2025 Biennial Groundwater Monitoring Report - Erb Street Well Field (W6B, W6C, W7, W8)

The Region of Waterloo

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R.J. Burnside & Associates Limited
292 Speedvale Avenue West Unit 20
Guelph ON N1H 1C4 CANADA

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R.J. Burnside & Associates Limited

Report Prepared By:

Stephanie Charity, P.Geo.
Hydrogeologist
SC:js

Report Reviewed By:

Dave Hopkins, P.Geo.
Senior Hydrogeologist
DH:js

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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 1541-AWGPZR) for the Erb Street Well Field (W6B, W6C, W7, W8), requires submission of a well field specific biennial report to the Ministry of Environment, Conservation and Parks (MECP) which documents production well pumping volumes and water levels in specific monitoring wells during 2024 and 2025. This report has been prepared to meet the reporting condition (4.3) of the PTTW for 2024 and 2025. A copy of the PTTW is included in Appendix A.

The location of the Erb Street Well Field is shown on Figure 1 and the production wells in Wilmot are shown in Figure 2 with the monitoring network for W6B, W6C, W7 and W8 shown in Figure 3. Well records for the production and monitoring wells are found in Appendix B.

1.1 Scope of Work

The Region records water levels on a regular basis within a network of monitoring wells to satisfy the requirements of their PTTW and to confirm that water taking is sustainable in the long term. The monitoring wells are concentrated near the production wells and 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 Erb Street Well Field in accordance with PTTW 1541-AWGPZR which consists of the following activities:

- Measuring the daily volume pumped from production wells W6B, W6C, W7 and W8 (Condition 4.1 of the PTTW);
- Measuring the water levels in monitoring wells WT-EB-OW322-02-AB, WT-EB-OW332-02-A, WT-EB-OW1-08-AB, WT-EB-OW2-08-AB, WT-EB-OW3-08-AB, WT-EB-OW6-09-AB, and WT-EB-OW1-15-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 Erb Street Well Field is located to the west of Waterloo, on the eastern boundary of the Township of Wilmot (Figure 2). Wells W6B and W6C are located north of Erb's Road between Wilmot Line and Notre Dame Drive. Wells W7 and W8 are located about 900 m south of Erb's Road (Figure 3). The closest active municipal well field is Strange Street, located about 4 km to the east (Figure 2). The Waterloo Waste Management Site is about 1.2 km east of the W7 and W8 wells. The closest surface water feature to the W6B, W6C, W7 and W8 site is the Knarr-Hoerle Drain located just north of Wells W7 and W8 (Figure 3).

2.1.1 Pumping Wells

The Erb Street Well Field consists of Wells W6B, W6C, W7 and W8. W6C was commissioned in November 2023. It was drilled adjacent to W6A / W6B in 2016 as a replacement for W6A, which was taken out of service in October 2012 and is no longer on the PTTW.

A summary of the production well construction details is provided in Table 1 below. Well records for the production wells are found in Appendix B.

Table 1: Production Well Construction Details

Well Name	Year Built	Casing / Screen Diameter (mm)	Screened Interval (mbgs)	Aquifer
W6B	1985	300	48.2 – 54.6	AFB2
W6C	2016	254	48.8 – 53.7	AFB2
W7	1966	400	32.9 – 42.1	AFB2
W8	1969	400	32.9 – 36.6	AFB2

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

Table 2: Water Takings 2024 / 2025

Well	PTTW	2024			2025		
	Permitted Max. Daily Water Taking (m^3)	Avg. Daily Water Taking (m^3)	Max Taken per Day (m^3)	Total Volume Pumped (m^3)	Avg. Daily Water Taking (m^3)	Max Taken per Day (m^3)	Total Volume Pumped (m^3)
W6B	4,582	1,605	1,771	585,874	1,394	1,530	508,799
W6C	5,561	2,552	2,657	931,606	1,702	2,593	621,262
W7	9,166	6,660	7,629	2,409,089	6,853	7,778	2,501,309
W8	10,475	1,350	2,271	492,894	1,371	1,629	500,312
Total	29,788	12,108	13,275	4,419,463	11,320	12,298	4,131,682

Condition 3.3 of the PTTW specifies that the combined daily water taking from W6C, W6B, W7 and W8 must not exceed an annual daily average of 17,272.800 m^3/day. As shown in Table 2, this requirement was met in both 2024 and 2025.

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

The pumping volumes are based on the total daily volumes as recorded by the Region's SCADA system and are presented in Appendix C as total monthly volumes. Pumping volumes from the well field ranged from 324,668 m^3/month to 394,441 m^3/month in 2024, and from 297,321 m^3/month to 378,069 m^3/month in 2025. In total, 4,419,463 m^3 was produced at this well field in 2024 and 4,131,682 m^3 was produced in 2025. These volumes are higher than volumes for the previous five years, and below the permitted volume of 6,304,572 m^3 per year (Table C-1). The increase in pumping recorded in 2024 and 2025 is the result of increased pumping of W6B and W6C.

2.1.2 Monitoring Wells

Water level monitoring is completed at observation wells WT-EB-OW322-02-AB, WT-EB-OW332-02-A, WT-EB-OW1-08-AB, WT-EB-OW2-08-AB, WT-EB-OW3-08-AB, WT-EB-OW6-09-AB, and WT-EB-OW1-15-AB (Figure 3).

Construction and monitoring well location details for the observation wells are described in Table 3 below. Well records for the monitoring wells are provided in Appendix B.

Table 3: Monitoring Well Construction Details

Monitoring Well ID	Year Built	Screened Depth (mbgs)	Screened Formation	Distance to W6B/W6C (m)	Distance to W7/W8 (m)
WT-EB-OW322-02-A	2002	65.2 – 68.3	AFB2	1,000	700
WT-EB-OW322-02-B	2002	53.0 - 56.0	AFB2	1,000	700
WT-EB-OW332-02-A	2002	49.1 – 52.1	AFB2	700	800
WT-EB-OW1-08-A	2008	56.1 – 59.1	AFB2	700	400
WT-EB-OW1-08-B	2008	44.2 – 47.3	AFB2	700	400
WT-EB-OW2-08-A	2008	58.8 – 61.9	AFB2	1,100	240
WT-EB-OW2-08-B	2008	44.8 – 47.9	AFB2	1,100	240
WT-EB-OW3-08-A	2008	53.7 – 56.7	AFB2	130	700
WT-EB-OW3-08-B	2008	43.3 – 46.3	AFB2	130	700
WT-EB-OW6-09-A	2009	46.6 – 49.7	AFB2	720	500
WT-EB-OW6-09-B,	2009	35.1 – 41.2	AFB2	720	500
WT-EB-OW1-15-A	2015	35.1 – 42.2	AFB2	900	near
WT-EB-OW1-15-B	2015	24.4 – 25.9	AFB2	900	near

2.2 Regional Geology and Hydrostratigraphy

The following sections provide a brief overview of the regional geology and hydrogeology of the Erb Street Well Field. The surficial geology based on regional OGS mapping is provided in Figure 4. The Erb Street Well Field is located in the core of the Waterloo Moraine (Figure 5). Representative cross-sections showing the stratigraphy in the vicinity of the Erb Street Well Field (W6B, W6C, W7, W8) are included as Figures 6, 7 and 8. The cross-section locations are provided on Figure 3.

The cross-sections are provided as a visual aid and do not necessarily contain all wells in the monitoring program for the Erb Street Well Field. The recently completed Tier Three Assessment Update Project (Aqua Insight et al, 2023) has revised the previous (Matrix 2015) stratigraphic interpretation of the lithology around the Erb Street Well Field. The lithological layers were updated in accordance with documentation provided in the Numerical Model Surface Transfer memorandum (Aqua Insight Inc, 2026).

Refinements (Aqua Insight et al, 2023) along the cross-sections (Figures 6, 7 & 8) include the following:

- ATA1 is shown at surface overlying ATB1 resulting in a thinner ATB1, and
- ATB2 is thicker and AFB2 is thinner in the area of the production wells

2.2.1 Surficial Geology and Conceptual Hydrostratigraphy

The surficial geology of the Study Area has been mapped and described by the Ontario Geological Survey (2003) and updated in Bajc and Shirota (2007). The surficial geology of the Erb Street Well Field is characterized by silty to clayey till sediments (Figure 4). Fine textured glaciolacustrine sediments are mapped near W7 and W8 however were not encountered in the well records. The deposition of the Waterloo Moraine in this area resulted in fine to coarse-grained sand and gravel deposits at surface south and west of the well field. The thickness of the overburden deposits generally ranges from 80 to 100 m in this area.

The Quaternary units typically present beneath the Waterloo Moraine are briefly described below, in order from youngest to oldest.

Aquitard ATA1 – Whittlesey Clay

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

Aquitard ATB1 – Tavistock Till

The Tavistock Till is a dark brown clayey silty till that is predominantly found along the western flanks of the Waterloo Moraine. In other parts of the Region, Bajc and Shirota (2007) have also used unit ATB1 to represent Port Stanley, Mornington and Upper Maryhill Tills. ATB1 ranges from 13 m to 20 m thick in the area of Erb Street Well Field. This unit is considered an aquitard and, where present, acts to restrict recharge to the lower aquifers.

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

Aquifer AFB1 / AFB2 represents the main water supply aquifer in the core areas of the Waterloo Moraine, including the Erb Street Well Field production wells. These units are generally comprised of layered silt and fine sand to coarse sand and gravel. Throughout the core areas of the Moraine (Figure 5), the unit typically exceeds 45 m in thickness. In some areas, the Upper Waterloo Moraine is interpreted to be bisected by the middle Maryhill Till (ATB2), effectively separating the aquifer into two units, AFB1 and AFB2.

This aquifer is the most prolific aquifer in the Waterloo Region due to its high hydraulic conductivity and transmissivity, lateral extent, and high recharge rate. This unit is approximately 15 m to 30 m thick in the Erb Street Well Field area.

Aquitard ATB3 – Lower Maryhill Till

The Lower Maryhill Till is described as a clayey silt to silty clay till. This unit represents one of the primary regional aquitards due to its strong influence on the groundwater flow system within the Waterloo Moraine. This unit is extensive within the core area of the Waterloo Moraine, and along the eastern flank tends to be thin, discontinuous, or re-worked and re-deposited as glaciofluvial sediments. This unit is approximately 20 m thick in the Erb Street Well Field area.

Aquifer AFB3 – Lower Waterloo Moraine Stratified Sediments

The Lower Waterloo Moraine Stratified Sediments is present below the Lower Maryhill Till, mainly along the eastern flank of the Moraine. This unit consists of stratified gravels, sands, or silts and is of very limited extent. AFB3 is not present in the Erb Street Well Field Area.

Aquitard ATC1 / ATC2 – Catfish Creek Till

The Catfish Creek Till was deposited by a major glacial advance from the north to northeast that covered all of southern Ontario. It is a dense, stony, sandy silt to silty sand till with little clay content. The hydrogeologic properties of the Catfish Creek Till are variable, ranging from a good aquitard to a poor aquifer, depending on local lithology, degree of compaction, and the presence of overlying aquitard units. The Catfish Creek Till is typically thickest in the core area of the Waterloo Moraine, and thin or absent along the eastern flank. It is approximately 20 m thick in the Erb Street Well Field area.

Aquifer AFD1 – Pre-Catfish Creek Sand and Gravel

Pre-Catfish Creek Till aquifer corresponds to sands and gravel re-worked from Catfish Creek and Pre-Catfish Creek Tills and represents the main supply aquifer in several production wells in the Cities of Kitchener and Waterloo. This unit is spatially discontinuous throughout much of the core areas of the Waterloo Moraine and pinches out near the Erb Street Well Field.

Aquitard ATE1 – Canning Drift

The Canning Drift is comprised of till and associated fine-textured lake deposits. It is typically found at depths of greater than 70 metres below ground surface (mbgs) in the Waterloo Moraine area and is identified to be discontinuous and limited in lateral extent

and thickness. Where it is absent, a hydraulic connection is present between the deep overburden aquifers and the underlying bedrock.

Aquifer AFF1 – Pre-Canning Till

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

2.2.2 Bedrock Geology

The underlying bedrock at the Erb Street Well Field is consists of the Salina, Guelph and Amabel Formation (OGS, 1991). The Salina Formation consists of interbedded grey and brown dolostone, green to red shale units, and gypsum. Groundwater extracted from this unit tends to be of poor quality due to high concentrations of calcium and sulphates. In the Erb Street Well Field area, bedrock is found at depths of approximately 80 mbgs.

2.3 Local Geology

The following description of local geology is based on sediments reported in the production well logs and monitoring well logs in the area of the Erb Street Well Field. Borehole logs of the Erb Street Well Field are included in Appendix B.

Tavistock Till (ATB1) – This unit is encountered at surface in the area of the Erb Street Well Field and is described in well logs as clay and clay and gravel. ATB1 is logged as extending to 13 m at W8 and 14.9 m at W7. At W6C silty clay and clayey silt extends to 32 m.

Upper Waterloo Moraine (AFB1 / AFB2) – This unit was identified in all of the Erb Street production wells. The unit was encountered at depths of between 32.9 mbgs (W7) and 48.5 mbgs (W6B). It was generally described as sand and gravel in the driller's logs and ranged in thickness from 10 m to 30 m. The Erb Street Well Field Production wells are all completed in this aquifer.

Lower Maryhill Till (ATB3) – This unit described as clay with trace sand was identified at W6C at a depth of 59 mbgs and in the log for WT-EBS-OW2-08-A at a depth of 63 m.

3.0 2024 / 2025 Results

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

3.1 Precipitation

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

Since variations in precipitation totals can occur throughout the Region due to localized events, monthly precipitation data from the GRCA, University of Waterloo (U of W) or Environment Canada station located closest to the production wells are used. The closest GRCA weather station relative to the Erb Street well field is Laurel Creek station located 4.3 km from the well field. The closest Environment Canada station is the Roseville station (13 km southeast of 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 the Laurel Dam station are shown on Figure D.1, Appendix D. At the Laurel Dam station, the long-term average was calculated from when measurements started until the end of 2025. The Roseville station has “Climate Normals” calculated by Environment Canada for 1981 to 2010.

Annual 2024 / 2025 precipitation data for the closest weather station and closest Environment Canada meteorological station to the Erb Street Well field are presented in Table 4 below. In 2024 Roseville was missing 5 days of data and 20 days in 2025. As a result, the precipitation totals may be under reported at this location.

Table 4: Summary of Precipitation Data

Station	2024 Precipitation (mm)	2024 Deviation (mm)	Long-Term Average (mm)	2025 Precipitation (mm)	2025 Deviation (mm)
Laurel Dam (C)	907	-31	938[A]	894	-44
Roseville Station (A)	856	-63	919[D]	786	-133

Sources: Environment Canada (1), GRCA (3),

[A] 1991 to 2020 Normal [C] 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 following the snowmelt and 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.

The 2024 total precipitation at the Laurel Dam station was 907 mm, which is 31 mm below the long-term average, indicating 2024 was a drier-than-average year at

the well field. A similar below long-term average trend is noted at the Roseville station. The March 1 GRCA snow survey indicated a snowpack across the Region that was low compared to normal.

In 2025, the total precipitation at the Laurel Dam station was 894 mm, which is 44 mm below the long-term average. The total precipitation at the Roseville station was 133 mm below the long-term average, indicating 2025 was a drier-than-average year. However, Roseville was missing 25 days of data in 2024 / 2025 and as a result, precipitation totals may be under reported. The snow survey conducted by the GRCA on March 15, 2025, showed that the stations in the Region had a high to very high measured snow water equivalent.

3.2 Monitoring Results

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

WT-EB-OW1-08-AB

WT-EB-OW1-08-AB is located about 400 m west of W7 / W8. Both screens are installed in the AFB2 aquifer unit. Water levels have been measured manually on a monthly basis since September 2010. A datalogger was installed in OW1-08-A in 2017.

Water levels in the A and B screens are generally similar and have ranged between 349.2 and 351.4 masl duirng the past 10 years. Historically, short term water level rises (November 2019, December 2020 and August 2024) can be observed in response to reduced pumping of W7. In December 2023, a decreasing water level trend is observed, coinciding with pumping of W6B and W6C and increased overall water taking at the Erb Street Well Field. Water levels decline from 350.3 masl in December 2023 to 349.2 masl in December 2025.

WT-EB-OW322-02-AB

WT-EB-OW322-02-AB is located about 700 m northeast of W7 / W8. Both screens are installed in the AFB2 aquifer unit. Water level data is collected using an electronic data logger at the A screen, and monthly manual measurements at the B screen.

Water level trends are similar in each screen. Daily fluctuations in the A screen of about 0.4 m suggest impacts from the pumping cycles of production wells. In both screens, water levels showed an increasing trend from 2008 to 2019 due to reduced pumping at W8 during which time the levels increased by approximately 2 m. A decreasing trend in water levels is apparent from January 2021 until January 2023 after which water levels

were stable. In 2024 / 2025 water levels decline 1.1 m in response to increased pumping at W6B and W6C.

WT-EB-OW332-02-A

WT-EB-OW332-02-A is located about 700 m east of W6B / W6C and is screened in the production aquifer (AFB2). Manual water level monitoring at this location began in October 2004 and an automatic water level meter was installed in July 2017.

Daily water level fluctuations of about 0.4 m are due to pumping cycles of production wells. Over the past ten years, water levels have ranged from 348.7 masl in 2025 to 350.7 masl in 2020. In 2024 / 2025 water levels decline 1.1m in response to increased pumping at W6B and W6C.

WT-EB-OW2-08-AB

WT-EB-OW2-08-AB is located about 240 m south of W7 / W8. Both screens are installed in the AFB2 aquifer unit. Manual water level monitoring at this location began in July 2010, and dataloggers were installed in October 2014. The datalogger in the B screen was removed in May 2017 and water levels are now measured manually.

Water levels in the A and B screens show a similar pattern with variations corresponding to changes in pumping at W7 and W8. An increasing trend from 2012 to 2019 is a result of decreased pumping at W8. Water levels decline from 349.9 masl in January 2020 to 347.6 masl in December 2025. In 2024 / 2025 water levels are about 1.2 m below historical water levels.

WT-EB-OW3-08-AB

WT-EB-OW3-08 is located about 130 m southeast of W6B/W6C. Both screens are installed in the AFB2 aquifer unit. Manual monitoring at this location began in May 2010 with dataloggers installed in each well in October 2014.

Water levels in both screens display similar trends, with the levels in the B screen consistently about 2.5 m higher than levels in the A screen. Both wells show a response to changes in pumping rates at W6B and W6C due to being screened in the production well aquifer and close proximity to the pumping wells. Water levels in 2024 / 2025 are about 3 m lower than historical levels due to increased pumping at W6B and W6C.

WT-EB-OW6-09-AB

WT-EB-OW6-09 is located about 720 m east of W6B / W6C. Both screens are installed in the AFB2 aquifer unit. The collection of monthly manual water levels began at this location in September 2010 and dataloggers were installed in October 2014. The

datalogger in the B screen was removed in June 2017 with manual water levels now colected monthly.

Water levels in the A and B screens are almost identical and between 2016 and 2025 varied between 349.1 masl and 351.5 masl with 0.2 m daily fluctuations in response to pumping of W6B. Water levels indicate seasonal fluctuations with levels generally highest in the spring and a decrease through the remainder of the year. The 2024 / 2025 water levels show a decreasing trend in response to increased pumping at W6B and W6, decreasing about 1 m from December 2023 to December 2025. Water levels in 2024 / 2025 are about 1.5 m lower than historical levels due to increased pumping at W6B and W6C.

WT-EB-OW1-15-AB

WT-EB-OW1-15-AB is located on the W7/W8 production well site and 900 m from W6B / W6C. It was constructed in July 2015 as a replacement for ET-EBS-OW7-57-B, which was decommissioned in October 2016.

The water level data from both the A screen (AFB2) and the B screen (AFB2) show responses to pumping of W7 / W8. Fluctuations of up to 1 m occur in response to periods of reduced pumping, though the response in the B screen is more subdued. The largest water level rises in response to decreased pumping are seen in November 2019, December 2020, August 2021 and August 2024. Smaller scale responses to reduced pumping are seen throughout 2024 / 2025. In 2024 / 2025 water levels are about 1.2 m below historical water levels.

4.0 Impact Assessment

4.1 Well Interference

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

PTTW Condition 5.2 states: “For Groundwater Takings - If the taking of water is observed to cause any negative impact to other water supplies obtained from any adequate sources that were in use prior to initial issuance of a Permit for this water taking, the Permit Holder shall take such action necessary to make available to those affected, a supply of water equivalent in quantity and quality to their normal takings, or shall compensate such persons for their reasonable costs of so doing, or shall reduce

the rate and amount of taking to prevent or alleviate the observed negative impact. Pending permanent restoration of the affected supplies, the Permit Holder shall provide to those affected temporary water supplies adequate to meet their normal requirements or shall compensate such persons for their reasonable costs of doing so. If permanent interference is caused by the water taking, the Permit Holder shall restore the water supplies of those permanently affected."

There were no well interference complaints related to pumping of W6B, W6C, W7 and W8 received in 2024 and 2025, therefore both conditions 5.1 and 5.2 have been met.

There are properties that are not municipally serviced for water supply within 500 m of the Erb Street Well Field. When a well interference complaint is received, the Region has a Well Interference Policy in place. A copy of the policy is presented in Appendix F of the 2019 Biennial Groundwater Monitoring Report – Multiple Well Fields (Burnside, 2020).

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

Table 5: PTTWs in Vicinity of Erb Street Well Field (W6B, W6C, W7, W8)

Permit Number	Permit Holder	Purpose	Source, Max Liters per Day	Distance from W6B, W6C and W7, W8 Supply Wells	Expiry Date
0540-CCQK8U	Miller Paving Limited	Aggregate Washing	Source Pond 1 – 9,720,000	1,700 m (W7, W8)	2/28/2027
1113-9RHQAE	Herrle-Braun	Agricultural	Dugout Pond 1,400,000	45 m (W6B,W6C) 300 m (W7,W8)	1/31/2025
8320-A4MMFP	Paul Mauthe	Agricultural	Dugout Pond 1,717,000	60 m (W6B,W6C) 300 m (W7,W8)	11/30/2025
7814-AW9KZ4	Herrle Farms Ltd.	Agricultural	Well 1, 696,600 Herrle Pond, 816,600	150 m (W6B,W6C) 750 m (W7,W8)	03/31/2028
6348-CHTK9H	Region of Waterloo	Remediation	EW433-21 1,296,000	1.4 km (W7,W8)	3/31/2032

Permit Number	Permit Holder	Purpose	Source, Max Liters per Day	Distance from W6B, W6C and W7, W8 Supply Wells	Expiry Date
			EW379-13, 1,008,000 EW77R-16, 534,240 EW362-09, 845,280 EW376-13, 263,021 EW377-13, 236,021 EW378-13, 773,281		

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 the Erb Street production wells and monitoring wells are located in the same sand aquifer (AFB2) and show daily water level fluctuations in response to pumping at the production wells. Water levels reported in 2024 and 2025 have declined in all wells in response to increased pumping at W6B and W6C. Water levels in all wells at the end of 2025 are the lowest seen in the last 10 years of monitoring. Aquifer levels are continuing to decline at the end of 2025 in all wells except WT-EB-OW1-15-AB and WT-EB-OW3-08-AB where levels have stabilized.

Most of the monitoring wells for the Erb Street Well Field do not show seasonal trends with aquifer levels being mostly impacted by the pumping rather than precipitation trends. Seasonal fluctuations are observed at WT-EB-OW6-09-AB when pumping rates are generally stable, with the highest and lowest levels observed in the spring and late summer / fall, respectively. 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 Erb Street Well Field (W6B, W6C, W7, W8) 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 1541-AWGPZR;
- There were no reported well interference complaints arising from water taking at the Erb Street well field;
- All monitoring wells show some response to pumping at the Erb Street production wells; and
- Increased pumping of W6B and W6C has resulted in declining water levels in 2024 and 2025.

6.0 References

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

Aqua Insight Inc.,et al. 2023. Hydrogeological Characterization and Conceptual Model Update Report, Region of Waterloo Tier Three Assessment Update Project, June 2023.

Aqua Insight Inc. 2023. Moraine Model Update and Recalibration Report. Region of Waterloo Tier Three Update Project. Final Report, June 2023.

Bajc, A.F. and Shirota J., 2007. Three-dimensional mapping of surficial deposits in the Regional Municipality of Waterloo, southwestern Ontario; report in Ontario Geological Survey, Groundwater Resources Study 3, p. 42.

Golder Associates, 2017. 2015 Municipal Well Construction and Testing-Erb Street Well Field W6 Site, January 2017.

Karrow, P.F., 1993. Quaternary Geology of the Stratford-Conestogo Area, Southern Ontario. Ontario Geologic Survey Report 283.

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R.J. Burnside & Associates Limited, 2024. 2023 Biennial Groundwater Monitoring Report – Erb Street Well Field, Region of Waterloo.

Stantec Consulting Ltd., 2009. Revised January 2012. Tier 3 Water Budget and Local Area Risk Assessment. Erb Street Well Field Characterization Study.

Stantec Consulting Ltd., 2016. 2015 Monitoring Well Replacement Program, Regional Municipality of Waterloo, December 20, 2016.

BURNSIDE

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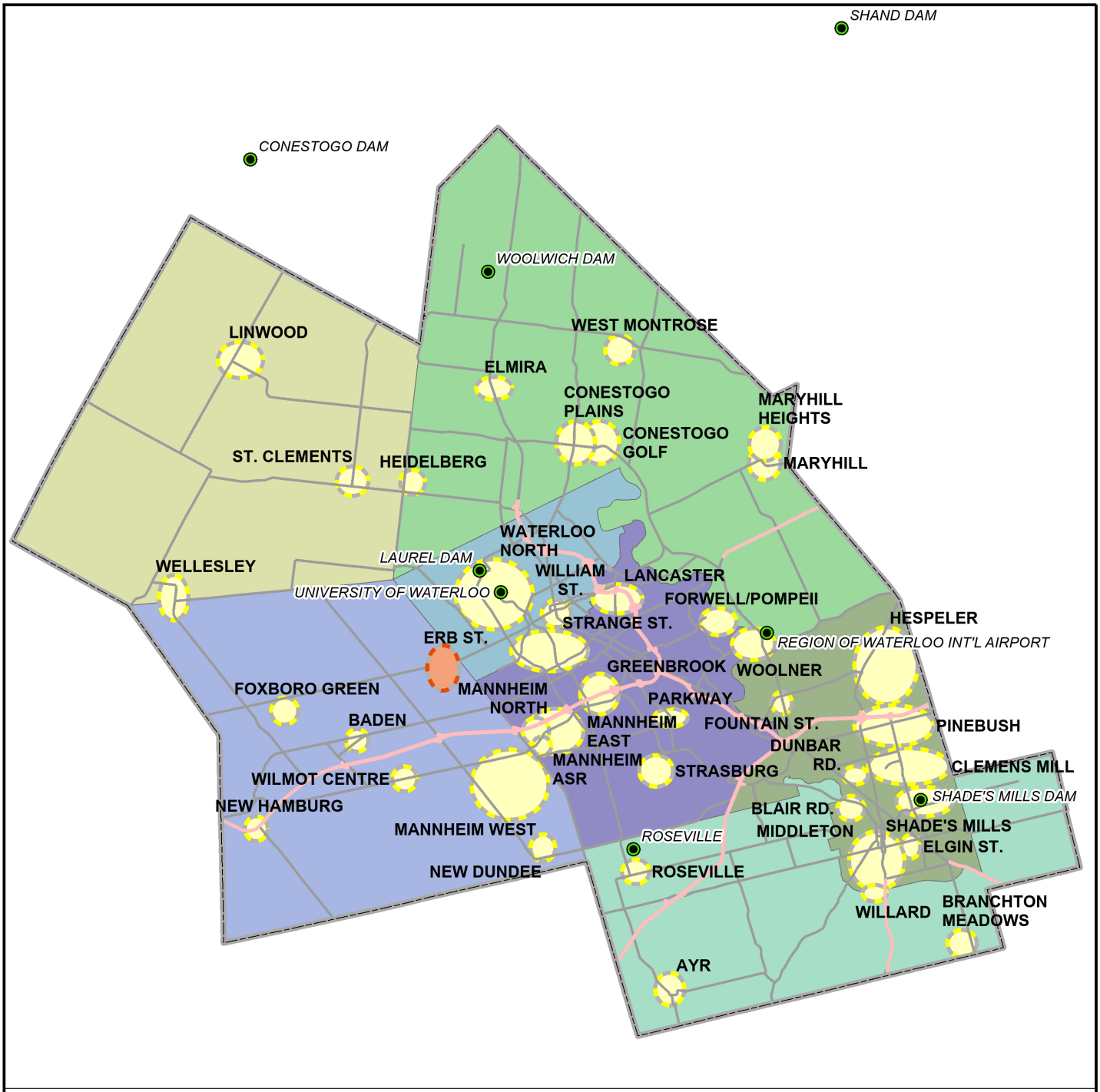
Figures



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Map Title

2025 GROUNDWATER MONITORING REPORT - ERB STREET WELL FIELD

WELL FIELD LOCATION MAP

Client

REGION OF WATERLOO

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

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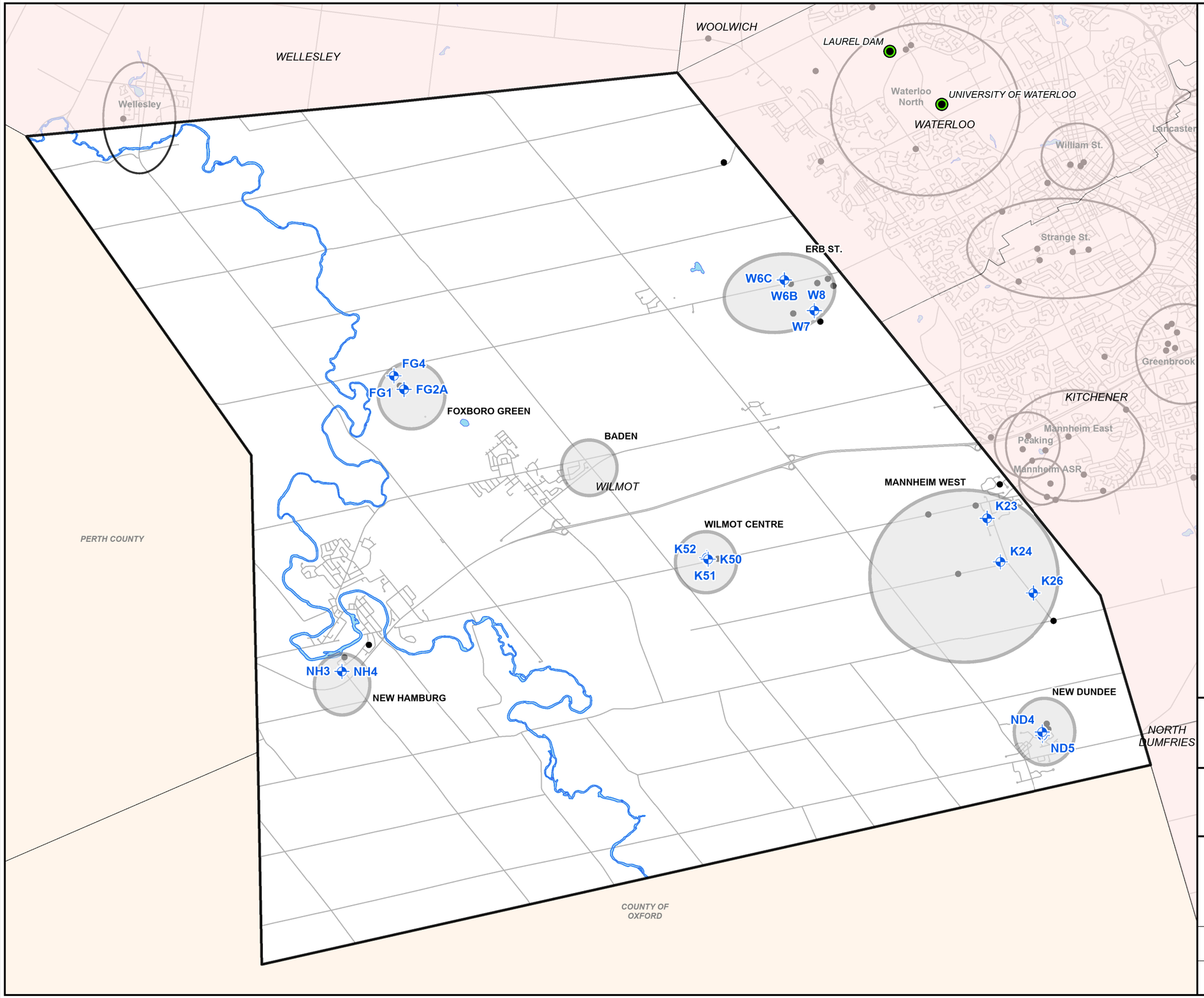

LEGEND

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

Sources:

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

Datum: North American 1983 CSRS

Coord. System: NAD 1983 CSRS UTM Zone 17N

N

0 1 2 3 4 5 6

Kilometers

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Client

REGION OF WATERLOO

Figure Title

2025 GROUNDWATER MONITORING REPORT - ERB STREET WELL FIELD

WILMOT WELL FIELDS AND MONITORING NETWORK

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HN	SQ	February 2026	2
Scale		Project No.	
1:80,000		HA0464020	

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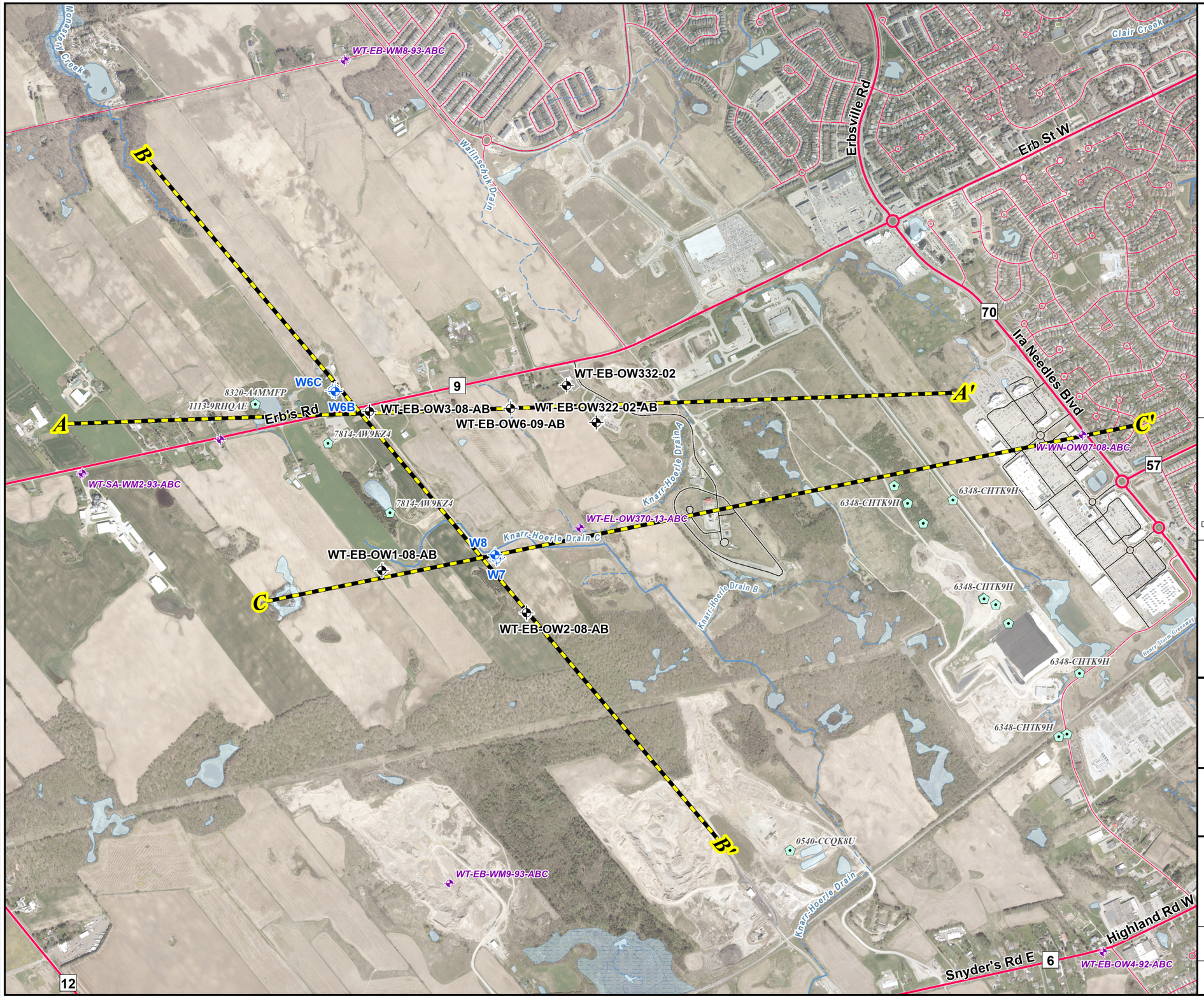

Legend

- Production Well Location
- Nearby Monitoring Well Location
- Abandoned Well Location

Additional MECP PTTW Locations

- Groundwater
- Cross Section Orientation
- Intermittent Creek
- Creek
- Ponds
- Provincially Significant Wetland (MNR)
- Roads (Regional) Labels
- Regional Road
- Local Road
- Private / Other Road

Sources:

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

Datum: North American 1983

N

0 200 400 600 800 1,000

Metres

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Client

REGION OF WATERLOO

Figure Title

2025 GROUNDWATER MONITORING REPORT - ERB STREET WELL FIELD

WELL LOCATION MAP

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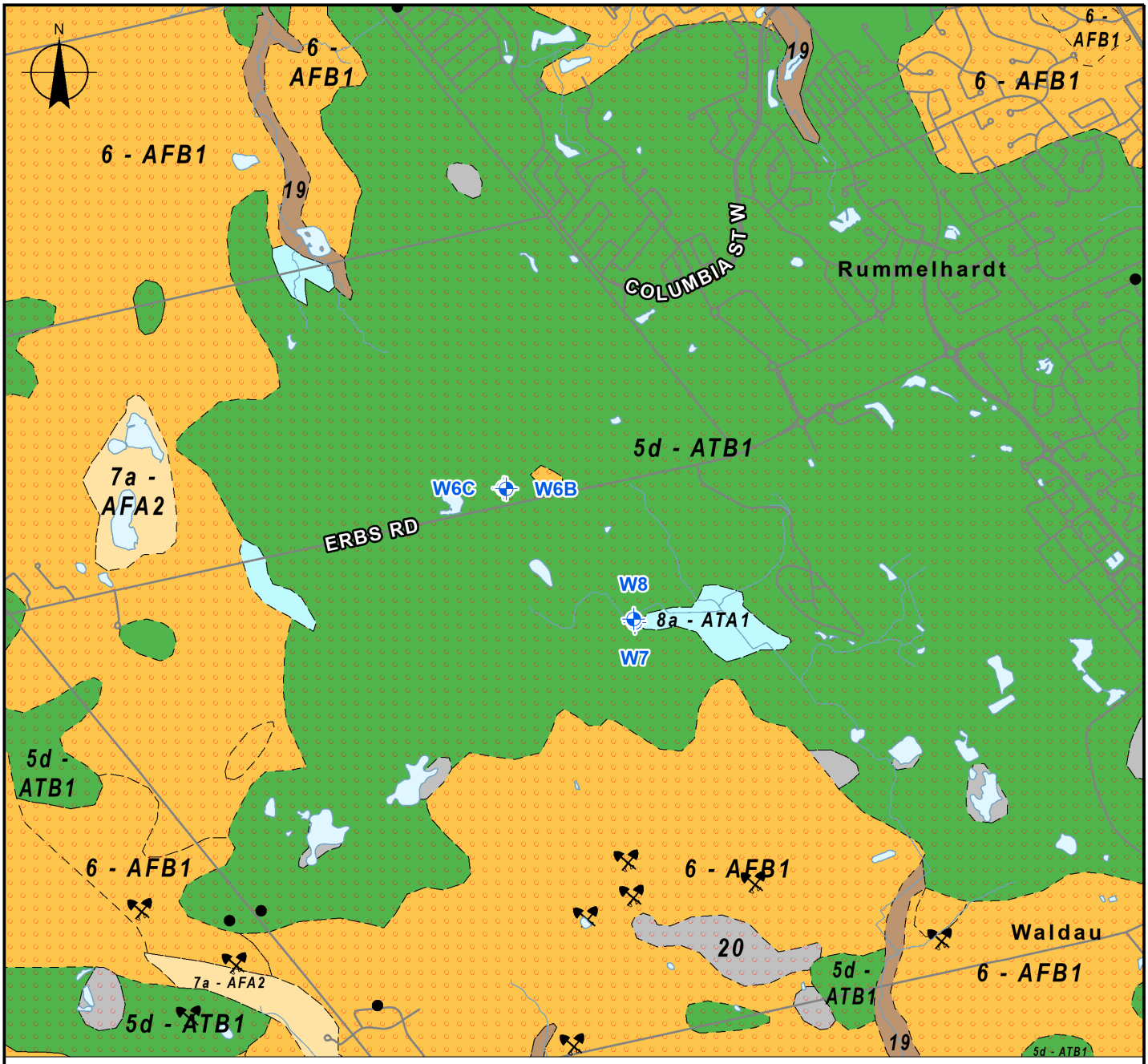

Data Source:
1. Ontario Geological Survey 2003. Surficial Geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128.
2. Region of Waterloo GIS

0 1,000 2,000
Meters

RMOW Supply Well
Watercourse
Waterbody

Surficial Geology

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

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

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

8a: Fine-textured glaciolacustrine deposits: Massive-well laminated (ATA1)

19: Modern alluvial deposits

20: Organic deposits

Sand and Gravel Pit
Sample Location
Hummocky Topography
Unit Contact Boundary

BURNSIDE

Map Title
2025 GROUNDWATER MONITORING REPORT - ERB STREET WELL FIELD

SURFICIAL GEOLOGY

Client
REGION OF WATERLOO

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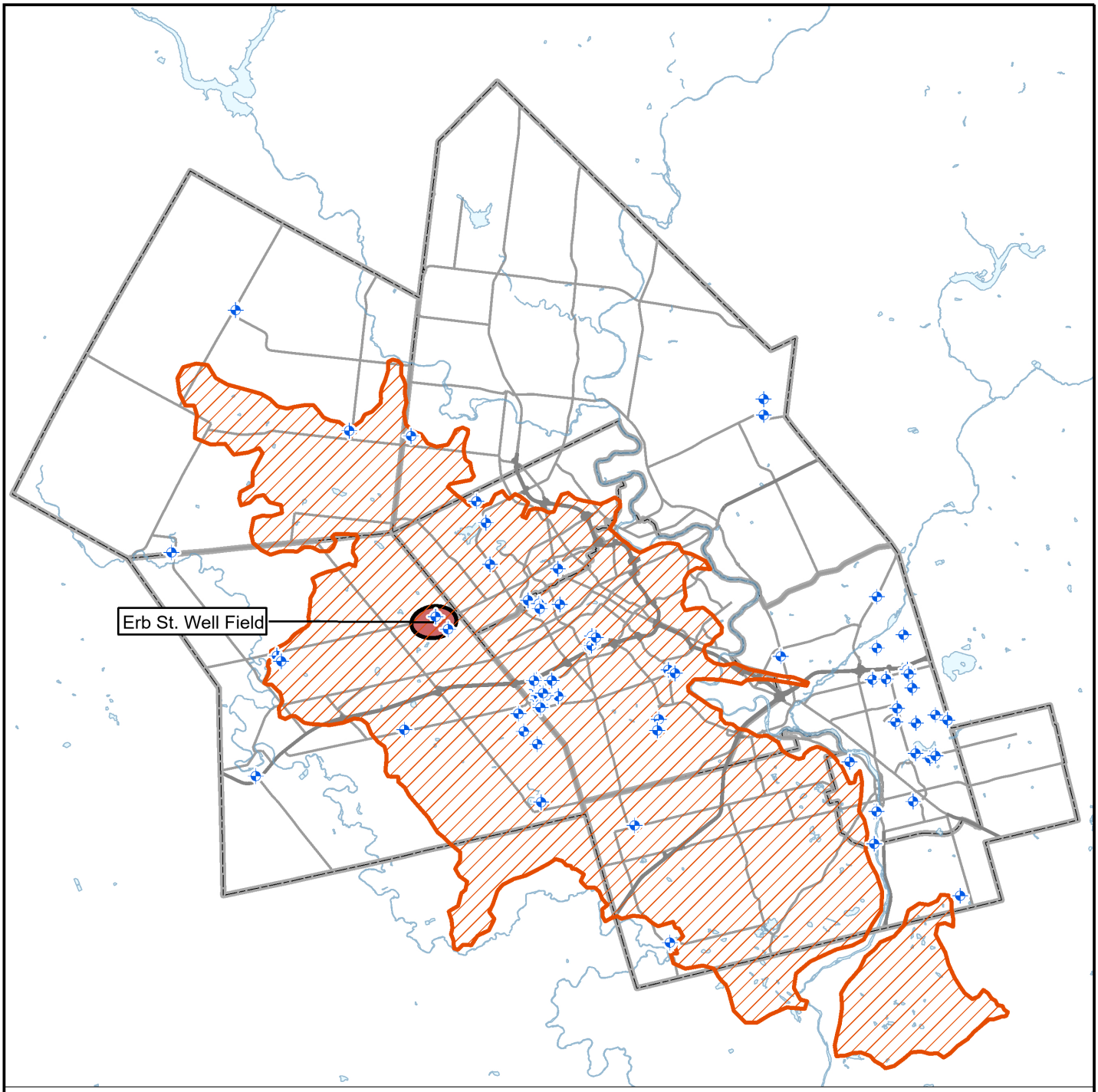

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Data Source:
1. Andy F. Bajc, Hazen A.J. Russell and David R. Sharpe (2014) A three-dimensional hydrostratigraphic model of the Waterloo Moraine area, Southern Ontario, Canada, Canadian Water Resources Journal / Revue canadienne des ressources hydriques,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

0 5 10 15 20 25
Kilometers

Production Well Location
Waterloo Moraine (2014)
Erb Street Well Field
Waterbody
Regional Municipal Boundaries

BURNSIDE

Map Title

2025 GROUNDWATER MONITORING REPORT - ERB STREET WELL FIELD

LOCATION OF THE WATERLOO MORAINE

Client

REGION OF WATERLOO

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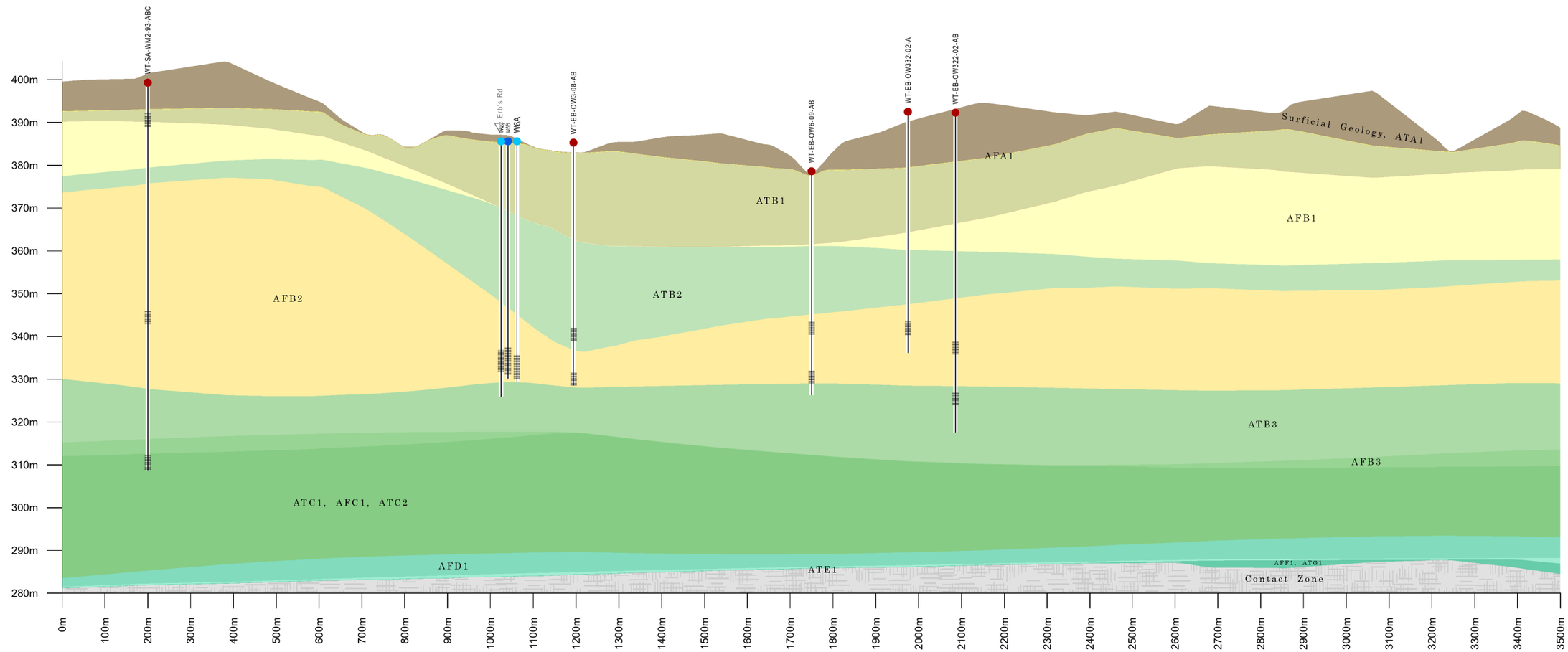

Wells

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

Moraine Model 2026

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

Wellhead

Well

Screen or Open Hole

BURNSIDE

Client

REGION OF WATERLOO

Figure Title

GEOLOGIC CROSS SECTION
REGION OF WATERLOO
Erb Street
Cross Section A - A'

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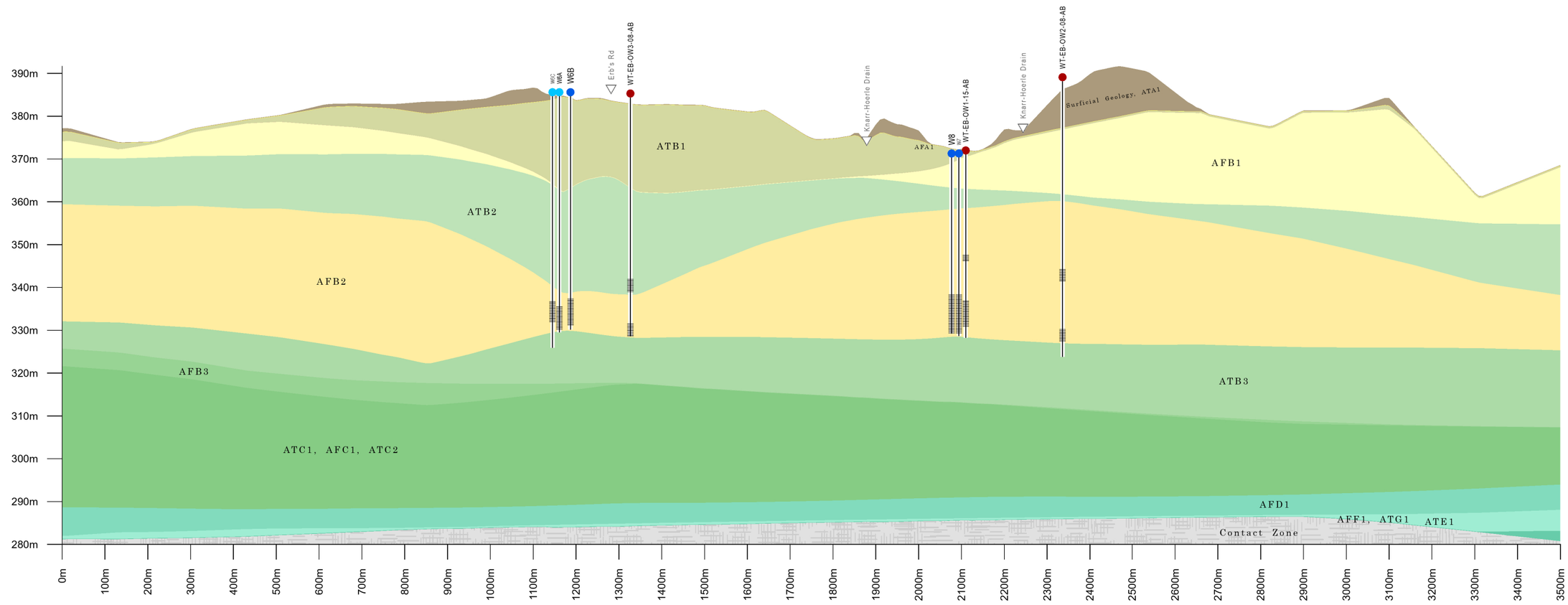

Wells

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

Moraine Model 2026

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

Wellhead

Well

Screen or Open Hole

BURNSIDE

Client

REGION OF WATERLOO

Figure Title

GEOLOGIC CROSS SECTION
REGION OF WATERLOO
Erb Street
Cross Section B - B'

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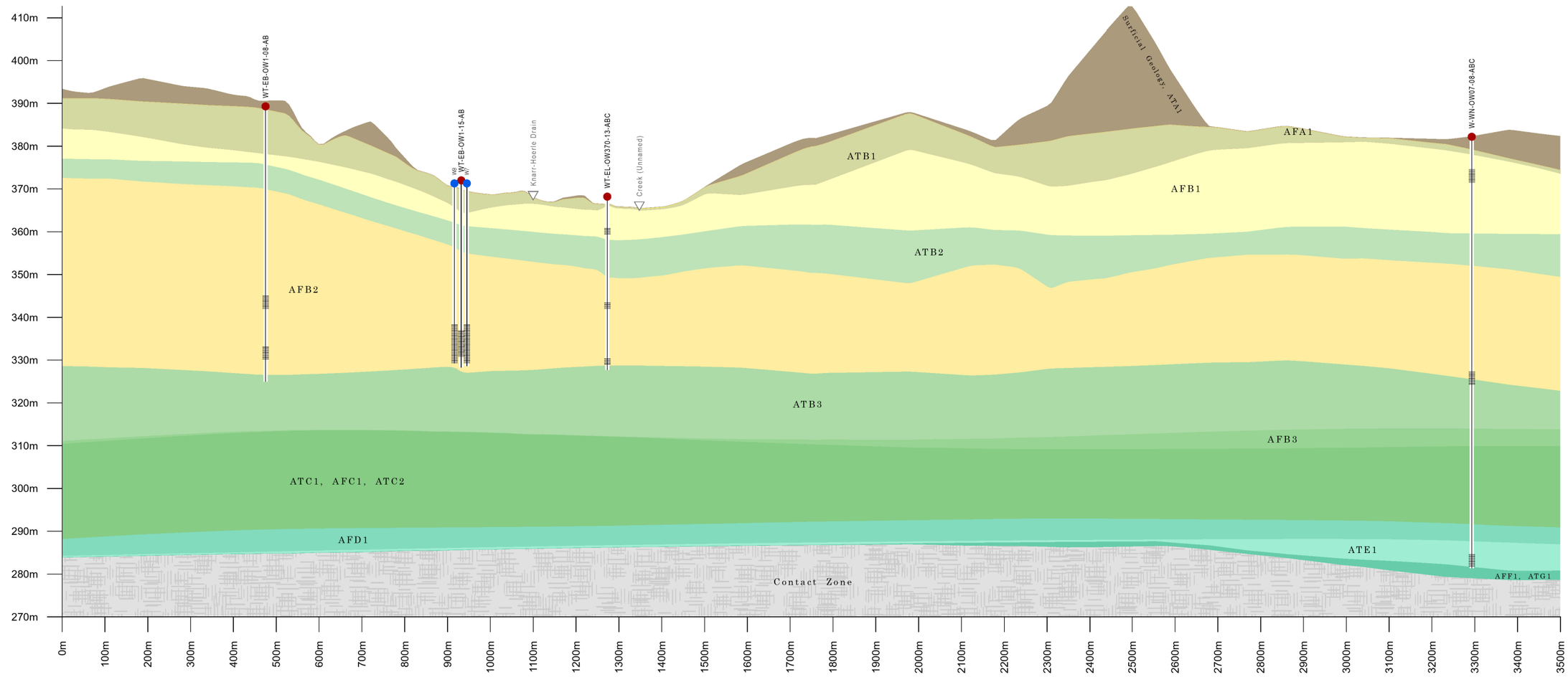

Wells

- Production Well (Active)
- Monitoring Well

Moraine Model 2026

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

Wellhead

Well

Screen or Open Hole

BURNSIDE

Client

REGION OF WATERLOO

Figure Title

GEOLOGIC CROSS SECTION REGION OF WATERLOO

Erb Street

Cross Section C - C'

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Appendix A

Permit To Take Water

AMENDED PERMIT TO TAKE WAT
Ground Wa
NUMBER 1541-AWGP

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
Floor 7 - 150 Frederick St
Kitchener, Ontario, N2G 4J3
Canada

For the water taking from: W6C, W6B, W7 and W8

Located at: Lot 2, Concession GERMAN BLOCK SOUTH OF ERBS ROAD, Geographic Township of Wilmot
Wilmot, Regional Municipality of Waterloo

Lot 2, Concession GERMAN BLOCK NORTH OF ERBS ROAD, Geographic Township of Wilmot
Wilmot, 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. 1541-AWGPZR including its Schedules, if any issued in accordance with Section 34.1 of the OWRA.

(f) "Permit Holder" means The Regional Municipality of Waterloo.

(g) "OWRA " means the *Ontario Water Resources Act,* R.S.O. 1990, c. O. 40, as amended.

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

TERMS AND CONDITIONS

1. Compliance with Permit

1.1 Except where modified by this Permit, the water taking shall be in accordance with the application for this Permit To Take Water, dated November 29, 2017 and signed by Richard Wootton, and all Schedules included in this Permit.

1.2 The Permit Holder shall ensure that any person authorized by the Permit Holder to take water under this Permit is provided with a copy of this Permit and shall take all reasonable measures to ensure that any such person complies with the conditions of this Permit.

1.3 Any person authorized by the Permit Holder to take water under this Permit shall comply with the conditions of this Permit.

1.4 This Permit is not transferable to another person.

1.5 This Permit provides the Permit Holder with permission to take water in accordance with the conditions of this Permit, up to the date of the expiry of this Permit. This Permit does not constitute a legal right, vested or otherwise, to a water allocation, and the issuance of this Perr 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 h request.

1.7 The Permit Holder shall report any changes of address to the Director within thirty days of an

such change. The Permit Holder shall report any change of ownership of the property for whi 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 Offic to carry out any and all inspections authorized by the OWRA, the *Environmental Protection* 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 oth applicable legal requirements, including the provisions of the *Ontario Water Resources Act* , 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, includin 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 o require any person to take any action in relation to the information, or the failure of a Provinci 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 th 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 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 Permi shall take precedence.

3. Water Takings Authorized by This Permit

3.1 **Expiry**

This Permit expires on **January 31, 2028**. 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 ar 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	W6C	Well Drilled	Municipal	Water Supply	3,865	24	5,565,600	365	17 532487 4809801
2	W6B	Well Drilled	Municipal	Water Supply	3,182	24	4,582,080	365	17 532492 4809796
3	W7	Well Drilled	Municipal	Water Supply	6,365	24	9,165,600	365	17 533135 4809136
4	W8	Well Drilled	Municipal	Water Supply	7,274	24	10,474,560	365	17 533130 4809153
						Total Taking:	29,787,840		

3.3 Notwithstanding the maximum total taking per day specified in Table A of Condition 3.2, the combined taking from wells W6C, W6B, W7 and W8 shall not exceed an annual daily average of 17,272,800 L/day.

4. Monitoring

4.1 Under section 9 of O. Reg. 387/04, and as authorized by subsection 34(6) of the *Ontario Wate 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 wa 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 h 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:

WT-EB-OW322-02-A
WT-EB-OW322-02-B
WT-EB-OW332-02-A
WT-EB-OW1-08-A
WT-EB-OW1-08-B
WT-EB-OW2-08-A
WT-EB-OW2-08-B
WT-EB-OW3-08-A
WT-EB-OW3-08-B
WT-EB-OW6-09-A
WT-EB-OW6-09-B
WT-EB-OW1-15-A
WT-EB-OW1-15-B

4.3 The Permit Holder shall prepare and submit a report every two years by June 30 commencing June 30, 2018, that presents the results of the well field water level monitoring for the two preceding calendar years, assesses changes in water levels in the supply aquifer(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.

4.4 Any application for renewal of this Permit shall be accompanied by an assessment of capture zones induced by the water taking under this Permit, relative to the Waterloo Landfill and related contamination in the municipal aquifer. Monthly water level monitoring data gathered both for this Permit and the following monitoring wells associated with the Waterloo Landfill shall be considered in that assessment:

OW358A-08
OW359A-08
OW338A-05
OW337A-05
OW6-57
OW336-05
OW345A-06
OW333-04

TW30-86

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 be taken or is proposed with regard to such complaint. The Permit Holder shall immediately noti the local District Office if the taking of water is observed to have any significant impact on th surrounding waters. After hours, calls shall be directed to the Ministry's Spills Action Centre a 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 obtaine 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, 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 taki 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 wa 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 reduc 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 suspensior 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 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 wat takings that are authorized by this Permit and the scope of this Permit.

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

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

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

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

This notice must be served upon:

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

AND

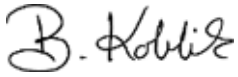
The Director, Section 34.1, Ministry of the Environment and Climate Change
12th Floor
119 King St W
Hamilton ON L8P 4Y7
Fax: (905) 521-7820

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

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

This Permit cancels and replaces Permit Number 0718-AV4S6J, issued on 2018/01/26.

Dated at Hamilton this 2nd day of March, 2018.



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 1541-AWGPZR, dated March 2, 2018.

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

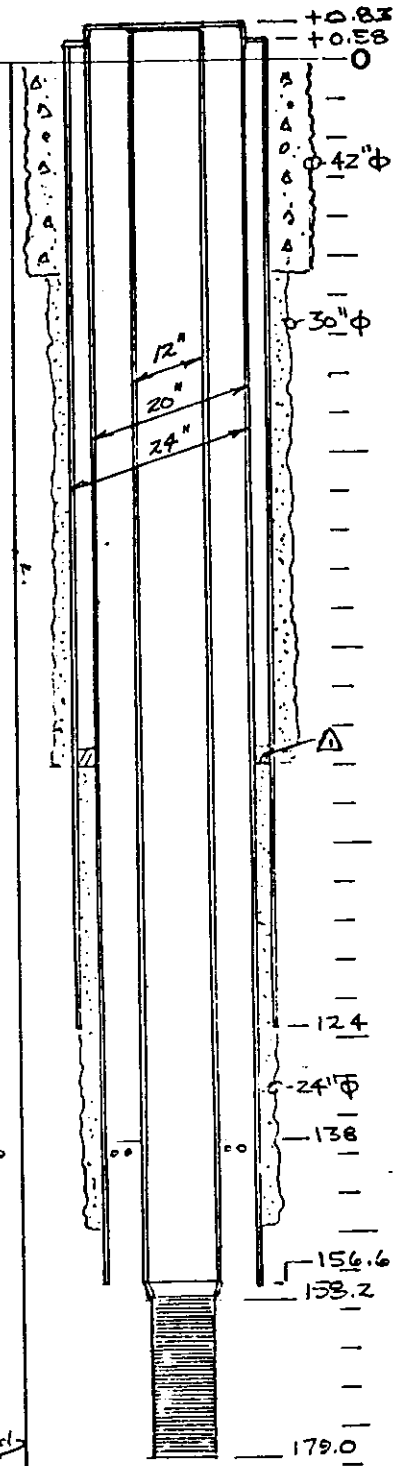
Appendix B

Well Records

W6B

WELL DIAGRAM

Depth FT	LOG
0	
	Brown Clay
18	
	Grey Clay
40	
50	
	Grey Clay Gravel
90	
	Sandy Clay Gravel
100	
103	
	Sandy Clay Boulders
115	
	Silty Grey Clay
125	
	Clay, Sandy Gravely Boulders
150	
159	
	Fine Gravel & Sand
177	Fine/Coe Gravel Sand
79	
82	Fine Sandy Clay



△ - Bentonite Pellet Seal

WELL MATERIAL

Outer Casing: 24 " dia., 0.375" Wall Thk. Matl.: STL
Cemented from 0 ' – " to 28 ' – "
Inner Casing: 12 " dia., 0.33" Wall Thk. Matl.: STL
Screen: Make John 12 " dia., Opening & Matl.: #50 SS
Plug: Type Plate, Matl SS, Other:
Gravel: Type, Size, Quantity

WELL TEST DATA

Preliminary Test Date: OCT 31/85 by R. Stroh
Static Level: 114.31 ' " below M.P. (+)3'-0"
Pumping Rate IGM: STEP TEST 104/396/593
Pumping Duration: 6 hrs. – min.
Pumping Level at Test End: 131.69 ' "
Performance Plots: dd-t Dwg.
dd-r Dwg.
Step Test B-85441

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

PUMP & MOTOR DATA

Pump Make LAYNE SUPER Rating 700 IGM @ 260 ' TH
Head: Type 8" FAB IWS ELB S.N.
Column: ' X 6 " X – ": Shaft Mtl: –
Bowl: 8TH Stage 3 : Curve: 36-069
Suction: – " dia. – ' – " Long
Special: Zinc Sleeves – ' : Taped Oil Line
Other –
Motor Make: Reuger Frame: VN8-87 SN:
75 HP, 3 ph, 60 hz, 3500 rpm, 575 Volts
Bearing No. Upper
Lower

Special Equipment
CABLE: 2/3 J w/No 6 Ground
Air Line Length: 145.0 ft.

WELL REVISIONS AND REHABILITATION

DATE	WORK DONE	BY

International Water Supply Limited

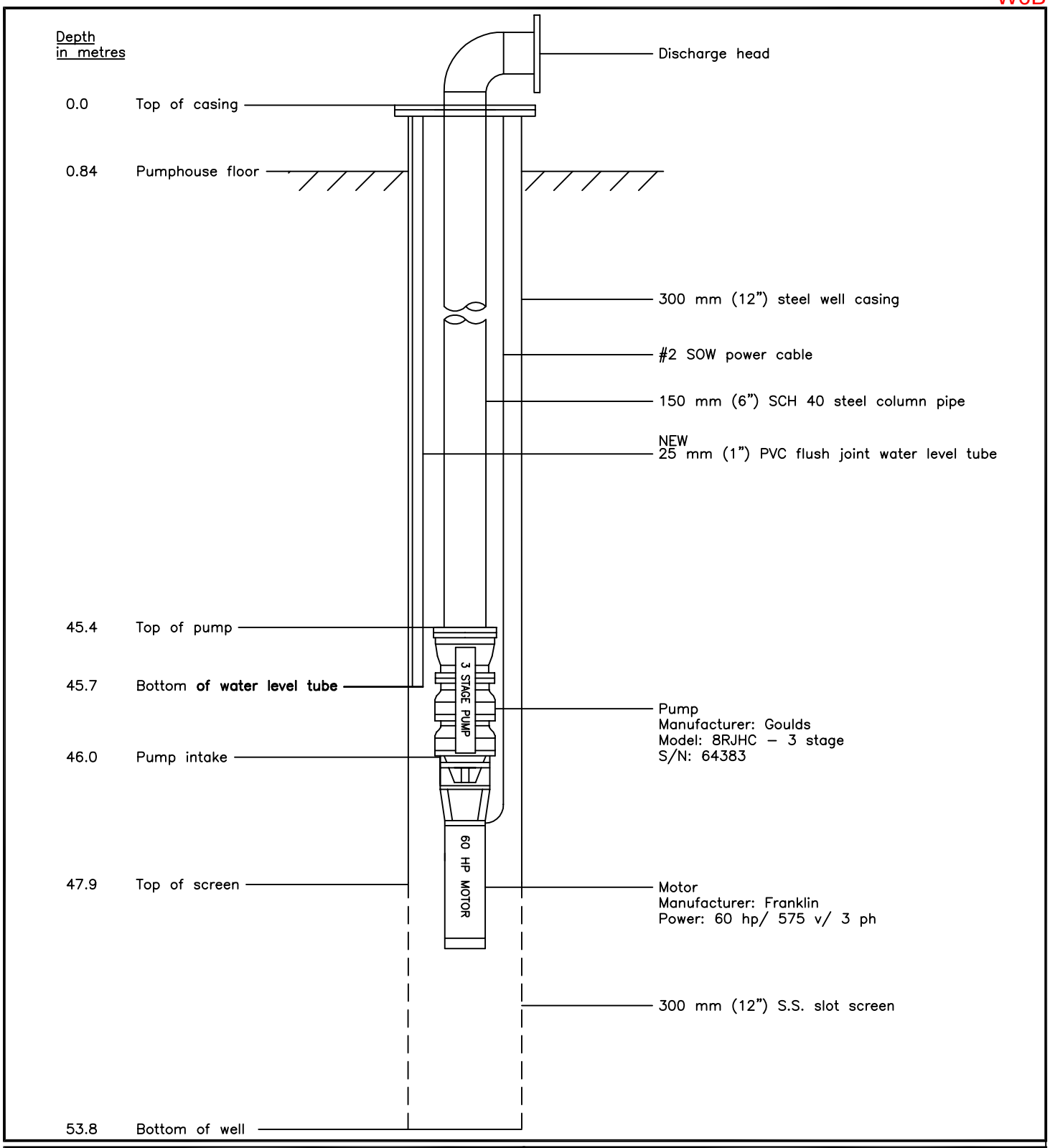
SASKATOON – BARRIE – MONTREAL

CLIENT: REGION of WATERLOO
WELL NO: W6B

DRILLED BY: Kyle DATE: 1985 DRAWN: B
INSTALLED BY: DATE: DATE: Nov 19/85

RECORDING CHARTS
GRAPHIC CONTROLS CANADA LTD.
BANANOQUE, ONTARIO

W6B



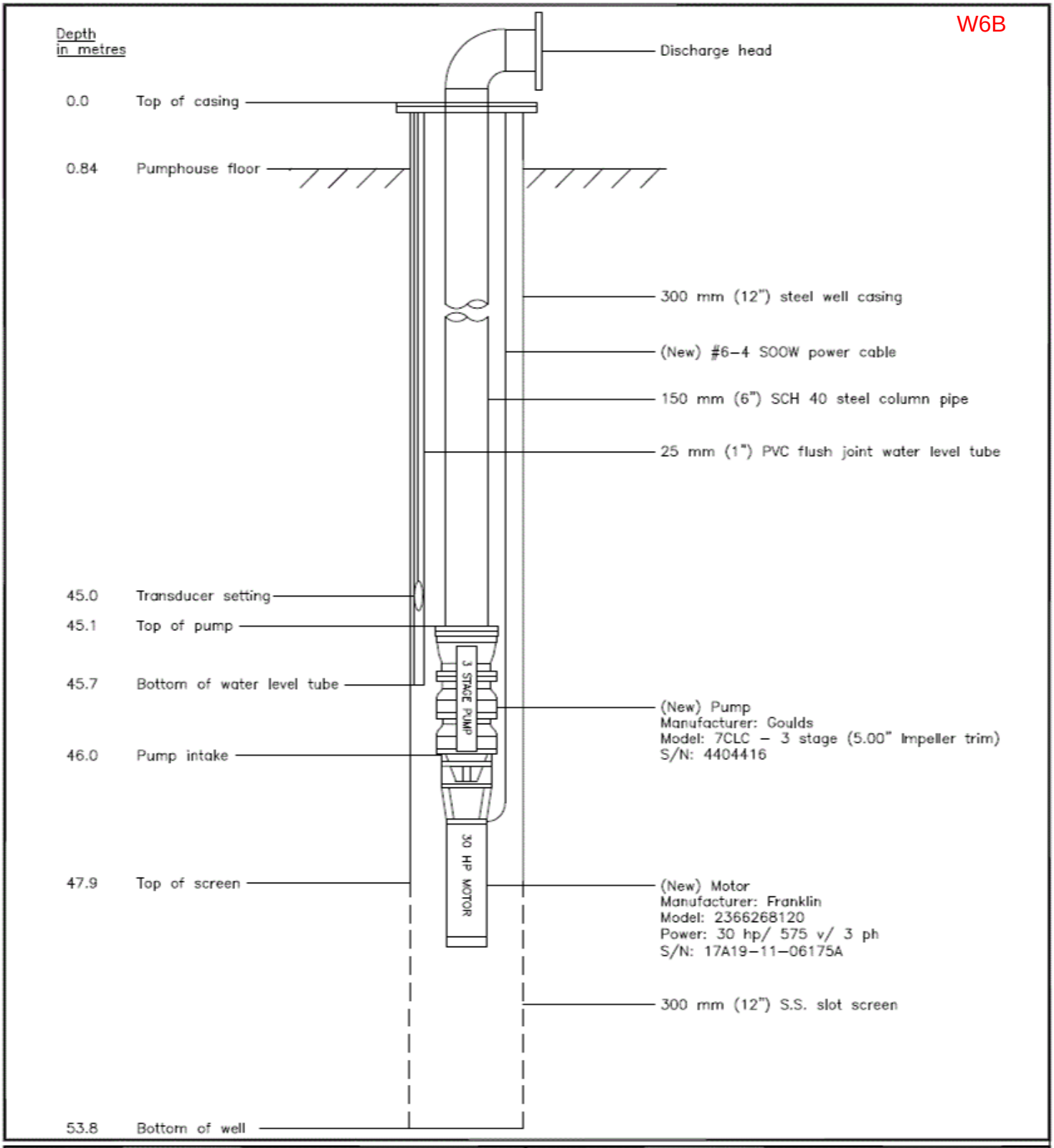
Lotowater TECHNICAL SERVICES INC.

CLIENT
Regional Municipality of Waterloo

TITLE
Well W6B
Pump Installation Drawing

PROJECT No.	006-205	G:\Lotowater Projects\006 Region of Waterloo\205 W6B Testing\Submersible Pump Installation.dwg		FIGURE
DESIGN				
DRAWN	EH	2011/04/25	REVISION No. 2011-04-25	SCALE N.T.S.	4
CHECKED				

W6B



Lotowater TECHNICAL SERVICES INC.

CLIENT
Regional Municipality of Waterloo

TITLE
Well W6B
Pump Installation Drawing

PROJECT No. 006-394			G:\Lotowater Projects\006 Region of Waterloo\394 W6B\Submersible Pump Installation.dwg		FIGURE
DESIGN					
DRAWN	EH	2012/12/05	REVISION No. 2017/05/04	SCALE N.T.S.	1
CHECKED					

PROJECT: 1520338

LOCATION: N 4809801.00; E 532486.70

RECORD OF BOREHOLE: W6C Pilot Hole

BORING DATE: December 2, 2015

DATUM: UTM NAD 83

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●; rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp ⊖W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		385.06							
0	Air Rotary	TOPSOIL		0.00							
1											
				383.54							
		(CL) SILTY CLAY, trace fine to medium sand, light brown, cohesive, W>PL, soft to very soft		1.52							
2											
3											
4											
5											
6											
7											
8											
9											
10											

CONTINUED NEXT PAGE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: HJ

CHECKED:

PROJECT: 1520338

LOCATION: N 4809801.00; E 532486.70

RECORD OF BOREHOLE: W6C Pilot Hole

BORING DATE: December 2, 2015

DATUM: UTM NAD 83

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●; rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp ⊖W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	Air Rotary	(CL) SILTY CLAY, trace fine to medium sand, light brown, cohesive, W>PL, soft to very soft									
11											
12											
13											
14											
15											
16											
17											
18											
19											
20		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: HJ

CHECKED:

PROJECT: 1520338

LOCATION: N 4809801.00; E 532486.70

RECORD OF BOREHOLE: W6C Pilot Hole

BORING DATE: December 2, 2015

DATUM: UTM NAD 83

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●; rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp ⊖W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
20	Air Rotary	(CL) SILTY CLAY, trace fine to medium sand, light brown, cohesive, W>PL, soft to very soft									
21											
22											
				362.20 / 22.86							
23		(ML) CLAYEY SILT, trace to some sand to fine gravel, light brown, cohesive, W>PL, soft to very soft									
24											
25											
26											
27		- grey to brown below 27.4 m									
28											
29											
30		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: HJ

CHECKED:

PROJECT: 1520338

LOCATION: N 4809801.00; E 532486.70

RECORD OF BOREHOLE: W6C Pilot Hole

BORING DATE: December 2, 2015

DATUM: UTM NAD 83

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●; rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp ⊖W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
30	Air Rotary	(ML) CLAYEY SILT, trace to some sand to fine gravel, light brown, cohesive, W>PL, soft to very soft									
31											
				353.06							
32		(GM) SILTY GRAVEL, fine to coarse, some fine to coarse sand, non-cohesive		32.00							
33											
34											
				350.01							
35		(ML) GRAVELLY CLAYEY SILT, fine gravel, some medium to coarse sand, grey to brown, cohesive, soft		35.05							
36											
				348.48							
		(CL) SILTY CLAY, trace to some sand, grey to brown, cohesive, soft to firm		36.58							
37											
38											
39											
40		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: HJ

CHECKED:

PROJECT: 1520338

LOCATION: N 4809801.00; E 532486.70

RECORD OF BOREHOLE: W6C Pilot Hole

BORING DATE: December 2, 2015

DATUM: UTM NAD 83

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp ⊖W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
40	Air Rotary	(CL) SILTY CLAY, trace to some sand, grey to brown, cohesive, soft to firm									
41											
42											
43											
44				340.86							
		(SM) GRAVELLY SILTY SAND, fine to coarse, fine to coarse gravel, some clay pockets, non-cohesive		44.20							
45				339.34							
		(SP) SAND and GRAVEL, some silt and clay, fine to coarse sand, fine gravel, trace clay pockets		45.72							
46				338.58							
		(SW) SAND, fine to medium, trace clay pockets		46.48							
47				337.05							
48		(SM) GRAVELLY SILTY SAND, fine to coarse, fine to coarse gravel, trace to some clay pockets to 49.5		48.01							
49											
50		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: HJ

CHECKED:

GTA-BHS 001 S:\CLIENTS\REGION_OF_WATERLOO\REGION_OF_WATERLOO\02_DATA\GINT\REGION_OF_WATERLOO.GPJ GAL-MIS.GDT 12/19/16

PROJECT: 1520338

LOCATION: N 4809801.00; E 532486.70

RECORD OF BOREHOLE: W6C Pilot Hole

BORING DATE: December 2, 2015

DATUM: UTM NAD 83

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●; rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp ⊖W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
50	Air Rotary	(SM) GRAVELLY SILTY SAND, fine to coarse, fine to coarse gravel, trace to some clay pockets to 49.5									
51				334.01 / 51.05							
		(SP) GRAVELLY SAND, fine to coarse, trace to some silt									
52											
53											
54				330.96 / 54.10							
		(SM) SILTY SAND, fine to medium, trace gravel									
55											
56											
57											
58				326.39 / 58.67							
		(CH) CLAY, trace medium to coarse sand, cohesive, soft									
59				325.32 / 59.74							
		END OF BOREHOLE									
60											

DEPTH SCALE

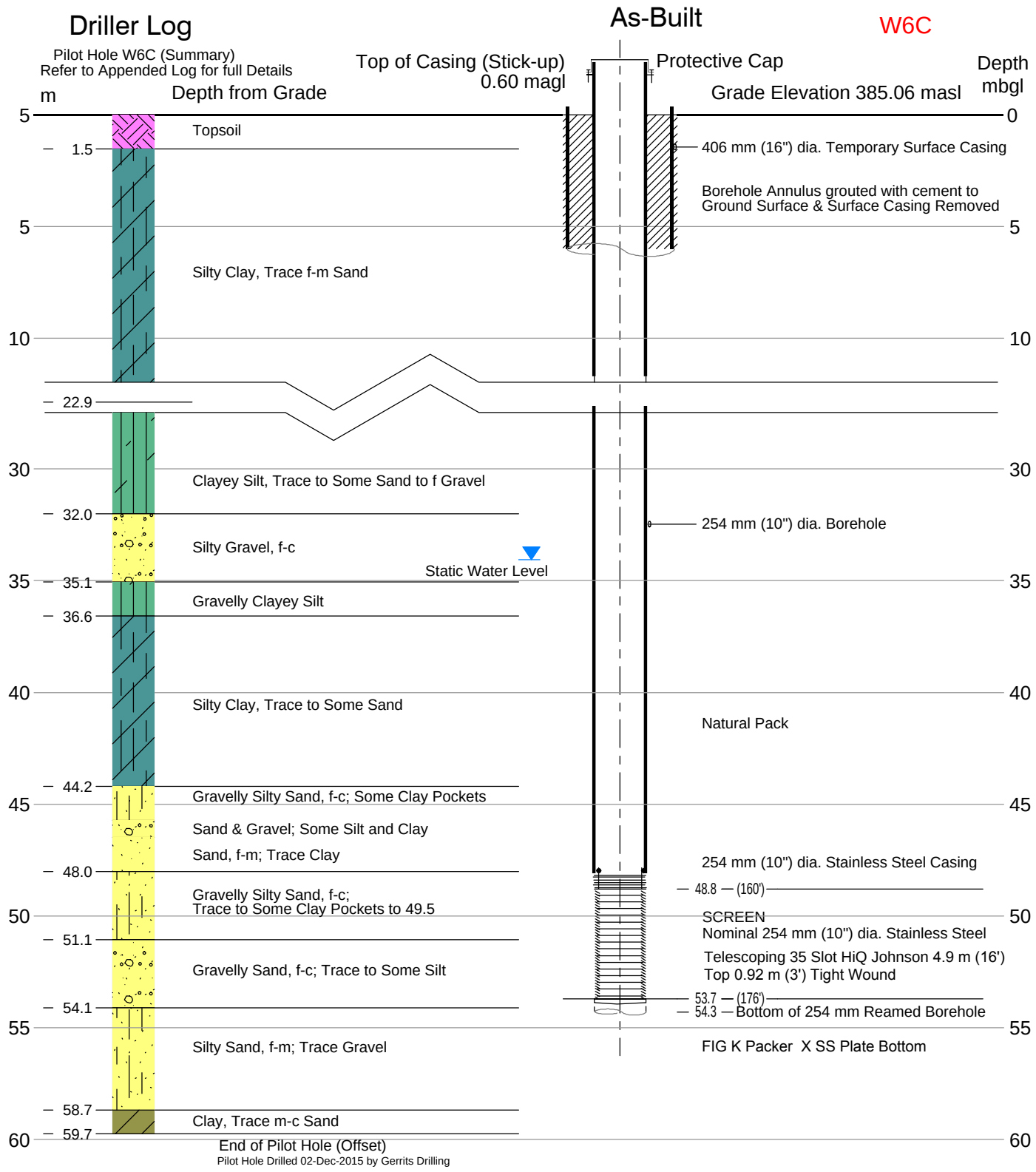
1 : 50

Golder Associates

LOGGED: HJ

CHECKED:

GTA-BHS 001 S:\CLIENTS\REGION_OF_WATERLOO\REGION_OF_WATERLOO\02_DATA\GINT\REGION_OF_WATERLOO.GPJ GAL-MIS.GDT 12/19/16



*Note:
All depths are metres below ground level unless otherwise stated.
Depths from metres to feet nominal 1 foot intervals

Well Constructed March 1 - 9, 2016 by Gerrits Drilling

CLIENT
REGION OF WATERLOO

PROJECT
ERB STREET WELL FIELD
2015 CONSTRUCTION AND TESTING AT SITE W6

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-07-18
PREPARED	JPR
DESIGN	JAE
REVIEW	
APPROVED	GWS

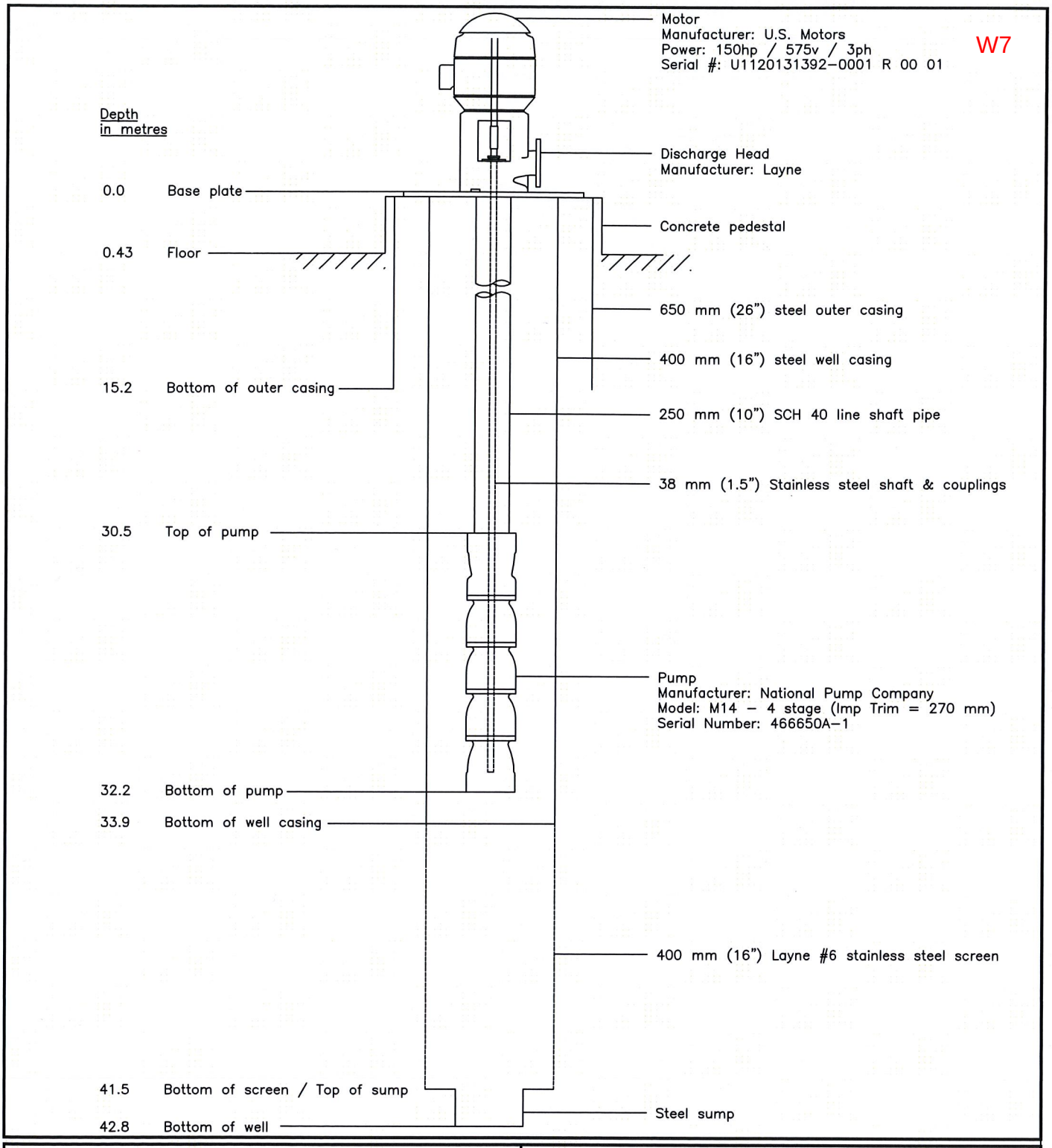
TITLE
TEST PRODUCTION WELL W6C
CONSTRUCTION AS-BUILT

PROJECT No.	Phase	Rev.	Figure
1520338	-		9

Path: \\golder.gds\gal\barrie\CAD - rojects\2015\1520338 (Region of Waterloo, Greenbrook)\-CA-Log\ | File Name: 1520338CALOG.dwg

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25 mm
0

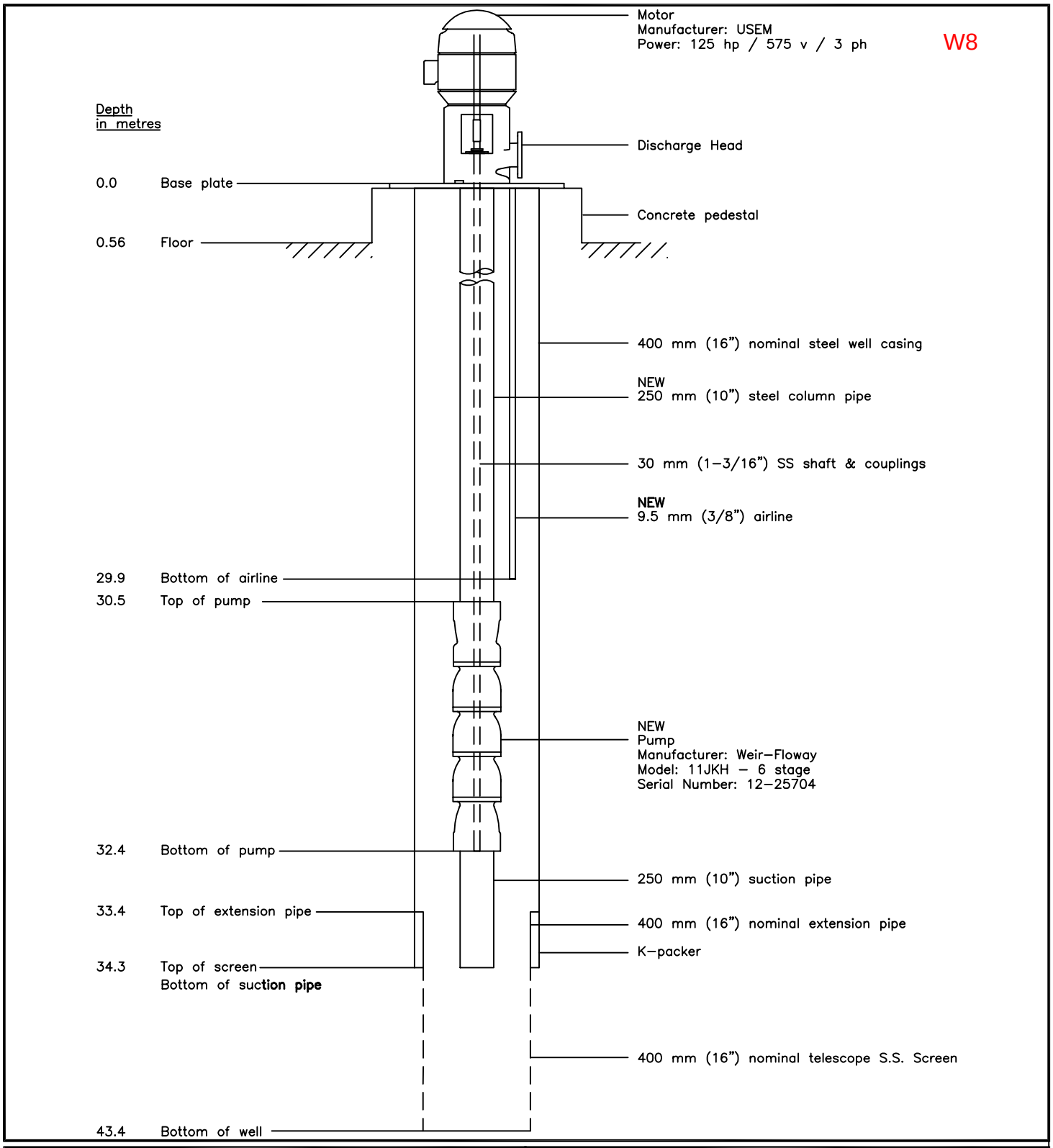


Lotowater TECHNICAL SERVICES INC.

CLIENT
Regional Municipality of Waterloo

TITLE
Well W7
Pump Installation Drawing

PROJECT No. 006-360			G:\Lotowater Projects\006 Regional of Waterloo\360 Well W7\Pump Install.dwg		FIGURE
DESIGN					1
DRAWN	EH	2016-02-18	REVISION No. 2016-02-22	SCALE N.T.S.	
CHECKED					



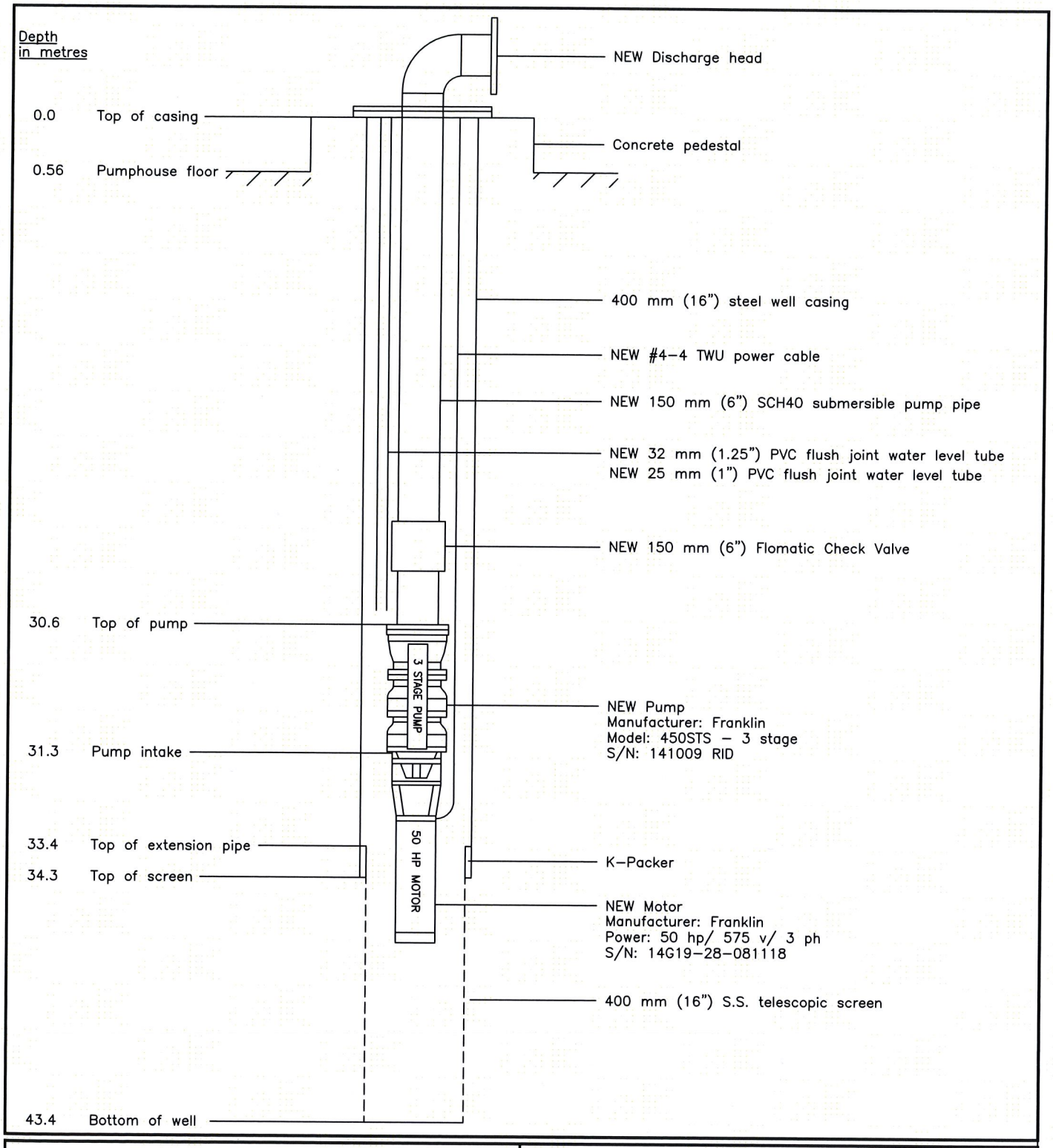
Lotowater TECHNICAL SERVICES INC.

CLIENT
REGIONAL MUNICIPALITY OF WATERLOO

TITLE
W8
Pump Installation Drawing

PROJECT No.	006-232		G:\Lotowater Projects\006 Region of Waterloo\232 W8 Repair\7. Technical\Pump Install.dwg		FIGURE
DESIGN					
DRAWN	EH	2012/08/02	REVISION No. 2012/08/02	SCALE N.T.S.	1
CHECKED					

W8



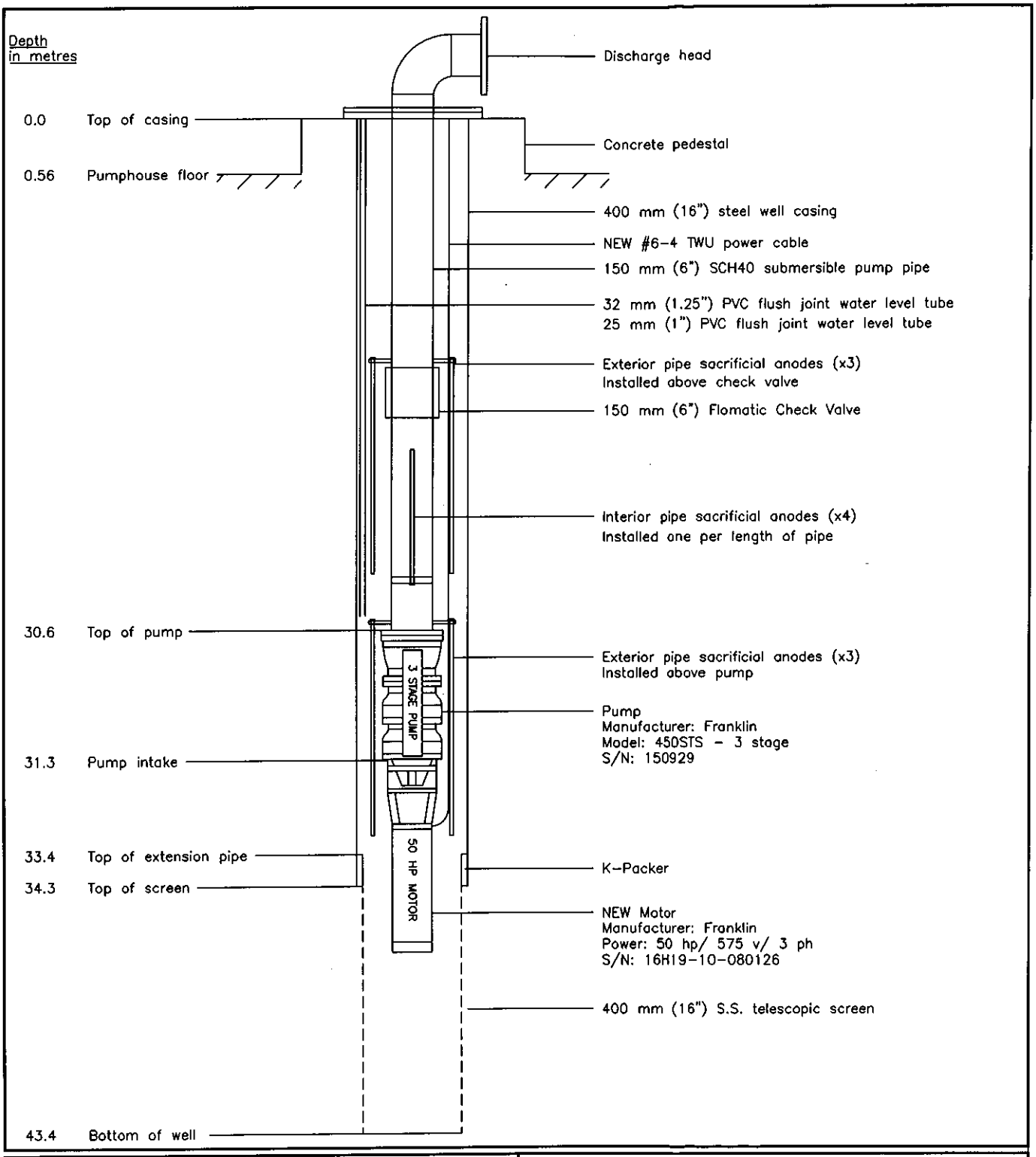
Lotowater TECHNICAL SERVICES INC.

CLIENT
Regional Municipality of Waterloo

TITLE
Well W8
Pump Installation Drawing

PROJECT No. **006-320**			G:\Lotowater Projects\006 Region of Waterloo\320 W8 Emergency\Pump Install.dwg	FIGURE
DESIGN				
DRAWN	**EH**	**2014/10/21**	REVISION No. 2014-10-28	SCALE **N.T.S.**	**1**
CHECKED				

W8



Lotowater TECHNICAL SERVICES INC.

CLIENT
Regional Municipality of Waterloo

TITLE
Well W8
Pump Installation Drawing

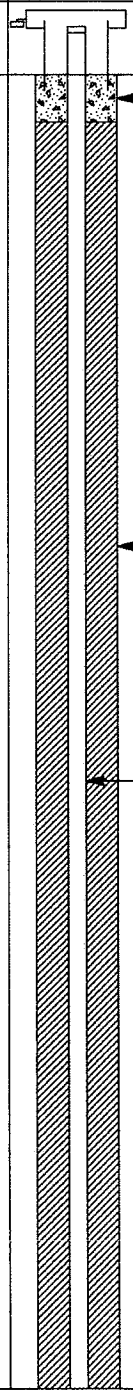
PROJECT No. 006-379			G:\Lotowater Projects\006 Region of Waterloo\379 W8 Emergency\Pump Install.dwg		FIGURE
DESIGN					
DRAWN	EH	2016/09/27	REVISION No. 2016-09-27	SCALE N.T.S.	1
CHECKED					

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN

HOLE DESIGNATION: OW345A-06
DATE COMPLETED: August 11, 2006
DRILLING METHOD: 6 1/4" ID HSA/ PQ CORING
FIELD PERSONNEL: B. IOTZOV

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS
	TOPSOIL	0.15
	ML-SILT, trace sand, trace clay, trace gravel, firm, low plasticity, massive, brown, dry	
1		
	- light brown to tan, trace silt at 1.52m BGS	
2		
	SP-SAND, compact, fine to medium grained sand, moderately to poorly graded, dry to moist, brown	2.59
3	ML-SILT, with sand, trace clay, trace gravel, firm, low plasticity, fine sand, massive, tan-brown, moist	3.20
4	SP-SAND, compact, fine to medium grained sand, moderately poorly graded, moist, brown	3.96
5	- stratified at 5.03m BGS	
	- massive at 5.79m BGS	
6	- stratified at 6.40m BGS	
7		
8		
9	- moist at 9.14m BGS	
10		
11	SM-SAND, with silt, fine grained, moist, light grey-brown, stratified	11.06
12	SP-SAND, loose, coarse grained sand, poorly graded, dry to moist, light brown	11.89 12.19
13	SM-SAND, with silt, fine and medium grained sand, well graded, light brown, dry to moist	
14		
15		
16		



SAMPLE NUMBER	INTERVAL	REC (m)	'N' VALUE
01	X	0.46	15
02	X	0.20	13
03	X	0.20	19
04	X	0.51	44
05	X	0.05	29
06	X	0.55	21
07	X	0.52	20
08	X	0.55	31
09	X	0.30	65
10		0.30	-
11		0.30	-
12		0.00	-
13		1.52	-
14		0.15	-
15		1.37	-
16		0.30	-

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN

HOLE DESIGNATION: OW345A-06
DATE COMPLETED: August 11, 2006
DRILLING METHOD: 6 1/4" ID HSA/ PQ CORING
FIELD PERSONNEL: B. IOTZOV

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	INTERVAL	REC (m)	'N' VALUE
18				17		0.61	-
	SP-SAND, loose, coarse grained sand, poorly graded, dry to moist, light brown	18.29					
19	SM/SP-SAND, with silt, fine to medium sand, stratified, light brown, dry to moist	18.90		18		0.91	-
20				19		0.00	-
21		21.34	BENTONITE GROUT				
22	SW/GW-SAND AND GRAVEL, dense, medium and coarse sand, fine to coarse gravel, possibly stratified, light brown - light grey, well graded, moist	22.10		20		1.22	-
	- trace clay in sand lense from 22.13 to 22.19m BGS	22.40					
23	SM-SAND, with silt, fine to medium sand, moderately to poorly graded, stratified, brown-tan, moist						
	- trace clay in sand lense from 22.37 to 22.40m BGS			21		0.00	-
24	SP-SAND, compact, medium to coarse sand, poorly graded, stratified, moist						
25				22		0.91	-
26	SW/GW-SAND AND GRAVEL, dense, medium and coarse sand, fine to coarse gravel, possibly stratified, tan-brown, well graded, moist	25.91	2" Ø SCH 80 PVC RISER PIPE	23		0.91	-
27							
28	CL-SITY CLAY, stiff, medium to high plasticity, massive, reddish brown, moist	28.04 / 28.13		24		0.30	-
29	SM/ML-SAND AND SILT, compact, fine sand, stratified, brown-tan, moist	28.96					
	ML-SILT (WATERLAIN), with clay to clayey, trace fine sand, low plasticiy, grey-brown, stratified, moist			25		1.22	-
30	- no sample recovery, losing large volume of drilling fluid from 30.48 to 33.53m BGS						
31				26		0.00	-
32							
33				27		0.00	-
	SM-SAND (WATERLAIN), with silt, fine to medium	33.53					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN

HOLE DESIGNATION: OW345A-06
DATE COMPLETED: August 11, 2006
DRILLING METHOD: 6 1/4" ID HSA/ PQ CORING
FIELD PERSONNEL: B. IOTZOV

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	INTERVAL	REC (m)	'N' VALUE
35	sand, moderately to poorly graded, stratified, moist, light grey-brown			28		1.22	-
36				29		0.00	-
37	SW-SAND, loose to compact, fine to coarse grained, well graded, light grey to light brown, moist to wet	36.58		30		1.22	-
38	SM-SAND (WATERLAIN), with silt, fine to medium sand, moderately to poorly graded, stratified, moist, light grey-brown	37.95		31		0.91	-
39							
40	ML-SILT (WATERLAIN), with clay, trace fine sand, low plasticity, stratified, light grey-brown, moist	39.62		32		0.00	-
41	SM/SP-SAND, with silt, medium grained sand, trace fine sand, stratified, occasional silt lense (1cm thick), light brown, wet - medium to coarse grained sand at 41.15m BGS	40.54					
42	- medium grained, becoming grey at 41.45m BGS			33		1.52	-
43	- no sample recovery from 42.67 to 45.72m BGS		BENTONITE GROUT	34		0.00	-
44							
45				35		0.00	-
46	SM-SAND, with silt, fine to medium grained sand, brown, wet	45.72	2" Ø SCH 80 PVC RISER PIPE	36		0.91	-
47							
48				37		0.76	-
49	SP-SAND, trace silt, medium grained, poorly graded, brown, wet	48.77		38		0.91	-
50	ML/SM-SILT AND SAND, stiff, very fine sand, stratified, dilatant, grey, wet, occasioinal clayey	50.29					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN

HOLE DESIGNATION: OW345A-06
DATE COMPLETED: August 11, 2006
DRILLING METHOD: 6 1/4" ID HSA/ PQ CORING
FIELD PERSONNEL: B. IOTZOV

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITOR INSTALLATION	SAMPLE NUMBER	INTERVAL	REC (m)	'N' VALUE
	seams - slightly coarser with depth at 51.82m BGS - medium grained sand from 53.34 to 53.64m BGS			39		0.61	-
52							
53			#1 SILICA SAND	40		0.61	-
54	SP/SM-SAND, with silt, fine to medium grained, some stratification, grey, wet	53.64	2" Ø STAINLESS STEEL SCREEN	41		0.91	-
55	ML/SM-SILT AND SAND, stiff, very fine sand, grey, wet, occasional stratification	54.86		42		1.22	-
56							
57				43		1.22	-
58							
59	SM/SW-SAND, with silt, fine to coarse sand, well graded, grey, wet	58.52	BENTONITE CHIPS	44		0.91	-
60				45		0.61	-
61	CL/ML-CLAY AND SILT (MARYHILL TILL), stiff, medium plasticity, wet, grey	60.96					
62				46		0.76	-
63	END OF BOREHOLE @ 62.48m BGS Lost large volume of drilling fluid between 27 and 33 metres below ground surface	62.48					
64							
65							
66							
67							

WELL DETAILS
Screened interval:
52.12 to 55.17m BGS
Length: 3.05m
Diameter: 51mm
Slot Size: 10
Material: STAINLESS STEEL
Seal:
0.91 to 50.60m BGS
Material: BENTONITE GROUT
Sand Pack:
50.60 to 62.48m BGS
Material: #1 SILICA SAND

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

9203593

Monitoring Well: WT-EBS-OW6A-09

Project:	Erb St. Class ESA	**Drilling method:**	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Jan-2-2009 / Jan-3-2009
Location:	Erb Street	**Ground surface elevation:**	378.21 m AMSL
Number:	1609-00505	**Top of casing elevation:**	378.96 m AMSL
Field investigator:	R.Dong	**Easting:**	533190.802
Contractor:	Pro Core Drilling	**Northing:**	4809730.08

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram / Description
			Ground Surface	378.21					Stick up=0.75 m Blue steel protective casing
0	0		TOPSOIL fine sand and silt, brown, rootlets, moist	0.00	1	SS	2-2-2-2 (4)	3" 13%	Concrete
	1				2	SS	1-2-2-2 (4)	16" 67%	
5			CLAYEY SILT trace very fine sand, brown with trace black, soft	376.68 1.52	3	SS	1-3-3-3 (6)	18" 75%	
	2		SAND fine grained, little coarse sand, little clay and silt, brown, firm, moist	376.08 2.13	4	SS	1-2-3-3 (5)	16" 67%	
10	3		no clay and silt, trace coarse sand at 2.59 m BGS		5	SS	n/a	36" 95%	
	4				6	SS	n/a	45" 75%	
15	5		seam of very fine sand, 0.13 m thick, at 4.67 m BGS increasing in moisture at 4.88 m BGS						PVC Sch80 50 mm diameter
20	6		seam of very fine sand 0.18 m thick at 5.72 m BGS		7	CC	n/a	37" 61%	Bentonite Grout
	7		wet at 6.63 m BGS		8	CC	n/a	42" 71%	
25	8		homogeneous, no trace at 8.13 m BGS						
30	9		seam of very fine and medium fine sand, mottled 0.13 m thick at 9.02 m BGS		9	CC	n/a	40" 67%	
	10		seam of silty clay and very fine sand 0.03 m thick at 10.13 m BGS		10	CC	n/a	53" 88%	
35	11		seam of layered silty clay 0.03 m thick at 10.69 m BGS seam of layered silty clay 0.03 m thick at 10.90 m BGS seam of very fine sand 0.03 m thick at 11.13 m BGS decrease in moisture content at 11.17 m BGS						
40	12		seam of medium sand 0.64 m thick at 11.81 m BGS seam of very fine sand 0.03 m thick at 11.91 m BGS		11	CC	n/a	57" 95%	
			wet at 12.70 m BGS	376.08					

Screen Interval: 46.63 - 49.68 m BGS
Sand Pack Interval: 45.36 - 50.22 m BGS
Well Seal Interval: 0.91 - 45.36 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

Monitoring Well: WT-EBS-OW6A-09

WT-EB-OW6-09-A

Project:	Erb St. Class ESA	**Drilling method:**	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Jan-2-2009 / Jan-3-2009
Location:	Erb Street	**Ground surface elevation:**	378.21 m AMSL
Number:	1609-00505	**Top of casing elevation:**	378.96 m AMSL
Field investigator:	R.Dong	**Easting:**	533190.802
Contractor:	Pro Core Drilling	**Northing:**	4809730.08

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
		SAND fine grained, little coarse sand, little clay and silt, brown, firm, moist	2.13	12	CC	n/a	42" 70%		
45	14	seam of very fine sand 0.10 m thick at 13.41 m BGS seam of very fine sand 0.03 m thick at 13.51 m BGS seam of layered silty clay 0.03 m thick at 13.84 m BGS seam of very fine sand 0.13 m thick at 14.43 m BGS		13	CC	n/a	60" 100%		
50	15	seam of very fine sand 0.08 m thick at 14.76 m BGS seam of very fine sand 0.25 m thick at 14.91 m BGS							
55	16	4 seams of soft brown clayey silt 3 mm thick between 16.05 to 16.10 m BGS		14	CC	n/a	61" 100%		
	17								
	18	becoming coarser fine sand at 17.65 m BGS becoming wet at 17.65 m BGS	359.90	15	CC	n/a	45" 76%		Bentonite Grout
60		SILTY CLAY AND CLAYEY SILT AND VERY FINE SAND brown, reddy brown and black layers, very stiff, moist mottled structure beginning at 18.68 m BGS increasing very fine sand content from 18.80 to 19.40 m BGS	18.31						
	19		358.80	16	CC	n/a	53" 88%		
65	20	SAND fine grained, brown, moist very fine sand 0.20 m thick at 20.12 m BGS seam of stiff, brown, silty clay 2 mm thick at 20.14 m BGS seam of stiff, brown silty clay 1 mm thick at 20.15 m BGS sulfurous odour beginning at 20.32 m BGS seam of very fine sand 0.08 m thick at 20.75 m BGS seam of very fine sand 0.08 m thick at 20.98 m BGS seam of silty clay 3 mm thick at 21.06 m BGS	19.41	17	CC	n/a	57" 95%		
70	21	seam of very fine sand 0.05 m thick at 21.62 m BGS							
	22			18	CC	n/a	53" 88%		
75	23	seam of silty clay 4 mm thick at 23.14 m BGS odour becoming less strong at 23.37 m BGS very wet from 23.14 to 23.37 m BGS							
	24	seam of very fine sand and silt 0.10 m thick at 23.93 m BGS seam of very fine sand and silt 0.03 m thick at 24.05 m BGS seam of very fine sand 0.18 m thick at 24.08 m BGS medium sand beginning at 24.38 m BGS		19	CC	n/a	49" 82%		
80	25			20	CC	n/a	57" 95%		
85	26		358.80						

Screen Interval: 46.63 - 49.68 m BGS
Sand Pack Interval: 45.36 - 50.22 m BGS
Well Seal Interval: 0.91 - 45.36 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

Monitoring Well: WT-EBS-OW6A-09

Project:	Erb St. Class ESA	**Drilling method:**	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Jan-2-2009 / Jan-3-2009
Location:	Erb Street	**Ground surface elevation:**	378.21 m AMSL
Number:	1609-00505	**Top of casing elevation:**	378.96 m AMSL
Field investigator:	R.Dong	**Easting:**	533190.802
Contractor:	Pro Core Drilling	**Northing:**	4809730.08

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			SAND fine grained, brown, moist seam of soft clayey silt 4 mm thick at 26.67 m BGS seam of very fine sand 0.15 m thick at 26.82 m BGS	19.41	21	CC	n/a	57" 95%		
90	27									
	28		black banding from 28.04 to 28.19 m BGS		22	CC	n/a	50" 83%		
95	29		seam of very fine sand 0.51 m thick at 28.96 m BGS	348.74						
			SILTY CLAY AND FINE SAND brown, mottled, moist	29.47	23	CC	n/a	55" 92%		
	30									
100				347.68						
			SAND fine to medium grained, brown, moist to wet	30.53						
	31				24	CC	n/a	57" 95%		
105	32									
	33		black banding 1-3 mm thick between 33.02 to 33.10 m BGS black banding 1-3 mm thick between 33.35 to 33.45 m BGS		25	CC	n/a	57" 95%		Bentonite Grout
110	34									
	35		black banding 1-3 mm thick between 35.05 to 35.36 m BGS		26	CC	n/a	49" 82%		
115	36		black banding 1-3 mm thick between 35.81 to 36.00 m BGS		27	CC	n/a	57" 95%		
120	37		odour beginning at 37.09 m BGS seam of silty clay and very fine sand 0.05 m thick at 37.57 m BGS		28	CC	n/a	57" 92%		
125	38									
	39				29	CC	n/a	58" 97%		
130	40			347.68						

Screen Interval: 46.63 - 49.68 m BGS
Sand Pack Interval:45.36 - 50.22 m BGS
Well Seal Interval: 0.91 - 45.36 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

Monitoring Well: WT-EBS-OW6A-09

Project:	Erb St. Class ESA	**Drilling method:**	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Jan-2-2009 / Jan-3-2009
Location:	Erb Street	**Ground surface elevation:**	378.21 m AMSL
Number:	1609-00505	**Top of casing elevation:**	378.96 m AMSL
Field investigator:	R.Dong	**Easting:**	533190.802
Contractor:	Pro Core Drilling	**Northing:**	4809730.08

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram / Description
			SAND fine to medium grained, brown, moist to wet	30.53					
135	41		seam of very fine sand 0.23 m thick at 41.43 m BGS		30	CC	n/a	57" 98%	
140	42 43		seam of mottled light brown and brown fine sand 0.10 m thick at 42.21 m BGS very fine sand beginning at 42.44 m BGS seam of mottled grey and brown fine sand 0.48 m thick at 42.70 m BGS		31	CC	n/a	58" 97%	Top of holeplug (41.81 m BGS) Holeplug
145	44 45		black coloured fine sand seams from 43.18 to 43.87 m BGS seam of medium sand 0.08 m thick at 43.87 m BGS fine sand beginning at 43.94 m BGS black coloured fine sand seams 1-3 mm thick from 44.20 to 44.27 m BGS grey and brown mottling from 44.35 to 44.65 m BGS seam of very fine sand with black seams from 44.65 to 46.18 m BGS		32	CC	n/a	58" 100%	
150	46		very wet at 46.17 m BGS seams of black colour 1-3 mm thick from 46.17 to 46.89 m BGS becoming browny grey at 46.34 m BGS		33	CC	n/a	18" 30%	Top of sand (45.36 m BGS)
155	47 48		fragments of silt and sand 0.03-0.05 m long and 1-2 mm thick between 48.08 to 48.56 m BGS seam of mottled soft grey clay 0.10 m thick at 48.56 m BGS		34	CC	n/a	52" 83%	Top of screen (46.63 m BGS) No.1 Silica Sand
160	49		seams of black colouring 1-3 mm thick from 49.25 to 49.79 m BGS		35	CC	n/a	58" 100%	No.10 Slot PVC screen 50 mm diameter
165	50 51		SILTY CLAY TILL trace fine gravel, trace coarse sand, browny grey, very stiff, moist	328.15 50.06	36	CC	n/a	62" 100%	Bottom of screen (49.68 m BGS) Sand
170	52				37	CC	n/a	60" 100%	
			End of Borehole	325.86 52.35					
175	53 54								

Screen Interval: 46.63 - 49.68 m BGS
Sand Pack Interval: 45.36 - 50.22 m BGS
Well Seal Interval: 0.91 - 45.36 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

WT-EB-OW6-09-B

Monitoring Well: WT-EBS-OW6B-09

Project:	Erb St. Class ESA	**Drilling method:**	Tricone mud rotary 5"
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Jan-2-2009
Location:	Erb Street	**Ground surface elevation:**	378.15 m AMSL
Number:	1609-00505	**Top of casing elevation:**	379.01 m AMSL
Field investigator:	R.Dong	**Easting:**	533190.626
Contractor:	Pro Core Drilling	**Northing:**	4809733.161

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			Ground Surface	378.15						Stick up=0.86 m Blue steel protective casing
0	0		For Lithological Description see WT-EBS-OW6A-08	0.00						
					1	SS	2-2-2-2 (4)	3" 13%		Concrete
	1				2	SS	1-2-2-2 (4)	16" 67%		
5					3	SS	1-3-3-3 (6)	18" 75%		
	2				4	SS	1-2-3-3 (5)	16" 67%		
10	3				5	SS	n/a	36" 95%		
	4				6	SS	n/a	45" 75%		PVC Sch80 50 mm diameter
15	5									
20	6				7	CC	n/a	37" 61%		Bentonite Grout
	7				8	CC	n/a	42" 71%		
25	8									
30	9				9	CC	n/a	40" 67%		
	10				10	CC	n/a	53" 88%		
35	11									
40	12				11	CC	n/a	57" 95%		
				378.15						

Screen Interval: 35.05 - 38.10 m BGS
Sand Pack Interval 33.48 - 38.79 m BGS
Well Seal Interval: 0.91 - 33.48 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

Monitoring Well: WT-EBS-OW6B-09

Project:	Erb St. Class ESA	**Drilling method:**	Tricone mud rotary 5"
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Jan-2-2009
Location:	Erb Street	**Ground surface elevation:**	378.15 m AMSL
Number:	1609-00505	**Top of casing elevation:**	379.01 m AMSL
Field investigator:	R.Dong	**Easting:**	533190.626
Contractor:	Pro Core Drilling	**Northing:**	4809733.161

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			For Lithological Description see WT-EBS-OW6A-08	0.00						
45	14				12	CC	n/a	42" 70%		
50	15				13	CC	n/a	60" 100%		
55	16				14	CC	n/a	61" 100%		
60	17				15	CC	n/a	45" 76%		Bentonite Grout
65	18				16	CC	n/a	53" 88%		
70	19				17	CC	n/a	57" 95%		
75	20				18	CC	n/a	53" 88%		
80	21				19	CC	n/a	49" 82%		
85	22				20	CC	n/a	57" 95%		
	23									
	24									
	25									
	26			378.15						

Screen Interval: 35.05 - 38.10 m BGS
Sand Pack Interval 33.48 - 38.79 m BGS
Well Seal Interval: 0.91 - 33.48 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

Monitoring Well: WT-EBS-OW6B-09

Project:	Erb St. Class ESA	**Drilling method:**	Tricone mud rotary 5"
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Jan-2-2009
Location:	Erb Street	**Ground surface elevation:**	378.15 m AMSL
Number:	1609-00505	**Top of casing elevation:**	379.01 m AMSL
Field investigator:	R.Dong	**Easting:**	533190.626
Contractor:	Pro Core Drilling	**Northing:**	4809733.161

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram / Description
			For Lithological Description see WT-EBS-OW6A-08	0.00					
					21	CC	n/a	57" 95%	
					22	CC	n/a	50" 83%	
					23	CC	n/a	55" 92%	Top of holeplug (30.30 m BGS)
					24	CC	n/a	57" 95%	Holeplug
					25	CC	n/a	57" 95%	Top of sand (33.48 m BGS)
					26	CC	n/a	49" 82%	Top of screen (35.05 m BGS)
					27	CC	n/a	57" 95%	No.1 Silica Sand
					28	CC	n/a	57" 92%	No.10 Slot PVC screen 50 mm diameter
				339.36					Bottom of screen (38.1 m BGS)
									Sand
			End of Borehole	38.79					

90, 95, 100, 105, 110, 115, 120, 125, 130 ft

27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 m

Screen Interval: 35.05 - 38.10 m BGS
Sand Pack Interval 33.48 - 38.79 m BGS
Well Seal Interval: 0.91 - 33.48 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

6502371

WT-EB-OW6-57-A

INTERNATIONAL WATER SUPPLY. LTD.

LONDON, ONTARIO, CANADA

LOG OF WELL

WT6-57

Log of Well for Public Utilities Commission Test No. 6-57

Address Waterloo, Ontario

Location:

Date Drilling started October 9, 1957 Date Test Hole Completed October 9, 1957

Total depth to bottom of Well 121' Diameter Test Hole

Water stands when not pumping feet inches from the surface of the ground

THICKNESS	FROM	TO	FORMATION FOUND EACH STRATUM	THICKNESS	FROM	TO	FORMATION FOUND EACH STRATUM
4	0	4	1.22 Top soil				
4	4	8	2.44 Brown clay				
67	8	75	22.86 Blue clay				
13	75	88	26.82 Silty clay				120 105 / 115
17	88	105	32.00 Clay				
16	105	121	Gravel with odd streak of clay				
			36.88				

Remarks and opinion of Test

B. S. Abbott

Driller.

Region of Waterloo

Digital Water Well Record

WT-EB-OW322-02-A

WELL OBJECT ID	MOE NUMBER	REGION ID	CONSULTANT ID	MUNICIPALITY CODE
9201415		WT-EL-OW322A-02	OW322A-02	

COUNTY	TOWNSHIP/BOROUGH/CITY/TOWN/VILLAGE	CON	LOT NUMBER	LOT LETTER
WATERLOO				

OWNER'S SURNAME	FIRST NAME	MIDDLE NAME	LOCATION OF WELL	DATE COMPLETED
RMOW				

ZONE	UTM EASTING	UTM NORTHING	GND.ELEVATION	UTM RELIABILITY	ELEVATION RELIABILITY
17	533528.91	4809674.14	397.36	< 3 M MARGIN OF ERROR; MEASURED FROM MAPPED FEATURES (I.E. ROAD INTERSECTIONS; BUILDINGS; RAILWAYS; LOT LINES, ETC) OR GPS TECHNOLOGY	INSTRUMENT LEVEL ACCURATE TO 0.3 M (1')

LOG OF OVERBURDEN AND BEDROCK MATERIALS

LAYER #	COLOUR	PRIME MATERIAL	OTHER MATERIAL 1	OTHER MATERIAL 2	BOTTOM_DEPTH
1	BROWN	SAND	SILT	TOPSOIL	0.31
2	GREY	SILT	CLAY	GRAVEL	7.32
3	BROWN	SAND	SILT	NA	9.45
4	GREY	SAND	CLAY	SILT	12.19
5	GREY	SILT	CLAY	SAND	17.07
6	GREY	SAND	GRAVEL	SILT	19.51
7	GREY	SAND	SILT	GRAVEL	38.41
8	GREY	SILT	CLAY	SAND	48.16
9	BROWN	SAND	SILT	NA	68.28
10	GREY	SILT	NA	NA	74.37
11	GREY	SILT	CLAY	GRAVEL	74.68

☑ **DETAILED LITHOLOGY DATA IS AVAILABLE IF THIS BOX IS CHECKED**

WATER RECORD

CASING AND OPEN HOLE RECORD

ID	DIAMETER	MATERIAL	DEPTH TO	TOC ELEV.	PIPE HT.
A	51	PVC	65.23	398.18	0.82
B					

SCREEN RECORD

ID	SLOT	DIAMETER	DEPTH FROM	DEPTH TO
A	10	51	65.23	68.28
B			53.34	56.39

PLUGGING AND SEALING RECORD

ID	DEPTH FROM	DEPTH TO	PLUG MATERIAL
A	68.73	74.68	BENTONITE
B	63.7	68.73	SAND PACK
C	62	63.7	BENTONITE
D	0.6	62	BENTONITE GROUT
E	0	0.6	CEMENT

PUMPING TEST

Region of Waterloo

Digital Water Well Record

WELL OBJECT ID	MOE NUMBER	REGION ID	CONSULTANT ID	MUNICIPALITY CODE
9201416		WT-EL-OW332-02	OW332-02	

COUNTY	TOWNSHIP/BOROUGH/CITY/TOWN/VILLAGE	CON	LOT NUMBER	LOT LETTER
WATERLOO				

OWNER'S SURNAME	FIRST NAME	MIDDLE NAME	LOCATION OF WELL	DATE COMPLETED
RMOW				

ZONE	UTM EASTING	UTM NORTHING	GND.ELEVATION	UTM RELIABILITY	ELEVATION RELIABILITY
17	533411.997	4809820.512	392.79	< 3 M MARGIN OF ERROR; MEASURED FROM MAPPED FEATURES (I.E. ROAD INTERSECTIONS; BUILDINGS; RAILWAYS; LOT LINES, ETC) OR GPS TECHNOLOGY	INSTRUMENT LEVEL ACCURATE TO 0.3 M (1')

LOG OF OVERBURDEN AND BEDROCK MATERIALS

LAYER #	COLOUR	PRIME MATERIAL	OTHER MATERIAL 1	OTHER MATERIAL 2	BOTTOM_DEPTH
1	BROWN	SAND	SILT	TOPSOIL	0.61
2	GREY	CLAY	SILT	TILL	4.57
3	BROWN	SAND	CLAY	SILT	8.53
4	GREY	SILT	CLAY	SAND	10.06
5	BROWN	SAND	SILT	CLAY	32
6	BROWN	SILT	CLAY	NA	42.67
7	GREY	SAND	SILT	CLAY	56.39

☑ **DETAILED LITHOLOGY DATA IS AVAILABLE IF THIS BOX IS CHECKED**

WATER RECORD

CASING AND OPEN HOLE RECORD

ID	DIAMETER	MATERIAL	DEPTH TO	TOC ELEV.	PIPE HT.
A	51	PVC	49.07	393.68	0.89

SCREEN RECORD

ID	SLOT	DIAMETER	DEPTH FROM	DEPTH TO
A	10	51	49.07	52.12

PLUGGING AND SEALING RECORD

ID	DEPTH FROM	DEPTH TO	PLUG MATERIAL
A	53.34	56.39	DRILL CUTTINGS
B	47.85	53.34	SAND PACK
C	46.3	47.85	BENTONITE
D	0.6	46.3	BENTONITE GROUT
E	0	0.6	CEMENT

PUMPING TEST

FINAL STATUS OF WELL
OBSERVATION

WATER USE
First Use:

Second Use:

METHOD OF CONSTRUCTION

NAME OF WELL CONTRACTOR

WELL CONTRACTOR'S LICENSE

CONTRACTOR ADDRESS

SUBMISSION DATE

☐ **WELL HAS BEEN ABANDONNED/DESTROYED IF THIS BOX IS CHECKED**

W. of N. expansion

WT-EB-OW322-02-A

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN

HOLE DESIGNATION: OW322A-02
DATE COMPLETED: 15 July 2002
DRILLING METHOD: ROTOSONIC
FIELD PERSONNEL: K. PETER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (m)	SAMPLE 'N' VALUE
	TOP OF RISER GROUND SURFACE	398.11 397.29					
1	SILTY SAND (TOPSOIL), loose, fine grained, poorly graded, dark brown, moist, vegetative matter (grass, rootlets)	396.98	CONCRETE SEAL				
2	ML/CL - CLAYEY SILT (TILL), trace gravel, firm, grey/brown, dry						
3							
4	- moist at 3.66m BGS - silty clay, stiff, grey at 4.27m BGS						
5							
6			51 mm Ø SCH 80 PVC RISER PIPE				
7	SM - SILTY SAND, dense, slightly cohesive, medium grained, well graded, brown, moist to wet	389.97					
8							
9			BENTONITE GROUT				
10	SC- CLAYEY SAND, with silt, trace gravel, dense, moderately cohesive, fine grained, well graded, grey, moist	387.84			A/B1		
11							
12	ML/CL - CLAYEY SILT (TILL), with sand, trace to with gravel, stiff, grey, moist	385.10	152 mm Ø BOREHOLE				
13							
14							
15							
16	- light brown at 15.85m BGS - sandy, very moist at 16.46m BGS					17.07	
17	SP - SAND, with gravel, trace silt, dense, slightly cohesive, medium grained, poorly graded, grey/brown, moist	380.22					
18	- fine grained at 17.98m BGS						
19							
	SM - SILTY SAND, trace gravel, dense, moderately	377.78					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN

HOLE DESIGNATION: OW322A-02
DATE COMPLETED: 15 July 2002
DRILLING METHOD: ROTOSONIC
FIELD PERSONNEL: K. PETER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (m)	SAMPLE 'N' VALUE
41							
42							
43							
44							
45							
46			51 mm Ø SCH 80 PVC RISER PIPE				
47	- sandy at 47.55m BGS						
48	SP - SAND, with silt, dense, slightly cohesive, medium grained, poorly graded, brown, moist to very moist	349.13			48.13		
49			BENTONITE GROUT				
50							
51							
52	- trace silt, coarse grained at 52.43m BGS		152 mm Ø BOREHOLE				
53						AFB2	
54							
55	- interbedded silt and clay layers, 1cm thick at 54.86m BGS						
56	- silty sand, cohesive, fine grained at 56.39m BGS						
57							
58	- wet at 57.91m BGS						
59							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

WT-EB-OW332-02-A

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN

HOLE DESIGNATION: OW332-02
DATE COMPLETED: 8 August 2002
DRILLING METHOD: ROTOSONIC
FIELD PERSONNEL: K. PETER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (m)	SAMPLE 'N' VALUE
	TOP OF RISER GROUND SURFACE	393.59 392.70					
	SILTY SAND (TOPSOIL), loose, fine grained, poorly graded, dark brown, moist, vegetative matter (grass, rootlets)	392.09	CONCRETE SEAL				
2	ML/CL - SILTY CLAY (TILL), trace gravel, stiff, grey, moist						
4							
	SC - CLAYEY SAND, trace silt, soft, brown/grey, wet	388.13					
6			51 mm SCH 80 PVC RISER PIPE		AFB1		
8							
	ML/CL - CLAYEY SILT (TILL), trace sand, trace gravel, grey, moist	384.17	BENTONITE GROUT			10	06
10	SP - SAND, trace silt, trace clay, dense, fine grained, poorly graded, light brown, dry	382.64					
	- with silt, grey, moist at 11.58m BGS						
12	- heavy oxidation at 12.50m BGS		152 mm Ø BOREHOLE				
	- silty sand, wet at 13.11m BGS						
14					AFB1		
16	- very hard, dry at 15.85m BGS						
18	- trace silt, trace gravel, light grey/beige at 17.68m BGS						
20							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN

HOLE DESIGNATION: OW332-02
DATE COMPLETED: 8 August 2002
DRILLING METHOD: ROTOSONIC
FIELD PERSONNEL: K. PETER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (m)	SAMPLE 'N' VALUE
22							
24			51 mm SCH 80 PVC RISER PIPE				
26					AFB1		
			BENTONITE GROUT				
28							
	- silty, dense, brown, moist to very moist at 29.57m BGS						
30	- wet at 30.48m BGS		152 mm Ø BOREHOLE				
				32			
32	ML - SILT (WATERLAID), with clay, firm, brown, wet	360.70					
	- brown/grey, moist at 33.53m BGS						
34							
36					AFB2		
38	- light grey, dry at 38.10m BGS						
	- with fine grained sand, trace clay at 39.62m BGS						
40							

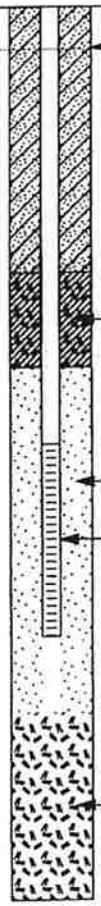
NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN

HOLE DESIGNATION: OW332-02
DATE COMPLETED: 8 August 2002
DRILLING METHOD: ROTOSONIC
FIELD PERSONNEL: K. PETER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (m)	SAMPLE 'N' VALUE
	SM/ML - SILTY SAND, trace clay, dense, medium grained, poorly graded, light grey, wet	350.03	152 mm ø BOREHOLE			42.67	
44						AFH2	
46			BENTONITE HOLEPLUG				
48							
50			SAND PACK; WELL SCREEN				
52	- moist at 51.82m BGS						
54	- wet at 54.86m BGS		HEAVED SAND				
56	END OF BOREHOLE @ 56.39m BGS	336.31					
58							
60							
62							



WELL DETAILS
Screened interval:
343.63 to 340.58m AMSL
49.07 to 52.12m BGS
Length: 3.05m
Diameter: 51mm
Slot Size: 10
Material: STAINLESS STEEL
Material: BENTONITE CHIPS
Sand Pack:
344.85 to 339.36m AMSL
47.85 to 53.34m BGS
Material: #1 SILICA SAND

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

obj.# 9205772 = W-EL-OW358A-08
9205773 = W-EL-OW358B-08

W-EL-OW358A-08-A

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING SUBCONTRACTOR: ALL-TERRAIN DRILLING

HOLE DESIGNATION: OW358A-08
DATE COMPLETED: December 9, 2008
DRILLING METHOD: PQ CORING (WET)
FIELD PERSONNEL: J. LEADER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITORING WELL	RUN NUMBER	CORE RECOVERY %	RQD %
	TOPSOIL - silt loam, dark brown, frozen; rootlets	0.10	CONCRETE			
	ML - SANDY SILT, firm, slight plasticity, damp	0.21				
1	SM - SILTY SAND, compact, dense, fine grained, brown, damp, hoizontally stratified					
2						
3	- silt with sand, firm, fine grained from 2.74 to 3.00m BGS	3.15				
4	- silt and sand, dense, fine to med. grained, horizontally stratified, slight plasticity, damp from 3.00 to 3.15m BGS					
	ML - SILT, trace clay, stiff, slight plasticity, brown, damp, massive	4.44				
5	- silt with sand, fine grained, brown, damp from 4.56 to 4.60m BGS					
6	SP/SM - SAND, trace silt, compact/dense, fine grained, brown, dry to damp, hoizontally stratified		BENTONITE GROUT			
7	- silt and sand, fine grained, brown, damp from 4.72 to 4.80m BGS					
8	- SW - sand, compact, fine to medium grained, stratified, becoming finer grained with depth from 4.80 to 12.85m BGS					
	- trace silt from 5.94 to 6.40m BGS					
	- with silt from 6.40 to 6.71m BGS					
9	- trace silt from 6.45 to 6.65m BGS		2" Ø SCH 80 PVC RISER PIPE			
10						
11						
12						
13	ML/SM - SANDY SILT, firm/compact, brown, dry/damp, horizontally stratified; occasional thin sand seems and thin silt seams	12.85				
	GP/GM - GRAVELLY SAND, with to trace silt, compact, fine to coarse gravel, subrounded	13.54 / 13.79				
14	SP/SM - SAND, trace silt, compact, fine to medium grained, brown, dry/damp; occasionally with silt					
15	- silty sand with gravel, both fine grained from 14.45 to 14.50m BGS					
16	- sand and gravel, trace silt, fine to coarse sand, fine gravel from 14.96 to 15.06m BGS					
17	- silty sand, trace gravel from 15.06 to 15.19m BGS					
	- sand, medium grained, trace fine grained, occassional thin silty seams and fine sand seems from 15.19 to 17.81m BGS					
18	- black streak, no odour at 17.73m BGS					
	- sand, trace silt, fine grained, trace medium grained at 17.83m BGS					
19	- silty sand, fine grained from 19.40 to 19.43m BGS					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING SUBCONTRACTOR: ALL-TERRAIN DRILLING

HOLE DESIGNATION: OW358A-08
DATE COMPLETED: December 9, 2008
DRILLING METHOD: PQ CORING (WET)
FIELD PERSONNEL: J. LEADER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITORING WELL	RUN NUMBER	CORE RECOVERY %	RQD %
	- sand, medium grained, trace fine grained from 20.37 to 20.57m BGS					
21	- silty sand, fine grained from 20.57 to 20.73m BGS		BENTONITE GROUT			
	- sand, fine to medium grained from 20.73 to 20.83m BGS					
22	- silty sand, fine grained from 20.83 to 20.96m BGS					
	- sand, fine to medium grained from 20.96 to 23.39m BGS					
23	- sand, fine to medium grained, trace coarse sand from 23.39 to 24.31m BGS					
24	- sand, medium to coarse grained, trace fine grained, trace gravel from 24.31 to 25.07m BGS					
25	- sand with to trace silt, fine grained from 25.07 to 27.56m BGS					
26						
27	- silty sand, fine grained from 27.56 to 28.12m BGS		2" Ø SCH 80 PVC RISER PIPE			
28	- sand, trace silt, fine to medium grained from 28.12 to 28.29m BGS					
29	- sand, medium grained, trace fine grained from 28.29 to 28.73m BGS					
	- sand, trace gravel, medium to coarse sand, fine gravel from 28.73 to 29.51m BGS					
30						
31						
32						
33	- silty sand, fine grained from 33.25 to 34.34m BGS					
34	- silt and sand, firm/dense, fine grained from 34.34 to 35.05m BGS					
35	- silty sand, fine grained from 35.05 to 37.16m BGS					
36						
37	SM/ML - SILTY SAND to SILT with SAND, alternating beds 10 to 30 cm thick; stratified, brown, dry/damp	37.16				
38						
39						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING SUBCONTRACTOR: ALL-TERRAIN DRILLING

HOLE DESIGNATION: OW358A-08
DATE COMPLETED: December 9, 2008
DRILLING METHOD: PQ CORING (WET)
FIELD PERSONNEL: J. LEADER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITORING WELL	RUN NUMBER	CORE RECOVERY %	RQD %
41						
42						
43						
44	- silt, firm from 44.17 to 44.24m BGS	44.17				
45	SM/SP - SILT AND SAND, firm to stiff/compact to dense, fine grained, brown, dry/damp; varying consistencies of silt and sand - sand, trace silt, stratified from 45.46 to 46.20m BGS					
46						
47	- sand, trace silt, fine to medium grained from 46.94 to 47.24m BGS	47.55				
48	ML - SILT, trace sand, firm to stiff, massive, fine grained sand, brown, damp					
49						
50	- silt and sand, firm to stiff, fine grained from 49.58 to 50.01m BGS - silt at 50.01m BGS					
51		51.36				
52	SM/SP - SILT AND SAND, firm to stiff/compact to dense, fine grained, brown, dry/damp; varying consistencies		3/8" BENTONITE GRAVEL			
53	- sand, trace silt, fine to medium grained, stratified at 52.58m BGS					
54						
55			#1 SILICA SAND			
56						
57			2" Ø STAINLESS STEEL SCREEN			
58		58.29				
59	ML - SILT, trace clay, very stiff, massive, brown, damp, slight plasticity					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING SUBCONTRACTOR: ALL-TERRAIN DRILLING

HOLE DESIGNATION: OW358A-08
DATE COMPLETED: December 9, 2008
DRILLING METHOD: PQ CORING (WET)
FIELD PERSONNEL: J. LEADER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITORING WELL	RUN NUMBER	CORE RECOVERY %	RQD %
61	- silt and sand, firm to stiff/compact to dense, fine grained from 60.25 to 60.63m BGS					
62	- silt and sand, firm to stiff/compact to dense, fine grained from 61.65 to 61.95m BGS - silt and sand, firm to stiff/compact to dense, fine grained from 62.10 to 62.76m BGS		3/8" BENTONITE GRAVEL			
63						
64	- silt and sand, firm to stiff/compact to dense, fine grained from 64.03 to 64.41m BGS					
65	ML/CI - SILT with CLAY (MARYHILL TILL), trace gravel, very dense, moderate plasticity, brown, damp	64.64				
66	END OF BOREHOLE @ 66.14m BGS	66.14	WELL DETAILS Screened interval: 55.47 to 58.52m BGS Length: 3.05m Diameter: 51mm Slot Size: 8 Material: STAINLESS STEEL Seal: 51.51 to 52.43m BGS Material: 3/8" BENTONITE GRAVEL Sand Pack: 52.43 to 58.83m BGS Material: #1 SILICA SAND ---------- Seal: 58.83 to 66.14m BGS Material: 3/8" BENTONITE GRAVEL				
67						
68						
69						
70						
71						
72						
73						
74						
75						
76						
77						
78						
79						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

Obj # 9205774 = W-EL-OW359A-08
9205775 = W-EL-OW359B-08

W-EL-OW359A-08-A

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING SUBCONTRACTOR: ALL-TERRAIN DRILLING

HOLE DESIGNATION: OW359A-08
DATE COMPLETED: November 19, 2008
DRILLING METHOD: PQ CORING (WET)
FIELD PERSONNEL: J. LEADER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITORING WELL	RUN NUMBER	CORE RECOVERY %	RQD %
	TOPSOIL - silt loam, trace sand, trace gravel, soft, dark brown, damp to moist; rootlets and worms	0.15	CONCRETE			
1	FILL - sand with silt, compact, fine grained, brown, dry to damp					
2	- sandy silt, trace gravel, compact, fine grained, dark brown, dry to damp; rootlets, piece of rope at 1.17m BGS					
	- 2.5 cm piece of red brick at 1.27m BGS					
3	- cobble encountered, subrounded at 1.35m BGS					
	- silt, trace sand, trace gravel, trace clay, dense, low plasticity, dark brown, ddry to damp; rootlets at 1.40m BGS					
4	- sand with silt, trace gravel, compact, fine grained, tan, dry to damp; iron staining; occassional thin silt lenses at 1.57m BGS					
5	- cobble, granit from 3.40 to 3.48m BGS					
	- plastic encountered at 3.55m BGS					
6	- wood, root inclusions from 4.34 to 5.49m BGS		BENTONITE GROUT			
	- high density plastic and a cobble encountered at 4.37m BGS					
7	- silt, trace sand, trace gravel; occasional rootlets at 4.42m BGS					
	- plastic encountered at 6.88m BGS					
8	- wood debris and rootlets at 8.03m BGS					
	- sand, trace gravel, fine grained sand at 8.13m BGS	8.31				
9	GP - SAND AND GRAVEL, trace silt, compact to dense, coarse grained gravel, subrounded, brown, fine to medium sand, brown, damp; trace coarse grained sand	9.30	2" Ø SCH 80 PVC RISER PIPE			
10	GW - SAND AND GRAVEL, with cobbles, trace silt, compact to dense, subrounded, fine to coarse grained, brown, damp; sand is becoming coarser with depth					
11						
12						
13	- SM to ML - SAND, with silt, compact, fine to medium grained, dry to damp, hoizontally stratified from 12.97 to 13.37m BGS	12.88				
14	ML - SILT, trace gravel, very stiff, subrounded, fine to coarse grained, brown, dry to damp; horizontally stratified					
15	- ML to SM - SILT, with sand, trace gravel, stiff from 13.49 to 14.10m BGS					
16	- ML to SM - SILT, with sand, trace gravel, stiff from 14.10 to 14.27m BGS					
	- GP - GRAVELLY SAND, trace silt, trace cobbles, dense, fine sand, fine to coarse gravel, subrounded, brown, dry from 14.27 to 14.73m BGS					
17	- SM/ML - SILTY SAND, trace gravel, compact to dense, fine grained gravel, fine grained sand, subrounded, brown, dry to damp from 14.73 to 16.92m BGS					
18	- SM/ML/GP - SILTY SAND, with gravel, fine to coarse grained, damp from 16.92 to 17.73m BGS					
19	- GM - SAND AND GRAVEL, trace silt, trace cobbles, compact to dense, fine to coarse grained,					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING SUBCONTRACTOR: ALL-TERRAIN DRILLING

HOLE DESIGNATION: OW359A-08
DATE COMPLETED: November 19, 2008
DRILLING METHOD: PQ CORING (WET)
FIELD PERSONNEL: J. LEADER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITORING WELL	RUN NUMBER	CORE RECOVERY %	RQD %
	brown from 17.73 to 18.92m BGS - ML - SILT, trace sand, stiff, moderate plasticity, brown, damp from 18.92 to 19.05m BGS - SM/ML - SAND, with silt, trace gravel, compact, brown; occassional cobble from 19.05 to 19.71m BGS - ML - SILT, trace sand, trace gravel, stiff, fine grained, brown, damp; no structure apparent from 19.71 to 20.12m BGS - GM - SAND AND GRAVEL, with silt, compact, brown, occasional cobbles from 20.12 to 20.27m BGS - SM/ML - SAND AND SILT, compact to firm, fine to medium grained, brown; no structure from 20.27 to 21.64m BGS - SM/ML - SAND, with silt, compact, fine to medium grained, occasional sand and silt lenses; horizontally stratified with black banding from 21.64 to 23.37m BGS - SM/ML - SILT AND SAND, firm to compact, brown, damp; hoizontal deposition; alternating silt/sand from 23.37 to 26.29m BGS - ML/SM - SILT, with sand, firm to stiff, fine grained, brown, damp; iron oxide staining (discolouration) at base of contact with lower unit from 26.29 to 26.82m BGS - sand, medium grained from 26.57 to 26.62m BGS - silty sand from 26.87 to 26.97m BGS - sandy silt, trace coarse sand, trace fine gravel from 26.97 to 27.48m BGS	26.82	BENTONITE GROUT				
	SP - SAND, compact, poorly graded/well sorted, medium grained, greyish, inferred to be wet - medium to coarse sand seam from 28.70 to 28.73m BGS - medium to coarse grained sand seam from 29.54 to 29.57m BGS - fine to medium grained sand from 30.58 to 34.11m BGS - SM - SILT, with sand, fine grained, firm, stratified from 34.11 to 34.20m BGS - medium grained sand, trace fine gravel from 34.20 to 34.90m BGS - fine to medium sand, stratified from 34.90 to 35.36m BGS - medium sand, trace coarse sand, stratified from 35.36 to 35.51m BGS - fine to medium graind sand, stratified from 35.51 to 36.27m BGS - medium grained sand, trace fine from 36.27 to 39.17m BGS - medium to coarse sand, trace fine gravel from 39.17 to 39.52m BGS - sand and gravel seam, coarse sand, fine gravel		2" Ø SCH 80 PVC RISER PIPE				

21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING SUBCONTRACTOR: ALL-TERRAIN DRILLING

HOLE DESIGNATION: OW359A-08
DATE COMPLETED: November 19, 2008
DRILLING METHOD: PQ CORING (WET)
FIELD PERSONNEL: J. LEADER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITORING WELL	RUN NUMBER	CORE RECOVERY %	RQD %	
	from 39.24 to 39.27m BGS - ML - SANDY SILT, firm fine grained, stratified, brown from 39.52 to 39.80m BGS - ML/SM - SILT AND SAND, compact, brown from 39.80 to 41.50m BGS - SP - medium grained sand, trace fine gravel, trace fine and coarse sand from 41.50 to 44.14m BGS - seam of firm silt from 41.73 to 41.81m BGS - SM - SILTY SAND, compact/fim, fine grained, brown, hoizontally stratified from 44.14 to 45.82m BGS - silty sand, fine to medium grained from 45.82 to 46.05m BGS - SP - SAND, trace gravel, compact, well graded, fine to coarse sand, fine gravel, grey from 46.05 to 46.18m BGS - SM - SAND, with silt, compact, fine to med. grained from 46.18 to 46.38m BGS - cobble, subrounded at 46.20m BGS - GM - SAND, with gravel, trace silt, fine to coarse sand from 46.38 to 47.22m BGS - no recovery (suspect washed out) from 48.56 to 48.56m BGS - gravel and cobbles from 48.59 to 48.69m BGS - sand, trace silt, fine grained sand, trace med. sand, increasing grain size with depth from 48.69 to 49.25m BGS - SILT, trace clay, firm, mod. plast., brown, damp from 49.25 to 49.30m BGS - SP - SAND, trace silt, fine grained, trace medium grained from 49.30 to 50.47m BGS - SILT, trace clay, firm, mod. plasticity, brown, damp from 50.47 to 50.54m BGS - SP - SAND, trace silt, fine to medium sand, brownish from 50.54 to 51.18m BGS - SM/ML - SILTY SAND, compact, fine grained, hoizontally stratified, brown from 51.18 to 52.12m BGS - SP - SAND, compact, medium grained, trace fine, brown from 52.12 to 54.18m BGS - seam of coarse gravel from 54.18 to 54.20m BGS - GW - SAND, with gravel, subrounded, fine to coarse grained sand, fine gravel, grey from 54.69 to 55.78m BGS - SM/ML - SAND, with silt, compact, horizontally stratified, fine grained, grey from 55.78 to 58.62m BGS - seam of silt, trace clay, firm, mod. plasticity, brownish grey, damp from 56.49 to 56.52m BGS - seam of silt, trace clay, firm, mod. plasticity, brownish grey, damp from 58.01 to 58.09m BGS - SM/ML - SILT AND SAND, compact/firm, mod. pasticity, rapid dilatency, fine grained, brownish						

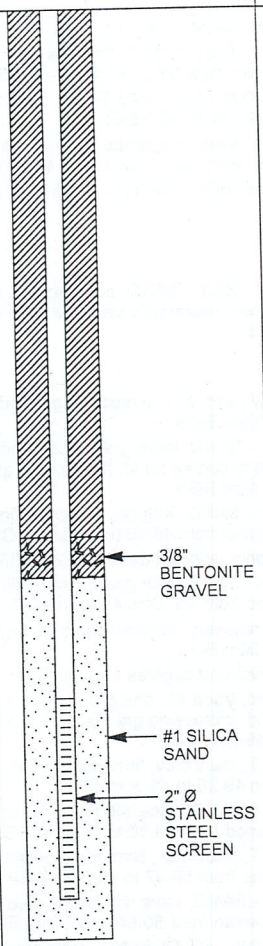
41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING SUBCONTRACTOR: ALL-TERRAIN DRILLING

HOLE DESIGNATION: OW359A-08
DATE COMPLETED: November 19, 2008
DRILLING METHOD: PQ CORING (WET)
FIELD PERSONNEL: J. LEADER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	MONITORING WELL	RUN NUMBER	CORE RECOVERY %	RQD %
	grey from 58.62 to 59.72m BGS - SM to SP - SAND, trace SILT, compact, fine to medium grained from 59.61 to 59.66m BGS - SP - SAND, compact, medium grained, trace fine grained, grey from 59.72 to 60.17m BGS - ML/SM - SILT SAND, compact/fimr, rapid dilatency, mod. plasticity, fine grained, grey, stratified from 60.17 to 61.87m BGS - SM - SAND, with silt, compact, fine grained, stratified from 61.87 to 62.33m BGS - ML/SM - SAND AND SILT, compact, fine grained, stratified from 62.33 to 63.58m BGS - silt and sand from 63.58 to 64.08m BGS - sand, fine to medium grained from 64.08 to 64.16m BGS					
61						
62						
63						
64						
65						
66						
67						
68						
69						
70	- trace gravel, trace silt, fine to coarse, stratified, grey, saturated at 70.10m BGS					
71						
72						
73		73.46				
74	ML/CL - SILT AND CLAY (MARYHILL TILL), trace to with sand, trace to with gravel, stiff, low t omod. plasticity, grey END OF BOREHOLE @ 74.07m BGS	74.07	WELL DETAILS Screened interval: 70.41 to 73.46m BGS Length: 3.05m Diameter: 51mm Slot Size: 8 Material: STAINLESS STEEL Seal: 67.97 to 68.58m BGS Material: 3/8" BENTONITE GRAVEL Sand Pack: 68.58 to 74.07m BGS Material: #1 SILICA SAND			
75						
76						
77						
78						
79						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

9203579

WT-EB-OW1-08-A

Monitoring Well: WT-EBS-OW1A-08

Project:	Erb St. Class ESA	Drilling method:	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	Date started/completed:	Oct-24-2008
Location:	Erb Street	Ground surface elevation:	389.04 m AMSL
Number:	1609-00505	Top of casing elevation:	389.80 m AMSL
Field investigator:	R.Dong	Easting:	532684.989
Contractor:	Pro Core Drilling	Northing:	4809092.453

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram / Description
									Stick up=0.76 m Steel protective casing
0	0		Ground Surface Not logged	389.04 0.00					Concrete
5	1, 2								
10	3		SAND TILL fine grained sand, trace medium to coarse sand, some fine to coarse gravel, brown seam of silt and gravel 76 mm thick at 2.82 m BGS	386.30 2.74 385.86 3.18 385.53	4	CC	n/a	21" 100%	
			SILT TILL trace fine, medium and coarse sand, brown, hard, moist	3.51					
15	4, 5		CLAYEY SILT TO SILTY CLAY some fine sand, trace medium to coarse sand, trace fine and coarse gravel, browny grey, stiff, moist		5	CC	n/a	55" 90%	PVC Sch80 50 mm diameter
					6	CC	n/a	54" 90%	
20	6		trace pockets of soft grey clay (2 mm diameter) alternating varved and mottled structures beginning at 6.10 m BGS seams of fine sand 3 to 25 mm thick beginning at 6.17 m BGS						
25	7, 8				7	CC	n/a	45" 75%	
					8	CC	n/a	54" 90%	
30	9, 10				9	CC	n/a	62" 102%	
35	11		trace soft, dry red clay pockets, 2 mm diameter, at 10.67 m BGS becoming light brown at 11.51 m BGS	377.33 11.71	10	CC	n/a	61" 102%	
40	12		SAND fine grained, light brown, some mottled pockets of light brown silty clay, moist sand and soft silty clay, soft sandy silt beginning at 11.92 m BGS becoming browny grey at 12.28 m BGS	376.57 12.47					

Screen Interval: 56.08 - 59.13 m BGS
Sand Pack Interval 54.33 - 61.06 m BGS
Well Seal Interval: 0.91 - 54.33 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
CC - continuous core sample

n/a - not available/applicable

Stantec

Drawn By/Checked By: OR/KM

Monitoring Well: WT-EBS-OW1A-08

Project:	Erb St. Class ESA	**Drilling method:**	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Oct-24-2008
Location:	Erb Street	**Ground surface elevation:**	389.04 m AMSL
Number:	1609-00505	**Top of casing elevation:**	389.80 m AMSL
Field Investigator:	R.Dong	**Easting:**	532684.989
Contractor:	Pro Core Drilling	**Northing:**	4809092.453

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
	13		varved structure of fine sand, sandy silt, silty clay and clay beginning at 12.50 m BGS SILTY CLAY little fine sand, trace medium and coarse sand, trace fine gravel, browny grey, moist seam of light brown 8.9 cm thick at 13.18 m BGS	376.57 12.47 375.12 13.92	11	CC	n/a	n/a		
45	14		SAND AND SILT trace medium and coarse sand, light brown, moist varved structure of silty clay, sand and sandy silt beginning at 13.92 m BGS		12	CC	n/a	18" 30%		
50	15									
	16				13	CC	n/a	55" 92%		
55	17				14	CC	n/a	44" 73%		
60	18			370.29 18.75						
	19		SAND fine grained, trace medium and coarse sand, trace coarse and fine gravel, browny grey, moist varved soft grey clay 5-10 cm thick beginning at 18.87 m BGS, repeating every 10-20 cm		15	CC	n/a	59" 100%		Bentonite Grout
65	20				16	CC	n/a	36" 62%		
	21		beginning light brown at 21.01 m BGS							
70	22		well graded with little fine and coarse gravel (max 60 mm), subrounded at 21.56 m BGS		17	CC	n/a	46" 77%		
75	23				18	CC	n/a	28" 46%		
	24									
80	25				19	CC	n/a	38" 63%		
85	26			370.29						

Screen Interval: 56.08 - 59.13 m BGS
Sand Pack Interval 54.33 - 61.06 m BGS
Well Seal Interval: 0.91 - 54.33 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
CC - continuous core sample

n/a - not available/applicable

Stantec

Drawn By/Checked By: OR/KM

Monitoring Well: WT-EBS-OW1A-08

Project:	Erb St. Class ESA	**Drilling method:**	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Oct-24-2008
Location:	Erb Street	**Ground surface elevation:**	389.04 m AMSL
Number:	1609-00505	**Top of casing elevation:**	389.80 m AMSL
Field Investigator:	R.Dong	**Easting:**	532684.989
Contractor:	Pro Core Drilling	**Northing:**	4809092.453

SUBSURFACE PROFILE				SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			SAND fine grained, trace medium and coarse sand, trace coarse and fine gravel, browny grey, moist	18.75	20	CC	n/a	55" 92%		
90	27									
	28				21	CC	n/a	56" 93%		
95	29									
	30		SAND AND GRAVEL brown, well graded, subrounded (max 75 mm), moist	359.22 29.82	22	CC	n/a	56" 100%		
100										
	31		layer of little coarse gravel from 31.04 to 31.45 m BGS		23	CC	n/a	56" 93%		
105	32		layer of little coarse gravel from 31.85 to 32.00 m BGS cobble at 32.05 m BGS cobble at 32.23 m BGS cobble at 32.31 m BGS							
	33		seam of little sand 25.4 cm thick at 32.81 m BGS		24	CC	n/a	54" 90%		
110			SAND fine grained, little coarse gravel, brown, moist	355.56 33.48						Bentonite Grout
	34				25	CC	n/a	4" 7%		
115	35		GRAVEL little sand (well graded), brown, wet cobble at 35.38 m BGS	353.83 35.20						
	36				26	CC	n/a	60" 100%		
120			cobble at 36.65 m BGS							
	37				27	CC	n/a	52" 87%		
125	38									
	39				28	CC	n/a	56" 95%		
130				349.29						
	40		SAND medium grained, trace to some gravel, brown	39.75 349.29						

Screen Interval: 56.08 - 59.13 m BGS
Sand Pack Interval: 54.33 - 61.06 m BGS
Well Seal Interval: 0.91 - 54.33 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: CR/KM

Stantec

Monitoring Well: WT-EBS-OW1A-08

Project:	Erb St. Class ESA	**Drilling method:**	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Oct-24-2008
Location:	Erb Street	**Ground surface elevation:**	389.04 m AMSL
Number:	1609-00505	**Top of casing elevation:**	389.80 m AMSL
Field investigator:	R.Dong	**Easting:**	532684.989
Contractor:	Pro Core Drilling	**Northing:**	4809092.453

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			SAND medium grained, trace to some gravel, brown	39.75	29	CC	n/a	30" 50%		
135	41									
	42				30	CC	n/a	59" 95%		
140	43		seam of coarse gravel from 43.41 to 44.39 m BGS		31	CC	n/a	57" 95%		
	44			344.65 44.39						
145			SAND AND GRAVEL well graded, brown, subrounded (max 75 mm), moist		32	CC	n/a	36" 60%		Bentonite Grout
	45									
150	46				33	CC	n/a	28" 47%		
	47									
155	48				34	CC	n/a	38" 63%		
160	49				35	CC	n/a	43" 72%		
	50			338.55 50.48						
165			SAND medium grained, trace fine gravel, brown		36	CC	n/a	13" 22%		Top of holeplug (51.69 m BGS)
	51									
170	52		seam of gravel 5.1 cm thick at 51.94 m BGS		37	CC	n/a	32" 53%		Holeplug
	53									
175				338.55						

Screen Interval: 56.08 - 59.13 m BGS
Sand Pack Interval 54.33 - 61.06 m BGS
Well Seal Interval: 0.91 - 54.33 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
CC - continuous core sample

n/a - not available/applicable

Stantec

Drawn By/Checked By: OR/KM

Monitoring Well: WT-EBS-OW1A-08

Project:	Erb St. Class ESA	**Drilling method:**	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Oct-24-2008
Location:	Erb Street	**Ground surface elevation:**	389.04 m AMSL
Number:	1609-00505	**Top of casing elevation:**	389.80 m AMSL
Field investigator:	R.Dong	**Easting:**	532684.989
Contractor:	Pro Core Drilling	**Northing:**	4809092.453

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			SAND medium grained, trace fine gravel, brown	50.48	38	CC	n/a	38" 63%		Top of sand (54.33 m BGS)
180	55									
	56		cobble at 55.68 m BGS		39	CC	n/a	45" 75%		Top of screen (56.08 m BGS)
185										
	57				40	CC	n/a	50" 87%		No.10 Slot PVC screen 50 mm diameter
190	58		coarse sand and trace fine gravel beginning at 58.19 m BGS							
	59				41	CC	n/a	50" 83%		Bottom of screen (59.13 m BGS)
195			seams of hard, brown clay till, 5-7.62 cm thick at 59.51 m BGS							
	60		seams of hard, brown clay till, 5-7.62 cm thick at 60.05 m BGS seams of hard, brown clay till, 5-7.62 cm thick at 60.15 m BGS seams of hard, brown clay till, 5-7.62 cm thick at 60.23 m BGS		42	CC	n/a	52" 87%		No.1 Silica Sand
200	61									
				327.32						
	62		SAND very fine grained, some silt seam of fine sand 5 cm thick at 61.95 m BGS	61.72	43	CC	n/a	57" 95%		Holeplug
205				326.43						
	63		CLAY browny grey, hard, moist	62.61	44	CC	n/a	61" 102%		
210	64			324.70						
			End of Borehole	64.34						
	65									
215										
	66									
220	67									

Screen Interval: 56.08 - 59.13 m BGS
Sand Pack Interval:54.33 - 61.06 m BGS
Well Seal Interval: 0.91 - 54.33 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

WT-EB-OW1-08-B

Monitoring Well: WT-EBS-OW1B-08

Project:	Erb St. Class ESA	**Drilling method:**	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Oct-30-2008
Location:	Erb Street	**Ground surface elevation:**	389.20 m AMSL
Number:	1609-00505	**Top of casing elevation:**	390.04 m AMSL
Field investigator:	C.Stewart	**Easting:**	532682.557
Contractor:	Pro Core Drilling	**Northing:**	4809090.487

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			Ground Surface	389.20						Stick up=0.84 m
0	0		Refer to WT-EBS-OW1A-08 for Lithology	0.00						Steel protective casing
										Concrete
5	1									
	2									
10	3				4	CC	n/a	21" 100%		
	4				5	CC	n/a	55" 90%		
15										PVC Sch80 50 mm diameter
	5				6	CC	n/a	54" 90%		
20	6									
	7				7	CC	n/a	45" 75%		
25	8				8	CC	n/a	54" 90%		
30	9									
	10				9	CC	n/a	62" 102%		
35	11				10	CC	n/a	61" 102%		
40	12			389.20						

Screen Interval: 44.22 - 47.27 m BGS
Sand Pack Interval:42.80 - 47.45 m BGS
Well Seal Interval: 0.91 - 42.80 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

Monitoring Well: WT-EBS-OW1B-08

Project:	Erb St. Class ESA	**Drilling method:**	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Oct-30-2008
Location:	Erb Street	**Ground surface elevation:**	389.20 m AMSL
Number:	1609-00505	**Top of casing elevation:**	390.04 m AMSL
Field investigator:	C.Stewart	**Easting:**	532682.557
Contractor:	Pro Core Drilling	**Northing:**	4809090.487

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			Refer to WT-EBS-OW1A-08 for Lithology	0.00						
	13				11	CC	n/a	n/a		
45										
	14									
	15				12	CC	n/a	18" 30%		
50										
	16				13	CC	n/a	55" 92%		
55										
	17									
	18				14	CC	n/a	44" 73%		
60										
	19				15	CC	n/a	59" 100%		
65										Bentonite Grout
	20									
	21				16	CC	n/a	36" 62%		
70										
	22				17	CC	n/a	46" 77%		
75										
	23									
	24				18	CC	n/a	28" 46%		
80										
	25				19	CC	n/a	38" 63%		
85										
	26			389.20						

Screen Interval: 44.22 - 47.27 m BGS
Sand Pack Interval:42.80 - 47.45 m BGS
Well Seal Interval: 0.91 - 42.80 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

Monitoring Well: WT-EBS-OW1B-08

Project:	Erb St. Class ESA	**Drilling method:**	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Oct-30-2008
Location:	Erb Street	**Ground surface elevation:**	389.20 m AMSL
Number:	1609-00505	**Top of casing elevation:**	390.04 m AMSL
Field investigator:	C.Stewart	**Easting:**	532682.557
Contractor:	Pro Core Drilling	**Northing:**	4809090.487

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			Refer to WT-EBS-OW1A-08 for Lithology	0.00						
	27				20	CC	n/a	55" 92%		
90										
	28				21	CC	n/a	56" 93%		
95	29									
	30				22	CC	n/a	56" 100%		
100										
	31				23	CC	n/a	56" 93%		
105	32									
	33				24	CC	n/a	54" 90%		
110										Bentonite Grout
	34				25	CC	n/a	4" 7%		
115	35									
	36				26	CC	n/a	60" 100%		
120										
	37				27	CC	n/a	52" 87%		
125	38									
	39				28	CC	n/a	56" 97%		
130										Top of holeplug (39.68 m BGS)
	40			389.20						

Screen Interval: 44.22 - 47.27 m BGS
Sand Pack Interval: 42.80 - 47.45 m BGS
Well Seal Interval: 0.91 - 42.80 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

Monitoring Well: WT-EBS-OW1B-08

Project:	Erb St. Class ESA	**Drilling method:**	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Oct-30-2008
Location:	Erb Street	**Ground surface elevation:**	389.20 m AMSL
Number:	1609-00505	**Top of casing elevation:**	390.04 m AMSL
Field investigator:	C.Stewart	**Easting:**	532682.557
Contractor:	Pro Core Drilling	**Northing:**	4809090.487

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			Refer to WT-EBS-OW1A-08 for Lithology	0.00	29	CC	n/a	30" 50%		Holeplug
135	41									
	42				30	CC	n/a	59" 97%		
140										Top of sand (42.80 m BGS)
	43				31	CC	n/a	57" 95%		
	44									
145										Top of screen (44.22 m BGS)
	45				32	CC	n/a	36" 60%		No.1 Silica Sand
150										
	46				33	CC	n/a	28" 47%		No.10 Slot PVC screen 50 mm diameter
	47									Bottom of screen (47.27 m BGS)
155				341.75						No.1 Silica Sand
			End of Borehole	47.45						
	48									
160										
	49									
	50									
165										
	51									
170										
	52									
	53									
175										

Screen Interval: 44.22 - 47.27 m BGS
Sand Pack Interval: 42.80 - 47.45 m BGS
Well Seal Interval: 0.91 - 42.80 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

Monitoring Well: WT-EB-OW1-15

Project: RMOW Well Replacement
Client: Regional Municipality of Waterloo
Location: Cambridge, ON
Number: 160900798

Field investigator: L.Carson
Contractor: Gerrits Well Drilling Inc.
Drilling method: Air Rotary
Date started/completed: 11-May-2015 / 15-May-2015

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type
			Ground Surface	370.48				
0	0		TOPSOIL organics, medium to coarse sand, fine to medium gravel, trace clay, dark brown (10YR 3/3)	0.00				
				369.56			1	GB
			TILL silty to clayey till, some fine and coarse sand, greyish- brown (10YR 5/2), medium to high placticity, soft	0.91				
5								
	2						2	GB
10			sand and gravel content increasing with depth		Possible ATB1	Possible Upper Maryhill Till		
							3	GB
	4							
15								
							4	GB
20	6			364.38				
			SAND and GRAVEL fine to coarse, trace silt, angular to subrounded, greyish-brown (10YR 5/2)	6.10				
							5	GB
25					Possible AFB1	Possible Upper Waterloo Moraine stratified sediments and equivalents		
	8		yellowish brown (10YR 5/4) at 7.92 m BGS				6	GB
				361.33				
30			TILL silt till, some fine to coarse sand and gravel, some clay, subangular to subrounded, greyish brown (10YR 5/2)	9.14				
	10						7	GB
35								
							8	GB
	12							
40			sand and gravel content increasing with depth		Possible ATB2	Possible Middle Maryhill Till and equivalents		
							9	GB
45								
	14							
							10	GB
				355.24				
50			SAND AND GRAVEL fine to coarse sand, fine to medium gravel, trace silt and clay, subangular to subrounded, greyish brown (10YR 5/4)	15.24				
	16						11	GB
55								
							12	GB
	18							
				352.19				
60			SAND fine to coarse, gravel, trace silt, subangular to subrounded, grey (7.5YR 6/1)	18.29				
							13	GB
65	20							
							14	GB
				349.14				
70			SAND and GRAVEL medium to coarse sand, fine to coarse gravel, trace silt, subangular and subrounded, grey (7.5YR 6/1)	21.34				
	22							

WELL DETAILS

	WT-EB-OW1A-15	WT-EB-OW1B-15
Name:	WT-EB-OW1A-15	WT-EB-OW1B-15
GS Elev:	370.48 m AMSL	370.48 m AMSL
TOC Elev:	371.24 m AMSL	371.01 m AMSL
Easting:	533141	533143
Northing:	4809141	4809139
Stick-up:	0.76 m	0.53 m

- Above Ground Casing
- Above Ground Casing
- Bentonite Holeplug/Grout 0 m BGS to 6.10 m BGS
- 160.8 mm Diameter Borehole 0 to 25.9 m BGS
- 155.5 mm ID Steel Casing 1 m AGS to 6 m BGS
- 254 mm Borehole 0 - 6.1 m BGS
- No.2 Silica Sand 6.10 m BGS to 9.14 m BGS
- Bentonite Holeplug 0 m BGS to 17.07 m BGS
- 48.5 mm ID Schedule 80 PVC Casing 0.5 m AGS to 24.38 m BGS
- 48.5 mm ID Schedule 80 PVC Casing 0.8 m AGS to 35.05 m BGS
- Bentonite Holeplug 9.14 m BGS to 15.24 m BGS
- 160.8 mm Diameter Borehole 6.1 to 43.7 m BGS
- No.2 Silica Sand 15.24 m BGS to 18.29 m BGS
- Natural Cave 17.07 m BGS to 18.59 m BGS
- Bentonite Holeplug 18.59 m BGS to 20.42 m BGS
- Natural Cave 20.42 m BGS to 21.64

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

WT-EB-OW1A-15 WRAS No. 9207191
WT-EB-OW1B-15 WRAS No. 9207192

Stantec

Drawn By/Checked By: EH, NS/LV

STANTEC BOREHOLE AND WELL - CLUST 11X17 160900798_20150309_CD.GPJ STANTEC - DATA TEMPLATE.GDT 1/26/16 NSPINA

Monitoring Well: WT-EB-OW1-15

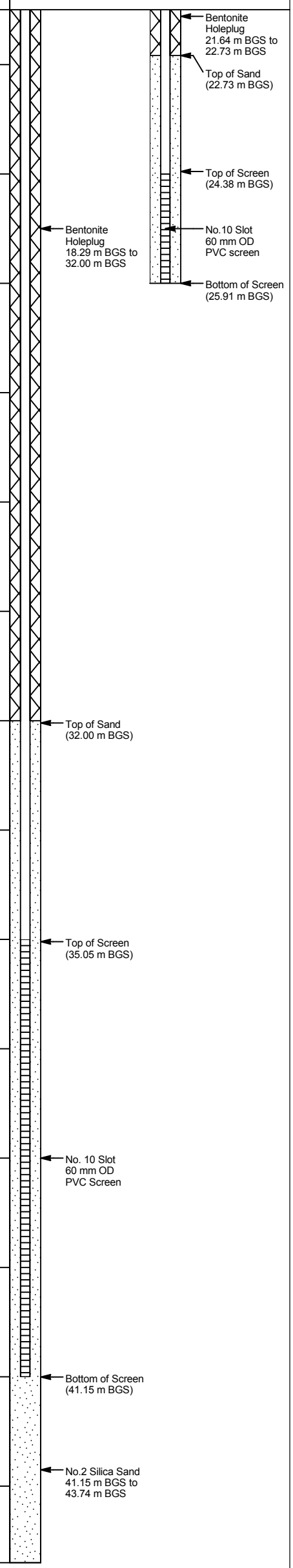
Project: RMOW Well Replacement
Client: Regional Municipality of Waterloo
Location: Cambridge, ON
Number: 160900798

Field investigator: L.Carson
Contractor: Gerrits Well Drilling Inc.
Drilling method: Air Rotary
Date started/completed: 11-May-2015 / 15-May-2015

SUBSURFACE PROFILE				HYDROGEOLOGY		SAMPLE DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Hydro Stratigraphic Unit	Description	Sample Number	Sample Type
			SAND and GRAVEL medium to coarse sand, fine to coarse gravel, trace silt, subangular and subrounded, grey (7.5YR 6/1)		Possible AFB2	Possible Middle Waterloo Moraine stratified sediments and equivalents	15	GB
75			silt content decreasing at 22.86 m BGS				16	GB
	24							
80							17	GB
85	26						18	GB
90	28						19	GB
95			gravel content increasing with depth at 28.96 m BGS				20	GB
	30							
100							21	GB
105	32						22	GB
110	34						23	GB
115							24	GB
	36							
120							25	GB
125	38			332.38				
			SAND fine to coarse sand and gravel, trace silt, subangular to subrounded, grey (7.5YR 6/1)	38.10			26	GB
130								
	40						27	GB
135			decreasing gravel content, dark greyish brown (10YR 4/2) at 41.15 m BGS					
	42						28	GB
140								
				326.89			29	GB
			TILL clay, some sand and silt, grey (7.5YR 6/1), firm, medium to high placticity	43.59 326.74	Possible ATB3	Possible Lower Maryhill Till		
	44		End of Borehole	43.74				
145								

WELL DETAILS

	WT-EB-OW1A-15	WT-EB-OW1B-15
Name:	WT-EB-OW1A-15	WT-EB-OW1B-15
GS Elev:	370.48 m AMSL	370.48 m AMSL
TOC Elev:	371.24 m AMSL	371.01 m AMSL
Easting:	533141	533143
Northing:	4809141	4809139
Stick-up:	0.76 m	0.53 m



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

WT-EB-OW1A-15 WRAS No. 9207191
WT-EB-OW1B-15 WRAS No. 9207192

Stantec

Drawn By/Checked By: EH, NS/LV

STANTEC BOREHOLE AND WELL - CLUST 11X17 160900798_20150309_CD.GPJ STANTEC - DATA TEMPLATE.GDT 1/26/16 NSPINA

9208518

WT-EB-OW2-08-A

Monitoring Well: WT-EBS-OW2A-08

Project:	Erb St. Class ESA	**Drilling method:**	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Nov-4-2008
Location:	Erb Street	**Ground surface elevation:**	390.01 m AMSL
Number:	1609-00505	**Top of casing elevation:**	390.85 m AMSL
Field investigator:	R.Dong	**Easting:**	533255.455
Contractor:	Pro Core Drilling	**Northing:**	4808920.28

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
		Ground Surface	390.01						Stick-up = 0.84 m Blue steel protective casing
0	0	TOPSOIL brown, moist	0.00 389.80						
		SILTY SAND fine grained, light brown, moist	0.20	1	SS	1-1-2-1 (3)	15" 63%		Concrete
	1	seam of fine sand with trace fine gravel 51mm thick at 1 m BGS seam of mottled brown and white silty fine sand 76 mm thick at 1.17m BGS		2	SS	2-2-3-2 (5)	16" 67%		
5		SAND AND SILT TILL	388.48 1.52						
	2	fine grained, little medium to coarse sand, light brown, hard, moist		3	SS	2-4-5-5 (9)	14" 58%		
				4	SS	n/a	20" 83%		
10	3	alternating layers of silty clay and sandy silt 305 mm thick at 3.0 m BGS	386.71	5	CC	n/a	35" 100%		
		SILTY SAND brown, firm, moist to wet	3.30 386.33						
	4	SAND fine grained, brown, moist, increasing grain size with depth	3.68						
15				6	CC	n/a	52" 87%		PVC Sch80 50 mm diameter
	5	seam of sandy silt, 38 mm thick at 4.7 m BGS							
20	6			7	CC	n/a	55" 92%		
	7								
25		some medium sand beginning at 7.3 m BGS		8	CC	n/a	48" 80%		
	8								
30	9			9	CC	n/a	50" 83%		Bentonite Grout
	10								
35				10	CC	n/a	60" 100%		
	11								
40	12	seam of soft clay pockets 101.5 mm thick at 12.11 m BGS seam of brown clay mottled with silt and sand 76.2 mm thick at 12.21 m BGS seam of brown clay mottle with silt and sand 38 mm thick at 12.32	386.33	11	CC	n/a	54" 90%		

Screen Interval: 58.83 - 61.87 m BGS
Sand Pack Interval 57.05 - 62.64 m BGS
Well Seal Interval: 0.91 - 57.05 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

Monitoring Well: WT-EBS-OW2A-08

Project:	Erb St. Class ESA	**Drilling method:**	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Nov-4-2008
Location:	Erb Street	**Ground surface elevation:**	390.01 m AMSL
Number:	1609-00505	**Top of casing elevation:**	390.85 m AMSL
Field investigator:	R.Dong	**Easting:**	533255.455
Contractor:	Pro Core Drilling	**Northing:**	4808920.28

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			m BGS SAND fine grained, brown, moist, increasing grain size with depth	3.68	12	CC	n/a	34" 56%		
45	14		seam of soft brown clay 101.6 mm thick at 14.45 m BGS seam of pockets of soft brown clay, 25.4 mm thick at 14.8 m BGS		13	CC	n/a	58" 97%		
50	15									
	16				14	CC	n/a	60" 100%		
55	17									
	18		seam of fine white sand 5 mm thick at 18.0 m BGS seams of soft brown clay 4 mm between 18.3 and 18.4 m BGS		15	CC	n/a	49" 82%		
60	19									
					16	CC	n/a	56" 97%		Bentonite Grout
65	20									
	21				17	CC	n/a	58" 95%		
70										
	22				18	CC	n/a	57" 93%		
75	23		trace fine gravel at 22.9 m BGS							
	24				19	CC	n/a	58" 97%		
80										
	25				20	CC	n/a	55" 92%		
85	26									

Screen Interval: 58.83 - 61.87 m BGS
Sand Pack Interval 57.05 - 62.64 m BGS
Well Seal Interval: 0.91 - 57.05 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

Monitoring Well: WT-EBS-OW2A-08

Project:	Erb St. Class ESA	Drilling method:	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	Date started/completed:	Nov-4-2008
Location:	Erb Street	Ground surface elevation:	390.01 m AMSL
Number:	1609-00505	Top of casing elevation:	390.85 m AMSL
Field investigator:	R.Dong	Easting:	533255.455
Contractor:	Pro Core Drilling	Northing:	4808920.28

SUBSURFACE PROFILE				SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
				362.93						
	27		SAND AND GRAVEL some cobble, grey, well graded, subrounded, wet	27.08	21	CC	n/a	36" 60%		
90										
	28			361.92						
			CLAY TILL some well graded gravel, brown, soft, moist	28.09	22	CC	n/a	24" 40%		
95	29			360.82						
			SAND AND GRAVEL brown and grey, well graded, subrounded, wet	29.18						
	30				23	CC	n/a	29" 50%		
100										
	31									
105	32		pockets of soft brown clay at 32.06 m BGS cobble at 32.2 m BGS		24	CC	n/a	40" 67%		
	33									
110			cobble at 33.15 m BGS cobble at 33.28 m BGS cobble at 33.58 m BGS		25	CC	n/a	49" 82%		Bentonite Grout
	34									
115	35		cobble at 35.05 m BGS cobble at 35.18 m BGS		26	CC	n/a	41" 71%		
	36									
120			cobble at 36.22 m BGS		27	CC	n/a	58" 97%		
	37									
125	38				28	CC	n/a	21" 33%		
			cobble at 38.61 m BGS							
	39				29	CC	n/a	51" 85%		
130										
	40		cobble at 39.85 m BGS cobble at 40.16 m BGS	360.82						

Screen Interval: 58.83 - 61.87 m BGS
Sand Pack Interval 57.05 - 62.64 m BGS
Well Seal Interval: 0.91 57.05 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

Monitoring Well: WT-EBS-OW2A-08

Project:	Erb St. Class ESA	**Drilling method:**	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Nov-4-2008
Location:	Erb Street	**Ground surface elevation:**	390.01 m AMSL
Number:	1609-00505	**Top of casing elevation:**	390.85 m AMSL
Field investigator:	R.Dong	**Easting:**	533255.455
Contractor:	Pro Core Drilling	**Northing:**	4808920.28

SUBSURFACE PROFILE				SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			SAND AND GRAVEL brown and grey, well graded, subrounded, wet	29.18						
135	41		cobble at 41.15 m BGS		30	CC	n/a	60" 100%		
140	42				31	CC	n/a	16" 29%		
	43									
145	44		cobble at 44.40 m BGS		32	CC	n/a	22" 36%		
150	45				33	CC	n/a	17" 29%		Bentonite Grout
	46									
155	47				34	CC	n/a	53" 88%		
	48		cobble at 47.70 m BGS	341.90						
			SAND fine to medium grained, trace fine gravel, brown, moist	48.11						
160	49				35	CC	n/a	50" 83%		
165	50				36	CC	n/a	0" 0%		
	51		no trace gravel beginning at 50.82 m BGS							
170	52				37	CC	n/a	54" 89%		
175	53				38	CC	n/a	58" 93%		
	54		trace coarse sand beginning at 53.65 m BGS	341.90						Top of holeplug (53.97 m BGS)

Screen Interval: 58.83 - 61.87 m BGS
Sand Pack Interval: 57.05 - 62.64 m BGS
Well Seal Interval: 0.91 - 57.05 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

Monitoring Well: WT-EBS-OW2A-08

Project:	Erb St. Class ESA	**Drilling method:**	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Nov-4-2008
Location:	Erb Street	**Ground surface elevation:**	390.01 m AMSL
Number:	1609-00505	**Top of casing elevation:**	390.85 m AMSL
Field investigator:	R.Dong	**Easting:**	533255.455
Contractor:	Pro Core Drilling	**Northing:**	4808920.28

SUBSURFACE PROFILE				SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			SAND fine to medium grained, trace fine gravel, brown, moist	48.11						
180	55				39	CC	n/a	42" 70%		Holeplug
	56		band of black sand 2 mm thick at 55.85 m BGS		40	CC	n/a	60" 100%		
185			band of black sand 2 mm thick at 56.69 m BGS							
	57		alternating layers of fine or coarser fine sand between 152 to 187 mm thick beginning at 57.25 m BGS bands of black sand 4 mm thick at 57.43 m BGS bands of black sand 4 mm thick at 57.58 m BGS bands of black sand 4 mm thick at 58.04 m BGS bands of black sand 4 mm thick at 58.01 m BGS interlaced black sand seams beginning at 58.04 m BGS								Top of sand (57.05 m BGS)
190	58				41	CC	n/a	49" 82%		No.1 Silica Sand
	59				42	CC	n/a	52" 87%		Top of screen (58.83 m BGS)
195	60		seam of 1 mm thick layered brown silt 25 mm thick at 59.72 m BGS							
200	61				43	CC	n/a	54" 90%		No.10 Slot PVC screen 50 mm diameter
	62				44	CC	n/a	50" 83%		Bottom of screen (61.87 m BGS) Top of coated holeplug 62.64 m BGS
205	63			326.84						
			CLAY TILL trace fine gravel, trace coarse sand, browny/grey, very stiff, moist	63.17						
210	64				45	CC	n/a	60" 100%		Coated Holeplug
	65			324.68	46	CC	n/a	28" 100%		
215			End of Borehole	65.33						
	66									
220	67									

Screen Interval: 58.83 - 61.87 m BGS
Sand Pack Interval 57.05 - 62.64 m BGS
Well Seal Interval: 0.91 - 57.05 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

WT-EB-OW2-08-B

Monitoring Well: WT-EBS-OW2B-08

Project:	Erb St. Class ESA	**Drilling method:**	Tricone mud rotary 5"
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Nov-4-2008
Location:	Erb Street	**Ground surface elevation:**	389.87 m AMSL
Number:	1609-00505	**Top of casing elevation:**	390.72 m AMSL
Field investigator:	R.Dong	**Easting:**	533253.708
Contractor:	Pro Core Drilling	**Northing:**	4808923.303

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram / Description
			Ground Surface	389.87					Stick up=0.85 m Steel protective casing
0	0		Refer to WT-EBS-OW2A-08 for Lithology	0.00	1	SS	1-1-2-1 (3)	15" 63%	Concrete
	1				2	SS	2-2-3-2 (5)	16" 67%	
5					3	SS	2-4-5-5 (9)	14" 58%	
	2				4	SS	n/a	20" 83%	
10	3				5	CC	n/a	35" 100%	
	4				6	CC	n/a	52" 87%	PVC Sch80 50 mm diameter
15	5								
20	6				7	CC	n/a	55" 92%	
	7				8	CC	n/a	48" 80%	
25	8								
30	9				9	CC	n/a	50" 83%	
	10				10	CC	n/a	60" 100%	
35	11								
40	12			389.87	11	CC	n/a	54" 90%	

Screen Interval: 44.81 - 47.85 m BGS
Sand Pack Interval:43.18 - 48.06 m BGS
Well Seal Interval: 0.91 - 43.18 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

Monitoring Well: WT-EBS-OW2B-08

Project:	Erb St. Class ESA	**Drilling method:**	Tricone mud rotary 5"
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Nov-4-2008
Location:	Erb Street	**Ground surface elevation:**	389.87 m AMSL
Number:	1609-00505	**Top of casing elevation:**	390.72 m AMSL
Field investigator:	R.Dong	**Easting:**	533253.708
Contractor:	Pro Core Drilling	**Northing:**	4808923.303

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft) (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
13		Refer to WT-EBS-OW2A-08 for Lithology	0.00						
45 14				12	CC	n/a	34" 56%		
15 50				13	CC	n/a	58" 97%		
16 55 17				14	CC	n/a	60" 100%		
18 60 19				15	CC	n/a	49" 82%		
65 20				16	CC	n/a	56" 97%		Bentonite Grout
21 70 22				17	CC	n/a	58" 95%		
75 23				18	CC	n/a	57" 93%		
24 80 25				19	CC	n/a	58" 97%		
85 26			389.87	20	CC	n/a	55" 92%		

Screen Interval: 44.81 - 47.85 m BGS
Sand Pack Interval:43.18 - 48.06 m BGS
Well Seal Interval: 0.91 - 43.18 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

Monitoring Well: WT-EBS-OW2B-08

Project:	Erb St. Class ESA	**Drilling method:**	Tricone mud rotary 5"
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Nov-4-2008
Location:	Erb Street	**Ground surface elevation:**	389.87 m AMSL
Number:	1609-00505	**Top of casing elevation:**	390.72 m AMSL
Field investigator:	R.Dong	**Easting:**	533253.708
Contractor:	Pro Core Drilling	**Northing:**	4808923.303

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			Refer to WT-EBS-OW2A-08 for Lithology	0.00						
	27				21	CC	n/a	36" 60%		
90										
	28				22	CC	n/a	24" 40%		
95	29									
	30				23	CC	n/a	29" 50%		
100										
	31				24	CC	n/a	40" 67%		
105	32									
	33				25	CC	n/a	49" 82%		Bentonite Grout
110										
	34				26	CC	n/a	41" 71%		
115	35									
	36				27	CC	n/a	58" 97%		
120										
	37				28	CC	n/a	21" 33%		
125	38									
	39				29	CC	n/a	51" 85%		Top of holeplug (39.70 m BGS)
130										
	40			389.87						

Screen Interval: 44.81 - 47.85 m BGS
Sand Pack Interval: 43.18 - 48.06 m BGS
Well Seal Interval: 0.91 - 43.18 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Stantec

Drawn By/Checked By: OR/KM

Monitoring Well: WT-EBS-OW2B-08

Project:	Erb St. Class ESA	**Drilling method:**	Tricone mud rotary 5"
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Nov-4-2008
Location:	Erb Street	**Ground surface elevation:**	389.87 m AMSL
Number:	1609-00505	**Top of casing elevation:**	390.72 m AMSL
Field investigator:	R.Dong	**Easting:**	533253.708
Contractor:	Pro Core Drilling	**Northing:**	4808923.303

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			Refer to WT-EBS-OW2A-08 for Lithology	0.00						
135	41				30	CC	n/a	60" 100%		Holeplug
140	42, 43				31	CC	n/a	16" 29%		
145	44				32	CC	n/a	22" 36%		Top of sand (43.18 m BGS) No.1 Silica Sand
150	45, 46				33	CC	n/a	17" 29%		Top of screen (44.81 m BGS)
155	47				34	CC	n/a	53" 88%		No.10 Slot PVC screen 50 mm diameter
	48			341.81						Bottom of screen (47.85 m BGS) No.1 Silica Sand
			End of Borehole	48.06						
160	49									
165	50									
170	51, 52									
175	53									

Screen Interval: 44.81 - 47.85 m BGS
Sand Pack Interval:43.18 - 48.06 m BGS
Well Seal Interval: 0.91 - 43.18 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

9 20 3 5/6

WT-EB-OW3-08-A

Monitoring Well: WT-EBS-OW3A-08

Project:	Erb St. Class ESA	**Drilling method:**	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Nov-18-2008 / Nov-20-2008
Location:	Erb Street	**Ground surface elevation:**	385.13 m AMSL
Number:	1609-00505	**Top of casing elevation:**	386.01 m AMSL
Field investigator:	R.Dong	**Easting:**	532634.653
Contractor:	Pro Core Drilling	**Northing:**	4809715.33

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			Ground Surface	385.13						Stick up=0.88 m
0	0		SAND AND GRAVEL FILL moist	0.00	1	SS	3-3-2-2 (5)	2" 8%		Steel protective casing
			SAND AND GRAVEL trace topsoil, medium grained, dark brown, moist	384.37 0.76	2	SS	3-2-3-3 (5)	8" 33%		
5	1				3	SS	3-2-4-7 (6)	6" 25%		
	2		SILT AND SAND TILL trace to some fine sand, trace gravel, brown, moist	382.84 2.29	4	SS	2-2-3-3 (5)	11.5" 48%		
10	3		seam of sand and gravel 0.1 m thick at 3.25 m BGS seam of sand and gravel 0.05 m thick at 3.25 m BGS	381.65 3.48	5	CC	n/a	20" 100%		
	4		SILTY CLAY browny grey, stiff, moist seam of fine to medium sand with trace silt 0.58 m thick at 3.76 m BGS seam of fine sand and trace silt 0.13 m thick at 4.42 m BGS		6	CC	n/a	44" 75%		PVC Sch80 50 mm diameter
15	5		seam of silt with trace sand 0.20 m thick at 4.9 m BGS SILTY CLAY TILL trace to little gravel, browny grey, firm, moist	380.02 5.11	7	CC	n/a	22" 37%		
20	6				8	CC	n/a	29" 47%		
25	7				9	CC	n/a	50" 82%		
30	8				10	CC	n/a	47.5" 86%		
35	9				11	CC	n/a	59" 95%		
40	10		seam of silt and fine sand 0.05 m thick at 13.23 m BGS	380.02						
	11									
	12									

Screen Interval: 53.67 - 56.72 m BGS
Sand Pack Interval 51.89 - 56.72 m BGS
Well Seal Interval: 0.00 - 51.89 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

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Monitoring Well: WT-EBS-OW3A-08

Project:	Erb St. Class ESA	**Drilling method:**	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Nov-18-2008 / Nov-20-2008
Location:	Erb Street	**Ground surface elevation:**	385.13 m AMSL
Number:	1609-00505	**Top of casing elevation:**	386.01 m AMSL
Field investigator:	R.Dong	**Easting:**	532634.653
Contractor:	Pro Core Drilling	**Northing:**	4809715.33

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			SILTY CLAY TILL trace to little gravel, browny grey, firm, moist	5.11	12	CC	n/a	60" 100%		
45	14				13	CC	n/a	60" 100%		
50	15									
	16				14	CC	n/a	60" 100%		
55	17				15	CC	n/a	60" 98%		
60	18									
	19		trace to little medium to coarse sand beginning at 18.6 m BGS		16	CC	n/a	60" 100%		
65	20		trace mottling pattern with clayey silt beginning at 19.59 m BGS							Bentonite Grout
	21				17	CC	n/a	46" 77%		
70	22									
75	23		trace soft grey clay pockets 2 mm diameter beginning at 22.43 m BGS trace dry red clay pockets 2 mm diameter beginning at 22.56 m BGS		18	CC	n/a	60" 95%		
	24				19	CC	n/a	60" 100%		
80			seam of very fine sand 10 mm thick at 24.61 m BGS seam of very fine sand 20 mm thick at 24.64 m BGS							
	25		little fine sand beginning at 25.30 m BGS seam of very fine sand 10 mm thick at 25.40 m BGS		20	CC	n/a	61" 100%		
85	26			380.02						

Screen Interval: 53.67 - 56.72 m BGS
Sand Pack Interval 51.89 - 56.72 m BGS
Well Seal Interval: 0.00 - 51.89 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

Monitoring Well: WT-EBS-OW3A-08

Project:	Erb St. Class ESA	**Drilling method:**	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Nov-18-2008 / Nov-20-2008
Location:	Erb Street	**Ground surface elevation:**	385.13 m AMSL
Number:	1609-00505	**Top of casing elevation:**	386.01 m AMSL
Field investigator:	R.Dong	**Easting:**	532634.653
Contractor:	Pro Core Drilling	**Northing:**	4809715.33

SUBSURFACE PROFILE				SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			SILTY CLAY TILL	5.11						
	27		trace to little gravel, browny grey, firm, moist		21	CC	n/a	60" 100%		
90			seam of silty clay 0.7 m thick at 27.4 m BGS							
	28		mottling of clayey silt and fine sand beginning at 28.07 m BGS							
			trace to little fine to coarse sand, trace fine and coarse gravel, beginning at 28.09 m BGS		22	CC	n/a	59" 98%		
95	29		trace soft grey clay pockets beginnig at 28.22 m BGS							
	30		trace dry, red pockets 1 mm deameters beginning at 28.07 m BGS		23	CC	n/a	60" 100%		
100										
	31									
			seam of soft clay 4 mm thick at 31.55 m BGS		24	CC	n/a	64" 100%		
105	32									
	33				25	CC	n/a	57" 100%		Bentonite Grout
110										
	34				26	CC	n/a	58" 97%		
115	35		seam of very fine sand 10 mm thick at 35.00 m BGS							
			trace to little fine gravel beginning at 35.36 m BGS							
	36				27	CC	n/a	60" 100%		
120										
	37		cobble at 37.03 m BGS							
					28	CC	n/a	4" 7%		
125	38		horizontal banding and mottled structure present							
	39				29	CC	n/a	60" 100%		
130										
	40			380.02						

Screen Interval: 53.67 - 56.72 m BGS
Sand Pack Interval 51.89 - 56.72 m BGS
Well Seal Interval: 0.00 - 51.89 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

Monitoring Well: WT-EBS-OW3A-08

Project:	Erb St. Class ESA	**Drilling method:**	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Nov-18-2008 / Nov-20-2008
Location:	Erb Street	**Ground surface elevation:**	385.13 m AMSL
Number:	1609-00505	**Top of casing elevation:**	386.01 m AMSL
Field investigator:	R.Dong	**Easting:**	532634.653
Contractor:	Pro Core Drilling	**Northing:**	4809715.33

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
		SILTY CLAY TILL trace to little gravel, browny grey, firm, moist	5.11	30	CC	n/a	60" 100%		
135	41								
	42	seam of soft clay 20 mm thick at 41.68 m BGS		31	CC	n/a	60" 100%		
140		seam of little fine gravel 0.3 m thick at 42.62 m BGS layering of silty clay and sandy clayey silt (10 mm) beginning at 42.87 m BGS	342.05						
	43	SAND fine grained, little silt, browny grey, homogenous, wet	43.08	32	CC	n/a	49" 82%		Bentonite Grout
145	44								
	45	CLAYEY SILT AND SAND TILL fine grained, little medium to coarse sand, trace fine gravel, browny grey, stiff, moist	340.04 45.09	33	CC	n/a	49" 82%		
150		SAND fine grained, little silt, browny grey, homogeneous, moist	339.43 45.70						
	46	CLAYEY SILT AND SAND TILL fine grained, trace to little medium to coarse sand, trace fine gravel, browny grey, very stiff, moist seam of silty clay till 0.05 m thick at 46.73 m BGS seam of silty clay till 0.1 m at 47.40 m BGS trace soft browny grey clay pockets 2 to 4 mm diameter beginning at 47.65 m BGS seam of clayey silt 0.15 m thick at 47.70 m BGS cobble at 48.21 m BGS	338.55 46.58	34	CC	n/a	60" 100%		
	47								
155	48			35	CC	n/a	61" 100%		
160	49								Top of holeplug (49.20 m BGS)
		SAND fine grained, browny grey, homogenous, wet	335.47 49.66	36	CC	n/a	53" 88%		
	50	SAND AND GRAVEL fine grained, well graded gravel, angular to subrounded seam of clayey silt and sand 0.1 m thick at 50.52 m BGS seam of fine sand 0.1 m thick at 50.62 m BGS sand becoming well graded at 50.72 m BGS	~~335.19~~ 49.94						Holeplug
165	51			37	CC	n/a	60" 107%		Top of sand (51.89 m BGS)
170	52	cobble at 52.33 m BGS cobble at 52.73 m BGS		38	CC	n/a	59" 98%		No.1 Silica Sand
	53	cobble at 53.19 m BGS cobble at 53.46 m BGS seam of silt and sand 0.48 m thick at 53.67 m BGS	335.19						Top of screen (53.67 mBGS)
175	54								

Screen Interval: 53.67 - 56.72 m BGS
Sand Pack Interval 51.89 - 56.72 m BGS
Well Seal Interval: 0.00 - 51.89 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

Monitoring Well: WT-EBS-OW3A-08

Project:	Erb St. Class ESA	**Drilling method:**	CME 75 PQ Coring
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Nov-18-2008 / Nov-20-2008
Location:	Erb Street	**Ground surface elevation:**	385.13 m AMSL
Number:	1609-00505	**Top of casing elevation:**	386.01 m AMSL
Field investigator:	R.Dong	**Easting:**	532634.653
Contractor:	Pro Core Drilling	**Northing:**	4809715.33

SUBSURFACE PROFILE				SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			SAND AND GRAVEL fine grained, well graded gravel, angular to subrounded cobble at 54.53 m BGS	49.94	39	CC	n/a	60" 100%		No.10 Slot PVC screen 50 mm diameter
180	55									
	56									
185				328.41						Bottom of screen (56.72 m BGS)
			End of Borehole	56.72						
	57									
190	58									
	59									
195	60									
200	61									
	62									
205	63									
210	64									
	65									
215	66									
220	67									

Screen Interval: 53.67 - 56.72 m BGS
Sand Pack Interval 51.89 - 56.72 m BGS
Well Seal Interval: 0.00 - 51.89 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Stantec

Drawn By/Checked By: OR/KM

WT-EB-OW3-08-B

Monitoring Well: WT-EBS-OW3B-08

Project:	Erb St. Class ESA	Drilling method:	Tricone mud rotary 5"
Client:	Regional Municipality of Waterloo	Date started/completed:	Nov-18-2008 / Nov-20-2008
Location:	Erb Street	Ground surface elevation:	385.23 m AMSL
Number:	1609-00505	Top of casing elevation:	386.14 m AMSL
Field investigator:	R.Dong	Easting:	532633.541
Contractor:	Pro Core Drilling	Northing:	4809717.798

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
										Stick up=0.91 m
			Ground Surface	385.23						Steel protective casing
0	0		Refer to WT-EBS-OW3A-08 for Lithology	0.00						
					1	SS	3-3-2-2 (5)	2" 8%		Concrete
	1				2	SS	3-2-3-3 (5)	8" 33%		
5					3	SS	3-2-4-7 (6)	6" 25%		
	2				4	SS	2-2-3-3 (5)	11.5" 48%		
10	3				5	CC	n/a	20" 111%		
	4				6	CC	n/a	44" 76%		PVC Sch80 50 mm diameter
15										
	5				7	CC	n/a	22" 37%		
20	6									
	7				8	CC	n/a	29" 47%		
25										
	8				9	CC	n/a	50" 82%		
30	9									
	10				10	CC	n/a	47.5" 86%		
35										
	11				11	CC	n/a	59" 95%		
40	12									
				385.23						

Screen Interval: 43.28 - 46.33 m BGS
Sand Pack Interval: 41.86 - 46.48 m BGS
Well Seal Interval: 0.91 - 41.86 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

Monitoring Well: WT-EBS-OW3B-08

Project:	Erb St. Class ESA	**Drilling method:**	Tricone mud rotary 5"
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Nov-18-2008 / Nov-20-2008
Location:	Erb Street	**Ground surface elevation:**	385.23 m AMSL
Number:	1609-00505	**Top of casing elevation:**	386.14 m AMSL
Field investigator:	R.Dong	**Easting:**	532633.541
Contractor:	Pro Core Drilling	**Northing:**	4809717.798

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			Refer to WT-EBS-OW3A-08 for Lithology	0.00						
	13				12	CC	n/a	60" 100%		
45										
	14				13	CC	n/a	60" 100%		
	15									
50										
	16				14	CC	n/a	60" 100%		
55										
	17				15	CC	n/a	60" 100%		
	18									
60										
	19				16	CC	n/a	60" 100%		Bentonite Grout
65										
	20				17	CC	n/a	46" 77%		
	21									
70										
	22				18	CC	n/a	60" 100%		
75										
	23				19	CC	n/a	60" 100%		
	24									
80										
	25				20	CC	n/a	61" 100%		
85										
	26			385.23						

Screen Interval: 43.28 - 46.33 m BGS
Sand Pack Interval: 41.86 - 46.48 m BGS
Well Seal Interval: 0.91 - 41.86 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

Monitoring Well: WT-EBS-OW3B-08

Project:	Erb St. Class ESA	Drilling method:	Tricone mud rotary 5"
Client:	Regional Municipality of Waterloo	Date started/completed:	Nov-18-2008 / Nov-20-2008
Location:	Erb Street	Ground surface elevation:	385.23 m AMSL
Number:	1609-00505	Top of casing elevation:	386.14 m AMSL
Field investigator:	R.Dong	Easting:	532633.541
Contractor:	Pro Core Drilling	Northing:	4809717.798

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			Refer to WT-EBS-OW3A-08 for Lithology	0.00						
	27				21	CC	n/a	60" 100%		
90										
	28									
95	29				22	CC	n/a	59" 98%		
	30				23	CC	n/a	57" 95%		
100										
	31									
105	32				24	CC	n/a	67" 105%		
	33				25	CC	n/a	57" 100%		
110										Bentonite Grout
	34									
115	35				26	CC	n/a	58" 97%		
	36				27	CC	n/a	60" 100%		
120										
	37									
125	38				28	CC	n/a	4" 7%		
	39				29	CC	n/a	60" 100%		Top of holeplug (38.56 m BGS)
130										
	40			385.23						Holeplug

Screen Interval: 43.28 - 46.33 m BGS
Sand Pack Interval: 41.86 - 46.48 m BGS
Well Seal Interval: 0.91 - 41.86 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample
n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

Monitoring Well: WT-EBS-OW3B-08

Project:	Erb St. Class ESA	**Drilling method:**	Tricone mud rotary 5"
Client:	Regional Municipality of Waterloo	**Date started/completed:**	Nov-18-2008 / Nov-20-2008
Location:	Erb Street	**Ground surface elevation:**	385.23 m AMSL
Number:	1609-00505	**Top of casing elevation:**	386.14 m AMSL
Field investigator:	R.Dong	**Easting:**	532633.541
Contractor:	Pro Core Drilling	**Northing:**	4809717.798

SUBSURFACE PROFILE			SAMPLE DETAILS					WELL DETAILS	
Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	N-Value	Recovery	Well Diagram	Description
			Refer to WT-EBS-OW3A-08 for Lithology	0.00						
					30	CC	n/a	60" 100%		
135	41									Top of sand (41.86 m BGS)
					31	CC	n/a	60" 100%		
140	42									
	43				32	CC	n/a	49" 82%		Top of screen (43.28 m BGS)
145	44									No.1 Silica Sand
	45				33	CC	n/a	49" 82%		No.10 Slot PVC screen 50 mm diameter
150	46			338.75						Bottom of screen (46.33 m BGS) No.1 Silica Sand
			End of Borehole	46.48						
155	47									
	48									
160	49									
	50									
165	51									
170	52									
	53									
175										

Screen Interval: 43.28 - 46.33 m BGS
Sand Pack Interval: 41.86 - 46.48 m BGS
Well Seal Interval: 0.91 - 41.86 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
CC - continuous core sample

n/a - not available/applicable

Drawn By/Checked By: OR/KM

Stantec

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN

HOLE DESIGNATION: OW322A-02
DATE COMPLETED: 15 July 2002
DRILLING METHOD: ROTOSONIC
FIELD PERSONNEL: K. PETER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (m)	SAMPLE 'N' VALUE
	TOP OF RISER GROUND SURFACE	398.11 397.29					
1	SILTY SAND (TOPSOIL), loose, fine grained, poorly graded, dark brown, moist, vegetative matter (grass, rootlets)	396.98	CONCRETE SEAL				
2	ML/CL - CLAYEY SILT (TILL), trace gravel, firm, grey/brown, dry						
3							
4	- moist at 3.66m BGS - silty clay, stiff, grey at 4.27m BGS						
5							
6			51 mm Ø SCH 80 PVC RISER PIPE				
7		389.97					
8	SM - SILTY SAND, dense, slightly cohesive, medium grained, well graded, brown, moist to wet						
9		387.84	BENTONITE GROUT				
10	SC- CLAYEY SAND, with silt, trace gravel, dense, moderately cohesive, fine grained, well graded, grey, moist						
11							
12		385.10	152 mm Ø BOREHOLE				
13	ML/CL - CLAYEY SILT (TILL), with sand, trace to with gravel, stiff, grey, moist						
14							
15							
16	- light brown at 15.85m BGS - sandy, very moist at 16.46m BGS						
17		380.22					
18	SP - SAND, with gravel, trace silt, dense, slightly cohesive, medium grained, poorly graded, grey/brown, moist - fine grained at 17.98m BGS						
19		377.78					
	SM - SILTY SAND, trace gravel, dense, moderately						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN

HOLE DESIGNATION: OW322A-02
DATE COMPLETED: 15 July 2002
DRILLING METHOD: ROTOSONIC
FIELD PERSONNEL: K. PETER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (m)	SAMPLE 'N' VALUE
	cohesive, medium to coarse grained, poorly graded, grey/brown, moist						
21							
22	- trace cobbles at 22.56m BGS						
23							
24	- cemented, dry at 24.38m BGS						
25							
26			51 mm Ø SCH 80 PVC RISER PIPE				
27							
28							
29			BENTONITE GROUT				
30							
31							
32			152 mm Ø BOREHOLE				
33							
34							
35							
36	- with clay, compact, moist to very moist at 35.66m BGS						
37							
38							
39	ML - SILT (TILL), trace clay, trace fine grained sand, stiff, grey, moist	358.88					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN

HOLE DESIGNATION: OW322A-02
DATE COMPLETED: 15 July 2002
DRILLING METHOD: ROTOSONIC
FIELD PERSONNEL: K. PETER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (m)	SAMPLE 'N' VALUE
41							
42							
43							
44							
45							
46			51 mm Ø SCH 80 PVC RISER PIPE				
47							
	- sandy at 47.55m BGS						
48		349.13					
	SP - SAND, with silt, dense, slightly cohesive, medium grained, poorly graded, brown, moist to very moist						
49			BENTONITE GROUT				
50							
51							
52			152 mm Ø BOREHOLE				
	- trace silt, coarse grained at 52.43m BGS						
53							
54							
55	- interbedded silt and clay layers, 1cm thick at 54.86m BGS						
56							
	- silty sand, cohesive, fine grained at 56.39m BGS						
57							
58	- wet at 57.91m BGS						
59							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN

HOLE DESIGNATION: OW322A-02
DATE COMPLETED: 15 July 2002
DRILLING METHOD: ROTOSONIC
FIELD PERSONNEL: K. PETER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (m)	SAMPLE 'N' VALUE
61							
62							
63			BENTONITE HOLEPLUG				
64	- coarse grained at 64.01m BGS						
65							
66			SAND PACK				
67			WELL SCREEN				
68		329.01					
	ML - SILT (WATERLAID), stiff, dark grey, moist						
69							
70							
71							
72			BENTONITE HOLEPLUG				
73							
74		322.92					
	ML/CL - CLAYEY SILT (TILL), trace gravel, stiff, light grey/brown, dry to moist	322.61					
75	END OF BOREHOLE @ 74.68m BGS						
76							
77							
78							
79							

WELL DETAILS
Screened interval:
332.06 to 329.01m AMSL
65.23 to 68.28m BGS
Length: 3.05m
Diameter: 51mm
Slot Size: 10
Material: STAINLESS STEEL
Material: BENTONITE CHIPS
Sand Pack:
333.59 to 328.56m AMSL
63.70 to 68.73m BGS
Material: #1 SILICA SAND

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

WT-EL-TW30-86-A

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NO.: 823-50
CLIENT: MACLAREN ENGINEERS INC.
LOCATION: AS PER PLAN

HOLE DESIGNATION: TW30-86
DATE COMPLETED: AUG. 12, 1986
DRILLING METHOD: ROTARY WITH MUD
CRA SUPERVISOR: G. PUCOVSKY

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
		1215.32	well cap			
0		1212.54				
	TOPSOIL					
10	BROWN CLAY, SILT, SAND		bentonite seal			
20	BROWN CLAYEY SILT (some sand)			1		
30		1182.5	6 inch ID steel casing			
40	GRAY CLAYEY SILT TILL (minor to some sand)			2		
50		1157.5		3		
60	GRAY CLAY, SILT, SAND		cave	4		
		1147.5		5		
70	GRAY SILT, SAND, FINE GRAVEL			6		
80				7		
	GRAY FINE TO MEDIUM SAND AND GRAVEL			8		
90				9		
		1117.5		10		
100				11		
				12		
	GRAY MEDIUM TO COARSE SAND AND GRAVEL			13		
110				14		
				15		
120				16		

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS WATER FOUND STATIC WATER LEVEL

STRATIGRAPHIC AND INSTRUMENTATION LOG

(OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE

PROJECT NO.: 823-50

CLIENT: MACLAREN ENGINEERS INC.

LOCATION: AS PER PLAN

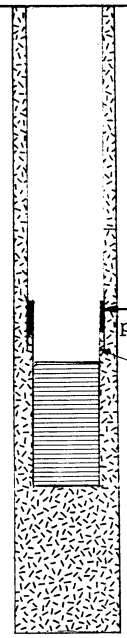
HOLE DESIGNATION: TW30-86

DATE COMPLETED: AUG. 12, 1986

DRILLING METHOD: ROTARY WITH MUD

CRA SUPERVISOR: G. PUCOVSKY

DEPTH ft BG	STRATIGRAPHY DESCRIPTION & REMARKS	ELEVATION ft AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE STATE	SAMPLE 'N' VALUE
120						
130	GRAY MEDIUM SAND, FINE TO MEDIUM GRAVEL	1082.5		17, 18, 19		
140				20		
150	GRAY MEDIUM SAND, FINE GRAVEL		K - packer; blank pipe	21, 22, 23		
160				24, 25		
170	GRAY CLAYEY SILT	1045.5		26, 27, 28		
180	END OF HOLE @ 180 Ft BGS	1032.5		29		
190						
200						
210						
220						
230						
240						



Screen Details

Set screen to 166 ft BGS (EL. 1046.5 ft)

Type - Johnson wire wound, stainless steel
Length - 12 ft
Diameter -6 inch telescopic
Slot - 20 slot (0.020 inch)

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

GRAIN SIZE ANALYSIS WATER FOUND STATIC WATER LEVEL

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN

HOLE DESIGNATION: OW332-02
DATE COMPLETED: 8 August 2002
DRILLING METHOD: ROTOSONIC
FIELD PERSONNEL: K. PETER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (m)	SAMPLE 'N' VALUE
	TOP OF RISER GROUND SURFACE	393.59 392.70					
	SILTY SAND (TOPSOIL), loose, fine grained, poorly graded, dark brown, moist, vegetative matter (grass, rootlets)	392.09	CONCRETE SEAL				
	ML/CL - SILTY CLAY (TILL), trace gravel, stiff, grey, moist						
2							
4							
	SC - CLAYEY SAND, trace silt, soft, brown/grey, wet	388.13					
6			51 mm SCH 80 PVC RISER PIPE				
8							
	ML/CL - CLAYEY SILT (TILL), trace sand, trace gravel, grey, moist	384.17	BENTONITE GROUT				
10							
	SP - SAND, trace silt, trace clay, dense, fine grained, poorly graded, light brown, dry	382.64					
	- with silt, grey, moist at 11.58m BGS						
12			152 mm Ø BOREHOLE				
	- heavy oxidation at 12.50m BGS						
	- silty sand, wet at 13.11m BGS						
14							
16	- very hard, dry at 15.85m BGS						
18	- trace silt, trace gravel, light grey/beige at 17.68m BGS						
20							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN

HOLE DESIGNATION: OW332-02
DATE COMPLETED: 8 August 2002
DRILLING METHOD: ROTOSONIC
FIELD PERSONNEL: K. PETER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (m)	SAMPLE 'N' VALUE
22							
24			51 mm SCH 80 PVC RISER PIPE				
26							
28			BENTONITE GROUT				
30	- silty, dense, brown, moist to very moist at 29.57m BGS - wet at 30.48m BGS		152 mm Ø BOREHOLE				
32	ML - SILT (WATERLAID), with clay, firm, brown, wet	360.70					
34	- brown/grey, moist at 33.53m BGS						
36							
38	- light grey, dry at 38.10m BGS						
40	- with fine grained sand, trace clay at 39.62m BGS						

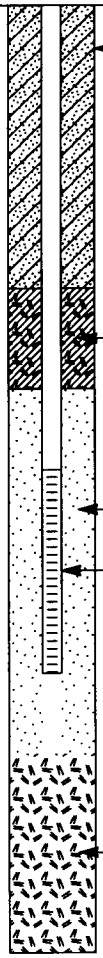
NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN

HOLE DESIGNATION: OW332-02
DATE COMPLETED: 8 August 2002
DRILLING METHOD: ROTOSONIC
FIELD PERSONNEL: K. PETER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (m)	SAMPLE 'N' VALUE
	SM/ML - SILTY SAND, trace clay, dense, medium grained, poorly graded, light grey, wet	350.03	152 mm Ø BOREHOLE				
44							
46			BENTONITE HOLEPLUG				
48							
50			SAND PACK WELL SCREEN				
52	- moist at 51.82m BGS						
54	- wet at 54.86m BGS		HEAVED SAND				
56	END OF BOREHOLE @ 56.39m BGS	336.31					
58							
60							
62							



WELL DETAILS
Screened interval:
343.63 to 340.58m AMSL
49.07 to 52.12m BGS
Length: 3.05m
Diameter: 51mm
Slot Size: 10
Material: STAINLESS STEEL
Material: BENTONITE CHIPS
Sand Pack:
344.85 to 339.36m AMSL
47.85 to 53.34m BGS
Material: #1 SILICA SAND

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING CONTRACTOR: ALLTERRAIN DRILLING

HOLE DESIGNATION: OW338A-05
DATE COMPLETED: September 16, 2005
DRILLING METHOD: PQ CORING
FIELD PERSONNEL: B. KEMPEL
DRILLER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITORING WELL	SAMPLE NUMBER	SAMPLE INTERVAL	REC (m)	'N' VALUE
	TOP OF RISER GROUND SURFACE	384.59 383.67					
	TOPSOIL						
	FILL - silt and sand, trace gravel, brown, dry to moist, occasional pieces of refuse, occasional clayey layers within increasing with depth	383.21	CONCRETE SEAL	01	PQ		
1							
2				02	PQ		
3				03	PQ		
4	- plastic bag at 4.57m BGS			04	PQ		
5							
6				05	PQ		
7	SM - SAND (NATIVE), trace to with silt, compact, fine grained, trace stratification, brown with occasional grey layering, wet, no odour	376.66		06	PQ		
8			122 mm Ø BOREHOLE				
	SP - SAND (WATERLAIN), trace silt, fine to medium grained, some stratification, brown, wet	375.44					
9			BENTONITE GROUT	07	PQ		
10	- coarse sand seam at 10.36m BGS			08	PQ		
11	- coarse sand seam at 10.97m BGS		51 mm Ø SCH 80 PVC RISER PIPE				
	SW - SAND (WATERLAIN), with gravel to and gravel, trace silt, fine to coarse grained, stratified, grey/brown, wet	372.39					
12				09	PQ		
	ML/SM - SILT AND SAND (TILL), with gravel and clay, stiff, fine grained sand, till structure with sand and gravel seams, buff to brown, wet	371.47					
13	- drilling fluid lost to formation from 13.14 to 15.62m BGS	370.56		10	PQ		
14	GW - GRAVEL (WATERLAIN), with sand, coarse grained gravel,						
15				11	PQ		
16	SM/SP - SAND (WATERLAIN), with silt, fine to medium grained sand, stratified, brown and grey, wet, no odour	368.05		12	PQ		
17	- coarse sand from 17.07 to 19.20m BGS				PQ		

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING CONTRACTOR: ALLTERRAIN DRILLING

HOLE DESIGNATION: OW338A-05
DATE COMPLETED: September 16, 2005
DRILLING METHOD: PQ CORING
FIELD PERSONNEL: B. KEMPEL
DRILLER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITORING WELL	SAMPLE NUMBER	INTERVAL	REC (m)	'N' VALUE
				13	PQ		
19	- medium sand from 19.20 to 20.42m BGS			14	PQ		
20				15	PQ		
	- medium sand with coarse sand from 20.42 to 21.03m BGS			16	PQ		
21	- silt and clay seam from 20.73 to 20.80m BGS	362.64					
	ML/CL - SILT AND CLAY (TILL), trace sand and gravel, firm, medium plasticity, massive, buff, very moist to wet			17	PQ		
22		361.93					
	SW/GW - SAND AND GRAVEL (WATERLAIN), medium to coarse grained, some stratification, grey			18	PQ		
23	- coarser with depth, coarse gravel and cobbles from 23.16 to 24.08m BGS						
24				19	PQ		
	SM/SP - SILTY SAND (WATERLAIN), fine to medium grained sand, stratified/laminated, layers of fine to medium sand apparent, light/brown grey, coarsening upward, grey, wet	359.59		20	PQ		
25							
26			BENTONITE GROUT	21	PQ		
27				22	PQ		
28			122 mm Ø BOREHOLE				
29			51 mm Ø SCH 80 PVC RISER PIPE	23	PQ		
30				24	PQ		
31							
32				25	PQ		
33				26	PQ		
34							
35				27	PQ		
					PQ		

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING CONTRACTOR: ALLTERRAIN DRILLING

HOLE DESIGNATION: OW338A-05
DATE COMPLETED: September 16, 2005
DRILLING METHOD: PQ CORING
FIELD PERSONNEL: B. KEMPEL
DRILLER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITORING WELL	SAMPLE NUMBER	INTERVAL	REC (m)	'N' VALUE
37				28	PQ		
38				29	PQ		
39	SP - SAND (WATERLAIN), primarily medium grained sand, occasionally silty, brown, saturated	345.26		30	PQ		
40			122 mm Ø BOREHOLE				
41			BENTONITE GROUT	31	PQ		
42	SM - SILTY SAND (WATERLAIN) fine grained sand, laminated, brown/grey, wet, coarsening with depth	341.60		32	PQ		
43			51 mm Ø SCH 80 PVC RISER PIPE				
44				33	PQ		
45	- trace silt, medium grained sand, becoming SP, coarsening downward at 45.11m BGS			34	PQ		
46							
47	- trace to with silt, fining downward at 46.63m BGS			35	PQ		
48							
49	ML - SANDY SILT (WATERLAIN), firm, fine grained, low plasticity, dilatant, grey, saturated	334.59		36	PQ		
50				37	PQ		
51							
52	SP - SAND (WATERLAIN), with silt, fine grained sand, some stratification, grey, saturated - no sample recovery, suspected fine sand (sampler problem) from 52.12 to 55.17m BGS	331.85	BENTONITE GRAVEL	38	PQ		
53				39	PQ		
					PQ		

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING CONTRACTOR: ALLTERRAIN DRILLING

HOLE DESIGNATION: OW338A-05
DATE COMPLETED: September 16, 2005
DRILLING METHOD: PQ CORING
FIELD PERSONNEL: B. KEMPEL
DRILLER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITORING WELL	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (m)	SAMPLE 'N' VALUE
55	- fine to medium grained sand, trace to with silt from 55.17 to 56.69m BGS		#00 SILICA SAND; 51 mm Ø STAINLESS STEEL WELL SCREEN	40	PQ		
56				41	PQ		
57	ML - SILT (WATER LAIN), trace to with fine sand, stiff to hard, low plasticity, some laminations, grey, coarsening downwards	326.97					
58	- buff clay seam, hard, high plasticity from 57.61 to 57.66m BGS			42	PQ		
	- buff clay seam, hard, high plasticity from 57.91 to 57.99m BGS	325.45					
59	SM/ML - SAND AND SILT (WATERLAIN), fine grained sand, stratified, grey, saturated			43	PQ		
60	- buff clay seam, hard, high plasticity from 59.13 to 59.18m BGS						
61	ML/CL - SILT AND CLAY (MARYHILL TILL), trace sand and gravel, very stiff, medium plasticity, massive, grey, saturated	322.71		44	PQ		
62				45	PQ		
63	END OF BOREHOLE @ 62.94m BGS	320.73					
64							
65							
66							
67							
68							
69							
70							
71							

WELL DETAILS
Screened interval:
330.02 to 326.97m AMSL
53.64 to 56.69m BGS
Length: 3.05m
Diameter: 51mm
Slot Size: 8
Material: STAINLESS STEEL
Seal:
332.46 to 331.55m AMSL
51.21 to 52.12m BGS
Material: BENTONITE GRAVEL
Sand Pack:
331.55 to 320.73m AMSL
52.12 to 62.94m BGS
Material: #00 SILICA SAND

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

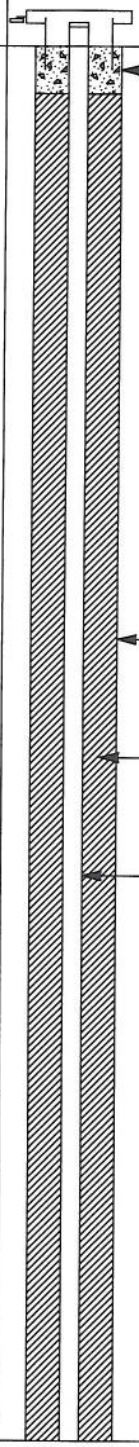
STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING CONTRACTOR: ALLTERRAIN DRILLING

HOLE DESIGNATION: OW337A-05
DATE COMPLETED: October 4, 2005
DRILLING METHOD: PQ CORING
FIELD PERSONNEL: B. KEMPEL
DRILLER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL
	TOP OF RISER GROUND SURFACE	377.73 376.77
	TOPSOIL	376.46
	SM/ML - SILTY SAND, compact, fine grained sand, medium brown, moist	375.55
	ML - SILT (TILL), with fine sand to sandy, trace gravel and clay, stiff, low plasticity, some fractures, light brown, moist	373.72
	SM - SAND (TILL), trace gravel and clay, dense, brown, moist	371.28
	ML - SILT (TILL), with fine grained sand, trace to with gravel and clay, stiff to hard, massive with some fractures, grey, low available moisture	364.57
	SW/GW - SAND AND GRAVEL (WATERLAIN), fine to grained, well graded, grey, moist	363.05
	ML/CL - CLAYEY SILT (TILL), with fine grained sand, trace gravel, stiff to hard, low plasticity, massive, grey, low available moisture	

MONITORING WELL



SAMPLE NUMBER	INTERVAL	REC (m)	'N' VALUE
01	PQ		
02	PQ		
03	PQ		
04	PQ		
05	PQ		
06	PQ		
07	PQ		
08	PQ		
09	PQ		
10	PQ		
11	PQ		
12	PQ		
13	PQ		
14	PQ		

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING CONTRACTOR: ALLTERRAIN DRILLING

HOLE DESIGNATION: OW337A-05
DATE COMPLETED: October 4, 2005
DRILLING METHOD: PQ CORING
FIELD PERSONNEL: B. KEMPEL
DRILLER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITORING WELL	SAMPLE NUMBER	INTERVAL	REC (m)	'N' VALUE
19					PQ		
				15	PQ		
20							
	SM/ML - SAND AND SILT, firm to stiff, fine grained sand, light brown, moist, till-like structure in part	356.34		16	PQ		
21	- becoming coarser, trace to with gravel at 21.34m BGS						
22				17	PQ		
23	- thin sand seams within from 22.86 to 23.47m BGS						
	SP/SM - SAND (WATERLAIN), trace to with silt, fine to medium grained sand, stratified, layers of clean medium sand to very fine sand and silt, laminations apparent in finer layers, moist	353.30		18	PQ		
24							
25				19	PQ		
26			BENTONITE GROUT				
27				20	PQ		
	SM - SILTY SAND (WATERLAIN), very fine gained sand, laminated, stratified, grey-brown, moist to wet	349.33	122 mm Ø BOREHOLE				
28				21	PQ		
29	- saturated, slightly coarse matrix with depth starting at 28.96m BGS		51 mm Ø SCH 80 PVC RISER PIPE				
30				22	PQ		
31				23	PQ		
32							
	SP - SAND (WATERLAIN), trace silt, fine to medium grained sand, stratified, grey, saturated	344.46		24	PQ		
33							
	SM - SILTY SAND (WATERLAIN), very fine gained sand, laminated, stratified, grey-brown, moist to wet	343.24					
34				25	PQ		
35				26	PQ		

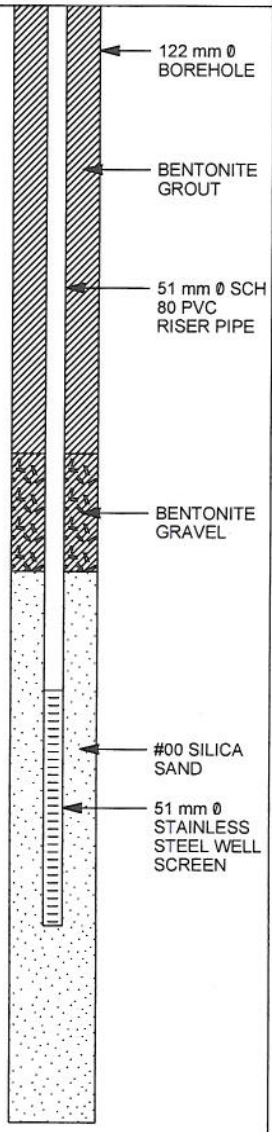
NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING CONTRACTOR: ALLTERRAIN DRILLING

HOLE DESIGNATION: OW337A-05
DATE COMPLETED: October 4, 2005
DRILLING METHOD: PQ CORING
FIELD PERSONNEL: B. KEMPEL
DRILLER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL
37, 38, 39		
	SM/SP - SAND (WATERLAIN), trace silt to silty, fine to medium grained sand, stratified/laminated, grey, saturated	337.75
40, 41, 42, 43, 44, 45		
	SP - SAND (WATERLAIN), trace silt, fine-medium to medium grained sand, stratified,laminated, grey, occasional layer oxidation stained, saturated	331.35
46, 47, 48		
	ML/CL - SILT AND CLAY (MARYHILL TILL), trace sand and gravel, hard, medium plasticity, massive, grey	328.61
49, 50		
	END OF BOREHOLE @ 50.39m BGS	326.38
51, 52, 53		



WELL DETAILS
Screened interval:
331.96 to 328.91m AMSL
44.81 to 47.85m BGS
Length: 3.05m
Diameter: 51mm
Slot Size: 8
Material: STAINLESS STEEL
Seal:
335.01 to 333.48m AMSL
41.76 to 43.28m BGS

SAMPLE NUMBER	INTERVAL	REC (m)	'N' VALUE
	PQ		
27	PQ		
28	PQ		
29	PQ		
30	PQ		
31	PQ		
32	PQ		
33	PQ		
34	PQ		
35	PQ		

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING CONTRACTOR: ALLTERRAIN DRILLING

HOLE DESIGNATION: OW337A-05
DATE COMPLETED: October 4, 2005
DRILLING METHOD: PQ CORING
FIELD PERSONNEL: B. KEMPEL
DRILLER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITORING WELL	SAMPLE NUMBER	INTERVAL	REC (m)	'N' VALUE	
55			Material: BENTONITE GRAVEL Sand Pack: 333.48 to 328.91m AMSL 43.28 to 47.85m BGS Material: #00 SILICA SAND					
56								
57								
58								
59								
60								
61								
62								
63								
64								
65								
66								
67								
68								
69								
70								
71								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

W. of Original Landfill

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING CONTRACTOR: ALLTERRAIN DRILLING

HOLE DESIGNATION: OW337B-05
DATE COMPLETED: October 6, 2005
DRILLING METHOD: PQ CORING
FIELD PERSONNEL: B. KEMPEL
DRILLER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITORING WELL	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (m)	SAMPLE 'N' VALUE
	TOP OF RISER GROUND SURFACE	377.73 376.82					
	TOPSOIL	376.51	CONCRETE SEAL				
1	SM/ML - SILTY SAND, compact, fine grained sand, medium brown, moist						
	ML - SILT (TILL), with fine sand to sandy, trace gravel and clay, stiff, low plasticity, some fractures, light brown, moist	375.60					
2							
3	SM - SAND (TILL), trace gravel and clay, dense, brown, moist	373.77					
4							
5							
	ML - SILT (TILL), with fine grained sand, trace to with gravel and clay, stiff to hard, massive with some fractures, grey, low available moisture	371.33					
6							
7							
8			122 mm ø BOREHOLE				
9			BENTONITE GROUT				
10							
11			51 mm ø SCH 80 PVC RISER PIPE				
12	SW/GW - SAND AND GRAVEL (WATERLAIN), fine to grained, well graded, grey, moist	364.62					
13							
14	ML/CL - CLAYEY SILT (TILL), with fine grained sand, trace gravel, stiff to hard, low plasticity, massive, grey, low available moisture	363.10					
15							
16							
17							

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING CONTRACTOR: ALLTERRAIN DRILLING

HOLE DESIGNATION: OW337B-05
DATE COMPLETED: October 6, 2005
DRILLING METHOD: PQ CORING
FIELD PERSONNEL: B. KEMPEL
DRILLER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITORING WELL	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (m)	SAMPLE 'N' VALUE
19							
20							
21	SM/ML - SAND AND SILT, firm to stiff, fine grained sand, light brown, moist, till-like structure in part - becoming coarser, trace to with gravel at 21.34m BGS	356.39					
22							
23	- thin sand seams within from 22.86 to 23.47m BGS						
24	SP/SM - SAND (WATERLAIN), trace to with silt, fine to medium grained sand, stratified, layers of clean medium sand to very fine sand and silt, laminations apparent in finer layers, moist	353.35					
25							
26			BENTONITE GROUT				
27							
28	SM - SILTY SAND (WATERLAIN), very fine gained sand, laminated, stratified, grey-brown, moist to wet	349.38	122 mm Ø BOREHOLE				
29	- saturated, slightly coarse matrix with depth starting at 28.96m BGS		51 mm Ø SCH 80 PVC RISER PIPE				
30							
31			BENTONITE GRAVEL				
32	SP - SAND (WATERLAIN), trace silt, fine to medium grained sand, stratified/laminated, grey, saturated	344.51					
33							
34	SM - SILTY SAND (WATERLAIN), very fine gained sand, laminated, stratified, grey-brown, moist to wet	343.29	#00 SILICA SAND				
35			51 mm Ø STAINLESS STEEL WELL				

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING CONTRACTOR: ALLTERRAIN DRILLING

HOLE DESIGNATION: OW337B-05
DATE COMPLETED: October 6, 2005
DRILLING METHOD: PQ CORING
FIELD PERSONNEL: B. KEMPEL
DRILLER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITORING WELL	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (m)	SAMPLE 'N' VALUE
	END OF BOREHOLE @ 36.58m BGS STRATIGRAPHY FROM NESTED WELL OW337A-05	340.24	SCREEN WELL DETAILS Screened interval: 343.29 to 340.24m AMSL 33.53 to 36.58m BGS Length: 3.05m Diameter: 51mm Slot Size: 8 Material: STAINLESS STEEL Seal: 346.34 to 344.81m AMSL 30.48 to 32.00m BGS Material: BENTONITE GRAVEL Sand Pack: 344.81 to 340.24m AMSL 32.00 to 36.58m BGS Material: #00 SILICA SAND				

37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING CONTRACTOR: ALLTERRAIN DRILLING

HOLE DESIGNATION: OW336-05
DATE COMPLETED: September 29, 2005
DRILLING METHOD: PQ CORING
FIELD PERSONNEL: B. KEMPEL
DRILLER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITORING WELL	SAMPLE NUMBER	INTERVAL	REC (m)	'N' VALUE
	TOP OF RISER GROUND SURFACE	391.19 390.41					
	TOPSOIL	390.11	CONCRETE SEAL	01	PQ		
1	ML - SILT (POSSIBLE FILL), with sand and gravel, trace clay, firm to stiff, low plasticity, brown, moist	389.19					
	SM/ML - SAND AND SILT (WATERLAIN), firm, fine grained, fine stratified, brown, moist	388.58		02	PQ		
2	ML - SILT (WATERLAIN), with fine sand and clay, very stiff, low plasticity, some laminations, brown, moist			03	PQ		
3	SM/ML - SAND AND SILT (TILL), with gravel and clay, occasional cobbles, firm to stiff, variable structure and stoniness, brown, very moist, some water modification evident, majority of till is fine grained sand	387.36		04	PQ		
4							
5				05	PQ		
6							
7				06	PQ		
8	- some alternating layers of silt and sand till with variable strength and gravel contents at 7.62m BGS		122 mm Ø BOREHOLE	07	PQ		
9			BENTONITE GROUT				
10				08	PQ		
11			51 mm Ø SCH 80 PVC RISER PIPE	09	PQ		
12	ML - SILT (TILL), with sand to sandy, with gravel, trace clay, stiff, massive, light brown/buff, moist to wet	378.22					
13				10	PQ		
14				11	PQ		
15							
16				12	PQ		
17	ML/SM - SILT AND SAND (WATERLAIN), trace gravel, firm, fine grained sand, partially laminated, light brown/buff, moist, till structure occasionally apparent, coarser with depth	373.65		13	PQ		

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING CONTRACTOR: ALLTERRAIN DRILLING

HOLE DESIGNATION: OW336-05
DATE COMPLETED: September 29, 2005
DRILLING METHOD: PQ CORING
FIELD PERSONNEL: B. KEMPEL
DRILLER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITORING WELL	SAMPLE NUMBER	INTERVAL	REC (m)	'N' VALUE
					PQ		
19				14	PQ		
20	SP - SAND (WATERLAIN), trace silt, trace gravel, medium grained, poorly graded, gray/brown, moist, fining upwards - with gravel to gravelly from 20.57 to 22.10m BGS	370.90		15	PQ		
21							
22	- fine to medium gravel from 22.10 to 22.86m BGS			16	PQ		
23	SW/GW - SAND AND GRAVEL (WATERLAIN), medium to coarse grained, well graded, grey, moist	367.55		17	PQ		
24							
25	SW - SAND (WATERLAIN), trace to with gravel, medium coarse grained, variable to well graded, grey, moist to wet	366.03		18	PQ		
26			BENTONITE GROUT				
27				19	PQ		
28	SW/GW - SAND AND GRAVEL (WATERLAIN), medium to coarse grained, well graded, grey, moist	362.98	122 mm Ø BOREHOLE	20	PQ		
29	SW - SAND (WATERLAIN), trace to with gravel, medium coarse grained, variable to well graded, grey, moist to wet	361.45	51 mm Ø SCH 80 PVC RISER PIPE	21	PQ		
30							
31				22	PQ		
32							
33				23	PQ		
34	ML - SILT (LACUSTRIAN), trace to fine sand, trace clay, firm to stiff, low plasticity, some laminations, brown, moist	356.27		24	PQ		
35				25	PQ		

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING CONTRACTOR: ALLTERRAIN DRILLING

HOLE DESIGNATION: OW336-05
DATE COMPLETED: September 29, 2005
DRILLING METHOD: PQ CORING
FIELD PERSONNEL: B. KEMPEL
DRILLER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITORING WELL	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (m)	SAMPLE 'N' VALUE
					PQ		
37	SM/ML - SAND AND SILT (LACUSTRIAN?), fine sand, stratified/laminated, brown, wet, alternating layers of predominantly fine sand or silt	353.83		26	PQ		
38	- orange oxidized seam from 38.13 to 38.19m BGS	352.31					
39	SP/SM - SAND (WATERLAIN), trace to with silt, fine to medium grained sand, coarsening upward, grey, wet			27	PQ		
40			122 mm Ø BOREHOLE				
41				28	PQ		
	SP - SAND (WATERLAIN), trace to with silt, fine to medium grained, grey, saturated	349.26	BENTONITE GROUT				
42				29	PQ		
43			51 mm Ø SCH 80 PVC RISER PIPE				
44				30	PQ		
45				31	PQ		
46							
47				32	PQ		
48				33	PQ		
49							
50				34	PQ		
51				35	PQ		
52							
53				36	PQ		
					PQ		

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

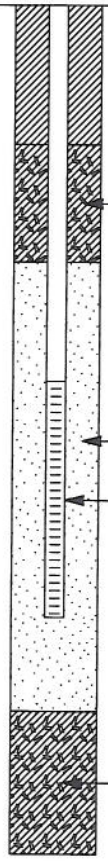
STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING CONTRACTOR: ALLTERRAIN DRILLING

HOLE DESIGNATION: OW336-05
DATE COMPLETED: September 29, 2005
DRILLING METHOD: PQ CORING
FIELD PERSONNEL: B. KEMPEL
DRILLER

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL
55	SM - SILTY SAND, to and silt, very fine sand, grey, wet	335.55
56		
57	SP - SAND (WATERLAIN), trace to with silt, fine to medium grained, grey, saturated	334.02
58		
59	- slightly coarse matrix, fine to medium sand, trace silt at 58.83m BGS	
60		
61		
62		
63	ML/CL - CLAYEY SILT (MARYHILL TILL), occasionally to and clay, trace fine sand, hard, low to medium plasticity, massive with some fractures, evidence of some lamination, grey	327.32
64		
65	END OF BOREHOLE @ 64.92m BGS	325.49
66		
67		
68		
69		
70		
71		

MONITORING WELL



WELL DETAILS
Screened interval:
331.58 to 328.54m AMSL
58.83 to 61.87m BGS
Length: 3.05m
Diameter: 51mm
Slot Size: 8
Material: STAINLESS STEEL
Seal:
334.63 to 333.11m AMSL
55.78 to 57.30m BGS
Material: BENTONITE GRAVEL
Sand Pack:
333.11 to 325.49m AMSL
57.30 to 64.92m BGS
Material: #00 SILICA SAND

SAMPLE NUMBER	INTERVAL	REC (m)	'N' VALUE
37	PQ		
38	PQ		
39	PQ		
40	PQ		
41	PQ		
42	PQ		
43	PQ		
44	PQ		

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

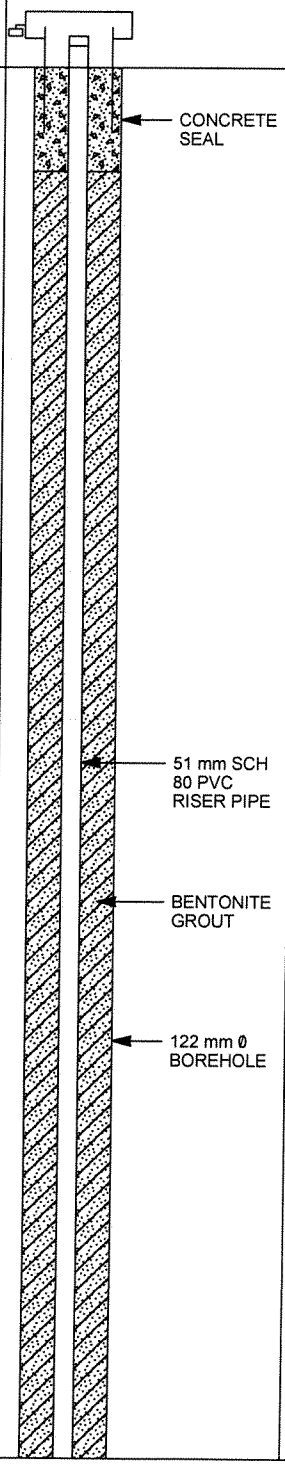
WT-EL-OW333-04-A

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING CONTRACTOR: LANTECH DRILLING SERVICES

HOLE DESIGNATION: OW333-04
DATE COMPLETED: 20 April 2004
DRILLING METHOD: PQ CORING
FIELD PERSONNEL: B.IOTZOV
DRILLER: MIKE SOKOLOW

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL
	TOP OF RISER GROUND SURFACE	370.07 369.26
	SM-SAND, with silt, loose to compact, fine to medium grained, massive, poorly to moderately well graded, brown, moist	
	GM-GRAVEL AND SAND, with silt, compact, fine to coarse grained, very poorly graded, brown, wet	366.36
	CL/ML-CLAY AND SILT TO SILTY CLAY (TILL), trace fine gravel and coarse sand, stiff to very stiff, medium plasticity, subtle fine lamination, brown, moist	363.66
	- grey at 5.80m BGS	363.09
	SM/ML-SAND AND SILT, lense, loose to compact, fine to medium grained, grey, moist to wet	362.88
	CL-CLAY (TILL), stiff, low plasticity, crumbly texture, grey, wet	362.61
	SM-SAND, with silt, compact, medium grained, poorly graded, fine stratified (laminated), grey, saturated	362.10
	ML-SILT(TILL), with clay, with to trace coarse sand and fine gravel, very stiff, medium plasticity, grey, wet, upper and lower contacts are gradational (across 5 cm)	361.41
	SM-SAND, with silt, compact, medium grained, poorly graded, grey, moist to wet, fine stratified (laminated)	
	- gravelly sand lense from 9.00 to 9.10m BGS	
	ML-SILT(TILL), trace clay, with gravel (in lenses),	359.56



SAMPLE NUMBER	INTERVAL	REC (%)	'N' VALUE
1		0	-
2		0	-
3		10	-
4		60	-
5		95	-
6		70	-

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING CONTRACTOR: LANTECH DRILLING SERVICES

HOLE DESIGNATION: OW333-04
DATE COMPLETED: 20 April 2004
DRILLING METHOD: PQ CORING
FIELD PERSONNEL: B.IOTZOV
DRILLER: MIKE SOKOLOW

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	INTERVAL	REC (%)	'N' VALUE
	stiff, low plasticity, massive, grey, moist			7		60	-
10.5	- gravelly lense from 10.43 to 10.60m BGS						
11.0		358.16					
	SM-SAND, with silt, compact, medium grained, fine stratified (laminated), poorly graded, grey, moist (saturated in places or locally saturated)						
11.5	- silty sand, lense, loose, very fine grained, massive, saturated, grey from 11.40 to 11.52m BGS			8		75	-
12.0	- silt, with clay, lense, stiff, crumbly texture (desiccation texture), wet, low plasticity from 11.56 to 11.64m BGS						
12.5	ML-SANDY SILT (TILL), with gravel, with to trace clay, hard, low to moderate plasticity, moderately graded, stratified, grey, moist, clay till clasts	356.76					
13.0	ML/CL-CLAYEY SILT, with trace fine sand, stiff, low to medium plasticity, laminated, crumbly desiccation texture, grey, moist, increasing silt and sand content with depth, gradational lower contact	356.46					
13.5	ML-SANDY SILT (TILL), with gravel, with to trace clay, hard, low to moderate plasticity, moderately graded, stratified, grey, moist, clay till clasts	356.10		9		75	-
14.0	CL-SILTY CLAY (TILL), very stiff, medium plasticity, grey, moist to wet	355.06					
14.5	ML-SILT, with fine sand, saturated	354.66					
	ML/SM-SILT AND SAND (TILL), loose to compact, fine to medium grained sand, grey, wet to saturated	354.51		10		60	-
15.0	CL-CLAY (TILL), with silt, with to trace gravel, stiff, medium plasticity, faint stratified (laminated), grey, wet	354.16	51 mm SCH 80 PVC RISER PIPE				
15.5	CL/ML-CLAY AND SILT (TILL), with very fine sand and gravel, stiff to hard, low plasticity, grey, moist	353.76					
16.0	- some very thin laminae (1mm) from 15.95 to 16.45m BGS		BENTONITE GROUT	11		100	-
16.5							
17.0			122 mm Ø BOREHOLE				
17.5	- sandy lense from 17.42 to 17.50m BGS			12		100	-
18.0							
18.5	SW-SAND, with gravel, loose, coarse grained, well graded, massive, grey, moist	350.66					
19.0	ML-SILT (TILL), with clay, with to trace gravel and sand, stiff, low plasticity, fine stratified to laminated, grey, moist	350.26		13		95	-
19.5	- sand lense from 19.21 to 19.26m BGS	349.81					
	ML/SM-SILT AND SAND, loose, fine grained, massive, grey, saturated	349.56					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING CONTRACTOR: LANTECH DRILLING SERVICES

HOLE DESIGNATION: OW333-04
DATE COMPLETED: 20 April 2004
DRILLING METHOD: PQ CORING
FIELD PERSONNEL: B.IOTZOV
DRILLER: MIKE SOKOLOW

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
	ML-SILT (TILL), with clay, with to trace gravel and sand, stiff, low plasticity, fine stratified to laminated, grey, moist	349.26					
20.5	ML/SM-SILT AND SAND, loose, fine grained, faintly fine stratified (laminated), grey, saturated	348.66					
	ML-CLAYEY SILT (TILL), with to trace fine gravel and sand, stiff, low plasticity, grey, wet	348.46		14		60	-
21.0	ML/SM-SILT AND SAND, loose, fine grained, grey, saturated	348.21					
21.5	ML-SILT (TILL), with clay, stiff, low plasticity, grey, moist - gravelly, sand seams from 21.60 to 22.00m BGS						
22.0	ML/SM-SILT AND SAND, loose, fine grained, grey, saturated	346.96		15		60	-
22.5							
23.0	ML/CL-SILT AND CLAY (TILL), stiff to very stiff, low plasticity, massive to fine stratified (laminated), grey, moist	346.31					
	SM-SAND, with silt, poorly graded, fine stratified, laminated, grey, moist	345.96					
23.5	ML/CL-SILT AND CLAY (TILL), stiff, low plasticity, grey, moist	345.66		16		60	-
24.0	ML/SM-SILT AND SAND, loose, fine grained, grey, moist	345.41					
24.5	ML/CL-SILT AND CLAY (TILL), trace fine gravel, stiff to very stiff (locally), low plasticity, massive, grey, dry to moist	345.06					
25.0			51 mm SCH 80 PVC RISER PIPE	17		55	-
25.5							
26.0	SM-SAND, with silt to silty (with depth), loose, poorly graded, medium to fine grained sand, fine stratified, grey, moist, gradational lower contact	343.16	BENTONITE GROUT				
26.5	ML/CL-SILT AND CLAY (TILL), stiff to very stiff, low plasticity, some lamination, grey, moist to wet, silt content increasing with depth	342.44	122 mm Ø BOREHOLE	18		80	-
27.0							
27.5							
28.0	- boulder from 28.30 to 28.40m BGS			19		95	-
28.5	SM/ML-SAND AND SILT (TILL), compact, poorly graded, fine to medium grained, massive, grey, moist to wet	340.86					
29.0							
29.5	GM/SM-GRAVEL AND SAND (TILL), with silt, with clay, compact, coarse grained (cobble), very well graded, grey, wet	339.86		20		30	-

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING CONTRACTOR: LANTECH DRILLING SERVICES

HOLE DESIGNATION: OW333-04
DATE COMPLETED: 20 April 2004
DRILLING METHOD: PQ CORING
FIELD PERSONNEL: B.IOTZOV
DRILLER: MIKE SOKOLOW

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
30.5							
31.0				21		30	-
31.5							
32.0			BENTONITE GROUT	21.5		0	-
32.5							
33.0				22		50	-
33.5							
34.0							
34.5	SP-SAND, loose to compact, medium to coarse grained, poorly graded, stratified (fine to medium bedded), mostly massive, grey, wet	334.76		23		25	-
35.0							
35.5							
36.0				24		60	-
36.5							
37.0			SAND PACK				
37.5	- medium to coarse grained from 37.30 to 37.85m BGS			25		75	-
38.0	- medium grained from 37.85 to 39.65m BGS		WELL SCREEN				
38.5							
39.0				26		90	-
39.5	- medium to coarse grained from 39.65 to 39.85m BGS						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: WATERLOO LANDFILL SITE
PROJECT NUMBER: 823-02
CLIENT: REGIONAL MUNICIPALITY OF WATERLOO
LOCATION: AS PER PLAN
DRILLING CONTRACTOR: LANTECH DRILLING SERVICES

HOLE DESIGNATION: OW333-04
DATE COMPLETED: 20 April 2004
DRILLING METHOD: PQ CORING
FIELD PERSONNEL: B.IOTZOV
DRILLER: MIKE SOKOLOW

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m AMSL	MONITOR INSTALLATION	SAMPLE NUMBER	INTERVAL	REC (%)	'N' VALUE
	- medium grained from 39.85 to 39.95m BGS - medium to coarse grained from 39.95 to 40.70m BGS			27		85	-
40.5							
	- very coarse grained from 40.70 to 40.80m BGS - medium to coarse grained from 40.80 to 41.00m BGS						
41.0							
	- medium grained from 41.00 to 41.40m BGS - fine to medium grained from 41.40 to 41.50m BGS - medium grained from 41.50 to 42.40m BGS						
41.5							
			BENTONITE HOLEPLUG	28		85	-
42.0							
	- medium to coarse grained from 42.40 to 42.80m BGS						
42.5							
43.0	CL-CLAY (MARY HILL TILL), with silt, trace gravel, stiff to very stiff, low plasticity, laminated, grey, dry to moist	326.31		29		75	-
43.5							
44.0	END OF BOREHOLE @ 44.00m BGS	325.26					
44.5							
45.0							
45.5							
46.0							
46.5							
47.0							
47.5							
48.0							
48.5							
49.0							
49.5							

WELL DETAILS
Screened interval:
332.73 to 329.72m AMSL
36.53 to 39.54m BGS
Length: 3.01m
Diameter: 2mm
Slot Size: 8
Material: STAINLESS STEEL
Sand Pack:
334.61 to 329.41m AMSL
34.65 to 39.85m BGS
Material: #00 SILICA SAND

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

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Appendix C

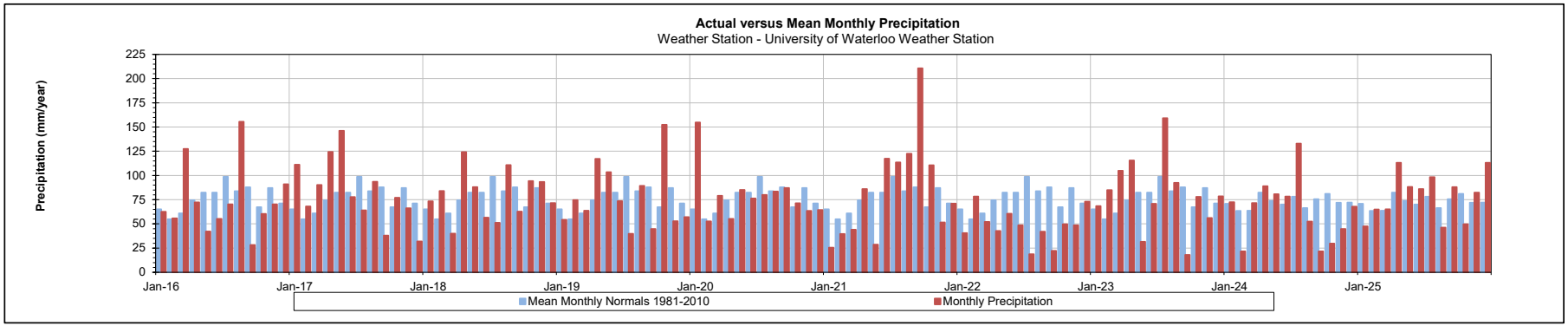
Monitoring Data
(Pumped Volumes and Hydrographs)

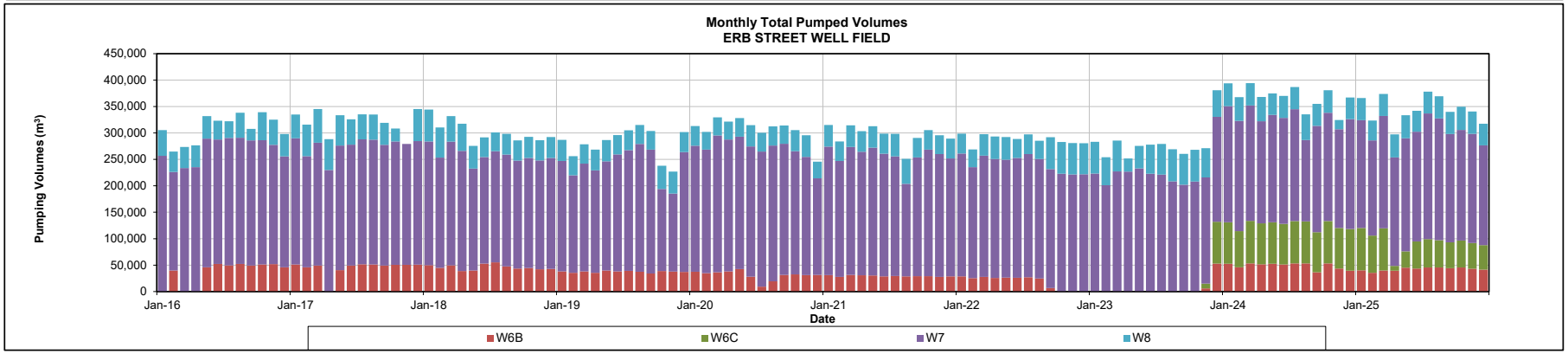
TABLE C-1
WELL FIELD WATER PRODUCTION SUMMARY
REGION OF WATERLOO - 2025 GROUNDWATER MONITORING REPORT

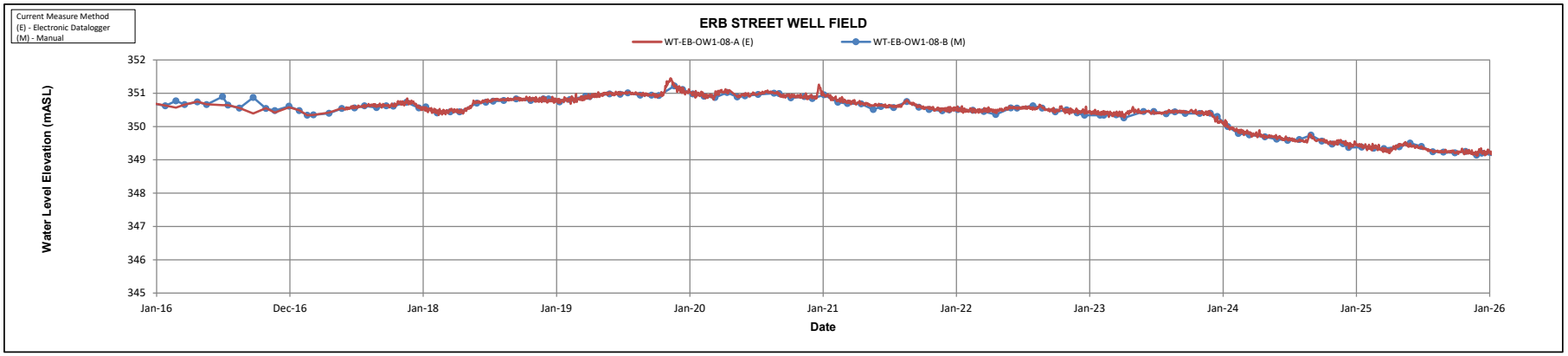
Well Field	Major or Minor Supply	Production Well Name	Permit to Take Water Details			2021 Production Summary			2022 Production Summary			2023 Production Summary			2024 Production Summary			2025 Production Summary		
			MOE Permit Number[1]	Permitted Capacity (total m^3/year)*	Permitted Rate (L/s)*	Total Production Well Volume (total m^3/year)	Average Daily Rate (m^3/day)	Average Rate (L/s)	Total Production Well Volume (total m^3/year)	Average Daily Rate (m^3/day)	Average Rate (L/s)	Total Production Well Volume (total m^3/year)	Average Daily Rate (m^3/day)	Average Rate (L/s)	Total Production Well Volume (total m^3/year)	Average Daily Rate (m^3/day)	Average Rate (L/s)	Total Production Well Volume (total m^3/year)	Average Daily Rate (m^3/day)	Average Rate (L/s)
Erb Street	Major	W6B	1541-AWGPZR	1,672,459	53.0	353,540	969	11.2	218,307	598	6.9	58,828	161	1.9	585,874	1,605	18.6	508,799	1,394	16.1
		W6C	1541-AWGPZR	2,031,444	64.4	0	0	0	0	0	0	88,257	242	2.8	931,606	2,552	29.5	621,262	1,702	19.7
		W7	1541-AWGPZR	3,345,444	106.1	2,732,706	7,487	86.7	2,696,994	7,389	85.5	2,574,478	7,053	81.6	2,409,089	6,600	76.4	2,501,309	6,853	79.3
		W8	1541-AWGPZR	3,823,214	121.2	472,955	1,296	15.0	543,653	1,489	17.2	635,594	1,741	20.2	492,894	1,350	15.6	500,312	1,371	15.9
			Well Field Total	***10,872,562***	***344.8***	***3,559,201***	***9,751***	***112.9***	***3,458,954***	***9,477***	***109.7***	***3,357,157***	***9,198***	***106.5***	***4,419,463***	***12,108***	***140.1***	***4,131,682***	***11,320***	***131.0***

*Combined taking from all wells not to exceed annual daily average of 17,272,800 L/day

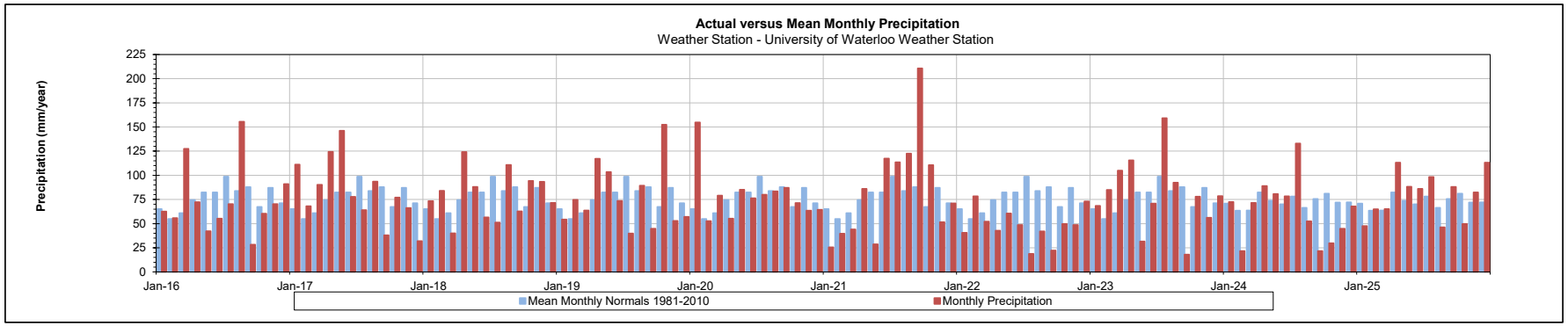
REGION OF WATERLOO
2025 GROUNDWATER MONITORING REPORT -
ERB STREET

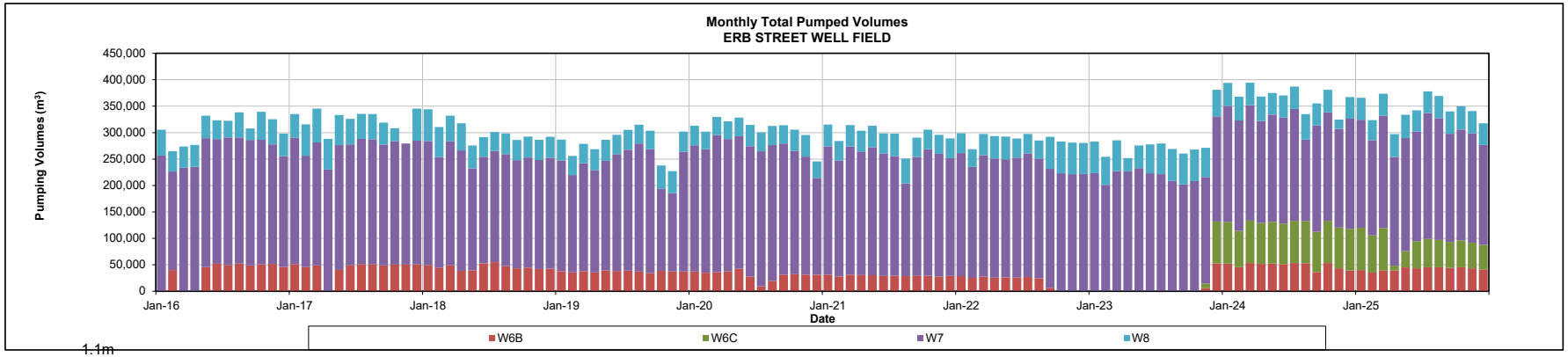






REGION OF WATERLOO
2025 GROUNDWATER MONITORING REPORT -
ERB STREET





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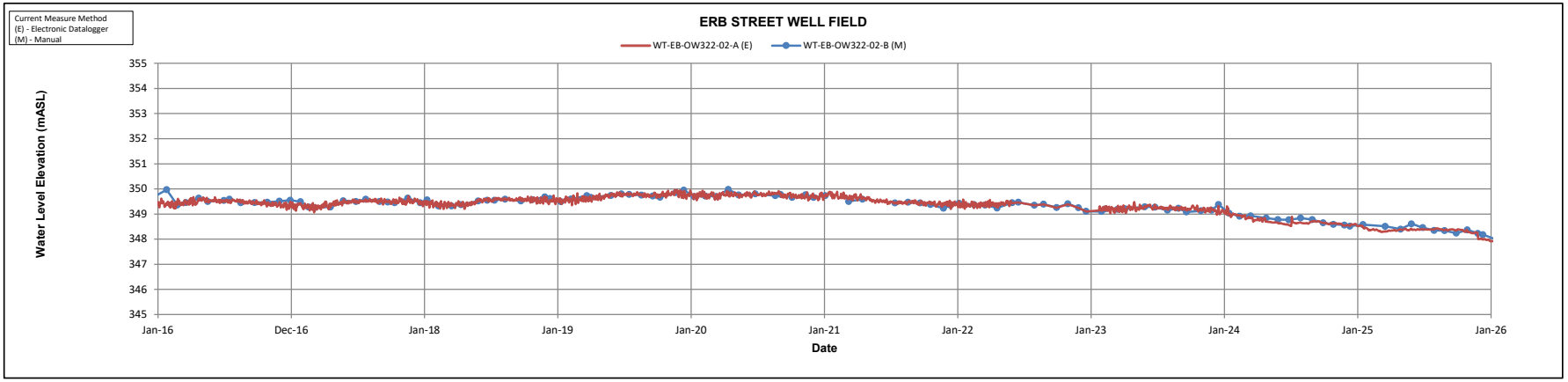
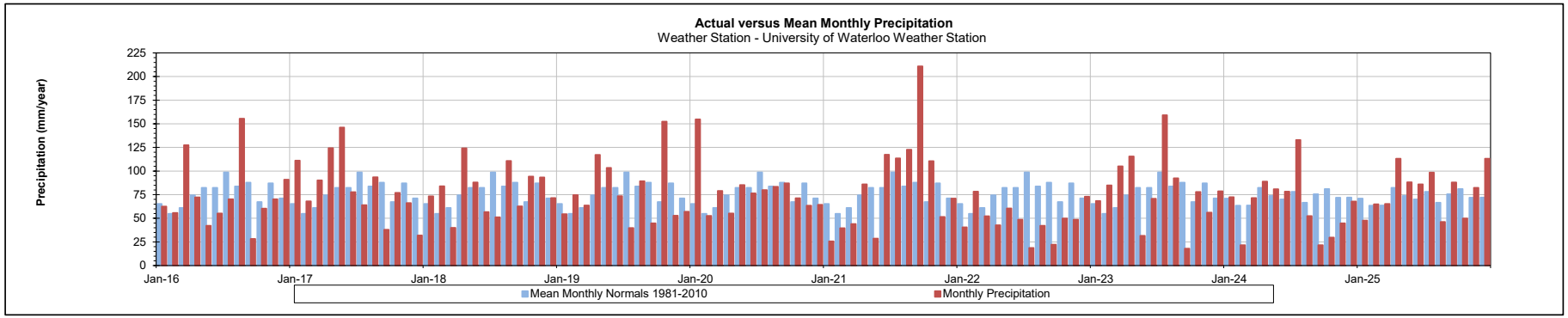
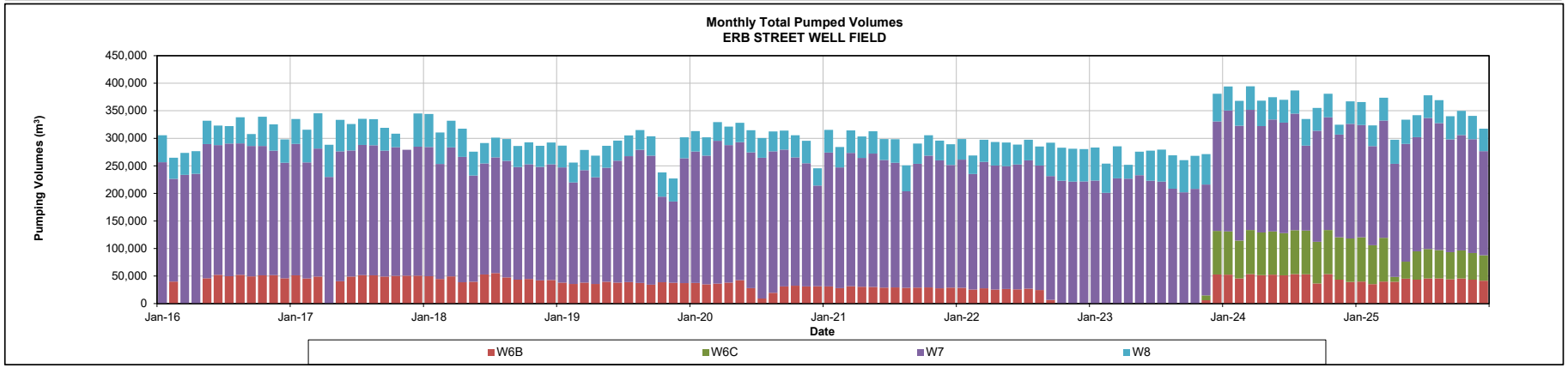
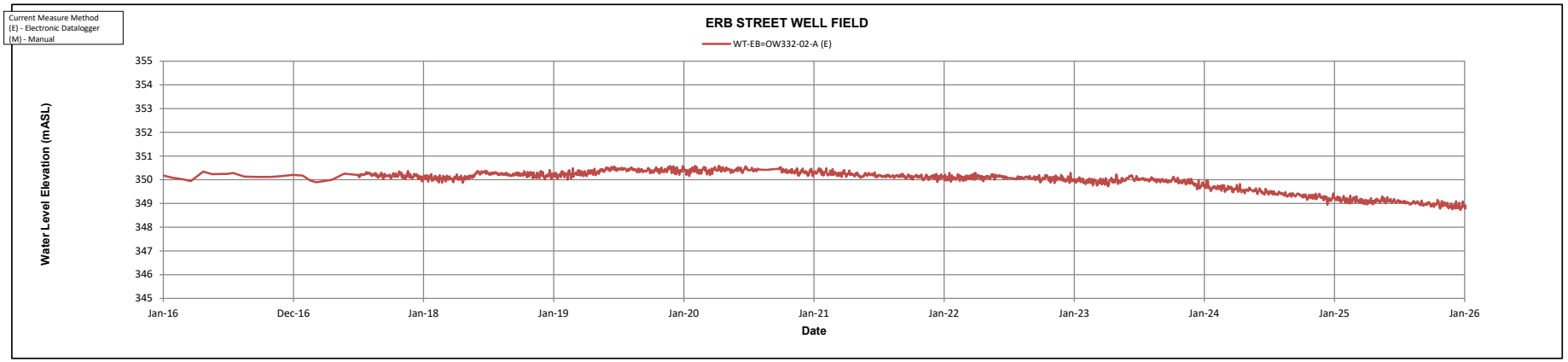


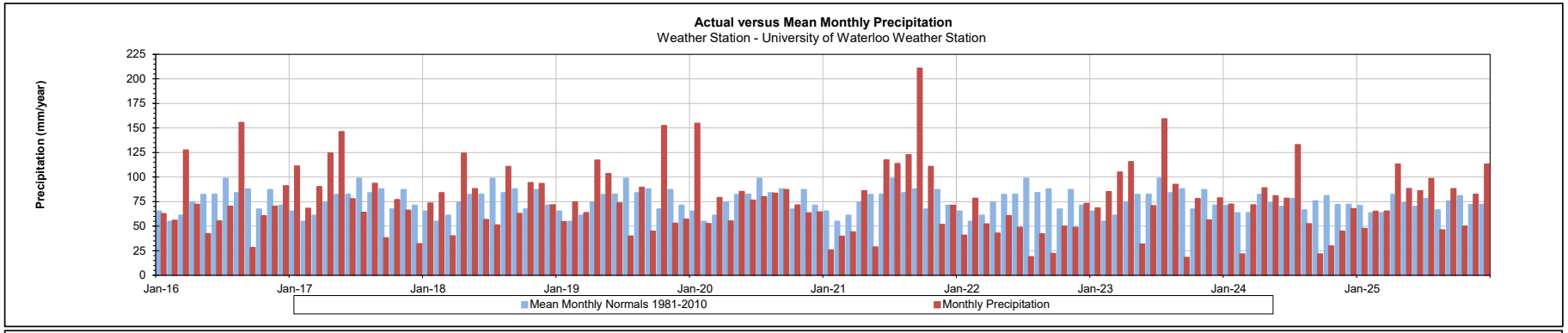
REGION OF WATERLOO
2025 GROUNDWATER MONITORING REPORT -
ERB STREET

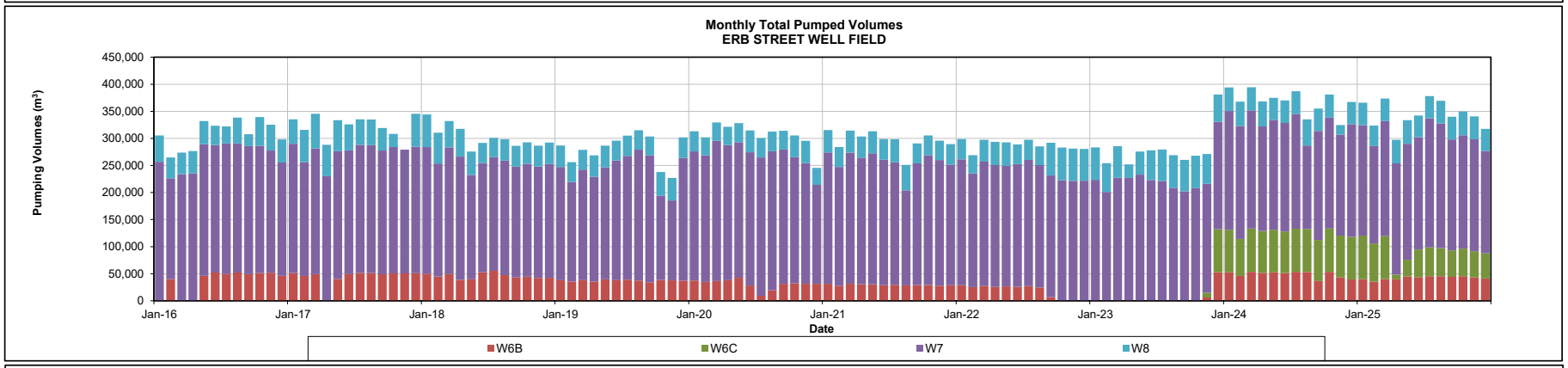


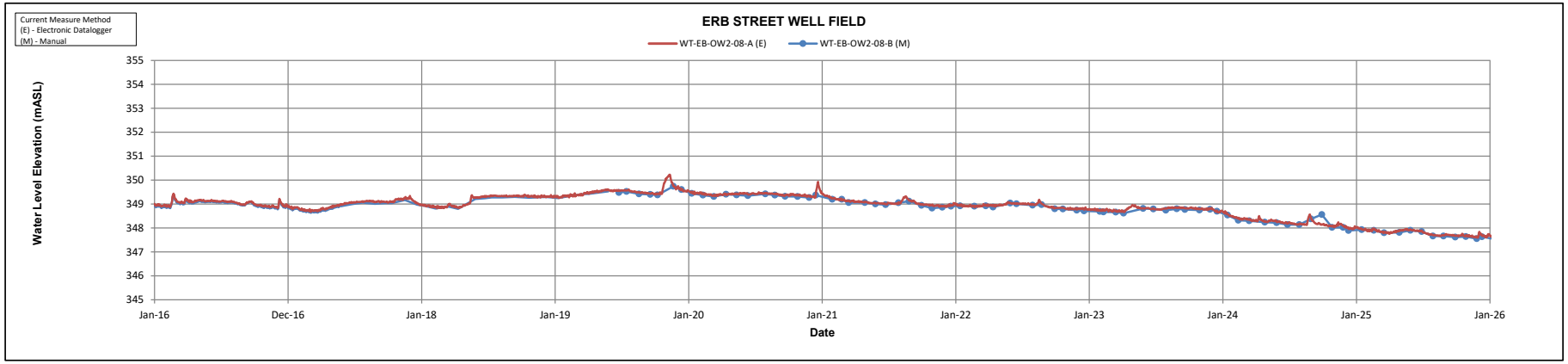




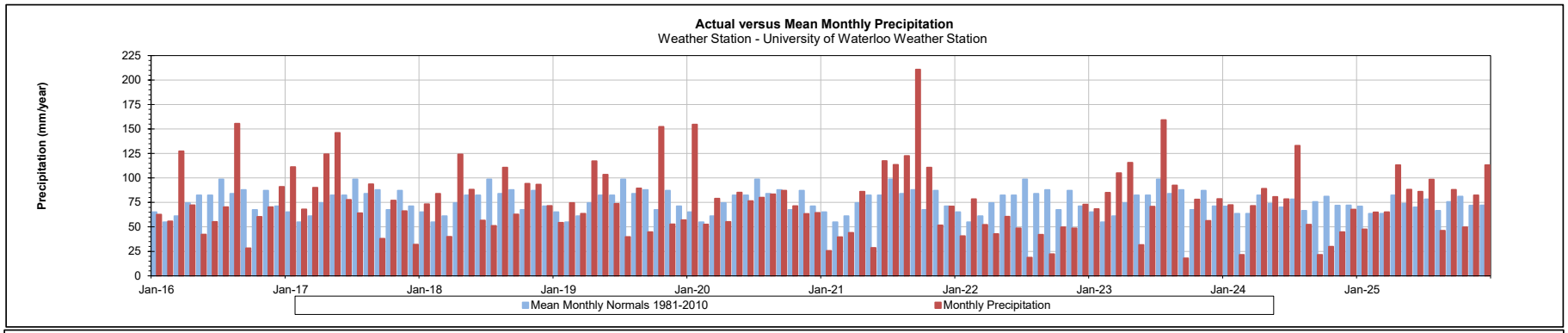
REGION OF WATERLOO
2025 GROUNDWATER MONITORING REPORT -
ERB STREET

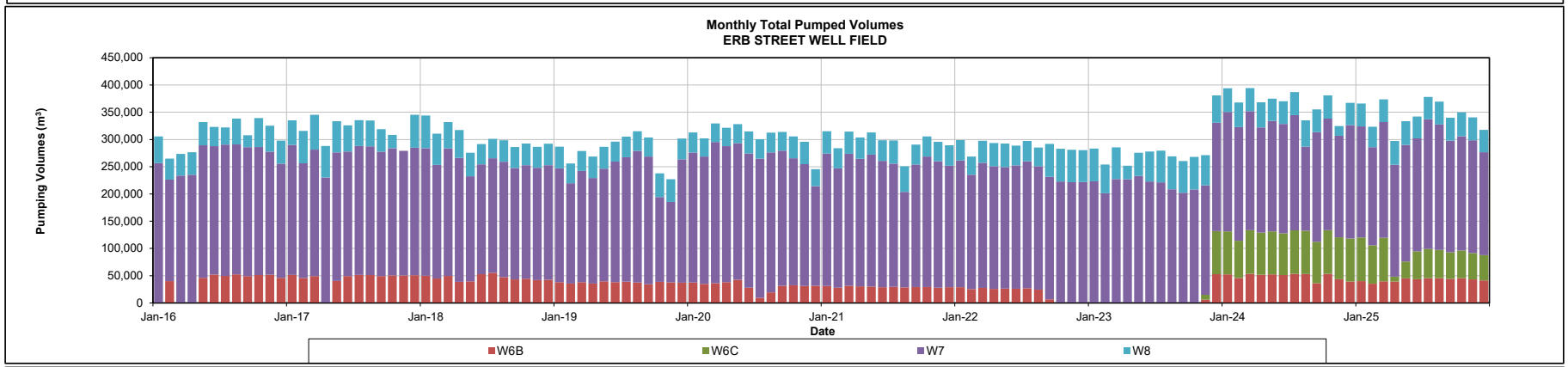


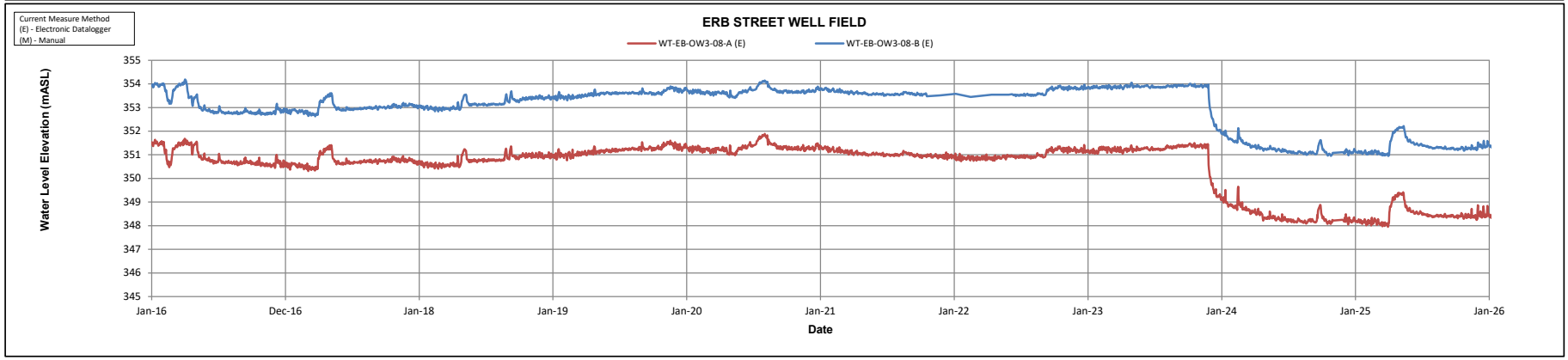




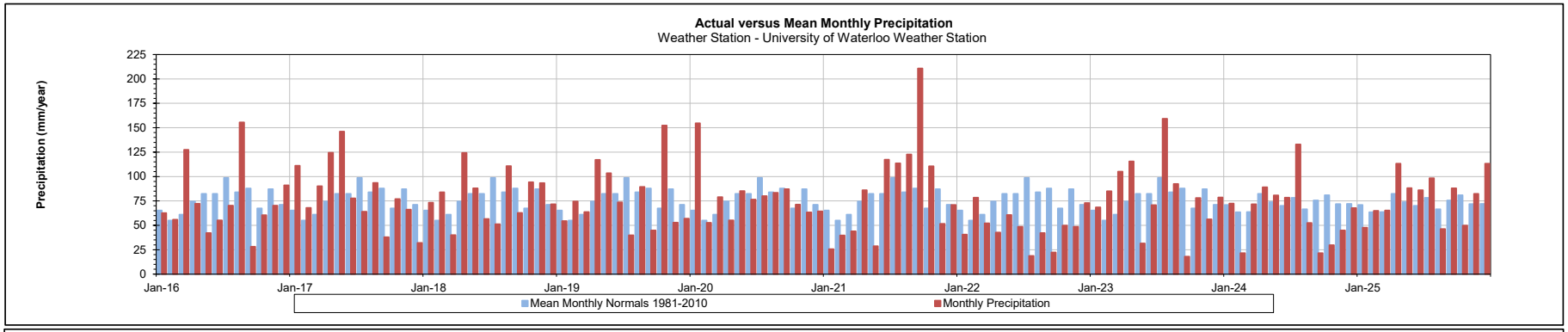
REGION OF WATERLOO
2025 GROUNDWATER MONITORING REPORT -
ERB STREET

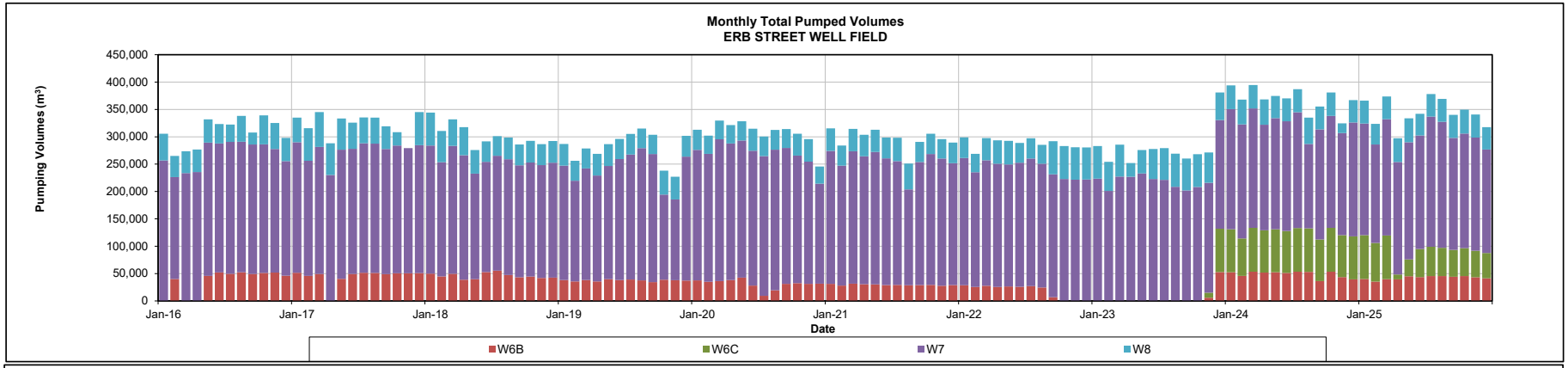


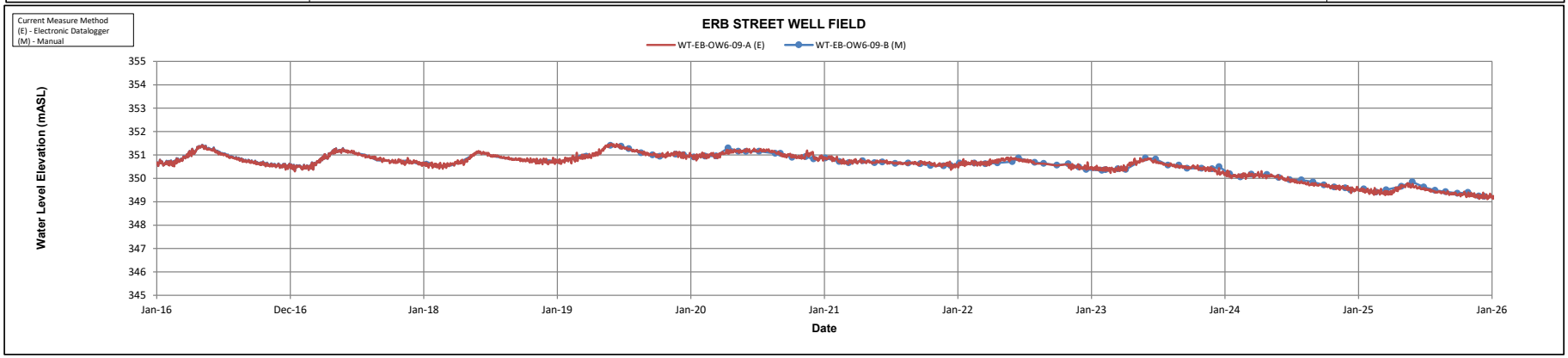




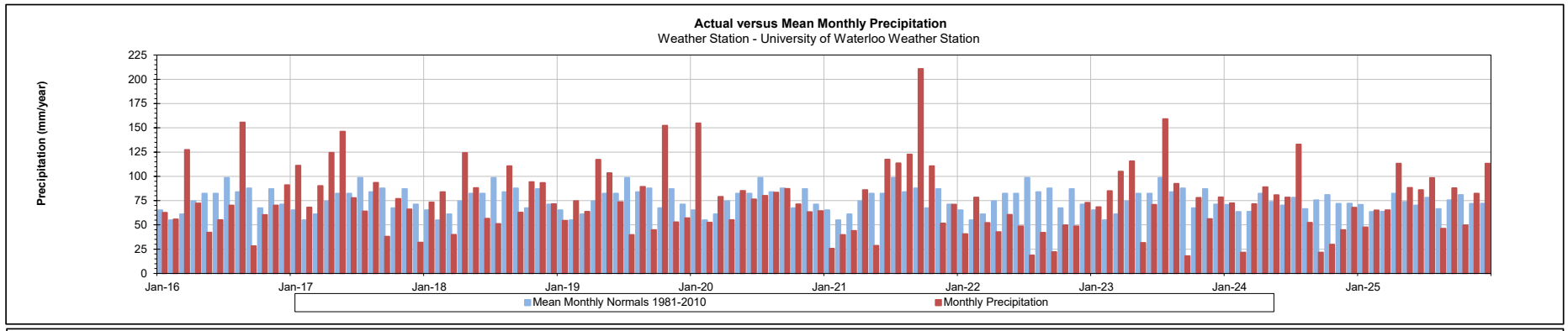
REGION OF WATERLOO
2025 GROUNDWATER MONITORING REPORT -
ERB STREET

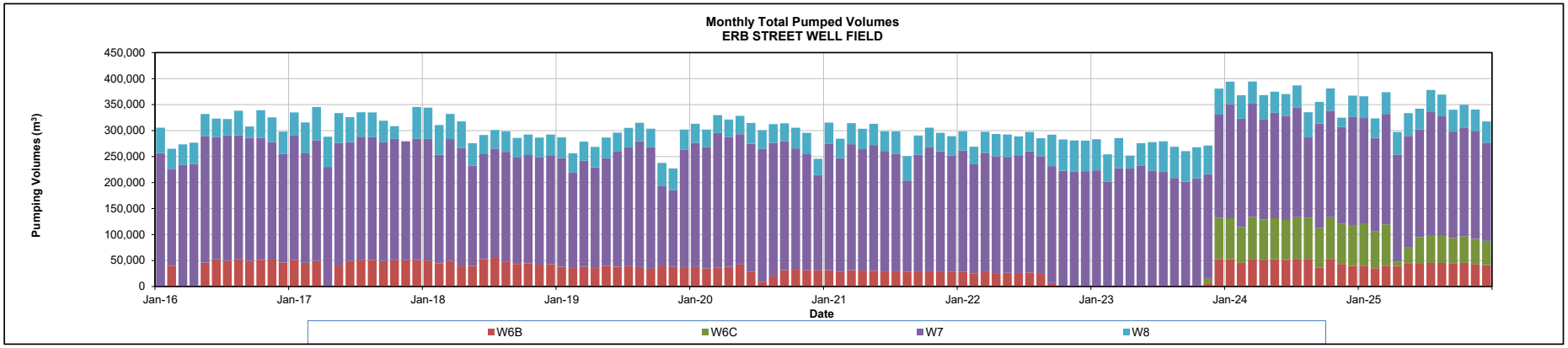


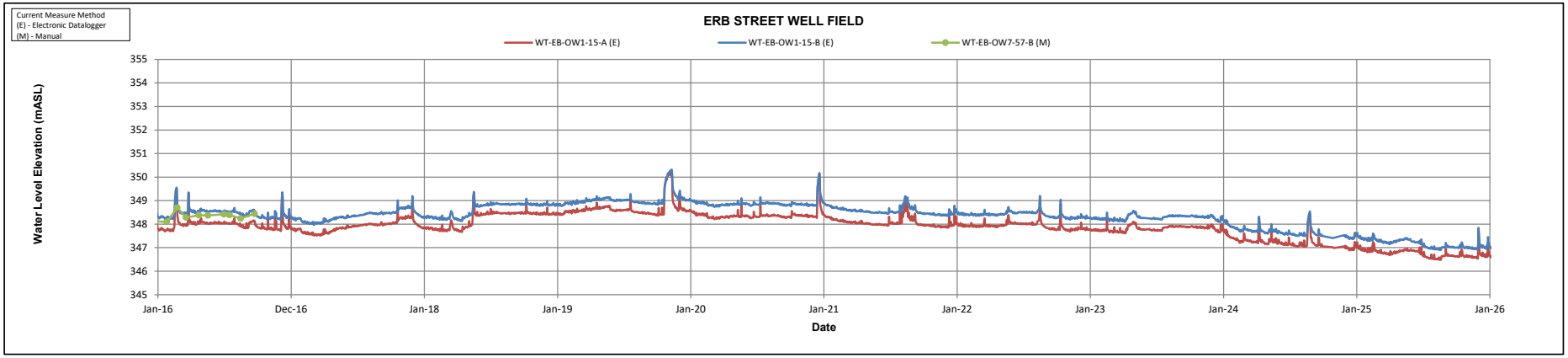




REGION OF WATERLOO
2025 GROUNDWATER MONITORING REPORT -
ERB STREET







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Appendix D

Precipitation Data

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

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

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

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

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

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

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

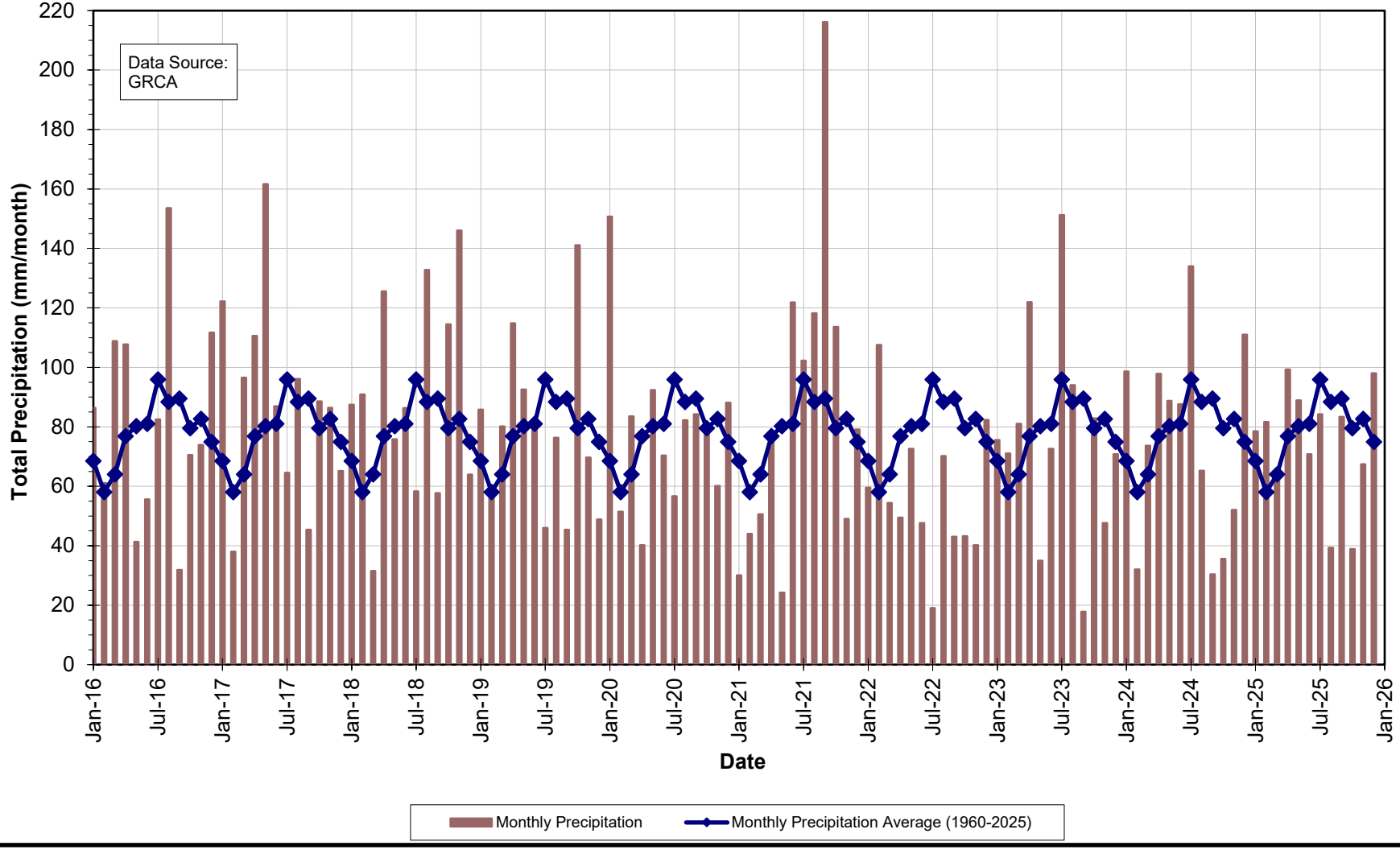
Year	Laurel Dam Established 1960		
	Annual Precipitation (mm)	Average Precipitation 1960-2025 (mm)	Difference (mm)
2016	985	938	**47**
2017	1062	938	**124**
2018	1071	938	**133**
2019	940	938	**2**
2020	938	938	**0**
2021	1027	938	**89**
2022	689	938	**-249**
2023	921	938	**-17**
2024	907	938	**-31**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

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

NOTES:

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

Figure D.1
Laurel Creek Dam
Monthly Precipitation



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

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Appendix E

Monitoring Program Overview

GROUNDWATER LEVEL MONITORING PROGRAM PROCEDURES

E.1 Overview

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

E.1.1 Production Well Pumping and Water Levels

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

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

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

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

E.1.2 Monitoring Wells and Surface Water levels

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

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

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

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

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

E.1.3 Climatological Data

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

E.2 Groundwater Level Collection Protocols

E.2.1 Groundwater Level Monitoring Network Summary Well Checklist

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

E.2.2 Well Inspection

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

E.2.3 Monitoring Well Manual Water Level Measurement Procedure

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

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

E.2.4 Downloading of Water Levels from Electronic Dataloggers Procedure

For Non-Vented (Absolute) Datalogger Models:
In-Situ Inc.® LevelTROLLs® and RuggedTROLLs®, *Van Essen Instruments* Divers®, and *Solinst*® Leveloggers®

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

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

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

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

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

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

R.J. Burnside & Associates Limited