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**2025 Biennial Groundwater Monitoring
Report - Fountain Street Well Field (P16)**

The Region of Waterloo



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2025 Biennial Groundwater Monitoring Report - Fountain Street Well Field (P16)

The Region of Waterloo

**R.J. Burnside & Associates Limited
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Guelph ON N1H 1C4 CANADA**

**June 2026
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1.0 Introduction

The Regional Municipality of Waterloo (the Region) is unique in Ontario in that it is the largest urban municipality to rely almost exclusively on groundwater supplies for its drinking-water (Region of Waterloo, 2015). Figure 1 shows the location of municipal well fields within the Region.

The Permit to Take Water (PTTW) for the Fountain Street Well Field, (2004-AKXNEB) requires submission of a well field specific biennial report to the Ministry of Environment, Conservation and Parks (MECP) which documents production well pumping volumes and water levels in specific monitoring wells during 2024 and 2025. This report has been prepared to meet the reporting conditions of the PTTW for 2024 and 2025. A copy of the PTTW is included in Appendix A.

The location of the Fountain Street Well Field is shown on Figure 1 and the production wells in Cambridge are shown on Figure 2 with the monitoring network for P16 shown on Figure 3. Well records for the production and monitoring wells are found in Appendix B.

1.1 Scope of Work

The Region records water levels on a regular basis within a network of monitoring wells to satisfy the requirements of their PTTW and to confirm that water taking is sustainable in the long term. The monitoring wells are concentrated near the production wells but are also located in known aquifer recharge areas. The data from these wells and regular measurements of pumping volume obtained from the production wells are used to evaluate the impact of Region pumping on aquifers and potential impacts to private wells, other water takers and the natural environment.

The Region has developed a monitoring program for Fountain Street Well Field (P16) in accordance with PTTW 2004-AKXNED which consists of the following activities:

- Measuring the daily volume pumped from the production well, P16 (Condition 4.1 of the PTTW).
- Measuring the water levels in monitoring well C-FS-TW4-76-A (Condition 4.2 of the PTTW).
- Review of precipitation data from the nearest GRCA / Environment Canada weather station.
- Completion of a biennial report (every 2 years) that presents data in compliance with condition 4.3 of the PTTW.

The Monitoring data (pumped volumes and hydrographs) are found in Appendix C with precipitation data in Appendix D. The monitoring program procedures and methodology are included in Appendix E.

2.0 Site Setting

2.1 Well Field Description

The Fountain Street Well Field is within an industrial area on the east side of Cambridge on Fountain Street, 300 m south of Maple Grove Road. The Hespeler Well Fields are located 5 km to the east and the Woolner Well Field is located 3 km to the north (Figure 2). The closest surface water features to the Fountain Street Well Field are a stormwater pond located about 210 m north of P16 and two unnamed tributaries that feed the Speed River to the southeast and Grand River to the west (Figure 3).

2.1.1 Pumping Wells

The Fountain Street Well Field consists of one production well P16. P16 was shut down in July 2003 and has not been used since that time (Golder, 2011). The well record for P16 is provided in Appendix B. A summary of the production well construction details is provided in Table 1 below.

Table 1: Production Well Construction Details

Well Name	Year Built	Casing / Screen Diameter (mm)	Screened Interval (mbgs)	Aquifer
P16	1986	250	34.7 – 39.6	AFD1

The water taking volumes for the Fountain Street well field are regulated by Condition 3.2 of the PTTW and are summarized in Table 2 below.

Table 2: Annual Water Taking 2024 / 2025

Well	PTTW	2024			2025		
		Days of Pumping	Max Taken per Day (m ³)	Total Volume Pumped (m ³)	Days of Pumping	Max Taken per Day (m ³)	Total Volume Pumped (m ³)
P16	1,964.16	3	172.56	409	0	0	0

Condition 3.2 of the PTTW specifies that the maximum daily water taking from the well field must not exceed 1,194.16 m³/day. As shown in Table 2, this requirement was met in both 2024 and 2025.

The Region of Waterloo's SCADA system records total daily water taking volumes including the dates and times of water takings, the rates of pumping, and calculations of

the total amounts of water pumped per day for each supply well, which complies with condition 4.1 of the PTTW.

The production well P16 at Fountain Street Well Field has not been used since 2003. In 2024 it was pumped for three days, producing a total of 409 m³. The well was not pumped in 2025.

2.1.2 Monitoring Wells

Observation well C-FS-TW4-76-A is located adjacent to P16 (Figure 3). Construction details for C-FS-TW4-76-A are described in Table 3 below. The well record for C-FS-TW4-76-A is provided in Appendix B.

Table 3: Monitoring Well Construction Details

Monitoring Well ID	Year Built	Screened Depth (mbgs)	Screened Formation	Distance to P16 (m)
C-FS-TW4-76-A	1976	29.26 – 32.61	AFD1	9

2.2 Regional Geology and Hydrostratigraphy

The following sections provide a brief overview of the regional geology and hydrogeology of the Fountain Street Well Field. The surficial geology based on regional OGS mapping is provided on Figure 4. Representative cross-sections showing the stratigraphy in the vicinity of the Fountain Street Well Field are included as Figures 5 and 6. The cross-section locations are provided on Figure 3. The layers displayed were generated from results of the Hydrogeological Characterization and Conceptual Model Tier 3 Assessment Update Project (Aqua Insight et al, 2023) and associated hydrogeological modelling work and may not necessarily match layers identified through borehole log interpretation.

The recently completed Tier Three Assessment Update Project (Aqua Insight et al, 2023) has revised the previous (Matrix 2015) stratigraphic interpretation of the lithology around the Fountain Street Wellfield. The lithological layers were updated in accordance with documentation provided in the Numerical Model Surface Transfer memorandum (Aqua Insight Inc, 2026).

Refinements (Aqua Insight et al, 2023) along cross-sections A-A" (Figure 5) and B-B' (Figures 5 & 6) include the following:

- Replacement of the surficial unit ATB1 (Port Stanley Till) with primarily AFB1 / ATB2 / AFB2,
- A thickening of ATB3 and thinning of ATC1 north of P16. Updated picks at C-FS-MW1-10-A and C-FS-MW2-10-A west of the well field reclassified the ATC1 unit having 10 m of thickness as ATB3.

- The thickness of AFD1 is interpreted to increase near Well P18 due to an approximately 5 m deepening of the bedrock surface.
- ATE1 is interpreted to extend southeast of the well field; however, it is interpreted to pinch out toward the northwest based on a revised interpretation from an existing lower-quality domestic well.
- The bedrock surface interpretation was updated using new bedrock picks in the area. The bedrock surface was interpreted to deepen near Well P18 based on data from C-FS-FSTW1-10 and by approximately 8 m immediately north of Well P18 based on C-FS-MW3-10-A.

2.2.1 Surficial Geology and Conceptual Hydrostratigraphy

The surficial geology of the Study Area has been mapped and described by the Ontario Geological Survey (2003) and updated in Bajc and Shiota (2007). The surficial geology of the Fountain Street Well Field is characterized primarily by silty to clayey till sediments and glaciofluvial and ice contact deposits of sand and gravel (Figure 4). Silty to clayey till sediments are mapped to the north and south of the well field. Modern alluvial deposits are present along the Speed River and Grand River and bedrock outcrops are mapped along the Speed River southeast of the wellfield.

The Quaternary Geology of the Cambridge area typically includes the units (Lotowater 1997, Karrow 1987 and Bajc and Shiota, 2007) described in more detail below.

Aquitard ATB1 - Port Stanley Till

The Port Stanley Till is a sandy silt to silty sand till, with occasional stony texture. The Port Stanley Till was deposited by ice advancing from the Erie-Ontario ice lobe. In other parts of the Region, Bajc and Shiota (2007) have also used unit ATB1 to represent Tavistock, Mornington and Upper Maryhill Tills. In the Grand River and Speed River valleys this unit has been largely removed by erosion. This unit is generally finer grained than the Wentworth Till and behaves as an aquitard.

Aquifer AFB1 - Upper Waterloo Moraine Stratified Sediments and Equivalents

Significant thicknesses of aquifer AFB1 are interpreted to occur southeast of the Speed River and west of Puslinch Lake and generally corresponds with mapped surficial ice-contact sands and gravels. AFB1 is generally fine sand with some gravel and is often slightly finer grained than unit AFA2, which typically contains greater amounts of gravel.

Aquitard ATB3 - Lower Maryhill Till

Fine grained till and glaciolacustrine deposits of the Lower Maryhill Till ATB3 generally separate AFB1 from the underlying Catfish Creek Till. The Lower Maryhill Till is described as a dense, dark brown, clayey silt to silty clay till and is interpreted to be present in the Fountain Street (Well P16) well field area above the Catfish Creek and below the Port Stanley Till.

Aquitard ATC1 – Upper / Main Catfish Creek Till

The Catfish Creek Till was deposited by a major glacial advance from the north to northeast that covered all of southern Ontario. The Catfish Creek Till is a dense, stony, sandy silt to silty sand till with little clay content. Although originally deposited over the entire Cambridge area, erosion, glaciations and meltwater events have removed areas of the Catfish Creek Till and it is now discontinuous. In the Cambridge Area, the thickness of this unit ranges from approximately 5 m in areas east of the Grand River, to approximately 20 m west of the Grand River, and is usually found immediately overlying bedrock and beneath clayey sediments. The hydrogeologic properties of the Catfish Creek Till are variable, ranging from a good aquitard to a poor aquifer, depending on local lithology, degree of compaction, and the presence of overlying aquitard units.

Aquifer AFD1 - Pre-Catfish Sand and Gravel

The Pre-Catfish sand and gravel aquifer is present below the Catfish Creek Till in the Fountain Street Well Field area but is not a significant unit elsewhere in the Cambridge area. This unit is the main municipal aquifer for the Fountain Street Well Field. The Pre-Catfish Sand and Gravel is found directly overlying bedrock in the Fountain Street Well Field area and is hydraulically connected with the upper weathered portion of the bedrock aquifer. Aquifer AFD1 corresponds to sands and gravel re-worked from Catfish Creek and Pre-Catfish Creek Tills.

2.2.1 Bedrock Geology

The majority of the municipal groundwater supplies in the City of Cambridge are derived from the Paleozoic Bedrock deposits, which comprise a regionally extensive bedrock aquifer system. The major bedrock formations underlying the City of Cambridge are the Guelph Formation and the Gasport Formation (formerly referred to as the Amabel Formation). The Guelph Formation is a Middle Silurian sedimentary deposit typically composed of dolostone. This formation is a reefal complex in which biohermal units and their inter-reefal strata can be distinguished. The Gasport Formation consists of a basal cross-bedded crinoidal grainstone-packstone succession with incipient microbial crinoidal reef mound lithofacies (Brunton, 2009).

2.3 Local Geology

Figure 3 displays the Fountain Street Well Field well plan and cross-section locations. Representative cross-sections are included as Figures 5 and 6 to visualize the stratigraphy described in this section.

In the Fountain Street Well Field area the surficial till is Port Stanley Till (ATB1) which is a sandy silt to silty sand till and AFB1 is generally thin (2 m or less) (Aqua Insight, 2023). Underlying the Port Stanley till and AFB1 is Lower Maryhill Till (ATB3) and the Catfish Creek Till (ATC1). The three units (ATB1, ATB3 and ATC1) comprise the upper 30 m of the overburden and essentially act as a single aquitard in the Fountain Street Well Field area. The drillers log for P16 is not detailed enough to distinguish between the three units. The Pre-Catfish sand and gravel aquifer (AFD1) is present below the Catfish Creek Till in the Fountain Street Well Field area and acts as the municipal aquifer for P16. At production well P16 the thickness of the unit is observed to be 12.5 m. AFD1 is interpreted to overlie the bedrock at P16.

3.0 2024 / 2025 Results

The following sections summarize groundwater levels at the monitoring well in relation to precipitation and water taking from the aquifer (in accordance with condition 4.3 of the PTTW).

3.1 Precipitation

Longer term precipitation trends can have an impact on water levels in the supply aquifer. To assess the potential influence, monthly precipitation is plotted for comparison to water levels and pumping and presented in Appendix C.

Since variations in precipitation totals can occur throughout the Region due to localized events, monthly precipitation data from the GRCA and Environment Canada station located closest to the production wells are used. The closest GRCA weather station relative to the Fountain Street well field is the Shades Mills Dam station located 9 km from the well field. The closest Environment Canada station is Waterloo International Airport (WIA) located about 4.4 km west / northwest from the well field. The locations of the meteorological stations are shown on Figure 1. Annual precipitation data from the past 10 years for all stations are compared with long term averages in Table D.1, Appendix D. Monthly precipitation data for the past 10 years at Shades Mills Dam are shown on Figure D.1, Appendix D. At the Shades Mills Dam station, the long-term average was calculated from when measurements started until the end of 2025. The Roseville and Region of Waterloo International Airport (WIA) has "Climate Normals" calculated by Environment Canada for 1981 to 2020.

Annual 2024 / 2025 precipitation data for the GRCA and Environment Canada meteorological station closest to the Fountain Street well field are presented in Table 4 below. WIA was missing 6 days of data in 2024 and 6 days in 2025. As a result, the precipitation totals may be under reported at this location.

Table 4: Summary of Precipitation Data

Station	2024 Precipitation (mm)	2024 Deviation (mm)	Long- Term Average (mm)	2025 Precipitation (mm)	2025 Deviation (mm)
Region of Waterloo International Airport ⁽¹⁾	874	+23	851 ^(A)	723	-128
Shades Mills Dam ⁽²⁾	976	+67	909 ^(B)	895	-14
Sources: Environment Canada (1), GRCA (2), ^A 1991 to 2020 Normal ^B Average annual precipitation since monitoring began to the end of 2025					

Water levels typically follow a seasonal trend with highest levels occurring in the spring with the depth and water content of the snowpack having a significant influence on water levels. Lowest levels occurring in July / August. Widespread synoptic rainfall events can also result in Region-wide water level responses. Summer thunderstorms tend to be short lived and occur over a smaller area resulting in short term, localized water level rises not typically seen in the monitoring wells.

The 2024 total precipitation at Shades Mills station was 976 mm, which is 67 mm above the long-term average, indicating 2024 was wetter-than-average at the well field. A similar above long-term average trend is noted at the WIA station. The March 1 GRCA snow survey indicated a snowpack across the Region that was low compared to normal. In 2025, the total precipitation was 895 mm, which is 14 mm below the long-term average. Similarly, the total precipitation at the WIA station was 128 mm below the long-term average, indicating 2025 was a drier-than-average year. However, WIA was missing 12 days of data in 2024 / 2025 and as a result, precipitation totals may be under reported. The snow survey conducted by the GRCA on March 15, 2025, showed that the stations in the Region had a high to very high measured snow water equivalent.

3.2 Monitoring Results

In accordance with condition 4.2 of the PTTW, water levels were measured and recorded once per month at C-FS-TW4-76. Hydrographs showing the results of water level monitoring over the past 10 years are provided in Appendix C. The method used to collect the water levels (manual or electronic) is indicated on the graphs in Appendix C.

C-FS-TW4-76-A

C-FS-TW4-76-A is completed in overburden with a screened interval similar to P16. Water level data for C-FS-TW4 76-A has been recorded manually since 2002. Water levels in 2024 / 2025 were consistent with historical results. There was no discernable response to pumping in September 2024. Prior to P16 going off-line in August 2003, water level fluctuations were directly related to pumping activities, with low water levels during peak pumping rates. Since P16 was taken off line in July 2003, the water level variations observed in C-FS-TW4-76-A have been consistent with seasonal water level variations recorded in wells across the Region.

4.0 Impact Assessment

4.1 Well Interference

PTTW Condition 5.1 states, "The Permit Holder shall immediately notify the local District Office of any complaint arising from the taking of water authorized under this Permit and shall report any action which has been taken or is proposed with regard to such complaint. The Permit Holder shall immediately notify the local District Office if the taking of water is observed to have any significant impact on the surrounding waters. After hours, calls shall be directed to the Ministry's Spills Action Centre at 1-800-268-6060."

PTTW Condition 5.2 states: "For Groundwater Takings - If the taking of water is observed to cause any negative impact to other water supplies obtained from any adequate sources that were in use prior to initial issuance of a Permit for this water taking, the Permit Holder shall take such action necessary to make available to those affected, a supply of water equivalent in quantity and quality to their normal takings, or shall compensate such persons for their reasonable costs of so doing, or shall reduce the rate and amount of taking to prevent or alleviate the observed negative impact. Pending permanent restoration of the affected supplies, the Permit Holder shall provide to those affected, temporary water supplies adequate to meet their normal requirements or shall compensate such persons for their reasonable costs of doing so. If permanent interference is caused by the water taking, the Permit Holder shall restore the water supplies of those permanently affected."

All properties within 500 m of P16 are municipally serviced. When a well interference complaint is received, the Region has a Well Interference Policy in place. A copy of the policy is presented in Appendix F of the 2019 Biennial Groundwater Monitoring Report - Multiple Well Fields (Burnside, 2020). There were no well interference complaints related to pumping of P16 received in 2024 and 2025.

Other groundwater takings registered in the MECP PTTW database within 2 km of the well field are mapped on Figure 3 and summarized below in Table 5 .

The closest PTTW to P16 was issued to Toyota Canada for dewatering at their manufacturing facility. It is assumed that dewatering is completed within the surficial aquifer and will not impact water levels in the production well aquifer.

Table 5: PTTWs in Vicinity of Fountain Well Field

Permit Number	Permit Holder	Purpose	Source - Max Liters per Day	Distance from P16 Supply Well	Expiry Date
6865-AAPN36 (Amended by 1675-AZAQ59)	Toyota Motor Manufacturing Canada	Dewatering	Dewatering Sumps – 562,000	~800 m	7/31/2026

4.2 Aquifer Response to Pumping and Precipitation

PTTW Condition 4.3 states: "The Permit Holder shall prepare and submit an electronic copy of a report every two years by June 30. The report shall present the results of the well field water level monitoring for the two preceding calendar years, assesses changes in water levels in the supply aquifer(s) in relation to precipitation and water taking from the aquifer(s)".

Production well P16 has not been pumped since 2003 therefore has not impacted the groundwater aquifer. Seasonal fluctuations in the aquifer are observed with the highest and lowest levels observed in spring and late summer / fall, respectively. The correlation of individual precipitation events with groundwater levels is difficult due to several reasons including but not limited to hydraulic conductivity, well depth, precipitation intensity and ground cover conditions.

5.0 Conclusions

Impacts from pumping the municipal wells at the Fountain Street Well Field were evaluated through implementation of the Groundwater Monitoring Program. Based on the information contained in the report, Burnside offers the following conclusions:

- The information presented in this report satisfies condition 4.3 of PTTW 2004-AKXNEB.
- There were no reported well interference complaints arising from water taking at the Fountain Street well field.
- Water level data collected at monitoring well C-FS-TW4-76-A provides baseline data under non-pumping conditions.

6.0 References

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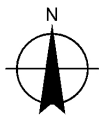
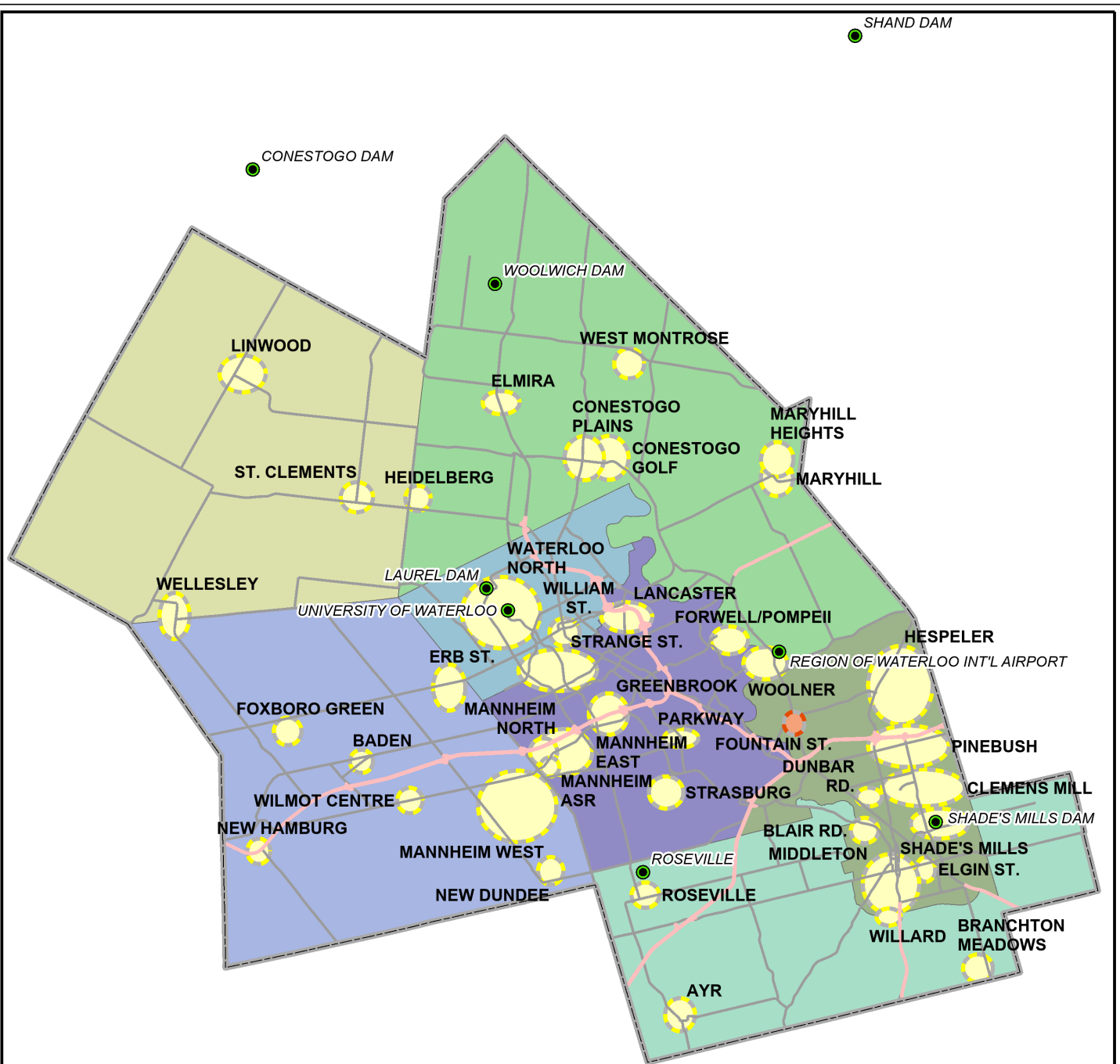


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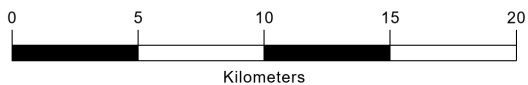
[THE DIFFERENCE IS OUR PEOPLE]



Figures



Data Source:
Region of Waterloo; Includes material © 2012 of the Queen's
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|-------------------------------|-------------------------------------|
| Well Field Location | Township of North Dumfries |
| Well Fields | Township of Wellesley |
| Regional Municipal Boundaries | Township of Wilmot |
| City of Cambridge | Township of Woolwich |
| City of Kitchener | Meteorological Monitoring Locations |
| City of Waterloo | |



Map Title

2025 GROUNDWATER MONITORING REPORT - FOUNTAIN STREET WELL FIELD

WELL FIELD LOCATION MAP

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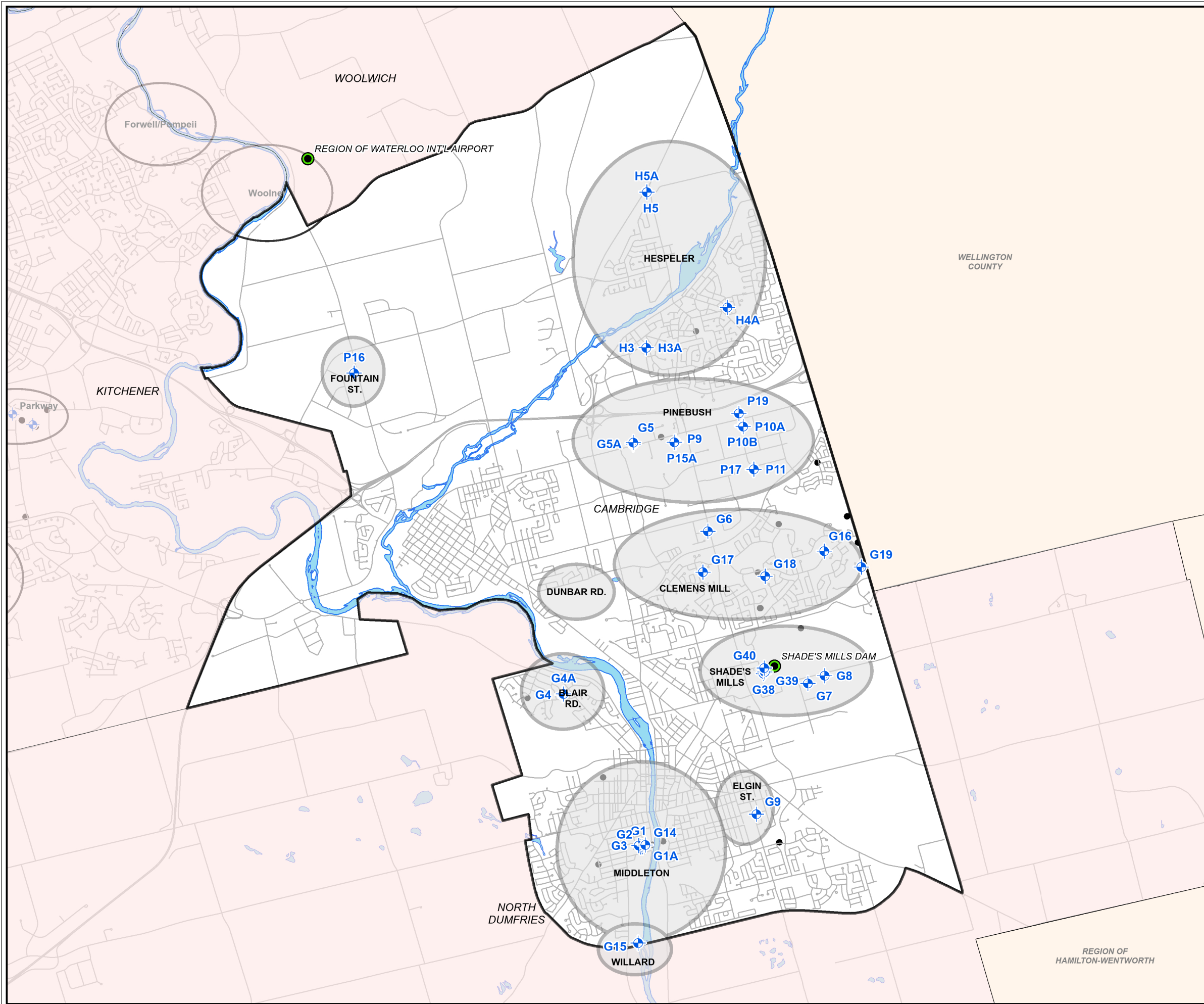
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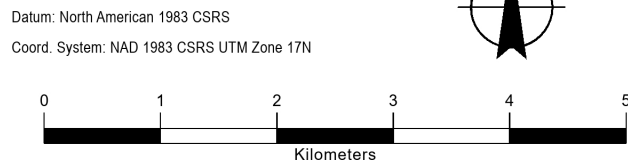
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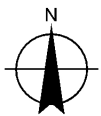
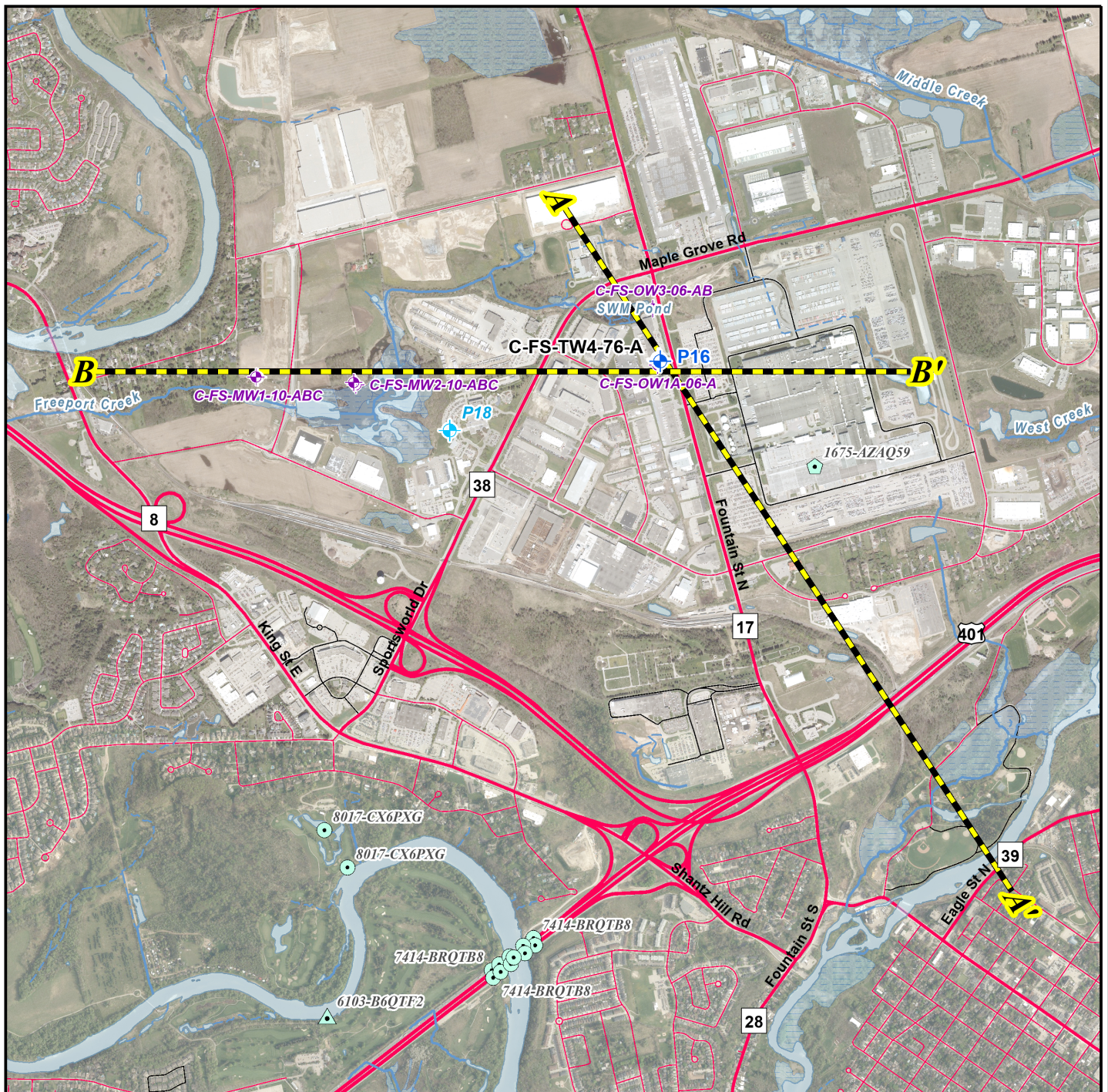
LEGEND

- Production Well Location
- Monitoring Well Location
- Well Fields
- Cambridge Municipal Boundary
- Meteorological Monitoring Locations

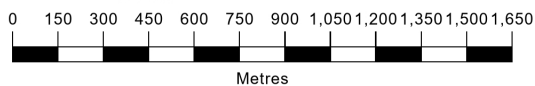
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2025 GROUNDWATER MONITORING REPORT - FOUNTAIN STREET WELL FIELD CAMBRIDGE WELL FIELDS AND MONITORING NETWORK			
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Region of Waterloo GIS Data; Background 2020 Air Photo;
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- Production Well Location
- Nearby Monitoring Well Location
- Nearby Production Well Location
- Groundwater
- Surface Water
- Surface and Ground Water
- Cross Section Orientation
- Intermittent Creek
- Creek
- Waterbody

- Provincially Significant Wetland (MNR)
- Provincial Highway
- Regional Road
- Local Road
- Private / Other Road



Map Title

2025 GROUNDWATER MONITORING REPORT - FOUNTAIN STREET WELL FIELD WELL LOCATION MAP

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REGION OF WATERLOO

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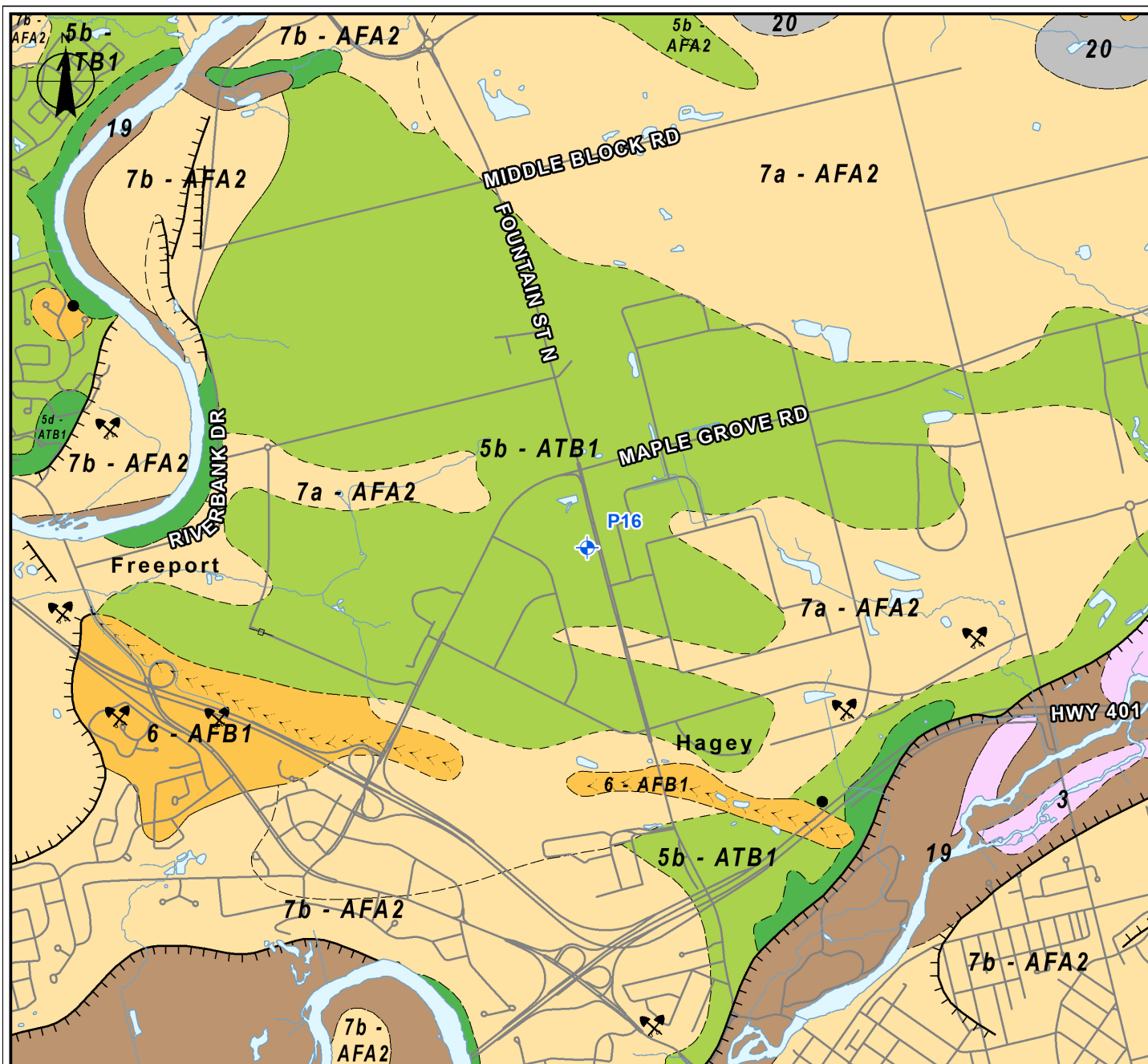
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Figure No.

3



Data Source:
 1. Ontario Geological Survey 2003, Surficial Geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128.
 2. Region of Waterloo GIS

RMOW Supply Well

Watercourse

Waterbody

Surficial Geology

3: Paleozoic bedrock

5b: Stone-poor, carbonate-derived silty to sandy till (ATA2/ATB1 - Aquitard)

5d: Glaciolacustrine-derived silty to clayey till (ATB1 - Aquitard)

6: Ice-contact stratified deposits (AFB1 - Aquifer)

7a: Glaciofluvial deposits: Sandy deposits (AFA2 - Aquifer)

7b: Glaciofluvial deposits: Gravelly deposits (AFA2 - Aquifer)

19: Modern alluvial deposits

20: Organic deposits

Sand and Gravel Pit

Esker: Direction of Flow Known

Terrace

Drumlin or drumlinoid ridges (point)

Sample Location

Unit Contact Boundary



Map Title

2025 GROUNDWATER MONITORING REPORT - FOUNTAIN STREET WELL FIELD

SURFICIAL GEOLOGY

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REGION OF WATERLOO

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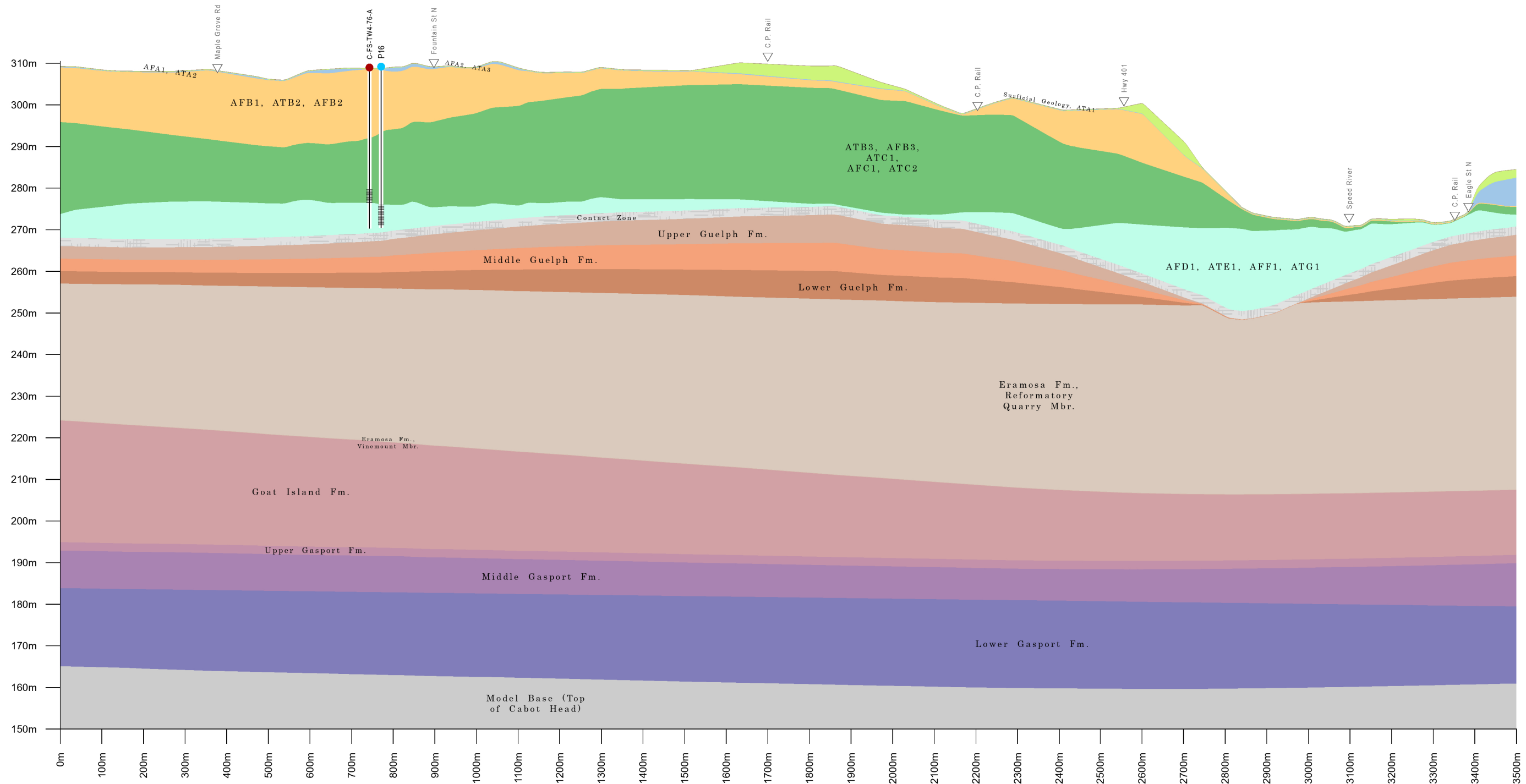
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4

A

A'



Wells

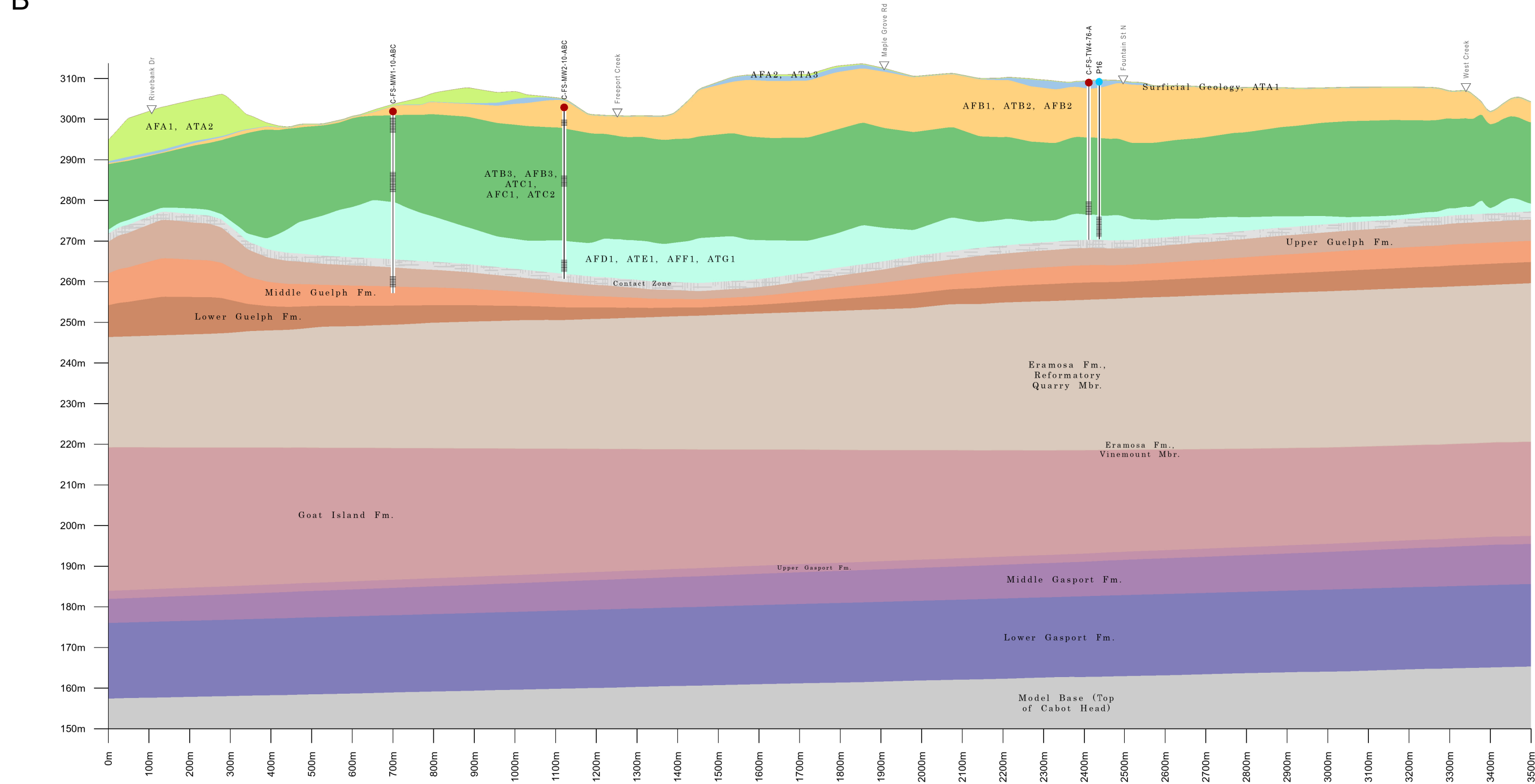
● Production Well (Inactive) ● Monitoring Well

Cambridge Model 2026

Surficial Geology, Whittlesey Clay (ATA1) Whittlesey Sand (AFA1), Wentworth Till (ATA2) Grand River Valley Outwash Deposits (AFA2), Fine Grain Deposits in the Grand River Valley (ATA3) Upper Waterloo Moraine Stratified Sediments & Equivalents (AFB1), Middle Maryhill Till & Equivalents (ATB2), Middle Waterloo Moraine Stratified Sediments & Equivalents (AFB2) Lower Maryhill Till & stratified Equivalents (ATB3), Lower Waterloo Moraine Stratified Sediments or Catfish Creek Till Outwash (AFB3), Upper / Main Catfish Creek Till (ATC1), Middle Catfish Creek Stratified Deposits (AFC1), Lower Catfish Creek Till (ATC2) Pre-Catfish Creek Coarse-Grained Glaciofluvial/ Lacustrine Deposits (AFD1), Canning Drift: Till & Fine Textured Glaciolacustrine Deposits (ATE1), Pre-Canning Coarse-Textured Glaciofluvial/ Glaciolacustrine Deposits (AFF1), Pre-Canning Coarse-Textured Till (ATG1) Weathered Bedrock Bedrock: Upper Guelph Fm. Bedrock: Middle Guelph Fm. Bedrock: Lower Guelph Fm. Bedrock: Eramosa Fm., Reformatory Quarry Mbr. Bedrock: Eramosa Fm., Vinemount Mbr. Bedrock: Goat Island Fm. Bedrock: Lower Gasport Fm. Bedrock: Upper Gasport Fm. Bedrock: Middle Gasport Fm. Model Base (Top of Cabot Head)	Wellhead Well Screen or Open Hole	Client REGION OF WATERLOO	Figure Title GEOLOGIC CROSS SECTION REGION OF WATERLOO Fountain Street Cross Section A - A' <table><tr><td>Drawn</td><td>Checked</td><td>Date</td><td rowspan="3">Figure No.</td></tr><tr><td>PS</td><td>DH</td><td>2026/06/01</td></tr><tr><td colspan="2">Horizontal Scale 1:10,000</td><td>Project No.</td></tr><tr><td colspan="2">Vertical Ex.:10x</td><td>HA046402</td><td></td></tr></table>	Drawn	Checked	Date	Figure No.	PS	DH	2026/06/01	Horizontal Scale 1:10,000		Project No.	Vertical Ex.:10x		HA046402	
Drawn	Checked	Date	Figure No.														
PS	DH	2026/06/01															
Horizontal Scale 1:10,000		Project No.															
Vertical Ex.:10x		HA046402															

B

B'

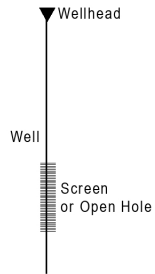


Wells

● Production Well (Inactive) ● Monitoring Well

Cambridge Model 2026

Surficial Geology, Whittlesey Clay (ATA1)	Upper Waterloo Moraine Stratified Sediments & Equivalents (AFB1), Middle Maryhill Till & Equivalents (ATB2), Middle Waterloo Moraine Stratified Sediments & Equivalents (AFB2)	Pre-Catfish Creek Coarse-Grained Glaciofluvial/ Lacustrine Deposits (AFD1), Canning Drift: Till & Fine Textured Glaciolacustrine Deposits (ATE1), Pre-Canning Coarse-Textured Glaciofluvial/ Glaciolacustrine Deposits (AFF1), Pre-Canning Coarse-Textured Till (ATG1)	Bedrock: Upper Guelph Fm.	Bedrock: Eramosa Fm., Vinemount Mbr.	Bedrock: Middle Gasport Fm.
Whittlesey Sand (AFA1), Wentworth Till (ATA2)	Lower Maryhill Till & stratified Equivalents (ATB3), Lower Waterloo Moraine Stratified Sediments or Catfish Creek Till Outwash (AFB3), Upper / Main Catfish Creek Till (ATC1), Middle Catfish Creek Stratified Deposits (AFC1), Lower Catfish Creek Till (ATC2)	Weathered Bedrock	Bedrock: Middle Guelph Fm.	Bedrock: Goat Island Fm.	Model Base (Top of Cabot Head)
Grand River Valley Outwash Deposits (AFA2), Fine Grain Deposits in the Grand River Valley (ATA3)			Bedrock: Lower Guelph Fm.	Bedrock: Lower Gasport Fm.	
			Bedrock: Eramosa Fm., Reformatory Quarry Mbr.	Bedrock: Upper Gasport Fm.	



Client

REGION OF WATERLOO

Figure Title

**GEOLOGIC CROSS SECTION
REGION OF WATERLOO**

Fountain Street
Cross Section B - B'

Drawn	Checked	Date	Figure No.
PS	DH	2026/06/01	6
Horizontal Scale 1:10,000		Project No.	
Vertical Ex.:10x		HA046402	



BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix A

Permit To Take Water

PERMIT TO TAKE WATER

Ground Water

NUMBER 2004-AKXNEB

Pursuant to Section 34.1 of the Ontario Water Resources Act, R.S.O. 1990 this Permit To Take Water is hereby issued to:

The Regional Municipality of Waterloo
150 Frederick St. 7th Floor
Kitchener, Ontario
N2G 4J3

For the water taking from: Municipal Well #P16

Located at: Lot 20, Concession Beasley Broken Front
Cambridge, Regional Municipality Of Waterloo

For the purposes of this Permit, and the terms and conditions specified below, the following definitions apply:

DEFINITIONS

- (a) "Director" means any person appointed in writing as a Director pursuant to section 5 of the OWRA for the purposes of section 34.1, OWRA.
- (b) "Provincial Officer" means any person designated in writing by the Minister as a Provincial Officer pursuant to section 5 of the OWRA.
- (c) "Ministry" means Ontario Ministry of the Environment and Climate Change.
- (d) "District Office" means the Guelph District Office.
- (e) "Permit" means this Permit to Take Water No. 2004-AKXNEB including its Schedules, if any, issued in accordance with Section 34.1 of the OWRA.
- (f) "Permit Holder" means The Regional Municipality of Waterloo.
- (g) "OWRA " means the *Ontario Water Resources Act*, R.S.O. 1990, c. O. 40, as amended.

You are hereby notified that this Permit is issued subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. Compliance with Permit

- 1.1 Except where modified by this Permit, the water taking shall be in accordance with the application for this Permit To Take Water, dated January 20, 2017 and signed by Richard Wootton, and all Schedules included in this Permit.
- 1.2 The Permit Holder shall ensure that any person authorized by the Permit Holder to take water under this Permit is provided with a copy of this Permit and shall take all reasonable measures to ensure that any such person complies with the conditions of this Permit.
- 1.3 Any person authorized by the Permit Holder to take water under this Permit shall comply with the conditions of this Permit.
- 1.4 This Permit is not transferable to another person.
- 1.5 This Permit provides the Permit Holder with permission to take water in accordance with the conditions of this Permit, up to the date of the expiry of this Permit. This Permit does not constitute a legal right, vested or otherwise, to a water allocation, and the issuance of this Permit does not guarantee that, upon its expiry, it will be renewed.
- 1.6 The Permit Holder shall keep this Permit available at all times at or near the site of the taking, and shall produce this Permit immediately for inspection by a Provincial Officer upon his or her request.
- 1.7 The Permit Holder shall report any changes of address to the Director within thirty days of any such change. The Permit Holder shall report any change of ownership of the property for which this Permit is issued within thirty days of any such change. A change in ownership in the property shall cause this Permit to be cancelled.

2. General Conditions and Interpretation

- 2.1 Inspections
The Permit Holder must forthwith, upon presentation of credentials, permit a Provincial Officer to carry out any and all inspections authorized by the OWRA, the *Environmental Protection Act*, R.S.O. 1990, the *Pesticides Act*, R.S.O. 1990, or the *Safe Drinking Water Act*, S. O. 2002.
- 2.2 Other Approvals
The issuance of, and compliance with this Permit, does not:
(a) relieve the Permit Holder or any other person from any obligation to comply with any other

applicable legal requirements, including the provisions of the *Ontario Water Resources Act* , and the *Environmental Protection Act* , and any regulations made thereunder; or

(b) limit in any way any authority of the Ministry, a Director, or a Provincial Officer, including the authority to require certain steps be taken or to require the Permit Holder to furnish any further information related to this Permit.

2.3 Information

The receipt of any information by the Ministry, the failure of the Ministry to take any action or require any person to take any action in relation to the information, or the failure of a Provincial Officer to prosecute any person in relation to the information, shall not be construed as:

(a) an approval, waiver or justification by the Ministry of any act or omission of any person that contravenes this Permit or other legal requirement; or

(b) acceptance by the Ministry of the information's completeness or accuracy.

2.4 Rights of Action

The issuance of, and compliance with this Permit shall not be construed as precluding or limiting any legal claims or rights of action that any person, including the Crown in right of Ontario or any agency thereof, has or may have against the Permit Holder, its officers, employees, agents, and contractors.

2.5 Severability

The requirements of this Permit are severable. If any requirements of this Permit, or the application of any requirements of this Permit to any circumstance, is held invalid or unenforceable, the application of such requirements to other circumstances and the remainder of this Permit shall not be affected thereby.

2.6 Conflicts

Where there is a conflict between a provision of any submitted document referred to in this Permit, including its Schedules, and the conditions of this Permit, the conditions in this Permit shall take precedence.

3. **Water Takings Authorized by This Permit**

3.1 **Expiry**

This Permit expires on **March 31, 2027**. No water shall be taken under authority of this Permit after the expiry date.

3.2 Amounts of Taking Permitted

The Permit Holder shall only take water from the source, during the periods and at the rates and amounts of taking specified in Table A. Water takings are authorized only for the purposes specified in Table A.

Table A

	Source Name / Description:	Source: Type:	Taking Specific Purpose:	Taking Major Category:	Max. Taken per Minute (litres):	Max. Num. of Hrs Taken per Day:	Max. Taken per Day (litres):	Max. Num. of Days Taken per Year:	Zone/ Easting/ Northing:
1	Municipal Well #P16	Well Drilled	Municipal	Water Supply	1,364	24	1,964,160	365	17 550338 4807753
						Total Taking:	1,964,160		

4. Monitoring

4.1 Under section 9 of O. Reg. 387/04, and as authorized by subsection 34(6) of the *Ontario Water Resources Act*, the Permit Holder shall, on each day water is taken under the authorization of this Permit, record the date, the volume of water taken on that date and the rate at which it was taken. The daily volume of water taken shall be measured by a flow meter or calculated in accordance with the method described in the application for this Permit, or as otherwise accepted by the Director. The Permit Holder shall keep all records required by this condition current and available at or near the site of the taking and shall produce the records for inspection by a Provincial Officer upon his or her request. The Permit Holder, unless otherwise required by the Director, shall submit, on or before March 31st in every year, the records required by this condition to the ministry's Water Taking Reporting System.

4.2 The Permit Holder shall measure and record water levels once a month in the following monitoring well:

C-FS-TW4-76

4.3 The Permit Holder shall prepare and submit a report every two years by June 30th commencing June 30, 2018, that presents the results of the well field water level monitoring for the two preceding calendar years, assesses changes in water levels in the supply aquifer in relation to the precipitation and the water taking from the aquifer, and provides a summary for all interference complaints received by the Permit Holder related to this permit and reported in the District Office in accordance with Condition 5.1 and the manner in which the Permit Holder has dealt with the complaint.

5. Impacts of the Water Taking

5.1 Notification

The Permit Holder shall immediately notify the local District Office of any complaint arising from the taking of water authorized under this Permit and shall report any action which has been taken or is proposed with regard to such complaint. The Permit Holder shall immediately notify the local District Office if the taking of water is observed to have any significant impact on the surrounding waters. After hours, calls shall be directed to the Ministry's Spills Action Centre at 1-800-268-6060.

5.2 For Groundwater Takings

If the taking of water is observed to cause any negative impact to other water supplies obtained from any adequate sources that were in use prior to initial issuance of a Permit for this water taking, the Permit Holder shall take such action necessary to make available to those affected, a supply of water equivalent in quantity and quality to their normal takings, or shall compensate such persons for their reasonable costs of so doing, or shall reduce the rate and amount of taking to prevent or alleviate the observed negative impact. Pending permanent restoration of the affected supplies, the Permit Holder shall provide, to those affected, temporary water supplies adequate to meet their normal requirements, or shall compensate such persons for their reasonable costs of doing so.

If permanent interference is caused by the water taking, the Permit Holder shall restore the water supplies of those permanently affected.

6. **Director May Amend Permit**

The Director may amend this Permit by letter requiring the Permit Holder to suspend or reduce the taking to an amount or threshold specified by the Director in the letter. The suspension or reduction in taking shall be effective immediately and may be revoked at any time upon notification by the Director. This condition does not affect your right to appeal the suspension or reduction in taking to the Environmental Review Tribunal under the *Ontario Water Resources Act*, Section 100 (4).

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is included to ensure that the conditions in this Permit are complied with and can be enforced.
2. Condition 2 is included to clarify the legal interpretation of aspects of this Permit.
3. Conditions 3 through 6 are included to protect the quality of the natural environment so as to safeguard the ecosystem and human health and foster efficient use and conservation of waters. These conditions allow for the beneficial use of waters while ensuring the fair sharing, conservation and sustainable use of the waters of Ontario. The conditions also specify the water takings that are authorized by this Permit and the scope of this Permit.

In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 101 of the Ontario Water Resources Act, R.S.O. 1990, as amended, provides that the Notice requiring the hearing shall state:

1. The portions of the Permit or each term or condition in the Permit in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

In addition to these legal requirements, the Notice should also include:

- a. The name of the appellant;
- b. The address of the appellant;
- c. The Permit to Take Water number;
- d. The date of the Permit to Take Water;
- e. The name of the Director;
- f. The municipality within which the works are located;

This notice must be served upon:

*The Secretary
Environmental Review Tribunal
655 Bay Street, 15th Floor
Toronto ON
M5G 1E5
Fax: (416) 326-5370
Email: ERTTribunalsecretary@ontario.ca*

AND

*The Director, Section 34.1, Ministry of the
Environment and Climate Change
12th Floor
119 King St W
Hamilton ON L8P 4Y7
Fax: (905) 521-7820*

Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal:

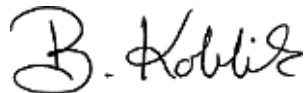
by Telephone at
(416) 212-6349
Toll Free 1(866) 448-2248

by Fax at
(416) 326-5370
Toll Free 1(844) 213-3474

by e-mail at
www.ert.gov.on.ca

This Permit cancels and replaces Permit Number 1405-78PRBW, issued on 2007/11/28.

Dated at Hamilton this 31st day of March, 2017.



Belinda Koblik
Director, Section 34.1
Ontario Water Resources Act , R.S.O. 1990

Schedule A

This Schedule “A” forms part of Permit To Take Water 2004-AKXNEB, dated March 31, 2017.



BURNSIDE

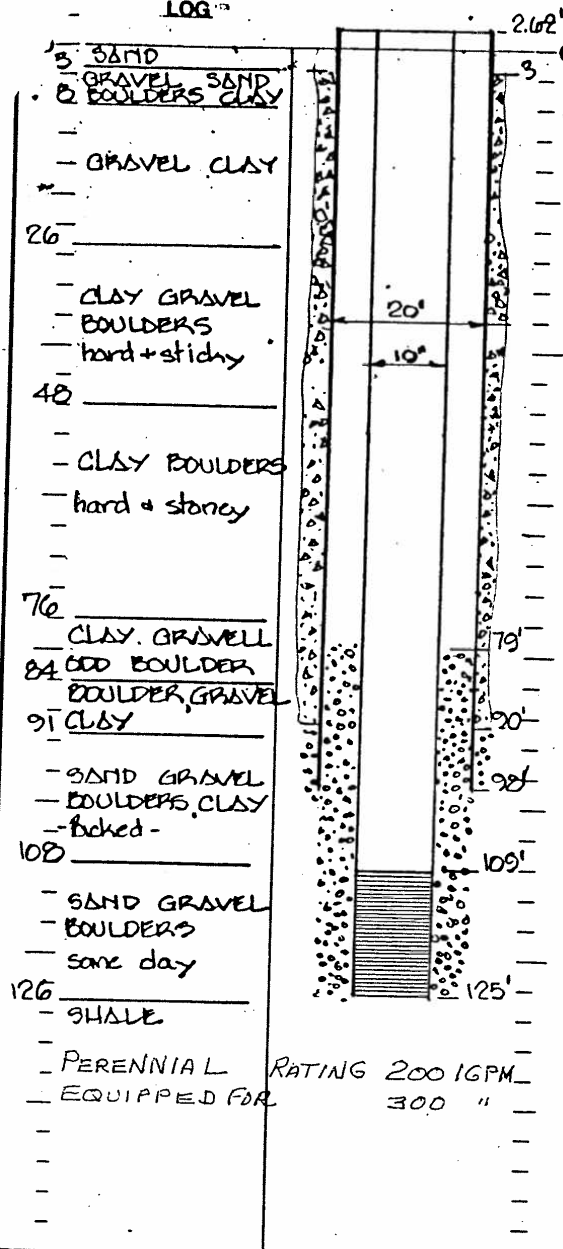
[THE DIFFERENCE IS OUR PEOPLE]

Appendix B

Well Records

WELL DIAGRAM

LOG



WELL MATERIAL

Outer Casing: 20 " dia., 375 " Wall Thk. Matl.: steel
Cemented from 90 " to 3 " "

Inner Casing: 10 " dia., 300 " Wall Thk. Matl.: steel
Screen: Made hand 18 " dia., Opening & Matl.: 20-40 ss.
Plug: Type plate Matl. steel Other: —
Gravel: Type silica Size 1/8 x 10 Quantity 10.8 tons

WELL TEST DATA

Preliminary Test Date: Nov 3-7, 1986 by B. Magee
Static Level: 63.25 " below M.P. + 2.62
Pumping Rate IGM: 300
Pumping Duration: 72 hrs. min.
Pumping Level at Test End: 90.43 "
Performance Plots: dd-t Dwg. A 86306
dd-r Dwg. A 86308
Step Test D 86309 / A 86310

Final Test: Date: by
Rated Well Capacity IGM
Pumping Rate IGM Static level
Pumping level " at hrs. min.
Pump pressure: psi Main pressure: psi
Shut off: AGH: psi; W.L.: "
Clear Well Depth from B.P.: " Air Line: "

PUMP & MOTOR DATA

Pump Make: Rating: IGM @ TH
Head: Type: S.N.
Column: " X " X " : Shaft Mtl.:
Bowl: Stage: Curve:
Suction: " dia. " Long
Special: Zinc Sleeves: Taped Oil Line:
Other:
Motor Make: Frame: SN:
HP, ph, hz, rpm, Volts
Bearing No. Upper:
Lower:

Special Equipment

WELL REVISIONS AND REHABILITATION

DATE	WORK DONE	BY

International Water Supply Limited

SASKATOON - BARRIE - MONTREAL

CLIENT: REGION of WATERLOO

WELL NO: - P-16

DRILLED BY: B. Magee

DATE: 11/86

DRAWN: J. Wall

INSTALLED BY:

DATE:

DATE: Nov 11, 1986

UNL. 168



Ministry
of the
Environment
Ontario

The Ontario Water Resources Act
WATER WELL RECORD

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

COUNTY OR DISTRICT WATERLOO	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE WATERLOO	CON., BLOCK, TRACT, SURVEY, ETC. Beasley Broken Front	LOT 20
OWNER (SURNAME FIRST) Region of Waterloo	ADDRESS Marsland Center Waterloo	DATE COMPLETED DAY 7 MO Nov YR 86	

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET	
				FROM	TO
	topsoil			0	1
	Sand			1	3
	Gravel	Sand boulders & clay		3	8
Grey	Gravel	clay		8	26
Grey	clay	gravel boulder	hard & sticky	26	48
Grey	clay	boulder	hard & sticky	48	76
	clay	gravel and boulder		76	84
	Boulders	gravel & clay		84	91
	Sand	gravel boulders clay packed		91	108
	Sand	gravel boulders some clay		108	126
	Shale			126	127

WATER RECORD	
WATER FOUND AT - FEET	KIND OF WATER
91	☒ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL
	☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL

CASING & OPEN HOLE RECORD			
INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET
	☒ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE		FROM TO
20"		.375	0 98
10"	☒ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE		+2.62 109

SCREEN	SIZE(S) OF OPENING (SLOT NO.) 20 slot	DIAMETER 10 INCHES	LENGTH 16 FEET
	MATERIAL AND TYPE stainless steel	DEPTH TO TOP OF SCREEN 109 FEET	
PLUGGING & SEALING RECORD			
DEPTH SET AT - FEET		MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)	
FROM TO			
92 3		Cement grout.	

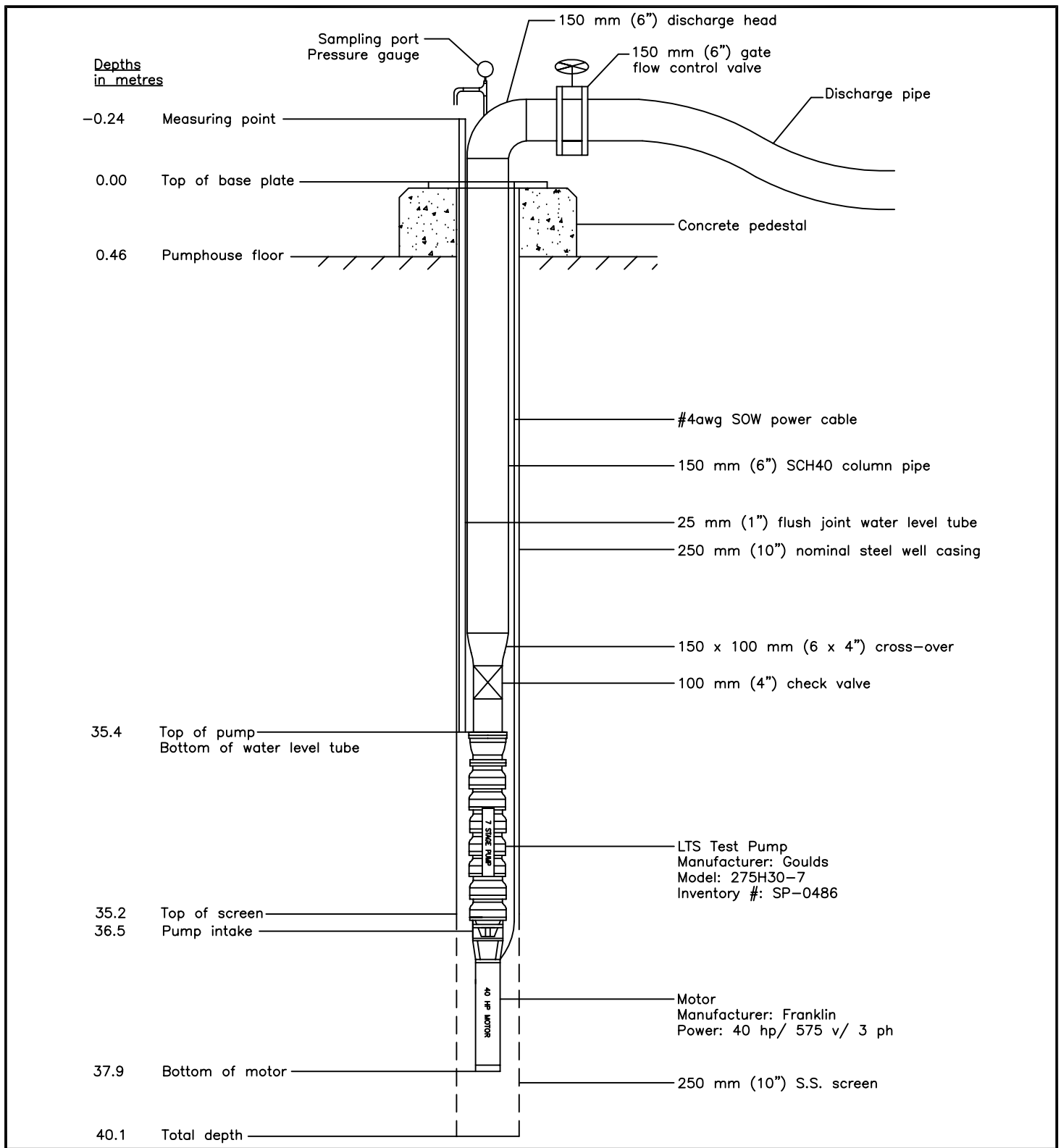
PUMPING TEST METHOD		PUMPING RATE	DURATION OF PUMPING
☒ PUMP ☐ BAILER		200 GPM	72 HOURS MINS
STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING	
63.25 FEET	50.43 FEET	☒ PUMPING ☐ RECOVERY	
		10 MINUTES 78.50 FEET	30 MINUTES 79.92 FEET
		45 MINUTES 80.81 FEET	60 MINUTES 81.06 FEET
IF FLOWING, GIVE RATE		PUMP INTAKE SET AT	WATER AT END OF TEST
			☐ CLEAR ☐ CLOUDY
RECOMMENDED PUMP TYPE		RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
☐ SHALLOW ☐ DEEP			

FINAL STATUS OF WELL	☒ WATER SUPPLY ☐ OBSERVATION WELL ☐ TEST HOLE ☐ RECHARGE WELL	☐ ABANDONED, INSUFFICIENT SUPPLY ☐ ABANDONED, POOR QUALITY ☐ UNFINISHED
WATER USE	☐ DOMESTIC ☐ STOCK ☐ IRRIGATION ☐ INDUSTRIAL ☐ OTHER	☐ COMMERCIAL ☐ MUNICIPAL ☒ PUBLIC SUPPLY ☐ COOLING OR AIR CONDITIONING ☐ NOT USED
METHOD OF DRILLING	☐ CABLE TOOL ☒ ROTARY (CONVENTIONAL) ☐ ROTARY (REVERSE) ☐ ROTARY (AIR) ☐ AIR PERCUSSION	

LOCATION OF WELL P-16	
IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.	
DRILLER'S REMARKS (IF ANY)	
05801001	

NAME OF WELL CONTRACTOR International Water Supply	LICENCE NUMBER 2801
ADDRESS P.O. Box 310 Barrie	
NAME OF DRILLER OR BORER B.C. Magee	LICENCE NUMBER
SIGNATURE OF CONTRACTOR [Signature]	SUBMISSION DATE DAY 11 MO 11 YR 86

OFFICE USE ONLY



CLIENT

REGIONAL MUNICIPALITY OF WATERLOO

TITLE

**Production Well P16 (Fountain Street N)
Pumping Test Setup (As-Installed)**PROJECT No. **006-199**

G:\Lotowater Projects\006 RMOW\199 Maple Grove Pumping Test & P16 Rehab\7. Technical\P16\

DESIGN		
DRAWN	MG	2011/05/03
CHECKED		

REVISION No. 2011-05-12

SCALE **N.T.S.**

FIGURE

8



Ontario

The Ontario Water Resources Act WATER WELL RECORD

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

COUNTY OR DISTRICT <u>Waterloo</u>	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE <u>Waterloo</u>	CON., BLOCK, TRACT, SURVEY, ETC. <u>Barley's Broken Front</u>	LOT <u>20</u>
OWNER (SURNAME FIRST) <u>Ray Munie of Waterloo</u>	ADDRESS <u>Marsland Centre Waterloo</u>	DATE COMPLETED <u>Day 25 MO June YR 76</u>	

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET	
				FROM	TO
	Top Sal.			0	1
	Sand	Gravel Boulders Clay		1	10
Grey	Gravel	Clay		10	15
	Sand	Gravel, Clay		15	26
	Clay	silt stones		26	74
Brown	Clay	sand gravel		74	83
"	"	silt gravel	packed	83	90
	Gravel	sand	"	90	104
	Gravel		loose	104	107
	Sand	Gravel Shale streaks		107	114
Grey	Sand	Gravel clay?		114	120
	Sand	" little clay		120	127

WATER RECORD	
WATER FOUND AT - FEET <u>20-127</u>	KIND OF WATER ☒ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL ☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL ☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL ☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL ☐ FRESH ☐ SULPHUR ☐ SALTY ☐ MINERAL

CASING & OPEN HOLE RECORD			
INSIDE DIAM. INCHES <u>2</u>	MATERIAL ☒ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE	WALL THICKNESS INCHES	DEPTH - FEET FROM TO <u>0</u> <u>96</u>
	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE		
	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE		

SIZE OF OPENING (SLOT NO.) <u>1/16" slot</u>	DIAMETER <u>2"</u>	LENGTH <u>11</u> FEET
MATERIAL AND TYPE <u>slotted pipe</u>	DEPTH TO TOP OF SCREEN <u>96</u> FEET	

PLUGGING & SEALING RECORD		
DEPTH SET AT - FEET FROM TO	MATERIAL AND TYPE	CEMENT GROUT, LEAD PACKER, ETC.

PUMPING TEST METHOD ☒ PUMP ☐ BAILEY	PUMPING RATE <u>20</u> GPM	DURATION OF PUMPING HOURS MIN — —
STATIC LEVEL <u>60.37</u> FEET	WATER LEVEL END OF PUMPING — FEET	WATER LEVELS DURING 15 MINUTES 30 MINUTES 45 MINUTES 60 MINUTES — FEET — FEET — FEET — FEET
IF FLOWING, GPH RATE — GPM	PUMP INTAKE SET AT — FEET	WATER AT END OF TEST ☐ CLEAR ☐ CLOUDY
RECOMMENDED PUMP TYPE ☐ SHALLOW ☐ DEEP	RECOMMENDED PUMP SETTING — FEET	RECOMMENDED PUMPING RATE — GPM

FINAL STATUS OF WELL ☐ WATER SUPPLY ☒ OBSERVATION WELL ☐ TEST HOLE ☐ RECHARGE WELL	☐ ABANDONED, INSUFFICIENT SUPPLY ☐ ABANDONED, POOR QUALITY ☐ UNFINISHED
WATER USE ☐ DOMESTIC ☐ STOCK ☐ IRRIGATION ☐ INDUSTRIAL ☐ OTHER	☐ COMMERCIAL ☐ MUNICIPAL ☐ PUBLIC SUPPLY ☐ COOLING OR AIR CONDITIONING ☒ NOT USED
METHOD OF DRILLING ☒ CABLE TOOL ☒ ROTARY (CONVENTIONAL) ☐ ROTARY (REVERSE) ☐ ROTARY (AIR) ☐ AIR PERCUSSION	☐ BORING ☐ DIAMOND ☐ JETTING ☐ DRIVING

LOCATION OF WELL	
IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.	
Fountain St. Maple Grove Rd. 1050' 204'	
DRILLER'S REMARKS	

NAME OF WELL CONTRACTOR <u>International Water Supply Ltd</u>	LICENCE NUMBER <u>2801</u>
ADDRESS <u>Box 310 Barrie</u>	
NAME OF DRILLER OR BORER <u>A. Grunster</u>	LICENCE NUMBER
SIGNATURE OF CONTRACTOR <u>[Signature]</u>	SUBMISSION DATE <u>Day 27 MO Aug YR 76</u>

OFFICE USE ONLY

CONTRACTOR'S COPY



BURNSIDE

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Appendix C

Monitoring Data (Pumped Volumes and Hydrographs)



TABLE C-1
WELL FIELD WATER PRODUCTION SUMMARY
REGION OF WATERLOO - 2025 GROUNDWATER MONITORING REPORT

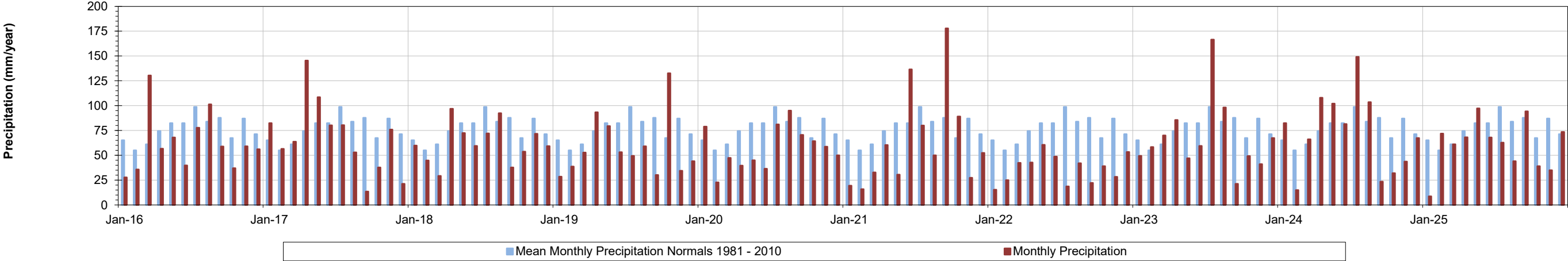


Well Field	Major or Minor Supply	Production Well Name	Status	Permit to Take Water Details			2021 Production Summary				2022 Production Summary				2023 Production Summary				2024 Production Summary				2025 Production Summary							
				MOE Permit Number ¹	Permitted Capacity (total m ³ /year)*	Permitted Rate (L/s)*	Total Production Well Volume (total m ³ /year)	Average Daily Rate (m ³ /day)	Average Rate (L/s)	Total Production Well Volume (total m ³ /year)	Average Daily Rate (m ³ /day)	Average Rate (L/s)	Total Production Well Volume (total m ³ /year)	Average Daily Rate (m ³ /day)	Average Rate (L/s)	Total Production Well Volume (total m ³ /year)	Average Daily Rate (m ³ /day)	Average Rate (L/s)	Total Production Well Volume (total m ³ /year)	Average Daily Rate (m ³ /day)	Average Rate (L/s)	Total Production Well Volume (total m ³ /year)	Average Daily Rate (m ³ /day)	Average Rate (L/s)						
Fountain Street	Minor	P16	Supply	PTTW 2004-AKONEB	716,918	22.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
				Well Field Total			0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0	0	0	0.0
				*Maximum rate and amount shall not exceed 1,364 L/min and 1,964,160 L/day, respectively																										

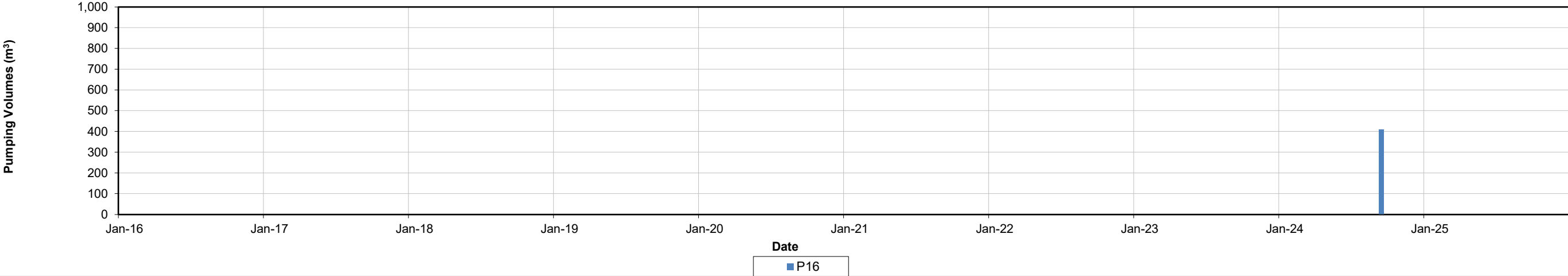
Notes:
- = no applicable data
n/a = data not available
* = rates and volumes based on permitted L/day
¹ = Current Permit

REGION OF WATERLOO
2025 GROUNDWATER MONITORING REPORT -
FOUNTAIN STREET

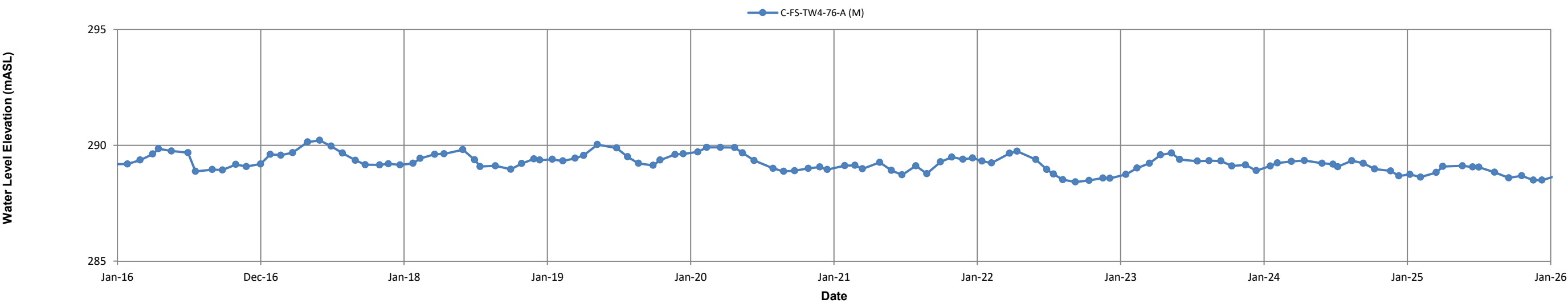
Actual versus Mean Monthly Precipitation
Weather Station - Region of Waterloo International Airport



Monthly Total Pumped Volumes
FOUNTAIN STREET WELL FIELD



FOUNTAIN STREET WELL FIELD





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Appendix D

Precipitation Data

Table D-1
Precipitation Variation from Average
Region of Waterloo - 2025 Groundwater Monitoring Report

Year	Kitchener/Waterloo Weather Station Established 1966		
	Annual Precipitation (mm)	30-yr NORMAL Precipitation 1981-2010 (mm)	Difference (mm)
2016	748	851	-103
2017	818	851	-33
2018	749	851	-102
2019	695	851	-156
2020	689	851	-162
2021	772	851	-79
2022	438	851	-413
2023	813	851	-38
2024	874	851	23
2025	723	851	-128

Year	University of Waterloo Station Established 1988		
	Annual Precipitation (mm)	Average Precipitation 1998-2024 (mm)	Difference (mm)
2016	891	871	20
2017	989	871	118
2018	950	871	79
2019	923	871	52
2020	953	871	82
2021	1022	871	151
2022	578	871	-293
2023	959	871	88
2024	763	871	-108
2025	943	871	72

Year	Shand Dam Established 1939		
	Annual Precipitation (mm)	Average Precipitation 1940-2025 (mm)	Difference (mm)
2016	976	926	50
2017	1093	926	167
2018	849	926	-77
2019	1081	926	155
2020	1017	926	91
2021	876	926	-50
2022	798	926	-128
2023	1015	926	89
2024	994	926	68
2025	995	926	69

Year	Conestogo Dam Established 1961		
	Annual Precipitation (mm)	Average Precipitation 1961-2025 (mm)	Difference (mm)
2016	983	990	-7
2017	1210	990	220
2018	962	990	-28
2019	992	990	2
2020	1021	990	31
2021	975	990	-15
2022	907	990	-83
2023	1053	990	63
2024	972	990	-18
2025	1025	990	35

Year	Woolwich Dam Established 1960		
	Annual Precipitation (mm)	Average Precipitation 1960-2025 (mm)	Difference (mm)
2016	844	835	9
2017	986	835	151
2018	869	835	34
2019	824	835	-11
2020	862	835	27
2021	649	835	-186
2022	668	835	-167
2023	859	835	24
2024	793	835	-42
2025	732	835	-103

Year	Shade's Mills Dam Established 1960		
	Annual Precipitation (mm)	Average Precipitation 1960-2025 (mm)	Difference (mm)
2016	934	909	24
2017	1092	909	183
2018	1042	909	133
2019	1059	909	150
2020	848	909	-62
2021	1020	909	111
2022	682	909	-227
2023	982	909	73
2024	976	909	67
2025	895	909	-14

Year	Laurel Dam Established 1960		
	Annual Precipitation (mm)	Average Precipitation 1960-2025 (mm)	Difference (mm)
2016	985	938	47
2017	1062	938	124
2018	1071	938	133
2019	940	938	2
2020	938	938	0
2021	1027	938	89
2022	689	938	-249
2023	921	938	-17
2024	907	938	-31
2025	894	938	-44

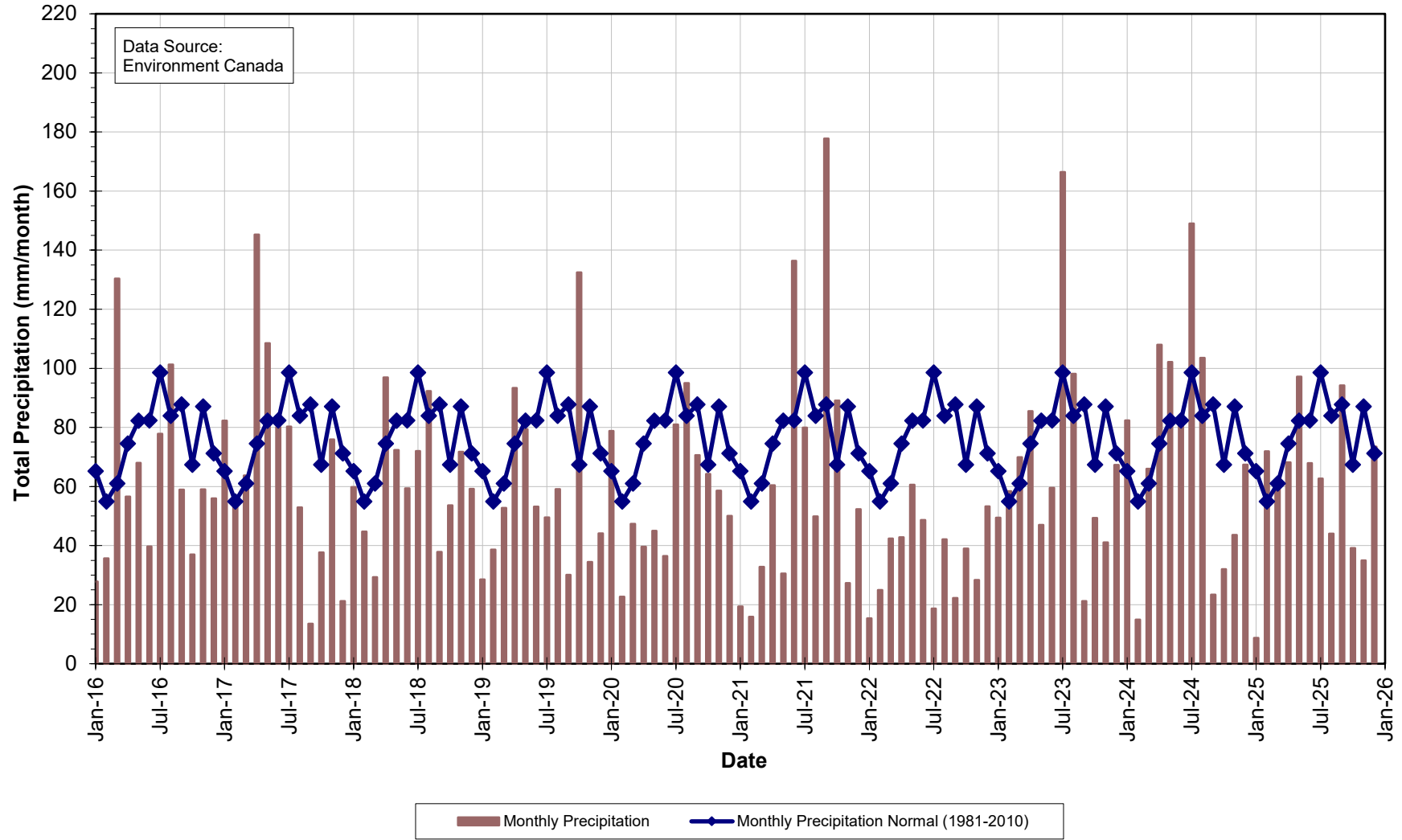
Year	Roseville Weather Station Established 1972		
	Annual Precipitation (mm)	30-yr NORMAL Precipitation 1981-2010 (mm)	Difference (mm)
2016	899	919	-20
2017	882	919	-37
2018	905	919	-14
2019	957	919	38
2020	817	919	-102
2021	832	919	-87
2022	637	919	-282
2023	945	919	26
2024	856	919	-63
2025	786	919	-133

NOTES:

WIA station data is not subject to review by the National Climate Archives, therefore, undergoes very limited quality checking.
 GRCA Dam stations data is not reviewed extensively and undergoes limited quality checking.

Region of Waterloo – 2025 Groundwater Monitoring Report

Figure D.1
Waterloo International Airport
Monthly Precipitation





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Appendix E

Monitoring Program Overview

GROUNDWATER LEVEL MONITORING PROGRAM PROCEDURES

E.1 Overview

The Region of Waterloo (Region) collects water level measurements at specific monitoring wells to ensure sustainable long-term water supply and to meet monitoring and reporting requirements for the Region's water-taking permits. The goal of the program is to manage and protect the Region's groundwater supply and to assess the potential impact of municipal pumping on the groundwater and surface water resources in the Region. The ongoing collection and assessment of groundwater level data is integral to assess any changes to the water resources that may occur due to pumping.

E.1.1 Production Well Pumping and Water Levels

In 2023 the Region managed approximately 132 production wells with status defined as:

- Commissioned – Active wells
- New Not-Commissioned – Well are inactive or locked out until future demand or repairs/maintenance of other wells requires activating them

The well fields are referred to as Urban (Kitchener, Waterloo, and Cambridge) and Rural (North Dumfries, Woolwich, Wilmot, and Wellesley). Well fields in Kitchener, Waterloo, and Cambridge are referred to as the Integrated Urban System (IUS).

The Region's active production wells are monitored through the Region's SCADA (Supervisory Control and Data Acquisition) system, which reads and records the volume pumped on a daily basis. A few wells do not have their own meter but are combined with other nearby well(s) in the well field and the combined flow is divided into a record for each source. Water level measurements are obtained from the production wells where required. All manual measurements are obtained using either an air line or a water level tape.

E.1.2 Monitoring Wells and Surface Water levels

Water levels are measured at monitoring wells and at some surface water features. The objective of this monitoring is to collect data to ensure that the Region's water taking has minimal impact on the environment and on private water takers.

Water levels in the Region's monitoring wells are measured either electronically or manually. Most of the wells that are monitored electronically use datalogger equipment manufactured by *In-Situ Inc.*® LevelTROLLs® and RuggedTROLLs®, as well as, by *Van Essen Instruments (formerly Schlumberger Water Services)* Mini-Divers®, Micro-Divers®, and TD-Divers®; or by *Solinst*® Levelloggers®. The datalogger pressure sensor models used may be either vented (gauged) or non-vented (absolute) for *In-Situ Inc.*®; whereas, for *Van Essen Instruments* and for *Solinst*®, non-vented (absolute) models are used. Barometric dataloggers by each manufacturer suspended in select well locations are also used with the non-vented (absolute) models to provide the required barometric pressure compensation necessary in producing the water level data. Manual monitoring is done using a *Solinst*® and/or *Heron Instruments Inc.* electronic water level meter with both visual and audio indicators.

The electronically monitored wells are typically measured every hour, with increased frequency as required. At the hourly frequency, the following trends can be distinguished in an individual monitoring well:

- Seasonal climate trends;
- Water level changes in the aquifer that is being pumped;
- Water level changes in aquifers connected to the pumped aquifer; and
- Individual precipitation events in unconfined aquifers.

The manually monitored wells are measured once per month. At this frequency only the first three responses listed above can be distinguished.

E.1.3 Climatological Data

To evaluate the reaction of water levels to changes in climatic conditions, precipitation data are monitored at various locations throughout the Region. Within the Region of Waterloo, climate data is collected by Environment Canada at the Region of Waterloo International Airport (WIA) and the Roseville weather station, by the Grand River Conservation Authority (GRCA) at various Dam locations and by the University of Waterloo at a weather station located on the north campus.

E.2 Groundwater Level Collection Protocols

E.2.1 Groundwater Level Monitoring Network Summary Well Checklist

A well checklist and data entry spreadsheet are prepared of all the measuring points where water levels will be collected on a monthly basis. The checklist and spreadsheet are organized by well field so wells in close proximity are grouped together and indicates whether locations are measured with electronic dataloggers or manual measurements only. Once a well is visited, data is entered in the spreadsheet and the well is checked off the list; thus, the checklist and spreadsheet provides an obvious indication that work is unfinished if a location is unchecked and has no data.

E.2.2 Well Inspection

Upon visiting a well for the first time, the well/casing/equipment details are noted, photos taken, and GPS coordinates are recorded in a field book and/or in the monthly data entry spreadsheet. Well/casing/equipment details includes: location, access, condition, materials, diameters, casing security, surface seal condition, requiring repair or not, well/casing stickup measurements from ground level, well total depth, and the type of datalogger and/or sampling equipment installed. Any notable deficiencies, concerns, problems, or changes in the well condition are recorded in a field book and/or in the monthly data entry spreadsheet, as well as, photos are taken. Also, any observed activities taking place around or near the well that are worth noting are recorded in a field book and/or in the monthly data entry spreadsheet.

E.2.3 Monitoring Well Manual Water Level Measurement Procedure

- Unlock well casing and open well casing lid.
- Remove well cap (if present).
- Use an Electronic Water Level meter and lower the probe down the well until the meter beeps to indicate the probe has encountered water.
- The probe is raised up until the beep of the meter stops, indicating the probe is now above the water.
- Then the probe is slowly lowered down until the probe just contacts the water level surface causing the meter to beep.
- At this point the depth (in meters) is read off the water level meter tape from the measuring point of the well (in most cases is the top of the casing or pipe) and this provides the water level depth below the measuring point.
- The date, time, and water level depth measured is recorded in a field book and/or in the monthly data entry spreadsheet.
- This procedure is repeated for each of the well screens inside the well casing.

- Replace well caps.
- Close well casing lid and lock well casing.

E.2.4 Downloading of Water Levels from Electronic Dataloggers Procedure

For Non-Vented (Absolute) Datalogger Models:

In-Situ Inc.® LevelTROLLs® and RuggedTROLLs®, *Van Essen Instruments Divers*®, and *Solinst*® Leveloggers®

- Prior to downloading data from the datalogger, a manual water level is measured in each well screen containing a datalogger.
- The datalogger is pulled out of the well, unthreaded from the cap that is attached to a wire cable and connected to (or placed in) the corresponding datalogger communication device. The communication device is connected to a laptop/tablet PC or a RuggedReader® Handheld PC and the associated datalogger software is started.
- Water level data stored in the datalogger is subsequently downloaded and viewed using the datalogger software and saved on the hard drive/memory.
- Note: downloading data from the datalogger does not automatically stop the datalogger from recording.
- The status of the datalogger is viewed and checked for correct operation and to confirm that the datalogger is hanging in the well water within its operating range.
- Select datalogger details such as the battery level and free/used memory are recorded in a field book and/or in the monthly data entry spreadsheet.
- If the datalogger does not require restarting to free up memory or to change the sample rate, then the datalogger is removed from the communication device and is threaded back onto its cap and lowered back down the well on the wire cable.
- If the datalogger does require restarting to free up memory or to change the sample rate, then the datalogger is stopped, reprogrammed, and restarted using the datalogger software and, as a result, erases the previous data stored in memory on the datalogger.
- This procedure is repeated for each datalogger within each of the well screens inside the well casing.
- After all the non-vented (absolute) dataloggers have been downloaded then the Barometric dataloggers are downloaded following the same procedure as above.

For Vented (Gauged) Datalogger Models:*In-Situ Inc.*® LevelTROLLs®

- Prior to downloading data from the datalogger, a manual water level is measured in each well screen containing a datalogger.
- The desiccant tube is disconnected from the datalogger cable.
- The datalogger cable is connected to a communication cable device that is connected to a laptop/tablet PC or a RuggedReader® Handheld PC and the datalogger software is started.
- Water level data stored in the datalogger is subsequently downloaded and viewed using the datalogger software and saved on the hard drive/memory.
- Note: downloading data from the datalogger does not automatically stop the datalogger from recording.
- The status of the datalogger is viewed and checked for correct operation and to confirm that the datalogger is hanging in the well water within its operating range.
- Select datalogger details such as the battery level, free/used memory, and desiccant condition (colour) are recorded in a field book and/or in the monthly data entry spreadsheet.
- The desiccant tube condition is checked and replaced if necessary.
- If the datalogger does not require restarting to free up memory or to change the sample rate, then the communication cable device is disconnected from the datalogger cable and the desiccant tube is reconnected.
- If the datalogger does require restarting to free up memory or to change the sample rate, then the datalogger is stopped, reprogrammed, and restarted using the datalogger software and, as a result, erases the previous data stored in memory on the datalogger.
- This procedure is repeated for each datalogger within each of the well screens inside the well casing.

E.2.5 Data Entry and Processing into the Burnside MS ACCESS/SQL® Database

- All field data collected (i.e. date, time, manual water level depth measured, comments) and recorded for each well screen and datalogger in a field book is entered into the monthly data entry spreadsheet, unless already entered in the field using a laptop/tablet PC.
- The monthly data entry spreadsheet is checked and reviewed prior to importing the data into a database table using Burnside Water Level Data Tools software. Manual water level depth values are converted into water level elevation values using the software during this import process.
- Any associated well notes, comments, and datalogger details are entered into a database table under the appropriate well and screen.

- Water level data from the dataloggers downloaded to a laptop/tablet PC or a RuggedReader® Handheld PC are transferred to Burnside file folder network upon returning to the office.
- These datalogger water level data files are subsequently read and the data is imported into a database table using Burnside Water Level Data Tools software.
- Using Burnside Water Level Data Tools software, the datalogger water level data are reviewed and processed (as described below) resulting in corrected water level depth values and corrected water level elevation values that are stored in a database table.
- *For Non-Vented (Absolute) Datalogger Models:*
Datalogger water level data is first barometric pressure compensated using selected Barometric datalogger data, then a manual water level depth value measured at the time of the most recent download is applied and used to convert the barometric compensated water level data into corrected water level depth values, which are converted into water level elevation values that are appended to a database table.
- *For Vented (Gauged) Datalogger Models:*
A manual water level depth value measured at the time of the most recent download is applied to the datalogger water level data to convert the water level data into corrected water level depth values, which are converted into water level elevation values that are appended to a database table.
- Temperature data recorded by the dataloggers are also imported into a database table.
- Hydrographs are subsequently created for each well and screen from the water level elevation data in the database for review and presentation. If there are some data points that are erroneous, then these data points are marked as non-reportable (invalid) within the database and/or are removed resulting in them not being plotted on the hydrographs.
- An updated data file is provided to the Region on a quarterly basis for upload into their eWRAS EQUIS database.

