2025 Biennial Groundwater Monitoring Report - Heidelberg Well Field (HD1, HD2)

The Region of Waterloo

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The Region of Waterloo

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1.0 Introduction

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

The Permit to Take Water (PTTW) for the Heidelberg Well Field (HD1, HD2), (2437-B8FR7E) 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 (4.3) of the PTTW for 2024 and 2025. A copy of the PTTW is included in Appendix A.

The location of the Heidelberg Well Field is shown in Figure 1 and the production wells in Woolwich are shown in Figure 2 with the monitoring network for HD1 and HD2 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 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 and known aquifer recharge areas. The data from these wells and regular measurements of pumping volume obtained from the production wells are used to evaluate the impact of Region pumping on aquifers and potential impacts to private wells, other water takers and the natural environment.

The Region has developed a monitoring program for Heidelberg Well Field (HD1, HD2) in accordance with PTTW 2437-B8FR7E which consists of the following activities:

- Measuring the daily volume pumped from the HD1 and HD2 production wells (Condition 4.1 of the PTTW);
- Measuring the water levels in monitoring well WH-HB-OW01-09-A (Condition 4.2 of the PTTW);
- An assessment of the changes in water levels in the supply aquifer(s) in relation to precipitation and water taking from the aquifer(s) (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 Heidelberg Well Field is located in the southwest portion of the Township of Woolwich. Production wells HD1 and HD2 are located to the east of the residential area of Heidelberg. The closest municipal well field is St. Clements, located about 3.2 km to the west in Wellesley Township (Figure 2). The closest surface water feature to the HD1 and HD2 site is a tributary of the Conestogo River located 230 m to the north (Figure 3).

2.1.1 Pumping Wells

Well records for the production wells are found in Appendix B. Production well HD1 was drilled in 1976 to a depth of 60.4 metres below ground surface (mbgs) and is screened in the deep overburden aquifer (AFD1).

Production well HD2 was drilled in 1985 to a depth of 58.5 mbgs and is screened in the deep overburden aquifer (AFD1).

A summary of the production well construction details are provided in Table 1 below.

Table 1: Production Well Construction Details

Well Name	Year Built	Casing Diameter (mm)	Open Hole Diameter (mm)	Open Hole interval (mbgs)	Aquifer
HD1	1976	203	178	54.9-60.4	Deep Overburden (AFD1)
HD2	1985	203	203	54.0-58.5	Deep Overburden (AFD1)

The water taking volumes for the Heidelberg HD1 and HD2 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)
HD1	1,375	86	271	31,547	0	0	0
HD2	1,375	57	259	20,798	0	0	0
Combined HD1, HD2	1,375	143	279*	52,345	0	0	0

*Note: The maximum daily volume was recorded on June 12, 2024, with HD1 at 271 m^3/day and HD2 at 8 m^3/day.

The pumping volumes are based on the total daily volumes recorded by the Region's SCADA system and are presented in Appendix C as total monthly volumes. Production wells HD1 and HD2 are pumped in alternation. Pumping volumes from the well field ranged from 1,817 m^3/month to 5,806 m^3/month from January 2024 to November 2024 when HD1 and HD2 were taken offline (last pumped on November 12, 2024). In total, 52,345 m^3 was produced at this well field in 2024. No water was pumped from the wells in 2025. The total volumes in 2024 and 2025 are below the previous three years and below the permitted volume of 501,948 m^3 per year (Table C-1).

As of late 2024, the Heidelberg water supply system was modified so that the St. Clements well field now supplies potable water to Heidelberg via a dedicated watermain connection. With this system change, production wells HD1 and HD2 were permanently taken offline and subsequently converted to monitoring wells. These modifications eliminate the use of HD1 and HD2 for municipal supply, while maintaining the wells for groundwater-level monitoring. Further details on the well modifications are provided in the Lotowater memo included in Appendix B.

The total combined water taking from Wells HD1 and HD2 shall not exceed 955 L/min, which corresponds to a maximum daily volume of 1,375 m^3/day, as specified in Condition 3.3 of the PTTW. As shown in Table 2, this requirement was met in both 2024 and 2025.

2.1.2 Monitoring Wells

The Region recently updated their well naming protocol and as a result, the well names in EQuIS may vary from the names listed on the PTTW. The well name on the PTTW is

shown below along with the updated name that is used by the Region. The updated Region name will be used throughout this report.

Table 3: Well Nomenclature

Monitoring well names as they appear on the PTTW	Revised well names consistent with Region nomenclature
WH-HB-OW1-09	WH-HB-OW01-09-A

Observation well WH-HB-OW01-09-A is located approximately 430 m west of wells HD1 and HD2 (Figure 3).

Construction details of WH-HB-OW01-09-A are described in Table 4. Well records for the monitoring well are provided in Appendix B.

Table 4: Monitoring Well Construction Details

Monitoring Well ID	Year Built	Screened Depth (mbgs)	Screened Formation	Distance to HD1 (m)	Distance to HD2 (m)
WH-HB-OW01-09-A	2009	59.4-62.5	Overburden (ATC1/AFC1/ATC2)	434	431

2.2 Regional Geology and Hydrostratigraphy

The surficial geology based on regional OGS mapping is provided in Figure 4. The village of Heidelberg is located near the north end of the Waterloo Moraine in the northwest part of the Region (Figure 5). Representative cross-sections showing the stratigraphy in the vicinity of the Heidelberg Well Field (HD1, HD2) are included as Figures 6 and 7. 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 Heidelberg Well Field (HD1, HD2). The recently completed Tier Three Assessment Update Project (Aqua Insight et al, 2023) has revised the previous (Matrix 2015) stratigraphic interpretation of the lithology around the Heidelberg Wellfield. The lithological layers were updated in accordance with documentation provided in the Numerical Model Surface Transfer memorandum (Aqua Insight Inc, 2026).

Aqua Insight Inc. and S.S. Papadopulos & Associates, Inc. (2024) indicated that in the Heidelberg area, the production aquifer was previously interpreted as a laterally continuous unit extending west of the well field. However, more recent borehole investigations completed within the municipal aquifer (AFD1) indicate that this unit is locally thin or absent in that direction. As a result, the thickness of the pre-Catfish Creek Aquifer (AFD1) was reassessed. Lithologic records show that sand and gravel near an

elevation of approximately 305 m asl vary considerably in thickness, ranging from about 0.3 m to 6 m, whereas the earlier Moraine Model represented this unit as being approximately 10 m thick at the Heidelberg wells. This discrepancy has important implications for well field performance and capture zone delineation. Accordingly, the elevations of both the top and base of AFD1 were revised using available borehole data from Heidelberg and the surrounding area.

Available data also indicate that AFD1 thins between Heidelberg and St. Clements and pinches out to the south and east of the well field. In addition, the Lower Waterloo Moraine Sand Aquifer (AFB3), which was previously derived from regional-scale OGS mapping (Bajc and Shirota, 2007), showed inconsistencies in elevation relative to the local conceptual model. These elevations were subsequently adjusted to better align with site-specific interpretations. Revisions were also made to the top elevations of the Lower Maryhill Till Aquitard (ATB3) and the underlying bedrock surface to address localized anomalies in the previous dataset. ATB3 is now interpreted to pinch out to the east of the production wells. AFB1 is now thinner but more laterally continuous.

2.2.1 Surficial Geology and Conceptual Hydrostratigraphy

The surficial geology has been mapped and described by the Ontario Geological Survey (2003) and updated in Bajc and Shirota (2007).

The lithologic units typically present within the Waterloo Moraine 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 area. AFA1 is continuous aquifer that facilitates groundwater flow within the upper overburden sequence.

Aquitard ATB1 – Tavistock Till

Bajc and Shirota (2007) have also used unit ATB1 to represent the Port Stanley, Tavistock, Mornington and Upper Maryhill Tills.

The Tavistock Till is a clayey silt till, with occasional stony texture, that is predominantly found along the northwestern flank of the Waterloo Moraine. The Port Stanley Till is a sandy silt to silty sand till, with occasional stony texture, that is predominantly found along the flanks of the Waterloo Moraine. Both units are considered an aquitard and, where present, act to restrict recharge to the lower aquifers.

Aquifer AFB1 / 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, 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. This unit is approximately 20 m thick in the Heidelberg Well Field area.

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.

Aquitard ATC1 / 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. The Catfish Creek Till is typically thickest in the core area of the Waterloo Moraine, and thin or absent along the eastern flank.

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.

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.

Aquifer AFF1 / ATG1 – Pre-Canning Till

The Pre-Canning aquifer is characterized by coarse-grained sand and gravel sediments and is typically found within bedrock depressions. This unit is discontinuous throughout the Region, and where present is hydraulically connected with the upper weathered portion of the bedrock aquifer.

2.2.2 Bedrock Geology and Conceptual Hydrostratigraphy

The underlying bedrock at the Heidelberg Well Field is the Salina Formation, and consists of interbedded grey and brown dolostone, green to red shale units, and gypsum. Groundwater extracted from this unit tends to be of poor quality due to the presence of sulphates (Johnston et al., 1992). In the Heidelberg Well Field area, bedrock is found at depths of approximately 70 metres below ground surface (mbgs).

2.3 Local Geology

The following description of local geology is based on drilling investigations for the installation of the production wells (CH2M Hill, 1995). Borehole logs of the Heidelberg Well Field are included in Appendix B.

The surficial geology of the Heidelberg Well Field is characterized primarily by silty to sandy till sediments and ice contact sand and gravel (Figure 4). In addition, the deposition of the Waterloo Moraine in this area resulted in fine to coarse-grained sand and gravel deposits at surface.

Aquitard ATB1 – Tavistock Till - This unit was identified at surface at HD1 and HD2 with a thickness of 8 m, and is absent at WH-HB-OW01-09-A. This is consistent with the OGS surficial geology mapping shown in Figure 4.

Aquifer AFB1 – Upper Waterloo Moraine Stratified Sediments and Equivalents - This unit was identified at surface at WH-HB-OW1-09 and underlying ATB1 at HD1 and HD2. The thickness of the unit in all boreholes is 28 m.

Aquitard ATB3 – Lower Maryhill Till - This unit was identified underlying AFB1 at HD1, HD2 and WH-HB-OW1-09. It ranges in thickness from 12 m at HD1 and HD2, to about 29 m at WH-HB-OW1-09.

Aquitard ATC1 / ATC2 – Catfish Creek Till - This unit was identified in HD1 and HD2 with a thickness of about 6 m, and in WH-HB-OW01-09-A with a thickness of about 3 m.

Aquifer AFD1 – Pre-Catfish Creek Sand and Gravel - This unit was identified in HD1 and HD2 with a thickness of about 5 m and is absent at WH-HB-OW01-09-A. Production wells HD1 and HD2 are both completed in this aquifer.

Aquifer ATG1 – Pre-Canning Till - The borehole log for WH-HB-OW01-09-A indicates the well is screened in ATG1 which was encountered from 42 m bgs to the bottom of the borehole at 66 m bgs. HD1 and HD2 did not encounter AFG1.

3.0 2024 / 2025 Results

In accordance with conditions 4.2 of the PTTW, water levels were measured and recorded once a month in all listed monitoring wells.

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

3.1 Precipitation

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

Since variations in precipitation totals can occur throughout the Region due to localized events, monthly precipitation data from the GRCA and Environment Canada station located closest to the production wells are used. The closest GRCA weather station relative to the Heidelberg well field is the Laurel Dam station located 6.4 km to the southeast. The closest Environment Canada station is the Waterloo Internation Airport (WIA) located 20.3 km to the southeast. The locations of the meteorological stations are shown in 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. At Laurel Dam, the long-term average was calculated from when measurements started until the end of 2025. The WIA have “Climate Normals” calculated by Environment Canada for 1971 to 2000.

Annual 2024 / 2025 precipitation data for all the meteorological stations closest to the Heidelberg well field are presented in Table 5 below. WIA was missing 6 days of data in 2024 and 6 days in 2025. As a result, the precipitation totals at these stations may be under reported.

Table 5: 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 (A)	874	+23	851[D]	723	-128
Laurel Dam (B)	907	-31	938[A]	894	-44

Sources: Environment Canada (1), GRCA (2)
[A] 1991 to 2020 Normal [B] 1998-2024 data
[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. In contrast, WIA station received 23 mm more precipitation than its 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 at each monitoring well 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-HB-OW1-09-A

WH-HB-OW1-09-A is located about 430 m west of the HD1 / HD2 production wells and is screened within the Pre-Canning Till (ATC1/AFC1/ATC2). Water level monitoring was completed using an electronic data logger.

Water levels at this well reflect seasonal trends, and there does not appear to be any correlation with pumping. Water levels increased approximately 4.5 m in November 2019 as a result of well development and well purging. Multiple manual readings from November 2019 to May 2023 confirm the water level rise while pumping rates remained consistent.

Throughout 2024 and 2025, distinct seasonal trends were observed, with spring recharge producing water-level increases of approximately 0.75 m in 2024 and 1.5 m in 2025, followed by a steady decline through early summer and a minor rise during the autumn period. Pumping from the wellfield ceased in November 2024 and there was no significant change in water levels confirming that the water levels in WH-HB-OW1-09-A are not influenced by pumping. Water levels observed in 2024 / 2025 were consistent with historical values.

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.

There are properties with private water supply within 500 m of the Heidelberg Well Field. In the event that 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 in the area surrounding the Heidelberg Well Field during 2024 and 2025.

Other non-municipal groundwater and surface water takings registered in the MECP's PTTW database within 2 km of the well field are mapped in Figure 3 and summarized below in Table 6. The PTTW database identified two permits located south-east of HD1 / HD2.

Table 6: PTTWs (Groundwater and Surface Water) in Vicinity of Heildelberg Well Field (HD1, HD2)

Permit Number	Permit Holder	Purpose	Max Liters per Day	Distance (km) from HD1/HD2 Supply Wells	Expiry Date	Source
5874-CD2Q6J	Unknown	Agricultural	1,382,400	0.9	12/31/2031	GW
5874-CD2Q6J	Unknown	Agricultural	1,031,184	0.9	12/31/2031	SW

4.2 Aquifer Response 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)".

Water levels in ATC1/AFC1/ATC2 monitored at WH-HB-OW1-09-A do not show a correlation with pumping volumes at the Heidelberg Well Field. The groundwater levels did not display a correlation with precipitation events.

During 2024 and 2025, water levels reached their highest point during the spring, gradually decreased through the summer, and experienced a slight increase towards the end of the year. The 2024 / 2025 precipitation data from the nearest weather station did not correlate with any specific water level response.

5.0 Conclusions

Impacts from pumping the municipal wells at the Heidelberg Well Field (HD1, HD2) 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 2437-B8FR7E;

- Production wells HD1 and HD2 were taken offline in November 2024;
- 2024 and 2025 pumping volumes were within the permitted range;
- There were no reported well interference complaints arising from water taking at the Heidelberg well field; and
- Water levels in ATC1 /AFC1 / ATC2 follow seasonal trends and do not respond to pumping.

6.0 References

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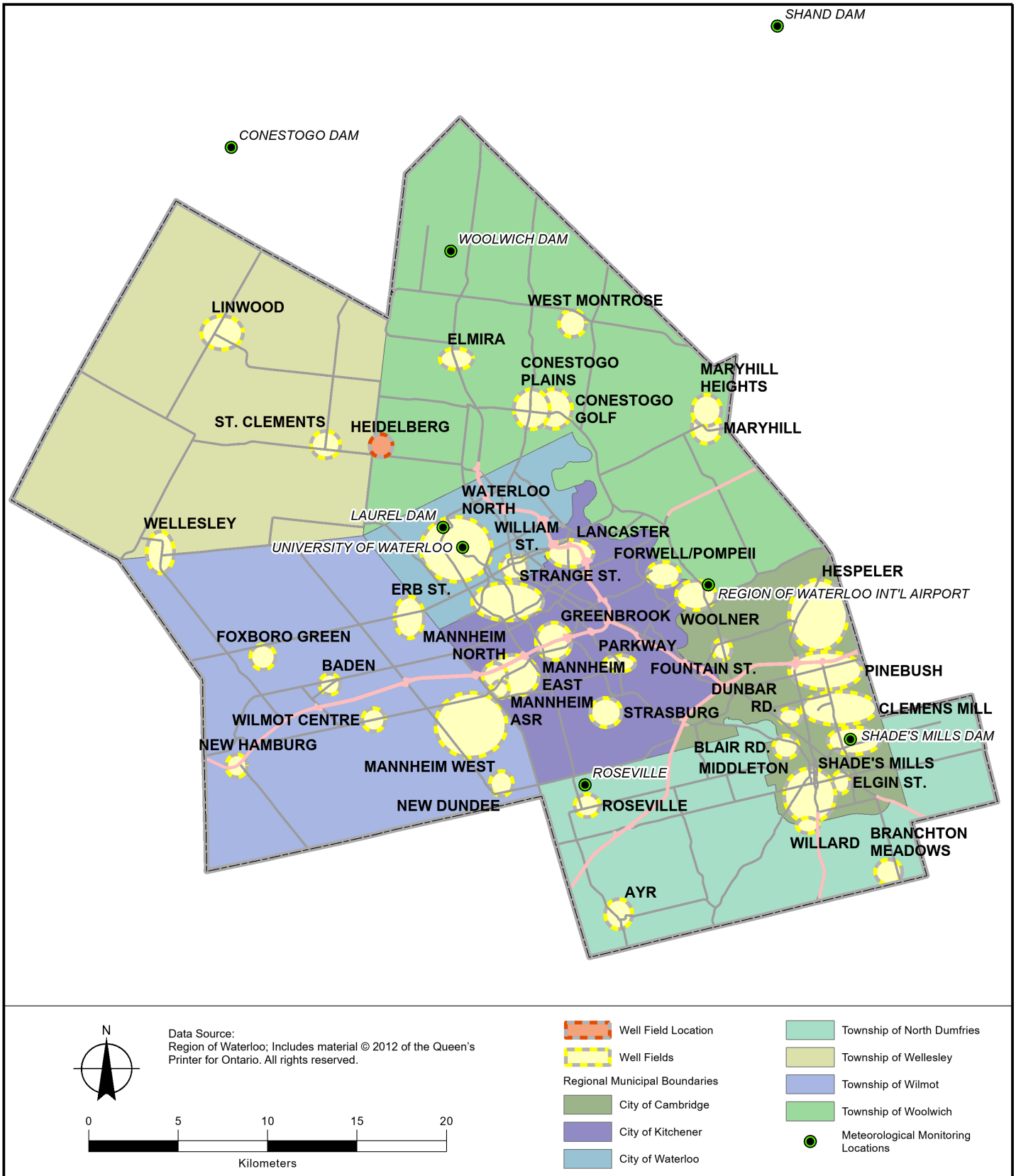
[THE DIFFERENCE IS OUR PEOPLE]

Figures



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Map Title

2025 GROUNDWATER MONITORING REPORT - HEIDELBERG WELL FIELD

WELL FIELD LOCATION MAP

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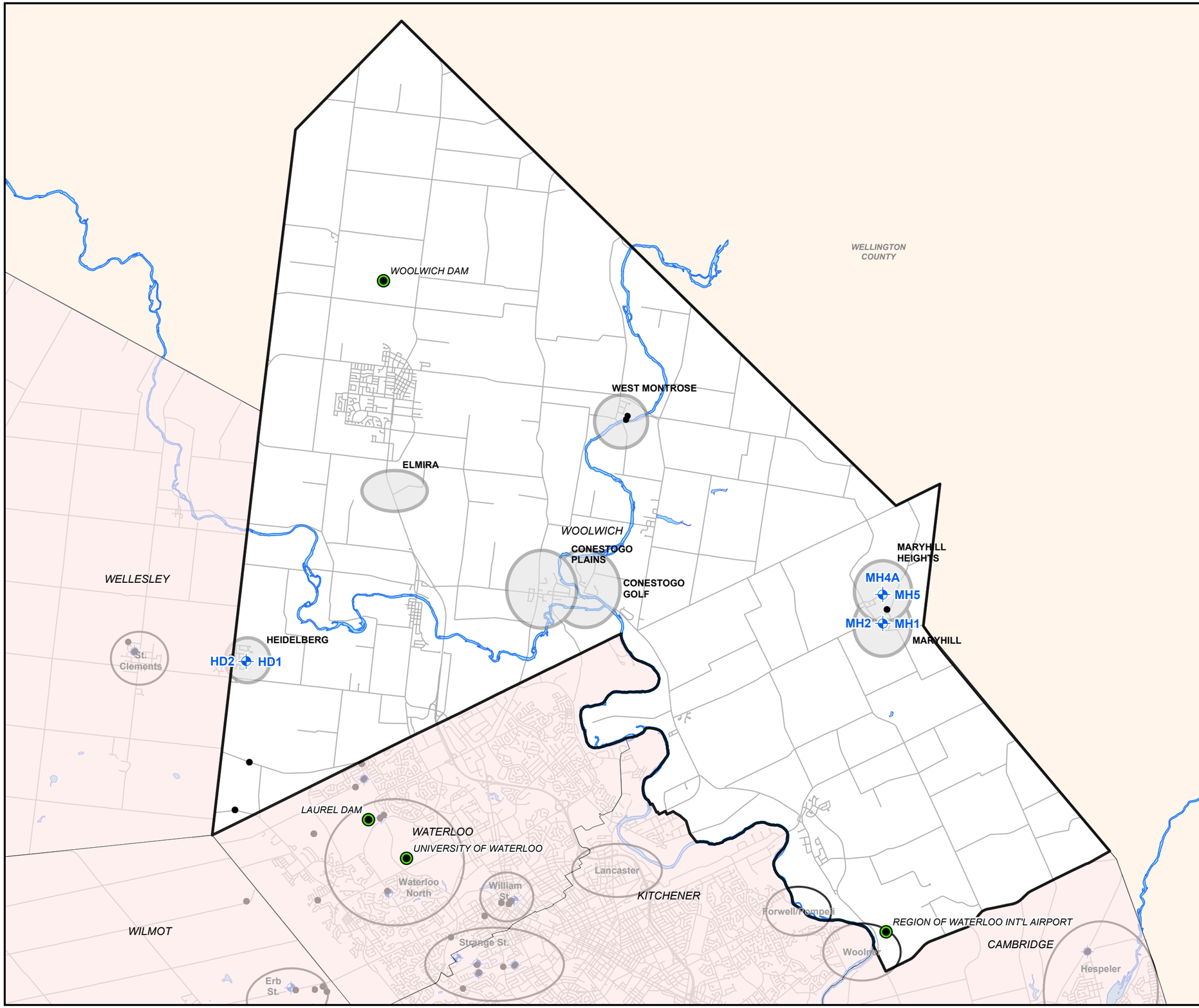

LEGEND

- 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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Figure Title

2025 GROUNDWATER MONITORING REPORT - HEIDELBERG WELL FIELD

WOOLWICH WELL FIELDS AND MONITORING NETWORK

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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

Production Well Location
Additional MECP PTTW Locations
Surface and Ground Water
Cross Section Orientation
Intermittent Creek
Creek
Waterbody
Provincially Significant Wetland (MNR)
Regional Road
Local Road

BURNSIDE

Map Title

2025 GROUNDWATER MONITORING REPORT - HEIDELBERG WELL FIELD

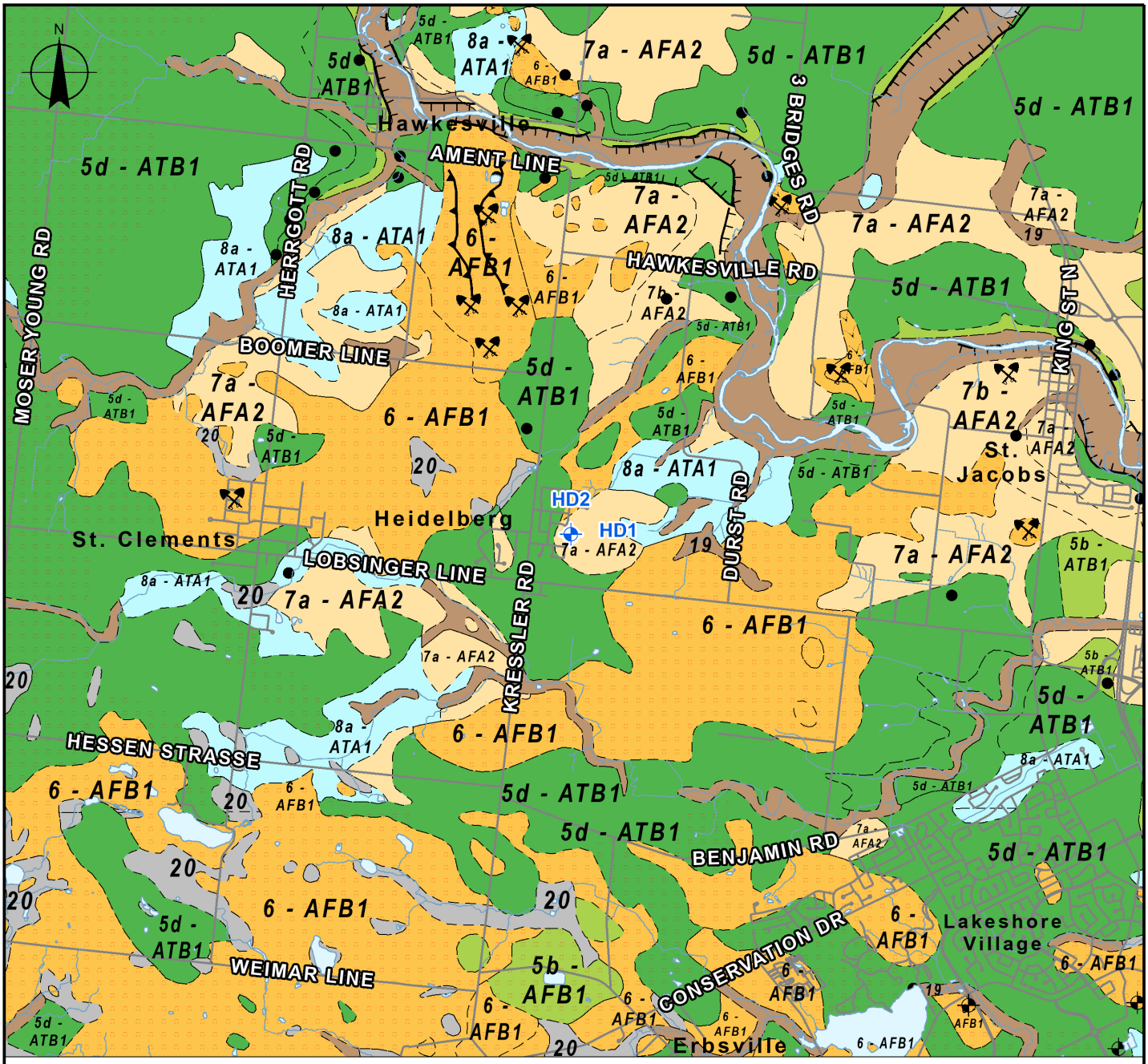
WELL LOCATION MAP

Client

REGION OF WATERLOO

Drawn	Checked	Date	Figure No.
HN	SQ	February 2026	3
Scale		Project No.	
1:20,000		HA0464020	

File Path: \\ELMO\GIS\Project\H Jobs\HA 04 6402 (Waterloo)\Reporting\Groundwater Level Monitoring Program\2025 Groundwater Report Figures\Heidelberg\PRO\HEIDELBERG\HEIDELBERG.aprx Print Date: 2026/02/16 Time: 02:10 PM



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)
- 8a: Fine-textured glaciolacustrine deposits: Massive-well laminated (ATA1)
- 19: Modern alluvial deposits
- 20: Organic deposits
- Sand and Gravel Pit
- Esker: Direction of Flow Known
- Ice-Contact Slope
- Terrace
- Drill Hole
- Sample Location
- Hummocky Topography
- Unit Contact Boundary

BURNSIDE

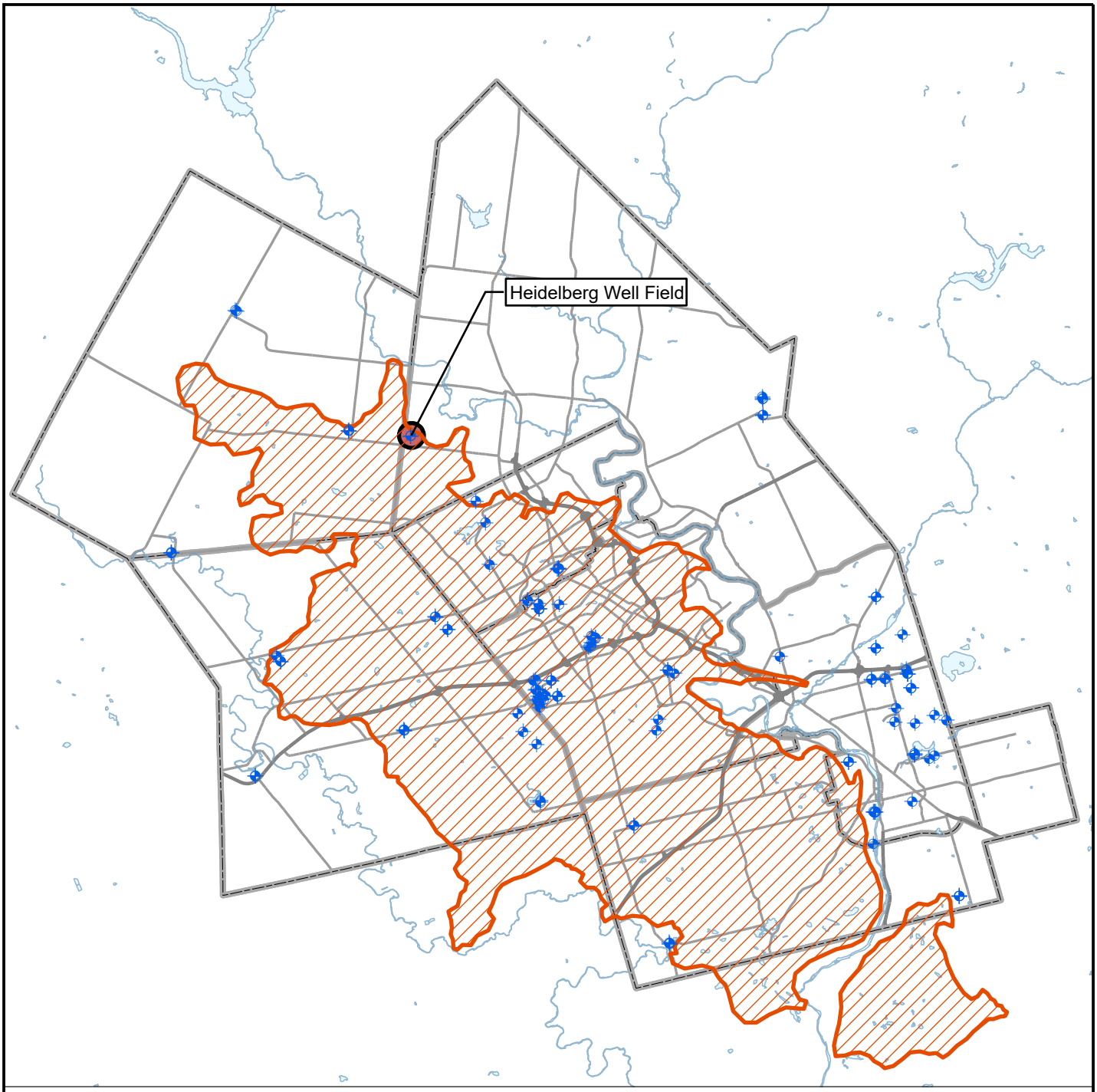
Map Title
2025 GROUNDWATER MONITORING REPORT - HEIDELBERG WELL FIELD

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



Data Source:
1. Andy F. Bajc, Hazen A.J. Russell and David R. Sharpe (2014) A three-dimensional hydrostratigraphic model of the Waterloo Moraine area, Southern Ontario, Canada, Canadian Water Resources Journal / Revue canadienne des ressources hydriques, 39:2, 95-119
2. Region of Waterloo; Includes material © 2019 of the Queen's Printer for Ontario. All rights reserved.

N

0 5 10 15 20 25
Kilometers

RMOW Supply Well
Waterloo Moraine (2014)
Heidelberg Well Field
Waterbody
Regional Municipal Boundaries

BURNSIDE

Map Title

2025 GROUNDWATER MONITORING REPORT - HEIDELBERG WELL FIELD

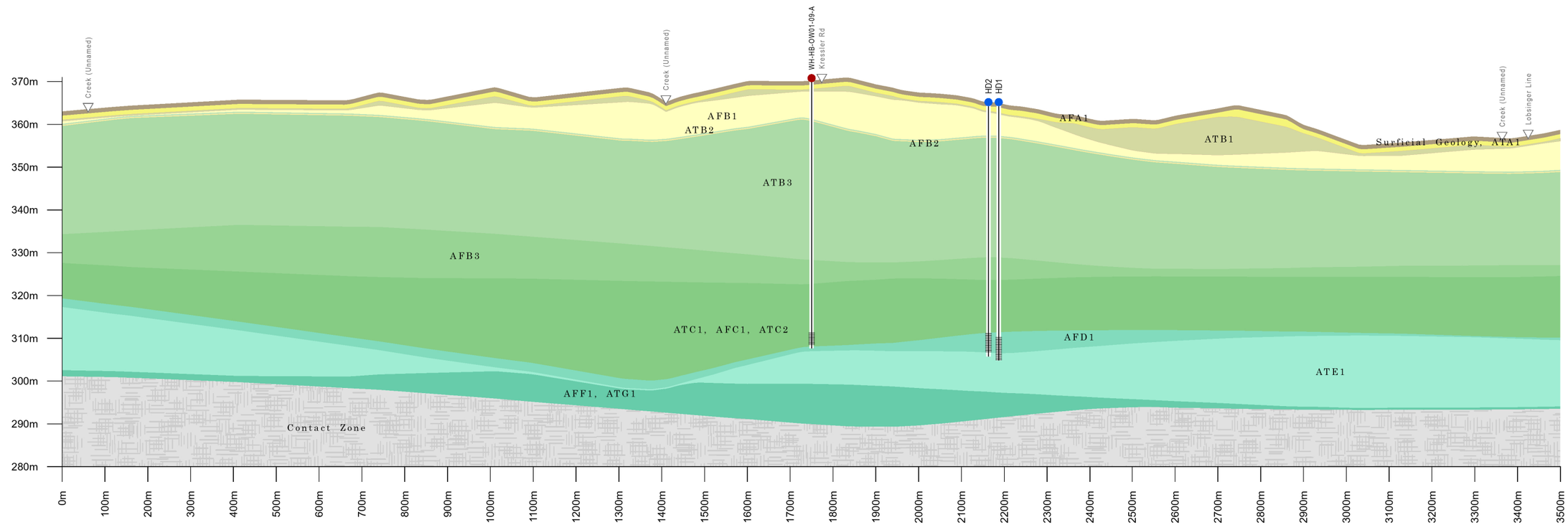
LOCATION OF THE WATERLOO MORAINE

Client

REGION OF WATERLOO

Drawn	Checked	Date	Figure No.
HN	SQ	February 2026	5
Scale		Project No.	
1:300,000		HA0464020	

File Path: \\ELMO\GIS\Project\H Jobs\HA 04 6402 (Waterloo)\Reporting\Groundwater Level Monitoring Program\2025 Groundwater Report Figures\Heidelberg\PRO\HEIDELBERG\HEIDELBERG.aprx Print Date: 2026/02/16 Time: 02:11 PM



Wells

- Production Well (Active)
- Monitoring Well

Moraine Model 2026

Surficial Geology, Whittlesey Clay (ATA1)	Upper Waterloo Moraine Stratified Sediments & Equivalents (AFB1)	Lower Maryhill Till & Stratified Equivalents (ATB3)	Pre-Catfish Creek Coarse-Grained Glaciofluvial/Lacustrine Deposits (AFD1)
Whittlesey Sand (AFA1)	Middle Maryhill Till & Equivalents (ATB2)	Lower Waterloo Moraine Stratified Sediments or Catfish Creek Till Outwash (AFB3)	Canning Drift, Till & Fine Textured Glaciolacustrine Deposits (ATE1)
Upper Maryhill, Port Stanley, Tavistock, Mornington, & Stratford Tills (ATB1)	Middle Waterloo Moraine Stratified Sediments & Equivalents (AFB2)	Upper/Main Catfish Creek Till (ATC1), Middle Catfish Creek Stratified Deposits (AFC1), Lower Catfish Creek Till (ATC2)	Pre-Canning Coarse Textured Glaciofluvial / Glaciolacustrine Deposits (AFF1), Pre-Canning Coarse Textured Till (ATG1)
Weathered Bedrock			

Wellhead

Well

Screen or Open Hole

BURNSIDE

Client

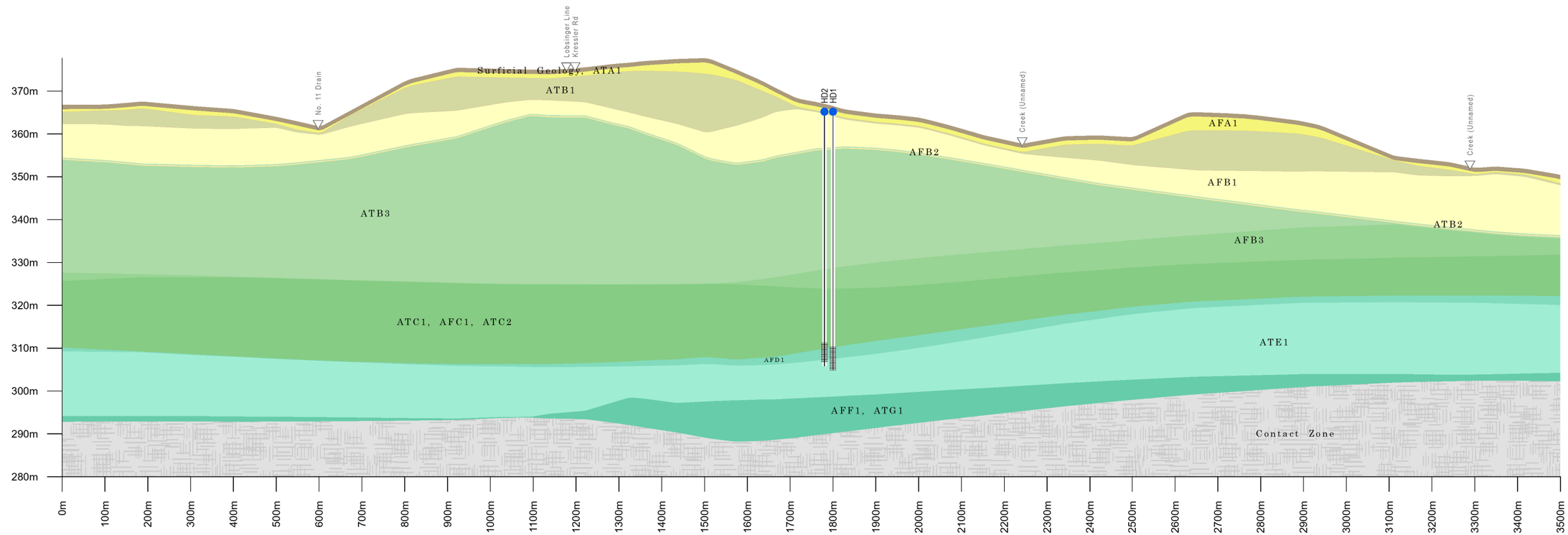
REGION OF WATERLOO

Figure Title

GEOLOGIC CROSS SECTION
REGION OF WATERLOO
Heidelberg
Cross Section A - A'

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

File Path: F:\GIS Working\Projects\ROW_Cross_Sections\ROW_Cross_Sections.aprx Print Date: 2026/06/01 Time: 09:00 PM



Wells

- Production Well (Active)

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
Heidelberg
Cross Section B - B'

Drawn	Checked	Date	Figure No.
PS	DH	2026/06/01	7
Horizontal Scale 1:10,000		Project No.	
Vertical Ex.:10x		HA046402	

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

BURNSIDE

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Appendix A

Permit To Take Water

AMENDED PERMIT TO TAKE WATER
Ground Water
NUMBER 2437-B8FR7E

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
Kitchener, Ontario, N2G 4J3
Canada

For the water taking from: HD1 (WWR# 6504610) and HD2 (WWR# 6505775)

Located at: Lot 13 & 14, 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. 2437-B8FR7E 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 6, 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 **January 29, 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	HD1 (WWR# 6504610)	Well Drilled	Municipal	Water Supply	955	24	1,375,200	365	17 531220 4819154
2	HD2 (WWR# 6505775)	Well Drilled	Municipal	Water Supply	955	24	1,375,200	365	17 531219 4819138
						Total Taking:	1,375,200		

3.3 Notwithstanding Table A, the Permit Holder shall not exceed the maximum rate and amount of taking of 955 L/min and 1,375,200 L/day from any well or combination of both wells.

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. 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 immediately for inspection by a Provincial Officer upon his or her request. The Permit Holder, unless otherwise required by the Director, shall submit, on or before March 31st in every year, the records required by this condition to the Ministry's Water Taking Reporting System.

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

WH-HB-OW1-09.

4.3 The Permit Holder shall prepare and submit an electronic copy of a report every two years by June 30th. The report shall present the results of the well field water level monitoring for the two preceding calendar years, assesses changes in water levels in the supply aquifer(s) in relation to precipitation and water taking from the aquifer(s), 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. Any application for an amendment or renewal shall be accompanied by the most recent biennial report.

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 8624-824PKF, issued on 2010/03/24.

Dated at Hamilton this 29th day of January, 2019.

Cynthia Doughty

Cynthia Doughty
Director, Section 34.1
Ontario Water Resources Act , R.S.O. 1990

Schedule A

This Schedule “A” forms part of Permit To Take Water 2437-B8FR7E, dated January 29, 2019.

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix B

Well Records

MINISTRY OF THE ENVIRONMENT
The Ontario Water Resources Act

HD1

40P/10E

WATER WELL RECORD

Ontario

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

11 | 6504610 | MUNICIP. 65005 | CON. GCT

COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	CON., BLOCK, TRACT, SURVEY, ETC.	LOT
[redacted]	Woolwich	G.C.T.	013

[redacted] Apollo Drive Heidelberg

DATE COMPLETED: DAY 18 MO 09 YR 76

[redacted] 818700 | RC 5 | ELEVATION 1220 | RC 5 | BASIN CODE 23

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	TO
BROWN	SANDY	CLAY		0	24
GREY	CLAY	SMALL STONES		24	70
GREY	CLAY	(GRAVELLY)		70	155
GREY	CLAY			155	170
GREY	CLAY	(GRAVELLY)		170	178
				178	198

31 | 0024 6058 1 | 0070 205 12 | 0155 205 72 | 0170 205 | 0178 205 72 | 0198 PA

32 | FEET

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
0178	1 ☒ FRESH 3 ☐ SULPHUR 14; 2 ☐ SALTY 4 ☐ MINERAL
15-18	1 ☐ FRESH 3 ☐ SULPHUR 19; 2 ☐ SALTY 4 ☐ MINERAL
20-23	1 ☐ FRESH 3 ☐ SULPHUR 24; 2 ☐ SALTY 4 ☐ MINERAL
25-28	1 ☐ FRESH 3 ☐ SULPHUR 29; 2 ☐ SALTY 4 ☐ MINERAL
30-33	1 ☐ FRESH 3 ☐ SULPHUR 34; 2 ☐ SALTY 4 ☐ MINERAL

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	TO
08 (10-11)	1 ☒ STEEL 12; 2 ☐ GALVANIZED; 3 ☐ CONCRETE; 4 ☐ OPEN HOLE	.188	0	0170 (16)
06 (17-18)	1 ☒ STEEL 19; 2 ☐ GALVANIZED; 3 ☐ CONCRETE; 4 ☐ OPEN HOLE	.188	169	0180 (20-23)
(24-25)	1 ☐ STEEL 26; 2 ☐ GALVANIZED; 3 ☐ CONCRETE; 4 ☐ OPEN HOLE	S.S. SCREEN	180	198 (27-30)

SCREEN

SIZE(S) OF OPENING (SLOT NO.) 31-33	DIAMETER 34-38	LENGTH 39-40
040	070 O.D. INCHES	18 FEET
MATERIAL AND TYPE	DEPTH TO TOP OF SCREEN 41-44	80
STAINLESS STEEL	0180 FEET	

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)
10-13	14-17	
18-21	22-25	
26-29	30-33	80

71 PUMPING TEST

PUMPING TEST METHOD 10	PUMPING RATE 11-14	DURATION OF PUMPING 15-16 HOURS 17-18 MINS
1 ☒ PUMP 2 ☐ BAILER	0325 GPM	01 HOURS 00 MINS

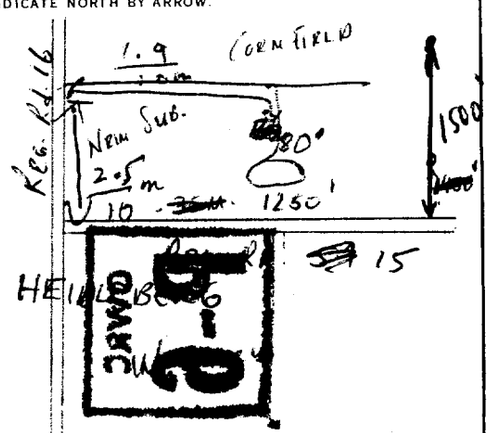
STATIC LEVEL	WATER LEVEL END OF PUMPING	25 WATER LEVELS DURING (1 ☒ PUMPING 2 ☐ RECOVERY)			
		15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
051 (19-21) FEET	(22-24) FEET	110 (26-28) FEET	125 (29-31) FEET	135 (32-34) FEET	146 (35-37) FEET

IF FLOWING, GIVE RATE 38-41 GPM	PUMP INTAKE SET AT FEET	WATER AT END OF TEST 42: 1 ☐ CLEAR 2 ☒ CLOUDY
RECOMMENDED PUMP TYPE: ☐ SHALLOW ☑ DEEP	RECOMMENDED PUMP SETTING 43-45 165 FEET	RECOMMENDED PUMPING RATE 46-49 0325 GPM

50-53 ___ GPM./FT. SPECIFIC CAPACITY

LOCATION OF WELL

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



DRILLERS REMARKS:

FINAL STATUS OF WELL 54	1 ☐ WATER SUPPLY; 2 ☐ OBSERVATION WELL; 3 ☐ TEST HOLE; 4 ☐ RECHARGE WELL; 5 ☐ ABANDONED, INSUFFICIENT SUPPLY; 6 ☐ ABANDONED, POOR QUALITY; 7 ☐ UNFINISHED	1
WATER USE 55-56	1 ☐ DOMESTIC; 2 ☐ STOCK; 3 ☐ IRRIGATION; 4 ☐ INDUSTRIAL; ☐ OTHER; 5 ☑ COMMERCIAL; 6 ☐ MUNICIPAL; 7 ☐ PUBLIC SUPPLY; 8 ☐ COOLING OR AIR CONDITIONING; 9 ☐ NOT USED	05
METHOD OF DRILLING 57	1 ☐ CABLE TOOL; 2 ☑ ROTARY (CONVENTIONAL); 3 ☐ ROTARY (REVERSE); 4 ☐ ROTARY (AIR); 5 ☐ AIR PERCUSSION; 6 ☐ BORING; 7 ☐ DIAMOND; 8 ☐ JETTING; 9 ☐ DRIVING	2

CONTRACTOR

NAME OF WELL CONTRACTOR	LICENCE NUMBER
LADCO DRILLING	3316
ADDRESS: GODERICH R.R. #5	
NAME OF DRILLER OR BORER: THOMAS LANG	LICENCE NUMBER 3316
SIGNATURE OF CONTRACTOR: T. Lang	SUBMISSION DATE: DAY 20 MO Sept YR 76

OFFICE USE ONLY

DATA SOURCE 58	CONTRACTOR 59-62	DATE RECEIVED 63-68	80
1	3316	310577	

DATE OF INSPECTION: June 26/78 INSPECTOR: EJ

REMARKS: APL CSS.S8 P.T.W. P WI

MINISTRY OF THE ENVIRONMENT COPY

FORM 7 MOE 07-091

Lotowater
TECHNICAL SERVICES INC.

P.O. Box 451
Paris, ON N3L 3T5

92 Scott Avenue
Paris, ON N3L 3R1
T (519) 442-2086
T (800) 923-6923
F (519) 442 7242
www.lotowater.com

Reference: **006-613**

Date: **2025/10/27**

To: **Padrig Keating, P.Eng., PMP.**
Regional Municipality of Waterloo

Cc: **Karl Belan, P.Geo.**
Regional Municipality of Waterloo

From: **Boyd Pendleton, P.Geo.**
Lotowater Technical Services Inc.

Subject: **Heidelberg Wells HD1 and HD2 Modifications (2025)**

This memo has been prepared to document the work completed by Lotowater Technical Services Inc. (Lotowater) at the Region of Waterloo Heidelberg Wells, HD1 and HD2. This work included removing the existing pumping equipment, conducting video inspections, converting the wells to monitoring wells and updating MECP well records. The field work portion of the work was completed August 27 – October 10, 2025.

Lotowater mobilized to the Heidelberg wells on August 27, 2025, and removed the existing pumping equipment from Wells HD1 and HD2. Well HD2 pump was removed without issue. However, during the HD1 pump removal the pump became stuck. Lotowater returned the following day and finished removing the pump with significant effort.

On August 29th both well casings were cut down roughly 2 m below grade and the pitless adapters were removed. Temporary caps were installed on the wells while the demolition of the existing below grade storage reservoirs was completed over several weeks (**Photo 1**).

Lotowater then returned on September 19th and 24th to add the casing extensions and a bentonite chip grout seals for both wells and as shown for HD1 in (**Photo 2**). As constructed details are shown in **Figures 1 and 2**. Well modification records were submitted to the Ministry of the Environment, Conservation and Parks (MECP) and are attached at the end of this memo.

Photo 1: HD2 temporarily capped below grade

Photo 2: HD1 New Annular Seal

Lotowater conducted a video inspection of each well on October 10, 2025, to confirm the wells condition. Important details of the video are summarized in **Tables 1 and 2** and the well video can be downloaded and viewed using this link:

Wells HD1 and HD2 Static Video Inspections

The video for Well HD1 shows the stainless steel liner is still in good condition. There is however a blockage at the top of the screen at 57.8 m (**Photo 3**). The video camera was unable to pass and the screen was not able to be inspected. We suspect this debris was in the line from the well to the pump house. When the pump was lifted off the pitless this debris washed into the well with the water in the line and jammed the well pump. A piece of PVC sounding tube was also found in the bottom of the well and likely broke off when removing the stuck well pump (**Photo 4**). Lotowater will arrange a time with the Regions well maintenance and operations team to remove the debris, sounding tube, airlift the well, then complete the well video, in the coming months when schedules allow.

Well HD2 video showed extensive corrosion and blistering of the well casing but no obvious holes. The screen was free of obstruction and open close to its reported depth.

Photo 3: Flush Joint at Bottom of Well HD1	**Photo 4: Flush Joint at Bottom of Well HD1**

Encl:

Table 1 Well HD1 Static Video Summary
Table 2 Well HD2 Static Video Summary
Figure 1 Well HD1 Modification (As-Constructed)
Figure 2 Well HD2 Modification (As-Constructed)
Well HD1 Updated MECP Well Record
Well HD2 Updated MECP Well Record

L:\Lotowater Projects\006 Regional Municipality of Waterloo\613 Heidelberg Well Conversion & Demo (2025)\9. Reports\Heidelberg Wells HD1 and H2 Modifications (2025).docx

TABLE 1

REGIONAL MUNICIPALITY OF WATERLOO

Heidelberg Well HD1
Static Video Summary
2025/10/10

Elapsed Time (h:min)	Depth (ft below MP)	Depth (m below MP)	Comments
0:00	0.00	0.00	Top of casing
0:01	9.61	2.93	Casing joint
0:05	30.74	9.37	Casing joint
0:08	50.85	15.50	Casing joint
0:11	70.93	21.62	Casing joint
0:13	81.69	24.90	Static water level (Turbid)
0:15	91.21	27.80	Casing joint
0:16	95.14	29.00	Pause to clean camera lens
0:18	112.89	34.41	Casing joint
0:20	133.40	40.66	Casing joint
0:21	134.86	41.11	Top of fallen flush joint
0:22	140.75	42.90	Possible casing joint
0:24	153.44	46.77	Casing joint
0:26	173.88	53.00	Reduction
0:27	174.60	53.22	Casing joint
0:27	176.84	53.90	Pause, camera got stuck
0:30	189.83	57.86	Bottom of well
0:33	176.80	53.89	Casing joint
0:36	156.69	47.76	Casing joint
0:39	138.12	42.10	Top of fallen flush joint
0:40	136.68	41.66	Casing joint
0:44	116.70	35.57	Casing joint
0:46	96.59	29.44	Casing joint
0:48	86.45	26.35	Static water level
0:50	76.41	23.29	Casing joint
0:53	56.23	17.14	Casing joint
0:55	36.19	11.03	Casing joint
0:58	15.29	4.66	Casing joint
0:59	5.25	1.60	Below top of casing

Video survey conducted by Michael Strasburher

Note: Measuring point (MP) is top of casing which is 0.50 m above ground level

TABLE 2

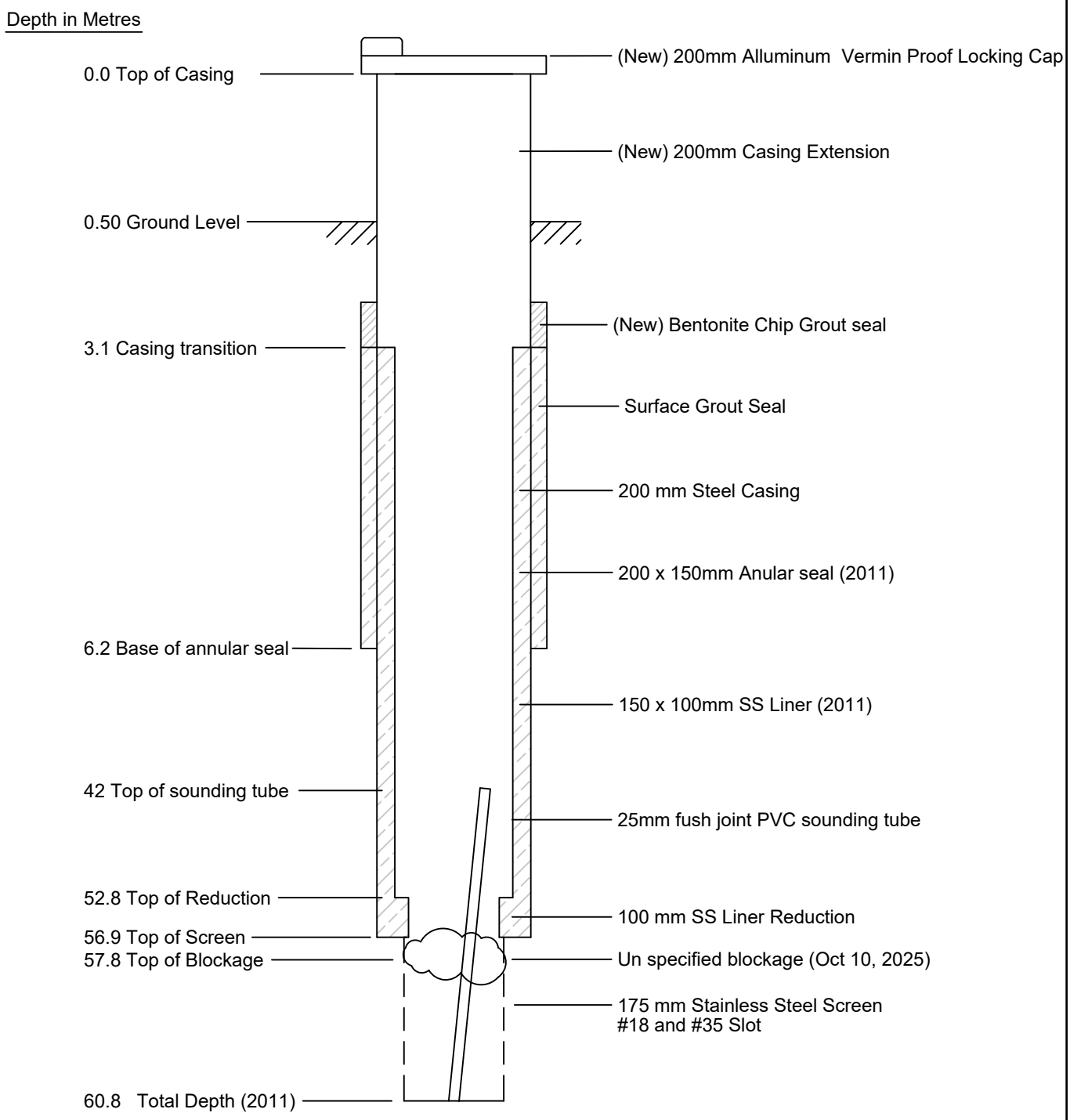
REGIONAL MUNICIPALITY OF WATERLOO

Heidelberg Well HD2
Static Video Summary
2025/10/10

Elapsed Time (h:min)	Depth (ft below MP)	Depth (m below MP)	Comments
0:00	0.00	0.00	Top of casing
0:01	10.70	3.26	Casing joint
0:03	17.36	5.29	Casing joint
0:10	64.01	19.51	Casing joint
0:12	82.68	25.20	Static water level (turbid)
0:14	88.06	26.84	Casing joint
0:15	100.92	30.76	Blistering
0:18	111.81	34.08	Casing joint
0:21	133.69	40.75	Possible casing joint
0:24	157.81	48.10	Casing joint
0:28	178.28	54.34	Reduction
0:00	182.25	55.55	Reduction
0:02	185.33	56.49	Top of screen
0:04	196.98	60.04	Bottom of well
0:06	186.28	56.78	Top of screen
0:07	183.07	55.80	Reduction
0:10	181.40	55.29	Corrosion
0:12	171.91	52.40	Corrosion
0:23	95.50	29.11	Blistering
0:24	94.59	28.83	Casing joint
0:27	88.25	26.90	Static water level
0:35	17.81	5.43	Casing joint
0:38	6.92	2.11	Below top of casing

Video survey conducted by Michael Strasburher

Note: Measuring point (MP) is top of casing which is 0.86 m above ground level

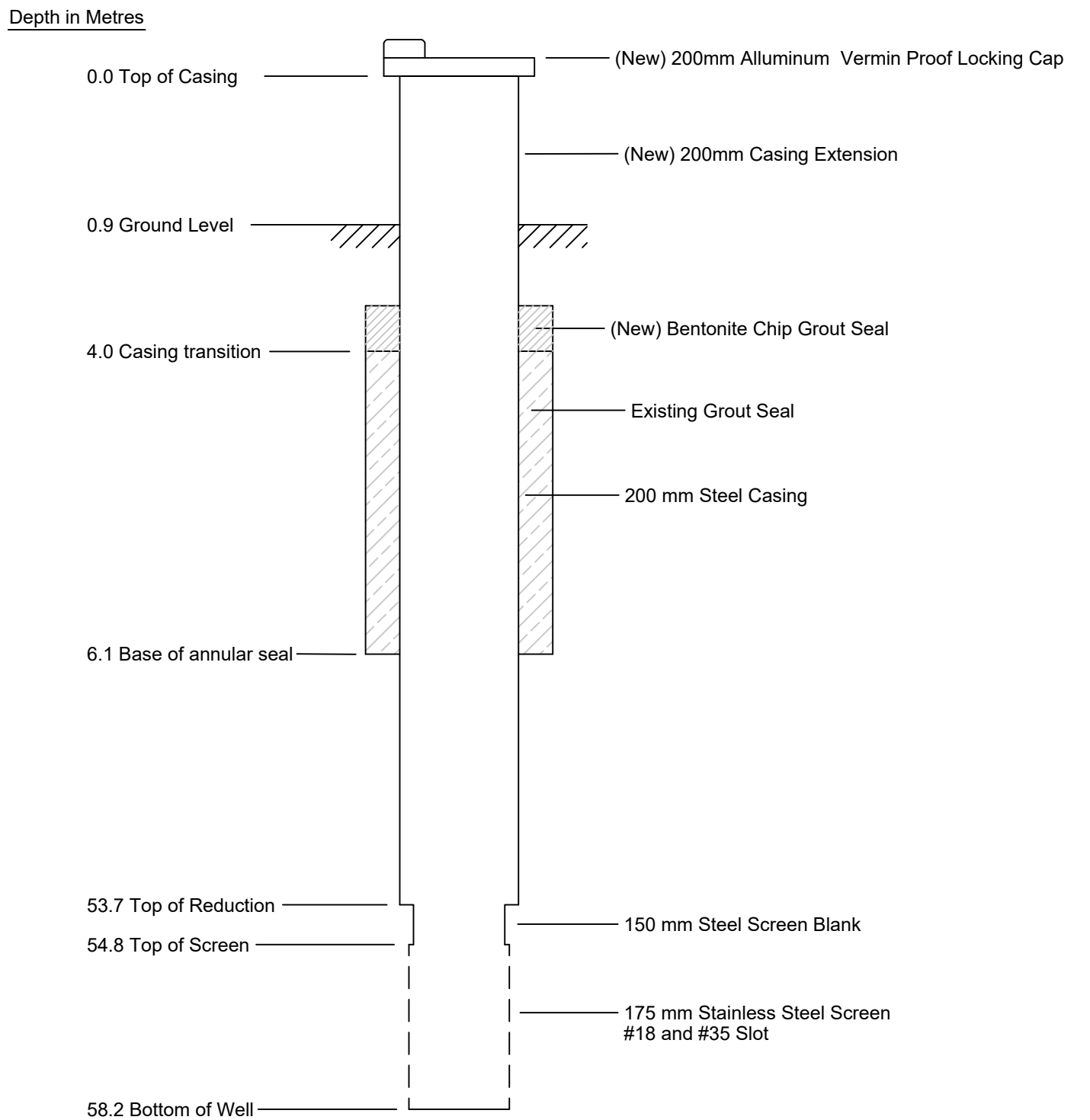


Lotowater TECHNICAL SERVICES INC.

CLIENT
REGIONAL MUNICIPALITY OF WATERLOO

TITLE
WELL HD1
WELL MODIFICATION (As Constructed)

PROJECT #:		006-613	G:\Lotowater Projects\006 Regional of Waterloo\		
DESIGN			REVISION No.	SCALE	FIGURE
DRAWN	EH	2022/09/26	Oct 10, 2025	N.T.S	1
CHECKED	BB	2022/09/29			



Lotowater TECHNICAL SERVICES INC.

CLIENT
REGIONAL MUNICIPALITY OF WATERLOO

TITLE
WELL HD2
WELL MODIFICATION (As Constructed)

PROJECT #:		006-613	G:\Lotowater Projects\006 Regional of Waterloo\		
DESIGN			REVISION No.	SCALE	FIGURE
DRAWN	EH	2022/09/26	Oct 24, 2025	N.T.S	2
CHECKED	BB	2022/09/29			

Ontario Ministry of the Environment, Conservation and Parks

Measurements recorded in: ☐ Metric ☐ Imperial

Well Tag No. (Place Sticker and/or Print Below) A021807

Well Record

Regulation 903 Ontario Water Resources Act

Well Owner's Information

First Name	Last Name/Organization	E-mail Address	☐ Well Constructed by Well Owner
	REGIONAL MUNICIPALITY OF WATERLOO	kbelan@regionofwaterloo.ca	

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
150 Frederick Street	Waterloo	ON	N2G4J3	5195754424

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
Bavarian Drive	Woolwich		

County/District/Municipality	City/Town/Village	Province	Postal Code
NTF ~~Woolwich~~ Waterloo	Heidelburg	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	531211	4819141		

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
	This well is known as Heidelburg Well 1 (HD1)				
	Original Well Record is attached.				
	Cut casing and remove pitless adapter			0	2
	Reinstall 8" steel casing.				
	Reinstall original Well Tag No. A021807				

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
0	2	Holeplug	0.5

Method of Construction

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

Well Use

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

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	Steel	0.365	0	10
6	Stainless Steel	0.134	10	172
4	Stainless Steel	0.120	172	184

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	To
6	Stainless Steel		184	198

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

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)

Pumping rate (l/min / GPM)

Duration of pumping ____ hrs + ____ min

Final water level end of pumping (m/ft)

If flowing give rate (l/min/GPM)

Recommended pump depth (m/ft)

Recommended pump rate (l/min/GPM)

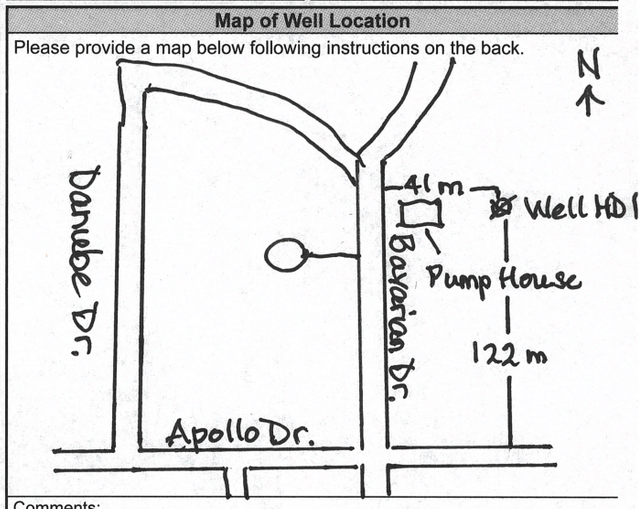
Well production (l/min/GPM)

Disinfected? ☐ Yes ☑ No

Draw Down Time (min)	Water Level (m/ft)	Recovery Time (min)	Water Level (m/ft)
Static Level			
1		1	
2		2	
3		3	
4		4	
5		5	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Water Details

Water found at Depth (m/ft)	☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify
Water found at Depth (m/ft)	☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify
Water found at Depth (m/ft)	☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Lotowater Technical Services Inc.	3428

Business Address (Street Number/Name)	Municipality
92 Scott Avenue	Paris

Province	Postal Code	Business E-mail Address
ON	N3L3R1	aohearn@lotowater.com

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
5194422086	O'Hearn, Alex

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
3928		20250929

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☐ Yes ☑ No	Y Y Y Y M M D D	20250924

Ministry Use Only

Audit No. Z458999

Received

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Ministry's Copy

MINISTRY OF THE ENVIRONMENT
The Ontario Water Resources Act

WATER WELL RECORD

40P/10E

Ontario

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

11 | 6504610 | MUNICIP 65005 | CON. GCT

COUNTY OR DISTRICT: [redacted] | TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE: Woolwich | CON., BLOCK, TRACT, SURVEY, ETC.: G.C.T. | LOT 013

[redacted] Apollo Drive Heidelberg | DATE COMPLETED: DAY 18 MO. 09 YR. 76

[redacted] 8/8700 | RC 5 | ELEVATION 1220 | RC 5 | BASIN CODE 23

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	TO
BROWN	SANDY	CLAY		0	24
GREY	CLAY	SMALL STONES		24	70
GREY	CLAY	(GRAVELLY)		70	155
GREY	CLAY			155	170
GREY	CLAY	(GRAVELLY)		170	178
				178	198

31 | 0024605181 | 0070205172 | 0155205772 | 0170205 | 0178205772 | 0198 PA

32 | [illegible]

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
0178	1 ☒ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
15-18	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
20-23	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
25-28	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
30-33	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL

51 CASING & OPEN HOLE RECORD

INSIDE DIAM. INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	TO
08	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	.188	0	0170
06	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	.188	169	0180
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	S.S. SCREEN		198

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER INCHES	LENGTH FEET
040	0.0	18

MATERIAL AND TYPE: STAINLESS STEEL | DEPTH TO TOP OF SCREEN: 0180 FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)
10-13	14-17	
18-21	22-25	
26-29	30-33	

71 PUMPING TEST

PUMPING TEST METHOD: 1 ☒ PUMP 2 ☐ BAILER | PUMPING RATE: 0325 GPM | DURATION OF PUMPING: 01 HOURS 00 MINS

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING (1 ☒ PUMPING 2 ☐ RECOVERY) 15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
051 FEET	FEET	110 FEET	125 FEET	135 FEET	146 FEET

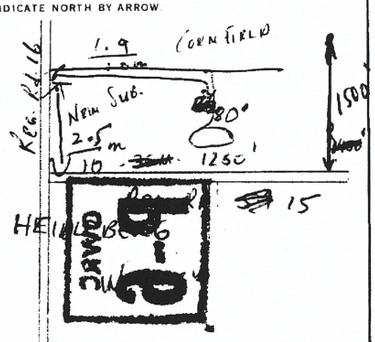
IF FLOWING, GIVE RATE: GPM | PUMP INTAKE SET AT: FEET | WATER AT END OF TEST: 1 ☐ CLEAR 2 ☒ CLOUDY

RECOMMENDED PUMP TYPE: ☐ SHALLOW ☑ DEEP | RECOMMENDED PUMP SETTING: 165 FEET | RECOMMENDED PUMPING RATE: 0325 GPM

50-53 ——.— GPM./FT. SPECIFIC CAPACITY

LOCATION OF WELL

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



DRILLERS REMARKS:

FINAL STATUS OF WELL	54: 1 ☐ WATER SUPPLY 2 ☐ OBSERVATION WELL 3 ☐ TEST HOLE 4 ☐ RECHARGE WELL 5 ☐ ABANDONED, INSUFFICIENT SUPPLY 6 ☐ ABANDONED, POOR QUALITY 7 ☐ UNFINISHED
WATER USE	55-56: 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 DRILLING	57: 1 ☐ CABLE TOOL 2 ☒ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☐ ROTARY (AIR) 5 ☐ AIR PERCUSSION 6 ☐ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING

CONTRACTOR

NAME OF WELL CONTRACTOR: LADCO DRILLING | LICENCE NUMBER: 3316

ADDRESS: GODERICH R.R. #5

NAME OF DRILLER OR BORER: THOMAS LANG | LICENCE NUMBER: 3316

SIGNATURE OF CONTRACTOR: T. Lang | SUBMISSION DATE: DAY 20 MO. Sept YR. 76

OFFICE USE ONLY

DATA SOURCE: 1 | CONTRACTOR: 3316 | DATE RECEIVED: 910577

DATE OF INSPECTION: June 26/78 | INSPECTOR: EJ

REMARKS: All Pit W.

P | WI

CS8.S8T.W.

MINISTRY OF THE ENVIRONMENT COPY

FORM 7 MOE 07-091

Ontario — Ministry of the Environment, Conservation and Parks

Measurements recorded in: ☐ Metric ☐ Imperial

Well Tag No. (Place Sticker and/or Print Below): A440443

Well Record

Regulation 903 Ontario Water Resources Act

Well Owner's Information

First Name	Last Name/Organization	E-mail Address	☐ Well Constructed by Well Owner
	REGIONAL MUNICIPALITY OF WATERLOO	khelan@regionofwaterloo.ca	

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
150 Frederick Street	Waterloo	ON	N2G4J3	5195754424

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
Bavarian Drive	Woolwich		

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

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	531218	4819146		

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
	This well is known as Heidelburg Well 2 (HD2)				
	Original Well Record is attached.				
	Cut casing and remove pitless adapter. Reinstall 8" steel casing. Install New Well Tag # A440443			0	2

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
0	2	Holeplug	0.50

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	Steel	0.250	0	177
6	Steel	0.250	173.6	176.7

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	To
7.5	Stainless Steel	35+18	176.7	192

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

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)

Pumping rate (l/min / GPM)

Duration of pumping ____ hrs + ____ min

Final water level end of pumping (m/ft)

If flowing give rate (l/min/GPM)

Recommended pump depth (m/ft)

Recommended pump rate (l/min/GPM)

Well production (l/min/GPM)

Disinfected? ☐ Yes ☑ No

Draw Down Time (min)	Water Level (m/ft)	Recovery Time (min)	Water Level (m/ft)
Static Level			
1		1	
2		2	
3		3	
4		4	
5		5	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	

Water Details

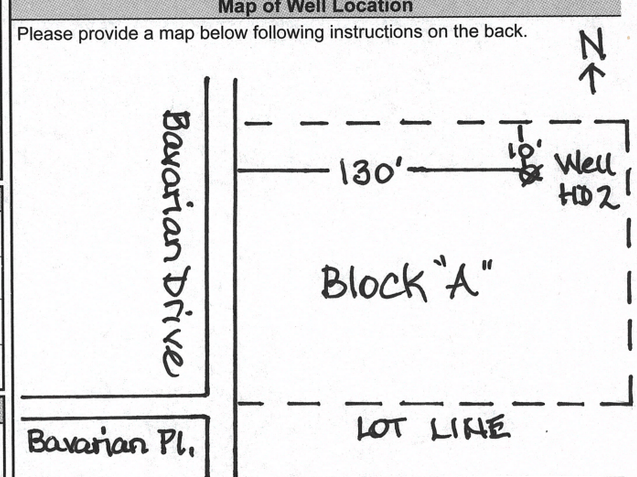
Water found at Depth (m/ft)	Kind of Water	
177-192	☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify
	☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify
	☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)

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.
Lotowater Technical Services Inc.	3428

Business Address (Street Number/Name)	Municipality
92 Scott Avenue	Paris

Province	Postal Code	Business E-mail Address
ON	N3L3R1	aohearn@lotowater.com

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
5194422086	O'Hearn, Alex

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
3928		20250929

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☐ Yes ☑ No	YYYY MM DD	2025 09 24

Ministry Use Only

Audit No. Z459000

Received

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Ministry's Copy

Ministry of the Environment
Ontario

54/85

The Ontario Water Resources Act

WATER WELL RECORD

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

11 — 6505775 — MUNICIP — CON.

COUNTY OR DISTRICT	TOWNSHIP BOROUGH CITY TOWN VILLAGE	CON BLOCK TRACT SURVEY ETC	LOT
Waterloo	Woolwich (Heidelberg)	G.C.T.	Pt. 13

OWNER (SURNAME FIRST)	ADDRESS	DATE COMPLETED
Heidelberg Estates Subdivision	c/o H. Huehn Limited Heidelberg, Ontario	DAY 15 MO Nov. YR 85

21 — UTM ZONE — EASTING — NORTHING — RC — ELEVATION — RC — BASIN CODE — II — III — IV

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	TO
	Topsoil			0	1
Brown	Sand	Silt	Soft	1	26
Grey	Clay	Gravel streaks	Med. soft	26	119
Grey	Sand	Clay, gravel streaks	Soft, mixed	119	141
Grey	Clay	Gravel streaks	Med.soft	141	158
Grey	Clay		Med. hard	158	177
Grey	Sand		Soft	177	192
Grey	Clay	Stones	Med. hard	192	195

31

32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
177 192	1 ☒ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	TO
8	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	.250	0	177
6	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	.250	173-6	176-7
7	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	St. St Screen	176-7	192-0

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER	LENGTH
6"x 35 slot 9"x 18 slot	7⅓ INCHES	15 FEET

MATERIAL AND TYPE	DEPTH TO TOP OF SCREEN
Stainless Steel Telescope	176' 7" FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT LEAD PACKER ETC.)
5	20	neat cement (annulus)
192	195	sand fill

71 PUMPING TEST

PUMPING TEST METHOD	PUMPING RATE	DURATION OF PUMPING
1 ☒ PUMP 2 ☐ BAILER	251 Imp. GPM	18 HOURS 0 MINS

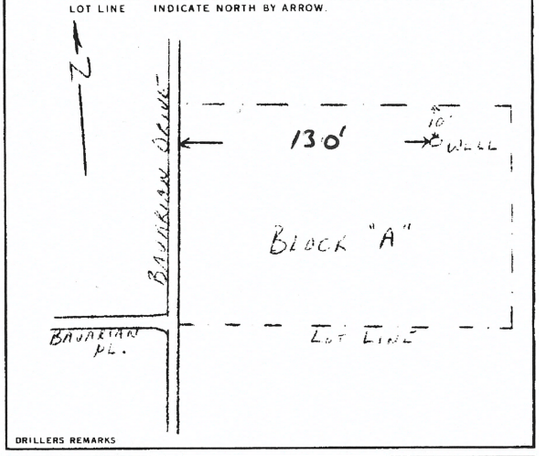
STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING (1 ☒ PUMPING 2 ☐ RECOVERY) 15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
55 5¼ FEET	139 11¾ FEET	123 6¾ FEET	[illegible] FEET	127 11¾ FEET	129 2¾ FEET

IF FLOWING, GIVE RATE	PUMP INTAKE SET AT	WATER AT END OF TEST
— GPM	160 FEET	1 ☒ CLEAR 2 ☐ CLOUDY

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
☐ SHALLOW ☒ DEEP	167 FEET	160 GPM

LOCATION OF WELL

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



DRILLERS REMARKS

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

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 DRILLING

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

CONTRACTOR

NAME OF WELL CONTRACTOR	LICENCE NUMBER
Graham Well Drilling Limited	2336
ADDRESS: 212 Waverley Dr., Guelph, Ontario N1E 1H4	
NAME OF DRILLER OR BORER: Davidson Well Drilling Limited	1737
SIGNATURE OF CONTRACTOR	SUBMISSION DATE: DAY 4 MO Dec. YR 85

OFFICE USE ONLY

DATA SOURCE	CONTRACTOR	DATE RECEIVED
		13 01 86

DATE OF INSPECTION — INSPECTOR

REMARKS: Well Permit 86-P-207

CSS.ES

FORM NO. 0506—4—77 FORM 7

MINISTRY OF THE ENVIRONMENT COPY

Ontario — Ministry of the Environment

Measurements recorded in: ☐ Metric ☒ Imperial

Well Tag No. (Place Sticker and/or Print Below): A 021807

HD1

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
	Regional Municipality of Waterloo	sfrank@waterloo.on.ca	

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
150 Frederick Street	Waterloo	ON	N2C4J3	5198832000

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
Bavarian Drive	Woolwich		

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

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	531211	4819141		

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
	This well is known as Heidelburg Well 1 (HD1)				
	150 mm (6") and 100 mm (4") nominal diameter		SCH10 304 SS Liner Installed.		

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
		Thixotropic cement base grout between well and new liner	

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
10	Steel	0.365	0	10
6	SS	0.134	10	172
4	SS	0.120	172	184

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	To
6	SS		184	198

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: ☐ Fresh ☐ Untested ☐ Gas ☐ Other, specify
Water found at Depth (m/ft)	Kind of Water: ☐ Fresh ☐ Untested ☐ Gas ☐ Other, specify
Water found at Depth (m/ft)	Kind of Water: ☐ Fresh ☐ Untested ☐ Gas ☐ Other, specify

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)

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)

Pumping rate (l/min / GPM)

Duration of pumping ___ hrs + ___ min

Final water level end of pumping (m/ft)

If flowing give rate (l/min / GPM)

Recommended pump depth (m/ft)

Recommended pump rate (l/min / GPM)

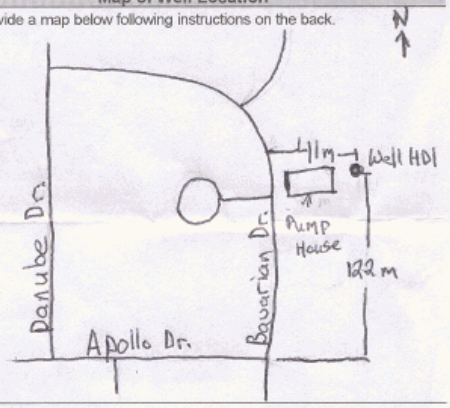
Well production (l/min / GPM)

Disinfected? ☐ Yes ☐ No

Draw Down Time (min)	Water Level (m/ft)	Recovery Time (min)	Water Level (m/ft)
Static Level			
1		1	
2		2	
3		3	
4		4	
5		5	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	

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.
Lotowater Technical Services Inc.	3428

Business Address (Street Number/Name)	Municipality
92 Scott Avenue	Paris

Province	Postal Code	Business E-mail Address
ON	N3L3R1	boydp@lotowater.com

Bus.Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
5194422086	Pendleton, Boyd

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
3298		2011 06 19

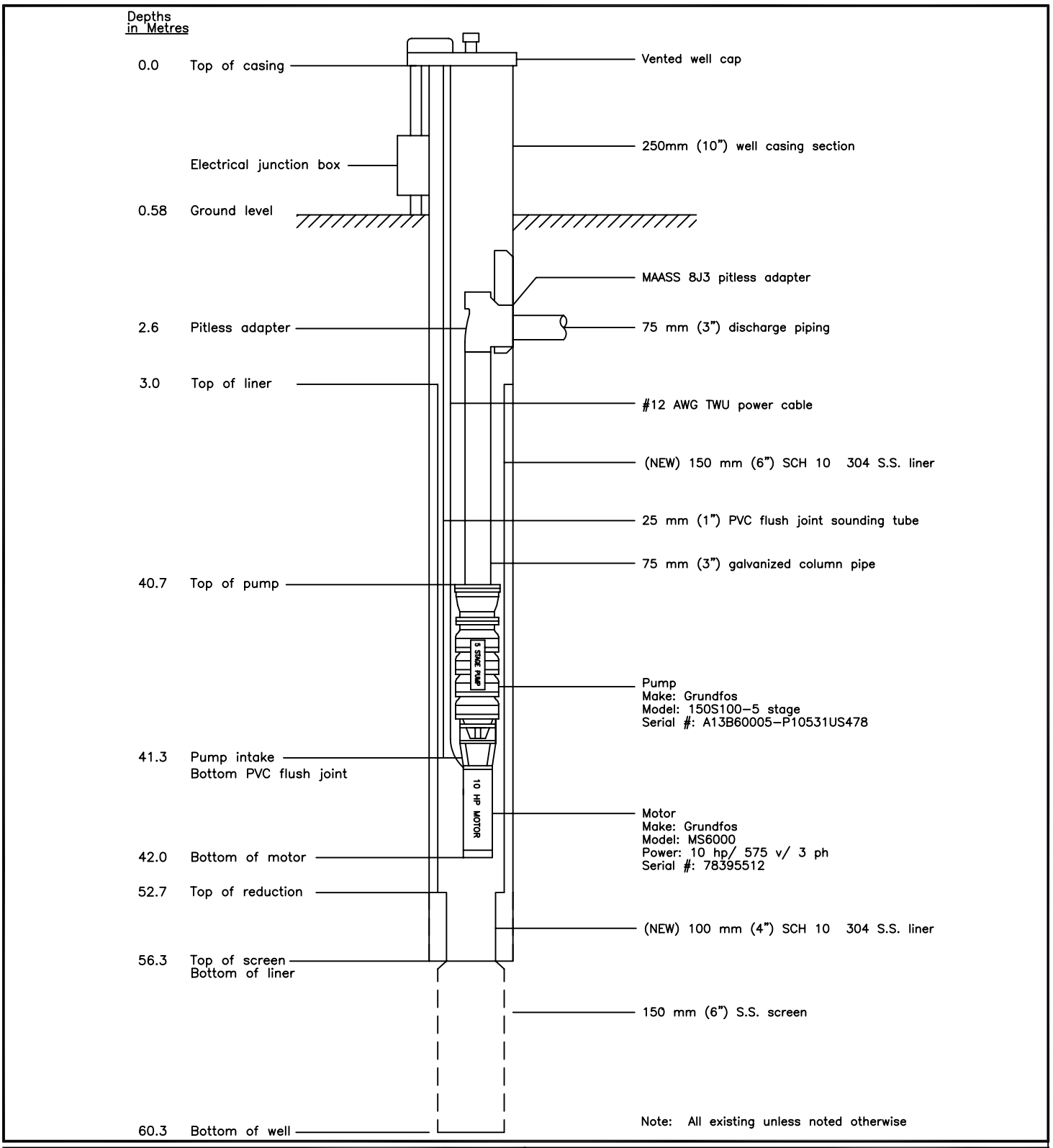
Well owner's information package delivered	Date Package Delivered	Date Work Completed
☐ Yes ☐ No	Y Y Y Y M M D D	2011 06 21

Ministry Use Only

Audit No. Z124242

Received MAY 24 2011

Ministry's Copy



Lotowater TECHNICAL SERVICES INC.

CLIENT
REGIONAL MUNICIPALITY OF WATERLOO

TITLE
Heidelberg Well 1 (HD1)
Pump Installation Drawing

PROJECT No.	006-197	G:\Lotowater Projects\006 Region of Waterloo\197 Heidelberg Well HD1\7. Technical		FIGURE
DESIGN	MG	2011/01/13	REVISION No. 2011-05-05	SCALE N.T.S.	5
DRAWN	RS	2011/05/05		
CHECKED	BP	2011/06/03		

HD2

Ministry of the Environment
Ontario

54/85

The Ontario Water Resources Act

WATER WELL RECORD

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

11 | 6505775 | MUNICIP | CON.

COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	CON., BLOCK, TRACT, SURVEY, ETC.	LOT
Waterloo	Woolwich (Heidelberg)	G.C.T.	Pt. 13

OWNER (SURNAME FIRST)	ADDRESS	DATE COMPLETED
Heidelberg Estates Subdivision	c/o H. Huehn Limited Heidelberg, Ontario	DAY 15 MO Nov. YR 85

21 | UTM ZONE | EASTING | NORTHING | RC | ELEVATION | RC | BASIN CODE | II | III | IV

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	TO
	Topsoil			0	1
Brown	Sand	Silt	Soft	1	26
Grey	Clay	Gravel streaks	Med. soft	26	119
Grey	Sand	Clay, gravel streaks	Soft, mixed	119	141
Grey	Clay	Gravel streaks	Med.soft	141	158
Grey	Clay		Med. hard	158	177
Grey	Sand		Soft	177	192
Grey	Clay	Stones	Med. hard	192	195

31

32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
177 - 192	1 ☒ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	TO
8	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	.250	0	177
6	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	.250	173-6	176-7
7	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	St. St Screen	176-7	192-0

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER	LENGTH
10" x 35 slot 9" x 18 slot	7⅛ INCHES	15 FEET

MATERIAL AND TYPE	DEPTH TO TOP OF SCREEN
Stainless Steel Telescope	176' 7" FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT LEAD PACKER, ETC.)
5	20	neat cement (annulus)
192	195	sand fill

71 PUMPING TEST

PUMPING TEST METHOD	PUMPING RATE	DURATION OF PUMPING
1 ☒ PUMP 2 ☐ BAILER	251 Imp. GPM	18 HOURS 0 MINS

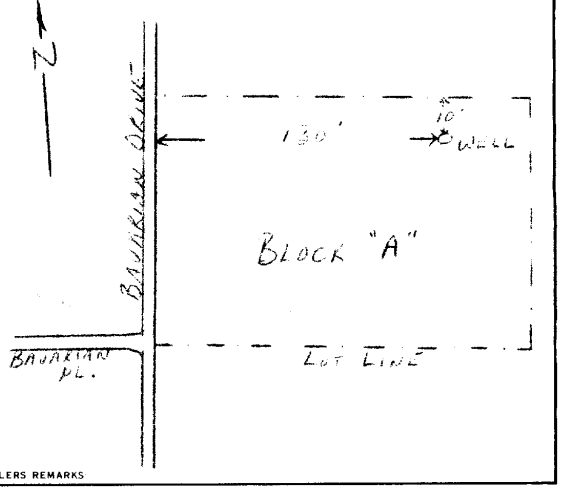
STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING (1 ☒ PUMPING 2 ☐ RECOVERY) 15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
55 5/4" FEET	139 11/4" FEET	123 6/4 FEET	126' 4/4 FEET	127' 11/4 FEET	129 2/4 FEET

IF FLOWING, GIVE RATE	PUMP INTAKE SET AT	WATER AT END OF TEST
— GPM	160 FEET	1 ☒ CLEAR 2 ☐ CLOUDY

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
☐ SHALLOW ☒ DEEP	167 FEET	160 GPM

LOCATION OF WELL

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



DRILLERS REMARKS

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

CONTRACTOR

NAME OF WELL CONTRACTOR	LICENCE NUMBER
Graham Well Drilling Limited	2336
ADDRESS: 212 Waverley Dr., Guelph, Ontario N1E 1H4	
NAME OF DRILLER OR BORER: Davidson Well Drilling Limited	1737
SIGNATURE OF CONTRACTOR	SUBMISSION DATE: DAY 4 MO. Dec. YR. 85

OFFICE USE ONLY

DATA SOURCE	CONTRACTOR	DATE RECEIVED
		13 01 86

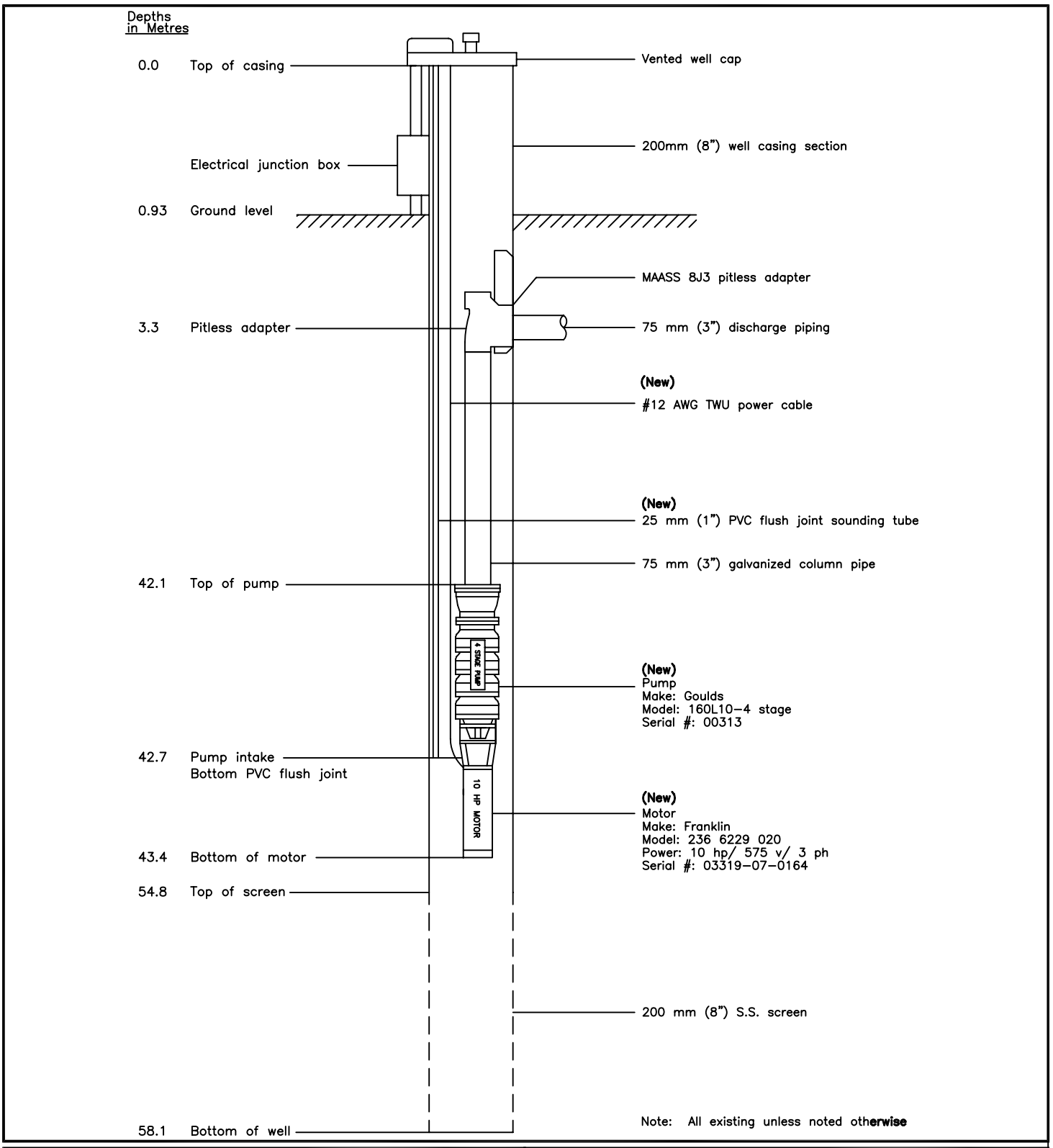
DATE OF INSPECTION | INSPECTOR

REMARKS: See Permit 86-P-007

CSS.ES

MINISTRY OF THE ENVIRONMENT COPY

FORM NO. 0506—4—77 FORM 7



Lotowater TECHNICAL SERVICES INC.

CLIENT
REGIONAL MUNICIPALITY OF WATERLOO

TITLE
Heidelberg Well 2 (HD2)
Pump Installation Drawing

PROJECT No.	006-193		G:\Lotowater Projects\006 Region of Waterloo\193 Heidelberg Well HD2\7. Technical		FIGURE
DESIGN					
DRAWN	MG	2011/01/13	REVISION No. 2011-01-13	SCALE N.T.S.	3
CHECKED					

PROJECT: 08-1112-0150

BOREHOLE LOG OF: WH-HB-OW01-09

LOCATION: N 4819268.0 ;E 530803.0

DRILLING DATE: September 9-14, 2009

DRILL RIG: PQ Coring

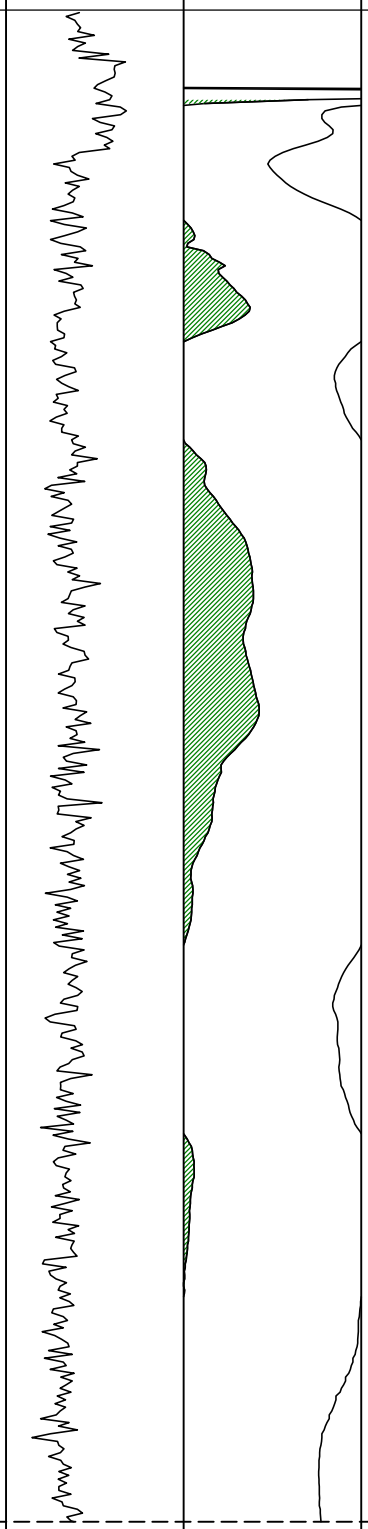
DRILLING CONTRACTOR: Davidson Well Drilling

DATUM: NAD83

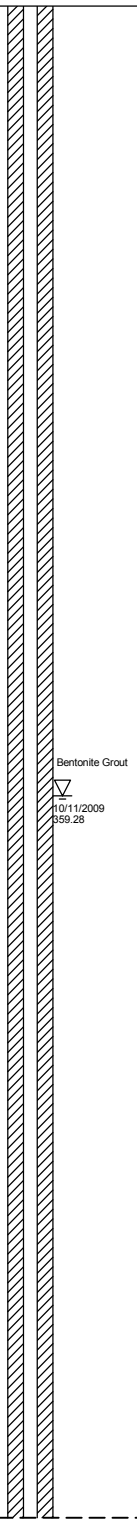
DEPTH SCALE METRES	DESCRIPTION	ELEV. / DEPTH (m)	OGS CODE
	GROUND SURFACE	369.73	
0	Dark brown, organic soil with rootlets, trace sand	0.00 / 369.10	
	Moist, medium brown/red, silty SAND, no odour	0.63	
2			
	(SA1 2.7-4.9 m)		
4			
6		362.80	
	Medium brown, sandy SILT, trace clay	6.93	AFB1
8			
10			
12			
14			
16			
18		351.04	
	Hard, dark brown/grey, CLAYEY SILT, trace sand, becoming medium dark brown/grey sandy silt with trace clay	18.69	
20			

CONTINUED NEXT PAGE

GEOPHYSICAL RECORD



PIEZOMETER OR STANDPIPE INSTALLATION



DEPTH SCALE

1 : 100

Golder Associates

LOGGED: SC/BH

CHECKED: DN

PROJECT: 08-1112-0150

BOREHOLE LOG OF: WH-HB-OW01-09

LOCATION: N 4819268.0 ;E 530803.0

DRILLING DATE: September 9-14, 2009

DATUM: NAD83

DRILL RIG: PQ Coring

DRILLING CONTRACTOR: Davidson Well Drilling

DEPTH SCALE METRES	DESCRIPTION	ELEV. / DEPTH (m)	OGS CODE
	--- CONTINUED FROM PREVIOUS PAGE ---		
20	Hard, dark brown/grey, CLAYEY SILT, trace sand, becoming medium dark brown/grey sandy silt with trace clay	348.55	
	Dark grey/brown, gravelly SAND, some silt	21.18 / 347.78	
22	Dark grey/brown, silty SAND, some gravel, trace clay, becoming dark grey/brown gravel with trace sand/silt	21.95 / 347.30	
	Hard, moist, medium brown/grey, silty SAND, trace gravel, trace boulder, trace cobbles (TILL)	22.43	AFB1
24			
26			
28	Hard, moist, grey, CLAYEY SILT, trace to some sand, trace gravel, trace cobbles (TILL)	341.73 / 28.00	
	(SA2 28.0-29.0 m)		ATB2
30			
32			
	Hard, moist, medium brown, SILTY CLAY, trace gravel, trace cobbles (TILL)	336.73 / 33.00	
34	(SA3 33.8-34.7 m)		ATB3
36			
38			
	Hard, moist, medium grey, sandy SILT, some gravel, trace cobbles (TILL)	331.13 / 38.60	ATC1
40	*CONTINUED NEXT PAGE*		

GEOPHYSICAL RECORD

GAMMA (cps): 25 50 75 100

CONDUCTIVITY (mS/m): 10 20 30 40

PIEZOMETER OR STANDPIPE INSTALLATION

Bentonite Grout

DEPTH SCALE

1 : 100

Golder Associates

LOGGED: SC/BH

CHECKED: DN

PROJECT: 08-1112-0150

BOREHOLE LOG OF: WH-HB-OW01-09

LOCATION: N 4819268.0 ;E 530803.0

DRILLING DATE: September 9-14, 2009

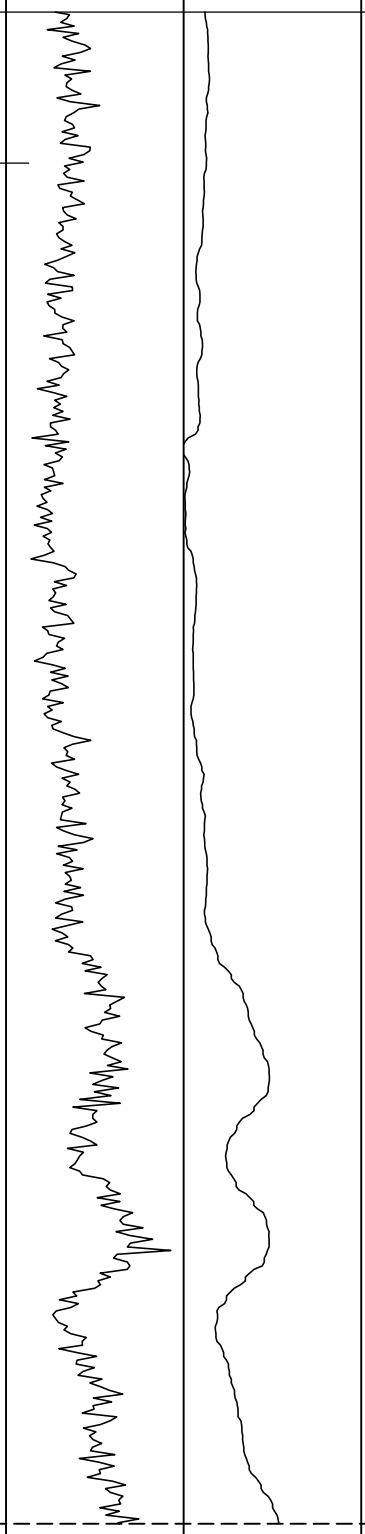
DATUM: NAD83

DRILL RIG: PQ Coring

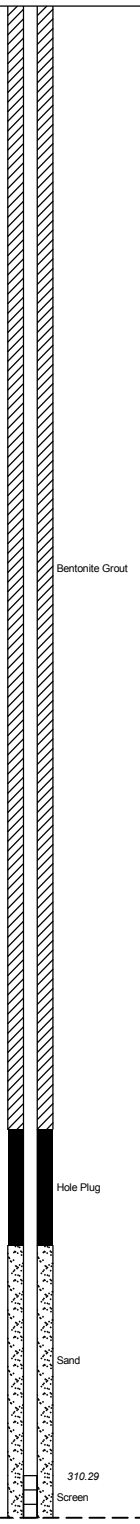
DRILLING CONTRACTOR: Davidson Well Drilling

DEPTH SCALE METRES	DESCRIPTION	ELEV. / DEPTH (m)	OGS CODE
	--- CONTINUED FROM PREVIOUS PAGE ---		
40	Hard, moist, medium grey, sandy SILT, some gravel, trace cobbles (TILL)	327.73	ATC1
42	Loose, coarse to fine SAND, some gravel	42.00 / 323.86	ATG1
46	Loose, coarse GRAVEL to COBBLES, sub-angular to sub-rounded	45.87 / 322.31	ATG1
48	Brown to grey brown, sandy SILT with cobbles and gravel (TILL)	47.42 / 316.85	ATG1
54	Grey, CLAYEY SILT with gravel (TILL)	52.88 / 312.58	ATG1
	Grey, Silty fine SAND, trace gravel	57.15 / 311.97	ATG1
58	Grey, CLAYEY SILT with GRAVEL (TILL)	57.76	ATG1
60	*CONTINUED NEXT PAGE*		

GEOPHYSICAL RECORD



PIEZOMETER OR STANDPIPE INSTALLATION



DEPTH SCALE

1 : 100

Golder Associates

LOGGED: SC/BH

CHECKED: DN

PROJECT: 08-1112-0150

BOREHOLE LOG OF: WH-HB-OW01-09

LOCATION: N 4819268.0 ;E 530803.0

DRILLING DATE: September 9-14, 2009

DRILL RIG: PQ Coring

DRILLING CONTRACTOR: Davidson Well Drilling

DATUM: NAD83

DEPTH SCALE METRES	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	OGS CODE	GEOPHYSICAL RECORD: GAMMA (cps) 25 50 75 100	GEOPHYSICAL RECORD: CONDUCTIVITY (mS/m) 10 20 30 40	PIEZOMETER OR STANDPIPE INSTALLATION
	--- CONTINUED FROM PREVIOUS PAGE ---						
60	Grey, CLAYEY SILT with GRAVEL (TILL) (SA4 60.1-60.9 m)		308.24	ATG1			Screen
	Grey brown, very fine SAND and SILT		61.49 / 307.37				
62	Dark brown, SILT and CLAY, trace gravel		62.36				*307.25* Sand
64							Hole Plug
			303.99				
66	END OF BOREHOLE		65.74				
68							
70							
72							
74							
76							
78							
80							

DEPTH SCALE

1 : 100

Golder Associates

LOGGED: SC/BH

CHECKED: DN

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

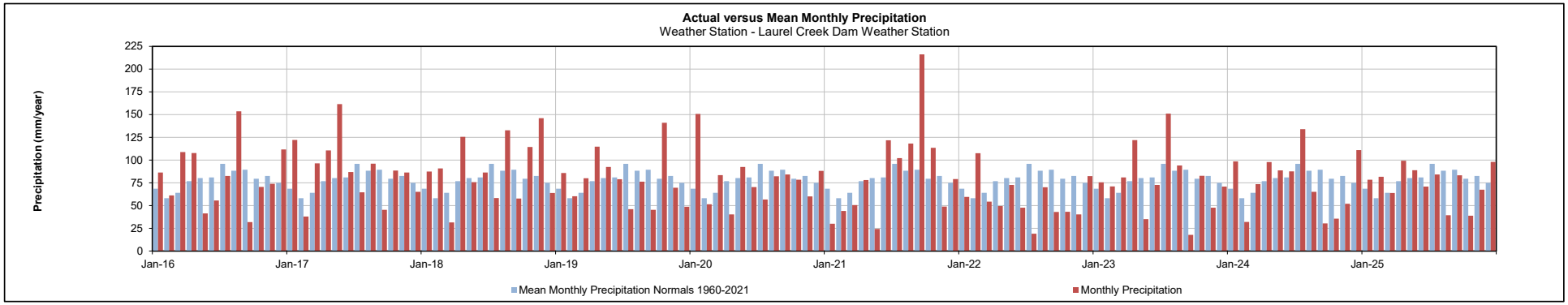
Appendix C

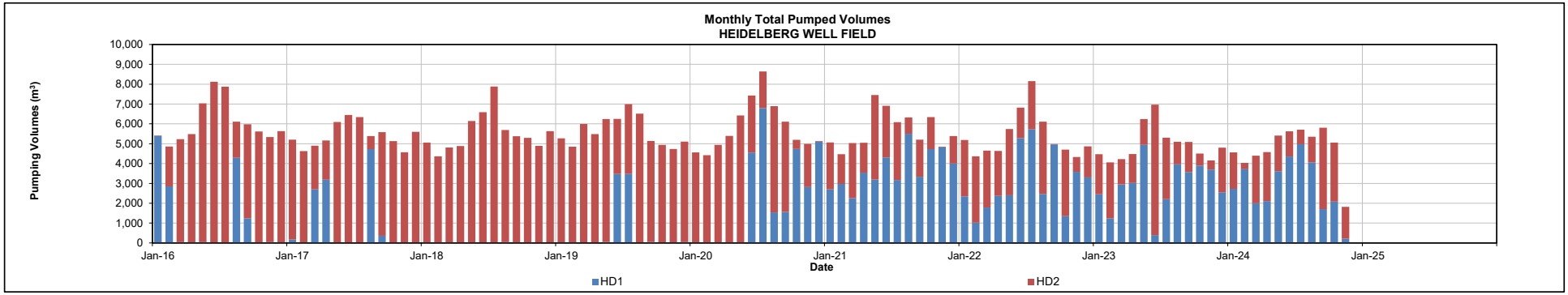
Monitoring Data
(Pumped Volumes and Hydrographs)

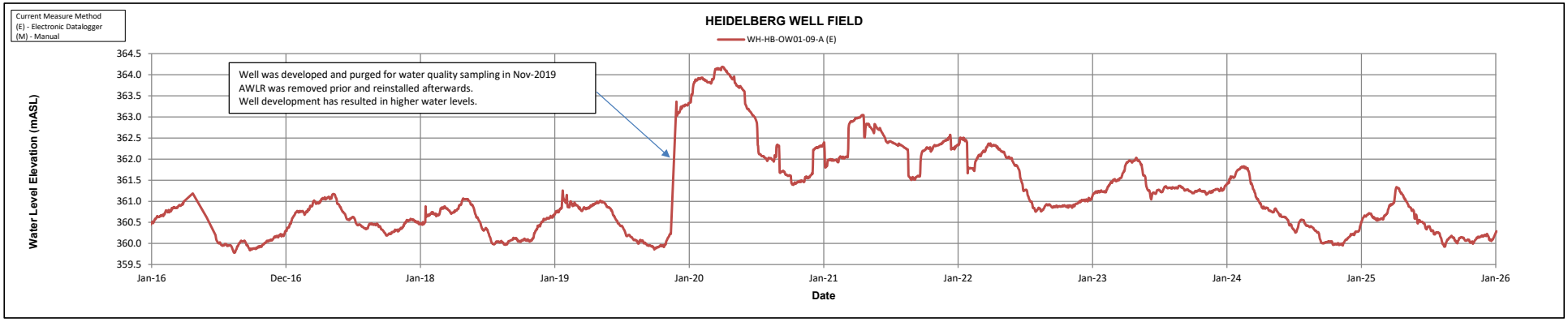
TABLE C-1
WELL FIELD WATER PRODUCTION SUMMARY
REGION OF WATERLOO - 2025 GROUNDWATER MONITORING REPORT

Well Field	Major or Minor Supply	Major Aquifer Name	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)
Heidelberg	Minor	-	HD1	2437-B8FR7E	Combined rate for PTTW 2437-B8FR7E		44,512	122	1.4	36,607	100	1.2	34,906	96	1.1	31,547	86	1.0	0	0	0.0
			HD2	2437-B8FR7E	501,948	15.9	23,666	65	0.8	27,950	77	0.9	24,492	67	0.8	20,798	57	0.7	0	0	0.0
				Well Field Total	***501,948***	***15.9***	***68,178***	***187***	***2.2***	***64,557***	***177***	***2.0***	***59,398***	***163***	***1.9***	***52,345***	***143***	***1.7***	***0***	***0***	***0.0***
				*Maximum rate and amount of taking shall not exceed 955L/min and 1,375,200 L/day respectively, for the wellfield																	

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


Actual versus Mean Monthly Precipitation
Weather Station - Laurel Creek Dam Weather Station
Precipitation (mm/year)
225
200
175
150
125
100
75
50
25
0
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
Mean Monthly Precipitation Normals 1960-2021
Monthly Precipitation


Monthly Total Pumped Volumes
HEIDELBERG WELL FIELD
Pumping Volumes (m³)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
Date
HD1
HD2


Current Measure Method
(E) - Electronic Datalogger
(M) - Manual
HEIDELBERG WELL FIELD
WH-HB-OW01-09-A (E)
Well was developed and purged for water quality sampling in Nov-2019
AWLR was removed prior and reinstalled afterwards.
Well development has resulted in higher water levels.
Water Level Elevation (mASL)
364.5
364.0
363.5
363.0
362.5
362.0
361.5
361.0
360.5
360.0
359.5
Jan-16
Dec-16
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24
Jan-25
Jan-26
Date

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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**

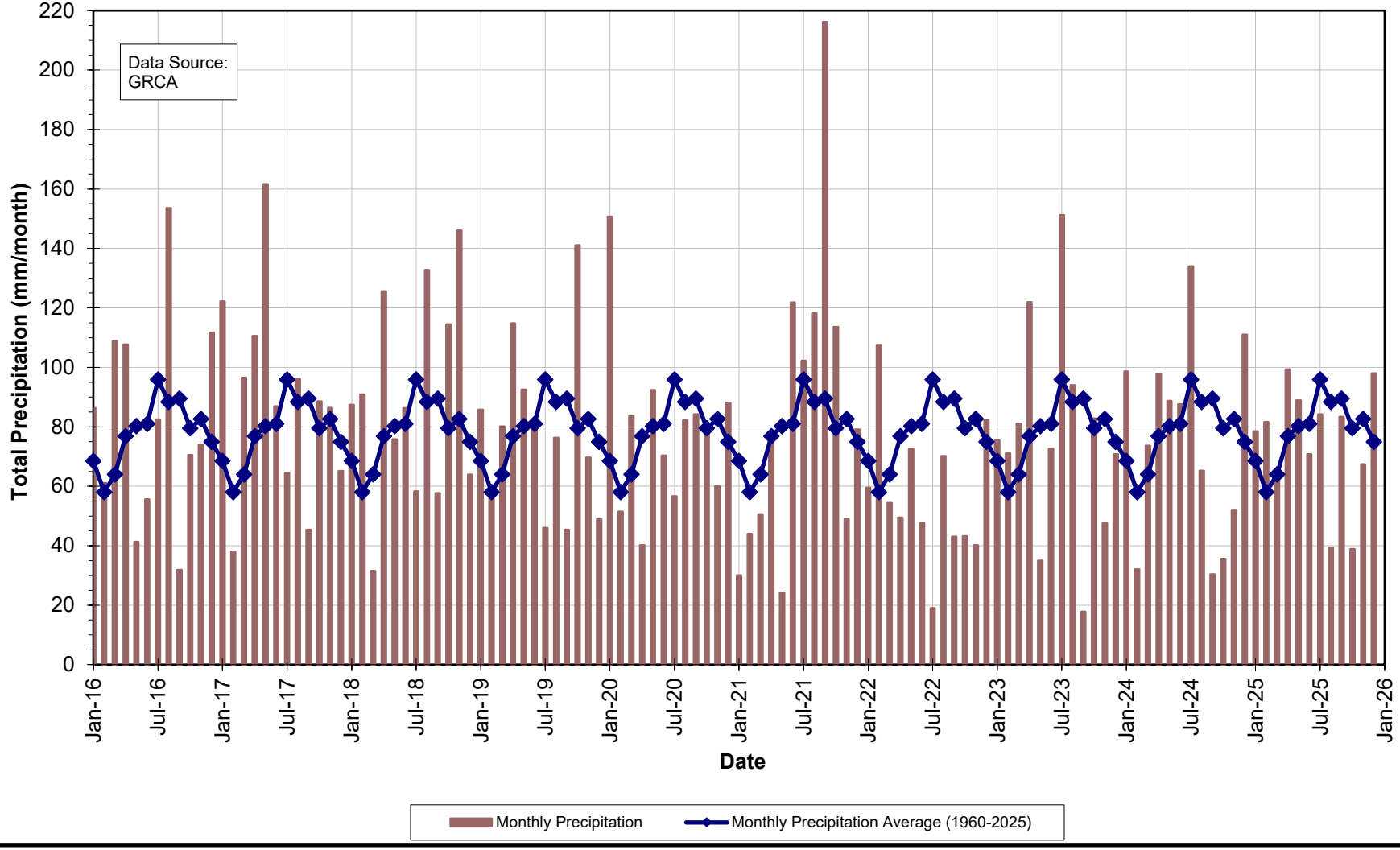
Year	Laurel Dam Established 1960		
	Annual Precipitation (mm)	Average Precipitation 1960-2025 (mm)	Difference (mm)
2016	985	938	**47**
2017	1062	938	**124**
2018	1071	938	**133**
2019	940	938	**2**
2020	938	938	**0**
2021	1027	938	**89**
2022	689	938	**-249**
2023	921	938	**-17**
2024	907	938	**-31**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



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

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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