



BURNSIDE

**2025 Biennial Groundwater Monitoring
Report – Shade’s Mills Well Field
(G7, G8, G38, G39, G40)**

The Region of Waterloo



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1.0 Introduction

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

The Permit to Take Water (PTTW) for the Shade’s Mills Well Field (G7, G8, G38, G39, G40), (3004-A9GHYU) requires submission of a well field specific biennial report to the Ministry of Environment, Conservation and Parks (MECP) which documents production well pumping volumes and water levels in specific monitoring wells during 2024 and 2025. This report has been prepared to meet the reporting conditions of the PTTW for 2024 and 2025. A copy of the PTTW is included in Appendix A.

The location of the Shade’s Mills Well Field is shown on Figure 1 and the production wells in Cambridge are shown on Figure 2 with the monitoring network for G7, G8, G38, G39 and G40 shown on Figure 3. Well records and well schematics for the production and monitoring wells are found in Appendix B.

1.1 Scope of Work

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

The Region has developed a monitoring program for Shade’s Mills Well Field in accordance with PTTW 3004-A9GHYU which consists of the following activities:

- Measuring the daily volume pumped from the G7, G8, G38, G39 and G40 production wells (Condition 4.1 of the PTTW);
- Measuring the water levels in C-SM-SM1-02-A, C-SM-SM3-07-ABC, C-SM-OW4-14-A, C-SM-OW5-14-A, C-SM-OW1-11-AB (Condition 4.2 of the PTTW);
- Review of precipitation data from the nearest GRCA/Environment Canada weather station; 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 Shade’s Mills Well Field is located in the southeast portion of Cambridge south of the Shade’s Mills Reservoir and Conservation Area, near Franklin Boulevard and Clyde Road (Figure 2). Wells G38, G39 and G40 are located just to the southwest of Shade’s Mills Reservoir and north of Mill Creek on the Shade’s Mills Water Treatment Plant property, east of Franklin Boulevard. Production wells G7 and G8 are located south of Clyde Road approximately 1 km to the east of G38 and G39 (Figure 3). The closest nearby well fields are the Clemens Mill Well Field located to the north and the Elgin Street Well and Middleton Well Fields are located to the south (Figure 2). The closest surface water feature to the G7, G8, G38, G39 and G40 site is Mill Creek (Figure 3).

2.1.1 Pumping Wells

Well records for the production wells are found in Appendix B. The Shade’s Mills Well Field consists of five production wells: G7, G8, G38, G39 and G40. The Shade’s Mills Well Field once contained wells G30 through G36, constructed within the overburden on the north side of the reservoir. These wells were constructed in 1987 and subsequently abandoned in 2000 due to poor aesthetic water quality.

Production well G7 was constructed in 1958. The well was constructed approximately 0.9 m into the top of bedrock and is screened in overburden (AFA2) between 277.3 and 274.2 masl. Production well G8 was constructed in 1965. The well was constructed to the top of bedrock at a depth of 17.7 metres below ground surface (mbgs) and is screened in overburden (AFA2) between 276.6 and 273.6 masl.

Production Wells G38 and G39 were constructed in 1995. G38 was screened from 29.9 mbgs to 39.2 mbgs in sediments interpreted to be deep overburden outwash sand and gravels deposits of AFA2. In 2004, a liner was installed and grouted in place to a depth of 35.3 mbgs to rectify sand production problems during operation from the upper section of the screen (Stantec, 2013). This limits the open interval for flow within the screen to the lower 3 m of screen (258.9 to 255.0 masl). Production Well G39 was constructed with the base of the well installed 0.2 m above the top of bedrock at 43.7 mbgs and screened across sediments of the AFA2 aquifer from 36.9 mbgs to 43.3 mbgs.

Production well G40 was constructed in 2011 within the deep overburden deposits of AFA2 and is screened from 33.6 mbgs to 40.5 mbgs. The well was constructed as a back-up supply to production wells G38 and G39 and was not connected to the municipal system until 2020.

Because of their proximity to the Shade’s Mills Reservoir and Mill Creek, production wells G38 and G39 were classified as groundwater under the direct influence of surface

water (GUDI) with effective filtration (Stantec, 2002). Production well G40, also located near the Shade’s Mills Reservoir is classified as GUDI (Stantec, 2023).

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

Table 1: Production Well Construction Details

Production Well ID	Year Constructed	Casing Diameter (mm)	Open Hole Diameter (mm)	Open Hole Interval (mbgs)	Aquifer
G7	1958	406	406	14.6 – 17.7	AFA2
G8	1965	400	406	14.5 – 17.5	AFA2
G38	1994	356	356	35.3 - 39.3	AFA2
G39	1995	355	355	36.9 – 43.3	AFA2
G40	2011	324	292	33.6 – 40.5	AFA2

The water taking volumes for the Shades Mills Well Field are regulated by Condition 3.2 of the PTTW and are summarized in Table 2 below.

Table 2: Water Takings 2024/2025

Wells	Permitted Max. Daily Water Taking (m ³)	2024			2025		
		Avg. Daily Water Taking (m ³)	Max Taken per Day (m ³)	Total Pumping Volume (m ³)	Avg. Daily Water Taking (m ³)	Max Taken per Day (m ³)	Total Pumping Volume (m ³)
G7, G8, G38, G39, G40	15,079.680	4,355	7,512	1,589,252	5,069	7,998	1,850,183

Condition 3.3 of the PTTW specifies that the combined daily water taking from the well field must not exceed an annual daily average of 12,690.432 m³/day from any combination of the five listed wells. As shown in Table 2, this requirement was met in both 2024 and 2025.

The Region of Waterloo's SCADA system records total daily water taking volumes including the dates and times of water takings, the rates of pumping, and calculations of the total amounts of water pumped per day for each supply well, which complies with condition 4.1 of the PTTW.

Pumping volumes from the well field ranged from 16,641 m³/month to 88,036 m³/month in 2024, and from 115,201 m³/month to 192,221 m³/month in 2025. In total,

1,589,252 m³ was produced at this well field in 2024 and 1,850,183 m³ was produced in 2025. Pumping volumes in 2025 were higher than the previous five years but below the permitted volume of 4,632,008 m³ per year (Table C-1).

2.1.1 Monitoring Wells

The Region recently updated their well naming protocol and as a result, the well names in EQuIS may vary from the names listed on the PTTW. The well names on the PTTW are shown below along with the updated name that is used by the Region. The updated Region names will be used throughout this report.

Table 3: Well Nomenclature

Monitoring well names as they appear on the PTTW	Revised well names consistent with Region nomenclature
C-SM-SM1-02	C-SM-SM1-02-A
C-SM-SM3ABC-07	C-SM-SM3-07-ABC
C-SM-OW4-14	C-SM-OW4-14-A
C-SM-OW5-14	C-SM-OW5-14-A
C-SM-OW1AB-11	C-SM-OW1-11-AB

The Region has been systematically decommissioning old wells due to age and poor condition; and in 2016, the Region decommissioned wells C-SM-TW3-94 and C-SM-OW1-94. Monitoring wells C-SM-OW1A-11 and C-SM-OW1B-11 were added to the monitoring program to replace near production well water level response data previously collected in the now decommissioned wells. Monitoring wells C-SM-SM1-02-A and C-SM-OW1-11-AB are located beside G40 and about 50 m north of G39. C-SM-SM3-07-ABC is located about 1 km northeast of G38/G39. C-SM-OW4-14-A is located on the G7 well site and C-SM-OW5-14-A is located on the G8 site. The locations of the monitoring wells are shown in Figure 3.

Construction and monitoring details of C-SM-SM1-02-A, C-SM-SM3-07-ABC, C-SM-OW4-14, C-SM-OW5-14, C-SM-OW1-11-AB are described in Table 4 below. Well records for the monitoring wells are provided in Appendix B.

Table 4: Monitoring Well Construction Details

Monitoring Well ID	Year Constructed	Screened Depth (mbgs)	Screened Formation	Closest Pumping Well (Distance to Well (m))
C-SM-SM1-02-A	2002	12.2 – 15.5	AFA2	G40 (beside)
C-SM-SM3-07-A	2007	91.4 – 109.7	Gasport	G38/G39 (1 km)
C-SM-SM3-07-B	2007	48.8 - 64	Guelph	G38/G39 (1 km)
C-SM-SM3-07-C	2007	27.4 - 30.5	Guelph	G38/G39 (1 km)

Monitoring Well ID	Year Constructed	Screened Depth (mbgs)	Screened Formation	Closest Pumping Well (Distance to Well (m))
C-SM-OW4-14-A	2014	14.4 – 17.5	AFA2	G7 (15 m)
C-SM-OW5-14-A	2014	14.3 – 17.3	AFA2	G8 (5 m)
C-SM-OW1-11-A	2011	47.3 - 50.3	Guelph	G40 (17 m)
C-SM-OW1-11-B	2011	32.9 - 36	AFA2	G40 (17 m)

2.2 Regional Geology and Hydrostratigraphy

The following sections provide a brief overview of the regional geology and hydrogeology of the study area. The surficial geology at the site based on regional OGS mapping is provided on Figure 4. Representative cross-sections showing the stratigraphy in the vicinity of the Shade’s Mills Well Field (G7, G8, G38, G39, G40) are included as Figures 5, 6 and 7 to visualize the stratigraphy described in this section. The cross-section locations are provided in Figure 3.

Note that the cross-sections are provided as a visual aid and do not necessarily contain all wells in the monitoring program for the Shade’s Mills Well Field. The layers displayed were generated from results of the Tier 3 Well Assessment Update Project (Aqua Insight et al, 2023) and are not significantly changed from the previous Tier 3 Assessment (Golder, 2011).

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 on Figure 4). Ice-contact kame stratified sands and gravels (Unit 6 on 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 Shade’s Mills, 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). These units are described in more detail 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 occasional stony texture. The Port Stanley Till was deposited by ice advancing from the Erie-Ontario ice lobe. In other parts of the Region, Bajc and Shirota (2007) have also used unit ATB1 to represent Tavistock, Mornington and Upper Maryhill Till. 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.

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 the Shade’s Mills Well Field are shown on the cross sections in Figures 5, 6 and 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 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.

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

Borehole logs of the Shade’s Mills Well Field are included in Appendix B.

The presence of surficial deposits of fine-grained sandy silt to silty sand till (ATA2) is documented to be of variable thickness in and around the area of the Shade’s Mills Well Field. The Wentworth Till is documented to be present north of G7 and G8, pinching out west around Mill Creek and is interpreted to be absent in the vicinity of G38, G39 and G40 (Stantec, 2016). These three wells are installed within a bedrock valley where bedrock is at depths of up to 43 m at the center of the valley (Figure 5).

Near G7 and G8, bedrock depth is only approximately 17 m and is outside the valley. Sand and gravel outwash deposits (AFA2) are generally 5 to 15 m thick outside the valley and were recently interpreted to infill the bedrock valley near G38 (Golder, 2011). AFA2 is interpreted to be the main production aquifer for the Shade’s Mills wells (Figure 6).

At G38, G39 and G40, the AFA2 deposit extends from surface to the bedrock and is up to 43 m thick. South of the well field the AFA2 deposits become interbedded with fine grained deposits (ATA3) (Stantec, 2016). All the production wells in the well field are installed at the base of the overburden aquifer near the bedrock surface, however, within the bedrock valley, the screened intervals are at lower elevation than at G7 and G8. The bedrock underlying the well field area is the Guelph Formation (Figure 7).

3.0 2024 / 2025 Results

The following sections summarize groundwater levels at the monitoring wells in relation to precipitation, 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 Shades Mills well field is the Shades Mills Dam station located within the

well field. The closest Environment Canada station is Waterloo International Airport (WIA) located about 12 km west/northwest from the well field. The locations of the meteorological stations are shown on Figure 1. Annual precipitation data from the past 10 years for all stations are compared with long term averages in Table D.1, Appendix D. Monthly precipitation data for the past 10 years at Shades Mills Dam are shown on Figure D.1, Appendix D. At the Shades Mills Dam station, the long-term average was calculated from when measurements started until the end of 2025. The Roseville and Region of Waterloo International Airport (WIA) has “Climate Normals” calculated by Environment Canada for 1981 to 2010.

Annual 2024 / 2025 precipitation data for the GRCA and Environment Canada meteorological station closest to the Shades Mills well field are presented in Table 5 below. In 2024, WIA was missing 6 days of data and 6 days in 2025. As a result, the precipitation totals may be under reported at this location.

Table 5: Summary of Precipitation Data

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

Sources: Environment Canada (1), GRCA (2)
^A 1981 to 2010 Normal ^B Average annual precipitation since monitoring began to the end of 2025

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

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

3.2 Monitoring Results

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

C-SM-SM1-02-A

Monitoring well C-SM-SM1-02-A is located beside G40 and is about 50 m north of G39. The well is screened in the shallow overburden (AFA2) from 12.2 to 15.5 below grade and has been monitored since July 2004. From 2015 to 2025 water levels ranged from 280.4 to 282.3 masl. No changes to the historical trends were observed in 2024 / 2025. The water levels display a seasonal response to precipitation with highest levels typically in the spring with declines throughout the summer months.

C-SM-SM3-07-ABC

The monitoring well nest C-SM-SM3-07-ABC is located about 1 km northeast of G38 / G39 and has been monitored since October 2007. The well monitors three levels:

- Screen A is completed in the Gasport Formation at a depth of 107 m below grade with the screened interval between 204.6 and 186.3 masl;
- Screen B is completed in the Guelph Formation at a depth of 64 m below grade with the screened interval between 247.2 and 232 masl; and
- Screen C is completed in the upper portion of the Guelph Formation at a depth of 30.5 m below grade with the screened interval between 268.6 and 265.5 masl.

Water levels observed in the A screen in 2024 / 2025 were consistent with historical values. Historically there has been no noticeable water level response to changes in pumping at the Shade’s Mills Well Field, as noted when no rise in water levels occurred when all production wells were off-line in February 2016 and in October and November 2020. It should be noted that a previous review has indicated that the A screen is influenced by the pumping of well G18, located in the Clemens Mills well field approximately 1 km away (Figure 5).

Water levels in the B screen varied within a 5 m range and showed a similar pattern to the A screen suggesting impacts from Clemens Well G18. Water levels in 2024 / 2025 varied between 285.64 masl and 287.2 masl, which is consistent with historical data.

Water levels in the C screen measured in 2024 / 2025 are consistent with historical levels. Water levels in the C screen vary within a 2.8 m range in response to variations in climatic conditions and show no response to pumping. The well displays similar trends as other wells in the Region located outside the influence of pumping.

C-SM-OW4-14-A

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C-SM-OW4-14-A is located adjacent to G7 and measures water levels in the overburden (AFA2). Monitoring at the well started in December 2014 and water levels ranged from 280.2 to 282 masl.

Water levels observed in 2024 / 2025 were consistent with historical values. A review of water levels at OW4-14 suggests that the well is influenced primarily by climate conditions, with a minor response observed due to pumping at G7 (Stantec, 2016). The water levels at OW4-14 also shows a typical seasonal trend with highest levels typically in the spring and declining throughout the summer months. An increase in water levels occurs after a large precipitation event in July 2024.

C-SM-OW5-14-A

C-SM-OW5-14-A is located adjacent to G8 and measures water levels in the overburden (AFA2). Water levels vary from 280.3 masl to 283.4 masl and daily fluctuations of up to 1 m are apparent, indicating the well is influenced by daily G8 pumping cycles.

Water levels observed in 2024 / 2025 were consistent with historical values. Water levels at C-SM-OW5-14-A also show seasonal fluctuations of about 2 m per year with water levels generally lowest in January and highest in the middle of the year (May to September).

C-SM-OW1-11-AB

The monitoring well nest C-SM-OW1-11-AB is located beside G40, about 50 m north of G39 and has been monitored since February 2016. The well monitors two levels:

- Screen A is completed in the Guelph Formation at a depth of 50.3 m below grade with the screened interval between 248.6 and 245.5 masl; and
- Screen B is completed in the overburden (AFA2) at a depth of 36 m below grade with the screened interval between 262.9 and 259.8 masl.

Water levels observed in 2024 / 2025 were consistent with historical values. Previous testing (Stantec, 2013) indicated that the A and B screens responded to pumping of G40, but that the wells were also impacted by pumping at Clemens Mills and Middleton. Water levels in the A screen from 2016 to 2025 varied from about 274.4 masl to 282.3 masl. A seasonal trend is not apparent in the data suggesting that the wells are influenced by pumping. Water levels also show a general increase when pumping at G39 and G40 is decreased. Water levels in the B screen show a similar pattern to the A screen but more subdued. Water levels in the B screen from 2016 to 2025 have varied between 278.2 masl and 281.3 masl.

4.0 Impact Assessment

4.1 Well Interference

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

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

There were no well interference complaints related to pumping at the Shade's Mills Well Field in 2024 and 2025, therefore both condition 5.1 and 5.2 were met.

The GRCA land surrounding the Shade's Mills Conservation Area is the only property that is unserved for municipal water supply within 500 m of the Shade's Mills wells. In the event that a well interference complaint is received, the Region has a Well Interference Policy in place. A copy of the policy is presented in Appendix F of the 2019 Biennial Groundwater Monitoring Report - Multiple Well Fields (Burnside, 2020). The PTTW database indicates two groundwater taking permits associated with remediation systems (at the Cambridge Landfill) consisting of three pumping wells each (Figure 3).

Other water takings registered in the MECP PTTW database within 2 km of the well field are mapped on Figure 3 and summarized below in Table 6.

Table 6: PTTWs in Vicinity of Shade’s Mills Well Field (G7, G8, G38, G39, G40)

Permit Number	Permit Holder	Purpose	Max Liters per Day	Distance from Closest Supply Well	Expiry Date	Source Type
3823-C4WJJE	Region of Waterloo	Remediation	950,400	~300 m	07/31/2031	Groundwater
			950,400	~750 m		
			950,400	~1,000 m		
0168-AW8S7T	Dana Canada Corporation	Remediation	213,000	~1,000 m	02/28/2028	Groundwater
			115,000			
			38,000			

4.2 Aquifer Response to Pumping and Precipitation

PTTW Condition 4.3 states: "The Permit Holder shall prepare and submit an electronic copy of a report every two years by June 30 commencing June 30, 2020, that presents the results of the well field water level monitoring for the two preceding calendar years, assesses changes in water levels in the supply aquifer(s) in relation to precipitation and water taking from the aquifer(s)".

All monitoring wells located in the supply aquifer AFA2 respond to pumping (except C-SM-SM1-02-A). Water levels observed in the AFA2 aquifer in 2024 / 2025 were consistent with historical data and show no long term impacts from pumping at the well field.

Monitoring wells located in the bedrock near the production wells (C-SM-OW1-11-A) show a response to pumping but do not show a response when located 1 km away (C-SM-SM3-07). Water levels in the bedrock aquifer are

C-SM-SM1-02-A, screened in the shallow overburden (AFA2) (Figure 7), did not appear to be impacted by pumping and seasonal fluctuations in the aquifer may be related to water level variations in the nearby reservoir.

Water level changes in C-SM-SM3-07-AB, screened within the Gasport and Guelph Formations and located to the north of the reservoir almost 1 km from the G38, G39 and G40 production wells, appear to be impacted by pumping at Clement Mills well G18.

All the monitoring wells show similar seasonal fluctuations with the highest and lowest levels observed in the spring and late summer / fall, respectively. However, the correlation of individual precipitation events with groundwater levels is difficult due to several reasons including but not limited to hydraulic conductivity, well depth, precipitation intensity, ground cover conditions and the time between water level measurements (monthly).

5.0 Conclusions

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

- The information presented in this report satisfies condition 4.3 of PTTW 3004-A9GHYU;
- There were no reported well interference complaints arising from water taking at the Shades Mills well field; and
- Water levels in monitoring wells have been stable for the past 10 years indicating that there are no adverse long-term impacts to water levels in the aquifer.

2025 Biennial Groundwater Monitoring Report – Shade’s Mills Well Field (G7, G8, G38, G39, G40)
June 2026

6.0 References

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Aqua Insight Inc., Stantec Consulting Ltd, S.S. Papadopoulos and Associates Inc. and WSP Canada Inc., 2023. Hydrogeologic Characterization and Conceptual Model Updates, Region of Waterloo Tier Three Update Project. Final Report, June 2023.

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Lotowater Ltd. 1997, Study of the Hydrogeology of the Cambridge Area, The Regional Municipality of Waterloo, 93p.

Matrix Solutions Inc., 2015. Technical Memorandum: Numerical Model Surfaces Data Transfer, Region of Waterloo, June 5, 2015.

R.J. Burnside & Associates Limited, 2024. Region of Waterloo 2025 Biennial Groundwater Monitoring Report - Shades Mills Well Field (G7, G8, G38, G39, G40).

R.J. Burnside & Associates Limited, 2018. Region of Waterloo 2016 / 2017 Biennial Groundwater Monitoring Report.

Stantec Consulting Ltd., 2005. Microbial Contamination, Control Plan, Production Wells G38 and G39, Shade’s Mill Well Field.

Stantec Consulting Ltd., 2013. Shade’s Mills Well Field Construction and Testing of Test Production Wells SM-PW1-11, Region of Waterloo.

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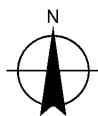
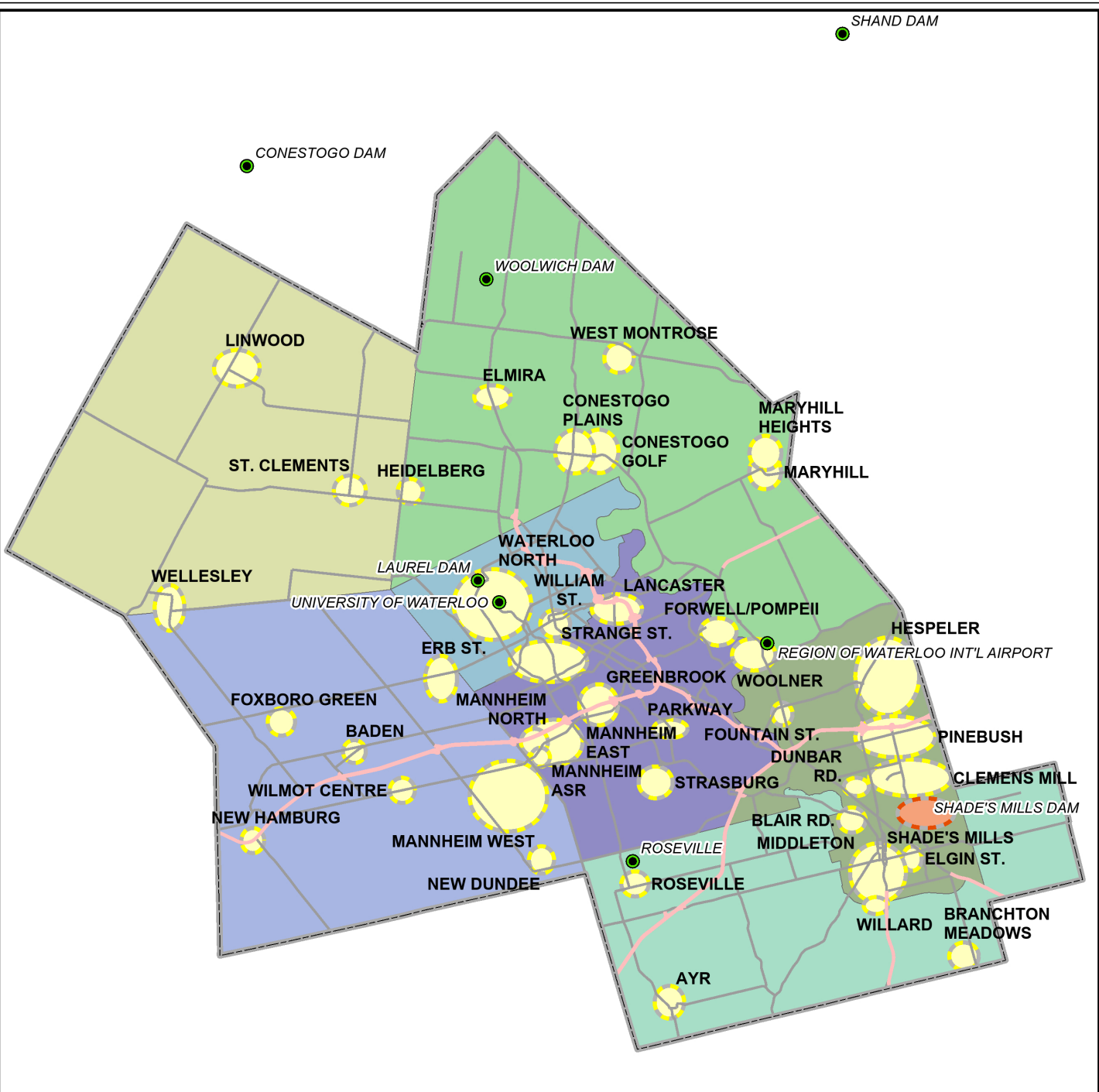


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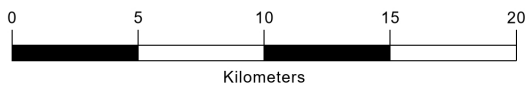
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Figures



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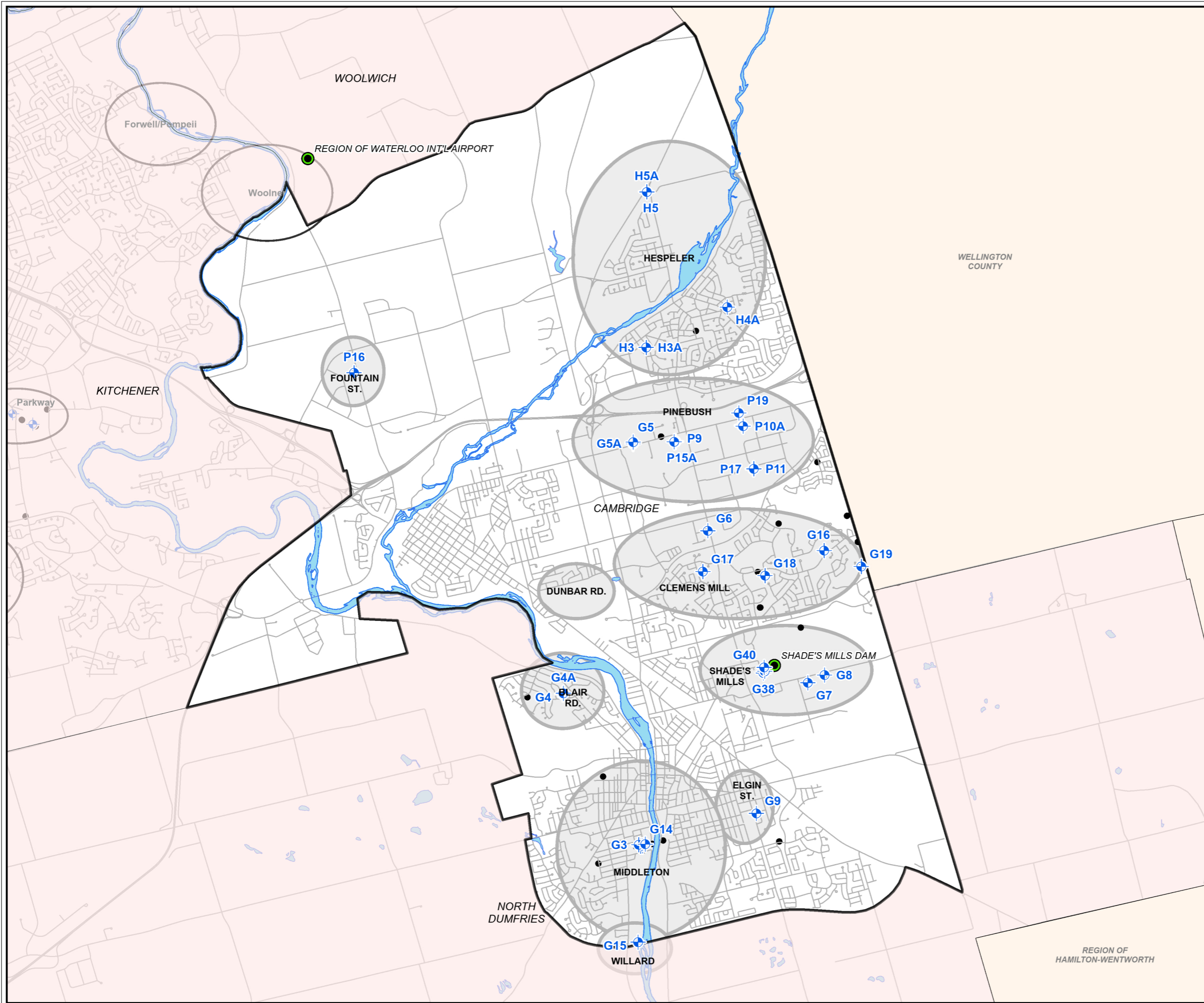
- Well Field Location
- Well Fields
- Regional Municipal Boundaries
- City of Cambridge
- City of Kitchener
- City of Waterloo
- Township of North Dumfries
- Township of Wellesley
- Township of Wilmot
- Township of Woolwich
- Meteorological Monitoring Locations



Map Title
**2025 GROUNDWATER MONITORING REPORT -
SHADE'S MILLS 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.

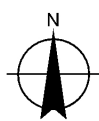
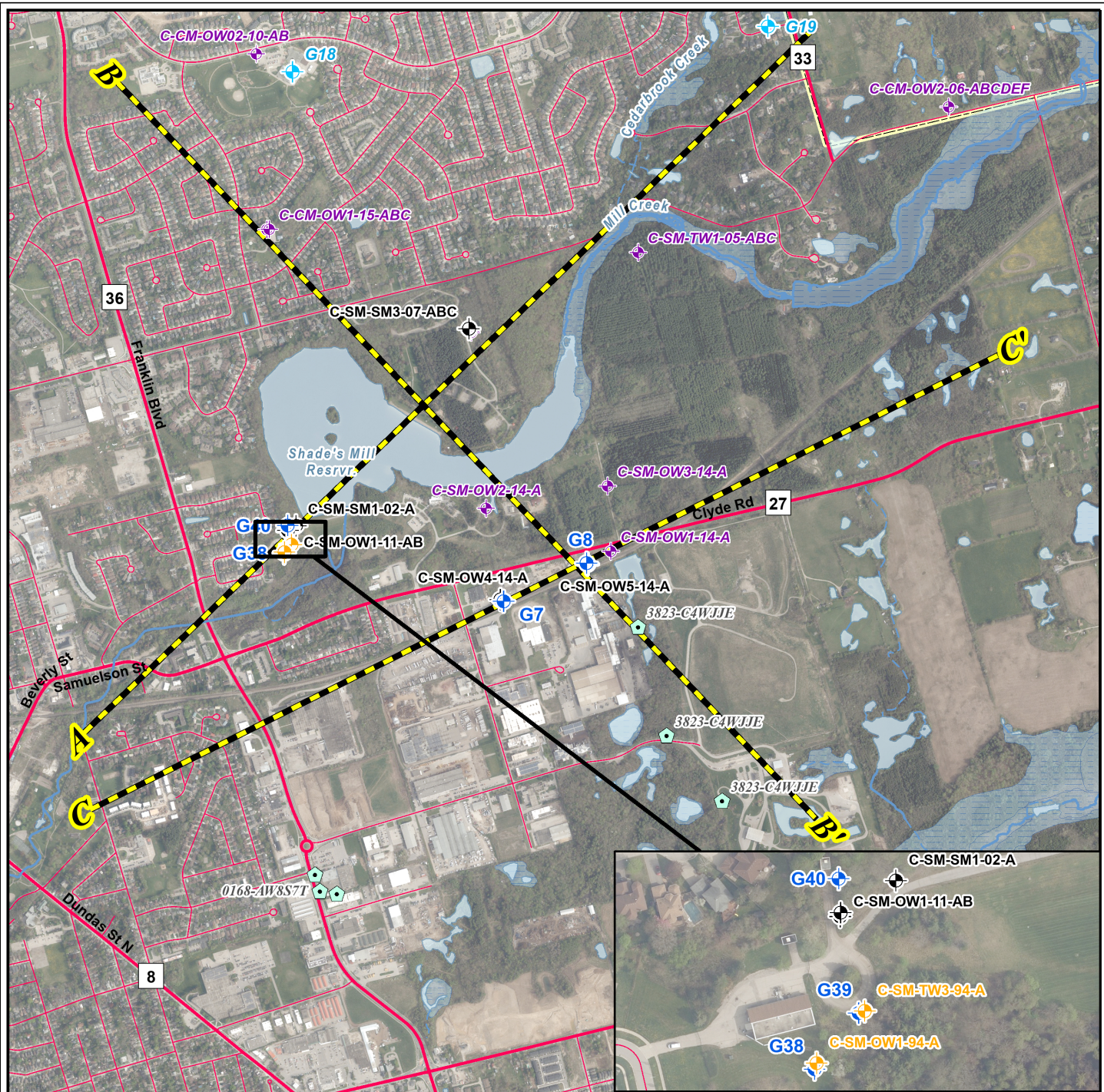
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 Coord. System: NAD 1983 CSRS UTM Zone 17N



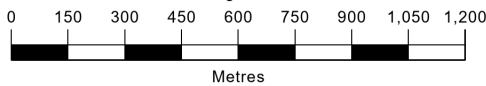
Client
REGION OF WATERLOO

Figure Title
2025 GROUNDWATER MONITORING REPORT - SHADE'S MILLS WELL FIELD
CAMBRIDGE WELL FIELDS AND MONITORING NETWORK

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



Data Source:
 Region of Waterloo GIS Data; Background 2018 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.



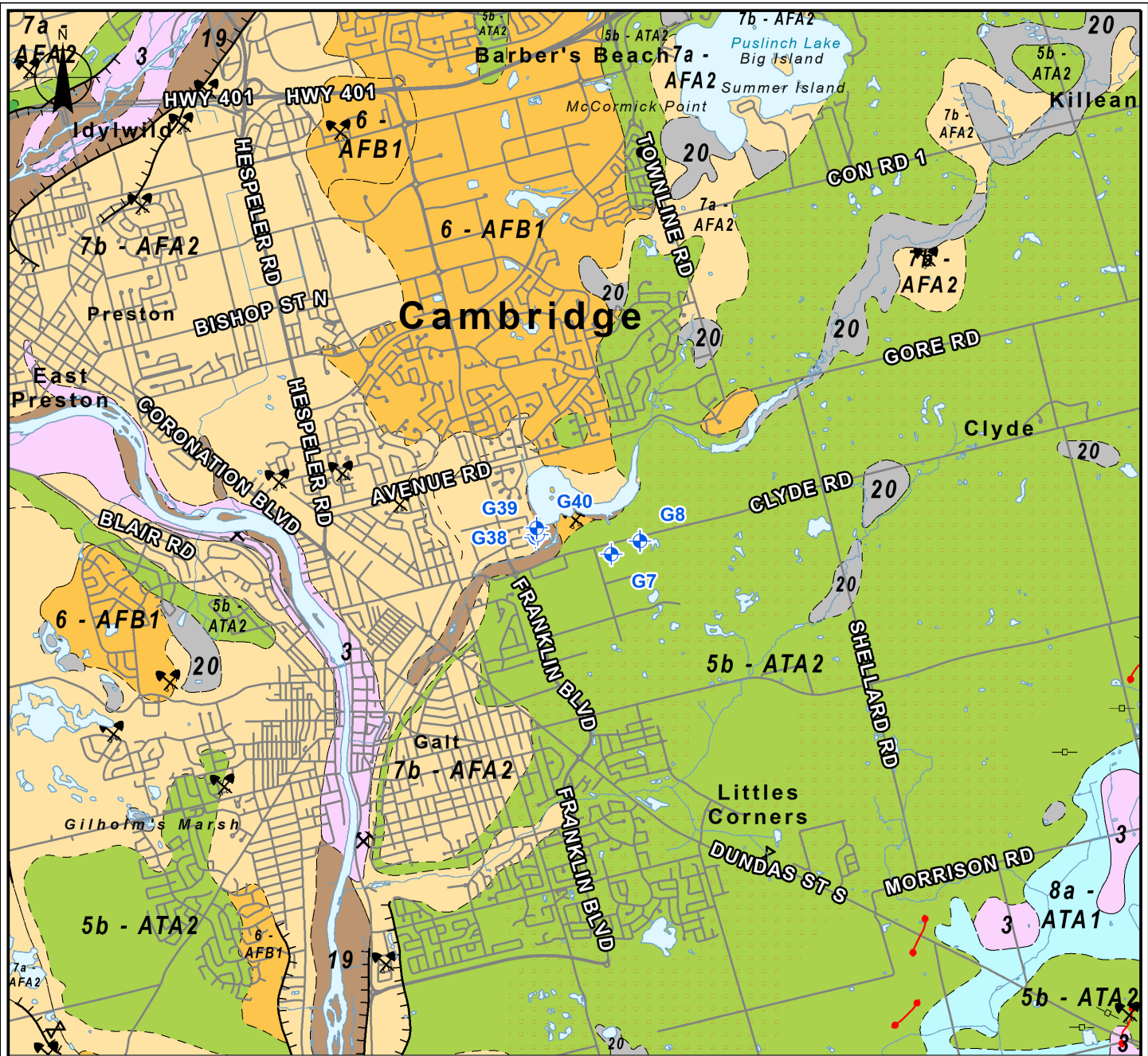
- Decommissioned Monitoring Well Location
- PTTW Monitoring Well Location
- Production Well Location
- Nearby Production Well Location
- Nearby Monitoring Well Location
- Additional MECP PTTW Locations
- Groundwater
- Cross Section Orientation
- Intermittent Creek
- Creek
- Provincially Significant Wetland (MNR)
- Regional Road
- Local Road
- Region of Waterloo Boundary



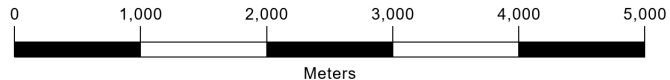
Map Title
2025 GROUNDWATER MONITORING REPORT - SHADE'S MILLS WELL FIELD
 WELL LOCATION MAP

Client
REGION OF WATERLOO

Drawn	Checked	Date	Figure No. 3
HN	SQ	February 2026	
Scale		Project No.	
1:20,000		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)
- 8a: Fine-textured glaciolacustrine deposits: Massive-well laminated (ATA1)
- 19: Modern alluvial deposits
- 20: Organic deposits
- Quarry (Point)
- Sand and Gravel Pit
- Beach
- Terrace
- Delta, glaciolacustrine
- Drumlin or drumlinoid ridges (point)
- Sample Location
- Hummocky Topography
- Unit Contact
- Boundary



Map Title
2025 GROUNDWATER MONITORING REPORT - SHADE'S MILLS WELL FIELD

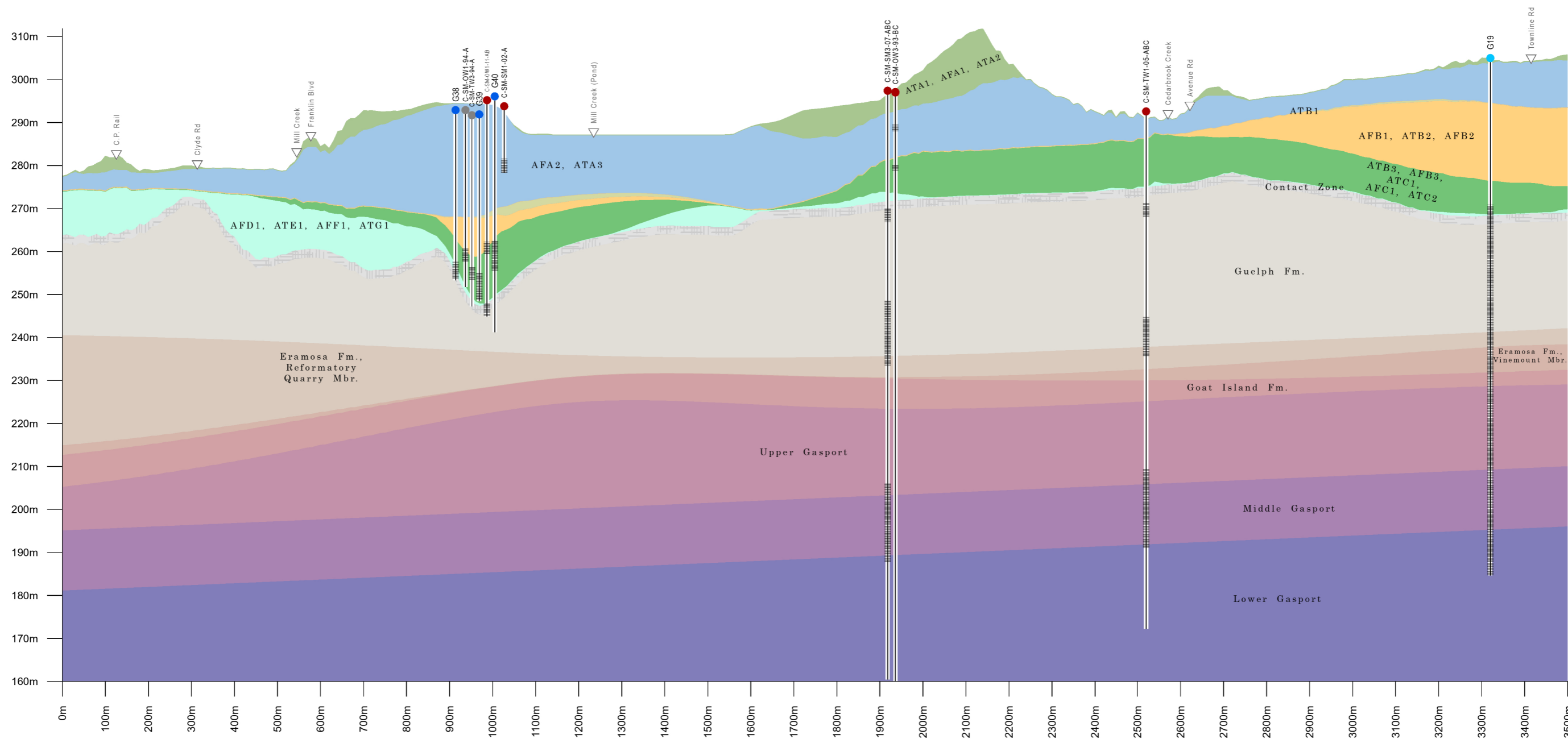
SURFICIAL GEOLOGY

Client
REGION OF WATERLOO

Drawn	Checked	Date	Figure No. 4
HN	SQ	February 2026	
Scale	Project No.		
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A

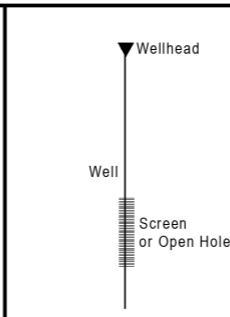
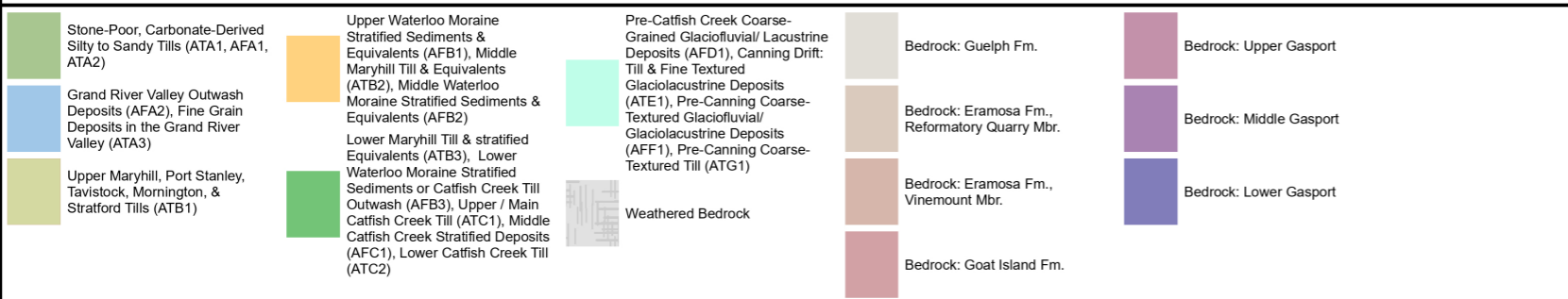
A'



Wells

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

Cambridge Model 2026



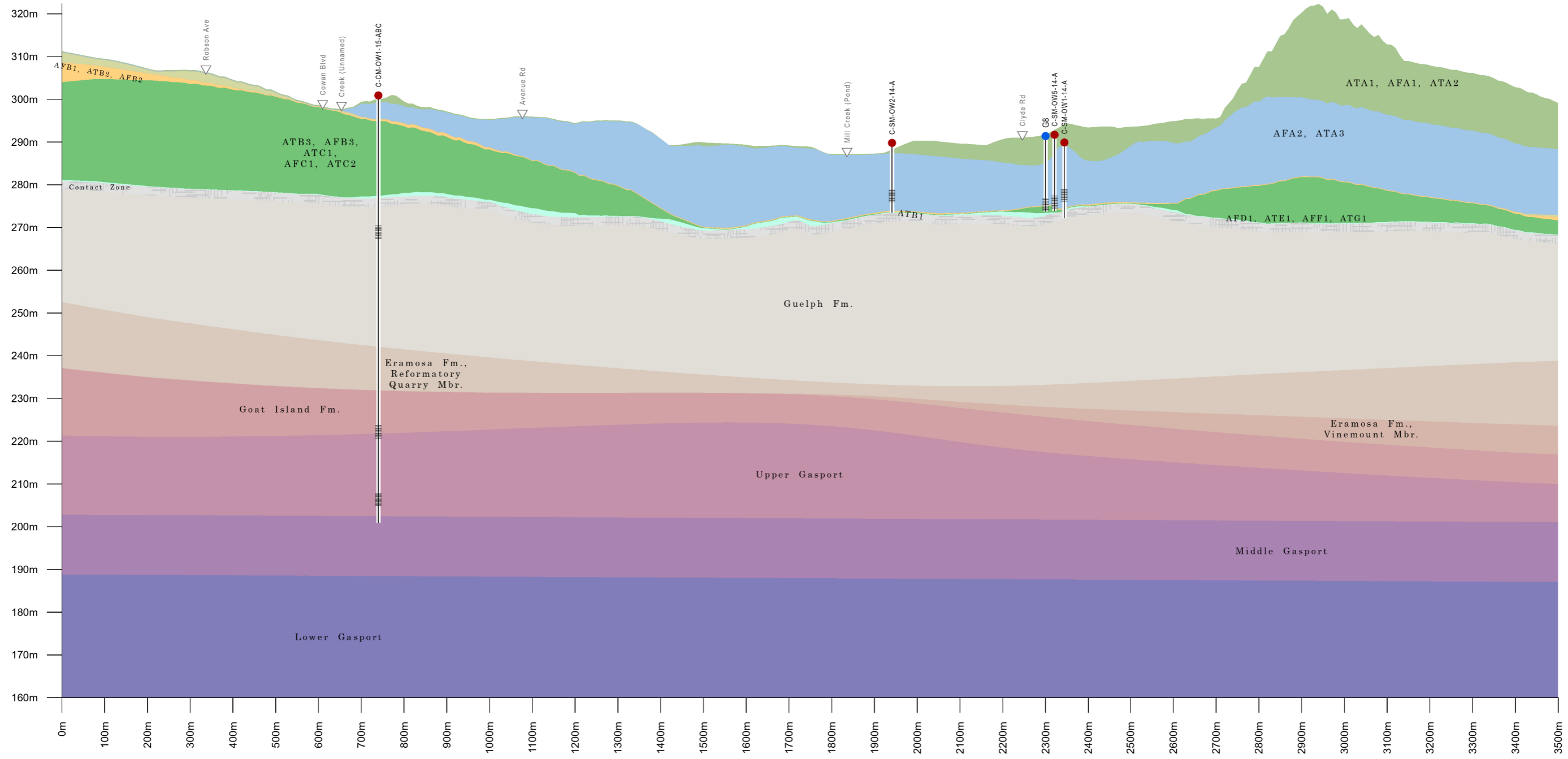
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Client
REGION OF WATERLOO

Figure Title			
GEOLOGIC CROSS SECTION REGION OF WATERLOO Shades Mills Cross Section A - A'			
Drawn PS	Checked DH	Date 2026/06/01	Figure No. 5
Horizontal Scale 1:10,000		Project No. HA046402	
Vertical Ex.:10x			

B

B'

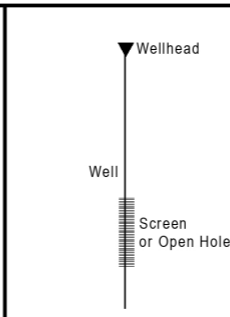


Wells

● Production Well (Active) ● Monitoring Well

Cambridge Model 2026

<ul style="list-style-type: none"> Stone-Poor, Carbonate-Derived Silty to Sandy Tills (ATA1, AFA1, ATA2) Grand River Valley Outwash Deposits (AFA2), Fine Grain Deposits in the Grand River Valley (ATA3) Upper Maryhill, Port Stanley, Tavistock, Mornington, & Stratford Tills (ATB1) 	<ul style="list-style-type: none"> Upper Waterloo Moraine Stratified Sediments & Equivalents (AFB1), Middle Maryhill Till & Equivalents (ATB2), Middle Waterloo Moraine Stratified Sediments & Equivalents (AFB2) Lower Maryhill Till & stratified Equivalents (ATB3), Lower Waterloo Moraine Stratified Sediments or Catfish Creek Till Outwash (AFB3), Upper / Main Catfish Creek Till (ATC1), Middle Catfish Creek Stratified Deposits (AFC1), Lower Catfish Creek Till (ATC2) 	<ul style="list-style-type: none"> Pre-Catfish Creek Coarse-Grained Glaciofluvial/ Lacustrine Deposits (AFD1), Canning Drift: Till & Fine Textured Glaciolacustrine Deposits (ATE1), Pre-Canning Coarse-Textured Glaciofluvial/ Glaciolacustrine Deposits (AFF1), Pre-Canning Coarse-Textured Till (ATG1) Weathered Bedrock 	<ul style="list-style-type: none"> Bedrock: Guelph Fm. Bedrock: Eramosa Fm., Reformatory Quarry Mbr. Bedrock: Eramosa Fm., Vinemount Mbr. Bedrock: Goat Island Fm. 	<ul style="list-style-type: none"> Bedrock: Upper Gasport Bedrock: Middle Gasport Bedrock: Lower Gasport
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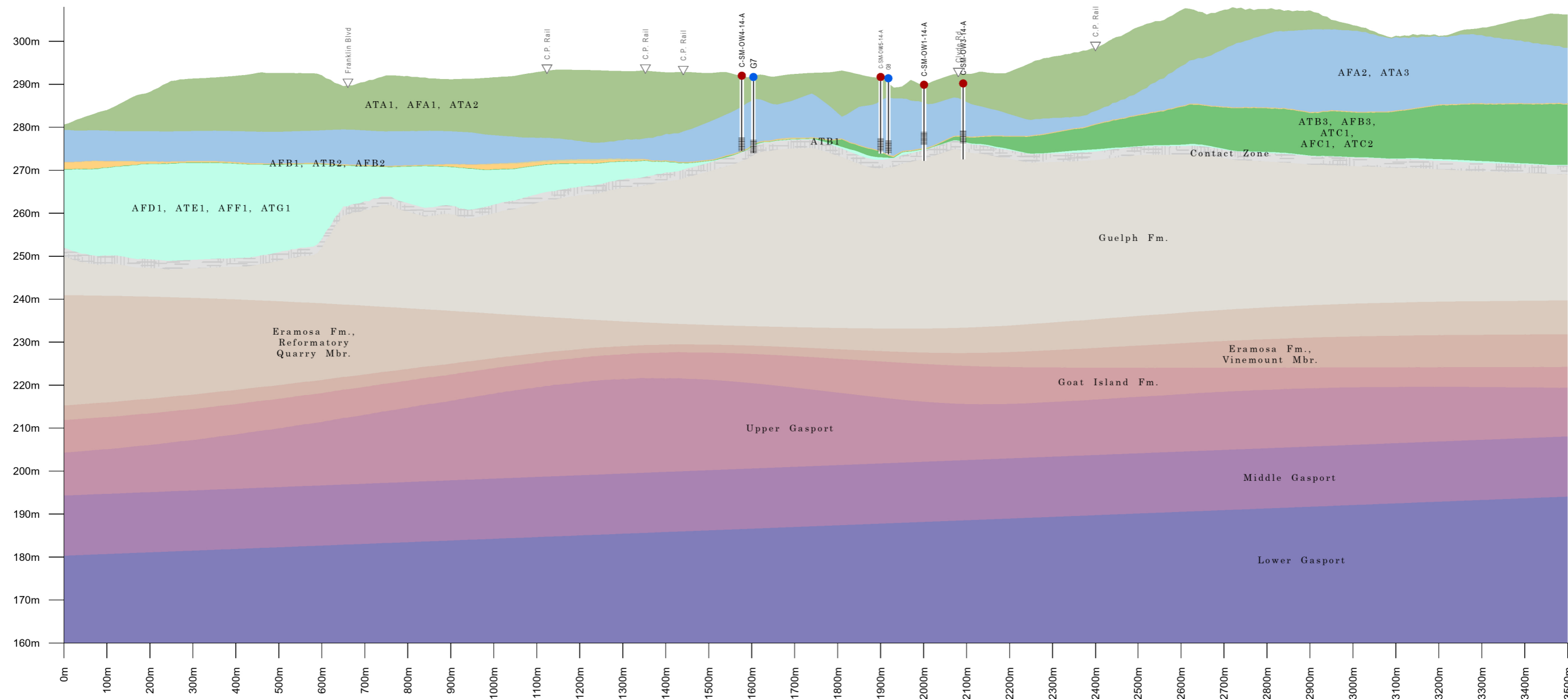
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Client
REGION OF WATERLOO

Figure Title GEOLOGIC CROSS SECTION REGION OF WATERLOO Shades Mills Cross Section B - B'			
Drawn PS	Checked DH	Date 2026/06/01	Figure No. 6
Horizontal Scale 1:10,000		Project No. HA046402	
Vertical Ex.:10x			

C

C'

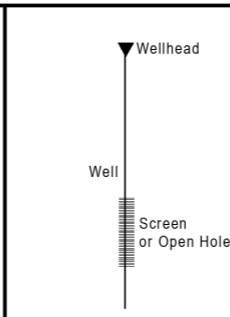


Wells

- Production Well (Active)
- Monitoring Well

Cambridge Model 2026

Stone-Poor, Carbonate-Derived Silty to Sandy Tills (ATA1, AFA1, ATA2)	Upper Waterloo Moraine Stratified Sediments & Equivalents (AFB1), Middle Maryhill Till & Equivalents (ATB2), Middle Waterloo Moraine Stratified Sediments & Equivalents (AFB2)	Pre-Catfish Creek Coarse-Grained Glaciolacustrine/Lacustrine Deposits (AFD1), Canning Drift: Till & Fine Textured Glaciolacustrine Deposits (ATE1), Pre-Canning Coarse-Textured Glaciolacustrine Deposits (AFF1), Pre-Canning Coarse-Textured Till (ATG1)	Bedrock: Guelph Fm.	Bedrock: Upper Gasport
Grand River Valley Outwash Deposits (AFA2), Fine Grain Deposits in the Grand River Valley (ATA3)	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: Eramosa Fm., Reformatory Quarry Mbr.	Bedrock: Middle Gasport
Upper Maryhill, Port Stanley, Tavistock, Mornington, & Stratford Tills (ATB1)			Bedrock: Eramosa Fm., Vinemount Mbr.	Bedrock: Lower Gasport
			Bedrock: Goat Island Fm.	



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Client
REGION OF WATERLOO

Figure Title				Figure No. 7
GEOLOGIC CROSS SECTION				
REGION OF WATERLOO				
Shades Mills	Drawn PS	Checked DH	Date 2026/06/01	Figure No. 7
Cross Section C - C'	Horizontal Scale 1:10,000		Project No.	
	Vertical Ex.:10x		HA046402	



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Appendix A

Permit to Take Water

Appendix A

PERMIT TO TAKE WATER
Ground Water
NUMBER 3004-A9GHYU

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

The Regional Municipality of Waterloo
150 Frederick St 6th Floor
Kitchener, Ontario
N2G 4J3

For the water

taking from: Five Wells (G7, G8, G38, G39, G40)

Located at: Lot 3, Concession 11, Geographic Township of Dumfries
Cambridge, Regional Municipality of Waterloo

Lot 3, Concession 11, Geographic Township of Dumfries
Cambridge, Regional Municipality of Waterloo

Lot 6, Concession 12, Geographic Township of Dumfries
Cambridge, Regional Municipality of Waterloo

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

DEFINITIONS

- (a) "Director" means any person appointed in writing as a Director pursuant to section 5 of the OWRA for the purposes of section 34.1, OWRA.
- (b) "Provincial Officer" means any person designated in writing by the Minister as a Provincial Officer pursuant to section 5 of the OWRA.
- (c) "Ministry" means Ontario Ministry of the Environment and Climate Change.
- (d) "District Office" means the Guelph District Office.
- (e) "Permit" means this Permit to Take Water No. 3004-A9GHYU including its Schedules, if any, issued in accordance with Section 34.1 of the OWRA.

- (f) "Permit Holder" means The Regional Municipality of Waterloo.
- (g) "OWRA " means the *Ontario Water Resources Act*, R.S.O. 1990, c. O. 40, as amended.

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

TERMS AND CONDITIONS

1. Compliance with Permit

- 1.1 Except where modified by this Permit, the water taking shall be in accordance with the application for this Permit To Take Water, dated February 8, 2016 and signed by Richard Wootton, and all Schedules included in this Permit.
- 1.2 The Permit Holder shall ensure that any person authorized by the Permit Holder to take water under this Permit is provided with a copy of this Permit and shall take all reasonable measures to ensure that any such person complies with the conditions of this Permit.
- 1.3 Any person authorized by the Permit Holder to take water under this Permit shall comply with the conditions of this Permit.
- 1.4 This Permit is not transferable to another person.
- 1.5 This Permit provides the Permit Holder with permission to take water in accordance with the conditions of this Permit, up to the date of the expiry of this Permit. This Permit does not constitute a legal right, vested or otherwise, to a water allocation, and the issuance of this Permit does not guarantee that, upon its expiry, it will be renewed.
- 1.6 The Permit Holder shall keep this Permit available at all times at or near the site of the taking, and shall produce this Permit immediately for inspection by a Provincial Officer upon his or her request.
- 1.7 The Permit Holder shall report any changes of address to the Director within thirty days of any such change. The Permit Holder shall report any change of ownership of the property for which this Permit is issued within thirty days of any such change. A change in ownership in the property shall cause this Permit to be cancelled.

2. General Conditions and Interpretation

2.1 Inspections

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

2.2 Other Approvals

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

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

2.3 Information

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

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

2.4 Rights of Action

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

2.5 Severability

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

2.6 Conflicts

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

3. Water Takings Authorized by This Permit

3.1 Expiry

This Permit expires on **April 30, 2026**. No water shall be taken under authority of this Permit after the expiry date.

3.2 Amounts of Taking Permitted

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

Table A

	Source Name / Description:	Source: Type:	Taking Specific Purpose:	Taking Major Category:	Max. Taken per Minute (litres):	Max. Num. of Hrs Taken per Day:	Max. Taken per Day (litres):	Max. Num. of Days Taken per Year:	Zone/ Easting/ Northing:
1	G7, G8, G38, G39, G40	Well Drilled	Municipal	Water Supply	10,472	24	15,079,680	365	17 558054 4802471
						Total Taking:	15,079,680		

3.3 Notwithstanding the Maximum Taken Per Day specified in Table A of Condition 3.2, taking from the well field (in any combination of the five listed wells) shall not exceed an annual daily average of 12,690,432 L/day.

4. Monitoring

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

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

- C-SM-SM1-02
- C-SM-TW3-94
- C-SM-SM3A-07
- C-SM-SM3B-07
- C-SM-SM3C-07
- C-SM-OW1-94
- C-SM-OW4-14
- C-SM-OW5-14

- C-SM-OW1A-11
- C-SM-OW1B-11

4.3 The Permit Holder shall prepare and submit a report every two years by June 30 commencing June 30, 2016, that presents the results of the well field water level monitoring for the two preceding calendar years, assesses changes in water levels in the supply aquifer(s) in relation to precipitation and water taking from the aquifer(s), and provides a summary for all interference complaints received by the Permit Holder related to this permit and reported in the District Office in accordance with Condition 5.1 and the manner in which the Permit Holder has dealt with the complaint.

5. Impacts of the Water Taking

5.1 Notification

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

5.2 For Groundwater Takings

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

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

6. Director May Amend Permit

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

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

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

This Permit cancels and replaces Permit Number 7825-6WLMDA, issued on 2006/12/29 and Permit Number 4323-83PPLG, issued on 2010/03/31

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

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

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

3. The name of the appellant;
4. The address of the appellant;
5. The Permit to Take Water number;
6. The date of the Permit to Take Water;
7. The name of the Director;
8. The municipality within which the works are located;

This notice must be served upon:

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

AND

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

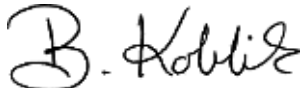
Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal:

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

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

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

Dated at Hamilton this 16th day of May, 2016.



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

Schedule A

This Schedule "A" forms part of Permit To Take Water 3004-A9GHYU, dated May 16, 2016.

- Shades Mill Well Field , Construction and Testing of Test Production Well SM-PW1-11, Final Report dated October 2013, prepared and signed by Lesley Veale and Roger Freymond, Stantec Consulting Ltd.

- Production Wells G7 & G8 Shutdown Test, Report dated January 2016, prepared and signed by Michelle Fraser; Craig Johnston and Roger Freymond, Stantec Consulting Ltd.

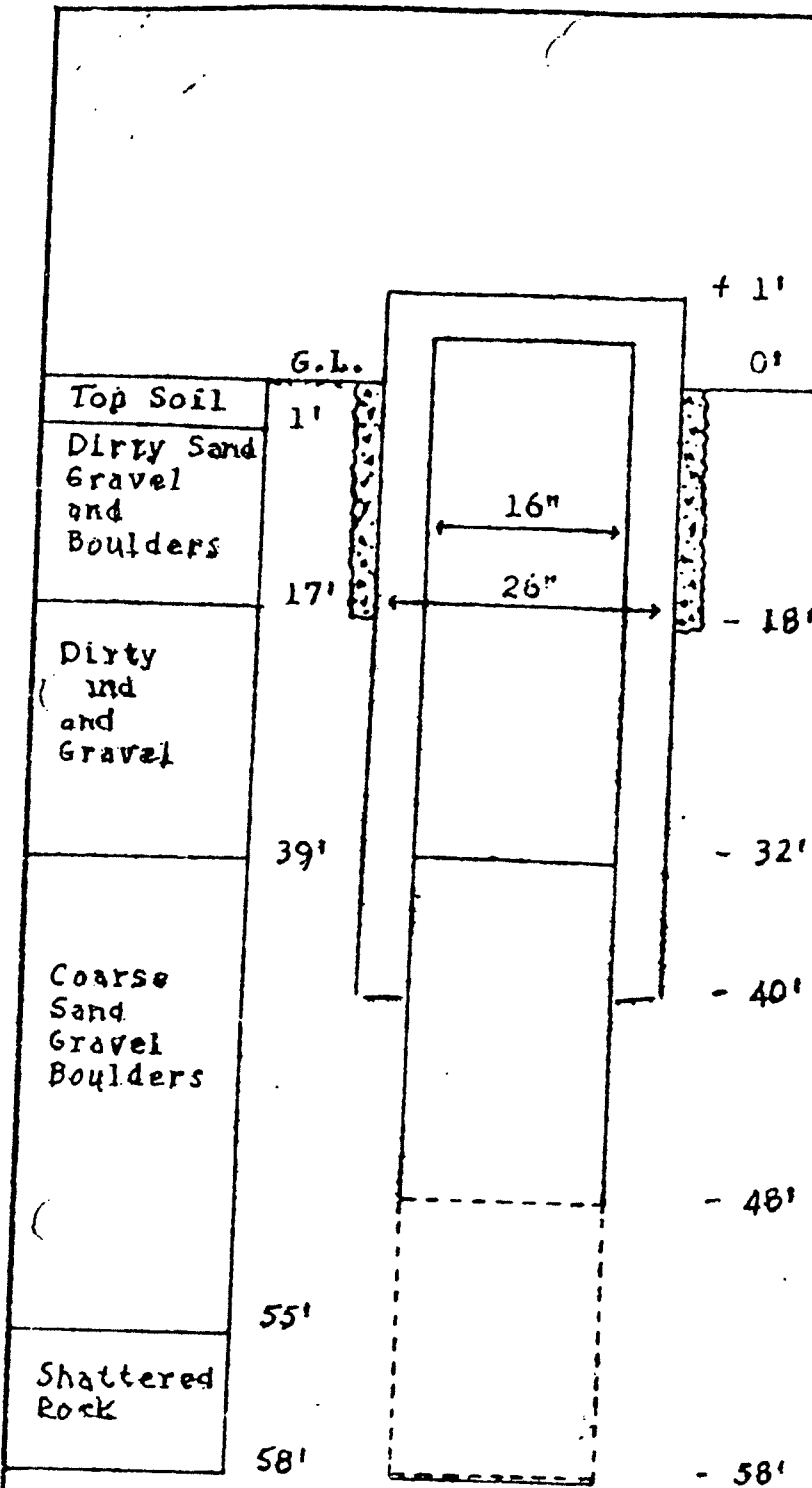


BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix B

Well Records



Well Material
 Outer Casing 41' - 26" casing
 Inner Casing 33' - 16" steel, 16
 Screen 10' - 16" s.s. No. 6
 Plug stainless plate
 Gravel 8 yds.

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

Materials or setting details other than sta
 Impellers: Trim

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

Special Equipment

Pumping Equipment supplied by

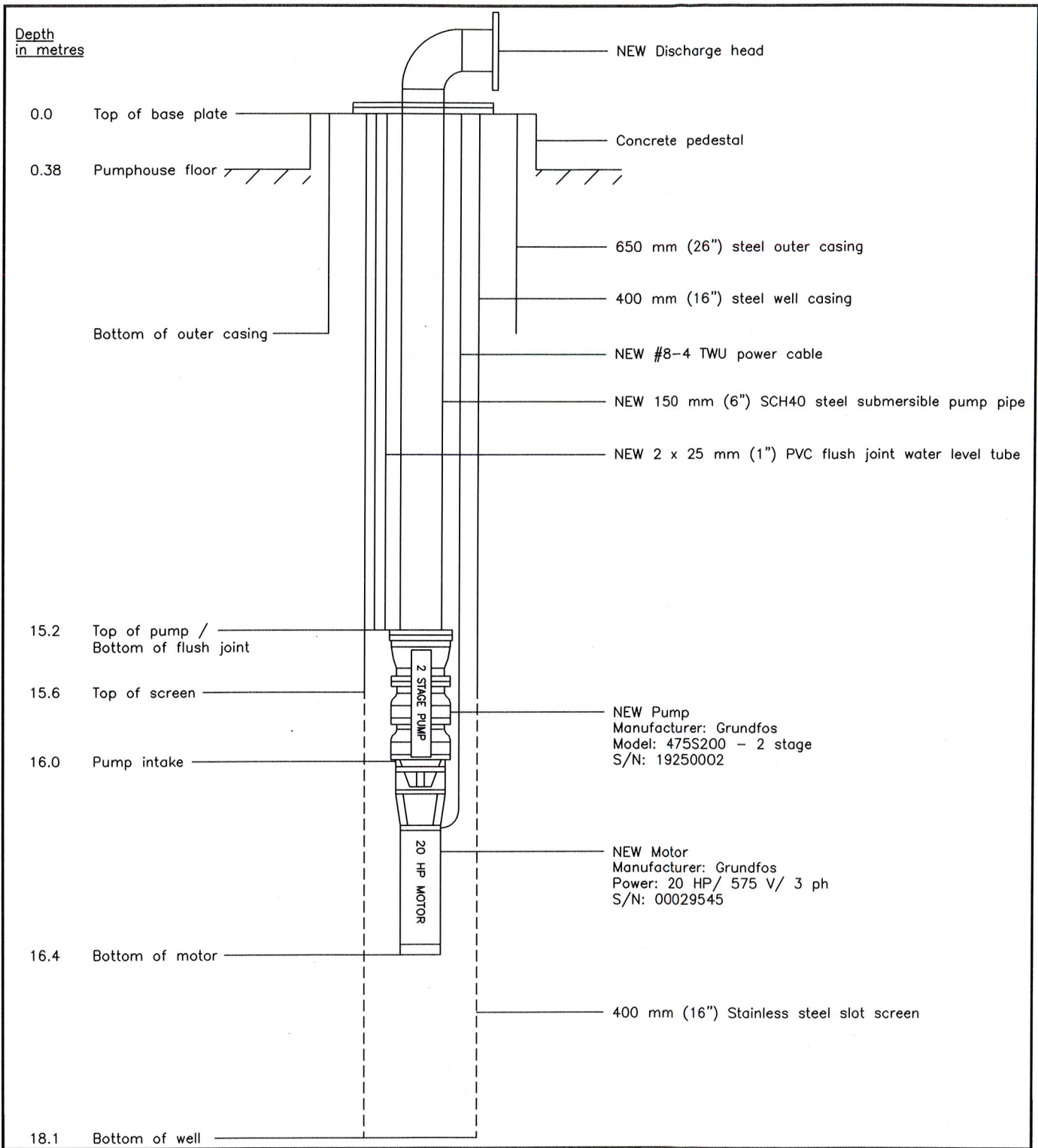
Well No. 1

B.P. referred to original ground level
 Clear depth below B.P.
 Started 7/30/58 Final Test
 Preliminary Test 9/3/58 Static Level 33'
 Final Test Pumping Level 40'
 Guarantee 10 G.P.M. Capacity 700 G.P.M.
 Contract Pressure = Pressure Pump
 Length Air Line Main

CLYDE ROAD WELL
 ON GYURITS FARM.
 CLYDE WELL #1

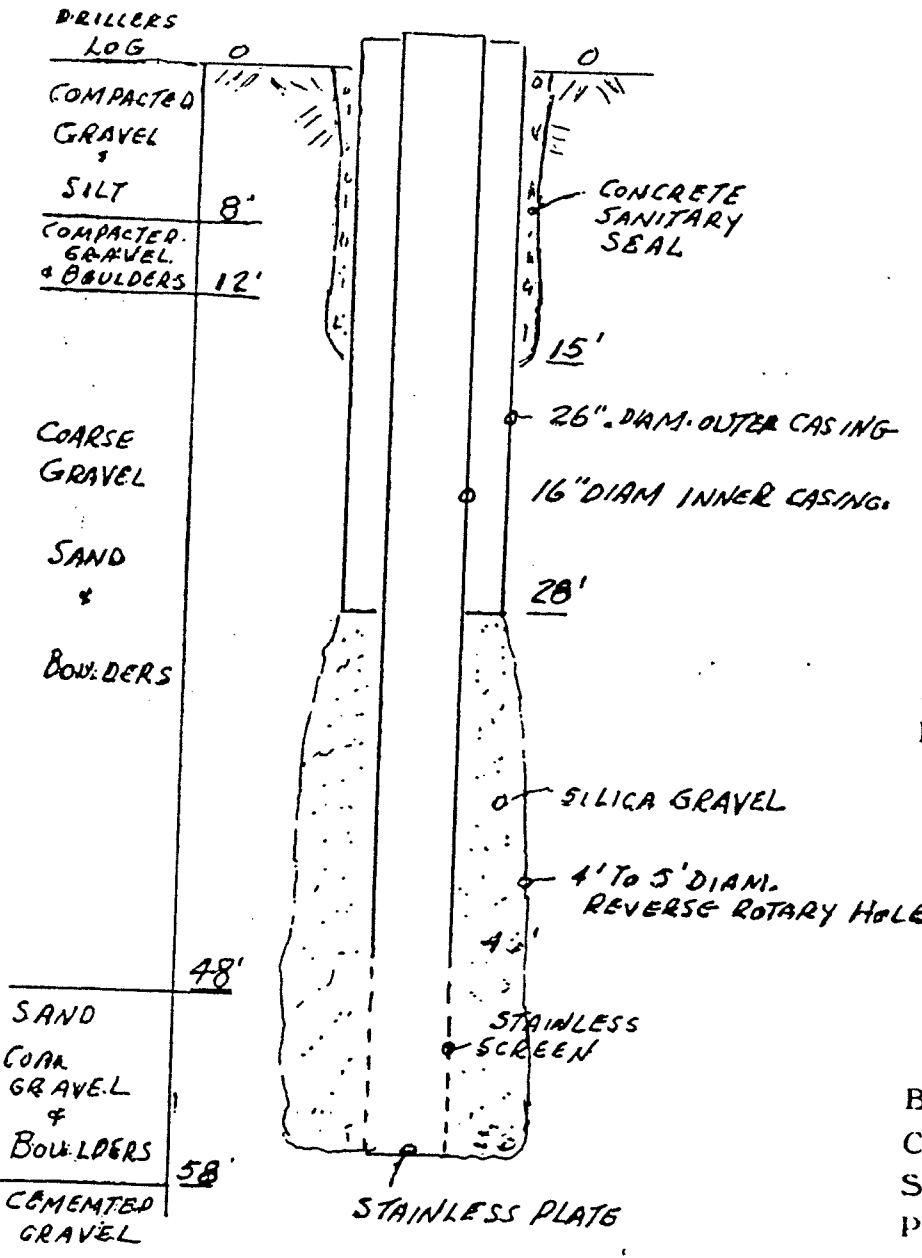
G7

INTERNATIONAL WATER SUPPLY LTD.
 MONTREAL LONDON, CANADA
 OAKVILLE WATER SUPPLY CONTRACTORS VANCOUVER
 PUBLIC UTILITIES COMMISSION
 GALT, ONTARIO
 R. Strub



	CLIENT	Regional Municipality of Waterloo
	TITLE	Well G7 Pump Installation Drawing

PROJECT No. 006-356		G:\Lotowater Projects\006 Region of Waterloo\356 Well G7\Pump Install.dwg		FIGURE 3
DESIGN		REVISION No. 2016-01-29	SCALE N.T.S.	
DRAWN	EH 2016/01/29			
CHECKED				



Well Material
 Outer Casing 26" ϕ , $\frac{3}{8}$ " WELDED STEEL
 Inner Casing 16" ϕ $\frac{3}{8}$ " WELDED STEEL
 Screen 16" ID 80 SLOT WIRE WRAPPED
 Plug STAINLESS PLATE
 Gravel $\frac{1}{4} \times \frac{1}{8}$

Pump
 No. Setting BP-MB
 No. Stages Length Bowl
 Bowl Size ϕ Lgth. Suction
 Head Size Column
 Materials or setting details other than stan
 Impellers: Trim

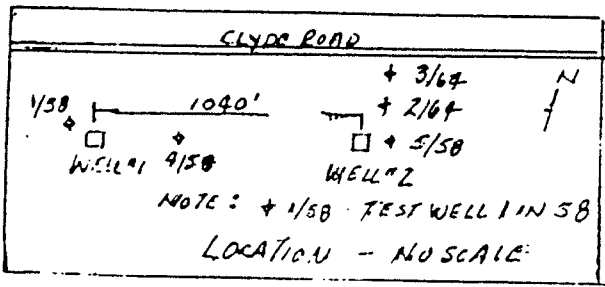
Motor
 Make Phase
 H. P. Cycles
 R. P. M. Volts
 Type Amps.
 Frame Serial
 Bearing Nos.

Special Equipment

G-8
 53

Well No. 2

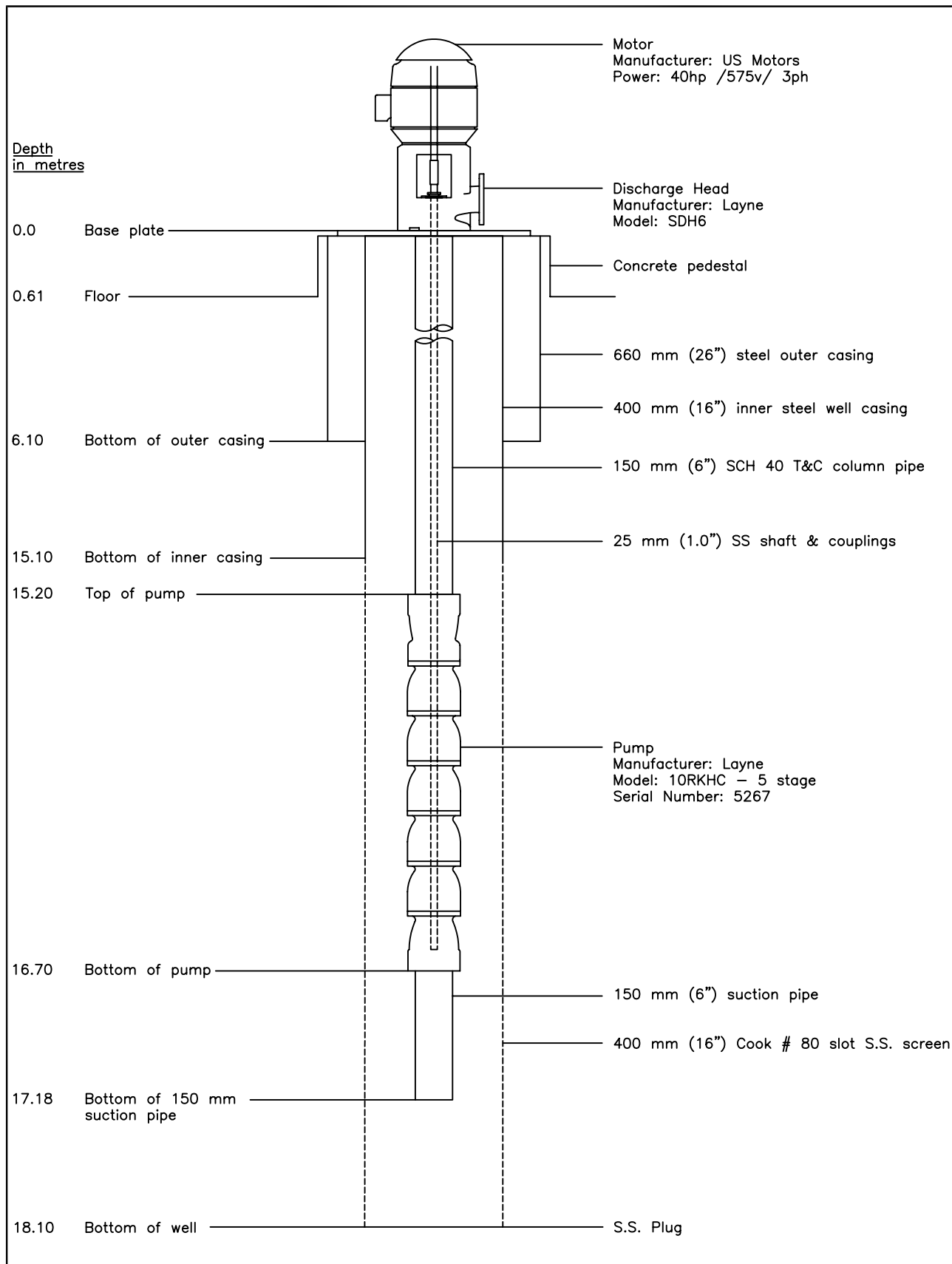
B. P. referred to original ground level
 Clear depth below B. P.
 Started Final Test
 Preliminary Test Static Level
 Final Test Pumping Level
 Guarantee 1 GPM Capacity 1 G P
 Contract Pressure = Pressure Pump
 Length Air Line Main



INTERNATIONAL WATER SUPPLY LTD
 MONTREAL LONDON, CANADA SASKATC
 OAKVILLE WATER SUPPLY CONTRACTORS VANCOU

PUBLIC UTILITIES COMMISSION OF GALT
 WELL #2
 CLYDE ROAD AQUIFER

DRILLED BY _____ DRAWN BY _____
 INSTALLED BY _____ APPROVED BY _____



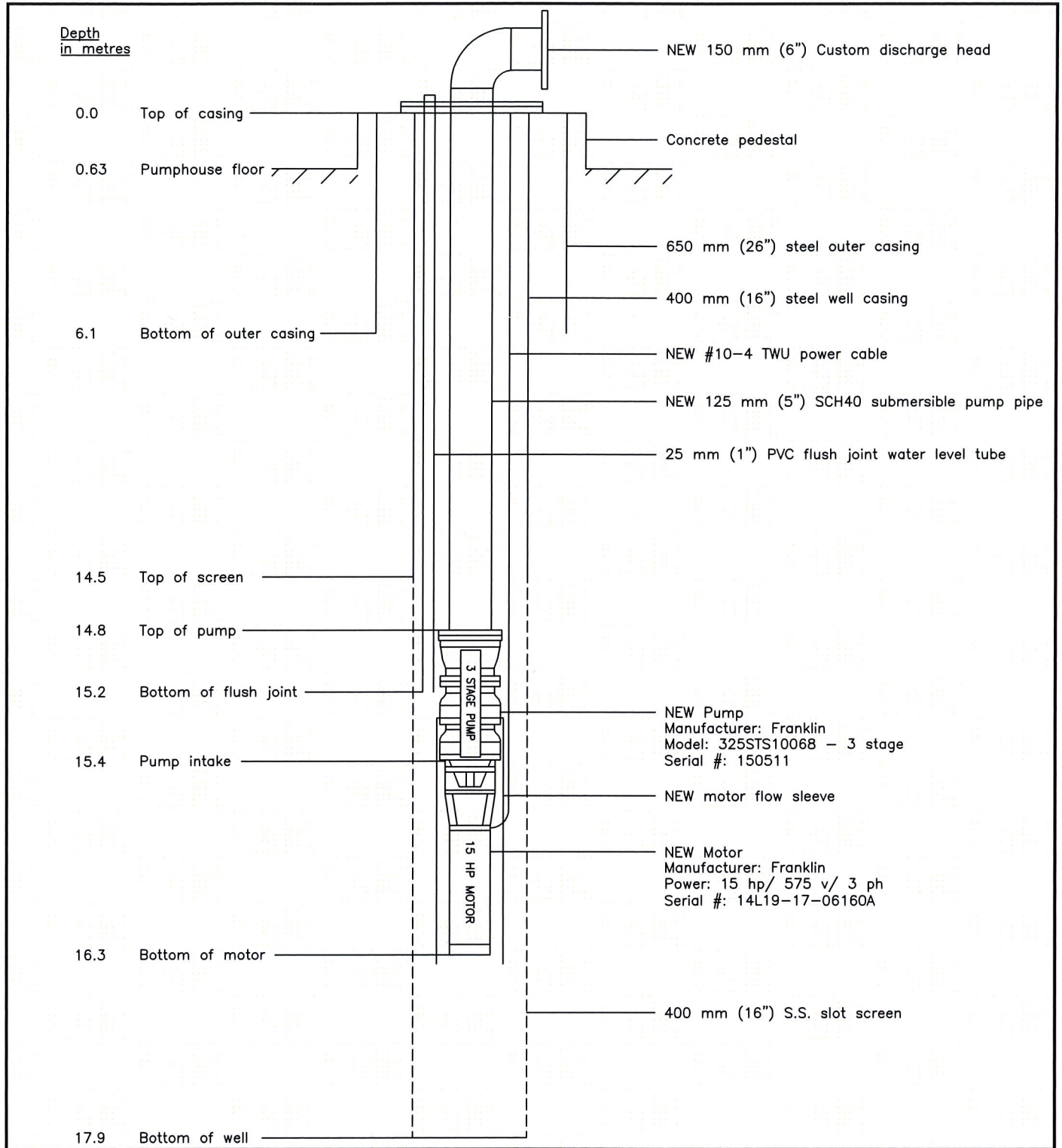
NOTES
 (1) All measurements below top of base plate which is 0.61 m above pumphouse floor.



CLIENT
 Regional Municipality of Waterloo

TITLE
 G8 Well
 Pump Installation Drawing

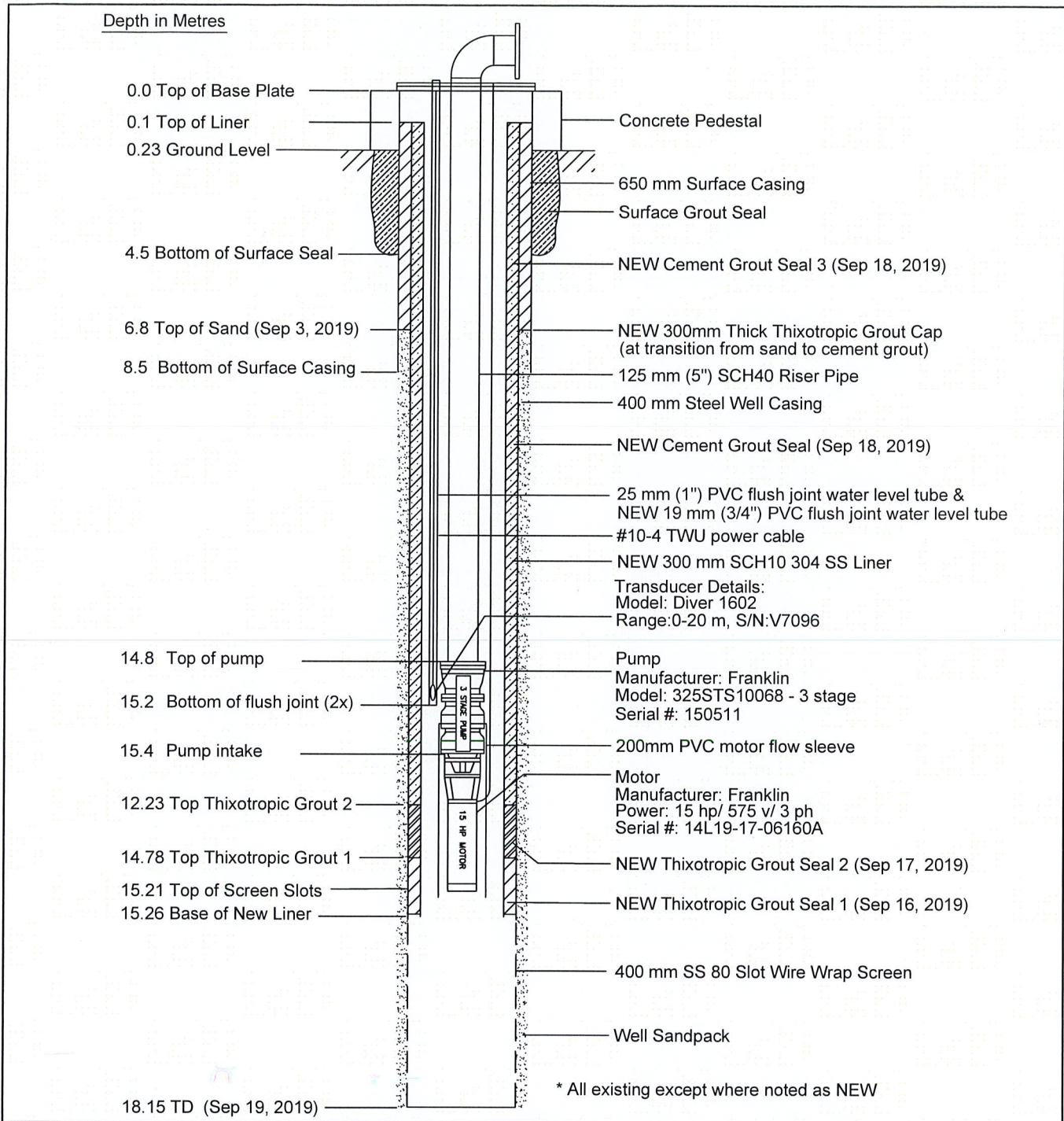
PROJECT No. 006-126		G:\Lotowater Projects\006 Region of Waterloo\126 G8 Maintenance\Lineshaft Install.dwg		
DESIGN		Revision No. 2009/11/17	SCALE N.T.S.	FIGURE 3
DRAWN	EH 2009/11/16			
CHECKED				



CLIENT
Regional Municipality of Waterloo

TITLE
Well G8
New Pump Installation Drawing

PROJECT No. 006-338		G:\Lotowater Projects\006 Region of Waterloo\338 Well G8\Pump Install.dwg		FIGURE 1
DESIGN		REVISION No. 2015/05/28	SCALE N.T.S.	
DRAWN	EH 2015/04/17			
CHECKED				



CLIENT
REGIONAL MUNICIPALITY OF WATERLOO

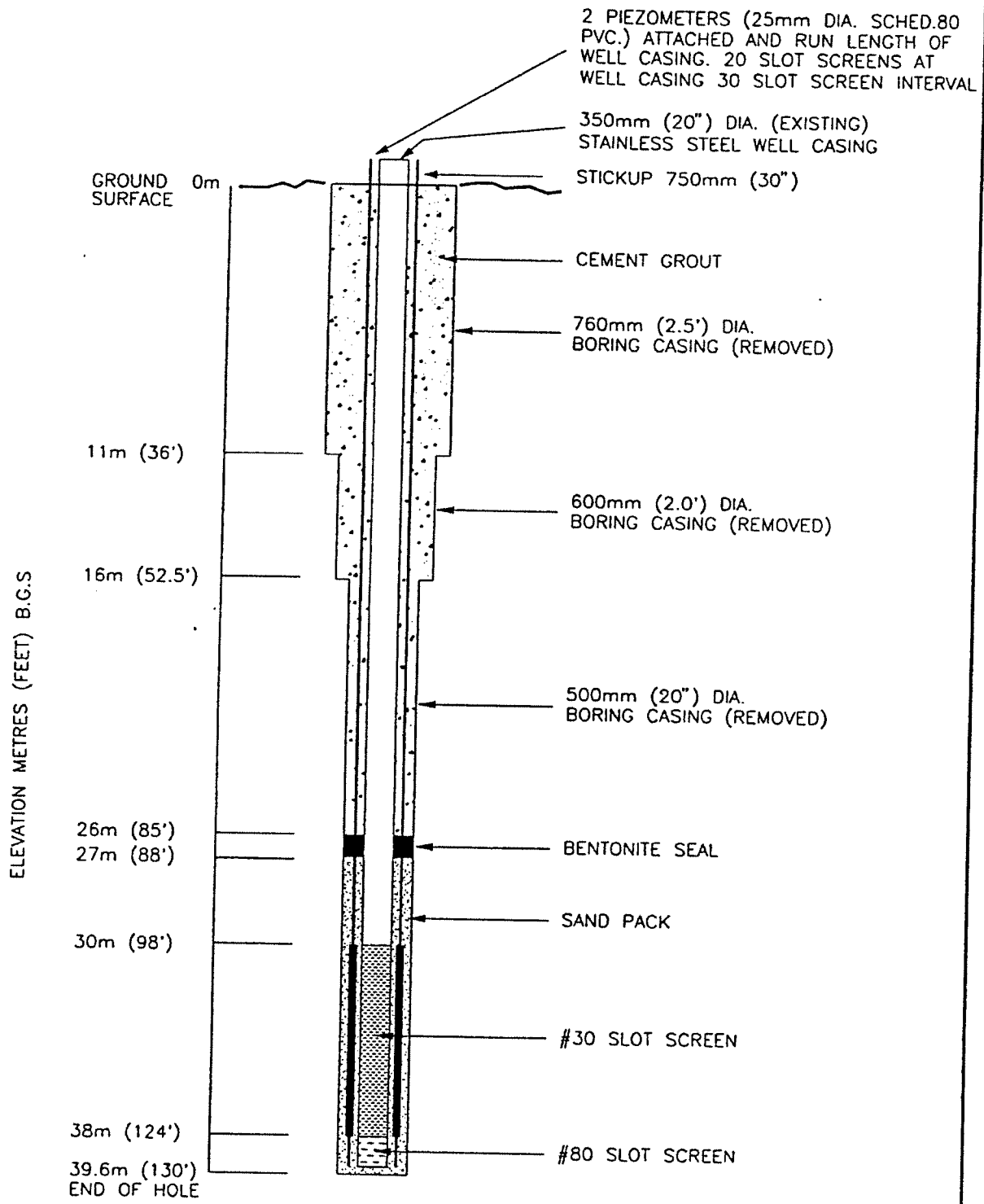
TITLE
WELL G8 (As Constructed)

PROJECT #: 006-462 L:\Lotowater Projects\006 Region of Waterloo\462 G8 Service and Rehab\7. Technical

DESIGN	BP	2019/09/03	REVISION No. 2019-09-26	SCALE N.T.S	FIGURE 2
DRAWN	BP	2019/09/03			
CHECKED	BP	2019/09/03			

G-38 WELL CONSTRUCTION DETAILS
SHADES MILL CONSERVATION AREA, CAMBRIDGE ONTARIO

FIGURE 3



C:\PROJECTS\941-9029\WELLS.DWG

Date ...AUGUST 1995

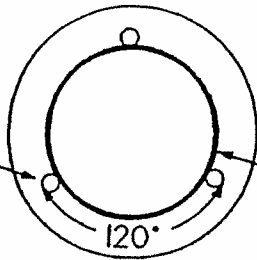
Project 941-9029...



Drawn ...MR.....

Chkd

Nominal 25 mm dia. PVC treatment conductor wells to be installed on perimeter of well casing



PLAN VIEW

Borehole

Well casing

FEET

0 Ground Level

10 sand, gravel and boulders

40 sand, gravel and boulders

73 fine to coarse sand

85 fine to coarse sand, fine gravel, silty clay streak

89 sand, gravel and boulders

93 fine to med. gravel, med. to coarse sand

121 fine to coarse sand, some fine gravel

130 fine to medium gravel

750 mm Above Ground Level

SECTION VIEW

Minimum 50 mm thick cement grout

Nominal 25 mm dia. Schedule 80 PVC casing, flush thread, strapped to well casing

Nominal 350 mm dia. steel well casing

Bentonite Seal

Nominal 25 mm dia. Schedule 80 PVC, 20 slot flush thread screen, strapped to well screen

Nominal 350 mm dia. stainless steel wire-wound well screen

350 mm

85'

88'

98'3"

30 slot

124'

129'80" slot

C:\P\W\CAMBRIDGE\GPO\CON.GCD

I	well log of TW 1/94	TB	JAN/95
NO.	VAS	BY	DATE

REGIONAL MUNICIPALITY OF WATERLOO
WELL CONSTRUCTION
G-38

DRN: T. Brown

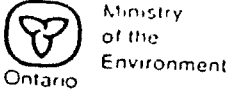
CKD: G. Kuehl

DRAWING NO.

A94277

International Water Supply Ltd.

MONTREAL - BARRE - SASKATOON



The Ontario Water Resources Act

WATER WELL RECORD

1. PRINT BOLD IN SPACES PROVIDED
2. CHECK CORRECT BOX WHEN APPLICABLE

11 6507733 65506

COUNTY OR DISTRICT: Region of Waterloo
 TOWNSHIP: Cambridge
 ADDRESS: 150 Fredericks St. Kitchener
 DATE COMPLETED: 20 02 94

LOG OF OVERBURDEN AND BEDROCK MATERIALS - SEE INSTRUCTIONS -

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET	
				FROM	TO
	Sand	gravel, bldrs		0	10
	Sand	gravel bldrs		10	40
	Sand f.c			40	73
	Sand f.c	Gravdp silty clay streaks		73	85
	Sand	gravel & bldrs		85	89
	Gravel m.f	sand m.c		89	93
	Sand f.c	some fine gravel		93	121
	Gravel m.f			121	150

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
10-15	1 FRESH 2 SULPHUR 3 CHLORIDE 4 MINERALS 5 SALT 6 GAS
15-20	1 FRESH 2 SULPHUR 3 CHLORIDE 4 MINERALS 5 SALT 6 GAS
20-25	1 FRESH 2 SULPHUR 3 CHLORIDE 4 MINERALS 5 SALT 6 GAS
25-30	1 FRESH 2 SULPHUR 3 CHLORIDE 4 MINERALS 5 SALT 6 GAS

51 CASING & OPEN HOLE RECORD

DEPTH - FEET	INSIDE DIA. INCHES	MATERIAL	WALL THICKNESS INCHES
0-14	14	1 STEEL 2 GALVANIZED 3 CONCRETE 4 OPEN HOLE 5 PLASTIC	.375
14-25		1 STEEL 2 GALVANIZED 3 CONCRETE 4 OPEN HOLE 5 PLASTIC	
25-98.25		1 STEEL 2 GALVANIZED 3 CONCRETE 4 OPEN HOLE 5 PLASTIC	

SCREEN

SIZE OF OPENING: 30 slot 25
 MATERIAL AND TYPE: 30 slot - 5' st steel wire wrap

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET	FROM	TO	MATERIAL AND TYPE	CEMENT GROUT LEAD PACKER ETC.
85	85	85	barite seal	
85	0	85	concrete grout	

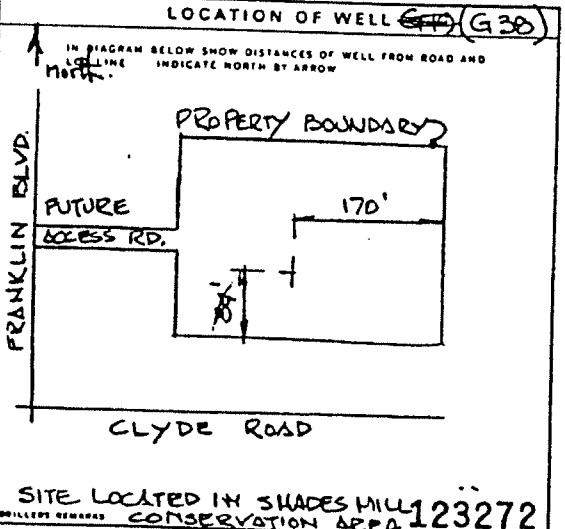
71 PUMPING TEST

PUMPING TEST METHOD: PUMP BAILEY

PUMPING RATE: 700 GPM

DURATION OF PUMPING: 2A HOURS

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVEL DURING
46.71 FEET	70.8 FEET	69.5 FEET
		68.8 FEET
		69 FEET



FINAL STATUS OF WELL: WATER SUPPLY

WATER USE: DOMESTIC MUNICIPAL PUBLIC SUPPLY

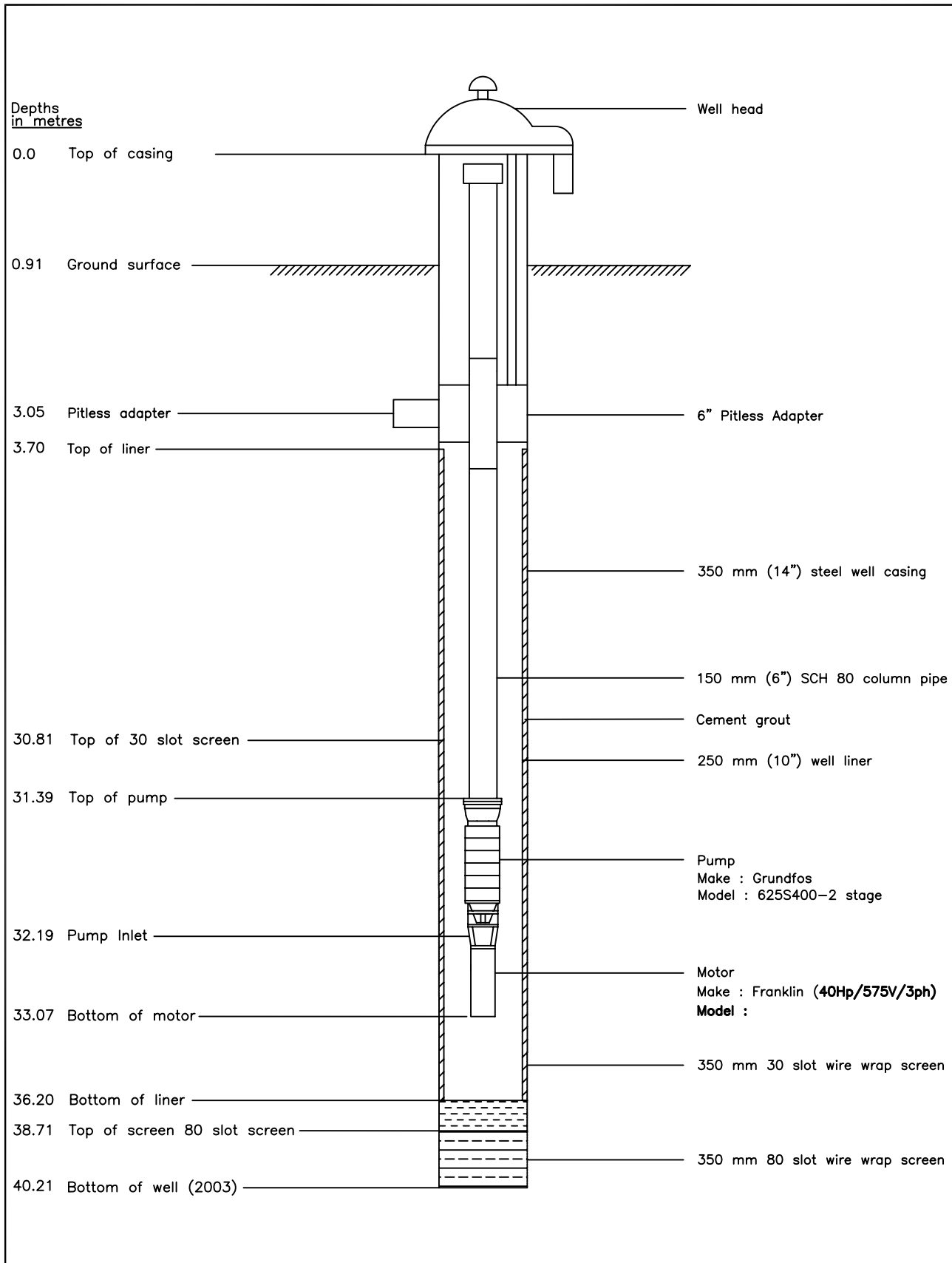
METHOD OF CONSTRUCTION: CABLE TOOL SOILING

CONTRACTOR: International Water Supply
 P.O. Box 310 Danville
 W. Hobbs
 T-0113

DATE: 16 02 94

OFFICE USE ONLY

CONTRACT NO: 2801
 DATE RECEIVED: MAR 09 1995



NOTES

- (1) All measurements below top of casing which is 0.91 m above ground.
- (2) All existing components, unless otherwise specified.
- (3)
- (4)
- (5)

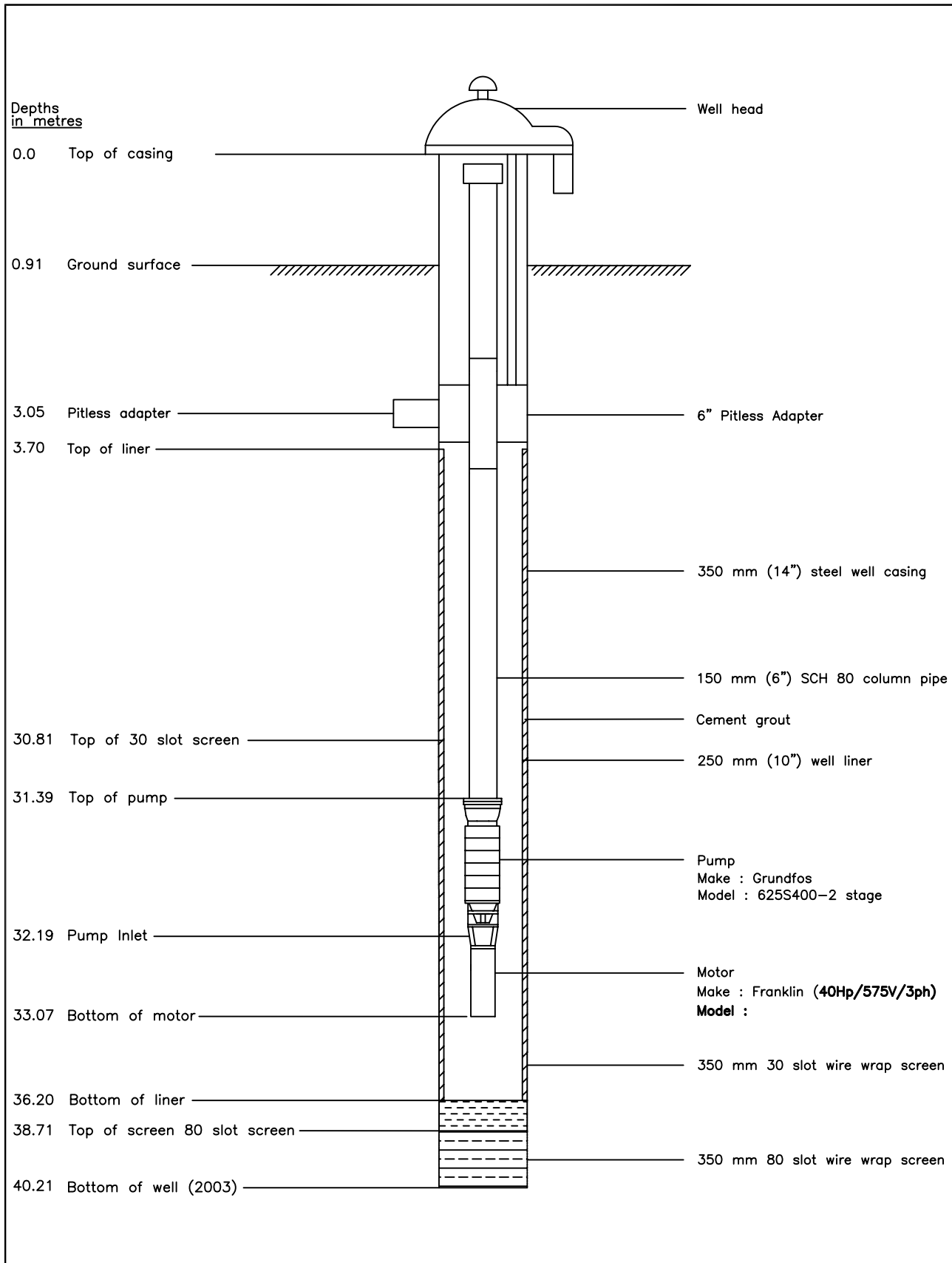


CLIENT
Regional Municipality of Waterloo

TITLE
**Well G38
Pump Installation Details**

PROJECT No. **213-130** G:\Lotowater Projects\006 Region of Waterloo\134 G38...\Pump Installation Details (G38).dwg

DESIGN			REVISION No. 2008-10-27	SCALE N.T.S.	FIGURE X
DRAWN	MO	2008/10/27			
CHECKED					



NOTES

- (1) All measurements below top of casing which is 0.91 m above ground.
- (2) All existing components, unless otherwise specified.
- (3)
- (4)
- (5)



CLIENT
Regional Municipality of Waterloo

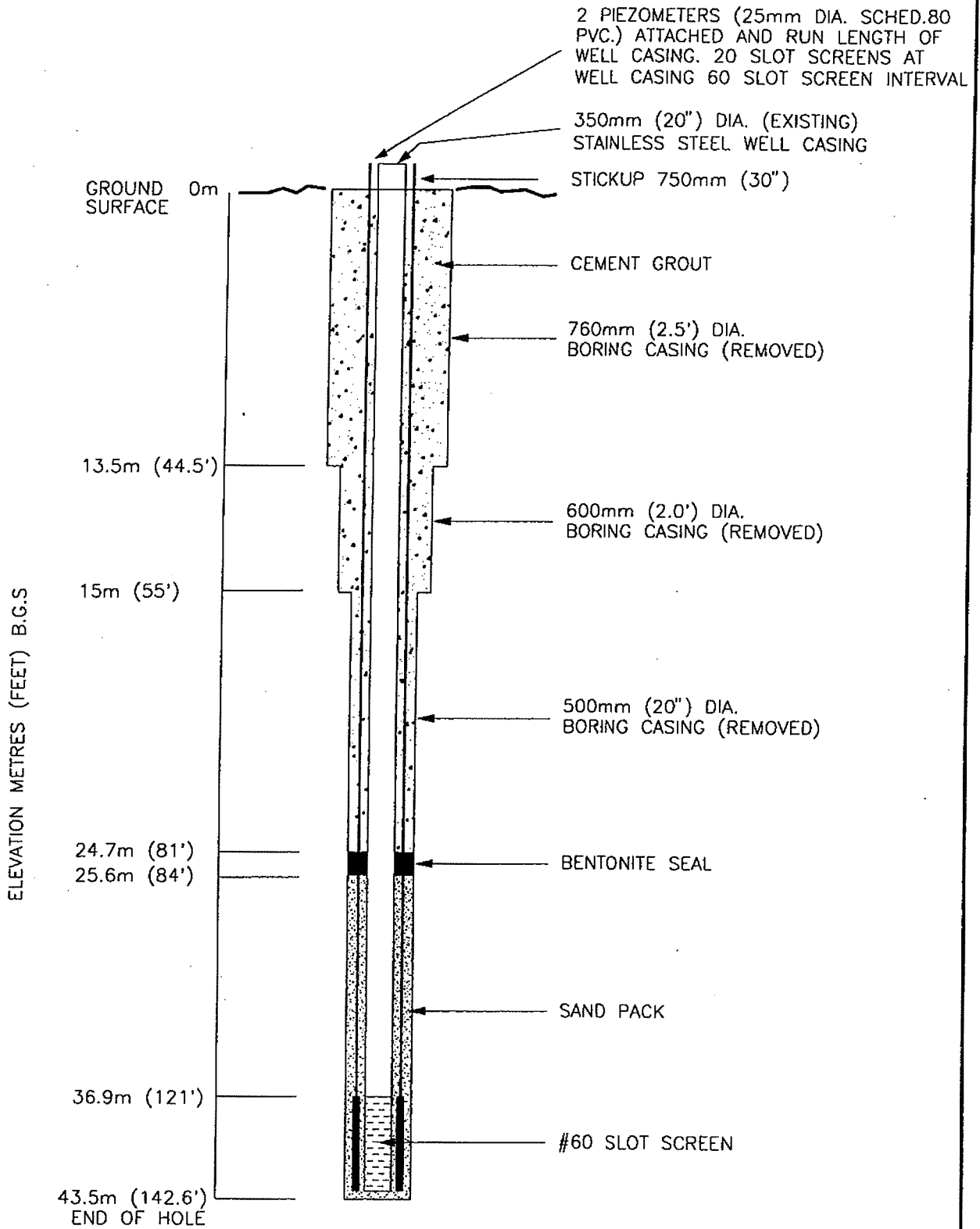
TITLE
**Well G38
Pump Installation Details**

PROJECT No. **213-130** G:\Lotowater Projects\006 Region of Waterloo\134 G38...\Pump Installation Details (G38).dwg

DESIGN			REVISION No.	2008-10-27	SCALE	N.T.S.	FIGURE	X
DRAWN	MO	2008/10/27						
CHECKED								

G-39 WELL CONSTRUCTION DETAILS
SHADES MILL CONSERVATION AREA, CAMBRIDGE ONTARIO

FIGURE 4



G:\PROJECTS\941-9029\WELLESZ.DWG

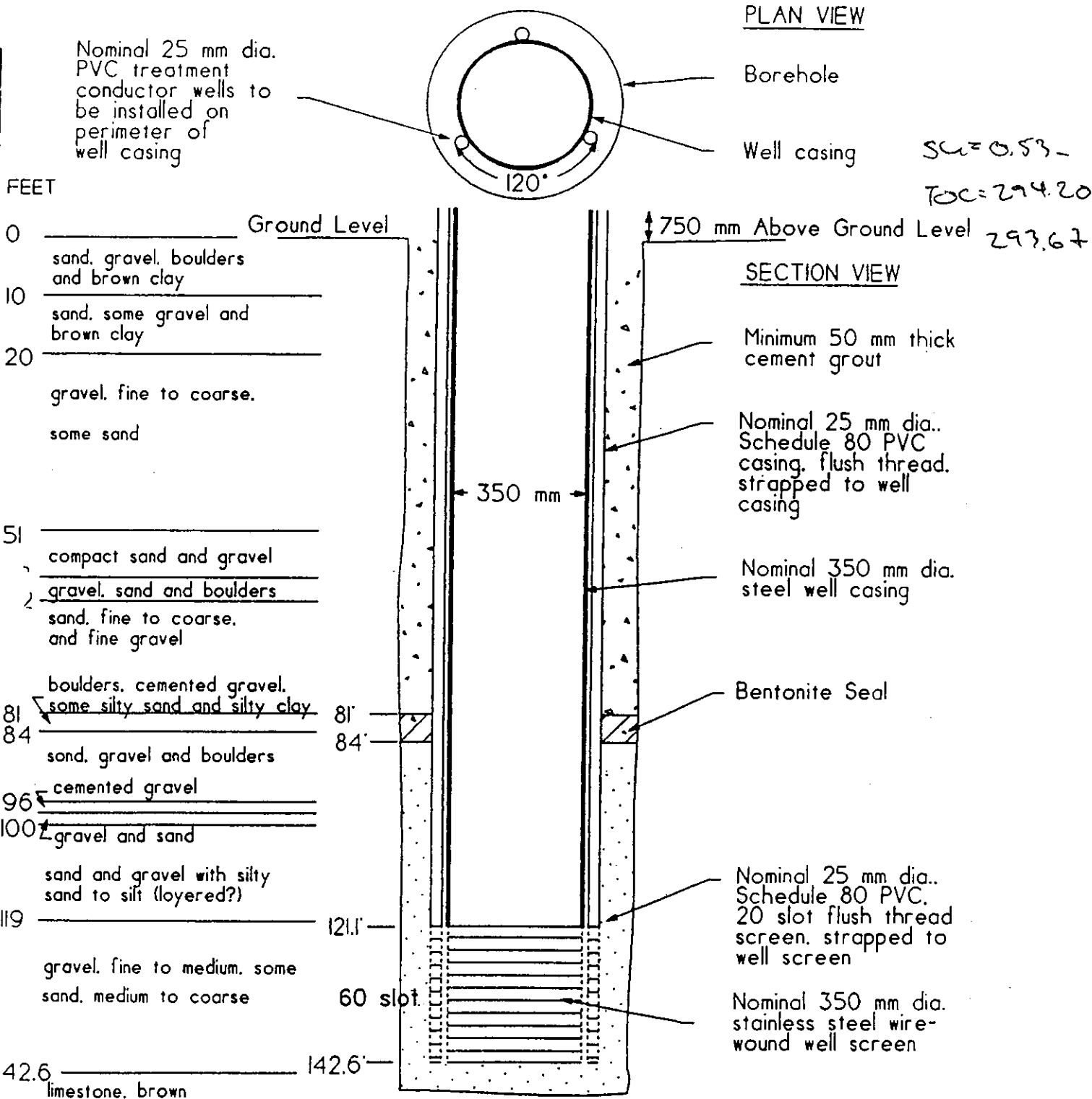
Date ...AUGUST...1995

Project 941-9029...



Drawn ...MR.....

Chkd



**REGIONAL MUNICIPALITY OF WATERLOO
WELL CONSTRUCTION
G-39**

WAS BY DATE

International Water Supply Ltd.

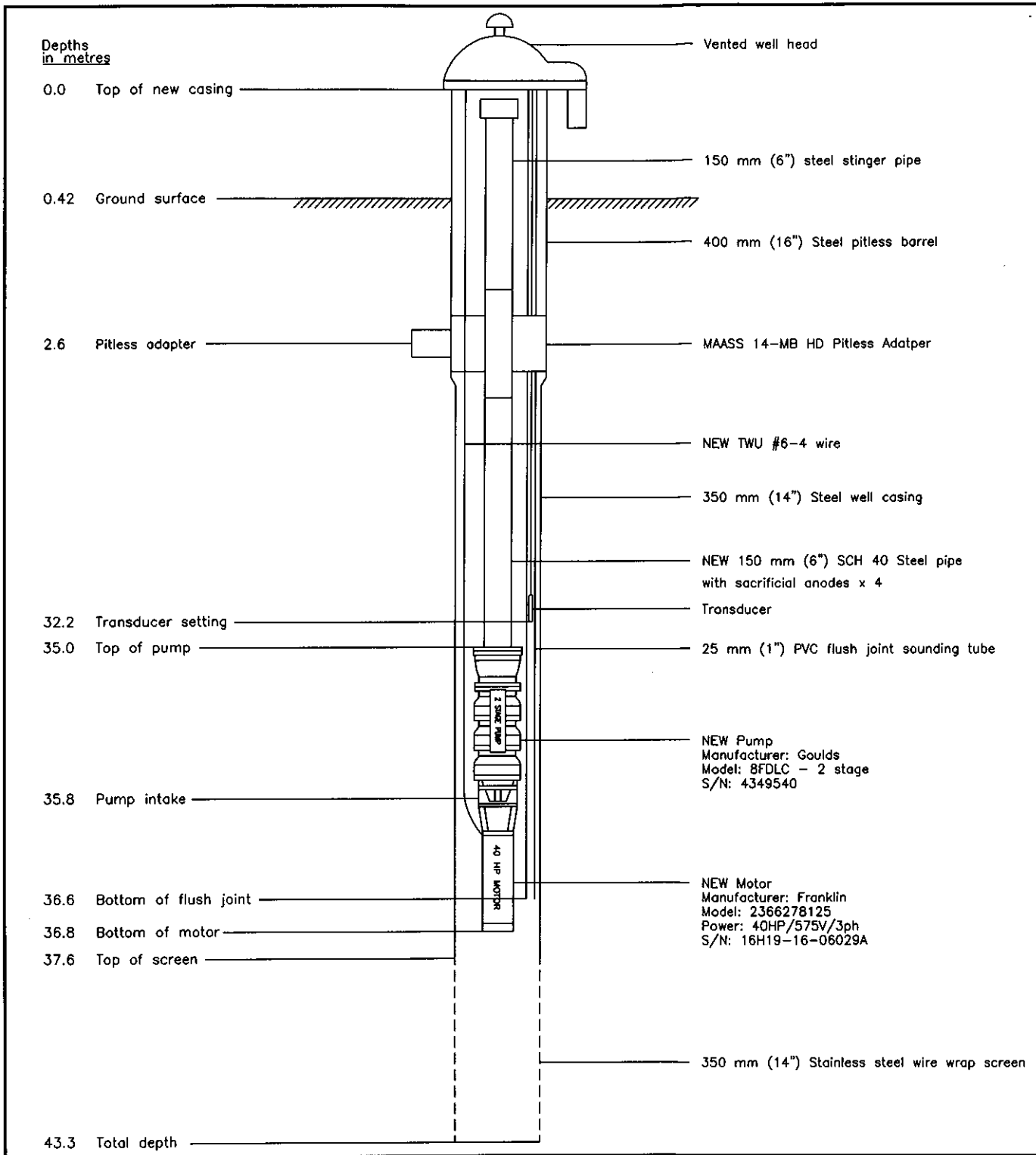
MONTREAL - BARRE - SASKATOON


DRN: T. Brown

CKD: G. Kueh

DRAWING NO.

A94278



	CLIENT Regional Municipality of Waterloo
	TITLE Well G39 Pump Installation Drawing

PROJECT No. 006-382		G:\Lotowater Projects\006 Region of Waterloo\382 Well G39\Pump Install.dwg		FIGURE 1
DESIGN	XX	REVISION No. 2016-11-23	SCALE N.T.S.	
DRAWN	EH 2016-11-23			
CHECKED				

Test Well: C-SM-PW1-11

G40

Project: 2011 Municipal Well Construction and Testing
Client: Region of Waterloo
Location: Shades Mill Well Field
Number: 160900651

Field Investigator: A. Vandenhoff
Contractor: Gerrits Well Drilling
Drilling method: Truck mount, DR 24, air rotary
Date started/completed: 17-Mar-2011 / 29-Jul-2011

Ground surface elevation: 297.14 m AMSL
Top of casing elevation: 297.80 m AMSL
Easting: 557314.5
Northing: 4802732.3

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS		GEOPHYSIC DETAILS			WELL DETAILS	
Depth (ft) (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Cement Bond Log	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	Caliper (cm)	Gamma (cps)	Resistivity (Ohm.m)	Well Details
0		Ground Surface	297.14									
5		SAND medium sand, little fine and coarse grained sand, little silt, trace organics, light yellowish brown, moist, well graded trace to little fine gravel at 1.52 to 4.60 m BGS	0.00				1	GB				
10							2	GB				
15		GRAVELLY SAND fine grained, some coarse grained sand, fine gravel, trace silt, light yellowish brown, moist	292.56 4.57				3	GB				
20		SAND coarse grained sand, little to some fine and medium grained sand, trace silt, light yellowish brown, moist some fine gravel, brown and wet beginning at 6.10 m BGS	291.65 5.49				4	GB				
25							5	GB				
30		colour change to greyish brown beginning at 10.70 m BGS					6	GB				
35							7	GB				
40							8	GB				
45		becoming finer at 13.70 m BGS, medium and coarse sand, trace to little fine gravel					9	GB				
50							10	GB				
55							11	GB				
60							12	GB				
65		GRAVELLY SAND medium grained sand, little fine grained sand, fine gravel, trace coarse grained sand, fine, trace to little coarse gravel, greyish brown, wet	277.32 19.81				13	GB				
70							14	GB				
75							15	GB				
80							16	GB				
85							17	GB				
90		SANDY GRAVEL coarse, trace medium sand, fine and coarse gravel, greyish brown, wet, angular to well rounded	269.70 27.43				18	GB				
95		GRAVELLY SAND coarse grained sand, some medium sand, trace fine grained sand, fine gravel, greyish brown, wet	268.18 28.96				19	GB				
100		SAND medium, some coarse, little fine grained sand, little fine gravel, trace silt, greyish brown, wet	266.66 30.48				20	GB				
105		GRAVELLY SAND medium and coarse grained sand, fine gravel, greyish brown, wet	265.13 32.00				21	GB				
110		SAND medium and coarse grained sand, little fine grained sand, little gravel, trace coarse gravel, greyish brown, wet	263.61 33.53				22	GB				
115							23	GB				
120		GRAVELLY SAND coarse, some medium grained sand, little coarse gravel, greyish brown, wet, mostly angular	260.56 36.58				24	GS				
125		SANDY GRAVEL coarse, little medium grained sand, fine and coarse gravel, greyish brown, wet, very angular to well rounded	259.04 38.10				25	GS				
130		GRAVELLY SAND medium and coarse, little fine grained sand, fine gravel, greyish brown, wet	257.51 39.62				26	GS				
135		SAND medium and coarse, little fine sand, trace gravel, trace cobbles, fine and coarse gravel, greyish brown, wet, very angular to well rounded	255.99 41.15				27	GS				
140		DOLOSTONE pale yellow	254.46 42.67				28	GS				
145							29	GB				
150		fracture producing little water at 46.50 m BGS										
155												
160												
165												
170												
175												
180		End of Borehole	242.27 54.86									
185												

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
GB - grab sample

m AGS - metres above ground surface
GS - grain size analysis completed
Geophysics completed on Sept. 15, 2011

n/a - not available/applicable

Drawn By/Checked By: EH / LV



1.8

Sheet 1 of 1

STANTEC BOREHOLE AND WELL - MASTER TX11 - 160900651 - BOREHOLES_110909.GPJ - STANTEC - DATA TEMPLATE.GDT_12/19/12 - EHAYMAN

Monitoring Well: C-SM-OW1AB-11

Project: 2011 Municipal Well Construction and Testing
Client: Region of Waterloo
Location: Shades Mill Well Field
Number: 160900651

Field investigator: E. Hayman
Contractor: Gerrits Well Drilling
Drilling method: Truck mount, DR 24, air rotary
Date started/completed: 11-Aug-2011 / 17-Aug-2011

SUBSURFACE PROFILE				HYDROGEOLOGY	SAMPLE DETAILS	WELL DETAILS			
Depth (ft) (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	Name: C-SM-OW1A-11 GS Elev: 295.83 m AMSL TOC Elev: 296.76 m AMSL Easting: 557314.97 Northing: 4807215.06 Stick-up: 0.93 m	Name: C-SM-OW1B-11 GS Elev: 295.78 m AMSL TOC Elev: 296.42 m AMSL Easting: 557314.76 Northing: 4802713.14 Stick-up: 0.65 m
0	Ground Surface		295.83 0.00						
0-5	SAND	medium sand, some fine to coarse gravel, light brown, moist, well graded				1	GB		
5-10		wet at 3.05 mBGS				2	GB		
10-15						3	GB		
15-20						4	GB		
20-25						5	GB		
25-30						6	GB		
30-35	GRAVELLY SAND	fine to coarse gravel, coarse sand, light brown, wet, subangular to subrounded	286.69 9.14			7	GB		
35-40						8	GB		
40-45						9	GB		
45-50						10	GB		
50-55	SAND	medium sand, trace fine gravel, light brown, moist	280.59 15.24			11	GB		
55-60						12	GS		
60-65	GRAVELLY SAND	fine to coarse gravel, medium to coarse sand, light brown, wet, subangular to subrounded	277.54 18.29			13	GS		
65-70		increasing coarse sand from 21.34 mBGS to 24.39 mBGS				14	GS		
70-75						15	GB		
75-80						16	GB		
80-85						17	GB		
85-90						18	GB		
90-95	SANDY GRAVEL	medium to coarse sand, fine to coarse gravel, varies in colour (grey, white, black, pinks and browns), wet, subangular to subrounded	268.40 27.43			19	GB		
95-100		increasing grey sand and gravel at 30.49 mBGS to 33.54 mBGS				20	GB		
100-105						21	GB		
105-110						22	GB		
110-115	GRAVELLY SAND	coarse sand, fine to coarse gravel, grey/brown, wet	262.30 33.53			23	GB		
115-120		fine sand from 36.59 mBGS to 39.63 mBGS				24	GB		
120-125						25	GB		
125-130						26	GB		
130-135	SAND and GRAVEL	medium to coarse sand, some gravel, grey, wet, subrounded to subangular	256.21 39.62			27	GB		
135-140						28	GB		
140-145	SAND	medium to coarse sand, trace gravel, grey, wet	253.16 42.67			29	GB		
145-150	DOLOSTONE	grey to pale yellow	251.64 44.20			30	GB		
150-155						31	GB		
155-160						32	GB		
160-165						33	GB		
165-170						34	GB		
170-175						35	GB		
175-180						36	GB		
180-185						37	GB		
185	End of Borehole		245.54 50.29			38	GB		

Notes:
 m AMSL - metres above mean sea level
 m BGS - metres below ground surface
 m BTOC - metres below top of casing
 GB - grab sample
 n/a - not available

m AMSL - metres above mean sea level
 mBGS - metres below ground surface
 GS - grain size analysis completed



STANTEC BOREHOLE AND WELL - CLUST 11X17 160900651 - BOREHOLES - 110908.GPJ - STANTEC - DATA TEMPLATE.GDT - 12/31/12 E.HAYMAN

Monitoring Well: C-SM-OW4-14

Project: Production Well G7 & G8 Hydrogeological Assessment
Client: Region of Waterloo
Location: Shades Mill Well Field
Number: 160900766
Field investigator: J. Koch
Contractor: Aardvark Drilling Inc.

Drilling method: Truck Mount CME75, 254 mm OD, HSA
Date started/completed: 28-May-2014 / 29-May-2014
Ground surface elevation: 292.09 m AMSL
Top of casing elevation: 292.91 m AMSL
Easting: 558046
Northing: 4802477

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS			INSTALLATION DETAILS	
Depth (ft) (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	Recovery	Diagram	Description
			292.90							
0		Ground Surface	292.09							← Above Ground Casing Stick-Up: 0.81 m
0		SILTY fine SAND to CLAYEY SILT (FILL) very stiff/compact, dark brown, fine grained sand, little fine grained gravel	0.00			1	CC	44" 73%		← Cement 0 to 0.9 m
5		No sample recovery	1.52			2	CC	5" 8%		
10		SAND and GRAVEL loose to compact, brown, trace to little cobbles, trace to little silt, variable grading with depth, moist	289.04			3	CC	51" 85%		← 51 mm Diameter Schedule 40 PVC Riser
15			3.05			4	CC	55" 92%		
20						5	CC	58" 97%		← 254 mm Diameter Borehole
25						6	CC	60" 100%		← Bentonite Chips 0.9 to 13.7 m
30						7	CC	58" 97%		
35		Wet at 10.4 m BGS		AFA2	Outwash Deposits	8	CC	51" 85%		
40						9	CC	39" 65%		
45						10	CC	45" 75%		← Silica Sand 13.7 to 17.5 m
50						11	CC	38" 63%		← No. 10 Slot Sch. 40 PVC Screen 51 mm Diameter 14.4 to 17.5 m
55										
60		Auger refusal at 17.45 m BGS End of Borehole	17.45							

Screen Interval: 14.40 - 17.45 m BGS
 Sand Pack Interval: 13.72 - 17.45 m BGS
 Well Seal Interval: 0.91 - 13.72 m BGS

Notes:
 m AMSL - metres above mean sea level
 m BGS - metres below ground surface
 CC - continuous core sample
 n/a - not available






WRAS No. 9207084



Monitoring Well: C-SM-OW5-14

Project: Production Well G7 & G8 Hydrogeological Assessment
Client: Region of Waterloo
Location: Shades Mill Well Field
Number: 160900766
Field investigator: J. Koch
Contractor: Aardvark Drilling Inc.

Drilling method: Truck Mount CME75, 254 mm OD, HSA
Date started/completed: 04-Jun-2014
Ground surface elevation: 291.40 m AMSL
Top of casing elevation: 292.09 m AMSL
Easting: 558346
Northing: 4802599

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS			INSTALLATION DETAILS	
Depth	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type	Recovery	Diagram	Description
0		Ground Surface	291.40							← Above Ground Casing Stick-Up: 0.76 m
0		GRAVELLY SAND (FILL) loose, brown, fine to medium sand, trace silt, trace coarse sand	0.00			1	CC	48" 80%		← Cement 0 to 0.9 m
5		SILTY SAND (FILL) compact, dark brown, mottled, fine grained, little fine gravel, moist	1.12			2	CC	60" 100%		
2		SAND and GRAVEL loose to compact, brown, trace to little cobbles, trace to little silt, variable grading with depth, moist	289.88			3	CC	60" 100%		← 254 mm Diameter Borehole
1.52			1.52			4	CC	60" 100%		
10		wet at 7.3 m				5	CC	60" 100%		← Bentonite Chips 0.9 to 13.5 m
4						6	CC	48" 80%		
15						7	CC	36" 60%		← 51 mm Diameter Schedule 40 PVC Riser
20						8	CC	46" 77%		
25						9	CC	55" 92%		
30						10	CC	52" 87%		← Silica Sand 13.5 to 17.4 m
35						11	CC	57" 95%		← No. 10 Slot Sch. 40 PVC Screen 51 mm Diameter 14.3 to 17.3 m
40						12	CC	36" 100%		← Natural Cave 17.4 to 17.8 m
45										
50										
55										
60		DOLOSTONE crushed	273.87							
17.53		Auger refusal at 17.83 m	17.53							
17.83		End of Borehole	273.57							
17.83			17.83							

Screen Interval: 14.33 - 17.37 m BGS
 Sand Pack Interval: 13.51 - 17.37 m BGS
 Well Seal Interval: 0.91 - 13.51 m BGS

Notes:
 m AMSL - metres above mean sea level
 m BGS - metres below ground surface
 CC - continuous core sample
 n/a - not available

WRAS No. 9207085



Borehole No.: MWSM1-02

Project: GUDI Study
Project No: E09-00116
Location: Shades Mill - North of access road and west of dam
Contractor: All-Terrain Drilling Limited
Drilling Method: 108 mm ID Hollow Stem Auger

Date: 16 July 2002
Supervisor: Matt Free
Ground Surface: 293.81 mAMSL
Top of Casing: 294.65 mAMSL

SUBSURFACE PROFILE				SAMPLE DETAILS				WELL DETAILS	
Depth	Lithologic Symbol	Lithologic Description	Elevation/Depth (m BGS)	Number	Type	Recovery	N-Value	Well	
ft m									
-1		Ground Surface	293.81						
0		SAND AND GRAVEL some boulders, brown, loose to compact, dry	0.00						Stick up (0.84 m)
1									Cement
2									Bentonite Seal
3	1								
4									
5									
6	2	geology was generally inferred from the drill cuttings and behaviour the rig while drilling							
7									
8									
9									
10	3								
11									
12									
13	4								
14									
15									
16	5								
17									
18									
19									
20	6								
21									
22									
23	7								
24									
25									Holeplug

Screen interval (shallow): 12.2 to 15.5 m BGS
 Screen interval (deep): n/a
 Sand pack interval (shallow): 11.3 to 15.5 m BGS
 Sand pack interval (deep): n/a
 Well seal interval (shallow): 0 to 11.3 m BGS
 Well seal interval (deep): n/a

Notes:
 mAMSL - metres above mean sea level
 mBGS - metres below ground surface
 n/v - no value
 SS - Split Spoon sample



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 Kitchener, ON
 N2H 6M7

Borehole No.: MWSM1-02

Project: GUDI Study

Date: 16 July 2002

Project No.: 609-00116

Supervisor: Matt Free

Location: Shades Mill - North of access road and west of dam

Ground Surface: 293.81 mAMSL

Contractor: All-Terrain Drilling Limited

Top of Casing: 294.65 mAMSL

Drilling Method: 108 mm ID Hollow Stem Auger

SUBSURFACE PROFILE				SAMPLE DETAILS				WELL DETAILS									
Depth	Lithologic Symbol	Lithologic Description	Elevation/Depth (m BGS)	Number	Type	Recovery	N-Value	Well									
26		End of Borehole wet at 13.4 m BGS	278.27 15.54	1	SS	50 %			Bottom of well (15.5 mBGS)								
27																	
28																	
29																	
30																	
31																	
32																	
33																	
34																	
35																	
36																	
37																	Top of Sand (11.3 m BGS)
38																	
39																	
40																	Top of Screen (12.2 mBGS)
41																	
42																	
43								No. 10 Slot PVC Screen 50 mm diameter No. 1 Silica Sand									
44																	
45																	
46																	
47																	
48																	
49																	
50																	
51																	
52																	

Screen interval (shallow): 12.2 to 15.5 m BGS
 Screen interval (deep): n/a
 Sand pack interval (shallow): 11.3 to 15.5 m BGS
 Sand pack interval (deep): n/a
 Well seal interval (shallow): 0 to 11.3 m BGS
 Well seal interval (deep): n/a

Notes:
 mAMSL - metres above mean sea level
 mBGS - metres below ground surface
 n/v - no value
 SS - Split Spoon sample



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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

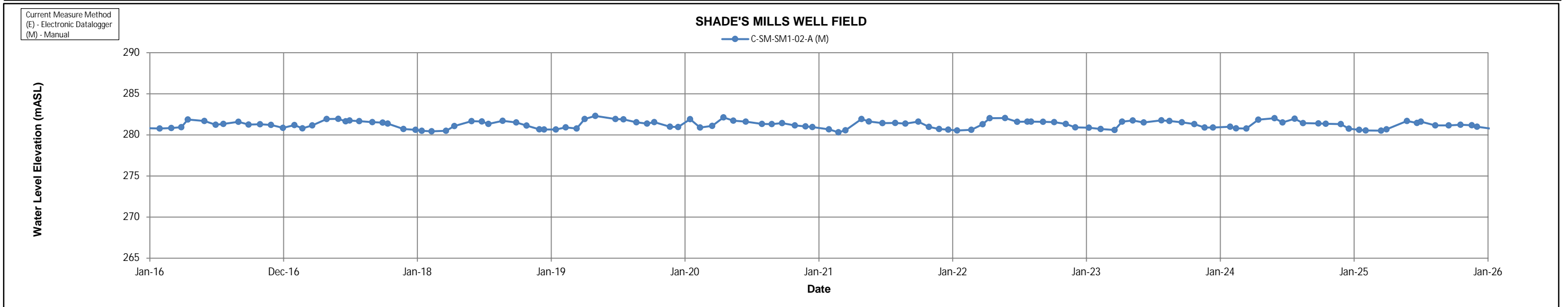
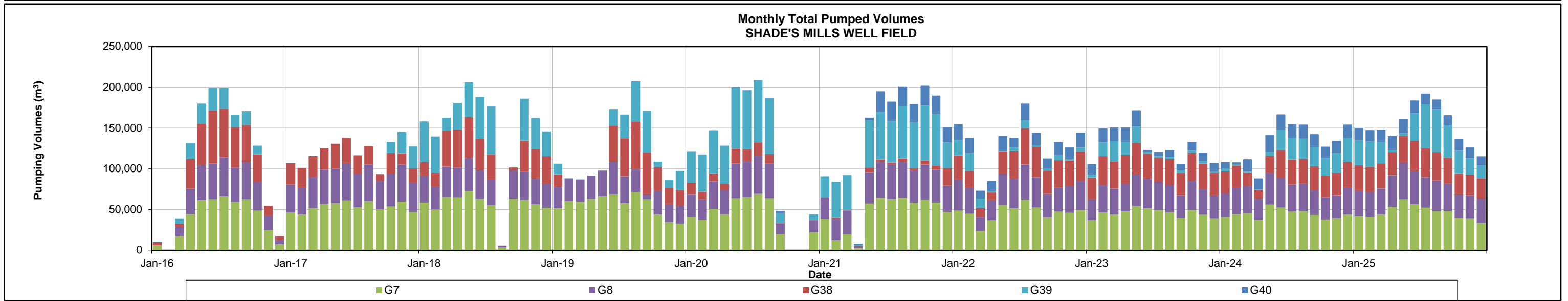
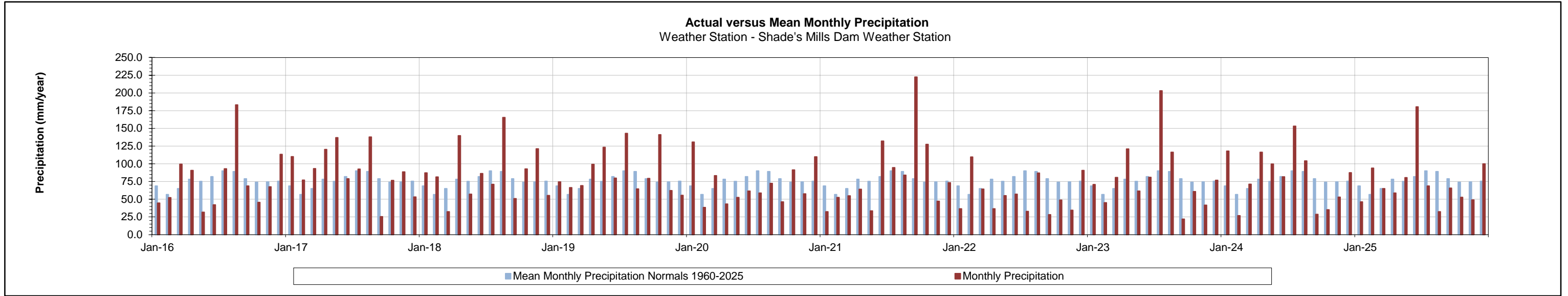


Well Field	Production Well Name	Status	Permit to Take Water Details			2021 Production Summary			2022 Production Summary			2023 Production Summary			2024 Production Summary			2025 Production Summary		
			MOE Permit Number	Permitted Capacity (total m ³ /year)*	Permitted Rate (L/s)*	Total Production Well 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)
Shade's Mills	G7	Supply	3004-A9GHYU	Combined rate for PTTW 3004-A9GHYU 4,632,008	174.5	546,456	1,497	17.3	558,103	1,529	17.7	547,307	1,499	17.4	534,984	1,466	17.0	558,784	1,531	17.7
	G8	Supply	3004-A9GHYU			408,743	1,120	13.0	391,891	1,074	12.4	390,355	1,069	12.4	382,040	1,047	12.1	412,027	1,129	13.1
	G38	Supply	3004-A9GHYU			53,499	147	1.7	344,385	944	10.9	383,287	1,050	12.2	312,456	856	9.9	371,749	1,018	11.8
	G39	Supply	3004-A9GHYU			562,178	1,540	17.8	88,288	242	2.8	98,414	270	3.1	186,635	511	5.9	336,028	921	10.7
	G40	Supply	3004-A9GHYU			167,053	458	5.3	185,005	507	5.9	140,648	385	4.5	173,410	475	5.5	171,595	470	5.4
						Well Field Total	4,632,008	174.5	1,737,929	4,761	55.1	1,567,672	4,295	49.7	1,560,011	4,274	49.5	1,589,525	4,355	50.4

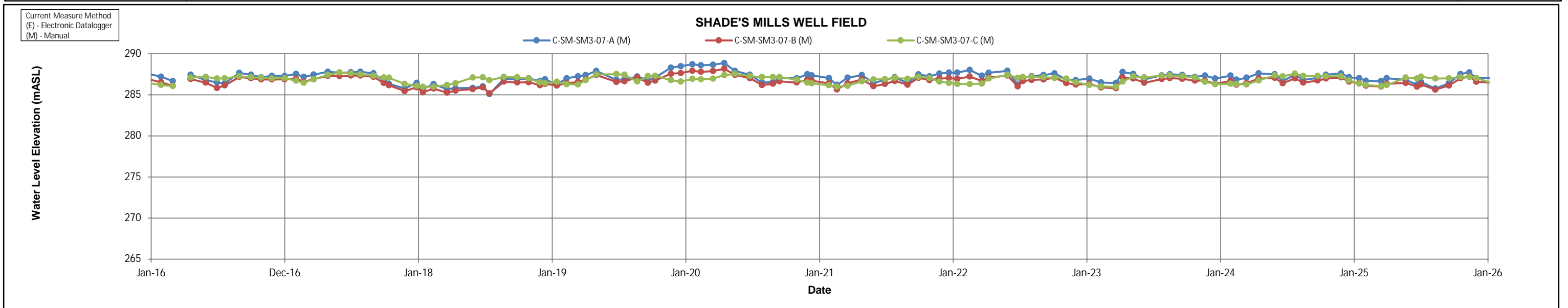
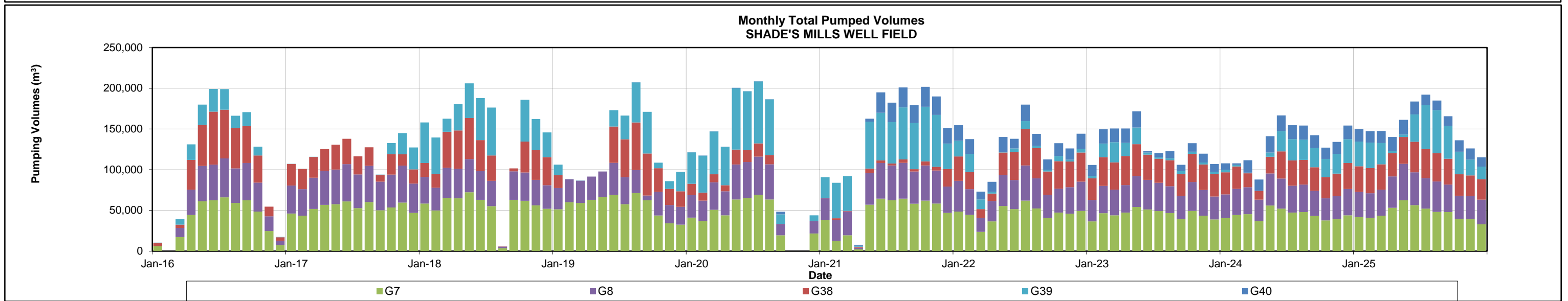
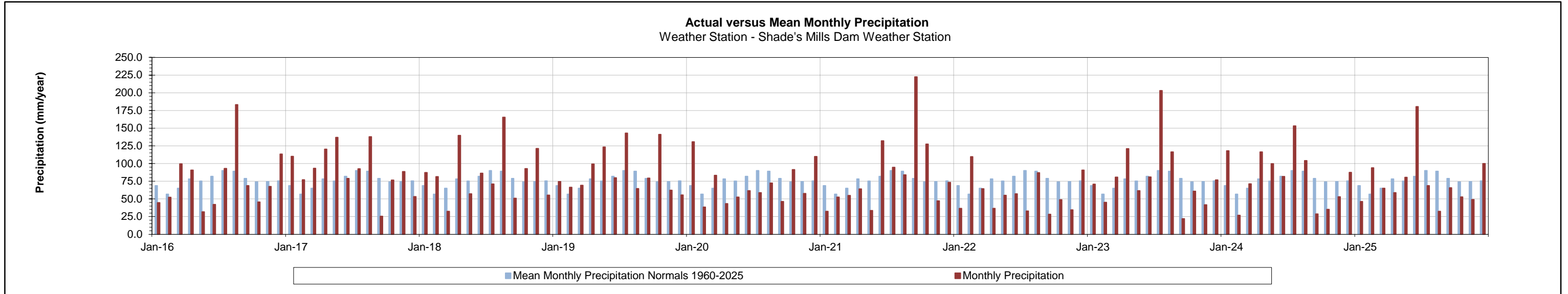
Notes:

- = no applicable data
- n/a = data not available
- * = rates and volumes based on permitted L/day

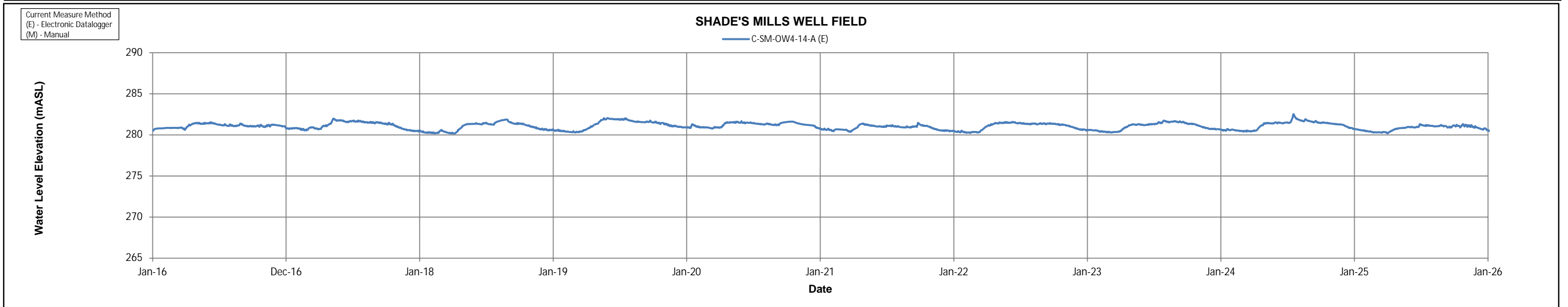
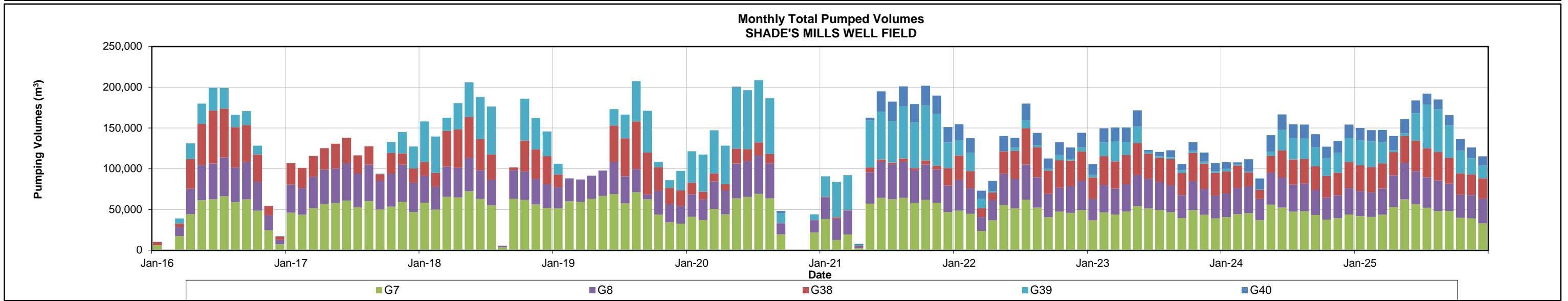
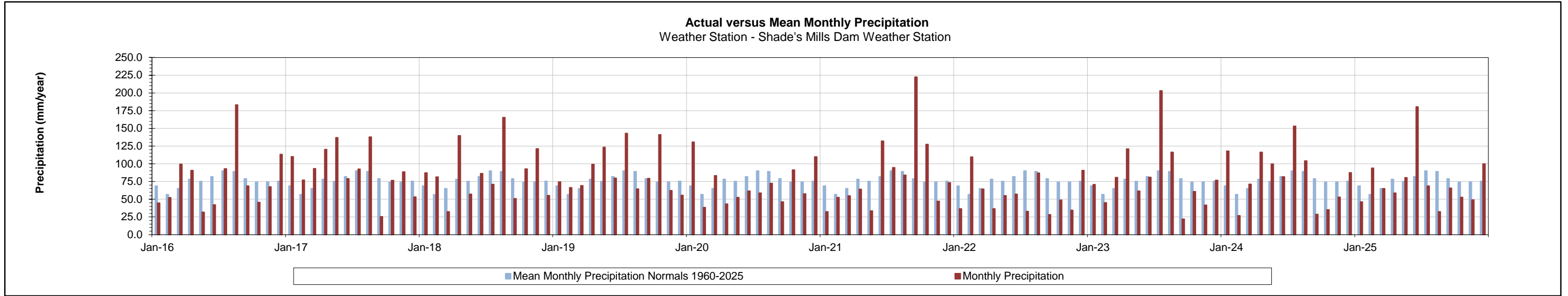
REGION OF WATERLOO
2025 GROUNDWATER MONITORING REPORT -
SHADE'S MILLS



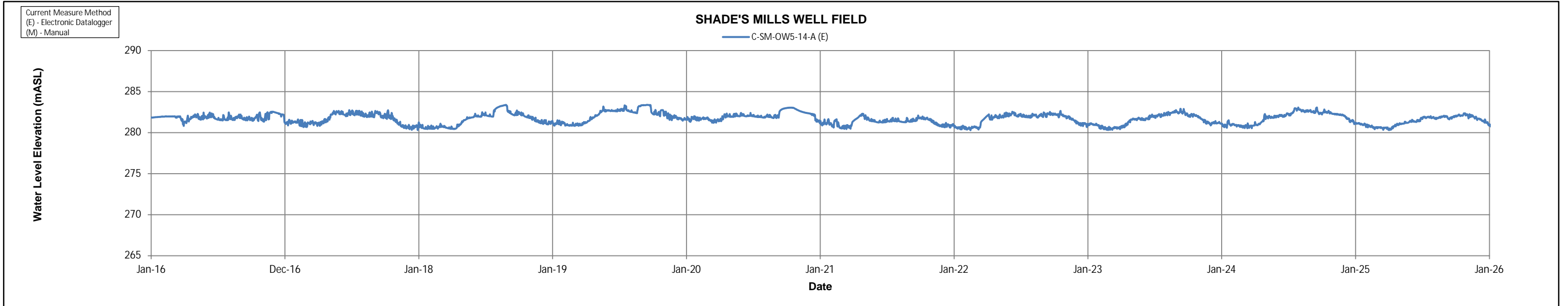
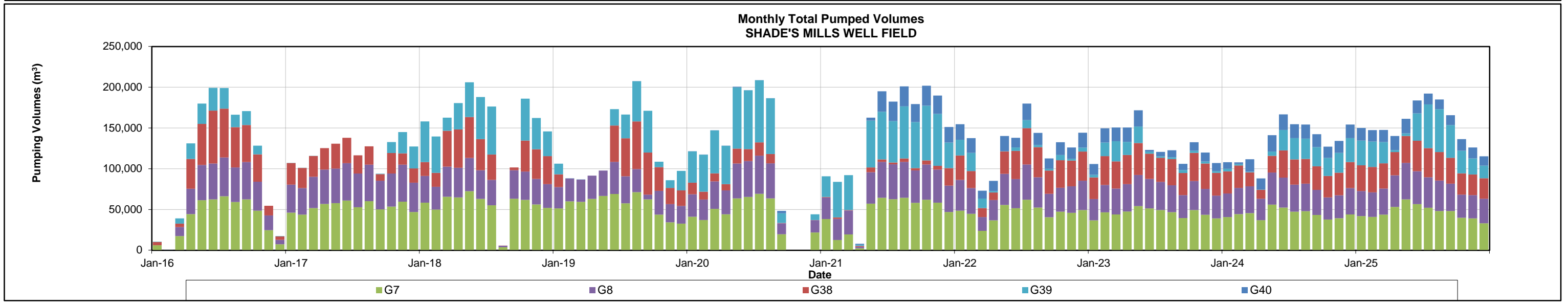
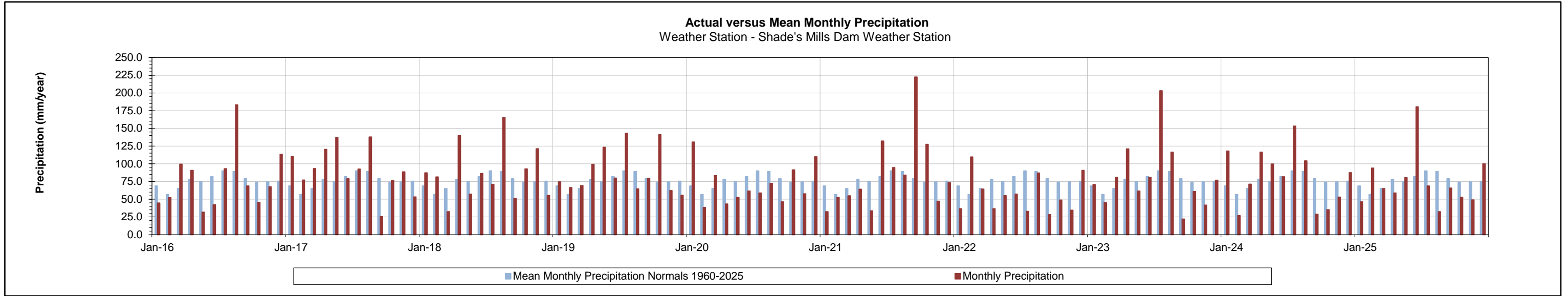
REGION OF WATERLOO
2025 GROUNDWATER MONITORING REPORT -
SHADE'S MILLS



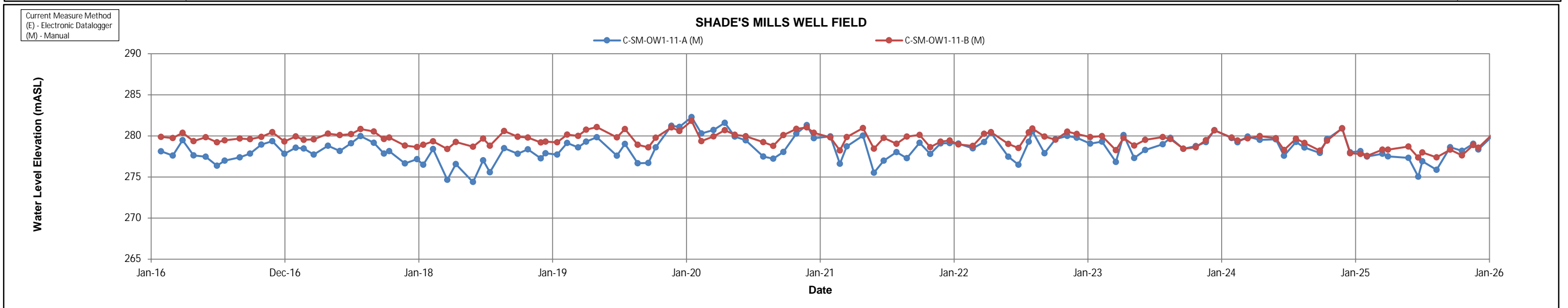
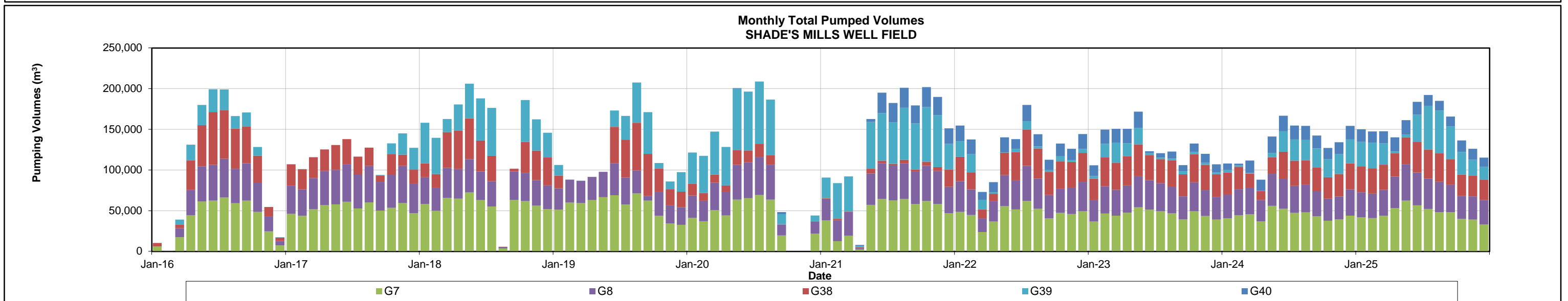
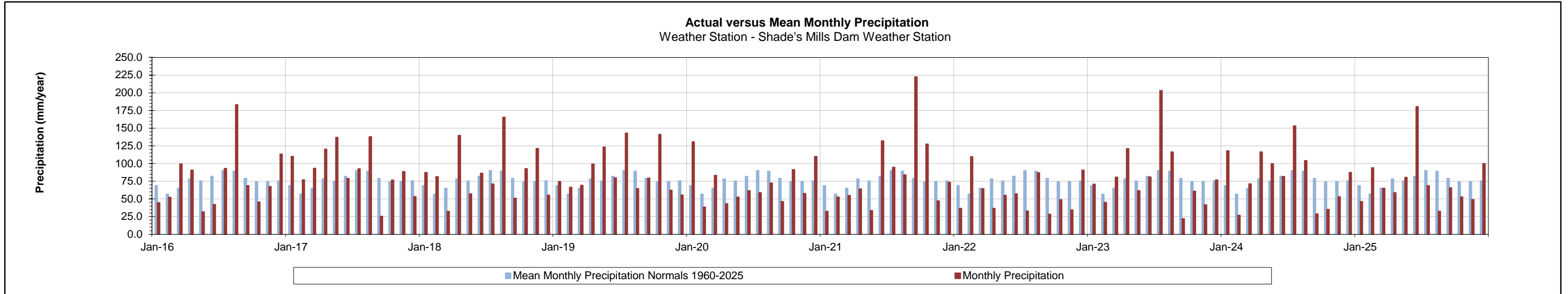
REGION OF WATERLOO
2025 GROUNDWATER MONITORING REPORT -
SHADE'S MILLS



REGION OF WATERLOO
2025 GROUNDWATER MONITORING REPORT -
SHADE'S MILLS



REGION OF WATERLOO
2025 GROUNDWATER MONITORING REPORT -
SHADE'S MILLS





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Appendix D

Precipitation Data

Table D-1
Precipitation Variation from Average
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Year	Kitchener/Waterloo Weather Station Established 1966		
	Annual Precipitation (mm)	30-yr NORMAL Precipitation 1981-2010 (mm)	Difference (mm)
	2016	748	851
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
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
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
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
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
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
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

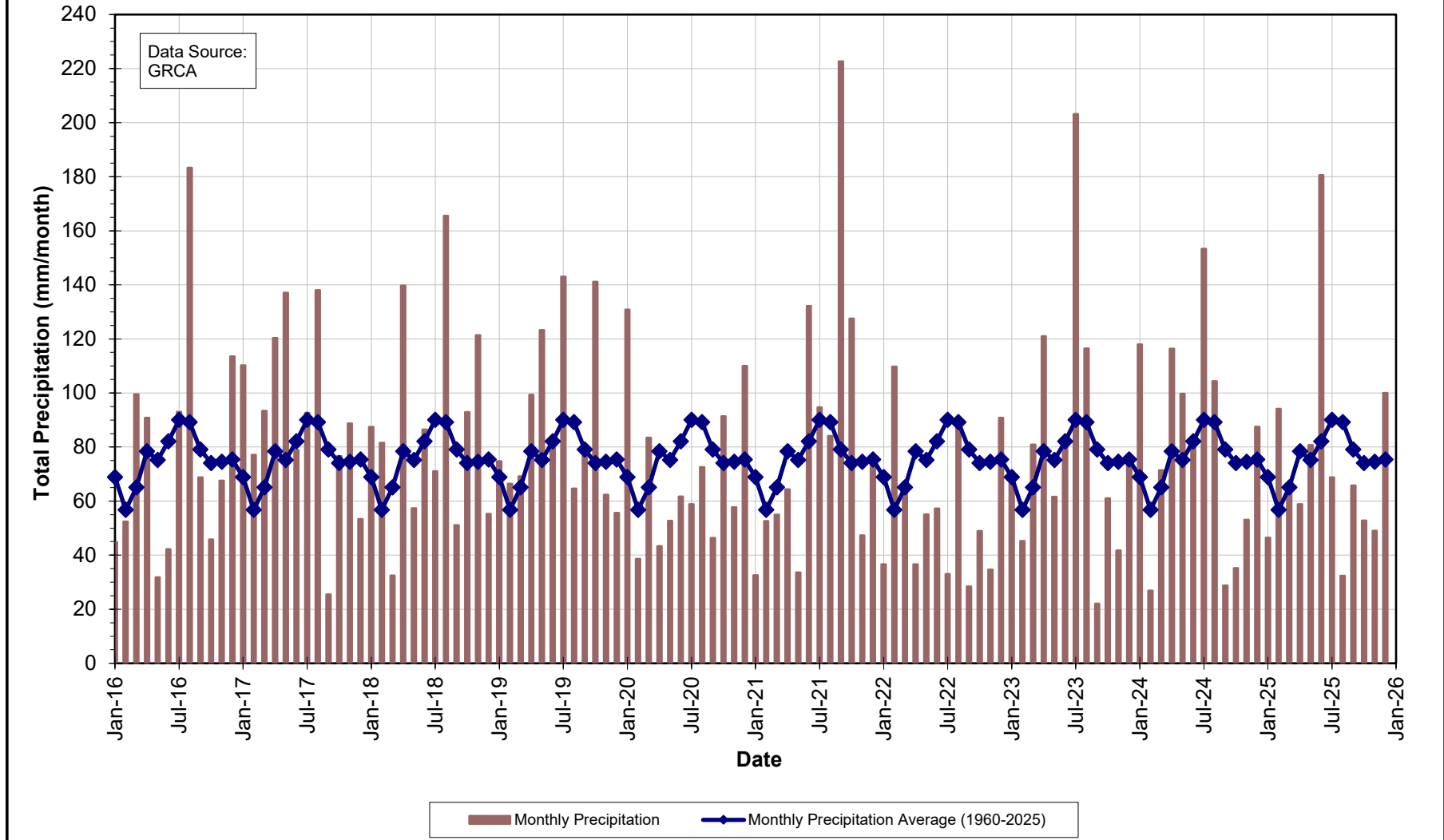
Year	Roseville Weather Station Established 1972		
	Annual Precipitation (mm)	30-yr NORMAL Precipitation 1981-2010 (mm)	Difference (mm)
	2016	899	919
2017	882	919	-37
2018	905	919	-14
2019	957	919	38
2020	817	919	-102
2021	832	919	-87
2022	637	919	-282
2023	945	919	26
2024	856	919	-63
2025	786	919	-133

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.

