2025 Biennial Groundwater Monitoring Report - Maryhill Heights Well Field (MH3, MH4A, MH5)

The Region of Waterloo

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The Region of Waterloo

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R.J. Burnside & Associates Limited

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Table of Contents

Tables

Figures

Appendices

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 1746-BBWLJR) for the Maryhill Heights Well Field 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 condition of the PTTW for 2024 and 2025. A copy of the PTTW is included in Appendix A.

The location of the Maryhill Heights Well Field is shown in Figure 1 and the production wells in Woolwich are shown in Figure 2 with the monitoring network for MH3 (abandoned), MH4A and MH5 shown in 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. 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 Maryhill Heights Well Field (MH3, MH4A, MH5) in accordance with PTTW 1746-BBWLJR which consists of the following activities:

- Measuring the daily volume pumped from the MH3 (abandoned), MH4A and MH5 production wells (Condition 4.1 of the PTTW);
- Measuring the water levels in monitoring wells WH-MH-MW1-05-AB and WH-MH-MW2-05-AB (Condition 4.2 of the PTTW);
- Review of precipitation data from the nearest GRCA / Environment Canada weather station (Condition 4.3 of the PTTW); and
- 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 Maryhill Heights Well Field is located in the southeast portion of the Township of Woolwich. Wells MH3 (abandoned), MH4A and MH5 are located to the northeast of the intersection of Maryhill Road and St. Charles Street. The closest municipal well field is the Maryhill Well Field (MH1 and MH2), located approximately 1 km to the south (Figure 2). The closest surface water feature to the MH4A and MH5 site is Hopewell Creek, a tributary of the Grand River, located 650 m to the east (Figure 3).

2.1.1 Pumping Wells

Well records for the production wells are found in Appendix B. Two production wells, MH3 (abandoned) and MH4, were drilled in 1989, and were abandoned in January 2021 and May 2005, respectively. Production well MH4 was replaced by MH4A which was drilled in June 2005 and began production in March 2007. Production well MH3 (abandoned) was replaced by MH5 which was drilled in 2017 and brought on-line in December 2020. MH4A and MH5 obtain water from a confined sand and gravel unit (AFD1) at a depth of approximately 20 to 30 mbgs.

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 Diameter (mm)	Screen Hole Diameter (mm)	Screened interval (mbgs)	Aquifer
MH3	1989	203	203	27.4	AFD1
MH4A	2005	203	190	28.7	AFD1
MH5	2017	203	179	29.9	AFD1

The water taking volumes for the Maryhill Heights MH3, MH4A and MH5 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

	PTTW Details	2024			2025		
Well	Permitted Max. Daily Water Taking (m^3)	Avg. Daily Water Taking (m^3)	Max Taken per Day (m^3)	Total Volume Pumped (m^3)	Avg. Daily Water Taking (m^3)	Max Taken per Day (m^3)	Total Volume Pumped (m^3)
MH3	2,232	Abandoned			Abandoned		
MH4A	2,232	40	169	14,599	68	251	24,946
MH5	2,232	28	157	10,167	44	227	15,943
Combined	2,232*	68	169	24,766	112	254	40,889

*the combined taking from wells MH3, MH4A and MH5 shall not exceed 2,232,000 L/day with the rate not to exceed 1,550 L/min.

The pumping volumes are based on the total daily volumes as recorded by the Region's SCADA system and are presented in Appendix C as total monthly volumes. Pumping in the Maryhill Well Field (MH1 and MH2) was reduced from November 2024 through 2025 due to a facility upgrade project, while pumping increased at the Maryhill Heights Well Field (MH4A and MH5). Pumping volumes from the Maryhill Heights Well Field ranged from 1,087 m^3/month to 3,322 m^3/month in 2024, and from 2,354 m^3/month to 5,138 m^3/month in 2025. In total, 24,766 m^3 was produced at this Well Field in 2024 and 40,889 m^3 was produced in 2025. These volumes are well above the historic range, but below the permitted volume of 814,680 m^3 per year (Table C-1).

2.1.2 Monitoring Wells

WH-MH-MW1-05-AB is located adjecent to wells MH4A / MH5 and WH-MH-MW2-05-AB is located adjacent to well MH3 (abandoned) (Figure 3).

Construction and monitoring details of WH-MH-MW1-05-AB and WH-MH-MW2-05-AB are described in Table 3 below. Well records for the monitoring wells are provided in Appendix B.

Table 3: Monitoring Well Construction Details

Monitoring Well ID	Year Built	Screened Depth (mbgs)	Screened Formation	Distance to MH3 (m)	Distance to MH4A (m)	Distance to MH5 (m)
WH-MH-MW1-05-A	2005	26.8	AFD1	104.9	13.5	29.7
WH-MH-MW1-05-B	2005	7.9	AFB1	104.9	13.5	29.7
WH-MH-MW2-05-A	2005	28.0	AFD1	28.2	71.6	101.3
WH-MH-MW2-05-B	2005	6.4	AFB1	28.2	71.6	101.3

2.2 Regional Geology and Hydrostratigraphy

The following sections provide a brief overview of the regional geology and hydrogeology of the Maryhill Heights Well Field. The surficial geology based on regional OGS mapping is provided in Figure 4. Representative cross-sections showing the stratigraphy in the vicinity of the Maryhill Heights Well Field are included as Figures 5 and 6. The cross-section locations are provided in Figure 3.

Note that the cross-sections are provided as a visual aid and do not necessarily contain all wells in the monitoring program for the Maryhill Heights Well Field. 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..

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 Shirota (2007). The surficial geology of the Maryhill Heights Well Field is characterized primarily by silty to sandy till sediments and glaciofluvial gravelly deposits (Figure 4). Modern Alluvial and outwash deposits are present along Hopewell Creek. The Breslau Moraine occurs to the west of the Maryhill Well Field and is comprised of clayey silt till. The thickness of the overburden deposits is approximately 32.5 m in this area.

The Quaternary units typically present in the Maryhill Heights Well Field area are briefly described below, in order from youngest to oldest.

Aquitard ATA1 – Whittlesey Clay

This silt and clay unit is present at surface across the section and corresponds to glaciolacustrine Whittlesey clay (Bajc and Shirota, 2007). This unit forms a laterally extensive, low-permeability aquitard that restricts infiltration and provides partial confinement to the underlying aquifer.

Aquifer AFA1 - Whittlesey Sand

This very fine to coarse sand unit is interpreted as glaciolacustrine Whittlesey sand (Bajc and Shirota, 2007) and is encountered immediately below ATA1 across the section. AFA1 is continuous aquifer that facilitates groundwater flow within the upper overburden sequence.

Aquitard ATB1 – Upper Maryhill / Port Stanley Till

The Upper Maryhill Till is a silty to clayey till, with occasional stony texture, that is predominantly found along the flanks of the Waterloo Moraine. The Upper Maryhill Till was deposited by ice advancing from the Erie-Ontario ice lobe. In other parts of the Region, Bajc and Shirota (2007) have also used unit ATB1 to represent Tavistock, Mornington, and Port Stanley Tills. This unit is considered an aquitard and, where present, acts to restrict recharge to the lower aquifers.

Aquifer AFB1 / ATB2 / AFB2 – Upper Waterloo Moraine Stratified Sediments and Equivalents

Aquifer AFB1 / AFB2 represents the main water supply aquifer in the core areas of the Waterloo Moraine. These units are generally comprised of layered silt and fine sand to coarse sand and gravel. Throughout the core areas of the Moraine (Figure 5), the unit typically exceeds 45 m in thickness. In some areas, the Upper Waterloo Moraine is interpreted to be bisected by the middle Maryhill Till (ATB2), effectively separating the aquifer into two units, AFB1 and AFB2. This aquifer is the most prolific aquifer in the Waterloo Region due to its high hydraulic conductivity and transmissivity, lateral extent, and high recharge rate.

Aquitard ATB3 – Lower Maryhill Till

The Lower Maryhill Till is described as a clayey silt to silty clay till. This unit represents one of the primary regional aquitards due to its strong influence on the groundwater flow system within the Waterloo Moraine. This unit is extensive within the core area of the Waterloo Moraine, and along the eastern flank tends to be thin, discontinuous, or re-worked and re-deposited as glaciofluvial sediments. This unit is generally less than 10 m thick in the Maryhill area.

Aquifer AFB3 – Catfish Creek Outwash Deposits

This unit consists of stratified gravels, sands, or silts and is discontinuous in the Maryhill area. It occurs as isolated patches throughout the Region with no apparent linear trends (Bajc and Shirota, 2007).

Aquitard ATC1 / AFC1 / ATC2 – 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. It is a dense, stony, sandy silt to silty sand till with little clay content. 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. This unit is approximately 3 m thick in the Maryhill area.

Aquifer AFD1 – Pre-Catfish Creek Sand and Gravel

Pre-Catfish Creek Till aquifer corresponds to sands and gravel re-worked from Catfish Creek and Pre-Catfish Creek Tills, and represents the main supply aquifer in several production wells in the Cities of Kitchener and Waterloo. This unit is spatially discontinuous throughout much of the core areas of the Waterloo Moraine and pinches out beneath Alder Creek. This unit is about 10m thick in the Maryhill area.

Aquitard ATE1 – Canning Drift

The Canning Drift is comprised of till and associated fine-textured lake deposits. It is typically found at depths of greater than 70 mbgs in the Waterloo Moraine area and is identified to be discontinuous and limited in lateral extent and thickness. Where it is absent, a hydraulic connection is present between the deep overburden aquifers and the underlying bedrock.

2.2.2 Bedrock Geology

The Paleozoic bedrock in the area consists of the Guelph Formation.

2.3 Local Geology

Figure 3 displays the Maryhill Heights 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.

Aquitard ATA1 – Whittlesey Clay - This silt and clay unit is present at surface across the section. ATA1 extends from ground surface to a depth of approximately a few metres below ground surface. Silt and clay were described at surface at MH4 and MH5.

Aquifer AFA1 - Whittlesey Sand - This very fine to coarse sand unit is encountered immediately below ATA1 across the section. AFA1 extends from a depth of approximately a few metres below ground surface and is a few metres thick. A sand unit was described in MH5 and WH-MH-MW2-05 well records.

Upper Maryhill / Port Stanley Till (ATB1) – This unit was encounterd at or near surface (below topsoil / fill) at each of the drilling locations in the Maryhill Heights Well Field except for MH3 (abandoned). This sandy silt to clayey silt till material was documented

in borehole logs to range in thickness from 5.2 m at WH-MH-MW2-05-AB, to 6.1 m at MH4A.

Waterloo Moraine and Equivalents (AFB1) – Borehole logs for each of the wells in the Maryhill Heights Well Field indicate deposits of sand and gravel which correspond with this hydrostratigraphic unit. The depth of this unit varies across the Well Field, with thickness ranging from 0.7 m at WH-MH-MW2-05-AB, 1.2 m at MH4A, 1.5 m at MH5, 2.1 m at WH-MH-MW1-05-AB, and 9.1 m at MH3 (abandoned). Monitoring well WH-MH-MW1-05-B is screened within this unit from 6.4 to 7.9 bmgs, and monitoring well WH-MH-MW2-05-B is also screened in AFB1 from 4.9 m to 6.4 mbgs.

Lower Maryhill Till (ATB3) – Clay and silty clay till deposits consistent with ATB3 were encountered at each of the wells in the Maryhill Heights Well Field. ATB3 materials were documented to range in thickness from 3.1 m at MH3 (abandoned), 7.6 m at MH5, 10.4 m at MH4A, 12.2 m at WH-MH-MW1-05-AB, to 15.2 m at WH-MH-MW2-05-AB.

Catfish Creek Outwash Deposits (AFB3) – At MH5, deposits which likely correspond with the Catfish Creek Outwash Deposits unit (AFB3) were recorded as sand and gravel from 14.6 to 16.9 mbgs. This unit was not identified at any other well location within the Maryhill Heights Well Field.

Catfish Creek Till (ATC1/AFC1/ATC2) – Borehole logs from MH3 (abandoned), MH5, and WH-MH-MW1-05-A documented clayey silt till with some gravel and sand layers which are interpreted as Catfish Creek Till. This unit was observed to have thicknesses ranging from 3.0 m at WH-MH-MW1-05-AB, 5.5 m at MH3 (abandoned), to 7.7 m at MH5.

Pre-Catfish Creek Aquifers (AFD1) – This unit was documented in each of the borehole logs within the Maryhill Heights Well Field. Production wells MH3 (abandoned), MH4A, MH5, and monitoring wells WH-MH-MW1-05-A and WH-MH-MW2-05-A are all screened whithin AFD1. Deposits described as sand and gravel were encountered at depths ranging from 17.9 to >29.6 mbgs at MH3 (abandoned); 17.9 to 29.0 mbgs at MH4A; 24.6 to 32.5 mbgs where bedrock was reached at MH5; 22.9 to >28.1 mbgs at WH-MH-MW1-05-A; and 21.3 to >28.0 mbgs at WH-MH-MW2-05-A.

Canning Drift (ATE1) – Deposits described as clayey silt till were documented at MH4A from 29.0 to >30.2 mbgs. These deposits are likely associated with the Canning Drift unit.

3.0 2024 / 2025 Results

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 Maryhill Heights Well Field is the Laurel Dam station located 16.4 km to the southwest. The closest Environment Canada station is Waterloo International Airport (WIA) located about 8 km south 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 Laurel Dam station, the long-term average was calculated from when measurements started until the end of 2025. The Region of Waterloo International Airport (WIA) has "Climate Normals" calculated by Environment Canada for 1991 to 2020.

Annual 2024 / 2025 precipitation data for the GRCA and Environment Canada meteorological station closest to the Maryhill 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
Laurel Dam (2)	907	-31	938 (B)	894	-44

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 Laurel Dam station was 907 mm, which is 31 mm below the long-term average. The 2024 total precipitation at WIA station was 874 mm, which is 23 mm above the long-term average. The March 1 GRCA snow survey indicated a snowpack across the Region that was low compared to normal.

In 2025, the total precipitation was 894 mm, which is 44 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

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.

WH-MH-MW1-05-AB

Monthly manual water levels were collected at WH-MH-MW1-05-AB which is located approximately 15 m from MH4A and 30 m from MH5. The A and B screens are installed within AFD1 and AFB1 respectively. Water levels in screen A and screen B show seasonal variations with highest levels in the spring and lowest levels in the summer. Water levels during 2024 and 2025 show typical seasonal effects and are within the historical range. The increased pumping in 2025 does not appear to have measurably influenced groundwater levels.

WH-MH-MW2-05-AB

Monthly manual readings were collected at WH-MH-MW2-05-which is located approximately 75 m from MH4A and 100 m from MH5. The A and B screens are installed within AFD1 and AFB1 respectively. Water levels in screen A and screen B display a pattern similar to WH-MH-MW1-05-AB and show seasonal variations with highest levels in the spring and lowest levels in the summer. Water levels during 2024 and 2025 show typical seasonal effects and are within historical range. The increased pumping in 2025 does not appear to have measurably influenced groundwater levels.

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.”

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 MH3 (abandoned), MH4A and MH5 received in 2024 and 2025.

There are no privately serviced properties for water supply within 2 km of MH4A and MH5. Registered groundwater takings within 2 km of the well field are identified in Figure 3 and summarized in **Table 5Table 5**; PTTW 2613-BBKR76 applies to the Maryhill wells (MH1 and MH2).

Table 5: PTTWs (Groundwater) in Vicinity of Maryhill Heights Well Field (MH3, MH4A, MH5)

Permit Number	Permit Holder	Purpose	Max Liters per Day	Distance (km) from MH3, MH4A and MH5 Supply Wells	Expiry Date
2613-BBKR76	The Regional Municipality of Waterloo	Municipal Water Supply	157,110	430	April 30, 2029

4.2 Aquifer Impacts to Pumping and Precipitation

PTTW Condition 4.3 states: " The Permit Holder shall prepare and submit a report every two years by June 30, 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(s) in relation to precipitation and water taking from the aquifer(s)”.

Based on monitoring results, the water levels in both AFB1 and AFD1 do not show a measurable response to municipal pumping. Water levels in AFB1 and AFD1 followed seasonal patterns with highest levels in the spring and followed by declines during summer months.

Water levels are recorded monthly, and as a result, responses to individual precipitation or storm events are not evident.

5.0 Conclusions

Impacts from pumping the municipal wells at the Maryhill Heights Well Field (MH4A and MH5) 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 1746-BBWLJR;
- 2024 and 2025 pumping volumes were within the permitted range;
- There were no reported well interference complaints arising from water taking at the Maryhill Heights (MH4A and MH5) well field;
- Water levels in AFD1 and AFB1 did not show a measurable response to pumping at MH4A and MH5; and
- Water levels in the overburden (ADF1 and AFB1) followed seasonal patterns.

6.0 References

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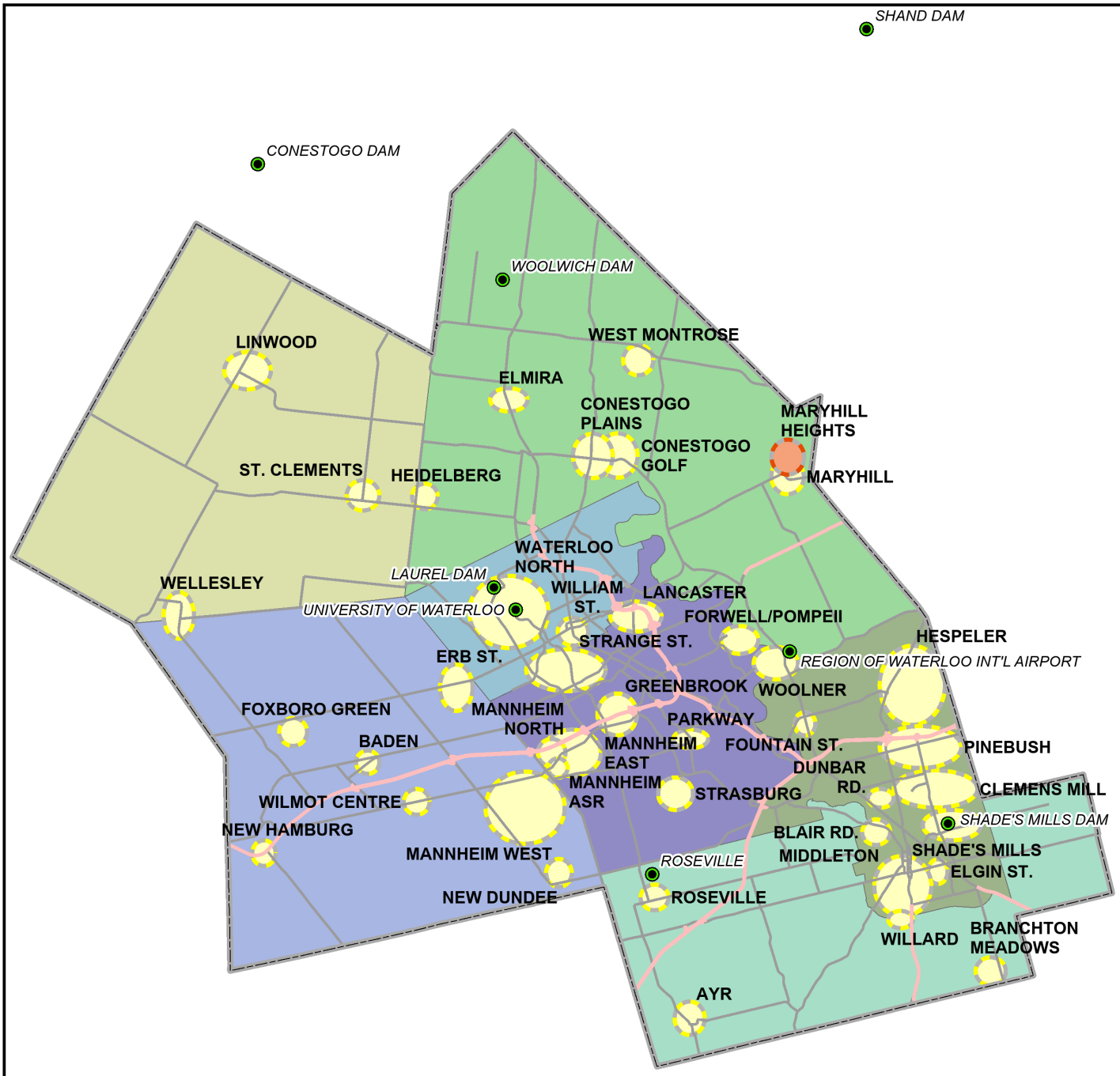
BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Figures



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Map Title

2025 GROUNDWATER MONITORING REPORT - MARYHILL HEIGHTS WELL FIELD

WELL FIELD LOCATION MAP

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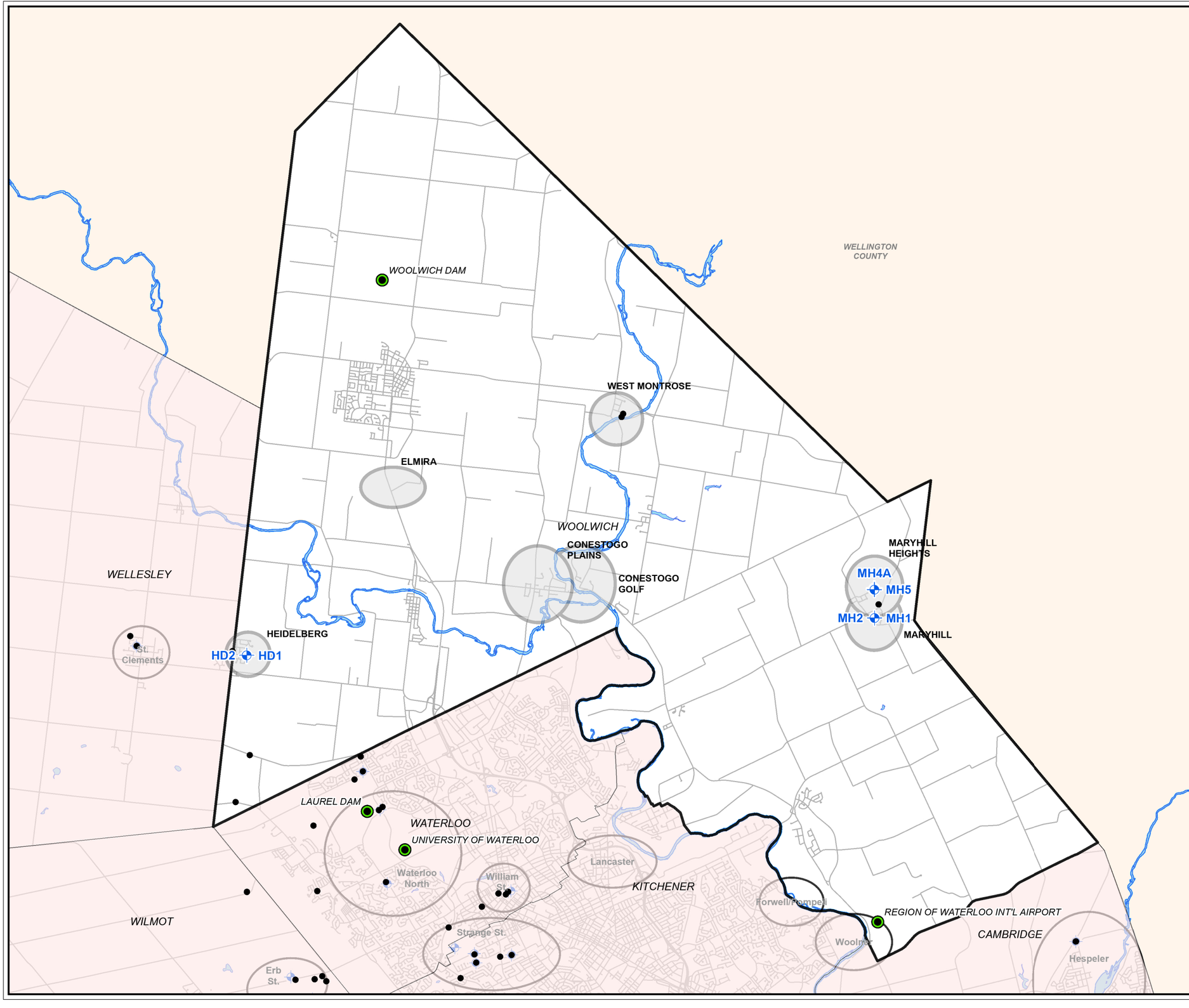

LEGEND

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

Sources:

1. Ministry of Natural Resources, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.

Datum: North American 1983 CSRS

Coord. System: NAD 1983 CSRS UTM Zone 17N

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Kilometers

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Client

REGION OF WATERLOO

Figure Title

2025 GROUNDWATER MONITORING REPORT - MARYHILL HEIGHTS WELL FIELD

WOOLWICH WELL FIELDS AND MONITORING NETWORK

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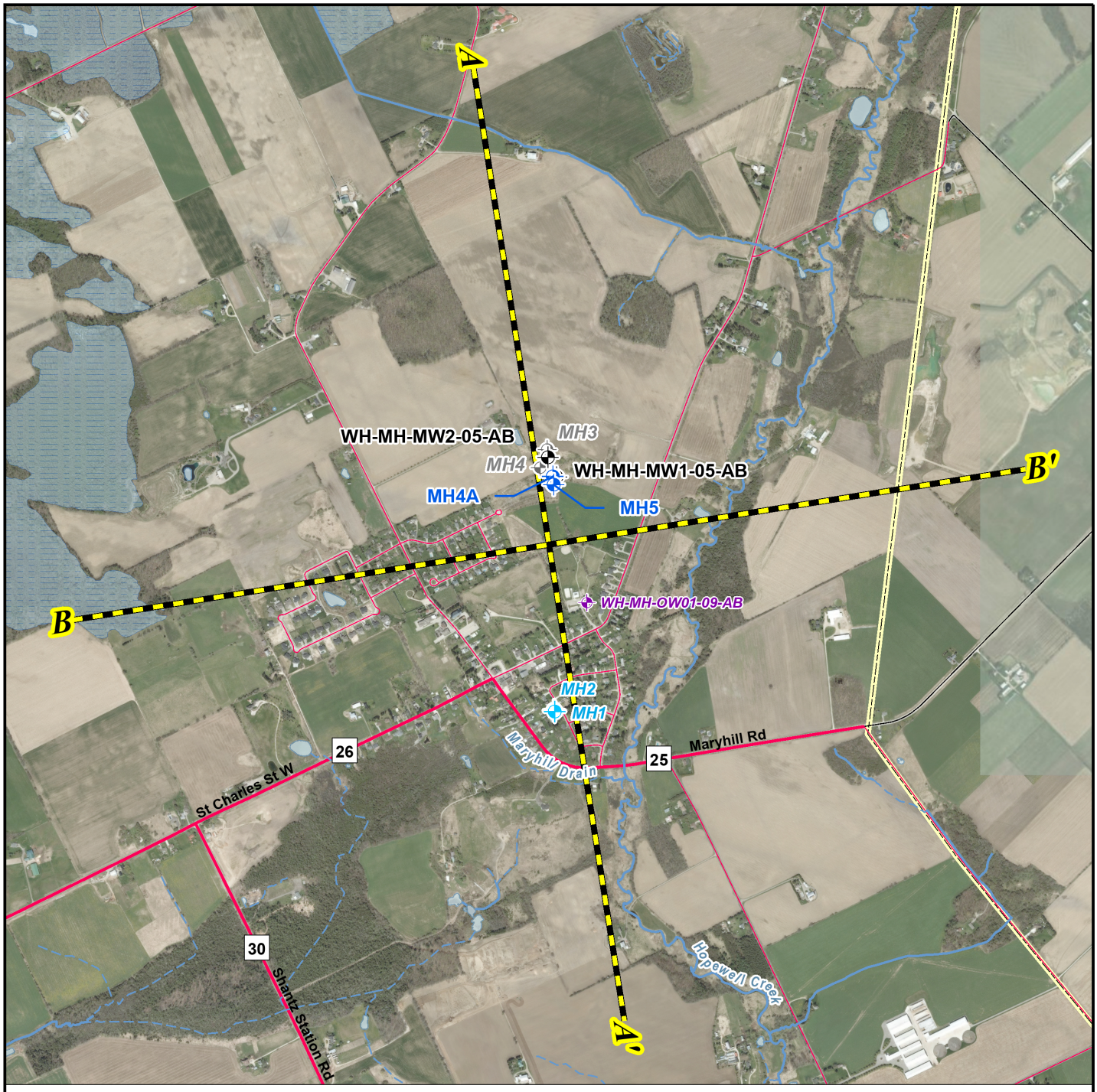

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Data Source:
Region of Waterloo GIS Data; Background 2020 Air Photo: ArcGIS Image Service Region of Waterloo; Ministry of Natural Resources, © Queen's Printer for Ontario; Natural Resources Canada © Her Majesty the Queen in Right of Canada.

0 150 300 450 600 750 900 1,050 1,200 1,350

Metres

- PTTW Monitoring Well Location
- Nearby Monitoring Well Location
- Nearby Production Well Location
- Decommissioned Production Well Location
- Cross Section Orientation
- Intermittent Creek
- Creek
- Provincially Significant Wetland (MNR)
- Regional Road
- Local Road
- Private / Other Road
- Region of Waterloo Boundary

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Map Title

2025 GROUNDWATER MONITORING REPORT - MARYHILL HEIGHTS WELL FIELD

WELL LOCATION MAP

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REGION OF WATERLOO

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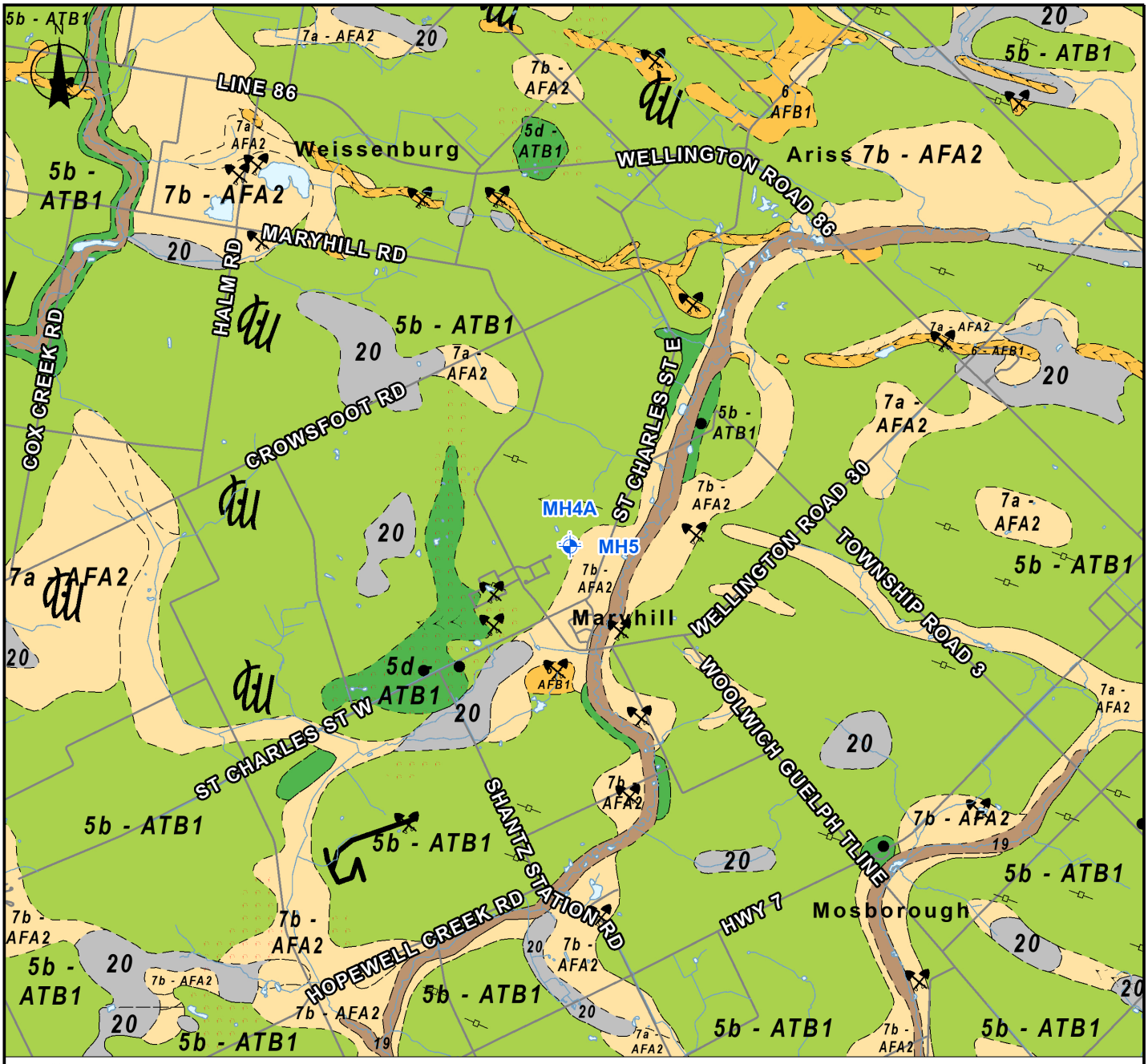


Data Source:
1. Ontario Geological Survey 2003. Surficial Geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128.
2. Region of Waterloo GIS

0 1,000 2,000 3,000 4,000 5,000
Meters

- RMOW Supply Well
- Watercourse
- Waterbody

Surficial Geology

- 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
- Crevasse Filling
- Esker: Direction of Flow Known
- Drumlin or drumlinoid ridges (point)
- Glacial flute
- Sample Location
- Hummocky Topography
- Unit Contact Boundary

BURNSIDE

Map Title
2025 GROUNDWATER MONITORING REPORT - MARYHILL HEIGHTS WELL FIELD
SURFICIAL GEOLOGY

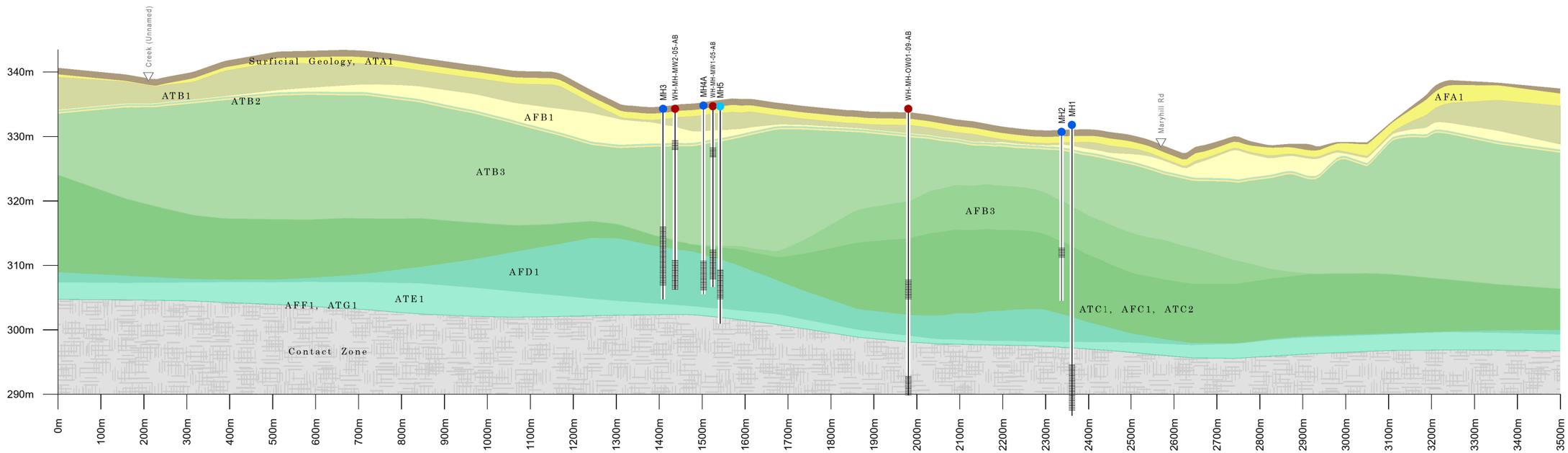
Client
REGION OF WATERLOO

Drawn	Checked	Date	Figure No.
HN	SQ	February 2026	4
Scale		Project No.	
1:60,000		HA0464020	

File Path: \\elmo\gis\Project\H Jobs\HA 04 6402 (Waterloo)\Reporting\Groundwater Level Monitoring Program\2025 Groundwater Report Figures\New Dundee\Pro\New Dundee\New Dundee.aprx Print Date: 2026/02/05 Time: 03:16 PM

A

A'



Wells

- Production Well (Active)
- Production Well (Inactive)
- Monitoring Well

Moraine Model 2026

- Surficial Geology, Whittlesey Clay (ATA1)
- Whittlesey Sand (AFA1)
- Upper Maryhill, Port Stanley, Tavistock, Mornington, & Stratford Tills (ATB1)
- 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

Wellhead

Well

Screen or Open Hole

BURNSIDE

Client

REGION OF WATERLOO

Figure Title

GEOLOGIC CROSS SECTION REGION OF WATERLOO

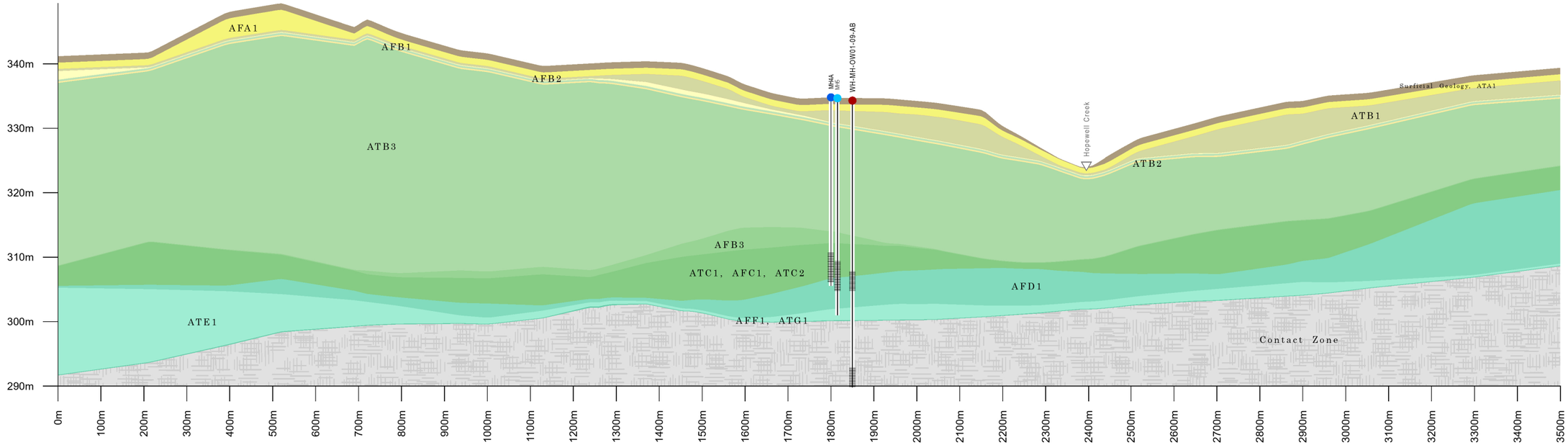
Maryhill Heights
Cross Section A - A'

Drawn	Checked	Date	Figure No.
PS	DH	2026/06/01	5
Horizontal Scale 1:10,000		Project No.	
Vertical Ex.:15x		HA046402	

File Path: F:\GIS Working\Projects\ROW_Cross_Sections\ROW_Cross_Sections.aprx Print Date: 2026/06/01 Time: 04:00 PM

B

B'



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- Canning Drift, Till & Fine Textured Glaciolacustrine Deposits (ATE1)
- Pre-Canning Coarse Textured Glaciofluvial / Glaciolacustrine Deposits (AFF1), Pre-Canning Coarse Textured Till (ATG1)
- Weathered Bedrock

Wellhead

Well

Screen or Open Hole

BURNSIDE

Client

REGION OF WATERLOO

Figure Title

GEOLOGIC CROSS SECTION REGION OF WATERLOO

Maryhill Heights
Cross Section B - B'

Drawn	Checked	Date	Figure No.
PS	DH	2026/06/01	6
Horizontal Scale 1:10,000		Project No.	
Vertical Ex.:15x		HA046402	

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix A

Permit To Take Water

PERMIT TO TAKE WATER
Ground Water
NUMBER 1746-BBWLJR

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 Floor 6
Kitchener, Ontario
N2G 4J3

For the water taking from: Three wells (MH3, MH4A and MH5)

Located at: Lot 98, Concession GERMAN COMPANY TRACT, Geographic Township of Waterloo
Woolwich, 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, Conservation and Parks.

(d) "District Office" means the Guelph District Office.

(e) "Permit" means this Permit to Take Water No. 1746-BBWLJR 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 November 19, 2018 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 **May 1, 2029**. 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	MH3	Well Drilled	Municipal	Water Supply	1,550	24	2,232,000	365	17 549430 4821180
2	MH4A	Well Drilled	Municipal	Water Supply	1,550	24	2,232,000	365	17 549450 4821083
3	MH5	Well Drilled	Municipal	Water Supply	1,550	24	2,232,000	365	17 549453 4821054
						Total Taking:	2,232,000		

3.3 Notwithstanding the Maximum Taken per Day specified in Table A of Condition 3.2, the combined taking from wells MH3, MH4A and MH5 shall not exceed 2,232,000 L/day with the rate not to exceed 1,550 L/min.

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. A separate record shall be maintained for each source. 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 wells:

WH-MH-MW1-05-A
WH-MH-MW1-05-B
WH-MH-MW2-05-A
WH-MH-MW2-05-B

4.3 The Permit Holder shall prepare and submit a report every two years by June 30 commencing June 30, 2020, 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(s) in relation to precipitation and water taking from the aquifer(s), 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

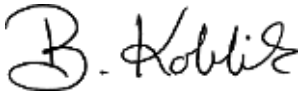
The Director, Section 34.1,
Ministry of the Environment, Conservation and Parks
12th Floor
119 King St W
Hamilton ON L8P 4Y7
Fax: (905) 521-7820

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

by Telephone at	by Fax at	by e-mail at
(416) 212-6349	(416) 326-5370	www.ert.gov.on.ca
Toll Free 1(866) 448-2248	Toll Free 1(844) 213-3474	

This Permit cancels and replaces Permit Number 7733-8ADP56, issued on 2010/12/20.

Dated at Hamilton this 9th day of May, 2019.



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 1746-BBWLJR, dated May 9, 2019.

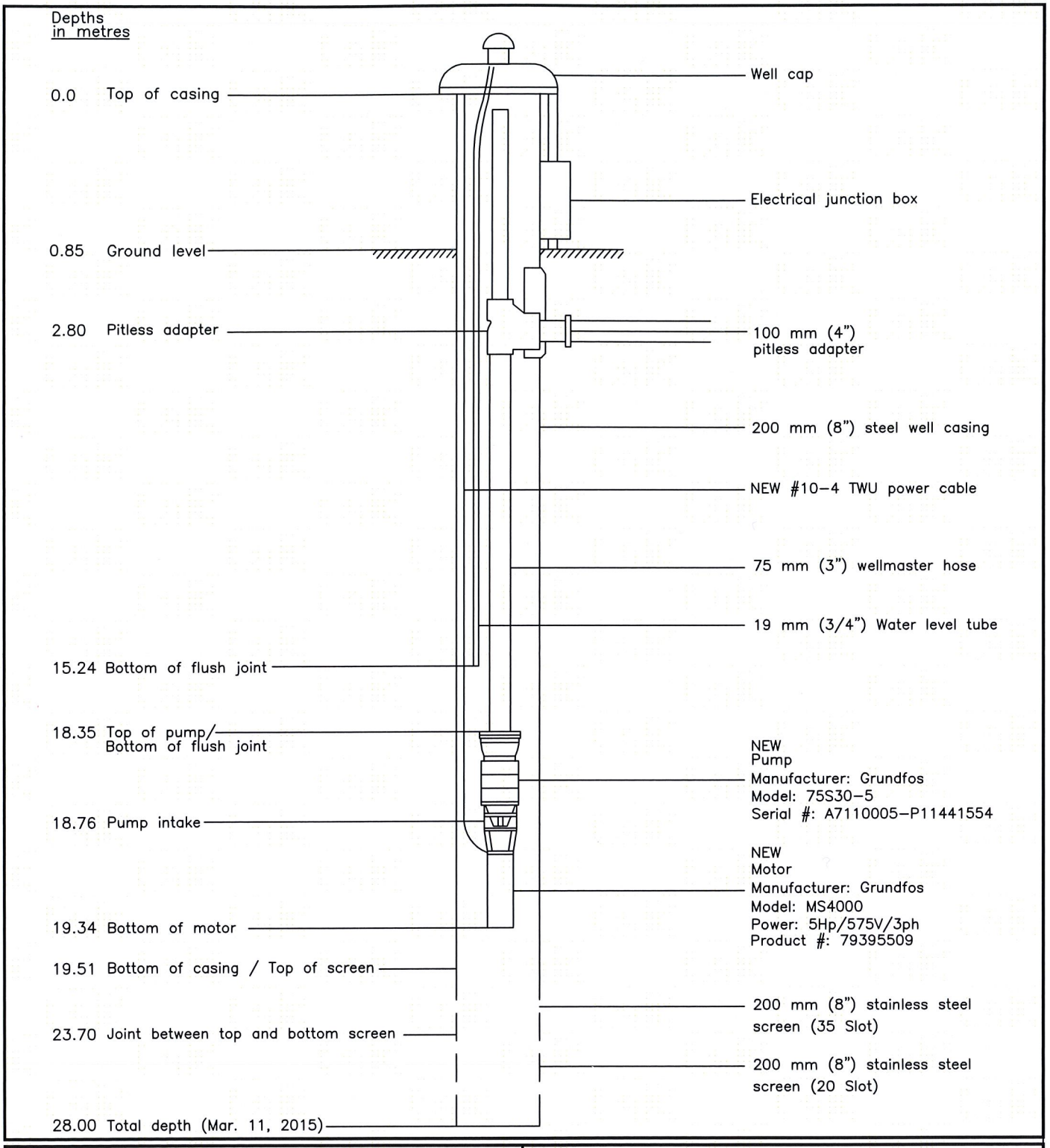
BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix B

Well Records

MH3



Lotowater
TECHNICAL SERVICES INC.

CLIENT
Regional Municipality of Waterloo

TITLE
Maryhill Village Well MH3
Pump Installation Drawing

PROJECT No. 006-332			G:\Lotowater Projects\006 Region of Waterloo\332 MH3 Service\Pump Installation.dwg		FIGURE 4
DESIGN			REVISION No. N/A	SCALE N.T.S.	
DRAWN	RS	2015/03/12			
CHECKED					

Ontario Ministry of the Environment

Well Tag Number (Place sticker and print number below)

MH3

Well Record

Regulation 903 Ontario Water Resources Act

page ___ of ___

Instructions for Completing Form

- For use in the **Province of Ontario** only. This document is a permanent **legal** document. Please retain for future reference.
- All Sections **must** be completed in full to avoid delays in processing. Further instructions and explanations are available on the back of this form.
- Questions regarding completing this application can be directed to the Water Well Management Coordinator at 416-235-6203.
- **All metre measurements shall be reported to 1/10th of a metre.**
- Please print clearly in blue or black ink only.

Ministry Use Only

MUN | CON | LOT

Well Owner's Information and Location of Well Information

First Name | Last Name | Mailing Address (Street Number/Name, RR,Lot,Concession)

[redacted]

Waterloo Region

RR#/Street Number/Name | City/Town/Village: Maryhill | Site/Compartment/Block/Tract etc.

GPS Reading | NAD: 83 | Zone: 17 | Easting: 549431 | Northing: 4821178 | Unit Make/Model: Garmin eTREX Venture | Mode of Operation: [X] Undifferentiated [ ] Differentiated, specify [ ] Averaged

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth From	Depth To
	Upgrade to MH3 Well - Previously drilled in 1989 by Ryors Well Drilling - MOE Well Record #: 15778				
	8" Diameter well. Raised casing to legal Height and placed annular seal. Drilled 15" Borehole to 33'.				

Hole Diameter

Depth From	Depth To	Diameter Centimetres

Water Record

Water found at ___ Metres / Kind of Water

___ m [ ] Fresh [ ] Sulphur [ ] Gas [ ] Salty [ ] Minerals [ ] Other: ___

___ m [ ] Fresh [ ] Sulphur [ ] Gas [ ] Salty [ ] Minerals [ ] Other: ___

___ m [ ] Fresh [ ] Sulphur [ ] Gas [ ] Salty [ ] Minerals [ ] Other: ___

After test of well yield, water was
[ ] Clear and sediment free
[ ] Other, specify ___

Chlorinated [ ] Yes [ ] No

Construction Record

Inside diam centimetres	Material	Wall thickness centimetres	Depth From	Depth To
Casing				
	[ ] Steel [ ] Fibreglass [ ] Plastic [ ] Concrete [ ] Galvanized			
	[ ] Steel [X] Fibreglass [ ] Plastic [ ] Concrete [ ] Galvanized			
	[ ] Steel [ ] Fibreglass [ ] Plastic [ ] Concrete [ ] Galvanized			
Screen				
Outside diam	[ ] Steel [ ] Fibreglass [ ] Plastic [ ] Concrete [ ] Galvanized	Slot No.		
No Casing or Screen				
	[ ] Open hole			

Test of Well Yield

Pumping test method	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Pump intake set at - (metres)	Static Level			
Pumping rate - (litres/min)	1		1	
	2		2	
Duration of pumping ____hrs +____ min	3		3	
Final water level end of pumping ____metres	4		4	
Recommended pump type. [ ] Shallow [ ] Deep	5		5	
Recommended pump depth. ____metres	10		10	
Recommended pump rate. (litres/min)	15		15	
If flowing give rate - (litres/min)	20		20	
If pumping discontinued, give reason.	25		25	
	30		30	
	40		40	
	50		50	
	60		60	

Plugging and Sealing Record

[X] Annular space [ ] Abandonment

Depth set at - Metres From	Depth set at - Metres To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
0'	33'	Neat Cement	0.82 m³

Method of Construction

[ ] Cable Tool [ ] Rotary (air) [ ] Diamond [ ] Digging
[ ] Rotary (conventional) [ ] Air percussion [ ] Jetting [ ] Other
[ ] Rotary (reverse) [ ] Boring [ ] Driving

Water Use

[ ] Domestic [ ] Industrial [ ] Public Supply [ ] Other
[ ] Stock [ ] Commercial [ ] Not used
[ ] Irrigation [ ] Municipal [ ] Cooling & air conditioning

Final Status of Well

[ ] Water Supply [ ] Recharge well [ ] Unfinished [ ] Abandoned, (Other)
[ ] Observation well [ ] Abandoned, insufficient supply [ ] Dewatering
[ ] Test Hole [ ] Abandoned, poor quality [ ] Replacement well

Well Contractor/Technician Information

Name of Well Contractor: Davidson Well Drilling Limited | Well Contractor's Licence No.: 1737

Business Address (street name, number, city etc.): 147 North St.W. Wingham, Ontario N0G 2W0

Name of Well Technician (last name, first name): Fenton Doug | Well Technician's Licence No.: T2003

Signature of Technician/Contractor: X J.C. Davidson | Date Submitted YYYY MM DD: 2005 06 30

Location of Well

In diagram below show distances of well from road, lot line, and building. Indicate north by arrow.

Audit No. Z 31831 | Date Well Completed YYYY MM DD: 2005 05 31

Was the well owner's information package delivered? [ ] Yes [ ] No | Date Delivered YYYY MM DD

Ministry Use Only

Data Source | Contractor: 1737

Date Received: MAR 14 2006 | Date of Inspection YYYY MM DD

Remarks | Well Record Number

0506E (09/03) Contractor's Copy [ ] Ministry's Copy [X] Well Owner's Copy [ ]

Cette formule est disponible en français

MH3

pw3-89

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

11 6506686 MUNICIP 65007 CON GCT pt

COUNTY OR DISTRICT: Region of Waterloo
TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE: Woolwich
CON BLOCK, TRACT, SURVEY ETC: GCT
LOT: 98
OWNER (SURNAME FIRST): A. J. Williams Const Ltd
ADDRESS: 1373 Victoria St. N. Unit 5 KITCHENER ONT
DATE COMPLETED: DAY 18 MO 9 YR 89
2 ZONE EASTING NORTHING RC ELEVATION RC MAGNETIC DECL N2B 3R6

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
Black	Top soil			0	1
Brown	Sand	gravel		1	30
Yellow	Clay			30	40
Yellow	Clay till	Some gravel		40	58
Brown	Sand	gravel		58	97
See hydrogeologists report: Waterloo Geoscience Consultants Ltd, Sept 1989					

31
32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
58 / 97	1 ☒ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
8"	1 ☒ STEEL 2 ☒ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC	188	+2	60
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC			
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC			

SCREEN

SIZE(S) OF OPENING (SLOT NO.): 35-20 15-15 30" — DIAMETER: 8" Pipe INCHES — LENGTH: 30 FEET
MATERIAL AND TYPE: SS — DEPTH TO TOP OF SCREEN: 60' FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	DEPTH SET AT - FEET TO	MATERIAL AND TYPE (CEMENT GROUT LEAD PACKER, ETC.)

71 PUMPING TEST

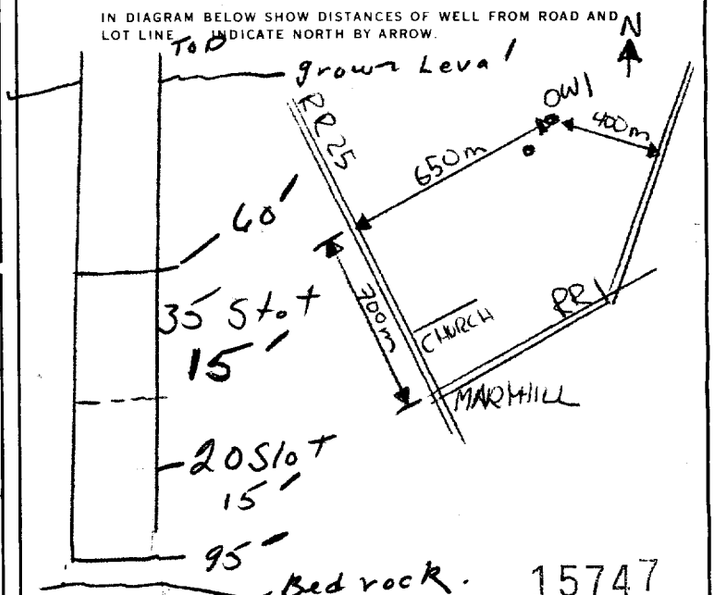
PUMPING TEST METHOD: 1 ☒ PUMP 2 ☐ BAILER
PUMPING RATE: 125 GPM
DURATION OF PUMPING: 24 HOURS ____ MINS
STATIC LEVEL: 15 FEET
WATER LEVEL END OF PUMPING: 49 FEET
WATER LEVELS DURING: 1 ☐ PUMPING 2 ☐ RECOVERY

15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
FEET	FEET	FEET	FEET

IF FLOWING, GIVE RATE: GPM
PUMP INTAKE SET AT: FEET
WATER AT END OF TEST: 1 ☒ CLEAR 2 ☐ CLOUDY
RECOMMENDED PUMP TYPE: ☐ SHALLOW ☐ DEEP
RECOMMENDED PUMP SETTING: FEET
RECOMMENDED PUMPING RATE: GPM

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS: 15747

FINAL STATUS OF WELL

1 ☒ WATER SUPPLY 2 ☐ OBSERVATION WELL 3 ☐ TEST HOLE 4 ☐ RECHARGE WELL 5 ☐ ABANDONED, INSUFFICIENT SUPPLY 6 ☐ ABANDONED, POOR QUALITY 7 ☐ UNFINISHED 9 ☐ DEWATERING

WATER USE

1 ☒ DOMESTIC 2 ☐ STOCK 3 ☐ IRRIGATION 4 ☐ INDUSTRIAL ☐ OTHER 5 ☐ COMMERCIAL 6 ☒ MUNICIPAL 7 ☐ PUBLIC SUPPLY 8 ☐ COOLING OR AIR CONDITIONING 9 ☐ NOT USED

METHOD OF CONSTRUCTION

1 ☐ CABLE TOOL 2 ☒ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☒ ROTARY (AIR) 5 ☐ AIR PERCUSSION 6 ☐ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING ☐ DIGGING ☐ OTHER

CONTRACTOR

NAME OF WELL CONTRACTOR: Ryors well Drilling
WELL CONTRACTOR'S LICENCE NUMBER: 4643
ADDRESS: Rr 3 Arthur
NAME OF WELL TECHNICIAN: R Baily
WELL TECHNICIAN'S LICENCE NUMBER: 4643
SIGNATURE OF TECHNICIAN/CONTRACTOR:
SUBMISSION DATE: DAY ____ MO. ____ YR. ____

OFFICE USE ONLY

DATA SOURCE: 58
CONTRACTOR: 4643
DATE RECEIVED: OCT 16 1989
DATE OF INSPECTION:
INSPECTOR:
REMARKS: CSS.ES

MINISTRY OF THE ENVIRONMENT COPY

FORM NO. 0506 (11/86) FORM 9

Ontario Ministry of the Environment

Well Tag Number (Place sticker and print number below)

MH4

Well Record

Regulation 903 Ontario Water Resources Act

page ___ of ___

Instructions for Completing Form

- For use in the **Province of Ontario** only. This document is a permanent **legal** document. Please retain for future reference.
- All Sections **must** be completed in full to avoid delays in processing. Further instructions and explanations are available on the back of this form.
- Questions regarding completing this application can be directed to the Water Well Management Coordinator at 416-235-6203.
- **All metre measurements shall be reported to 1/10th of a metre.**
- Please print clearly in blue or black ink only.

Ministry Use Only

MUN | CON | LOT

Well Owner's Information and Location of Well Information

First Name | Last Name | Mailing Address (Street Number/Name, RR,Lot,Concession)

[redacted]

RR#/Street Number/Name | City/Town/Village: Maryhill | Site/Compartment/Block/Tract etc.

GPS Reading: NAD 83 | Zone 17 | Easting 549477 | Northing 48 21105

Unit Make/Model: Garmin eTREX Venture | Mode of Operation: ☒ Undifferentiated ☐ Differentiated, specify ☐ Averaged

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth From	Depth To
			Overdrilled existing 8-inch well with 12-3/4-inch special casing & bit to create annular space to 30 feet		

Hole Diameter

Depth From (Ft. ~~Metres~~)	Depth To	Diameter (~~Centimetres~~)
0	30'	12.75

Water Record

Water found at ___ Metres / Kind of Water

- ___ m ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other: ___
- ___ m ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other: ___
- ___ m ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other: ___

After test of well yield, water was
☐ Clear and sediment free
☐ Other, specify ___

Chlorinated ☒ Yes ☐ No

Construction Record

Inside diam (~~centimetres~~)	Material	Wall thickness centimetres	Depth From	Depth To
Casing				
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
Screen				
Outside diam	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	Slot No.		
No Casing or Screen				
	☐ Open hole			

Test of Well Yield

Pumping test method	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Pump intake set at - (metres)	Static Level			
Pumping rate - (litres/min)	1		1	
Duration of pumping ___hrs +___ min	2		2	
Final water level end of pumping ___metres	3		3	
Recommended pump type. ☐ Shallow ☐ Deep	4		4	
Recommended pump depth. ___metres	5		5	
Recommended pump rate. (litres/min)	10		10	
	15		15	
If flowing give rate - (litres/min)	20		20	
	25		25	
If pumping discontinued, give reason.	30		30	
	40		40	
	50		50	
	60		60	

Ft. Plugging and Sealing Record

☐ Annular space ☒ Abandonment

Depth set at - (~~Metres~~) From	To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
108'	85'	Sand inside	0.26
85	80	Holeplug	0.6
80	0	Neat cement	0.91
Outside			
	30'	Neat Cement	2

Method of Construction

☐ Cable Tool ☐ Rotary (air) ☐ Diamond ☐ Digging
☐ Rotary (conventional) ☐ Air percussion ☐ Jetting ☐ Other
☐ Rotary (reverse) ☐ Boring ☐ Driving

Water Use

☐ Domestic ☐ Industrial ☐ Public Supply ☐ Other
☐ Stock ☐ Commercial ☐ Not used
☐ Irrigation ☐ Municipal ☐ Cooling & air conditioning

Final Status of Well

☐ Water Supply ☐ Recharge well ☐ Unfinished ☐ Abandoned, (Other)
☐ Observation well ☐ Abandoned, insufficient supply ☐ Dewatering
☐ Test Hole ☐ Abandoned, poor quality ☐ Replacement well

Well Contractor/Technician Information

Name of Well Contractor: Davidson Well Drilling Limited | Well Contractor's Licence No.: 1737

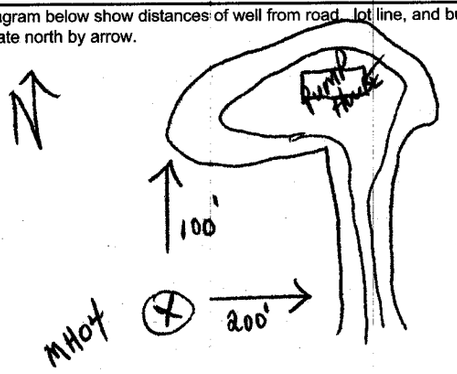
Business Address (street name, number, city etc.): 147 North St.W. Wingham, Ontario NOG 2W0

Name of Well Technician (last name, first name): Fenton Doug | Well Technician's Licence No.: T2003

Signature of Technician/Contractor: X J.C. Davidson | Date Submitted YYYY MM DD: 2005 06 15

Location of Well

In diagram below show distances of well from road, lot line, and building. Indicate north by arrow.



Audit No. Z 31810 | Date Well Completed YYYY MM DD: 2005 05 31

Was the well owner's information package delivered? ☐ Yes ☐ No | Date Delivered YYYY MM DD

Ministry Use Only

Data Source | Contractor: 1737

Date Received YYYY MM DD: MAR 14 2006 | Date of Inspection YYYY MM DD

Remarks | Well Record Number

0506E (09/03) Contractor's Copy ☐ Ministry's Copy ☒ Well Owner's Copy ☐

Cette formule est disponible en français

MH4A

Borehole No.: MH04A (TH3-05)

Project: Maryhill Production Well

Project No: 1609-00313

Location: Maryhill, Ontario

Contractor: Davidson Drilling Ltd.

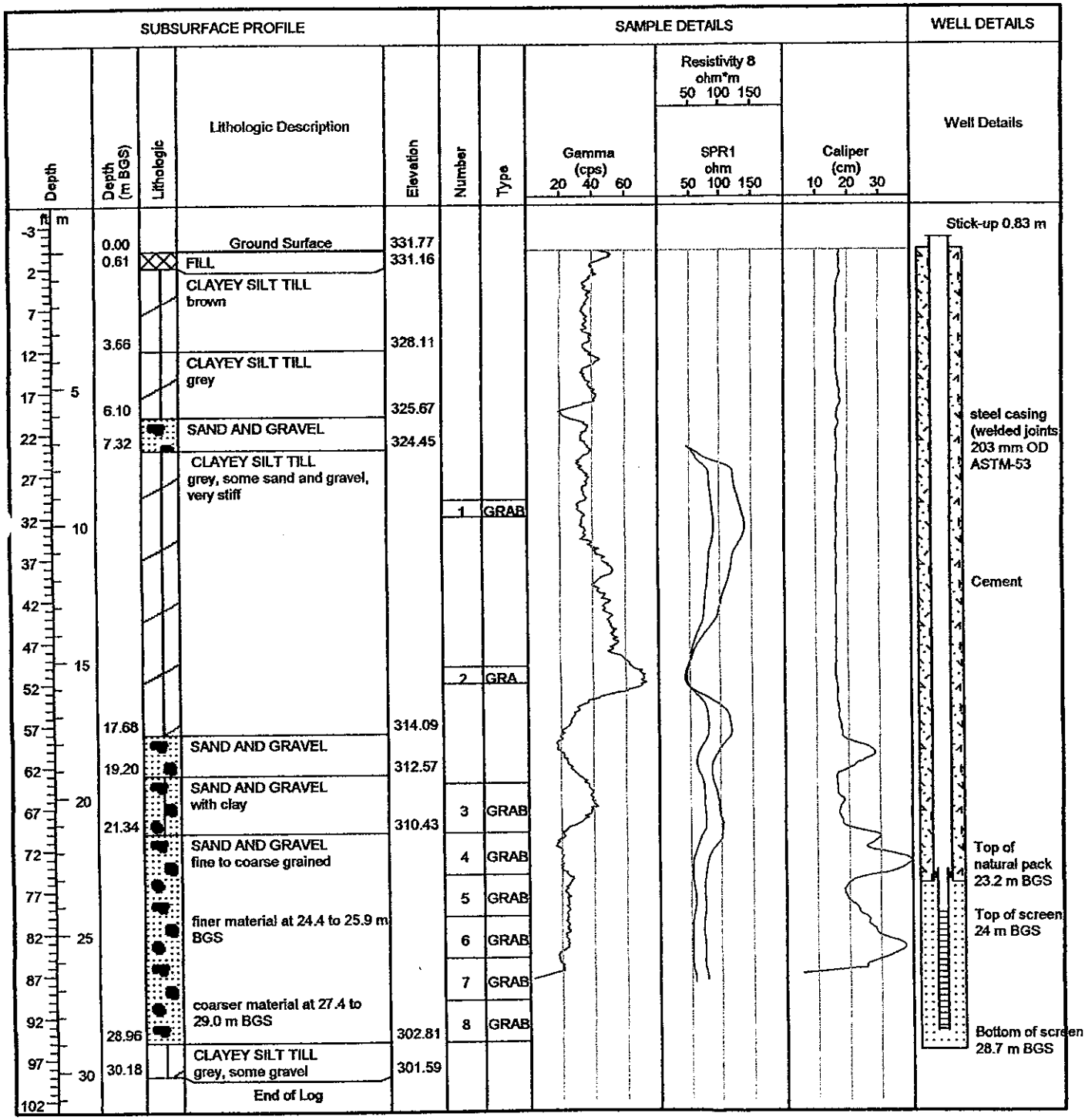
Drilling Method: Mud rotary

Date: 3-Jun-05

Supervisor: L.Veale

Ground Surface: 331.77 m AMSL

Top of Casing: 332.60 m AMSL



Drawn By/Checked By: OR/LV

Screen details:

No.45 slot. Continuous wrap stainless steel Johnson high capacity well screen (8" telescopic diameter)

Notes:
mBGS - metres below ground surface
GRAB - grab sample

Stantec Consulting Ltd.
49 Frederick Street
Kitchener, Ontario
N2H 6M7

Stantec

MH4A

Borehole No.: MH04A (TH3-05)

Project: Maryhill Production Well
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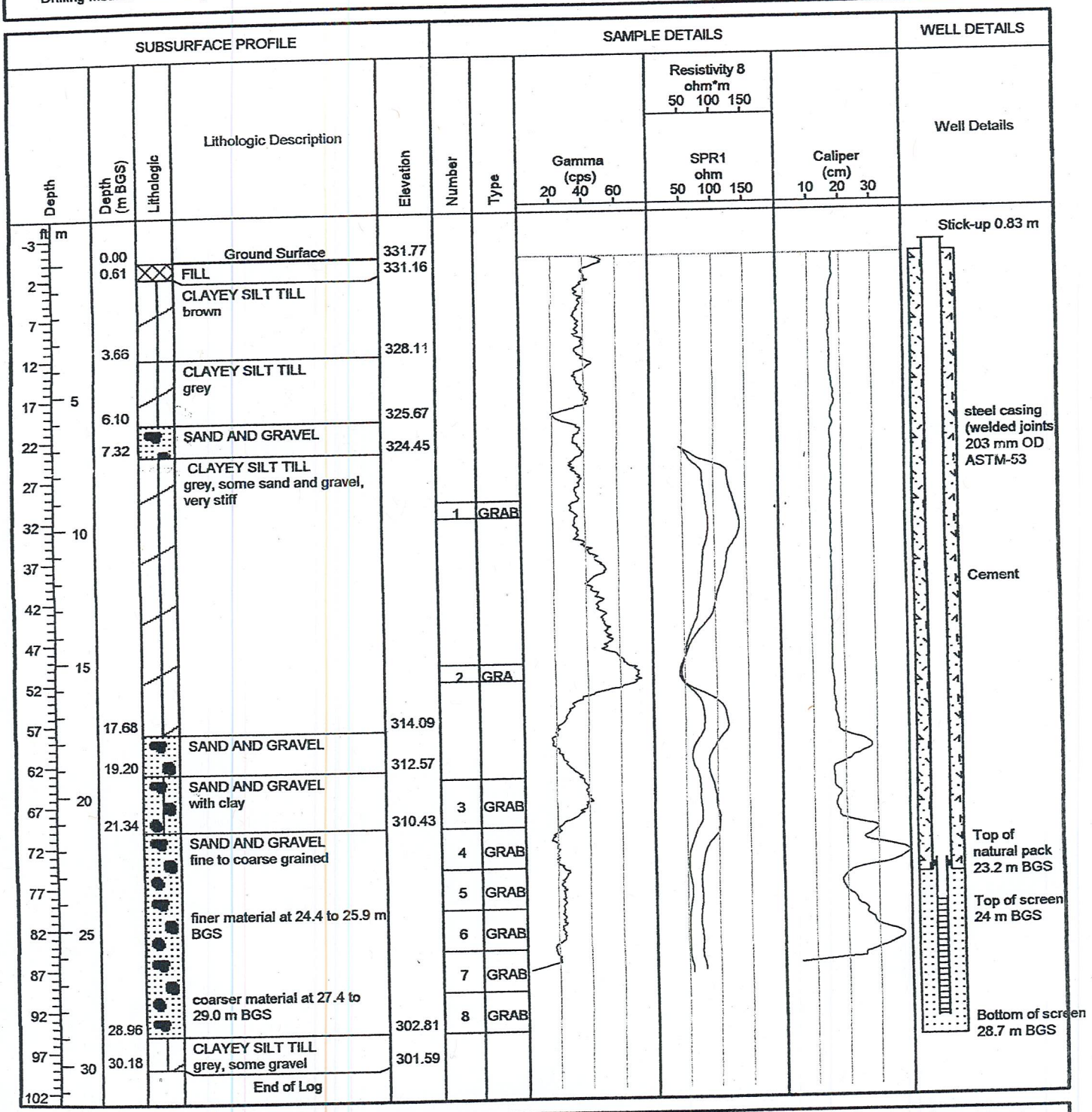
Location: Maryhill, Ontario
Contractor: Davidson Drilling Ltd.
Drilling Method: Mud rotary

Date: 3-Jun-05
Supervisor: L.Veale
Ground Surface: 331.77 m AMSL
Top of Casing: 332.60 m AMSL



Drawn By/Checked By: OR/LV

Screen details:
No.45 slot. Continuous wrap stainless steel Johnson high capacity well screen (8" telescopic diameter)

Notes:
mBGS - metres below ground surface
GRAB - grab sample

Stantec Consulting Ltd.
49 Frederick Street
Kitchener, Ontario
N2H 6M7

Stantec

MH4A

Ontario Ministry of the Environment

A 023699 (d print number below)
A023699

Well Record
Regulation 903 Ontario Water Resources Act

page ___ of ___

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- **All metre measurements shall be reported to 1/10th of a metre.**
- Please print clearly in blue or black ink only.

Ministry Use Only
MUN | CON | LOT

Well Owner's Information and Location of Well Information

First Name	Last Name	Mailing Address (Street Number/Name, RR,Lot,Concession)
	Regional Municipality of Waterloo	150 Frederick St. 4th Floor

County/District/Municipality	Township/City/Town/Village	Province	Postal Code	Telephone Number (include area code)
Waterloo Region	Kitchener	Ontario	N2G 4J3	519-575-4433

Address of Well Location (County/District/Municipality)	Township	Lot	Concession
Waterloo Region	Woolwich (Waterloo)	81	GCT

RR#/Street Number/Name	City/Town/Village	Site/Compartment/Block/Tract etc.
	Maryhill	

GPS Reading	NAD	Zone	Easting	Northing	Unit Make/Model	Mode of Operation
	83	17	549453	4821088	Garmin eTREX Venture	[X] Undifferentiated [ ] Averaged [ ] Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth From (Ft.)	Depth To (Ft.)
Black	Topsoil			0	1'
Brown	Clay	Stones		1	12
Grey	Clay		Hard	12	20
Brown	Gravel			20	24
Grey	Clay	Till	Hard	24	48
Grey	Clay		Hard	49	58
Grey	Till	Stones		58	62
BrnGry	Gravel	Sand,stones,till		62	96

Hole Diameter

Depth (Ft.) From	To	Diameter (inches)
0	96'	6"
0	96'	12½"

Water Record

Water found at (Ft.)	Kind of Water		
79'-94'	[X] Fresh	[ ] Sulphur	[ ] Gas
	[ ] Salty	[ ] Minerals	[ ] Other:
___ m	[ ] Fresh	[ ] Sulphur	[ ] Gas
	[ ] Salty	[ ] Minerals	[ ] Other:
___ m	[ ] Fresh	[ ] Sulphur	[ ] Gas
	[ ] Salty	[ ] Minerals	[ ] Other:

After test of well yield, water was
[X] Clear and sediment free
[ ] Other, specify

Chlorinated [X] Yes [ ] No

Construction Record

Inside diam (centimetres)	Material	Wall thickness (centimetres)	Depth From (Ft.)	Depth To (Ft.)
Casing				
8"	[X] Steel [ ] Fibreglass [ ] Plastic [ ] Concrete [ ] Galvanized	.322"	+3	76'
	[ ] Steel [ ] Fibreglass [ ] Plastic [ ] Concrete [ ] Galvanized			
	[ ] Steel [ ] Fibreglass [ ] Plastic [ ] Concrete [ ] Galvanized			
Screen				
Outside diam 7½"	[X] Steel [ ] Fibreglass [ ] Plastic [ ] Concrete [ ] Galvanized	Slot No. 45	79'	94'
No Casing or Screen				
	[ ] Open hole			

Test of Well Yield

Pumping test method	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Pump intake set at - (metres)	Static Level			
Pumping rate - (litres/min)	1		1	
Duration of pumping ___hrs +___ min	2		2	
Final water level end of pumping ___metres	3		3	
Recommended pump type. [ ] Shallow [ ] Deep	4		4	
Recommended pump depth. ___metres	5		5	
Recommended pump rate. (litres/min)	10		10	
	15		15	
If flowing give rate - (litres/min)	20		20	
	25		25	
If pumping discontinued, give reason.	30		30	
	40		40	
	50		50	
	60		60	

(Ft.) Plugging and Sealing Record
[X] Annular space [ ] Abandonment

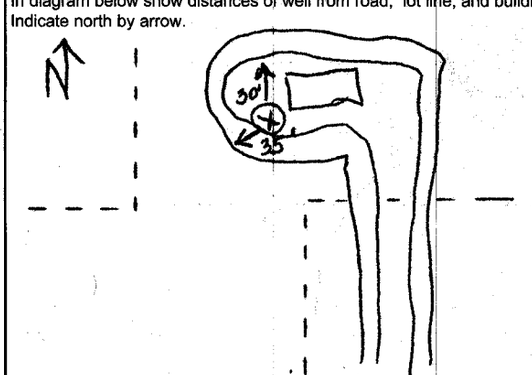
Depth set at - (Metres) From	To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
76'	0'	Cement	

Method of Construction
[ ] Cable Tool [ ] Rotary (air) [ ] Diamond [ ] Digging
[X] Rotary (conventional) [ ] Air percussion [ ] Jetting [ ] Other
[ ] Rotary (reverse) [ ] Boring [ ] Driving

Water Use
[ ] Domestic [ ] Industrial [ ] Public Supply [ ] Other
[ ] Stock [ ] Commercial [ ] Not used
[ ] Irrigation [X] Municipal [ ] Cooling & air conditioning

Final Status of Well
[X] Water Supply [ ] Recharge well [ ] Unfinished [ ] Abandoned, (Other)
[ ] Observation well [ ] Abandoned, insufficient supply [ ] Dewatering
[ ] Test Hole [ ] Abandoned, poor quality [ ] Replacement well

Location of Well
In diagram below show distances of well from road, lot line, and building. Indicate north by arrow.



Audit No. Z 26669
Date Well Completed YYYY MM DD: 2005 06 15
Was the well owner's information package delivered? [ ] Yes [ ] No
Date Delivered YYYY MM DD

Well Contractor/Technician Information

Name of Well Contractor	Well Contractor's Licence No.
Davidson Well Drilling Limited	1737

Business Address (street name, number, city etc.): 147 North St.W. Wingham, Ontario N0G 2W0

Name of Well Technician (last name, first name)	Well Technician's Licence No.
Fenton Doug	T2003

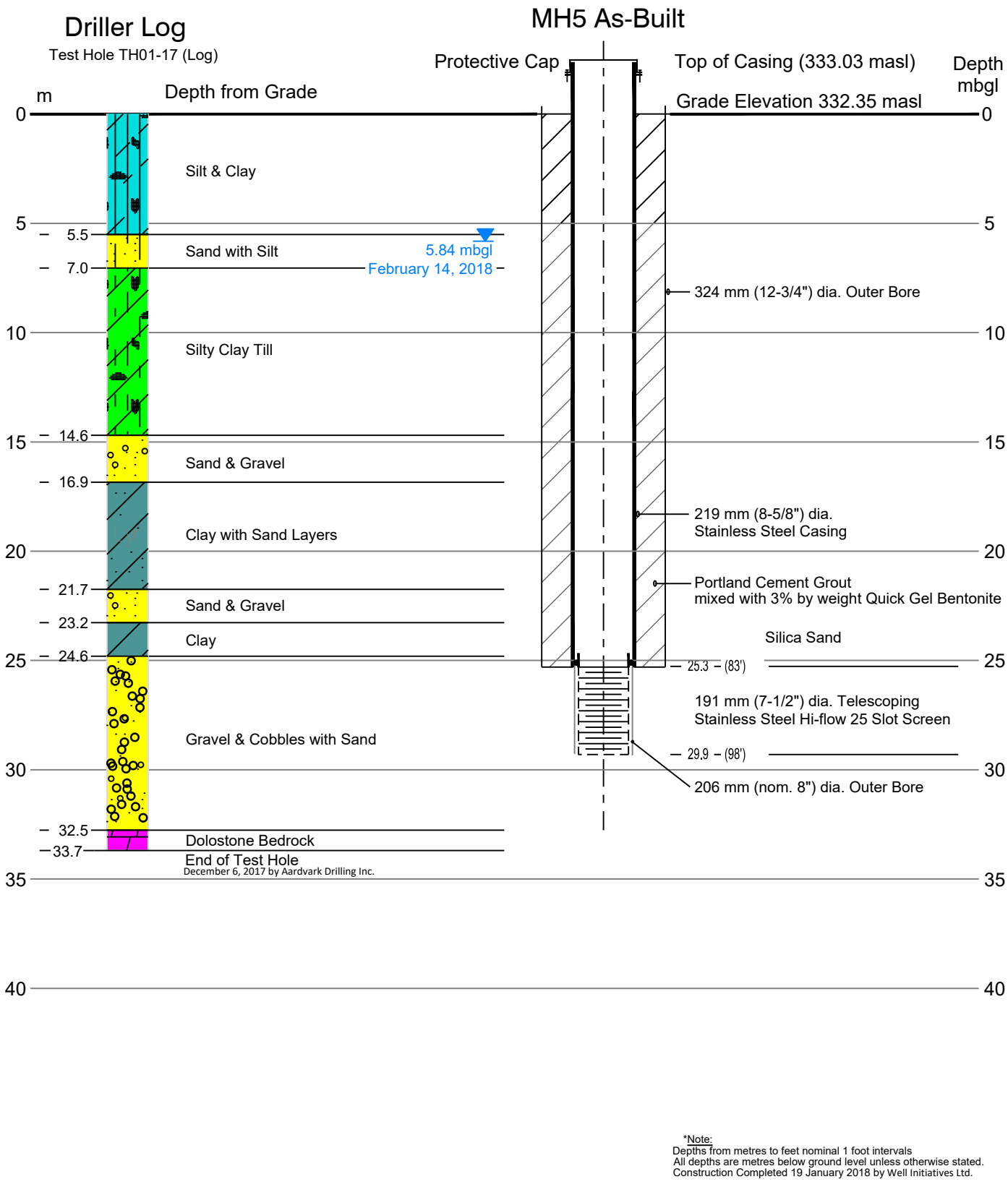
Signature of Technician/Contractor: X J.C. Davidson
Date Submitted YYYY MM DD: 2005 06 15

Ministry Use Only

Data Source	Contractor 1737
Date Received YYYY MM DD: MAR 14 2006	Date of Inspection YYYY MM DD
Remarks	Well Record Number

0506E (09/03) Contractor's Copy [ ] Ministry's Copy [X] Well Owner's Copy [ ]

Cette formule est disponible en français



*Note:
Depths from metres to feet nominal 1 foot intervals
All depths are metres below ground level unless otherwise stated.
Construction Completed 19 January 2018 by Well Initiatives Ltd.

CLIENT
REGION OF WATERLOO

PROJECT
MARYHILL MH3 REPLACEMENT WELL
CONSTRUCTION AND TESTING

CONSULTANT
GOLDER

YYYY-MM-DD	2018-05-24
PREPARED	PGM
DESIGN	PGM
REVIEW	PGM
APPROVED	GRP

TITLE
WELL MH5 CONSTRUCTION AS-BUILT

PROJECT No.	CONTROL	Rev.	FIGURE
1547812	0005	----	7

MH5

Ontario — Ministry of the Environment and Climate Change

Measurements recorded in: ☐ Metric ☒ Imperial

Well Tag No. *(Place Sticker and/or Print Below)* A236805

Well Record

Regulation 903 Ontario Water Resources Act

Page 1 of 1

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	Region of Waterloo		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
150 Frederick St W	Kitchener	ON	N2G4J3	5195754400

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
24 St Boniface Drive	Woolwich		

County/District/Municipality	City/Town/Village	Province	Postal Code
Waterloo	Maryhill	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	554944	4921054		

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	To
Br	clay	Stones	Hard	0	15
Grey	clay	Stones	Hard	15	53
Br	gravel		Course	53	58
Grey	Till		Hard	58	79
Br	Gravel	Sand - Stones	Course	79	98

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
93	0	Neat Cement	39 bags

Method of Construction

☐ Cable Tool ☐ Diamond
☒ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☐ Air percussion
☐ Other, *specify*

Well Use

☐ Public ☐ Commercial ☐ Not used
☐ Domestic ☒ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, *specify*

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	To
8 1/2	steel	325	+2	83

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	To
7 5/8	steel	25	98	83

Status of Well

☒ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, *specify*
☐ Other, *specify*

Water Details

Water found at Depth (m/ft)	Kind of Water	Hole Diameter Depth (m/ft) From	To	Diameter (cm/in)
☐ Gas	☐ Fresh ☒ Untested ☐ Other, *specify* 98-93	0	83	12 3/4
Water found at Depth (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify*	83	98	8 1/8
Water found at Depth (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, *specify*			

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, *specify*

If pumping discontinued, give reason:

Pump intake set at (m/ft): 66

Pumping rate (l/min / GPM): 235

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 23.95

If flowing give rate (l/min / GPM)

Recommended pump depth (m/ft): 66

Recommended pump rate (l/min / GPM): 230

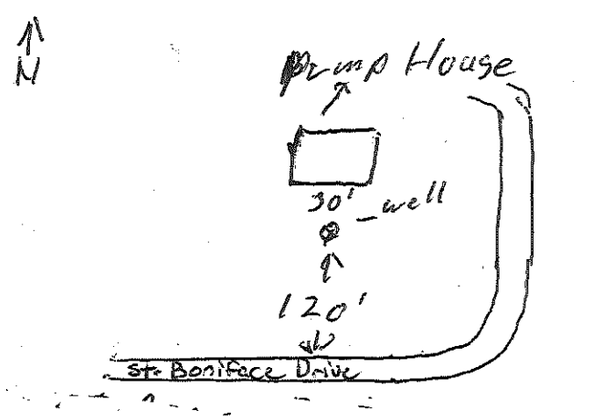
Well production (l/min / GPM)

Disinfected? ☒ Yes ☐ No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level		20.07		
1	23.20		1	22.24
2	23.20		2	22.15
3	23.33		3	22.05
4	23.33		4	21.98
5	23.29		5	21.95
10	23.39		10	21.72
15	23.46		15	21.55
20	23.56		20	21.42
25	23.62		25	21.36
30	23.69		30	21.26
40	23.75		40	21.13
50	23.85		50	20.99
60	23.95		60	20.93

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Well Initiatives	7121

Business Address (Street Number/Name)	Municipality
19 Town Line Orangeville	

Province	Postal Code	Business E-mail Address
Ont	L9W3R4	info@wellinitiatives.com

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
5199469289	Fenton, Doug

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
T2003	Doug Fenton	2018/03/02

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☐ Yes ☐ No		2018/02/28

Ministry Use Only

Audit No. Z272648

Received MAR 05 2018

WH-MH-MW1-05-(A-B)

9202689

Monitoring Well No.: MW1-05 S/D

Project: Maryhill Production Well

Project No: 1609-00313

Location: Maryhill, Ontario

Contractor: Davidson

Drilling Method: mud rotary

Date: 20-Jun-05

Field Investigator: L.Veale

Ground Surface: 331.595 m AMSL

Top of Casing: 332.555 m AMSL(Shallow);332.515 (Deep)

SUBSURFACE PROFILE

Distance Along Borehole Axis (ft / m)	Lithologic Symbol	Lithologic Description	Elevation (m AMSL)
-3 ft		Ground Surface	331.60
7 ft		SANDY CLAY brown	
17 ft		GRAVEL	326.11
27 ft		CLAYEY SILT TILL grey	323.98
10 m			
37 ft			
47 ft			
57 ft			
67 ft		GRAVEL	311.78
20 m		TILL	310.26
77 ft		GRAVEL	308.74
87 ft		till at bottom	303.55
97 ft		End of Borehole	

WELL DETAILS

Well

Stick up 0.96 m (Shallow)
Stick up 0.92 m (Deep)

Holeplug

Top of Sand
6.40 m BGS

Top of screen
6.40 m BGS

PVC #10 Slot
51 mm diameter

Bottom of screen
7.92 m BGS

Holeplug

Top of Sand
19.81 m BGS

Top of screen
22.25 m BGS

PVC #10 Slot
51 mm diameter

Bottom of screen
26.82 m BGS

Native Cave

Screen interval: 6.40-7.92 m BGS(Shallow); 22.25-26.82 m BGS(Deep)

Well seal interval: 0-5.49 m BGS(Shallow);8.23-19.81 m BGS(Deep)

Sand pack interval: 5.49-7.92 m BGS(Shallow);19.81-26.82 m BGS(Dee

Drawn By/Checked By: OR/LV

Notes:
mAMSL - metres above mean sea level
mBGS - metres below ground surface

Stantec Consulting Ltd.
49 Frederick Street
Kitchener, Ontario
N2H 6M7

Stantec

WH-MH-MW2-05-(A-B)

9202690

Monitoring Well No.: MW2-05 S/D

Project: Maryhill Production Well

Project No: 1609-00313

Location: Maryhill, Ontario

Contractor: Davidson

Drilling Method: mud rotary

Date: 20-Jun-05

Field Investigator: L.Veale

Ground Surface: 330.453 m AMSL

Top of Casing: 331.253 m AMSL(Deep);331.283(Shallow)

SUBSURFACE PROFILE

Distance Along Borehole Axis (ft / m)	Lithologic Symbol	Lithologic Description	Elevation (m AMSL)
-3		Ground Surface	330.45
7		SANDY CLAY brown, streaks of sand	
17		SAND brown	325.27 324.66
27		CLAYEY SILT TILL grey with gravel	
10			
37			
47			
57			
67			
20			309.12
77		SAND AND GRAVEL streaks of finer material	
87		till at bottom	302.41
97		End of Borehole	

WELL DETAILS

Well

Stick up 0.83 m (Shallow)
Stick up 0.80 m (Deep)

Holeplug

Top of Sand
3.96 m BGS

Top of screen
4.88 m BGS

PVC #10 Slot
51 mm diameter

Bottom of screen
6.40 m BGS

Holeplug

Top of Sand
21.95 m BGS

Top of screen
23.47 m BGS

PVC #10 Slot
51 mm diameter

Bottom of screen
28.04 m BGS

Screen interval: 4.88-6.40 m BGS(Shallow); 23.47-28.04 m BGS(Deep)

Well seal interval: 0-3.96 m BGS(Shallow);6.71-21.95 m BGS(Deep)

Sand pack interval: 3.96-6.40 m BGS(Shallow);21.95-28.04 m BGS(Dee

Drawn By/Checked By: OR/LV

Notes:
mAMSL - metres above mean sea level
mBGS - metres below ground surface

Stantec Consulting Ltd.
49 Frederick Street
Kitchener, Ontario
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Appendix C

Monitoring Data
(Pumped Volumes and Hydrographs)

Region of Waterloo

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

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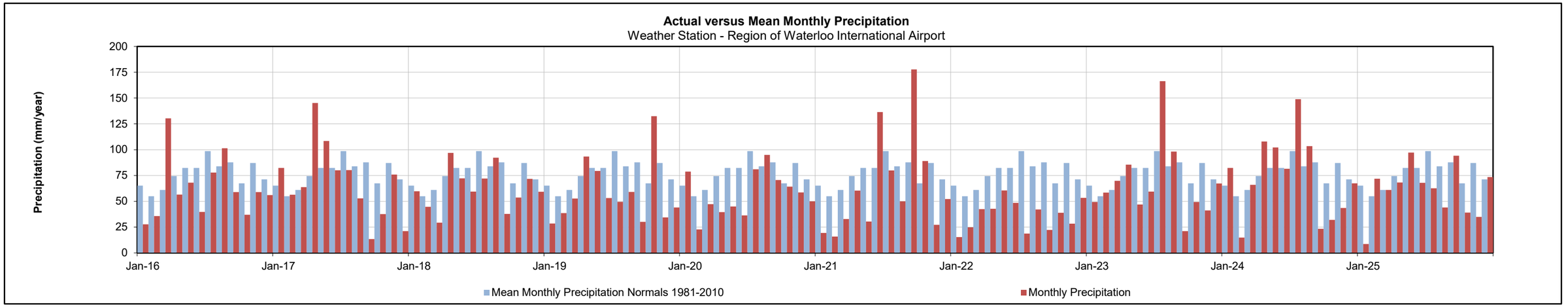
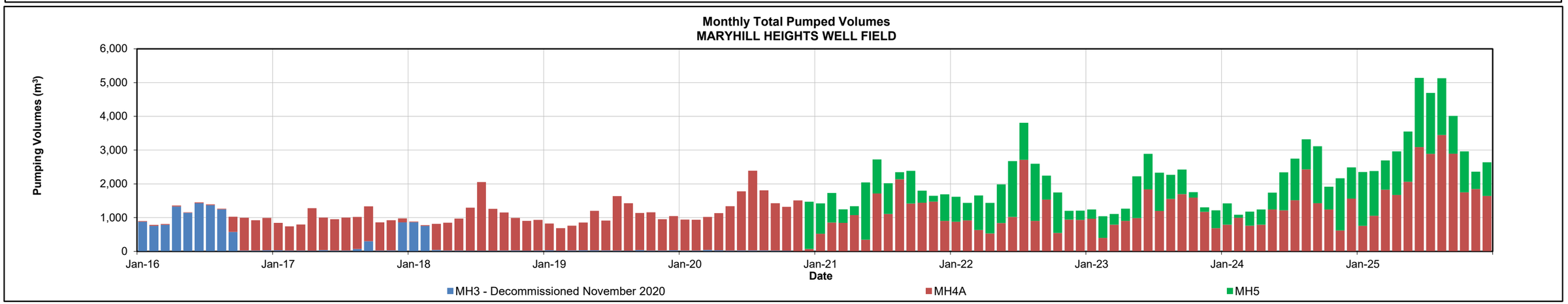
Well Field	Major or Minor Supply	Production Well Name	Permit to Take Water Details			2021 Production Summary			2022 Production Summary			2023 Production Summary			2024 Production Summary			2025 Production Summary		
			MOE Permit Number[1]	Permitted Capacity (total m^3/year)*	Permitted Rate (L/s)*	Total 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)
Maryhill Heights	Minor	MH3	1746-BBWLJR	Combined rate for PTTW	1746-BBWL	1,777	5	0.06	0	0	0.00	0	0	0.00	0	0	0	0	0	0
		MH4A	1746-BBWLJR	814,680	25.8	13,842	38	0.44	12,393	34	0.39	13,789	38	0.44	14,599	40	0.46	24,946	68	0.79
		MH5	1746-BBWLJR			8,549	0	0	11,220	0	0	7,288	20	0.23	10,167	28	0.32	15,943	44	0.51
			Well Field Total	***814,680***	***25.8***	***12,596***	***35***	***0.40***	***12,393***	***34***	***0.39***	***21,077***	***58***	***0.67***	***24,766***	***68***	***0.79***	***40,889***	***112***	***1.30***

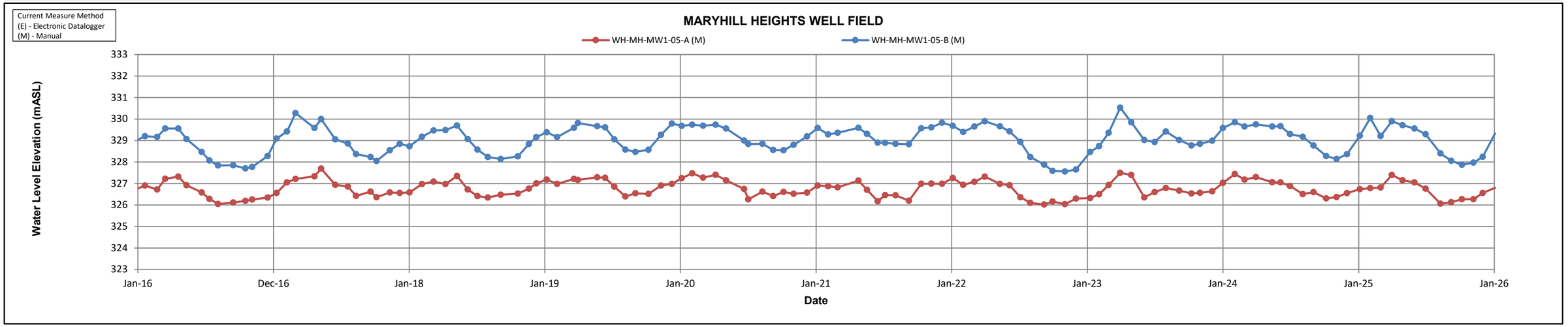
*Maximum taking is 1,550 L/min at each well and combined taking shall not exceed 2,232,000 L/day

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

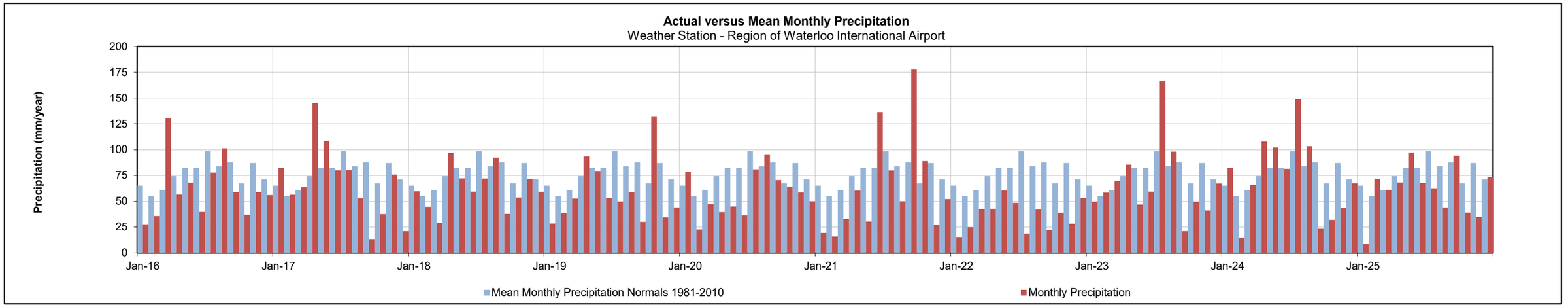
REGION OF WATERLOO
2025 GROUNDWATER MONITORING REPORT -
MARYHILL HEIGHTS

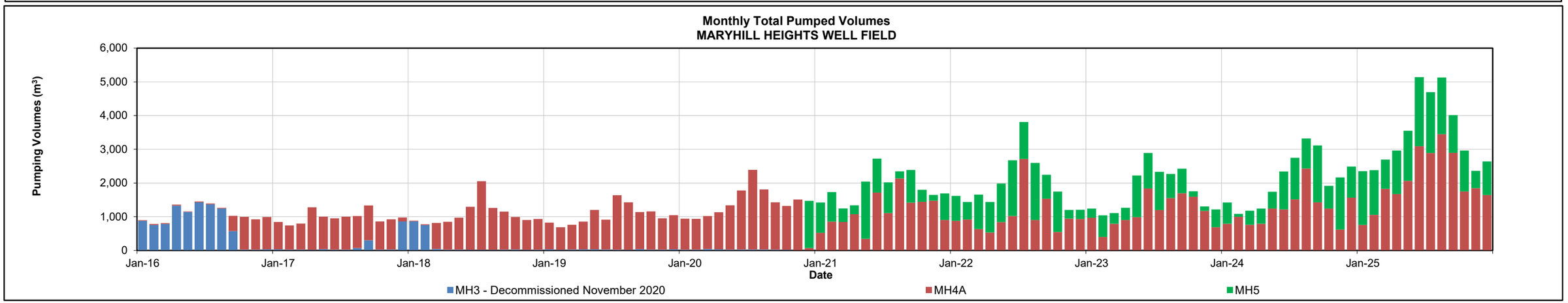


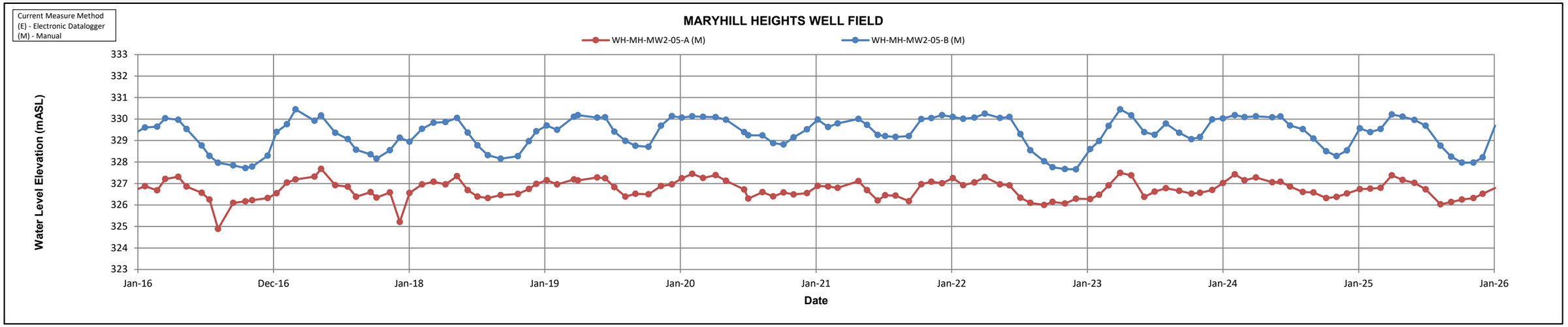




REGION OF WATERLOO
2025 GROUNDWATER MONITORING REPORT -
MARYHILL HEIGHTS







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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

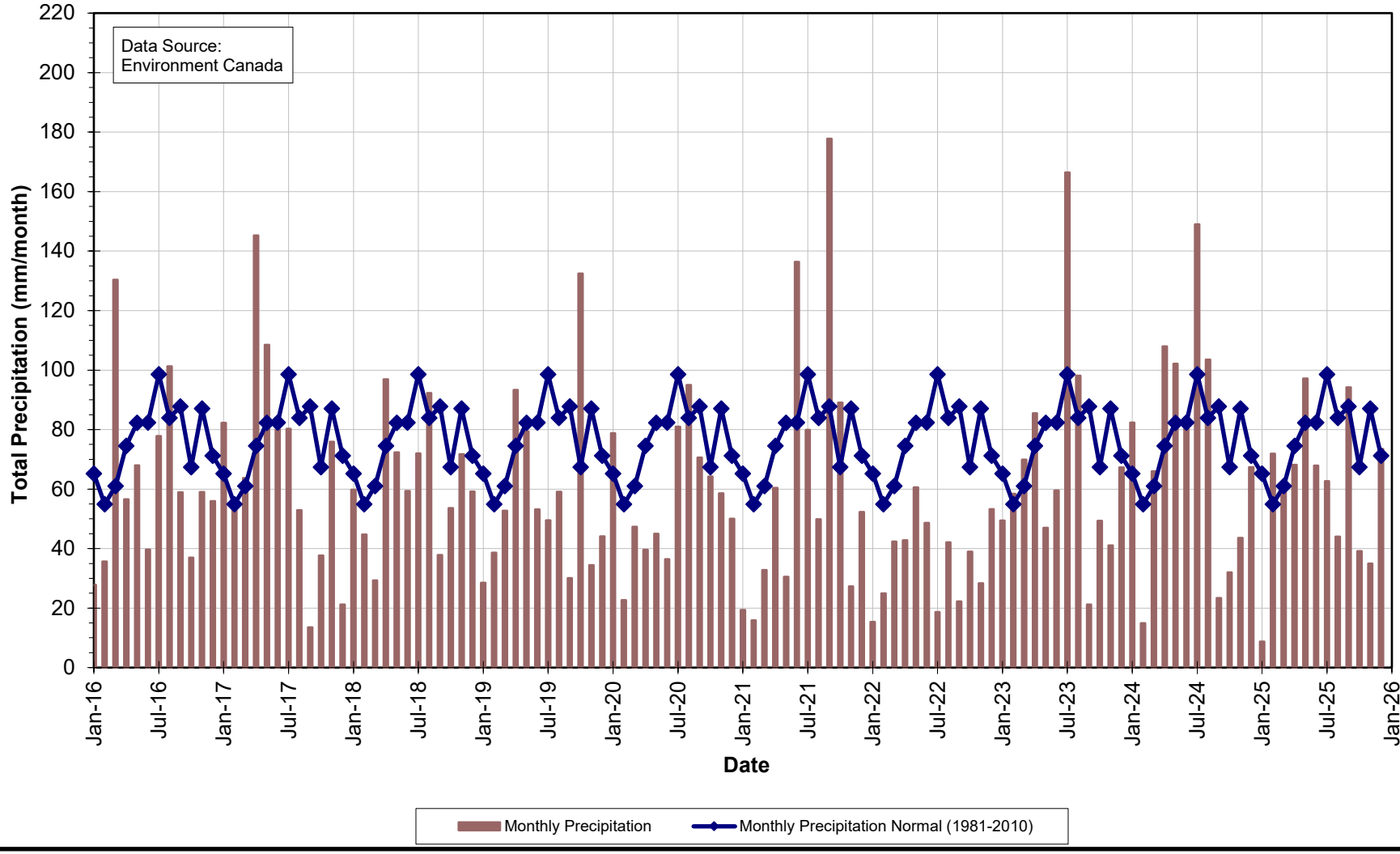
Year	Laurel Dam Established 1960		
	Annual Precipitation (mm)	Average Precipitation 1960-2025 (mm)	Difference (mm)
2016	985	938	47
2017	1062	938	124
2018	1071	938	133
2019	940	938	2
2020	938	938	0
2021	1027	938	89
2022	689	938	-249
2023	921	938	-17
2024	907	938	-31
2025	894	938	-44

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.

Figure D.1
Waterloo International Airport
Monthly Precipitation



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Prepared By: C.D.
Printed On: 2/13/2026
File: Appendix D Precipitation Data/Monthly WIA

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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*® Leveloggers®. 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 unconnected 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.

R.J. Burnside & Associates Limited