

## Ontario Ministry of Transportation (MTO)

# Groundwater Existing Environmental Conditions Study

Hanlon Expressway / Wellington Road 34 Midblock Interchange, GWP 3059-20-00

#### Prepared by:

AECOM Canada Ltd. 105 Commerce Valley Drive West, 7<sup>th</sup> Floor Markham, ON L3T 7W3 Canada

T: 905.886.7022 F: 905.886.9494 www.aecom.com

#### Prepared for:

Ministry of Transportation 159 Sir William Hearst Avenue 7<sup>th</sup> Floor, Major Projects Office Toronto, ON M3M 0B7

 Date:
 June 2021

 Project #:
 60541071

#### **Distribution List**

# Hard Copies	PDF Required	Association / Company Name
	$\checkmark$	Ontario Ministry of Transportation (MTO)
	$\checkmark$	AECOM Canada Ltd.

## **Revision History**

Rev #	Date	Revised By:	Revision Description
Draft	2021-05-20	Peter Moffat	Draft report
Final	2021-06-08	Sergiy Tchernikov	Final report
Final	2021-06-23	Sergiy Tchernikov	Final report

## **Statement of Qualifications and Limitations**

The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("AECOM") for the benefit of the Client ("Client") in accordance with the agreement between AECOM and Client, including the scope of work detailed therein (the "Agreement").

The information, data, recommendations and conclusions contained in the Report (collectively, the "Information"):

- is subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the "Limitations");
- represents AECOM's professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to AECOM which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

AECOM shall be entitled to rely upon the accuracy and completeness of information that was provided to it and has no obligation to update such information. AECOM accepts no responsibility for any events or circumstances that may have occurred since the date on which the Report was prepared and, in the case of subsurface, environmental or geotechnical conditions, is not responsible for any variability in such conditions, geographically or over time.

AECOM agrees that the Report represents its professional judgement as described above and that the Information has been prepared for the specific purpose and use described in the Report and the Agreement, but AECOM makes no other representations, or any guarantees or warranties whatsoever, whether express or implied, with respect to the Report, the Information or any part thereof.

Without in any way limiting the generality of the foregoing, any estimates or opinions regarding probable construction costs or construction schedule provided by AECOM represent AECOM's professional judgement in light of its experience and the knowledge and information available to it at the time of preparation. Since AECOM has no control over market or economic conditions, prices for construction labour, equipment or materials or bidding procedures, AECOM, its directors, officers and employees are not able to, nor do they, make any representations, warranties or guarantees whatsoever, whether express or implied, with respect to such estimates or opinions, or their variance from actual construction costs or schedules, and accept no responsibility for any loss or damage arising therefrom or in any way related thereto. Persons relying on such estimates or opinions do so at their own risk.

Except (1) as agreed to in writing by AECOM and Client; (2) as required by-law; or (3) to the extent used by governmental reviewing agencies for the purpose of obtaining permits or approvals, the Report and the Information may be used and relied upon only by Client.

AECOM accepts no responsibility, and denies any liability whatsoever, to parties other than Client who may obtain access to the Report or the Information for any injury, loss or damage suffered by such parties arising from their use of, reliance upon, or decisions or actions based on the Report or any of the Information ("improper use of the Report"), except to the extent those parties have obtained the prior written consent of AECOM to use and rely upon the Report and the Information. Any injury, loss or damages arising from improper use of the Report shall be borne by the party making such use.

This Statement of Qualifications and Limitations is attached to and forms part of the Report and any use of the Report is subject to the terms hereof.

AECOM: 2015-04-13 © 2009-2015 AECOM Canada Ltd. All Rights Reserved.

## **Authors**

**Report Prepared By:** 

Original Signed By

Peter Moffat, M.Eng., P.Eng. Hydrogeologist

**Report Approved By:** 

Original Signed By

Sergiy Tchernikov, M.Sc., P.Geo. Senior Environmental Scientist/Hydrogeologist Senior Project Manager

## **Table of Contents**

			page
1.		Objective and Scope	<b>1</b>
	1.1		
2.	Stu	dy Area Description	4
	2.1	Site Location and Study Area Limits	4
	2.2	Current Land Use	4
_	2.3	Significant Environmental Features and Site Sensitivity	4
3.	Phy	sical Settings	7
	3.1	Physiography, Topography and Drainage	7
	3.2	Geology	7
		5.2.1 Quaternary and bedrock Geology	1
4.	Hyd	lrogeology	10
	4.1	Overburden and Bedrock Aquifers	10
	4.2	Groundwater Table Elevations and Groundwater Flow	10
	4.3	Groundwater Recharge and Discharge Conditions	11
	4.4 4.5	Groundwater Vulnerability to Contamination	11
	4.5	Permit to Take Water Records	13
	4.7	Municipal Wells and Wellhead Protection Areas (WHPA)	
	4.8	Surface Water Intakes	15
5.	Cor	ntaminant Inventory Review	16
6.	Drir	nking Water Source Protection	17
	6.1	Background	17
	6.2	Threats to Drinking Water	17
		6.2.1 Handling and Storage Fuel	
		6.2.2 Application of Road Salt	17
7	Pre	liminary Assessment of Potential Groundwater Impacts	19
••	7 1	Temporary and Permanent Construction Impacts	10
	1.1	7.1.1 Potential Impacts to Groundwater Recharge and Discharge	
		7.1.2 Construction below Groundwater Table and Dewatering	19
	7.2	Likelihood of Release of Contaminants	20
		7.2.1 Fuel Spills	20 20
		7.2.3 Commercial Fertilizer	20
0	Dat	ontial Water Well Impacts	24
υ.	FUL	ธาณลา พังลเฮา พังธา กกษุลธเจ	<b>∠ I</b>

9.	Conclusions and Recommendations	22
10.	Limiting Conditions	24
11.	References	25

## **List of Figures**

Figure 1:	Study Area	2
Figure 2:	Natural Environment and Built Features	6
Figure 3:	Quaternary Geology	8
Figure 4:	Bedrock Geology	9
Figure 5:	Highly Vulnerable Aquifers and Significant Groundwater Recharge Areas	12

## List of Tables

Table 1:	Summary of Permit to Take Water Records	. 15
----------	---	------

## Appendices

- Appendix A. Summary of Existing MECP Water Wells and Active PTTW Records
- Appendix B. Door-to-Door Well Survey (AECOM, 2020)

# 1. Introduction

AECOM Canada Ltd. (AECOM) has been retained by the Ontario Ministry of Transportation (MTO) to undertake a Groundwater Existing Conditions Study under Class Environmental Assessment (EA) for Provincial Transportation Facilities (2000) for improvements to Highways 6 and 401 in the Town of Puslinch, Wellington County, and the City of Hamilton (GWP 3042-14-00). The planned transportation improvements will provide a better connection between the Highways 6 and 401 corridors which will reduce road congestion, collision potential and associated costs and encourage the utilization of Hanlon Expressway (north of Highway 401), which will support municipal planning initiatives.

The first phase of implementing the GWP 3042-14-00 improvements will include the improvements along Hanlon Expressway north of Highway 401 and henceforth referred to as the Hanlon Expressway / Wellington Road 34 Midblock Interchange project (GWP 3059-20-00), which included the new Wellington Road 34 flyover structure at Hanlon Expressway, the new interchange on Hanlon Expressway midway between Wellington Road 34 and Maltby Road, and other associated connecting roadways.

The above noted project, the Hanlon Expressway / Wellington Road 34 Midblock Interchange project, is the subject of this report.

The objective of the Groundwater Existing Environmental Conditions Study was to establish baseline of groundwater environmental conditions prior to the start of the construction activities for the project.

The Study Area location is presented in Figure 1.

### 1.1 Objective and Scope

The objective of this Groundwater Existing Environmental Conditions Study was to:

- Evaluate the local hydrogeological conditions within the Study Area (defined in **Section 2**);
- Identify potential impacts from the highway planning and design work to the local hydrogeology within the Study Area;
- Identify existing and potential drinking water threats within the Study Area and potential impacts from the proposed highway work to the existing drinking water wells located within the Study Area, if present; and,
- Recommend measures to mitigate the identified potential impacts.

The Study has been conducted in accordance with the proposed work plan (prepared by AECOM and approved by MTO). It should be noted that this Study was completed as a desktop review study only as per the proposed/approved work plan. Field inspections or investigations for subsurface investigations involving drilling and monitoring wells were not part of this assignment.

The work scope for this assessment generally follows MTO's *Environmental Reference for Highway Design* (ERD), *Environmental Standards and Practice User Guide, Section 3.3 Groundwater*, dated June 2013 (the *Guide*). The purpose of the *Guide* is to provide guidance to managing the typical hydrogeological impacts faced in transportation project design with respect to groundwater.



by controls in 20,470 dots (20,644) 07,1400.CAD C (31830.0492) (615.Graphics) 920-ENVIDe sign/01\_ Reports/Hydro Note structure and the form of the structure and The scope of work of the previously completed water well survey (AECOM, 2020) consisted of the identification of all MECP record water wells and unregistered water wells located within the Study Area, and testing (i.e., groundwater level measurement and pumping test) and sampling of the potable water wells where access was granted.

#### 1. Records Review

- Review of physiographic, geological and hydrogeological maps and reports to identify the general topography, geology and hydrogeology within the Study Area to understand the general condition and dynamics of the groundwater;
- Review of the Ministry of the Environment, Conservation and Parks (MECP) Water Well Records to obtain any relevant information on the construction of wells, depth to bedrock, static groundwater level, geological/hydrogeological units and ground surface elevation;
- Review of official plans, watershed plans and studies from local municipalities and conservation authorities; and
- Review of source protection assessment reports and source protection plans developed by Source Protection Committees.

#### 2. Reporting

Compilation of a report consisting of interpretation and assessment of collected data, evaluation
of potential road construction impacts to the local groundwater aquifer systems, and
recommendations of measures to mitigate those potential impacts.

# 2. Study Area Description

## 2.1 Site Location and Study Area Limits

The limits for the Groundwater Existing Environmental Conditions Study consisted of a 2.5 km stretch of Concession Road 7 and the Hanlon Expressway, Puslinch, Ontario, between Maltby Road West / Concession Road 4 and Wellington Road 34, with an approximate 2.0 km stretch of Wellington Road 34, slightly east of Sideroad 20 North to approximately 390 m east of Concession Road 7, presented in **Figure 2**. The Study Area for the Groundwater Existing Conditions Study includes the Project limits of work (Site) and a 300 m buffer zone from the limits of work. The Site and the Study Area are mainly located within the Township of Puslinch with a small northern portion of the Study Area extending into the City of Guelph.

## 2.2 Current Land Use

A review of Google Images (Google Earth Pro, 2020 Image) indicates that the land use within the Study Area is predominantly agricultural. A small area of residential properties is located east of Highway 6 North and south of Wellington Road 34. As indicated on Figure 2, a large proportion of the forested area situated near Wellington Road 34 and Highway 6 North is considered Provincially Significant Wetland based on Ministry of Natural Resources and Forestry Mapping.

As stated previously, the majority of the Study Area is located within the Township of Puslinch. According to the Township of Puslinch Zoning By-law (2018), the land uses within the Township of Puslinch component of the Study Area include "Agricultural", "Rural Residential", "Open Space", "Natural Environment" (with and without "Natural Environmental Protection"), "Future Development" and "Industrial". The areas identified as "Natural Environment" with "Natural Environmental Protection" correspond to the Greenlands designation in the County Official Plan, indicating that a physical feature within the "Natural Environment" area may require further review or permissions prior to development approvals or the issuance of a building permit (The Corporation of the County of Wellington, 2021).

The northwest edge of the Study Area encroaches on the City of Guelph by approximately 500 m. According to the City of Guelph Zoning By-law, the land uses within this portion of the Study Area include "Industrial", "Urban Reserve", "Wetland" and "Conservation Land" (City of Guelph, 2020).

## 2.3 Significant Environmental Features and Site Sensitivity

According to the natural heritage information available from the Ministry of Natural Resources and Forestry website (Make a Map, Natural Heritage Areas, accessed May 2021), the Study Area is situated outside of the Green Belt Plan Designation Area. The Study Area does not include any Area of Natural and Scientific Interest (ANSI). The Study Area is not located within the Niagara Escarpment Plan (NEP) or Oak Ridges Moraine Conservation Plan (ORM) areas.

Provincially Significant Wetlands (PSW) are observed throughout the Study Area, with the majority of them situated in the Wellington Road 34 and Highway 6 intersection area, stretching from west to east at the southern limits of the Site. PSW are also present in a minor capacity at the northern limits of the Study Area, just east of Maltby Road West and Crawley Road.

Small sections of unevaluated wetlands are observed at several locations within the Study Area, with the majority of them being situated in the vicinity of the intersection of Wellington Road 34 and Sideroad 20 North.

In reviewing the Official Plan for County of Wellington, there are additional significant natural features within the Study Area identified within the Greenlands System (The Corporation of the County of Wellington, 2021). The Greenlands System includes areas/features of Wellington's natural heritage or areas in which natural or humanmade conditions may pose a threat to public safety, such as wetlands, floodplains or hazardous lands etc. The purpose of the Greenlands System is to protect and enhance the natural heritage of the County of Wellington. Greenlands System is to be maintained or enhanced, with activities that will diminish or degrade the essential functions of the Greenlands System being prohibited. The "Core Greenlands", which represent the Greenlands with the greatest sensitivity, are generally present within the Study Area within the same footprint as the PSWs. "Greenlands" (i.e., Greenlands which are not considered "Core") are present within the Study Area in the outer edges of the "Core Greenlands", as well as on the eastern side of Concession Road 7, just south of Maltby Road.

The key natural features and built environment within the Study Area are provided in Figure 2.





# 3. Physical Settings

## 3.1 Physiography, Topography and Drainage

According to the Physiography of Southern Ontario (Chapman and Putnam, 1984) and "Map 2226-Physiography of South Central Southern Ontario" (Ontario Ministry of Natural Resources (OMNR), 1972), the Study Area is located within one (1) physiographic region identified as the Horseshoe Moraines, with landforms consisting of Till Moraines.

According to the topographic map for the area

(https://www.lioapplications.lrc.gov.on.ca/MakeATopographicMap/index.html?viewer=Make\_A\_Topographic\_Map. MATM&locale=en-CA, accessed April 21, 2021), the ground surface within the Study Area is generally undulating, with ground surface elevations ranging from greater than 345 mASL (close to the Guelph/Puslinch boundary) to less than 310 mASL (on the south side of Wellington Road 34).

The Study Area is situated within the Grand River watershed, which falls under the jurisdiction of the Grand River Conservation Authority (GRCA). The Grand River watershed is considered to be within the Grand River Source Protection Area (SPA), which is within the Lake Erie Source Protection Region (SPR).

Regional groundwater flow within the Grand River watershed is southerly towards the Lake Erie based on the groundwater flow map covered in the Grand River Assessment Report SPA (LESPC, 2021). Locally, surface water runoff and groundwater flow are influenced by ground surface topography, flowing from elevated areas to the valleys, including towards local creeks within the PSW.

## 3.2 Geology

#### 3.2.1 Quaternary and Bedrock Geology

According to the "Quaternary Geology of Ontario, Southern Sheet" (Ontario Geological Survey, Map 2556, Scale 1:1,000,000), the predominant quaternary deposit within the Study Area is sandy silt to silt till (Wentworth Till). Glaciofluvial ice-contact deposits comprising gravel and sand minor till, including esker, kame, end moraine, ice-marginal delta and subaqueous fan deposits, are present in the northeastern portion of the Study Area, east of Highway 6 North between Wellington Road 34 and Maltby Road (**Figure 3**).

According to the "Bedrock Geology of Ontario, Southern Sheet" (Ontario Geological Survey's, Ministry of Northern Development and Mines, Map 2544) and available MECP well records, underlying the overburden deposits within the Study Area is sandstone, shale, dolostone and siltstone of the Guelph Formation (**Figure 4**).

Based on the MECP well records, the overburden thickness or depth to the bedrock in the vicinity of the Study Area range from approximately 5.5 to 42.7 m.



1-2-2	eigus	Bramptos
Elmira	Roci	kwood Mississ
SLR.	Guelph	
Kitchener		Oakville
THE REAL	×C	
1 A	Cambridge	Burlington
1	THE	O Hamilton
	ad	
Legei	iu	
——— F	Proposed Alig	gnment
F	reeway	
<u> </u>	/lajor Road	
——— F	Ramp	
(	Other	
v	Vatercourse	
٧	Vaterbody	
	/lunicipality B	Boundary
	Study Area	
1	4: Wentwortl	h Till
2	2: Glaciofluv	rial Ice
2	23: Glaciofluv	rial Outwash deposits
		771 530 Ou
0 L_1	100 200 300	0 400 500 600 700  <i>I</i> etres
Groundwat	er Existing E	Environmental Conditions
Study, Han Midblo	ck Interchar	nge, GWP 3059-20-00
	Quaternar	y Geology
Jun, 2021	1:12,500	Datum: NAD 1983 UTM Zone 17N Source: MNRF, MOECC, NRC, MNDM (EDS014-REV)
P#: 60541071	when printed 11 x1/"	0 29 29 20 20 20 20 20 20 20 20 20 20 20 20 20
AEC	COM	Figure 3
This drawing has b used, reproduced and its client, as re AECOM accepts r party that modifies	been prepared for the or relied upon by the equired by law or for to responsibility, and this drawing withou	ne use of AECOM's client and may not be nird parties, except as agreed by AECOM use by governmental reviewing agencies. d denies any liability whatsoever, to any t AECOM's express written consent.



# 4. Hydrogeology

## 4.1 Overburden and Bedrock Aquifers

A review of the MECP well records indicates that the overburden deposits underlying the central and north section of the Study Area include a mixture of clay, gravel and sand. In the southwest corner of the site, MECP well records indicate overburden consisting of alternating layers of predominantly clay and sand material. Some of these areas are identified as having predominantly coarse-grained material (i.e., sand or gravel) at ground surface. Within the rural residential area east of Highway 6 and south of Wellington Road 34, overburden material at ground surface is typically comprised predominantly of fine-grained material. This rural residential area is located within a valley.

A shallow overburden aquifer is observed within the sand deposits close to the ground surface or in sand/gravel layers at a shallow depth within the fine-textured deposit; however, this shallow overburden aquifer is not located consistently throughout the Study Area. Of the available MECP water supply well records within the Study Area where the screened material is identified, only 17% are screened in the shallow overburden aquifer. The majority (83%) of available MECP water supply well records indicate screening within the deep bedrock aquifer.

The majority of the Study Area is located within the Township of Puslinch, with a small area at the northern limits of the Study Area located in the City of Guelph. Potable water within the Township of Puslinch is dependant on private well water. The Study Area located within the City of Guelph is dependant on private well water. According to the MECP well records, there are no municipal supply wells located within the Study Area limit; a large number (i.e., 67) of private water wells were identified within the Study Area. Detailed information on the MECP well record review within the Study Area is provided in **Section 4.5**.

## 4.2 Groundwater Table Elevations and Groundwater Flow

Groundwater flow is controlled by the permeability and porosity of the soil / rock material and by the existing hydraulic gradients. In general, the shallow groundwater flow within the overburden deposits is associated with the surface topography and conveyed to topographic lows, wetlands, and surface watercourses. The deeper aquifer systems, including bedrock aquifer, tend to be more uniform and are less influenced by topographic variations. Vertically, groundwater flow in the shallow aquifer will travel downwards towards the deeper aquifer system. Variations to the flow direction will change depending on proximity to surface watercourses and subsurface geology.

As discussed earlier in **Section 4.1**, there are two (2) major aquifer systems in the vicinity of the Study Area: the shallow overburden aquifer and the deep bedrock aquifer. The groundwater table and flow within the shallow overburden aquifer usually follows the ground topography, flowing from elevated areas to low-lying areas. Based on the regional groundwater flow map provided in the Source Protection Assessment Report, the regional groundwater flow in the vicinity of the Study Area is southerly towards Lake Erie.

Based on the MECP well records, the static groundwater levels in four (4) overburden water supply well records ranged from approximately 8.5 to 15.5 m below ground surface (bgs) within the Study Area. One (1) overburden observation well record indicated a static groundwater level of 0.9 m bgs. A review of twenty (20) bedrock water supply well records located in the Study Area indicated that the static groundwater levels ranged from 0.6 to 22.3 m bgs. Detailed discussions of the water levels obtained from the MECP well records are provided in **Section 4.5**.

## 4.3 Groundwater Recharge and Discharge Conditions

Recharge areas are characterized by permeable soils exposed at the ground surface, such as sand or gravel, which allows rainwater to seep easily into the ground to recharge the underlying aquifer. A recharge area is considered significant when it helps maintain the water level in an aquifer that supplies a community with drinking water or supplies groundwater recharge to a cold-water ecosystem that is dependent on this recharge to maintain its ecological function (MECP, 2007).

The presence of fine-textured overburden soil of considerable thickness limits the groundwater recharge ability, especially for the deep overburden and bedrock aquifers. Higher recharge rates are expected in the areas where coarse-textured soil (i.e., sand and gravel) are present at the ground surface and where the overburden aquifers are shallow. As per the Significant Groundwater Recharge Areas (SGRA) mapping completed as part of the Source Protection Assessment Report, SGRAs are present throughout the Study Area. The majority of the site is located within the Medium SGRA Vulnerability Level, while the northern portion of the Study Area is located within the Low SGRA Vulnerability Level. The southern edge of the Study Area is located just within the High SGRA Vulnerability Level. A portion of the Study Area located within the large PSW at the intersection of Wellington Road 34 and Highway 6 is not within an SGRA.

The SGRAs present in the Study Area with their vulnerability levels, as obtained from the Source Protection Information Atlas of MECP, are presented in **Figure 5**.

Typically, groundwater discharges from the groundwater system to the surface as springs, seeps or upwellings. Groundwater discharge typically occurs along surface water bodies, streams and wetlands. Within the Study Area, groundwater discharge likely occurs within the wetlands as well as the water courses.

## 4.4 Groundwater Vulnerability to Contamination

Aquifer susceptibility is a measure of how easy and how fast contamination at the ground surface reaches the underlying production aquifers. The degree of groundwater susceptibility largely depends on the presence or absence of permeable surficial materials, the depth to the water table and location relative to surface water features and water wells. Generally, aquifer susceptibility is higher in areas characterized as having a shallow aquifer system and overlain by permeable surficial soil deposits. Conversely, the vulnerability of the aquifer will typically be lower where a greater thickness of fine-grained lower permeability soils is observed to cover the aquifer.

A Highly Vulnerable Aquifer (HVA) is defined as an aquifer on which external sources have or are likely to have a significant adverse effect, and includes the land above the aquifer (*Ontario Regulation 287/07*). In general, a HVA consists of source granular aquifer materials or fractured rock that have a high permeability and are exposed near the ground surface with a relatively shallow water table.

Considering the general presence of relatively fine-textured overburden deposits of considerable thickness based on a review of available MECP water well records, the aquifers within the Study Area are generally considered to have a low to medium vulnerability for contamination. Higher vulnerability is expected in the areas where coarsetextured soil (i.e., sand and gravel) are present at the ground surface and where the overburden aquifers are shallow. The overburden aquifer has a higher vulnerability when compared to the bedrock aquifer.

HVAs have been mapped based on the Source Protection Information Atlas of MECP. According to the HVA map, the aquifer vulnerability underlying the very southern limits of the Study Area, east of Highway 6, has been rated as an HVA.

The HVA within the Study Area, as obtained from the Source Protection Information Atlas of MECP, are presented in **Figure 5**.



## 4.5 Water Well Records Review and Groundwater Usage

The Study Area is located within the Township of Puslinch and City of Guelph. Potable water within the Township of Puslinch is dependent on private well water. The small northern portion of the Study Area located within the City of Guelph is also located within an area where residents are dependent on private well water.

According to the MECP well records, there are sixty-seven (67) existing water supply wells within the Study Area. Out of these sixty-seven (67) water supply well records, four (4) water supply wells terminated in overburden soil, twenty (20) water supply wells terminated in bedrock and forty-three (43) water supply well records have unknown well type. In addition, sixteen (16) groundwater observation wells were identified within the Study Area limits. A summary of the key information obtained from the MECP well records for the existing water wells within the Study Area is provided in **Appendix A**.

A summary of the existing sixty-seven (67) "Water Supply" water wells is provided below:

- Commercial: three (3) wells;
- Domestic: fifty-eight (58) wells;
- Livestock: three (3) wells;
- Unknown: two (2) wells;
- Public: one (1) well (MECP Well ID# 7122940). Based on a review of the Source Water Protection Atlas as well as the Grand River Assessment Report (LERSPC, 2021), this "Public" well is not a municipal supply well.

A review of the detailed records for the observation wells and water supply wells indicates the following:

- The depths of the observation wells range from approximately 3.4 to 99.9 m bgs, with nine (9) of the observation wells being shallow wells with a well depth less than 10 m bgs. Among the sixteen (16) observation wells, ten (10) are drilled with casing diameters ranging from approximately 0.025 to 0.31 m, while the remaining six (6) wells have unknown casing diameters. Out of these sixteen (16) groundwater observation wells, twelve (12) observation wells terminated in overburden and four (4) groundwater observation well records have unknown well type;
- The depths of the overburden water supply wells range from approximately 20.4 to 29.9 m bgs. The four (4) overburden water supply wells are drilled with casing diameters ranging from approximately 0.13 to 0.15 m. Among the four (4) overburden water supply wells, three (3) have recommended pump rates ranging from 10 to 15 gallon per minute (gpm) (55 to 82 m<sup>3</sup>/day), while the remaining one (1) well has an unknown recommended pump rate. None of the overburden water supply wells are considered large volume wells since recommended pump rates did not exceed 50 gpm (273 m<sup>3</sup>/day);
- The depths of the bedrock water supply wells range from approximately 9.1 to 51.8 m bgs. Among the twenty (20) bedrock water supply wells, sixteen (16) are drilled with casing diameters ranging from approximately 0.13 to 0.30 m, while the remaining four (4) bedrock water supply wells have unknown casing diameters. The recommended pump rates were available for nineteen (19) of the twenty (20) bedrock water supply wells and ranged from 5 to 30 gpm (27 to 164 m<sup>3</sup>/day). None of the bedrock water supply wells are considered large volume wells since recommended pump rates did not exceed 50 gpm;
- Static groundwater levels were available for one (1) of the overburden observation well records and was 0.9 m bgs. The remaining eleven (11) overburden groundwater observation wells records within the Study Area did not provide information on static groundwater level. Static groundwater levels for bedrock observation well records are not available; MECP well record database indicates that no bedrock observation wells are located within the Study Area;

- Static groundwater levels were available for all four (4) overburden water supply well records and ranged from 8.5 to 15.5 m bgs; and,
- Static groundwater levels were available for all twenty (20) of the bedrock water supply well records and ranged from 0.6 to 22.3 m bgs. Ten (10) records indicated static groundwater levels at 5 m bgs or shallower.

The locations of the existing water supply wells identified by the MECP well records, are presented on Figure 3.

An initial door-to-door water well survey was also completed by AECOM in 2018 and 2019 (See **Appendix B**). The objective of the water well survey was to fulfill the requirement specified in the EA Notice of Approval 7.3(d) issued by the MECP, specifically to identify the current groundwater well users and establish baseline groundwater conditions prior to the start of the construction activities for the project. The study area of the door-to-door water well survey included the Provincial Transportation Facilities improvements to Highways 6 and 401 in the Town of Puslinch, Wellington County, and the City of Hamilton (GWP 3042-14-00), which includes the subject area of this report, specifically for the improvements along Hanlon Expressway north of Highway 401 (including 300 m buffer).

The water well survey included the following tasks completed within the Study Area:

- Identifying the accurate location of the existing drinking water well and well owner's information (i.e., name, address, phone number);
- Entering the property to access the well if permitted;
- Interviewing the well owner regarding general well information (well type, depth, age);
- Measuring the physical parameters (depth, pH, temperature, etc.) of the drinking water well;
- Collecting groundwater samples from the well for laboratory analysis;
- Conducting pumping tests on the well to identify volume and recovery rates, if required; and,
- Providing the results of the quality testing to the well owner and the MTO.

The reader is referred to **Appendix B** for the results of the door-to-door water well survey. It is noted that during the door-to-door water well survey investigation, the absence and presence of water supply wells on some of the properties within the study area could not be confirmed because there was no response received from the property owners, and therefore the wells present on those properties could not be surveyed. Some property owners who had water wells on their properties previously refused to participate in the well survey program documented in the door-to-door water well survey report. Additionally, a review of the water well records during preparation of this *Groundwater Existing Environmental Conditions Study* provides a more up to date record of water wells within the MECP database, and includes additional wells not identified during the door-to-door water well survey completed by AECOM in 2020.

#### 4.6 Permit to Take Water Records

Water taking from aquifers, especially large volume and long-term water taking, can potentially impact the quantity and quality of groundwater by lowering the groundwater tables and changing the flow patterns and flow rates. Under Section 34 of the *Ontario Water Resources Act* (amended July 1, 2019) and *Ontario Regulation 63/16* (amended May 5, 2016), the MECP requires groundwater or surface water users who are taking volumes of water greater than 50 m<sup>3</sup>/day to register the water takings as "prescribed activities" on the Environmental Activity and Sector Registry (EASR) (taking volume between 50 m<sup>3</sup>/day and 400 m<sup>3</sup>/day) or obtain a Category 3 Permit to Take Water (PTTW) (taking volume greater than 400 m<sup>3</sup>/day).

A review of the MECP PTTW database identified one (1) active PTTW within the Study Area. A summary of the PTTW record is provided in the table below:

Table 1:	Summary	of Permit to	<b>Take Water</b>	Records
----------	---------	--------------	-------------------	---------

Permit No.	Latitude (UTM)	Longitude (UTM)	Permit Holder Name	Purpose/Specific Purpose	Max Litres per Day	Source Type
4373-8TXQK3	43.45813702	-80.16593656	Capital Paving Inc.	Industrial/ Other-Industrial	515600	Groundwater

It should be noted that the MECP PTTW database is updated irregularly based on the active permits issued by the Permit to Take Water Program. Therefore, the number of active permits within the Study Area, especially the short term permits for construction purposes, may vary day to day. It is recommended that the MECP PTTW database be reviewed prior to, or at the beginning of, the construction phase to obtain the most up-to-date data within the Study Area.

#### 4.7 Municipal Wells and Wellhead Protection Areas (WHPA)

According to the MECP Source Protection Information Atlas and Source Protection Assessment Report, there are no municipal water wells located within the Study Area. WHPAs related to municipal supply wells (the well locations are outside of the Study Area) are partially located within the Study Area. A summary of these WHPAs is provided below:

- WHPA D related to municipal wells located:
  - In the City of Guelph, relating to combined taking from various municipal wells including the nearest municipal well at Downey Rd.; and,
  - In the Region of Waterloo relating to combined taking from various municipal wells including wells located in the City of Cambridge, including Shades Mill and Clemens Mill.

#### 4.8 Surface Water Intakes

Surface Water Intake Protection Zones (IPZ) are areas of land and water delineated around the end of the municipal intake pipes. These zones are typically determined by the amount of time it would take for spilled material to reach the water intake. Up to three (3) zones may be established around an intake. The nearest to the intake is Zone 1, with Zones 2 and 3 extending out sequentially from the previous zone. Zone 1 (IPZ 1) is the most vulnerable zone for contamination, while Zone 3 (IPZ 3) is the least vulnerable zone. Each IPZ provides an opportunity for the source protection committee or municipality to apply different levels of protective measures on activities planned or existing within the zone. Detailed information on the delineation of the IPZs can be found in the MECP document entitled *"Technical rules under the Clean Water Act"* (amended January 2017).

A review of the MECP Source Protection Information Atlas and Assessment Report indicates there are no IPZ zones related to surface water intake within the Study Area.

# 5. Contaminant Inventory Review

A Contamination Overview Study (COS) was conducted by AECOM for the Hanlon Expressway / Wellington Road 34 Midblock Interchange Project (AECOM, 2021). The objective of this COS was to identify and review properties / areas within the COS Study Area with actual or potential site contamination that may impact future highway design and to identify appropriate future environmental work and mitigation measures to be implemented during the detail design and construction phases of the project.

The limits of the COS Site consisted of approximately a 2.5 km stretch of Concession Road 7 and the Hanlon Expressway, Puslinch, Ontario, between Maltby Road West and south of Wellington Road 34, with an approximate 2.0 km stretch of Wellington Road 34, slightly east of Sideroad 20 North to approximately 390 m east of Concession Road 7. The Study Area included the COS Site and a 250 m buffer was added to the Site boundaries, to identify off-site facilities and properties that could impact the Site.

A review of the 2017 Environmental Risk Information Services (ERIS) report, City Directories, Fire Insurance Plans, and aerial photographs determined several Potentially Contaminating Activities (PCAs) exist within the Study Area. Upon review of the background information, properties identified as commercial areas were given a medium risk rating, low was mainly residential and undeveloped areas. A high environmental risk rating for the property was determined based on identifiable PCAs as defined in MECP's List of PCAs and areas of uncertainty for environmental risk.

Based on the records review, 27 properties were identified within the GWP 3059-20-00 Study Area; two (2) of which were identified as having a "high" potential for environmental contamination; two (2) were identified as having "medium" potential for environmental contamination; and remaining 23 properties were identified as having "low" potential for environmental contamination. 10 significant spill locations were identified within the GWP 3059-20-00 COS Study Area.

The high risk rated properties include a historic landfill site (PIDs 8130414641) and Club 6 Golf Course (PID 8130414407), identified as using fertilizers and pesticides for course maintenance purposes. Effects from these properties may be confirmed with Phases One and Two Environmental Site Assessments (ESAs).

The Galt Moraine located on Concession Road 7 and Concession Road 1 is an Area of Natural Significance, and is located south of the Midblock interchange, and the impacts of construction of the midblock interchange should consider its effects on this vulnerable area.

As stated previously, the objective of the COS was to identify and review properties within the GWP 3059-20-00 COS Study Area with actual or potential site contamination that may impact future highway design and to identify appropriate future environmental work and mitigation measures to be implemented during the Detail Design and construction phases of this study. Further environmental studies / investigations of those high and medium properties directly impacted by interim and long-term operational improvements of Hanlon Expressway and Wellington Road 34 Midblock Interchange would be recommended to confirm the environmental conditions of such lands in support of both property acquisition, environmental due diligence, road construction and management of surplus / excess soil / materials. These studies / investigations may include a review of ERIS data and spills records available at detail design, Phase One ESAs and Phase Two ESA. If contamination is identified, mitigation measures may need to be developed and implemented which may include environmental site clean-up / remediation and/or risk assessment.

# 6. Drinking Water Source Protection

## 6.1 Background

The GRCA together with the local municipality of Puslinch Township and City of Guelph, as well as the upper tier municipality of Wellington County are identified are identified as having important roles in implementing the Source Protection Plan (amended September 17, 2019) (the Plan) in the vicinity of the Study Area, and have been regular active participants in the *Class Environmental Assessment* consultation process throughout the development of this project. The key objectives of the Plan are outlined within the *Clean Water Act (2006)* and require existing and future drinking water sources within the source protection area be protected. Key objectives of *the Plan* also include ensuring that, for areas identified within the Source Protection Assessment Report as areas where an activity is or would be a significant drinking water threat, the activity never becomes or ceases to be a significant drinking water threat.

## 6.2 Threats to Drinking Water

As discussed in the previous sections, there are no municipal supply wells or surface water intakes located within the Study Area. WHPA D are present within the Study Area in relation to active municipal pumping wells. In addition, there are SGRAs present throughout the Study Area.

A review of the MECP Source Protection Information Atlas indicates that there are no significant threats identified for the WHPAs, HVAs and SGRAs present within the Study Area. Therefore, the proposed highway work is not anticipated to pose significant drinking water threats in the vulnerable areas.

MTO will follow and apply the current MTO Best Management Practices (BMPs) to minimize threats from these activities by way of adherence to the Ministry plans and policies, the use of special contract provisions, and contract oversight and monitoring.

#### 6.2.1 Handling and Storage Fuel

The contractor will be handling fuels for refuelling mobile and stationary equipment during highway construction time. The contract shall contain provisions and operational constraints to minimize the risk of spills as per the Ministry policies and BMPs. Spill containment and clean-up kits will be required on site. A spill action plan shall be in place to ensure any spills are reported and handled appropriately and as required by legislation.

#### 6.2.2 Application of Road Salt

The chemicals of concern for road salt are listed as sodium and chloride. The application of road salt is considered as a low risk threat in the vulnerable areas within the Study Area, where road salt is applied to highways and may result in a release to groundwater or surface water. Based on the nature of the highway work, there will be an increase in the pavement surfaces. Therefore, there will be an increase in road salt application within the Study Area. MTO will continue to implement relevant BMPs/procedures and its Salt Management Plan for road salt application on this section of highway for safety purpose during winter weather conditions.

MTO and its contractors monitor weather and road conditions so they can respond to winter storm events in a quick and efficient manner. The contract will contain provisions and operational constraints to minimize the risk of spills

as per the Ministry policies and BMPs. Contractors are required to meet the Ministry's maintenance standards which have been developed based on extensive experience, and are consistent with the best practices of highway authorities in North America. Clearing winter roads to bare pavement usually requires a combination of plowing and salting operations. The purpose of the salt is to break the bond between the snow and the pavement surface, in order to allow the snow to be removed by snow plows. In order to ensure the continued safety of highways, and the health of our environment, MTO have developed guidelines for the responsible and appropriate use of road salt in winter maintenance operations.

MTO's Salt Management Plan ensures that salt is used efficiently and effectively. For example, all salt spreading trucks are required to be equipped with electronic spreading controls to reduce waste and maximize the effectiveness of the materials used.

Anti-icing is a road maintenance strategy that is employed before a winter storm event to prevent snow and ice from bonding to the pavement surface along MTO highways. This is accomplished through the use of liquid salt solutions. These liquids are also added to road salt, to help it stick to the road and activate more quickly. This reduces the quantity of salt required and minimizes the impact on the environment.

#### 6.2.3 Application of Commercial Fertilizer

Nitrogen is the primary chemical of concern in commercial fertilizer. If fertilizer is applied to land, it may result in the release of nitrogen to groundwater or surface water. The risk score increases where the percent of managed land (i.e., areas where there may be application of agricultural source material, commercial fertilizer, or non-agricultural source material) in a vulnerable area is greater than 80% and as Nutrient units per acre of managed land increase.

As part of the highway project, there will be exposed earth surfaces which will require seeding to re-establish vegetative cover. Based on the MECP Source Protection Information Atlas, the percent managed land present in the Study Area is up to 80%. A review of the significant threats information on the Atlas indicates that there are no significant threats identified for the managed land within the Study Area. Therefore, seeding activities of the highway project will not pose a significant threat to the drinking water system within the Study Area.

MTO prescribes the use of commercial fertilizer containing nitrogen where cover is to be re-established on earth surfaces through seeding. Nitrogen application rates and soil surface conditions are prescribed in the contract by Ontario Provincial Standard Specification (OPSS 0804) such that the risk of runoff is minimized.

# 7. Preliminary Assessment of Potential Groundwater Impacts

## 7.1 Temporary and Permanent Construction Impacts

#### 7.1.1 Potential Impacts to Groundwater Recharge and Discharge

The following equation represents the natural water balance:

#### Precipitation = Evapotranspiration + Recharge + Runoff

Where, Evapotranspiration is the sum of evaporation and plant transpiration.

The most significant difference associated with water balance during highway construction is the removal of vegetation and the installation of the impervious surface (i.e., concrete and/or asphalt roadway surface). Impervious surfaces prevent infiltration of the surface runoff water into the soils and the removal of vegetation eliminates the plant transpiration from the evapotranspiration component of the natural water balance, and therefore these practices result in increased surface water runoff and a decrease in water infiltration into the subsurface. Consequently, this will affect groundwater recharge/discharge and possibly the environmental groundwater quality in the shallow aquifer system. In addition, compaction during road bed preparation prior to road surfacing activities will reduce the void space in the soil, and therefore result in reduced groundwater recharge to the overburden and bedrock aquifers systems. Obstruction to groundwater recharge will have the greatest impact in elevated areas where permeable deposits such as sand and gravel are removed, compacted, or paved over.

Based on the nature of this highway project, there will be an increase in the amount of pavement surfaces. Obstruction to groundwater discharge may occur if paving or compaction takes place adjacent to surface water bodies and seepage zones. However, paving compaction can also increase surface water runoff to nearby watercourses.

#### 7.1.2 Construction below Groundwater Table and Dewatering

Cuts and excavations which intercept the water table have the potential to capture and redirect groundwater flow in the shallow aquifer system. Excavations below the water table in areas where fine-textured soils are present will release a limited quantity of groundwater; most of the groundwater would be retained in the soil during excavation. In these areas, seepage into excavations would be minimal and dewatering may not be needed. More significant impacts would occur when excavating within saturated permeable deposits, where dewatering may be required. Construction under the water table and the consequent dewatering activities can result in a temporary or permanent change of groundwater level, groundwater flow patterns and possibly the groundwater quality of the underlying aquifer and water wells in surrounding areas. Embankments, foundations, footings, abutments and piers constructed for bridges and culverts constructed to convey streams across the roadways can obstruct and hence alter the flow of groundwater (base flow) to surface water courses.

As discussed earlier in **Section 4.1**, the shallow overburden aquifer exists in the sand and gravel layers close to ground surface or at shallow depth within the fine-grained deposits. Only one (1) shallow overburden well record within the Study Area provided static groundwater table conditions and it was noted as 0.9 m bgs. The total depth of this shallow well was 4.3 m bgs. Additional static groundwater level information was only provided for overburden wells greater than 21 m bgs in total depth. Shallow groundwater conditions are also likely present in the vicinity of the surface water bodies and their associated wetlands.

Based on the nature of the highway work, excavations and groundwater dewatering may be required during the future highway construction work. The dewatering activities will have to be registered as "prescribed activities" on the EASR if the amount of groundwater taken exceeds 50 m<sup>3</sup>/day and is below 400 m<sup>3</sup>/day. A Category 3 PTTW must be obtained from the MECP if the amount of groundwater taken exceeds 400 m<sup>3</sup>/day during the dewatering activities.

It should be noted that the areas of high groundwater table as discussed in **Section 4.2** have been identified based on a well record review and topographic mapping. It is noted that minimal static groundwater level information is available for shallow overburden wells within the Study Area. If excavations are proposed during the later stage of the project and dewatering is required, a more accurate EASR or PTTW evaluation should be conducted as the design progresses. Geotechnical investigation/design reports, if available, and detail design drawings for the project shall be reviewed to confirm the geological/hydrogeological conditions (stratigraphy, groundwater level, thickness and hydraulic conductivity of the overburden aquifer) in the areas where deep excavations are required.

## 7.2 Likelihood of Release of Contaminants

#### 7.2.1 Fuel Spills

There is a potential of accidental spill / release of fuels during highway construction work. Spills onto fine-textured soils (i.e., clay and silt) have a higher potential to impact the surface water quality due to surface runoff. Spills onto more permeable soils, directly onto the bedrock or bedrock with thin soil cover, have more potential to impact the groundwater systems due to faster infiltration. Spills occurring in the wetland areas or where the water table is at or near the ground surface have the most potential to impact the groundwater quality.

Higher risk is present for the shallow overburden aquifer when compared to the deep bedrock aquifer. The risk for contaminations also increases in the area where coarse-textured soil, shallow groundwater table, and in the vicinity of surface water bodies. Mitigation measures regarding potential spills are discussed in detail in **Section 6.2.1** of this report.

#### 7.2.2 Road De-icing

Concentrations of sodium and chloride will increase in the runoff along roadside ditches and through roadside infiltration as a result of road de-icing, and therefore affect the underlying groundwater system. Chloride at high concentrations (> 250 mg/L) may impact the taste of the water, and elevated concentrations of sodium may be of concern to persons suffering from hypertension or other medical conditions.

Based on the nature of the highway project, there will be an increase in pavement surfaces. Therefore, there will be an increase on road salt application within the Study Area. The MTO will continue to implement relevant best management practices (BMPs) as well as its Salt Management Plan for road salt application on this section of Highway 6 for safety purpose during winter weather conditions. Other general mitigation measures for salt application are provided in **Section 6.2.2** of this report.

#### 7.2.3 Commercial Fertilizer

As part of highway construction, there will be exposed earth surfaces which will require seeding to re-establish vegetative cover. Nitrogen is known as a common chemical of concern in commercial fertilizer. When fertilizer is applied to the land as part of re-establishing vegetative cover, it may result in a release of nitrogen to groundwater or surface water.

Mitigation measures regarding nitrogen release from the application of commercial fertilizers are discussed in detail in **Section 6.2.3** of this report.

# 8. Potential Water Well Impacts

As discussed earlier in **Section 4.5** and **4.7** there are no municipal water supply wells located within the Study Area. A large number of private water wells were identified within the Study Area based on a review of the MECP well records.

Based on the nature of the highway project, excavations may be required for the construction of highway structure foundations. If significant excavations and groundwater dewatering are proposed for the highway work, potential impacts to the water wells located in the vicinity will be possible.

Potential groundwater impacts resulting from highway construction activities are expected to be greatest for well users with the following conditions:

- Water wells of shallow depth and/or large diameter in areas where road construction work is being performed below the shallow water table. Groundwater seeping into the excavation has the potential to impact groundwater resources as groundwater will have to be pumped out during excavation. This action may lower the water table, temporarily reducing water supply to local wells, particularly shallow water wells;
- Water wells drilled/bored/dug in the shallow aquifer, as road construction activities have the potential to adversely impact the shallow aquifer through disturbing contaminated soils, or handling and management practices (e.g., spills of fuel, lubricants etc.); thus introducing contaminants that could enter the groundwater system and impact nearby water wells; and
- Water wells closest to the area of construction, as road construction activities have the potential to
  physically impact water wells due to vibration and shock.

# 9. Conclusions and Recommendations

The groundwater vulnerability of the majority of the Study Area is classified as low to medium. Higher risk is present in vulnerable areas including WHPAs, HVAs and SGRAs (**Figure 5**) as well as the extensive PSWs present throughout the Study Area (**Figure 2**).

The potential impacts from the highway work to the local groundwater system include, but are not limited to, the following:

- Changes to recharge/discharge regimes resulting from the increase of pavement surface, the disturbance of the ground surface, ground clearing and compaction;
- Potential spills of hydrocarbons and other chemicals used during construction activities could impact the groundwater aquifer and groundwater-dependent water bodies;
- Application of commercial fertilizers during seeding activities to re-establish vegetative cover; and
- Potential dewatering impacts, if dewatering is required, that include a reduction in groundwater level and/or reduced flow to the nearby water wells and groundwater dependent water bodies.

The following mitigation measures are recommended to manage the potential impacts:

- Minimize disturbance to existing vegetation and grassed slopes where re-grading is required (disturbed areas should be re-vegetated as quickly as possible after completion of construction activities);
- Prepare and implement a spill prevention and control management plan as per the MTO's BMPs;
- Minimize commercial fertilizer usage and runoff by following the MTO prescribed BMPs and Ontario Provincial Standard Specification (OPSS 0804);
- If excavations and groundwater dewatering are required during the highway work:
  - Dewatering activities should be conducted in accordance with the control procedures as specified in the Ontario Provincial Standard Specification (OPSS) 518 Construction Specification for Control of Water from Dewatering Operations;
  - As per Ontario Regulation 387/04 (water taking regulation) and Ontario Regulation 63/16 (water taking registration regulation), the dewatering activities will need to be registered as "prescribed activities" on the EASR, if the amount of water taking exceeds 50 m<sup>3</sup>/day and is below 400 m<sup>3</sup>/day. A Category 3 PTTW must be obtained from the MECP if the amount of water taken exceeds 400 m<sup>3</sup>/day. Further site-specific investigations including drilling/installation of groundwater monitoring wells, groundwater and/or soil sampling will be required in support of the hydrogeological assessment in support of the EASR registration and/or Category 3 PTTW applications; and
  - A door-to-door water well survey was completed by AECOM in 2018 and 2019 for the Provincial Transportation Facilities improvements to Highways 6 and 401 in the Town of Puslinch, Wellington County, and the City of Hamilton (GWP 3042-14-00), which includes the subject area of this report (including 300 m buffer), and is provided in **Appendix B**. Survey information regarding water wells within the Study Area may be included in this door-to-door survey. However, it is noted that during the door-to-door water well survey investigation, the absence and presence of water supply wells on some of the properties within the Study Area could not be confirmed because there was no response received from the property owners.

Some property owners who had water wells on their properties previously refused to participate in the well survey program documented in the door-to-door water well survey report. Additionally, a review of the water well records during preparation of this Groundwater Existing Environmental Conditions Study provides a more up to date record of water wells within the MECP database, and includes additional wells not identified during the door-to-door water well survey completed by AECOM (2020). An additional door-to-door water well survey is recommended to confirm the presence and/or absence of the water wells in the vicinity (i.e., 500 m radius) of the dewatering locations to establish baseline conditions. A Monitoring Program shall be developed to monitor and mitigate potential impacts to the water wells in the vicinity of the dewatering locations. The door-to-door survey recommended in this report is in regard to potential dewatering activities and will be used to identify additional wells not included in the original survey, as well as develop monitoring and mitigation strategies for the dewatering works, if necessary, to monitor drinking water wells during and upon completion of construction.

Any groundwater monitoring wells or water wells within the Study Area, if no longer in use or in the construction zone, or any other unregistered water wells (if encountered) shall be properly decommissioned as per the Ontario Wells Regulation (R.R.O. 1990, Reg. 903) to avoid the creation of potential pathways for surficial contamination to get to the underlying aquifers;

# **10. Limiting Conditions**

The conclusions presented in this report are professional judgements based on a desktop review and interpretation of available geological/hydrogeological information and documentation as noted in this report. This study did not include field visits, field investigations or subsurface investigations involving drilling and monitoring wells.

Services have been performed in a manner consistent with the level of care and skill ordinarily exercised by members of our profession. No other warranties are expressed or implied.

It should be recognized that this study is intended only as desktop review of the existing groundwater conditions within the Study Area and was not intended to be a comprehensive hydrogeological investigation. Therefore, the conclusions provided are not necessarily inclusive of all the possible conditions. Given the limitation of the scope of work of this study and the availabilities of geological/hydrogeological information, it is possible that currently unrecognized subsurface geological and hydrogeological conditions might exist within the Study Area as exploratory borings, soil and/or groundwater sampling or analytical testing were not undertaken.

# 11. References

AECOM Canada Ltd. (AECOM), 2020:

Door-to-Door Water Well Survey, Highway 6 and Highway 401 Improvements, Hamilton North Limits to Guelph South Limits, G.W.P. 3042 14-00. April 2020.

AECOM Canada Ltd. (AECOM), 2021:

Contamination Overview Study Hanlon Expressway / Wellington Road 34 Midblock Interchange, GWP 3059-20-00. April 2021.

- Barnett, P.J., W.R. Cowan and A.P. Henry, 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.* 3<sup>rd</sup> *Edition.* Ontario Geological Survey, Special Vol.2, Ontario, Canada.

City of Guelph, 2020:

*Interactive Zoning By-law Map*. Accessed May 2021. https://geodatahubcityofguelph.opendata.arcgis.com/datasets/ae5e0f8e8209463eb5766e09640493ec

- Lake Erie Region Source Protection Committee (LERSPC, 2021): Grand River Source Protection Area. Approved Assessment Report. February 2, 2021.
- Ministry of Natural Resources and Forestry:

Make a Map, Natural Heritage Areas (accessed December 2019) http://www.gisapplication.lrc.gov.on.ca/mamnh/Index.html?site=MNR\_NHLUPS\_NaturalHeritage&viewer=N aturalHeritage&locale=en-US

Ministry of the Environment, Conservation and Parks:

Source Protection Information Atlas (accessed May 2021). <u>https://www.gisapplication.lrc.gov.on.ca/SourceWaterProtection/Index.html?site=SourceWaterProtection&vi</u> ewer=SWPViewer&locale=en-US

#### Ministry of the Environment, Conservation and Parks:

Online Water Well Records (accessed May 2021). <u>https://www.ontario.ca/environment-and-energy/map-well-records</u>.

#### Ontario Geological Survey:

Bedrock Geology of Ontario Southern Sheet, Map 2544, 1991. Scale 1:1,000,000.

Ontario Ministry of Transportation:

Environmental Standard and Practice User Guide, Section 3.3 Groundwater. June 2013.

The Corporation of the County of Wellington, 2021: County of Wellington Official Plan. Last updated: January 8, 2021.

#### Township of Puslinch, 2018:

Puslinch Zoning By-law. April 2018.





# Summary of Existing MECP Water Wells and Active PTTW Records

# Appendix A1. MECP Water Well Records within the Study Area

Well ID	Construction Date	UTM Zone	Easting (NAD83)	Northing (NAD83)	Casing Diameter (cm)	Well Type	Final Status	Primary Water Use	Well Depth (m)	Recommended Pump Rate (gpm)	Static Level (m)	Depth to Bedrock (m)
7122940	4/17/2009	17	566012	4813237	15.6		Water Supply	Public	35.66160202	40	21.94560051	
6702354	12/6/1965	17	567032.3	4812124	15.2	Bedrock	Water Supply	Domestic	19.20240021	10	6.400800228	17.6784
6702499	9/1/1967	17	565349.3	4814138	12.7	Overburden	Water Supply	Domestic	20.42160034		15.23999977	
6702507	8/24/1967	17	566824.3	4812988	15.2	Bedrock	Water Supply	Livestock	21,94560051	10	8.83920002	21.6408
6702508	11/3/1966	17	567189.3	4812498	15.2	Bedrock	Water Supply	Domestic	19.81200027	10	6.400800228	16.4592
6702510	1/22/1964	17	567261.3	4812616	15.2	Bedrock	Water Supply	Domestic	28.34640121	8	16.15439987	27.432
6703314	10/28/1968	17	566754.3	4812643	15.2	Bedrock	Water Supply	Domestic	9.144000053	15	4.267199993	5.4864
6703823	11/18/1970	17	565504.3	4811483		Bedrock	Water Supply	Domestic	18.28800011	10	2,133599997	12,4968
6703865	10/28/1970	17	565314.3	4814173		Bedrock	Water Supply	Domestic	50,29199982	7	21.33600044	42.672
6704325	7/26/1972	17	567154.3	4812093		Bedrock	Water Supply	Domestic	18.89760017	15	4.572000027	17,9832
6704687	3/23/1973	17	565259.3	4811693	15.2	Bedrock	Water Supply	Domestic	19.50720024	10	4.267199993	19.2024
6704843	10/31/1973	17	566121.3	4813361	15.2	Bedrock	Water Supply	Domestic	38,10000229	6	21.33600044	37.1856
6705029	4/15/1974	17	567317.3	4812307	30.5	Bedrock	Water Supply	Commerical	33.52799988	30	1.828799963	12.4968
6705091	3/23/1974	17	565540.3	4811635	15.2	Bedrock	Water Supply	Domestic	24,99360085	10	4,267199993	23.4696
6705870	7/11/1975	17	567138.3	4812055	15.2	Overburden	Water Supply	Domestic	21.33600044	10	8.534399986	
6705876	8/21/1975	17	565508.3	4812167	15.2	Bedrock	Water Supply	Livestock	32.00400162	5	10.36320019	24.384
6706156	8/9/1976	17	565814.3	4813543	12.7	Bedrock	Water Supply	Domestic	51.81600189	10	11.27760029	35.6616
6706620	12/8/1977	17	566474 3	4812183	15.2	Bedrock	Water Supply	Domestic	44 80559921	20	4 572000027	22 2504
6706771	8/14/1978	17	567214 3	4812523	12.7	Overburden	Water Supply	Livestock	29 87039948	10	14 02080059	
6707737	11/13/1982	17	565454 3	4813843	15.2	Bedrock	Water Supply	Domestic	47 85359955		22 25040054	38 7096
6708127	11/4/1983	17	566934.3	4812403	30.5	Overburden	Observation Wells	Not Used	4 267199993		0.914399981	00.1000
6708738	11/18/1986	17	565623.3	4814068	15.2	Overburden	Water Supply	Commerical	22 86000061	15	15 5447998	
6711404	5/11/1994	17	566442.3	4811765	10.2	Overburden	Observation Wells	Not Used	6 705600262	10	10.0447000	
6711405	5/11/1994	17	566464 3	4811772		Overburden	Observation Wells	Not Used	6 705600262			
6711406	5/12/1994	17	566607.3	4811652		Overburden	Observation Wells	Not Used	8 229599953			
6711408	5/20/1994	17	566656.3	4811671	10.2	Overburden	Observation Wells	Hot obcu	5 181600094			
6711409	5/20/1994	17	566751.3	4811901	10.2	Overburden	Observation Wells		3 352800131			
6711410	5/20/1994	17	566972.3	4811823		Overburden	Observation Wells		9 753600121			
6711411	5/20/1004	17	566691 3	4811020		Overburden	Observation Wells		3 352800131			
6711410	5/12/1004	17	566472 3	4811544	12 7	Overburden	Dewatering	Commerical	6 400800228		0.914399981	
6711744	6/13/1005	17	566428 3	4811703	15.2	Bedrock	Test Hole	Domestic	18 28800011		0.014000001	14 0208
6711750	6/25/1005	17	566462 3	4811615	30.5	Bedrock	Test Hole	Commerical	18 28800011			13 716
6711760	6/10/1005	17	566474 3	4811574	15.2	Bedrock	Test Hole	Commerical	18 28800011			13.716
6711761	6/28/1005	17	566465 3	4811619	15.2	Overburden	Abandoned_Other	Commerical	18 28800011			15.710
6712380	11/20/1995	17	565482 3	4811521	15.2	Bedrock	Water Supply	Domestic	24 38/00078	15	0.60960008	13 1064
6713680	5/16/2001	17	565175	4813768	15.2	Bedrock	Water Supply Water Supply	Domestic	42 67200080	15	14 03510074	36.8808
6714261	0/18/2002	17	565018 6	4813708	15.2	Bodrock	Water Supply	Domestic	18 28800011	15	1 524000049	17 3736
6715003	9/10/2002	17	565801	4011703	15.2	Bedrock	Water Supply	Domestic	16 72132874	13	16 15/30087	6 006
6715177	0/0/2004	17	565006	4011723		Deulock		Domestic	10.72132074	20	10.15459907	0.090
70/10/7	2/27/2007	17	505990	4011701	2.5	Overburden	Observation Walls		00.01000917			
7041007	3/27/2007	17	505003	4013071	2.5	Overburden	Observation Wells		99.91999017			
7041000	3/27/2007	17	505063	4013071	2.5	Overburden	Observation Wells		20 61000002			
7041069	3/27/2007	17	505003	4013071	2.5	Overburden	Observation Wells		39.01999093			
7140726	3/21/2007	17	566747	40130/1	2.3	Overburden			19.00999947	1		
7161070	3/14/2010	17	567122	4011012	15.6		Water Supply	Domostio	31 60010069	0	2 7/220006/	
7171/07	3/14/2011	17	00/ 10Z	401100/	10.0		Water Supply	Domestic	31.09919900	0	2.143200004	
7100440	5/24/2011	17	200/43	4011919	10.0		Wotor Supply	Domestic	10.049099884	10	0.914099901	
7102140	5/31/2012 7/06/0040	17	2024/9 FCCCF4	4011000	15.9		water Supply	Domesuc	19.01200027	20 4E	3.048000097	
7185524	1/20/2012	17	500051	4811980	15.0		A handanad Othan	Irrigation	21.33600044	15	2.43840003	
7191239	10/25/2012	17	505321	4813930	45.0		Abandoned-Other	Demestic	40.0000044	45	1 524000040	
7193673	11/6/2012	1/	5000770	4811879	15.0		water Supply	Domestic	18.28800011	15	1.524000049	
7193674	11/5/2012	17	500773	4011950	15.0		Water Supply	Domestic	17.008/999/	15	4.87080000	
7200440	3/4/2013	17	506799	4812011	15.6		vvater Supply	Domestic	18.28800011	12	6.096000195	
/210/28	10/3/2013	1/	566820	4811/2/	15.6		Water Supply	Domestic	16.76399994	15	2.133599997	
/2214/6	5/27/2014	1/	566/5/	4811814	15.9		Water Supply	Domestic	15.84959984	15	1.828/99963	
7223625	6/5/2014	1/	566927	4811/8/	15.9		Water Supply	Domestic	15.84959984	15	2.743200064	
7225328	//30/2014	1/	566900	4811//5	15.9		vvater Supply	Domestic	16.76399994	15	3.048000097	
/237757	1/23/2015	17	566774	4811696	15.9		Observation Wells	Domestic	14.32560062	15	4 007 / 00000	
/239663	3/9/2015	17	566894	4811894	15.9		Water Supply	Domestic	16.45919991	15	4.26/199993	
/242624	5/15/2015	1/	567056	4812232	15.9		vvater Supply	Commerical	15.23999977	15	4.572000027	
/251736	10/26/2015	17	567059	4811880	15.9		Water Supply	Domestic	15.23999977	15	2.743200064	
7255634	12/17/2015	17	566789	4811833	15.6		Water Supply	Domestic	18.28800011	15	3.96239996	

#### ОМТО

#### Groundwater Existing Environmental Conditions Study Hanlon Expressway/Wellington Road 34 Midblock Interchange GWP 3059-20-00

# Appendix A1. MECP Water Well Records within the Study Area

Well ID	Construction Date	UTM Zone	Easting (NAD83)	Northing (NAD83)	Casing Diameter (cm)	Well Type	Final Status	Primary Water Use	Well Depth (m)	Recommended Pump Rate (gpm)	Static Level (m)	Depth to Bedrock (m)
7255635	12/17/2015	17	566913	4811869	15.6		Water Supply	Domestic	17.37360001	15	4.572000027	
7261162	3/30/2016	17	566855	4811949	15.9		Water Supply	Domestic	19.20240021	15	5.181600094	
7261163	3/21/2016	17	567083	4811900	15.9		Water Supply	Domestic	19.20240021	12	2.743200064	
7264650	4/19/2016	17	566741	4811844	15.9		Water Supply	Domestic	16.76399994	15	0.304800004	
7264651	4/18/2016	17	566820	4811854	15.6		Water Supply	Domestic	18.28800011	15	3.96239996	
7266808	5/1/2016	17	566931	4811768	15.6		Water Supply		16.76399994		2.43840003	
7268485	7/19/2016	17	566819	4811987	15.6		Water Supply	Domestic	15.5447998	15	5.791200161	
7268486	7/19/2016	17	566892	4811862	15.9		Water Supply	Domestic	15.84959984	15	4.572000027	
7270846	8/24/2016	17	566864	4811903	15.6		Water Supply	Domestic	16.76399994	15	4.87680006	
7273135	9/7/2016	17	566767	4811684	15.9		Water Supply	Domestic	12.80160046	15		
7273137	9/6/2016	17	566786	4811851	15.9		Water Supply	Domestic	19.50720024	15	3.96239996	
7274474	10/13/2016	17	567053	4812167	15.6		Water Supply	Domestic	18.28800011	15	5.486400127	
7274475	10/12/2016	17	567064	4811900	15.6		Water Supply	Domestic	15.84959984	15	3.352800131	
7280761	8/4/2016	17	566859	4811915	15.6		Water Supply	Domestic	16.76399994	15	4.87680006	
7285953	4/24/2017	17	566883	4811763	15.6		Water Supply	Domestic	16.45919991	15	2.743200064	
7289675	6/12/2017	17	566751	4811721	15.9		Water Supply	Domestic	15.84959984	15		
7289676	6/13/2017	17	566706	4811854	15.9		Water Supply	Domestic	18.28800011	15	0.914399981	
7289680	6/27/2017	17	566722	4811787	15.9		Water Supply	Domestic	15.5447998	15	-0.609600008	
7298571	10/18/2017	17	565372	4811596	15.2		Water Supply	Domestic	21.94560051	40	4.267199993	
7298792	10/10/2017	17	567095	4811874	15.9		Water Supply	Domestic	16.76399994	15	2.43840003	
7301984	11/29/2017	17	565996	4812789	5.1		Observation Wells	Monitoring	22.86000061			
7304977	1/26/2018	17	566953	4811888	15.6		Water Supply	Domestic	19.50720024	15	4.87680006	
7312679	2/6/2018	17	566625	4811859			Abandoned-Other					
7312680	12/15/2017	17	566625	4811859	5.1		Observation Wells	Test Hole	16.76399994			
7313796	12/11/2017	17	566255	4811946	5.1		Observation Wells	Test Hole	9.144000053			
7315729	7/10/2018	17	566859	4811990	15.6		Water Supply	Domestic	33.52799988	15	3.657599926	
7320128	9/14/2018	17	566875	4811961	15.6		Water Supply	Domestic	33.52799988	15	3.96239996	
7322870	10/23/2018	17	566772	4811729	15.6		Water Supply	Domestic	14.02080059	12	0.609600008	
7322871	10/22/2010	17	566832	4811773	15.6		Water Supply	Domestic	16.76399994	15	3.352800131	
7333200	4/17/2019	17	566943	4811924	15.6		Water Supply	Domestic	42.67200089	10	3.96239996	
7339430	7/4/2019	17	566714	4811842	15.6		Water Supply		18.28800011	15	0.304800004	
7339436	7/18/2019	17	566965	4811903	15.6		Water Supply	Domestic	20.11680031	12	4.87680006	

#### OMTO Groundwater Existing Environmental Conditions Study Hanlon Expressway/Wellington Road 34 Midblock Interchange GWP 3059-20-00

# Appendix A2. PTTW within the Study Area

PermitNo	ClientName	PurposeCat	SPurpose	ExpiryDate	IssuedDate	UTMZone	Easting	Northing	SurfGrnd	SourceID	MaxL_Day	Days_Year	Hrs_DayMax	L_Minute
4373-8TXQK3	Capital Paving Inc.	Industrial	Other - Industrial	2022-05-31	2012-05-04	17	567476	4812030	Ground Water	Well B - Asphalt Plant (MOE # 6705029)	515600	300	14	615

#### OMTO Groundwater Existing Environmental Conditions Study Hanlon Expressway / Wellington Road 34 Midblock Interchange GWP 3059-20-00



# Appendix **B**

Door-to-Door Well Survey (AECOM, 2020)



Due to the sensitive nature of this appendix it was not provided for public review, however, results of private well testing was shared with property owners on their request. Should you have questions or comments please contact the Project Team.

aecom.com