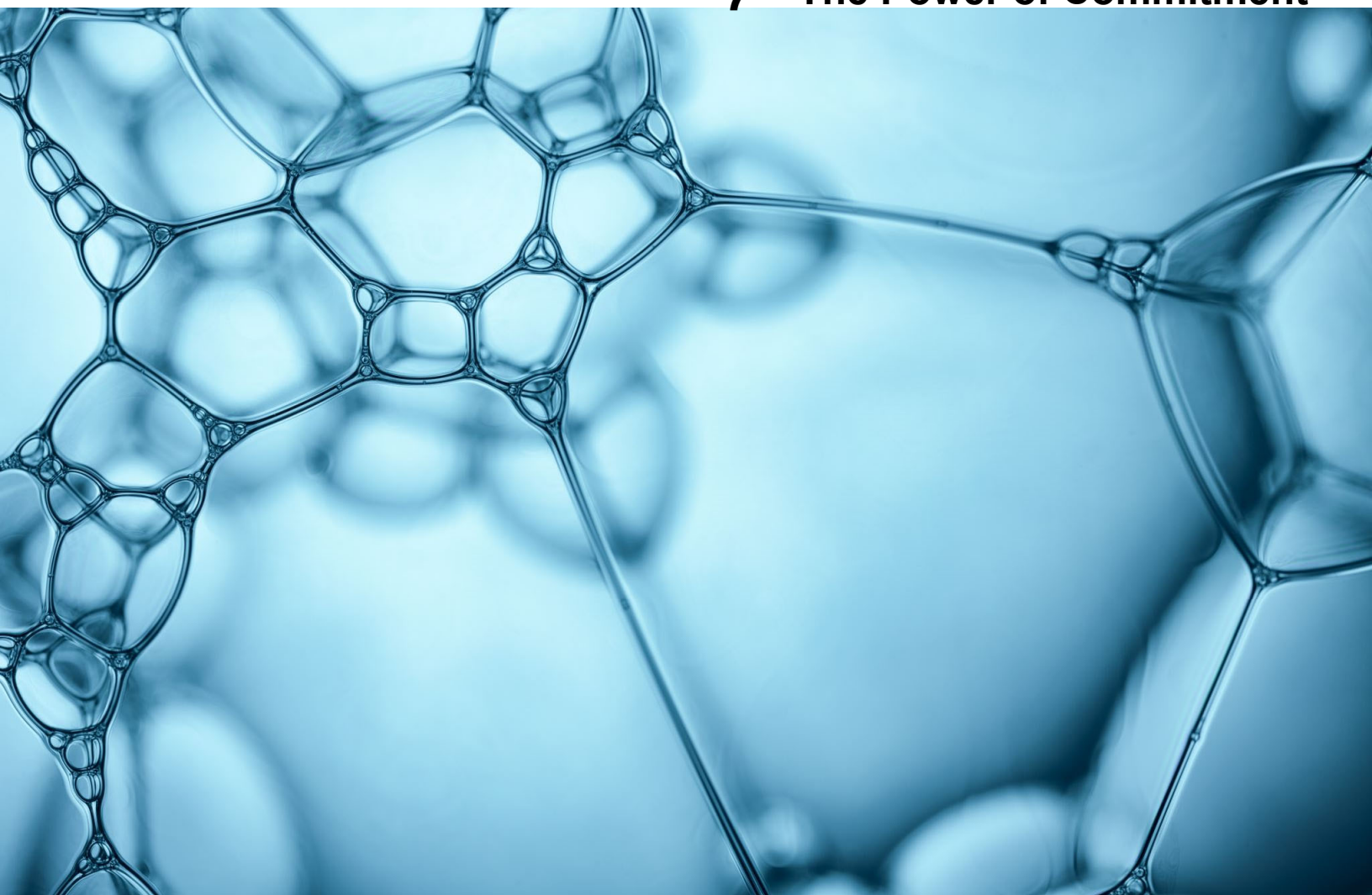
Hydrogeological Assessment

Existing Vacant Property, 46 Stevens Road, Bowmanville, Ontario

Kaitlin Corporation

03 June 2022

→ The Power of Commitment



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1. Introduction

GHD Limited (GHD) is pleased to present the following hydrogeological report in support of the design and construction of a proposed retirement community development situated upon approximately 86,252 square metres (21.5 acres) of land at the municipal address of 46 Stevens Road in Bowmanville, Ontario (herein referred to as "the Site"). The general location of the Site with respect to surrounding roads and watercourses is illustrated on the **Site Location Plan**, **Figure 1**.

It is GHD's understanding that the planned development will consist of an assisted care building, senior's condo building, townhouses, and associated paving for parking and accessways. Two (2) levels of underground parking are proposed which will be beneath each of the non-townhouse buildings. It is GHD's understanding that the Site will be municipally serviced for water and sewer services. The surrounding area is also municipally serviced.

The purpose of the assessment was to identify the local hydrogeology of the Site including a desktop review of available geological, groundwater mapping, and Ministry of the Environment, Conservation and Parks (MECP) well records; exploration of the soil and groundwater conditions; a generic water balance to establish target values for infiltration to address recharge / discharge characteristics and base flow; and an evaluation of potential impacts from the proposed development.

1.1 Terms of Reference

GHD was retained by Kaitlin Corporation (the Client) to complete this hydrogeological assessment in general accordance with our proposal reference no. 12579364, dated April 5, 2022.

The factual data, interpretations and recommendations contained in this report pertain to this specific project as described in the report and are not applicable to any other project or site location. This report should be read in conjunction with the Statement of Limitations appended to this report. The reader's attention is specifically drawn to this information, as it is essential for the proper use and interpretation of this report.

2. Hydrogeological Assessment

2.1 Assessment Overview

To identify the local hydrogeology of the Site, the scope of work included: a review of background information; a site inspection; advancement of test pits to investigate the subsurface soil stratigraphy; soil sampling and testing; infiltration testing; a review of available well records; a generic water balance calculation; and the evaluation of potential impacts from the proposed development and related construction.

The Site has a total site area of about 86,252 square metres (~21.5 acres) and is a vacant lot. The development is focused in a smaller parcel of the Site comprising an area of about 25,900 square metres (~6.4 acres). The proposed development is to be municipally serviced for water and sewer.

The hydrogeological subsurface exploration program consisted of ten (10) test pits excavated to depths ranging from about 0.4 metres (m) to 3.0 m using a track-mounted excavator on May 26, 2022. The test pits advanced for this program are illustrated on the **Concept & Test Hole Plan, Figure 2**. The test pit logs and soil classification results are provided in **Appendix A**.

2.2 Existing Conditions

2.2.1 General

The Site is located at the municipal address of 46 Stevens Road, Bowmanville, Ontario, covering an area of approximately 86,252 square metres (~21.5 acres). The Site is bounded by Bowmanville Creek on the north and east side, flowing to the south and located within a valley about 10 m below the ground surface of the area to be developed. The adjacent land use includes Bowmanville Creek, Stevens Road and residential lots.

The surrounding area is municipally serviced for water and sewer services.

2.2.2 Topography and Drainage

Regional topography is illustrated on **Figure 3** showing a gentle overall slope toward Bowmanville Creek and tributary of Bowmanville Creek with steeper slopes in close proximity of these waterbodies. The regional topography is toward Lake Ontario. Surface water and shallow groundwater flow is expected to follow the local topography towards Bowmanville Creek.

2.2.3 Physiography

The Site is situated in the physiographic region known as the Iroquois Plain (Chapman and Putnam, 1984) and the localized terrain is dominated by clayey till plains. The physiographic region is shown on the figure entitled Physiography, **Figure 4**.

2.2.4 Geology and Soils

The Quaternary geology is presented on **Figure 5** depicting the Site area as underlain by till consisting of predominantly sandy silt to silt. The Site also borders an area of glaciolacustrine deposits consisting of silts and clays with some sands. **Figure 6** illustrates the bedrock to consist of shale / limestone / dolostone / siltstone of the Georgian Bay formation.

2.2.4.1 Local Geology

This section of the report discusses the subsurface soil conditions observed during the test hole program. The subsurface stratigraphy was investigated by advancing ten (10) test pits on May 26, 2022. The locations of the test holes are illustrated on the **Concept & Test Hole Plan**, **Figure 2**. Details of the subsurface conditions encountered are presented graphically in **Appendix A**.

It should be noted that the boundaries between the strata have been inferred from the test hole observations and non-continuous samples. They generally represent a transition from one soil type to another and should not be inferred to represent an exact plane of geological change. Further, conditions may vary between and beyond the test holes.

Subsurface conditions at the test hole locations were generally found to be consistent with the regional geology. The soils encountered generally consisted of topsoil over silt underlain by silty clay / clayey silt. A layer of fill was identified in test pit TP-7 over the silty clay / clayey silt layer. It is noted that this test pit was advanced within the area of the former residential dwelling.

Groundwater seepage was encountered within two (2) of the test pits excavated on the northeast area of the Site at depths ranging from 0.5 to 0.9 meters below ground surface (mbgs). Groundwater seepage was not observed in the other eight (8) test pits to depths of 3.0 m.

Topsoil was encountered at each test hole location. The topsoil ranged in thickness from 230 mm to 460 mm and averaged 270 mm in thickness.

The silt layer was encountered below the topsoil layer in each of the test holes beginning at depths ranging from about 0.2 to 0.5 mbgs and extended to the bottom of test pits TP-1, TP-2, TP-3, TP-9 and TP-10. The silt layer extended in depth from 0.4 to 1.0 mbgs. This soil was generally described as light to dark brown silt, with clay and containing

trace sand and was noted to exist in a moist in-situ state. Moisture content test results of the silt yielded values ranging from 14 percent to 43 percent moisture by weight (averaged 25 percent).

The fill layer was encountered below the topsoil in TP-7 and extended to 1.6 mbgs. The soil was described as dark brown silt with clay and contained trace construction materials (i.e. brick and wood) and existed in a moist in-situ state.

The clayey silt / silty clay layers were encountered in TP-4, TP-5, TP-6, and TP-8 below the silt layer beginning at depths ranging from 0.5 to 0.8 mbgs and at 1.6 mbgs below the fill in TP-7 and extended to the terminal depth of each of these test holes. The clayey silt / silty clay appeared light brown in colour and was generally encountered in a moist in-situ state. Moisture content test results of the clayey silt / silty clay yielded values ranging from 15 percent to 26 percent moisture by weight (averaged 19 percent).

The soil was generally brown in colour indicating that these soils are likely not saturated year-round. Soil moisture and groundwater levels at the Site will fluctuate seasonally and in response to climatic events.

Grain size distribution analyses were carried out on five (5) soil samples and are provided in **Appendix A**. **Table 1** provides a summary of the grain size distributions for the soils encountered.

Table 1 Grain Size Distribution Summary

Location	Depth (m)	Grain Size Distribution				Observed Soil Unit
		%Gravel	%Sand	%Silt	%Clay	
TP-4	2.0	0	13	66	21	Silty Clay
TP-6	1.2	0	36	47	17	Clayey Silt
TP-7	2.1	0	9	68	23	Silty Clay
TP-8	0.6	11	29	35	25	Silt with clay and sand, trace gravel
TP-9	0.9	0	12	63	25	Silt with clay, trace sand

2.2.5 Groundwater

During field activities, groundwater seepage was encountered within two (2) of the test holes at TP-9 and TP-10 at depths ranging from 0.5 to 0.9 mbgs. Groundwater seepage was observed to be rapid into the test pits. These test pits were excavated in a low-lying area of the Site which may have contributed to the flow of water into the test pits. No groundwater was observed within test pits TP-1 through TP-8. The groundwater flow direction is inferred to be towards Bowmanville Creek. It is noted by GHD that the shallow groundwater seepage at TP-9 and TP-10 are likely indicative of seasonal interflow and does not indicate a permanent water table.

It should be noted that groundwater levels are transient and tend to fluctuate with the seasons, periods of precipitation and temperature. It is our opinion that any high groundwater levels are seasonal in nature and will lower during drier summer or winter months.

2.2.6 Infiltration Testing

In-situ constant head permeameter tests were conducted on May 26, 2022 at test pits TP-4 and TP-5 locations to evaluate the infiltration capacity of the shallow vadose (i.e. unsaturated) zone. Bedrock was not encountered in the test pits. The importance of infiltration is for the implementation of Low Impact Development (LID) strategies to recharge precipitation into the ground at pre-development or near pre-development values. Infiltration testing was completed using an ETC Pask (constant head well) permeameter.

The testing was conducted at 0.5 and 2.0 mbgs within TP-4, and 0.6 and 2.0 mbgs within TP-5. The test pits were observed to be dry upon completion (i.e. no standing water or seepage observed). Infiltration rates are provided in **Table 2** based on the results of the infiltration testing. Infiltration testing results are provided in **Appendix B**.

Table 2 Infiltration Testing Results

Infiltration Location	Depth of Test (mbgs)	Soil Material at Test Depth	Estimated Field Saturated Hydraulic Conductivity (m/sec)	Estimated Infiltration Rate (mm/hour)
TP-4	0.5	ML - SILT	$1.6x10^{-6}$	~54
	2.0	CLM – SILTY CLAY	$6.3x10^{-7}$	~42
TP-5	0.6	CLM – SILTY CLAY	$3.1x10^{-7}$	~36
	2.0		$3.1x10^{-8}$	~17

Based upon the infiltration testing results, the vadose zone tested consists of soils with a field saturated hydraulic conductivity on the order of 10^{-6} to 10^{-8} cm/sec. Based on the Supplementary Guidelines to the Ontario Building Code 2012, this data correlates to infiltration rates on the order of 17 to 54 mm/hour. It is noted, however, that slight variations in the soil stratigraphy may cause variations in the permeability of the soil in both vertical and horizontal orientations.

Based on the Low Impact Development Stormwater Management Planning and Design Guide, the infiltration rate used to design the infiltration facility must incorporate a safety correction factor that compensates for potential reductions in soil permeability due to compaction or smearing during construction, gradual accumulation of fine sediments over the lifespan of the infiltration facility and uncertainty in measured values when less permeable horizons exist within 1.5 m below the bottom of the infiltration facility (whatever that may be). Based upon the results outlined in **Table 2**, the safety correction factor will be 3.5 resulting in infiltration values ranging from about 4 to 15 mm/hr.

If Low Impact Development measures (LIDs) are to be constructed in the area of TP-9 or TP-10, these facilities will need to consider the shallow groundwater of this area. Bedrock was not encountered in any of the test pits and is not expected to be a concern from an LID perspective.

LIDs can be applied to any soil type; however, it is recommended that more permeable zones are targeted and that infiltration locations be kept away from private lands. LIDs require maintenance and long-term care. If possible, naturally occurring infiltration strategies such as roof water discharged via downspouts to sodded lawns with adequate topsoil depths and maximized flow path distances are recommended.

2.2.7 Source Water Protection Considerations

Where proposed developments are being planned, it is important to determine the presence of Significant Groundwater Recharge Areas (SGRAs) and Highly Vulnerable Aquifers (HVAs) in the area. These areas are protected under the Clean Water Act (2006). In general, SGRAs are defined as areas where water seeps into an aquifer from rain and melting snow, supplying water to the underlying aquifer. An HVA aquifer occurs where the subsurface material offers limited protection from contamination resulting from surface activities. GHD considered the potential for SGRAs and HVAs by reviewing the “Source Protection Information Atlas” that is currently available through the MECP website. The published information is dated May 12, 2022. The Site falls within the Central Lake Ontario Source Protection Area.

Based on the information reviewed from the “Source Water Protection Atlas” the Site is not within an HVA, SGRA or a wellhead protection area (WHPA) as illustrated on **Figure 7**. A WHPA is defined as the surface and subsurface area surrounding a water well or well field that supplies a municipal residential system through which contaminants are reasonably likely to move so as to eventually reach the water well. The WHPA does not apply.

The Site is not within a wellhead protection area Q1 or Q2. WHPA Q1/Q2 (moderate risk level) means that activities that take water without returning it to the same source may be a threat (Q1) and activities that reduce recharge may be a threat (Q2). Activities that take water would include construction dewatering or other groundwater pumping. Pumping or dewatering activities may require appropriate permitting from the MECP but are not a concern from a source water protection perspective.

2.2.8 MECP Well Records

The compiled MECP data included twenty-five (25) well records within 250 m of the Site. The well records considered are provided in **Appendix C** and includes physical and hydraulic data. The well records included six (6) monitoring wells and abandonment records which are not considered in **Table 3**. Nineteen (19) well records are considered in **Table 3**. The well records indicate the presence of two (2) principal aquifer systems:

1. Drilled or dug / bored wells that tap into a sand and / or gravel overburden aquifer below a confining clay layer.
2. Drilled wells tapping water bearing units / layers within underlying bedrock

The dug / bored wells comprised 58 percent of the well records considered for the statistical breakdown. There were also three (3) drilled overburden wells (16 percent of the well records considered) and five (5) bedrock wells (26 percent of the well records considered).

The dug / bored wells were advanced to an average depth of 13.2 m; encountered water at an average depth of 8.7 m and produced yields averaging 23.7 litres per minute (L/min) or 6.3 U.S. gallons per minute (gpm). Flowing artesian conditions were not reported in any of the dug / bored wells. The groundwater encountered in these well records was described as “fresh”.

The drilled overburden wells were drilled to an average depth of 20.5 m; encountered water at an average depth of 19.7 m and produced yields averaging 27.8 L/min or 7.3 gpm. Flowing artesian conditions were not reported in any of the drilled wells. The groundwater encountered was described as “fresh” in the well records reviewed.

The drilled bedrock wells were drilled to an average depth of 42.7 m; encountered water at an average depth of 30.2 m and produced yields averaging 22.0 L/min or 5.7 gpm. Flowing artesian conditions were not reported in any of the drilled wells. The groundwater encountered in these wells was described as “fresh”.

The monitoring wells were drilled to an average depth of 7.3 m and encountered water at an average depth of 4.8 m.

The statistical summary of MECP well data is provided in **Table 3**.

Table 3 Summary of MECP Well Record Information

Total Number of Wells Inventoried:	19
Dug/Bored Wells:	11 (58%)
Drilled Wells (Overburden):	3 (16%)
Drilled Wells (Bedrock):	5 (26%)
NOT INCLUDING*:	
Monitoring Wells / Abandonments / Unknown:	6 well records

Parameters	Statistical Summary					
	Dug / Bored Wells		Drilled – Overburden		Drilled – Bedrock	
WELL YIELDS						
Range	3.8 – 30.3 L/min	1 – 8 gpm	11.4 – 56.8 L/min	3 – 15 gpm	7.8 – 46.5 L/min	2 – 12 gpm
Average	23.7 L/min	6.3 gpm	27.8 L/min	7.3 gpm	22.0 L/min	5.7 gpm
REPORTED YIELDS	Frequency		Frequency		Frequency	
Not Reported	0	0%	0	0%	2	40%
Dry	0	0%	0	0%	0	0%
0 to 1 USgpm	1	9%	0	0%	0	0%
2 to 4 USgpm	1	9%	2	67%	2	40%
5 to 9 USgpm	9	82%	0	0%	0	0%
≥10 USgpm	0	0%	1	33%	1	20%
STATIC WATER LEVELS						
Range	2.7 to 12.2 m	9 to 40 ft	2.4 to 10.7 m	8 to 35 ft	8.5 to 12.2 m	28 to 40 ft
Average	7.4 m	24.4 ft	6.4 m	21.0 ft	10.0 m	32.7 ft
WATER ENCOUNTERED						
Range	5.5 to 15.2 m	18 to 50 ft	12.2 to 31.7 m	40 to 104 ft	13.7 to 36.6 m	45 to 120 ft
Average	8.7 m	28.5 ft	19.7 m	64.7 ft	30.2 m	99.0 ft
WELL DEPTH						
Range	9.1 to 16.8 m	30 to 55 ft	13.7 to 32.0 m	45 to 105 ft	34.4 to 45.7 m	113 to 150 ft
Average	13.2 m	43.2 ft	20.5 m	67.3 ft	39.7 m	130.3 ft

Notes:
Data based on MECP well record information (refer to **Appendix C** for well information).
*Monitoring wells, well abandonments or unknown wells are not included in the statistical data summarized in **Table 3.**

2.3 Water Balance Evaluation

The water balance was completed to compute the potential impacts that may occur in the recharge / discharge characteristics related to the proposed development. This evaluation is based upon the concept plan provided in **Figure 2** which shows the overall area of the Site to be about 86,252 square metres. The developable area is focused within a smaller portion within the Site comprising an area of about 25,900 square metres (~6.4 acres). The objective of this water balance is to illustrate that post-development infiltration within the developable area can meet or be close to pre-development values. The water balance is not intended for design of LIDs. The computations have used detailed parameters such as precipitation (Bowmanville Mostert weather station using data from 1986 to 2010 was used), regional evapotranspiration, infiltration and runoff. Weather data from Bowmanville Mostert was selected as it was the closest weather station to the Site (~2.6 km away). The detailed calculations can be reviewed in **Appendix D**. Below is a summary of the expected pre-development water balance values for the proposed development based on the current information.

2.3.1 Pre-Development

The pre-development water balance incorporated the existing soils, slope and agricultural areas. The infiltration factor for the area was calculated from the table of values presented in the “Land Development Guidelines” (MOEE, 1995). It is based on three sub-factors which are:

– Topography sub-factor;
– Soil sub-factor; and
– Cover sub-factor.

A topography factor of 0.2 was selected representing rolling topography and soil factor of 0.1 representing the silty clay / clayey silt was used. The vegetation factor was selected to be 0.15 representing grass covered vegetation at the pre-development site (see **Appendix D.2** for detailed calculations). **Table 4** summarizes the expected pre-development water balance values for the Site.

Table 4 Pre-Development Summary

Total Precipitation (Bowmanville Mostert)	- 866 mm / year
Regional Evapotranspiration	- 590 mm / year
Recharge Available	- 276 mm / year
Area of Recharge Available	- 86,252 m^2
Water Surplus Available	- 23,824 m^3 / year
Total Estimated Infiltration	- 10,721 m^3 / year (14.3 % of available precipitation)
Total Estimated Runoff	- 13,103 m^3 / year (17.5 % of available precipitation)

Based upon our calculations, the current pre-development site is 100% pervious. Based upon the pre-development values, the overall Site infiltrates on the order of 10,721 m^3 per year or about 124 mm/year which appears to be reasonable based upon the relatively low permeability subsurface soils encountered.

2.3.2 Post-Development Water Balance (No Enhancements)

The computation of the water budget was repeated for the proposed development assuming no mitigation techniques, that is, runoff from impervious surfaces is unrecoverable and not infiltrated into the ground. The anticipated impact of the development is related to increased runoff from imperious surfaces such as the building roof tops, and paved areas. These are assumed to be impervious surfaces with zero infiltration capacity in this model. The naturalized area that will not be developed is assumed to have the same area and infiltration characteristics as the pre-development model. A summary of the computations is provided in **Table 5** based upon concepts provided to GHD (refer to **Appendix D.3** for detailed calculations).

Table 5 Post-Development Summary (No Enhancements)

Area of Site	- 86,252 m^2
Impervious Surfaces	- 17,230 m^2 (20% of total area)
Pervious Surfaces	- 69,022 m^2 (80% of total area)
Water Surplus Available	- 31,008 m^3 / year
Total Estimated Infiltration	- 8,579 m^3 / year (11.5 % of available precipitation)
Infiltration Deficit (post- vs pre-)	- -2,142 m^3
Total Estimated Runoff	- 22,428 m^3 / year (30 % of available precipitation)

Assumptions that were made in order to compute the post-development water budget in **Table 5** included evaporation from impervious surfaces (20% of precipitation) and the impermeable surface areas were estimated from the concept plan. Under this scenario, impervious surfaces increased by 20% resulting in an infiltration deficit of over 2,000 m^3 and an increase in runoff of over 9,300 m^3.

The infiltration and runoff have significantly reduced and increased, respectively, versus the pre-development values. Groundwater base flow would be expected to decrease over time in this scenario. Based upon this scenario, mitigative strategies are required to minimize infiltration losses and reduce storm water runoff. The following section

discusses the water balance after considering the mitigation strategy of conveying rooftop stormwater to the ground for infiltration.

2.3.3 Post-Development Water Balance (Enhanced Infiltration)

The post-construction water budget computations were repeated considering enhanced infiltration strategies including downspout disconnection. These strategies are known as a LIDs. These strategies may include and are not restricted to rainwater harvesting, downspout disconnection, infiltration trenches / galleries, vegetated filter strips, bioretention, permeable pavement, enhanced grass swales, dry swales and perforated pipe systems in order to balance the water budget.

The post-development water balance was modelled to include the disconnection of downspouts from storm sewers and directing water from the building roof tops to sodded areas or undeveloped grass areas. The downspout disconnections can reduce runoff by as much as 50% based on LID documentation developed by the Credit Valley Conservation and Toronto and Region Conservation Authority. A summary of the post-construction water budget with enhancements for infiltration is presented in **Table 6**.

Table 6 Post-Development Summary (With Downspout Disconnection)

Rooftop Surplus Water Available	- 6,640 m^3 / year
Infiltration Deficit	- 2,142 m^3 / year
% of Rooftop Runoff Required to Maintain Pre-Development Infiltration	- 32%
Total Estimated Post-Development Infiltration with Rooftop Runoff Reduction	- 10,721 m^3 / year (no change)
Total Estimated Post-Development Runoff with Rooftop Runoff Reduction	- 20,287 m^3 / year (55% increase)

In this scenario and based on the preliminary information provided, and assuming that about 32% of the rooftop water surplus will be infiltrated, the infiltration values have been modelled to show that there will be no infiltration change from an overall site perspective when compared with pre-development values. The water balance indicates that there is sufficient stormwater runoff available to maintain pre-development infiltration values if enhanced infiltration measures are applied. Refer to **Appendix D.4** for a summary of the detailed water balance calculations.

2.3.4 Impact on Groundwater Baseflow

The importance of the groundwater baseflow is that, depending upon the hydraulic functionality with the Site, it may provide discharge to the nearby Bowmanville Creek. There are no known wells in this area to support with groundwater baseflow. Water infiltrating into the underlying soils may provide water to the creek; however, these contributions are expected to be minor as the soils encountered are of relatively low permeability. It is GHD's professional opinion that there is not expected to be a significant impact to the shallow groundwater baseflow due to the construction and operation of the development provided LID mitigation is implemented.

2.3.5 Impact on Surface Water Bodies

The impacts to surface water bodies are related to the reduction of the groundwater baseflow and water quality concerns related to human activities such as road salting, minor fuel and oil leaks, fertilizer application etc. It is expected that there may be minor impacts to groundwater and neighbouring surface water bodies from these activities on the developed Site. Further details should be reviewed within a Functional Servicing / Stormwater Management Report regarding the management of stormwater at the Site.

2.3.6 Mitigation Measures

Mitigative techniques are recommended in order to address concerns relating to the potential for impact to the base flow. The impact and mitigation measures can be arranged into two (2) distinct categories: construction phase and operational phase.

2.3.6.1 Construction Phase

Prior to construction, storm water management techniques should be incorporated to control additional surface water runoff and permit enhanced infiltration into the surrounding ground. Storm water management techniques will minimize the potential for groundwater impact and minimize the amount of silt or other fine-grained soil particles becoming mobile and entering into downgradient areas. The installation of strategically placed silt fences will reduce flow velocities of storm water enabling particulate to settle out prior to entering downgradient areas.

If groundwater volumes of greater than 50,000 L/day are to be pumped during construction activities, then a permit obtained from the MECP's Environmental Activity and Sector Registry (EASR) would be required. An EASR can be obtained relatively quickly after the appropriate documentation is prepared.

If the volumes are to exceed 400,000 L/day, a Permit to Take Water (PTTW) would be required through the MECP and can take an appreciable amount of time to obtain due to the report that is required and the review process by the Ministry.

During the construction phase and grading work, suitable sedimentation controls will be required to help control surface water flow. As construction work progresses at the Site, regular maintenance and additional sedimentation measures may be required to limit the effect of siltation of run-off water in localized areas. Vegetative cover should be re-established in disturbed areas following the completion of the construction work to reduce erosion and sediment loading to the adjacent features.

2.3.6.2 Operational Phase

During the operational phase, it is expected that storm water excess will be controlled as per a Functional Servicing Report or Stormwater Management plan. As indicated above, if LIDs are implemented, they can be used to maintain pre-development infiltration values and help to reduce storm water runoff.

3. Summary and Recommendations

Supporting data upon which our conclusions and recommendations are based have been presented in the foregoing sections of this report. The following conclusions and recommendations are governed by the physical properties of the subsurface materials that were encountered at the Site and assume that they are representative of the overall Site conditions. It should be noted that these conclusions and recommendations are intended for use by the designers only. Contractors bidding on or undertaking any work at the Site should examine the factual results of the assessment, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of this factual data as it affects their proposed construction techniques, equipment capabilities, costs, sequencing, and the like. Comments, techniques, or recommendations pertaining to construction should not be construed as instructions to the contractor.

The test holes generally encountered topsoil over silt underlain by silty clay/ clayey silt. Fill material was observed within test pit TP-7. Groundwater seepage was encountered within test pits TP-9 and TP-10 at depths ranging from 0.5 to 0.9 mbgs and was observed to rapid into the test pits. These test pits were excavated within a low lying area which may have contributed to the flow of water into the test pits. The water within these test pits is expected to be seasonal. The soils were observed to be brown in colour from TP-9 and TP-10 suggesting that these soils are likely not saturated year-round. No groundwater was observed within test pits TP-1 through TP-8.

The groundwater flow direction is inferred to be toward Bowmanville Creek.

It should be noted that groundwater levels are transient and tend to fluctuate with the seasons, periods of precipitation and temperature. It is our opinion that any high groundwater levels within the shallow, low permeability soils at the Site are seasonal in nature and will lower or deplete during drier summer or winter months.

Based upon the water balance calculations, the post-development infiltration will be reduced by about 2,142 m^3/year compared with the pre-development infiltration. Approximately 32% of the rooftop water surplus will need to be

infiltrated such that there will be no infiltration change from an overall site perspective when compared with pre-development values.

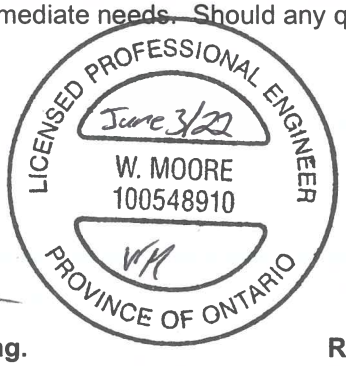
Groundwater impacts are not expected as a result of the future development provided that appropriate planning, mitigation measures and proper construction techniques are considered.

It is GHD's opinion that the results of this hydrogeological assessment including the infiltration testing and water balance supports the proposed development.

The following Statement of Limitations should be read carefully and is an integral part of this report. We trust this report meets your immediate needs. Should any questions arise regarding any aspect of our report, please contact our office.

Sincerely,

GHD



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Robert Neck, P.Geo. (Limited)
Associate, Project Director

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5. Statement of Limitations

This report is intended solely for Kaitlin Corporation in assessing the hydrogeologic aspects of the lands situated at the municipal address of 46 Stevens Road in Bowmanville, Ontario associated with the proposed development. This report is prohibited for use by others without GHD's prior written consent, is considered GHD's professional work product and shall remain the sole property of GHD. Any unauthorized reuse, redistribution of or reliance on the report shall be at the Client and recipient's sole risk, without liability to GHD. Client shall defend, indemnify and hold GHD harmless from any liability arising from or related to Client's unauthorized distribution of the report. No portion of this report may be used as a separate entity; it is to be read in its entirety and shall include all supporting drawings and appendices.

The recommendations made in this report are in accordance with our present understanding of the project, the current site use, ground surface elevations and conditions, and are based on the work scope approved by the Client and described in the report. The services were performed in a manner consistent with that level of care and skill ordinarily exercised by members of hydrogeological engineering professions currently practicing under similar conditions in the same locality. No other representations, and no warranties or representations of any kind, either expressed or implied, are made. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

All details of design and construction are rarely known at the time of completion of a hydrogeological study. The recommendations and comments made in the study report are based on our interpretation of the subsurface conditions and resulting understanding of the project, as defined at the time of the study. We should be retained to review our recommendations when the drawings and specifications are complete. Without this review, GHD will not be liable for any misunderstanding of our recommendations or their application and adaptation into the final design. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

Figures

Data Disclaimer

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1 cm = 100 meters

0 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

GHD

Vad Retail Ltd.
46 Stevens Road, Bowmanville, ON
Municipality of Clarington
Regional Municipality of Durham

Hydrogeological Assessment

Site Location Plan

Project No. 12579364
Revision No.
Date Jun 1, 2022

Figure 1

Q:\GIS\PROJECTS\12579000s\12579364\Layouts\202206_RPT001\12579364_202206_RPT001_GIS001 - Site Location Plan.mxd
Print date: 01 Jun 2022 - 10:09

Data source: © Image: Municipality of Clarington, 2021.

Data Disclaimer

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1 cm = 23 meters

0 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

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46 Stevens Road, Bowmanville, ON
Municipality of Clarington
Regional Municipality of Durham

Hydrogeological Assessment

Concept & Test Hole Plan

Project No. 12579364
Revision No.
Date Jun 1, 2022

Figure 2

O:\GIS\PROJECTS\12579000s\12579364\Layouts\202206_RPT001\12579364_202206_RPT001_GIS002 - Concept and Test Hole Plan.mxd
Print date: 01 Jun 2022 - 10:08

Data source: © Image: Municipality of Clarington, 2021.

1 cm = 50 meters

0 30 60 90 120

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

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Vad Retail Ltd.
46 Stevens Road, Bowmanville, ON
Municipality of Clarington
Regional Municipality of Durham

Hydrogeological Assessment

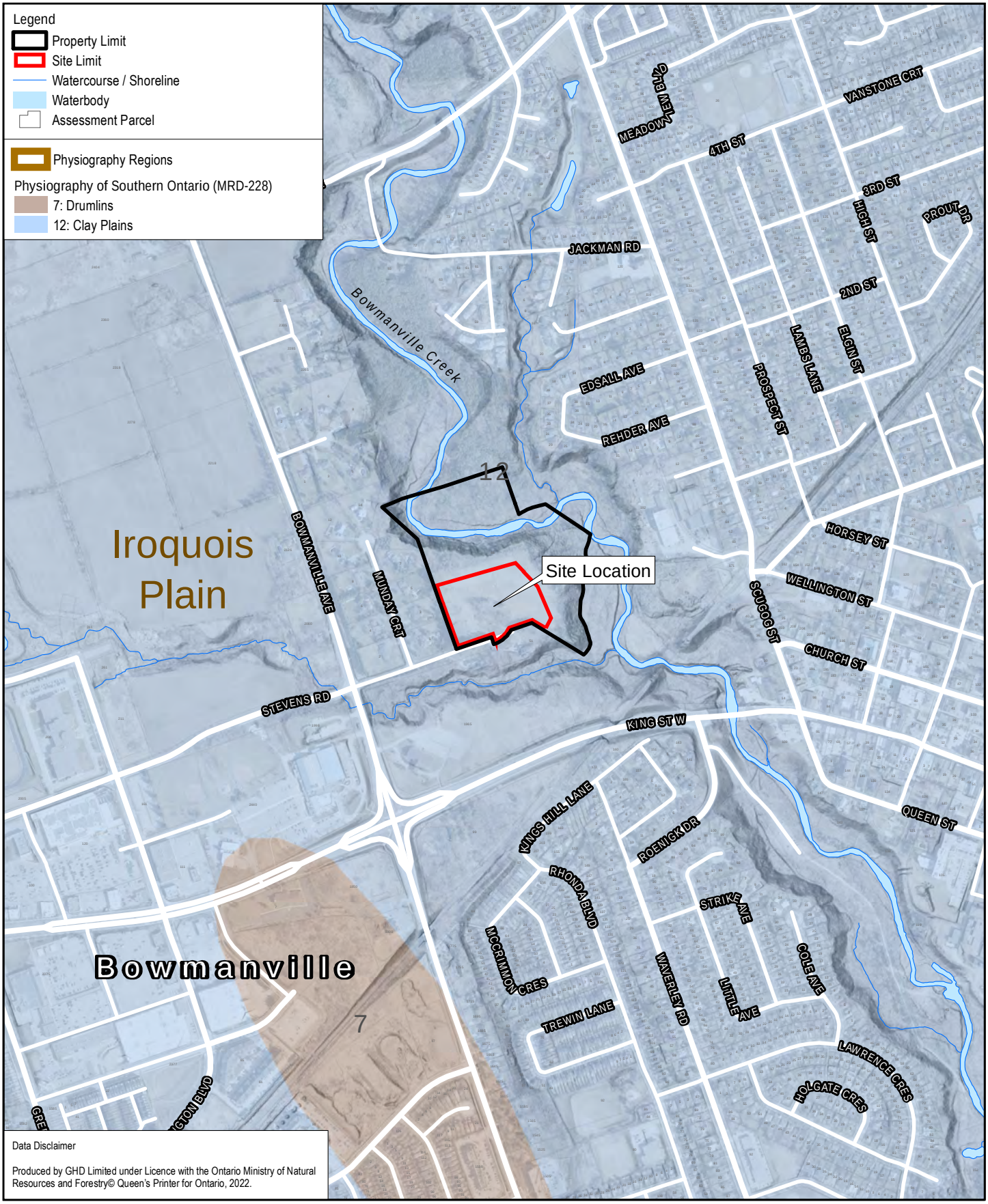
Regional Topography

Project No. 12579364
Revision No.
Date Jun 1, 2022

Figure 3

O:\GIS\PROJECTS\12579000s\12579364\Layouts\202206_RPT001\12579364_202206_RPT001_GIS003 - Regional Topography.mxd
Print date: 01 Jun 2022 - 10:13

Data source: © Image: Municipality of Clarington, 2021.



1 cm = 100 meters

0 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

GHD

Vad Retail Ltd.
46 Stevens Road, Bowmanville, ON
Municipality of Clarington
Regional Municipality of Durham

Hydrogeological Assessment

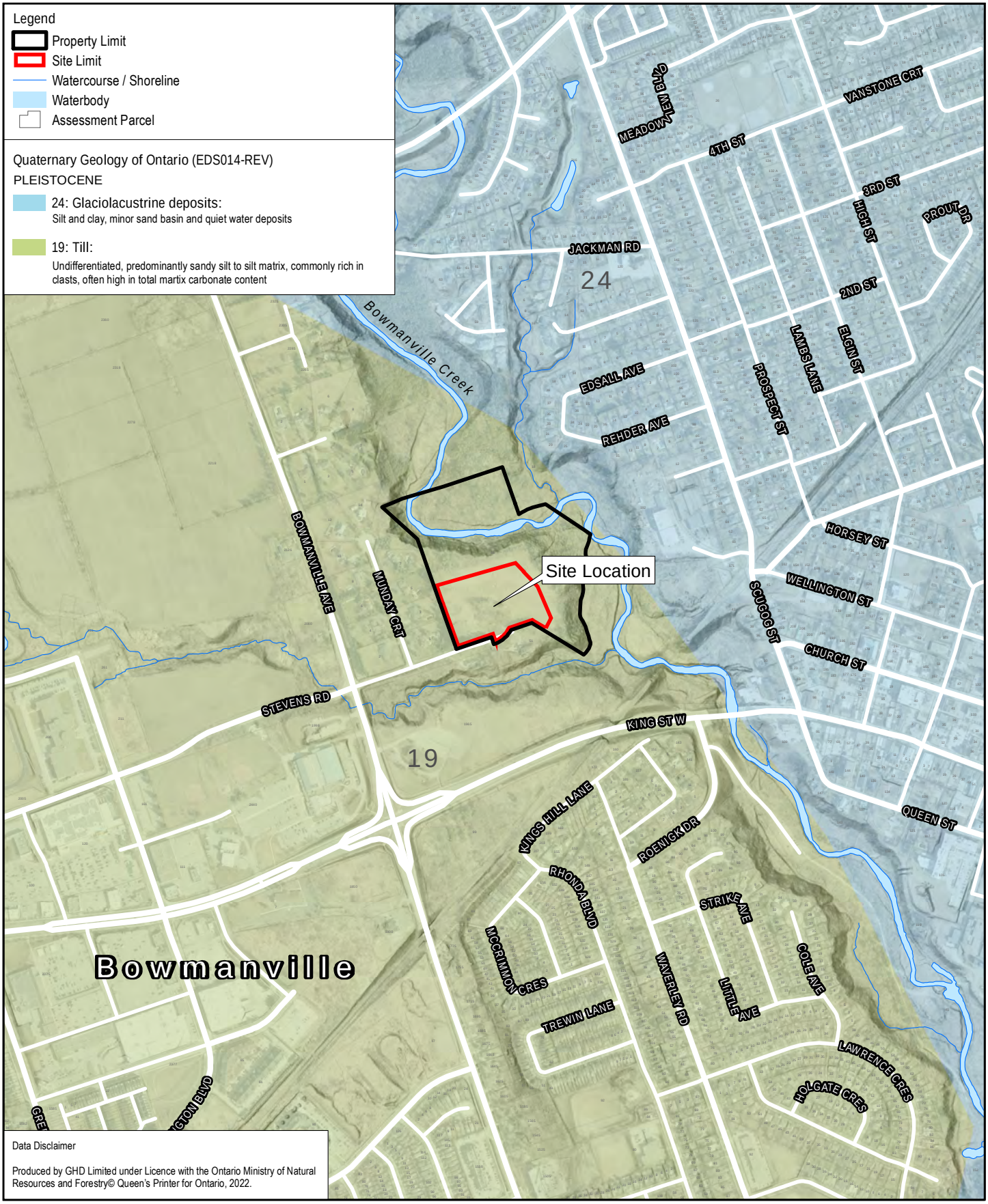
Physiography

Project No. 12579364
Revision No.
Date Jun 1, 2022

Figure 3

Q:\GIS\PROJECTS\12579000s\12579364\Layouts\202206_RPT001\12579364_202206_RPT001_GIS004 - Physiography.mxd
Print date: 01 Jun 2022 - 10:05

Data source: Chapman, L.J. and Putnam, D.F. 2007. Physiography of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 228 ISBN 978-1-4249-5158-1.,



1 cm = 100 meters

0 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

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Vad Retail Ltd.
46 Stevens Road, Bowmanville, ON
Municipality of Clarington
Regional Municipality of Durham

Hydrogeological Assessment

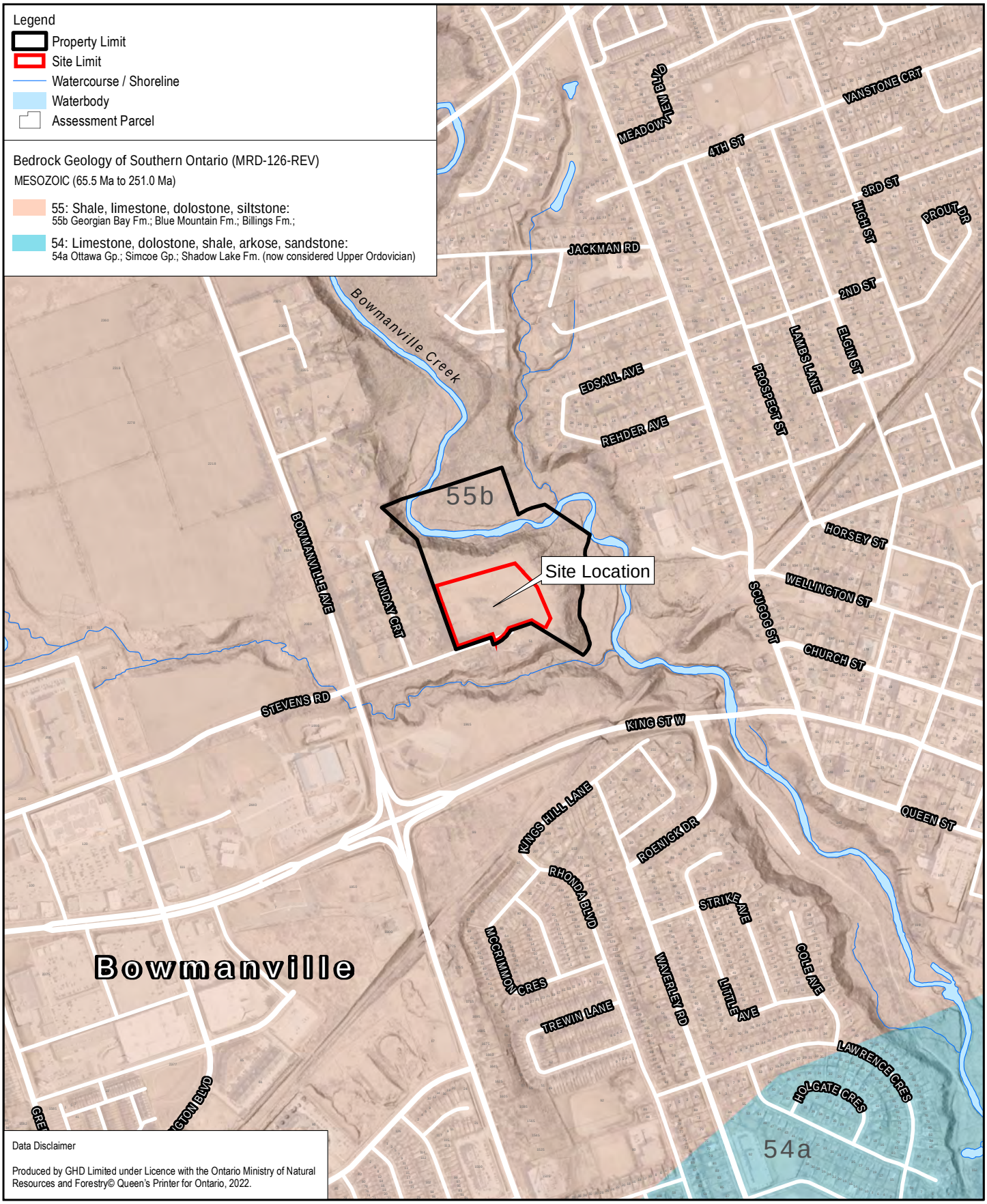
Quaternary Geology

Project No. 12579364
Revision No.
Date Jun 1, 2022

Figure 5

Q:\GIS\PROJECTS\12579000s\12579364\Layouts\202206_RPT001\12579364_202206_RPT001_GIS005 - Quaternary Geology.mxd
Print date: 01 Jun 2022 - 10:02

Data source: EDS014-REV. Ontario Geological Survey, 1997. Quaternary geology, seamless coverage of the province of Ontario: Ontario Geological Survey, Data Set 14., © Image: Municipality of Clarington, 2021.



1 cm = 100 meters

0 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

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Vad Retail Ltd.
46 Stevens Road, Bowmanville, ON
Municipality of Clarington
Regional Municipality of Durham

Hydrogeological Assessment

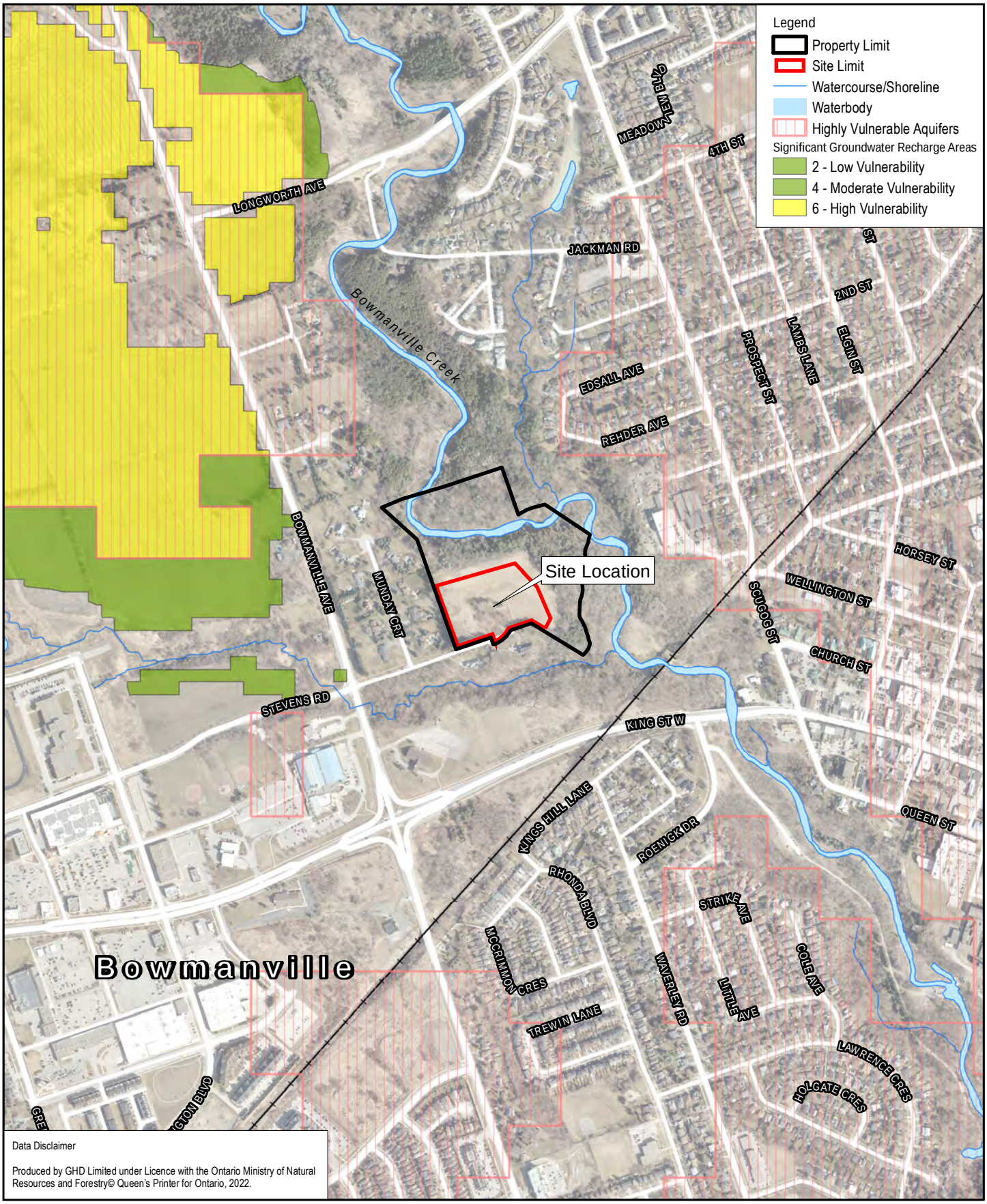
Bedrock Geology

Project No. 12579364
Revision No.
Date Jun 1, 2022

Figure 6

Q:\GIS\PROJECTS\12579000s\12579364\Layouts\202206_RPT001\12579364_202206_RPT001_GIS006 - Bedrock Geology.mxd
Print date: 01 Jun 2022 - 09:32

Data source: MRD126-REV. Ontario Geological Survey 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release---Data 126-Revision 1., © Image: Municipality of Clarington, 2021.



1 cm = 100 meters

0 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

Vad Retail Ltd.
46 Stevens Road, Bowmanville, ON
Municipality of Clarington
Regional Municipality of Durham

Hydrogeological Assessment

Source Protection

Project No. 12579364
Revision No.
Date Jun 1, 2022

Figure 7

Q:\GIS\PROJECTS\12579000s\12579364\Layouts\202206_RPT001\12579364_202206_RPT001_GIS007 - Source Protection.mxd
Print date: 01 Jun 2022 - 09:41

Data source: Source Protection Information Atlas. Ministry of Environment, Conservation and Parks. Web Application., © Image: Municipality of Clarington, 2021.

Appendices

Appendix A

Subsurface Exploration Data

REFERENCE No.: 12579364-01 ENCLOSURE No.: A-1

TEST PIT No.: TP-1
ELEVATION: Existing

TEST PIT REPORT

CLIENT: Kaitlin Corporation
PROJECT: Hydrogeotechnical Investigation
LOCATION: 46 Stevens Road, Bowmanville, ON
DESCRIBED BY: R. Sanford DATE: 26 May 2022
CHECKED BY: W. Moore DATE: 31 May 2022

LEGEND

GSE - GRAB SAMPLE (environmental)
GS - GRAB SAMPLE (geotechnical)
Cu - SHEAR TEST
CHEM - CHEMICAL ANALYSIS
OVC - ORGANIC VAPOR CONCENTRATION
INF - INFILTRATION
▼ - WATER LEVEL

Depth Feet	Depth Metres	Elevation (m) BGS Existing	Symbol	STRATIGRAPHY	Sample Type & Number	Moisture %	Tests Type	▼ INF
				TOPSOIL - (250mm)				
		0.25						
1				**ML -** SILT, with clay, trace sand, dark brown, moist, firm	GS-1	20.8		
		0.38		**END OF HOLE**				
	0.5			**NOTES:** -Hole open upon completion -Hole dry upon completion				
2								
3	1.0							
4								
5	1.5							
6								
	2.0							
7								
8	2.5							
9								
10	3.0							
11								
	3.5							

REFERENCE No.: 12579364-01 ENCLOSURE No.: A-2

TEST PIT No.: TP-2
ELEVATION: Existing

TEST PIT REPORT

CLIENT: Kaitlin Corporation
PROJECT: Hydrogeotechnical Investigation
LOCATION: 46 Stevens Road, Bowmanville, ON
DESCRIBED BY: R. Sanford DATE: 26 May 2022
CHECKED BY: W. Moore DATE: 31 May 2022

LEGEND

GSE - GRAB SAMPLE (environmental)
GS - GRAB SAMPLE (geotechnical)
Cu - SHEAR TEST
CHEM - CHEMICAL ANALYSIS
OVC - ORGANIC VAPOR CONCENTRATION
INF - INFILTRATION
▼ - WATER LEVEL

Depth Feet	Depth Metres	Elevation (m) BGS Existing	Symbol	STRATIGRAPHY	Sample Type & Number	Moisture %	Tests Type	▼ INF
		0.25		**TOPSOIL** - (250mm)				
1				**ML** - SILT, with clay, trace sand, dark brown, moist, firm	GS-1	23.3		
	0.5	0.46		**END OF HOLE**				
2				**NOTES:** -Hole open upon completion -Hole dry upon completion				
3	1.0							
4								
5	1.5							
6								
	2.0							
7								
8	2.5							
9								
10	3.0							
11								
	3.5							

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REFERENCE No.: 12579364-01 ENCLOSURE No.: A-3

TEST PIT No.: TP-3
ELEVATION: Existing

TEST PIT REPORT

CLIENT: Kaitlin Corporation
PROJECT: Hydrogeotechnical Investigation
LOCATION: 46 Stevens Road, Bowmanville, ON
DESCRIBED BY: R. Sanford DATE: 26 May 2022
CHECKED BY: W. Moore DATE: 31 May 2022

LEGEND

GSE - GRAB SAMPLE (environmental)
GS - GRAB SAMPLE (geotechnical)
Cu - SHEAR TEST
CHEM - CHEMICAL ANALYSIS
OVC - ORGANIC VAPOR CONCENTRATION
INF - INFILTRATION
▼ - WATER LEVEL

Depth Feet	Depth Metres	Elevation (m) BGS Existing	Symbol	STRATIGRAPHY	Sample Type & Number	Moisture %	Tests Type	▼ INF
				TOPSOIL - (230mm)				
		0.23						
1				**ML** - SILT, with clay, trace sand, dark brown, firm, moist	GS-1	28.1		
		0.41						
	0.5			**END OF HOLE**				
2				**NOTES:** -Hole open upon completion -Hole dry upon completion				
3	1.0							
4								
5	1.5							
6								
	2.0							
7								
8	2.5							
9								
10	3.0							
11								
	3.5							

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REFERENCE No.: 12579364-01 ENCLOSURE No.: A-4

TEST PIT No.: TP-4
ELEVATION: Existing

TEST PIT REPORT

CLIENT: Kaitlin Corporation
PROJECT: Hydrogeotechnical Investigation
LOCATION: 46 Stevens Road, Bowmanville, ON
DESCRIBED BY: R. Sanford DATE: 26 May 2022
CHECKED BY: W. Moore DATE: 31 May 2022

LEGEND

GSE - GRAB SAMPLE (environmental)
GS - GRAB SAMPLE (geotechnical)
Cu - SHEAR TEST
CHEM - CHEMICAL ANALYSIS
OVC - ORGANIC VAPOR CONCENTRATION
INF - INFILTRATION
▼ - WATER LEVEL

Depth Feet	Depth Metres	Elevation (m) BGS Existing	Symbol	STRATIGRAPHY	Sample Type & Number	Moisture %	Tests Type	▼ INF
		0.23		**TOPSOIL** - (230mm)				
1	0.5			**ML** - SILT, with clay, trace sand, dark brown, moist, firm	GS-1	21.6		
2		0.71		**MLC** - CLAYEY SILT, light brown, moist, stiff, mottled				
3	1.0	1.01			GS-2	20.9		
4				**CLM** - SILTY CLAY, few sand, light brown, moist, very stiff				
5	1.5							
6				GS-3 Gravel: 0%, Sand: 13%, Silt: 66%, Clay: 21% LL: 18, PL: 14, PI: 4	GS-3	15		
7	2.0	2.03		**END OF HOLE**				
8				**NOTES:** -Hole open upon completion -Hole dry upon completion -Infiltration test INF-01 completed at 0.51 mbgs -Infiltration test INF-02 completed at 2.0 mbgs -LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index				
9	2.5							
10	3.0							
11	3.5							

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REFERENCE No.: 12579364-01 ENCLOSURE No.: A-5

TEST PIT No.: TP-5
ELEVATION: Existing

TEST PIT REPORT

CLIENT: Kaitlin Corporation
PROJECT: Hydrogeotechnical Investigation
LOCATION: 46 Stevens Road, Bowmanville, ON
DESCRIBED BY: R. Sanford DATE: 26 May 2022
CHECKED BY: W. Moore DATE: 31 May 2022

LEGEND

GSE - GRAB SAMPLE (environmental)
GS - GRAB SAMPLE (geotechnical)
Cu - SHEAR TEST
CHEM - CHEMICAL ANALYSIS
OVC - ORGANIC VAPOR CONCENTRATION
INF - INFILTRATION
▼ - WATER LEVEL

Depth Feet	Depth Metres	Elevation (m) BGS Existing	Symbol	STRATIGRAPHY	Sample Type & Number	Moisture %	Tests Type	▼ INF
		0.25		**TOPSOIL** - (250mm)				
1				**ML -** SILT with clay, trace sand, dark brown, moist, firm				
	0.5	0.46		**CLM** - Silty clay, light brown, moist, very stiff	GS-1	21		
2								
3								
	1.0				GS-2	21.6		
4		1.17		**END OF HOLE**				
5	1.5			**NOTES:** -Hole open upon completion -Hole dry upon completion -Infiltration test INF-03 completed at 0.60 meters below grade -Infiltration test INF-04 completed at 2.0 meters below grade				
6								
	2.0							
7								
8								
	2.5							
9								
10	3.0							
11								
	3.5							

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REFERENCE No.: 12579364-01 ENCLOSURE No.: A-6

TEST PIT No.: TP-6
ELEVATION: Existing

TEST PIT REPORT

CLIENT: Kaitlin Corporation
PROJECT: Hydrogeotechnical Investigation
LOCATION: 46 Stevens Road, Bowmanville, ON
DESCRIBED BY: R. Sanford DATE: 26 May 2022
CHECKED BY: W. Moore DATE: 31 May 2022

LEGEND

GSE - GRAB SAMPLE (environmental)
GS - GRAB SAMPLE (geotechnical)
Cu - SHEAR TEST
CHEM - CHEMICAL ANALYSIS
OVC - ORGANIC VAPOR CONCENTRATION
INF - INFILTRATION
▼ - WATER LEVEL

Depth Feet	Depth Metres	Elevation (m) BGS Existing	Symbol	STRATIGRAPHY	Sample Type & Number	Moisture %	Tests Type	▼ INF
				TOPSOIL - (250mm)				
		0.25						
1				**ML -** SILT with clay, trace sand, dark brown, moist, firm				
	0.5							
2					GS-1	15.2		
		0.79						
				MLC - SANDY SILT, with clay, light brown, moist, stiff				
3								
	1.0				GS-2	19.8		
4					GS-3	18.8		
				GS-3 Gravel: 0%, Sand: 36%, Silt: 47%, Clay: 17%				
5								
	1.5							
6		1.83		**CLM** - SILTY CLAY, light brown, very stiff, moist	GS-4	17.5		
	2.0							
7					GS-5	16.1		
		2.16		**END OF HOLE**				
				NOTES: -Hole open upon completion -Hole dry upon completion				
8								
	2.5							
9								
10	3.0							
11								
	3.5							

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REFERENCE No.: 12579364-01 ENCLOSURE No.: A-7

TEST PIT No.: TP-7
ELEVATION: Existing

TEST PIT REPORT

CLIENT: Kaitlin Corporation
PROJECT: Hydrogeotechnical Investigation
LOCATION: 46 Stevens Road, Bowmanville, ON
DESCRIBED BY: R. Sanford DATE: 26 May 2022
CHECKED BY: W. Moore DATE: 31 May 2022

LEGEND

GSE - GRAB SAMPLE (environmental)
GS - GRAB SAMPLE (geotechnical)
Cu - SHEAR TEST
CHEM - CHEMICAL ANALYSIS
OVC - ORGANIC VAPOR CONCENTRATION
INF - INFILTRATION
▼ - WATER LEVEL

Depth Feet	Depth Metres	Elevation (m) BGS Existing	Symbol	STRATIGRAPHY	Sample Type & Number	Moisture %	Tests Type	▼ INF
		0.25		**TOPSOIL** - (250mm)				
1	0.5			**FILL:** SILT, with clay, trace sand, dark brown, moist, firm, reworked native with construction material				
2					GS-1	22.7		
		0.81		CLAYEY SILT, dark brown, moist, stiff, reworked native with construction material				
3	1.0							
4					GS-2	16.8		
5	1.5	1.55		**NATIVE:** **CLM** - SILTY CLAY, few sand, light brown, moist, very stiff				
6								
	2.0							
7					GS-3	16.4		
				GS-3 Gravel: 0%, Sand: 9%, Silt: 68%, Clay: 23%				
8					GS-4	15.7		
	2.5							
9								
		2.95		**END OF HOLE**				
10	3.0			**NOTES:** -Hole open upon completion -Hole dry upon completion				
11								
	3.5							

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REFERENCE No.: 12579364-01 ENCLOSURE No.: A-8

TEST PIT No.: TP-8
ELEVATION: Existing

TEST PIT REPORT

CLIENT: Kaitlin Corporation
PROJECT: Hydrogeotechnical Investigation
LOCATION: 46 Stevens Road, Bowmanville, ON
DESCRIBED BY: R. Sanford DATE: 26 May 2022
CHECKED BY: W. Moore DATE: 31 May 2022

LEGEND

GSE - GRAB SAMPLE (environmental)
GS - GRAB SAMPLE (geotechnical)
Cu - SHEAR TEST
CHEM - CHEMICAL ANALYSIS
OVC - ORGANIC VAPOR CONCENTRATION
INF - INFILTRATION
▼ - WATER LEVEL

Depth Feet	Depth Metres	Elevation (m) BGS Existing	Symbol	STRATIGRAPHY	Sample Type & Number	Moisture %	Tests Type	▼ INF
				TOPSOIL - (250mm)				
		0.25		**MLS** - SANDY SILT, with clay, few gravel, dark brown, moist, firm				
1	0.5							
2				GS-1 Gravel: 11%, Sand: 29%, Silt: 35%, Clay: 25%	GS-1	13.6		
		0.76		**CLM** - SILTY CLAY, light brown, moist, very stiff				
3	1.0							
4								
5	1.5							
6					GS-2	25.9		
	2.0							
7		2.19			GS-3	19		
				END OF HOLE				
8	2.5			**NOTES:** -Hole open upon completion -Hole dry upon completion				
9								
10	3.0							
11								
	3.5							

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REFERENCE No.: 12579364-01 ENCLOSURE No.: A-9

TEST PIT No.: TP-9
ELEVATION: Existing

TEST PIT REPORT

CLIENT: Kaitlin Corporation
PROJECT: Hydrogeotechnical Investigation
LOCATION: 46 Stevens Road, Bowmanville, ON
DESCRIBED BY: R. Sanford DATE: 26 May 2022
CHECKED BY: W. Moore DATE: 31 May 2022

LEGEND

GSE - GRAB SAMPLE (environmental)
GS - GRAB SAMPLE (geotechnical)
Cu - SHEAR TEST
CHEM - CHEMICAL ANALYSIS
OVC - ORGANIC VAPOR CONCENTRATION
INF - INFILTRATION
▼ - WATER LEVEL

Depth Feet	Depth Metres	Elevation (m) BGS Existing	Symbol	STRATIGRAPHY	Sample Type & Number	Moisture %	Tests Type	▼ INF
				TOPSOIL - (250mm)				
		0.25		**ML** - SILT, with clay, few sand, light brown, moist, firm				
1	0.5							
2					GS-1	42.6		
				GS-2 Gravel: 0%, Sand: 12%, Silt: 63%, Clay: 25%				
3					GS-2	27.3		
	1.0	0.97		becomes wet				
4				**END OF HOLE**				
				NOTES: -Hole open upon completion -Water infiltration encountered at 0.94 meters below grade -Water to 0.94 meters below grade upon completion				
5	1.5							
6								
	2.0							
7								
8	2.5							
9								
10	3.0							
11								
	3.5							

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REFERENCE No.: 12579364-01 ENCLOSURE No.: A-10

TEST PIT No.: TP-10
ELEVATION: Existing

TEST PIT REPORT

CLIENT: Kaitlin Corporation
PROJECT: Hydrogeotechnical Investigation
LOCATION: 46 Stevens Road, Bowmanville, ON
DESCRIBED BY: R. Sanford DATE: 26 May 2022
CHECKED BY: W. Moore DATE: 31 May 2022

LEGEND

GSE - GRAB SAMPLE (environmental)
GS - GRAB SAMPLE (geotechnical)
Cu - SHEAR TEST
CHEM - CHEMICAL ANALYSIS
OVC - ORGANIC VAPOR CONCENTRATION
INF - INFILTRATION
▼ - WATER LEVEL

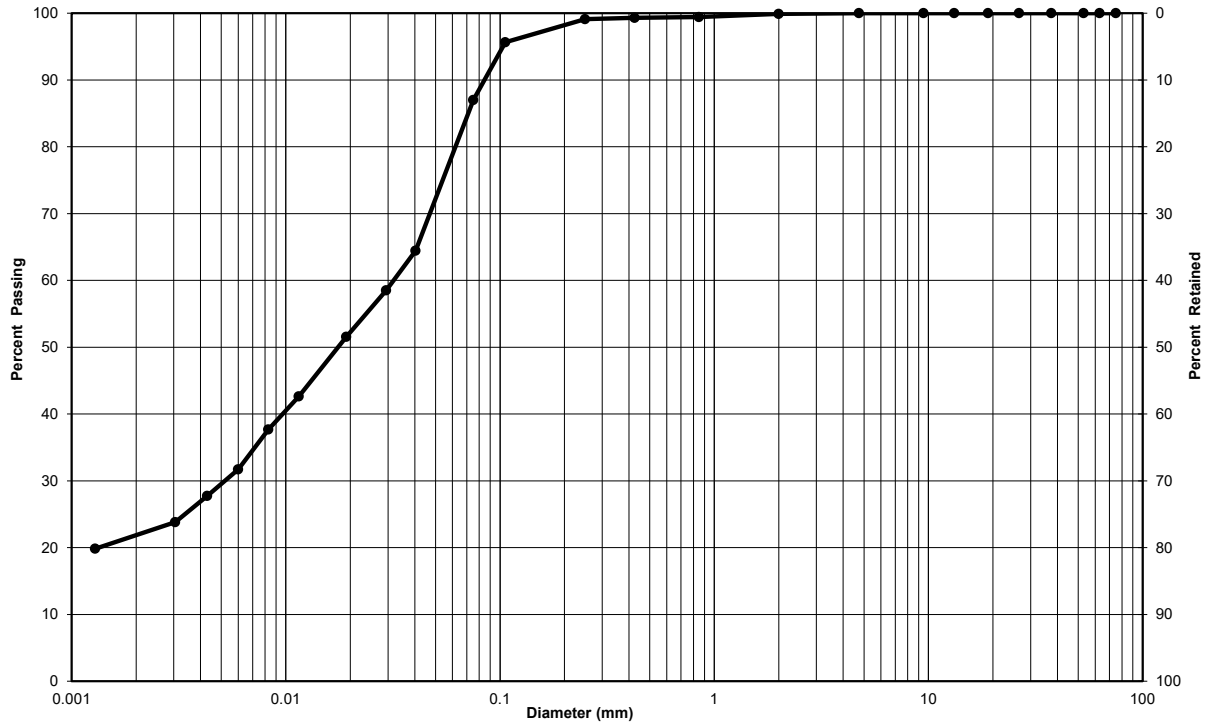
Depth Feet	Depth Metres	Elevation (m) BGS Existing	Symbol	STRATIGRAPHY	Sample Type & Number	Moisture %	Tests Type	▼ INF
		0.25		**TOPSOIL** - (250mm)				
1				**ML** - SILT, with clay, trace sand, light brown, wet, firm				
	0.5	0.51			GS-1	30		
2				**END OF HOLE**				
				NOTES: -Hole open upon completion -Water infiltration encountered at 0.45 meters below grade -Water to 0.5 meters below grade upon completion				
3	1.0							
4								
5	1.5							
6								
	2.0							
7								
8								
	2.5							
9								
10	3.0							
11								
	3.5							

File: N:\CA\PETERBOROUGH\PROJECTS\662\12579364\WORKSHARE\DESIGN\12579364-01, 22-05-27 TEST PIT GINT LOGS RS.GPJ Library File: GHD_GEOTECH_V09.GLB Report: TEST PIT LOG Date: 3/6/22

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Kaitlin Corp	**Lab No.:**	SS-22-24
Project, Site:	46 Stevens Road	**Project No.:**	12579364-02

Borehole No.:	TP-4	Sample No.:	GS-3
Depth:	2.03m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty clay (CL-ML)	0	13	87
Silt-size particles (%) :	66		
Clay-size particles (%) (<0.002 mm):	21		

Additional laboratory reporting information available upon request.

Remarks:

Performed by:	Reanna McIlveen	**Date:**	June 3, 2022
Verified by:	Joe Sullivan	**Date:**	June 3, 2022
Laboratory Location:	GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON		

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

Client:	Kaitlin Corp	**Lab no.:**	SS-22-24
Project/Site:	46 Stevens Road	**Project no.:**	12579364-02

Borehole no.:	TP-4	Sample no.:	GS-3	Depth:	2.03m
Soil Description:	Silty Clay (CL-ML)			Date sampled:	May 27, 2022

Apparatus:	Hand Crank	Balance no.:	10	Porcelain bowl no.:	1
Liquid limit device no.:	n/a	Oven no.:	B33-02667	Spatula no.:	1
Sieve no.:	Cohesive	Glass plate no.:	1		

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	29	25	18
Water Content:			
Tare no.	7	8	9
Wet soil+tare, g	28.25	29.59	28.49
Dry soil+tare, g	27.24	28.28	27.39
Mass of water, g	1.01	1.31	1.10
Tare, g	21.56	21.19	21.75
Mass of soil, g	5.68	7.09	5.64
Water content %	17.8%	18.5%	19.5%

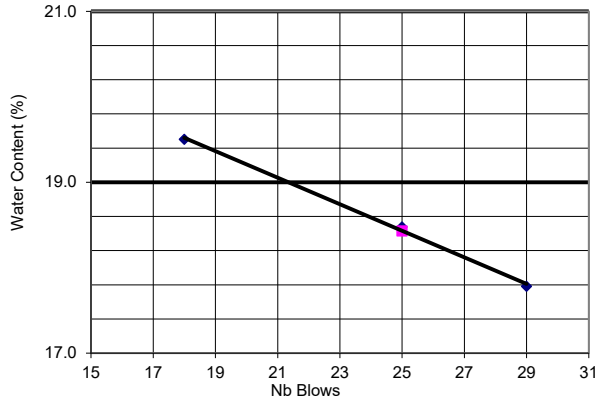
Plastic Limit (PL) - Water Content:		
Tare no.	1	2
Wet soil+tare, g	29.66	29.87
Dry soil+tare, g	28.62	28.83
Mass of water, g	1.04	1.04
Tare, g	21.32	21.45
Mass of soil, g	7.30	7.38
Water content %	14.2%	14.1%
Average water content %	14.2%	

Natural Water Content (W^n):		
Tare no.	Bowl	
Wet soil+tare, g	968.48	
Dry soil+tare, g	862.80	
Mass of water, g	105.68	
Tare, g	159.00	
Mass of soil, g	703.80	
Water content %	15.0%	

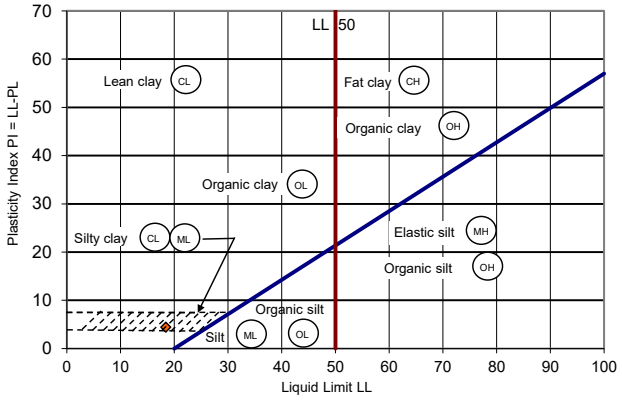
Soil Preparation:

- ☐ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☐ Dry preparation (oven dried))
- ☐ Dry preparation (air dried)
- ☐ Wet preparation

Results



Soil Plasticity Chart ASTM D2487



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
18	14	4	15.0

Additional laboratory reporting information available upon request.

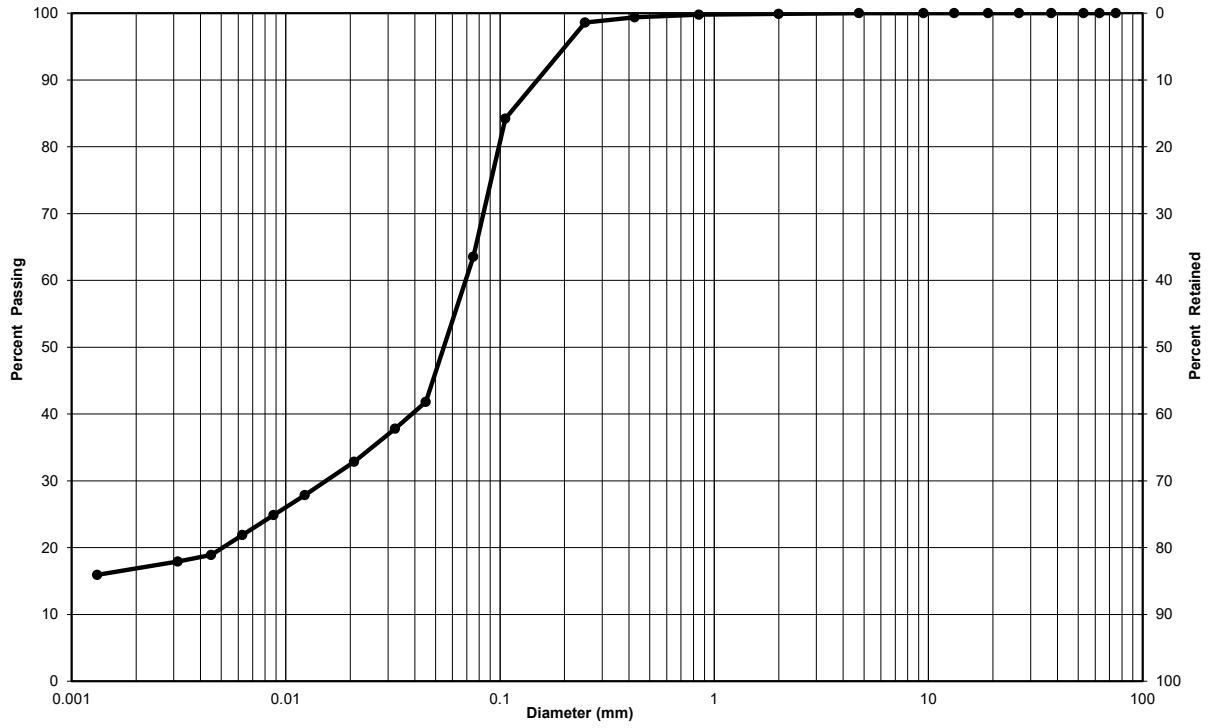
Remarks:

Performed by:	Reanna McIlveen	**Date:**	June 3, 2022
Verified by:	Joe Sullivan	**Date:**	June 3, 2022
Laboratory Location:	GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON		

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Kaitlin Corp	**Lab No.:**	SS-22-24
Project, Site:	46 Stevens Road	**Project No.:**	12579364-02□

Borehole No.:	TP-6	Sample No.:	GS-3
Depth:	1.17m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sandy silt with clay	0	36	64
Silt-size particles (%) :	47		
Clay-size particles (%) (<0.002 mm):	17		

Additional laboratory reporting information available upon request.

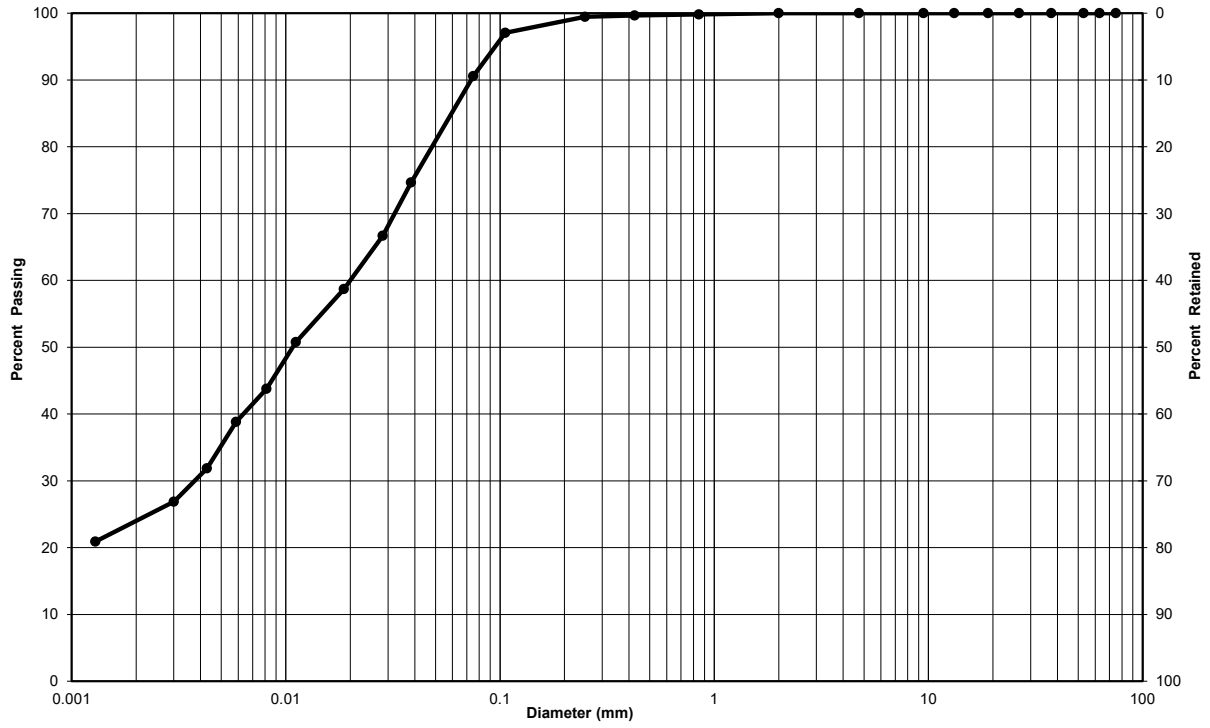
Remarks:

Performed by:	Reanna McIlveen	**Date:**	June 3, 2022
Verified by:	Joe Sullivan	**Date:**	June 3, 2022
Laboratory Location:	GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON		

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Kaitlin Corp	**Lab No.:**	SS-22-24
Project, Site:	46 Stevens Road	**Project No.:**	12579364-02

Borehole No.:	TP-7	Sample No.:	GS-3
Depth:	2.06m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silt with clay, few sand	0	9	91
Silt-size particles (%) :	68		
Clay-size particles (%) (<0.002 mm):	23		

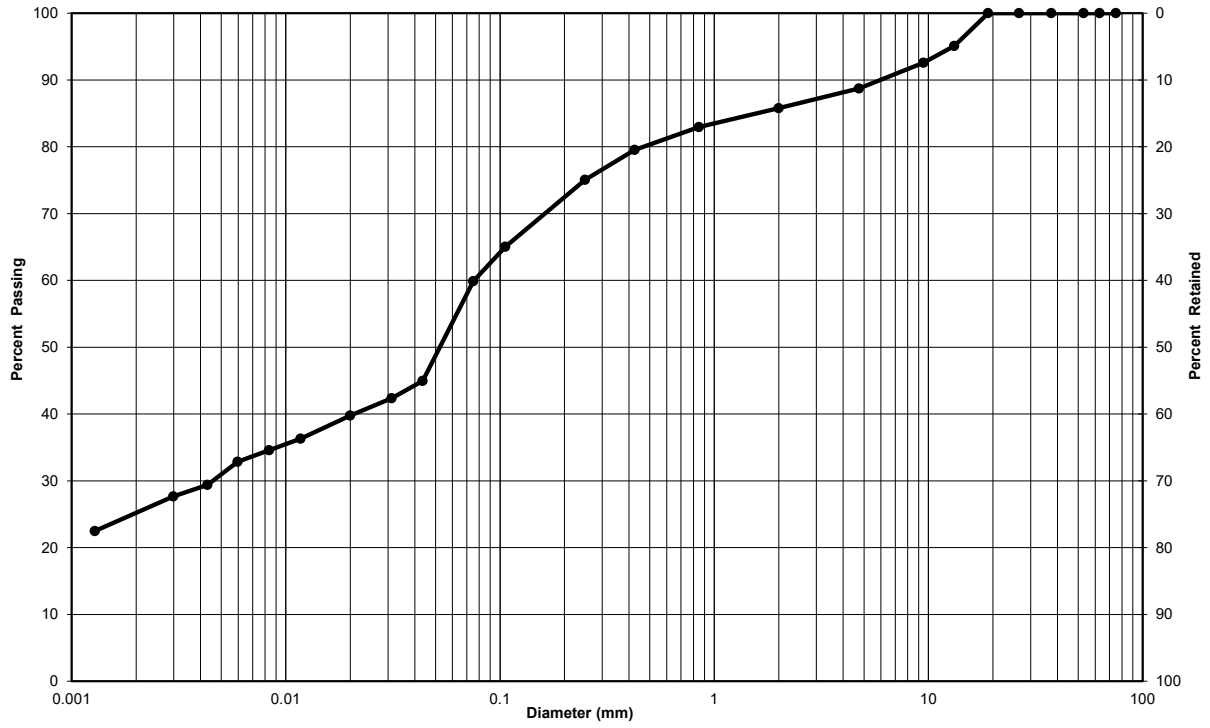
Additional laboratory reporting information available upon request.

Remarks:

Performed by:	Reanna McIlveen	**Date:**	June 3, 2022
Verified by:	Joe Sullivan	**Date:**	June 3, 2022
Laboratory Location:	GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON		

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Kaitlin Corp	**Lab No.:**	SS-22-24
Project, Site:	46 Stevens Road	**Project No.:**	12579364-02
Borehole No.:	TP-8	Sample No.:	GS-1
Depth:	0.61m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silt with clay and sand, few gravel	11	29	60
Silt-size particles (%) :	35		
Clay-size particles (%) (<0.002 mm):	25		

Additional laboratory reporting information available upon request.

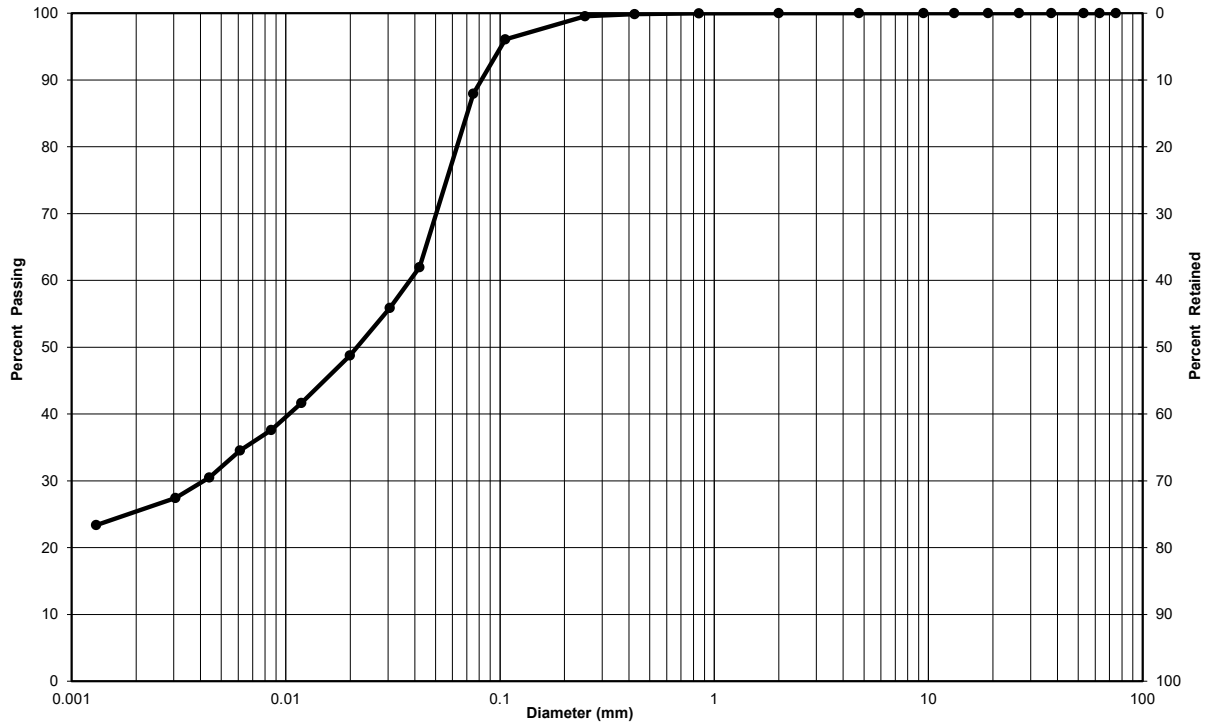
Remarks:

Performed by:	Reanna McIlveen	**Date:**	June 3, 2022
Verified by:	Joe Sullivan	**Date:**	June 3, 2022
Laboratory Location:	GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON		

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Kaitlin Corp	**Lab No.:**	SS-22-24
Project, Site:	46 Stevens Road	**Project No.:**	12579364-02

Borehole No.:	TP-9	Sample No.:	GS-2
Depth:	0.94m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silt with clay, few sand	0	12	88
Silt-size particles (%) :	63		
Clay-size particles (%) (<0.002 mm):	25		

Additional laboratory reporting information available upon request.

Remarks:

Performed by:	Reanna McIlveen	**Date:**	June 3, 2022
Verified by:	Joe Sullivan	**Date:**	June 3, 2022
Laboratory Location:	GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON		

Moisture Content of Soils
(LS-701/ASTM D 2216)

Client:	Kaitlin Corp	**Lab No.:**	SS-22-24
Project/Site:	46 Stevens Road	**Project No.:**	12579364-02

Apparatus Used for Testing

Oven No.: _____ **Scale No.:** _____

BH No.:	TP1	TP2	TP3	TP4	TP4	TP4	TP5	TP5
Sample No.:	GS1	GS1	GS1	GS1	GS2	GS3	GS1	GS2
Depth:	18"	18"	18"	10"	40"	80"	22"	40"
Container no.	N23	J11	N8	N18	N22	BOWL	J26	J19
Mass of container + wet soil (g)	189.98	184.02	163.06	201.88	143.7	968.48	259.94	256.03
Mass of container + dry soil (g)	165.21	157.93	137.29	174.05	126.71	862.80	222.57	218.78
Mass of container (g)	46.22	46.08	45.60	45.22	45.34	159.00	45.00	46.67
Mass of dry soil (g)	119.0	111.9	91.7	128.8	81.4	703.8	177.6	172.1
Mass of water (g)	24.8	26.1	25.8	27.8	17.0	105.7	37.4	37.3
Moisture content (%)	20.8	23.3	28.1	21.6	20.9	15.0	21.0	21.6
BH No.:	TP6	TP6	TP6	TP6	TP6	TP7	TP7	TP7
Sample No.:	GS1	GS2	GS3	GS4	GS5	GS1	GS2	GS3
Depth:	24"	42"	46"	73"	85"	27"	45"	81"
Container no.	N33	R3	BOWL	N27	J5	J6	N31	BOWL
Mass of container + wet soil (g)	267.71	183.83	871.46	234.11	156.50	187.24	194.39	897.68
Mass of container + dry soil (g)	238.55	161.03	766.67	206.17	141.03	161.11	173.00	799.64
Mass of container (g)	47.05	45.62	208.03	46.15	45.11	46.10	45.55	201.91
Mass of dry soil (g)	191.5	115.4	558.6	160.0	95.9	115.0	127.5	597.7
Mass of water (g)	29.2	22.8	104.8	27.9	15.5	26.1	21.4	98.0
Moisture content (%)	15.2	19.8	18.8	17.5	16.1	22.7	16.8	16.4

Additional laboratory reporting information available upon request.

Remarks:

Performed By:	Reanna McIlveen	**Date:**	June 1, 2022
Verified by :	Joe Sullivan	**Date:**	June 3, 2022
Laboratory Location:	GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON		

Moisture Content of Soils
(LS-701/ASTM D 2216)

Client:	Kaitlin Corp	**Lab No.:**	SS-22-24
Project/Site:	46 Stevens Road	**Project No.:**	12579364-02

Apparatus Used for Testing

Oven No.: _____ **Scale No.:** _____

BH No.:	TP7	TP8	TP8	TP8	TP9	TP9	TP10	
Sample No.:	GS4	GS1	GS2	GS3	GS1	GS2	GS1	
Depth:	92"	24"	72"	96"	23"	37"	19"	
Container no.	J22	BOWL	N21	J9	T14	BOWL	J23	
Mass of container + wet soil (g)	227.08	902.61	256.89	265.69	163.95	766.35	274.03	
Mass of container + dry soil (g)	202.38	820.38	213.40	230.55	128.50	646.75	221.41	
Mass of container (g)	45.34	213.70	45.20	45.29	45.30	208.43	46.08	
Mass of dry soil (g)	157.0	606.7	168.2	185.3	83.2	438.3	175.3	
Mass of water (g)	24.7	82.2	43.5	35.1	35.5	119.6	52.6	
Moisture content (%)	15.7	13.6	25.9	19.0	42.6	27.3	30.0	
BH No.:								
Sample No.:								
Depth:								
Container no.								
Mass of container + wet soil (g)								
Mass of container + dry soil (g)								
Mass of container (g)								
Mass of dry soil (g)								
Mass of water (g)								
Moisture content (%)								

Additional laboratory reporting information available upon request.

Remarks: _____

Performed By:	Reanna McIlveen	**Date:**	June 1, 2022
Verified by :	Joe Sullivan	**Date:**	June 3, 2022
Laboratory Location:	GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON		

Appendix B

Infiltration Testing Results

Appendix B: Infiltration Testing (in-situ)

Project No.: 12579364-01
Date: May 26, 2022
Equipment: ETC Pask Permeameter

	INF-01	INF-02	INF-03	INF-04
Test ID.:				
Description:	South-west side of site	South-west side of site	South-east side of site	South-east side of site
Location:	Inside TP-4	Inside TP-4	Inside TP-5	Inside TP-5
Depth of hole:	0.51 mbgs	2.0 mbgs	0.60 mbgs	2.0 m bgs

Elapsed Time (minutes)	Permeameter Reading (cm)	Rate (cm/min)
0.0	36.0	--
0.5	35.5	1.0
1.0	35.5	0.0
1.5	35.0	1.0
2.0	34.5	1.0
2.5	34.0	1.0
7.5	31.0	0.6
9.5	30.0	0.5
15.5	27.0	0.5
16.5	26.0	1.0
17.5	25.5	0.5
18.5	25.5	0.0
19.5	25.0	0.5
20.5	24.5	0.5
21.5	24.0	0.5
22.5	23.5	0.5
23.5	23.0	0.5
24.5	22.5	0.5

Elapsed Time (minutes)	Permeameter Reading (cm)	Rate (cm/min)
0.0	34.5	--
1.0	34.5	0.0
2.0	34.5	0.0
3.0	34.5	0.0
4.0	34.5	0.0
5.0	34.5	0.0
6.0	34.5	0.0
8.0	34.5	0.0
23.0	33.5	0.1
30.0	32.5	0.1
34.0	31.7	0.2
44.0	30.0	0.2

Elapsed Time (minutes)	Permeameter Reading (cm)	Rate (cm/min)
0.0	41.1	--
1.0	41.1	0.0
10.0	40.9	0.0
20.0	40.6	0.0
30.0	39.5	0.1
40.0	39.0	0.1
50.0	38.5	0.1
60.0	37.8	0.1
70.0	37.5	0.03
80.0	36.5	0.1
90.0	35.5	0.1

Elapsed Time (minutes)	Permeameter Reading (cm)	Rate (cm/min)
0.0	34.6	--
10.0	33.5	0.11
20.0	32.2	0.13
30.0	32.2	0.00
40.0	32.1	0.01
50.0	32.0	0.01
60.0	31.9	0.01
70.0	31.8	0.01

Quasi Steady Flow Rate ® (cm/min)	0.5	0.2	0.1	0.01
Field-Saturated Hydraulic Conductivity (Ksf) (m/sec)	1.60E-06	6.30E-07	3.10E-07	3.10E-08
Estimated Infiltration Rate (mm/hr)	54	42	36	17

Appendix C

MECP Well Records

APPENDIX C.1: WELL SUMMARY
Well Record Summary - Drilled Overburden Wells
Project Number: 12579364
46 Stevens Road, Bowmanville, ON

MECP Well No.	Well Use	Water Found		Static Level		Test Rate		Well Depth		Depth to Bedrock		Comments
		Feet	Metres	Feet	Metres	GPM	LPM	Feet	Metres	Feet	Metres	
1904111	Domestic	50	15.2	20	6.1	3	11.4	52	15.8	--	--	0-2' Topsoil, 2'-20' Clay, 20'-52' Sandy Gravel
1905877	Domestic	104	31.7	35	10.7	15	56.8	105	32.0	--	--	0-30' Brown Clay, 30'-104' Grey Clay, 104'-105' Loose Gravel
1907803	Domestic	40	12.2	8	2.4	4	15.1	45	13.7	--	--	0-5' Coarse Fill, 5'-40' Clay, 40'-45' Sand

Total Number of Wells = 3

	Water Found		Static Level		Test Rate		Well Depth		Depth to Bedrock	
	Feet	Metres	Feet	Metres	GPM	LPM	Feet	Metres	Feet	Metres
AVERAGE	64.7	19.7	21.0	6.4	7.3	27.8	67.3	20.5	--	--
MAXIMUM	104.0	31.7	35.0	10.7	15.0	56.8	105	32.0	--	--
MINIMUM	40.0	12.2	8.0	2.4	3.0	11.4	45.0	13.7	--	--

Notes:
-- indicates no data available
GPM: US Gallons per Minute
LPM: Litres per Minute

APPENDIX C.2: WELL SUMMARY
Well Record Summary - Drilled Bedrock Wells
Project Number: 12579364
46 Stevens Road, Bowmanville, ON

MECP Well No.	Well Use	Water Found		Static Level		Test Rate		Well Depth		Depth to Bedrock		Comments
		Feet	Metres	Feet	Metres	GPM	LPM	Feet	Metres	Feet	Metres	
1901203	Domestic	119	36.269	28	8.534	2	7.8	130	39.62	119	36.2694	0-24' Previously Dug, 24'-60' Clay, 60'-102' Sand, 102'-119' Clay, 119'-130' Limestone
1903869	Domestic	120	36.574	30	9.144	12	46.5	128	39.01	120	36.5742	0-120' Clay, 120'128' Shale
1908702	Abandoned - Insufficient	45	13.715	--	--	--	--	150	45.72	110	33.5264	0-12' Loam, 12'-45' Clay, 45'-46' Sand, 46'-110' Clay, 110'-150' Limestone
1909480	Abandonment	--	--	--	--	--	--	180	54.9	116	35.4	0-5' Topsoil, 5'-116' Clay. 116'-180' Limestone
1911569	Domestic	112	34.136	40	12.19	3	11.6	113	34.44	110	33.5264	0-2' Topsoil, 2'-110' Clay, 110'-113' Limestone

Total Number of Wells = 5

	Water Found		Static Level		Test Rate		Well Depth		Depth to Bedrock	
	Feet	Metres	Feet	Metres	GPM	LPM	Feet	Metres	Feet	Metres
AVERAGE	99.0	30.2	32.7	10.0	5.7	22.0	140.2	42.7	115.0	35.1
MAXIMUM	120.0	36.6	40.0	12.2	12.0	46.5	180.0	54.9	120.0	36.6
MINIMUM	45.0	13.7	28.0	8.5	2.0	7.8	113.0	34.4	110.0	33.5

Notes:
-- indicates no data available
GPM: US Gallons per Minute
LPM: Litres per Minute

APPENDIX C.3: WELL SUMMARY

Well Record Summary - Dug / Bored Wells
Project Number: 12579364
46 Stevens Road, Bowmanville, ON

MECP Well No.	Well Use	Water Found		Static Level		Test Rate		Well Depth		Depth to Bedrock		Comments
		Feet	Metres	Feet	Metres	GPM	LPM	Feet	Metres	Feet	Metres	
1901204	Domestic	50	15.2	9	2.7	1	3.8	55	16.8	--	--	0-1' Topsoil, 1'-50' Clay, 50'-53' Fine Sand, 53'-55' Clay
1907766	Domestic	25	7.6	25	7.6	5	18.9	40	12.2	27	8.2292	0-1' Topsoil, 1'-27' Clay, 27'-40' Hardpan, Limestone
1908060	Domestic	24	7.3	20	6.1	6	22.7	38	11.6	--	--	0-1' Topsoil, 1'-24' Clay, 24'-25' Sand, 25'-30' Clay, 30'-31' Sand, 31'-38' Clay
1908106	Domestic	18	5.5	15	4.6	8	30.3	30	9.1	--	--	0-1' Topsoil, 1'-30' Clay
1908379	Domestic	30	9.1	30	9.1	7	26.5	50	15.2	--	--	0-1' Topsoil, 1'-50' Clay
1908714	Domestic	40	12.2	40	12.2	6	22.7	50	15.2	--	--	0-1' Topsoil, 1'-50' Clay
1908871	Domestic	20	6.1	15	4.6	8	30.3	30	9.1	--	--	0-1' Topsoil, 1'-5' Clay, 5'-15' Sand, 15'-29' Clay, 29'-30' Sand
1909089	Domestic	25	7.6	24	7.3	8	30.3	39	11.9	--	--	0-1' Topsoil, 1'-18' Clay, 18'-25' Stones, 25'-30' Sand, 30'-39' Rocks
1909297	Domestic	32	9.8	32	9.8	8	30.3	53	16.2	--	--	0-1' Topsoil, 1'-32' Clay, 32'-33' Sand, 33'-41' Clay, 41'-44' Stones, 44'-50' Clay, 50'-53' Sand
1909479	Domestic	25	7.6	25	7.6	8	30.3	46	14.0	--	--	0-1' Topsoil, 1'-46' Clay
1911120	Domestic	25	7.6	33	10.1	4	15.1	44	13.4	--	--	0-1' Topsoil, 1'-44' Clay

Total Number of Wells = 11

	Water Found		Static Level		Test Rate		Well Depth		Depth to Bedrock	
	Feet	Metres	Feet	Metres	GPM	LPM	Feet	Metres	Feet	Metres
AVERAGE	28.5	8.7	24.4	7.4	6.3	23.7	43.2	13.2	27.0	8.2
MAXIMUM	50.0	15.2	40.0	12.2	8.0	30.3	55.0	16.8	27.0	8.2
MINIMUM	18.0	5.5	9.0	2.7	1.0	3.8	30.0	9.1	27.0	8.2

Notes:
-- indicates no data available
GPM: US Gallons per Minute
LPM: Litres per Minute

APPENDIX C.4: WELL SUMMARY
Well Record Summary - Monitoring Wells
Project Number: 12579364
46 Stevens Road, Bowmanville, ON

MECP Well No.	Well Use	Water Found		Static Level		Test Rate		Well Depth		Comments
		Feet	Metres	Feet	Metres	GPM	LPM	Feet	Metres	
1917480	Monitoring	4.265	1.3	--	--	--	--	11.8	3.6	0-10' Sandy Silt, 10'-12' Clayey Silt
7295320	Abandonment	--	--	--	--	--	--	20	3.6	
7295736	Monitoring	--	--	--	--	--	--	21	6.4	0-1' Topsoil, 1'-15' Clay, 15'-21' Silt
7331749	Monitoring	23.5	7.2	--	--	--	--	25	7.6	0-0.5' Topsoil, 0.5'-10' Fill, 10'-25' Clayey Till
7331751	Monitoring	10	3.0	--	--	--	--	35	10.7	0-35' Clay
7331752	Monitoring	25	7.6	--	--	--	--	40	12.2	

Total Number of Wells = 6

	Water Found		Static Level		Test Rate		Well Depth	
	Feet	Metres	Feet	Metres	GPM	LPM	Feet	Metres
AVERAGE	15.7	4.8	--	--	--	--	25.5	7.3
MAXIMUM	25.0	7.6	--	--	--	--	40	12.2
MINIMUM	4.3	1.3	--	--	--	--	11.8	3.6

Notes:
-- indicates no data available
GPM: US Gallons per Minute
LPM: Litres per Minute

Data Disclaimer

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1 cm = 52 meters

0 30 60 90 120

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

GHD

Vad Retail Ltd.
46 Stevens Road, Bowmanville, ON
Municipality of Clarington
Regional Municipality of Durham

Hydrogeological Assessment

MECP Well Location Plan

Project No. 12579364
Revision No.
Date Apr 25, 2022

Appendix C

Q:\GIS\PROJECTS\12579000s\12579364\Layouts\202204_RPT001\12579364_202204_RPT001_GIS001 - MECP Well Location Plan.mxd
Print date: 25 Apr 2022 - 10:14

Data source: Water Well Information System (WWIS). Ministry of the Environment, Conservation, and Parks. 2021., © Municipality of Clarington, 2020.

MECP WELL RECORD LISTINGS

Ministry of the Environment, Conservation & Parks (MECP)

17

Easting:	684294.10
Northing:	4865171.00
Elev (masl):	120.65

Latitude: 43.916599
Longitude: -78.704564

Well ID: 1901203

LOCATION

Lot: 015
Con: 02
Municipality: DURHAM
Township: NEWCASTLE TOWN (DARLINGTON)
Street:
City: n/a

WELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use: Domestic
Boring Method: Cable Tool

PUMP TEST

Test Method: CLEAR
Pump Set (m): n/a
SWL (ft) 28
Final Level: 124 ft
Pump Rate: 2 GPM
Recom. Rate: 2 GPM

Tag:
Audit No:
Contractor License: 2113
Well Completion Date: 12/30/1959
Received Date: 02/15/1960

Well Depth (m): 39.624
Depth to Bedrock (m): 119
Depth to Water: ft
Water Kind: FRESH

Pipe ID: 10618836
Pump Test ID 991901203
Flowing: N
Pump Duration (hr): 3
Pump Duration (m): 0

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930127606	6	inch	STEEL	n/a	119 ft
2	930127607	6	inch	OPEN HOLE	n/a	130 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	PREVIOUSLY DUG	n/a	n/a	n/a	0	24 ft
2	CLAY	n/a	n/a	GREY	24	60 ft
3	MEDIUM SAND	CLAY	n/a	GREY	60	102 ft
4	CLAY	n/a	n/a	GREY	102	119 ft
5	LIMESTONE	n/a	n/a	BROWN	119	130 ft

End of Record

17

Easting:	684292.10
Northing:	4865097.00
Elev (masl):	119.69

Latitude: 43.915933
Longitude: -78.704614

Well ID: 1901204

LOCATION

Lot: 015
Con: 02
Municipality: DURHAM
Township: NEWCASTLE TOWN (DARLINGTON)
Street:
City: n/a

WELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use: Domestic
Boring Method: Boring

PUMP TEST

Test Method: CLEAR
Pump Set (m): n/a
SWL (ft) 9
Final Level: n/a ft
Pump Rate: 1 GPM
Recom. Rate: 1 GPM

Tag:
Audit No:
Contractor License: 5412
Well Completion Date: 08/29/1964
Received Date: 09/30/1964

Well Depth (m): 16.764
Depth to Bedrock (m): n/a
Depth to Water: ft
Water Kind: FRESH

Pipe ID: 10618837
Pump Test ID 991901204
Flowing: N
Pump Duration (hr): n/a
Pump Duration (m): n/a

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930127608	30	inch	CONCRETE	n/a	55 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	n/a	n/a	n/a	0	1 ft
2	CLAY	n/a	n/a	BROWN	1	8 ft
3	CLAY	STONES	n/a	BLUE	8	50 ft
4	FINE SAND	n/a	n/a	n/a	50	53 ft
5	CLAY	n/a	n/a	BLUE	53	55 ft

End of Record

17

Easting:	684459.10
Northing:	4865313.00
Elev (masl):	116.53

Latitude: 43.917835
Longitude: -78.702461

Well ID: 1903869

LOCATION

Lot: 014
Con: 02
Municipality: DURHAM
Township: NEWCASTLE TOWN (DARLINGTON)
Street:
City: n/a

Tag:
Audit No:
Contractor License: 2214
Well Completion Date: 01/04/1974
Received Date: 06/21/1974

WELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Cable Tool

Well Depth (m): 39.0144
Depth to Bedrock (m): 120
Depth to Water: ft
Water Kind: FRESH

PUMP TEST

Test Method: n/a
Pump Set (m): n/a
SWL (ft) 30
Final Level: 30 ft
Pump Rate: 12 GPM
Recom. Rate: 5 GPM

Pipe ID: 10621471
Pump Test ID 991903869
Flowing: N
Pump Duration (hr): 1
Pump Duration (m): 0

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930130518	6	inch	STEEL	n/a	120 ft
2	930130519	6	inch	OPEN HOLE	n/a	128 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	CLAY	n/a	n/a	BROWN	0	15 ft
2	CLAY	STONES	n/a	BLUE	15	80 ft
3	CLAY	STONES	n/a	GREY	80	120 ft
4	SHALE	n/a	n/a	n/a	120	128 ft

End of Record

17

Easting:	684783.10
Northing:	4864745.00
Elev (masl):	112.16

Latitude: 43.912644
Longitude: -78.698626

Well ID: 1904111

LOCATION

Lot: n/a
Con: n/a
Municipality: DURHAM
Township: BOWMANVILLE TOWN
Street:
City: n/a

Tag:
Audit No:
Contractor License: 2104
Well Completion Date: 03/14/1975
Received Date: 04/08/1975

WELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Cable Tool

Well Depth (m): 15.8496
Depth to Bedrock (m): n/a
Depth to Water: ft
Water Kind: FRESH

PUMP TEST

Test Method: CLEAR
Pump Set (m): n/a
SWL (ft) 20
Final Level: 50 ft
Pump Rate: 3 GPM
Recom. Rate: 3 GPM

Pipe ID: 10621692
Pump Test ID 991904111
Flowing: N
Pump Duration (hr): 16
Pump Duration (m): 0

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930130765	6	inch	STEEL	n/a	37 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	n/a	n/a	n/a	0	2 ft
2	CLAY	n/a	n/a	YELLOW	2	20 ft
3	GRAVEL	SAND	STONES	BROWN	20	52 ft

End of Record

17

Easting:	684775.10
Northing:	4864743.00
Elev (masl):	112.49

Latitude: 43.912628
Longitude: -78.698726

Well ID: 1905877

LOCATION

Lot: 014
Con: 01
Municipality: DURHAM
Township: NEWCASTLE TOWN (DARLINGTON)
Street:
City: n/a

Tag:
Audit No:
Contractor License: 2104
Well Completion Date: 11/05/1980
Received Date: 11/13/1980

WELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Cable Tool

Well Depth (m): 32.004
Depth to Bedrock (m): n/a
Depth to Water: ft
Water Kind: FRESH

PUMP TEST

Test Method: CLEAR
Pump Set (m): n/a
SWL (ft) 35
Final Level: 85 ft
Pump Rate: 15 GPM
Recom. Rate: 10 GPM

Pipe ID: 10623255
Pump Test ID 991905877
Flowing: N
Pump Duration (hr): 3
Pump Duration (m): 30

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930132438	6	inch	STEEL	n/a	105 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	CLAY	STONES	MEDIUM-GRAINED	BROWN	0	30 ft
2	CLAY	STONES	MEDIUM GRAVEL	GREY	30	104 ft
3	GRAVEL	LOOSE	n/a	GREY	104	105 ft

End of Record

17

Easting:	684695.10
Northing:	4865389.00
Elev (masl):	111.03

Latitude: 43.918459
Longitude: -78.699498

Well ID: 1907766

LOCATION

Lot: 014
Con: 02
Municipality: DURHAM
Township: NEWCASTLE TOWN (DARLINGTON)
Street:
City: n/a

Tag:
Audit No: NA
Contractor License: 3129
Well Completion Date: 07/09/1986
Received Date: 07/21/1986

WELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Boring

Well Depth (m): 12.192
Depth to Bedrock (m): 27
Depth to Water: ft
Water Kind: FRESH

PUMP TEST

Test Method: CLEAR
Pump Set (m): n/a
SWL (ft) 25
Final Level: 33 ft
Pump Rate: n/a GPM
Recom. Rate: 5 GPM

Pipe ID: 10624971
Pump Test ID 991907766
Flowing: N
Pump Duration (hr): 1
Pump Duration (m): 0

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930134253	30	inch	CONCRETE	n/a	40 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	n/a	n/a	n/a	0	1 ft
2	CLAY	HARD	BOULDERS	n/a	1	15 ft
3	CLAY	HARD	n/a	BLUE	15	25 ft
4	CLAY	n/a	n/a	n/a	25	27 ft
5	HARDPAN	LIMESTONE	n/a	n/a	27	40 ft

End of Record

17

Easting:	684465.10
Northing:	4864734.00
Elev (masl):	114.89

Latitude: 43.912624
Longitude: -78.702587

Well ID: 1907803

LOCATION

Lot: 014
Con: 01
Municipality: DURHAM
Township: NEWCASTLE TOWN (DARLINGTON)
Street:
City: n/a

Tag:
Audit No: NA
Contractor License: 2517
Well Completion Date: 06/26/1986
Received Date: 08/14/1986

WELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Rotary (Air)

Well Depth (m): 13.716
Depth to Bedrock (m): n/a
Depth to Water: ft
Water Kind: FRESH

PUMP TEST

Test Method: CLEAR
Pump Set (m): n/a
SWL (ft) 8
Final Level: n/a ft
Pump Rate: 4 GPM
Recom. Rate: n/a GPM

Pipe ID: 10625008
Pump Test ID 991907803
Flowing: N
Pump Duration (hr): 3
Pump Duration (m): 0

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930134293	6	inch	STEEL	n/a	45 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	FILL	STONES	n/a	n/a	0	5 ft
2	CLAY	STONES	n/a	BROWN	5	40 ft
3	SAND	GRAVEL	n/a	GREY	40	45 ft

End of Record

17

Easting:	684530.10
Northing:	4864915.00
Elev (masl):	115.83

Latitude: 43.914237
Longitude: -78.701715

Well ID: 1908060

LOCATION

Lot: 014
Con: 02
Municipality: DURHAM
Township: NEWCASTLE TOWN (DARLINGTON)
Street:
City: n/a

Tag:
Audit No: 02278
Contractor License: 2214
Well Completion Date: 12/22/1986
Received Date: 01/29/1987

WELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Boring

Well Depth (m): 11.5824
Depth to Bedrock (m): n/a
Depth to Water: ft
Water Kind: FRESH

PUMP TEST

Test Method: CLOUDY
Pump Set (m): n/a
SWL (ft) 20
Final Level: 30 ft
Pump Rate: 6 GPM
Recom. Rate: 3 GPM

Pipe ID: 10625264
Pump Test ID 991908060
Flowing: N
Pump Duration (hr): 1
Pump Duration (m): 0

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930134556	30	inch	CONCRETE	n/a	25 ft
2	930134557	24	inch	GALVANIZED	n/a	38 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	n/a	n/a	BLACK	0	1 ft
2	CLAY	PACKED	n/a	BROWN	1	10 ft
3	CLAY	STONES	PACKED	GREY	10	24 ft
4	SAND	WATER-BEARING	n/a	GREY	24	25 ft
5	CLAY	BOULDERS	CEMENTED	GREY	25	27 ft
6	CLAY	PACKED	HARD	BLUE	27	30 ft
7	SAND	WATER-BEARING	n/a	GREY	30	31 ft
8	CLAY	BOULDERS	CEMENTED	GREY	31	38 ft

End of Record

17

Easting:	684382.10
Northing:	4865328.00
Elev (masl):	118.73

Latitude: 43.917989
Longitude: -78.703414

Well ID: **1908106**

LOCATION

Lot: 014
Con: 02
Municipality: DURHAM
Township: NEWCASTLE TOWN (DARLINGTON)
Street:
City: n/a

Tag:
Audit No: 05955
Contractor License: 3129
Well Completion Date: 02/20/1987
Received Date: 02/26/1987

WELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Boring

Well Depth (m): 9.144
Depth to Bedrock (m): n/a
Depth to Water: ft
Water Kind: FRESH

PUMP TEST

Test Method: CLEAR
Pump Set (m): n/a
SWL (ft) 15
Final Level: 21 ft
Pump Rate: 8 GPM
Recom. Rate: 5 GPM

Pipe ID: 10625310
Pump Test ID 991908106
Flowing: N
Pump Duration (hr): 1
Pump Duration (m): 0

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930134604	30	inch	CONCRETE	n/a	30 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	n/a	n/a	n/a	0	1 ft
2	CLAY	STONES	n/a	BROWN	1	8 ft
3	CLAY	STONEY	HARD	BLUE	8	15 ft
4	CLAY	SILTY	WATER-BEARING	BLUE	15	18 ft
5	CLAY	HARD	n/a	BLUE	18	30 ft

End of Record

17

Easting:	684507.10
Northing:	4864949.00
Elev (masl):	115.82

Latitude: 43.914548
Longitude: -78.70199

Well ID: **1908379**

LOCATION

Lot: 014
Con: 02
Municipality: DURHAM
Township: NEWCASTLE TOWN (DARLINGTON)
Street:
City: n/a

Tag:
Audit No: 02298
Contractor License: 2214
Well Completion Date: 05/20/1987
Received Date: 07/07/1987

WELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Boring

Well Depth (m): 15.24
Depth to Bedrock (m): n/a
Depth to Water: ft
Water Kind: FRESH

PUMP TEST

Test Method: CLOUDY
Pump Set (m): n/a
SWL (ft) 30
Final Level: 40 ft
Pump Rate: 7 GPM
Recom. Rate: 3 GPM

Pipe ID: 10625582
Pump Test ID 991908379
Flowing: N
Pump Duration (hr): 1
Pump Duration (m): 0

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930134868	30	inch	CONCRETE	n/a	50 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	n/a	n/a	BLACK	0	1 ft
2	CLAY	PACKED	n/a	BROWN	1	27 ft
3	CLAY	STONES	HARD	BLUE	27	30 ft
4	CLAY	SAND	LAYERED	GREY	30	35 ft
5	CLAY	STONES	CEMENTED	GREY	35	45 ft
6	CLAY	SAND	LAYERED	GREY	45	50 ft

End of Record

17

Easting:	684313.10
Northing:	4865315.00
Elev (masl):	121.39

Latitude: 43.917889
Longitude: -78.704277

Well ID: 1908702

LOCATION

Lot: 014
Con: 02
Municipality: DURHAM
Township: NEWCASTLE TOWN (DARLINGTON)
Street:
City: n/a

Tag:
Audit No: 18841
Contractor License: 4743
Well Completion Date: 11/13/1987
Received Date: 12/16/1987

WELL

Well Status: Abandoned-Supply
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Cable Tool

Well Depth (m): 45.72
Depth to Bedrock (m): 110
Depth to Water: ft
Water Kind: Not stated

PUMP TEST

Test Method:
Pump Set (m):
SWL (ft)
Final Level:
Pump Rate:
Recom. Rate:

Pipe ID:
Pump Test ID
Flowing:
Pump Duration (hr):
Pump Duration (m):

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930135208	6	inch	STEEL	n/a	110 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	n/a	n/a	BROWN	0	12 ft
2	CLAY	STONES	HARD	GREY	12	45 ft
3	SAND	n/a	n/a	BROWN	45	46 ft
4	CLAY	STONES	HARD	GREY	46	85 ft
5	CLAY	SILT	SOFT	BLUE	85	91 ft
6	CLAY	STONES	HARD	GREY	91	110 ft
7	LIMESTONE	DENSE	n/a	BROWN	110	150 ft

End of Record

17

Easting:	684498.10
Northing:	4864998.00
Elev (masl):	115.54

Latitude: 43.914991
Longitude: -78.702085

Well ID: 1908714

LOCATION

Lot: 014
Con: 02
Municipality: DURHAM
Township: NEWCASTLE TOWN (DARLINGTON)
Street:
City: n/a

Tag:
Audit No: NA
Contractor License: 2214
Well Completion Date: 09/19/1987
Received Date: 12/09/1987

WELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Boring

Well Depth (m): 15.24
Depth to Bedrock (m): n/a
Depth to Water: ft
Water Kind: FRESH

EST

Test Method: CLOUDY
Pump Set (m):

Pipe ID: 10625913
Pump Test ID 991908714

PUMP TI

SWL (ft)	40	**Flowing:**	N
Final Level:	50 ft	**Pump Duration (hr):**	1
Pump Rate:	6 GPM	**Pump Duration (m):**	0
Recom. Rate:	3 GPM		

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930135218	30	inch	CONCRETE	n/a	50 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	PACKED	n/a	BLACK	0	1 ft
2	CLAY	STONES	PACKED	BROWN	1	20 ft
3	CLAY	STONES	CEMENTED	BLUE	20	40 ft
4	CLAY	SAND	WATER-BEARING	GREY	40	42 ft
5	CLAY	BOULDERS	CEMENTED	GREY	42	50 ft

End of Record

17

Easting:	684354.10
Northing:	4865323.00
Elev (masl):	119.97

Latitude: 43.917951
Longitude: -78.703764

Well ID: **1908871**

LOCATION

Lot:	014	**Tag:**	
Con:	02	**Audit No:**	19902
Municipality:	DURHAM	**Contractor License:**	3129
Township:	NEWCASTLE TOWN (DARLINGTON)	**Well Completion Date:**	12/15/1987
Street:		**Received Date:**	02/25/1988
City:	n/a		

WELL

Well Status:	Water Supply	**Well Depth (m):**	9.144
Prim. Use:	n/a	**Depth to Bedrock (m):**	n/a
Sec. Use:	n/a	**Depth to Water:**	ft
Boring Method:	Boring	**Water Kind:**	FRESH

PUMP TEST

Test Method:	CLEAR	**Pipe ID:**	10626069
Pump Set (m):	n/a	**Pump Test ID**	991908871
SWL (ft)	15	**Flowing:**	N
Final Level:	22 ft	**Pump Duration (hr):**	1
Pump Rate:	8 GPM	**Pump Duration (m):**	0
Recom. Rate:	4 GPM		

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930135373	30	inch	CONCRETE	n/a	30 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	n/a	n/a	n/a	0	1 ft
2	CLAY	n/a	n/a	BROWN	1	5 ft
3	SAND	n/a	n/a	n/a	5	15 ft
4	CLAY	n/a	n/a	BLUE	15	29 ft
5	SAND	WATER-BEARING	n/a	n/a	29	30 ft

End of Record

17

Easting:	684460.10
Northing:	4865020.00
Elev (masl):	116.48

Latitude: 43.915199
Longitude: -78.70255

Well ID: **1909089**

LOCATION

Lot:	014	**Tag:**	
Con:	02	**Audit No:**	30670
Municipality:	DURHAM	**Contractor License:**	3129
Township:	NEWCASTLE TOWN (DARLINGTON)	**Well Completion Date:**	06/01/1988
Street:		**Received Date:**	06/15/1988
City:	n/a		

WELL

Well Status:	Water Supply	**Well Depth (m):**	11.8872
Prim. Use:	n/a	**Depth to Bedrock (m):**	n/a
Sec. Use:	n/a	**Depth to Water:**	ft
Boring Method:	Boring	**Water Kind:**	FRESH

PUMP TEST

Test Method:
Pump Set (m): n/a
SWL (ft) 24
Final Level: 30 ft
Pump Rate: 8 GPM
Recom. Rate: 4 GPM

Pipe ID:
Pump Test ID 991909089
Flowing: N
Pump Duration (hr): 1
Pump Duration (m): 0

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930135590	30	inch	CONCRETE	n/a	39 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	n/a	n/a	n/a	0	1 ft
2	CLAY	n/a	n/a	BROWN	1	18 ft
3	STONES	HARD	n/a	BLUE	18	25 ft
4	SAND	WATER-BEARING	n/a	n/a	25	30 ft
5	HARDPAN	STONES	n/a	n/a	30	39 ft

End of Record

17

Easting:	684377.10
Northing:	4864990.00
Elev (masl):	117.48

Latitude: 43.91495
Longitude: -78.703593

Well ID: **1909297**

LOCATION

Lot: 014
Con: 02
Municipality: DURHAM
Township: NEWCASTLE TOWN (DARLINGTON)
Street:
City: n/a

Tag:
Audit No: 25263
Contractor License: 2214
Well Completion Date: 06/22/1988
Received Date: 09/02/1988

WELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Boring

Well Depth (m): 16.1544
Depth to Bedrock (m): n/a
Depth to Water: ft
Water Kind: FRESH

PUMP TEST

Test Method: CLOUDY
Pump Set (m): n/a
SWL (ft) 32
Final Level: n/a ft
Pump Rate: 8 GPM
Recom. Rate: 3 GPM

Pipe ID: 10626494
Pump Test ID 991909297
Flowing: N
Pump Duration (hr): 1
Pump Duration (m): 0

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930135797	30	inch	STEEL	n/a	53 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	n/a	n/a	BLACK	0	1 ft
2	CLAY	STONES	PACKED	GREY	1	20 ft
3	CLAY	STONES	CEMENTED	GREY	20	32 ft
4	SAND	WATER-BEARING	n/a	GREY	32	33 ft
5	CLAY	STONES	HARD	GREY	33	41 ft
6	STONES	WATER-BEARING	n/a	GREY	41	44 ft
7	CLAY	SAND	HARD	GREY	44	50 ft
8	SAND	WATER-BEARING	n/a	GREY	50	53 ft

End of Record

17

Easting:	684503.10
Northing:	4865000.00
Elev (masl):	115.36

Latitude: 43.915008
Longitude: -78.702022

Well ID: **1909479**

LOCATION

Lot: 014
Con: 02
Municipality: DURHAM
Township: NEWCASTLE TOWN (DARLINGTON)
Street:
City: n/a

Tag:
Audit No: 45594
Contractor License: 3129
Well Completion Date: 12/05/1988
Received Date: 12/15/1988

WELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Boring

Well Depth (m): 14.0208
Depth to Bedrock (m): n/a
Depth to Water: ft
Water Kind: FRESH

PUMP TEST

Test Method: CLEAR
Pump Set (m): n/a
SWL (ft) 25
Final Level: 32 ft
Pump Rate: 8 GPM
Recom. Rate: 4 GPM

Pipe ID: 10626676
Pump Test ID 991909479
Flowing: N
Pump Duration (hr): 1
Pump Duration (m): 0

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930135980	30	inch	CONCRETE	n/a	n/a ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	n/a	n/a	n/a	0	1 ft
2	CLAY	STONES	n/a	BLUE	1	25 ft
3	CLAY	SILTY	WATER-BEARING	BLUE	25	46 ft

End of Record

17

Easting:	684515.10
Northing:	4864971.00
Elev (masl):	115.59

Latitude: 43.914744
Longitude: -78.701883

Well ID: 1909480

LOCATION

Lot: 014
Con: 02
Municipality: DURHAM
Township: NEWCASTLE TOWN (DARLINGTON)
Street:
City: n/a

Tag:
Audit No: 50040
Contractor License: 2104
Well Completion Date: 11/28/1988
Received Date: 12/13/1988

WELL

Well Status: Abandoned-Supply
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Other Method

Well Depth (m): 54.864
Depth to Bedrock (m): 116
Depth to Water:
Water Kind:

PUMP TEST

Test Method:
Pump Set (m):
SWL (ft)
Final Level:
Pump Rate:
Recom. Rate:

Pipe ID:
Pump Test ID
Flowing:
Pump Duration (hr):
Pump Duration (m):

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930135981	6	inch	STEEL	n/a	116 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	MEDIUM-GRAINED	n/a	BROWN	0	5 ft
2	CLAY	GRAVEL	DENSE	BROWN	5	10 ft
3	CLAY	GRAVEL	DENSE	GREY	10	75 ft
4	CLAY	MEDIUM-GRAINED	n/a	GREY	75	82 ft
5	CLAY	GRAVEL	MEDIUM-GRAINED	GREY	82	116 ft
6	LIMESTONE	HARD	n/a	GREY	116	180 ft

End of Record

17

Easting:	684563.10
Northing:	4864928.00
Elev (masl):	115.88

Latitude: 43.914345
Longitude: -78.7013

Well ID: 1911120

LOCATION

Lot: 014
Con: 02
Municipality: DURHAM
Township: NEWCASTLE TOWN (DARLINGTON)
Street:
City: n/a

Tag:
Audit No: 71882
Contractor License: 3129
Well Completion Date: 07/19/1991
Received Date: 07/30/1991

WELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Boring

Well Depth (m): 13.4112
Depth to Bedrock (m): n/a
Depth to Water: ft
Water Kind: FRESH

PUMP TEST

Test Method: CLEAR
Pump Set (m): n/a
SWL (ft) 33
Final Level: 38 ft
Pump Rate: 4 GPM
Recom. Rate: 4 GPM

Pipe ID: 10628313
Pump Test ID 991911120
Flowing: N
Pump Duration (hr): 1
Pump Duration (m): 0

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930137669	30	inch	CONCRETE	n/a	44 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	n/a	n/a	n/a	0	1 ft
2	CLAY	n/a	n/a	BROWN	1	15 ft
3	CLAY	STONES	n/a	BLUE	15	34 ft
4	CLAY	SANDY	WATER-BEARING	BLUE	34	44 ft

End of Record

17

Easting:	684404.10
Northing:	4865102.00
Elev (masl):	118.67

Latitude: 43.91595
Longitude: -78.703219

Well ID: **1911569**

LOCATION

Lot: 014
Con: 02
Municipality: DURHAM
Township: NEWCASTLE TOWN (DARLINGTON)
Street:
City: n/a

Tag:
Audit No: 118378
Contractor License: 2104
Well Completion Date: 08/05/1992
Received Date: 09/09/1992

WELL

Well Status: Water Supply
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Cable Tool

Well Depth (m): 34.4424
Depth to Bedrock (m): 110
Depth to Water: ft
Water Kind: FRESH

PUMP TEST

Test Method: CLEAR
Pump Set (m): n/a
SWL (ft) 40
Final Level: 110 ft
Pump Rate: 3 GPM
Recom. Rate: 3 GPM

Pipe ID: 10628762
Pump Test ID 991911569
Flowing: N
Pump Duration (hr): 3
Pump Duration (m): 0

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	930138151	6	inch	STEEL	n/a	110 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	TOPSOIL	MEDIUM-GRAINED	n/a	BROWN	0	2 ft
2	CLAY	GRAVEL	MEDIUM-GRAINED	BROWN	2	21 ft
3	CLAY	GRAVEL	HARD	GREY	21	70 ft
4	CLAY	MEDIUM-GRAINED	n/a	GREY	70	110 ft
5	LIMESTONE	HARD	n/a	BLACK	110	113 ft

End of Record

17

Easting:	685090.00
Northing:	4865270.00
Elev (masl):	118.96

Latitude: 43.91729
Longitude: -78.694624

Well ID: **1917480**

LOCATION

Lot: n/a
Con: n/a
Municipality: DURHAM
Township: NEWCASTLE TOWN (DARLINGTON)
Street: 12 STORROCK RD
City: BOWMANVILLE

Tag: A019226
Audit No: Z24269
Contractor License: 6607
Well Completion Date: 02/22/2005
Received Date: 03/22/2005

WELL

Well Status: Observation Wells
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Boring

Well Depth (m): 3.6
Depth to Bedrock (m): n/a
Depth to Water: m
Water Kind:

PUMP TEST

Test Method:
Pump Set (m):
SWL (ft)
Final Level:
Pump Rate:
Recom. Rate:

Pipe ID:
Pump Test ID
Flowing:
Pump Duration (hr):
Pump Duration (m):

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth	
1	930856913	5.1	cm	PLASTIC	0	0.6	m

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth	
1	SILT	SANDY	SOFT	BROWN	0	3	m
2	SILT	CLAYEY	SOFT	GREY	3	3.6	m

End of Record

---

n/a

Easting:	<null>
Northing:	<null>
Elev (masl):	118.95

Latitude: 43.917012
Longitude: -78.694236

Well ID: **7295320**

LOCATION

Lot: 013
Con: 02
Municipality: DURHAM
Township: NEWCASTLE TOWN (DARLINGTON)
Street: 72.5 SCUGOG ST
City: BOWMANVILLE

Tag: A225096
Audit No: Z264803
Contractor License: 2662
Well Completion Date: 06/23/2017
Received Date: 09/29/2017

WELL

Well Status: Abandoned-Other
Prim. Use: n/a
Sec. Use: n/a
Boring Method: n/a

Well Depth (m): 0
Depth to Bedrock (m): n/a
Depth to Water: ft
Water Kind:

PUMP TEST

Test Method:
Pump Set (m):
SWL (ft)
Final Level:
Pump Rate:
Recom. Rate:

Pipe ID:
Pump Test ID
Flowing:
Pump Duration (hr):
Pump Duration (m):

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth	
0	1006897945	n/a	inch	<null>	n/a	n/a	ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth

End of Record

---

n/a

Easting:	<null>
Northing:	<null>
Elev (masl):	113.11

Latitude: 43.911895
Longitude: -78.69812

Well ID: **7295736**

LOCATION

Lot: n/a
Con: n/a
Municipality: DURHAM
Township: BOWMANVILLE TOWN
Street: 215 KING STREET WEST
City: BOWMANVILLE

Tag: A233853
Audit No: Z268139
Contractor License: 7241
Well Completion Date: 08/23/2017
Received Date: 09/29/2017

WELL

Well Status: Monitoring and Test Hole
Prim. Use: n/a
Sec. Use: Monitoring
Boring Method: Direct Push

Well Depth (m): 6.4008
Depth to Bedrock (m): n/a
Depth to Water: ft
Water Kind:

PUMP TEST

Test Method:
Pump Set (m):
SWL (ft)
Final Level:
Pump Rate:
Recom. Rate:

Pipe ID:
Pump Test ID
Flowing:
Pump Duration (hr):
Pump Duration (m):

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth	
1	1006883545	2	inch	PLASTIC	0	11	ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth	
1	TOPSOIL	n/a	n/a	BLACK	0	1	ft
2	CLAY	SILT	n/a	BROWN	1	15	ft
3	SILT	SAND	n/a	GREY	15	21	ft

End of Record

---

n/a

Easting:	<null>
Northing:	<null>
Elev (masl):	

Latitude: 43.915117
Longitude: -78.703389

Well ID: **7331749**

LOCATION

Lot: n/a
Con: n/a
Municipality: DURHAM
Township: NEWCASTLE TOWN (DARLINGTON)
Street: 1965 Martin Road
City: BOWMANVILLE

Tag: A260484
Audit No: Z307881
Contractor License: 7644
Well Completion Date: 03/11/2019
Received Date: 04/24/2019

WELL

Well Status: <null>
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Rotary (Convent.)

Well Depth (m): 7.62
Depth to Bedrock (m): n/a
Depth to Water: ft
Water Kind: Untested

PUMP TEST

Test Method: n/a
Pump Set (m): n/a
SWL (ft) n/a
Final Level: n/a ft
Pump Rate: n/a GPM
Recom. Rate: n/a GPM

Pipe ID: 1007817903
Pump Test ID 1007819697
Flowing: n/a
Pump Duration (hr): n/a
Pump Duration (m): n/a

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth	
1	1007819318	2	Inch	PLASTIC	0	15	ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth	
1	TOPSOIL	n/a	SOFT	BROWN	0	0.5	ft
2	FILL	CLAY	SILT	BROWN	0.5	10	ft
3	TILL	CLAY	GRAVEL	GREY	10	25	ft

End of Record

---

n/a

Easting:	<null>
Northing:	<null>
Elev (masl):	

Latitude: 43.911852
Longitude: -78.6973

Well ID: **7331751**

LOCATION

Lot: n/a
Con: n/a
Municipality: DURHAM
Township: NEWCASTLE TOWN (DARLINGTON)
Street: Old Highway 2
City: BOWMANVILLE

Tag: A260307
Audit No: Z301479
Contractor License: 7644
Well Completion Date: 02/26/2019
Received Date: 04/24/2019

ELL

Well Status: Monitoring and Test Hole
Prim. Use:

Well Depth (m): 10.668
Depth to Bedrock (m): n/a

WE

Sec. Use: n/a
Boring Method: Boring

Depth to Water: ft
Water Kind: Untested

PUMP TEST

Test Method: n/a
Pump Set (m): n/a
SWL (ft) n/a
Final Level: n/a ft
Pump Rate: n/a GPM
Recom. Rate: n/a GPM

Pipe ID: 1007817905
Pump Test ID 1007819699
Flowing: n/a
Pump Duration (hr): n/a
Pump Duration (m): n/a

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	1007819320	2	Inch	PLASTIC	0	25 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth
1	CLAY	SAND	SILT	BROWN	0	8 ft
2	CLAY	SILT	n/a	BROWN	8	20 ft
3	CLAY	SILT	n/a	GREY	20	35 ft

End of Record

---

n/a

Easting:	<null>
Northing:	<null>
Elev (masl):	

Latitude: 43.912356
Longitude: -78.70088

Well ID: **7331752**

LOCATION

Lot: n/a
Con: n/a
Municipality: DURHAM
Township: NEWCASTLE TOWN (DARLINGTON)
Street: Old Highway 2 Regional Road 57
City: BOWMANVILLE

Tag: A260483
Audit No: Z310710
Contractor License: 7644
Well Completion Date: 03/04/2019
Received Date: 04/24/2019

WELL

Well Status: Monitoring and Test Hole
Prim. Use: n/a
Sec. Use: n/a
Boring Method: Boring

Well Depth (m): 0
Depth to Bedrock (m): n/a
Depth to Water: ft
Water Kind:

PUMP TEST

Test Method: n/a
Pump Set (m): n/a
SWL (ft) n/a
Final Level: n/a ft
Pump Rate: n/a GPM
Recom. Rate: n/a GPM

Pipe ID: 1007817906
Pump Test ID 1007819700
Flowing: n/a
Pump Duration (hr): n/a
Pump Duration (m): n/a

CASING DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Case ID	Casing Diamter	Diamter Units	Material	Top Depth	Bottom Depth
1	1007819321	2	Inch	PLASTIC	0	30 ft

FORMATION DETAILS

Layer Value of "0" denotes a Null value and cannot be stratified and ordered.

Layer	Material	Material 2	Material 3	Colour	Top Depth	Bottom Depth

End of Record

Appendix D

Water Balance Calculations

Appendix D.1

Water Budget (Thornthwaite Method) - Average Values*

Weather Station: Bomanville Mostert (1981 - 2010)
Climate ID: 6150830 **Elevation:** 99.1 masl **Distance Away:** ~ 2.61 km

Month	Mean Temperature (^{o}C)	Heat Index	Potential ET (mm)	Daylight Correction Factor	Adjusted ET (mm)	Total Precipitation (mm)	Surplus (mm)	Deficit (mm)
January	-5.6	0	0	0.82	0	63.1	63.1	
February	-4.4	0	0	0.82	0	50.5	50.5	
March	-0.2	0	0	1.03	0	55.0	55.0	
April	6.4	1.45	29.5	1.12	33.1	70.6	37.5	
May	12.4	3.96	59.7	1.27	75.9	75.9	0.0	
June	17.5	6.66	86.3	1.28	110.4	83.8	0.0	26.6
July	20	8.16	99.5	1.3	129.3	63.2	0.0	66.1
August	19.2	7.67	95.2	1.2	114.3	78.1	0.0	36.2
September	15	5.28	73.2	1.04	76.1	98.7	22.6	
October	8.7	2.31	40.9	0.95	38.9	70.8	31.9	
November	3.4	0.56	15.0	0.81	12.2	88.6	76.4	
December	-2.2	0	0	0.78	0	68.1	68.1	
TOTAL	7.5	36.0	499.4		590.2	866.4	405.2	128.9
					TOTAL WATER SURPLUS:	276.2	mm	

Notes:

Bomanville Mostert weather station utilized: 43^{o} 55' N, 78^{o} 40' W. Data from 1981 - 2010.
*Average values of precipitation were used. Average values of temperature were also used.
Water budget adjusted for latitude and daylight
Total Water Surplus is calculated as total precipitation minus adjusted potential evapotranspiration
Total Moisture Surplus is calculated as total precipitation minus actual evapotranspiration

Appendix D.2
Water Budget Pre-Development

Site area = 8.6 hectares

Catchment Designation	PRE-DEVELOPMENT SITE	
	Undeveloped Lands	TOTAL
Area (m^2)	86252	86252
Pervious Area (m^2)	86252	86252
% Pervious	100.0%	100.0%
Impervious Area (m^2)	0	0
% Impervious	0.0%	0.0%
INFILTRATION FACTORS		
Topography Infiltration Factor	0.20	
Soil Infiltration Factor	0.10	
Land Cover Infiltration Factor	0.15	
MOE Infiltration Factor	0.45	
Actual Infiltration Factor	0.45	
Runoff Coefficient	0.55	
Runoff from Impervious Surfaces*	0	
INPUTS (PER UNIT AREA)		
Precipitation (mm/yr)	866	866
Run On (mm/yr)	0	0
Other Inputs (mm/yr)	0	0
Total Inputs (mm/yr)	866	866
OUTPUTS (PER UNIT AREA)		
Precipitation Surplus (mm/yr)	276	276
Net Surplus (mm/yr)	276	276
Evaportranspiration (mm/yr)	590	590
Infiltration (mm/yr)	124	124
Rooftop Infiltration (mm/yr)	0	0
Total Infiltration (mm/yr)	124	124
Runoff Pervious Areas	152	152
Runoff Impervious Areas	0	0
Total Runoff (mm/yr)	152	152
Total Outputs (mm/yr)	866	866
Difference (Inputs - Outputs)	0	0
INPUTS (VOLUMES)		
Precipitation (m^3/yr)	74728	74728
Run On (m^3/yr)	0	0
Other Inputs (m^3/yr)	0	0
Total Inputs (m^3/yr)	74728	74728
OUTPUTS (VOLUMES)		
Precipitation Surplus (m^3/yr)	23824	23824
Net Surplus (m^3/yr)	23824	23824
Evaportranspiration (m^3/yr)	50904	50904
Infiltration (m^3/yr)	10721	10721
Rooftop Infiltration (m^3/yr)	0	0
Total Infiltration (m^3/yr)	10721	10721
Runoff Pervious Areas (m^3/yr)	13103	13103
Runoff Impervious Areas (m^3/yr)	0	0
Total Runoff (m^3/yr)	13103	13103
Total Outputs (m^3/yr)	74728	74728
Difference (Inputs - Outputs)	0	0

Appendix D.3

Water Budget Post-Development - No Mitigation Strategies

Site area = 8.6 hectares

Catchment Designation	POST-DEVELOPMENT SITE			Total
	Building Rooftop	Asphalt Parking & Access	Landscaping / Grass	
Area (m^2)	9580	7650	69022	86252
Pervious Area (m^2)	0	0	69022	69022
% Pervious Area	0%	0%	80.0%	80.0%
Impervious Area (m^2)	9580	7650	0	17230
% Impervious Area	11.1%	8.9%	0%	20.0%
INFILTRATION FACTORS				
Topography Infiltration Factor	0	0	0.2	
Soil Infiltration Factor	0	0	0.10	
Land Cover Infiltration Factor	0	0	0.15	
MOE Infiltration Factor	0	0	0.45	
Actual Infiltration Factor	0	0	0.45	
Runoff Coefficient	1	1	0.55	
Runoff from Impervious Surfaces*	0.8	0.8	0	
INPUTS (PER UNIT AREA)				
Precipitation (mm/yr)	866	866	866	866
Run On (mm/yr)	0	0	0	0
Other Inputs (mm/yr)	0	0	0	0
Total Inputs (mm/yr)	866	866	866	29458
OUTPUTS (PER UNIT AREA)				
Precipitation Surplus (mm/yr)	693	693	276	360
Net Surplus (mm/yr)	693	693	276	360
Evaportranspiration (mm/yr)	173	173	590	507
Infiltration (mm/yr)	0	0	124	99
Rooftop Infiltration (mm/yr)	0	0	0	0
Total Infiltration (mm/yr)	0	0	124	99
Runoff Pervious Areas	0	0	152	122
Runoff Impervious Areas	693	693	0	138
Total Runoff (mm/yr)	693	693	152	260
Total Outputs (mm/yr)	866	866	866	866
Difference (Inputs - Outputs)	0	0	0	0
INPUTS (VOLUMES)				
Precipitation (m^3/yr)	8300	6628	59801	74729
Run On (m^3/yr)	0	0	0	0
Other Inputs (m^3/yr)	0	0	0	0
Total Inputs (m^3/yr)	8300	6628	59801	74729
OUTPUTS (VOLUMES)				
Precipitation Surplus (m^3/yr)	6640	5302	19065	31008
Net Surplus (m^3/yr)	6640	5302	19065	31008
Evaportranspiration (m^3/yr)	1660	1326	40735	43721
Infiltration (m^3/yr)	0	0	8579	8579
Rooftop Infiltration (m^3/yr)	0	0	0	0
Total Infiltration (m^3/yr)	0	0	8579	8579
Runoff Pervious Areas (m^3/yr)	0	0	10486	10486
Runoff Impervious Areas (m^3/yr)	6640	5302	0	11942
Total Runoff (m^3/yr)	6640	5302	10486	22428
Total Outputs (m^3/yr)	8300	6628	59801	74729
Difference (Inputs - Outputs)	0	0	0	0

Notes:

*Evaporation from impervious areas was assumed to be 20% of precipitation.

Asphalt has 0% infiltration capability

Building area based upon Chamberlain Architect Services Limited drawing "Key Plan - A001a", dated 2019-08-08.

Appendix D.4

Water Budget Post-Development - With Enhanced Infiltration Strategies

Site area = 8.6 hectares

Catchment Designation	POST-DEVELOPMENT SITE			Total
	Building Rooftop	Asphalt Parking & Access	Lawns / Landscaping	
Area (m^2)	9580	7650	69022	86252
Pervious Area (m^2)	0	0	69022	69022
% Pervious Area	0%	0%	80.0%	80.0%
Impervious Area (m^2)	9580	7650	0	17230
% Impervious Area	11.1%	8.9%	0%	20.0%
INFILTRATION FACTORS				
Topography Infiltration Factor	0	0	0.2	
Soil Infiltration Factor	0	0	0.10	
Land Cover Infiltration Factor	0	0	0.15	
MOE Infiltration Factor	0	0	0.45	
Actual Infiltration Factor	0	0	0.45	
Runoff Coefficient	1	1	0.55	
Runoff from Impervious Surfaces*	0.8	0.8	0	
INPUTS (PER UNIT AREA)				
Precipitation (mm/yr)	866	866	866	866
Run On (mm/yr)	0	0	0	0
Other Inputs (mm/yr)	0	0	0	0
Total Inputs (mm/yr)	866	866	866	29458
OUTPUTS (PER UNIT AREA)				
Precipitation Surplus (mm/yr)	693	693	276	360
Net Surplus (mm/yr)	693	693	276	360
Evaportranspiration (mm/yr)	173	173	590	507
Infiltration (mm/yr)	0	0	124	99
% of Rooftop Runoff Req'd to Infiltrate to Meet Pre-Dev	32%	--	--	--
Rooftop Infiltration (mm/yr)	224	0	0	25
Total Infiltration (mm/yr)	224	0	124	124
Runoff Pervious Areas	0	0	152	122
Runoff Impervious Areas	470	693	0	114
Total Runoff (mm/yr)	470	693	152	235
Total Outputs (mm/yr)	866	866	866	866
Difference (Inputs - Outputs)	0	0	0	0
INPUTS (VOLUMES)				
Precipitation (m^3/yr)	8300	6628	59801	74729
Run On (m^3/yr)	0	0	0	0
Other Inputs (m^3/yr)	0	0	0	0
Total Inputs (m^3/yr)	8300	6628	59801	74729
OUTPUTS (VOLUMES)				
Precipitation Surplus (m^3/yr)	6640	5302	19065	31008
Net Surplus (m^3/yr)	6640	5302	19065	31008
Evaportranspiration (m^3/yr)	1660	1326	40735	43721
Infiltration (m^3/yr)	0	0	8579	8579
Rooftop Infiltration (m^3/yr)	2142	0	0	2142
Total Infiltration (m^3/yr)	2142	0	8579	10721
Runoff Pervious Areas (m^3/yr)	0	0	10486	10486
Runoff Impervious Areas (m^3/yr)	4498	5302	0	9801
Total Runoff (m^3/yr)	4498	5302	10486	20287
Total Outputs (m^3/yr)	8300	6628	59801	74729
Difference (Inputs - Outputs)	0	0	0	0

Notes:

*Evaporation from impervious areas was assumed to be 20% of precipitation.

Asphalt has 0% infiltration capability

Building area based upon Chamberlain Architect Services Limited drawing "Key Plan - A001a", dated 2019-08-08.

Appendix D.5
Water Budget Summary

PARAMETER	SITE				
	Pre-Development	*Post-Development No Mitigation*	*Difference Pre- vs. Post-*	*Post-Development Rooftop Mitigation*	*Difference Pre- vs. Post-*
INPUTS (VOLUMES)					
Precipitation (m^3/yr)	74728	74729	0%	74729	0%
Run On (m^3/yr)	0	0	0%	0	0%
Other Inputs (m^3/yr)	0	0	0%	0	0%
Total Inputs (m^3/yr)	74728	74729	0%	74729	0%
OUTPUTS (VOLUMES)					
Precipitation Surplus (m^3/yr)	23824	31008	30%	31008	30%
Net Surplus (m^3/yr)	23824	31008	30%	31008	30%
Evapotranspiration (m^3/yr)	50904	43721	-14%	43721	-14%
Infiltration (m^3/yr)	10721	8579	-20%	8579	-20%
% of Rooftop Runoff Required to Infiltrate to Meet Pre-Dev	--	--	--	32%	--
Total Infiltration (m^3/yr)	10721	8579	-20%	10721	0%
Runoff Pervious Areas (m^3/yr)	13103	10486	-20%	10486	-20%
Runoff Impervious Areas (m^3/yr)	0	11942	--	9801	--
Total Runoff (m^3/yr)	13103	22428	71%	20287	55%
Total Outputs (m^3/yr)	74728	74729	0%	74729	0%