



**HYDROGEOLOGICAL ASSESSMENT  
SCHEDULE C  
CLASS ENVIRONMENTAL ASSESSMENT  
FOR WIDENING OF MCLAUGHLIN ROAD  
AND CONSTRUCTION OF EAST-WEST SPINE ROAD  
(MAYFIELD WEST PHASE 2)  
CALEDON, ONTARIO**

Submitted to:

**The Corporation of the Town of Caledon**  
Town Hall, 6311 Old Church Road  
Caledon, Ontario, L7C 1J6  
Canada

Submitted by:

**Amec Foster Wheeler Environment & Infrastructure,  
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October 16, 2017

Amec Foster Wheeler Reference No.: TPB166090



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## 1.0 INTRODUCTION

Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited (Amec Foster Wheeler), was retained by The Corporation of the Town of Caledon (the Town), to complete a hydrogeological assessment in support of a Schedule C Class Environmental Assessment (EA) study for the widening of McLaughlin Road two-lane road to a four-lane road extending north from Mayfield Road and the construction of Spine Road from Hurontario Street (east) to Chinguacousy Road (west) in the Town of Caledon, Ontario. The site location is shown by an outline in Figure 1. These road expansions and extensions will include the installation of subsurface sewer infrastructure to support future development in the local area.

The purpose of this report is to provide a hydrogeological assessment of the impacts of the proposed construction on the surrounding private well users and local environment. This report summarizes the findings of a previously completed geotechnical and hydrogeological investigation completed at the site, including in-situ hydraulic conductivity testing and groundwater level measurements to assess the dewatering effort required. The report also describes the local environment in the area of the proposed construction.

## 2.0 SOURCES OF INFORMATION

Information reviewed as part of the preparation of this report includes both studies completed at the site, as well as regional-scale mapping products. For this report, Amec Foster Wheeler is reliant on field work and a dewatering assessment previously completed at the site by WSP Canada Inc. (WSP). This work included the following:

- ) Drilling of 45 boreholes drilled to depths between 3.2 m and 18.9 m between 11 January and 26 February 2016 as part of a geotechnical investigation;
- ) Installation of 50 mm (2") PVC monitoring wells in 19 of the boreholes upon the completion of drilling;
- ) Collection of groundwater levels at all functional monitoring wells on at least one (1) occasion following the completion of the monitoring well construction; and
- ) Review of available hydraulic conductivity data for the soil types encountered during drilling.

Results of the above field activities are summarized in this report, but are explained in greater detail in the following report completed by WSP Canada Inc.:

- ) Geotechnical Investigation, Sanitary Trunk Sewer on Mayfield West Phase 2, Caledon, Ontario, Final (version 1) (WSP Canada Inc., August 31, 2016).

Using the information included in this report, Amec Foster Wheeler then conducted an impact assessment of the dewatering efforts, and prepared this report to summarize the findings of the findings of that assessment.

The regional-scale map products reviewed as part of the work completed at this site include the following:

- J Orthophotography, ESRI ArcGIS Online, World Imagery, 2013.
- J Ontario Ministry of Northern Development and Mines, Surficial Geology of Southern Ontario, 2003, Miscellaneous Release - Data 128.
- J Ontario Geological Survey, Bedrock Geology of Ontario, 2011, Miscellaneous Release – Data 126, 1:250,000 scale.
- J Chapman L.J. and Putnam, D.F. 1984 (digitized 2007). Physiography of Southern Ontario: Ontario Geological Survey, Miscellaneous Release – Data 228.

### **3.0 PROPOSED CONSTRUCTION**

The proposed construction is expected to consist of road widening along McLaughlin Road and Chinguacousy Road from two (2) lanes to four (4) and the construction of Spine Road as a four (4) lane east-west road between Hurontario Street and Chinguacousy Road. Additionally, infrastructure consisting of sanitary trunk sewers are to be installed below the expanded roadways and in the local area to support future residential development in the local area. The sanitary trunk sewer is to consist of the following sections:

- J 450 mm diameter extending between Chinguacousy Road from 360 m north of Etobicoke Creek to Spine Road, turning eastward along Spine Road to Collector Road C;
- J 525 mm dia. sanitary trunk sewer extending along McLaughlin Road from Etobicoke Creek to Spine Road, turning westward along Spine Road to Collector Road D;
- J 600 mm dia. sanitary trunk sewer extending along Spine Road from Collector Road D to Collector Road C;
- J 750 mm dia. sanitary trunk sewer extending along Collector Road C from Spine Road to Mayfield Road; and
- J 375 mm dia. sanitary trunk sewer extending along McLaughlin Road from Collector Road B to Mayfield Road, turning eastward along Mayfield Road to Van Kirk Drive.

The widening or installation of roadways are not expected to require any major excavations. The excavations required for the installation of the sanitary trunk sewer segments are expected to be completed by open cut methods and may extend up to 14 m below existing ground surface (m bgs). These excavations will extend below the water table and require dewatering.

#### **4.0 METHODOLOGY**

The hydrogeological work completed by WSP Canada Inc. at this site as part of the geotechnical investigation consisted of the following main tasks. Each task is listed below and discussed in more detail in Sections 5.0 and 6.0:

1. Review of previous geotechnical report and available data in the site area.
2. Collect groundwater levels to establish the depth to the water table.
3. Review available hydraulic conductivity information and dewatering effort required for the proposed excavations.
4. Prepare sections within the geotechnical report summarizing information regarding the hydrogeology.

Amec Foster Wheeler utilized this information in conducting an impacts assessment of the proposed construction and dewatering in support of the Class EA.

#### **5.0 PREVIOUS GEOTECHNICAL INVESTIGATION**

A geotechnical investigation was previously completed by WSP for the Site. The geotechnical report, "Draft Report on Geotechnical Investigation, Sanitary Trunk Sewer on Mayfield West Phase 2, Caledon Ontario" was issued on August 31, 2016 (Final, version 1). The findings of this geotechnical investigation are summarized in the following sections.

##### **5.1 Borehole Drilling and Monitoring Well Construction**

The Site included the drilling of 45 boreholes between 11 January 2016 and 26 February 2016. The boreholes were drilled to depths terminating between 3.2 m and 18.9 m below ground surface.

The boreholes were advanced using power auger drilling machines, under the supervision of WSP personnel.

Upon completion of drilling, monitoring wells were constructed in 19 of these boreholes, consisting of 50 mm (2") PVC for the purpose of long-term groundwater level monitoring. The monitoring well screens were installed at depths between 3.1 m and 13.7 m bgs.

##### **5.2 Geotechnical Soils**

The geotechnical investigation indicated that the soil profile for the Site comprised, topsoil and fill overlying glacial till of silty clay to sand and silt. The glacial till was underlain by the till/shale complex of clayey silt to silty sand containing extensive broken bedrock. In some areas, the glacial till is interbedded with cohesive silty clay to clayey silt and cohesionless silty sand, sand and silt,

sandy silt and/or silt layers/seams. The Queenston Formation (mudstone shale interbedded with limestone/siltstone) was encountered at depths as shallow as 3.0 m to 6.1 m bgs in select borehole locations, but was not encountered during drilling across most of the site, with overburden extending to almost 15 m without encountering bedrock.

### **5.3 Groundwater Conditions**

In the monitoring wells, based on a single March 2016 groundwater level reading, the groundwater levels were noted between 0.3 m to 6.8 m bgs. Perched groundwater may be encountered in areas of shallow cohesionless fill. The groundwater table would be expected to be found at the surface near surface water features.

### **5.4 Dewatering Assessment**

During the geotechnical investigation, no hydraulic conductivity testing was completed. A discussion of construction dewatering was included in the WSP geotechnical report using general estimates of hydraulic conductivity based on the soil descriptions encountered. Based on these values ( $10^{-5}$  cm/s and  $10^{-4}$  cm/s or higher; WSP estimated that if the excavation work was completed in 30 m segments, the dewatering effort could be maintained at less than 50 m<sup>3</sup>/day (50,000 L/day) and therefore, neither a Permit To Take Water (PTTW) nor an Environmental Activity and Sector Registry (EASR) registration would be required.

## **6.0 PHYSICAL SETTING**

The Site is situated within the Etobicoke Creek watershed within the south part of the City of Caledon in Peel Region (Figure 1). The Site is located between Mayfield Road (south) and Old School Road (north) and between Hurontario Street (northeast) and Chinguacousy Road (southwest).

The area that includes the Site generally consists of agricultural land to the north and west. Along the south and east edges of the Site consists of single-family residential homes.

### **6.1 Topography**

The proposed location of the road expansion appears to cross a local topographic high, generally located at approximate elevations of between 255 masl (at the east end of the site) and 265 masl (generally between 260 and 265 masl across the majority of the site).

Along the alignment, the topography ranges between elevations of approximately 264 masl and 255 masl based on the surveyed ground surface elevations of the WSP geotechnical boreholes drilled across the Site.

## **6.2 Surface Water Features**

The proposed construction will be situated within close proximity to Etobicoke Creek, but while the upper reaches of the main branch of Etobicoke Creek and tributaries of Credit River are present around the planned construction and these tributaries from both watersheds begin nearby and flow away from the Site, the planned construction area does not contain any creek crossings through the exact route of the Spine Road construction.

## **6.3 Physiography and Surficial Geology**

The local physiography consisted of drumlinized till plains. These are associated with the South Slope physiographic region. This physiographic region consists of till soils, with the slope smoothed and faintly drumlinized. The South Slope is cut at intervals by the valleys created by tributaries of several of the river systems of the Greater Toronto Area.

The surficial geology across the site consists of predominantly till materials with a silt to silty clay matrix, high in matrix carbonate content and clast poor. This likely corresponds to the interpreted Halton Till or equivalent.

## **6.4 Bedrock Geology**

The bedrock across the area consists of Queenston Formation shale. Bedrock is not considered a hydrogeological factor in this investigation due to the relatively shallow nature of the works to be completed. This may change depending on whether the train tracks are planned to remain as a level crossing, as they currently are at the road crossings both north and south of the proposed roadway. If either the tracks or the roadway are expected to be raised or tunneled across then the bedrock may factor into tunneling or bridge footing installation activities. Based on the findings of the WSP geotechnical report, some locations may encounter bedrock during excavations for the installation of subsurface infrastructure.

## **6.5 Stratigraphy & Hydrostratigraphy**

Based on geotechnical borehole logs prepared by WSP Canada Inc. (2016), the site appears to be covered by primarily fill material consisting of primarily silty clay/clayey silt soils with some sand and gravel. This fill extends up to 2 m below ground surface across the site.

Below the fill soils, thick sequences of till or till-like soils were noted, primarily silty clay to clayey silt, with some sequences of silty sand to sandy silt. These silty sand to sandy silt till to till-like soils were discontinuous, as they were not noted in every borehole. The till or till-like soils were noted to the bottoms of the boreholes, with thicknesses of 15 m or more in most locations.





## **6.6 Groundwater Flow**

Unconfined groundwater flow generally follows the topography, indicating a regional flow direction towards the south. The local groundwater flow direction, will be towards the nearby streams, which serves as the local groundwater discharge zone. These generally consist of tributaries of Etobicoke Creek and the Credit River, resulting in local flow towards the north-northwest and south-southeast, respectively, towards the creek channels.

## **6.7 Groundwater Quality & Dewatering Disposal**

Investigations completed in the area of the site to date have not included groundwater chemistry sampling. As the area that the proposed construction consists of agricultural land and hydraulically upgradient also consists of agricultural land use, potential groundwater quality issues that may impact dewatering disposal options are not expected beyond those associated with rural residential and agriculture land use (nitrates, pesticides, fertilizers, etc.).

As no confirmation of the presence or absence of potential groundwater quality impacts has been completed at this time, the groundwater quality will need to be confirmed to establish disposal options for any water collected during dewatering efforts during construction.

Dewatering for the project is expected to remain within the immediate vicinity and dewatering these excavations is not expected to draw water from downgradient areas. The proposed dewatering effort has the potential to draw in contaminants originating from activities upgradient of the Site, but only if a contaminant plume already exists and is already migrating towards the Site.

Any water collected during dewatering would need to be tested and potentially treated prior to disposal to confirm the appropriate disposal location and method. Options for disposal would include release to the natural environment (requiring that the discharge meets the Ontario Provincial Water Quality Objectives), local sanitary or storm sewers, if not too far removed from the Site (requiring that the discharge meets the appropriate Peel Region Sewer Use Bylaw criteria), or it could be contained and trucked offsite for treatment.

## **6.8 Impacts to Private Wells**

This area of the Region of Peel is on the edge of mature and established developments consisting of single-family residential uses. This construction will result in the local area being connected to municipal water and sewer. Currently this area is agricultural/undeveloped land, with areas to the north and west that will remain undeveloped in the near future following the completion of this construction.



A water well record search was conducted within a 1 km radius of the Site. The search returned a total of 221 wells located within this radius. The records that were provided by the MOECC were examined, as well as obtaining more detailed information from the MOECC's online interactive Water Well Record search access at: <http://www.ene.gov.on.ca/environment/en/mapping/wells/index.htm>. The locations of these records are shown in Figure 6.

Upon closer examination of the information from these sources, Amec Foster Wheeler determined that fifty-four (54) of these records contained no information and were assumed to have been abandoned, twenty-one (21) were listed as observation wells or test holes, and thirty-nine (39) were listed as abandoned. Of the remaining 107 records that identify as water supplies, many of these, particularly those located to the north-northwest (upgradient) of the construction area will remain as private supplied. The wells that are located within the construction area that are currently private wells will remain as private supplies until the land is re-developed into residential developments, which will then be serviced by municipal water and sewer. The records that appear to the south and east of the Site indicate wells that are assumed to have been abandoned as these areas are currently municipally serviced.

Based on this information, there are no private well supplies located within a 1 km radius of the proposed construction that are expected to be impacted by the construction. As a due diligence measure, a pre- and post-construction private well survey should be completed within a 500 m radius of the Site, to consist of accounts from local well owners regarding the quantity and quality of their current well supplies.

## **6.9 Surface Water Impacts**

The planned construction area does not include any creek crossings which result in no direct impacts to the local surface water due to the installation of culverts or diversions (temporary or permanent).

Additionally, the planned construction will consist of short-term excavations in relatively fine-grained soils for the purposes of installing water and sewer infrastructure, while the installation of the road itself will not require any significant excavation. The subsurface infrastructure installation may require some dewatering, but due to the nature of the soils across the Site, the dewatering effort is expected to be small and localized, such that no impacts from dewatering would be expected.

Measures should be used during construction to limit the potential for sediment to wash overland into surface water features.

## 6.10 Dewatering-Induced Settlement

As the Site currently consists of agricultural land and there are no creek crossings (i.e. no existing culverts), there are no existing structures to be impacted by settlement from dewatering. All of the dewatering and construction associated with the installation of the infrastructure would be completed by the time of the completion of the road extension and any future residential and/or commercial development. Additionally, the excavations will be of short duration and are expected to require minimal dewatering, so this combined with the relatively fine-grained nature of the overburden material to be excavated, is not expected to be sufficient to dewater the surrounding soils enough to cause soil settlement in the area of the excavations.

## 7.0 CONCLUSIONS AND RECOMMENDATIONS

Based on a review of the available information for the Site and surrounding area, Amec Foster Wheeler has made the following conclusions:

- ) The available physiographic and surficial geology mapping, as well as geotechnical borehole logs completed across the Site suggests that the subsurface soils consist of fine-grained, relatively cohesive till or till-like soils.
- ) Due to the nature of the subsurface soils and the available groundwater levels, the dewatering effort is expected to be small and according to WSP's findings, neither a PTTW nor an EASR would be required if the excavations of subsurface infrastructure across the Site were limited to excavations of up to 30 m at a time.
- ) There are no creek crossings or surface water features that are in the immediate vicinity of the Site and as such, no impacts to surface water would be expected during the completion of construction activities.
- ) Local wells found as a result of a water well record search are not expected to be active supply wells, as most local properties are connected to municipal water and sewer, or will be upon the completion of construction. Remaining wells that may be private supplies are located upgradient and are not expected to be impacted by the construction activities.
- ) The local groundwater has not been tested and therefore the local groundwater quality has not been confirmed. The upgradient land use is primarily agricultural so the presence of local contaminants is expected to be low.

Amec Foster Wheeler also has the following recommendations:

- ) As a due diligence measure, a private well survey should be completed within a 500 m radius pre-construction to establish the number of active wells that are present nearby and the quality and quantity of the water produced by these wells, as well as an assessment of the conditions of these wells. Any well complaints received during the course of the construction should be investigated by a qualified professional and recommendations

generated on the potential source of the well complaint and recommendations on how to address the issue (if required).

- ) Prior to the release of any collected groundwater discharge, the water should be held and tested to determine whether it complies with the restrictions associated with the desired discharge point.

## 8.0 CLOSURE

The information and recommendations contained in this report should be used solely for the purpose of hydrogeological investigation of the subject site.

If you should have any questions regarding this submission, please contact Kimberly Gilder at 905-568-2929 or by email [kimberly.gilder@amecfw.com](mailto:kimberly.gilder@amecfw.com), or Martin Shepley at 905-335-2353 or by email [martin.shepley@amecfw.com](mailto:martin.shepley@amecfw.com).

The Report Limitations included in Appendix B are an integral part of this report.

Sincerely,

**Amec Foster Wheeler Environment & Infrastructure,  
a Division of Amec Foster Wheeler Americas Limited**



Kimberly Gilder, B.Sc., P.Geo.  
Hydrogeologist



Martin Shepley, M.Sc., D.Phil., P.Geo.  
Associate Hydrogeologist

## 9.0 REFERENCES

Barnett, P.J., W.R. Cowan, and A.P. Morgan. 1991. Quaternary geology of Ontario, southern sheet ; Ontario Geological Survey, Map 2556, scale 1 :1,000,000.

Chapman, L.J. and D.F. Putnam. 1984. *The Physiography of Southern Ontario, 3rd Edition*. Ontario Geological Survey Special Volume 2. Accompanied by Map P.2715 (coloured), scale 1 :600,000. Ontario Ministry of Natural Resources, Toronto, Canada : 270 pp.

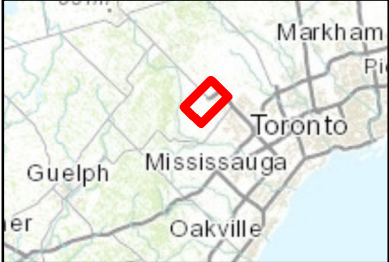
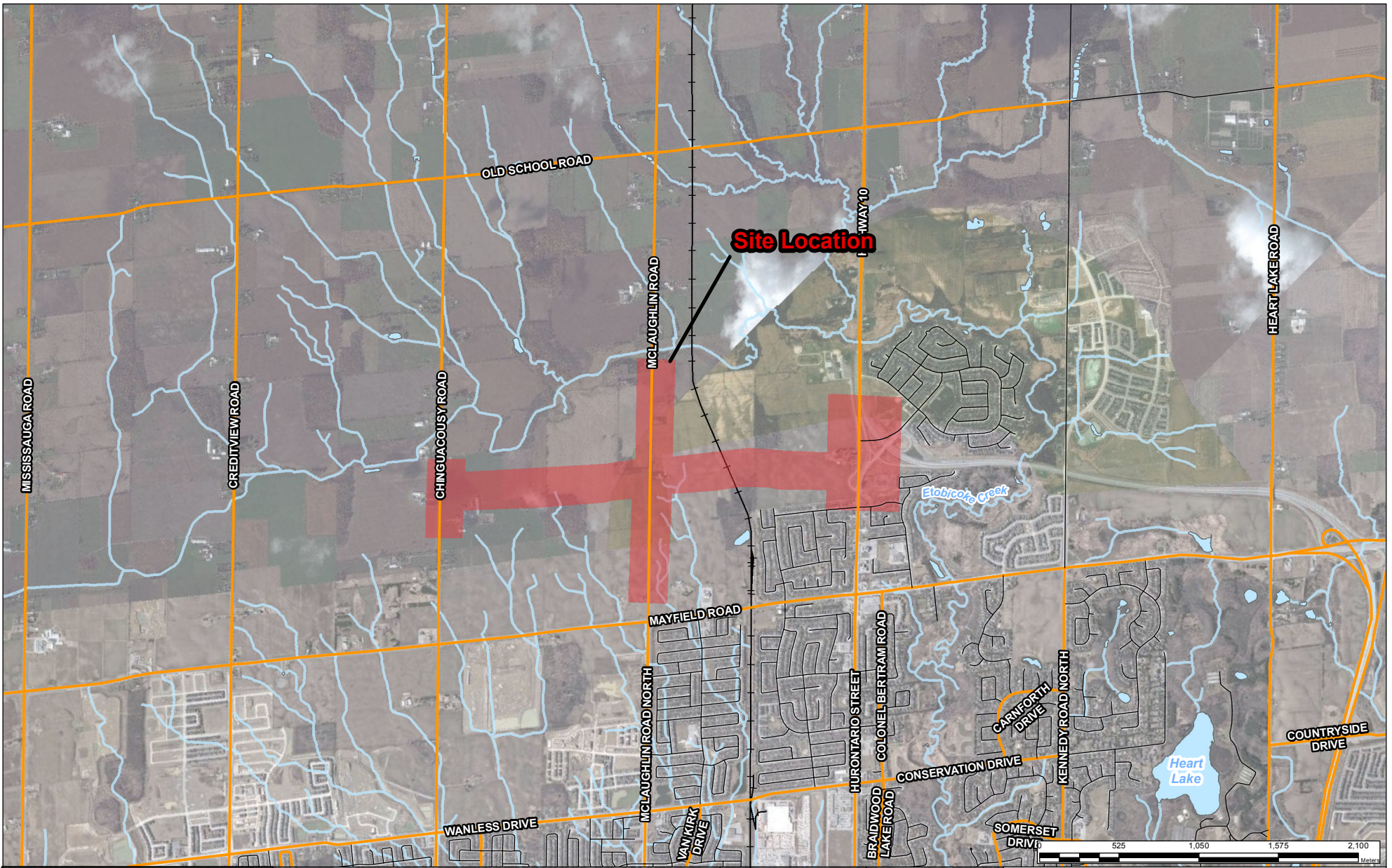
Ontario Geological Survey. 1991. Bedrock geology of Ontario, southern sheet ; Ontario Geological Survey, Map 2544, scale 1 :1,000,000.

Sharpe, D.R. 1980. Quaternary Geology of Toronto and Surrounding Area. Ontario Geological Survey Preliminary Map P.2204, Geological Series, scale 1 :100,000.

WSP Canada Inc. August 31, 2016. *Report on Geotechnical Investigation, Sanitary Trunk Sewer on Mayfield West Phase 2, Caledon, Ontario* (Final, version 1).



**FIGURES**



**LEGEND**

- Study Area
- Railway
- Waterbody
- Permanent Watercourse

**NOTES:**

LOCATION OF FEATURES ARE APPROXIMATE


This drawing should be read in conjunction with the AMEC Foster Wheeler Environment & Infrastructure Report No. TPB166090

Conditions encountered in the field may be different from the interpreted information presented on this figure.

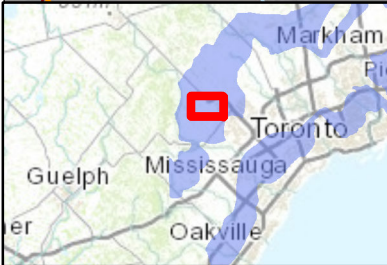
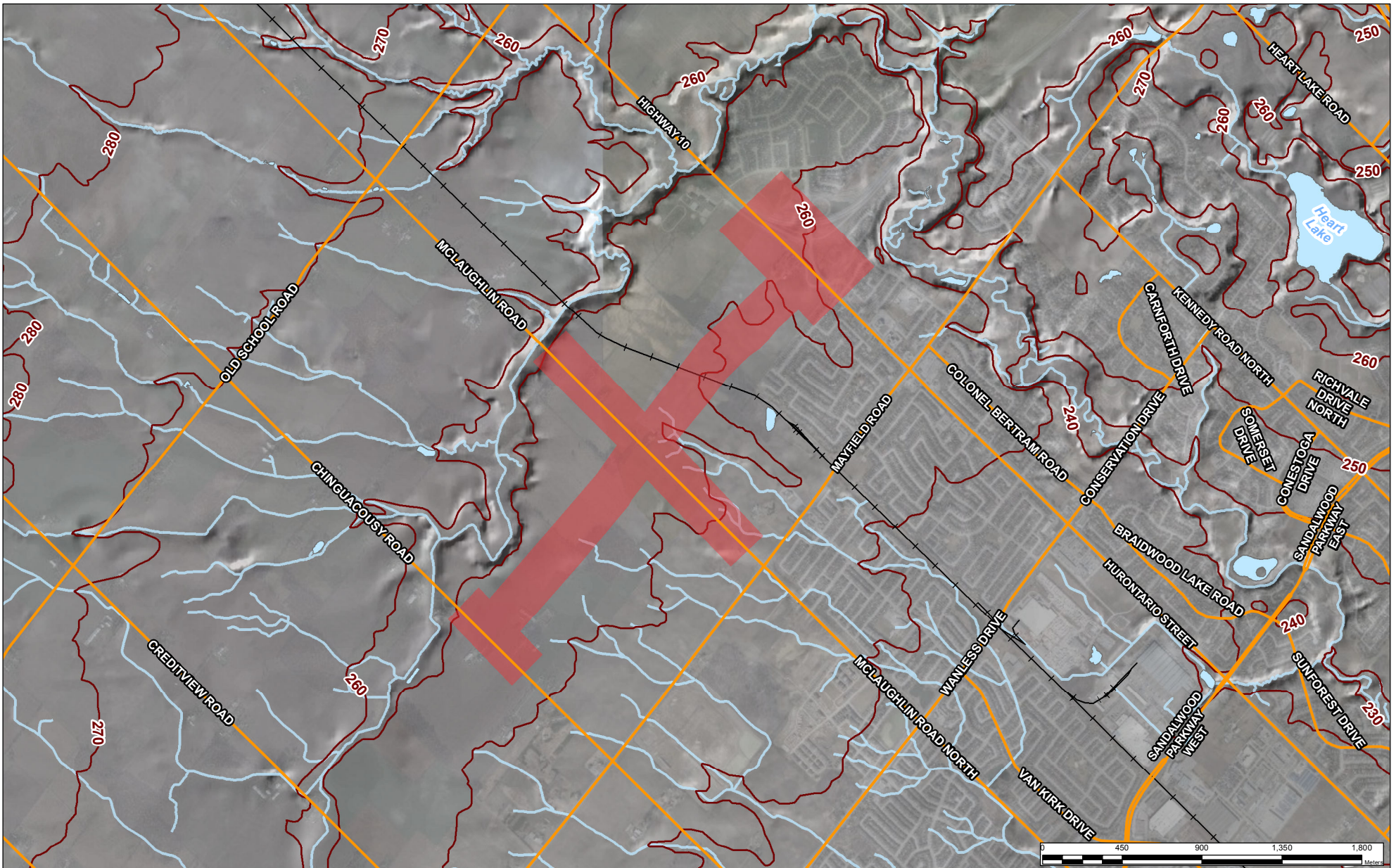
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**CLIENT:**

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Revision: A	Projection: UTM Zone 17N
SCALE: 1:34,954	



<b>HYDROGEOLOGICAL INVESTIGATION</b>	
McLaughlin Road, Brampton Ontario	
Site Location Plan	
PROJECT N°: TPB166090	FIGURE: <b>1</b>
DATE: October 2017	
<b>Amec Foster Wheeler Environment &amp; Infrastructure</b> 505 Woodward Ave., Hamilton, Ontario, L8H 6N6 tel: 905-312-0700    www.amecfw.com	



**LEGEND**

- Study Area
- Railway
- Waterbody
- Permanent Watercourse

**Topography (mASL)**  
 High : 254  
 Low : 220

**NOTES:**  
 LOCATION OF FEATURES ARE APPROXIMATE

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 SCALE: 1:30,000

**HYDROGEOLOGICAL INVESTIGATION**  
 McLaughlin Road, Brampton Ontario

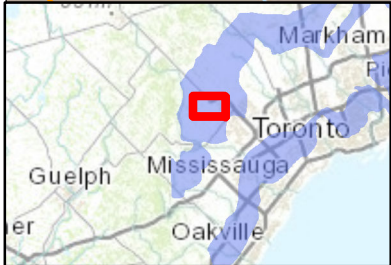
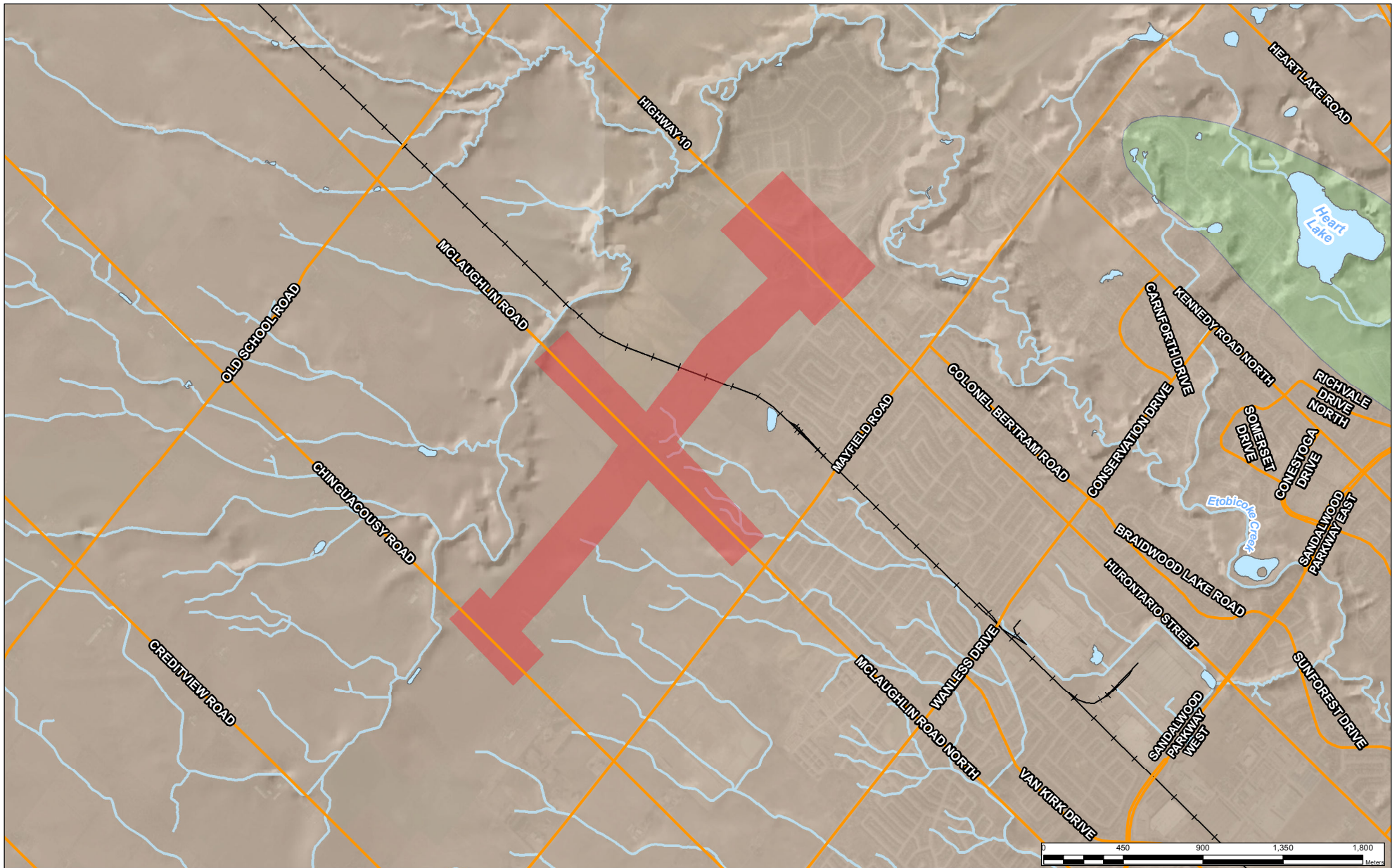
Topography and Surface Water Features

PROJECT N°: TPB166090	FIGURE: <b>2</b>
DATE: October 2017	

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**LEGEND**

- Study Area
- Railway
- Waterbody
- Permanent Watercourse

**Physiographic Unit & Description Topography (mASL)**

- Eskers
- Till Plains (Drumlinized)
- Physiographic Region
- South Slope

High : 254  
Low : 220

**NOTES:**

LOCATION OF FEATURES ARE APPROXIMATE

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Conditions encountered in the field may be different from the interpreted information presented on this figure.

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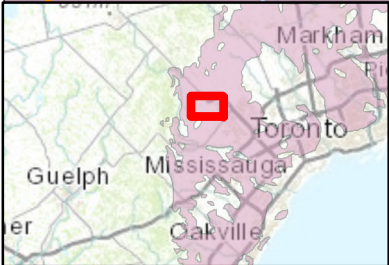
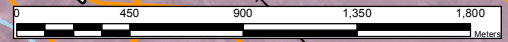
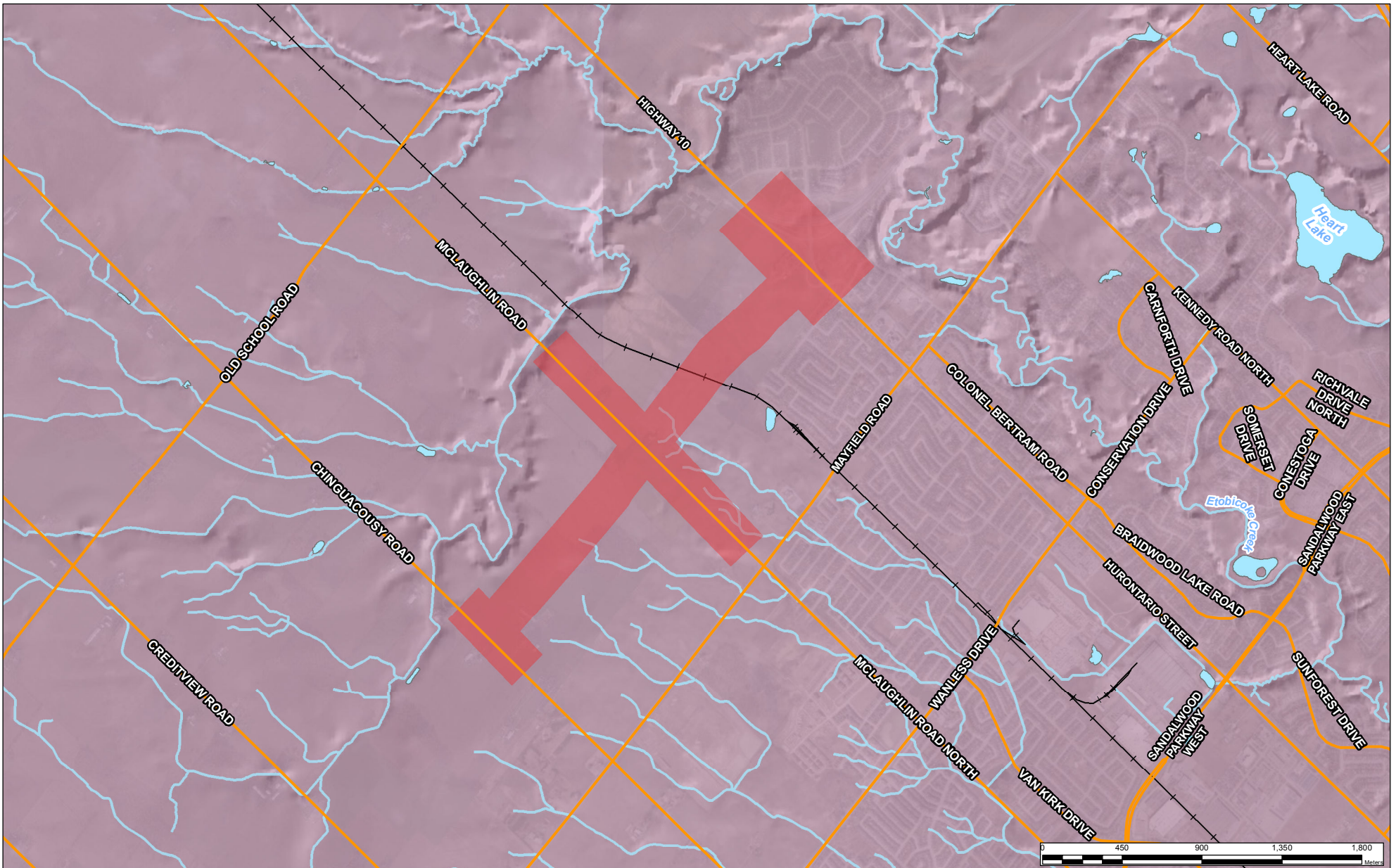
**HYDROGEOLOGICAL INVESTIGATION**  
McLaughlin Road, Brampton Ontario

Physiography

PROJECT N°: TPB166090	FIGURE: <b>3</b>
DATE: October 2017	

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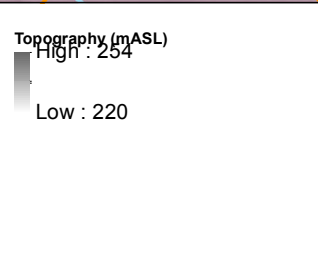


**LEGEND**

- Study Area
- Railway
- Waterbody
- Permanent Watercourse

**Quaternary Geology**

- predominantly silt to silty clay matrix, high in matrix carbonate content and clast poor



**NOTES:**

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Conditions encountered in the field may be different from the interpreted information presented on this figure.

SOURCE: Some data presented in this figure is from the Ontario open dataset: Hillshade (2012); ORN, 2012; Canvec10 (contours).

**CLIENT:**

Drawn By: LJM      Checked By: KG

Revision: A      Projection: UTM Zone 17N

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**HYDROGEOLOGICAL INVESTIGATION**

McLaughlin Road, Brampton Ontario

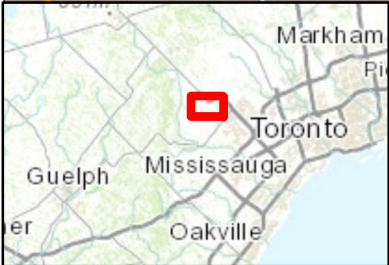
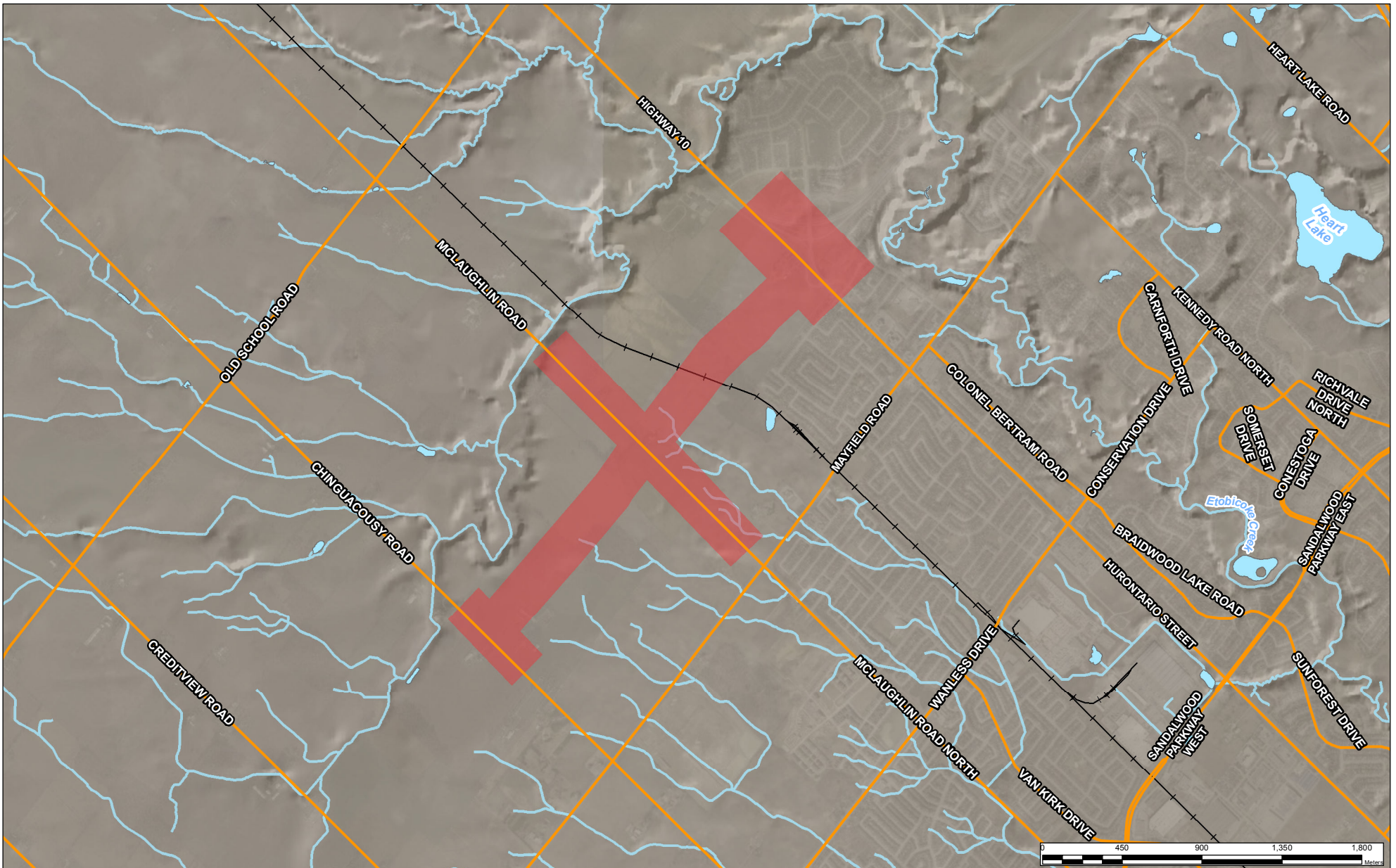
Quaternary Geology

PROJECT N°: TPB166090      **FIGURE: 4**

DATE: October 2017

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**LEGEND**

- Study Area
- Railway
- Waterbody
- Permanent Watercourse

**Geopoly**

- Queenston Formation

**Topography (mASL)**  
 High : 254  
 Low : 220

**NOTES:**

LOCATION OF FEATURES ARE APPROXIMATE

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Revision: A      Projection: UTM Zone 17N

SCALE: 1:30,000

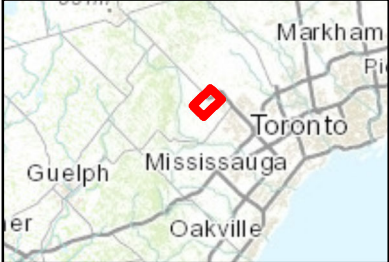
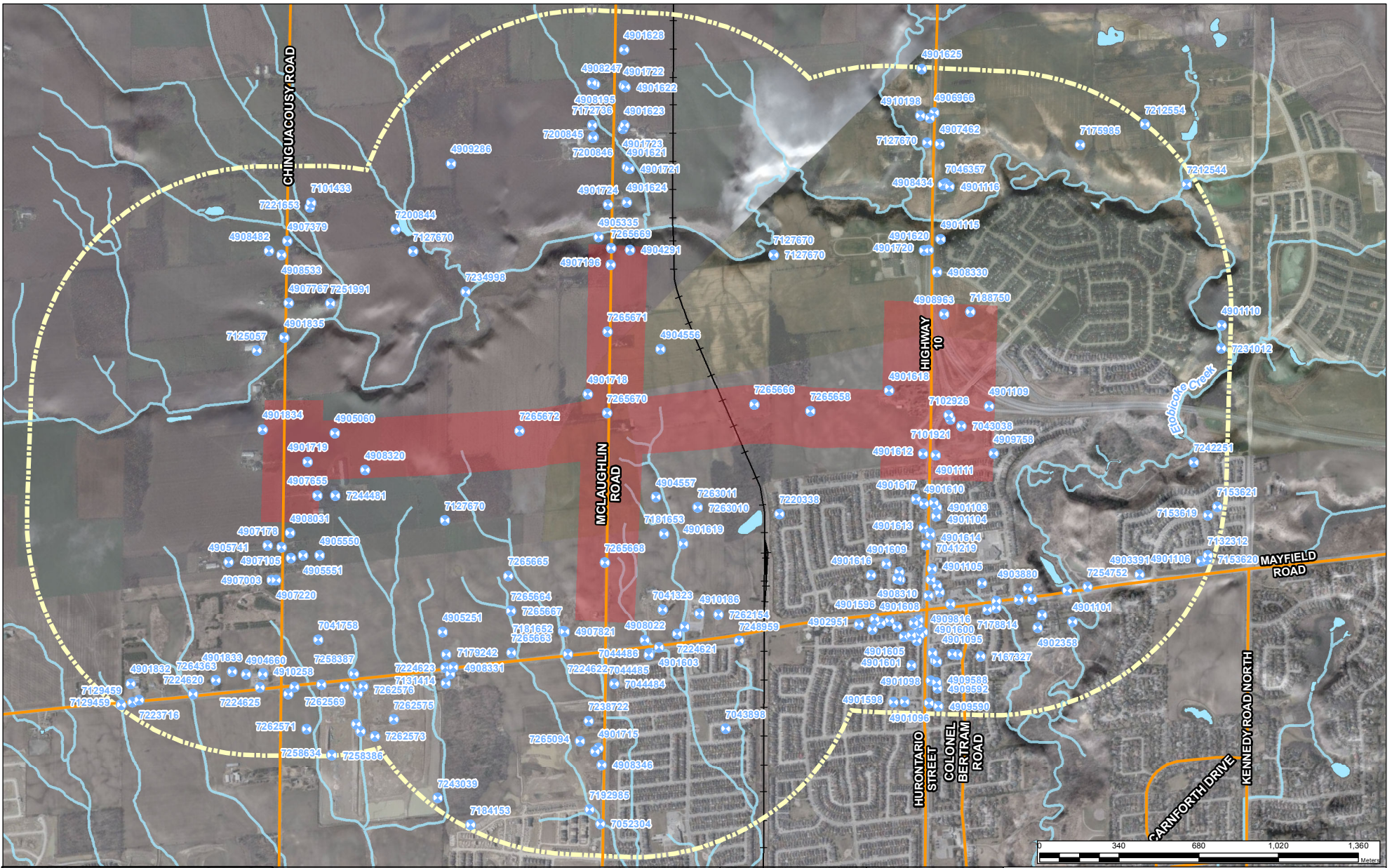
**HYDROGEOLOGICAL INVESTIGATION**  
 McLaughlin Road, Brampton Ontario

**Bedrock Geology**

PROJECT N°: TPB166090	<b>FIGURE: 5</b>
DATE: October 2017	

**Amec Foster Wheeler Environment & Infrastructure**

505 Woodward Ave., Hamilton, Ontario, L8H 6N6  
 tel: 905-312-0700      www.amefcw.com



**LEGEND**

- Study Area
- Railway
- Waterbody
- Permanent Watercourse
- 1km Buffer
- Water Well Record within 1km of Approximate Site Location

**Topography (mASL)**  
 High : 254  
 Low : 220

**NOTES:**

LOCATION OF FEATURES ARE APPROXIMATE

This drawing should be read in conjunction with the AMEC Foster Wheeler Environment & Infrastructure Report No. TPB166090

Conditions encountered in the field may be different from the interpreted information presented on this figure.

**SOURCE:** Some data presented in this figure is from the Ontario open dataset: Hillshade (2012); ORN, 2012; Canvec10 (contours).

**CLIENT:**

Drawn By: LJM	Checked By: KG
Revision: A	Projection: UTM Zone 17N
SCALE: 1:22,638	

**HYDROGEOLOGICAL INVESTIGATION**  
McLaughlin Road, Brampton Ontario

Water Well Records

PROJECT N°: TPB166090	FIGURE: <b>6</b>
DATE: October 2017	

**Amec Foster Wheeler Environment & Infrastructure**

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**APPENDICES**



**APPENDIX A**

**MOECC Water Well Record  
Search Results**



**Table A-1: Water Well Record Search Results - 1 km Radius**

McLaughlin Class EA

Water Well Record ID	Date Constructed	Easting	Northing	Final Well Status	Primary Water Use	Secondary Water Use
4901091	20-May-50	594874	4843288	Water Supply	Domestic	-
4901092	15-Oct-52	594781	4842864	Water Supply	Domestic	-
4901093	16-Apr-56	594832	4843195	Water Supply	Domestic	-
4901095	15-Jun-56	594843	4842922	Water Supply	Domestic	-
4901096	28-Jul-56	594925	4842705	Water Supply	Domestic	-
4901097	29-Mar-58	594913	4843329	Water Supply	Domestic	-
4901098	03-Apr-58	594862	4842777	Water Supply	Domestic	-
4901099	22-May-62	594860	4842937	Water Supply	Domestic	-
4901101	16-Jun-67	595101	4843388	Water Supply	Domestic	-
4901102	11-Sep-67	594821	4842852	Water Supply	Domestic	-
4901103	18-May-54	594348	4843310	Water Supply	Domestic	-
4901104	01-Nov-61	594373	4843281	Water Supply	Domestic	-
4901105	04-Jul-62	594522	4843112	Water Supply	Domestic	-
4901106	22-Feb-64	595295	4843961	Water Supply	Domestic	-
4901107	25-Jun-64	594594	4843022	Water Supply	Commerical	-
4901108	01-Jun-67	594550	4843077	Water Supply	Domestic	-
4901109	12-Jun-54	594192	4843770	Water Supply	Domestic	-
4901110	08-Jan-59	594633	4844724	Water Supply	Livestock	-
4901111	16-Jan-61	594183	4843461	Water Supply	Domestic	-
4901115	03-Nov-55	593535	4844116	Water Supply	Domestic	-
4901116	22-Nov-55	593400	4844300	Water Supply	Domestic	-
4901596	07-Jul-67	594506	4842788	Water Supply	Domestic	-
4901597	21-Feb-56	594635	4842895	Water Supply	Domestic	-
4901598	03-May-56	594816	4842599	Water Supply	Domestic	-
4901599	30-Oct-52	594698	4842853	Water Supply	Domestic	-
4901600	26-Oct-56	594690	4842898	Water Supply	Commerical	-
4901601	09-Nov-56	594757	4842764	Water Supply	Livestock	Domestic
4901602	22-Aug-57	594848	4842634	Water Supply	Domestic	-
4901603	14-Aug-62	593953	4842041	Water Supply	Domestic	-
4901605	20-May-65	594646	4842825	Abandoned-Supply	Not Used	-
4901606	26-Sep-67	594531	4842749	Water Supply	Domestic	-
4901607	19-Dec-67	594536	4842794	Water Supply	Domestic	-
4901608	15-Dec-67	594556	4842827	Water Supply	Domestic	-

**Notes:**

"-" = No information recorded in the water well record database



**Table A-1: Water Well Record Search Results - 1 km Radius**

McLaughlin Class EA

Water Well Record ID	Date Constructed	Easting	Northing	Final Well Status	Primary Water Use	Secondary Water Use
4901609	18-Sep-53	594371	4842987	Water Supply	Domestic	-
4901610	20-Jun-54	594298	4843282	Water Supply	Domestic	-
4901611	03-Jul-54	594459	4842983	Water Supply	Domestic	-
4901612	18-Dec-55	594143	4843426	Water Supply	Domestic	-
4901613	19-Sep-61	594371	4843208	Water Supply	Domestic	-
4901614	04-Apr-62	594411	4843208	Water Supply	Domestic	-
4901615	13-Oct-62	593966	4842182	Water Supply	Domestic	-
4901616	03-Dec-62	594359	4842907	Abandoned-Quality	Not Used	-
4901617	23-Aug-61	594260	4843269	Water Supply	Domestic	-
4901618	16-Nov-63	593847	4843508	Water Supply	Livestock	Domestic
4901619	26-Nov-63	593708	4842424	Water Supply	Domestic	-
4901620	06-Jul-67	593533	4844046	Water Supply	Livestock	Domestic
4901621	10-Sep-59	592383	4843367	Water Supply	Livestock	-
4901622	26-Sep-59	592135	4843600	Water Supply	Domestic	-
4901623	08-Sep-64	592249	4843484	Water Supply	Domestic	-
4901624	15-Oct-64	592492	4843263	Water Supply	Domestic	-
4901625	14-Jun-67	592957	4844563	Water Supply	Livestock	Domestic
4901628	13-Aug-62	592016	4843707	Water Supply	Domestic	-
4901715	21-Jun-61	594083	4841557	Water Supply	Domestic	-
4901717	22-Jan-64	593068	4840895	Test Hole	Not Used	-
4901718	06-Jul-59	592965	4842574	Water Supply	Domestic	-
4901719	26-Jul-62	592342	4841513	Water Supply	Livestock	-
4901720	26-Dec-58	593521	4844031	Water Supply	Livestock	Domestic
4901721	03-Jun-64	592396	4843370	Water Supply	Domestic	-
4901722	19-Nov-64	592125	4843598	Water Supply	Domestic	-
4901723	07-Jun-66	592254	4843469	Water Supply	Domestic	-
4901724	31-May-67	592443	4843198	Water Supply	Domestic	-
4901832	22-Aug-62	592498	4840313	Water Supply	Domestic	-
4901833	02-Dec-63	592762	4840659	Water Supply	Domestic	-
4901834	18-Nov-59	592110	4841471	Water Supply	Livestock	-
4901835	22-Apr-63	591891	4841809	Water Supply	Domestic	-
4902358	21-Jun-62	595015	4843263	Water Supply	Domestic	-
4902890	03-Jun-68	594405	4843213	Water Supply	Domestic	-

**Notes:**

"-" = No information recorded in the water well record database





**Table A-1: Water Well Record Search Results - 1 km Radius**

McLaughlin Class EA

Water Well Record ID	Date Constructed	Easting	Northing	Final Well Status	Primary Water Use	Secondary Water Use
4902898	11-Mar-68	594595	4842833	Water Supply	Domestic	-
4902951	23-Sep-68	594475	4842723	Water Supply	Domestic	-
4902974	08-Nov-68	594665	4842853	Water Supply	Public	-
4903391	12-Oct-69	595155	4843733	Water Supply	Domestic	-
4903880	05-Oct-72	594865	4843348	Water Supply	Domestic	-
4904046	07-Jun-72	593131	4844443	Water Supply	Domestic	-
4904136	07-Jun-73	594990	4843313	Water Supply	Domestic	-
4904291	15-Dec-73	592647	4843131	Water Supply	Domestic	-
4904556	15-May-74	593042	4842930	Water Supply	Domestic	-
4904557	17-Jun-74	593483	4842478	Water Supply	Domestic	-
4904660	19-May-75	592812	4840694	Water Supply	Domestic	-
4905060	15-Dec-76	592335	4841683	Water Supply	Livestock	-
4905251	09-Jun-77	593265	4841423	Water Supply	Irrigation	Domestic
4905335	31-Aug-77	592515	4843073	Abandoned-Quality	Domestic	-
4905535	13-Nov-78	593415	4841323	Water Supply	Domestic	-
4905550	25-Jul-78	592665	4841273	Water Supply	Domestic	-
4905551	20-Jul-78	592615	4841223	Water Supply	Domestic	-
4905741	12-Jul-80	592415	4840973	Water Supply	Domestic	-
4906966	23-Nov-88	593128	4844473	Water Supply	Domestic	-
4907003	19-Oct-88	592598	4841053	Water Supply	Domestic	-
4907073	17-Mar-87	594082	4841536	Water Supply	Domestic	-
4907105	10-Mar-89	592588	4841177	Water Supply	Domestic	-
4907178	20-Jul-89	592480	4841142	Water Supply	Domestic	-
4907196	15-Jun-89	592636	4843028	Water Supply	Domestic	-
4907220	03-Nov-89	592612	4841066	Water Supply	Domestic	-
4907379	27-Sep-90	591604	4842105	-	Domestic	-
4907462	11-Dec-90	593240	4844395	Water Supply	Domestic	-
4907655	10-Feb-92	592474	4841443	Water Supply	Domestic	-
4907767	20-Mar-93	591798	4841926	Water Supply	Domestic	-
4907821	10-Sep-93	593625	4841799	Water Supply	Domestic	-
4908022	15-Jun-93	593889	4842019	Water Supply	Domestic	-
4908031	31-May-95	592508	4841248	Water Supply	Domestic	-
4908195	06-Sep-96	592035	4843513	Water Supply	Domestic	-

**Notes:**

"-" = No information recorded in the water well record database



**Table A-1: Water Well Record Search Results - 1 km Radius**

McLaughlin Class EA

Water Well Record ID	Date Constructed	Easting	Northing	Final Well Status	Primary Water Use	Secondary Water Use
4908247	24-Jun-97	592021	4843508	-	Domestic	-
4908310	15-Jul-97	594448	4842977	Abandoned-Other	Not Used	-
4908320	08-Jan-98	592538	4841665	Water Supply	Domestic	-
4908330	10-Dec-97	593625	4844007	Abandoned-Other	-	-
4908331	12-Dec-97	593405	4841352	Water Supply	Domestic	-
4908346	04-Nov-97	594144	4841517	Recharge Well	Domestic	-
4908434	27-Jun-98	593376	4844284	Abandoned-Supply	Not Used	-
4908473	31-Aug-99	594688	4842878	Abandoned-Other	Not Used	-
4908474	31-Aug-99	594659	4842898	Abandoned-Other	Not Used	-
4908482	18-Sep-99	591579	4842019	Water Supply	Domestic	-
4908533	29-Sep-99	591629	4842046	Water Supply	Domestic	-
4908803	18-May-01	592526	4841180	Water Supply	Domestic	-
4908963	27-Mar-02	593776	4843904	Abandoned-Other	Not Used	-
4909286	10-Oct-03	591853	4842838	Water Supply	Domestic	-
4909572	16-Nov-04	594714	4843223	Observation Wells	-	-
4909588	26-Nov-04	594883	4842790	Abandoned-Other	Not Used	-
4909590	26-Nov-04	594962	4842725	Abandoned-Other	Not Used	-
4909592	26-Nov-04	594904	4842774	Abandoned-Other	Not Used	-
4909758	25-May-05	594350	4843643	Abandoned-Other	Not Used	-
4909816	20-Apr-05	594685	4843064	Observation Wells	Not Used	-
4910186	08-Mar-06	593969	4842265	Test Hole	Not Used	-
4910198	13-May-06	593096	4844420	Abandoned-Other	-	-
4910207	11-May-06	594810	4842850	Abandoned-Other	Not Used	-
4910258	27-Jun-06	592859	4840745	Water Supply	Domestic	-
4910312	05-Jul-06	592859	4840748	Abandoned-Other	-	-
4910388	01-Nov-06	594812	4843214	Abandoned-Other	-	-
7034881	21-Aug-06	594324	4843313	Abandoned-Other	-	-
7041219	12-Jan-07	594429	4843164	Observation Wells	Not Used	-
7041323	30-Dec-06	593848	4842164	Water Supply	Domestic	-
7041758	01-Feb-07	592920	4841018	Abandoned-Other	Not Used	-
7043038	03-Apr-07	594170	4843626	Observation Wells	-	-
7043898	05-May-07	594400	4842005	Abandoned-Other	Not Used	-
7044484	23-May-07	593931	4841796	Abandoned-Other	-	-

**Notes:**

"-" = No information recorded in the water well record database



**Table A-1: Water Well Record Search Results - 1 km Radius**

McLaughlin Class EA

Water Well Record ID	Date Constructed	Easting	Northing	Final Well Status	Primary Water Use	Secondary Water Use
7044485	23-May-07	593945	4841987	Abandoned-Other	-	-
7044486	23-May-07	593942	4841994	Abandoned-Other	-	-
7046357	27-Jun-07	593379	4844297	Water Supply	Domestic	-
7052303	24-Oct-07	592994	4840805	Observation Wells	Monitoring	-
7052304	24-Oct-07	594319	4841338	Observation Wells	Monitoring	-
7101433	10-Jan-07	591557	4842292	Water Supply	Domestic	-
7101921	24-Jan-08	594116	4843613	Abandoned-Other	-	-
7102926	17-Dec-07	594100	4843619	Abandoned-Other	-	-
7125057	27-May-09	591848	4841687	Water Supply	Domestic	Livestock
7127670	10-Feb-09	593088	4843557	Test Hole	Monitoring	-
7127670	09-Feb-09	592008	4842460	Test Hole	Monitoring	-
7127670	09-Feb-09	592928	4841760	Test Hole	Monitoring	-
7127670	09-Feb-09	592008	4842460	Test Hole	Monitoring	-
7127670	09-Feb-09	592008	4842460	Test Hole	Monitoring	-
7127670	12-Feb-09	593200	4844361	Test Hole	Monitoring	-
7127670	12-Feb-09	592316	4844432	Test Hole	Monitoring	-
7127670	09-Feb-09	592928	4841760	Test Hole	Monitoring	-
7127670	10-Feb-09	593088	4843557	Test Hole	Monitoring	-
7127670	12-Feb-09	592316	4844432	Test Hole	Monitoring	-
7127670	12-Feb-09	593200	4844361	Test Hole	Monitoring	-
7127670	11-Feb-09	593088	4843557	Test Hole	Monitoring	-
7127670	12-Feb-09	592316	4844432	Test Hole	Monitoring	-
7127670	11-Feb-09	593088	4843557	Test Hole	Monitoring	-
7127670	09-Feb-09	592928	4841760	Test Hole	Monitoring	-
7127670	10-Feb-09	593088	4843557	Test Hole	Monitoring	-
7127670	11-Feb-09	593088	4843557	Test Hole	Monitoring	-
7127670	12-Feb-09	593200	4844361	Test Hole	Monitoring	-
7127670	12-Feb-09	592327	4844738	Test Hole	Monitoring	-
7127670	11-Feb-09	593088	4843557	Test Hole	Monitoring	-
7127670	12-Feb-09	592327	4844738	Test Hole	Monitoring	-
7127670	12-Feb-09	592327	4844738	Test Hole	Monitoring	-
7127670	12-Feb-09	592327	4844738	Test Hole	Monitoring	-
7127670	10-Feb-09	593088	4843557	Test Hole	Monitoring	-
7127670	11-Feb-09	593088	4843557	Test Hole	Monitoring	-

**Notes:**

"-" = No information recorded in the water well record database



**Table A-1: Water Well Record Search Results - 1 km Radius**

McLaughlin Class EA

Water Well Record ID	Date Constructed	Easting	Northing	Final Well Status	Primary Water Use	Secondary Water Use
7127670	09-Feb-09	592928	4841760	Test Hole	Monitoring	-
7127670	12-Feb-09	592327	4844738	Test Hole	Monitoring	-
7127670	12-Feb-09	592327	4844738	Test Hole	Monitoring	-
7127670	10-Feb-09	593088	4843557	Test Hole	Monitoring	-
7127670	12-Feb-09	592316	4844432	Test Hole	Monitoring	-
7127670	12-Feb-09	593200	4844361	Test Hole	Monitoring	-
7127670	09-Feb-09	592008	4842460	Test Hole	Monitoring	-
7127670	09-Feb-09	592008	4842460	Test Hole	Monitoring	-
7127670	12-Feb-09	593200	4844361	Test Hole	Monitoring	-
7127670	09-Feb-09	592928	4841760	Test Hole	Monitoring	-
7127670	12-Feb-09	592316	4844432	Test Hole	Monitoring	-
7129459	15-Jul-09	592532	4840219	Test Hole	Monitoring and Test Hole	-
7129459	16-Jul-09	592535	4840221	Test Hole	Monitoring and Test Hole	-
7129459	15-Jul-09	592559	4840263	Test Hole	Monitoring and Test Hole	-
7129459	15-Jul-09	592559	4840263	Test Hole	Monitoring and Test Hole	-
7129459	16-Jul-09	592535	4840221	Test Hole	Monitoring and Test Hole	-
7129459	15-Jul-09	592532	4840219	Test Hole	Monitoring and Test Hole	-
7129459	15-Jul-09	592532	4840219	Test Hole	Monitoring and Test Hole	-
7129459	15-Jul-09	592559	4840263	Test Hole	Monitoring and Test Hole	-
7129459	16-Jul-09	592535	4840221	Test Hole	Monitoring and Test Hole	-
7131414	01-Oct-09	593431	4841280	Abandoned-Other	-	-
7132312	07-Oct-09	595298	4843999	Abandoned-Other	Not Used	-
7153619	11-Aug-10	595175	4844117	Abandoned-Other	Not Used	-
7153620	11-Aug-10	595307	4843984	Abandoned-Other	-	-
7153621	11-Aug-10	595176	4844171	Abandoned-Other	-	-
7167327	26-Jul-11	594934	4843002	-	Monitoring and Test Hole	-
7171268	06-Oct-11	594615	4843067	-	-	-
7172736	31-May-11	592152	4843385	Water Supply	Domestic	-
7175985	13-Jan-12	593659	4844824	Test Hole	Monitoring and Test Hole	-
7178814	01-Mar-12	594810	4843162	-	-	-
7179242	25-Oct-11	593345	4841367	-	-	-
7181652	24-Apr-12	593619	4841795	Abandoned-Other	Domestic	Livestock
7181653	24-Apr-12	593619	4842395	Abandoned-Other	Domestic	Livestock

**Notes:**

"-" = No information recorded in the water well record database



**Table A-1: Water Well Record Search Results - 1 km Radius**

McLaughlin Class EA

Water Well Record ID	Date Constructed	Easting	Northing	Final Well Status	Primary Water Use	Secondary Water Use
7184153	15-Jun-12	593939	4840937	Observation Wells	Monitoring	-
7188750	04-May-12	593846	4843992	-	-	-
7192985	16-Oct-12	594244	4841347	-	-	-
7198988	29-Jan-13	594638	4842919	-	-	-
7200844	28-May-12	591889	4842472	Abandoned-Supply	Not Used	-
7200845	28-May-12	592192	4843355	Abandoned-Supply	Not Used	-
7200846	28-May-12	592192	4843349	Abandoned-Supply	Not Used	-
7200893	11-Mar-13	594434	4843002	Abandoned-Other	-	-
7212544	15-Nov-13	594096	4845034	Abandoned-Other	-	-
7212554	15-Nov-13	593789	4845084	Abandoned-Other	-	-
7220338	10-Apr-14	593901	4842807	Water Supply	Domestic	-
7221653	23-May-14	591567	4842275	Abandoned-Other	-	-
7223716	01-Feb-14	592573	4840290	Test Hole	Test Hole	-
7224620	04-Feb-13	592715	4840473	-	-	-
7224621	01-Feb-14	593965	4842137	-	-	-
7224622	04-Feb-14	593703	4841743	-	-	-
7224623	04-Feb-14	593382	4841326	-	-	-
7224625	04-Feb-13	592892	4840697	-	-	-
7231012	16-Oct-14	594702	4844653	Observation Wells	Monitoring	-
7234998	11-Nov-14	592287	4842502	-	-	-
7238722	09-Nov-14	593969	4841607	-	-	-
7242251	-	-	-	-	-	-
7243039	-	-	-	-	-	-
7244481	-	-	-	-	-	-
7248959	-	-	-	-	-	-
7251991	-	-	-	-	-	-
7254752	-	-	-	-	-	-
7254753	-	-	-	-	-	-
7254942	-	-	-	-	-	-
7258386	-	-	-	-	-	-
7258387	-	-	-	-	-	-
7258388	-	-	-	-	-	-
7258634	-	-	-	-	-	-

**Notes:**

"-" = No information recorded in the water well record database



**Table A-1: Water Well Record Search Results - 1 km Radius**

McLaughlin Class EA

Water Well Record ID	Date Constructed	Easting	Northing	Final Well Status	Primary Water Use	Secondary Water Use
7258635	-	-	-	-	-	-
7258636	-	-	-	-	-	-
7259060	-	-	-	-	-	-
7262154	-	-	-	-	-	-
7262569	-	-	-	-	-	-
7262570	-	-	-	-	-	-
7262571	-	-	-	-	-	-
7262572	-	-	-	-	-	-
7262573	-	-	-	-	-	-
7262575	-	-	-	-	-	-
7262576	-	-	-	-	-	-
7263010	-	-	-	-	-	-
7263011	-	-	-	-	-	-
7264363	-	-	-	-	-	-
7265094	-	-	-	-	-	-
7265658	-	-	-	-	-	-
7265663	-	-	-	-	-	-
7265664	-	-	-	-	-	-
7265665	-	-	-	-	-	-
7265666	-	-	-	-	-	-
7265667	-	-	-	-	-	-
7265668	-	-	-	-	-	-
7265669	-	-	-	-	-	-
7265670	-	-	-	-	-	-
7265671	-	-	-	-	-	-
7265672	-	-	-	-	-	-

**Notes:**

"-" = No information recorded in the water well record database



**APPENDIX B**  
**Report Limitations**



**Amec Foster Wheeler Environment & Infrastructure,  
a Division of Amec Foster Wheeler Americas Limited**

**REPORT LIMITATIONS**

The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environmental aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the Geotechnical Engineer be retained during the construction to confirm that the subsurface conditions across the site do not deviate materially from those encountered in the test holes.

The design recommendations given in this report are applicable only to the project described in the text, and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, it is recommended that Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited be retained during the final design stage to verify that the design is consistent with Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited's recommendations, and that assumptions made in Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited's analysis are valid.

The comments made in this report relating to potential construction problems and possible methods of construction are intended only for the guidance of the Designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The Contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices. No other warranty is expressed or implied.

The benchmark and elevations mentioned in this report were obtained strictly for use by Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited in the geotechnical report. They should not be used by any other party for any other purpose.

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. Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.