

|               |                                           |       |                                                            |
|---------------|-------------------------------------------|-------|------------------------------------------------------------|
| To:           | Peter Armbruster<br>Activa Holdings, Inc. | From: | Allison Healey, Grant Whitehead<br>Stantec Consulting Ltd. |
| Project/File: | 160310788.700.100                         | Date: | November 14, 2024                                          |

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**Reference: Hydrogeological Technical Memorandum, Supplementary Groundwater Monitoring and Wetland Assessment, Carriage Crossing Subdivision (400 Millenium Boulevard), Blocks 320 and 326 (Registered Plan 58M-506), Waterloo, Ontario**

## 1 Introduction

Activa Holdings Inc (Activa) retained Stantec Consulting Ltd (Stantec) to conduct supplementary groundwater monitoring and a wetland assessment for the Carriage Crossing Subdivision, Blocks 320 and 326 (the Site). The Site is located at 400 Millenium Boulevard, located on the north edge of Waterloo, Ontario. The Site is bound by Country Squire Road to the north, Millenium Boulevard to the south and east, and residential and green space to the west. These lands have an area of approximately 15 hectares and is presently vacant. Figure 1 (Attachment 1) shows the location of the Site.

The proposed subdivision development will consist of a combination of single-family houses, townhomes, low-rise residential buildings, commercial spaces, a park, a stormwater management pond, and associated roads and parking. The proposed development is presented on Figure 1.

The objectives of the supplementary groundwater monitoring program are to characterize the geological and hydrogeological conditions at the Site, including identifying hydrostratigraphic/aquifer units, seasonal fluctuations in groundwater levels, and groundwater flow regimes.

The objectives of the wetland assessment are to assess the potential groundwater and surface water connection between the Site and the abutting wetland to the southwest of the Site by installing multi-level drive-point piezometers along a transect of the wetland and monitoring groundwater levels.

This Technical Memorandum is arranged into five sections, including this introduction (Section 1). Section 2 presents the physical setting of the Site at a regional scale. Section 3 presents the methodology for the supplementary groundwater monitoring program and wetland assessment. Section 4 presents local geological and hydrogeological conditions, with conclusions presented in Section 5.

All figures and tables referenced in this memorandum are presented in Attachments 1 and 2, respectively. The borehole logs are presented in Attachment 3.

**Reference:** Hydrogeological Technical Memorandum, Supplementary Groundwater Monitoring and Wetland Assessment, Carriage Crossing Subdivision (400 Millenium Boulevard), Blocks 320 and 326 (Registered Plan 58M-506), Waterloo, Ontario

## 2 Physical Setting

### 2.1 Physiography and Surface Water Features

The Site is located within the physiographic region defined by Chapman and Putnam (2007<sup>1</sup>) as the Oxford Till Plain (Figure 2). The Oxford Till Plain in this area is characterized by drumlinized till plains consisting of sands and silts. Spillways associated with the Grand River are located to the west, north, and east of the Site (Figure 2).

The Site is located in the Grand River Watershed and a tributary to the Grand River begins on the eastern edge of the Site boundary and flows east towards the Grand River (Figure 2). Immediately adjacent to the western boundary of the Site is an unevaluated wetland classified as a Silver Maple Deciduous Swamp (Stantec, 2024<sup>2</sup>).

### 2.2 Regional Geology / Hydrogeology

Figure 3 presents the surficial geology in and surrounding the Site as mapped by the Ontario Geological Society (OGS) (2010<sup>3</sup>). The mapping indicates that the Site is covered by stone-poor, sandy to silty till (Unit 5b, Figure 3) and is surrounded by areas of glaciolacustrine-derived silty to clayey till (Unit 5d, Figure 3) as well as sandy and gravelly glaciofluvial deposits (Units 7a and 7b, Figure 3) and modern alluvial deposits (Unit 19, Figure 3).

Geological and hydrogeological conditions in the region have been mapped and described in the Region of Waterloo Tier Three Water Budget and Local Area Risk Assessment report prepared by Aqua Resource Inc (2012<sup>4</sup>). Subsurface conditions throughout the Region of Waterloo (Region) containing the Site consist of the following major geological formations and associated hydrostratigraphic classifications, with these units being listed from ground surface downward:

**Surficial Outwash Deposits:** Outwash sand and gravel is mapped at surface near the Grand River. Outwash sediment consists of fine- to coarse-grained sand and gravel and reaches a thickness of up to 15 m (units 7a and 7b, Figure 3).

**Aquitard 1 - Port Stanley Till/Upper Maryhill Till:** The Port Stanley till consists of silty to sandy till of glaciolacustrine origin. The Upper Maryhill Till is characterized as a stone-poor, clay rich till.

**Aquifer 1 - Upper Waterloo Moraine Stratified sediment and equivalents, Middle Maryhill Till, Middle Waterloo Moraine Stratified Sediment and Equivalents:** The composition of this unit can vary from silt and fine sand to coarse sand and gravel.

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<sup>1</sup> Chapman, L.J. and D.F. Putnam. 2007. Physiography of southern Ontario. Ontario Geological Survey. Miscellaneous Release - Data 228.

<sup>2</sup> Stantec Consulting Limited. 2024. Environmental Impact Statement Update – 400 Millennium Boulevard, Waterloo, Ontario. November 2024.

<sup>3</sup> Ontario Geological Survey (OGS). 2010. Surficial geology of southern Ontario; Ontario Geological Survey, Miscellaneous Release Data 128 – Revised.

<sup>4</sup> AquaResource Inc. 2012. Region of Waterloo Tier Three Water Budget and Local Area Risk Assessment, Rural Well Fields Characterization Report. Prepared for the Regional Municipality of Waterloo, September 2012.

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**Aquitard 2 - Lower Maryhill Till:** The Lower Maryhill Till is a clay to silty clay till unit and is a regional hydrostratigraphic unit.

**Aquifer 2 - Catfish Creek Outwash:** This unit consists of the lower moraine stratified sediments comprising fine to coarse sand and some gravel. When present, these deposits are found below Aquitard 2, mainly along the eastern flank of the Waterloo Moraine (i.e., Waterloo Hills as shown in Figure 2).

**Aquitard 3 - Catfish Creek Drift:** This unit is nearly continuous throughout the Region. Together with Aquitard 2, these units form a main hydrostratigraphic marker within the Waterloo Moraine. This unit comprises a stony, sandy silt to silty sand till with little clay content, commonly referred to as “hardpan” by water well drillers.

**Aquifer 3 - Pre-Catfish Creek Outwash:** The pre-Catfish Creek outwash is described as coarse-grained, pebble to cobble gravel with a medium to coarse-grained sand matrix.

**Aquitard 4 - Canning Drift, Pre-Canning Till:** This unit is characterized as silty to clayey till and is located intermittently throughout the Region.

**Aquifer 4 - Pre-Canning Outwash:** This unit consists of glaciofluvial and glaciolacustrine sands and gravels, typically found east of the Grand River.

## 3 Methodology

### 3.1 Supplementary Groundwater Monitoring

#### 3.1.1 Borehole Advancement

From March 15 to 22, 2022, Aardvark Drilling Inc. (Aardvark) drilled eight boreholes at the Site under the observation of Stantec personnel, with each borehole being equipped with a single monitoring well (i.e., MW101-22 to MW108-22). Overall, Stantec strategically located the boreholes throughout the Site near the same location as wells/boreholes that were previously installed onsite (LVM, 2006<sup>5</sup>) but are no longer intact. Boreholes were spread across the Site to obtain a spatially representative understanding of soil and groundwater conditions and to evaluate local patterns of groundwater flow. Figure 1 provides the locations of the new boreholes as well as boreholes from the LVM (2006) investigation.

Aardvark drilled the boreholes using a CME 850 rig equipped with a hollow stem auger drilling system. Soil sampling occurred using a 0.6 m long stainless-steel split spoon sampler at 0.75 m intervals for the entire depth of each borehole. The completed depths of the boreholes ranged from 4.4 to 7.6 m below ground surface (BGS). Stantec logged the borehole stratigraphy using the American Society for Testing and Materials (ASTM) guideline for the description and identification of soils. The borehole logs contained descriptions (where relevant and possible) of soil type, texture, colour, structure, consistency, plasticity, moisture content, and other visual and olfactory observations. Attachment 3 provides copies of the borehole logs.

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<sup>5</sup> LVM Naylor. 2006. Hydrogeological and Geotechnical Investigation, Activa Waterloo East Lands, Woolwich Street and Country Squire Road, Waterloo, Ontario. Prepared for Activa Group, February 2006.

Reference: Hydrogeological Technical Memorandum, Supplementary Groundwater Monitoring and Wetland Assessment, Carriage Crossing Subdivision (400 Millenium Boulevard), Blocks 320 and 326 (Registered Plan 58M-506), Waterloo, Ontario

### **3.1.2 Monitoring Well Installations**

Aardvark installed the monitoring wells adhering to the construction requirements as outlined under Ontario Regulation 903 (O.Reg. 903). Installation details for each of the monitoring wells are summarized in Table 1 and on the borehole logs provided in Attachment 3. Each monitoring well is constructed of 50 mm inner diameter, Schedule 40 polyvinyl chloride (PVC) pipe, having a No. 10 slot screen (0.01-inch slot) measuring 3.0 m in length. Backfilling of the screened interval consisted of No. 2 grade silica sand to heights ranging from 0.1 to 0.3 m above the top of screen, followed by bentonite holeplug to ground surface prevent a hydraulic connection from occurring between the screened formation and overlying soils. The completion of each monitoring well involved encasing the pipe stick-up in a lockable steel casing, with the base of this casing being held in place with bentonite holeplug and/or cement. Stantec Geomatics surveyed the ground surface and top-of-pipe elevations at each borehole location to a geodetic benchmark using a Trimble R10-2, having a spatial accuracy of +/- 0.03 m and +/- 0.02 m in the vertical and horizontal plane, respectively.

### **3.1.3 Groundwater Level Monitoring**

Stantec recorded groundwater levels in the eight monitoring wells using a combination of automated and manual measurement techniques. The automated measurement of water levels occurred using a Solinst Edge Levellogger®, which is a single device consisting of a pressure transducer and data logger suspended in the water column of each monitoring well (Logger). The Loggers record total pressure (atmospheric + height of water column) and require correcting using atmospheric pressure data collected from a Solinst Barologger® (suspended in the air of one of the onsite monitoring wells). Figures 4 and 5 present the corrected Logger data recorded at the previously mentioned monitoring wells from March 2022 to July 2024.

Stantec personnel manually measured water levels in the previously mentioned monitoring wells from March 2022 to July 2024, with the results of this monitoring being presented in Table 2. Manual measurements were obtained using a battery operated Heron™ water level meter. Equipped with an electrode connected to a graduated polyethylene tape, Stantec personnel used the meters to measure the depth to water by slowly lowering the electrode into the well until the buzzer sounded. Stantec personnel recorded the water level measurements in metres to the nearest 0.01 m and converted to elevations above mean sea level (AMSL) using surveyed elevation data. The manual water level data were also used to calibrate and check the accuracy of the data recorded by the Levelloggers.

## **3.2 Wetland Assessment**

### **3.2.1 Drive-Point Piezometer Installation**

In April 2023, Stantec personnel installed three multi-level drive-point piezometers, each consisting of a shallow (S) and deep (D) pipe (i.e., DP101-23(S/D) to DP103-23(S/D)), into the wetland adjacent to the Site to assess the potential groundwater and surface water connection between the wetland and the Site. The drive-point piezometers consist of a 19 mm diameter, 0.45 m long steel screen, connected to 25 mm diameter steel risers of varying lengths. The piezometers were hand-driven into the substrate using a fence post driver. Figure 1 presents the locations of the drive-point piezometers, with a summary of the construction details provided in Table 1.

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### **3.2.2 Groundwater and Surface Water Level Monitoring**

Stantec recorded groundwater and surface water levels at the previously mentioned drive-point piezometers using a combination of automated and manual measurement techniques. The automated measurement of water levels occurred using a Solinst Edge Levellogger® or a VanEssen Diver® Logger, both of which are a single device consisting of a pressure transducer and data logger suspended in the water column of each monitoring well. The Loggers record total pressure (atmospheric + height of water column) and require correcting using atmospheric pressure data collected from the same Barologger® used for the monitoring wells.

Figure 6 presents the corrected Logger data recorded at the drive-point piezometers between April 2023 and July 2024. Stantec manually measured water levels in the drive-point piezometers seven times between April 2023 and July 2024, with the results of this monitoring presented in Table 3. Manual measurements were obtained using a similar water level meter as was used for the monitoring wells (Section 3.1.3).

## **4 Local Geology and Hydrostratigraphy**

### **4.1 Geology and Hydrostratigraphy**

Figure 3 presents the surficial geology of the Site as mapped by the OGS (2010), which indicates that the Site is covered by silty to sandy till deposits (unit 5b, Figure 3). In general, the results from the on-Site drilling support this interpretation. Soils at the Site consist of surficial topsoil extending to approximately 0.4 to 0.9 m BGS, which in turn overlies sandy silt and/or clayey silt till. The sandy silt/clayey silt till is interpreted to be part of the Port Stanley Till and/or Upper Maryhill Till. In the central and eastern portions of the Site (e.g. at all wells except MW101-22 and MW105-22), sand was also encountered in the boreholes and are interpreted to represent ice-contact stratified deposits. The till/sand extended to the maximum depth of investigation, which ranged between 4.4 to 7.6 m BGS. An interpretation of the stratigraphy of the Site along Cross-Section A-A' is presented on Figure 7.

Previous soil and groundwater investigations conducted in the Site and on adjacent lands by LVM Naylor (2006<sup>5</sup>) included the drilling of seven boreholes (i.e., BH1 to BH3 and BH7 to BH10; Figure 1). The subsurface soils beneath the topsoil (0.3 to 0.5 m thick) were reported to consist of silt, silt till, and/or clay till, with sand also being encountered in the central and eastern portions of the property. Findings of the LVM Naylor (2006) report are consistent with the drilling completed as a part of Stantec's investigation.

### **4.2 Hydrogeology**

#### **4.2.1 Groundwater Levels**

##### **4.2.1.1 Monitoring Wells**

Data loggers equipped in on-Site monitoring wells have been recording groundwater elevations since March 2022. Figures 4 and 5 present hydrographs of groundwater elevation fluctuations recorded in the monitoring wells, which have ranged from 329.0 to 333.1 m AMSL. In May 2022, heaving occurred at MW108-22, resulting in the top of casing being raised by approximately 0.7 m and the hydrographs were adjusted to account for this change in elevation. In general, groundwater elevations in the monitoring wells exhibited seasonal variability, with higher groundwater elevations during the late winter to spring and lower

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groundwater elevations during the late summer and fall. This seasonal variability in groundwater elevation fluctuations is typical of shallow groundwater systems in southern Ontario.

The interpreted high groundwater contours are presented on Figure 8, which are derived using the highest groundwater measurements recorded in the on-Site monitoring wells and drive-point piezometers between March 2022 and July 2024. Figure 8 indicates that groundwater levels are highest in the northwest portion of the Site and lowest in the southeast portion of the Site.

#### **4.2.1.2 Drive-Point Piezometers**

Figure 6 presents a summary of the groundwater elevations at the drive-point piezometers located in the wetland to the west of the Site. In the shallow drive-point piezometers, groundwater elevations range between 330.9 and 332.5 m AMSL, with these groundwater elevations being reflective of the water table surface. Groundwater elevations in the shallow piezometers are generally consistent with surface water elevations adjacent to the piezometer, suggesting that during periods when ponded water is observed in the wetland that the water table intersects the wetland substrate. Vertical hydraulic gradients at each of the multi-level drive-point piezometers fluctuated from predominantly downward (recharge condition) to periodically upward (discharge condition), with gradients ranging from 0.55 to -1.00 over the monitoring period (March 2022 and July 2024). Overall, average vertical hydraulic gradients recorded at DP101-23(S/D), DP102-23(S/D), and DP103-23(S/D) have ranged from -0.20 to -0.77, suggesting that the wetland predominantly functions as a groundwater recharge feature.

#### **4.2.2 Groundwater Flow**

Groundwater flow contours based on manual water level measurements obtained from monitoring wells and drive-point piezometers on May 25, 2023, are presented on Figure 9. Groundwater flow is generally from the northwest to the southeast, with flow moving away from the wetland and across the Site towards Millennium Boulevard. These results indicate that the future development of the Site will not have an impact on existing groundwater flows that may sustain the wetland, given that these potential groundwater inputs originate from the lands to the northeast of the Site.

## **5 Conclusions**

The following conclusions are provided based on the completed supplementary groundwater monitoring program and wetland assessment:

1. Stratigraphic conditions beneath the Site consist predominantly of surficial topsoil overlying native deposits of sandy silt and/or clayey silt till. In the central and eastern portions of the Site, sand is encountered in the glacial till deposits.
2. Groundwater elevations at the on-Site monitoring wells range between 329.0 to 333.1 m AMSL depending on the location and season. Season variability was observed at all monitoring wells, with higher groundwater elevations occurring during the late winter to spring and the lowest groundwater elevations occurring during the late summer and fall. This seasonal variability in groundwater elevation fluctuations is typical of shallow groundwater systems in southern Ontario.

**Reference:** Hydrogeological Technical Memorandum, Supplementary Groundwater Monitoring and Wetland Assessment, Carriage Crossing Subdivision (400 Millenium Boulevard), Blocks 320 and 326 (Registered Plan 58M-506), Waterloo, Ontario

3. Groundwater elevations measured at the drive-point piezometers in the wetland immediately adjacent to the western boundary of the Site have ranged between 330.9 and 332.5 m AMSL. Although measured vertical hydraulic gradients are occasionally upward beneath the wetland, suggesting the presence of groundwater discharge conditions, overall, average vertical hydraulic gradients throughout the monitoring period (March 2022 and July 2024) have ranged from -0.20 to -0.77 (downward), suggesting that the wetland predominantly functions as a groundwater recharge feature.
4. Groundwater flow direction is from the northwest to the southeast away from the wetland towards Millennium Boulevard. The direction of groundwater flow indicates that development of the Site is not expected to have an impact on pre-existing groundwater flow that may sustain the wetland. These results indicate that the future development of the Site will not have an impact on existing groundwater flows that may sustain the wetland, given that these potential groundwater inputs originate from the lands to the northeast of the Site.

Stantec trusts that this memorandum sufficiently highlights the results of the supplementary groundwater monitoring and wetland assessment programs.

Sincerely,

**Stantec Consulting Ltd.**

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by Healey,  
Allison  
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**Allison Healey** M.Sc., P.Geo.  
Hydrogeologist  
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Allison.Healey@stantec.com



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by Whitehead,  
Grant  
Date: 2024.11.14  
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**Grant Whitehead** MES, P.Geo. (Limited)  
Senior Hydrogeologist  
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Attachments: Attachment 1 – Figures  
Attachment 2 – Tables  
Attachment 3 – Borehole Logs

November 14, 2024  
Peter Armbruster

**Reference:** Hydrogeological Technical Memorandum, Supplementary Groundwater Monitoring and Wetland Assessment, Carriage Crossing Subdivision (400 Millenium Boulevard), Blocks 320 and 326 (Registered Plan 58M-506), Waterloo, Ontario

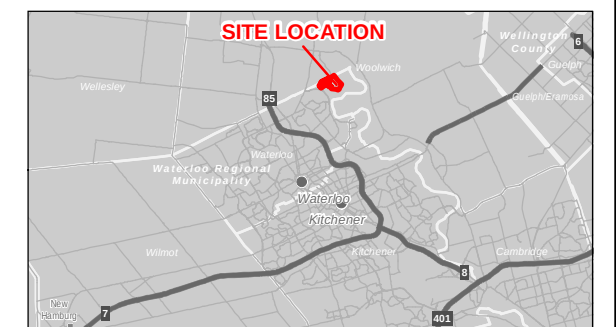
## **Attachment 1      Figures**



- Monitoring Well (Stantec, 2022)
- Borehole (Naylor, 2006)
- Drive-point Piezometer (Stantec, 2022)
- Proposed Site Plan
- Cross-Section Location
- Topographic Contour (1m Interval)
- Topographic Contour 0.5m Interval)
- Wetland - Not evaluated per Ontario Wetland Evaluation System
- Wetland - Evaluated (GRCA)
- Site Boundary

0 50 100 metres  
1:2,500 (At original document size of 11x17)

- Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
  2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2017.
  3. Orthoimagery © First Base Solutions, 2022. Imagery Date, 2020.



Project Location: Waterloo, ON

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Prepared by PRM on 2023-10-26

Technical Review by GW on 2023-10-26

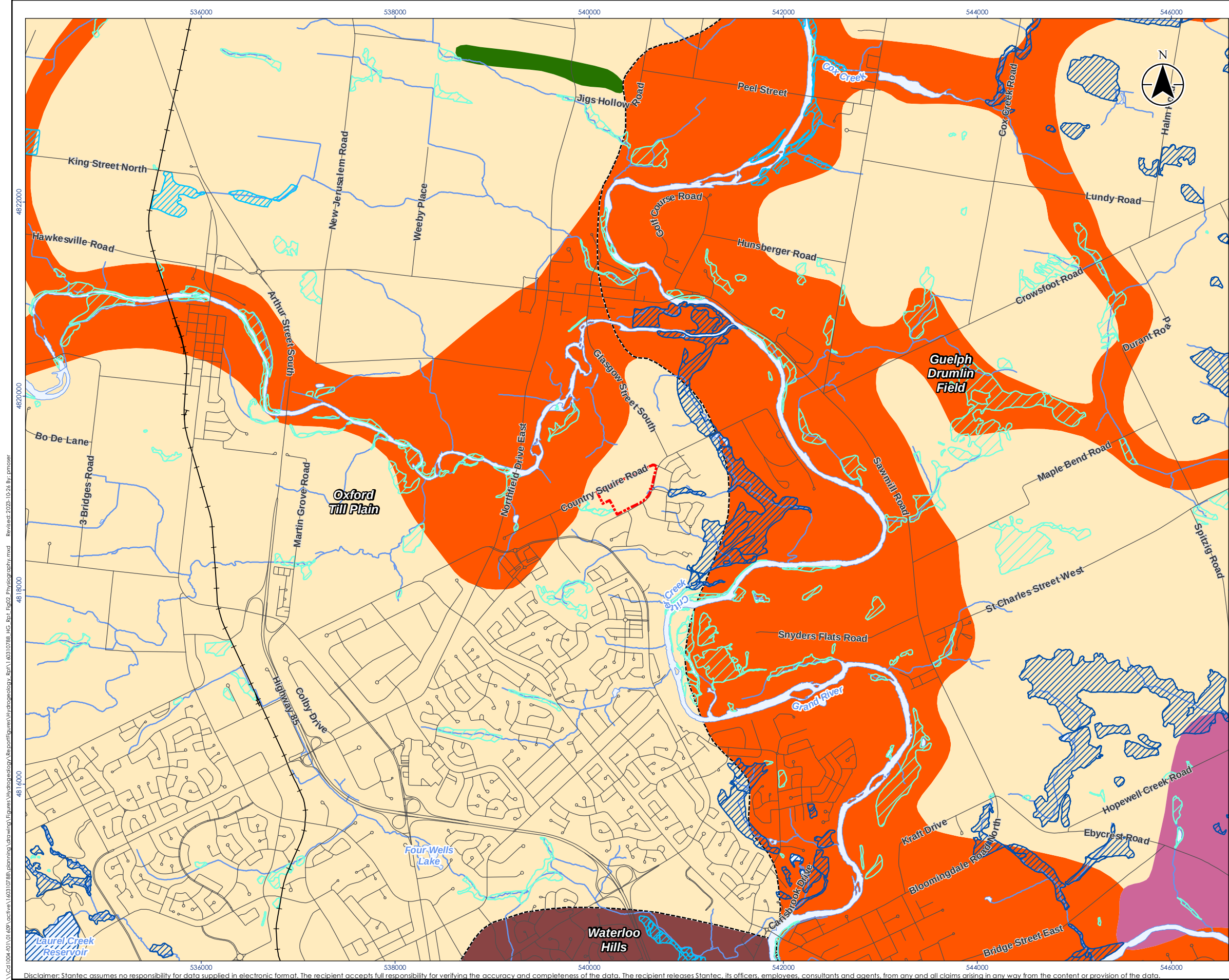
Client/Project: ACTIVA HOLDINGS INC. SUPPLEMENTARY GROUNDWATER MONITORING 400 MILLENNIUM BOULEVARD, WATERLOO

Figure No.

1

Title

Site Location



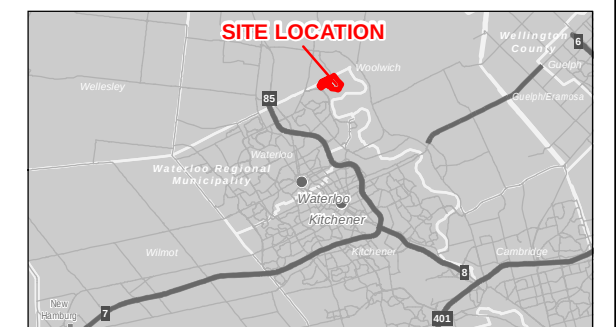
- Site Boundary
- Road
- Railway
- Watercourse
- Waterbody
- Wetland - Evaluated (Provincial)
- Wetland - Evaluated (Other)
- Wetland - Not evaluated per Ontario Wetland Evaluation System

#### Physiography

- 13: Eskers
- 6: Till Plains (Drumlinized)
- 4: Kame Moraines
- 3: Spillways
- 2: Till Moraines
- Physiographic Region Boundary

0 1 2 km  
1:40,000 (At original document size of 11x17)

- Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
  2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2017.
  3. Chapman, L.J. and Putnam, D.F. 2007. Physiography of southern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 228.



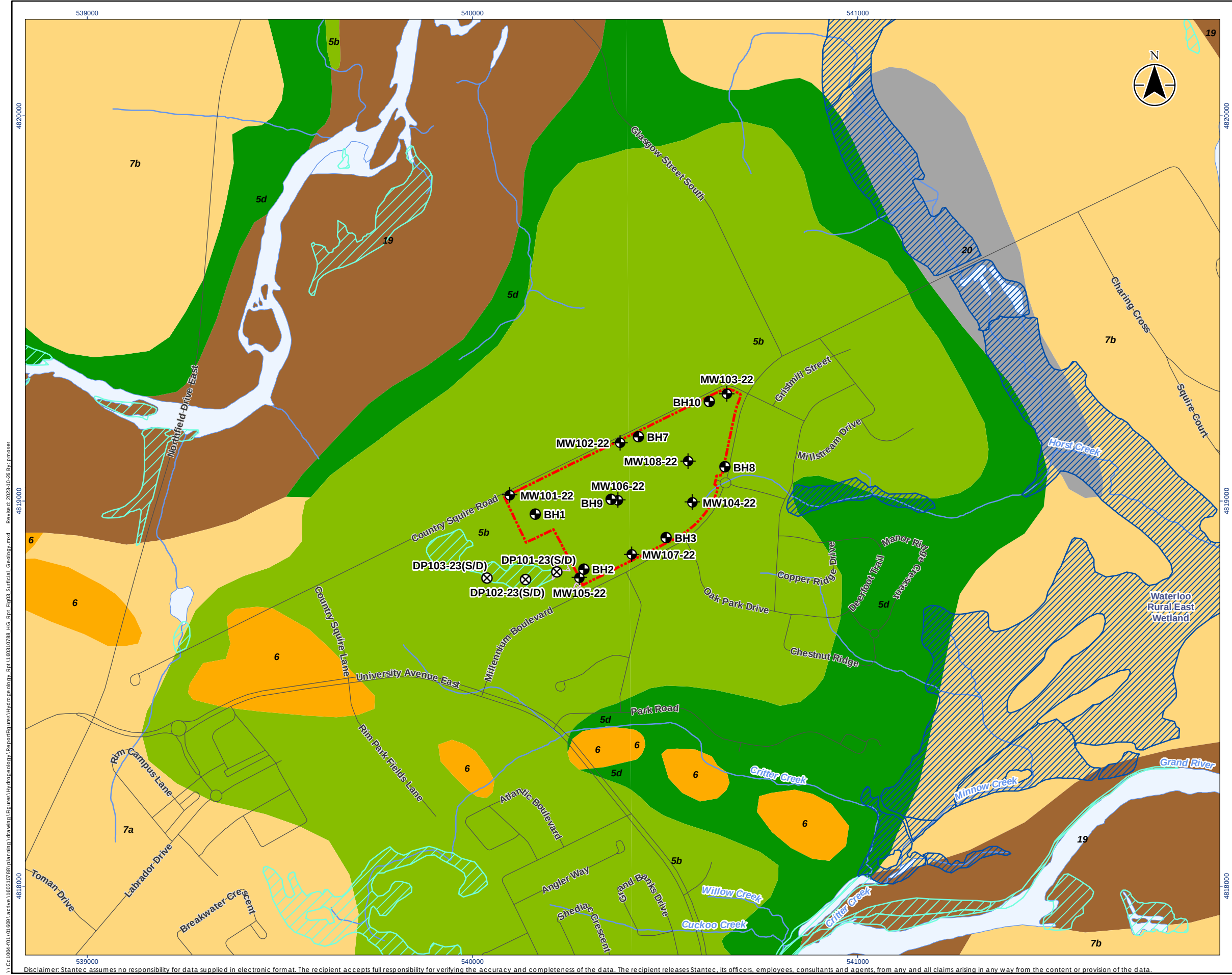
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SUPPLEMENTARY GROUNDWATER MONITORING  
400 MILLENNIUM BOULEVARD, WATERLOO

Figure No.  
2

Title  
Physiography



Site Boundary

Monitoring Well (Stantec, 2022)

Borehole (Naylor, 2006)

Drive-point Piezometer (Stantec, 2022)

Road

Watercourse

Waterbody

Evaluated-Provincial

Wetland - Not evaluated per Ontario Wetland Evaluation System

Wetland - Evaluated (GRCA)

**Surficial Geology**

20: Organic deposits

19: Modern alluvial deposits

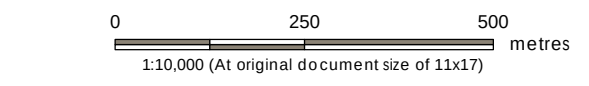
7a: Glaciofluvial deposits (Sandy deposits)

7b: Glaciofluvial deposits (Gravelly deposits)

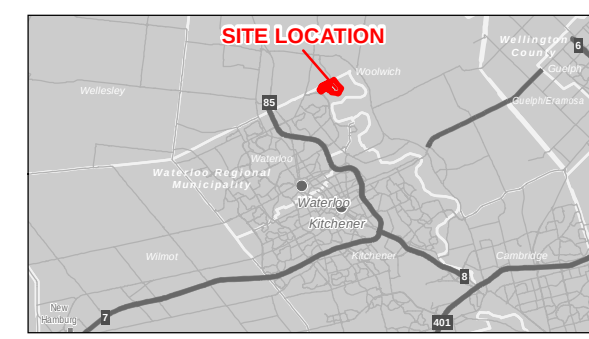
6: Ice-contact stratified deposits

5b: Stone-poor, carbonate-derived silty to sandy till

5d: Glaciolacustrine-derived silty to clayey till



- Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
  2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2017.
  3. Ontario Geological Survey 2010. Surficial geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128-REV ISBN 978-1-4435-2483-4.



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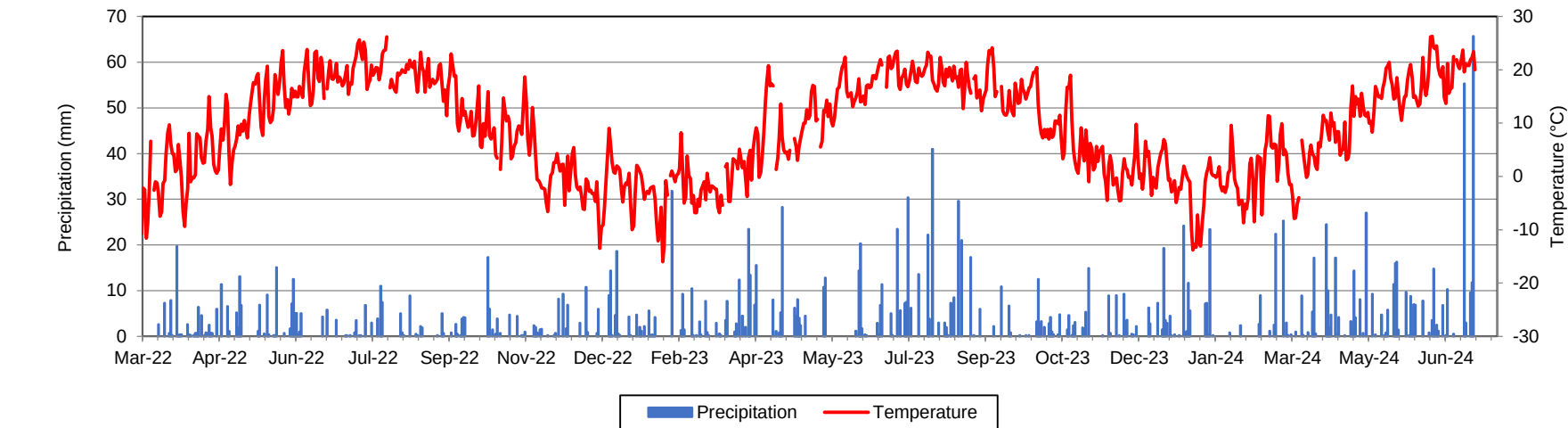
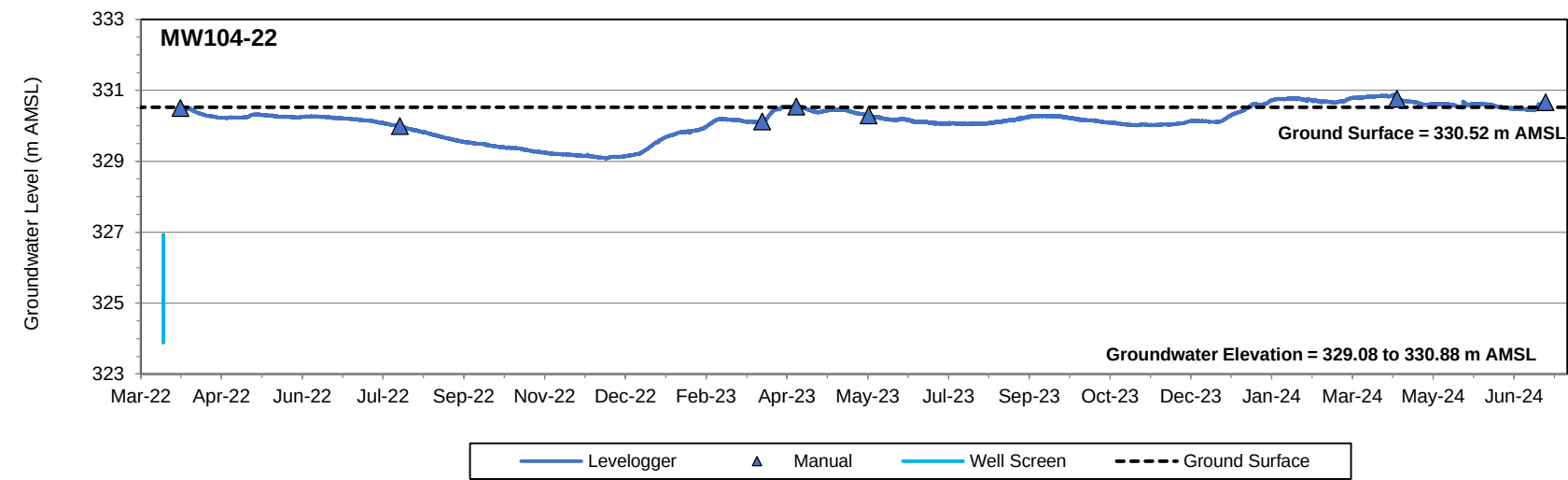
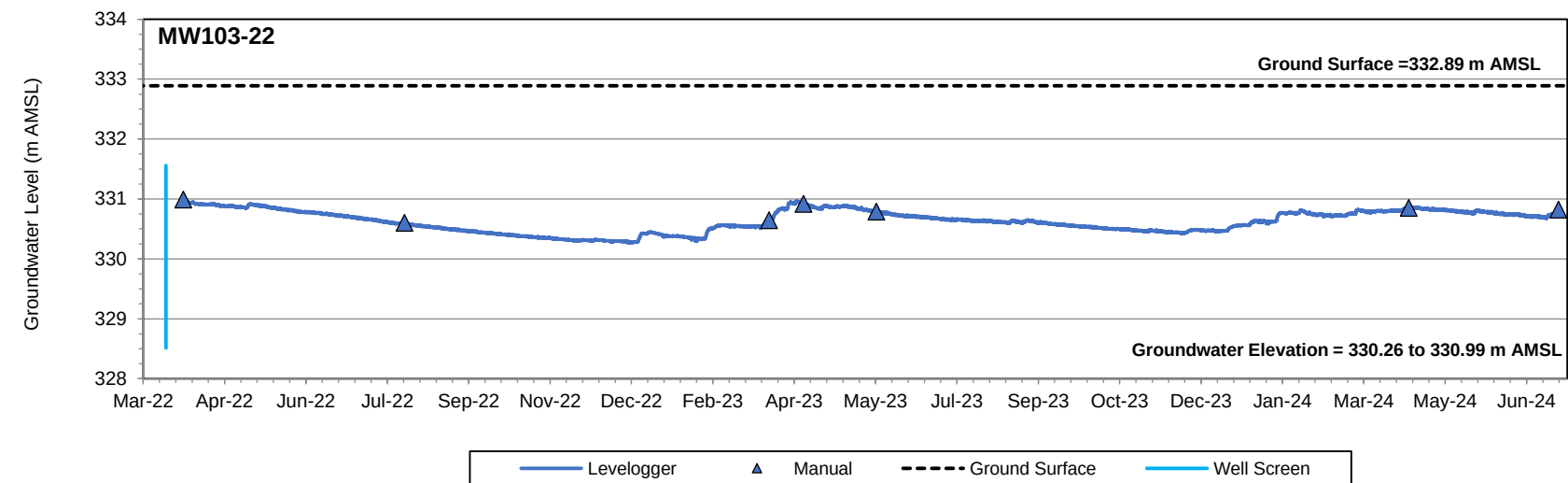
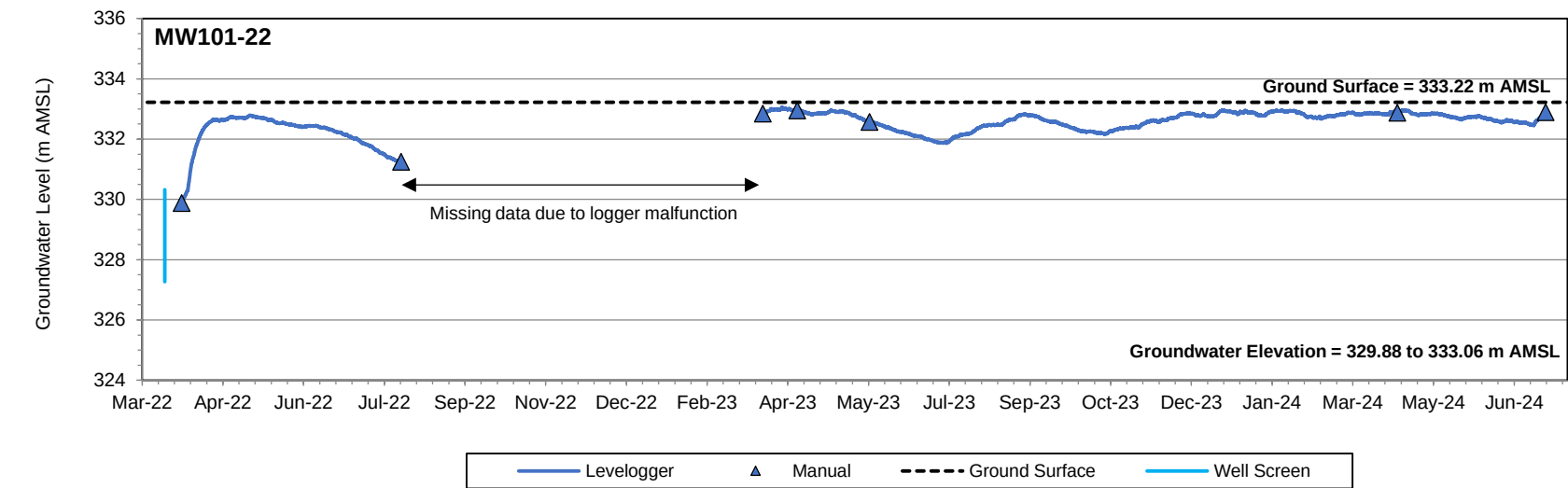
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Technical Review by GW on 2023-10-26

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SUPPLEMENTARY GROUNDWATER MONITORING  
400 MILLENNIUM BOULEVARD, WATERLOO

Figure No.  
3

Title  
Surficial Geology

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**Notes:**

Precipitation and temperature data obtained from Environment Canada for the Kitchener-Waterloo Climate Station (Station ID 6144239). Accessed July 2024.

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400 Millennium Boulevard, Waterloo

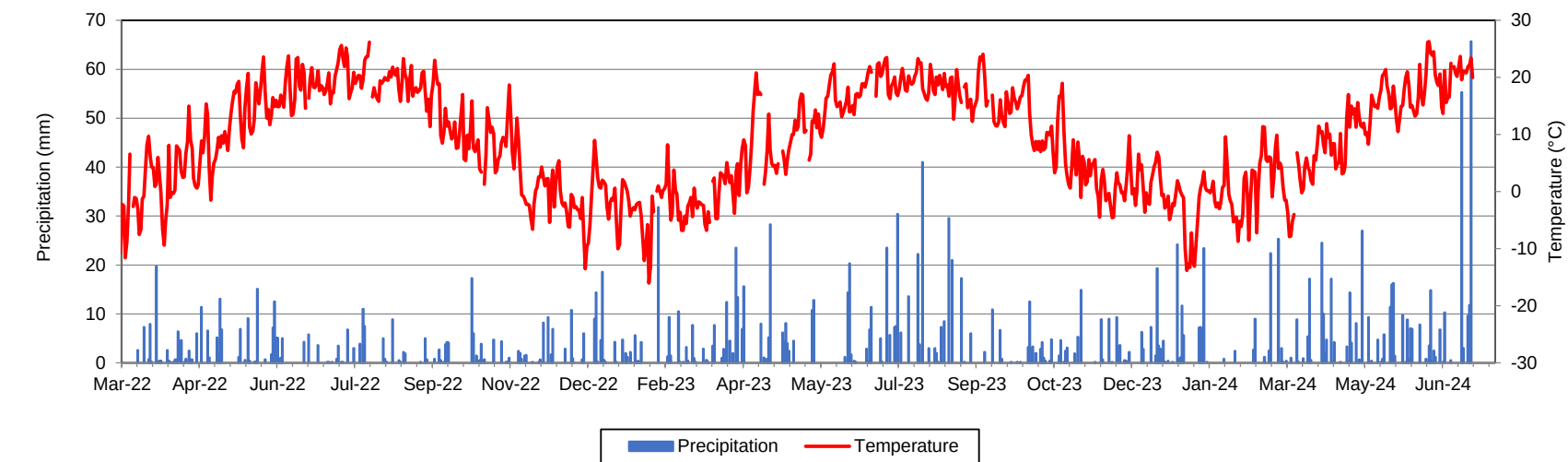
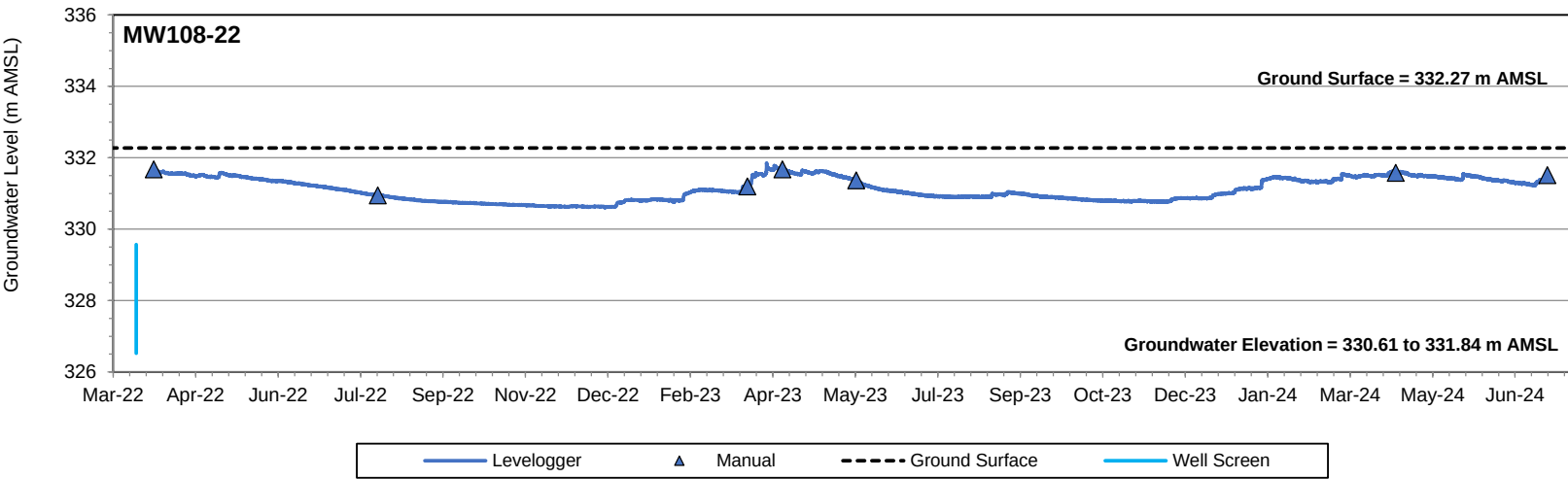
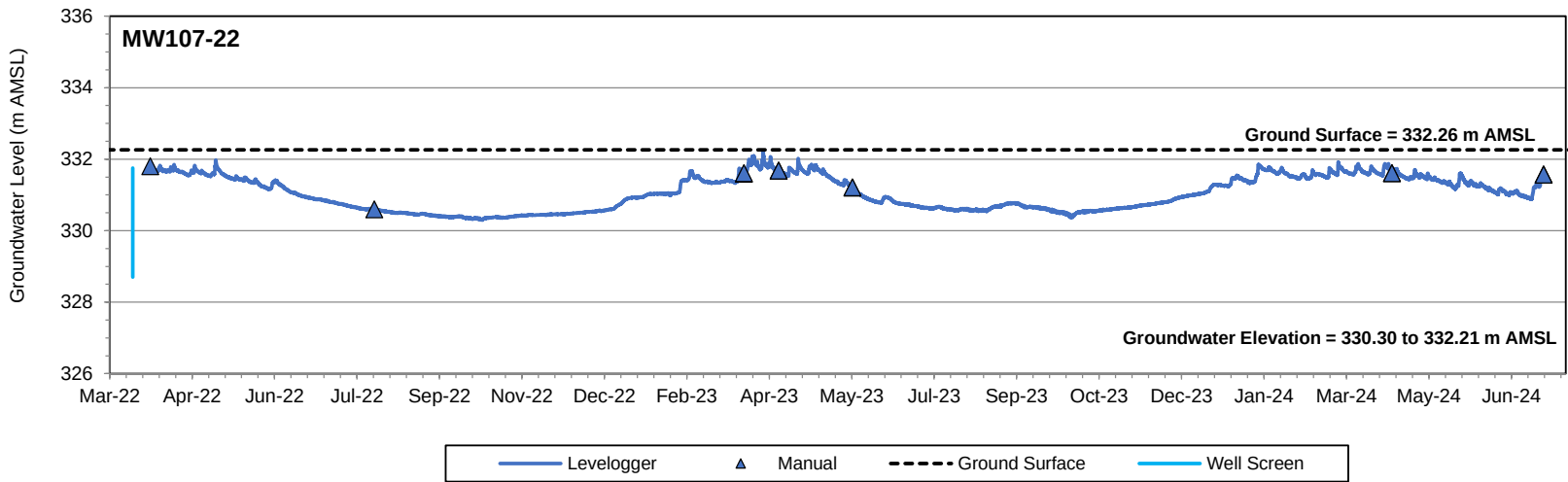
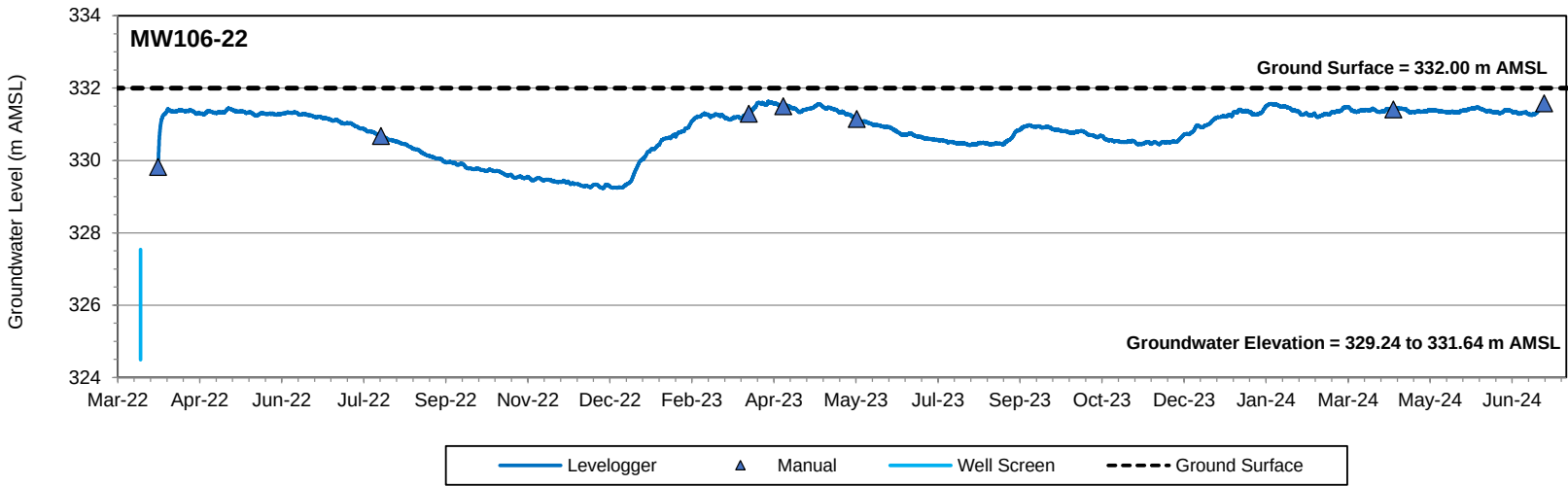
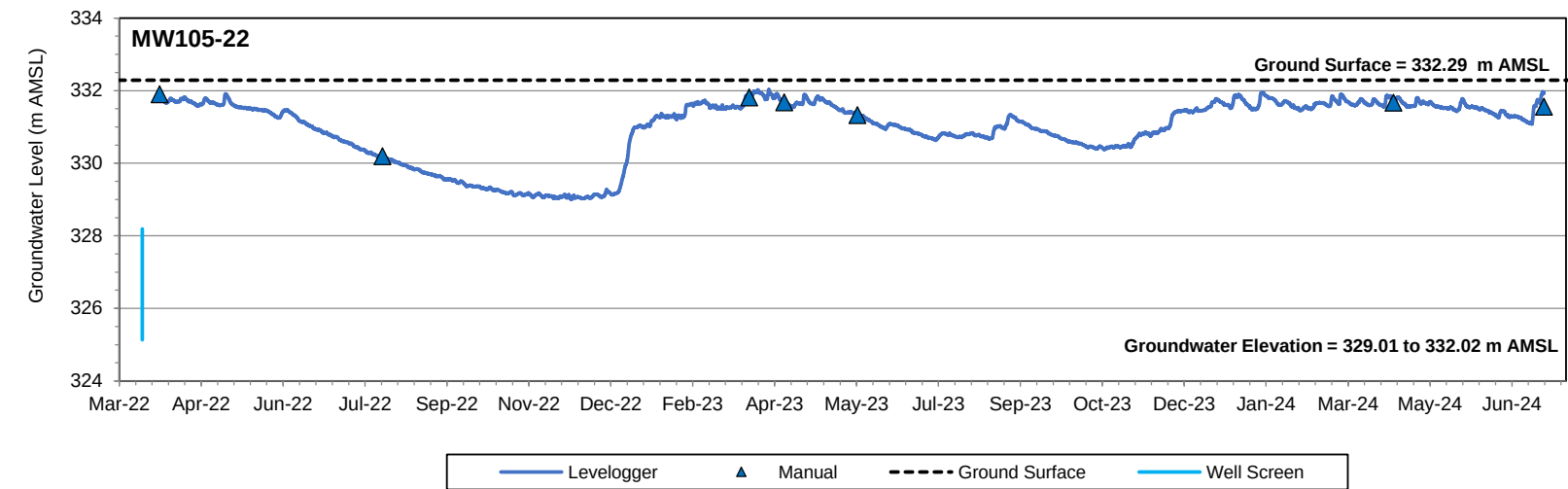
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**Title**

**HYDROGRAPHS**  
**MW101-22 to MW104-22**





**Notes:**

Precipitation and temperature data obtained from Environment Canada for the Kitchener-Waterloo Climate Station (Station ID 6144239). Accessed July 2024.

**Client/Project**

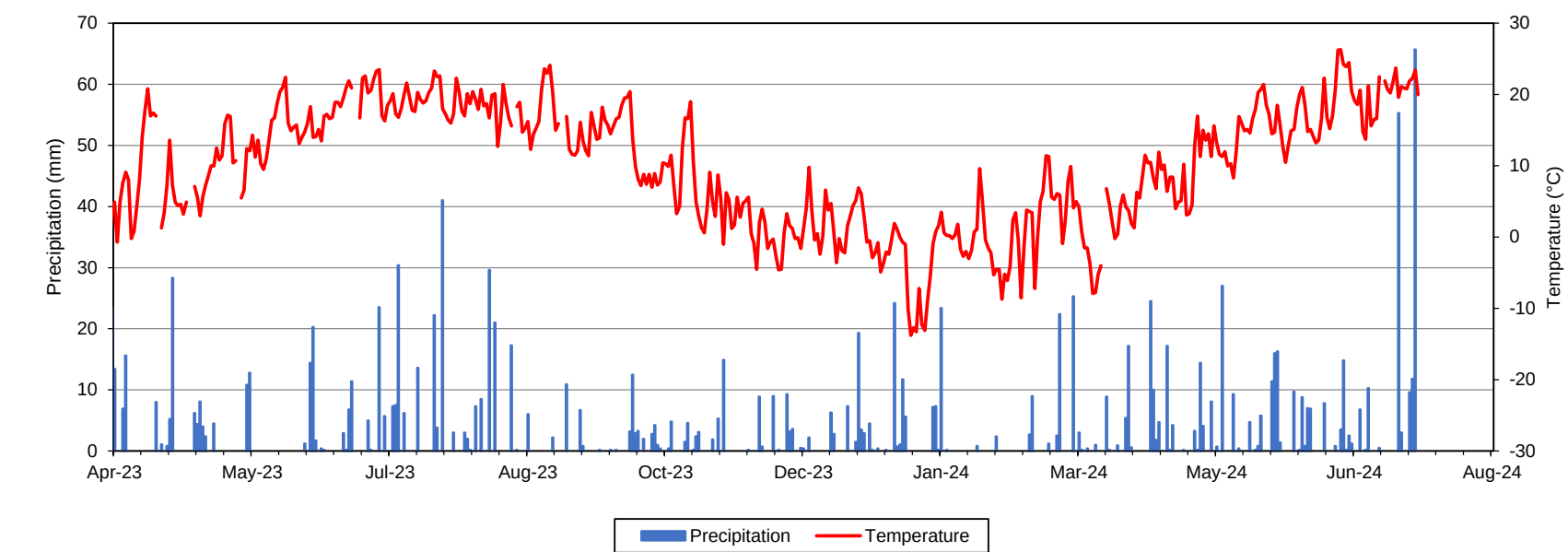
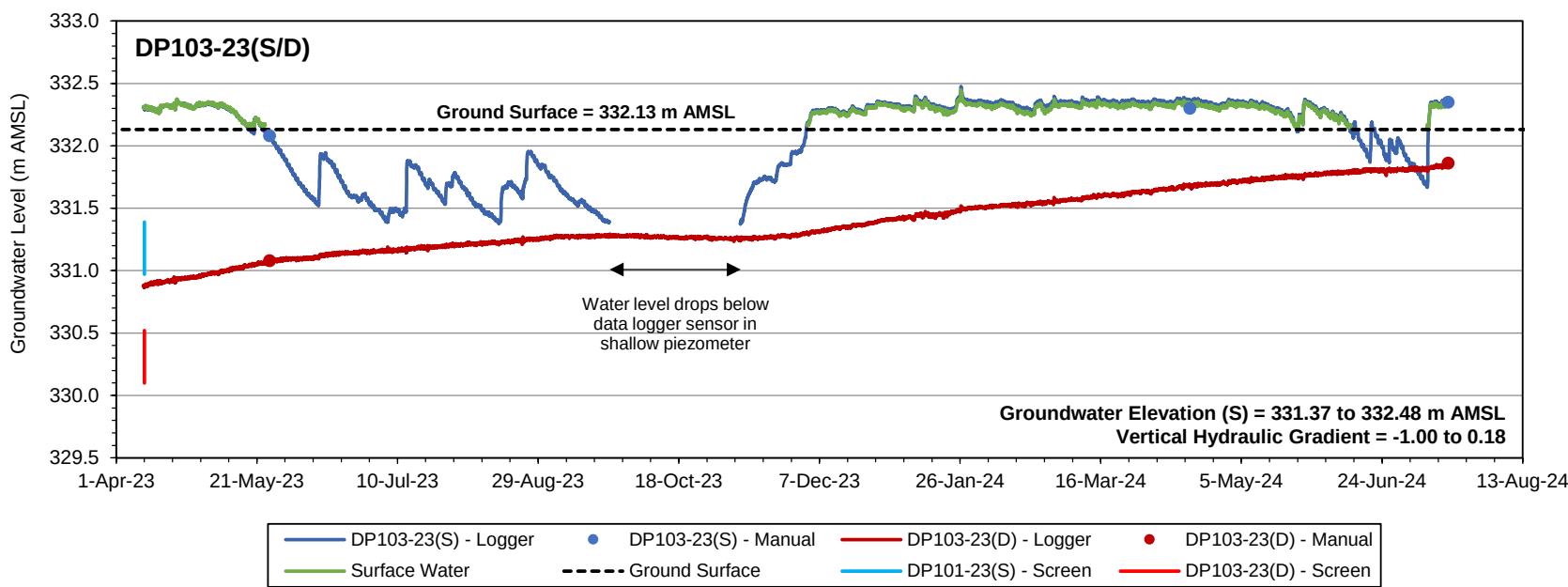
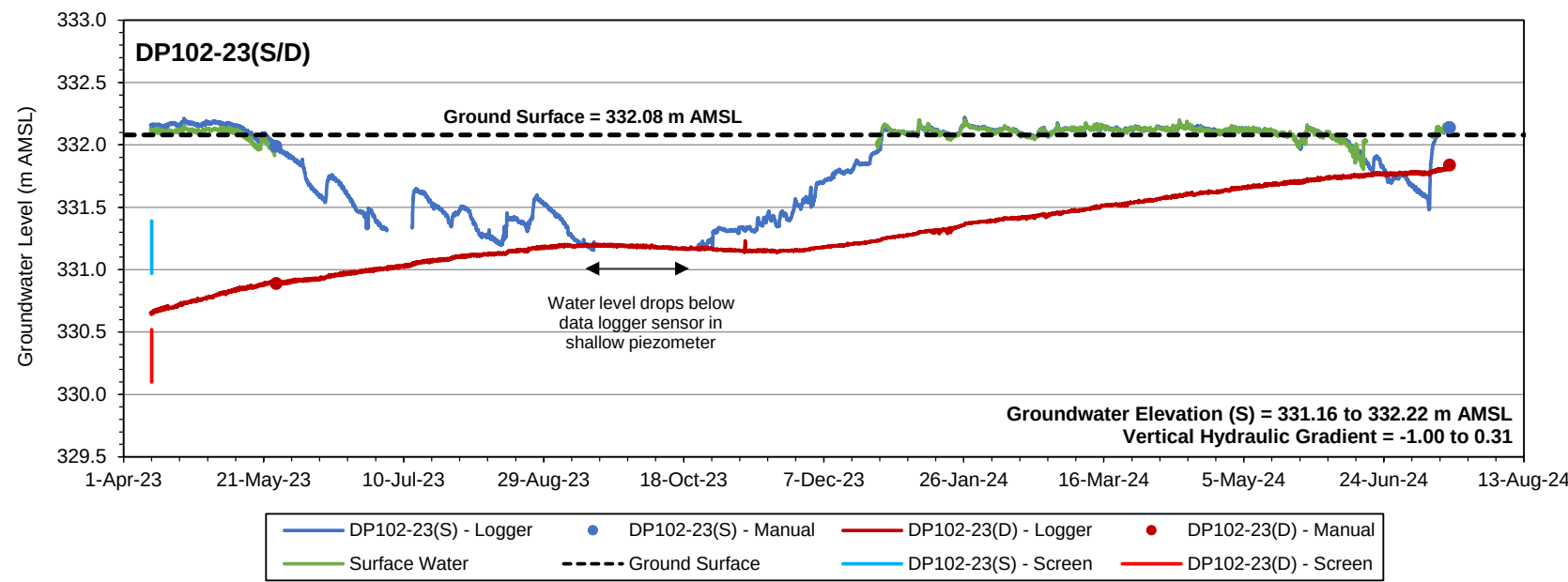
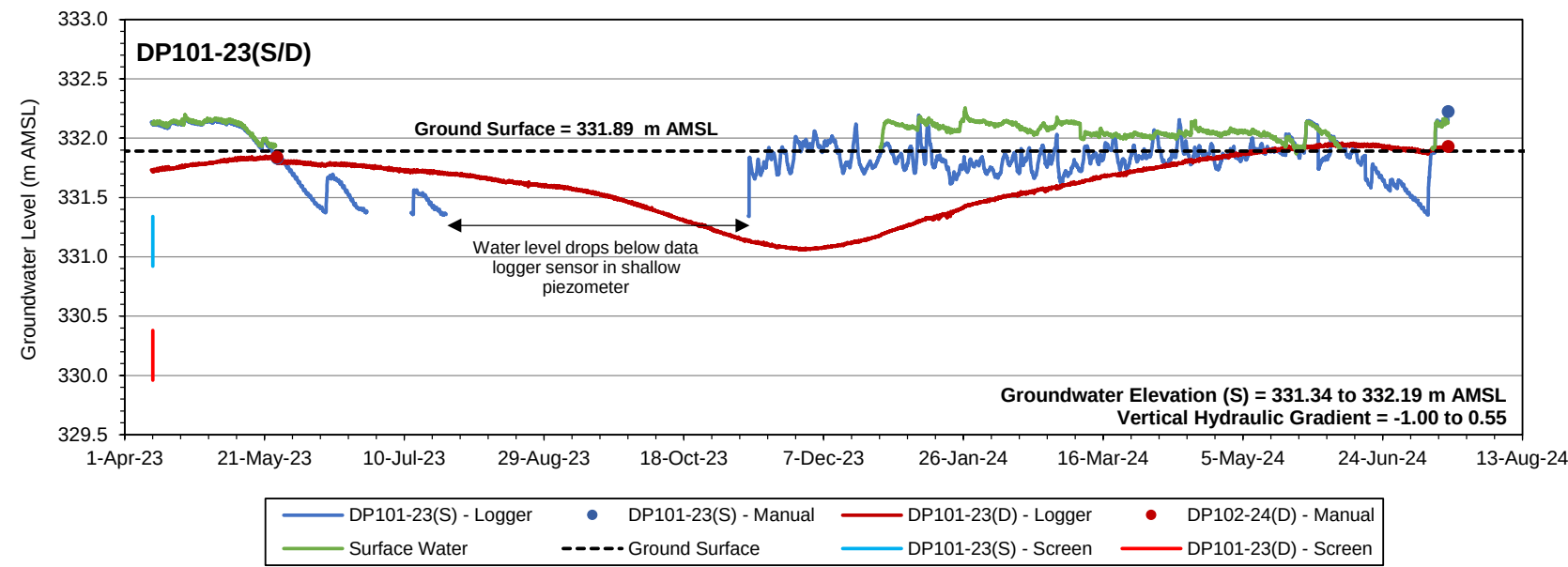
Activa Holdings, Inc  
Supplementary Groundwater Monitoring  
400 Millennium Boulevard, Waterloo

**Figure No.**

5

**Title**

**HYDROGRAPHS**  
**MW5-02 to MW103-22**



**Notes:**

1) Precipitation and temperature data obtained from Environment Canada for the Kitchener-Waterloo Climate Station (Station ID 6144239). Accessed November 2024.  
2) Unrepresentative dry and freezing data have been removed form the hydrographs.

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Supplementary Groundwater Monitoring  
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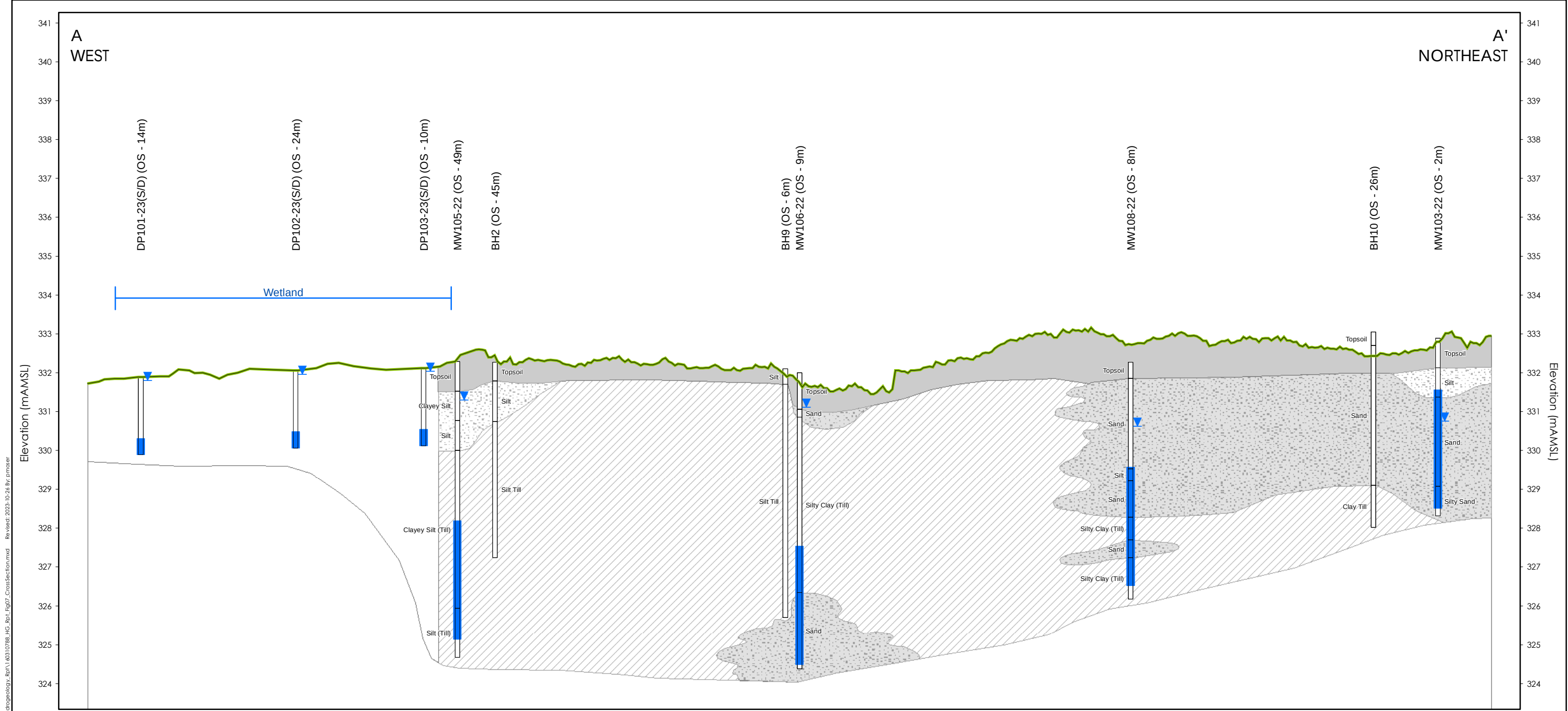
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6

**Title**

**HYDROGRAPHS  
DP101-23 to DP103-23**





**Notes**

1. Groundwater elevations measured by Stantec on May 25, 2023.

2. Topography derived from the Southwestern Ontario Orthophotography Project (2015) – Breaklines and Masspoints data © Queen's Printer for Ontario, 2015.

**Well ID (Offset)**

**Stratigraphy**

**Water Level (May 25, 2023)**

**Well Screen**

**Legend**

Topsoil (Silt)

Ice-Contact Stratified Deposits (Silty Sand to Sand)

Port Stanley Till (Sandy Silt to Silty Sand Till) and/or Upper Maryhill Till (Clayey Silt to Silty Clay Till)

Silt

Insufficient Information

**Surficial Geology**

5b: Stone-poor, carbonate-derived silty to sandy till

25x Vertical Exaggeration

0 40 80 metres

1:2,500 (At original document size of 11x17)



Project Location 160310788 REVA  
Waterloo, ON Prepared by pmoser on 2023-10-26  
Technical Review by GW on 2023-10-26

Client/Project  
ACTIVA HOLDINGS INC.  
SUPPLEMENTARY GROUNDWATER MONITORING  
400 MILLENNIUM BOULEVARD, WATERLOO

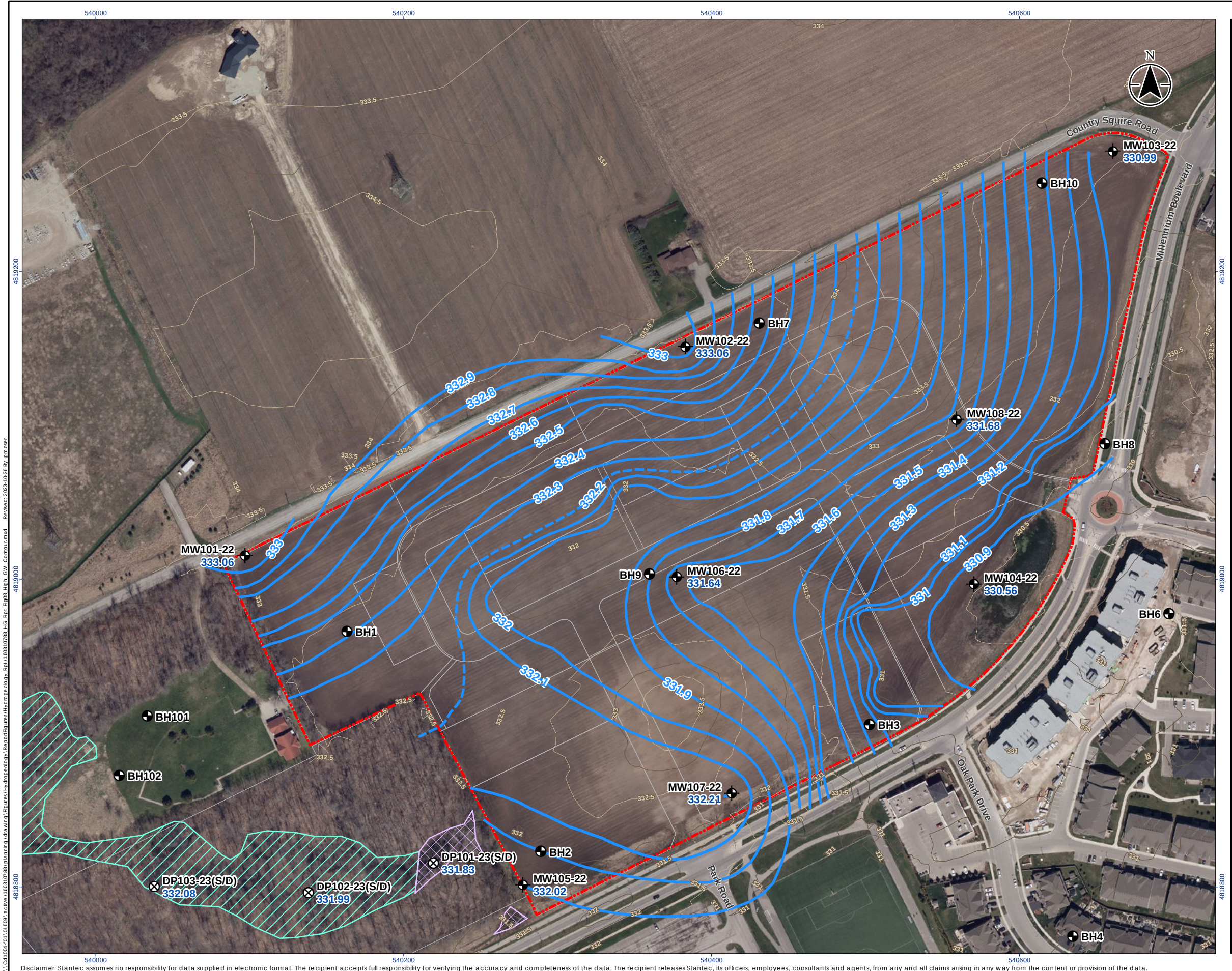
Figure No.

7

Title

Cross-Section A-A'

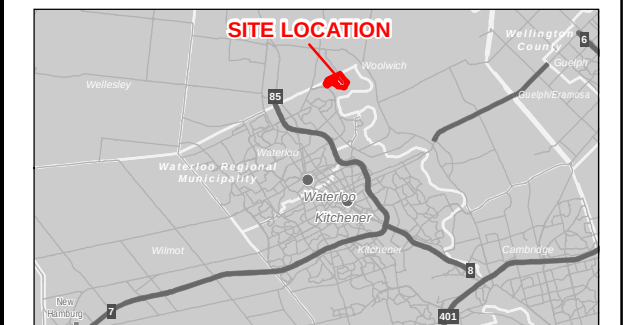
Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.



- 330.65 Groundwater Elevation (m AMSL)
- Monitoring Well (Stantec, 2022)
  - Borehole (Naylor, 2006)
  - Drive-point Piezometer (Stantec, 2022)
  - Proposed Site Plan
  - High Groundwater Contour
  - Topographic Contour (1m Interval)
  - Topographic Contour (0.5m Interval)
  - Wetland - Not evaluated per Ontario Wetland Evaluation System
  - Wetland - Evaluated (GRCA)
  - Site Boundary

0 50 100 metres  
1:2,500 (At original document size of 11x17)

- Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
  2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2017.
  3. Orthoimagery © First Base Solutions, 2022. Imagery Date, 2020.
  4. Groundwater contours derived using highest groundwater elevations observed in on-site monitoring wells and drive-point piezometers between March 2022 and May 2023.

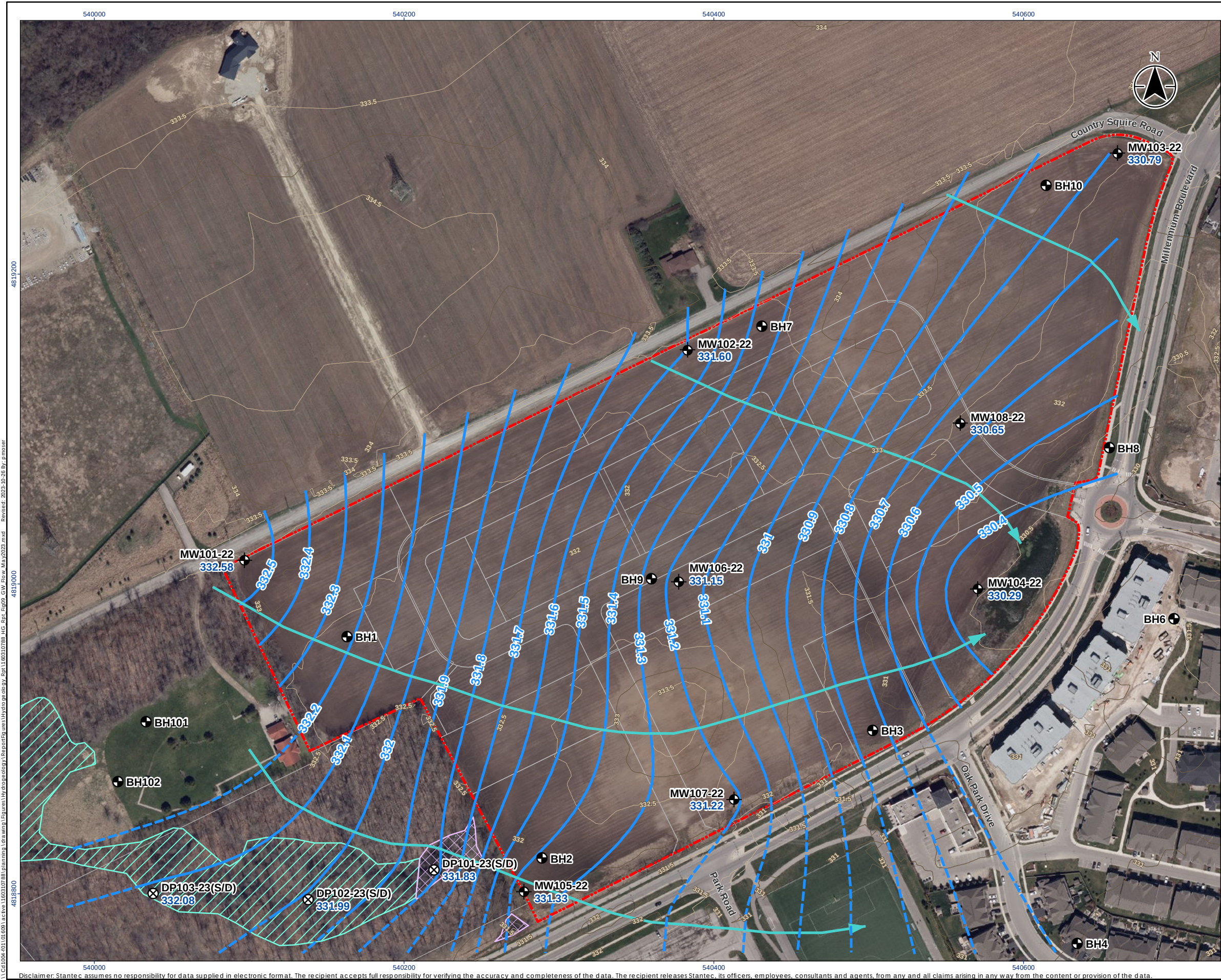


Project Location: Waterloo, ON  
160310788 REV F  
Prepared by PRM on 2023-10-26  
Technical Review by GW on 2023-10-26

Client/Project: ACTIVA HOLDINGS INC.  
SUPPLEMENTARY GROUNDWATER MONITORING  
400 MILLENNIUM BOULEVARD, WATERLOO

Figure No.: 8

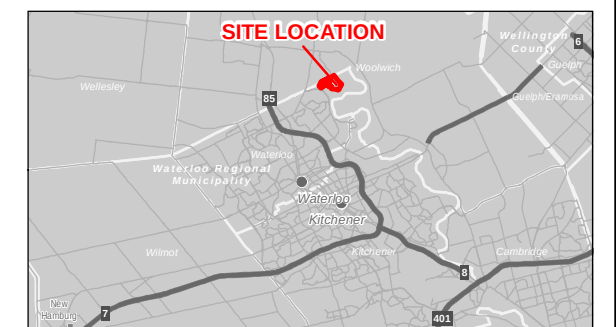
Title: High Groundwater Contours



- 330.65 Groundwater Elevation (m AMSL)
- Monitoring Well (Stantec, 2022)
  - Borehole (Naylor, 2006)
  - Drive-point Piezometer (Stantec, 2022)
  - Proposed Site Plan
  - Topographic Contour (1m Interval)
  - Topographic Contour (0.5m Interval)
  - Interpreted Direction of Groundwater Flow
  - Groundwater Contour (May 25, 2023)
  - Wetland - Not evaluated per Ontario Wetland Evaluation System
  - Wetland - Evaluated (GRCA)
  - Site Boundary

0 50 100 metres  
1:2,500 (At original document size of 11x17)

- Notes
- Coordinate System: NAD 1983 UTM Zone 17N
  - Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2017.
  - Orthoimagery © First Base Solutions, 2022. Imagery Date, 2020.



Project Location  
Waterloo, ON

160310788 REV F  
Prepared by PRM on 2023-10-26  
Technical Review by GW on 2023-10-26

Client/Project  
ACTIVA HOLDINGS INC.  
SUPPLEMENTARY GROUNDWATER MONITORING  
400 MILLENNIUM BOULEVARD, WATERLOO

Figure No.  
9

Title  
Groundwater Flow  
(May 25, 2023)

November 14, 2024  
Peter Armbruster

**Reference:** Hydrogeological Technical Memorandum, Supplementary Groundwater Monitoring and Wetland Assessment, Carriage Crossing Subdivision (400 Millenium Boulevard), Blocks 320 and 326 (Registered Plan 58M-506), Waterloo, Ontario

## **Attachment 2      Tables**

TABLE 1  
WELL CONSTRUCTION DETAILS

| Well ID                 | UTM Coordinates |         | Elevations             |                         | Source                  | Well Stick-up (m) | Well Depth (m BTOC) | Well Depth (m BGS) | Well Base Elevation (m AMSL) | Screened Interval                 |        |                                      |        | Screened Material Description <sup>(a)</sup><br>(% of Screened Interval) |
|-------------------------|-----------------|---------|------------------------|-------------------------|-------------------------|-------------------|---------------------|--------------------|------------------------------|-----------------------------------|--------|--------------------------------------|--------|--------------------------------------------------------------------------|
|                         | Northing        | Easting | Top of Casing (m AMSL) | Ground Surface (m AMSL) |                         |                   |                     |                    |                              | Top Elevation<br>(m BGS) (m AMSL) |        | Bottom Elevation<br>(m BGS) (m AMSL) |        |                                                                          |
| MONITORING WELLS        |                 |         |                        |                         |                         |                   |                     |                    |                              |                                   |        |                                      |        |                                                                          |
| MW101-22                | 4819015         | 540097  | 334.34                 | 333.22                  | Stantec, 2022           | 1.12              | 7.07                | 5.95               | 327.27                       | 2.90                              | 330.32 | 5.95                                 | 327.27 | CLAYEY SILT TILL (50%), SILT TILL (50%)                                  |
| MW102-22                | 4819151         | 540383  | 334.37                 | 333.25                  | Stantec, 2022           | 1.12              | 5.42                | 4.30               | 328.95                       | 1.25                              | 332.00 | 4.30                                 | 328.95 | SAND (100%), CLAYEY SILT TILL (50%)                                      |
| MW103-22                | 4819278         | 540661  | 333.90                 | 332.89                  | Stantec, 2022           | 1.01              | 5.39                | 4.38               | 328.51                       | 1.33                              | 331.56 | 4.38                                 | 328.51 | SAND (75%), SILTY SAND (25%)                                             |
| MW104-22                | 4818997         | 540570  | 331.44                 | 330.52                  | Stantec, 2022           | 0.92              | 7.56                | 6.64               | 323.88                       | 3.59                              | 326.93 | 6.64                                 | 323.88 | SILTY CLAY TILL (100%)                                                   |
| MW105-22                | 4818801         | 540277  | 333.29                 | 332.29                  | Stantec, 2022           | 1.00              | 8.15                | 7.15               | 325.14                       | 4.10                              | 328.19 | 7.15                                 | 325.14 | CLAYEY SILT TILL (67%), SILT TILL (33%)                                  |
| MW106-22                | 4819001         | 540377  | 332.90                 | 332.00                  | Stantec, 2022           | 0.90              | 8.41                | 7.51               | 324.49                       | 4.46                              | 327.54 | 7.51                                 | 324.49 | SILTY CLAY TILL (50%), SAND (50%)                                        |
| MW107-22                | 4818861         | 540413  | 333.35                 | 332.26                  | Stantec, 2022           | 1.09              | 4.65                | 3.56               | 328.70                       | 0.51                              | 331.75 | 3.56                                 | 328.70 | CLAYEY SILT (40%), SAND (40%), SILT TILL (20%)                           |
| MW108-22                | 4819104         | 540559  | 333.17                 | 332.27                  | Stantec, 2022           | 0.90              | 6.65                | 5.75               | 326.52                       | 2.70                              | 329.57 | 5.75                                 | 326.52 | SAND (50%), SILTY CLAY TILL (50%)                                        |
|                         |                 |         | 333.89                 | 332.27                  | Field Measurement, 2023 | 1.62              | 6.65                | 5.03               | 327.24                       | 1.98                              | 330.29 | 5.03                                 | 327.24 |                                                                          |
|                         |                 |         |                        |                         |                         |                   |                     |                    |                              |                                   |        |                                      |        |                                                                          |
| DRIVE-POINT PIEZOMETERS |                 |         |                        |                         |                         |                   |                     |                    |                              |                                   |        |                                      |        |                                                                          |
| DP101-23(S)             | 4818815         | 540219  | 333.16                 | 331.89                  | -                       | 1.27              | 2.24                | 0.97               | 330.92                       | 0.55                              | 331.34 | 0.97                                 | 330.92 | -                                                                        |
| DP101-23(D)             | 4818815         | 540220  | 333.44                 | 331.88                  | -                       | 1.56              | 3.48                | 1.92               | 329.96                       | 1.50                              | 330.38 | 1.92                                 | 329.96 | -                                                                        |
| DP102-23(S)             | 4818796         | 540138  | 333.52                 | 332.06                  | -                       | 1.46              | 2.55                | 1.09               | 330.97                       | 0.67                              | 331.39 | 1.09                                 | 330.97 | -                                                                        |
| DP102-23(D)             | 4818796         | 540138  | 333.57                 | 332.10                  | -                       | 1.47              | 3.47                | 2.00               | 330.10                       | 1.58                              | 330.52 | 2.00                                 | 330.10 | -                                                                        |
| DP103-23(S)             | 4818800         | 540038  | 333.55                 | 332.12                  | -                       | 1.43              | 2.58                | 1.15               | 330.97                       | 0.73                              | 331.39 | 1.15                                 | 330.97 | -                                                                        |
| DP103-23(D)             | 4818800         | 540038  | 333.72                 | 332.15                  | -                       | 1.57              | 3.47                | 1.90               | 330.25                       | 1.48                              | 330.67 | 1.90                                 | 330.25 | -                                                                        |

**Notes:**  
(a) Refer to Attachment C for borehole and well construction logs

m AMSL = meters above mean sea level  
m BGS = meters below ground surface  
m BTOC = meters below top of well casing  
- = data not available

TABLE 2  
GROUNDWATER LEVEL DATA - MONITORING WELLS

| Well ID  | Date      | Time     | Well Depth |         |          | Screen Length | Top of Casing Elevation | Ground Surface Elevation | Pipe Stick-up | Groundwater Level      |          |          |
|----------|-----------|----------|------------|---------|----------|---------------|-------------------------|--------------------------|---------------|------------------------|----------|----------|
|          |           |          | (m BTOC)   | (m BGS) | (m AMSL) |               |                         |                          |               | (m BGS) <sup>(1)</sup> | (m BTOC) | (m AMSL) |
| MW101-22 | 25-Mar-22 | 12:15 PM | 7.07       | 5.95    | 327.27   | 3.05          | 334.34                  | 333.22                   | 1.12          | 3.34                   | 4.46     | 329.88   |
|          | 8-Aug-22  | 10:00 AM |            |         |          |               |                         |                          |               | 1.97                   | 3.09     | 331.25   |
|          | 2-Dec-22  | 11:32 AM |            |         |          |               |                         |                          |               | 2.64                   | 3.76     | 330.58   |
|          | 20-Mar-23 | 12:45 PM |            |         |          |               |                         |                          |               | 0.37                   | 1.49     | 332.85   |
|          | 10-Apr-23 | 5:44 PM  |            |         |          |               |                         |                          |               | 0.27                   | 1.39     | 332.95   |
|          | 25-May-23 | 12:44 PM |            |         |          |               |                         |                          |               | 0.64                   | 1.76     | 332.58   |
|          | 16-Apr-24 | 1:45 PM  |            |         |          |               |                         |                          |               | 0.34                   | 1.46     | 332.88   |
|          | 17-Jul-24 | 1:45 PM  |            |         |          |               |                         |                          |               | 0.32                   | 1.44     | 332.90   |
| MW102-22 | 25-Mar-22 | 1:41 PM  | 5.42       | 4.30    | 328.95   | 3.05          | 334.37                  | 333.25                   | 1.12          | 0.85                   | 1.97     | 332.40   |
|          | 8-Aug-22  | 10:37 AM |            |         |          |               |                         |                          |               | 2.16                   | 3.28     | 331.09   |
|          | 2-Dec-22  | 11:50 AM |            |         |          |               |                         |                          |               | 2.40                   | 3.52     | 330.85   |
|          | 20-Mar-23 | 1:04 PM  |            |         |          |               |                         |                          |               | 1.30                   | 2.42     | 331.95   |
|          | 10-Apr-23 | 5:33 PM  |            |         |          |               |                         |                          |               | 1.02                   | 2.14     | 332.23   |
|          | 25-May-23 | 12:52 PM |            |         |          |               |                         |                          |               | 1.65                   | 2.77     | 331.60   |
|          | 16-Apr-24 | 1:40 PM  |            |         |          |               |                         |                          |               | 1.10                   | 2.22     | 332.15   |
|          | 17-Jul-24 | 11:49 AM |            |         |          |               |                         |                          |               | 0.91                   | 2.03     | 332.34   |
| MW103-22 | 25-Mar-22 | 2:30 PM  | 5.39       | 4.38    | 328.51   | 3.05          | 333.90                  | 332.89                   | 1.01          | 1.90                   | 2.91     | 330.99   |
|          | 8-Aug-22  | 11:03 AM |            |         |          |               |                         |                          |               | 2.29                   | 3.30     | 330.60   |
|          | 2-Dec-22  | 12:03 PM |            |         |          |               |                         |                          |               | 2.57                   | 3.58     | 330.32   |
|          | 20-Mar-23 | 1:22 PM  |            |         |          |               |                         |                          |               | 2.25                   | 3.26     | 330.64   |
|          | 10-Apr-23 | 5:49 PM  |            |         |          |               |                         |                          |               | 1.91                   | 2.92     | 330.98   |
|          | 25-May-23 | 1:00 PM  |            |         |          |               |                         |                          |               | 2.10                   | 3.11     | 330.79   |
|          | 17-Jul-24 | 1:32 PM  |            |         |          |               |                         |                          |               | 2.04                   | 3.05     | 330.85   |
| MW104-22 | 25-Mar-22 | 3:20 PM  | 7.56       | 6.64    | 323.88   | 3.05          | 331.44                  | 330.52                   | 0.92          | 0.02                   | 0.94     | 330.50   |
|          | 8-Aug-22  | 11:37 AM |            |         |          |               |                         |                          |               | 0.52                   | 1.44     | 330.00   |
|          | 2-Dec-22  | 12:29 PM |            |         |          |               |                         |                          |               | 1.36                   | 2.28     | 329.16   |
|          | 20-Mar-23 | 2:26 PM  |            |         |          |               |                         |                          |               | 0.39                   | 1.31     | 330.13   |
|          | 10-Apr-23 | 6:02 PM  |            |         |          |               |                         |                          |               | -0.02                  | 0.90     | 330.54   |
|          | 25-May-23 | 12:06 PM |            |         |          |               |                         |                          |               | 0.23                   | 1.15     | 330.29   |
|          | 16-Apr-24 | 1:05 PM  |            |         |          |               |                         |                          |               | -0.24                  | 0.68     | 330.76   |
|          | 17-Jul-24 | 1:07 PM  |            |         |          |               |                         |                          |               | -0.14                  | 0.78     | 330.66   |
| MW105-22 | 25-Mar-22 | 4:20 PM  | 8.15       | 7.15    | 325.14   | 3.05          | 333.29                  | 332.29                   | 1.00          | 0.38                   | 1.38     | 331.91   |
|          | 8-Aug-22  | -        |            |         |          |               |                         |                          |               | 2.09                   | 3.09     | 330.20   |
|          | 2-Dec-22  | 1:02 PM  |            |         |          |               |                         |                          |               | 3.23                   | 4.23     | 329.06   |
|          | 20-Mar-23 | 11:54 AM |            |         |          |               |                         |                          |               | 0.48                   | 1.48     | 331.81   |
|          | 10-Apr-23 | 5:13 PM  |            |         |          |               |                         |                          |               | 0.61                   | 1.61     | 331.68   |
|          | 25-May-23 | 1:14 PM  |            |         |          |               |                         |                          |               | 0.96                   | 1.96     | 331.33   |
|          | 16-Apr-24 | 2:10 PM  |            |         |          |               |                         |                          |               | 0.62                   | 1.62     | 331.67   |
|          | 17-Jul-24 | 1:47 PM  |            |         |          |               |                         |                          |               | 0.72                   | 1.72     | 331.57   |
| MW106-22 | 25-Mar-22 | 1:22 PM  | 8.41       | 7.51    | 324.49   | 3.05          | 332.90                  | 332.00                   | 0.90          | 2.18                   | 3.08     | 329.82   |
|          | 8-Aug-22  | 10:45 AM |            |         |          |               |                         |                          |               | 1.32                   | 2.22     | 330.68   |
|          | 2-Dec-22  | 12:51 PM |            |         |          |               |                         |                          |               | 2.68                   | 3.58     | 329.32   |
|          | 20-Mar-23 | 3:23 PM  |            |         |          |               |                         |                          |               | 0.70                   | 1.60     | 331.30   |
|          | 10-Apr-23 | 5:28 PM  |            |         |          |               |                         |                          |               | 0.50                   | 1.40     | 331.50   |
|          | 25-May-23 | 12:27 PM |            |         |          |               |                         |                          |               | 0.85                   | 1.75     | 331.15   |
|          | 16-Apr-24 | 12:56 PM |            |         |          |               |                         |                          |               | 0.59                   | 1.49     | 331.41   |
|          | 17-Jul-24 | 12:17 PM |            |         |          |               |                         |                          |               | 0.42                   | 1.32     | 331.58   |
| MW107-22 | 25-Mar-22 | 3:49 PM  | 4.65       | 3.56    | 328.70   | 3.05          | 333.35                  | 332.26                   | 1.09          | 0.46                   | 1.55     | 331.80   |
|          | 8-Aug-22  | 11:44 AM |            |         |          |               |                         |                          |               | 1.66                   | 2.75     | 330.60   |
|          | 2-Dec-22  | 12:39 PM |            |         |          |               |                         |                          |               | 1.78                   | 2.87     | 330.48   |
|          | 20-Mar-23 | 3:53 PM  |            |         |          |               |                         |                          |               | 0.66                   | 1.75     | 331.60   |
|          | 10-Apr-23 | 5:21 PM  |            |         |          |               |                         |                          |               | 0.58                   | 1.67     | 331.68   |
|          | 25-May-23 | 11:29 AM |            |         |          |               |                         |                          |               | 1.04                   | 2.13     | 331.22   |
|          | 16-Apr-24 | 1:56 PM  |            |         |          |               |                         |                          |               | 0.65                   | 1.74     | 331.61   |
|          | 17-Jul-24 | 1:29 PM  |            |         |          |               |                         |                          |               | 0.69                   | 1.78     | 331.57   |
| MW108-22 | 25-Mar-22 | 2:50 PM  | 6.65       | 5.75    | 326.52   | 3.05          | 333.17                  | 332.27                   | 0.90          | 0.59                   | 1.49     | 331.68   |
|          | 8-Aug-22  | 11:17 AM |            |         |          |               |                         |                          |               | 1.32                   | 2.94     | 330.95   |
|          | 2-Dec-22  | 12:39 PM |            |         |          |               |                         |                          |               | 1.64                   | 3.26     | 330.63   |
|          | 20-Mar-23 | 2:07 PM  |            |         |          |               |                         |                          |               | 1.06                   | 2.68     | 331.21   |
|          | 10-Apr-23 | 5:56 PM  |            |         |          |               |                         |                          |               | 0.59                   | 2.21     | 331.68   |
|          | 25-May-23 | 12:15 PM |            |         |          |               |                         |                          |               | 0.90                   | 2.52     | 331.37   |
|          | 16-Apr-24 | 1:25 PM  |            |         |          |               |                         |                          |               | 0.69                   | 2.31     | 331.58   |
|          | 17-Jul-24 | 12:32 PM |            |         |          |               |                         |                          |               | 0.75                   | 2.37     | 331.52   |

Notes:

m BGS = meters below ground surface  
m BTOC = meters below top of casing  
m AMSL = meters above mean sea level

TABLE 3  
GROUNDWATER LEVELS - DRIVE-POINT PIEZOMETERS

| Piezometer ID | Depth    |         | Screen Length<br>(m) | Screen Separation <sup>(1)</sup><br>(m) | Pipe Stick-up<br>(m) | Ground Surface Elevation<br>(m AMSL) | Top of Casing Elevation<br>(m AMSL) | Date                                             | Time                                       | Groundwater Level           |                           |                                 | Surface Water Level         |                                 | Vertical Hydraulic Gradient <sup>(2)</sup><br><br>(+) = Upward<br>(-) = Downward |
|---------------|----------|---------|----------------------|-----------------------------------------|----------------------|--------------------------------------|-------------------------------------|--------------------------------------------------|--------------------------------------------|-----------------------------|---------------------------|---------------------------------|-----------------------------|---------------------------------|----------------------------------------------------------------------------------|
|               | (m BTOC) | (m BGS) |                      |                                         |                      |                                      |                                     |                                                  |                                            | (m BGS)                     | (m BTOC)                  | (m AMSL)                        | (m BTOC)                    | (m AMSL)                        |                                                                                  |
| DP101-23(S)   | 2.24     | 0.97    | 0.42                 |                                         | 1.27                 | 331.89                               | 333.16                              | 10-Apr-23<br>25-May-23<br>16-Apr-24<br>17-Jul-24 | 7:18 PM<br>10:20 AM<br>2:40 PM<br>10:14 AM | -<br>0.06<br>-0.15<br>-0.34 | -<br>1.33<br>1.12<br>0.93 | -<br>331.83<br>332.04<br>332.23 | 1.03<br>DRY<br>1.02<br>1.03 | 332.13<br>-<br>332.14<br>332.13 |                                                                                  |
| DP101-23(D)   | 3.48     | 1.92    | 0.42                 | 0.95                                    | 1.56                 | 331.88                               | 333.44                              | 10-Apr-23<br>25-May-23<br>16-Apr-24<br>17-Jul-24 | 7:18 PM<br>10:31 AM<br>2:40 PM<br>10:01 AM | -<br>0.04<br>0.13<br>-0.05  | -<br>1.60<br>1.69<br>1.51 | -<br>331.84<br>331.75<br>331.93 | -<br>-<br>-<br>-            | -<br>-<br>-<br>-                | -<br>0.00<br>-0.31<br>-0.32                                                      |
| DP102-23(S)   | 2.55     | 1.09    | 0.42                 |                                         | 1.46                 | 332.06                               | 333.52                              | 10-Apr-23<br>25-May-23<br>16-Apr-24<br>17-Jul-24 | 2:15 PM<br>10:45 AM<br>2:50 PM<br>10:45 AM | -<br>0.07<br>0.03<br>-0.08  | -<br>1.53<br>1.49<br>1.38 | -<br>331.99<br>332.03<br>332.14 | 1.39<br>DRY<br>1.39<br>1.38 | 332.13<br>-<br>332.13<br>332.14 |                                                                                  |
| DP102-23(D)   | 3.47     | 2.00    | 0.42                 | 0.91                                    | 1.47                 | 332.10                               | 333.57                              | 10-Apr-23<br>25-May-23<br>16-Apr-24<br>17-Jul-24 | -<br>10:51 AM<br>2:50 PM<br>10:36 AM       | -<br>1.21<br>0.62<br>0.27   | -<br>2.68<br>2.09<br>1.74 | -<br>330.89<br>331.48<br>331.83 | -<br>-<br>-<br>-            | -<br>-<br>-<br>-                | -<br>-1.00<br>-0.60<br>-0.34                                                     |
| DP103-23(S)   | 2.58     | 1.15    | 0.42                 |                                         | 1.43                 | 332.12                               | 333.55                              | 10-Apr-23<br>25-May-23<br>16-Apr-24<br>17-Jul-24 | 4:30 PM<br>11:03 AM<br>3:08 PM<br>11:07 AM | -<br>0.04<br>-0.18<br>-0.23 | -<br>1.47<br>1.25<br>1.20 | -<br>332.08<br>332.30<br>332.35 | 1.23<br>DRY<br>1.21<br>1.21 | 332.32<br>-<br>332.34<br>332.34 |                                                                                  |
| DP103-23(D)   | 3.47     | 1.90    | 0.42                 | 0.75                                    | 1.57                 | 332.15                               | 333.72                              | 10-Apr-23<br>25-May-23<br>16-Apr-24<br>17-Jul-24 | -<br>11:06 AM<br>3:08 PM<br>11:05 AM       | -<br>1.07<br>0.58<br>0.29   | -<br>2.64<br>2.15<br>1.86 | -<br>331.08<br>331.57<br>331.86 | -<br>-<br>-<br>-            | -<br>-<br>-<br>-                | -<br>-1.00<br>-0.97<br>-0.65                                                     |

**Notes:**  
(1) Distance between the mid-point of the screened intervals of the shallow and deep piezometer.  
(2) Vertical hydraulic gradient between the mid-points of the shallow and deep piezometer screen.

m BGS = meters below ground surface  
m BTOC = meters below top of casing  
m AMSL = m above mean sea level  
DRY = no groundwater or surface water was observed in the piezometer or watercourse, respectively  
- = measurement not available

November 14, 2024  
Peter Armbruster

**Reference:** Hydrogeological Technical Memorandum, Supplementary Groundwater Monitoring and Wetland Assessment, Carriage Crossing Subdivision (400 Millenium Boulevard), Blocks 320 and 326 (Registered Plan 58M-506), Waterloo, Ontario

## **Attachment 3      Borehole Logs**

# Monitoring Well: MW101-22

**Project:** Supplementary Groundwater Monitoring  
**Client:** Activa Holdings Inc.  
**Location:** 400 Millennium Blvd., Waterloo ON  
**Number:** 160310788  
**Field investigator:** J. Hale  
**Contractor:** Aardvark Drilling Inc.

**Method:** CME 850 - Hollow Stem Auger/Split Spoon  
**Date started/completed:** 15-Mar-2022  
**Ground surface elevation:** 333.22 m AMSL  
**Top of casing elevation:** 334.34 m AMSL  
**Easting:** 540097  
**Northing:** 4819151

| SUBSURFACE PROFILE |             |                                                                   |                                     | SAMPLE DETAILS |             |          |                 | INSTALLATION DETAILS |                                                   |
|--------------------|-------------|-------------------------------------------------------------------|-------------------------------------|----------------|-------------|----------|-----------------|----------------------|---------------------------------------------------|
| Depth              | Graphic Log | Stratigraphic Description                                         | Elevation (m AMSL)<br>Depth (m BGS) | Sample Number  | Sample Type | Recovery | N Value         | Diagram              | Description                                       |
| (ft)               | (m)         |                                                                   |                                     |                |             |          |                 |                      |                                                   |
| 0                  | 0           | Ground Surface                                                    | 333.22                              |                |             |          |                 |                      |                                                   |
|                    |             | TOPSOIL                                                           | 0.00                                | 1              | SS          | 20" 83%  | 1-3-3-2 (6)     |                      | Above Ground Casing 1.12 m stick-up               |
|                    |             | Clayey silt, trace sand, gravel and organics, very moist          | 332.46                              |                |             |          |                 |                      |                                                   |
|                    |             | SANDY SILT (TILL)                                                 | 0.76                                | 2              | SS          | 22" 92%  | 1-2-3-3 (5)     |                      |                                                   |
|                    |             | Trace gravel, light brown, firm to stiff, very moist, well graded |                                     |                |             |          |                 |                      |                                                   |
| 5                  | 2           | Very stiff                                                        |                                     | 3              | SS          | 20" 83%  | 1-6-10-10 (16)  |                      | Holeplug 0 to 2.60 m                              |
|                    |             |                                                                   |                                     | 4              | SS          | 24" 100% | 4-13-11-10 (24) |                      | 203 mm Borehole Diameter 0 to 6.10 m              |
| 10                 |             | CLAYEY SILT (TILL)                                                | 330.17                              | 5              | SS          | 22" 92%  | 7-23-23-21 (46) |                      | Water Level 25-MAR-2022 3.34 m BGS                |
|                    |             | Trace sand and gravel, light brown, hard, very moist              | 3.05                                |                |             |          |                 |                      |                                                   |
| 4                  |             | Becomes wet at 3.96 m BGS                                         |                                     | 6              | SS          | 18" 75%  | 7-25-28-24 (53) |                      | No.2 Silica Sand 2.60 to 6.10 m                   |
| 15                 |             | SILT (TILL)                                                       | 328.65                              | 7              | SS          | 18" 75%  | 7-24-35-35 (59) |                      | No. 10 Slot Schedule 40 PVC Screen 2.90 to 5.95 m |
|                    |             | Some clay, trace sand and gravel, hard, moist                     | 4.57                                |                |             |          |                 |                      |                                                   |
| 20                 | 6           | End of Borehole                                                   | 327.12                              | 8              | SS          | 18" 75%  | 7-18-28-27 (46) |                      |                                                   |
|                    |             |                                                                   | 6.10                                |                |             |          |                 |                      |                                                   |
| 25                 |             |                                                                   |                                     |                |             |          |                 |                      |                                                   |

Notes:  
m AMSL - metres above mean sea level  
m BGS - metres below ground surface  
SS - split-spoon sample  
n/a - not available



# Monitoring Well: MW102-22

**Project:** Supplementary Groundwater Monitoring  
**Client:** Activa Holdings Inc.  
**Location:** 400 Millennium Blvd., Waterloo ON  
**Number:** 160310788  
**Field investigator:** J. Hale  
**Contractor:** Aardvark Drilling Inc.

**Method:** CME 850 - Hollow Stem Auger/Split Spoon  
**Date started/completed:** 16-Mar-2022  
**Ground surface elevation:** 333.25 m AMSL  
**Top of casing elevation:** 334.37 m AMSL  
**Easting:** 540383  
**Northing:** 4819151

| SUBSURFACE PROFILE |             |                                                                             |                                     | SAMPLE DETAILS |             |            |                  | INSTALLATION DETAILS |                                                              |
|--------------------|-------------|-----------------------------------------------------------------------------|-------------------------------------|----------------|-------------|------------|------------------|----------------------|--------------------------------------------------------------|
| Depth              | Graphic Log | Stratigraphic Description                                                   | Elevation (m AMSL)<br>Depth (m BGS) | Sample Number  | Sample Type | Recovery   | N Value          | Diagram              | Description                                                  |
| (ft) (m)           |             |                                                                             | 334.37                              |                |             |            |                  |                      |                                                              |
| 0                  | 0           | Ground Surface                                                              | 333.25                              |                |             |            |                  |                      | ← Above Ground Casing<br>1.12 m stick-up                     |
|                    |             | TOPSOIL<br>Clayey silt, trace sand and organics, very moist                 | 0.00                                | 1              | SS          | 16"<br>67% | 1-2-2-3<br>(4)   |                      | ← Holeplug<br>0 to 1.00 m                                    |
|                    |             | CLAYEY SILT (TILL)<br>Trace sand and gravel, light brown, stiff, very moist | 0.76                                | 2              | SS          | 2"<br>8%   | 2-6-8-9<br>(14)  |                      | ← Water Level<br>25-MAR-2022<br>0.85 m BGS                   |
| 5                  |             | SAND<br>Trace silt, brown, loose, moist                                     | 1.52                                | 3              | SS          | 14"<br>58% | 2-3-6-6<br>(9)   |                      |                                                              |
| 2                  |             | SILTY SAND<br>Brown, very moist                                             | 2.19                                |                |             |            |                  |                      | ← 203 mm Borehole<br>Diameter<br>0 to 4.42 m                 |
|                    |             | SAND<br>Trace silt, brown, loose, wet                                       | 2.29                                | 4              | SS          | 12"<br>50% | 2-2-5-9<br>(7)   |                      | ← No.2 Silica Sand<br>1.00 to 4.42 m                         |
| 10                 |             | CLAYEY SILT (TILL)<br>Trace sand and gravel, brown, stiff, very moist       | 3.05                                | 5              | SS          | 18"<br>75% | 4-4-8-10<br>(12) |                      | ← No. 10 Slot<br>Schedule 40<br>PVC Screen<br>1.30 to 4.30 m |
| 4                  |             | Grey at 3.81 m BGS                                                          |                                     | 6              | SS          | 16"<br>67% | 4-4-8-9<br>(12)  |                      |                                                              |
| 15                 |             | End of Borehole                                                             | 4.42                                |                |             |            |                  |                      |                                                              |

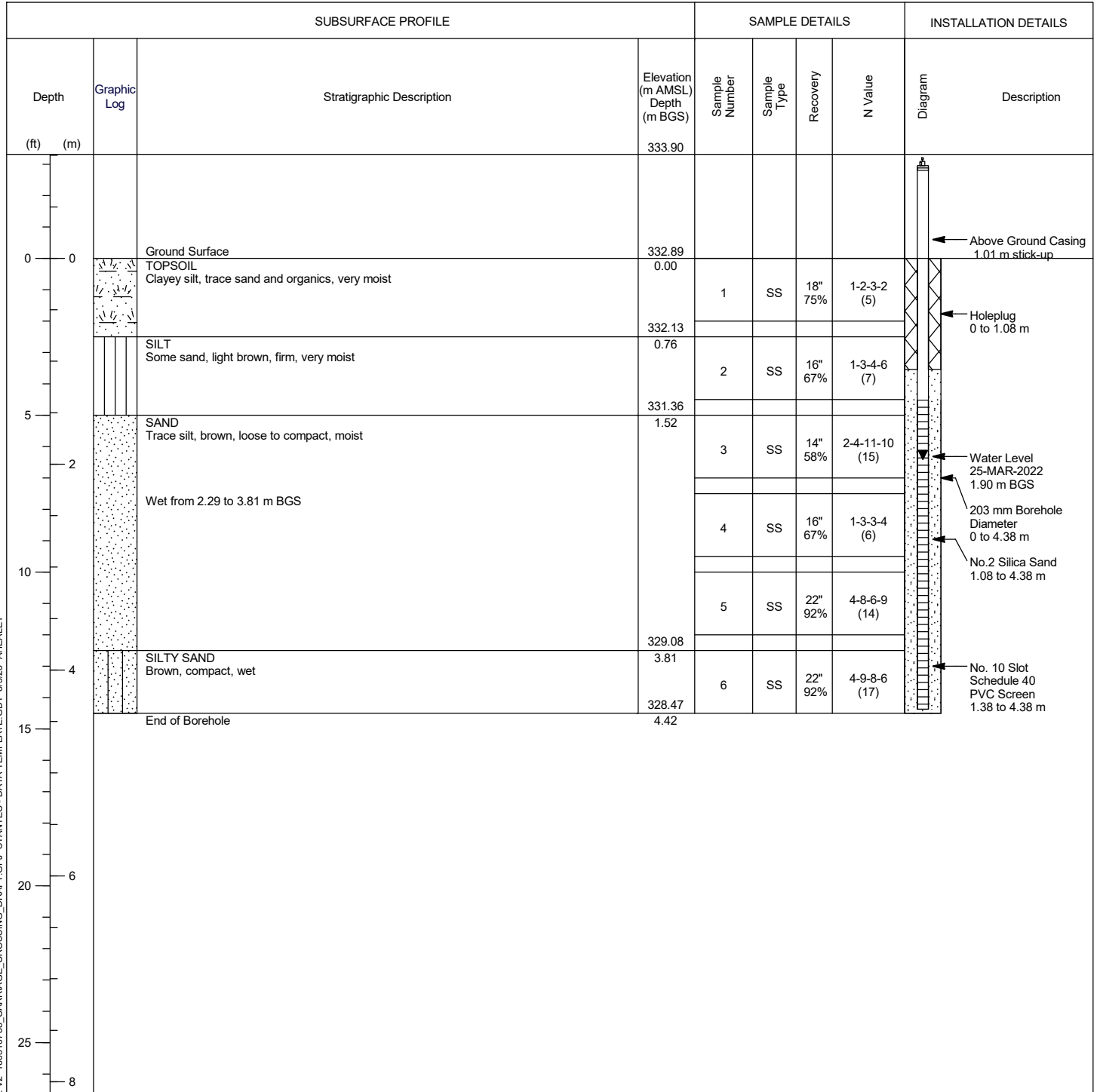
Notes:  
m AMSL - metres above mean sea level  
m BGS - metres below ground surface  
SS - split-spoon sample  
n/a - not available



# Monitoring Well: MW103-22

**Project:** Supplementary Groundwater Monitoring  
**Client:** Activa Holdings Inc.  
**Location:** 400 Millennium Blvd., Waterloo ON  
**Number:** 160310788  
**Field investigator:** J. Hale  
**Contractor:** Aardvark Drilling Inc.

**Method:** CME 850 - Hollow Stem Auger/Split Spoon  
**Date started/completed:** 16-Mar-2022  
**Ground surface elevation:** 332.89 m AMSL  
**Top of casing elevation:** 333.90 m AMSL  
**Easting:** 540661  
**Northing:** 4819278



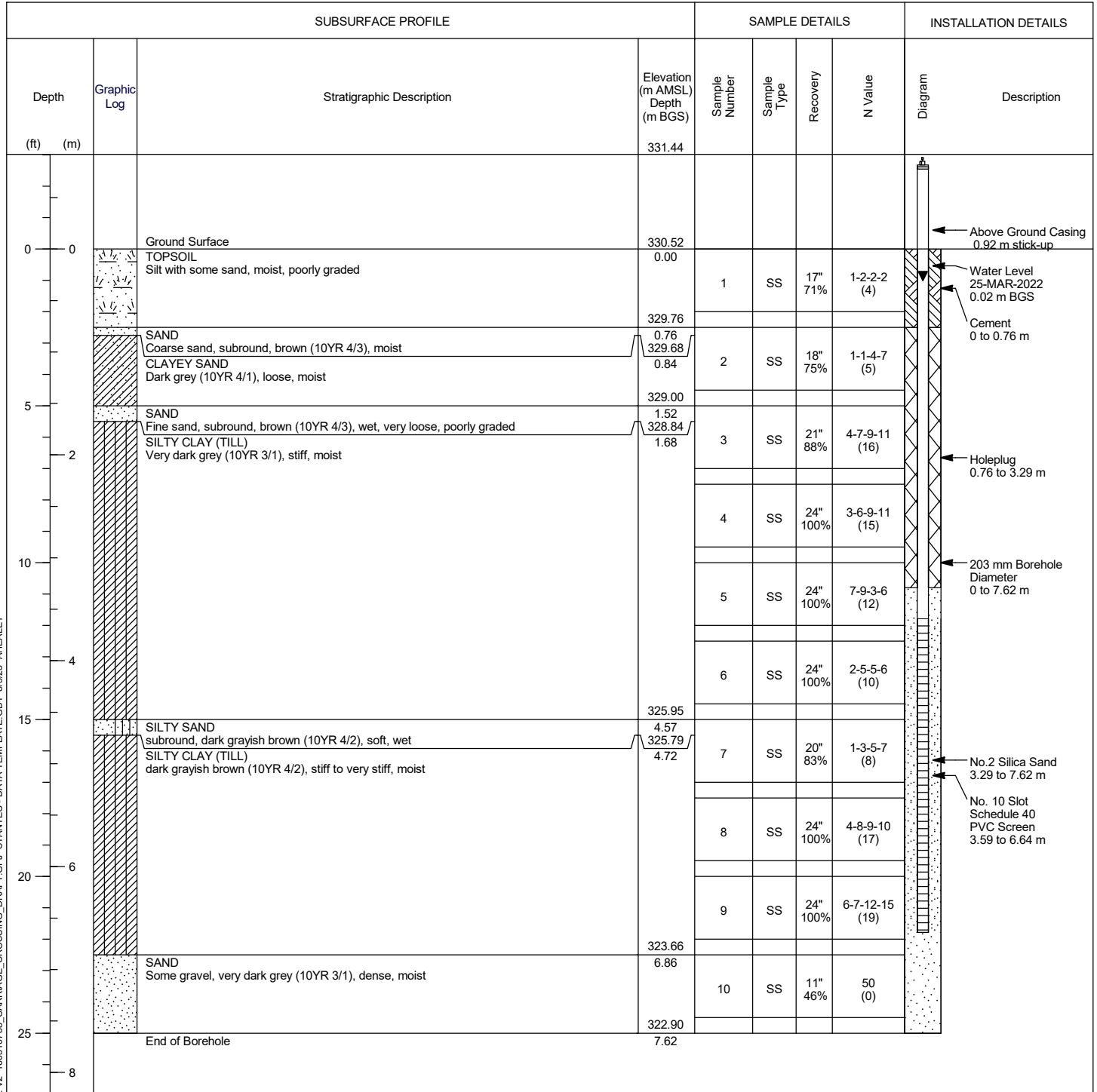
Notes:  
m AMSL - metres above mean sea level  
m BGS - metres below ground surface  
SS - split-spoon sample  
n/a - not available



# Monitoring Well: MW104-22

**Project:** Supplementary Groundwater Monitoring  
**Client:** Activa Holdings Inc.  
**Location:** 400 Millennium Blvd., Waterloo ON  
**Number:** 160310788  
**Field investigator:** S. Hutchinson  
**Contractor:** Aardvark Drilling Inc.

**Method:** CME 850 - Hollow Stem Auger/Split Spoon  
**Date started/completed:** 22-Mar-2022  
**Ground surface elevation:** 330.52 m AMSL  
**Top of casing elevation:** 331.44 m AMSL  
**Easting:** 540570  
**Northing:** 4818997



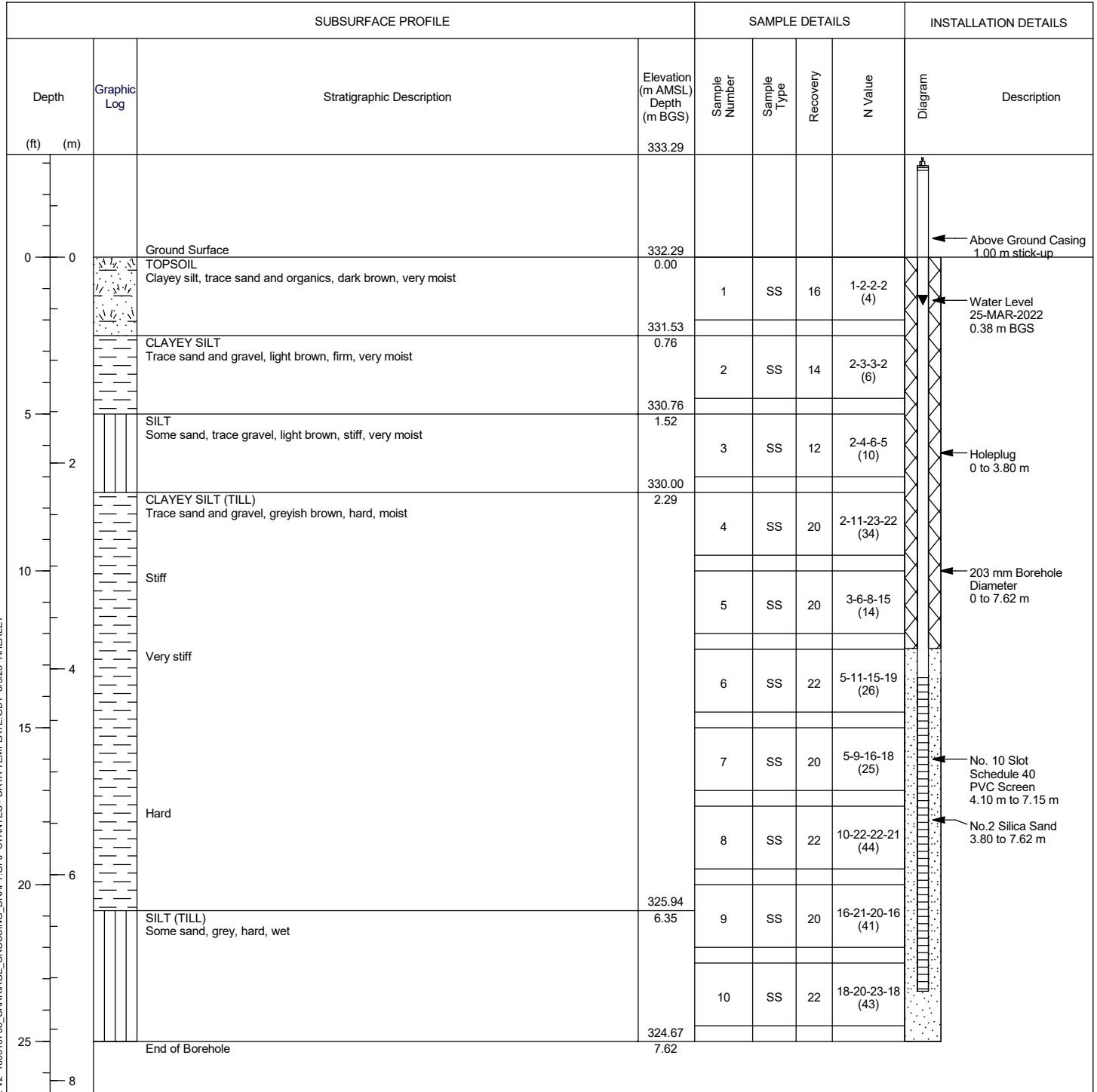
Notes:  
m AMSL - metres above mean sea level  
m BGS - metres below ground surface  
SS - split-spoon sample  
n/a - not available



# Monitoring Well: MW105-22

**Project:** Supplementary Groundwater Monitoring  
**Client:** Activa Holdings Inc.  
**Location:** 400 Millennium Blvd., Waterloo ON  
**Number:** 160310788  
**Field investigator:** J. Hale  
**Contractor:** Aardvark Drilling Inc.

**Method:** CME 850 - Hollow Stem Auger/Split Spoon  
**Date started/completed:** 16-Mar-2022  
**Ground surface elevation:** 332.29 m AMSL  
**Top of casing elevation:** 333.29 m AMSL  
**Easting:** 540277  
**Northing:** 4818801



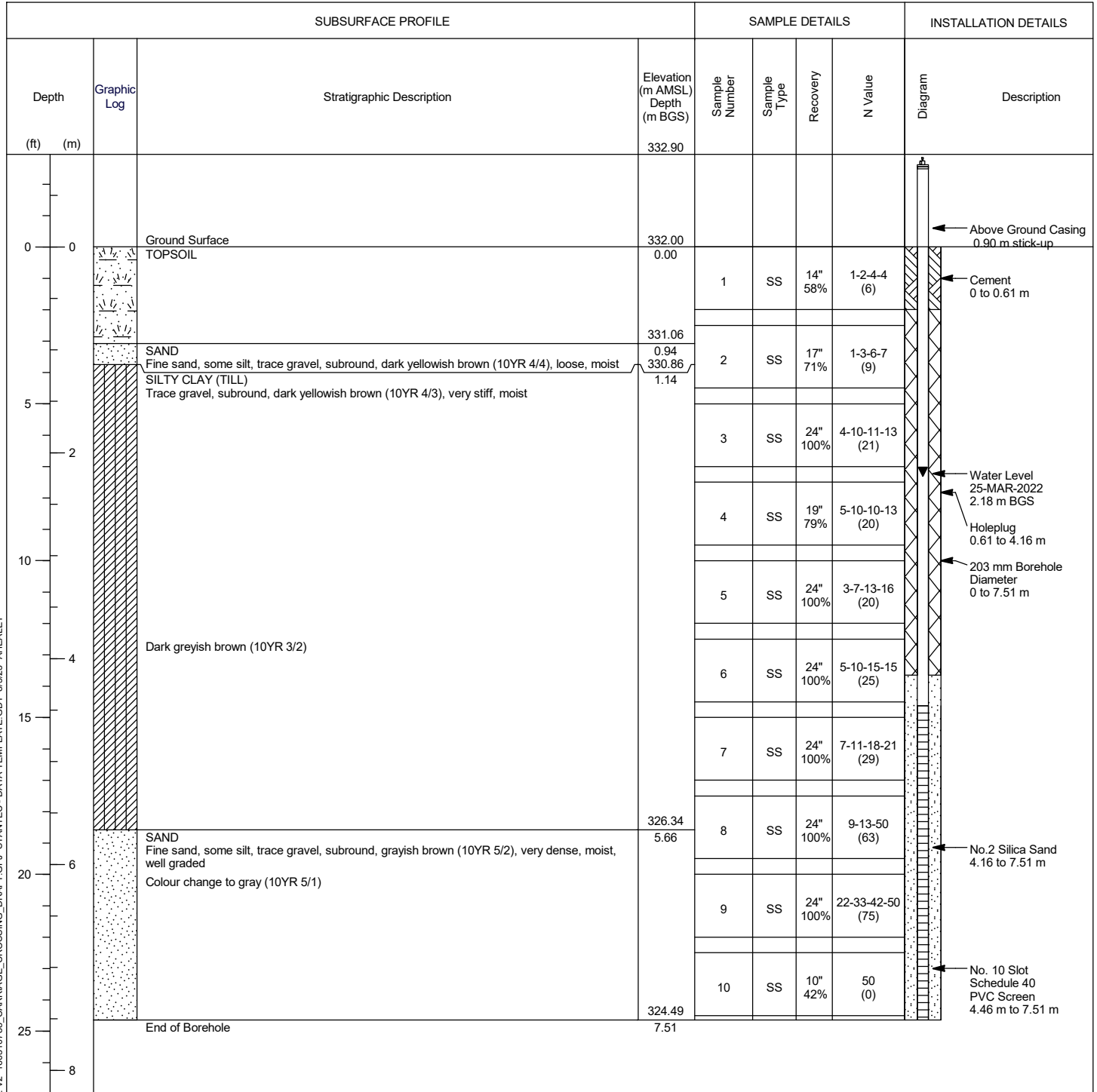
Notes:  
m AMSL - metres above mean sea level  
m BGS - metres below ground surface  
SS - split-spoon sample  
n/a - not available



# Monitoring Well: MW106-22

**Project:** Supplementary Groundwater Monitoring  
**Client:** Activa Holdings Inc.  
**Location:** 400 Millennium Blvd., Waterloo ON  
**Number:** 160310788  
**Field investigator:** S. Hutchinson  
**Contractor:** Aardvark Drilling Inc.

**Method:** CME 850 - Hollow Stem Auger/Split Spoon  
**Date started/completed:** 16-Mar-2022  
**Ground surface elevation:** 332.00 m AMSL  
**Top of casing elevation:** 332.90 m AMSL  
**Easting:** 540377  
**Northing:** 4819001



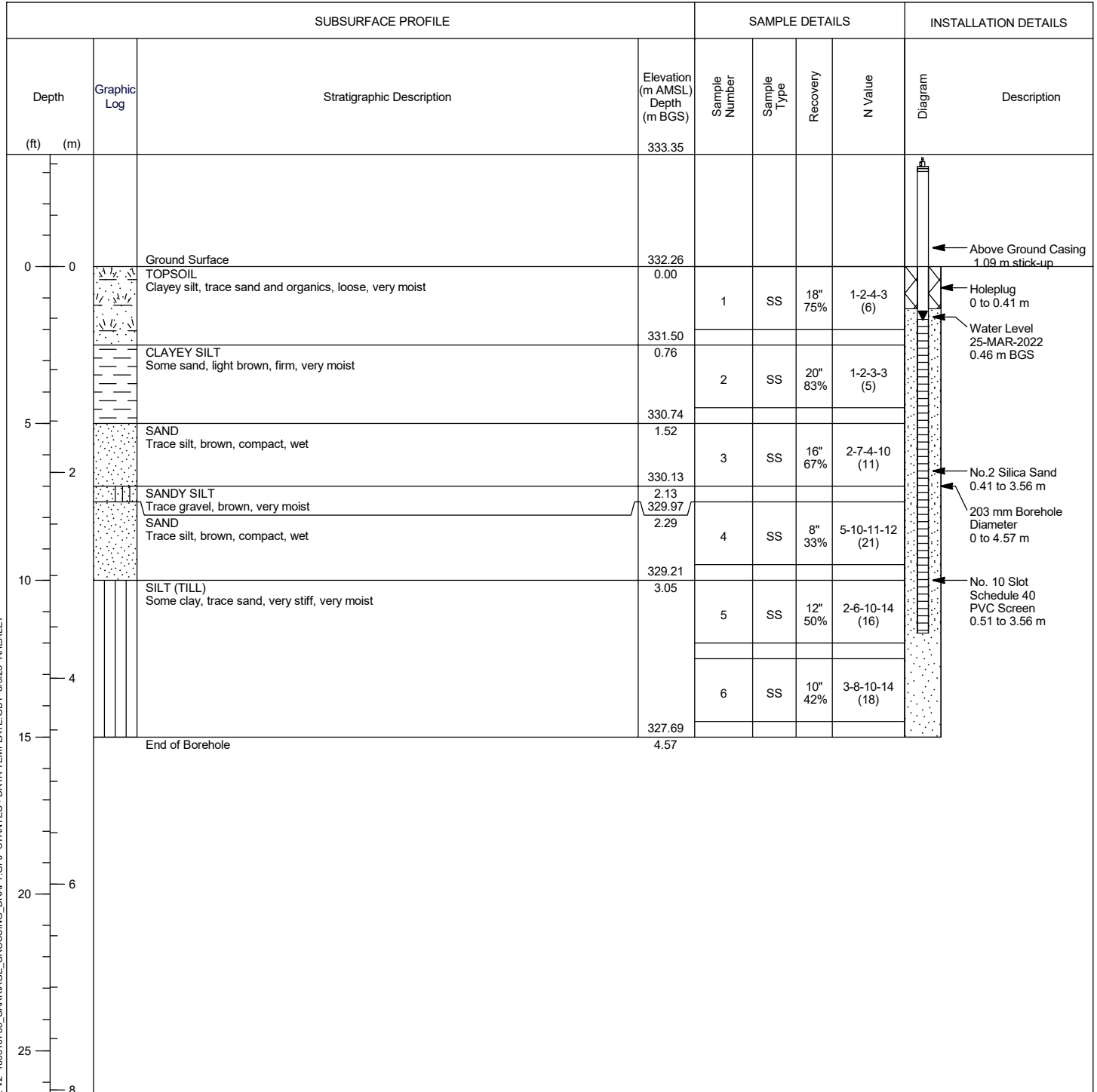
Notes:  
m AMSL - metres above mean sea level  
m BGS - metres below ground surface  
SS - split-spoon sample  
n/a - not available



# Monitoring Well: MW107-22

**Project:** Supplementary Groundwater Monitoring  
**Client:** Activa Holdings Inc.  
**Location:** 400 Millennium Blvd., Waterloo ON  
**Number:** 160310788  
**Field investigator:** J. Hale  
**Contractor:** Aardvark Drilling Inc.

**Method:** CME 850 - Hollow Stem Auger/Split Spoon  
**Date started/completed:** 16-Mar-2022  
**Ground surface elevation:** 332.26 m AMSL  
**Top of casing elevation:** 333.35 m AMSL  
**Easting:** 540413  
**Northing:** 4818861



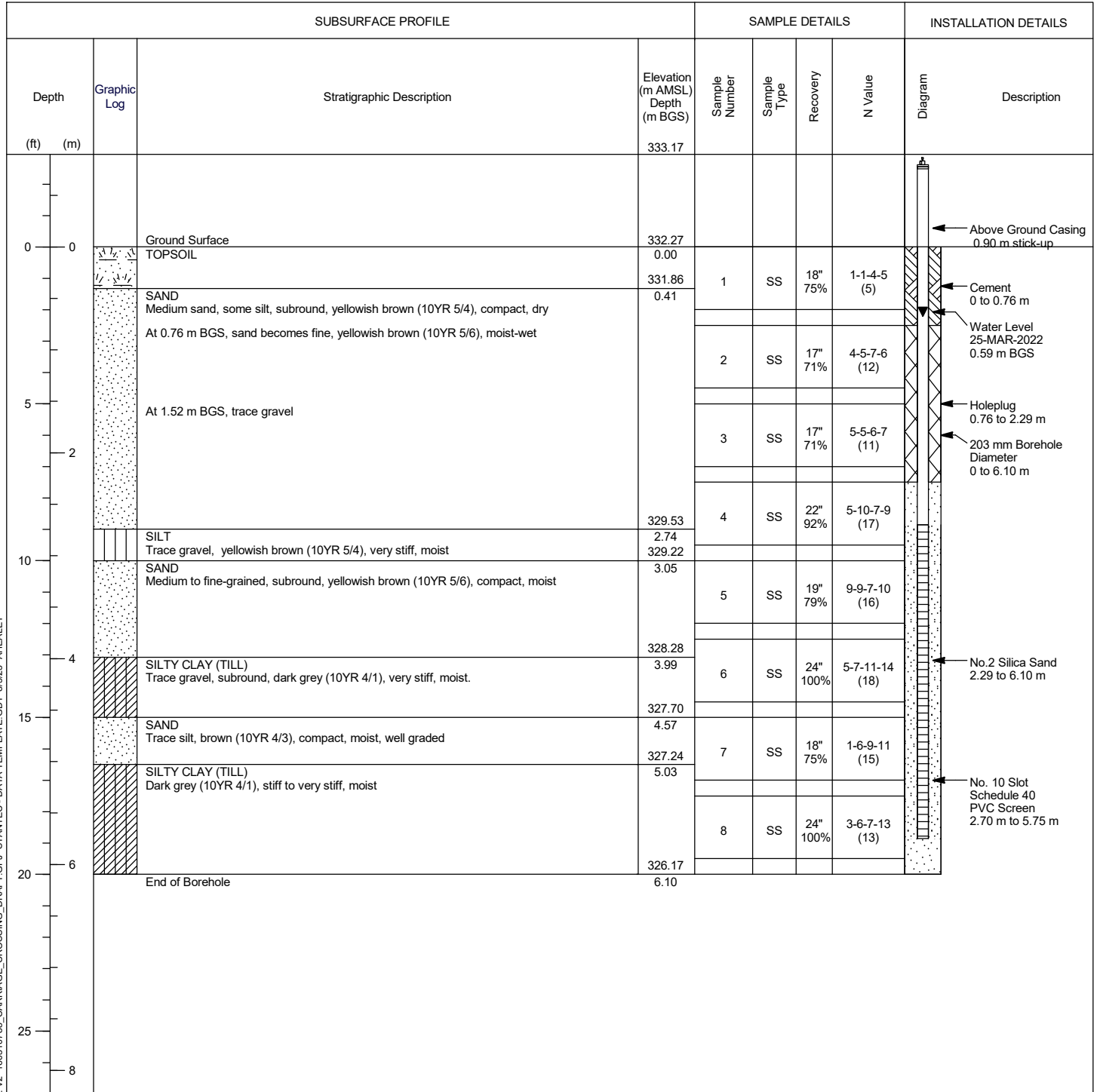
Notes:  
m AMSL - metres above mean sea level  
m BGS - metres below ground surface  
SS - split-spoon sample  
n/a - not available



# Monitoring Well: MW108-22

**Project:** Supplementary Groundwater Monitoring  
**Client:** Activa Holdings Inc.  
**Location:** 400 Millennium Blvd., Waterloo ON  
**Number:** 160310788  
**Field investigator:** S. Hutchinson  
**Contractor:** Aardvark Drilling Inc.

**Method:** CME 850 - Hollow Stem Auger/Split Spoon  
**Date started/completed:** 22-Mar-2022  
**Ground surface elevation:** 332.27 m AMSL  
**Top of casing elevation:** 333.17 m AMSL  
**Easting:** 540559  
**Northing:** 4819104



Notes:  
m AMSL - metres above mean sea level  
m BGS - metres below ground surface  
SS - split-spoon sample  
n/a - not available





**Naylor  
Engineering  
Associates** L3  
CONSULTING ENGINEERS

**Borehole Number: 1**

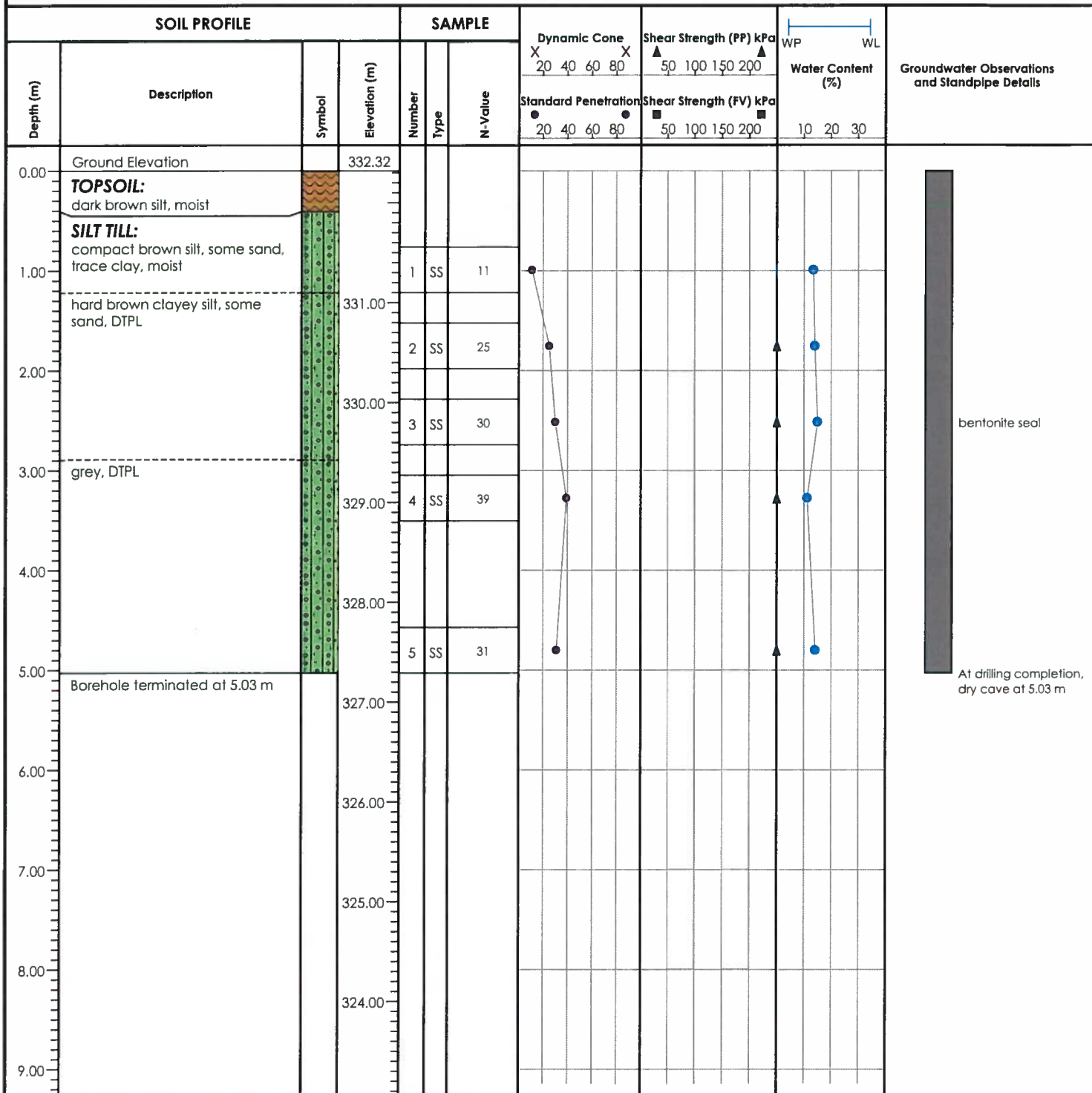
**Ground Elevation: 332.32 m**

**Project: Activa Waterloo East Lands**

**Job No.: 5830G1**

**Location: Waterloo, Ontario**

**Drill Date: October 28, 2005**



**Reviewed by: DN**  
**Drill Method: Solid Stem Auger**  
**Notes:**

**Field Tech.: RM**  
**Sheet: 1 of 1**  
**Drafted by: DC (01a)**



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Engineering  
Associates Ltd.  
CONSULTING ENGINEERS

Borehole Number: 2

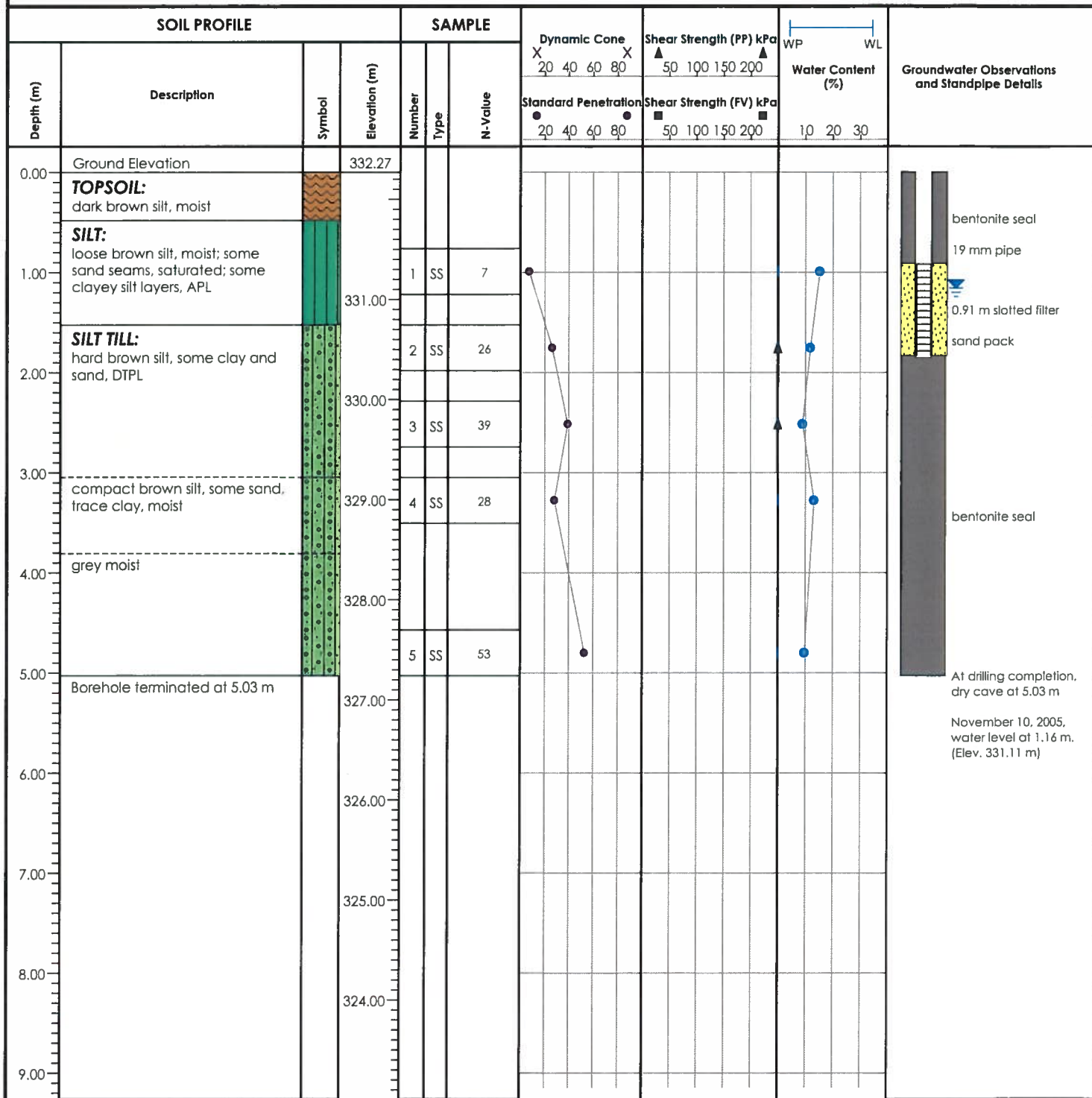
Ground Elevation: 332.27 m

Project: Axtiva Waterloo East Lands

Job No.: 5830G1

Location: Waterloo, Ontario

Drill Date: October 28, 2005



Reviewed by: DN

Drill Method: Solid Stem Auger

Notes:

Field Tech.: RM

Sheet: 1 of 1

Drafted by: DC (01a)



**Naylor  
Engineering  
Associates**  
CONSULTING ENGINEERS

**Borehole Number: 3**

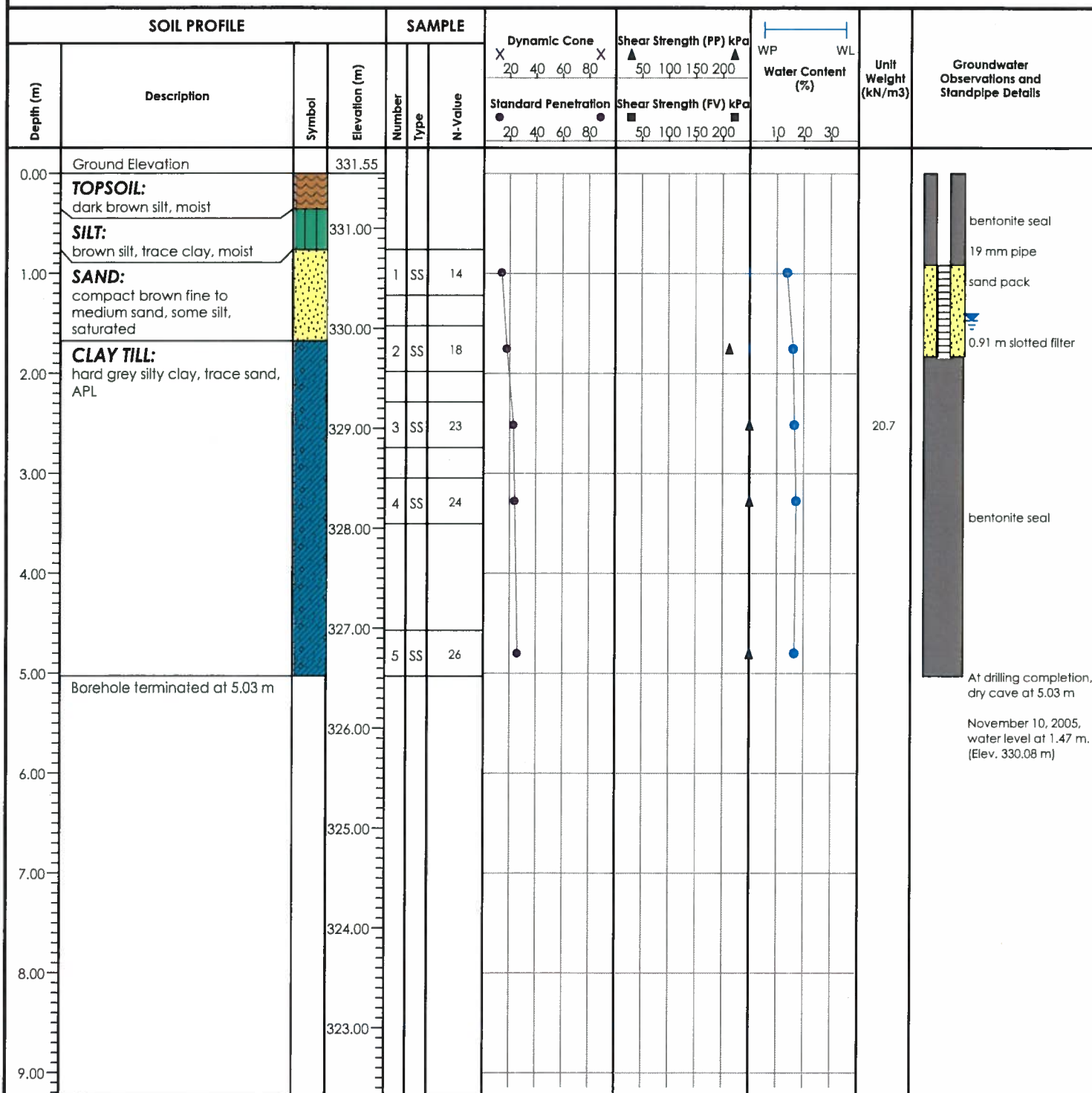
**Ground Elevation: 331.55 m**

**Project: Activa Waterloo East Lands**

**Job No.: 5830G1**

**Location: Waterloo, Ontario**

**Drill Date: October 28, 2005**



**Reviewed by: DN**

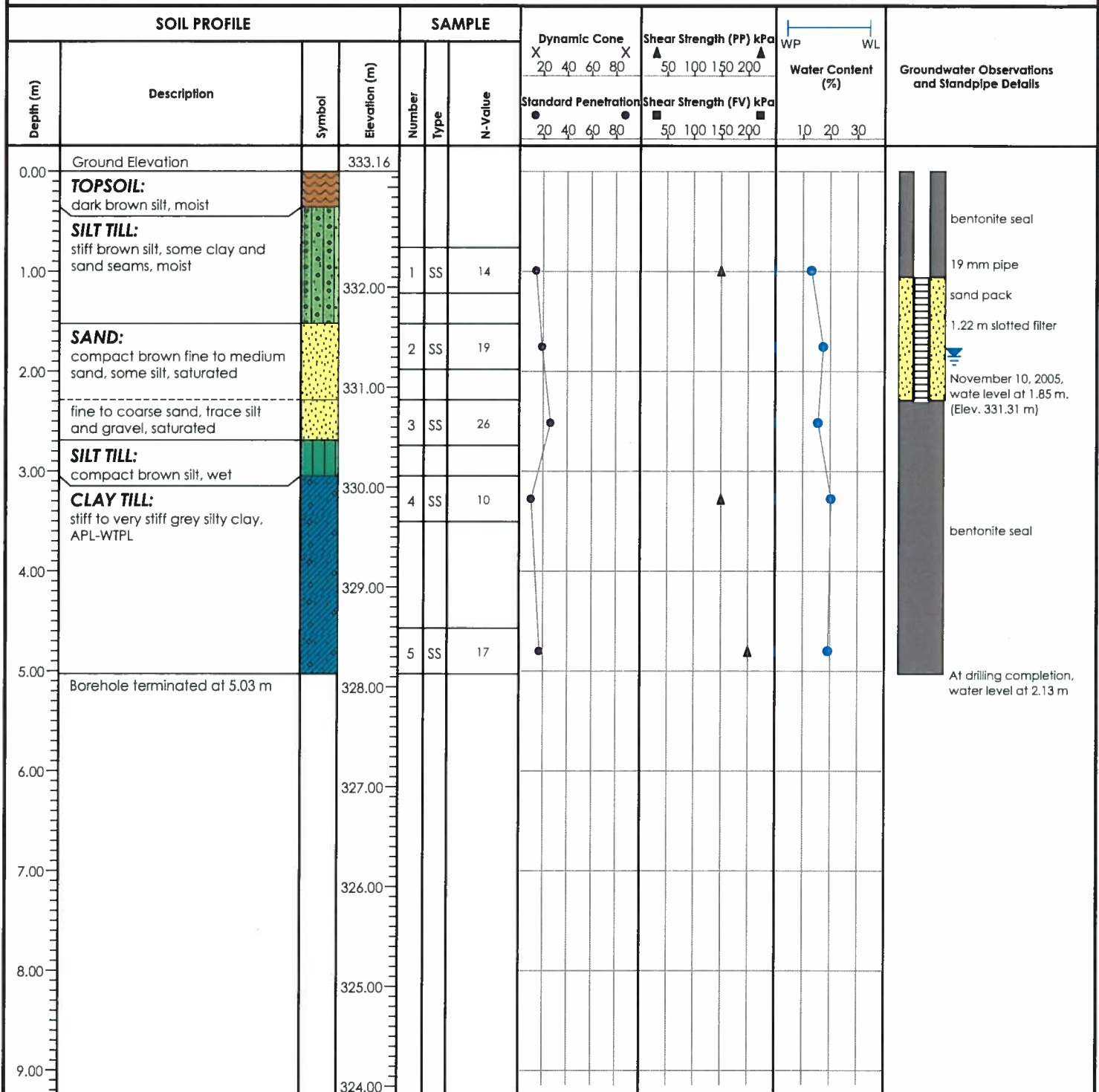
**Field Tech.: RM**

**Drill Method: Solid Stem Auger**

**Sheet: 1 of 1**

**Notes:**

**Drafted by: DC (01h)**



**Reviewed by: DN**  
**Drill Method: Solid Stem Auger**  
**Notes:**

**Field Tech.: RM**  
**Sheet: 1 of 1**  
**Drafted by: DC (01a)**



**Naylor  
Engineering  
Associates** L.L.  
CONSULTING ENGINEERS

**Borehole Number: 8**

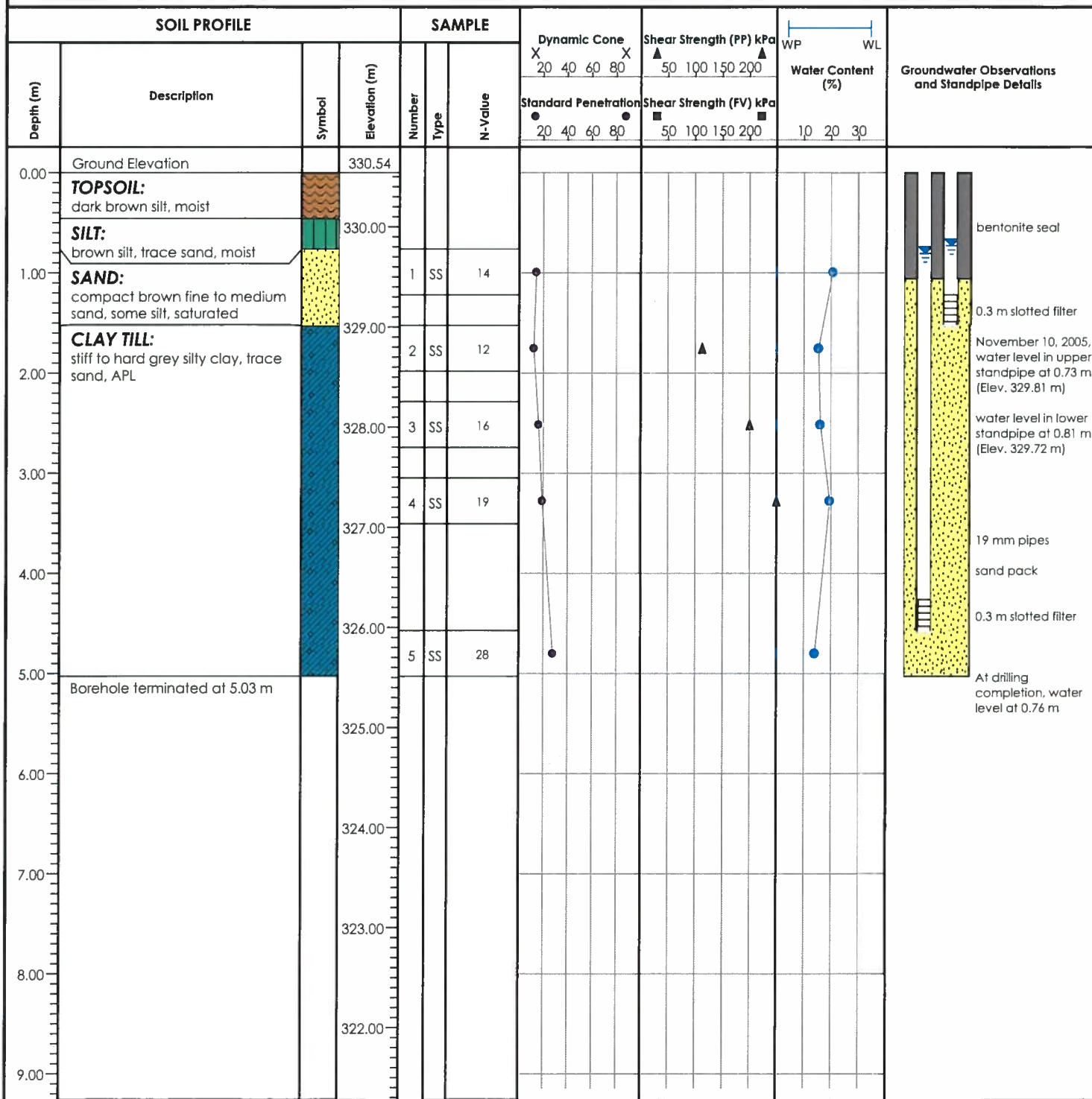
**Ground Elevation: 330.54 m**

**Project: Axtiva Waterloo East Lands**

**Job No.: 5830G1**

**Location: Waterloo, Ontario**

**Drill Date: November 1, 2005**



**Reviewed by: DN**

**Drill Method: Solid Stem Auger**

**Notes:**

**Field Tech.: RM**

**Sheet: 1 of 1**

**Drafted by: DC (01a)**



**Naylor  
Engineering  
Associates Ltd.**  
CONSULTING ENGINEERS

**Borehole Number: 9**

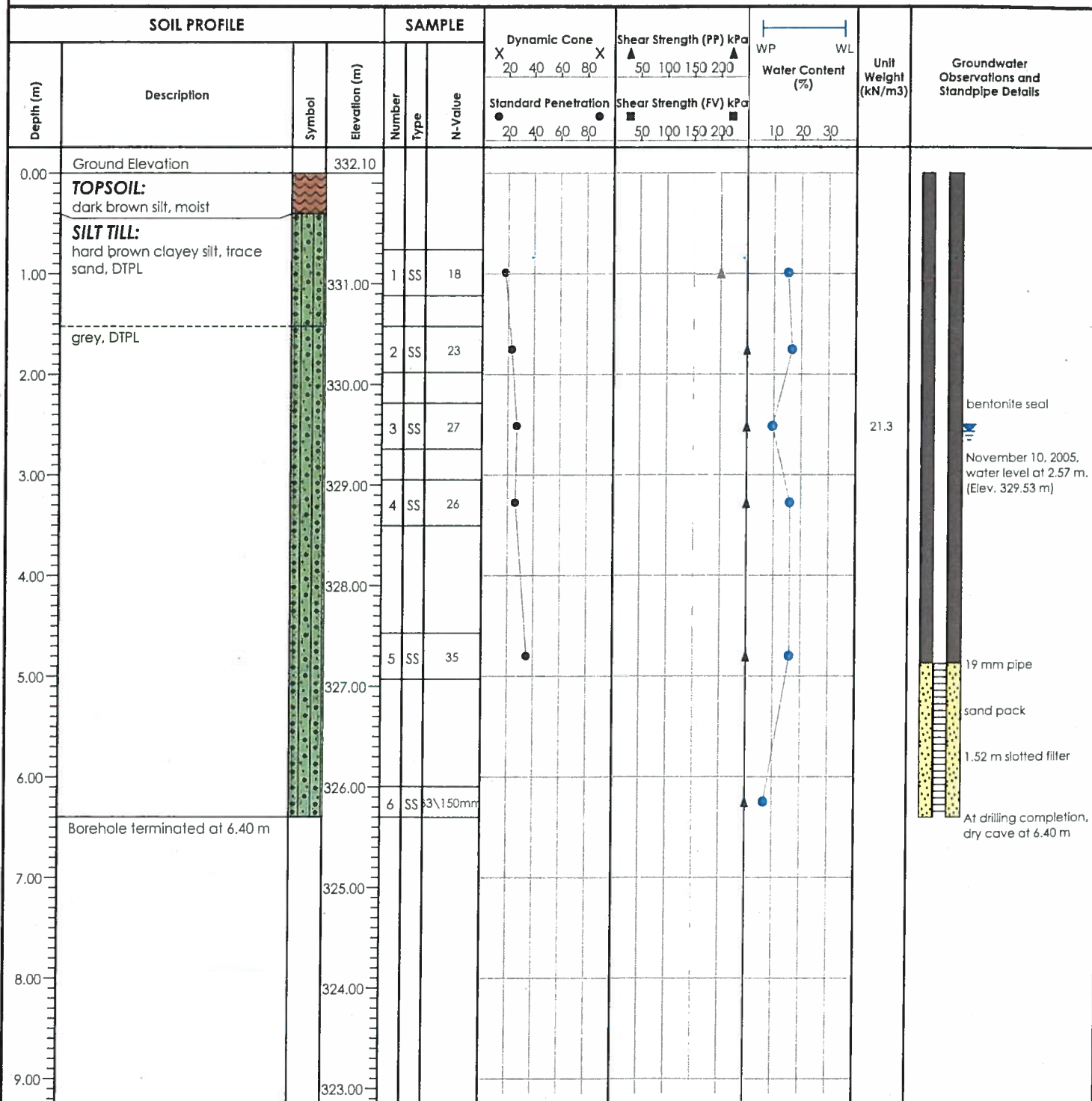
**Ground Elevation: 332.10 m**

**Project: Activa Waterloo East Lands**

**Job No.: 5830G1**

**Location: Waterloo, Ontario**

**Drill Date: October 28, 2005**



**Reviewed by: DN**

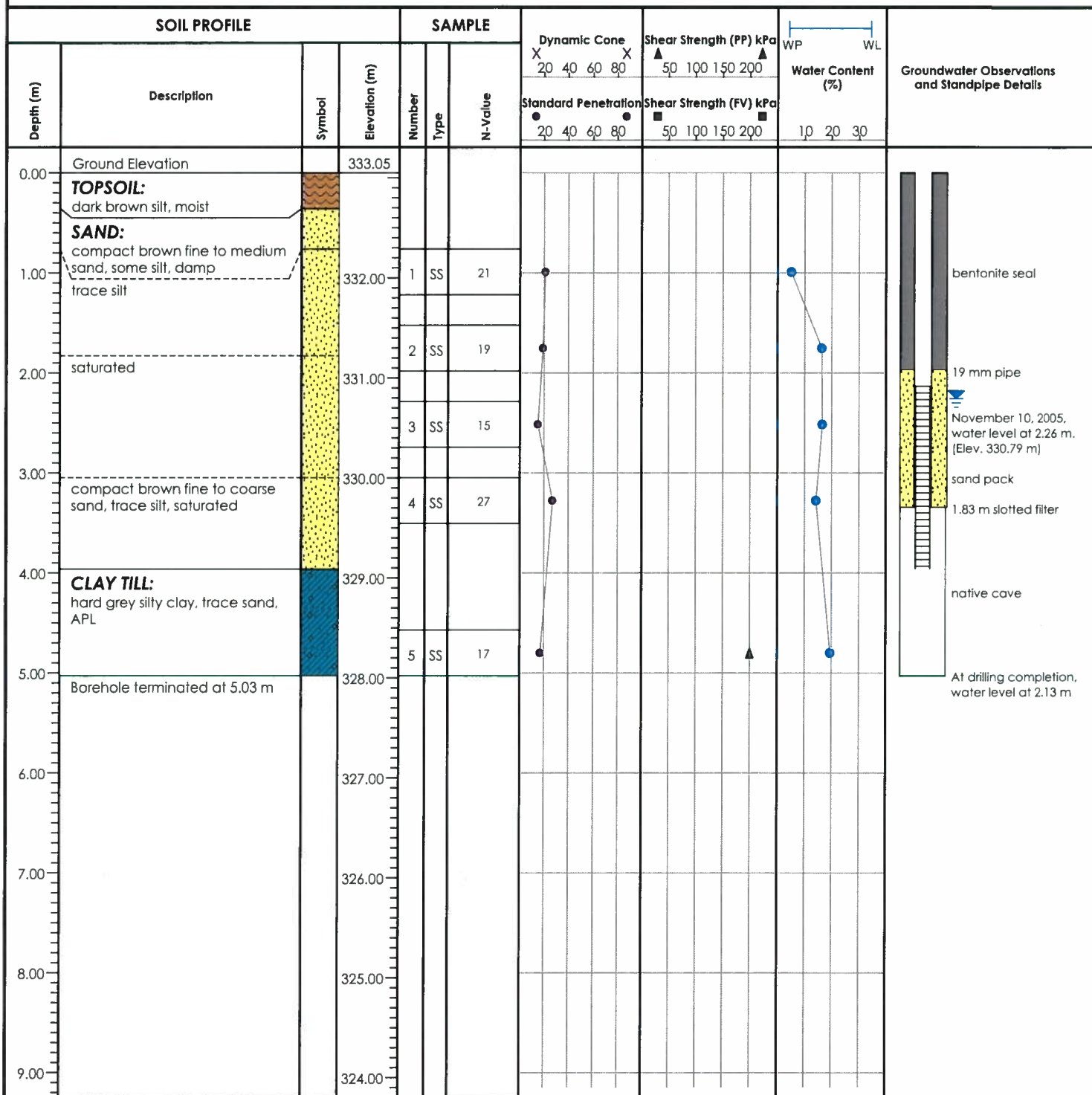
**Field Tech.: RM**

**Drill Method: Solid Stem Auger**

**Sheet: 1 of 1**

**Notes: Bulk sample taken from 1.52 to 3.05 m.**

**Drafted by: DC (01h)**



**Reviewed by: DN**

**Drill Method: Solid Stem Auger**

**Notes:**

**Field Tech.: RM**

**Sheet: 1 of 1**

**Drafted by: DC (01a)**