APPENDIX I

Hydrogeological Assessment Report

COUNTY OF DUFFERIN

DESKTOP HYDROGEOLOGICAL ASSESSMENT REPORT

SCHEDULE C MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT DUFFERIN COUNTY ROAD 109 / 2ND LINE REALIGNMENT

NOVEMBER 08, 2023

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COUNTY OF DUFFERIN

FNIAL

PROJECT NO.: 221-08590-00
DATE: NOVEMBER 08, 2023

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1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by the County of Dufferin to complete a Schedule C Municipal Class Environmental Assessment Study (EA) in support of the Dufferin County Road 109 and 2nd Line realignment project. The EA is being conducted to determine the potential impacts of the Dufferin County Road 109 and 2nd Line realignment at two locations in Dufferin County, Ontario. The purpose of this report is to complete a desktop hydrogeological assessment of the two locations shown on Figure 1. The first location (herein referred to as "Site 1") is located north of County Road 109 along the 2nd Line and extends south of County Road 109 between County Road 3 and County Road 23. Site 1 is currently a mixture of agricultural land and residential and industrial buildings with an area of approximately 26.3 hectares (65.1 acres). The second location (herein referred to as "Site 2") is located at the intersection of County Road 3 and County Road 11. Site 2 has an approximate area of 17.5 hectares (43.4 acres) and is currently used for agricultural purposes. To evaluate regional hydrogeological conditions, a 500-metre (m) buffer zone ("Study Area 1" and "Study Area 2") was added around each Site. The locations of each Site and Study Area are shown in Figures 2 and 3.

1.1 OBJECTIVES AND METHODOLOGY

The objective of the desktop hydrogeological assessment study is to provide relevant background information regarding the groundwater conditions in each Study Area as input into the EA. This information will assist with the preliminary design for the Dufferin County Road 109 and 2nd Line realignment and provide input to detailed design. Key aspects that will be addressed include the following:

- Review of the existing conditions within both Study Areas, including subsurface geological and hydrogeological conditions;
- Determine the potential for impacts based on hydrogeological conditions, including influence of variations in groundwater on sensitive surface water features and existing private water well users;
- Considerations for mitigation measures (if any) for impacts to groundwater and/or surface water receptors; and
- Recommendations on monitoring efforts and/or detailed studies in specific areas of potential concern to be implemented at later stages of the project.

To achieve the investigation objectives, WSP initiated the following scope of work:

- Desktop review of pertinent geological and hydrogeological resources and databases;
- Review of the Ministry of the Environment, Conservation and Parks Water Well Records (MECP WWRs); and
- Review of the Source Water Protection database to identify any significant groundwater recharge areas or sensitive features.

2 STUDY AREA CONDITIONS

2.1 PHYSIOGRAPHY AND DRAINAGE

2.1.1 STUDY AREA 1

Study Area 1 is located entirely within the Credit River watershed (CTC Source Protection Committee, 2019). The area is within the Dundalk Till Plain physiographic region, which is comprised of drumlinized till plains, moraines, and glacial spillways (Chapman and Putnam, 1972; Chapman and Putnam, 1984). The ground surface in this till plain is undulating (CTC Source Protection Committee, 2019).

There are two tributaries within the Study Area. The first is a tributary that bisects Study Area 1 along County Road 109. Based upon aerial photo review and a visual inspection, this tributary appears to be a historical headwater drainage feature. Currently, there is no channelized area surrounding this historical watercourse feature. A second tributary is present in the northeast portion of the Study Area north of County Road 109. An aerial photo review could not confirm the presence of the tributary. Mill Creek is also present approximately 100 m east and 50 m south of Study Area 1. A review of available resources indicates that Study Area 1 does not intersect a Provincially Significant Wetland (PSW). Wetland areas are present approximately 1.2 kilometres (km) southeast of Study Area 1.

2.1.2 STUDY AREA 2

Study Area 2 straddles the Grand River watershed and the Credit River watershed (Lake Erie Region Source Protection Committee, 2022c). Study Area 2 is also within the Dundalk Till Plain (Chapman and Putnam, 1972; Chapman and Putnam, 1984). This till plain is drumlinized and is comprised of clay, gravel, and boulders from retreating glaciers and exhibits low permeability (AquaResource Inc., 2009). The ground surface within the till plains is undulating and typically ranges from 425 metres above sea level (mASL) to 530 mASL (Lake Erie Region Source Protection Committee, 2022c).

The only surface water feature present within the Study Area boundary is a small pond in the southwestern portion of the Study Area. Tributaries to the Upper Grand River watershed are present approximately 200 m southwest of Study Area 2. Tributaries to the headwater streams of the Credit River watershed are present approximately 200 m to the east of the Study Area. A review of available resources indicates that Study Area 2 does not intersect a PSW. Wetland areas are present approximately 1.5 km west and 1.75 km southeast of Study Area 2.

2.2 SURFICIAL GEOLOGY

The occurrence and character of the overburden is a result of the repeated glacial advances and retreats that occurred in Southern Ontario. A discussion of surficial geology is provided in the following sections.

2.2.1 STUDY AREA 1

There are several surficial geologic units present within Study Area 1 (Ontario Geological Survey, 2010). The northern portion of Study Area 1 is comprised of (1) glaciofluvial deposits that are described as sandy, and (2) till with silt-texture derived from glaciolacustrine deposits or shale. The southern portion of Study Area 1 is comprised of (1) ice-contact stratified deposits of sand and gravel with minor silt, clay, and till and (2) till with silt-texture derived from glaciolacustrine deposits or shale. The till is likely consistent with Tavistock Till (Cowan, 1976) and

may reach a thickness of about 6 m across Study Area 1 (Oak Ridges Moraine Groundwater Program, Accessed October 2022).

2.2.2 STUDY AREA 2

Within Study Area 2, the surficial geology is a till with clay to silt-texture derived from glaciolacustrine deposits or shale (Ontario Geological Survey, 2010). The till is likely consistent with Tavistock Till (Cowan, 1976), which may reach a thickness of about 20 m across Study Area 2 (Oak Ridges Moraine Groundwater Program, Accessed October 2022).

2.3 SITE STRATIGRAPHY

Records from the MECP WWR database were reviewed to determine the number and location of water wells present within each Study Area (Ministry of Environment, Conservation and Parks, 2018). The identified MECP WWRs are provided in Appendix A, and additional details regarding the MECP WWRs are provided in Section 3.1.

The lithologic data associated with the identified MECP WWRs were utilized to create a lithological profile of each Study Area. WSP was not able to verify the lithologic descriptions for any of the logs, and the cross sections presented below were created solely from the MECP WWR data.

2.3.1 STUDY AREA 1

The geologic cross sections A-A' (west to east along County Road 109) and B-B' (northwest to southeast along County Road 23) for Study Area 1 are presented in Figures 4 and 5, respectively.

In cross section A-A', the general subsurface conditions consist of a sandy material extending to approximately 35 metres below ground surface (mbgs) in the west and clay material extending to approximately 19 mbgs in the east. Isolated layers of clay, gravel, silt, and hardpan exist throughout the Study Area. Beneath the sand and clay layers is a limestone bedrock. The sands are expected to behave as aquifers. According to the MECP WWRs, static water levels within the Study Area range from approximately 15-18 mbgs in the west to 5-12 mbgs in the east.

In cross section B-B', the general subsurface conditions consist of a sandy or clay material extending to approximately 60 mbgs in the west and approximately 19 mbgs in the east. Isolated layers of clay, gravel, silt, and hardpan exist throughout the Study Area. Beneath the sand and clay layers is a limestone or dolostone bedrock. The surficial sands are expected to behave as unconfined aquifers. According to the MECP WWRs, static water levels within the Study Area range from approximately 32-33 mbgs in the northwest to 12-24 mbgs in the southeast. The static water levels also indicate that two overburden wells are present within the southeast portion of the Study Area that are identified as Municipal water supply wells in the database. The static water levels for these two wells are reported as 1.2 mbgs and 4.2 mbgs. However, the lithologic data is not present in the WWRs for these two wells.

2.3.2 STUDY AREA 2

The geologic cross section C-C' (southwest to northeast along County Road 3) for Study Area 2 is presented in Figure 6. The general subsurface conditions consist of a clay material extending approximately 55-65 mbgs. Isolated layers of sand exist in the southwest portion of the Study Area between 4-19 mbgs and 27-39 mbgs. Beneath the clay layer is bedrock consisting of limestone or dolostone bedrock (noted in the well records as dolomite). Shale bedrock was encountered beneath the limestone and dolostone in the southwest portion of the Study Area at approximately 118 mbgs. The areas of clay are expected to behave as aquitards, whereas areas of sand are expected to behave as aquifers. Limestones and dolostones in the area are aquifers that have been targeted by private supply wells. According to the MECP WWRs, static water levels within the Study Area range from approximately 18 mbgs in the southwest to 34-36 mbgs in the northeast.

2.4 BEDROCK GEOLOGY

The bedrock geology in Study Area 1 and Study Area 2 is interpreted to be the sandstone, shale, dolostone and siltstone of the Amabel Formation (Ontario Geological Survey, 1991). Available mapping indicates that the depth to bedrock is between 25-55 mbgs in Study Area 1 and between 50-60 mbgs in Study Area 2 (Figures 7 and 8, respectively). Based on these observed depths, the bedrock is not hydrogeologically significant with respect to the Dufferin County Road 109 and 2nd Line realignment project at either Study Area.

3 HYDROGEOLOGICAL ASSESSMENT

3.1 MINISTRY OF THE ENVIRONMENT, CONSERVATION AND PARKS WATER WELL RECORD REVIEW

The MECP WWR database was reviewed to determine the number and location of water wells present within a 500-metre radius of each Site boundary. Details for the water wells present within each Study Area are provided below, and a summary of the MECP WWRs is provided in Appendix A.

3.1.1 STUDY AREA 1

The MECP WWR database indicated that there are forty-two well records at Study Area 1. All identified well records are shown on Figure 2. A review of the well records indicates that twenty-seven wells are considered water supply wells, four wells are reported as abandoned or not used, nine wells are classified as test and observation wells, and two wells are reported as unknown.

Only twenty-eight of the wells are bedrock wells screened in either the limestone or dolostone bedrock units. Static water levels for the bedrock wells range from approximately 5-36 mbgs, with an average of 19.5 mbgs. Five wells are considered overburden wells based on the reported lithology. A single overburden well has a reported static water level of 7.9 mbgs. Additional wells appear to be overburden wells; however, the lithology surrounding the well screens cannot be confirmed due missing lithology details within the WWRs.

3.1.2 STUDY AREA 2

The MECP WWR database indicated that there are seven well records at Study Area 2. All identified well records are shown on Figure 3. A review of the well records indicates that four wells are considered water supply wells, one well is reported as abandoned or not used, and two wells are reported as unknown.

According to the WWRs, all wells are bedrock wells screened in either the limestone or shale bedrock units. Static water levels within the Study Area range from approximately 18 mbgs in the southwest to 34-36 mbgs in the northeast.

3.2 EXISITING PERMIT TO TAKE WATER AND ENVIRONMENTAL ACTIVITY AND SECTOR REGISTRY SEARCH

The MECP maintains a database of all active Permit to Take Water (PTTW) and Environmental Activity and Sector Registry (EASR) items. A review of the MECP PTTW database was conducted, and environment records for any active construction dewatering EASRs were accessed and reviewed for each Study Area.

3.2.1 STUDY AREA 1

A review of the MECP PTTW database indicates that there are two active PTTWs found within 1 km of Study Area 1. Table 3.2.1 includes a summary of the active PTTW registrations. The first permit includes water takings for all of the Municipal water supply wells within Orangeville, whereas the second permit was issued for Municipal water supply well 5B only. There are no EASR records for construction dewatering found within 1 km of the Study Area.

Table 3.1.1 Study Area 1: Permit to Take Water and Environmental Activity and Sector Registration Summary

PERMIT #	TYPE	PURPOSE	CLIENT	SOURCE
7518-8XGL8T	PTTW	Water Supply	The Corporation of the Town of Orangeville	Municipal
5832-CG5QVZ	PTTW	Water Supply	The Corporation of the Town of Orangeville	Municipal

Source: MECP, Access Environment Web Portal, http://www.accessenvironment.ene.gov.on.ca, Date accessed: August 12, 2022

3.2.2 STUDY AREA 2

A review of the MECP PTTW database indicates that there are no active PTTWs found within 1 km of Study Area 2. There were no EASR records for construction dewatering identified within 1 km of the Study Area.

3.3 SOURCE WATER PROTECTION – IDENTIFICATION OF VULNERABLE AREAS

The Study Area boundaries for both Sites were evaluated to identify any potential drinking water vulnerabilities and threats, including the proximity to any vulnerable areas, including the following:

- Well head Protection Areas (WHPA);
- Intake Protection Zones (IPZ);
- Highly Vulnerable Aquifers (HVA);
- Significant Groundwater Recharge Areas (SGRA); and
- Wellhead Protection Area-Q (WHPA-Q, Water Quantity).

Details for each Study Area are provided below. A map with an overview of the identified vulnerability areas in both Study Areas is provided in Appendix B.

3.3.1 STUDY AREA 1

Study Area 1 lies within the Credit Valley Source Protection Area (SPA) and is under the jurisdiction of the CTC Source Protection Region encompassing Credit Valley, Toronto and Region, and Central Lake Ontario. The Approved Source Protection Plan of the CTC Source Protection Region is the reference document that outlines the relevant policies within the jurisdiction boundaries (CTC Source Protection Committee, 2022).

The MECP Source Protection Information Atlas indicates that Study Area 1 falls within vulnerable areas (Table 3.3.1).

Table 3.3.1 Study Area 1: Summary of Source Protection Vulnerability

SOURCE PROTECTION DETAILS FOR STUDY AREA 1			
Source Protection Area:	Credit Valley	Wellhead Protection Area WHPA):	B
Wellhead Protection Area (GUDI):	No	Intake Protection Zone (IPZ):	No
Issue Contributing Area:	Yes – Contaminant: Sodium and Chloride	Significant Groundwater Recharge Area (SGRA):	Yes
Highly Vulnerable Aquifer (HVA):	Yes	Event Based Area:	No
Wellhead Protection Area Q1 (WHPA-Q1):	Yes – Stress: Significant	Wellhead Protection Area Q2 (WHPA-Q2):	Yes – Stress: Significant
Intake Protection Zone Q (IPZ-Q):	No		

Source: MECP, Access Environment Web Portal, http://www.accessenvironment.ene.gov.on.ca, Date accessed: August 16, 2022

As indicated in Table 3.3.1 and available mapping, Study Area 1 is within the WHPA-B for Orangeville Supply Wells 2A, 5, 5A, 7, 9A and 9B with a score of 6, except near the intersection of County Roads 3 and 109, where the score is 8. Contaminants from land-based activities in this area would take less than 2 years to travel to the well within the area. The Study Area is also located within an issue contributing area where sodium and chloride from road salt are the unwanted substances of concern. Study Area 1 is also located in a SGRA, or an area where precipitation recharges the groundwater source or aquifer, and an HVA, an area with an underground water supply that can easily be contaminated because overlaying soil layers are thin or permeable. Lastly, Study Area 1 is also within a WHPA-Q1 and WHPA-Q2.

3.3.2 STUDY AREA 2

Study Area 2 lies within both the Grand River SPA and the Credit Valley SPA. The Grand River SPA is under the Lake Erie Source Protection Region, and the approved Grand River SPA Plan Volumes I and II are the reference documents that outline the relevant policies within the jurisdiction boundaries (Lake Erie Region Source Protection Committee, 2022a; Lake Erie Region Source Protection Committee, 2022b). The Credit Valley SPA is under the jurisdiction of the CTC Source Protection Region encompassing Credit Valley, Toronto and Region, and Central Lake Ontario. The Approved Source Protection Plan of the CTC Source Protection Region is the reference document that outlines the relevant policies within the jurisdiction boundaries (CTC Source Protection Committee, 2022).

The MECP Source Protection Information Atlas indicates that Study Area 2 falls within vulnerable areas (Table 3.3.2).

Table 3.3.2 Study Area 2: Summary of Source Protection Vulnerability

SOURCE PROTECTION DETAILS FOR STUDY AREA 2			
Source Protection Area:	Grand River and Credit Valley	Wellhead Protection Area (WHPA):	D
Wellhead Protection Area (GUDI):	No	Intake Protection Zone (IPZ):	No

SOURCE PROTECTION DETAILS FOR STUDY AREA 2			
Issue Contributing Area:	Yes – Contaminant: Sodium and Chloride	Significant Groundwater Recharge Area (SGRA):	Yes
Highly Vulnerable Aquifer (HVA):	No	Event Based Area:	No
Wellhead Protection Area Q1 (WHPA-Q1):	Yes – Stress: Significant	Wellhead Protection Area Q2 (WHPA-Q2):	Yes – Stress: Significant
Intake Protection Zone Q (IPZ-Q):	No		

Source: MECP, Access Environment Web Portal, http://www.accessenvironment.ene.gov.on.ca, Date accessed: August 16, 2022

As indicated in Table 3.3.2 and available mapping, the southwest end of Study Area 2 is within the WHPA-D for Orangeville Supply Wells 6 and 11 with a score of 2, while the northeast end is within the combined WHPA-D for Orangeville Supply Wells 2A, 5, 5A, 7, 9A and 9B with a score of 2. Within a WHPA-D, contaminants are expected to take up to 25 years to travel to a well. The Study Area is also located within an issue contributing area, which is defined as an area where land-based activities contribute to the presence of an unwanted substance in the water source. In the region of Study Area 2, sodium and chloride from road salt are the unwanted substances of concern. Study Area 2 is also located in a SGRA, or an area where precipitation recharges the groundwater source or aquifer. Lastly, Study Area 2 is within a WHPA-Q1 and WHPA-Q2. WHPA-Q1 is delineated as the combined area that is the cone of influence of a well and the whole of the cones of influence of all other wells that intersect that area. WHPA-Q2 is defined as the WHPA-Q1 area plus any area where a future reduction in recharge may have a measurable effect on the wells inside the WHPA-Q1.

3.4 WATER TABLE

The observed database (Oak Ridges Moraine Groundwater Program) utilizes a program that creates contour maps based on static water levels from all wells screened within the region. The program includes a disclaimer stating that the actual water table may deviate up to 2-3 m from the contoured water table any given time of the year due to the dynamic nature of the groundwater system. The database program was utilized to create a water table map and a depth to water table map of the generalized area surrounding Study Area 1 and Study Area 2. All generated maps are provided in Appendix C.

The water table map was created with Level 1 (WT1) data. This WT1 dataset includes the shallow well static water levels corrected to ground surface (Level 0 WT0 data) and the incorporation of stream data and intermediate depth wells screen less than 40 mbgs. Based on this dataset, the water table is approximately between 470-490 mASL in Study Area 1, and 485-490 mASL in Study Area 2. This equates to a depth of approximately 10-25 mbgs in Study Area 1, and approximately 20-25 mbgs in Study Area 2.

The observed database water levels are generally shallower compared to the MECP WWR static water levels. In Study Area 1, MECP WWR static water levels for the bedrock wells range from approximately 5-36 mbgs, with an average of 19.5 mbgs. The average static water level is within the observed database range of water levels. In Study Area 2, the MECP WWR static water levels ranged from 18 mbgs in the southwest to 34-36 mbgs in the northeast, which is deeper compared to the observed database.

3.5 LOCAL GROUNDWATER MONITORING WELLS

The observed database (Oak Ridges Moraine Groundwater Program) indicates that there are no active groundwater monitoring wells within either Study Area that have more than 30 water level measurements.

4 GROUNDWATER DISCUSSION

A desktop hydrogeological assessment of Study Area 1 and Study Area 2 was conducted to assist with evaluation of alternatives for the EA and the preliminary design for the Dufferin County Road 109 and 2nd Line realignment, and to provide input to detailed design. Excavation activities associated with the realignment project are anticipated to be shallow (i.e., less than 3 mbgs). If the final design for the project requires excavation depths greater than 3 mbgs, then groundwater dewatering will potentially need to be addressed. Additional potential impacts from the road realignment construction activities are discussed in the following sections.

4.1 IMPACTS TO GROUNDWATER USERS

As indicated in Section 3.1, the well record search indicates that there are water wells present within 500 m of both Study Areas. The potential impact from the road realignment construction activities is not expected to be significant based on the anticipated shallow depth of construction in relation to groundwater levels. However, WSP recommends a door-to-door water well survey be completed during detailed design. The purpose of the survey is (1) to confirm the existence of wells and water use at the properties identified in the well record search and (2) to obtain background information with respect to groundwater quality. A questionnaire shall be prepared and filled out with the well owners to obtain well details, including water levels (if possible), water quality issues, previous quantity issues, and additional well-related information. During this process, shallow wells shall be identified that may be impacted as part of the construction activities. A monitoring and mitigation plan shall be prepared.

4.2 IMPACTS TO MUNICIPAL WELLS

As indicated in Section 3.3, the source water protection search indicates that both Study Areas are within vulnerable areas. The vulnerable areas include WHPA (WHPA-B for Study Area 1, WHPA-D for Study Area 2), issue contributing areas (contaminants of concern include sodium and chloride), SGRA, WHPA-Q1, and WHPA-Q2. In addition, Study Area 1 is in an HVA. These factors will need to be taken into consideration when preparing the final design of the road realignment.

Vulnerable areas WHPA-B and WHPA-D indicate how long contaminants from land-based activities will take to travel to a well within the area. The final design of the realignment project will need to take into consideration impacts from working within the WHPA-B and WHPA-D areas. For example, during road construction activities, unintentional spills of fuel or hydraulic fluids from heavy machinery can occur. Spill kits should be present near the construction areas to limit the impact of potential spills.

The issue contributing contaminants in both Study Areas are sodium and chloride. The Grand River Source Protection Plan indicates that road salt, the storage of snow, and sewage systems are the threat policy categories that identify chloride and sodium as an issue (Lake Erie Region Source Protection Committee, 2022b). Sewage systems are also associated with nitrate and trichloroethene. As these contaminants are not reported as an ICA contaminant in the Study Areas, it is likely that the chloride and sodium are from road salt and the storage of snow. The CTC Source Protection Plan recognizes that the main source of sodium and chloride in snow is from road salt, and that the application of road salt is a drinking water threat anywhere in an ICA for sodium and chloride (CTC Source Protection Committee, 2022). Both Source Protection Plans require a risk management plan for the handling of and storage of salt on public roads. The risk management plan requires provisions for the reduction of salt usage and the use of certified contractors for salt applications (CTC Source Protection Committee, 2022; Lake Erie Region Source Protection Committee, 2022b).

As both Study Areas are in a SGRA, and Study Area 1 is in an HVA, the potential for sediment migration from the construction activities should be addressed. It is considered best practice to initiate a pro-active Erosion and Sediment Control (ESC) plan for any groundwater receptors in the Study Areas. ESC best practices should be applied during all phases of the project to prevent sediment-laden runoff from entering any known precipitation recharge area.

The potential impact from the road realignment construction activities is not expected to be significant based on the anticipated shallow depth of construction. Since dewatering is not anticipated due to the shallow construction depths, no mitigation is expected to be required as part of the WHPA-Q1 and WHPA-Q2. However, if the road alignment creates a greater impervious surface area compared to the previous road design, a slight decrease to the area available for groundwater recharge could result and mitigation action items would be necessary to compensate for the reduced recharge area. This will need to be discussed with the local conservation authorities.

4.3 IMPACTS TO NATURAL ENVIRONMENTAL FEATURES

A review of available maps indicated that there are no sensitive surface water features or wetland features within either Study Area boundary. There are two tributaries within Study Area 1, and a small pond in the southwestern portion of Study Area 2. These surface water features are not expected to be affected from the road realignment construction activities.

5 SUMMARY

5.1 CONCLUSIONS

The following conclusions are based on the desktop hydrogeological assessment completed for both Study Areas.

- The surficial geology within both Study Areas consists of till with clay, sand, gravel, and silt layers. The areas of clay are expected to behave as aquitards, whereas areas of sand are expected to behave as aquifers. The sandy areas could present zones of increased recharge and/or permeability.
- Bedrock is not hydrogeologically significant with respect to the Dufferin County Road 109 and 2nd Line realignment project at either Study Area.
- Both study areas are within wellhead protection areas for the Orangeville Municipal Wells.
- There are no sensitive surface water features or wetland features within either Study Area boundary.
- Both Study Areas are located within an issue contributing area where sodium and chloride from road salt are the unwanted substances of concern.
- Both Study Areas are also located in a SGRA, or an area where precipitation recharges the groundwater source or aquifer.
- Study Area 1 is located within an HVA, or an area with an underground water supply that can easily be contaminated because overlaying soil layers are thin or permeable.
- Groundwater levels are expected to be approximately 10-25 mbgs surface in Study Area 1 and approximately 20-25 mbgs in Study Area 2.

5.2 RECOMMENDATIONS

The following recommendations are based on the desktop hydrogeological assessment completed for both Study Areas.

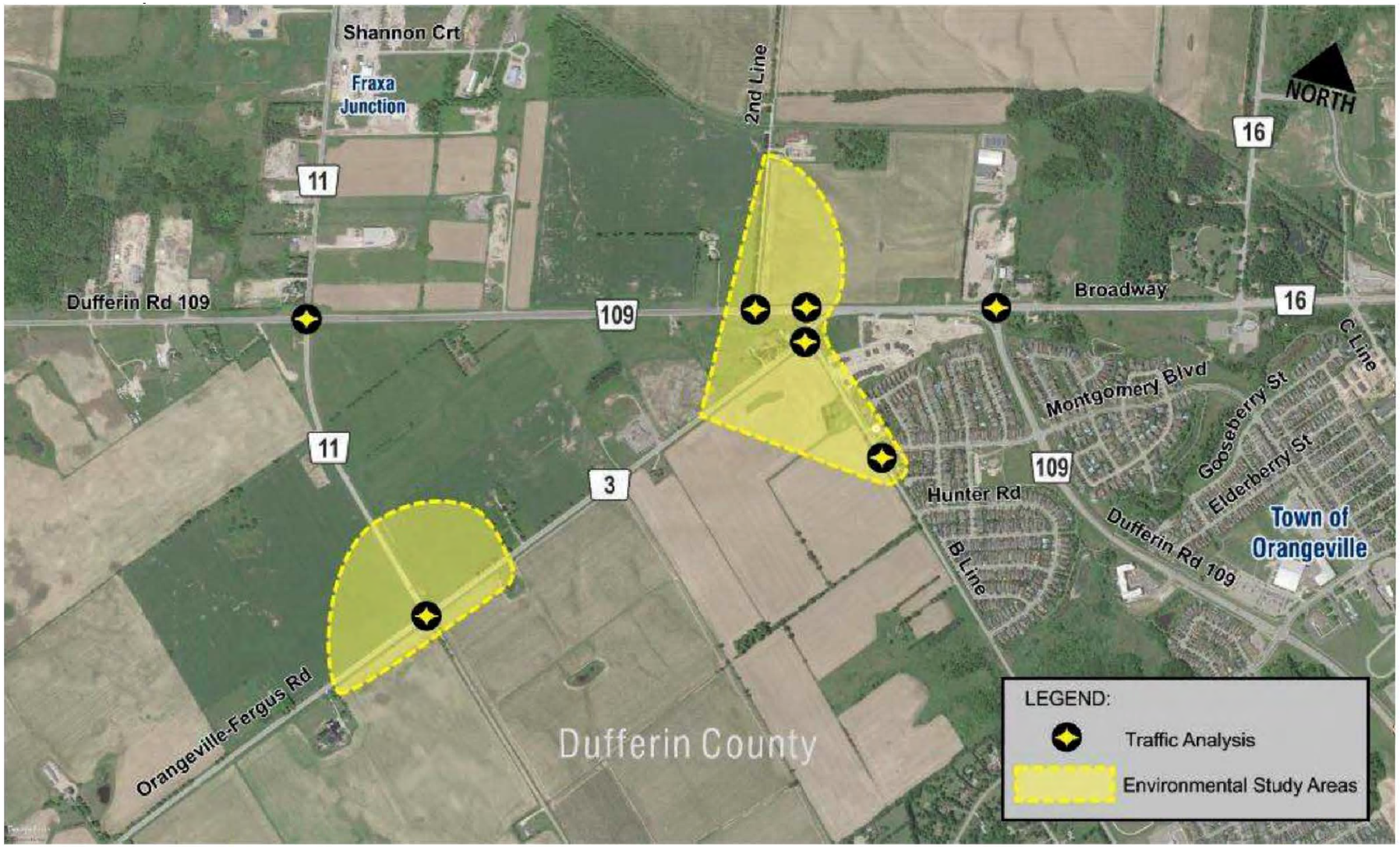
- A ground inspection of the tributaries noted in Study Area 1 shall be completed. The tributary bisecting Study Area 1 was determined to be a historical headwater drainage feature based on visual inspection. The second tributary, located northeast of County Road 109, should be located to confirm the status of the tributary. Results of the tributary ground inspection may impact the final design of the realignment project. The tributary should be evaluated to assess the potential for groundwater input.
- Precise groundwater elevations could not be determined for either Study Area based on the reviewed data. WSP recommends that a robust hydrogeological program be implemented during detailed design to assess groundwater elevations and potential dewatering. This would include installation of monitoring wells in cooperation with the geotechnical and environmental field programs. A groundwater monitoring program is recommended to be implemented during detailed design, along with single well hydraulic testing and groundwater quality sampling to be tested against Provincial Water Quality Objectives (PWQO). Sodium and chloride shall be included in all water quality samples taken as part of the field program due to the proximity of the Orangeville water supply wells.
- A door-to-door private water well survey shall be completed for all potential water well owners within 500 m of the two Study Areas as part of detailed design. A questionnaire shall be prepared and filled out with the well owners to obtain well details, including water levels, water quality issues, previous quantity issues, etc. Shallow wells shall be identified that may be impacted as part of the work.
- WSP recommends implementing an ESC plan for any groundwater receptors in the Study Areas. Both Study Areas are located in a SGRA, and Study Area 1 is located within HVA. ESC best practices should be applied during the construction, clean-up, and restoration to prevent sediment-laden runoff from entering any known precipitation recharge area.

BIBLIOGRAPHY

- AquaResource Inc. (2009). Integrated Water Budget Report, Grand River Watershed: Final Report. June.
- Chapman and Putnam. (1984). The Physiography of Southern Ontario. Ontario Geological Survey Special Volume 2, Ontario Ministry of Natural Resources.
- Chapman, L.J. and Putnam, D.F. (1972). Physiography of the South Central Portion of Southern Ontario; Ontario Department of Mines and Northern Affairs, Map 2226, scale 1:253 440.
- Cowan, W.R. (1976). Quaternary Geology of the Orangeville Area, Southern Ontario. Ontario Geological Survey Geoscience Report 141.
- CTC Source Protection Committee. (2019). Approved Assessment Report: Credit Valley Source Protection Area. Version 4. December.
- CTC Source Protection Committee. (2022). Approved Source Protection Plan: CTC Source Protection Region. Version 5.
- Lake Erie Region Source Protection Committee. (2022a). Grand River Source Protection Area Approved Source Protection Plan Volume I. February 9.
- Lake Erie Region Source Protection Committee. (2022b). Grand River Source Protection Area Approved Source Protection Plan Volume II. February 9.
- Lake Erie Region Source Protection Committee. (2022c). Grand River Source Protection Area Approved Assessment Report. February.
- Ministry of Environment, Conservation and Parks. (2018). Well records. Retrieved from Ontario.ca: https://www.ontario.ca/page/well-records. October 1.
- Ontario Geological Survey. (1991). Bedrock Geology of Ontario: Southern Sheet. Ministry of Northern Development and Mines Map 2544, Scale 1: 1,000,000.
- Ontario Geological Survey. (2010). Surficial geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128-REV ISBN 978-1-4435-2483-4 [DVD] ISBN 978-1-4435-2482-7 [zip file].

FIGURES

Prepared By: Tanya.Peterson



TITLE: SITE LOCATIONS

PROJECT: HYDROGEOLOGICAL INVESTIGATION
DUFFERIN COUNTY ROAD 109 EA

CLIENT: COUNTY OF DUFFERIN

	PROJECT NO.:	REVIEWED BY:
WSP GOLDER	221-08590-00	ML
	DATE: OCTOBER 2022	FIGURE: 1

C:\aProjects\221-08590-00\MXD\221-08590-00 Figure 1 Site Location.mxd

Prepared By: Tanya.Peterson

LEGEND:

- STUDY AREA 1
- 500 m STUDY AREA BUFFER
- MECP WATER WELL

TITLE:
MECP WATER WELL LOCATIONS:
STUDY AREA 1

PROJECT:
HYDROGEOLOGICAL INVESTIGATION
DUFFERIN COUNTY ROAD 109 EA
STUDY AREA 1

CLIENT:
COUNTY OF DUFFERIN

GOLDER

PROJECT NO.:	REVIEWED BY:
221-08590-00	ML
DATE: JANUARY 2023	FIGURE: 2

C:\aProjects\221-08590-00\MXD\221-08590-00 Figure 3 MECP Wells Study Area 2.mxd

Prepared By: Tanya.Peterson

LEGEND:

- STUDY AREA 2
- 500 m STUDY AREA BUFFER
- MECP WATER WELL

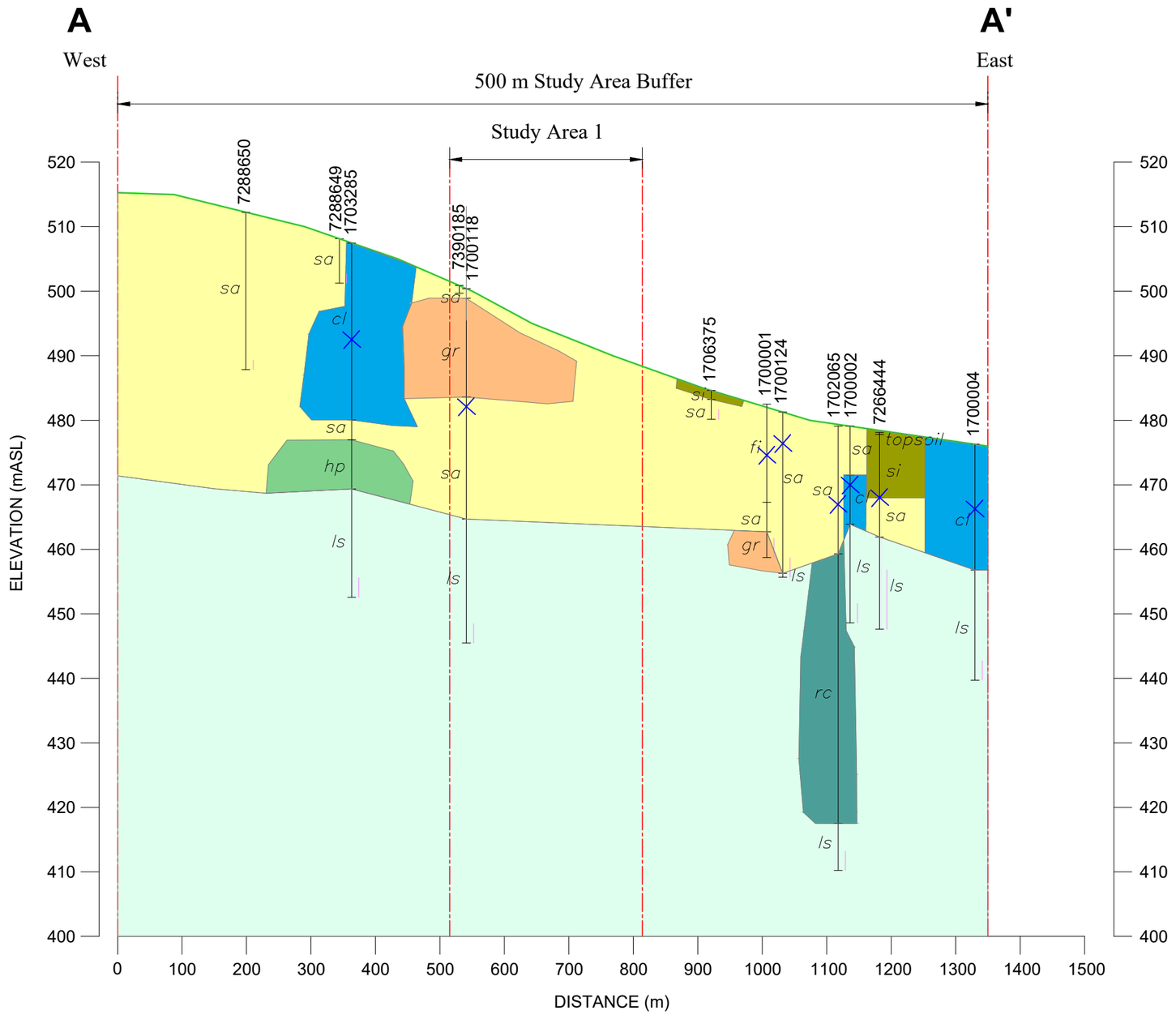
TITLE:
MECP WATER WELL LOCATIONS:
STUDY AREA 2

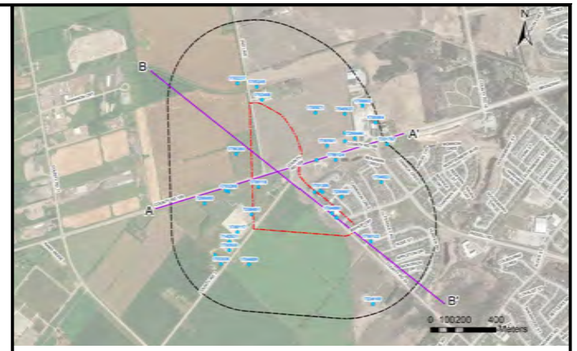
PROJECT:
HYDROGEOLOGICAL INVESTIGATION
DUFFERIN COUNTY ROAD 109 EA
STUDY AREA 2

CLIENT:
COUNTY OF DUFFERIN

GOLDER	PROJECT NO.: 221-08590-00	REVIEWED BY: ML
	DATE: JANUARY 2023	FIGURE: 3

C:\aProjects\221-08590-00\MXD\221-08590-00 Figure 2 MECP Wells Study Area 1.mxd





Key Plan
N.T.S.

LEGEND

1700118 — WELL ID

GROUND SURFACE

WATER LEVEL / WELL SCREEN

CHANGE IN STRATIGRAPHY

END OF BORING (mBGL)

CLAY

SAND

SILT

GRAVEL

HARDPAN

ROCK

LIMESTONE

SOIL DESCRIPTION:

fi - FILL
topsoil - TOPSOIL
cl - CLAY
sa - SAND
si - SILT
gr - GRAVEL
rc - ROCK
hp - HARDPAN
ls - LIMESTONE

0 12.5 25
1:750 METRES
VERTICAL SCALE

0 125 250
1:7,500 METRES
HORIZONTAL SCALE

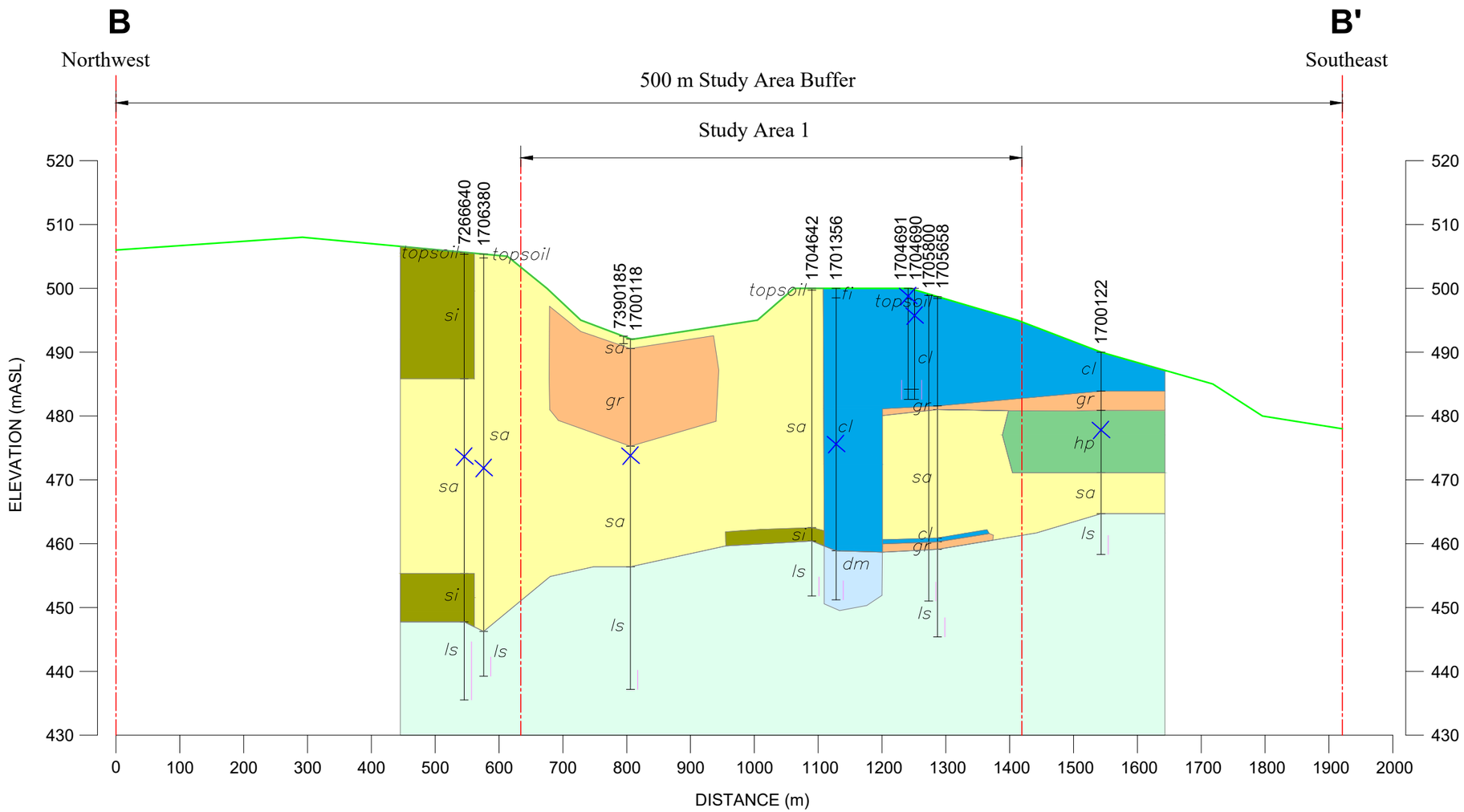
NOTE:
THE ACTUAL SOIL STRATIFICATION HAS BEEN VERIFIED FROM DATA OBTAINED AT THE WELL LOCATIONS ONLY. THE INFERRED CONTACTS SHOWN ARE BASED ON GEOLOGICAL EVIDENCE AND THESE MAY VARY FROM THOSE SHOWN BETWEEN BORINGS. WELL DATA IS PROJECTED ONTO THE SECTION WHICH ALSO MAY CREATE SOME IRREGULARITIES IN CONTACT DEPTHS.

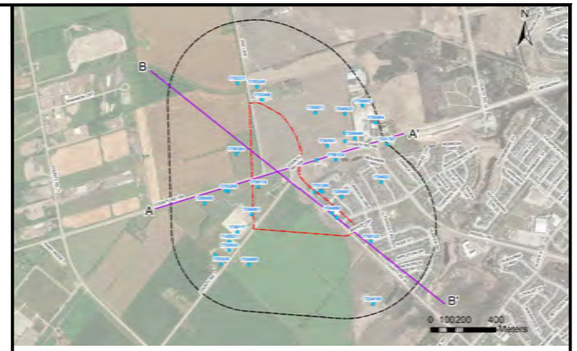
TITLE:
CROSS SECTION A-A'

PROJECT:
HYDROGEOLOGICAL INVESTIGATION
DUFFERIN COUNTY ROAD 109 EA
STUDY AREA 1

CLIENT:
COUNTY OF DUFFERIN

PROJECT NO.:	REVIEWED BY:
221-08590-00	ML
DATE: JANUARY 2023	FIGURE: 4





Key Plan
N.T.S.

LEGEND

1700118 — WELL ID

GROUND SURFACE

WATER LEVEL / WELL SCREEN

CHANGE IN STRATIGRAPHY

END OF BORING (mBGL)

- CLAY
- SAND
- SILT
- GRAVEL
- HARDPAN
- DOLOMITE
- LIMESTONE

SOIL DESCRIPTION:

fi - FILL	hp - HARDPAN
topsoil - TOPSOIL	dm - DOLOMITE
cl - CLAY	ls - LIMESTONE
sa - SAND	
si - SILT	
gr - GRAVEL	

TITLE:
CROSS SECTION B-B'

PROJECT:
HYDROGEOLOGICAL INVESTIGATION
DUFFERIN COUNTY ROAD 109 EA
STUDY AREA 1

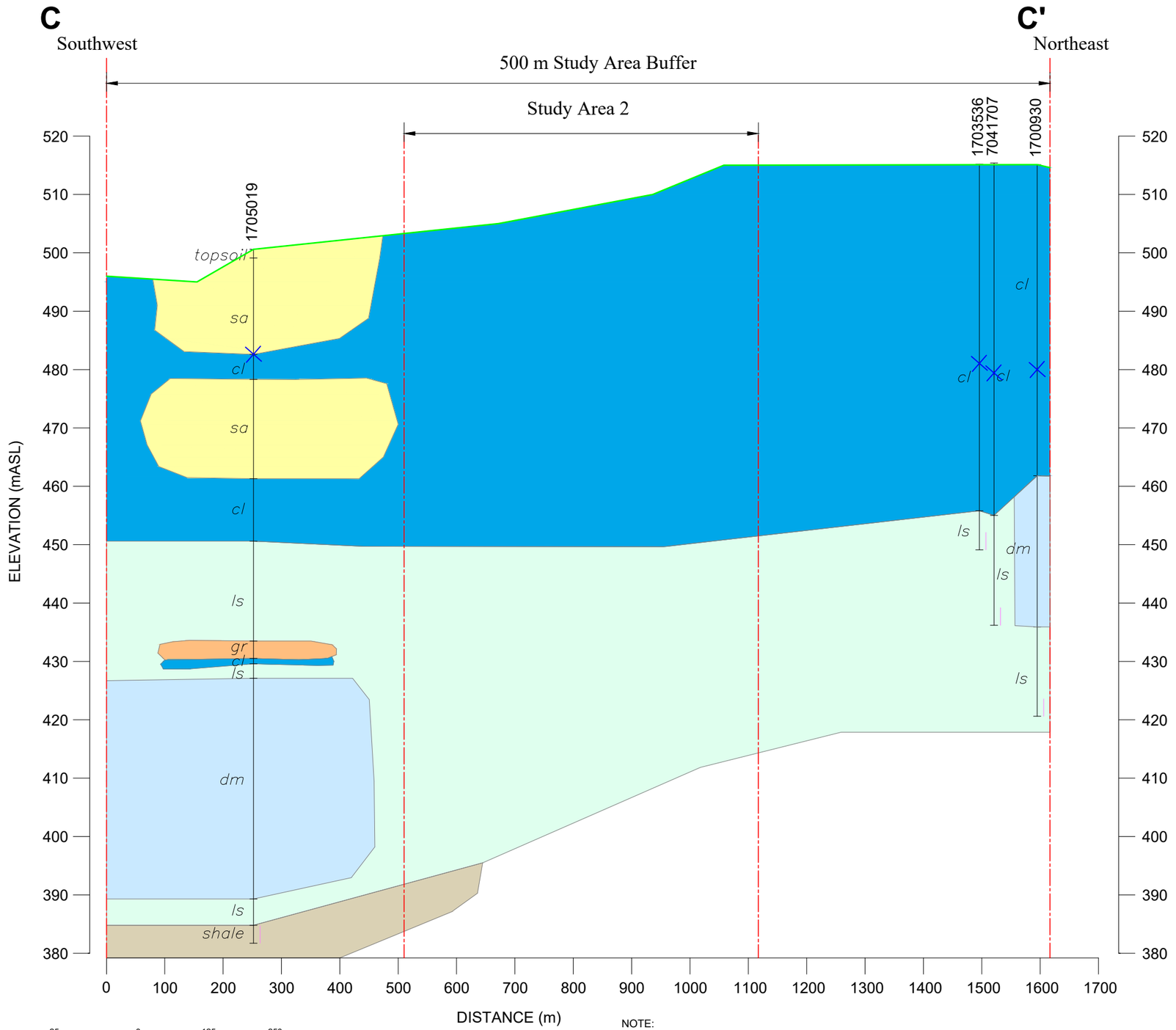
CLIENT:
COUNTY OF DUFFERIN

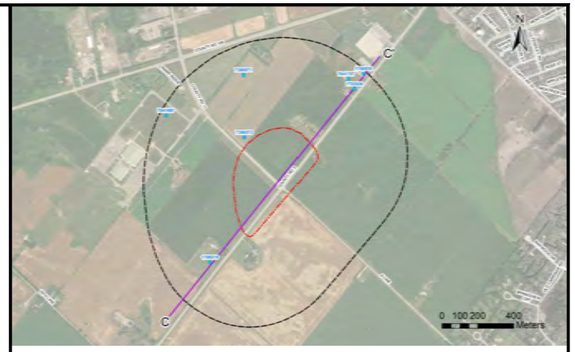
PROJECT NO.:	REVIEWED BY:
221-08590-00	ML
DATE: JANUARY 2023	FIGURE: 5

0 12.5 25
1:750 METRES
VERTICAL SCALE

0 125 250
1:7,500 METRES
HORIZONTAL SCALE

NOTE:
THE ACTUAL SOIL STRATIFICATION HAS BEEN VERIFIED FROM DATA OBTAINED AT THE WELL LOCATIONS ONLY. THE INFERRED CONTACTS SHOWN ARE BASED ON GEOLOGICAL EVIDENCE AND THESE MAY VARY FROM THOSE SHOWN BETWEEN BORINGS. WELL DATA IS PROJECTED ONTO THE SECTION WHICH ALSO MAY CREATE SOME IRREGULARITIES IN CONTACT DEPTHS.





Key Plan

N.T.S.

LEGEND

1705019 — WELL ID

GROUND SURFACE

WATER LEVEL / WELL SCREEN

CHANGE IN STRATIGRAPHY

END OF BORING (mBGL)

- CLAY
- SAND
- GRAVEL
- DOLOMITE
- LIMESTONE
- SHALE

SOIL DESCRIPTION:

topsoil - TOPSOIL	dm - DOLOMITE
cl - CLAY	ls - LIMESTONE
sa - SAND	shale - SHALE
gr - GRAVEL	

0 12.5 25
1:750 METRES
VERTICAL SCALE

0 125 250
1:7,500 METRES
HORIZONTAL SCALE

NOTE:
THE ACTUAL SOIL STRATIFICATION HAS BEEN VERIFIED FROM DATA OBTAINED AT THE WELL LOCATIONS ONLY. THE INFERRED CONTACTS SHOWN ARE BASED ON GEOLOGICAL EVIDENCE AND THESE MAY VARY FROM THOSE SHOWN BETWEEN BORINGS. WELL DATA IS PROJECTED ONTO THE SECTION WHICH ALSO MAY CREATE SOME IRREGULARITIES IN CONTACT DEPTHS.

TITLE:
CROSS SECTION C-C'

PROJECT:
HYDROGEOLOGICAL INVESTIGATION
DUFFERIN COUNTY ROAD 109 EA
STUDY AREA 2

CLIENT:
COUNTY OF DUFFERIN

PROJECT NO.:	REVIEWED BY:
221-08590-00	ML
DATE: JANUARY 2023	FIGURE: 6

LEGEND:

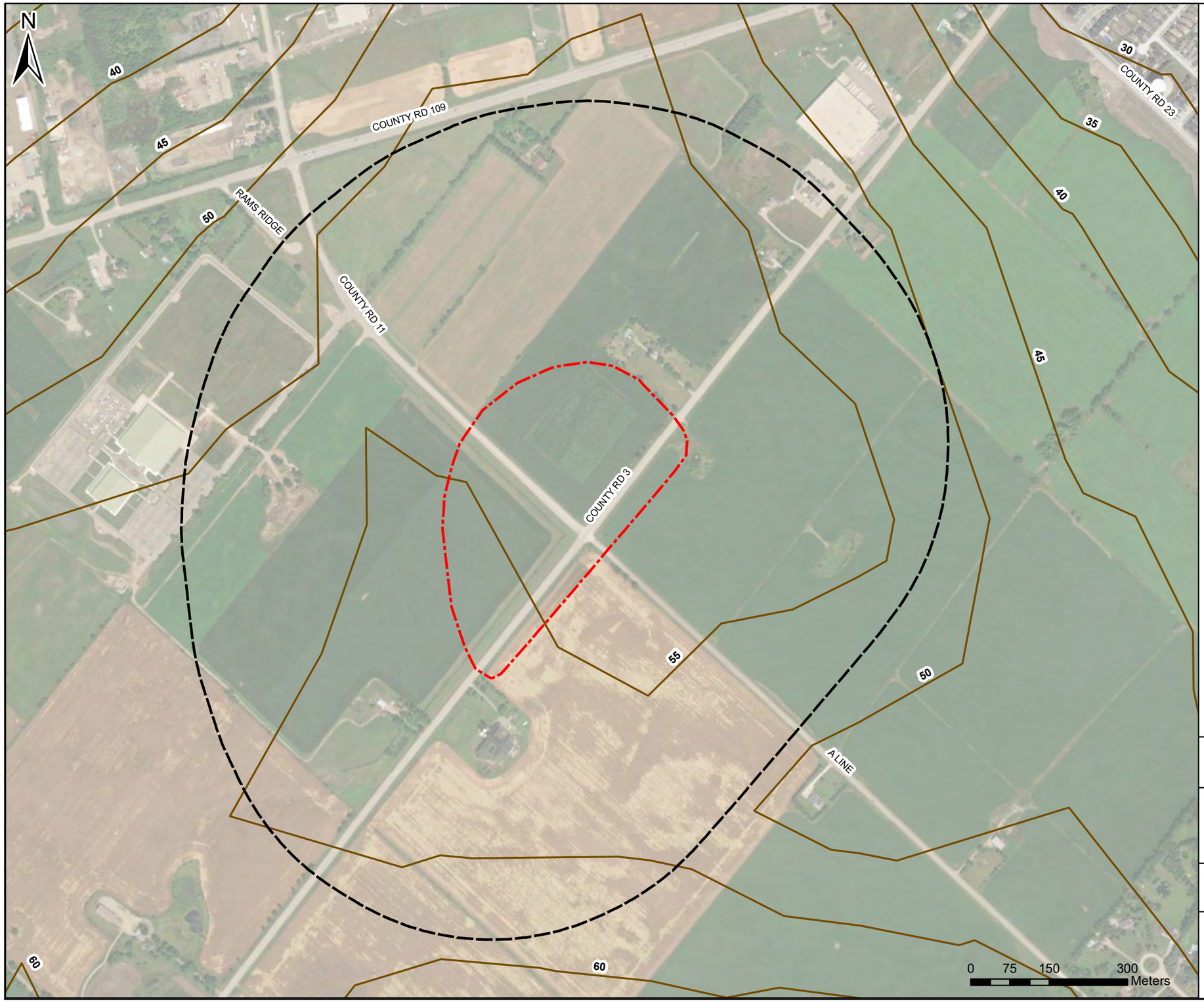
- 500 m STUDY AREA BUFFER
- STUDY AREA 1
- BEDROCK CONTOURS (5m)

TITLE:
BEDROCK CONTOURS: STUDY AREA 1

PROJECT:
HYDROGEOLOGICAL INVESTIGATION
DUFFERIN COUNTY ROAD 109 EA
STUDY AREA 1

CLIENT:
COUNTY OF DUFFERIN

PROJECT NO.:	REVIEWED BY:
221-08590-00	ML
DATE: JANUARY 2023	FIGURE: 7



LEGEND:

- STUDY AREA 2
- 500 m STUDY AREA BUFFER
- BEDROCK CONTOURS (5m)

TITLE:
BEDROCK CONTOURS: STUDY AREA 2

PROJECT:
HYDROGEOLOGICAL INVESTIGATION
DUFFERIN COUNTY ROAD 109 EA
STUDY AREA 2

CLIENT:
COUNTY OF DUFFERIN

PROJECT NO.:	REVIEWED BY:
221-08590-00	ML
DATE: JANUARY 2023	FIGURE: 8

APPENDIX

A

MINISTRY OF THE ENVIRONMENT, CONSERVATION AND PARKS WATER WELL RECORD REVIEW LOGS: STUDY AREA 1 AND STUDY AREA 2

MECP Water Well Records

Well Record #

1700001 — Lot 001 Conc 01 — AMARANTH TOWNSHIP / DUFFERIN

Date 5/30/1949 (DD/MM/YYYY)

Elev (masl) | Easting 568855 | Northing 4862245

Domestic / Livestock | Water Supply | UTM RC 9 unknown UTM

Water Found 15.2 (mbgs) (masl) FRESH

Casing Diameter inch | Casing Material:

Top of Screen (mbgs) | Bottom of Screen (mbgs)

Screen Interval (m)

Flowing? N

SWL	7.9	(mbgs)	(masl)
Pumping WL	9.1	(mbgs)	(masl)
Pump Rate	136.4	(LPM)	8 / 0
Spec. Cap.	111.86	(LPM/m)	Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0			
10.7			PREVIOUSLY DUG /
15.2			FILL /
19.8			MEDIUM SAND /
23.8			GRAVEL /

1700002 — Lot 001 Conc 01 — AMARANTH TOWNSHIP / DUFFERIN

Date 10/22/1959 (DD/MM/YYYY)

Elev (masl) | Easting 568964 | Northing 4862323

/ Domestic | Water Supply | UTM RC 5 margin of error : 100 m - 300 m

Water Found 25.9 (mbgs) (masl) FRESH

Casing Diameter 4 inch | Casing Material: STEEL

Top of Screen (mbgs) | Bottom of Screen (mbgs)

Screen Interval (m)

Flowing? N

SWL	9.1	(mbgs)	(masl)
Pumping WL	12.2	(mbgs)	(masl)
Pump Rate	68.2	(LPM)	2 / 30
Spec. Cap.	22.37	(LPM/m)	Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0			
7.6			FINE SAND / CLAY /
15.2		RED	CLAY / MEDIUM SAND /
30.5			LIMESTONE /

1700003 — Lot 001 Conc 01 — AMARANTH TOWNSHIP / DUFFERIN

Date 6/10/1964 (DD/MM/YYYY)

Elev (masl) | Easting 569072 | Northing 4862485

/ Industrial | Water Supply | UTM RC 5 margin of error : 100 m - 300 m

Water Found 27.4 (mbgs) (masl) FRESH

Casing Diameter 6 inch | Casing Material: STEEL

Top of Screen (mbgs) | Bottom of Screen (mbgs)

Screen Interval (m)

Flowing? N

SWL	6.1	(mbgs)	(masl)
Pumping WL	10.7	(mbgs)	(masl)
Pump Rate	272.8	(LPM)	4 / 0
Spec. Cap.	59.66	(LPM/m)	Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0			
8.5			CLAY / MEDIUM SAND /
15.8			GRAVEL / MEDIUM SAND /
27.4		BROWN	LIMESTONE /
45.7		GREY	LIMESTONE /
79.2		BLUE	LIMESTONE /
80.8		WHITE	LIMESTONE /
82.3		GREY	LIMESTONE /
83.8			SHALE /

1700004 — Lot 001 Conc 01 — AMARANTH TOWNSHIP / DUFFERIN

Date 11/17/1967 (DD/MM/YYYY)

Elev (masl) | Easting 569149 | Northing 4862386

/ Domestic | Water Supply | UTM RC 5 margin of error : 100 m - 300 m

Water Found 21.3 (mbgs) (masl) FRESH

Casing Diameter 4 inch | Casing Material: STEEL

Top of Screen (mbgs) | Bottom of Screen (mbgs)

Screen Interval (m)

Flowing? N

SWL	10.1	(mbgs)	(masl)
Pumping WL	16.8	(mbgs)	(masl)
Pump Rate	22.7	(LPM)	1 / 0
Spec. Cap.	3.39	(LPM/m)	Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0			
19.5			CLAY / MEDIUM SAND /
36.6		BROWN	LIMESTONE /

Well Record #

1700117 — Lot 006 Conc B — EAST GARAFRAXA TOWNSHIP / DUFFERIN

Date 7/16/1963 (DD/MM/YYYY)
Elev (masl) Easting 568314 Northing 4861723
Domestic / Livestock Water Supply UTM RC 5 margin of error : 100 m - 300 m
Water Found 55.5 (mbgs) (masl) FRESH
Casing Diameter 6 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing? N
SWL 9.1 (mbgs) (masl)
Pumping WL 9.1 (mbgs) (masl)
Pump Rate 45.5 (LPM) 2 / 0
Spec. Cap. 9,999.99 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions		
0.0					
13.7			PREVIOUSLY DUG /		/
34.1			SAND /	CLAY	/
43.9			HARDPAN /	BOULDERS	/
56.1		BROWN	LIMESTONE /		/

1700118 — Lot 006 Conc B — EAST GARAFRAXA TOWNSHIP / DUFFERIN

Date 4/16/1966 (DD/MM/YYYY)
Elev (masl) Easting 568442 Northing 4861995
/ Domestic Water Supply UTM RC 5 margin of error : 100 m - 300 m
Water Found 54.3 (mbgs) (masl) FRESH
Casing Diameter 4 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing? N
SWL 18.3 (mbgs) (masl)
Pumping WL 21.9 (mbgs) (masl)
Pump Rate 22.7 (LPM) 3 / 0
Spec. Cap. 6.21 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions		
0.0					
1.5			MEDIUM SAND /		/
16.8			GRAVEL /		/
35.7			MEDIUM SAND /		/
54.9		GREY	LIMESTONE /		/

1700122 — Lot 004 Conc C — EAST GARAFRAXA TOWNSHIP / DUFFERIN

Date 11/23/1961 (DD/MM/YYYY)
Elev (masl) Easting 569122 Northing 4861666
Domestic / Livestock Water Supply UTM RC 5 margin of error : 100 m - 300 m
Water Found 30.5 (mbgs) (masl) FRESH
Casing Diameter 4 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing? N
SWL 12.2 (mbgs) (masl)
Pumping WL 21.3 (mbgs) (masl)
Pump Rate 36.4 (LPM) 2 / 0
Spec. Cap. 3.98 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions		
0.0					
6.1			CLAY /	BOULDERS	/
9.1			GRAVEL /		/
18.9			HARDPAN /		/
25.3			MEDIUM SAND /		/
31.7		BROWN	LIMESTONE /		/

1700124 — Lot 005 Conc C — EAST GARAFRAXA TOWNSHIP / DUFFERIN

Date 8/24/1961 (DD/MM/YYYY)
Elev (masl) Easting 568907 Northing 4862160
/ Commerical Water Supply UTM RC 5 margin of error : 100 m - 300 m
Water Found 25.3 (mbgs) (masl) FRESH
Casing Diameter 4 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing? N
SWL 4.9 (mbgs) (masl)
Pumping WL 6.1 (mbgs) (masl)
Pump Rate 36.4 (LPM) 6 / 0
Spec. Cap. 29.83 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions		
0.0					
25.0			MEDIUM SAND /	STONES	/
25.6		WHITE	LIMESTONE /		/

Well Record #

1700930 — **Lot 006 Conc B** — **EAST GARAFRAXA TOWNSHIP / DUFFERIN**

Date 9/17/1968 (DD/MM/YYYY)
Elev (masl) Easting 568264 Northing 4861613
/ Domestic Water Supply UTM RC 4 margin of error : 30 m - 100 m
Water Found 93.0 (mbgs) (masl) FRESH
Casing Diameter 4 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing? N
SWL 35.1 (mbgs) (masl)
Pumping WL 36.6 (mbgs) (masl)
Pump Rate 68.2 (LPM) 1 / 0
Spec. Cap. 44.74 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0			
53.3			CLAY / MEDIUM SAND /
57.9		BROWN	DOLOMITE / CLAY /
79.2		BROWN	DOLOMITE / /
85.3		BROWN	LIMESTONE / /
94.5		WHITE	LIMESTONE / /

1701356 — **Lot 005 Conc C** — **EAST GARAFRAXA TOWNSHIP / DUFFERIN**

Date 8/17/1972 (DD/MM/YYYY)
Elev (masl) Easting 568814 Northing 4861973
Domestic / Livestock Water Supply UTM RC 4 margin of error : 30 m - 100 m
Water Found 41.1 (mbgs) (masl) FRESH
Casing Diameter 4 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing? N
SWL 24.4 (mbgs) (masl)
Pumping WL 25.0 (mbgs) (masl)
Pump Rate 45.5 (LPM) 4 / 0
Spec. Cap. 74.57 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0			
1.5		BROWN	FILL / SAND /
32.3		GREY	CLAY / SILT /
41.1		GREY	CLAY / GRAVEL /
48.8		BROWN	DOLOMITE / /

1702065 — **Lot 001 Conc 01** — **AMARANTH TOWNSHIP / DUFFERIN**

Date 10/16/1975 (DD/MM/YYYY)
Elev (masl) Easting 568964 Northing 4862273
/ Domestic Water Supply UTM RC 5 margin of error : 100 m - 300 m
Water Found 68.0 (mbgs) (masl) FRESH
Casing Diameter 4 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing? N
SWL 12.2 (mbgs) (masl)
Pumping WL 13.7 (mbgs) (masl)
Pump Rate 50.0 (LPM) 3 / 0
Spec. Cap. 32.81 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0			
19.8			SAND / CLAY /
61.6		BROWN	ROCK / /
68.9		GREY	LIMESTONE / /

1702237 — **Lot 001 Conc 02** — **AMARANTH TOWNSHIP / DUFFERIN**

Date 10/4/1976 (DD/MM/YYYY)
Elev (masl) Easting 568314 Northing 4862623
/ Domestic Water Supply UTM RC 5 margin of error : 100 m - 300 m
Water Found 47.9 (mbgs) (masl) FRESH
Casing Diameter 4 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing? N
SWL 18.3 (mbgs) (masl)
Pumping WL 23.8 (mbgs) (masl)
Pump Rate 54.6 (LPM) 2 / 0
Spec. Cap. 9.94 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0			
19.2		BROWN	CLAY / /
44.8		BROWN	CLAY / SAND /
47.9		BROWN	LIMESTONE / /

Well Record #

1702408 — **Lot 001 Conc 01 AMARANTH TOWNSHIP / DUFFERIN**

Date 6/21/1978 (DD/MM/YYYY)
Elev (masl) Easting 568464 Northing 4862523
Domestic / Livestock Water Supply UTM RC 5 margin of error : 100 m - 300 m
Water Found 51.8 (mbgs) (masl) FRESH
Casing Diameter 5 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing? N
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate 227.3 (LPM) 1 / 30
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color			
0.0		Soil Descriptions			
4.0		BROWN	SAND /		/
14.3		BROWN	CLAY /	SAND	/
41.8			CLAY /	GRAVEL	/
42.4			GRAVEL /		/
53.3		WHITE	LIMESTONE /		/

1703285 — **Lot 006 Conc B EAST GARAFRAXA TOWNSHIP / DUFFERIN**

Date 7/17/1986 (DD/MM/YYYY)
Elev (masl) Easting 568260 Northing 4861969
/ Domestic Water Supply UTM RC 3 margin of error : 10 - 30 m
Water Found 53.3 (mbgs) (masl) FRESH
Casing Diameter 6 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing? N
SWL 14.9 (mbgs) (masl)
Pumping WL 22.9 (mbgs) (masl)
Pump Rate 36.4 (LPM) 10 / 0
Spec. Cap. 4.59 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color			
0.0		Soil Descriptions			
19.8		BROWN	CLAY /	SAND	/ DENSE
27.4		BLUE	CLAY /	SAND	/ DENSE
30.5		BLUE	SAND /		/ LOOSE
38.1		BLUE	HARDPAN /		/ CONGLOMERATE
54.9		GREY	LIMESTONE /	POROUS	/ HARD

1703536 — **Lot 006 Conc B EAST GARAFRAXA TOWNSHIP / DUFFERIN**

Date 8/18/1987 (DD/MM/YYYY)
Elev (masl) Easting 568213 Northing 4861529
/ Domestic Water Supply UTM RC 3 margin of error : 10 - 30 m
Water Found 66.1 (mbgs) (masl) FRESH
Casing Diameter 5 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing? N
SWL 34.1 (mbgs) (masl)
Pumping WL 38.1 (mbgs) (masl)
Pump Rate 45.5 (LPM) 1 / 30
Spec. Cap. 11.47 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color			
0.0		Soil Descriptions			
55.5		BROWN	CLAY /	SAND	/
59.4			CLAY /	STONES	/
66.1		BROWN	LIMESTONE /		/

1704642 — **Lot 005 Conc C EAST GARAFRAXA TOWNSHIP / DUFFERIN**

Date 10/13/1993 (DD/MM/YYYY)
Elev (masl) Easting 568778 Northing 4861965
/ Domestic Water Supply UTM RC 3 margin of error : 10 - 30 m
Water Found 42.1 (mbgs) (masl) FRESH
Casing Diameter 6 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing? N
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate 54.6 (LPM) 1 / 0
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color			
0.0		Soil Descriptions			
0.3			TOPSOIL /		/
1.5		BROWN	SAND /		/
37.5		BROWN	SAND /	GRAVEL	/
39.6		GREY	SILT /	GRAVEL	/
40.2		GREY	LIMESTONE /	CLAY	/ LAYERED

48.2 GREY LIMESTONE / /

1704690 Lot 006 Conc B — EAST GARAFRAXA TOWNSHIP / DUFFERIN

Date 4/15/1993 DD/MM/YYYY
Elev (masl) / Municipal
Easting 568885 Northing 4861836
Water Supply UTM RC 4 margin of error : 30 m - 100 m
Water Found (mbgs) (masl)
Casing Diameter 8 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing? N
SWL 4.3 (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate 1136.5 (LPM) 48 / 0
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0			
15.8			PREV. DRILLED / /
17.4			UNKNOWN TYPE / /

1704691 Lot 006 Conc B — EAST GARAFRAXA TOWNSHIP / DUFFERIN

Date 4/15/1993 DD/MM/YYYY
Elev (masl) / Municipal
Easting 568885 Northing 4861836
Water Supply UTM RC 4 margin of error : 30 m - 100 m
Water Found (mbgs) (masl)
Casing Diameter 8 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing? N
SWL 1.2 (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate 909.2 (LPM) 48 / 0
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0			
15.8			PREV. DRILLED / /
17.4			UNKNOWN TYPE / /

1704823 Lot 005 Conc C — EAST GARAFRAXA TOWNSHIP / DUFFERIN

Date 2/2/1995 DD/MM/YYYY
Elev (masl) / Municipal
Easting 569185 Northing 4862026
Test Hole UTM RC 9 unknown UTM
Water Found (mbgs) (masl)
Casing Diameter 10 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing?
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0			
36.6		BROWN	CLAY / SAND / LOOSE
53.3		GREY	LIMESTONE / HARD /

1704864 Lot 005 Conc C — EAST GARAFRAXA TOWNSHIP / DUFFERIN

Date 5/19/1995 DD/MM/YYYY
Elev (masl) / Municipal
Easting 569185 Northing 4862026
Water Supply UTM RC 9 unknown UTM
Water Found 38.1 (mbgs) (masl) Not stated
Casing Diameter 8 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing? N
SWL 11.0 (mbgs) (masl)
Pumping WL 70.1 (mbgs) (masl)
Pump Rate 341.0 (LPM) 2 / 0
Spec. Cap. 5.77 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0			
11.0		BROWN	SAND / SILT / LOOSE
75.0		GREY	LIMESTONE / HARD /

1704889 Lot 005 Conc B — EAST GARAFRAXA TOWNSHIP / DUFFERIN

Date 6/30/1995 DD/MM/YYYY
Elev (masl) / Domestic
Easting 568385 Northing 4861527
Water Supply UTM RC 3 margin of error : 10 - 30 m
Water Found 57.6 (mbgs) (masl) FRESH
Casing Diameter 6 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing? N
SWL 32.0 (mbgs) (masl)
Pumping WL 42.7 (mbgs) (masl)
Pump Rate 68.2 (LPM) 1 / 30
Spec. Cap. 6.39 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0			

Well Record #

10.1	BROWN	SAND /	CLAY	/
17.1	BROWN	CLAY /	GRAVEL	/ STONES
49.1	BROWN	HARDPAN /	STONES	/
56.1	GREY	CLAY /	GRAVEL	/ STONES
58.8	BROWN	LIMESTONE /		/

1705245 **Lot 001 Conc 01** **AMARANTH TOWNSHIP / DUFFERIN**

Date 5/7/1998 DD/MM/YYYY
Elev (masl) Easting 568431 Northing 4862602
/ Domestic Water Supply UTM RC 3 margin of error : 10 - 30 m
Water Found 44.5 (mbgs) (masl) FRESH
Casing Diameter 6 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing? N
SWL 14.9 (mbgs) (masl)
Pumping WL 16.5 (mbgs) (masl)
Pump Rate 45.5 (LPM) 1 / 30
Spec. Cap. 29.83 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color		Soil Descriptions	
0.0					
0.3			TOPSOIL /		/
1.5		BROWN	CLAY /	STONES	/
3.0			SAND /		/
13.7			CLAY /	SAND	/ STONES
41.5		BROWN	CLAY /	SAND	/
44.5		BROWN	LIMESTONE /		/

1705658 **Lot Conc** **ORANGEVILLE TOWN / DUFFERIN**

Date 8/22/2000 DD/MM/YYYY
Elev (masl) Easting 568911 Northing 4861811
/ Not Used Observation Wells UTM RC 3 margin of error : 10 - 30 m
Water Found 30.5 (mbgs) (masl) Not stated
Casing Diameter 6 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing? N
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate 113.7 (LPM) 1 /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color		Soil Descriptions	
0.0					
0.3		BLACK	TOPSOIL /		/
17.1		BROWN	CLAY /	STONES	/ SANDY
17.7		BROWN	GRAVEL /		/
30.5		BROWN	SAND /		/
37.8		BROWN	SAND /	CLAY	/ STONES
38.4		GREY	CLAY /	SILT	/
39.6		GREY	GRAVEL /		/
40.8		BROWN	LIMESTONE /		/
53.3		BROWN	LIMESTONE /		/

1705800 **Lot 005 Conc C** **EAST GARAFRAXA TOWNSHIP / DUFFERIN**

Date 2/15/2001 DD/MM/YYYY
Elev (masl) Easting 568913 Northing 4861810
/ Not Used Observation Wells UTM RC 3 margin of error : 10 - 30 m
Water Found (mbgs) (masl)
Casing Diameter 10 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing?
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color		Soil Descriptions	
0.0					
47.9			UNKNOWN TYPE /		/

Well Record #

1705871 — **Lot 001 Conc 01** — **AMARANTH TOWNSHIP / DUFFERIN**

Date 8/13/2002 (DD/MM/YYYY)
Elev (masl) Easting 568784 Northing 4862446
Commerical / Industrial Water Supply UTM RC 5 margin of error : 100 m - 300 m
Water Found 64.3 (mbgs) (masl) FRESH
Casing Diameter 6 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing? N
SWL 21.9 (mbgs) (masl)
Pumping WL 76.5 (mbgs) (masl)
Pump Rate 45.5 (LPM) 2 / 0
Spec. Cap. 0.83 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color		Soil Descriptions	
0.0					
9.4		BROWN	SAND /	SILTY	/
12.8		BROWN	GRAVEL /	SAND	/
16.8		GREY	CLAY /	SILTY	/
23.2		GREY	CLAY /	STONES	/
39.0		GREY	LIMESTONE /		/
71.6		BROWN	LIMESTONE /		/
77.7		GREY	LIMESTONE /		/
84.1		GREY	DOLOMITE /		/
85.3		GREY	SHALE /		/

1705892 — **Lot 001 Conc 01** — **AMARANTH TOWNSHIP / DUFFERIN**

Date 9/18/2002 (DD/MM/YYYY)
Elev (masl) Easting 569069 Northing 4862497
Commerical / Domestic Water Supply UTM RC 5 margin of error : 100 m - 300 m
Water Found 23.5 (mbgs) (masl) FRESH
Casing Diameter 6 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing? N
SWL 11.9 (mbgs) (masl)
Pumping WL 16.8 (mbgs) (masl)
Pump Rate 181.8 (LPM) 3 / 0
Spec. Cap. 37.29 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color		Soil Descriptions	
0.0					
5.5		BROWN	SAND /		/
9.8		BROWN	GRAVEL /		/
18.9		GREY	CLAY /	GRAVEL	/ LAYERED
25.0		BROWN	LIMESTONE /		/

1706375 — **Lot Conc** — **ORANGEVILLE TOWN / DUFFERIN**

Date 12/5/2005 (DD/MM/YYYY)
Elev (masl) Easting 568791 Northing 4862160
/ Not Used Test Hole UTM RC 4 margin of error : 30 m - 100 m
Water Found (mbgs) (masl)
Casing Diameter 5 cm Casing Material: PLASTIC
Top of Screen 3.0 (mbgs) Bottom of Screen 4.5 (mbgs)
Screen Interval 1.5 (m)

Flowing?
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color		Soil Descriptions	
0.0					
0.2			/		/
1.4		BROWN	SILT /	SAND	/ LOOSE
4.2		BROWN	SAND /	SILT	/ DENSE
4.5		BROWN	SAND /	GRAVEL	/ DENSE

1706380 — **Lot 001 Conc 02** — **AMARANTH TOWNSHIP / DUFFERIN**

Date 2/25/2005 (DD/MM/YYYY)
Elev (masl) Easting 568306 Northing 4862196
/ Domestic Water Supply UTM RC 4 margin of error : 30 m - 100 m
Water Found 63.4 (mbgs) (masl) FRESH
Casing Diameter 6 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing?
SWL 33.5 (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate 10.0 (LPM) 1 /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color		Soil Descriptions	
0.0					
0.6		BLACK	TOPSOIL /		/

Well Record #

		59.1	BROWN	SAND /	CLAY	/ GRAVEL
		66.1	BROWN	LIMESTONE /		/

7041707 — **Lot 006 Conc B** — **EAST GARAFRAXA TOWNSHIP / DUFFERIN**

Date 11/28/2006 (DD/MM/YYYY)
Elev (masl) — Easting 568179 — Northing 4861583
/ Domestic — Water Supply — UTM RC 3 — margin of error : 10 - 30 m
Water Found 77.4 (mbgs) (masl) FRESH
Casing Diameter 6 inch — Casing Material: STEEL
Top of Screen (mbgs) — Bottom of Screen (mbgs)
Screen Interval (m)

Flowing?
SWL 36.0 (mbgs) (masl)
Pumping WL 44.8 (mbgs) (masl)
Pump Rate 45.5 (LPM) 2 / 0
Spec. Cap. 5.14 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color		Soil Descriptions
0.0				
20.7		BROWN	CLAY / SANDY	/
53.6		GREY	CLAY / SILT	/ STONES
60.4		GREY	CLAY / STONES	/
79.2		GREY	LIMESTONE /	/

7045637 — **Lot 001 Conc 01** — **AMARANTH TOWNSHIP / DUFFERIN**

Date 6/3/2007 (DD/MM/YYYY)
Elev (masl) — Easting 568963 — Northing 4862438
/ Abandoned-Other — UTM RC 3 — margin of error : 10 - 30 m
Water Found (mbgs) (masl)
Casing Diameter — Casing Material:
Top of Screen (mbgs) — Bottom of Screen (mbgs)
Screen Interval (m)

Flowing?
SWL 11.0 (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color		Soil Descriptions
0.0				
			/	/

7142831 — **Lot 006 Conc B** — **EAST GARAFRAXA TOWNSHIP / DUFFERIN**

Date 1/25/2010 (DD/MM/YYYY)
Elev (masl) — Easting 568265 — Northing 4861666
/ Domestic — Water Supply — UTM RC 4 — margin of error : 30 m - 100 m
Water Found 77.7 (mbgs) (masl) FRESH
Casing Diameter 6 inch — Casing Material: STEEL
Top of Screen (mbgs) — Bottom of Screen (mbgs)
Screen Interval (m)

Flowing?
SWL 33.5 (mbgs) (masl)
Pumping WL 50.3 (mbgs) (masl)
Pump Rate 90.9 (LPM) 2 /
Spec. Cap. 5.42 (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color		Soil Descriptions
0.0				
29.9		BROWN	SAND / SILTY	/
59.4		GREY	CLAY / STONES	/
79.9		GREY	LIMESTONE /	/

7170407 — **Lot 005 Conc C** — **EAST GARAFRAXA TOWNSHIP / DUFFERIN**

Date 4/21/2011 (DD/MM/YYYY)
Elev (masl) — Easting 568827 — Northing 4861965
/ Abandoned-Other — UTM RC 3 — margin of error : 10 - 30 m
Water Found (mbgs) (masl)
Casing Diameter — Casing Material:
Top of Screen (mbgs) — Bottom of Screen (mbgs)
Screen Interval (m)

Flowing?
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color		Soil Descriptions
0.0				
			/	/

Well Record #

7200867 — Lot 005 Conc C — EAST GARAFRAXA TOWNSHIP / DUFFERIN

Date 11/14/2012 (DD/MM/YYYY)
Elev (masl) / Easting 568944 Northing 4861936
Abandoned-Other UTM RC 4 margin of error : 30 m - 100 m
Water Found (mbgs) (masl)
Casing Diameter 30 inch Casing Material: CONCRETE
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing?
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions	
0.0				/ /

7234100 — Lot 004 Conc B — EAST GARAFRAXA TOWNSHIP / DUFFERIN

Date 12/17/2014 (DD/MM/YYYY)
Elev (masl) / Not Used Easting 569134 Northing 4861287
Abandoned-Other UTM RC 4 margin of error : 30 m - 100 m
Water Found (mbgs) (masl)
Casing Diameter 91 inch Casing Material: CONCRETE
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing?
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions	
0.0				/ /

7266443 — Lot Conc — AMARANTH TOWNSHIP / DUFFERIN

Date 2/19/2016 (DD/MM/YYYY)
Elev (masl) / Test Hole Easting 568347 Northing 4862657
Water Supply UTM RC 4 margin of error : 30 m - 100 m
Water Found 48.8 (mbgs) (masl) FRESH
Casing Diameter 6 inch Casing Material: STEEL
Top of Screen (mbgs) Bottom of Screen (mbgs)
Screen Interval (m)

Flowing? N
SWL 19.8 (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate 272.8 (LPM) 1 /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color			
0.0			Soil Descriptions		
0.3			TOPSOIL /		/
16.8		BROWN	SAND /	GRAVEL	/
41.1		BROWN	SILT /	FINE SAND	/
44.8		BROWN	SAND /		/ COARSE SAND
53.6		BROWN	LIMESTONE /		/ SOFT

7266444 — Lot 001 Conc 01 — AMARANTH TOWNSHIP / DUFFERIN

Date 2/23/2016 (DD/MM/YYYY)
Elev (masl) / Monitoring Easting 569024 Northing 4862289
Observation Wells UTM RC 4 margin of error : 30 m - 100 m
Water Found 18.3 (mbgs) (masl) FRESH
Casing Diameter 2 inch Casing Material: PLASTIC
Top of Screen 21.3 (mbgs) Bottom of Screen 30.5 (mbgs)
Screen Interval 9.1 (m)

Flowing? N
SWL 10.1 (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color			
0.0			Soil Descriptions		
0.3			TOPSOIL /		/
10.1		BROWN	SILT /	CLAY	/
14.6		BROWN	SAND /		/ MEDIUM SAND
16.2		BROWN	SAND /	GRAVEL	/
18.3		GREY	LIMESTONE /		/
24.4		BROWN	LIMESTONE /		/
29.6		GREY	LIMESTONE /		/
30.5		GREY	LIMESTONE /		/

Well Record #

7266640 — **Lot 001 Conc 02** — **AMARANTH TOWNSHIP / DUFFERIN**

Date 2/26/2016 (DD/MM/YYYY)
Elev (masl) / Monitoring
Water Found 61.0 (mbgs) (masl)
Casing Diameter 2 inch
Top of Screen 61.0 (mbgs)
Screen Interval 9.1 (m)
Easting 568322 Northing 4862216
Observation Wells UTM RC 4 margin of error : 30 m - 100 m
FRESH
Casing Material: PLASTIC
Bottom of Screen 70.1 (mbgs)

Flowing? N
SWL 32.0 (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions		
0.0					
0.3			TOPSOIL /		/
10.7		BROWN	SILT /	GRAVEL	/
19.8		BROWN	SILT /	SAND	/
24.4		BROWN	SAND /	GRAVEL	/
25.9		BROWN	SAND /		/ COARSE SAND
35.1		BROWN	SAND /		/ FINE SAND
50.3		BROWN	SAND /		/ COARSE SAND
54.9		GREY	SILT /	GRAVEL	/
57.9		GREY	SILT /	GRAVEL	/
59.4		BROWN	LIMESTONE /		/ FRACTURED
67.1		BROWN	LIMESTONE /		/
70.1		GREY	LIMESTONE /		/

7288649 — **Lot Conc** — **EAST GARAFRAXA TOWNSHIP / DUFFERIN**

Date 4/11/2017 (DD/MM/YYYY)
Elev (masl) / Monitoring / Test Hole
Water Found 6.5 (mbgs) (masl)
Casing Diameter 5 inch
Top of Screen 6.5 (mbgs)
Screen Interval 0.5 (m)
Easting 568244 Northing 4861974
Observation Wells UTM RC 4 margin of error : 30 m - 100 m
Casing Material: PLASTIC
Bottom of Screen 6.9 (mbgs)

Flowing?
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions		
0.0					
6.6		BROWN	SAND /	GRAVEL	/ DRY
6.9		BROWN	SAND /		/ WATER-BEARING

7288650 — **Lot Conc** — **EAST GARAFRAXA TOWNSHIP / DUFFERIN**

Date 4/11/2017 (DD/MM/YYYY)
Elev (masl) / Monitoring / Test Hole
Water Found 23.2 (mbgs) (masl)
Casing Diameter 5 cm
Top of Screen 22.9 (mbgs)
Screen Interval 1.5 (m)
Easting 568115 Northing 4861897
Observation Wells UTM RC 4 margin of error : 30 m - 100 m
Casing Material: PLASTIC
Bottom of Screen 24.4 (mbgs)

Flowing?
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions		
0.0					
22.5		BROWN	SAND /		/ DRY
24.4		BROWN	FINE SAND /	SILT	/ WATER-BEARING

7288651 — **Lot Conc** — **EAST GARAFRAXA TOWNSHIP / DUFFERIN**

Date 4/12/2017 (DD/MM/YYYY)
Elev (masl) / Monitoring / Test Hole
Water Found 28.0 (mbgs) (masl)
Casing Diameter 5 cm
Top of Screen 27.7 (mbgs)
Screen Interval 1.6 (m)
Easting 568400 Northing 4861829
Observation Wells UTM RC 4 margin of error : 30 m - 100 m
Casing Material: PLASTIC
Bottom of Screen 29.3 (mbgs)

Flowing?
SWL (mbgs) (masl)
Pumping WL (mbgs) (masl)
Pump Rate (LPM) /
Spec. Cap. (LPM/m) Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions		
0.0					
6.9		BROWN	SAND /		/ DRY
14.6		BROWN	SAND /	GRAVEL	/ DRY

Well Record #

					27.4	BROWN	SAND /	SILTY	/ DRY
					29.3	BROWN	FINE SAND /	MEDIUM SAND	/ WATER-BEARING

7331767 **Lot** **Conc** **EAST GARAFRAXA TOWNSHIP / DUFFERIN**

Flowing?

Date 2/27/2019 Elev (masl) Easting 569221 Northing 4862255 SWL (mbgs) (masl)

DD/MM/YYYY / UTM RC 4 margin of error : 30 m - 100 m Pumping WL (mbgs) (masl)

Water Found (mbgs) (masl) Pump Rate (LPM) /

Spec. Cap. (LPM/m) Hour / Minute

Casing Diameter Casing Material: Depth (m) Elev (masl)

0.0 Color Soil Descriptions

Top of Screen (mbgs) Bottom of Screen (mbgs)

Screen Interval (m)

/ /

7390185 **Lot 006** **Conc B** **EAST GARAFRAXA TOWNSHIP / DUFFERIN**

Flowing?

Date 4/28/2021 Elev (masl) Easting 568442 Northing 4861997 SWL (mbgs) (masl)

DD/MM/YYYY / UTM RC 4 margin of error : 30 m - 100 m Pumping WL (mbgs) (masl)

Water Found (mbgs) (masl) Pump Rate (LPM) /

Spec. Cap. (LPM/m) Hour / Minute

Casing Diameter Casing Material: Depth (m) Elev (masl)

0.0 Color Soil Descriptions

Top of Screen (mbgs) Bottom of Screen (mbgs)

Screen Interval (m)

/ /

MECP Water Well Records

Well Record #

1700930 — Lot 006 Conc B — EAST GARAFRAXA TOWNSHIP / DUFFERIN

Date 9/17/1968 (DD/MM/YYYY) — Elev (masl) — Easting 568264 — Northing 4861613

/ Domestic — Water Supply — UTM RC 4 — margin of error : 30 m - 100 m

Water Found 93.0 (mbgs) (masl) FRESH

Casing Diameter 4 inch — Casing Material: STEEL

Top of Screen (mbgs) — Bottom of Screen (mbgs)

Screen Interval (m)

Flowing? N

SWL	35.1	(mbgs)	(masl)
Pumping WL	36.6	(mbgs)	(masl)
Pump Rate	68.2	(LPM)	1 / 0
Spec. Cap.	44.74	(LPM/m)	Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions		
0.0					
53.3			CLAY /	MEDIUM SAND	/
57.9		BROWN	DOLOMITE /	CLAY	/
79.2		BROWN	DOLOMITE /		/
85.3		BROWN	LIMESTONE /		/
94.5		WHITE	LIMESTONE /		/

1703536 — Lot 006 Conc B — EAST GARAFRAXA TOWNSHIP / DUFFERIN

Date 8/18/1987 (DD/MM/YYYY) — Elev (masl) — Easting 568213 — Northing 4861529

/ Domestic — Water Supply — UTM RC 3 — margin of error : 10 - 30 m

Water Found 66.1 (mbgs) (masl) FRESH

Casing Diameter 5 inch — Casing Material: STEEL

Top of Screen (mbgs) — Bottom of Screen (mbgs)

Screen Interval (m)

Flowing? N

SWL	34.1	(mbgs)	(masl)
Pumping WL	38.1	(mbgs)	(masl)
Pump Rate	45.5	(LPM)	1 / 30
Spec. Cap.	11.47	(LPM/m)	Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions		
0.0					
55.5		BROWN	CLAY /	SAND	/
59.4			CLAY /	STONES	/
66.1		BROWN	LIMESTONE /		/

1705019 — Lot 006 Conc A — EAST GARAFRAXA TOWNSHIP / DUFFERIN

Date 8/26/1996 (DD/MM/YYYY) — Elev (masl) — Easting 567411 — Northing 4860567

/ Not Used — Test Hole — UTM RC 4 — margin of error : 30 m - 100 m

Water Found 22.3 (mbgs) (masl) Not stated

Casing Diameter 6 inch — Casing Material: STEEL

Top of Screen (mbgs) — Bottom of Screen (mbgs)

Screen Interval (m)

Flowing? N

SWL	18.0	(mbgs)	(masl)
Pumping WL		(mbgs)	(masl)
Pump Rate	818.3	(LPM)	3 / 0
Spec. Cap.		(LPM/m)	Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions		
0.0					
1.5		BROWN	TOPSOIL /	SANDY	/ TOPSOIL
4.3		BROWN	SANDSTONE /		/
10.7		RED	SAND /	MEDIUM-GRAINED	/
14.3			SAND /	GRAVEL	/
18.0		BROWN	SAND /		/
19.8		BROWN	CLAY /	STONES	/ TILL
22.3		GREY	CLAY /	STONES	/
27.1		BROWN	SAND /	GRAVEL	/ MEDIUM-GRAINED
39.3		BROWN	SAND /	FINE-GRAINED	/ SILTY
48.5		GREY	CLAY /	SOFT	/
50.0		GREY	CLAY /	STONES	/ TILL
66.4		BROWN	LIMESTONE /	SAND	/ LAYERED
67.1		GREY	LIMESTONE /		/
70.1			GRAVEL /		/
71.0		BROWN	CLAY /	STONES	/
73.5		BROWN	LIMESTONE /	GRAVEL	/ LAYERED
104.5		WHITE	DOLOMITE /	STONES	/
110.0		GREY	DOLOMITE /	STONES	/

Well Record #

111.3	WHITE	DOLOMITE /	STONES	/
115.2	BLUE	LIMESTONE /		/
115.8	GREEN	LIMESTONE /		/
118.9	BLUE	SHALE /		/

7041697 **Lot 007 Conc A** **EAST GARAFRAXA TOWNSHIP / DUFFERIN**

Date 2/5/2007 DD/MM/YYYY

Elev (masl) Easting 567166 Northing 4861381

/ Domestic Water Supply UTM RC 3 margin of error : 10 - 30 m

Water Found 65.2 (mbgs) (masl) FRESH

Casing Diameter 6 inch Casing Material: STEEL

Top of Screen (mbgs) Bottom of Screen (mbgs)

Screen Interval (m)

Flowing?

SWL	19.8	(mbgs)	(masl)
Pumping WL	20.1	(mbgs)	(masl)
Pump Rate	68.2	(LPM)	8 / 0
Spec. Cap.	223.72	(LPM/m)	Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0			
11.3		BROWN	SAND / SILTY /
17.7		BROWN	CLAY / SILTY /
50.9		GREY	CLAY / /
53.0		GREY	CLAY / STONES /
55.8		BROWN	LIMESTONE / SOFT /
67.1		BROWN	LIMESTONE / /

7041707 **Lot 006 Conc B** **EAST GARAFRAXA TOWNSHIP / DUFFERIN**

Date 11/28/2006 DD/MM/YYYY

Elev (masl) Easting 568179 Northing 4861583

/ Domestic Water Supply UTM RC 3 margin of error : 10 - 30 m

Water Found 77.4 (mbgs) (masl) FRESH

Casing Diameter 6 inch Casing Material: STEEL

Top of Screen (mbgs) Bottom of Screen (mbgs)

Screen Interval (m)

Flowing?

SWL	36.0	(mbgs)	(masl)
Pumping WL	44.8	(mbgs)	(masl)
Pump Rate	45.5	(LPM)	2 / 0
Spec. Cap.	5.14	(LPM/m)	Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0			
20.7		BROWN	CLAY / SANDY /
53.6		GREY	CLAY / SILT / STONES
60.4		GREY	CLAY / STONES /
79.2		GREY	LIMESTONE / /

7390071 **Lot Conc** **EAST GARAFRAXA TOWNSHIP / DUFFERIN**

Date 4/22/2021 DD/MM/YYYY

Elev (masl) Easting 567599 Northing 4861606

/ UTM RC 4 margin of error : 30 m - 100 m

Water Found (mbgs) (masl)

Casing Diameter Casing Material:

Top of Screen (mbgs) Bottom of Screen (mbgs)

Screen Interval (m)

Flowing?

SWL		(mbgs)	(masl)
Pumping WL		(mbgs)	(masl)
Pump Rate		(LPM)	/
Spec. Cap.		(LPM/m)	Hour / Minute

Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0			
			/ /

7390072 **Lot Conc** **EAST GARAFRAXA TOWNSHIP / DUFFERIN**

Date 4/22/2021 DD/MM/YYYY

Elev (masl) Easting 567603 Northing 4861260

/ UTM RC 4 margin of error : 30 m - 100 m

Water Found (mbgs) (masl)

Casing Diameter Casing Material:

Top of Screen (mbgs) Bottom of Screen (mbgs)

Screen Interval (m)

Flowing?

SWL		(mbgs)	(masl)
Pumping WL		(mbgs)	(masl)
Pump Rate		(LPM)	/
Spec. Cap.		(LPM/m)	Hour / Minute

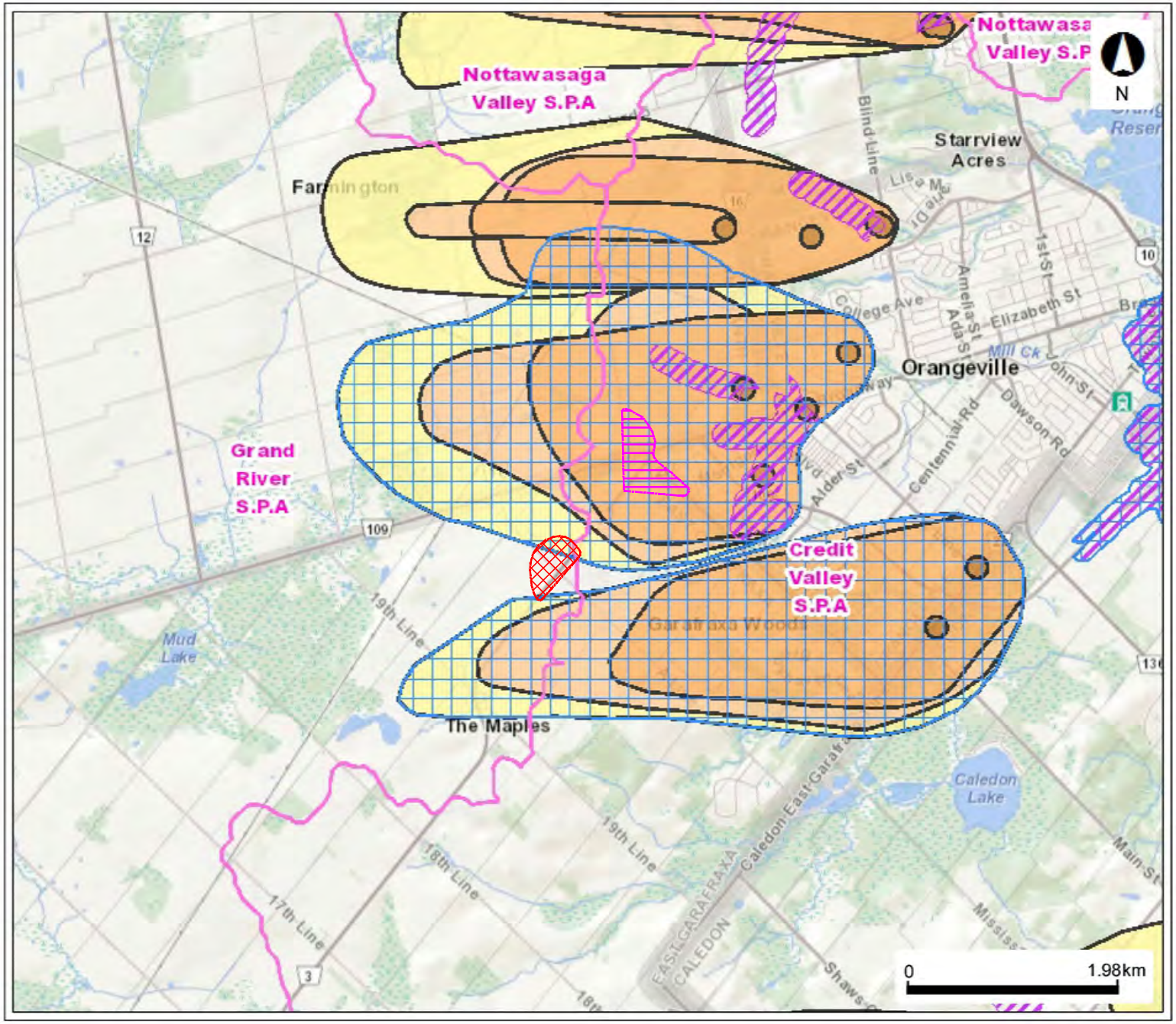
Depth (m)	Elev (masl)	Color	Soil Descriptions
0.0			
			/ /

APPENDIX

B

IDENTIFICATION OF VULNERABLE AREAS: STUDY AREA 1 AND STUDY AREA 2

Source Protection Vulnerability



Legend

- Study Area 2
- Study Area 1
- Source Protection Areas
- Issue Contributing Areas
- WHPA Groundwater Under Direct Influence (WHPA-E)
- Wellhead Protection Area
  - A
  - B
  - C
  - C1
  - D
  - F
- Intake Protection Zone 1
- Event Based Areas
- Intake Protection Zone 2

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Environment, Conservation and Parks (MECP) shall not be liable in any way for the use or any information on this map. of, or reliance upon, this map.

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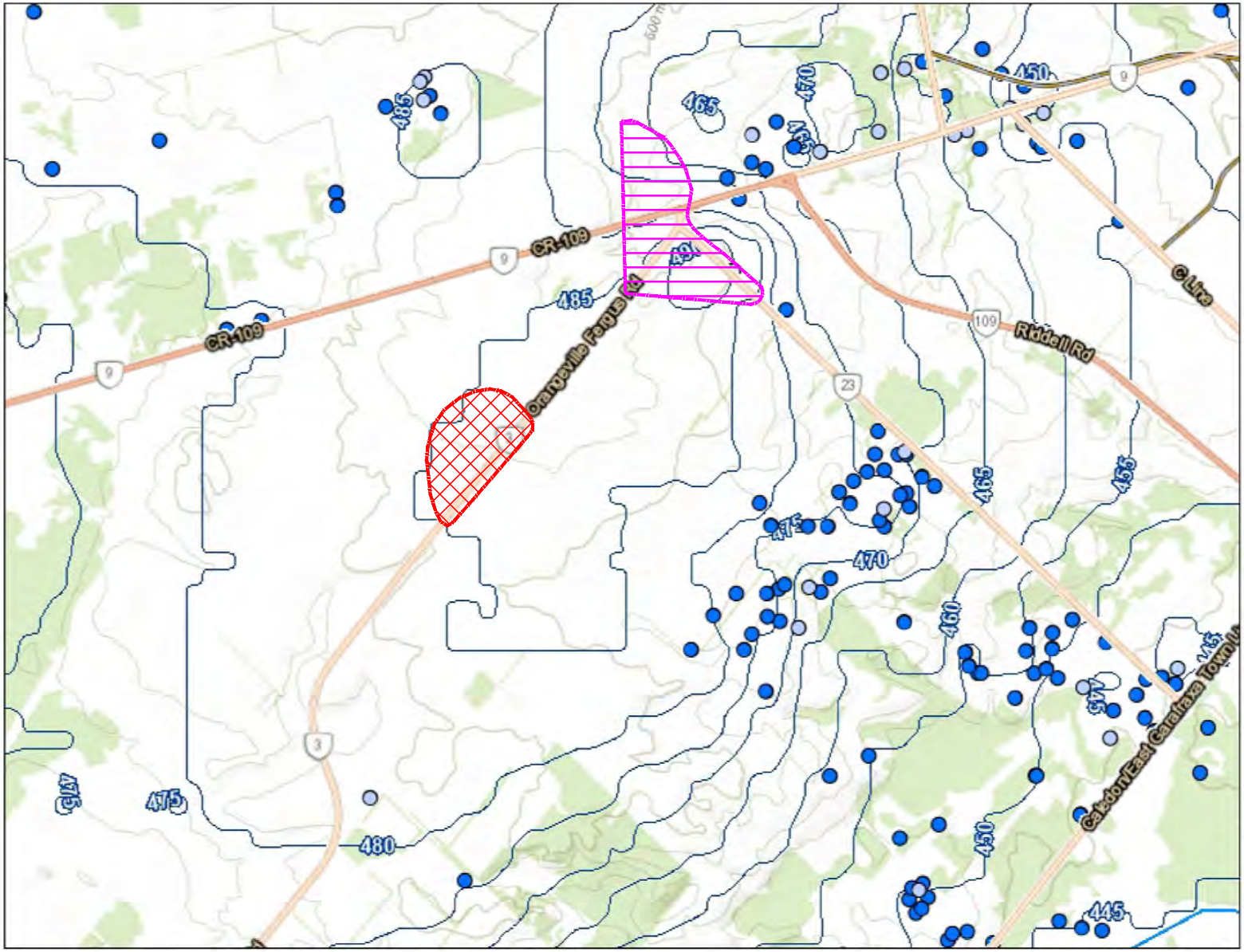
Map Created: 11/1/2022
Map Center: 43.9039 N, -80.15214 W

APPENDIX

C

OAK RIDGES MORAINE GROUNDWATER PROGRAM GENERATED WATER TABLE MAPS

Water Table



Legend

- Study Area 2
- Study Area 1
- Shallow Wells (Bottom of screen <20 m c
- Intermediate Wells (Bottom of screen 20-
- Streams (Strahler > Class 3)
- Water Bodies
- World Hillshade

York Region

1.8 0 0.92 1.8 Km

1: 36,112

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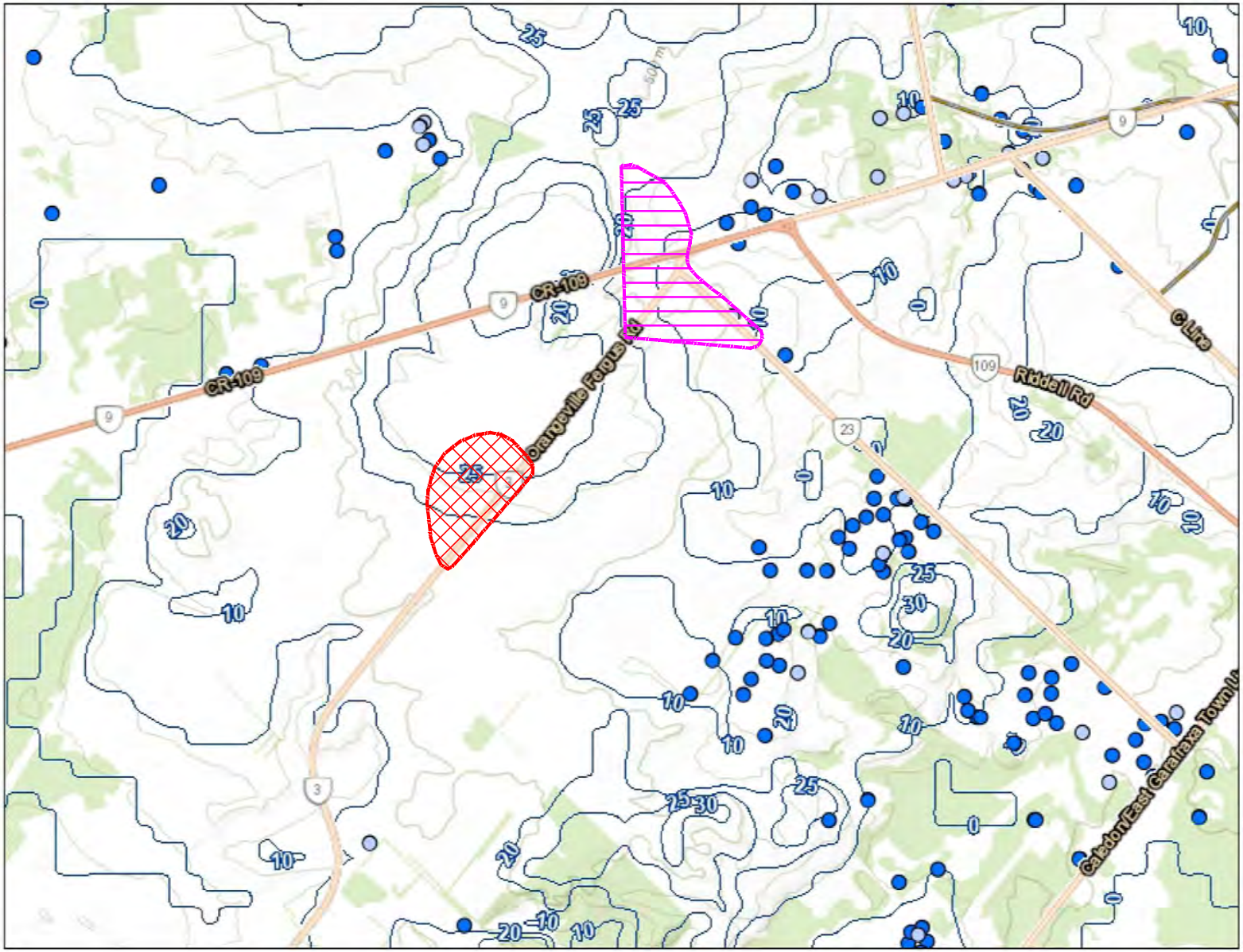
SOURCE: ORMGP, 2022; MNRF, 2022;

PROJECTION: WGS_1984_Web_Mercator_Auxiliary_Sphere

DATE PRINTED: November 1, 2022

Depth to Water Table



Legend

- Study Area 2
- Study Area 1
- Shallow Wells (Bottom of screen <20 m c
- Intermediate Wells (Bottom of screen 20-
- Streams (Strahler > Class 3)
- Water Bodies
- World Hillshade

York Region

1.8 0 0.92 1.8 Km

1: 36,112

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