



BURNSIDE

**2025 Biennial Groundwater Monitoring
Report - Pinebush West Well Field
(G5, G5A)**

The Region of Waterloo



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(G5, G5A)**

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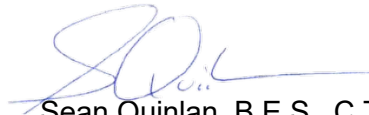
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1.0 Introduction

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.

A new consolidated Permit to Take Water (PTTW), P-300-6117976847 Version 2.0, was issued on October 10, 2025, combining the previously separate permits for Pinebush West wells (G5 and G5A; Permit P-300-6117976847 Version 1.0) and the Pinebush wells (P9, P15, and P15A; Permit 7600-A27N5B). Version 2.0 brings all five production wells under a single permit and carries forward the established maximum daily rates, monitoring requirements, and biennial reporting obligations from the earlier permits. As most of the current reporting period (2024-2025) fell under the original, separate permits, Burnside has prepared individual reports to ensure full compliance with the terms and conditions of Permit P-300-6117976847 Version 1.0 and Permit 7600-A27N5B. All required monitoring and reporting obligations under both permits have been fully addressed. The next biennial report (2026-2027), will consolidate the required data from the two wellfields into a single document in accordance with the Conditions of PTTW P-300-6117976847 Version 2.0.

PTTW P-300-6117976847 Version 1.0 for the Pinebush West Well Field requires submission of a well field specific biennial report to the Ministry of Environment, Conservation and Parks (MECP) which documents production well pumping volumes and water levels in specific monitoring wells during 2024 and 2025. This report has been prepared to meet the reporting condition of the PTTW for 2024 and 2025. A copy of the PTTW is included in Appendix A.

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

The Region has developed a monitoring program for Pinebush West Well Field (G5, G5A) in accordance with PTTW P-300-6117976847 Version 1.0 which consists of the following activities:

- Measuring the daily volume pumped from the G5 and G5A production wells (Condition 4.1 of the PTTW);
- Measuring water levels in monitoring wells C-PB-OW2-08-ABC, C-PB-OW1-08-B, and C-PB-OW3-95-ABCDEFGH (Condition 4.2 of the PTTW);
- Review of precipitation data from the nearest GRCA / Environment Canada weather station (Condition 4.3 of the PTTW); and
- Completion of a biennial report (every 2 years) that presents data in compliance with condition 4.3 of the PTTW.

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

2.0 Site Setting

2.1 Well Field Description

The Pinebush West wells (G5 and G5A) are located on the north side of Pinebush Road, south of the Highway 401 corridor in the City of Cambridge (Figure 3). The other four properties that are included in the Pinebush Well Field include: the P9 / P15 / P15A property about 720 m to the east ("Pinebush"), the P10 / P10A / P10B property about 1.9 km to the east, the P19 property about 1.9 km east, and the P11 / P17 property about 2.1 km to the southeast (collectively "Pinebush East"). The Clemens Mill Well Field is located 2 km to the south of G5 / G5A and the Hespeler Well Field is located 1.5 km to the north (Figure 2). The wells are in an urban area that is municipally serviced. The closest surface water feature to the G5 and G5A site is the Speed River located 1.6 km to the northwest (Figure 3).

2.1.1 Pumping Wells

Well records for the production wells are found in Appendix B.

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

Table 1: Production Well Construction Details

Well Name	Year Built	Casing Diameter (mm)	Open Hole Diameter (mm)	Open Hole interval (mbgs)	Aquifer
G5	1958	305	305	21.9-24.1	Eramosa Formation

Well Name	Year Built	Casing Diameter (mm)	Open Hole Diameter (mm)	Open Hole interval (mbgs)	Aquifer
G5A	2009	305	305	50.0-126.5	Goat Island / Gasport Formation

The water taking volumes for the Pinebush West G5 and G5A well field are regulated by Condition 3.2 of the PTTW and are summarized in Table 2 below.

Table 2: Annual Water Taking 2024/2025

Well	PTTW Details	2024			2025		
		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)
G5	4,320*	677	1,383	246,986	743	1,440	271,177
G5A	4,320*	666	1,440	242,972	546	1,405	199,168
Combined G5, G5A	4,320*	1,342	1,440 ¹	489,958	1,289	1,440 ²	470,345

Note: * the Max Taken per Day of 4,320 m³/day is based on a combined Max taken per minute of 3.0 (m³).

¹ Daily maximum water taking in 2024 of 1,440 m³ was recorded on November 3rd.

² Daily maximum water taking in 2025 of 1,440 m³ was recorded on November 2nd.

As shown in Table 2, this requirement was met in both 2024 and 2025. Production wells G5 and G5A are pumped in alternation. The pumping volumes are based on the total daily volumes as recorded by the Region’s SCADA system and are presented in Appendix C as total monthly volumes. Pumping volumes from the well field ranged from 37,661 m³/month to 42,736 m³/month in 2024, and from 26,137 m³/month to 43,529 m³/month in 2025. In total, 489,958 m³ was produced at this well field in 2024 and 468,967 m³ was produced in 2025. These volumes are within the historical range and below the permitted volume of 1,576,800 m³ per year (Table C-1).

2.1.2 Monitoring Wells

Observation wells C-PB-OW2-08-ABC and C-PB-OW1-08-B are located adjacent to wells G5 and G5A (Figure 3) while C-PB-OW3-95-ABCDEFGH is located approximately 490 m to the east. C-PB-OW2-08-ABC is a multi-level bedrock well that was originally drilled as one of the exploratory holes on the site and was subsequently converted to a

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monitoring well nest. Well nest C-PB-OW1-08-B is an overburden well that was constructed to monitor water levels during the long-term test of G5A.

Construction and monitoring details of C-PB-OW2-08-ABC, C-PB-OW1-08-B and C-PB-OW3-95-ABCDEFGH, are provided in the table below. Well records for the monitoring wells are provided in Appendix B.

Table 3: Monitoring Well Construction Details

Monitoring Well ID	Year Built	Screened Depth (mbgs)	Screened Formation	Distance to G5 (m)	Distance to G5A (m)
C-PB-OW2-08-A	2008	99.1-102.1	Middle Gasport Fm.	11.2	14.8
C-PB-OW2-08-B	2008	55.9-59.0	Goat Island Fm.	11.2	14.8
C-PB-OW2-08-C	2008	28.9-32.0	Lower Guelph to Reformatory Quarry	11.2	14.8
C-PB-OW1-08-B	2008	18.0-19.8	ATC1 / AFC1 / ATC2 / AFD1	22.3	1.3
C-PB-OW3-95-A	1995	143.3-146.3	Lower Gasport Fm.	483.5	491.1
C-PB-OW3-95-B	1995	84.7-90.8	Goat Island Fm.	483.5	491.1
C-PB-OW3-95-C	1995	66.1-72.2	Goat Island Fm.	483.5	491.1
C-PB-OW3-95-D	1995	47.9-52.4	Lower Guelph to Goat Island Fm.	483.5	491.1
C-PB-OW3-95-E	1995	36.0-39.0	Upper Guelph Fm	483.5	491.1
C-PB-OW3-95-F	1995	34.8-36.3	Guelph Fm to Upper Contact.	483.5	491.1
C-PB-OW3-95-G	1995	29.0-30.5	ATC1 / AFC1 / ATC2	483.5	491.1
C-PB-OW3-95-H	1995	7.0-8.5	AFA2 / ATB1	483.5	491.1

2.2 Regional Geology and Hydrostratigraphy

The following sections provide a brief overview of the regional geology and hydrogeology of the Pinebush West Well Field. The surficial geology based on regional OGS mapping is provided in Figure 4. Representative cross-sections showing the stratigraphy in the vicinity of the Pinebush West Well Field (G5, G5A) are included as Figures 5 to 7 to visualize the stratigraphy described in this section. The cross-section locations are provided in Figure 3. The cross-sections are provided as a visual aid and do not necessarily contain all wells in the monitoring program for the Pinebush West Well Field.

There were no significant changes to bedrock picks in the area of G5/G5A wells and as a result, the previous Tier 3 Water Budget and Local Area Risk Assessment (Golder 2011) provides detailed information on the hydrostratigraphic interpretation for the Pinebush West Well Field (Aqua Insight Inc et al, 2023). Surfaces used for the cross-section were obtained as detailed in the Technical Memorandum (Aqua Insight Inc, 2026).

The lithological layers were updated in accordance with documentation provided in the Numerical Model Surface Transfer memorandum (Aqua Insight Inc, 2026).

2.2.1 Surficial Geology and Conceptual Hydrostratigraphy

The surficial geology of the Study Area has been mapped and described by Karrow (1987). Along the eastern side of the Grand River and the south side of the Speed River, the surficial geology (Figure 4) largely consists of sand and gravel outwash deposits (Units 7a and 7b in Figure 4). Ice-contact kame stratified sands and gravels (Unit 6 in Figure 4) are present east of the outwash deposits and extend towards Puslinch Lake.

The thickness of overburden deposits generally range from approximately 5 to 10 m in areas of outwash deposits, however, can be up to approximately 30 to 40 m thick in areas of the Paris and Galt moraines to the east of Cambridge. In the vicinity of the Shades Mill, Clemens Mill and Pinebush Well Fields, the overburden thickness is generally 20 to 40 m. In the Hespeler Well Field area in northern Cambridge adjacent to the Speed River, overburden thickness is generally less than 20 m and the overburden is thin or absent in the Speed River Valley.

The Quaternary Geology of the Cambridge area includes the following units (Lotowater 1997, Karrow 1987 and Bajc and Shirota, 2007 described below.

Aquitard ATA2 - Wentworth Till

The Wentworth Till was deposited by the last glacier to advance in the area. It is described as a stony, sandy silt to sand textured till, and is often inter-bedded with sand and gravel. In the Cambridge area, the Wentworth Till is generally less than 10 m thick. Due to the loose, coarse-grained nature of the till, the unit behaves as a leaky aquitard or poor aquifer that is readily recharged from precipitation.

Aquifer AFA2 - Outwash Deposits

The outwash sand and gravel sediments of AFA2 are present within the Grand River Valley and vicinity, however extensive deposits have also been identified underlying the Wentworth Till in the Paris and Galt moraines. These outwash deposits are interpreted as the main production aquifer for the Shade's Mills municipal wells.

Aquitard ATB1 - Port Stanley Till

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

Aquifer AFB1 - Upper Waterloo Moraine Stratified Sediments and Equivalents

Significant thicknesses of aquifer AFB1 are interpreted to occur southeast of the Speed River and west of Puslinch Lake, and generally corresponds with mapped surficial ice-contact sands and gravels. AFB1 is generally fine sand with some gravel and is often slightly finer grained than unit AFA2, which typically contains greater amounts of gravel. Since AFB1 and AFA2 both behave as aquifers, differentiation of these units is not critical from a hydraulic perspective, although it is necessary to represent AFB1 separately from AFA2 to allow sequential layers for aquifer units both above and below the Port Stanley Till (ATB1), where this situation occurs. Where AFB1 is not present, Port Stanley Till may directly overlie Maryhill Till and Catfish Creek Till (described below), forming a single combined aquitard unit composed of these tills.

Aquitard ATB3 - Lower Maryhill Till

Fine grained till and glaciolacustrine deposits of the Lower Maryhill Till ATB3 generally separate AFB1 from the underlying Catfish Creek Till. The Lower Maryhill Till is described as a dense, dark brown, clayey silt to silty clay till and is interpreted to be present in the Fountain Street (Well P16) well field area above the Catfish Creek and below the Port Stanley Till. Aquitard ATB3 can be difficult to distinguish from ATB1 throughout most of the study area due to the similar lithologies of these units. Lotowater (1997) grouped the Port Stanley and Maryhill Tills as a single aquitard hydrostratigraphic

unit, which is a reasonable approach where no significant thickness of sand and gravel separate these units.

Aquitard ATC1 – Upper / Main Catfish Creek Till

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

2.2.2 Bedrock Geology and Conceptual Hydrostratigraphy

The stratigraphy discussed below is consistent with the revised stratigraphic framework described by the OGS (Brunton, 2009) and is also used in the Tier 3 Study of the area (Golder, 2011). A brief description (from Stantec, 2013) of each bedrock formation and conceptual hydrostratigraphic units typically present in Cambridge is provided below (from youngest to oldest). The formations present in the vicinity of G5 and G5A are shown on the cross sections in Figures 5 to 7.

Guelph Formation

The Guelph Formation is a cream-coloured fossiliferous dolostone that represents an important aquifer in the Cambridge and Guelph area, where it is most often the uppermost bedrock unit.

Eramosa Formation

The Upper Eramosa Formation is described by Brunton (2009) as light brown to cream coloured, pseudonodular, thickly bedded and coarsely crystalline dolostone. The formation consists of the Reformatory Quarry Member, and the Vinemount Member.

The Reformatory Quarry Member is susceptible to karstification due to its uniform fine dolomite crystallinity (Brunton, 2009), and also often contains mud-rich and microbial mat-bearing lithofacies. As a result, this unit generally represents a poor aquifer or poor aquitard. This unit was described as either the Guelph Formation or Eramosa Member in previous studies within the Region.

The Vinemount Member is comprised of thinly bedded, fine crystalline dolostone with shaley beds that give off a distinctive petroliferous odour when broken

(Brunton, 2009). This unit represents an aquitard when present within the Cambridge and Guelph areas.

Goat Island Formation

The Goat Island Formation consists of the upper Ancaster Member and lower Niagara Falls Member. The Ancaster Member is a chert rich, finely crystalline dolostone that is medium to ash grey in colour. The Niagara Falls Member is a finely crystalline and cross laminated crinoidal grainstone with small reef mounds. The finely crystalline nature of these Members results in a lower hydraulic conductivity and transmissivity compared to the underlying Gasport Formation (Brunton, 2009). Conceptually, the two members of the Goat Island Formation are treated as a single hydrostratigraphic unit.

Gasport (Amabel) Formation

The Gasport Formation is a cross-bedded crinoidal grainstone-packstone with sequences of reef mound and coquina (shell bed) lithofacies. This unit has commonly been referred to as the Amabel Formation in previous studies in the Region. Upper, middle and lower hydrostratigraphic units of the Gasport have been defined to allow for general representation of the vertical distribution of the more transmissive reef mound and coquina bed lithofacies. Highly transmissive reef mounds, crinoidal grainstones and coquina beds are generally present in the upper and middle portions of the formation, and are largely absent from the lower 10 m to 20 m. These deposits are the source of water for the bedrock wells in Cambridge.

The lower portion of the Gasport Formation has been grouped with the Rochester, Irondequoit, Rockway, and Merriton Formations due to the difficulty in distinguishing the various units from available borehole data and geophysical logs. All four formations, as well as the base of the Gasport Formation, are relatively less permeable than the upper sections of the Gasport Formation.

2.3 Local Geology

Figure 3 displays the Pinebush West Well Field well plan and cross-section locations. Representative cross-sections are included as Figures 5 to 7 to visualize the stratigraphy described in this section.

An investigation at the G5 / G5A property (Burnside, 2010) included a continuously cored borehole (G5-TW1B-08). The upper 8 m of overburden consisted of predominantly sand with some silt and gravel (ATB1 / ATB2). This unit is underlain by 11 m of fine silt containing some clay and is sandy at times (ATB3 / ATC1). Beneath this is a 3 m thick silty gravel till (AFD1 / ATE1 / AFF1 / ATG1) overlying bedrock that subcrops at a depth of 22.5 m.

2.3.1 Bedrock Geology

Frank Brunton of the OGS identified and correlated the bedrock formation characteristics at the G5 / G5A site based on rock core collected at the G5 site in 2009. The Guelph, Eramosa, Goat Island, and Gasport formations are present, with interpreted thicknesses of 6 m, 8.7 m, 53 m and 34.3 m, respectively. The thickness of the dolostone units at G5 / G5A is approximately 99.7 m, which is relatively consistent with a total thickness of approximately 111 m for the dolostone formations identified 490 m to the east (Lotowater 1997). Water production from G5 is derived from the Eramosa Formation at approximately 22 to 24.5 m below ground surface (bgs), while G5A extracts from the Goat Island Formation between 54 and 58 m bgs, as well as from the Gasport Formation at approximately 98 m bgs.

3.0 2024 / 2025 Results

In accordance with condition 4.2 of the PTTW, water levels were measured and recorded in monitoring wells C-PB-OW1-08-B, C-PB-OW2-08-ABC and C-PB-OW3-95-ABCDEFG.

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 Pinebush West G5 and G5A well field is the Shades Mills Dam station located 4.5 km southeast. The closest Environment Canada station is the Waterloo International Airport (WIA) located 7.4 km to the northwest. 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 the Shades Mills Dam, the long-term average was calculated from when measurements started until the end of 2025. The WIA has "Climate Normals" calculated by Environment Canada for 1991 to 2020.

Annual 2024 / 2025 precipitation data for all the meteorological stations closest to the Pinebush West G5, G5A well field are presented in Table 4 below. WIA was missing 6 days of data in 2024 and 6 days in 2025. As a result, the precipitation totals at this station may be under reported.

Table 4: Summary of Precipitation Data

Station	2024 Precipitation (mm)	2024 Deviation (mm)	Long-Term Average (mm)	2025 Precipitation (mm)	2025 Deviation (mm)
Region of Waterloo International Airport ^(A)	874	+23	851 ^o	723	-128
Shades Mills Dam ^(B)	976	+67	909 ^a	895	-14

Sources: Environment Canada (1), GRCA (2)
^A 1991 to 2020 Normal
^B Average annual precipitation since monitoring began to the end of 2025

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

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

3.2 Monitoring Results

Hydrographs showing the results of water level monitoring over the past 10 years are provided in Appendix C. The method used to collect the water levels (manual or electronic) is indicated on the graphs in Appendix C.

C-PB-OW1-08-B

Monitoring well C-PB-OW1-08-B is located on the G5 / G5A site and monitors overburden water levels within the Catfish Creek Till unit (ATC1 / AFC1 / ATC2 / AFD1). Water levels have been collected at this location since August 2011. During the 2024 to 2025 monitoring period, water levels stayed within the historical range, peaking in April 2024 and May 2025, with annual variations of approximately 1.0 m in 2024 and 1.6 m in 2025. Water levels exhibit a seasonal trend and do not show declining trends because of pumping. Water levels at C-PB-OW1-08-B are primarily influenced by pumping of G5. This is notable after July 2018, when water levels start to rise following

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the commissioning of G5A. This is supported by previous testing (Burnside, 2010) which indicated a response at C-PB-OW1-08-B following the shutdown of G5, and minimal drawdown during the long-term test of G5A (0.09 m).

Water levels at C-PB-OW1-08-B also respond to nearby municipal wells P9 and P15. This was indicated in previous testing (Burnside, 2010), which showed water level increases in response to the short-term shutdown of P9 and P15, as well as the reduced pumping of P9 and P15 from September 2021 to December 2021.

C-PB-OW2-08

Monitoring well nest C-PB-OW2-08 is located on the G5 / G5A site and monitors water levels at three depths.

Water levels at C-PB-OW2-08-A and B are primarily influenced by pumping of G5A. Water levels in the A and B screens show a similar pattern, with the levels in the A screen generally about 5 cm higher than the B screen during periods of non-pumping. Water levels during 2024 and 2025 followed a similar historical pattern of lower water levels when G5A was pumping. Water levels in the A and B screens do not stabilize during pumping of G5A and levels when G5A is not pumping are almost 5 m lower than they were in 2018 prior to G5A being commissioned. Pumping at G5 does not appear to influence water levels at C-PB-OW2-08-A and B. Water level changes also correspond to pumping at P9 / P10B / P15A, which is shown by a further decrease in the water levels by approximately 5 to 10 m corresponding with pumping at P9 / P10B / P15A starting January 2022. After September 2021, G5A pumping resulted in a 20 to 25 m decline in water levels in the A and B screens.

Water levels in the C screen (Guelph Formation and Reformatory Quarry Formation) vary within a 2 m range due to pumping at G5. After G5A came online (July 2021) a 2 to 4 m decline in water levels in the C screen was observed. Water levels decline gradually when G5 begins pumping, but show an immediate 1 to 2 m decline when G5A begins pumping. Water levels observed in 2024 / 2025 are consistent with historical values and do not show any declining trends because of pumping.

C-PB-OW3-95

Monitoring well nest C-PB-OW3-95 is located about 500 m east of G5 and G5A and monitors water levels at seven depths.

The water levels at well nest C-PB-OW3-95 are influenced by pumping at several municipal wells, including G5 / G5A located approximately 480 m west of the monitoring well, P9 / P15 located approximately 240 m northwest, P10 and P11 / P17 located further to the east and southeast and H3 / H3A located approximately 1.6 km to the north. Water levels in the A, B, C and D screens follow a very similar pattern, with levels in the B and C screens almost identical.

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Water levels measured in 2024-2025 were consistent with those recorded in 2022-2023, reflecting the increased pumping at wells P9 and P15A which began in 2022 and do not show any declining trends because of pumping.

Water levels collected at the A (Lower Gasport), B (Goat Island), C (Goat Island) and D (Guelph Formation and Reformatory Quarry Formation) screens show a response to pumping at G5A, but not from G5. G5A was brought online in July 2018, and water levels in the A, B, C and D screens responded to pumping. Water levels also appear to respond to pumping of P9 / P15 / P15A, where water levels decreased following an increase in pumping at P9 / P15A in January 2022.

Screens E (Upper Guelph Formation), F (Upper Guelph to Contact)), and G (ATC1 / AFC1 / ATC2) showed a similar response to pumping of G5 and G5A but with more subdued trends compared to screens A to D.

Screen H (AFA2 / ATB1) has been dry since it was installed in 1995.

From May to November 2023, June to October 2024 and July to December 2025 water levels rose approximately 4.0 m in screens A / B / C, 2.5 m in screen D and less than 1 m in screens EFG. The rise in water levels is attributed to switching the pumping from G5A to G5. An increase in water level by 1 m is noticeable on screens A, B, and C, corresponding to the period when H3A and G5 / G5A were not operational, spanning from November 2018 to December 2018. The effects of these wells being offline can also be seen in deep bedrock monitoring wells near the P9 / P15 / P15A property (C-PB-W1-13-ABC) and H4 / H4A property (C-CA-OW2-95-ABC).

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

2025 Biennial Groundwater Monitoring Report - Pinebush West Well Field (G5, G5A)
June 2026

temporary water supplies adequate to meet their normal requirements or shall compensate such people for their reasonable costs of doing so. If permanent interference is caused by the water taking, the Permit Holder shall restore the water supplies of those permanently affected.

When a well interference complaint is received, the Region has a Well Interference Policy in place. A copy of the policy is presented in Appendix F of the 2019 Biennial Groundwater Monitoring Report – Multiple Well Fields (Burnside, 2020). There were no well interference complaints related to pumping of G5, G5A received in 2024 and 2025.

There are no other Groundwater takings registered in the MECP PTTW database within 2 km of the G5, G5A wells other than Regional production wells.

4.2 Aquifer Impacts to Pumping and Precipitation

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

Based on monitoring results, water levels in Guelph Formation / Eramosa Formation Aquifer have a minor response to pumping, with the greatest drawdown of up to 2.6 m occurring at C-PB-OW2-08-C. The greatest drawdown observed in the Goat Island Formation was at C-PB-OW2-08-B with a drawdown of 35 m, as this is the source water aquifer for G5A and P9 / P15A. Water levels in the Middle Gasport Formation also indicate a major response to pumping at C-PB-OW2-08-A (drawdown of 17 m) while water levels in the lower Gasport Formation indicated a minor response to pumping at C-PB-OW3-95-A (drawdown of 3 m). Water levels in C-PB-OW2-08-AB do not appear to stabilize when G5A is pumping and water levels when G5A is not pumping are almost 5 m lower in 2024 / 2025 than they were in 2018. The observed declining trend may be attributable to increased pumping rates at P9, P10B, and P15B. The groundwater levels in Guelph Formation, Eramosa Formation and Gasport Formation did not display a correlation with precipitation events.

Water levels in the lower overburden (ATC1 / AFC1 / ATC2 / AFD1) were monitored using monitoring well C-PB-OW1-08-B and C-CP-OW3-95-G. Based on monitoring results, the water levels in the lower overburden showed a minor response to pumping, with a drawdown of approximately 0.4 m at C-PB-OW3-95-G. Groundwater levels in ATC1, AFC1, ATC2, and AFD1 are measured monthly, which limits the ability to identify short-term changes that may occur in response to individual precipitation events. Overall, water levels in the overburden aquifer followed typical seasonal patterns, with higher levels in the spring and a gradual decline through the summer months.

5.0 Conclusions

Impacts from pumping the municipal wells at the Pinebush West Well Field (G5, G5A) 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 P-300-6117976847 Version 1.0;
- 2024 and 2025 pumping volumes were within the permitted range;
- There were no reported well interference complaints arising from water taking at the Pinebush West G5, G5A well field;
- Water levels in wells screened in the Guelph Formation, Eramosa Formation, Goat Island Formation and the Middle and Lower Gasport Formation show a measurable response to pumping;
- Water levels in C-PB-OW2-08-A and C-PB-OW2-08-B do not stabilize during pumping of G5A and levels when G5A is offline, and are about 5m lower in 2024 / 2025 than they were in 2018; and
- Water levels in the lower and shallow overburden show a measured response to pumping and followed a seasonal pattern.

2025 Biennial Groundwater Monitoring Report - Pinebush West Well Field (G5, G5A)
June 2026

6.0 References

Aqua Insight Inc., Technical Memorandum Numerical Model Surface Transfer, March 2026.

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R.J. Burnside & Associates Limited, 2024. 2023 Biennial Groundwater Monitoring Report – Pinebush West Well Field (G5, G5A), Region of Waterloo R.J. Burnside & Associates Limited, 2010. Production Well G5A Construction and Testing Report, Regional Municipality of Waterloo.

2025 Biennial Groundwater Monitoring Report - Pinebush West Well Field (G5, G5A)
June 2026

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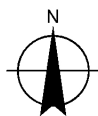
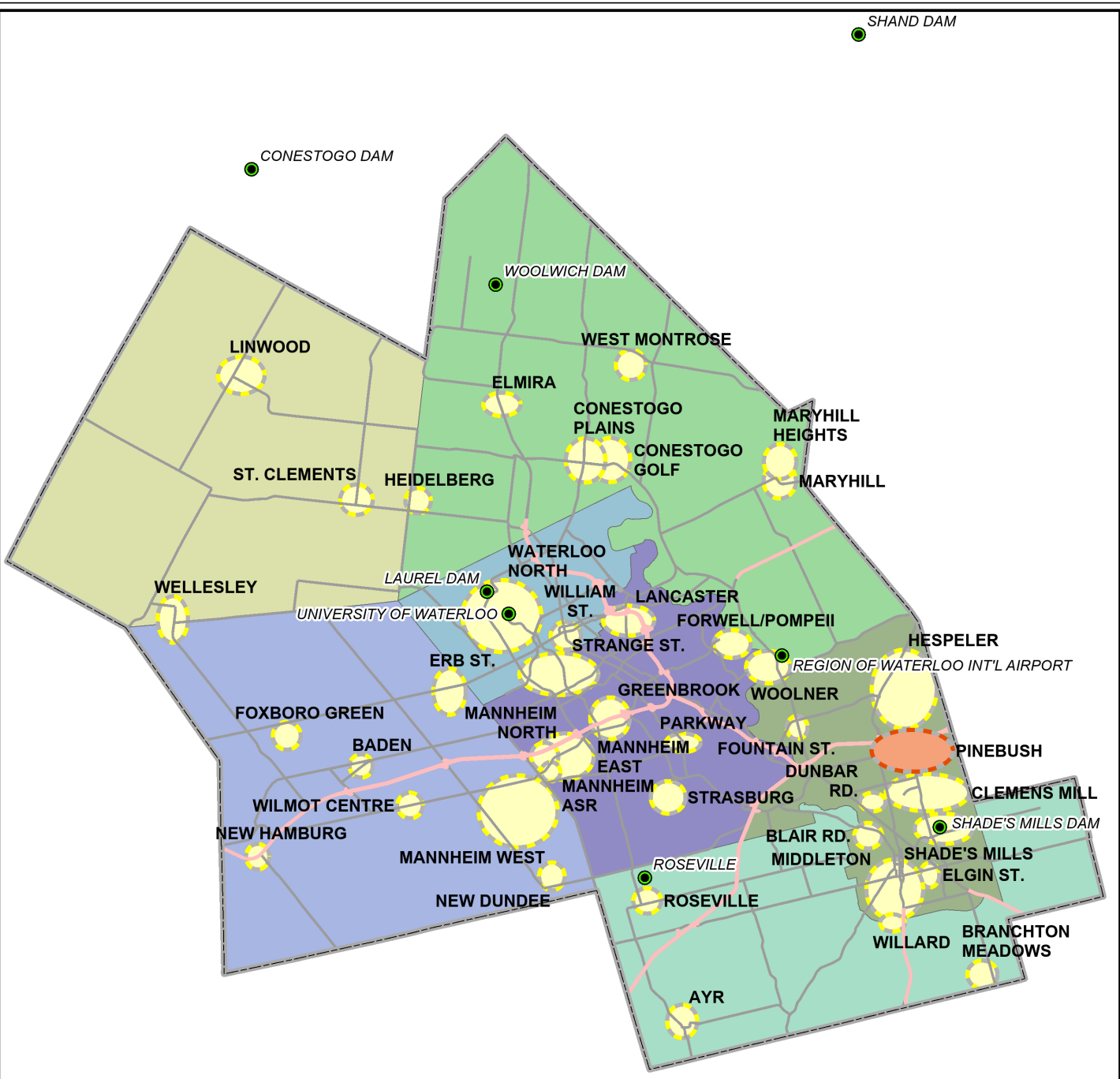


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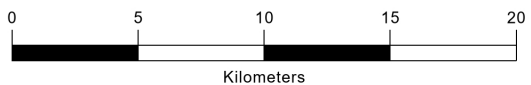
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Figures



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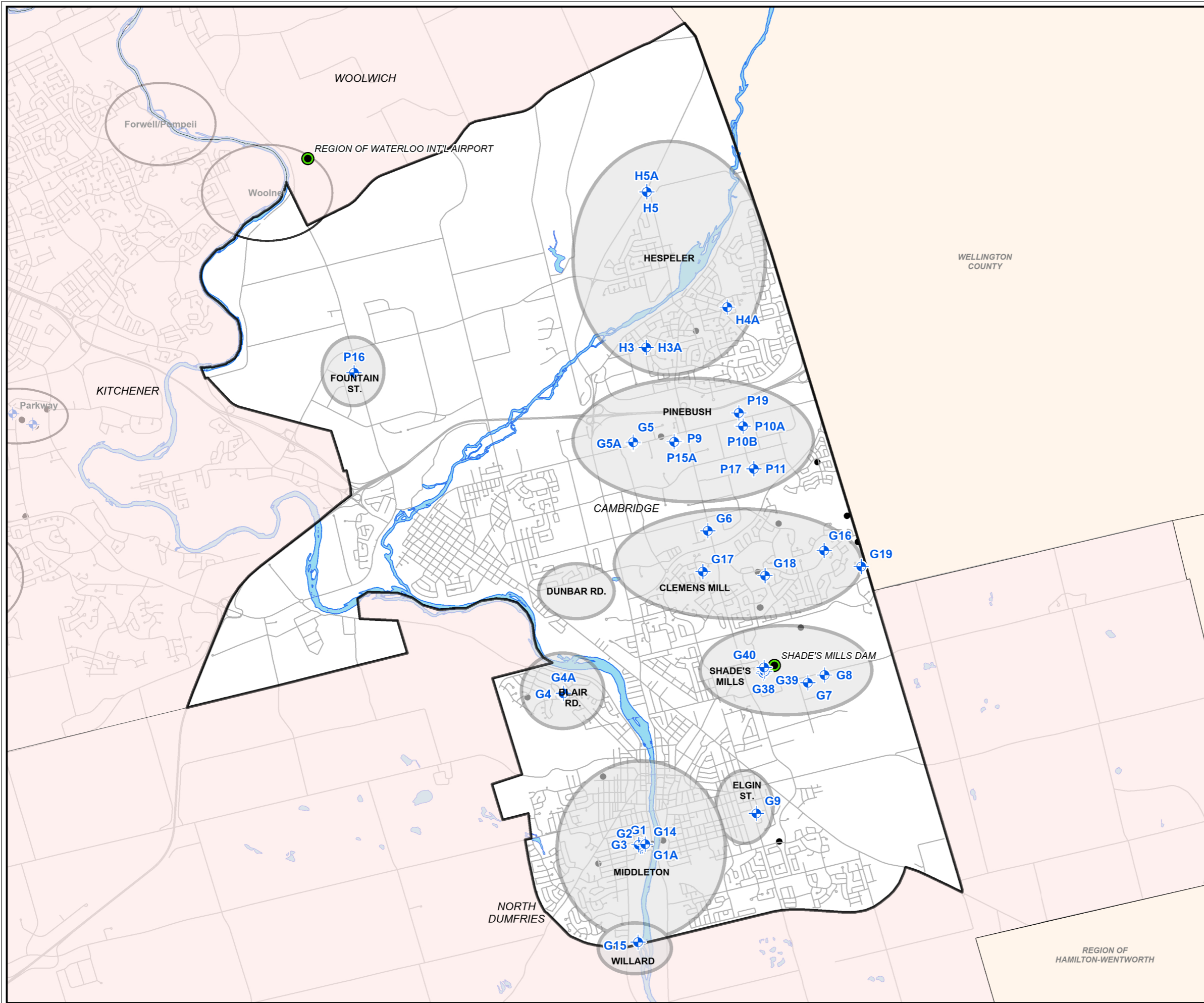
- Well Field Location
- Well Fields
- Regional Municipal Boundaries
- City of Cambridge
- City of Kitchener
- City of Waterloo
- Township of North Dumfries
- Township of Wellesley
- Township of Wilmot
- Township of Woolwich
- Meteorological Monitoring Locations



Map Title
**2025 GROUNDWATER MONITORING REPORT -
PINEBUSH WEST (G5/G5A) WELL FIELD**
WELL FIELD LOCATION MAP

Client
REGION OF WATERLOO

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



LEGEND

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



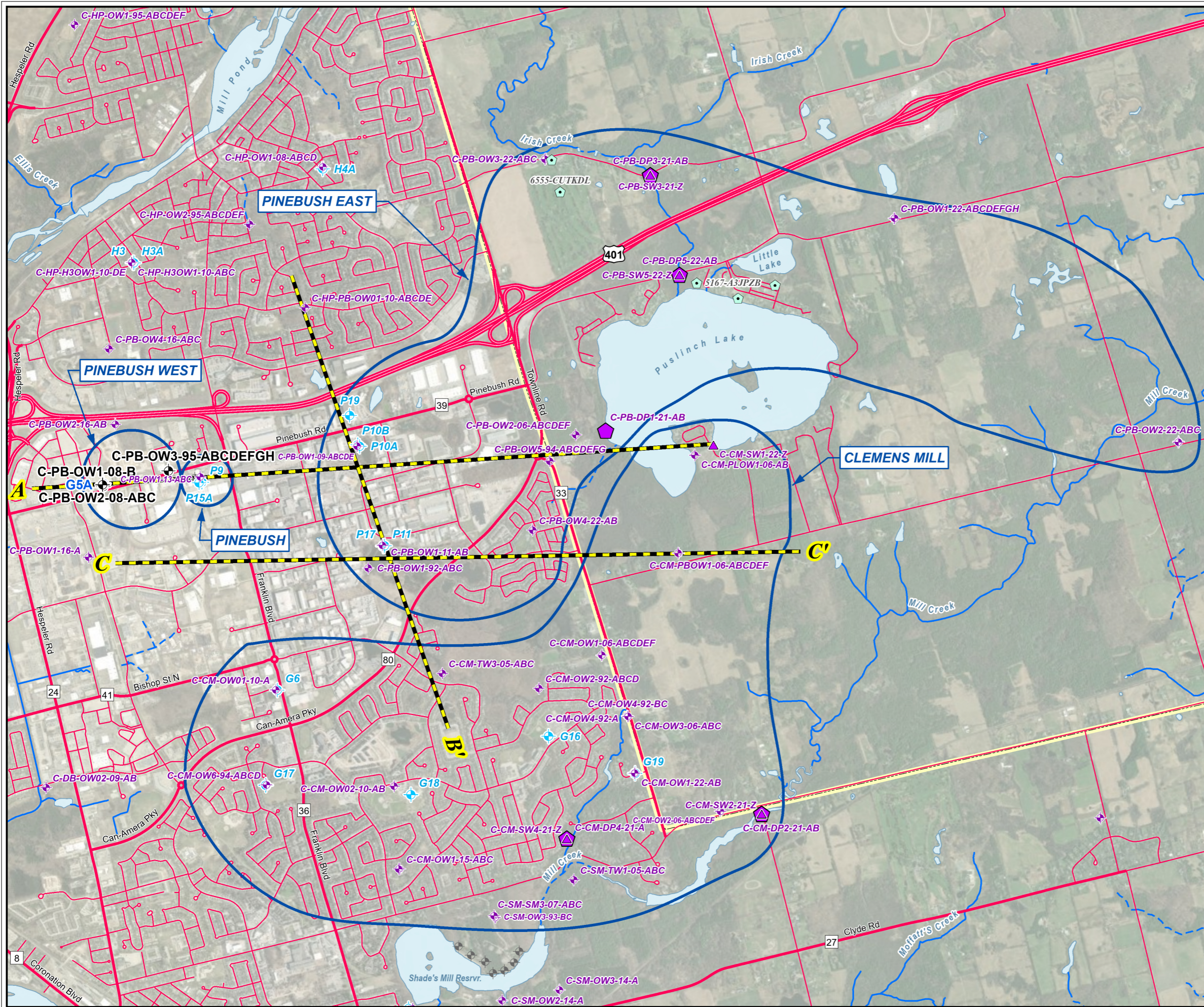
Client

REGION OF WATERLOO

Figure Title

**2025 GROUNDWATER MONITORING REPORT -
 PINEBUSH WEST (G5/G5A) WELL FIELD
 CAMBRIDGE WELL FIELDS AND
 MONITORING NETWORK**

Drawn	Checked	Date	Figure No. 2
HN	SQ	February 2026	
Scale	Project No.		
1:65,000		HA0464020	



Legend

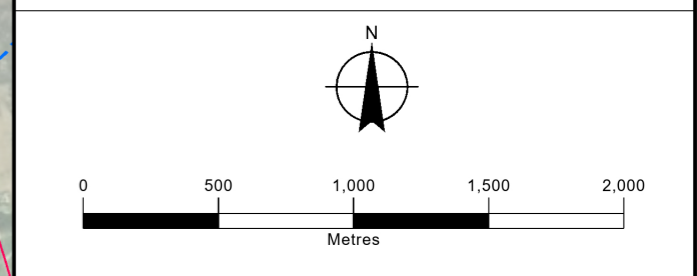
- PTTW Monitoring Well Location
- Nearby Monitoring Well Location
- Nearby Production Well Location
- Decommissioned Production Well Location
- Nearby Piezometer Location
- Nearby Surface Water Location

Additional MECP PTTW Locations

- Groundwater
- Cross Section Orientation
- Well Fields
- Provincial Highway
- Municipal Roads
- Local Roads
- Stream: Permanent (OHN)
- Stream: Intermittent (OHN)
- Waterbody: Permanent (OHN)
- Region of Waterloo Municipal Boundary

Sources:
 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.

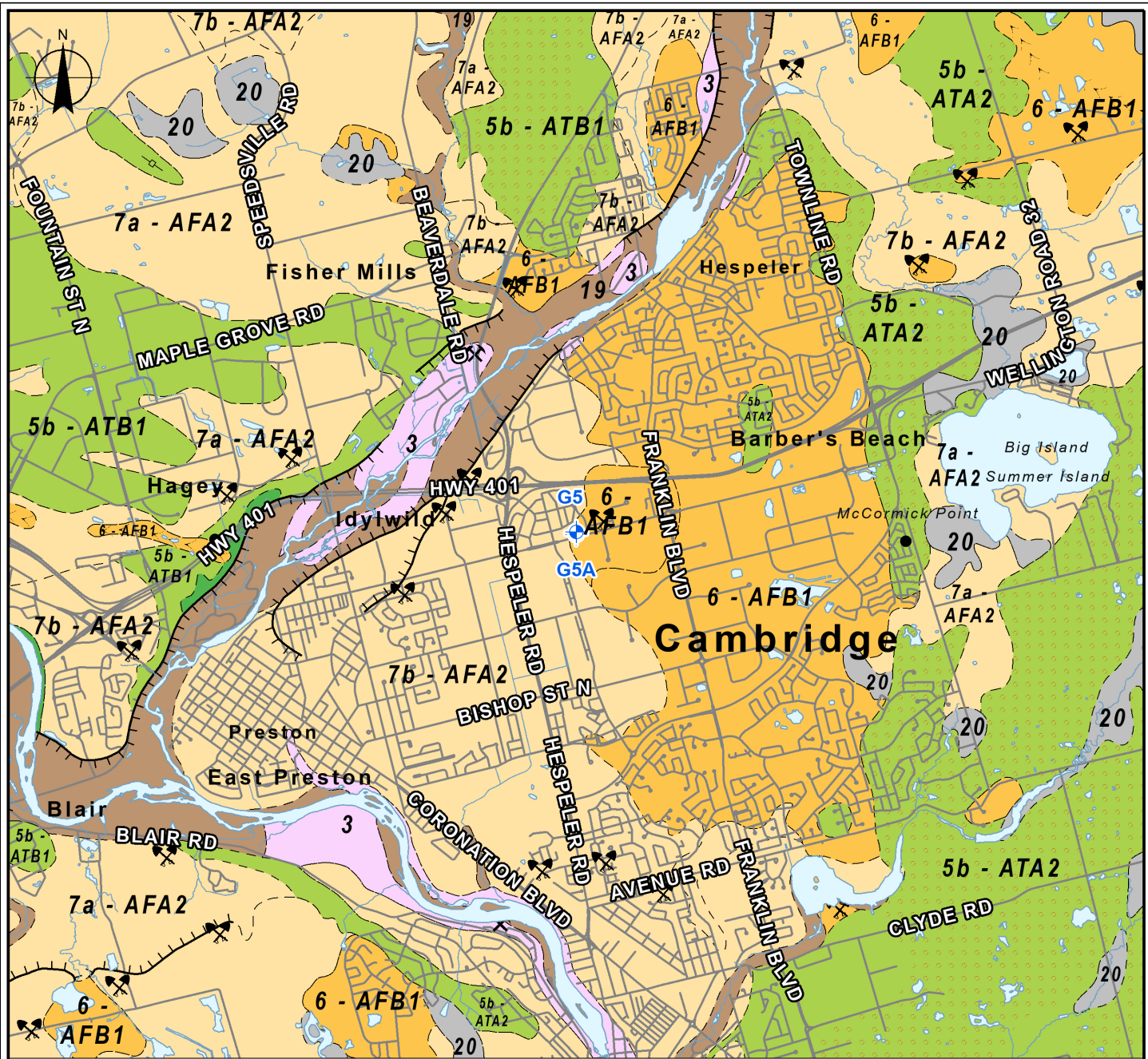
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Client
REGION OF WATERLOO

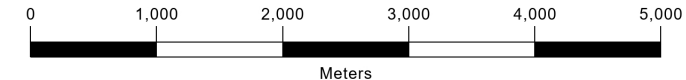
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2025 GROUNDWATER MONITORING REPORT
PINEBUSH WEST (G5/G5A) WELL PLAN AND CROSS SECTION LOCATIONS

Drawn	Checked	Date	Figure No. 3
HN	SQ	February 2026	
Scale	Project No.		
1:28,000	HA0464020		



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

- RMOV Supply Well
- Watercourse
- Waterbody
- Surficial Geology**
- 3: Paleozoic bedrock
- 5b: Stone-poor, carbonate-derived silty to sandy till (ATA2/ATB1 - Aquitard)
- 5d: Glaciolacustrine-derived silty to clayey till (ATB1 - Aquitard)
- 6: Ice-contact stratified deposits (AFB1 - Aquifer)
- 7a: Glaciofluvial deposits: Sandy deposits (AFA2 - Aquifer)
- 7b: Glaciofluvial deposits: Gravelly deposits (AFA2 - Aquifer)
- 19: Modern alluvial deposits



- 20: Organic deposits
- Sample Location
- Quarry (Point)
- Sand and Gravel Pit
- Esker: Direction of Flow Known
- Terrace
- Drumlin or drumlinoid ridges (point)
- Hummocky Topography
- Unit Contact
- Boundary



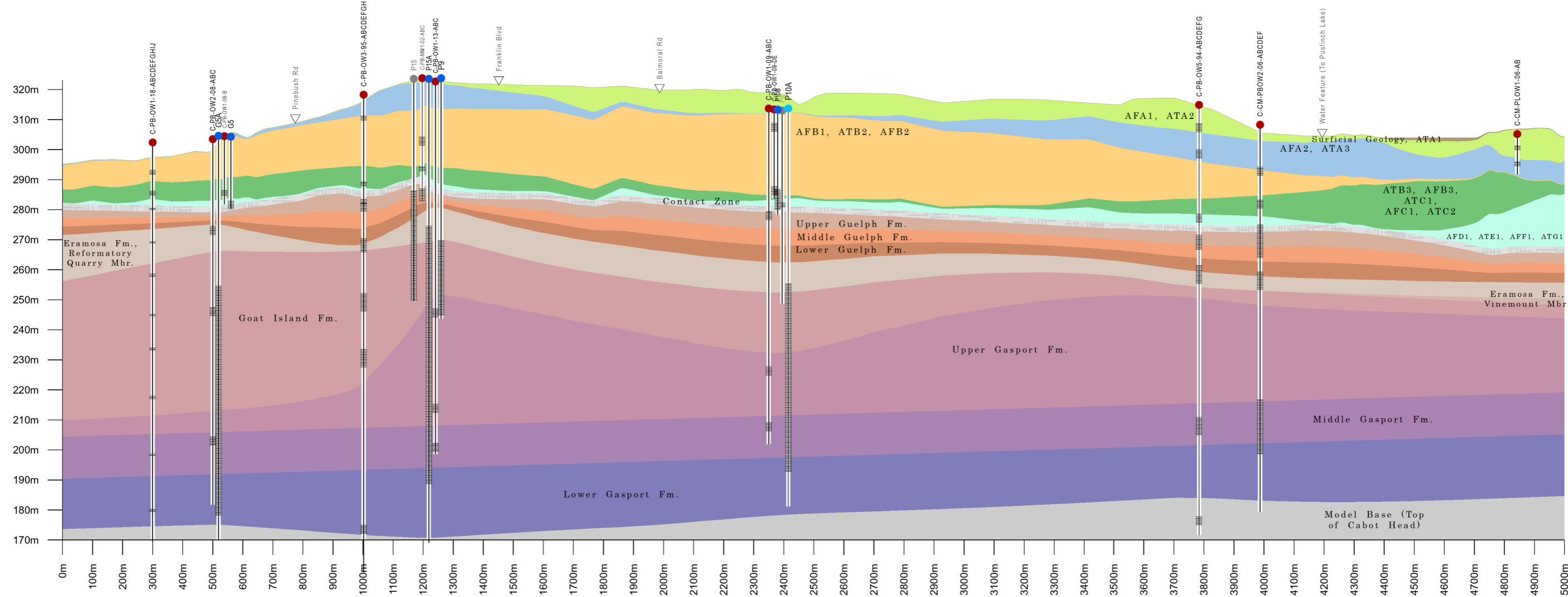
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2025 GROUNDWATER MONITORING REPORT - PINEBUSH WEST (G5/G5A) WELL FIELD
SURFICIAL GEOLOGY

Client
REGION OF WATERLOO

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

A

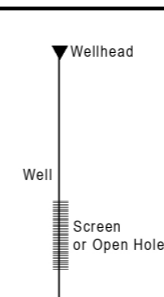
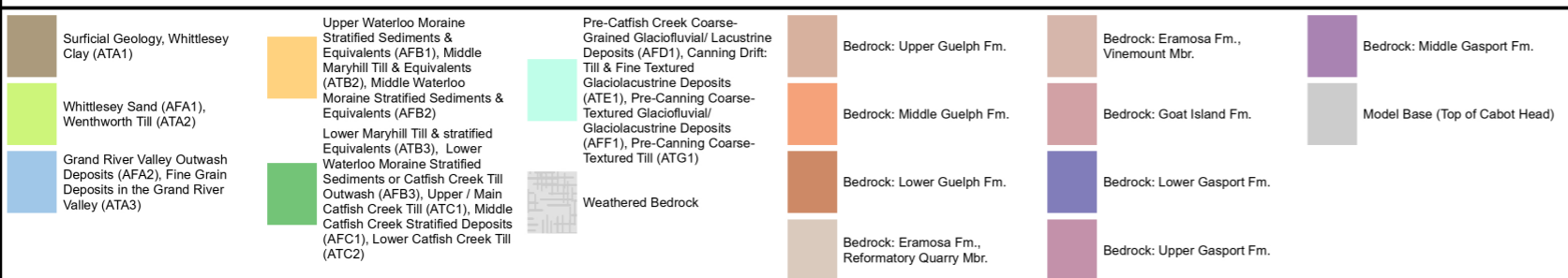
A'



Wells

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

Cambridge Model 2026



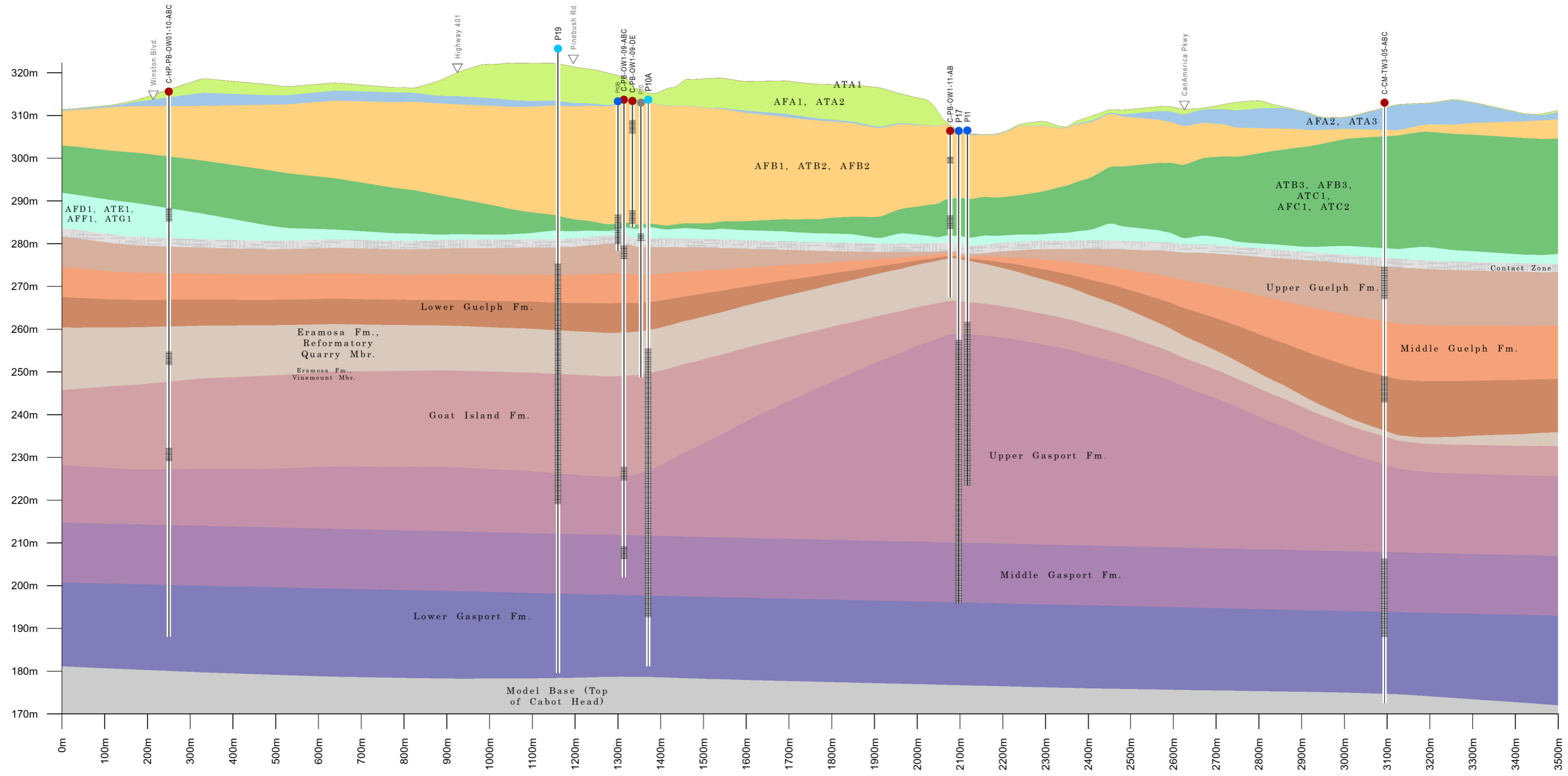
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Client
REGION OF WATERLOO

Figure Title				Figure No.
GEOLOGIC CROSS SECTION REGION OF WATERLOO Pinebush Cross Section A - A'				
Drawn	Checked	Date		
PS	DH	2026/06/25		
Horizontal Scale 1:14,000		Project No.		
Vertical Ex.:10x		HA046402		

B

B'

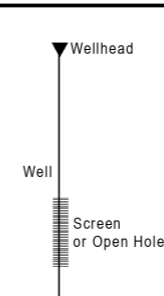


Wells

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

Cambridge Model 2026

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



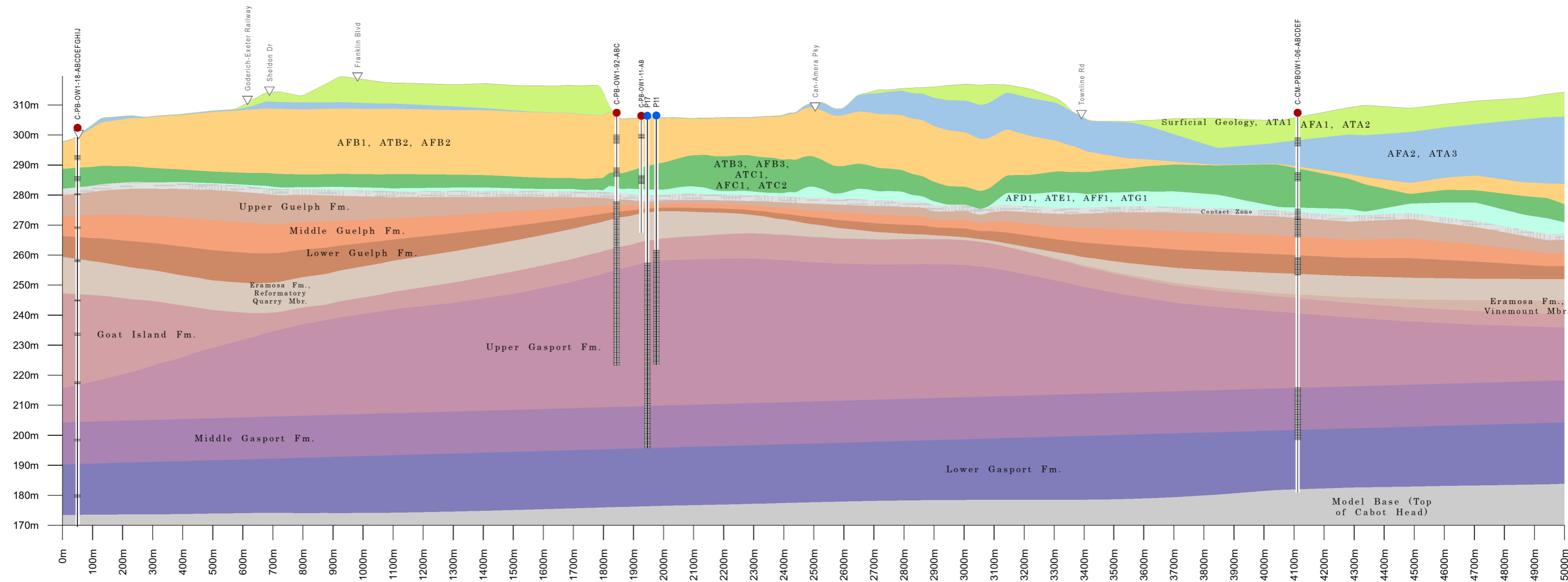
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REGION OF WATERLOO

Figure Title GEOLOGIC CROSS SECTION REGION OF WATERLOO Pinebush Cross Section B - B'			
Drawn PS	Checked DH	Date 2026/06/25	Figure No. 6
Horizontal Scale 1:10,000		Project No. HA046402	
Vertical Ex.:10x			

C

C'

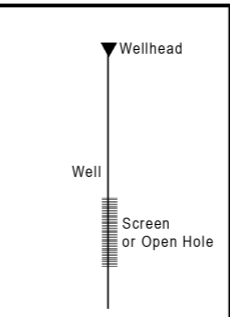


Wells

- Production Well (Active)
- Monitoring Well

Cambridge Model 2026

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



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Figure Title GEOLOGIC CROSS SECTION REGION OF WATERLOO Pinebush Cross Section C - C'			
Drawn PS	Checked DH	Date 2026/06/25	Figure No. 7
Horizontal Scale 1:14,000		Project No. HA046402	
Vertical Ex.:10x			



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Appendix A

Permit To Take Water

Appendix A

PERMIT TO TAKE WATER

Ground Water
NUMBER P-300-6117976847
Version: 1.0
Effective Date: June 15, 2021
Expiry Date: May 31, 2031

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

REGIONAL MUNICIPALITY OF
WATERLOO

150 Frederick Street
6th Floor
KITCHENER
ONTARIO
Canada
N2G 4J3

For the water taking from

G5A

G5

Located at:

98 PINEBUSH Road , CAMBRIDGE, CAMBRIDGE, ONTARIO,
CANADA, N1R 8J8

This Permit cancels and replaces Permit Number 4220-8HZHZQ, issued on August 17, 2011.

DEFINITIONS

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

- 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 of the 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 the ministry of the government of Ontario responsible for the administration of the OWRA, currently named the Ministry of the Environment, Conservation and Parks.
- d. "District Office" means the Guelph District Office of the Ministry.

- e. "Permit" or "PTTW" means this Permit to Take Water No. P-300-6117976847 including its Schedules, if any, issued in accordance with Section 34.1 of the OWRA, as may amended.
- f. "Permit Holder" means REGIONAL MUNICIPALITY OF WATERLOO.
- g. "OWRA" means the *Ontario Water Resources Act*, R.S.O. 1990, c. O. 40.

TERMS AND CONDITIONS

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

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, attested to by Karl Belan, on February 25, 2021, and all Schedules included in this Permit.
- 1.2. The Permit Holder shall ensure that any person authorized by the Permit Holder to take water under this Permit is provided with a copy of this Permit and shall take all reasonable measures to ensure that any such person complies with the conditions of this Permit.
- 1.3. Any person authorized by the Permit Holder to take water under this Permit shall comply with the conditions of this Permit.
- 1.4. This Permit is not transferable to another person.
- 1.5. This Permit provides the Permit Holder with permission to take water in accordance with the conditions of this Permit, up to the date of the expiry of this Permit. This Permit does not constitute a legal right, vested or otherwise, to a water allocation, and the issuance of this Permit does not guarantee that, upon its expiry, it will be renewed.
- 1.6. The Permit Holder shall keep this Permit available at all times at or near the site of the taking, and shall produce this Permit immediately for inspection by a Provincial Officer upon his or her request.
- 1.7. The Permit Holder shall report any changes of address to the Director within thirty days of any such change. The Permit Holder shall report any change of ownership of the property for which this Permit is issued within thirty days of any such change. A change in ownership in the property shall cause this Permit to be cancelled.

2. General Conditions and Interpretation

2.1. Inspections

The Permit Holder must forthwith, upon presentation of credentials, permit a Provincial Officer to carry out any and all inspections authorized by the OWRA, the Environmental Protection Act, R.S.O. 1990, the Pesticides Act, R.S.O. 1990, or the Safe Drinking Water Act, S. O. 2002.

2.2. Other Approvals

The issuance of, and compliance with this Permit, does not:

- (a) relieve the Permit Holder or any other person from any obligation to comply with any other applicable legal requirements, including the provisions of the Ontario Water Resources Act, and the Environmental Protection Act, and any regulations made thereunder; or
- (b) limit in any way any authority of the Ministry, a Director, or a Provincial Officer, including the authority to require certain steps be taken or to require the Permit Holder to furnish any further information related to this Permit.

2.3. Information

The receipt of any information by the Ministry, the failure of the Ministry to take any action or

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

- (a) an approval, waiver or justification by the Ministry of any act or omission of any person that contravenes this Permit or other legal requirement; or
- (b) acceptance by the Ministry of the information's completeness or accuracy.

2.4. Rights of Action

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

2.5. Severability

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

2.6. Conflicts

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

3. Water Takings Authorized by This Permit

3.1. Expiry

This Permit expires on May 31, 2031. 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 (litres)

	Source Name / Description	Source Type	Purpose Category	Specific Purpose	Activity	Max. Taken per minute	Max. No. of Hrs Taken per day	Max. volume per Day	Max. days in a year	Zone / Easting / Northing
1	G5 (G5)	Well	Public administration	Municipal Supply	Water Supply	3000	24	4320000	365	17 / 555087 / 4806566
2	G5A (G5A)	Well	Public administration	Municipal Supply	Water Supply	3000	24	4320000	365	17 / 555084 / 4806544
Total Taking								4320000		

3.3. Notwithstanding the Maximum Waken per Day specified in Table A of Condition 3.2, the combined taking from wells G5 and G5A shall not exceed 4,320,000 L/day with the rate not to exceed 3,000 L/min.

4. Monitoring

4.1. The Permit Holder shall maintain a record of all water takings. This record shall include the dates and times of water takings, the rates of pumping, and an estimated calculation of the total amounts of water pumped per day for each day that water is taken under the authorization of this Permit. A separate record shall be maintained for each source. The Permit Holder shall keep all required records up to date 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.

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

C-CA-OW2ABC-08
C-CA-OW1B-08
C-CA-OW3ABCDEFGH-95

4.3. The Permit Holder shall prepare and submit a report to the Director every two years by June 30 commencing June 30, 2023, that presents the results of the well field water level monitoring for the two preceding calendar years, assesses changes in water levels in the supply aquifer(s) in relation to precipitation and water taking from the aquifer(s) and provides a summary for all interference complaints received by the Permit Holder related to this permit and reported in the District Office in accordance with Condition 5.1 and the manner in which the Permit Holder has dealt with the complaint.

5. Impacts of the Water Taking

5.1. Notification

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

5.2. Impacts for Water Situation Type

For Surface-Water Takings

The taking of water (including the taking of water into storage and the subsequent or simultaneous withdrawal from storage) shall be carried out in such a manner that streamflow is not stopped and is not reduced to a rate that will cause interference with downstream uses of water or with the natural functions of the stream.

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

6.1. 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).

REASONS

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.

APPEAL PROVISIONS

In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, you may by written notice served upon me, the Environmental Review Tribunal and the Minister of the Environment, Conservation and Parks, within 15 days after receipt of this Notice, require a hearing by the Tribunal. The Minister of the Environment, Conservation and Parks will place notice of your appeal on the Environmental Registry. Section 101 of the Ontario Water Resources Act, as amended, provides that the Notice requiring a 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
135 St. Clair Avenue West, 1st Floor
Toronto, ON
M4V 1P5*

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

*by Telephone at
(416) 212-6349*

*by Fax at
(416) 326-5370*

by e-mail at

Dated at Toronto this 14th day of June, 2021

A handwritten signature in blue ink, appearing to read 'G. Meek', is written over a light blue rectangular background.

Gregory Meek

Director, Section 34.1

Ontario Water Resources Act , R.S.O. 1990

c: Karl Belan, Regional Municipality of Waterloo

SCHEDULE 1

This Schedule "A" forms part of Permit To Take Water P-300-6117976847 Version Number 1.0, dated June 14, 2021.

PERMIT TO TAKE WATER

Ground Water

NUMBER P-300-6117976847

Version: 2.0

Effective Date: October 10, 2025

Expiry Date: May 31, 2035

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

REGIONAL MUNICIPALITY OF WATERLOO

150 Frederick Street

6th Floor

KITCHENER

ONTARIO

Canada

N2G 4J3

For the water taking from

G5

G5A

P9

P15A

Located at:

98 PINEBUSH Road , CAMBRIDGE, CAMBRIDGE, ONTARIO, CANADA,

N1R 8J8

191 Pinebush Road , Cambridge, CAMBRIDGE, ONTARIO, CANADA, N1R

7H8

This Permit cancels and replaces Permit Number P-300-6117976847 Version 1.0, issued on June 14, 2021.

DEFINITIONS

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

- 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 of the 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 the ministry of the government of Ontario responsible for the administration of the OWRA, currently named the Ministry of the Environment, Conservation and Parks.
- d. "District Office" means the Guelph District Office
Guelph District Office
of the Ministry.
- e. "Permit" or "PTTW" means this Permit to Take Water No. P-300-6117976847 including its Schedules, if any, issued in accordance with Section 34.1 of the OWRA, as may amended.
- f. "Permit Holder" means REGIONAL MUNICIPALITY OF WATERLOO.
- g. "OWRA" means the *Ontario Water Resources Act*, R.S.O. 1990, c. O. 40.

TERMS AND CONDITIONS

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

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, attested to by Frank Kosa, on June 19, 2025, 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 without the Director's written consent.

- 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.

2. General Conditions and Interpretation

2.1. Inspections

The Permit Holder must forthwith, upon presentation of credentials, permit a Provincial Officer to carry out any and all inspections authorized by the *OWRA*, the *Environmental Protection Act*, R.S.O. 1990, the *Pesticides Act*, R.S.O. 1990, or the *Safe Drinking Water Act*, S. O. 2002.

2.2. Other Approvals

The issuance of, and compliance with this Permit, does not:

- (a) relieve the Permit Holder or any other person from any obligation to comply with any other applicable legal requirements, including the provisions of the *Ontario Water Resources Act*, and the *Environmental Protection Act*, and any regulations made thereunder; or
- (b) limit in any way any authority of the Ministry, a Director, or a Provincial Officer, including the authority to require certain steps be taken or to require the Permit Holder to furnish any further information related to this Permit.

2.3. Information

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

- (a) an approval, waiver or justification by the Ministry of any act or omission of any person that contravenes this Permit or other legal requirement; or
- (b) acceptance by the Ministry of the information's completeness or accuracy.

2.4. Rights of Action

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

2.5. Severability

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

2.6. Conflicts

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

3. Water Takings Authorized by This Permit

3.1. Expiry

This Permit expires on May 31, 2035. 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 (litres)

	Source Name and Location (Zone/Easting/Northing)	Source Information	Permitted Maximums
1	G5 (17 / 555087 / 4806566)	Source Type: Well Purpose Category: Public administration Specific Purpose: Municipal Supply Activity: Water Supply	Litres taken per minute: 3,000 Number of hours taken per day: 24 Litres taken per day: 4,320,000 Number of days taken per year: 365
2	G5A (17 / 555084 / 4806544)	Source Type: Well Purpose Category: Public administration Specific Purpose: Municipal Supply Activity: Water Supply	Litres taken per minute: 3,000 Number of hours taken per day: 24 Litres taken per day: 4,320,000 Number of days taken per year: 365
3	P9	Source Type: Well	Litres taken per minute:

Source Name and Location (Zone/Easting/Northing)	Source Information	Permitted Maximums
(17 / 555804 / 4806576)	Purpose Category: Public administration Specific Purpose: Municipal Supply Activity: Water Supply	2,937 Number of hours taken per day: 24 Litres taken per day: 4,229,280 Number of days taken per year: 365
4 P15A (17 / 555784 / 4806573)	Source Type: Well Purpose Category: Public administration Specific Purpose: Municipal Supply Activity: Water Supply	Litres taken per minute: 2,937 Number of hours taken per day: 24 Litres taken per day: 4,229,280 Number of days taken per year: 365
Maximum Total Liters Taken per day:		8,549,280

3.3. Notwithstanding Table A, the combined taking from **Source 1 and 2** (wells G5 and G5A, respectively) shall not exceed **4,320,000 litres per day**.

3.4. Notwithstanding Table A, the combined taking from **Source 3 and 4** (wells P9 and P15A, respectively) shall not exceed **4,229,280 litres per day**, and the annual daily average rate shall not exceed **3,628,800 litres per day**.

4. Monitoring

4.1. The Permit Holder shall maintain a record of all water takings. The daily volume of water taken shall be measured by a flow meter or calculated in accordance with the method described in the application for this Permit, or as otherwise accepted by the Director.

This record shall include the dates and times of water takings, the rates of pumping, and the total measured amounts of water pumped per day for each day that water is taken under the authorization of this Permit. A separate record shall be maintained for each source. The Permit Holder shall keep all required records up to date 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 Regulatory Self Reporting System.

4.2. The Permit Holder shall measure and record water levels once a month in the

following monitoring wells:

- i. C-PB-OW2-08-ABC
- ii. C-PB-OW1-08-B
- iii. C-PB-OW3-95-ABCDEFG
- iv. C-PB-OW1-13-ABC

4.3. The Permit Holder shall prepare and submit a report to the Director and the Guelph District every two years by **June 30** commencing **June 30, 2027** that presents the results of the well field water level monitoring for the two preceding calendar years, assesses changes in water levels in the supply aquifer(s) in relation to precipitation and water taking from the aquifer(s), and provides a summary for all interference complaints received by the Permit Holder related to this Permit and reported in the District Office in accordance with Condition 5.1, including the manner in which the Permit Holder has dealt with the complaint.

5. Impacts of the Water Taking

5.1. Notification

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

5.2. Impacts for Water Situation Type

For Surface-Water Takings

The taking of water (including the taking of water into storage and the subsequent or simultaneous withdrawal from storage) shall be carried out in such a manner that streamflow is not stopped and is not reduced to a rate that will cause interference with downstream uses of water or with the natural functions of the stream.

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

6.1. 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).

REASONS

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.

APPEAL PROVISIONS

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 Ontario Land 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 ("the Notice") 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:

1. The name of the appellant;
2. The address of the appellant;
3. The permit to take water number;
4. The date of the permit to take water;
5. The name of the Director;
6. The municipality within which the works are located;

This Notice must be served upon:

Registrar*		The Director, Section 34.1,
Ontario Land Tribunal		Ministry of the Environment, Conservation and Parks
655 Bay Street, Suite 1500	and	5775 Yonge Street, 8 th Floor
Toronto ON		Toronto, ON
M5G 1E5		M2M 4J1
OLT.Registrar@ontario.ca		Fax: (416) 325-6347

*** Further information on the Ontario Land Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349 or 1 (866) 448-2248, or [Ontario Land Tribunal's](#)**

Dated at Toronto this 9th day of October, 2025



Matthew Corriveau

Director, Section 34.1

Ontario Water Resources Act, R.S.O. 1990

c: Frank Kosa, REGIONAL MUNICIPALITY OF WATERLOO

Karl Belan, REGIONAL MUNICIPALITY OF WATERLOO

SCHEDULE 1

This Schedule "1" forms part of Permit To Take Water P-300-6117976847 Version Number 2.0, dated October 9, 2025.

1. Email entitled "PTTW Application Reference Number 1000363872, Pinebush Well – Request for Additional Information", from Karl Belan of the Region of Waterloo to MECP, dated August 13, 2025.



BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix B

Well Records

8-5

Well Material

Outer Casing 70' - 12" casing
Inner Casing
Screen
Plug
Gravel

G5

Pump

No. Setting BP-MB
No. Stages Length Bowl
Bowl Size & Lgth. Suction
Head Size Column

Materials or setting details other than standard:
Impellers: Trim

Motor

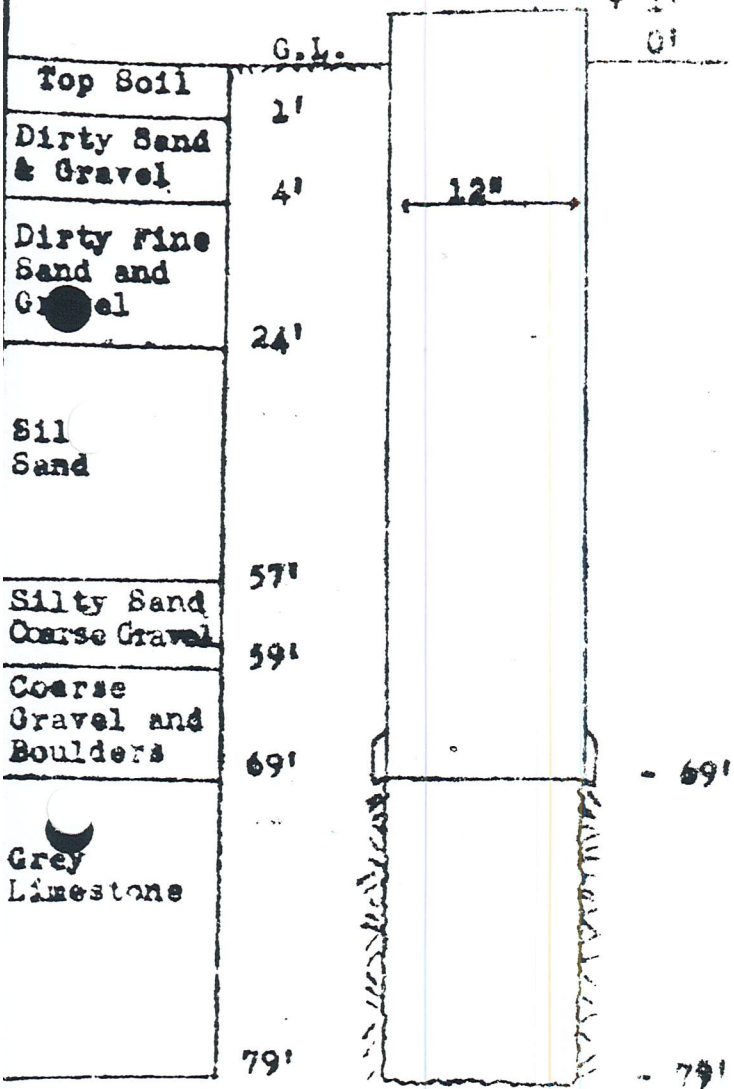
Make Phase
H. P. Cycles
R. P. M. Volts
Type Amps.
Frame Serial
Bearing Nos.

Special Equipment

G 5

Well No. 3-58

B. P. referred to original ground level
Clear depth below B. P.
Started 9/15/58 Final Test
Preliminary Test 9/20/58 Static Level 36' 1"
Final Test Pumping Level 42'
Guarantee 10 GPM Capacity 840 1 G P M
Contract Pressure # Pressure Pump #
Length Air Line Man



*From John
Ponchartraine*

INTERNATIONAL WATER SUPPLY LTD.
 MONTREAL LONDON CANADA SASKATOON
 OAKVILLE WATER SUPPLY CONTRACTORS VANCOUVER

PUBLIC UTILITIES COMMISSION
 GALT, ONTARIO

DESIGNED BY R. Stroh DRAWN BY J.W.
 CHECKED BY APPROVED BY

Measurements recorded in: Metric Imperial

(and/or Print Below)
A 063061
 A063061

Page _____ of _____

Well Owner's Information

First Name RE	Last Name / Organization IONAL MUNICIPALITY OF WATERLOO	E-mail Address	<input type="checkbox"/> Well Constructed by Well Owner
Mailing Address (Street Number/Name) 150 Frederick St.	Municipality KITCHENER	Province ON	Postal Code N2G4J3
		Telephone No. (inc. area code) 519 575 4433	

Well Location

Address of Well Location (Street Number/Name) Pinebush Rd.		Township Cambridge	Lot	Concession
County/District/Municipality Waterloo Region		City/Town/Village Cambridge	Province Ontario	Postal Code
UTM Coordinates	Zone 18	Easting 83117555082	Northing 4806570	Municipal Plan and Sublot Number
				Other

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
Brown	Clay	Stones		0'	14'
Brown	Clay	Sand		14'	76'
Lt. Brown	Limestone			76'	196'
Lt. Grey	Limestone			196'	406'
Dk. Grey	Limestone			406'	436'
	shale			436'	441'

Annular Space			
Depth Set at (m/ft)	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)	
From: 12' To: 164'	4' Cement Grout	8 cu. m.	
6" hole filled back with sand & hole plug to 420'			
420'	415' Cement		

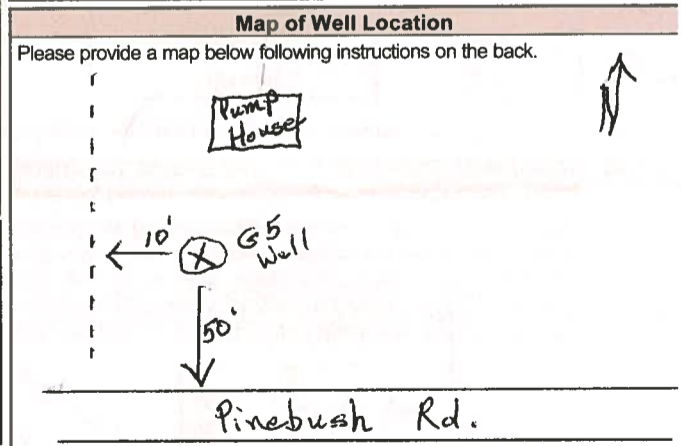
Results of Well Yield Testing				
After test of well yield, water was: <input type="checkbox"/> Clear and sand free <input type="checkbox"/> Other, specify _____	Draw Down		Recovery	
	Time (min)	Water Level (m/ft)	Time (min)	Water Level (m/ft)
If pumping discontinued, give reason: Pump intake set at (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? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	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		

Method of Construction		Well Use	
<input checked="" type="checkbox"/> Cable Tool	<input type="checkbox"/> Diamond	<input type="checkbox"/> Public	<input checked="" type="checkbox"/> Commercial
<input type="checkbox"/> Rotary (Conventional)	<input type="checkbox"/> Jetting	<input type="checkbox"/> Domestic	<input type="checkbox"/> Not used
<input type="checkbox"/> Rotary (Reverse)	<input type="checkbox"/> Driving	<input type="checkbox"/> Livestock	<input type="checkbox"/> Dewatering
<input type="checkbox"/> Boring	<input type="checkbox"/> Digging	<input type="checkbox"/> Irrigation	<input type="checkbox"/> Test Hole
<input type="checkbox"/> Air percussion		<input type="checkbox"/> Industrial	<input type="checkbox"/> Cooling & Air Conditioning
<input type="checkbox"/> Other, specify _____		<input type="checkbox"/> Other, specify _____	

Construction Record - Casing				Status of Well	
Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		<input checked="" type="checkbox"/> Water Supply <input type="checkbox"/> Replacement Well <input type="checkbox"/> Test Hole <input type="checkbox"/> Recharge Well <input type="checkbox"/> Dewatering Well <input type="checkbox"/> Observation and/or Monitoring Hole <input type="checkbox"/> Alteration (Construction) <input type="checkbox"/> Abandoned, Insufficient Supply <input type="checkbox"/> Abandoned, Poor Water Quality <input type="checkbox"/> Abandoned, other, specify _____ <input type="checkbox"/> Other, specify _____
			From	To	
12"	Steel	.375	0'	164'	
12"	Open Hole		164'	415'	

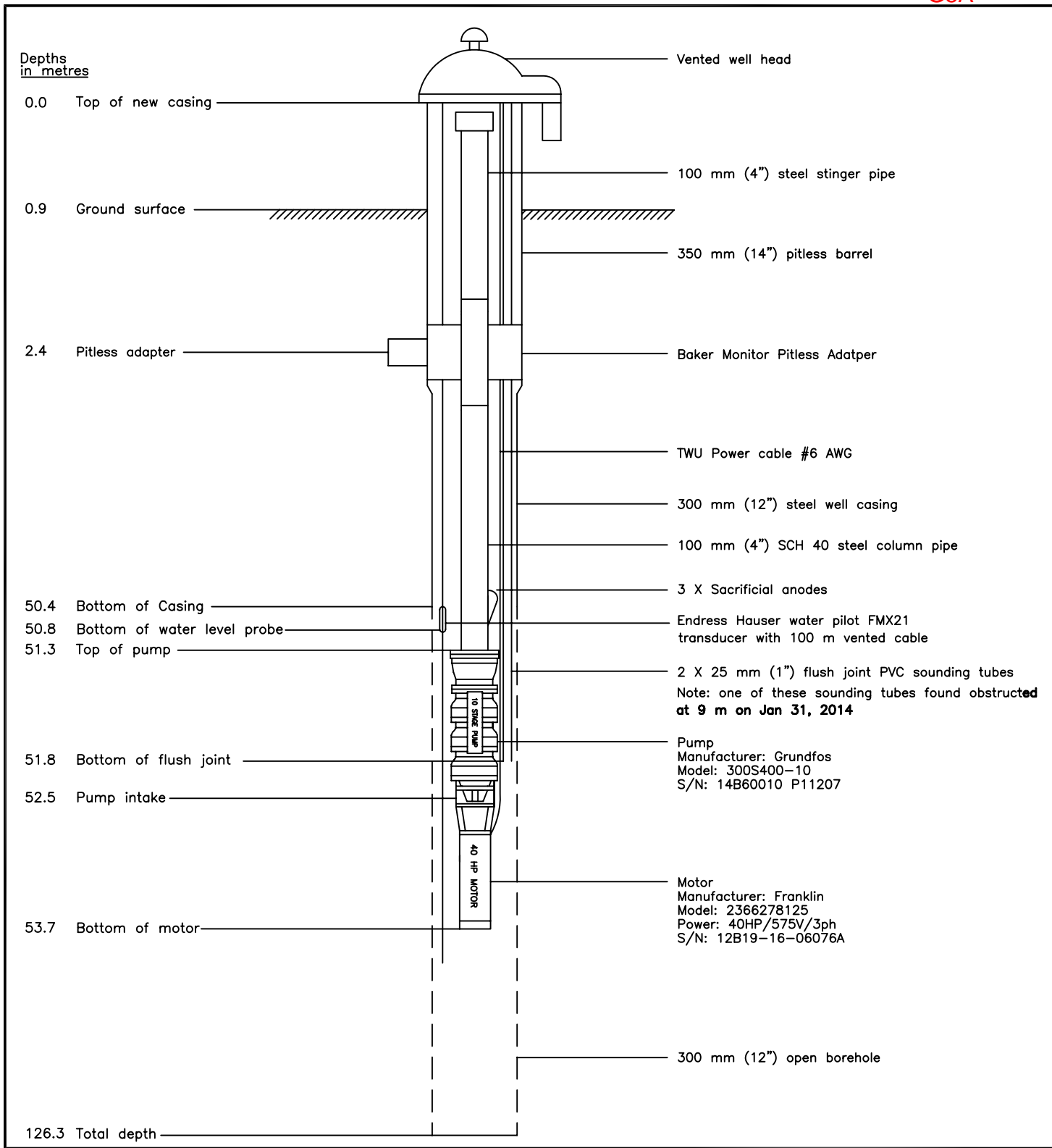
Water Details		Hole Diameter	
Water found at Depth (m/ft)	Kind of Water: <input checked="" type="checkbox"/> Fresh <input type="checkbox"/> Untested <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____	Depth (m/ft)	Diameter (cm/in)
98'		From: 0' To: 76'	20"
148'		76' to 164'	16 1/2"
412'		164' to 415'	12"


Well Contractor and Well Technician Information			
Business Name of Well Contractor DAVIDSON WELL DRILLING LIMITED		Well Contractor's Licence No. 117 3 17	
Business Address (Street Number/Name) 147 North St. W.		Municipality WINGHAM	
Province ON	Postal Code N0G2W0	Business E-mail Address info@davidsondrilling.com	
Bus. Telephone No. (inc. area code) 519 357 1960		Name of Well Technician (Last Name, First Name) LOSCH KIM	
Well Technician's Licence No. 71927	Signature of Technician and/or Contractor <i>J.C. Davidson</i>		Date Submitted 2007/11/28



Comments:

Well owner's information package delivered <input type="checkbox"/> Yes <input type="checkbox"/> No	Date Package Delivered Y Y Y Y M M D D	Ministry Use Only Audit No. Z 095781
	Date Work Completed 2 0 0 7 1 1 2 8	
Received		



	CLIENT Regional Municipality of Waterloo
	TITLE Well G5A Pump Installation Drawing

PROJECT No. 006-309	G:\Lotowater Projects\006 Region of Waterloo\254 Well Transducer Install (H4a, G4a, G5a)\Pump Installation.dwg	FIGURE 1
DESIGN	REVISION No. 2014/04/04	SCALE N.T.S.
DRAWN EH 2012/05/02		
CHECKED BP 2014/04/04		

LOG OF DRILLING OPERATIONS



R.J. Burnside & Associates Ltd.
 15 Townline, Orangeville, Ontario L9W 3R4
 telephone (519) 941-5331 fax (519) 941-8120

G5-TW1B-08

Page 1 of 1

Client: Region of Waterloo	Project Name: Well Optimization	Logged by: S. Quinlan
Project No.: MTA14155.0	Location: Cambridge	Ground (m amsl): 303.87
Drilling Co.: Geoenergy Solutions Inc.	Date Started: 4/29/2008	Static Water Level (m amsl): 286.73
Drilling Method: Sonic Drilling	Date Completed: 4/29/2008	Sand Pack (m amsl): 284.06-287.11

Depth Scale (ft) (m)	Stratigraphic Description	Strat. Plot	Depth (m)	Diagram	SAMPLE				Depth Scale (ft) (m)
					Num.	Type	Int.	%Recov.	
	Surface Elevation (m): 303.87								
0.0	TOPSOIL - black, moist.		0.30			CS		100	0.0
1.0	SAND - with some gravel, brown, moist to dry					CS		100	1.0
3.0	SAND - fine, brown, dry.		3.05			CS		100	3.0
5.0	SAND - fine, dark brown, dry		5.18			CS		100	5.0
7.0	SILT - dense, brown, dry.		7.01			CS		100	7.0
8.0	SAND - fine, with trace of silt, brown, dry.		7.62			CS		100	8.0
9.0	SILT - with trace of sand, light brown, dry.		8.23			CS		100	9.0
10.0	SILT - with some clay, dense, grey brown, dry.		9.14			CS		100	10.0
11.0	SILT - brown, dry.		9.45			CS		100	11.0
12.0	SILT - with clay, medium to dense, layered, brown, dry.		11.28			CS		100	12.0
13.0	SILT - very dense, brown, some moisture.		12.19			CS		100	13.0
14.0	SANDY SILT - brown, dry.		12.80			CS		100	14.0
15.0	SILT - fine, light brown, dry.		14.33			CS		100	15.0
16.0	SILT - fine with some fine gravel, brown, dry.		15.24			CS		100	16.0
17.0	SILT - fine, brown, dry.		16.15			CS		100	17.0
18.0	SILT - fine, with some fine gravel, brown, dry.		17.07			CS		100	18.0
19.0	SILT - fine, dense, grey-brown, moist.		17.68			CS		100	19.0
20.0	SANDY SILT - brown, moist.		18.29			CS		100	20.0
21.0	GRAVEL - with some silt, moist to wet. Boulder at 19.5 m.		18.90			CS		98	21.0
22.0	SANDY SILT - dense, with gravel, brown, wet.		19.81			CS		100	22.0
	GRAVEL - loose, wet.		21.34			CS		100	
	BEDROCK - LIMESTONE, wet.		22.71			CS		100	

B:\LOG GUELLPH.P\GINT\PROJECTS\MMTA14155\CAMBRIDGE.GPJ TEMPLATE.GDT 7/12/10

Prepared By: **S. Quinlan** Checked By: **J. Baxter** Date Prepared: **5/5/2008**

This borehole log was prepared for hydrogeological and/or environmental purposes and does not necessarily contain information suitable for a geotechnical assessment of the subsurface conditions. Borehole data requires interpretation by R. J. Burnside & Associates Limited personnel before use by others.

LEGEND	MONITORING WELL DATA	SAMPLE TYPE	AC Auger Cutting	SS Split Spoon
Water found @ time of drilling	Pipe: 51 mm dia. PVC	CS Continuous	AR Air Rotary	WC Wash Cuttings
Static Water Level - 2/25/2010	Screen: 51 mm dia. PVC #10 slot	RC Rock Core		

LOG OF DRILLING OPERATIONS



R.J. Burnside & Associates Limited
 15 Townline, Orangeville, Ontario L9W 3R4
 telephone (519) 941-5331 fax (519) 941-8120

G5-TW2-08

Client: Region of Waterloo	Project Name: Cambridge Well Optimization	Logged by: S. Quinlan
Project No.: MTA14155	Location: Cambridge, ON	Ground (m amsl): 303.20
Drilling Co.: Davidson Drilling Limited	Date Started: 11/17/2008	Static Water Level (m amsl): 289.18
Drilling Method: Air Rotary	Date Completed: 11/20/2008	Sand Pack (m amsl): N/A

Depth Scale (ft) (m)	Stratigraphic Description	Strat. Plot	Depth (m)	[Diagram]	SAMPLE			Depth Scale (ft) (m)
					Num.	Type	Int.	
	Surface Elevation (m): 303.20							
0.0	TOPSOIL - black, moist.	[Symbol]	0.30					0.0
1.0	SAND - with some gravel, brown, moist to dry	[Symbol]						1.0
3.0	SAND - fine, brown, dry.	[Symbol]	3.05					3.0
7.0	SILT - dense, brown, dry.	[Symbol]	7.01					7.0
7.5	SAND - fine, with trace of silt, brown, dry.	[Symbol]	7.62					7.5
8.0	SILT - with trace of sand, light brown, dry.	[Symbol]	8.23					8.0
12.8	SANDY SILT - brown, dry.	[Symbol]	12.80					12.8
14.3	SILT - fine, light brown, dry.	[Symbol]	14.33	▽				14.3
18.2	SANDY SILT - brown, moist.	[Symbol]	18.29					18.2
19.5	GRAVEL - with some silt, moist to wet. Boulder at 19.5 m.	[Symbol]	19.90					19.5
21.0	SANDY SILT - dense, with gravel, brown, wet.	[Symbol]	19.81					21.0
21.3	GRAVEL - loose, wet.	[Symbol]	21.34					21.3
22.5	DOLOSTONE - grey, slightly porous, fine crystalline	[Symbol]	22.56					22.5

Prepared By: **S. Quinlan** Checked By: **J. Baxter** Date Prepared: **11/27/2008**

This borehole log was prepared for hydrogeological and/or environmental purposes and does not necessarily contain information suitable for a geotechnical assessment of the subsurface conditions. Borehole data requires interpretation by R. J. Burnside & Associates Limited personnel before use by others.

LEGEND	MONITORING WELL DATA	SAMPLE TYPE
▽ Water found @ time of drilling	Pipe: 20.3 cm dia. steel	AC [Symbol] Auger Cutting
▽ Static Water Level - 2/25/2010	Screen: 15.6 cm dia. open hole	CS [Symbol] Continuous
		RC [Symbol] Rock Core
		SS [Symbol] Split Spoon
		AR [Symbol] Air Rotary
		WC [Symbol] Wash Cuttings

BHLOG GUEIPH P:\GINT\PROJECTS\MMTA14155\G5 TW2\1A & TW2.GPJ TEMPLATE.GDT 7/12/10

LOG OF DRILLING OPERATIONS

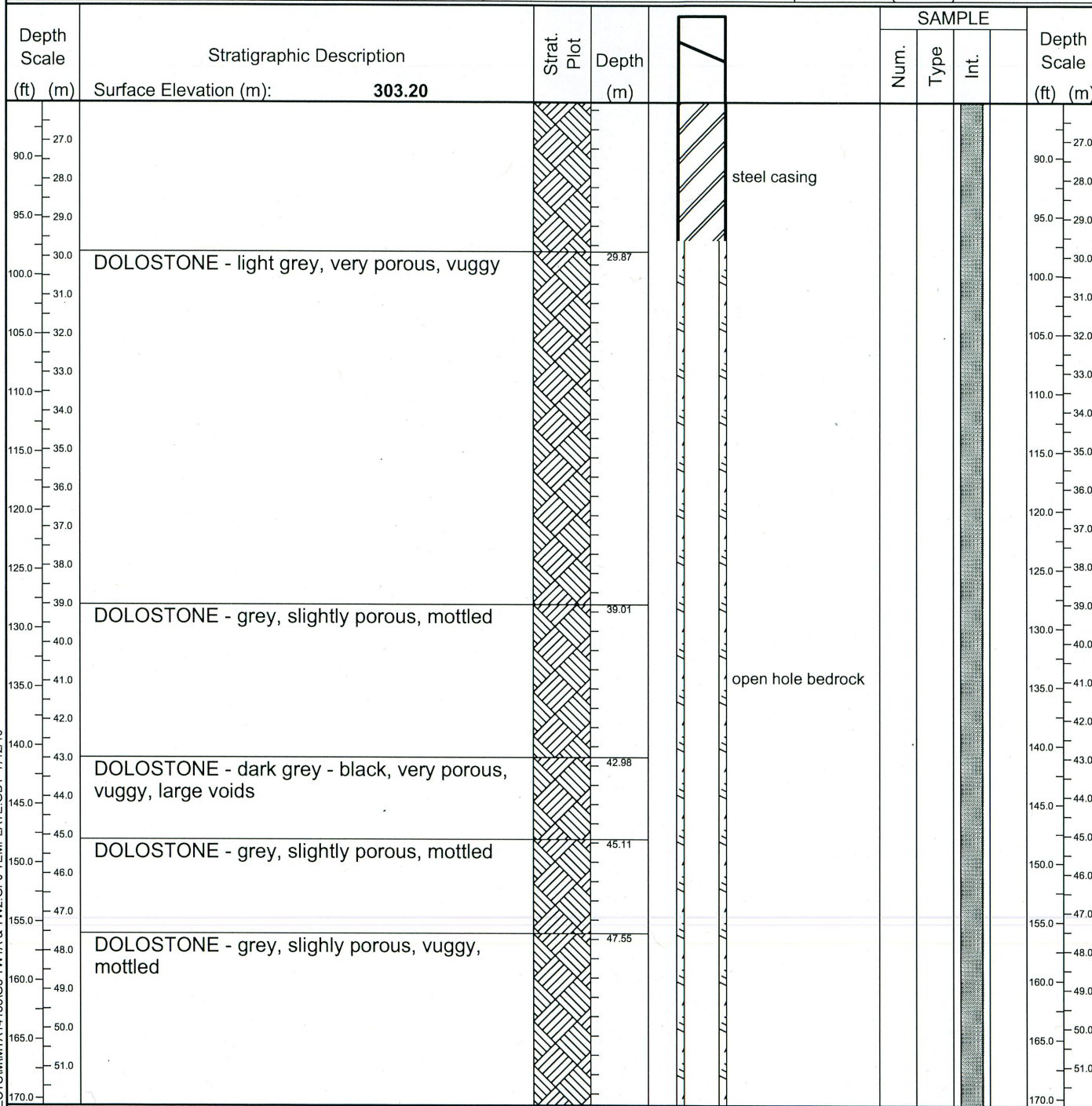


R.J. Burnside & Associates Limited
 15 Towaline, Orangeville, Ontario L9W 3R4
 telephone (519) 941-5331 fax (519) 941-8120

G5-TW2-08

Page 2 of 5

Client: Region of Waterloo	Project Name: Cambridge Well Optimization	Logged by: S. Quinlan
Project No.: MTA14155	Location: Cambridge, ON	Ground (m amsl): 303.20
Drilling Co.: Davidson Drilling Limited	Date Started: 11/17/2008	Static Water Level (m amsl): 289.18
Drilling Method: Air Rotary	Date Completed: 11/20/2008	Sand Pack (m amsl): N/A



B:\LOG GUELLPH.P\GINT\PROJECTS\M\MTA14155\G5-TW1A & TW2.GPJ TEMPLATE.GDT 7/12/10

Prepared By: **S. Quinlan** Checked By: **J. Baxter** Date Prepared: **11/27/2008**

This borehole log was prepared for hydrogeological and/or environmental purposes and does not necessarily contain information suitable for a geotechnical assessment of the subsurface conditions. Borehole data requires interpretation by R. J. Burnside & Associates Limited personnel before use by others.

LEGEND ▼ Water found @ time of drilling ▽ Static Water Level - 2/25/2010	MONITORING WELL DATA Pipe: 20.3 cm dia. steel Screen: 15.6 cm dia. open hole	SAMPLE TYPE AC Auger Cutting SS Split Spoon CS Continuous AR Air Rotary RC Rock Core WC Wash Cuttings
---	---	--

LOG OF DRILLING OPERATIONS

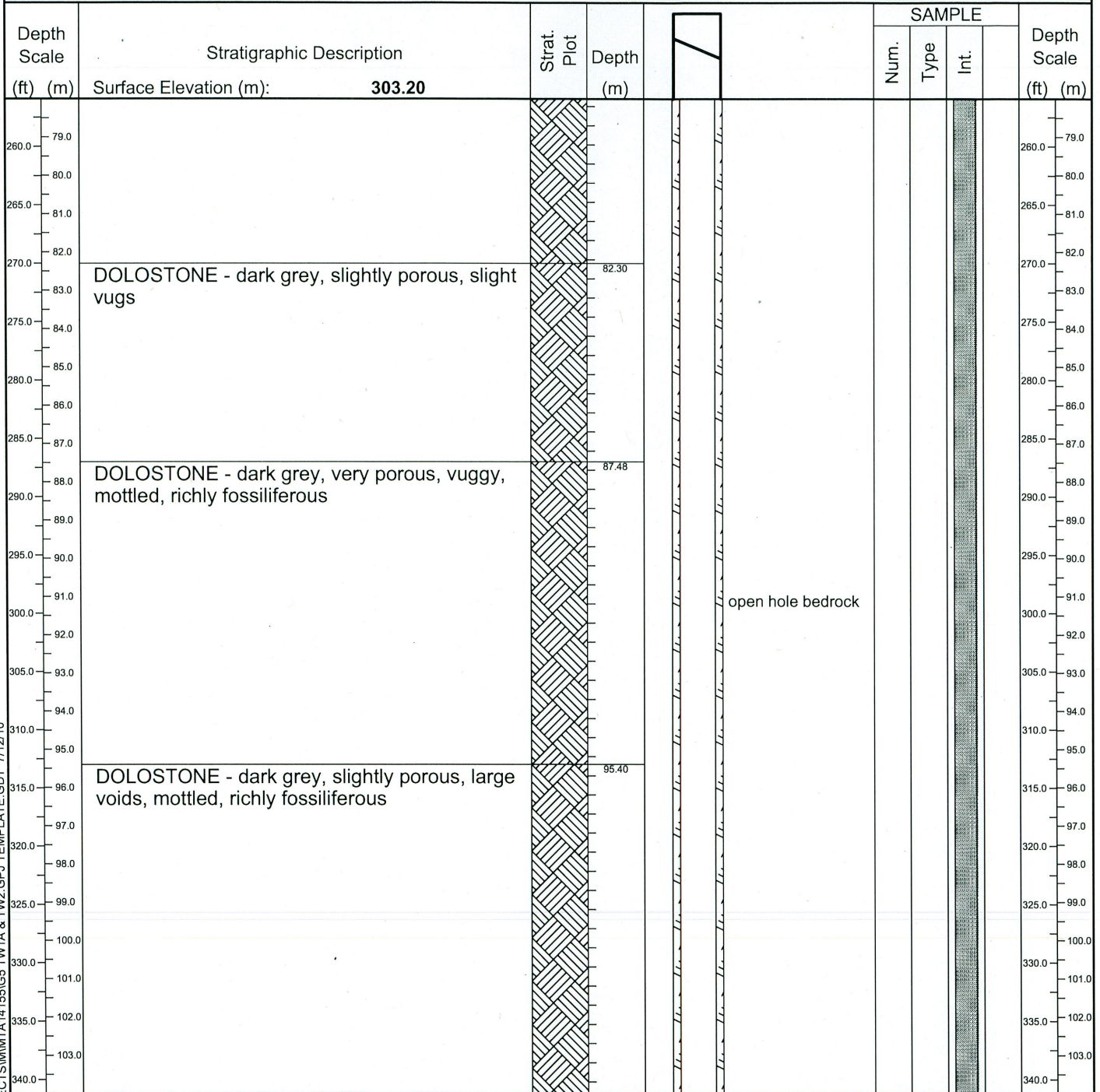


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 telephone (519) 941-5331 fax (519) 941-8120

G5-TW2-08

Page **4** of **5**

Client: Region of Waterloo	Project Name: Cambridge Well Optimization	Logged by: S. Quinlan
Project No.: MTA14155	Location: Cambridge, ON	Ground (m amsl): 303.20
Drilling Co.: Davidson Drilling Limited	Date Started: 11/17/2008	Static Water Level (m amsl): 289.18
Drilling Method: Air Rotary	Date Completed: 11/20/2008	Sand Pack (m amsl): N/A



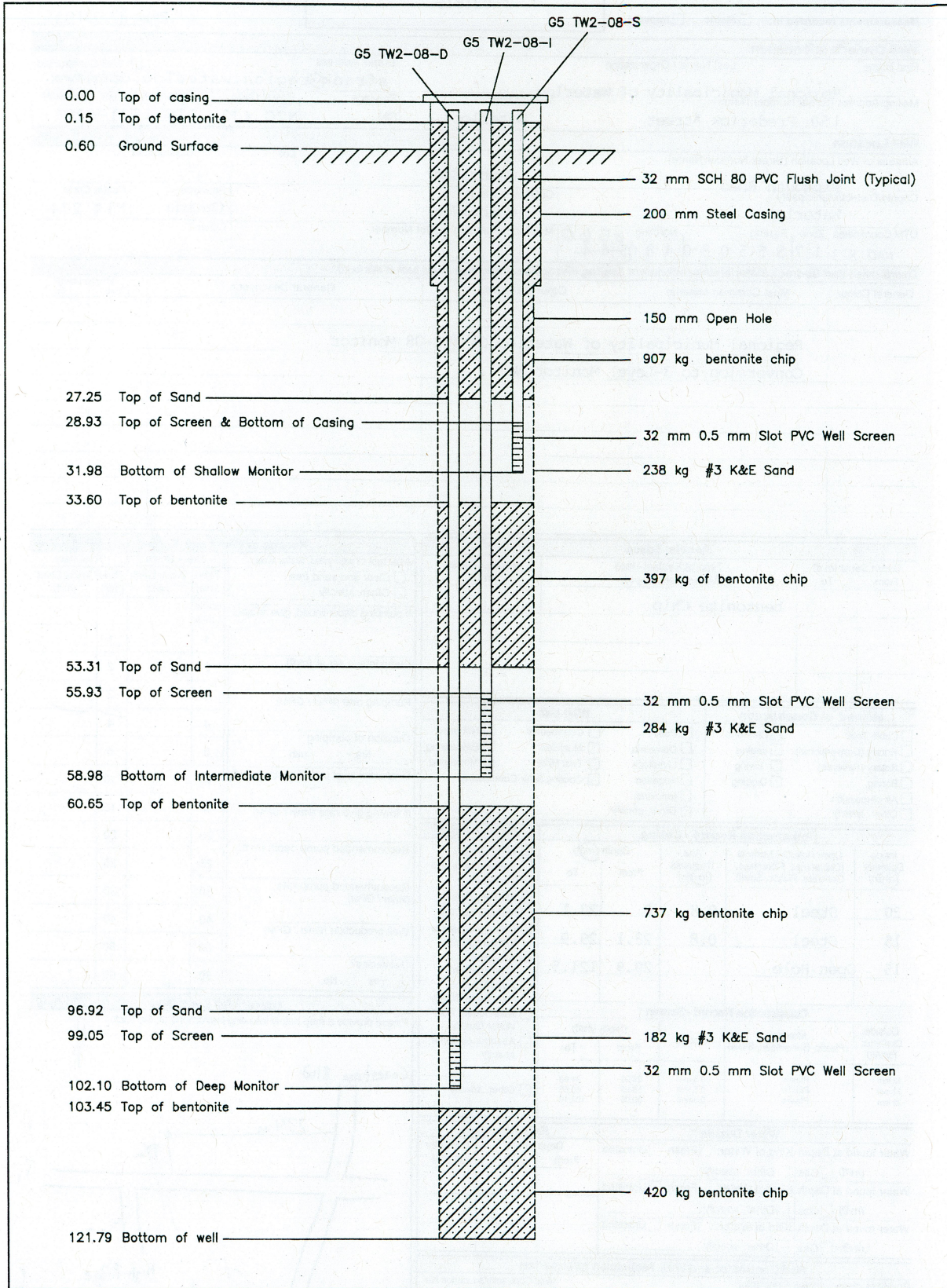
B:\LOG GUELPH P:\GINT\PROJECTS\M\MTA14155\G5_TW2.GPJ TEMPLATE.GDT 7/12/10

Prepared By: **S. Quinlan** Checked By: **J. Baxter** Date Prepared: **11/27/2008**

This borehole log was prepared for hydrogeological and/or environmental purposes and does not necessarily contain information suitable for a geotechnical assessment of the subsurface conditions. Borehole data requires interpretation by R. J. Burnside & Associates Limited personnel before use by others.

LEGEND	MONITORING WELL DATA	SAMPLE TYPE
▼ Water found @ time of drilling ▽ Static Water Level - 2/25/2010	Pipe: 20.3 cm dia. steel Screen: 15.6 cm dia. open hole	AC [Symbol] Auger Cutting CS [Symbol] Continuous RC [Symbol] Rock Core SS [Symbol] Split Spoon AR [Symbol] Air Rotary WC [Symbol] Wash Cuttings

9205794



NOTES

- (1) All measurements referenced to top of casing.
- (2) Well drilled Fall 2008, Monitor constructed May 1, 2009



CLIENT: City of **Guelph**

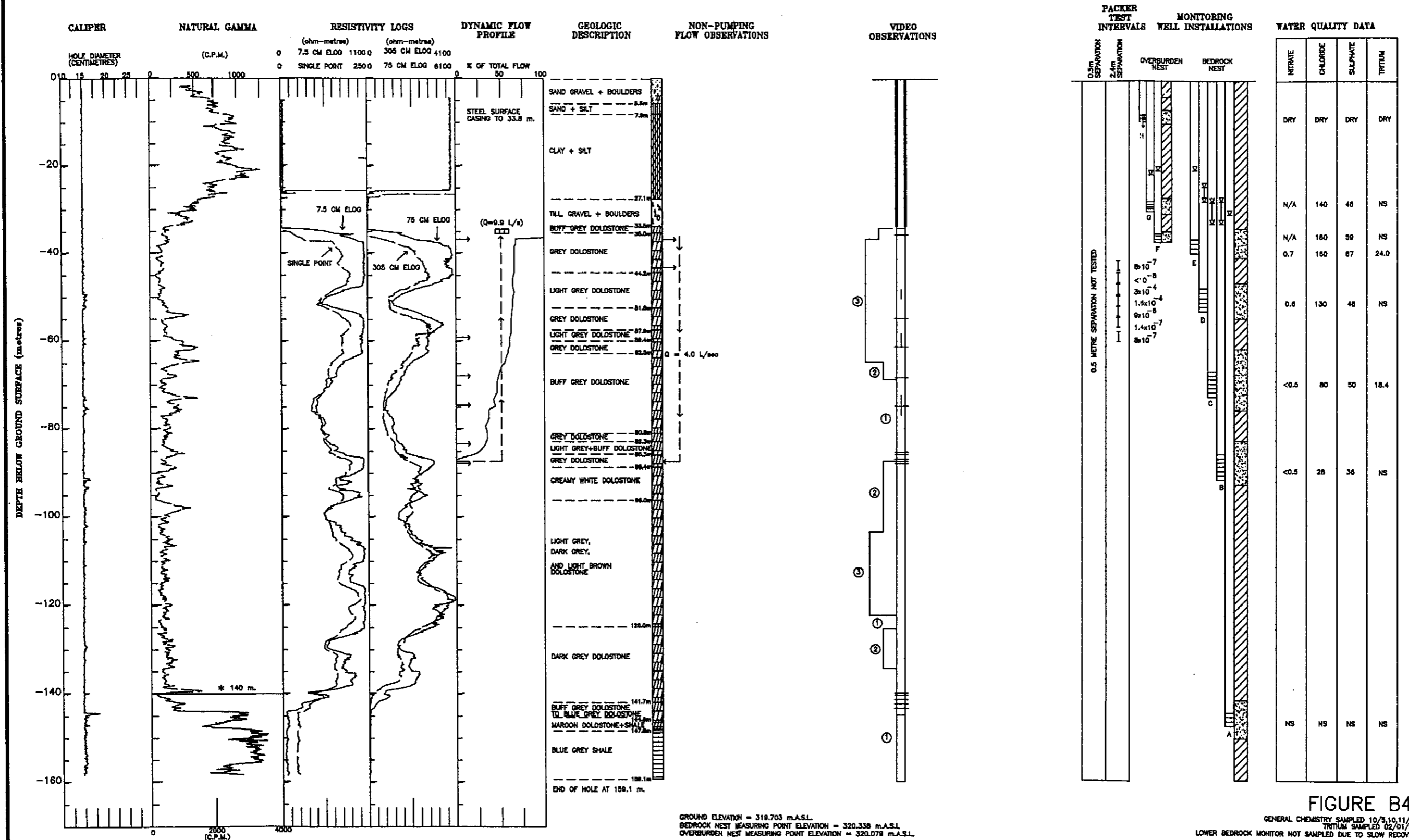
TITLE: **G5-TW2-08 As Constructed**

PROJECT No. 006-110		G:\Lotowater Projects\006 Region of Waterloo\110 G5-TW2-08\Monitor Well Construction.dwg	
DESIGN		REVISION No. 1	SCALE N.T.S.
DRAWN	EH	2009/05/01	
CHECKED			



FIGURE **1**

TEST HOLE/MONITORING WELL OW3/95 PINEBUSH ROAD



GROUND ELEVATION = 319.703 m.A.S.L.
 BEDROCK NEST MEASURING POINT ELEVATION = 320.338 m.A.S.L.
 OVERBURDEN NEST MEASURING POINT ELEVATION = 320.078 m.A.S.L.

FIGURE B4

GENERAL CHEMISTRY SAMPLED 10/5,10,11/95
 TRITIUM SAMPLED 02/01/88
 LOWER BEDROCK MONITOR NOT SAMPLED DUE TO SLOW RECOVERY

OW3-95

1. TRITIUM MONITORING COLLUMS AT 41.0, 51.0, 61.0, 71.0, 81.0, 91.0, 101.0, 111.0, 121.0, 131.0, 141.0, 151.0, 161.0, 171.0, 181.0, 191.0, 201.0, 211.0, 221.0, 231.0, 241.0, 251.0, 261.0, 271.0, 281.0, 291.0, 301.0, 311.0, 321.0, 331.0, 341.0, 351.0, 361.0, 371.0, 381.0, 391.0, 401.0, 411.0, 421.0, 431.0, 441.0, 451.0, 461.0, 471.0, 481.0, 491.0, 501.0, 511.0, 521.0, 531.0, 541.0, 551.0, 561.0, 571.0, 581.0, 591.0, 601.0, 611.0, 621.0, 631.0, 641.0, 651.0, 661.0, 671.0, 681.0, 691.0, 701.0, 711.0, 721.0, 731.0, 741.0, 751.0, 761.0, 771.0, 781.0, 791.0, 801.0, 811.0, 821.0, 831.0, 841.0, 851.0, 861.0, 871.0, 881.0, 891.0, 901.0, 911.0, 921.0, 931.0, 941.0, 951.0, 961.0, 971.0, 981.0, 991.0, 1001.0



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Appendix C

Monitoring Data (Pumped Volumes and Hydrographs)



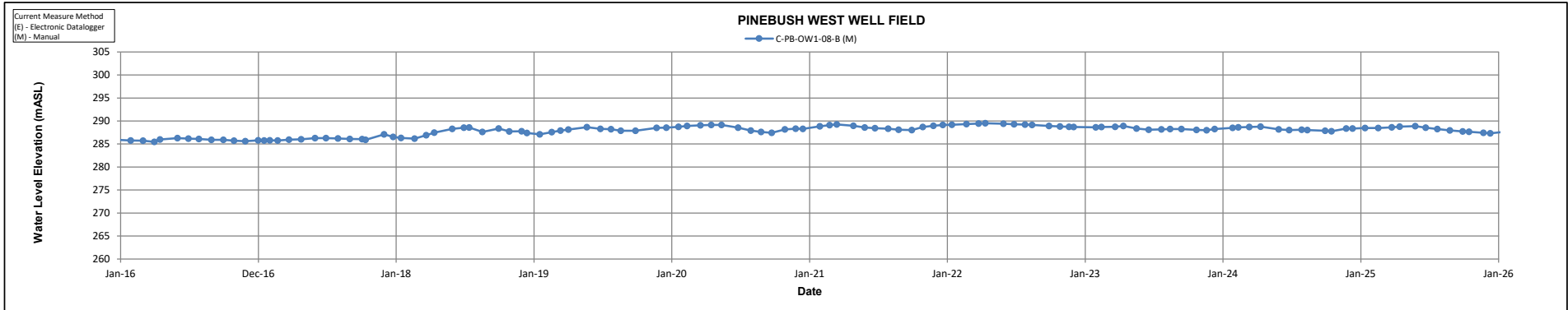
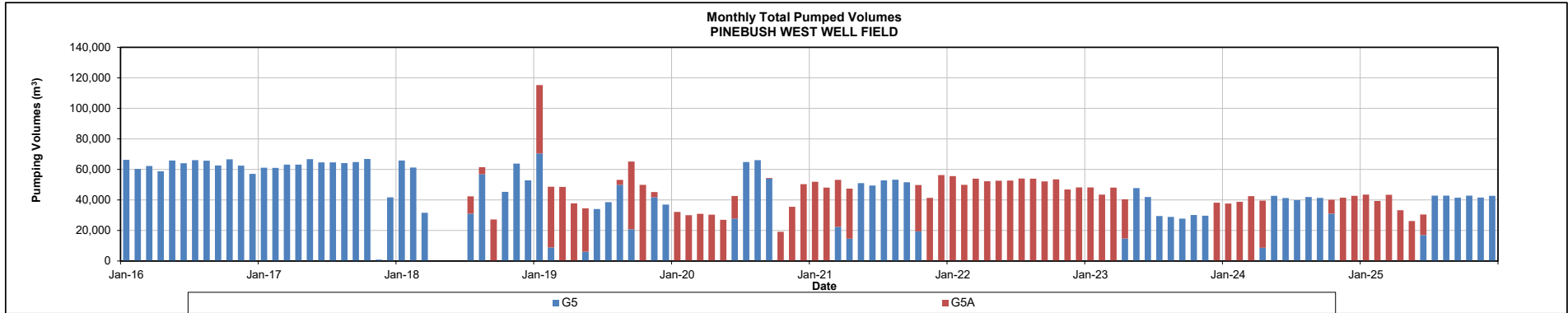
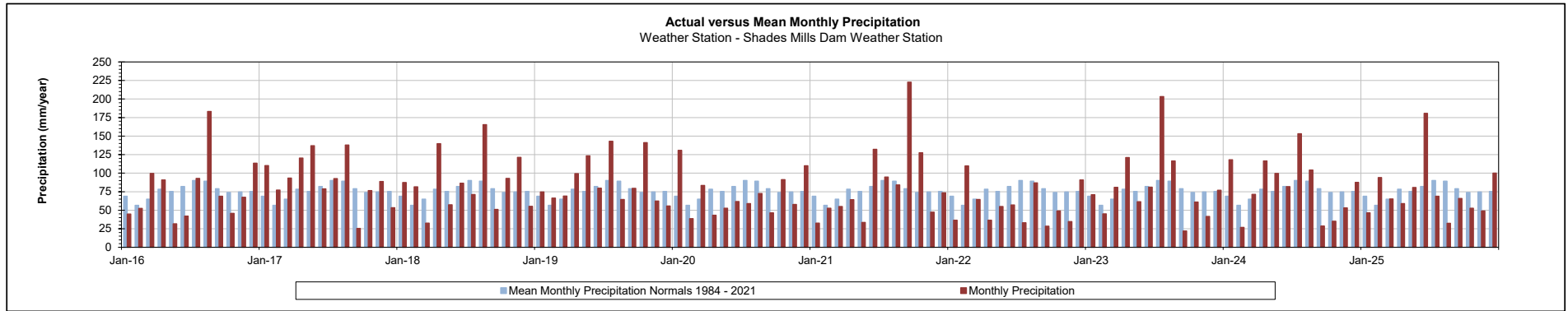
TABLE C-1
WELL FIELD WATER PRODUCTION SUMMARY
REGION OF WATERLOO - 2025 GROUNDWATER MONITORING REPORT



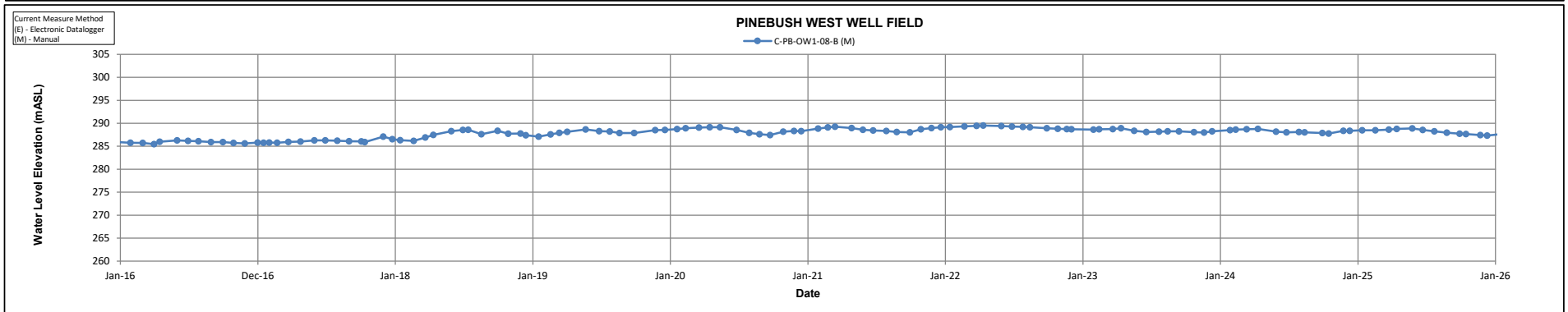
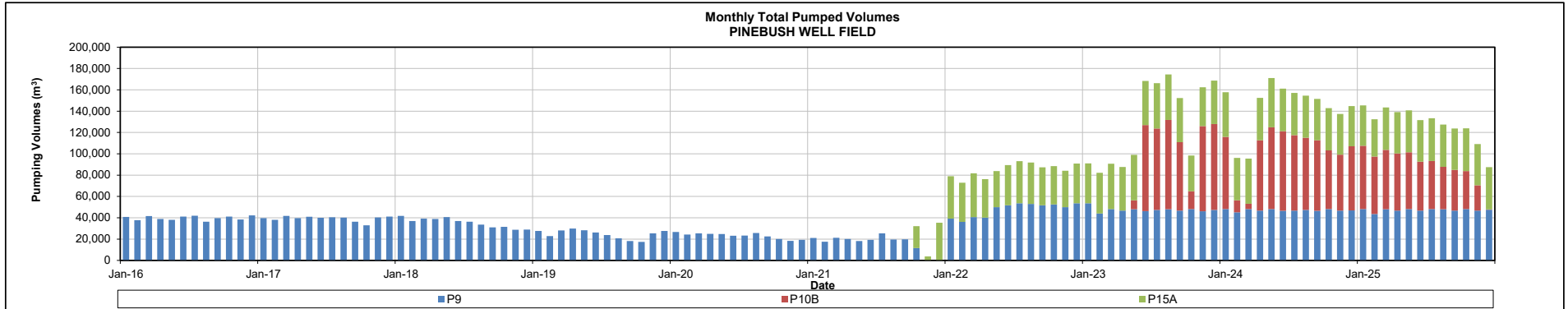
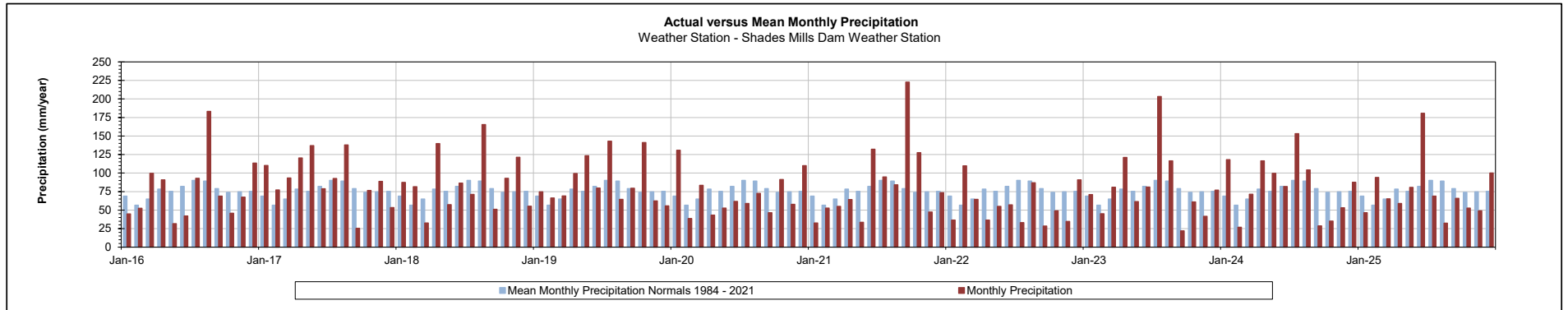
Well Field	Major or Minor Supply	Production Well Name	Status	Permit to Take Water Details			2021 Production Summary			2022 Production Summary			2023 Production Summary			2024 Production Summary			2025 Production Summary		
				MOE Permit Number ¹	Permitted Capacity (total m ³ /year)*	Permitted Rate (L/s)*	Total Production Well Volume (total m ³ /year)	Average Daily Rate (m ³ /day)	Average Rate (L/s)	Total Production Well Volume (total m ³ /year)	Average Daily Rate (m ³ /day)	Average Rate (L/s)	Total Production Well Volume (total m ³ /year)	Average Daily Rate (m ³ /day)	Average Rate (L/s)	Total Production Well Volume (total m ³ /year)	Average Daily Rate (m ³ /day)	Average Rate (L/s)	Total Production Well Volume (total m ³ /year)	Average Daily Rate (m ³ /day)	Average Rate (L/s)
Pinebush West	Major	G5 G5A	Supply Supply	P-300-6117976847	1,576,800	50	314,562	862	10	239	1	0	250,303	686	8	246,986	677	8	271,177	743	9
					1,576,800	50	291,636	799	9	625,308	1,713	20	203,778	558	6	242,972	666	8	199,168	546	6
		Well Field Total				1,576,800	50	606,198	1,661	19	625,547	1,714	20	454,081	1,244	14	489,958	1,342	16	470,345	1,289

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

REGION OF WATERLOO
 2025 GROUNDWATER MONITORING REPORT -
 PINEBUSH WEST G5/G5A WELL FIELD

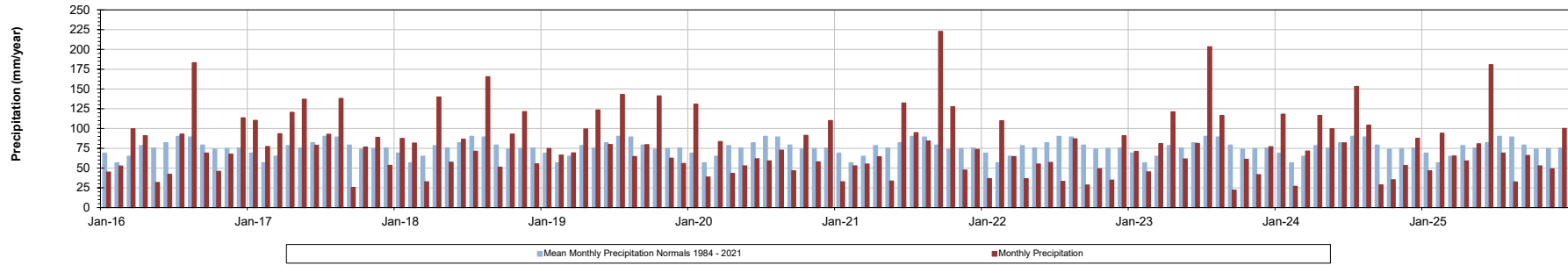


REGION OF WATERLOO
 2025 GROUNDWATER MONITORING REPORT -
 PINEBUSH WEST G5/G5A WELL FIELD

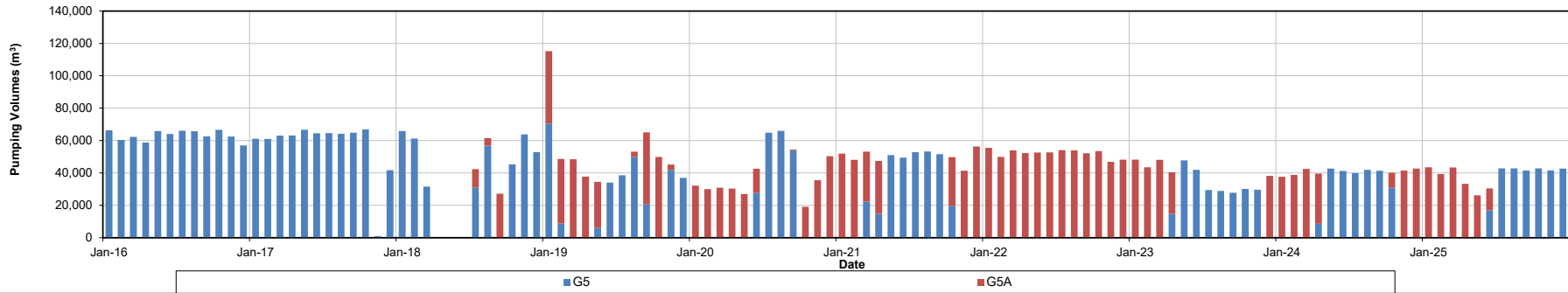


REGION OF WATERLOO
 2025 GROUNDWATER MONITORING REPORT -
 PINEBUSH WEST G5/G5A WELL FIELD

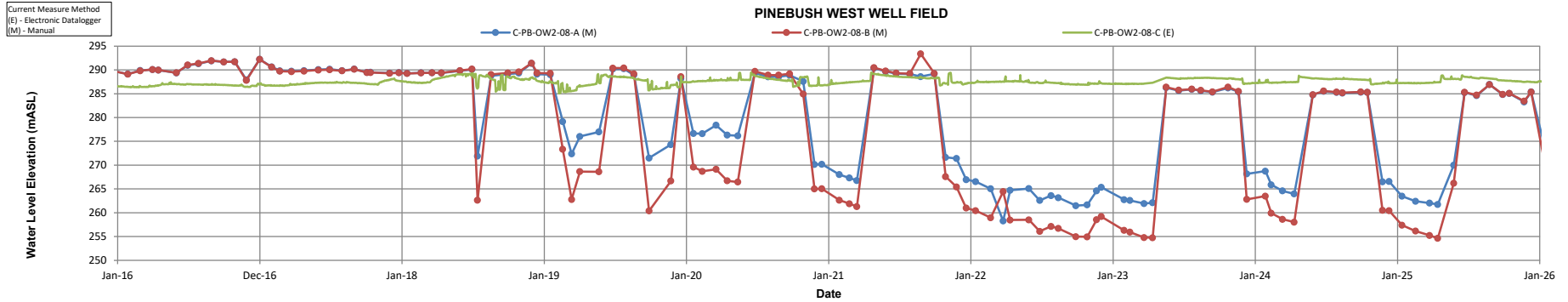
Actual versus Mean Monthly Precipitation
 Weather Station - Shades Mills Dam Weather Station



Monthly Total Pumped Volumes
 PINEBUSH WEST WELL FIELD

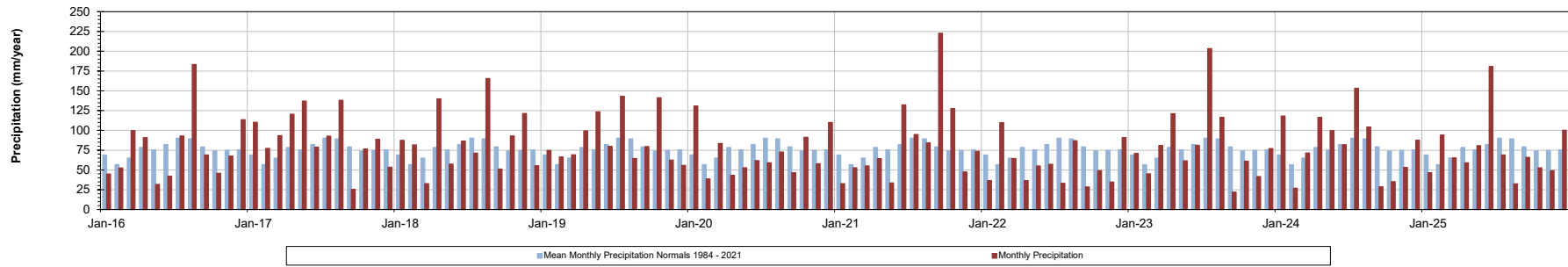


PINEBUSH WEST WELL FIELD

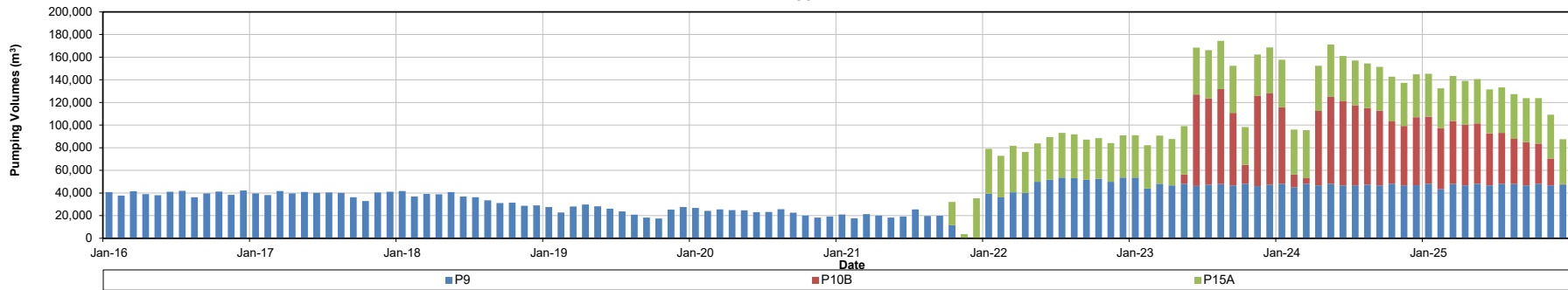


REGION OF WATERLOO
 2025 GROUNDWATER MONITORING REPORT -
 PINEBUSH WEST G5/G5A WELL FIELD

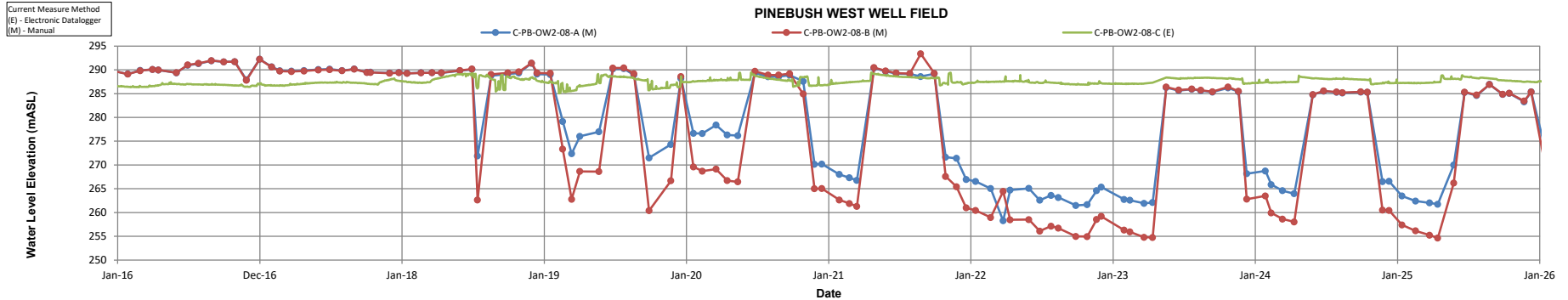
Actual versus Mean Monthly Precipitation
 Weather Station - Shades Mills Dam Weather Station



Monthly Total Pumped Volumes
 PINEBUSH WELL FIELD

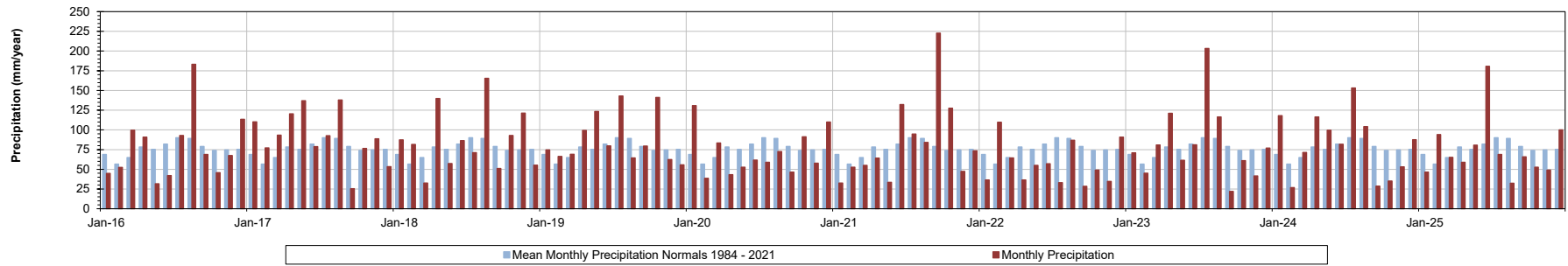


PINEBUSH WEST WELL FIELD

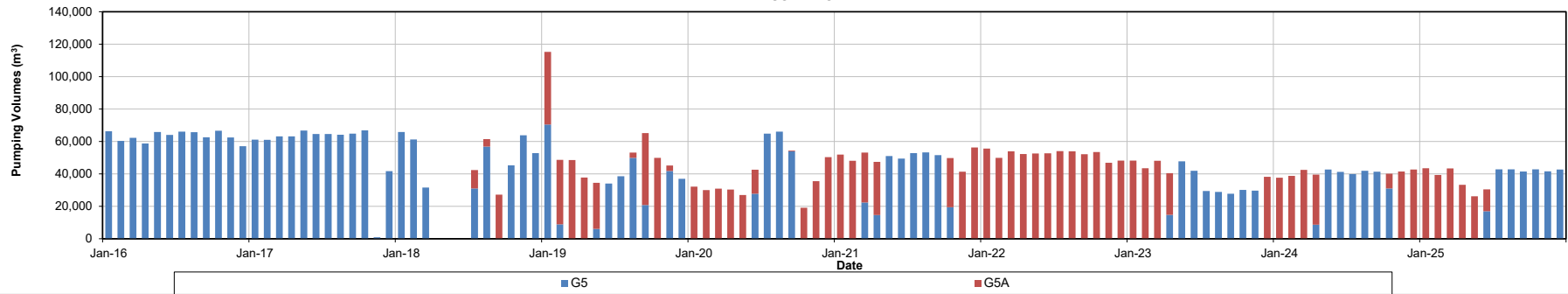


REGION OF WATERLOO
 2025 GROUNDWATER MONITORING REPORT -
 PINEBUSH WEST G5/G5A WELL FIELD

Actual versus Mean Monthly Precipitation
 Weather Station - Shades Mills Dam Weather Station

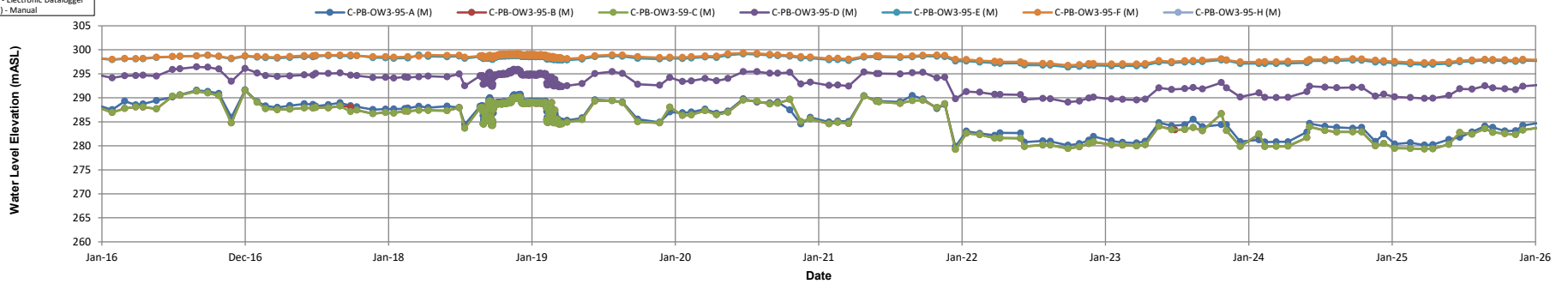


Monthly Total Pumped Volumes
 PINEBUSH WEST WELL FIELD



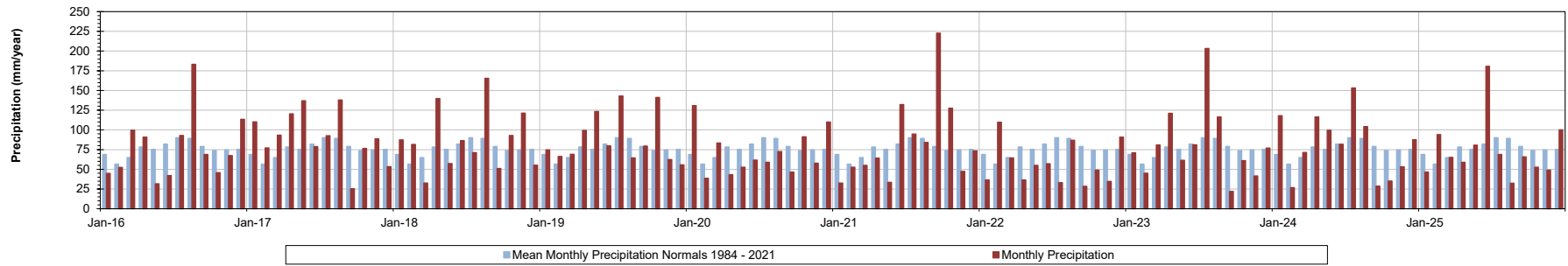
PINEBUSH WEST WELL FIELD

Current Measure Method
 (E) - Electronic Datalogger
 (M) - Manual

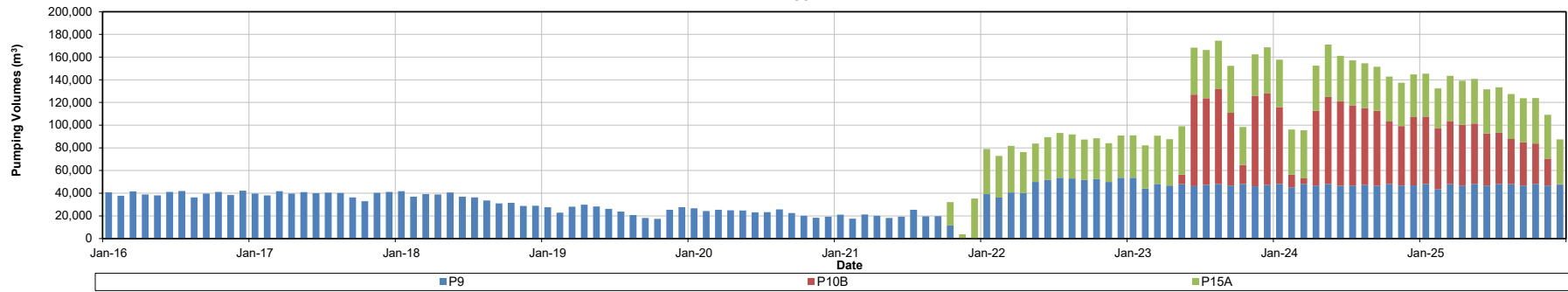


REGION OF WATERLOO
 2025 GROUNDWATER MONITORING REPORT -
 PINEBUSH WEST G5/G5A WELL FIELD

Actual versus Mean Monthly Precipitation
 Weather Station - Shades Mills Dam Weather Station

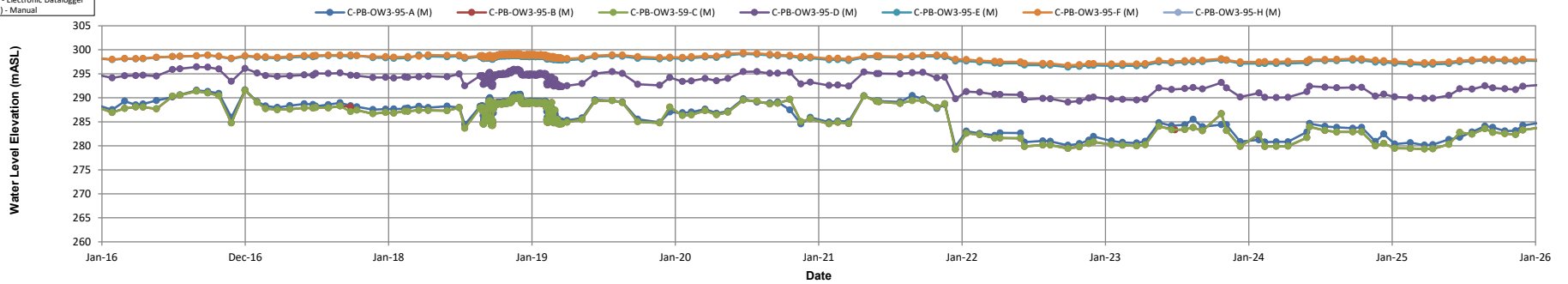


Monthly Total Pumped Volumes
 PINEBUSH WELL FIELD



PINEBUSH WEST WELL FIELD

Current Measure Method
 (E) - Electronic Datalogger
 (M) - Manual





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Appendix D

Precipitation Data

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

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

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

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

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

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

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

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

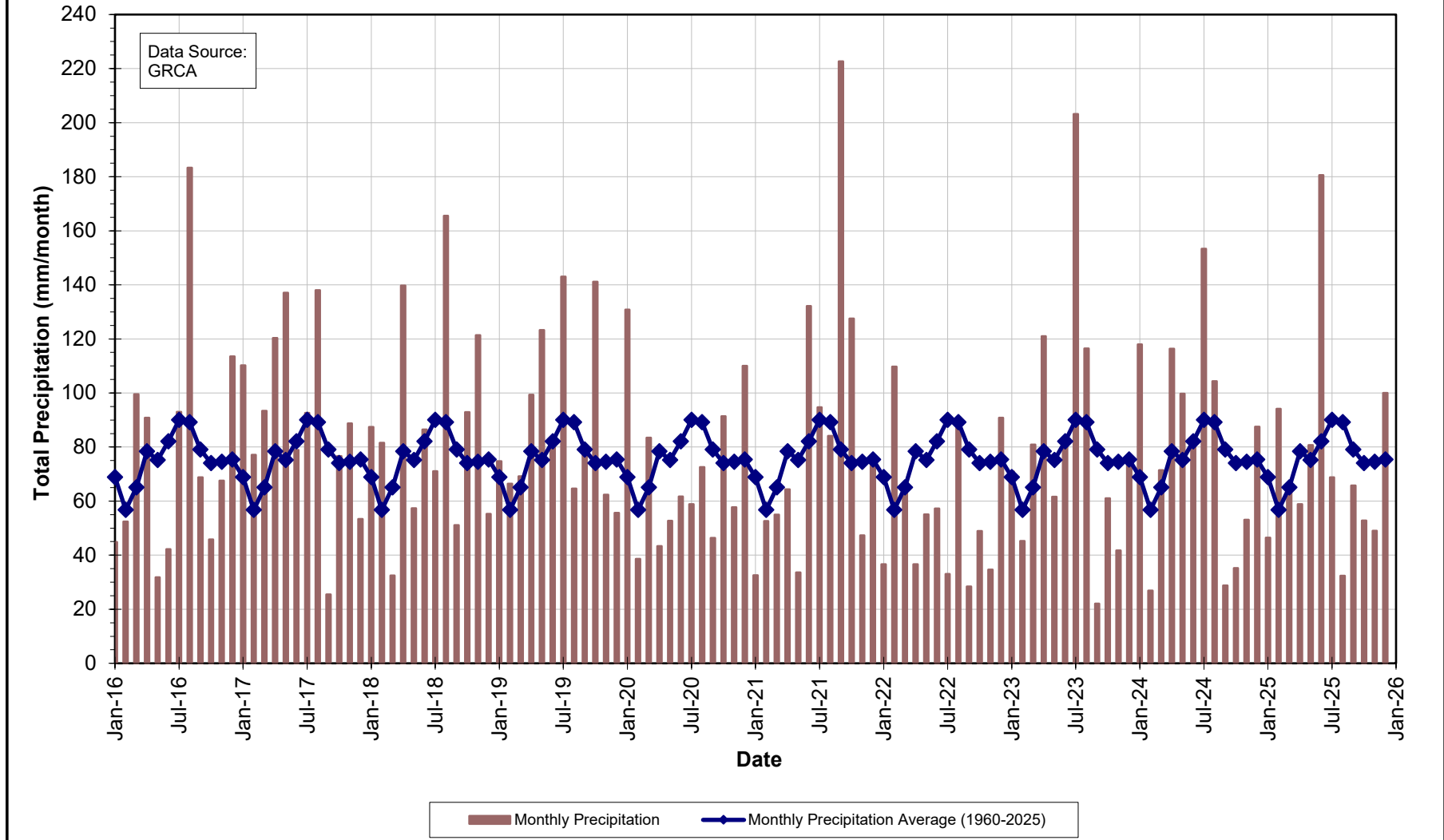
Year	Roseville Weather Station Established 1972		
	Annual Precipitation (mm)	30-yr NORMAL Precipitation 1981-2010 (mm)	Difference (mm)
2016	899	919	-20
2017	882	919	-37
2018	905	919	-14
2019	957	919	38
2020	817	919	-102
2021	832	919	-87
2022	637	919	-282
2023	945	919	26
2024	856	919	-63
2025	786	919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

NOTES:

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

Region of Waterloo – 2025 Groundwater Monitoring Report

Figure D.1
Shade's Mills Dam
Monthly Precipitation





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Appendix E

Monitoring Program Overview

GROUNDWATER LEVEL MONITORING PROGRAM PROCEDURES

E.1 Overview

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

E.1.1 Production Well Pumping and Water Levels

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

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

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

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

E.1.2 Monitoring Wells and Surface Water levels

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

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

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

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

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

E.1.3 Climatological Data

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

E.2 Groundwater Level Collection Protocols

E.2.1 Groundwater Level Monitoring Network Summary Well Checklist

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

E.2.2 Well Inspection

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

E.2.3 Monitoring Well Manual Water Level Measurement Procedure

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

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

E.2.4 Downloading of Water Levels from Electronic Dataloggers Procedure

For Non-Vented (Absolute) Datalogger Models:

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

- 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.

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- 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.

