1. The westernmost part of the site is found in the unsaturated zone of aquitard ATB1, however, on-site drilling does not corroborate this finding. The aquitard is not present in the samples obtained from borehole MW3. The Stantec report finds that aquifers AFB1 and AFB2 beneath the Hallman Pit are separated by aquitard ATB2. However, ATB2 is absent in the vicinity of K51/K52/K50 and the two aquifers beneath the Hallman Pit are geologically connected to the water producing zone in the wellfield.

The drawdown effect from municipal pumping test observed in AFB1 is inferred to be less than 0.10 metres at the site as shown on Figure 9 of the Stantec report. The on-site monitoring at the Hallman Pit site obtained from 1-hour interval datalogger data during the testing period found that there is no indication that the test drawdown interfered with water levels in any on-site monitor.

The drawdown during the test period in AFB2, the deeper aquifer, is less than 0.12 metres as measured in the monitoring well OW10-67-A (a deep monitor) located on the adjacent property near to the northwest corner of the site (Figure 8 of Stantec Report).

The on-site data collected by Harden finds that groundwater flow direction in AFB1 is found to be in a southerly direction away from the wellfield. This means that groundwater beneath the Site cannot contribute to the municipal wells via the shallow aquifer AFB1. This information was not known by Stantec at the time of writing their draft report.

The presence of the aquitard ATB2 will greatly restrict vertical movement of water from AFB1 to AFB2. The groundwater potential in OW10-67 (completed in AFB2) at the time of the testing was 353.8 to 354.1 m AMSL. The nearest on-site monitor MW4 (completed in AFB1) has groundwater potentials of 354.4 to 354.9 m AMSL. This confirms downward gradients in this area albeit with a thick silt layer between AFB1 and AFB2. The proposed extractive operation will not be physically disturbing any local aquifer and water quality improvements will be made through the reduction of nutrient applications.

4.3 SOURCE WATER PROTECTION

A portion of the proposed pit falls within the Well Head Protection Area of the municipal wells as shown on Figure 4.3. The pit also falls within an Issue Contributing Area related to nitrate contamination (Figure 4.4).

The March and July 2019 water quality sampling has shown that the nitrate concentration beneath the on-site cash crop fields has a range of 5 to 15 mg/L. The sandy soils already allow for the migration of nitrogen through the unsaturated zone to the water table. The removal of the sandy overburden will decrease the thickness of the unsaturated zone. This is of little or no consequence

to nitrate movement as discussed in Section 6.3.1. The groundwater flow at the water table (upper aquifer AFB1) is determined to be away from the ROW wells K50/K51/K52. Therefore, any nitrate in the groundwater beneath the site will continue to move away from the wellfield. Jackson Harvest Farms, the site owner, has also agreed restrict nitrogen applications in the issue contributing area through a Section 59 notice. Therefore, nutrient applications in the northern portion of the site will be reduced thus reducing the nitrate contribution from this site for the long-term.

Figure 4.5 shows that the site is located in an area of Significant Groundwater Recharge. This condition will not change as a result of the pit development.

Figure 4.6 shows that the vulnerability score of the portion of the site within the WHPA is either 4 or 6. The reduction in overburden thickness will increase the vulnerability score, however:

a) there will be a reduction of nutrients applied within the WHPA and Issue Contributing Area thus improving groundwater quality,

b) groundwater is flowing away from the municipal wells in the shallow groundwater regime beneath the site,

c) aggregate extraction activities are not a threat to drinking water and

d) aggregate extraction is permitted in Well Head Protection Areas.

4.4 WATER QUALITY

The on-site water sampling and water sampling by others off-site, has confirmed that the existing agricultural activities both on-site and off-site are having an impact on the groundwater quality. The groundwater is impacted by elevated concentrations of nitrate. On-site, nitrate concentrations are found to range from 0 mg/L (MW1) to 14.6 mg/L (MW2). MW2 is located at the northern edge of the site and groundwater is moving from north to south, thus the elevated nitrate in this area originates off-site. Widespread nitrate contamination of groundwater is documented in the annual monitoring report for Wilmot Center prepared by Burnside and Associates in 2019. Figure 10 of the Burnside Report shows the widespread nature of nitrate contamination in the catchment area of the municipal wells. The Burnside report also states that reduced nitrogen applications in the Issue Contributing Area of the municipal wells is resulting in improved water quality.

4.5 ON-SITE HYDROLOGY

There are five micro drainage areas on the Hallman Pit site as shown on Figure 4.7. Table 7 summarizes the hydrology of each of the drainage areas. The volume of infiltration within each

micro-drainage area was estimated using the MECP Hydrogeological Technical Information Requirements for Land Development Applications. The partition of surplus water into infiltration and runoff is estimated using an infiltration factor. The infiltration factor is based on topography, soil type and vegetation and for the micro-drainage areas at the site is either 0.6 or 0.7 depending on slope. Where drainage ends up on-site as within closed depressions, the infiltration factor is 1.

Table 7: Micro Drainage Areas

Micro Drainage Area	Size (hectares)	Hydrology
D1	5.7902	Rolling land with an infiltration factor of 0.6. There is runoff from this area to offsite. This runoff will be captured by the pit and converted to infiltration or runoff towards the on-site wetland.
D2	6.2059	Rolling land with an infiltration factor of 1. Presently depression focused recharge but will become part of catchment area of on-site wetland post extraction.
D3	11.2725	Rolling land with an infiltration factor of 1. Presently draining to on-site depression and infiltrates.
D4	24.7749	Rolling land with an infiltration factor of 0.7. Presently contributes runoff to the on-site wetland.
D5	4.2070	Rolling land with an infiltration factor of 0.6. Runoff flows out of proposed extraction area but will be captured in the future pit.

Table 8 summarizes the pre-development water balance for the site. The infiltration value is determined by multiplying surplus water (Precipitation – Evaporation) by the infiltration factor. Runoff is determined by subtracting infiltration values from the surplus water value.

Table 8: Pre Development Water Balance for Entire Site

	Value	Units			
Precipitation	889	mm/year			
Evapotranspiration	489	mm/year			
Evaporation	652	mm/year			
Total Extraction Area	52.2400	hectare	Infiltration Factor		
Drainage Area D1	5.79	hectare	0.6		
Drainage AREa D2	6.20	hectare	1		
Drainage Area D3	11.27	hectare	1		
Drainage Area D4	24.77	hectare	0.7		
Drainage Area D5	4.21	hectare	0.6		
Wetland Area	2.00	hectare	1		

		Pre Extraction Water Balance			
	Area	Precipitation	Evapotranspiration	Runoff	Infiltration
	(hectare)	(m^3/year)	(m^3/year)	(m^3/year)	(m^3/year)
Pre Development					
Drainage Area D1	5.79	51,473	28,310	9,265	13,898
Drainage AREa D2	6.20	55,118	30,315	-	24,803
Drainage Area D3	11.27	100,190	55,105	-	45,086
Drainage Area D4	24.77	220,205	121,113	29,728	69,365
Drainage Area D5	4.21	37,427	20,585	6,737	10,105
Pre Development Summary	52.24	464,414	255,427	45,730	163,256

The water balance shows that a main hydrological function of this site is groundwater recharge (infiltration).

4.6 FEATURE SPECIFIC HYDROLOGY

The on-site wetland located along the eastern property boundary, has a surface water catchment area of approximately 182 hectares (Figure 2.7). The on-site surface water catchment of the wetland (Micro drainage Area D4) is shown on Figure 4.7 to be approximately 25 hectares or 14% of the overall catchment.

The hydrograph for the wetland surface water level shown on Figure 1.10 is interpreted to show that the support hydrology for the wetland comes from three sources; precipitation, overland runoff and groundwater. The pond is open to the atmosphere and therefore there will be direct input of precipitation. Following significant rainfall or snowmelt events, the surface water level in the wetland is higher than groundwater in MW1 as seen in the period of January through to

May in 2018 and February through to May in 2019. This confirms input from runoff. As evaporation effects increase and the wetland recharges the groundwater system, the water level in the wetland decreased to a position just lower than than the elevation of the groundwater at MW1. This shows that the wetland water levels influence groundwater levels and visa versa. That is, the wetland is not isolated from the groundwater system. In this way, pond levels during seasonal low periods, are very stable as supported by the local water table.

An extreme rainfall and snowmelt event in February 2018 resulted in raising the wetland water level by 0.9 metres and an unusual wet spring in 2019 resulted in the pond level rise of 1.1 m. The elevated water level required approximately 120 days to recover to static condition, this is approximately 60 days longer than the response in the groundwater system. This suggests that although the pond and the groundwater system are hydraulically, connected, changes in groundwater or surface water will be slow to have an effect. This observation also suggests that any significant increase in runoff will have a medium-term impact (months not days) on pond levels.

The highest water level recorded for the pond in March 2019 is 355.6 m AMSL. The lowest water levels occur in February 2019 at 353.9 m AMSL.

The pre-development water balance for the wetland presently includes runoff from Drainage Area D4, direct precipitation, evaporation from the wetland and is supported by, but does not receive a significant volume of groundwater. Our interpretation of the groundwater/surface water interaction is that the pond is supported by the water table but groundwater does not discharge to the feature in discrete locations. That is to say, that significant upwellings of groundwater into the pond are not expected to occur and none have been observed. This finding is supported by the absence of nitrate in the pond water. Provided, then, that the position of the water table does not change significantly, the groundwater support for the wetland will also not change.

With this understanding, the annual water balance for the wetland feature, assuming no year over year change in storage is as follows;

Precipitation + Runoff – Evapotranspiration ±Groundwater Input = 0

Table 9: Pre Development Water Balance for the Wetland

		Wetland Pre Extraction Water Balance			
	Area	Precipitation	Evapotranspiration	Surface Water Input	Infiltration
	(hectare)	(m^3/year)	(m^3/year)	(m^3/year)	(m^3/year)
Wetland	2.20	19,558	14,344	29,728	34,942

The pre development wetland water balance only considers surface water input from the site. There is a significant catchment area for the wetland from off-site lands but considering that this development will not alter those conditions, only on-site contributions are considered in this water balance.

The wetland does receive a significant volume of surface water input from the adjacent lands, including the proposed development. As such, one of the main functions of this wetland is to temporarily store runoff and slowly exfiltrate this water to the groundwater system. This is observed to occur from February through to May in both 2018 and 2019. This water balance approach indicates that on an average annual basis approximately 35,000 m^3 of water infiltrates via the wetland from on-site sources.

5.0 PROPOSED EXTRACTION

The proposed above-water-table extraction area is shown on Figure 5.1. A minimum separation distance of 1.5 metres will be maintained between the proposed pit floor and the water table.

5.1 LEVEL 2 EVALUATION

Given the local presence of water wells and wetlands, a Level 2 evaluation as described by the Ministry of Natural Resources and Forestry standards for aggregate license applications, is warranted. Table 10 summarizes the need for a Level 2 assessment.

Table 10: Evaluation of Need for Level 2 Hydrogeological Assessment

Category	Level 1 Assessment	Level 2 Assessment Needed?
Water Wells	Water wells located within 120 metres of the Site obtain water from sand and gravel aquifer.	Level 2 Assessment for water wells required.
Springs	No springs located downgradient of Site	Level 2 assessment is not needed to assess potential impact on springs.
Groundwater Aquifers	Extraction will not occur in the local groundwater aquifer, however there will be a reduction in the unsaturated zone thickness.	Level 2 assessment required to evaluate the potential water quality impact of decrease in unsaturated zone thickness.

Category	Level 1 Assessment	Level 2 Assessment Needed?
Discharge to Surface Water	The Site will be operating in geological materials that are contiguous with off-site surface water features.	Level 2 assessment required to evaluate the impact of changes to wetland.
Water Diversion, Storage and Drainage Facilities On-Site	No water diversion, storage or drainage facilities associated with proposed extraction.	A Level 2 assessment is not required to address alterations to water diversion, storage and drainage facilities.
Water Balance	There will be an increase in evaporation from the Site.	Level 2 assessment is needed to evaluate changes in the water balance.

6.0 LEVEL 2 ASSESSMENT

The following areas will be assessed as part of the Level 2 assessment;

1) Impact to Local Water Wells and Municipal Wells.
2) Impact to the Wetland
3) Water Quality and Quantity Impact to Sand And Gravel Aquifer
4) Changes to the Water Balance

6.1 ASSESSMENT OF CONSUMPTIVE LOSSES FROM AGGREGATE WASHING

We have prepared a water balance to analyze the overall potential change in the quantity of water contributed to the unconfined sand and gravel aquifer at the site.

The components of the water balance are as follows.

6.1.1 PRECIPITATION

According to the Environment Canada station in Kitchener Waterloo, the average annual precipitation is 889 mm/year (1973-2010). Neither the development of the pit, nor the taking of water from the pumping well will affect the rate of precipitation.

6.1.2 EVAPOTRANSPIRATION

The estimated evapotranspiration is 55% of precipitation or 489 mm/year. This applies to the original agricultural state of the site. We estimate that during active extraction,

evapotranspiration will be reduced by at least 50% in the disturbed area due to a reduction of transpiration in the root zone. This is due to the lack of uptake by vegetation and relatively rapid infiltration through the inorganic soil since the A Horizon of the soil will have been removed. Therefore, disturbed areas are assigned an evapotranspiration value of 245 mm/year. We assume that no more than 17.5 hectares are disturbed at any given time.

6.1.3 EVAPORATION

The estimate of evaporation 654 mm/year. This value is applied to the wash pond. The wash pond and silt ponds are proposed to have an area of 15,185 m^2.

6.1.4 SURPLUS WATER

Surplus water can either runoff of the Site or infiltrate. The amount of infiltration at the Site was estimated using the MOEE Hydrogeological Technical Information Requirements for Land Development Applications (1995). The partition of surplus water into infiltration and runoff is estimated using an infiltration factor. The infiltration factor is based on topography, soil type and vegetation and for this site is determined to be 0.7 (Table 11).

Table 11: Summary of Infiltration Factors

MOE Infiltration Factors			
Topo (Rolling)	Open Sandy	Cultivated Cover	Total
0.2	0.4	0.1	0.7

At the Hallman Pit it is assumed that all of the surplus water in the disturbed area is captured on site. We base this on observations of topography of the disturbed area and on original ground contours shown on various mapping products.

6.1.5 CONSUMPTION

The consumption of water by the wash plant will occur as water is entrained with the outgoing aggregate products and water evaporates from the washing system. A study by Golder Associates found that approximately 89L of water are 'consumed' for every tonne of aggregate processed. The license allows for a maximum of 750,000 tonnes of aggregate to be processed, resulting in an estimated consumption of 66,750 m^3 of water per year.

The following table summarizes the water balance of the Hallman Pit before and after aggregate extraction.

Table 12: Water Balance Comparison Before and During Aggregate Extraction

	Pre Extraction			During Extraction		
	Rate	Area	Volume	Rate	Area	Volume
	mm/year	m^2	m^3	mm/year	m^2	m^3
Precipitation	889	522,400	464413.6	889	522,400	464,414
Evaporation From Created Ponds	654	0	0	654	15,185	9,931
Evapotranspiration from Cultivated Lands	489	522,400	255453.6	489	347,400	169,879
Evapotranspiration from Disturbed Lands	245	0	0	245	159,815	39,155
Surplus Water on Cultivated Land			208960			138,960
Surplus Water on Disturbed Land			0			102,921
Surplus Water in Ponds			0			3,568
Infiltrated Water Cultivated Land			104480			69,480
Infiltrated Water Disturbed Land			0			102,921
Infiltrated Water in Created Ponds			0			3,568
Total Infiltration			104480			175,969
Difference Pre Extraction to Post						71,489
Consumption						66,750
Net Increase/Decrease in Water during Aggregate Extraction (m3)						4,739
*from Golder (2006) study 89 L/ tonne, licensed for 750,000 tonnes						

This analysis shows that for a disturbed area of 17.5 hectares, there is an increase of 4,739 m^3 of surplus water annually due to a decrease in evapotranspiration arising from the loss of vegetation in the disturbed area. It is thus shown that the operation of the wash plant will not result in an overall loss of recharge to the underlying aquifer.

6.2 POTENTIAL LONG-TERM WATER BALANCE CHANGES

The proposed aggregate extraction will alter the topography of the site including the catchment area of the on-site wetland. Figure 6.1 depicts the proposed drainage areas post extraction. There will be two drainage areas on the site post-extraction. Post Extraction drainage area 1 (PE1) is designed to have a gradual slope to the on-site wetland. This will result in a larger on-site catchment area for the wetland, increasing from 24.8 hectares to 32.3 hectares. Post extraction Drainage Area 2 (PE2) will slope southerly and infiltrate on-site.

The post development water balance for the site is summarized in Table 13.

Table 13: Post Development Water Balance for Entire Site

	Area	Precipitation	Evapotranspiration	Runoff	Infiltration
Post Development	(hectare)	(m^3/year)	(m^3/year)	(m^3/year)	(m^3/year)
PE1	32.31	287,263	157,994	38,780	90,488
PE2	19.93	177,151	97,433	-	79,718
Post Development Summary	52.24	464,414	255,427	38,780	170,206

The differences between pre and post development in water balance is summarized in Table 14.

Table 14: Water Balance Change between Pre and Post Development for Entire Site

	Area	Precipitation	Evapotranspiration	Runoff	Infiltration
	(hectare)	(m^3/year)	(m^3/year)	(m^3/year)	(m^3/year)
Pre Development Summary	52.24	464,414	255,427	45,730	163,256
Post Development Summary	52.24	464,414	255,427	38,780	170,206
Difference	-	-	-	- 6,949	6,949

The gentle slope and capture of water in the pit results in a small increase (4%) in infiltration.

6.2.1 POST DEVELOPMENT WATER BALANCE FOR ON-SITE WETLAND

The only change in hydrology for the wetland is an increase in on-site catchment area. Table 15 summarizes the anticipated post development water balance for the wetland.

Table 15: Post Development Water Balance for the Wetland

		Wetland Post Extraction Water Balance			
	Area	Precipitation	Evapotranspiration	Surface Water Input	Infiltration
	(hectare)	(m^3/year)	(m^3/year)	(m^3/year)	(m^3/year)
Wetland	2.20	19,558	14,344	38,780	43,994

Although the infiltration potential increases due to more gradual grading on the proposed pit floor, there will be an increase in runoff to the wetland. The difference between pre and post development water balance is shown on Table 16

Table 16: Difference between Pre and Post Water Balance for Wetland

	Area	Precipitation	Evapotranspiration	Surface Water Input	Infiltration
	(hectare)	(m^3/year)	(m^3/year)	(m^3/year)	(m^3/year)
Pre Development Wetland	2.20	19,558	14,344	29,728	34,942
Post Development Wetland	2.20	19,558	14,344	38,780	43,994
Difference	-	-	-	9,053	9,053

Considering that surface water inputs to date are shown to only occur between February and May, the increase in surface water input will tend to prolong the period that the surface water level is somewhat higher than the surrounding groundwater elevation.

6.3 AGGREGATE EXTACTION AND WATER QUALITY

6.3.1 REDUCTION IN THICKNESS UNSATURATED ZONE

The water quality data for the site confirms that nitrogen compounds are being carried down to the water table with infiltrating water. The shallow groundwater regime is thus impacted with nitrogen in the form of the nitrate compound. The concentration of nitrate presently exceeds the drinking water quality standards (10 mg/L) of Ontario in monitoring wells MW2 and MW5. It is worth noting that at MW1, where the unsaturated overburden thickness is less than two metres, there is no nitrate detected.

The sandy aggregate material in the overburden does not react chemically or physically with nitrogen compounds as they migrate from the ground surface to the water table in infiltrating waters. It is well understood that nitrogen fertilizers leach from sandy soils rather than being retained by them. The nitrate ion is negatively charged as are receptor sites on the aggregate materials. Thus, nitrate ions are neither attracted to nor adsorbed by the aggregate. Therefore, removal of the unsaturated zone will not significantly increase nitrate transport to the water table. This also means that nitrogen compounds are not stored in the unsaturated sand and gravel deposits and therefore there will not be a "release" of nitrogen when the aggregate deposit is disturbed by extractive activities.

Jackson Harvest Farms has agreed to limit nutrient applications within the Issue Contributing Area as is recommended in the Source Water Protection Plan. In this way there will be an improvement in water quality compared to the present condition. As noted by Burnside and Associates (2019), an overall reduction in fertilizer use in the Issue Contributing Area of the municipal wells has led to groundwater quality improvement.

6.3.2 LUBRICANTS, FUELS AND COOLANTS

Aggregate production does not require the use of any chemicals for either the extraction (digging) or processing (conveyors, crushers, sorters etc.). Chemicals are used for;

- machinery, mainly for lubrication, cooling and fuel

Although the possibility exists of a gas tank rupture, hydraulic hose failure or coolant leak, these are rare events involving relatively small quantities of chemicals and are easily and quickly mitigated through a Spill Response Protocol. In over twenty-five years of monitoring pits and

quarries, Harden Environmental has never encountered a water quality impact arising from a spill. Nonetheless, a Spill Response Protocol has been designed for this Site and will be used to mitigate any potential spill (see Section 6.3.3).

6.3.3 SPILL RESPONSE

A spill response protocol has been established for the Site. In the unlikely event of a contaminant spill, the procedures outlined in the Spill Response Protocol (Appendix F) will be followed.

6.4 GROUNDWATER ELEVATION FOR SITE PLANS

The Aggregate Resources Act requires that above-water-table pits remain a minimum of 1.5 metres above the annual high groundwater elevation. The highest recorded water levels for each monitor are shown on Figure 3.3B and groundwater equipotentials are inferred from this information. The 1.5 metre buffer is an adequate separation distance between the pit floor and the high-water table.

7.0 IMPACT DISCUSSION

The following sections will discuss the potential impacts to nearby wells, wetlands, ponds and streams arising from the proposed aggregate extraction.

7.1 WATER WELLS

7.1.1 WATER QUANTITY

There will be no dewatering or mining below the water table at the Site (except for a small area for the wash pond) and therefore no disturbance of the position of the water table. Although water taking is required for aggregate processing, the water is recirculated on-site. The decreased evapotranspiration in the disturbed areas results in a net increase in groundwater availability during active mining. No impact to water availability to any private well or municipal well will occur.

7.1.2 WATER QUALITY

It is unlikely that water quality impacts will occur at this Site for the following reasons;

- excavation processes do not use chemicals,
- any accidental spills would likely be minor in nature and the operator will maintain spill control materials on Site,
- the excavation process will not 'release' nutrients from processed aggregate.

Nonetheless, we have evaluated each nearby water well with respect to water quality changes and summarize our findings in Table 17.

Table 17: Potential Water Quality Impact to Private Wells

ID	Firecode	Street	Hydraulic Position Relative to Site	Potential Quality Impact
R1	2078 Unit B	Bleams Rd	Upgradient	None
R2	2118	Bleams Rd	Upgradient	None
R3	2143	Bleams Rd	Upgradient	None
R4	2175	Bleams Rd	Upgradient	None
R5	2229	Bleams Rd	Upgradient	None
R6	2295	Bleams Rd	Upgradient	None
R7	1768	Witmer Rd	Cross Gradient	None
R8	1790	Witmer Rd	Cross Gradient	None
R9	1785	Witmer Rd	Cross Gradient	None
R10	1850	Witmer Rd	Cross Gradient	None
R12	2008	Witmer Rd	Cross Gradient	None
R13	2040	Witmer Rd	Cross Gradient	None
R14	2056	Witmer Rd	Cross Gradient	None
R15	2089	Witmer Rd	Cross Gradient	None
R16	1874	Witmer Rd	Downgradient	None

There are several factors that we consider when evaluating the susceptibility of a private well to any type of contamination. These are;

i) the location of the well with respect to the Site within the regional groundwater flow system;

Wells that are upgradient or cross-gradient to the Site are not susceptible to any contamination from a spill at the site. In these situations, there is no movement of groundwater between the

Site and the well, therefore, contaminants cannot move from the Site to the well. R16 is the only water well downgradient of the site. The well servicing R16 is 103 metres deep and accesses water from a deep bedrock source and is separated from the shallow aquifer by an aquitard. In this way the water source is naturally protected.

ii) the depth of well and presence of aquitards;

Wells that are completed in deeper formations and protected by either a silt or clay layer are also not susceptible to contamination from the pit. This is because groundwater will preferentially flow through shallow permeable deposits and if even there is flow through an aquitard it is extremely slow.

iii) the distance from the Site to the well;

Wells that are distant from the site and downgradient benefit from slow groundwater flow rates, dilution in the aquifer by the regional groundwater flow, dilution from infiltrating precipitation, discharge of groundwater to surface water features and natural attenuation such as sorption and biological activity.

Using these three criteria we have found that none of the local wells are susceptible to water quality impacts arising from spills at the site.

7.1.3 POST-DEVELOPMENT – AGRICULTURAL USE

The site will be returned to agricultural potential by placing topsoil back onto the pit floor and sides. We recommend that best management practices related to nutrient applications are adhered to in the future farmland. The farmland within the Issue Contributing Area (ICA) should have restrictions or prohibition on nutrient applications. We understand this can be achieved through the Risk Management Plan process at the Region of Waterloo and we understand from the annual monitoring report that water quality improvements are being achieved elsewhere in the ICA through a reduction in nutrient applications.

Jackson Harvest Farms has agreed to limit nutrient applications within the Issue Contributing Area as is recommended in the Source Water Protection Plan. This will be undertaken through a Section 59 notice. In this way there will be an improvement in water quality compared to the present condition.

7.2 SITE WATER BALANCE CHANGES

It is anticipated that there will be no significant long-term changes to the water balance. In the short-term, during excavation activities, there will be an increase in infiltration due to the decrease in evapotranspiration. The phasing of the site development has been modified to ensure

that there is not a loss of potential surface water runoff to the wetland. The recommended pit floor elevation is shown on Figure 7.1. This has been reflected on the site plans and as seen on the Rehabilitation Page of the site plans, there is a 'hinge' line along the final pit floor. All lands north of the 'hinge' line will drain towards the wetland, thus maintaining its surface water catchment area. The slope is somewhat less than existing conditions, resulting in a small increase in infiltration.

It is predicted that infiltration at the site will be greater than presently occurs, thereby maintaining the water table position in the vicinity of the wetland. There is a small potential increase in runoff to the wetland, however, no change in the hydroperiod of the wetland is anticipated.

The increased infiltration also maintains the position of the water table in regard to nearby private wells.

7.3 REGIONAL CUMULATIVE IMPACT

The site falls within the Middle Nith Groundwater Assessment area as defined in the Grand River Integrated Water Budget Report, 2009. The present stress level for this assessment area is Low. The report states that the maximum monthly groundwater demand from all water taking in the area is 142 L/s. The maximum monthly demand is 7% of available water. A low stress level is maintained at less than 10% groundwater demand.

The consumption of water from a wash plant is approximately 89 L/tonne (Golder, 2006). This results in a consumptive loss of 66,750 m^3/year or 2.1 L/s. The maximum monthly water demand will increase to 144 L/s resulting in a maximum monthly demand of 7%. The stress level of the Middle Nith River will not change.

The overall water balance at the site during and post extraction is that there will be an increase in water available for infiltration.

7.4 CLIMATE CHANGE

All of the surplus water at this site either infiltrates via the land surface or via the on-site wetland. This is also the case post-extraction. Therefore, any long-term change in climate will have a similar impact on groundwater resources with or without the proposed development.

8.0 MONITORING PROGRAM

We recommend that on-site monitoring of MW1 and SG1 continue during the site development. This monitoring pair is sufficient to evaluate future changes to the hydroperiod of the wetland. We recommend obtaining daily water levels in both MW1 and SG1.

9.0 MITIGATION MEASURES

No mitigation measures are required for groundwater or surface water features provided that the site plans are implemented as prepared at the time of this report.

10.0 CONCLUSIONS

1. There will be no affect on the size, shape or hydroperiod of the on-site wetland.
2. There will be no impact on the quality or quantity of water available to any private or municipal well.
3. There is an opportunity to reduce nitrate concentrations in groundwater within the Issue Contributing Area for the municipal wells by restricting future nutrient use in that area.

11.0 RECOMMENDATIONS

1. We recommend that the monitoring plan as provided in Section 8 of this report be implemented.
2. We recommend that the Spills Mitigation and Contingency plan as detailed in Appendix F of this report be adopted.
3. We recommend that the pit floor have an elevation not less than 1.5 metres above the groundwater equipotentials shown on Figure 7.1.
4. We recommend that nutrient applications be restricted or eliminated in the Issue Contributing Area of the municipal wells.

All of Which is Respectfully Submitted,
Harden Environmental Services Ltd.

Stan Denhoed, P.Eng., M.Sc.
President

12.0 REFERENCES AND OTHER SUPPORTING DOCUMENTS

AquaResources Inc, 2009, Tier 2 Water Quantity Stress Assessment Report, Grand River Watershed, Final Report, December 2009

Burnside and Associates, March 2019, 2017 Annual Monitoring Report Wilmot Centre Monitoring Program

Golder Associates, 2006, Water Consumption Study, Project 04-1112-059

Grand River Conservation Authority, 2011, Data Class Shapefiles (Drainage-Network, Wetland, Subcatchment Basin)

Integrated Water Budget Report Prepared by Grand River Watershed Final Report June 2009, Grand River Conservation Authority

MECP, 2018, Water Well Information System (WWIS)

Ministry of Natural Resources and Forestry, Spatial Data, 2018, [Wetland, Contour, Ontario Road Network Segment with Address, OHN - Watercourse, OHN - Waterbody, Aggregate Site Authorized Active, Aggregate Site Authorized Inactive, ANSI, Geographic Lot Fabric, Railway, Municipal Boundary - Upper Tier and District, Municipal Boundary - Lower and Single Tier].

MOEE Hydrogeological Technical Information Requirements For Land Development Applications(1995)

Stantec 2018 Operational Testing Program, Wilmot Centre Well Field Report dated April 2019

Table 1: Monitor Installation Details

Monitor	NAD 83 Zone 17 Easting	NAD 83 Zone 17 Northing	Top of Reference Elevation (mAMSL)	Ground Elevation (mAMSL)	Depth (mbtoc)	Stick-up (m)	Depth (mbgs)	Depth (mAMSL)
MW1	532,479	4,803,510	356.085	355.17	6.15	0.92	5.23	349.94
MW2	532,228	4,803,804	369.096	367.98	16.17	1.12	15.05	352.93
MW3	531,804	4,803,877	371.936	371.06	19.07	0.88	18.19	352.87
MW4	531,990	4,803,236	375.276	374.43	23.71	0.85	22.86	351.57
MW5	532,631	4,803,011	370.354	369.49	20.09	0.86	19.23	350.26
SG1	532,510	4,803,409	355.342	354.05	2.36	1.29	1.07	352.99

mbtoc - metres below top of casing/reference | mbgs - metres below ground surface

Table 2: Manual Water Level Measurements

Water Level Below Reference Point (mbref)

Monitor	Top of Reference Elevation (mAMSL)	26-May-17	07-Jun-17	21-Jul-17	06-Dec-17	02-May-18	23-Aug-18	14-Nov-18	26-Mar-19	08-Jul-19
MW1 in	356.085	1.74	1.71		1.76	1.62	1.78	2.03	1.18	1.52
MW1 out	356.085								0.95	dry
MW2	369.096	14.25	14.19		14.29	14.16	14.33		14.11	13.98
MW3	371.936	16.68	16.61		16.64	16.63	16.67		16.64	16.35
MW4	375.276	20.87	20.79		20.65	20.77	20.72	20.97	20.86	20.55
MW5	370.354			17.62	17.71	17.76	17.71		17.75	17.52
SG1	355.342		1.13		1.00	0.83	1.13			0.87

Water Level Elevation (mAMSL)

Monitor	Top of Reference Elevation (mAMSL)	26-May-17	07-Jun-17	21-Jul-17	06-Dec-17	02-May-18	23-Aug-18	14-Nov-18	26-Mar-19	08-Jul-19
MW1 in	356.085	354.35	354.38		354.33	354.47	354.31	354.06	354.91	354.57
MW1 out	356.085								355.14	
MW2	369.096	354.85	354.91		354.81	354.94	354.77		354.99	355.12
MW3	371.936	355.26	355.33		355.30	355.31	355.27		355.30	355.59
MW4	375.276	354.41	354.49		354.63	354.51	354.56	354.31	354.42	354.73
MW5	370.354			352.73	352.64	352.59	352.64		352.60	352.83
SG1	355.342		354.21		354.34	354.52	354.21			354.47

Table 4: Water Quality Results

Sampling Date					2019-03-26 12:20	2019-07-08 11:59	2019-03-26 11:30	2019-07-08 09:10	2019-03-26 10:25	2019-07-08 17:00
Sample ID					**MW1**	**MW1**	**MW2**	**MW2**	**MW3**	**MW3**
	UNITS	**Criteria**	**MAC**	**A/O**						
Calculated Parameters										
Anion Sum	me/L				2.11	2.53	7.34	7.04	7.70	7.49
Bicarb. Alkalinity (calc. as CaCO3)	mg/L				96	110	260	250	270	280
Calculated TDS	mg/L			500	110	130	410	390	420	410
Carb. Alkalinity (calc. as CaCO3)	mg/L				ND	1.2	1.6	1.7	1.9	2.3
Cation Sum	me/L				2.15	2.49	7.28	7.24	7.45	7.62
Hardness (CaCO3)	mg/L			80:100	98	110	310	320	300	310
Ion Balance (% Difference)	%				NC	NC	0.410	1.37	1.60	0.890
Langelier Index (@ 20C)	N/A				0.109	0.292	0.760	0.783	0.800	0.900
Langelier Index (@ 4C)	N/A				-0.142	0.0410	0.512	0.535	0.552	0.651
Saturation pH (@ 20C)	N/A				7.88	7.77	7.07	7.08	7.07	7.04
Saturation pH (@ 4C)	N/A				8.13	8.02	7.32	7.32	7.32	7.29
Inorganics										
Total Ammonia-N	mg/L				0.053	0.22	ND	ND	0.051	ND
Colour	TCU			5	14	12	ND	ND	ND	ND
Conductivity	umho/cm				210	220	720	650	760	670
Total Kjeldahl Nitrogen (TKN)	mg/L				0.48	0.64	ND (1)	ND (1)	0.21	ND (1)
Dissolved Organic Carbon	mg/L			5	5.6	3.6	0.63	0.70	0.73	1.5
Total Organic Carbon (TOC)	mg/L									
Orthophosphate (P)	mg/L				0.21	0.092	ND	ND	ND	ND
pH	pH	6.5:8.5		6.5:8.5	7.99	8.07	7.83	7.86	7.87	7.94
Total Phosphorus	mg/L	0.01			0.29	3.7	4.8	2.8	0.58	0.59
Dissolved Sulphate (SO4)	mg/L			500	ND	1.9	12	13	18	18
Turbidity	NTU			5	30	490	9900	3500	700	790
Alkalinity (Total as CaCO3)	mg/L			30:500	97	110	260	250	270	280
Dissolved Chloride (Cl-)	mg/L			250	5.5	7.5	31	33	42	32
Nitrite (N)	mg/L		1		ND	ND	ND	ND	ND	ND
Nitrate (N)	mg/L		10		ND	ND	14.6	10.8	9.44	8.93
Nitrate + Nitrite (N)	mg/L		10		ND	ND	14.6	10.8	9.44	8.93

Table 4: Water Quality Results

Sampling Date					2019-03-26 12:20	2019-07-08 11:59	2019-03-26 11:30	2019-07-08 09:10	2019-03-26 10:25	2019-07-08 17:00
Sample ID					**MW1**	**MW1**	**MW2**	**MW2**	**MW3**	**MW3**
	UNITS	**Criteria**	**MAC**	**A/O**						
Metals ('Total' for SG1 Pond)										
Dissolved Aluminum (Al)	mg/L			0.1	0.0052	0.0056	ND	ND	ND	ND
Dissolved Antimony (Sb)	mg/L	0.02	0.006		ND	ND	ND	ND	ND	ND
Dissolved Arsenic (As)	mg/L	0.1	0.01		ND	ND	ND	ND	ND	ND
Dissolved Barium (Ba)	mg/L		1		0.016	0.025	0.11	0.10	0.052	0.060
Dissolved Beryllium (Be)	mg/L	0.011			ND	ND	ND	ND	ND	ND
Dissolved Bismuth (Bi)	mg/L				ND	ND	ND	ND	ND	ND
Dissolved Boron (B)	mg/L	0.2	5		0.011	0.020	0.015	0.016	0.024	0.052
Dissolved Cadmium (Cd)	mg/L	0.0002	0.005		ND	ND	ND	ND	ND	ND
Dissolved Calcium (Ca)	mg/L				30	34	93	92	87	92
Dissolved Chromium (Cr)	mg/L		0.05		ND	ND	ND	ND	ND	ND
Dissolved Cobalt (Co)	mg/L	0.0009			ND	ND	ND	ND	ND	ND
Dissolved Copper (Cu)	mg/L	0.005		1	0.0072	0.010	ND	ND	0.0010	ND
Dissolved Iron (Fe)	mg/L	0.3		0.3	ND	ND	ND	ND	ND	ND
Dissolved Lead (Pb)	mg/L	0.005	0.01		ND	ND	ND	ND	ND	ND
Dissolved Magnesium (Mg)	mg/L				5.4	6.4	20	21	19	20
Dissolved Manganese (Mn)	mg/L			0.05	0.019	0.072	ND	ND	ND	ND
Dissolved Molybdenum (Mo)	mg/L	0.04			0.00063	0.00067	ND	ND	ND	ND
Dissolved Nickel (Ni)	mg/L	0.025			ND	ND	ND	ND	ND	ND
Dissolved Phosphorus (P)	mg/L				0.27	0.14	ND	ND	ND	ND
Dissolved Potassium (K)	mg/L				4.3	6.4	2.1	2.0	1.3	1.4
Dissolved Selenium (Se)	mg/L	0.1	0.05		ND	ND	ND	ND	ND	ND
Dissolved Silicon (Si)	mg/L				0.82	1.7	4.6	4.3	4.7	4.7
Dissolved Silver (Ag)	mg/L	0.0001			ND	ND	ND	ND	ND	ND
Dissolved Sodium (Na)	mg/L			200	1.8	2.1	22	20	35	31
Dissolved Strontium (Sr)	mg/L				0.035	0.040	0.13	0.13	0.13	0.13
Dissolved Thallium (Tl)	mg/L	0.0003			ND	ND	ND	ND	ND	ND
Dissolved Titanium (Ti)	mg/L				ND	ND	ND	ND	ND	ND
Dissolved Uranium (U)	mg/L	0.005	0.02		ND	ND	0.00032	0.00027	0.00024	0.00026
Dissolved Vanadium (V)	mg/L	0.006			0.00065	0.0026	ND	ND	ND	ND
Dissolved Zinc (Zn)	mg/L	0.03		5	ND	ND	ND	ND	ND	ND

ND = Not detected | N/A = Not Applicable

(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

Criteria: Ontario Provincial Water Quality Objectives Ref. to MOEE Water Management document dated Feb.1999

MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively (Made under the Ontario Safe Drinking Water Act, 2002)

Table 4: Water Quality Results

Sampling Date					2019-03-26 09:05	2019-07-08 14:37	2019-03-26 07:55	2019-07-08 10:45	2019-07-08 12:40
Sample ID					**MW4**	**MW4**	**MW5**	**MW5**	**SG1 POND**
	UNITS	**Criteria**	**MAC**	**A/O**					
Calculated Parameters									
Anion Sum	me/L				5.01	5.07	10.6	11.4	
Bicarb. Alkalinity (calc. as CaCO3)	mg/L				220	210	430	460	57
Calculated TDS	mg/L			500	270	270	610	620	71
Carb. Alkalinity (calc. as CaCO3)	mg/L				1.7	2.0	1.7	1.8	ND
Cation Sum	me/L				5.09	5.12	12.3	11.6	
Hardness (CaCO3)	mg/L			80:100	240	250	570	530	52
Ion Balance (% Difference)	%				0.770	0.440	7.27	0.730	
Langelier Index (@ 20C)	N/A				0.711	0.787	1.02	0.995	-0.622
Langelier Index (@ 4C)	N/A				0.462	0.538	0.775	0.748	-0.873
Saturation pH (@ 20C)	N/A				7.22	7.21	6.61	6.62	8.40
Saturation pH (@ 4C)	N/A				7.46	7.46	6.85	6.87	8.65
Inorganics									
Total Ammonia-N	mg/L				0.052	ND	0.12	ND	ND
Colour	TCU			5	ND	ND	ND	ND	25
Conductivity	umho/cm				480	460	970	950	130
Total Kjeldahl Nitrogen (TKN)	mg/L				ND (1)	ND (1)	ND (1)	ND (1)	0.82
Dissolved Organic Carbon	mg/L			5	0.61	0.84	1.8	1.4	
Total Organic Carbon (TOC)	mg/L								10
Orthophosphate (P)	mg/L				ND	ND	ND	ND	0.081
pH	pH	6.5:8.5		6.5:8.5	7.93	8.00	7.63	7.61	7.78
Total Phosphorus	mg/L	0.01			0.28	0.64	0.40	0.25	0.18
Dissolved Sulphate (SO4)	mg/L			500	6.4	4.1	41	38	ND
Turbidity	NTU			5	630	460	230	270	3.0
Alkalinity (Total as CaCO3)	mg/L			30:500	220	220	430	460	58
Dissolved Chloride (Cl-)	mg/L			250	5.2	4.4	14	21	5.9
Nitrite (N)	mg/L		1		ND	ND	0.022	ND	ND
Nitrate (N)	mg/L		10		4.47	7.60	11.5	12.2	ND
Nitrate + Nitrite (N)	mg/L		10		4.47	7.60	11.5	12.2	

Table 4: Water Quality Results

Sampling Date					2019-03-26 09:05	2019-07-08 14:37	2019-03-26 07:55	2019-07-08 10:45	2019-07-08 12:40
Sample ID					**MW4**	**MW4**	**MW5**	**MW5**	**SG1 POND**
	UNITS	**Criteria**	**MAC**	**A/O**					
Metals ('Total' for SG1 Pond)									
Dissolved Aluminum (Al)	mg/L			0.1	ND	ND	ND	ND	0.055
Dissolved Antimony (Sb)	mg/L	0.02	0.006		ND	ND	ND	ND	ND
Dissolved Arsenic (As)	mg/L	0.1	0.01		ND	ND	ND	ND	ND
Dissolved Barium (Ba)	mg/L		1		0.033	0.031	0.068	0.072	0.0071
Dissolved Beryllium (Be)	mg/L	0.011			ND	ND	ND	ND	ND
Dissolved Bismuth (Bi)	mg/L				ND	ND	ND	ND	
Dissolved Boron (B)	mg/L	0.2	5		0.010	ND	0.026	0.024	0.023
Dissolved Cadmium (Cd)	mg/L	0.0002	0.005		ND	ND	ND	ND	ND
Dissolved Calcium (Ca)	mg/L				71	74	180	160	15
Dissolved Chromium (Cr)	mg/L		0.05		ND	ND	ND	ND	ND
Dissolved Cobalt (Co)	mg/L	0.0009			ND	ND	0.0015	0.0013	ND
Dissolved Copper (Cu)	mg/L	0.005		1	ND	ND	0.0022	0.0017	ND
Dissolved Iron (Fe)	mg/L	0.3		0.3	ND	ND	ND	ND	1.4
Dissolved Lead (Pb)	mg/L	0.005	0.01		ND	ND	ND	ND	ND
Dissolved Magnesium (Mg)	mg/L				16	16	31	30	3.9
Dissolved Manganese (Mn)	mg/L			0.05	ND	ND	0.45	0.15	0.15
Dissolved Molybdenum (Mo)	mg/L	0.04			ND	ND	ND	ND	ND
Dissolved Nickel (Ni)	mg/L	0.025			ND	ND	0.0019	ND	ND
Dissolved Phosphorus (P)	mg/L				ND	ND	ND	ND	
Dissolved Potassium (K)	mg/L				0.75	0.55	19	19	8.6
Dissolved Selenium (Se)	mg/L	0.1	0.05		ND	ND	ND	ND	ND
Dissolved Silicon (Si)	mg/L				4.5	4.4	4.5	4.2	0.34
Dissolved Silver (Ag)	mg/L	0.0001			ND	ND	ND	ND	ND
Dissolved Sodium (Na)	mg/L			200	4.3	3.2	7.2	11	1.7
Dissolved Strontium (Sr)	mg/L				0.11	0.095	0.21	0.20	0.026
Dissolved Thallium (Tl)	mg/L	0.0003			ND	ND	0.000051	ND	ND
Dissolved Titanium (Ti)	mg/L				ND	ND	ND	ND	ND
Dissolved Uranium (U)	mg/L	0.005	0.02		0.00030	0.00018	0.00085	0.00068	ND
Dissolved Vanadium (V)	mg/L	0.006			ND	ND	ND	ND	ND
Dissolved Zinc (Zn)	mg/L	0.03		5	ND	ND	0.0069	ND	ND

ND = Not detected | N/A = Not Applicable

(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

Criteria: Ontario Provincial Water Quality Objectives Ref. to MOEE Water Management document dated Feb.1999

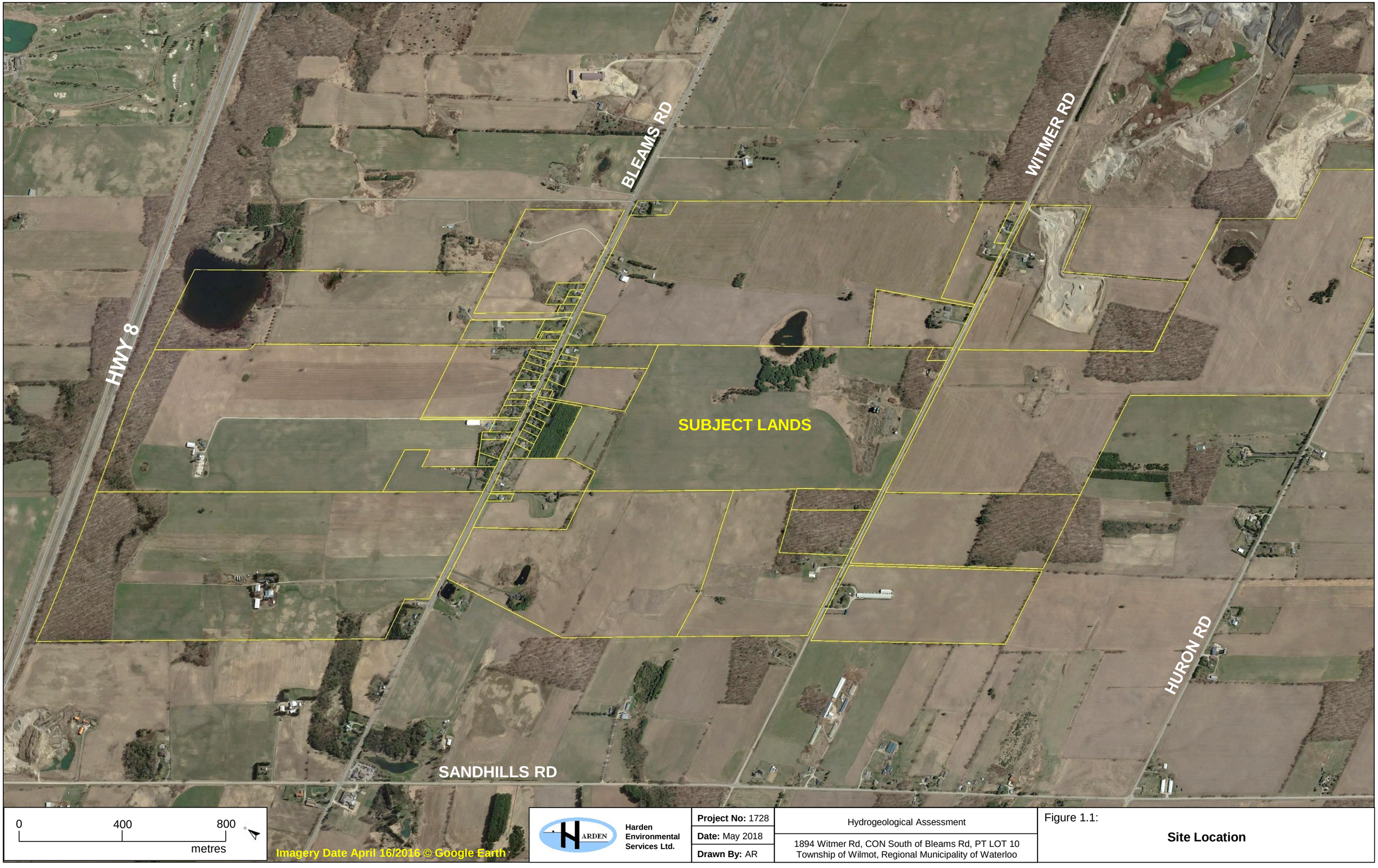
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively (Made under the Ontario Safe Drinking Water Act, 2002)

Table 5: Water Well Survey Summary

Water Wells Within 500m of Subject Lands

ID	Firecode	Street	Status	Well Record No.	Well Type	Stick-up (m)	Date Completed	Well Depth (mbgs)	Static Water Level (mbgs)	Pumping Rate (gpm)
R1	2078 Unit B	Bleams Rd	not completed - no response to letters delivered April 19 and May 28 or to business card left at door on June 3, 2019	7102464	Drilled 6.25"	Unknown	17-Oct-2007	33.80	26.72	12
R2	2118	Bleams Rd	Completed	Unknown	Dug 36" OD	0.87	~1970s	Unknown	Unknown	Unknown
R3	2143	Bleams Rd	not completed - no response to letters delivered April 19 and May 28 or to business card left at door on June 3, 2019	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
R4	2175	Bleams Rd	Completed	Unknown	Drilled in well pit	Below grade in well pit	1977	34.14	Unknown	Unknown
R5	2229	Bleams Rd	Completed	Unknown	Drilled 6"	0.60	Unknown	At least 67 m	36.23	Unknown
R6	2295	Bleams Rd	not completed - no response to letters delivered April 19 and May 28 or to business card left at door on June 3, 2019	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
R7	1768	Witmer Rd	Completed	Unknown	Dug 36" ID	0.34	~1952	12.79	9.33	Unknown
R8	1790	Witmer Rd	Completed	Unknown	Drilled in well pit	1.68 metres below grade	~1969-70	Unknown	Unknown	Unknown
R9	1785	Witmer Rd	Completed	Unknown	Drilled in well pit	1.80 metres below grade	Unknown	Unknown	Unknown	Unknown
R10	1850	Witmer Rd	not completed - no response to letters delivered April 19 and May 28 or to business card left at door on June 3, 2019	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
R11	1901	Witmer Rd	Not required since this is Lafarge property, no resident exists	----	----	----	----	----	----	----
R12	2008	Witmer Rd	Completed	6506072	Drilled 6.25"	0.31	21-Oct-1986	30.48	24.38	10
R13	2040	Witmer Rd	Completed	6504197	Drilled 5"	0.02	16-Sep-1974	30.78	20.63	8
R14	2056	Witmer Rd	Completed	6507228	Drilled 6"	0.26	07-Nov-1991	28.35	21.30	6
R15	2089	Witmer Rd	Completed	7289418	Drilled 6"	0.73	05-Mar-2017	24.99	18.44	10
R16	1874	Witmer Rd	Completed	6504927	Drilled 5"	0.02	18-Jul-1979	103.02	42.91	10

Information From Well Record



Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	Figure 1.1:
	Date: May 2018	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	**Site Location**
	Drawn By: AR		

Harden Environmental Services Ltd.

Project No: 1728
Date: May 2018
Drawn By: AR

Hydrogeological Assessment

1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10
Township of Wilmot, Regional Municipality of Waterloo

Figure 1.2:

Civic Address Within 500 Metres

Legend

- 500 metre Buffer
- Subject Lands
- Subcatchment Basins (GRCA)
- Virtual Drainage Line (GRCA)
- Watercourse
- Wetland - Provincially Significant
- Contour - 1m Interval (Region of Waterloo)
- Waterbody
- Wetland

250 0 250 Meters

NITH RIVER ALDER CREEK

NITH RIVER

BLEAMS RD

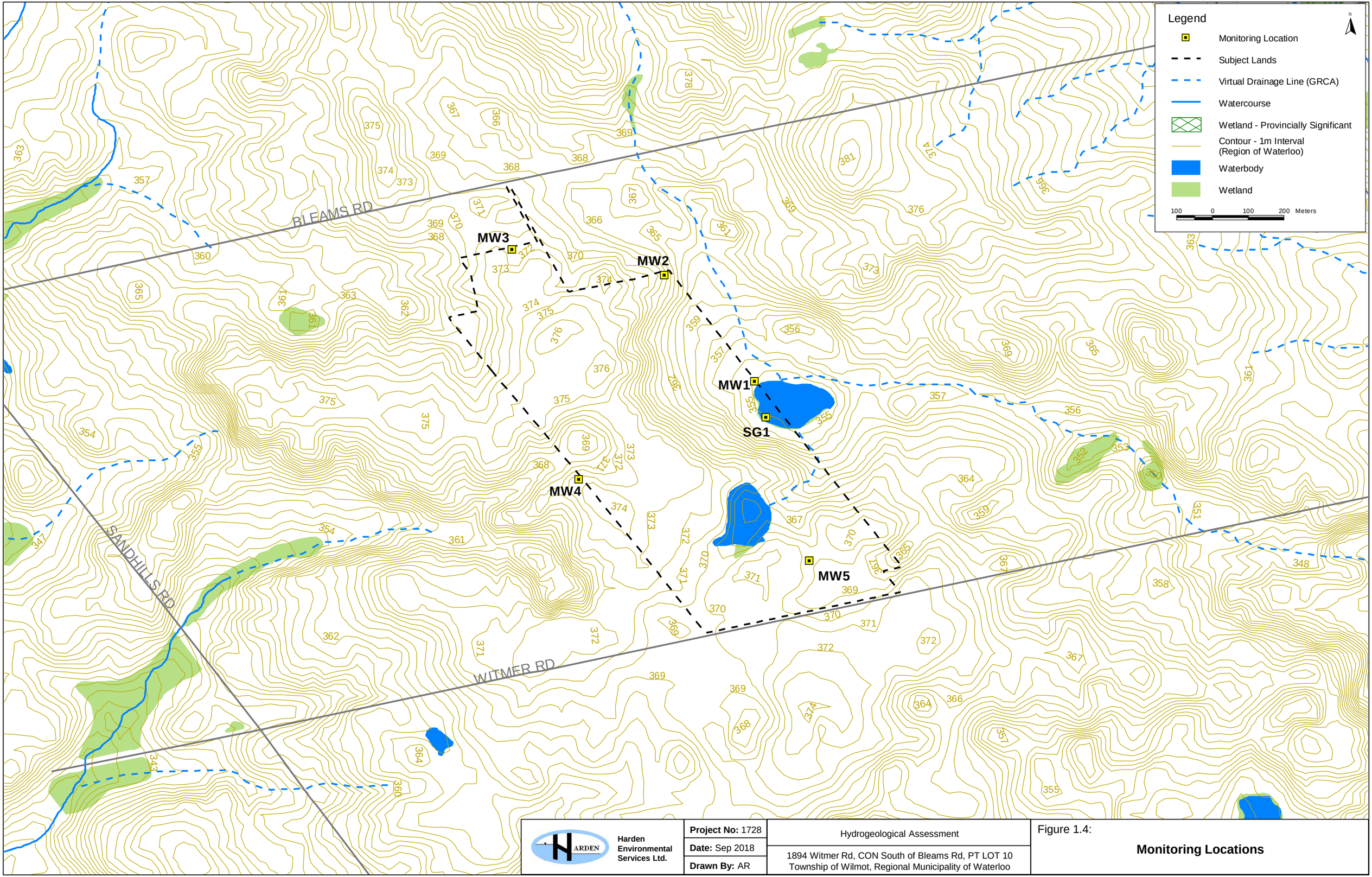
WITMER RD

HURON RD

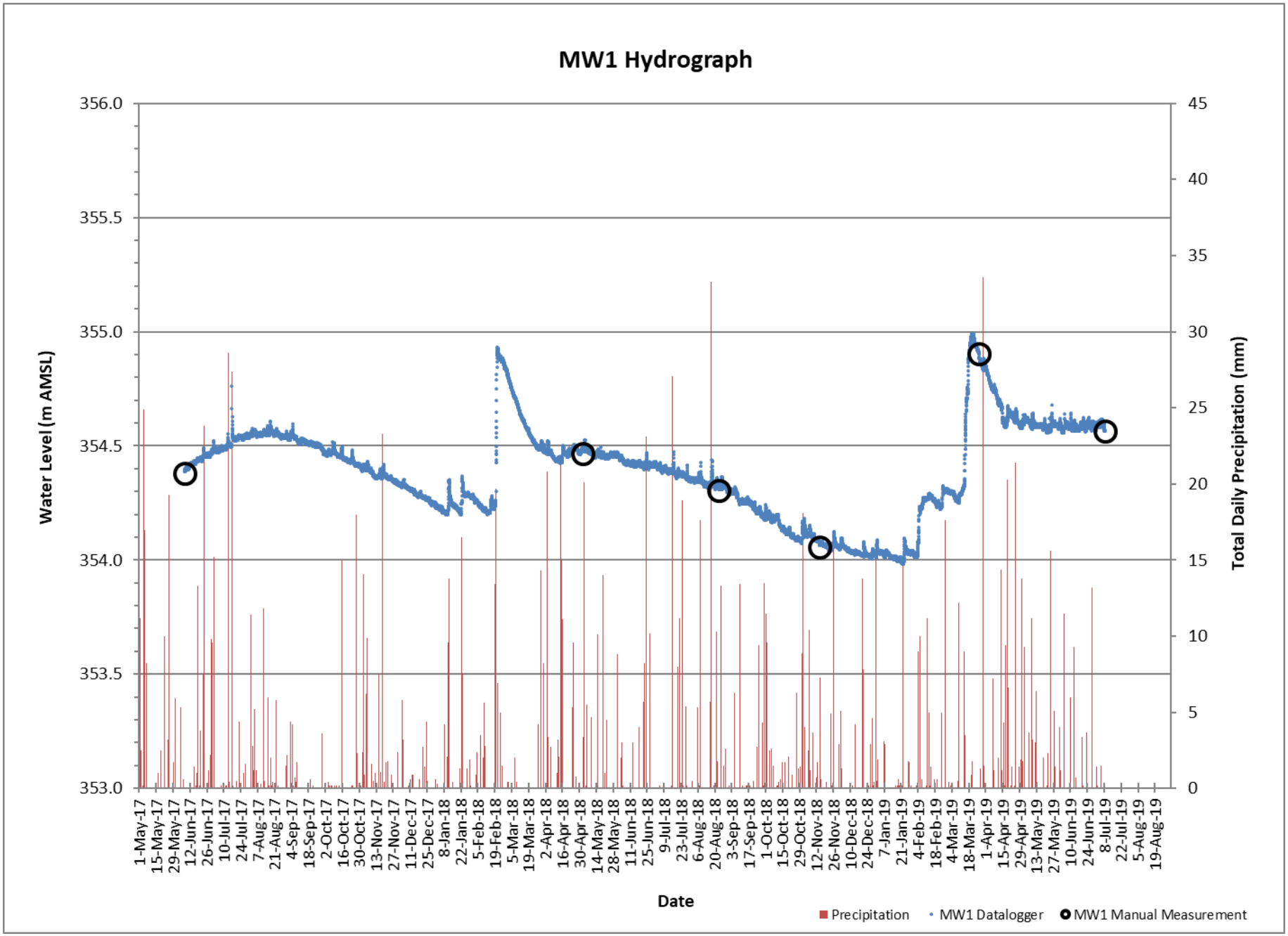
QUEEN ST

SANDHILLS RD

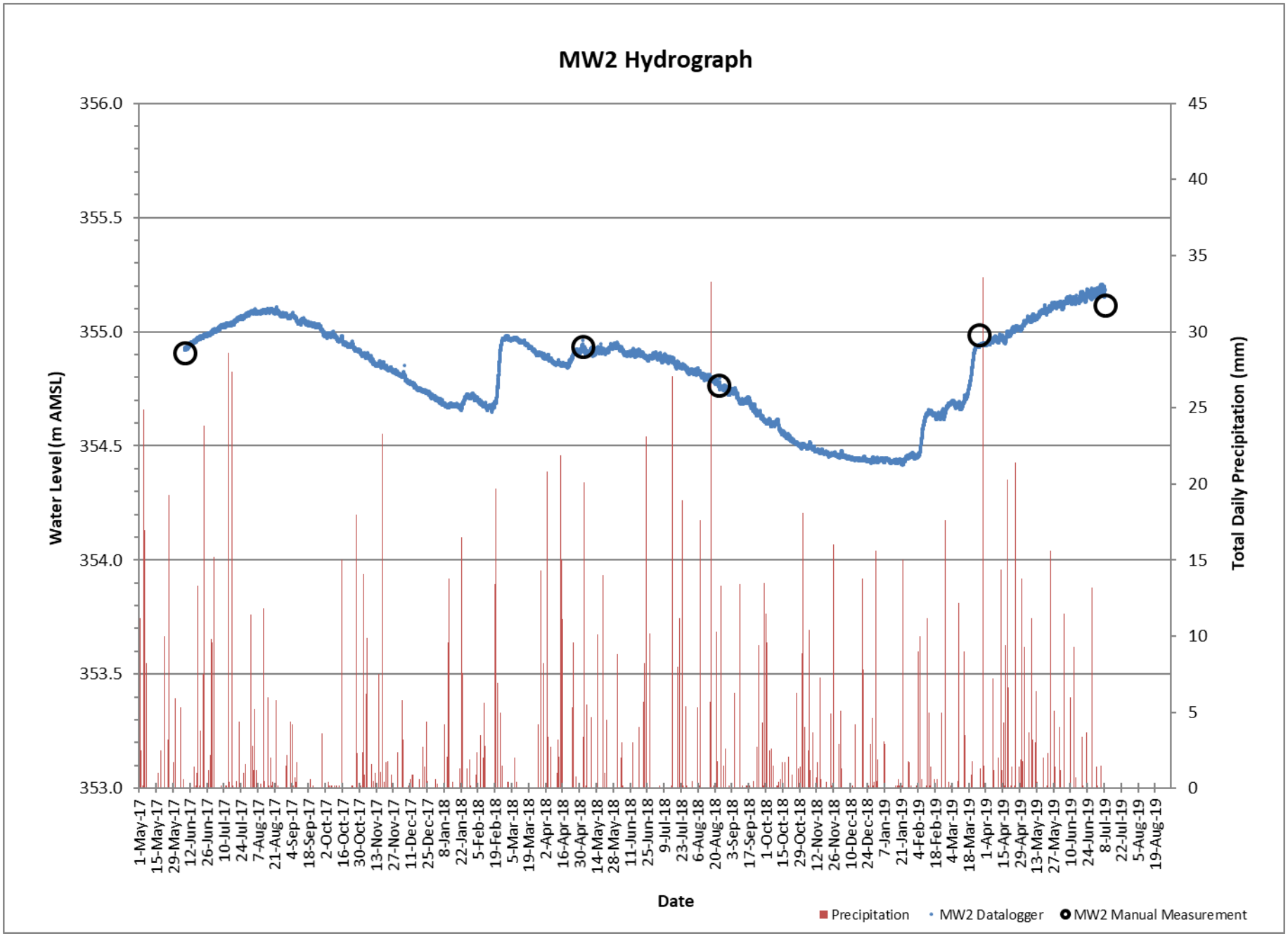
Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	Figure 1.3:
	Date: Sep 2018	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	**Subwatershed Areas**
	Drawn By: AR		



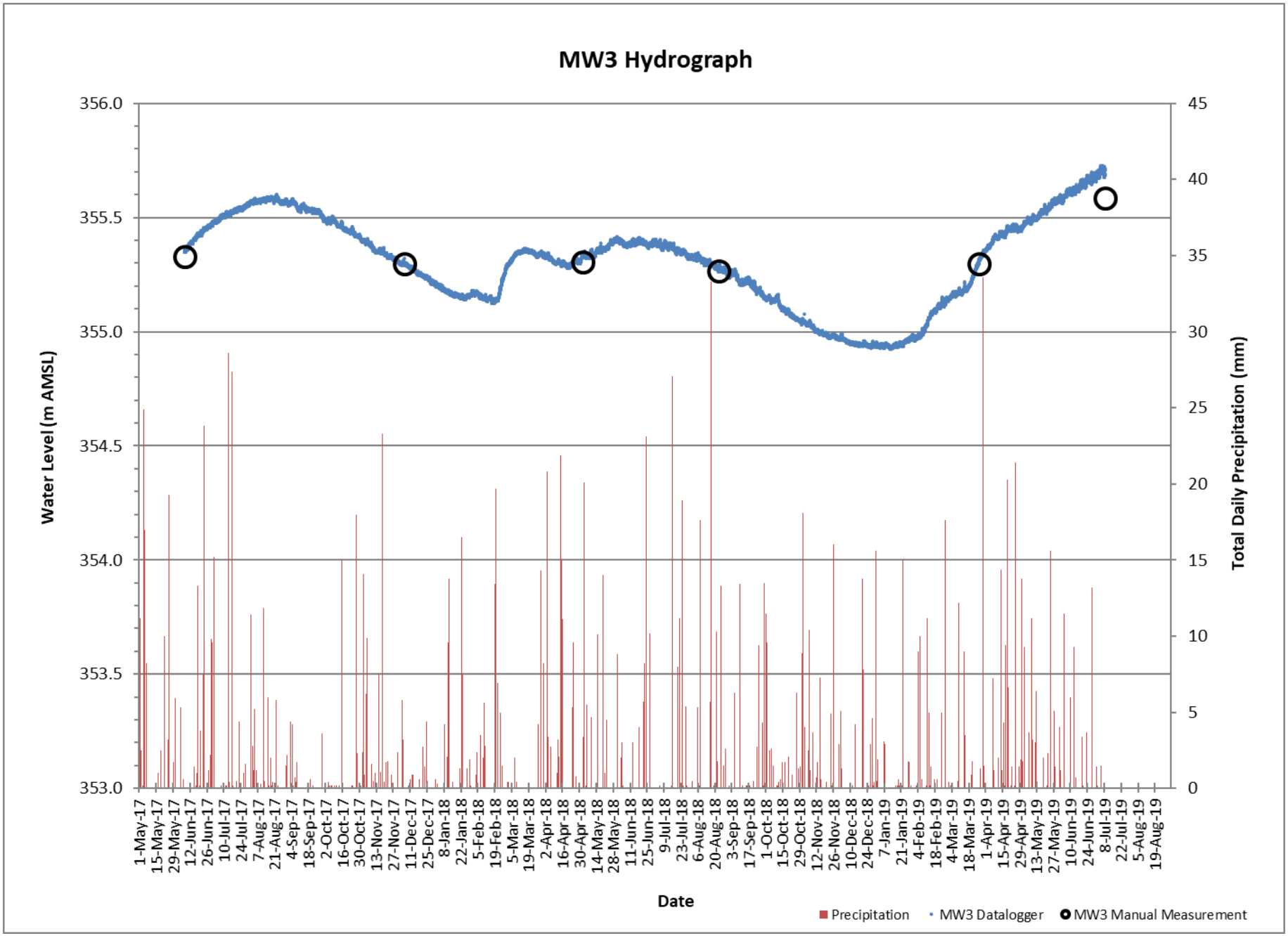
Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	Figure 1.4:
	Date: Sep 2018	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	**Monitoring Locations**
	Drawn By: AR		



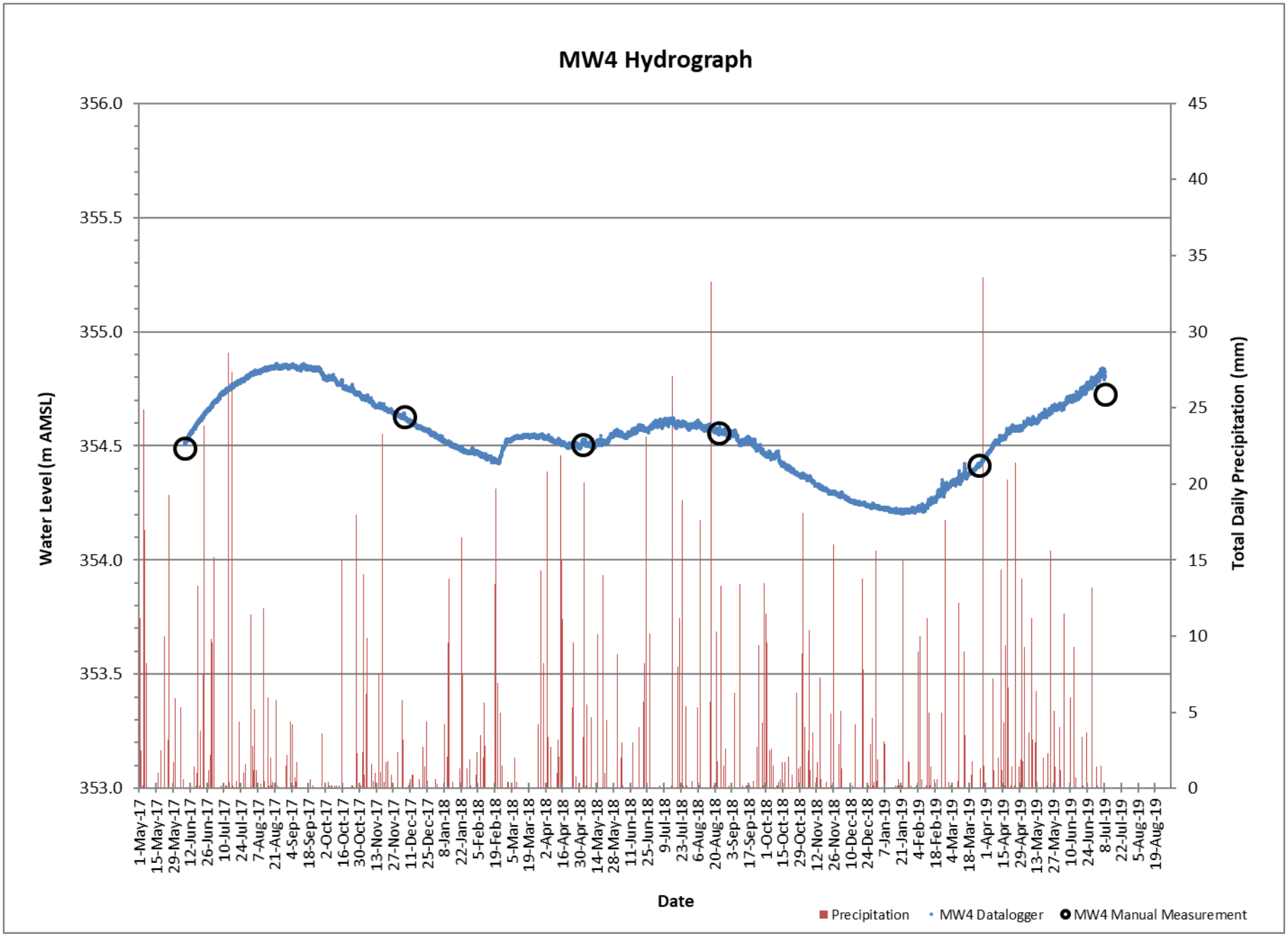
Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	**Figure 1.5: MW1 Hydrograph**
	Date: Jul 2019	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	
	Drawn By: AR		



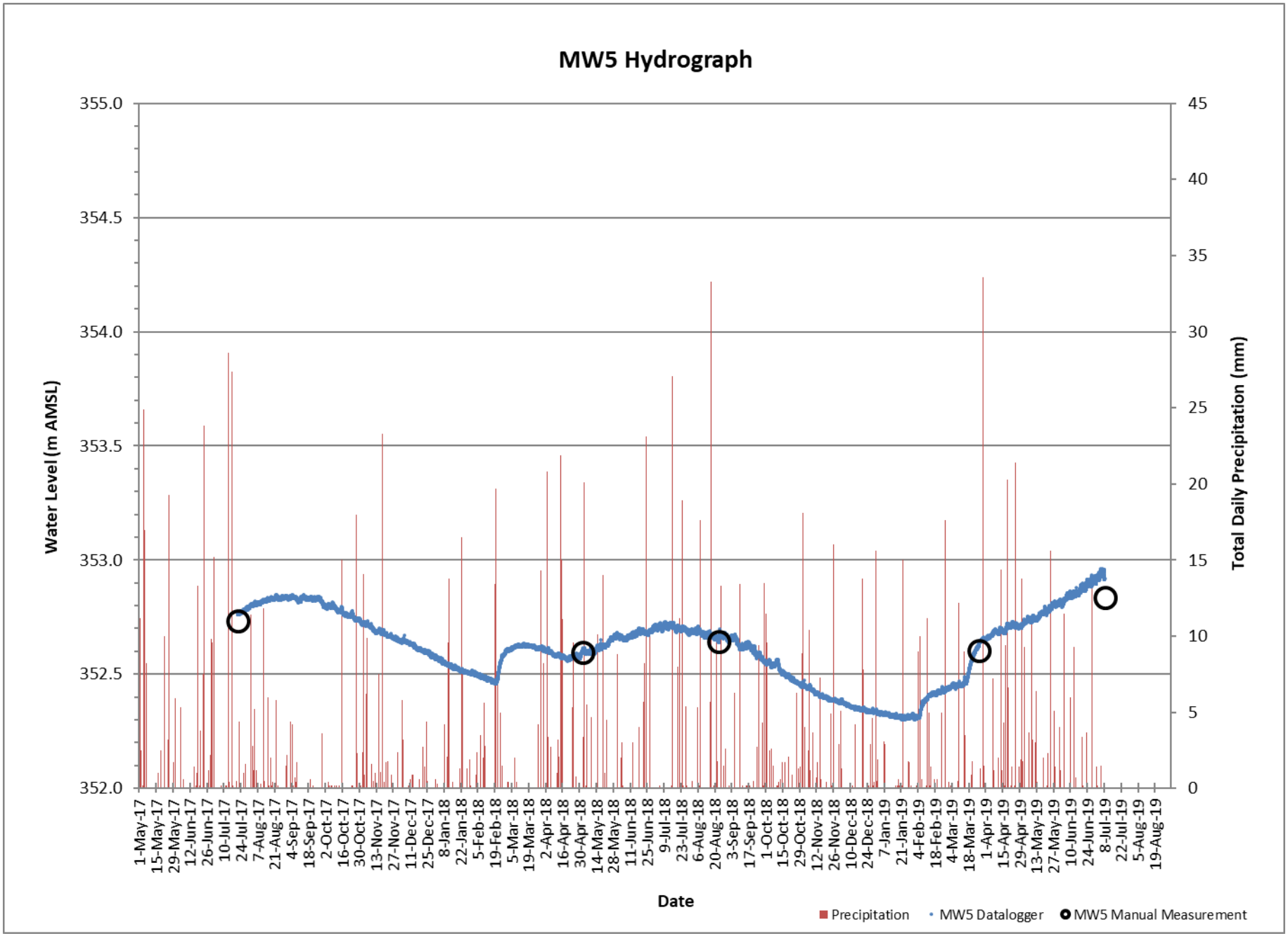
Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	**Figure 1.6: MW2 Hydrograph**
	Date: Jul 2019	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	
	Drawn By: AR		



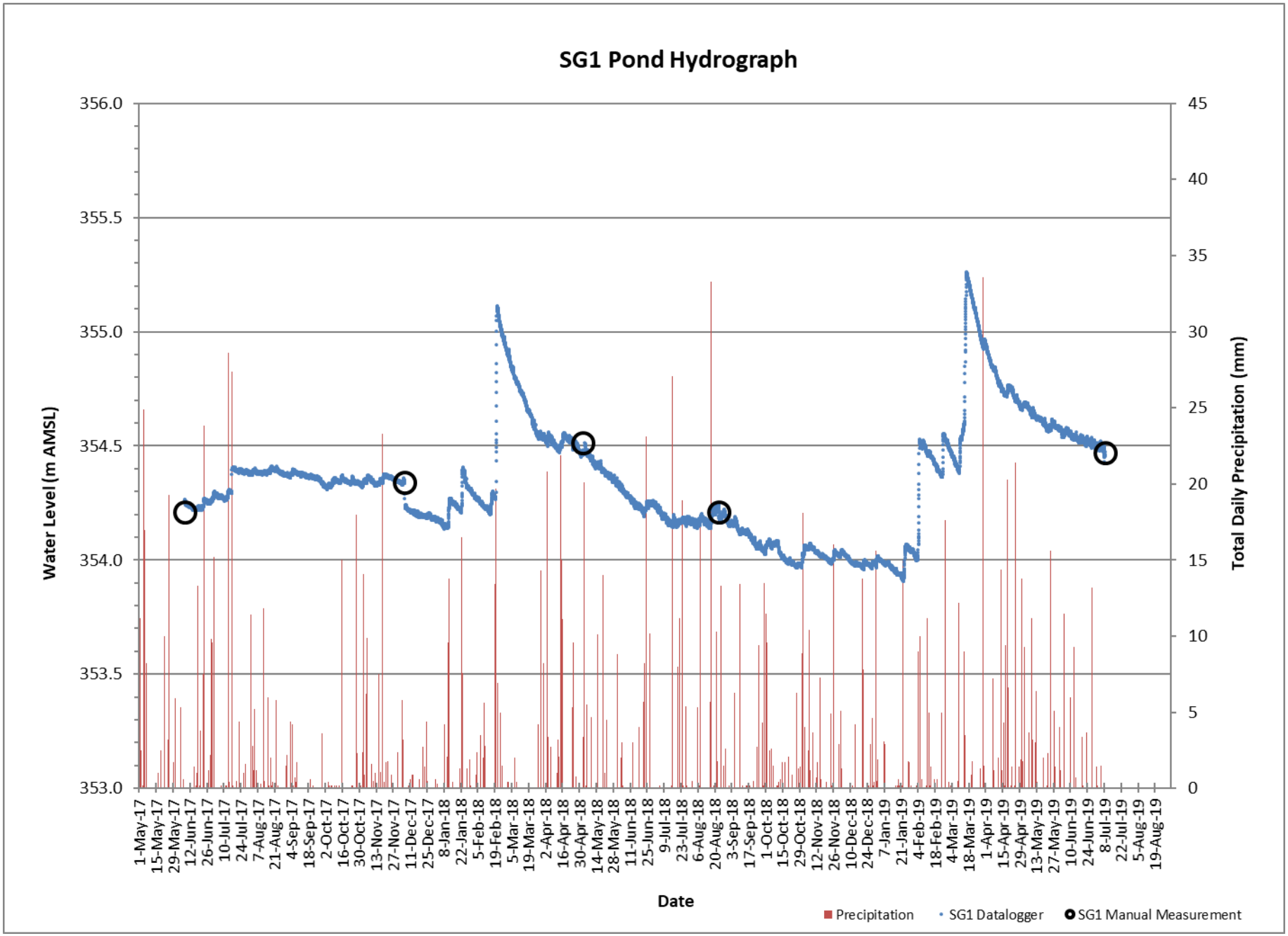
Harden Environmental Services Ltd.	**Project No:** 1728 **Date:** Jul 2019 **Drawn By:** AR	Hydrogeological Assessment 1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	**Figure 1.7: MW3 Hydrograph**



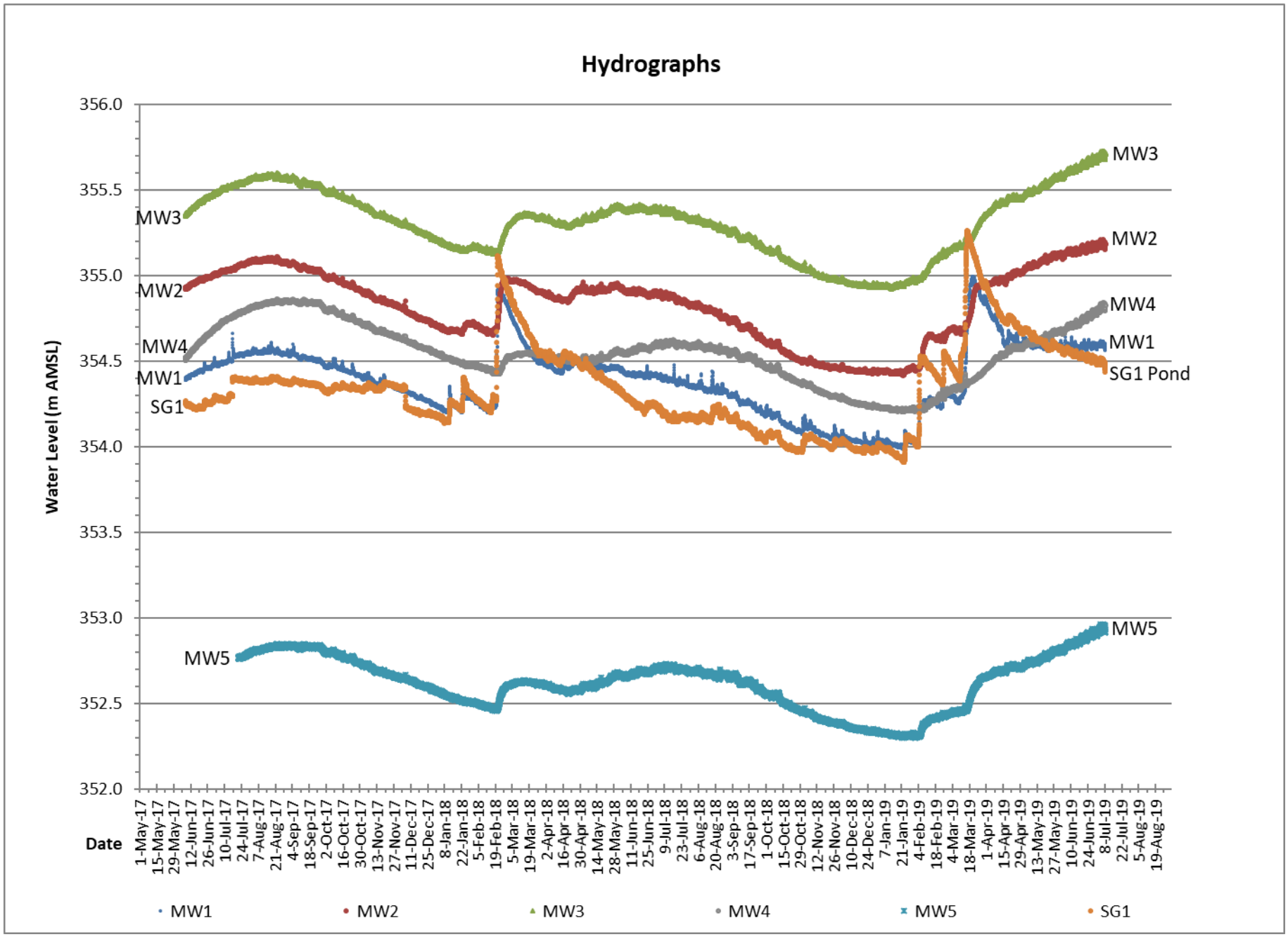
Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	**Figure 1.8: MW4 Hydrograph**
	Date: Jul 2019	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	
	Drawn By: AR		



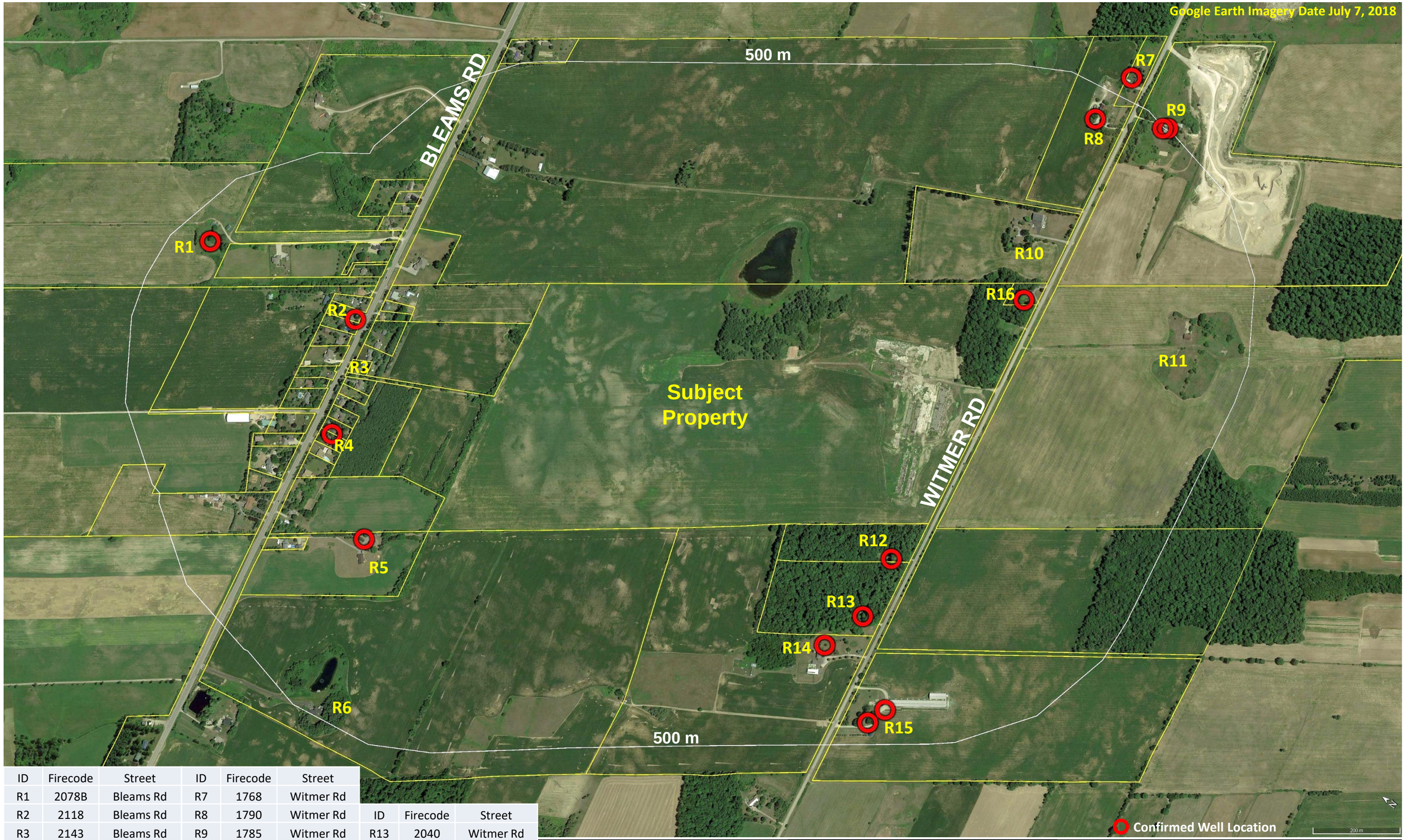
Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	**Figure 1.9: MW5 Hydrograph**
	Date: Jul 2019	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	
	Drawn By: AR		



Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	**Figure 1.10: SG1 Pond Hydrograph**
	Date: Jul 2019	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	
	Drawn By: AR		



Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	**Figure 1.11: Hydrographs**
	Date: Jul 2019	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	
	Drawn By: AR		



ID	Firecode	Street	ID	Firecode	Street
R1	2078B	Bleams Rd	R7	1768	Witmer Rd
R2	2118	Bleams Rd	R8	1790	Witmer Rd
R3	2143	Bleams Rd	R9	1785	Witmer Rd
R4	2175	Bleams Rd	R10	1850	Witmer Rd
R5	2229	Bleams Rd	R11	1901	Witmer Rd
R6	2295	Bleams Rd	R12	2008	Witmer Rd

ID	Firecode	Street
R13	2040	Witmer Rd
R14	2056	Witmer Rd
R15	2089	Witmer Rd
R16	1874	Witmer Rd

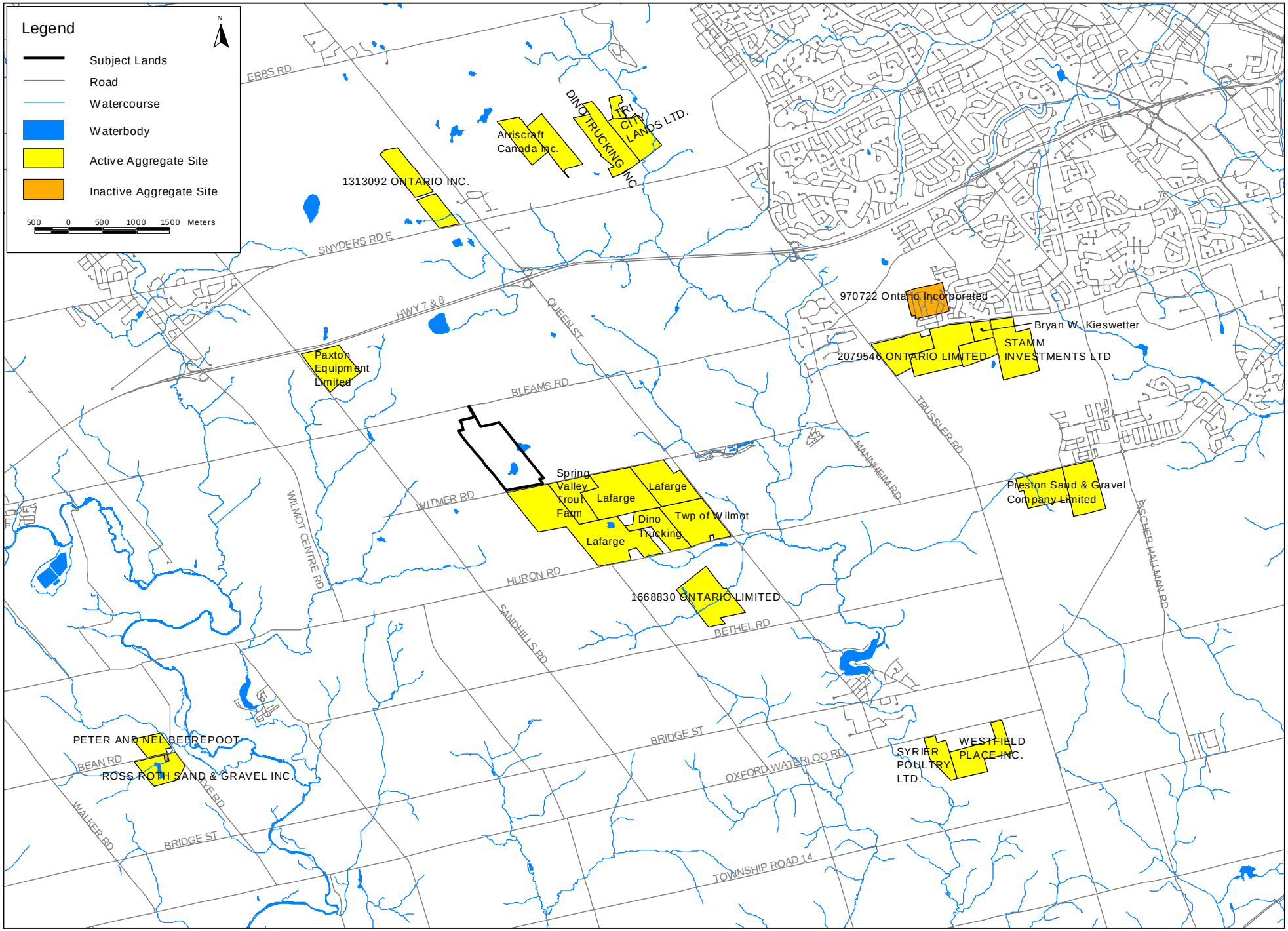
Harden Environmental Services Ltd.

Project No: 1728
Date: Jun 2019
Drawn By: AR

Hydrogeological Assessment

1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10
Township of Wilmot, Regional Municipality of Waterloo

Figure 1.12:
Water Well Survey
Residents within 500 m Not on Town Water Supply



Harden Environmental Services Ltd.	**Project No:** 1728 **Date:** Sep 2018 **Drawn By:** AR	Hydrogeological Assessment 1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo

Figure 2.1: Aggregate Sites

Legend

- 500 metre Buffer
- Subject Lands
- Watercourse
- Wetland - Provincially Significant
- Contour - 1m Interval (Region of Waterloo)
- Waterbody
- Wetland

250 0 250 Meters

NITH RIVER
ALDER CREEK

BLEAMS RD

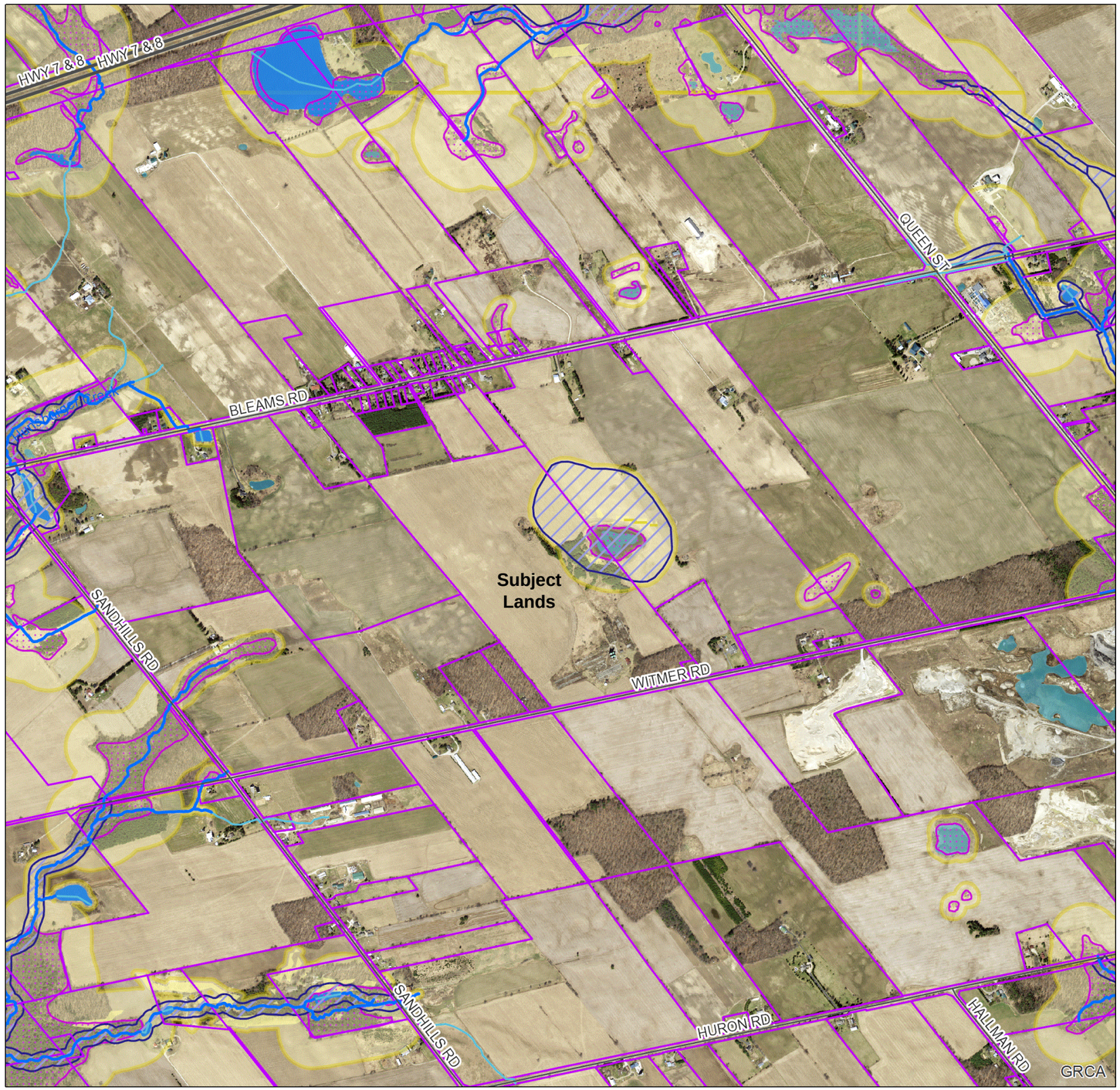
WITMER RD

HURON RD

QUEEN ST

SANDHILLS RD

Harden Environmental Services Ltd.	**Project No:** 1728 **Date:** Sep 2018 **Drawn By:** AR	Hydrogeological Assessment 1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	Figure 2.2: **Environmental Features**



Grand River Conservation Authority

Date: Jul 11, 2019

Legend

- Regulation Limit (GRCA)
- Regulated Watercourse (GRCA)
- Regulated Waterbody (GRCA)
- Wetland (GRCA)
- Floodplain (GRCA)
  - Engineered
  - Estimated
  - Approximate
  - Special Policy Area
- Slope Valley (GRCA)
  - Steep
  - Oversteep
  - Steep
- Slope Erosion (GRCA)
  - Oversteep
  - Toe
- Lake Erie Flood (GRCA)
- Lake Erie Shoreline Reach (GRCA)
- Lake Erie Dynamic Beach (GRCA)
- Lake Erie Erosion (GRCA)
- Parcel - Assessment (MPAC/MNRF)

This legend is static and may not fully reflect the layers shown on the map. The text of Ontario Regulation 150/06 supercedes the mapping as represented by these layers.

0 130 260 520 780 Metres

N

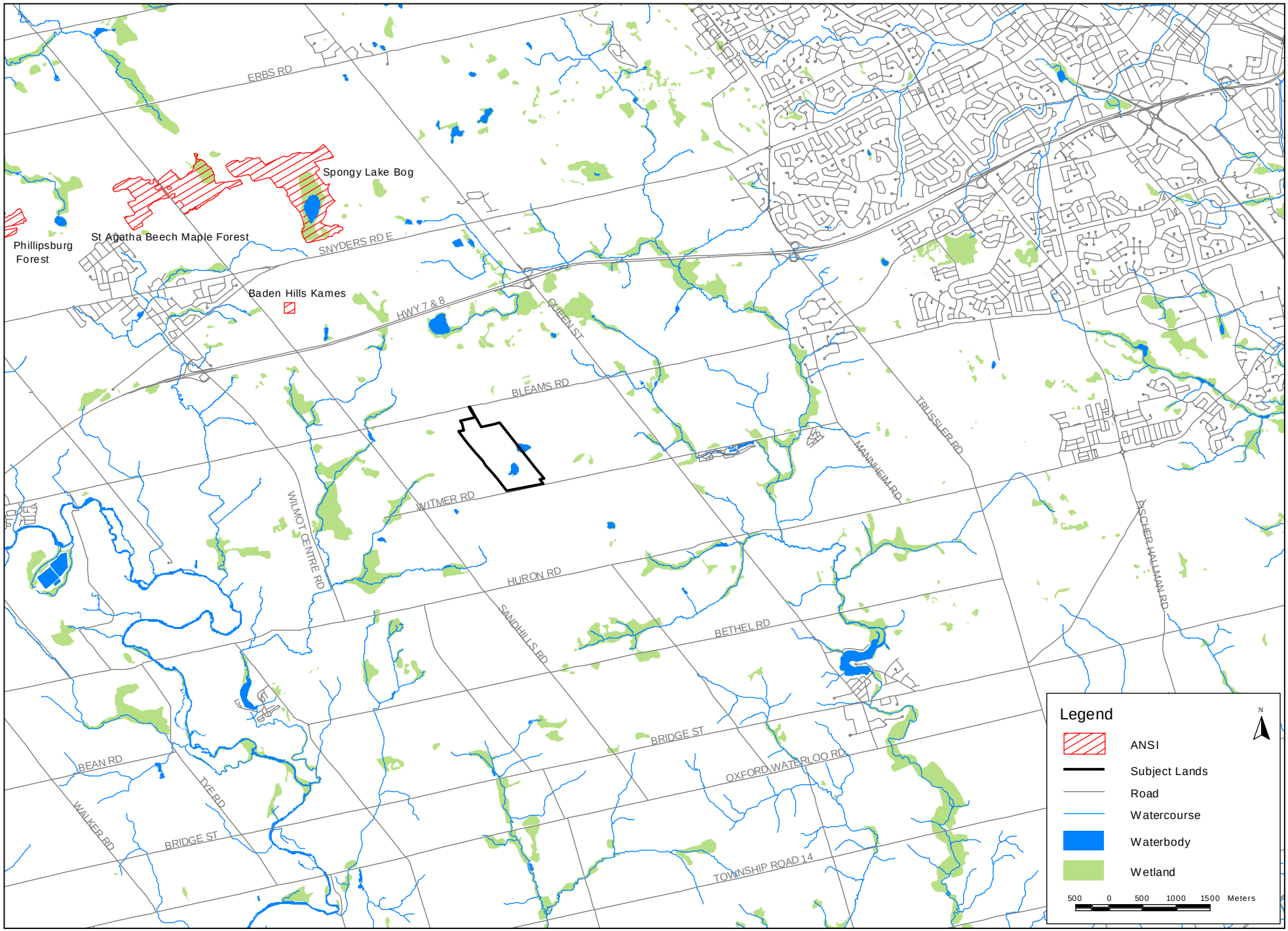
Map Centre (UTM NAD83 z17): 532,374.47 4,803,433.28

This map is not to be used for navigation | 2015 Ortho (ON)

NAD 1983 UTM Zone 17N

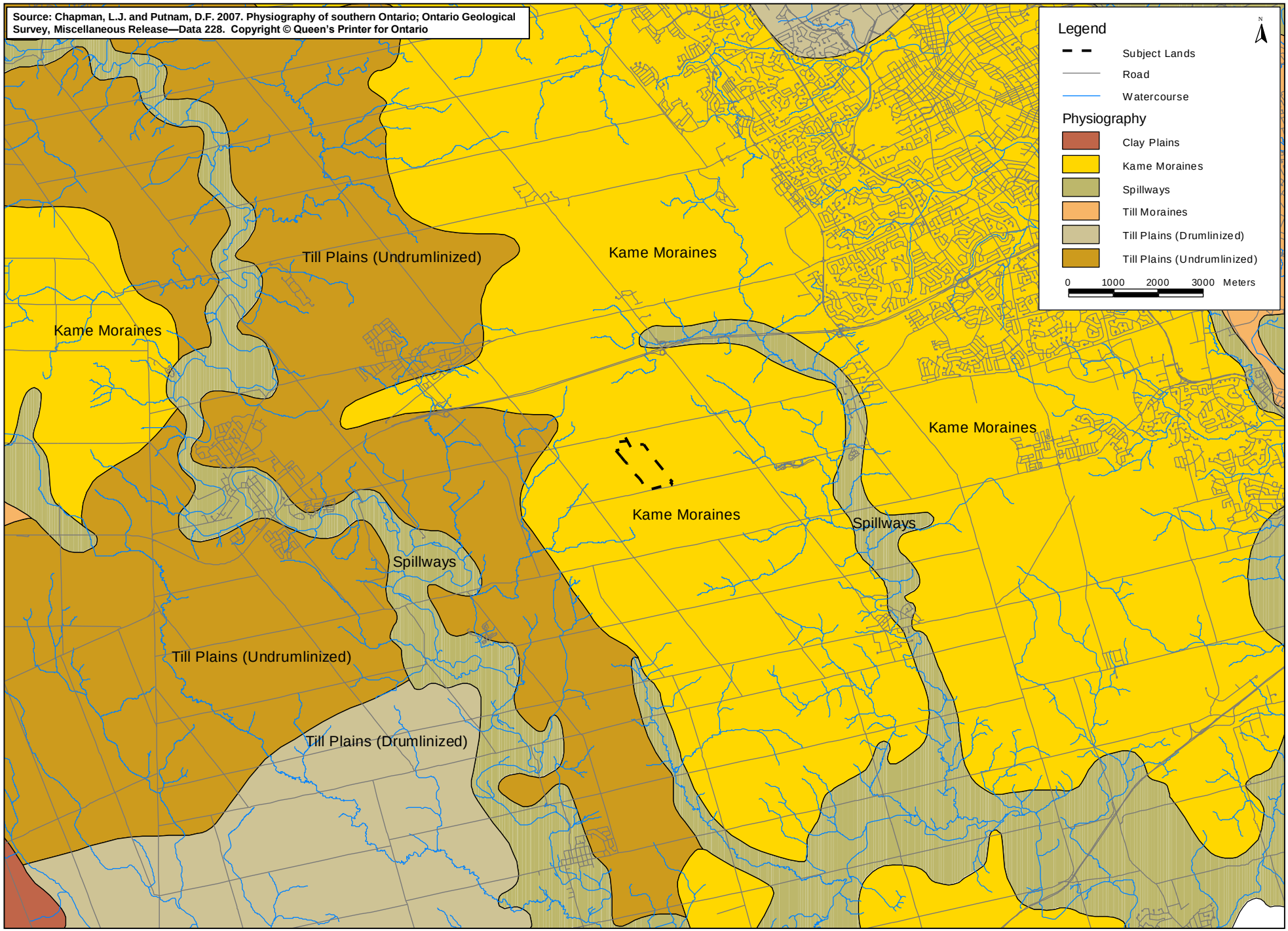
Scale: 21,480

Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	Figure 2.3: **GRCA Regulated Areas**
	Date: Jul 2019	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	
	Drawn By: AR		

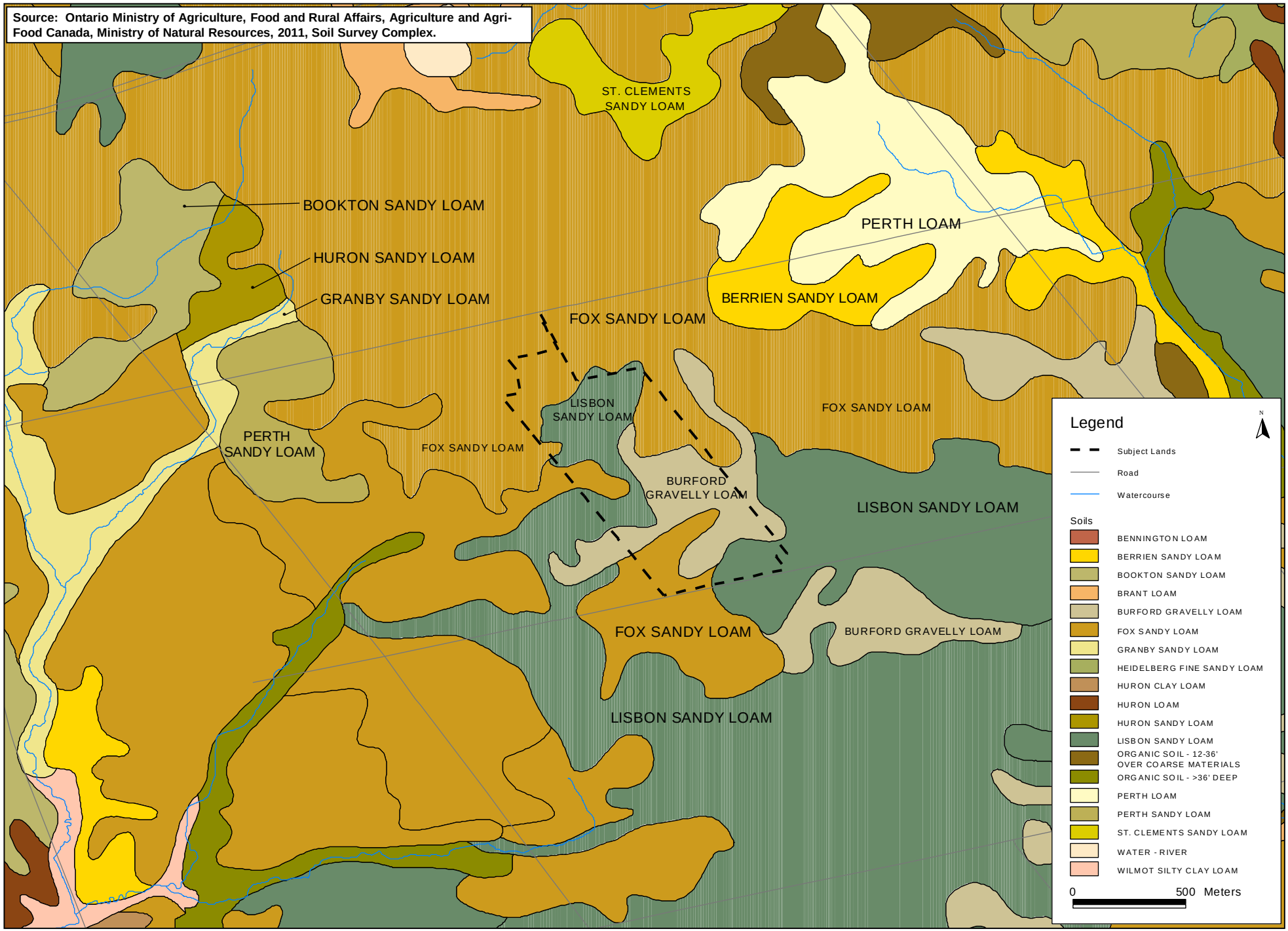


Harden Environmental Services Ltd.	**Project No:** 1728 **Date:** Sep 2018 **Drawn By:** AR	Hydrogeological Assessment 1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo

Figure 2.4: ANSI



Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	**Figure 2.5: Physiography**
	Date: Sep 2018	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	
	Drawn By: AR		



Harden Environmental Services Ltd.	**Project No:** 1728 **Date:** Sep 2018 **Drawn By:** AR	Hydrogeological Assessment 1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	**Figure 2.6: Soils**

Legend

- Proposed Limit of Extraction
- Subject Lands
- Pond Catchment Area (1,818,744 m2)
- Pond Catchment Area Within Limit of Extraction (247,750 m2)
- Watercourse
- Wetland - Provincially Significant
- Contour - 1m Interval (Region of Waterloo)
- Waterbody
- Wetland

250 0 250 Meters

1,818,744 m²

247,750 m²

Culvert

BLEAMS RD

WITMER RD

SANDHILLS RD

QUEEN ST

Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	Figure 2.7: **Pond Catchment Area**
	Date: Sep 2018	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	
	Drawn By: AR		

Legend

- Well Record
- 500 metre Buffer
- Subject Lands
- Parcel within 500m
- Virtual Drainage Line (GRCA)
- Watercourse
- Contour - 5 metre Interval (m AMSL)
- Wetland
- Waterbody

100 0 100 200 Meters

N

BLEAMS RD

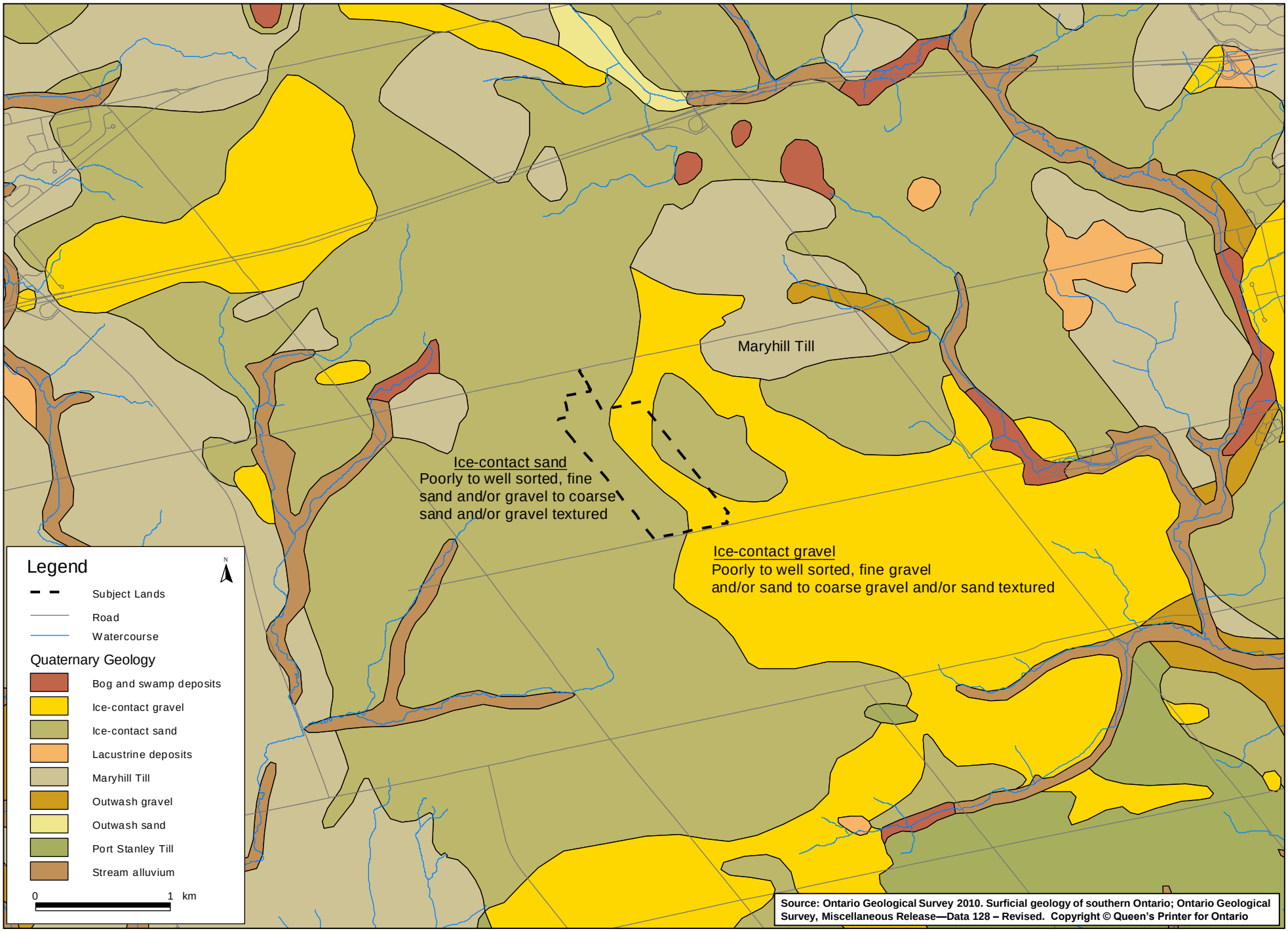
QUEEN ST

WITMER RD

SANDHILLS RD

6502140 7102464 7101340 6502141 7160503 7160504 7192463 7161196 7161197 7161195 6502142 6502181 6502185 6502183 7285469 Municipal Wells K50/K51/K52 6503292 7043674 6502184 7285468 7285467 7285466 7290595 6502182 6503788 6504009 6504927 6504472 6504418 6504197 6504011 6510771 6502212 6507228 6506072 7289418 6502214

Harden Environmental Services Ltd.	**Project No:** 1728 **Date:** Sep 2018 **Drawn By:** AR	Hydrogeological Assessment 1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	Figure 3.1: **Well Records Within 500 Metres**



Harden Environmental Services Ltd.	**Project No:** 1728 **Date:** Sep 2018 **Drawn By:** AR	Hydrogeological Assessment 1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo

Figure 3.2: Quaternary Geology

Legend

- Monitoring Location
- Property Line
- Proposed Limit of Extraction
- Proposed Licensed Boundary
- Watercourse
- Wetland - Provincially Significant
- Contour - 1m Interval (Region of Waterloo)
- Waterbody
- Wetland

100 0 100 200 Meters

N

BLEAMS RD

WITMER RD

SANDHILLS RD

MW1 354.0

MW2 354.4

MW3 354.9

MW4 354.2

MW5 352.3

SG1 353.9

Groundwater Flow Direction

Water Levels

123.4 Low - January 2019

Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	Figure 3.3A: **Inferred Groundwater Contours – Seasonal Low**
	Date: Jul 2019	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	
	Drawn By: AR		

Legend

- Monitoring Location
- Property Line
- Proposed Limit of Extraction
- Proposed Licensed Boundary
- Watercourse
- Wetland - Provincially Significant
- Contour - 1m Interval (Region of Waterloo)
- Waterbody
- Wetland

100 0 100 200 Meters

N

BLEAMS RD

WITMER RD

SANDHILLS RD

MW1
355.0
354.0

MW2
355.2
354.4

MW3
355.7
354.9

MW4
354.8
354.2

MW5
352.9
352.3

SG1
355.25
353.9

Groundwater Flow Direction

355.5
355.25
355
354.5
354
353.5
353

Water Levels

123.9	High – July 2019
123.1	Low – January 2019

Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	Figure 3.3B:
	Date: Jul 2019	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	**Inferred Groundwater Contours – Seasonal High**
	Drawn By: AR		

WEST Bleams Rd EAST

A

A’

6503292 Domestic
R5 Domestic
6502185 Domestic
6502142 TW6/67
7043674 OW
6502181 Domestic
R1 7102464 Domestic
7161196 ROW OW
6502184 TW10/67
7285469 MW3
R1 7101340 Domestic
7161197 ROW OW
6502141 TW5/67
6502140 TW16/66
7285468 MW2
7160503 ROW OW
7161195 ROW OW
6502183 Domestic

Bottom of Pit Excavation 357.5 mAMSL

Water Table

R5: Unknown Material - Well Record Not Confirmed
Exact depth is unknown but is at least 67 m
Water Level Measured June 10, 2019

Unknown Material - Previously Drilled No Well Record

Proposed Licensed Boundary
OW Observation Well
TW Test Well
Water Level

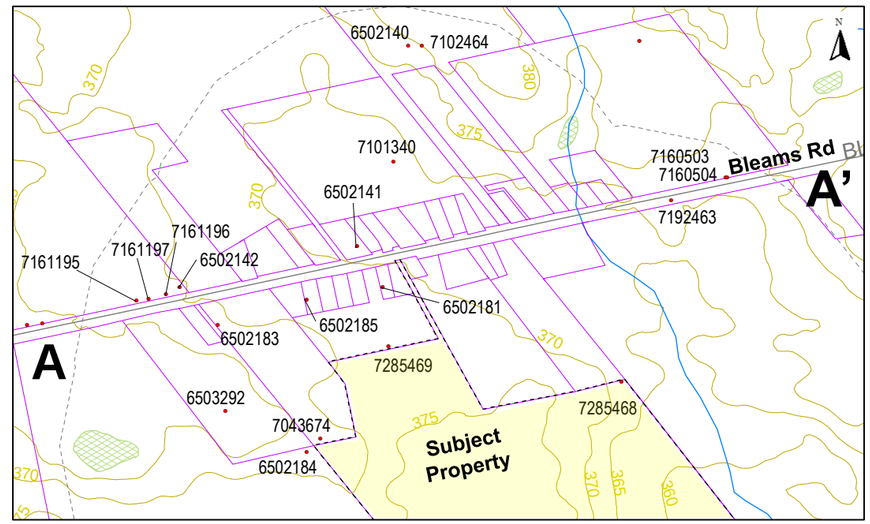
Sand and Gravel
Silt/Clay/Till
Limestone
Shale

Elevation (m AMSL)

400 390 380 370 360 350 340 330 320 310 300 290 280 270 260 250 240

0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600

Distance (metres)



Harden Environmental Services Ltd.

Project No: 1728
Date: Aug 2019
Drawn By: AR

Hydrogeological Assessment

1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10
Township of Wilmot, Regional Municipality of Waterloo

Figure 4.1:

Conceptual Cross Section A-A’ – Bleams Road

WEST Witmer Rd EAST

Elevation (m AMSL)

400 390 380 370 360 350 340 330 320 310 300 290 280 270 260 250 240

0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600

Distance (metres)

B

B’

R15
7289418
Domestic
Livestock

6507228
Domestic

6506072
Domestic

6504197
Domestic

6504011
Livestock

6504472
Livestock

6502182
Domestic
Livestock

7290595
MW5

6504418
Irrigation

6504009
Domestic

6504927
Domestic

6510771
OW

6503788
Domestic

6502214
Farm

6502212
Domestic

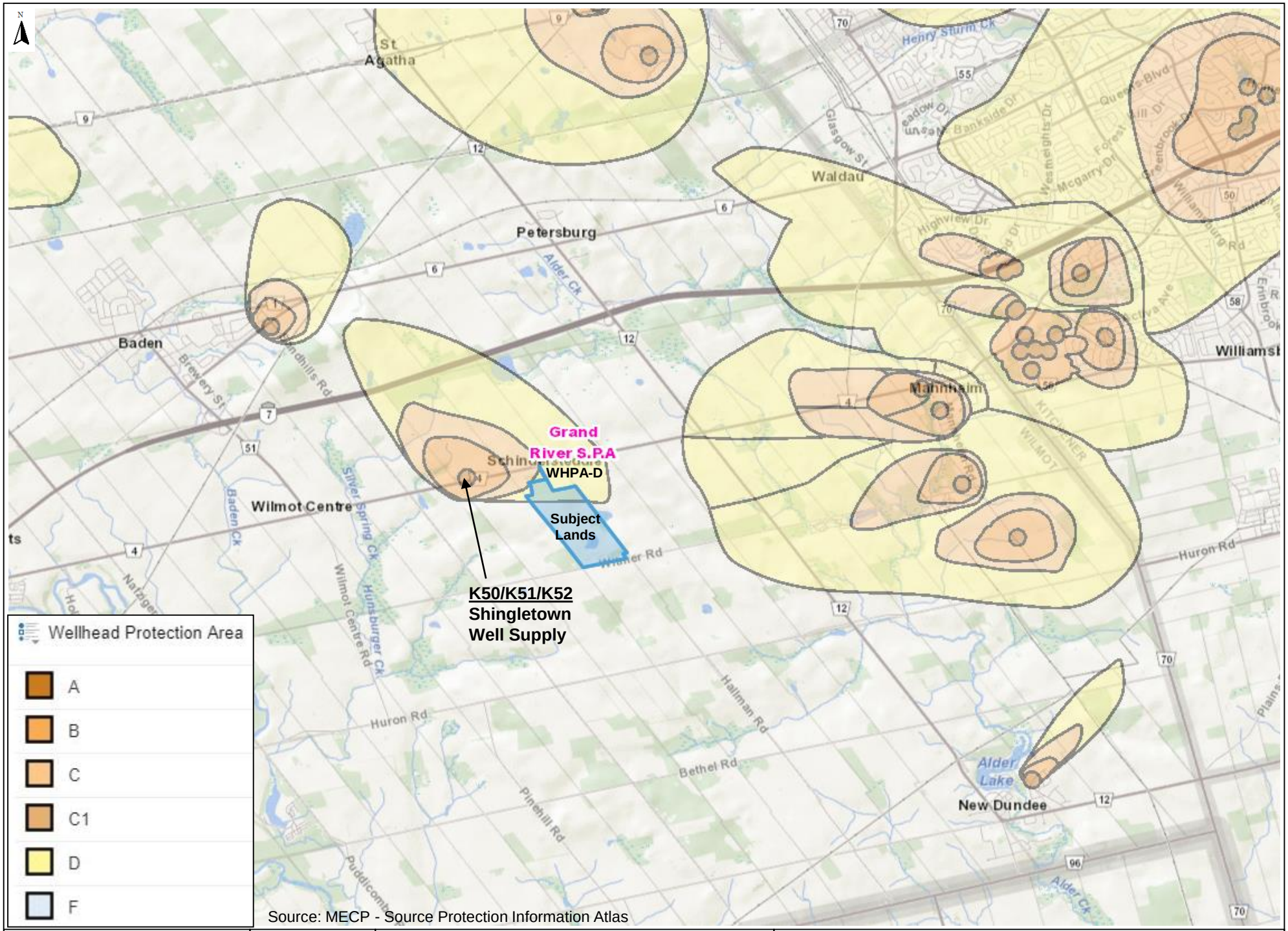
Water Table

Bottom of Pit
Excavation 354.8 mAMSL

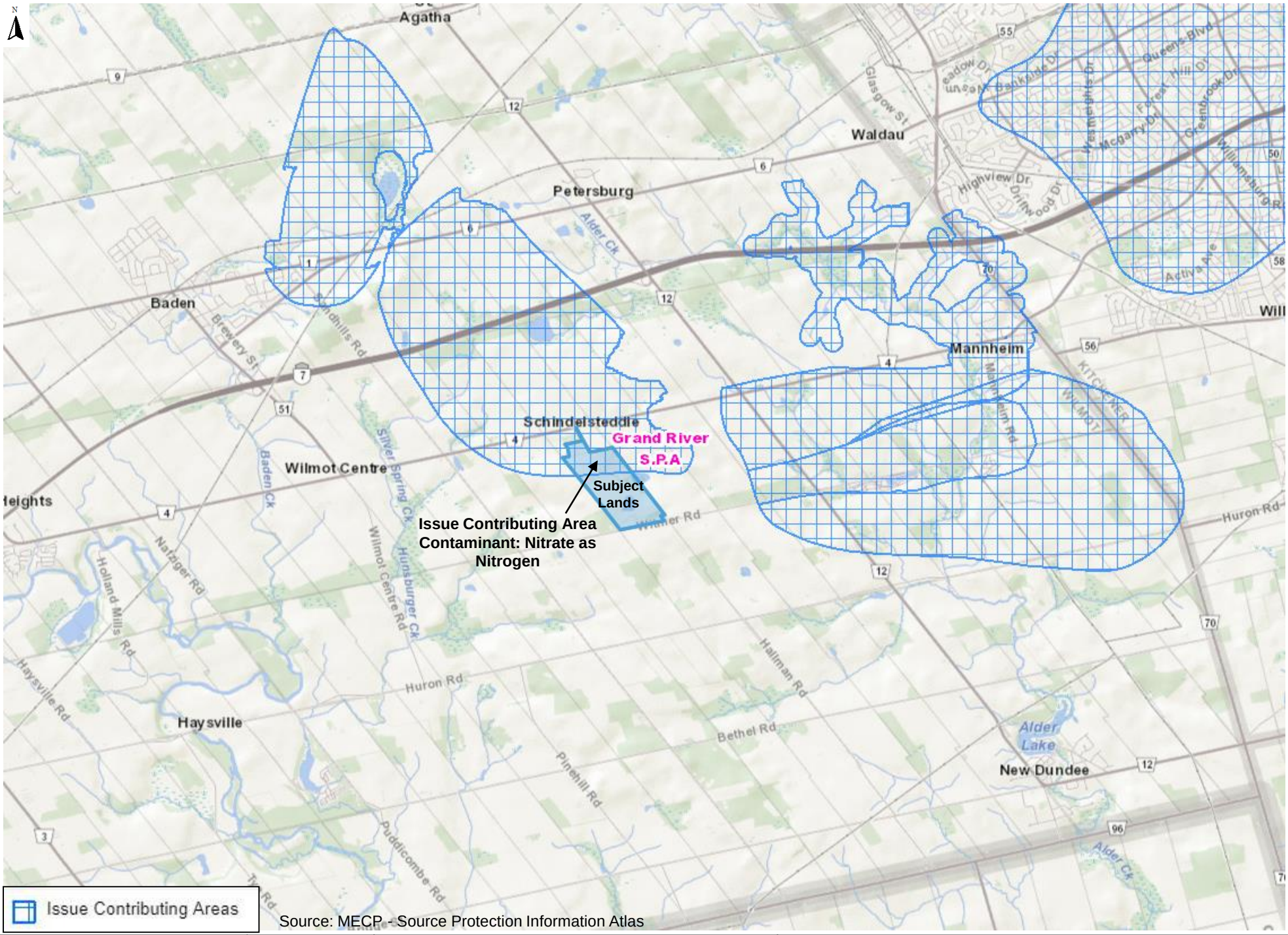
Proposed Licensed Boundary
OW Observation Well
TW Test Well
Water Level

Sand and Gravel
Silt/Clay/Till
Limestone
Shale

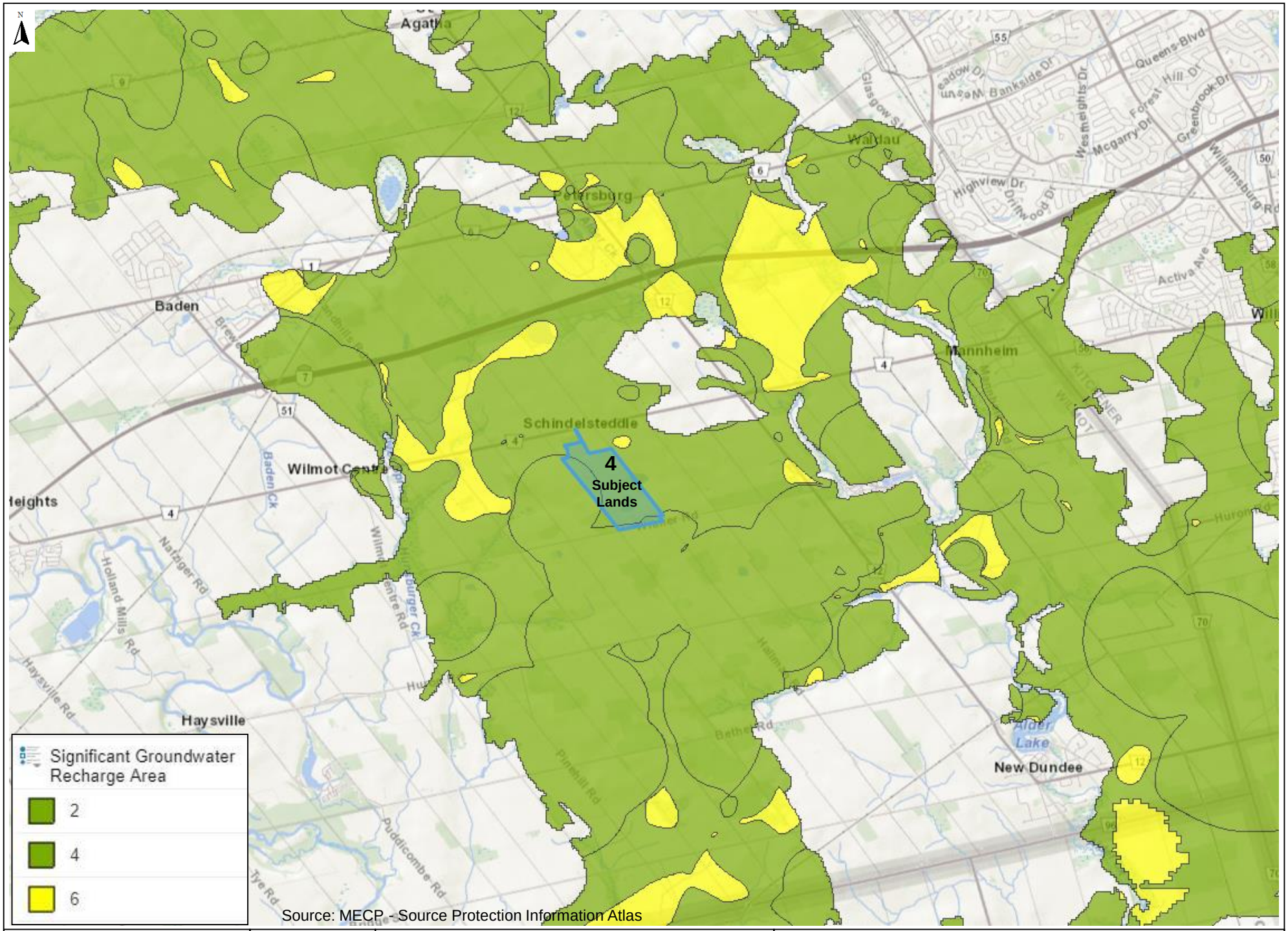
Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	Figure 4.2:
	Date: Aug 2019	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	**Conceptual Cross Section B-B’ – Witmer Road**
	Drawn By: AR		



Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	**Figure 4.3: WHPAs**
	Date: Sep 2018	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	
	Drawn By: AR		

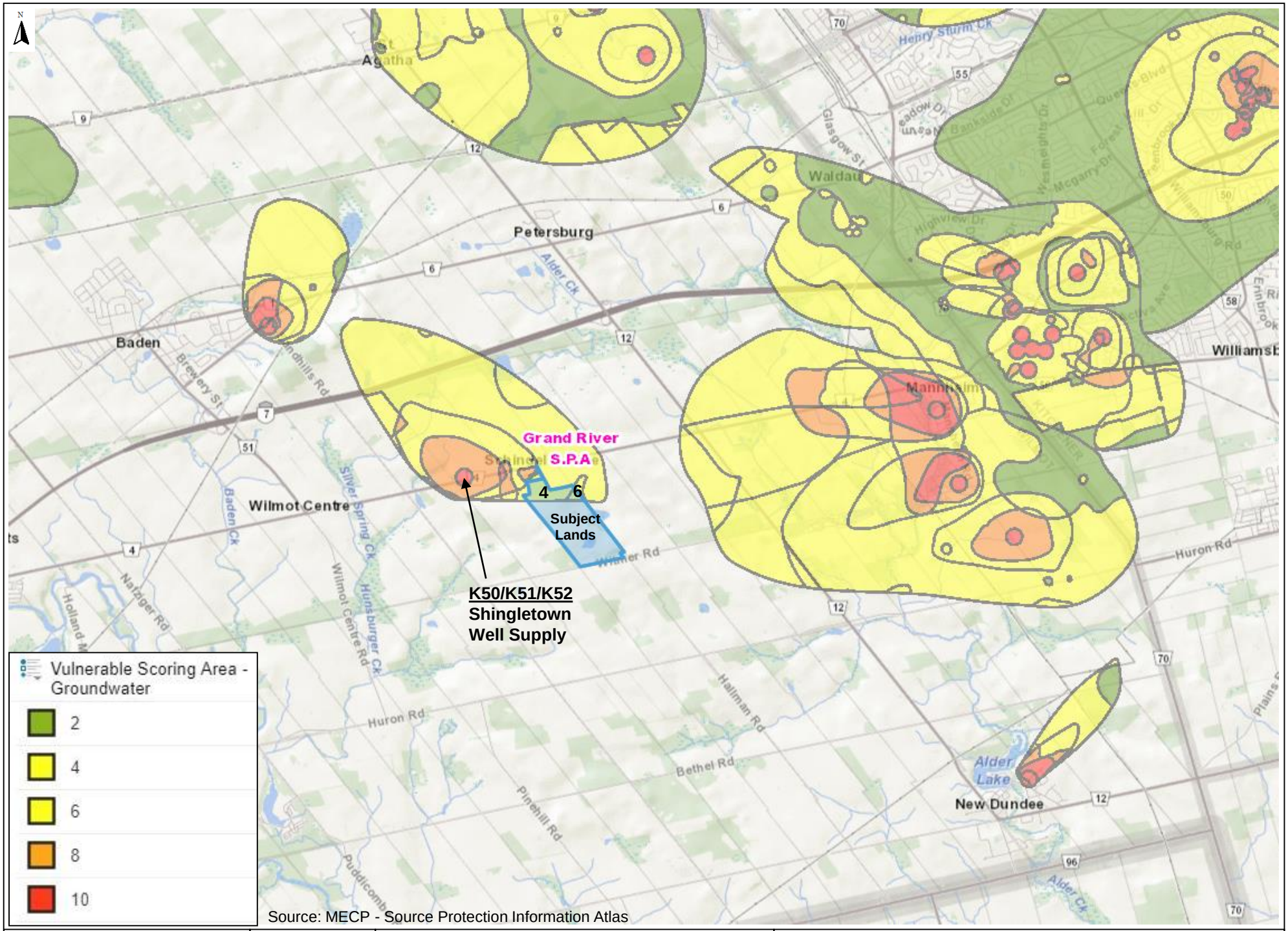


Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	**Figure 4.4: Issue Contributing Areas**
	Date: Sep 2018	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	
	Drawn By: AR		

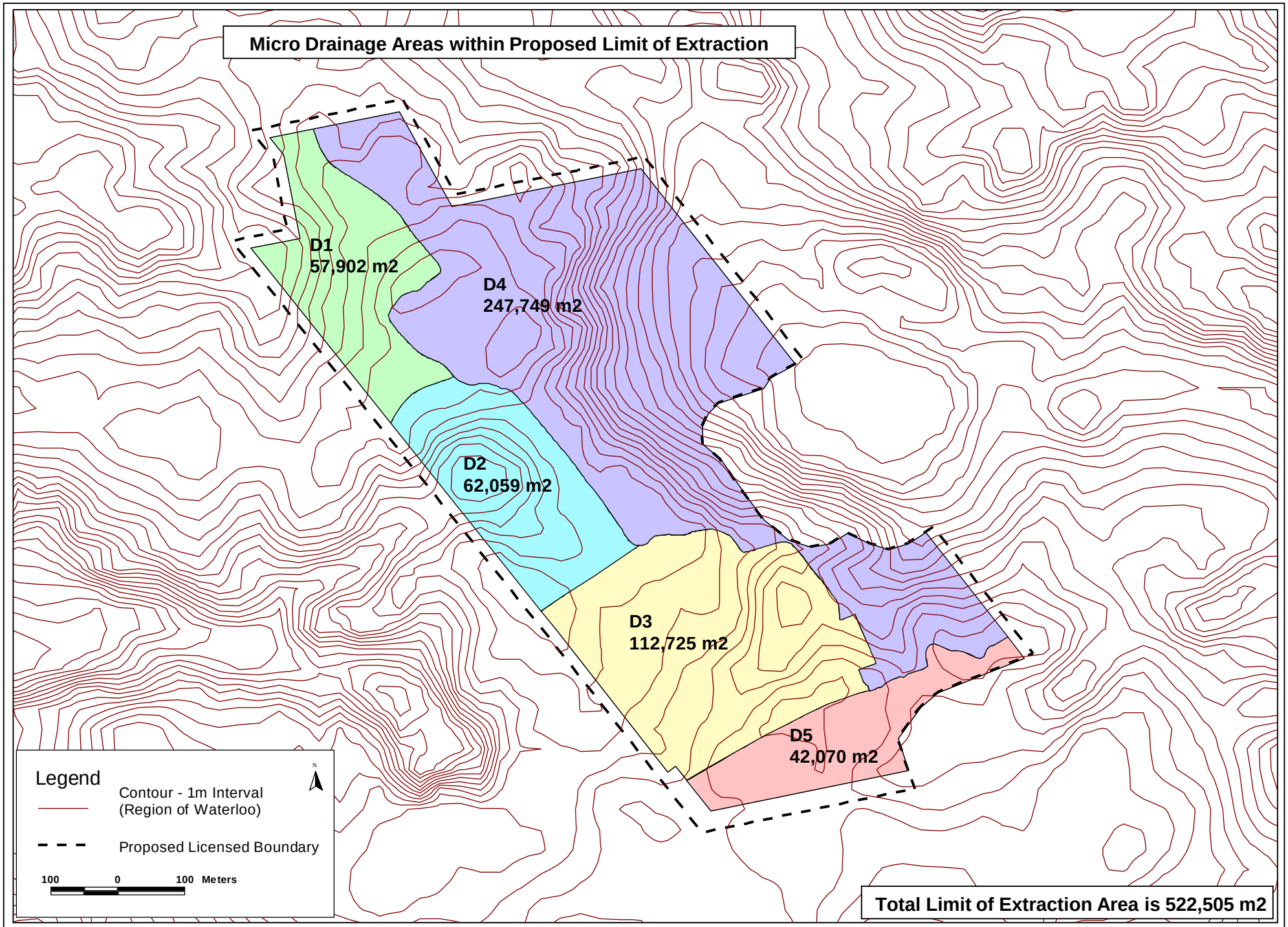


Source: MECP - Source Protection Information Atlas

Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	**Figure 4.5: Significant Groundwater Recharge Area**
	Date: Sep 2018	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	
	Drawn By: AR		

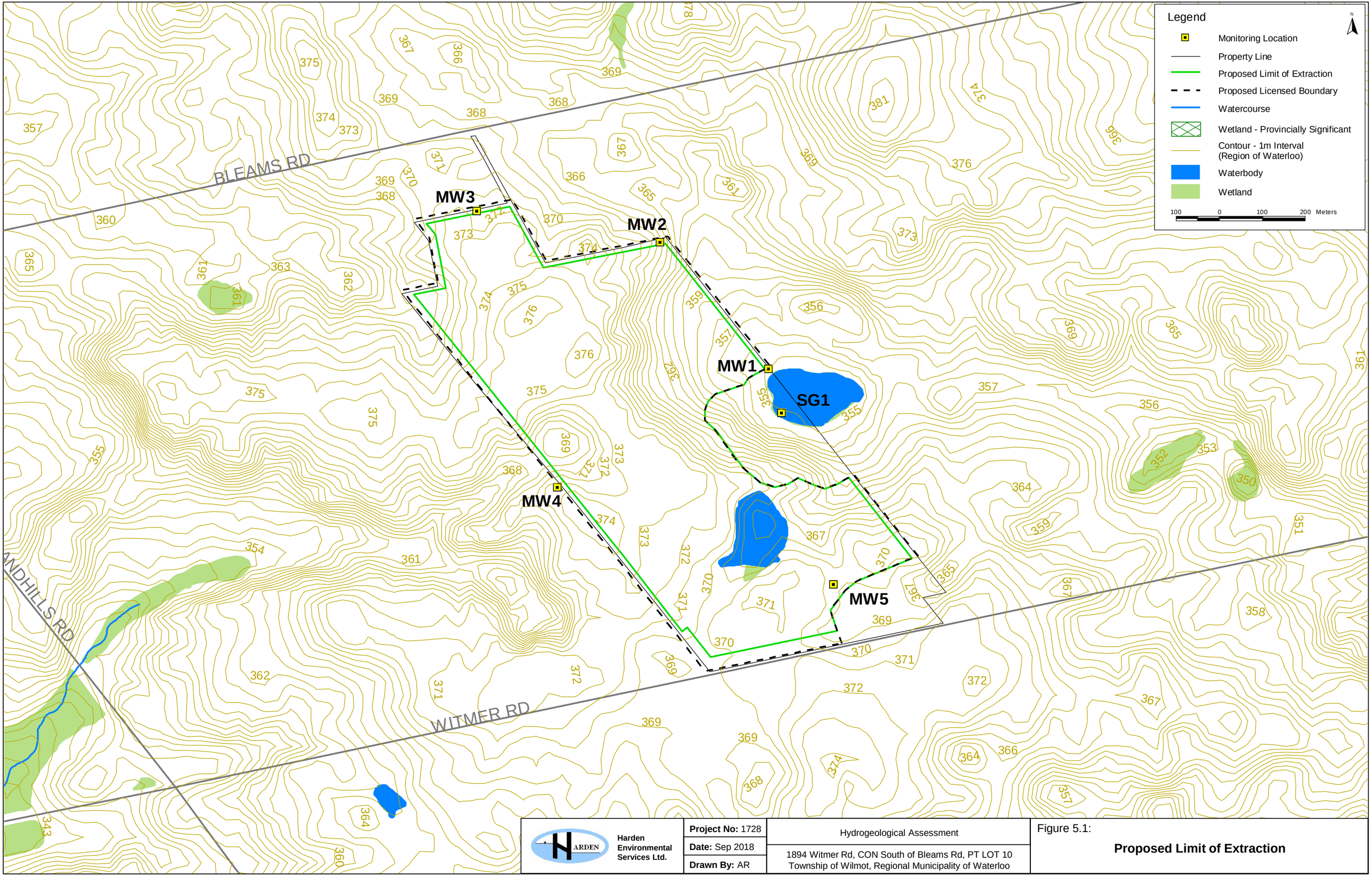


Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	**Figure 4.6: Vulnerable Scoring Area**
	Date: Sep 2018	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	
	Drawn By: AR		

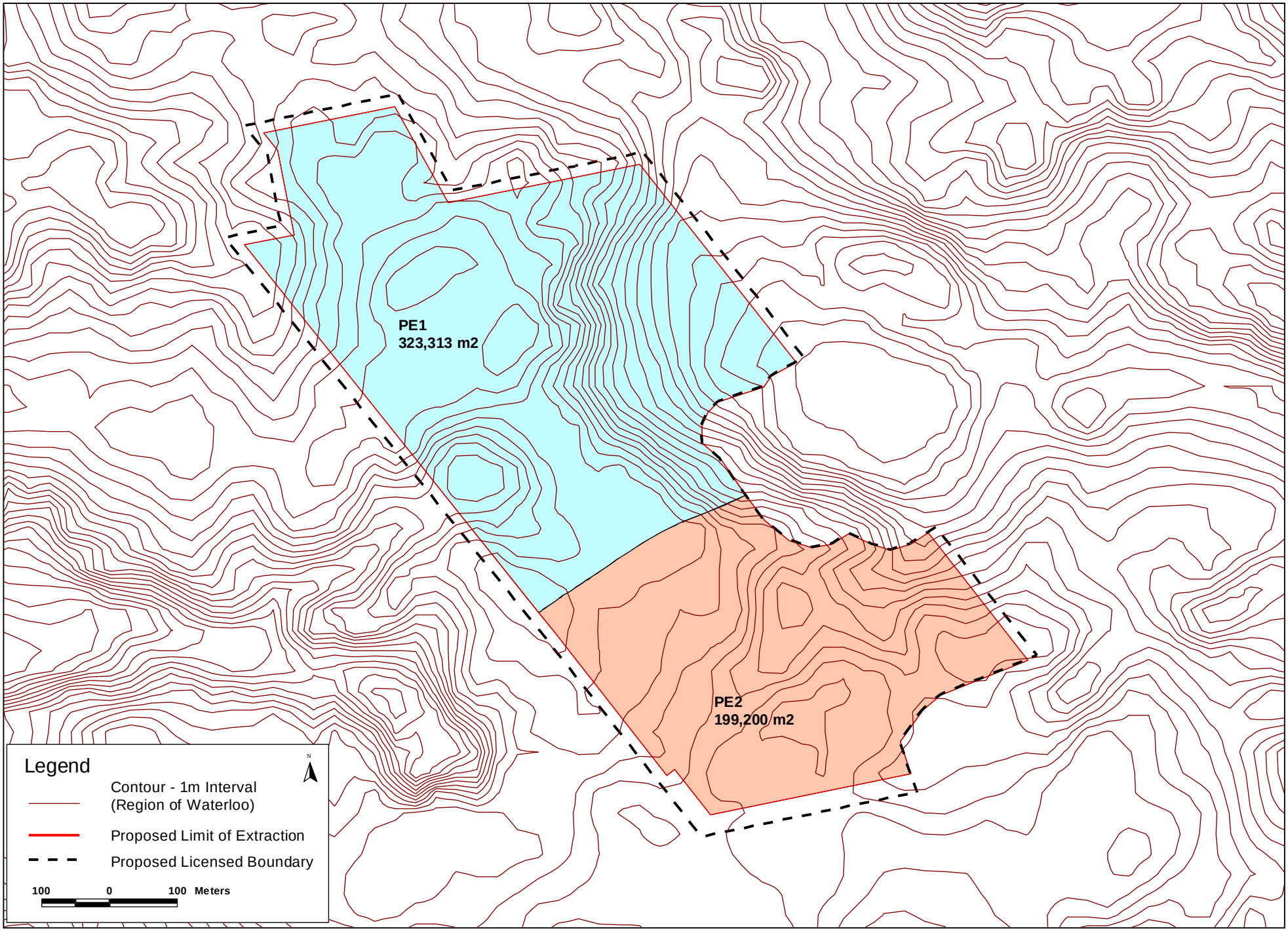


Harden Environmental Services Ltd.	**Project No:** 1728 **Date:** Jul 2019 **Drawn By:** AR	Hydrogeological Assessment 1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo

Figure 4.7: Micro Drainage Areas



Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	Figure 5.1: **Proposed Limit of Extraction**
	Date: Sep 2018	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	
	Drawn By: AR		



Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	**Figure 6.1: Post Extraction Drainage Areas**
	Date: Jul 2019	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	
	Drawn By: AR		

Legend

- Monitoring Location
- Property Line
- Proposed Limit of Extraction
- Proposed Licensed Boundary
- Watercourse
- Wetland - Provincially Significant
- Contour - 1m Interval (Region of Waterloo)
- Waterbody
- Wetland

100 0 100 200 Meters

N

356.0 Proposed Pit Floor Elevations

Grade Direction on Pit Floor

BLEAMS RD

WITMER RD

SANDHILLS RD

Hinge Line

MW1

MW2

MW3

MW4

MW5

SG1

357.2

356.7

356.5

356.7

356.7

355.5

355.5

354.5

354.5

Harden Environmental Services Ltd.	**Project No:** 1728	Hydrogeological Assessment	Figure 7.1:
	Date: Sep 2019	1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10 Township of Wilmot, Regional Municipality of Waterloo	**Recommended Final Pit Floor Elevations**
	Drawn By: SD		

Appendix A

Scope of Work - GRCA Comments

Administration Centre: 400 Clyde Road, P.O. Box 729 Cambridge, ON N1R 5W6

Phone: 519-621-2761 Toll free: 1-866-900-4722 Fax: 519-621-4844 www.grandriver.ca

January 25, 2019

Andrew Martin
Manager of Planning/EDO
Township of Wilmot
60 Snyder's Road West
Baden, ON N3A 1A1

Diane Schwier
Ministry of Natural Resources and Forestry
1 Stone Road West
Guelph, Ontario N1G 4Y2

Re: Pre-consultation for Category 3 Aggregate Licence, Zone Change Amendment
Proposed Hallman Pit, 1894 Witmer Road, Township of Wilmot

GRCA staff attended a pre-consultation meeting on November 29, 2018 and have now reviewed the Terms of Reference for an Environmental Impact Study (EIS) dated December 14, 2018 (Dance Environmental Inc.) as well as the Terms of Reference for the Hydrological Study dated January 9, 2019 (Harden Environmental Services Ltd.) for an above water aggregate pit.

Current information available at our office indicates that the proposed pit is within areas of interest to the GRCA due to the presence of a wetland. We note that our mapping currently illustrates a floodplain on the property, however upon further review; we will be revising our mapping to remove the floodplain.

Wetlands
GRCA staff attended a site meeting on September 17, 2018 to confirm the flagged wetland boundary. Based on information provided to date, it is our understanding that no development (excavation, grading) is proposed within the wetland. This must be clearly demonstrated in the submission. Development is proposed adjacent to the wetland, therefore it must be demonstrated through an Environmental Impact Study (EIS) and Hydrogeology Study that the proposal will not have a negative or adverse impact on the wetlands.

We have reviewed the Terms of Reference for the EIS and have the following comments:
- It is noted on Page 2 that "Features and functions to be mapped will include all of those listed in 2.1.1 through 2.1.13, inclusive from the Scoped EIS guidelines in the GNIG." Since all of the listed features may not be present on this site and to ensure a full consideration of all possible aspects of the Natural Heritage System (e.g. habitat linkages, topography, soil regimes), it may be helpful to simply acknowledge that the current EIS shall be carried out in accordance with the Region's Guideline for Full Environmental Impact Statements.
- Section 4.3.10 on Page 3 of the EIS should note that the wetland has been evaluated and is considered an isolated unit of the Locally Significant Schindelsteddle South Wetland Complex.
- Page 3 of the EIS should note that the wetland boundary was flagged and confirmed by GRCA staff on September 17, 2018.
- Section 4.3.10 on Page 3 states that the wetland boundary will be plotted on the Existing Conditions Plan of the ARA application and on Figures contained with the EIS. The EIS should be revised as the wetland boundary and proposed buffer determined through the EIS should be shown on all plans, including the Operational Plan.
- Section 4.5 on page 3 states that the groundwater monitoring and interpretation of groundwater/surface water interactions undertaken by Harden Environmental Services Ltd. will

be summarized and this discussion will address implications for wetland habitat and the pond located on the eastern margin of the site. Section 6.0 and 7.0 speak to evaluation of impacts; however it would be useful to clarify in Section 4.5 that information from the Hydrogeology Study will inform the impact assessment and recommendations to be undertaken in Section 6.0 and 7.0 of the EIS.

We have also reviewed the Terms of Reference (TOR) for the Hydrogeology Study and offer the following comments:
- The TOR and example Table of Contents are general in nature. It appears our interests will be addressed as potential water balance changes to the wetland, impact discussion and mitigation measures have been included in the Table of Contents. However, we recommend a site-specific work plan be submitted when available which details how the wetland will be characterized and impacts will be evaluated. For example, where are the borehole, piezometer and monitoring well locations, what is the length of monitoring, etc. It would be useful to reach agreement on these aspects of the study prior to completion of the field program and submission of the study for review.
- The TOR should also mention the property is within the study area for the Alder Creek Watershed Study and Upper Strasburg Creek Subwatershed Plan (dated January 2008, GRCA) and that any applicable recommendations will be considered in the study.

Regulatory Comments:
Activities approved under the Aggregate Resources Act do not require a permit from the GRCA.

Zoning
Further discussion is required on how the wetland and associated buffer should be zoned for its long-term protection.

Review Fees:
The GRCA applies review fees for Planning Act applications located within GRCA areas of interest. In the case of multiple applications we charge the highest fee; therefore the Aggregate application fee will be required at the time of submission (2019 fee is $9,135.00).

If you have any questions, please do not hesitate to contact Christian Tinney, Resource Planner, at 519-621-2763 ext 2292 or ctinney@grandriver.ca .

Sincerely,

Beth Brown

Beth Brown
Supervisor of Resource Planning

c.c. IBI Group – David Sisco
Jane Gurney, Region of Waterloo
David Marriott, MNRF

Appendix B

Borehole Logs

PROJECT: 1728

MW1

LOCATION: 1922 Witmer Rd

BORING DATE: April 6, 2017 DATUM: G.S. 355.17 masl DIP: 90 LOGGED: TG

DEPTH SCALE METRES	DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	DEPTH B.G.S. (m)	SAMPLES ID	SAMPLES TYPE	SAMPLES RECOVERY (%)	SAMPLES "N" VALUE
0	0	Auger	355.17						
			Topsoil		0				
	2				0.3				
1	4								
	6								
2	8		Brown Sand						
	10								
3	12								
	14								
4	16				4.57				
	18		Sand and Gravel						
5	20								
	22		END OF HOLE @ 6.10m		6.10				
6	24								
	26								
7	28								
	30								
8	32								
	34								
9	36								
	38								
10	40								
	42								
11	44								
	46								
12	48								
13	50								

CONCENTRATION (%)

LEL ◆

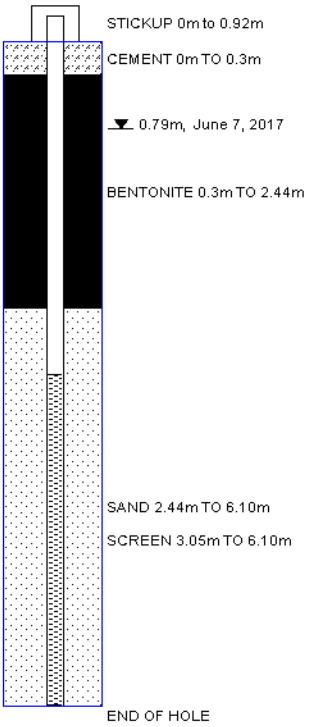
MOISTURE CONTENT ●

GAS CONCENTRATION ■

0 20 40 60 80 100

INSTALLATION INFORMATION

MW1



DRAWN: AR

Harden Environmental Services Ltd.

CHECKED: SD

PROJECT: 1728

MW2

LOCATION: 1922 Witmer Rd

BORING DATE: April 7, 2017 DATUM: G.S. 367.98 masl DIP: 90 LOGGED: TG

DEPTH SCALE METRES	DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	DEPTH B.G.S. (m)
			367.98		
0	0	Auger	Sand and Cobbles (3")		0
					4.57
			Brown Sand		
					9.14
			Coarse Gravel		
			Continued on next page		

SAMPLES: ID, TYPE, RECOVERY (%), "N" VALUE

CONCENTRATION (%): LEL ◆, MOISTURE CONTENT ●, GAS CONCENTRATION ■; 0 20 40 60 80 100

INSTALLATION INFORMATION

MW2

STICKUP 0m to 1.12m

CEMENT 0m TO 0.30m

BENTONITE 0.30m TO 11.58m

▼ 13.07m, June 7, 2017

SAND 11.58m TO 15.24m

SCREEN 12.19m TO 15.24m

DRAWN: AR

Harden Environmental Services Ltd.

CHECKED: SD

PROJECT: 1728

MW2

LOCATION: 1922 Witmer Rd

BORING DATE: April 7, 2017 DATUM: G.S. 367.98 masl DIP: 90 LOGGED: TG

DEPTH SCALE METRES	DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	DEPTH B.G.S. (m)	SAMPLES ID	SAMPLES TYPE	SAMPLES RECOVERY (%)	SAMPLES "N" VALUE	CONCENTRATION (%)	INSTALLATION INFORMATION
15	50	Auger	Coarse Gravel							LEL ◆ MOISTURE CONTENT ● GAS CONCENTRATION ■ 0 20 40 60 80 100	MW2
			END OF HOLE @15.24m		15.24						END OF HOLE
	52										
16	54										
17	56										
	58										
18	60										
19	62										
	64										
20	66										
	68										
21	70										
	72										
22	74										
23	76										
	78										
24	80										
25	82										
	84										
26	86										
	88										
27	90										
	92										
28	94										
29	96										
	98										
30											

DRAWN: AR

Harden Environmental Services Ltd.

CHECKED: SD

PROJECT: 1728

MW3

LOCATION: 1922 Witmer Rd

BORING DATE: April 10, 2017 DATUM: G.S. 371.06 masl DIP: 90 LOGGED: TG

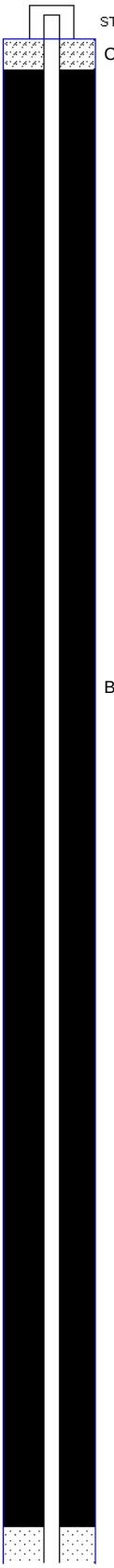
DEPTH SCALE METRES	DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	DEPTH B.G.S. (m)
			371.06		
0	0	Auger	Topsoil		0
					0.3
	2				
1	4				
	6				
2	8		Brown Sand		
	10				
3	12				
4	14				
					4.57
5	16				
	18				
6	20				
	22				
7	24				
	26				
8	28				
	30				
9	32		Sand and Gravel		
10	34				
	36				
11	38				
	40				
12	42				
13	44				
	46				
14	48				
15	50		Continued on next page		

SAMPLES: ID | TYPE | RECOVERY (%) | "N" VALUE

CONCENTRATION (%): LEL ◆ MOISTURE CONTENT ● GAS CONCENTRATION ■ (0 20 40 60 80 100)

INSTALLATION INFORMATION

MW3



DRAWN: AR

Harden Environmental Services Ltd.

CHECKED: SD

PROJECT: 1728

MW3

LOCATION: 1922 Witmer Rd

BORING DATE: April 10, 2017 DATUM: G.S. 371.06 masl DIP: 90 LOGGED: TG

DEPTH SCALE METRES	DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	DEPTH B.G.S. (m)	SAMPLES ID	SAMPLES TYPE	SAMPLES RECOVERY (%)	SAMPLES "N" VALUE	CONCENTRATION (%) LEL / MOISTURE CONTENT / GAS CONCENTRATION (0 20 40 60 80 100)	INSTALLATION INFORMATION
15	50	Auger	Sand and Gravel								MW3
16	52										15.73m, June 7, 2017
16	54										Sand 14.63 to 18.29m
17	56										SCREEN 15.24m TO 18.29m
17	58										
18	60		END OF HOLE @18.29m		18.29						END OF HOLE
19	62										
19	64										
20	66										
20	68										
21	70										
22	72										
22	74										
23	76										
23	78										
24	80										
25	82										
25	84										
26	86										
26	88										
27	90										
28	92										
28	94										
29	96										
29	98										
30											

DRAWN: AR

Harden Environmental Services Ltd.

CHECKED: SD

PROJECT: 1728

MW4

LOCATION: 1922 Witmer Rd

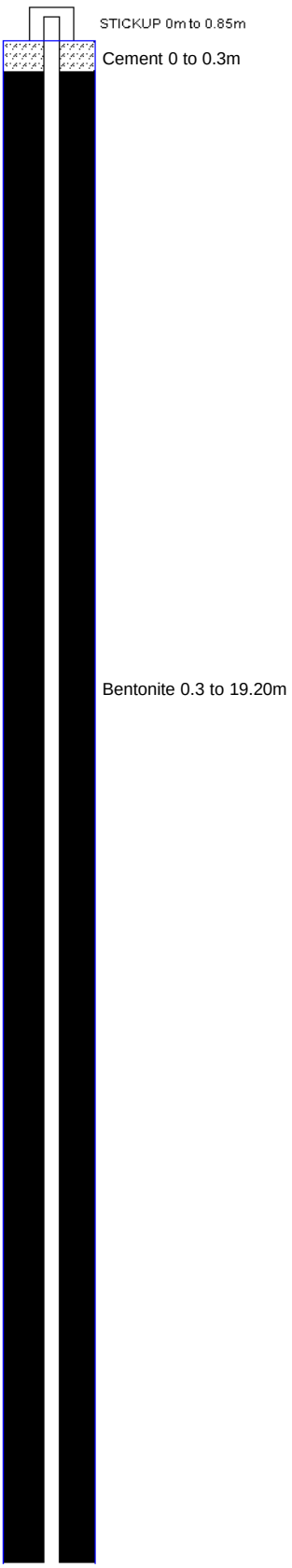
BORING DATE: April 10, 2017 DATUM: G.S. 374.43 masl DIP: 90 LOGGED: TG

DEPTH SCALE METRES	DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	DEPTH B.G.S. (m)
			374.43		
0	0	Auger	Topsoil		0
					0.3
			Brown Sand		
					9.14
			Sand and Gravel		
			Continued on next page		

SAMPLES: ID | TYPE | RECOVERY (%) | "N" VALUE

CONCENTRATION (%): LEL ◆ MOISTURE CONTENT ● GAS CONCENTRATION ■ (0 20 40 60 80 100)

INSTALLATION INFORMATION



DRAWN: AR

Harden Environmental Services Ltd.

CHECKED: SD

PROJECT: 1728

MW4

LOCATION: 1922 Witmer Rd

BORING DATE: April 10, 2017 DATUM: G.S. 374.43 masl DIP: 90 LOGGED: TG

DEPTH SCALE METRES	DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	DEPTH B.G.S. (m)	SAMPLES ID	SAMPLES TYPE	SAMPLES RECOVERY (%)	SAMPLES "N" VALUE
15	50	Auger	Sand and Gravel						
16	52								
17	54								
18	56								
19	58								
20	60								
21	62								
22	64								
23	66								
24	68								
25	70								
26	72								
27	74								
28	76								
29	78								
30	80								
	82								
	84								
	86								
	88								
	90								
	92								
	94								
	96								
	98		END OF HOLE @ 22.86m		22.86				

CONCENTRATION (%)

LEL ◆

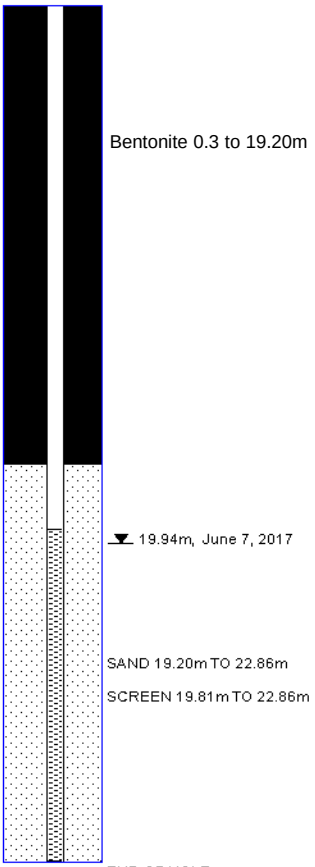
MOISTURE CONTENT ●

GAS CONCENTRATION ■

0 20 40 60 80 100

INSTALLATION INFORMATION

MW4



DRAWN: AR

Harden Environmental Services Ltd.

CHECKED: SD

CHUNG & VANDER DOELEN ENGINEERING LTD.

Borehole No. MW5

Client: **Tri City Lands**

Project: **Phase II Environmental Site Assessment**

Location: **1894 & 1922 Witmer Road, Petersburg, Ontario**

EQUIPMENT DATA

Machine: **CME-75**
Method: **Hollow Stem Auger**
Size: **107 mm I.D.**
Date: **Jul 04 / 17** TO **Jul 04 / 17**

Ground Elevation: **369.49**

ELEV./ DEPTH (m)	DESCRIPTION	SAMPLE ID	TYPE	N-VALUE
	TOPSOIL	1-1	SS	11
0.61	sand, trace silt, rootlets, organics, brown, moist	1-2	SS	2
	loose to compact, brown SAND fine to medium sand, trace gravel	1-3	SS	10
		1-4	SS	37
	dry to saturated	1-5	SS	31
		1-6	SS	41
		1-7	SS	38
		1-8	SS	38
19.81	End of Borehole			

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

REMARKS

Stickup 0.86m

steel monument casing set in concrete

bentonite seal

50 mm I.D. PVC riser

water level at 17.45 m depth on July 5, 2017

3.0 m long, 50 mm I.D. PVC screen with sandpack

PROJECT: 1728

SG1

LOCATION: 1922 Witmer Rd

BORING DATE: June 7, 2017 DATUM: G.S. 354.05 masl DIP: 90 LOGGED: AR

DEPTH SCALE METRES	DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	DEPTH B.G.S. (m)	SAMPLES ID	SAMPLES TYPE	SAMPLES RECOVERY (%)	SAMPLES "N" VALUE
0	0	Hand Auger	354.05						
			Black Organics		0				
	2		Brown Fine Sand		0.63				
1	4		END OF HOLE @1.07m		1.07				
	6								
2	8								
3	10								
	12								
4	14								
5	16								
	18								
6	20								
	22								
7	24								
8	26								
	28								
9	30								
	32								
10	34								
11	36								
	38								
12	40								
	42								
13	44								
	46								
14	48								
15	50								

CONCENTRATION (%)

LEL ◆

MOISTURE CONTENT ●

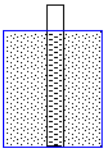
GAS CONCENTRATION ■

0 20 40 60 80 100

INSTALLATION INFORMATION

SG1

STICKUP 0m to 1.29m



-0.16m June 7, 2017

CAVED MATERIAL 0m TO 1.07m

Screen -0.45 to 1.07m

END OF HOLE

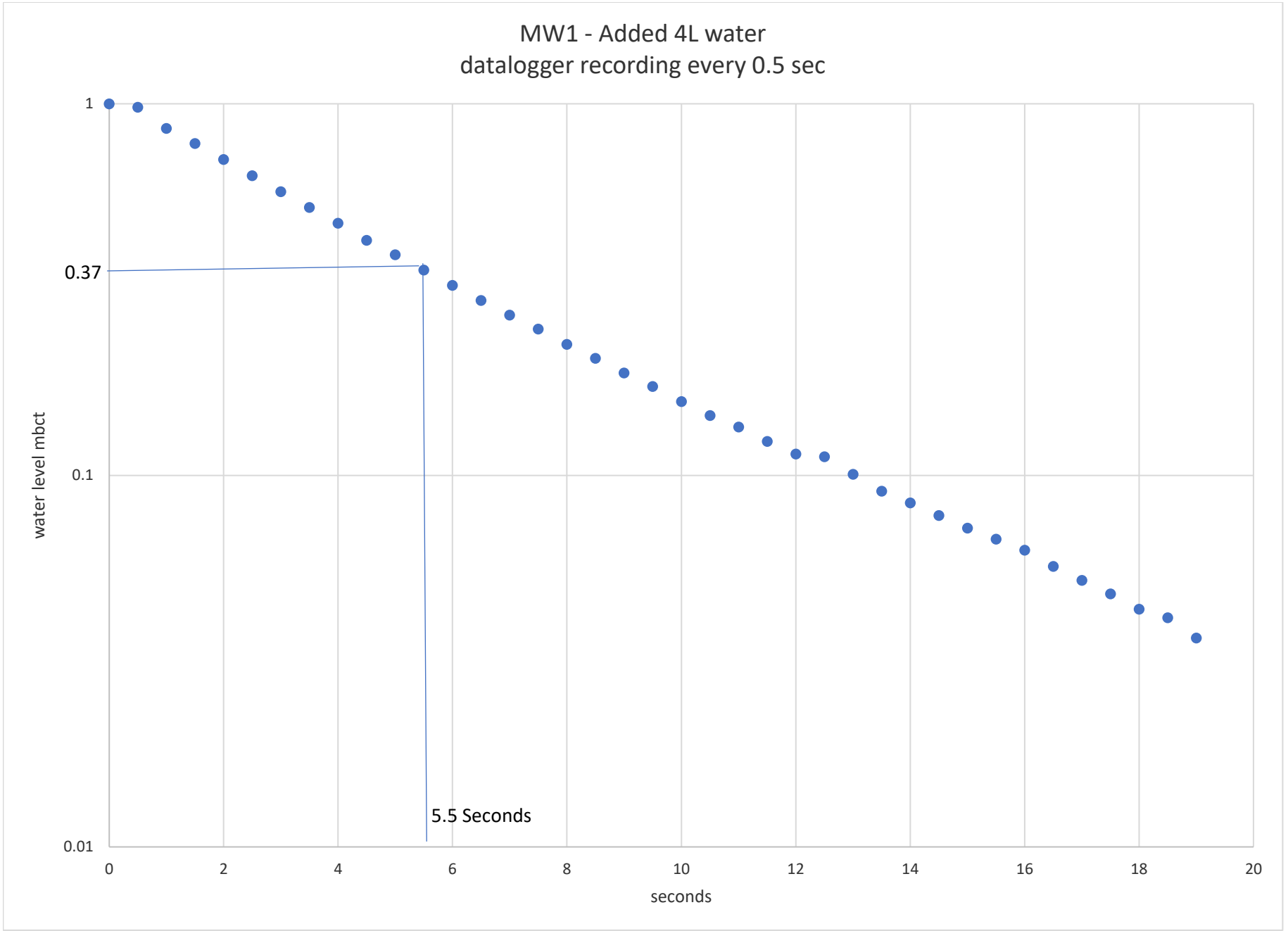
DRAWN: AR

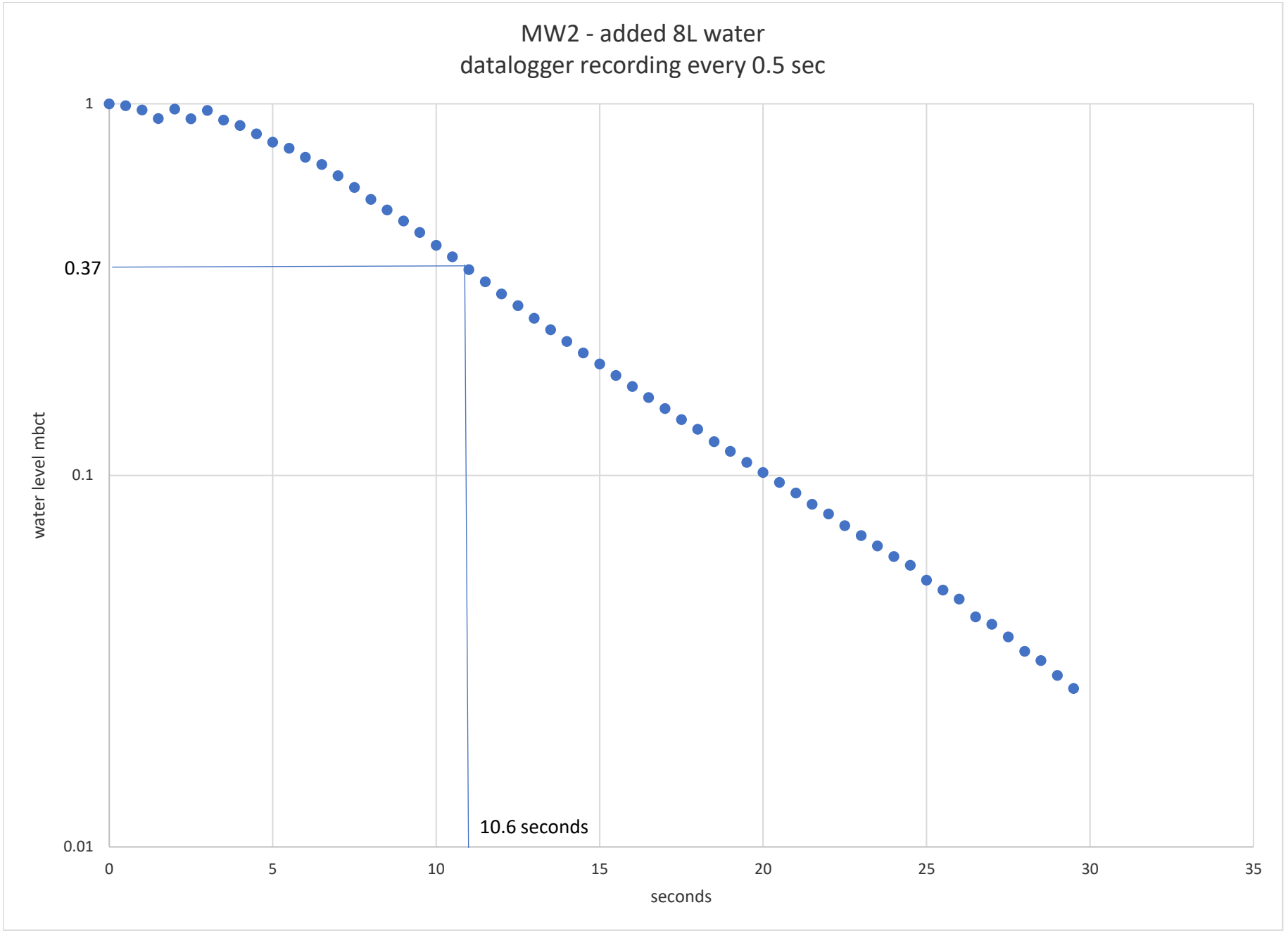
Harden Environmental Services Ltd.

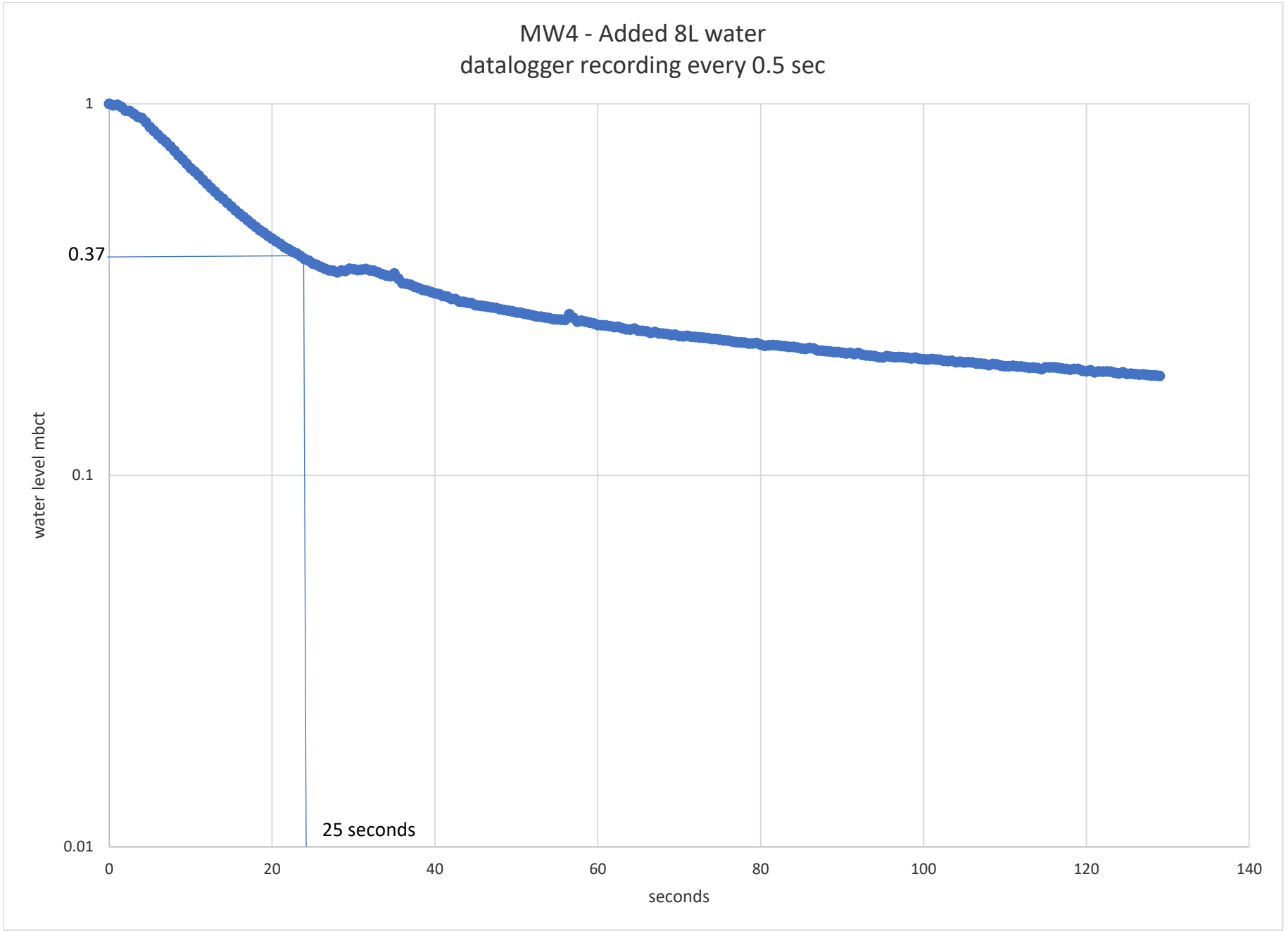
CHECKED: SD

Appendix C

Hydraulic Testing


MW1 - Added 4L water
datalogger recording every 0.5 sec
water level mbct
1
0.37
0.1
0.01
5.5 Seconds
0
2
4
6
8
10
12
14
16
18
20
seconds


MW2 - added 8L water
datalogger recording every 0.5 sec
water level mbct
1
0.37
0.1
0.01
10.6 seconds
0
5
10
15
20
25
30
35
seconds


MW4 - Added 8L water
datalogger recording every 0.5 sec
water level mbct
1
0.37
0.1
0.01
25 seconds
0
20
40
60
80
100
120
140
seconds

Appendix D

Water Quality Results

Maxxam
A Bureau Veritas Group Company

Your Project #: 1728
Site Location: HALLMAN
Your C.O.C. #: N/A

Attention: Allan Rodie

Harden Environmental
4622 Nassagaweya-Puslinch Twnl
Moffat, ON
CANADA L0P 1J0

Report Date: 2019/04/02
Report #: R5653382
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B978077
Received: 2019/03/26, 13:53

Sample Matrix: Water
Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Alkalinity	5	N/A	2019/03/28	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	5	N/A	2019/03/29	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	4	N/A	2019/03/29	CAM SOP-00463	EPA 325.2 m
Chloride by Automated Colourimetry	1	N/A	2019/04/01	CAM SOP-00463	EPA 325.2 m
Colour	5	N/A	2019/03/29	CAM SOP-00412	SM 23 2120C m
Conductivity	5	N/A	2019/03/28	CAM SOP-00414	SM 23 2510 m
Dissolved Organic Carbon (DOC) (1)	5	N/A	2019/03/28	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	5	N/A	2019/04/01	CAM SOP 00102/00408/00447	SM 2340 B
Dissolved Metals by ICPMS	5	N/A	2019/04/01	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	5	N/A	2019/04/01		
Anion and Cation Sum	5	N/A	2019/04/01		
Total Ammonia-N	5	N/A	2019/03/29	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	5	N/A	2019/03/28	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	5	2019/03/27	2019/03/28	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	4	N/A	2019/03/29	CAM SOP-00461	EPA 365.1 m
Orthophosphate	1	N/A	2019/04/01	CAM SOP-00461	EPA 365.1 m
Sat. pH and Langelier Index (@ 20C)	5	N/A	2019/04/01		
Sat. pH and Langelier Index (@ 4C)	5	N/A	2019/04/01		
Sulphate by Automated Colourimetry	4	N/A	2019/03/29	CAM SOP-00464	EPA 375.4 m
Sulphate by Automated Colourimetry	1	N/A	2019/04/01	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	5	N/A	2019/04/01		
Total Kjeldahl Nitrogen in Water	5	2019/03/28	2019/03/28	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric)	5	2019/03/28	2019/03/28	CAM SOP-00407	SM 23 4500 P B H m
Turbidity	5	N/A	2019/03/27	CAM SOP-00417	SM 23 2130 B m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Your Project #: 1728
Site Location: HALLMAN
Your C.O.C. #: N/A

Attention: Allan Rodie

Harden Environmental
4622 Nassagaweya-Puslinch Twnl
Moffat, ON
CANADA L0P 1J0

Report Date: 2019/04/02
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MAXXAM JOB #: B978077
Received: 2019/03/26, 13:53

indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.

(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Ashton Gibson, Project Manager
Email: AGibson@maxxam.ca
Phone# (905) 817-5700

==========

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Maxxam Job #: B978077
Report Date: 2019/04/02

Harden Environmental
Client Project #: 1728
Site Location: HALLMAN
Sampler Initials: AR

RESULTS OF ANALYSES OF WATER

Maxxam ID		JHE173			JHE174			JHE175			
Sampling Date		2019/03/26 07:55			2019/03/26 09:05			2019/03/26 10:25			
COC Number		N/A			N/A			N/A			
	UNITS	**MW5**	**RDL**	**MDL**	**MW4**	**RDL**	**MDL**	**MW3**	**RDL**	**MDL**	**QC Batch**
Calculated Parameters											
Anion Sum	me/L	10.6	N/A	N/A	5.01	N/A	N/A	7.70	N/A	N/A	6037275
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	430	1.0	0.20	220	1.0	0.20	270	1.0	0.20	6037271
Calculated TDS	mg/L	610	1.0	0.20	270	1.0	0.20	420	1.0	0.20	6037278
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.7	1.0	0.20	1.7	1.0	0.20	1.9	1.0	0.20	6037271
Cation Sum	me/L	12.3	N/A	N/A	5.09	N/A	N/A	7.45	N/A	N/A	6037275
Hardness (CaCO3)	mg/L	570	1.0	1.0	240	1.0	1.0	300	1.0	1.0	6037273
Ion Balance (% Difference)	%	7.27	N/A	N/A	0.770	N/A	N/A	1.60	N/A	N/A	6037274
Langelier Index (@ 20C)	N/A	1.02			0.711			0.800			6037276
Langelier Index (@ 4C)	N/A	0.775			0.462			0.552			6037277
Saturation pH (@ 20C)	N/A	6.61			7.22			7.07			6037276
Saturation pH (@ 4C)	N/A	6.85			7.46			7.32			6037277
Inorganics											
Total Ammonia-N	mg/L	0.12	0.050	0.0080	0.052	0.050	0.0080	0.051	0.050	0.0080	6041931
Colour	TCU	ND	2	N/A	ND	2	N/A	ND	2	N/A	6039297
Conductivity	umho/cm	970	1.0	0.20	480	1.0	0.20	760	1.0	0.20	6039996
Total Kjeldahl Nitrogen (TKN)	mg/L	ND (1)	0.50	0.30	ND (1)	0.20	0.12	0.21	0.20	0.12	6041690
Dissolved Organic Carbon	mg/L	1.8	0.50	0.070	0.61	0.50	0.070	0.73	0.50	0.070	6039898
Orthophosphate (P)	mg/L	ND	0.010	0.0050	ND	0.010	0.0050	ND	0.010	0.0050	6042471
pH	pH	7.63			7.93			7.87			6039994
Total Phosphorus	mg/L	0.40	0.10	0.015	0.28	0.040	0.0060	0.58	0.10	0.015	6041602
Dissolved Sulphate (SO4)	mg/L	41	1.0	0.10	6.4	1.0	0.10	18	1.0	0.10	6042465
Turbidity	NTU	230	0.1	0.1	630	0.1	0.1	700	0.1	0.1	6037617
Alkalinity (Total as CaCO3)	mg/L	430	1.0	0.20	220	1.0	0.20	270	1.0	0.20	6039993
Dissolved Chloride (Cl-)	mg/L	14	1.0	0.30	5.2	1.0	0.30	42	1.0	0.30	6042463
Nitrite (N)	mg/L	0.022	0.010	0.0020	ND	0.010	0.0020	ND	0.010	0.0020	6039954
Nitrate (N)	mg/L	11.5	0.10	0.010	4.47	0.10	0.010	9.44	0.10	0.010	6039954
Nitrate + Nitrite (N)	mg/L	11.5	0.10	0.010	4.47	0.10	0.010	9.44	0.10	0.010	6039954

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable
ND = Not detected
(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B978077
Report Date: 2019/04/02

Harden Environmental
Client Project #: 1728
Site Location: HALLMAN
Sampler Initials: AR

RESULTS OF ANALYSES OF WATER

Maxxam ID		JHE176				JHE177			
Sampling Date		2019/03/26 11:30				2019/03/26 12:20			
COC Number		N/A				N/A			
	UNITS	**MW2**	**RDL**	**MDL**	**QC Batch**	**MW1**	**RDL**	**MDL**	**QC Batch**
Calculated Parameters									
Anion Sum	me/L	7.34	N/A	N/A	6037275	2.11	N/A	N/A	6037275
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	260	1.0	0.20	6037271	96	1.0	0.20	6037271
Calculated TDS	mg/L	410	1.0	0.20	6037278	110	1.0	0.20	6037278
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.6	1.0	0.20	6037271	ND	1.0	0.20	6037271
Cation Sum	me/L	7.28	N/A	N/A	6037275	2.15	N/A	N/A	6037275
Hardness (CaCO3)	mg/L	310	1.0	1.0	6037273	98	1.0	1.0	6037273
Ion Balance (% Difference)	%	0.410	N/A	N/A	6037274	NC	N/A	N/A	6037274
Langelier Index (@ 20C)	N/A	0.760			6037276	0.109			6037276
Langelier Index (@ 4C)	N/A	0.512			6037277	-0.142			6037277
Saturation pH (@ 20C)	N/A	7.07			6037276	7.88			6037276
Saturation pH (@ 4C)	N/A	7.32			6037277	8.13			6037277
Inorganics									
Total Ammonia-N	mg/L	ND	0.050	0.0080	6041931	0.053	0.050	0.0080	6041931
Colour	TCU	ND	2	N/A	6039297	14	2	N/A	6039297
Conductivity	umho/cm	720	1.0	0.20	6039996	210	1.0	0.20	6039996
Total Kjeldahl Nitrogen (TKN)	mg/L	ND (1)	0.50	0.30	6041690	0.48	0.10	0.060	6041690
Dissolved Organic Carbon	mg/L	0.63	0.50	0.070	6039898	5.6	0.50	0.070	6039898
Orthophosphate (P)	mg/L	ND	0.010	0.0050	6042471	0.21	0.010	0.0050	6044683
pH	pH	7.83			6039994	7.99			6039994
Total Phosphorus	mg/L	4.8	0.20	0.030	6041602	0.29	0.020	0.0030	6041602
Dissolved Sulphate (SO4)	mg/L	12	1.0	0.10	6042465	ND	1.0	0.10	6044684
Turbidity	NTU	9900	0.5	0.5	6037617	30	0.1	0.1	6037617
Alkalinity (Total as CaCO3)	mg/L	260	1.0	0.20	6039993	97	1.0	0.20	6039993
Dissolved Chloride (Cl-)	mg/L	31	1.0	0.30	6042463	5.5	1.0	0.30	6044679
Nitrite (N)	mg/L	ND	0.010	0.0020	6039954	ND	0.010	0.0020	6039960
Nitrate (N)	mg/L	14.6	0.10	0.010	6039954	ND	0.10	0.010	6039960
Nitrate + Nitrite (N)	mg/L	14.6	0.10	0.010	6039954	ND	0.10	0.010	6039960

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable
ND = Not detected
(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

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Maxxam Job #: B978077
Report Date: 2019/04/02

Harden Environmental
Client Project #: 1728
Site Location: HALLMAN
Sampler Initials: AR

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		JHE173	JHE174	JHE175	JHE176	JHE177			
Sampling Date		2019/03/26 07:55	2019/03/26 09:05	2019/03/26 10:25	2019/03/26 11:30	2019/03/26 12:20			
COC Number		N/A	N/A	N/A	N/A	N/A			
	UNITS	**MW5**	**MW4**	**MW3**	**MW2**	**MW1**	**RDL**	**MDL**	**QC Batch**
Metals									
Dissolved Aluminum (Al)	mg/L	ND	ND	ND	ND	0.0052	0.0050	0.0050	6041933
Dissolved Antimony (Sb)	mg/L	ND	ND	ND	ND	ND	0.00050	0.00050	6041933
Dissolved Arsenic (As)	mg/L	ND	ND	ND	ND	ND	0.0010	0.0010	6041933
Dissolved Barium (Ba)	mg/L	0.068	0.033	0.052	0.11	0.016	0.0020	0.0020	6041933
Dissolved Beryllium (Be)	mg/L	ND	ND	ND	ND	ND	0.00050	0.00050	6041933
Dissolved Bismuth (Bi)	mg/L	ND	ND	ND	ND	ND	0.0010	0.0010	6041933
Dissolved Boron (B)	mg/L	0.026	0.010	0.024	0.015	0.011	0.010	0.010	6041933
Dissolved Cadmium (Cd)	mg/L	ND	ND	ND	ND	ND	0.00010	0.00010	6041933
Dissolved Calcium (Ca)	mg/L	180	71	87	93	30	0.20	0.20	6041933
Dissolved Chromium (Cr)	mg/L	ND	ND	ND	ND	ND	0.0050	0.0050	6041933
Dissolved Cobalt (Co)	mg/L	0.0015	ND	ND	ND	ND	0.00050	0.00050	6041933
Dissolved Copper (Cu)	mg/L	0.0022	ND	0.0010	ND	0.0072	0.0010	0.0010	6041933
Dissolved Iron (Fe)	mg/L	ND	ND	ND	ND	ND	0.10	0.050	6041933
Dissolved Lead (Pb)	mg/L	ND	ND	ND	ND	ND	0.00050	0.00050	6041933
Dissolved Magnesium (Mg)	mg/L	31	16	19	20	5.4	0.050	0.050	6041933
Dissolved Manganese (Mn)	mg/L	0.45	ND	ND	ND	0.019	0.0020	0.0020	6041933
Dissolved Molybdenum (Mo)	mg/L	ND	ND	ND	ND	0.00063	0.00050	0.00050	6041933
Dissolved Nickel (Ni)	mg/L	0.0019	ND	ND	ND	ND	0.0010	0.0010	6041933
Dissolved Phosphorus (P)	mg/L	ND	ND	ND	ND	0.27	0.10	0.050	6041933
Dissolved Potassium (K)	mg/L	19	0.75	1.3	2.1	4.3	0.20	0.20	6041933
Dissolved Selenium (Se)	mg/L	ND	ND	ND	ND	ND	0.0020	0.0020	6041933
Dissolved Silicon (Si)	mg/L	4.5	4.5	4.7	4.6	0.82	0.050	0.050	6041933
Dissolved Silver (Ag)	mg/L	ND	ND	ND	ND	ND	0.00010	0.00010	6041933
Dissolved Sodium (Na)	mg/L	7.2	4.3	35	22	1.8	0.10	0.10	6041933
Dissolved Strontium (Sr)	mg/L	0.21	0.11	0.13	0.13	0.035	0.0010	0.0010	6041933
Dissolved Thallium (Tl)	mg/L	0.000051	ND	ND	ND	ND	0.000050	0.000050	6041933
Dissolved Titanium (Ti)	mg/L	ND	ND	ND	ND	ND	0.0050	0.0050	6041933
Dissolved Uranium (U)	mg/L	0.00085	0.00030	0.00024	0.00032	ND	0.00010	0.00010	6041933
Dissolved Vanadium (V)	mg/L	ND	ND	ND	ND	0.00065	0.00050	0.00050	6041933
Dissolved Zinc (Zn)	mg/L	0.0069	ND	ND	ND	ND	0.0050	0.0050	6041933

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not detected

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Maxxam Job #: B978077
Report Date: 2019/04/02

Harden Environmental
Client Project #: 1728
Site Location: HALLMAN
Sampler Initials: AR

TEST SUMMARY

Maxxam ID: JHE173
Sample ID: MW5
Matrix: Water

Collected: 2019/03/26
Shipped:
Received: 2019/03/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	6039993	N/A	2019/03/28	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	6037271	N/A	2019/03/29	Automated Statchk
Chloride by Automated Colourimetry	KONE	6042463	N/A	2019/03/29	Deonarine Ramnarine
Colour	SPEC	6039297	N/A	2019/03/29	Viorica Rotaru
Conductivity	AT	6039996	N/A	2019/03/28	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	6039898	N/A	2019/03/28	Mandeep Kaur
Hardness (calculated as CaCO3)		6037273	N/A	2019/04/01	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	6041933	N/A	2019/04/01	Thao Nguyen
Ion Balance (% Difference)	CALC	6037274	N/A	2019/04/01	Automated Statchk
Anion and Cation Sum	CALC	6037275	N/A	2019/04/01	Automated Statchk
Total Ammonia-N	LACH/NH4	6041931	N/A	2019/03/29	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6039954	N/A	2019/03/28	Chandra Nandlal
pH	AT	6039994	2019/03/27	2019/03/28	Surinder Rai
Orthophosphate	KONE	6042471	N/A	2019/03/29	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	6037276	N/A	2019/04/01	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	6037277	N/A	2019/04/01	Automated Statchk
Sulphate by Automated Colourimetry	KONE	6042465	N/A	2019/03/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	6037278	N/A	2019/04/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	6041690	2019/03/28	2019/03/28	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	6041602	2019/03/28	2019/03/28	Amanpreet Sappal
Turbidity	AT	6037617	N/A	2019/03/27	Kazzandra Adeva

Maxxam ID: JHE174
Sample ID: MW4
Matrix: Water

Collected: 2019/03/26
Shipped:
Received: 2019/03/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	6039993	N/A	2019/03/28	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	6037271	N/A	2019/03/29	Automated Statchk
Chloride by Automated Colourimetry	KONE	6042463	N/A	2019/03/29	Deonarine Ramnarine
Colour	SPEC	6039297	N/A	2019/03/29	Viorica Rotaru
Conductivity	AT	6039996	N/A	2019/03/28	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	6039898	N/A	2019/03/28	Mandeep Kaur
Hardness (calculated as CaCO3)		6037273	N/A	2019/04/01	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	6041933	N/A	2019/04/01	Thao Nguyen
Ion Balance (% Difference)	CALC	6037274	N/A	2019/04/01	Automated Statchk
Anion and Cation Sum	CALC	6037275	N/A	2019/04/01	Automated Statchk
Total Ammonia-N	LACH/NH4	6041931	N/A	2019/03/29	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6039954	N/A	2019/03/28	Chandra Nandlal
pH	AT	6039994	2019/03/27	2019/03/28	Surinder Rai
Orthophosphate	KONE	6042471	N/A	2019/03/29	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	6037276	N/A	2019/04/01	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	6037277	N/A	2019/04/01	Automated Statchk
Sulphate by Automated Colourimetry	KONE	6042465	N/A	2019/03/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	6037278	N/A	2019/04/01	Automated Statchk

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Maxxam Job #: B978077
Report Date: 2019/04/02

Harden Environmental
Client Project #: 1728
Site Location: HALLMAN
Sampler Initials: AR

TEST SUMMARY

Maxxam ID: JHE174
Sample ID: MW4
Matrix: Water

Collected: 2019/03/26
Shipped:
Received: 2019/03/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Kjeldahl Nitrogen in Water	SKAL	6041690	2019/03/28	2019/03/28	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	6041602	2019/03/28	2019/03/28	Amanpreet Sappal
Turbidity	AT	6037617	N/A	2019/03/27	Kazzandra Adeva

Maxxam ID: JHE174 Dup
Sample ID: MW4
Matrix: Water

Collected: 2019/03/26
Shipped:
Received: 2019/03/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Metals by ICPMS	ICP/MS	6041933	N/A	2019/04/01	Thao Nguyen

Maxxam ID: JHE175
Sample ID: MW3
Matrix: Water

Collected: 2019/03/26
Shipped:
Received: 2019/03/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	6039993	N/A	2019/03/28	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	6037271	N/A	2019/03/29	Automated Statchk
Chloride by Automated Colourimetry	KONE	6042463	N/A	2019/03/29	Deonarine Ramnarine
Colour	SPEC	6039297	N/A	2019/03/29	Viorica Rotaru
Conductivity	AT	6039996	N/A	2019/03/28	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	6039898	N/A	2019/03/28	Mandeep Kaur
Hardness (calculated as CaCO3)		6037273	N/A	2019/04/01	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	6041933	N/A	2019/04/01	Thao Nguyen
Ion Balance (% Difference)	CALC	6037274	N/A	2019/04/01	Automated Statchk
Anion and Cation Sum	CALC	6037275	N/A	2019/04/01	Automated Statchk
Total Ammonia-N	LACH/NH4	6041931	N/A	2019/03/29	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6039954	N/A	2019/03/28	Chandra Nandlal
pH	AT	6039994	2019/03/27	2019/03/28	Surinder Rai
Orthophosphate	KONE	6042471	N/A	2019/03/29	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	6037276	N/A	2019/04/01	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	6037277	N/A	2019/04/01	Automated Statchk
Sulphate by Automated Colourimetry	KONE	6042465	N/A	2019/03/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	6037278	N/A	2019/04/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	6041690	2019/03/28	2019/03/28	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	6041602	2019/03/28	2019/03/28	Amanpreet Sappal
Turbidity	AT	6037617	N/A	2019/03/27	Kazzandra Adeva

Maxxam ID: JHE176
Sample ID: MW2
Matrix: Water

Collected: 2019/03/26
Shipped:
Received: 2019/03/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	6039993	N/A	2019/03/28	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	6037271	N/A	2019/03/29	Automated Statchk

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Maxxam Job #: B978077
Report Date: 2019/04/02

Harden Environmental
Client Project #: 1728
Site Location: HALLMAN
Sampler Initials: AR

TEST SUMMARY

Maxxam ID: JHE176
Sample ID: MW2
Matrix: Water

Collected: 2019/03/26
Shipped:
Received: 2019/03/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	6042463	N/A	2019/03/29	Deonarine Ramnarine
Colour	SPEC	6039297	N/A	2019/03/29	Viorica Rotaru
Conductivity	AT	6039996	N/A	2019/03/28	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	6039898	N/A	2019/03/28	Mandeep Kaur
Hardness (calculated as CaCO3)		6037273	N/A	2019/04/01	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	6041933	N/A	2019/04/01	Thao Nguyen
Ion Balance (% Difference)	CALC	6037274	N/A	2019/04/01	Automated Statchk
Anion and Cation Sum	CALC	6037275	N/A	2019/04/01	Automated Statchk
Total Ammonia-N	LACH/NH4	6041931	N/A	2019/03/29	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6039954	N/A	2019/03/28	Chandra Nandlal
pH	AT	6039994	2019/03/27	2019/03/28	Surinder Rai
Orthophosphate	KONE	6042471	N/A	2019/03/29	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	6037276	N/A	2019/04/01	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	6037277	N/A	2019/04/01	Automated Statchk
Sulphate by Automated Colourimetry	KONE	6042465	N/A	2019/03/29	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	6037278	N/A	2019/04/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	6041690	2019/03/28	2019/03/28	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	6041602	2019/03/28	2019/03/28	Amanpreet Sappal
Turbidity	AT	6037617	N/A	2019/03/27	Kazzandra Adeva

Maxxam ID: JHE177
Sample ID: MW1
Matrix: Water

Collected: 2019/03/26
Shipped:
Received: 2019/03/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	6039993	N/A	2019/03/28	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	6037271	N/A	2019/03/29	Automated Statchk
Chloride by Automated Colourimetry	KONE	6044679	N/A	2019/04/01	Deonarine Ramnarine
Colour	SPEC	6039297	N/A	2019/03/29	Viorica Rotaru
Conductivity	AT	6039996	N/A	2019/03/28	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	6039898	N/A	2019/03/28	Mandeep Kaur
Hardness (calculated as CaCO3)		6037273	N/A	2019/04/01	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	6041933	N/A	2019/04/01	Thao Nguyen
Ion Balance (% Difference)	CALC	6037274	N/A	2019/04/01	Automated Statchk
Anion and Cation Sum	CALC	6037275	N/A	2019/04/01	Automated Statchk
Total Ammonia-N	LACH/NH4	6041931	N/A	2019/03/29	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6039960	N/A	2019/03/28	Chandra Nandlal
pH	AT	6039994	2019/03/27	2019/03/28	Surinder Rai
Orthophosphate	KONE	6044683	N/A	2019/04/01	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	6037276	N/A	2019/04/01	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	6037277	N/A	2019/04/01	Automated Statchk
Sulphate by Automated Colourimetry	KONE	6044684	N/A	2019/04/01	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	6037278	N/A	2019/04/01	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	6041690	2019/03/28	2019/03/28	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	6041602	2019/03/28	2019/03/28	Amanpreet Sappal

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Maxxam Job #: B978077
Report Date: 2019/04/02

Harden Environmental
Client Project #: 1728
Site Location: HALLMAN
Sampler Initials: AR

TEST SUMMARY

Maxxam ID: JHE177
Sample ID: MW1
Matrix: Water

Collected: 2019/03/26
Shipped:
Received: 2019/03/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Turbidity	AT	6037617	N/A	2019/03/27	Kazzandra Adeva

Maxxam ID: JHE177 Dup
Sample ID: MW1
Matrix: Water

Collected: 2019/03/26
Shipped:
Received: 2019/03/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	6044679	N/A	2019/04/01	Deonarine Ramnarine
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6039960	N/A	2019/03/28	Chandra Nandlal
Orthophosphate	KONE	6044683	N/A	2019/04/01	Alina Dobreanu
Sulphate by Automated Colourimetry	KONE	6044684	N/A	2019/04/01	Alina Dobreanu

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GENERAL COMMENTS

Results relate only to the items tested.

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Maxxam Job #: B978077
Report Date: 2019/04/02

Harden Environmental
Client Project #: 1728
Site Location: HALLMAN
Sampler Initials: AR

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
6037617	KAD	Spiked Blank	Turbidity	2019/03/27		100	%	85 - 115
6037617	KAD	Method Blank	Turbidity	2019/03/27	ND, RDL=0.1		NTU	
6037617	KAD	RPD	Turbidity	2019/03/27	1.2		%	20
6039297	VRO	Spiked Blank	Colour	2019/03/29		99	%	80 - 120
6039297	VRO	Method Blank	Colour	2019/03/29	ND,RDL=2		TCU	
6039297	VRO	RPD	Colour	2019/03/29	NC		%	25
6039898	KRM	Matrix Spike	Dissolved Organic Carbon	2019/03/27		95	%	80 - 120
6039898	KRM	Spiked Blank	Dissolved Organic Carbon	2019/03/27		100	%	80 - 120
6039898	KRM	Method Blank	Dissolved Organic Carbon	2019/03/27	ND, RDL=0.50		mg/L	
6039898	KRM	RPD	Dissolved Organic Carbon	2019/03/27	2.2		%	20
6039954	C_N	Matrix Spike	Nitrite (N)	2019/03/28		114	%	80 - 120
			Nitrate (N)	2019/03/28		118	%	80 - 120
6039954	C_N	Spiked Blank	Nitrite (N)	2019/03/28		102	%	80 - 120
			Nitrate (N)	2019/03/28		104	%	80 - 120
6039954	C_N	Method Blank	Nitrite (N)	2019/03/28	ND, RDL=0.010		mg/L	
			Nitrate (N)	2019/03/28	ND, RDL=0.10		mg/L	
6039954	C_N	RPD	Nitrite (N)	2019/03/28	0.54		%	20
			Nitrate (N)	2019/03/28	0.68		%	20
6039960	C_N	Matrix Spike [JHE177-01]	Nitrite (N)	2019/03/28		105	%	80 - 120
			Nitrate (N)	2019/03/28		105	%	80 - 120
6039960	C_N	Spiked Blank	Nitrite (N)	2019/03/28		98	%	80 - 120
			Nitrate (N)	2019/03/28		99	%	80 - 120
6039960	C_N	Method Blank	Nitrite (N)	2019/03/28	ND, RDL=0.010		mg/L	
			Nitrate (N)	2019/03/28	ND, RDL=0.10		mg/L	
6039960	C_N	RPD [JHE177-01]	Nitrite (N)	2019/03/28	NC		%	20
			Nitrate (N)	2019/03/28	NC		%	20
6039993	SAU	Spiked Blank	Alkalinity (Total as CaCO3)	2019/03/28		95	%	85 - 115
6039993	SAU	Method Blank	Alkalinity (Total as CaCO3)	2019/03/28	ND, RDL=1.0		mg/L	
6039993	SAU	RPD	Alkalinity (Total as CaCO3)	2019/03/28	1.0		%	20
6039994	SAU	Spiked Blank	pH	2019/03/28		102	%	98 - 103
6039994	SAU	RPD	pH	2019/03/28	1.6		%	N/A
6039996	SAU	Spiked Blank	Conductivity	2019/03/28		101	%	85 - 115
6039996	SAU	Method Blank	Conductivity	2019/03/28	ND, RDL=1.0		umho/cm	
6039996	SAU	RPD	Conductivity	2019/03/28	0		%	25
6041602	ASP	Matrix Spike	Total Phosphorus	2019/03/28		104	%	80 - 120
6041602	ASP	QC Standard	Total Phosphorus	2019/03/28		101	%	80 - 120
6041602	ASP	Spiked Blank	Total Phosphorus	2019/03/28		99	%	80 - 120
6041602	ASP	Method Blank	Total Phosphorus	2019/03/28	ND, RDL=0.020		mg/L	
6041602	ASP	RPD	Total Phosphorus	2019/03/28	1.0		%	20
6041690	RTY	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2019/03/28		102	%	80 - 120
6041690	RTY	QC Standard	Total Kjeldahl Nitrogen (TKN)	2019/03/28		94	%	80 - 120
6041690	RTY	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2019/03/28		94	%	80 - 120
6041690	RTY	Method Blank	Total Kjeldahl Nitrogen (TKN)	2019/03/28	ND, RDL=0.10		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
6041690	RTY	RPD	Total Kjeldahl Nitrogen (TKN)	2019/03/28	3.4		%	20
6041931	COP	Matrix Spike	Total Ammonia-N	2019/03/29		92	%	75 - 125
6041931	COP	Spiked Blank	Total Ammonia-N	2019/03/29		97	%	80 - 120
6041931	COP	Method Blank	Total Ammonia-N	2019/03/29	ND, RDL=0.050		mg/L	
6041931	COP	RPD	Total Ammonia-N	2019/03/29	10		%	20
6041933	TNG	Matrix Spike [JHE174-04]	Dissolved Aluminum (Al)	2019/04/01		104	%	80 - 120
			Dissolved Antimony (Sb)	2019/04/01		103	%	80 - 120
			Dissolved Arsenic (As)	2019/04/01		99	%	80 - 120
			Dissolved Barium (Ba)	2019/04/01		100	%	80 - 120
			Dissolved Beryllium (Be)	2019/04/01		102	%	80 - 120
			Dissolved Bismuth (Bi)	2019/04/01		92	%	80 - 120
			Dissolved Boron (B)	2019/04/01		99	%	80 - 120
			Dissolved Cadmium (Cd)	2019/04/01		101	%	80 - 120
			Dissolved Calcium (Ca)	2019/04/01		NC	%	80 - 120
			Dissolved Chromium (Cr)	2019/04/01		99	%	80 - 120
			Dissolved Cobalt (Co)	2019/04/01		98	%	80 - 120
			Dissolved Copper (Cu)	2019/04/01		99	%	80 - 120
			Dissolved Iron (Fe)	2019/04/01		98	%	80 - 120
			Dissolved Lead (Pb)	2019/04/01		97	%	80 - 120
			Dissolved Magnesium (Mg)	2019/04/01		95	%	80 - 120
			Dissolved Manganese (Mn)	2019/04/01		100	%	80 - 120
			Dissolved Molybdenum (Mo)	2019/04/01		105	%	80 - 120
			Dissolved Nickel (Ni)	2019/04/01		97	%	80 - 120
			Dissolved Phosphorus (P)	2019/04/01		107	%	80 - 120
			Dissolved Potassium (K)	2019/04/01		99	%	80 - 120
			Dissolved Selenium (Se)	2019/04/01		105	%	80 - 120
			Dissolved Silicon (Si)	2019/04/01		101	%	80 - 120
			Dissolved Silver (Ag)	2019/04/01		99	%	80 - 120
			Dissolved Sodium (Na)	2019/04/01		95	%	80 - 120
			Dissolved Strontium (Sr)	2019/04/01		99	%	80 - 120
			Dissolved Thallium (Tl)	2019/04/01		98	%	80 - 120
			Dissolved Titanium (Ti)	2019/04/01		102	%	80 - 120
			Dissolved Uranium (U)	2019/04/01		95	%	80 - 120
			Dissolved Vanadium (V)	2019/04/01		100	%	80 - 120
			Dissolved Zinc (Zn)	2019/04/01		100	%	80 - 120
6041933	TNG	Spiked Blank	Dissolved Aluminum (Al)	2019/04/01		102	%	80 - 120
			Dissolved Antimony (Sb)	2019/04/01		100	%	80 - 120
			Dissolved Arsenic (As)	2019/04/01		98	%	80 - 120
			Dissolved Barium (Ba)	2019/04/01		99	%	80 - 120
			Dissolved Beryllium (Be)	2019/04/01		99	%	80 - 120
			Dissolved Bismuth (Bi)	2019/04/01		92	%	80 - 120
			Dissolved Boron (B)	2019/04/01		99	%	80 - 120
			Dissolved Cadmium (Cd)	2019/04/01		99	%	80 - 120
			Dissolved Calcium (Ca)	2019/04/01		101	%	80 - 120
			Dissolved Chromium (Cr)	2019/04/01		98	%	80 - 120
			Dissolved Cobalt (Co)	2019/04/01		98	%	80 - 120
			Dissolved Copper (Cu)	2019/04/01		99	%	80 - 120
			Dissolved Iron (Fe)	2019/04/01		96	%	80 - 120
			Dissolved Lead (Pb)	2019/04/01		96	%	80 - 120
			Dissolved Magnesium (Mg)	2019/04/01		96	%	80 - 120
			Dissolved Manganese (Mn)	2019/04/01		97	%	80 - 120
			Dissolved Molybdenum (Mo)	2019/04/01		102	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Nickel (Ni)	2019/04/01		97	%	80 - 120
			Dissolved Phosphorus (P)	2019/04/01		105	%	80 - 120
			Dissolved Potassium (K)	2019/04/01		96	%	80 - 120
			Dissolved Selenium (Se)	2019/04/01		103	%	80 - 120
			Dissolved Silicon (Si)	2019/04/01		98	%	80 - 120
			Dissolved Silver (Ag)	2019/04/01		99	%	80 - 120
			Dissolved Sodium (Na)	2019/04/01		93	%	80 - 120
			Dissolved Strontium (Sr)	2019/04/01		97	%	80 - 120
			Dissolved Thallium (Tl)	2019/04/01		97	%	80 - 120
			Dissolved Titanium (Ti)	2019/04/01		95	%	80 - 120
			Dissolved Uranium (U)	2019/04/01		93	%	80 - 120
			Dissolved Vanadium (V)	2019/04/01		98	%	80 - 120
			Dissolved Zinc (Zn)	2019/04/01		99	%	80 - 120
6041933	TNG	Method Blank	Dissolved Aluminum (Al)	2019/04/01	ND, RDL=0.0050		mg/L	
			Dissolved Antimony (Sb)	2019/04/01	ND, RDL=0.00050		mg/L	
			Dissolved Arsenic (As)	2019/04/01	ND, RDL=0.0010		mg/L	
			Dissolved Barium (Ba)	2019/04/01	ND, RDL=0.0020		mg/L	
			Dissolved Beryllium (Be)	2019/04/01	ND, RDL=0.00050		mg/L	
			Dissolved Bismuth (Bi)	2019/04/01	ND, RDL=0.0010		mg/L	
			Dissolved Boron (B)	2019/04/01	ND, RDL=0.010		mg/L	
			Dissolved Cadmium (Cd)	2019/04/01	ND, RDL=0.00010		mg/L	
			Dissolved Calcium (Ca)	2019/04/01	ND, RDL=0.20		mg/L	
			Dissolved Chromium (Cr)	2019/04/01	ND, RDL=0.0050		mg/L	
			Dissolved Cobalt (Co)	2019/04/01	ND, RDL=0.00050		mg/L	
			Dissolved Copper (Cu)	2019/04/01	ND, RDL=0.0010		mg/L	
			Dissolved Iron (Fe)	2019/04/01	ND, RDL=0.10		mg/L	
			Dissolved Lead (Pb)	2019/04/01	ND, RDL=0.00050		mg/L	
			Dissolved Magnesium (Mg)	2019/04/01	ND, RDL=0.050		mg/L	
			Dissolved Manganese (Mn)	2019/04/01	ND, RDL=0.0020		mg/L	
			Dissolved Molybdenum (Mo)	2019/04/01	ND, RDL=0.00050		mg/L	
			Dissolved Nickel (Ni)	2019/04/01	ND, RDL=0.0010		mg/L	
			Dissolved Phosphorus (P)	2019/04/01	ND, RDL=0.10		mg/L	
			Dissolved Potassium (K)	2019/04/01	ND, RDL=0.20		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Selenium (Se)	2019/04/01	ND, RDL=0.0020		mg/L	
			Dissolved Silicon (Si)	2019/04/01	ND, RDL=0.050		mg/L	
			Dissolved Silver (Ag)	2019/04/01	ND, RDL=0.00010		mg/L	
			Dissolved Sodium (Na)	2019/04/01	ND, RDL=0.10		mg/L	
			Dissolved Strontium (Sr)	2019/04/01	ND, RDL=0.0010		mg/L	
			Dissolved Thallium (Tl)	2019/04/01	ND, RDL=0.000050		mg/L	
			Dissolved Titanium (Ti)	2019/04/01	ND, RDL=0.0050		mg/L	
			Dissolved Uranium (U)	2019/04/01	ND, RDL=0.00010		mg/L	
			Dissolved Vanadium (V)	2019/04/01	ND, RDL=0.00050		mg/L	
			Dissolved Zinc (Zn)	2019/04/01	ND, RDL=0.0050		mg/L	
6041933	TNG	RPD [JHE174-04]	Dissolved Aluminum (Al)	2019/04/01	NC		%	20
			Dissolved Antimony (Sb)	2019/04/01	NC		%	20
			Dissolved Arsenic (As)	2019/04/01	NC		%	20
			Dissolved Barium (Ba)	2019/04/01	1.5		%	20
			Dissolved Beryllium (Be)	2019/04/01	NC		%	20
			Dissolved Bismuth (Bi)	2019/04/01	NC		%	20
			Dissolved Boron (B)	2019/04/01	2.4		%	20
			Dissolved Cadmium (Cd)	2019/04/01	NC		%	20
			Dissolved Calcium (Ca)	2019/04/01	0.80		%	20
			Dissolved Chromium (Cr)	2019/04/01	NC		%	20
			Dissolved Cobalt (Co)	2019/04/01	NC		%	20
			Dissolved Copper (Cu)	2019/04/01	NC		%	20
			Dissolved Iron (Fe)	2019/04/01	NC		%	20
			Dissolved Lead (Pb)	2019/04/01	NC		%	20
			Dissolved Magnesium (Mg)	2019/04/01	1.2		%	20
			Dissolved Manganese (Mn)	2019/04/01	NC		%	20
			Dissolved Molybdenum (Mo)	2019/04/01	NC		%	20
			Dissolved Nickel (Ni)	2019/04/01	NC		%	20
			Dissolved Phosphorus (P)	2019/04/01	NC		%	20
			Dissolved Potassium (K)	2019/04/01	1.1		%	20
			Dissolved Selenium (Se)	2019/04/01	NC		%	20
			Dissolved Silicon (Si)	2019/04/01	1.2		%	20
			Dissolved Silver (Ag)	2019/04/01	NC		%	20
			Dissolved Sodium (Na)	2019/04/01	0.70		%	20
			Dissolved Strontium (Sr)	2019/04/01	3.2		%	20
			Dissolved Thallium (Tl)	2019/04/01	NC		%	20
			Dissolved Titanium (Ti)	2019/04/01	NC		%	20
			Dissolved Uranium (U)	2019/04/01	6.9		%	20
			Dissolved Vanadium (V)	2019/04/01	NC		%	20
			Dissolved Zinc (Zn)	2019/04/01	NC		%	20
6042463	DRM	Matrix Spike	Dissolved Chloride (Cl-)	2019/03/29		NC	%	80 - 120
6042463	DRM	Spiked Blank	Dissolved Chloride (Cl-)	2019/03/29		102	%	80 - 120

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Maxxam Job #: B978077
Report Date: 2019/04/02

Harden Environmental
Client Project #: 1728
Site Location: HALLMAN
Sampler Initials: AR

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
6042463	DRM	Method Blank	Dissolved Chloride (Cl-)	2019/03/29	ND, RDL=1.0		mg/L	
6042463	DRM	RPD	Dissolved Chloride (Cl-)	2019/03/29	4.6		%	20
6042465	ADB	Matrix Spike	Dissolved Sulphate (SO4)	2019/03/29		NC	%	75 - 125
6042465	ADB	Spiked Blank	Dissolved Sulphate (SO4)	2019/03/29		100	%	80 - 120
6042465	ADB	Method Blank	Dissolved Sulphate (SO4)	2019/03/29	ND, RDL=1.0		mg/L	
6042465	ADB	RPD	Dissolved Sulphate (SO4)	2019/03/29	0.17		%	20
6042471	ADB	Matrix Spike	Orthophosphate (P)	2019/03/29		114	%	75 - 125
6042471	ADB	Spiked Blank	Orthophosphate (P)	2019/03/29		100	%	80 - 120
6042471	ADB	Method Blank	Orthophosphate (P)	2019/03/29	ND, RDL=0.010		mg/L	
6042471	ADB	RPD	Orthophosphate (P)	2019/03/29	1.3		%	25
6044679	DRM	Matrix Spike [JHE177-01]	Dissolved Chloride (Cl-)	2019/04/01		103	%	80 - 120
6044679	DRM	Spiked Blank	Dissolved Chloride (Cl-)	2019/04/01		101	%	80 - 120
6044679	DRM	Method Blank	Dissolved Chloride (Cl-)	2019/04/01	ND, RDL=1.0		mg/L	
6044679	DRM	RPD [JHE177-01]	Dissolved Chloride (Cl-)	2019/04/01	4.3		%	20
6044683	ADB	Matrix Spike [JHE177-01]	Orthophosphate (P)	2019/04/01		120	%	75 - 125
6044683	ADB	Spiked Blank	Orthophosphate (P)	2019/04/01		101	%	80 - 120
6044683	ADB	Method Blank	Orthophosphate (P)	2019/04/01	ND, RDL=0.010		mg/L	
6044683	ADB	RPD [JHE177-01]	Orthophosphate (P)	2019/04/01	2.6		%	25
6044684	ADB	Matrix Spike [JHE177-01]	Dissolved Sulphate (SO4)	2019/04/01		115	%	75 - 125
6044684	ADB	Spiked Blank	Dissolved Sulphate (SO4)	2019/04/01		99	%	80 - 120
6044684	ADB	Method Blank	Dissolved Sulphate (SO4)	2019/04/01	ND, RDL=1.0		mg/L	
6044684	ADB	RPD [JHE177-01]	Dissolved Sulphate (SO4)	2019/04/01	NC		%	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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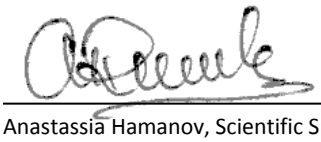
Maxxam Job #: B978077
Report Date: 2019/04/02

Harden Environmental
Client Project #: 1728
Site Location: HALLMAN
Sampler Initials: AR

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Anastassia Hamanov, Scientific Specialist

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Your Project #: 1728
Site Location: HALL MAN
Your C.O.C. #: n/a

Attention: Allan Rodie

Harden Environmental
4622 Nassagaweya-Puslinch Twnl
Moffat, ON
CANADA L0P 1J0

Report Date: 2019/07/16
Report #: R5800150
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: B9I8336
Received: 2019/07/09, 11:28

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Alkalinity	6	N/A	2019/07/11	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	6	N/A	2019/07/12	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	6	N/A	2019/07/11	CAM SOP-00463	SM 4500-Cl E m
Colour	6	N/A	2019/07/12	CAM SOP-00412	SM 23 2120C m
Conductivity	6	N/A	2019/07/11	CAM SOP-00414	SM 23 2510 m
Dissolved Organic Carbon (DOC) (1)	5	N/A	2019/07/10	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	6	N/A	2019/07/15	CAM SOP 00102/00408/00447	SM 2340 B
Lab Filtered Metals Analysis by ICP	1	2019/07/11	2019/07/15	CAM SOP-00408	EPA 6010D m
Dissolved Metals by ICPMS	5	N/A	2019/07/12	CAM SOP-00447	EPA 6020B m
Total Metals Analysis by ICPMS	1	N/A	2019/07/12	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	5	N/A	2019/07/15		
Anion and Cation Sum	5	N/A	2019/07/15		
Total Ammonia-N	6	N/A	2019/07/11	CAM SOP-00441	USGS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	6	N/A	2019/07/12	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	6	2019/07/10	2019/07/11	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	6	N/A	2019/07/11	CAM SOP-00461	EPA 365.1 m
Sat. pH and Langelier Index (@ 20C)	6	N/A	2019/07/15		
Sat. pH and Langelier Index (@ 4C)	6	N/A	2019/07/15		
Sulphate by Automated Colourimetry	6	N/A	2019/07/11	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	6	N/A	2019/07/15		
Total Kjeldahl Nitrogen in Water	3	2019/07/10	2019/07/11	CAM SOP-00938	OMOE E3516 m
Total Kjeldahl Nitrogen in Water	3	2019/07/10	2019/07/12	CAM SOP-00938	OMOE E3516 m
Total Organic Carbon (TOC) (3)	1	N/A	2019/07/10	CAM SOP-00446	SM 23 5310B m
Total Phosphorus (Colourimetric)	1	2019/07/10	2019/07/12	CAM SOP-00407	SM 23 4500 P B H m
Total Phosphorus (Colourimetric)	1	2019/07/10	2019/07/11	CAM SOP-00407	SM 23 4500 P B H m
Total Phosphorus (Colourimetric)	4	2019/07/12	2019/07/12	CAM SOP-00407	SM 23 4500 P B H m
Turbidity	6	N/A	2019/07/10	CAM SOP-00417	SM 23 2130 B m

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

Your Project #: 1728
Site Location: HALL MAN
Your C.O.C. #: n/a

Attention: Allan Rodie

Harden Environmental
4622 Nassagaweya-Puslinch Twnl
Moffat, ON
CANADA L0P 1J0

Report Date: 2019/07/16
Report #: R5800150
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CERTIFICATE OF ANALYSIS

BV LABS JOB #: B9I8336
Received: 2019/07/09, 11:28

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
(3) Total Organic Carbon (TOC) present in the sample should be considered as non-purgeable TOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Ashton Gibson, Project Manager
Email: Ashton.Gibson@bvlabs.com
Phone# (905)817-5765
==========
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

BV Labs Job #: B9I8336
Report Date: 2019/07/16

Harden Environmental
Client Project #: 1728
Site Location: HALL MAN
Sampler Initials: AR

RESULTS OF ANALYSES OF WATER

BV Labs ID					KFJ826				KFJ827			
Sampling Date					2019/07/08 10:45				2019/07/08 11:59			
COC Number					n/a				n/a			
	UNITS	**Criteria**	**MAC**	**A/O**	**MW5**	**RDL**	**MDL**	**QC Batch**	**MW1**	**RDL**	**MDL**	**QC Batch**
Calculated Parameters												
Anion Sum	me/L	-	-	-	11.4	N/A	N/A	6219709	2.53	N/A	N/A	6219709
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	-	-	460	1.0	0.20	6219705	110	1.0	0.20	6219705
Calculated TDS	mg/L	-	-	500	620	1.0	0.20	6219703	130	1.0	0.20	6219703
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	-	-	1.8	1.0	0.20	6219705	1.2	1.0	0.20	6219705
Cation Sum	me/L	-	-	-	11.6	N/A	N/A	6219709	2.49	N/A	N/A	6219709
Hardness (CaCO3)	mg/L	-	-	80:100	530	1.0	1.0	6218167	110	1.0	1.0	6218167
Ion Balance (% Difference)	%	-	-	-	0.730	N/A	N/A	6219708	NC	N/A	N/A	6219708
Langelier Index (@ 20C)	N/A	-	-	-	0.995			6219711	0.292			6219711
Langelier Index (@ 4C)	N/A	-	-	-	0.748			6219712	0.0410			6219712
Saturation pH (@ 20C)	N/A	-	-	-	6.62			6219711	7.77			6219711
Saturation pH (@ 4C)	N/A	-	-	-	6.87			6219712	8.02			6219712
Inorganics												
Total Ammonia-N	mg/L	-	-	-	ND	0.050	0.0080	6221228	0.22	0.050	0.0080	6221228
Colour	TCU	-	-	5	ND	2	N/A	6223134	12	2	N/A	6223134
Conductivity	umho/cm	-	-	-	950	1.0	0.20	6221559	220	1.0	0.20	6221559
Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	-	ND (1)	0.50	0.30	6221036	0.64	0.10	0.060	6221080
Dissolved Organic Carbon	mg/L	-	-	5	1.4	0.50	0.070	6220266	3.6	0.50	0.070	6220266
Orthophosphate (P)	mg/L	-	-	-	ND	0.010	0.0050	6221496	0.092	0.010	0.0050	6221496
pH	pH	6.5:8.5	-	6.5:8.5	7.61			6221560	8.07			6221560
Total Phosphorus	mg/L	0.01	-	-	0.25	0.040	0.0060	6224725	3.7	0.10	0.015	6224725
Dissolved Sulphate (SO4)	mg/L	-	-	500	38	1.0	0.10	6221495	1.9	1.0	0.10	6221495
Turbidity	NTU	-	-	5	270	0.1	0.1	6220445	490	0.1	0.1	6220445
Alkalinity (Total as CaCO3)	mg/L	-	-	30:500	460	1.0	0.20	6221551	110	1.0	0.20	6221551
Dissolved Chloride (Cl-)	mg/L	-	-	250	21	1.0	0.30	6221486	7.5	1.0	0.30	6221486
Nitrite (N)	mg/L	-	1	-	ND	0.010	0.0020	6221835	ND	0.010	0.0020	6221835
Nitrate (N)	mg/L	-	10	-	12.2	0.10	0.010	6221835	ND	0.10	0.010	6221835

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
(Made under the Ontario Safe Drinking Water Act, 2002)
N/A = Not Applicable
ND = Not detected
(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

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BV Labs Job #: B9I8336
Report Date: 2019/07/16

Harden Environmental
Client Project #: 1728
Site Location: HALL MAN
Sampler Initials: AR

RESULTS OF ANALYSES OF WATER

BV Labs ID					KFJ826				KFJ827			
Sampling Date					2019/07/08 10:45				2019/07/08 11:59			
COC Number					n/a				n/a			
	UNITS	**Criteria**	**MAC**	**A/O**	**MW5**	**RDL**	**MDL**	**QC Batch**	**MW1**	**RDL**	**MDL**	**QC Batch**
Nitrate + Nitrite (N)	mg/L	-	10	-	12.2	0.10	0.010	6221835	ND	0.10	0.010	6221835

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
(Made under the Ontario Safe Drinking Water Act, 2002)
ND = Not detected

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BV Labs Job #: B9I8336
Report Date: 2019/07/16

Harden Environmental
Client Project #: 1728
Site Location: HALL MAN
Sampler Initials: AR

RESULTS OF ANALYSES OF WATER

BV Labs ID					KFJ828				KFJ829			
Sampling Date					2019/07/08 12:40				2019/07/08 14:37			
COC Number					n/a				n/a			
	UNITS	**Criteria**	**MAC**	**A/O**	**POND**	**RDL**	**MDL**	**QC Batch**	**MW4**	**RDL**	**MDL**	**QC Batch**
Calculated Parameters												
Anion Sum	me/L	-	-	-					5.07	N/A	N/A	6219709
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	-	-	57	1.0	0.20	6219705	210	1.0	0.20	6219705
Calculated TDS	mg/L	-	-	500	71	1.0	0.20	6219703	270	1.0	0.20	6219703
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	-	-	ND	1.0	0.20	6219705	2.0	1.0	0.20	6219705
Cation Sum	me/L	-	-	-					5.12	N/A	N/A	6219709
Hardness (CaCO3)	mg/L	-	-	80:100	52	1.0	1.0	6218167	250	1.0	1.0	6218167
Ion Balance (% Difference)	%	-	-	-					0.440	N/A	N/A	6219708
Langelier Index (@ 20C)	N/A	-	-	-	-0.622			6219711	0.787			6219711
Langelier Index (@ 4C)	N/A	-	-	-	-0.873			6219712	0.538			6219712
Saturation pH (@ 20C)	N/A	-	-	-	8.40			6219711	7.21			6219711
Saturation pH (@ 4C)	N/A	-	-	-	8.65			6219712	7.46			6219712
Inorganics												
Total Ammonia-N	mg/L	-	-	-	ND	0.050	0.0080	6221228	ND	0.050	0.0080	6221228
Colour	TCU	-	-	5	25	2	N/A	6223134	ND	2	N/A	6223134
Conductivity	umho/cm	-	-	-	130	1.0	0.20	6221559	460	1.0	0.20	6221559
Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	-	0.82	0.10	0.060	6221080	ND (1)	0.20	0.12	6221080
Dissolved Organic Carbon	mg/L	-	-	5					0.84	0.50	0.070	6220266
Total Organic Carbon (TOC)	mg/L	-	-	-	10	0.50	0.090	6221062				
Orthophosphate (P)	mg/L	-	-	-	0.081	0.010	0.0050	6221496	ND	0.010	0.0050	6221496
pH	pH	6.5:8.5	-	6.5:8.5	7.78			6221560	8.00			6221560
Total Phosphorus	mg/L	0.01	-	-	0.18	0.02	0.01	6221120	0.64	0.040	0.0060	6224725
Dissolved Sulphate (SO4)	mg/L	-	-	500	ND	1.0	0.10	6221495	4.1	1.0	0.10	6221495
Turbidity	NTU	-	-	5	3.0	0.1	0.1	6220445	460	0.1	0.1	6220445
Alkalinity (Total as CaCO3)	mg/L	-	-	30:500	58	1.0	0.20	6221551	220	1.0	0.20	6221551
Dissolved Chloride (Cl-)	mg/L	-	-	250	5.9	1.0	0.30	6221486	4.4	1.0	0.30	6221486
Nitrite (N)	mg/L	-	1	-	ND	0.010	0.0020	6221835	ND	0.010	0.0020	6221835

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
(Made under the Ontario Safe Drinking Water Act, 2002)
N/A = Not Applicable
ND = Not detected
(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

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BV Labs Job #: B9I8336
Report Date: 2019/07/16

Harden Environmental
Client Project #: 1728
Site Location: HALL MAN
Sampler Initials: AR

RESULTS OF ANALYSES OF WATER

BV Labs ID					KFJ828				KFJ829			
Sampling Date					2019/07/08 12:40				2019/07/08 14:37			
COC Number					n/a				n/a			
	UNITS	**Criteria**	**MAC**	**A/O**	**POND**	**RDL**	**MDL**	**QC Batch**	**MW4**	**RDL**	**MDL**	**QC Batch**
Nitrate (N)	mg/L	-	10	-	ND	0.10	0.010	6221835	7.60	0.10	0.010	6221835
Nitrate + Nitrite (N)	mg/L	-	10	-					7.60	0.10	0.010	6221835

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
(Made under the Ontario Safe Drinking Water Act, 2002)
ND = Not detected

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BV Labs Job #: B9I8336
Report Date: 2019/07/16

Harden Environmental
Client Project #: 1728
Site Location: HALL MAN
Sampler Initials: AR

RESULTS OF ANALYSES OF WATER

BV Labs ID					KFJ830				KFJ831			
Sampling Date					2019/07/08 17:00				2019/07/08 09:10			
COC Number					n/a				n/a			
	UNITS	**Criteria**	**MAC**	**A/O**	**MW3**	**RDL**	**MDL**	**QC Batch**	**MW2**	**RDL**	**MDL**	**QC Batch**
Calculated Parameters												
Anion Sum	me/L	-	-	-	7.49	N/A	N/A	6219709	7.04	N/A	N/A	6219709
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	-	-	280	1.0	0.20	6219705	250	1.0	0.20	6219705
Calculated TDS	mg/L	-	-	500	410	1.0	0.20	6219703	390	1.0	0.20	6219703
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	-	-	2.3	1.0	0.20	6219705	1.7	1.0	0.20	6219705
Cation Sum	me/L	-	-	-	7.62	N/A	N/A	6219709	7.24	N/A	N/A	6219709
Hardness (CaCO3)	mg/L	-	-	80:100	310	1.0	1.0	6218167	320	1.0	1.0	6218167
Ion Balance (% Difference)	%	-	-	-	0.890	N/A	N/A	6219708	1.37	N/A	N/A	6219708
Langelier Index (@ 20C)	N/A	-	-	-	0.900			6219711	0.783			6219711
Langelier Index (@ 4C)	N/A	-	-	-	0.651			6219712	0.535			6219712
Saturation pH (@ 20C)	N/A	-	-	-	7.04			6219711	7.08			6219711
Saturation pH (@ 4C)	N/A	-	-	-	7.29			6219712	7.32			6219712
Inorganics												
Total Ammonia-N	mg/L	-	-	-	ND	0.050	0.0080	6221228	ND	0.050	0.0080	6221228
Colour	TCU	-	-	5	ND	2	N/A	6223134	ND	2	N/A	6223134
Conductivity	umho/cm	-	-	-	670	1.0	0.20	6221559	650	1.0	0.20	6221559
Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	-	ND (1)	0.50	0.30	6221080	ND (1)	0.50	0.30	6221080
Dissolved Organic Carbon	mg/L	-	-	5	1.5	0.50	0.070	6220266	0.70	0.50	0.070	6220266
Orthophosphate (P)	mg/L	-	-	-	ND	0.010	0.0050	6221496	ND	0.010	0.0050	6221496
pH	pH	6.5:8.5	-	6.5:8.5	7.94			6221560	7.86			6221560
Total Phosphorus	mg/L	0.01	-	-	0.59	0.10	0.015	6220600	2.8	0.10	0.015	6224725
Dissolved Sulphate (SO4)	mg/L	-	-	500	18	1.0	0.10	6221495	13	1.0	0.10	6221495
Turbidity	NTU	-	-	5	790	0.1	0.1	6220445	3500	0.2	0.2	6220445
Alkalinity (Total as CaCO3)	mg/L	-	-	30:500	280	1.0	0.20	6221551	250	1.0	0.20	6221551
Dissolved Chloride (Cl-)	mg/L	-	-	250	32	1.0	0.30	6221486	33	1.0	0.30	6221486
Nitrite (N)	mg/L	-	1	-	ND	0.010	0.0020	6221835	ND	0.010	0.0020	6221835
Nitrate (N)	mg/L	-	10	-	8.93	0.10	0.010	6221835	10.8	0.10	0.010	6221835

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
(Made under the Ontario Safe Drinking Water Act, 2002)
N/A = Not Applicable
ND = Not detected
(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

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BV Labs Job #: B9I8336
Report Date: 2019/07/16

Harden Environmental
Client Project #: 1728
Site Location: HALL MAN
Sampler Initials: AR

RESULTS OF ANALYSES OF WATER

BV Labs ID					KFJ830				KFJ831			
Sampling Date					2019/07/08 17:00				2019/07/08 09:10			
COC Number					n/a				n/a			
	UNITS	**Criteria**	**MAC**	**A/O**	**MW3**	**RDL**	**MDL**	**QC Batch**	**MW2**	**RDL**	**MDL**	**QC Batch**
Nitrate + Nitrite (N)	mg/L	-	10	-	8.93	0.10	0.010	6221835	10.8	0.10	0.010	6221835

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
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BV Labs Job #: B9I8336
Report Date: 2019/07/16

Harden Environmental
Client Project #: 1728
Site Location: HALL MAN
Sampler Initials: AR

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID					KFJ826	KFJ827			
Sampling Date					2019/07/08 10:45	2019/07/08 11:59			
COC Number					n/a	n/a			
	UNITS	**Criteria**	**MAC**	**A/O**	**MW5**	**MW1**	**RDL**	**MDL**	**QC Batch**
Metals									
Dissolved Calcium (Ca)	mg/L	-	-	-	160	34	0.20	0.20	6220220
Dissolved Magnesium (Mg)	mg/L	-	-	-	30	6.4	0.050	0.050	6220220
Dissolved Potassium (K)	mg/L	-	-	-	19	6.4	0.20	0.20	6220220
Dissolved Sodium (Na)	mg/L	-	-	200	11	2.1	0.10	0.10	6220220
Dissolved Aluminum (Al)	mg/L	-	-	0.1	ND	0.0056	0.0050	0.0050	6220220
Dissolved Antimony (Sb)	mg/L	0.02	0.006	-	ND	ND	0.00050	0.00050	6220220
Dissolved Arsenic (As)	mg/L	0.1	0.01	-	ND	ND	0.0010	0.0010	6220220
Dissolved Barium (Ba)	mg/L	-	1	-	0.072	0.025	0.0020	0.0020	6220220
Dissolved Beryllium (Be)	mg/L	0.011	-	-	ND	ND	0.00050	0.00050	6220220
Dissolved Bismuth (Bi)	mg/L	-	-	-	ND	ND	0.0010	0.0010	6220220
Dissolved Boron (B)	mg/L	0.2	5	-	0.024	0.020	0.010	0.010	6220220
Dissolved Cadmium (Cd)	mg/L	0.0002	0.005	-	ND	ND	0.00010	0.00010	6220220
Dissolved Chromium (Cr)	mg/L	-	0.05	-	ND	ND	0.0050	0.0050	6220220
Dissolved Cobalt (Co)	mg/L	0.0009	-	-	0.0013	ND	0.00050	0.00050	6220220
Dissolved Copper (Cu)	mg/L	0.005	-	1	0.0017	0.010	0.0010	0.0010	6220220
Dissolved Iron (Fe)	mg/L	0.3	-	0.3	ND	ND	0.10	0.050	6220220
Dissolved Lead (Pb)	mg/L	0.005	0.01	-	ND	ND	0.00050	0.00050	6220220
Dissolved Manganese (Mn)	mg/L	-	-	0.05	0.15	0.072	0.0020	0.0020	6220220
Dissolved Molybdenum (Mo)	mg/L	0.04	-	-	ND	0.00067	0.00050	0.00050	6220220
Dissolved Nickel (Ni)	mg/L	0.025	-	-	ND	ND	0.0010	0.0010	6220220
Dissolved Phosphorus (P)	mg/L	-	-	-	ND	0.14	0.10	0.050	6220220
Dissolved Selenium (Se)	mg/L	0.1	0.05	-	ND	ND	0.0020	0.0020	6220220
Dissolved Silicon (Si)	mg/L	-	-	-	4.2	1.7	0.050	0.050	6220220
Dissolved Silver (Ag)	mg/L	0.0001	-	-	ND	ND	0.00010	0.00010	6220220
Dissolved Strontium (Sr)	mg/L	-	-	-	0.20	0.040	0.0010	0.0010	6220220
Dissolved Thallium (Tl)	mg/L	0.0003	-	-	ND	ND	0.000050	0.000050	6220220
Dissolved Titanium (Ti)	mg/L	-	-	-	ND	ND	0.0050	0.0050	6220220
Dissolved Uranium (U)	mg/L	0.005	0.02	-	0.00068	ND	0.00010	0.00010	6220220

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
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BV Labs Job #: B9I8336
Report Date: 2019/07/16

Harden Environmental
Client Project #: 1728
Site Location: HALL MAN
Sampler Initials: AR

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID					KFJ826	KFJ827			
Sampling Date					2019/07/08 10:45	2019/07/08 11:59			
COC Number					n/a	n/a			
	UNITS	**Criteria**	**MAC**	**A/O**	**MW5**	**MW1**	**RDL**	**MDL**	**QC Batch**
Dissolved Vanadium (V)	mg/L	0.006	-	-	ND	0.0026	0.00050	0.00050	6220220
Dissolved Zinc (Zn)	mg/L	0.03	-	5	ND	ND	0.0050	0.0050	6220220

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
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BV Labs Job #: B9I8336
Report Date: 2019/07/16

Harden Environmental
Client Project #: 1728
Site Location: HALL MAN
Sampler Initials: AR

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID					KFJ828				KFJ829			
Sampling Date					2019/07/08 12:40				2019/07/08 14:37			
COC Number					n/a				n/a			
	UNITS	**Criteria**	**MAC**	**A/O**	**POND**	**RDL**	**MDL**	**QC Batch**	**MW4**	**RDL**	**MDL**	**QC Batch**
Metals												
Dissolved Calcium (Ca)	mg/L	-	-	-	14.5	0.05	0.01	6223541	74	0.20	0.20	6220220
Dissolved Magnesium (Mg)	mg/L	-	-	-	3.87	0.05	0.01	6223541	16	0.050	0.050	6220220
Dissolved Potassium (K)	mg/L	-	-	-	9	1	0.2	6223541	0.55	0.20	0.20	6220220
Dissolved Sodium (Na)	mg/L	-	-	200	1.7	0.5	0.1	6223541	3.2	0.10	0.10	6220220
Dissolved Aluminum (Al)	mg/L	-	-	0.1					ND	0.0050	0.0050	6220220
Total Aluminum (Al)	mg/L	-	-	0.1	0.055	0.0050	0.0020	6220366				
Dissolved Antimony (Sb)	mg/L	0.02	0.006	-					ND	0.00050	0.00050	6220220
Total Antimony (Sb)	mg/L	0.02	0.006	-	ND	0.00050	0.00030	6220366				
Dissolved Arsenic (As)	mg/L	0.1	0.01	-					ND	0.0010	0.0010	6220220
Total Arsenic (As)	mg/L	0.1	0.01	-	ND	0.0010	0.00050	6220366				
Dissolved Barium (Ba)	mg/L	-	1	-					0.031	0.0020	0.0020	6220220
Total Barium (Ba)	mg/L	-	1	-	0.0071	0.0020	0.00050	6220366				
Dissolved Beryllium (Be)	mg/L	0.011	-	-					ND	0.00050	0.00050	6220220
Total Beryllium (Be)	mg/L	0.011	-	-	ND	0.00050	0.00010	6220366				
Dissolved Bismuth (Bi)	mg/L	-	-	-					ND	0.0010	0.0010	6220220
Dissolved Boron (B)	mg/L	0.2	5	-					ND	0.010	0.010	6220220
Total Boron (B)	mg/L	0.2	5	-	0.023	0.010	0.00030	6220366				
Dissolved Cadmium (Cd)	mg/L	0.0002	0.005	-					ND	0.00010	0.00010	6220220
Total Cadmium (Cd)	mg/L	0.0002	0.005	-	ND	0.00010	0.000090	6220366				
Total Calcium (Ca)	mg/L	-	-	-	15	0.20	0.050	6220366				
Dissolved Chromium (Cr)	mg/L	-	0.05	-					ND	0.0050	0.0050	6220220
Total Chromium (Cr)	mg/L	-	0.05	-	ND	0.0050	0.0050	6220366				
Dissolved Cobalt (Co)	mg/L	0.0009	-	-					ND	0.00050	0.00050	6220220
Total Cobalt (Co)	mg/L	0.0009	-	-	ND	0.00050	0.00010	6220366				
Dissolved Copper (Cu)	mg/L	0.005	-	1					ND	0.0010	0.0010	6220220
Total Copper (Cu)	mg/L	0.005	-	1	ND	0.0010	0.00050	6220366				
Dissolved Iron (Fe)	mg/L	0.3	-	0.3					ND	0.10	0.050	6220220
Total Iron (Fe)	mg/L	0.3	-	0.3	1.4	0.10	0.010	6220366				

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
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BV Labs Job #: B9I8336
Report Date: 2019/07/16

Harden Environmental
Client Project #: 1728
Site Location: HALL MAN
Sampler Initials: AR

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID					KFJ828				KFJ829			
Sampling Date					2019/07/08 12:40				2019/07/08 14:37			
COC Number					n/a				n/a			
	UNITS	**Criteria**	**MAC**	**A/O**	**POND**	**RDL**	**MDL**	**QC Batch**	**MW4**	**RDL**	**MDL**	**QC Batch**
Dissolved Lead (Pb)	mg/L	0.005	0.01	-					ND	0.00050	0.00050	6220220
Total Lead (Pb)	mg/L	0.005	0.01	-	ND	0.00050	0.00010	6220366				
Total Magnesium (Mg)	mg/L	-	-	-	3.9	0.050	0.020	6220366				
Dissolved Manganese (Mn)	mg/L	-	-	0.05					ND	0.0020	0.0020	6220220
Total Manganese (Mn)	mg/L	-	-	0.05	0.15	0.0020	0.00050	6220366				
Dissolved Molybdenum (Mo)	mg/L	0.04	-	-					ND	0.00050	0.00050	6220220
Total Molybdenum (Mo)	mg/L	0.04	-	-	ND	0.00050	0.00020	6220366				
Dissolved Nickel (Ni)	mg/L	0.025	-	-					ND	0.0010	0.0010	6220220
Total Nickel (Ni)	mg/L	0.025	-	-	ND	0.0010	0.00050	6220366				
Dissolved Phosphorus (P)	mg/L	-	-	-					ND	0.10	0.050	6220220
Total Potassium (K)	mg/L	-	-	-	8.6	0.20	0.050	6220366				
Dissolved Selenium (Se)	mg/L	0.1	0.05	-					ND	0.0020	0.0020	6220220
Total Selenium (Se)	mg/L	0.1	0.05	-	ND	0.0020	0.00050	6220366				
Dissolved Silicon (Si)	mg/L	-	-	-					4.4	0.050	0.050	6220220
Total Silicon (Si)	mg/L	-	-	-	0.34	0.050	0.030	6220366				
Dissolved Silver (Ag)	mg/L	0.0001	-	-					ND	0.00010	0.00010	6220220
Total Silver (Ag)	mg/L	0.0001	-	-	ND	0.00010	0.000070	6220366				
Total Sodium (Na)	mg/L	-	-	200	1.7	0.10	0.050	6220366				
Dissolved Strontium (Sr)	mg/L	-	-	-					0.095	0.0010	0.0010	6220220
Total Strontium (Sr)	mg/L	-	-	-	0.026	0.0010	0.00050	6220366				
Dissolved Thallium (Tl)	mg/L	0.0003	-	-					ND	0.000050	0.000050	6220220
Total Thallium (Tl)	mg/L	0.0003	-	-	ND	0.000050	0.000020	6220366				
Dissolved Titanium (Ti)	mg/L	-	-	-					ND	0.0050	0.0050	6220220
Total Titanium (Ti)	mg/L	-	-	-	ND	0.0050	0.0040	6220366				
Dissolved Uranium (U)	mg/L	0.005	0.02	-					0.00018	0.00010	0.00010	6220220
Total Uranium (U)	mg/L	0.005	0.02	-	ND	0.00010	0.000050	6220366				
Dissolved Vanadium (V)	mg/L	0.006	-	-					ND	0.00050	0.00050	6220220
Total Vanadium (V)	mg/L	0.006	-	-	ND	0.00050	0.00040	6220366				
Dissolved Zinc (Zn)	mg/L	0.03	-	5					ND	0.0050	0.0050	6220220

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
(Made under the Ontario Safe Drinking Water Act, 2002)
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BV Labs Job #: B9I8336
Report Date: 2019/07/16

Harden Environmental
Client Project #: 1728
Site Location: HALL MAN
Sampler Initials: AR

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID					KFJ828				KFJ829			
Sampling Date					2019/07/08 12:40				2019/07/08 14:37			
COC Number					n/a				n/a			
	UNITS	**Criteria**	**MAC**	**A/O**	**POND**	**RDL**	**MDL**	**QC Batch**	**MW4**	**RDL**	**MDL**	**QC Batch**
Total Zinc (Zn)	mg/L	0.03	-	5	ND	0.0050	0.0030	6220366				

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
(Made under the Ontario Safe Drinking Water Act, 2002)
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BV Labs Job #: B9I8336
Report Date: 2019/07/16

Harden Environmental
Client Project #: 1728
Site Location: HALL MAN
Sampler Initials: AR

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID					KFJ830	KFJ831			
Sampling Date					2019/07/08 17:00	2019/07/08 09:10			
COC Number					n/a	n/a			
	UNITS	**Criteria**	**MAC**	**A/O**	**MW3**	**MW2**	**RDL**	**MDL**	**QC Batch**
Metals									
Dissolved Calcium (Ca)	mg/L	-	-	-	92	92	0.20	0.20	6220220
Dissolved Magnesium (Mg)	mg/L	-	-	-	20	21	0.050	0.050	6220220
Dissolved Potassium (K)	mg/L	-	-	-	1.4	2.0	0.20	0.20	6220220
Dissolved Sodium (Na)	mg/L	-	-	200	31	20	0.10	0.10	6220220
Dissolved Aluminum (Al)	mg/L	-	-	0.1	ND	ND	0.0050	0.0050	6220220
Dissolved Antimony (Sb)	mg/L	0.02	0.006	-	ND	ND	0.00050	0.00050	6220220
Dissolved Arsenic (As)	mg/L	0.1	0.01	-	ND	ND	0.0010	0.0010	6220220
Dissolved Barium (Ba)	mg/L	-	1	-	0.060	0.10	0.0020	0.0020	6220220
Dissolved Beryllium (Be)	mg/L	0.011	-	-	ND	ND	0.00050	0.00050	6220220
Dissolved Bismuth (Bi)	mg/L	-	-	-	ND	ND	0.0010	0.0010	6220220
Dissolved Boron (B)	mg/L	0.2	5	-	0.052	0.016	0.010	0.010	6220220
Dissolved Cadmium (Cd)	mg/L	0.0002	0.005	-	ND	ND	0.00010	0.00010	6220220
Dissolved Chromium (Cr)	mg/L	-	0.05	-	ND	ND	0.0050	0.0050	6220220
Dissolved Cobalt (Co)	mg/L	0.0009	-	-	ND	ND	0.00050	0.00050	6220220
Dissolved Copper (Cu)	mg/L	0.005	-	1	ND	ND	0.0010	0.0010	6220220
Dissolved Iron (Fe)	mg/L	0.3	-	0.3	ND	ND	0.10	0.050	6220220
Dissolved Lead (Pb)	mg/L	0.005	0.01	-	ND	ND	0.00050	0.00050	6220220
Dissolved Manganese (Mn)	mg/L	-	-	0.05	ND	ND	0.0020	0.0020	6220220
Dissolved Molybdenum (Mo)	mg/L	0.04	-	-	ND	ND	0.00050	0.00050	6220220
Dissolved Nickel (Ni)	mg/L	0.025	-	-	ND	ND	0.0010	0.0010	6220220
Dissolved Phosphorus (P)	mg/L	-	-	-	ND	ND	0.10	0.050	6220220
Dissolved Selenium (Se)	mg/L	0.1	0.05	-	ND	ND	0.0020	0.0020	6220220
Dissolved Silicon (Si)	mg/L	-	-	-	4.7	4.3	0.050	0.050	6220220
Dissolved Silver (Ag)	mg/L	0.0001	-	-	ND	ND	0.00010	0.00010	6220220
Dissolved Strontium (Sr)	mg/L	-	-	-	0.13	0.13	0.0010	0.0010	6220220
Dissolved Thallium (Tl)	mg/L	0.0003	-	-	ND	ND	0.000050	0.000050	6220220
Dissolved Titanium (Ti)	mg/L	-	-	-	ND	ND	0.0050	0.0050	6220220
Dissolved Uranium (U)	mg/L	0.005	0.02	-	0.00026	0.00027	0.00010	0.00010	6220220

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
(Made under the Ontario Safe Drinking Water Act, 2002)
ND = Not detected

BV Labs Job #: B9I8336
Report Date: 2019/07/16

Harden Environmental
Client Project #: 1728
Site Location: HALL MAN
Sampler Initials: AR

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID					KFJ830	KFJ831			
Sampling Date					2019/07/08 17:00	2019/07/08 09:10			
COC Number					n/a	n/a			
	UNITS	**Criteria**	**MAC**	**A/O**	**MW3**	**MW2**	**RDL**	**MDL**	**QC Batch**
Dissolved Vanadium (V)	mg/L	0.006	-	-	ND	ND	0.00050	0.00050	6220220
Dissolved Zinc (Zn)	mg/L	0.03	-	5	ND	ND	0.0050	0.0050	6220220

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
(Made under the Ontario Safe Drinking Water Act, 2002)
ND = Not detected

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BV Labs Job #: B9I8336
Report Date: 2019/07/16

Harden Environmental
Client Project #: 1728
Site Location: HALL MAN
Sampler Initials: AR

TEST SUMMARY

BV Labs ID: KFJ826
Sample ID: MW5
Matrix: Water

Collected: 2019/07/08
Shipped:
Received: 2019/07/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	6221551	N/A	2019/07/11	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	6219705	N/A	2019/07/12	Automated Statchk
Chloride by Automated Colourimetry	KONE	6221486	N/A	2019/07/11	Deonarine Ramnarine
Colour	SPEC	6223134	N/A	2019/07/12	Christine Pham
Conductivity	AT	6221559	N/A	2019/07/11	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	6220266	N/A	2019/07/10	Mandeep Kaur
Hardness (calculated as CaCO3)		6218167	N/A	2019/07/15	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	6220220	N/A	2019/07/12	Matthew Ritenburg
Ion Balance (% Difference)	CALC	6219708	N/A	2019/07/15	Automated Statchk
Anion and Cation Sum	CALC	6219709	N/A	2019/07/15	Automated Statchk
Total Ammonia-N	LACH/NH4	6221228	N/A	2019/07/11	Mazin Wakai
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6221835	N/A	2019/07/12	Chandra Nandlal
pH	AT	6221560	2019/07/10	2019/07/11	Surinder Rai
Orthophosphate	KONE	6221496	N/A	2019/07/11	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	6219711	N/A	2019/07/15	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	6219712	N/A	2019/07/15	Automated Statchk
Sulphate by Automated Colourimetry	KONE	6221495	N/A	2019/07/11	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	6219703	N/A	2019/07/15	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	6221036	2019/07/10	2019/07/11	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	6224725	2019/07/12	2019/07/12	Nimarta Singh
Turbidity	AT	6220445	N/A	2019/07/10	Kazzandra Adeva

BV Labs ID: KFJ826 Dup
Sample ID: MW5
Matrix: Water

Collected: 2019/07/08
Shipped:
Received: 2019/07/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Turbidity	AT	6220445	N/A	2019/07/10	Kazzandra Adeva

BV Labs ID: KFJ827
Sample ID: MW1
Matrix: Water

Collected: 2019/07/08
Shipped:
Received: 2019/07/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	6221551	N/A	2019/07/11	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	6219705	N/A	2019/07/12	Automated Statchk
Chloride by Automated Colourimetry	KONE	6221486	N/A	2019/07/11	Deonarine Ramnarine
Colour	SPEC	6223134	N/A	2019/07/12	Christine Pham
Conductivity	AT	6221559	N/A	2019/07/11	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	6220266	N/A	2019/07/10	Mandeep Kaur
Hardness (calculated as CaCO3)		6218167	N/A	2019/07/15	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	6220220	N/A	2019/07/12	Matthew Ritenburg
Ion Balance (% Difference)	CALC	6219708	N/A	2019/07/15	Automated Statchk
Anion and Cation Sum	CALC	6219709	N/A	2019/07/15	Automated Statchk
Total Ammonia-N	LACH/NH4	6221228	N/A	2019/07/11	Mazin Wakai

BV Labs Job #: B9I8336
Report Date: 2019/07/16

Harden Environmental
Client Project #: 1728
Site Location: HALL MAN
Sampler Initials: AR

TEST SUMMARY

BV Labs ID: KFJ827
Sample ID: MW1
Matrix: Water

Collected: 2019/07/08
Shipped:
Received: 2019/07/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6221835	N/A	2019/07/12	Chandra Nandlal
pH	AT	6221560	2019/07/10	2019/07/11	Surinder Rai
Orthophosphate	KONE	6221496	N/A	2019/07/11	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	6219711	N/A	2019/07/15	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	6219712	N/A	2019/07/15	Automated Statchk
Sulphate by Automated Colourimetry	KONE	6221495	N/A	2019/07/11	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	6219703	N/A	2019/07/15	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	6221080	2019/07/10	2019/07/11	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	6224725	2019/07/12	2019/07/12	Nimarta Singh
Turbidity	AT	6220445	N/A	2019/07/10	Kazzandra Adeva

BV Labs ID: KFJ828
Sample ID: POND
Matrix: Water

Collected: 2019/07/08
Shipped:
Received: 2019/07/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	6221551	N/A	2019/07/11	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	6219705	N/A	2019/07/12	Automated Statchk
Chloride by Automated Colourimetry	KONE	6221486	N/A	2019/07/11	Deonarine Ramnarine
Colour	SPEC	6223134	N/A	2019/07/12	Christine Pham
Conductivity	AT	6221559	N/A	2019/07/11	Surinder Rai
Hardness (calculated as CaCO3)		6218167	N/A	2019/07/15	Automated Statchk
Lab Filtered Metals Analysis by ICP	ICP	6223541	2019/07/11	2019/07/15	Azita Fazaeli
Total Metals Analysis by ICPMS	ICP/MS	6220366	N/A	2019/07/12	Nan Raykha
Total Ammonia-N	LACH/NH4	6221228	N/A	2019/07/11	Mazin Wakai
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6221835	N/A	2019/07/12	Chandra Nandlal
pH	AT	6221560	2019/07/10	2019/07/11	Surinder Rai
Orthophosphate	KONE	6221496	N/A	2019/07/11	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	6219711	N/A	2019/07/15	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	6219712	N/A	2019/07/15	Automated Statchk
Sulphate by Automated Colourimetry	KONE	6221495	N/A	2019/07/11	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	6219703	N/A	2019/07/15	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	6221080	2019/07/10	2019/07/11	Shivani Shivani
Total Organic Carbon (TOC)	TOCV/NDIR	6221062	N/A	2019/07/10	Mandeep Kaur
Total Phosphorus (Colourimetric)	LACH/P	6221120	2019/07/10	2019/07/12	Nimarta Singh
Turbidity	AT	6220445	N/A	2019/07/10	Kazzandra Adeva

BV Labs ID: KFJ828 Dup
Sample ID: POND
Matrix: Water

Collected: 2019/07/08
Shipped:
Received: 2019/07/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Colour	SPEC	6223134	N/A	2019/07/12	Christine Pham

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BV Labs Job #: B9I8336
Report Date: 2019/07/16

Harden Environmental
Client Project #: 1728
Site Location: HALL MAN
Sampler Initials: AR

TEST SUMMARY

BV Labs ID: KFJ829
Sample ID: MW4
Matrix: Water

Collected: 2019/07/08
Shipped:
Received: 2019/07/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	6221551	N/A	2019/07/11	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	6219705	N/A	2019/07/12	Automated Statchk
Chloride by Automated Colourimetry	KONE	6221486	N/A	2019/07/11	Deonarine Ramnarine
Colour	SPEC	6223134	N/A	2019/07/12	Christine Pham
Conductivity	AT	6221559	N/A	2019/07/11	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	6220266	N/A	2019/07/10	Mandeep Kaur
Hardness (calculated as CaCO3)		6218167	N/A	2019/07/15	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	6220220	N/A	2019/07/12	Matthew Ritenburg
Ion Balance (% Difference)	CALC	6219708	N/A	2019/07/15	Automated Statchk
Anion and Cation Sum	CALC	6219709	N/A	2019/07/15	Automated Statchk
Total Ammonia-N	LACH/NH4	6221228	N/A	2019/07/11	Mazin Wakai
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6221835	N/A	2019/07/12	Chandra Nandlal
pH	AT	6221560	2019/07/10	2019/07/11	Surinder Rai
Orthophosphate	KONE	6221496	N/A	2019/07/11	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	6219711	N/A	2019/07/15	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	6219712	N/A	2019/07/15	Automated Statchk
Sulphate by Automated Colourimetry	KONE	6221495	N/A	2019/07/11	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	6219703	N/A	2019/07/15	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	6221080	2019/07/10	2019/07/12	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	6224725	2019/07/12	2019/07/12	Nimarta Singh
Turbidity	AT	6220445	N/A	2019/07/10	Kazzandra Adeva

BV Labs ID: KFJ830
Sample ID: MW3
Matrix: Water

Collected: 2019/07/08
Shipped:
Received: 2019/07/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	6221551	N/A	2019/07/11	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	6219705	N/A	2019/07/12	Automated Statchk
Chloride by Automated Colourimetry	KONE	6221486	N/A	2019/07/11	Deonarine Ramnarine
Colour	SPEC	6223134	N/A	2019/07/12	Christine Pham
Conductivity	AT	6221559	N/A	2019/07/11	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	6220266	N/A	2019/07/10	Mandeep Kaur
Hardness (calculated as CaCO3)		6218167	N/A	2019/07/15	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	6220220	N/A	2019/07/12	Matthew Ritenburg
Ion Balance (% Difference)	CALC	6219708	N/A	2019/07/15	Automated Statchk
Anion and Cation Sum	CALC	6219709	N/A	2019/07/15	Automated Statchk
Total Ammonia-N	LACH/NH4	6221228	N/A	2019/07/11	Mazin Wakai
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6221835	N/A	2019/07/12	Chandra Nandlal
pH	AT	6221560	2019/07/10	2019/07/11	Surinder Rai
Orthophosphate	KONE	6221496	N/A	2019/07/11	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	6219711	N/A	2019/07/15	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	6219712	N/A	2019/07/15	Automated Statchk
Sulphate by Automated Colourimetry	KONE	6221495	N/A	2019/07/11	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	6219703	N/A	2019/07/15	Automated Statchk

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BV Labs Job #: B9I8336
Report Date: 2019/07/16

Harden Environmental
Client Project #: 1728
Site Location: HALL MAN
Sampler Initials: AR

TEST SUMMARY

BV Labs ID: KFJ830
Sample ID: MW3
Matrix: Water

Collected: 2019/07/08
Shipped:
Received: 2019/07/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Kjeldahl Nitrogen in Water	SKAL	6221080	2019/07/10	2019/07/12	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	6220600	2019/07/10	2019/07/11	Nimarta Singh
Turbidity	AT	6220445	N/A	2019/07/10	Kazzandra Adeva

BV Labs ID: KFJ831
Sample ID: MW2
Matrix: Water

Collected: 2019/07/08
Shipped:
Received: 2019/07/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	6221551	N/A	2019/07/11	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	6219705	N/A	2019/07/12	Automated Statchk
Chloride by Automated Colourimetry	KONE	6221486	N/A	2019/07/11	Deonarine Ramnarine
Colour	SPEC	6223134	N/A	2019/07/12	Christine Pham
Conductivity	AT	6221559	N/A	2019/07/11	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	6220266	N/A	2019/07/10	Mandeep Kaur
Hardness (calculated as CaCO3)		6218167	N/A	2019/07/15	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	6220220	N/A	2019/07/12	Matthew Ritenburg
Ion Balance (% Difference)	CALC	6219708	N/A	2019/07/15	Automated Statchk
Anion and Cation Sum	CALC	6219709	N/A	2019/07/15	Automated Statchk
Total Ammonia-N	LACH/NH4	6221228	N/A	2019/07/11	Mazin Wakai
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6221835	N/A	2019/07/12	Chandra Nandlal
pH	AT	6221560	2019/07/10	2019/07/11	Surinder Rai
Orthophosphate	KONE	6221496	N/A	2019/07/11	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	6219711	N/A	2019/07/15	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	6219712	N/A	2019/07/15	Automated Statchk
Sulphate by Automated Colourimetry	KONE	6221495	N/A	2019/07/11	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	6219703	N/A	2019/07/15	Automated Statchk
Total Kjeldahl Nitrogen in Water	SKAL	6221080	2019/07/10	2019/07/12	Shivani Shivani
Total Phosphorus (Colourimetric)	LACH/P	6224725	2019/07/12	2019/07/12	Nimarta Singh
Turbidity	AT	6220445	N/A	2019/07/10	Kazzandra Adeva

BV Labs ID: KFJ831 Dup
Sample ID: MW2
Matrix: Water

Collected: 2019/07/08
Shipped:
Received: 2019/07/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	6221551	N/A	2019/07/11	Surinder Rai
Conductivity	AT	6221559	N/A	2019/07/11	Surinder Rai
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	6221835	N/A	2019/07/12	Chandra Nandlal
pH	AT	6221560	2019/07/10	2019/07/11	Surinder Rai

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GENERAL COMMENTS

Results relate only to the items tested.

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BV Labs Job #: B9I8336
Report Date: 2019/07/16

Harden Environmental
Client Project #: 1728
Site Location: HALL MAN
Sampler Initials: AR

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
6220220	MRG	Matrix Spike	Dissolved Aluminum (Al)	2019/07/12		99	%	80 - 120
			Dissolved Antimony (Sb)	2019/07/12		103	%	80 - 120
			Dissolved Arsenic (As)	2019/07/12		98	%	80 - 120
			Dissolved Barium (Ba)	2019/07/12		101	%	80 - 120
			Dissolved Beryllium (Be)	2019/07/12		101	%	80 - 120
			Dissolved Bismuth (Bi)	2019/07/12		55 (1)	%	80 - 120
			Dissolved Boron (B)	2019/07/12		97	%	80 - 120
			Dissolved Cadmium (Cd)	2019/07/12		102	%	80 - 120
			Dissolved Calcium (Ca)	2019/07/12		NC	%	80 - 120
			Dissolved Chromium (Cr)	2019/07/12		96	%	80 - 120
			Dissolved Cobalt (Co)	2019/07/12		94	%	80 - 120
			Dissolved Copper (Cu)	2019/07/12		99	%	80 - 120
			Dissolved Iron (Fe)	2019/07/12		96	%	80 - 120
			Dissolved Lead (Pb)	2019/07/12		94	%	80 - 120
			Dissolved Magnesium (Mg)	2019/07/12		NC	%	80 - 120
			Dissolved Manganese (Mn)	2019/07/12		96	%	80 - 120
			Dissolved Molybdenum (Mo)	2019/07/12		102	%	80 - 120
			Dissolved Nickel (Ni)	2019/07/12		93	%	80 - 120
			Dissolved Phosphorus (P)	2019/07/12		113	%	80 - 120
			Dissolved Potassium (K)	2019/07/12		97	%	80 - 120
			Dissolved Selenium (Se)	2019/07/12		91	%	80 - 120
			Dissolved Silicon (Si)	2019/07/12		100	%	80 - 120
			Dissolved Silver (Ag)	2019/07/12		59 (1)	%	80 - 120
			Dissolved Sodium (Na)	2019/07/12		NC	%	80 - 120
			Dissolved Strontium (Sr)	2019/07/12		NC	%	80 - 120
			Dissolved Thallium (Tl)	2019/07/12		91	%	80 - 120
			Dissolved Titanium (Ti)	2019/07/12		102	%	80 - 120
			Dissolved Uranium (U)	2019/07/12		93	%	80 - 120
			Dissolved Vanadium (V)	2019/07/12		99	%	80 - 120
			Dissolved Zinc (Zn)	2019/07/12		98	%	80 - 120
6220220	MRG	Spiked Blank	Dissolved Aluminum (Al)	2019/07/15		106	%	80 - 120
			Dissolved Antimony (Sb)	2019/07/15		104	%	80 - 120
			Dissolved Arsenic (As)	2019/07/15		100	%	80 - 120
			Dissolved Barium (Ba)	2019/07/15		104	%	80 - 120
			Dissolved Beryllium (Be)	2019/07/15		100	%	80 - 120
			Dissolved Bismuth (Bi)	2019/07/15		97	%	80 - 120
			Dissolved Boron (B)	2019/07/15		101	%	80 - 120
			Dissolved Cadmium (Cd)	2019/07/15		104	%	80 - 120
			Dissolved Calcium (Ca)	2019/07/15		109	%	80 - 120
			Dissolved Chromium (Cr)	2019/07/15		97	%	80 - 120
			Dissolved Cobalt (Co)	2019/07/15		95	%	80 - 120
			Dissolved Copper (Cu)	2019/07/15		99	%	80 - 120
			Dissolved Iron (Fe)	2019/07/15		100	%	80 - 120
			Dissolved Lead (Pb)	2019/07/15		98	%	80 - 120
			Dissolved Magnesium (Mg)	2019/07/15		98	%	80 - 120
			Dissolved Manganese (Mn)	2019/07/15		99	%	80 - 120
			Dissolved Molybdenum (Mo)	2019/07/15		101	%	80 - 120
			Dissolved Nickel (Ni)	2019/07/15		94	%	80 - 120
			Dissolved Phosphorus (P)	2019/07/15		111	%	80 - 120
			Dissolved Potassium (K)	2019/07/15		101	%	80 - 120
			Dissolved Selenium (Se)	2019/07/15		103	%	80 - 120
			Dissolved Silicon (Si)	2019/07/15		105	%	80 - 120
			Dissolved Silver (Ag)	2019/07/15		98	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Sodium (Na)	2019/07/15		99	%	80 - 120
			Dissolved Strontium (Sr)	2019/07/15		100	%	80 - 120
			Dissolved Thallium (Tl)	2019/07/15		94	%	80 - 120
			Dissolved Titanium (Ti)	2019/07/15		106	%	80 - 120
			Dissolved Uranium (U)	2019/07/15		94	%	80 - 120
			Dissolved Vanadium (V)	2019/07/15		98	%	80 - 120
			Dissolved Zinc (Zn)	2019/07/15		104	%	80 - 120
6220220	MRG	Method Blank	Dissolved Aluminum (Al)	2019/07/12	ND, RDL=0.0050		mg/L	
			Dissolved Antimony (Sb)	2019/07/12	ND, RDL=0.00050		mg/L	
			Dissolved Arsenic (As)	2019/07/12	ND, RDL=0.0010		mg/L	
			Dissolved Barium (Ba)	2019/07/12	ND, RDL=0.0020		mg/L	
			Dissolved Beryllium (Be)	2019/07/12	ND, RDL=0.00050		mg/L	
			Dissolved Bismuth (Bi)	2019/07/12	ND, RDL=0.0010		mg/L	
			Dissolved Boron (B)	2019/07/12	ND, RDL=0.010		mg/L	
			Dissolved Cadmium (Cd)	2019/07/12	ND, RDL=0.00010		mg/L	
			Dissolved Calcium (Ca)	2019/07/12	ND, RDL=0.20		mg/L	
			Dissolved Chromium (Cr)	2019/07/12	ND, RDL=0.0050		mg/L	
			Dissolved Cobalt (Co)	2019/07/12	ND, RDL=0.00050		mg/L	
			Dissolved Copper (Cu)	2019/07/12	ND, RDL=0.0010		mg/L	
			Dissolved Iron (Fe)	2019/07/12	ND, RDL=0.10		mg/L	
			Dissolved Lead (Pb)	2019/07/12	ND, RDL=0.00050		mg/L	
			Dissolved Magnesium (Mg)	2019/07/12	ND, RDL=0.050		mg/L	
			Dissolved Manganese (Mn)	2019/07/12	ND, RDL=0.0020		mg/L	
			Dissolved Molybdenum (Mo)	2019/07/12	ND, RDL=0.00050		mg/L	
			Dissolved Nickel (Ni)	2019/07/12	ND, RDL=0.0010		mg/L	
			Dissolved Phosphorus (P)	2019/07/12	ND, RDL=0.10		mg/L	
			Dissolved Potassium (K)	2019/07/12	ND, RDL=0.20		mg/L	
			Dissolved Selenium (Se)	2019/07/12	ND, RDL=0.0020		mg/L	
			Dissolved Silicon (Si)	2019/07/12	ND, RDL=0.050		mg/L	
			Dissolved Silver (Ag)	2019/07/12	ND, RDL=0.00010		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Sodium (Na)	2019/07/12	ND, RDL=0.10		mg/L	
			Dissolved Strontium (Sr)	2019/07/12	ND, RDL=0.0010		mg/L	
			Dissolved Thallium (Tl)	2019/07/12	ND, RDL=0.000050		mg/L	
			Dissolved Titanium (Ti)	2019/07/12	ND, RDL=0.0050		mg/L	
			Dissolved Uranium (U)	2019/07/12	ND, RDL=0.00010		mg/L	
			Dissolved Vanadium (V)	2019/07/12	ND, RDL=0.00050		mg/L	
			Dissolved Zinc (Zn)	2019/07/12	ND, RDL=0.0050		mg/L	
6220220	MRG	RPD	Dissolved Lead (Pb)	2019/07/12	NC		%	20
6220266	KRM	Matrix Spike	Dissolved Organic Carbon	2019/07/10		91	%	80 - 120
6220266	KRM	Spiked Blank	Dissolved Organic Carbon	2019/07/10		94	%	80 - 120
6220266	KRM	Method Blank	Dissolved Organic Carbon	2019/07/10	ND, RDL=0.50		mg/L	
6220266	KRM	RPD	Dissolved Organic Carbon	2019/07/10	0.93		%	20
6220366	N_R	Matrix Spike	Total Aluminum (Al)	2019/07/12		NC	%	80 - 120
			Total Antimony (Sb)	2019/07/12		102	%	80 - 120
			Total Arsenic (As)	2019/07/12		101	%	80 - 120
			Total Barium (Ba)	2019/07/12		99	%	80 - 120
			Total Beryllium (Be)	2019/07/12		104	%	80 - 120
			Total Boron (B)	2019/07/12		101	%	80 - 120
			Total Cadmium (Cd)	2019/07/12		100	%	80 - 120
			Total Calcium (Ca)	2019/07/12		NC	%	80 - 120
			Total Chromium (Cr)	2019/07/12		95	%	80 - 120
			Total Cobalt (Co)	2019/07/12		96	%	80 - 120
			Total Copper (Cu)	2019/07/12		100	%	80 - 120
			Total Iron (Fe)	2019/07/12		98	%	80 - 120
			Total Lead (Pb)	2019/07/12		93	%	80 - 120
			Total Magnesium (Mg)	2019/07/12		97	%	80 - 120
			Total Manganese (Mn)	2019/07/12		96	%	80 - 120
			Total Molybdenum (Mo)	2019/07/12		102	%	80 - 120
			Total Nickel (Ni)	2019/07/12		94	%	80 - 120
			Total Potassium (K)	2019/07/12		105	%	80 - 120
			Total Selenium (Se)	2019/07/12		100	%	80 - 120
			Total Silicon (Si)	2019/07/12		101	%	80 - 120
			Total Silver (Ag)	2019/07/12		95	%	80 - 120
			Total Sodium (Na)	2019/07/12		NC	%	80 - 120
			Total Strontium (Sr)	2019/07/12		NC	%	80 - 120
			Total Thallium (Tl)	2019/07/12		95	%	80 - 120
			Total Titanium (Ti)	2019/07/12		98	%	80 - 120
			Total Uranium (U)	2019/07/12		96	%	80 - 120
			Total Vanadium (V)	2019/07/12		98	%	80 - 120
			Total Zinc (Zn)	2019/07/12		98	%	80 - 120
6220366	N_R	Spiked Blank	Total Aluminum (Al)	2019/07/12		94	%	80 - 120
			Total Antimony (Sb)	2019/07/12		99	%	80 - 120
			Total Arsenic (As)	2019/07/12		96	%	80 - 120
			Total Barium (Ba)	2019/07/12		93	%	80 - 120
			Total Beryllium (Be)	2019/07/12		98	%	80 - 120

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Boron (B)	2019/07/12		96	%	80 - 120
			Total Cadmium (Cd)	2019/07/12		97	%	80 - 120
			Total Calcium (Ca)	2019/07/12		96	%	80 - 120
			Total Chromium (Cr)	2019/07/12		92	%	80 - 120
			Total Cobalt (Co)	2019/07/12		91	%	80 - 120
			Total Copper (Cu)	2019/07/12		95	%	80 - 120
			Total Iron (Fe)	2019/07/12		94	%	80 - 120
			Total Lead (Pb)	2019/07/12		91	%	80 - 120
			Total Magnesium (Mg)	2019/07/12		94	%	80 - 120
			Total Manganese (Mn)	2019/07/12		93	%	80 - 120
			Total Molybdenum (Mo)	2019/07/12		95	%	80 - 120
			Total Nickel (Ni)	2019/07/12		89	%	80 - 120
			Total Potassium (K)	2019/07/12		93	%	80 - 120
			Total Selenium (Se)	2019/07/12		97	%	80 - 120
			Total Silicon (Si)	2019/07/12		94	%	80 - 120
			Total Silver (Ag)	2019/07/12		93	%	80 - 120
			Total Sodium (Na)	2019/07/12		93	%	80 - 120
			Total Strontium (Sr)	2019/07/12		92	%	80 - 120
			Total Thallium (Tl)	2019/07/12		91	%	80 - 120
			Total Titanium (Ti)	2019/07/12		93	%	80 - 120
			Total Uranium (U)	2019/07/12		92	%	80 - 120
			Total Vanadium (V)	2019/07/12		92	%	80 - 120
			Total Zinc (Zn)	2019/07/12		97	%	80 - 120
6220366	N_R	Method Blank	Total Aluminum (Al)	2019/07/12	ND, RDL=0.0050		mg/L	
			Total Antimony (Sb)	2019/07/12	ND, RDL=0.00050		mg/L	
			Total Arsenic (As)	2019/07/12	ND, RDL=0.0010		mg/L	
			Total Barium (Ba)	2019/07/12	ND, RDL=0.0020		mg/L	
			Total Beryllium (Be)	2019/07/12	ND, RDL=0.00050		mg/L	
			Total Boron (B)	2019/07/12	ND, RDL=0.010		mg/L	
			Total Cadmium (Cd)	2019/07/12	ND, RDL=0.00010		mg/L	
			Total Calcium (Ca)	2019/07/12	ND, RDL=0.20		mg/L	
			Total Chromium (Cr)	2019/07/12	ND, RDL=0.0050		mg/L	
			Total Cobalt (Co)	2019/07/12	ND, RDL=0.00050		mg/L	
			Total Copper (Cu)	2019/07/12	ND, RDL=0.0010		mg/L	
			Total Iron (Fe)	2019/07/12	ND, RDL=0.10		mg/L	
			Total Lead (Pb)	2019/07/12	ND, RDL=0.00050		mg/L	
			Total Magnesium (Mg)	2019/07/12	ND, RDL=0.050		mg/L	
			Total Manganese (Mn)	2019/07/12	ND, RDL=0.0020		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Molybdenum (Mo)	2019/07/12	ND, RDL=0.00050		mg/L	
			Total Nickel (Ni)	2019/07/12	ND, RDL=0.0010		mg/L	
			Total Potassium (K)	2019/07/12	ND, RDL=0.20		mg/L	
			Total Selenium (Se)	2019/07/12	ND, RDL=0.0020		mg/L	
			Total Silicon (Si)	2019/07/12	ND, RDL=0.050		mg/L	
			Total Silver (Ag)	2019/07/12	ND, RDL=0.00010		mg/L	
			Total Sodium (Na)	2019/07/12	ND, RDL=0.10		mg/L	
			Total Strontium (Sr)	2019/07/12	ND, RDL=0.0010		mg/L	
			Total Thallium (Tl)	2019/07/12	ND, RDL=0.000050		mg/L	
			Total Titanium (Ti)	2019/07/12	ND, RDL=0.0050		mg/L	
			Total Uranium (U)	2019/07/12	ND, RDL=0.00010		mg/L	
			Total Vanadium (V)	2019/07/12	ND, RDL=0.00050		mg/L	
			Total Zinc (Zn)	2019/07/12	ND, RDL=0.0050		mg/L	
6220366	N_R	RPD	Total Aluminum (Al)	2019/07/12	5.7		%	20
			Total Antimony (Sb)	2019/07/12	8.6		%	20
			Total Arsenic (As)	2019/07/12	8.5		%	20
			Total Barium (Ba)	2019/07/12	5.7		%	20
			Total Beryllium (Be)	2019/07/12	NC		%	20
			Total Boron (B)	2019/07/12	8.7		%	20
			Total Cadmium (Cd)	2019/07/12	NC		%	20
			Total Calcium (Ca)	2019/07/12	5.3		%	20
			Total Chromium (Cr)	2019/07/12	NC		%	20
			Total Cobalt (Co)	2019/07/12	NC		%	20
			Total Copper (Cu)	2019/07/12	2.1		%	20
			Total Lead (Pb)	2019/07/12	4.9		%	20
			Total Magnesium (Mg)	2019/07/12	5.2		%	20
			Total Manganese (Mn)	2019/07/12	0.30		%	20
			Total Molybdenum (Mo)	2019/07/12	6.1		%	20
			Total Nickel (Ni)	2019/07/12	0.91		%	20
			Total Potassium (K)	2019/07/12	3.4		%	20
			Total Selenium (Se)	2019/07/12	NC		%	20
			Total Silicon (Si)	2019/07/12	5.3		%	20
			Total Silver (Ag)	2019/07/12	NC		%	20
			Total Sodium (Na)	2019/07/12	4.2		%	20
			Total Strontium (Sr)	2019/07/12	5.8		%	20
			Total Thallium (Tl)	2019/07/12	NC		%	20
			Total Titanium (Ti)	2019/07/12	NC		%	20
			Total Vanadium (V)	2019/07/12	3.0		%	20
			Total Zinc (Zn)	2019/07/12	NC		%	20
6220445	KAD	Spiked Blank	Turbidity	2019/07/10		113	%	85 - 115

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QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
6220445	KAD	Method Blank	Turbidity	2019/07/10	ND, RDL=0.1		NTU	
6220445	KAD	RPD [KFJ826-01]	Turbidity	2019/07/10	4.9		%	20
6220600	NS3	Matrix Spike	Total Phosphorus	2019/07/11		101	%	80 - 120
6220600	NS3	QC Standard	Total Phosphorus	2019/07/11		99	%	80 - 120
6220600	NS3	Spiked Blank	Total Phosphorus	2019/07/11		101	%	80 - 120
6220600	NS3	Method Blank	Total Phosphorus	2019/07/11	ND, RDL=0.020		mg/L	
6220600	NS3	RPD	Total Phosphorus	2019/07/11	0.61		%	20
6221036	SSV	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2019/07/11		100	%	80 - 120
6221036	SSV	QC Standard	Total Kjeldahl Nitrogen (TKN)	2019/07/10		106	%	80 - 120
6221036	SSV	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2019/07/10		109	%	80 - 120
6221036	SSV	Method Blank	Total Kjeldahl Nitrogen (TKN)	2019/07/10	ND, RDL=0.10		mg/L	
6221036	SSV	RPD	Total Kjeldahl Nitrogen (TKN)	2019/07/11	17		%	20
6221062	KRM	Matrix Spike	Total Organic Carbon (TOC)	2019/07/10		92	%	80 - 120
6221062	KRM	Spiked Blank	Total Organic Carbon (TOC)	2019/07/10		97	%	80 - 120
6221062	KRM	Method Blank	Total Organic Carbon (TOC)	2019/07/10	ND, RDL=0.50		mg/L	
6221062	KRM	RPD	Total Organic Carbon (TOC)	2019/07/10	NC		%	20
6221080	SSV	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2019/07/12		NC	%	80 - 120
6221080	SSV	QC Standard	Total Kjeldahl Nitrogen (TKN)	2019/07/11		102	%	80 - 120
6221080	SSV	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2019/07/11		106	%	80 - 120
6221080	SSV	Method Blank	Total Kjeldahl Nitrogen (TKN)	2019/07/11	ND, RDL=0.10		mg/L	
6221080	SSV	RPD	Total Kjeldahl Nitrogen (TKN)	2019/07/12	7.2		%	20
6221120	NS3	Matrix Spike	Total Phosphorus	2019/07/11		95	%	80 - 120
6221120	NS3	QC Standard	Total Phosphorus	2019/07/11		91	%	80 - 120
6221120	NS3	Spiked Blank	Total Phosphorus	2019/07/11		97	%	80 - 120
6221120	NS3	Method Blank	Total Phosphorus	2019/07/11	ND, RDL=0.004		mg/L	
6221120	NS3	RPD	Total Phosphorus	2019/07/11	3.7		%	20
6221228	MT4	Matrix Spike	Total Ammonia-N	2019/07/11		102	%	75 - 125
6221228	MT4	Spiked Blank	Total Ammonia-N	2019/07/11		102	%	80 - 120
6221228	MT4	Method Blank	Total Ammonia-N	2019/07/11	ND, RDL=0.050		mg/L	
6221228	MT4	RPD	Total Ammonia-N	2019/07/11	NC		%	20
6221486	DRM	Matrix Spike	Dissolved Chloride (Cl-)	2019/07/11		NC	%	80 - 120
6221486	DRM	Spiked Blank	Dissolved Chloride (Cl-)	2019/07/11		103	%	80 - 120
6221486	DRM	Method Blank	Dissolved Chloride (Cl-)	2019/07/11	ND, RDL=1.0		mg/L	
6221486	DRM	RPD	Dissolved Chloride (Cl-)	2019/07/11	3.0		%	20
6221495	ADB	Matrix Spike	Dissolved Sulphate (SO4)	2019/07/11		NC	%	75 - 125
6221495	ADB	Spiked Blank	Dissolved Sulphate (SO4)	2019/07/12		99	%	80 - 120
6221495	ADB	Method Blank	Dissolved Sulphate (SO4)	2019/07/12	ND, RDL=1.0		mg/L	
6221495	ADB	RPD	Dissolved Sulphate (SO4)	2019/07/11	0.13		%	20
6221496	ADB	Matrix Spike	Orthophosphate (P)	2019/07/11		105	%	75 - 125
6221496	ADB	Spiked Blank	Orthophosphate (P)	2019/07/11		100	%	80 - 120
6221496	ADB	Method Blank	Orthophosphate (P)	2019/07/11	ND, RDL=0.010		mg/L	
6221496	ADB	RPD	Orthophosphate (P)	2019/07/11	NC		%	25
6221551	SAU	Spiked Blank	Alkalinity (Total as CaCO3)	2019/07/11		96	%	85 - 115

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QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
6221551	SAU	Method Blank	Alkalinity (Total as CaCO3)	2019/07/11	ND, RDL=1.0		mg/L	
6221551	SAU	RPD [KFJ831-01]	Alkalinity (Total as CaCO3)	2019/07/11	0.14		%	20
6221559	SAU	Spiked Blank	Conductivity	2019/07/11		101	%	85 - 115
6221559	SAU	Method Blank	Conductivity	2019/07/11	ND, RDL=1.0		umho/cm	
6221559	SAU	RPD [KFJ831-01]	Conductivity	2019/07/11	1.4		%	25
6221560	SAU	Spiked Blank	pH	2019/07/11		102	%	98 - 103
6221560	SAU	RPD [KFJ831-01]	pH	2019/07/11	0.26		%	N/A
6221835	C_N	Matrix Spike [KFJ831-01]	Nitrite (N)	2019/07/12		101	%	80 - 120
			Nitrate (N)	2019/07/12		88	%	80 - 120
6221835	C_N	Spiked Blank	Nitrite (N)	2019/07/12		105	%	80 - 120
			Nitrate (N)	2019/07/12		101	%	80 - 120
6221835	C_N	Method Blank	Nitrite (N)	2019/07/12	ND, RDL=0.010		mg/L	
			Nitrate (N)	2019/07/12	ND, RDL=0.10		mg/L	
6221835	C_N	RPD [KFJ831-01]	Nitrite (N)	2019/07/12	NC		%	20
			Nitrate (N)	2019/07/12	0.59		%	20
6223134	CP	Spiked Blank	Colour	2019/07/12		99	%	80 - 120
6223134	CP	Method Blank	Colour	2019/07/12	ND,RDL=2		TCU	
6223134	CP	RPD [KFJ828-01]	Colour	2019/07/12	0.33		%	25
6223541	AFZ	Matrix Spike	Dissolved Calcium (Ca)	2019/07/15		NC	%	80 - 120
			Dissolved Magnesium (Mg)	2019/07/15		NC	%	80 - 120
			Dissolved Potassium (K)	2019/07/15		106	%	80 - 120
			Dissolved Sodium (Na)	2019/07/15		NC	%	80 - 120
6223541	AFZ	Spiked Blank	Dissolved Calcium (Ca)	2019/07/15		97	%	80 - 120
			Dissolved Magnesium (Mg)	2019/07/15		97	%	80 - 120
			Dissolved Potassium (K)	2019/07/15		102	%	80 - 120
			Dissolved Sodium (Na)	2019/07/15		100	%	80 - 120
6223541	AFZ	Method Blank	Dissolved Calcium (Ca)	2019/07/15	ND, RDL=0.05		mg/L	
			Dissolved Magnesium (Mg)	2019/07/15	ND, RDL=0.05		mg/L	
			Dissolved Potassium (K)	2019/07/15	ND,RDL=1		mg/L	
			Dissolved Sodium (Na)	2019/07/15	ND, RDL=0.5		mg/L	
6223541	AFZ	RPD	Dissolved Calcium (Ca)	2019/07/15	2.7		%	25
			Dissolved Magnesium (Mg)	2019/07/15	2.2		%	25
			Dissolved Potassium (K)	2019/07/15	2.8		%	25
			Dissolved Sodium (Na)	2019/07/15	1.7		%	25
6224725	NS3	Matrix Spike	Total Phosphorus	2019/07/12		99	%	80 - 120
6224725	NS3	QC Standard	Total Phosphorus	2019/07/12		101	%	80 - 120
6224725	NS3	Spiked Blank	Total Phosphorus	2019/07/12		100	%	80 - 120
6224725	NS3	Method Blank	Total Phosphorus	2019/07/12	ND, RDL=0.020		mg/L	

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
6224725	NS3	RPD	Total Phosphorus	2019/07/12	NC		%	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

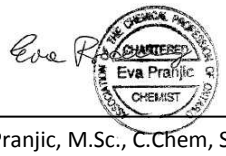
Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

BV Labs Job #: B9I8336
Report Date: 2019/07/16

Harden Environmental
Client Project #: 1728
Site Location: HALL MAN
Sampler Initials: AR

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports.
For Service Group specific validation please refer to the Validation Signature Page.

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

Appendix E

Private Well Survey

Harden Environmental Services Ltd.
4622 Nassagaweya-Puslinch Townline
Moffat, Ontario, L0P 1J0
Phone: (519) 826-0099 Fax: (519) 826-9099

Groundwater Studies

Geochemistry

Phase I / II

Regional Flow Studies

Contaminant Investigations

OMB Hearings

Water Quality Sampling

Monitoring

Groundwater Protection Studies

Groundwater Modelling

Groundwater Mapping

May 28, 2019

Dear Resident:

Re: Residential Well Survey

On behalf of Jackson Harvest Farms Ltd. (Proposed Hallman Pit) we are conducting a door-to-door inventory of water supply wells for those residents that are within 500 metres of the subject lands that are not on the town water supply.

The well survey was requested by the Region of Waterloo as part of the aggregate licence application process. The well survey is subject to permission of the well owner and well accessibility. We would like to arrange a date and time that would be convenient for you to have us visit your residence.

The well survey (attached) will document the following (where possible): well location, method of construction, static water level, well depth, pump intake depth, type of pumping system, history of any water quality or quantity issues.

We are planning to visit residences during the week of **June 3 to June 7**. We will be knocking on your door and if you are not home we will leave a card requesting to make an appointment. If you would prefer to make an appointment ahead of time, please let us know a date and time that is convenient for you. Evening appointments are available.

Feel free to call/text (519) 400-7113 or email your response or any questions you may have.

Sincerely,

Stan Denhoed, M.Sc., P. Eng.
Senior Hydrogeologist

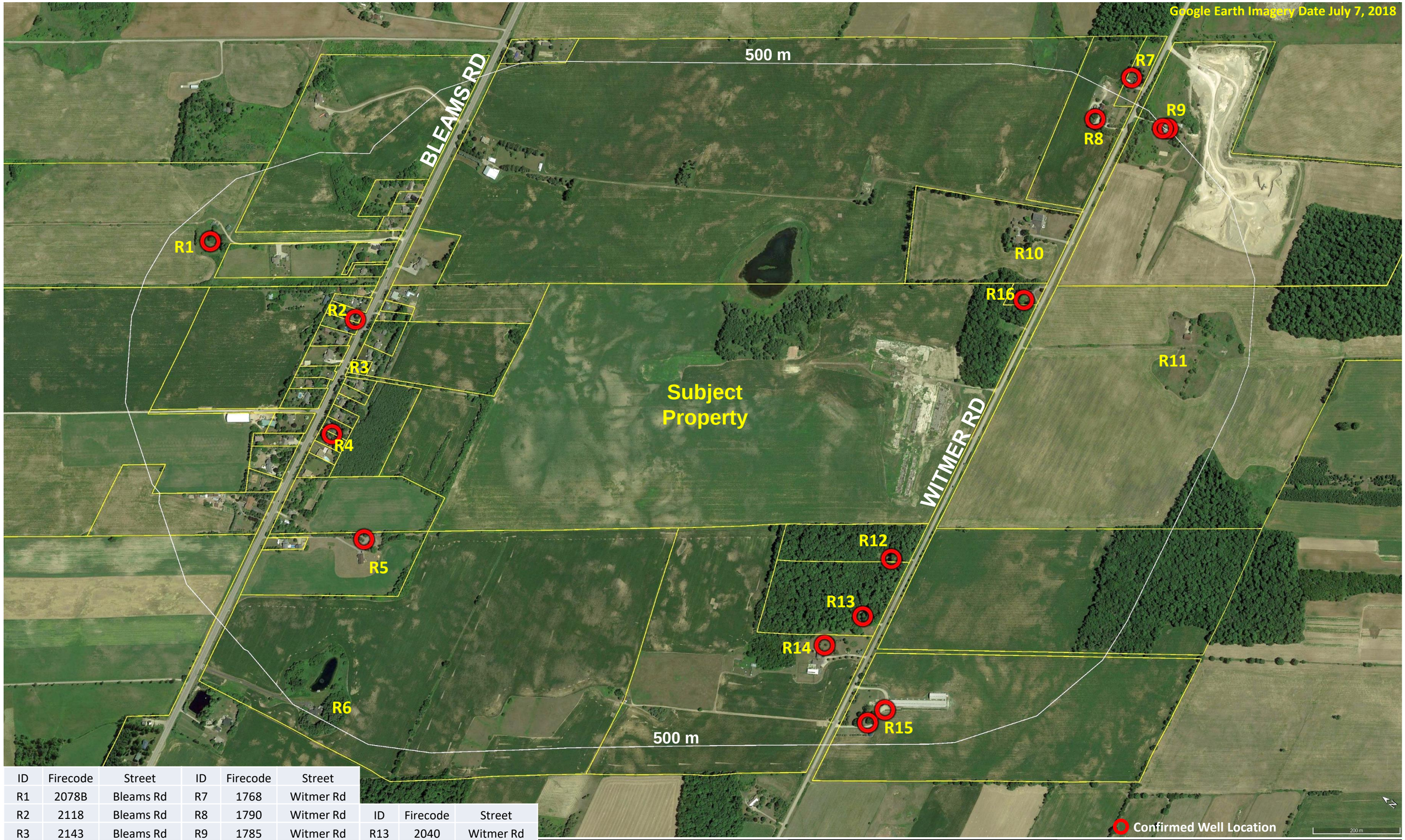
Allan Rodie, C.Tech.
Water Resources Technician
mobile: (519) 400-7113
email: arodie@hardenv.com

Proposed Hallman Pit Water Well Survey Summary

Water Wells Within 500m of Subject Lands

ID	Firecode	Street	Status	Well Record No.	Well Type	Stick-up (m)	Date Completed	Well Depth (mbgs)	Static Water Level (mbgs)	Pumping Rate (gpm)
R1	2078 Unit B	Bleams Rd	not completed - no response to letters delivered April 19 and May 28 or to business card left at door on June 3, 2019	7102464	Drilled 6.25"	Unknown	17-Oct-2007	33.80	26.72	12
R2	2118	Bleams Rd	Completed	Unknown	Dug 36" OD	0.87	~1970s	Unknown	Unknown	Unknown
R3	2143	Bleams Rd	not completed - no response to letters delivered April 19 and May 28 or to business card left at door on June 3, 2019	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
R4	2175	Bleams Rd	Completed	Unknown	Drilled in well pit	Below grade in well pit	1977	34.14	Unknown	Unknown
R5	2229	Bleams Rd	Completed	Unknown	Drilled 6"	0.60	Unknown	At least 67 m	36.23	Unknown
R6	2295	Bleams Rd	not completed - no response to letters delivered April 19 and May 28 or to business card left at door on June 3, 2019	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
R7	1768	Witmer Rd	Completed	Unknown	Dug 36" ID	0.34	~1952	12.79	9.33	Unknown
R8	1790	Witmer Rd	Completed	Unknown	Drilled in well pit	1.68 metres below grade	~1969-70	Unknown	Unknown	Unknown
R9	1785	Witmer Rd	Completed	Unknown	Drilled in well pit	1.80 metres below grade	Unknown	Unknown	Unknown	Unknown
R10	1850	Witmer Rd	not completed - no response to letters delivered April 19 and May 28 or to business card left at door on June 3, 2019	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
R11	1901	Witmer Rd	Not required since this is Lafarge property, no resident exists	----	----	----	----	----	----	----
R12	2008	Witmer Rd	Completed	6506072	Drilled 6.25"	0.31	21-Oct-1986	30.48	24.38	10
R13	2040	Witmer Rd	Completed	6504197	Drilled 5"	0.02	16-Sep-1974	30.78	20.63	8
R14	2056	Witmer Rd	Completed	6507228	Drilled 6"	0.26	07-Nov-1991	28.35	21.30	6
R15	2089	Witmer Rd	Completed	7289418	Drilled 6"	0.73	05-Mar-2017	24.99	18.44	10
R16	1874	Witmer Rd	Completed	6504927	Drilled 5"	0.02	18-Jul-1979	103.02	42.91	10

Information From Well Record



ID	Firecode	Street	ID	Firecode	Street
R1	2078B	Bleams Rd	R7	1768	Witmer Rd
R2	2118	Bleams Rd	R8	1790	Witmer Rd
R3	2143	Bleams Rd	R9	1785	Witmer Rd
R4	2175	Bleams Rd	R10	1850	Witmer Rd
R5	2229	Bleams Rd	R11	1901	Witmer Rd
R6	2295	Bleams Rd	R12	2008	Witmer Rd

ID	Firecode	Street
R13	2040	Witmer Rd
R14	2056	Witmer Rd
R15	2089	Witmer Rd
R16	1874	Witmer Rd

Harden Environmental Services Ltd.

Project No: 1728
Date: Jun 2019
Drawn By: AR

Hydrogeological Assessment

1894 Witmer Rd, CON South of Bleams Rd, PT LOT 10
Township of Wilmot, Regional Municipality of Waterloo

Figure 1.12:
Water Well Survey
Residents within 500 m Not on Town Water Supply

R1
2078 Unit B Bleams Road

Well Records
7101340
7102464

Ontario Ministry of the Environment

Well Tag No. *(Place Sticker and/or Print Below)* A 047815

Well Record

Regulation 903 Ontario Water Resources Act

Page 1 of 1

*IMPERIAL MEASUREMENT

[redacted]

Address of Well Location (Street Number/Name, RR)	Township	Lot	Concession
2078 BLEAMS RD. UNIT B	WILMOT.	9	BRN

County/District/Municipality	City/Town/Village	Province	Postal Code
WATERLOO	NEW HAMBURG.	Ontario	N3A3B2

UTM Coordinates NAD 83	Zone	Easting	Northing	GPS Unit Make	Model	Mode of Operation
	17	531785	4804245	MAG.	SPORT	☑ Undifferentiated ☐ Averaged ☐ Differentiated, specify

Overburden and Bedrock Materials *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (Metres) From	Depth (Metres) To
			BUT		
			PREVIOUSLY DRILLED TO 308. FT. (NO RECORD)		
			CLEANED OUT AND LINED WITH NEW 6" CASING. OLD CASING PULLED, THEN GROUTED.		
			BROWN LIMESTONE 308 TO 317 FT.		

Annular Space/Abandonment Sealing Record

Depth Set at (Metres) From	To	Type of Sealant Used (Material and Type)	Volume Placed (Cubic Metres)
0	308	BENTONITE / QUICKSET GROUT	

Method of Construction

☐ Cable Tool ☐ Diamond
☑ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Rotary (Air) ☐ Digging
☐ Air percussion ☐ Boring
☐ Other, *specify*

Water Use

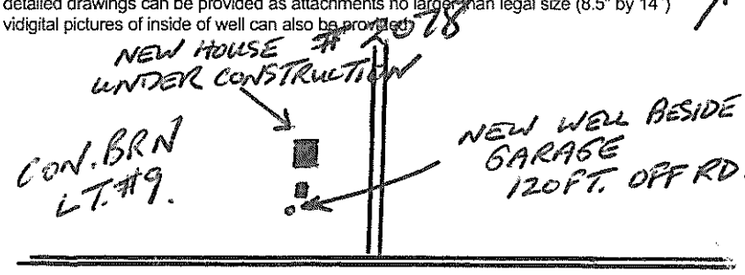
☐ Public ☐ Commercial ☐ Not used
☑ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, *specify*

Status of Well

☑ Water Supply ☐ Dewatering Well ☐ Observation and/or Monitoring Hole
☐ Replacement Well ☐ Abandoned, Insufficient Supply ☐ Alteration (Construction)
☐ Test Hole ☐ Abandoned, Poor Water Quality ☐ Other, *specify*
☐ Recharge Well ☐ Abandoned, other, *specify*

Location of Well

Please provide a map below showing:
- all property boundaries, and measurements sufficient to locate the well in relation to fixed points,
- an arrow indicating the North direction
- detailed drawings can be provided as attachments no larger than legal size (8.5" by 14")
- vidigital pictures of inside of well can also be provided



Results of Well Yield Testing

Check box if after test of well yield, water was:
☑ Clear and sand free
☐ Cannot develop to sand-free state

If pumping discontinued, give reason: CLEAR

Pumping test method: PUMP

Pump intake set at *(Metres)*: 177

Pumping rate *(Litres/min)*: 40

Duration of pumping: 2 hrs + 30 min

Final water level end of pumping *(Metres)*: 159

Recommended pump type: ☐ Shallow ☑ Deep

Recommended pump depth: 177 Metres

Recommended pump rate *(Litres/min)*: 15

If flowing give rate *(Litres/min)*: NOT

Draw Down Time (Min)	Draw Down Water Level (Metres)	Recovery Time (Min)	Recovery Water Level (Metres)
Static Level	153	Static Level	159
1	155'9	1	156
2	156'4	2	154'3
3	156'11	3	153'4
4	157'3	4	153
5	157'5	5	153
10	158'9	10	153
15	159	15	153
20	159	20	153
25	159	25	153
30	159	30	153
40	159	40	153
50	159	50	153
60	159	60	153

Water Details

Water found at Depth	Kind of Water
310 Metres ☐ Gas	☑ Fresh ☐ Salty ☐ Sulphur ☐ Minerals
Metres ☐ Gas	☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals
Metres ☐ Gas	☐ Fresh ☐ Salty ☐ Sulphur ☐ Minerals

Casing Used

☐ Galvanized
☑ Steel 6"
☐ Fibreglass
☐ Plastic
☐ Concrete

Screen Used

☐ Galvanized
☐ Steel NONE
☐ Fibreglass
☐ Plastic
☐ Concrete

No Casing and Screen Used

☑ Open Hole 308-311

Disinfected? ☑ Yes ☐ No

Casing and Well Details

Diameter of the Hole *(Centimetres)*: 9"

Depth of the Hole *(Metres)*: 308

Wall Thickness *(Metres)*: .188

Inside Diameter of the Casing *(Metres)*: 5" TO

Depth of the Casing *(Metres)*: 308

Date Well Completed (yyyy/mm/dd)	Was the well owner's information package delivered?	Date the Well Record and Package Delivered to Well Owner (yyyy/mm/dd)
07/12/12	☑ Yes ☐ No	SAME.

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
HAYDEN WATER WELLS.	7090

Business Address (Street No./Name, number, RR)	Municipality
R.R #1 LUCAN	BIDDULPH.

Province	Postal Code	Business E-mail Address
ONT	N0M2J0	N/A.

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
5199270057	J. HAYDEN

Well Technician's Licence No.	Signature of Technician	Date Submitted (yyyy/mm/dd)
7034		

Ministry Use Only

Audit No.	Well Contractor No.
Z 75044	
Date Received (yyyy/mm/dd)	**Date of Inspection (yyyy/mm/dd)**
JAN 17 2008	
Remarks	

0506E (11/2006)

Ministry's Copy

Well ID

Well ID Number: 7102464
Well Audit Number: *Z69072*
Well Tag Number: *A057294*

This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	2078B BLEAMS ROAD
Township	WILMOT TOWNSHIP
Lot	009
Concession	
County/District/Municipality	WATERLOO
City/Town/Village	PETERSBURG
Province	ON
Postal Code	n/a
UTM Coordinates	NAD83 — Zone 17 Easting: 531841.00 Northing: 4804473.00
Municipal Plan and Sublot Number	
Other	

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
	LOAM			0 m	.3 m
BRWN	SAND	SILT		.3 m	3.1 m
BRWN	SAND	CLAY	STNS	3.1 m	11.6 m
GREY	SAND	CLAY	SLTY	11.6 m	14.3 m
BRWN	SAND	CLAY	SLTY	14.3 m	32 m
BRWN	SAND	GRVL		32 m	33.8 m

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed
0 m	25 m	BENTONITE SLURRY	

Method of Construction & Well Use

Method of Construction	Well Use
Rotary (Convent.)	
	Domestic

Status of Well

Water Supply

Construction Record - Casing

Inside Diameter	Open Hole or material	Depth From	Depth To
.16 cm	STEEL		32.9 m

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To
	STEEL		

Well Contractor and Well Technician Information

Well Contractor's Licence Number: 6865

Results of Well Yield Testing

After test of well yield, water was	CLEAR
If pumping discontinued, give reason	
Pump intake set at	30 m
Pumping Rate	45 LPM
Duration of Pumping	1 h:0 m
Final water level	27.02 m
If flowing give rate	
Recommended pump depth	30 m
Recommended pump rate	45 LPM
Well Production	SUBMERGE
Disinfected?	Y

Draw Down & Recovery

Draw Down Time(min)	Draw Down Water level	Recovery Time(min)	Recovery Water level
SWL	26.72 m		
1	27.02 m	1	26.72 m
2	27.02 m	2	26.72 m
3	27.02 m	3	26.72 m
4	27.02 m	4	26.72 m
5	27.02 m	5	26.72 m
10	27.02 m	10	26.72 m
15	27.02 m	15	26.72 m
20	27.02 m	20	26.72 m
25	27.02 m	25	26.72 m
30	27.02 m	30	26.72 m
40	27.02 m	40	26.72 m
45		45	
50	27.02 m	50	26.72 m
60	27.02 m	60	26.72 m

Water Details

Water Found at Depth	Kind
33 m	Not Stated

Hole Diameter

Depth From	Depth To	Diameter
	33.8 m	25 cm

Audit Number: Z69072

Date Well Completed: October 17, 2007

Date Well Record Received by MOE: March 05, 2008

Harden Environmental Services Ltd.
4622 Nassagaweya-Puslinch Townline
Moffat, Ontario, L0P 1J0
Phone: (519) 826-0099

Water Well Survey

File: 1728 Proposed Hallman Pit

R2

Date/Time: June 3, 2019 / 1:00 pm

Location: 2118 Bleams Road

Well Record No. Unknown

Contact Information:

Resident(s) Names:

Owners Name if Different:

Address: 2118 Bleams Road

Petersburg, ON N0B 2H0

Person Interviewed:

Telephone:

Email:

How long at Property? Since 1981

Well Details:

Number of Wells on Property: 1 Number of Wells in Use: 1

Copy of Well Record?: No Is the Well Buried?: No

Is the Well Sealed Shut/Inaccessible?: No

Date Constructed: Unknown - 1970s Type (drilled or Dug): Dug Well Depth: Unknown

Pump Depth: Unknown

Well Use (domestic, livestock, irrigation) Domestic

Water Source (overburden/bedrock): Overburden Contractor: Unknown

Well Testing:

Has the Well Been Tested for Bacteria?: Yes How Often?: Approximately every 2 years

When Was the Last Bacteria Sample Taken?: within 10 years ago

Where is the Sample Collected From/Method?: Kitchen tap

Testing Results: Always passed (0 total coliform per 100 mL and 0 E. coli per 100 mL)

Have There Been Any Water Quality Problems?: None

What was done to correct the Problem?:

Other Notes on Water Quality: Water quality is excellent

Pump:

Pump Type (Suction-lift Jet Pump In Basement/Submersible Pump In Well): Unknown

Depth of Pump Intake: Unknown Pumping Rate: Unknown

Storage Tank?: Yes Type: Pressure Tank Cistern?: No

Water Well Survey

Location: 2118 Bleams Road

Treatment:

☑ Water Softener ☐ Chlorinator ☐ UV Lamp ☐ Cartridge Filter ☐ RO Filter ☐ Other

Notes:

Water Quantity:

Have There Been Any Water Quantity Problems?: No

Has the Well Ever Gone Dry?: No When Was the Last Time the Well Went Dry?: _____

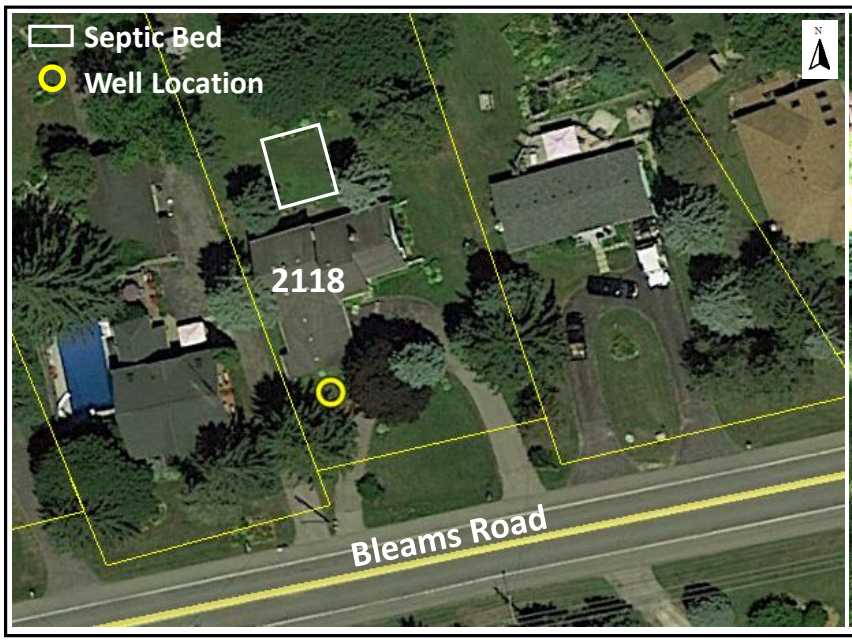
Notes:

Maintenance:

Has the Well Been Cleaned?: No Deepened?: No Silt Removed?: No

Note: Stick-up was increased by one concrete well tile (top of well used to be flush with ground)

Sketch of Well Location: (house, road, septic, well, etc. north arrow)



Measurements:

Well Tag: None Casing Outside Diameter: 36 inches Well Location: NAD83 UTM17 Easting 531903 Northing 4804111 (+/- 3m)

Water Level Measurement: not taken – well lid cannot be lifted by hand

Well Depth: Unknown Stick up: 0.87 m

Casing Type: Concrete Wellhead Condition: Good

Vermin Proof?: yes

General Condition/Notes on Well:

Survey Completed By: Allan Rodie Date: June 3, 2019

Harden Environmental Services Ltd.
4622 Nassagaweya-Puslinch Townline
Moffat, Ontario, L0P 1J0
Phone: (519) 826-0099

Water Well Survey

File: 1728 Proposed Hallman Pit

R4

Date/Time: June 3, 2019 / 2:50 pm

Location: 2175 Bleams Road

Well Record No. Unknown

Contact Information:

Resident(s) Names:

Owners Name if Different:

Address: 2175 Bleams Road

RR2 Petersburg, ON N0B 2H0

Person Interviewed:

Telephone:

Email:

How long at Property?

Well Details:

Number of Wells on Property: 1 Number of Wells in Use: 1

Copy of Well Record?: No Is the Well Buried?: No

Is the Well Sealed Shut/Inaccessible?: Yes, drilled well in well pit

Date Constructed: 1977 Type (drilled or Dug): Drilled Well Depth: 112 feet

Pump Depth: approximately 100 feet

Well Use (domestic, livestock, irrigation) Domestic

Water Source (overburden/bedrock): Overburden Contractor: Unknown

Well Testing:

Has the Well Been Tested for Bacteria?: Yes How Often?: Annually

When Was the Last Bacteria Sample Taken?: 2018

Where is the Sample Collected From/Method?: Kitchen tap

Testing Results: Always passed (0 total coliform per 100 mL and 0 E. coli per 100 mL)

Have There Been Any Water Quality Problems?: None, some hardness

---

What was done to correct the Problem?:

Other Notes on Water Quality: Water quality is excellent

Pump:

Pump Type (Suction-lift Jet Pump In Basement/Submersible Pump In Well): Submersible

Depth of Pump Intake: approximately 100 feet Pumping Rate: Unknown

Storage Tank?: Yes Type: Pressure Tank Cistern?: No

Water Well Survey

Location: 2175 Bleams Road

Treatment:

☑ Water Softener ☐ Chlorinator ☐ UV Lamp ☐ Cartridge Filter ☐ RO Filter ☐ Other

Notes:

_____

Water Quantity:

Have There Been Any Water Quantity Problems?: No

Has the Well Ever Gone Dry?: No When Was the Last Time the Well Went Dry?: _____

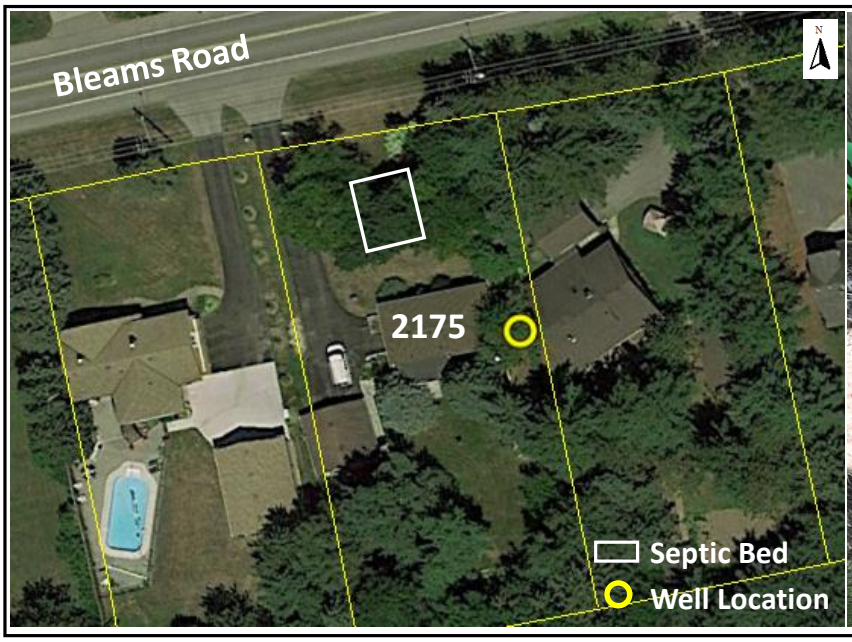
Notes:

Maintenance:

Has the Well Been Cleaned?: No Deepened?: No Silt Removed?: No

Note:

Sketch of Well Location: (house, road, septic, well, etc. north arrow)



Measurements:

Well Tag: None Casing Inside Diameter: Unknown Well Location: NAD83 UTM17 Easting 531666 Northing 4803992 (+/- 3m)

Water Level Measurement: not taken – drilled well in well pit

Well Depth: 112 feet Stick up: Unknown

Casing Type: Steel Wellhead Condition: Unknown

Vermin Proof?: yes

General Condition/Notes on Well:

Survey Completed By: Allan Rodie Date: June 3, 2019

Harden Environmental Services Ltd.
4622 Nassagaweya-Puslinch Townline
Moffat, Ontario, L0P 1J0
Phone: (519) 826-0099

Water Well Survey

File: 1728 Proposed Hallman Pit

R5

Date/Time: June 10, 2019 / 5:30 pm

Location: 2229 Bleams Road

Well Record No. Unknown - possibly 6503292

Contact Information:

Resident(s) Names:

Owners Name if Different:

Address: 2229 Bleams Road

Petersburg, ON N0B 2H0

Person Interviewed:

Telephone:

Email:

How long at Property?

Well Details:

Number of Wells on Property: 1 Number of Wells in Use: 1

Copy of Well Record?: No Is the Well Buried?: No

Is the Well Sealed Shut/Inaccessible?: No

Date Constructed: Unknown Type (drilled or Dug): Drilled Well Well Depth: At least 67 metres (220 feet)

Pump Depth: approximately 67 metres (based on pump replacement invoice 2018)

Well Use (domestic, livestock, irrigation) Domestic at House and as water supply to sink in shop (minimal use)

Water Source (overburden/bedrock): Unknown Contractor: Unknown

Well Testing:

Has the Well Been Tested for Bacteria?: Yes How Often?: 3 times every summer

When Was the Last Bacteria Sample Taken?: 2018

Where is the Sample Collected From/Method?: unsoftened water - bypass kitchen tap

Testing Results: Always passes (0 total coliform per 100 mL and 0 E. coli per 100 mL)

Have There Been Any Water Quality Problems?: No

What was done to correct the Problem?:

Other Notes on Water Quality: Water quality is good

Pump:

Pump Type (Suction-lift Jet Pump In Basement/Submersible Pump In Well): Submersible

Depth of Pump Intake: approximately 67 metres Pumping Rate: Unknown

Storage Tank?: Yes Type: Pressure Tank Cistern?: No

Water Well Survey

Location: 2229 Bleams Road

Treatment:

☑ Water Softener ☐ Chlorinator ☐ UV Lamp ☐ Cartridge Filter ☐ RO Filter ☐ Other

Notes: bypass tap for unsoftened water in kitchen

Water Quantity:

Have There Been Any Water Quantity Problems?: No

Has the Well Ever Gone Dry?: No When Was the Last Time the Well Went Dry?: _____

Notes:

Maintenance:

Has the Well Been Cleaned?: No Deepened?: No Silt Removed?: No

Note: Pump was replaced in 2018 - 67 metres of pump wire on invoice

Sketch of Well Location: (house, road, septic, well, etc. north arrow)

Measurements:

Well Tag: None Casing Inside Diameter: 6 inches (plastic) Well Depth: At least 67 metres (220 feet) based on 2018 pump replacement invoice

Well Location: NAD83 UTM17 Easting 531522 Northing 4803789 (+/- 3m)

Water Level Measurement: 36.83 metres below top of casing (36.23 metres / 118 feet 10 inches below ground surface)

Stick up: 0.60 m Casing Type: plastic pipe Wellhead Condition: Good

Vermin Proof?: Yes

Note:

Survey Completed By: Allan Rodie Date: June 10, 2019

Harden Environmental Services Ltd.
4622 Nassagaweya-Puslinch Townline
Moffat, Ontario, L0P 1J0
Phone: (519) 826-0099

Water Well Survey

File: 1728 Proposed Hallman Pit

R7

Date/Time: June 3, 2019 / 4:30 pm

Location: 1768 Witmer Road

Well Record No. Unknown

Contact Information:

Resident(s) Names:

Owners Name if Different:

Address: 1768 Witmer Road

Petersburg, ON N0B 2H0

Person Interviewed:

Telephone:

Email:

How long at Property?

Well Details:

Number of Wells on Property: 1 Number of Wells in Use: 1

Copy of Well Record?: No Is the Well Buried?: No

Is the Well Sealed Shut/Inaccessible?: No

Date Constructed: Approximately 1952 Type (drilled or Dug): Dug Well Well Depth: 45 feet

Pump Depth: approximately 40 feet

Well Use (domestic, livestock, irrigation) Domestic

Water Source (overburden/bedrock): Overburden Contractor: Unknown

Well Testing:

Has the Well Been Tested for Bacteria?: Yes How Often?: Frequently

When Was the Last Bacteria Sample Taken?: Approximately 2015

Where is the Sample Collected From/Method?: Kitchen tap

Testing Results: Always passed (0 total coliform per 100 mL and 0 E. coli per 100 mL)

Have There Been Any Water Quality Problems?: None

What was done to correct the Problem?:

Other Notes on Water Quality: Water quality is excellent

Pump:

Pump Type (Suction-lift Jet Pump In Basement/Submersible Pump In Well): Submersible

Depth of Pump Intake: approximately 40 feet Pumping Rate: Unknown

Storage Tank?: Yes Type: Pressure Tank Cistern?: No

Water Well Survey

Location: 1768 Witmer Road

Treatment:

☑ Water Softener ☐ Chlorinator ☐ UV Lamp ☐ Cartridge Filter ☐ RO Filter ☐ Other

Notes:

Water Quantity:

Have There Been Any Water Quantity Problems?: No

Has the Well Ever Gone Dry?: No When Was the Last Time the Well Went Dry?: _____

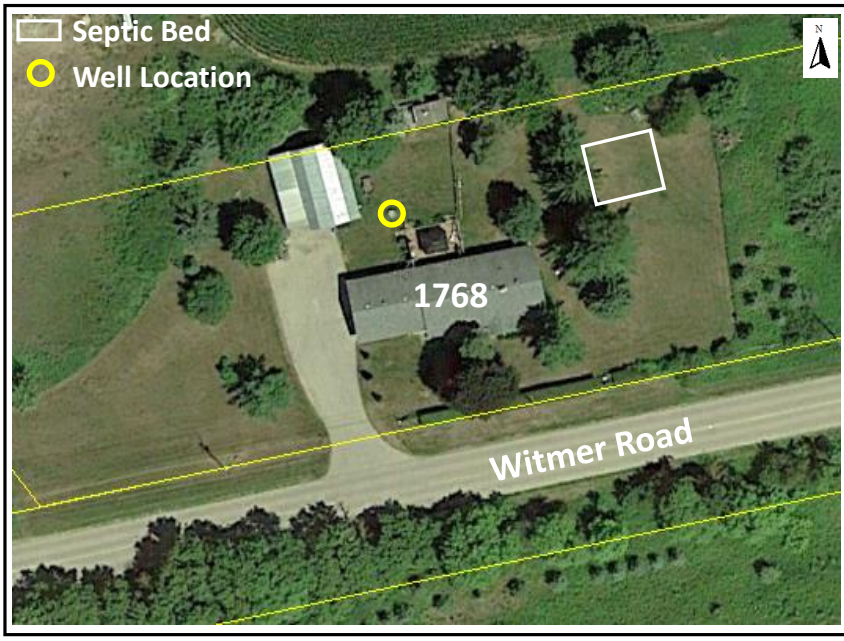
Notes:

Maintenance:

Has the Well Been Cleaned?: No Deepened?: No Silt Removed?: No

Note: New pump installed in approximately 2006

Sketch of Well Location: (house, road, septic, well, etc. north arrow)



Measurements:

Well Tag: None Casing Inside Diameter: 36 inches (0.93m)

Well Location: NAD83 UTM17 Easting 533425 Northing 4803067 (+/- 3m)

Water Level Measurement: 9.67 metres below top of lid (9.33 metres below ground surface)

Well Depth: 13.13 metres below top of lid (12.79 metres below ground surface) (42 feet below ground surface)

Stick up: 0.34 m Casing Type: Concrete Wellhead Condition: Needs repair, concrete is deteriorating in spots

Vermin Proof?: no, 1-2 inch gap approximately 5 inches long between lid and upper tile due to missing concrete

Note: Owner planning to repair concrete asap

Survey Completed By: Allan Rodie Date: June 3, 2019

Harden Environmental Services Ltd.
4622 Nassagaweya-Puslinch Townline
Moffat, Ontario, L0P 1J0
Phone: (519) 826-0099

Water Well Survey

File: 1728 Proposed Hallman Pit

R8

Date/Time: June 3, 2019 / 5:30 pm

Location: 1790 Witmer Road

Well Record No. Unknown

Contact Information:

Resident(s) Names:

Owners Name if Different:

Address: 1790 Witmer Road

Petersburg, ON N0B 2H0

Person Interviewed:

Telephone:

Email:

How long at Property?

Well Details:

Number of Wells on Property: 1 Number of Wells in Use: 1

Copy of Well Record?: No Is the Well Buried?: No, in well pit 6 feet below grade

Is the Well Sealed Shut/Inaccessible?: Yes

Date Constructed: Approximately 1969-70 Type (drilled or Dug): Drilled Well Well Depth: Unknown

Pump Depth: Unknown

Well Use (domestic, livestock, irrigation) Domestic

Water Source (overburden/bedrock): Unknown Contractor: Unknown

Well Testing:

Has the Well Been Tested for Bacteria?: Yes How Often?: Not recently

When Was the Last Bacteria Sample Taken?: Unknown

Where is the Sample Collected From/Method?: Kitchen Tap

Testing Results: Passed (0 total coliform per 100 mL and 0 E. coli per 100 mL)

Have There Been Any Water Quality Problems?: No

What was done to correct the Problem?:

Other Notes on Water Quality: Water quality is very good

Pump:

Pump Type (Suction-lift Jet Pump In Basement/Submersible Pump In Well): Submersible

Depth of Pump Intake: Unknown Pumping Rate: Unknown

Storage Tank?: Yes Type: Pressure Tank Cistern?: No

Water Well Survey

Location: 1790 Witmer Road

Treatment:

☐ Water Softener ☐ Chlorinator ☐ UV Lamp ☐ Cartridge Filter ☐ RO Filter ☐ Other

Notes: No Treatment

Water Quantity:

Have There Been Any Water Quantity Problems?: No

Has the Well Ever Gone Dry?: No When Was the Last Time the Well Went Dry?: _____

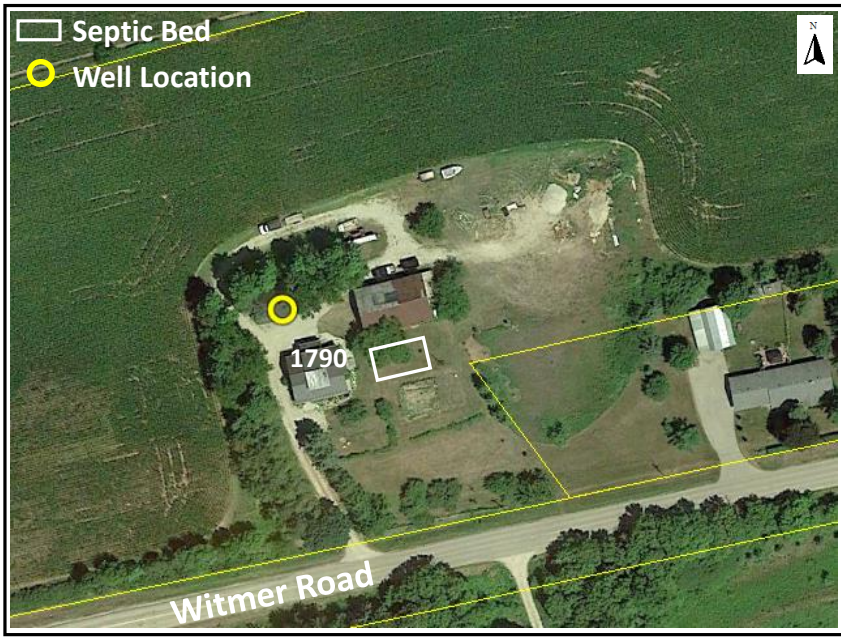
Notes:

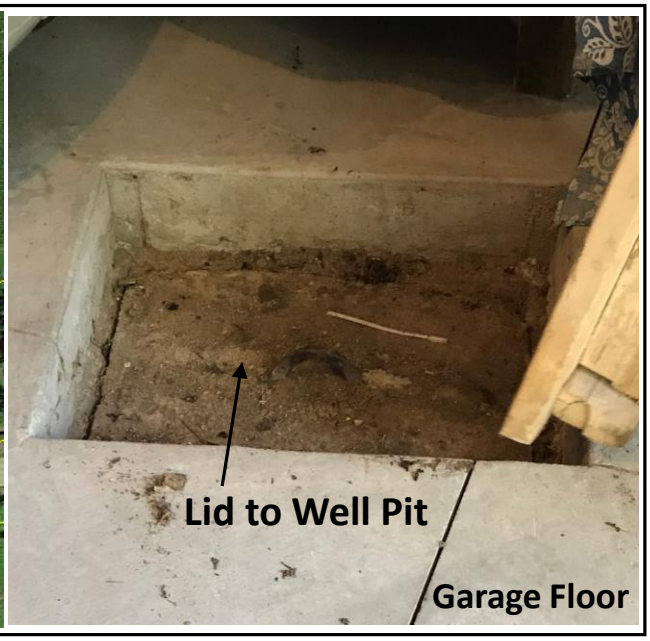
Maintenance:

Has the Well Been Cleaned?: No Deepened?: No Silt Removed?: No

Note:

Sketch of Well Location: (house, road, septic, well, etc. north arrow)





Measurements:

Well Tag: None Casing Inside Diameter: 6 to 6 1/4 inches Vermin Proof?: Yes

Well Location: NAD83 UTM17 Easting 533298 Northing 4803075 (+/- 3m)

Water Level Measurement: Unable to measure, water line from well to house comes back under pressure to feed garden hose and sink in garage. Top of well casing is 5 1/2 feet below grade in well pit.

Well Depth: Unknown

Stick up: 5 1/2 feet below grade (1.68 metres) Casing Type: Steel Wellhead Condition: Good

Note: Top of well casing is 5 1/2 feet below grade, 6 inches above well pit floor. Well pit is dry.

Survey Completed By: Allan Rodie Date: June 3, 2019

Harden Environmental Services Ltd.
4622 Nassagaweya-Puslinch Townline
Moffat, Ontario, L0P 1J0
Phone: (519) 826-0099

Water Well Survey

File: 1728 Proposed Hallman Pit

R9

Date/Time: June 5, 2019 / 1:30 pm

Location: 1785 Witmer Road

Well Record No. Unknown

Contact Information:

Resident(s) Names:

Owners Name if Different:

Address: 1785 Witmer Road

Petersburg, ON N0B 2H0

Person Interviewed:

Telephone:

Email:

How long at Property?

Well Details:

Number of Wells on Property: 2 Number of Wells in Use: 1 Note: Dug well with hand pump exists

Copy of Well Record?: No Is the Well Buried?: Drilled well in well pit - top of steel casing is 1.8 metres below grade

Is the Well Sealed Shut/Inaccessible?: Yes

Date Constructed: Unknown Type (drilled or Dug): Drilled Well Well Depth: Unknown

Pump Depth: Unknown

Well Use (domestic, livestock, irrigation) Domestic

Water Source (overburden/bedrock): Unknown Contractor: Unknown

Well Testing:

Has the Well Been Tested for Bacteria?: Yes How Often?: Occasionally

When Was the Last Bacteria Sample Taken?: Approximately 2014

Testing Results: Always passes (0 total coliform per 100 mL and 0 E. coli per 100 mL)

Have There Been Any Water Quality Problems?: No

What was done to correct the Problem?:

Other Notes on Water Quality:

Pump:

Pump Type (Suction-lift Jet Pump In Basement/Submersible Pump In Well): Submersible 1/2 hp

Depth of Pump Intake: Unknown Pumping Rate: Unknown

Storage Tank?: Yes Type: Pressure Tank Cistern?: No

Water Well Survey

Location: 1785 Witmer Road

Treatment:

☑ Water Softener ☐ Chlorinator ☐ UV Lamp ☐ Cartridge Filter ☐ RO Filter ☐ Other

Notes:

Water Quantity:

Have There Been Any Water Quantity Problems?: No

Has the Well Ever Gone Dry?: No When Was the Last Time the Well Went Dry?: _____

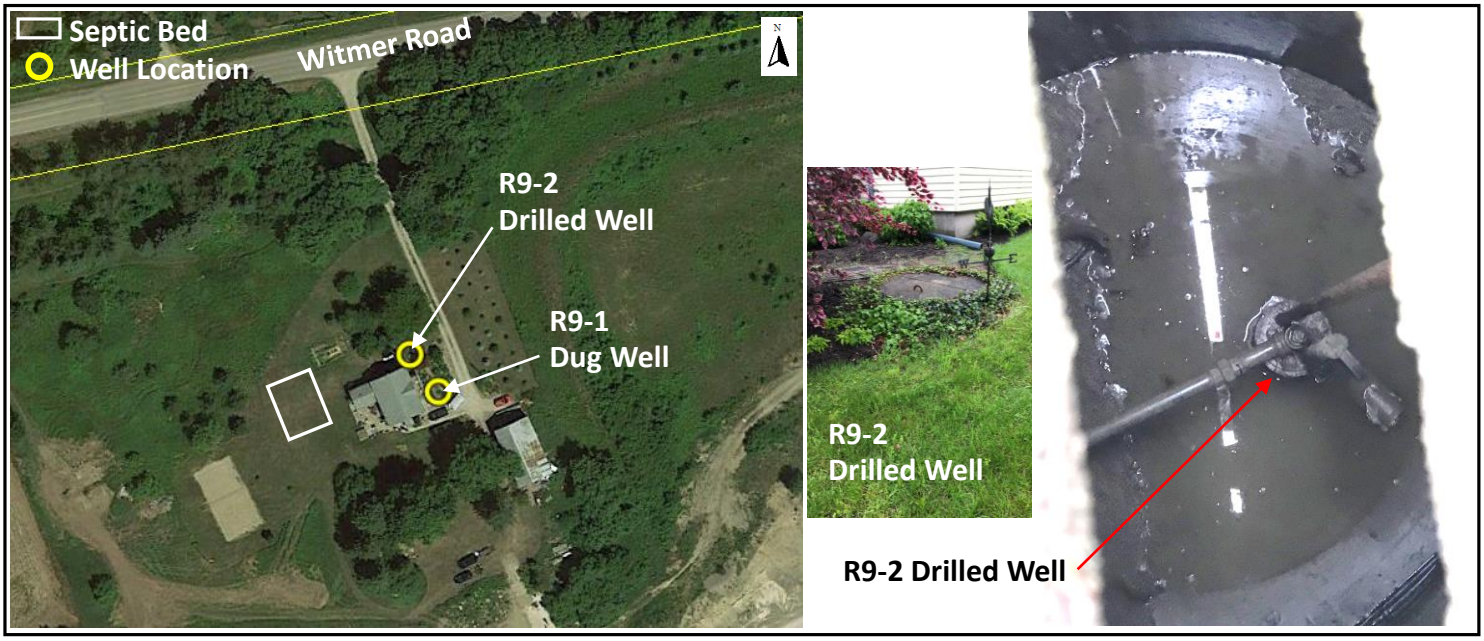
Notes:

Maintenance:

Has the Well Been Cleaned?: No Deepened?: No Silt Removed?: No

Note:

Sketch of Well Location: (house, road, septic, well, etc. north arrow)



Measurements:

Well Tag: None Casing Inside Diameter: approximately 6 inches Well Depth: Unknown

Well Location: NAD83 UTM17 - R9-1 Dug Well Easting 533384 Northing 4802932

- R9-2 Drilled Well Easting 533377 Northing 4802941

Water Level Measurement: Not taken, well sealed shut in well pit, water in pit is about 10 cm deep

Stick up: Well Pit is 2.00 metres deep below top of lid, top of steel casing is 1.80 metres deep below top of lid

Casing Type: Steel Wellhead Condition: Unknown, appears OK

Vermin Proof?: Appears to be, however surface water easily enters well pit through crack between dug well lid halves

Survey Completed By: Allan Rodie Date: June 5, 2019

Harden Environmental Services Ltd.
4622 Nassagaweya-Puslinch Townline
Moffat, Ontario, L0P 1J0
Phone: (519) 826-0099

Water Well Survey

File: 1728 Proposed Hallman Pit

R12

Date/Time: June 3, 2019 / 10:00 am

Location: 2008 Witmer Road

Well Record No. 6506072

Contact Information:

Resident(s) Names:

Owners Name if Different:

Address: 2008 Witmer Road

Petersburg, ON N0B 2H0

Person Interviewed:

Telephone:

Email:

How long at Property?

Well Details:

Number of Wells on Property: 1 Number of Wells in Use: 1

Copy of Well Record?: Yes Is the Well Buried?: No

Is the Well Sealed Shut/Inaccessible?: No

Date Constructed: Oct 21, 1986 Type (drilled or Dug): Drilled Well Well Depth: 100 feet

Pump Depth: recommended 90 feet

Well Use (domestic, livestock, irrigation) Domestic

Water Source (overburden/bedrock): Overburden Contractor: McLaughlin Water Wells

Well Testing:

Has the Well Been Tested for Bacteria?: Yes How Often?: occasionally

When Was the Last Bacteria Sample Taken?: approximately 2014

Where is the Sample Collected From/Method?: kitchen tap

Testing Results: Always passes (0 total coliform per 100 mL and 0 E. coli per 100 mL)

Have There Been Any Water Quality Problems?: Water is very good other than some hardness, calcium.

What was done to correct the Problem?:

Other Notes on Water Quality:

Pump:

Pump Type (Suction-lift Jet Pump In Basement/Submersible Pump In Well): Submersible

Depth of Pump Intake: recommended 90 feet Pumping Rate: recommended 10 gpm

Storage Tank?: Yes Type: Pressure Tank Cistern?: No

Water Well Survey

Location: 2008 Witmer Road

Treatment:

☐ Water Softener ☐ Chlorinator ☐ UV Lamp ☐ Cartridge Filter ☐ RO Filter ☐ Other

Notes: No treatment

Water Quantity:

Have There Been Any Water Quantity Problems?: No

Has the Well Ever Gone Dry?: No When Was the Last Time the Well Went Dry?: _____

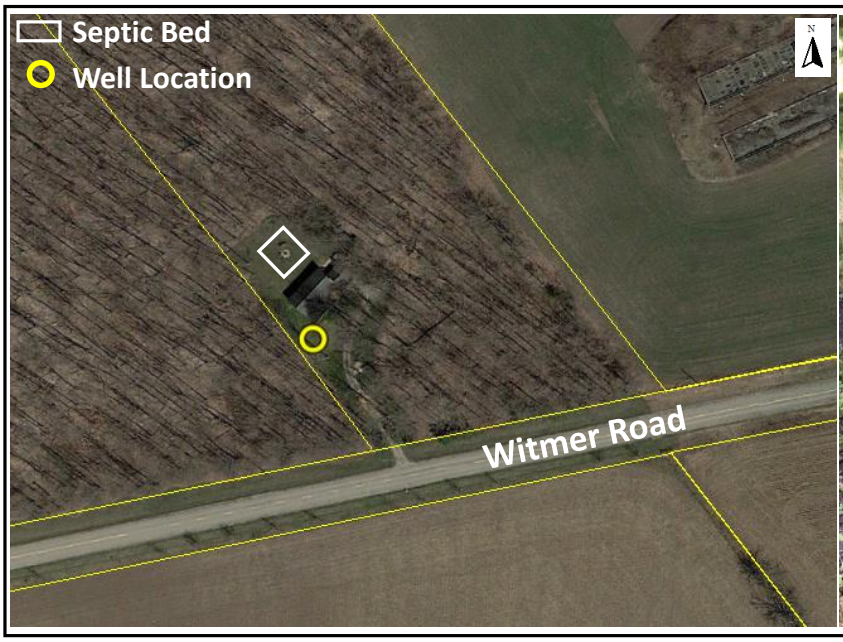
Notes:

Maintenance:

Has the Well Been Cleaned?: No Deepened?: No Silt Removed?: No

Note:

Sketch of Well Location: (house, road, septic, well, etc. north arrow)



Measurements:

Well Tag: None Casing Inside Diameter: 6 1/4 inches Well Depth: 100 feet

Well Location: NAD83 UTM17 Easting 532226 Northing 4802825 (+/- 3m)

Water Level Measurement: No measurement taken, cannot easily remove cap, allen key bolts seized

Stick up: 0.31 m Casing Type: Steel Wellhead Condition: Good

Vermin Proof?: Yes

Note: Stick-up is not to code (O.Reg. 903 requires stick-up > 0.40 m), Cap says “McLaughlin Water Wells”

Survey Completed By: Allan Rodie Date: June 3, 2019

HARDEN

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

6506072

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

COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	CON., BLOCK, TRACT, SURVEY ETC.	LOT
WATERLOO	WILMOT	S. BLEAMS RD.	11

[redacted] RR 2 PETERSBURG ONT

DATE COMPLETED: DAY 21 MO 10 YR 86

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
BLACK	TOPSOIL			0	1
BROWN	SAND	SILT	FINE LOOSE	1	94
BROWN	SAND		LOOSE	94	100

31
32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
94 -	1 ☑ FRESH 3 ☐ SULPHUR; 2 ☐ SALTY 4 ☐ MINERAL
98	1 ☐ FRESH 3 ☐ SULPHUR; 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR; 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR; 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR; 2 ☐ SALTY 4 ☐ MINERAL

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
6 1/4	1 ☑ STEEL; 2 ☐ GALVANIZED; 3 ☐ CONCRETE	.188	0	94
6	5 SCREEN		94	98
5 1/8	1 ☑ STEEL POCKET		98	100
	1 ☐ STEEL; 2 ☐ GALVANIZED; 3 ☐ CONCRETE; 4 ☐ OPEN HOLE			

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER	LENGTH
14	6 INCHES	4 FEET

MATERIAL AND TYPE: S.S. JOHNSTON
DEPTH TO TOP OF SCREEN: 94 FEET

61 PLUGGING & SEALING RECORD

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

71 PUMPING TEST

PUMPING TEST METHOD	PUMPING RATE	DURATION OF PUMPING
1 ☑ AIR PUMP 2 ☐ BAILER	12 GPM	1 HOURS 30 MINS

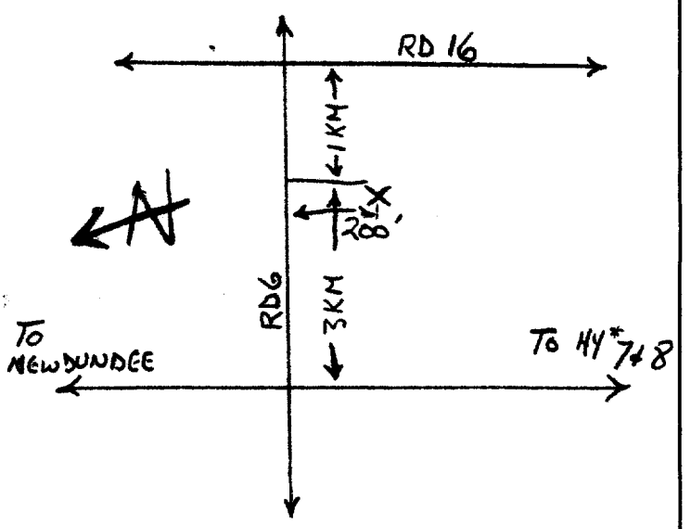
STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING: 1 ☐ PUMPING 2 ☑ RECOVERY	15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
80 FEET	85 FEET		80 FEET	— FEET	— FEET	— FEET

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

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
☐ SHALLOW ☑ DEEP	90 FEET	10 GPM

LOCATION OF WELL

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



DRILLERS REMARKS:

FINAL STATUS OF WELL

1 ☑ WATER SUPPLY; 2 ☐ OBSERVATION WELL; 3 ☐ TEST HOLE; 4 ☐ RECHARGE WELL; 5 ☐ ABANDONED, INSUFFICIENT SUPPLY; 6 ☐ ABANDONED, POOR QUALITY; 7 ☐ UNFINISHED

WATER USE

1 ☑ DOMESTIC; 2 ☐ STOCK; 3 ☐ IRRIGATION; 4 ☐ INDUSTRIAL; ☐ OTHER; 5 ☐ COMMERCIAL; 6 ☐ MUNICIPAL; 7 ☐ PUBLIC SUPPLY; 8 ☐ COOLING OR AIR CONDITIONING; 9 ☐ NOT USED

METHOD OF DRILLING

1 ☐ CABLE TOOL; 2 ☐ ROTARY (CONVENTIONAL); 3 ☐ ROTARY (REVERSE); 4 ☑ ROTARY (AIR); 5 ☐ AIR PERCUSSION; 6 ☐ BORING; 7 ☐ DIAMOND; 8 ☐ JETTING; 9 ☐ DRIVING

CONTRACTOR

NAME OF WELL CONTRACTOR: M'LAUGHLIN WATER WELLS — LICENCE NUMBER: 3518
ADDRESS: 38 DOLMAN ST. BRESLAU, ONT. NOB1M0
NAME OF DRILLER OR BORER: DON M'LAUGHLIN — LICENCE NUMBER:
SIGNATURE OF CONTRACTOR: R. M° Laughlin — SUBMISSION DATE: DAY 27 MO. 11 YR. 86

OFFICE USE ONLY

DATA SOURCE | CONTRACTOR | DATE RECEIVED: JUL 13 1987
DATE OF INSPECTION | INSPECTOR
REMARKS

CSS.ES

MINISTRY OF THE ENVIRONMENT COPY

FORM NO. 0506—4—77 FORM 7

Harden Environmental Services Ltd.
4622 Nassagaweya-Puslinch Townline
Moffat, Ontario, L0P 1J0
Phone: (519) 826-0099

Water Well Survey

File: 1728 Proposed Hallman Pit

Date/Time: June 5, 2019 / 3:00 pm

R13

Location: 2040 Witmer Road
Well Record No. 6504197

Contact Information:

Resident(s) Names:
Owners Name if Different:
Address: 2040 Witmer Road
RR2, Petersburg, ON N0B 2H0

Person Interviewed:
Telephone:
Email:
How long at Property?

Well Details:

Number of Wells on Property: 1 Number of Wells in Use: 1
Copy of Well Record?: Yes Is the Well Buried?: No
Is the Well Sealed Shut/Inaccessible?: No
Date Constructed: Sep 16, 1974 Type (drilled or Dug): Drilled Well Well Depth: 101 feet
Pump Depth: recommended pump setting of 90 feet
Well Use (domestic, livestock, irrigation) Domestic
Water Source (overburden/bedrock): Overburden Contractor: C. A. Kerr Well Drilling

Well Testing:

Has the Well Been Tested for Bacteria?: Yes How Often?: Once, not since purchase of home
When Was the Last Bacteria Sample Taken?: 2011
Where is the Sample Collected From/Method?: unknown
Testing Results: Passed (0 total coliform per 100 mL and 0 E. coli per 100 mL)

Have There Been Any Water Quality Problems?: Water is good other than hardness, some staining from iron and manganese

---

What was done to correct the Problem?:

Other Notes on Water Quality: Bottled water is used for drinking water

Pump:

Pump Type (Suction-lift Jet Pump In Basement/Submersible Pump In Well): Submersible
Depth of Pump Intake: approximately 90 feet Pumping Rate: recommended 8 gpm
Storage Tank?: Yes Type: Pressure Tank Cistern?: No

Water Well Survey

Location: 2040 Witmer Road

Treatment:

☐ Water Softener ☐ Chlorinator ☐ UV Lamp ☐ Cartridge Filter ☐ RO Filter ☐ Other

Notes: Water softener installed but currently not working. Bottled water is used for drinking water.

Water Quantity:

Have There Been Any Water Quantity Problems?: No

Has the Well Ever Gone Dry?: No When Was the Last Time the Well Went Dry?: _____

Notes:

Maintenance:

Has the Well Been Cleaned?: No Deepened?: No Silt Removed?: No

Note:

Sketch of Well Location: (house, road, septic, well, etc. north arrow)

Measurements:

Well Tag: None Casing Inside Diameter: 5 inches

Well Location: NAD83 UTM17 Easting 532084 Northing 4802796 (+/- 3m)

Water Level Measurement: 20.65 metres below casing top (20.63 metres / 67 feet 8 inches below ground surface)

Well Depth: 30.78 metres below ground surface (101 feet below ground surface)

Stick up: 0.02 m Casing Type: Steel Wellhead Condition: Good

Vermin Proof?: Yes

Note: Stick-up is not to code (O.Reg. 903 requires stick-up of >0.40 m)

Survey Completed By: Allan Rodie Date: June 5, 2019

MINISTRY OF THE ENVIRONMENT
The Ontario Water Resources Act

WATER WELL RECORD

40 P/7h

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

11 | 6504197 | MUNICIP. 65004 | CON. BR S

COUNTY OR DISTRICT: [redacted]
TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE: Wilmot
CON., BLOCK, TRACT, SURVEY, ETC.: South of Bleams Road
LOT: 010
DATE COMPLETED: DAY 16 MO Sept. YR. 74
ADDRESS OF WELL: [redacted] R. R.2 Peterabura
02637 | RC 4 | ELEVATION 1228 | RC 4 | BASIN CODE 23

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
Brown	Dry Gravel		Loose	I	95
" "	Sand		" "	95	IOI

31 | 0095611 7768 0101 62077

32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
0095	1 ☒ FRESH 3 ☐ SULPHUR; 2 ☐ SALTY 4 ☐ MINERAL
95-101	
	1 ☐ FRESH 3 ☐ SULPHUR; 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR; 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR; 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR; 2 ☐ SALTY 4 ☐ MINERAL

51 CASING & OPEN HOLE RECORD

OUTSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
05	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	258	I	0095
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			

SCREEN

SIZE(S) OF OPENING (SLOT NO.): 016
DIAMETER: 05.000 INCHES
LENGTH: 03 FEET
MATERIAL AND TYPE: Stainless Steel
DEPTH TO TOP OF SCREEN: 0088 FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT LEAD PACKER ETC.)
00	[redacted]	of 4½" tail pipe with marlin packer

71 PUMPING TEST

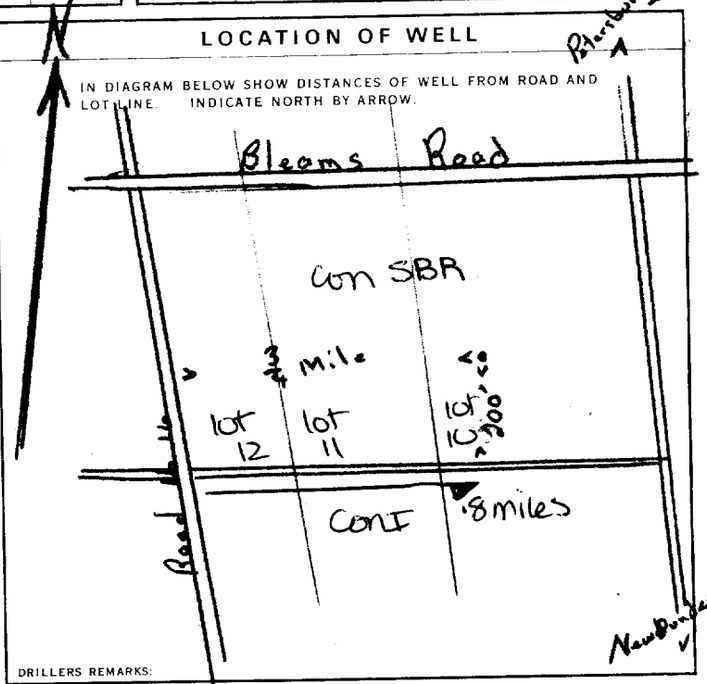
PUMPING TEST METHOD: 1 ☐ PUMP 2 ☐ BAILER
PUMPING RATE: 0010 GPM
DURATION OF PUMPING: 08 HOURS 00 MINS

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING: 1 ☒ PUMPING 2 ☐ RECOVERY	15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
067 FEET	[redacted] FEET		077 FEET	079 FEET	079 FEET	079 FEET

IF FLOWING, GIVE RATE: GPM
PUMP INTAKE SET AT: 90 FEET
WATER AT END OF TEST: 1 ☒ CLEAR 2 ☐ CLOUDY
RECOMMENDED PUMP TYPE: ☐ SHALLOW ☒ DEEP
RECOMMENDED PUMP SETTING: 090 FEET
RECOMMENDED PUMPING RATE: 0008 GPM

LOCATION OF WELL

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



DRILLERS REMARKS:

FINAL STATUS OF WELL: 1
1 ☒ WATER SUPPLY 2 ☐ OBSERVATION WELL 3 ☐ TEST HOLE 4 ☐ RECHARGE WELL 5 ☐ ABANDONED, INSUFFICIENT SUPPLY 6 ☐ ABANDONED, POOR QUALITY 7 ☐ UNFINISHED

WATER USE: 01
1 ☒ DOMESTIC 2 ☐ STOCK 3 ☐ IRRIGATION 4 ☐ INDUSTRIAL ☐ OTHER 5 ☐ COMMERCIAL 6 ☐ MUNICIPAL 7 ☐ PUBLIC SUPPLY 8 ☐ COOLING OR AIR CONDITIONING 9 ☐ NOT USED

METHOD OF DRILLING: 1
1 ☒ CABLE TOOL 2 ☐ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☐ ROTARY (AIR) 5 ☐ AIR PERCUSSION 6 ☐ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING

CONTRACTOR

NAME OF WELL CONTRACTOR: C. A. Kerr Well Drilling
LICENCE NUMBER: 3134
ADDRESS: Box 281 Baden
NAME OF DRILLER OR BORER: Charles A. Kerr
LICENCE NUMBER: 3134
SIGNATURE OF CONTRACTOR: Charles A. Kerr
SUBMISSION DATE: DAY 25 MO Sept YR. 74

OFFICE USE ONLY

DATA SOURCE: 1
CONTRACTOR: 3134
DATE RECEIVED: 161074
DATE OF INSPECTION:
INSPECTOR: KP/P
REMARKS: CSS.S8

MINISTRY OF THE ENVIRONMENT COPY

FORM 7 07-091

Harden Environmental Services Ltd.
4622 Nassagaweya-Puslinch Townline
Moffat, Ontario, L0P 1J0
Phone: (519) 826-0099

Water Well Survey

File: 1728 Proposed Hallman Pit

Date/Time: June 3, 2019 / 9:00 am

R14

Location: 2056 Witmer Road
Well Record No. 6507228

Contact Information:

Resident(s) Names:
Owners Name if Different:
Address: 2056 Witmer Road
RR2, Petersburg, ON N0B 2H0

Person Interviewed:
Telephone:
Email:
How long at Property?

Well Details:

Number of Wells on Property: 1 Number of Wells in Use: 1
Copy of Well Record?: Yes Is the Well Buried?: No
Is the Well Sealed Shut/Inaccessible?: No
Date Constructed: Nov 7, 1991 Type (drilled or Dug): Drilled Well Well Depth: 93 feet
Pump Depth: recommended pump setting of 82 feet
Well Use (domestic, livestock, irrigation) Domestic and for Water Supply to Dog Kennel
Water Source (overburden/bedrock): Overburden Contractor: Davidson Well Drilling

Well Testing:

Has the Well Been Tested for Bacteria?: Yes How Often?: Occasionally
When Was the Last Bacteria Sample Taken?: Approximately 2014
Where is the Sample Collected From/Method?: Kitchen tap
Testing Results: Always passed (0 total coliform per 100 mL and 0 E. coli per 100 mL)

Have There Been Any Water Quality Problems?: None, very good water, no iron or sulphur issues

---

What was done to correct the Problem?:

Other Notes on Water Quality: Water quality is excellent, hot water tank has lasted 28 years
Nitrate sample taken March 21, 2006, nitrate level was 6.61 mg/L (see attached)

Pump:

Pump Type (Suction-lift Jet Pump In Basement/Submersible Pump In Well): Submersible
Depth of Pump Intake: approximately 82 feet Pumping Rate: recommended 6 gpm
Storage Tank?: Yes Type: Pressure Tank Cistern?: No

Water Well Survey

Location: 2056 Witmer Road

Treatment:

☐ Water Softener ☐ Chlorinator ☐ UV Lamp ☐ Cartridge Filter ☐ RO Filter ☐ Other

Notes: No Treatment

Water Quantity:

Have There Been Any Water Quantity Problems?: No

Has the Well Ever Gone Dry?: No When Was the Last Time the Well Went Dry?: _____

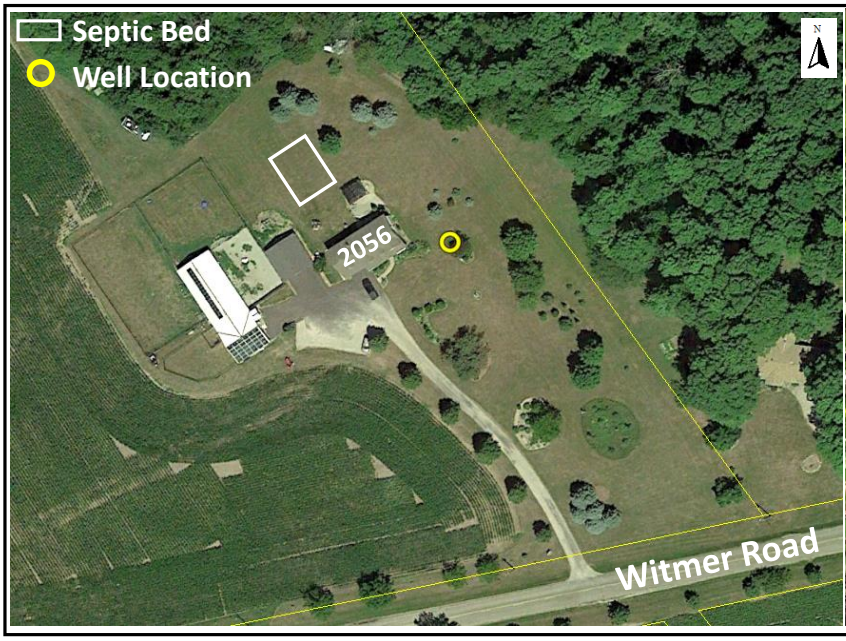
Notes:

Maintenance:

Has the Well Been Cleaned?: No Deepened?: No Silt Removed?: No

Note:

Sketch of Well Location: (house, road, septic, well, etc. north arrow)



Measurements:

Well Tag: None Casing Inside Diameter: 6 inches

Well Location: NAD83 UTM17 Easting 531979 Northing 4802823 (+/- 3m)

Water Level Measurement: 21.56 metres below casing top (21.30 metres / 69.9 feet below ground surface)

Well Depth: 28.35 metres below ground surface (93 feet below ground surface)

Stick up: 0.26 m Casing Type: Steel Wellhead Condition: Good

Vermin Proof?: Very small opening between conduit and lid, owner to fix today June 3, 2019

Note: Stick-up is not to code (O.Reg. 903 requires stick-up of >0.40 m)

Survey Completed By: Allan Rodie Date: June 3, 2019

Region of Waterloo

PUBLIC HEALTH
Environmental Health
and Lifestyle Resources
P.O. Box 1633
99 Regina Street South
Waterloo ON Canada N2J 4V3
Telephone: (519) 883-2008
Fax: (519) 883-2226
www.region.waterloo.on.ca

April12, 2006

2056 Witmer Road, RR #2
Petersburg, ON N0B 2H0

Thank you for participating in our well water sampling program. This program was provided to you by Region of Waterloo Public Health and the Public Health Agency of Canada.

The drinking water samples you submitted on March 21, 2006 taken at the above address were tested for the presence of nitrates and both Total Coliform and *E.coli* bacterial indicators of contamination. The results indicated a nitrate level of 6.61 mg/L; a Total Coliform level of 0/100 mL; and an *E.Coli* level of 0/100 mL.

Interpretation:

☒ Meets the Ontario Drinking Water Quality Chemical Standards of 10 mg/L nitrate or less.

☐ Exceeds the Ontario Drinking Water Quality Chemical Standards of greater than 10 mg/L nitrate.

☒ No significant evidence of bacterial contamination.
3 consecutive samples, taken 1 to 3 weeks apart, with this designation are needed to determine the stability of the water supply.

☐ Significant evidence of bacterial contamination.
May be unsafe to drink.

☐ Unsafe to drink.
Evidence of sewage contamination.

If your sample exceeds water quality standards, has significant evidence of bacterial contamination or is unsafe to drink, please refer to the fact sheets found in the 'Keeping Your Well Water Safe to Drink' package which was included with your sample bottle. **If you have any questions or concerns please contact Environmental Health at 883-2008 ext. 5147 and speak with a Public Health Inspector.**

It is recommended that private wells be tested for nitrates once per year and for bacteria three times per year.

Best regards,

Brenda Miller

Brenda Miller, BA CIPHI(C)
Acting Manager, Environmental Health
(519) 883-2271

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

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

11 | 6507228 | MUNICIP 65004 | CON. BR S

COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	CON., BLOCK, TRACT, SURVEY, ETC	LOT
Waterloo	Wilmot Twp.	Con. Bleams Rd. S.	Pt.11

[redacted] R.R. 2, Petersburg, Ontario. N0B 2H0

DATE COMPLETED: DAY 7 MO Nov. YR 91.

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
Brown	Sand		Soft	0	18
Brown	Gravel		Soft	18	29
Brown	Sand		Soft	29	93

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
86-89	1 ☒ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
6	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC	.188	+1-4	86-0
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC			
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC			

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER	LENGTH
# 18 slot	5.75 INCHES	3 FEET

MATERIAL AND TYPE: STainless Steel Telescope

DEPTH TO TOP OF SCREEN: 86 FEET

61 PLUGGING & SEALING RECORD

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

71 PUMPING TEST

PUMPING TEST METHOD	PUMPING RATE	DURATION OF PUMPING
1 ☒ PUMP 2 ☐ BAILER	7 GPM	2 HOURS ___ MINS

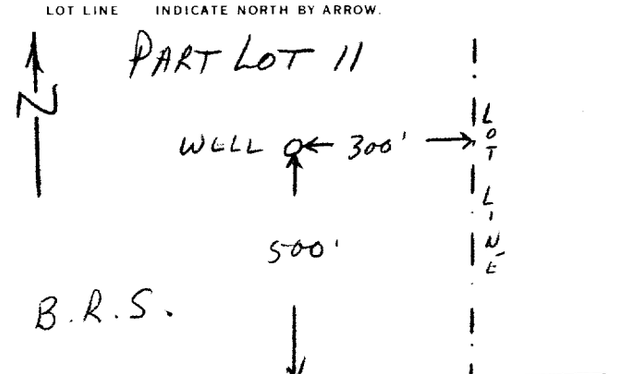
STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING	15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
71 FEET	72 FEET	1 ☐ PUMPING 2 ☒ RECOVERY	71 FEET	71 FEET	71 FEET	71 FEET

IF FLOWING, GIVE RATE	PUMP INTAKE SET AT	WATER AT END OF TEST
GPM	82 FEET	1 ☒ CLEAR 2 ☐ CLOUDY

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
☐ SHALLOW ☒ DEEP	82 FEET	6 GPM

LOCATION OF WELL

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



DRILLERS REMARKS: 099778

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

CONTRACTOR

NAME OF WELL CONTRACTOR: Davidson Well Drilling Limited
WELL CONTRACTOR'S LICENCE NUMBER: 1737
ADDRESS: Box 486, Wingham, Ontario. N0G 2W0
NAME OF WELL TECHNICIAN: D. Fenton
WELL TECHNICIAN'S LICENCE NUMBER: T2003
SIGNATURE OF TECHNICIAN/CONTRACTOR: [signature]
SUBMISSION DATE: DAY 15 MO. Nov. YR. 91.

OFFICE USE ONLY

DATA SOURCE | CONTRACTOR 1737 | DATE RECEIVED FEB 10 1992
DATE OF INSPECTION | INSPECTOR
REMARKS: CSS.ES

MINISTRY OF THE ENVIRONMENT COPY

FORM NO. 0506 (11/86) FORM 9

Harden Environmental Services Ltd.
4622 Nassagaweya-Puslinch Townline
Moffat, Ontario, L0P 1J0
Phone: (519) 826-0099

Water Well Survey

File: 1728 Proposed Hallman Pit

Date/Time: June 5, 2019 / 2:00 pm

R15

Location: 2089 Witmer Road
Well Record No. 7289418
TAG A216960

Contact Information:

Resident(s) Names:
Owners Name if Different:
Mailing Address: 2634 Bleams Road
New Hamburg, ON N3A 3H9

Person Interviewed:
Telephone:
Email:
How long at Property?

Well Details:

Number of Wells on Property: 2 Number of Wells in Use: 1 Note: Dug well is used for backup if needed
Copy of Well Record?: Yes Is the Well Buried?: No
Is the Well Sealed Shut/Inaccessible?: No (Stone lined dug well is not accessible for a water level measurement)
Date Constructed: March 5/2017 Type (drilled or Dug): Drilled Well Well Depth: 82 feet (Dug well depth is unknown)
Pump Depth: recommended 70 feet
Well Use (domestic, livestock, irrigation) Livestock (chickens) The residence no longer exists, strictly livestock use.
Water Source (overburden/bedrock): Overburden Contractor: HOPPER WELL DRILLING

Well Testing:

Has the Well Been Tested for Bacteria?: Yes How Often?: Every 6 months
When Was the Last Bacteria Sample Taken?: 2019
Testing Results: Always passes (0 total coliform per 100 mL and 0 E. coli per 100 mL)

Have There Been Any Water Quality Problems?: No

What was done to correct the Problem?:

Other Notes on Water Quality:

Pump:

Pump Type (Suction-lift Jet Pump In Basement/Submersible Pump In Well): Submersible
Depth of Pump Intake: 70 feet Pumping Rate: recommended 10 gpm
Storage Tank?: Yes Type: Pressure Tank Cistern?: No

Water Well Survey

Location: 2089 Witmer Road

Treatment:

☐ Water Softener ☐ Chlorinator ☐ UV Lamp ☐ Cartridge Filter ☐ RO Filter ☐ Other

Notes: Automated daily peroxide treatment for bacteria, up to 90,000 chickens are supplied with water.

Water Quantity:

Have There Been Any Water Quantity Problems?: No

Has the Well Ever Gone Dry?: No When Was the Last Time the Well Went Dry?: _____

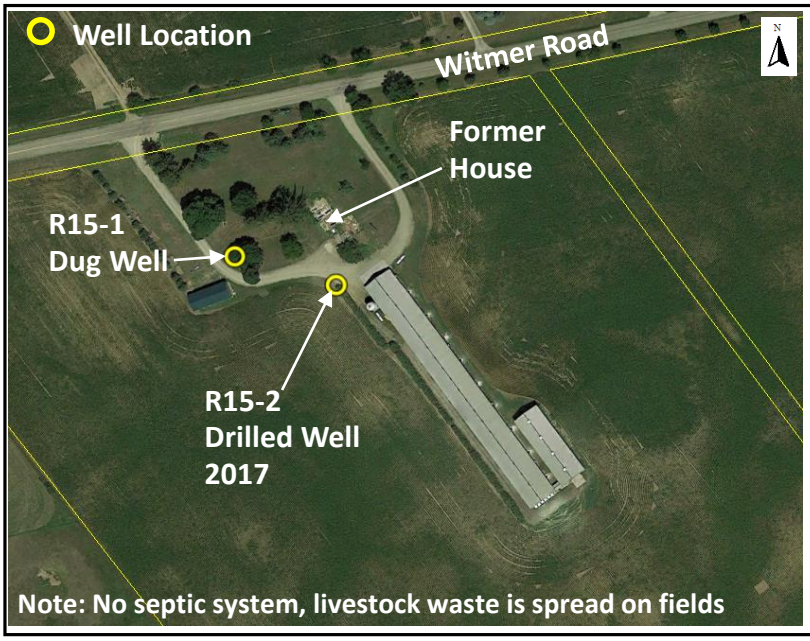
Notes:

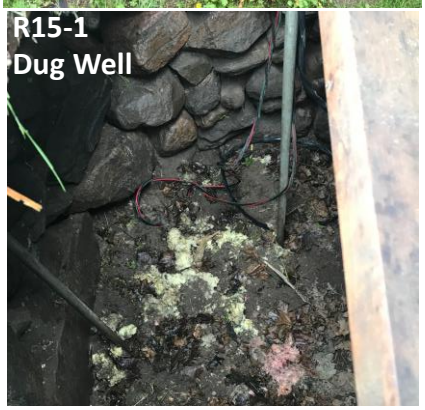
Maintenance:

Has the Well Been Cleaned?: No Deepened?: No Silt Removed?: No

Note:

Sketch of Well Location: (house, road, septic, well, etc. north arrow)





Measurements:

Well Tag: A216960 Casing Inside Diameter: 6 inches Well Depth: 82 feet below ground surface

Well Location: NAD83 UTM17 - R15-1 Dug Well Easting 531901 Northing 4802638

- R15-2 Drilled Well Easting 531948 Northing 4802625

Water Level Measurement: Not taken, owner does not want well cap taken off (well record static water level is 60.5 feet)

Water level and depth of dug well cannot be measured, well is sealed

Stick up: 0.73 m Casing Type: Steel Wellhead Condition: Good

Vermin Proof?: Yes

Survey Completed By: Allan Rodie Date: June 5, 2019

Well ID Number: 7289418
Well Audit Number: *Z247096*
Well Tag Number: *A216960*

This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	2089 WITMER ROAD
Township	WILMOT TOWNSHIP
Lot	011
Concession	BLOC A 01
County/District/Municipality	WATERLOO
City/Town/Village	PETERSBURG
Province	ON
Postal Code	n/a
UTM Coordinates	NAD83 — Zone 17 Easting: 531942.00 Northing: 4802624.00
Municipal Plan and Sublot Number	
Other	

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
BRWN	SAND		SLTY	0 ft	13 ft
BRWN	SAND	GRVL		13 ft	30 ft
BRWN	SAND			30 ft	40 ft
RED	CLAY		SLTY	40 ft	48 ft
BRWN	SAND			48 ft	60 ft
BRWN	CSND			60 ft	67 ft
BRWN	SAND		SLTY	67 ft	81 ft
BRWN	CLAY			81 ft	82 ft

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed
0 ft	58 ft	BENTONITE SLURRY	
58 ft	82 ft	SAND PACK	

Method of Construction & Well Use

Method of Construction	Well Use
Rotary (Convent.)	Livestock Domestic

Status of Well

Construction Record - Casing

Inside Diameter	Open Hole or material	Depth From	Depth To
6 inch	STEEL	-2 ft	63 ft
6 inch	STEEL	67 ft	82 ft

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To
6 inch	STAINLESS STEEL	63 ft	67 ft

Well Contractor and Well Technician Information

Well Contractor's Licence Number: 2644

Results of Well Yield Testing

After test of well yield, water was	CLEAR
If pumping discontinued, give reason	
Pump intake set at	70 ft
Pumping Rate	10 GPM
Duration of Pumping	1 h:0 m
Final water level	63.2 ft
If flowing give rate	
Recommended pump depth	70 ft
Recommended pump rate	10 GPM
Well Production	
Disinfected?	Y

Draw Down & Recovery

Draw Down Time(min)	Draw Down Water level	Recovery Time(min)	Recovery Water level
SWL	60.5 ft		
1	62.9 ft	1	60.5 ft
2	63.1 ft	2	30.7 ft
3	63.1 ft	3	60.7 ft
4	63.1 ft	4	60.7 ft
5	63.1 ft	5	60.7 ft
10	63.1 ft	10	60.7 ft
15	62.9 ft	15	60.7 ft
20	63 ft	20	60.7 ft
25	63 ft	25	60.6 ft
30	63 ft	30	60.6 ft
40	63.1 ft	40	60.5 ft
45		45	
50	63.2 ft	50	60.5 ft
60	63.2 ft	60	60.5 ft

Water Details

Water Found at Depth	Kind
63 ft	Fresh
67 ft	Fresh

Hole Diameter

Depth From	Depth To	Diameter
0 ft	82 ft	8.75 inch

Audit Number: Z247096

Date Well Completed: March 05, 2017

Date Well Record Received by MOE: June 30, 2017

Harden Environmental Services Ltd.
4622 Nassagaweya-Puslinch Townline
Moffat, Ontario, L0P 1J0
Phone: (519) 826-0099

Water Well Survey

File: 1728 Proposed Hallman Pit

Date/Time: June 3, 2019 / 11:00 am

R16

Location: 1874 Witmer Road

Well Record No. 6504927

Contact Information:

Resident(s) Names:

Owners Name if Different:

Address: 1874 Witmer Road

Petersburg, ON N0B 2H0

Person Interviewed:

Telephone:

Email:

How long at Property?

Well Details:

Number of Wells on Property: 1 Number of Wells in Use: 1

Copy of Well Record?: Yes Is the Well Buried?: No

Is the Well Sealed Shut/Inaccessible?: No Note: Well is connected to 1894 Witmer Rd, line to 1894 is now shut off with valve

Date Constructed: Jul 18, 1979 Type (drilled or Dug): Drilled Well Well Depth: 338 feet

Pump Depth: approximately 200 feet

Well Use (domestic, livestock, irrigation) Domestic (well used to supply two houses, house at 1894 no longer exists)

Water Source (overburden/bedrock): Bedrock Contractor: C. A. Kerr Well Drilling

Well Testing:

Has the Well Been Tested for Bacteria?: Yes How Often?: Once, not since purchase of home

When Was the Last Bacteria Sample Taken?: 2005

Where is the Sample Collected From/Method?: unknown

Testing Results: Passed (0 total coliform per 100 mL and 0 E. coli per 100 mL)

Have There Been Any Water Quality Problems?: Water is good other than hardness, iron. Odour issue occurs twice per year in bathroom, treated with vinegar in trap. Brown / orange staining.

What was done to correct the Problem?: Iron Filter, reverse osmosis system for drinking water.

Other Notes on Water Quality:

Pump:

Pump Type (Suction-lift Jet Pump In Basement/Submersible Pump In Well): Submersible

Depth of Pump Intake: recommended 170 feet Pumping Rate: recommended 10 gpm

Storage Tank?: Yes Type: Pressure Tank Cistern?: No

Water Well Survey

Location: 1874 Witmer Road

Treatment:

☑ Water Softener ☐ Chlorinator ☐ UV Lamp ☐ Cartridge Filter ☑ RO Filter ☐ Other

Notes: New water softener and RO system in 2012. Iron filter new 2005.

Water Quantity:

Have There Been Any Water Quantity Problems?: No

Has the Well Ever Gone Dry?: No When Was the Last Time the Well Went Dry?: _____

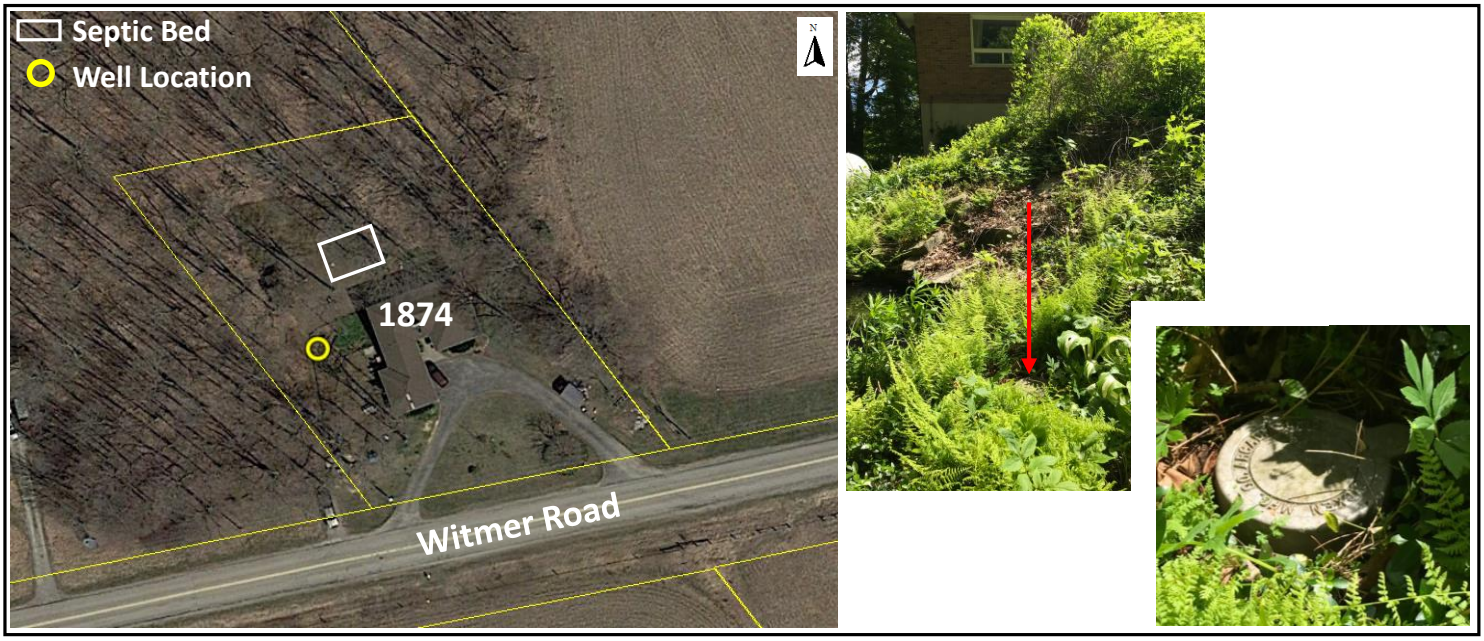
Notes:

Maintenance:

Has the Well Been Cleaned?: No Deepened?: No Silt Removed?: No

Note: New pump in 2008

Sketch of Well Location: (house, road, septic, well, etc. north arrow)



Measurements:

Well Tag: None Casing Inside Diameter: 5 inches

Well Location: NAD83 UTM17 Easting 532873 Northing 4802950 (+/- 3m)

Water Level Measurement: 42.93 metres below casing top (42.91 metres / 140 feet 9 inches below ground surface)

Well Depth: 103 metres below ground surface (338 feet below ground surface)

Stick up: 0.02 m Casing Type: Steel Wellhead Condition: Good

Vermin Proof?: No, cap is loose, some very small openings <5mm

Note: Stick-up is not to code (O.Reg. 903 requires stick-up of >0.40 m)

Survey Completed By: Allan Rodie Date: June 3, 2019

Ministry of the Environment

Ontario

The Ontario Water Resources Act

WATER WELL RECORD

40P/7h.

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

(11) 6504927 MUNICIP. 65004 CON. BA S

COUNTY OR DISTRICT: [redacted]

TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE: Wilmot

CON., BLOCK, TRACT, SURVEY, ETC.: South Of Bleams Road

LOT: 010

DATE COMPLETED: DAY 18 MO July YR 79

R. 2 Petersburg

ELEVATION: 1120 RC 4 BASIN CODE 23

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
Brown	Sand		Loose	I	I8
" "	Gravel	Clay	" "	I8	78
" "	Clay	Stones	Hard	78	I08
" "	Clay		" "	I08	I38
" "	Clay	Gravel	" "	I38	I66
Gray	Clay		" "	I66	248
Brown	Clay	Stones	" "	248	330
" "	Limestone		" "	330	338

(31) (32)

(41) WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
0336	1 ☒ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL

(51) CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
05	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	244	I	0330
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER INCHES	LENGTH FEET
MATERIAL AND TYPE	DEPTH TO TOP OF SCREEN FEET	

(61) PLUGGING & SEALING RECORD

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

(71) PUMPING TEST

PUMPING TEST METHOD	PUMPING RATE	DURATION OF PUMPING
1 ☒ PUMP 2 ☐ BAILER	0012 GPM	05 HOURS 00 MINS

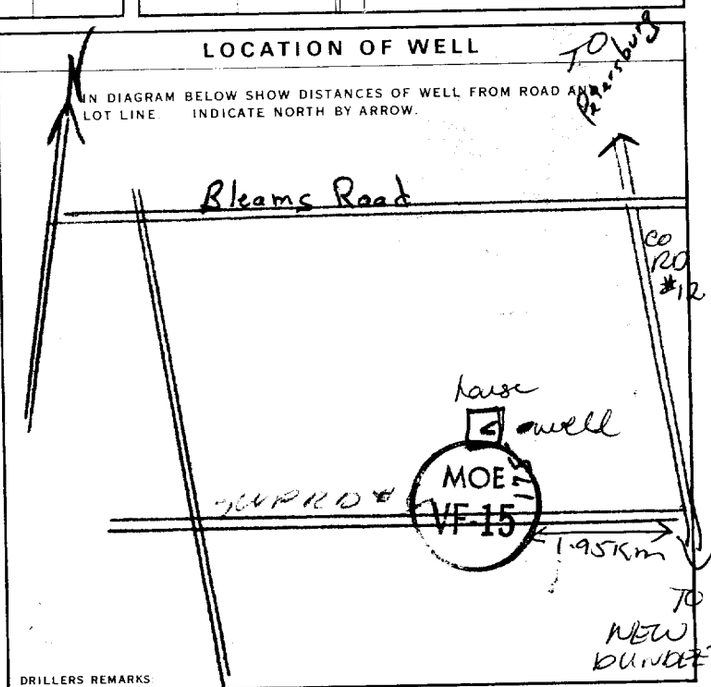
STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING: 1 ☒ PUMPING 2 ☐ RECOVERY			
		15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
I48 FEET	I52 FEET	I52 FEET	FEET	FEET	I52 FEET

IF FLOWING, GIVE RATE	PUMP INTAKE SET AT	WATER AT END OF TEST
GPM	I70 FEET	1 ☒ CLEAR 2 ☐ CLOUDY

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
☐ SHALLOW ☒ DEEP	I70 FEET	0010 GPM

LOCATION OF WELL

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



DRILLERS REMARKS:

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

CONTRACTOR

NAME OF WELL CONTRACTOR: C. A. Kerr Well Drilling — LICENCE NUMBER: 3134

ADDRESS: 66 Christian St. Baden

NAME OF DRILLER OR BORER: Charles A. Kerr — LICENCE NUMBER: 3134

SIGNATURE OF CONTRACTOR: Charles A. Kerr — SUBMISSION DATE: DAY 21 MO July YR 79

OFFICE USE ONLY

DATA SOURCE: 1 — CONTRACTOR: 3134 — DATE RECEIVED: 300779

DATE OF INSPECTION — INSPECTOR: May 25/81 JW Gooder

REMARKS: CSS.S8

FORM NO. 0506—4—77

MINISTRY OF THE ENVIRONMENT COPY

Appendix F

Spill Contingency Plan

RECOMMENDED PROCEDURES FOR THE PREVENTION AND MITIGATION OF CONTAMINANT SPILLS 2019

JACKSON HARVEST FARMS LIMITED

Emergency Response Numbers:

Fire, Ambulance, Police	**911**
MECP Spills Action Centre	**1-800-268-6060**
Tri City Materials Office	**1-519-634-5110**
Tri City Materials Emergency (R. Esbaugh)	**1-519-588-2884**
Tri City Materials Emergency (A. Kropf)	**1-519-505-0574**
Region of Waterloo - Emergency	**911**
Region of Waterloo Service First Call Centre	**519-575-4400**
Township of Wilmot (General Contact)	**519-634-8444**

TABLE OF CONTENTS

ATTACHMENTS

1.0 Introduction

The majority of spills can be minimized through the adoption of good housekeeping policies. Cleanliness, readiness to respond to problems and correct waste management techniques will go a long way to creating a better working environment and prevention of spills. The following list identifies the more common contaminants which could be present on a regular basis on the site.

Vehicular Operating Fuels	Gasoline, diesel fuel
Lubricants	Motor oil, grease, lubricants, coolants, brake fluids, transmission fluids and other liquids used in the normal operation of a vehicle.
Miscellaneous Liquids	degreasing agents, solvents

The site foreman and all employees on site shall be familiar with procedures as set out in the attached document - “Plan of Action - Contaminant Spills".

2.0 Objective

The objective of this brief is to describe the procedures which will be undertaken to prevent and ameliorate spills of contaminant materials and to minimize the adverse effects if a spill does occur. A spill can be defined as a discharge of a pollutant:

a) into the natural environment,
b) from or out of a structure, vehicle or any other container and
c) which will have an adverse impact on the natural environment.

3.0 Prevention

The majority of products listed in the Introduction are used in the operation and maintenance of vehicles. One of the various methods, as outlined in this section will be used by the site operators to service vehicles and machinery, depending on the level of activity at the site or on the stage at which the pit is operating.

3.1 Vehicular Maintenance

3.1.1 Outdoor Maintenance

Mobile vehicles will be driven off-site for maintenance.

3.2 Immobile Equipment

Crushers, screens, conveyers, generators etc. require regular maintenance. This often entails lubrication, cleaning and/or replacement of oils. All fluids removed from this machinery will be collected and removed from the site. All spillage of fuels, liquids, lubricants etc. will be cleaned up immediately. The use of degreasers on immobile machinery will be kept to a minimum.

4.0 Mitigation

Due to unforeseeable circumstances and/or catastrophic events, spills of larger quantities of materials may occur. In the event of this occurring the following procedure will be followed:

4.1 The following information regarding the spill will be reported immediately to the site foreman:

- Type of substance spilled
- Quantity of substance spilled

- Location of spill
- Time that spill occurred

4.2 If the spill is over 80 litres of oils or 40 litres of fuel, degreasing agents, coolants or solvents, the MECP and the Region of Waterloo will be informed immediately. The current telephone number for the MECP Spills Action Centre is 1-800-268-6060 (24 hrs) and the Region of Waterloo is 911 or 519-575-4400. Attached is the Region of Waterloo Spills Response Fact Sheet.

4.3 Regardless of the quantity of the spill, mitigative measures will commence immediately in accordance with the attached plan of action. Initial measures will involve excavation of the contaminated soil. The soil removed from the spill area will be stored onsite in a manner acceptable to the MECP until the MECP has had an opportunity to assess the situation. If required by the MECP, the site operator will remove the contaminated material from the site by an approved waste hauler to an approved waste receiver.

4.4 If it is reasonable to suspect that the contamination will ultimately reach the groundwater the following procedures will be followed.

4.4.1 The excavation will be extended to the water table and a pump, suitable for the type of contamination, will be installed and operated to collect the contaminated groundwater. The collected groundwater will be stored, treated and discharged or removed from the site as recommended by the MECP.

4.4.2 Where the thickness of soil above the water table makes it impossible to excavate to the water table, a withdrawal well will be drilled and a pumping system installed and operated to collect the contaminated ground water. The collected ground water will be stored on site, treated and discharged or removed from the site.

4.5 If required, additional ground water monitors will be installed to verify that the

contamination has been mitigated.

4.6 If there is a potential for domestic wells being impacted by the spill, the users of those wells will be notified.

5.0 Employee Training

The site employees are required to have the following training.

5.1 All employees shall be familiar with "Recommended Procedures for the Prevention and Mitigation of Contaminant Spills" cleanup, the associated plan of action report form, any and all materials and equipment that would be used and their location in the event of a contaminant spill.

5.2 Employees shall receive training in respect to the use of materials and equipment required in a contaminant spill cleanup.

6.0 Reporting Requirements

A copy of each written contaminant spill report will be stored on-site for future reference and will be made available to the MECP and/or the Region of Waterloo upon request.

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PLAN OF ACTION
CONTAMINANT SPILLS

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1. Contact the foreman.

2. Appraise the situation and take immediate action to stop further spillage.
   a) Stop the source.
   b) Confine or contain the spill.
   c) Appropriate service vehicles in the area to proceed immediately to the spill site when advised that a spill has occurred.
   d) Use kit materials to start removing spill product.
   Kit material to be located in scale house or maintenance building.

   Spill Kit contains: 1 - 27 litre (7 gallon) polyethylene pail
   1- Gasket seal lid,
   6- 'Eliminator ' E-2 socks and
   1 - Polyethylene disposal bag.

   e) Use 45 gallon containers to contain smaller spills. Put any absorbed oils into containers for disposal

3. The dispatcher/scale operator/foreman is to confirm that the Ministry of the Environment Conservation and Parks and the Region of Waterloo has been contacted, where necessary. The phone numbers are 1-800-268-6060 (MECP) and the Region of Waterloo is 911 or 519-575-4400.

4. The spill site supervisor is to contact the Fire and Police departments, where deemed necessary.

5. The site supervisor and person finding the spill will make out a full written report immediately after the spill is taken care of. The following shall be documented in the report:

a) location in pit (shown on reduced site plan photocopy)
b) time of spill
c) type of spill
d) estimated quantity
e) cause of spill
f) property damage
g) response time and number of people involved
h) clean up measures taken
i) assessment of area affected after clean up
j) an assessment of how spill could have been prevented
k) a diagram of the spill area
l) signature of site supervisor and personnel involved in cleanup

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CONTAMINANT SPILL

CLEAN UP REPORT FORM

Location: _____

_____

_____

Time of Spill: _____

_____

_____

Type of Spill: _____

_____

_____

Estimated Quantity of Spill: _____

_____

_____

Cause of Spill: _____

_____

_____

Property Damage:

Response Times and Names of People involved in Cleanup:

Clean up measures Taken:

Assessment of area affected after clean up:

How could this spill have been prevented?

Diagrams:

Signature of Site Supervisor and personnel involved in clean-up:

Appendix G

Qualifications

Stan Denhoed, P.Eng., M.Sc. (2019)

Senior Hydrogeologist

Education:

Institute for Hydraulic Engineering, Delft, The Netherlands, 1994
Master of Science in Hydrological Engineering Degree

University of Waterloo, Waterloo, Ontario, 1986
Bachelor of Applied Science Degree, Geological Engineering

Professional Experience

Groundwater and Surface Water Contaminant Experience

2011 Phase II Environmental Site Assessment for former wrecking yard in Hamilton, Ontario. Test pit soil samples obtained and tested for inorganic and organic contamination. Estimates of contaminated soils were prepared.

2009 Hydrocarbon contamination of former Township works yard in Puslinch, Ontario. Excavations were made and samples were obtained to determine potential for soil and groundwater contamination.

Evaluation of water quality results from the Marathon Landfill and preparation of annual monitoring reports from 2008 to 2010.

2007 Toluene contamination of municipal drinking water supply well in Marathon, Ontario. Responsible for identifying source and removal of source of toluene.

2007 Sampling of 120 private wells in Coleman Township investigating the presence of arsenic in drinking water. Results of sampling was compared to locations of mine tailings and historical mining activity.

Groundwater, surface water and soil sampling in and near Puslinch Lake as related to dredging operation.

Source Water Protection/Groundwater Management Studies

Senior hydrogeologist for five-Township groundwater protection study (Artemesia, Melancthon, Osprey, Euphrasia and Town of Blue Mountains) including preparation of recharge/discharge maps, aquifer susceptibility maps, groundwater flow maps and geological maps. Senior hydrogeologist/Project Manager for groundwater management studies for Marathon, Blind River, Burk's Falls, St. Joseph's Island and Gogama (2002-2005). GUDI Study for Val Rita Harty (2018).

Peer reviewer of Tier One and Tier Two Source Water Protection Studies for the Ausable-Bayfield Coalition and the Maitland Valley Conservation Area. Peer reviewer of the Vulnerability Assessment reports for the Trent Conservation Authority and Upper Thames Regional Conservation Authority.

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Email sdenhoed@hardenv.com

Stan Denhoed, P.Eng., M.Sc. (2019)

Senior Hydrogeologist

Supervision of Well Drilling and Water Sampling

Supervision of aquifer testing for water supply and for cone of influence of pumping wells or dewatering systems. Supervision of drilling contractors for the installation of pumping wells. Extensive experience with the evaluation of groundwater movement through fractured rock and the analysis of pumping test data related to confined and unconfined aquifers. Extensive experience in the sampling of well water and evaluation of water quality results.

Document Review/Peer Review

Review of mining applications, subdivisions, golf courses and septic system impacts on behalf of the Township of Puslinch, Grand River Conservation Authority and the County of Wellington. Evaluation of applications to gauge compliance with Ministry of the Environment policies and environmental guidelines developed by the Township and the County. Peer reviewer for the 2002 GUDI studies for nineteen communities in Ontario.

Aggregate Licensing, Letters of Opinion and Level I/II Hydrogeological Reports

Environmental investigations to ascertain potential impacts from dewatering or extractive activities in bedrock and sand and gravel. Compliance monitoring of active quarries and pits. Development of detailed water balances for extractive operation. Groundwater flow studies related to extraction and dewatering. I have worked in the following geological environments in regards to pits and quarries; Aberfoyle Outwash Deposit, Paris Moraine, Galt Moraine, Oro Hills, Caledon Outwash, Amabel Formation, Guelph Formation, Eramosa Formation, Gull River Formation, Bobcaygeon Formation, Verulum Formation, Oak Ridges Moraine, Precambrian Shield, Bois Blanc Formation, Simcoe Uplands.

Environmental Audits (Phase I and II ESAs)

Investigations of properties during real estate transactions to ascertain potential environmental liabilities associated with the property.

Surface Water / Groundwater Interactions

Evaluation of changing groundwater levels on wetlands and fisheries. Working with both the Ministry of Natural Resources and the Federal Department of Fisheries and Oceans on projects related to man-induced groundwater level changes and their real and potential impacts on cold water fisheries. Investigation of groundwater inflow component to wetlands to evaluate potential impacts of urbanization in recharge areas.

Ontario Municipal Board Experience

Representation of clients' interest at five OMB hearings (Oro Hills, Penetanguishene, Sturgeon Falls, Uxbridge and Aikensville) related to gravel pit and quarry applications. Three OMB mediated hearings in relation to septic system impacts (Goderich), quarry application (Owen Sound) and large water taking application (Artemesia).

Employment History

1993- Present	Harden Environmental Services Ltd., Moffat, Ontario *President/Senior Hydrogeologist*

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Email sdenhoed@hardenv.com

Stan Denhoed, P.Eng., M.Sc. (2019)

Senior Hydrogeologist

1991-1992	Keewatin-Aski Ltd., Concord, Ontario *Manager of Hydrogeological Projects*
1987-1990	M.M. Dillon Ltd., Toronto, Ontario *Project Hydrogeologist*
1986-1987	Environment Canada, Burlington, Ontario *Research Hydrogeologist*

Associations, Licenses and Committee Participation

Professional Engineers of Ontario

Licensed Water Well Contractor/Technician in the Province of Ontario

Publications

Denhoed, S.E., 1994, *The Role of Sorption in the Accumulation of Arsenic by Peat in the Western Netherlands*, M.Sc. Thesis, Institute for Hydraulic Engineering, Delft, The Netherlands

Denhoed, S.E., Kell, R. and G. Parker.,1990, *Predictive Monitoring of Groundwater Quality at a Municipal Landfill Site*, Proceedings of Canadian Society for Civil Engineers, Annual Conference, Hamilton, Ontario, May 1990

Priddel, M., Jackson, R.E., Novakowski, K.S. and Denhoed, S.E., 1986, *Migration and Fate of Aldicarb in the sandstone Aquifer of Prince Edward Island*, Groundwater in Canada, Special Issue.

Harman, J., McLellan, J. Rudolph, D., Heagle, D, Piller, C. and S. Denhoed, 2001, *A proposed Framework for Managing the Impacts of Agriculture on Groundwater: A Report Prepared For the Sierra/Alert Coalition for Submission in Part 2 of the Walkerton Inquiry*.

Denhoed, S., Warkentin, A., Sarvas, P., 2007, Project Unit 06-031, *Investigation into the Relationship between Groundwater Quality and Geology in Coleman Township, North Eastern Ontario*, Summary of Field Work and Other Activities, Ontario Geological Survey, Open File Report 6213, p26-1 to 26-10.

Presentations

Source Water Protection Conference: Cornwall, Ontario, 2006: *Surface Water / Groundwater Interactions: Mill Creek Experience*

Source Water Protection Committee: Trent Coalition, July 2009: *Groundwater Modelling*

Ontario Research Fund April 2011: Sustainable Bedrock Water Supplies for Ontario Communities: *Compromised Aquitards – Unwelcome Transport Pathways*

Ontario Sand, Stone and Gravel Association, 2014, Impacts of Below-Water-Table Extraction in Unconsolidated Materials

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